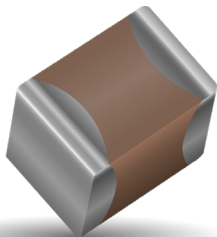


# Automotive MLCC

## General Specifications



### GENERAL DESCRIPTION

KYOCERA AVX has supported the Automotive Industry requirements for Multilayer Ceramic Capacitors consistently for more than 25 years. Products have been developed and tested specifically for automotive applications and all manufacturing facilities are QS9000 and VDA 6.4 approved.

KYOCERA 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.

### HOW TO ORDER

| 0805                                                        | 5                                                                                                                     | A                                                  | 104                                                                                      | K                                                                                                                                                                                                                                                                                                           | 4                                       | T                                                                                                                             | 2                                               | A                                      |
|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|----------------------------------------|
| <b>Size</b><br>0402<br>0603<br>0805<br>1206<br>1210<br>1812 | <b>Voltage</b><br>6.3V = 6<br>10V = Z<br>16V = Y<br>25V = 3<br>35V = D<br>50V = 5<br>100V = 1<br>200V = 2<br>500V = 7 | <b>Dielectric</b><br>NP0 = A<br>X7R = C<br>X8R = F | <b>Capacitance Code (In pF)</b><br>2 Sig. Digits +<br>Number of Zeros<br>e.g. 10 F = 106 | <b>Capacitance Tolerance</b><br>B = $\pm 0.1\text{pF}$ ( $<10\text{pF}$ )*<br>C = $\pm 0.25\text{pF}$ ( $<10\text{pF}$ )*<br>D = $\pm 0.5\text{pF}$ ( $<10\text{pF}$ )*<br>F = $\pm 1\%$ *<br>G = $\pm 2\%$ *<br>J = $\pm 5\%$ ( $\leq 1\mu\text{F}$ )<br>K = $\pm 10\%$<br>M = $\pm 20\%$<br><br>*NPO only | <b>Failure Rate</b><br><br>4=Automotive | <b>Terminations</b><br>T = Plated Ni and Sn<br>Z = FLEXITERM <sup>®</sup> **<br>U = Conductive Epo<br><br>**X7R      X8R only | <b>Packaging</b><br>2 = 7" Reel<br>4 = 13" Reel | <b>Special Code</b><br>A = Std.Product |

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                                                                                                |
|----------------------------------------------------------------|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>Administrative</b>                                          | Standard Part Numbers.<br>No restriction on who purchases these parts. | Specific Automotive Part Number. Used to control supply of product to Automotive customers.               |
| <b>Lot Qualification (Destructive Physical Analysis - DPA)</b> | As per EIA RS469                                                       | Increased sample plan stricter criteria.                                                                  |
| <b>Visual/Cosmetic Quality</b>                                 | Standard process and inspection                                        | 100% inspection                                                                                           |
| <b>Application Robustness</b>                                  | 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. |

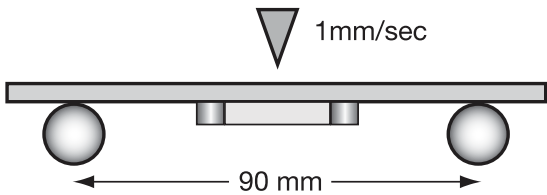
All Tests have Accept/Reject Criteria 0/1

Automotive MLCC  
NP0/X7R Dielectric



FLEXITERM FEATURES

- a) Bend Test  
The capacitor is soldered to the PC Board as shown:



Typical bend test results are shown below:

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

- a) Temperature Cycle testing  
FLEXITERM® has the ability to withstand at least 1000 cycles between -55°C and +125°C

Automotive MLCC-NP0

Capacitance Range



| Case Size       |             | 0402                           |    |     |    | 0603                           |     |     |     |    | 0805                           |     |     |     |     |     |    | 1206                           |     |     |     |     |     |      | 1210                           |     |     |     |     |     |      |  |
|-----------------|-------------|--------------------------------|----|-----|----|--------------------------------|-----|-----|-----|----|--------------------------------|-----|-----|-----|-----|-----|----|--------------------------------|-----|-----|-----|-----|-----|------|--------------------------------|-----|-----|-----|-----|-----|------|--|
| Length (L)      | mm<br>(in.) | 1.00 ± 0.10<br>(0.040 ± 0.004) |    |     |    | 1.60 ± 0.15<br>(0.063 ± 0.006) |     |     |     |    | 2.01 ± 0.20<br>(0.079 ± 0.008) |     |     |     |     |     |    | 3.20 ± 0.20<br>(0.126 ± 0.008) |     |     |     |     |     |      | 3.20 ± 0.20<br>(0.126 ± 0.008) |     |     |     |     |     |      |  |
| Width (W)       | mm<br>(in.) | 0.50 ± 0.10<br>(0.020 ± 0.004) |    |     |    | 0.81 ± 0.15<br>(0.032 ± 0.006) |     |     |     |    | 1.25 ± 0.20<br>(0.049 ± 0.008) |     |     |     |     |     |    | 1.60 ± 0.20<br>(0.063 ± 0.008) |     |     |     |     |     |      | 2.50 ± 0.20<br>(0.098 ± 0.008) |     |     |     |     |     |      |  |
| Terminal<br>(t) | mm<br>(in.) | 0.25 ± 0.15<br>(0.010 ± 0.006) |    |     |    | 0.35 ± 0.15<br>(0.014 ± 0.006) |     |     |     |    | 0.50 ± 0.25<br>(0.020 ± 0.010) |     |     |     |     |     |    | 0.50 ± 0.25<br>(0.020 ± 0.010) |     |     |     |     |     |      | 0.50 ± 0.25<br>(0.020 ± 0.010) |     |     |     |     |     |      |  |
| CAP             | CAP<br>Code | 25                             | 50 | 100 | 25 | 50                             | 100 | 200 | 250 | 25 | 50                             | 100 | 200 | 250 | 500 | 630 | 25 | 50                             | 100 | 200 | 250 | 500 | 630 | 1000 | 50                             | 100 | 200 | 250 | 500 | 630 | 1000 |  |
| 0.5             | 0R5         | C                              | C  | C   | G  | G                              | G   | G   | G   | J  | J                              | J   | J   | J   | J   | J   | J  | J                              | J   | J   | J   | J   | Q   | Q    | J                              | J   | J   | J   | J   | J   | J    |  |
| 1               | 1R0         | C                              | C  | C   | G  | G                              | G   | G   | G   | J  | J                              | J   | J   | J   | J   | J   | J  | J                              | J   | J   | J   | J   | Q   | Q    | J                              | J   | J   | J   | J   | J   | J    |  |
| 5               | 5R0         | C                              | C  | C   | G  | G                              | G   | G   | G   | J  | J                              | J   | J   | J   | J   | J   | J  | J                              | J   | J   | J   | J   | Q   | Q    | J                              | J   | J   | J   | J   | J   | J    |  |
| 10              | 100         | C                              | C  | C   | G  | G                              | G   | G   | G   | J  | J                              | J   | J   | J   | J   | J   | J  | J                              | J   | J   | J   | J   | Q   | Q    | J                              | J   | J   | J   | J   | J   | J    |  |
| 12              | 120         | C                              | C  | C   | G  | G                              | G   | G   | G   | J  | J                              | J   | J   | J   | J   | J   | J  | J                              | J   | J   | J   | J   | Q   | Q    | J                              | J   | J   | J   | J   | J   | J    |  |
| 15              | 150         | C                              | C  | C   | G  | G                              | G   | G   | G   | J  | J                              | J   | J   | J   | J   | J   | J  | J                              | J   | J   | J   | J   | Q   | Q    | J                              | J   | J   | J   | J   | J   | J    |  |
| 18              | 180         | C                              | C  | C   | G  | G                              | G   | G   | G   | J  | J                              | J   | J   | J   | J   | J   | J  | J                              | J   | J   | J   | J   | Q   | Q    | J                              | J   | J   | J   | J   | J   | J    |  |
| 22              | 220         | C                              | C  | C   | G  | G                              | G   | G   | G   | J  | J                              | J   | J   | J   | J   | J   | J  | J                              | J   | J   | J   | J   | Q   | Q    | J                              | J   | J   | J   | J   | J   | J    |  |
| 27              | 270         | C                              | C  | C   | G  | G                              | G   | G   | G   | J  | J                              | J   | J   | J   | J   | J   | J  | J                              | J   | J   | J   | J   | Q   | Q    | J                              | J   | J   | J   | J   | J   | J    |  |
| 33              | 330         | C                              | C  | C   | G  | G                              | G   | G   | G   | J  | J                              | J   | J   | J   | J   | J   | J  | J                              | J   | J   | J   | J   | Q   | Q    | J                              | J   | J   | J   | J   | J   | J    |  |
| 39              | 390         | C                              | C  | C   | G  | G                              | G   | G   | G   | J  | J                              | J   | J   | J   | J   | J   | J  | J                              | J   | J   | J   | J   | Q   | Q    | J                              | J   | J   | J   | J   | J   | J    |  |
| 47              | 470         | C                              | C  | C   | G  | G                              | G   | G   | G   | J  | J                              | J   | J   | J   | J   | J   | J  | J                              | J   | J   | J   | J   | Q   | Q    | J                              | J   | J   | J   | J   | J   | J    |  |
| 56              | 560         | C                              | C  | C   | G  | G                              | G   | G   | G   | J  | J                              | J   | J   | J   | N   |     | J  | J                              | J   | J   | J   | J   | Q   | Q    | J                              | J   | J   | J   | J   | J   | J    |  |
| 68              | 680         | C                              | C  | C   | G  | G                              | G   | G   | G   | J  | J                              | J   | J   | J   | N   |     | J  | J                              | J   | J   | J   | J   | Q   | Q    | J                              | J   | J   | J   | J   | J   | J    |  |
| 82              | 820         | C                              | C  | C   | G  | G                              | G   | G   | G   | J  | J                              | J   | J   | J   | N   |     | J  | J                              | J   | J   | J   | J   | Q   | Q    | N                              | N   | N   | N   | N   | N   | N    |  |
| 100             | 101         | C                              | C  | C   | G  | G                              | G   | G   | G   | J  | J                              | J   | J   | J   | N   |     | J  | J                              | J   | J   | J   | J   | Q   | Q    | N                              | N   | N   | N   | N   | N   | N    |  |
| 120             | 121         |                                |    |     | G  | G                              | G   |     |     | J  | J                              | J   | J   | J   | N   |     | J  | J                              | J   | J   | J   | J   | Q   | Q    | N                              | N   | N   | N   | P   | P   | X    |  |
| 150             | 151         |                                |    |     | G  | G                              | G   |     |     | J  | J                              | J   | J   | J   | N   |     | J  | J                              | J   | J   | J   | J   | Q   | Q    | N                              | N   | N   | N   | P   | P   | X    |  |
| 180             | 181         |                                |    |     | G  | G                              | G   |     |     | J  | J                              | J   | J   | J   | N   |     | J  | J                              | J   | J   | J   | J   | Q   | Q    | N                              | N   | N   | N   | P   | P   | X    |  |
| 220             | 221         |                                |    |     | G  | G                              | G   |     |     | J  | J                              | J   | J   | J   | N   |     | J  | J                              | J   | J   | J   | J   | Q   | Q    | N                              | N   | N   | N   | P   | P   | X    |  |
| 270             | 271         |                                |    |     | G  | G                              | G   |     |     | J  | J                              | J   | J   | J   | N   |     | J  | J                              | J   | J   | J   | J   | Q   |      | N                              | N   | N   | N   | P   | P   | X    |  |
| 330             | 331         |                                |    |     | G  | G                              | G   |     |     | J  | J                              | J   | J   | J   | N   |     | J  | J                              | J   | J   | J   | J   | Q   |      | N                              | N   | N   | N   | P   | P   | X    |  |
| 390             | 391         |                                |    |     | G  | G                              | G   |     |     | J  | J                              | J   | J   | J   |     |     | J  | J                              | J   | J   | J   | J   | Q   |      | N                              | N   | N   | N   | P   | P   | X    |  |
| 430             | 431         |                                |    |     | G  | G                              |     |     |     | J  | J                              | J   | J   | J   |     |     | J  | J                              | J   | J   | J   | J   | Q   |      | N                              | N   | N   | N   | P   | P   | X    |  |
| 470             | 471         |                                |    |     | G  | G                              |     |     |     | J  | J                              | J   | J   | J   |     |     | J  | J                              | J   | J   | J   | J   | Q   |      | N                              | N   | N   | N   | P   | P   | X    |  |
| 560             | 561         |                                |    |     | G  | G                              |     |     |     | J  | J                              | J   | J   |     |     |     | J  | J                              | J   | J   | M   | Q   | Q   |      | N                              | N   | N   | N   | P   | P   |      |  |
| 680             | 681         |                                |    |     | G  | G                              |     |     |     | J  | J                              | J   | J   |     |     |     | J  | J                              | J   | J   | M   | Q   | Q   |      | N                              | N   | N   | N   | P   | P   |      |  |
| 1,000           | 102         |                                |    |     | G  | G                              |     |     |     | J  | J                              | J   |     |     |     |     | J  | J                              | J   | J   | M   | Q   | Q   |      | N                              | N   | N   | N   | P   | P   | X    |  |
| 1,200           | 122         |                                |    |     | G  | G                              |     |     |     | J  | J                              |     |     |     |     |     | N  | N                              | N   | N   |     |     |     |      | N                              | N   | N   | N   | P   | P   |      |  |
| 1,500           | 152         |                                |    |     | G  | G                              |     |     |     | J  | J                              |     |     |     |     |     | N  | N                              | N   | N   |     |     |     |      | N                              | N   | N   | N   | P   | P   |      |  |
| 2,200           | 222         |                                |    |     | G  |                                |     |     |     | J  | J                              |     |     |     |     |     | J  | J                              | J   | J   | J   | J   | J   |      | N                              | N   | N   | N   | P   | K   | K    |  |
| 2,700           | 272         |                                |    |     | G  |                                |     |     |     |    |                                |     |     |     |     |     | J  | J                              | J   | J   | J   | J   | J   |      |                                |     |     |     | K   | K   |      |  |
| 3,300           | 332         |                                |    |     | G  |                                |     |     |     |    |                                |     |     |     |     |     | M  | M                              | M   | M   | M   | M   | M   |      |                                |     |     |     | K   | K   |      |  |
| 3,900           | 392         |                                |    |     | G  |                                |     |     |     |    |                                |     |     |     |     |     | M  | M                              | M   | M   | M   | M   | M   |      |                                |     |     |     | M   | M   |      |  |
| 4,700           | 472         |                                |    |     | G  |                                |     |     |     |    |                                |     |     |     |     |     | P  | P                              | P   | P   | P   | P   | P   |      |                                |     |     |     | M   | M   |      |  |
| 5,600           | 562         |                                |    |     | G  |                                |     |     |     |    |                                |     |     |     |     |     |    |                                |     |     |     |     |     |      |                                |     |     |     | M   | M   |      |  |
| 6,800           | 682         |                                |    |     | G  |                                |     |     |     |    |                                |     |     |     |     |     |    |                                |     |     |     |     |     |      |                                |     |     |     | N   | N   |      |  |
| 8,200           | 822         |                                |    |     | G  |                                |     |     |     |    |                                |     |     |     |     |     |    |                                |     |     |     |     |     |      |                                |     |     |     | P   | P   |      |  |
| 10,000          | 103         |                                |    |     | G  |                                |     |     |     |    |                                |     |     |     |     |     |    |                                |     |     |     |     |     |      |                                |     |     | X   | X   | X   |      |  |
| 12,000          | 123         |                                |    |     |    |                                |     |     |     |    |                                |     |     |     |     |     |    |                                |     |     |     |     |     |      |                                |     |     | X   |     |     |      |  |
| 15,000          | 153         |                                |    |     |    |                                |     |     |     |    |                                |     |     |     |     |     |    |                                |     |     |     |     |     |      |                                |     |     | X   |     |     |      |  |
| 18,000          | 183         |                                |    |     |    |                                |     |     |     |    |                                |     |     |     |     |     |    |                                |     |     |     |     |     |      |                                |     |     | X   |     |     |      |  |
| 22,000          | 223         |                                |    |     |    |                                |     |     |     |    |                                |     |     |     |     |     |    |                                |     |     |     |     |     |      |                                |     |     | X   |     |     |      |  |
| 27,000          | 273         |                                |    |     |    |                                |     |     |     |    |                                |     |     |     |     |     |    |                                |     |     |     |     |     |      |                                |     |     | X   |     |     |      |  |
| 33,000          | 333         |                                |    |     |    |                                |     |     |     |    |                                |     |     |     |     |     |    |                                |     |     |     |     |     |      |                                |     |     | X   |     |     |      |  |
| 39,000          | 393         |                                |    |     |    |                                |     |     |     |    |                                |     |     |     |     |     |    |                                |     |     |     |     |     |      |                                |     |     |     |     |     |      |  |
| 47,000          | 473         |                                |    |     |    |                                |     |     |     |    |                                |     |     |     |     |     |    |                                |     |     |     |     |     |      |                                |     |     |     |     |     |      |  |
| 56,000          | 563         |                                |    |     |    |                                |     |     |     |    |                                |     |     |     |     |     |    |                                |     |     |     |     |     |      |                                |     |     |     |     |     |      |  |
| 68,000          | 683         |                                |    |     |    |                                |     |     |     |    |                                |     |     |     |     |     |    |                                |     |     |     |     |     |      |                                |     |     |     |     |     |      |  |
| 82,000          | 823         |                                |    |     |    |                                |     |     |     |    |                                |     |     |     |     |     |    |                                |     |     |     |     |     |      |                                |     |     |     |     |     |      |  |
| 100,000         | 104         |                                |    |     |    |                                |     |     |     |    |                                |     |     |     |     |     |    |                                |     |     |     |     |     |      |                                |     |     |     |     |     |      |  |
| CAP             | CAP<br>Code | 25                             | 50 | 100 | 25 | 50                             | 100 | 200 | 250 | 25 | 50                             | 100 | 200 | 250 | 500 | 630 | 25 | 50                             | 100 | 200 | 250 | 500 | 630 | 1000 | 50                             | 100 | 200 | 250 | 500 | 630 | 1000 |  |
| Case Size       |             | 0402                           |    |     |    | 0603                           |     |     |     |    | 0805                           |     |     |     |     |     |    | 1206                           |     |     |     |     |     |      | 1210                           |     |     |     |     |     |      |  |

| 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        |                 |                 |                 |                 |                 |                 |                 |

[illegible]

# Automotive MLCC - X8R

## Capacitance Range



| SIZE      |      |       | 0603        |     |      | 0805        |     |      | 1206        |     |
|-----------|------|-------|-------------|-----|------|-------------|-----|------|-------------|-----|
| Soldering |      |       | Reflow/Wave |     |      | Reflow/Wave |     |      | Reflow/Wave |     |
| WVDC      | WVDC |       | 25V         | 50V | 100V | 25V         | 50V | 100V | 25V         | 50V |
| 472       | pF   | 4700  | G           | G   | G    | J           | J   | J    | J           | J   |
| 562       |      | 5600  | G           | G   | G    | J           | J   | J    | J           | J   |
| 682       |      | 6800  | G           | G   | G    | J           | J   | J    | J           | J   |
| 822       |      | 8200  | G           | G   | G    | J           | J   | J    | J           | J   |
| 103       | uF   | 0.01  | G           | G   | G    | J           | J   | J    | J           | J   |
| 123       |      | 0.012 | G           | G   |      | J           | J   | N    | J           | J   |
| 153       |      | 0.015 | G           | G   |      | J           | J   | N    | J           | J   |
| 183       |      | 0.018 | G           | G   |      | J           | J   | N    | J           | J   |
| 223       |      | 0.022 | G           | G   |      | J           | J   | N    | 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           | M   |
| 474       |      | 0.47  |             |     |      |             |     |      | M           | Q   |
| 684       |      | 0.68  |             |     |      |             |     |      | Q           | Q   |
| 824       |      | 0.82  |             |     |      |             |     |      | Q           | Q   |
| 105       |      | 1     |             |     |      |             |     |      | Q           | Q   |
| WVDC      | WVDC |       | 25V         | 50V | 100V | 25V         | 50V | 100V | 25V         | 50V |
| SIZE      |      |       | 0603        |     |      | 0805        |     |      | 1206        |     |

| 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          |                 |                 |                 |                 |                 | EMBOSS          |                 |                 |                 |                 |                 |                 |                 |