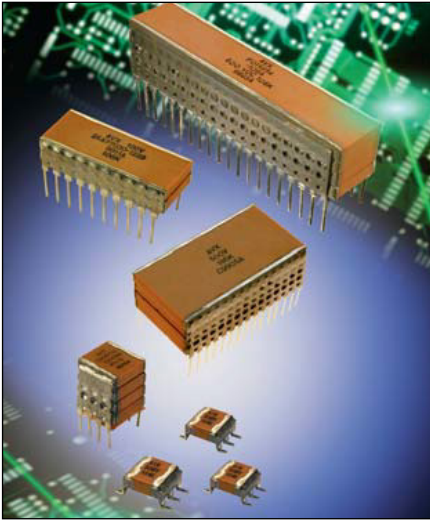


# SMPS Stacked MLC Capacitors

## SM Style Stacked MLC Capacitors



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 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, 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

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

SM0	1	7	C	106	M	A	N	650
<b>AVX Style</b> SM0 = Uncoated SM5 = Epoxy Coated	<b>Size</b> See Dimensions chart	<b>Voltage</b> 50V = 5 100V = 1 200V = 2 500V = 7	<b>Temperature Coefficient</b> COG = A N1500 = 4 X7R = C	<b>Capacitance Code</b> (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	<b>Capacitance Tolerance</b> COG/N1500: J = ±5% K = ±10% M = ±20% X7R: K = ±10% M = ±20% Z = +80%, -20%	<b>Test Level</b> A = Standard B = Hi-Rel* 5 = Standard/MIL** 6 = Hi-Rel/MIL***	<b>Termination</b> N = Straight Lead J = Leads formed in L = Leads formed out P = P Style Leads Z = Z Style Leads	<b>Height</b> 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.

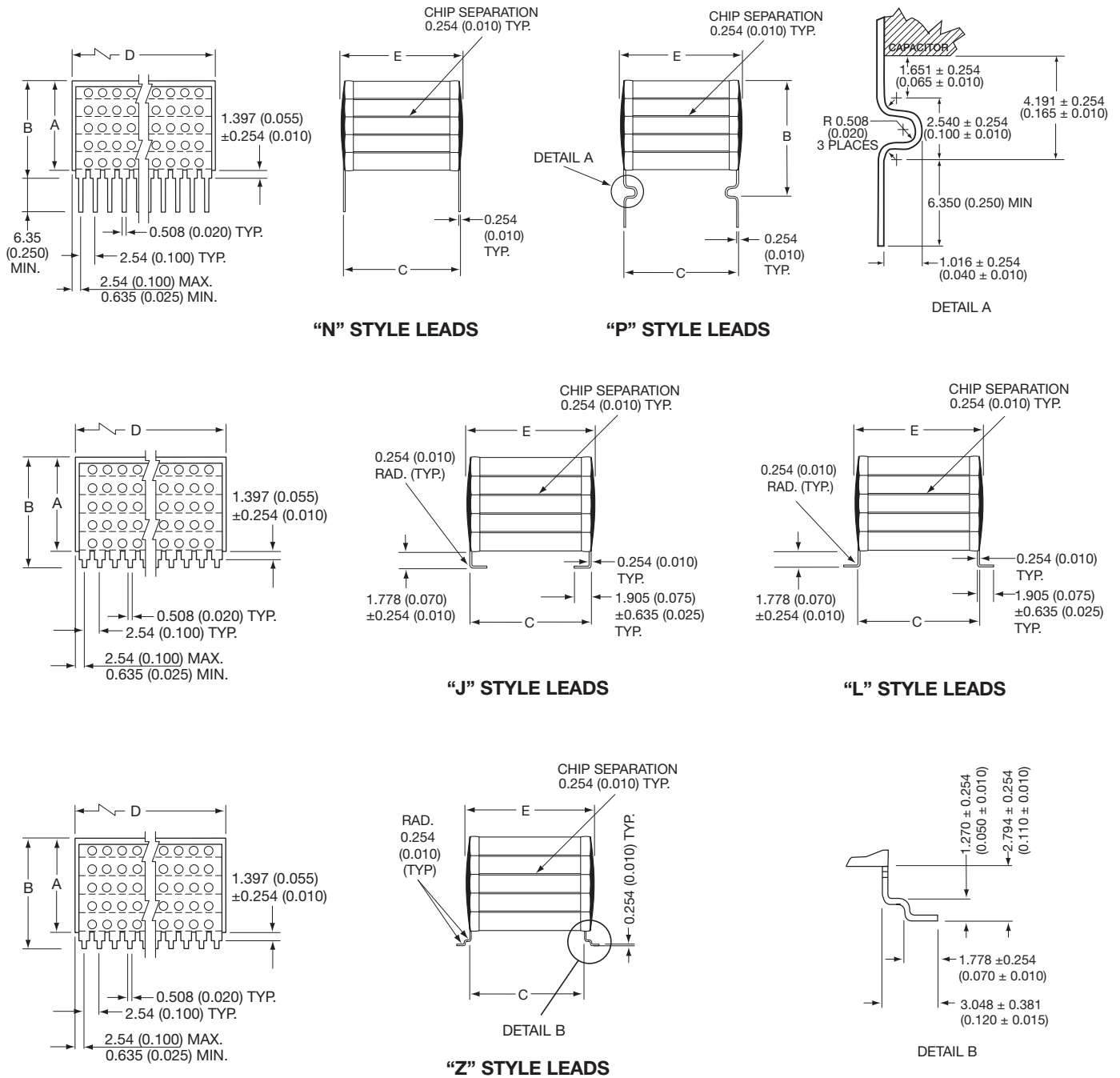
**Typical ESR Performance (mΩ)**

	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 - <http://www.avx.com/download/software/SpiCalci-AVX.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

Cap $\mu\text{F}$	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 $\mu$ 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									240	240		240	360		480	480																						
0.47				120									120	240		240	360		480	650																						
0.56				240									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

Cap $\mu$ 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		120	240		120	480								
2.7				240							120	360		120	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						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		480					120	240	360	
33				120	240	650					120	240	360		240								120	120	240	480
39				120	240	480					120	360	480		360								120	120	240	650
47				120	240	480					120	360	650		360								120	240	240	650
56				120	240	650					120	360	650		480								120	240	360	
68				120	240	480					120	360	650		480								120	240	360	
82				120	240	650					120	360	650		480								120	240	360	
100				120	240	480					120	360	650		480								120	240	360	
120				120	240	480					120	360	650		480								120	240	360	
150				120	240	480					120	360	650		480								120	240	360	
180				120	240	480					120	360	650		480								120	240	360	
220				120	240	480					120	360	650		480								120	240	360	
270				120	240	480					120	360	650		480								120	240	360	
330				120	240	480					120	360	650		480								120	240	360	
390				120	240	480					120	360	650		480								120	240	360	

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.**

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