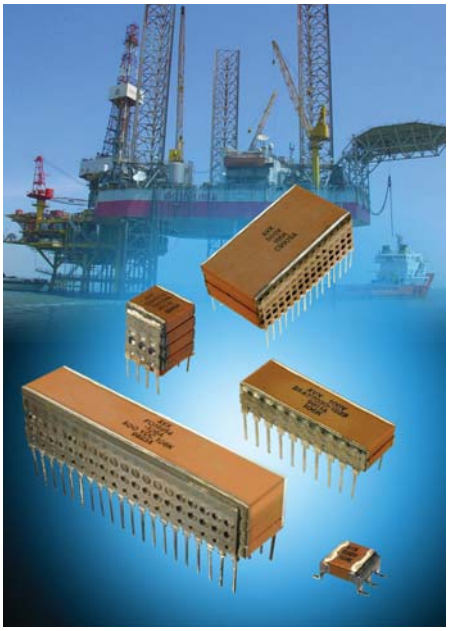
# SMPS Stacked MLC Capacitors

## SMX Style for High Temperature Applications up to 200ºC

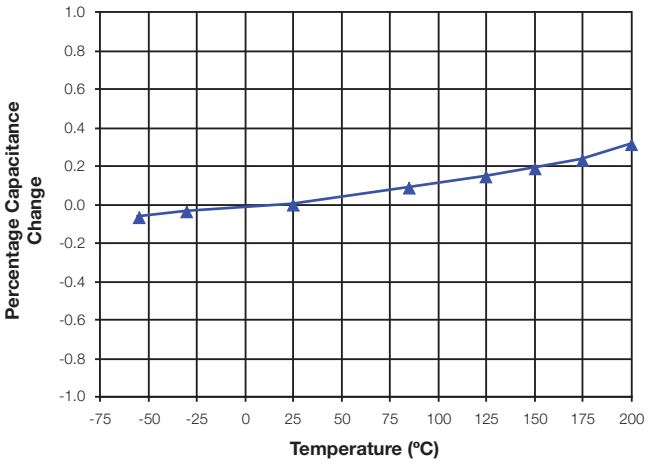


SMX-style, stacked Switch Mode Power Supply Capacitors (SMPS) utilizing Multilayer Ceramic (MLCC) construction are ideally suited for high temperature applications up to 200ºC. This product is intended for downhole oil exploration, including logging while drilling, geophysical probes, as well as space and aerospace electronics. The high temperature solder utilized in the construction of SMX-style parts assures reliable operation in harsh environments. The wide product offering provides designers a solution for high capacitance value and high voltage capacitors rated at 200ºC. The SMX-style capacitors are ideally suited for applications as DC filters in high power, high frequency motor drives, high pulsed-current circuitry, as well as low power electronics.

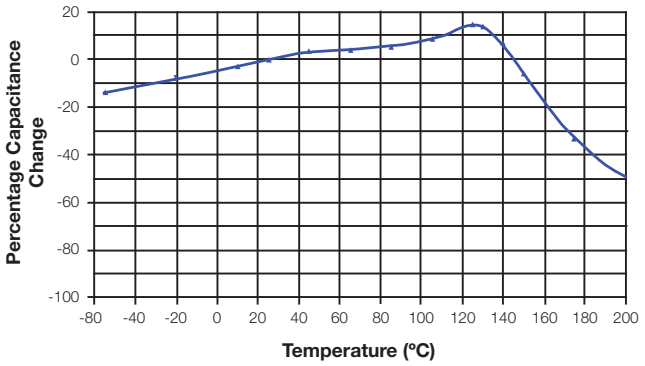
SMX-style, SMPS capacitors are characterized with excellent performance in comparison to wet tantalum products. The main benefits of SMX-product over wet tantalum capacitors include:

- Much lower ESR and lower losses
- Excellent capacitance retention with frequency
- Excellent high frequency performance
- Low DC leakage current
- Much higher current handling capabilities

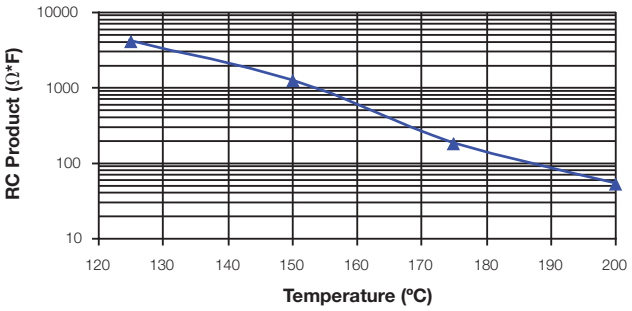
**Typical Extended Temperature TCC Characterization of C0G, SMPS Capacitors**
Test conditions: 1 Vrms, 1 kHz, 0 VDC bias



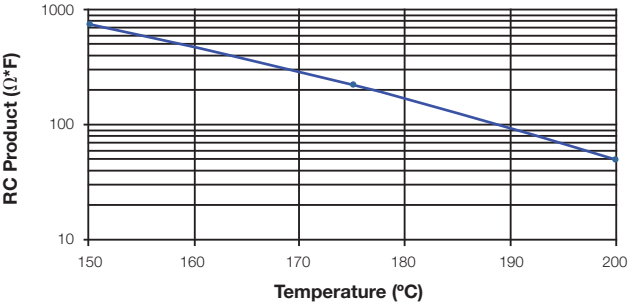

**Typical Extended Temperature TCC Characterization of VHT/X7R, SMPS Capacitors**
Test conditions: 1 Vrms, 1 kHz, 0 VDC bias




**Typical Extended Temperature IR Characterization of C0G, SMPS Capacitors**




**Typical Extended Temperature IR Characterization of VHT/X7R, SMPS Capacitors**



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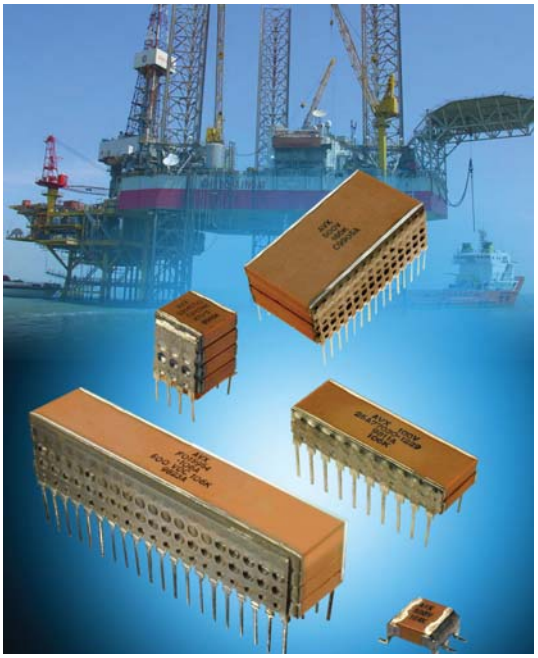

## ELECTRICAL SPECIFICATIONS

**Temperature Coefficient**

| | | |
|---|---|---|
| C0G: | A Temperature Coefficient | 0 ±30 ppm/°C, -55° to +200°C |
| VHT/X7R: | C Temperature Coefficient | ±15%, -55°C to +125°C |
| | | +15% - 56%, -55ºC to +200°C |

**Capacitance Test** (MIL-STD-202 Method 305)
25°C, 1.0±0.2 Vrms (open circuit voltage) at 1KHz

**Dissipation Factor 25°C**
C0G: 0.15% Max @ 25°C, 1.0±0.2 Vrms (open circuit voltage) at 1KHz
VHT/X7R: 2.5% Max @ 25°C, 1.0±0.2 Vrms (open circuit voltage) at 1KHz

**Insulation Resistance 25°C** (MIL-STD-202 Method 302)
100K MΩ or 1000 MΩ-µF, whichever is less.

**Insulation Resistance 125°C** (MIL-STD-202 Method 302)
10K MΩ or 100 MΩ-µF, whichever is less.

**Insulation Resistance 200°C** (MIL-STD-202 Method 302)
1K MΩ or 10 MΩ -µF, whichever is less.

**Dielectric Withstanding Voltage 25°C** (Flash Test)
250% rated voltage for 5 seconds with 50 mA max charging current. (500 Volt units @ 750 VDC)

**Moisture Resistance** (MIL-STD-202 Method 106)
Ten cycles with no voltage applied.

**Thermal Shock** (MIL-STD-202 Method 107, Condition A)

**Immersion Cycling** (MIL-STD-202 Method 104, Condition B)

**Resistance To Solder Heat** (MIL-STD-202, Method 210, Condition B, for 20 seconds)

**Not RoHS Compliant**

## HOW TO ORDER

**AVX Styles: SMX1, SMX2, SMX3, SMX4, SMX5, SMX6**

| SMX | 1 | 7 | C | 106 | M | A | N | 650 |
|---|---|---|---|---|---|---|---|---|
| **AVX Style** | **Size** | **Voltage** | **Temperature Coefficient** | **Capacitance Code** | **Capacitance Tolerance** | **Test Level** | **Termination** | **Height** |
| SMX = Uncoated | See Dimensions chart | 25 = 3<br>50V = 5<br>100V = 1<br>200V = 2<br>500V = 7 | C0G = A<br>VHT/X7R = C | (2 significant digits + number of zeros)<br>10 pF = 100<br>100 pF = 101<br>1,000 pF = 102<br>22,000 pF = 223<br>220,000 pF = 224<br>1µF = 105<br>10 µF = 106<br>100 µF = 107 | C0G:<br>J = ±5%<br>K = ±10%<br>M = ±20%<br>VHT/X7R:<br>K = ±10%<br>M = ±20%<br>Z = +80%, -20% | A = Standard | N = Straight Lead<br>J = Leads formed in<br>L = Leads formed out<br>P = P Style Leads<br>Z = Z Style Leads | Max Dimension "A"<br>120 = 0.120"<br>240 = 0.240"<br>360 = 0.360"<br>480 = 0.480"<br>650 = 0.650" |

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

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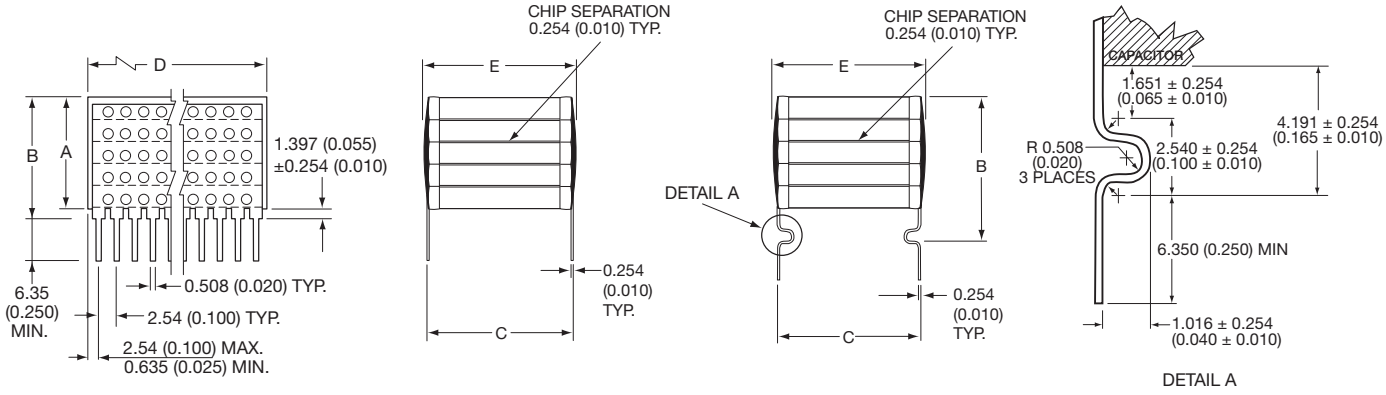
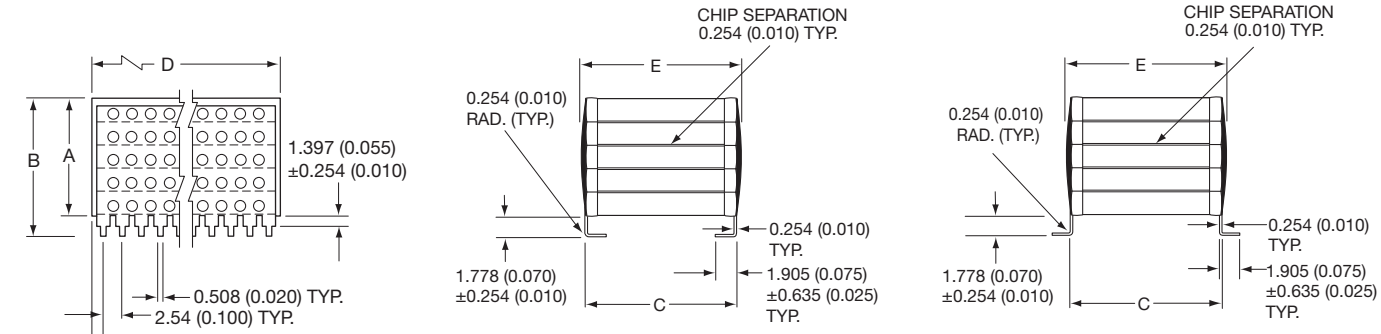



**"N" STYLE LEADS**

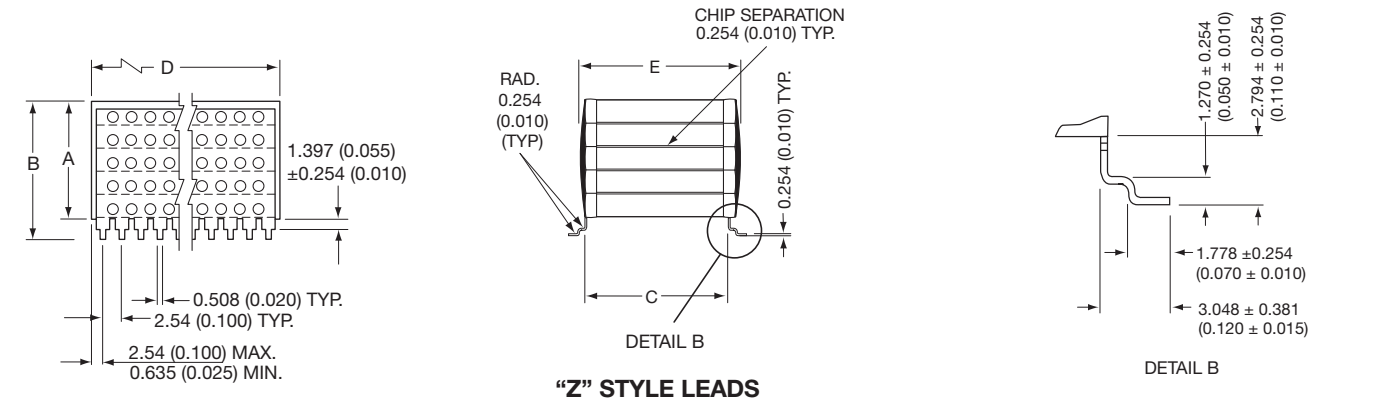
**"P" STYLE LEADS**

DETAIL A




**"J" STYLE LEADS**

**"L" STYLE LEADS**




**"Z" STYLE LEADS**

DETAIL B

## DIMENSIONS

**millimeters (inches)**

| Style | A (max.) | B (max.) | C ±.635 (±0.025) | D ±.635 (±0.025) | E (max.) | No. of Leads per side |
|---|---|---|---|---|---|---|
| SMX1 | See page 46 for maximum "A" Dimension | For "N" Style Leads: "A" Dimension Plus 1.651 (0.065)<br>For "J" & "L" Style Leads: "A" Dimension Plus 2.032 (0.080)<br>For "P" Style Leads: "A" Dimension Plus 4.445 (0.175)<br>For "Z" Style Leads: "A" Dimension Plus 3.048 (0.120) | 11.4 (0.450) | 52.1 (2.050) | 12.7 (0.500) | 20 |
| SMX2 | | | 20.3 (0.800) | 38.4 (1.510) | 22.1 (0.870) | 15 |
| SMX3 | | | 11.4 (0.450) | 26.7 (1.050) | 12.7 (0.500) | 10 |
| SMX4 | | | 10.2 (0.400) | 10.2 (0.400) | 11.2 (0.440) | 4 |
| SMX5 | | | 6.35 (0.250) | 6.35 (0.250) | 7.62 (0.300) | 3 |
| SMX6 | | | 31.8 (1.250) | 52.1 (2.050) | 34.3 (1.350) | 20 |

# SMPS Stacked MLC Capacitors

## SMX Style for High Temperature Applications up to 200ºC

### Max Capacitance (µF) Available Versus Style with Height (A) of 0.120" - 3.05mm

| AVX STYLE | SMX1 _ _ _ _ _ _ AN120 | | | | | SMX2 _ _ _ _ _ _ AN120 | | | | | SMX3 _ _ _ _ _ _ AN120 | | | | | SMX4 _ _ _ _ _ _ AN120 | | | | | SMX5 _ _ _ _ _ _ AN120 | | | | | SMX6 _ _ _ _ _ _ AN120 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V |
| C0G | 1.0 | .70 | .40 | .18 | .068 | 1.2 | 1.0 | .60 | .26 | .10 | .50 | .40 | .20 | .09 | .033 | .16 | .13 | .07 | .02 | .01 | .05 | .04 | .02 | .01 | .0039 | 3.2 | 2.4 | 1.3 | .50 | .20 |
| VHT/X7R | – | 18 | 10 | 3.9 | 1.8 | – | 27 | 15 | 5.6 | 2.7 | 12 | 8.2 | 4.7 | 1.8 | .82 | 3.9 | 2.7 | 1.5 | .56 | .27 | 1.5 | 1.0 | .56 | .22 | .10 | – | 56 | 33 | 12 | 5.6 |

### Max Capacitance (µF) Available Versus Style with Height (A) of 0.240" - 6.10mm

| AVX STYLE | SMX1 _ _ _ _ _ _ AN240 | | | | | SMX2 _ _ _ _ _ _ AN240 | | | | | SMX3 _ _ _ _ _ _ AN240 | | | | | SMX4 _ _ _ _ _ _ AN240 | | | | | SMX5 _ _ _ _ _ _ AN240 | | | | | SMX6 _ _ _ _ _ _ AN240 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V |
| C0G | 2.0 | 1.4 | .80 | .36 | .13 | 2.4 | 2.0 | 1.2 | .52 | .20 | 1.0 | .80 | .40 | .18 | .068 | .33 | .26 | .14 | .05 | .02 | .10 | .08 | .05 | .02 | .0078 | 6.4 | 4.8 | 2.6 | 1.0 | .40 |
| VHT/X7R | – | 33 | 18 | 6.8 | 3.3 | – | 47 | 27 | 10 | 4.7 | 22 | 15 | 8.2 | 3.3 | 1.5 | 6.8 | 4.7 | 2.7 | 1.0 | .47 | 2.7 | 1.8 | 1.0 | .39 | .18 | – | 100 | 56 | 22 | 10 |

### Max Capacitance (µF) Available Versus Style with Height (A) of 0.360" - 9.14mm

| AVX STYLE | SMX1 _ _ _ _ _ _ AN360 | | | | | SMX2 _ _ _ _ _ _ AN360 | | | | | SMX3 _ _ _ _ _ _ AN360 | | | | | SMX4 _ _ _ _ _ _ AN360 | | | | | SMX5 _ _ _ _ _ _ AN360 | | | | | SMX6 _ _ _ _ _ _ AN360 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V |
| C0G | 3.0 | 2.1 | 1.2 | .54 | .22 | 3.6 | 3.0 | 1.8 | .78 | .30 | 1.5 | 1.2 | .60 | .27 | .10 | .48 | .39 | .21 | .07 | .03 | .15 | .12 | .07 | .03 | .011 | 10 | 7.2 | 3.9 | 1.5 | .60 |
| VHT/X7R | – | 47 | 27 | 10 | 4.7 | – | 68 | 39 | 15 | 6.8 | 33 | 22 | 12 | 5.6 | 2.2 | 12 | 6.8 | 3.9 | 1.5 | .68 | 3.9 | 2.7 | 1.5 | .56 | .27 | – | 150 | 82 | 33 | 15 |

### Max Capacitance (µF) Available Versus Style with Height (A) of 0.480" - 12.2mm

| AVX STYLE | SMX1 _ _ _ _ _ _ AN480 | | | | | SMX2 _ _ _ _ _ _ AN480 | | | | | SMX3 _ _ _ _ _ _ AN480 | | | | | SMX4 _ _ _ _ _ _ AN480 | | | | | SMX5 _ _ _ _ _ _ AN480 | | | | | SMX6 _ _ _ _ _ _ AN480 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V |
| C0G | 4.0 | 2.8 | 1.6 | .72 | .27 | 4.8 | 4.0 | 2.2 | 1.0 | .40 | 2.0 | 1.6 | .80 | .36 | .130 | .64 | .52 | .28 | .10 | .04 | .20 | .16 | .10 | .04 | .015 | 13 | 9.6 | 5.2 | 2.0 | .80 |
| VHT/X7R | – | 68 | 39 | 15 | 6.8 | – | 100 | 56 | 22 | 10 | 47 | 33 | 18 | 6.8 | 3.3 | 15 | 10 | 5.6 | 2.2 | 1.0 | 5.6 | 3.9 | 2.2 | .82 | .39 | – | 220 | 120 | 47 | 22 |

### Max Capacitance (µF) Available Versus Style with Height (A) of 0.650" - 16.5mm

| AVX STYLE | SMX1 _ _ _ _ _ _ AN650 | | | | | SMX2 _ _ _ _ _ _ AN650 | | | | | SMX3 _ _ _ _ _ _ AN650 | | | | | SMX4 _ _ _ _ _ _ AN650 | | | | | SMX5 _ _ _ _ _ _ AN650 | | | | | SMX6 _ _ _ _ _ _ AN650 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V | 25V | 50V | 100V | 200V | 500V |
| C0G | 5.0 | 3.5 | 2.0 | .90 | .34 | 6.0 | 5.0 | 3.0 | 1.3 | .50 | 2.5 | 2.0 | 1.0 | .45 | .160 | .82 | .65 | .35 | .12 | .05 | .25 | .20 | .12 | .05 | .019 | 16 | 12 | 6.5 | 2.5 | 1.0 |
| VHT/X7R | – | 82 | 47 | 18 | 8.2 | – | 120 | 68 | 27 | 12 | 56 | 39 | 22 | 8.2 | 3.9 | 18 | 12 | 6.8 | 2.7 | 1.2 | 6.8 | 4.7 | 2.7 | 1.0 | .47 | – | 270 | 150 | 56 | 27 |

# Mouser Electronics

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