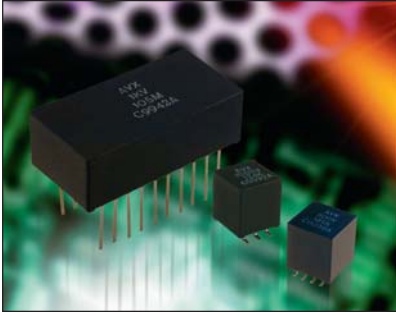


SMPS Stacked MLC Capacitors

(SM9 Style) Technical Information on SMPS Capacitors



AVX is the original inventor of large capacitance value, stacked MLCC capacitors constructed with DIP leads. Similar to SM-product, the SM9-style, encapsulated Switch Mode Power Supply (SMPS) capacitors offer high CV product and extremely low ESR and ESL. SM9-style capacitors offer additional mechanical and thermal protection and are recommended for applications where they will undergo extreme high frequency vibration or mechanical shock. Encapsulated version allows for “strapping” the parts or bonding to the board on the perimeter of the plastic case and thus preventing oscillation and lead breakage.

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

(SM9 Style) Technical Information on SMPS Capacitors

HOW TO ORDER

AVX Styles: SM91, SM92, SM93, SM94, SM95, SM96

SM9	1	7	C	106	M	A	N	660
AVX Style SM9 = Plastic Case	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	Height Max Dimension "A" 270 = 0.270" 390 = 0.390" 530 = 0.530" 660 = 0.660" 800 = 0.800" 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)

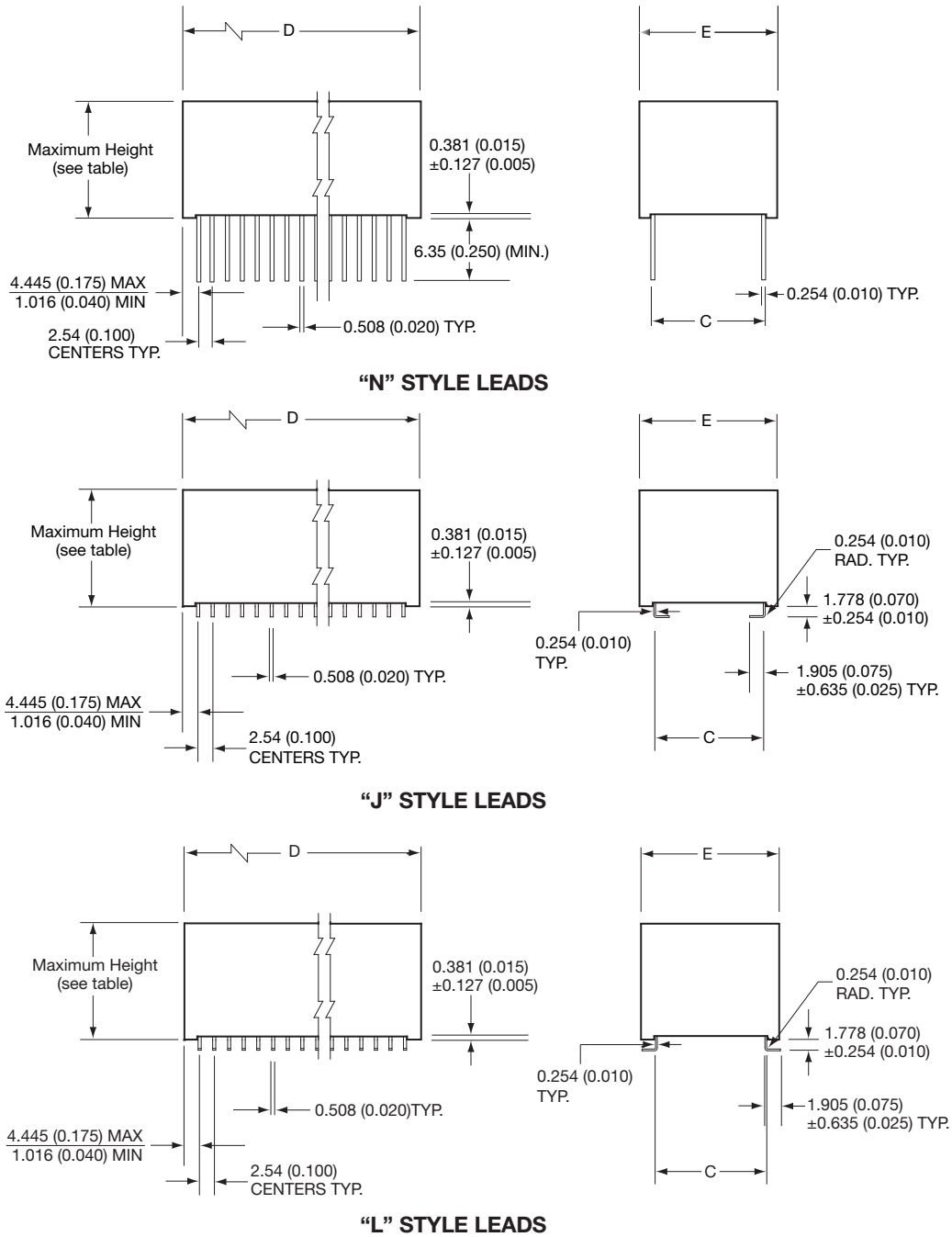
	Aluminum Electrolytic 100μF/50V	Low ESR Solid Tantalum 100μF/10V	Solid Aluminum Electrolytic 100μF/16V	MLCC SMPS 100μF/50V	MLCC SMPS 4.7μF/50V
ESR @ 10KHz	300	72	29	3	66
ESR @ 50KHz	285	67	22	2	23
ESR @ 100KHz	280	62	20	2.5	15
ESR @ 500KHz	265	56	18	4	8
ESR @ 1MHz	265	56	17	7	7.5
ESR @ 5MHz	335	72	17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

SMPS Stacked MLC Capacitors

Encapsulated in DAP (Diallyl Phthalate) Case (SM9 Style)



DIMENSIONS

millimeters (inches)

Case Code	± 0.635 (0.025) C	± 0.254 (0.010) D	+0.000 (0.000) -0.254 (0.010) E	No. of Leads per side*
SM91	11.4 (0.450)	54.7 (2.155)	14.7 (0.580)	20
SM92	20.3 (0.800)	41.0 (1.615)	24.1 (0.950)	15
SM93	11.4 (0.450)	29.3 (1.155)	14.7 (0.580)	10
SM94	10.2 (0.400)	12.3 (0.485)	12.3 (0.485)	4
SM95	6.35 (0.250)	9.02 (0.355)	9.02 (0.355)	3
SM96	31.8 (1.250)	54.7 (2.155)	36.3 (1.430)	20

*Leads styles N, J or L available

