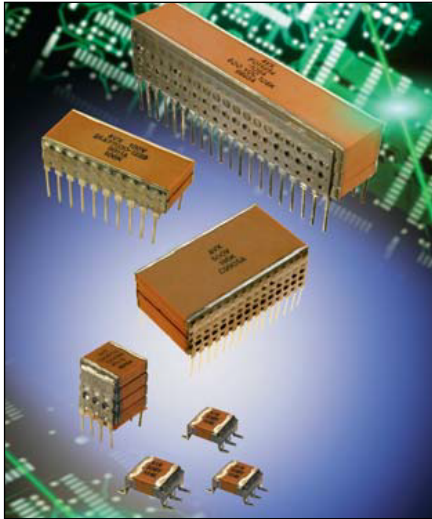


SMPS Stacked MLC Capacitors

SM Style Stacked MLC Capacitors



KYOCERA AVX is the original inventor of large capacitance value, stacked MLCC capacitors constructed with DIP leads. The SM-style, Switch Mode Power Supply (SMPS) capacitors were introduced by KYOCERA AVX in 1980s. These capacitors are the closest to the ideal electrical energy storage devices due to high CV product and extremely low ESR and ESL.

In addition to traditionally offered COG (Class I) and X7R (Class II) type dielectrics, KYOCERA AVX introduces another class I, temperature compensated N1500 dielectric characterized with very low dissipation factor. Thanks to considerably higher relative dielectric constant of N1500 dielectric, the CV product is more than doubled in comparison to ultra-stable COG dielectric, resulting in a significant reduction in the size of capacitor and a significant improvement of volumetric efficiency.

The typical applications for different type dielectrics are:

- COG:** High frequency resonant capacitors, avionic AC line filters (400Hz to 800Hz), snubbers, timing circuits, high current repetitive discharge
- N1500:** Avionic AC line filters (400Hz to 800Hz), snubbers, high current repetitive discharge, capacitive temperature compensation
- X7R:** General filtering, input and output filters in DC/DC converters, bulk filters, DC link capacitors, motor drive filters, high current non-repetitive discharge

Not RoHS Compliant

GENERAL SPECIFICATIONS FOR ALL DIELECTRIC TYPES

Operating Temperature Range

-55° to +125°C

Voltage Ratings

50VDC through 500VDC (+125°C)

Dielectric Withstanding Voltage

250% rated voltage for 5 seconds with 30 to 50mA charging current (500 Volt units @ 750VDC)

Insulation Resistance (25°C, rated DC voltage)

100KMΩ min. or 1000MΩ-μF min. whichever is less

Insulation Resistance (125°C, rated DC voltage)

10KMΩ min. or 100MΩ-μF min. whichever is less

Thermal Shock Capabilities

5 cycles (-55°C to +125°C)

Life Test Capabilities (1000 hours)

200% rated voltage at +125°C (500 Volt units @ 600VDC)

GENERAL SPECIFICATIONS FOR ALL DIELECTRIC TYPES

COG Dielectric

Capacitance Range

0.01μF to 15μF
(+25°C, 1.0 ± 0.2Vrms at 1kHz)

Capacitance Tolerances

±5%, ±10%, ±20%

Temperature Characteristic

0 ± 30 ppm/°C

Dissipation Factor

0.15% max.
(+25°C, 1.0 ± 0.2Vrms at 1kHz)

N1500

Capacitance Range

0.018μF to 33μF
(+25°C, 1.0 ± 0.2Vrms at 1kHz)

Capacitance Tolerances

±5%, ±10%, ±20%

Temperature Characteristic

-1500 ± 250 ppm/°C

Dissipation Factor

0.15% max.
(+25°C, 1.0 ± 0.2Vrms at 1kHz)

X7R Dielectric

Capacitance Range

0.1μF to 390μF
(+25°C, 1.0 ± 0.2Vrms at 1kHz)

Capacitance Tolerances

±10%, ±20%, +80%, -20%

Temperature Characteristic

±15%

Dissipation Factor

2.5% max.
(+25°C, 1.0 ± 0.2Vrms at 1kHz)

SMPS Stacked MLC Capacitors

SM Style Stacked MLC Capacitors

HOW TO ORDER

KYOCERA AVX Styles: SM-1, SM-2, SM-3, SM-4, SM-5, SM-6

SM0	1	7	C	106	M	A	N	650
Style SM0 = Uncoated SM5 = Epoxy Coated	Size See Dimensions chart	Voltage 50V = 5 100V = 1 200V = 2 500V = 7	Temperature Coefficient COG = A N1500 = 4 X7R = C	Capacitance Code (2 significant digits + number of zeros) 1,000 pF = 102 22,000 pF = 223 220,000 pF = 224 1 μF = 105 10 μF = 106 100 μF = 107	Capacitance Tolerance COG/N1500: J = ±5% K = ±10% M = ±20% X7R: K = ±10% M = ±20% Z = +80%, -20%	Test Level A = Standard B = Hi-Rel* 5 = Standard/MIL** 6 = Hi-Rel/MIL***	Termination N = Straight Lead J = Leads formed in L = Leads formed out P = P Style Leads Z = Z Style Leads	Height Max Dimension "A" 120 = 0.120" 240 = 0.240" 360 = 0.360" 480 = 0.480" 650 = 0.650"

See tables for capacitance available in specific height and dielectric

Note: Capacitors with X7R dielectric are not intended for applications across AC supply mains or AC line filtering with polarity reversal. Contact plant for recommendations.

* Hi-Rel screening option. Screening consists of 100% Group A (B Level), Subgroup 1 per MIL-PRF-49470.

** Form, fit & function equivalent to MIL-PRF-49470 part.

Applies to 50V rated parts only. No screening.
*** Form, fit & function equivalent to MIL-PRF-49470 part.
Applies to 50V rated parts only. Hi-Rel screening the same as option B.

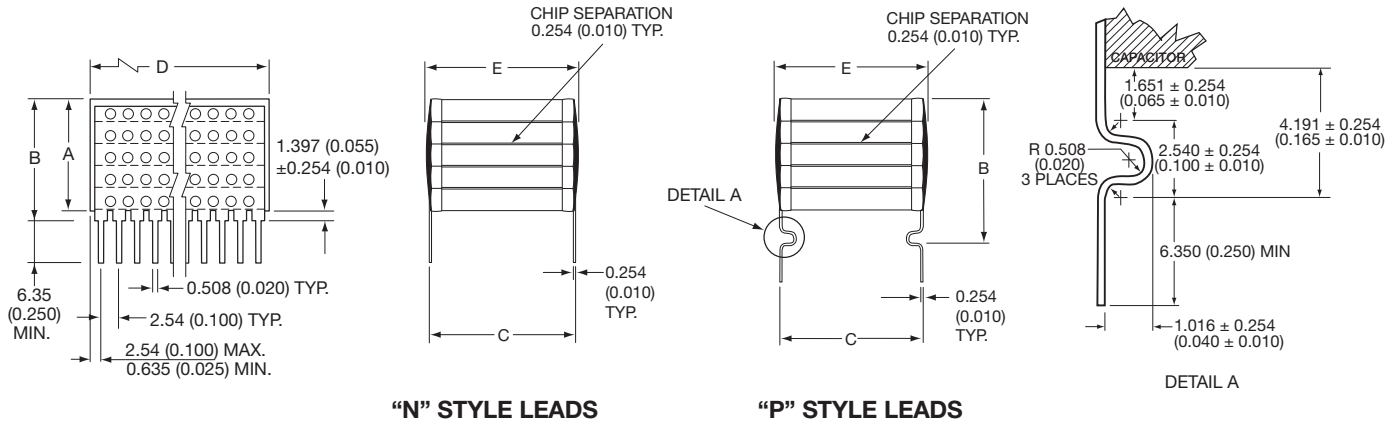
Typical ESR Performance (mΩ)

	Aluminum Electrolytic 100μF/50V	Low ESR Solid Tantalum 100μF/10V	Solid Aluminum Electrolytic 100μF/16V	MLCC SMPS 100μF/50V	MLCC SMPS 4.7μF/50V
ESR @ 10KHz	300	72	29	3	66
ESR @ 50KHz	285	67	22	2	23
ESR @ 100KHz	280	62	20	2.5	15
ESR @ 500KHz	265	56	18	4	8
ESR @ 1MHz	265	56	17	7	7.5
ESR @ 5MHz	335	72	17	12.5	8
ESR @ 10MHz	560	91	22	20	14

Performance of SMPS capacitors can be simulated by downloading SpiCalci software program - <https://www.kyocera-avx.com/download/software/SpiCalci-V10.zip>

SMPS Stacked MLC Capacitors

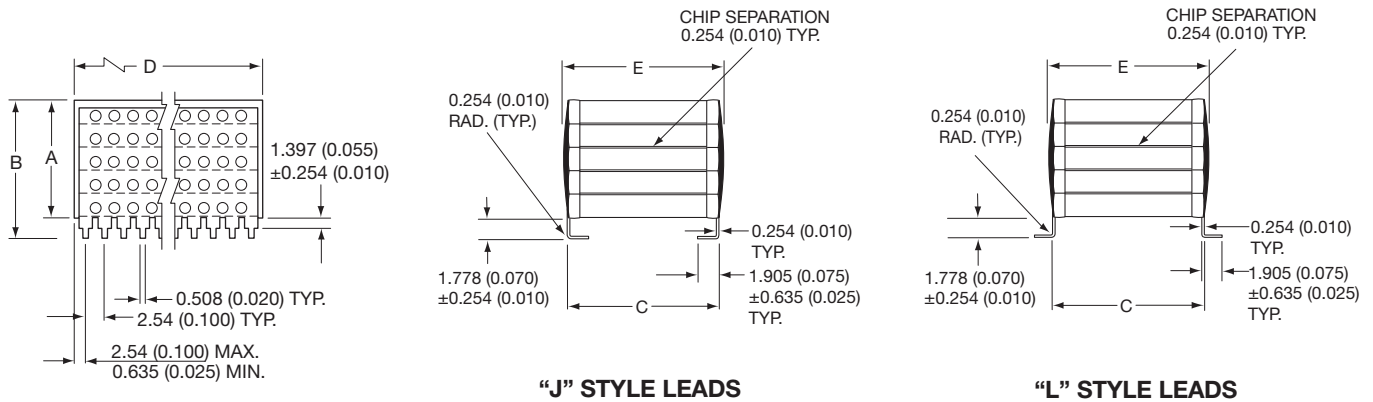
SM Style Surface Mount and Thru-Hole Styles (SM0, SM5)



“N” STYLE LEADS

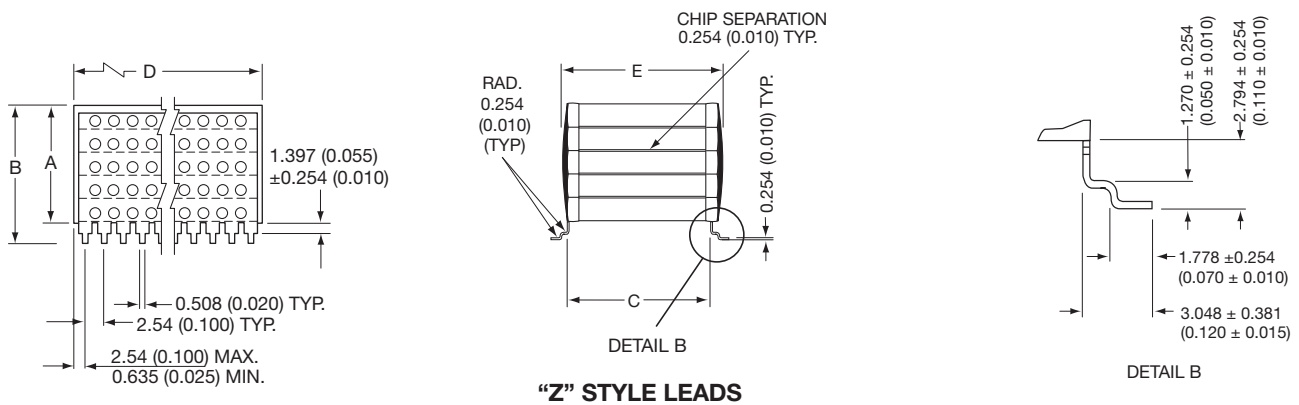
“P” STYLE LEADS

DETAIL A



“J” STYLE LEADS

“L” STYLE LEADS



“Z” STYLE LEADS

DETAIL B

DIMENSIONS

millimeters (inches)

Style	A (max.)	B (max.)	C ± 0.635 (±0.025)	D ± 0.635 (±0.025)	E (max.)	No. of Leads per side
SM-1	See capacitance range table for maximum "A" dimensions	For "N" Style Leads: "A" Dimension Plus 1.651 (0.065) For "J" & "L" Style Leads: "A" Dimension Plus 2.032 (0.080) For "P" Style Leads: "A" Dimension Plus 4.445 (0.175) For "Z" Style Leads: "A" Dimension Plus 3.048 (0.120)	11.4 (0.450)	52.1 (2.050)	12.7 (0.500)	20
SM-2			20.3 (0.800)	38.4 (1.510)	22.1 (0.870)	15
SM-3			11.4 (0.450)	26.7 (1.050)	12.7 (0.500)	10
SM-4			10.2 (0.400)	10.2 (0.400)	11.2 (0.440)	4
SM-5			6.35 (0.250)	6.35 (0.250)	7.62 (0.300)	3
SM-6			31.8 (1.250)	52.1 (2.050)	34.3 (1.350)	20

Note: For SM5 add 0.127 (0.005) to max. and nominal dimensions A, B, D, & E

SMPS Stacked MLC Capacitors

SM Style



COG CLASS I DIELECTRIC, ULTRA STABLE CERAMIC

Cap μ F	SM01				SM02				SM03				SM04				SM05				SM06					
	50	100	200	500	50	100	200	500	50	100	200	500	50	100	200	500	50	100	200	500	50	100	200	500		
0.01																							120			
0.012															120			120	240							
0.015															120			120	240							
0.018															120			120	240							
0.022															240			240	360							
0.027															240		120	240	360							
0.033															240	120	120	240	480							
0.039															240	120	120	240	480							
0.047															120	240	120	240	240	650						
0.056											120				120	360	240	240	360							
0.068											120				120	360	240	240	360							
0.082											120			120	240	480	240	360	480							
0.1											240	120	120	240	480	240	360	480								
0.12				120							120	240	120	120	240	650	360	360	650							
0.15				120				120			120	240	120	240	360		360	480								
0.18				120				120			120	240	240	240	360		480	650								
0.22				240				120			240	360	240	240	480		650									
0.27			120	240				240		120	240	360	240	360	480											
0.33			120	240				240	120	120	240	480	360	360	650								120			
0.39			120	360				120	240	120	120	240	650	360	360								120			
0.47			240	360				120	240	120	240	360	650	360	480								120			
0.56		120	240	480				120	360	240	240	360		480	650								240			
0.68		120	240	480				120	240	360	240	480		650									240			
0.82	120	240	360	650	120	120	240	480	240	360	650												120	240		
1	120	240	360		120	120	240	480	240	360	650												120	240		
1.2	240	240	360		120	240	240	650	360	360													120	120	360	
1.5	240	360	480		240	240	360		360	480													120	240	360	
1.8	240	360	650		240	240	360		480	650													120	120	240	480
2.2	360	480			240	360	480		650														120	120	240	650
2.7	360	480			360	360	650																120	240	360	
3.3	480	650			360	480																	240	240	360	
3.9	480				480	480																	240	240	360	
4.7	650				480	650																	240	240	480	
5.6					650																		240	360	650	
6.8																							360	360		
8.2																							360	480		
10																							480	650		
12																							480	650		
15																							650			

The number represented in each cell corresponds to the maximum "A" dimension (in mils) and to the last 3 digits of the part number.

CUSTOM VALUES, RATING AND CONFIGURATIONS ARE ALSO AVAILABLE.

SMPS Stacked MLC Capacitors

SM Style



N1500 CLASS I DIELECTRIC, TEMPERATURE COMPENSATED CERAMIC

Cap μ F	SM01				SM02				SM03				SM04				SM05				SM06			
	50	100	200	500	50	100	200	500	50	100	200	500	50	100	200	500	50	100	200	500	50	100	200	500
0.018																								120
0.022																								120
0.027															120					120	120			
0.033															120					120	240			
0.039															120					120	240			
0.047															120					120	240			
0.056															120					120	360			
0.068															120			120	120	360				
0.082															240	120	120	240	360					
0.1															120	240	120	120	240	480				
0.12															120	240	120	240	240	650				
0.15															120	240	240	240	360					
0.18										120			120	120	360	240	240	360						
0.22										120	120		120	240	480	240	360	480						
0.27										120	120		120	240	480	360	360	480						
0.33				120						240	120		240	240	650	360	480	650						
0.39				120				120		240	240		240	360		480	480							
0.47				120				120		120	240		240	360		480	650							
0.56				240				120		120	360		240	480		650								
0.68				240				240		120	120		360	240		360	480							
0.82			120	240				240	120	120	240		360	360		360	650							
1			120	360				240	120	120	240		480	360		480								120
1.2		120	120	360			120	360	120	240	240		650	480		650								120
1.5		120	240	480			120	360	240	240	360		650											120
1.8	120	120	240	480			120	480	240	240	360													240
2.2	120	240	240	650	120	120	240	480	240	360	480													240
2.7	240	240	360		120	120	240	650	360	360	480												120	240
3.3	240	240	360		120	240	240		360	480	650												120	360
3.9	240	360	480		240	240	360		480	480													120	360
4.7	360	360	480		240	240	360		480	650												120	120	480
5.6	360	480	650		240	360	480		650													120	120	480
6.8	480	480			360	360	480															120	240	650
8.2	480	650			360	360	650															240	240	360
10	650				360	480																240	240	360
12					480	650																240	360	480
15					650																	360	360	480
18																						360	480	650
22																						480	480	
27																						480	650	
33																						650		

The number represented in each cell corresponds to the maximum "A" dimension (in mils) and to the last 3 digits of the part number.

CUSTOM VALUES, RATING AND CONFIGURATIONS ARE ALSO AVAILABLE.

SMPS Stacked MLC Capacitors

SM Style



X7R CLASS II DIELECTRIC, STABLE CERAMIC

Cap μ F	SM01				SM02				SM03				SM04				SM05				SM06					
	50	100	200	500	50	100	200	500	50	100	200	500	50	100	200	500	50	100	200	500	50	100	200	500		
0.1																								120		
0.12																								120		
0.15																			120	120						
0.18														120				120	240							
0.22														120				120	240							
0.27														120				120	240							
0.33														120				120	360							
0.39														120		120		120	360							
0.47														240		120		240	360							
0.56														120	240		120	240	480							
0.68											120			120	240		120	240	650							
0.82											120			120	360		240	360								
1											120			120	120	360	120	240	360							
1.2											120			120	240	360	120	240	360							
1.5				120							240			120	240	480	120	360	480							
1.8				120							120	240		120	240	650	120	360	650							
2.2				120							120	240		240	240		120	480								
2.7				240							120	360		240	360		120	480								
3.3				240							120	120	360	120	240	360		240	650							
3.9				120	240						120	240	360	120	360	480		240								
4.7				120	240						240	120	240	480	120	360	650		240					120		
5.6				120	360						120	240	650	120	480			240						120		
6.8				120	120	360					120	240		240	240		120	480						120		
8.2				120	240	480					120	360	120	240	360		240	650						120		
10				120	240	480					120	120	360	120	240	360		240						240		
12				120	240	650					120	240	360	120	240	480		240						120	240	
15				120	240	360					120	240	480	120	360	650		240						120	240	
18				120	240	360					120	240	650	120	360	650		360						120	240	
22				120	240	480					120	240	480				360						120	120	360	
27				120	240	480					120	240	360		240	650							120	120	360	
33				240	360	650					120	240	360		240								120	120	240	480
39				240	480						120	360	480		360								120	120	240	650
47				240	480						240	360	650		360								120	240	240	650
56				360	650						240	480	650		480								120	240	360	
68				360							240	480			480								120	240	360	
82				360							240	650			650								240	360	480	
100				480							360												240	360	650	
120				650							360												240	360	650	
150											480												240	480		
180											650												360	650		
220																							360			
270																							480			
330																							650			
390																							650			

The number represented in each cell corresponds to the maximum "A" dimension (in mils) and to the last 3 digits of the part number.

CUSTOM VALUES, RATING AND CONFIGURATIONS ARE ALSO AVAILABLE.