

R60, Radial, 10 – 37.5 mm Lead Spacing, 50 – 1,000 VDC (Automotive Grade)

Overview

The R60 is constructed of metallized polyester film (wound or stacked technology) with radial leads of tinned wire. Radial leads are electrically welded to the contact metal layer on the ends of the capacitor winding. The capacitor is encapsulated with thermosetting resin in a box material meeting the UL 94V-0 requirements.

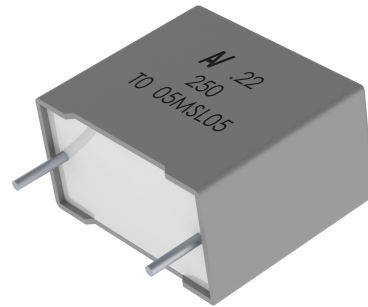
R60 components (up to lead spacing 22.5 mm) meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements.

Applications

Typical applications include blocking, coupling, decoupling, bypassing and interference suppression in low voltage applications such as automotive. Not suitable for across-the-line application (see suppressor capacitors).

Benefits

- Voltage range: 50 – 1000 VDC
- Capacitance range: 0.001 – 150.0 μ F
- Lead spacing: 10.0 – 37.5 mm
- Capacitance tolerance: $\pm 5\%$, $\pm 10\%$, $\pm 20\%$
- Climatic category: 55/105/56
- Operating temperature range of -55°C to $+105^{\circ}\text{C}$
- RoHS compliance and lead (Pb)-free terminations
- Tape and reel packaging in accordance with IEC 60286-2
- Self-healing
- Automotive (AEC-Q200) grades up to pitch 22.5 mm



Part Number System

R60	M	F	2470	AA	60	K
Series	Rated Voltage (VDC)	Length (mm)	Capacitance Code (pF)	Packaging	Internal Use	Capacitance Tolerance
Metallized Polyester	C = 50 D = 63 E = 100 G = 160 I = 250 M = 400 P = 630 Q = 1,000	F = 10 I = 15 N = 22.5 R = 27.5 W = 37.5	The last three digits represent significant figures. First digit specifies the number of zeros to be added.	See Ordering Options Table	00 01 30 40 50 6A L0 L1	J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$

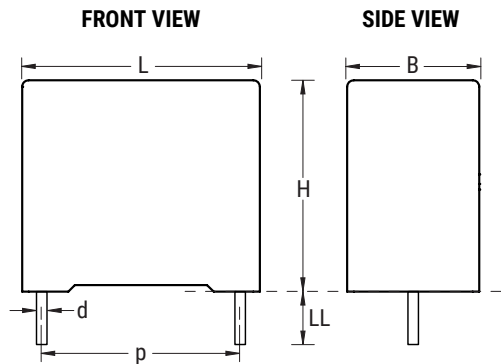
Ordering Options Table

Lead Spacing Nominal (mm)	Type of Leads and Packaging	LL Lead Length (mm)	Lead and Packaging Code
10 15 22.5	Standard Lead and Packaging Options		
	Bulk (bag) – short leads	4 +2/-0	AA
	Ammo Pack	H ₀ = 18.5 ±0.5	DQ
	Other Lead and Packaging Options		
	Tape & Reel (Standard reel Ø 355 mm)	H ₀ = 18.5 ±0.5	GY
	Tape & Reel (Large reel Ø 500 mm)	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	10 ±1	JC
	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	JM*
	Bulk (bag) – long leads	17 +1/-2	Z3**
	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	AA
	Other Lead and Packaging Options		
	Tape & Reel (Large reel Ø 500 mm)	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	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	AA
	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	JM
	Bulk (bag) – long leads	30 +5/-0	40
	Bulk (bag) – long leads	25 +2/-1	50

* Only available for lead spacing ≥15 mm.

** Only available for 10 mm lead spacing.

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	0.8	±0.05
15.0	±0.4	6.0	+0.2	12.0	+0.1	18.0	+0.3	0.8	±0.05
15.0	±0.4	7.5	+0.2	13.5	+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	0.8	±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	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	12.0	+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
27.5	±0.4	24.0	+0.2	15.0	+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
37.5	±0.4	24.0	+0.3	15.0	+0.1	41.5	+0.3	1.0	±0.05
37.5	±0.4	24.0	+0.3	19.0	+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/H₀) options.

Performance Characteristics

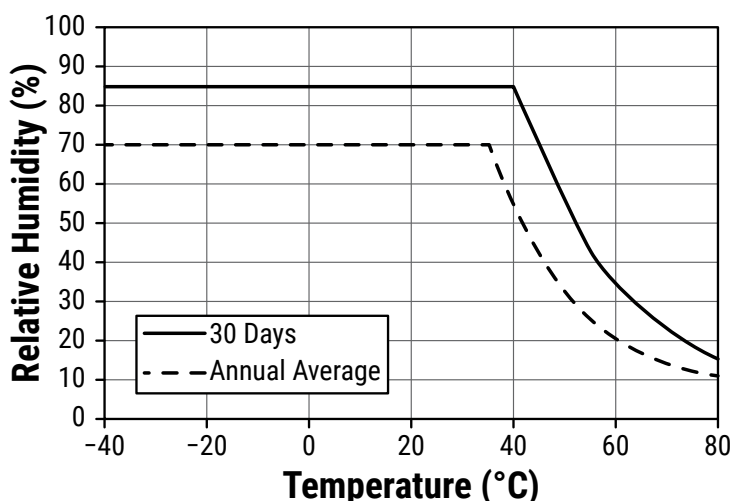
Dielectric	Polyester film (polyethylene terephthalate).							
Plates	Metal layer deposited by evaporation under vacuum.							
Winding	Non-inductive type.							
Leads	Tinned wire.							
Protection	Plastic case, thermosetting resin filled. Box material is solvent resistant and flame retardant according to UL 94.							
Related Documents	IEC 60384-2							
Rated Voltage V _R (VDC)	50	63	100	160	250	400	630	1000
Rated Voltage V _R (VAC)	30	40	63	90	160	200	220	250
Capacitance Range (μF)	1.5 – 5.6	0.68 – 100	0.33 – 150	0.22 – 150	0.1 – 68	0.022 – 33	0.0047 – 10	0.001 – 4.7
Capacitance Values	E6 series (IEC 60063) measured at 1 kHz and +20 ±1°C							
Capacitance Tolerance	±5%, ±10%, ±20%							
Operating Temperature Range	-55°C to +105°C Upper operating temperature of +125°C is allowed for a maximum operating time of 1,000 hours.							
Rated Temperature T _R	+85°C							
Voltage Derating	Above +85°C DC and AC voltage derating is 1.25%/°C							
Climatic Category	55/105/56 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)							
Test Voltage	1.6 x V _R VDC for 2 seconds (between terminations) at +25°C ±5°C							
Capacitance Drift	Maximum 3% after a 2 year storage period at a temperature of +10°C to +40°C and a relative humidity of 40% to 60%							
Reliability (Reference MIL-HDBK-217)	Operational life > 200,000 hours							
	Failure rate ≤ 5 FIT, T = +40°C, V = 0.5 x V _R							
	Failure criteria: open or short circuit, capacitance change > 10%, DF 2 times the catalog limits, IR < 0.005 x initial limit							
Maximum Pulse Steepness	dV/dt according to Table 1. For peak to peak voltages lower than rated voltage (V _{pp} < V _R), the specified dv/dt can be multiplied by the factor V _R /V _{pp}							
Temperature Coefficient	+400 (±200) ppm/°C at 1 kHz							
Self Inductance (Lead Length ~ 2 mm)	Lead Spacing (mm)	10	15	22.5	27.5	37.5		
	L (nH)	9	10	18	18	22		
	Maximum 1 nH per 1 mm lead and capacitor length.							

Performance Characteristics cont'd

Dissipation Factor $\tan\delta$	Maximum Values at 25°C ±5°C		
	Frequency	C ≤ 1 μF	C > 1 μF
	1 kHz	1.00%	1.00%
	10 kHz	1.50%	–
Insulation Resistance	Measured at +25°C ±5°C, according to IEC 60384-2		
	Minimum Values Between Terminals		
	Voltage Charge/Time	C ≤ 0.33 μF	C > 0.33 μF
	50 VDC for $V_R \leq 100$ VDC 1 minute	≥ 3,750 MΩ (≥ 50,000 MΩ) *	≥ 1,250 MΩ • μF (≥ 5,000 MΩ • μF) *
	100 VDC for $V_R > 100$ VDC 1 minute	≥ 30,000 MΩ (≥ 50,000 MΩ) *	≥ 10,000 MΩ • μF (≥ 17,000 MΩ • μF) *

* typical value

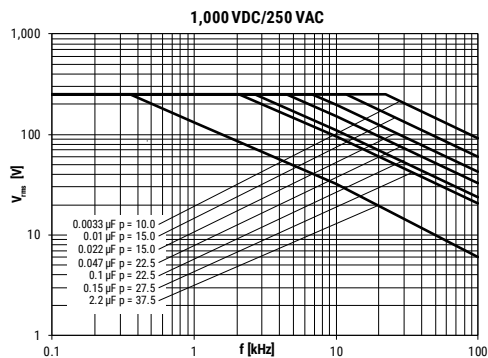
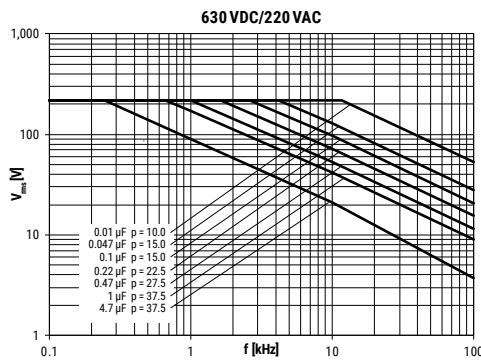
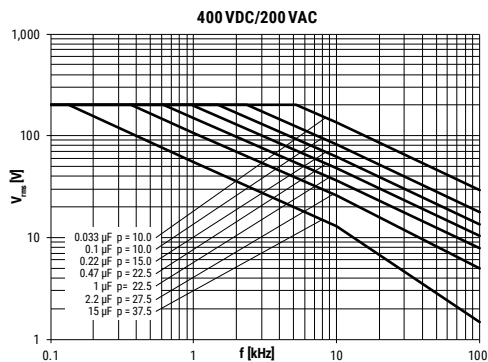
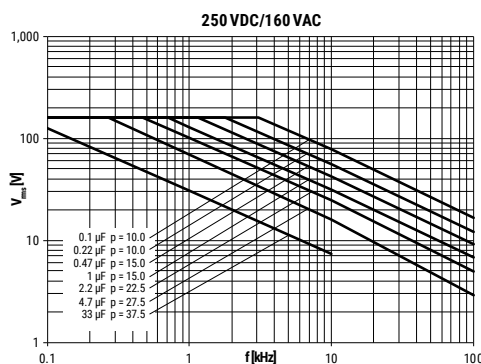
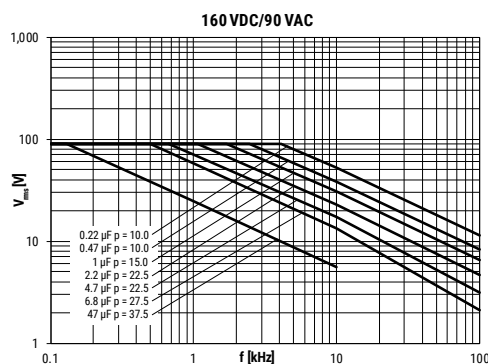
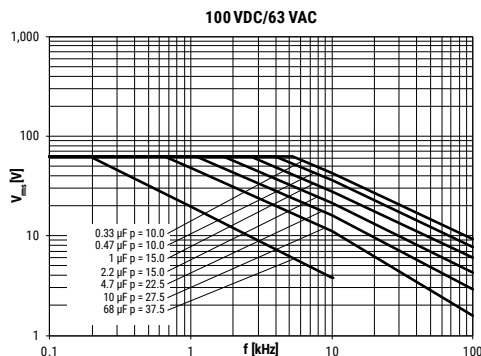
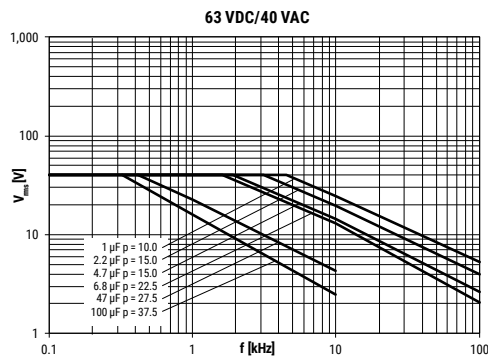
Maximum Humidity in Storage Conditions



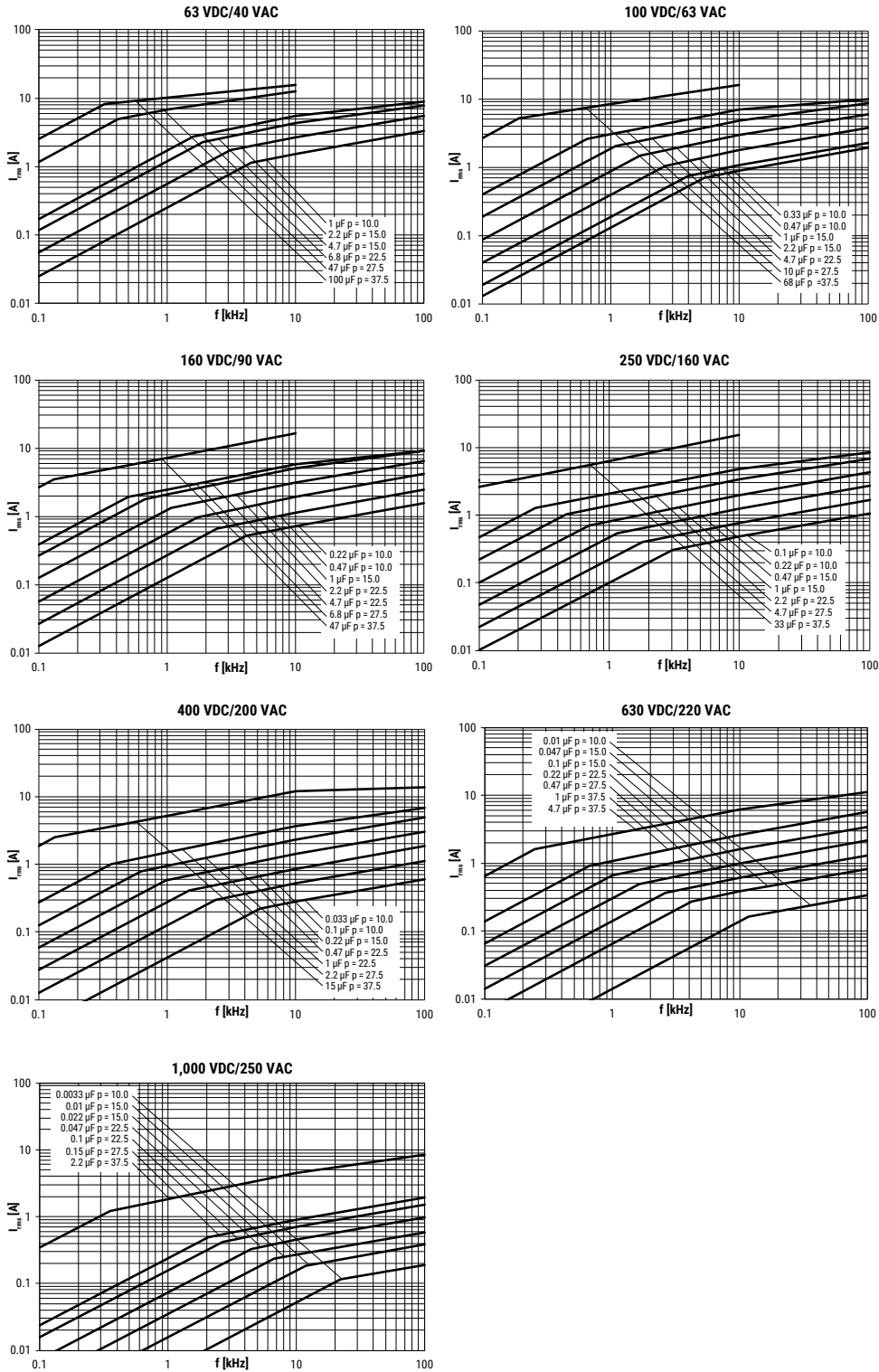
Qualification

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.

Maximum Voltage (V_{rms}) vs. Frequency (Sinusoidal Waveform/ $T_h \leq 40^\circ\text{C}$)



Maximum Current (I_{rms}) vs. Frequency (Sinusoidal Waveform/ $T_h \leq 40^\circ\text{C}$)



Environmental Test Data

Damp Heat, Steady State Test	Test Conditions		Performances
	Temperature Relative humidity (RH) Test duration	+40°C ±2°C 93% ±2% 56 days	Δ C/C ≤ 5%, Δ tanδ ≤ 0.005 at 1 kHz IR after test ≥ 50% of initial limit
Endurance Test	Test Conditions		Performances
	Temperature Voltage applied Test duration	+105°C ±2°C 1.25 x V _C 2,000 hours	Δ C/C ≤ 5%, Δ tanδ ≤ 0.005 at 10 kHz for C ≤ 1 μF Δ tanδ ≤ 0.003 at 1 kHz for C > 1 μF IR after test ≥ 50% of initial limit
Resistance to Soldering Heat Test	Test Conditions		Performances
	Solder bath temperature Dipping time (with heat screen)	260°C ±5°C 10 seconds ±1 second	Δ C/C ≤ 2%, Δ tanδ ≤ 0.005 at 10 kHz for C ≤ 1 μF Δ tanδ ≤ 0.003 at 1 kHz for C > 1 μF IR after test ≥ initial limit

Environmental Compliance

All KEMET MKT capacitors are RoHS compliant.

Table 1A – Ratings & Part Number Reference (Stacked Capacitor Technology)

VDC	VAC	Capacitance Value (μF)	Dimensions in mm			Lead Spacing	dV/dt (V/μs)	Maximum K ₀ (V ² /μs)	New KEMET Part Number	Legacy Part Number
			B	H	L					
50	30	1.5	4.0	9.0	13.0	10.0	30	3000	60CF4150(1)6A(2)	R60CF4150(1)6A(2)
50	30	2.2	4.0	9.0	13.0	10.0	30	3000	60CF4220(1)6A(2)	R60CF4220(1)6A(2)
50	30	3.3	5.0	11.0	13.0	10.0	30	3000	60CF4330(1)6A(2)	R60CF4330(1)6A(2)
50	30	4.7	6.0	12.0	13.0	10.0	30	3000	60CF4470(1)6A(2)	R60CF4470(1)6A(2)
50	30	5.6	6.0	12.0	13.0	10.0	30	3000	60CF4560(1)6A(2)	R60CF4560(1)6A(2)
63	40	1.0	4.0	9.0	13.0	10.0	50	6300	60DF4100(1)6A(2)	R60DF4100(1)6A(2)
63	40	1.5	5.0	11.0	13.0	10.0	50	6300	60DF4150(1)6A(2)	R60DF4150(1)6A(2)
63	40	2.2	5.0	11.0	13.0	10.0	50	6300	60DF4220(1)6A(2)	R60DF4220(1)6A(2)
63	40	3.3	6.0	12.0	13.0	10.0	50	6300	60DF4330(1)6A(2)	R60DF4330(1)6A(2)
100	63	0.33	4.0	9.0	13.0	10.0	75	15000	60EF3330(1)6A(2)	R60EF3330(1)6A(2)
100	63	0.47	4.0	9.0	13.0	10.0	75	15000	60EF3470(1)6A(2)	R60EF3470(1)6A(2)
100	63	0.68	4.0	9.0	13.0	10.0	75	15000	60EF3680(1)6A(2)	R60EF3680(1)6A(2)
100	63	1.0	5.0	11.0	13.0	10.0	75	15000	60EF4100(1)6A(2)	R60EF4100(1)6A(2)
100	63	1.5	5.0	11.0	13.0	10.0	75	15000	60EF4150(1)6A(2)	R60EF4150(1)6A(2)
160	90	0.22	4.0	9.0	13.0	10.0	100	32000	60GF3220(1)6A(2)	R60GF3220(1)6A(2)
160	90	0.33	4.0	9.0	13.0	10.0	100	32000	60GF3330(1)6A(2)	R60GF3330(1)6A(2)
160	90	0.47	5.0	11.0	13.0	10.0	100	32000	60GF3470(1)6A(2)	R60GF3470(1)6A(2)
160	90	0.68	6.0	12.0	13.0	10.0	100	32000	60GF3680(1)6A(2)	R60GF3680(1)6A(2)
250	160	0.10	4.0	9.0	13.0	10.0	150	75000	60IF3100(1)6A(2)	R60IF3100(1)6A(2)
250	160	0.15	4.0	9.0	13.0	10.0	150	75000	60IF3150(1)6A(2)	R60IF3150(1)6A(2)
250	160	0.22	5.0	11.0	13.0	10.0	150	75000	60IF3220(1)6A(2)	R60IF3220(1)6A(2)
250	160	0.33	5.0	11.0	13.0	10.0	150	75000	60IF3330(1)6A(2)	R60IF3330(1)6A(2)
250	160	0.47	6.0	12.0	13.0	10.0	150	75000	60IF3470(1)6A(2)	R60IF3470(1)6A(2)
VDC	VAC	Capacitance Value (μF)	B (mm)	H (mm)	L (mm)	Lead Spacing	dV/dt (V/μs)	Max K ₀ (V ² /μs)	New KEMET Part Number	Legacy Part Number

Table 1A – Ratings & Part Number Reference (Stacked Capacitor Technology) cont'd

VDC	VAC	Capacitance Value (µF)	Dimensions in mm			Lead Spacing	dV/dt (V/µs)	Maximum K ₀ (V ² /µs)	New KEMET Part Number	Legacy Part Number
			B	H	L					
400	200	0.033	4.0	9.0	13.0	10.0	175	140000	60MF2330(1)6A(2)	R60MF2330(1)6A(2)
400	200	0.047	4.0	9.0	13.0	10.0	175	140000	60MF2470(1)6A(2)	R60MF2470(1)6A(2)
400	200	0.068	4.0	9.0	13.0	10.0	175	140000	60MF2680(1)6A(2)	R60MF2680(1)6A(2)
400	200	0.10	5.0	11.0	13.0	10.0	175	140000	60MF3100(1)6A(2)	R60MF3100(1)6A(2)
400	200	0.15	6.0	12.0	13.0	10.0	175	140000	60MF3150(1)6A(2)	R60MF3150(1)6A(2)
630	220	0.010	4.0	9.0	13.0	10.0	200	252000	60PF2100(1)6A(2)	R60PF2100(1)6A(2)
630	220	0.015	4.0	9.0	13.0	10.0	200	252000	60PF2150(1)6A(2)	R60PF2150(1)6A(2)
630	220	0.022	4.0	9.0	13.0	10.0	200	252000	60PF2220(1)6A(2)	R60PF2220(1)6A(2)
630	220	0.033	5.0	11.0	13.0	10.0	200	252000	60PF2330(1)6A(2)	R60PF2330(1)6A(2)
630	220	0.047	5.0	11.0	13.0	10.0	200	252000	60PF2470(1)6A(2)	R60PF2470(1)6A(2)
VDC	VAC	Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing	dV/dt (V/µs)	Max K ₀ (V ² /µs)	New KEMET Part Number	Legacy Part Number

Table 1B – Ratings & Part Number Reference (Wound Capacitor Technology)

VDC	VAC	Capacitance Value (µF)	Dimensions in mm			Lead Spacing	dV/dt (V/µs)	Maximum K ₀ (V ² /µs)	New KEMET Part Number	Legacy Part Number
			B	H	L					
63	40	0.68	5.0	11.0	18.0	15.0	2.5	315	60DI3680(1)30(2)	R60DI3680(1)30(2)
63	40	1.0	5.0	11.0	18.0	15.0	2.5	315	60DI4100(1)30(2)	R60DI4100(1)30(2)
63	40	1.5	5.0	11.0	18.0	15.0	2.5	315	60DI4150(1)30(2)	R60DI4150(1)30(2)
63	40	2.2	6.0	12.0	18.0	15.0	2.5	315	60DI4220(1)30(2)	R60DI4220(1)30(2)
63	40	3.3	7.5	13.5	18.0	15.0	2.5	315	60DI4330(1)30(2)	R60DI4330(1)30(2)
63	40	3.3	9.0	12.5	18.0	15.0	2.5	315	60DI4330(1)L0(2)	R60DI4330(1)L0(2)
63	40	4.7	8.5	14.5	18.0	15.0	2.5	315	60DI4470(1)30(2)	R60DI4470(1)30(2)
63	40	4.7	13.0	12.0	18.0	15.0	2.5	315	60DI4470(1)L0(2)	R60DI4470(1)L0(2)
63	40	6.8	10.0	16.0	18.0	15.0	2.5	315	60DI4680(1)30(2)	R60DI4680(1)30(2)
63	40	3.3	6.0	15.0	26.5	22.5	1.5	189	60DN4330(1)30(2)	R60DN4330(1)30(2)
63	40	4.7	7.0	16.0	26.5	22.5	1.5	189	60DN4470(1)30(2)	R60DN4470(1)30(2)
63	40	6.8	7.0	16.0	26.5	22.5	1.5	189	60DN4680(1)30(2)	R60DN4680(1)30(2)
63	40	10.0	8.5	17.0	26.5	22.5	1.5	189	60DN5100(1)30(2)	R60DN5100(1)30(2)
63	40	15.0	11.0	20.0	26.5	22.5	1.5	189	60DN5150(1)30(2)	R60DN5150(1)30(2)
63	40	4.7	13.0	12.0	32.0	27.5	1.0	126	60DR4470(1)L0(2)	R60DR4470(1)L0(2)
63	40	6.8	13.0	12.0	32.0	27.5	1.0	126	60DR4680(1)L0(2)	R60DR4680(1)L0(2)
63	40	10.0	9.0	17.0	32.0	27.5	1.0	126	60DR5100(1)30(2)	R60DR5100(1)30(2)
63	40	15.0	11.0	20.0	32.0	27.5	1.0	126	60DR5150(1)30(2)	R60DR5150(1)30(2)
63	40	15.0	24.0	15.0	32.0	27.5	1.0	126	60DR5150(1)L0(2)	R60DR5150(1)L0(2)
63	40	22.0	13.0	22.0	32.0	27.5	1.0	126	60DR5220(1)30(2)	R60DR5220(1)30(2)
63	40	22.0	24.0	15.0	32.0	27.5	1.0	126	60DR5220(1)L0(2)	R60DR5220(1)L0(2)
63	40	22.0	11.0	20.0	32.0	27.5	1.0	126	60DR5220(1)40(2)	R60DR5220(1)40(2)
63	40	33.0	18.0	33.0	32.0	27.5	1.0	126	60DR5330(1)50(2)	R60DR5330(1)50(2)
63	40	47.0	22.0	37.0	32.0	27.5	1.0	126	60DR5470(1)50(2)	R60DR5470(1)50(2)
63	40	68.0	22.0	37.0	32.0	27.5	1.0	126	60DR5680(1)30(2)	R60DR5680(1)30(2)
63	40	22.0	11.0	22.0	41.5	37.5	0.8	101	60DW5220(1)30(2)	R60DW5220(1)30(2)
63	40	22.0	24.0	15.0	41.5	37.5	0.8	101	60DW5220(1)L0(2)	R60DW5220(1)L0(2)
63	40	33.0	13.0	24.0	41.5	37.5	0.8	101	60DW5330(1)50(2)	R60DW5330(1)50(2)
63	40	33.0	24.0	15.0	41.5	37.5	0.8	101	60DW5330(1)L0(2)	R60DW5330(1)L0(2)
63	40	47.0	16.0	28.5	41.5	37.5	0.8	101	60DW5470(1)50(2)	R60DW5470(1)50(2)
63	40	47.0	24.0	19.0	41.5	37.5	0.8	101	60DW5470(1)L0(2)	R60DW5470(1)L0(2)
63	40	68.0	19.0	32.0	41.5	37.5	0.8	101	60DW5680(1)30(2)	R60DW5680(1)30(2)
63	40	100.0	20.0	40.0	41.5	37.5	0.8	101	60DW6100(1)50(3)	R60DW6100(1)50(3)
63	40	100.0	24.0	44.0	41.5	37.5	0.8	101	60DW6100(1)60(2)	R60DW6100(1)60(2)
100	63	0.33	5.0	11.0	18.0	15.0	3.0	600	60EI3330(1)30(2)	R60EI3330(1)30(2)
100	63	0.47	5.0	11.0	18.0	15.0	3.0	600	60EI3470(1)30(2)	R60EI3470(1)30(2)
100	63	0.68	5.0	11.0	18.0	15.0	3.0	600	60EI3680(1)30(2)	R60EI3680(1)30(2)
VDC	VAC	Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing	dV/dt (V/µs)	Max K ₀ (V ² /µs)	New KEMET Part Number	Legacy Part Number

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

(2) J = 5%, K = 10%, M = 20%

(3) K = 10%, M = 20%

Table 1B – Ratings & Part Number Reference (Wound Capacitor Technology) cont'd

VDC	VAC	Capacitance Value (µF)	Dimensions in mm			Lead Spacing	dV/dt (V/µs)	Maximum K ₀ (V ² /µs)	New KEMET Part Number	Legacy Part Number
			B	H	L					
1000	250	0.047	10.0	16.0	18.0	15.0	30.0	60000	60QI2470(1)00(2)	R60QI2470(1)00(2)
1000	250	0.047	13.0	12.0	18.0	15.0	30.0	60000	60QI2470(1)L0(2)	R60QI2470(1)L0(2)
1000	250	0.068	11.0	19.0	18.0	15.0	30.0	60000	60QI2680(1)00(2)	R60QI2680(1)00(2)
1000	250	0.033	6.0	15.0	26.5	22.5	15.0	30000	60QN2330(1)00(2)	R60QN2330(1)00(2)
1000	250	0.047	6.0	15.0	26.5	22.5	15.0	30000	60QN2470(1)00(2)	R60QN2470(1)00(2)
1000	250	0.068	7.0	16.0	26.5	22.5	15.0	30000	60QN2680(1)30(2)	R60QN2680(1)30(2)
1000	250	0.10	8.5	17.0	26.5	22.5	15.0	30000	60QN3100(1)30(2)	R60QN3100(1)30(2)
1000	250	0.15	13.0	22.0	26.5	22.5	15.0	30000	60QN3150(1)00(2)	R60QN3150(1)00(2)
1000	250	0.15	9.0	17.0	32.0	27.5	12.0	24000	60QR3150(1)30(2)	R60QR3150(1)30(2)
1000	250	0.22	9.0	17.0	32.0	27.5	12.0	24000	60QR3220(1)40(2)	R60QR3220(1)40(2)
1000	250	0.33	11.0	20.0	32.0	27.5	12.0	24000	60QR3330(1)40(2)	R60QR3330(1)40(2)
1000	250	0.33	24.0	15.0	32.0	27.5	12.0	24000	60QR3330(1)L0(2)	R60QR3330(1)L0(2)
1000	250	0.47	13.0	22.0	32.0	27.5	12.0	24000	60QR3470(1)40(2)	R60QR3470(1)40(2)
1000	250	0.47	24.0	15.0	32.0	27.5	12.0	24000	60QR3470(1)L0(2)	R60QR3470(1)L0(2)
1000	250	0.68	14.0	28.0	32.0	27.5	12.0	24000	60QR3680(1)40(2)	R60QR3680(1)40(2)
1000	250	1.0	18.0	33.0	32.0	27.5	12.0	24000	60QR4100(1)40(2)	R60QR4100(1)40(2)
1000	250	1.5	22.0	37.0	32.0	27.5	12.0	24000	60QR4150(1)40(2)	R60QR4150(1)40(2)
1000	250	0.47	11.0	22.0	41.5	37.5	10.0	20000	60QW3470(1)30(2)	R60QW3470(1)30(2)
1000	250	0.68	11.0	22.0	41.5	37.5	10.0	20000	60QW3680(1)40(2)	R60QW3680(1)40(2)
1000	250	0.68	24.0	15.0	41.5	37.5	10.0	20000	60QW3680(1)L0(2)	R60QW3680(1)L0(2)
1000	250	1.0	16.0	28.5	41.5	37.5	10.0	20000	60QW4100(1)50(2)	R60QW4100(1)50(2)
1000	250	1.0	24.0	15.0	41.5	37.5	10.0	20000	60QW4100(1)L0(2)	R60QW4100(1)L0(2)
1000	250	1.5	19.0	32.0	41.5	37.5	10.0	20000	60QW4150(1)50(2)	R60QW4150(1)50(2)
1000	250	2.2	20.0	40.0	41.5	37.5	10.0	20000	60QW4220(1)30(2)	R60QW4220(1)30(2)
1000	250	3.3	24.0	44.0	41.5	37.5	10.0	20000	60QW4330(1)00(2)	R60QW4330(1)00(2)
1000	250	4.7	30.0	45.0	41.5	37.5	10.0	20000	60QW4470(1)40(3)	R60QW4470(1)40(3)
VDC	VAC	Capacitance Value (µF)	B (mm)	H (mm)	L (mm)	Lead Spacing	dV/dt (V/µs)	Max K ₀ (V ² /µs)	New KEMET Part Number	Legacy Part Number

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

(2) J = 5%, K = 10%, M = 20%

(3) K = 10%, M = 20%

Soldering Process

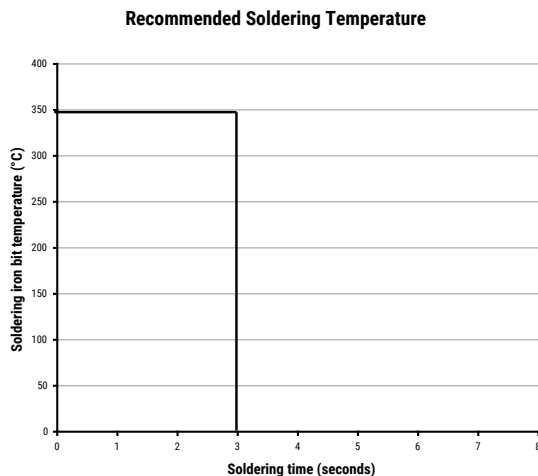
The implementation of the RoHS directive has resulted in the selection of SnAgCu (SAC) alloys or SnCu alloys as primary solder. This has increased the liquidus temperature from that of 183°C for SnPb eutectic alloy to 217 – 221°C for the new alloys. As a result, the heat stress to the components, even 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.

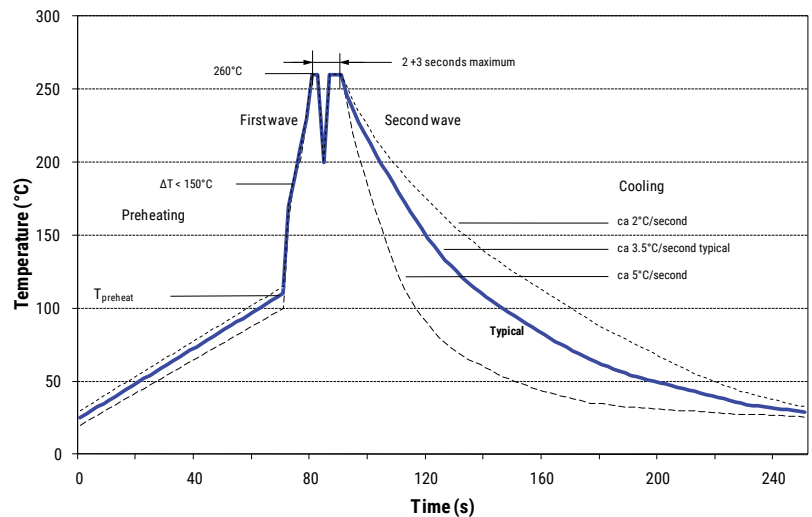
Manual Soldering Recommendations

The following is a 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

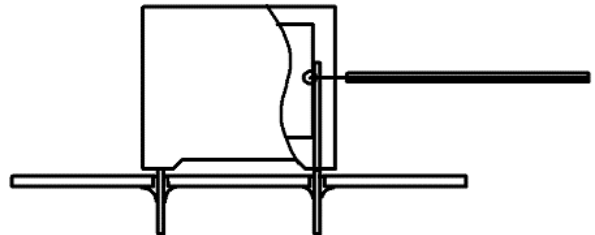
1. The table indicates the maximum set-up temperature of the soldering process
Figure 1.

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.

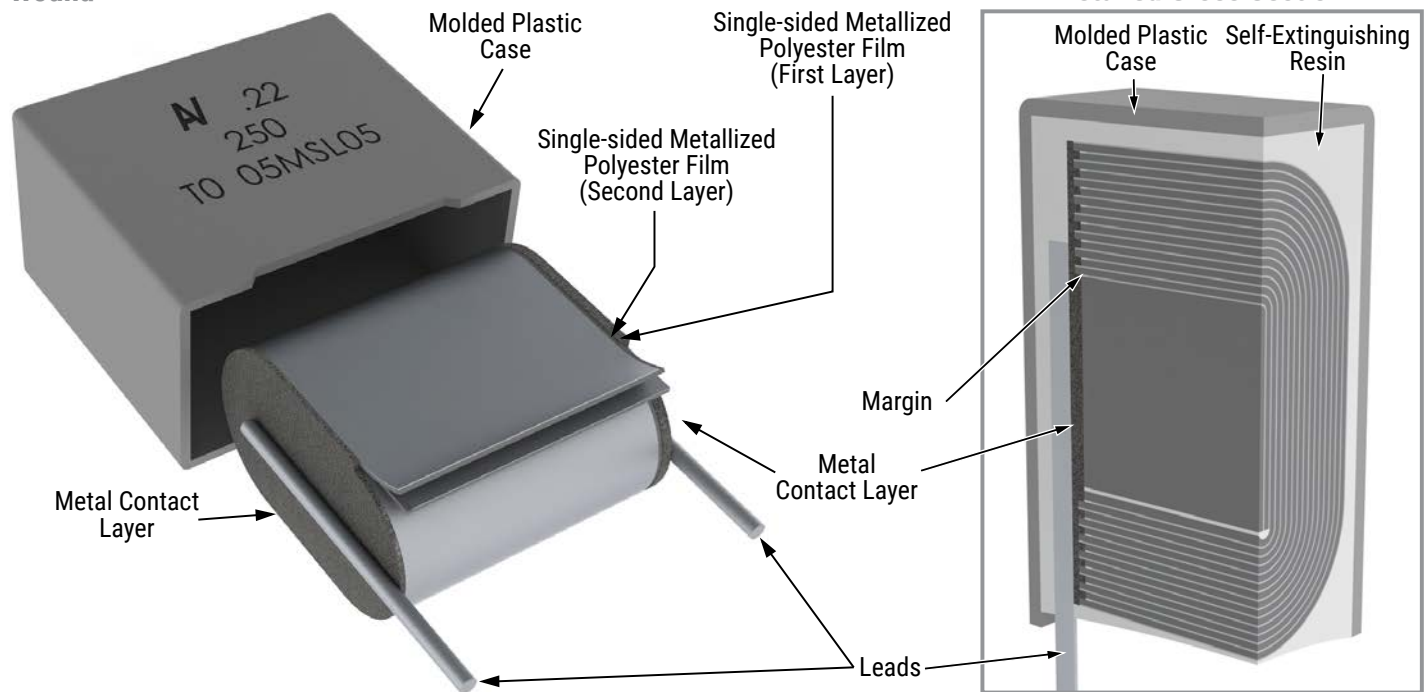
Selective Soldering Recommendations

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.

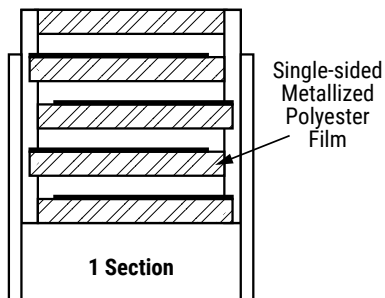
The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document, **however, instead of two baths, there is only one bath with a time from 3 to 10 seconds.** In selective soldering, the risk of overheating is greater than in double wave flow soldering,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

Construction

Wound

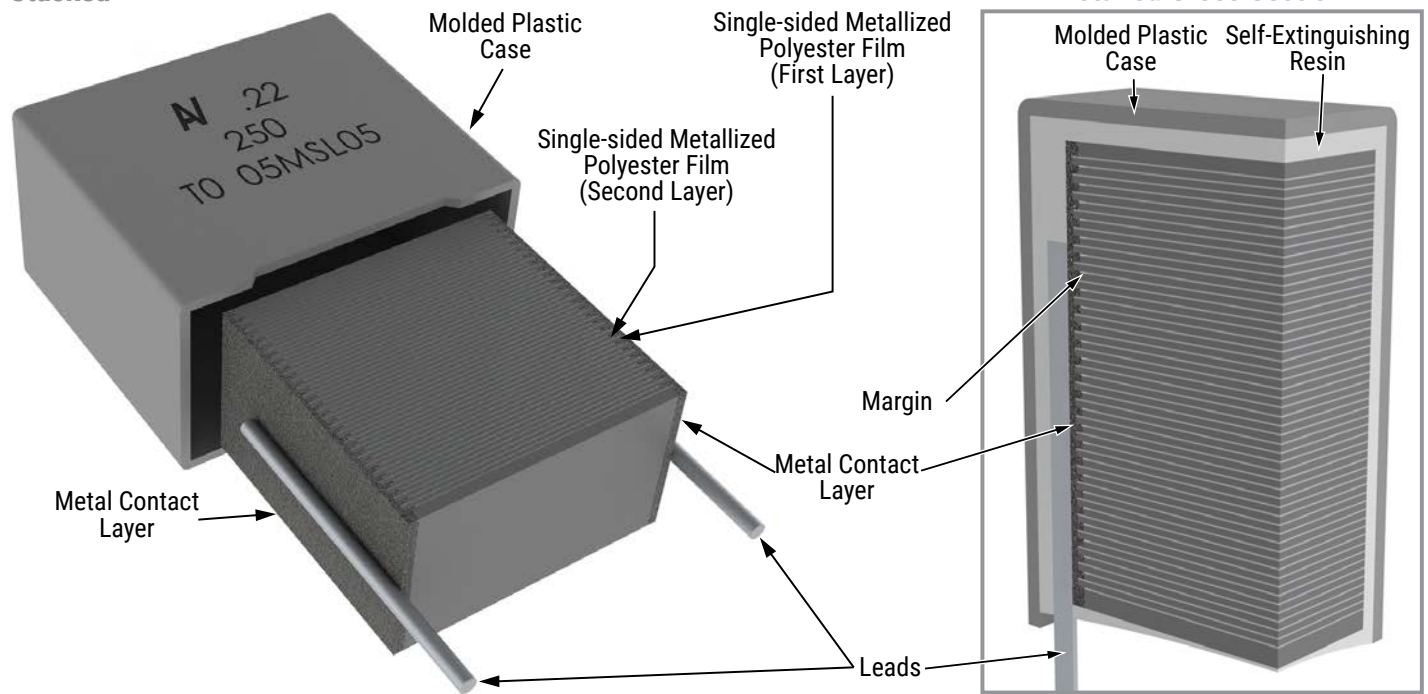


Winding Scheme

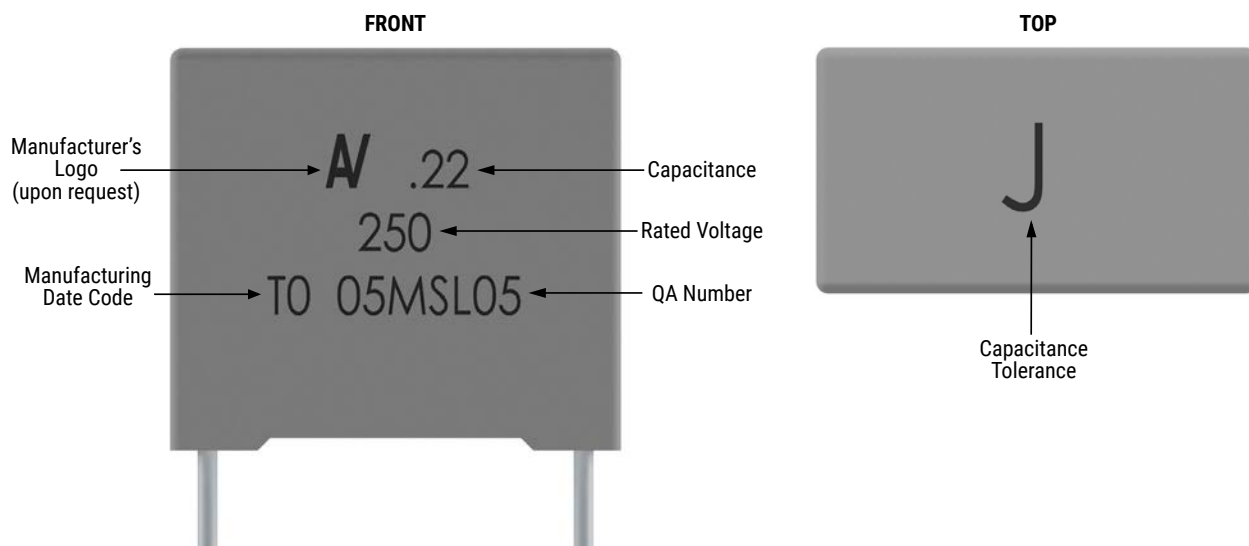


Construction cont'd

Stacked



Marking

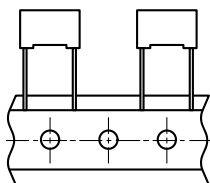


Packaging Quantities

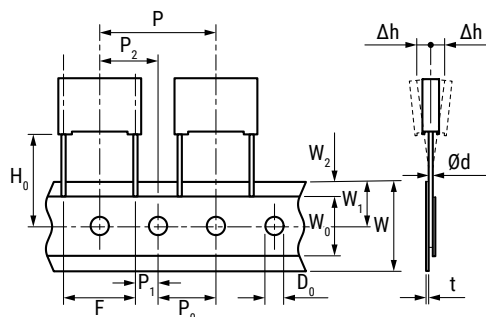
Lead Spacing	Thickness (mm)	Height (mm)	Length (mm)	Bulk Short Leads	Bulk Long Leads	Standard Reel ø 355 mm	Large Reel ø 500 mm	Ammo
10	4.0	9.0	13.0	2,000	1,800	750	1,500	1,000
	5.0	11.0	13.0	1,300	1,500	600	1,250	800
	6.0	12.0	13.0	1,000	1,200	500	1,000	680
15	5.0	11.0	18.0	2,000	1,000	600	1,250	800
	6.0	12.0	18.0	1,750	900	500	1,000	680
	7.5	13.5	18.0	1,000	700	350	800	500
	8.5	14.5	18.0	1,000	500	300	700	440
	9.0	12.5	18.0	1,000	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
	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			
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			
	24.0	44.0	41.5	108	72			
	30.0	45.0	41.5	90	60			

Lead Taping & Packaging (IEC 60286-2)

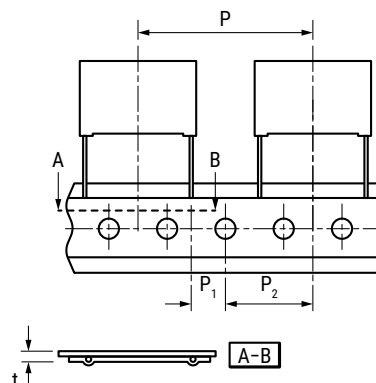
**Figure 1 – Lead Spacing
10 mm**



**Figure 2 – Lead Spacing
15 mm**



**Figure 3 – Lead Spacing
22.5 & 27.5 mm**



Description	Symbol	Dimensions (mm)				
		Lead Space				Tolerance
		10.0	15.0	22.5	27.5	
		Figure 1	Figure 2	Figure 3	Figure 3	
Lead wire diameter	d	0.6	0.6 – 0.8	0.8	0.8	±0.05
Taping lead space	P	25.4	25.4	38.1	38.1	±1
Feed hole lead space*	P ₀	12.7	12.7	12.7	12.7	±0.2 **
Centering of the lead wire	P ₁	7.7	5.2	7.8	5.3	±0.7
Centering of the body	P ₂	12.7	12.7	19.05	19.05	±1.3
Lead spacing***	F	10.0	15.0	22.5	27.5	+0.6/-0.1
Component alignment	Δh	0	0	0	0	±2
Height of component from tape center	H ₀ ****	18.5	18.5	18.5	18.5	±0.5
Carrier tape width	W	18	18	18	18	+1/-0.5
Hold down tape width	W ₀	9	10	10	10	Minimum
Hole position	W ₁	9	9	9	9	±0.5
Hold down tape position	W ₂	3	3	3	3	Maximum
Feed hole diameter	D ₀	4	4	4	4	±0.2
Total tape thickness	t	0.7	0.7	0.7	0.7	±0.2

* Available also 15 mm.

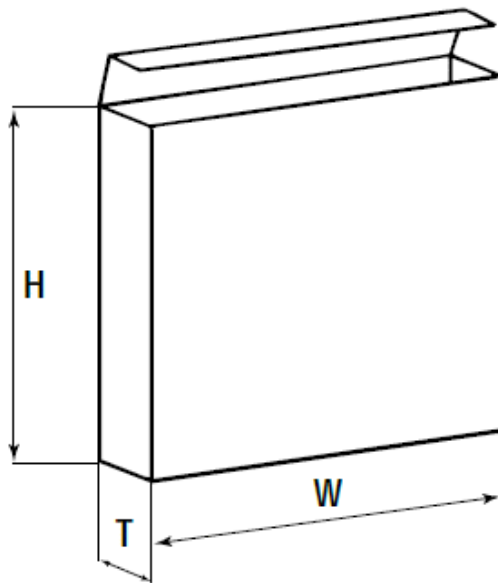
** Maximum 1 mm on 20 lead spaces.

*** Lead Spacing 15mm and 10mm taped to 7.5 mm (crimped leads) available upon request.

**** H = 16.5 mm is available upon request.

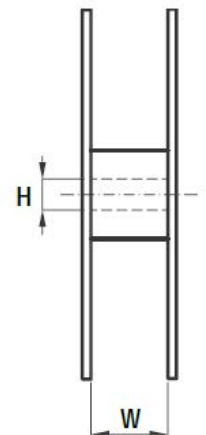
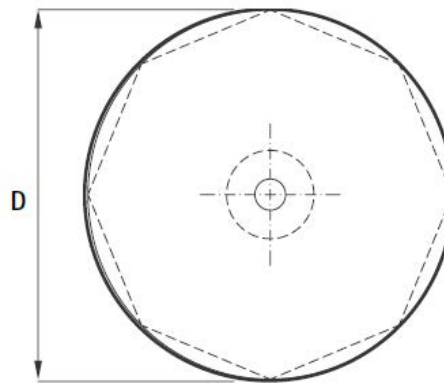
Ammo Specifications

Dimensions in mm		
H	W	T
360	340	59



Reel Specifications

Dimensions in mm		
D	H	W
355	30	55 maximum
500	25	



Manufacturing Date Code (IEC-60062)

Y = Year, Z = Month					
Year	Code	Year	Code	Month	Code
2010	A	2022	P	January	1
2011	B	2023	R	February	2
2012	C	2024	S	March	3
2013	D	2025	T	April	4
2014	E	2026	U	May	5
2015	F	2027	V	June	6
2016	H	2028	W	July	7
2017	J	2029	X	August	8
2018	K	2030	A	September	9
2019	L			October	0
2020	M			November	N
2021	N			December	D

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