

# Automotive MLCC



## Automotive

### GENERAL DESCRIPTION

AVX Corporation has supported the Automotive Industry requirements for Multilayer Ceramic Capacitors consistently for more than 10 years. Products have been developed and tested specifically for automotive applications and all manufacturing facilities are QS9000 and VDA 6.4 approved.

As part of our sustained investment in capacity and state of the art technology, we are now transitioning from the established Pd/Ag electrode system to a Base Metal Electrode system (BME).

AVX is using AECQ200 as the qualification vehicle for this transition. A detailed qualification package is available on request and contains results on a range of part numbers including:

- X7R dielectric components containing BME electrode and copper terminations with a Ni/Sn plated overcoat.
- X7R dielectric components, BME electrode with epoxy finish for conductive glue mounting.
- X7R dielectric components BME electrode and soft terminations with a Ni/Sn plated overcoat.
- NP0 dielectric components containing Pd/Ag electrode and silver termination with a Ni/Sn plated overcoat.



### HOW TO ORDER

| 0805                                         | 5                                                                            | A                             | 104                                                       | K                                                                              | 4              | T                                                                  | 2                           | A                |
|----------------------------------------------|------------------------------------------------------------------------------|-------------------------------|-----------------------------------------------------------|--------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------|-----------------------------|------------------|
| Size                                         | Voltage                                                                      | Dielectric                    | Capacitance Code (In pF)                                  | Capacitance Tolerance                                                          | Failure Rate   | Terminations                                                       | Packaging                   | Special Code     |
| 0402<br>0603<br>0805<br>1206<br>1210<br>1812 | 10V = Z<br>16V = Y<br>25V = 3<br>50V = 5<br>100V = 1<br>200V = 2<br>500V = 7 | NP0 = A<br>X7R = C<br>X8R = F | 2 Significant Digits + Number of Zeros<br>e.g. 10µF = 106 | F = ±1% (≥10pF)*<br>G = ±2% (≥10pF)*<br>J = ±5% (≤1µF)<br>K = ±10%<br>M = ±20% | 4 = Automotive | T = Plated Ni and Sn<br>Z = FLEXITERM®**<br>U = Conductive Epoxy** | 2 = 7" Reel<br>4 = 13" Reel | A = Std. Product |

\*NP0 only

\*\*X7R & X8R only

Contact factory for availability of Tolerance Options for Specific Part Numbers.

NOTE: Contact factory for non-specified capacitance values.  
0402 case size available in T termination only.



### COMMERCIAL VS AUTOMOTIVE MLCC PROCESS COMPARISON

|                                                         | Commercial                                                             | Automotive                                                                                                |
|---------------------------------------------------------|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Administrative                                          | Standard Part Numbers.<br>No restriction on who purchases these parts. | Specific Automotive Part Number. Used to control supply of product to Automotive customers.               |
| Design                                                  | Minimum ceramic thickness of 0.020"                                    | Minimum Ceramic thickness of 0.029" (0.74mm) on all X7R product.                                          |
| Dicing                                                  | Side & End Margins = 0.003" min                                        | Side & End Margins = 0.004" min<br>Cover Layers = 0.003" min                                              |
| Lot Qualification (Destructive Physical Analysis - DPA) | As per EIA RS469                                                       | Increased sample plan – stricter criteria.                                                                |
| Visual/Cosmetic Quality                                 | Standard process and inspection                                        | 100% inspection                                                                                           |
| Application Robustness                                  | Standard sampling for accelerated wave solder on X7R dielectrics       | Increased sampling for accelerated wave solder on X7R and NP0 followed by lot by lot reliability testing. |

All Tests have Accept/Reject Criteria 0/1



# Automotive MLCC

## NP0/X7R Dielectric



### FLEXITERM® FEATURES

a) Bend Test

The capacitor is soldered to the PC Board as shown:



b) Temperature Cycle testing

FLEXITERM® has the ability to withstand at least 1000 cycles between -55°C and +125°C

Typical bend test results are shown below:

| Style | Conventional Term | Soft Term |
|-------|-------------------|-----------|
| 0603  | >2mm              | >5        |
| 0805  | >2mm              | >5        |
| 1206  | >2mm              | >5        |

# Automotive MLCC - NP0

## Capacitance Range



|          | 0603 |     |      | 0805 |     |      | 1206 |     |      |      |      | 1210 |     |      |      | 1812 |      |
|----------|------|-----|------|------|-----|------|------|-----|------|------|------|------|-----|------|------|------|------|
|          | 25V  | 50V | 100V | 25V  | 50V | 100V | 25V  | 50V | 100V | 200V | 500V | 25V  | 50V | 100V | 200V | 50V  | 100V |
| 100 10pF | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 120 12   | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 150 15   | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 180 18   | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 220 22   | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 270 27   | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 330 33   | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 390 39   | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 470 47   | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 510 51   | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 560 56   | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 680 68   | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 820 82   | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 101 100  | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 121 120  | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 151 150  | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 181 180  | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 221 220  | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 271 270  | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 331 330  | G    | G   | G    | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 391 390  | G    | G   |      | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 471 470  | G    | G   |      | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 561 560  |      |     |      | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 681 680  |      |     |      | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 821 820  |      |     |      | J    | J   | J    | J    | J   | J    | J    | J    |      |     |      |      |      |      |
| 102 1000 |      |     |      | J    | J   | J    | J    | J   | J    | J    | J    | J    | J   | J    | J    |      |      |
| 122 1200 |      |     |      |      |     |      | J    | J   | J    | J    | J    | J    | J   | M    | M    |      |      |
| 152 1500 |      |     |      |      |     |      | J    | M   | M    | M    | M    | J    | J   | M    | M    |      |      |
| 182 1800 |      |     |      |      |     |      | J    | M   | M    | M    | M    | J    | J   | M    | M    |      |      |
| 222 2200 |      |     |      |      |     |      | J    | M   | M    | M    | M    | J    | J   | M    | M    |      |      |
| 272 2700 |      |     |      |      |     |      | J    | M   |      |      |      | J    | J   | M    |      |      |      |
| 332 3300 |      |     |      |      |     |      | J    | M   |      |      |      | J    | J   | P    |      | K    | K    |
| 392 3900 |      |     |      |      |     |      |      |     |      |      |      | J    | J   | P    |      | K    | K    |
| 472 4700 |      |     |      |      |     |      |      |     |      |      |      | J    | J   | P    |      | K    | K    |
| 103 10nF |      |     |      |      |     |      |      |     |      |      |      |      |     |      |      |      |      |
|          | 25V  | 50V | 100V | 25V  | 50V | 100V | 25V  | 50V | 100V | 200V | 500V | 25V  | 50V | 100V | 200V | 50V  | 100V |
|          | 0603 |     |      | 0805 |     |      | 1206 |     |      |      |      | 1210 |     |      |      | 1812 |      |

| Letter         | A               | C               | E               | G               | J               | K               | M               | N               | P               | Q               | X               | Y               | Z               |
|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Max. Thickness | 0.33<br>(0.013) | 0.56<br>(0.022) | 0.71<br>(0.028) | 0.90<br>(0.035) | 0.94<br>(0.037) | 1.02<br>(0.040) | 1.27<br>(0.050) | 1.40<br>(0.055) | 1.52<br>(0.060) | 1.78<br>(0.070) | 2.29<br>(0.090) | 2.54<br>(0.100) | 2.79<br>(0.110) |
|                | PAPER           |                 |                 |                 |                 | EMBOSSED        |                 |                 |                 |                 |                 |                 |                 |

 = Under Development

# Automotive MLCC - X7R

## Capacitance Range



|     |             | 0402 |     |     | 0603 |     |     |      |      | 0805 |     |     |      |      | 1206 |     |     |      |      |      | 1210 |     |     |      | 1812 |      |     | 2220 |   |
|-----|-------------|------|-----|-----|------|-----|-----|------|------|------|-----|-----|------|------|------|-----|-----|------|------|------|------|-----|-----|------|------|------|-----|------|---|
|     |             | 16V  | 25V | 50V | 16V  | 25V | 50V | 100V | 200V | 16V  | 25V | 50V | 100V | 200V | 16V  | 25V | 50V | 100V | 200V | 500V | 16V  | 25V | 50V | 100V | 50V  | 100V | 25V | 50V  |   |
| 221 | Cap<br>(nF) | .22  |     |     |      |     |     |      |      |      |     |     |      |      |      |     |     |      |      |      |      |     |     |      |      |      |     |      |   |
| 271 |             | .27  |     |     |      |     |     |      |      |      |     |     |      |      |      |     |     |      |      |      |      |     |     |      |      |      |     |      |   |
| 331 |             | .33  |     |     |      |     |     |      |      |      |     |     |      |      |      |     |     |      |      |      |      |     |     |      |      |      |     |      |   |
| 391 |             | .39  |     |     |      |     |     |      |      |      |     |     |      |      |      |     |     |      |      |      |      |     |     |      |      |      |     |      |   |
| 471 |             | .47  |     |     |      |     |     |      |      |      |     |     |      |      |      |     |     |      |      |      |      |     |     |      |      |      |     |      |   |
| 561 |             | .56  |     |     |      |     |     |      |      |      |     |     |      |      |      |     |     |      |      |      |      |     |     |      |      |      |     |      |   |
| 681 |             | .68  |     |     |      |     |     |      |      |      |     |     |      |      |      |     |     |      |      |      |      |     |     |      |      |      |     |      |   |
| 821 |             | .82  |     |     |      |     |     |      |      |      |     |     |      |      |      |     |     |      |      |      |      |     |     |      |      |      |     |      |   |
| 102 | 1           |      |     |     | G    | G   | G   | G    | G    | J    | J   | J   | J    | J    | J    | J   | J   | J    | J    | J    | J    | K   | K   | K    | K    | K    | K   |      |   |
| 182 | 1.8         |      |     |     | G    | G   | G   | G    |      | J    | J   | J   | J    | J    | J    | J   | J   | J    | J    | J    | J    | K   | K   | K    | K    | K    | K   |      |   |
| 222 | 2.2         |      |     |     | G    | G   | G   | G    |      | J    | J   | J   | J    | J    | J    | J   | J   | J    | J    | J    | J    | K   | K   | K    | K    | K    | K   |      |   |
| 332 | 3.3         |      |     |     | G    | G   | G   | G    |      | J    | J   | J   | J    | J    | J    | J   | J   | J    | J    | J    | J    | K   | K   | K    | K    | K    | K   |      |   |
| 472 | 4.7         |      |     |     | G    | G   | G   | G    |      | J    | J   | J   | J    | J    | J    | J   | J   | J    | J    | J    | J    | K   | K   | K    | K    | K    | K   |      |   |
| 103 | 10          |      |     |     | G    | G   | G   | G    |      | J    | J   | J   | J    | J    | J    | J   | J   | J    | J    | J    | J    | K   | K   | K    | K    | K    | K   |      |   |
| 123 | 12          |      |     |     | G    | G   | G   |      |      | J    | J   | J   | M    |      | J    | J   | J   | J    | J    | J    |      | K   | K   | K    | K    | K    | K   |      |   |
| 153 | 15          |      |     |     | G    | G   | G   |      |      | J    | J   | J   | M    |      | J    | J   | J   | J    | J    |      |      | K   | K   | K    | K    | K    | K   |      |   |
| 183 | 18          |      |     |     | G    | G   | G   |      |      | J    | J   | J   | M    |      | J    | J   | J   | J    | J    |      |      | K   | K   | K    | K    | K    | K   |      |   |
| 223 | 22          |      |     |     | G    | G   | G   |      |      | J    | J   | J   | M    |      | J    | J   | J   | J    | J    |      |      | K   | K   | K    | K    | K    | K   |      |   |
| 273 | 27          |      |     |     | G    | G   | G   |      |      | J    | J   | J   | M    |      | J    | J   | J   | J    | J    |      |      | K   | K   | K    | K    | K    | K   |      |   |
| 333 | 33          |      |     |     | G    | G   | G   |      |      | J    | J   | J   | M    |      | J    | J   | J   | J    | J    |      |      | K   | K   | K    | K    | K    | K   |      |   |
| 473 | 47          |      |     |     | G    | G   | G   |      |      | J    | J   | J   | M    |      | J    | J   | J   | M    | J    |      |      | K   | K   | K    | K    | K    | K   |      |   |
| 563 | 56          |      |     |     | G    | G   | G   |      |      | J    | J   | J   | M    |      | J    | J   | J   | M    | J    |      |      | K   | K   | K    | M    | K    | K   |      |   |
| 683 | 68          |      |     |     | G    | G   | G   |      |      | J    | J   | J   | M    |      | J    | J   | J   | M    | J    |      |      | K   | K   | K    | M    | K    | K   |      |   |
| 823 | 82          |      |     |     | G    | G   | G   |      |      | J    | J   | J   | M    |      | J    | J   | J   | M    | J    |      |      | K   | K   | K    | M    | K    | K   |      |   |
| 104 | 100         |      |     |     | G    | G   | G   |      |      | J    | J   | M   | M    |      | J    | J   | J   | M    | J    |      |      | K   | K   | K    | M    | K    | K   |      |   |
| 124 | 120         |      |     |     |      |     |     |      |      | J    | J   | M   |      |      | J    | J   | M   | M    |      |      |      | K   | K   | K    | P    | K    | K   |      |   |
| 154 | 150         |      |     |     |      |     |     |      |      | M    | N   | M   |      |      | J    | J   | M   | M    |      |      |      | K   | K   | K    | P    | K    | K   |      |   |
| 224 | 220         |      |     |     |      |     |     |      |      | M    | N   | M   |      |      | J    | M   | M   | Q    |      |      |      | M   | M   | M    | P    | M    | M   |      |   |
| 334 | 330         |      |     |     |      |     |     |      |      | N    | N   | M   |      |      | J    | M   | P   | Q    |      |      |      | P   | P   | P    | Q    | X    | X   |      |   |
| 474 | 470         |      |     |     |      |     |     |      |      | N    | N   | M   |      |      | M    | M   | P   | Q    |      |      |      | P   | P   | P    | Q    | X    | X   |      |   |
| 684 | 680         |      |     |     |      |     |     |      |      | N    | N   |     |      |      | M    | Q   | Q   | Q    |      |      |      | P   | P   | Q    | X    | X    | X   |      |   |
| 105 | Cap<br>(μF) | 1    |     |     |      |     |     |      |      | N    | N   |     |      |      | M    | Q   | Q   | Q    |      |      |      | P   | Q   | Q    | X    | X    | X   |      |   |
| 155 |             | 1.5  |     |     |      |     |     |      |      |      |     |     |      |      | Q    | Q   |     |      |      |      |      | P   | Q   | Z    | Z    | X    | X   |      |   |
| 225 |             | 2.2  |     |     |      |     |     |      |      |      |     |     |      |      | Q    | Q   |     |      |      |      |      | X   | Z   | Z    | Z    | Z    | Z   |      |   |
| 335 |             | 3.3  |     |     |      |     |     |      |      |      |     |     |      |      |      |     |     |      |      |      |      | X   | Z   | Z    |      | Z    |     |      |   |
| 475 |             | 4.7  |     |     |      |     |     |      |      |      |     |     |      |      |      |     |     |      |      |      |      | X   | Z   | Z    |      | Z    |     |      |   |
| 106 |             | 10   |     |     |      |     |     |      |      |      |     |     |      |      |      |     |     |      |      |      |      |     |     |      |      |      |     |      | Z |
| 226 |             | 22   |     |     |      |     |     |      |      |      |     |     |      |      |      |     |     |      |      |      |      |     |     |      |      |      |     |      | Z |
|     |             | 16V  | 25V | 50V | 16V  | 25V | 50V | 100V | 200V | 16V  | 25V | 50V | 100V | 200V | 16V  | 25V | 50V | 100V | 200V | 500V | 16V  | 25V | 50V | 100V | 50V  | 100V | 25V | 50V  |   |
|     |             | 0402 |     |     | 0603 |     |     |      |      | 0805 |     |     |      |      | 1206 |     |     |      |      |      | 1210 |     |     |      | 1812 |      |     | 2220 |   |

 = Under Development

| Letter         | A               | C               | E               | G               | J               | K               | M               | N               | P               | Q               | X               | Y               | Z               |
|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Max. Thickness | 0.33<br>(0.013) | 0.56<br>(0.022) | 0.71<br>(0.028) | 0.90<br>(0.035) | 0.94<br>(0.037) | 1.02<br>(0.040) | 1.27<br>(0.050) | 1.40<br>(0.055) | 1.52<br>(0.060) | 1.78<br>(0.070) | 2.29<br>(0.090) | 2.54<br>(0.100) | 2.79<br>(0.110) |
| PAPER          |                 |                 |                 |                 |                 | EMBOSSED        |                 |                 |                 |                 |                 |                 |                 |

# Automotive MLCC - X8R



## Capacitance Range

| SIZE |            | 0603 |     | 0805 |     | 1206 |     |
|------|------------|------|-----|------|-----|------|-----|
|      | WVDC       | 25V  | 50V | 25V  | 50V | 25V  | 50V |
| 271  | Cap 270    | G    | G   |      |     |      |     |
| 331  | (pF) 330   | G    | G   | J    | J   |      |     |
| 471  | 470        | G    | G   | J    | J   |      |     |
| 681  | 680        | G    | G   | J    | J   |      |     |
| 102  | 1000       | G    | G   | J    | J   | J    | J   |
| 152  | 1500       | G    | G   | J    | J   | J    | J   |
| 182  | 1800       | G    | G   | J    | J   | J    | J   |
| 222  | 2200       | G    | G   | J    | J   | J    | J   |
| 272  | 2700       | G    | G   | J    | J   | J    | J   |
| 332  | 3300       | G    | G   | J    | J   | J    | J   |
| 392  | 3900       | G    | G   | J    | J   | J    | J   |
| 472  | 4700       | G    | G   | J    | J   | J    | J   |
| 562  | 5600       | G    | G   | J    | J   | J    | J   |
| 682  | 6800       | G    | G   | J    | J   | J    | J   |
| 822  | 8200       | G    | G   | J    | J   | J    | J   |
| 103  | Cap 0.01   | G    | G   | J    | J   | J    | J   |
| 123  | (μF) 0.012 | G    | G   | J    | J   | J    | J   |
| 153  | 0.015      | G    | G   | J    | J   | J    | J   |
| 183  | 0.018      | G    | G   | J    | J   | J    | J   |
| 223  | 0.022      | G    | G   | J    | J   | J    | J   |
| 273  | 0.027      | G    | G   | J    | J   | J    | J   |
| 333  | 0.033      | G    | G   | J    | J   | J    | J   |
| 393  | 0.039      | G    | G   | J    | J   | J    | J   |
| 473  | 0.047      | G    | G   | J    | J   | J    | J   |
| 563  | 0.056      | G    |     | N    | N   | M    | M   |
| 683  | 0.068      | G    |     | N    | N   | M    | M   |
| 823  | 0.082      |      |     | N    | N   | M    | M   |
| 104  | 0.1        |      |     | N    | N   | M    | M   |
| 124  | 0.12       |      |     | N    | N   | M    | M   |
| 154  | 0.15       |      |     | N    | N   | M    | M   |
| 184  | 0.18       |      |     | N    |     | M    | M   |
| 224  | 0.22       |      |     | N    |     | M    | M   |
| 274  | 0.27       |      |     |      |     | M    | M   |
| 334  | 0.33       |      |     |      |     | M    | M   |
| 394  | 0.39       |      |     |      |     | M    |     |
| 474  | 0.47       |      |     |      |     | M    |     |
| 684  | 0.68       |      |     |      |     |      |     |
| 824  | 0.82       |      |     |      |     |      |     |
| 105  | 1          |      |     |      |     |      |     |
| SIZE |            | 0603 |     | 0805 |     | 1206 |     |
|      | WVDC       | 25V  | 50V | 25V  | 50V | 25V  | 50V |

| Letter         | A               | C               | E               | G               | J               | K               | M               | N               | P               | Q               | X               | Y               | Z               |
|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Max. Thickness | 0.33<br>(0.013) | 0.56<br>(0.022) | 0.71<br>(0.028) | 0.90<br>(0.035) | 0.94<br>(0.037) | 1.02<br>(0.040) | 1.27<br>(0.050) | 1.40<br>(0.055) | 1.52<br>(0.060) | 1.78<br>(0.070) | 2.29<br>(0.090) | 2.54<br>(0.100) | 2.79<br>(0.110) |
|                | PAPER           |                 |                 |                 |                 | EMBOSSED        |                 |                 |                 |                 |                 |                 |                 |

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