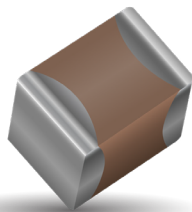


# Automotive MLCC, KAM Series

## 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.

The KAM series are plated with a Nickel/Tin finish. For FLEXITERM® please refer to the KAF series datasheet.

### HOW TO ORDER

| KAM                                               | 31                                                                                                                               | G                                 | R7                                                                                                    | 1H                                                                                                                                                                                                                                         | 475                                                                                                                           | K                                                                                                                                                                                                                                                                                   | U                                   |
|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <b>Series</b><br>AEC-Q200<br>Tin Nickel<br>Finish | <b>Size</b><br>03 = 0201<br>05 = 0402<br>15 = 0603<br>21 = 0805<br>31 = 1206<br>32 = 1210<br>42 = 1808<br>43 = 1812<br>55 = 2220 | <b>Thickness</b><br>See Cap Chart | <b>Dielectric</b><br>CG = COG<br>R7 = X7R<br>S7 = X7S<br>T7 = X7T<br>R8 = X8R<br>L8 = X8L<br>G8 = X8G | <b>Voltage</b><br>0E = 2.5V<br>0G = 4V<br>0J = 6.3V<br>1A = 10V<br>1C = 16V<br>1E = 25V<br>1H = 50V<br>2A = 100V<br>2D = 200V<br>2E = 250V<br>2H = 500V<br>2J = 630V<br>3A = 1000V<br>3N = 1500V<br>3D = 2000V<br>3E = 2500V<br>3U = 3000V | <b>Capacitance Code Code (in pF)</b><br>2 Significant Digits<br>+Number of zeros<br>eg 10uF = 106<br>10nF = 103<br>47pF = 470 | <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 = $\pm 5\%$<br>K = $\pm 10\%$<br>M = $\pm 20\%$<br><br>*COG only | <b>Packaging</b><br>See Table Below |

### PACKAGING CODES

| Packaging Code | Size Code | EIA (inch)  | IEC (mm)    | Width | Pitch | Material | Reel Size  |
|----------------|-----------|-------------|-------------|-------|-------|----------|------------|
| H              | 03 & 05   | 0201 & 0402 | 0603 & 1005 | 8mm   | 2mm   | Paper    | 7" Reel    |
| T              | 15-32     | 0603-1210   | 1608-3225   | 8mm   | 4mm   | Paper    |            |
| U              | 15-32     | 0603-1210   | 1608-3225   | 8mm   | 4mm   | Embossed |            |
| Y              | 42        | 1808        | 4520        | 12mm  | 4mm   | Embossed |            |
| V              | 43 & 55   | 1812 & 2220 | 4532 & 5750 | 12mm  | 8mm   | Embossed |            |
| N              | 03 & 05   | 0201 & 0402 | 0603 & 1005 | 8mm   | 2mm   | Paper    | 13" Reel   |
| M              | 15-32     | 0603-1210   | 1608-3225   | 8mm   | 4mm   | Paper    |            |
| L              | 15-32     | 0603-1210   | 1608-3225   | 8mm   | 4mm   | Embossed |            |
| K              | 42        | 1808        | 4520        | 12mm  | 4mm   | Embossed |            |
| S              | 43 & 55   | 1812 & 2220 | 4532 & 5750 | 12mm  | 8mm   | Embossed |            |
| A              | 15-31     | 0603-1206   | 1608-3216   | 8mm   | 4mm   | Paper    | Maxi Reel* |
| D              | 21 & 31   | 0805 & 1206 | 2012 & 3216 | 8mm   | 4mm   | Embossed |            |

Note: thickness determines paper or plastic embossed packaging

\*please consult factory for maxi reel availability

### DIELECTRIC

| Dielectric | Operating Temperature (°C) | Capacitance Change Rate             |
|------------|----------------------------|-------------------------------------|
| X7R        | -55~+125                   | $\pm 15\%$                          |
| X7T        | -55~+125                   | $\pm 22/-33\%$                      |
| X8R        | -55~+150                   | $\pm 15\%$                          |
| X8L        | -55~+125                   | $\pm 15\%$                          |
| X8L        | +125~+150                  | +15/-40%                            |
| X8G        | -55~+150                   | 0 $\pm 30\text{ppm}/^\circ\text{C}$ |
| NP0        | -55~+125                   | 0 $\pm 30\text{ppm}/^\circ\text{C}$ |

### TYPICAL APPLICATIONS

#### X7R KAM

- High capacitance values
- Broadest voltage and cap offering
- Cameras
- Body control modules
- Infotainment
- ECU
- Climate control

#### X7T KAM

- Motor drive
- Door lock

#### NP0 KAM

- Extreme capacitance stability
- Automotive LED Lighting System
- Key fob
- Audio
- Touchscreen
- GPS
- Safety

#### X8G KAM

- Extreme capacitance stability
- High temperature
- Battery Management Systems
- Powertrain Sensors & Actuators
- Engine management
- Transmission control
- Safety



The Important Information/Disclaimer is incorporated in the catalog where these specifications came from or available online at [www.kyocera-avx.com/disclaimer/](http://www.kyocera-avx.com/disclaimer/) by reference and should be reviewed in full before placing any order.

TDS-SMDMLCC-0033 | Rev 12

# Automotive MLCC, KAM Series

## General Specifications



### 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. |
| 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                          | Increased sampling for accelerated wave solder followed by lot by lot reliability testing.  |

All Tests have Accept/Reject Criteria 0/1



# Automotive MLCC - COG

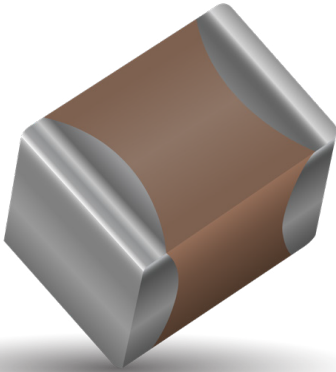
## General Specifications

### TYPICAL APPLICATIONS

- Extreme capacitance stability
- Automotive LED Lighting System
- Key fob
- Audio
- Touchscreen
- GPS
- Safety

### ENGINEERING TOOLS

- Samples
- Technical Articles
- Application Engineering
- Application Support



Automotive MLCC - C0G

Capacitance Range



| Case Size    |          | 0402                           |     |      |      |     |      |      |      | 0603                           |     |      |      |      |      |      |     | 0805                           |      |      |      |      |      |       |     | 1206                           |      |      |      |      |       |     |      | 1210                           |   |  |  |  |  |  |  | 1812                           |  |  |
|--------------|----------|--------------------------------|-----|------|------|-----|------|------|------|--------------------------------|-----|------|------|------|------|------|-----|--------------------------------|------|------|------|------|------|-------|-----|--------------------------------|------|------|------|------|-------|-----|------|--------------------------------|---|--|--|--|--|--|--|--------------------------------|--|--|
| Length (L)   | mm (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) |   |  |  |  |  |  |  | 4.5 ± 0.3<br>(0.177 ± 0.012)   |  |  |
| Width (W)    | mm (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) |   |  |  |  |  |  |  | 3.2 ± 0.2<br>(0.126 ± 0.008)   |  |  |
| Terminal (t) | mm (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) |   |  |  |  |  |  |  | 0.61 ± 0.36<br>(0.024 ± 0.014) |  |  |
| WVDC         |          | 25V                            | 50V | 100V | 25V  | 50V | 100V | 200V | 250V | 25V                            | 50V | 100V | 200V | 250V | 500V | 630V | 25V | 50V                            | 100V | 200V | 250V | 500V | 630V | 1000V | 50V | 100V                           | 200V | 250V | 500V | 630V | 1000V | 50V | 100V | 250V                           |   |  |  |  |  |  |  |                                |  |  |
| Cap (pF) 0R5 | 0.5      | A                              | A   | A    | A    | A   | A    | A    | A    | B                              | B   | B    | B    | B    | B    | B    |     | B                              | B    | B    | B    | B    | B    | G     | Q   | Q                              | Q    | Q    | Q    | Q    | Q     | Q   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 1R0          | 1.0      | A                              | A   | A    | A    | A   | A    | A    | A    | B                              | B   | B    | B    | B    | B    | B    |     | B                              | B    | B    | B    | B    | B    | G     | Q   | Q                              | Q    | Q    | Q    | Q    | Q     | Q   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 100          | 10       | A                              | A   | A    | A    | A   | A    | A    | A    | B                              | B   | B    | B    | B    | B    | B    |     | B                              | B    | B    | B    | B    | B    | G     | Q   | Q                              | Q    | Q    | Q    | Q    | Q     | Q   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 120          | 12       | A                              | A   | A    | A    | A   | A    | A    | A    | B                              | B   | B    | B    | B    | B    |      |     | B                              | B    | B    | B    | B    | G    | G     | Q   | Q                              | Q    | Q    | Q    | Q    | Q     | Q   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 150          | 15       | A                              | A   | A    | A    | A   | A    | A    | A    | B                              | B   | B    | B    | B    | B    |      |     | B                              | B    | B    | B    | B    | G    | G     | Q   | Q                              | Q    | Q    | Q    | Q    | Q     | Q   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 180          | 18       | A                              | A   | A    | A    | A   | A    | A    | A    | B                              | B   | B    | B    | B    | B    |      |     | B                              | B    | B    | B    | B    | G    | G     | Q   | Q                              | Q    | Q    | Q    | Q    | Q     | Q   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 220          | 22       | A                              | A   | A    | A    | A   | A    | A    | A    | B                              | B   | B    | B    | B    | B    |      |     | B                              | B    | B    | B    | B    | G    | G     | Q   | Q                              | Q    | Q    | Q    | Q    | Q     | Q   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 270          | 27       | A                              | A   | A    | A    | A   | A    | A    | A    | B                              | B   | B    | B    | B    | B    |      |     | B                              | B    | B    | B    | B    | G    | G     | Q   | Q                              | Q    | Q    | Q    | Q    | Q     | Q   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 330          | 33       | A                              | A   | A    | A    | A   | A    | A    | A    | B                              | B   | B    | B    | B    | B    |      |     | B                              | B    | B    | B    | B    | G    | G     | Q   | Q                              | Q    | Q    | Q    | Q    | Q     | Q   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 390          | 39       | A                              | A   | A    |      | A   | A    | A    | A    | B                              | B   | B    | B    | B    | B    |      |     | B                              | B    | B    | B    | B    | G    | G     | Q   | Q                              | Q    | Q    | Q    | Q    | Q     | Q   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 470          | 47       | A                              | A   |      |      | A   | A    | A    | A    | B                              | B   | B    | B    | B    | B    |      |     | B                              | B    | B    | B    | B    | G    | G     | Q   | Q                              | Q    | Q    | Q    | Q    | Q     | Q   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 560          | 56       | A                              | A   |      |      | A   | A    | A    | A    | A                              | B   | B    | B    | B    | A    |      |     | B                              | B    | B    | B    | B    | G    | G     | Q   | Q                              | Q    | Q    | Q    | Q    | Q     | Q   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 680          | 68       | A                              | A   |      |      | A   | A    | A    | A    | A                              | B   | B    | B    | B    | A    |      |     | B                              | B    | B    | B    | B    | G    | G     | Q   | Q                              | Q    | Q    | Q    | Q    | Q     | Q   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 820          | 82       | A                              | A   |      |      | A   | A    | A    | A    | A                              | B   | B    | B    | B    | A    |      |     | B                              | B    | B    | B    | B    | G    | G     | D   | D                              | D    | D    | D    | D    | D     | D   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 101          | 100      | A                              | A   |      |      | A   | A    | A    | A    | A                              | B   | B    | B    | B    | A    |      |     | B                              | B    | B    | B    | B    | G    | G     | D   | D                              | D    | D    | D    | D    | D     | D   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 121          | 120      |                                |     |      |      | A   | A    | A    |      | A                              | B   | B    | B    | B    | A    |      |     | B                              | B    | B    | B    | B    | G    | G     | D   | D                              | D    | D    | F    | F    | F     | K   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 151          | 150      |                                |     |      |      | A   | A    | A    |      | A                              | B   | B    | B    | B    | A    |      |     | B                              | B    | B    | B    | N    | G    | G     | D   | D                              | D    | D    | F    | F    | F     | K   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 181          | 180      |                                |     |      |      | A   | A    | A    |      | A                              | B   | B    | B    | B    | A    |      |     | B                              | B    | B    | B    | N    | G    | G     | D   | D                              | D    | D    | F    | F    | F     | K   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 221          | 220      |                                |     |      |      | A   | A    | A    |      | A                              | B   | B    | B    | B    | A    |      |     | B                              | B    | B    | B    | N    | G    | G     | D   | D                              | D    | D    | F    | F    | F     | K   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 271          | 270      |                                |     |      |      | A   | A    | A    |      | A                              | B   | B    | B    | B    | A    |      |     | B                              | B    | B    | B    | N    | G    |       | D   | D                              | D    | D    | F    | F    | F     | K   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 331          | 330      |                                |     |      |      | A   | A    | A    |      | A                              | B   | B    | B    | B    | A    |      |     | B                              | B    | B    | B    | N    | G    |       | D   | D                              | D    | D    | F    | F    | F     | K   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 391          | 390      |                                |     |      |      | A   | A    | A    |      | A                              | B   | B    | B    | B    | A    |      |     | B                              | B    | B    | B    | N    | G    |       | D   | D                              | D    | D    | F    | F    | F     | K   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 471          | 470      |                                |     |      |      | A   | A    | A*   |      | A                              | B   | B    | B    | B    | A    |      |     | B                              | B    | B    | N    | N    | G    |       | D   | D                              | D    | D    | F    | F    | F     | K   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 561          | 560      |                                |     |      |      | A   | A    | A*   |      | A                              | B   | B    | B    | B    | A    |      |     | B                              | B    | B    | N    | G    | G    |       | D   | D                              | D    | D    | F    | F    | F     | K   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 681          | 680      |                                |     |      |      | A   | A    | A*   |      | A                              | B   | B    | B    | B    | A    |      |     | B                              | B    | B    | N    | G    | G    |       | D   | D                              | D    | D    | F    | F    | F     | K   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 821          | 820      |                                |     |      |      | A*  | A*   | A*   |      | A                              | B   | B    | B    | B    | A    |      |     | B                              | B    | N    | N    | G    | G    |       | D   | D                              | D    | D    | F    | F    | F     | K   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 102          | 1000     |                                |     |      |      | A*  | A*   | A*   |      | A                              | B   | B    | B    | B    | A    |      |     | B                              | B    | N    | N    | G    | G    |       | D   | D                              | D    | D    | F    | F    | K     | K   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 122          | 1200     |                                |     |      |      | A*  | A*   | A*   |      | A                              | B   | B    | B    | B    | A    |      |     | D                              | N    | N    | B    | B    | B    |       | D   | D                              | D    | D    | F    | F    | F     | K   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 152          | 1500     |                                |     |      |      | A*  | A*   | A*   |      | A                              | B   | B    | B    | B    | A    |      |     | D                              | N    | N    | B    | B    | B    |       | D   | D                              | D    | D    | F    | F    | F     | G   | Y    | Y                              | Y |  |  |  |  |  |  |                                |  |  |
| 222          | 2200     |                                |     |      |      | A*  | A*   | A*   |      |                                | B   | A    | B    |      | B    |      |     | B                              | B    | B    | B    | B    | B    |       | D   | D                              | D    | D    | F    | G    | G     | G   |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 272          | 2700     |                                |     |      |      | A*  | A*   |      |      |                                | K   | K    |      | K    |      |      |     | B                              | B    | B    | B    | B    | B    |       | G   | G                              | G    | G    | G    | G    | G     | G   |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 332          | 3300     |                                |     |      |      | A*  | A*   |      |      |                                | K   | K    |      | K    |      |      |     | G                              | G    | G    | G    | G    | G    |       | G   | G                              | G    | G    | G    | G    | G     | G   |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 392          | 3900     |                                |     |      |      | A*  | A*   |      |      |                                | K   | K    |      | K    |      |      |     | G                              | G    | G    | G    | G    | G    |       | G   | G                              | G    | G    | G    | G    | G     | G   |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 472          | 4700     |                                |     |      |      | A*  | A*   |      |      |                                | K   | K    |      | K    |      |      |     | G                              | G    | G    | G    | G    | G    |       | G   | G                              | G    | G    | G    | G    | G     | G   |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 562          | 5600     |                                |     |      |      | A*  | A*   |      |      |                                | K   | K    |      | K    |      |      |     | G                              | G    | G    | G    | G    | G    |       | G   | G                              | G    | G    | G    | G    | G     | G   |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 682          | 6800     |                                |     |      |      | A*  | A*   |      |      |                                | K   | K    |      | K    |      |      |     | G                              | G    | G    | G    | G    | G    |       | K   | K                              | K    | K    | K    | K    | K     | K   |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 822          | 8200     |                                |     |      |      | A*  |      |      |      |                                | K   | K    |      | K    |      |      |     | G                              | G    | G    | G    | G    | G    |       | K   | K                              | K    | K    | K    | K    | K     | K   |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 103          | 10000    |                                |     |      |      | A*  |      |      |      |                                | K   | A    |      |      |      |      |     | G                              | G    | G    | G    | G    | G    |       | K   | K                              | K    | K    | K    | K    | K     | L   |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 123          | 12000    |                                |     |      |      |     |      |      |      |                                |     |      |      |      |      |      |     | G                              | G    | G    | G    | G    |      |       | K   | K                              | K    | K    | K    | K    | K     |     |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 153          | 15000    |                                |     |      |      |     |      |      |      |                                |     |      |      |      |      |      |     | G                              | G    | G    | G    | G    |      |       | L   | L                              | L    | L    | L    | L    | L     |     |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 183          | 18000    |                                |     |      |      |     |      |      |      |                                |     |      |      |      |      |      |     | G                              | G    | G    | G    | G    |      |       | L   | L                              | L    | L    | L    | L    | L     |     |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 223          | 22000    |                                |     |      |      |     |      |      |      |                                |     |      |      |      |      |      |     | G                              | G    | G    |      |      |      |       | L   | L                              | L    | L    | L    | L    | L     |     |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 273          | 27000    |                                |     |      |      |     |      |      |      |                                |     |      |      |      |      |      |     | G                              | G    | G    |      |      |      |       | L   | L                              | L    | L    | L    | L    | L     |     |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 333          | 33000    |                                |     |      |      |     |      |      |      |                                |     |      |      |      |      |      |     | G                              | G    | G    |      |      |      |       | L   | L                              | L    | L    | L    | L    | L     |     |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 393          | 39000    |                                |     |      |      |     |      |      |      |                                |     |      |      |      |      |      |     | G                              | G    |      |      |      |      |       |     |                                |      |      |      |      |       |     |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 473          | 47000    |                                |     |      |      |     |      |      |      |                                |     |      |      |      |      |      |     | G                              | G    |      |      |      |      |       |     |                                |      |      |      |      |       |     |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 563          | 56000    |                                |     |      |      |     |      |      |      |                                |     |      |      |      |      |      |     |                                |      |      |      |      |      |       |     |                                |      |      |      |      |       |     |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 683          | 68000    |                                |     |      |      |     |      |      |      |                                |     |      |      |      |      |      |     |                                |      |      |      |      |      |       |     |                                |      |      |      |      |       |     |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 823          | 82000    |                                |     |      |      |     |      |      |      |                                |     |      |      |      |      |      |     |                                |      |      |      |      |      |       |     |                                |      |      |      |      |       |     |      |                                |   |  |  |  |  |  |  |                                |  |  |
| 104          | 100000   |                                |     |      |      |     |      |      |      |                                |     |      |      |      |      |      |     |                                |      |      |      |      |      |       |     |                                |      |      |      |      |       |     |      |                                |   |  |  |  |  |  |  |                                |  |  |
| WVDC         |          | 25V                            | 50V | 100V | 25V  | 50V | 100V | 200V | 250V | 25V                            | 50V | 100V | 200V | 250V | 500V | 630V | 25V | 50V                            | 100V | 200V | 250V | 500V | 630V | 1000V | 50V | 100V                           | 200V | 250V | 500V | 630V | 1000V | 50V | 100V | 250V                           |   |  |  |  |  |  |  |                                |  |  |
| Case Size    |          | 0402                           |     |      | 0603 |     |      |      | 0805 |                                |     |      |      |      | 1206 |      |     |                                |      |      |      |      | 1210 |       |     |                                |      |      | 1812 |      |       |     |      |                                |   |  |  |  |  |  |  |                                |  |  |

\* These dimensions differ from the standard in table above and are:

0603 L = 1.6 ± 0.2 mm, W = 0.8 ± 0.2 mm

1210 L = 3.2 ± 0.4 mm, W = 2.5 ± 0.3 mm

| Case Size               | 0402<br>(KAM05) | 0603<br>(KAM15) | 0805<br>(KAM21) |     |      | 1206<br>(KAM31) |      |      |      | 1210<br>(KAM32) |      |      |      |      |      | 1812<br>(KAM43) |
|-------------------------|-----------------|-----------------|-----------------|-----|------|-----------------|------|------|------|-----------------|------|------|------|------|------|-----------------|
| Thickness Letter        | A               | A               | B               | K   | A    | B               | N    | D    | G    | Q               | D    | F    | G    | K    | L    | Y               |
| Max Thickness (mm)      | 0.55            | 0.90            | 0.94            | 1.4 | 1.45 | 0.94            | 1.27 | 1.45 | 1.78 | 0.94            | 1.45 | 1.52 | 1.78 | 2.29 | 2.80 | 1.02            |
| Carrier Tape            | PAPER           | PAPER           | PAPER           | EMB | EMB  | PAPER           | EMB  | EMB  | EMB  | PAPER           | EMB  | EMB  | EMB  | EMB  | EMB  | EMB             |
| Packaging Code 7" reel  | H               | T               | T               | U   | U    | T               | U    | U    | U    | T               | U    | U    | U    | U    | U    | V               |
| Packaging Code 13" reel | N               | M               | M               | L   | L    | M               | L    | L    | L    | M               | L    | L    | L    | L    | L    | S               |
|                         | PAPER           |                 |                 |     |      | EMBOSSED (EMB)  |      |      |      |                 |      |      |      |      |      |                 |

# Automotive MLCC - X7R / X7T

## General Specifications

### TYPICAL APPLICATIONS

#### X7R KAM

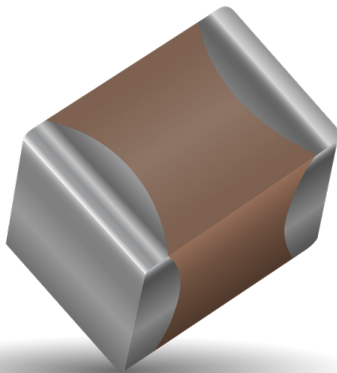
- High capacitance values
- Broadest voltage and cap offering
- Cameras
- Body control modules
- Infotainment
- ECU
- Climate control

#### X7T KAM

- Motor drive
- Door lock

### ENGINEERING TOOLS

- Samples
- Technical Articles
- Application Engineering
- Application Support



## Automotive MLCC - X7R, 4V to 500V

[illegible]

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| Case Size               | 0201(KAM03) |       |  | 0402(KAM05) |       |       | 0603(KAM15) |       |       | 0805(KAM21) |      |      |      | 1206(KAM31) |      |      |      | 1210(KAM32)    |       |      |      |      |      | 1812(KAM43) |      |      |      | 2220(KAM55) |      |      |   |  |
|-------------------------|-------------|-------|--|-------------|-------|-------|-------------|-------|-------|-------------|------|------|------|-------------|------|------|------|----------------|-------|------|------|------|------|-------------|------|------|------|-------------|------|------|---|--|
| Thickness Letter        | A           | C     |  | A           | F     | C     | A           | B     | C     | B           | J    | K    | A    | B           | N    | A    | G    | H              | Q     | C    | F    | G    | K    | L           | Y    | Z    | G    | J           | A    | C    |   |  |
| Max Thickness(mm)       | 0.33        | 0.39  |  | 0.56        | 0.6   | 0.70  | 0.90        | 0.95  | 1.00  | 0.94        | 1.27 | 1.40 | 1.45 | 0.94        | 1.27 | 1.52 | 1.78 | 1.9            | 0.94  | 1.27 | 1.52 | 1.78 | 2.29 | 2.80        | 1.02 | 1.27 | 2.29 | 2.80        | 2.29 | 2.80 |   |  |
| Carrier Tape            | PAPER       | PAPER |  | PAPER       | PAPER | PAPER | PAPER       | PAPER | PAPER | PAPER       | EMB  | EMB  | EMB  | PAPER       | EMB  | EMB  | EMB  | EMB            | PAPER | EMB  | EMB  | EMB  | EMB  | EMB         | EMB  | EMB  | EMB  | EMB         | EMB  | EMB  |   |  |
| Packaging Code 7' reel  | H           | H     |  | H           | H     | H     | T           | T     | T     | T           | U    | U    | U    | T           | U    | U    | U    | U              | T     | U    | U    | U    | U    | U           | V    | V    | V    | V           | V    | V    |   |  |
| Packaging Code 13' reel | N           | N     |  | N           | N     | N     | M           | M     | M     | M           | L    | L    | L    | M           | L    | L    | L    | L              | L     | M    | L    | L    | L    | L           | L    | S    | S    | S           | S    | S    | S |  |
|                         | PAPER       |       |  |             |       |       |             |       |       |             |      |      |      |             |      |      |      | EMBOSSED (EMB) |       |      |      |      |      |             |      |      |      |             |      |      |   |  |



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# Automotive MLCC - X7R, 630V to 3000V

## Capacitance Range



### PREFERRED SIZES ARE SHADED

| Case Size    | 1206        |                              |      |      |      | 1210                         |      |      |      | 1808                           |      |      |      |      |      | 1812                           |      |      |      |      |      | 2220                           |      |      |      |      |      |
|--------------|-------------|------------------------------|------|------|------|------------------------------|------|------|------|--------------------------------|------|------|------|------|------|--------------------------------|------|------|------|------|------|--------------------------------|------|------|------|------|------|
| Soldering    | Reflow/Wave |                              |      |      |      | Reflow/Wave                  |      |      |      | Reflow Only                    |      |      |      |      |      | Reflow Only                    |      |      |      |      |      | Reflow Only                    |      |      |      |      |      |
| (L) Length   | mm<br>(in.) | 3.2 ± 0.2<br>(0.126 ± 0.008) |      |      |      | 3.2 ± 0.2<br>(0.126 ± 0.008) |      |      |      | 4.57 ± 0.25<br>(0.18 ± 0.01)   |      |      |      |      |      | 4.5 ± 0.3<br>(0.177 ± 0.012)   |      |      |      |      |      | 5.7 ± 0.5<br>(0.224 ± 0.02)    |      |      |      |      |      |
| (W) Width    | mm<br>(in.) | 1.6 ± 0.2<br>(0.063 ± 0.008) |      |      |      | 2.5 ± 0.2<br>(0.098 ± 0.008) |      |      |      | 2.03 ± 0.25<br>(0.08 ± 0.01)   |      |      |      |      |      | 3.2 ± 0.2<br>(0.126 ± 0.008)   |      |      |      |      |      | 5 ± 0.4<br>(0.197 ± 0.016)     |      |      |      |      |      |
| (t) Terminal | mm<br>max   | 0.5 ± 0.25<br>(0.02 ± 0.01)  |      |      |      | 0.5 ± 0.25<br>(0.02 ± 0.01)  |      |      |      | 0.61 ± 0.36<br>(0.024 ± 0.014) |      |      |      |      |      | 0.61 ± 0.36<br>(0.024 ± 0.014) |      |      |      |      |      | 0.64 ± 0.39<br>(0.025 ± 0.015) |      |      |      |      |      |
| Voltage (V)  |             | 630                          | 1000 | 1500 | 2000 | 2500                         | 630  | 1000 | 1500 | 2000                           | 630  | 1000 | 1500 | 2000 | 2500 | 3000                           | 630  | 1000 | 1500 | 2000 | 2500 | 3000                           | 630  | 1000 | 1500 | 2000 | 3000 |
| 101          | Cap 100     | B                            | B    | B    | B    | B                            |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |
| 121          | (pF) 120    | B                            | B    | B    | B    | B                            |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |
| 151          | 150         | B                            | B    | B    | B    | B                            |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |
| 181          | 180         | B                            | B    | B    | B    | B                            |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |
| 221          | 220         | B                            | B    | B    | B    | B                            |      |      |      |                                | B    | B    | B    | B    | B    | B                              |      |      |      |      |      |                                |      |      |      |      |      |
| 271          | 270         | B                            | B    | B    | B    | B                            | H    | H    | H    | H                              | B    | B    | B    | B    | B    | B                              |      |      |      |      |      |                                |      |      |      |      |      |
| 331          | 330         | B                            | B    | B    | B    | B                            | H    | H    | H    | H                              | B    | B    | B    | B    | B    | B                              | E    |      |      |      |      |                                |      |      |      |      |      |
| 391          | 390         | B                            | B    | B    | B    | B                            | H    | H    | H    | H                              | B    | B    | B    | B    | B    | B                              | E    |      |      |      |      |                                |      |      |      |      |      |
| 471          | 470         | B                            | B    | B    | B    | B                            | H    | H    | H    | H                              | B    | B    | B    | B    | B    | B                              | E    | E    | E    | E    | E    | E                              |      |      |      |      |      |
| 561          | 560         | B                            | B    | B    | B    | B                            | H    | H    | H    | H                              | B    | B    | B    | B    | B    | B                              | E    | E    | E    | E    | E    | E                              |      |      |      |      |      |
| 681          | 680         | B                            | B    | B    | B    | B                            | H    | H    | H    | H                              | B    | B    | B    | B    | B    | B                              | E    | E    | E    | E    | E    | E                              |      |      |      |      |      |
| 821          | 820         | B                            | B    | B    | B    | B                            | H    | H    | H    | H                              | B    | B    | C    | C    | C    | C                              | E    | E    | E    | E    | E    | E                              |      |      |      |      |      |
| 102          | 1000        | B                            | B    | B    | B    | B                            | H    | H    | H    | H                              | B    | B    | C    | C    | C    | C                              | E    | E    | E    | E    | E    | E                              | Z    | Z    | Z    | Z    | C    |
| 122          | 1220        | D                            | A    | A    | A    |                              | H    | H    | H    | H                              |      |      |      |      |      |                                | F    | F    | F    | F    | F    |                                | Z    | Z    | Z    | Z    | C    |
| 152          | 1500        | D                            | A    | A    | A    |                              | H    | H    | H    | H                              |      |      |      |      |      |                                | F    | F    | F    | F    | F    |                                | Z    | Z    | Z    | Z    | C    |
| 182          | 1800        | D                            | A    | A    |      |                              | H    | H    | H    | H                              |      |      |      |      |      |                                | F    | F    | F    | F    | F    |                                | Z    | Z    | Z    | Z    | C    |
| 222          | 2200        | D                            | A    | A    |      |                              | H    | H    | H    | H                              |      |      |      |      |      |                                | F    | F    | F    | F    | F    |                                | Z    | Z    | Z    | Z    | C    |
| 272          | 2700        | D                            | A    | A    |      |                              | H    | H    | H    | H                              |      |      |      |      |      |                                | F    | F    | F    | F    |      |                                | Z    | Z    | Z    | Z    |      |
| 332          | 3300        | D                            | A    |      |      |                              | H    | H    | H    | H                              |      |      |      |      |      |                                | F    | F    | F    | F    |      |                                | Z    | Z    | Z    | Z    |      |
| 392          | 3900        | D                            | A    |      |      |                              | H    | H    | H    |                                |      |      |      |      |      |                                | F    | F    | F    | F    |      |                                | Z    | Z    | Z    | Z    |      |
| 472          | 4700        | D                            | A    |      |      |                              | H    | H    | H    |                                |      |      |      |      |      |                                | F    | F    | J    | J    |      |                                | Z    | Z    | Z    | Z    |      |
| 562          | 5600        | D                            | A    |      |      |                              | H    | H    | H    |                                |      |      |      |      |      |                                | F    | F    | J    | J    |      |                                | Z    | Z    | Z    | Z    |      |
| 682          | 6800        | A                            | A    |      |      |                              | H    | H    |      |                                |      |      |      |      |      |                                | F    | F    | J    | J    |      |                                | Z    | Z    | Z    | Z    |      |
| 822          | 8200        | A                            |      |      |      |                              | H    | H    |      |                                |      |      |      |      |      |                                | F    | F    | J    | J    |      |                                | Z    | Z    | C    | C    |      |
| 103          | Cap 0.01    | A                            |      |      |      |                              | H    | H    |      |                                |      |      |      |      |      |                                | F    | F    | J    |      |      |                                | C    | C    | C    | C    |      |
| 123          | (μF) 0.012  |                              |      |      |      |                              | H    | H    |      |                                |      |      |      |      |      |                                | F    | F    | J    |      |      |                                | C    | C    | C    | C    |      |
| 153          | 0.015       |                              |      |      |      |                              | H    | H    |      |                                |      |      |      |      |      |                                | F    | F    | J    |      |      |                                | C    | C    | C    | C    |      |
| 183          | 0.018       |                              |      |      |      |                              | H    |      |      |                                |      |      |      |      |      |                                | F    | F    |      |      |      |                                | C    | C    | C    | C    |      |
| 223          | 0.022       |                              |      |      |      |                              | H    |      |      |                                |      |      |      |      |      |                                | F    | F    |      |      |      |                                | C    | C    | C    | C    |      |
| 273          | 0.027       |                              |      |      |      |                              | H    |      |      |                                |      |      |      |      |      |                                | F    | F    |      |      |      |                                | C    | C    | C    |      |      |
| 333          | 0.033       |                              |      |      |      |                              |      |      |      |                                |      |      |      |      |      |                                | F    |      |      |      |      |                                | C    | C    |      |      |      |
| 393          | 0.039       |                              |      |      |      |                              |      |      |      |                                |      |      |      |      |      |                                | F    |      |      |      |      |                                | C    | C    |      |      |      |
| 473          | 0.047       |                              |      |      |      |                              |      |      |      |                                |      |      |      |      |      |                                | F    |      |      |      |      |                                | C    | C    |      |      |      |
| 563          | 0.056       |                              |      |      |      |                              |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |                                | C    | C    |      |      |      |
| 683          | 0.068       |                              |      |      |      |                              |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |                                | C    | C    |      |      |      |
| 823          | 0.082       |                              |      |      |      |                              |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |                                | C    | C    |      |      |      |
| 104          | 0.1         |                              |      |      |      |                              |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |                                | C    | C    |      |      |      |
| 124          | 0.12        |                              |      |      |      |                              |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |                                | C    |      |      |      |      |
| 154          | 0.15        |                              |      |      |      |                              |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |                                | C    |      |      |      |      |
| 224          | 0.22        |                              |      |      |      |                              |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |
| 334          | 0.33        |                              |      |      |      |                              |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |
| 474          | 0.47        |                              |      |      |      |                              |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |
| 684          | 0.68        |                              |      |      |      |                              |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |
| 105          | 1           |                              |      |      |      |                              |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |                                |      |      |      |      |      |
| WVDC         |             | 630                          | 1000 | 1500 | 2000 | 2500                         | 630  | 1000 | 1500 | 2000                           | 630  | 1000 | 1500 | 2000 | 2500 | 3000                           | 630  | 1000 | 1500 | 2000 | 2500 | 3000                           | 630  | 1000 | 1500 | 2000 | 3000 |
| Size         |             | 1206                         |      |      |      |                              | 1210 |      |      |                                | 1808 |      |      |      |      |                                | 1812 |      |      |      |      |                                | 2220 |      |      |      |      |

NOTE: Contact factory for non-specified capacitance values

| Case Size              | 1206(KAM31) |      |      | 1210(KAM32) |      | 1808(KAM42) |                | 1812(KAM43) |      |      | 2220(KAM55) |  |  |
|------------------------|-------------|------|------|-------------|------|-------------|----------------|-------------|------|------|-------------|--|--|
| Thickness Letter       | B           | D    | A    | H           | B    | C           | E              | F           | J    | Z    | C           |  |  |
| Max Thickness          | 0.94        | 1.45 | 1.80 | 1.80        | 1.80 | 2.21        | 1.80           | 2.21        | 2.80 | 2.21 | 2.80        |  |  |
| Carrier Tape           | PAPER       | EMB  | EMB  | EMB         | EMB  | EMB         | EMB            | EMB         | EMB  | EMB  | EMB         |  |  |
| Packaging Code 7"reel  | T           | U    | U    | U           | Y    | Y           | V              | V           | V    | V    | V           |  |  |
| Packaging Code 13"reel | M           | L    | L    | L           | K    | K           | S              | S           | S    | S    | S           |  |  |
|                        | PAPER       |      |      |             |      |             | EMBOSSED (EMB) |             |      |      |             |  |  |

# Automotive MLCC - X8R / X8L

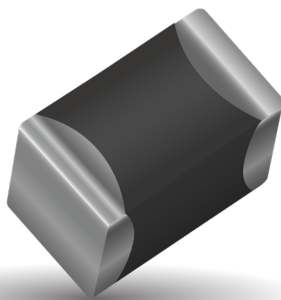
## General Specifications

### TYPICAL APPLICATIONS

- All market sectors with a 150°C requirement
- Automotive on engine applications
- Oil exploration applications
- Hybrid automotive applications
  - Battery control
  - Inverter / converter circuits
  - Motor control applications
  - Water pump
- Hybrid commercial applications
  - Emergency circuits
  - Sensors
  - Temperature regulation

### ENGINEERING TOOLS

- Samples
- Technical Articles
- Application Engineering
- Application Support

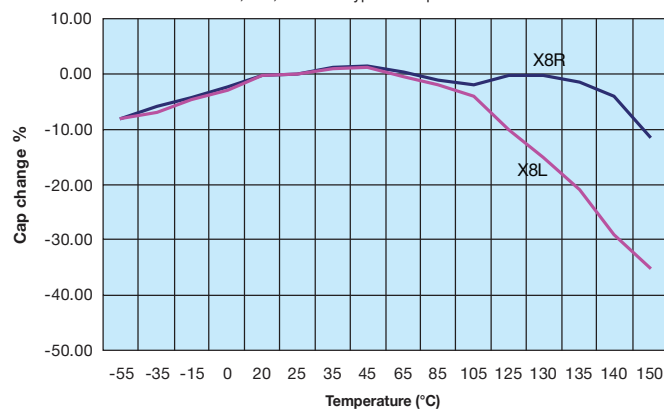


### ADVANTAGES OF X8R AND X8L MLC CAPACITORS

- Both ranges are qualified to the highest automotive AEC-Q200 standards
- Excellent reliability compared to other capacitor technologies
- RoHS compliant
- Low ESR / ESL compared to other technologies
- Tin solder finish
- FLEXITERM® available
- 100V range available

### X8R/X8L Dielectric

0805, 50V, X8R/X8L Typical Temperature Coefficient





# Automotive MLCC - X8R / X8L

## Capacitance Range

KYOCERA AVX has developed a range of multilayer ceramic capacitors designed for use in applications up to 150°C. These capacitors are manufactured with an X8R and an X8L dielectric material. X8R material has capacitance variation of  $\pm 15\%$  between -55°C and +150°C. The X8L material has capacitance variation of  $\pm 15\%$  between -55°C to 125°C to 125°C and +15/40% from +125°C to +150°C.

The need for X8R and X8L performance has been driven by customer requirements for parts that operate at elevated temperatures. They provide a highly reliable capacitor with low loss and stable capacitance over temperature.

They are ideal for automotive under the hood sensors, and various industrial applications. Typical industrial application would be drilling monitoring system. They can also be used as bulk capacitors for high temperature camera modules.

### X8R

| SIZE         |             | 0402                          |  | 0603                           |     |      | 0805                          |     |      | 1206                         |     |      |
|--------------|-------------|-------------------------------|--|--------------------------------|-----|------|-------------------------------|-----|------|------------------------------|-----|------|
| Soldering    |             | Reflow/Wave                   |  | Reflow/Wave                    |     |      | Reflow/Wave                   |     |      | Reflow/Wave                  |     |      |
| (L) Length   | mm<br>(in.) | 1.0 ± 0.2<br>(0.04 ± 0.008)   |  | 1.6 ± 0.15<br>(0.063 ± 0.006)  |     |      | 2.01 ± 0.2<br>(0.079 ± 0.008) |     |      | 3.2 ± 0.2<br>(0.126 ± 0.008) |     |      |
| (W) Width    | mm<br>(in.) | 0.5 ± 0.2<br>(0.02 ± 0.008)   |  | 0.81 ± 0.15<br>(0.032 ± 0.006) |     |      | 1.25 ± 0.2<br>(0.049 ± 0.008) |     |      | 1.6 ± 0.2<br>(0.063 ± 0.008) |     |      |
| (t) Terminal | mm<br>(in.) | 0.25 ± 0.15<br>(0.01 ± 0.006) |  | 0.35 ± 0.15<br>(0.014 ± 0.006) |     |      | 0.5 ± 0.25<br>(0.02 ± 0.01)   |     |      | 0.5 ± 0.25<br>(0.02 ± 0.01)  |     |      |
| WVDC         |             | 50V                           |  | 25V                            | 50V | 100V | 25V                           | 50V | 100V | 25V                          | 50V | 100V |
| 271          | Cap 270     | A                             |  | A                              | A   | A    |                               |     |      |                              |     |      |
| 331          | (pF) 330    | A                             |  | A                              | A   | A    | B                             | B   | B    |                              |     |      |
| 471          | 470         | A                             |  | A                              | A   | A    | B                             | B   | B    |                              |     |      |
| 681          | 680         | A                             |  | A                              | A   | A    | B                             | B   | B    |                              |     |      |
| 102          | 1000        | A                             |  | A                              | A   | A    | B                             | B   | B    | B                            | B   |      |
| 152          | 1500        | A                             |  | A                              | A   | A    | B                             | B   | B    | B                            | B   |      |
| 182          | 1800        | A                             |  | A                              | A   | A    | B                             | B   | B    | B                            | B   |      |
| 222          | 2200        | A                             |  | A                              | A   | A    | B                             | B   | B    | B                            | B   |      |
| 272          | 2700        | A                             |  | A                              | A   | A    | B                             | B   | B    | B                            | B   |      |
| 332          | 3300        | A                             |  | A                              | A   | A    | B                             | B   | B    | B                            | B   |      |
| 392          | 3900        | A                             |  | A                              | A   | A    | B                             | B   | B    | B                            | B   |      |
| 472          | 4700        | A                             |  | A                              | A   | A    | B                             | B   | B    | B                            | B   |      |
| 562          | 5600        |                               |  | A                              | A   | A    | B                             | B   | B    | B                            | B   |      |
| 682          | 6800        |                               |  | A                              | A   | A    | B                             | B   | B    | B                            | B   |      |
| 822          | 8200        |                               |  | A                              | A   | A    | B                             | B   | B    | B                            | B   |      |
| 103          | Cap 0.01    |                               |  | A                              | A   | A    | B                             | B   | B    | B                            | B   |      |
| 123          | (uF) 0.012  |                               |  | A                              | A   |      | B                             | B   | B    | B                            | B   |      |
| 153          | 0.015       |                               |  | A                              | A   |      | B                             | B   | A    | B                            | B   |      |
| 183          | 0.018       |                               |  | A                              | A   |      | B                             | B   | A    | B                            | B   |      |
| 223          | 0.022       |                               |  | A                              | A   |      | B                             | B   | A    | B                            | B   |      |
| 273          | 0.027       |                               |  | A                              | A   |      | B                             | B   |      | B                            | B   |      |
| 333          | 0.033       |                               |  | A                              | A   |      | B                             | B   |      | B                            | B   |      |
| 393          | 0.039       |                               |  | A                              | A   |      | B                             | B   |      | B                            | B   |      |
| 473          | 0.047       |                               |  | A                              | A   |      | B                             | B   |      | B                            | B   |      |
| 563          | 0.056       |                               |  | A                              |     |      | A                             | A   |      | N                            | N   |      |
| 683          | 0.068       |                               |  | A                              |     |      | A                             | A   |      | N                            | N   |      |
| 823          | 0.082       |                               |  |                                |     |      | A                             | A   |      | N                            | N   |      |
| 104          | 0.1         |                               |  |                                |     |      | A                             | A   |      | N                            | N   |      |
| 124          | 0.12        |                               |  |                                |     |      | A                             | A   |      | N                            | N   |      |
| 154          | 0.15        |                               |  |                                |     |      | A                             | A   |      | N                            | N   |      |
| 184          | 0.18        |                               |  |                                |     |      | A                             |     |      | N                            | N   |      |
| 224          | 0.22        |                               |  |                                |     |      | A                             |     |      | N                            | N   |      |
| 274          | 0.27        |                               |  |                                |     |      |                               |     |      | N                            | N   |      |
| 334          | 0.33        |                               |  |                                |     |      |                               |     |      | N                            | N   |      |
| 394          | 0.39        |                               |  |                                |     |      |                               |     |      | E                            | G   |      |
| 474          | 0.47        |                               |  |                                |     |      |                               |     |      | E                            | G   |      |
| 684          | 0.68        |                               |  |                                |     |      |                               |     |      | G                            | G   |      |
| 824          | 0.82        |                               |  |                                |     |      |                               |     |      | G                            | G   |      |
| 105          | 1           |                               |  |                                |     |      |                               |     |      | G                            | G   |      |
| WVDC         |             | 50V                           |  | 25V                            | 50V | 100V | 25V                           | 50V | 100V | 25V                          | 50V | 100V |
| SIZE         |             | 0402                          |  | 0603                           |     |      | 0805                          |     |      | 1206                         |     |      |

| Case Size               | 0402(KAM05) | 0603(KAM15) |       | 0805(KAM21) |      | 1206(KAM31)    |      |      |      | 1210(KAM32) | 2220(KAM55) |
|-------------------------|-------------|-------------|-------|-------------|------|----------------|------|------|------|-------------|-------------|
| Thickness Letter        | A           | A           | B     | B           | A    | B              | N    | E    | G    | L           | C           |
| Max Thickness           | 0.56        | 0.90        | 0.95  | 0.94        | 1.45 | 0.94           | 1.27 | 1.52 | 1.78 | 2.79        | 2.80        |
| Carrier Tape            | PAPER       | PAPER       | PAPER | PAPER       | EMB  | PAPER          | EMB  | EMB  | EMB  | EMB         | EMB         |
| Packaging Code 7' reel  | H           | T           | T     | T           | U    | T              | U    | U    | U    | U           | V           |
| Packaging Code 13' reel | N           | M           | M     | M           | L    | M              | L    | L    | L    | L           | S           |
|                         | PAPER       |             |       |             |      | EMBOSSED (EMB) |      |      |      |             |             |

### X8L

| SIZE         |             | 0603                           |     |      | 0805                          |     |      | 1206                         |     |     |      | 1210                         |     |     |      | 2220                           |      |   |
|--------------|-------------|--------------------------------|-----|------|-------------------------------|-----|------|------------------------------|-----|-----|------|------------------------------|-----|-----|------|--------------------------------|------|---|
| Soldering    |             | Reflow/Wave                    |     |      | Reflow/Wave                   |     |      | Reflow/Wave                  |     |     |      | Reflow/Wave                  |     |     |      | Reflow Only                    |      |   |
| (L) Length   | mm<br>(in.) | 1.6 ± 0.15<br>(0.063 ± 0.006)  |     |      | 2.01 ± 0.2<br>(0.079 ± 0.008) |     |      | 3.2 ± 0.2<br>(0.126 ± 0.008) |     |     |      | 3.2 ± 0.2<br>(0.126 ± 0.008) |     |     |      | 5.7 ± 0.5<br>(0.224 ± 0.02)    |      |   |
| (W) Width    | mm<br>(in.) | 0.81 ± 0.15<br>(0.032 ± 0.006) |     |      | 1.25 ± 0.2<br>(0.049 ± 0.008) |     |      | 1.6 ± 0.2<br>(0.063 ± 0.008) |     |     |      | 2.5 ± 0.2<br>(0.098 ± 0.008) |     |     |      | 5 ± 0.4<br>(0.197 ± 0.016)     |      |   |
| (t) Terminal | mm<br>(in.) | 0.35 ± 0.15<br>(0.014 ± 0.006) |     |      | 0.5 ± 0.25<br>(0.02 ± 0.01)   |     |      | 0.5 ± 0.25<br>(0.02 ± 0.01)  |     |     |      | 0.5 ± 0.25<br>(0.02 ± 0.01)  |     |     |      | 0.64 ± 0.39<br>(0.025 ± 0.015) |      |   |
| WVDC         |             | 25V                            | 50V | 100V | 25V                           | 50V | 100V | 16V                          | 25V | 50V | 100V | 10V                          | 25V | 50V | 100V | 200V                           | 250V |   |
| 271          | Cap 270     | A                              | A   |      |                               |     |      |                              |     |     |      |                              |     |     |      |                                |      |   |
| 331          | (pF) 330    | A                              | A   | A    | B                             | B   | B    |                              |     |     |      |                              |     |     |      |                                |      |   |
| 471          | 470         | A                              | A   | A    | B                             | B   | B    |                              |     |     |      |                              |     |     |      |                                |      |   |
| 681          | 680         | A                              | A   | A    | B                             | B   | B    |                              |     |     |      |                              |     |     |      |                                |      |   |
| 102          | 1000        | A                              | A   | A    | B                             | B   | B    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 152          | 1500        | A                              | A   | A    | B                             | B   | B    |                              |     | B   | B    | B                            |     |     |      |                                |      |   |
| 182          | 1800        | A                              | A   | A    | B                             | B   | B    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 222          | 2200        | A                              | A   | A    | B                             | B   | B    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 272          | 2700        | A                              | A   | A    | B                             | B   | B    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 332          | 3300        | A                              | A   | A    | B                             | B   | B    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 392          | 3900        | A                              | A   | A    | B                             | B   | B    |                              |     | B   | B    | B                            |     |     |      |                                |      |   |
| 472          | 4700        | A                              | A   | A    | B                             | B   | B    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 562          | 5600        | A                              | A   | A    | B                             | B   | B    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 682          | 6800        | A                              | A   | A    | B                             | B   | B    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 822          | 8200        | A                              | A   | A    | B                             | B   | B    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 103          | Cap 0.01    | A                              | A   | A    | B                             | B   | B    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 123          | (uF) 0.012  | A                              | A   |      | B                             | B   | B    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 153          | 0.015       | A                              | A   |      | B                             | B   | B    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 183          | 0.018       | A                              | A   |      | B                             | B   | B    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 223          | 0.022       | A                              | A   |      | B                             | B   | B    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 273          | 0.027       | A                              | A   |      | B                             | B   | B    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 333          | 0.033       | A                              | A   |      | B                             | B   | A    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 393          | 0.039       | A                              | A   |      | B                             | B   | A    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 473          | 0.047       | A                              | A   |      | B                             | B   | A    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 563          | 0.056       | A                              | A   |      | B                             | B   | A    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 683          | 0.068       | A                              | A   |      | B                             | B   | A    |                              | B   | B   | B    |                              |     |     |      |                                |      |   |
| 823          | 0.082       | A                              | A   |      | B                             | B   | A    |                              | B   | B   | N    |                              |     |     |      |                                |      |   |
| 104          | 0.1         | A                              | A   |      | B                             | B   | A    |                              | B   | B   | N    |                              |     |     |      |                                |      |   |
| 124          | 0.12        |                                |     |      | B                             | A   |      |                              | B   | B   | N    |                              |     |     |      |                                |      |   |
| 154          | 0.15        |                                |     |      | B                             | A   |      |                              | B   | B   | N    |                              |     |     |      |                                |      |   |
| 184          | 0.18        |                                |     |      | A                             | A   |      |                              | B   | B   | B    | G                            |     |     |      |                                |      |   |
| 224          | 0.22        |                                |     |      | A                             | A   |      |                              | B   | B   | B    | G                            |     |     |      |                                |      |   |
| 274          | 0.27        |                                |     |      | A                             | A   |      |                              | B   | N   | N    |                              |     |     |      |                                |      |   |
| 334          | 0.33        |                                |     |      | A                             | A   |      |                              | B   | N   | E    |                              |     |     |      |                                |      |   |
| 394          | 0.39        |                                |     |      | A                             | A   |      |                              | N   | N   | E    |                              |     |     |      |                                |      |   |
| 474          | 0.47        |                                |     |      | A                             | A   |      |                              | N   | N   | E    |                              |     |     |      |                                |      |   |
| 684          | 0.68        |                                |     |      | A                             | A   |      |                              | N   | G   | G    |                              |     |     |      |                                |      |   |
| 824          | 0.82        |                                |     |      | A                             | A   |      |                              | N   | G   | G    |                              |     |     |      |                                |      |   |
| 105          | 1           |                                |     |      | A                             | A   |      |                              | N   | G   | G    |                              |     |     |      |                                |      |   |
| 155          | 1.5         |                                |     |      | A                             |     |      |                              | G   | G   | G    |                              |     |     |      |                                |      |   |
| 225          | 2.2         |                                |     |      | A                             |     |      |                              | G   | G   | G    |                              |     |     | L    | L                              | C    | C |
| 475          | 4.7         |                                |     |      |                               |     |      |                              | G   | G   |      |                              |     |     | L    |                                |      |   |
| 106          | 10          |                                |     |      |                               |     |      |                              |     |     |      |                              |     |     | L    |                                |      |   |
| WVDC         |             | 25V                            | 50V | 100V | 25V                           | 50V | 100V | 16V                          | 25V | 50V | 100V | 10V                          | 25V | 50V | 100V | 200V                           | 250V |   |
| SIZE         |             | 0603                           |     |      | 0805                          |     |      | 1206                         |     |     |      | 1210                         |     |     |      | 2220                           |      |   |

# Automotive MLCC - X8G

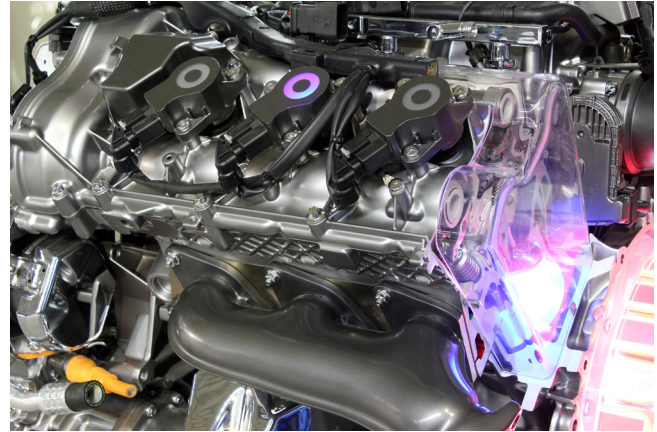
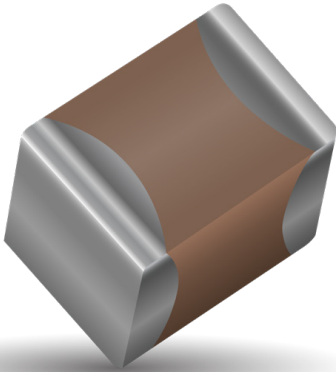
## General Specifications

### TYPICAL APPLICATIONS

- Extreme capacitance stability
- High temperature
- Battery Management Systems
- Powertrain Sensors & Actuators
- Engine management
- Transmission control
- Safety

### ENGINEERING TOOLS

- Samples
- Technical Articles
- Application Engineering
- Application Support



# Automotive X8G (-55°C to 150°C , ±30ppm/°C)

## Capacitance Range

| SIZE         |             | 0402                          |     | 0603                           |     | 0805                          |      |      |      |
|--------------|-------------|-------------------------------|-----|--------------------------------|-----|-------------------------------|------|------|------|
| Soldering    |             | Reflow/Wave                   |     | Reflow/Wave                    |     | Reflow/Wave                   |      |      |      |
| (L) Length   | mm<br>(in.) | 1 ± 0.1<br>(0.04 ± 0.004)     |     | 1.6 ± 0.15<br>(0.063 ± 0.006)  |     | 2.01 ± 0.2<br>(0.079 ± 0.008) |      |      |      |
| (W) Width    | mm<br>(in.) | 0.5 ± 0.1<br>(0.02 ± 0.004)   |     | 0.81 ± 0.15<br>(0.032 ± 0.006) |     | 1.25 ± 0.2<br>(0.049 ± 0.008) |      |      |      |
| (t) Terminal | mm<br>(in.) | 0.25 ± 0.15<br>(0.01 ± 0.006) |     | 0.35 ± 0.15<br>(0.014 ± 0.006) |     | 0.5 ± 0.25<br>(0.02 ± 0.01)   |      |      |      |
| WVDC         |             | 25V                           | 50V | 25V                            | 50V | 50V                           | 100V | 200V | 250V |
| 0R5          | 0.5         |                               |     | A                              | A   | B                             | B    | B    | B    |
| 1R0          | 1.0         |                               |     | A                              | A   | B                             | B    | B    | B    |
| 1R2          | 1.2         |                               |     | A                              | A   | B                             | B    | B    | B    |
| 1R5          | 1.5         |                               |     | A                              | A   | B                             | B    | B    | B    |
| 1R8          | 1.8         |                               |     | A                              | A   | B                             | B    | B    | B    |
| 2R2          | 2.2         |                               |     | A                              | A   | B                             | B    | B    | B    |
| 2R7          | 2.7         |                               |     | A                              | A   | B                             | B    | B    | B    |
| 3R3          | 3.3         |                               |     | A                              | A   | B                             | B    | B    | B    |
| 3R9          | 3.9         |                               |     | A                              | A   | B                             | B    | B    | B    |
| 4R7          | 4.7         |                               |     | A                              | A   | B                             | B    | B    | B    |
| 5R0          | 5           |                               |     | A                              | A   | B                             | B    | B    | B    |
| 5R6          | 5.6         |                               |     | A                              | A   | B                             | B    | B    | B    |
| 6R8          | 6.8         |                               |     | A                              | A   | B                             | B    | B    | B    |
| 8R2          | 8.2         |                               |     | A                              | A   | B                             | B    | B    | B    |
| 100          | 10          |                               |     | A                              | A   | B                             | B    | B    | B    |
| 120          | 12          |                               |     | A                              | A   | B                             | B    | B    | B    |
| 150          | 15          |                               |     | A                              | A   | B                             | B    | B    | B    |
| 180          | 18          |                               |     | A                              | A   | B                             | B    | B    | B    |
| 220          | 22          |                               |     | A                              | A   | B                             | B    | B    | B    |
| 270          | 27          |                               |     | A                              | A   | B                             | B    | B    | B    |
| 330          | 33          |                               |     | A                              | A   | B                             | B    | B    | B    |
| 390          | 39          |                               |     | A                              | A   | B                             | B    | B    | B    |
| 470          | 47          | A                             | A   | A                              | A   | B                             | B    | B    | B    |
| 510          | 51          | A                             | A   | A                              | A   | B                             | B    | B    | B    |
| 560          | 56          | A                             | A   | A                              | A   | B                             | B    | B    | B    |
| 680          | 68          | A                             | A   | A                              | A   | B                             | B    | B    | J    |
| 820          | 82          | A                             | A   | A                              | A   | B                             | B    | B    | J    |
| 101          | 100         | A                             | A   | A                              | A   | B                             | B    | B    | J    |
| 121          | 120         |                               |     | A                              | A   | B                             | B    | B    | J    |
| 151          | 150         |                               |     | A                              | A   | B                             | B    | B    | J    |
| 181          | 180         |                               |     | A                              | A   | B                             | B    | B    | J    |
| 221          | 220         |                               |     | A                              | A   | B                             | B    | B    | J    |
| 271          | 270         |                               |     | A                              | A   | B                             | B    | B    | J    |
| 331          | 330         |                               |     | A                              | A   | B                             | B    | B    | J    |
| 391          | 390         |                               |     | A                              | A   | B                             | B    | B    | J    |
| 471          | 470         |                               |     | A                              | A   | B                             | B    | B    | J    |
| 561          | 560         |                               |     | A                              | A   | B                             | B    | J    | J    |
| 681          | 680         |                               |     | A                              | A   | B                             | B    | J    | J    |
| 821          | 820         |                               |     |                                |     | B                             | B    | J    | J    |
| 102          | 1000        |                               |     |                                |     | B                             | B    | J    | J    |
| 122          | 1200        |                               |     |                                |     | B                             | B    | J    | J    |
| 152          | 1500        |                               |     |                                |     | B                             | B    | J    | J    |
| 182          | 1800        |                               |     |                                |     |                               |      |      |      |
| 222          | 2200        |                               |     |                                |     |                               |      |      |      |
| 272          | 2700        |                               |     |                                |     |                               |      |      |      |
| 332          | 3300        |                               |     |                                |     |                               |      |      |      |
| 392          | 3900        |                               |     |                                |     |                               |      |      |      |
| 472          | 4700        |                               |     |                                |     |                               |      |      |      |
| 562          | 5600        |                               |     |                                |     |                               |      |      |      |
| 682          | 6800        |                               |     |                                |     |                               |      |      |      |
| 103          | 10nF        |                               |     |                                |     |                               |      |      |      |
| WVDC         |             | 25V                           | 50V | 25V                            | 50V | 50V                           | 100V | 200V | 250V |
| Size         |             | 0402                          |     | 0603                           |     | 0805                          |      |      |      |

| Case Size              | 0402(KAM05) | 0603(KAM15) | 0805(KAM21) |           |
|------------------------|-------------|-------------|-------------|-----------|
| Letter                 | A           | A           | B           | J         |
| Max Thickness mm       | 0.56        | 0.90        | 0.94        | 1.27      |
| Carrier Tape           | Paper       | Paper       | Paper       | Emb       |
| Packaging Code 7"reel  | H           | T           | T           | U         |
| Packaging Code 13"reel | N           | M           | M           | L         |
|                        | PAPER       |             |             | EMBOSSSED |