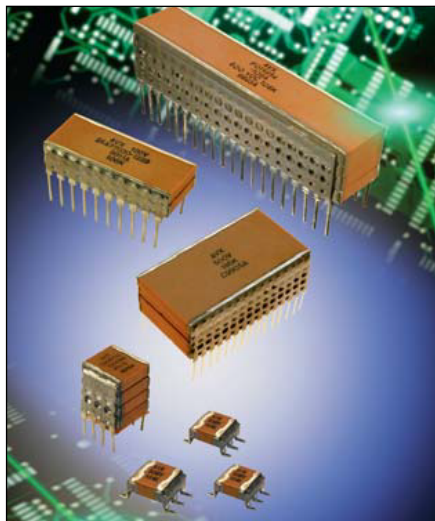


SMPS Stacked MLC Capacitors

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	Size	Voltage	Temperature Coefficient	Capacitance Code	Capacitance Tolerance	Test Level	Termination	Height
SM0 = Uncoated SM5 = Epoxy Coated	See Dimensions chart	50V = 5 100V = 1 200V = 2 500V = 7	C0G = A N1500 = 4 X7R = C	(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	C0G/N1500: J = ±5% K = ±10% M = ±20% X7R: K = ±10% M = ±20% Z = +80%, -20%	A = Standard B = Hi-Rel* 5 = Standard/MIL** 6 = Hi-Rel/MIL***	N = Straight Lead J = Leads formed in L = Leads formed out P = P Style Leads Z = Z Style Leads	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.

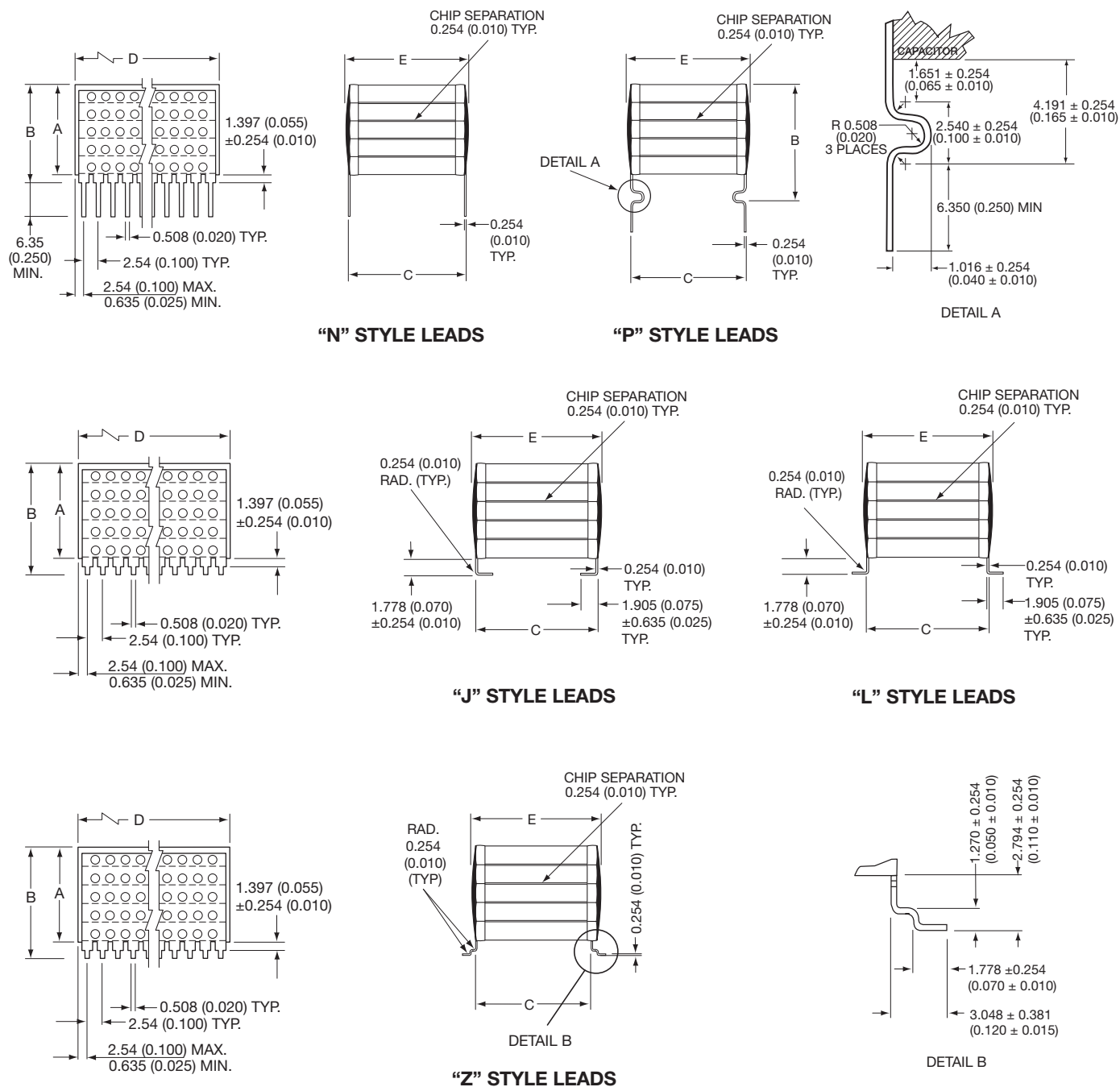
Typical ESR Performance (mΩ)

	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)



DIMENSIONS

millimeters (inches)

Style	A (max.)	B (max.)	C ±.635 (±0.025)	D ±.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

	SM01				SM02				SM03				SM04				SM05				SM06			
Cap μ F	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	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

	SM01				SM02				SM03				SM04				SM05				SM06			
Cap μ F	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	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	240	360		480	650						
0.56				240				120			120	360	240	360	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	120	360
4.7	360	360	480		240	240	360		480	650											120	120	240	480
5.6	360	480	650		240	360	480		650												120	120	240	480
6.8	480	480			360	360	480														120	240	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

	SM01				SM02				SM03				SM04				SM05				SM06			
Cap μ F	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	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	240			120	480				
2.7				240				120				120	360		240	360			120	480				
3.3				240				120		120	120	360	120	240	360			240	650					
3.9			120	240				120		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		120	240	650	120	480			240						120
6.8		120	120	360				120	240		240	240		120	480			360						120
8.2		120	240	480				120	360	120	240	360		240	650			360						120
10		120	240	480			120	120	360	120	240	360		240				480						240
12		120	240	650			120	240	360	120	240	480		240				650						120 240
15	120	240	360				120	240	480	120	360	650		240										120 240
18	120	240	360			120	120	240	650	120	360	650		360										120 240
22	120	240	480			120	240	240		240	480			360										120 120 360
27	120	360	480			120	240	360		240	650			480										120 240 360
33	240	360	650			120	240	360		240				650								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.