

KPS HV, Large Case, SM Series, X7R Dielectric, 500VDC-10KVDC (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 10mm 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 $\pm 15\%$ from -55°C to $+125^\circ\text{C}$.

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 $+125^\circ\text{C}$ operating temperature range
- Large Case Sizes (≥ 1515)
- Formed "L" or "J" leadframe configurations
- Group A & B screening per MIL-PRF-49467 available
- Reliable & robust leadframe termination system
- DC voltage ratings of 500V, 1KV, 2KV, 3KV, 4KV, 5KV, 7.5KV & 10KV
- Capacitance offerings ranging from 150pF up to 5.6 μF
- Advanced protection against thermal & mechanical stress
- Provides up to 10mm of board flex capability
- Reduces audible, microphonic noise
- Low ESR & ESL
- Non-polar device, minimizing installation concerns
- Silver plated copper alloy leadframe termination system

Applications

Typical applications include switch mode power supplies (input filters, resonators, tank circuits, snubber circuits, output filters), high voltage coupling and DC blocking, voltage multiplier circuits, DC/DC converters and coupling capacitors in Ćuk converters, noise reduction (piezoelectric/mechanical), circuits with a direct battery or power source connection, critical and safety relevant circuits without (integrated) current limitation and any application that is subject to high levels of board flexure or temperature cycling. Markets include power supply, LCD fluorescent backlight ballasts, HID lighting, telecom equipment, industrial and medical equipment/control and Military.



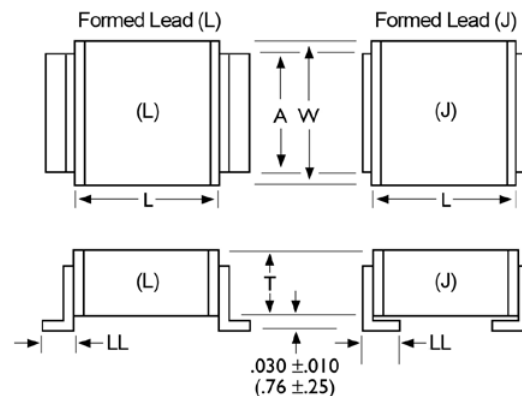
Ordering Information

SM20		B	153	K	501	B	M
Style/Size		Dielectric	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Lead Configuration ¹	Testing/ Inspection Option ²
SM20	SM30	B = X7R	2 Sig. Digits + Number of Zeros.	K = $\pm 10\%$ M = $\pm 20\%$ P = $+100\%$, -0% Z = $+80\%$, -20%	501 = 500V	A = Formed "L" B = Formed "J"	Blank = None M = Group A per MIL-PRF-49467
SM21	SM31				102 = 1000V		
SM22	SM33				202 = 2000V		
SM23	SM34				302 = 3000V		
SM24	SM35				402 = 4000V		
SM25	SM36				502 = 5000V		
SM26							

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)	0.220 (5.59)	0.200 (5.08)		0.100 ± 0.020 (2.54 ± 0.51)	
SM23	0.350 ± 0.030 (8.89 ± 0.76)	0.300 ± 0.030 (7.62 ± 0.76)		0.300 (7.62)			
SM24	0.450 ± 0.030 (11.43 ± 0.76)	0.400 ± 0.030 (10.20 ± 0.76)		0.400 (10.20)			
SM25	0.550 ± 0.030 (14.00 ± 0.76)	0.500 ± 0.030 (12.70 ± 0.76)		0.500 (12.70)			
SM26	0.650 ± 0.030 (16.50 ± 0.76)	0.600 ± 0.030 (15.20 ± 0.76)	0.140 (3.55)	0.100 (2.54)			0.100 ± 0.020 (2.54 ± 0.51)
SM30	0.300 ± 0.030 (7.62 ± 0.76)	0.150 ± 0.015 (3.81 ± 0.38)	0.130 (3.30)				
SM31	0.400 ± 0.030 (10.20 ± 0.76)	0.200 ± 0.020 (5.08 ± 0.51)	0.180 (4.57)	0.200 (5.08)			
SM33	0.700 ± 0.030 (17.08 ± 0.76)	0.300 ± 0.030 (7.62 ± 0.76)	0.220 (5.59)	0.300 (7.62)			
SM34	0.900 ± 0.030 (22.90 ± 0.76)	0.400 ± 0.030 (10.20 ± 0.76)		0.400 (10.2)			
SM35	1.100 ± 0.030 (27.90 ± 0.76)	0.500 ± 0.030 (12.70 ± 0.76)		0.500 (12.7)			
SM36	1.350 ± 0.030 (33.00 ± 0.76)	0.600 ± 0.030 (15.20 ± 0.76)					

Qualification/Certification

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

Environmental Compliance

RoHS compliant with Exemption(s)

Electrical Parameters/Characteristics

Item	Parameters/Characteristics
Operating Temperature Range	-55°C to +125°C
Capacitance Change with Reference to +25°C and 0 VDC Applied (TCC)	±15%
Aging Rate (Max % Cap Loss/Decade Hour)	3.0%
Dielectric Withstanding Voltage	150% of rated voltage for voltage rating of ≤ 1250Vdc 120% of rated voltage for voltage rating of > 1250Vdc (5 ± 1 seconds and charge/discharge not exceeding 50mA)
Dissipation Factor (DF) Maximum Limits @ 25°C	2.5%
Insulation Resistance (IR) Limit @ 25°C	1000 megohm microfarads or 100GΩ (Rated voltage DC applied for 120 ± 5 secs @ 25°C for voltage rating of ≤ 500VDC) (500VDC applied for 120 ± 5 secs @ 25°C for voltage rating of > 500VDC)

Regarding Aging Rate: Capacitance measurements (including tolerance) are indexed to a referee time of 1000 hours.

To obtain IR limit, divide $M\Omega\text{-}\mu F$ value by the capacitance and compare to $G\Omega$ limit. Select the lower of the two limits.

Capacitance and Dissipation Factor (DF) measured under the following conditions:

1kHz ± 50Hz and 1.0Vrms ± 0.2V if capacitance >100pF

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & Agilent E4980 have a feature known as Automatic Level Control (ALC). The ALC feature should be switched to "ON".

Post Environmental Limits

High Temperature Life, Biased Humidity, Moisture Resistance				
Dielectric	Rated DC Voltage	Capacitance Value	DF (%)	Cap Shift
X7R	All	All	3.0	± 20%

Table 1A – SM20 - SM24 Style/Size

Style/Size	SM20			SM21			SM22			SM23				SM24					Cap Tol				
Dimensions - Inches (mm)																							
Length	0.150 ± 0.015 (3.81 ± 0.38)			0.200 ± 0.020 (5.08 ± 0.51)			0.250 ± 0.020 (6.35 ± 0.51)			0.350 ± 0.030 (8.89 ± 0.76)				0.450 ± 0.030 (11.43 ± 0.76)									
Width	0.150 ± 0.015 (3.81 ± 0.38)			0.200 ± 0.020 (5.08 ± 0.51)			0.200 ± 0.020 (5.08 ± 0.51)			0.300 ± 0.030 (7.62 ± 0.76)				0.400 ± 0.030 (10.20 ± 0.76)									
Thickness Max.	0.130 (3.30)			0.180 (4.57)			0.180 (4.57)			0.220 (5.59)				0.220 (5.59)									
Lead Width Max.	0.100 (2.54)			0.100 (2.54)			0.100 (2.54)			0.200 (5.08)				0.300 (7.62)									
Lead Length "L"	0.100 ± 0.020 (2.54 ± 0.51)			0.100 ± 0.020 (2.54 ± 0.51)			0.100 ± 0.020 (2.54 ± 0.51)			0.100 ± 0.020 (2.54 ± 0.51)				0.100 ± 0.020 (2.54 ± 0.51)									
Lead Length "J"	0.040 ± 0.010 (1.02 ± 0.25)			0.040 ± 0.010 (1.02 ± 0.25)			0.040 ± 0.010 (1.02 ± 0.25)			0.100 ± 0.020 (2.54 ± 0.51)				0.100 ± 0.020 (2.54 ± 0.51)									
X7R Dielectric																							
Voltage Code	501	102	202	501	102	202	302	501	102	202	302	501	102	202	302	402	501	102	202	302	402	502	Cap Tol
Voltage DC	500	1K	2K	500	1K	2K	3K	500	1K	2K	3K	500	1K	2K	3K	4K	500	1K	2K	3K	4K	5K	
Capacitance	Capacitance Code																						
270pF	331	331	331																				
330pF	391	391	391																				
390pF	471	471	471																				
470pF	561	561	561																				
560pF	681	681	681					681	681	681	681												
680pF	821	821	821	821	821	821	821	821	821	821	821												
820pF	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102
1,000pF	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122
1,200pF	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152
1,500pF	182	182	182	182	182	182	182	182	182	182	182	182	182	182	182	182	182	182	182	182	182	182	182
1,800pF	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222
2,200pF	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272
2,700pF	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332
3,300pF	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392
3,900pF	472	472		472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472
4,700pF	562	562		562	562	562		562	562	562	562	562	562	562	562	562	562	562	562	562	562	562	562
5,600pF	682	682		682	682	682		682	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682
6,800pF	822	822		822	822	822		822	822	822	822	822	822	822	822	822	822	822	822	822	822	822	822
8,200pF	103	103		103	103	103		103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103
0.01µF	123	123		123	123	123		123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123
0.012µF	153	153		153	153			153	153	153			153	153	153	153			153	153	153	153	
0.015µF	183	183		183	183			183	183			183	183	183			183	183	183	183			
0.018µF	223	223		223	223			223	223			223	223	223			223	223	223	223			
0.022µF	273			273	273			273	273			273	273	273			273	273	273	273			
0.027µF	333			333	333			333	333			333	333	333			333	333	333	333			
0.033µF	393			393	393			393	393			393	393			393	393	393					
0.039µF	473			473	473			473	473			473	473			473	473	473					
0.047µF	563			563	563			563	563			563	563			563	563	563					
0.056µF	683			683	683			683	683			683	683			683	683	683					
0.068µF	823			823				823	823			823	823			823	823	823					
0.082µF				104				104	104			104	104			104	104	104					
0.1µF				124				124			124	124			124	124		124					
0.12µF				154				154			154	154			154	154		154					
0.15µF				184				184			184	184			184	184		184					
0.18µF								224			224	224			224	224		224					
0.22µF								274			274	274			274	274		274					
0.27µF											334			334			334	334					
0.33µF											394			394			394	394					
0.39µF											474			474			474	474					
0.47µF											564			564			564						
0.56µF														684			684						
0.68µF														824			824						
0.82µF														105			105						
1.0µF														125			125						
1.2µF																							

Table 1B – SM25 - SM31 Style/Size

Style/Size	SM25					SM26					SM30					SM31					Cap Tol				
Dimensions - In. (mm)																									
Length	0.550 ± 0.030 (14.00 ± 0.76)					0.650 ± 0.030 (16.50 ± 0.76)					0.300 ± 0.030 (7.62 ± 0.76)					0.400 ± 0.030 (10.20 ± 0.76)									
Width	0.500 ± 0.030 (12.70 ± 0.76)					0.600 ± 0.030 (15.20 ± 0.76)					0.150 ± 0.015 (3.81 ± 0.38)					0.200 ± 0.020 (5.08 ± 0.51)									
Thickness Max.	0.220 (5.59)					0.220 (5.59)					0.140 (3.55)					0.130 (3.30)									
Lead Width Max.	0.400 (10.20)					0.500 (12.70)					0.100 (2.54)					0.100 (2.54)									
Lead Length "L"	0.100 ± 0.020 (2.54 ± 0.51)					0.100 ± 0.020 (2.54 ± 0.51)					0.100 ± 0.020 (2.54 ± 0.51)					0.100 ± 0.020 (2.54 ± 0.51)									
Lead Length "J"	0.100 ± 0.020 (2.54 ± 0.51)					0.100 ± 0.020 (2.54 ± 0.51)					0.100 ± 0.020 (2.54 ± 0.51)					0.100 ± 0.020 (2.54 ± 0.51)									
X7R Dielectric																									
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	Cap Tol	
Voltage DC	500	1K	2K	3K	4K	5K	500	1K	2K	3K	4K	5K	500	1K	2K	3K	4K	500	1K	2K	3K	4K	5K		
Capacitance	Capacitance Code																								
150pF													151	151	151	151	151								
180pF													181	181	181	181	181								
220pF													221	221	221	221	221								
270pF													271	271	271	271	271								
330pF													331	331	331	331	331								
390pF													391	391	391	391	391								
470pF													471	471	471	471	471								
560pF													561	561	561	561	561								
680pF													681	681	681	681	681	681	681	681	681	681	681	681	
820pF													821	821	821	821	821	821	821	821	821	821	821	821	
1,000pF													102	102	102	102	102	102	102	102	102	102	102	102	
1,200pF													122	122	122	122	122	122	122	122	122	122	122	122	
1,500pF													152	152	152	152	152	152	152	152	152	152	152	152	
1,800pF													182	182	182	182	182	182	182	182	182	182	182	182	
2,200pF	222	222	222	222	222	222	222	222	222	222			222	222	222	222	222	222	222	222	222	222	222	222	
2,700pF	272	272	272	272	272	272	272	272	272	272			272	272	272	272	272	272	272	272	272	272	272	272	
3,300pF	332	332	332	332	332	332	332	332	332	332			332	332	332	332	332	332	332	332	332	332	332	332	
3,900pF	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	
4,700pF	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	
5,600pF	562	562	562	562	562	562	562	562	562	562	562	562	562	562	562	562	562	562	562	562	562	562	562	562	
6,800pF	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682	
8,200pF	822	822	822	822	822	822	822	822	822	822	822	822	822	822	822	822	822	822	822	822	822	822	822	822	
0.01µF	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	
0.012µF	123	123	123	123	123								123	123	123	123	123	123	123	123	123	123	123	123	
0.015µF	153	153	153	153	153								153	153	153	153	153	153	153	153	153	153	153	153	
0.018µF	183	183	183	183									183	183	183	183	183	183	183	183	183	183	183	183	
0.022µF	223	223	223	223									223	223	223	223	223	223	223	223	223	223	223	223	
0.027µF	273	273	273	273									273	273	273	273	273	273	273	273	273	273	273	273	
0.033µF	333	333	333	333									333	333	333	333	333	333	333	333	333	333	333	333	
0.039µF	393	393	393	393									393	393	393	393	393	393	393	393	393	393	393	393	
0.047µF	473	473	473	473									473	473											
0.056µF	563	563	563										563	563											
0.068µF	683	683	683										683	683	683	683									
0.082µF	823	823	823										823	823	823	823									
0.1µF	104	104	104										104	104	104	104									
0.12µF	124	124	124										124	124	124										
0.15µF	154	154											154	154	154										
0.18µF	184	184											184	184	184										
0.22µF	224	224											224	224											
0.27µF	274	274											274	274											
0.33µF	334	334											334	334											
0.39µF	394	394											394	394											
0.47µF	474	474											474	474											
0.56µF	564												564	564											
0.68µF	684												684	684											
0.82µF	824												824	824											

Table 1B – SM25 - SM31 Style/Size con't

Style/Size	SM25					SM26					SM30					SM31									
Dimensions - In. (mm)																									
Length	0.550 ± 0.030 (14.00 ± 0.76)					0.650 ± 0.030 (16.50 ± 0.76)					0.300 ± 0.030 (7.62 ± 0.76)					0.400 ± 0.030 (10.20 ± 0.76)									
Width	0.500 ± 0.030 (12.70 ± 0.76)					0.600 ± 0.030 (15.20 ± 0.76)					0.150 ± 0.015 (3.81 ± 0.38)					0.200 ± 0.020 (5.08 ± 0.51)									
Thickness Max.	0.220 (5.59)					0.220 (5.59)					0.140 (3.55)					0.130 (3.30)									
Lead Width Max.	0.400 (10.20)					0.500 (12.70)					0.100 (2.54)					0.100 (2.54)									
Lead Length "L"	0.100 ± 0.020 (2.54 ± 0.51)					0.100 ± 0.020 (2.54 ± 0.51)					0.100 ± 0.020 (2.54 ± 0.51)					0.100 ± 0.020 (2.54 ± 0.51)									
Lead Length "J"	0.100 ± 0.020 (2.54 ± 0.51)					0.100 ± 0.020 (2.54 ± 0.51)					0.100 ± 0.020 (2.54 ± 0.51)					0.100 ± 0.020 (2.54 ± 0.51)									
X7R Dielectric																									
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	Cap Tol	
Voltage DC	500	1K	2K	3K	4K	5K	500	1K	2K	3K	4K	5K	500	1K	2K	3K	4K	500	1K	2K	3K	4K	5K		
Capacitance	Capacitance Code																								
1.0µF	105						105	105																K, M, P, Z	
1.2µF	125						125																		
1.5µF	155						155																		
1.8µF	185						185																		
2.2µF							225																		
2.7µF							275																		
2.9µF							295																		

Table 1C – SM33 - SM35 Style/Size

Style/Size	SM33							SM34							SM35							Cap Tol		
Dimensions - In. (mm)																								
Length	0.700 ± 0.030 (17.08 ± 0.76)							0.900 ± 0.030 (22.90 ± 0.76)							1.100 ± 0.030 (27.90 ± 0.76)									
Width	0.300 ± 0.030 (7.62 ± 0.76)							0.400 ± 0.030 (10.20 ± 0.76)							0.500 ± 0.030 (12.70 ± 0.76)									
Thickness Max.	0.180 (4.57)							0.220 (5.59)							0.220 (5.59)									
Lead Width Max.	0.200 (5.08)							0.300 (7.62)							0.400 (10.2)									
Lead Length "L"	0.100 ± 0.020 (2.54 ± 0.51)							0.100 ± 0.020 (2.54 ± 0.51)							0.100 ± 0.020 (2.54 ± 0.51)									
Lead Length "J"	0.100 ± 0.020 (2.54 ± 0.51)							0.100 ± 0.020 (2.54 ± 0.51)							0.100 ± 0.020 (2.54 ± 0.51)									
X7R Dielectric																								
Voltage Code	501	102	202	302	402	502	752	501	102	202	302	402	502	752	103	501	102	202	302	402	502	752	103	Cap Tol
Voltage DC	500	1K	2K	3K	4K	5K	7.5K	500	1K	2K	3K	4K	5K	7.5K	10K	500	1K	2K	3K	4K	5K	7.5K	10K	
Capacitance	Capacitance Code																							
820pF	821	821	821	821	821	821	821	102	102	102	102	102	102	102	102									102
1,000pF	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102									102
1,200pF	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122									122
1,500pF	152	152	152	152	152	152	152	152	152	152	152	152	152	152	152									152
1,800pF	182	182	182	182	182	182	182	182	182	182	182	182	182	182	182									182
2,200pF	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222									222
2,700pF	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272									272
3,300pF	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332	332
3,900pF	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392
4,700pF	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472	472
5,600pF	562	562	562	562	562	562		562	562	562	562	562	562	562	562	562	562	562	562	562	562	562	562	562
6,800pF	682	682	682	682	682	682		682	682	682	682	682	682	682	682									682
8,200pF	822	822	822	822	822			822	822	822	822	822	822	822										822
0.01µF	103	103	103	103	103			103	103	103	103	103	103	103										103
0.012µF	123	123	123	123	123			123	123	123	123	123	123											
0.015µF	153	153	153	153				153	153	153	153	153	153											
0.018µF	183	183	183	183				183	183	183	183	183	183											
0.022µF	223	223	223	223				223	223	223	223	223	223	223										
0.027µF	273	273	273	273				273	273	273	273	273	273											
0.033µF	333	333	333	333				333	333	333	333	333												
0.039µF	393	393	393	393				393	393	393	393													
0.047µF	473	473	473					473	473	473	473													
0.056µF	563	563	563					563	563	563	563													
0.068µF	683	683	683					683	683	683	683													
0.082µF	823	823	823					823	823	823	823													
0.1µF	104	104						104	104	104														
0.12µF	124	124						124	124	124														
0.15µF	154	154						154	154	154														
0.18µF	184	184						184	184	184														
0.22µF	224	224						224	224	224														
0.27µF	274	274						274	274	274														
0.33µF	334	334						334	334															
0.39µF	394	394						394	394															
0.47µF	474	474						474	474															
0.56µF	564	564						564	564															
0.68µF	684	684						684	684															
0.82µF	824							824	824															
1.0µF	105							105	105															
1.2µF	125							125																
1.5µF	155							155																
1.8µF								185																
2.2µF								225																
2.7µF																								
2.9µF																								
3.3µF																								
3.9µF																								

Table 1D – SM36 Style/Size

Style/Size	SM36								Cap Tol
Dimensions - In. (mm)									
Length	1.350 ± 0.030 (33.00 ± 0.76)								
Width	0.600 ± 0.030 (15.20 ± 0.76)								
Thickness Max.	0.220 (5.59)								
Lead Width Max.	0.500 (12.7)								
Lead Length "L"	0.100 ± 0.020 (2.54 ± 0.51)								
Lead Length "J"	0.100 ± 0.020 (2.54 ± 0.51)								
X7R Dielectric									
Voltage Code	501	102	202	302	402	502	752	103	Cap Tol
Voltage DC	500	1K	2K	3K	4K	5K	7.5K	10K	
Capacitance	Capacitance Code								K, M, P, Z
1,500pF								152	
1,800pF								182	
2,200pF								222	
2,700pF								272	
3,300pF								332	
3,900pF								392	
4,700pF	472	472	472	472	472	472	472	472	
5,600pF	562	562	562	562	562	562	562	562	
6,800pF	682	682	682	682	682	682	682	682	
8,200pF	822	822	822	822	822	822	822	822	
0.01µF	103	103	103	103	103	103	103	103	
0.012µF	123	123	123	123	123	123	123		
0.015µF	153	153	153	153	153	153	153		
0.018µF	183	183	183	183	183	183	183		
0.022µF	223	223	223	223	223	223	223		
0.027µF	273	273	273	273	273	273			
0.033µF	333	333	333	333	333	333			
0.039µF	393	393	393	393	393	393			
0.047µF	473	473	473	473	473				
0.056µF	563	563	563	563	563				
0.068µF	683	683	683	683	683				
0.082µF	823	823	823	823	823				
0.1µF	104	104	104	104					
0.12µF	124	124	124	124					
0.15µF	154	154	154	154					
0.18µF	184	184	184						
0.22µF	224	224	224						
0.27µF	274	274	274						
0.33µF	334	334	334						
0.39µF	394	394							
0.47µF	474	474							
0.56µF	564	564							
0.68µF	684	684							
0.82µF	824	824							
1.0µF	105	105							
1.2µF	125	125							
1.5µF	155	155							
1.8µF	185	185							
2.2µF	225	225							
2.7µF	275								
2.9µF	295								
3.3µF	335								
3.9µF	395								
4.7µF	475								
5.6µF	565								

Table 2 – Chip Thickness / Packaging Quantities

Series	Style/Size	Tray Quantity Min. ¹	Tray Quantity Max. 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

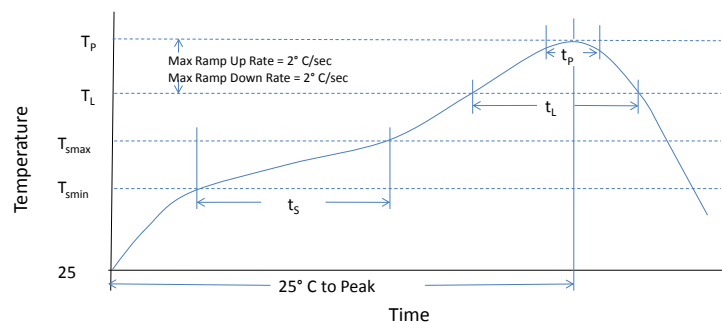
Preheating and Reflow Profile Notes:

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:

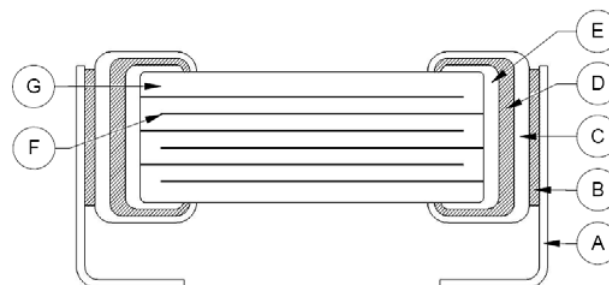
Profile Feature	SnPb Assembly
Preheat/Soak	
Temperature Min (T_{smin})	100°C
Temperature Max (T_{smax})	150°C
Time (t_s) from T_{smin} to T_{smax}	60-90 sec
Ramp-up Rate (T_L to T_p)	2°C/sec
Liquidous Temperature (T_L)	183°C
Time Above Liquidous (t_L)	95 sec
Peak Temperature (T_p)	240°C
Time within 5°C of Max Peak Temperature (t_p)	5 sec
Ramp-down Rate (T_p to T_L)	2°C/sec
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.



Construction

Reference	Item	Material
A	Leadframe	Phosphor Bronze - Alloy 510 (Silver plated / Nickel Underplate)
B	Leadframe Attach Material	Silver Epoxy
C	MLCC Termination System	Solderable Silver
D		
E	Electrode	PdAg
F	Dielectric	BaTiO ₃



Note: Image is exaggerated in order to clearly identify all components of construction

Product Marking

Product marking is an extra-cost option. These devices 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.

Table 3 – Performance & Reliability: Test Methods and Conditions

Stress	Reference	Test or Inspection Method
Board Flex	JIS-C-6429	Appendix 2, Note: 2 mm (min) for all except 3 mm for C0G.
Solderability	J-STD-002	Magnification 50 X. Conditions:
		a) Method B, 4 hours @ 155°C, dry heat @ 235°C
		b) Method B @ 215°C category 3
		c) Method D, category 3 @ 260°C
		1000 cycles (-55°C to +125°C). Measurement at 24 hours +/- 2 hours after test conclusion.
Biased Humidity	MIL-STD-202 Method 103	Load Humidity: 1000 hours 85°C/85%RH and 300VDC Max. Add 100K ohm resistor. Measurement at 24 hrs. +/- 2 hrs after test conclusion.
		Low Volt Humidity: 1000 hours 85°C/85%RH and 1.5V. Add 100K ohm resistor. Measurement at 24 hrs. +/- 2 hrs after test conclusion.
		t = 24 hours/cycle. Steps 7a & 7b not required. Unpowered. Measurement at 24 hours. +/- 2 hours after test conclusion.
Thermal Shock	MIL-STD-202 Method 107	-55°C/+125°C. Note: Number of cycles required – 300. Maximum transfer time – 20 seconds. D14 dwell time – 15 minutes. Air-Air.
High Temperature Life	MIL-STD-202 Method 108 / EIA -198	1000 hours at 125°C (85°C for X5R, Z5U and Y5V) with rated voltage applied.
Storage Life	MIL-STD-202 Method 108	150°C, 0VDC, for 1000 hours.
Vibration	MIL-STD-202 Method 204	5 g for 20 min., 12 cycles each of 3 orientations. Note: Use 8"X5" PCB .031" thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10–2000 Hz.
Resistance to Soldering Heat	MIL-STD-202 Method 210	Condition B. No preheat of samples. Note: single wave solder – procedure 2.
Terminal Strength	MIL-STD-202 Method 211	Conditions A (2.3kg or 5lbs).
Mechanical Shock	MIL-STD-202 Method 213	Figure 1 of Method 213, Condition F.
Resistance to Solvents	MIL-STD-202 Method 215	Add aqueous wash chemical – OKEM Clean or equivalent.

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. In addition, 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.

Application Notes

X7R dielectric is not recommended for AC line filtering or pulse applications.

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Schaumburg, IL
Tel: 847-882-3590

Carmel, IN
Tel: 317-706-6742

West

Milpitas, CA
Tel: 408-433-9950

Mexico

Zapopan, Jalisco
Tel: 52-33-3123-2141

Europe

Southern Europe

Geneva, Switzerland
Tel: 41-22-715-0100

Paris, France
Tel: 33-1-4646-1009

Sasso Marconi, Italy
Tel: 39-051-939111

Milan, Italy
Tel: 39-02-57518176

Rome, Italy
Tel: 39-06-23231718

Madrid, Spain
Tel: 34-91-804-4303

Central Europe

Landsberg, Germany
Tel: 49-8191-3350800

Dortmund, Germany
Tel: 49-2307-3619672

Kwidzyn, Poland
Tel: 48-55-279-7025

Northern Europe

Bishop's Stortford, United Kingdom
Tel: 44-1279-757201

Weymouth, United Kingdom
Tel: 44-1305-830747

Coatbridge, Scotland
Tel: 44-1236-434455

Färjestaden, Sweden
Tel: 46-485-563934

Espoo, Finland
Tel: 358-9-5406-5000

Asia

Northeast Asia

Hong Kong
Tel: 852-2305-1168

Shenzhen, China
Tel: 86-755-2518-1306

Beijing, China
Tel: 86-10-5829-1711

Shanghai, China
Tel: 86-21-6447-0707

Taipei, Taiwan
Tel: 886-2-27528585

Southeast Asia

Singapore
Tel: 65-6586-1900

Penang, Malaysia
Tel: 60-4-6430200

Bangalore, India
Tel: 91-806-53-76817

Note: KEMET reserves the right to modify minor details of internal and external construction at any time in the interest of product improvement. KEMET does not assume any responsibility for infringement that might result from the use of KEMET Capacitors in potential circuit designs. KEMET is a registered trademark of KEMET Electronics Corporation.

Other KEMET Resources

Tools	
Resource	Location
Configure A Part: CapEdge	http://capacitoredge.kemet.com
SPICE & FIT Software	http://www.kemet.com/spice
Search Our FAQs: KnowledgeEdge	http://www.kemet.com/keask

Product Information	
Resource	Location
Products	http://www.kemet.com/products
Technical Resources (Including Soldering Techniques)	http://www.kemet.com/technicalpapers
RoHS Statement	http://www.kemet.com/rohs
Quality Documents	http://www.kemet.com/qualitydocuments

Product Request	
Resource	Location
Sample Request	http://www.kemet.com/sample
Engineering Kit Request	http://www.kemet.com/kits

Contact	
Resource	Location
Website	www.kemet.com
Contact Us	http://www.kemet.com/contact
Investor Relations	http://www.kemet.com/ir
Call Us	1-877-MyKEMET
Twitter	http://twitter.com/kemetcapacitors

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Although we design and manufacture our 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.

