Surface Mount Multilayer Ceramic Chip Capacitors (SMD MLCCs)

KPS HV, Large Case, SM Series, X7R Dielectric, 500 – 10,000 VDC (Industrial Grade)

Overview

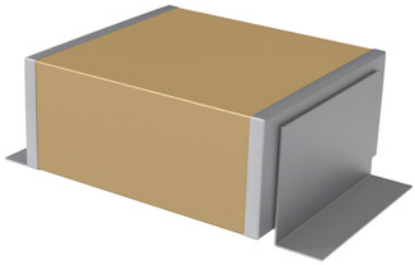
KPS HV (KEMET Power Solutions, High Voltage), Large Case (≥ 1515), SM Series capacitors in X7R dielectric are designed to meet robust performance standards required in higher reliability industrial applications. Utilizing lead-frame technology, SM Series devices isolate the multilayer ceramic chip component from the printed circuit board providing advanced mechanical and thermal stress performance. Isolation of the chip component also addresses concerns for audible, microphonic noise that may occur when a bias voltage is applied. Although this technology does not eliminate the potential for mechanical damage that may propagate during extreme environmental and handling conditions, it does demonstrate superior performance over non-isolating systems. Available in both formed "L" and "J" lead configurations, SM Series devices offer up to 10 mm of board flex capability and exhibit lower ESR, ESL and higher current discharge capability when compared to other dielectric solutions.

Combined with the stability of an X7R dielectric, KEMET's High Voltage SM Series devices exhibit a predictable change in capacitance with respect to time and voltage and boast a minimal change in capacitance with reference to ambient temperature. Capacitance change is limited to ±15% from −55°C to +125°C.

KEMET's Industrial grade products offer additional screening options for higher reliability applications. Both Group A and Group B testing/inspection options per MIL–PRF–49467 are available for the SM Series.

Benefits

- −55°C to +125°C operating temperature range
- Large Case Sizes (≥ 1515)
- Formed “L” or “J” leadframe configurations
- Group A and B screening per MIL–PRF–49467 available
- Reliable and robust leadframe termination system
- DC voltage ratings of 500 V, 1 KV, 2 KV, 3 KV, 4 KV, 5 KV, 7.5 KV, and 10 KV
- Capacitance offerings ranging from 180 pF up to 4.7 µF



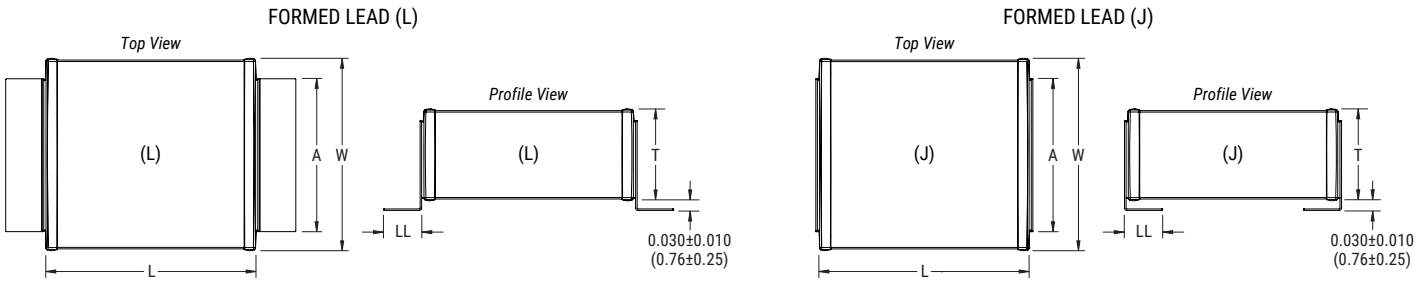
Ordering Information

SM20		B	153	K	501	B	M
Style/Size		Dielectric	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VDC)	Lead Configuration[1]	Testing/ Inspection Option[2]
SM20 SM21 SM22 SM23 SM24 SM25 SM26	SM30 SM31 SM33 SM34 SM35 SM36	B = X7R	Two significant digits and number of zeros	K = ±10% M = ±20% P = 0/+100% Z = -20%/+80%	501 = 500 102 = 1,000 202 = 2,000 302 = 3,000 402 = 4,000 502 = 5,000 752 = 7,500 103 = 10,000	A = Formed L B = Formed J	Blank = None M = Group A per MIL-PRF-49467

[1] Standard lead configuration is formed "J". If the appropriate character is excluded from the ordering code, the assumed lead configuration will be formed "J".

[2] Group B testing/inspection option per MIL–PRF–49467 is available upon request. Please contact KEMET for ordering details.

Dimensions – Inches (Millimeters)



Style/ Size	L Length	W Width	T Thickness Max.	A Lead Width Max.	LL Lead Length (Formed "L")	LL Lead Length (Formed "J")
SM20	0.150±0.015 (3.81±0.38)	0.150±0.015 (3.81±0.38)	0.130 (3.30)	0.100 (2.54)	0.100±0.020 (2.54±0.51)	0.040±0.010 (1.02±0.25)
SM21	0.200±0.020 (5.08±0.51)	0.200±0.020 (5.08±0.51)	0.180 (4.57)			
SM22	0.250±0.020 (6.35±0.51)	0.200±0.020 (5.08±0.51)				
SM23	0.350±0.030 (8.89±0.76)	0.300±0.030 (7.62±0.76)	0.220 (5.59)	0.200 (5.08)		0.100±0.020 (2.54±0.51)
SM24	0.450±0.030 (11.43±0.76)	0.400±0.030 (10.20±0.76)		0.300 (7.62)		
SM25	0.550±0.030 (14.00±0.76)	0.500±0.030 (12.70±0.76)		0.400 (10.20)		
SM26	0.650±0.030 (16.50±0.76)	0.600±0.030 (15.20±0.76)		0.500 (12.70)		
SM30	0.300±0.030 (7.62±0.76)	0.150±0.015 (3.81±0.38)	0.140 (3.55)	0.100 (2.54)		
SM31	0.400±0.030 (10.20±0.76)	0.200±0.020 (5.08±0.51)	0.130 (3.30)			
SM33	0.700±0.030 (17.08±0.76)	0.300±0.030 (7.62±0.76)	0.180 (4.57)	0.200 (5.08)		
SM34	0.900±0.030 (22.90±0.76)	0.400±0.030 (10.20±0.76)	0.220 (5.59)	0.300 (7.62)		
SM35	1.100±0.030 (27.90±0.76)	0.500±0.030 (12.70±0.76)		0.400 (10.2)		
SM36	1.350±0.030 (33.00±0.76)	0.600±0.030 (15.20±0.76)		0.500 (12.7)		

Benefits cont.

- Advanced protection against thermal and mechanical stress
- Provides up to 10 mm of board flex capability
- Reduces audible, microphonic noise
- Low ESR and ESL
- Non-polar device, minimizing installation concerns
- Silver plated copper alloy leadframe termination system

Applications

- Charging stations
- LCD fluorescent backlight ballasts
- Voltage multiplier circuits
- DC/DC converters
- Power supply
- LAN/WAN interface
- High voltage decoupling
- Filters
- DC blocking
- ESD Protection
- Low ESR and ESL
- Non-polar device, minimizing installation concerns
- Silver plated copper alloy leadframe termination system

Application Notes

X7R dielectric is not recommended for AC line filtering or pulse applications. These capacitors and/or the assembled circuit board containing these capacitors may require a protective surface coating to prevent external surface arcing.

Qualification/Certification

Industrial Grade products are subject to internal qualification. Details regarding test methods and conditions are referenced in Table 3, Performance & Reliability.

Environmental Compliance

RoHS Compliant with Exemption(s).

Table 1A – Capacitance Range/Selection Waterfall SM20 – SM24 Style/Size

Style/Size			SM20			SM21				SM22				SM23					SM24					
Voltage Code			501	102	202	501	102	202	302	501	102	202	302	501	102	202	302	402	501	102	202	302	402	502
Voltage DC			500	1 K	2 K	500	1 K	2 K	3 K	500	1 K	2 K	3 K	500	1 K	2 K	3 K	4 K	500	1 K	2 K	3 K	4 K	5 K
Capacitance	Capacitance Code	Capacitance Tolerance	Capacitance Code																					
330pF	331	K M P Z	X	X	X																			
390pF	391	K M P Z	X	X	X																			
470pF	471	K M P Z	X	X	X																			
560pF	561	K M P Z	X	X	X	X	X	X	X															
680pF	681	K M P Z	X	X	X	X	X	X	X	X	X	X	X											
820pF	821	K M P Z	X	X	X	X	X	X	X	X	X	X	X											
1,000pF	102	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1,200pF	122	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1,500pF	152	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1,800pF	182	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2,200pF	222	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2,700pF	272	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3,300pF	332	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3,900pF	392	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4,700pF	472	K M P Z	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5,600pF	562	K M P Z	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6,800pF	682	K M P Z	X	X		X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X	X
8,200pF	822	K M P Z	X	X		X	X	X		X	X	X		X	X	X	X		X	X	X	X	X	
0.01µF	103	K M P Z	X	X		X	X	X		X	X	X		X	X	X	X		X	X	X	X	X	
0.012µF	123	K M P Z	X	X		X	X	X		X	X	X		X	X	X	X		X	X	X	X	X	
0.015µF	153	K M P Z	X	X		X	X	X		X	X	X		X	X	X	X		X	X	X	X		
0.018µF	183	K M P Z	X	X		X	X			X	X			X	X	X	X		X	X	X	X		
0.022µF	223	K M P Z	X	X		X	X			X	X			X	X	X			X	X	X	X		
0.027µF	273	K M P Z	X			X	X			X	X			X	X	X			X	X	X	X		
0.033µF	333	K M P Z	X			X	X			X	X			X	X	X			X	X	X	X		
0.039µF	393	K M P Z	X			X	X			X	X			X	X	X			X	X	X			
0.047µF	473	K M P Z	X			X	X			X	X			X	X				X	X	X			
0.056µF	563	K M P Z	X			X	X			X	X			X	X				X	X	X			
0.068µF	683	K M P Z	X			X	X			X	X			X	X				X	X	X			
0.082µF	823	K M P Z	X			X				X	X			X	X				X	X	X			
0.1µF	104	K M P Z	X			X				X	X			X	X				X	X	X			
0.12µF	124	K M P Z				X				X				X	X				X	X				
0.15µF	154	K M P Z				X				X				X	X				X	X				
0.18µF	184	K M P Z				X				X				X	X				X	X				
0.22µF	224	K M P Z				X				X				X	X				X	X				
0.27µF	274	K M P Z				X				X				X	X				X	X				
0.33µF	334	K M P Z												X					X	X				
0.39µF	394	K M P Z												X					X	X				
0.47µF	474	K M P Z												X					X	X				
0.56µF	564	K M P Z												X					X					
0.68µF	684	K M P Z												X					X					
0.82µF	824	K M P Z																	X					
1.0µF	105	K M P Z																	X					
1.2µF	125	K M P Z																	X					

Table 1B – Capacitance Range/Selection Waterfall SM25 – SM31 Style/Size

Style/Size			SM25						SM26						SM30					SM31					
Voltage Code			501	102	202	302	402	502	501	102	202	302	402	502	501	102	202	302	402	501	102	202	302	402	502
Voltage DC			500	1 K	2 K	3 K	4 K	5 K	500	1 K	2 K	3 K	4 K	5 K	500	1 K	2 K	3 K	4 K	500	1 K	2 K	3 K	4 K	5 K
Capacitance	Capacitance Code	Capacitance Tolerance	Capacitance Code																						
180pF	181	K M P Z													X	X	X	X	X						
220pF	221	K M P Z													X	X	X	X	X						
270pF	271	K M P Z													X	X	X	X	X						
330pF	331	K M P Z													X	X	X	X	X						
390pF	391	K M P Z													X	X	X	X	X						
470pF	471	K M P Z													X	X	X	X	X	X	X	X	X	X	X
560pF	561	K M P Z													X	X	X	X	X	X	X	X	X	X	X
680pF	681	K M P Z													X	X	X	X	X	X	X	X	X	X	X
820pF	821	K M P Z													X	X	X	X	X	X	X	X	X	X	X
1,000pF	102	K M P Z	X	X	X	X	X	X							X	X	X	X	X	X	X	X	X	X	X
1,200pF	122	K M P Z	X	X	X	X	X	X							X	X	X	X	X	X	X	X	X	X	X
1,500pF	152	K M P Z	X	X	X	X	X	X							X	X	X	X		X	X	X	X	X	X
1,800pF	182	K M P Z	X	X	X	X	X	X							X	X	X	X		X	X	X	X	X	
2,200pF	222	K M P Z	X	X	X	X	X	X							X	X	X	X		X	X	X	X	X	
2,700pF	272	K M P Z	X	X	X	X	X	X							X	X	X	X		X	X	X	X	X	
3,300pF	332	K M P Z	X	X	X	X	X	X							X	X	X	X		X	X	X	X	X	
3,900pF	392	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X		
4,700pF	472	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X		
5,600pF	562	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X		
6,800pF	682	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X		
8,200pF	822	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X		
0.01µF	103	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X		
0.012µF	123	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X			
0.015µF	153	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X			
0.018µF	183	K M P Z	X	X	X	X	X		X	X	X	X	X		X	X				X	X	X			
0.022µF	223	K M P Z	X	X	X	X	X		X	X	X	X	X		X	X				X	X				
0.027µF	273	K M P Z	X	X	X	X	X		X	X	X	X	X		X	X				X	X				
0.033µF	333	K M P Z	X	X	X	X			X	X	X	X	X		X	X				X	X				
0.039µF	393	K M P Z	X	X	X	X			X	X	X	X	X		X	X				X	X				
0.047µF	473	K M P Z	X	X	X	X			X	X	X	X			X	X				X	X				
0.056µF	563	K M P Z	X	X	X	X			X	X	X	X			X	X				X	X				
0.068µF	683	K M P Z	X	X	X	X			X	X	X	X			X					X	X				
0.082µF	823	K M P Z	X	X	X				X	X	X	X			X					X	X				
0.1µF	104	K M P Z	X	X	X				X	X	X	X			X					X	X				
0.12µF	124	K M P Z	X	X	X				X	X	X				X					X	X				
0.15µF	154	K M P Z	X	X					X	X	X				X					X	X				
0.18µF	184	K M P Z	X	X					X	X	X				X					X					
0.22µF	224	K M P Z	X	X					X	X										X					
0.27µF	274	K M P Z	X	X					X	X										X					
0.33µF	334	K M P Z	X	X					X	X										X					
0.39µF	394	K M P Z	X	X					X	X										X					
0.47µF	474	K M P Z	X	X					X	X															
0.56µF	564	K M P Z	X	X					X	X															
0.68µF	684	K M P Z	X	X					X	X															
0.82µF	824	K M P Z	X	X					X	X															
1.0µF	105	K M P Z	X						X	X															
1.2µF	125	K M P Z	X						X																
1.5µF	155	K M P Z	X						X																
1.8µF	185	K M P Z	X						X																
2.2µF	225	K M P Z							X																
2.7µF	275	K M P Z							X																

Table 1C – Capacitance Range/Selection Waterfall SM33 – SM35 Style/Size

Style/Size			SM33							SM34							SM35						
Voltage Code			501	102	202	302	402	502	752	501	102	202	302	402	502	752	501	102	202	302	402	502	752
Voltage DC			500	1 K	2 K	3 K	4 K	5 K	7.5 K	500	1 K	2 K	3 K	4 K	5 K	7.5 K	500	1 K	2 K	3 K	4 K	5 K	7.5 K
Capacitance	Capacitance Code	Capacitance Tolerance	Capacitance Code																				
1,000pF	102	K M P Z								X	X	X	X	X	X	X							
1,200pF	122	K M P Z								X	X	X	X	X	X	X							
1,500pF	152	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X							
1,800pF	182	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X							
2,200pF	222	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X							
2,700pF	272	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X							
3,300pF	332	K M P Z	X	X	X	X	X	X	X	X	X	X	X	X	X	X							
3,900pF	392	K M P Z	X	X	X	X	X	X		X	X	X	X	X	X	X							
4,700pF	472	K M P Z	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
5,600pF	562	K M P Z	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
6,800pF	682	K M P Z	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
8,200pF	822	K M P Z	X	X	X	X	X			X	X	X	X	X	X		X	X	X	X	X	X	X
0.01µF	103	K M P Z	X	X	X	X	X			X	X	X	X	X	X		X	X	X	X	X	X	X
0.012µF	123	K M P Z	X	X	X	X	X			X	X	X	X	X	X		X	X	X	X	X	X	X
0.015µF	153	K M P Z	X	X	X	X				X	X	X	X	X	X		X	X	X	X	X	X	X
0.018µF	183	K M P Z	X	X	X	X				X	X	X	X	X			X	X	X	X	X	X	X
0.022µF	223	K M P Z	X	X	X	X				X	X	X	X	X			X	X	X	X	X	X	
0.027µF	273	K M P Z	X	X	X	X				X	X	X	X	X			X	X	X	X	X	X	
0.033µF	333	K M P Z	X	X	X	X				X	X	X	X	X			X	X	X	X	X	X	
0.039µF	393	K M P Z	X	X	X	X				X	X	X	X				X	X	X	X	X		
0.047µF	473	K M P Z	X	X	X					X	X	X	X				X	X	X	X	X		
0.056µF	563	K M P Z	X	X	X					X	X	X	X				X	X	X	X	X		
0.068µF	683	K M P Z	X	X	X					X	X	X	X				X	X	X	X			
0.082µF	823	K M P Z	X	X	X					X	X	X	X				X	X	X	X			
0.1µF	104	K M P Z	X	X						X	X	X					X	X	X	X			
0.12µF	124	K M P Z	X	X						X	X	X					X	X	X	X			
0.15µF	154	K M P Z	X	X						X	X	X					X	X	X				
0.18µF	184	K M P Z	X	X						X	X	X					X	X	X				
0.22µF	224	K M P Z	X	X						X	X	X					X	X	X				
0.27µF	274	K M P Z	X	X						X	X	X					X	X	X				
0.33µF	334	K M P Z	X	X						X	X						X	X					
0.39µF	394	K M P Z	X	X						X	X						X	X					
0.47µF	474	K M P Z	X	X						X	X						X	X					
0.56µF	564	K M P Z	X	X						X	X						X	X					
0.68µF	684	K M P Z	X							X	X						X	X					
0.82µF	824	K M P Z	X							X	X						X	X					
1.0µF	105	K M P Z	X							X	X						X	X					
1.2µF	125	K M P Z	X							X							X	X					
1.5µF	155	K M P Z	X							X							X	X					
1.8µF	185	K M P Z								X							X						
2.2µF	225	K M P Z								X							X						
2.7µF	275	K M P Z															X						
3.3µF	335	K M P Z															X						
3.9µF	395	K M P Z															X						

Table 1D – Capacitance Range/Selection Waterfall SM36 Style/Size

Style/Size						SM36							
Voltage Code						501	102	202	302	402	502	752	103
Voltage DC						500	1 K	2 K	3 K	4 K	5 K	7.5 K	10 K
Capacitance	Capacitance Code	Capacitance Tolerance				Capacitance Code							
2,700pF	272	K	M	P	Z	X	X	X	X	X	X	X	
3,300pF	332	K	M	P	Z	X	X	X	X	X	X	X	
3,900pF	392	K	M	P	Z	X	X	X	X	X	X	X	
4,700pF	472	K	M	P	Z	X	X	X	X	X	X	X	
5,600pF	562	K	M	P	Z	X	X	X	X	X	X	X	
6,800pF	682	K	M	P	Z	X	X	X	X	X	X	X	
8,200pF	822	K	M	P	Z	X	X	X	X	X	X	X	
0.01µF	103	K	M	P	Z	X	X	X	X	X	X	X	X
0.012µF	123	K	M	P	Z	X	X	X	X	X	X	X	
0.015µF	153	K	M	P	Z	X	X	X	X	X	X	X	
0.018µF	183	K	M	P	Z	X	X	X	X	X	X	X	
0.022µF	223	K	M	P	Z	X	X	X	X	X	X	X	
0.027µF	273	K	M	P	Z	X	X	X	X	X	X		
0.033µF	333	K	M	P	Z	X	X	X	X	X	X		
0.039µF	393	K	M	P	Z	X	X	X	X	X	X		
0.047µF	473	K	M	P	Z	X	X	X	X	X			
0.056µF	563	K	M	P	Z	X	X	X	X	X			
0.068µF	683	K	M	P	Z	X	X	X	X	X			
0.082µF	823	K	M	P	Z	X	X	X	X				
0.1µF	104	K	M	P	Z	X	X	X	X				
0.12µF	124	K	M	P	Z	X	X	X	X				
0.15µF	154	K	M	P	Z	X	X	X	X				
0.18µF	184	K	M	P	Z	X	X	X	X				
0.22µF	224	K	M	P	Z	X	X	X					
0.27µF	274	K	M	P	Z	X	X	X					
0.39µF	394	K	M	P	Z	X	X	X					
0.47µF	474	K	M	P	Z	X	X	X					
0.56µF	564	K	M	P	Z	X	X						
0.68µF	684	K	M	P	Z	X	X						
0.82µF	824	K	M	P	Z	X	X						
1.0µF	105	K	M	P	Z	X	X						
1.2µF	125	K	M	P	Z	X	X						
1.5µF	155	K	M	P	Z	X	X						
1.8µF	185	K	M	P	Z	X	X						
2.2µF	225	K	M	P	Z	X	X						
2.7µF	275	K	M	P	Z	X	X						
2.7µF	275	K	M	P	Z	X							
3.3µF	335	K	M	P	Z	X							
3.9µF	395	K	M	P	Z	X							
4.7µF	475	K	M	P	Z	X							
5.6µF	565	K	M	P	Z	X							

Table 2 – Chip Thickness/Packaging Quantities

Series	Style/Size	Tray Quantity Minimum[1]	Tray Quantity Maximum[1]
SM	SM20	1	50
	SM21		
	SM22		
	SM23		
	SM24		
	SM25		
	SM26		
	SM30		
	SM31		
	SM33		25
	SM34		10
	SM35		
	SM36		

[1] *Minimum order value applies. Contact KEMET for details.*

Soldering Process

The capacitors and assemblies outlined in this specification sheet are susceptible to thermal shock damage due to their large ceramic mass. Temperature profiles used should provide adequate temperature rise and cool-down time to prevent damage from thermal shock. In general, KEMET recommends against hand soldering for these types of large ceramic devices.

Recommended Soldering Technique:

- Solder reflow only

Preheating and Reflow Profile Notes:
Due to differences in the coefficient of thermal expansion for the different materials of construction, it is critical to monitor and control the heating and cooling rates during the soldering process. During the reflow soldering process, the maximum recommended heating and cooling rate (dT/dt) is 4°C/second. To ensure optimal component reliability, KEMET's recommended heating and cooling rate is 2°C/second. After soldering, the capacitors should be air cooled to room temperature before further processing. Forced air cooling is not recommended.

Recommended Reflow Soldering Profile:

Profile Feature	SnPb Assembly
Preheat/Soak	
Temperature Minimum (T_{Smin})	100°C
Temperature Maximum (T_{Smax})	150°C
Time (t_s) from Tsmin to T_{smax})	60 – 90 seconds
Ramp-up Rate (T_L to T_P)	2°C/seconds
Liquidous Temperature (T_L)	183°C
Time Above Liquidous (t_L)	95 seconds
Peak Temperature (T_P)	240°C
Time within 5°C of Maximum Peak Temperature (t_P)	5 seconds
Ramp-down Rate (T_P to T_L)	2°C/seconds
Time 25°C to Peak Temperature	3.5 minutes

Note 1: All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow.

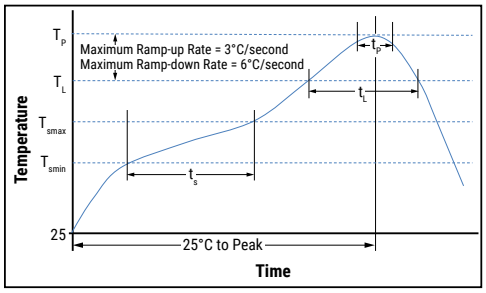


Table 3 – Performance & Reliability: Test Methods and Conditions

<table>
<tr><th>TEST</th><th>REFERENCE</th><th>Test Condition</th><th>LIMITS</th></tr>
<tr><td>Visual & Mechanical</td><td>KEMET Internal</td><td>No defects that may affect performance (10X)</td><td>Dimensions according KEMET Spec Sheet</td></tr>
<tr><td>Capacitance (Cap)</td><td>KEMET Internal</td><td>C ≤ 10µF 1 kHz ±50 Hz and 1.0 ±0.2 Vrms or 0.5 ±0.2 Vrms*
* See part number specification sheet for voltage

Capacitance measurements (including tolerance) are indexed to a referee time of 48 or 1,000 hours
Please refer to a part number specification sheet for referee time details</td><td>Within Tolerance</td></tr>
<tr><td>Dissipation Factor (DF)</td><td>KEMET Internal</td><td>C ≤ 10µF
Frequency: 1 kHz ±50 Hz
Voltage*:1.0 ±0.2 Vrms, 0.5 ±0.2 Vrms,
* See part number specification sheet for voltage</td><td>Within Specification
Dissipation factor (DF) maximum limit at 25°C = 2.5%</td></tr>
<tr><td>Insulation Resistance (IR)</td><td>KEMET Internal</td><td>500VDC applied for 120±5 seconds at 25°C</td><td>Within Specification
To obtain IR limit, divide MΩ-µF value by the capacitance and compare to GΩ limit. Select the lower of the two limits: 1,000 megohm microfarads or 100 GΩ.</td></tr>
<tr><td>Temperature Coefficient of Capacitance (TCC)</td><td>KEMET Internal</td><td>C ≤ 10µF
Frequency: 1 kHz ±50 Hz
Voltage*:1.0 ±0.2 Vrms, 0.5 ±0.2 Vrms, 0.2 ±0.1 Vrms

* See part number specification sheet for voltage

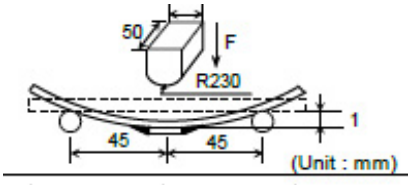
<table><tr><th>Step</th><th>Temperature (°C)</th></tr><tr><td>1</td><td>+25°C</td></tr><tr><td>2</td><td>-55°C</td></tr><tr><td>3</td><td>+25°C (Reference Temperature)</td></tr><tr><td>4</td><td>+125°C</td></tr></table></td><td>Capacitance ±15% over −55°C to +125°C</td></tr>
<tr><td>Dielectric Withstanding Voltage (DWV)</td><td>KEMET Internal</td><td>150% of rated voltage for voltage rating of ≤ 1,250 VDC
120% of rated voltage for voltage rating of > 1,250 VDC
(5 ±1 seconds and charge/discharge not exceeding 50 mA)</td><td>Withstand test voltage without insulation breakdown or damage.</td></tr>
<tr><td>Aging Rate (Maximum % Capacitance Loss/ Decade Hour)</td><td>KEMET Internal</td><td>Capacitance measurements (including tolerance) are indexed to a referee time of 48 or 1,000 hours. Please refer to a part number specific datasheet for referee time details.</td><td>Please refer to a part number specification sheet for specific Aging rate</td></tr>
<tr><td>Terminal Strength</td><td>KEMET Internal</td><td>Conditions A (2.3 kg or 5 lbs).</td><td>No evidence of mechanical damage</td></tr>
<tr><td>Board Flex</td><td>AEC-Q200-005</td><td>Standard Termination system 2.0 mm
Flexible Termination System 3.0 mm
Test time: 60± 5sec Ramp time: 1 mm / sec
 
</td><td>No evidence of mechanical damage</td></tr>
<tr><td>Solderability</td><td>J-STD-002</td><td>Condition: 4 hours ± 15 minutes at 155°C dry bake apply all methods
Test 245 ±5°C (SnPb & Pb-Free)</td><td>Visual Inspection. 95% coverage on termination. No leaching</td></tr>
</table>

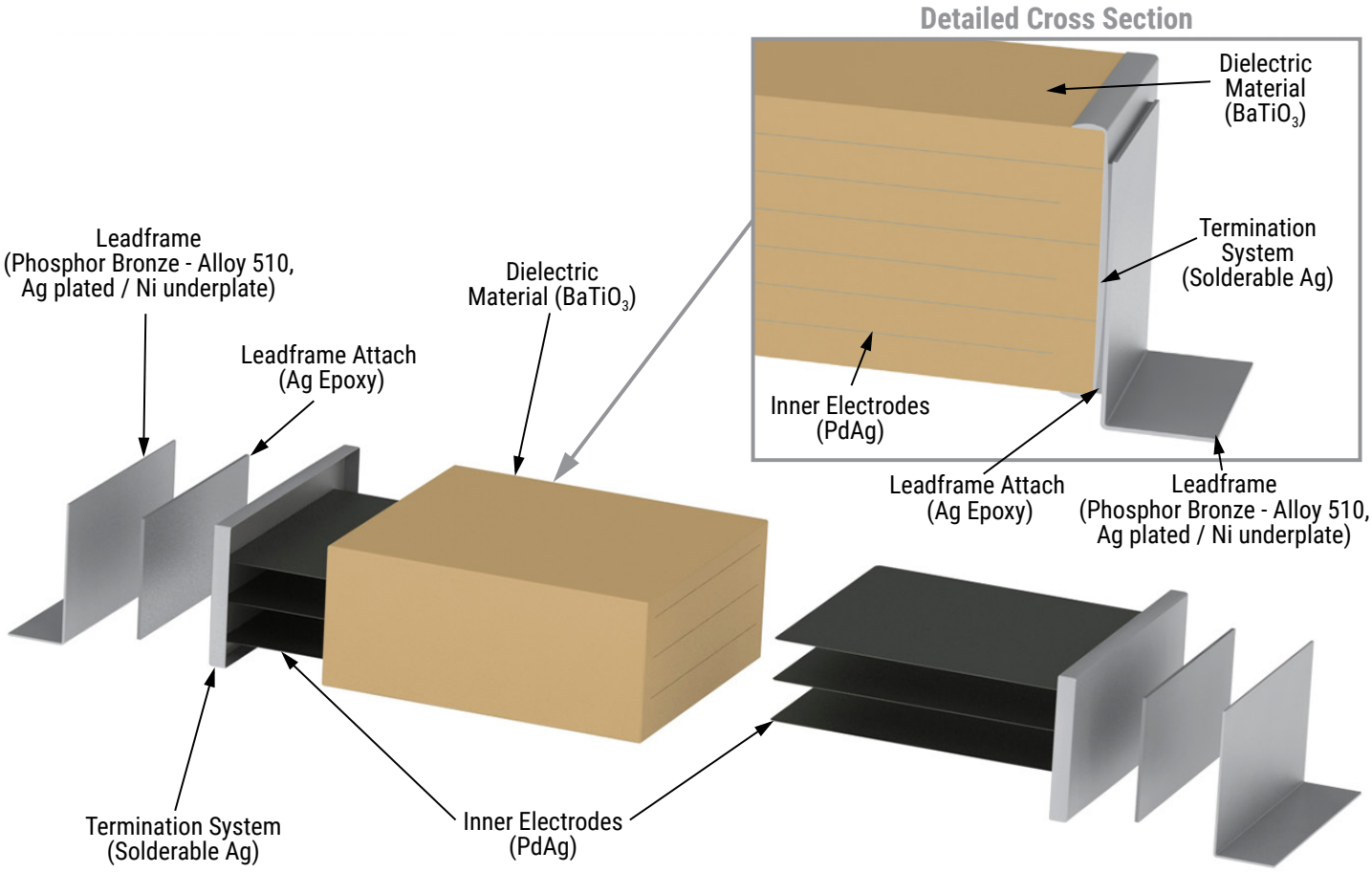
Table 3 – Performance & Reliability: Test Methods and Conditions cont.

Temperature Cycling	JESD22 Method JA-104	1,000 cycles (-55°C to +125°C) 2-3 cycles per hour Soak Time 1 or 5 min	Measurement at 24 hours ±4 hours after test conclusion. Cap: ±20% shift DF: Initial Limit IR: Initial Limit
Biased Humidity	MIL-STD-202 Method 103	Load Humidity: 1,000 hours 85°C / 85% RH and 200 VDC maximum	Measurement at 24 hours ±4 hours after test conclusion. Within Post Environmental Limits Cap: ±20% shift IR: 10% of Initial Limit DF Limit Maximum: 3.0%
		Low Volt Humidity: 1,000 hours 85°C / 85% RH and 1.5 V.	
Moisture Resistance	MIL-STD-202 Method 106	Number of cycles required 10, 24 hours per cycle. Steps 7a and 7b not required	Measurement at 24 hours ±4 hours after test conclusion. Within Post Environmental Limits Cap: ±20% shift IR: 10% of Initial Limit DF Limit Maximum: 3.0%
Thermal Shock	MIL-STD-202 Method 107	Number of cycles required 5, (-55°C to 125°C) Dwell time 15 minutes.	Cap: ±20% shift DF: Initial Limit IR: Initial Limit
High Temperature Life	MIL-STD-202 Method 108	1,000 hours at 125°C with rated voltage applied.	Within Post Environmental Limits Cap: ±20% shift IR: 10% of Initial Limit DF Limit Maximum: 3.0%
Vibration	MIL-STD-202 Method 204	5 g's for 20 minutes, 12 cycles each of 3 orientations. Test from 10 – 2,000 Hz	Cap: ±20% shift DF: Initial Limit IR: Initial Limit
Mechanical Shock	MIL-STD-202 Method 213	1500g's 0.5ms Half-sine, Velocity Change 15.4 ft/sec (Condition F)	Cap: ±20% shift DF: Initial Limit IR: Initial Limit
Resitance to Soldering Heat	MIL-STD-202 Method 210	Condition K, time above 217°C, 60s – 150s	Cap: ±0.3% or ±0.25 pF shift DF: Initial Limit IR: Initial Limit

Storage and Handling

Ceramic chip capacitors should be stored in normal working environments. While the chips themselves are quite robust in other environments, solderability will be degraded by exposure to high temperatures, high humidity, corrosive atmospheres, and long term storage. In addition, packaging materials will be degraded by high temperature–reels may soften or warp and tape peel force may increase. KEMET recommends that maximum storage temperature not exceed 40°C and maximum storage humidity not exceed 70% relative humidity. Temperature fluctuations should be minimized to avoid condensation on the parts and atmospheres should be free of chlorine and sulfur bearing compounds. For optimized solderability chip stock should be used promptly, preferably within 1.5 years of receipt.

Construction



Product Marking

Product marking is an extra-cost option. These devises will be supplied unmarked unless otherwise specified and/or requested. For more detailed information regarding marked product and how to request this option, please contact KEMET.

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Although KEMET designs and manufactures its products to the most stringent quality and safety standards, given the current state of the art, isolated component failures may still occur. Accordingly, customer applications which require a high degree of reliability or safety should employ suitable designs or other safeguards (such as installation of protective circuitry or redundancies) in order to ensure that the failure of an electrical component does not result in a risk of personal injury or property damage.

Although all product–related warnings, cautions and notes must be observed, the customer should not assume that all safety measures are indicated or that other measures may not be required.