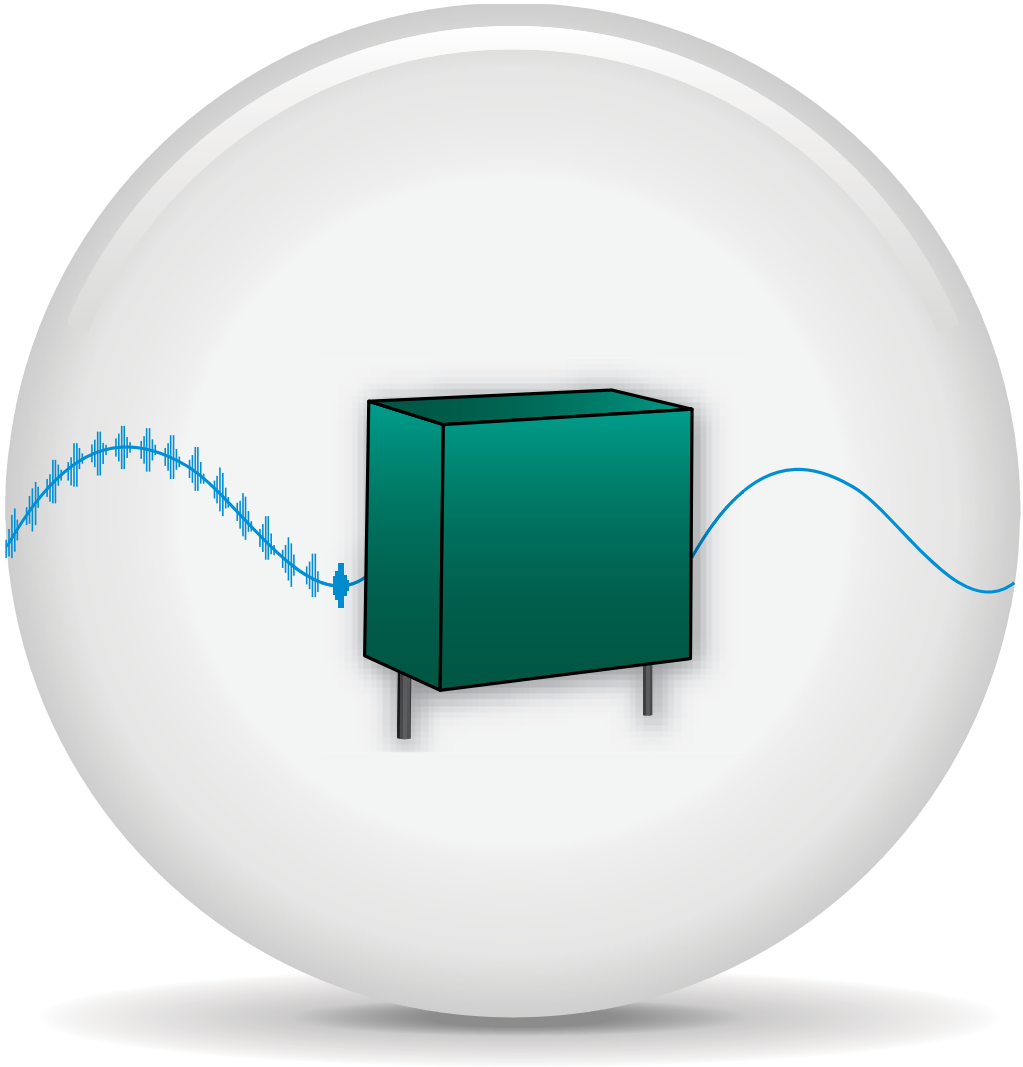
Film Through-Hole Capacitors

AC Line EMI Suppression and RC Networks



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Table of Contents

Page

Why Choose KEMET 4

Class X1

F871 Series Metallized Polypropylene Film, 330 VAC 6
F872 Series Metallized Polypropylene Film, 480 VAC 22
F873 Series Metallized Polypropylene Film, 760 VAC 37
R49 Series Metallized Polypropylene Film, 310 VAC 49
R49 Series Metallized Polypropylene Film, 330 VAC 61
R47 Series Metallized Polypropylene Film, 440 VAC 73
PHE844 Series Metallized Polypropylene Film, 440/480 VAC 86
PHE845 Series Metallized Polypropylene Film 760 VAC 97
PME271E Series Metallized Impregnated Paper, 300 VAC 108
PME278 Series Metallized Impregnated Paper, 440 VAC 117
P278 Series Metallized Impregnated Paper, 480 VAC 126

Class X2

F861 Series Metallized Polypropylene Film, 310 VAC 136
F862 Series Metallized Polypropylene Film for Harsh Environmental Conditions, 310 VAC 151
R46 Series Metallized Polypropylene Film, 275 VAC 161
R46 (Miniature) Series Metallized Polypropylene Film, 275 VAC 175
R46 Series 125°C Metallized Polypropylene Film, 275 VAC 188
R46 Series Metallized Polypropylene Film, 310 VAC 201
R47 Series Metallized Polypropylene Film, 440 VAC 215
R47 Series Metallized Polypropylene Film, 520 VAC 228
PHE820M Series Metallized Polyester Film, 275 VAC 241
PHE820E Series Metallized Polyester Film, 300 VAC 251
PME271M Series Metallized Impregnated Paper, 275 VAC 259
PME264 Series Metallized Impregnated Paper, 660 VAC 269

Class Y2

F881 Series Metallized Polypropylene Film, 300 VAC 277
R41 Series Metallized Polypropylene Film, 300 VAC 291
PME271Y Series Metallized Impregnated Paper, 250 VAC 304
PME271Y A–E Series Metallized Impregnated Paper, 300 VAC 313
SMP253 Series Metallized Impregnated Paper, 250 VAC, Surface Mount Device 323

Class Y1

PME295 Series Metallized Impregnated Paper, 440 VAC/480 VAC 329
P295 Series Metallized Impregnated Paper, 500 VAC 338

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Multiple X & Y Combinations

PZB300 Series Metallized Impregnated Paper, 275 VAC Delta Configuration X2 + 2x Y2 347
PMZ2074 Series Metallized Impregnated Paper, 275 VAC 2x X2 with One Common Terminal 353
PHZ9004 Series Metallized Polypropylene Film, 300 VAC 3x X2 with Separate Terminals for Three-Phase Filtering 359

RC Snubber Networks

F43 Series Metallized Polypropylene Film, 160 VAC/250 VDC, 200 VAC/400 VDC, 220 VAC/630 VDC & Class X2, 275 VAC 367
PMR205 Series Metallized Impregnated Paper, 125 VAC/250 VDC 375
PMR209 Series Metallized Impregnated Paper, Class X2, 250 VAC 383
P409 Series Metallized Impregnated Paper, Class X2, 275 VAC 392
PMR210 Series Metallized Impregnated Paper, Class X1, 250 VAC 401
P410 Series Metallized Impregnated Paper, Class X1, 300 VAC 409
PMZ2035 Series Metallized Impregnated Paper, Class X1, 440 VAC/1,000 VDC 417

Packaging Information

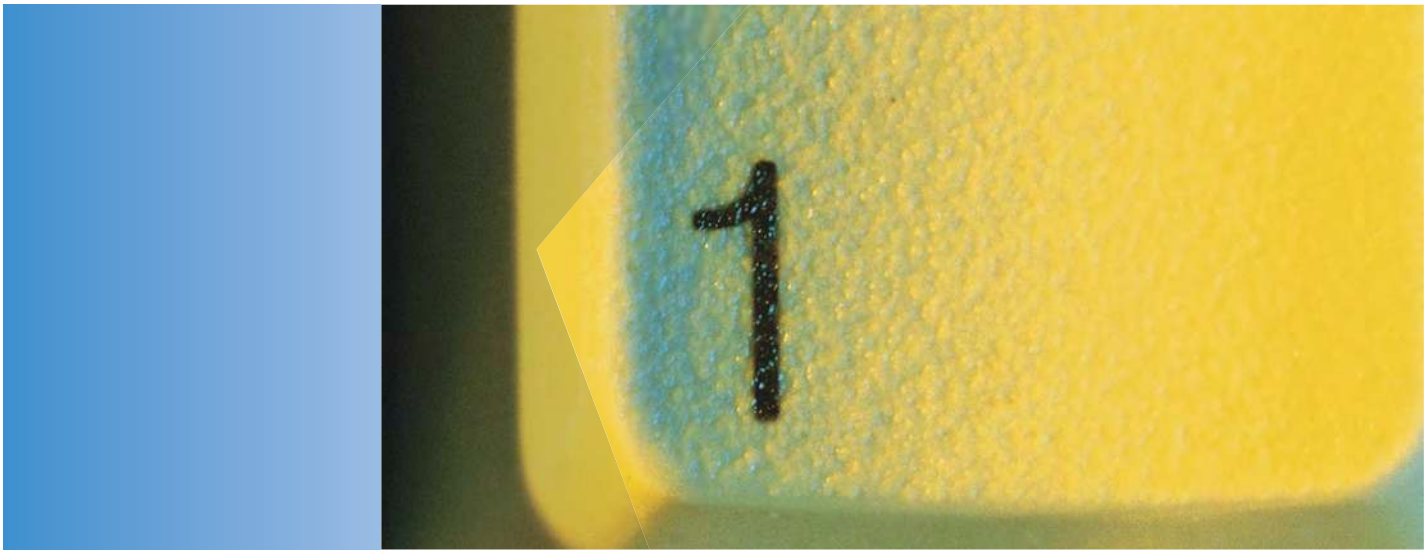
Lead Taping & Packaging for Pxxx, PMExxx & PMRxxx (IEC 60286–2) 425
Lead Taping & Packaging for F8xx, R4x + R, R4x, PHExxx, & F43 (IEC 60286–2) 427

Packaging Information for SMP253 is product-specific and included within the appropriate product sections.

KEMET Corporation Sales Offices 429

Disclaimer 430

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About KEMET.

KEMET Corporation is a leading global supplier of electronic components. We offer our customers the broadest selection of capacitor technologies in the industry across multiple dielectrics, along with an expanding range of electromechanical devices, and electromagnetic compatibility solutions. Our vision is to be the preferred supplier of electronic component solutions for customers demanding the highest standards of quality, delivery and service.

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F871 Series Polypropylene Metallized Film, Class X1, 330 VAC

Overview

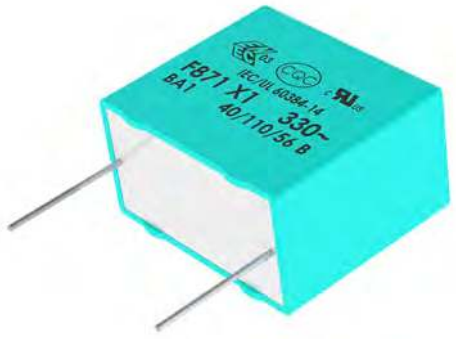
The F871 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material recognized to UL 94 V–0.

Applications

For worldwide use as electromagnetic interference (EMI) suppression filter in across-the-line applications requiring X1 safety classification. Not for use in "series with mains" type applications.

Benefits

- Approvals: ENEC, UL, cUL, CQC
- Rated voltage: 330 VAC 50/60 Hz
- Capacitance range: 0.001 – 8.2 µF
- Lead spacing: 10 – 37.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category 40/110/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 2,500 VDC



Part Number System

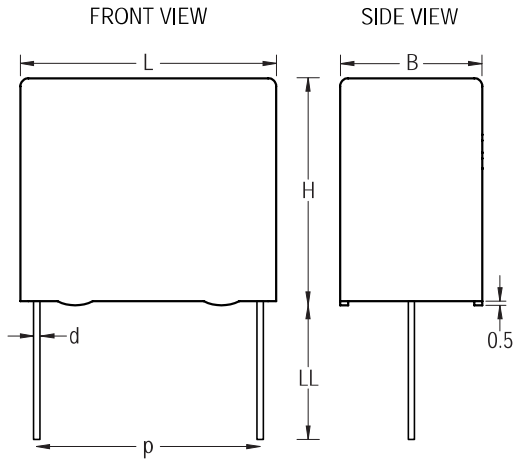
F	871	B	K	104	M	330	C
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Voltage (VAC)	Packaging
F = Film	X1, Metallized Polypropylene	A = 10 B = 15 D = 22.5 F = 27.5 R = 37.5	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	K = ±10% M = ±20%	330	See Ordering Options Table

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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
10	Standard Lead and Packaging Options		
	Bulk (Bag)–Short Leads	4 +2/-0	C
	Bulk (Bag)–Long Leads	17 +0/-1	A
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L
	Other Lead and Packaging Options		
	Bulk (Bag)–Max Length Leads	20 +5/-0	ALL0L
	Ammo Pack	H_0= 18.5 +/-0.5	R
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P
15	Standard Lead and Packaging Options		
	Bulk (Bag)–Short Leads	4 +2/-0	C
	Bulk (Bag)–Long Leads	17 +0/-1	A
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L
	Pizza Pack	4 +2/-0	Z
	Other Lead and Packaging Options		
	Bulk (Bag)–Max Length Leads	25 +5/-0	ALR0L
	Ammo Pack	H_0= 18.5 +/-0.5	R
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P
22.5	Standard Lead and Packaging Options		
	Pizza – Long Leads	17 +0/-1	ZLH0J
	Pizza Pack	4 +2/-0	Z
	Other Lead and Packaging Options		
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P
	Ammo Pack	H_0= 18.5 +/-0.5	R
27.5	Standard Lead and Packaging Options		
	Pizza – Long Leads	17 +0/-1	ZLH0J
	Pizza Pack	4 +2/-0	Z
37.5	Standard Lead and Packaging Options		
	Pizza – Long Leads	17 +0/-1	ZLH0J
	Pizza Pack	4 +2/-0	Z

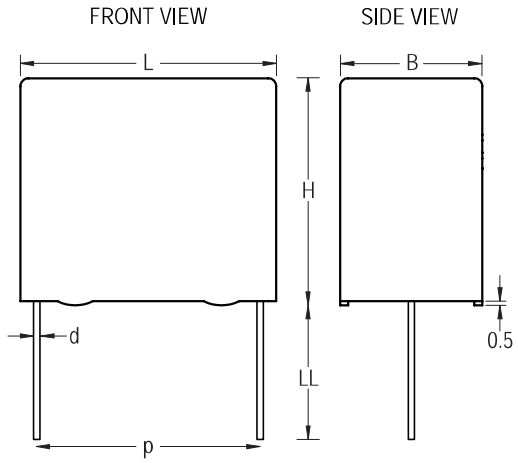
Dimensions – Millimeters



Size Code	Version	p		B		H		L		d	
		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
AG		10.0	+/-0.4	4.0	Maximum	9.0	Maximum	13.0	Maximum	0.6	+/-0.05
AK		10.0	+/-0.4	5.0	Maximum	11.0	Maximum	13.0	Maximum	0.6	+/-0.05
AP		10.0	+/-0.4	6.0	Maximum	12.0	Maximum	13.0	Maximum	0.6	+/-0.05
AO		10.0	+/-0.4	7.0	Maximum	17.0	Maximum	13.0	Maximum	0.6	+/-0.05
AL	Low Profile	10.0	+/-0.4	9.5	Maximum	7.5	Maximum	13.0	Maximum	0.6	+/-0.05
AE	Special Version	10.0	+/-0.4	4.0	Maximum	8.0	Maximum	13.0	Maximum	0.6	+/-0.05
BB		15.0	+/-0.4	4.0	Maximum	10.0	Maximum	18.0	Maximum	0.8	+/-0.05
BC		15.0	+/-0.4	5.0	Maximum	11.0	Maximum	18.0	Maximum	0.8	+/-0.05
BE		15.0	+/-0.4	5.5	Maximum	12.5	Maximum	18.0	Maximum	0.8	+/-0.05
BG		15.0	+/-0.4	6.0	Maximum	12.0	Maximum	18.0	Maximum	0.8	+/-0.05
BI	High Profile	15.0	+/-0.4	6.0	Maximum	17.5	Maximum	18.0	Maximum	0.8	+/-0.05
BK		15.0	+/-0.4	7.5	Maximum	13.5	Maximum	18.0	Maximum	0.8	+/-0.05
BO	High Profile	15.0	+/-0.4	7.5	Maximum	18.5	Maximum	18.0	Maximum	0.8	+/-0.05
BP		15.0	+/-0.4	8.5	Maximum	14.5	Maximum	18.0	Maximum	0.8	+/-0.05
BT		15.0	+/-0.4	9.0	Maximum	12.5	Maximum	18.0	Maximum	0.8	+/-0.05
BS		15.0	+/-0.4	10.0	Maximum	16.0	Maximum	18.0	Maximum	0.8	+/-0.05
BY		15.0	+/-0.4	11.0	Maximum	19.0	Maximum	18.0	Maximum	0.8	+/-0.05
BZ	Special Version	15.0	+/-0.4	12.0	Maximum	20.0	Maximum	18.0	Maximum	0.8	+/-0.05
BR	Low Profile	15.0	+/-0.4	13.0	Maximum	12.0	Maximum	18.0	Maximum	0.8	+/-0.05
DB		22.5	+/-0.4	6.0	Maximum	14.5	Maximum	26.0	Maximum	0.8	+/-0.05
DI		22.5	+/-0.4	7.0	Maximum	16.0	Maximum	26.0	Maximum	0.8	+/-0.05
DH		22.5	+/-0.4	8.0	Maximum	16.0	Maximum	26.0	Maximum	0.8	+/-0.05
DJ		22.5	+/-0.4	8.5	Maximum	17.0	Maximum	26.0	Maximum	0.8	+/-0.05
DM		22.5	+/-0.4	9.0	Maximum	18.5	Maximum	26.0	Maximum	0.8	+/-0.05
DO		22.5	+/-0.4	10.0	Maximum	18.5	Maximum	26.0	Maximum	0.8	+/-0.05
DP		22.5	+/-0.4	11.0	Maximum	20.0	Maximum	26.0	Maximum	0.8	+/-0.05
DU		22.5	+/-0.4	13.0	Maximum	22.0	Maximum	26.0	Maximum	0.8	+/-0.05
DY		22.5	+/-0.4	15.5	Maximum	24.5	Maximum	26.0	Maximum	0.8	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Dimensions – Millimeters cont'd



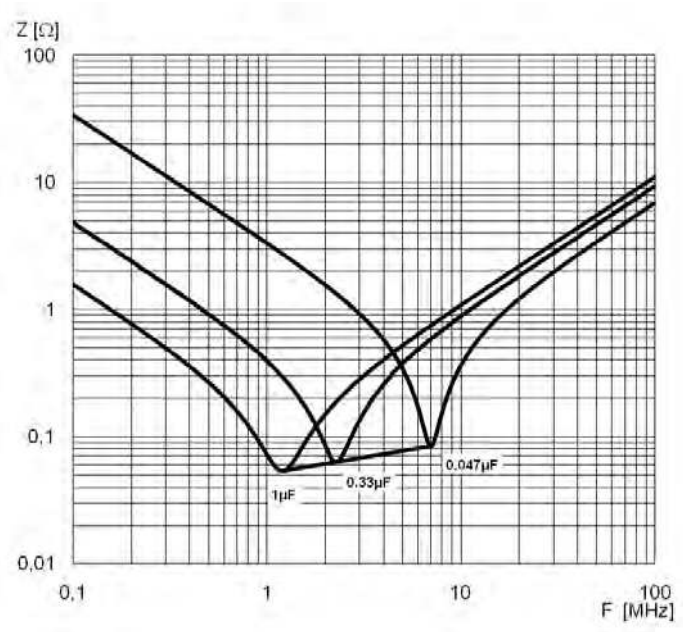
Size Code	Version	p		B		H		L		d	
		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
FB		27.5	+/-0.4	9.0	Maximum	17.0	Maximum	31.5	Maximum	0.8	+/-0.05
FC		27.5	+/-0.4	11.0	Maximum	20.0	Maximum	31.5	Maximum	0.8	+/-0.05
FI		27.5	+/-0.4	13.0	Maximum	25.0	Maximum	31.5	Maximum	0.8	+/-0.05
FN		27.5	+/-0.4	14.0	Maximum	28.0	Maximum	31.5	Maximum	0.8	+/-0.05
FO	High Profile	27.5	+/-0.4	17.0	Maximum	40.0	Maximum	31.5	Maximum	0.8	+/-0.05
FR		27.5	+/-0.4	17.5	Maximum	28.0	Maximum	31.5	Maximum	0.8	+/-0.05
FS		27.5	+/-0.4	19.0	Maximum	29.0	Maximum	31.5	Maximum	0.8	+/-0.05
FY		27.5	+/-0.4	22.0	Maximum	37.0	Maximum	31.5	Maximum	0.8	+/-0.05
FH	Low Profile	27.5	+/-0.4	21.0	Maximum	12.5	Maximum	31.5	Maximum	0.8	+/-0.05
FQ	Low Profile	27.5	+/-0.4	27.5	Maximum	16.0	Maximum	31.5	Maximum	0.8	+/-0.05
FT	Low Profile	27.5	+/-0.4	31.0	Maximum	19.0	Maximum	31.5	Maximum	0.8	+/-0.05
RB		37.5	+/-0.4	11.0	Maximum	22.0	Maximum	41.0	Maximum	1	+/-0.05
RF		37.5	+/-0.4	13.0	Maximum	24.0	Maximum	41.0	Maximum	1	+/-0.05
RH		37.5	+/-0.4	15.0	Maximum	26.0	Maximum	41.0	Maximum	1	+/-0.05
RC		37.5	+/-0.4	16.0	Maximum	28.5	Maximum	41.0	Maximum	1	+/-0.05
RD		37.5	+/-0.4	19.0	Maximum	32.0	Maximum	41.0	Maximum	1	+/-0.05
RP		37.5	+/-0.4	21.0	Maximum	38.0	Maximum	41.0	Maximum	1	+/-0.05
RO		37.5	+/-0.4	24.0	Maximum	44.0	Maximum	41.0	Maximum	1	+/-0.05
RU		37.5	+/-0.4	30.0	Maximum	45.0	Maximum	41.0	Maximum	1	+/-0.05
RV	Low Profile	37.5	+/-0.4	24.0	Maximum	15.0	Maximum	41.0	Maximum	1	+/-0.05
RW	Low Profile	37.5	+/-0.4	24.0	Maximum	19.0	Maximum	41.0	Maximum	1	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Rated Voltage	330 VAC 50/60 Hz		
Capacitance Range	0.001 – 8.2 µF		
Capacitance Tolerance	±20%, ±10%		
Temperature Range	-40°C to +110°C		
Climatic Category	40/110/56		
Approvals	ENEC, UL, cUL, CQC		
Dissipation Factor	Maximum Values at +23°C		
		C ≤ 0.1 µF	C > 0.1 µF
	1 kHz	0.3%	0.2%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,500 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.		
Insulation Resistance	Between Terminals:		
	C ≤ 0.33 µF	≥ 30,000 MΩ	
	C > 0.33 µF	≥ 10,000 MΩ • µF	
In DC Applications	Recommended voltage ≤ 800 VDC		

Impedance Graph



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 4 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384–14	CA08.00186
	UL 60384–14 and CAN/CSA–E60384–14	E97797
	IEC 60384-14	CQC12001084008 CQC12001084009 CQC12001084010 CQC12001084012 CQC12001086291 CQC12001086290

Environmental Compliance

All new KEMET EMI capacitors are RoHS Compliant and Halogen Free.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Size Code	Maximum Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	Part Number
		B	H	L			
0.001	AE	4	8	13	10	500	F871AE102(1)330(2)
0.0012	AE	4	8	13	10	500	F871AE122(1)330(2)
0.0015	AE	4	8	13	10	500	F871AE152(1)330(2)
0.0018	AE	4	8	13	10	500	F871AE182(1)330(2)
0.0018	AL	9.5	7.5	13	10	500	F871AL182(1)330(2)
0.0022	AE	4	8	13	10	500	F871AE222(1)330(2)
0.0022	AL	9.5	7.5	13	10	500	F871AL222(1)330(2)
0.0025	AE	4	8	13	10	500	F871AE252(1)330(2)
0.0025	AL	9.5	7.5	13	10	500	F871AL252(1)330(2)
0.0027	AE	4	8	13	10	500	F871AE272(1)330(2)
0.0027	AL	9.5	7.5	13	10	500	F871AL272(1)330(2)
0.0033	AE	4	8	13	10	500	F871AE332(1)330(2)
0.0033	AL	9.5	7.5	13	10	500	F871AL332(1)330(2)
0.0039	AE	4	8	13	10	500	F871AE392(1)330(2)
0.0039	AL	9.5	7.5	13	10	500	F871AL392(1)330(2)
0.0047	AE	4	8	13	10	500	F871AE472(1)330(2)
0.0047	AL	9.5	7.5	13	10	500	F871AL472(1)330(2)
0.0056	AE	4	8	13	10	500	F871AE562(1)330(2)
0.0056	AL	9.5	7.5	13	10	500	F871AL562(1)330(2)
0.0068	AE	4	8	13	10	500	F871AE682(1)330(2)
0.0068	AL	9.5	7.5	13	10	500	F871AL682(1)330(2)
0.0082	AE	4	8	13	10	500	F871AE822(1)330(2)
0.0082	AL	9.5	7.5	13	10	500	F871AL822(1)330(2)
0.01	AE	4	8	13	10	500	F871AE103(3)330(2)
0.01	AG	4	9	13	10	500	F871AG103(1)330(2)
0.01	AL	9.5	7.5	13	10	500	F871AL103(1)330(2)
0.012	AG	4	9	13	10	500	F871AG123(1)330(2)
0.012	AL	9.5	7.5	13	10	500	F871AL123(1)330(2)
0.015	AK	5	11	13	10	500	F871AK153(1)330(2)
0.015	AL	9.5	7.5	13	10	500	F871AL153(1)330(2)
0.018	AK	5	11	13	10	500	F871AK183(1)330(2)
0.018	AL	9.5	7.5	13	10	500	F871AL183(1)330(2)
0.022	AK	5	11	13	10	500	F871AK223(3)330(2)
0.022	AL	9.5	7.5	13	10	500	F871AL223(1)330(2)
0.022	AP	6	12	13	10	500	F871AP223(1)330(2)
0.025	AL	9.5	7.5	13	10	500	F871AL253(1)330(2)
0.025	AP	6	12	13	10	500	F871AP253(1)330(2)
0.027	AL	9.5	7.5	13	10	500	F871AL273(1)330(2)
0.027	AP	6	12	13	10	500	F871AP273(1)330(2)
0.033	AO	7	17	13	10	500	F871AO333(1)330(2)
0.033	AP	6	12	13	10	500	F871AP333(3)330(2)
0.035	AO	7	17	13	10	500	F871AO353(1)330(2)
0.039	AO	7	17	13	10	500	F871AO393(1)330(2)
0.047	AO	7	17	13	10	500	F871AO473(3)330(2)
0.0027	BB	4	10	18	15	400	F871BB272(1)330(2)
0.0033	BB	4	10	18	15	400	F871BB332(1)330(2)
0.0039	BB	4	10	18	15	400	F871BB392(1)330(2)
0.0047	BB	4	10	18	15	400	F871BB472(1)330(2)
0.0056	BB	4	10	18	15	400	F871BB562(1)330(2)
0.0068	BB	4	10	18	15	400	F871BB682(1)330(2)
0.0082	BB	4	10	18	15	400	F871BB822(1)330(2)
0.01	BB	4	10	18	15	400	F871BB103(1)330(2)
0.012	BB	4	10	18	15	400	F871BB123(1)330(2)
0.015	BB	4	10	18	15	400	F871BB153(1)330(2)
0.018	BB	4	10	18	15	400	F871BB183(1)330(2)
0.022	BB	4	10	18	15	400	F871BB223(1)330(2)
0.025	BB	4	10	18	15	400	F871BB253(1)330(2)
0.027	BB	4	10	18	15	400	F871BB273(1)330(2)
Capacitance Value (µF)	Size Code	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	Part Number

(1) M = ±20%, K = ±10%.
(2) Insert lead and packaging code. See table for available options.
(3) M = ±20% (only available tolerance).

Table 1 – Ratings & Part Number Reference cont'd

Capacitance Value (µF)	Size Code	Maximum Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	Part Number
		B	H	L			
0.033	BB	4	10	18	15	400	F871BB333(3)330(2)
0.033	BC	5	11	18	15	400	F871BC333(1)330(2)
0.039	BC	5	11	18	15	400	F871BC393(1)330(2)
0.047	BC	5	11	18	15	400	F871BC473(3)330(2)
0.047	BE	5.5	12.5	18	15	400	F871BE473(1)330(2)
0.056	BE	5.5	12.5	18	15	400	F871BE563(1)330(2)
0.068	BE	5.5	12.5	18	15	400	F871BE683(3)330(2)
0.068	BG	6	12	18	15	400	F871BG683(1)330(2)
0.082	BI	6	17.5	18	15	400	F871BI823(1)330(2)
0.082	BK	7.5	13.5	18	15	400	F871BK823(1)330(2)
0.082	BR	13	12	18	15	400	F871BR823(1)330(2)
0.082	BT	9	12.5	18	15	400	F871BT823(1)330(2)
0.1	BI	6	17.5	18	15	400	F871BI104(1)330(2)
0.1	BK	7.5	13.5	18	15	400	F871BK104(1)330(2)
0.1	BR	13	12	18	15	400	F871BR104(1)330(2)
0.1	BT	9	12.5	18	15	400	F871BT104(1)330(2)
0.12	BI	6	17.5	18	15	400	F871BI124(1)330(2)
0.12	BK	7.5	13.5	18	15	400	F871BK124(3)330(2)
0.12	BP	8.5	14.5	18	15	400	F871BP124(1)330(2)
0.12	BR	13	12	18	15	400	F871BR124(1)330(2)
0.12	BT	9	12.5	18	15	400	F871BT124(3)330(2)
0.15	BO	7.5	18.5	18	15	400	F871BO154(1)330(2)
0.15	BP	8.5	14.5	18	15	400	F871BP154(3)330(2)
0.15	BR	13	12	18	15	400	F871BR154(1)330(2)
0.18	BO	7.5	18.5	18	15	400	F871BO184(3)330(2)
0.18	BR	13	12	18	15	400	F871BR184(1)330(2)
0.18	BS	10	16	18	15	400	F871BS184(1)330(2)
0.22	BY	11	19	18	15	400	F871BY224(1)330(2)
0.25	BY	11	19	18	15	400	F871BY254(3)330(2)
0.25	BZ	12	20	18	15	400	F871BZ254(1)330(2)
0.27	BY	11	19	18	15	400	F871BY274(3)330(2)
0.27	BZ	12	20	18	15	400	F871BZ274(1)330(2)
0.039	DB	6	14.5	26	22.5	200	F871DB393(1)330(2)
0.047	DB	6	14.5	26	22.5	200	F871DB473(1)330(2)
0.056	DB	6	14.5	26	22.5	200	F871DB563(1)330(2)
0.068	DB	6	14.5	26	22.5	200	F871DB683(1)330(2)
0.082	DB	6	14.5	26	22.5	200	F871DB823(1)330(2)
0.1	DB	6	14.5	26	22.5	200	F871DB104(1)330(2)
0.12	DB	6	14.5	26	22.5	200	F871DB124(1)330(2)
0.15	DB	6	14.5	26	22.5	200	F871DB154(3)330(2)
0.15	DI	7	16	26	22.5	200	F871DI154(1)330(2)
0.18	DI	7	16	26	22.5	200	F871DI184(1)330(2)
0.22	DI	7	16	26	22.5	200	F871DI224(1)330(2)
0.25	DH	8	16	26	22.5	200	F871DH254(1)330(2)
0.27	DH	8	16	26	22.5	200	F871DH274(3)330(2)
0.33	DJ	8.5	17	26	22.5	200	F871DJ334(3)330(2)
0.33	DM	9	18.5	26	22.5	200	F871DM334(1)330(2)
0.39	DM	9	18.5	26	22.5	200	F871DM394(3)330(2)
0.39	DO	10	18.5	26	22.5	200	F871DO394(1)330(2)
0.47	DO	10	18.5	26	22.5	200	F871DO474(3)330(2)
0.47	DP	11	20	26	22.5	200	F871DP474(1)330(2)
0.56	DP	11	20	26	22.5	200	F871DP564(3)330(2)
0.68	DU	13	22	26	22.5	200	F871DU684(1)330(2)
0.82	DU	13	22	26	22.5	200	F871DU824(3)330(2)
0.82	DY	15.5	24.5	26	22.5	200	F871DY824(1)330(2)
1	DY	15.5	24.5	26	22.5	200	F871DY105(1)330(2)
0.15	FC	11	20	31.5	27.5	150	F871FC154(1)330(2)
0.18	FC	11	20	31.5	27.5	150	F871FC184(1)330(2)
Capacitance Value (µF)	Size Code	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	Part Number

(1) M = ±20%, K = ±10%.
(2) Insert lead and packaging code. See table for available options.
(3) M = ±20% (only available tolerance).

Table 1 – Ratings & Part Number Reference cont'd

Capacitance Value (µF)	Size Code	Maximum Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	Part Number
		B	H	L			
0.22	FB	9	17	31.5	27.5	150	F871FB224(1)330(2)
0.25	FB	9	17	31.5	27.5	150	F871FB254(1)330(2)
0.25	FH	21	12.5	31.5	27.5	150	F871FH254(1)330(2)
0.27	FB	9	17	31.5	27.5	150	F871FB274(1)330(2)
0.27	FH	21	12.5	31.5	27.5	150	F871FH274(1)330(2)
0.33	FB	9	17	31.5	27.5	150	F871FB334(1)330(2)
0.33	FH	21	12.5	31.5	27.5	150	F871FH334(1)330(2)
0.39	FB	9	17	31.5	27.5	150	F871FB394(1)330(2)
0.39	FH	21	12.5	31.5	27.5	150	F871FH394(1)330(2)
0.47	FC	11	20	31.5	27.5	150	F871FC474(1)330(2)
0.47	FH	21	12.5	31.5	27.5	150	F871FH474(1)330(2)
0.56	FC	11	20	31.5	27.5	150	F871FC564(1)330(2)
0.56	FH	21	12.5	31.5	27.5	150	F871FH564(1)330(2)
0.68	FC	11	20	31.5	27.5	150	F871FC684(1)330(2)
0.68	FH	21	12.5	31.5	27.5	150	F871FH684(1)330(2)
0.82	FI	13	25	31.5	27.5	150	F871FI824(1)330(2)
1	FI	13	25	31.5	27.5	150	F871FI105(1)330(2)
1.2	FN	14	28	31.5	27.5	150	F871FN125(3)330(2)
1.2	FQ	27.5	16	31.5	27.5	150	F871FQ125(1)330(2)
1.5	FR	17.5	28	31.5	27.5	150	F871FR155(1)330(2)
1.5	FT	31	19	31.5	27.5	150	F871FT155(1)330(2)
1.8	FO	17	40	31.5	27.5	150	F871FO185(1)330(2)
1.8	FR	17.5	28	31.5	27.5	150	F871FR185(3)330(2)
1.8	FS	19	29	31.5	27.5	150	F871FS185(1)330(2)
1.8	FT	31	19	31.5	27.5	150	F871FT185(1)330(2)
2.2	FO	17	40	31.5	27.5	150	F871FO225(3)330(2)
2.2	FY	22	37	31.5	27.5	150	F871FY225(1)330(2)
2.5	FY	22	37	31.5	27.5	150	F871FY255(1)330(2)
2.7	FY	22	37	31.5	27.5	150	F871FY275(1)330(2)
3.3	FY	22	37	31.5	27.5	150	F871FY335(3)330(2)
0.33	RB	11	22	41	37.5	100	F871RB334(1)330(2)
0.39	RB	11	22	41	37.5	100	F871RB394(1)330(2)
0.47	RB	11	22	41	37.5	100	F871RB474(1)330(2)
0.56	RB	11	22	41	37.5	100	F871RB564(1)330(2)
0.56	RV	24	15	41	37.5	100	F871RV564(1)330(2)
0.68	RB	11	22	41	37.5	100	F871RB684(1)330(2)
0.68	RV	24	15	41	37.5	100	F871RV684(1)330(2)
0.82	RB	11	22	41	37.5	100	F871RB824(1)330(2)
0.82	RV	24	15	41	37.5	100	F871RV824(1)330(2)
1	RB	11	22	41	37.5	100	F871RB105(1)330(2)
1	RV	24	15	41	37.5	100	F871RV105(1)330(2)
1.2	RF	13	24	41	37.5	100	F871RF125(1)330(2)
1.2	RV	24	15	41	37.5	100	F871RV125(3)330(2)
1.5	RF	13	24	41	37.5	100	F871RF155(1)330(2)
1.5	RH	15	26	41	37.5	100	F871RH155(1)330(2)
1.5	RV	24	15	41	37.5	100	F871RV155(1)330(2)
1.8	RH	15	26	41	37.5	100	F871RH185(1)330(2)
1.8	RW	24	19	41	37.5	100	F871RW185(1)330(2)
2.2	RC	16	28.5	41	37.5	100	F871RC225(1)330(2)
2.2	RW	24	19	41	37.5	100	F871RW225(3)330(2)
2.5	RD	19	32	41	37.5	100	F871RD255(1)330(2)
2.5	RW	24	19	41	37.5	100	F871RW255(3)330(2)
2.7	RD	19	32	41	37.5	100	F871RD275(1)330(2)
2.7	RW	24	19	41	37.5	100	F871RW275(3)330(2)
3.3	RD	19	32	41	37.5	100	F871RD335(1)330(2)
3.3	RP	21	38	41	37.5	100	F871RP335(1)330(2)
3.9	RP	21	38	41	37.5	100	F871RP395(1)330(2)
4.7	RP	21	38	41	37.5	100	F871RP475(1)330(2)
Capacitance Value (µF)	Size Code	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	Part Number

(1) M = ±20%, K = ±10%.
(2) Insert lead and packaging code. See table for available options.
(3) M = ±20% (only available tolerance).

Table 1 – Ratings & Part Number Reference cont'd

Capacitance Value (µF)	Size Code	Maximum Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	Part Number
		B	H	L			
4.7	RO	24	44	41	37.5	100	F871RO475(1)330(2)
5.6	RO	24	44	41	37.5	100	F871RO565(1)330(2)
6.8	RO	24	44	41	37.5	100	F871RO685(3)330(2)
6.8	RU	30	45	41	37.5	100	F871RU685(1)330(2)
8.2	RU	30	45	41	37.5	100	F871RU825(3)330(2)
Capacitance Value (µF)	Size Code	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	Part Number

(1) M = ±20%, K = ±10%.
(2) Insert lead and packaging code. See table for available options.
(3) M = ±20% (only available tolerance).

Soldering Process

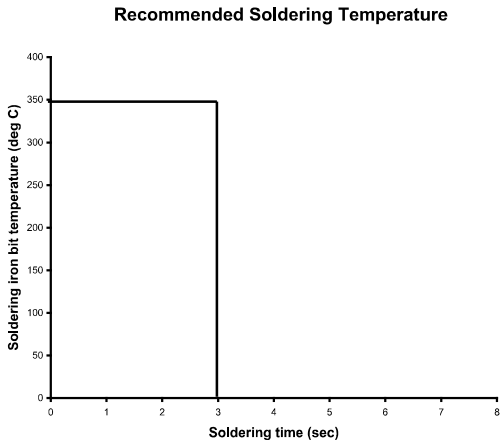
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

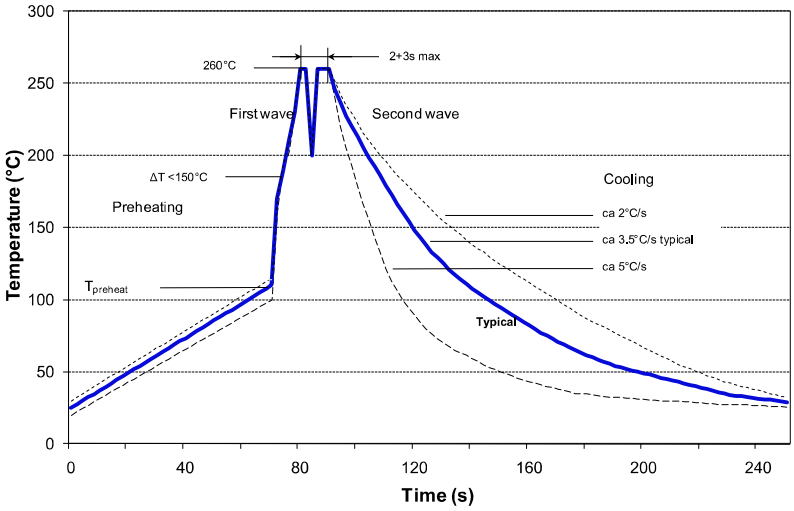
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

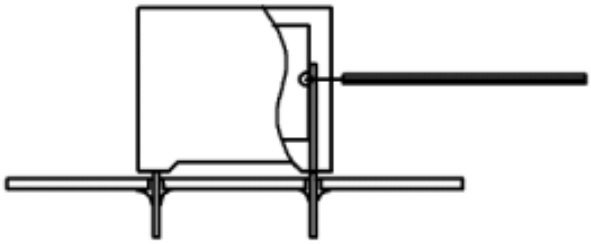
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



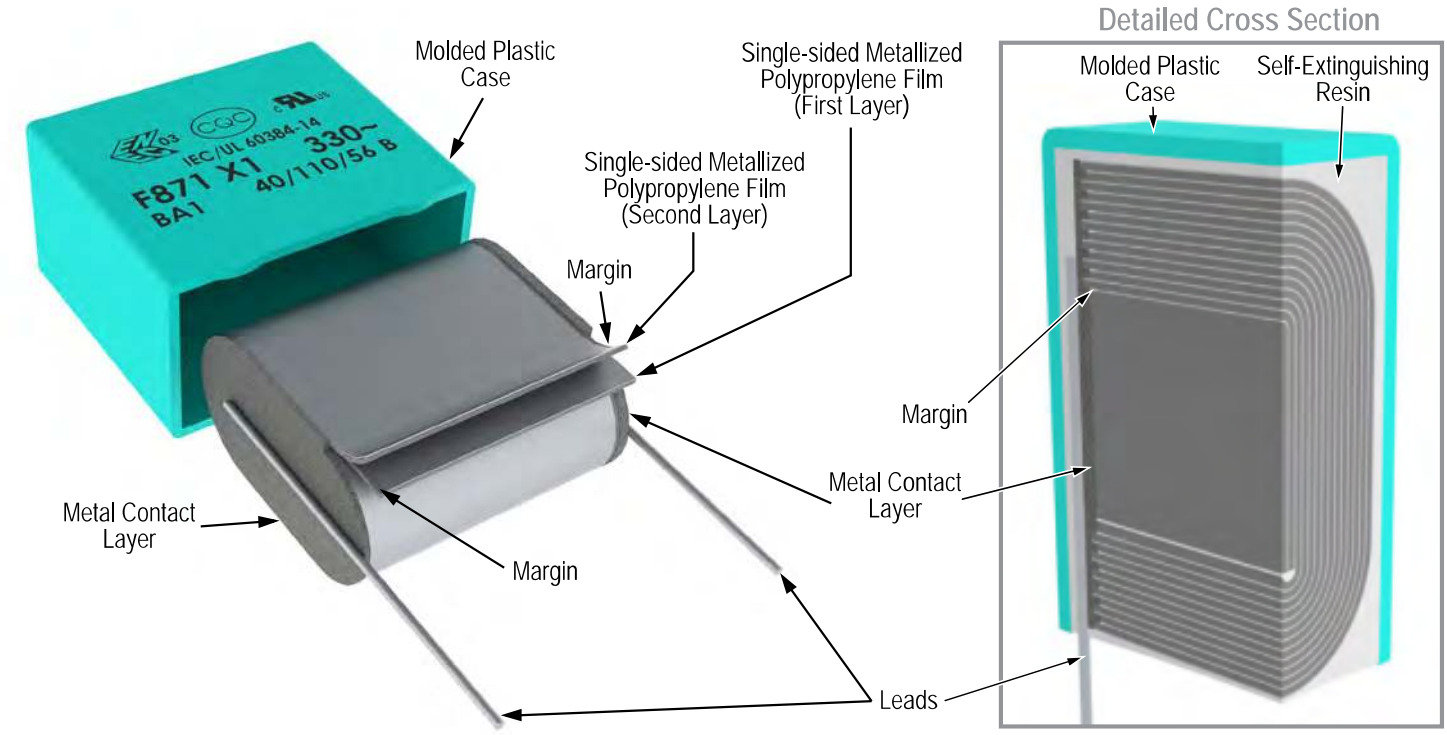
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

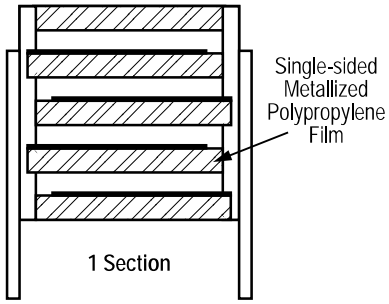
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

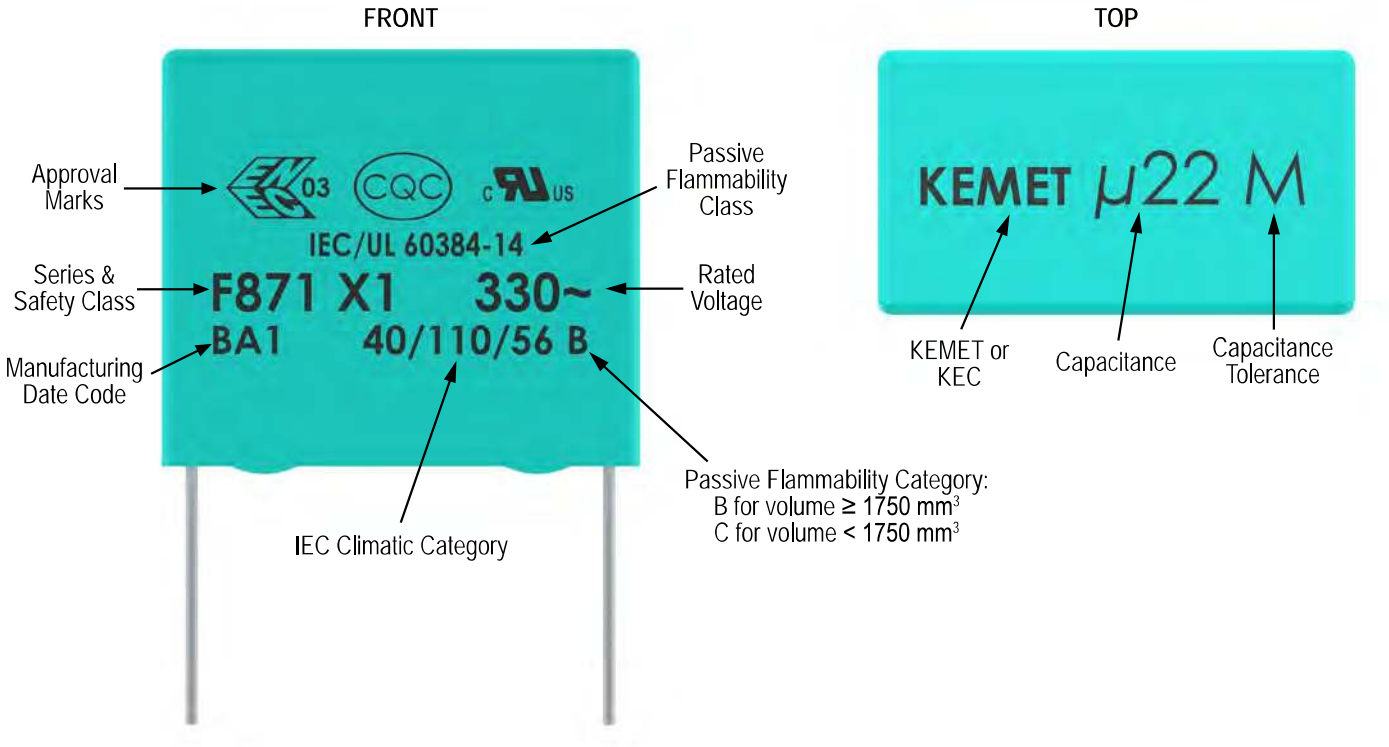
Construction



Winding Scheme



Marking


FRONT
TOP
Approval Marks
Passive Flammability Class
IEC/UL 60384-14
Series & Safety Class
F871 X1
330~
Rated Voltage
Manufacturing Date Code
BA1
40/110/56 B
IEC Climatic Category
Passive Flammability Category:
B for volume ≥ 1750 mm³
C for volume < 1750 mm³
KEMET μ22 M
KEMET or KEC
Capacitance
Capacitance Tolerance

Packaging Quantities

Size Code	Lead Spacing	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo	Pizza
AN	10	3.5	9	13	2200	3200	850	1700	1150	
AG		4	9	13	2000	2200	750	1500	1000	
AK		5	11	13	1300	2000	600	1250	800	
AP		6	12	13	1000	1800	500	1000	680	
AO		7	17	13	600	900	450	900	580	
AL		9.5	7.5	13	1100	2000	300	600	430	
AE		4	8	13	2000	2200	750	1500	1000	
BB	15	4	10	18	1300	1500	750	1500	1000	1411
BC		5	11	18	1000	1250	600	1250	800	1139
BE		5.5	12.5	18	800	1100	550	1100	750	1020
BG		6	12	18	1750	1000	500	1000	680	935
BK		7.5	13.5	18	1000	800	350	800	500	748
BI		6	17.5	18	1000	800	500	1000	680	935
BP		8.5	14.5	18	1000	650	300	700	440	663
BT		9	12.5	18	1000	700	270	650	410	629
BO		7.5	18.5	18	900	600	350	800	500	748
BS		10	16	18	750	550	300	600	380	561
BR		13	12	18	750	520	200	480	280	425
BY		11	19	18	450	400	250	500	340	510
BA		8.5	12.5	18	1000	650	300	700	440	663
BZ		12	20	18	350	300	220	450	330	459
DB	22.5	6	14.5	26	1638	702	300	700	464	660
DI		7	16	26	1188	594	250	550	380	564
DH		8.0	16.0	26	1026	513	240	500	330	492
DJ		8.5	17	26	972	486	250	450	280	468
DM		9	18.5	26	918	459	200	400	300	444
DO		10	18.5	26	810	405	160	350	235	396
DP		11	20	26	756	378	190	350	217	360
DU		13	22	26	540	324	150	300	200	300
DY		15.5	24.5	26	450	270	120	250	170	252

Packaging Quantities cont'd

Size Code	Lead Spacing	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo	Pizza
FB	27.5	9.0	17.0	31.5	816	408				370
FC		11.0	20.0	31.5	672	336				300
FI		13.0	25.0	31.5	480	288				250
FN		14.0	28.0	31.5	352	176				230
FO		17.0	40.0	31.5	216	144				190
FR		17.5	28.0	31.5	256	128				190
FS		19.0	29.0	31.5	256	128				170
FY		22.0	37.0	31.5	168	112				150
FH		21.0	12.5	31.5	392	168				150
FQ		27.5	16.0	31.5	280	120				120
FT		31.0	19.0	31.5	240	120				100
RB	37.5	11.0	22.0	41.0	420	252				210
RF		13.0	24.0	41.0	360	216				175
RH		15.0	26.0	41.0	300	180				154
RC		16.0	28.5	41.0	216	108				140
RD		19.0	32.0	41.0	192	96				119
RP		21.0	38.0	41.0	126	84				105
RO		24.0	44.0	41.0	108	72				91
RU		30.0	45.0	41.0	90	60				77
RV		24.0	15.0	41.0	252	108				91
RW		24.0	19.0	41.0	216	108				91

F872 Series Metallized Polypropylene Film, Class X1, 480 VAC

Overview

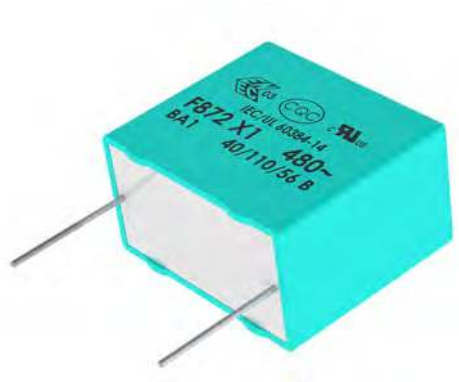
The F872 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material meeting the requirements of UL 94 V–0.

Applications

For worldwide use as electromagnetic interference (EMI) suppression filter in across-the-line applications requiring X1 safety classification.

Benefits

- Approvals: ENEC, UL, cUL, CQC
- Rated voltage: 480 VAC 50/60 Hz
- Capacitance range: 0.001 – 3.5 µF
- Lead spacing: 10 – 37.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category: 40/110/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 3,000 VDC



Part Number System

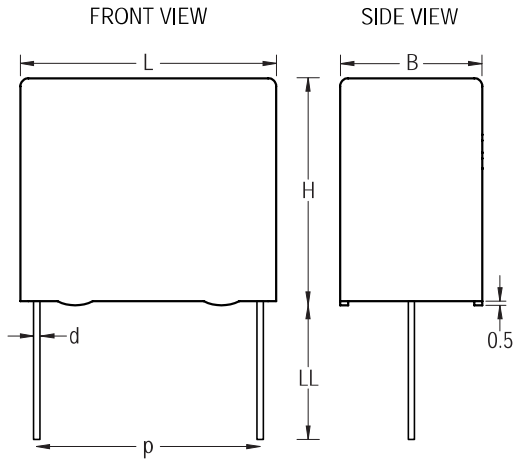
F	872	B	S	104	M	480	C
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Voltage (VAC)	Packaging
F = Film	X1, Metallized Polypropylene	A = 10 B = 15 D = 22.5 F = 27.5 R = 37.5	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	K = ±10% M = ±20%	480	See Ordering Options Table

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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
10	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	C
	Bulk (Bag) – Long Leads	17 +0/-1	A
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L
	Other Lead and Packaging Options		
	Bulk (Bag) – Max Length Leads	20 +5/-0	ALL0L
	Ammo Pack	H_0 = 18.5 +/-0.5	R
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	P
15	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	C
	Bulk (Bag) – Long Leads	17 +0/-1	A
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L
	Pizza Pack	4 +2/-0	Z
	Other Lead and Packaging Options		
	Bulk (Bag) – Max Length Leads	25 +5/-0	ALR0L
	Ammo Pack	H_0 = 18.5 +/-0.5	R
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	P
22.5	Standard Lead and Packaging Options		
	Pizza – Long Leads	17 +0/-1	ZLH0J
	Pizza Pack	4 +2/-0	Z
	Other Lead and Packaging Options		
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	P
	Ammo Pack	H_0 = 18.5 +/-0.5	R
27.5	Standard Lead and Packaging Options		
	Pizza – Long Leads	17 +0/-1	ZLH0J
	Pizza Pack	4 +2/-0	Z
37.5	Standard Lead and Packaging Options		
	Pizza – Long Leads	17 +0/-1	ZLH0J
	Pizza Pack	4 +2/-0	Z

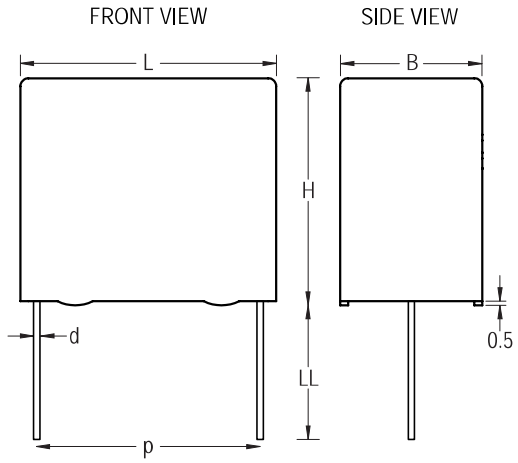
Dimensions – Millimeters



Size Code	Version	p		B		H		L		d	
		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
AG		10.0	+/-0.4	4.0	Maximum	9.0	Maximum	13.0	Maximum	0.6	+/-0.05
AK		10.0	+/-0.4	5.0	Maximum	11.0	Maximum	13.0	Maximum	0.6	+/-0.05
AP		10.0	+/-0.4	6.0	Maximum	12.0	Maximum	13.0	Maximum	0.6	+/-0.05
AO		10.0	+/-0.4	7.0	Maximum	17.0	Maximum	13.0	Maximum	0.6	+/-0.05
AL	Low Profile	10.0	+/-0.4	9.5	Maximum	7.5	Maximum	13.0	Maximum	0.6	+/-0.05
AE	Special Version	10.0	+/-0.4	4.0	Maximum	8.0	Maximum	13.0	Maximum	0.6	+/-0.05
BB		15.0	+/-0.4	4.0	Maximum	10.0	Maximum	18.0	Maximum	0.8	+/-0.05
BC		15.0	+/-0.4	5.0	Maximum	11.0	Maximum	18.0	Maximum	0.8	+/-0.05
BE		15.0	+/-0.4	5.5	Maximum	12.5	Maximum	18.0	Maximum	0.8	+/-0.05
BG		15.0	+/-0.4	6.0	Maximum	12.0	Maximum	18.0	Maximum	0.8	+/-0.05
BI	High Profile	15.0	+/-0.4	6.0	Maximum	17.5	Maximum	18.0	Maximum	0.8	+/-0.05
BK		15.0	+/-0.4	7.5	Maximum	13.5	Maximum	18.0	Maximum	0.8	+/-0.05
BO	High Profile	15.0	+/-0.4	7.5	Maximum	18.5	Maximum	18.0	Maximum	0.8	+/-0.05
BP		15.0	+/-0.4	8.5	Maximum	14.5	Maximum	18.0	Maximum	0.8	+/-0.05
BT		15.0	+/-0.4	9.0	Maximum	12.5	Maximum	18.0	Maximum	0.8	+/-0.05
BS		15.0	+/-0.4	10.0	Maximum	16.0	Maximum	18.0	Maximum	0.8	+/-0.05
BY		15.0	+/-0.4	11.0	Maximum	19.0	Maximum	18.0	Maximum	0.8	+/-0.05
BZ	Special Version	15.0	+/-0.4	12.0	Maximum	20.0	Maximum	18.0	Maximum	0.8	+/-0.05
BR	Low Profile	15.0	+/-0.4	13.0	Maximum	12.0	Maximum	18.0	Maximum	0.8	+/-0.05
DB		22.5	+/-0.4	6.0	Maximum	14.5	Maximum	26.0	Maximum	0.8	+/-0.05
DI		22.5	+/-0.4	7.0	Maximum	16.0	Maximum	26.0	Maximum	0.8	+/-0.05
DH		22.5	+/-0.4	8.0	Maximum	16.0	Maximum	26.0	Maximum	0.8	+/-0.05
DJ		22.5	+/-0.4	8.5	Maximum	17.0	Maximum	26.0	Maximum	0.8	+/-0.05
DM		22.5	+/-0.4	9.0	Maximum	18.5	Maximum	26.0	Maximum	0.8	+/-0.05
DO		22.5	+/-0.4	10.0	Maximum	18.5	Maximum	26.0	Maximum	0.8	+/-0.05
DP		22.5	+/-0.4	11.0	Maximum	20.0	Maximum	26.0	Maximum	0.8	+/-0.05
DU		22.5	+/-0.4	13.0	Maximum	22.0	Maximum	26.0	Maximum	0.8	+/-0.05
DY		22.5	+/-0.4	15.5	Maximum	24.5	Maximum	26.0	Maximum	0.8	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Dimensions – Millimeters cont'd



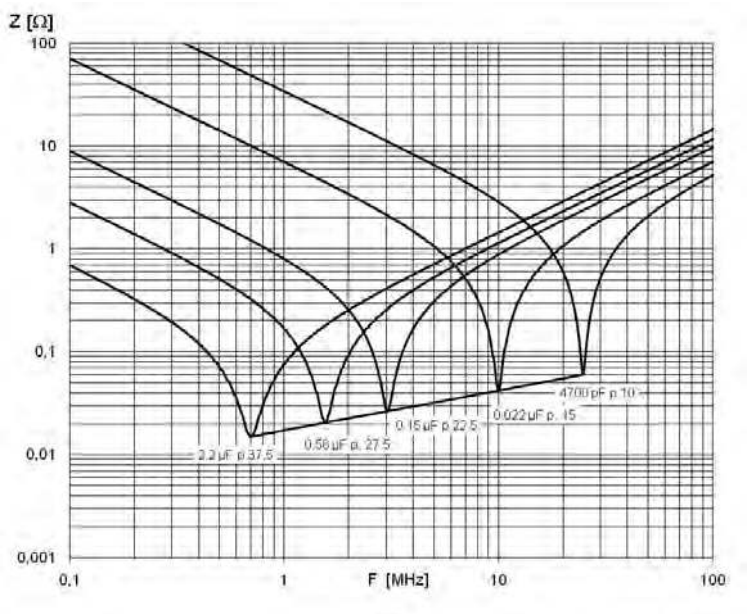
Size Code	Version	p		B		H		L		d	
		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
FB		27.5	+/-0.4	9.0	Maximum	17.0	Maximum	31.5	Maximum	0.8	+/-0.05
FC		27.5	+/-0.4	11.0	Maximum	20.0	Maximum	31.5	Maximum	0.8	+/-0.05
FI		27.5	+/-0.4	13.0	Maximum	25.0	Maximum	31.5	Maximum	0.8	+/-0.05
FN		27.5	+/-0.4	14.0	Maximum	28.0	Maximum	31.5	Maximum	0.8	+/-0.05
FO	High Profile	27.5	+/-0.4	17.0	Maximum	40.0	Maximum	31.5	Maximum	0.8	+/-0.05
FR		27.5	+/-0.4	17.5	Maximum	28.0	Maximum	31.5	Maximum	0.8	+/-0.05
FS		27.5	+/-0.4	19.0	Maximum	29.0	Maximum	31.5	Maximum	0.8	+/-0.05
FY		27.5	+/-0.4	22.0	Maximum	37.0	Maximum	31.5	Maximum	0.8	+/-0.05
FH	Low Profile	27.5	+/-0.4	21.0	Maximum	12.5	Maximum	31.5	Maximum	0.8	+/-0.05
FQ	Low Profile	27.5	+/-0.4	27.5	Maximum	16.0	Maximum	31.5	Maximum	0.8	+/-0.05
FT	Low Profile	27.5	+/-0.4	31.0	Maximum	19.0	Maximum	31.5	Maximum	0.8	+/-0.05
RB		37.5	+/-0.4	11.0	Maximum	22.0	Maximum	41.0	Maximum	1	+/-0.05
RF		37.5	+/-0.4	13.0	Maximum	24.0	Maximum	41.0	Maximum	1	+/-0.05
RH		37.5	+/-0.4	15.0	Maximum	26.0	Maximum	41.0	Maximum	1	+/-0.05
RC		37.5	+/-0.4	16.0	Maximum	28.5	Maximum	41.0	Maximum	1	+/-0.05
RD		37.5	+/-0.4	19.0	Maximum	32.0	Maximum	41.0	Maximum	1	+/-0.05
RP		37.5	+/-0.4	21.0	Maximum	38.0	Maximum	41.0	Maximum	1	+/-0.05
RO		37.5	+/-0.4	24.0	Maximum	44.0	Maximum	41.0	Maximum	1	+/-0.05
RU		37.5	+/-0.4	30.0	Maximum	45.0	Maximum	41.0	Maximum	1	+/-0.05
RV	Low Profile	37.5	+/-0.4	24.0	Maximum	15.0	Maximum	41.0	Maximum	1	+/-0.05
RW	Low Profile	37.5	+/-0.4	24.0	Maximum	19.0	Maximum	41.0	Maximum	1	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Rated Voltage	480 VAC 50/60 Hz		
Capacitance Range	0.001 – 3.5 µF		
Capacitance Tolerance	±20%, ±10%		
Temperature Range	-40°C to +110°C		
Climatic Category	40/110/56		
Approvals	ENEC, UL, cUL, CQC		
Dissipation Factor	Maximum Values at +23°C		
		C ≤ 0.1 µF	C > 0.1 µF
	1 kHz	0.3%	0.2%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,500 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.		
Insulation Resistance	Minimum Values Between Terminals		
	C ≤ 0.33 µF	≥ 30,000 MΩ	
	C > 0.33 µF	≥ 10,000 MΩ • µF	
In DC Applications	Recommended voltage ≤ 1,000 VDC		

Impedance Graph



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 4 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384–14	CA08.00187
	UL 60384–14 and CAN/CSA–E60384–14	E97797
	IEC 60384–14	CQC12001084716 CQC12001084708 CQC12001084714 CQC12001084713 CQC12001084715 CQC12001088081

Environmental Compliance

All new KEMET EMI capacitors are RoHS Compliant and Halogen Free.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Size Code	Maximum Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	Part Number
		B	H	L			
0.001	AE	4	8	13	10	750	F872AE102(1)480(2)
0.0012	AE	4	8	13	10	750	F872AE122(1)480(2)
0.0015	AE	4	8	13	10	750	F872AE152(1)480(2)
0.0018	AE	4	8	13	10	750	F872AE182(1)480(2)
0.0018	AL	9.5	7.5	13	10	750	F872AL182(1)480(2)
0.0022	AE	4	8	13	10	750	F872AE222(1)480(2)
0.0022	AL	9.5	7.5	13	10	750	F872AL222(1)480(2)
0.0025	AE	4	8	13	10	750	F872AE252(1)480(2)
0.0025	AL	9.5	7.5	13	10	750	F872AL252(1)480(2)
0.0027	AE	4	8	13	10	750	F872AE272(1)480(2)
0.0027	AL	9.5	7.5	13	10	750	F872AL272(1)480(2)
0.0033	AE	4	8	13	10	750	F872AE332(1)480(2)
0.0033	AL	9.5	7.5	13	10	750	F872AL332(1)480(2)
0.0039	AE	4	8	13	10	750	F872AE392(3)480(2)
0.0039	AG	4	9	13	10	750	F872AG392(1)480(2)
0.0039	AL	9.5	7.5	13	10	750	F872AL392(1)480(2)
0.0047	AG	4	9	13	10	750	F872AG472(1)480(2)
0.0047	AL	9.5	7.5	13	10	750	F872AL472(1)480(2)
0.0056	AK	5	11	13	10	750	F872AK562(1)480(2)
0.0056	AL	9.5	7.5	13	10	750	F872AL562(1)480(2)
0.0068	AK	5	11	13	10	750	F872AK682(1)480(2)
0.0068	AL	9.5	7.5	13	10	750	F872AL682(1)480(2)
0.0082	AK	5	11	13	10	750	F872AK822(3)480(2)
0.0082	AL	9.5	7.5	13	10	750	F872AL822(1)480(2)
0.01	AL	9.5	7.5	13	10	750	F872AL103(1)480(2)
0.01	AP	6	12	13	10	750	F872AP103(1)480(2)
0.012	AP	6	12	13	10	750	F872AP123(3)480(2)
0.015	AO	7	17	13	10	750	F872AO153(1)480(2)
0.018	AO	7	17	13	10	750	F872AO183(3)480(2)
0.0027	BB	4	10	18	15	600	F872BB272(1)480(2)
0.0033	BB	4	10	18	15	600	F872BB332(1)480(2)
0.0039	BB	4	10	18	15	600	F872BB392(1)480(2)
0.0047	BB	4	10	18	15	600	F872BB472(1)480(2)
0.0056	BB	4	10	18	15	600	F872BB562(1)480(2)
0.0068	BB	4	10	18	15	600	F872BB682(1)480(2)
0.0082	BB	4	10	18	15	600	F872BB822(1)480(2)
0.01	BB	4	10	18	15	600	F872BB103(1)480(2)
0.012	BB	4	10	18	15	600	F872BB123(1)480(2)
0.015	BB	4	10	18	15	600	F872BB153(1)480(2)
0.015	BT	9	12.5	18	15	600	F872BT153(1)480(2)
0.018	BC	5	11	18	15	600	F872BC183(1)480(2)
0.018	BT	9	12.5	18	15	600	F872BT183(1)480(2)
0.022	BC	5	11	18	15	600	F872BC223(1)480(2)
0.022	BT	9	12.5	18	15	600	F872BT223(1)480(2)
0.025	BE	5.5	12.5	18	15	600	F872BE253(1)480(2)
0.025	BT	9	12.5	18	15	600	F872BT253(1)480(2)
0.027	BE	5.5	12.5	18	15	600	F872BE273(1)480(2)
0.027	BT	9	12.5	18	15	600	F872BT273(1)480(2)
0.033	BE	5.5	12.5	18	15	600	F872BE333(3)480(2)
0.033	BG	6	12	18	15	600	F872BG333(1)480(2)
0.033	BT	9	12.5	18	15	600	F872BT333(1)480(2)
0.039	BI	6	17.5	18	15	600	F872BI393(3)480(2)
0.039	BK	7.5	13.5	18	15	600	F872BK393(1)480(2)
0.039	BR	13	12	18	15	600	F872BR393(1)480(2)
0.039	BT	9	12.5	18	15	600	F872BT393(1)480(2)
0.047	BI	6	17.5	18	15	600	F872BI473(1)480(2)
0.047	BK	7.5	13.5	18	15	600	F872BK473(1)480(2)
0.047	BR	13	12	18	15	600	F872BR473(1)480(2)
0.047	BT	9	12.5	18	15	600	F872BT473(1)480(2)
Capacitance Value (µF)	Size Code	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	Part Number

(1) M = ±20%, K = ±10%.

(2) Insert lead and packaging code. See Ordering Options Table for available options.

(3) M = ±20% (only available tolerance).

Table 1 – Ratings & Part Number Reference cont'd

Capacitance Value (µF)	Size Code	Maximum Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	Part Number
		B	H	L			
0.056	BI	6	17.5	18	15	600	F872BI563(3)480(2)
0.056	BK	7.5	13.5	18	15	600	F872BK563(3)480(2)
0.056	BO	7.5	18.5	18	15	600	F872BO563(1)480(2)
0.056	BP	8.5	14.5	18	15	600	F872BP563(1)480(2)
0.056	BR	13	12	18	15	600	F872BR563(1)480(2)
0.068	BO	7.5	18.5	18	15	600	F872BO683(1)480(2)
0.068	BP	8.5	14.5	18	15	600	F872BP683(3)480(2)
0.068	BR	13	12	18	15	600	F872BR683(1)480(2)
0.082	BO	7.5	18.5	18	15	600	F872BO823(3)480(2)
0.082	BR	13	12	18	15	600	F872BR823(1)480(2)
0.082	BS	10	16	18	15	600	F872BS823(1)480(2)
0.1	BS	10	16	18	15	600	F872BS104(3)480(2)
0.1	BY	11	19	18	15	600	F872BY104(1)480(2)
0.12	BY	11	19	18	15	600	F872BY124(3)480(2)
0.12	BZ	12	20	18	15	600	F872BZ124(1)480(2)
0.15	BZ	12	20	18	15	600	F872BZ154(3)480(2)
0.039	DB	6	14.5	26	22.5	300	F872DB393(1)480(2)
0.047	DB	6	14.5	26	22.5	300	F872DB473(1)480(2)
0.056	DB	6	14.5	26	22.5	300	F872DB563(1)480(2)
0.068	DB	6	14.5	26	22.5	300	F872DB683(1)480(2)
0.082	DI	7	16	26	22.5	300	F872DI823(1)480(2)
0.1	DI	7	16	26	22.5	300	F872DI104(1)480(2)
0.12	DH	8	16	26	22.5	300	F872DH124(1)480(2)
0.12	DI	7	16	26	22.5	300	F872DI124(3)480(2)
0.15	DJ	8.5	17	26	22.5	300	F872DJ154(3)480(2)
0.15	DM	9	18.5	26	22.5	300	F872DM154(1)480(2)
0.18	DM	9	18.5	26	22.5	300	F872DM184(3)480(2)
0.18	DO	10	18.5	26	22.5	300	F872DO184(1)480(2)
0.22	DO	10	18.5	26	22.5	300	F872DO224(3)480(2)
0.22	DP	11	20	26	22.5	300	F872DP224(1)480(2)
0.25	DU	13	22	26	22.5	300	F872DU254(1)480(2)
0.27	DU	13	22	26	22.5	300	F872DU274(1)480(2)
0.33	DU	13	22	26	22.5	300	F872DU334(1)480(2)
0.39	DU	13	22	26	22.5	300	F872DU394(3)480(2)
0.39	DY	15.5	24.5	26	22.5	300	F872DY394(1)480(2)
0.47	DY	15.5	24.5	26	22.5	300	F872DY474(1)480(2)
0.15	FB	9	17	31.5	27.5	225	F872FB154(1)480(2)
0.18	FB	9	17	31.5	27.5	225	F872FB184(1)480(2)
0.22	FC	11	20	31.5	27.5	225	F872FC224(1)480(2)
0.25	FC	11	20	31.5	27.5	225	F872FC254(1)480(2)
0.25	FH	21	12.5	31.5	27.5	225	F872FH254(1)480(2)
0.27	FC	11	20	31.5	27.5	225	F872FC274(1)480(2)
0.27	FH	21	12.5	31.5	27.5	225	F872FH274(1)480(2)
0.33	FC	11	20	31.5	27.5	225	F872FC334(1)480(2)
0.33	FH	21	12.5	31.5	27.5	225	F872FH334(1)480(2)
0.39	FI	13	25	31.5	27.5	225	F872FI394(1)480(2)
0.39	FH	21	12.5	31.5	27.5	225	F872FH394(3)480(2)
0.47	FI	13	25	31.5	27.5	225	F872FI474(1)480(2)
0.56	FQ	27.5	16	31.5	27.5	225	F872FQ564(1)480(2)
0.56	FN	14	28	31.5	27.5	225	F872FN564(1)480(2)
0.68	FQ	27.5	16	31.5	27.5	225	F872FQ684(3)480(2)
0.68	FR	17.5	28	31.5	27.5	225	F872FR684(1)480(2)
0.68	FT	31	19	31.5	27.5	225	F872FT684(1)480(2)
0.82	FR	17.5	28	31.5	27.5	225	F872FR824(1)480(2)
0.82	FS	19	29	31.5	27.5	225	F872FS824(1)480(2)
0.82	FT	31	19	31.5	27.5	225	F872FT824(1)480(2)
0.82	FO	17	40	31.5	27.5	225	F872FO824(1)480(2)
1	FO	17	40	31.5	27.5	225	F872FO105(1)480(2)
1	FS	19	29	31.5	27.5	225	F872FS105(3)480(2)
Capacitance Value (µF)	Size Code	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	Part Number

(1) M = ±20%, K = ±10%.

(2) Insert lead and packaging code. See Ordering Options Table for available options.

(3) M = ±20% (only available tolerance).

Table 1 – Ratings & Part Number Reference cont'd

Capacitance Value (µF)	Size Code	Maximum Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	Part Number
		B	H	L			
1	FY	22	37	31.5	27.5	225	F872FY105(1)480(2)
1	FT	31	19	31.5	27.5	225	F872FT105(1)480(2)
1.2	FO	17	40	31.5	27.5	225	F872FO125(3)480(2)
1.2	FY	22	37	31.5	27.5	225	F872FY125(1)480(2)
1.5	FY	22	37	31.5	27.5	225	F872FY155(3)480(2)
1.8	FY	22	37	31.5	27.5	225	F872FY185(3)480(2)
0.33	RB	11	22	41	37.5	150	F872RB334(1)480(2)
0.39	RB	11	22	41	37.5	150	F872RB394(1)480(2)
0.47	RB	11	22	41	37.5	150	F872RB474(1)480(2)
0.56	RB	11	22	41	37.5	150	F872RB564(1)480(2)
0.56	RV	24	15	41	37.5	150	F872RV564(1)480(2)
0.68	RF	13	24	41	37.5	150	F872RF684(1)480(2)
0.68	RV	24	15	41	37.5	150	F872RV684(1)480(2)
0.82	RH	15	26	41	37.5	150	F872RH824(1)480(2)
0.82	RW	24	19	41	37.5	150	F872RW824(1)480(2)
1	RC	16	28.5	41	37.5	150	F872RC105(1)480(2)
1	RH	15	26	41	37.5	150	F872RH105(3)480(2)
1	RW	24	19	41	37.5	150	F872RW105(1)480(2)
1.2	RD	19	32	41	37.5	150	F872RD125(1)480(2)
1.2	RC	16	28.5	41	37.5	150	F872RC125(3)480(2)
1.2	RW	24	19	41	37.5	150	F872RW125(3)480(2)
1.5	RD	19	32	41	37.5	150	F872RD155(1)480(2)
1.8	RD	19	32	41	37.5	150	F872RD185(3)480(2)
1.8	RP	21	38	41	37.5	150	F872RP185(1)480(2)
2.2	RO	24	44	41	37.5	150	F872RO225(1)480(2)
2.5	RO	24	44	41	37.5	150	F872RO255(1)480(2)
2.7	RO	24	44	41	37.5	150	F872RO275(1)480(2)
3.3	RU	30	45	41	37.5	150	F872RU335(1)480(2)
3.5	RU	30	45	41	37.5	150	F872RU355(3)480(2)
Capacitance Value (µF)	Size Code	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	Part Number

(1) M = ±20%, K = ±10%.
(2) Insert lead and packaging code. See Ordering Options Table for available options.
(3) M = ±20% (only available tolerance).

Soldering Process

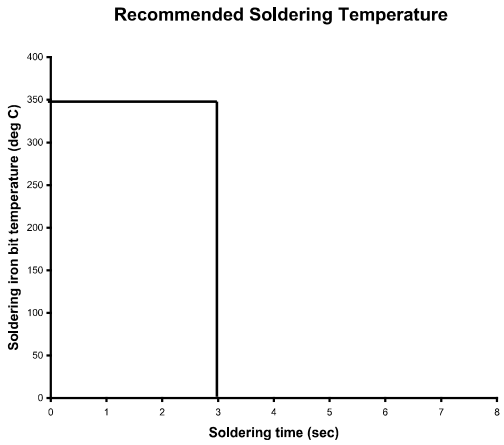
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

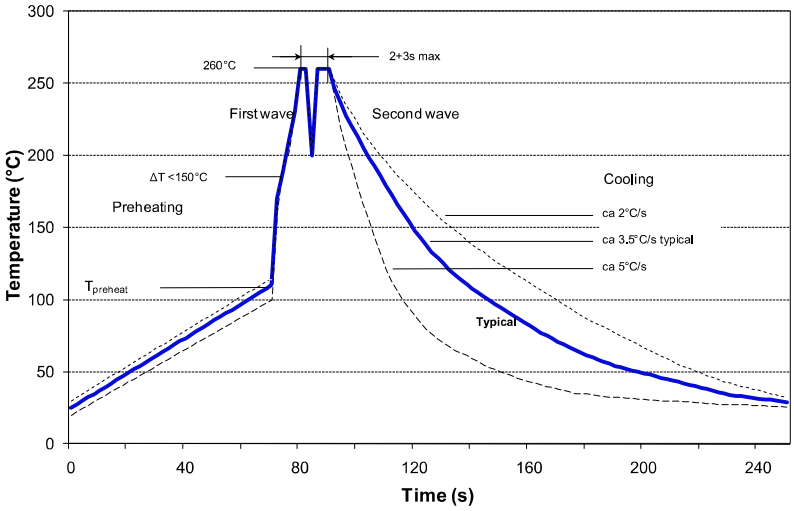
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

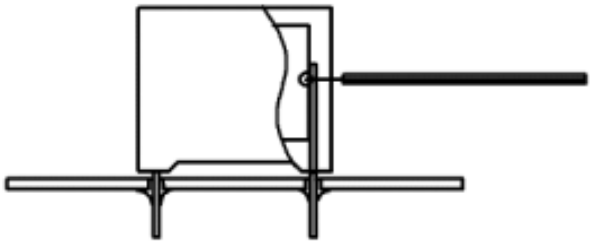
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



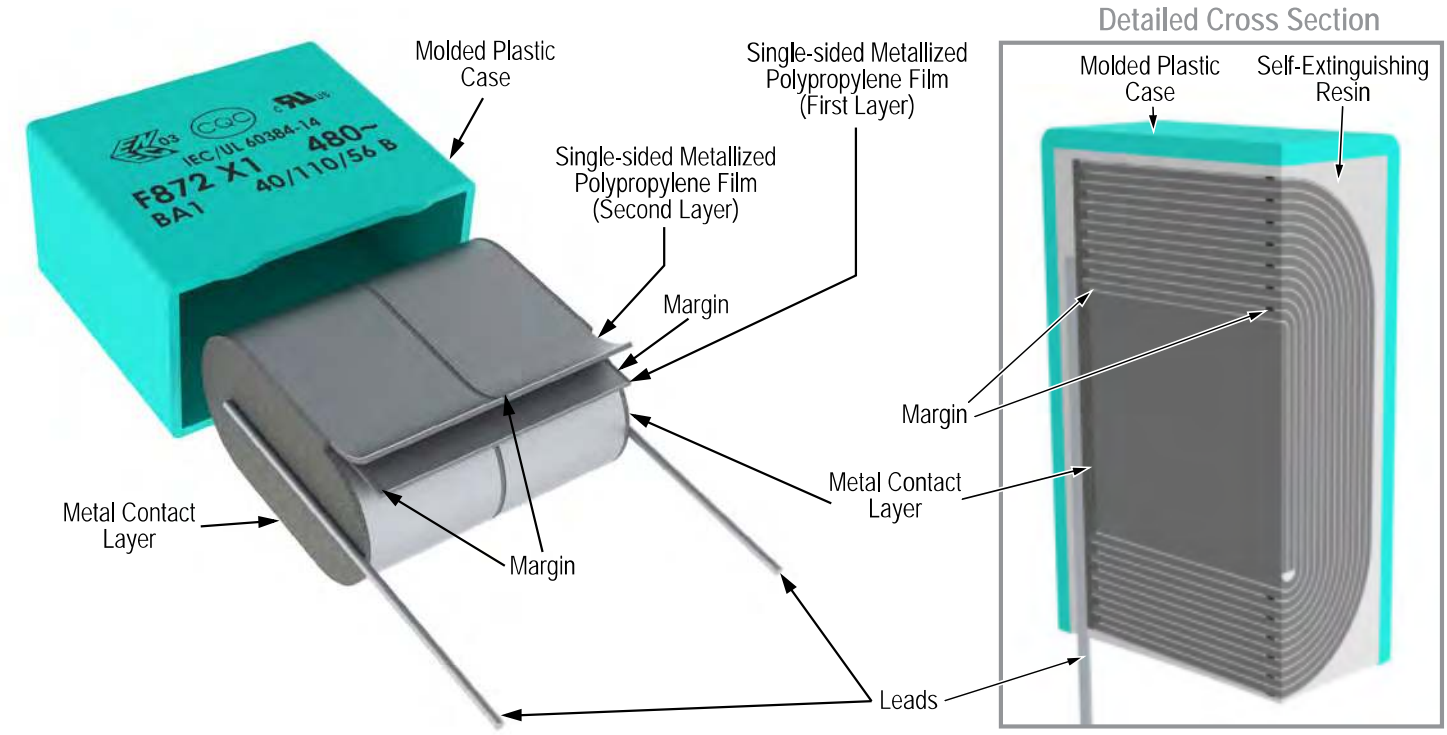
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

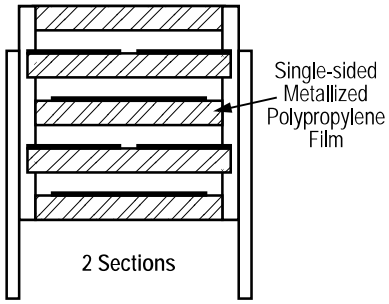
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

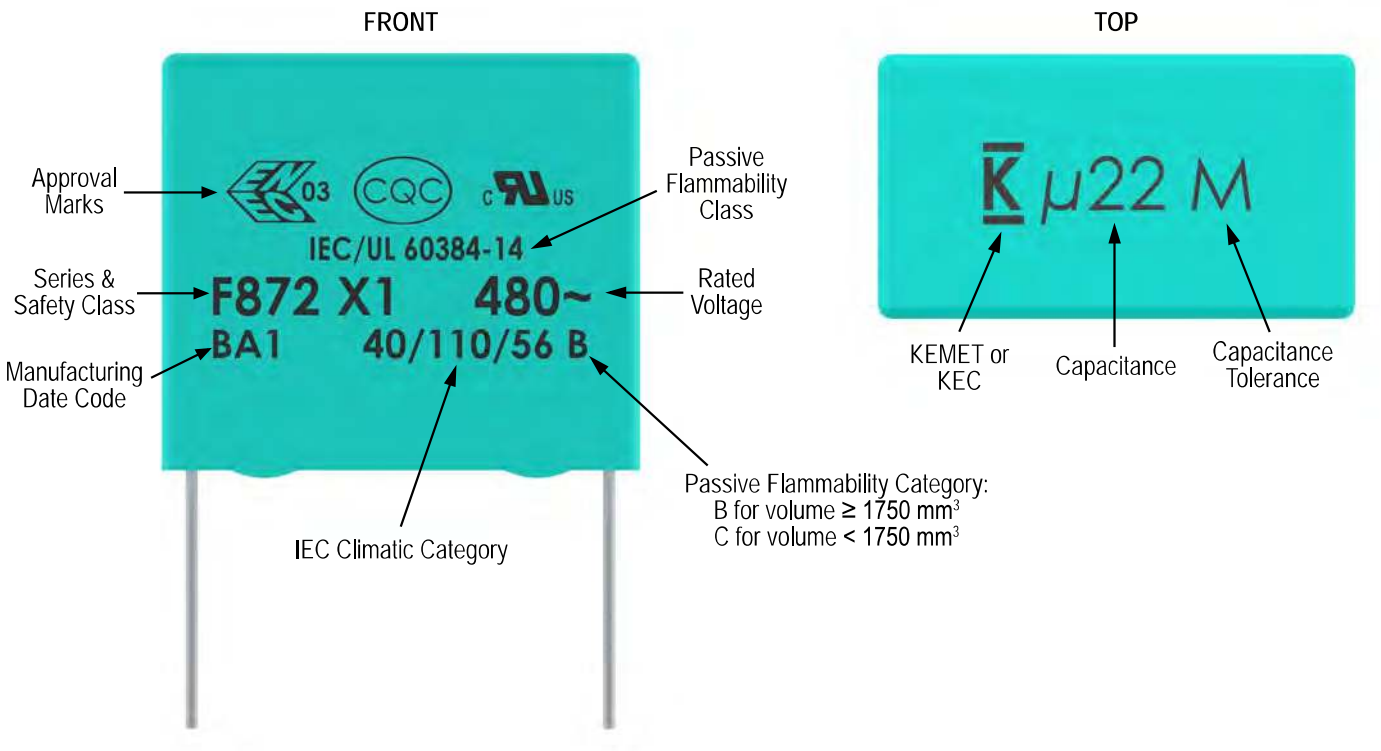
Construction



Winding Scheme



Marking


FRONT
TOP
Approval Marks
03
CQC
c US
IEC/UL 60384-14
Passive Flammability Class
Series & Safety Class
F872 X1
480~
Rated Voltage
Manufacturing Date Code
BA1
40/110/56 B
IEC Climatic Category
Passive Flammability Category:
B for volume ≥ 1750 mm³
C for volume < 1750 mm³
K µ22 M
KEMET or KEC
Capacitance
Capacitance Tolerance

Packaging Quantities

Size Code	Lead Spacing	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo	Pizza
AN	10	3.5	9	13	2000	2200	850	1700	1150	
AG		4	9	13	2000	2200	750	1500	1000	
AK		5	11	13	1300	2000	600	1250	800	
AP		6	12	13	1000	1800	500	1000	680	
AO		7	17	13	600	700	450	900	580	
AL		9.5	7.5	13	1000	1500	300	600	430	
AE		4	8	13	2000	2200	750	1500	1000	
BB	15	4	10	18	2500	1500	750	1500	1000	1411
BC		5	11	18	1000	1250	600	1250	800	1139
BE		5.5	12.5	18	800	1000	550	1100	750	1020
BG		6	12	18	1750	1000	500	1000	680	935
BK		7.5	13.5	18	1000	800	350	800	500	748
BI		6	17.5	18	1000	800	500	1000	680	935
BP		8.5	14.5	18	1000	650	300	700	440	663
BT		9	12.5	18	1000	700	270	650	410	629
BO		7.5	18.5	18	900	500	350	800	500	748
BS		10	16	18	750	550	300	600	380	561
BR		13	12	18	750	520	200	480	280	425
BY		11	19	18	450	400	250	500	340	510
BA		8.5	12.5	18	1000	650	300	700	440	663
BZ		12	20	18	350	300	220	450	330	459
DB	22.5	6	14.5	26	805	450	300	700	464	660
DI		7	16	26	700	450	250	550	380	564
DH		8.0	16.0	26	520	300	240	500	330	492
DJ		8.5	17	26	450	350	250	450	280	468
DM		9	18.5	26	400	225	200	400	300	444
DO		10	18.5	26	360	350	160	350	235	396
DP		11	20	26	300	200	190	350	217	360
DU		13	22	26	230	150	150	300	200	300
DY		15.5	24.5	26	150	100	120	250	170	252

Packaging Quantities cont'd

Size Code	Lead Spacing	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo	Pizza
FB	27.5	9.0	17.0	31.5						370
FC		11.0	20.0	31.5						300
FI		13.0	25.0	31.5						250
FN		14.0	28.0	31.5						230
FO		17.0	40.0	31.5						190
FR		17.5	28.0	31.5						190
FS		19.0	29.0	31.5						170
FY		22.0	37.0	31.5						150
FH		21.0	12.5	31.5						150
FQ		27.5	16.0	31.5						120
FT		31.0	19.0	31.5						100
RB	37.5	11.0	22.0	41.0						210
RF		13.0	24.0	41.0						175
RH		15.0	26.0	41.0						154
RC		16.0	28.5	41.0						140
RD		19.0	32.0	41.0						119
RP		21.0	38.0	41.0						105
RO		24.0	44.0	41.0						91
RU		30.0	45.0	41.0						77
RV		24.0	15.0	41.0						91
RW		24.0	19.0	41.0						91

F873 Series Polypropylene Metallized Film, Class X1, 760 VAC

Overview

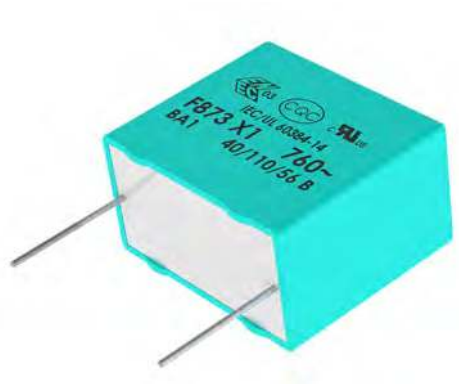
Metallized polypropylene film encapsulated with self-extinguishing resin in a box of material recognized to UL 94 V–0.

Applications

For worldwide use as electromagnetic interference (EMI) suppression filter in across-the-line applications requiring X1 safety classification.

Benefits

- Approvals: ENEC, UL, cUL, CQC
- Rated voltage: 760 VAC 50/60 Hz
- Capacitance range: 0.01 – 1.8 µF
- Lead spacing: 22.5 – 37.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category 40/110/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 4,250 VDC



Part Number System

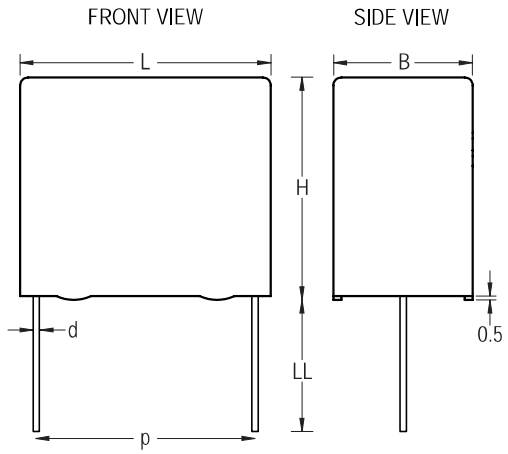
F	873	D	U	104	M	760	C
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Voltage (VAC)	Packaging
F = Film	X1, Metallized Polypropylene	D = 22.5 F = 27.5 R = 37.5	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	K = ±10% M = ±20%	760	See Ordering Options Table

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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
22.5	Standard Lead and Packaging Options		
	Pizza – Long Leads	17 +0/-1	ZLH0J
	Pizza Pack	4 +2/-0	Z
	Other Lead and Packaging Options		
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	P
	Ammo Pack	H_0 = 18.5 +/-0.5	R
27.5	Standard Lead and Packaging Options		
	Pizza – Long Leads	17 +0/-1	ZLH0J
	Pizza Pack	4 +2/-0	Z
37.5	Standard Lead and Packaging Options		
	Pizza – Long Leads	17 +0/-1	ZLH0J
	Pizza Pack	4 +2/-0	Z

Dimensions – Millimeters



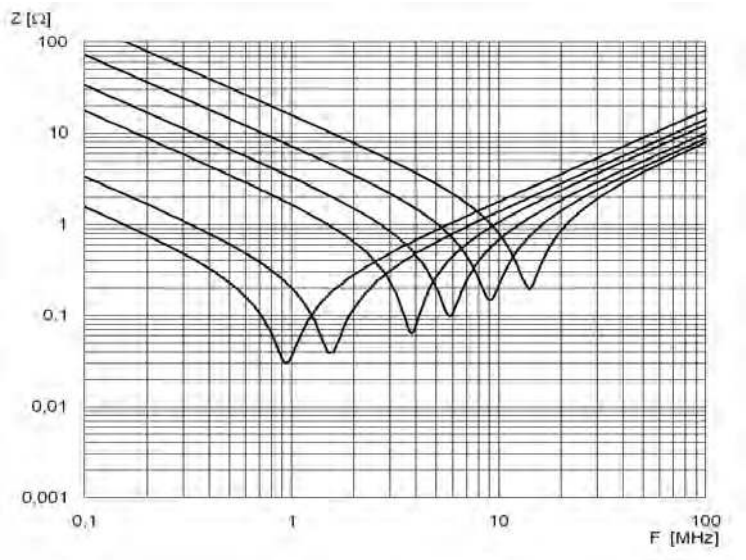
Size Code	Version	p		B		H		L		d	
		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
DB		22.5	+/-0.4	6.0	Maximum	14.5	Maximum	26.0	Maximum	0.8	+/-0.05
DI		22.5	+/-0.4	7.0	Maximum	16.0	Maximum	26.0	Maximum	0.8	+/-0.05
DH		22.5	+/-0.4	8.0	Maximum	16.0	Maximum	26.0	Maximum	0.8	+/-0.05
DJ		22.5	+/-0.4	8.5	Maximum	17.0	Maximum	26.0	Maximum	0.8	+/-0.05
DM		22.5	+/-0.4	9.0	Maximum	18.5	Maximum	26.0	Maximum	0.8	+/-0.05
DO		22.5	+/-0.4	10.0	Maximum	18.5	Maximum	26.0	Maximum	0.8	+/-0.05
DP		22.5	+/-0.4	11.0	Maximum	20.0	Maximum	26.0	Maximum	0.8	+/-0.05
DU		22.5	+/-0.4	13.0	Maximum	22.0	Maximum	26.0	Maximum	0.8	+/-0.05
DY		22.5	+/-0.4	15.5	Maximum	24.5	Maximum	26.0	Maximum	0.8	+/-0.05
FB		27.5	+/-0.4	9.0	Maximum	17.0	Maximum	31.5	Maximum	0.8	+/-0.05
FC		27.5	+/-0.4	11.0	Maximum	20.0	Maximum	31.5	Maximum	0.8	+/-0.05
FI		27.5	+/-0.4	13.0	Maximum	25.0	Maximum	31.5	Maximum	0.8	+/-0.05
FN		27.5	+/-0.4	14.0	Maximum	28.0	Maximum	31.5	Maximum	0.8	+/-0.05
FO	High Profile	27.5	+/-0.4	17.0	Maximum	40.0	Maximum	31.5	Maximum	0.8	+/-0.05
FR		27.5	+/-0.4	17.5	Maximum	28.0	Maximum	31.5	Maximum	0.8	+/-0.05
FS		27.5	+/-0.4	19.0	Maximum	29.0	Maximum	31.5	Maximum	0.8	+/-0.05
FY		27.5	+/-0.4	22.0	Maximum	37.0	Maximum	31.5	Maximum	0.8	+/-0.05
FH	Low Profile	27.5	+/-0.4	21.0	Maximum	12.5	Maximum	31.5	Maximum	0.8	+/-0.05
FQ	Low Profile	27.5	+/-0.4	27.5	Maximum	16.0	Maximum	31.5	Maximum	0.8	+/-0.05
FT	Low Profile	27.5	+/-0.4	31.0	Maximum	19.0	Maximum	31.5	Maximum	0.8	+/-0.05
RB		37.5	+/-0.4	11.0	Maximum	22.0	Maximum	41.0	Maximum	1	+/-0.05
RF		37.5	+/-0.4	13.0	Maximum	24.0	Maximum	41.0	Maximum	1	+/-0.05
RH		37.5	+/-0.4	15.0	Maximum	26.0	Maximum	41.0	Maximum	1	+/-0.05
RC		37.5	+/-0.4	16.0	Maximum	28.5	Maximum	41.0	Maximum	1	+/-0.05
RD		37.5	+/-0.4	19.0	Maximum	32.0	Maximum	41.0	Maximum	1	+/-0.05
RP		37.5	+/-0.4	21.0	Maximum	38.0	Maximum	41.0	Maximum	1	+/-0.05
RO		37.5	+/-0.4	24.0	Maximum	44.0	Maximum	41.0	Maximum	1	+/-0.05
RU		37.5	+/-0.4	30.0	Maximum	45.0	Maximum	41.0	Maximum	1	+/-0.05
RV	Low Profile	37.5	+/-0.4	24.0	Maximum	15.0	Maximum	41.0	Maximum	1	+/-0.05
RW	Low Profile	37.5	+/-0.4	24.0	Maximum	19.0	Maximum	41.0	Maximum	1	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Rated Voltage	760 VAC 50/60 Hz		
Capacitance Range	0.01 – 1.8 µF		
Capacitance Tolerance	±20%, ±10%		
Temperature Range	-40°C to +110°C		
Climatic Category	40/110/56		
Approvals	ENEC, UL, cUL, CQC		
Dissipation Factor	Maximum Values at +23°C		
		C ≤ 0.1 µF	C > 0.1 µF
	1 kHz	0.1%	0.1%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 4,250 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.		
Insulation Resistance	Between Terminals:		
	C ≤ 0.33 µF	≥ 30,000 MΩ	
	C > 0.33 µF	≥ 10,000 MΩ • µF	
In DC Applications	Recommended voltage ≤ 1,500 VDC		

Impedance Graph



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 4 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384–14	CA08.00188
	UL 60384–14 and CAN/CSA–E60384–14	E97797
	IEC 60384–14	CQC12001084815 CQC12001084817 CQC12001084814 CQC12001084820 CQC12001086324 CQC12001088068

Environmental Compliance

All new KEMET EMI capacitors are RoHS Compliant and Halogen Free.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Size Code	Maximum Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	Part Number
		B	H	L			
0.01	DB	6	14.5	26	22.5	300	F873DB103(1)760(2)
0.012	DB	6	14.5	26	22.5	300	F873DB123(1)760(2)
0.015	DB	6	14.5	26	22.5	300	F873DB153(1)760(2)
0.018	DB	6	14.5	26	22.5	300	F873DB183(1)760(2)
0.022	DB	6	14.5	26	22.5	300	F873DB223(1)760(2)
0.025	DB	6	14.5	26	22.5	300	F873DB253(3)760(2)
0.025	DI	7	16	26	22.5	300	F873DI253(1)760(2)
0.027	DI	7	16	26	22.5	300	F873DI273(1)760(2)
0.033	DI	7	16	26	22.5	300	F873DI333(1)760(2)
0.039	DI	7	16	26	22.5	300	F873DI393(1)760(2)
0.047	DH	8	16	26	22.5	300	F873DH473(3)760(2)
0.047	DJ	8.5	17	26	22.5	300	F873DJ473(1)760(2)
0.056	DJ	8.5	17	26	22.5	300	F873DJ563(3)760(2)
0.056	DM	9	18.5	26	22.5	300	F873DM563(1)760(2)
0.068	DO	10	18.5	26	22.5	300	F873DO683(1)760(2)
0.082	DO	10	18.5	26	22.5	300	F873DO823(3)760(2)
0.082	DP	11	20	26	22.5	300	F873DP823(1)760(2)
0.1	DP	11	20	26	22.5	300	F873DP104(3)760(2)
0.1	DU	13	22	26	22.5	300	F873DU104(1)760(2)
0.12	DU	13	22	26	22.5	300	F873DU124(1)760(2)
0.15	DY	15.5	24.5	26	22.5	300	F873DY154(1)760(2)
0.18	DY	15.5	24.5	26	22.5	300	F873DY184(1)760(2)
0.056	FB	9	17	31.5	27.5	225	F873FB563(1)760(2)
0.068	FB	9	17	31.5	27.5	225	F873FB683(1)760(2)
0.082	FB	9	17	31.5	27.5	225	F873FB823(3)760(2)
0.082	FC	11	20	31.5	27.5	225	F873FC823(1)760(2)
0.1	FC	11	20	31.5	27.5	225	F873FC104(1)760(2)
0.1	FH	21	12.5	31.5	27.5	225	F873FH104(1)760(2)
0.12	FC	11	20	31.5	27.5	225	F873FC124(3)760(2)
0.12	FH	21	12.5	31.5	27.5	225	F873FH124(1)760(2)
0.15	FH	21	12.5	31.5	27.5	225	F873FH154(3)760(2)
0.15	FI	13	25	31.5	27.5	225	F873FI154(1)760(2)
0.18	FI	13	25	31.5	27.5	225	F873FI184(1)760(2)
0.22	FI	13	25	31.5	27.5	225	F873FI224(3)760(2)
0.22	FN	14	28	31.5	27.5	225	F873FN224(1)760(2)
0.22	FQ	27.5	16	31.5	27.5	225	F873FQ224(1)760(2)
0.25	FN	14	28	31.5	27.5	225	F873FN254(3)760(2)
0.25	FO	17	40	31.5	27.5	225	F873FO254(1)760(2)
0.25	FQ	27.5	16	31.5	27.5	225	F873FQ254(3)760(2)
0.25	FR	17.5	28	31.5	27.5	225	F873FR254(1)760(2)
0.27	FO	17	40	31.5	27.5	225	F873FO274(1)760(2)
0.27	FR	17.5	28	31.5	27.5	225	F873FR274(1)760(2)
0.27	FT	31	19	31.5	27.5	225	F873FT274(1)760(2)
0.33	FO	17	40	31.5	27.5	225	F873FO334(1)760(2)
0.33	FR	17.5	28	31.5	27.5	225	F873FR334(3)760(2)
0.33	FS	19	29	31.5	27.5	225	F873FS334(1)760(2)
0.33	FT	31	19	31.5	27.5	225	F873FT334(1)760(2)
0.39	FO	17	40	31.5	27.5	225	F873FO394(1)760(2)
0.39	FS	19	29	31.5	27.5	225	F873FS394(3)760(2)
0.39	FY	22	37	31.5	27.5	225	F873FY394(1)760(2)
0.47	FY	22	37	31.5	27.5	225	F873FY474(1)760(2)
0.56	FY	22	37	31.5	27.5	225	F873FY564(1)760(2)
0.15	RB	11	22	41	37.5	150	F873RB154(1)760(2)
0.18	RB	11	22	41	37.5	150	F873RB184(1)760(2)
0.22	RB	11	22	41	37.5	150	F873RB224(3)760(2)
0.22	RV	24	15	41	37.5	150	F873RV224(1)760(2)
0.25	RF	13	24	41	37.5	150	F873RF254(1)760(2)
0.25	RV	24	15	41	37.5	150	F873RV254(1)760(2)
Capacitance Value (µF)	Size Code	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	Part Number

(1) M = ±20%, K = ±10%.
(2) Insert lead and packaging code. See table for available options.
(3) M = ±20% (only available tolerance).

Table 1 – Ratings & Part Number Reference cont'd

Capacitance Value (µF)	Size Code	Maximum Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	Part Number
		B	H	L			
0.27	RF	13	24	41	37.5	150	F873RF274(1)760(2)
0.27	RV	24	15	41	37.5	150	F873RV274(1)760(2)
0.33	RF	13	24	41	37.5	150	F873RF334(3)760(2)
0.33	RH	15	26	41	37.5	150	F873RH334(1)760(2)
0.33	RV	24	15	41	37.5	150	F873RV334(3)760(2)
0.33	RW	24	19	41	37.5	150	F873RW334(1)760(2)
0.39	RC	16	28.5	41	37.5	150	F873RC394(1)760(2)
0.39	RW	24	19	41	37.5	150	F873RW394(1)760(2)
0.47	RC	16	28.5	41	37.5	150	F873RC474(3)760(2)
0.47	RD	19	32	41	37.5	150	F873RD474(1)760(2)
0.47	RW	24	19	41	37.5	150	F873RW474(3)760(2)
0.56	RD	19	32	41	37.5	150	F873RD564(1)760(2)
0.68	RD	19	32	41	37.5	150	F873RD684(3)760(2)
0.68	RP	21	38	41	37.5	150	F873RP684(1)760(2)
0.82	RO	24	44	41	37.5	150	F873RO824(1)760(2)
0.82	RP	21	38	41	37.5	150	F873RP824(3)760(2)
1	RO	24	44	41	37.5	150	F873RO105(1)760(2)
1.2	RO	24	44	41	37.5	150	F873RO125(1)760(2)
1.5	RU	30	45	41	37.5	150	F873RU155(1)760(2)
1.8	RU	30	45	41	37.5	150	F873RU185(3)760(2)
Capacitance Value (µF)	Size Code	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	Part Number

(1) M = ±20%, K = ±10%.
(2) Insert lead and packaging code. See table for available options.
(3) M = ±20% (only available tolerance).

Soldering Process

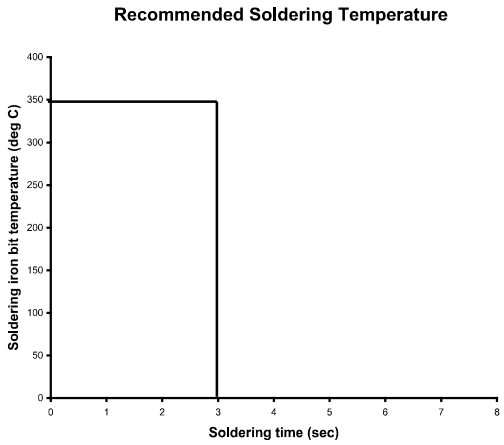
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

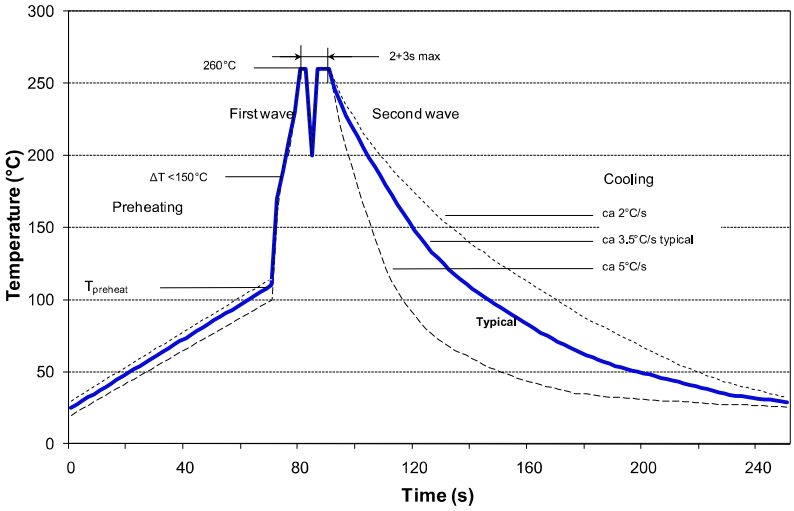
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

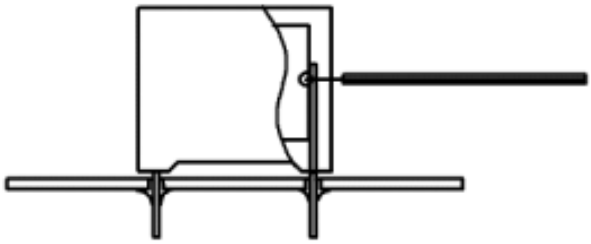
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



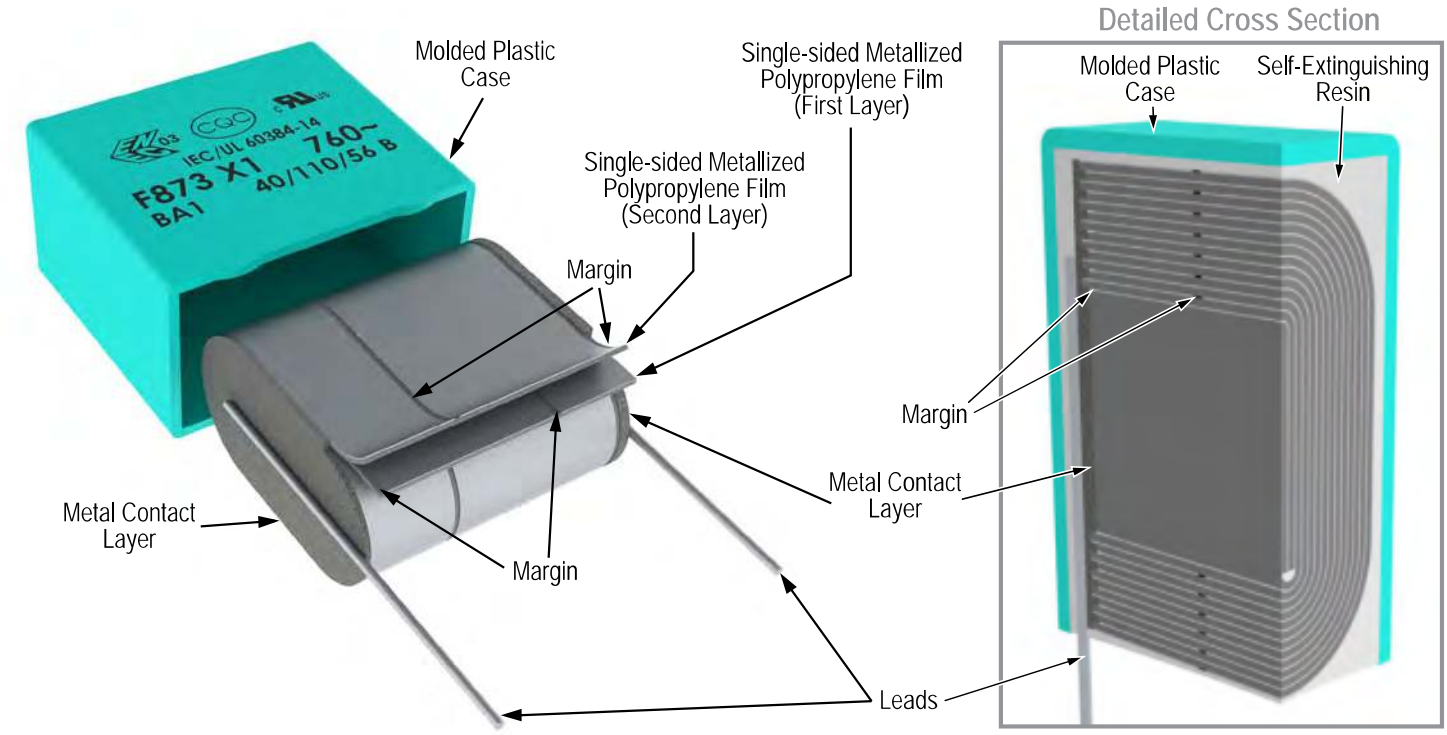
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

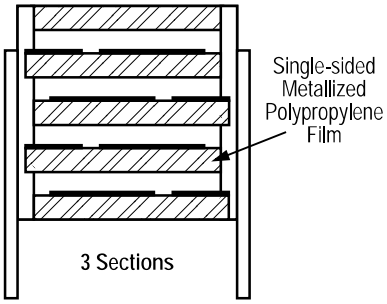
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

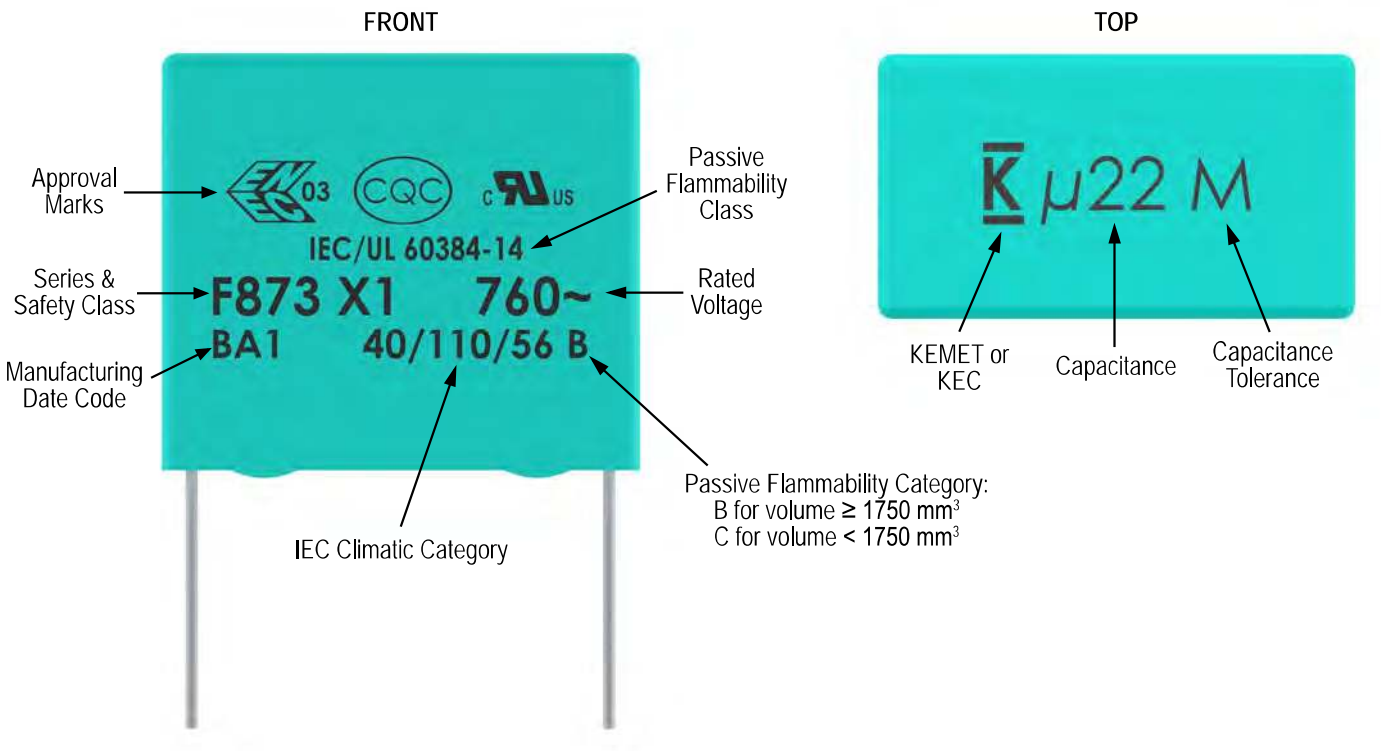
Construction



Winding Scheme



Marking


FRONT
TOP
Approval Marks
03
CQC
c US
IEC/UL 60384-14
Passive Flammability Class
Series & Safety Class
F873 X1
760~
Rated Voltage
Manufacturing Date Code
BA1
40/110/56 B
IEC Climatic Category
Passive Flammability Category:
B for volume ≥ 1750 mm³
C for volume < 1750 mm³
K µ22 M
KEMET or KEC
Capacitance
Capacitance Tolerance

Packaging Quantities

Size Code	Lead Spacing	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo	Pizza
DB	22.5	6	14.5	26	1638	702	300	700	464	660
DI		7	16	26	1188	594	250	550	380	564
DH		8.0	16.0	26	1026	513	240	500	330	492
DJ		8.5	17	26	972	486	250	450	280	468
DM		9	18.5	26	918	459	200	400	300	444
DO		10	18.5	26	810	405	160	350	235	396
DP		11	20	26	756	378	190	350	217	360
DU		13	22	26	540	324	150	300	200	300
DY		15.5	24.5	26	450	270	120	250	170	252
FB	27.5	9.0	17.0	31.5	816	408				370
FC		11.0	20.0	31.5	672	336				300
FI		13.0	25.0	31.5	480	288				250
FN		14.0	28.0	31.5	352	176				230
FO		17.0	40.0	31.5	216	144				190
FR		17.5	28.0	31.5	256	128				190
FS		19.0	29.0	31.5	256	128				170
FY		22.0	37.0	31.5	168	112				150
FH		21.0	12.5	31.5	392	168				150
FQ		27.5	16.0	31.5	280	120				120
FT		31.0	19.0	31.5	240	120				100
RB	37.5	11.0	22.0	41.0	420	252				210
RF		13.0	24.0	41.0	360	216				175
RH		15.0	26.0	41.0	300	180				154
RC		16.0	28.5	41.0	216	108				140
RD		19.0	32.0	41.0	192	96				119
RP		21.0	38.0	41.0	126	84				105
RO		24.0	44.0	41.0	108	72				91
RU		30.0	45.0	41.0	90	60				77
RV		24.0	15.0	41.0	252	108				91
RW		24.0	19.0	41.0	216	108				91

R49 Series, Class X1, 310 VAC, 110ºC

Overview

The R49 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material meeting the requirements of UL 94 V–0.

Applications

For use as electromagnetic interference (EMI) suppression filter in across-the-line applications requiring X1 safety classification. Intended for use in situations where exposure to a shock in the event of capacitor failure is not possible. Not for use in "series with mains" type applications. X1 classified capacitors are for use only in a permanently connected apparatus with a connection to mains which cannot be loosened without the use of a tool.

Benefits

- Approvals: ENEC, UL, cUL
- Class X1 (IEC 60384-14)
- Rated voltage: 310 VAC 50/60 Hz
- Capacitance range: 0.01 – 2.2 µF
- Lead spacing: 10.0 – 27.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category: 40/110/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 2,200 VDC/1,500 VAC
- Self-healing properties



Part Number System

R49	A	I	3100	00	01	M
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Packaging	Internal Use	Capacitance Tolerance
X1, Metallized Polypropylene	A = 310	F = 10.0 I = 15.0 N = 22.5 R = 27.5	The last three digits represent significant figures. The first digit specifies number of zeros to be added.	See Ordering Options Table	01 M1	K = ±10% M = ±20%

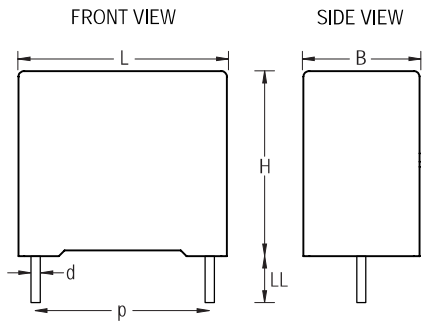
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Ordering Options Table

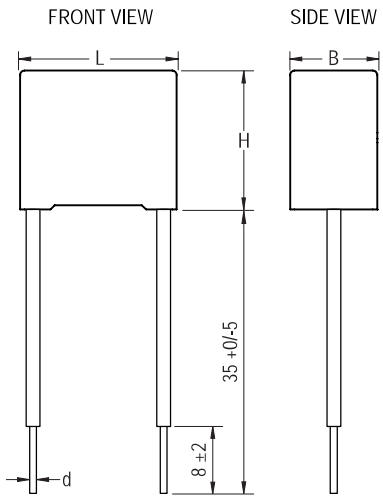
Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
10, 15, 22.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Ammo Pack	H_0 = 18.5 +/-0.5	DQ
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	CK
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Short Leads	3.2 +0.3/-0.2	JH
	Bulk (Bag) – Long Leads	18 +1/-1	JM
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
	Bulk (Bag) – Insulated Rigid Leads	30 +5/-0 (sp 8+2/-2)	51
	Bulk (Bag) – Insulated Flexible Leads	150 +5/-5 (sp 8+2/-2)	52
27.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	CK
	Other Lead and Packaging Options		
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
	Bulk (Bag) – Insulated Rigid Leads	30 +5/-0 (sp 8+2/-2)	51
	Bulk (Bag) – Insulated Flexible Leads	150 +5/-5 (sp 8+2/-2)	52
37.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Other Lead and Packaging Options		
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
	Bulk (Bag) – Insulated Rigid Leads	30 +5/-0 (sp 8+2/-2)	51
	Bulk (Bag) – Insulated Flexible Leads	150 +5/-5 (sp 8+2/-2)	52

Dimensions – Millimeters

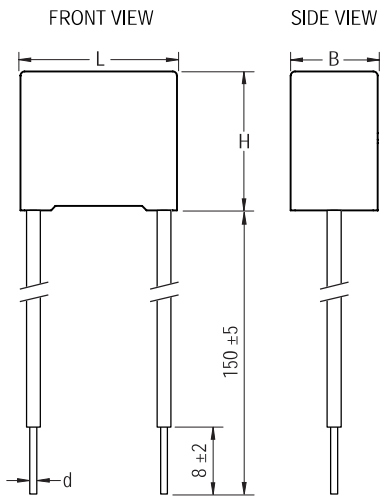
Loose



Insulated Rigid Leads



Insulated Flexible Leads 0.5 mm²



p		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
10.0	+/-0.4	5.0	+0.2	11.0	+0.1	13.0	+0.2	0.6	+/-0.05
10.0	+/-0.4	6.0	+0.2	12.0	+0.1	13.0	+0.2	0.6	+/-0.05
15.0	+/-0.4	5.0	+0.2	11.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	12.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	7.5	+0.2	13.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	8.5	+0.2	14.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	10.0	+0.2	16.0	+0.1	18.0	+0.5	0.8	+/-0.05
22.5	+/-0.4	6.0	+0.2	15.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	7.0	+0.2	16.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	8.5	+0.2	17.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	10.0	+0.2	18.5	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	11.0	+0.2	20.0	+0.1	26.5	+0.3	0.8	+/-0.05
27.5	+/-0.4	9.0	+0.2	17.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	11.0	+0.2	20.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	13.0	+0.2	22.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	14.0	+0.2	28.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	18.0	+0.2	33.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	22.0	+0.2	37.0	+0.1	32.0	+0.3	0.8	+/-0.05
Note: See Ordering Options Table for lead length (LL/H_0) options.									

Performance Characteristics

Dielectric	Polypropylene film
Plates	Metal layer deposited by evaporation under vacuum
Winding	Non-inductive type
Leads	Tinned wire
Protection	Plastic case, thermosetting resin filled. Box material is solvent resistant and flame retardant according to UL94.
Related documents	IEC 60384-14, EN 60384-14
Rated Voltage (V_R)	310 VAC (50/60 Hz), 800 VDC
Capacitance Range	0.010 µF to 2.2 µF
Capacitance Values	E6 series (IEC 60063)
Capacitance Tolerance	±10%, ±20%
Temperature Range	-40°C to +110°C
Climatic Category	40/110/56 IEC 60068-1
Approvals	ENEC, UL, cUL
Dissipation Factor (tanδ)	≤ 0.1% (0.06%*) at 1kHz , +25°C ±5°C (* typical value)
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,200 VDC/1,500 VAC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.

Insulation Resistance

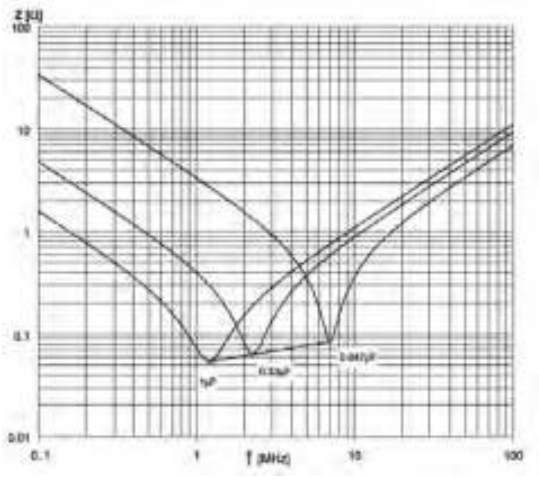
Measured at +25°C ±5°C, according to IEC 60384–2

Minimum Values Between Terminals

Voltage Charge	Voltage Charge Time	C ≤ 0.33 µF	C > 0.33 µF
100 VDC	1 min	≥ 1 • 10^5 MΩ (≥ 5 • 10^5 MΩ)* * typical value	≥ 30,000 MΩ • µF (≥ 150,000 MΩ • µF)* * typical value

In DC Applications	Recommended voltage ≤ 800 VDC

Impedance Graph



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	EN/IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 4 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384-14	CA08.00030
	UL 60384-14 and CAN/CSA E60384-14 (310 VAC)	E97797

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L				
0.010	5.0	11.0	13.0	10.0	600	49AF2100(1)01(2)	R49AF2100(1)01(2)
0.015	5.0	11.0	13.0	10.0	600	49AF2150(1)01(2)	R49AF2150(1)01(2)
0.022	6.0	12.0	13.0	10.0	600	49AF2120(1)01(2)	R49AF2120(1)01(2)
0.033	6.0	12.0	13.0	10.0	600	49AF2330(1)01(2)	R49AF2330(1)01(2)
0.010	5.0	11.0	18.0	15.0	500	49AI2100(1)01(2)	R49AI2100(1)01(2)
0.015	5.0	11.0	18.0	15.0	500	49AI2150(1)01(2)	R49AI2150(1)01(2)
0.022	5.0	11.0	18.0	15.0	500	49AI2220(1)01(2)	R49AI2220(1)01(2)
0.033	5.0	11.0	18.0	15.0	500	49AI2330(1)01(2)	R49AI2330(1)01(2)
0.047	6.0	12.0	18.0	15.0	500	49AI2470(1)01(2)	R49AI2470(1)01(2)
0.068	6.0	12.0	18.0	15.0	500	49AI2680(1)M1(3)	R49AI2680(1)M1(3)
0.068	7.5	13.5	18.0	15.0	500	49AI2680(1)01(2)	R49AI2680(1)01(2)
0.10	7.5	13.5	18.0	15.0	500	49AI3100(1)M1(3)	R49AI3100(1)M1(3)
0.10	8.5	14.5	18.0	15.0	500	49AI3100(1)01(2)	R49AI3100(1)01(2)
0.15	10.0	16.0	18.0	15.0	500	49AI3150(1)01(2)	R49AI3150(1)01(2)
0.10	6.0	15.0	26.5	22.5	400	49AN3100(1)01(2)	R49AN3100(1)01(2)
0.15	7.0	16.0	26.5	22.5	400	49AN3150(1)01(2)	R49AN3150(1)01(2)
0.22	8.5	17.0	26.5	22.5	400	49AN3220(1)01(2)	R49AN3220(1)01(2)
0.33	10.0	18.5	26.5	22.5	400	49AN3330(1)01(2)	R49AN3330(1)01(2)
0.47	11.0	20.0	26.5	22.5	400	49AN3470(1)01(2)	R49AN3470(1)01(2)
0.33	9.0	17.0	32.0	27.5	200	49AR3330(1)01(2)	R49AR3330(1)01(2)
0.47	11.0	20.0	32.0	27.5	200	49AR3470(1)01(2)	R49AR3470(1)01(2)
0.68	13.0	22.0	32.0	27.5	200	49AR3680(1)01(2)	R49AR3680(1)01(2)
1.0	14.0	28.0	32.0	27.5	200	49AR4100(1)01(2)	R49AR4100(1)01(2)
1.5	18.0	33.0	32.0	27.5	200	49AR4150(1)01(2)	R49AR4150(1)01(2)
2.2	22.0	37.0	32.0	27.5	200	49AR4220(1)01(2)	R49AR4220(1)01(2)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) Insert lead and packaging code. See Ordering Options Table for available options.
(2) M = ±20%, K = ±10%
(3) M = ±20% (only available tolerance).

Soldering Process

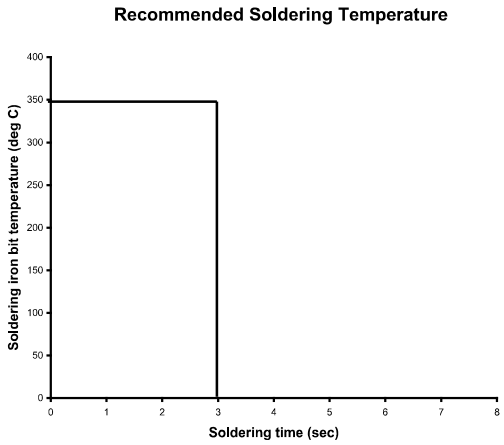
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

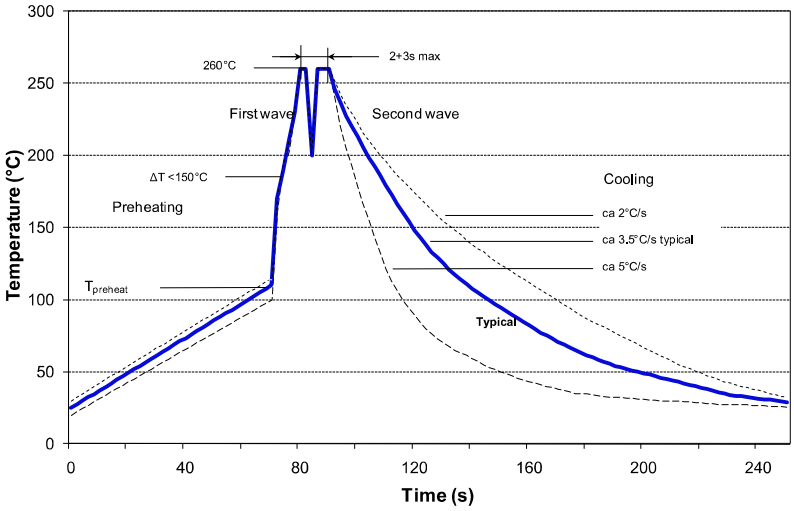
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

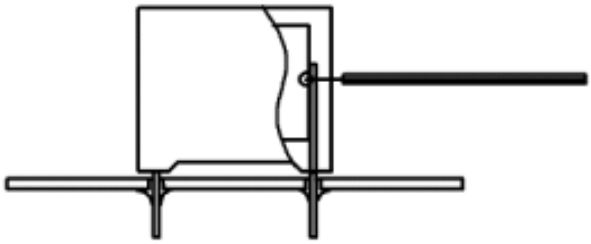
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



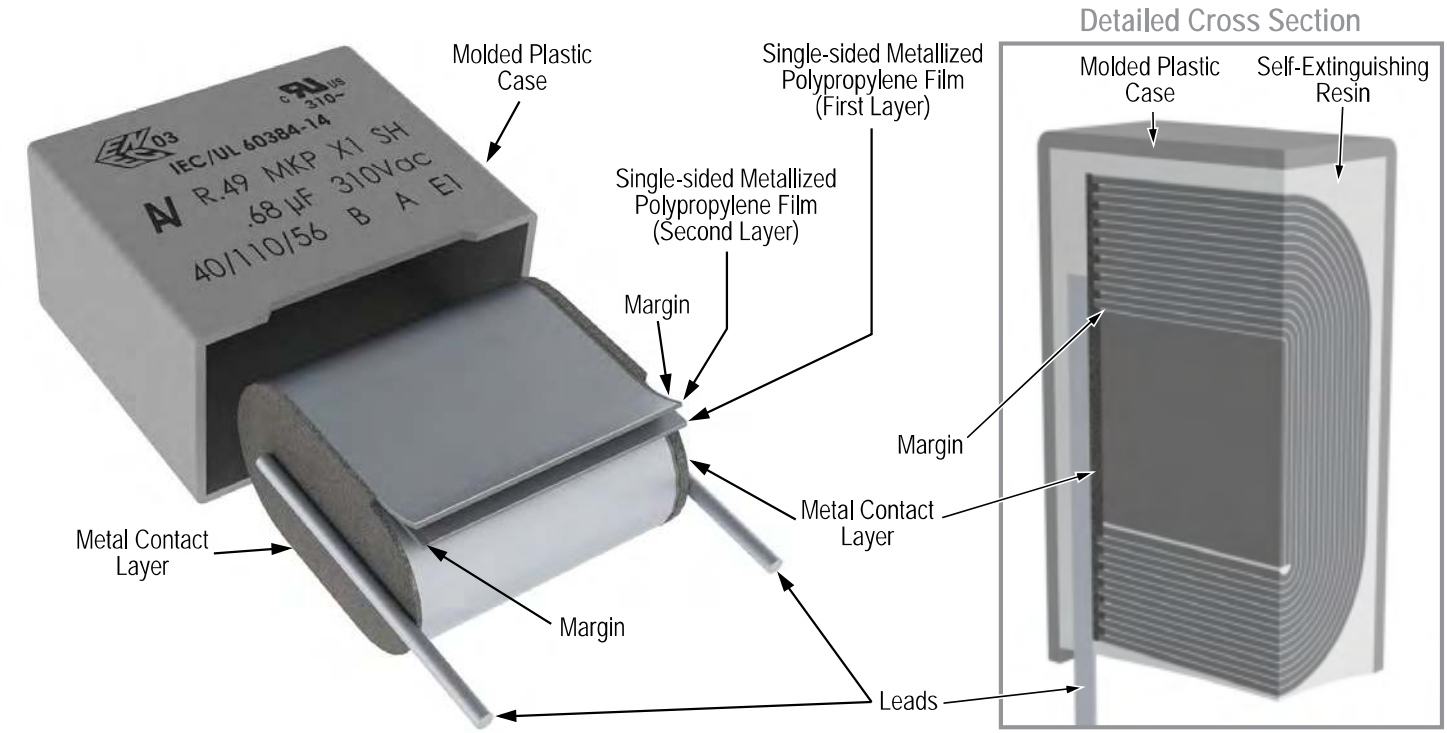
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

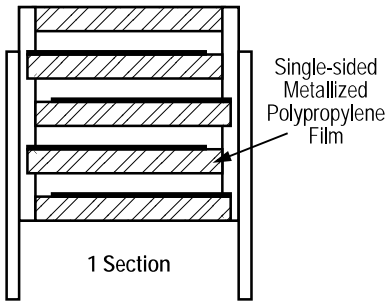
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

Construction

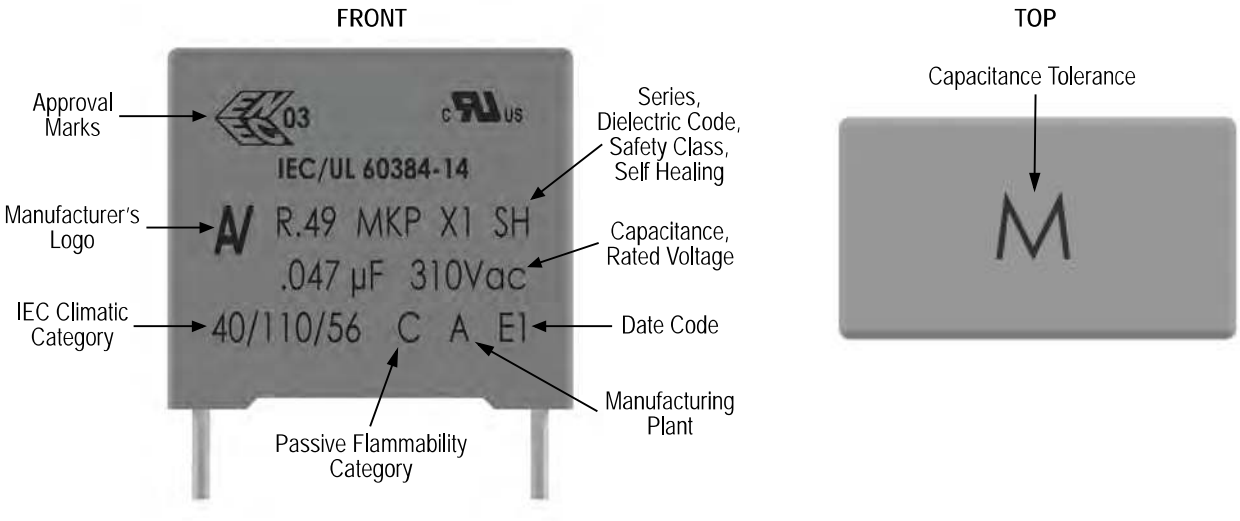


Winding Scheme

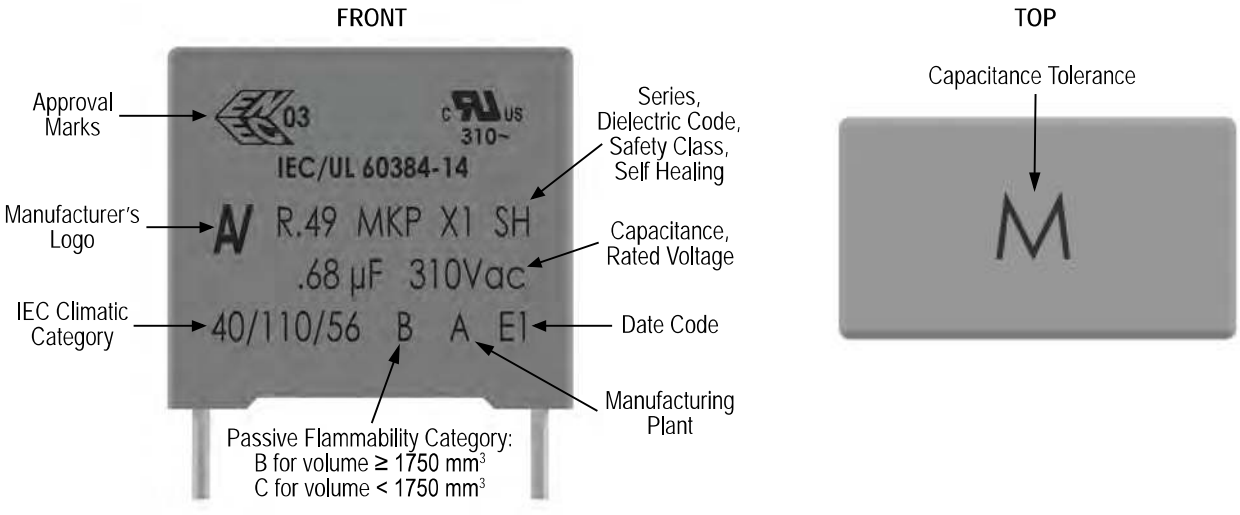


Marking

Lead Spacing 10 mm

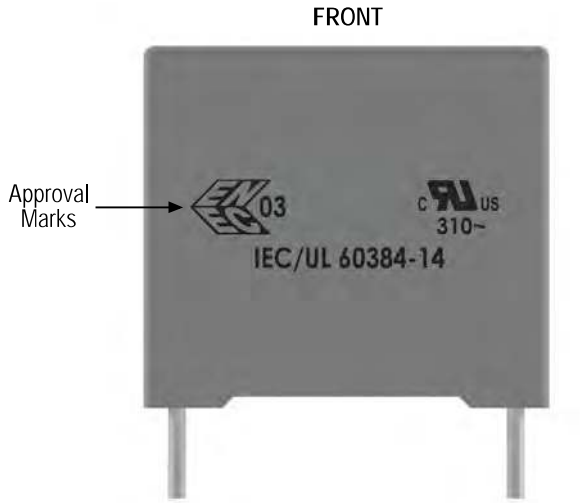


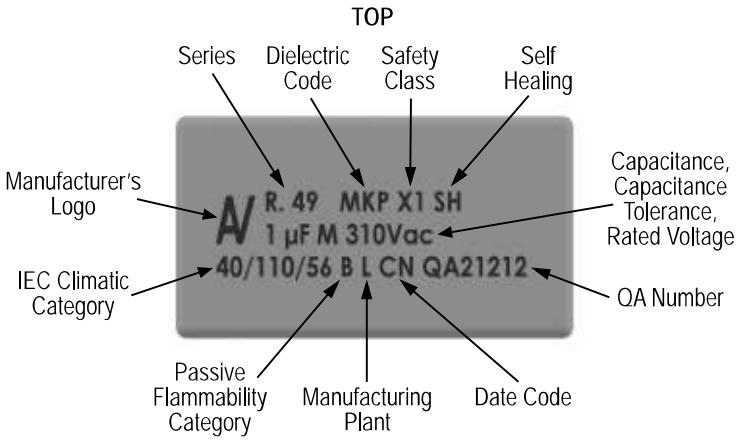
Lead Spacing 15 mm, 22.5 mm (small case sizes)



Marking cont'd

Lead Spacing 22.5 mm (large case sizes), 27.5 mm, 37.5 mm





Manufacturing Date Code (IEC 60062)			
Y = Year, Z = Month			
Year	Code	Month	Code
2000	M	January	1
2001	N	February	2
2002	P	March	3
2003	R	April	4
2004	S	May	5
2005	T	June	6
2006	U	July	7
2007	V	August	8
2008	W	September	9
2009	X	October	O
2010	A	November	N
2011	B	December	D
2012	C		
2013	D		
2014	E		
2015	F		
2016	H		
2017	J		
2018	K		
2019	L		
2020	M		

Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo Taped
10	5.0	11.0	13.0	1300	1500	600	1250	800
	6.0	12.0	13.0	1000	1200	500	1000	680
15	5.0	11.0	18.0	2000	1000	600	1250	800
	6.0	12.0	18.0	1750	900	500	1000	680
	7.5	13.5	18.0	1000	700	350	800	500
	8.5	14.5	18.0	1000	500	300	700	440
	10.0	16.0	18.0	750	500	300	600	380
22.5	6.0	15.0	26.5	805	500	–	700	464
	7.0	16.0	26.5	700	500	–	550	380
	8.5	17.0	26.5	468	300	–	450	280
	10.0	18.5	26.5	396	300	–	350	235
	11.0	20.0	26.5	360	250	–	350	217
27.5	9.0	17.0	32.0	816	408	–	450	–
	11.0	20.0	32.0	560	336	–	350	–
	13.0	22.0	32.0	480	288	–	300	–
	14.0	28.0	32.0	352	176	–	–	–
	18.0	33.0	32.0	256	128	–	–	–
	22.0	37.0	32.0	168	112	–	–	–

R49 Series, Class X1, 330 VAC, 110ºC

Overview

The R49 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material meeting the requirements of UL 94 V–0.

Applications

For use as electromagnetic interference (EMI) suppression filter in across-the-line applications requiring X1 safety classification. Intended for use in situations where exposure to a shock in the event of capacitor failure is not possible. Not for use in "series with mains" type applications. X1 classified capacitors are for use only in a permanently connected apparatus with a connection to mains which cannot be loosened without the use of a tool.

Benefits

- Approvals: ENEC, UL, cUL
- Class X1 (IEC 60384-14)
- Rated voltage: 330 VAC 50/60 Hz
- Capacitance range: 0.047 – 6.8 µF
- Lead spacing: 15.0 – 37.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category: 40/110/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 2,200 VDC/1,500 VAC
- Self-healing properties



Part Number System

R49	A	N	3150	00	B1	M
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Lead and Packaging Code	Internal Use	Capacitance Tolerance
X1, Metallized Polypropylene	A = 330	I = 15.0 N = 22.5 R = 27.5 W = 37.5	The last three digits represent significant figures. The first digit specifies number of zeros to be added.	See Ordering Options Table	A1 A2 A3 B1 B2	K = ±10% M = ±20%

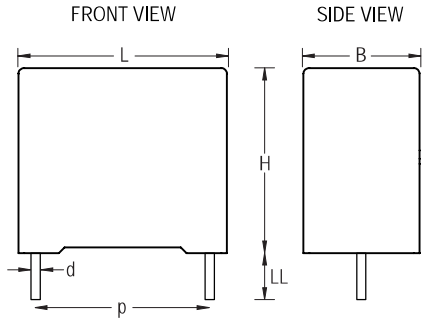
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Ordering Options Table

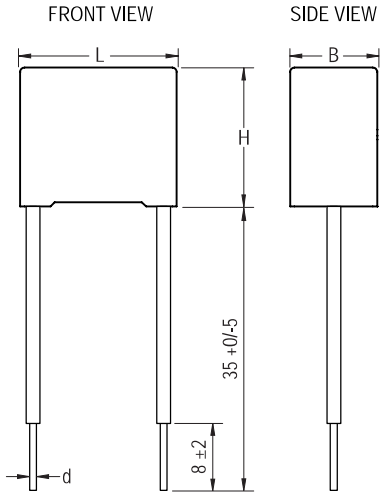
Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
10, 15, 22.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Ammo Pack	H_0= 18.5 +/-0.5	DQ
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	CK
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Short Leads	3.2 +0.3/-0.2	JH
	Bulk (Bag) – Long Leads	18 +1/-1	JM
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
	Bulk (Bag) – Insulated Rigid Leads	30 +5/-0 (sp 8+2/-2)	51
	Bulk (Bag) – Insulated Flexible Leads	150 +5/-5 (sp 8+2/-2)	52
27.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	CK
	Other Lead and Packaging Options		
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
	Bulk (Bag) – Insulated Rigid Leads	30 +5/-0 (sp 8+2/-2)	51
	Bulk (Bag) – Insulated Flexible Leads	150 +5/-5 (sp 8+2/-2)	52
37.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Other Lead and Packaging Options		
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
	Bulk (Bag) – Insulated Rigid Leads	30 +5/-0 (sp 8+2/-2)	51
	Bulk (Bag) – Insulated Flexible Leads	150 +5/-5 (sp 8+2/-2)	52

Dimensions – Millimeters

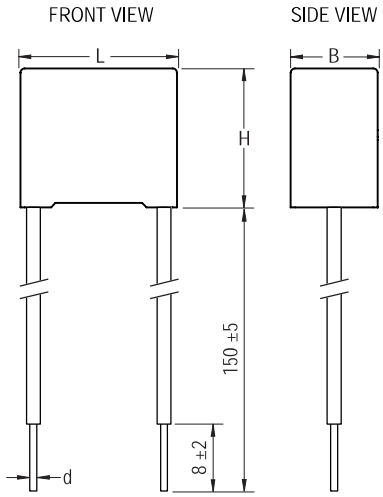
Loose



Insulated Rigid Leads



Insulated Flexible Leads 0.5 mm²



p		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
15.0	+/-0.4	5.0	+0.2	11.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	12.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	17.5	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	8.5	+0.2	14.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	10.0	+0.2	16.0	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	11.0	+0.2	19.0	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	13.0	+0.2	12.0	+0.1	18.0	+0.5	0.8	+/-0.05
22.5	+/-0.4	6.0	+0.2	15.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	7.0	+0.2	16.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	8.5	+0.2	17.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	10.0	+0.2	18.5	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	13.0	+0.2	22.0	+0.1	26.5	+0.3	0.8	+/-0.05
27.5	+/-0.4	9.0	+0.2	17.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	11.0	+0.2	20.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	13.0	+0.2	22.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	13.0	+0.2	25.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	14.0	+0.2	28.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	18.0	+0.2	33.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	22.0	+0.2	37.0	+0.1	32.0	+0.3	0.8	+/-0.05
37.5	+/-0.4	11.0	+0.3	22.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	13.0	+0.3	24.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	16.0	+0.3	28.5	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	19.0	+0.3	32.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	30.0	+0.3	45.0	+0.1	41.5	+0.3	1.0	+/-0.05

Note: See Ordering Options Table for lead length (LL/H_0) options.

Performance Characteristics

Dielectric	Polypropylene film
Plates	Metal layer deposited by evaporation under vacuum
Winding	Non-inductive type
Leads	Tinned wire
Protection	Plastic case, thermosetting resin filled. Box material is solvent resistant and flame retardant according to UL94.
Related documents	IEC 60384-14, EN 60384-14
Rated Voltage (V_R)	330 VAC (50/60 Hz), 800 VDC
Capacitance Range	0.047 µF to 6.8 µF
Capacitance Values	E6 series (IEC 60063)
Capacitance Tolerance	±10%, ±20%
Temperature Range	-40°C to +110°C
Climatic Category	40/110/56 IEC 60068-1
Approvals	ENEC, UL, cUL
Dissipation Factor (tanδ)	≤ 0.1% (0.06%*) at 1kHz , +25°C ±5°C (* typical value)
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,200 VDC/1,500 VAC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.

Insulation Resistance

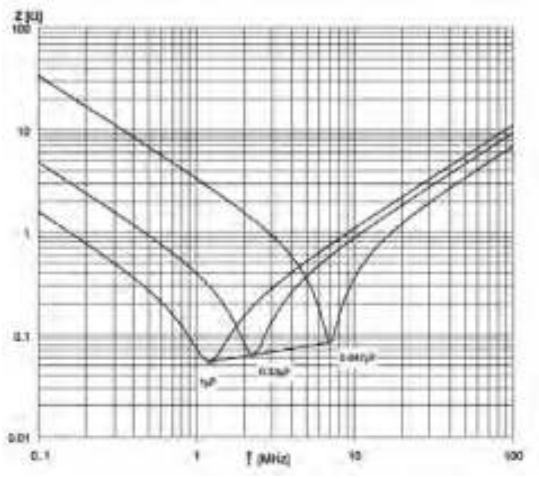
Measured at +25°C ±5°C, according to IEC 60384–2

Minimum Values Between Terminals

Voltage Charge	Voltage Charge Time	C ≤ 0.33 µF	C > 0.33 µF
100 VDC	1 min	≥ 1 • 10^5 MΩ (≥ 5 • 10^5 MΩ)* * typical value	≥ 30,000 MΩ • µF (≥ 150,000 MΩ • µF)* * typical value

In DC Applications	Recommended voltage ≤ 800 VDC

Impedance Graph



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	EN/IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 4 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384-14	CA08.00030
	UL 60384-14 and CAN/CSA E60384-14 (330 VAC)	E97797

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L				
0.047	5.0	11.0	18.0	15.0	500	49AI2470(1)B1(2)	R49AI2470(1)B1(2)
0.068	6.0	12.0	18.0	15.0	500	49AI2680(1)B1(2)	R49AI2680(1)B1(2)
0.068	6.0	17.5	18.0	15.0	500	49AI2680(1)A2(2)	R49AI2680(1)A2(2)
0.10	6.0	17.5	18.0	15.0	500	49AI3100(1)A2(2)	R49AI3100(1)A2(2)
0.15	8.5	14.5	18.0	15.0	500	49AI3150(1)B1(3)	R49AI3150(1)B1(3)
0.22	10.0	16.0	18.0	15.0	500	49AI3220(1)B2(3)	R49AI3220(1)B2(3)
0.22	11.0	19.0	18.0	15.0	500	49AI3220(1)B1(2)	R49AI3220(1)B1(2)
0.15	6.0	15.0	26.5	22.5	400	49AN3150(1)B1(2)	R49AN3150(1)B1(2)
0.22	7.0	16.0	26.5	22.5	400	49AN3220(1)B1(2)	R49AN3220(1)B1(2)
0.33	8.5	17.0	26.5	22.5	400	49AN3330(1)B1(3)	R49AN3330(1)B1(3)
0.47	10.0	18.5	26.5	22.5	400	49AN3470(1)B1(3)	R49AN3470(1)B1(3)
0.68	13.0	22.0	26.5	22.5	400	49AN3680(1)B1(3)	R49AN3680(1)B1(3)
0.33	9.0	17.0	32.0	27.5	200	49AR3330(1)A1(2)	R49AR3330(1)A1(2)
0.47	11.0	20.0	32.0	27.5	200	49AR3470(1)A1(2)	R49AR3470(1)A1(2)
0.68	11.0	20.0	32.0	27.5	200	49AR3680(1)B1(2)	R49AR3680(1)B1(2)
0.68	13.0	22.0	32.0	27.5	200	49AR3680(1)A1(2)	R49AR3680(1)A1(2)
1.0	13.0	25.0	32.0	27.5	200	49AR4100(1)B1(2)	R49AR4100(1)B1(2)
1.0	14.0	28.0	32.0	27.5	200	49AR4100(1)A1(2)	R49AR4100(1)A1(2)
1.5	14.0	28.0	32.0	27.5	200	49AR4150(1)B1(2)	R49AR4150(1)B1(2)
1.5	18.0	33.0	32.0	27.5	200	49AR4150(1)A1(2)	R49AR4150(1)A1(2)
2.2	18.0	33.0	32.0	27.5	200	49AR4220(1)B1(2)	R49AR4220(1)B1(2)
2.2	22.0	37.0	32.0	27.5	200	49AR4220(1)A1(2)	R49AR4220(1)A1(2)
3.3	22.0	37.0	32.0	27.5	200	49AR4330(1)B1(2)	R49AR4330(1)B1(2)
0.68	11.0	22.0	41.5	37.5	100	49AW3680(1)B1(2)	R49AW3680(1)B1(2)
1.0	11.0	22.0	41.5	37.5	100	49AW4100(1)B1(2)	R49AW4100(1)B1(2)
1.5	13.0	24.0	41.5	37.5	100	49AW4150(1)B1(2)	R49AW4150(1)B1(2)
2.2	16.0	28.5	41.5	37.5	100	49AW4220(1)B1(2)	R49AW4220(1)B1(2)
3.3	19.0	32.0	41.5	37.5	100	49AW4330(1)B1(2)	R49AW4330(1)B1(2)
4.7	19.0	32.0	41.5	37.5	100	49AW4470(1)B1(2)	R49AW4470(1)B1(2)
6.8	30.0	45.0	41.5	37.5	100	49AW4680(1)B1(2)	R49AW4680(1)B1(2)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) Insert lead and packaging code. See Ordering Options Table for available options.
(2) M = ±20%, K = ±10%
(3) M = ±20% (only available tolerance).

Soldering Process

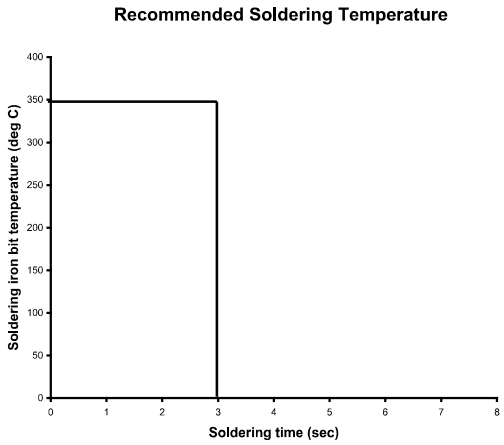
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183°C for SnPb eutectic alloy to 217 – 221°C for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170°C). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

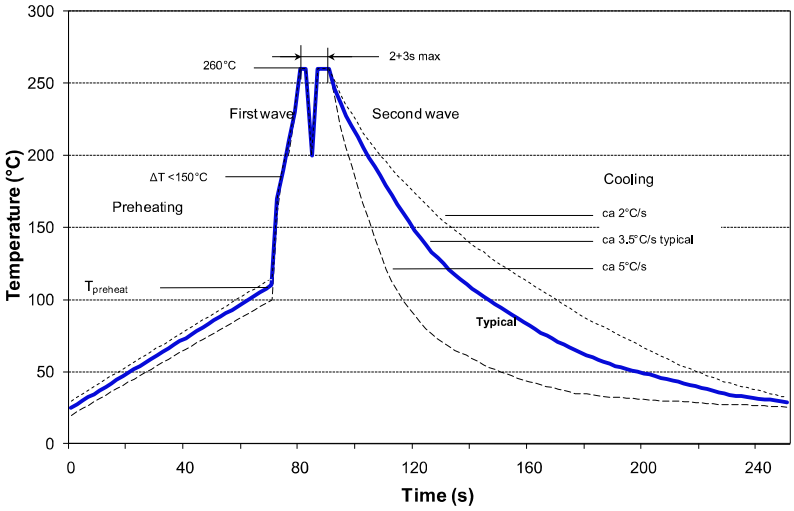
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

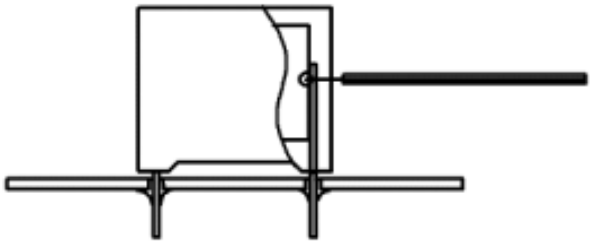
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



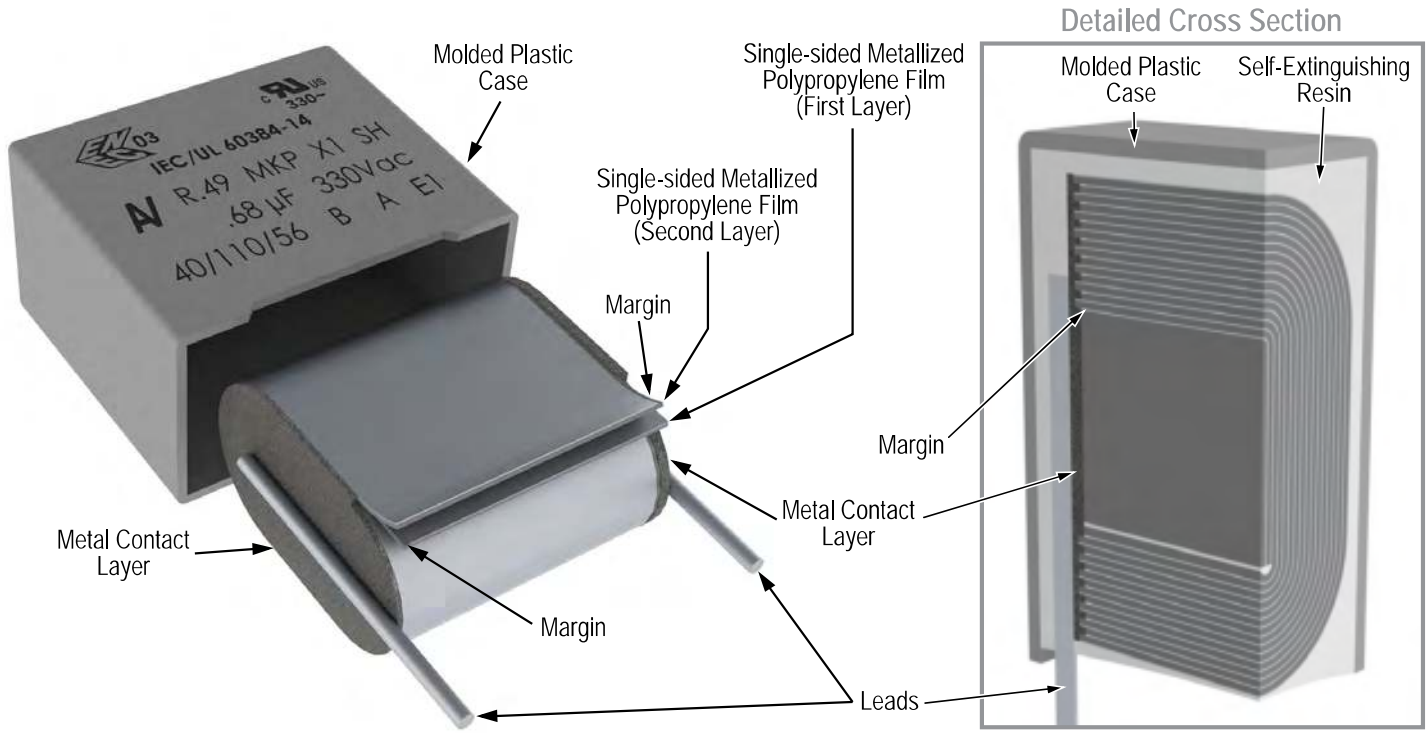
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

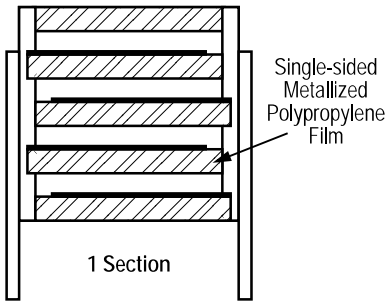
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

Construction

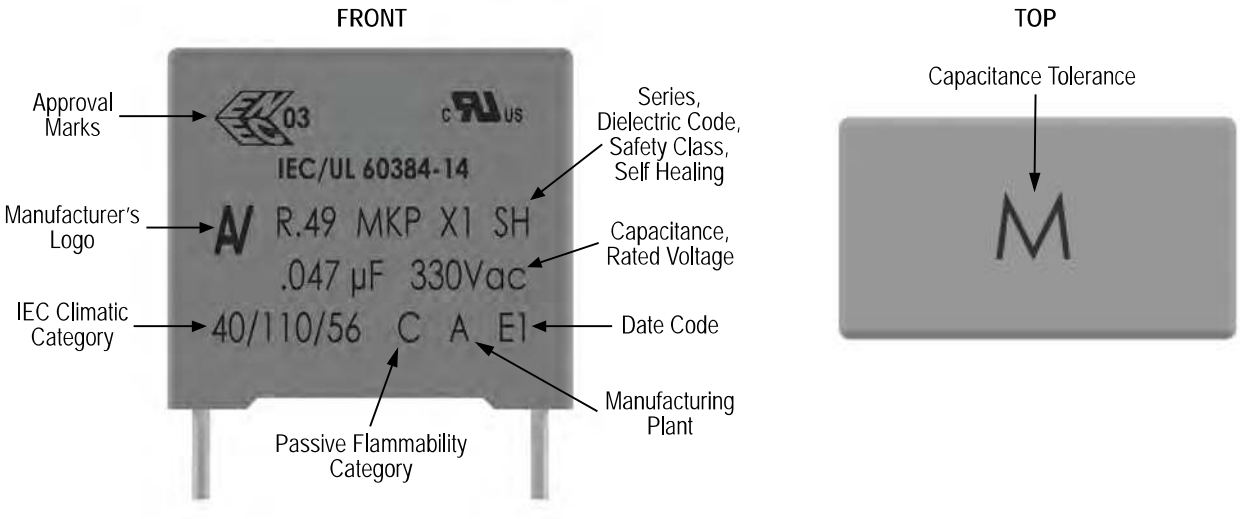


Winding Scheme

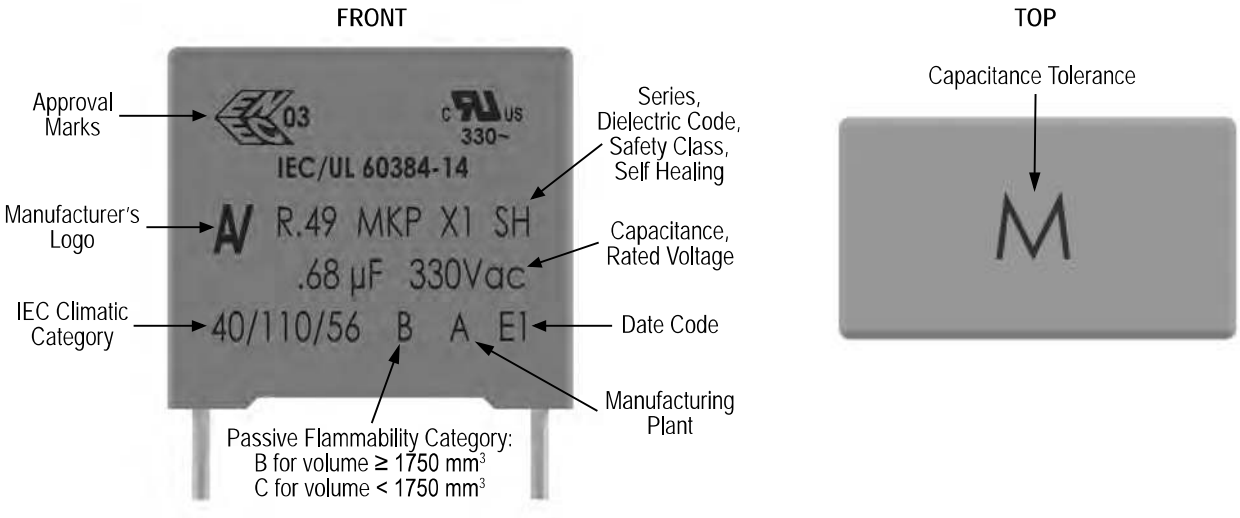


Marking

Lead Spacing 10 mm

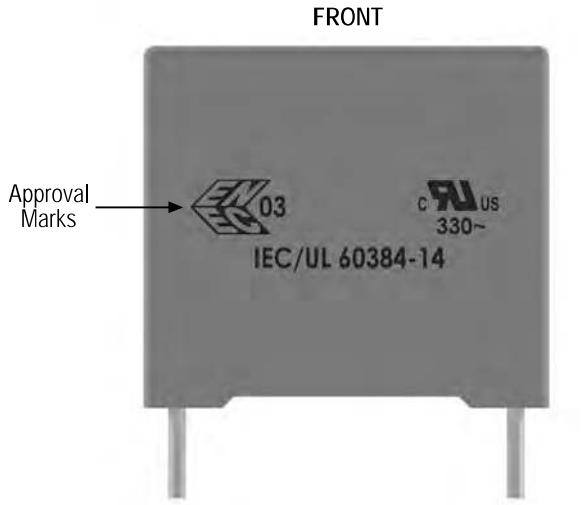


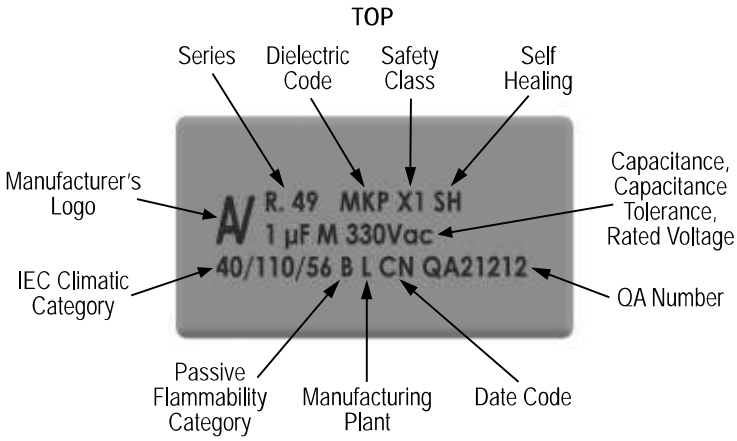
Lead Spacing 15 mm, 22.5 mm (small case sizes)



Marking cont'd

Lead Spacing 22.5 mm (large case sizes), 27.5 mm, 37.5 mm





Manufacturing Date Code (IEC 60062)			
Y = Year, Z = Month			
Year	Code	Month	Code
2000	M	January	1
2001	N	February	2
2002	P	March	3
2003	R	April	4
2004	S	May	5
2005	T	June	6
2006	U	July	7
2007	V	August	8
2008	W	September	9
2009	X	October	O
2010	A	November	N
2011	B	December	D
2012	C		
2013	D		
2014	E		
2015	F		
2016	H		
2017	J		
2018	K		
2019	L		
2020	M		

Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo Taped
15	5.0	11.0	18.0	2000	1000	600	1250	800
	6.0	12.0	18.0	1750	900	500	1000	680
	6.0	17.5	18.0	1000	700	500	1000	680
	8.5	14.5	18.0	1000	500	300	700	440
	10.0	16.0	18.0	750	500	300	600	380
	11.0	19.0	18.0	450	350	–	500	340
	13.0	12.0	18.0	750	490	200	480	280
22.5	6.0	15.0	26.5	805	500	–	700	464
	7.0	16.0	26.5	700	500	–	550	380
	8.5	17.0	26.5	468	300	–	450	280
	10.0	18.5	26.5	396	300	–	350	235
	13.0	22.0	26.5	300	200	–	300	–
27.5	9.0	17.0	32.0	816	408	–	450	–
	11.0	20.0	32.0	560	336	–	350	–
	13.0	22.0	32.0	480	288	–	300	–
	13.0	25.0	32.0	480	288	–	–	–
	14.0	28.0	32.0	352	176	–	–	–
	18.0	33.0	32.0	256	128	–	–	–
	22.0	37.0	32.0	168	112	–	–	–
37.5	11.0	22.0	41.5	420	252	–	–	–
	13.0	24.0	41.5	360	216	–	–	–
	16.0	28.5	41.5	216	108	–	–	–
	19.0	32.0	41.5	192	96	–	–	–
	30.0	45.0	41.5	90	60	–	–	–

Metallized Polypropylene Film EMI Suppression Capacitors

R47 Series, Class X1, 440 VAC, 110ºC (Automotive Grade)

Electronic Components
KEMET
CHARGED.

Overview

The R47 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material meeting the requirements of UL 94 V–0.

Automotive Grade devices are available (up to 22.5 mm Lead Spacing) and meet the demanding Automotive Electronics Council's AEC–Q200 qualification requirements.

Applications

For use as a electromagnetic interference (EMI) suppression filter in across-the-line applications requiring X1 safety classification. Intended for use in situations where exposure to a shock in the event of capacitor failure is not possible. X1 classified capacitors are for use only in a permanently connected apparatus with a connection to mains which cannot be loosened without the use of a tool.

Benefits

- Approvals: ENEC, UL, cUL
- Class X1 (IEC 60384-14)
- Rated voltage: 440 VAC 50/60 Hz
- Capacitance range: 0.0047 – 2.2 µF
- Lead spacing: 10.0 – 37.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category: 40/110/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 2,700 VDC/1,700 VAC
- Self-healing properties
- Automotive (AEC–Q200) grades available up to 22.5 mm Lead Spacing



Part Number System

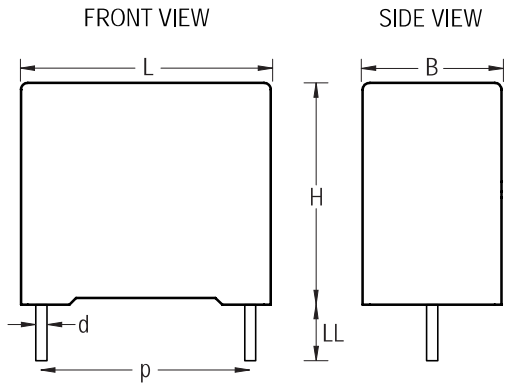
R47	4	I	2100	00	A1	M
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Packaging	Internal Use	Capacitance Tolerance
X1, Metallized Polypropylene	4 = 440	F = 10.0 I = 15.0 N = 22.5 R = 27.5 W = 37.5	The last three digits represent significant figures. The first digit specifies number of zeros to be added.	See Ordering Options Table	A1 A2 A3	K = ±10% M = ±20%

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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
10, 15, 22.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Ammo Pack	H_0 = 18.5 +/-0.5	DQ
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	CK
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Short Leads	3.2 +0.3/-0	JH
	Bulk (Bag) – Long Leads	18 +1/-1	JM
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
27.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	CK
	Other Lead and Packaging Options		
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Short Leads	3.2 +0.3/-0	JH
	Bulk (Bag) – Long Leads	18 +1/-1	JM
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
37.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Other Lead and Packaging Options		
	Bulk (Bag) – Short Leads	2.7 +0.5/-0	JA
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Short Leads	3.2 +0.3/-0	JH
	Bulk (Bag) – Long Leads	18 +1/-1	JM
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50

Dimensions – Millimeters



p		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
10.0	+/-0.4	4.0	+0.2	9.0	+0.1	13.0	+0.2	0.6	+/-0.05
10.0	+/-0.4	5.0	+0.2	11.0	+0.1	13.0	+0.2	0.6	+/-0.05
10.0	+/-0.4	6.0	+0.2	12.0	+0.1	13.0	+0.2	0.6	+/-0.05
15.0	+/-0.4	5.0	+0.2	11.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	12.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	17.5	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	7.5	+0.2	13.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	7.5	+0.2	18.5	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	8.5	+0.2	14.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	9.0	+0.2	12.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	10.0	+0.2	16.0	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	11.0	+0.2	19.0	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	13.0	+0.2	12.0	+0.1	18.0	+0.5	0.8	+/-0.05
22.5	+/-0.4	6.0	+0.2	15.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	6.5	+0.2	13,5	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	7.0	+0.2	16.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	8.5	+0.2	17.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	10.0	+0.2	18.5	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	11.0	+0.2	20.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	13.0	+0.2	22.0	+0.1	26.5	+0.3	0.8	+/-0.05
27.5	+/-0.4	9.0	+0.2	17.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	11.0	+0.2	20.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	13.0	+0.2	22.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	14.0	+0.2	28.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	18.0	+0.2	33.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	22.0	+0.2	37.0	+0.1	32.0	+0.3	0.8	+/-0.05
37.5	+/-0.4	11.0	+0.3	22.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	13.0	+0.3	24.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	16.0	+0.3	28.5	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	19.0	+0.3	32.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	20.0	+0.3	40.0	+0.1	41.5	+0.3	1.0	+/-0.05

Note: See Ordering Options Table for lead length (LL/H_0) options.

Performance Characteristics

Dielectric	Polypropylene film
Plates	Metal layer deposited by evaporation under vacuum
Winding	Non-inductive type
Leads	Tinned wire
Protection	Plastic case, thermosetting resin filled. Box material is solvent resistant and flame retardant according to UL94.
Related documents	IEC 60384-14, EN 60384-14
Rated Voltage (V_R)	440 VAC (50/60 Hz), 1,000 VDC
Capacitance Range	0.0047 µF to 2.2 µF
Capacitance Values	E6/E12 series (IEC 60063)
Capacitance Tolerance	±10%, ±20%
Temperature Range	-40ºC to +110°C
Climatic Category	40/110/56 IEC 60068-1
Approvals	ENEC, UL, cUL
Dissipation Factor (tanδ)	≤ 0.1% (0.06%*) at 1kHz , +25°C ±5°C (* typical value)
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,700 VDC/1,700 VAC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.
Insulation Resistance	Measured at +25°C ±5°C, according to IEC 60384–2

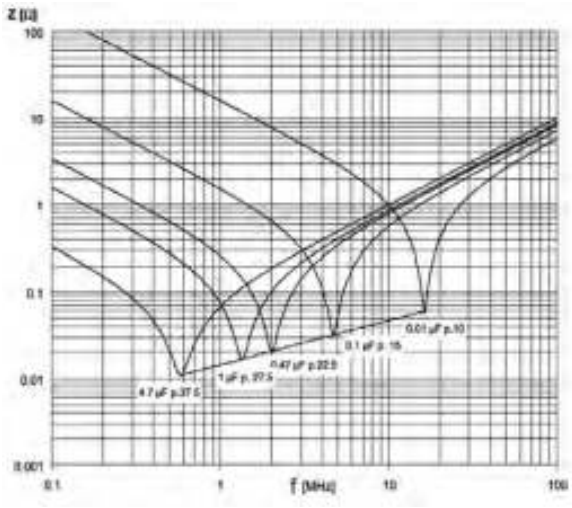
Minimum Values Between Terminals			
Voltage Charge	Voltage Charge Time	C ≤ 0.33 µF	C > 0.33 µF
100 VDC	1 min	≥ 1 • 10^5 MΩ	≥ 30,000 MΩ • µF

In DC Applications	Recommended voltage ≤ 1,000 VDC

Qualification

Automotive Grade products meet or exceed the requirements outlined by the Automotive Electronics Council. Details regarding test methods and conditions are referenced in document AEC–Q200, Stress Test Qualification for Passive Components. For additional information regarding the Automotive Electronics Council and AEC–Q200, please visit their website at www.aecouncil.com.

Impedance Graph



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	EN/IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 4 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384-14	CA08.00101
	UL 60384-14 and CAN/CSA E60384-14 (440 VAC)	E97797

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L				
0.0047	4.0	9.0	13.0	10.0	750	474F1470(1)A1(2)	R474F1470(1)A1(2)
0.0068	5.0	11.0	13.0	10.0	750	474F1680(1)A1(2)	R474F1680(1)A1(2)
0.0082	6.0	12.0	13.0	10.0	750	474F1820(1)A1(2)	R474F1820(1)A1(2)
0.010	6.0	12.0	13.0	10.0	750	474F2100(1)A1(2)	R474F2100(1)A1(2)
0.010	5.0	11.0	18.0	15.0	600	474I2100(1)A1(2)	R474I2100(1)A1(2)
0.012	5.0	11.0	18.0	15.0	600	474I2120(1)A1(2)	R474I2120(1)A1(2)
0.015	5.0	11.0	18.0	15.0	600	474I2150(1)A1(2)	R474I2150(1)A1(2)
0.018	5.0	11.0	18.0	15.0	600	474I2180(1)A1(2)	R474I2180(1)A1(2)
0.022	6.0	12.0	18.0	15.0	600	474I2220(1)A1(2)	R474I2220(1)A1(2)
0.027	6.0	12.0	18.0	15.0	600	474I2270(1)A1(2)	R474I2270(1)A1(2)
0.033	6.0	12.0	18.0	15.0	600	474I2330(1)A1(2)	R474I2330(1)A1(2)
0.039	7.5	13.5	18.0	15.0	600	474I2390(1)A1(2)	R474I2390(1)A1(2)
0.047	7.5	13.5	18.0	15.0	600	474I2470(1)A1(2)	R474I2470(1)A1(2)
0.047	6.0	17.5	18.0	15.0	600	474I2470(1)A2(2)	R474I2470(1)A2(2)
0.047	9.0	12.5	18.0	15.0	600	474I2470(1)A3(2)	R474I2470(1)A3(2)
0.056	8.5	14.5	18.0	15.0	600	474I2560(1)A1(2)	R474I2560(1)A1(2)
0.068	10.0	16.0	18.0	15.0	600	474I2680(1)A1(2)	R474I2680(1)A1(2)
0.068	7.5	18.5	18.0	15.0	600	474I2680(1)A2(2)	R474I2680(1)A2(2)
0.068	13.0	12.0	18.0	15.0	600	474I2680(1)A3(2)	R474I2680(1)A3(2)
0.082	10.0	16.0	18.0	15.0	600	474I2820(1)A1(2)	R474I2820(1)A1(2)
0.10	11.0	19.0	18.0	15.0	600	474I3100(1)A1(2)	R474I3100(1)A1(2)
0.047	6.0	15.0	26.5	22.5	300	474N2470(1)A1(2)	R474N2470(1)A1(2)
0.047	6.5	13.5	26.5	22.5	300	474N2470(1)A2(2)	R474N2470(1)A2(2)
0.068	6.0	15.0	26.5	22.5	300	474N2680(1)A1(2)	R474N2680(1)A1(2)
0.10	7.0	16.0	26.5	22.5	300	474N3100(1)A1(2)	R474N3100(1)A1(2)
0.12	8.5	17.0	26.5	22.5	300	474N3120(1)A1(2)	R474N3120(1)A1(2)
0.15	10.0	18.5	26.5	22.5	300	474N3150(1)A1(2)	R474N3150(1)A1(2)
0.18	10.0	18.5	26.5	22.5	300	474N3180(1)A1(2)	R474N3180(1)A1(2)
0.22	11.0	20.0	26.5	22.5	300	474N3220(1)A1(2)	R474N3220(1)A1(2)
0.27	13.0	22.0	26.5	22.5	300	474N3270(1)A1(2)	R474N3270(1)A1(2)
0.33	13.0	22.0	26.5	22.5	300	474N3330(1)A1(2)	R474N3330(1)A1(2)
0.15	9.0	17.0	32.0	27.5	225	474R3150(1)A1(2)	R474R3150(1)A1(2)
0.18	9.0	17.0	32.0	27.5	225	474R3180(1)A1(2)	R474R3180(1)A1(2)
0.22	9.0	17.0	32.0	27.5	225	474R3220(1)A1(2)	R474R3220(1)A1(2)
0.27	9.0	17.0	32.0	27.5	225	474R3270(1)A2(2)	R474R3270(1)A2(2)
0.33	11.0	20.0	32.0	27.5	225	474R3330(1)A2(2)	R474R3330(1)A2(2)
0.39	11.0	20.0	32.0	27.5	225	474R3390(1)A1(2)	R474R3390(1)A1(2)
0.47	13.0	22.0	32.0	27.5	225	474R3470(1)A1(2)	R474R3470(1)A1(2)
0.56	13.0	22.0	32.0	27.5	225	474R3560(1)A1(2)	R474R3560(1)A1(2)
0.68	14.0	28.0	32.0	27.5	225	474R3680(1)A1(2)	R474R3680(1)A1(2)
0.82	18.0	33.0	32.0	27.5	225	474R3820(1)A1(2)	R474R3820(1)A1(2)
1.0	18.0	33.0	32.0	27.5	225	474R4100(1)A1(2)	R474R4100(1)A1(2)
1.2	18.0	33.0	32.0	27.5	225	474R4120(1)A1(2)	R474R4120(1)A1(2)
1.5	22.0	37.0	32.0	27.5	225	474R4150(1)A1(2)	R474R4150(1)A1(2)
0.47	11.0	22.0	41.5	37.5	150	474W3470(1)A1(2)	R474W3470(1)A1(2)
0.56	11.0	22.0	41.5	37.5	150	474W3560(1)A1(2)	R474W3560(1)A1(2)
0.68	13.0	24.0	41.5	37.5	150	474W3680(1)A1(2)	R474W3680(1)A1(2)
0.82	16.0	28.5	41.5	37.5	150	474W3820(1)A1(2)	R474W3820(1)A1(2)
1.0	16.0	28.5	41.5	37.5	150	474W4100(1)A1(2)	R474W4100(1)A1(2)
1.2	19.0	32.0	41.5	37.5	150	474W4120(1)A1(2)	R474W4120(1)A1(2)
1.5	19.0	32.0	41.5	37.5	150	474W4150(1)A1(2)	R474W4150(1)A1(2)
1.8	20.0	40.0	41.5	37.5	150	474W4180(1)A1(2)	R474W4180(1)A1(2)
2.2	20.0	40.0	41.5	37.5	150	474W4220(1)A1(2)	R474W4220(1)A1(2)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) Insert lead and packaging code. See Ordering Options Table for available options.
(2) M = ±20%, K = ±10%

Soldering Process

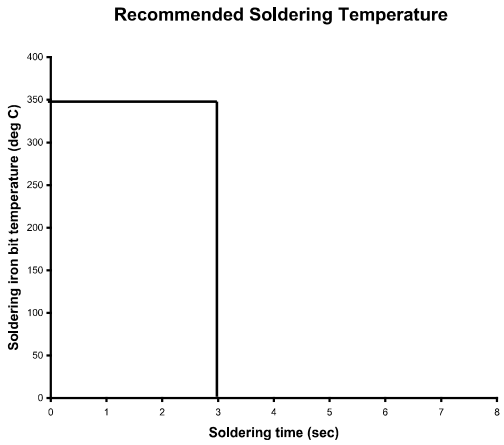
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

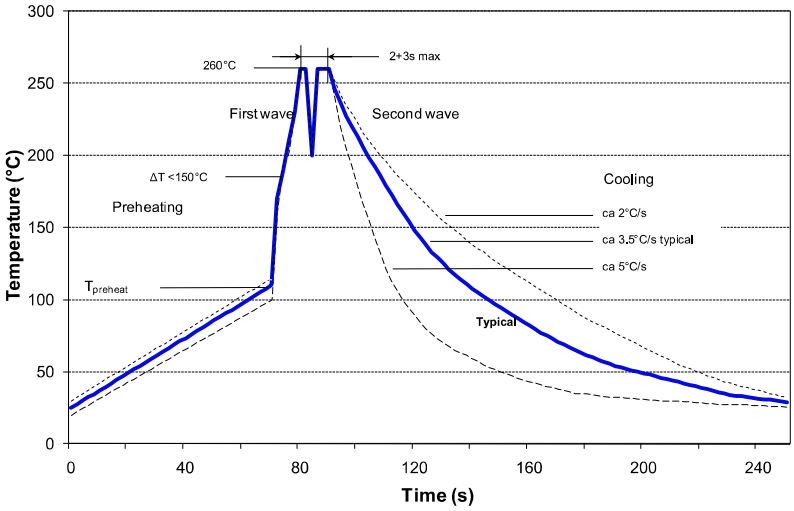
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

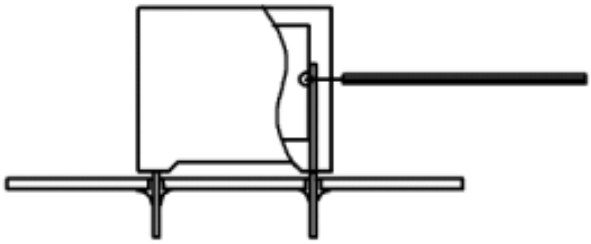
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



Temperature monitored inside the capacitor.

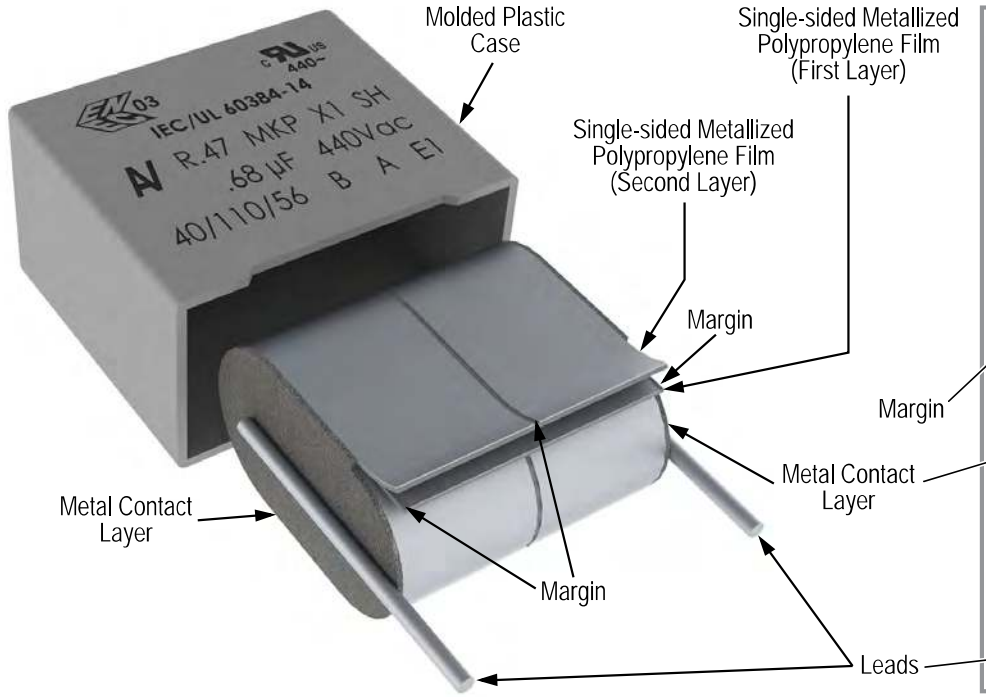
Selective Soldering Recommendations

Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

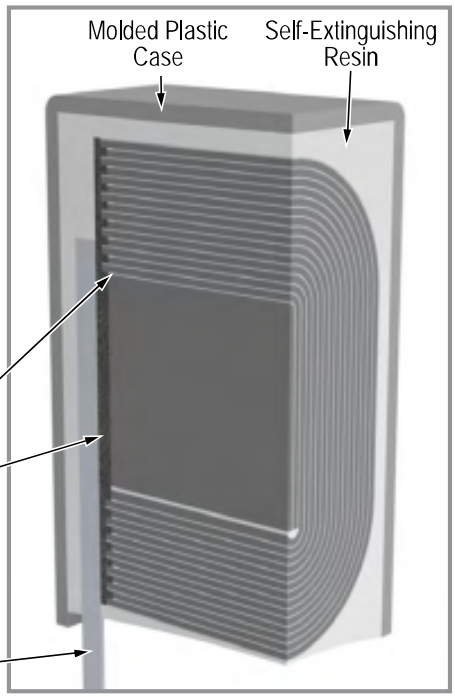
The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

Construction

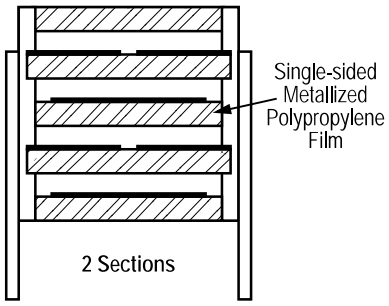
2 Sections



Detailed Cross Section

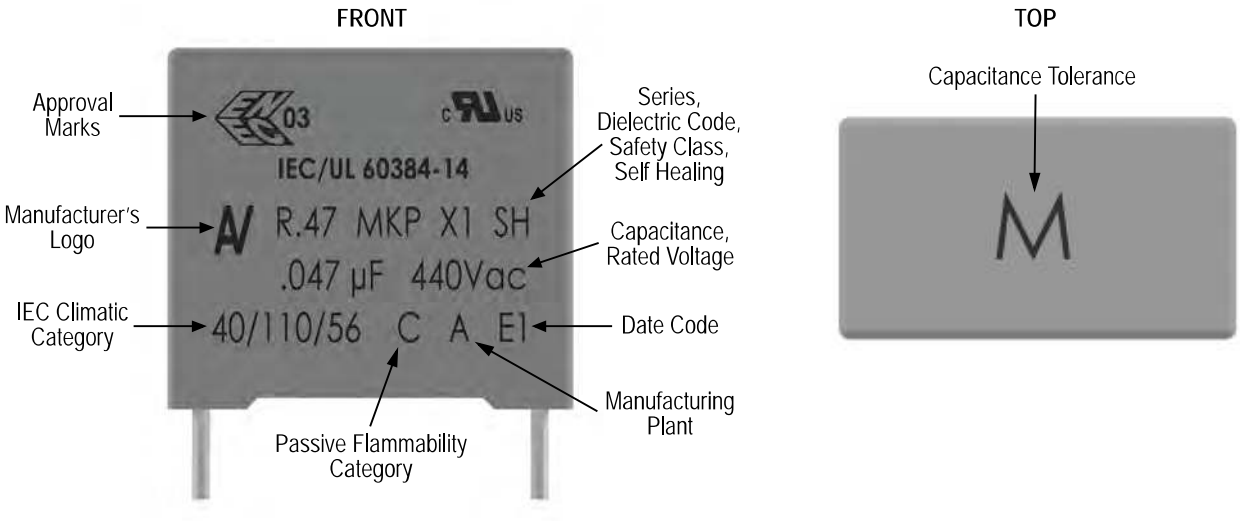


Winding Scheme

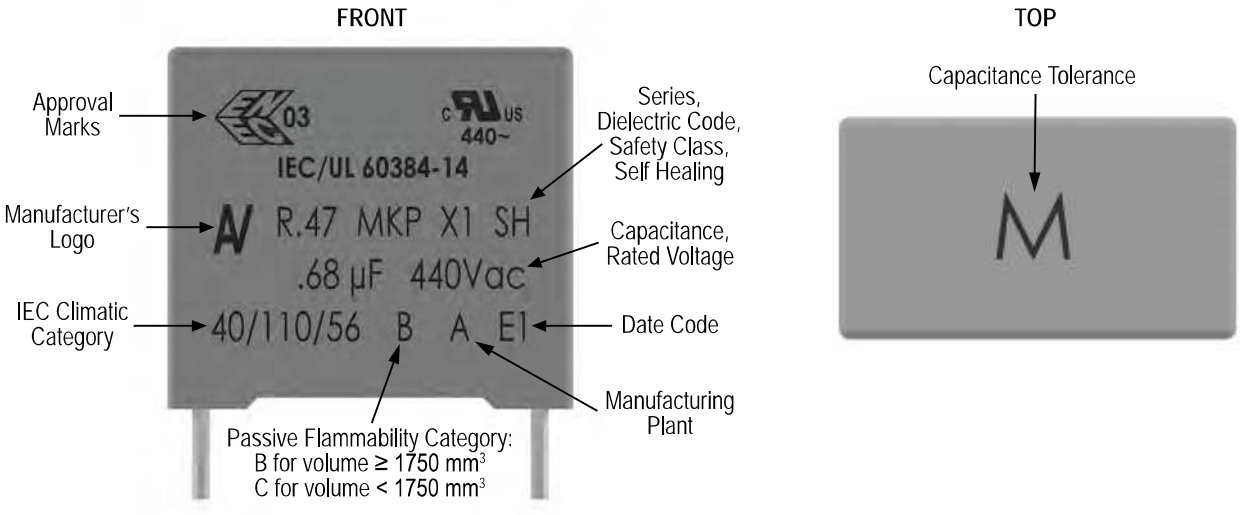


Marking

Lead Spacing 10 mm

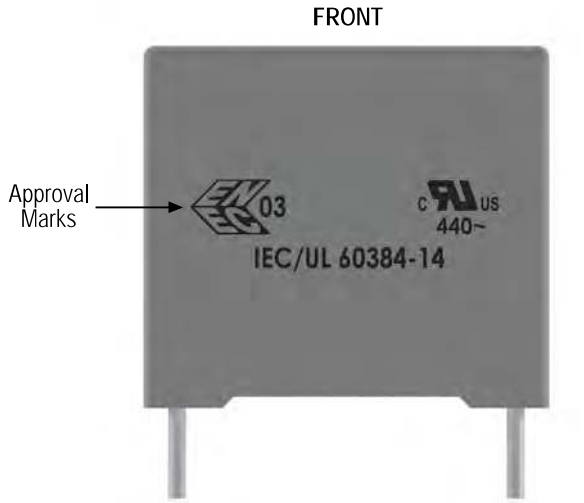


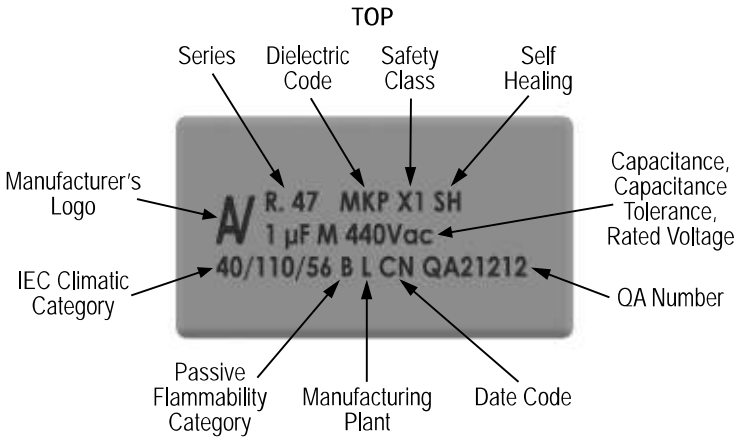
Lead Spacing 15 mm, 22.5 mm (small case sizes)



Marking cont'd

Lead Spacing 22.5 mm (large case sizes), 27.5 mm, 37.5 mm





Manufacturing Date Code (IEC 60062)			
Y = Year, Z = Month			
Year	Code	Month	Code
2000	M	January	1
2001	N	February	2
2002	P	March	3
2003	R	April	4
2004	S	May	5
2005	T	June	6
2006	U	July	7
2007	V	August	8
2008	W	September	9
2009	X	October	O
2010	A	November	N
2011	B	December	D
2012	C		
2013	D		
2014	E		
2015	F		
2016	H		
2017	J		
2018	K		
2019	L		
2020	M		

Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo Taped
10	4.0	9.0	13.0	2000	1800	750	1500	1000
	5.0	11.0	13.0	1300	1500	600	1250	800
	6.0	12.0	13.0	1000	1200	500	1000	680
15	5.0	11.0	18.0	2000	1000	600	1250	800
	6.0	12.0	18.0	1750	900	500	1000	680
	6.0	17.5	18.0	1000	700	500	1000	680
	7.5	13.5	18.0	1000	700	350	800	500
	7.5	18.5	18.0	900	500	–	800	500
	8.5	14.5	18.0	1000	500	300	700	440
	9.0	12.5	18.0	1000	520	270	650	410
	10.0	16.0	18.0	750	500	300	600	380
	11.0	19.0	18.0	450	350	–	500	340
	13.0	12.0	18.0	750	490	200	480	280
22.5	6.0	15.0	26.5	805	500	–	700	464
	6.5	13.5	26.5	800	–	–	–	–
	7.0	16.0	26.5	700	500	–	550	380
	8.5	17.0	26.5	468	300	–	450	280
	10.0	18.5	26.5	396	300	–	350	235
	11.0	20.0	26.5	360	250	–	350	217
	13.0	22.0	26.5	300	200	–	300	–
27.5	9.0	17.0	32.0	816	408	–	450	–
	11.0	20.0	32.0	560	336	–	350	–
	13.0	22.0	32.0	480	288	–	300	–
	14.0	28.0	32.0	352	176	–	–	–
	18.0	33.0	32.0	256	128	–	–	–
	22.0	37.0	32.0	168	112	–	–	–
	22.0	37.0	32.0	168	112	–	–	–
37.5	11.0	22.0	41.5	420	252	–	–	–
	13.0	24.0	41.5	360	216	–	–	–
	16.0	28.5	41.5	216	108	–	–	–
	19.0	32.0	41.5	192	96	–	–	–
	20.0	40.0	41.5	126	84	–	–	–

PHE844 Series, Class X1, 440/480 VAC, 105°C

Overview

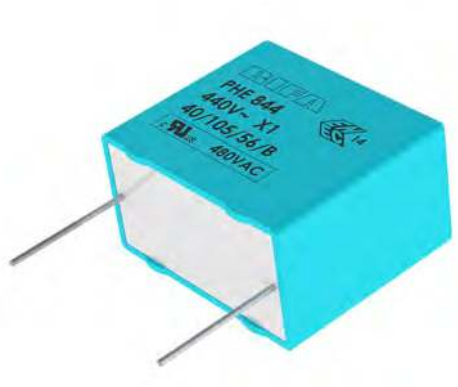
The PHE844 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material meeting the requirements of UL 94 V–0.

Applications

For use as a electromagnetic interference (EMI) suppression filter in across-the-line applications requiring X1 safety classification. Suitable for use in situations where failure of the capacitor would not lead to danger of electric shock.

Benefits

- Approvals: ENEC, UL, cUL
- Class X1 (IEC 60384-14)
- Rated Voltage: 440 VAC 50/60 Hz (ENEC), 480VAC 50/60 Hz (UL, cUL)
- Capacitance range: 0.1 – 2.2 µF
- Lead spacing: 22.5 – 37.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category 40/105/56/B, IEC 60068-1
- Tape and reel in accordance with IEC 60286-2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +105˚C
- 100% screening factory test at 3,000 VDC
- Self-healing properties



Legacy Part Number System

PHE844	R	D	6100	M	R06L2
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Capacitance Tolerance	Packaging
X1, Metallized Polypropylene	R = 440	D = 22.5 F = 27.5 R = 37.5	The last three digits represent significant figures. The first digit specifies the total number of digits.	K = ±10% M = ±20%	See Ordering Options Table

New KEMET Part Number System

F	844	D	H	104	M	440	C
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging
F = Film	X1, Metallized Polypropylene	D = 22.5 F = 27.5 R = 37.5	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	K = ±10% M = ±20%	440 = 440	See Ordering Options Table

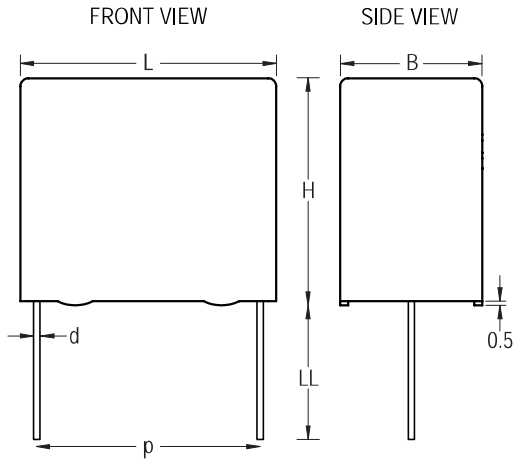
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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
22.5	Standard Lead and Packaging Options			
	Bulk (Tray)–Short Leads	6 +0/-1	C	R06L2(1)
	Other Lead and Packaging Options			
	Pizza Pack	6 +0/-1	Z	R06L2(1)
	Bulk (Tray)–Long Leads	30 +0/-1	ALW0L	R30L2
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R17T0
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R17T1
27.5	Standard Lead and Packaging Options			
	Bulk (Tray)–Short Leads	6 +0/-1	C	R06L2(1)
	Other Lead and Packaging Options			
	Pizza Pack	6 +0/-1	Z	R06L2(1)
	Bulk (Tray)–Long Leads	30 +0/-1	ALW0L	R30L2
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R17T1
37.5	Standard Lead and Packaging Options			
	Bulk (Tray)–Short Leads	6 +0/-1	C	R06L2(1)
	Other Lead and Packaging Options			
	Pizza Pack	6 +0/-1	Z	R06L2(1)

(1) Please specify Bulk (Tray) or Pizza Packaging

Dimensions – Millimeters



KEMET Size Code	Legacy Size Code	p		B		H		L		d	
		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
DH	D14	22.5	+/- 0.4	8.0	Maximum	16.0	Maximum	26.0	Maximum	0.8	+/- 0.05
DM	D15	22.5	+/- 0.4	9.0	Maximum	18.5	Maximum	26.0	Maximum	0.8	+/- 0.05
DT	D16	22.5	+/- 0.4	11.0	Maximum	21.5	Maximum	26.0	Maximum	0.8	+/- 0.05
DW	D20	22.5	+/- 0.4	13.5	Maximum	23.0	Maximum	26.0	Maximum	0.8	+/- 0.05
DY	D19	22.5	+/- 0.4	15.5	Maximum	24.5	Maximum	26.0	Maximum	0.8	+/- 0.05
FE	F11	27.5	+/- 0.4	10.5	Maximum	20.5	Maximum	31.5	Maximum	0.8	+/- 0.05
FK	F03	27.5	+/- 0.4	13.5	Maximum	23.0	Maximum	31.5	Maximum	0.8	+/- 0.05
FM	F13	27.5	+/- 0.4	14.5	Maximum	24.5	Maximum	31.5	Maximum	0.8	+/- 0.05
FR	F14	27.5	+/- 0.4	17.5	Maximum	28.0	Maximum	31.5	Maximum	0.8	+/- 0.05
FV	F16	27.5	+/- 0.4	21.0	Maximum	30.0	Maximum	31.5	Maximum	0.8	+/- 0.05
RF	R05	37.5	+/- 0.5	13.0	Maximum	24.0	Maximum	41.0	Maximum	1.0	+/- 0.05
RH	R04	37.5	+/- 0.5	15.0	Maximum	26.0	Maximum	41.0	Maximum	1.0	+/- 0.05
RM	R03	37.5	+/- 0.5	19.0	Maximum	36.0	Maximum	41.0	Maximum	1.0	+/- 0.05
RP	R06	37.5	+/- 0.5	21.0	Maximum	38.0	Maximum	41.0	Maximum	1.0	+/- 0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Dielectric	Polypropylene film			
Plates	Metal layer deposited by evaporation under vacuum			
Winding	Non-inductive type. Series design.			
Leads	Tinned wire			
Protection	Plastic case, thermosetting resin filled. Box material is solvent resistant and flame retardant according to UL94.			
Rated Voltage (V_R)	440 VAC 50/60 Hz (ENEC) - 480 VAC 50/60 Hz (UL,cUL)			
Capacitance Range	0.10 µF to 2.2 µF			
Capacitance Values	E6 series (IEC 60063)			
Capacitance Tolerance	±20% standard, ±10% option			
Temperature Range	-40°C to 105°C			
Climatic Category	40/105/56/B IEC 60068-1			
Approvals	ENEC, UL, cUL			
Related Documents	EN/IEC 60384-14:2005, UL 60384-14, CAN/CSA E60384-14:09			
Dissipation Factor (tanδ)	Maximum Values at +23°C			
	Frequency	C ≤ 0.1 µF	0.1 µF < C ≤ 1 µF	C > 1 µF
	1 kHz	0.1%	0.1%	0.1%
	10 kHz	0.2%	0.4%	0.8%
	100 kHz	0.6%	-	-
Test Voltage Between Terminals	The 100% screening factory test is carried out at 3,000 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.			
Resonance Frequency	Tabulated self-resonance frequencies f_o (see Table 1 - Ratings & Part Number Reference)			
Insulation Resistance	Measured at +25°C ±5°C, according to IEC 60384–2			
	Minimum Values Between Terminals			
	C ≤ 0.33 µF		C > 0.33 µF	
	≥ 30,000 MΩ		≥ 10,000 MΩ • µF	
In DC Applications	Recommended voltage ≤ 1,000 VDC			

Environmental Test Data

Test	IEC Publication	Procedure
Endurance	IEC 60384-14:2005	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2 No visible damage. No open or short circuit.
Bump	IEC 60068-2-29 Test Eb	1,000 bumps at 390 m/s^2 No visible damage. No open or short circuit.
Change of Temperature	IEC 60068-2-14 Test Na	Upper and lower rated temperature 5 cycles No visible damage.
Active Flammability	IEC 60384-14:2005	V_R + 20 surge pulses at 4 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384-14:2005	IEC 60384–1, IEC 60695–11–5 Needle Flame Test
Damp Heat Steady State	IEC 60068-2-78 Test Cab	+40°C and 90 – 95% RH, 56 days

Approvals

Certification Body	Mark	Specification	File Number
Intertek Semko AB		EN/IEC 60384-14	SE/0140–1C
UL		UL 60384 and CAN/CSA E60384-14:09 (480 VAC)	E73869

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Size Code (New/Legacy)	Max Dimensions in mm			Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
		B	H	L					
0.10	DH/D14	8.0	16.0	26.0	22.5	3.2	100	F844DH104(1)440(2)	PHE844RD6100(1)(2)
0.15	DM/D15	9.0	18.5	26.0	22.5	2.6	100	F844DM154(1)440(2)	PHE844RD6150(1)(2)
0.22	DT/D16	11.0	21.5	26.0	22.5	2.1	100	F844DT224(1)440(2)	PHE844RD6220(1)(2)
0.33	DW/D20	13.5	23.0	26.0	22.5	1.8	100	F844DW334(1)440(2)	PHE844RD6330(1)(2)
0.47	DY/D19	15.5	24.5	26.0	22.5	1.5	100	F844DY474(1)440(2)	PHE844RD6470(1)(2)
0.22	FE/F11	10.5	20.5	31.5	27.5	2.2	100	F844FE224(1)440(2)	PHE844RF6220(1)(2)
0.33	FK/F03	13.5	23.0	31.5	27.5	1.7	100	F844FK334(1)440(2)	PHE844RF6330(1)(2)
0.47	FM/F13	14.5	24.5	31.5	27.5	1.4	100	F844FM474(1)440(2)	PHE844RF6470(1)(2)
0.68	FR/F14	17.5	28.0	31.5	27.5	1.1	100	F844FR684(1)440(2)	PHE844RF6680(1)(2)
1.0	FV/F16	21.0	30.0	31.5	27.5	1.0	100	F844FV105(1)440(2)	PHE844RF7100(1)(2)
0.47	RF/R05	13.0	24.0	41.0	37.5	1.3	100	F844RF474(1)440(2)	PHE844RR6470(1)(2)
0.68	RF/R05	13.0	24.0	41.0	37.5	1.1	100	F844RF684(1)440(2)	PHE844RR6680(1)(2)
1.0	RH/R04	15.0	26.0	41.0	37.5	0.92	100	F844RH105(1)440(2)	PHE844RR7100(1)(2)
1.5	RM/R03	19.0	36.0	41.0	37.5	0.74	100	F844RM155(1)440(2)	PHE844RR7150(1)(2)
2.2	RP/R06	21.0	38.0	41.0	37.5	0.60	100	F844RP225(1)440(2)	PHE844RR7220(1)(2)
Capacitance Value (µF)	Size Code (New/ Legacy)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) M = ±20%, K = ±10%.

(2) Insert ordering code for lead type and packaging. See Ordering Options Table for available options.

Soldering Process

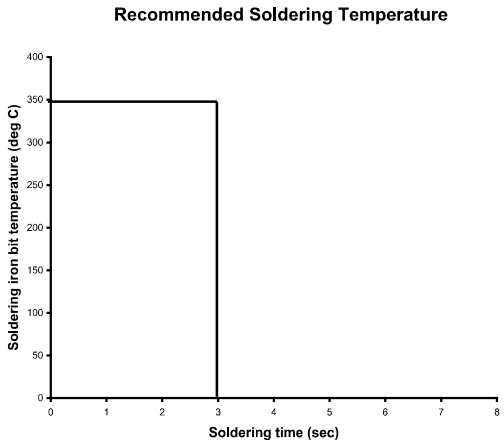
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

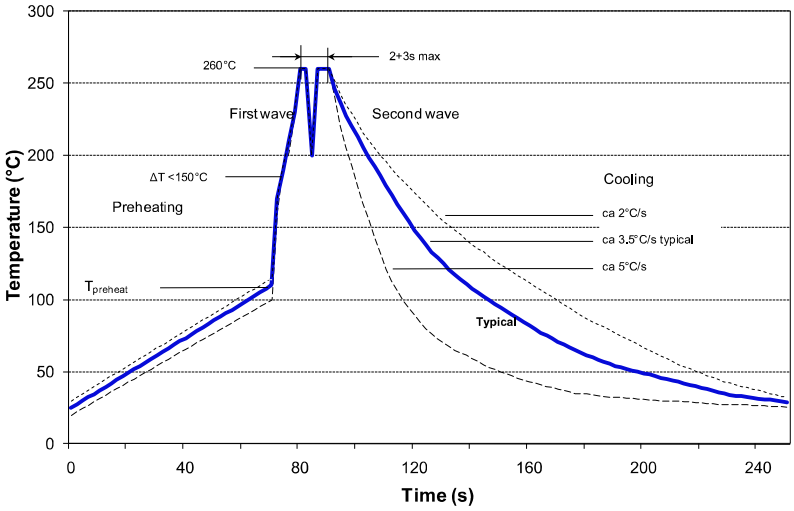
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

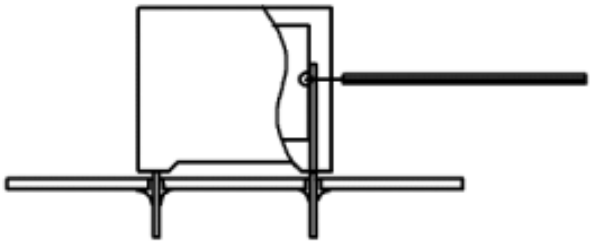
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



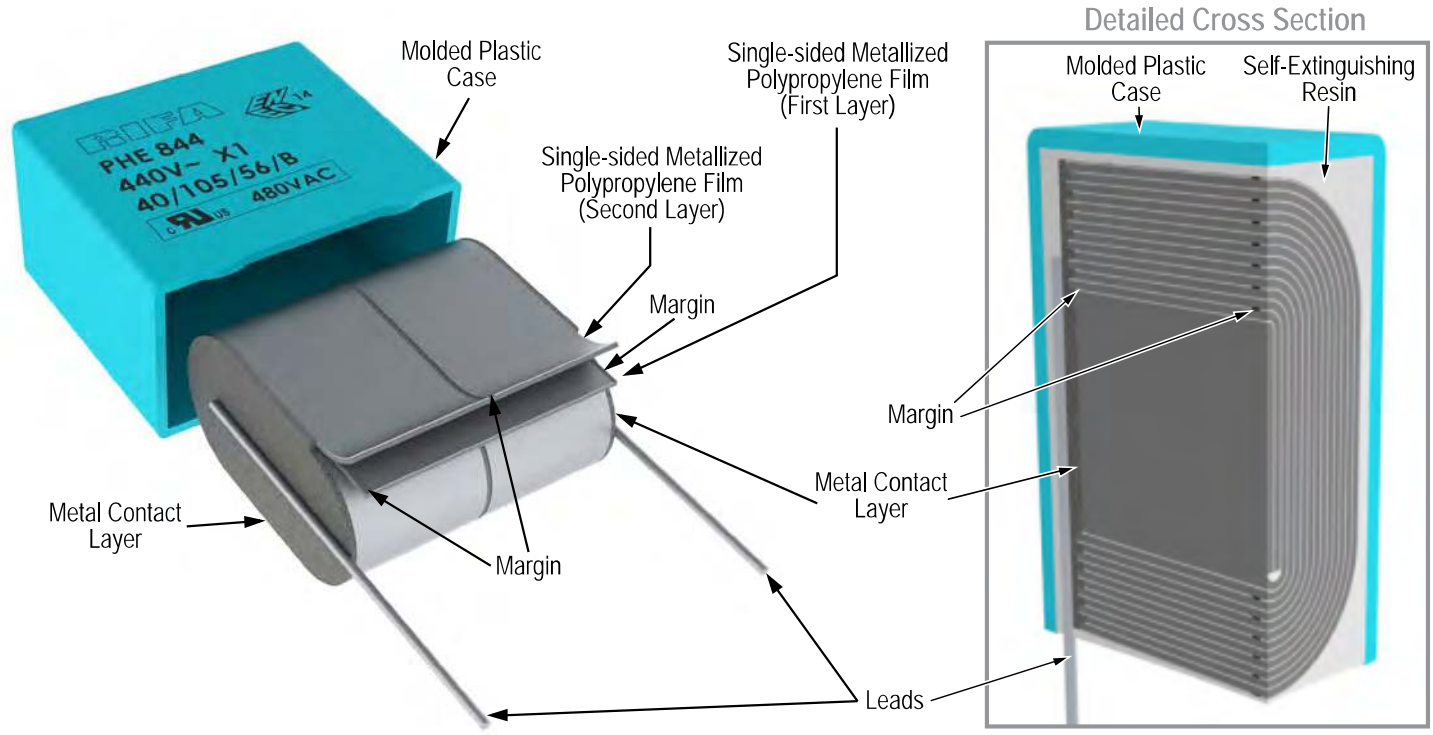
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

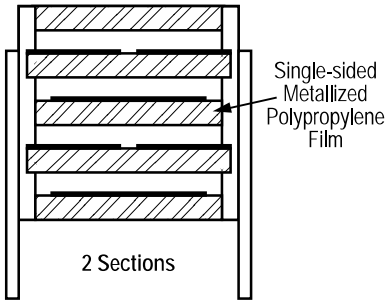
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

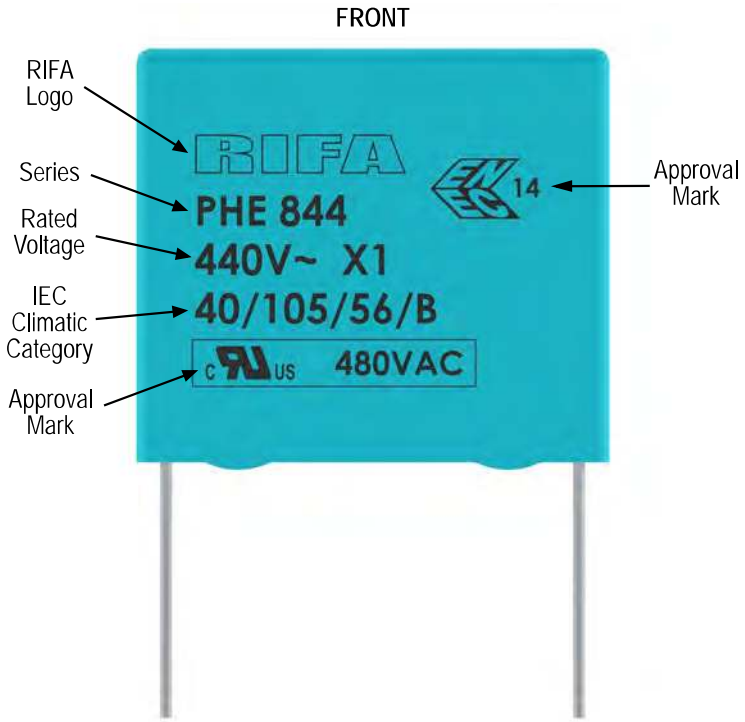
Construction

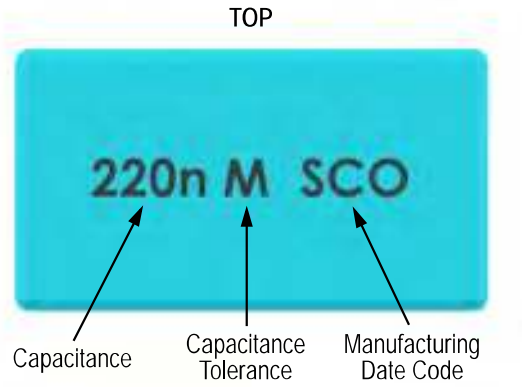


Winding Scheme



Marking





Manufacturing Date Code (IEC 60062)			
Y = Year, Z = Month			
Year	Code	Month	Code
2000	M	January	1
2001	N	February	2
2002	P	March	3
2003	R	April	4
2004	S	May	5
2005	T	June	6
2006	U	July	7
2007	V	August	8
2008	W	September	9
2009	X	October	O
2010	A	November	N
2011	B	December	D
2012	C		
2013	D		
2014	E		
2015	F		
2016	H		
2017	J		
2018	K		
2019	L		
2020	M		

Packaging Quantities

KEMET Size Code	Legacy Size Code	Lead Spacing	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Standard Reel ø 360 mm	Large Reel ø 500 mm	Ammo Bulk (Pizza)
DD	D13	22.5	6.5	14.5	26.0	234	300	600	440
DH	D14		8.0	16.0	26.0	186	250	500	352
DM	D15		9.0	18.5	26.0	308	250	500	308
DT	D16		11.0	21.5	26.0	253	200	400	253
DF	D17		7.0	16.5	26.0	216	300	600	396
DR	D18		10.5	19.0	26.0	264	200	400	264
DY	D19		15.5	24.5	26.0	176	110	250	176
DW	D20		13.5	23.0	26.0	209	160	300	209
FK	F03	27.5	13.5	23.0	31.5	171		250	171
FE	F11		10.5	20.5	31.5	216		350	216
FG	F12		11.5	22.5	31.5	198		300	198
FM	F13		14.5	24.5	31.5	153		250	153
FR	F14		17.5	28.0	31.5	126			126
FS	F15		19.0	29.0	31.5	117			117
FV	F16		21.0	30.0	31.5	108			108
FH	F17		21.0	12.5	31.5	108			108
FT	F18		31.0	18.5	31.5	72			72
FQ	F19		27.5	16.0	31.5	81			81
RK	R02	37.5	16.5	32.0	41.0	105			105
RM	R03		19.0	36.0	41.0	91			91
RH	R04		15.0	26.0	41.0	119			119
RF	R05		13.0	24.0	41.0	140			140
RP	R06		21.0	38.0	41.0	84			84
RS	R08		28.0	43.0	41.0	54			54

PHE845 Series, Class X1, 760 VAC, 105°C

Overview

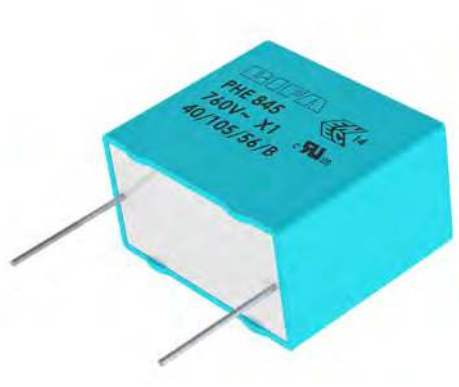
The PHE845 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material meeting the requirements of UL 94 V–0.

Applications

For use as a electromagnetic interference (EMI) suppression filter in across-the-line applications requiring X1 safety classification. Suitable for use in situations where failure of the capacitor would not lead to danger of electric shock.

Benefits

- Approvals: ENEC, UL, cUL
- Class X1 (IEC 60384-14)
- Rated Voltage: 760VAC 50/60Hz
- Capacitance range: 0.01 – 1.0 µF
- Lead spacing: 22.5 – 37.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category 40/105/56/B, IEC 60068-1
- Tape and reel in accordance with IEC 60286-2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +105˚C
- 100% screening factory test at 4,250 VDC
- Self-healing properties



Legacy Part Number System

PHE845	V	D	5100	M	R06L2
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Capacitance Tolerance	Packaging
X1, Metallized Polypropylene	V = 760	D = 22.5 F = 27.5 R = 37.5	The last three digits represent significant figures. The first digit specifies the total number of digits.	K = ±10% M = ±20%	See Ordering Options Table

New KEMET Part Number System

F	845	D	D	103	M	760	C
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging
F = Film	X1, Metallized Polypropylene	D = 22.5 F = 27.5 R = 37.5	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	K = ±10% M = ±20%	760 = 760	See Ordering Options Table

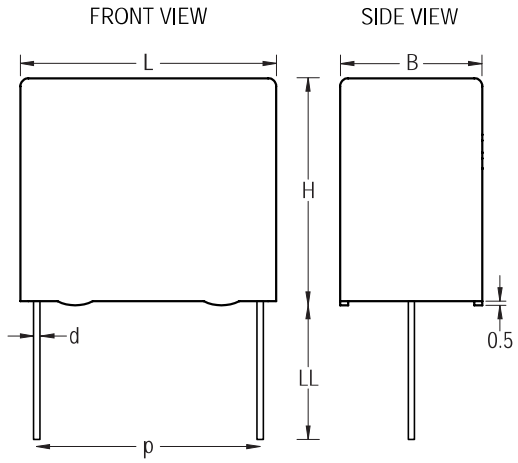
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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
22.5	Standard Lead and Packaging Options			
	Bulk (Tray)–Short Leads	6 +0/-1	C	R06L2(1)
	Other Lead and Packaging Options			
	Pizza Pack	6 +0/-1	Z	R06L2(1)
	Bulk (Tray)–Long Leads	30 +0/-1	ALW0L	R30L2
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R17T0
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R17T1
27.5	Standard Lead and Packaging Options			
	Bulk (Tray)–Short Leads	6 +0/-1	C	R06L2(1)
	Other Lead and Packaging Options			
	Pizza Pack	6 +0/-1	Z	R06L2(1)
	Bulk (Tray)–Long Leads	30 +0/-1	ALW0L	R30L2
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R17T1
37.5	Standard Lead and Packaging Options			
	Bulk (Tray)–Short Leads	6 +0/-1	C	R06L2(1)
	Other Lead and Packaging Options			
	Pizza Pack	6 +0/-1	Z	R06L2(1)

(1) Please specify Bulk (Tray) or Pizza Packaging

Dimensions – Millimeters



KEMET Size Code	Legacy Size Code	p		B		H		L		d	
		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
DD	D13	22.5	+/- 0.4	6.5	Maximum	14.5	Maximum	26.0	Maximum	0.8	+/- 0.05
DG	D17	22.5	+/- 0.4	7.0	Maximum	16.5	Maximum	26.0	Maximum	0.8	+/- 0.05
DM	D15	22.5	+/- 0.4	9.0	Maximum	18.5	Maximum	26.0	Maximum	0.8	+/- 0.05
DR	D18	22.5	+/- 0.4	10.5	Maximum	19.0	Maximum	26.0	Maximum	0.8	+/- 0.05
DT	D16	22.5	+/- 0.4	11.0	Maximum	21.5	Maximum	26.0	Maximum	0.8	+/- 0.05
DW	D20	22.5	+/- 0.4	13.5	Maximum	23.0	Maximum	26.0	Maximum	0.8	+/- 0.05
DY	D19	22.5	+/- 0.4	15.5	Maximum	24.5	Maximum	26.0	Maximum	0.8	+/- 0.05
FE	F11	27.5	+/- 0.4	10.5	Maximum	20.5	Maximum	31.5	Maximum	0.8	+/- 0.05
FG	F12	27.5	+/- 0.4	11.5	Maximum	22.5	Maximum	31.5	Maximum	0.8	+/- 0.05
FK	F03	27.5	+/- 0.4	13.5	Maximum	23.0	Maximum	31.5	Maximum	0.8	+/- 0.05
FS	F15	27.5	+/- 0.4	19.0	Maximum	29.0	Maximum	31.5	Maximum	0.8	+/- 0.05
FV	F16	27.5	+/- 0.4	21.0	Maximum	30.0	Maximum	31.5	Maximum	0.8	+/- 0.05
RH	R04	37.5	+/- 0.5	15.0	Maximum	26.0	Maximum	41.0	Maximum	1.0	+/- 0.05
RK	R02	37.5	+/- 0.5	16.5	Maximum	32.0	Maximum	41.0	Maximum	1.0	+/- 0.05
RM	R03	37.5	+/- 0.5	19.0	Maximum	36.0	Maximum	41.0	Maximum	1.0	+/- 0.05
RP	R06	37.5	+/- 0.5	21.0	Maximum	38.0	Maximum	41.0	Maximum	1.0	+/- 0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Dielectric	Polypropylene film
Plates	Metal layer deposited by evaporation under vacuum
Winding	Non-inductive type. Triple design.
Leads	Tinned wire
Protection	Plastic case, thermosetting resin filled. Box material is solvent resistant and flame retardant according to UL94.
Rated Voltage (V_R)	760 VAC 50/60 Hz
Capacitance Range	0.010 µF to 1.0 µF
Capacitance Values	E6 series (IEC 60063)
Capacitance Tolerance	±20% standard, ±10% option
Temperature Range	-40°C to 105°C
Climatic Category	40/105/56/B IEC 60068-1
Approvals	ENEC, UL, cUL
Related Documents	EN/IEC 60384-14:2005, UL 60384-14, CAN/CSA E60384-14:09

Dissipation Factor (tanδ) — Maximum Values at +23°C

Frequency	C ≤ 0.1 µF	0.1 µF < C ≤ 1 µF
1 kHz	0.1%	0.1%
10 kHz	0.2%	0.4%
100 kHz	0.6%	-

Test Voltage Between Terminals	The 100% screening factory test is carried out at 4,250 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.
Resonance Frequency	Tabulated self-resonance frequencies f_o (see Table 1 - Ratings & Part Number Reference)

Insulation Resistance — Measured at +25°C ±5°C, according to IEC 60384–2

Minimum Values Between Terminals	
C ≤ 0.33 µF	C > 0.33 µF
≥ 30,000 MΩ	≥ 10,000 MΩ • µF

In DC Applications	Recommended voltage ≤ 1,500 VDC

Environmental Test Data

Test	IEC Publication	Procedure
Endurance	IEC 60384-14:2005	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2 No visible damage. No open or short circuit.
Bump	IEC 60068-2-29 Test Eb	1,000 bumps at 390 m/s^2 No visible damage. No open or short circuit.
Change of Temperature	IEC 60068-2-14 Test Na	Upper and lower rated temperature 5 cycles No visible damage.
Active Flammability	IEC 60384-14:2005	V_R + 20 surge pulses at 4 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384-14:2005	IEC 60384–1, IEC 60695–11–5 Needle Flame Test
Damp Heat Steady State	IEC 60068-2-78 Test Cab	+40°C and 90 – 95% RH, 56 days

Approvals

Certification Body	Mark	Specification	File Number
Intertek Semko AB		EN/IEC 60384-14	SE/0140–17D
UL		UL 60384 and CAN/CSA E60384-14:09 (760 VAC)	E73869

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Size Code (New/Legacy)	Max Dimensions in mm			Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
		B	H	L					
0.010	DD/D13	6.5	14.5	26.0	22.5	11	100	F845DD103(1)760(2)	PHE845VD5100(1)(2)
0.015	DD/D13	6.5	14.5	26.0	22.5	9.2	100	F845DD153(1)760(2)	PHE845VD5150(1)(2)
0.022	DD/D13	6.5	14.5	26.0	22.5	7.6	100	F845DD223(1)760(2)	PHE845VD5220(1)(2)
0.033	DF/D17	7.0	16.5	26.0	22.5	6.4	100	F845DF333(1)760(2)	PHE845VD5330(1)(2)
0.047	DM/D15	9.0	18.5	26.0	22.5	5.3	100	F845DM473(1)760(2)	PHE845VD5470(1)(2)
0.068	DR/D18	10.5	19.0	26.0	22.5	4.4	100	F845DR683(1)760(2)	PHE845VD5680(1)(2)
0.10	DT/D16	11.0	21.5	26.0	22.5	3.5	100	F845DT104(1)760(2)	PHE845VD6100(1)(2)
0.15	DW/D20	13.5	23.0	26.0	22.5	3.1	100	F845DW154(1)760(2)	PHE845VD6150(1)(2)
0.22	DY/D19	15.5	24.5	26.0	22.5	2.7	100	F845DY224M760(2)	PHE845VY6220M(2)
0.10	FE/F11	10.5	20.5	31.5	27.5	3.4	100	F845FE104(1)760(2)	PHE845VF6100(1)(2)
0.15	FG/F12	11.5	22.5	31.5	27.5	3.0	100	F845FG154(1)760(2)	PHE845VF6150(1)(2)
0.22	FK/F03	13.5	23.0	31.5	27.5	2.4	100	F845FK224(1)760(2)	PHE845VF6220(1)(2)
0.33	FS/F15	19.0	29.0	31.5	27.5	2.0	100	F845FS334(1)760(2)	PHE845VF6330(1)(2)
0.47	FV/F16	21.0	30.0	31.5	27.5	1.6	100	F845FV474M760(2)	PHE845VZ6470M(2)
0.47	RH/R04	15.0	26.0	41.0	37.5	1.6	100	F845RH474M760(2)	PHE845VW6470M(2)
0.47	RK/R02	16.5	32.0	41.0	37.5	1.6	100	F845RK474(1)760(2)	PHE845VR6470(1)(2)
0.68	RM/R03	19.0	36.0	41.0	37.5	1.2	100	F845RM684(1)760(2)	PHE845VR6680(1)(2)
1.0	RP/R06	21.0	38.0	41.0	37.5	1.0	100	F845RP105M760(2)	PHE845VW7100M(2)
Capacitance Value (µF)	Size Code (New/ Legacy)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) M = ±20%, K = ±10%.

(2) Insert ordering code for lead type and packaging. See Ordering Options Table for available options.

Soldering Process

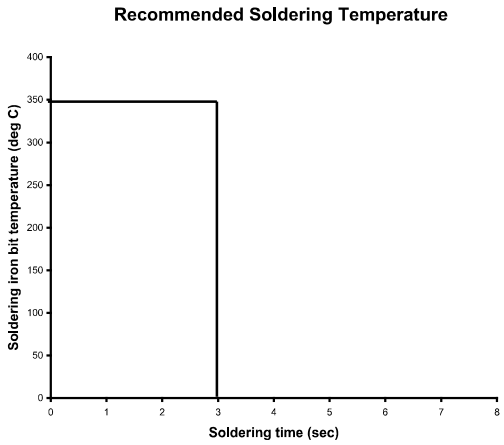
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

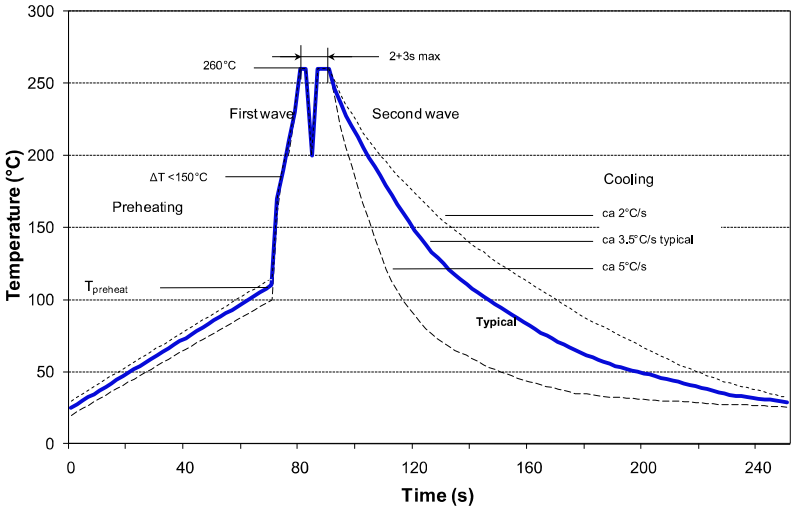
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

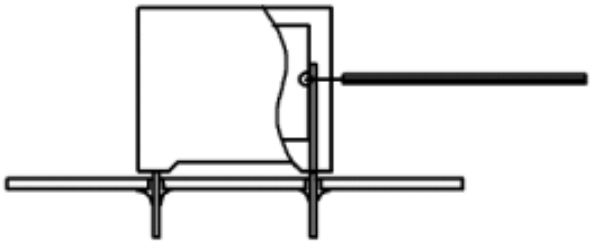
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



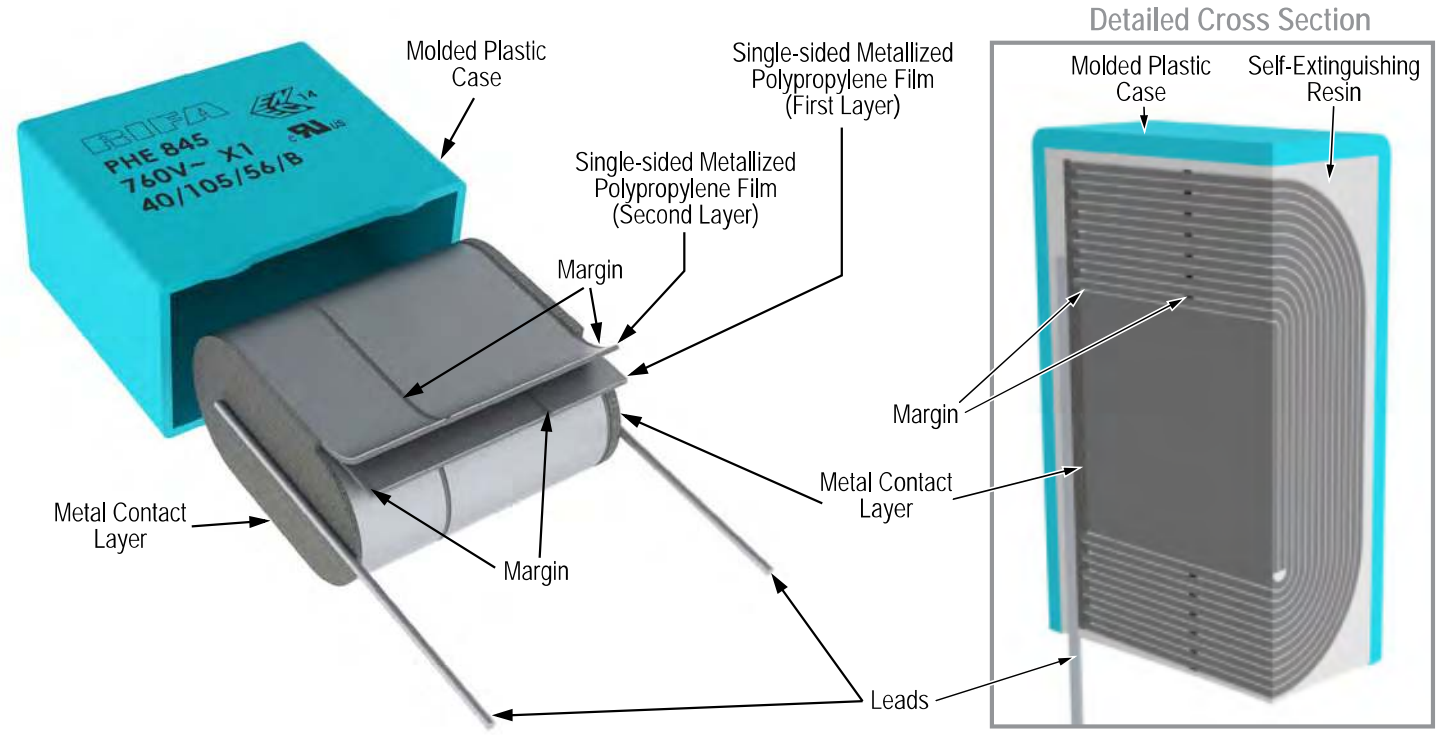
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

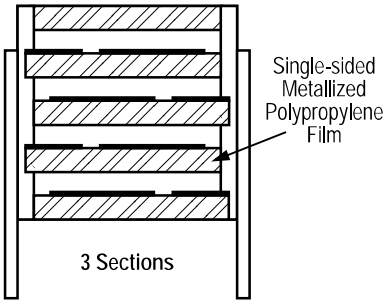
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

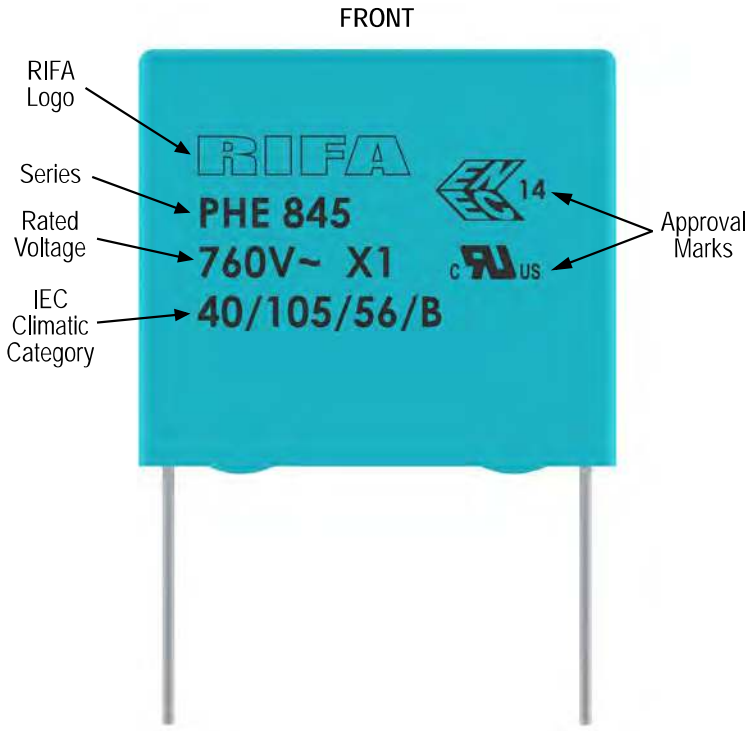
Construction

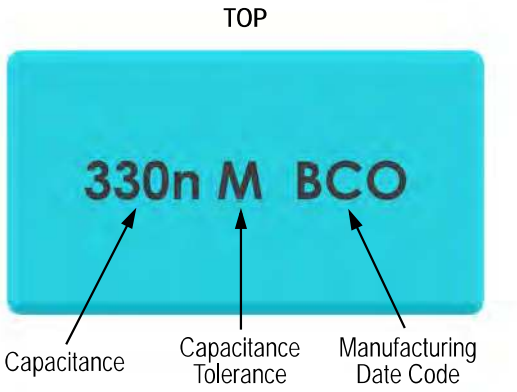


Winding Scheme



Marking





Manufacturing Date Code (IEC 60062)			
Y = Year, Z = Month			
Year	Code	Month	Code
2000	M	January	1
2001	N	February	2
2002	P	March	3
2003	R	April	4
2004	S	May	5
2005	T	June	6
2006	U	July	7
2007	V	August	8
2008	W	September	9
2009	X	October	O
2010	A	November	N
2011	B	December	D
2012	C		
2013	D		
2014	E		
2015	F		
2016	H		
2017	J		
2018	K		
2019	L		
2020	M		

Packaging Quantities

KEMET Size Code	Legacy Size Code	Lead Spacing	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Standard Reel ø 360 mm	Large Reel ø 500 mm	Ammo Bulk (Pizza)
DD	D13	22.5	6.5	14.5	26.0	234	300	600	440
DH	D14		8.0	16.0	26.0	186	250	500	352
DM	D15		9.0	18.5	26.0	308	250	500	308
DT	D16		11.0	21.5	26.0	253	200	400	253
DF	D17		7.0	16.5	26.0	216	300	600	396
DR	D18		10.5	19.0	26.0	264	200	400	264
DY	D19		15.5	24.5	26.0	176	110	250	176
DW	D20		13.5	23.0	26.0	209	160	300	209
FK	F03	27.5	13.5	23.0	31.5	171		250	171
FE	F11		10.5	20.5	31.5	216		350	216
FG	F12		11.5	22.5	31.5	198		300	198
FM	F13		14.5	24.5	31.5	153		250	153
FR	F14		17.5	28.0	31.5	126			126
FS	F15		19.0	29.0	31.5	117			117
FV	F16		21.0	30.0	31.5	108			108
FH	F17		21.0	12.5	31.5	108			108
FT	F18		31.0	18.5	31.5	72			72
FQ	F19		27.5	16.0	31.5	81			81
RK	R02	37.5	16.5	32.0	41.0	105			105
RM	R03		19.0	36.0	41.0	91			91
RH	R04		15.0	26.0	41.0	119			119
RF	R05		13.0	24.0	41.0	140			140
RP	R06		21.0	38.0	41.0	84			84
RS	R08		28.0	43.0	41.0	54			54

PME271E Series Metallized Impregnated Paper, Class X1, 300 VAC

Overview

The PME271E Series consists of multilayer metallized paper, encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use as an electromagnetic interference suppressor in all X1 and across-the-line applications.

Benefits

- Approvals: ENEC, UL
- Rated voltage: 300 VAC 50/60 Hz
- Capacitance range: 0.01 – 0.22 µF
- Lead spacing: 15.2 – 25.4 mm
- Capacitance tolerance: ±20% for C ≤ 0.1 µF, ±10% for C > 0.1 µF
- Climatic category: 40/110/56/B, IEC 60068–1
- Tape and reel packaging in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 2,150 VDC
- Highest possible safety regarding active and passive flammability



Legacy Part Number System

PME271	E	(D)	510(0)	M	R30
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Capacitance Tolerance	Packaging
X1, Metallized Paper	E = 300	Blank = Standard D = 22.5	The last three digits represent significant figures. The first digit specifies the total number of digits.	M = ±20% (for C ≤ 0.1 µF) K = ±10% (for C > 0.1 µF)	See Ordering Options Table

New KEMET Part Number System

P	277	Q	E	103	M	300	A
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging
P = Paper	X1, Metallized Paper	Q = 15.2 C = 20.3 S = 22.5 E = 25.4	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20% (for C ≤ 0.1 µF) K = ±10% (for C > 0.1 µF)	300 = 300	See Ordering Options Table

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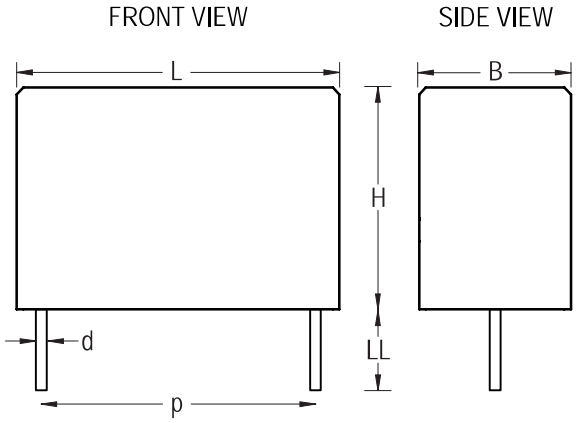
Benefits cont'd

- Excellent self-healing properties which ensure long life even when subjected to frequent over-voltages
- Good resistance to ionization due to impregnated paper dielectric
- High dV/dt capability
- Impregnated paper ensures excellent stability and reliability properties, particularly in applications with continuous operation

Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
15.2	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
20.3	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
22.5	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
25.4	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30

Dimensions – Millimeters



Size Code	p		B		H		L		d	
	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
QE	15.2	+/-0.4	5.2	Maximum	10.5	Maximum	18.5	Maximum	0.8	+/-0.05
QN	15.2	+/-0.4	7.3	Maximum	13	Maximum	19	Maximum	0.8	+/-0.05
QS	15.2	+/-0.4	8.5	Maximum	14.3	Maximum	18.5	Maximum	0.8	+/-0.05
CE	20.3	+/-0.4	7.6	Maximum	14	Maximum	24	Maximum	0.8	+/-0.05
CP	20.3	+/-0.4	11.3	Maximum	16.5	Maximum	24	Maximum	0.8	+/-0.05
SJ	22.5	+/-0.4	8	Maximum	17	Maximum	27	Maximum	0.8	+/-0.05
SP	22.5	+/-0.4	10	Maximum	19	Maximum	27	Maximum	0.8	+/-0.05
SU	22.5	+/-0.4	12	Maximum	22	Maximum	27	Maximum	0.8	+/-0.05
EE	25.4	+/-0.4	10.6	Maximum	16.1	Maximum	30.5	Maximum	1	+/-0.05
EJ	25.4	+/-0.4	12.1	Maximum	19	Maximum	30.5	Maximum	1	+/-0.05
Note: See Ordering Options Table for lead length (LL) options.										

Performance Characteristics

Rated Voltage	300 VAC 50/60 Hz	
Capacitance Range	0.01 – 0.22 µF	
Capacitance Tolerance	±20% for C ≤ 0.1 µF, ±10% for C > 0.1 µF	
Temperature Range	-40°C to +110°C	
Climatic Category	40/110/56/B	
Approvals	ENEC, UL	
Dissipation Factor	Maximum Values at +23°C	
	1 kHz	1.3%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,150 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.	
Insulation Resistance	Minimum Values Between Terminals	
	C ≤ 0.33 µF	≥ 12,000 MΩ
	C > 0.33 µF	≥ 4,000 MΩ • µF
In DC Applications	Recommended voltage ≤ 630 VDC	

Environmental Test Data

Test	IEC Publication	Procedure
Endurance	IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384–14	SE/0140–15C
	UL 1283 (310 VAC)	E100117

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Maximum Dimensions in mm			Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L					
0.010	5.2	10.5	18.5	15.2	16	1200	P277QE103M300(1)	PME271E510M(1)
0.015	5.2	10.5	18.5	15.2	13	1200	P277QE153M300(1)	PME271E515M(1)
0.022	7.3	13	18.5	15.2	9.8	1200	P277QN223M300(1)	PME271E522M(1)
0.033	7.3	13	18.5	15.2	7	1200	P277QN333M300(1)	PME271E533M(1)
0.047	8.5	14.3	18.5	15.2	6.4	1200	P277QS473M300(1)	PME271E547M(1)
0.068	7.6	14	24	20.3	5.2	600	P277CE683M300(1)	PME271E568M(1)
0.1	11.3	16.5	24	20.3	4.1	600	P277CP104M300(1)	PME271E610M(1)
0.068	8	17	27	22.5	4.7	600	P277SJ683M300(1)	PME271ED5680M(1)
0.1	8	17	27	22.5	4.1	600	P277SJ104M300(1)	PME271ED6100M(1)
0.15	10	19	27	22.5	3.2	600	P277SP154K300(1)	PME271ED6150K(1)
0.22	12	22	27	22.5	2.5	600	P277SU224K300(1)	PME271ED6220K(1)
0.15	10.6	16.1	30.5	25.4	3.3	400	P277EE154K300(1)	PME271E615K(1)
0.22	12.1	19	30.5	25.4	2.6	400	P277EJ224K300(1)	PME271E622K(1)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) Insert lead and packaging code. See Ordering Options Table for available options.

Soldering Process

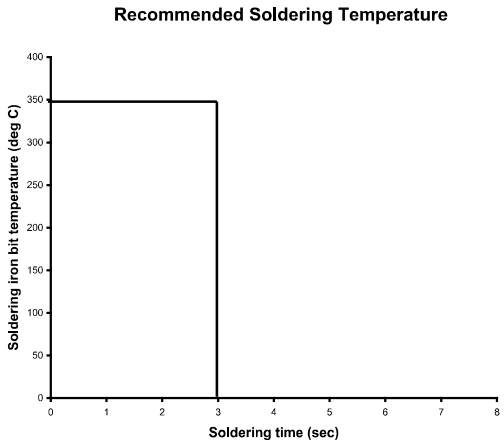
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Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

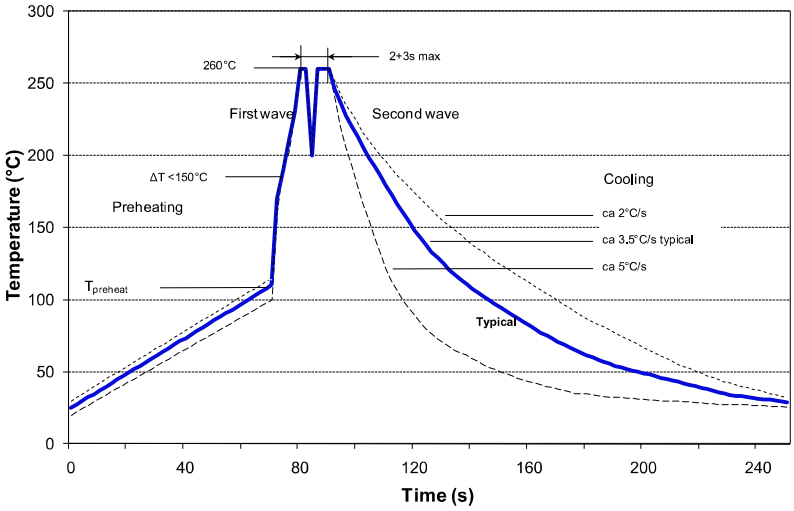
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Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

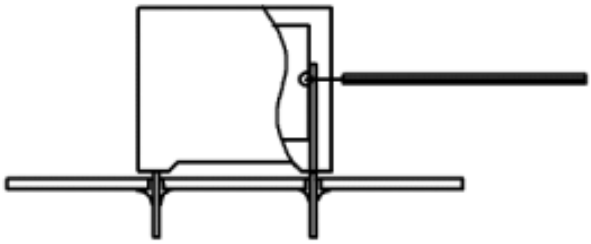
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



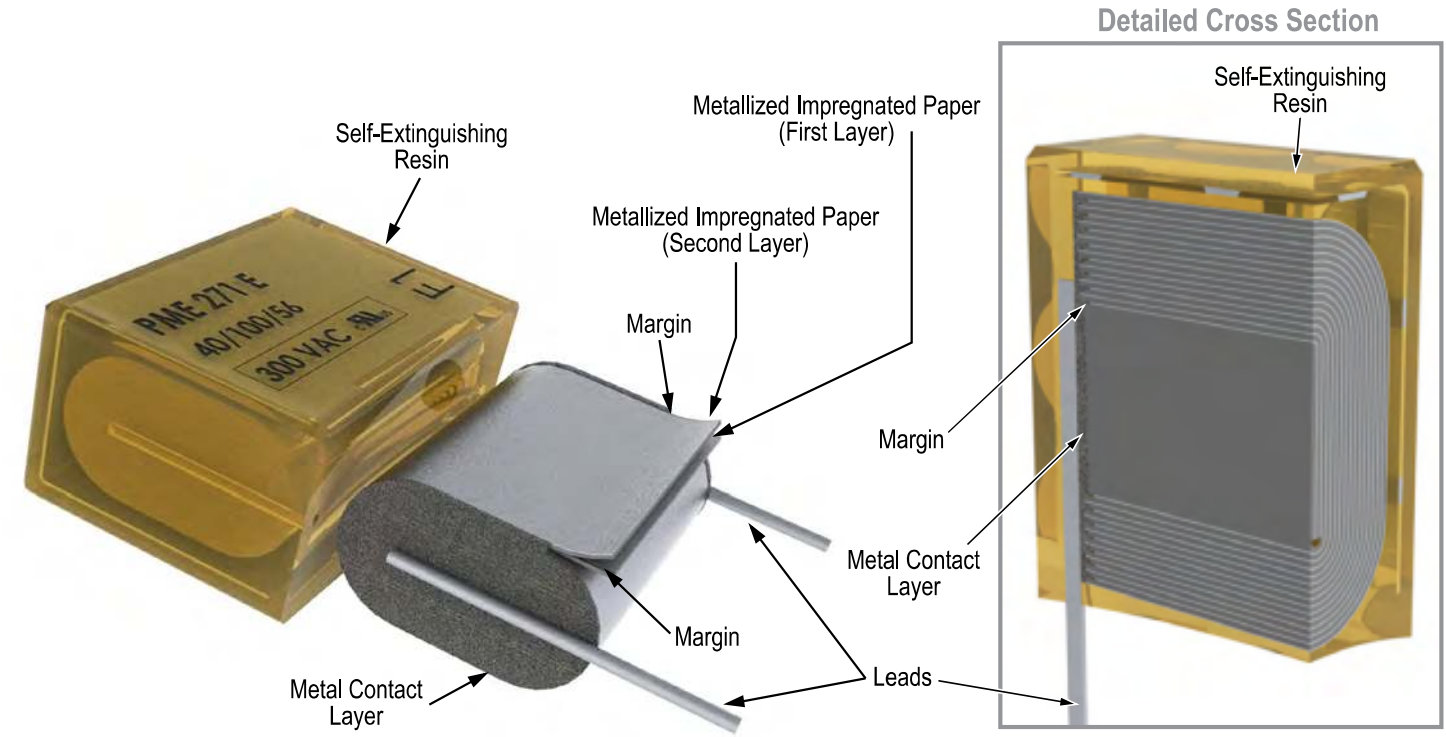
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

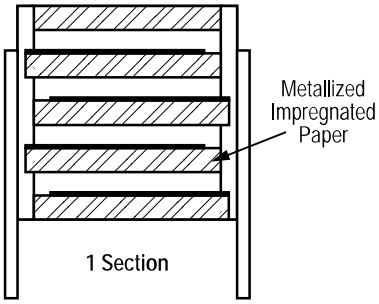
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

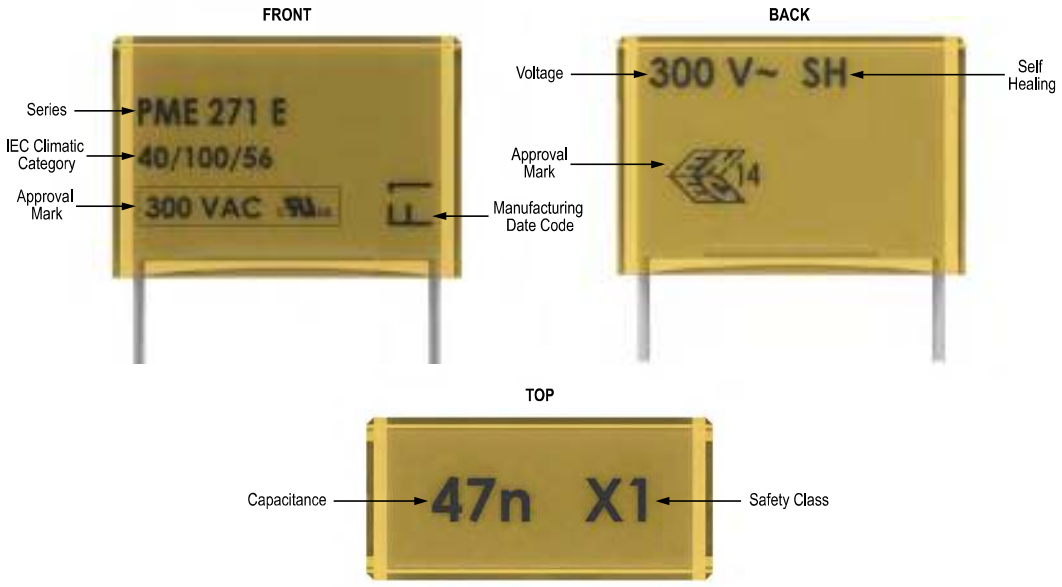
Construction



Winding Scheme



Marking



Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 360 mm	Large Reel ø 500 mm
15.2	5.5	12.5	18	1000	500	600	
	6.5	12.5	18	600	400	400	
	7.5	14.5	18	600	400	400	
	8.5	16	18	400	250	400	
	5.2	10.5	18.5	1000	500	600	
	5.5	11	18.5	1000	500	500	
	6	12.5	18.5	600	400	400	
	7.3	13	18.5	600	400	400	800
	7.8	13.5	18.5	600	400	400	
	8.5	14.3	18.5	500	300	350	
20.3	7.6	14	24	1500	250	250	500
	8.4	14	24	1200	200	250	500
	9	15	24	1500	200	250	
	11.3	16.5	24	1000	150	180	400
22.5	8	17	27	1200	200		
	10	19	27	1000	150	200	
	12	22	27	800	100	180	350
25.4	10.6	16.1	30.5	1000	150		
	10.5	17.3	30.5	1000	100		
	12.1	19	30.5	800	100		
	15.3	22	30.5	600	75		

PME278 Series Metallized Impregnated Paper, Class X1, 440 VAC

Overview

The PME278 Series is constructed of multilayer metallized paper encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use as an electromagnetic interference suppressor in all X1 and across-the-line applications.

Benefits

- Approvals: ENEC
- Rated voltage: 440 VAC 50/60 Hz
- Capacitance range: 0.001 – 0.15 µF
- Lead spacing: 10.2 – 25.4 mm
- Capacitance tolerance: ±20%
- Climatic category: 40/110/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 2,700 VDC
- Highest possible safety regarding active and passive flammability
- Excellent self-healing properties which ensure long life even when subjected to frequent over voltages



Legacy Part Number System

PME278	R	A	5100	M	R30
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Capacitance Tolerance	Packaging
X1, Metallized Paper	R = 440	A = 10.2 B = 15.2 C = 20.3 D = 22.5 E = 25.4	The last three digits represent significant figures. The first digit specifies the total number of digits.	M = ±20%	See Ordering Options Table

New KEMET Part Number System

P	278	H	E	102	M	440	A
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging
P = Paper	X1, Metallized Paper	H = 10.2 Q = 15.2 C = 20.3 S = 22.5 E = 25.4	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20%	440 = 440	See Ordering Options Table

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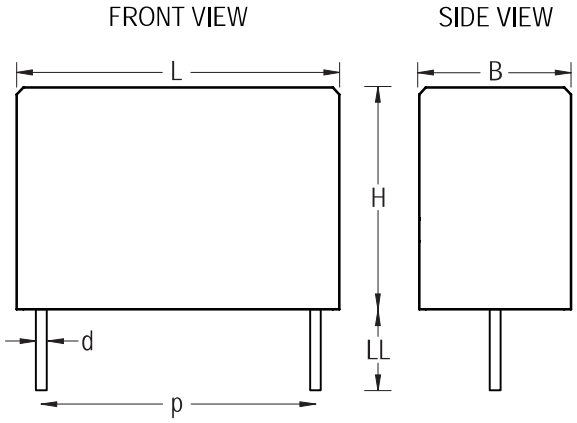
Benefits cont'd

- Good resistance to ionization due to impregnated paper dielectric
- Impregnated paper ensures excellent stability and reliability properties, particularly in applications with continuous operation

Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
10.2	Standard Lead and Packaging Options			
	Bulk (Bag)–Short Leads	6 +0/-1	C	R06
	Bulk (Bag)–Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
Native 10.2 formed to 7.5	Ammo Pack	H_0= 16.5 +/-0.5	LAF3	R30XA
15.2	Standard Lead and Packaging Options			
	Bulk (Bag)–Short Leads	6 +0/-1	C	R06
	Bulk (Bag)–Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
20.3	Standard Lead and Packaging Options			
	Bulk (Tray)–Short Leads	6 +0/-1	C	R06
	Bulk (Bag)–Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
22.5	Standard Lead and Packaging Options			
	Bulk (Tray)–Short Leads	6 +0/-1	C	R06
	Bulk (Bag)–Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
25.4	Standard Lead and Packaging Options			
	Bulk (Tray)–Short Leads	6 +0/-1	C	R06
	Bulk (Bag)–Max Length Leads	30 +5/-0	A	R30

Dimensions – Millimeters



Size Code	p		B		H		L		d	
	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
HE	10.2	+/-0.4	3.9	Maximum	7.5	Maximum	13.5	Maximum	0.6	+/-0.05
HH	10.2	+/-0.4	4.1	Maximum	8.2	Maximum	13.5	Maximum	0.6	+/-0.05
HL	10.2	+/-0.4	5.1	Maximum	10.5	Maximum	13.5	Maximum	0.6	+/-0.05
QE	15.2	+/-0.4	5.2	Maximum	10.5	Maximum	18.5	Maximum	0.8	+/-0.05
QJ	15.2	+/-0.4	5.5	Maximum	11.1	Maximum	18.5	Maximum	0.8	+/-0.05
QS	15.2	+/-0.4	8.5	Maximum	14.3	Maximum	18.5	Maximum	0.8	+/-0.05
CE	20.3	+/-0.4	7.6	Maximum	14	Maximum	24	Maximum	0.8	+/-0.05
CJ	20.3	+/-0.4	9	Maximum	15	Maximum	24	Maximum	0.8	+/-0.05
CP	20.3	+/-0.4	11.3	Maximum	16.5	Maximum	24	Maximum	0.8	+/-0.05
SJ	22.5	+/-0.4	8	Maximum	17	Maximum	27	Maximum	0.8	+/-0.05
SP	22.5	+/-0.4	10	Maximum	19	Maximum	27	Maximum	0.8	+/-0.05
SU	22.5	+/-0.4	12	Maximum	22	Maximum	27	Maximum	0.8	+/-0.05
EJ	25.4	+/-0.4	12.1	Maximum	19	Maximum	30.5	Maximum	1	+/-0.05
EL	25.4	+/-0.4	15.3	Maximum	22	Maximum	30.5	Maximum	1	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Rated Voltage	440 VAC 50/60 Hz	
Capacitance Range	0.001 – 0.15 µF	
Capacitance Tolerance	±20%	
Temperature Range	-40°C to +110°C	
Climatic Category	40/110/56/B	
Approvals	ENEC	
Dissipation Factor	Maximum Values at +23°C	
	1 kHz	1.3%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,700 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.	
Insulation Resistance	Minimum Value Between Terminals	
	≥ 12,000 MΩ	
In DC Applications	Recommended voltage ≤ 1,000 VDC	

Environmental Test Data

Test	IEC Publication	Procedure
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	4,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Certification Body	Mark	Specification	File Number
Intertek Semko AB		EN/IEC 60384-14	SE/0140–14C

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Maximum Dimensions in mm			Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L					
0.001	3.9	7.5	13.5	10.2	53	2000	P278HE102M440(1)	PME278RA4100M(1)
0.0015	3.9	7.5	13.5	10.2	44	2000	P278HE152M440(1)	PME278RA4150M(1)
0.0022	3.9	7.5	13.5	10.2	37	2000	P278HE222M440(1)	PME278RA4220M(1)
0.0033	4.1	8.2	13.5	10.2	30	2000	P278HH332M440(1)	PME278RA4330M(1)
0.0047	5.1	10.5	13.5	10.2	24	2000	P278HL472M440(1)	PME278RA4470M(1)
0.0068	5.2	10.5	18.5	15.2	18.5	1400	P278QE682M440(1)	PME278RB4680M(1)
0.010	5.2	10.5	18.5	15.2	15.5	1400	P278QE103M440(1)	PME278RB5100M(1)
0.015	5.5	11	18.5	15.2	13	1400	P278QH153M440(1)	PME278RB5150M(1)
0.022	8.5	14.3	18.5	15.2	9.6	1400	P278QS223M440(1)	PME278RB5220M(1)
0.033	7.6	14	24	20.3	9.6	1000	P278CE333M440(1)	PME278RC5330M(1)
0.047	9	15	24	20.3	7.5	1000	P278CJ473M440(1)	PME278RC5470M(1)
0.068	11.3	16.5	24	20.3	6.2	1000	P278CP683M440(1)	PME278RC5680M(1)
0.033	8	17	27	22.5	7.2	1000	P278SJ333M440(1)	PME278RD5330M(1)
0.047	8	17	27	22.5	6	1000	P278SJ473M440(1)	PME278RD5470M(1)
0.068	10	19	27	22.5	4.8	1000	P278SP683M440(1)	PME278RD5680M(1)
0.1	12	22	27	22.5	3.6	600	P278SU104M440(1)	PME278RD6100M(1)
0.1	12.1	19	30.5	25.4	3.9	600	P278EJ104M440(1)	PME278RE6100M(1)
0.15	15.3	22	30.5	25.4	3.2	600	P278EL154M440(1)	PME278RE6150M(1)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) Insert lead and packaging code. See Ordering Options Table for available options.

Soldering Process

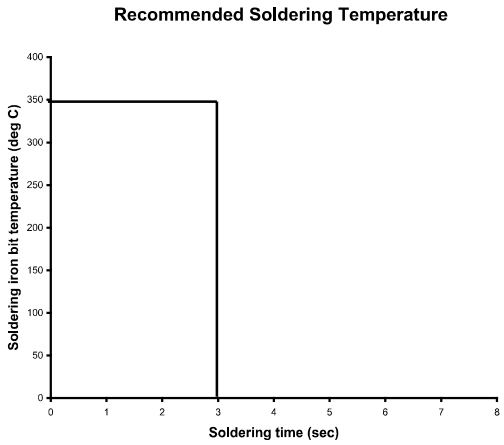
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

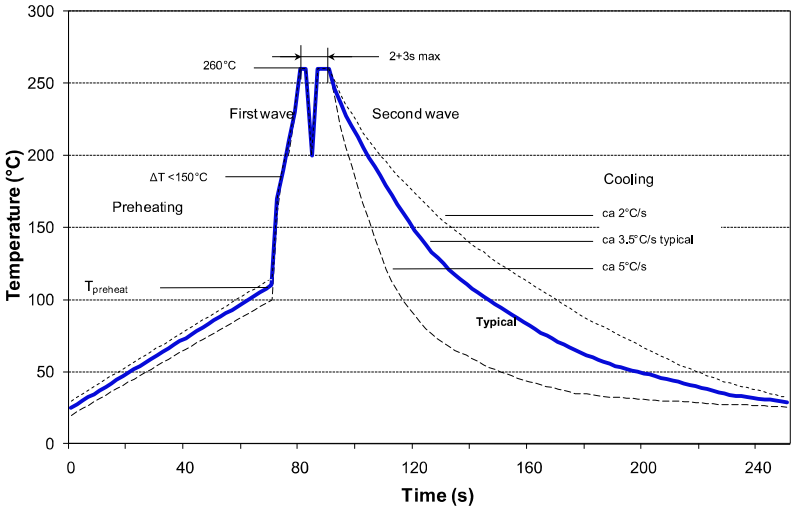
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

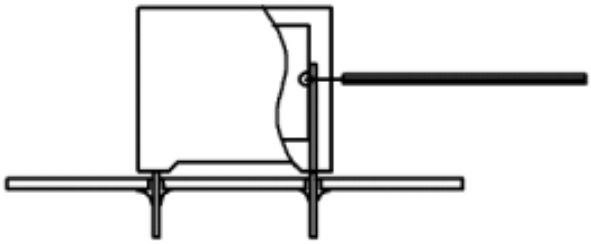
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



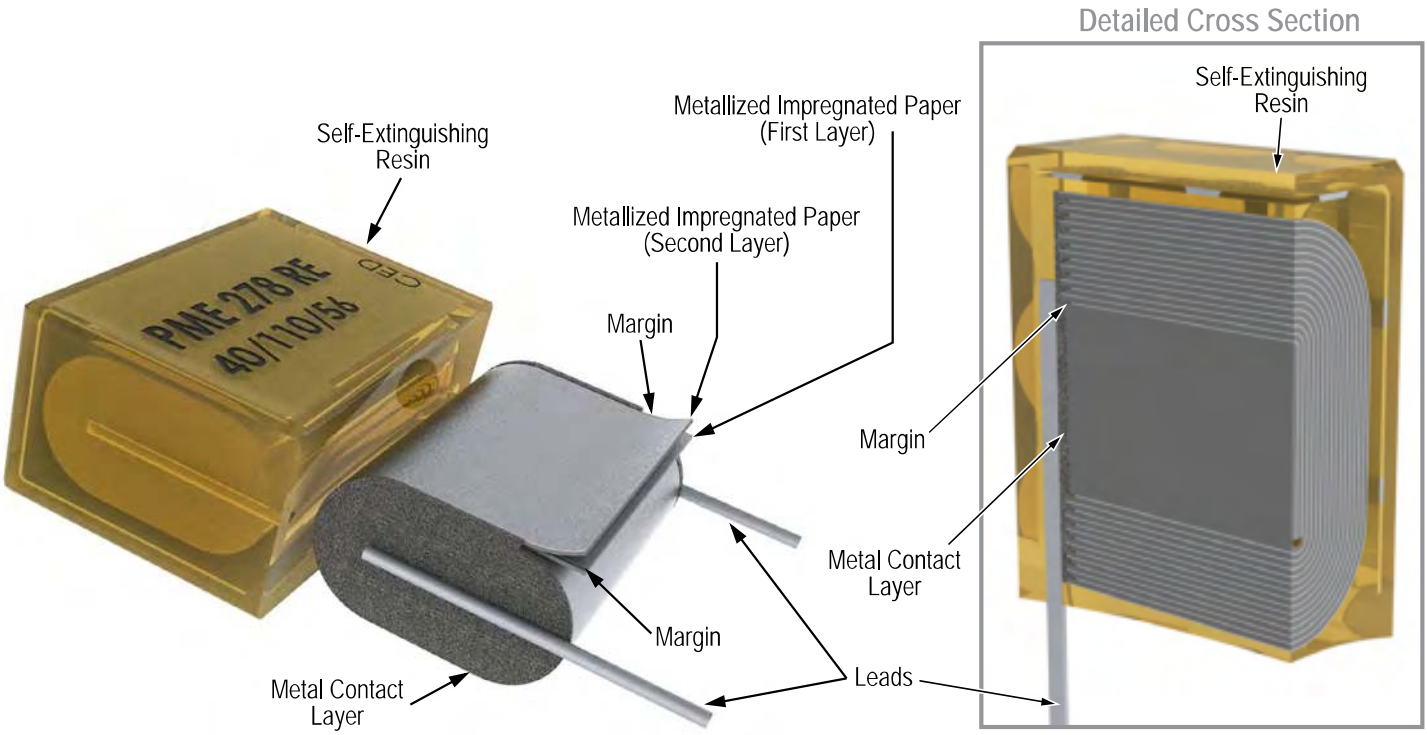
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

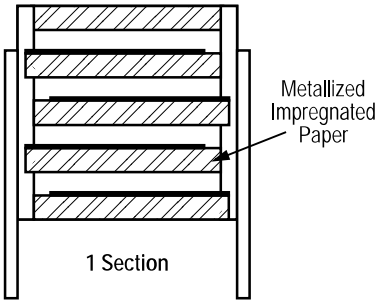
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

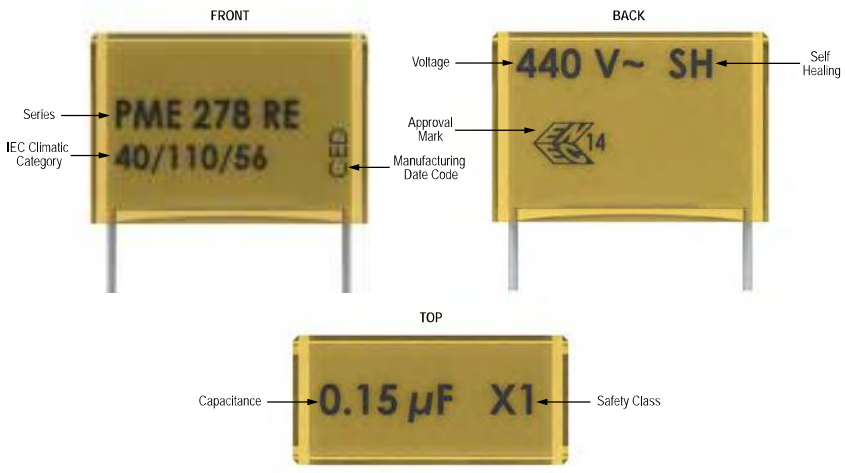
Construction



Winding Scheme



Marking



Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 360 mm	Large Reel ø 500 mm	Ammo Formed
10.2	3.9	7.5	13.5	2000	1000	700	1400	800
	4.1	8.2	13.5	2000	1000	600		780
	5.1	10.5	13.5	1600	800	600	1200	630
15.2	5.5	12.5	18	1000	500	600		
	6.5	12.5	18	600	400	400		
	7.5	14.5	18	600	400	400		
	8.5	16	18	400	250	400		
	5.2	10.5	18.5	1000	500	600		
	5.5	11	18.5	1000	500	500		
	6	12.5	18.5	600	400	400		
	7.3	13	18.5	600	400	400	800	
	7.8	13.5	18.5	600	400	400		
	8.5	14.3	18.5	500	300	350		
20.3	7.6	14	24	1500	250	250	500	
	8.4	14	24	1200	200	250	500	
	9	15	24	1500	200	250		
	11.3	16.5	24	1000	150	180	400	
22.5	8	17	27	1200	200			
	10	19	27	1000	150	200		
	12	22	27	800	100	180	350	
25.4	10.6	16.1	30.5	1000	150			
	10.5	17.3	30.5	1000	100			
	12.1	19	30.5	800	100			
	15.3	22	30.5	600	75			

P278 Series Metallized Impregnated Paper, Class X1, 480 VAC

Overview

The P278 Series is constructed of multilayer metallized paper encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use as an electromagnetic interference suppressor in all X1 and across-the-line applications.

Benefits

- Approvals: ENEC, UL, cUL
- Rated voltage: 480 VAC 50/60 Hz
- Capacitance range: 0.001 – 0.15 µF
- Lead spacing: 10.2 – 25.4 mm
- Capacitance tolerance: ±20%
- Climatic category: 40/110/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 2,700 VDC
- Highest possible safety regarding active and passive flammability
- Excellent self-healing properties which ensure long life even when subjected to frequent over voltages
- Good resistance to ionization due to impregnated paper dielectric
- Impregnated paper ensures excellent stability and reliability properties, particularly in applications with continuous operation



Part Number System

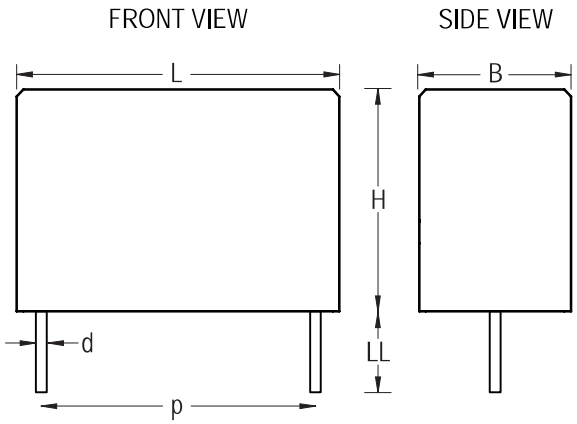
P	278	H	E	102	M	480	A
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging
P = Paper	X1, Metallized Paper	H = 10.2 Q = 15.2 C = 20.3 S = 22.5 E = 25.4	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20%	480 = 480	See Ordering Options Table

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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Part Number (Insert at 14th character)
10.2	Standard Lead and Packaging Options		
	Bulk – Short Leads	6 +0/-1	C
	Bulk – Maximum Length Leads	30 +5/-0	A
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L
	Other Lead and Packaging Options		
	Ammo Pack	H_0 = 18.5 +/-0.5	XLAF1
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	P
15.2	Standard Lead and Packaging Options		
	Bulk – Short Leads	6 +0/-1	C
	Bulk – Maximum Length Leads	30 +5/-0	A
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	P
20.3	Standard Lead and Packaging Options		
	Tray – Short Leads	6 +0/-1	C
	Bulk – Maximum Length Leads	30 +5/-0	A
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	P
22.5	Standard Lead and Packaging Options		
	Tray – Short Leads	6 +0/-1	C
	Bulk – Maximum Length Leads	30 +5/-0	A
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	P
25.4	Standard Lead and Packaging Options		
	Tray – Short Leads	6 +0/-1	C
	Bulk – Maximum Length Leads	30 +5/-0	A

Dimensions – Millimeters



Size Code	p		B		H		L		d	
	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
HE	10.2	+/-0.4	3.9	Maximum	7.5	Maximum	13.5	Maximum	0.6	+/-0.05
HH	10.2	+/-0.4	4.1	Maximum	8.2	Maximum	13.5	Maximum	0.6	+/-0.05
HL	10.2	+/-0.4	5.1	Maximum	10.5	Maximum	13.5	Maximum	0.6	+/-0.05
QE	15.2	+/-0.4	5.2	Maximum	10.5	Maximum	18.5	Maximum	0.8	+/-0.05
QJ	15.2	+/-0.4	5.5	Maximum	11.1	Maximum	18.5	Maximum	0.8	+/-0.05
QS	15.2	+/-0.4	8.5	Maximum	14.3	Maximum	18.5	Maximum	0.8	+/-0.05
CE	20.3	+/-0.4	7.6	Maximum	14.0	Maximum	24.0	Maximum	0.8	+/-0.05
CJ	20.3	+/-0.4	9.0	Maximum	15.0	Maximum	24.0	Maximum	0.8	+/-0.05
CP	20.3	+/-0.4	11.3	Maximum	16.5	Maximum	24.0	Maximum	0.8	+/-0.05
SJ	22.5	+/-0.4	8.0	Maximum	17.0	Maximum	27.0	Maximum	0.8	+/-0.05
SP	22.5	+/-0.4	10.0	Maximum	19.0	Maximum	27.0	Maximum	0.8	+/-0.05
SU	22.5	+/-0.4	12.0	Maximum	22.0	Maximum	27.0	Maximum	0.8	+/-0.05
EJ	25.4	+/-0.4	12.1	Maximum	19.0	Maximum	30.5	Maximum	1.0	+/-0.05
EL	25.4	+/-0.4	15.3	Maximum	22.0	Maximum	30.5	Maximum	1.0	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Rated Voltage	480 VAC 50/60 Hz	
Capacitance Range	0.001 – 0.15 µF	
Capacitance Tolerance	±20%	
Temperature Range	-40°C to +110°C	
Climatic Category	40/110/56/B	
Approvals	ENEC, UL, cUL	
Dissipation Factor	Maximum Values at +23°C	
	1 kHz	1.3%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,700 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.	
Insulation Resistance	Minimum Value Between Terminals	
	≥ 12,000 MΩ	
In DC Applications	Recommended voltage ≤ 1,000 VDC	

Environmental Test Data

Test	IEC Publication	Procedure
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 500 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	4,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 4.0 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Certification Body	Mark	Specification	File Number
Intertek Semko AB		EN/IEC 60384-14	SE/0140–35
UL		UL 60384-14 CAN/ CSA-E60384-14-09	E73869

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Maximum Dimensions in mm			Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	KEMET Part Number
	B	H	L				
0.001	3.9	7.5	13.5	10.2	53	2000	P278HE102M480(1)
0.0015	3.9	7.5	13.5	10.2	44	2000	P278HE152M480(1)
0.0022	3.9	7.5	13.5	10.2	37	2000	P278HE222M480(1)
0.0033	4.1	8.2	13.5	10.2	30	2000	P278HH332M480(1)
0.0047	5.1	10.5	13.5	10.2	24	2000	P278HL472M480(1)
0.0068	5.2	10.5	18.5	15.2	18.5	1400	P278QE682M480(1)
0.010	5.2	10.5	18.5	15.2	15.5	1400	P278QE103M480(1)
0.015	5.5	11.1	18.5	15.2	13	1400	P278QJ153M480(1)
0.022	8.5	14.3	18.5	15.2	9.6	1400	P278QS223M480(1)
0.033	7.6	14.0	24.0	20.3	9.6	1000	P278CE333M480(1)
0.047	9.0	15.0	24.0	20.3	7.5	1000	P278CJ473M480(1)
0.068	11.3	16.5	24.0	20.3	6.2	1000	P278CP683M480(1)
0.033	8.0	17.0	27.0	22.5	7.2	1000	P278SJ333M480(1)
0.047	8.0	17.0	27.0	22.5	6	1000	P278SJ473M480(1)
0.068	10.0	19.0	27.0	22.5	4.8	1000	P278SP683M480(1)
0.1	12.0	22.0	27.0	22.5	3.6	600	P278SU104M480(1)
0.1	12.1	19.0	30.5	25.4	3.9	600	P278EJ104M480(1)
0.15	15.3	22.0	30.5	25.4	3.2	600	P278EL154M480(1)
Capacitance Value (µF)	**B (mm)**	**H (mm)**	**L (mm)**	**Lead Spacing (p)**	**f_o (MHz)**	**dV/dt (V/µs)**	**KEMET Part Number**

(1) Insert ordering code for lead type and packaging. See Ordering Options Table for available options.

Soldering Process

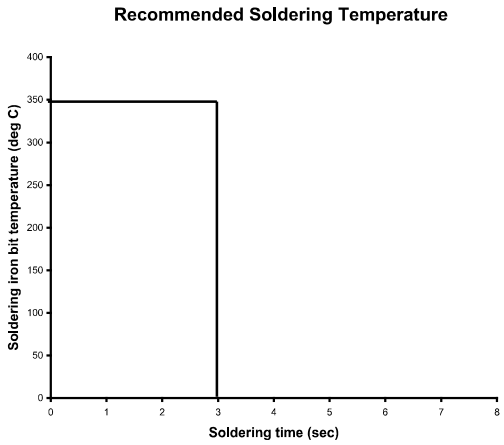
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

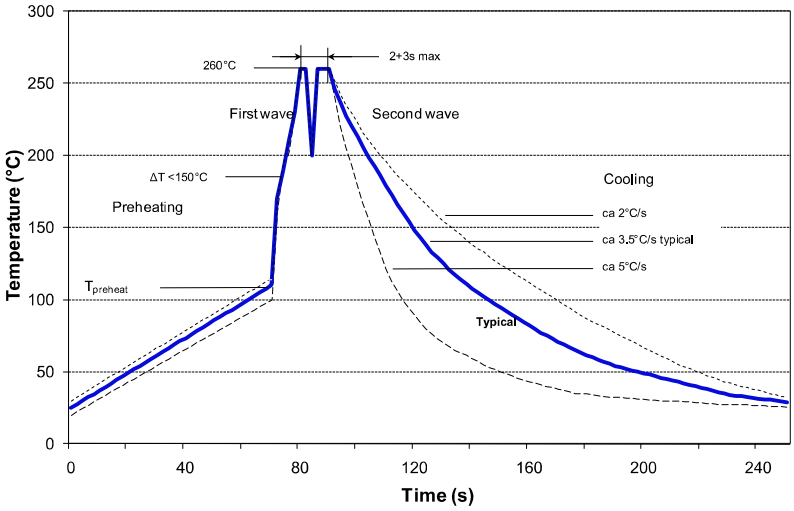
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

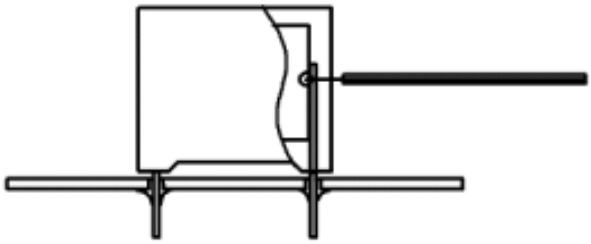
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



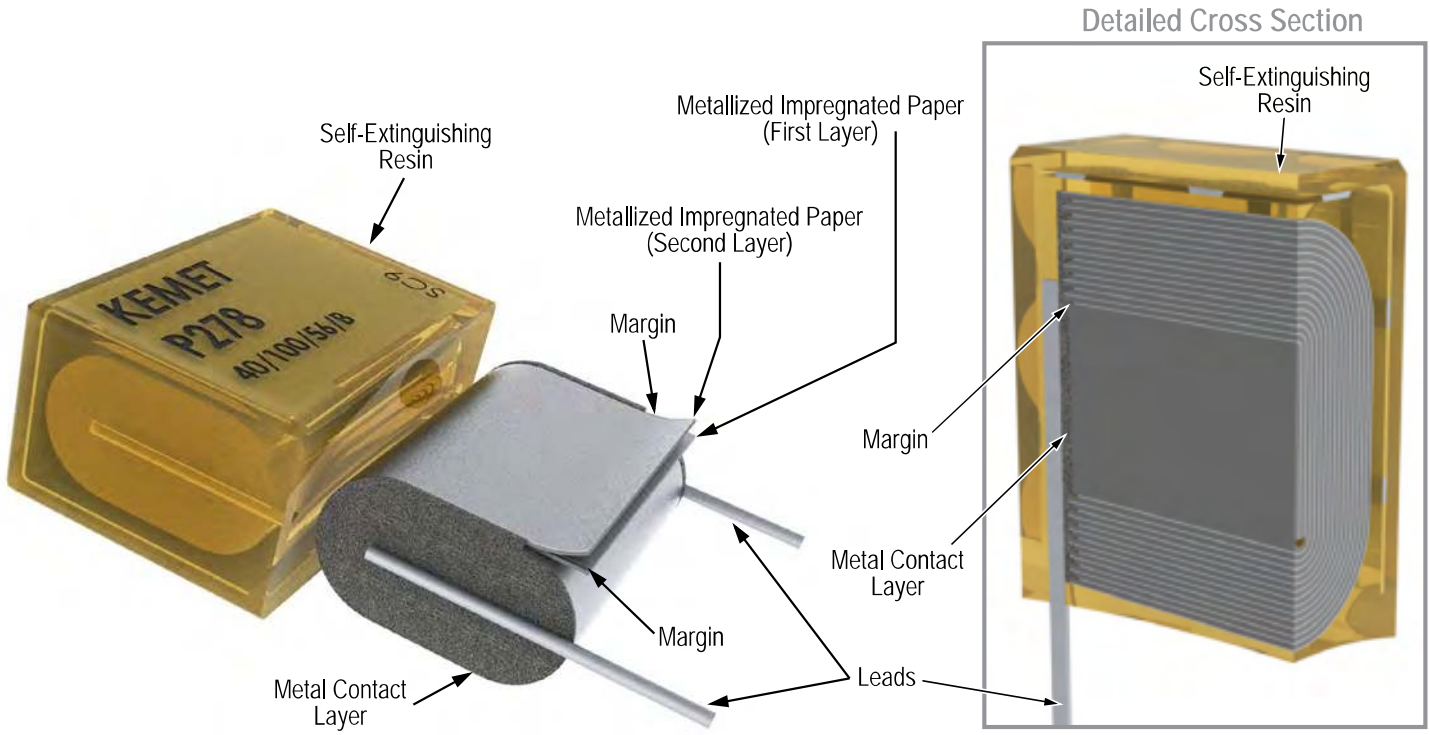
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

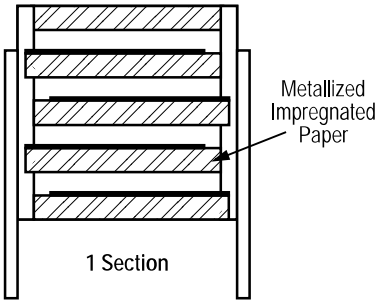
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, **however, instead of two baths, there is only one bath with a time from 3 to 10 seconds.** In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

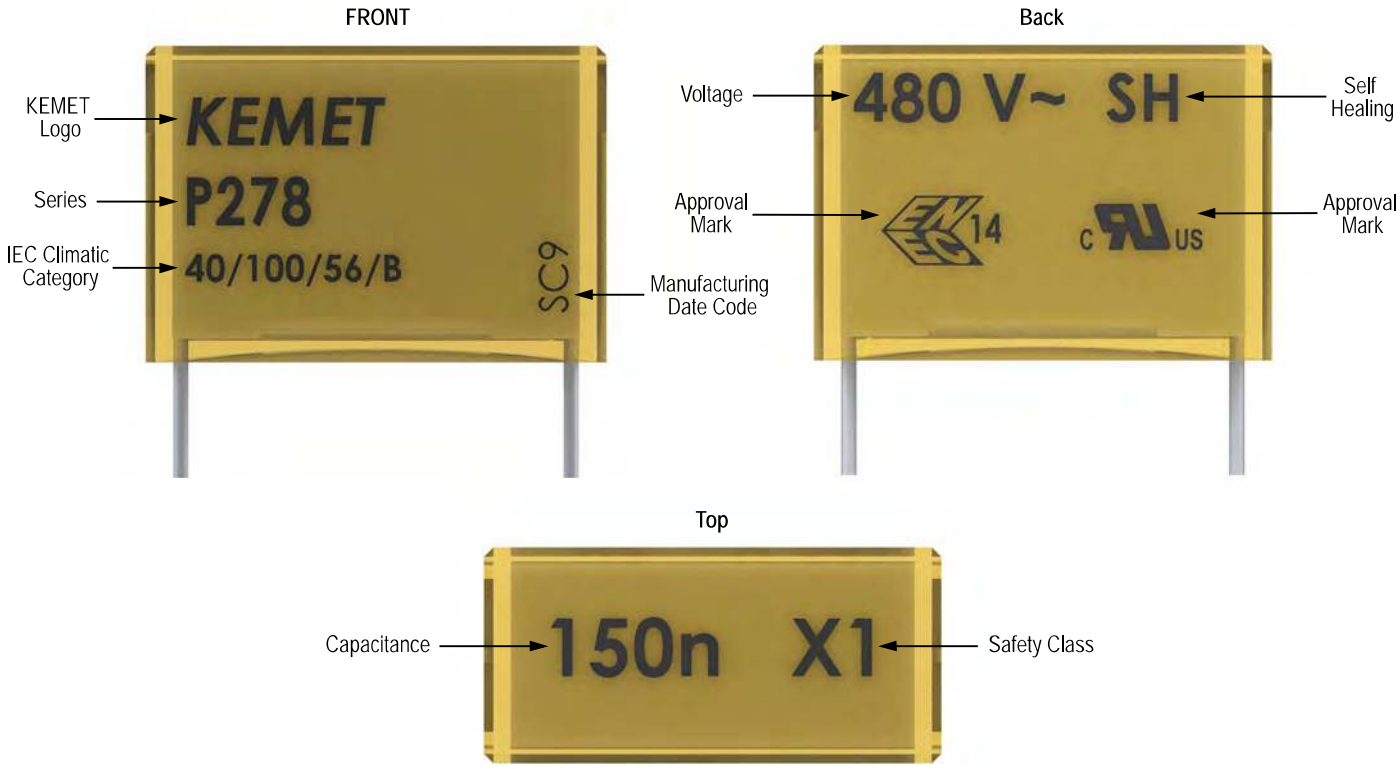
Construction



Winding Scheme



Marking


FRONT
KEMET Logo
KEMET
Series
P278
IEC Climatic Category
40/100/56/B
SC9
Manufacturing Date Code
Back
Voltage
480 V~ SH
Self Healing
Approval Mark
14
C US
Approval Mark
Top
Capacitance
150n X1
Safety Class

Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 360 mm	Large Reel ø 500 mm	Ammo Formed
10.2	3.9	7.5	13.5	2000	1000	700	1400	800
	4.1	8.2	13.5	2000	1000	600		780
	5.1	10.5	13.5	1600	800	600	1200	630
15.2	5.5	12.5	18.0	1000	500	600		
	6.5	12.5	18.0	600	400	400		
	7.5	14.5	18.0	600	400	400		
	8.5	16.0	18.0	400	250	400		
	5.2	10.5	18.5	1000	500	600		
	5.5	11.1	18.5	1000	500	500		
	6.0	12.5	18.5	600	400	400		
	7.3	13.0	18.5	600	400	400	800	
	7.8	13.5	18.5	600	400	400		
	8.5	14.3	18.5	500	300	350		
20.3	7.6	14.0	24.0	1500	250	250	500	
	8.4	14.0	24.0	1200	200	250	500	
	9.0	15.0	24.0	1500	200	250		
	11.3	16.5	24.0	1000	150	180	400	
22.5	8.0	17.0	27.0	1200	200			
	10.0	19.0	27.0	1000	150	200		
	12.0	22.0	27.0	800	100	180	350	
25.4	10.6	16.1	30.5	1000	150			
	10.5	17.3	30.5	1000	100			
	12.1	19.0	30.5	800	100			
	15.3	22.0	30.5	600	75			

F861 Series Metallized Polypropylene Film, Class X2, 310 VAC

Overview

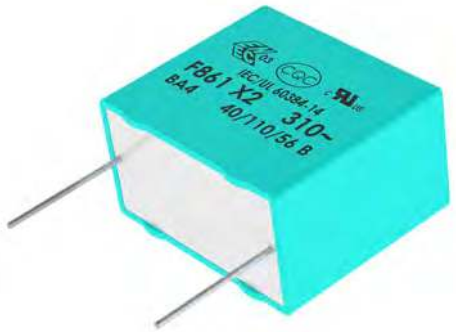
The F861 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material meeting the requirements of UL 94 V–0.

Applications

For use as electromagnetic interference (EMI) noise suppression in across-the-line applications requiring X2 safety classification according to IEC 60384-14. Not for use in "series with mains" and as AC Power filtering type applications.

Benefits

- Approvals: ENEC, UL, cUL, CQC
- Rated voltage: 310 VAC 50/60 Hz
- Capacitance range: 0.01 – 4.7 µF
- Lead spacing: 7.5 – 37.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category: 40/110/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 1,900 VDC



Part Number System

F	861	B	C	104	M	310	C
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Voltage (VAC)	Packaging
F = Film	X2, Metallized Polypropylene	K = 7.5 A = 10 B = 15 D = 22.5 F = 27.5 R = 37.5	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	K = ±10% M = ±20%	310	See Ordering Options Table

Ordering Options Table

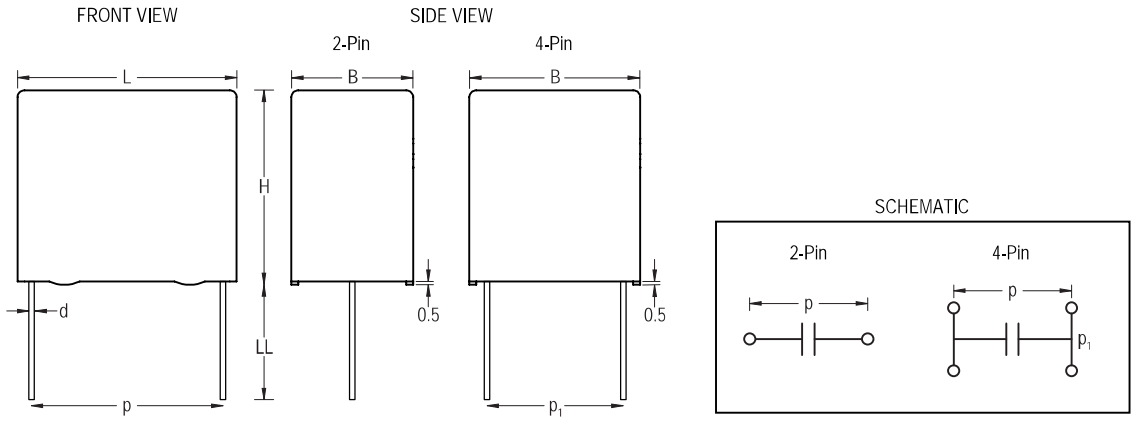
Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
7.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	C
	Bulk (Bag) – Long Leads	17 +0/-1	A
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L
	Other Lead and Packaging Options		
	Bulk (Bag) – Max Length Leads	20 +5/-0	ALL0L
	Ammo Pack	H_0 = 18.5 +/-0.5	R

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Ordering Options Table cont'd

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
10	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	C
	Bulk (Bag) – Long Leads	17 +0/-1	A
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L
	Other Lead and Packaging Options		
	Bulk (Bag) – Max Length Leads	20 +5/-0	ALL0L
	Ammo Pack	H_0 = 18.5 +/-0.5	R
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	P
15	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	C
	Bulk (Bag) – Long Leads	17 +0/-1	A
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L
	Pizza Pack	4 +2/-0	Z
	Other Lead and Packaging Options		
	Bulk (Bag) – Max Length Leads	25 +5/-0	ALR0L
	Ammo Pack	H_0 = 18.5 +/-0.5	R
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	P
22.5	Standard Lead and Packaging Options		
	Pizza – Long Leads	17 +0/-1	ZLH0J
	Pizza Pack	4 +2/-0	Z
	Other Lead and Packaging Options		
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	P
	Ammo Pack	H_0 = 18.5 +/-0.5	R
27.5	Standard Lead and Packaging Options		
	Pizza – Long Leads	17 +0/-1	ZLH0J
	Pizza Pack	4 +2/-0	Z
37.5	Standard Lead and Packaging Options		
	Pizza – Long Leads	17 +0/-1	ZLH0J
	Pizza Pack	4 +2/-0	Z

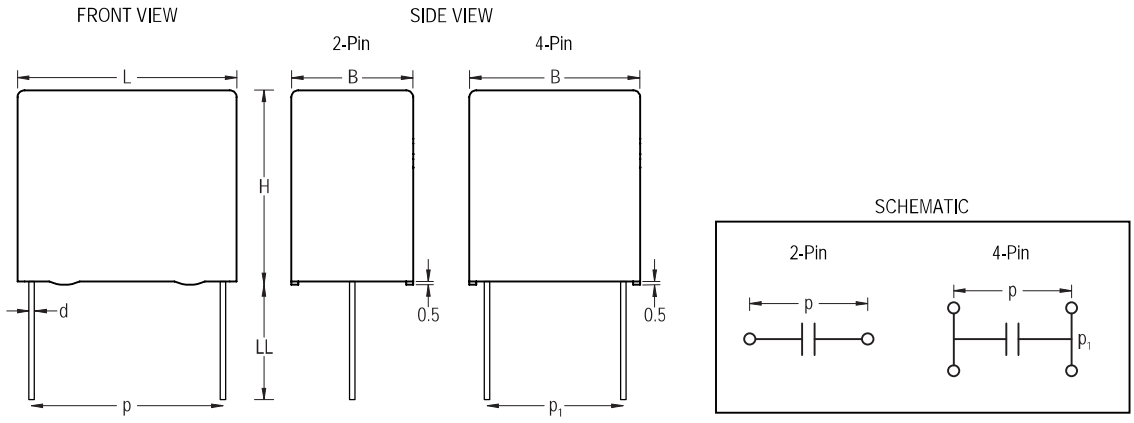
Dimensions – Millimeters



Size Code	Version	p		p[1]		B		H		L		d	
		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
KG		7.5	+/-0.4			4	Maximum	8	Maximum	10	Maximum	0.6	+/-0.05
KH		7.5	+/-0.4			4	Maximum	9	Maximum	10	Maximum	0.6	+/-0.05
KJ		7.5	+/-0.4			5	Maximum	10.5	Maximum	10	Maximum	0.6	+/-0.05
KM		7.5	+/-0.4			6	Maximum	12	Maximum	10.5	Maximum	0.6	+/-0.05
AG		10.0	+/-0.4			4.0	Maximum	9.0	Maximum	13.0	Maximum	0.6	+/-0.05
AK		10.0	+/-0.4			5.0	Maximum	11.0	Maximum	13.0	Maximum	0.6	+/-0.05
AP		10.0	+/-0.4			6.0	Maximum	12.0	Maximum	13.0	Maximum	0.6	+/-0.05
AO		10.0	+/-0.4			7.0	Maximum	17.0	Maximum	13.0	Maximum	0.6	+/-0.05
AL	Low Profile	10.0	+/-0.4			9.5	Maximum	7.5	Maximum	13.0	Maximum	0.6	+/-0.05
AE	Special Version	10.0	+/-0.4			4.0	Maximum	8.0	Maximum	13.0	Maximum	0.6	+/-0.05
BB		15.0	+/-0.4			4.0	Maximum	10.0	Maximum	18.0	Maximum	0.8	+/-0.05
BC		15.0	+/-0.4			5.0	Maximum	11.0	Maximum	18.0	Maximum	0.8	+/-0.05
BE		15.0	+/-0.4			5.5	Maximum	12.5	Maximum	18.0	Maximum	0.8	+/-0.05
BG		15.0	+/-0.4			6.0	Maximum	12.0	Maximum	18.0	Maximum	0.8	+/-0.05
BI	High Profile	15.0	+/-0.4			6.0	Maximum	17.5	Maximum	18.0	Maximum	0.8	+/-0.05
BK		15.0	+/-0.4			7.5	Maximum	13.5	Maximum	18.0	Maximum	0.8	+/-0.05
BO	High Profile	15.0	+/-0.4			7.5	Maximum	18.5	Maximum	18.0	Maximum	0.8	+/-0.05
BP		15.0	+/-0.4			8.5	Maximum	14.5	Maximum	18.0	Maximum	0.8	+/-0.05
BT		15.0	+/-0.4			9.0	Maximum	12.5	Maximum	18.0	Maximum	0.8	+/-0.05
BS		15.0	+/-0.4			10.0	Maximum	16.0	Maximum	18.0	Maximum	0.8	+/-0.05
BY		15.0	+/-0.4			11.0	Maximum	19.0	Maximum	18.0	Maximum	0.8	+/-0.05
BZ	Special Version	15.0	+/-0.4			12.0	Maximum	20.0	Maximum	18.0	Maximum	0.8	+/-0.05
BR	Low Profile	15.0	+/-0.4			13.0	Maximum	12.0	Maximum	18.0	Maximum	0.8	+/-0.05
DB		22.5	+/-0.4			6.0	Maximum	14.5	Maximum	26.0	Maximum	0.8	+/-0.05
DI		22.5	+/-0.4			7.0	Maximum	16.0	Maximum	26.0	Maximum	0.8	+/-0.05
DH		22.5	+/-0.4			8.0	Maximum	16.0	Maximum	26.0	Maximum	0.8	+/-0.05
DJ		22.5	+/-0.4			8.5	Maximum	17.0	Maximum	26.0	Maximum	0.8	+/-0.05
DM		22.5	+/-0.4			9.0	Maximum	18.5	Maximum	26.0	Maximum	0.8	+/-0.05
DO		22.5	+/-0.4			10.0	Maximum	18.5	Maximum	26.0	Maximum	0.8	+/-0.05
DP		22.5	+/-0.4			11.0	Maximum	20.0	Maximum	26.0	Maximum	0.8	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Dimensions – Millimeters cont'd



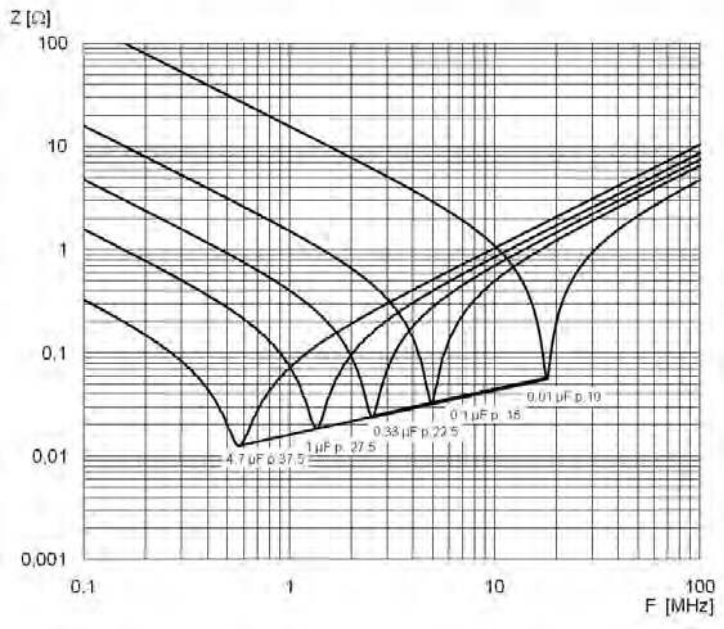
Size Code	Version	p		p[1]		B		H		L		d	
		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
DU		22.5	+/-0.4			13.0	Maximum	22.0	Maximum	26.0	Maximum	0.8	+/-0.05
DY		22.5	+/-0.4			15.5	Maximum	24.5	Maximum	26.0	Maximum	0.8	+/-0.05
FB		27.5	+/-0.4			9.0	Maximum	17.0	Maximum	31.5	Maximum	0.8	+/-0.05
FC		27.5	+/-0.4			11.0	Maximum	20.0	Maximum	31.5	Maximum	0.8	+/-0.05
FI		27.5	+/-0.4			13.0	Maximum	25.0	Maximum	31.5	Maximum	0.8	+/-0.05
FN		27.5	+/-0.4			14.0	Maximum	28.0	Maximum	31.5	Maximum	0.8	+/-0.05
FO	High Profile	27.5	+/-0.4			17.0	Maximum	40.0	Maximum	31.5	Maximum	0.8	+/-0.05
FR		27.5	+/-0.4			17.5	Maximum	28.0	Maximum	31.5	Maximum	0.8	+/-0.05
FS		27.5	+/-0.4			19.0	Maximum	29.0	Maximum	31.5	Maximum	0.8	+/-0.05
FY		27.5	+/-0.4			22.0	Maximum	37.0	Maximum	31.5	Maximum	0.8	+/-0.05
FH	Low Profile	27.5	+/-0.4			21.0	Maximum	12.5	Maximum	31.5	Maximum	0.8	+/-0.05
FQ	Low Profile	27.5	+/-0.4			27.5	Maximum	16.0	Maximum	31.5	Maximum	0.8	+/-0.05
FT	Low Profile	27.5	+/-0.4			31.0	Maximum	19.0	Maximum	31.5	Maximum	0.8	+/-0.05
RB		37.5	+/-0.4			11.0	Maximum	22.0	Maximum	41.0	Maximum	1	+/-0.05
RF		37.5	+/-0.4			13.0	Maximum	24.0	Maximum	41.0	Maximum	1	+/-0.05
RH		37.5	+/-0.4			15.0	Maximum	26.0	Maximum	41.0	Maximum	1	+/-0.05
RC		37.5	+/-0.4			16.0	Maximum	28.5	Maximum	41.0	Maximum	1	+/-0.05
RD		37.5	+/-0.4			19.0	Maximum	32.0	Maximum	41.0	Maximum	1	+/-0.05
RP		37.5	+/-0.4			21.0	Maximum	38.0	Maximum	41.0	Maximum	1	+/-0.05
RO		37.5	+/-0.4			24.0	Maximum	44.0	Maximum	41.0	Maximum	1	+/-0.05
RU		37.5	+/-0.4			30.0	Maximum	45.0	Maximum	41.0	Maximum	1	+/-0.05
RV	Low Profile	37.5	+/-0.4			24.0	Maximum	15.0	Maximum	41.0	Maximum	1	+/-0.05
RW	Low Profile	37.5	+/-0.4			24.0	Maximum	19.0	Maximum	41.0	Maximum	1	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Rated Voltage	310 VAC 50/60 Hz		
Capacitance Range	0.01 – 4.7 µF		
Capacitance Tolerance	±20%, ±10%		
Temperature Range	-40°C to +110°C		
Climatic Category	40/110/56		
Approvals	ENEC, UL, cUL, CQC		
Dissipation Factor	Maximum Values at +23°C		
		C ≤ 0.1 µF	C > 0.1 µF
	1 kHz	0.3%	0.2%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 1,900 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.		
Insulation Resistance	Minimum Values Between Terminals		
	C ≤ 0.33 µF	≥ 30,000 MΩ	
	C > 0.33 µF	≥ 10,000 MΩ • µF	
In DC Applications	Recommended voltage ≤ 630 VDC		

Impedance Graph



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384–14	CA08.00189
	UL 60384–14 and CAN/CSA–E60384–14	E97797
	IEC 60384–14	CQC12001084206 CQC12001084386 CQC12001084205 CQC12001084204 CQC12001084195 CQC12001084207

Environmental Compliance

All new KEMET EMI capacitors are RoHS Compliant and Halogen Free.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Size Code	Maximum Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	Part Number
		B	H	L			
0.01	KG	4.0	8.0	10.0	7.5	500	F861KG103(1)310(2)
0.012	KG	4.0	8.0	10.0	7.5	500	F861KG123(1)310(2)
0.015	KH	4.0	9.0	10.0	7.5	500	F861KH153(3)310(2)
0.018	KJ	5.0	10.5	10.0	7.5	500	F861KJ183(1)310(2)
0.022	KJ	5.0	10.5	10.0	7.5	500	F861KJ223(1)310(2)
0.025	KJ	5.0	10.5	10.0	7.5	500	F861KJ253(1)310(2)
0.027	KJ	5.0	10.5	10.0	7.5	500	F861KJ273(1)310(2)
0.033	KJ	5.0	10.5	10.0	7.5	500	F861KJ333(3)310(2)
0.033	KM	6.0	12.0	10.5	7.5	500	F861KM333(1)310(2)
0.039	KM	6.0	12.0	10.5	7.5	500	F861KM393(1)310(2)
0.047	KM	6.0	12.0	10.5	7.5	500	F861KM473(3)310(2)
0.01	AE	4.0	8.0	13.0	10.0	500	F861AE103(1)310(2)
0.01	AL	9.5	7.5	13.0	10.0	500	F861AL103(1)310(2)
0.012	AE	4.0	8.0	13.0	10.0	500	F861AE123(1)310(2)
0.015	AE	4.0	8.0	13.0	10.0	500	F861AE153(1)310(2)
0.015	AL	9.5	7.5	13.0	10.0	500	F861AL153(1)310(2)
0.018	AE	4.0	8.0	13.0	10.0	500	F861AE183(1)310(2)
0.018	AL	9.5	7.5	13.0	10.0	500	F861AL183(1)310(2)
0.022	AE	4.0	8.0	13.0	10.0	500	F861AE223(1)310(2)
0.022	AL	9.5	7.5	13.0	10.0	500	F861AL223(1)310(2)
0.025	AE	4.0	8.0	13.0	10.0	500	F861AE253(1)310(2)
0.025	AL	9.5	7.5	13.0	10.0	500	F861AL253(1)310(2)
0.027	AE	4.0	8.0	13.0	10.0	500	F861AE273(1)310(2)
0.027	AL	9.5	7.5	13.0	10.0	500	F861AL273(1)310(2)
0.033	AE	4.0	8.0	13.0	10.0	500	F861AE333(1)310(2)
0.033	AL	9.5	7.5	13.0	10.0	500	F861AL333(1)310(2)
0.039	AE	4.0	8.0	13.0	10.0	500	F861AE393(1)310(2)
0.039	AL	9.5	7.5	13.0	10.0	500	F861AL393(1)310(2)
0.047	AE	4.0	8.0	13.0	10.0	500	F861AE473(3)310(2)
0.047	AL	9.5	7.5	13.0	10.0	500	F861AL473(1)310(2)
0.056	AG	4.0	9.0	13.0	10.0	500	F861AG563(1)310(2)
0.056	AL	9.5	7.5	13.0	10.0	500	F861AL563(1)310(2)
0.068	AK	5.0	11.0	13.0	10.0	500	F861AK683(1)310(2)
0.068	AL	9.5	7.5	13.0	10.0	500	F861AL683(1)310(2)
0.082	AK	5.0	11.0	13.0	10.0	500	F861AK823(1)310(2)
0.082	AL	9.5	7.5	13.0	10.0	500	F861AL823(1)310(2)
0.1	AK	5.0	11.0	13.0	10.0	500	F861AK104(3)310(2)
0.1	AL	9.5	7.5	13.0	10.0	500	F861AL104(1)310(2)
0.1	AP	6.0	12.0	13.0	10.0	500	F861AP104(1)310(2)
0.12	AL	9.5	7.5	13.0	10.0	500	F861AL124(1)310(2)
0.12	AP	6.0	12.0	13.0	10.0	500	F861AP124(1)310(2)
0.15	AO	7.0	17.0	13.0	10.0	500	F861AO154(1)310(2)
0.15	AP	6.0	12.0	13.0	10.0	500	F861AP154(3)310(2)
0.18	AO	7.0	17.0	13.0	10.0	500	F861AO184(1)310(2)
0.22	AO	7.0	17.0	13.0	10.0	500	F861AO224(1)310(2)
0.25	AO	7.0	17.0	13.0	10.0	500	F861AO254(1)310(2)
0.27	AO	7.0	17.0	13.0	10.0	500	F861AO274(1)310(2)
0.01	BB	4.0	10.0	18.0	15.0	400	F861BB103(1)310(2)
0.012	BB	4.0	10.0	18.0	15.0	400	F861BB123(1)310(2)
0.015	BB	4.0	10.0	18.0	15.0	400	F861BB153(1)310(2)
0.018	BB	4.0	10.0	18.0	15.0	400	F861BB183(1)310(2)
0.022	BB	4.0	10.0	18.0	15.0	400	F861BB223(1)310(2)
0.025	BB	4.0	10.0	18.0	15.0	400	F861BB253(1)310(2)
0.027	BB	4.0	10.0	18.0	15.0	400	F861BB273(1)310(2)
0.033	BB	4.0	10.0	18.0	15.0	400	F861BB333(1)310(2)
0.039	BB	4.0	10.0	18.0	15.0	400	F861BB393(1)310(2)
0.047	BB	4.0	10.0	18.0	15.0	400	F861BB473(1)310(2)
0.056	BB	4.0	10.0	18.0	15.0	400	F861BB563(1)310(2)
0.068	BB	4.0	10.0	18.0	15.0	400	F861BB683(1)310(2)
Capacitance Value (µF)	Size Code	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	Part Number

(1) M = ±20%, K = ±10%.

(2) Insert lead and packaging code. See Ordering Options Table for available options.

(3) M = ±20% (only available tolerance).

Table 1 – Ratings & Part Number Reference cont'd

Capacitance Value (µF)	Size Code	Maximum Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	Part Number
		B	H	L			
0.082	BB	4.0	10.0	18.0	15.0	400	F861BB823(1)310(2)
0.1	BB	4.0	10.0	18.0	15.0	400	F861BB104(1)310(2)
0.12	BB	4.0	10.0	18.0	15.0	400	F861BB124(3)310(2)
0.12	BC	5.0	11.0	18.0	15.0	400	F861BC124(1)310(2)
0.15	BC	5.0	11.0	18.0	15.0	400	F861BC154(1)310(2)
0.15	BT	9.0	12.5	18.0	15.0	400	F861BT154(1)310(2)
0.18	BC	5.0	11.0	18.0	15.0	400	F861BC184(3)310(2)
0.18	BE	5.5	12.5	18.0	15.0	400	F861BE184(1)310(2)
0.18	BT	9.0	12.5	18.0	15.0	400	F861BT184(1)310(2)
0.22	BE	5.5	12.5	18.0	15.0	400	F861BE224(1)310(2)
0.22	BG	6.0	12.0	18.0	15.0	400	F861BG224(1)310(2)
0.22	BT	9.0	12.5	18.0	15.0	400	F861BT224(1)310(2)
0.25	BG	6.0	12.0	18.0	15.0	400	F861BG254(1)310(2)
0.25	BT	9.0	12.5	18.0	15.0	400	F861BT254(1)310(2)
0.27	BG	6.0	12.0	18.0	15.0	400	F861BG274(3)310(2)
0.27	BI	6.0	17.5	18.0	15.0	400	F861BI274(1)310(2)
0.27	BK	7.5	13.5	18.0	15.0	400	F861BK274(1)310(2)
0.27	BR	13.0	12.0	18.0	15.0	400	F861BR274(1)310(2)
0.27	BT	9.0	12.5	18.0	15.0	400	F861BT274(1)310(2)
0.33	BI	6.0	17.5	18.0	15.0	400	F861BI334(1)310(2)
0.33	BK	7.5	13.5	18.0	15.0	400	F861BK334(1)310(2)
0.33	BR	13.0	12.0	18.0	15.0	400	F861BR334(1)310(2)
0.33	BT	9.0	12.5	18.0	15.0	400	F861BT334(1)310(2)
0.39	BI	6.0	17.5	18.0	15.0	400	F861BI394(1)310(2)
0.39	BK	7.5	13.5	18.0	15.0	400	F861BK394(3)310(2)
0.39	BP	8.5	14.5	18.0	15.0	400	F861BP394(1)310(2)
0.39	BR	13.0	12.0	18.0	15.0	400	F861BR394(1)310(2)
0.39	BT	9.0	12.5	18.0	15.0	400	F861BT394(1)310(2)
0.47	BO	7.5	18.5	18.0	15.0	400	F861BO474(1)310(2)
0.47	BP	8.5	14.5	18.0	15.0	400	F861BP474(1)310(2)
0.47	BR	13.0	12.0	18.0	15.0	400	F861BR474(1)310(2)
0.56	BO	7.5	18.5	18.0	15.0	400	F861BO564(1)310(2)
0.56	BR	13.0	12.0	18.0	15.0	400	F861BR564(1)310(2)
0.56	BS	10.0	16.0	18.0	15.0	400	F861BS564(1)310(2)
0.68	BR	13.0	12.0	18.0	15.0	400	F861BR684(3)310(2)
0.68	BS	10.0	16.0	18.0	15.0	400	F861BS684(1)310(2)
0.82	BY	11.0	19.0	18.0	15.0	400	F861BY824(1)310(2)
1	BZ	12.0	20.0	18.0	15.0	400	F861BZ105(3)310(2)
0.039	DB	6.0	14.5	26.0	22.5	200	F861DB393(1)310(2)
0.047	DB	6.0	14.5	26.0	22.5	200	F861DB473(1)310(2)
0.056	DB	6.0	14.5	26.0	22.5	200	F861DB563(1)310(2)
0.068	DB	6.0	14.5	26.0	22.5	200	F861DB683(1)310(2)
0.082	DB	6.0	14.5	26.0	22.5	200	F861DB823(1)310(2)
0.1	DB	6.0	14.5	26.0	22.5	200	F861DB104(1)310(2)
0.12	DB	6.0	14.5	26.0	22.5	200	F861DB124(1)310(2)
0.15	DB	6.0	14.5	26.0	22.5	200	F861DB154(1)310(2)
0.18	DB	6.0	14.5	26.0	22.5	200	F861DB184(1)310(2)
0.22	DB	6.0	14.5	26.0	22.5	200	F861DB224(1)310(2)
0.25	DB	6.0	14.5	26.0	22.5	200	F861DB254(1)310(2)
0.27	DB	6.0	14.5	26.0	22.5	200	F861DB274(1)310(2)
0.33	DB	6.0	14.5	26.0	22.5	200	F861DB334(1)310(2)
0.39	DB	6.0	14.5	26.0	22.5	200	F861DB394(1)310(2)
0.47	DB	6.0	14.5	26.0	22.5	200	F861DB474(3)310(2)
0.47	DI	7.0	16.0	26.0	22.5	200	F861DI474(1)310(2)
0.56	DI	7.0	16.0	26.0	22.5	200	F861DI564(1)310(2)
0.68	DI	7.0	16.0	26.0	22.5	200	F861DI684(1)310(2)
0.82	DH	8.0	16.0	26.0	22.5	200	F861DH824(1)310(2)
1	DJ	8.5	17.0	26.0	22.5	200	F861DJ105(3)310(2)
1.2	DM	9.0	18.5	26.0	22.5	200	F861DM125(3)310(2)
Capacitance Value (µF)	Size Code	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	Part Number

(1) M = ±20%, K = ±10%.

(2) Insert lead and packaging code. See Ordering Options Table for available options.

(3) M = ±20% (only available tolerance).

Table 1 – Ratings & Part Number Reference cont'd

Capacitance Value (µF)	Size Code	Maximum Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	Part Number
		B	H	L			
1.2	DO	10.0	18.5	26.0	22.5	200	F861DO125(1)310(2)
1.5	DP	11.0	20.0	26.0	22.5	200	F861DP155(1)310(2)
1.8	DP	11.0	20.0	26.0	22.5	200	F861DP185(3)310(2)
1.8	DU	13.0	22.0	26.0	22.5	200	F861DU185(1)310(2)
2.2	DU	13.0	22.0	26.0	22.5	200	F861DU225(1)310(2)
2.5	DU	13.0	22.0	26.0	22.5	200	F861DU255(3)310(2)
2.5	DY	15.5	24.5	26.0	22.5	200	F861DY255(1)310(2)
2.7	DY	15.5	24.5	26.0	22.5	200	F861DY275(1)310(2)
3.3	DY	15.5	24.5	26.0	22.5	200	F861DY335(3)310(2)
0.15	FB	9.0	17.0	31.5	27.5	150	F861FB154(1)310(2)
0.18	FB	9.0	17.0	31.5	27.5	150	F861FB184(1)310(2)
0.22	FB	9.0	17.0	31.5	27.5	150	F861FB224(1)310(2)
0.25	FB	9.0	17.0	31.5	27.5	150	F861FB254(1)310(2)
0.25	FH	21.0	12.5	31.5	27.5	150	F861FH254(1)310(2)
0.27	FB	9.0	17.0	31.5	27.5	150	F861FB274(1)310(2)
0.27	FH	21.0	12.5	31.5	27.5	150	F861FH274(1)310(2)
0.33	FB	9.0	17.0	31.5	27.5	150	F861FB334(1)310(2)
0.33	FH	21.0	12.5	31.5	27.5	150	F861FH334(1)310(2)
0.39	FB	9.0	17.0	31.5	27.5	150	F861FB394(1)310(2)
0.39	FH	21.0	12.5	31.5	27.5	150	F861FH394(1)310(2)
0.47	FB	9.0	17.0	31.5	27.5	150	F861FB474(1)310(2)
0.47	FH	21.0	12.5	31.5	27.5	150	F861FH474(1)310(2)
0.56	FB	9.0	17.0	31.5	27.5	150	F861FB564(1)310(2)
0.56	FH	21.0	12.5	31.5	27.5	150	F861FH564(1)310(2)
0.68	FB	9.0	17.0	31.5	27.5	150	F861FB684(1)310(2)
0.68	FH	21.0	12.5	31.5	27.5	150	F861FH684(1)310(2)
0.82	FB	9.0	17.0	31.5	27.5	150	F861FB824(1)310(2)
0.82	FH	21.0	12.5	31.5	27.5	150	F861FH824(1)310(2)
1	FB	9.0	17.0	31.5	27.5	150	F861FB105(1)310(2)
1	FH	21.0	12.5	31.5	27.5	150	F861FH105(1)310(2)
1.2	FB	9.0	17.0	31.5	27.5	150	F861FB125(3)310(2)
1.2	FC	11.0	20.0	31.5	27.5	150	F861FC125(1)310(2)
1.2	FH	21.0	12.5	31.5	27.5	150	F861FH125(1)310(2)
1.5	FC	11.0	20.0	31.5	27.5	150	F861FC155(1)310(2)
1.5	FH	21.0	12.5	31.5	27.5	150	F861FH155(1)310(2)
1.8	FC	11.0	20.0	31.5	27.5	150	F861FC185(3)310(2)
1.8	FH	21.0	12.5	31.5	27.5	150	F861FH185(1)310(2)
2.2	FH	21.0	12.5	31.5	27.5	150	F861FH225(3)310(2)
2.2	FI	13.0	25.0	31.5	27.5	150	F861FI225(1)310(2)
2.5	FI	13.0	25.0	31.5	27.5	150	F861FI255(1)310(2)
2.5	FQ	27.5	16.0	31.5	27.5	150	F861FQ255(1)310(2)
2.7	FI	13.0	25.0	31.5	27.5	150	F861FI275(1)310(2)
2.7	FQ	27.5	16.0	31.5	27.5	150	F861FQ275(1)310(2)
3.3	FI	13.0	25.0	31.5	27.5	150	F861FI335(3)310(2)
3.3	FN	14.0	28.0	31.5	27.5	150	F861FN335(1)310(2)
3.3	FO	17.0	40.0	31.5	27.5	150	F861FO335(1)310(2)
3.3	FQ	27.5	16.0	31.5	27.5	150	F861FQ335(1)310(2)
3.9	FO	17.0	40.0	31.5	27.5	150	F861FO395(1)310(2)
3.9	FQ	27.5	16.0	31.5	27.5	150	F861FQ395(3)310(2)
3.9	FR	17.5	28.0	31.5	27.5	150	F861FR395(1)310(2)
3.9	FT	31.0	19.0	31.5	27.5	150	F861FT395(1)310(2)
4.7	FO	17.0	40.0	31.5	27.5	150	F861FO475(1)310(2)
4.7	FR	17.5	28.0	31.5	27.5	150	F861FR475(1)310(2)
4.7	FT	31.0	19.0	31.5	27.5	150	F861FT475(1)310(2)
4.7	RF	13.0	24.0	41.0	37.5	100	F861RF475(3)310(2)
4.7	RH	15.0	26.0	41.0	37.5	100	F861RH475(1)310(2)
4.7	RV	24.0	15.0	41.0	37.5	100	F861RV475(3)310(2)
4.7	RW	24.0	19.0	41.0	37.5	100	F861RW475(1)310(2)
Capacitance Value (µF)	Size Code	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	Part Number

(1) M = ±20%, K = ±10%.

(2) Insert lead and packaging code. See Ordering Options Table for available options.

(3) M = ±20% (only available tolerance).

Soldering Process

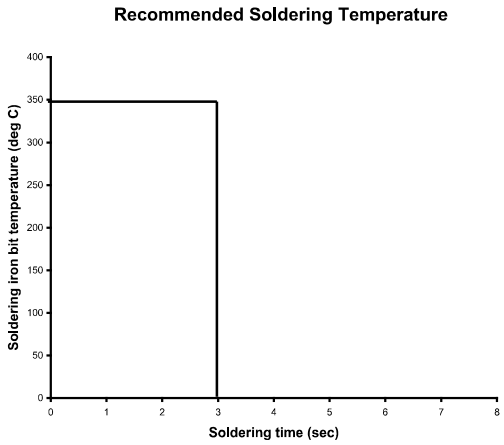
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183°C for SnPb eutectic alloy to 217 – 221°C for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170°C). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

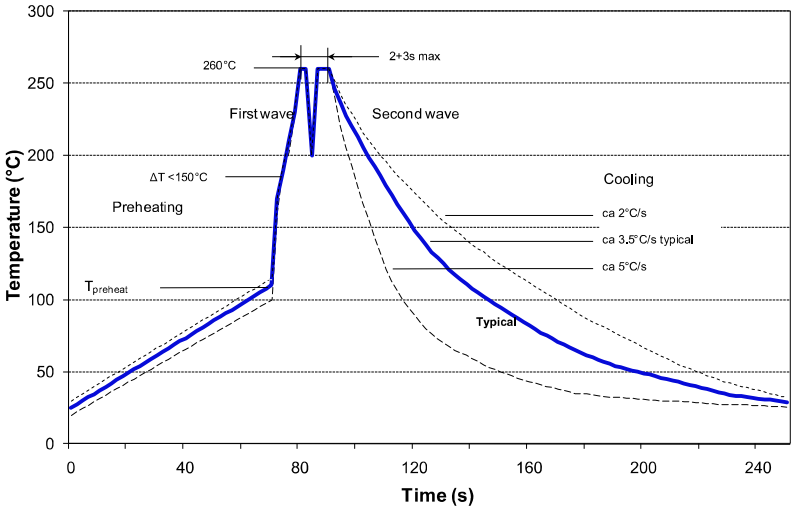
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

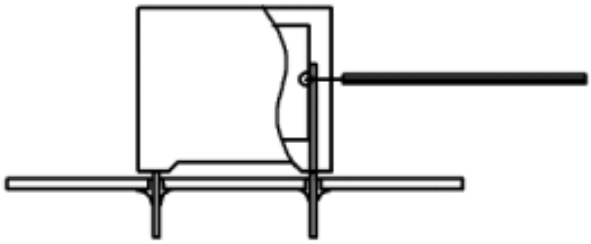
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



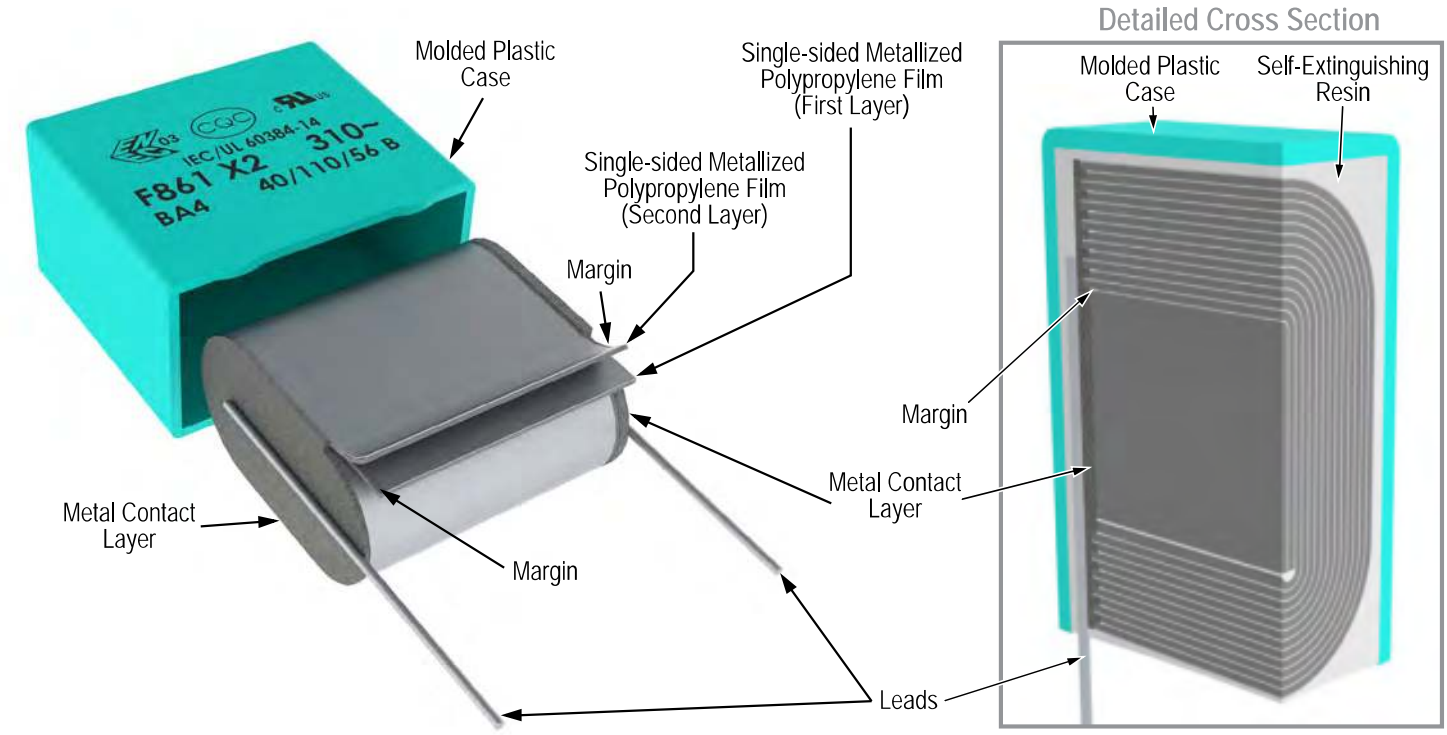
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

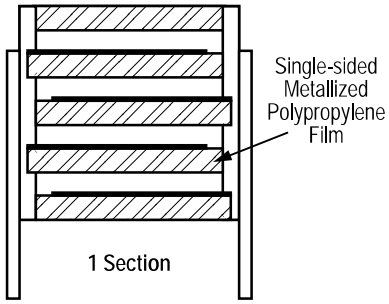
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

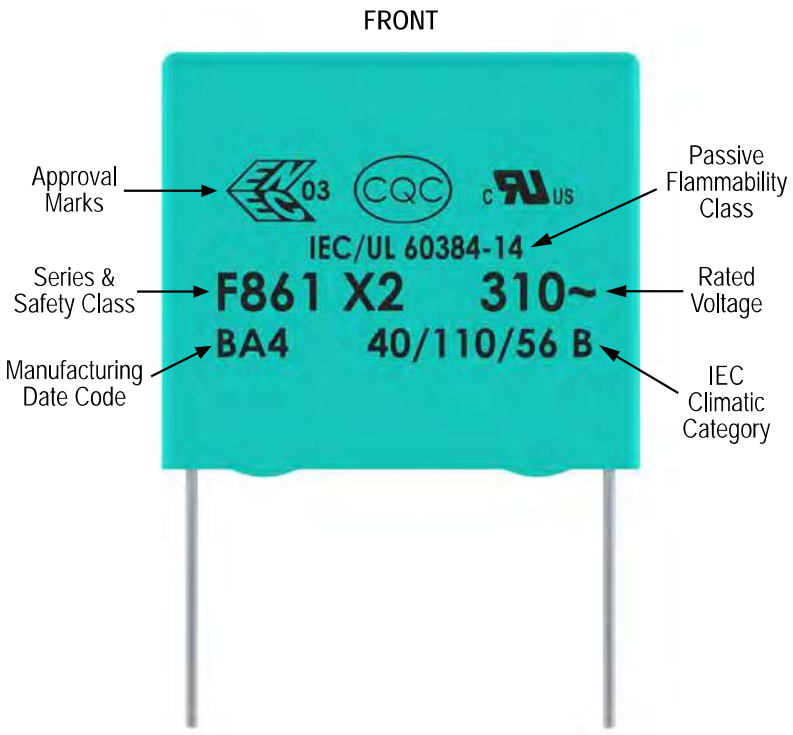
Construction

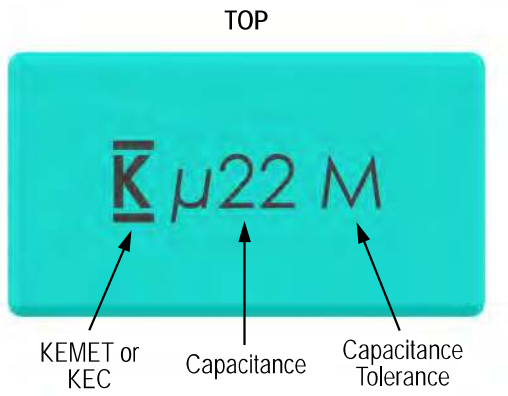


Winding Scheme



Marking


FRONT
Approval Marks
03
CQC
c US
Passive Flammability Class
IEC/UL 60384-14
Series & Safety Class
F861 X2
310~
Rated Voltage
Manufacturing Date Code
BA4
40/110/56 B
IEC Climatic Category


TOP
K µ22 M
KEMET or KEC
Capacitance
Capacitance Tolerance

Packaging Quantities

Size Code	Lead Spacing	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo	Pizza
KE	7.5	2.5	6	10	2000	2500	2500		3500	
KF		3	8	10	1500	1750	2100		2800	
KG		4	8	10	2000	1500	1500		2100	
KJ		5	10.5	10	1500	1000	1200		1600	
KM		6	12	10.5	1000	800	1000		1350	
KH		4	9	10	2000	1500	1500		2100	
AN	10	3.5	9	13	2000	2200	850	1700	1150	
AG		4	9	13	2000	2200	750	1500	1000	
AK		5	11	13	1300	2000	600	1250	800	
AP		6	12	13	1000	1800	500	1000	680	
AO		7	17	13	600	700	450	900	580	
AL		9.5	7.5	13	1000	1500	300	600	430	
AE		4	8	13	2000	2200	750	1500	1000	
BB	15	4	10	18	2500	1500	750	1500	1000	1411
BC		5	11	18	1000	1250	600	1250	800	1139
BE		5.5	12.5	18	800	1000	550	1100	750	1020
BG		6	12	18	1750	1000	500	1000	680	935
BK		7.5	13.5	18	1000	800	350	800	500	748
BI		6	17.5	18	1000	800	500	1000	680	935
BP		8.5	14.5	18	1000	650	300	700	440	663
BT		9	12.5	18	1000	700	270	650	410	629
BO		7.5	18.5	18	900	500	350	800	500	748
BS		10	16	18	750	550	300	600	380	561
BR		13	12	18	750	520	200	480	280	425
BY		11	19	18	450	400	250	500	340	510
BA		8.5	12.5	18	1000	650	300	700	440	663
BZ		12	20	18	350	300	220	450	330	459
DB	22.5	6	14.5	26	805	450	300	700	464	660
DI		7	16	26	700	450	250	550	380	564
DH		8.0	16.0	26	520	300	240	500	330	492
DJ		8.5	17	26	450	350	250	450	280	468
DM		9	18.5	26	400	225	200	400	300	444
DO		10	18.5	26	360	350	160	350	235	396
DP		11	20	26	300	200	190	350	217	360
DU		13	22	26	230	150	150	300	200	300
DY		15.5	24.5	26	150	100	120	250	170	252

Packaging Quantities cont'd

Size Code	Lead Spacing	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo	Pizza
FB	27.5	9.0	17.0	31.5						370
FC		11.0	20.0	31.5						300
FI		13.0	25.0	31.5						250
FN		14.0	28.0	31.5						230
FO		17.0	40.0	31.5						190
FR		17.5	28.0	31.5						190
FS		19.0	29.0	31.5						170
FY		22.0	37.0	31.5						150
FH		21.0	12.5	31.5						150
FQ		27.5	16.0	31.5						120
FT		31.0	19.0	31.5						100
RB	37.5	11.0	22.0	41.0						210
RF		13.0	24.0	41.0						175
RH		15.0	26.0	41.0						154
RC		16.0	28.5	41.0						140
RD		19.0	32.0	41.0						119
RP		21.0	38.0	41.0						105
RO		24.0	44.0	41.0						91
RU		30.0	45.0	41.0						77
RV		24.0	15.0	41.0						91
RW		24.0	19.0	41.0						91

F862 Series Metallized Polypropylene Film for Harsh Environmental Conditions, Class X2, 310 VAC (Automotive Grade)

Overview

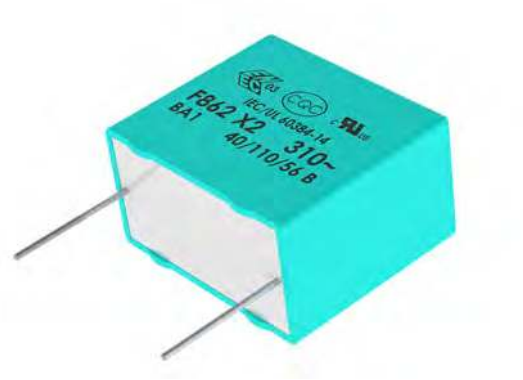
The F862 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box material recognized by UL 94 V–0. The F862 Series is ideal for harsh environmental conditions and meets the demanding Automotive Electronics Council's AEC–Q200 qualification requirements.

Applications

Typical applications include connection in series with the mains, capacitive power supplies and energy meters, with special emphasis in automotive applications for severe ambient conditions.

Benefits

- Approvals: ENEC, UL, cUL, CQC
- Rated voltage: 310 VAC 50/60 Hz
- Capacitance range: 0.1 – 4.7 µF
- Lead spacing: 15.0 – 27.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category: 40/110/56, IEC 60068-1
- Tape and reel in accordance with IEC 60286-2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 1,900 VDC
- Qualification based on AEC-Q200 guidelines



Part Number System

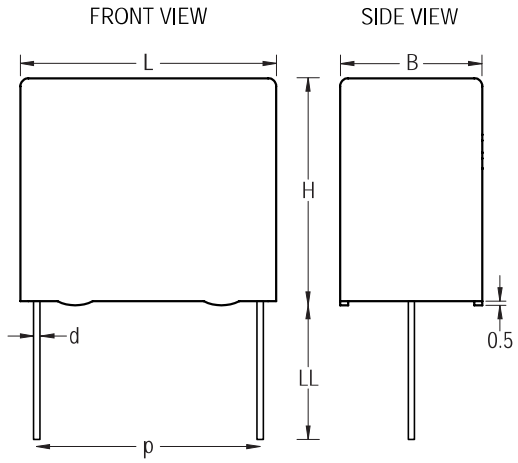
F	862	B	C	104	M	310	Z
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Voltage (VAC)	Packaging
F = Film	X2, Metallized Polypropylene	B = 15 D = 22.5 F = 27.5	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	K = ±10% M = ±20%	310	See Ordering Options Table

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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
15	Standard Lead and Packaging Options		
	Pizza Pack	4 +2/-0	Z
	Other Lead and Packaging Options		
	Pizza – Short Leads	3.2 +0.3/-0.2	ZL32K
	Bulk (Bag) – Max Length Leads	25 +5/-0	ALR0L
	Ammo Pack	H_0 = 18.5 +/-0.5	R
22.5	Standard Lead and Packaging Options		
	Pizza Pack	4 +2/-0	Z
	Pizza Pack – Long Leads	17 +0/-1	ZLH0J
	Other Lead and Packaging Options		
	Pizza – Short Leads	3.2 +0.3/-0.2	ZL32K
	Pizza Pack – Max Length Leads	25 +5/-0	ZLR0L
	Ammo Pack	H_0 = 18.5 +/-0.5	R
27.5	Standard Lead and Packaging Options		
	Pizza Pack	4 +2/-0	Z
	Pizza – Long Leads	17 +0/-1	ZLH0J
	Pizza – Short Leads	3.2 +0.3/-0.2	ZL32K

Dimensions – Millimeters



Size Code	p		B		H		L		d	
	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
BG	15.0	+/-0.4	6.0	Maximum	12.0	Maximum	18.0	Maximum	0.8	+/-0.05
BK	15.0	+/-0.4	7.5	Maximum	13.5	Maximum	18.0	Maximum	0.8	+/-0.05
BP	15.0	+/-0.4	8.5	Maximum	14.5	Maximum	18.0	Maximum	0.8	+/-0.05
BS	15.0	+/-0.4	10.0	Maximum	16.0	Maximum	18.0	Maximum	0.8	+/-0.05
BY	15.0	+/-0.4	11.0	Maximum	19.0	Maximum	18.0	Maximum	0.8	+/-0.05
BZ	15.0	+/-0.4	12.0	Maximum	20.0	Maximum	18.0	Maximum	0.8	+/-0.05
DB	22.5	+/-0.4	6.0	Maximum	14.5	Maximum	26.0	Maximum	0.8	+/-0.05
DI	22.5	+/-0.4	7.0	Maximum	16.0	Maximum	26.0	Maximum	0.8	+/-0.05
DJ	22.5	+/-0.4	8.5	Maximum	17.0	Maximum	26.0	Maximum	0.8	+/-0.05
DO	22.5	+/-0.4	10.0	Maximum	18.5	Maximum	26.0	Maximum	0.8	+/-0.05
DP	22.5	+/-0.4	11.0	Maximum	20.0	Maximum	26.0	Maximum	0.8	+/-0.05
DU	22.5	+/-0.4	13.0	Maximum	22.0	Maximum	26.0	Maximum	0.8	+/-0.05
FC	27.5	+/-0.4	11.0	Maximum	20.0	Maximum	31.5	Maximum	0.8	+/-0.05
FI	27.5	+/-0.4	13.0	Maximum	25.0	Maximum	31.5	Maximum	0.8	+/-0.05
FN	27.5	+/-0.4	14.0	Maximum	28.0	Maximum	31.5	Maximum	0.8	+/-0.05
FS	27.5	+/-0.4	19.0	Maximum	29.0	Maximum	31.5	Maximum	0.8	+/-0.05
FY	27.5	+/-0.4	22.0	Maximum	37.0	Maximum	31.5	Maximum	0.8	+/-0.05

Note: See Ordering Options Table for lead length (LL/H_0) options.

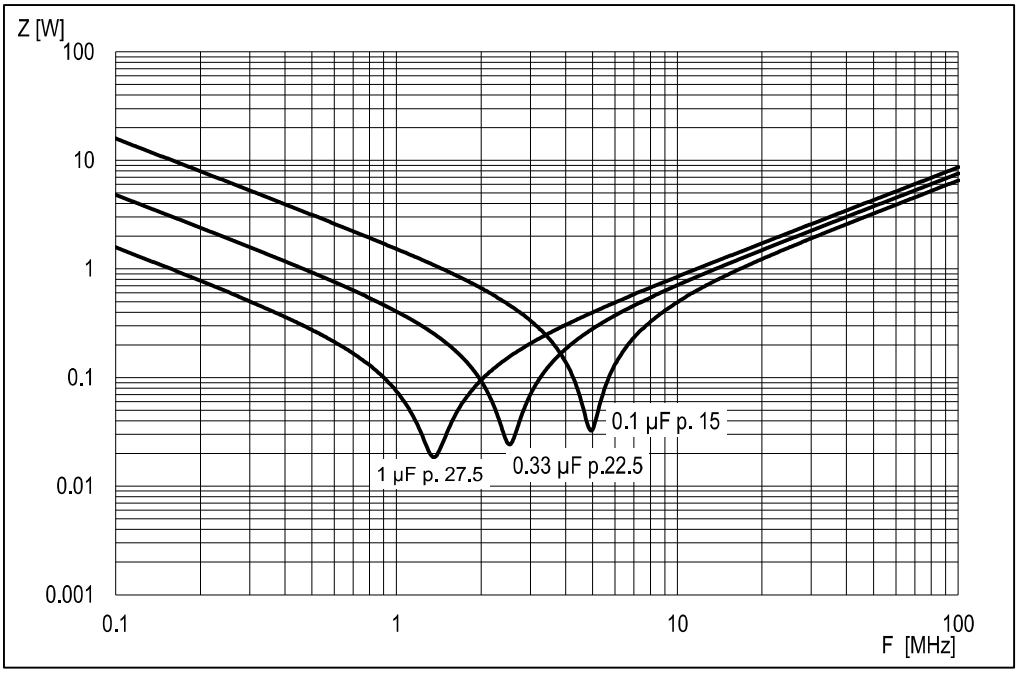
Qualification

Automotive Grade products meet or exceed the requirements outlined by the Automotive Electronics Council. Details regarding test methods and conditions are referenced in document AEC–Q200, Stress Test Qualification for Passive Components. For additional information regarding the Automotive Electronics Council and AEC–Q200, please visit their website at www.aecouncil.com.

Performance Characteristics

Rated Voltage	310 VAC 50/60 Hz		
Capacitance Range	0.1 – 4.7 µF		
Capacitance Tolerance	±20%, ±10%		
Temperature Range	-40°C to +110°C		
Climatic Category	40/110/56		
Approvals	ENEC, UL, cUL, CQC		
Dissipation Factor	Maximum Values at +23°C		
		C ≤ 0.1 µF	C > 0.1 µF
	1 kHz	0.3%	0.2%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 1,900 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.		
Insulation Resistance	Minimum Values Between Terminals		
	C ≤ 0.33 µF	≥ 30,000 MΩ	
	C > 0.33 µF	≥ 10,000 MΩ • µF	
In DC Applications	Recommended voltage ≤ 630 VDC		

Impedance Graph



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days
THB Test		85°C, 85% RH and 240 VAC, 1,000 hours Capacitance change (ΔC/C): ≤ 10% Dissipation factor change (Δtan δ): ≤ 5 * 10^{-3} (at 1 kHz) Insulation resistance Rins or time constant τ = CR Rins: ≥ 50% of initial limit

Approvals

Mark	Specification	File Number
	EN/IEC 60384–14	CA08.00203
	UL 60384–14 and CAN/CSA–E60384–14	E97797
	IEC 60384-14	CQC14001105462 CQC14001105463 CQC14001105464 CQC14001105465 CQC14001105692 CQC14001114605

Environmental Compliance

All new KEMET EMI capacitors are RoHS Compliant and Halogen Free.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Size Code	Maximum Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	Part Number
		B	H	L			
0.1	BK	7.5	13.5	18	15	400	F862BK104(1)310(2)
0.12	BK	7.5	13.5	18	15	400	F862BK124(1)310(2)
0.15	BK	7.5	13.5	18	15	400	F862BK154(1)310(2)
0.18	BP	8.5	14.5	18	15	400	F862BP184(1)310(2)
0.22	BP	8.5	14.5	18	15	400	F862BP224(1)310(2)
0.33	BS	10	16	18	15	400	F862BS334(1)310(2)
0.39	BS	10	16	18	15	400	F862BS394(1)310(2)
0.47	BY	11	19	18	15	400	F862BY474(1)310(2)
0.56	BZ	12	20	18	15	400	F862BZ564(1)310(2)
0.47	DO	10	18.5	26	22.5	200	F862DO474(1)310(2)
0.56	DO	10	18.5	26	22.5	200	F862DO564(1)310(2)
0.68	DP	11	20	26	22.5	200	F862DP684(1)310(2)
0.82	DP	11	20	26	22.5	200	F862DP824(1)310(2)
1	DU	13	22	26	22.5	200	F862DU105(1)310(2)
1.2	DU	13	22	26	22.5	200	F862DU125(1)310(2)
1	FC	11	20	31.5	27.5	150	F862FC105(1)310(2)
1.5	FI	13	25	31.5	27.5	150	F862FI155(1)310(2)
2.2	FN	14	28	31.5	27.5	150	F862FN225(1)310(2)
3.3	FS	19	29	31.5	27.5	150	F862FS335(1)310(2)
4.7	FY	22	37	31.5	27.5	150	F862FY475(1)310(2)
Capacitance Value (µF)	Size Code	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	Part Number

(1) M = ±20%, K = ±10%.

(2) Insert lead and packaging code. See Ordering Options Table for available options.

Soldering Process

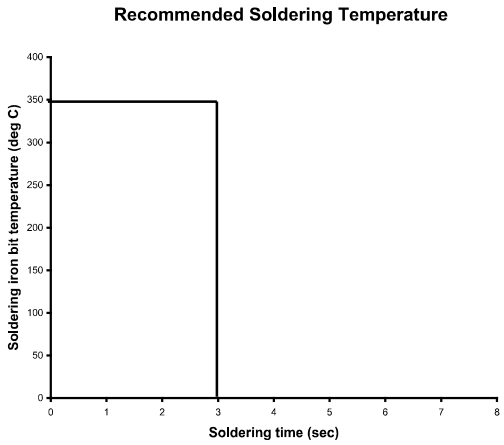
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

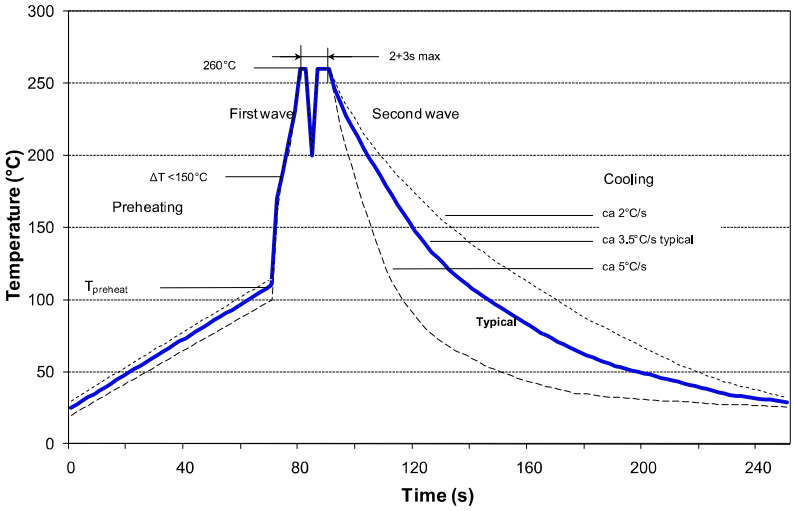
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

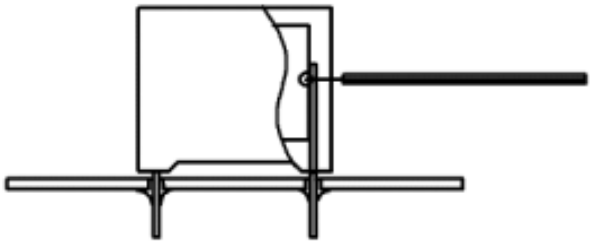
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



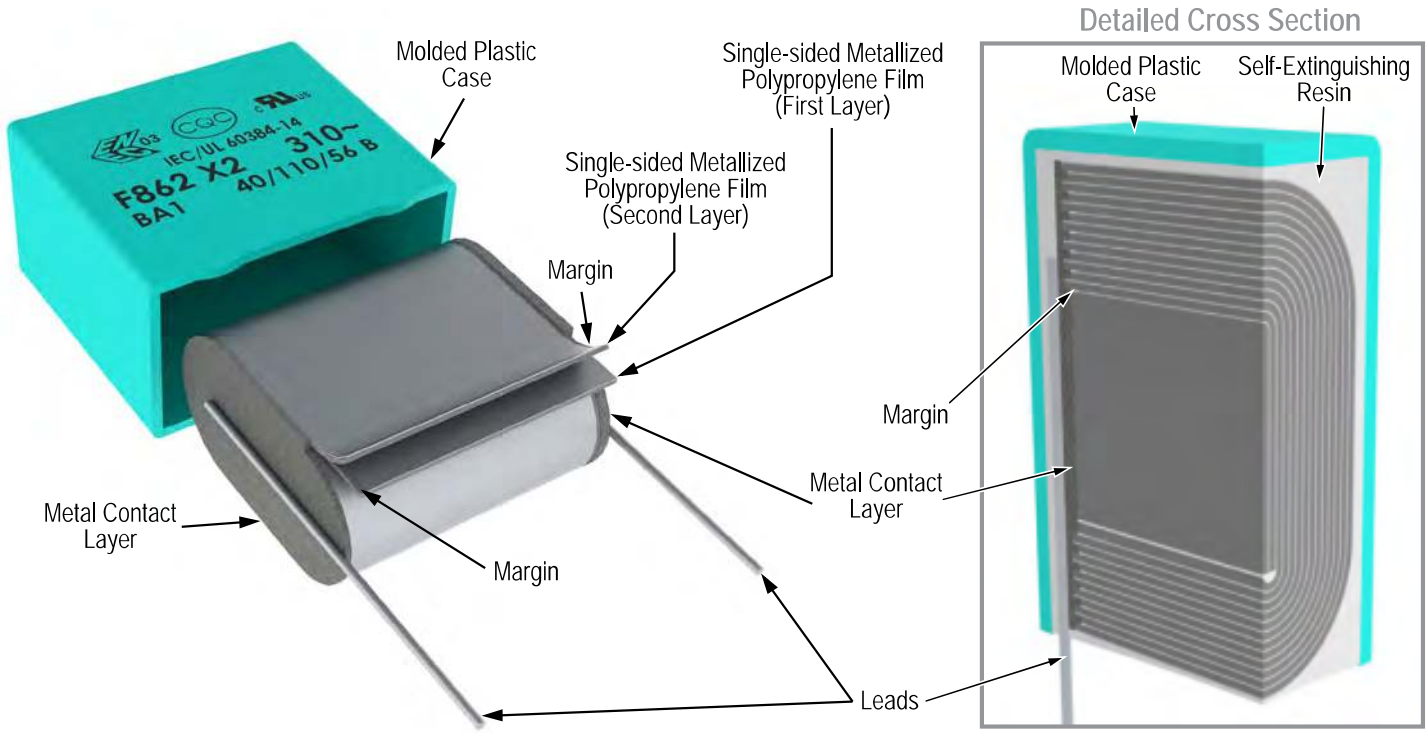
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

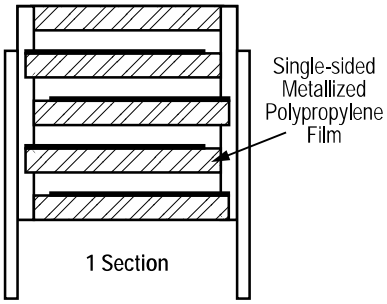
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

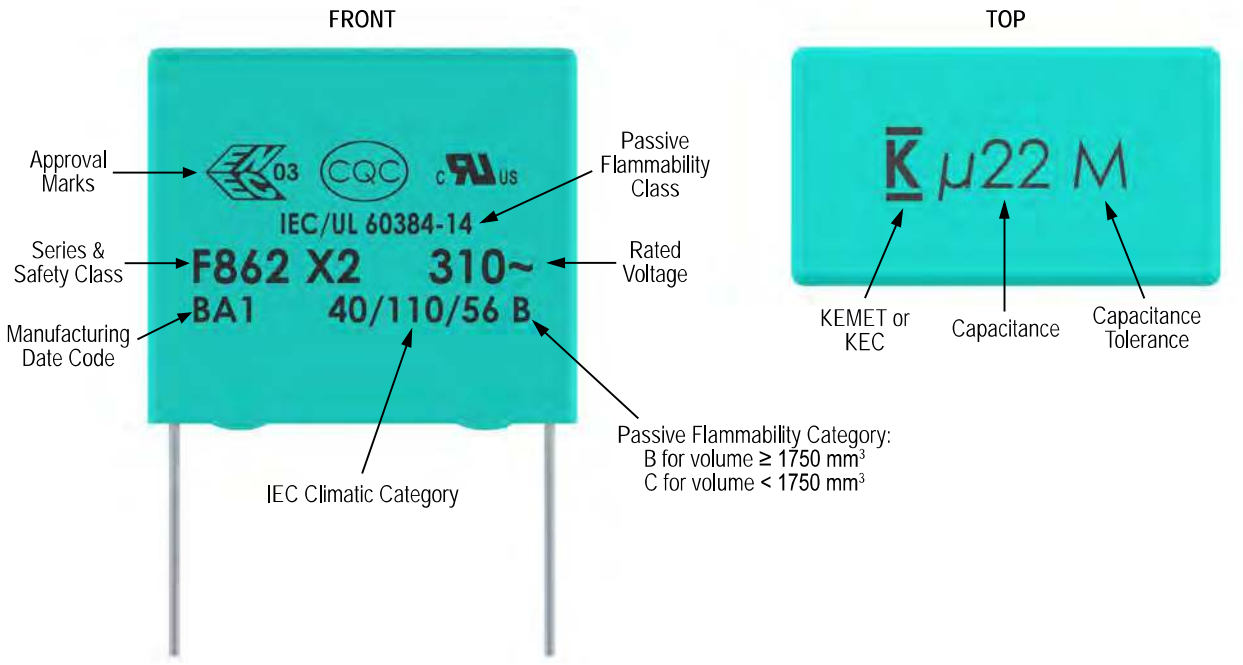
Construction



Winding Scheme



Marking



Packaging Quantities

Size Code	Lead Spacing	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Ammo	Pizza
BG	15	6	12	18	1750	1000	680	935
BK		7.5	13.5	18	1000	800	500	748
BP		8.5	14.5	18	1000	650	440	663
BS		10	16	18	750	550	380	561
BY		11	19	18	450	400	340	510
BZ		12	20	18	350	300	330	459
DB	22.5	6	14.5	26	805	450	464	660
DI		7	16	26	700	450	380	564
DJ		8.5	17	26	450	350	280	468
DO		10	18.5	26	360	350	235	396
DP		11	20	26	300	200	217	360
DU		13	22	26	230	150	200	300
FC	27.5	11.0	20.0	31.5				300
FI		13.0	25.0	31.5				250
FN		14.0	28.0	31.5				230
FS		19.0	29.0	31.5				170
FY		22.0	37.0	31.5				150

R46 Series, Class X2, 275 VAC, 110ºC

Overview

The R46 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material meeting the requirements of UL 94 V–0.

Applications

For worldwide use in electromagnetic interference (EMI) suppression in across-the-line applications requiring X2 safety classification. Intended for use in situations where capacitor failure would not result in exposure to electric shock. Not for use in "series with mains" type applications.

Benefits

- Approvals: ENEC, UL, cUL, CQC
- Class X2 (IEC 60384-14)
- Rated voltage: 275 VAC 50/60 Hz
- Capacitance range: 0.01 – 10 µF
- Lead spacing: 10.0 – 37.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category: 40/110/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 2,200 VDC/1,500 VAC
- Self-healing properties



Part Number System

R46	K	I	2100	00	01	M
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Packaging	Internal Use	Capacitance Tolerance
X2, Metallized Polypropylene	K = 275	F = 10.0 I = 15.0 N = 22.5 R = 27.5 W = 37.5	The last three digits represent significant figures. The first digit specifies number of zeros to be added.	See Ordering Options Table	01 02 L2 M1 M2 N0 N1 N2	K = ±10% M = ±20%

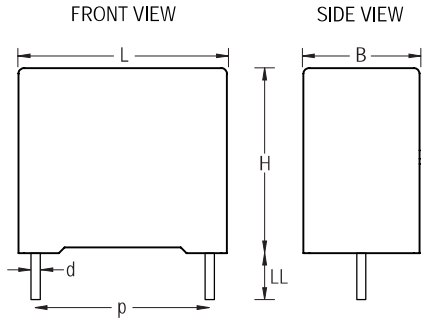
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Ordering Options Table

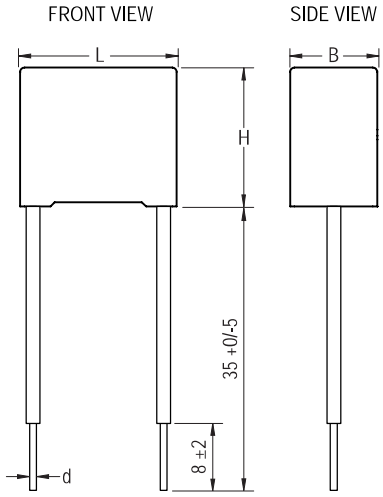
Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
10, 15, 22.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Ammo Pack	H_0 = 18.5 +/-0.5	DQ
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	CK
	Bulk (Bag) – Short Leads	2.7 +0.5/-0	JA
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Short Leads	3.2 +0.3/-0.2	JH
	Bulk (Bag) – Long Leads	18 +1/-1	JM
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
	Bulk (Bag) – Insulated Rigid Leads	30 +5/-0 (sp 8+2/-2)	51
	Bulk (Bag) – Insulated Flexible Leads	150 +5/-5 (sp 8+2/-2)	52
27.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	CK
	Other Lead and Packaging Options		
	Bulk (Bag) – Short Leads	2.7 +0.5/-0	JA
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Short Leads	3.2 +0.3/-0.2	JH
	Bulk (Bag) – Long Leads	18 +1/-1	JM
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
	Bulk (Bag) – Insulated Rigid Leads	30 +5/-0 (sp 8+2/-2)	51
	Bulk (Bag) – Insulated Flexible Leads	150 +5/-5 (sp 8+2/-2)	52
37.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Other Lead and Packaging Options		
	Bulk (Bag) – Short Leads	2.7 +0.5/-0	JA
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Short Leads	3.2 +0.3/-0.2	JH
	Bulk (Bag) – Long Leads	18 +1/-1	JM
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
	Bulk (Bag) – Insulated Rigid Leads	30 +5/-0 (sp 8+2/-2)	51
	Bulk (Bag) – Insulated Flexible Leads	150 +5/-5 (sp 8+2/-2)	52

Dimensions – Millimeters

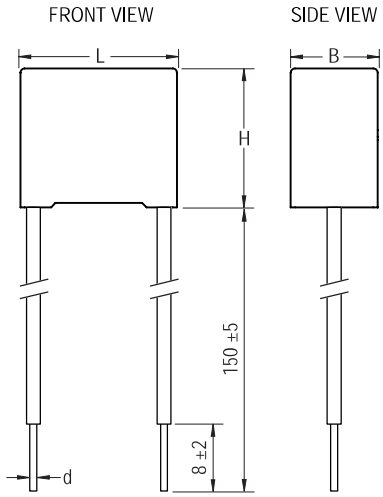
Loose



Insulated Rigid Leads



Insulated Flexible Leads 0.5 mm²

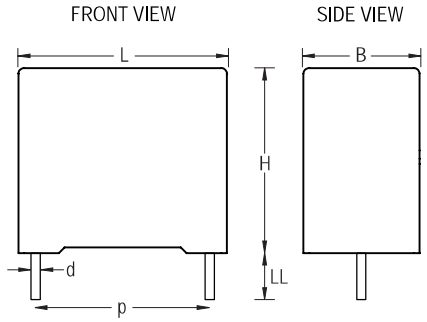


p		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
10.0	+/-0.4	4.0	+0.2	9.0	+0.1	13.0	+0.2	0.6	+/-0.05
10.0	+/-0.4	5.0	+0.2	11.0	+0.1	13.0	+0.2	0.6	+/-0.05
10.0	+/-0.4	6.0	+0.2	12.0	+0.1	13.0	+0.2	0.6	+/-0.05
15.0	+/-0.4	5.0	+0.2	11.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	12.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	17.5	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	7.5	+0.2	13.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	7.5	+0.2	18.5	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	8.5	+0.2	14.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	9.0	+0.2	12.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	10.0	+0.2	16.0	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	11.0	+0.2	19.0	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	13.0	+0.2	12.0	+0.1	18.0	+0.5	0.8	+/-0.05
22.5	+/-0.4	6.0	+0.2	15.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	7.0	+0.2	16.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	10.0	+0.2	18.5	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	11.0	+0.2	20.0	+0.1	26.5	+0.3	0.8	+/-0.05
27.5	+/-0.4	9.0	+0.2	17.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	11.0	+0.2	20.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	13.0	+0.2	22.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	13.0	+0.2	25.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	14.0	+0.2	28.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	18.0	+0.2	33.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	22.0	+0.2	37.0	+0.1	32.0	+0.3	0.8	+/-0.05

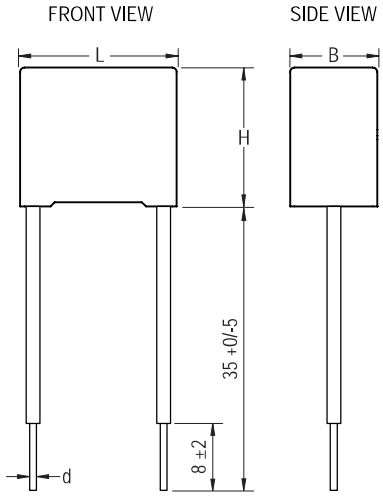
Note: See Ordering Options Table for lead length (LL/H_0) options.

Dimensions – Millimeters cont'd

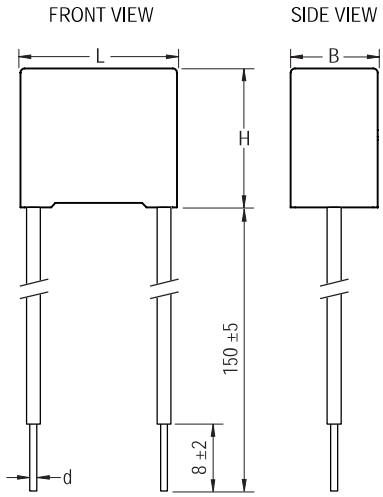
Loose



Insulated Rigid Leads



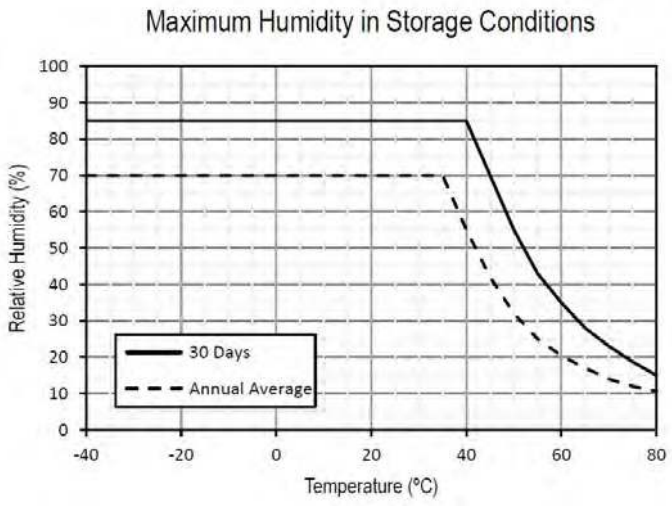
Insulated Flexible Leads 0.5 mm²



p		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
37.5	+/-0.4	11.0	+0.3	22.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	13.0	+0.3	24.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	16.0	+0.3	28.5	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	19.0	+0.3	32.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	20.0	+0.3	40.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	24.0	+0.3	44.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	30.0	+0.3	45.0	+0.1	41.5	+0.3	1.0	+/-0.05
Note: See Ordering Options Table for lead length (LL/H_0) options.									

Performance Characteristics

Dielectric	Polypropylene film
Plates	Metal layer deposited by evaporation under vacuum
Winding	Non-inductive type
Leads	Tinned wire
Protection	Plastic case, thermosetting resin filled. Box material is solvent resistant and flame retardant according to UL94.
Related documents	IEC 60384-14, EN 60384-14
Rated Voltage (V_R)	275 VAC (50/60 Hz), 560 VDC
Capacitance Range	0.010 µF to 10 µF
Capacitance Values	E6 series (IEC 60063) measured @ 1 kHz and +20 ±1°C
Capacitance Tolerance	±10%, ±20%
Temperature Range	-40ºC to +110°C
Climatic Category	40/110/56 IEC 60068-1
Storage Conditions	Storage time: ≤ 24 months from the date marked on the label package
	Average relative humidity per year ≤ 70%
	RH ≤ 85% for 30 days randomly distributed throughout the year
	Dew is absent
	Temperature: -40 to 80°C (see "Maximum Humidity in Storage Conditions" graph below)
Approvals	ENEC, UL, cUL, CQC

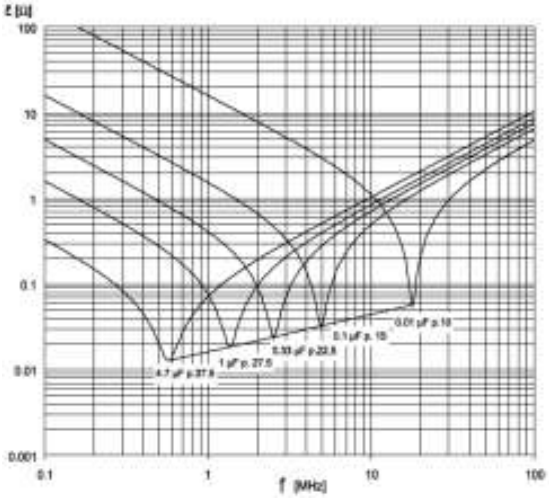


Performance Characteristics cont'd

Dissipation Factor (tanδ)	≤ 0.1% (0.06%*) @ 1 kHz , +25°C ±5°C (* typical value)			
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,200 VDC/1,500 VAC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.			
Insulation Resistance	Measured at +25°C ±5°C, according to IEC 60384–2			
	Minimum Values Between Terminals			
	Voltage Charge	Voltage Charge Time	C ≤ 0.33 µF	C > 0.33 µF
	100 VDC	1 minute	≥ 1 • 10^5 MΩ (≥ 5 • 10^5 MΩ)*	≥ 30,000 MΩ • µF (≥ 150,000 MΩ • µF)*
In DC Applications	Recommended voltage ≤ 560 VDC			

** typical value*

Impedance Graph



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	EN/IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384-14	V4413
	UL 60384-14 and CAN/CSA E60384-14 (310VAC)	E97797
	GB/T 14472 IEC 60384-14	CQC08001026549 CQC11001060118 CQC13001087757 CQC14001116028 CQC13001101266 CQC14001116000

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L				
0.010	4.0	9.0	13.0	10.0	500	46KF2100(1)N0(2)	R46KF2100(1)N0(2)
0.015	4.0	9.0	13.0	10.0	500	46KF2150(1)N0(2)	R46KF2150(1)N0(2)
0.022	4.0	9.0	13.0	10.0	500	46KF2220(1)N0(2)	R46KF2220(1)N0(2)
0.033	5.0	11.0	13.0	10.0	500	46KF2330(1)M1(2)	R46KF2330(1)M1(2)
0.047	5.0	11.0	13.0	10.0	500	46KF2470(1)N0(2)	R46KF2470(1)N0(2)
0.068	6.0	12.0	13.0	10.0	500	46KF2680(1)M1(2)	R46KF2680(1)M1(2)
0.10	6.0	12.0	13.0	10.0	500	46KF3100(1)M1(3)	R46KF3100(1)M1(3)
0.010	5.0	11.0	18.0	15.0	400	46KI 2100(1)01(2)	R46KI 2100(1)01(2)
0.015	5.0	11.0	18.0	15.0	400	46KI 2150(1)01(2)	R46KI 2150(1)01(2)
0.022	5.0	11.0	18.0	15.0	400	46KI 2220(1)01(2)	R46KI 2220(1)01(2)
0.033	5.0	11.0	18.0	15.0	400	46KI 2330(1)01(2)	R46KI 2330(1)01(2)
0.047	5.0	11.0	18.0	15.0	400	46KI 2470(1)01(2)	R46KI 2470(1)01(2)
0.068	5.0	11.0	18.0	15.0	400	46KI 2680(1)01(2)	R46KI 2680(1)01(2)
0.10	5.0	11.0	18.0	15.0	400	46KI 3100(1)M1(2)	R46KI 3100(1)M1(2)
0.15	6.0	12.0	18.0	15.0	400	46KI 3150(1)M2(2)	R46KI 3150(1)M2(2)
0.15	9.0	12.5	18.0	15.0	400	46KI 3150(1)L2(2)	R46KI 3150(1)L2(2)
0.22	7.5	13.5	18.0	15.0	400	46KI 3220(1)M2(2)	R46KI 3220(1)M2(2)
0.22	9.0	12.5	18.0	15.0	400	46KI 3220(1)L2(2)	R46KI 3220(1)L2(2)
0.22	6.0	17.5	18.0	15.0	400	46KI 3220(1)02(2)	R46KI 3220(1)02(2)
0.33	8.5	14.5	18.0	15.0	400	46KI 3330(1)N0(2)	R46KI 3330(1)N0(2)
0.33	10.0	16.0	18.0	15.0	400	46KI 3330(1)M1(2)	R46KI 3330(1)M1(2)
0.33	9.0	12.5	18.0	15.0	400	46KI 3330(1)N1(3)	R46KI 3330(1)N1(3)
0.33	7.5	18.5	18.0	15.0	400	46KI 3330(1)02(2)	R46KI 3330(1)02(2)
0.33	13.0	12.0	18.0	15.0	400	46KI 3330(1)01(2)	R46KI 3330(1)01(2)
0.47	7.5	18.5	18.0	15.0	400	46KI 3470(1)02(3)	R46KI 3470(1)02(3)
0.47	10.0	16.0	18.0	15.0	400	46KI 3470(1)N0(3)	R46KI 3470(1)N0(3)
0.47	11.0	19.0	18.0	15.0	400	46KI 3470(1)M1(2)	R46KI 3470(1)M1(2)
0.56	11.0	19.0	18.0	15.0	400	46KI 3560(1)N0(2)	R46KI 3560(1)N0(2)
0.60	11.0	19.0	18.0	15.0	400	46KI 3600(1)N0(2)	R46KI 3600(1)N0(2)
0.15	6.0	15.0	26.5	22.5	200	46KN3150(1)01(2)	R46KN3150(1)01(2)
0.22	6.0	15.0	26.5	22.5	200	46KN3220(1)M1(2)	R46KN3220(1)M1(2)
0.33	6.0	15.0	26.5	22.5	200	46KN3330(1)N0(2)	R46KN3330(1)N0(2)
0.47	7.0	16.0	26.5	22.5	200	46KN3470(1)N0(2)	R46KN3470(1)N0(2)
0.68	10.0	18.5	26.5	22.5	200	46KN3680(1)M2(2)	R46KN3680(1)M2(2)
1.00	10.0	18.5	26.5	22.5	200	46KN4100(1)N2(3)	R46KN4100(1)N2(3)
1.00	11.0	20.0	26.5	22.5	200	46KN4100(1)N1(2)	R46KN4100(1)N1(2)
0.47	9.0	17.0	32.0	27.5	150	46KR3470(1)01(2)	R46KR3470(1)01(2)
0.68	9.0	17.0	32.0	27.5	150	46KR3680(1)M1(2)	R46KR3680(1)M1(2)
1.0	11.0	20.0	32.0	27.5	150	46KR4100(1)M1(2)	R46KR4100(1)M1(2)
1.5	13.0	22.0	32.0	27.5	150	46KR4150(1)M1(2)	R46KR4150(1)M1(2)
2.2	13.0	25.0	32.0	27.5	150	46KR4220(1)M2(2)	R46KR4220(1)M2(2)
2.2	14.0	28.0	32.0	27.5	150	46KR4220(1)M1(2)	R46KR4220(1)M1(2)
3.3	18.0	33.0	32.0	27.5	150	46KR4330(1)M2(2)	R46KR4330(1)M2(2)
4.7	18.0	33.0	32.0	27.5	150	46KR4470(1)M2(2)	R46KR4470(1)M2(2)
4.7	22.0	37.0	32.0	27.5	150	46KR4470(1)M1(2)	R46KR4470(1)M1(2)
1.5	11.0	22.0	41.5	37.5	100	46KW4150(1)M1(2)	R46KW4150(1)M1(2)
2.2	11.0	22.0	41.5	37.5	100	46KW4220(1)M2(3)	R46KW4220(1)M2(3)
2.2	13.0	24.0	41.5	37.5	100	46KW4220(1)M1(2)	R46KW4220(1)M1(2)
3.3	16.0	28.5	41.5	37.5	100	46KW4330(1)M1(2)	R46KW4330(1)M1(2)
4.7	16.0	28.5	41.5	37.5	100	46KW4470(1)M2(3)	R46KW4470(1)M2(3)
4.7	19.0	32.0	41.5	37.5	100	46KW4470(1)M1(2)	R46KW4470(1)M1(2)
6.8	20.0	40.0	41.5	37.5	100	46KW4680(1)M2(2)	R46KW4680(1)M2(2)
6.8	24.0	44.0	41.5	37.5	100	46KW4680(1)M1(2)	R46KW4680(1)M1(2)
10.0	30.0	45.0	41.5	37.5	100	46KW5100(1)M1(2)	R46KW5100(1)M1(2)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) Insert lead and packaging code. See Ordering Options Table for available options.

(2) M = ±20%, K = ±10%

(3) M = ±20% (only available tolerance).

Soldering Process

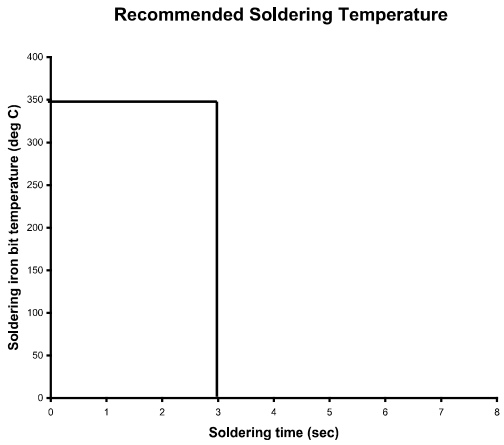
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

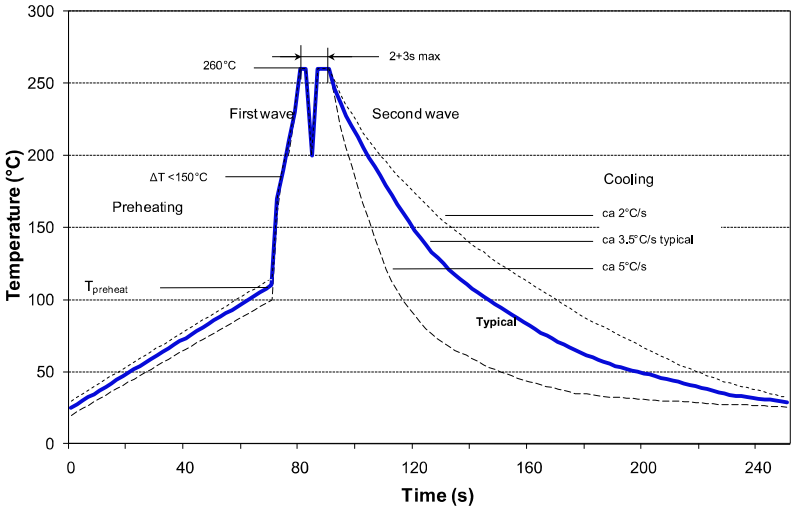
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

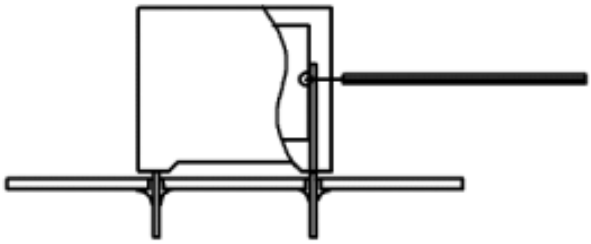
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



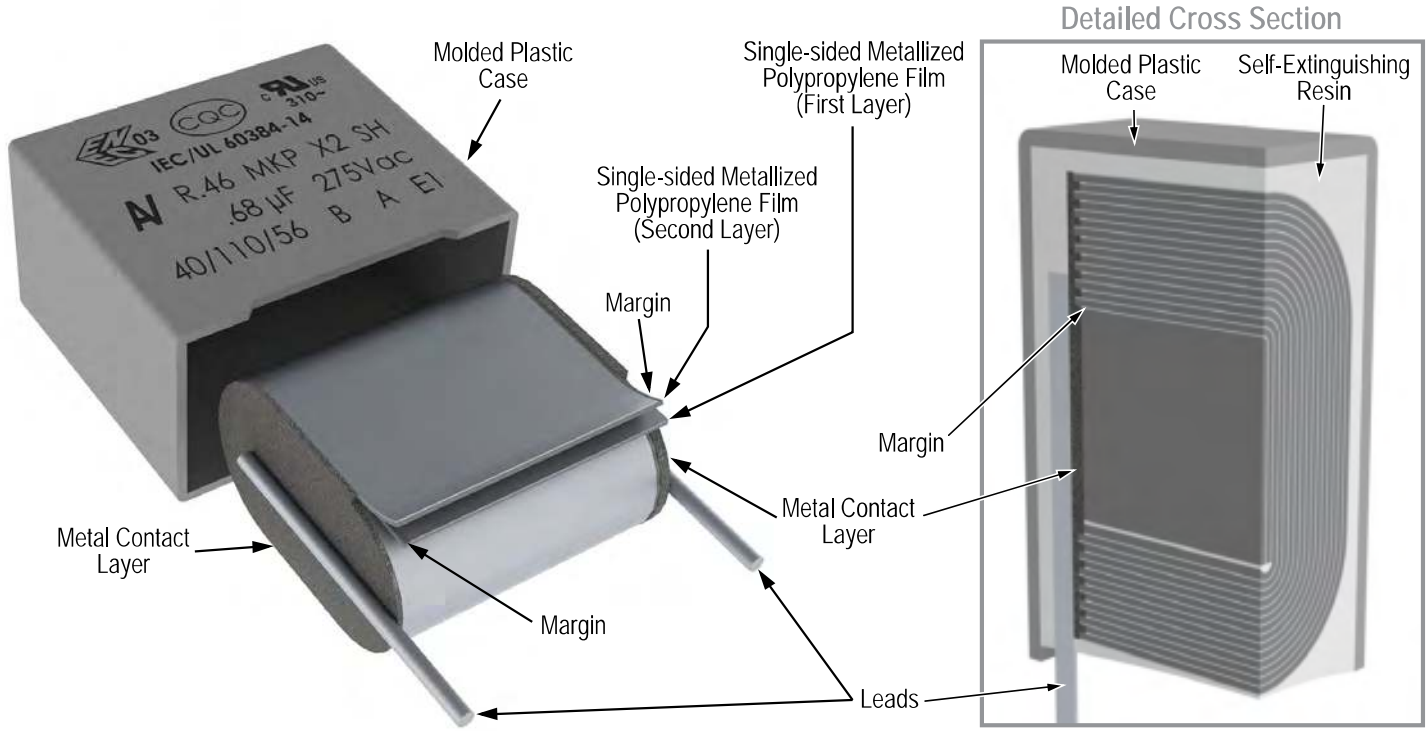
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

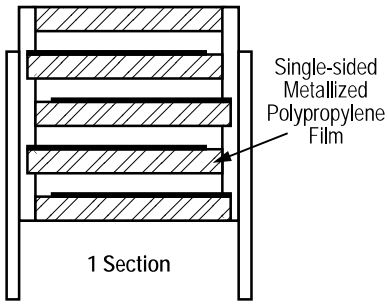
The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

Construction



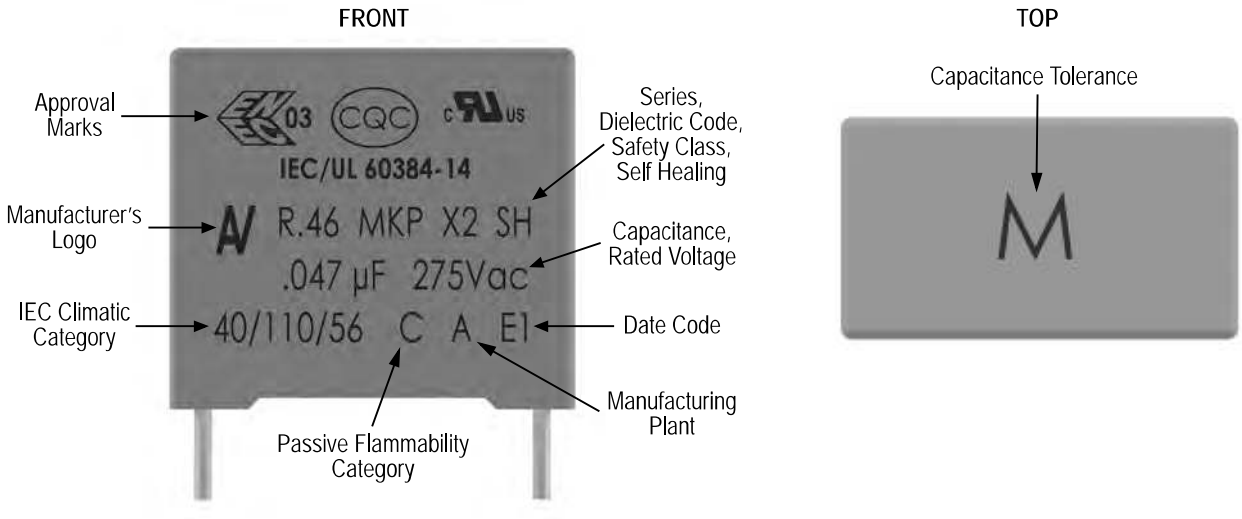
Detailed Cross Section

Winding Scheme

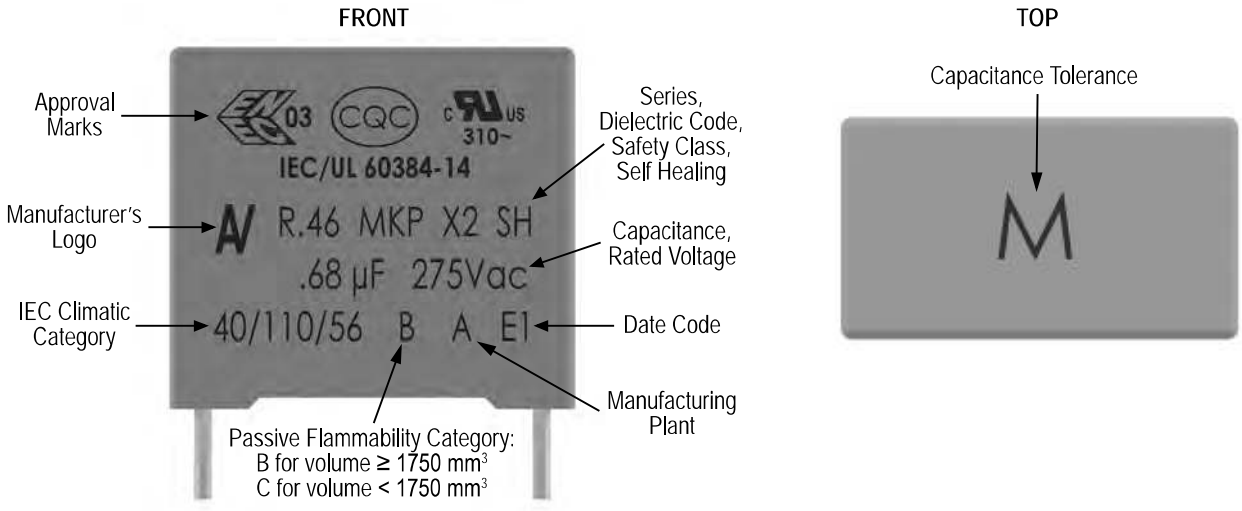


Marking

Lead Spacing 10 mm

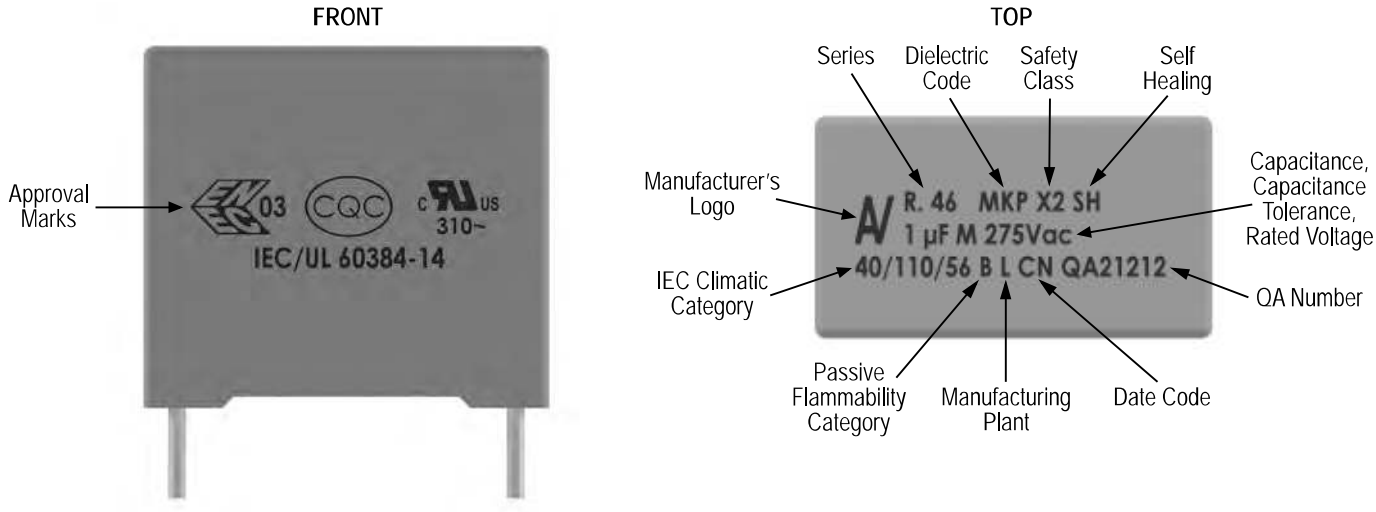


Lead Spacing 15 mm, 22.5 mm (small case sizes)



Marking cont'd

Lead Spacing 22.5 mm (large case sizes), 27.5 mm, 37.5 mm



Manufacturing Date Code (IEC 60062)			
Y = Year, Z = Month			
Year	Code	Month	Code
2000	M	January	1
2001	N	February	2
2002	P	March	3
2003	R	April	4
2004	S	May	5
2005	T	June	6
2006	U	July	7
2007	V	August	8
2008	W	September	9
2009	X	October	O
2010	A	November	N
2011	B	December	D
2012	C		
2013	D		
2014	E		
2015	F		
2016	H		
2017	J		
2018	K		
2019	L		
2020	M		

Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo Taped
10	4	9	13	2000	1800	750	1500	1000
	5	11	13	1300	1500	600	1250	800
	6	12	13	1000	1200	500	1000	680
15	5	11	18	2000	1000	600	1250	800
	6	12	18	1750	900	500	1000	680
	6	17.5	18	1000	700	500	1000	680
	7.5	13.5	18	1000	700	350	800	500
	7.5	18.5	18	900	500	–	800	500
	8.5	14.5	18	1000	500	300	700	440
	9	12.5	18	1000	520	270	650	410
	10	16	18	750	500	300	600	380
	11	19	18	450	350	–	500	340
	13	12	18	750	490	200	480	280
22.5	6	15	26.5	805	500	–	700	464
	7	16	26.5	700	500	–	550	380
	10	18.5	26.5	396	300	–	350	235
	11	20	26.5	360	250	–	350	217
27.5	9	17	32	816	408	–	450	–
	11	20	32	560	336	–	350	–
	13	22	32	480	288	–	300	–
	13	25	32	480	288	–	–	–
	14	28	32	352	176	–	–	–
	18	33	32	256	128	–	–	–
	22	37	32	168	112	–	–	–
37.5	11	22	41.5	420	252	–	–	–
	13	24	41.5	360	216	–	–	–
	16	28.5	41.5	216	108	–	–	–
	19	32	41.5	192	96	–	–	–
	20	40	41.5	126	84	–	–	–
	24	44	41.5	108	72	–	–	–
	30	45	41.5	90	60	–	–	–

R46 (Miniature) Series, Class X2, 275 VAC, 110ºC

Overview

The R46 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material meeting the requirements of UL 94 V–0.

Applications

For worldwide use in electromagnetic interference (EMI) suppression in across-the-line applications requiring X2 safety classification. Intended for use in situations where capacitor failure would not result in exposure to electric shock. Not for use in “series with mains” type applications.

Benefits

- Approvals: ENEC, UL, cUL, CQC
- Class X2 (IEC 60384-14)
- Rated voltage: 275 VAC 50/60 Hz
- Capacitance range: 0.033 – 10 µF
- Lead spacing: 10.0 – 37.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category: 40/110/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 2,200 VDC/1,500 VAC
- Self-healing properties



Part Number System

R46	K	I	3470	00	P0	M
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Packaging	Internal Use	Capacitance Tolerance
X2, Metallized Polypropylene	K = 275	F = 10.0 I = 15.0 N = 22.5 R = 27.5 W = 37.5	The last three digits represent significant figures. The first digit specifies number of zeros to be added.	See Ordering Options Table	P0 P1 P2 P3	K = ±10% M = ±20%

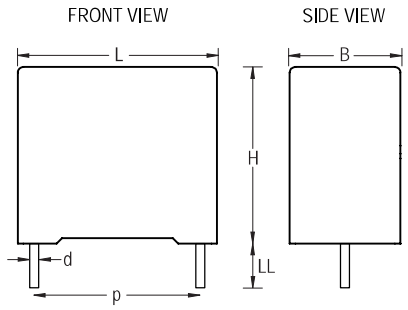
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Ordering Options Table

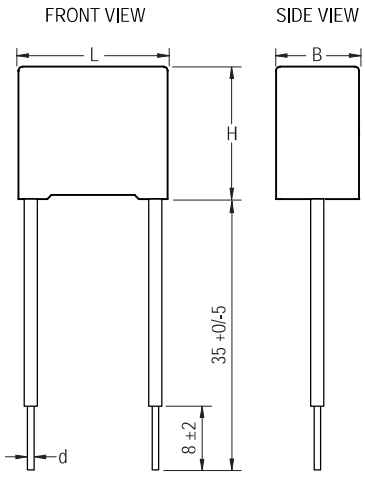
Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
10, 15, 22.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Ammo Pack	H_0 = 18.5 +/-0.5	DQ
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	CK
	Bulk (Bag) – Short Leads	2.7 +0.5/-0	JA
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Short Leads	3.2 +0.3/-0.2	JH
	Bulk (Bag) – Long Leads	18 +1/-1	JM
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
	Bulk (Bag) – Insulated Rigid Leads	30 +5/-0 (sp 8+2/-2)	51
	Bulk (Bag) – Insulated Flexible Leads	150 +5/-5 (sp 8+2/-2)	52
27.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	CK
	Other Lead and Packaging Options		
	Bulk (Bag) – Short Leads	2.7 +0.5/-0	JA
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Short Leads	3.2 +0.3/-0.2	JH
	Bulk (Bag) – Long Leads	18 +1/-1	JM
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
	Bulk (Bag) – Insulated Rigid Leads	30 +5/-0 (sp 8+2/-2)	51
	Bulk (Bag) – Insulated Flexible Leads	150 +5/-5 (sp 8+2/-2)	52
37.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Other Lead and Packaging Options		
	Bulk (Bag) – Short Leads	2.7 +0.5/-0	JA
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Short Leads	3.2 +0.3/-0.2	JH
	Bulk (Bag) – Long Leads	18 +1/-1	JM
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
	Bulk (Bag) – Insulated Rigid Leads	30 +5/-0 (sp 8+2/-2)	51
	Bulk (Bag) – Insulated Flexible Leads	150 +5/-5 (sp 8+2/-2)	52

Dimensions – Millimeters

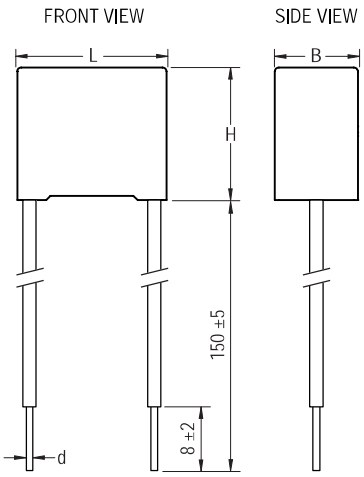
Loose



Insulated Rigid Leads



Insulated Flexible Leads 0.5 mm²

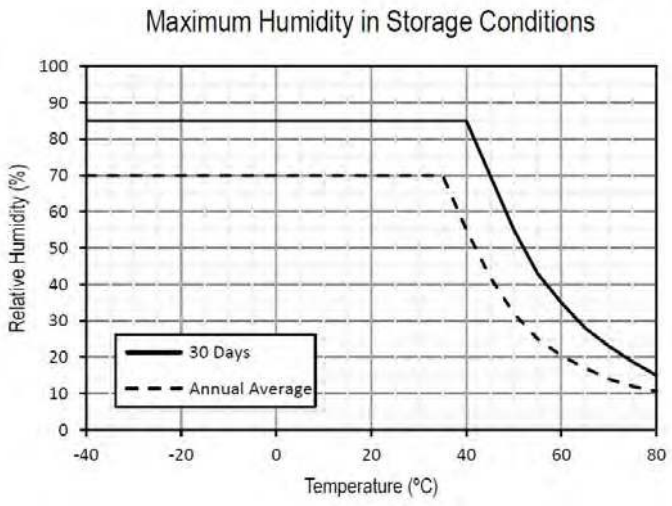


p		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
10.0	+/-0.4	4.0	+0.2	9.0	+0.1	13.0	+0.2	0.6	+/-0.05
10.0	+/-0.4	5.0	+0.2	11.0	+0.1	13.0	+0.2	0.6	+/-0.05
10.0	+/-0.4	6.0	+0.2	12.0	+0.1	13.0	+0.2	0.6	+/-0.05
15.0	+/-0.4	5.0	+0.2	11.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	12.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	17.5	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	7.5	+0.2	13.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	7.5	+0.2	18.5	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	8.5	+0.2	14.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	9.0	+0.2	12.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	10.0	+0.2	16.0	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	11.0	+0.2	19.0	+0.1	18.0	+0.5	0.8	+/-0.05
22.5	+/-0.4	6.0	+0.2	15.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	7.0	+0.2	16.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	8.5	+0.2	17.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	10.0	+0.2	18.5	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	11.0	+0.2	20.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	13.0	+0.2	22.0	+0.1	26.5	+0.3	0.8	+/-0.05
27.5	+/-0.4	9.0	+0.2	17.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	11.0	+0.2	20.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	13.0	+0.2	22.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	14.0	+0.2	28.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	18.0	+0.2	33.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	22.0	+0.2	37.0	+0.1	32.0	+0.3	0.8	+/-0.05
37.5	+/-0.4	11.0	+0.3	22.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	13.0	+0.3	24.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	16.0	+0.3	28.5	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	19.0	+0.3	32.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	20.0	+0.3	40.0	+0.1	41.5	+0.3	1.0	+/-0.05

Note: See Ordering Options Table for lead length (LL/H_0) options.

Performance Characteristics

Dielectric	Polypropylene film
Plates	Metal layer deposited by evaporation under vacuum
Winding	Non-inductive type
Leads	Tinned wire
Protection	Plastic case, thermosetting resin filled. Box material is solvent resistant and flame retardant according to UL94.
Related documents	IEC 60384-14, EN 60384-14
Rated Voltage (V_R)	275 VAC (50/60 Hz), 560 VDC
Capacitance Range	0.033 µF to 10 µF
Capacitance Values	E6 series (IEC 60063) measured @ 1 kHz and +20 ±1°C
Capacitance Tolerance	±10%, ±20%
Temperature Range	-40°C to +110°C
Climatic Category	40/110/56 IEC 60068-1
Storage Conditions	Storage time: ≤ 24 months from the date marked on the label package
	Average relative humidity per year ≤ 70%
	RH ≤ 85% for 30 days randomly distributed throughout the year
	Dew is absent
	Temperature: -40 to 80°C (see "Maximum Humidity in Storage Conditions" graph below)
Approvals	ENEC, UL, cUL, CQC

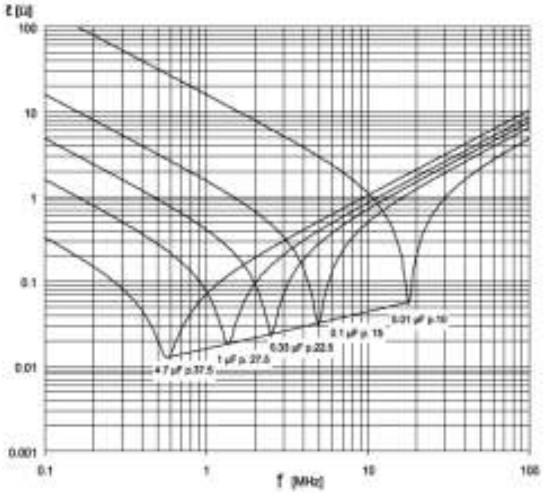


Performance Characteristics cont'd

Dissipation Factor (tanδ)	≤ 0.1% (0.06%*) @ 1 kHz , +25°C ±5°C (* typical value)			
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,200 VDC/1,500 VAC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.			
Insulation Resistance	Measured at +25°C ±5°C, according to IEC 60384–2			
	Minimum Values Between Terminals			
	Voltage Charge	Voltage Charge Time	C ≤ 0.33 µF	C > 0.33 µF
	100 VDC	1 minute	≥ 1 • 10^5 MΩ (≥ 5 • 10^5 MΩ)*	≥ 30,000 MΩ • µF (≥ 150,000 MΩ • µF)*
In DC Applications	Recommended voltage ≤ 560 VDC			

** typical value*

Impedance Graph



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	EN/IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384-14	V4413
	UL 60384-14 and CAN/CSA E60384-14 (310VAC)	E97797
	GB/T 14472 IEC 60384-14	CQC08001026549 CQC11001060118 CQC13001087757 CQC14001116028 CQC13001101266 CQC14001116000

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L				
0.033	4.0	9.0	13.0	10.0	500	46KF2330(1)P0(2)	R46KF2330(1)P0(2)
0.047	4.0	9.0	13.0	10.0	500	46KF2470(1)P0(2)	R46KF2470(1)P0(2)
0.068	5.0	11.0	13.0	10.0	500	46KF2680(1)P0(2)	R46KF2680(1)P0(2)
0.10	5.0	11.0	13.0	10.0	500	46KF3100(1)P1(3)	R46KF3100(1)P1(3)
0.10	6.0	12.0	13.0	10.0	500	46KF3100(1)P0(2)	R46KF3100(1)P0(2)
0.15	6.0	12.0	13.0	10.0	500	46KF3150(1)P0(3)	R46KF3150(1)P0(3)
0.15	5.0	11.0	18.0	15.0	400	46KI3150(1)P0(2)	R46KI3150(1)P0(2)
0.22	6.0	12.0	18.0	15.0	400	46KI3220(1)P0(2)	R46KI3220(1)P0(2)
0.33	7.5	13.5	18.0	15.0	400	46KI3330(1)P0(2)	R46KI3330(1)P0(2)
0.33	9.0	12.5	18.0	15.0	400	46KI3330(1)P1(2)	R46KI3330(1)P1(2)
0.33	6.0	17.5	18.0	15.0	400	46KI3330(1)P2(2)	R46KI3330(1)P2(2)
0.47	8.5	14.5	18.0	15.0	400	46KI3470(1)P0(2)	R46KI3470(1)P0(2)
0.47	9.0	12.5	18.0	15.0	400	46KI3470(1)P1(3)	R46KI3470(1)P1(3)
0.47	6.0	17.5	18.0	15.0	400	46KI3470(1)P2(3)	R46KI3470(1)P2(3)
0.47	7.5	18.5	18.0	15.0	400	46KI3470(1)P3(2)	R46KI3470(1)P3(2)
0.68	10.0	16.0	18.0	15.0	400	46KI3680(1)P1(3)	R46KI3680(1)P1(3)
0.68	11.0	19.0	18.0	15.0	400	46KI3680(1)P0(2)	R46KI3680(1)P0(2)
0.82	11.0	19.0	18.0	15.0	400	46KI3820(1)P0(3)	R46KI3820(1)P0(3)
0.47	6.0	15.0	26.5	22.5	200	46KN3470(1)P1(2)	R46KN3470(1)P1(2)
0.56	6.0	15.0	26.5	22.5	200	46KN3560(1)P1(3)	R46KN3560(1)P1(3)
0.56	7.0	16.0	26.5	22.5	200	46KN3560(1)P0(2)	R46KN3560(1)P0(2)
0.68	7.0	16.0	26.5	22.5	200	46KN3680(1)P0(2)	R46KN3680(1)P0(2)
1.0	8.5	17.0	26.5	22.5	200	46KN4100(1)P1(3)	R46KN4100(1)P1(3)
1.0	10.0	18.5	26.5	22.5	200	46KN4100(1)P0(2)	R46KN4100(1)P0(2)
1.5	10.0	18.5	26.5	22.5	200	46KN4150(1)P1(3)	R46KN4150(1)P1(3)
1.5	11.0	20.0	26.5	22.5	200	46KN4150(1)P0(2)	R46KN4150(1)P0(2)
2.2	13.0	22.0	26.5	22.5	200	46KN4220(1)P0(3)	R46KN4220(1)P0(3)
1.0	9.0	17.0	32.0	27.5	150	46KR4100(1)P0(2)	R46KR4100(1)P0(2)
1.5	11.0	20.0	32.0	27.5	150	46KR4150(1)P0(2)	R46KR4150(1)P0(2)
2.2	13.0	22.0	32.0	27.5	150	46KR4220(1)P0(2)	R46KR4220(1)P0(2)
3.3	14.0	28.0	32.0	27.5	150	46KR4330(1)P0(2)	R46KR4330(1)P0(2)
4.7	14.0	28.0	32.0	27.5	150	46KR4470(1)P1(3)	R46KR4470(1)P1(3)
4.7	18.0	33.0	32.0	27.5	150	46KR4470(1)P0(2)	R46KR4470(1)P0(2)
6.8	22.0	37.0	32.0	27.5	150	46KR4680(1)P0(2)	R46KR4680(1)P0(2)
2.2	11.0	22.0	41.5	37.5	100	46KW4220(1)P0(2)	R46KW4220(1)P0(2)
3.3	13.0	24.0	41.5	37.5	100	46KW4330(1)P0(2)	R46KW4330(1)P0(2)
4.7	16.0	28.5	41.5	37.5	100	46KW4470(1)P0(2)	R46KW4470(1)P0(2)
6.8	19.0	32.0	41.5	37.5	100	46KW4680(1)P0(2)	R46KW4680(1)P0(2)
10.0	20.0	40.0	41.5	37.5	100	46KW5100(1)P0(2)	R46KW5100(1)P0(2)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) Insert lead and packaging code. See Ordering Options Table for available options.
(2) M = ±20%, K = ±10%
(3) M = ±20% (only available tolerance).

Soldering Process

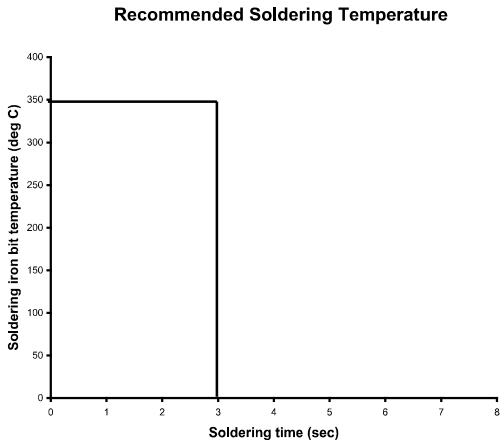
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

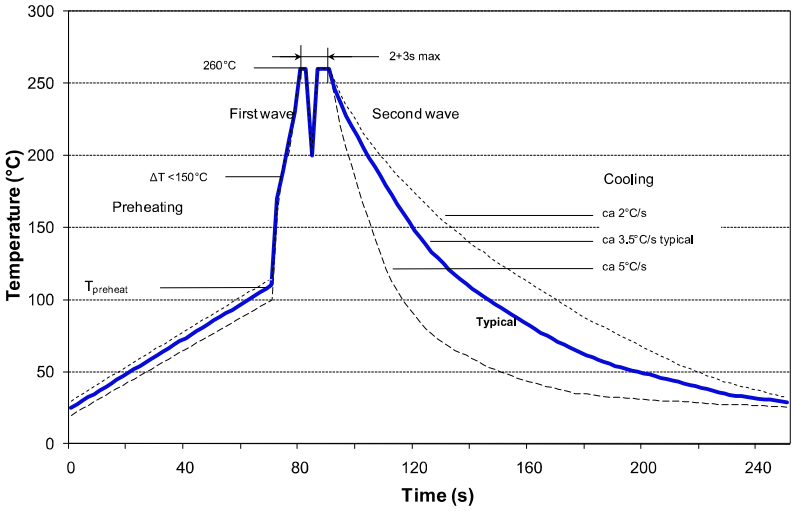
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

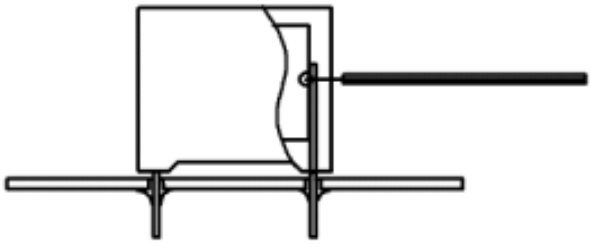
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



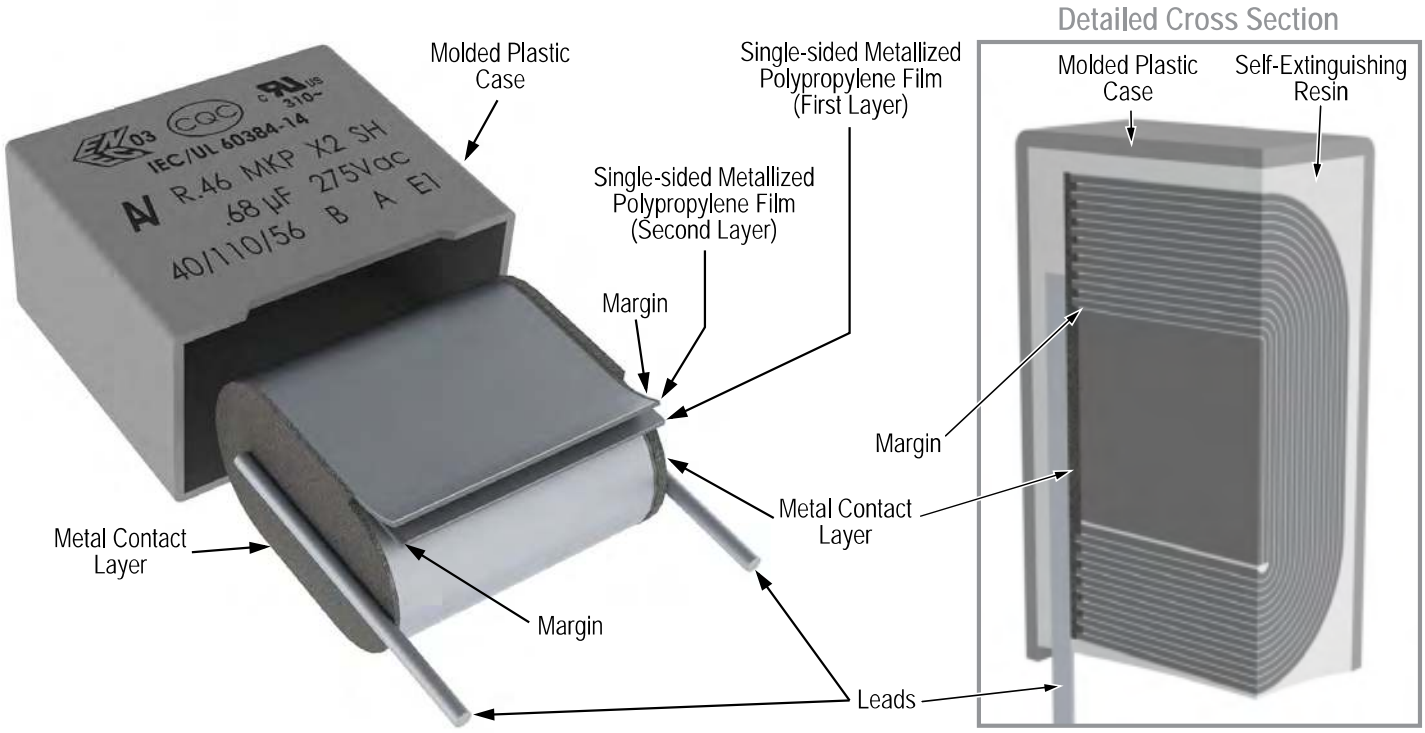
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

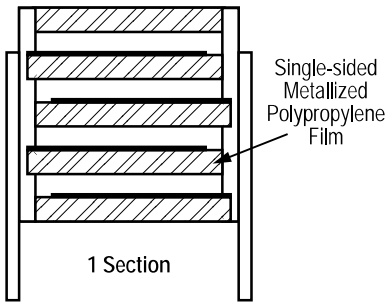
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

Construction

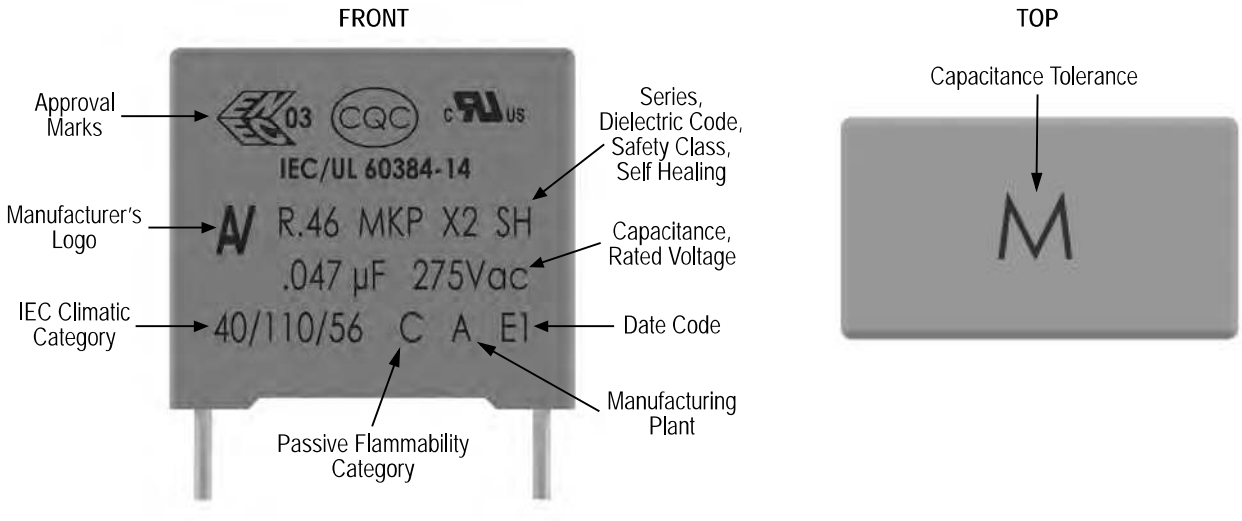


Winding Scheme

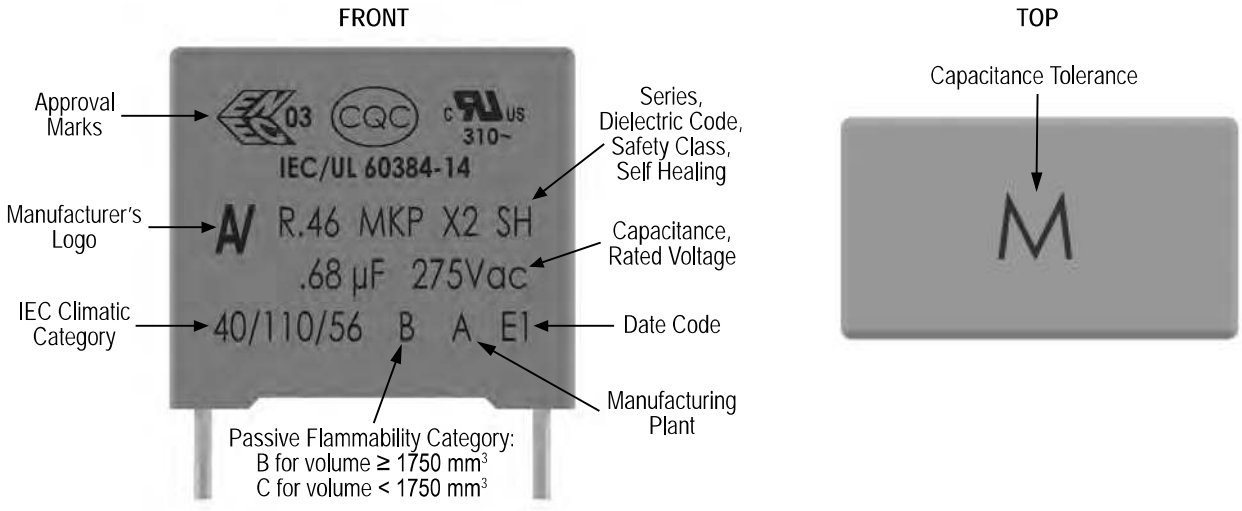


Marking

Lead Spacing 10 mm

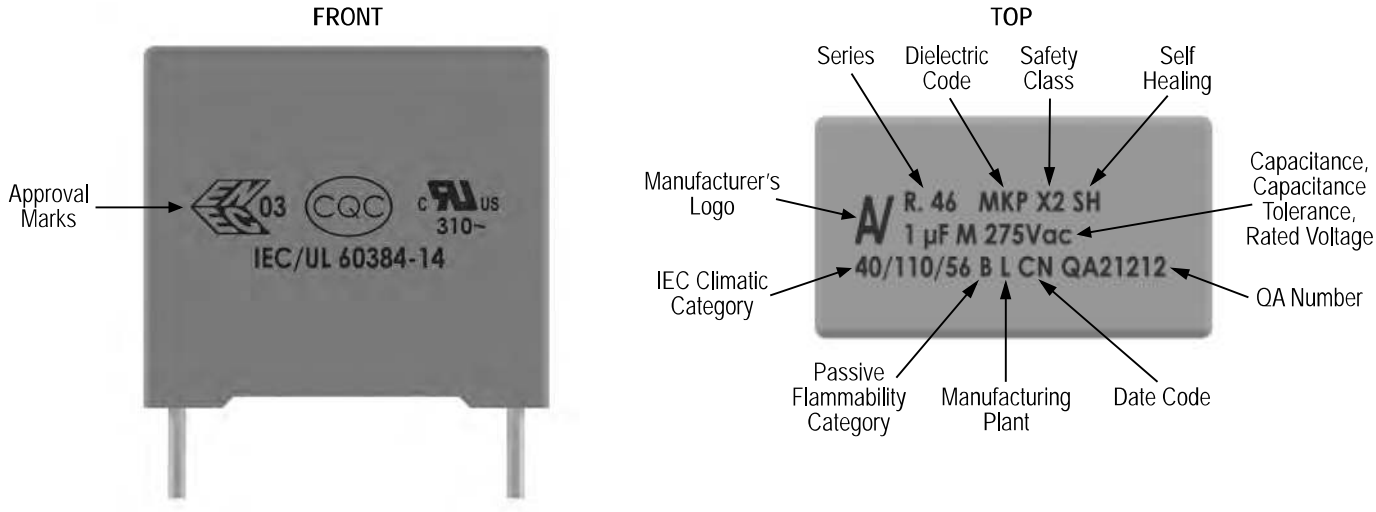


Lead Spacing 15 mm, 22.5 mm (small case sizes)



Marking cont'd

Lead Spacing 22.5 mm (large case sizes), 27.5 mm, 37.5 mm



Manufacturing Date Code (IEC 60062)			
Y = Year, Z = Month			
Year	Code	Month	Code
2000	M	January	1
2001	N	February	2
2002	P	March	3
2003	R	April	4
2004	S	May	5
2005	T	June	6
2006	U	July	7
2007	V	August	8
2008	W	September	9
2009	X	October	O
2010	A	November	N
2011	B	December	D
2012	C		
2013	D		
2014	E		
2015	F		
2016	H		
2017	J		
2018	K		
2019	L		
2020	M		

Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo Taped
10	4	9	13	2000	1800	750	1500	1000
	5	11	13	1300	1500	600	1250	800
	6	12	13	1000	1200	500	1000	680
15	5	11	18	2000	1000	600	1250	800
	6	12	18	1750	900	500	1000	680
	6	17.5	18	1000	700	500	1000	680
	7.5	13.5	18	1000	700	350	800	500
	7.5	18.5	18	900	500	–	800	500
	8.5	14.5	18	1000	500	300	700	440
	9	12.5	18	1000	520	270	650	410
	10	16	18	750	500	300	600	380
	11	19	18	450	350	–	500	340
22.5	6	15	26.5	805	500	–	700	464
	7	16	26.5	700	500	–	550	380
	8.5	17	26.5	468	300	–	450	280
	10	18.5	26.5	396	300	–	350	235
	11	20	26.5	360	250	–	350	217
	13	22	26.5	300	200	–	300	–
27.5	9	17	32	816	408	–	450	–
	11	20	32	560	336	–	350	–
	13	22	32	480	288	–	300	–
	14	28	32	352	176	–	–	–
	18	33	32	256	128	–	–	–
	22	37	32	168	112	–	–	–
	22	37	32	168	112	–	–	–
37.5	11	22	41.5	420	252	–	–	–
	13	24	41.5	360	216	–	–	–
	16	28.5	41.5	216	108	–	–	–
	19	32	41.5	192	96	–	–	–
	20	40	41.5	126	84	–	–	–

R46 Series, Class X2, 275 VAC, 125ºC

Overview

The R46 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material meeting the requirements of UL 94 V–0.

Applications

For worldwide use in electromagnetic interference (EMI) suppression in across-the-line applications requiring X2 safety classification. Intended for use in situations where capacitor failure would not result in exposure to electric shock. Not for use in “series with mains” type applications.

Benefits

- Approvals: ENEC, UL, cUL
- Class X2 (IEC 60384-14)
- Rated voltage: 275 VAC 50/60 Hz
- Capacitance range: 0.01 – 1 µF
- Lead spacing: 10.0 – 22.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category: 40/125/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +125˚C
- 100% screening factory test at 2,200 VDC/1,500 VAC
- Self-healing properties



Part Number System

R46	K	N	3220	00	H1	M
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Packaging	Internal Use	Capacitance Tolerance
X2, Metallized Polypropylene	K = 275	F = 10.0 I = 15.0 N = 22.5	The last three digits represent significant figures. The first digit specifies number of zeros to be added.	See Ordering Options Table	H = High Temperature H1 H2 H3 H4	K = ±10% M = ±20%

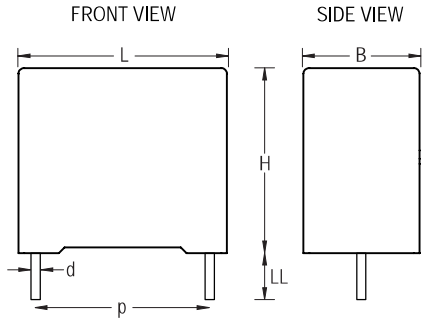
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Ordering Options Table

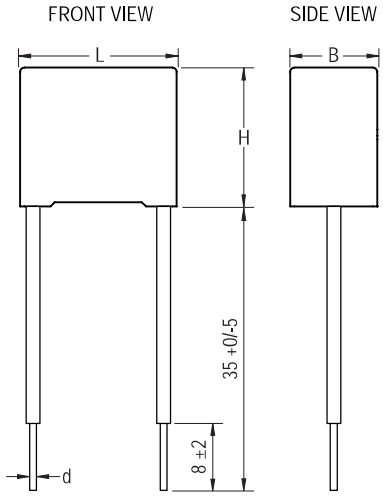
Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
10, 15, 22.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Ammo Pack	H_0 = 18.5 +/-0.5	DQ
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	CK
	Bulk (Bag) – Short Leads	2.7 +0.5/-0	JA
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Short Leads	3.2 +0.3/-0.2	JH
	Bulk (Bag) – Long Leads	18 +1/-1	JM
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
	Bulk (Bag) – Insulated Rigid Leads	30 +5/-0 (sp 8+2/-2)	51
	Bulk (Bag) – Insulated Flexible Leads	150 +5/-5 (sp 8+2/-2)	52

Dimensions – Millimeters

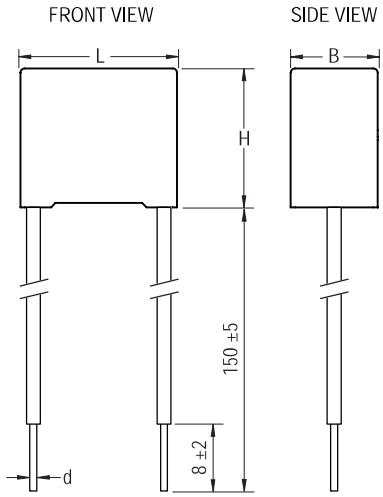
Loose



Insulated Rigid Leads



Insulated Flexible Leads 0.5 mm²

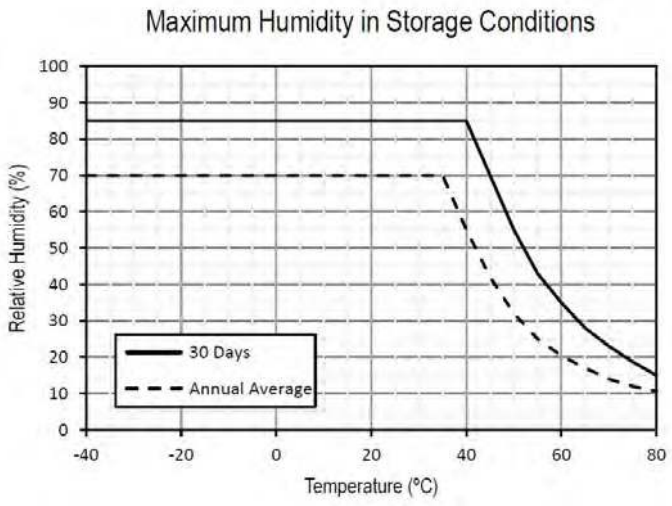


p		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
10.0	+/-0.4	5.0	+0.2	11.0	+0.1	13.0	+0.2	0.6	+/-0.05
10.0	+/-0.4	6.0	+0.2	12.0	+0.1	13.0	+0.2	0.6	+/-0.05
15.0	+/-0.4	5.0	+0.2	11.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	12.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	17.5	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	7.5	+0.2	13.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	7.5	+0.2	18.5	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	8.5	+0.2	14.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	9.0	+0.2	12.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	10.0	+0.2	16.0	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	11.0	+0.2	19.0	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	13.0	+0.2	12.0	+0.1	18.0	+0.5	0.8	+/-0.05
22.5	+/-0.4	6.0	+0.2	15.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	7.0	+0.2	16.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	10.0	+0.2	18.5	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	11.0	+0.2	20.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	13.0	+0.2	22.0	+0.1	26.5	+0.3	0.8	+/-0.05

Note: See Ordering Options Table for lead length (LL/H_0) options.

Performance Characteristics

Dielectric	Polypropylene film
Plates	Metal layer deposited by evaporation under vacuum
Winding	Non-inductive type
Leads	Tinned wire
Protection	Plastic case, thermosetting resin filled. Box material is solvent resistant and flame retardant according to UL94.
Related documents	IEC 60384-14, EN 60384-14
Rated Voltage (V_R)	275 VAC (50/60 Hz), 560 VDC
Capacitance Range	0.010 µF to 1 µF
Capacitance Values	E6 series (IEC 60063) measured @ 1 kHz and +20 ±1°C
Capacitance Tolerance	±10%, ±20%
Temperature Range	-40°C to +125°C
Climatic Category	40/125/56 IEC 60068-1
Storage Conditions	Storage time: ≤ 24 months from the date marked on the label package
	Average relative humidity per year ≤ 70%
	RH ≤ 85% for 30 days randomly distributed throughout the year
	Dew is absent
	Temperature: -40 to 80°C (see "Maximum Humidity in Storage Conditions" graph below)
Approvals	ENEC, UL, cUL

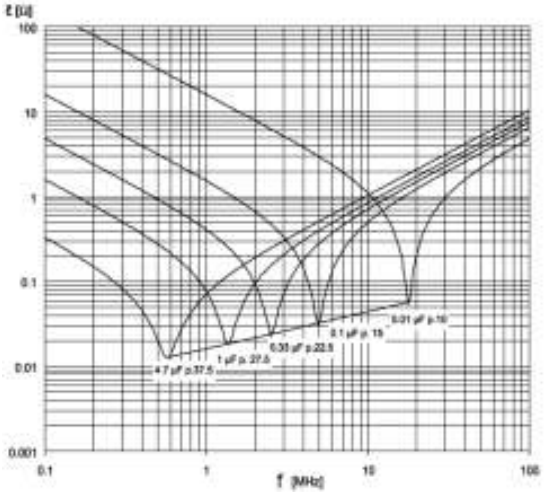


Performance Characteristics cont'd

Dissipation Factor (tanδ)	≤ 0.1% (0.06%*) @ 1 kHz, +25°C ±5°C (* typical value)			
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,200 VDC/1,500 VAC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.			
Insulation Resistance	Measured at +25°C ±5°C, according to IEC 60384–2			
	Minimum Values Between Terminals			
	Voltage Charge	Voltage Charge Time	C ≤ 0.33 µF	C > 0.33 µF
	100 VDC	1 minute	≥ 1 • 10^5 MΩ (≥ 5 • 10^5 MΩ)*	≥ 30,000 MΩ • µF (≥ 150,000 MΩ • µF)*
In DC Applications	Recommended voltage ≤ 560 VDC			

** typical value*

Impedance Graph



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	EN/IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384-14	V4413
	UL 60384-14 and CAN/CSA E60384-14 (310VAC)	E97797

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L				
0.010	5.0	11.0	13.0	10.0	500	46KF2100(1)H1(2)	R46KF2100(1)H1(2)
0.015	5.0	11.0	13.0	10.0	500	46KF2150(1)H1(2)	R46KF2150(1)H1(2)
0.022	5.0	11.0	13.0	10.0	500	46KF2220(1)H1(2)	R46KF2220(1)H1(2)
0.033	5.0	11.0	13.0	10.0	500	46KF2330(1)H1(2)	R46KF2330(1)H1(2)
0.047	6.0	12.0	13.0	10.0	500	46KF2470(1)H1(2)	R46KF2470(1)H1(2)
0.068	6.0	12.0	13.0	10.0	500	46KF2680(1)H1(3)	R46KF2680(1)H1(3)
0.010	5.0	11.0	18.0	15.0	400	46KI2100(1)H1(2)	R46KI2100(1)H1(2)
0.015	5.0	11.0	18.0	15.0	400	46KI2150(1)H1(2)	R46KI2150(1)H1(2)
0.022	5.0	11.0	18.0	15.0	400	46KI2220(1)H1(2)	R46KI2220(1)H1(2)
0.033	5.0	11.0	18.0	15.0	400	46KI2330(1)H1(2)	R46KI2330(1)H1(2)
0.047	5.0	11.0	18.0	15.0	400	46KI2470(1)H1(2)	R46KI2470(1)H1(2)
0.068	5.0	11.0	18.0	15.0	400	46KI2680(1)H1(2)	R46KI2680(1)H1(2)
0.10	6.0	12.0	18.0	15.0	400	46KI3100(1)H1(2)	R46KI3100(1)H1(2)
0.15	6.0	17.5	18.0	15.0	400	46KI3150(1)H2(2)	R46KI3150(1)H2(2)
0.15	9.0	12.5	18.0	15.0	400	46KI3150(1)H3(2)	R46KI3150(1)H3(2)
0.15	7.5	13.5	18.0	15.0	400	46KI3150(1)H1(2)	R46KI3150(1)H1(2)
0.22	8.5	14.5	18.0	15.0	400	46KI3220(1)H1(2)	R46KI3220(1)H1(2)
0.22	6.0	17.5	18.0	15.0	400	46KI3220(1)H2(3)	R46KI3220(1)H2(3)
0.22	9.0	12.5	18.0	15.0	400	46KI3220(1)H3(3)	R46KI3220(1)H3(3)
0.22	7.5	18.5	18.0	15.0	400	46KI3220(1)H4(2)	R46KI3220(1)H4(2)
0.33	10.0	16.0	18.0	15.0	400	46KI3330(1)H1(3)	R46KI3330(1)H1(3)
0.33	7.5	18.5	18.0	15.0	400	46KI3330(1)H2(3)	R46KI3330(1)H2(3)
0.33	13.0	12.0	18.0	15.0	400	46KI3330(1)H3(3)	R46KI3330(1)H3(3)
0.47	11.0	19.0	18.0	15.0	400	46KI3470(1)H1(3)	R46KI3470(1)H1(3)
0.15	6.0	15.0	26.5	22.5	200	46KN3150(1)H1(2)	R46KN3150(1)H1(2)
0.22	6.0	15.0	26.5	22.5	200	46KN3220(1)H1(2)	R46KN3220(1)H1(2)
0.33	7.0	16.0	26.5	22.5	200	46KN3330(1)H1(2)	R46KN3330(1)H1(2)
0.47	10.0	18.5	26.5	22.5	200	46KN3470(1)H1(2)	R46KN3470(1)H1(2)
0.68	11.0	20.0	26.5	22.5	200	46KN3680(1)H1(2)	R46KN3680(1)H1(2)
1.0	13.0	22.0	26.5	22.5	200	46KN4100(1)H1(2)	R46KN4100(1)H1(2)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) Insert lead and packaging code. See Ordering Options Table for available options.
(2) M = ±20%, K = ±10%
(3) M = ±20% (only available tolerance).

Soldering Process

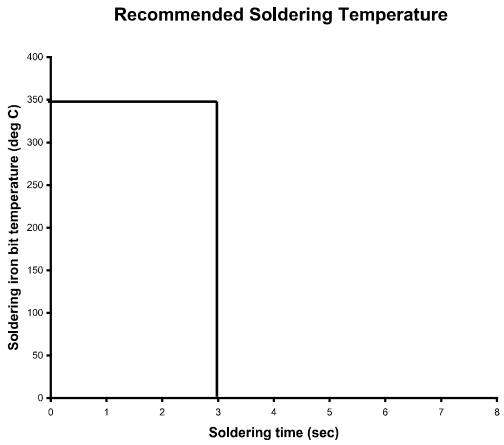
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

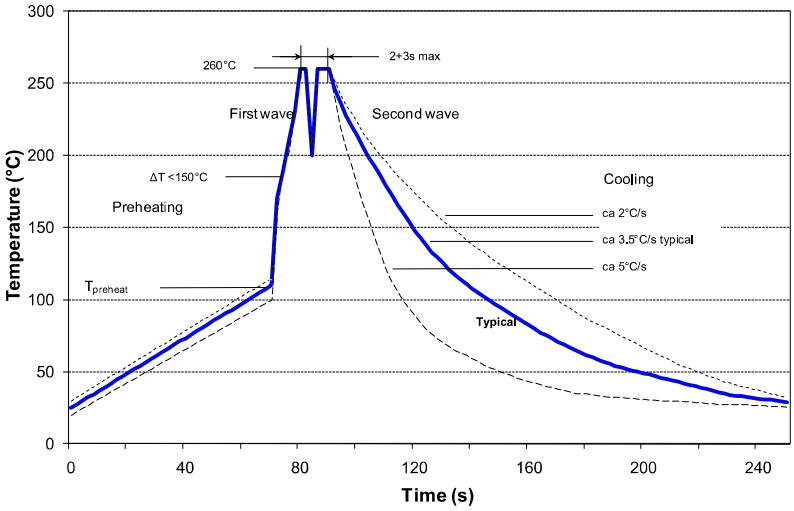
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

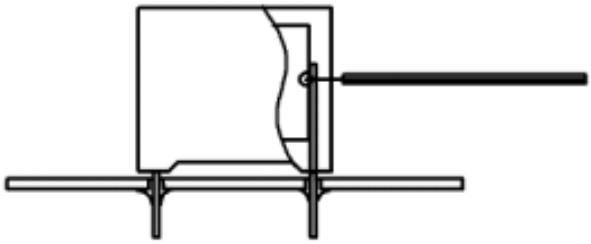
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



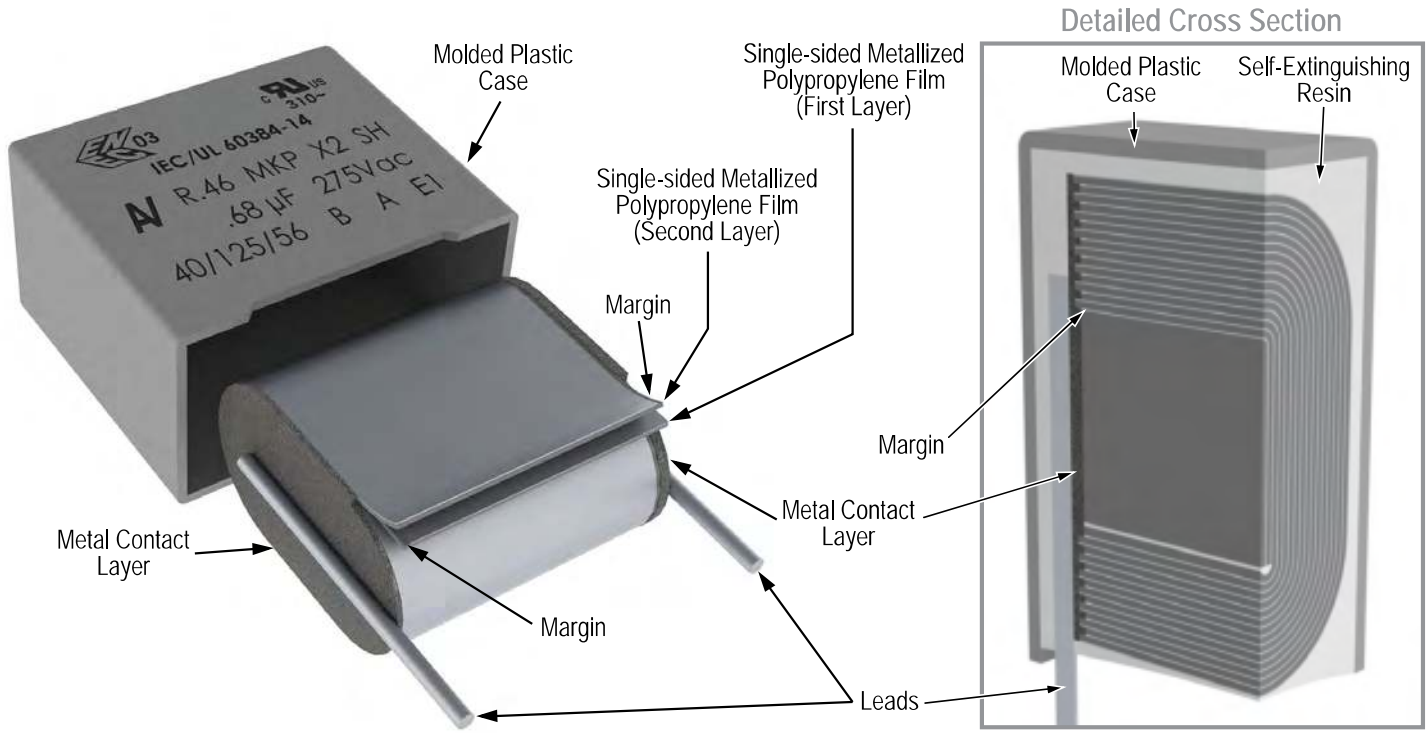
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

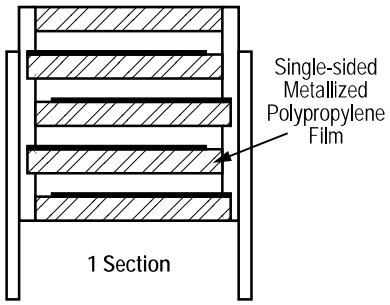
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

Construction

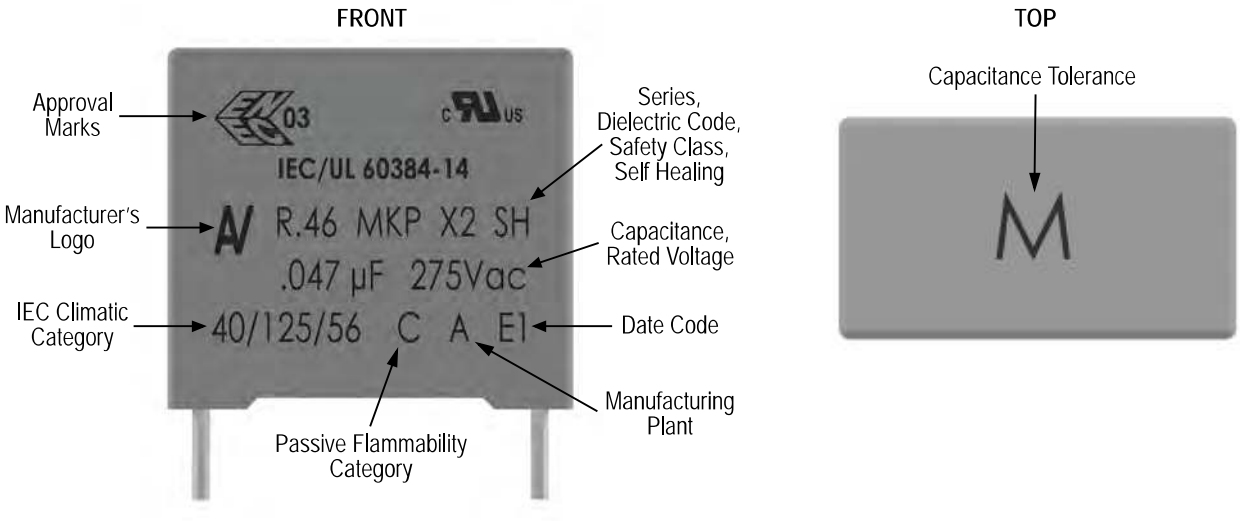


Winding Scheme

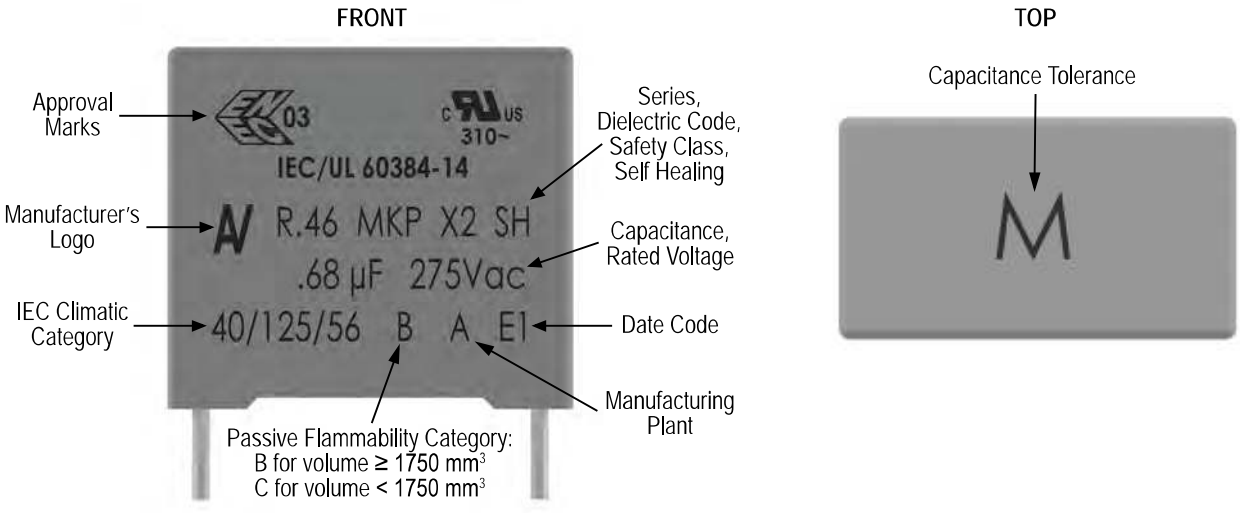


Marking

Lead Spacing 10 mm

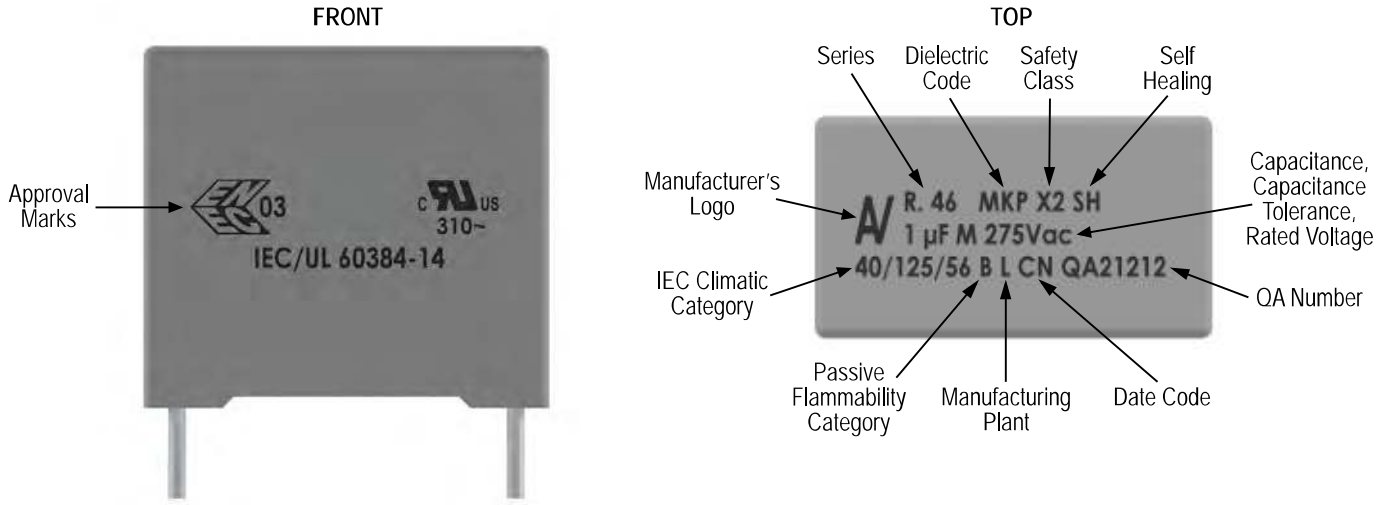


Lead Spacing 15 mm, 22.5 mm (small case sizes)



Marking cont'd

Lead Spacing 22.5 mm (large case sizes), 27.5 mm, 37.5 mm



Manufacturing Date Code (IEC 60062)			
Y = Year, Z = Month			
Year	Code	Month	Code
2000	M	January	1
2001	N	February	2
2002	P	March	3
2003	R	April	4
2004	S	May	5
2005	T	June	6
2006	U	July	7
2007	V	August	8
2008	W	September	9
2009	X	October	O
2010	A	November	N
2011	B	December	D
2012	C		
2013	D		
2014	E		
2015	F		
2016	H		
2017	J		
2018	K		
2019	L		
2020	M		

Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo Taped
10	5	11	13	1300	1500	600	1250	800
	6	12	13	1000	1200	500	1000	680
15	5	11	18	2000	1000	600	1250	800
	6	12	18	1750	900	500	1000	680
	6	17.5	18	1000	700	500	1000	680
	7.5	13.5	18	1000	700	350	800	500
	7.5	18.5	18	900	500	–	800	500
	8.5	14.5	18	1000	500	300	700	440
	9	12.5	18	1000	520	270	650	410
	10	16	18	750	500	300	600	380
	11	19	18	450	350	–	500	340
	13	12	18	750	490	200	480	280
22.5	6	15	26.5	805	500	–	700	464
	7	16	26.5	700	500	–	550	380
	10	18.5	26.5	396	300	–	350	235
	11	20	26.5	360	250	–	350	217
	13	22	26.5	300	200	–	300	–

R46 Series, Class X2, 310 VAC, 110ºC

Overview

The R46 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material meeting the requirements of UL 94 V–0.

Applications

For worldwide use in electromagnetic interference (EMI) suppression in across-the-line applications requiring X2 safety classification. Intended for use in situations where capacitor failure would not result in exposure to electric shock. Not for use in “series with mains” type applications.

Benefits

- Approvals: ENEC, UL, cUL, CQC
- Class X2 (IEC 60384-14)
- Rated voltage: 310 VAC 50/60 Hz
- Capacitance range: 0.01 – 10 µF
- Lead spacing: 10.0 – 37.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category: 40/110/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 2,200 VDC/1,500 VAC
- Self-healing properties



Part Number System

R46	3	N	3150	00	01	M
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Packaging	Internal Use	Capacitance Tolerance
X2, Metallized Polypropylene	3 = 310	F = 10.0 I = 15.0 N = 22.5 R = 27.5 W = 37.5	The last three digits represent significant figures. The first digit specifies number of zeros to be added.	See Ordering Options Table	01 02 L2 M1 M2 N0 N1 N2	K = ±10% M = ±20%

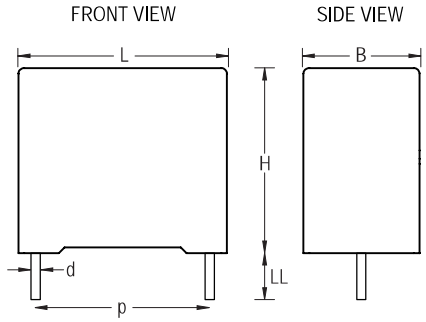
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Ordering Options Table

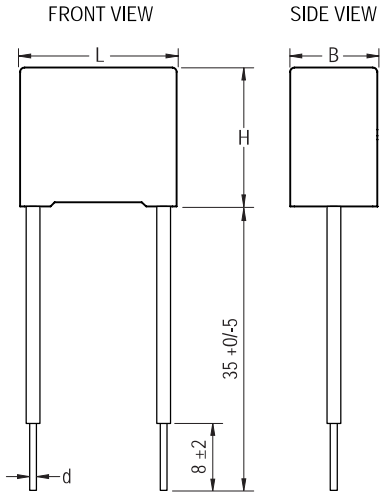
Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
10, 15, 22.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Ammo Pack	H_0 = 18.5 +/-0.5	DQ
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	CK
	Bulk (Bag) – Short Leads	2.7 +0.5/-0	JA
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Short Leads	3.2 +0.3/-0.2	JH
	Bulk (Bag) – Long Leads	18 +1/-1	JM
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
	Bulk (Bag) – Insulated Rigid Leads	30 +5/-0 (sp 8+2/-2)	51
	Bulk (Bag) – Insulated Flexible Leads	150 +5/-5 (sp 8+2/-2)	52
27.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	CK
	Other Lead and Packaging Options		
	Bulk (Bag) – Short Leads	2.7 +0.5/-0	JA
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Short Leads	3.2 +0.3/-0.2	JH
	Bulk (Bag) – Long Leads	18 +1/-1	JM
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
	Bulk (Bag) – Insulated Rigid Leads	30 +5/-0 (sp 8+2/-2)	51
	Bulk (Bag) – Insulated Flexible Leads	150 +5/-5 (sp 8+2/-2)	52
37.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Other Lead and Packaging Options		
	Bulk (Bag) – Short Leads	2.7 +0.5/-0	JA
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Short Leads	3.2 +0.3/-0.2	JH
	Bulk (Bag) – Long Leads	18 +1/-1	JM
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
	Bulk (Bag) – Insulated Rigid Leads	30 +5/-0 (sp 8+2/-2)	51
	Bulk (Bag) – Insulated Flexible Leads	150 +5/-5 (sp 8+2/-2)	52

Dimensions – Millimeters

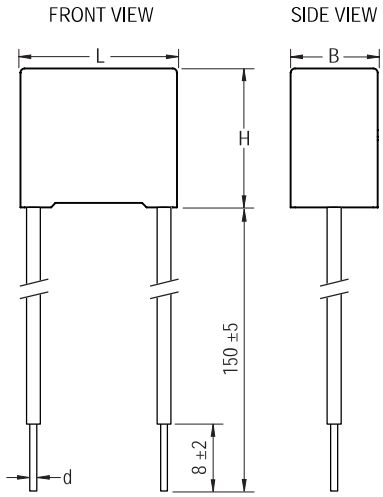
Loose



Insulated Rigid Leads



Insulated Flexible Leads 0.5 mm²

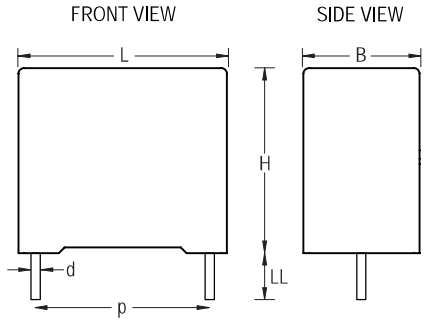


p		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
10.0	+/-0.4	4.0	+0.2	9.0	+0.1	13.0	+0.2	0.6	+/-0.05
10.0	+/-0.4	5.0	+0.2	11.0	+0.1	13.0	+0.2	0.6	+/-0.05
10.0	+/-0.4	6.0	+0.2	12.0	+0.1	13.0	+0.2	0.6	+/-0.05
15.0	+/-0.4	5.0	+0.2	11.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	12.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	17.5	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	7.5	+0.2	13.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	7.5	+0.2	18.5	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	8.5	+0.2	14.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	9.0	+0.2	12.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	10.0	+0.2	16.0	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	11.0	+0.2	19.0	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	13.0	+0.2	12.0	+0.1	18.0	+0.5	0.8	+/-0.05
22.5	+/-0.4	6.0	+0.2	15.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	7.0	+0.2	16.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	10.0	+0.2	18.5	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	11.0	+0.2	20.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	13.0	+0.2	22.0	+0.1	26.5	+0.3	0.8	+/-0.05
27.5	+/-0.4	9.0	+0.2	17.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	11.0	+0.2	20.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	13.0	+0.2	22.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	13.0	+0.2	25.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	14.0	+0.2	28.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	18.0	+0.2	33.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	22.0	+0.2	37.0	+0.1	32.0	+0.3	0.8	+/-0.05

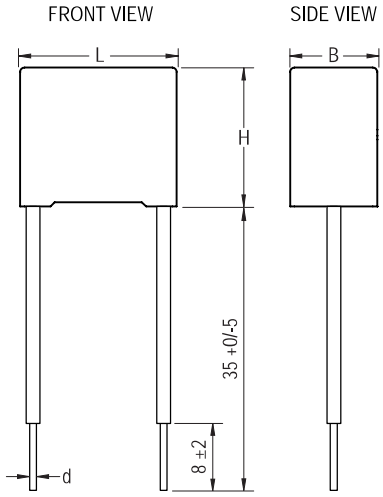
Note: See Ordering Options Table for lead length (LL/H_0) options.

Dimensions – Millimeters cont'd

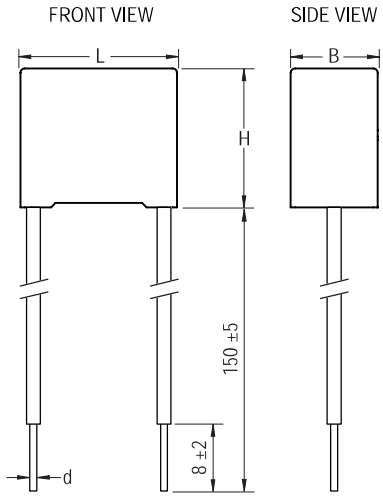
Loose



Insulated Rigid Leads



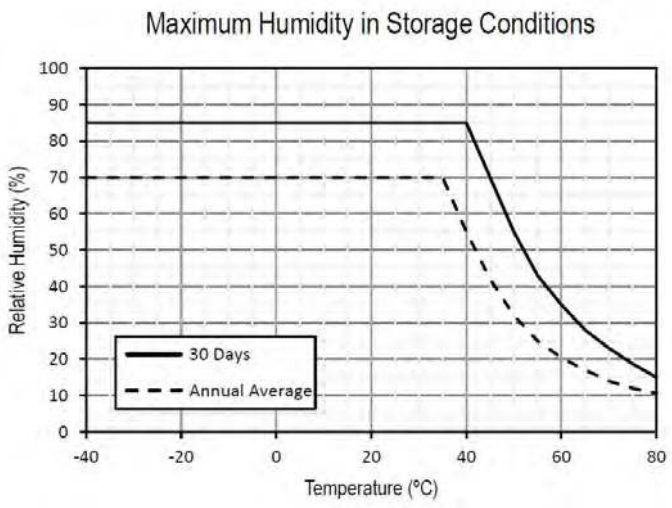
Insulated Flexible Leads 0.5 mm²



p		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
37.5	+/-0.4	11.0	+0.3	22.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	13.0	+0.3	24.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	16.0	+0.3	28.5	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	19.0	+0.3	32.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	20.0	+0.3	40.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	24.0	+0.3	44.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	30.0	+0.3	45.0	+0.1	41.5	+0.3	1.0	+/-0.05
Note: See Ordering Options Table for lead length (LL/H_0) options.									

Performance Characteristics

Dielectric	Polypropylene film
Plates	Metal layer deposited by evaporation under vacuum
Winding	Non-inductive type
Leads	Tinned wire
Protection	Plastic case, thermosetting resin filled. Box material is solvent resistant and flame retardant according to UL94.
Related documents	IEC 60384-14, EN 60384-14
Rated Voltage (V_R)	310 VAC (50/60 Hz), 630 VDC
Capacitance Range	0.010 µF to 10 µF
Capacitance Values	E6 series (IEC 60063) measured @ 1 kHz and +20 ±1°C
Capacitance Tolerance	±10%, ±20%
Temperature Range	-40°C to +110°C
Climatic Category	40/110/56 IEC 60068-1
Storage Conditions	Storage time: ≤ 24 months from the date marked on the label package
	Average relative humidity per year ≤ 70%
	RH ≤ 85% for 30 days randomly distributed throughout the year
	Dew is absent
	Temperature: -40 to 80°C (see "Maximum Humidity in Storage Conditions" graph below)
Approvals	ENEC, UL, cUL, CQC

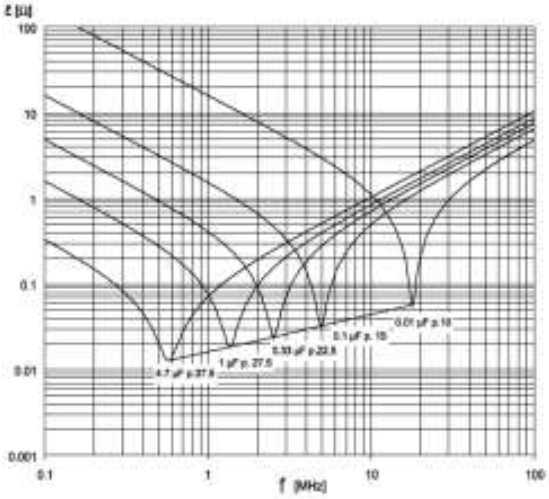


Performance Characteristics cont'd

Dissipation Factor (tanδ)	≤ 0.1% (0.06%*) @ 1 kHz , +25°C ±5°C (* typical value)			
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,200 VDC/1,500 VAC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.			
Insulation Resistance	Measured at +25°C ±5°C, according to IEC 60384–2			
	Minimum Values Between Terminals			
	Voltage Charge	Voltage Charge Time	C ≤ 0.33 µF	C > 0.33 µF
	100 VDC	1 minute	≥ 1 • 10^5 MΩ (≥ 5 • 10^5 MΩ)*	≥ 30,000 MΩ • µF (≥ 150,000 MΩ • µF)*
In DC Applications	Recommended voltage ≤ 630 VDC			

** typical value*

Impedance Graph



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	EN/IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384-14	V4413
	UL 60384-14 and CAN/CSA E60384-14 (310VAC)	E97797
	GB/T 14472 IEC 60384-14	CQC08001026549 CQC11001060118 CQC13001087757 CQC14001116028 CQC13001101266 CQC14001116000

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L				
0.010	4.0	9.0	13.0	10.0	500	463F2100(1)N0(2)	R463F2100(1)N0(2)
0.015	4.0	9.0	13.0	10.0	500	463F2150(1)N0(2)	R463F2150(1)N0(2)
0.022	4.0	9.0	13.0	10.0	500	463F2220(1)N0(2)	R463F2220(1)N0(2)
0.033	5.0	11.0	13.0	10.0	500	463F2330(1)M1(2)	R463F2330(1)M1(2)
0.047	5.0	11.0	13.0	10.0	500	463F2470(1)N0(2)	R463F2470(1)N0(2)
0.068	6.0	12.0	13.0	10.0	500	463F2680(1)M1(2)	R463F2680(1)M1(2)
0.10	6.0	12.0	13.0	10.0	500	463F3100(1)M1(3)	R463F3100(1)M1(3)
0.010	5.0	11.0	18.0	15.0	400	463I2100(1)01(2)	R463I2100(1)01(2)
0.015	5.0	11.0	18.0	15.0	400	463I2150(1)01(2)	R463I2150(1)01(2)
0.022	5.0	11.0	18.0	15.0	400	463I2220(1)01(2)	R463I2220(1)01(2)
0.033	5.0	11.0	18.0	15.0	400	463I2330(1)01(2)	R463I2330(1)01(2)
0.047	5.0	11.0	18.0	15.0	400	463I2470(1)01(2)	R463I2470(1)01(2)
0.068	5.0	11.0	18.0	15.0	400	463I2680(1)01(2)	R463I2680(1)01(2)
0.10	5.0	11.0	18.0	15.0	400	463I3100(1)M1(2)	R463I3100(1)M1(2)
0.15	6.0	12.0	18.0	15.0	400	463I3150(1)M2(2)	R463I3150(1)M2(2)
0.15	9.0	12.5	18.0	15.0	400	463I3150(1)L2(2)	R463I3150(1)L2(2)
0.22	7.5	13.5	18.0	15.0	400	463I3220(1)M2(2)	R463I3220(1)M2(2)
0.22	9.0	12.5	18.0	15.0	400	463I3220(1)L2(2)	R463I3220(1)L2(2)
0.22	6.0	17.5	18.0	15.0	400	463I3220(1)02(2)	R463I3220(1)02(2)
0.33	8.5	14.5	18.0	15.0	400	463I3330(1)N0(2)	R463I3330(1)N0(2)
0.33	10.0	16.0	18.0	15.0	400	463I3330(1)M1(2)	R463I3330(1)M1(2)
0.33	7.5	18.5	18.0	15.0	400	463I3330(1)02(2)	R463I3330(1)02(2)
0.33	13.0	12.0	18.0	15.0	400	463I3330(1)01(2)	R463I3330(1)01(2)
0.47	10.0	16.0	18.0	15.0	400	463I3470(1)N0(3)	R463I3470(1)N0(3)
0.47	11.0	19.0	18.0	15.0	400	463I3470(1)M1(2)	R463I3470(1)M1(2)
0.56	11.0	19.0	18.0	15.0	400	463I3560(1)N0(2)	R463I3560(1)N0(2)
0.60	11.0	19.0	18.0	15.0	400	463I3600(1)N0(2)	R463I3600(1)N0(2)
0.15	6.0	15.0	26.5	22.5	200	463N3150(1)01(2)	R463N3150(1)01(2)
0.22	6.0	15.0	26.5	22.5	200	463N3220(1)M1(2)	R463N3220(1)M1(2)
0.33	6.0	15.0	26.5	22.5	200	463N3330(1)N0(2)	R463N3330(1)N0(2)
0.47	7.0	16.0	26.5	22.5	200	463N3470(1)N0(2)	R463N3470(1)N0(2)
0.68	10.0	18.5	26.5	22.5	200	463N3680(1)M2(2)	R463N3680(1)M2(2)
1.0	10.0	18.5	26.5	22.5	200	463N4100(1)N2(3)	R463N4100(1)N2(3)
1.0	11.0	20.0	26.5	22.5	200	463N4100(1)N1(2)	R463N4100(1)N1(2)
1.5	13.0	22.0	26.5	22.5	200	463N4150(1)N1(2)	R463N4150(1)N1(2)
0.47	9.0	17.0	32.0	27.5	150	463R3470(1)01(2)	R463R3470(1)01(2)
0.68	9.0	17.0	32.0	27.5	150	463R3680(1)M1(2)	R463R3680(1)M1(2)
1.0	11.0	20.0	32.0	27.5	150	463R4100(1)M1(2)	R463R4100(1)M1(2)
1.5	13.0	22.0	32.0	27.5	150	463R4150(1)M1(2)	R463R4150(1)M1(2)
2.2	13.0	25.0	32.0	27.5	150	463R4220(1)M2(2)	R463R4220(1)M2(2)
2.2	14.0	28.0	32.0	27.5	150	463R4220(1)M1(2)	R463R4220(1)M1(2)
3.3	18.0	33.0	32.0	27.5	150	463R4330(1)M2(2)	R463R4330(1)M2(2)
4.7	18.0	33.0	32.0	27.5	150	463R4470(1)M2(2)	R463R4470(1)M2(2)
4.7	22.0	37.0	32.0	27.5	150	463R4470(1)M1(2)	R463R4470(1)M1(2)
1.5	11.0	22.0	41.5	37.5	100	463W4150(1)M1(2)	R463W4150(1)M1(2)
2.2	11.0	22.0	41.5	37.5	100	463W4220(1)M2(3)	R463W4220(1)M2(3)
2.2	13.0	24.0	41.5	37.5	100	463W4220(1)M1(2)	R463W4220(1)M1(2)
3.3	16.0	28.5	41.5	37.5	100	463W4330(1)M1(2)	R463W4330(1)M1(2)
4.7	16.0	28.5	41.5	37.5	100	463W4470(1)M2(3)	R463W4470(1)M2(3)
4.7	19.0	32.0	41.5	37.5	100	463W4470(1)M1(2)	R463W4470(1)M1(2)
6.8	20.0	40.0	41.5	37.5	100	463W4680(1)M2(2)	R463W4680(1)M2(2)
6.8	24.0	44.0	41.5	37.5	100	463W4680(1)M1(2)	R463W4680(1)M1(2)
10.0	30.0	45.0	41.5	37.5	100	463W5100(1)M1(2)	R463W5100(1)M1(2)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) Insert lead and packaging code. See Ordering Options Table for available options.
(2) M = ±20%, K = ±10%
(3) M = ±20% (only available tolerance).

Soldering Process

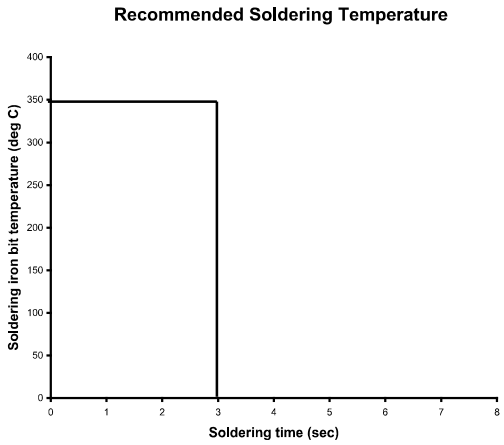
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

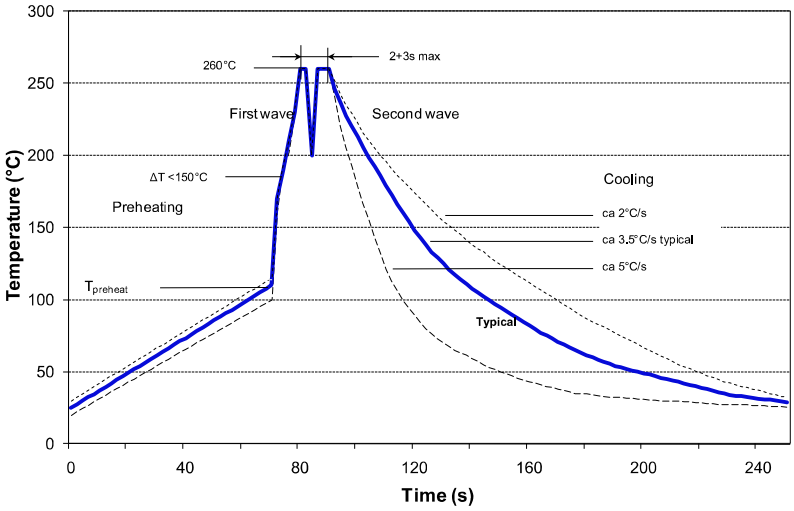
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

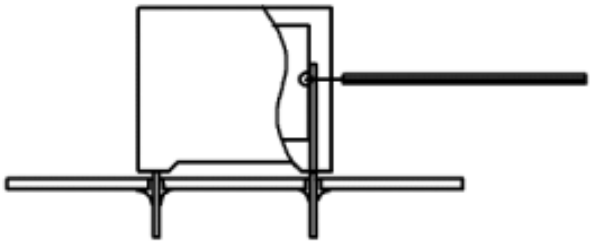
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



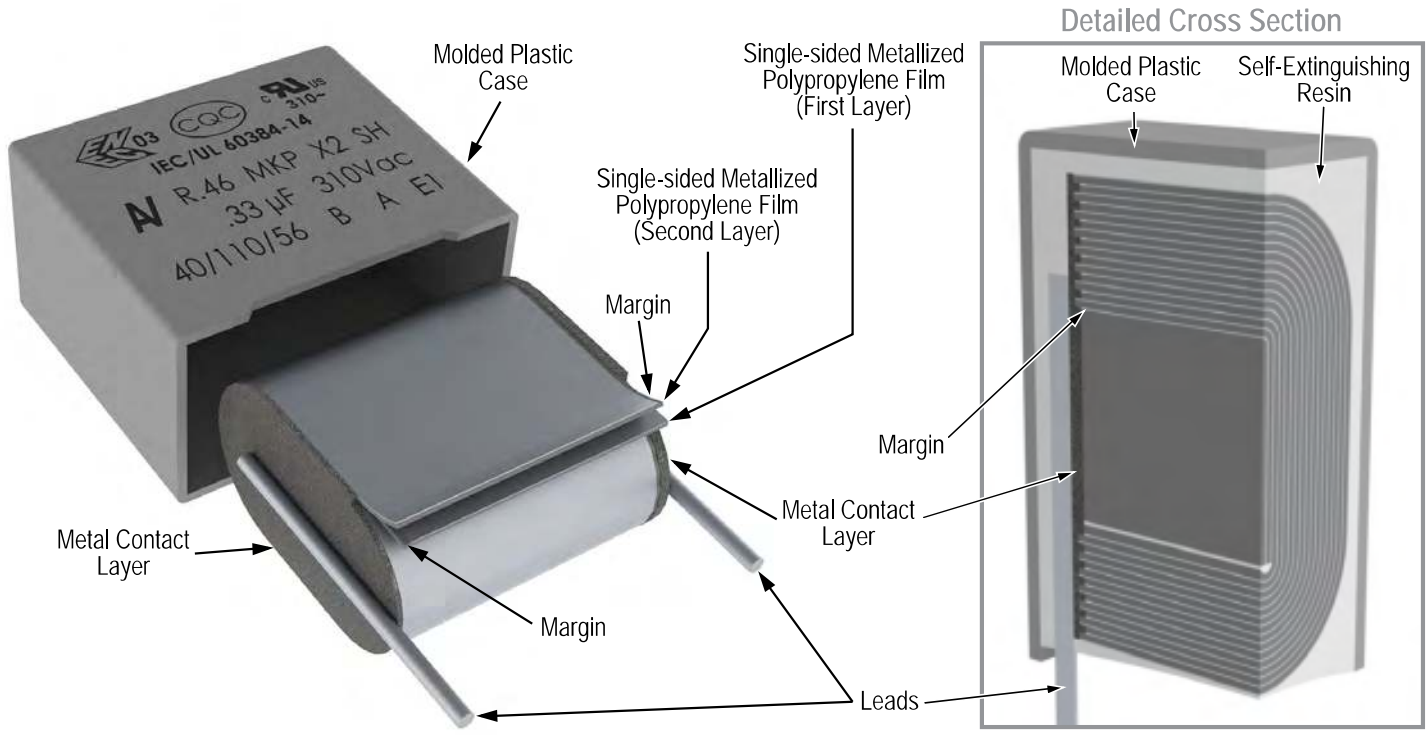
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

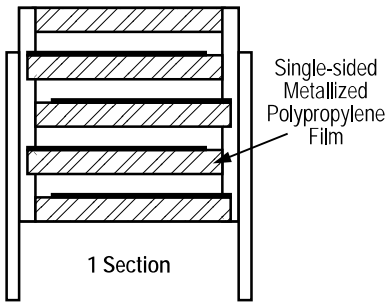
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

Construction

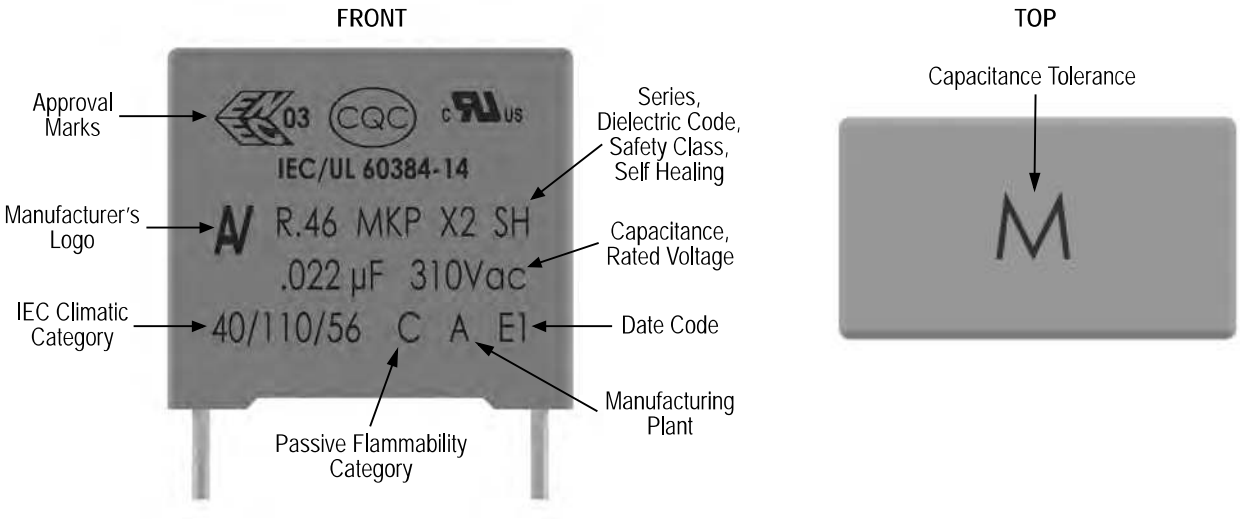


Winding Scheme

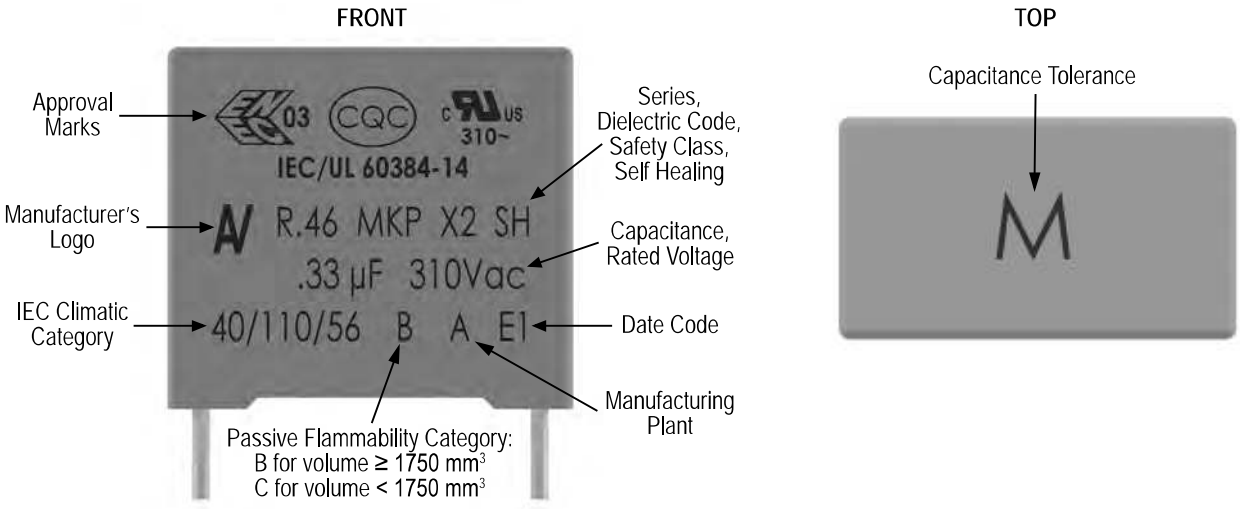


Marking

Lead Spacing 10 mm

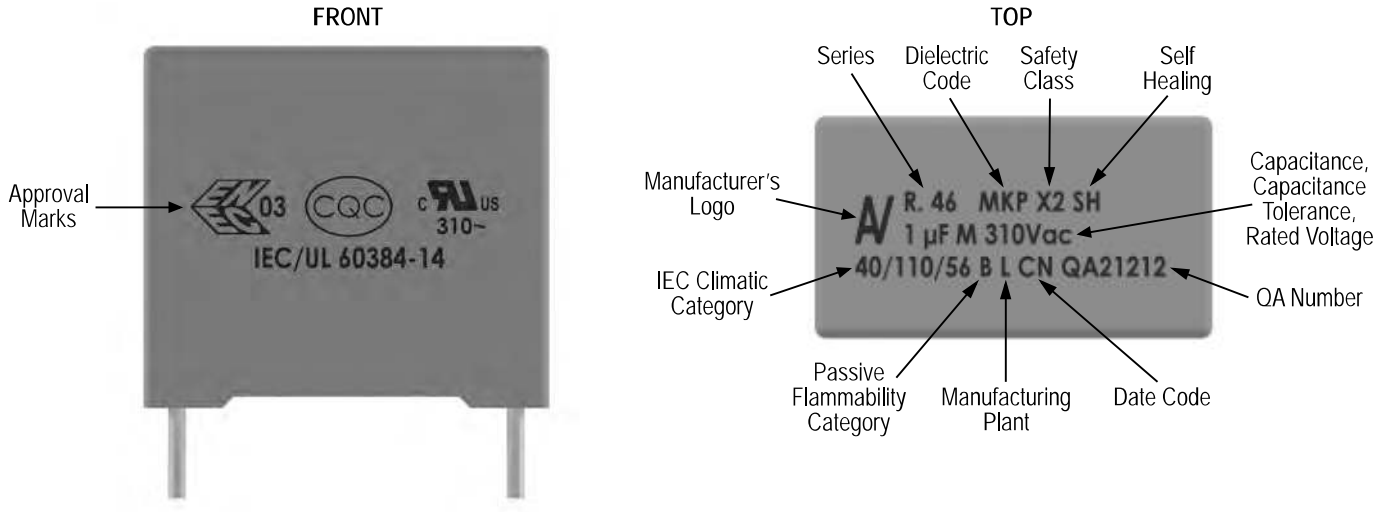


Lead Spacing 15 mm, 22.5 mm (small case sizes)



Marking cont'd

Lead Spacing 22.5 mm (large case sizes), 27.5 mm, 37.5 mm



Manufacturing Date Code (IEC 60062)			
Y = Year, Z = Month			
Year	Code	Month	Code
2000	M	January	1
2001	N	February	2
2002	P	March	3
2003	R	April	4
2004	S	May	5
2005	T	June	6
2006	U	July	7
2007	V	August	8
2008	W	September	9
2009	X	October	O
2010	A	November	N
2011	B	December	D
2012	C		
2013	D		
2014	E		
2015	F		
2016	H		
2017	J		
2018	K		
2019	L		
2020	M		

Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo Taped
10	4	9	13	2000	1800	750	1500	1000
	5	11	13	1300	1500	600	1250	800
	6	12	13	1000	1200	500	1000	680
15	5	11	18	2000	1000	600	1250	800
	6	12	18	1750	900	500	1000	680
	6	17.5	18	1000	700	500	1000	680
	7.5	13.5	18	1000	700	350	800	500
	7.5	18.5	18	900	500	–	800	500
	8.5	14.5	18	1000	500	300	700	440
	9	12.5	18	1000	520	270	650	410
	10	16	18	750	500	300	600	380
	11	19	18	450	350	–	500	340
	13	12	18	750	490	200	480	280
22.5	6	15	26.5	805	500	–	700	464
	7	16	26.5	700	500	–	550	380
	10	18.5	26.5	396	300	–	350	235
	11	20	26.5	360	250	–	350	217
	13	22	26.5	300	200	–	300	–
27.5	9	17	32	816	408	–	450	–
	11	20	32	560	336	–	350	–
	13	22	32	480	288	–	300	–
	13	25	32	480	288	–	–	–
	14	28	32	352	176	–	–	–
	18	33	32	256	128	–	–	–
	22	37	32	168	112	–	–	–
37.5	11	22	41.5	420	252	–	–	–
	13	24	41.5	360	216	–	–	–
	16	28.5	41.5	216	108	–	–	–
	19	32	41.5	192	96	–	–	–
	20	40	41.5	126	84	–	–	–
	24	44	41.5	108	72	–	–	–
	30	45	41.5	90	60	–	–	–

Metallized Polypropylene Film EMI Suppression Capacitors

R47 Series, Class X2, 440 VAC, 110ºC (Automotive Grade)

Electronic Components
KEMET
CHARGED.

Overview

The R47 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material meeting the requirements of UL 94 V–0.

Automotive Grade devices are available (up to 22.5 mm Lead Spacing) and meet the demanding Automotive Electronics Council's AEC–Q200 qualification requirements.

Applications

For worldwide use in electromagnetic interference (EMI) suppression in across-the-line applications requiring X2 safety classification. Intended for use in situations where capacitor failure would not result in exposure to electric shock.

Benefits

- Approvals: ENEC, UL, cUL
- Class X2 (IEC 60384-14)
- Rated voltage: 440 VAC 50/60 Hz
- Capacitance range: 0.0047 – 2.2 µF
- Lead spacing: 10.0 – 37.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category: 40/110/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 2,200 VDC/1,500 VAC
- Self-healing properties
- Automotive (AEC–Q200) grades available up to 22.5 mm Lead Spacing



Part Number System

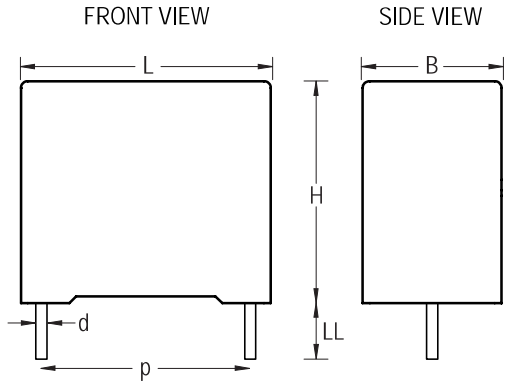
R47	4	F	1470	00	01	M
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Packaging	Internal Use	Capacitance Tolerance
X2, Metallized Polypropylene	4 = 440	F = 10.0 I = 15.0 N = 22.5 R = 27.5 W = 37.5	The last three digits represent significant figures. The first digit specifies number of zeros to be added.	See Ordering Options Table	01 02 03	K = ±10% M = ±20%

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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
10, 15, 22.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Ammo Pack	H_0 = 18.5 +/-0.5	DQ
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	CK
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
27.5, 37.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	CK
	Other Lead and Packaging Options		
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50

Dimensions – Millimeters

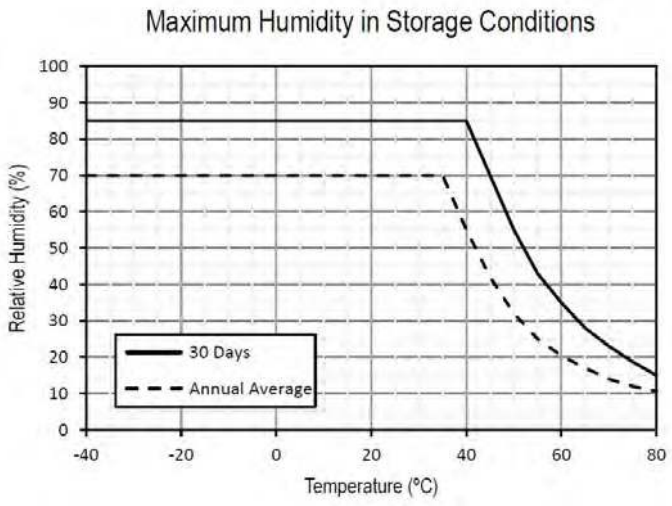


p		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
10.0	+/-0.4	4.0	+0.2	9.0	+0.1	13.0	+0.2	0.6	+/-0.05
10.0	+/-0.4	5.0	+0.2	11.0	+0.1	13.0	+0.2	0.6	+/-0.05
10.0	+/-0.4	6.0	+0.2	12.0	+0.1	13.0	+0.2	0.6	+/-0.05
15.0	+/-0.4	5.0	+0.2	11.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	12.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	17.5	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	7.5	+0.2	13.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	7.5	+0.2	18.5	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	8.5	+0.2	14.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	9.0	+0.2	12.5	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	10.0	+0.2	16.0	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	11.0	+0.2	19.0	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	13.0	+0.2	12.0	+0.1	18.0	+0.5	0.8	+/-0.05
22.5	+/-0.4	6.0	+0.2	15.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	6.5	+0.2	13.5	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	7.0	+0.2	16.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	8.5	+0.2	17.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	10.0	+0.2	18.5	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	11.0	+0.2	20.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	13.0	+0.2	22.0	+0.1	26.5	+0.3	0.8	+/-0.05
27.5	+/-0.4	9.0	+0.2	17.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	11.0	+0.2	20.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	13.0	+0.2	22.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	14.0	+0.2	28.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	18.0	+0.2	33.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	22.0	+0.2	37.0	+0.1	32.0	+0.3	0.8	+/-0.05
37.5	+/-0.4	11.0	+0.3	22.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	13.0	+0.3	24.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	16.0	+0.3	28.5	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	19.0	+0.3	32.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	20.0	+0.3	40.0	+0.1	41.5	+0.3	1.0	+/-0.05

Note: See Ordering Options Table for lead length (LL/H_0) options.

Performance Characteristics

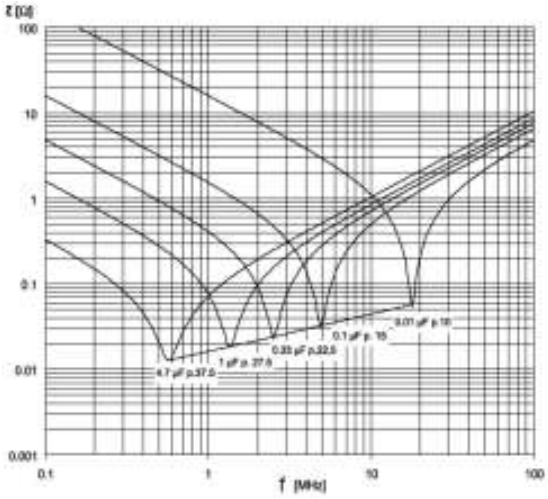
Dielectric	Polypropylene film
Plates	Metal layer deposited by evaporation under vacuum
Winding	Non-inductive type
Leads	Tinned wire
Protection	Plastic case, thermosetting resin filled. Box material is solvent resistant and flame retardant according to UL94.
Related documents	IEC 60384-14, EN 60384-14
Rated Voltage (V_R)	440 VAC (50/60 Hz), 1,000 VDC
Capacitance Range	4700 pF to 1 µF
Capacitance Values	E6 series (IEC 60063) measured @ 1 kHz and +20 ±1°C
Capacitance Tolerance	±10%, ±20%
Temperature Range	-40°C to +110°C
Climatic Category	40/110/56 IEC 60068-1
Storage Conditions	Storage time: ≤ 24 months from the date marked on the label package
	Average relative humidity per year ≤ 70%
	RH ≤ 85% for 30 days randomly distributed throughout the year
	Dew is absent
	Temperature: -40 to 80°C (see "Maximum Humidity in Storage Conditions" graph below)
Approvals	ENEC, UL, cUL



Performance Characteristics cont'd

Dissipation Factor (tanδ)	≤ 0.1% (0.06%*) @ 1 kHz , +25°C ±5°C (* typical value)			
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,700 VDC/1,700 VAC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.			
Insulation Resistance	Measured at +25°C ±5°C, according to IEC 60384–2			
	Minimum Values Between Terminals			
	Voltage Charge	Voltage Charge Time	C ≤ 0.33 µF	C > 0.33 µF
	100 VDC	1 minute	≥ 1 • 10^5 MΩ	≥ 30,000 MΩ • µF
In DC Applications	Recommended voltage ≤ 1,000 VDC			

Impedance Graph



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	EN/IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384-14	CA08.00101
	UL 60384-14 and CAN/CSA E60384-14 (440VAC)	E97797

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L				
0.0047	4.0	9.0	13.0	10.0	750	474F1470(1)01(2)	R474F1470(1)01(2)
0.0068	5.0	11.0	13.0	10.0	750	474F1680(1)01(2)	R474F1680(1)01(2)
0.0082	6.0	12.0	13.0	10.0	750	474F1820(1)01(2)	R474F1820(1)01(2)
0.010	6.0	12.0	13.0	10.0	750	474F2100(1)01(2)	R474F2100(1)01(2)
0.010	5.0	11.0	18.0	15.0	600	474I2100(1)01(2)	R474I2100(1)01(2)
0.012	5.0	11.0	18.0	15.0	600	474I2120(1)01(2)	R474I2120(1)01(2)
0.015	5.0	11.0	18.0	15.0	600	474I2150(1)01(2)	R474I2150(1)01(2)
0.018	5.0	11.0	18.0	15.0	600	474I2180(1)01(2)	R474I2180(1)01(2)
0.022	6.0	12.0	18.0	15.0	600	474I2220(1)01(2)	R474I2220(1)01(2)
0.027	6.0	12.0	18.0	15.0	600	474I2270(1)01(2)	R474I2270(1)01(2)
0.033	6.0	12.0	18.0	15.0	600	474I2330(1)01(2)	R474I2330(1)01(2)
0.039	7.5	13.5	18.0	15.0	600	474I2390(1)01(2)	R474I2390(1)01(2)
0.047	7.5	13.5	18.0	15.0	600	474I2470(1)01(2)	R474I2470(1)01(2)
0.047	6.0	17.5	18.0	15.0	600	474I2470(1)02(2)	R474I2470(1)02(2)
0.047	9.0	12.5	18.0	15.0	600	474I2470(1)03(2)	R474I2470(1)03(2)
0.056	8.5	14.5	18.0	15.0	600	474I2560(1)01(2)	R474I2560(1)01(2)
0.068	10.0	16.0	18.0	15.0	600	474I2680(1)01(2)	R474I2680(1)01(2)
0.068	7.5	18.5	18.0	15.0	600	474I2680(1)02(2)	R474I2680(1)02(2)
0.068	13.0	12.0	18.0	15.0	600	474I2680(1)03(2)	R474I2680(1)03(2)
0.082	10.0	16.0	18.0	15.0	600	474I2820(1)01(2)	R474I2820(1)01(2)
0.10	11.0	19.0	18.0	15.0	600	474I3100(1)01(2)	R474I3100(1)01(2)
0.047	6.0	15.0	26.5	22.5	300	474N2470(1)01(2)	R474N2470(1)01(2)
0.047	6.5	13.5	26.5	22.5	300	474N2470(1)02(2)	R474N2470(1)02(2)
0.068	6.0	15.0	26.5	22.5	300	474N2680(1)01(2)	R474N2680(1)01(2)
0.10	7.0	16.0	26.5	22.5	300	474N3100(1)01(2)	R474N3100(1)01(2)
0.12	8.5	17.0	26.5	22.5	300	474N3120(1)01(2)	R474N3120(1)01(2)
0.15	10.0	18.5	26.5	22.5	300	474N3150(1)01(2)	R474N3150(1)01(2)
0.18	10.0	18.5	26.5	22.5	300	474N3180(1)01(2)	R474N3180(1)01(2)
0.22	11.0	20.0	26.5	22.5	300	474N3220(1)01(2)	R474N3220(1)01(2)
0.27	13.0	22.0	26.5	22.5	300	474N3270(1)01(2)	R474N3270(1)01(2)
0.33	13.0	22.0	26.5	22.5	300	474N3330(1)01(2)	R474N3330(1)01(2)
0.15	9.0	17.0	32.0	27.5	225	474R3150(1)01(2)	R474R3150(1)01(2)
0.18	9.0	17.0	32.0	27.5	225	474R3180(1)01(2)	R474R3180(1)01(2)
0.22	9.0	17.0	32.0	27.5	225	474R3220(1)01(2)	R474R3220(1)01(2)
0.27	9.0	17.0	32.0	27.5	225	474R3270(1)02(2)	R474R3270(1)02(2)
0.33	11.0	20.0	32.0	27.5	225	474R3330(1)02(2)	R474R3330(1)02(2)
0.39	11.0	20.0	32.0	27.5	225	474R3390(1)01(2)	R474R3390(1)01(2)
0.47	13.0	22.0	32.0	27.5	225	474R3470(1)01(2)	R474R3470(1)01(2)
0.56	13.0	22.0	32.0	27.5	225	474R3560(1)01(2)	R474R3560(1)01(2)
0.68	14.0	28.0	32.0	27.5	225	474R3680(1)01(2)	R474R3680(1)01(2)
0.82	18.0	33.0	32.0	27.5	225	474R3820(1)01(2)	R474R3820(1)01(2)
1.0	18.0	33.0	32.0	27.5	225	474R4100(1)01(2)	R474R4100(1)01(2)
1.2	18.0	33.0	32.0	27.5	225	474R4120(1)01(2)	R474R4120(1)01(2)
1.5	22.0	37.0	32.0	27.5	225	474R4150(1)01(2)	R474R4150(1)01(2)
0.47	11.0	22.0	41.5	37.5	150	474W3470(1)01(2)	R474W3470(1)01(2)
0.56	11.0	22.0	41.5	37.5	150	474W3560(1)01(2)	R474W3560(1)01(2)
0.68	13.0	24.0	41.5	37.5	150	474W3680(1)01(2)	R474W3680(1)01(2)
0.82	16.0	28.5	41.5	37.5	150	474W3820(1)01(2)	R474W3820(1)01(2)
1.0	16.0	28.5	41.5	37.5	150	474W4100(1)01(2)	R474W4100(1)01(2)
1.2	19.0	32.0	41.5	37.5	150	474W4120(1)01(2)	R474W4120(1)01(2)
1.5	19.0	32.0	41.5	37.5	150	474W4150(1)01(2)	R474W4150(1)01(2)
1.8	20.0	40.0	41.5	37.5	150	474W4180(1)01(2)	R474W4180(1)01(2)
2.2	20.0	40.0	41.5	37.5	150	474W4220(1)01(2)	R474W4220(1)01(2)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) Insert ordering code for lead type and packaging. See Ordering Options Table for available options.
(2) M = ±20%, K = ±10%

Soldering Process

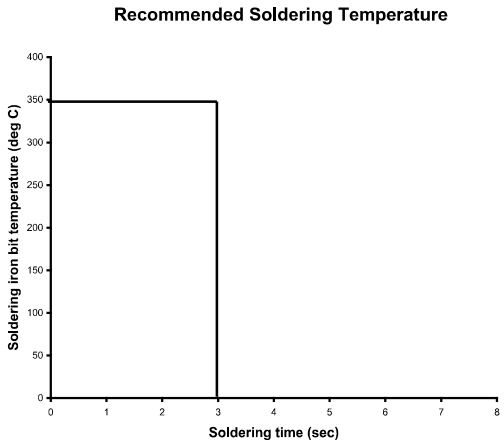
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183°C for SnPb eutectic alloy to 217 – 221°C for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170°C). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

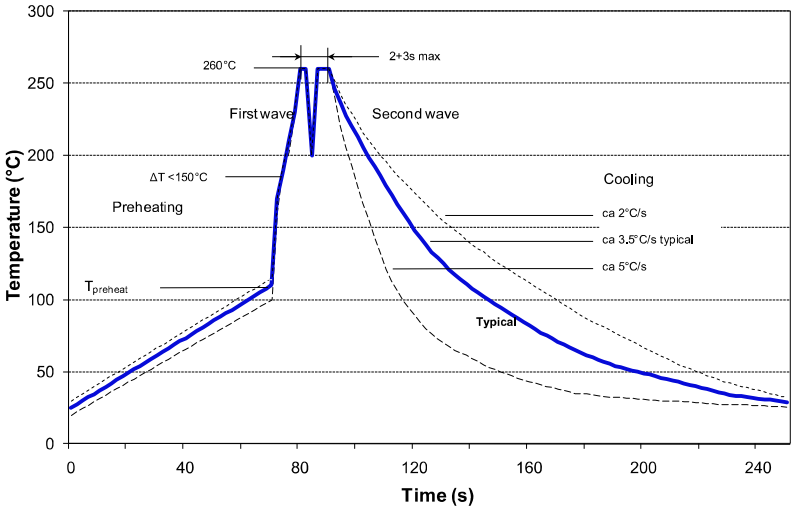
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

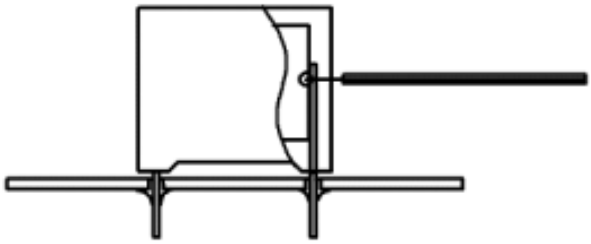
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



Temperature monitored inside the capacitor.

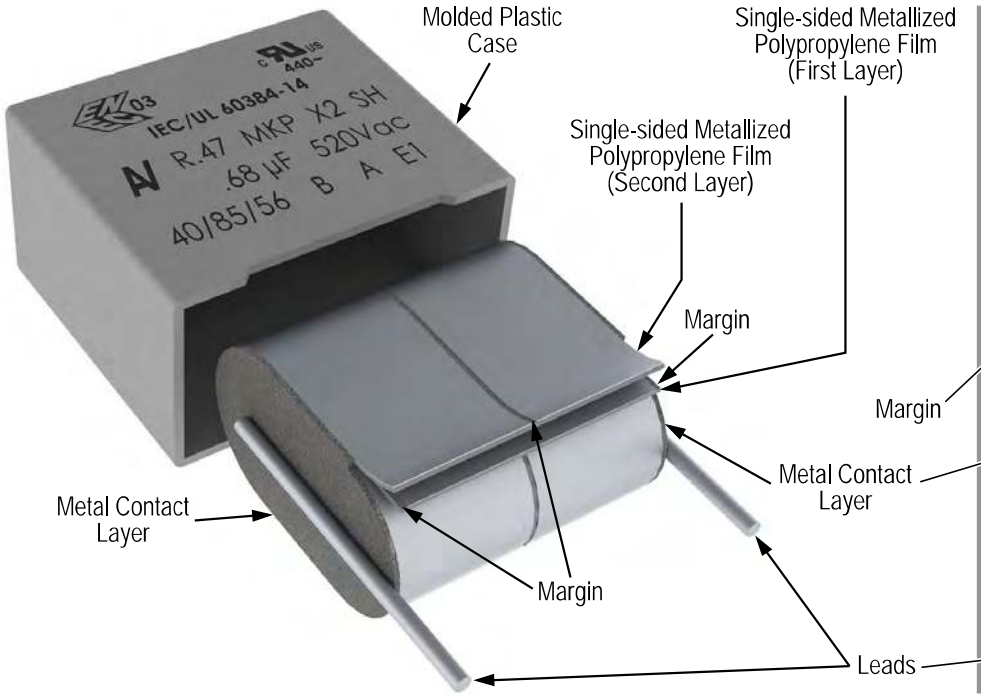
Selective Soldering Recommendations

Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

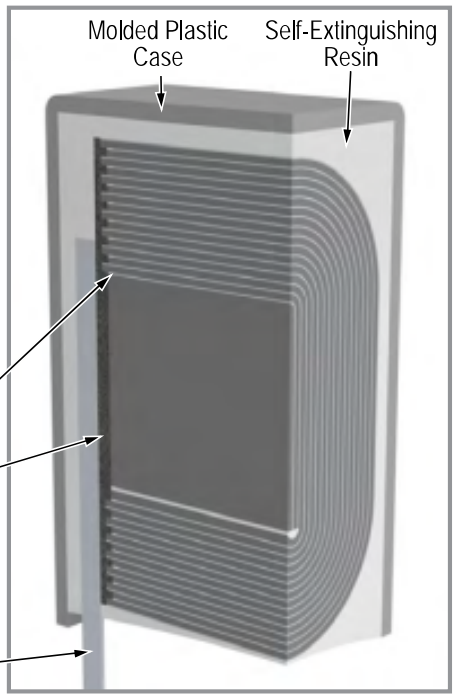
The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

Construction

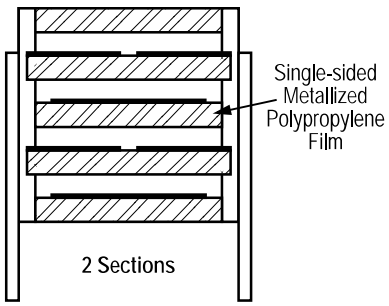
2 Sections



Detailed Cross Section

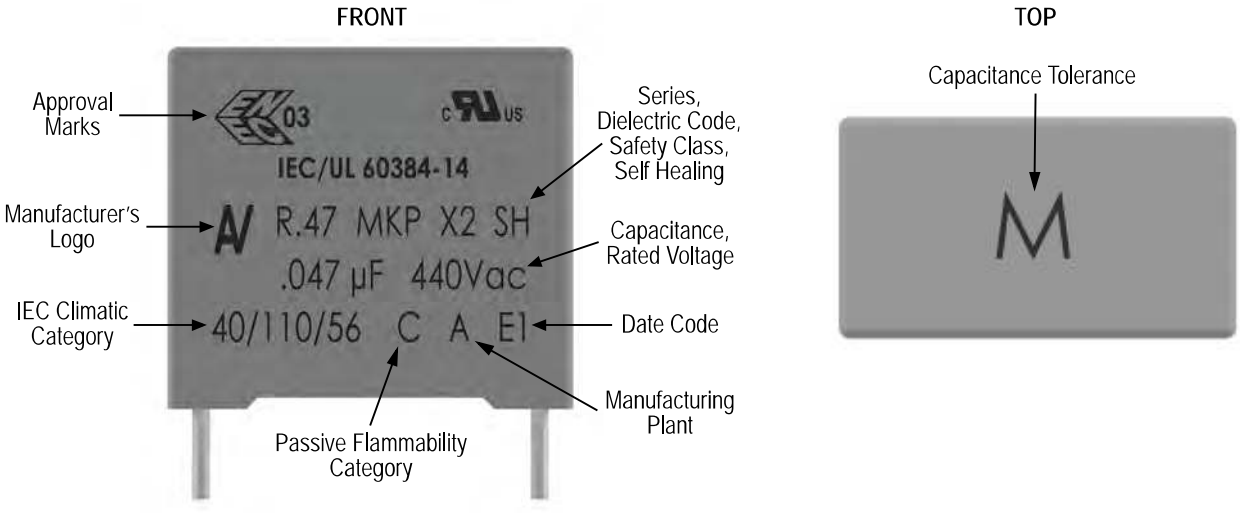


Winding Scheme

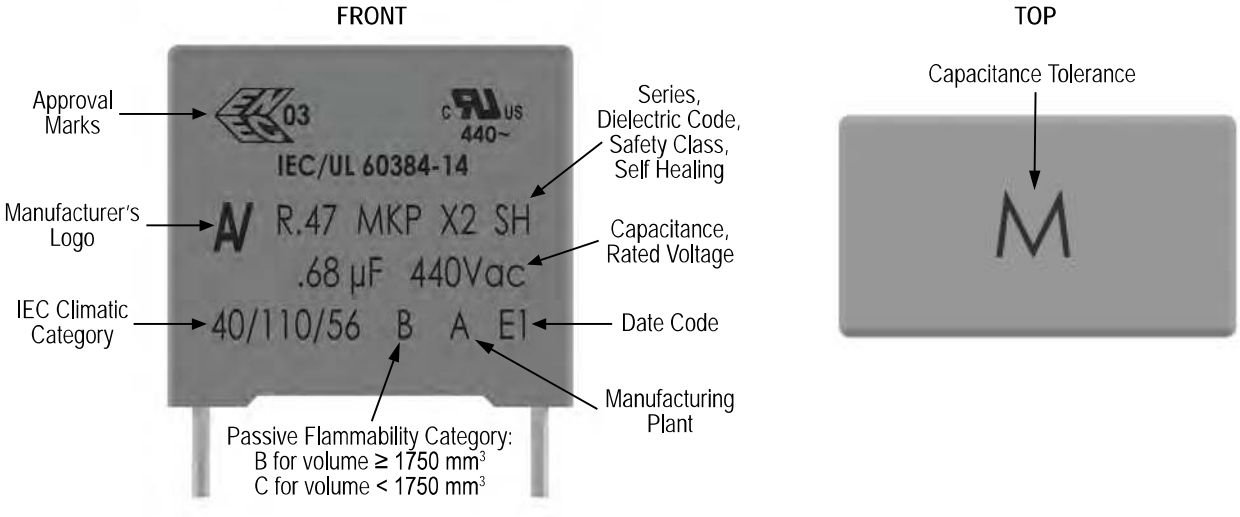


Marking

Lead Spacing 10 mm

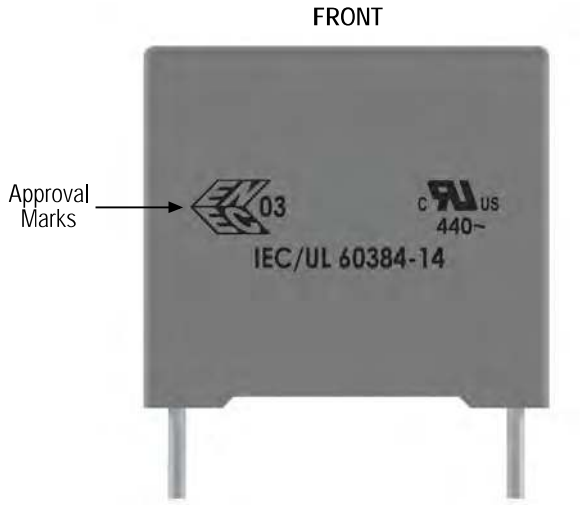


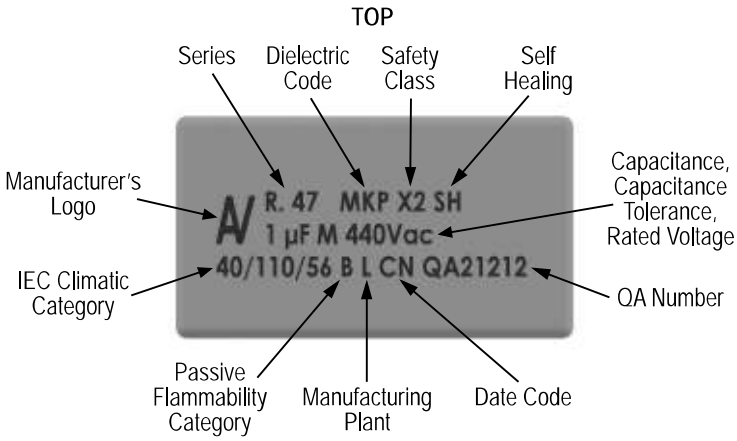
Lead Spacing 15 mm, 22.5 mm (small case sizes)



Marking cont'd

Lead Spacing 22.5 mm (large case sizes), 27.5 mm, 37.5 mm





Manufacturing Date Code (IEC 60062)			
Y = Year, Z = Month			
Year	Code	Month	Code
2000	M	January	1
2001	N	February	2
2002	P	March	3
2003	R	April	4
2004	S	May	5
2005	T	June	6
2006	U	July	7
2007	V	August	8
2008	W	September	9
2009	X	October	O
2010	A	November	N
2011	B	December	D
2012	C		
2013	D		
2014	E		
2015	F		
2016	H		
2017	J		
2018	K		
2019	L		
2020	M		

Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo Taped
10	4	9	13	2000	1800	750	1500	1000
	5	11	13	1300	1500	600	1250	800
	6	12	13	1000	1200	500	1000	680
15	5	11	18	2000	1000	600	1250	800
	6	12	18	1750	900	500	1000	680
	6	17.5	18	1000	700	500	1000	680
	7.5	13.5	18	1000	700	350	800	500
	7.5	18.5	18	900	500	–	800	500
	8.5	14.5	18	1000	500	300	700	440
	9	12.5	18	1000	520	270	650	410
	10	16	18	750	500	300	600	380
	11	19	18	450	350	–	500	340
	13	12	18	750	490	200	480	280
22.5	6	15	26.5	805	500	–	700	464
	6.5	13,5	26.5	800	–	–	–	–
	7	16	26.5	700	500	–	550	380
	8.5	17	26.5	468	300	–	450	280
	10	18.5	26.5	396	300	–	350	235
	11	20	26.5	360	250	–	350	217
	13	22	26.5	300	200	–	300	–
27.5	9	17	32	816	408	–	450	–
	11	20	32	560	336	–	350	–
	13	22	32	480	288	–	300	–
	14	28	32	352	176	–	–	–
	18	33	32	256	128	–	–	–
	22	37	32	168	112	–	–	–
37.5	11	22	41.5	420	252	–	–	–
	13	24	41.5	360	216	–	–	–
	16	28.5	41.5	216	108	–	–	–
	19	32	41.5	192	96	–	–	–
	20	40	41.5	126	84	–	–	–

Metallized Polypropylene Film EMI Suppression Capacitors

R47 Series, Class X2, 520 VAC, 85ºC (Automotive Grade)

Electronic Components
KEMET
CHARGED.

Overview

The R47 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material meeting the requirements of UL 94 V–0.

Automotive Grade devices are available (up to 22.5 mm Lead Spacing) and meet the demanding Automotive Electronics Council's AEC–Q200 qualification requirements.

Applications

For worldwide use in electromagnetic interference (EMI) suppression in across-the-line applications requiring X2 safety classification. Intended for use in situations where capacitor failure would not result in exposure to electric shock.

Benefits

- Approvals: ENEC, UL, cUL
- Class X2 (IEC 60384-14)
- Rated voltage: 520 VAC 50/60 Hz
- Capacitance range: 0.0047 – 2.2 µF
- Lead spacing: 10.0 – 37.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category: 40/85/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +85˚C
- 100% screening factory test at 2,200 VDC/1,500 VAC
- Self-healing properties
- Automotive (AEC–Q200) grades available up to 22.5 mm Lead Spacing



Part Number System

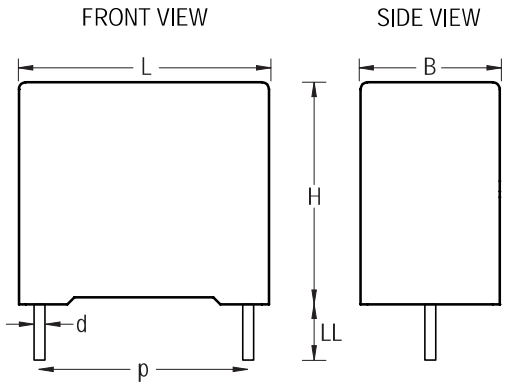
R47	5	I	2100	00	01	M
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Packaging	Internal Use	Capacitance Tolerance
X2, Metallized Polypropylene	5 = 520	F = 10.0 I = 15.0 N = 22.5 R = 27.5 W = 37.5	The last three digits represent significant figures. The first digit specifies number of zeros to be added.	See Ordering Options Table	01 02 03	K = ±10% M = ±20%

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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
10, 15, 22.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Ammo Pack	H_0 = 18.5 +/-0.5	DQ
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	CK
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
27.5, 37.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	CK
	Other Lead and Packaging Options		
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50

Dimensions – Millimeters

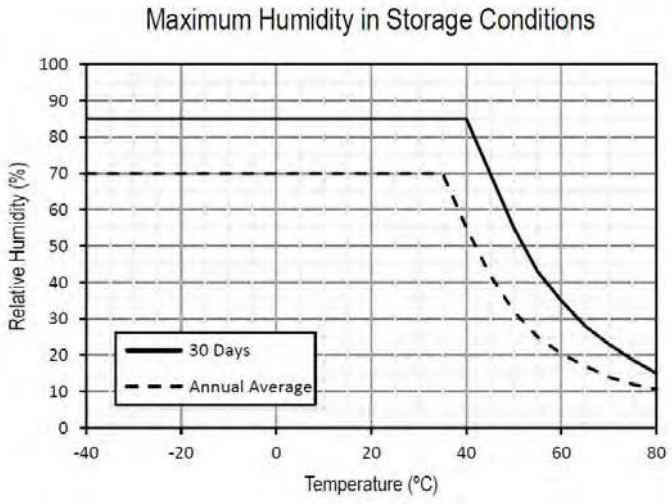


p		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
10.0	+/-0.4	4.0	+0.2	9.0	+0.1	13.0	+0.2	0.6	+/-0.05
10.0	+/-0.4	5.0	+0.2	11.0	+0.1	13.0	+0.2	0.6	+/-0.05
10.0	+/-0.4	6.0	+0.2	12.0	+0.1	13.0	+0.2	0.6	+/-0.05
15.0	+/-0.4	5.0	+0.2	11.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	12.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	17.5	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	7.5	+0.2	13.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	7.5	+0.2	18.5	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	8.5	+0.2	14.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	9.0	+0.2	12.5	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	10.0	+0.2	16.0	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	11.0	+0.2	19.0	+0.1	18.0	+0.5	0.8	+/-0.05
15.0	+/-0.4	13.0	+0.2	12.0	+0.1	18.0	+0.5	0.8	+/-0.05
22.5	+/-0.4	6.0	+0.2	15.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	6.5	+0.2	13.5	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	7.0	+0.2	16.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	8.5	+0.2	17.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	10.0	+0.2	18.5	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	11.0	+0.2	20.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	13.0	+0.2	22.0	+0.1	26.5	+0.3	0.8	+/-0.05
27.5	+/-0.4	9.0	+0.2	17.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	11.0	+0.2	20.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	13.0	+0.2	22.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	14.0	+0.2	28.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	18.0	+0.2	33.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	22.0	+0.2	37.0	+0.1	32.0	+0.3	0.8	+/-0.05
37.5	+/-0.4	11.0	+0.3	22.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	13.0	+0.3	24.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	16.0	+0.3	28.5	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	19.0	+0.3	32.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	20.0	+0.3	40.0	+0.1	41.5	+0.3	1.0	+/-0.05

Note: See Ordering Options Table for lead length (LL/H_0) options.

Performance Characteristics

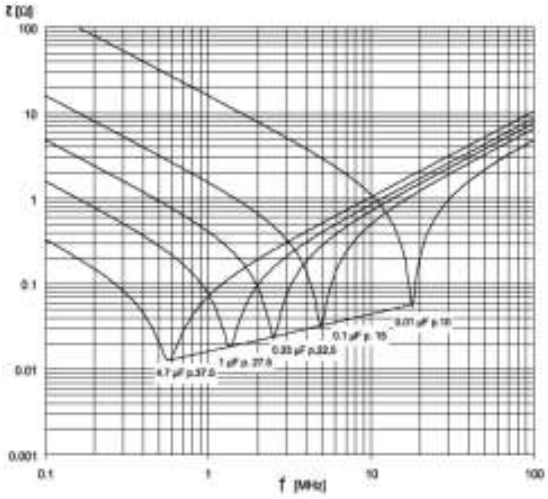
Dielectric	Polypropylene film
Plates	Metal layer deposited by evaporation under vacuum
Winding	Non-inductive type
Leads	Tinned wire
Protection	Plastic case, thermosetting resin filled. Box material is solvent resistant and flame retardant according to UL94.
Related documents	IEC 60384-14, EN 60384-14
Rated Voltage (V_R)	520 VAC (50/60 Hz), 1,000 VDC
Capacitance Range	4,700 pF to 1 µF
Capacitance Values	E6 series (IEC 60063) measured @ 1 kHz and +20 ±1°C
Capacitance Tolerance	±10%, ±20%
Temperature Range	-40°C to +85°C
Climatic Category	40/85/56 IEC 60068-1
Storage Conditions	Storage time: ≤ 24 months from the date marked on the label package
	Average relative humidity per year ≤ 70%
	RH ≤ 85% for 30 days randomly distributed throughout the year
	Dew is absent
	Temperature: -40 to 80°C (see "Maximum Humidity in Storage Conditions" graph below)
Approvals	ENEC, UL, cUL



Performance Characteristics cont'd

Dissipation Factor (tanδ)	≤ 0.1% (0.06%*) @ 1 kHz , +25°C ±5°C (* typical value)			
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,700 VDC/1,700 VAC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.			
Insulation Resistance	Measured at +25°C ±5°C, according to IEC 60384–2			
	Minimum Values Between Terminals			
	Voltage Charge	Voltage Charge Time	C ≤ 0.33 µF	C > 0.33 µF
	100 VDC	1 minute	≥ 1 • 10^5 MΩ	≥ 30,000 MΩ • µF
In DC Applications	Recommended voltage ≤ 1,000 VDC			

Impedance Graph



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	EN/IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384-14	CA08.00101
	UL 60384-14 and CAN/CSA E60384-14 (440VAC)	E97797

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L				
0.0047	4.0	9.0	13.0	10.0	750	475F1470(1)01(2)	R475F1470(1)01(2)
0.0068	5.0	11.0	13.0	10.0	750	475F1680(1)01(2)	R475F1680(1)01(2)
0.0082	6.0	12.0	13.0	10.0	750	475F1820(1)01(2)	R475F1820(1)01(2)
0.010	6.0	12.0	13.0	10.0	750	475F2100(1)01(2)	R475F2100(1)01(2)
0.010	5.0	11.0	18.0	15.0	600	475I2100(1)01(2)	R475I2100(1)01(2)
0.012	5.0	11.0	18.0	15.0	600	475I2120(1)01(2)	R475I2120(1)01(2)
0.015	5.0	11.0	18.0	15.0	600	475I2150(1)01(2)	R475I2150(1)01(2)
0.018	5.0	11.0	18.0	15.0	600	475I2180(1)01(2)	R475I2180(1)01(2)
0.022	6.0	12.0	18.0	15.0	600	475I2220(1)01(2)	R475I2220(1)01(2)
0.027	6.0	12.0	18.0	15.0	600	475I2270(1)01(2)	R475I2270(1)01(2)
0.033	6.0	12.0	18.0	15.0	600	475I2330(1)01(2)	R475I2330(1)01(2)
0.039	7.5	13.5	18.0	15.0	600	475I2390(1)01(2)	R475I2390(1)01(2)
0.047	7.5	13.5	18.0	15.0	600	475I2470(1)01(2)	R475I2470(1)01(2)
0.047	6.0	17.5	18.0	15.0	600	475I2470(1)02(2)	R475I2470(1)02(2)
0.047	9.0	12.5	18.0	15.0	600	475I2470(1)03(2)	R475I2470(1)03(2)
0.056	8.5	14.5	18.0	15.0	600	475I2560(1)01(2)	R475I2560(1)01(2)
0.068	10.0	16.0	18.0	15.0	600	475I2680(1)01(2)	R475I2680(1)01(2)
0.068	7.5	18.5	18.0	15.0	600	475I2680(1)02(2)	R475I2680(1)02(2)
0.068	13.0	12.0	18.0	15.0	600	475I2680(1)03(2)	R475I2680(1)03(2)
0.082	10.0	16.0	18.0	15.0	600	475I2820(1)01(2)	R475I2820(1)01(2)
0.10	11.0	19.0	18.0	15.0	600	475I3100(1)01(2)	R475I3100(1)01(2)
0.047	6.0	15.0	26.5	22.5	300	475N2470(1)01(2)	R475N2470(1)01(2)
0.047	6.5	13.5	26.5	22.5	300	475N2470(1)02(2)	R475N2470(1)02(2)
0.068	6.0	15.0	26.5	22.5	300	475N2680(1)01(2)	R475N2680(1)01(2)
0.10	7.0	16.0	26.5	22.5	300	475N3100(1)01(2)	R475N3100(1)01(2)
0.12	8.5	17.0	26.5	22.5	300	475N3120(1)01(2)	R475N3120(1)01(2)
0.15	10.0	18.5	26.5	22.5	300	475N3150(1)01(2)	R475N3150(1)01(2)
0.18	10.0	18.5	26.5	22.5	300	475N3180(1)01(2)	R475N3180(1)01(2)
0.22	11.0	20.0	26.5	22.5	300	475N3220(1)01(2)	R475N3220(1)01(2)
0.27	13.0	22.0	26.5	22.5	300	475N3270(1)01(2)	R475N3270(1)01(2)
0.33	13.0	22.0	26.5	22.5	300	475N3330(1)01(2)	R475N3330(1)01(2)
0.15	9.0	17.0	32.0	27.5	225	475R3150(1)01(2)	R475R3150(1)01(2)
0.18	9.0	17.0	32.0	27.5	225	475R3180(1)01(2)	R475R3180(1)01(2)
0.22	9.0	17.0	32.0	27.5	225	475R3220(1)01(2)	R475R3220(1)01(2)
0.27	9.0	17.0	32.0	27.5	225	475R3270(1)02(2)	R475R3270(1)02(2)
0.33	11.0	20.0	32.0	27.5	225	475R3330(1)02(2)	R475R3330(1)02(2)
0.39	11.0	20.0	32.0	27.5	225	475R3390(1)01(2)	R475R3390(1)01(2)
0.47	13.0	22.0	32.0	27.5	225	475R3470(1)01(2)	R475R3470(1)01(2)
0.56	13.0	22.0	32.0	27.5	225	475R3560(1)01(2)	R475R3560(1)01(2)
0.68	14.0	28.0	32.0	27.5	225	475R3680(1)01(2)	R475R3680(1)01(2)
0.82	18.0	33.0	32.0	27.5	225	475R3820(1)01(2)	R475R3820(1)01(2)
1.0	18.0	33.0	32.0	27.5	225	475R4100(1)01(2)	R475R4100(1)01(2)
1.2	18.0	33.0	32.0	27.5	225	475R4120(1)01(2)	R475R4120(1)01(2)
1.5	22.0	37.0	32.0	27.5	225	475R4150(1)01(2)	R475R4150(1)01(2)
0.47	11.0	22.0	41.5	37.5	150	475W3470(1)01(2)	R475W3470(1)01(2)
0.56	11.0	22.0	41.5	37.5	150	475W3560(1)01(2)	R475W3560(1)01(2)
0.68	13.0	24.0	41.5	37.5	150	475W3680(1)01(2)	R475W3680(1)01(2)
0.82	16.0	28.5	41.5	37.5	150	475W3820(1)01(2)	R475W3820(1)01(2)
1.0	16.0	28.5	41.5	37.5	150	475W4100(1)01(2)	R475W4100(1)01(2)
1.2	19.0	32.0	41.5	37.5	150	475W4120(1)01(2)	R475W4120(1)01(2)
1.5	19.0	32.0	41.5	37.5	150	475W4150(1)01(2)	R475W4150(1)01(2)
1.8	20.0	40.0	41.5	37.5	150	475W4180(1)01(2)	R475W4180(1)01(2)
2.2	20.0	40.0	41.5	37.5	150	475W4220(1)01(2)	R475W4220(1)01(2)
Capacitance Value (µF)	**B (mm)**	**H (mm)**	**L (mm)**	**Lead Spacing (p)**	**dV/dt (V/µs)**	**New KEMET Part Number**	**Legacy Part Number**

(1) Insert ordering code for lead type and packaging. See Ordering Options Table for available options.
(2) M = ±20%, K = ±10%

Soldering Process

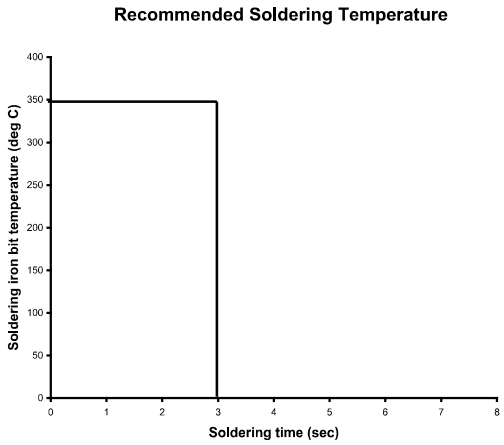
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

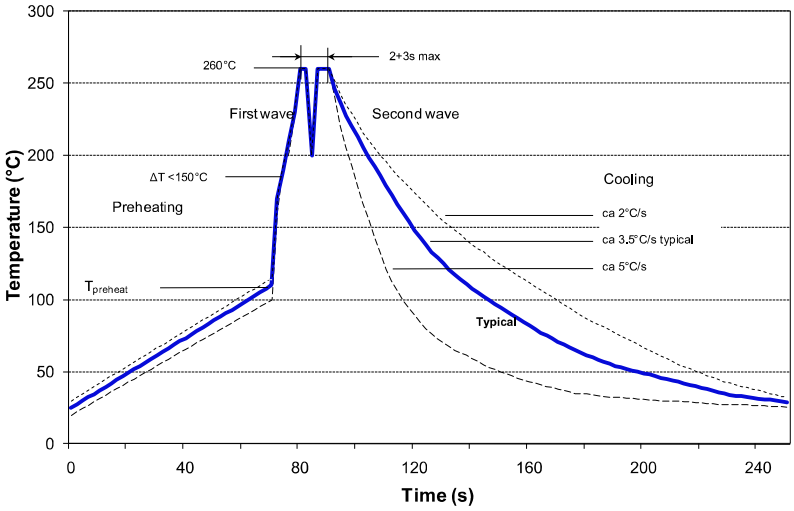
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

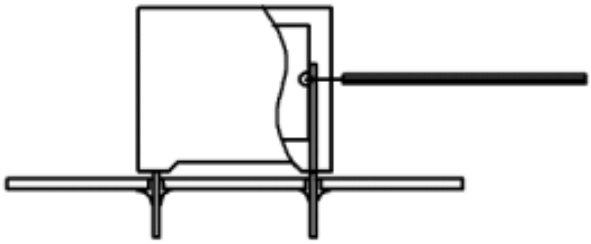
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



Temperature monitored inside the capacitor.

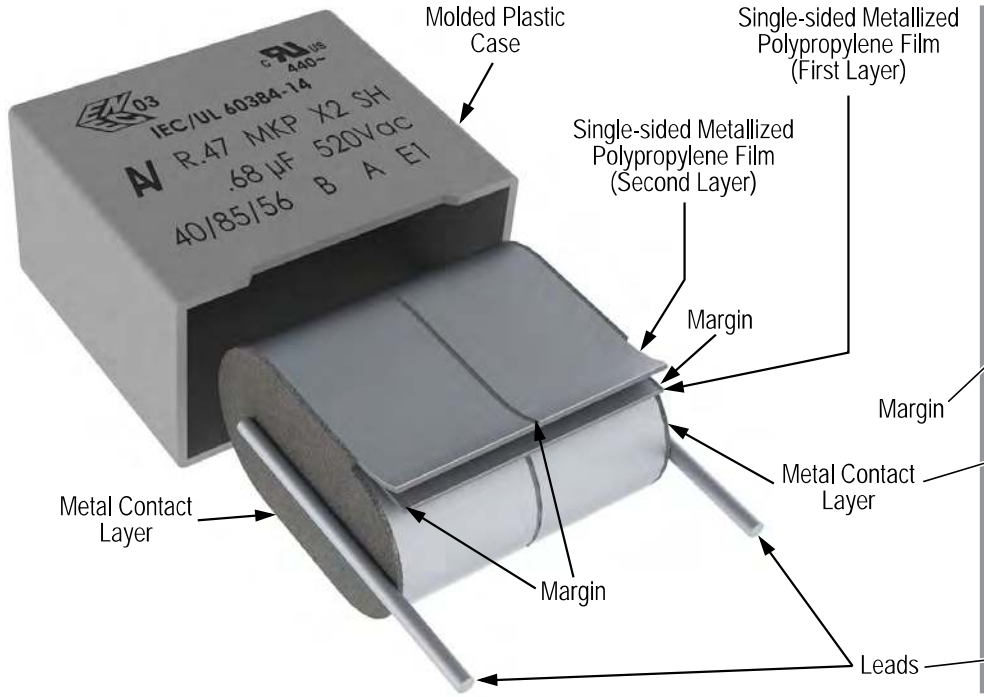
Selective Soldering Recommendations

Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

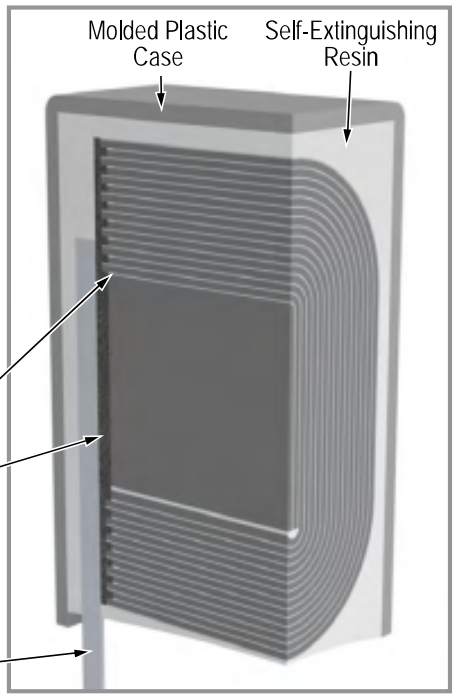
The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

Construction

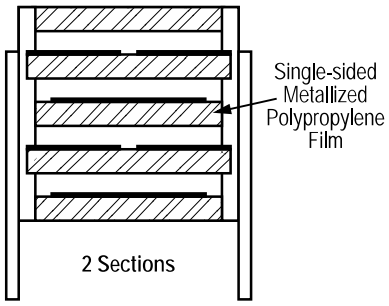
2 Sections



Detailed Cross Section

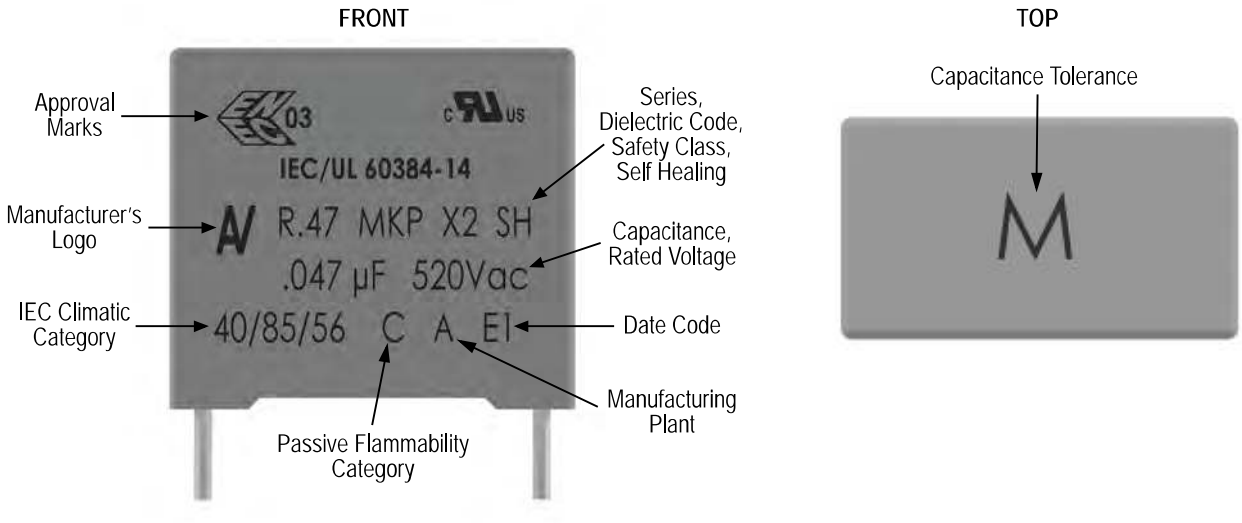


Winding Scheme

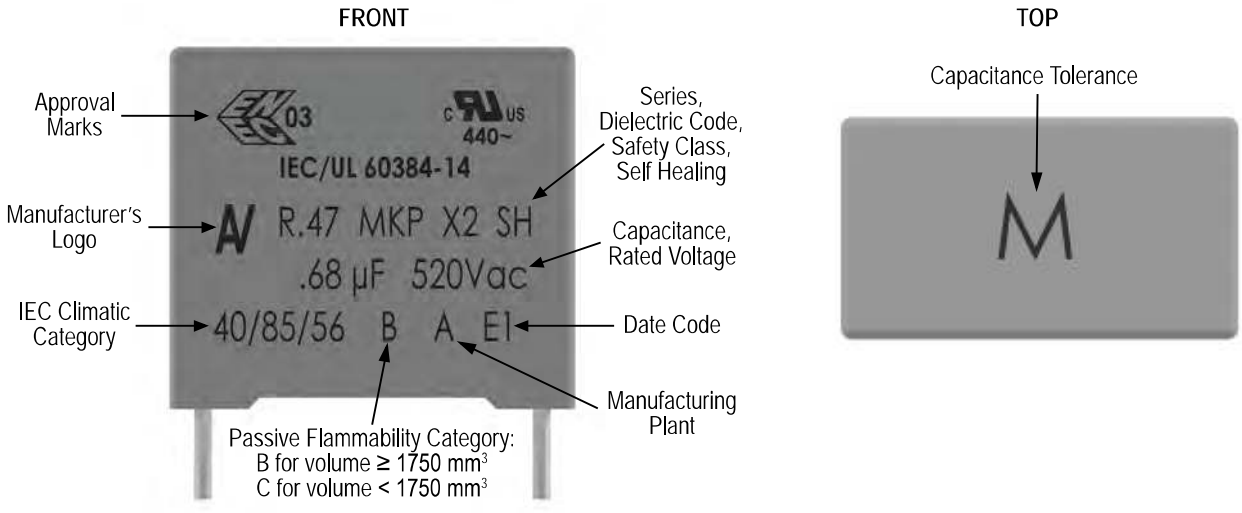


Marking

Lead Spacing 10 mm

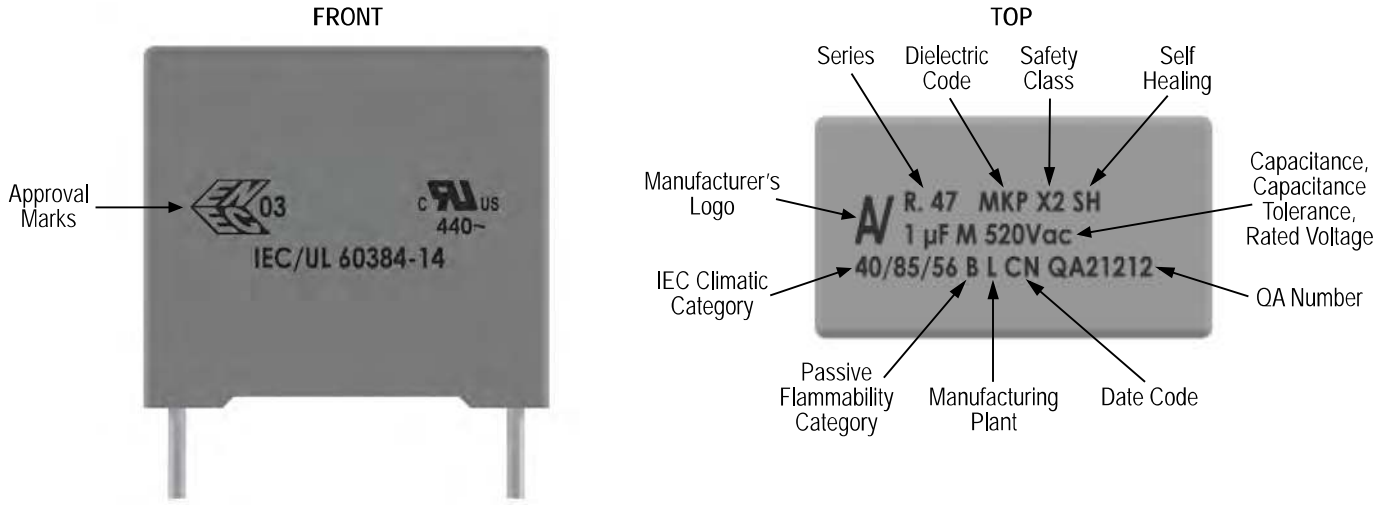


Lead Spacing 15 mm, 22.5 mm (small case sizes)



Marking cont'd

Lead Spacing 22.5 mm (large case sizes), 27.5 mm, 37.5 mm



Manufacturing Date Code (IEC 60062)			
Y = Year, Z = Month			
Year	Code	Month	Code
2000	M	January	1
2001	N	February	2
2002	P	March	3
2003	R	April	4
2004	S	May	5
2005	T	June	6
2006	U	July	7
2007	V	August	8
2008	W	September	9
2009	X	October	O
2010	A	November	N
2011	B	December	D
2012	C		
2013	D		
2014	E		
2015	F		
2016	H		
2017	J		
2018	K		
2019	L		
2020	M		

Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo Taped
10	4	9	13	2000	1800	750	1500	1000
	5	11	13	1300	1500	600	1250	800
	6	12	13	1000	1200	500	1000	680
15	5	11	18	2000	1000	600	1250	800
	6	12	18	1750	900	500	1000	680
	6	17.5	18	1000	700	500	1000	680
	7.5	13.5	18	1000	700	350	800	500
	7.5	18.5	18	900	500	–	800	500
	8.5	14.5	18	1000	500	300	700	440
	9	12.5	18	1000	520	270	650	410
	10	16	18	750	500	300	600	380
	11	19	18	450	350	–	500	340
	13	12	18	750	490	200	480	280
22.5	6	15	26.5	805	500	–	700	464
	6.5	13,5	26.5	800	–	–	–	–
	7	16	26.5	700	500	–	550	380
	8.5	17	26.5	468	300	–	450	280
	10	18.5	26.5	396	300	–	350	235
	11	20	26.5	360	250	–	350	217
	13	22	26.5	300	200	–	300	–
27.5	9	17	32	816	408	–	450	–
	11	20	32	560	336	–	350	–
	13	22	32	480	288	–	300	–
	14	28	32	352	176	–	–	–
	18	33	32	256	128	–	–	–
	22	37	32	168	112	–	–	–
37.5	11	22	41.5	420	252	–	–	–
	13	24	41.5	360	216	–	–	–
	16	28.5	41.5	216	108	–	–	–
	19	32	41.5	192	96	–	–	–
	20	40	41.5	126	84	–	–	–

PHE820M Series Metallized Polyester Film, Class X2, 275 VAC

Overview

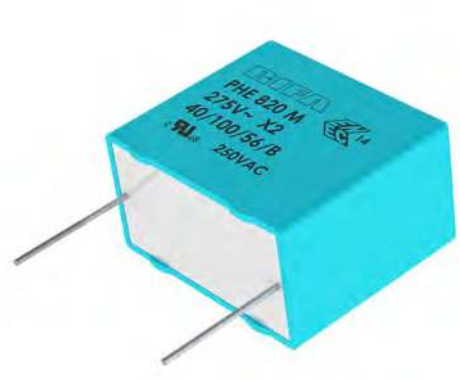
The PHE820M Series is constructed of series winding of metallized polyester encapsulated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use in electromagnetic interference suppression in all X2 and across-the-line applications.

Benefits

- Approvals: ENEC, UL, cUL
- Rated voltage: 275 VAC 50/60 Hz
- Capacitance range: 0.01 – 2.2 µF
- Lead spacing: 15.0 – 37.5 mm
- Capacitance tolerance: ±20%, ±10%, ±5% on request
- Climatic category: 40/100/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +100˚C
- 100% screening factory test at 2,150 VDC



Legacy Part Number System

PHE820	M	B	5100	M	R17
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Capacitance Tolerance	Packaging
X2, Metallized Polyester	M = 275	B = 15.0 D = 22.5 F = 27.5 R = 37.5	The last three digits represent significant figures. The first digit specifies the total number of digits.	J = ±5% K = ±10% M = ±20%	See Ordering Options Table

New KEMET Part Number System

F	720	B	D	103	M	275	A
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging
F = Film	X2, Metallized Polyester	B = 15.0 D = 22.5 F = 27.5 R = 37.5	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	J = ±5% K = ±10% M = ±20%	275 = 275	See Ordering Options Table

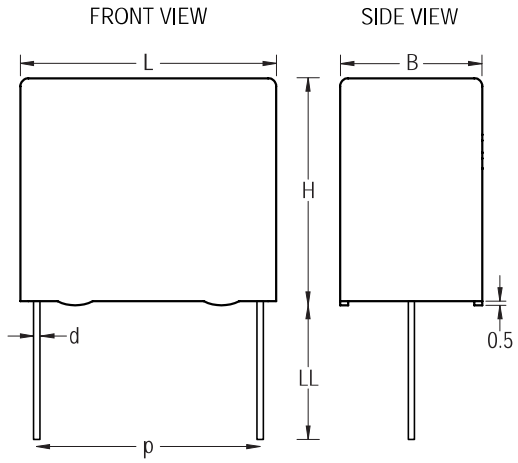
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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
15	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Long Leads	17 +0/-1	A	R17
	Other Lead and Packaging Options			
	Bulk (Bag) – Max Length Leads	30 +5/-0	ALW0L	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R17T0
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R17T1
Native 15 formed to 7.5	Ammo Pack	H_0= 16.5 +/-0.5	XLAF1	R25XA
	Tape & Reel (Standard Reel)	H_0= 16.5 +/-0.5	XLTF1	R25X2
22.5	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06L2(1)
	Other Lead and Packaging Options			
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R17T0
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R17T1
	Pizza Pack	6 +0/-1	Z	R06L2(1)
27.5	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06L2(1)
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R17T1
	Pizza Pack	6 +0/-1	Z	R06L2(1)
37.5	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06L2(1)
	Other Lead and Packaging Options			
	Pizza Pack	6 +0/-1	Z	R06L2(1)

(1) Please specify Bulk (Tray) or Pizza Packaging.

Dimensions – Millimeters



KEMET Size Code	Legacy Size Code	p		B		H		L		d	
		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
BD	B04	15	+/-0.4	5.5	Maximum	10.5	Maximum	18.0	Maximum	0.8	+/-0.05
BE	B05	15	+/-0.4	5.5	Maximum	12.5	Maximum	18.0	Maximum	0.8	+/-0.05
BL	B06	15	+/-0.4	7.5	Maximum	14.5	Maximum	18.0	Maximum	0.8	+/-0.05
BJ	B10	15	+/-0.4	6.5	Maximum	12.5	Maximum	18.0	Maximum	0.8	+/-0.05
BQ	B11	15	+/-0.4	8.5	Maximum	16.0	Maximum	18.0	Maximum	0.8	+/-0.05
DD	D13	22.5	+/-0.4	6.5	Maximum	14.5	Maximum	26.0	Maximum	0.8	+/-0.05
DH	D14	22.5	+/-0.4	8.0	Maximum	16.0	Maximum	26.0	Maximum	0.8	+/-0.05
DM	D15	22.5	+/-0.4	9.0	Maximum	18.5	Maximum	26.0	Maximum	0.8	+/-0.05
DT	D16	22.5	+/-0.4	11.0	Maximum	21.5	Maximum	26.0	Maximum	0.8	+/-0.05
FG	F12	27.5	+/-0.4	11.5	Maximum	22.5	Maximum	31.5	Maximum	0.8	+/-0.05
FM	F13	27.5	+/-0.4	14.5	Maximum	24.5	Maximum	31.5	Maximum	0.8	+/-0.05
FR	F14	27.5	+/-0.4	17.5	Maximum	28.0	Maximum	31.5	Maximum	0.8	+/-0.05
RK	R02	37.5	+/-0.4	16.5	Maximum	32.0	Maximum	41.0	Maximum	1	+/-0.05
RM	R03	37.5	+/-0.4	19.0	Maximum	36.0	Maximum	41.0	Maximum	1	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Rated Voltage	275 VAC 50/60 Hz	
Capacitance Range	0.01 – 2.2 µF	
Capacitance Tolerance	±20%, ±10%, ±5% on request	
Temperature Range	-40°C to +100°C	
Climatic Category	40/100/56	
Approvals	ENEC, UL, cUL	
Dissipation Factor	Maximum Values at +23°C	
	1 kHz	1.0%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,150 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.	
Insulation Resistance	Minimum Values Between Terminals	
	C ≤ 0.33 µF	≥ 30,000 MΩ
	C > 0.33 µF	≥ 10,000 MΩ • µF
In DC Applications	Recommended voltage ≤ 760 VDC	

Environmental Test Data

Test	IEC Publication	Procedure
Endurance	EN/IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle Flame Test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384–14	SE/0140–12E
	UL 1414 (up to 1 µF, 85°C, 250 VAC)	E73869
	CSA – C22.2 No. 1 (up to 1 µF, 85°C, 250 VAC)	E73869
	UL 1283 (310 VAC)	E100117
	CSA – C22.2 No. 8 (310 VAC)	E100117

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Size Code (New/Legacy)	Max Dimensions in mm			Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
		B	H	L					
0.010	BD/B04	5.5	10.5	18.0	15	13	100	F720BD103(1)275(2)	PHE820MB5100(1)(2)
0.015	BD/B04	5.5	10.5	18.0	15	11	100	F720BD153(1)275(2)	PHE820MB5150(1)(2)
0.022	BD/B04	5.5	10.5	18.0	15	9.0	100	F720BD223(1)275(2)	PHE820MB5220(1)(2)
0.033	BE/B05	5.5	12.5	18.0	15	7.5	100	F720BE333(1)275(2)	PHE820MB5330(1)(2)
0.047	BJ/B10	6.5	12.5	18.0	15	6.5	100	F720BJ473(1)275(2)	PHE820MB5470(1)(2)
0.068	BL/B06	7.5	14.5	18.0	15	5.5	100	F720BL683(1)275(2)	PHE820MB5680(1)(2)
0.10	BQ/B11	8.5	16.0	18.0	15	4.5	100	F720BQ104(1)275(2)	PHE820MB6100(1)(2)
0.10	DD/D13	6.5	14.5	26.0	22.5	4.5	100	F720DD104(1)275(2)	PHE820MD6100(1)(2)
0.15	DH/D14	8.0	16.0	26.0	22.5	3.9	100	F720DH154(1)275(2)	PHE820MD6150(1)(2)
0.22	DM/D15	9.0	18.5	26.0	22.5	2.7	100	F720DM224(1)275(2)	PHE820MD6220(1)(2)
0.33	DT/D16	11.0	21.5	26.0	22.5	2.5	100	F720DT334(1)275(2)	PHE820MD6330(1)(2)
0.47	FG/F12	11.5	22.5	31.5	27.5	1.9	100	F720FG474(1)275(2)	PHE820MF6470(1)(2)
0.68	FM/F13	14.5	24.5	31.5	27.5	1.6	100	F720FM684(1)275(2)	PHE820MF6680(1)(2)
1.0	FR/F14	17.5	28.0	31.5	27.5	1.3	100	F720FR105(1)275(2)	PHE820MF7100(1)(2)
1.5	RK/R02	16.5	32.0	41.0	37.5	0.75	100	F720RK155(1)275(2)	PHE820MR7150(1)(2)
2.2	RM/R03	19.0	36.0	41.0	37.5	0.65	100	F720RM225(1)275(2)	PHE820MR7220(1)(2)
Capacitance Value (µF)	Size Code (New/ Legacy)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) M = ±20%, K = ±10%, J = ±5% on request.

(2) Insert ordering code for lead type and packaging. See Ordering Options Table for available options.

Soldering Process

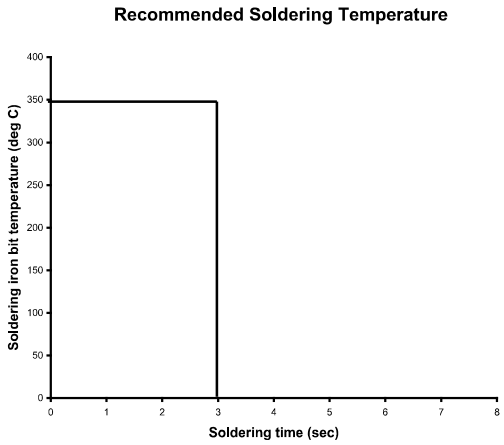
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

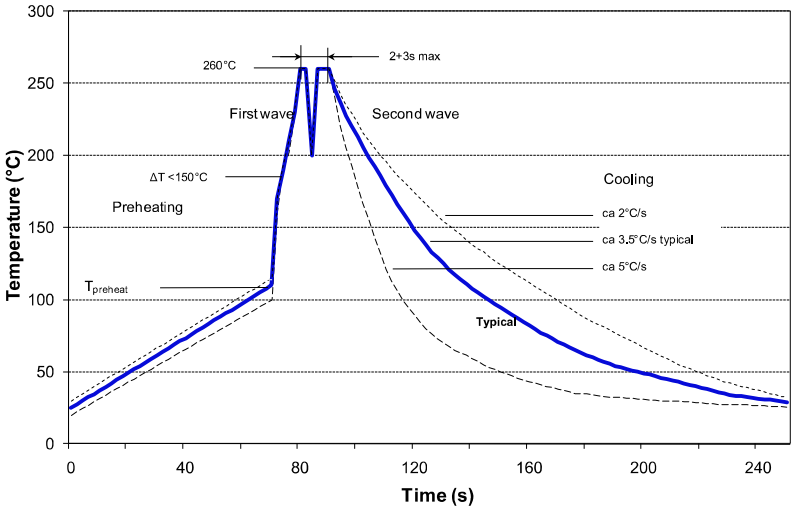
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

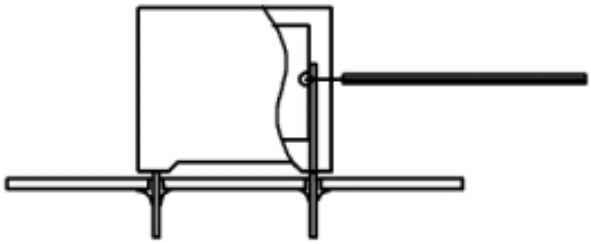
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



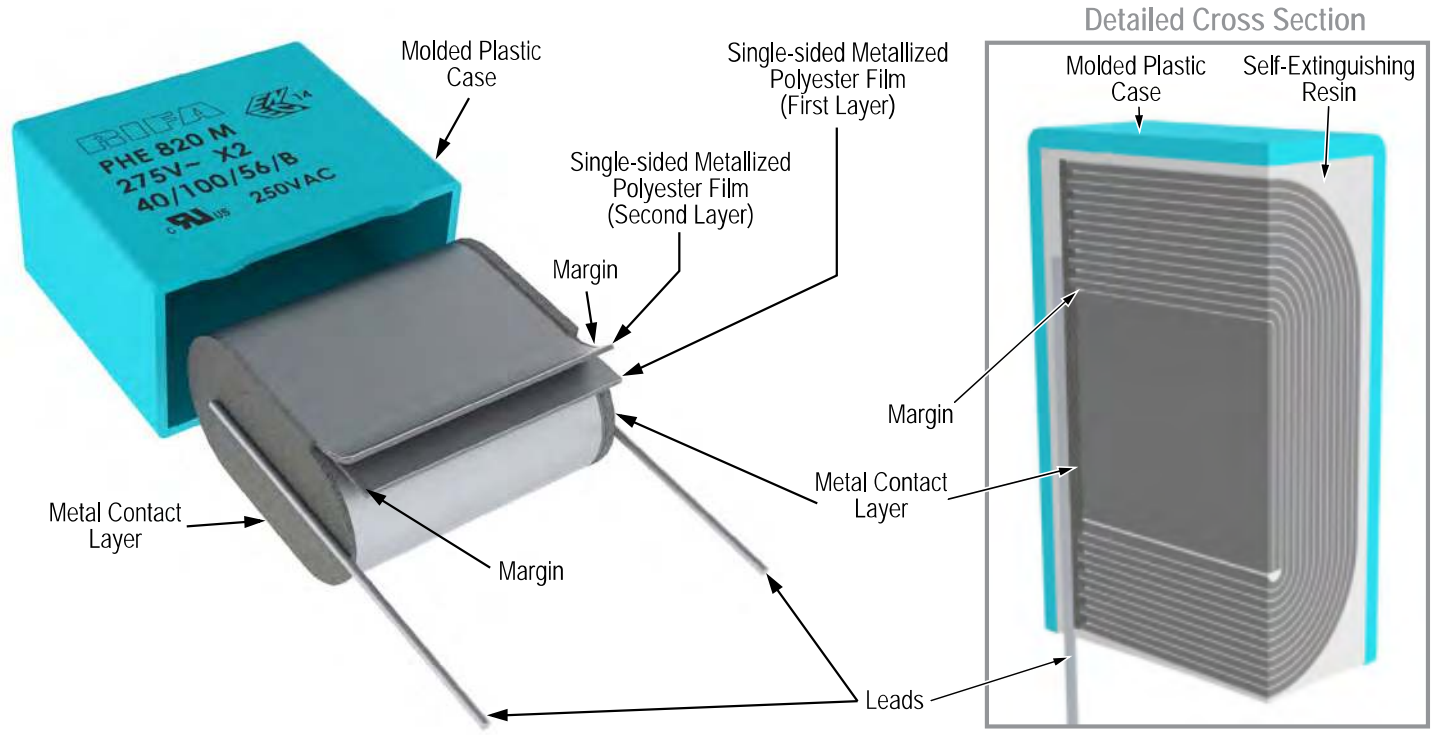
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

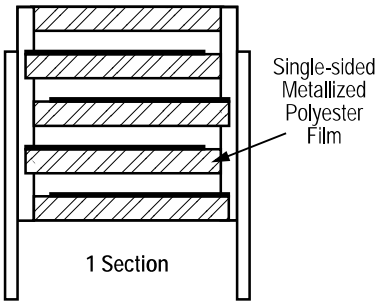
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

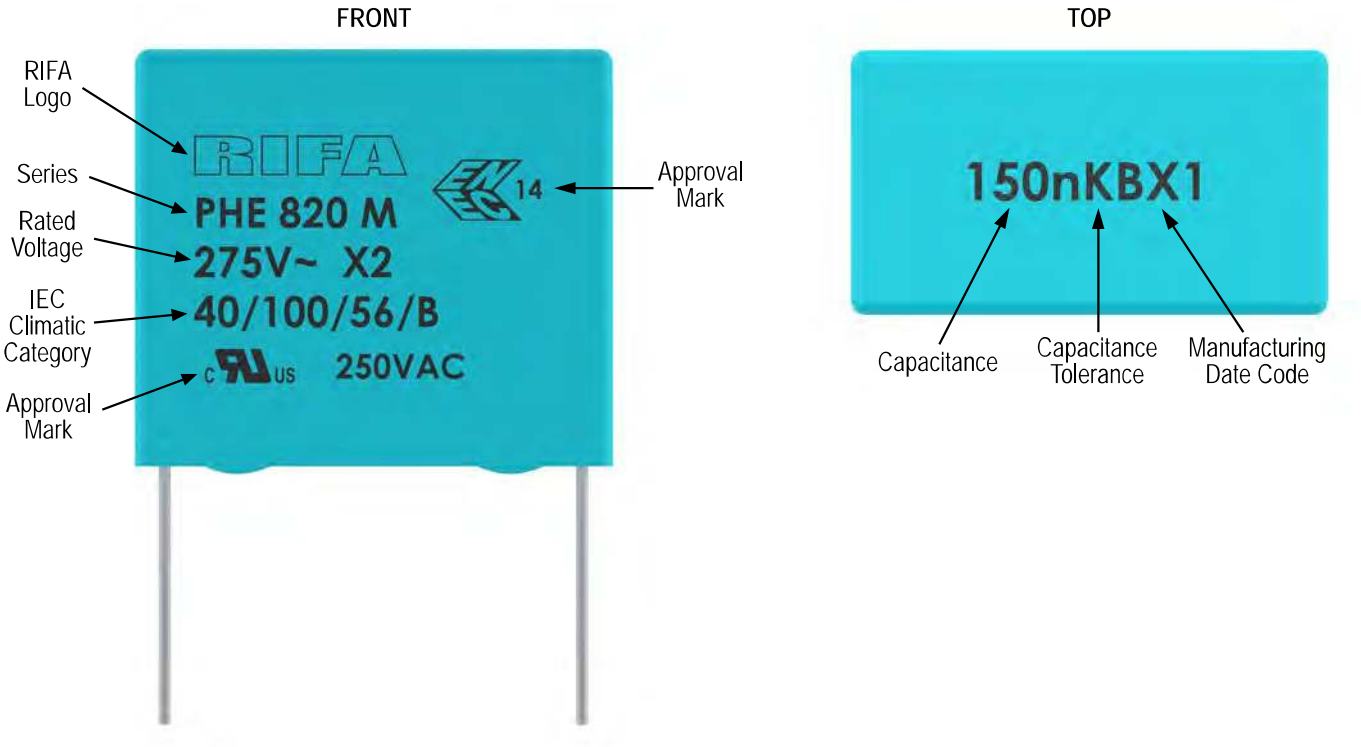
Construction



Winding Scheme



Marking


FRONT
RIFA Logo
Series
Rated Voltage
IEC Climatic Category
Approval Mark
RIFA
PHE 820 M
275V~ X2
40/100/56/B
c UL us 250VAC
14
Approval Mark
TOP
150nKBX1
Capacitance
Capacitance Tolerance
Manufacturing Date Code

Packaging Quantities

KEMET Size Code	Legacy Size Code	Lead Spacing	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 360 mm	Large Reel ø 500 mm	Pizza	Standard Reel Formed	Ammo Formed
BD	B04	15	5.5	10.5	18	1000	800	600	1200		550	570
BE	B05		5.5	12.5	18	1000	800	600	1200		550	570
BL	B06		7.5	14.5	18	800	400	400	800		350	378
BJ	B10		6.5	12.5	18	1000	600	500	1000		450	480
BQ	B11		8.5	16	18	600	400	400	800		350	324
BM	B12		8	15	18	600	400	400	800		350	351
BV	B14		9.5	17.5	18	500	300	350	700		250	297
BG	B15		6	12	18	1000	800	500	1000		450	520
BY	B16		11	19	18	450	250	300	600		250	252
BU	B17		13	12.5	18	400	300	250	500		200	216
DD	D13	22.5	6.5	14.5	26.5	234		300	600	440		
DH	D14		8	16	26.5	186		250	500	352		
DM	D15		9	18.5	26.5	308		250	500	308		
DT	D16		11	21.5	26.5	253		200	400	253		
DF	D17		7	16.5	26.5	216		300	600	396		
DR	D18		10.5	19	26.5	264		200	400	264		
DY	D19		15.5	24.5	26.5	176		110	250	176		
DW	D20		13.5	23	26.5	209		160	300	209		
FK	F03	27.5	13.5	23	31.5	171			250	171		
FE	F11		10.5	20.5	31.5	216			350	216		
FG	F12		11.5	22.5	31.5	198			300	198		
FM	F13		14.5	24.5	31.5	153			250	153		
FR	F14		17.5	28	31.5	126				126		
FS	F15		19	29	31.5	117				117		
FV	F16		21	30	31.5	108				108		
FH	F17		21	12.5	31.5	108				108		
FT	F18		31	18.5	31.5	72				72		
FQ	F19		27.5	16	31.5	81				81		
RK	R02	37.5	16.5	32	41	105				105		
RM	R03		19	36	41	91				91		
RH	R04		15	26	41	119				119		
RF	R05		13	24	41	140				140		
RP	R06		21	38	41	84				84		
RS	R08		28	43	41	54				54		

PHE820E Series Metallized Polyester Film, Class X2, 300 VAC

Overview

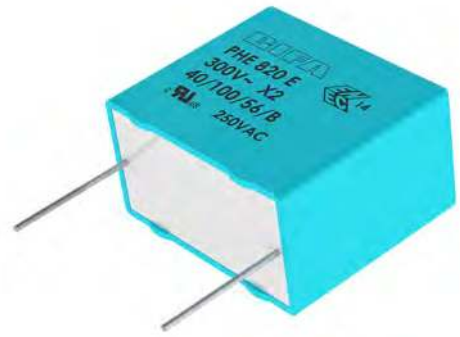
The PHE820E Series is constructed of series winding of metallized polyester encapsulated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use in electromagnetic interference suppression in all X2 and across-the-line applications.

Benefits

- Approvals: ENEC, UL, cUL
- Rated voltage: 300 VAC 50/60 Hz
- Capacitance range: 0.01 – 2.2 µF
- Lead spacing: 15.0 – 37.5 mm
- Capacitance tolerance: ±20%, ±10%, ±5% on request
- Climatic category: 40/100/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +100˚C
- 100% screening factory test at 2,150 VDC



Legacy Part Number System

PHE820	E	B	5100	M	R17
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Capacitance Tolerance	Packaging
X2, Metallized Polyester	E = 300	B = 15.0 D = 22.5 F = 27.5 R = 37.5	The last three digits represent significant figures. The first digit specifies the total number of digits.	J = ±5% K = ±10% M = ±20%	See Ordering Options Table

New KEMET Part Number System

F	720	B	D	103	M	300	A
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging
F = Film	X2, Metallized Polyester	B = 15.0 D = 22.5 F = 27.5 R = 37.5	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	J = ±5% K = ±10% M = ±20%	300 = 300	See Ordering Options Table

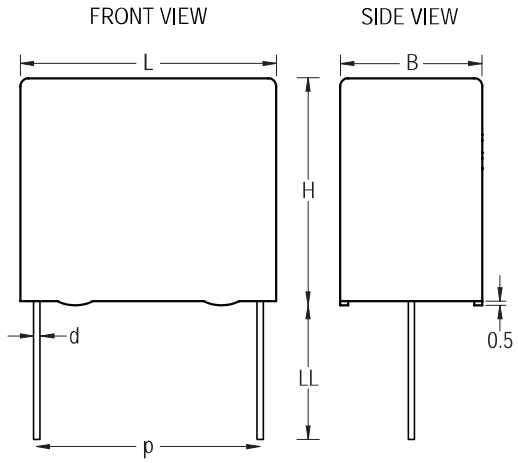
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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
15	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Long Leads	17 +0/-1	A	R17
	Other Lead and Packaging Options			
	Bulk (Bag) – Max Length Leads	30 +5/-0	ALW0L	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R17T0
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R17T1
Native 15 formed to 7.5	Ammo Pack	H_0= 16.5 +/-0.5	XLAF1	R25XA
	Tape & Reel (Standard Reel)	H_0= 16.5 +/-0.5	XLTF1	R25X2
22.5	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06L2(1)
	Other Lead and Packaging Options			
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R17T0
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R17T1
	Pizza Pack	6 +0/-1	Z	R06L2(1)
27.5	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06L2(1)
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R17T1
	Pizza Pack	6 +0/-1	Z	R06L2(1)
37.5	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06L2(1)
	Other Lead and Packaging Options			
	Pizza Pack	6 +0/-1	Z	R06L2(1)

(1) Please specify Bulk (Tray) or Pizza Packaging.

Dimensions – Millimeters



KEMET Size Code	Legacy Size Code	p		B		H		L		d	
		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
BD	B04	15	+/-0.4	5.5	Maximum	10.5	Maximum	18.0	Maximum	0.8	+/-0.05
BE	B05	15	+/-0.4	5.5	Maximum	12.5	Maximum	18.0	Maximum	0.8	+/-0.05
BL	B06	15	+/-0.4	7.5	Maximum	14.5	Maximum	18.0	Maximum	0.8	+/-0.05
BJ	B10	15	+/-0.4	6.5	Maximum	12.5	Maximum	18.0	Maximum	0.8	+/-0.05
BQ	B11	15	+/-0.4	8.5	Maximum	16.0	Maximum	18.0	Maximum	0.8	+/-0.05
DD	D13	22.5	+/-0.4	6.5	Maximum	14.5	Maximum	26.0	Maximum	0.8	+/-0.05
DH	D14	22.5	+/-0.4	8.0	Maximum	16.0	Maximum	26.0	Maximum	0.8	+/-0.05
DM	D15	22.5	+/-0.4	9.0	Maximum	18.5	Maximum	26.0	Maximum	0.8	+/-0.05
DT	D16	22.5	+/-0.4	11.0	Maximum	21.5	Maximum	26.0	Maximum	0.8	+/-0.05
FE	F11	27.5	+/-0.4	10.5	Maximum	20.5	Maximum	31.5	Maximum	0.8	+/-0.05
FG	F12	27.5	+/-0.4	11.5	Maximum	22.5	Maximum	31.5	Maximum	0.8	+/-0.05
FM	F13	27.5	+/-0.4	14.5	Maximum	24.5	Maximum	31.5	Maximum	0.8	+/-0.05
FR	F14	27.5	+/-0.4	17.5	Maximum	28.0	Maximum	31.5	Maximum	0.8	+/-0.05
RK	R02	37.5	+/-0.4	16.5	Maximum	32.0	Maximum	41.0	Maximum	1	+/-0.05
RM	R03	37.5	+/-0.4	19.0	Maximum	36.0	Maximum	41.0	Maximum	1	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Rated Voltage	300 VAC 50/60 Hz	
Capacitance Range	0.01 – 2.2 µF	
Capacitance Tolerance	±20%, ±10%, ±5% on request	
Temperature Range	-40°C to +100°C	
Climatic Category	40/100/56	
Approvals	ENEC, UL, cUL	
Dissipation Factor	Maximum Values at +23°C	
	1 kHz	1.0%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,150 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.	
Insulation Resistance	Minimum Values Between Terminals	
	C ≤ 0.33 µF	≥ 30,000 MΩ
	C > 0.33 µF	≥ 10,000 MΩ • µF
In DC Applications	Recommended voltage ≤ 760 VDC	

Environmental Test Data

Test	IEC Publication	Procedure
Endurance	EN/IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384–14	SE/0140–12E
	UL 1414 (up to 1 µF, 85°C, 250 VAC)	E73869
	CSA – C22.2 No. 1 (up to 1 µF, 85°C, 250 VAC)	E73869
	UL 1283 (310 VAC)	E100117
	CSA – C22.2 No. 8 (310 VAC)	E100117

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Size Code (New/Legacy)	Max Dimensions in mm			Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
		B	H	L					
0.010	BD/B04	5.5	10.5	18.0	15	13	100	F720BD103(1)300(2)	PHE820EB5100(1)(2)
0.015	BD/B04	5.5	10.5	18.0	15	11	100	F720BD153(1)300(2)	PHE820EB5150(1)(2)
0.022	BD/B04	5.5	10.5	18.0	15	9.0	100	F720BD223(1)300(2)	PHE820EB5220(1)(2)
0.033	BE/B05	5.5	12.5	18.0	15	7.5	100	F720BE333(1)300(2)	PHE820EB5330(1)(2)
0.047	BJ/B10	6.5	12.5	18.0	15	6.5	100	F720BJ473(1)300(2)	PHE820EB5470(1)(2)
0.068	BL/B06	7.5	14.5	18.0	15	5.5	100	F720BL683(1)300(2)	PHE820EB5680(1)(2)
0.10	BQ/B11	8.5	16.0	18.0	15	4.5	100	F720BQ104(1)300(2)	PHE820EB6100(1)(2)
0.10	DD/D13	6.5	14.5	26.0	22.5	4.5	100	F720DD104(1)300(2)	PHE820ED6100(1)(2)
0.15	DH/D14	8.0	16.0	26.0	22.5	3.9	100	F720DH154(1)300(2)	PHE820ED6150(1)(2)
0.22	DM/D15	9.0	18.5	26.0	22.5	2.7	100	F720DM224(1)300(2)	PHE820ED6220(1)(2)
0.33	DT/D16	11.0	21.5	26.0	22.5	2.5	100	F720DT334(1)300(2)	PHE820ED6330(1)(2)
0.33	FE/F11	10.5	20.5	31.5	27.5	2.4	100	F720FE334(1)300(2)	PHE820EF6330(1)(2)
0.47	FG/F12	11.5	22.5	31.5	27.5	1.9	100	F720FG474(1)300(2)	PHE820EF6470(1)(2)
0.68	FM/F13	14.5	24.5	31.5	27.5	1.6	100	F720FM684(1)300(2)	PHE820EF6680(1)(2)
1.0	FR/F14	17.5	28.0	31.5	27.5	1.3	100	F720FR105(1)300(2)	PHE820EF7100(1)(2)
1.5	RK/R02	16.5	32.0	41.0	37.5	0.75	100	F720RK155(1)300(2)	PHE820ER7150(1)(2)
2.2	RM/R03	19.0	36.0	41.0	37.5	0.65	100	F720RM225(1)300(2)	PHE820ER7220(1)(2)
Capacitance Value (µF)	Size Code (New/ Legacy)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) M = ±20%, K = ±10%, J = ±5% on request.
(2) Insert ordering code for lead type and packaging. See Ordering Options Table for available options.

Soldering Process

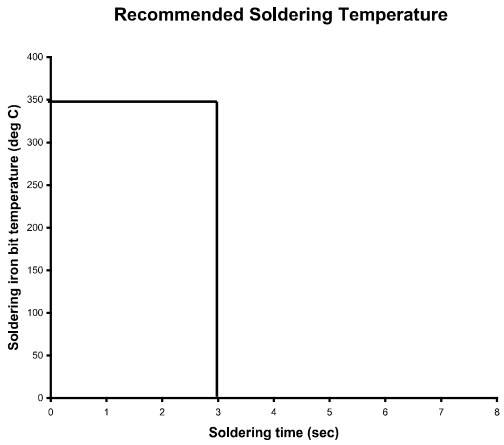
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

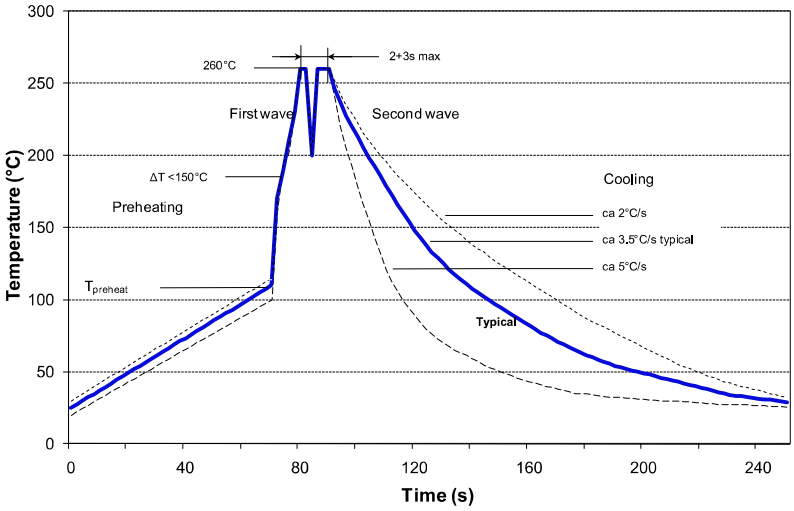
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

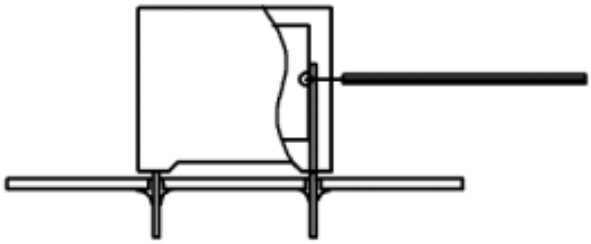
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



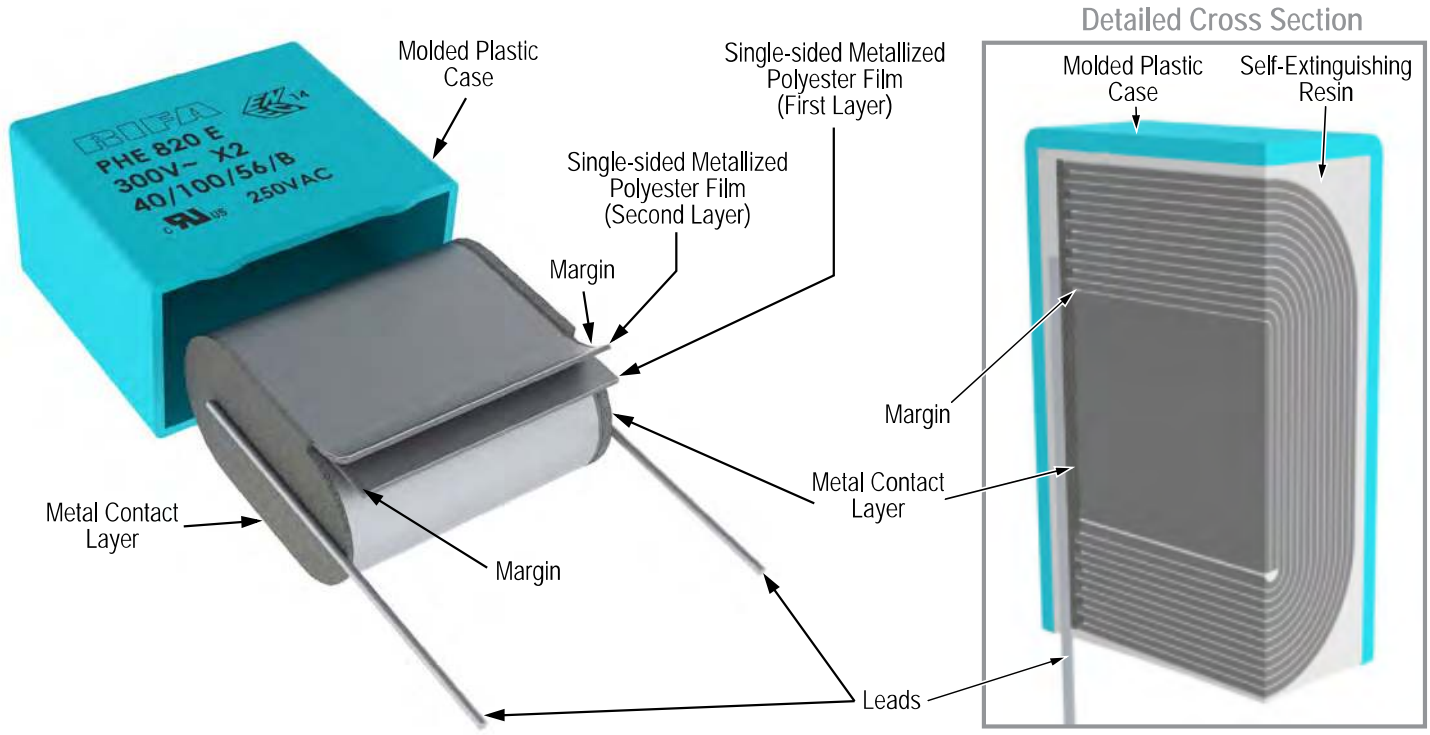
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

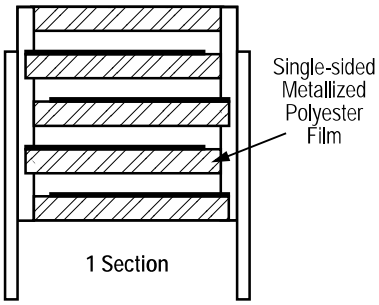
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

Construction



Winding Scheme



PME271M Series Metallized Impregnated Paper, Class X2, 275 VAC

Overview

The PME271M Series is constructed of multilayer metallized paper encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use in electromagnetic interference suppression in all X2 and across-the-line applications.

Benefits

- Approvals: ENEC, UL, cUL
- Rated voltage: 275 VAC 50/60 Hz
- Capacitance range: 0.001 - 0.6 µF
- Lead spacing: 10.2 – 25.4 mm
- Capacitance tolerance: M = ±20% (for C ≤ 0.1 µF), K = ±10% (for C > 0.1 µF)
- Climatic category: 40/110/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 2,150 VDC



Legacy Part Number System

PME271	M	(B)	610(0)	M	R30
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Capacitance Tolerance	Packaging
X2, Metallized Paper	M = 275	Blank = Standard A = 10.2 B = 15.2 D = 22.5	The last three digits represent significant figures. The first digit specifies the total number of digits.	M = ±20% (for C ≤ 0.1 µF) K = ±10% (for C > 0.1 µF)	See Ordering Options Table

New KEMET Part Number System

P	276	Q	E	104	M	275	A
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging
P = Paper	X2, Metallized Paper	H = 10.2 Q = 15.2 C = 20.3 S = 22.5 E = 25.4	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20% (for C ≤ 0.1 µF) K = ±10% (for C > 0.1 µF)	275 = 275	See Ordering Options Table

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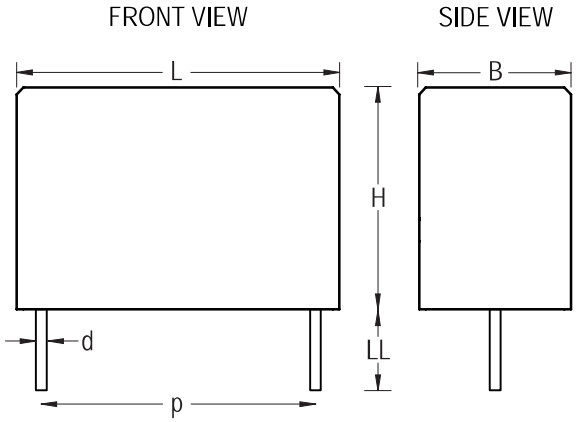
Benefits cont'd

- The highest possible safety regarding active and passive flammability
- Excellent self-healing properties ensure long life even when subjected to frequent over voltages
- Good resistance to ionization due to impregnated dielectric
- High dV/dt capability
- The impregnated paper ensures excellent stability and outstanding reliability properties, especially in applications with continuous operation

Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
10.2	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	P	R19T1
Native 10.2 formed to 7.5	Ammo Pack	H_0 = 16.5 +/-0.5	LAF3	R30XA
15.2	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	P	R19T1
20.3	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	P	R19T1
25.4	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30

Dimensions – Millimeters



Size Code	p		B		H		L		d	
	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
HE	10.2	+/-0.4	3.9	Maximum	7.5	Maximum	13.5	Maximum	0.6	+/-0.05
HH	10.2	+/-0.4	4.1	Maximum	8.2	Maximum	13.5	Maximum	0.6	+/-0.05
HL	10.2	+/-0.4	5.1	Maximum	10.5	Maximum	13.5	Maximum	0.6	+/-0.05
QE	15.2	+/-0.4	5.2	Maximum	10.5	Maximum	18.5	Maximum	0.8	+/-0.05
QL	15.2	+/-0.4	6	Maximum	12.5	Maximum	18.5	Maximum	0.8	+/-0.05
QP	15.2	+/-0.4	7.8	Maximum	13.5	Maximum	18.5	Maximum	0.8	+/-0.05
QS	15.2	+/-0.4	8.5	Maximum	14.3	Maximum	18.5	Maximum	0.8	+/-0.05
CE	20.3	+/-0.4	7.6	Maximum	14	Maximum	24	Maximum	0.8	+/-0.05
CJ	20.3	+/-0.4	9	Maximum	15	Maximum	24	Maximum	0.8	+/-0.05
CP	20.3	+/-0.4	11.3	Maximum	16.5	Maximum	24	Maximum	0.8	+/-0.05
SJ	22.5	+/-0.4	8	Maximum	17	Maximum	27	Maximum	0.8	+/-0.05
SP	22.5	+/-0.4	10	Maximum	19	Maximum	27	Maximum	0.8	+/-0.05
SU	22.5	+/-0.4	12	Maximum	22	Maximum	27	Maximum	0.8	+/-0.05
EG	25.4	+/-0.4	10.5	Maximum	17.3	Maximum	30.5	Maximum	1	+/-0.05
EJ	25.4	+/-0.4	12.1	Maximum	19	Maximum	30.5	Maximum	1	+/-0.05
EL	25.4	+/-0.4	15.3	Maximum	22	Maximum	30.5	Maximum	1	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Rated Voltage	275 VAC 50/60 Hz	
Capacitance Range	0.001 – 0.6 µF	
Capacitance Tolerance	±20%, ±10%, ±5% on request	
Temperature Range	-40°C to +110°C	
Climatic Category	40/110/56	
Approvals	ENEC, UL, cUL	
Dissipation Factor	Maximum Values at +23°C	
	1 kHz	1.3%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,150 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.	
Insulation Resistance	Minimum Values Between Terminals	
	C ≤ 0.33 µF	≥ 12,000 MΩ
	C > 0.33 µF	≥ 4,000 MΩ • µF
In DC Applications	Recommended voltage ≤ 630 VDC	

Environmental Test Data

Test	IEC Publication	Procedure
Endurance	EN/IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384–14	SE/0140–16C
	UL 1414 (up to 1 µF, 85°C, 250 VAC)	E73869
	CSA – C22.2 No. 1 (up to 1 µF, 85°C, 250 VAC)	E73869
	UL 1283 (310 VAC)	E100117

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Maximum Dimensions in mm			Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L					
0.001	3.9	7.5	13.5	10.2	53	1200	P276HE102M275(1)	PME271M410M(1)
0.0015	3.9	7.5	13.5	10.2	44	1200	P276HE152M275(1)	PME271M415M(1)
0.0022	3.9	7.5	13.5	10.2	37	1200	P276HE222M275(1)	PME271M422M(1)
0.0033	4.1	8.2	13.5	10.2	30	1200	P276HH332M275(1)	PME271M433M(1)
0.0047	5.1	10.5	13.5	10.2	24	1200	P276HL472M275(1)	PME271M447M(1)
0.0068	5.1	10.5	13.5	10.2	21	1200	P276HL682M275(1)	PME271MA4680M(1)
0.0068	5.2	10.5	18.5	15.2	19	1200	P276QE682M275(1)	PME271M468M(1)
0.010	5.2	10.5	18.5	15.2	16	1200	P276QE103M275(1)	PME271M510M(1)
0.015	5.2	10.5	18.5	15.2	13	1200	P276QE153M275(1)	PME271M515M(1)
0.022	6	12.5	18.5	15.2	10	1200	P276QL223M275(1)	PME271M522M(1)
0.033	6	12.5	18.5	15.2	8.4	1200	P276QL333M275(1)	PME271M533M(1)
0.047	6	12.5	18.5	15.2	7	1200	P276QL473M275(1)	PME271M547M(1)
0.068	7.8	13.5	18.5	15.2	5.6	1200	P276QP683M275(1)	PME271M568M(1)
0.1	8.5	14.3	18.5	15.2	4.3	1200	P276QS104M275(1)	PME271MB6100M(1)
0.1	7.6	14	24	20.3	4.1	600	P276CE104M275(1)	PME271M610M(1)
0.15	9	15	24	20.3	3.4	600	P276CJ154K275(1)	PME271M615K(1)
0.22	11.3	16.5	24	20.3	2.7	600	P276CP224K275(1)	PME271M622K(1)
0.1	8	17	27	22.5	3.9	600	P276SJ104M275(1)	PME271MD6100M(1)
0.15	8	17	27	22.5	3.3	600	P276SJ154K275(1)	PME271MD6150K(1)
0.22	10	19	27	22.5	2.6	600	P276SP224K275(1)	PME271MD6220K(1)
0.27	12	22	27	22.5	2.3	400	P276SU274K275(1)	PME271MD6270K(1)
0.33	12	22	27	22.5	2.1	400	P276SU334K275(1)	PME271MD6330K(1)
0.27	10.5	17.3	30.5	25.4	2.4	400	P276EG274K275(1)	PME271M627K(1)
0.33	12.1	19	30.5	25.4	2.1	400	P276EJ334K275(1)	PME271M633K(1)
0.47	15.3	22	30.5	25.4	1.8	400	P276EL474K275(1)	PME271M647K(1)
0.6	15.3	22	30.5	25.4	1.6	400	P276EL604K275(1)	PME271M660K(1)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) Insert ordering code for lead type and packaging. See Ordering Options Table for available options.

Soldering Process

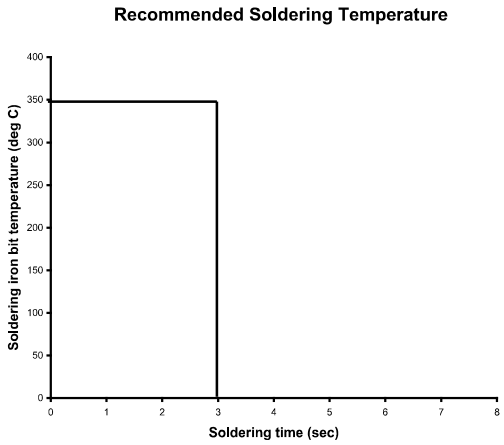
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

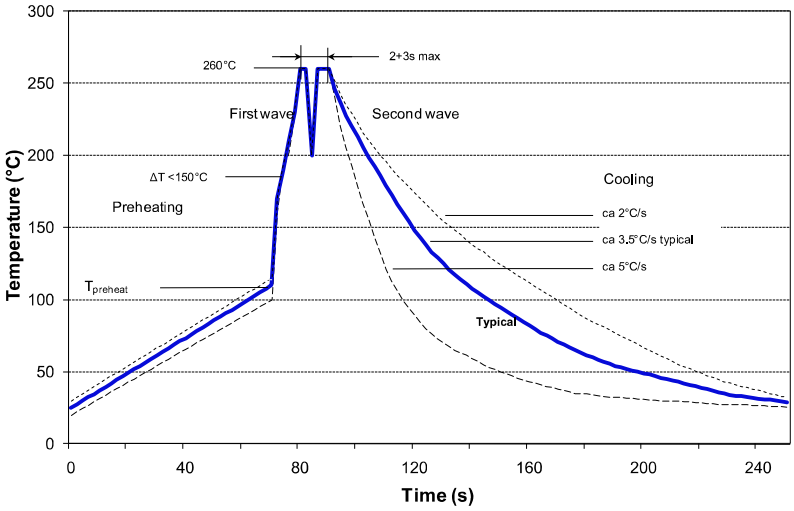
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

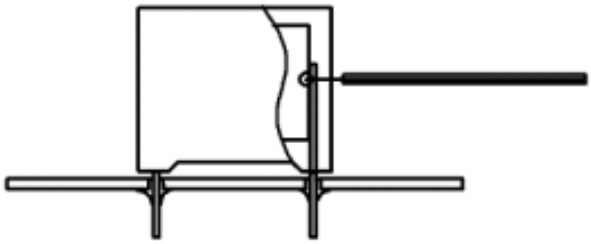
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



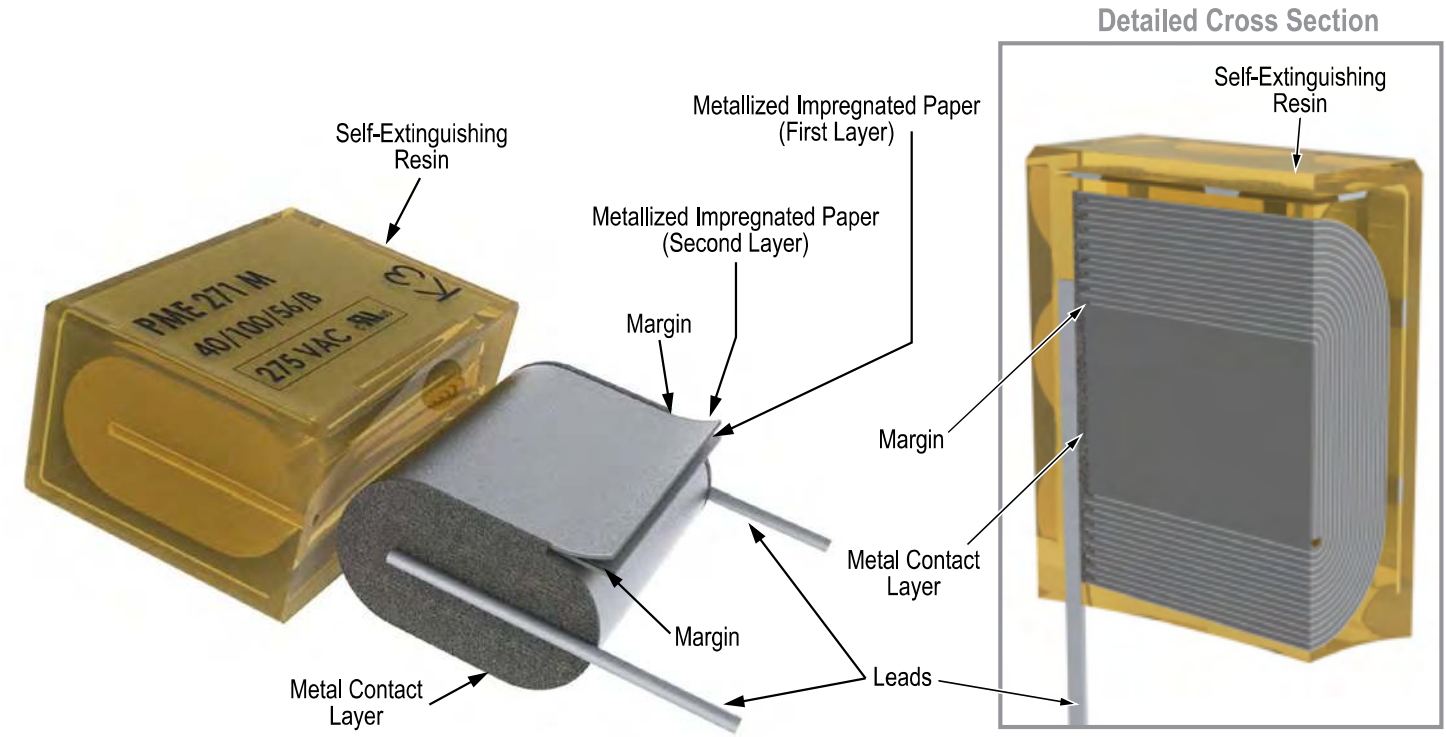
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

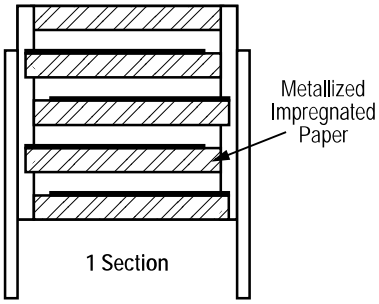
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

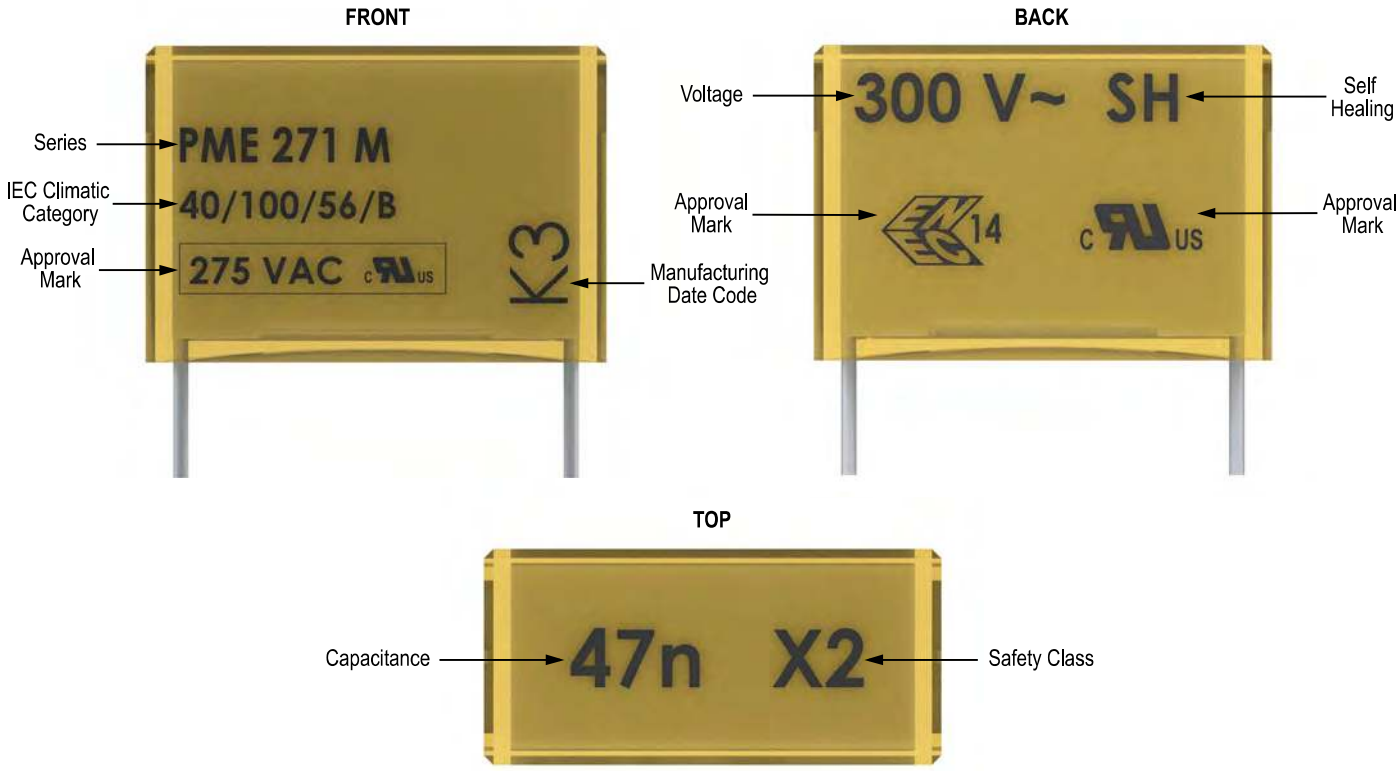
Construction



Winding Scheme



Marking


FRONT
Series
PME 271 M
IEC Climatic Category
40/100/56/B
Approval Mark
275 VAC
Manufacturing Date Code
BACK
Voltage
300 V~ SH
Self Healing
Approval Mark
14
Approval Mark
TOP
Capacitance
47n X2
Safety Class

Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 360 mm	Large Reel ø 500 mm	Ammo Formed
10.2	3.9	7.5	13.5	2000	1000	700	1400	800
	4.1	8.2	13.5	2000	1000	600		780
	5.1	10.5	13.5	1600	800	600	1200	630
15.2	5.5	12.5	18	1000	500	600		
	6.5	12.5	18	600	400	400		
	7.5	14.5	18	600	400	400		
	8.5	16	18	400	250	400		
	5.2	10.5	18.5	1000	500	600		
	5.5	11	18.5	1000	500	500		
	6	12.5	18.5	600	400	400		
	7.3	13	18.5	600	400	400	800	
	7.8	13.5	18.5	600	400	400		
	8.5	14.3	18.5	500	300	350		
20.3	7.6	14	24	1500	250	250	500	
	8.4	14	24	1200	200	250	500	
	9	15	24	1500	200	250		
	11.3	16.5	24	1000	150	180	400	
22.5	8	17	27	1200	200			
	10	19	27	1000	150	200		
	12	22	27	800	100	180	350	
25.4	10.6	16.1	30.5	1000	150			
	10.5	17.3	30.5	1000	100			
	12.1	19	30.5	800	100			
	15.3	22	30.5	600	75			

PME264 Series Metallized Impregnated Paper, Class X2, 660 VAC

Overview

The PME264 Series is constructed of multilayer metallized paper encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use in electromagnetic interference suppression in all X2 and across-the-line applications. These capacitors are also for use in high AC and DC voltage applications such as commutator capacitor in converters and ignition circuits.

Benefits

- Approvals: ENEC, UL, cUL
- Rated voltage: 660 VAC 50/60 Hz
- Capacitance range: 0.001 – 0.1 µF
- Lead spacing: 15.2 – 25.4 mm
- Capacitance tolerance: ±20%
- Climatic category: 40/85/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations



Legacy Part Number System

PME264	N	B	5100	M	R30
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Capacitance Tolerance	Packaging
X2, Metallized Paper	N = 660	B = 15.2 C = 20.3 E = 25.4	The last three digits represent significant figures. The first digit specifies the total number of digits.	M = ±20%	See Ordering Options Table

New KEMET Part Number System

P	264	Q	E	103	M	660	A
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging
P = Paper	X2, Metallized Paper	Q = 15.2 C = 20.3 E = 25.4	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20%	660 = 660	See Ordering Options Table

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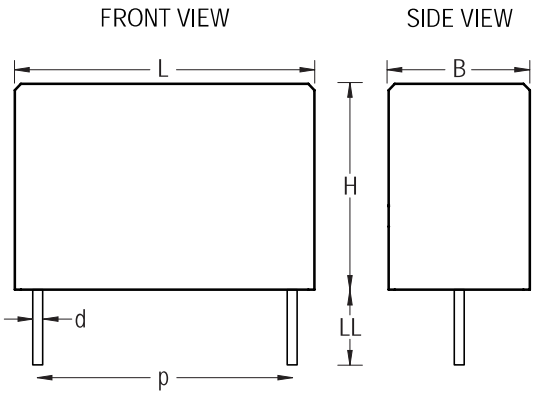
Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
15.2	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	P	R19T1
20.3	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
25.4	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30

Benefits cont'd

- Operating temperature range of -40˚C to +85˚C
- 100% screening factory test at 3,000 VDC
- The highest possible safety regarding active and passive flammability
- Excellent self-healing properties ensure long life even when subjected to frequent over-voltages
- Good resistance to ionization due to impregnated dielectric
- High dV/dt capability
- The impregnated paper ensures excellent stability and outstanding reliability properties, especially in applications with continuous operation

Dimensions – Millimeters



Size Code	p		B		H		L		d	
	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
QE	15.2	+/-0.4	5.2	Maximum	10.5	Maximum	18.5	Maximum	0.8	+/-0.05
QM	15.2	+/-0.4	7.3	Maximum	13	Maximum	18.5	Maximum	0.8	+/-0.05
CE	20.3	+/-0.4	7.6	Maximum	14	Maximum	24	Maximum	0.8	+/-0.05
CJ	20.3	+/-0.4	9	Maximum	15	Maximum	24	Maximum	0.8	+/-0.05
CP	20.3	+/-0.4	11.3	Maximum	16.5	Maximum	24	Maximum	0.8	+/-0.05
EF	25.4	+/-0.4	10.5	Maximum	17	Maximum	30.5	Maximum	1	+/-0.05
EJ	25.4	+/-0.4	12.1	Maximum	19	Maximum	30.5	Maximum	1	+/-0.05
EL	25.4	+/-0.4	15.3	Maximum	22	Maximum	30.5	Maximum	1	+/-0.05
Note: See Ordering Options Table for lead length (LL) options.										

Performance Characteristics

Rated Voltage	660 VAC 50/60 Hz	
Capacitance Range	0.001 – 0.1 µF	
Capacitance Tolerance	±20%	
Temperature Range	-40°C to +85°C	
Climatic Category	40/85/56	
Approvals	ENEC, UL, CUL	
Dissipation Factor	Maximum Values at +23°C	
	1 kHz	1.3%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 3,000 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.	
Insulation Resistance	Minimum Value Between Terminals	
	≥ 12,000 MΩ	
In DC Applications	Recommended voltage ≤ 1,500 VDC	

Environmental Test Data

Test	IEC Publication	Procedure
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	4,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	File Number
	SE/0140–25C
	E73869

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Maximum Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L				
0.001	5.2	10.5	18.5	15.2	2000	P264QE102M660(1)	PME264NB4100M(1)
0.0015	5.2	10.5	18.5	15.2	2000	P264QE152M660(1)	PME264NB4150M(1)
0.0022	5.2	10.5	18.5	15.2	2000	P264QE222M660(1)	PME264NB4220M(1)
0.0033	5.2	10.5	18.5	15.2	2000	P264QE332M660(1)	PME264NB4330M(1)
0.0047	5.2	10.5	18.5	15.2	2000	P264QE472M660(1)	PME264NB4470M(1)
0.0068	7.3	13	18.5	15.2	1400	P264QM682M660(1)	PME264NB4680M(1)
0.010	7.3	13	18.5	15.2	1400	P264QM103M660(1)	PME264NB5100M(1)
0.015	7.6	14	24	20.3	1400	P264CE153M660(1)	PME264NC5150M(1)
0.022	9	15	24	20.3	1400	P264CJ223M660(1)	PME264NC5220M(1)
0.033	11.3	16.5	24	20.3	1000	P264CP333M660(1)	PME264NC5330M(1)
0.047	10.5	17	30.5	25.4	1000	P264EF473M660(1)	PME264NE5470M(1)
0.068	12.1	19	30.5	25.4	1000	P264EJ683M660(1)	PME264NE5680M(1)
0.1	15.3	22	30.5	25.4	600	P264EL104M660(1)	PME264NE6100M(1)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) Insert ordering code for lead type and packaging. See Ordering Options Table for available options.

Soldering Process

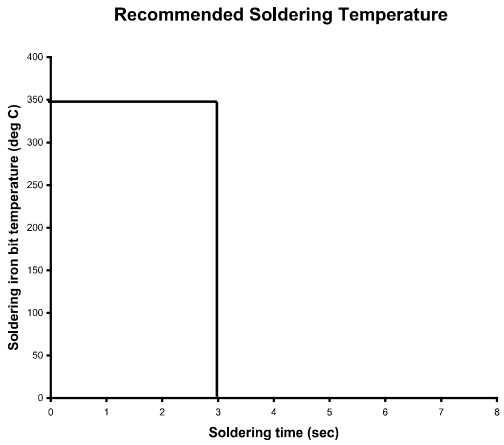
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

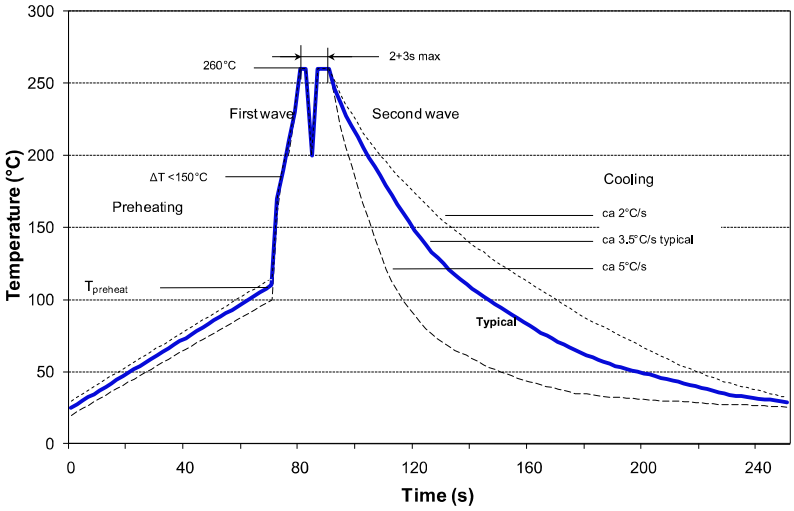
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

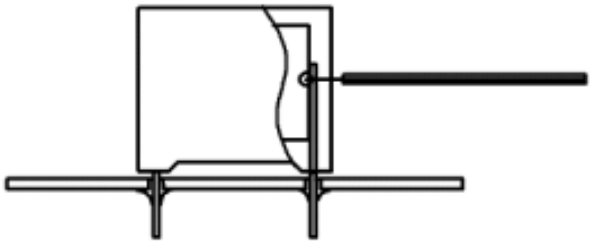
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



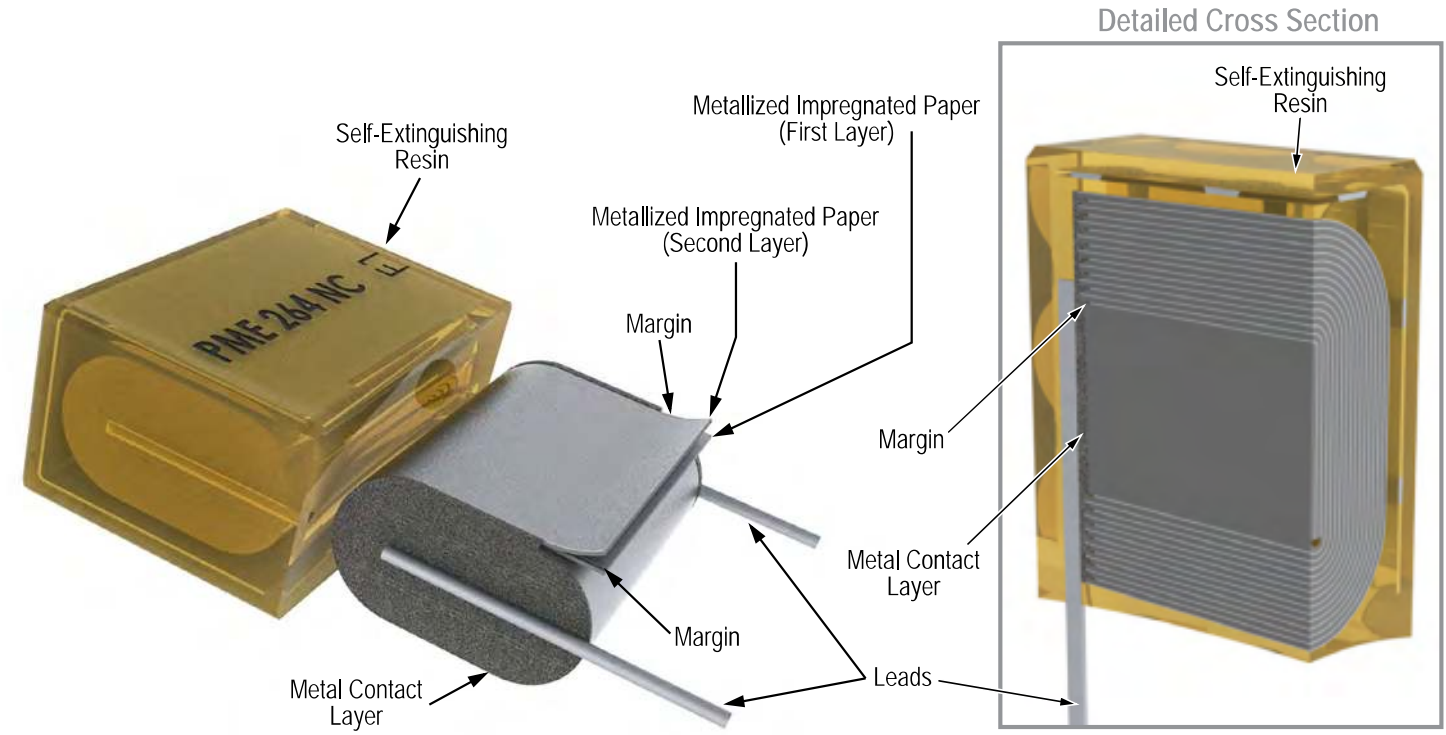
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

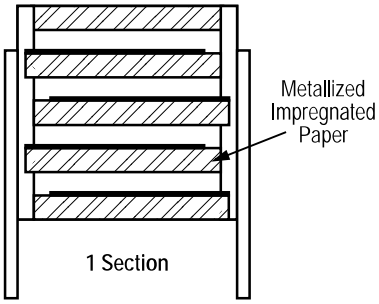
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

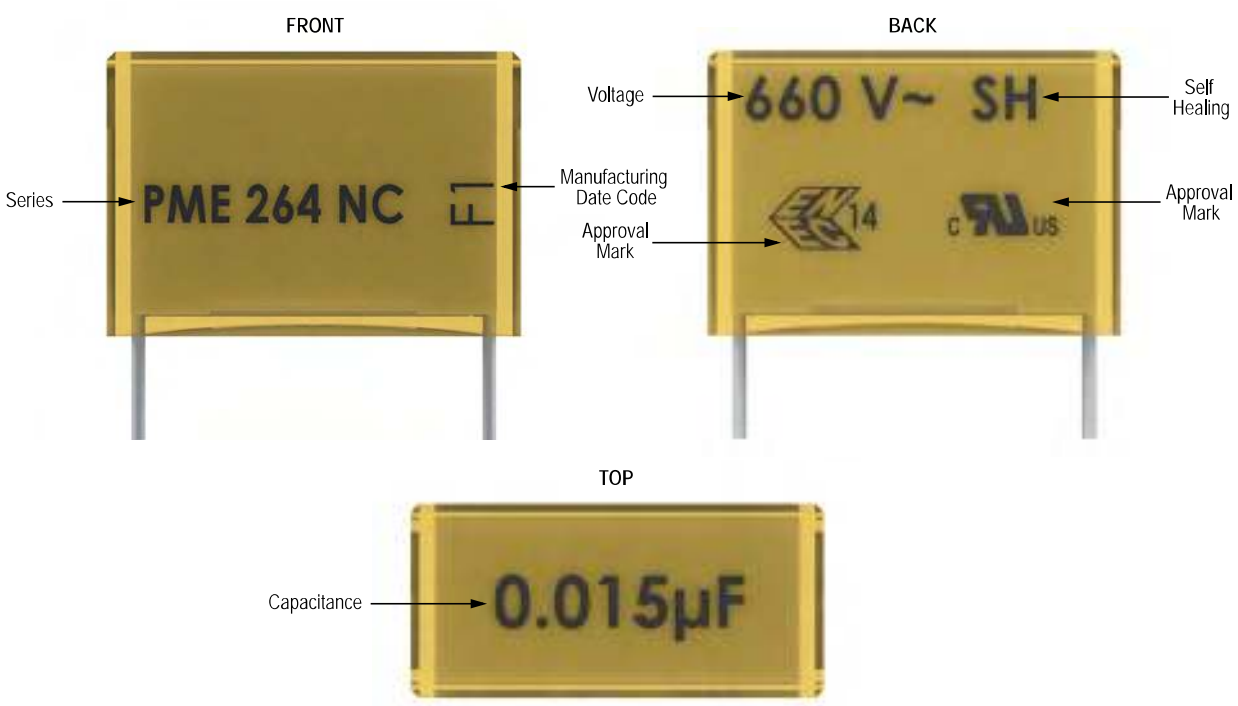
Construction



Winding Scheme



Marking



Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 360 mm	Large Reel ø 500 mm
15.2	5.5	12.5	18	1000	500	600	
	6.5	12.5	18	600	400	400	
	7.5	14.5	18	600	400	400	
	8.5	16	18	400	250	400	
	5.2	10.5	18.5	1000	500	600	
	5.5	11	18.5	1000	500	500	
	6	12.5	18.5	600	400	400	
	7.3	13	18.5	600	400	400	800
	7.8	13.5	18.5	600	400	400	
	8.5	14.3	18.5	500	300	350	
20.3	7.6	14	24	1500	250	250	500
	8.4	14	24	1200	200	250	500
	9	15	24	1500	200	250	
	11.3	16.5	24	1000	150	180	400
25.4	10.6	16.1	30.5	1000	150		
	10.5	17.3	30.5	1000	100		
	12.1	19	30.5	800	100		
	15.3	22	30.5	600	75		

F881 Series Metallized Polypropylene Film, Class Y2, 300 VAC

Overview

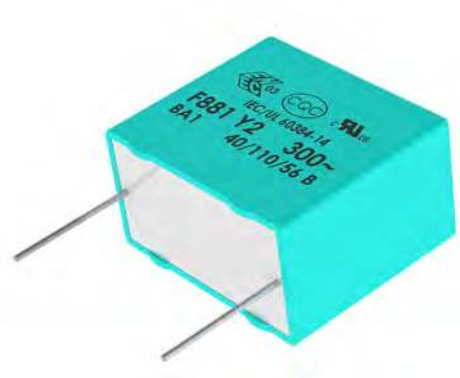
The F881 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material meeting the requirements of UL 94 V–0.

Applications

For worldwide use as electromagnetic interference (EMI) suppression in all "line to earth" applications requiring Y2 safety classification.

Benefits

- Approvals: ENEC, UL, cUL, CQC
- Rated voltage: 300 VAC 50/60 Hz
- Capacitance range: 0.001 – 1.0 µF
- Lead spacing: 7.5 – 37.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category: 40/110/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 4,000 VDC and 2,500 VAC



Part Number System

F	881	B	C	103	M	300	C
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Voltage (VAC)	Packaging
F = Film	Y2, Metallized Polypropylene	K = 7.5 A = 10 B = 15 D = 22.5 F = 27.5 R = 37.5	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	K = ±10% M = ±20%	300	See Ordering Options Table

Ordering Options Table

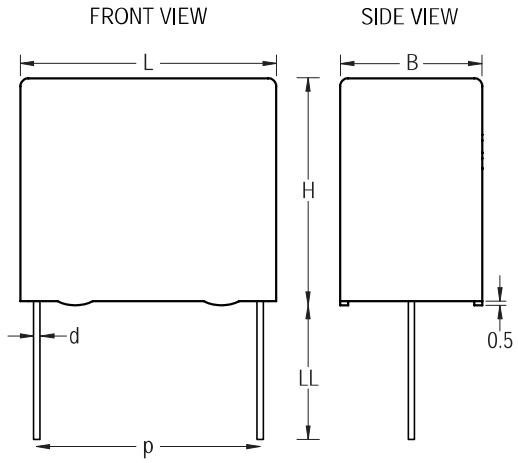
Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
7.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	C
	Bulk (Bag) – Long Leads	17 +0/-1	A
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L
	Other Lead and Packaging Options		
	Bulk (Bag) – Max Length Leads	20 +5/-0	ALL0L
	Ammo Pack	H_0 = 18.5 +/-0.5	R

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Ordering Options Table cont'd

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
10	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	C
	Bulk (Bag) – Long Leads	17 +0/-1	A
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L
	Other Lead and Packaging Options		
	Bulk (Bag) – Max Length Leads	20 +5/-0	ALL0L
	Ammo Pack	H_0 = 18.5 +/-0.5	R
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	P
15	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	C
	Bulk (Bag) – Long Leads	17 +0/-1	A
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L
	Pizza Pack	4 +2/-0	Z
	Other Lead and Packaging Options		
	Bulk (Bag) – Max Length Leads	25 +5/-0	ALR0L
	Ammo Pack	H_0 = 18.5 +/-0.5	R
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	P
22.5	Standard Lead and Packaging Options		
	Pizza – Long Leads	17 +0/-1	ZLH0J
	Pizza Pack	4 +2/-0	Z
	Other Lead and Packaging Options		
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	P
	Ammo Pack	H_0 = 18.5 +/-0.5	R
27.5	Standard Lead and Packaging Options		
	Pizza – Long Leads	17 +0/-1	ZLH0J
	Pizza Pack	4 +2/-0	Z
	Other Lead and Packaging Options		
	Bulk (Bag) – Long Leads	17 +0/-1	A
37.5	Standard Lead and Packaging Options		
	Pizza – Long Leads	17 +0/-1	ZLH0J
	Pizza Pack	4 +2/-0	Z

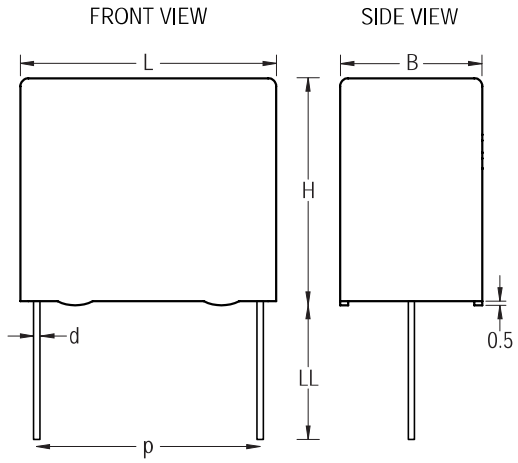
Dimensions – Millimeters



Size Code	Version	p		B		H		L		d	
		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
KF		7.5	+/-0.4	3	Maximum	8	Maximum	10	Maximum	0.6	+/-0.05
KG		7.5	+/-0.4	4	Maximum	8	Maximum	10	Maximum	0.6	+/-0.05
KH		7.5	+/-0.4	4	Maximum	9	Maximum	10	Maximum	0.6	+/-0.05
KJ		7.5	+/-0.4	5	Maximum	10.5	Maximum	10	Maximum	0.6	+/-0.05
KM		7.5	+/-0.4	6	Maximum	12	Maximum	10.5	Maximum	0.6	+/-0.05
AG		10.0	+/-0.4	4.0	Maximum	9.0	Maximum	13.0	Maximum	0.6	+/-0.05
AK		10.0	+/-0.4	5.0	Maximum	11.0	Maximum	13.0	Maximum	0.6	+/-0.05
AP		10.0	+/-0.4	6.0	Maximum	12.0	Maximum	13.0	Maximum	0.6	+/-0.05
AO		10.0	+/-0.4	7.0	Maximum	17.0	Maximum	13.0	Maximum	0.6	+/-0.05
AL	Low Profile	10.0	+/-0.4	9.5	Maximum	7.5	Maximum	13.0	Maximum	0.6	+/-0.05
AE	Special Version	10.0	+/-0.4	4.0	Maximum	8.0	Maximum	13.0	Maximum	0.6	+/-0.05
BB		15.0	+/-0.4	4.0	Maximum	10.0	Maximum	18.0	Maximum	0.8	+/-0.05
BC		15.0	+/-0.4	5.0	Maximum	11.0	Maximum	18.0	Maximum	0.8	+/-0.05
BE		15.0	+/-0.4	5.5	Maximum	12.5	Maximum	18.0	Maximum	0.8	+/-0.05
BG		15.0	+/-0.4	6.0	Maximum	12.0	Maximum	18.0	Maximum	0.8	+/-0.05
BI	High Profile	15.0	+/-0.4	6.0	Maximum	17.5	Maximum	18.0	Maximum	0.8	+/-0.05
BK		15.0	+/-0.4	7.5	Maximum	13.5	Maximum	18.0	Maximum	0.8	+/-0.05
BO	High Profile	15.0	+/-0.4	7.5	Maximum	18.5	Maximum	18.0	Maximum	0.8	+/-0.05
BP		15.0	+/-0.4	8.5	Maximum	14.5	Maximum	18.0	Maximum	0.8	+/-0.05
BT		15.0	+/-0.4	9.0	Maximum	12.5	Maximum	18.0	Maximum	0.8	+/-0.05
BS		15.0	+/-0.4	10.0	Maximum	16.0	Maximum	18.0	Maximum	0.8	+/-0.05
BY		15.0	+/-0.4	11.0	Maximum	19.0	Maximum	18.0	Maximum	0.8	+/-0.05
BZ	Special Version	15.0	+/-0.4	12.0	Maximum	20.0	Maximum	18.0	Maximum	0.8	+/-0.05
BR	Low Profile	15.0	+/-0.4	13.0	Maximum	12.0	Maximum	18.0	Maximum	0.8	+/-0.05
DB		22.5	+/-0.4	6.0	Maximum	14.5	Maximum	26.0	Maximum	0.8	+/-0.05
DI		22.5	+/-0.4	7.0	Maximum	16.0	Maximum	26.0	Maximum	0.8	+/-0.05
DH		22.5	+/-0.4	8.0	Maximum	16.0	Maximum	26.0	Maximum	0.8	+/-0.05
DJ		22.5	+/-0.4	8.5	Maximum	17.0	Maximum	26.0	Maximum	0.8	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Dimensions – Millimeters cont'd



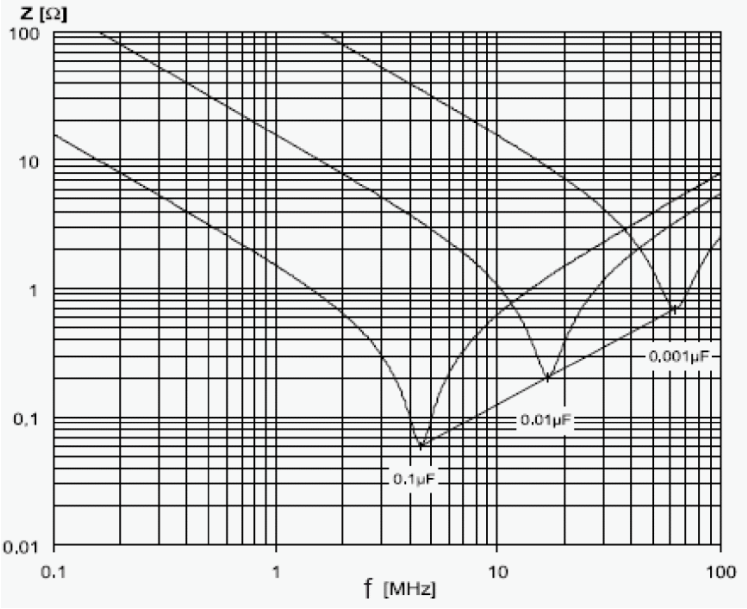
Size Code	Version	p		B		H		L		d	
		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
DM		22.5	+/-0.4	9.0	Maximum	18.5	Maximum	26.0	Maximum	0.8	+/-0.05
DO		22.5	+/-0.4	10.0	Maximum	18.5	Maximum	26.0	Maximum	0.8	+/-0.05
DP		22.5	+/-0.4	11.0	Maximum	20.0	Maximum	26.0	Maximum	0.8	+/-0.05
DU		22.5	+/-0.4	13.0	Maximum	22.0	Maximum	26.0	Maximum	0.8	+/-0.05
DY		22.5	+/-0.4	15.5	Maximum	24.5	Maximum	26.0	Maximum	0.8	+/-0.05
FB		27.5	+/-0.4	9.0	Maximum	17.0	Maximum	31.5	Maximum	0.8	+/-0.05
FC		27.5	+/-0.4	11.0	Maximum	20.0	Maximum	31.5	Maximum	0.8	+/-0.05
FI		27.5	+/-0.4	13.0	Maximum	25.0	Maximum	31.5	Maximum	0.8	+/-0.05
FN		27.5	+/-0.4	14.0	Maximum	28.0	Maximum	31.5	Maximum	0.8	+/-0.05
FO	High Profile	27.5	+/-0.4	17.0	Maximum	40.0	Maximum	31.5	Maximum	0.8	+/-0.05
FR		27.5	+/-0.4	17.5	Maximum	28.0	Maximum	31.5	Maximum	0.8	+/-0.05
FS		27.5	+/-0.4	19.0	Maximum	29.0	Maximum	31.5	Maximum	0.8	+/-0.05
FY		27.5	+/-0.4	22.0	Maximum	37.0	Maximum	31.5	Maximum	0.8	+/-0.05
FH	Low Profile	27.5	+/-0.4	21.0	Maximum	12.5	Maximum	31.5	Maximum	0.8	+/-0.05
FQ	Low Profile	27.5	+/-0.4	27.5	Maximum	16.0	Maximum	31.5	Maximum	0.8	+/-0.05
FT	Low Profile	27.5	+/-0.4	31.0	Maximum	19.0	Maximum	31.5	Maximum	0.8	+/-0.05
RB		37.5	+/-0.4	11.0	Maximum	22.0	Maximum	41.0	Maximum	1	+/-0.05
RF		37.5	+/-0.4	13.0	Maximum	24.0	Maximum	41.0	Maximum	1	+/-0.05
RH		37.5	+/-0.4	15.0	Maximum	26.0	Maximum	41.0	Maximum	1	+/-0.05
RC		37.5	+/-0.4	16.0	Maximum	28.5	Maximum	41.0	Maximum	1	+/-0.05
RD		37.5	+/-0.4	19.0	Maximum	32.0	Maximum	41.0	Maximum	1	+/-0.05
RP		37.5	+/-0.4	21.0	Maximum	38.0	Maximum	41.0	Maximum	1	+/-0.05
RO		37.5	+/-0.4	24.0	Maximum	44.0	Maximum	41.0	Maximum	1	+/-0.05
RU		37.5	+/-0.4	30.0	Maximum	45.0	Maximum	41.0	Maximum	1	+/-0.05
RV	Low Profile	37.5	+/-0.4	24.0	Maximum	15.0	Maximum	41.0	Maximum	1	+/-0.05
RW	Low Profile	37.5	+/-0.4	24.0	Maximum	19.0	Maximum	41.0	Maximum	1	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Rated Voltage	300 VAC 50/60 Hz		
Capacitance Range	0.001 – 1.0 µF		
Capacitance Tolerance	±20%, ±10%		
Temperature Range	-40°C to +110°C		
Climatic Category	40/110/56		
Approvals	ENEC, UL, cUL, CQC		
Dissipation Factor	Maximum Values at +23°C		
		C ≤ 0.1 µF	C > 0.1 µF
	1 kHz	0.3%	0.2%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 4,000 VDC and 2,500 VAC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.		
Insulation Resistance	Minimum Values Between Terminals		
	C ≤ 0.33 µF	≥ 30,000 MΩ	
	C > 0.33 µF	≥ 10,000 MΩ • µF	
In DC Applications	Recommended voltage ≤ 1,000 VDC		

Impedance Graph



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	IEC 60384–14	1.7 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384–14	CA08.00185
	UL 60384–14 and CAN/CSA–E60384–14	E97797
	IEC 60384–14	CQC12001081968 CQC12001081972 CQC12001081971 CQC12001081970 CQC12001084226 CQC12001088067

Environmental Compliance

All new KEMET EMI capacitors are RoHS Compliant and Halogen Free.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Size Code	Maximum Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	Part Number
		B	H	L			
0.001	KF	3	8	10	7.5	800	F881KF102(1)300(2)
0.0012	KG	4	8	10	7.5	800	F881KG122(1)300(2)
0.0015	KG	4	8	10	7.5	800	F881KG152(1)300(2)
0.0018	KH	4	9	10	7.5	800	F881KH182(1)300(2)
0.0022	KH	4	9	10	7.5	800	F881KH222(3)300(2)
0.0025	KJ	5	10.5	10	7.5	800	F881KJ252(1)300(2)
0.0027	KJ	5	10.5	10	7.5	800	F881KJ272(1)300(2)
0.0033	KJ	5	10.5	10	7.5	800	F881KJ332(1)300(2)
0.0039	KJ	5	10.5	10	7.5	800	F881KJ392(3)300(2)
0.0039	KM	6	12	10.5	7.5	800	F881KM392(1)300(2)
0.0047	KM	6	12	10.5	7.5	800	F881KM472(1)300(2)
0.0056	KM	6	12	10.5	7.5	800	F881KM562(3)300(2)
0.001	AE	4	8	13	10	800	F881AE102(1)300(2)
0.0012	AE	4	8	13	10	800	F881AE122(1)300(2)
0.0015	AE	4	8	13	10	800	F881AE152(1)300(2)
0.0018	AE	4	8	13	10	800	F881AE182(1)300(2)
0.0018	AL	9.5	7.5	13	10	800	F881AL182(1)300(2)
0.0022	AE	4	8	13	10	800	F881AE222(1)300(2)
0.0022	AL	9.5	7.5	13	10	800	F881AL222(1)300(2)
0.0025	AG	4	9	13	10	800	F881AG252(1)300(2)
0.0025	AL	9.5	7.5	13	10	800	F881AL252(1)300(2)
0.0027	AG	4	9	13	10	800	F881AG272(1)300(2)
0.0027	AL	9.5	7.5	13	10	800	F881AL272(1)300(2)
0.0033	AK	5	11	13	10	800	F881AK332(1)300(2)
0.0033	AL	9.5	7.5	13	10	800	F881AL332(1)300(2)
0.0039	AK	5	11	13	10	800	F881AK392(1)300(2)
0.0039	AL	9.5	7.5	13	10	800	F881AL392(1)300(2)
0.0047	AK	5	11	13	10	800	F881AK472(3)300(2)
0.0047	AL	9.5	7.5	13	10	800	F881AL472(1)300(2)
0.0056	AL	9.5	7.5	13	10	800	F881AL562(1)300(2)
0.0056	AP	6	12	13	10	800	F881AP562(1)300(2)
0.0068	AL	9.5	7.5	13	10	800	F881AL682(3)300(2)
0.0068	AP	6	12	13	10	800	F881AP682(1)300(2)
0.0082	AO	7	17	13	10	800	F881AO822(1)300(2)
0.01	AO	7	17	13	10	800	F881AO103(1)300(2)
0.0027	BB	4	10	18	15	600	F881BB272(1)300(2)
0.0033	BB	4	10	18	15	600	F881BB332(1)300(2)
0.0039	BB	4	10	18	15	600	F881BB392(1)300(2)
0.0047	BB	4	10	18	15	600	F881BB472(1)300(2)
0.0056	BB	4	10	18	15	600	F881BB562(1)300(2)
0.0068	BB	4	10	18	15	600	F881BB682(1)300(2)
0.0082	BB	4	10	18	15	600	F881BB822(1)300(2)
0.01	BB	4	10	18	15	600	F881BB103(3)300(2)
0.01	BC	5	11	18	15	600	F881BC103(1)300(2)
0.012	BC	5	11	18	15	600	F881BC123(1)300(2)
0.015	BC	5	11	18	15	600	F881BC153(3)300(2)
0.015	BE	5.5	12.5	18	15	600	F881BE153(1)300(2)
0.015	BT	9	12.5	18	15	600	F881BT153(1)300(2)
0.018	BE	5.5	12.5	18	15	600	F881BE183(1)300(2)
0.018	BT	9	12.5	18	15	600	F881BT183(1)300(2)
0.022	BG	6	12	18	15	600	F881BG223(3)300(2)
0.022	BT	9	12.5	18	15	600	F881BT223(1)300(2)
0.025	BI	6	17.5	18	15	600	F881BI253(3)300(2)
0.025	BK	7.5	13.5	18	15	600	F881BK253(1)300(2)
0.025	BR	13	12	18	15	600	F881BR253(1)300(2)
0.025	BT	9	12.5	18	15	600	F881BT253(1)300(2)
0.027	BI	6	17.5	18	15	600	F881BI273(1)300(2)
0.027	BK	7.5	13.5	18	15	600	F881BK273(1)300(2)
0.027	BR	13	12	18	15	600	F881BR273(1)300(2)
Capacitance Value (µF)	Size Code	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	Part Number

(1) M = ±20%, K = ±10%.

(2) Insert lead and packaging code. See Ordering Options Table for available options.

(3) M = ±20% (only available tolerance).

Table 1 – Ratings & Part Number Reference cont'd

Capacitance Value (µF)	Size Code	Maximum Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	Part Number
		B	H	L			
0.027	BT	9	12.5	18	15	600	F881BT273(1)300(2)
0.033	BI	6	17.5	18	15	600	F881BI333(1)300(2)
0.033	BO	7.5	18.5	18	15	600	F881BO333(1)300(2)
0.033	BR	13	12	18	15	600	F881BR333(1)300(2)
0.033	BT	9	12.5	18	15	600	F881BT333(1)300(2)
0.039	BI	6	17.5	18	15	600	F881BI393(3)300(2)
0.039	BO	7.5	18.5	18	15	600	F881BO393(1)300(2)
0.039	BP	8.5	14.5	18	15	600	F881BP393(1)300(2)
0.039	BR	13	12	18	15	600	F881BR393(1)300(2)
0.039	BT	9	12.5	18	15	600	F881BT393(3)300(2)
0.047	BO	7.5	18.5	18	15	600	F881BO473(1)300(2)
0.047	BP	8.5	14.5	18	15	600	F881BP473(3)300(2)
0.047	BR	13	12	18	15	600	F881BR473(1)300(2)
0.047	BS	10	16	18	15	600	F881BS473(1)300(2)
0.056	BO	7.5	18.5	18	15	600	F881BO563(3)300(2)
0.056	BR	13	12	18	15	600	F881BR563(3)300(2)
0.056	BS	10	16	18	15	600	F881BS563(1)300(2)
0.068	BY	11	19	18	15	600	F881BY683(1)300(2)
0.082	BY	11	19	18	15	600	F881BY823(3)300(2)
0.082	BZ	12	20	18	15	600	F881BZ823(1)300(2)
0.039	DB	6	14.5	26	22.5	500	F881DB393(1)300(2)
0.047	DB	6	14.5	26	22.5	500	F881DB473(1)300(2)
0.056	DB	6	14.5	26	22.5	500	F881DB563(3)300(2)
0.056	DI	7	16	26	22.5	500	F881DI563(1)300(2)
0.068	DI	7	16	26	22.5	500	F881DI683(1)300(2)
0.082	DH	8	16	26	22.5	500	F881DH823(1)300(2)
0.082	DI	7	16	26	22.5	500	F881DI823(3)300(2)
0.1	DH	8	16	26	22.5	500	F881DH104(3)300(2)
0.1	DJ	8.5	17	26	22.5	500	F881DJ104(1)300(2)
0.12	DJ	8.5	17	26	22.5	500	F881DJ124(3)300(2)
0.12	DM	9	18.5	26	22.5	500	F881DM124(1)300(2)
0.15	DO	10	18.5	26	22.5	500	F881DO154(1)300(2)
0.18	DP	11	20	26	22.5	500	F881DP184(1)300(2)
0.22	DP	11	20	26	22.5	500	F881DP224(3)300(2)
0.22	DU	13	22	26	22.5	500	F881DU224(1)300(2)
0.25	DU	13	22	26	22.5	500	F881DU254(1)300(2)
0.27	DU	13	22	26	22.5	500	F881DU274(1)300(2)
0.33	DY	15.5	24.5	26	22.5	500	F881DY334(1)300(2)
0.39	DY	15.5	24.5	26	22.5	500	F881DY394(1)300(2)
0.1	FB	9	17	31.5	27.5	400	F881FB104(1)300(2)
0.12	FB	9	17	31.5	27.5	400	F881FB124(1)300(2)
0.15	FB	9	17	31.5	27.5	400	F881FB154(1)300(2)
0.18	FC	11	20	31.5	27.5	400	F881FC184(1)300(2)
0.22	FC	11	20	31.5	27.5	400	F881FC224(1)300(2)
0.22	FH	21	12.5	31.5	27.5	400	F881FH224(1)300(2)
0.25	FC	11	20	31.5	27.5	400	F881FC254(3)300(2)
0.25	FH	21	12.5	31.5	27.5	400	F881FH254(1)300(2)
0.27	FC	11	20	31.5	27.5	400	F881FC274(3)300(2)
0.27	FH	21	12.5	31.5	27.5	400	F881FH274(1)300(2)
0.27	FI	13	25	31.5	27.5	400	F881FI274(1)300(2)
0.33	FH	21	12.5	31.5	27.5	400	F881FH334(3)300(2)
0.33	FI	13	25	31.5	27.5	400	F881FI334(1)300(2)
0.39	FI	13	25	31.5	27.5	400	F881FI394(1)300(2)
0.39	FQ	27.5	16	31.5	27.5	400	F881FQ394(1)300(2)
0.47	FR	17.5	28	31.5	27.5	400	F881FR474(1)300(2)
0.47	FQ	27.5	16	31.5	27.5	400	F881FQ474(1)300(2)
0.56	FN	14	28	31.5	27.5	400	F881FN564(1)300(2)
0.56	FR	17.5	28	31.5	27.5	400	F881FR564(1)300(2)
0.56	FT	31	19	31.5	27.5	400	F881FT564(1)300(2)
Capacitance Value (µF)	Size Code	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	Part Number

(1) M = ±20%, K = ±10%.
(2) Insert lead and packaging code. See Ordering Options Table for available options.
(3) M = ±20% (only available tolerance).

Table 1 – Ratings & Part Number Reference cont'd

Capacitance Value (µF)	Size Code	Maximum Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	Part Number
		B	H	L			
0.68	FO	17	40	31.5	27.5	400	F881FO684(1)300(2)
0.68	FR	17.5	28	31.5	27.5	400	F881FR684(1)300(2)
0.68	FT	31	19	31.5	27.5	400	F881FT684(1)300(2)
0.82	FO	17	40	31.5	27.5	400	F881FO824(1)300(2)
0.82	FT	31	19	31.5	27.5	400	F881FT824(3)300(2)
0.82	FY	22	37	31.5	27.5	400	F881FY824(1)300(2)
1	FY	22	37	31.5	27.5	400	F881FY105(1)300(2)
0.33	RB	11	22	41	37.5	300	F881RB334(1)300(2)
0.39	RB	11	22	41	37.5	300	F881RB394(1)300(2)
0.47	RF	13	24	41	37.5	300	F881RF474(1)300(2)
0.47	RV	24	15	41	37.5	300	F881RV474(1)300(2)
0.56	RH	15	26	41	37.5	300	F881RH564(1)300(2)
0.56	RV	24	15	41	37.5	300	F881RV564(1)300(2)
0.68	RH	15	26	41	37.5	300	F881RH684(1)300(2)
0.68	RW	24	19	41	37.5	300	F881RW684(1)300(2)
0.82	RH	15	26	41	37.5	300	F881RH824(1)300(2)
0.82	RW	24	19	41	37.5	300	F881RW824(1)300(2)
1	RD	19	32	41	37.5	300	F881RD105(1)300(2)
1	RW	24	19	41	37.5	300	F881RW105(1)300(2)
Capacitance Value (µF)	Size Code	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	Part Number

(1) M = ±20%, K = ±10%.
(2) Insert lead and packaging code. See Ordering Options Table for available options.
(3) M = ±20% (only available tolerance).

Soldering Process

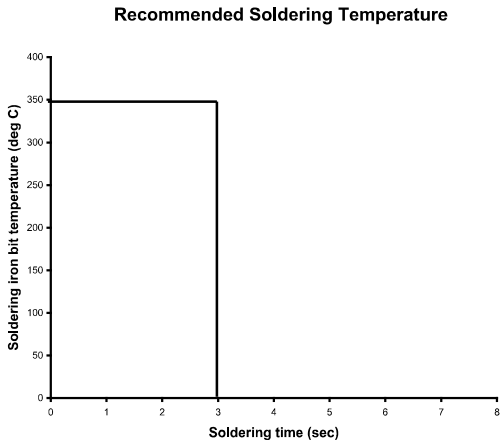
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

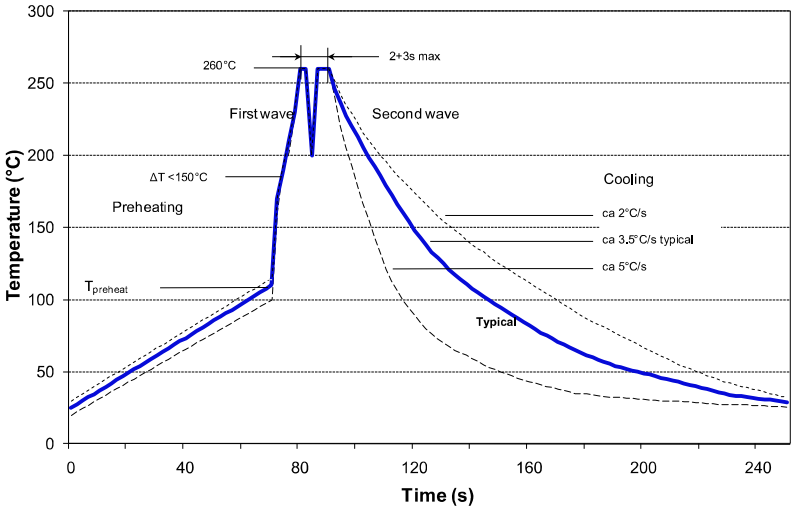
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

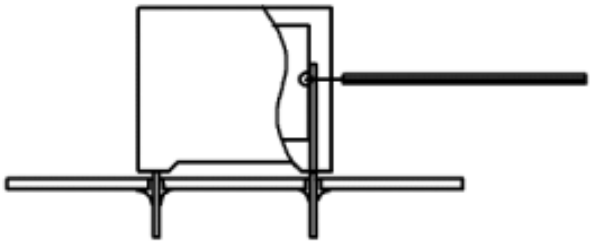
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



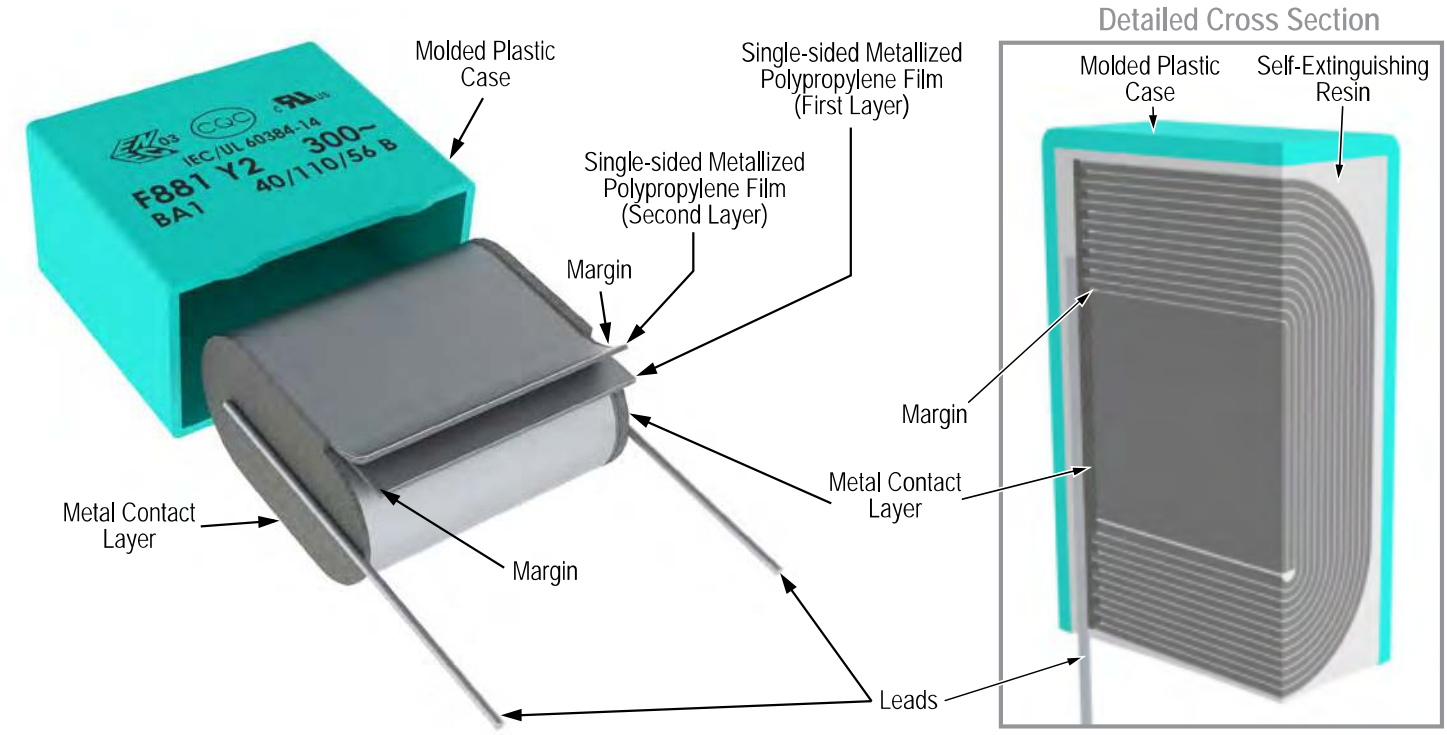
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

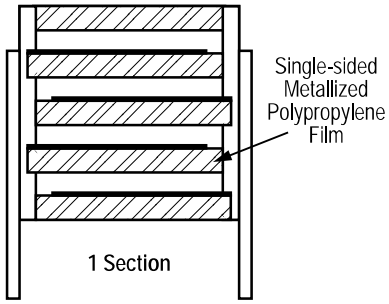
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

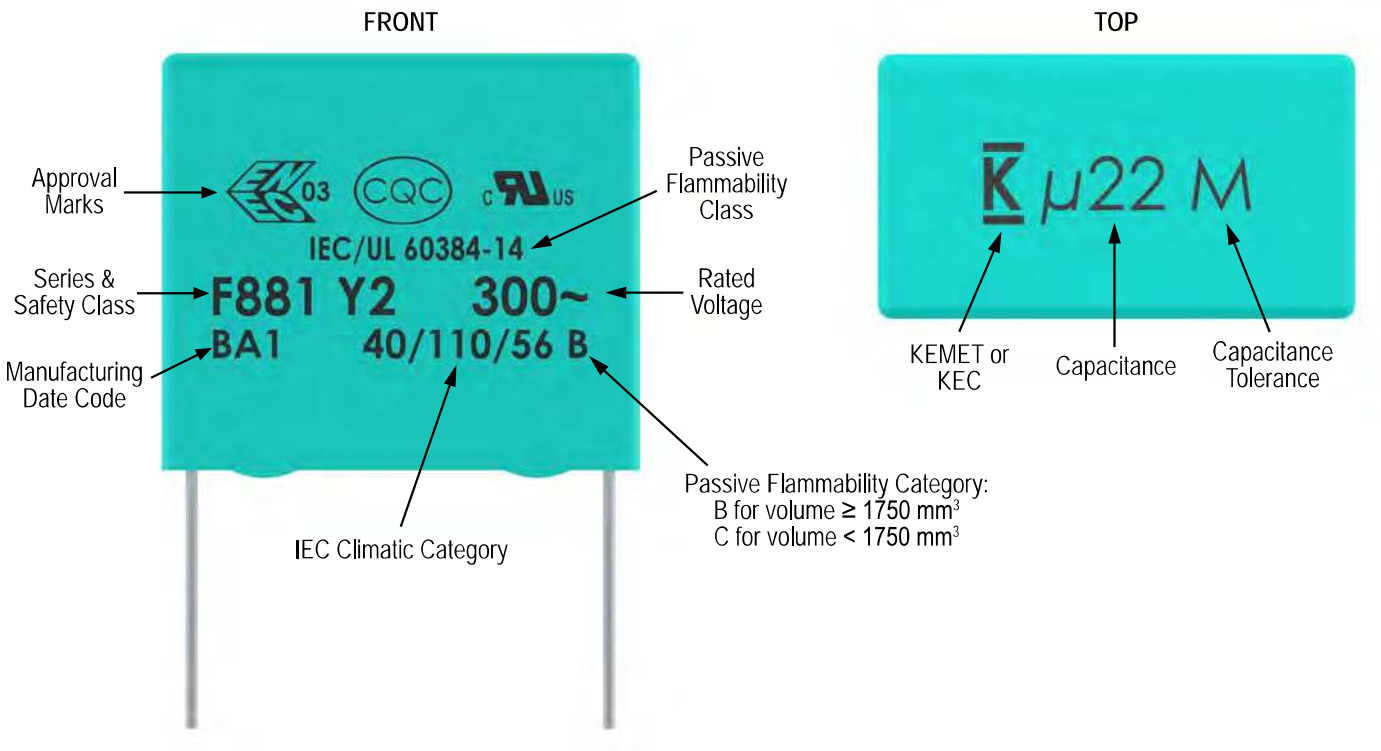
Construction



Winding Scheme



Marking


FRONT
TOP
Approval Marks
03
CQC
c US
IEC/UL 60384-14
Passive Flammability Class
Series & Safety Class
F881 Y2
300~
Rated Voltage
Manufacturing Date Code
BA1
40/110/56 B
IEC Climatic Category
Passive Flammability Category:
B for volume ≥ 1750 mm³
C for volume < 1750 mm³
K µ22 M
KEMET or KEC
Capacitance
Capacitance Tolerance

Packaging Quantities

Size Code	Lead Spacing	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo	Pizza
KE	7.5	2.5	6	10	2000	2500	2500		3500	
KF		3	8	10	1500	1750	2100		2800	
KG		4	8	10	2000	1500	1500		2100	
KJ		5	10.5	10	1500	1000	1200		1600	
KM		6	12	10.5	1000	800	1000		1350	
KH		4	9	10	2000	1500	1500		2100	
AN	10	3.5	9	13	2000	2200	850	1700	1150	
AG		4	9	13	2000	2200	750	1500	1000	
AK		5	11	13	1300	2000	600	1250	800	
AP		6	12	13	1000	1800	500	1000	680	
AO		7	17	13	600	700	450	900	580	
AL		9.5	7.5	13	1000	1500	300	600	430	
AE		4	8	13	2000	2200	750	1500	1000	
BB	15	4	10	18	2500	1500	750	1500	1000	1411
BC		5	11	18	1000	1250	600	1250	800	1139
BE		5.5	12.5	18	800	1000	550	1100	750	1020
BG		6	12	18	1750	1000	500	1000	680	935
BK		7.5	13.5	18	1000	800	350	800	500	748
BI		6	17.5	18	1000	800	500	1000	680	935
BP		8.5	14.5	18	1000	650	300	700	440	663
BT		9	12.5	18	1000	700	270	650	410	629
BO		7.5	18.5	18	900	500	350	800	500	748
BS		10	16	18	750	550	300	600	380	561
BR		13	12	18	750	520	200	480	280	425
BY		11	19	18	450	400	250	500	340	510
BA		8.5	12.5	18	1000	650	300	700	440	663
BZ		12	20	18	350	300	220	450	330	459
DB	22.5	6	14.5	26	805	450	300	700	464	660
DI		7	16	26	700	450	250	550	380	564
DH		8.0	16.0	26	520	300	240	500	330	492
DJ		8.5	17	26	450	350	250	450	280	468
DM		9	18.5	26	400	225	200	400	300	444
DO		10	18.5	26	360	350	160	350	235	396
DP		11	20	26	300	200	190	350	217	360
DU		13	22	26	230	150	150	300	200	300
DY		15.5	24.5	26	150	100	120	250	170	252

Metallized Polypropylene Film EMI Suppression Capacitors

R41 Series, Class Y2, 300 VAC, 110ºC (Automotive Grade)

Electronic Components
KEMET
CHARGED.

Overview

The R41 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material meeting the requirements of UL 94 V–0.

Automotive Grade devices are available (up to 22.5 mm Lead Spacing) and meet the demanding Automotive Electronics Council's AEC–Q200 qualification requirements.

Applications

For use in electromagnetic interference (EMI) suppression filter in "line-to-ground" and "across-the-line" applications requiring Y2 / X1 safety classification. Suitable for use in situations where failure of the capacitor could lead to danger of electric shock. Not for use in "series with mains" type applications.

Benefits

- Approvals: ENEC, UL, cUL, CQC
- Class Y2 / X1 (IEC 60384-14)
- Rated voltage: 300 VAC 50/60 Hz
- Capacitance range: 0.001 – 1 µF
- Lead spacing: 10 – 37.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category: 40/110/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 5,000 VDC/2,500 VAC
- Self-healing properties
- Automotive (AEC–Q200) grades available up to 22.5 mm Lead Spacing



Part Number System

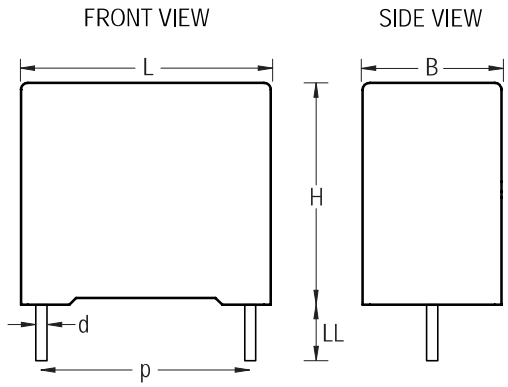
R41	3	I	2330	00	M1	M
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Packaging	Internal Use	Capacitance Tolerance
Y2, Metallized Polypropylene	3 = 300	F = 10.0 I = 15.0 N = 22.5 R = 27.5 W = 37.5	The last three digits represent significant figures. The first digit specifies number of zeros to be added.	See Ordering Options Table	00 M1	K = ±10% M = ±20%

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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Lead and Packaging Code
10, 15, 22.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Ammo Pack	H_0 = 18.5 +/-0.5	DQ
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	CK
	Bulk (Bag) – Short Leads	3.5 +0.5/-0	JB
	Bulk (Bag) – Short Leads	4.0 +0.5/-0	JE
	Bulk (Bag) – Short Leads	3.2 +0.3/-0.2	JH
	Bulk (Bag) – Long Leads	18 +1/-1	JM
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
27.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	CK
	Other Lead and Packaging Options		
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50
37.5	Standard Lead and Packaging Options		
	Bulk (Bag) – Short Leads	4 +2/-0	00
	Other Lead and Packaging Options		
	Bulk (Bag) – Long Leads	30 +5/-0	40
	Bulk (Bag) – Long Leads	25 +2/-1	50

Dimensions – Millimeters



p		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
10.0	+/-0.4	4.0	+0.2	9.0	+0.1	13.0	+0.2	0.6	+/-0.05
10.0	+/-0.4	5.0	+0.2	11.0	+0.1	13.0	+0.2	0.6	+/-0.05
10.0	+/-0.4	6.0	+0.2	12.0	+0.1	13.0	+0.2	0.6	+/-0.05
15.0	+/-0.4	5.0	+0.2	11.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	6.0	+0.2	12.0	+0.1	18.0	+0.3	0.6	+/-0.05
15.0	+/-0.4	7.5	+0.2	13.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	8.5	+0.2	14.5	+0.1	18.0	+0.5	0.6	+/-0.05
15.0	+/-0.4	11.0	+0.2	19.0	+0.1	18.0	+0.5	0.8	+/-0.05
22.5	+/-0.4	6.0	+0.2	15.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	7.0	+0.2	16.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	8.5	+0.2	17.0	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	10.0	+0.2	18.5	+0.1	26.5	+0.3	0.8	+/-0.05
22.5	+/-0.4	13.0	+0.2	22.0	+0.1	26.5	+0.3	0.8	+/-0.05
27.5	+/-0.4	13.0	+0.2	22.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	14.0	+0.2	28.0	+0.1	32.0	+0.3	0.8	+/-0.05
27.5	+/-0.4	18.0	+0.2	33.0	+0.1	32.0	+0.3	0.8	+/-0.05
37.5	+/-0.4	13.0	+0.3	24.0	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	16.0	+0.3	28.5	+0.1	41.5	+0.3	1.0	+/-0.05
37.5	+/-0.4	20.0	+0.3	40.0	+0.1	41.5	+0.3	1.0	+/-0.05

Note: See Ordering Options Table for lead length (LL/H_0) options.

Performance Characteristics

Dielectric	Polypropylene film
Plates	Metal layer deposited by evaporation under vacuum
Winding	Non-inductive type
Leads	Tinned wire
Protection	Plastic case, thermosetting resin filled. Box material is solvent resistant and flame retardant according to UL94.
Related Documents	IEC 60384-14, EN 60384-14
Rated Voltage (V_R)	300 VAC (50/60 Hz), 1,000 VDC
Capacitance Range	0.0010 µF to 1 µF
Capacitance Values	E6 series (IEC 60063)
Capacitance Tolerance	±10%, ±20%
Temperature Range	-40°C to +110°C
Climatic Category	40/110/56 IEC 60068-1
Approvals	ENEC, UL, cUL, CQC
Dissipation Factor (tanδ)	≤ 0.3% (0.2%*) at 1kHz , +25°C ±5°C (* typical value)
Test Voltage Between Terminals	The 100% screening factory test is carried out at 5,000 VDC/2,500 VAC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.
Insulation Resistance	Measured at +25°C ±5°C, according to IEC 60384–2

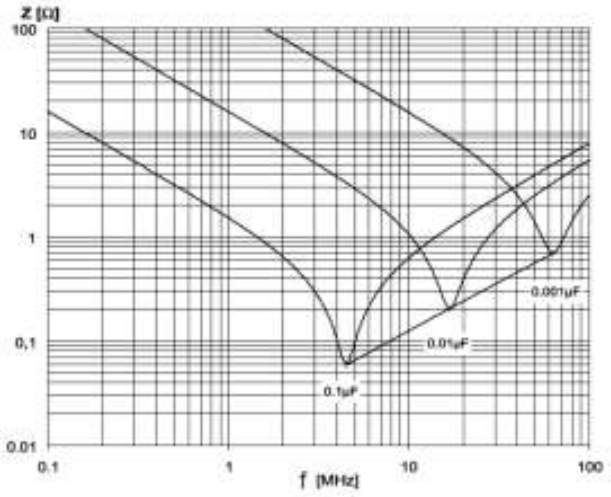
Minimum Values Between Terminals			
Voltage Charge	Voltage Charge Time	C ≤ 0.33 µF	C > 0.33 µF
100 VDC	1 min	≥ 1 • 10^5 MΩ (≥ 5 • 10^5 MΩ)* * typical value	≥ 30,000 MΩ • µF (≥ 150,000 MΩ • µF)* * typical value

In DC Applications	Recommended voltage ≤ 1,000 VDC

Qualification

Automotive Grade products meet or exceed the requirements outlined by the Automotive Electronics Council. Details regarding test methods and conditions are referenced in document AEC–Q200, Stress Test Qualification for Passive Components. For additional information regarding the Automotive Electronics Council and AEC–Q200, please visit their website at www.aecouncil.com.

Impedance Graph



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	EN/IEC 60384–14	1.7 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384-14	V41160
	UL 60384-14 and CAN/CSA E60384-14 (300 VAC)	E97797
	GB/T 14472 IEC 60384-14	CQC13001087758 CQC13001101264 CQC14001116018 CQC14001116611

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Dimensions in mm			Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L				
0.0010	4.0	9.0	13.0	10.0	800	413F1100(1)00(2)	R413F1100(1)00(2)
0.0015	4.0	9.0	13.0	10.0	800	413F1150(1)00(2)	R413F1150(1)00(2)
0.0022	4.0	9.0	13.0	10.0	800	413F1220(1)00(2)	R413F1220(1)00(2)
0.0033	4.0	9.0	13.0	10.0	800	413F1330(1)M1(2)	R413F1330(1)M1(2)
0.0047	5.0	11.0	13.0	10.0	800	413F1470(1)M1(2)	R413F1470(1)M1(2)
0.0068	6.0	12.0	13.0	10.0	800	413F1680(1)00(3)	R413F1680(1)00(3)
0.0033	5.0	11.0	18.0	15.0	600	413I1330(1)00(2)	R413I1330(1)00(2)
0.0047	5.0	11.0	18.0	15.0	600	413I1470(1)00(2)	R413I1470(1)00(2)
0.0068	5.0	11.0	18.0	15.0	600	413I1680(1)00(2)	R413I1680(1)00(2)
0.010	5.0	11.0	18.0	15.0	600	413I2100(1)00(2)	R413I2100(1)00(2)
0.015	5.0	11.0	18.0	15.0	600	413I2150(1)M1(2)	R413I2150(1)M1(2)
0.022	6.0	12.0	18.0	15.0	600	413I2220(1)M1(2)	R413I2220(1)M1(2)
0.033	7.5	13.5	18.0	15.0	600	413I2330(1)M1(2)	R413I2330(1)M1(2)
0.047	8.5	14.5	18.0	15.0	600	413I2470(1)M1(2)	R413I2470(1)M1(2)
0.068	11.0	19.0	18.0	15.0	600	413I2680(1)00(2)	R413I2680(1)00(2)
0.047	6.0	15.0	26.5	22.5	500	413N2470(1)00(2)	R413N2470(1)00(2)
0.068	6.0	15.0	26.5	22.5	500	413N2680(1)M1(3)	R413N2680(1)M1(3)
0.068	7.0	16.0	26.5	22.5	500	413N2680(1)00(2)	R413N2680(1)00(2)
0.10	8.5	17.0	26.5	22.5	500	413N3100(1)M1(2)	R413N3100(1)M1(2)
0.15	10.0	18.5	26.5	22.5	500	413N3150(1)M1(2)	R413N3150(1)M1(2)
0.22	13.0	22.0	26.5	22.5	500	413N3220(1)00(2)	R413N3220(1)00(2)
0.22	13.0	22.0	32.0	27.5	400	413R3220(1)00(2)	R413R3220(1)00(2)
0.33	14.0	28.0	32.0	27.5	400	413R3330(1)00(2)	R413R3330(1)00(2)
0.47	18.0	33.0	32.0	27.5	400	413R3470(1)00(2)	R413R3470(1)00(2)
0.68	18.0	33.0	32.0	27.5	400	413R3680(1)00(2)	R413R3680(1)00(2)
0.47	13.0	24.0	41.5	37.5	300	413W 3470(1)00(2)	R413W 3470(1)00(2)
0.68	16.0	28.5	41.5	37.5	300	413W 3680(1)00(2)	R413W 3680(1)00(2)
1.0	20.0	40.0	41.5	37.5	300	413W 4100(1)00(2)	R413W 4100(1)00(2)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) Insert lead and packaging code. See Ordering Options Table for available options.
(2) M = ±20%, K = ±10%
(3) M = ±20% (only available tolerance).

Soldering Process

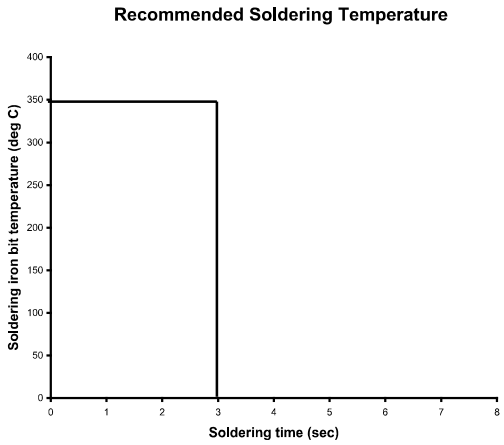
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183°C for SnPb eutectic alloy to 217 – 221°C for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170°C). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

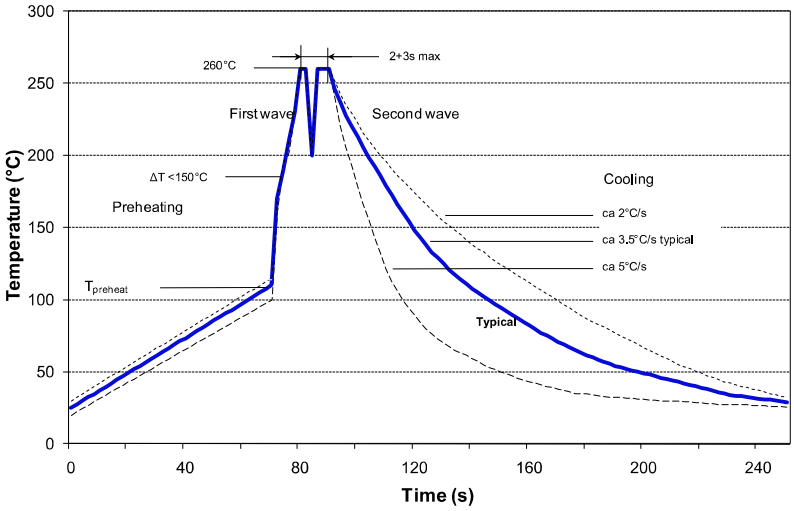
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

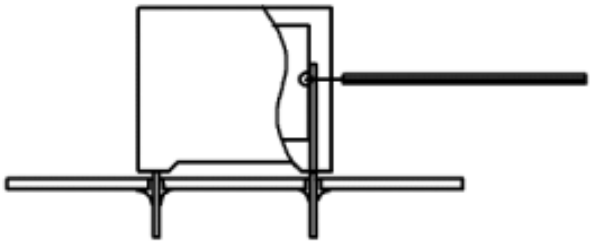
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



Temperature monitored inside the capacitor.

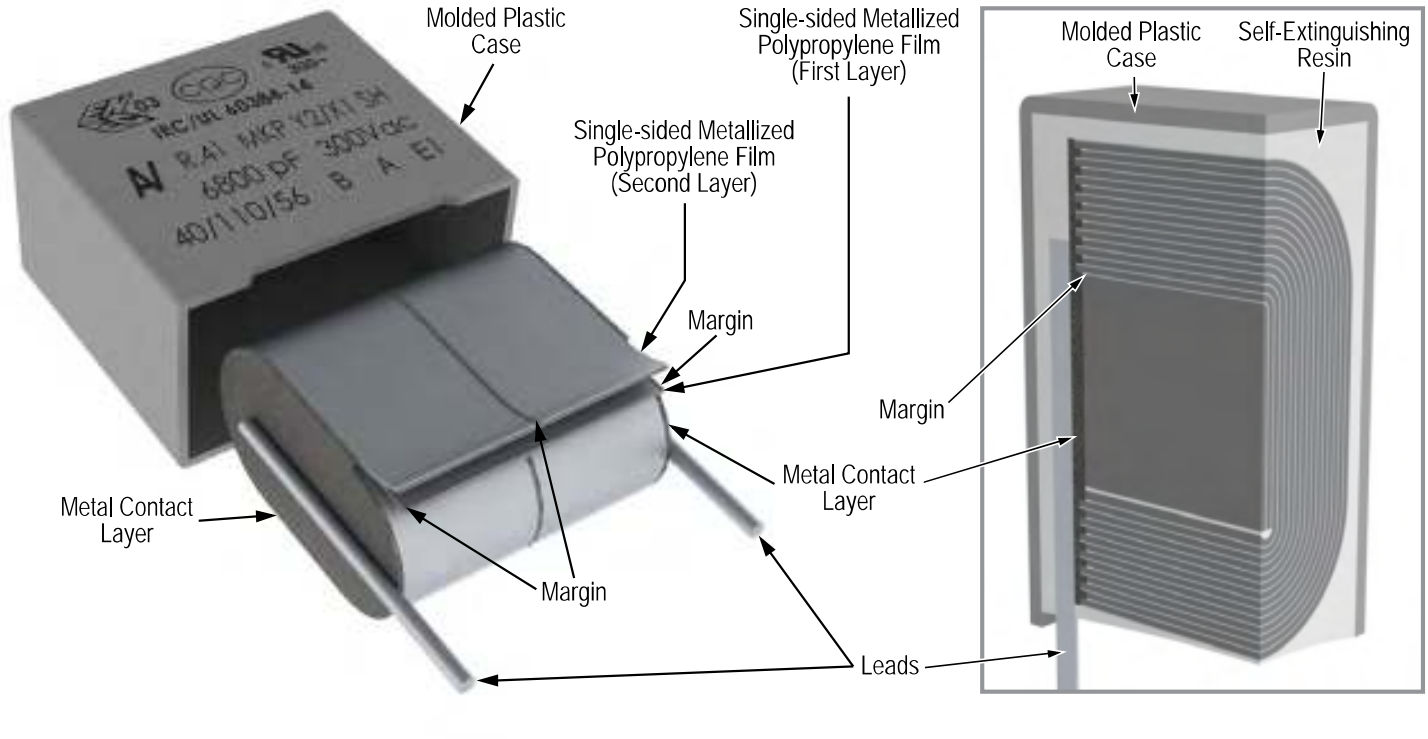
Selective Soldering Recommendations

Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

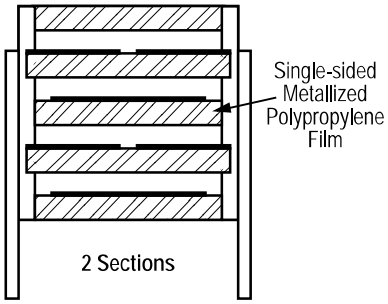
Construction

2 Sections



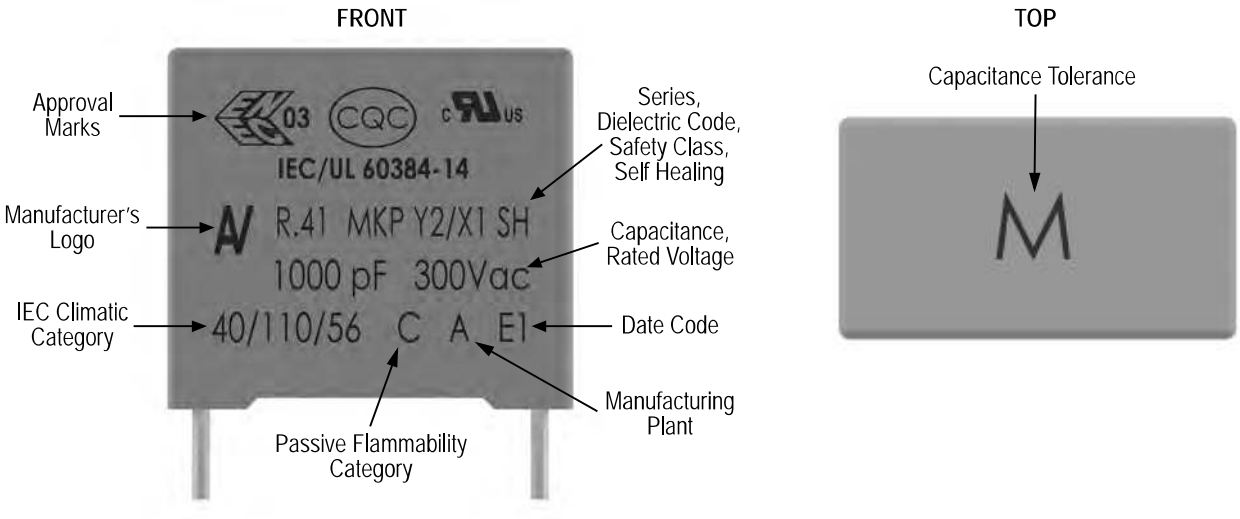
Detailed Cross Section

Winding Scheme

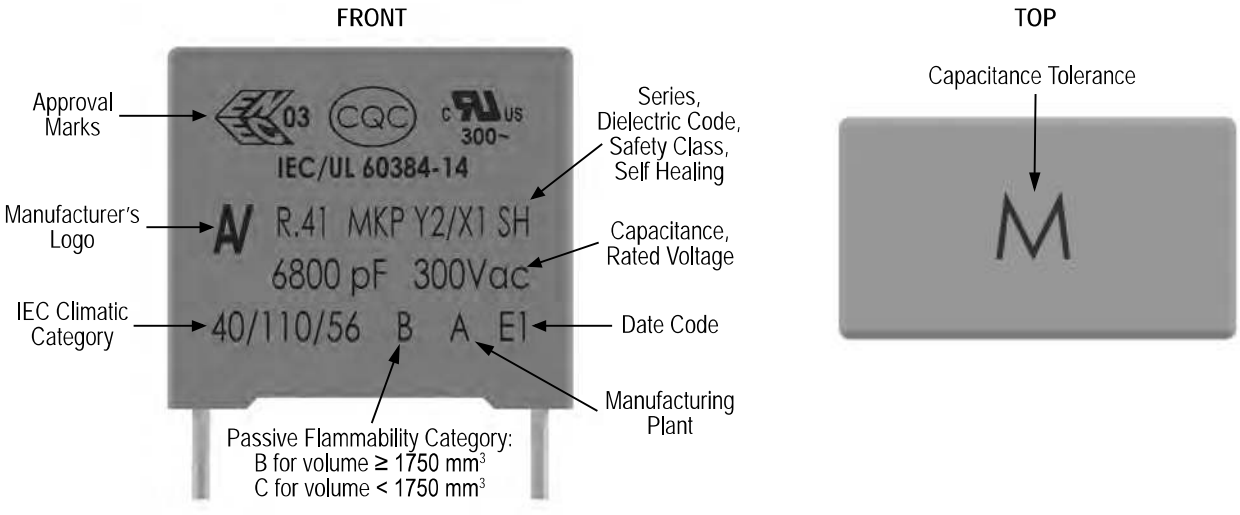


Marking

Lead Spacing 10 mm

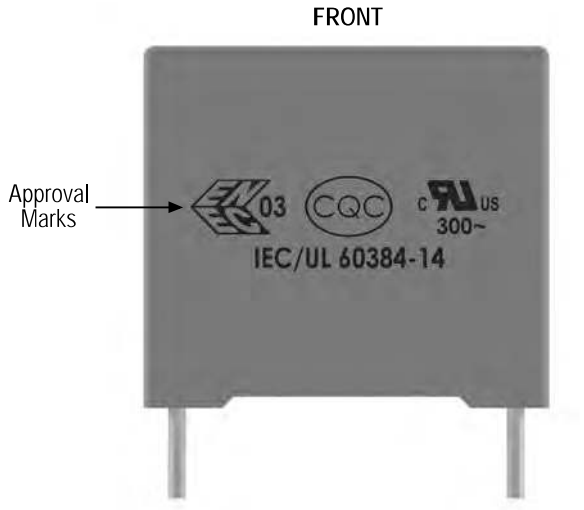


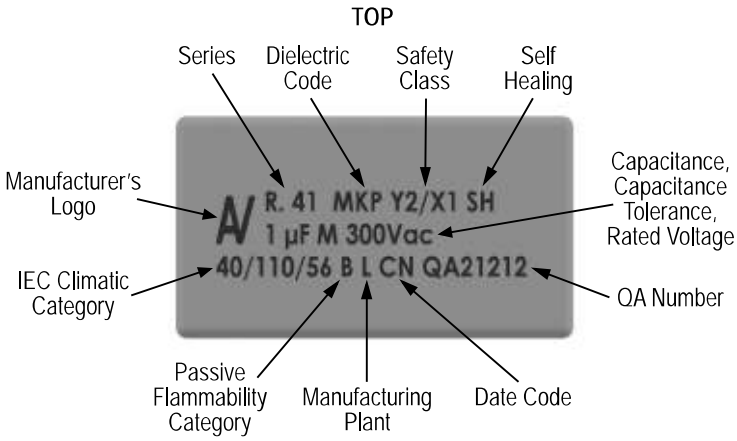
Lead Spacing 15 mm, 22.5 mm (small case sizes)



Marking cont'd

Lead Spacing 22.5 mm (large case sizes), 27.5 mm, 37.5 mm





Manufacturing Date Code (IEC 60062)			
Y = Year, Z = Month			
Year	Code	Month	Code
2000	M	January	1
2001	N	February	2
2002	P	March	3
2003	R	April	4
2004	S	May	5
2005	T	June	6
2006	U	July	7
2007	V	August	8
2008	W	September	9
2009	X	October	O
2010	A	November	N
2011	B	December	D
2012	C		
2013	D		
2014	E		
2015	F		
2016	H		
2017	J		
2018	K		
2019	L		
2020	M		

Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo Taped
10	4.0	9.0	13.0	2000	1800	750	1500	1000
	5.0	11.0	13.0	1300	1500	600	1250	800
	6.0	12.0	13.0	1000	1200	500	1000	680
15	5.0	11.0	18.0	2000	1000	600	1250	800
	6.0	12.0	18.0	1750	900	500	1000	680
	7.5	13.5	18.0	1000	700	350	800	500
	8.5	14.5	18.0	1000	500	300	700	440
	11.0	19.0	18.0	450	350	–	500	340
22.5	6.0	15.0	26.5	805	500	–	700	464
	7.0	16.0	26.5	700	500	–	550	380
	8.5	17.0	26.5	468	300	–	450	280
	10.0	18.5	26.5	396	300	–	350	235
	13.0	22.0	26.5	300	200	–	300	–
27.5	13.0	22.0	32.0	480	288	–	300	–
	14.0	28.0	32.0	352	176	–	–	–
	18.0	33.0	32.0	256	128	–	–	–
37.5	13.0	24.0	41.5	360	216	–	–	–
	16.0	28.5	41.5	216	108	–	–	–
	20.0	40.0	41.5	126	84	–	–	–

PME271Y Series Metallized Impregnated Paper, Class Y2, 250 VAC

Overview

The PME271Y Series is constructed of multilayer metallized paper encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use as electromagnetic interference suppressor in all Y2 applications, line-to-earth.

Benefits

- Approvals: ENEC, UL, CSA, CQC
- Rated voltage: 250 VAC 50/60 Hz
- Capacitance range: 0.001 – 0.1 µF
- Lead spacing: 10.2 – 25.4 mm
- Capacitance tolerance: ±20%
- Climatic category: 40/100/56/B, IEC 60068–1
- Tape and reel packaging in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +100˚C
- 100% screening factory test at 3,000 VDC
- Highest possible safety regarding active and passive flammability



Legacy Part Number System

PME271	Y	410	M	R30
Series	Rated Voltage (VAC)	Capacitance Code (pF)	Capacitance Tolerance	Packaging
Y2, Metallized Paper	Y = 250	The last two digits represent significant figures. The first digit specifies the total number of digits.	M = ±20%	See Ordering Options Table

New KEMET Part Number System

P	271	H	E	102	M	250	A
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Lead and Packaging Code
P = Paper	Y2, Metallized Paper	H = 10.2 Q = 15.2 C = 20.3 E = 25.4	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20%	250 = 250	See Ordering Options Table

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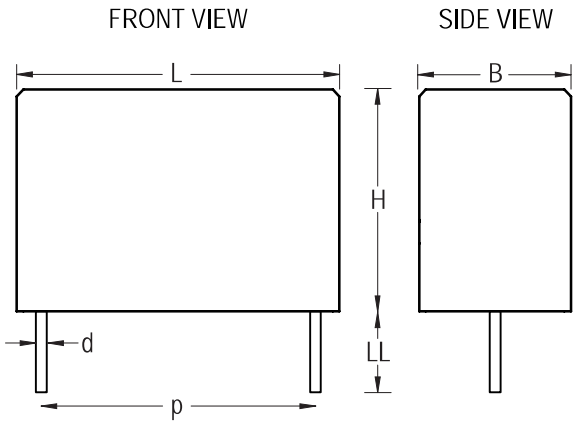
Benefits cont'd

- Excellent self-healing properties ensure long life even when subjected to frequent over-voltages
- Good resistance to ionization due to impregnated dielectric
- High dV/dt capability
- Impregnated paper ensures excellent stability and reliability properties, particularly in applications with continuous operation

Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
10.2	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
Native 10.2 formed to 7.5	Ammo Pack	H_0= 16.5 +/-0.5	LAF3	R30XA
15.2	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
20.3	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
25.4	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30

Dimensions – Millimeters



p		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
10.2	+/-0.4	3.9	Maximum	7.5	Maximum	13.5	Maximum	0.6	+/-0.05
10.2	+/-0.4	4.1	Maximum	8.2	Maximum	13.5	Maximum	0.6	+/-0.05
10.2	+/-0.4	5.1	Maximum	10.5	Maximum	13.5	Maximum	0.6	+/-0.05
15.2	+/-0.4	5.2	Maximum	10.5	Maximum	18.5	Maximum	0.8	+/-0.05
15.2	+/-0.4	5.5	Maximum	11	Maximum	18.5	Maximum	0.8	+/-0.05
15.2	+/-0.4	7.3	Maximum	13	Maximum	18.5	Maximum	0.8	+/-0.05
20.3	+/-0.4	7.6	Maximum	14	Maximum	24	Maximum	0.8	+/-0.05
20.3	+/-0.4	9	Maximum	15	Maximum	24	Maximum	0.8	+/-0.05
20.3	+/-0.4	11.3	Maximum	16.5	Maximum	24	Maximum	0.8	+/-0.05
25.4	+/-0.4	12.1	Maximum	19	Maximum	30.5	Maximum	1	+/-0.05
Note: See Ordering Options Table for lead length (LL) options.									

Performance Characteristics

Rated Voltage	250 VAC 50/60 Hz	
Capacitance Range	0.001 – 0.1 µF	
Capacitance Tolerance	±20%	
Temperature Range	-40°C to +100°C	
Climatic Category	40/100/56/B	
Approvals	ENEC, UL, CSA, CQC	
Dissipation Factor	Maximum Values at +23°C	
	1 kHz	1.3%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 3,000 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.	
Insulation Resistance	Minimum Value Between Terminals	
	≥ 12,000 MΩ	
In DC Applications	Recommended voltage ≤ 1,000 VDC	

Environmental Test Data

Test	IEC Publication	Procedure
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 500 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	4,000 bumps at 390 m/s^2
Solderability	IEC 60068–2–20 Test Ta	Solder globule method
Active Flammability	IEC 60384–14	
Passive Flammability	IEC 60384–14	Needle-flame test
Humidity	IEC 60068–2–3 Test Ca	+40°C and 90 – 95% RH

Approvals

Mark	Specification	File Number
	EN/IEC 60384-14	SE/0140-27C
	UL 60384-14	E73869
	CQC	10001043355

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Maximum Dimensions in mm			Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L					
0.0010	3.9	7.5	13.5	10.2	53	2000	P271HE102M250(1)	PME271Y410M(1)
0.0015	3.9	7.5	13.5	10.2	44	2000	P271HE152M250(1)	PME271Y415M(1)
0.0022	3.9	7.5	13.5	10.2	37	2000	P271HE222M250(1)	PME271Y422M(1)
0.0033	4.1	8.2	13.5	10.2	30	2000	P271HH332M250(1)	PME271Y433M(1)
0.0047	5.1	10.5	13.5	10.2	24	2000	P271HL472M250(1)	PME271Y447M(1)
0.0068	5.2	10.5	18.5	15.2	19	1400	P271QE682M250(1)	PME271Y468M(1)
0.0100	5.2	10.5	18.5	15.2	16	1400	P271QE103M250(1)	PME271Y510M(1)
0.0150	5.5	11.0	18.5	15.2	13	1400	P271QH153M250(1)	PME271Y515M(1)
0.0220	7.3	13.0	18.5	15.2	9.8	1400	P271QM223M250(1)	PME271Y522M(1)
0.0330	7.6	14.0	24.0	20.3	7.0	1000	P271CE333M250(1)	PME271Y533M(1)
0.0470	9.0	15.0	24.0	20.3	6.0	1000	P271CJ473M250(1)	PME271Y547M(1)
0.0680	11.3	16.5	24.0	20.3	4.6	600	P271CP683M250(1)	PME271Y568M(1)
0.1000	12.1	19.0	30.5	25.4	3.9	400	P271EJ104M250(1)	PME271Y610M(1)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) Insert ordering code for lead type and packaging. See Ordering Options Table for available options.

Soldering Process

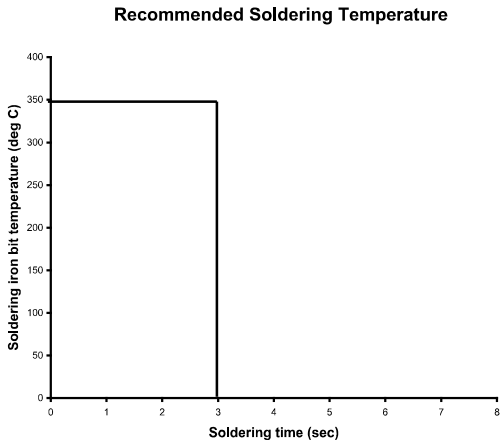
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

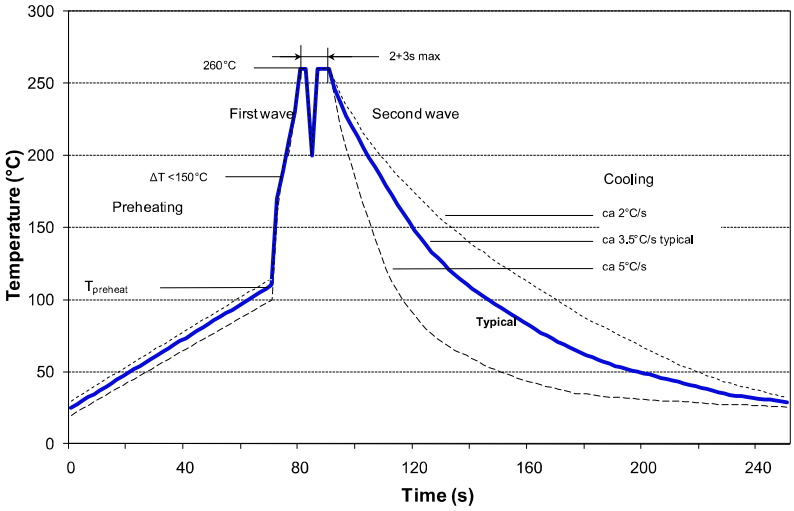
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

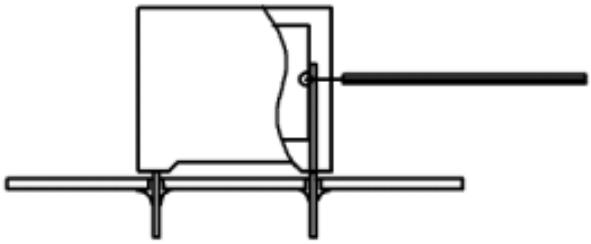
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



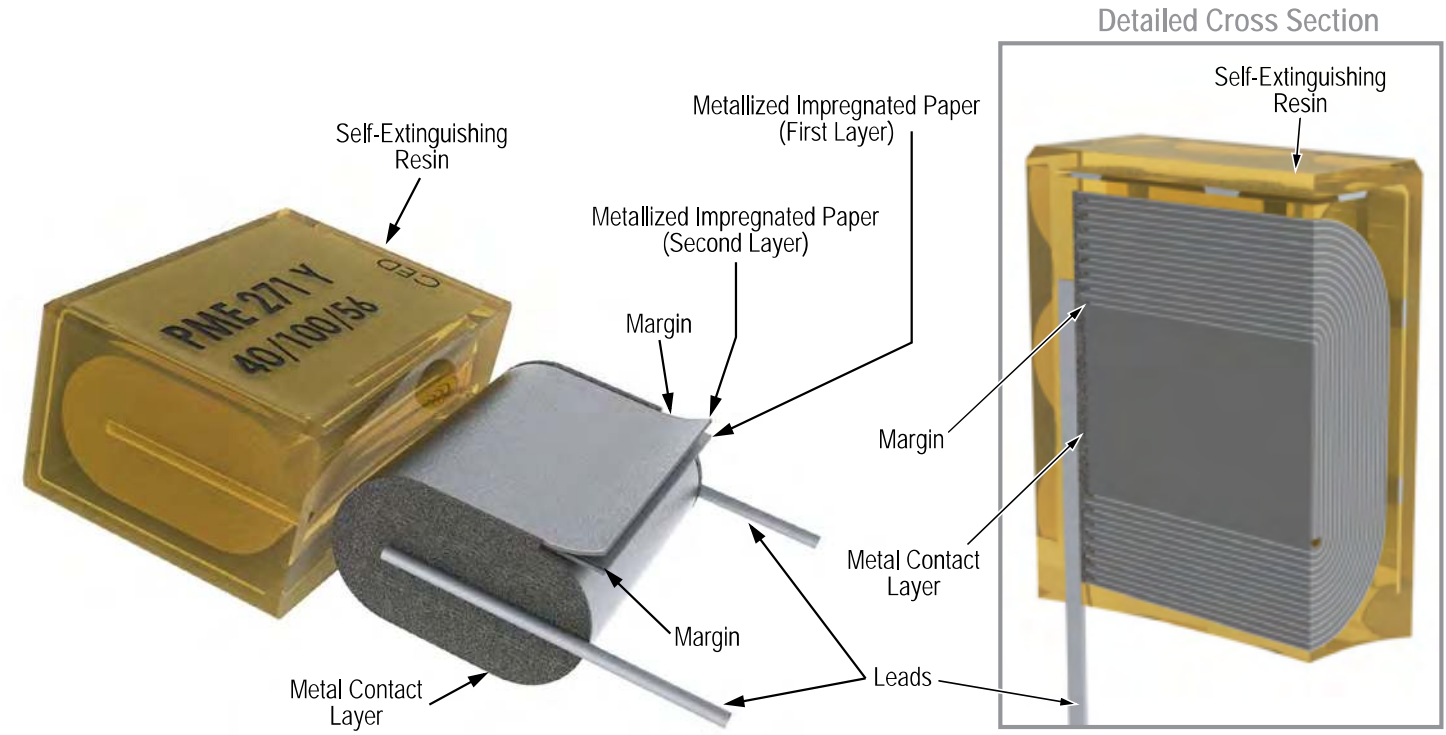
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

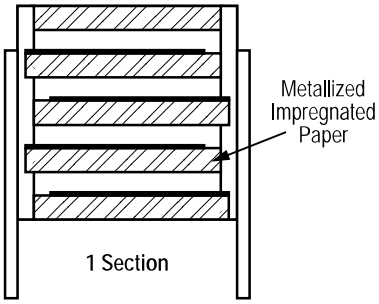
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

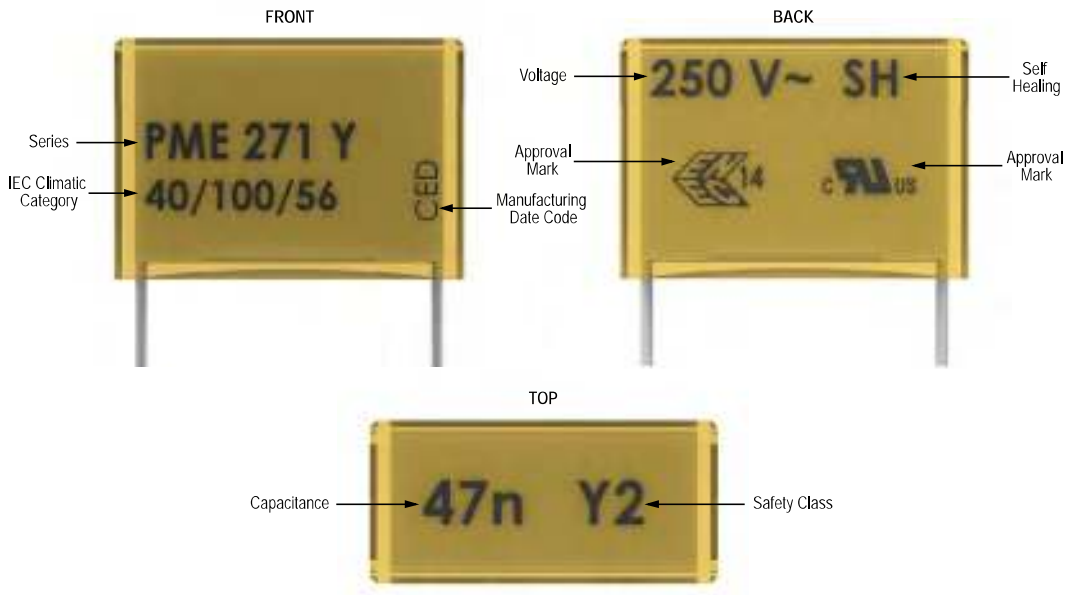
Construction



Winding Scheme



Marking



Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 360 mm	Large Reel ø 500 mm	Ammo Formed
10.2	3.9	7.5	13.5	2000	1000	700	1400	800
	4.1	8.2	13.5	2000	1000	600		780
	5.1	10.5	13.5	1600	800	600	1200	630
15.2	5.5	12.5	18	1000	500	600		
	6.5	12.5	18	600	400	400		
	7.5	14.5	18	600	400	400		
	8.5	16	18	400	250	400		
	5.2	10.5	18.5	1000	500	600		
	5.5	11	18.5	1000	500	500		
	6	12.5	18.5	600	400	400		
	7.3	13	18.5	600	400	400	800	
	7.8	13.5	18.5	600	400	400		
	8.5	14.3	18.5	500	300	350		
20.3	7.6	14	24	1500	250	250	500	
	8.4	14	24	1200	200	250	500	
	9	15	24	1500	200	250		
	11.3	16.5	24	1000	150	180	400	
25.4	10.6	16.1	30.5	1000	150			
	10.5	17.3	30.5	1000	100			
	12.1	19	30.5	800	100			
	15.3	22	30.5	600	75			

PME271Y A–E Series Metallized Impregnated Paper, Class Y2, 300 VAC

Overview

The PME271Y A–E Series is constructed of multilayer metallized paper encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use as electromagnetic interference suppressor in all Y2 applications, line-to-earth.

Benefits

- Approvals: ENEC, UL, CSA, CQC
- Rated voltage: 300 VAC 50/60 Hz
- Capacitance range: 0.001 – 0.15 µF
- Lead spacing: 10.2 – 25.4 mm
- Capacitance tolerance: ±20% for C > 0.1 µF, ±10% for C ≤ 0.1 µF
- Climatic category: 40/115/56/B, IEC 60068–1
- Tape and reel packaging in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +115˚C
- 100% screening factory test at 3,000 VDC
- The highest possible safety regarding active and passive flammability



Legacy Part Number System

PME271	Y	A	4100	M	R30
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Capacitance Tolerance	Packaging
Y2, Metallized Paper	Y = 300	A = 10.2 B = 15.2 C = 20.3 D = 22.5 E = 25.4	The last three digits represent significant figures. The first digit specifies the total number of digits.	M = ±20% (for C ≤ 0.1 µF) K = ±10% (for C > 0.1 µF)	See Ordering Options Table

New KEMET Part Number System

P	272	H	E	102	M	300	A
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging
P = Paper	Y2, Metallized Paper	H = 10.2 Q = 15.2 C = 20.3 D = 22.5 E = 25.4	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20% (for C ≤ 0.1 µF) K = ±10% (for C > 0.1 µF)	300 = 300	See Ordering Options Table

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Benefits cont'd

- Excellent self-healing properties ensure long life even when subjected to frequent over-voltages
- Good resistance to ionization due to impregnated dielectric
- High dV/dt capability
- Impregnated paper ensures excellent stability and reliability properties, particularly in applications with continuous operation

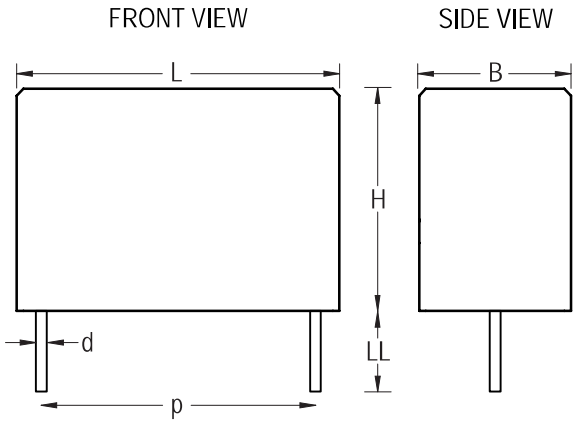
Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
10.2	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
Native 10.2 formed to 7.5	Ammo Pack	H_0= 16.5 +/-0.5	LAF3	R30XA
15.2	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
20.3	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
22.5	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1

Ordering Options Table cont'd

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
25.4	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30

Dimensions – Millimeters



p		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
10.2	+/-0.4	3.9	Maximum	7.5	Maximum	13.5	Maximum	0.6	+/-0.05
10.2	+/-0.4	4.1	Maximum	8.2	Maximum	13.5	Maximum	0.6	+/-0.05
10.2	+/-0.4	5.1	Maximum	10.5	Maximum	13.5	Maximum	0.6	+/-0.05
15.2	+/-0.4	5.2	Maximum	10.5	Maximum	18.5	Maximum	0.8	+/-0.05
15.2	+/-0.4	5.5	Maximum	11	Maximum	18.5	Maximum	0.8	+/-0.05
15.2	+/-0.4	7.3	Maximum	13	Maximum	18.5	Maximum	0.8	+/-0.05
20.3	+/-0.4	7.6	Maximum	14	Maximum	24	Maximum	0.8	+/-0.05
20.3	+/-0.4	9	Maximum	15	Maximum	24	Maximum	0.8	+/-0.05
20.3	+/-0.4	11.3	Maximum	16.5	Maximum	24	Maximum	0.8	+/-0.05
22.5	+/-0.4	8	Maximum	17	Maximum	27	Maximum	0.8	+/-0.05
22.5	+/-0.4	10	Maximum	19	Maximum	27	Maximum	0.8	+/-0.05
22.5	+/-0.4	12	Maximum	22	Maximum	27	Maximum	0.8	+/-0.05
25.4	+/-0.4	12.1	Maximum	19	Maximum	30.5	Maximum	1	+/-0.05
25.4	+/-0.4	15.3	Maximum	22	Maximum	30.5	Maximum	1	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Rated Voltage	300 VAC 50/60 Hz	
Capacitance Range	0.001 – 0.15 µF	
Capacitance Tolerance	± 20% for C ≤ 0.1µF, ± 10% for C > 0.1µF	
Temperature Range	-40°C to +115°C	
Climatic Category	40/115/56/B	
Approvals	ENEC, UL, CSA, CQC	
Dissipation Factor	Maximum Values at +23°C	
	1 kHz	1.3%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 3,000 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.	
Insulation Resistance	Minimum Value Between Terminals	
	≥ 12,000 MΩ	
In DC Applications	Recommended voltage ≤ 1,000 VDC	

Environmental Test Data

Test	IEC Publication	Procedure
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 500 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	4,000 bumps at 390 m/s^2
Solderability	IEC 60068–2–20 Test Ta	Solder globule method
Active Flammability	IEC 60384–14	
Passive Flammability	IEC 60384–14	Needle-flame test
Humidity	IEC 60068–2–3 Test Ca	+40°C and 90 – 95% RH

Approvals

Mark	Specification	File Number
	EN/IEC 60384-14	SE/0140-27C
	UL 60384-14	E73869
	CQC	10001043354

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Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Maximum Dimensions in mm			Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L					
0.0010	3.9	7.5	13.5	10.2	53.0	2000	P272HE102M300(1)	PME271YA4100M(1)
0.0015	3.9	7.5	13.5	10.2	44.0	2000	P272HE152M300(1)	PME271YA4150M(1)
0.0022	3.9	7.5	13.5	10.2	37	2000	P272HE222M300(1)	PME271YA4220M(1)
0.0025	4.1	8.2	13.5	10.2	35	2000	P272HH252M300(1)	PME271YA4250M(1)
0.0033	4.1	8.2	13.5	10.2	30	2000	P272HH332M300(1)	PME271YA4330M(1)
0.0047	5.1	10.5	13.5	10.2	24	2000	P272HL472M300(1)	PME271YA4470M(1)
0.0068	5.2	10.5	18.5	15.2	19	1400	P272QE682M300(1)	PME271YB4680M(1)
0.0100	5.2	10.5	18.5	15.2	16	1400	P272QE103M300(1)	PME271YB5100M(1)
0.0150	5.5	11	18.5	15.2	13	1400	P272QH153M300(1)	PME271YB5150M(1)
0.0220	7.3	13	18.5	15.2	9.8	1400	P272QM223M300(1)	PME271YB5220M(1)
0.0330	7.6	14	24	20.3	7	1000	P272CE333M300(1)	PME271YC5330M(1)
0.0470	9	15	24	20.3	6	1000	P272CJ473M300(1)	PME271YC5470M(1)
0.0680	11.3	16.5	24	20.3	4.6	1000	P272CP683M300(1)	PME271YC5680M(1)
0.0330	8	17	27	22.5	6.8	600	P272SJ333M300(1)	PME271YD5330M(1)
0.0470	8	17	27	22.5	5.8	600	P272SJ473M300(1)	PME271YD5470M(1)
0.0680	10	19	27	22.5	4.8	600	P272SP683M300(1)	PME271YD5680M(1)
0.1000	12	22	27	22.5	3.8	600	P272SU104M300(1)	PME271YD6100M(1)
0.1000	12.1	19	30.5	25.4	3.9	400	P272EJ104M300(1)	PME271YE6100M(1)
0.1500	15.3	22	30.5	25.4	3.1	400	P272EL154K300(1)	PME271YE6150K(1)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) Insert ordering code for lead type and packaging. See Ordering Options Table for available options.

Soldering Process

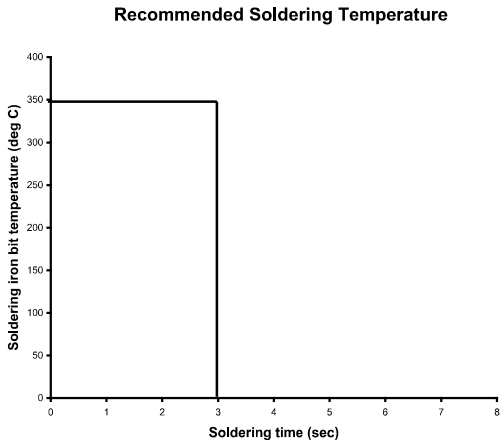
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Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

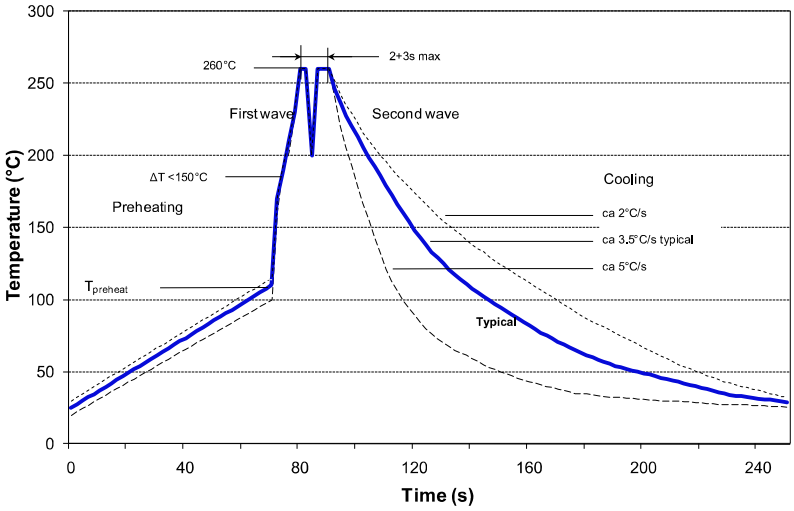
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Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

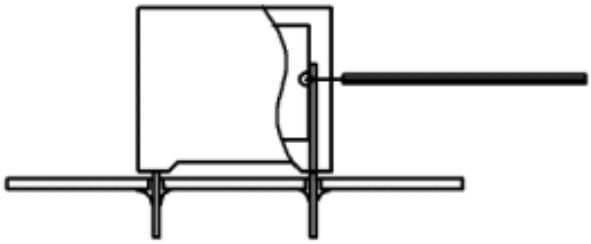
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



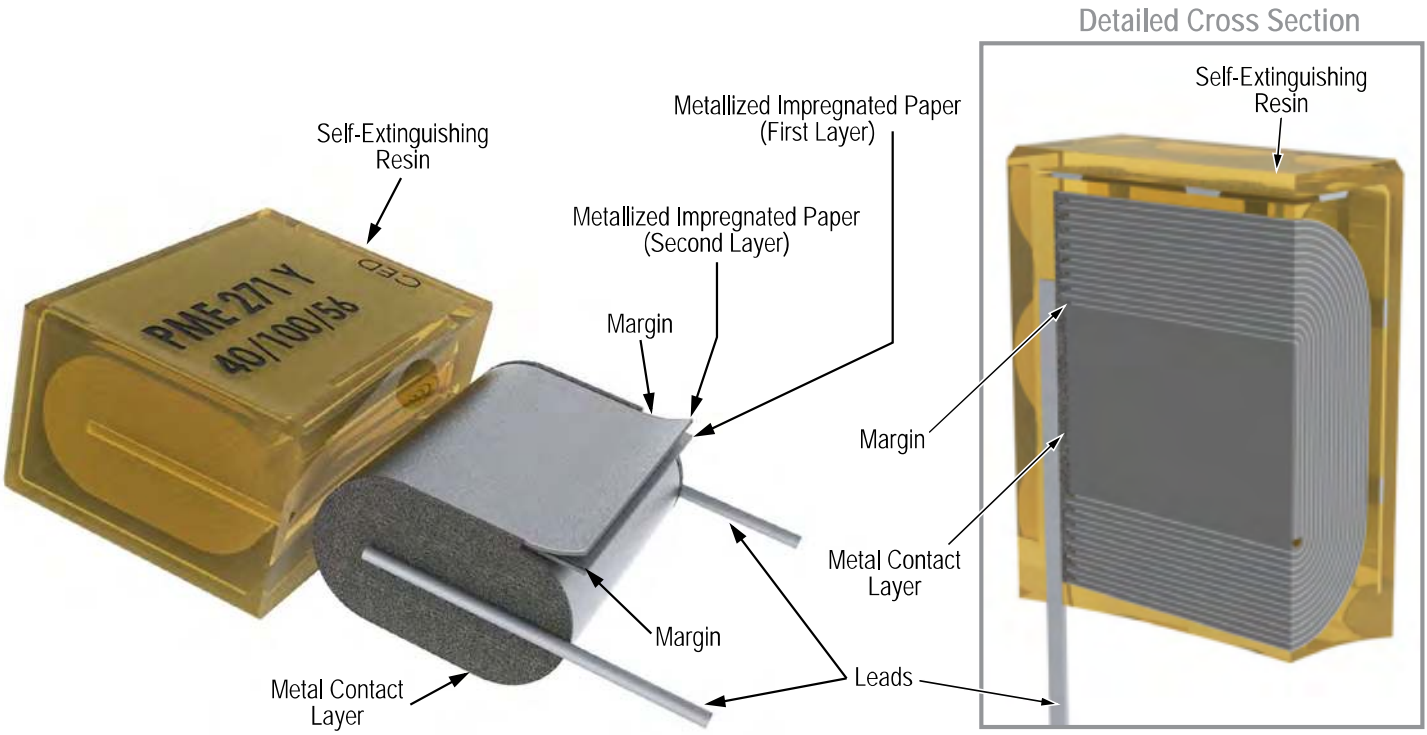
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

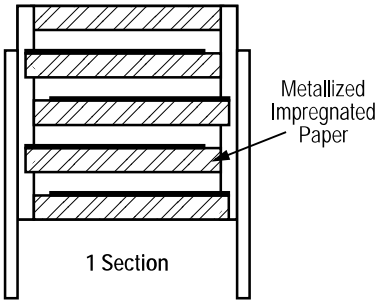
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

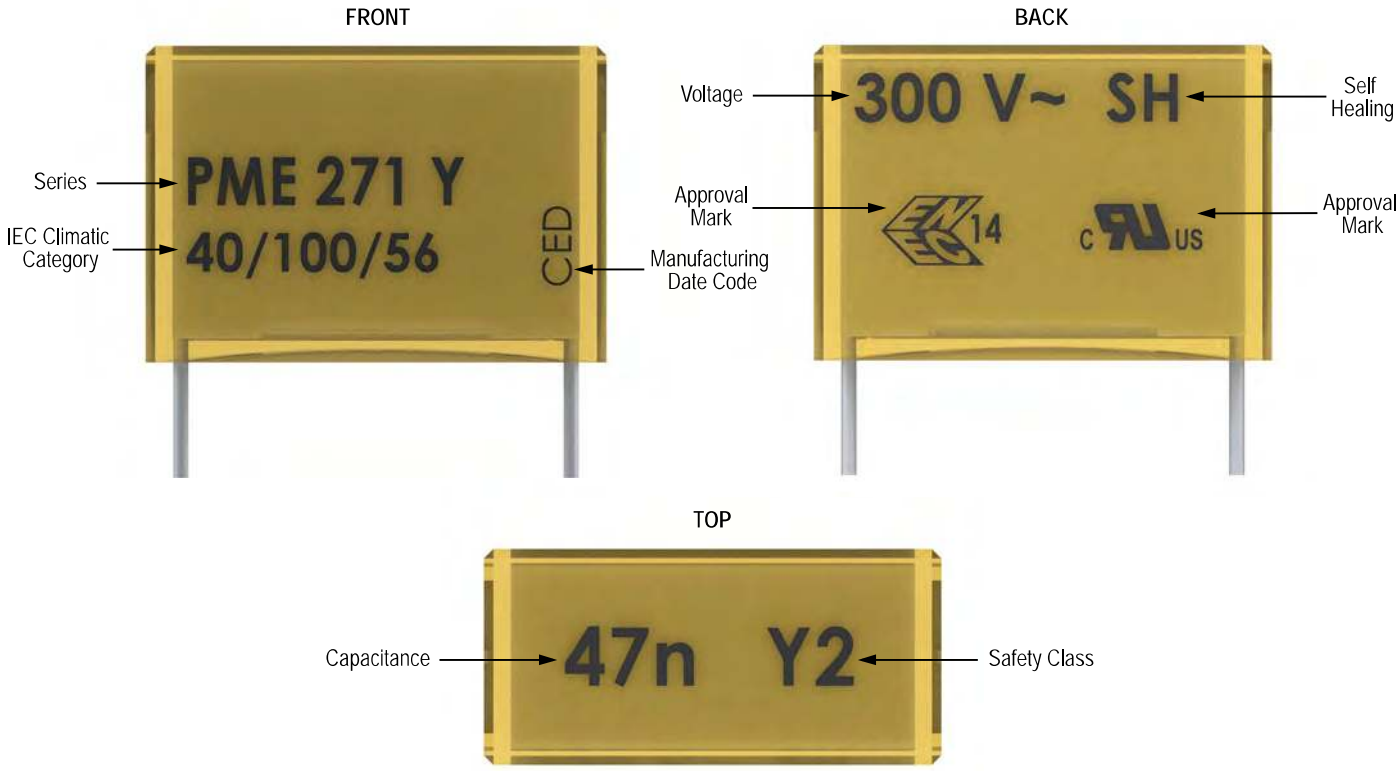
Construction



Winding Scheme



Marking


FRONT
BACK
Series
PME 271 Y
IEC Climatic Category
40/100/56
CED
Manufacturing Date Code
Voltage
300 V~ SH
Self Healing
Approval Mark
14
c US
Approval Mark
TOP
Capacitance
47n Y2
Safety Class

Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 360 mm	Large Reel ø 500 mm	Ammo Formed
10.2	3.9	7.5	13.5	2000	1000	700	1400	800
	4.1	8.2	13.5	2000	1000	600		780
	5.1	10.5	13.5	1600	800	600	1200	630
15.2	5.5	12.5	18	1000	500	600		
	6.5	12.5	18	600	400	400		
	7.5	14.5	18	600	400	400		
	8.5	16	18	400	250	400		
	5.2	10.5	18.5	1000	500	600		
	5.5	11	18.5	1000	500	500		
	6	12.5	18.5	600	400	400		
	7.3	13	18.5	600	400	400	800	
	7.8	13.5	18.5	600	400	400		
	8.5	14.3	18.5	500	300	350		
20.3	7.6	14	24	1500	250	250	500	
	8.4	14	24	1200	200	250	500	
	9	15	24	1500	200	250		
	11.3	16.5	24	1000	150	180	400	
22.5	8	17	27	1200	200			
	10	19	27	1000	150	200		
	12	22	27	800	100	180	350	
25.4	10.6	16.1	30.5	1000	150			
	10.5	17.3	30.5	1000	100			
	12.1	19	30.5	800	100			
	15.3	22	30.5	600	75			

General Purpose, Pulse and DC Transient Suppression

SMP253 Series Metallized Impregnated Paper, Class Y2, 250 VAC, Surface Mount Device

Overview

The SMP253 Series is constructed of multilayer metallized paper, encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use as electromagnetic interference suppressor in all Y2 applications, line-to-earth.

Benefits

- Approvals: ENEC, UL, CSA
- Rated voltage: 250 VAC 50/60 Hz
- Capacitance range: 0.001 – 0.0047 µF
- Size code: 5045, 12.7 mm
- Capacitance tolerance: ±20%
- Climatic category: 40/100/56/B, IEC 60068–1
- Tape and reel packaging in accordance with IEC 60286–3
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +100˚C
- 100% screening factory test at 3,000 VDC
- Highest possible safety regarding active and passive flammability
- Excellent self-healing properties ensure long life even when subjected to frequent over voltages
- Good resistance to ionization due to impregnated dielectric
- High dV/dt capability
- Impregnated paper ensures excellent stability and reliability properties, particularly in applications with continuous operation



Legacy Part Number System

SMP253	M	A	4100	M	TR24
Series	Rated Voltage (VAC)	Chip Length (mm)	Capacitance Code (pF)	Capacitance Tolerance	Packaging
Y2, Metallized Paper	M = 250	A = 12.7	The last three digits represent significant figures. The first digit specifies the total number of digits.	M = ±20%	See Ordering Options Table

New KEMET Part Number System

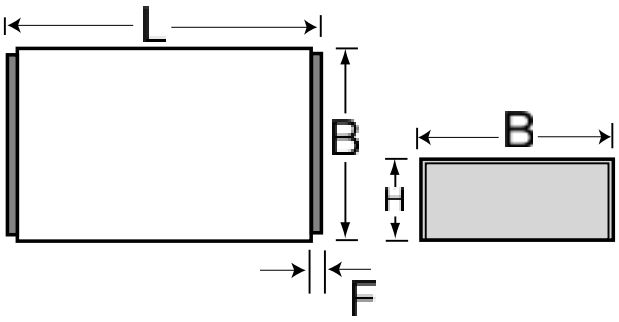
P	101	AA	102	M	250	V
Capacitor Class	Series	Chip Size	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging
P = Paper	Y2, Metallized Paper	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20%	250 = 250	See Ordering Options Table

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Ordering Options Table

Packaging Type	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
Standard Lead and Packaging Options		
Tape & Reel (Standard Reel)	V	TR24
Bulk (Bag)	A	BULK
Other Lead and Packaging Options		
Tape & Reel (Vertical Orientation Standard Reel)	Y	TV24

Dimensions – Millimeters



Chip Size	B		H		L		F	
EIA	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
5045	11.5	+/-0.2	6.5	+/-0.2	12.7	+/-0.2	0.5	Nominal

Performance Characteristics

Rated Voltage	250 VAC 50/60 Hz	
Capacitance Range	0.001 – 0.0047 µF	
Capacitance Tolerance	±20%	
Temperature Range	-40°C to +100°C	
Climatic Category	40/100/56/B	
Approvals	S, UL, CSA	
Dissipation Factor	Maximum Values at +23°C	
	1 kHz	1.3%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 3,000 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. It is not permitted to repeat this test as there is a risk to damage the capacitor. KEMET is not liable in such case for any failures.	
Insulation Resistance	Minimum Value Between Terminals	
	≥ 12,000 MΩ	

Environmental Test Data

Test	IEC Publication	Procedure
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 500 Hz at 0.75 mm or 98 m/s^2
Active Flammability	IEC 60384–14	
Passive Flammability	IEC 60384–14	Needle-flame test
Humidity	IEC 60068–2–3 Test Ca	+40°C and 90 – 95% RH

Approvals

Mark	Specification	File Number
	EN/IEC 60384–14	Pending
	UL 60384 and CAN/CSA E60384-14:09	Pending

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

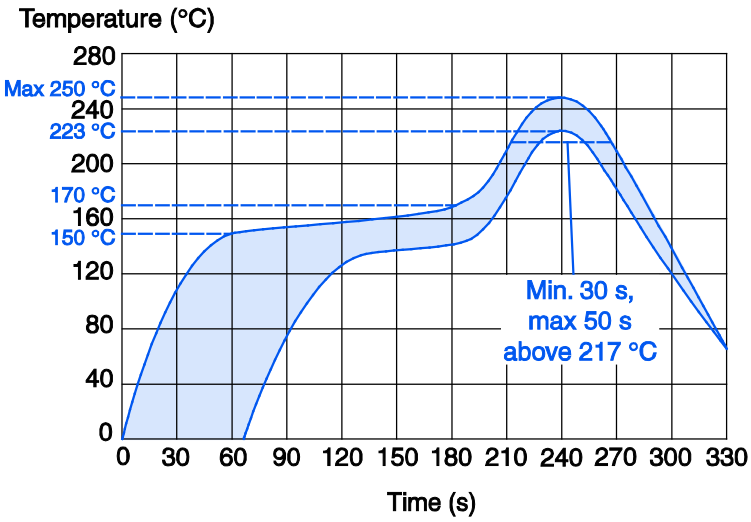
Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Maximum Dimensions in mm			dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L			
0.0010	11.5	6.5	12.7	2000	P101AA102M250(1)	SMP253MA4100M(1)
0.0015	11.5	6.5	12.7	2000	P101AA152M250(1)	SMP253MA4150M(1)
0.0022	11.5	6.5	12.7	2000	P101AA222M250(1)	SMP253MA4220M(1)
0.0025	11.5	6.5	12.7	2000	P101AA252M250(1)	SMP253MA4250M(1)
0.0033	11.5	6.5	12.7	2000	P101AA332M250(1)	SMP253MA4330M(1)
0.0039	11.5	6.5	12.7	2000	P101AA392M250(1)	SMP253MA4390M(1)
0.0047	11.5	6.5	12.7	2000	P101AA472M250(1)	SMP253MA4470M(1)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) Insert packaging code. See Ordering Options Table for available options.

Soldering Process

Reflow soldering temperature shall be measured on the top body surface of the component. The profiles herewith are recommended soldering profiles for convection reflow ovens and IR reflow ovens. If vapor phase reflow oven is used, please consult KEMET. Exceeding the manufacturer's process recommendations may harm the component. KEMET is not liable for any defect caused by exceeding recommendations. According to international standards, the maximum temperature capability shall be measured on the top surface of a component. The international standards do not define how the thermocouple should be fastened on the component. Our recommendation for attaching the thermocouple on the top surface of the component is to glue it with high temperature resistant glue.



Marking

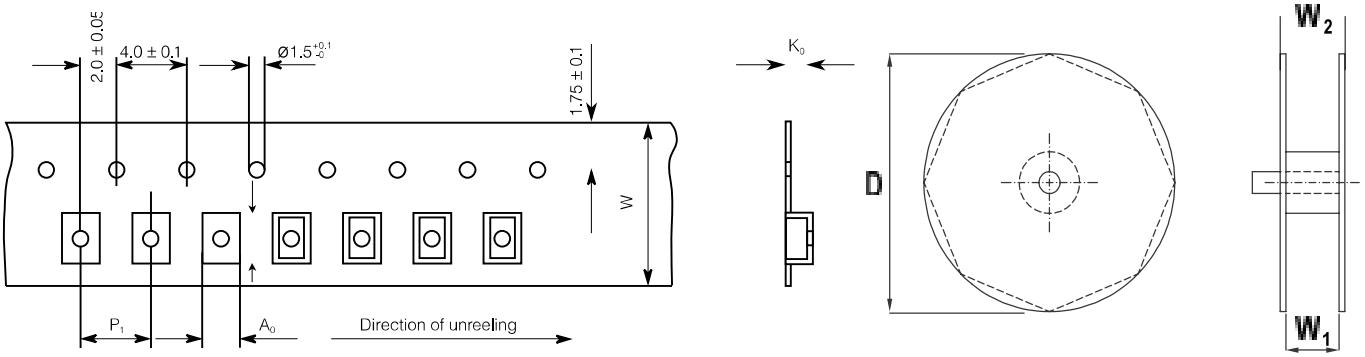
- KEMET's logo
- Series
- Capacitance
- Rated voltage
- Capacitor class
- Manufacturing date code

Packaging Quantities

Chip Size EIA	Thickness (mm)	Height (mm)	Length (mm)	Standard Reel ø 330 mm	
				Horizontal Orientation	Vertical Orientation
5045	11.5	6.5	12.7	600	400

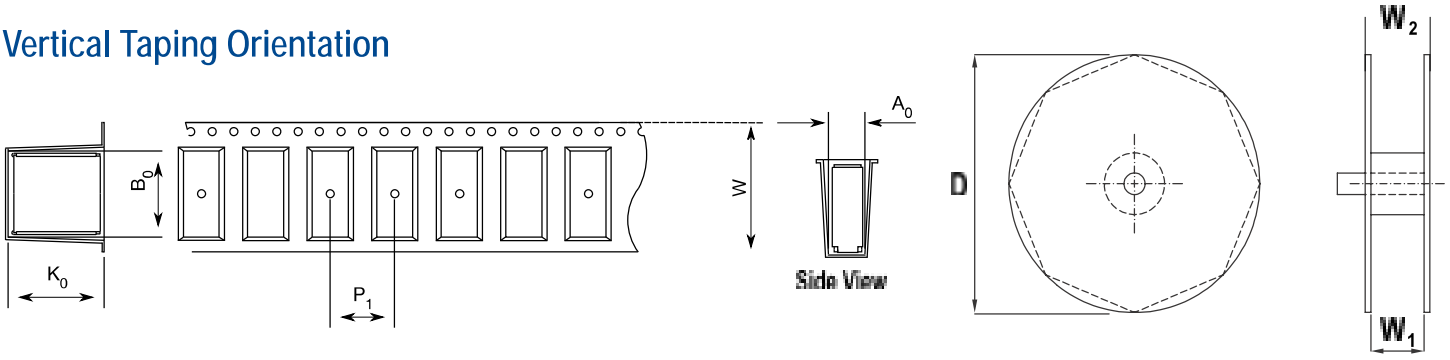
Carrier Taping & Packaging (IEC 60286–2)

Horizontal Taping Orientation



EIA Size Code Horizontal Mounting	Dimensions in mm			Taping Specification							
	B	H	L	W	P_1	A_0	B_0	K_0	D	W_1	W_2
	Nominal	Nominal	Nominal	-0/+0.3	+/-0.1	Nominal	Nominal	Nominal	-/+2.0	-0/+2	Maximum
5045	11.5	6.5	12.7	24.0	16.0	11.9	13.1	6.8	330	24.4	30.0

Vertical Taping Orientation



EIA Size Code Vertical Mounting	Dimensions in mm			Taping Specification							
	B	H	L	W	P_1	A_0	B_0	K_0	D	W_1	W_2
	Nominal	Nominal	Nominal	-0/+0.3	+/-0.1	Nominal	Nominal	Nominal	-/+2.0	-0/+2	Maximum
5026 (5045)	12.7	6.5	11.5	24.0	16.0	6.9	13.1	11.8	330	24.4	30.0

PME295 Series Metallized Impregnated Paper, Class Y1, 440 VAC/480 VAC

Overview

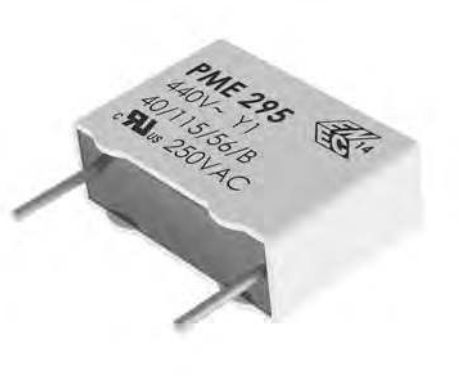
The PME295 Series is constructed of multilayer metallized paper encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include safety capacitors for bridging of double or reinforced insulation applications requiring voltage test up to 4,000 VAC at 60 seconds. PME295 Series capacitors can be left in place during this test.

Benefits

- Approvals: ENEC, UL, cUL
- Rated voltage: 440 VAC/480 VAC 50/60 Hz
- Capacitance range: 470 – 4700 pF
- Lead spacing: 15.0 mm
- Capacitance tolerance: ±20%
- Climatic category: 40/115/56/B, IEC 60068–1
- Tape and reel packaging in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +115˚C
- 100% screening factory test at 4,000 VAC, 50 Hz, 2 seconds



Legacy Part Number System

PME295	R	B	3470	M	R30
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Capacitance Tolerance	Packaging
Y1, Metallized Paper	R = 440	B = 15.0	The last three digits represent significant figures. The first digit specifies the total number of digits.	M = ±20%	See Ordering Options Table

New KEMET Part Number System

P	295	B	E	471	M	440	A
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging
P = Paper	Y1, Metallized Paper	B = 15.0	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20%	440 = 440	See Ordering Options Table

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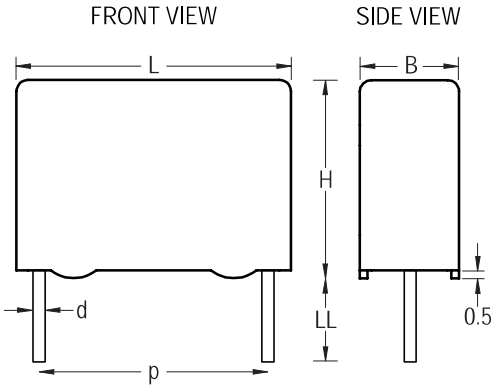
Benefits cont'd

- Highest possible safety regarding active and passive flammability
- Excellent self-healing properties ensure long life even when subjected to frequent over voltages
- Good resistance to ionization due to impregnated dielectric
- High dV/dt capability
- Impregnated paper provides excellent stability and reliability properties, particularly in applications with continuous operation

Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
15	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
Native 15 formed to 7.5	Ammo Pack	H_0= 16.5 +/-0.5	LAF3	R30XA
	Tape & Reel (Standard Reel)	H_0= 16.5 +/-0.5	XLTF1	R25X2

Dimensions – Millimeters

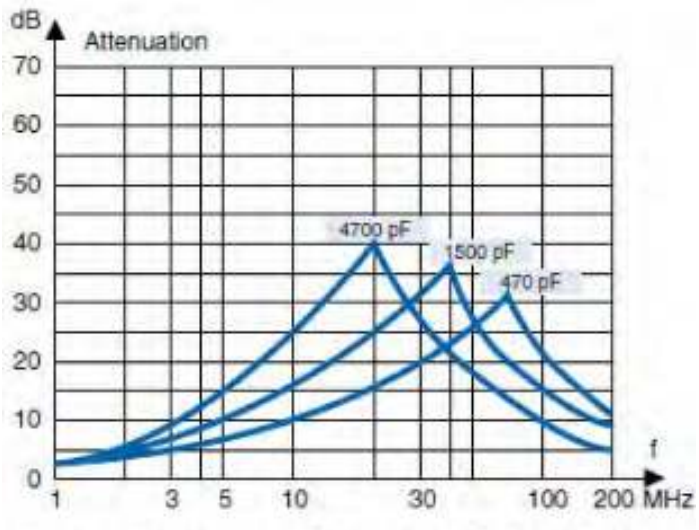


p		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
15	+/-0.4	5.5	Maximum	12.5	Maximum	18	Maximum	0.8	+/-0.05
15	+/-0.4	6.5	Maximum	12.5	Maximum	18	Maximum	0.8	+/-0.05
15	+/-0.4	7.5	Maximum	14.5	Maximum	18	Maximum	0.8	+/-0.05
15	+/-0.4	8.5	Maximum	16	Maximum	18	Maximum	0.8	+/-0.05
Note: See Ordering Options Table for lead length (LL) options.									

Performance Characteristics

Rated Voltage	440 VAC 50/60 Hz (ENEC)	
	480 VAC 50/60 Hz (UL, cUL)	
Capacitance Range	0.00047 – 0.0047 µF	
Capacitance Tolerance	±20%	
Temperature Range	-40°C to +115°C	
Climatic Category	40/115/56/B	
Approvals	ENEC, UL, cUL	
Dissipation Factor	Maximum Values at +23°C	
	1 kHz	1.3%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 4,000 VAC, 50 Hz, 2 seconds. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test.	
Insulation Resistance	Measured at 500 VDC after 60 seconds, +23°C	
	Minimum Value Between Terminals	
	≥ 12,000 MΩ	
In DC Applications	Recommended voltage ≤ 1,500 VDC	
Resonance Frequency	Tabulated self-resonance frequencies f_0 refer to 5 mm lead length	

Suppression vs. Frequency, Typical Values



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	IEC 60384-14	1.7 x V_R Vac 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature.
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 500 Hz at 0.75 mm or 98m/s2
Bump	IEC 60068–2–29 Test Eb	4,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068-2-14 test Na	Upper and lower rated temperature 5 cycles
Passive Flammability	IEC 60384–14	IEC 60384-1, IEC 60695-11-5 Needle flame test
Humidity	IEC 60068–2–3 Test Ca	+40°C and 93% RH, 56 days

Approvals

Certification Body	Mark	Specification	File Number
Intertek Semko AB		EN/IEC 60384-14 (440 VAC)	SE/0140–13C
UL		UL 60384-14	E73869
		CAN/CSA-E60384-14:09	

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Maximum Dimensions in mm			Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
	B	H	L					
0.00047	5.5	12.5	18	15	64	2000	P295BE471M440(1)	PME295RB3470M(1)
0.00056	5.5	12.5	18	15	59	2000	P295BE561M440(1)	PME295RB3560M(1)
0.00068	5.5	12.5	18	15	54	2000	P295BE681M440(1)	PME295RB3680M(1)
0.00082	5.5	12.5	18	15	49	2000	P295BE821M440(1)	PME295RB3820M(1)
0.001	5.5	12.5	18	15	46	2000	P295BE102M440(1)	PME295RB4100M(1)
0.0012	6.5	12.5	18	15	43	2000	P295BJ122M440(1)	PME295RB4120M(1)
0.0015	6.5	12.5	18	15	40	2000	P295BJ152M440(1)	PME295RB4150M(1)
0.0018	6.5	12.5	18	15	37	2000	P295BJ182M440(1)	PME295RB4180M(1)
0.0022	6.5	12.5	18	15	33	2000	P295BJ222M440(1)	PME295RB4220M(1)
0.0025	7.5	14.5	18	15	31	2000	P295BL252M440(1)	PME295RB4250M(1)
0.0027	7.5	14.5	18	15	30	2000	P295BL272M440(1)	PME295RB4270M(1)
0.0033	7.5	14.5	18	15	27	2000	P295BL332M440(1)	PME295RB4330M(1)
0.0039	8.5	16	18	15	24	2000	P295BQ392M440(1)	PME295RB4390M(1)
0.0047	8.5	16	18	15	22	2000	P295BQ472M440(1)	PME295RB4470M(1)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number

(1) Insert ordering code for lead type and packaging. See Ordering Options Table for available options.

Soldering Process

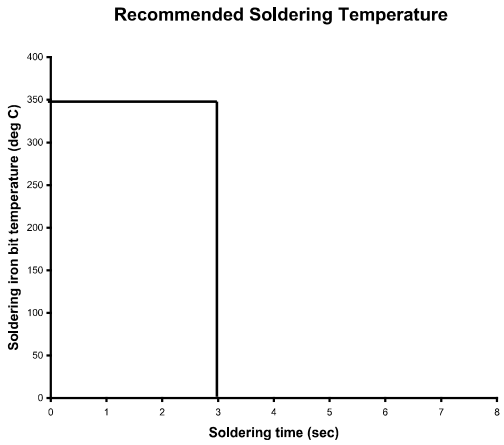
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

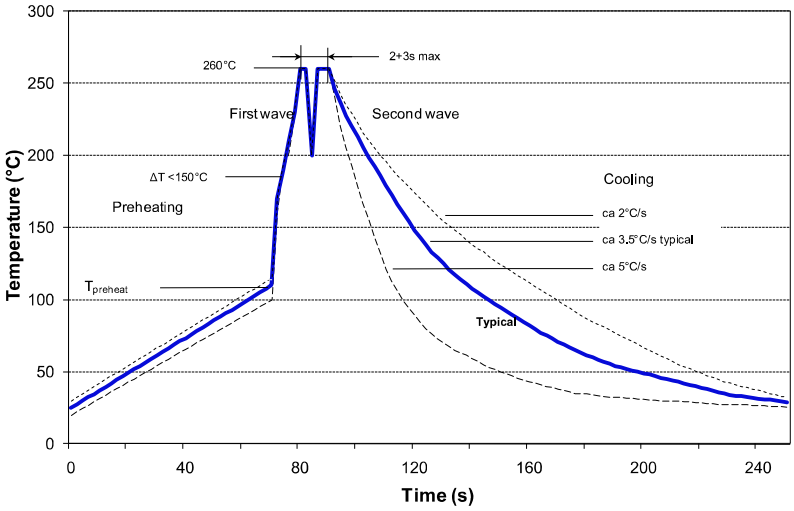
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

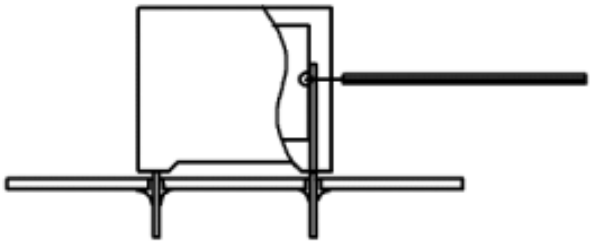
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



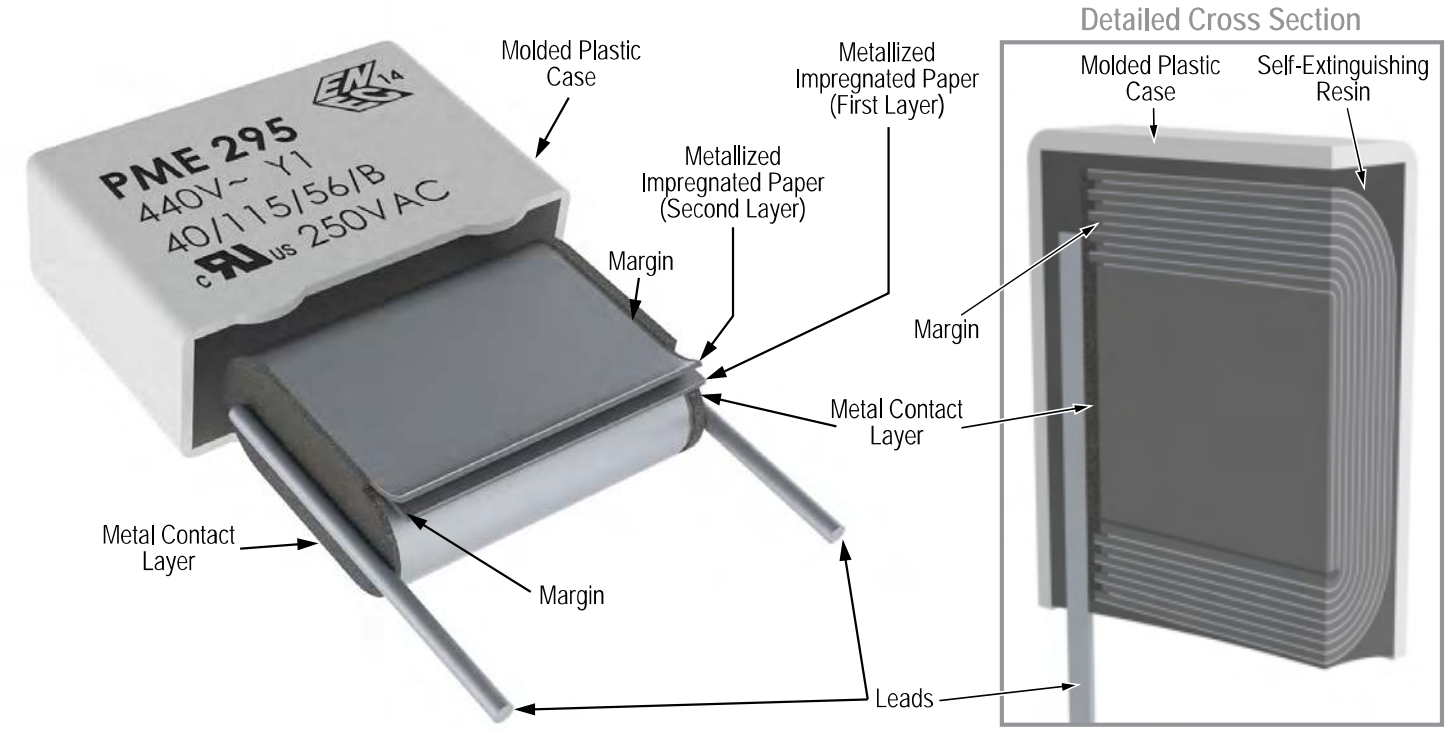
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

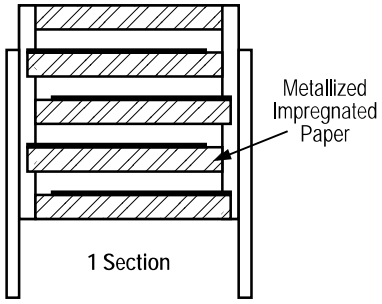
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, **however, instead of two baths, there is only one bath with a time from 3 to 10 seconds.** In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

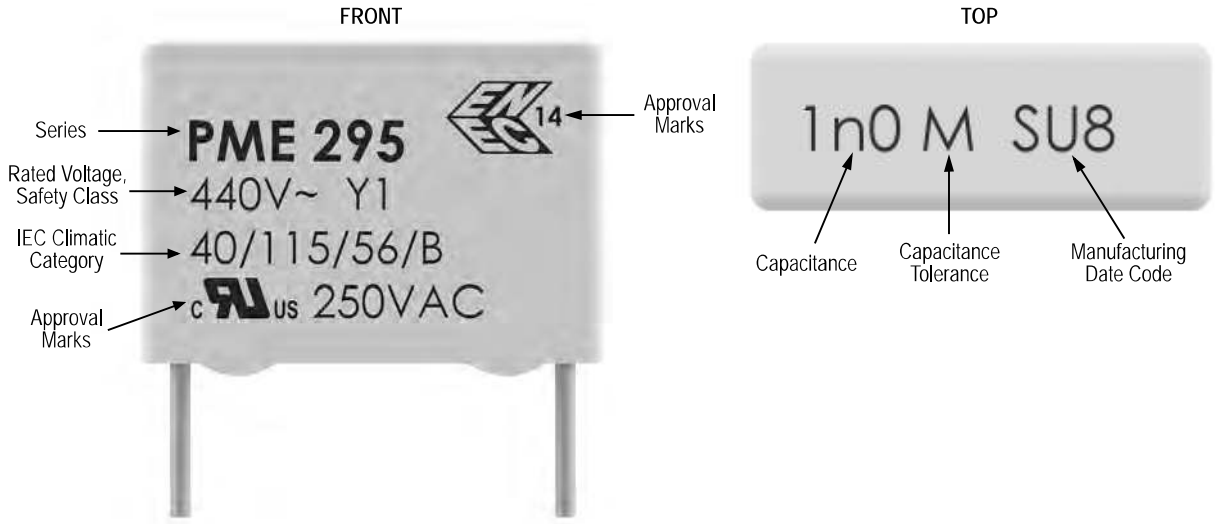
Construction



Winding Scheme



Marking



Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 360 mm	Large Reel ø 500 mm	Standard Reel Formed	Ammo Formed
15	5.5	10.5	18	1000	800	600	1200	550	570
	5.5	12.5	18	1000	800	600	1200	550	570
	7.5	14.5	18	800	400	400	800	350	378
	6.5	12.5	18	1000	600	500	1000	450	480
	8.5	16	18	600	400	400	800	350	324
	8	15	18	600	400	400	800	350	351
	9.5	17.5	18	500	300	350	700	250	297
	6	12	18	1000	800	500	1000	450	520
	11	19	18	450	250	300	600	250	252
	13	12.5	18	400	300	250	500	200	216

P295 Series Metallized Impregnated Paper, Class Y1, 500 VAC

Overview

The P295 Series is constructed of multilayer metallized paper encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include safety capacitors for bridging of double or reinforced insulation applications requiring voltage test up to 4,000 VAC at 60 seconds. P295 Series capacitors can be left in place during this test.

Benefits

- Approvals: ENEC, UL, cUL
- Rated voltage: 500 VAC 50/60 Hz
- Capacitance range: 470 – 4,700 pF
- Lead spacing: 15.0 mm
- Capacitance tolerance: ±20%
- Climatic category: 40/115/56/B, IEC 60068–1
- Tape and reel packaging in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +115˚C
- 100% screening factory test at 4,000 VAC, 50 Hz, 2 seconds
- Highest possible safety regarding active and passive flammability
- Excellent self-healing properties ensure long life even when subjected to frequent over voltages
- Good resistance to ionization due to impregnated dielectric
- High dV/dt capability
- Impregnated paper provides excellent stability and reliability properties, particularly in applications with continuous operation



Part Number System

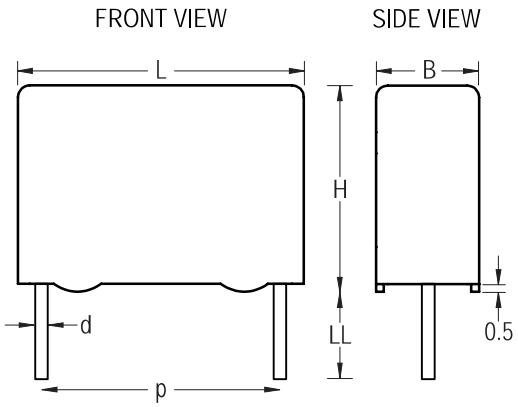
P	295	B	E	471	M	500	A
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging
P = Paper	Y1, Metallized Paper	B = 15.0	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20%	500 = 500	See Ordering Options Table

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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code
15	Standard Lead and Packaging Options		
	Bulk – Short Leads	6 +0/-1	C
	Bulk – Maximum Length Leads	30 +5/-0	A
	Tape & Reel (Standard Reel)	H_0 = 18.5 +/-0.5	L
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0 = 18.5 +/-0.5	P

Dimensions – Millimeters



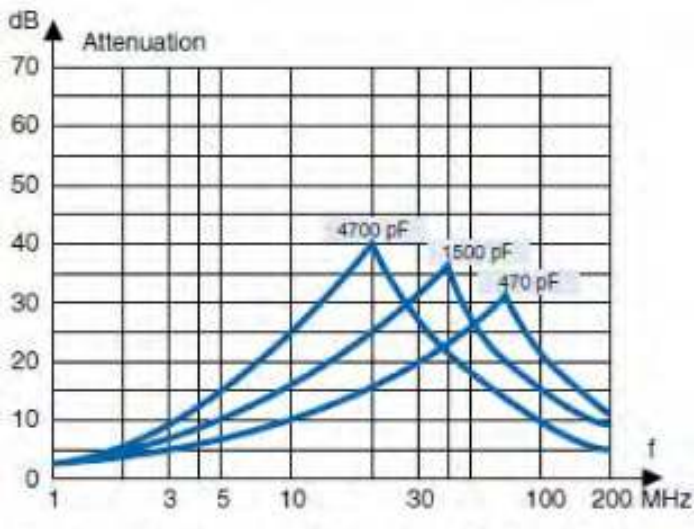
Size Code	p		B		H		L		d	
	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
BE	15.0	+/-0.4	5.5	Maximum	12.5	Maximum	18.0	Maximum	0.8	+/-0.05
BJ	15.0	+/-0.4	6.5	Maximum	12.5	Maximum	18.0	Maximum	0.8	+/-0.05
BL	15.0	+/-0.4	7.5	Maximum	14.5	Maximum	18.0	Maximum	0.8	+/-0.05
BQ	15.0	+/-0.4	8.5	Maximum	16.0	Maximum	18.0	Maximum	0.8	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Rated Voltage	500 VAC 50/60 Hz	
Capacitance Range	0.00047 – 0.0047 µF	
Capacitance Tolerance	±20%	
Temperature Range	-40°C to +115°C	
Climatic Category	40/115/56/B	
Approvals	ENEC, UL, cUL	
Dissipation Factor	Maximum Values at +23°C	
	1 kHz	1.3%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 4,000 VAC, 50 Hz, 2 seconds. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test.	
Insulation Resistance	Measured at 500 VDC after 60 seconds, +23°C	
	Minimum Value Between Terminals	
	≥ 12,000 MΩ	
In DC Applications	Recommended voltage ≤ 1,500 VDC	
Resonance Frequency	Tabulated self-resonance frequencies f_0 refer to 5 mm lead length	

Suppression vs. Frequency, Typical Values



Environmental Test Data

Test	IEC Publication	Procedure
Endurance	IEC 60384–14	1.7 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10–500 Hz at 0.75 mm or 98m/s^2
Bump	IEC 60068–2–29 Test Eb	4,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Passive Flammability	IEC 60384–14	IEC 60384-1, IEC 60695-11-5 Needle flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Certification Body	Mark	Specification	File Number
Intertek Semko AB		EN/IEC 60384-14	SE/0140–34
UL		UL 60384-14 CAN/CSA-E60384-14-09	E73869

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Capacitance Value (µF)	Maximum Dimensions in mm			Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	KEMET Part Number
	B	H	L				
0.00047	5.5	12.5	18	15	64	2000	P295BE471M500(1)
0.00056	5.5	12.5	18	15	59	2000	P295BE561M500(1)
0.00068	5.5	12.5	18	15	54	2000	P295BE681M500(1)
0.00082	5.5	12.5	18	15	49	2000	P295BE821M500(1)
0.001	5.5	12.5	18	15	46	2000	P295BE102M500(1)
0.0012	6.5	12.5	18	15	43	2000	P295BJ122M500(1)
0.0015	6.5	12.5	18	15	40	2000	P295BJ152M500(1)
0.0018	6.5	12.5	18	15	37	2000	P295BJ182M500(1)
0.0022	6.5	12.5	18	15	33	2000	P295BJ222M500(1)
0.0025	7.5	14.5	18	15	31	2000	P295BL252M500(1)
0.0027	7.5	14.5	18	15	30	2000	P295BL272M500(1)
0.0033	7.5	14.5	18	15	27	2000	P295BL332M500(1)
0.0039	8.5	16.0	18	15	24	2000	P295BQ392M500(1)
0.0047	8.5	16.0	18	15	22	2000	P295BQ472M500(1)
Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	f_o (MHz)	dV/dt (V/µs)	KEMET Part Number

(1) Insert lead and packaging code. See Ordering Options Table for available options.

Soldering Process

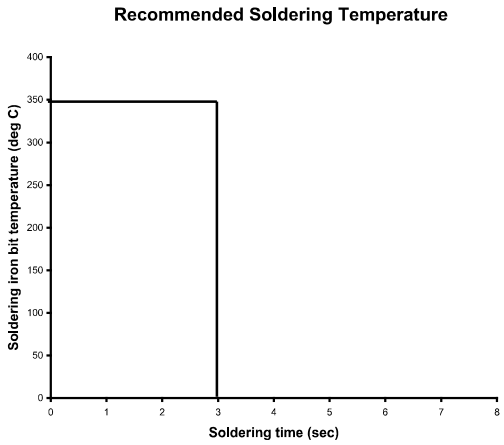
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

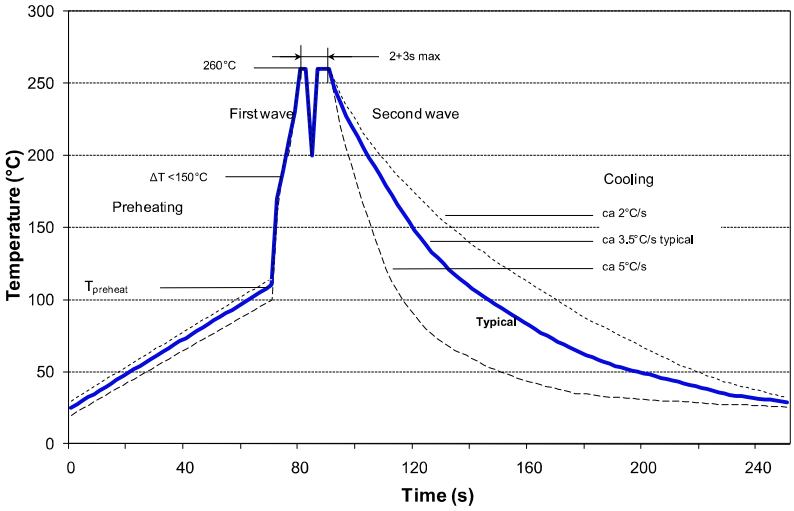
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

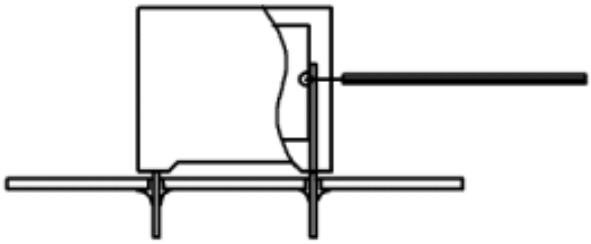
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



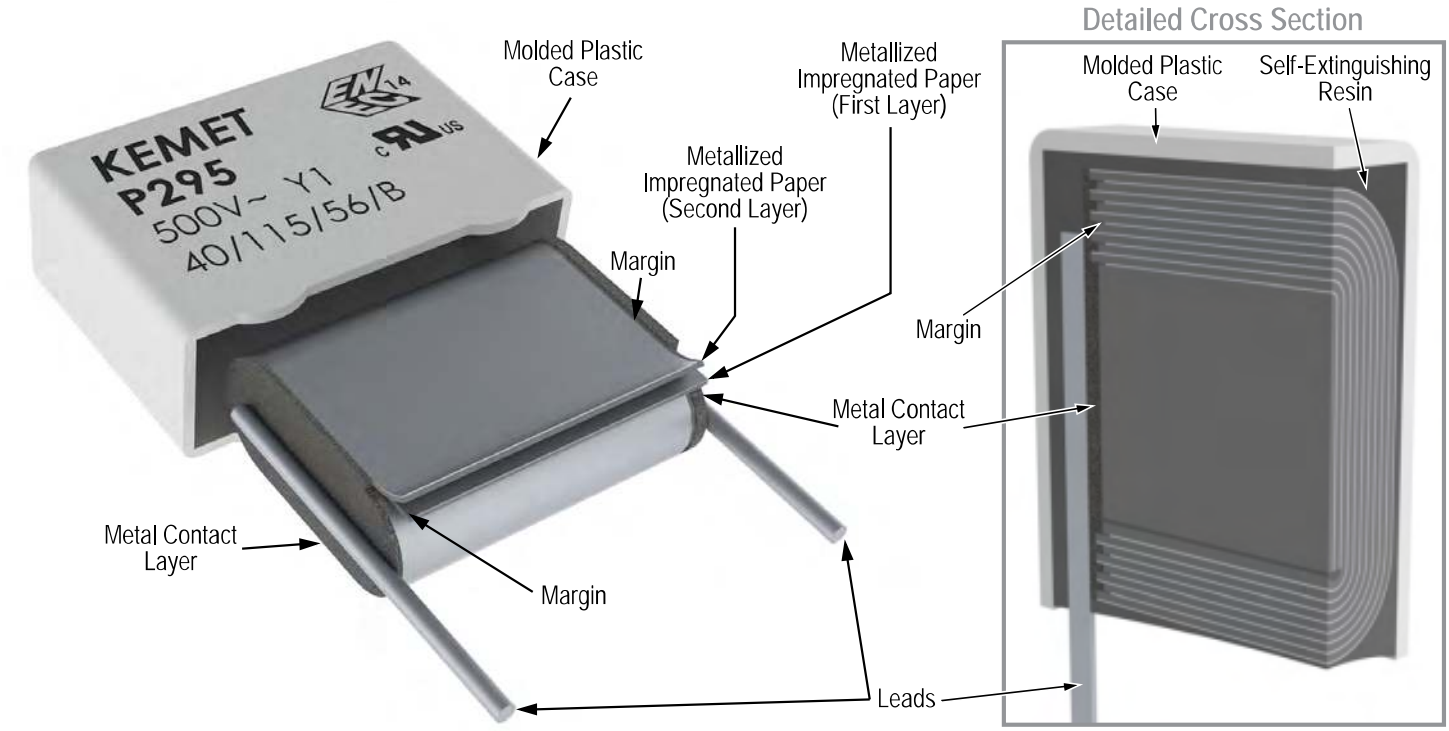
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

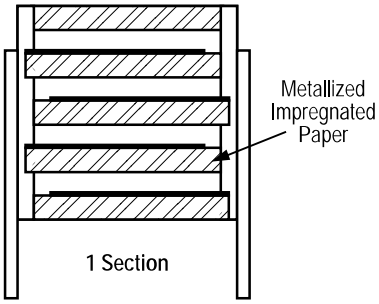
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

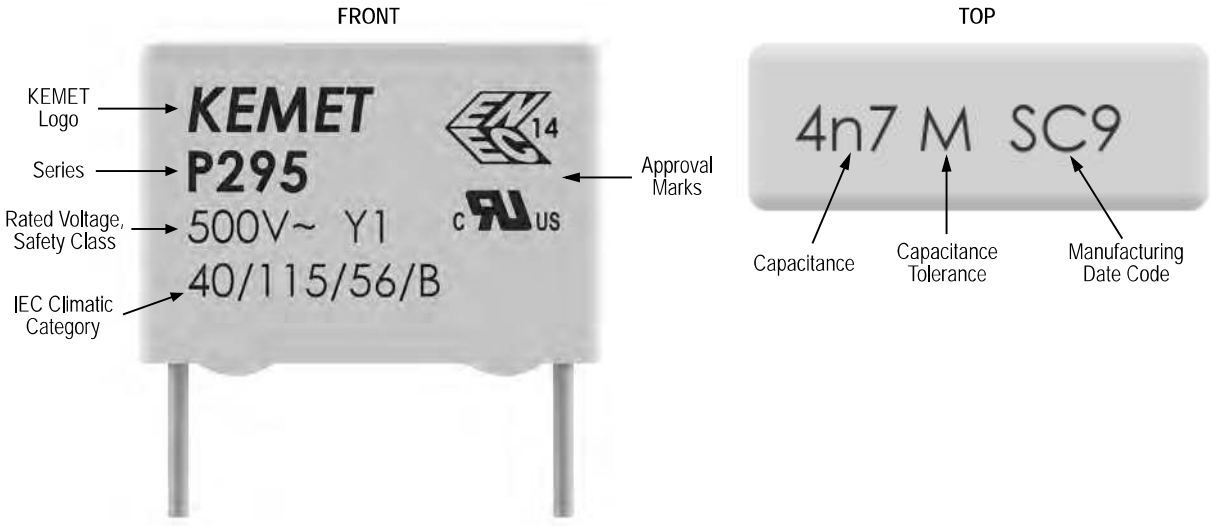
Construction



Winding Scheme



Marking



Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 360 mm	Large Reel ø 500 mm	Standard Reel Formed	Ammo Formed
15	5.5	10.5	18	1000	800	600	1200	550	570
	5.5	12.5	18	1000	800	600	1200	550	570
	7.5	14.5	18	800	400	400	800	350	378
	6.5	12.5	18	1000	600	500	1000	450	480
	8.5	16	18	600	400	400	800	350	324
	8	15	18	600	400	400	800	350	351
	9.5	17.5	18	500	300	350	700	250	297
	6	12	18	1000	800	500	1000	450	520
	11	19	18	450	250	300	600	250	252
	13	12.5	18	400	300	250	500	200	216

PZB300 Series Metallized Impregnated Paper, 275 VAC Delta Configuration X2 + 2x Y2

Overview

The PZB300 Series is constructed of multilayer metallized paper encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include interference suppressors with X2 + 2x Y2 capacitors in a delta configuration.

Benefits

- Approvals: ENEC, UL, CSA
- Rated voltage: 275 VAC 50/60 Hz
- Capacitance X Value: 0.1 µF and 0.15 µF
- Capacitance Y Value: 0.0022 µF, 0.0033 µF and 0.0047 µF
- Lead spacing: 20 mm
- Capacitance tolerance: ±20%



Legacy Part Number System

PZB300	M	C	11	R30
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Packaging
Delta EMI, X2 + 2x Y2, Metallized Paper	M = 275	C = 20.0	The first digit indicates the value of the X capacitor: 1 = 0.10 µF 2 = 0.15 µF The second digit indicates the value of the Y capacitor: 1 = 0.0022 µF 2 = 0.0033 µF 3 = 0.0047 µF	See Ordering Options Table

New KEMET Part Number System

P	300	P	L	104	M	275	A	C222
Capacitor Class	Series	Lead Spacing (mm)	Size Code	X Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging	Y Capacitance Code
P = Paper	Delta EMI, X2 + 2x Y2, Metallized Paper	P = 20	See Dimension Table	First two digits indicate the two most significant digits of the capacitance value in picofarads. The third digit is the number of following zeros.	M = ±20%	275 = 275	See Ordering Options Table	C plus first two digits represent significant figures. Third digit specifies number of zeros.

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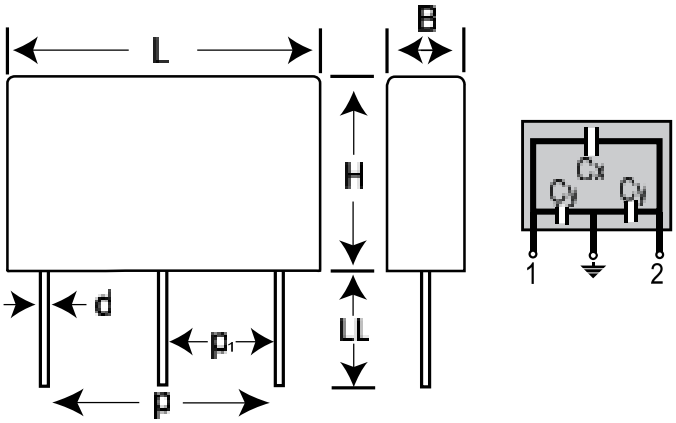
Benefits cont'd

- Climatic category: 40/100/56/B, IEC 60068–1
- Tape and reel packaging in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +100˚C
- 100% screening Factory Test at 2,150 VDC for X2 capacitors and 3,000 VDC for Y2 capacitors
- Excellent self-healing properties ensure long life even when subjected to frequent over voltages
- Good resistance to ionization due to impregnated paper dielectric
- High dV/dt capability
- Impregnated paper ensures excellent stability and reliability properties, particularly in applications with continuous operation

Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
20	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag)–Max Length Leads	30 +5/-0	A	R30

Dimensions – Millimeters



p		p1		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
20.0	+/-0.5	10.0	Nominal	12.5	Maximum	16.0	Maximum	24.0	Maximum	0.8	+/-0.05
Note: See Ordering Options Table for lead length (LL) options.											

Performance Characteristics

Rated Voltage	275 VAC 50/60 Hz	
Capacitance Range	0.1 µF and 0.15 µF	
Capacitance Tolerance	±20%	
Temperature Range	-40°C to +100°C	
Climatic Category	40/100/56/B	
Approvals	ENEC, UL, CSA	
Dissipation Factor	Maximum Values at +23°C	
	1 kHz	1.3%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,150 VDC for X2 capacitors and 3,000 VDC for Y2 capacitors. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. This test may not be repeated due to potential capacitor damage. KEMET is not liable in such case for any failures.	
Insulation Resistance	Minimum Value Between Terminals	
	≥ 12,000 MΩ	

Environmental Test Data

Test	IEC Publication	Procedure
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each, 10 – 500 Hz at 0.75 mm or 98 m/s^2 (PZB300 MCx mounted on PC board)
Bump	IEC 60068–2–29 Test Eb	4,000 bumps at 390 m/s^2
Solderability	IEC 60068–2–20 Test Ta	Solder globule method Wetting time < 1 second
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Humidity	IEC 60068–2–3 Test Ca	+40°C and 90 – 95% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384–14	SE/0140-24C
	UL 1283	E100117
	CSA – C22.2 No. 8	E100117

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Cx (µF)	Cy (µF)	Maximum Dimensions in mm			Lead Spacing (p)	Package Quantity				New KEMET Part Number	Legacy Part Number
		B	H	L		A (R30)	C (R06)	dV/dt Cx	dV/dt Cy		
0.10	0.0022	12.5	16.0	24.0	20.0	150	1000	600	1000	P300PL104M275(1)C222	PZB300MC11(1)
0.10	0.0033	12.5	16.0	24.0	20.0	150	1000	600	1000	P300PL104M275(1)C332	PZB300MC12(1)
0.10	0.0047	12.5	16.0	24.0	20.0	150	1000	600	1000	P300PL104M275(1)C472	PZB300MC13(1)
0.15	0.0022	12.5	16.0	24.0	20.0	150	1000	600	1000	P300PL154M275(1)C222	PZB300MC21(1)
0.15	0.0033	12.5	16.0	24.0	20.0	150	1000	600	1000	P300PL154M275(1)C332	PZB300MC22(1)
0.15	0.0047	12.5	16.0	24.0	20.0	150	1000	600	1000	P300PL154M275(1)C472	PZB300MC23(1)
Cx (µF)	Cy (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	A (R30)	C (R06)	dV/dt Cx	dV/dt Cy	New KEMET Part Number	Legacy Part Number

(1) Insert lead and packaging code. See Ordering Options Table for available options.

Marking

- KEMET's logo
- Series
- Capacitance
- Rated voltage
- Capacitor class
- Approval marks
- Manufacturing date code
- IEC climatic category
- Passive flammability class
- Circuit diagram

Soldering Process

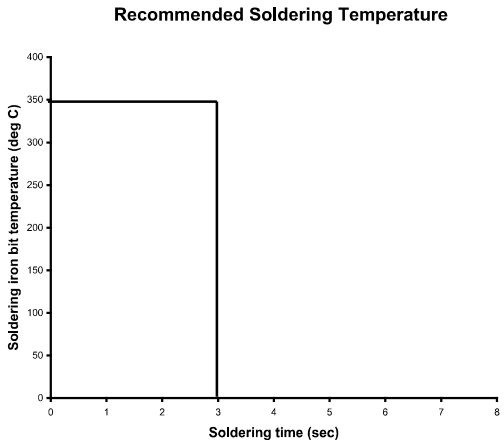
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Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

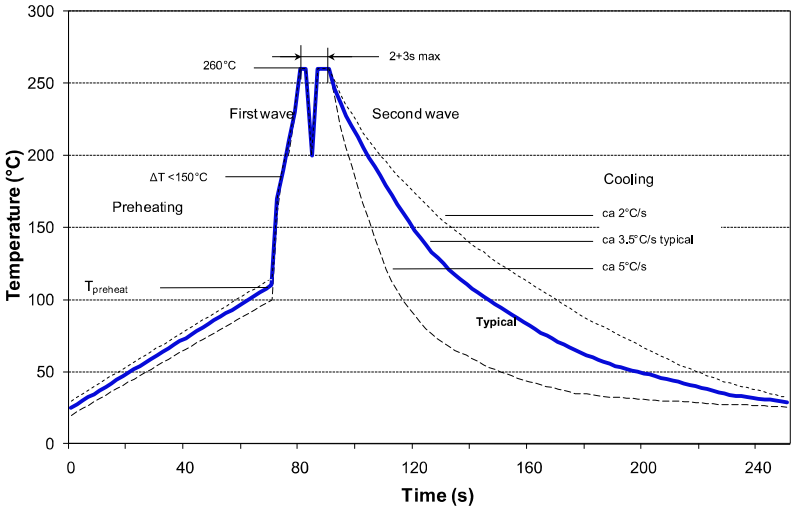
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

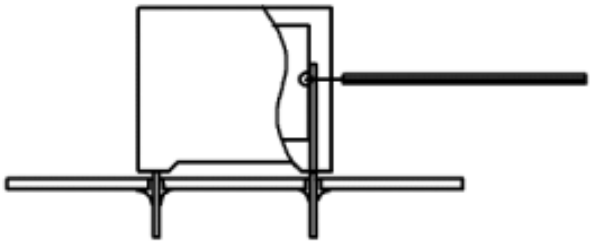
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



Temperature monitored inside the capacitor.

Selective Soldering Recommendations

Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

PMZ2074 Series Metallized Impregnated Paper, 275 VAC 2x X2 with One Common Terminal

Overview

The PMZ2074 Series is constructed of multilayer metallized paper encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use as an electromagnetic interference suppressor in all X2, across-the-line applications or other demanding applications where two capacitors are utilized in series.

Benefits

- Approvals: ENEC
- Rated voltage: 275 VAC 50/60 Hz
- Capacitance: 0.15 µF + 0.033 µF, 0.15 µF + 0.047 µF, 0.15 µF + 0.068 µF, 0.22 µF + 0.082 µF, 0.22 µF + 0.1 µF
- Lead spacing: 20.3 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category: 40/110/56/B, IEC 60068–1
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +110˚C
- 100% screening factory test at 2,150 VDC



Legacy Part Number System

PMZ2074	M	C	615	M	533	M	R30
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Capacitance Tolerance	Capacitance Code (pF)	Internal Use	Packaging
Double Capacitor X2, Metallized Paper	M = 275	C = 20.3	The last two digits represent significant figures. The first digit specifies the total number of digits.	K = ±10% M = ±20%	The last two digits represent significant figures. The first digit specifies the total number of digits.	M (Standard)	See Ordering Options Table

New KEMET Part Number System

P	374	C	L	154	M	275	A	C333
Capacitor Class	Series	Lead Spacing (mm)	Size Code	X Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging	Y Capacitance Code
P = Paper	Double Capacitor X2, Metallized Paper	C = 20.3	See Dimension Table	First two digits indicate the two most significant digits of the capacitance value in picofarads. The third digit is the number of following zeros.	M = ±20%	275 = 275	See Ordering Options Table	C plus first two digits represent significant figures. Third digit specifies number of zeros.

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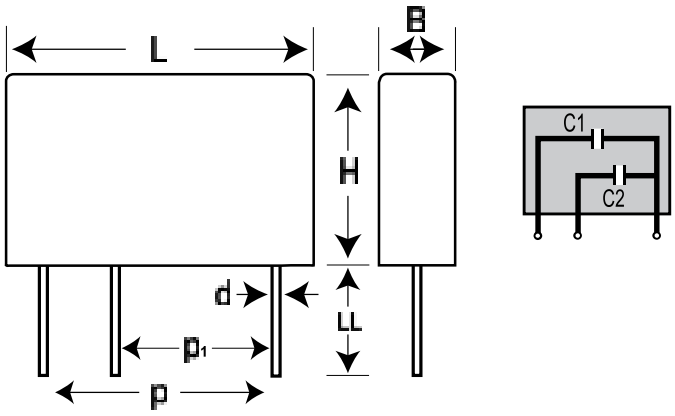
Benefits cont'd

- Highest possible safety regarding active and passive flammability
- Excellent self-healing properties ensure long life even when subjected to frequent over voltages
- Good resistance to ionization due to impregnated paper dielectric
- High dV/dt capability
- Impregnated paper ensures excellent stability and reliability properties, particularly in applications with continuous operation

Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
20.3	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30

Dimensions – Millimeters



p		p_1		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
20.3	+/-0.4	15.2	Nominal	12.5	Maximum	16.0	Maximum	24.0	Maximum	0.8	+/-0.05
20.3	+/-0.4	15.2	Nominal	14	Maximum	18	Maximum	24.0	Maximum	0.8	+/-0.05
Note: See Ordering Options Table for lead length (LL) options.											

Performance Characteristics

Rated Voltage	275 VAC 50/60 Hz	
Capacitance Range	0.15 µF + 0.033 µF, 0.15 µF + 0.047 µF, 0.15 µF + 0.068 µF, 0.22 µF + 0.082 µF, 0.22 µF + 0.1 µF	
Capacitance Tolerance	±20%, ±10%	
Temperature Range	-40°C to +110°C	
Climatic Category	40/110/56/B	
Approvals	ENEC	
Dissipation Factor	Maximum Values at +23°C	
	1 kHz	1.3%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,150 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. This test may not be repeated due to potential capacitor damage. KEMET is not liable in such case for any failures.	
Insulation Resistance	Minimum Value Between Terminals	
	≥ 12,000 MΩ	
In DC Applications	Recommended voltage ≤ 630 VDC	

Environmental Test Data

Test	IEC Publication	Procedure
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each, 10 – 500 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	4,000 bumps at 390 m/s^2
Solderability	IEC 60068–2–20 Test Ta	Solder globule method Wetting time for d > 0.8 < 1.5 seconds
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Humidity	IEC 60068–2–3 Test Ca	+40°C and 90 – 95% RH, 56 days

Approvals

Mark	Specification	File Number
	EN/IEC 60384–14	

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

C1 (µF)	C2 (µF)	Maximum Dimensions in mm			Lead Spacing (p)	Package Quantity		dV/dt C1	dV/dt C2	New KEMET Part Number	Legacy Part Number
		B	H	L		A (R30)	C (R06)				
0.15	0.033	12.5	16.0	24.0	20.3	150	900	600	1200	P374CL154(1)275(2)C333	PMZ2074MC615(1)533M(2)
0.15	0.047	12.5	16.0	24.0	20.3	150	900	600	1200	P374CL154(1)275(2)C473	PMZ2074MC615(1)547M(2)
0.15	0.068	12.5	16.0	24.0	20.3	150	900	600	1200	P374CL154(1)275(2)C683	PMZ2074MC615(1)568M(2)
0.22	0.082	14.0	18.0	24.0	20.3	100	900	600	1200	P374CR224(1)275(2)C823	PMZ2074MC622(1)582M(2)
0.22	0.10	14.0	18.0	24.0	20.3	100	900	600	1200	P374CR224(1)275(2)C104	PMZ2074MC622(1)610M(2)
C1 (µF)	C2 (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	A (R30)	C (R06)	dV/dt C1	dV/dt C2	New KEMET Part Number	Legacy Part Number

(1) M = ±20%, K = ±10%.
(2) Insert lead and packaging code. See Ordering Options Table for available options.

Marking

- KEMET's logo
- Series
- Capacitance
- Rated voltage
- Capacitor class
- Approval marks
- Manufacturing date code
- IEC climatic category
- Passive flammability class

Soldering Process

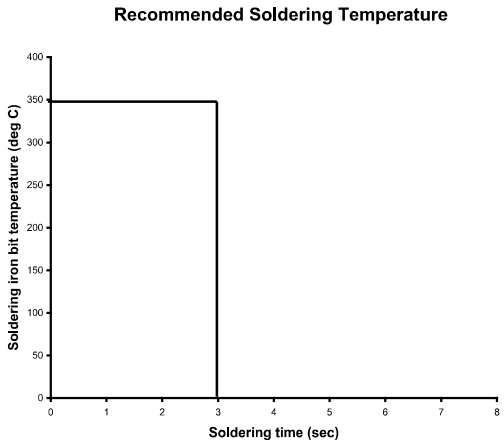
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

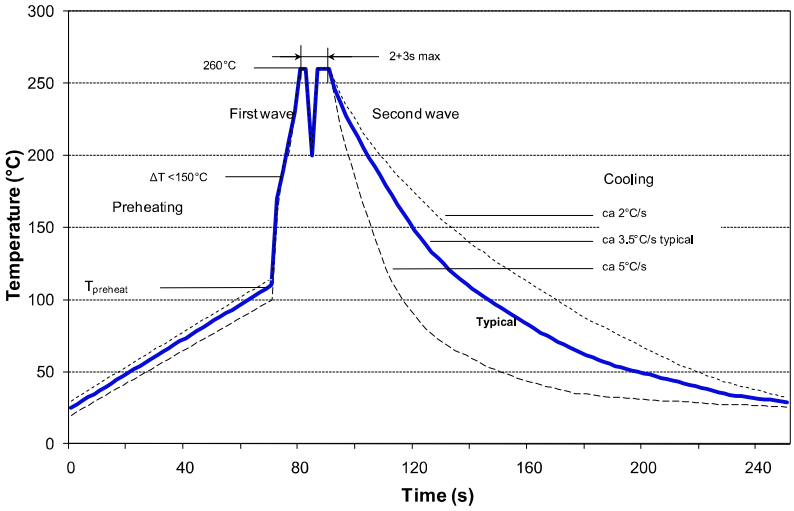
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

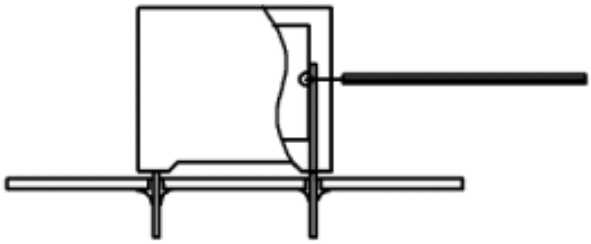
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



Temperature monitored inside the capacitor.

Selective Soldering Recommendations

Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

PHZ9004 Series Metallized Polypropylene Film, 300 VAC 3x X2 with Separate Terminals for Three-Phase Filtering

Overview

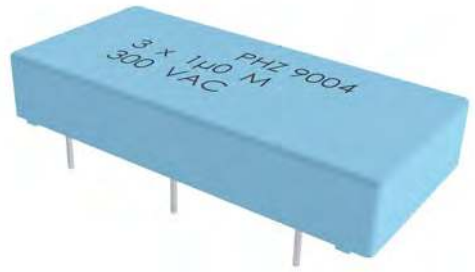
The PHZ9004 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use as an electromagnetic interference suppressor in X2 and across-the-line applications for three phases.

Benefits

- Rated voltage: 300 VAC 50/60 Hz
- Capacitance range: 3 x 1.0 µF
- Lead spacing: 27.5 mm
- Capacitance tolerance: ±20%, other tolerances on request
- Climatic category: 55/105/56, IEC 60068–1
- Tape and reel in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -55˚C to +105˚C
- 100% screening factory test at 2,200 VDC



Legacy Part Number System

PHZ9004	E	F	7100	M	R06L2
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Capacitance Tolerance	Packaging
Triple Capacitor X2, Metallized Polypropylene	E = 300	F = 27.5	The last three digits represent significant figures. The first digit specifies the total number of digits.	M = ±20%	See Ordering Options Table

New KEMET Part Number System

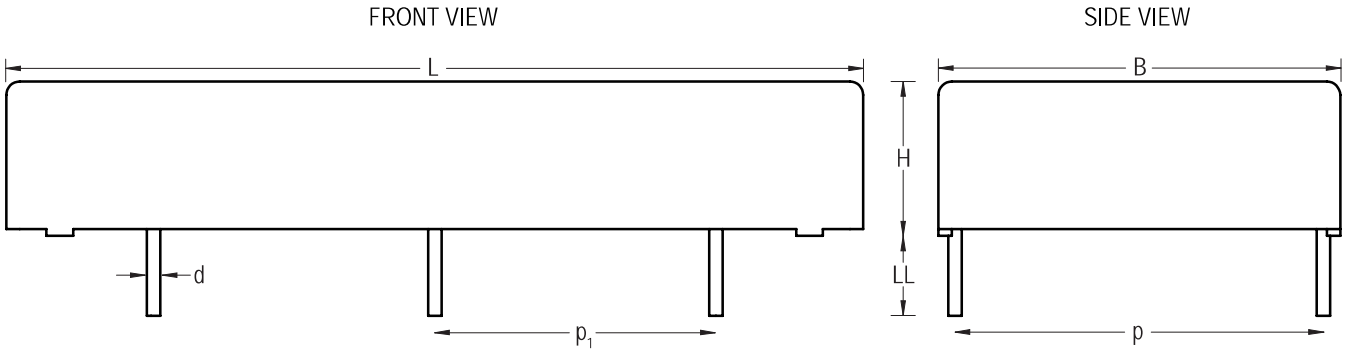
9004	AA	105	M	300	C	DECT	V680
Capacitor Class	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging	C-Spec	V-Spec
Triple Capacitor X2, Metallized Polypropylene	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20%	300 = 300	See Ordering Options Table	Optional additional characters at KEMET's option.	Part Number specific version code

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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
27.5	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06L2

Dimensions – Millimeters



p		p_1		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
27.5	+/-0.5	21	+/-0.5	30	Maximum	11.5	Maximum	64	Maximum	1	+/-0.05
Note: See Ordering Options Table for lead length (LL) options.											

Performance Characteristics

Rated Voltage	300 VAC 50/60 Hz	
Capacitance Range	3 x 1.0 µF	
Capacitance Tolerance	±20%, other tolerances on request	
Temperature Range	-55 to +105°C	
Climatic Category	55/105/56	
Dissipation Factor	Maximum Values at +23°C	
	1 kHz	0.10%
	10 kHz	0.50%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 2,200 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. This test may not be repeated due to potential capacitor damage. KEMET is not liable in such case for any failures.	
Insulation Resistance	Minimum Value Between Terminals	
	≥ 10,000 MΩ • µF	
	Minimum Value Between Terminals and Case	
	≥ 100,000 MΩ	

Environmental Test Data

Test	IEC Publication	Procedure
Endurance	IEC 60384–14	1.25 x V_R VAC 50 Hz, once every hour increase to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 55 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	1,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068–2–14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Humidity	IEC 60068–2–3 Test Ca	+40°C and 90 – 95% RH, 56 days

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

VAC	Cap Value (µF)	Max Dimensions in mm			Lead Spacing (p)	Package Quantity C (R06I2)	dV/dt (V/µs)	New KEMET Part Number	Legacy Part Number
		B	H	L					
300	3 x 1.0	30.0	11.5	64.0	27.5	72	100	9004AA105M300CDECTV680	PHZ9004EF7100MR06L2

Soldering Process

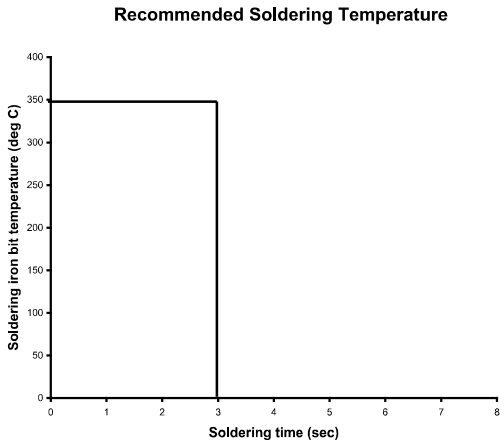
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

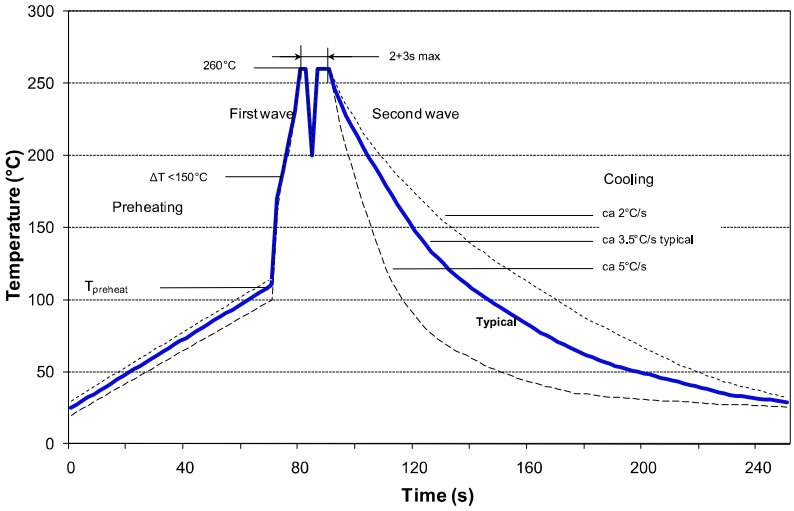
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

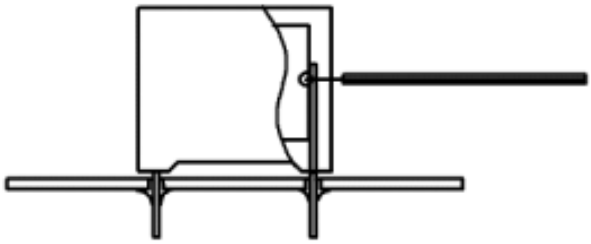
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



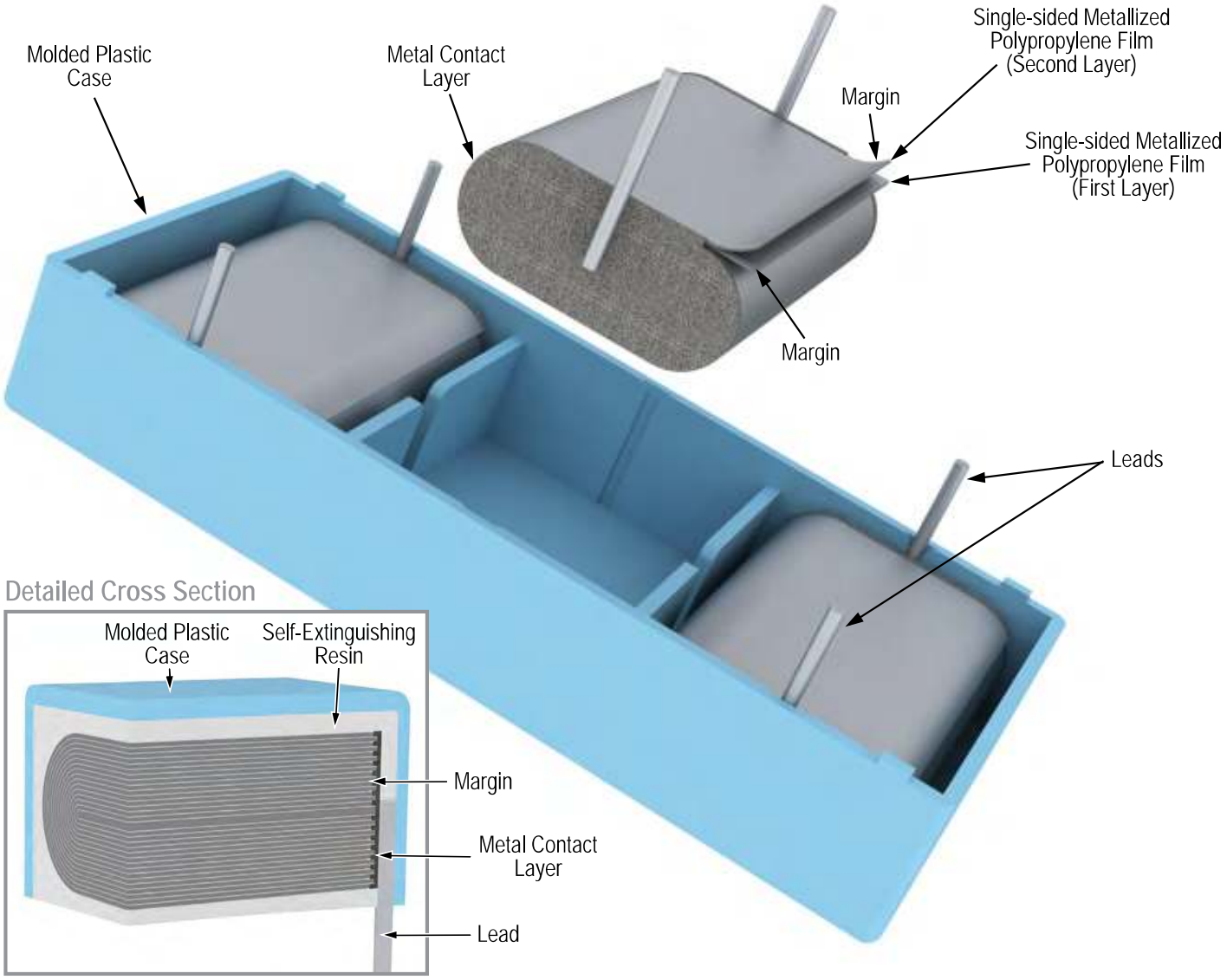
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

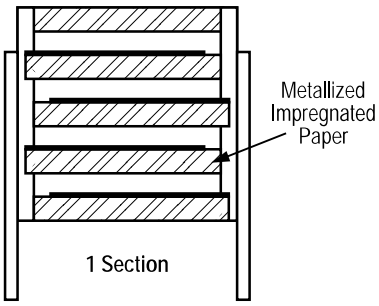
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

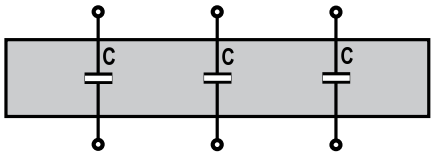
Construction



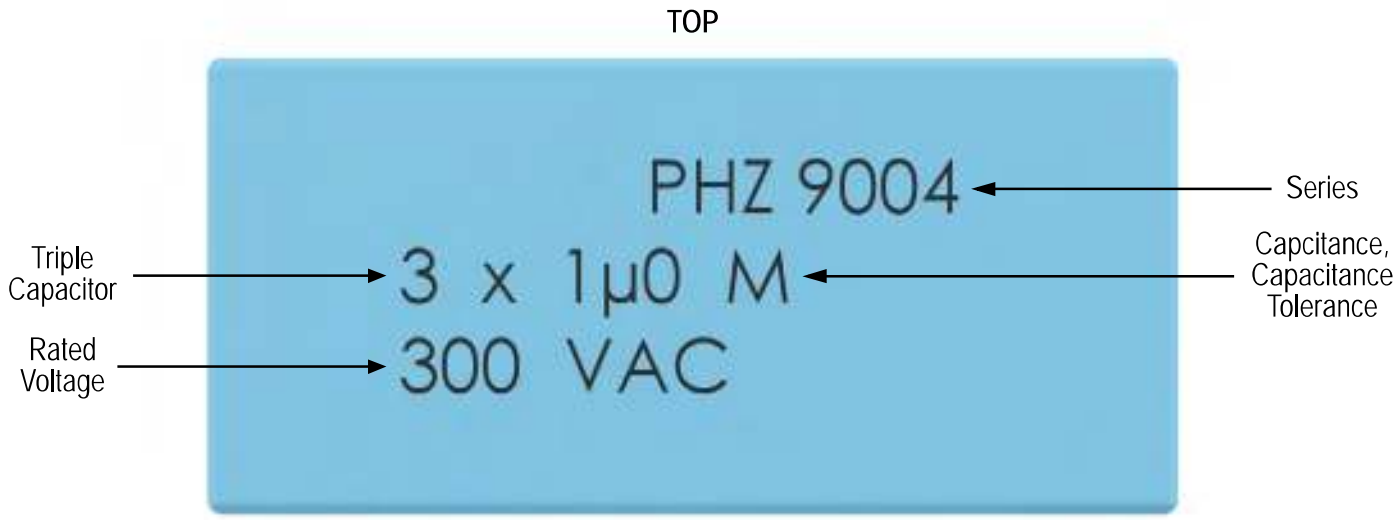
Winding Scheme



Electrical Scheme



Marking


TOP
PHZ 9004
Series
Triple Capacitor
3 x 1µ0 M
Capcitance, Capacitance Tolerance
Rated Voltage
300 VAC

F43 Series Metallized Polypropylene Film, 160 VAC/250 VDC, 200 VAC/400 VDC, 220 VAC/630 VDC and Class X2, 275 VAC

Overview

The F43 Series is constructed of metallized polypropylene film encapsulated with self-extinguishing resin in a box of material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use in contact protection, contact interference suppression and transient suppression.

Benefits

- Approvals (for 275 VAC only): ENEC, UL
- Rated voltage: 160 VAC/250 VDC, 200 VAC/400 VDC, 220 VAC/630 VDC, and Class X2, 275 VAC
- Capacitance range: 0.01 – 1.0 µF
- Lead spacing: 15.0 – 27.5 mm
- Capacitance tolerance: ±20%, ±10%
- Climatic category: 55/100/56, IEC 60068–1 and 40/100/56 (275 VAC), IEC 60068–1
- Tape and reel packaging in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range: -55˚C to +100˚C and -40˚C to +100˚C (275 VAC)



Part Number System

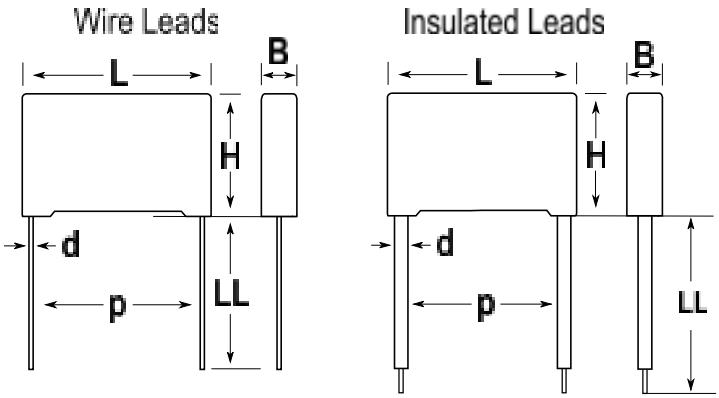
F	43	K	N	3100	XX	01	M
Capacitor Class	Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Packaging	Internal Use	Capacitance Tolerance
Legacy PN: F New KEMET PN: Omit this character	RC Snubber, Metallized Polypropylene	I = 160 M = 200 P = 220 K = 275 (X2)	I = 15.0 N = 22.5 R = 27.5	The last three digits represent significant figures. The first digit specifies number of zeros to be added.	Contact KEMET for packaging availability and details	00, 01, 04 (Standard)	K = ±10% M = ±20%

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Ordering Options Table

Lead Type	Lead Length (mm)	Lead and Packaging Code
Wire leads	up to 30	Contact KEMET for availability and details
Insulated wire leads	up to 30	
Flexible cable leads	up to 270	

Dimensions – Millimeters



p		B		H		L		d	
Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
15.0	+/-0.4	7.5	Maximum	14.5	Maximum	18.0	Maximum	0.6	+/-0.05
15.0	+/-0.4	8.5	Maximum	14.5	Maximum	18.0	Maximum	0.8	+/-0.05
15.0	+/-0.4	10.0	Maximum	16.0	Maximum	18.0	Maximum	0.6	+/-0.05
22.5	+/-0.4	6.0	Maximum	15.0	Maximum	26.5	Maximum	0.8	+/-0.05
22.5	+/-0.4	7.0	Maximum	16.0	Maximum	26.5	Maximum	0.6(1)	+/-0.05
22.5	+/-0.4	8.5	Maximum	17.0	Maximum	26.5	Maximum	0.6(1)	+/-0.05
22.5	+/-0.4	10.0	Maximum	18.5	Maximum	26.5	Maximum	0.8	+/-0.05
22.5	+/-0.4	10.0	Maximum	20.0	Maximum	26.5	Maximum	0.6	+/-0.05
22.5	+/-0.4	11.0	Maximum	20.0	Maximum	26.5	Maximum	0.6(1)	+/-0.05
27.5	+/-0.4	11.0	Maximum	20.0	Maximum	32.0	Maximum	0.8	+/-0.05
27.5	+/-0.4	13.0	Maximum	22.0	Maximum	32.0	Maximum	0.8	+/-0.05
27.5	+/-0.4	18.0	Maximum	33.0	Maximum	32.0	Maximum	0.8	+/-0.05
Note: See Ordering Options Table for lead length (LL) options.									

(1) d = 0.8 when capacitance ≥ 0.25 µF.

Performance Characteristics

Rated Voltage	160 VAC/250 VDC, 200 VAC/400 VDC, 220 VAC/630 VDC, & Class X2, 275 VAC	
Capacitance Range	0.01 – 1.0 µF	
Capacitance Tolerance	±20%, ±10%	
Temperature Range	-55°C to +100°C, -40°C to +100°C (275 VAC)	
Climatic Category	55/100/56, 40/100/56 (275 VAC)	
Approvals	ENEC, UL	
Dissipation Factor	Maximum Values at +23°C	
	Frequency	tanδ
	1 kHz	0.1%
Test Voltage Between Terminals	The 100% screening factory test is carried out at 1.6 V_R, 4.3 V_R for 275 VAC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test. This test may not be repeated due to potential capacitor damage. KEMET is not liable in such case for any failures.	
Insulation Resistance	Minimum Value Between Terminals	
	C ≤ 0.33 µF	≥ 10,000 MΩ
	C > 0.33 µF	≥ 3,000 MΩ • µF
In DC Applications	Recommended voltage ≤ 800 VDC	

Environmental Test Data

Test	IEC Publication	Procedure
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 500 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	4,000 bumps at 390 m/s^2
Solderability	IEC 60068–2–20 Test Ta	Wetting time d or d > 0.8 < 1.5 seconds
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Certification Body	Specification	File Number
	EN/IEC 60384–14	CA08.00032
	UL 60384–14 and CAN/CSA–E60384–14	E97797

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

VAC	VDC	Capacitance Value (µF)	Max Dimensions in mm			Lead Spacing (p)	Available E12[3] Resistor Values (Ω)	New KEMET Part Number	Legacy Part Number
			B	H	L				
160	250	0.25	8.5	14.5	18.0	15.0	10–100	43II3250(1)01(2)	F43II3250(1)01(2)
160	250	0.33	6.0	15.0	26.5	22.5	10–100	43IN3330(1)01(2)	F43IN3330(1)01(2)
160	250	0.47	8.5	17.0	26.5	22.5	10–100	43IN3470(1)01(2)	F43IN3470(1)01(2)
160	250	0.5	8.5	17.0	26.5	22.5	10–100	43IN3500(1)01(2)	F43IN3500(1)01(2)
160	250	1	10.0	18.5	26.5	22.5	10–22	43IN4100(1)01(2)	F43IN4100(1)01(2)
200	400	0.25	7.0	16.0	26.5	22.5	10–100	43MN3250(1)01(2)	F43MN3250(1)01(2)
200	400	0.5	10.0	18.5	26.5	22.5	10–100	43MN3500(1)01(2)	F43MN3500(1)01(2)
200	400	1	13.0	22.0	32.0	27.5	10–22	43MR4100(1)01(2)	F43MR4100(1)01(2)
220	630	0.022	7.5	14.5	18.0	15.0	10–1000	43PI2220(1)01(2)	F43PI2220(1)01(2)
220	630	0.1	7.0	16.0	26.5	22.5	10–1000	43PN3100(1)01(2)	F43PN3100(1)01(2)
220	630	0.25	11.0	20.0	26.5	22.5	10–100	43PN3250(1)01(2)	F43PN3250(1)01(2)
220	630	0.5	13.0	22.0	32.0	27.5	10–100	43PR3500(1)01(2)	F43PR3500(1)01(2)
275 (X2)		0.01	7.5	14.5	18.0	15.0	10–1000	43KI2100(1)01(2)	F43KI2100(1)01(2)
275 (X2)		0.015	7.5	14.5	18.0	15.0	10–1000	43KI2150(1)01(2)	F43KI2150(1)01(2)
275 (X2)		0.022	7.5	14.5	18.0	15.0	10–1000	43KI2220(1)01(2)	F43KI2220(1)01(2)
275 (X2)		0.033	7.5	14.5	18.0	15.0	10–1000	43KI2330(1)01(2)	F43KI2330(1)01(2)
275 (X2)		0.047	7.5	14.5	18.0	15.0	10–1000	43KI2470(1)01(2)	F43KI2470(1)01(2)
275 (X2)		0.068	10.0	16.0	18.0	15.0	10–1000	43KI2680(1)01(2)	F43KI2680(1)01(2)
275 (X2)		0.1	8.5	17.0	26.5	22.5	10–1000	43KN3100(1)01(2)	F43KN3100(1)01(2)
275 (X2)		0.15	10.0	20.0	26.5	22.5	10–470	43KN3150(1)01(2)	F43KN3150(1)01(2)
275 (X2)		0.22	11.0	20.0	26.5	22.5	10–470	43KN3220(1)01(2)	F43KN3220(1)01(2)
275 (X2)		0.25	11.0	20.0	32.0	27.5	10–100	43KR3250(1)01(2)	F43KR3250(1)01(2)
275 (X2)		0.33	11.0	20.0	32.0	27.5	10–100	43KR3330(1)01(2)	F43KR3330(1)01(2)
275 (X2)		0.47	13.0	22.0	32.0	27.5	10–100	43KR3470(1)01(2)	F43KR3470(1)01(2)
275 (X2)		0.5	13.0	22.0	32.0	27.5	10–100	43KR3500(1)01(2)	F43KR3500(1)01(2)
275 (X2)		0.68	18.0	33.0	32.0	27.5	10–100	43KR3680(1)01(2)	F43KR3680(1)01(2)
275 (X2)		1	18.0	33.0	32.0	27.5	10–22	43KR4100(1)01(2)	F43KR4100(1)01(2)
VAC	VDC	Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing (p)	Available E12[3] Resistor Values (Ω)	New KEMET Part Number	Legacy Part Number

(1) Lead and packaging code. Contact KEMET for availability and details.
(2) M = ±20%, K = ±10%.
[3] *E12 values are multiples of 10 in the following range: 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82. The standard resistance tolerance is 10%.*

Soldering Process

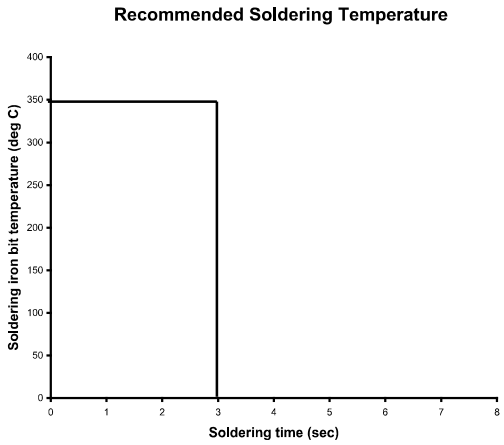
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

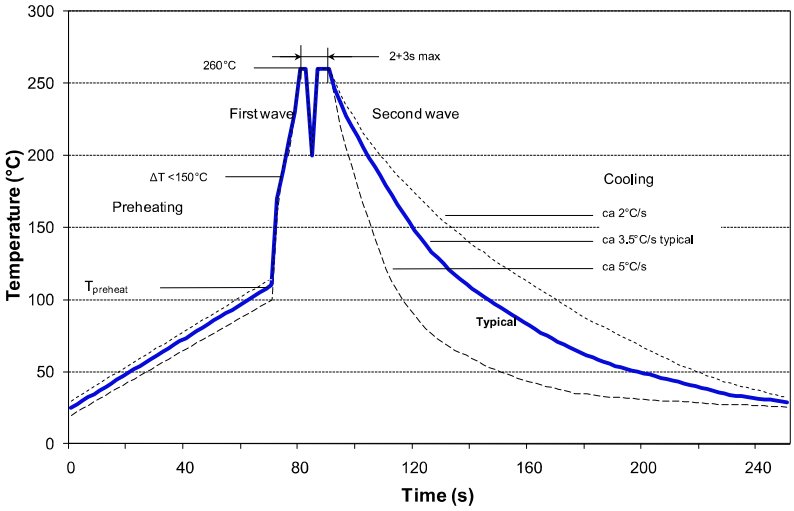
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

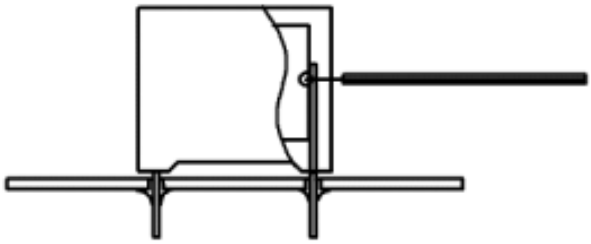
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



Temperature monitored inside the capacitor.

Selective Soldering Recommendations

Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

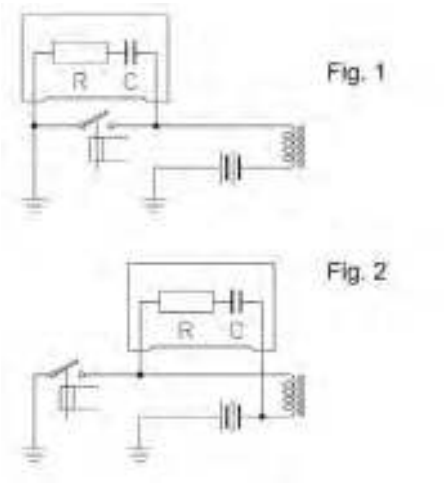
The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

Marking

- KEMET's logo
- Series
- Capacitance
- Rated resistance
- Rated voltage
- Capacitor class
- Approval marks
- IEC climatic category
- Passive flammability class
- Manufacturing date code

Mounting

RC units are mounted in parallel with the contacts to be protected or in parallel with the inductive load (Fig. 1 and Fig. 2). RC units are generally mounted in parallel with the contacts to suppress radio interferences (Fig. 1).



PMR205 Series Metallized Impregnated Paper, 125 VAC/250 VDC

Overview

The PMR205 Series is constructed of multilayer metallized paper encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use in contact protection, contact interference suppression and transient suppression.

Benefits

- Rated voltage: 125 VAC/250 VDC, 50/60 Hz
- Capacitance range: 0.1 – 1.0 µF
- Capacitance tolerance: ±20%
- Resistance range: 22 – 680 Ω
- Resistance tolerance: ±30%
- Lead spacing: 15.2 – 25.4 mm
- Climatic category: 40/085/56/B, IEC 60068–1
- Tape and reel packaging in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +85˚C
- Excellent self-healing properties which ensure long life even when subjected to frequent over voltages
- Good resistance to ionization due to impregnated paper dielectric
- High dV/dt capability
- Impregnated paper ensures excellent stability and reliability properties, particularly in applications with continuous operation



Legacy Part Number System

PMR205	A	B	6100	M	033	R30
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Capacitance Tolerance	Resistance (Ω)	Packaging
RC Snubber, Metallized Paper	A = 125	B = 15.2 C = 20.3 E = 25.4	The last three digits represent significant figures. The first digit specifies the total number of digits.	M = ±20%	Resistance Value in Ω	See Ordering Options Table

New KEMET Part Number System

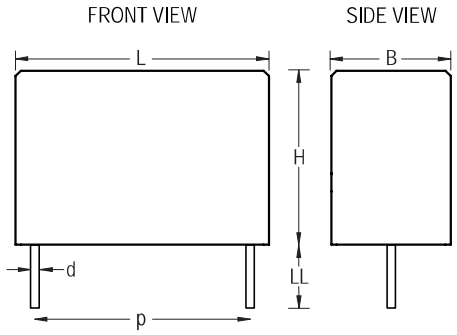
P	405	Q	E	104	M	125	A	H330
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging	Resistance (Ω)
P = Metallized Paper	RC Snubber	Q = 15.2 C = 20.3 E = 25.4	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20%	125 = 125	See Ordering Options Table	H plus first two digits represent significant figures. Third digit specifies number of zeros.

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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
15.2	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
20.3	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
25.4	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Tray) – Max Length Leads	30 +5/-0	A	R30

Dimensions – Millimeters

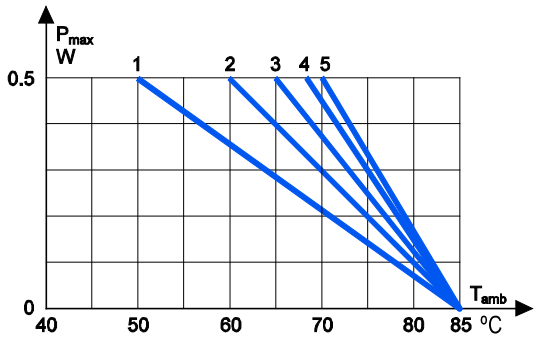


Size Code	p		B		H		L		d	
	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
QE	15.2	+/-0.4	5.2	Maximum	10.5	Maximum	18.5	Maximum	0.8	+/-0.05
QM	15.2	+/-0.4	7.3	Maximum	13.0	Maximum	18.5	Maximum	0.8	+/-0.05
QP	15.2	+/-0.4	7.8	Maximum	13.5	Maximum	18.5	Maximum	0.8	+/-0.05
CE	20.3	+/-0.4	7.6	Maximum	14.0	Maximum	24.0	Maximum	0.8	+/-0.05
CJ	20.3	+/-0.4	9.0	Maximum	15.0	Maximum	24.0	Maximum	0.8	+/-0.05
CP	20.3	+/-0.4	11.3	Maximum	16.5	Maximum	24.0	Maximum	0.8	+/-0.05
EE	25.4	+/-0.4	10.6	Maximum	16.1	Maximum	30.5	Maximum	1.0	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Rated Voltage	125 VAC 50/60 Hz	
Capacitance Range	0.1 – 1.0 µF	
Capacitance Tolerance	±20%	
Resistance Range	22 – 680 Ω	
Resistance Tolerance	±30%	
Temperature Range	-40°C to +85°C	
Climatic Category	40/085/56/B	
Peak Pulse Voltage	375 V	
Series Resistance	The series resistance is defined at 1 kHz for RC ≥ 50 µs and at 100 kHz for RC < 50 µs	
Insulation Resistance	Minimum Values Between Terminals	
	C ≤ 0.33 µF	≥ 3,000 MΩ
	C > 0.33 µF	≥ 1,000 MΩ • µF
Power Ratings	The average losses may reach 0.5 W provided the surface temperature does not exceed + 85°C. For maximum permitted power dissipation vs. temperature, see Derating Curves.	
Derating Curves	Maximum Allowable Power Dissipation vs. Ambient Temperature and Case Sizes.	



Curve	Dimension B (mm)
1	5.2
2	7.3
2	7.8
3	7.6
4	9
5	11.3

Environmental Test Data

Test	IEC Publication	Procedure
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each 10 – 500 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	4,000 bumps at 390 m/s^2
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Lead Spacing (p)	Capacitance Value (µF)	Resistance (Ω)	Maximum Dimensions in mm			New KEMET Part Number	Legacy Part Number
			B	H	L		
15.2	0.10	33	5.2	10.5	18.5	P405QE104M125(1)H330	PMR205AB6100M033(1)
15.2	0.10	47	5.2	10.5	18.5	P405QE104M125(1)H470	PMR205AB6100M047(1)
15.2	0.10	100	5.2	10.5	18.5	P405QE104M125(1)H101	PMR205AB6100M100(1)
15.2	0.10	220	5.2	10.5	18.5	P405QE104M125(1)H221	PMR205AB6100M220(1)
15.2	0.15	68	5.2	10.5	18.5	P405QE154M125(1)H680	PMR205AB6150M068(1)
15.2	0.15	100	5.2	10.5	18.5	P405QE154M125(1)H101	PMR205AB6150M100(1)
15.2	0.22	47	7.3	13.0	18.5	P405QM224M125(1)H470	PMR205AB6220M047(1)
15.2	0.22	100	7.3	13.0	18.5	P405QM224M125(1)H101	PMR205AB6220M100(1)
15.2	0.22	220	7.3	13.0	18.5	P405QM224M125(1)H221	PMR205AB6220M220(1)
15.2	0.22	330	7.3	13.0	18.5	P405QM224M125(1)H331	PMR205AB6220M330(1)
15.2	0.22	470	7.3	13.0	18.5	P405QM224M125(1)H471	PMR205AB6220M470(1)
15.2	0.25	200	7.3	13.0	18.5	P405QM254M125(1)H201	PMR205AB6250M200(1)
15.2	0.25	350	7.3	13.0	18.5	P405QM254M125(1)H351	PMR205AB6250M350(1)
15.2	0.25	600	7.3	13.0	18.5	P405QM254M125(1)H601	PMR205AB6250M600(1)
15.2	0.33	47	7.8	13.5	18.5	P405QP334M125(1)H470	PMR205AB6330M047(1)
20.3	0.47	22	7.6	14.0	24.0	P405CE474M125(1)H220	PMR205AC6470M022(1)
20.3	0.47	33	7.6	14.0	24.0	P405CE474M125(1)H330	PMR205AC6470M033(1)
20.3	0.47	47	7.6	14.0	24.0	P405CE474M125(1)H470	PMR205AC6470M047(1)
20.3	0.47	68	7.6	14.0	24.0	P405CE474M125(1)H680	PMR205AC6470M068(1)
20.3	0.47	100	7.6	14.0	24.0	P405CE474M125(1)H101	PMR205AC6470M100(1)
20.3	0.47	150	7.6	14.0	24.0	P405CE474M125(1)H151	PMR205AC6470M150(1)
20.3	0.47	220	7.6	14.0	24.0	P405CE474M125(1)H221	PMR205AC6470M220(1)
20.3	0.47	330	7.6	14.0	24.0	P405CE474M125(1)H331	PMR205AC6470M330(1)
20.3	0.47	470	9.0	15.0	24.0	P405CJ474M125(1)H471	PMR205AC6470M470(1)
20.3	0.47	680	11.3	16.5	24.0	P405CP474M125(1)H681	PMR205AC6470M680(1)
25.4	1.0	33	10.6	16.1	30.5	P405EE105M125(1)H330	PMR205AE7100M033(1)
20.3	1.0	47	11.3	16.5	24.0	P405CP105M125(1)H470	PMR205AC7100M047(1)
20.3	1.0	68	11.3	16.5	24.0	P405CP105M125(1)H680	PMR205AC7100M068(1)
20.3	1.0	100	11.3	16.5	24.0	P405CP105M125(1)H101	PMR205AC7100M100(1)
20.3	1.0	150	11.3	16.5	24.0	P405CP105M125(1)H151	PMR205AC7100M150(1)
20.3	1.0	220	11.3	16.5	24.0	P405CP105M125(1)H221	PMR205AC7100M220(1)
Lead Spacing (p)	Capacitance Value (µF)	**Resistance Ω**	B (mm)	H (mm)	L (mm)	New KEMET Part Number	Legacy Part Number

(1) Insert lead and packaging code. See Ordering Options Table for available options.

Soldering Process

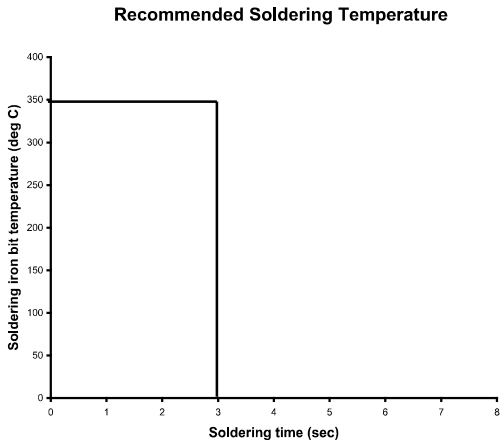
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

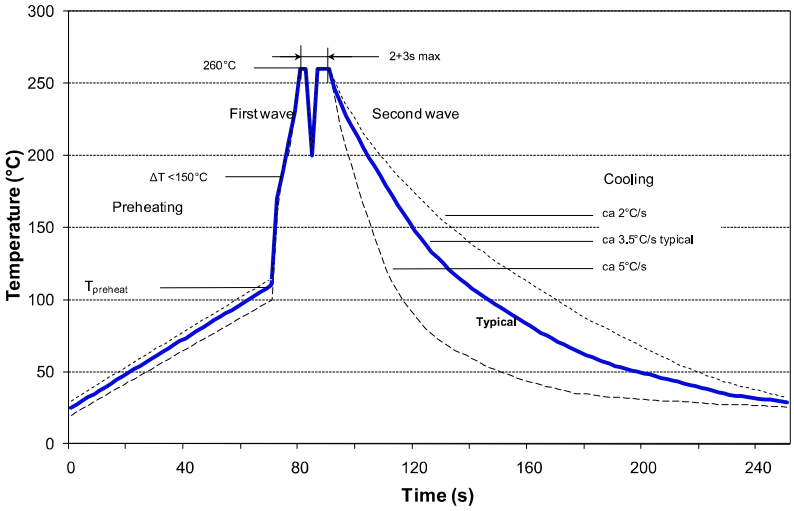
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

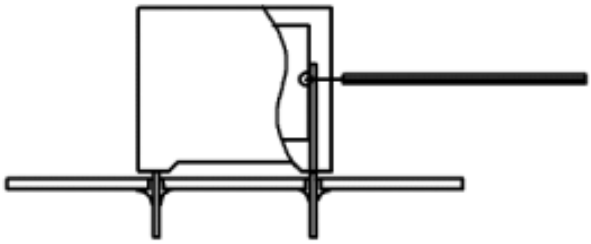
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



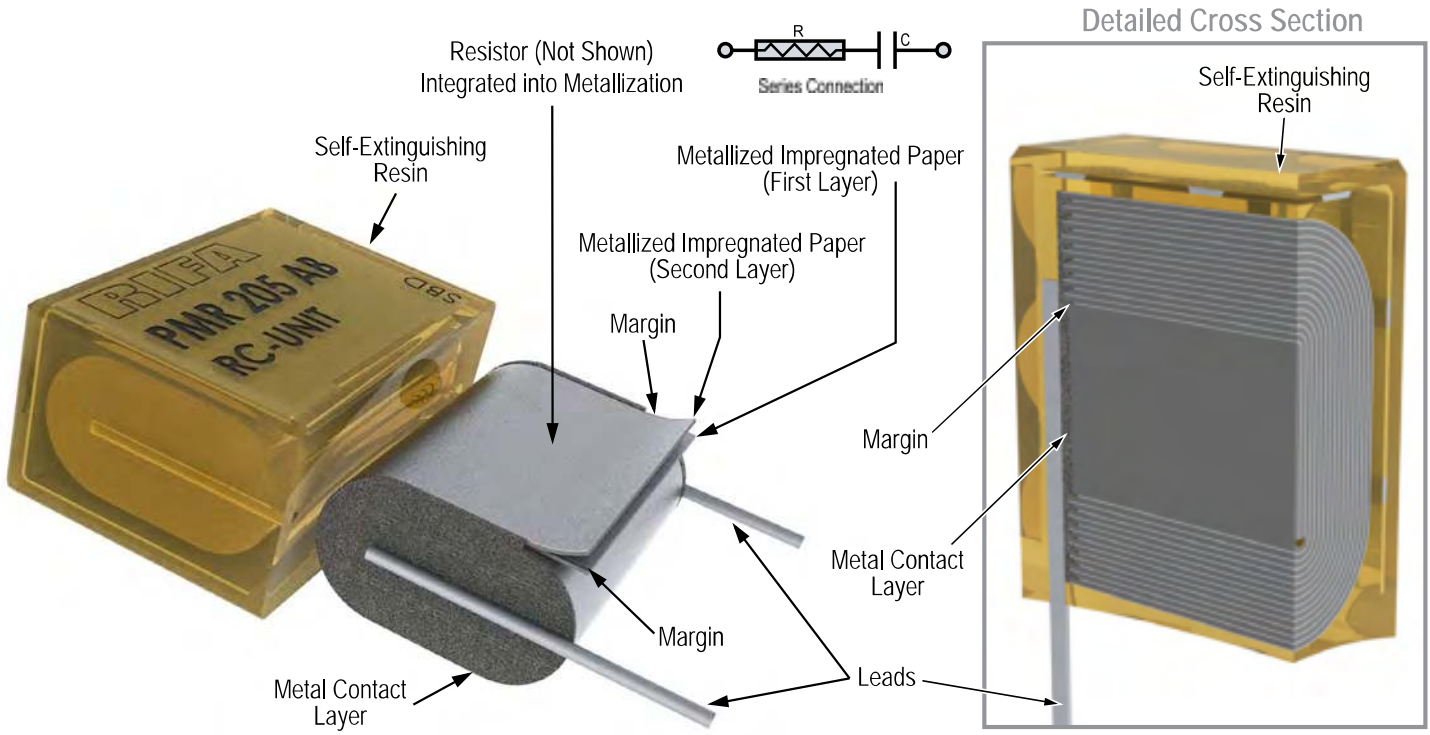
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

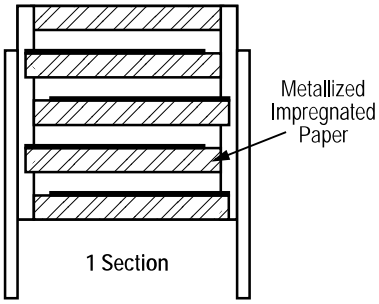
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

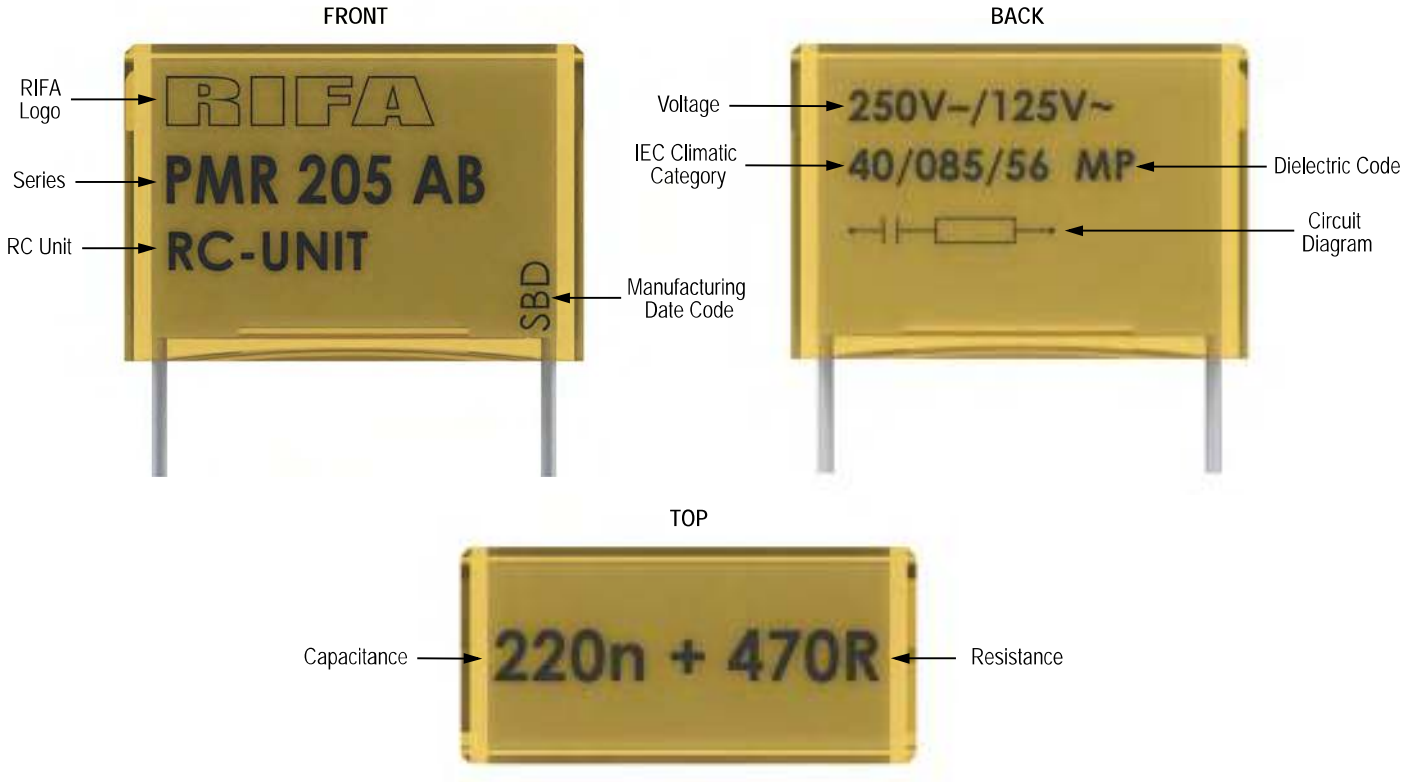
Construction



Winding Scheme



Marking



Packaging Quantities

Size Code	Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 360 mm
QE	15.2	5.2	10.5	18.5	500	100	600
QM	15.2	7.3	13.0	18.5	400	800	400
QP	15.2	7.8	13.5	18.5	400	800	400
CE	20.3	7.6	14.0	24.0	250	1500	250
CJ	20.3	9.0	15.0	24.0	200	1200	250
CP	20.3	11.3	16.5	24.0	150	1000	180
EE	25.4	10.6	16.1	30.5	150	1000	

PMR209 Series Metallized Impregnated Paper, Class X2, 250 VAC

Overview

The PMR209 Series is constructed of multilayer metallized paper encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use in contact protection, contact interference suppression and transient suppression.

Benefits

- Approvals: ENEC, UL, cUL
- Rated voltage: 250 VAC 50/60 Hz
- Capacitance range: 0.047 – 0.47 µF
- Capacitance tolerance: ±20%
- Resistance range: 22 – 470 Ω
- Resistance tolerance: ±30%
- Lead spacing: 15.2 – 25.4 mm
- Climatic category: 40/085/56/B, IEC 60068–1
- Tape and reel packaging in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +85˚C
- Excellent self-healing properties which ensure long life even when subjected to frequent over voltages
- Good resistance to ionization due to impregnated paper dielectric
- High dV/dt capability
- Impregnated paper ensures excellent stability and reliability properties, particularly in applications with continuous operation



Legacy Part Number System

PMR209	M	B	5470	M	047	R30
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Capacitance Tolerance	Resistance (Ω)	Packaging
RC Snubber, Metallized Paper	M = 250	B = 15.2 C = 20.3 E = 25.4	The last three digits represent significant figures. The first digit specifies the total number of digits.	M = ±20%	Resistance Value in Ω	See Ordering Options Table

New KEMET Part Number System

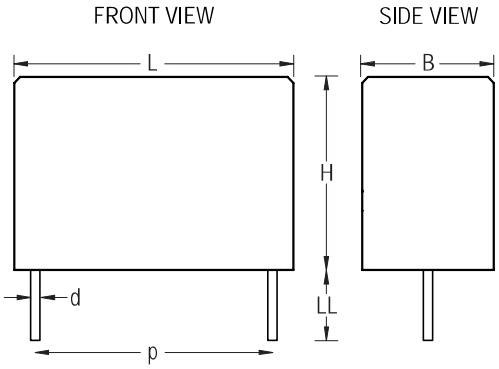
P	409	Q	M	473	M	250	A	H470
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging	Resistance (Ω)
P= Metallized Paper	RC Snubber	Q = 15.2 C = 20.3 E = 25.4	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20%	250 = 250	See Ordering Options Table	H plus first two digits represent significant figures. Third digit specifies number of zeros.

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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
15.2	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
20.3	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
25.4	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Tray) – Max Length Leads	30 +5/-0	A	R30

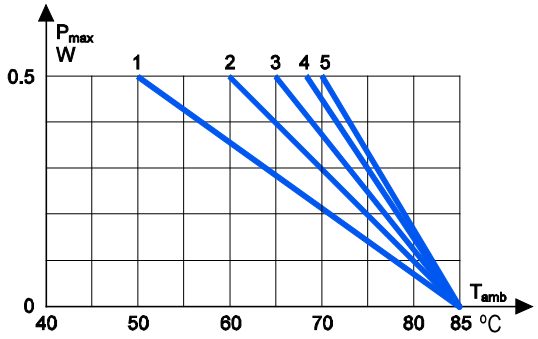
Dimensions – Millimeters



Size Code	p		B		H		L		d	
	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
QM	15.2	+/-0.4	7.3	Maximum	13.0	Maximum	18.5	Maximum	0.8	+/-0.05
CE	20.3	+/-0.4	7.6	Maximum	14.0	Maximum	24.0	Maximum	0.8	+/-0.05
CP	20.3	+/-0.4	11.3	Maximum	16.5	Maximum	24.0	Maximum	0.8	+/-0.05
EJ	25.4	+/-0.4	12.1	Maximum	19.0	Maximum	30.5	Maximum	1.0	+/-0.05
EL	25.4	+/-0.4	15.3	Maximum	22.0	Maximum	30.5	Maximum	1.0	+/-0.05
Note: See Ordering Options Table for lead length (LL) options.										

Performance Characteristics

Rated Voltage	250 VAC 50/60 Hz	
Capacitance Range	0.047 – 0.47 µF	
Capacitance Tolerance	±20%	
Resistance Range	22 – 470 Ω	
Resistance Tolerance	±30%	
Temperature Range	-40°C to +85°C	
Climatic Category	40/085/56/B	
Approvals	ENEC, UL, cUL	
Peak Pulse Voltage	1,000 V	
Series Resistance	The series resistance is defined at 1 kHz for RC ≥ 50 µs and at 100 kHz for RC < 50 µs	
Insulation Resistance	Minimum Values Between Terminals	
	C ≤ 0.33 µF	≥ 3,000 MΩ
	C > 0.33 µF	≥ 1,000 MΩ • µF
Pulse Current	Maximum 12 A repetitive. Maximum 20 A peak for occasional transients.	
Test Voltage Between Terminals	The 100% screening factory test is carried out at 1,800 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test.	
In DC Applications	Recommended voltage ≤ 630 VDC	
Power Ratings	The average losses may reach 0.5 W provided the surface temperature does not exceed + 85°C. For maximum permitted power dissipation vs. temperature, see Derating Curves.	
Derating Curves	Maximum Allowable Power Dissipation vs. Ambient Temperature and Case Sizes.	



Curve	Dimension B (mm)
1	7.3
2	7.6
3	11.3
4	15.3

Environmental Test Data

Test	IEC Publication	Procedure
Endurance	IEC 60384-14	1.25 x V_R VAC 50 Hz, once every hour increased to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature.
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each, 10 – 500 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	4,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068-2-14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Certification Body	Mark	Specification	File Number
Intertek Semko AB		EN/IEC 60384-14	SE/0140–28C
UL		UL 60384-14 CAN/ CSA-E60384-14-09	E73869

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Lead Spacing (p)	Capacitance Value (µF)	Resistance (Ω)	Maximum Dimensions in mm			New KEMET Part Number	Legacy Part Number
			B	H	L		
15.2	0.047	47	7.3	13	18.5	P409QM473M250(1)H470	PMR209MB5470M047(1)
15.2	0.047	100	7.3	13	18.5	P409QM473M250(1)H101	PMR209MB5470M100(1)
20.3	0.1	22	7.6	14	24	P409CE104M250(1)H220	PMR209MC6100M022(1)
20.3	0.1	33	7.6	14	24	P409CE104M250(1)H330	PMR209MC6100M033(1)
20.3	0.1	47	7.6	14	24	P409CE104M250(1)H470	PMR209MC6100M047(1)
20.3	0.1	68	7.6	14	24	P409CE104M250(1)H680	PMR209MC6100M068(1)
20.3	0.1	100	7.6	14	24	P409CE104M250(1)H101	PMR209MC6100M100(1)
20.3	0.1	150	11.3	16.5	24	P409CP104M250(1)H151	PMR209MC6100M150(1)
20.3	0.1	220	11.3	16.5	24	P409CP104M250(1)H221	PMR209MC6100M220(1)
20.3	0.1	330	11.3	16.5	24	P409CP104M250(1)H331	PMR209MC6100M330(1)
20.3	0.1	470	11.3	16.5	24	P409CP104M250(1)H471	PMR209MC6100M470(1)
20.3	0.22	22	11.3	16.5	24	P409CP224M250(1)H220	PMR209MC6220M022(1)
20.3	0.22	33	11.3	16.5	24	P409CP224M250(1)H330	PMR209MC6220M033(1)
20.3	0.22	47	11.3	16.5	24	P409CP224M250(1)H470	PMR209MC6220M047(1)
20.3	0.22	68	11.3	16.5	24	P409CP224M250(1)H680	PMR209MC6220M068(1)
20.3	0.22	100	11.3	16.5	24	P409CP224M250(1)H101	PMR209MC6220M100(1)
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25.4	0.22	330	12.1	19	30.5	P409EJ224M250(1)H331	PMR209ME6220M330(1)
25.4	0.22	470	15.3	22	30.5	P409EL224M250(1)H471	PMR209ME6220M470(1)
25.4	0.47	33	15.3	22	30.5	P409EL474M250(1)H330	PMR209ME6470M033(1)
25.4	0.47	47	15.3	22	30.5	P409EL474M250(1)H470	PMR209ME6470M047(1)
25.4	0.47	68	15.3	22	30.5	P409EL474M250(1)H680	PMR209ME6470M068(1)
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25.4	0.47	150	15.3	22	30.5	P409EL474M250(1)H151	PMR209ME6470M150(1)
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Lead Spacing (p)	Capacitance Value (µF)	**Resistance Ω**	B (mm)	H (mm)	L (mm)	New KEMET Part Number	Legacy Part Number

(1) Insert lead and packaging code. See Ordering Options Table for available options.

Soldering Process

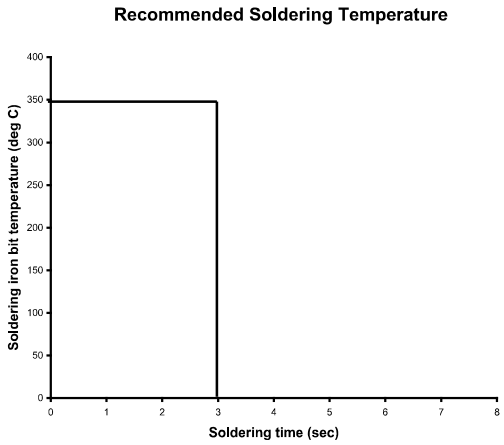
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Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

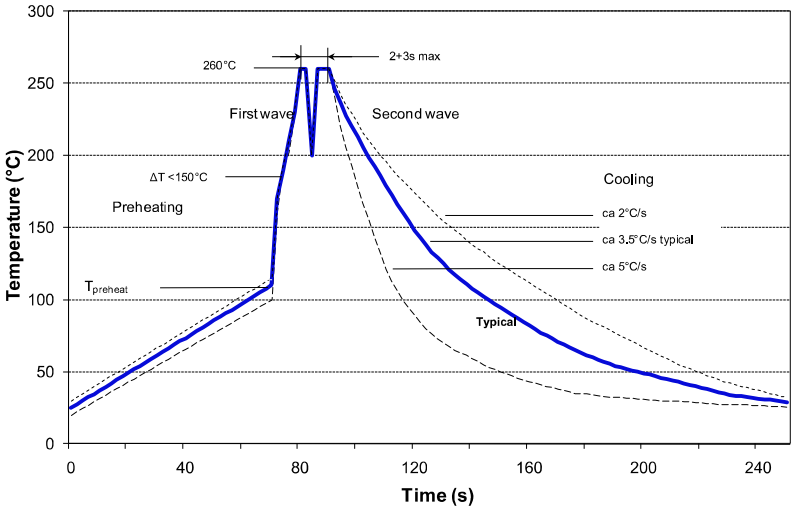
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

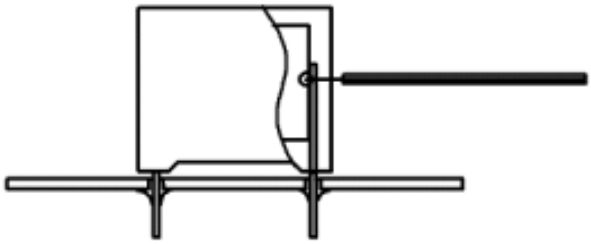
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



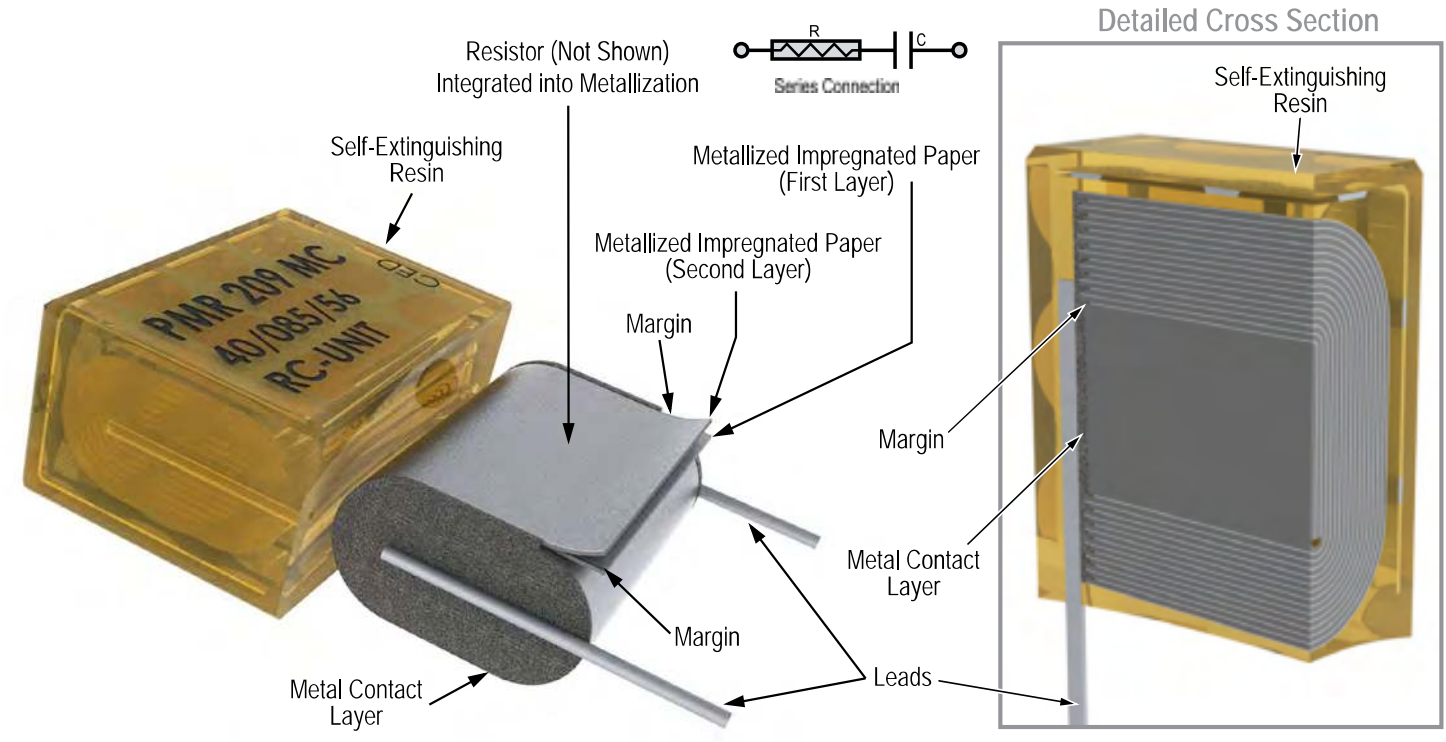
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

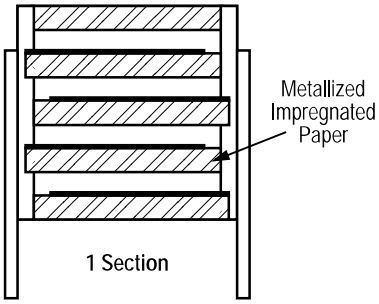
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

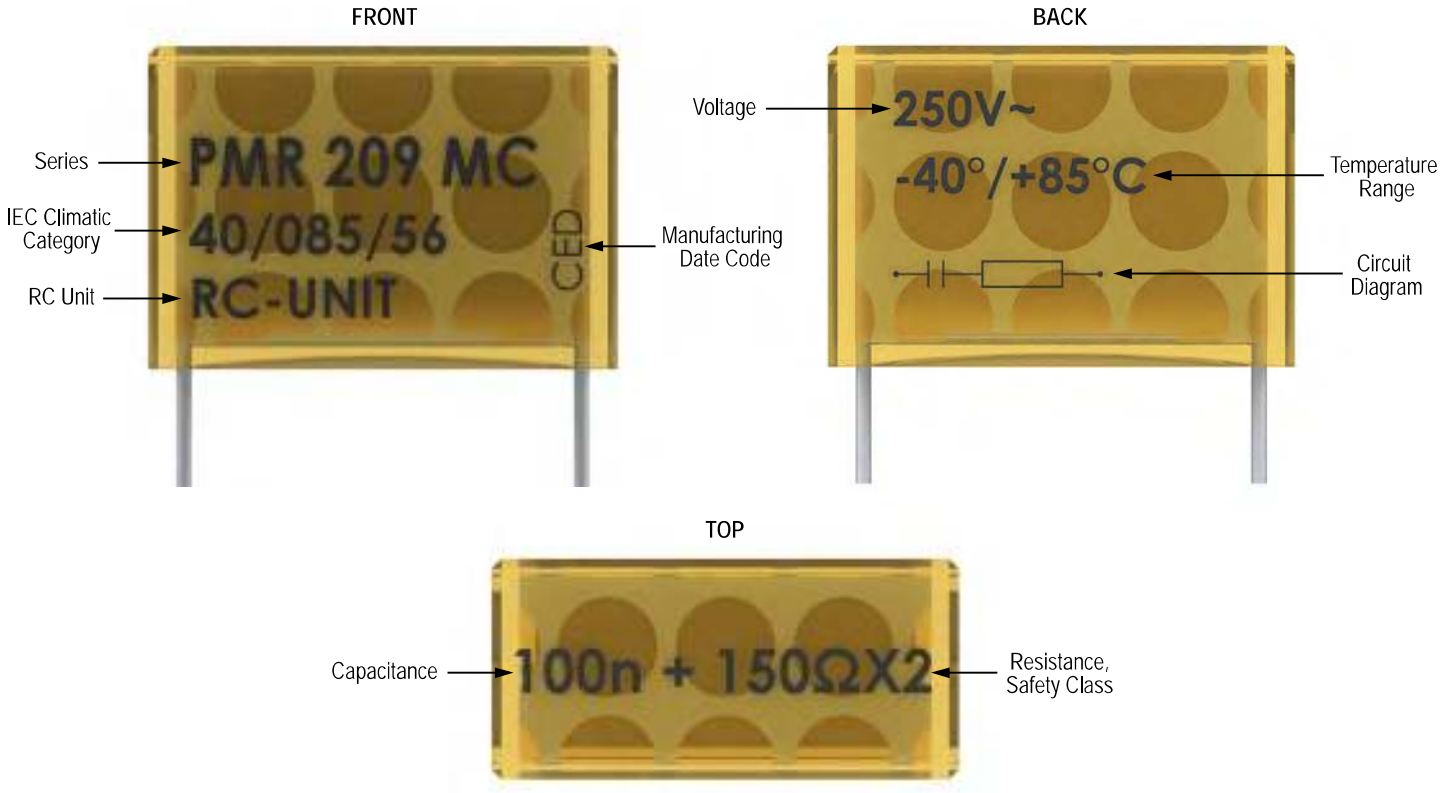
Construction



Winding Scheme



Marking



Packaging Quantities

Size Code	Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 360 mm
QM	15.2	7.3	13.0	18.5	500	100	600
CE	20.3	7.6	14.0	24.0	250	1500	250
CP	20.3	11.3	16.5	24.0	150	1000	180
EJ	25.4	12.1	19.0	30.5	100	800	
EL	25.4	15.3	22.0	30.5	75	600	

AC Line EMI Suppression and RC Networks

P409 Series Metallized Impregnated Paper Class X2, 275 VAC

Overview

The P409 Series is constructed of multilayer metallized paper encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use in contact protection, contact interference suppression and transient suppression.

Benefits

- Approvals: ENEC, UL, cUL
- Rated voltage: 275 VAC 50/60 Hz
- Capacitance range: 0.047 – 0.47 µF
- Capacitance tolerance: ±20%
- Resistance range: 22 – 470 Ω
- Resistance tolerance: ±30%
- Lead spacing: 15.2 – 25.4 mm
- Climatic category: 40/085/56/B, IEC 60068–1
- Tape and reel packaging in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +85˚C
- Excellent self-healing properties which ensure long life even when subjected to frequent over voltages
- Good resistance to ionization due to impregnated paper dielectric
- High dV/dt capability
- Impregnated paper ensures excellent stability and reliability properties, particularly in applications with continuous operation



Part Number System

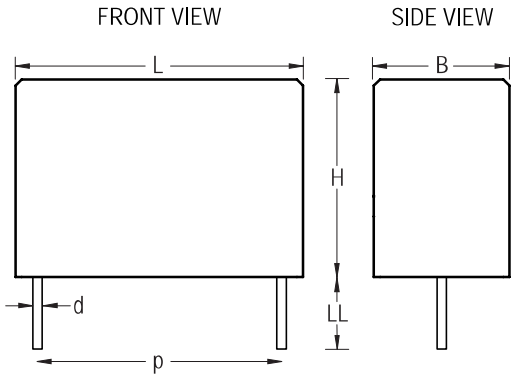
P	409	Q	M	473	M	275	A	H470
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging	Resistance (Ω)
P= Metallized Paper	RC Snubber	Q = 15.2 C = 20.3 E = 25.4	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20%	275 = 275	See Ordering Options Table	H plus first two digits represent significant figures. Third digit specifies number of zeros.

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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Part Number (Insert at 14th character)
15.2	Standard Lead and Packaging Options		
	Bulk – Short Leads	6 +0/-1	C
	Bulk – Maximum Length Leads	30 +5/-0	A
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P
20.3	Standard Lead and Packaging Options		
	Tray – Short Leads	6 +0/-1	C
	Bulk – Maximum Length Leads	30 +5/-0	A
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P
25.4	Standard Lead and Packaging Options		
	Bulk – Short Leads	6 +0/-1	C
	Bulk – Maximum Length Leads	30 +5/-0	A

Dimensions – Millimeters

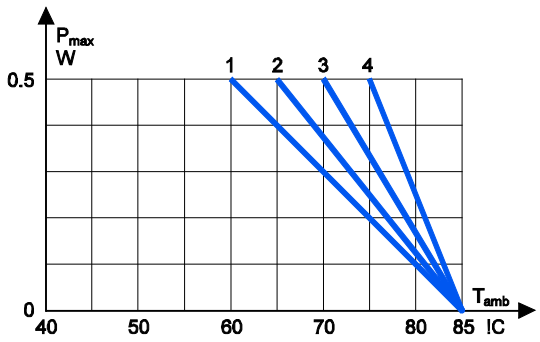


Size Code	p		B		H		L		d	
	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
QM	15.2	+/-0.4	7.3	Maximum	13.0	Maximum	18.5	Maximum	0.8	+/-0.05
CE	20.3	+/-0.4	7.6	Maximum	14.0	Maximum	24.0	Maximum	0.8	+/-0.05
CP	20.3	+/-0.4	11.3	Maximum	16.5	Maximum	24.0	Maximum	0.8	+/-0.05
EJ	25.4	+/-0.4	12.1	Maximum	19.0	Maximum	30.5	Maximum	1.0	+/-0.05
EL	25.4	+/-0.4	15.3	Maximum	22.0	Maximum	30.5	Maximum	1.0	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Rated Voltage	275 VAC 50/60 Hz	
Capacitance Range	0.047 – 0.47 µF	
Capacitance Tolerance	±20%	
Resistance Range	22 – 470 Ω	
Resistance Tolerance	±30%	
Temperature Range	-40°C to +85°C	
Climatic Category	40/085/56/B	
Approvals	ENEC, UL, cUL	
Peak Pulse Voltage	1,000 V	
Series Resistance	The series resistance is defined at 1 kHz for RC ≥ 50 µs and at 100 kHz for RC < 50 µs	
Insulation Resistance	Minimum Values Between Terminals	
	C ≤ 0.33 µF	≥ 3,000 MΩ
	C > 0.33 µF	≥ 1,000 MΩ • µF
Pulse Current	Maximum 12 A repetitive. Maximum 20 A peak for occasional transients.	
Test Voltage Between Terminals	The 100% screening factory test is carried out at 1,800 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test.	
In DC Applications	Recommended voltage ≤ 630 VDC	
Power Ratings	The average losses may reach 0.5 W provided the surface temperature does not exceed + 85°C. For maximum permitted power dissipation vs. temperature, see Derating Curves.	
Derating Curves	Maximum Allowable Power Dissipation vs. Ambient Temperature and Case Sizes.	



Curve	Dimension B (mm)
1	7.3
2	7.6
3	11.3
4	15.3

Environmental Test Data

Test	IEC Publication	Procedure
Endurance	IEC 60384-14	1.25 x V_R Vac 50Hz, once every hour increase to 1,000 Vac for 0.1 second, 1,000 hours at upper rated temperature.
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each, 10 – 500 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	4,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068-2-14 Test Na	Upper and lower temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 2.5 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Certification Body	Mark	Specification	File Number
Intertek Semko AB		EN/IEC 60384-14	SE/0140–33
UL		UL 60384-14 CAN/CSA-E60384-14-09	E73869

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Lead Spacing (p)	Capacitance Value (µF)	Resistance (Ω)	Maximum Dimensions in mm			KEMET Part Number
			B	H	L	
15.2	47	47	7.3	13.0	18.5	P409QM473M275(1)H470
15.2	47	100	7.3	13.0	18.5	P409QM473M275(1)H101
20.3	0.1	22	7.6	14.0	24.0	P409CE104M275(1)H220
20.3	0.1	33	7.6	14.0	24.0	P409CE104M275(1)H330
20.3	0.1	47	7.6	14.0	24.0	P409CE104M275(1)H470
20.3	0.1	68	7.6	14.0	24.0	P409CE104M275(1)H680
20.3	0.1	100	7.6	14.0	24.0	P409CE104M275(1)H101
20.3	0.1	150	11.3	16.5	24.0	P409CP104M275(1)H151
20.3	0.1	220	11.3	16.5	24.0	P409CP104M275(1)H221
20.3	0.1	330	11.3	16.5	24.0	P409CP104M275(1)H331
20.3	0.1	470	11.3	16.5	24.0	P409CP104M275(1)H471
20.3	0.22	22	11.3	16.5	24.0	P409CP224M275(1)H220
20.3	0.22	33	11.3	16.5	24.0	P409CP224M275(1)H330
20.3	0.22	47	11.3	16.5	24.0	P409CP224M275(1)H470
20.3	0.22	68	11.3	16.5	24.0	P409CP224M275(1)H680
20.3	0.22	100	11.3	16.5	24.0	P409CP224M275(1)H101
20.3	0.22	150	11.3	16.5	24.0	P409CP224M275(1)H151
20.3	0.22	220	11.3	16.5	24.0	P409CP224M275(1)H221
25.4	0.22	330	12.1	19.0	30.5	P409EJ224M275(1)H331
25.4	0.22	470	15.3	22.0	30.5	P409EL224M275(1)H471
25.4	0.47	33	15.3	22.0	30.5	P409EL474M275(1)H330
25.4	0.47	47	15.3	22.0	30.5	P409EL474M275(1)H470
25.4	0.47	68	15.3	22.0	30.5	P409EL474M275(1)H680
25.4	0.47	100	15.3	22.0	30.5	P409EL474M275(1)H101
25.4	0.47	150	15.3	22.0	30.5	P409EL474M275(1)H151
25.4	0.47	220	15.3	22.0	30.5	P409EL474M275(1)H221
Lead Spacing (p)	Capacitance Value (µF)	**Resistance Ω**	B (mm)	H (mm)	L (mm)	KEMET Part Number

(1) Insert lead and packaging code. See Ordering Options Table for available options.

Soldering Process

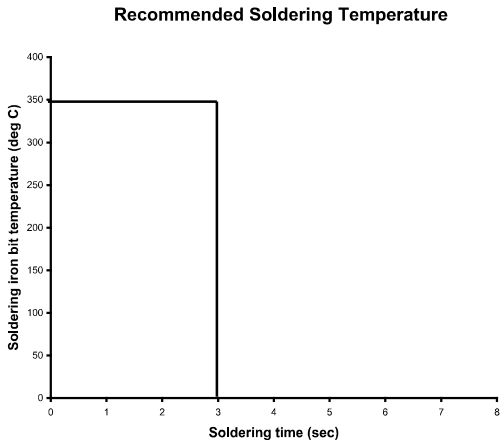
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

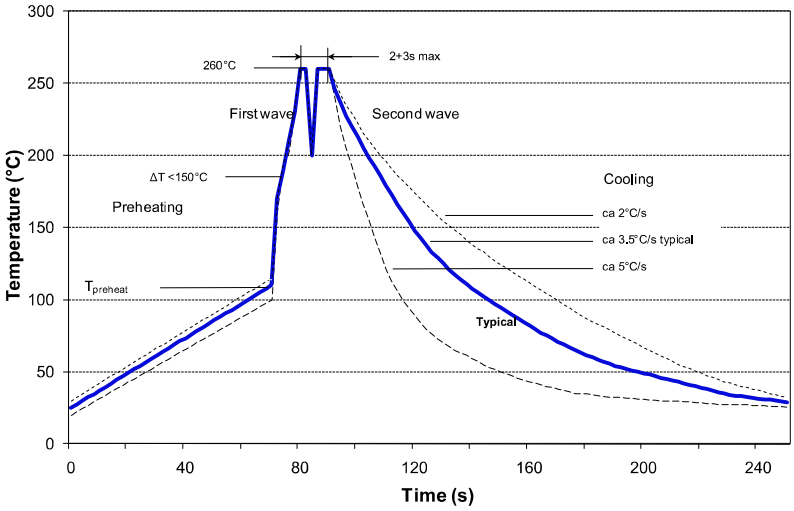
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

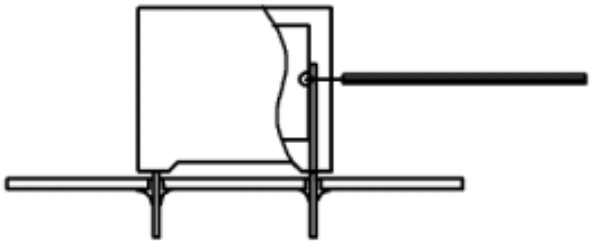
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



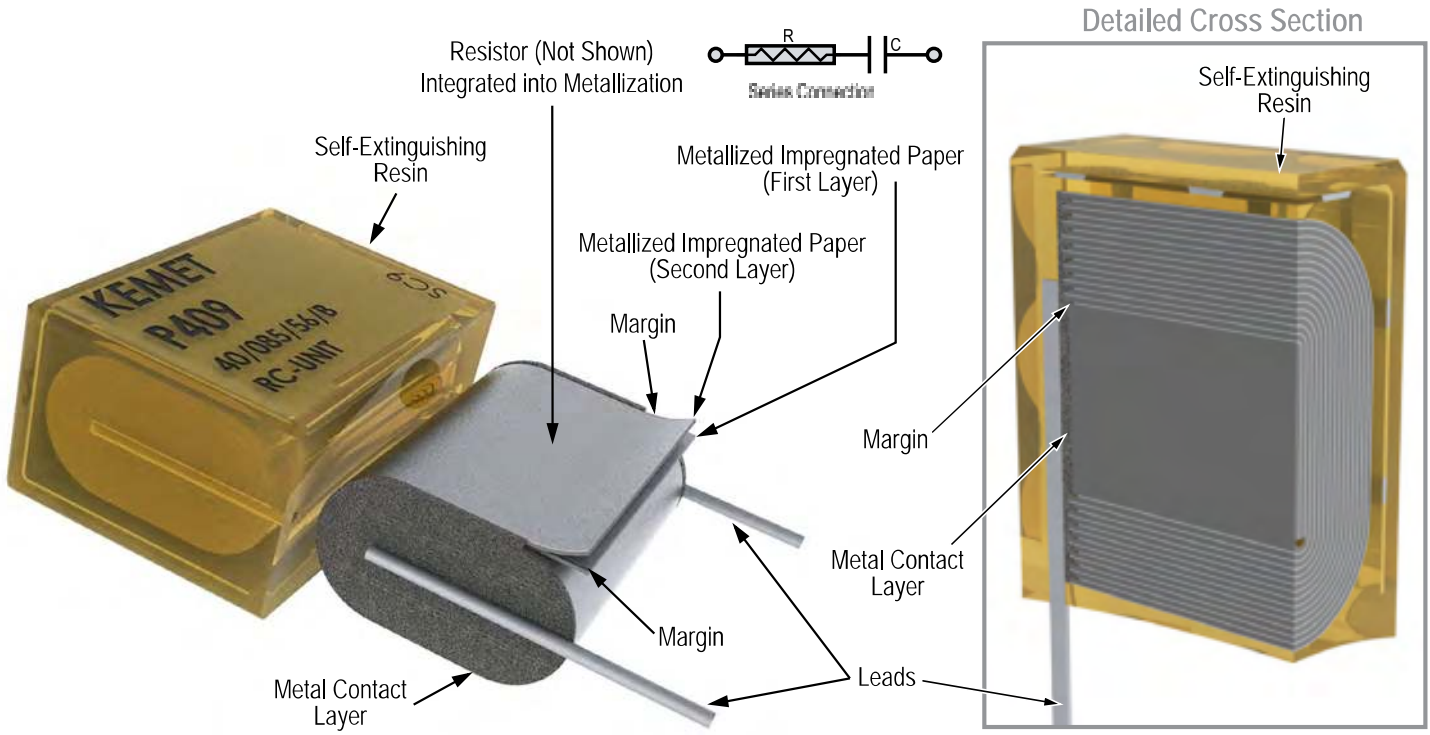
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

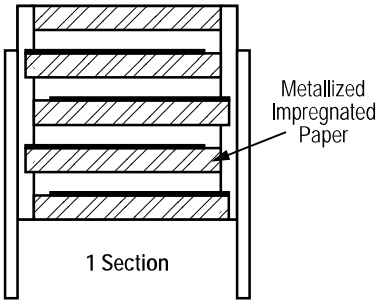
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

Construction



Winding Scheme



Mounting

RC units are mounted in parallel with the contacts to be protected or in parallel with the inductive load (Fig. 1 and Fig. 2). RC units are generally mounted in parallel with the contacts to suppress radio interferences (Fig. 1).

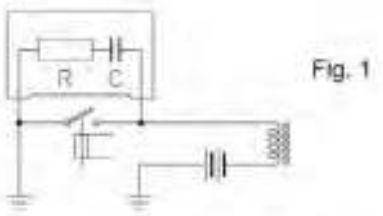


Fig. 1

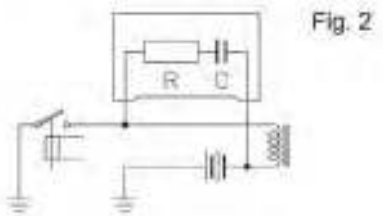
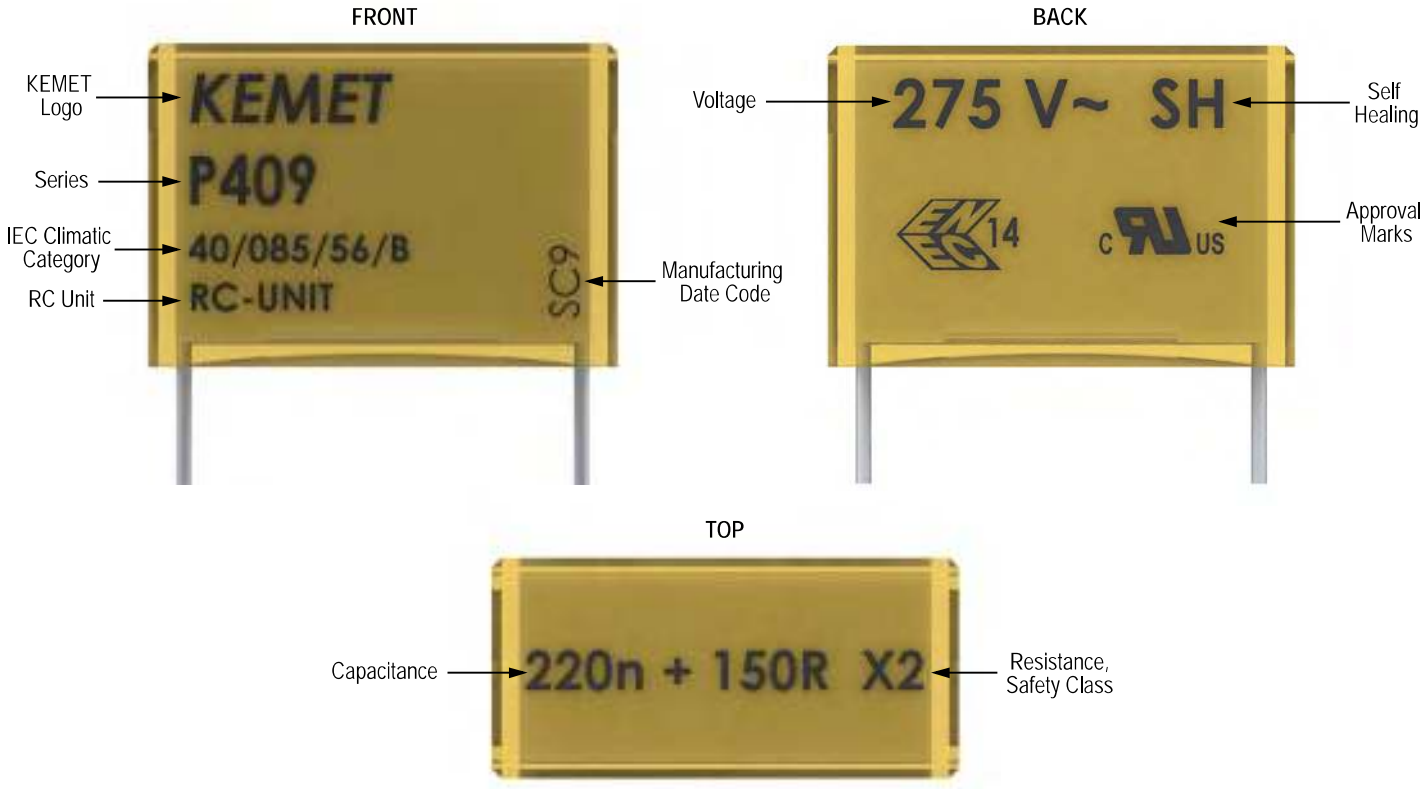


Fig. 2

Marking



Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 360 mm
15.2	7.3	13.0	18.5	500	100	600
20.3	7.6	14.0	24.0	250	1500	250
	11.3	16.5	24.0	150	1000	180
25.4	12.1	19.0	30.5	100	800	
	15.3	22.0	30.5	75	600	

PMR210 Series Metallized Impregnated Paper, Class X1, 250 VAC

Overview

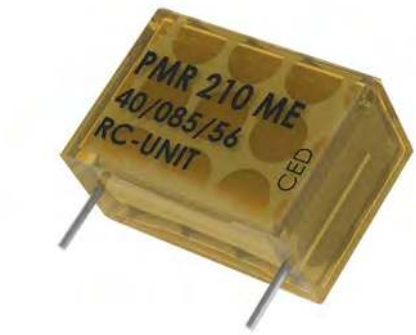
The PMR210 Series is constructed of multilayer metallized paper encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use in contact protection, contact interference suppression and transient suppression.

Benefits

- Approvals: ENEC, UL, cUL
- Rated voltage: 250 VAC 50/60 Hz
- Capacitance range: 0.022 – 0.1 µF
- Capacitance tolerance: ±20%
- Resistance range: 100 Ω
- Resistance tolerance: ±30%
- Lead spacing: 15.2 – 25.4 mm
- Climatic category: 40/085/56/B, IEC 60068–1
- Tape and reel packaging in accordance with IEC 60286–2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +85˚C
- Excellent self-healing properties which ensure long life even when subjected to frequent over voltages
- Good resistance to ionization due to impregnated paper dielectric
- High dV/dt capability
- Impregnated paper ensures excellent stability and reliability properties, particularly in applications with continuous operation



Legacy Part Number System

PMR210	M	B	5220	M	100	R30
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Capacitance Tolerance	Resistance (Ω)	Packaging
RC Snubber, Metallized Paper	M = 250	B = 15.2 C = 20.3 E = 25.4	The last three digits represent significant figures. The first digit specifies the total number of digits.	M = ±20%	Resistance value in Ω	See Ordering Options Table

New KEMET Part Number System

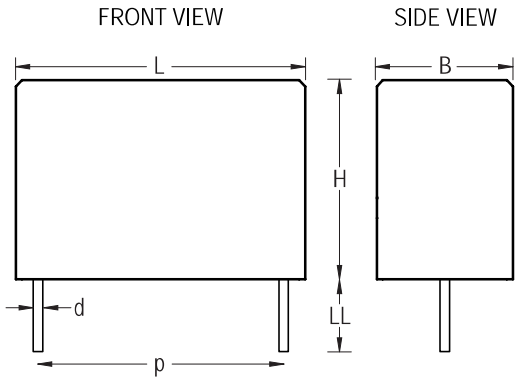
P	410	Q	M	223	M	250	A	H101
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Lead and Packaging Code	Resistance (Ω)
P = Metallized Paper	RC Snubber	Q = 15.2 C = 20.3 E = 25.4	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20%	250 = 250	See Ordering Options Table	H plus first two digits represent significant figures. Third digit specifies number of zeros.

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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
15.2	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
20.3	Standard Lead and Packaging Options			
	Bulk (Tray) – Short Leads	6 +0/-1	C	R06
	Bulk (Bag) – Max Length Leads	30 +5/-0	A	R30
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L	R19T0
	Other Lead and Packaging Options			
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P	R19T1
25.4	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Tray) – Max Length Leads	30 +5/-0	A	R30

Dimensions – Millimeters

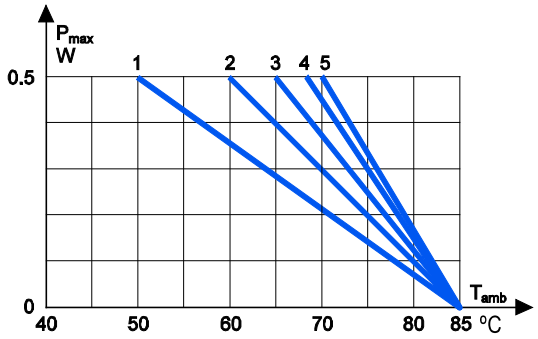


Size Code	p		B		H		L		d	
	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
QM	15.2	+/-0.4	7.3	Maximum	13.0	Maximum	18.5	Maximum	0.8	+/-0.05
QS	15.2	+/-0.4	8.5	Maximum	14.3	Maximum	18.5	Maximum	0.8	+/-0.05
CJ	20.3	+/-0.4	9.0	Maximum	15.0	Maximum	24.0	Maximum	0.8	+/-0.05
CP	20.3	+/-0.4	11.3	Maximum	16.5	Maximum	24.0	Maximum	0.8	+/-0.05
EE	25.4	+/-0.4	10.6	Maximum	16.1	Maximum	30.5	Maximum	1.0	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Rated Voltage	250 VAC 50/60 Hz
Capacitance Range	0.022 – 0.1 µF
Capacitance Tolerance	±20%
Resistance Range	100 Ω
Resistance Tolerance	±30%
Temperature Range	-40°C to +85°C
Climatic Category	40/085/56/B
Approvals	ENEC, UL, cUL
Peak Pulse Voltage	1,000 V
Series Resistance	The series resistance is defined at 1 kHz for RC ≥ 50 µs and at 100 kHz for RC < 50 µs
Insulation Resistance	Minimum Value Between Terminals ≥ 1,000 MΩ
Pulse Current	Maximum 12 A repetitive. Maximum 20 A peak for occasional transients.
Test Voltage Between Terminals	The 100% screening factory test is carried out at 3,000 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test.
In DC Applications	Recommended voltage ≤ 1,000 VDC
Power Ratings	The average losses may reach 0.5 W provided the surface temperature does not exceed + 85°C. For maximum permitted power dissipation vs. temperature, see Derating Curves.
Derating Curves	Maximum Allowable Power Dissipation vs. Ambient Temperature and Case Sizes.



Curve	Dimension B (mm)
1	7.3
1	8.5
2	9
3	11.3
4	10.6

Environmental Test Data

Test	IEC Publication	Procedure
Endurance	IEC 60384-14	1.25 x V_R VAC 50 Hz, once every hour increased to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature.
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each, 10 – 500 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	4,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068-2-14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 4.0 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Certification Body	Mark	Specification	File Number
Intertek Semko AB		EN/IEC 60384-14	SE/0140–21C
UL		UL 60384-14 CAN/ CSA-E60384-14-09	E73869

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Lead Spacing (p)	Capacitance Value (µF)	Resistance (Ω)	Maximum Dimensions in mm			New KEMET Part Number	Legacy Part Number
			B	H	L		
15.2	0.022	100	7.3	13	18.5	P410QM223M250(1)H101	PMR210MB5220M100(1)
15.2	0.033	100	8.5	14.3	18.5	P410QS333M250(1)H101	PMR210MB5330M100(1)
20.3	0.047	100	9	15	24	P410CJ473M250(1)H101	PMR210MC5470M100(1)
20.3	0.068	100	11.3	16.5	24	P410CP683M250(1)H101	PMR210MC5680M100(1)
25.4	0.1	100	10.6	16.1	30.5	P410EE104M250(1)H101	PMR210ME6100M100(1)

(1) Insert lead and packaging code. See Ordering Options Table for available options.

Soldering Process

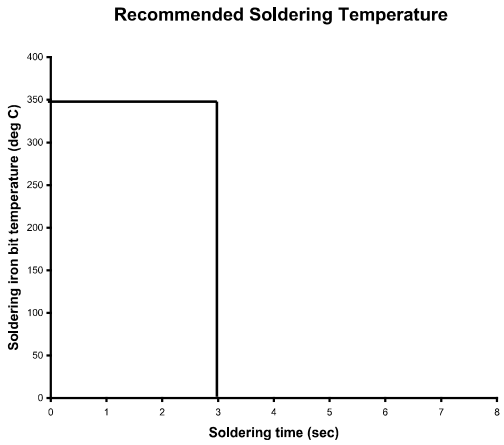
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

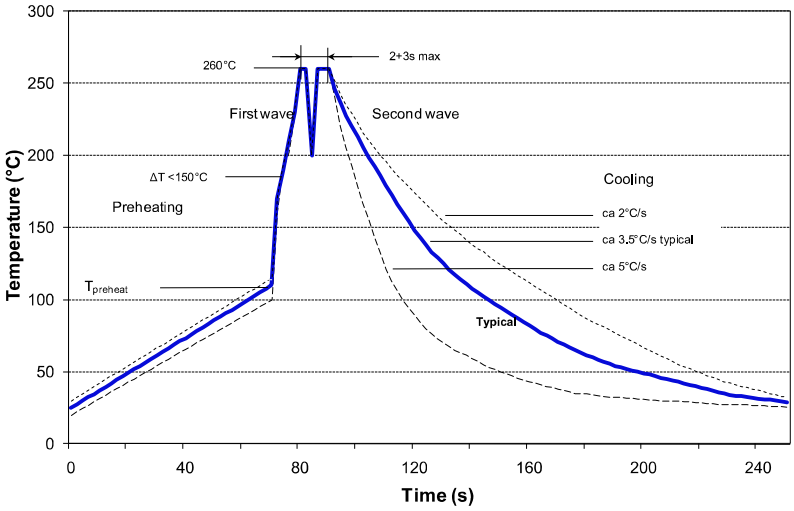
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

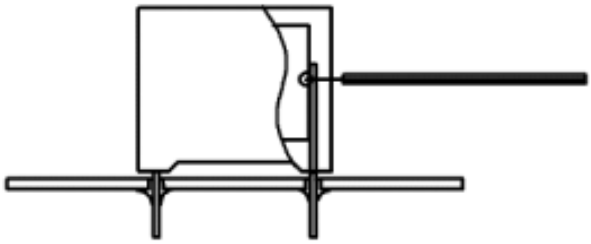
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



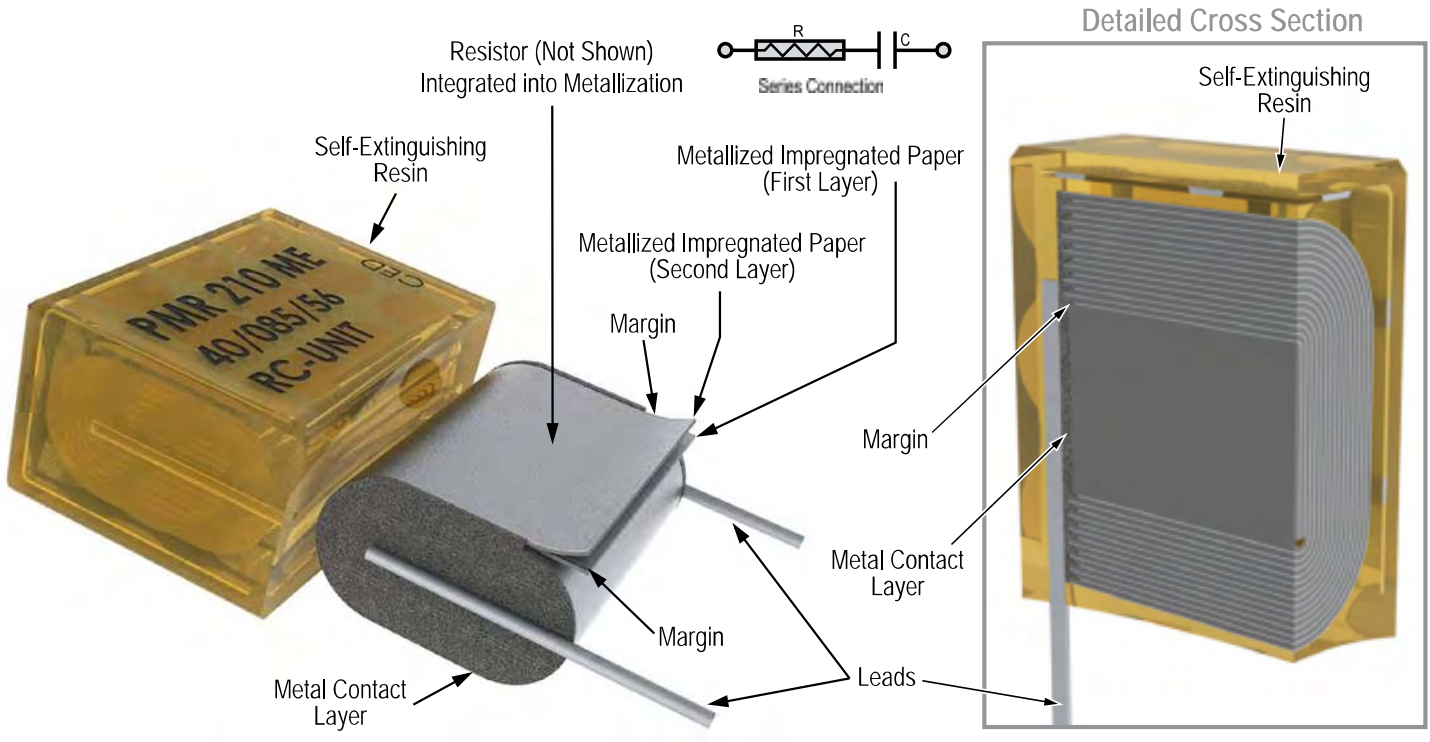
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

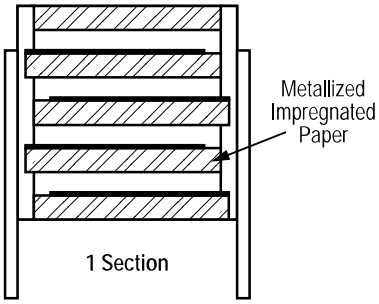
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

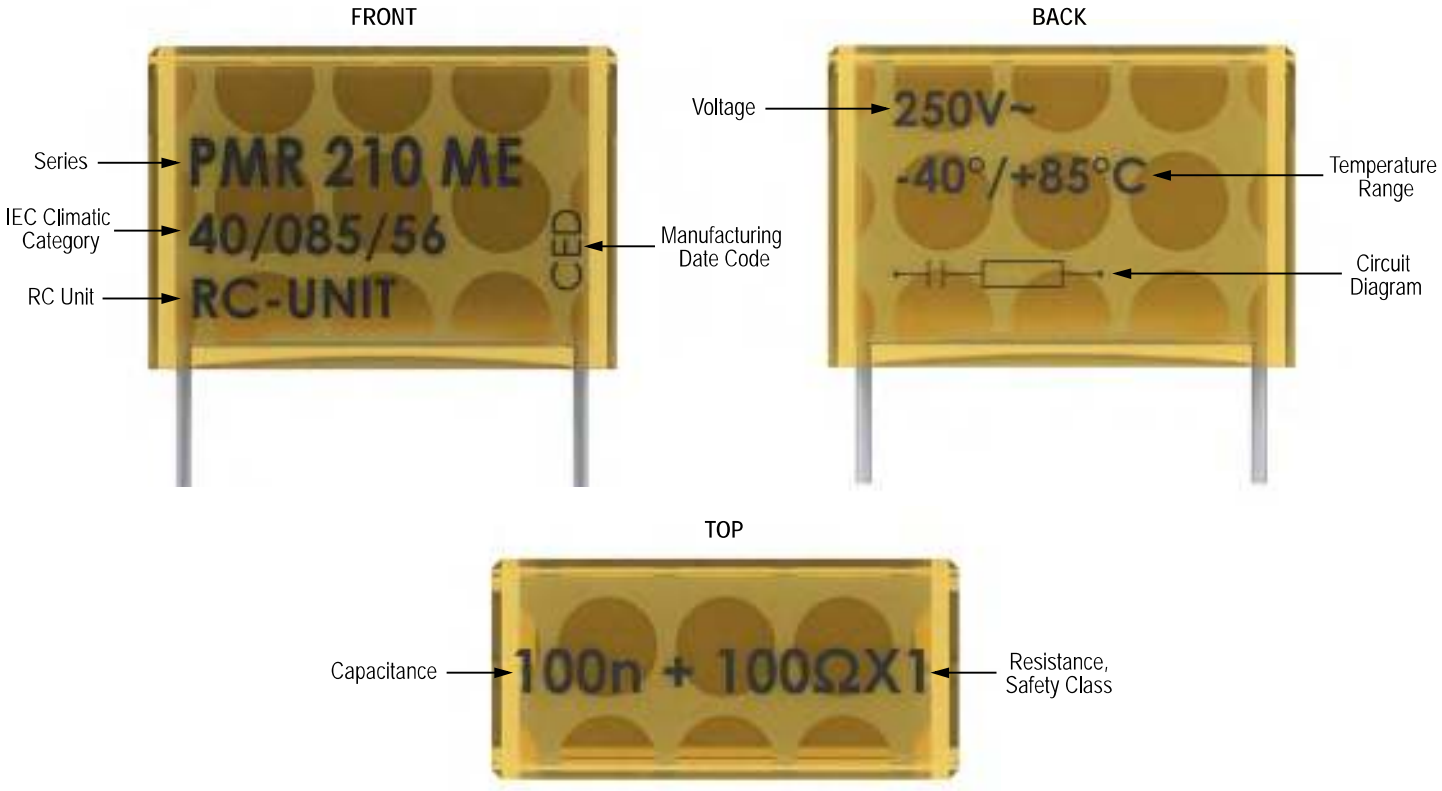
Construction



Winding Scheme



Marking



Packaging Quantities

Size Code	Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 360 mm
QE	15.2	5.2	10.5	18.5	500	100	600
QS		8.5	14.3	18.5	300	500	350
CJ	20.3	9.0	15.0	24.0	200	1200	250
CP		11.3	16.5	24.0	150	1000	180
EE	25.4	10.6	16.1	30.5	150	1000	

AC Line EMI Suppression and RC Networks

P410 Series Metallized Impregnated Paper Class X1, 300 VAC

Overview

The P410 Series is constructed of multilayer metallized paper encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use in contact protection, contact interference suppression and transient suppression.

Benefits

- Approvals: ENEC, UL, cUL
- Rated voltage: 300 VAC 50/60 Hz
- Capacitance range: 0.022 – 0.1 µF
- Capacitance tolerance: ± 20%
- Resistance range: 100 Ω
- Resistance tolerance: ± 30%
- Lead spacing: 15.2 – 25.4 mm
- Climatic category: 40/085/56/B, IEC 60068-1
- Tape and reel packaging in accordance with IEC 60286-2
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +85˚C
- Excellent self-healing properties which ensure long life even when subjected to frequent over-voltages
- Good resistance to ionization due to impregnated paper dielectric
- High dV/dt capability
- Impregnated paper ensures excellent stability and reliability properties, particularly in applications with continuous operation



Part Number System

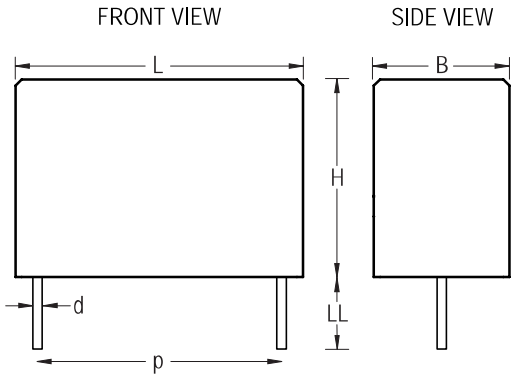
P	410	Q	M	223	M	300	A	H101
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging	Resistance (Ω)
P= Metallized Paper	RC Snubber	Q = 15.2 C = 20.3 E = 25.4	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20%	300 = 300	See Ordering Options Table	H plus first two digits represent significant figures. Third digit specifies number of zeros.

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Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	Part Number (Insert at 14th character)
15.2	Standard Lead and Packaging Options		
	Bulk – Short Leads	6 +0/-1	C
	Bulk – Maximum Length Leads	30 +5/-0	A
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P
20.3	Standard Lead and Packaging Options		
	Tray – Short Leads	6 +0/-1	C
	Bulk – Maximum Length Leads	30 +5/-0	A
	Tape & Reel (Standard Reel)	H_0= 18.5 +/-0.5	L
	Other Lead and Packaging Options		
	Tape & Reel (Large Reel)	H_0= 18.5 +/-0.5	P
25.4	Standard Lead and Packaging Options		
	Bulk – Short Leads	6 +0/-1	C
	Bulk – Maximum Length Leads	30 +5/-0	A

Dimensions – Millimeters

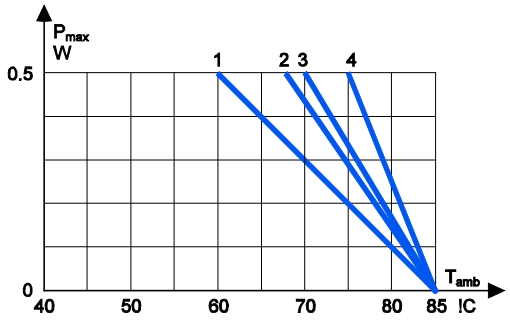


Size Code	p		B		H		L		d	
	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
QM	15.2	+/-0.4	7.3	Maximum	13.0	Maximum	18.5	Maximum	0.8	+/-0.05
QS	15.2	+/-0.4	8.5	Maximum	14.3	Maximum	18.5	Maximum	0.8	+/-0.05
CJ	20.3	+/-0.4	9.0	Maximum	15.0	Maximum	24.0	Maximum	0.8	+/-0.05
CP	20.3	+/-0.4	11.3	Maximum	16.5	Maximum	24.0	Maximum	0.8	+/-0.05
EE	25.4	+/-0.4	10.6	Maximum	16.1	Maximum	30.5	Maximum	1.0	+/-0.05

Note: See Ordering Options Table for lead length (LL) options.

Performance Characteristics

Rated Voltage	300 VAC 50/60 Hz
Capacitance Range	0.022 – 0.1 µF
Capacitance Tolerance	±20%
Resistance Range	100 Ω
Resistance Tolerance	±30%
Temperature Range	-40°C to +85°C
Climatic Category	40/085/56/B
Approvals	ENEC, UL, cUL
Peak Pulse Voltage	1,000 V
Series Resistance	The series resistance is defined at 1 kHz for RC ≥ 50 µs and at 100 kHz for RC < 50 µs
Insulation Resistance	Minimum Values Between Terminals ≥ 1,000 MΩ
Pulse Current	Maximum 12 A repetitive. Maximum 20 A peak for occasional transients.
Test Voltage Between Terminals	The 100% screening factory test is carried out at 3,000 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test.
In DC Applications	Recommended voltage ≤ 1,000 VDC
Power Ratings	The average losses may reach 0.5 W provided the surface temperature does not exceed + 85°C. For maximum permitted power dissipation vs. temperature, see Derating Curves.
Derating Curves	Maximum Allowable Power Dissipation vs. Ambient Temperature and Case Sizes.



Curve	Dimension B (mm)
1	7.3
1	8.5
2	9
3	11.3
4	10.6

Environmental Test Data

Test	IEC Publication	Procedure
Endurance	IEC 60384-14	1.25 x V_R Vac 50Hz, once every hour increase to 1,000 Vac for 0.1 second, 1,000 hours at upper rated temperature.
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each, 10 – 500 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	4,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068-2-14 Test Na	Upper and lower temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 4.0 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Certification Body	Mark	Specification	File Number
Intertek Semko AB		EN/IEC 60384-14	SE/0140–36
UL		UL 60384-14 CAN/CSA-E60384-14-09	E73869

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Lead Spacing (p)	Capacitance Value (µF)	Resistance (Ω)	Maximum Dimensions in mm			KEMET Part Number
			B	H	L	
15.2	22	100	7.3	13.0	18.5	P410QM223M300(1)H101
15.2	33	100	8.5	14.3	18.5	P410QS333M300(1)H101
20.3	47	100	9.0	15.0	24.0	P410CJ473M300(1)H101
20.3	68	100	11.3	16.5	24.0	P410CP683M300(1)H101
25.4	0.1	100	10.6	16.1	30.5	P410EE104M300(1)H101

(1) Insert lead and packaging code. See Ordering Options Table for available options.

Soldering Process

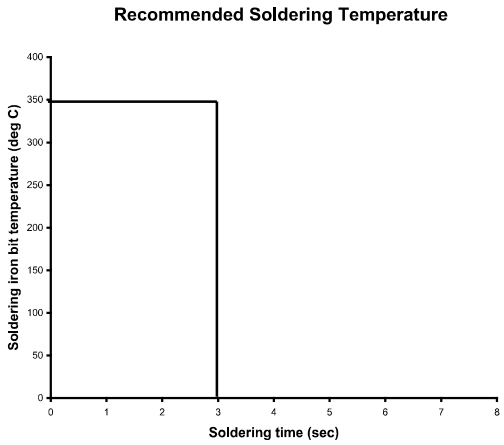
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

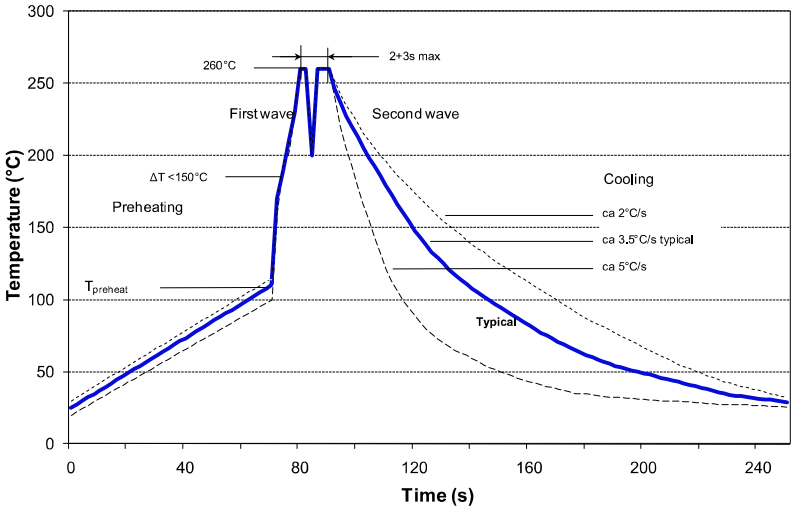
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

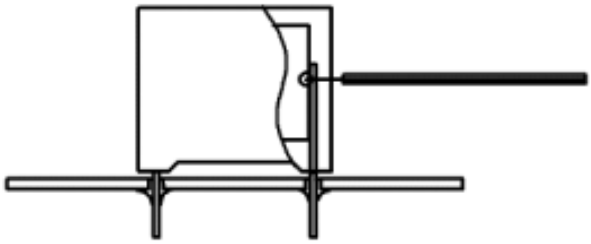
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



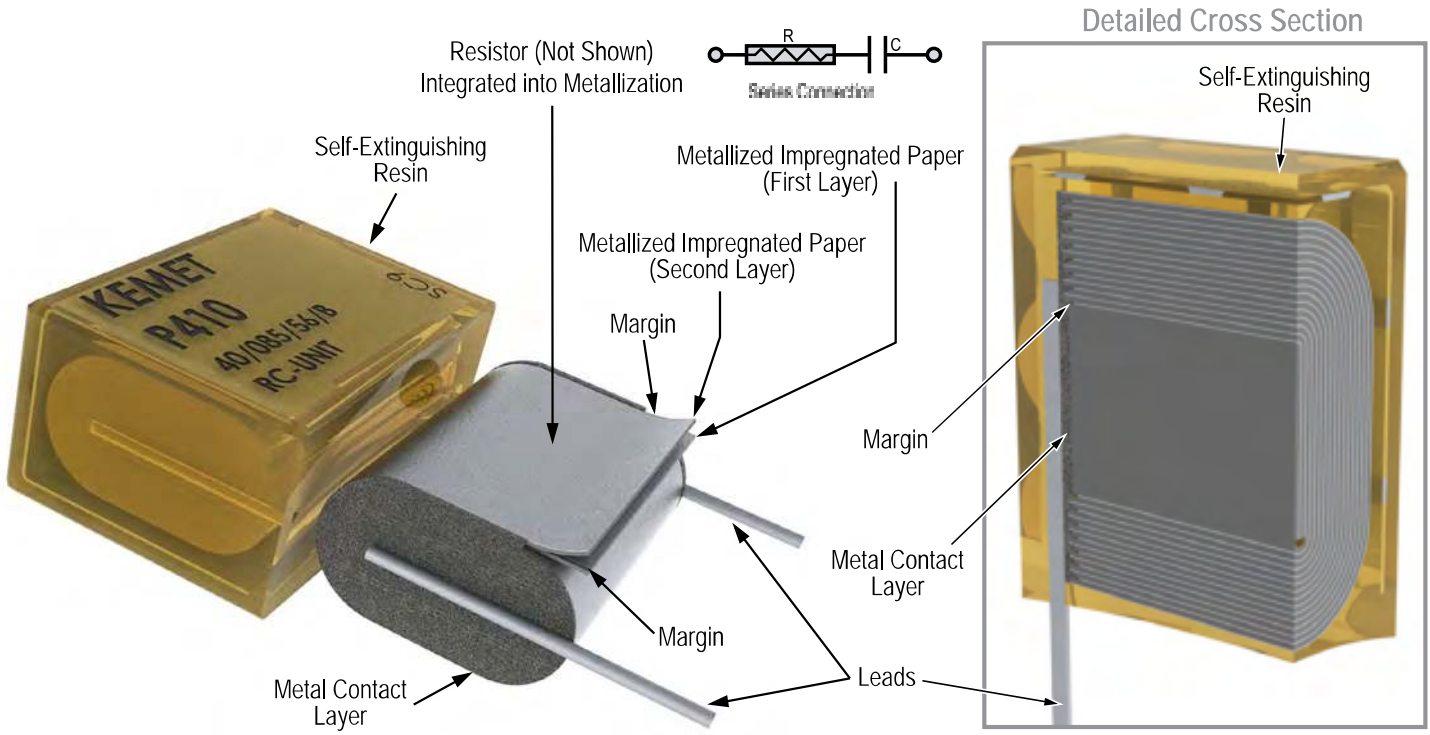
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

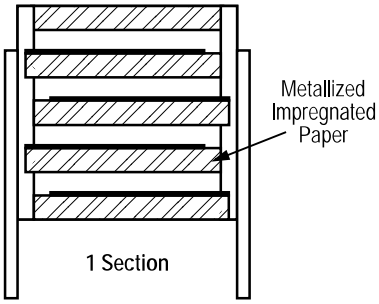
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

Construction



Winding Scheme



Mounting

RC units are mounted in parallel with the contacts to be protected or in parallel with the inductive load (Fig. 1 and Fig. 2). RC units are generally mounted in parallel with the contacts to suppress radio interferences (Fig. 1).

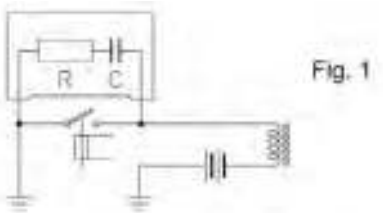


Fig. 1

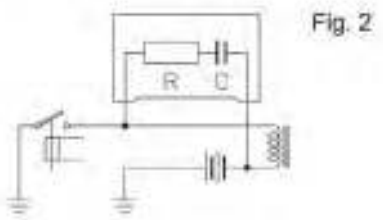
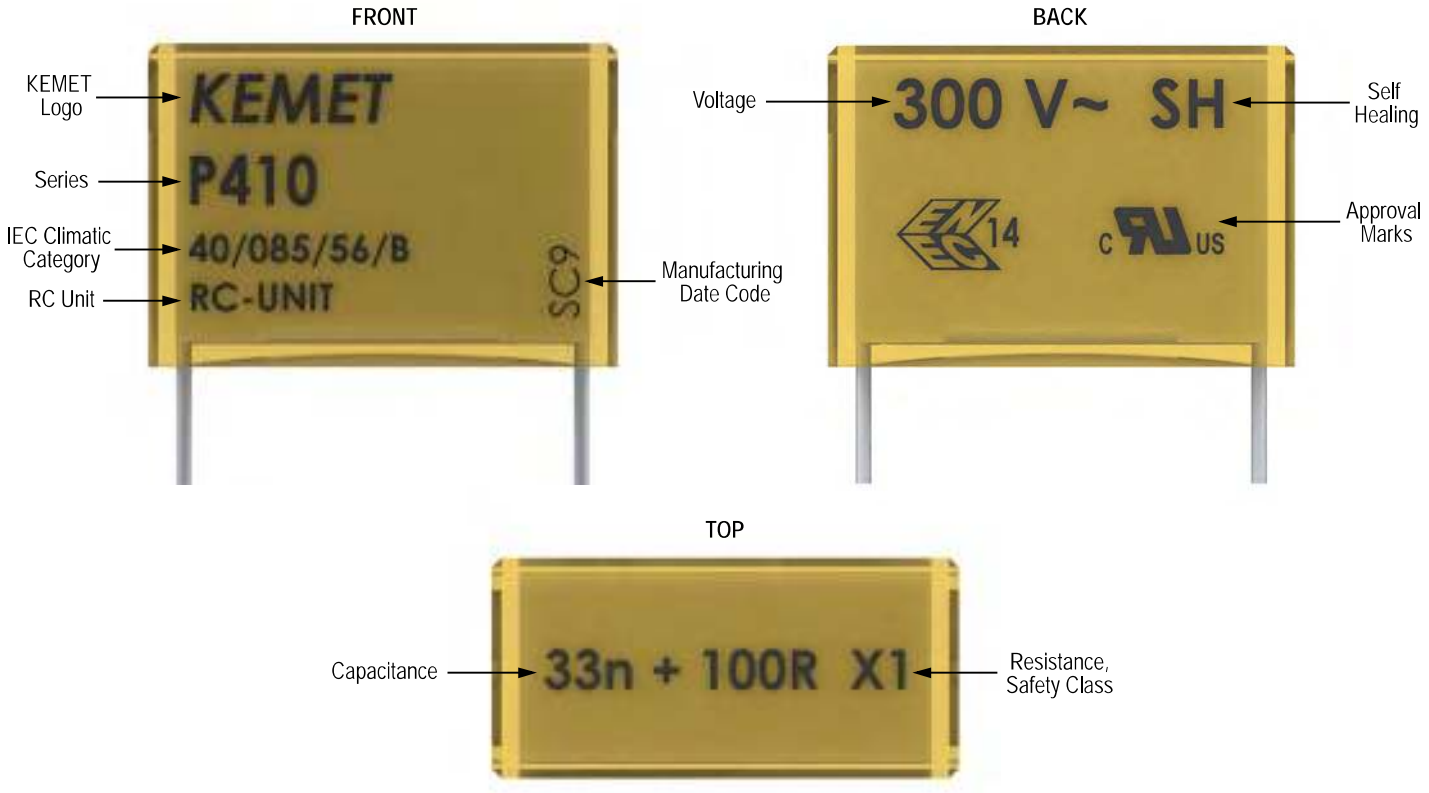


Fig. 2

Marking



Packaging Quantities

Lead Spacing (mm)	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 360 mm
15.2	5.2	10.5	18.5	500	100	600
	8.5	14.3	18.5	300	500	350
20.3	9.0	15.0	24.0	200	1200	250
	11.3	16.5	24.0	150	1000	180
25.4	10.6	16.1	30.5	150	1000	

PMZ2035 Series Metallized Impregnated Paper, Class X1, 440 VAC/1,000 VDC

Overview

The PMZ2035 Series is constructed of multilayer metallized paper encapsulated and impregnated in self-extinguishing material meeting the requirements of UL 94 V–0.

Applications

Typical applications include worldwide use in contact protection, contact interference suppression and transient suppression.

Benefits

- Approvals: ENEC
- Rated voltage: 440 VDC 50/60 Hz
- Capacitance: 0.1 µF
- Capacitance tolerance: ±10%, other tolerances on request
- Resistance: 150 Ω
- Resistance tolerance: ±30%
- Lead spacing: 25.4 mm
- Climatic category: 40/085/56/B, IEC 60068–1
- RoHS Compliant and lead-free terminations
- Operating temperature range of -40˚C to +85˚C
- Excellent self-healing properties which ensure long life even when subjected to frequent over voltages
- Good resistance to ionization due to impregnated paper dielectric
- High dV/dt capability
- Impregnated paper ensures excellent stability and reliability properties, particularly in applications with continuous operation



Legacy Part Number System

PMZ2035	R	E	6100	K	150	R30
Series	Rated Voltage (VAC)	Lead Spacing (mm)	Capacitance Code (pF)	Capacitance Tolerance	Resistance (Ω)	Packaging
RC Snubber, Metallized Paper	R = 440	E = 25.4	The last three digits represent significant figures. The first digit specifies the total number of digits.	K = ±10% M = ±20%	Resistance Value in Ω	See Ordering Options Table

New KEMET Part Number System

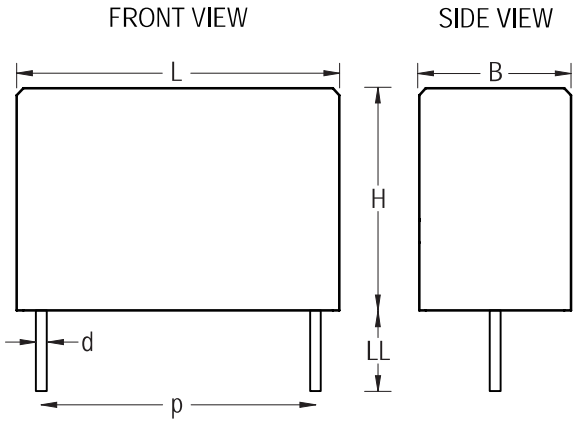
P	435	E	J	104	K	440	A	H151
Capacitor Class	Series	Lead Spacing (mm)	Size Code	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VAC)	Packaging	Resistance (Ω)
P = Metallized Paper	RC Snubber	E = 25.4	See Dimension Table	First two digits represent significant figures. Third digit specifies number of zeros.	K = ±10% M = ±20%	440 = 440	See Ordering Options Table	H plus first two digits represent significant figures. Third digit specifies number of zeros.

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Ordering Options Table

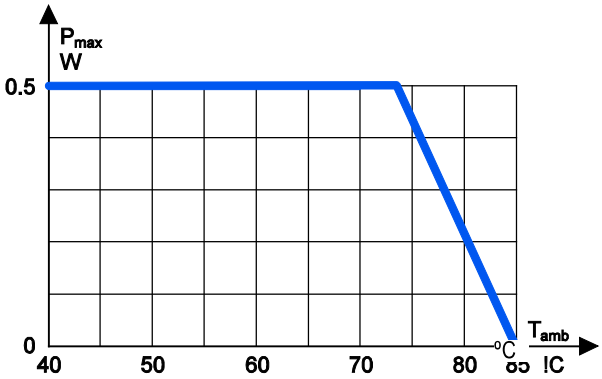
Lead Spacing Nominal (mm)	Type of Leads and Packaging	Lead Length (mm)	KEMET Lead and Packaging Code	Legacy Lead and Packaging Code
25.4	Standard Lead and Packaging Options			
	Bulk (Bag) – Short Leads	6 +0/-1	C	R06
	Bulk (Tray) – Max Length Leads	30 +5/-0	A	R30

Dimensions – Millimeters



Size Code	p		B		H		L		d	
	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
EJ	25.4	+/-0.4	12.1	Maximum	19.0	Maximum	30.5	Maximum	1.0	+/-0.05
Note: See Ordering Options Table for lead length (LL) options.										

Performance Characteristics

Rated Voltage	440 VAC 50/60 Hz
Capacitance Range	0.1 µF
Capacitance Tolerance	±10%, other tolerances on request
Resistance Range	150 Ω
Resistance Tolerance	±30%
Temperature Range	-40°C to +85°C
Climatic Category	40/085/56/B
Approvals	ENEC
Peak Pulse Voltage	1,000 V
Series Resistance	The series resistance is defined at 100 kHz
Insulation Resistance	Minimum Value Between Terminals ≥ 6,000 MΩ
Pulse Current	Maximum 12 A repetitive. Maximum 20 A peak for occasional transients.
Test Voltage Between Terminals	The 100% screening factory test is carried out at 1,800 VDC. The voltage level is selected to meet the requirements in applicable equipment standards. All electrical characteristics are checked after the test.
In DC Applications	Recommended voltage ≤ 1,000 VDC
Power Ratings	The average losses may reach 0.5 W provided the surface temperature does not exceed + 85°C. For maximum permitted power dissipation vs. temperature, see Derating Curves.
Derating Curves	Maximum Allowable Power Dissipation vs. Ambient Temperature and Case Sizes. 

Environmental Test Data

Test	IEC Publication	Procedure
Endurance	IEC 60384-14	1.25 x V_R VAC 50 Hz, once every hour increased to 1,000 VAC for 0.1 second, 1,000 hours at upper rated temperature.
Vibration	IEC 60068–2–6 Test Fc	3 directions at 2 hours each, 10 – 500 Hz at 0.75 mm or 98 m/s^2
Bump	IEC 60068–2–29 Test Eb	4,000 bumps at 390 m/s^2
Change of Temperature	IEC 60068-2-14 Test Na	Upper and lower rated temperature 5 cycles
Active Flammability	IEC 60384–14	V_R + 20 surge pulses at 4.0 kV (pulse every 5 seconds)
Passive Flammability	IEC 60384–14	IEC 60384–1, IEC 60695–11–5 Needle-flame test
Damp Heat Steady State	IEC 60068–2–78 Test Cab	+40°C and 93% RH, 56 days

Approvals

Certification Body	Specification	File Number
	EN/IEC 60384–14	SE/0140–29A

Environmental Compliance

All KEMET EMI capacitors are RoHS Compliant.

Table 1 – Ratings & Part Number Reference

Lead Space	Capacitance Value (µF)	Resistance Ω	Maximum Dimensions (mm)			Quantity per Package		F Article Code	Part Number
			B	H	L	R06	R30		
25.4	0.1	150	12.1	19	30.5	100	800	P435EJ104K440(1)H151	PMZ2035RE6100K150(1)

(1) Insert lead and packaging code. See Ordering Options Table for available options.

Soldering Process

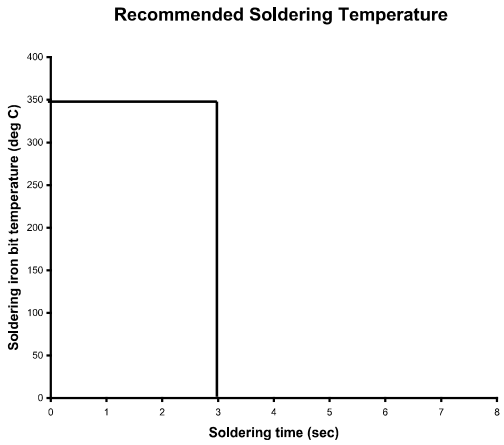
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183ºC for SnPb eutectic alloy to 217 – 221ºC for the new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170ºC). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 mm to 15 mm), and great care has to be taken during soldering. The recommended solder profiles from KEMET should be used. Please consult KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760-1 Edition 2 serves as a solid guideline for successful soldering. Please see Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the above the recommended limits may result to degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after the curing of surface mount parts. Consult KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Please allow time for the capacitor surface temperature to return to a normal temperature before the second soldering cycle.

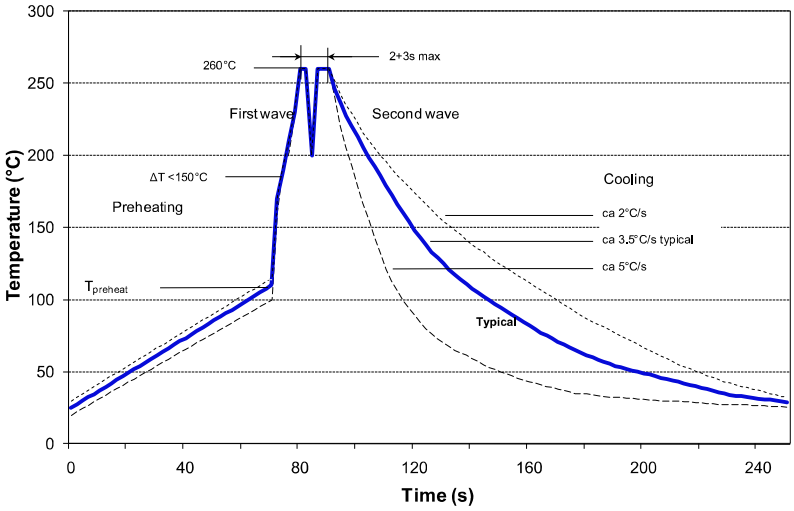
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C maximum) with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont'd

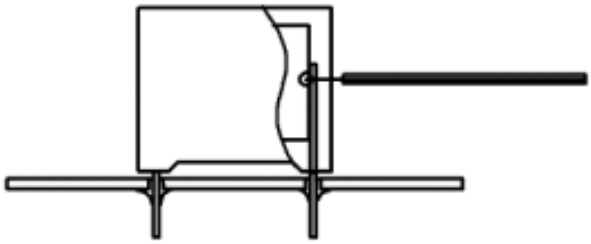
Wave Soldering Recommendations cont'd

1. The table indicates the maximum set-up temperature of the soldering process
Figure 1

Dielectric Film Material	Maximum Preheat Temperature			Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 10 mm	Capacitor Pitch = 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	130°C	270°C	270°C
Polypropylene	100°C	110°C	130°C	260°C	270°C
Paper	130°C	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor:
Set the temperature so that inside the element the maximum temperature is below the limit:

Dielectric Film Material	Maximum temperature measured inside the element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene sulphide	160°C



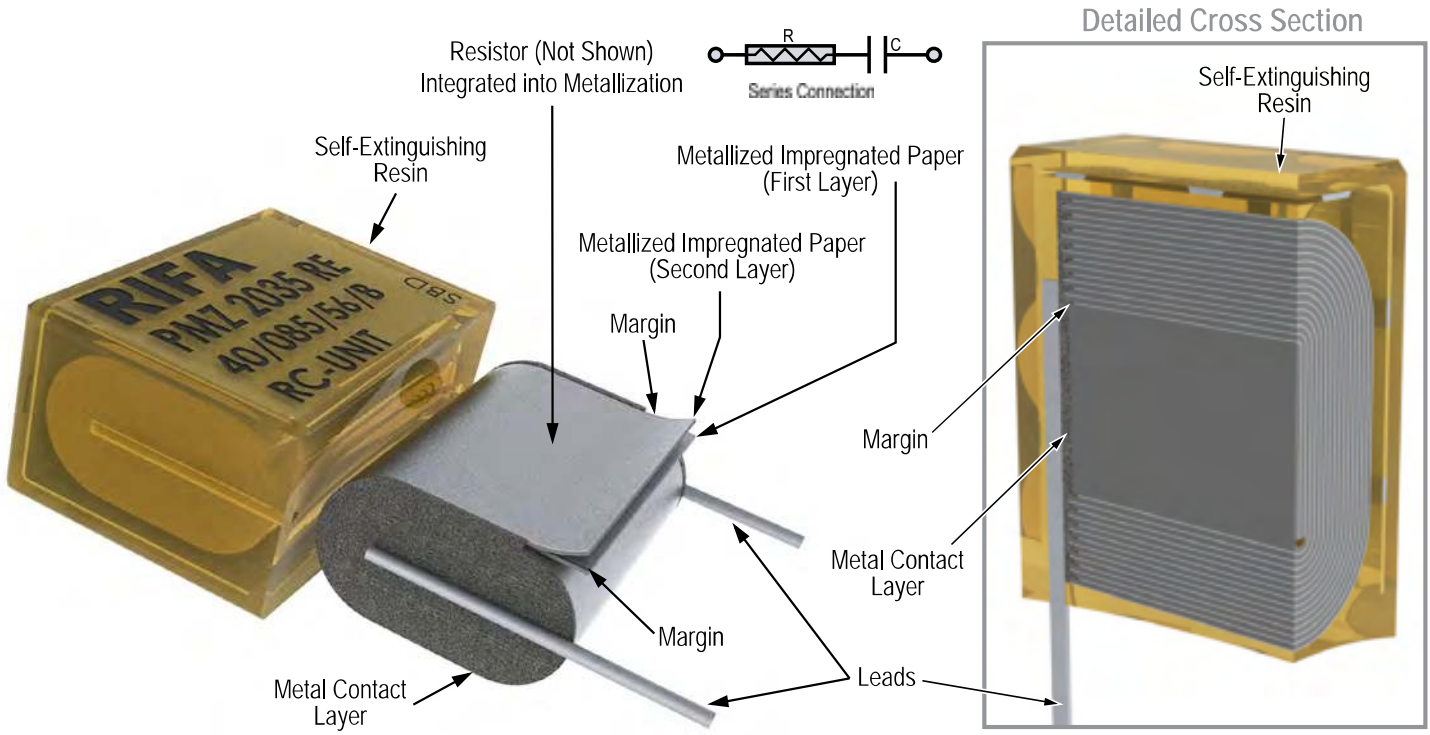
Temperature monitored inside the capacitor.

Selective Soldering Recommendations

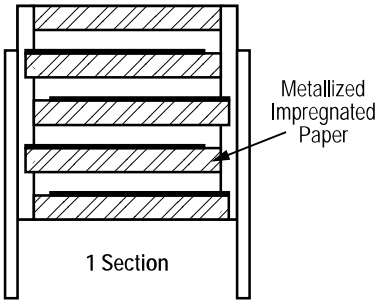
Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is preheated and transported over the solder bath as in normal flow soldering without touching the solder. When the board is over the bath, it is stopped and pre-designed solder pots are lifted from the bath with molten solder only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, however, instead of two baths, there is only one bath with a time from 3 to 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts are not overheated.

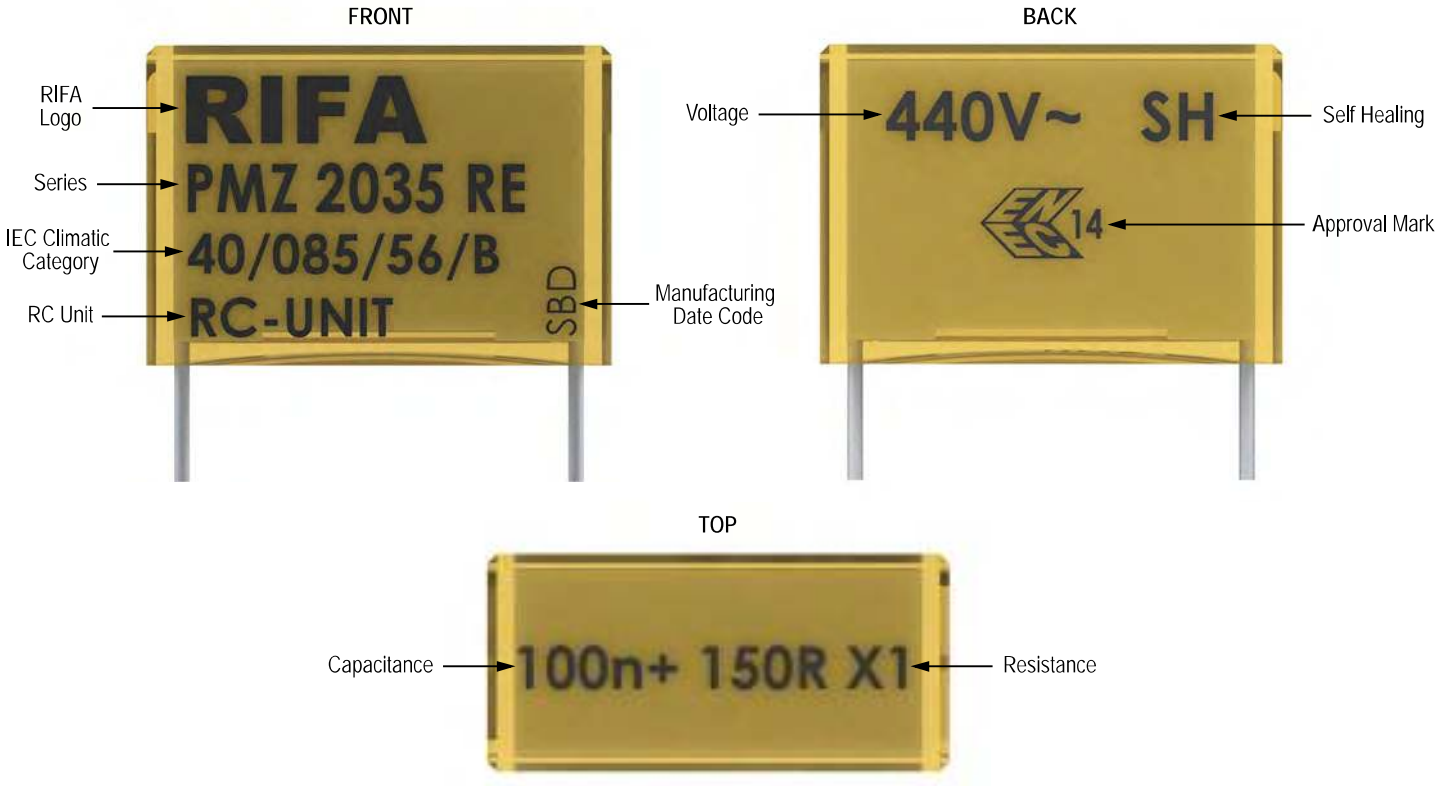
Construction



Winding Scheme

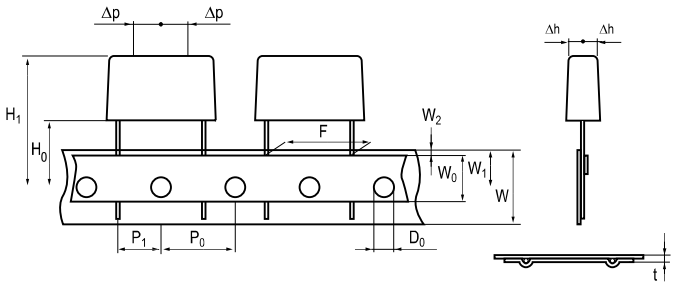


Marking

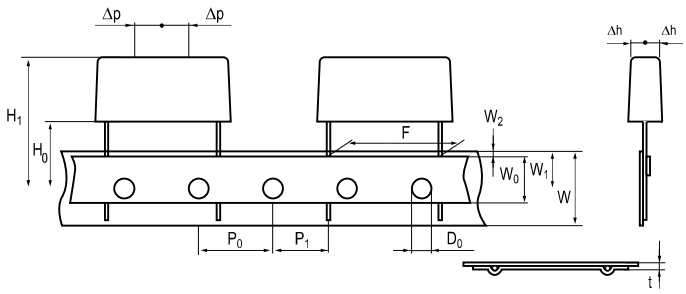

FRONT
RIFA Logo
RIFA
Series
PMZ 2035 RE
IEC Climatic Category
40/085/56/B
RC Unit
RC-UNIT
SBD
Manufacturing Date Code
BACK
Voltage
440V~
SH
Self Healing
14
Approval Mark
TOP
Capacitance
100n+ 150R X1
Resistance

Lead Taping & Packaging for Pxxx, PMExxx & PMRxxx (IEC 60286–2)

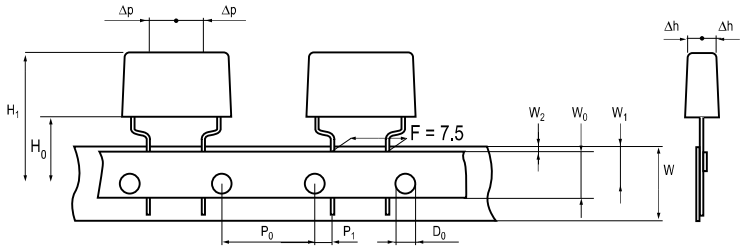
Lead Spacing 10.2 – 15.2 mm



Lead Spacing 20.3 – 22.5 mm



Formed Leads from 10.2 to 7.5 mm



Taping Specification

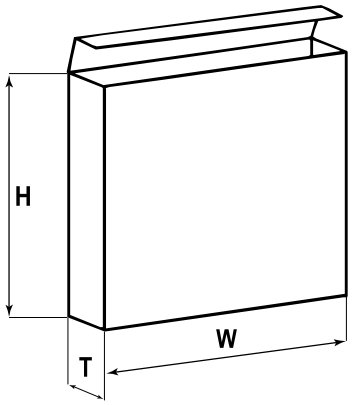
Dimensions in mm								Standard IEC 60286–2
Lead spacing	+6/-0.1	F	Formed 7.5	10.2	15.2	20.3	22.5	F
Carrier tape width	+/-0.5	W	18	18	18	18	18	$18^{+1/-0.5}$
Hold-down tape width	+/-0.3	W_0	9	12	12	12	12	
Position of sprocket hole	+/-0.5	W_1	9	9	9	9	9	$9^{+0.75/-0.5}$
Distance between tapes	Maximum	W_2	3	3	3	3	3	3
Sprocket hole diameter	+/-0.2	D_0	4	4	4	4	4	4
Feed hole lead spacing	+/-0.3	P_0 (1)	12.7(4)	12.7	12.7	12.7	12.7	12.7
Distance lead – feed hole	+/-0.7	P_1	3.75	7.6	5.1	8.9	5.3	P1
Deviation tape – plane	Maximum	Δp	1.3	1.3	1.3	1.3	1.3	1.3
Lateral deviation	Maximum	Δh	2	2	2	2	2	2
Total thickness	+/-0.2	t	0.7	0.7	0.7	0.7	0.9^{MAX}	0.9^{MAX}
Sprocket hole/cap body	Nominal	H_0 (2)	$18^{+2/-0}$	$18^{+2/-0}$	$18^{+2/-0}$	$18^{+2/-0}$	$18.5^{+/-0.5}$	$18^{+2/-0}$
Sprocket hole/top of cap body	Maximum	H_1 (3)	35	35	35	35	58	58^{MAX}

(1) Maximum cumulative feed hole error, 1 mm per 20 parts.
(2) 16.5 mm available on request.
(3) Depending on case size.
(4) 15 mm available on request.

Lead Taping & Packaging for PMExxx & PMRxxx (IEC 60286–2) cont'd

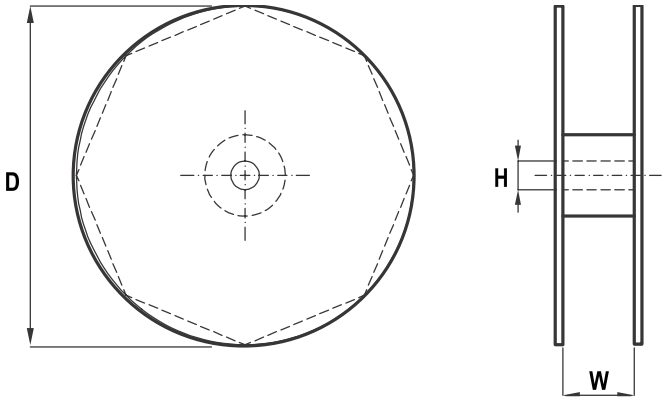
Ammo Specifications

Series	Dimensions (mm)		
	H	W	T
R4x, R4x+R, R7x, RSB	360	340	59
F5A, F5B, F5D			
F6xx, F8xx			
PHExxx, PMExxx, PMRxxx	330	330	50



Reel Specifications

Series	Dimensions (mm)		
	D	H	W
R4x, R4x+R, R7x, RSB	355	30	55 (Max)
F5A, F5B, F5D	500	25	
F6xx, F8xx			
PHExxx, PMExxx, PMRxxx	360 500	30	46 (Max)

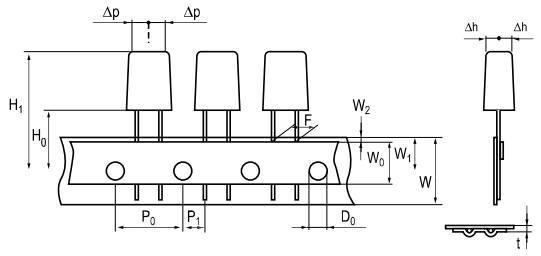


Manufacturing Date Code (IEC–60062)

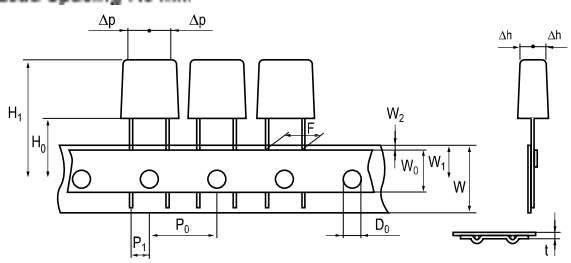
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2005	T	June	6
2006	U	July	7
2007	V	August	8
2008	W	September	9
2009	X	October	O
2010	A	November	N
2011	B	December	D
2012	C		
2013	D		
2014	E		
2015	F		
2016	H		
2017	J		
2018	K		
2019	L		
2020	M		

Lead Taping & Packaging for R4x + R, R4x, PHExxx, & F43 (IEC 60286–2)

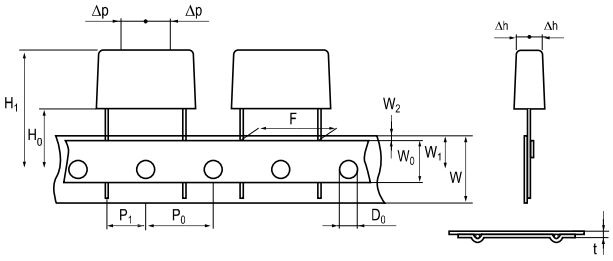
Lead Spacing 5 mm



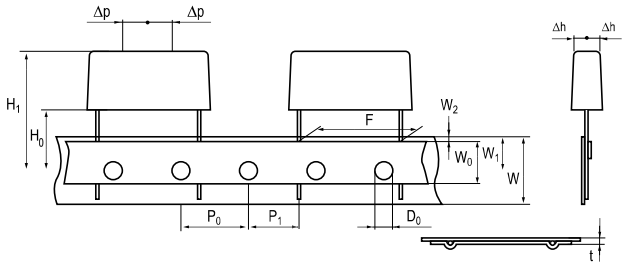
Lead Spacing 7.5 mm



Lead Spacing 10 – 15 mm



Lead Spacing 22.5 – 27.5 mm



Taping Specification

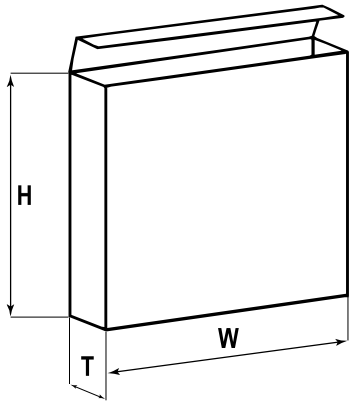
Dimensions in mm									Standard IEC 60286–2
Lead spacing	+6/-0.1	F	5	7.5	10	15	22.5	27.5	F
Carrier tape width	+1/-0.5	W	18	18	18	18	18	18	$18^{+1/-0.5}$
Hold-down tape width	Minimum	W_0	6	6	9	10	10	10	
Position of sprocket hole	+/-0.5	W_1	9	9	9	9	9	9	$9^{+0.75/-0.5}$
Distance between tapes	Maximum	W_2	3	3	3	3	3	3	3
Sprocket hole diameter	+/-0.2	D_0	4	4	4	4	4	4	4
Feed hole lead spacing	+/-0.2(1)	P_0(3)	12.7	12.7	12.7	12.7	12.7	12.7	12.7
Distance lead – feed hole	+/-0.7	P_1	3.85	3.75	7.7	5.2	7.8	5.3	P1
Deviation tape – plane	Maximum	Δp	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Lateral deviation	+/-2	Δh	2	2	2	2	2	2	2
Total thickness	+/-0.2	t	0.7	0.7	0.7	0.7	0.9^{MAX}	0.9^{MAX}	0.9^{MAX}
Sprocket hole/cap body	+/-0.5	H_0(2)	$18.5^{+/-0.5}$	$18.5^{+/-0.5}$	$18.5^{+/-0.5}$	$18.5^{+/-0.5}$	$18.5^{+/-0.5}$	$18.5^{+/-0.5}$	$18^{+2/-0}$

(1) Maximum cumulative feed hole error, 1 mm per 20 parts.
(2) 16.5 mm available on request.
(3) 15 mm available on request (F ≥ 10 mm).

Lead Taping & Packaging for F8xx, R4x + R, R4x, PHExxx, & F43 (IEC 60286–2) cont'd

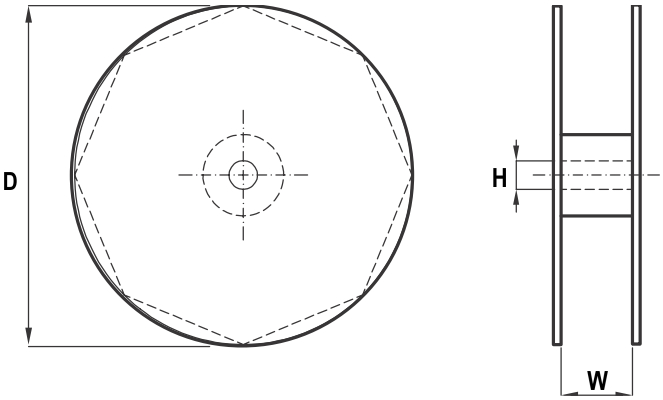
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F5A, F5B, F5D			
F6xx, F8xx			
PHExxx, PMExxx, PMRxxx	330	330	50



Reel Specifications

Series	Dimensions (mm)		
	D	H	W
R4x, R4x+R, R7x, RSB	355 500	30 25	55 (Max)
F5A, F5B, F5D			
F6xx, F8xx			
PHExxx, PMExxx, PMRxxx	360 500	30	46 (Max)



Manufacturing Date Code (IEC–60062)

Y = Year, Z = Month			
Year	Code	Month	Code
2000	M	January	1
2001	N	February	2
2002	P	March	3
2003	R	April	4
2004	S	May	5
2005	T	June	6
2006	U	July	7
2007	V	August	8
2008	W	September	9
2009	X	October	O
2010	A	November	N
2011	B	December	D
2012	C		
2013	D		
2014	E		
2015	F		
2016	H		
2017	J		
2018	K		
2019	L		
2020	M		

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