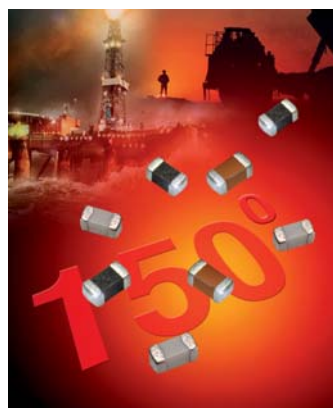


# X8R/X8L Dielectric



## General Specifications



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 and  $\pm 15/-40\%$  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.

Both X8R and X8L dielectric capacitors are automotive AEC-Q200 qualified. Optional termination systems, tin, FLEXITERM® and conductive epoxy for hybrid applications are available. Providing this series with our FLEXITERM® termination system provides further advantage to customers by way of enhanced resistance to both, temperature cycling and mechanical damage.

### PART NUMBER (see page 2 for complete part number explanation)

**0805**

**Size**  
0603  
0805  
1206

**5**

**Voltage**  
16V = Y  
25V = 3  
50V = 5  
100V = 1

**F**

**Dielectric**  
X8R = F  
X8L = L

**104**

**Capacitance Code (in pF)**  
2 Sig. Digits + Number of Zeros  
e.g. 10 $\mu$ F = 106

**K**

**Capacitance Tolerance**  
J =  $\pm 5\%$   
K =  $\pm 10\%$   
M =  $\pm 20\%$

**4**

**Failure Rate**  
4 = Automotive  
A = Not Applicable

**T**

**Terminations**  
T = Plated Ni and Sn  
Z = FLEXITERM®  
U = Conductive Epoxy for Hybrid apps

**2**

**Packaging**  
2 = 7" Reel  
4 = 13" Reel

**A**

**Special Code**  
A = Std. Product

NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers.

#### X8R

| SIZE |                  | 0603 |     | 0805 |     | 1206 |     |
|------|------------------|------|-----|------|-----|------|-----|
|      | WVDC             | 25V  | 50V | 25V  | 50V | 25V  | 50V |
| 331  | Cap 330          | G    | G   | J    | J   |      |     |
| 471  | (pF) 470         | G    | G   | J    | J   |      |     |
| 681  | 680              | G    | G   | J    | J   |      |     |
| 102  | 1000             | G    | G   | J    | J   | J    | J   |
| 152  | 1500             | G    | G   | J    | J   | J    | J   |
| 222  | 2200             | G    | G   | J    | J   | J    | J   |
| 332  | 3300             | G    | G   | J    | J   | J    | J   |
| 472  | 4700             | G    | G   | J    | J   | J    | J   |
| 682  | 6800             | G    | G   | J    | J   | J    | J   |
| 103  | Cap 0.01         | G    | G   | J    | J   | J    | J   |
| 153  | ( $\mu$ F) 0.015 | G    | G   | J    | J   | J    | J   |
| 223  | 0.022            | G    | G   | J    | J   | J    | J   |
| 333  | 0.033            | G    | G   | J    | J   | J    | J   |
| 473  | 0.047            | G    | G   | J    | J   | J    | J   |
| 683  | 0.068            | G    |     | N    | N   | M    | M   |
| 104  | 0.1              |      |     | N    | N   | M    | M   |
| 154  | 0.15             |      |     | N    | N   | M    | M   |
| 224  | 0.22             |      |     | N    |     | M    | M   |
| 334  | 0.33             |      |     |      |     | M    | M   |
| 474  | 0.47             |      |     |      |     | M    |     |
| 684  | 0.68             |      |     |      |     |      |     |
| 105  | 1                |      |     |      |     |      |     |
|      | WVDC             | 25V  | 50V | 25V  | 50V | 25V  | 50V |
| SIZE |                  | 0603 |     | 0805 |     | 1206 |     |

#### X8L

| SIZE |                  | 0603 |     |      | 0805 |     |      | 1206 |     |     |      |
|------|------------------|------|-----|------|------|-----|------|------|-----|-----|------|
|      | WVDC             | 25V  | 50V | 100V | 25V  | 50V | 100V | 16V  | 25V | 50V | 100V |
| 331  | Cap 330          |      | G   | G    |      | J   | J    |      |     |     |      |
| 471  | (pF) 470         |      | G   | G    |      | J   | J    |      |     |     |      |
| 681  | 680              |      | G   | G    |      | J   | J    |      |     |     |      |
| 102  | 1000             |      | G   | G    |      | J   | J    |      |     |     |      |
| 152  | 1500             |      | G   | G    |      | J   | J    |      |     | J   | J    |
| 222  | 2200             |      | G   | G    |      | J   | J    |      |     | J   | J    |
| 332  | 3300             |      | G   | G    |      | J   | J    |      |     | J   | J    |
| 472  | 4700             |      | G   | G    |      | J   | J    |      |     | J   | J    |
| 682  | 6800             |      | G   | G    |      | J   | J    |      |     | J   | J    |
| 103  | Cap 0.01         |      | G   | G    |      | J   | J    |      |     | J   | J    |
| 153  | ( $\mu$ F) 0.015 | G    | G   |      | J    | J   | J    |      |     | J   | J    |
| 223  | 0.022            | G    | G   |      | J    | J   | J    |      |     | J   | J    |
| 333  | 0.033            | G    | G   |      | J    | J   | N    |      |     | J   | J    |
| 473  | 0.047            | G    | G   |      | J    | J   | N    |      |     | J   | J    |
| 683  | 0.068            | G    | G   |      | J    | J   |      |      |     | J   | J    |
| 104  | 0.1              | G    | G   |      | J    | J   |      |      |     | J   | M    |
| 154  | 0.15             |      |     |      | J    | N   |      | J    | J   | J   | Q    |
| 224  | 0.22             |      |     |      | N    | N   |      | J    | J   | J   | Q    |
| 334  | 0.33             |      |     |      | N    |     |      | J    | M   | P   | Q    |
| 474  | 0.47             |      |     |      | N    |     |      | M    | M   | P   |      |
| 684  | 0.68             |      |     |      |      |     |      | M    |     |     |      |
| 105  | 1                |      |     |      |      |     |      | M    |     |     |      |
|      | WVDC             | 25V  | 50V | 100V | 25V  | 50V | 100V | 16V  | 25V | 50V | 100V |
| SIZE |                  | 0603 |     |      | 0805 |     |      | 1206 |     |     |      |

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

  = AEC-Q200 Qualified

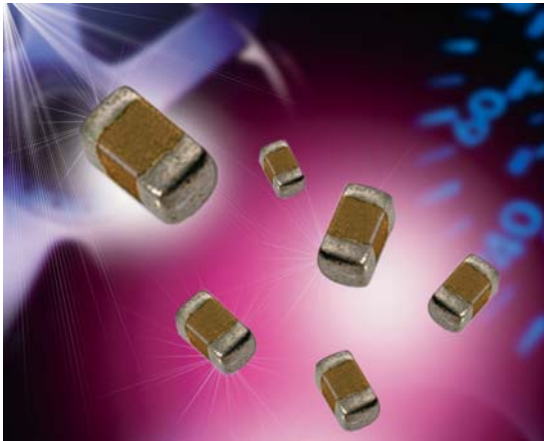
# X8R/X8L Dielectric



## General Specifications

### APPLICATIONS FOR X8R AND X8L CAPACITORS

- 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

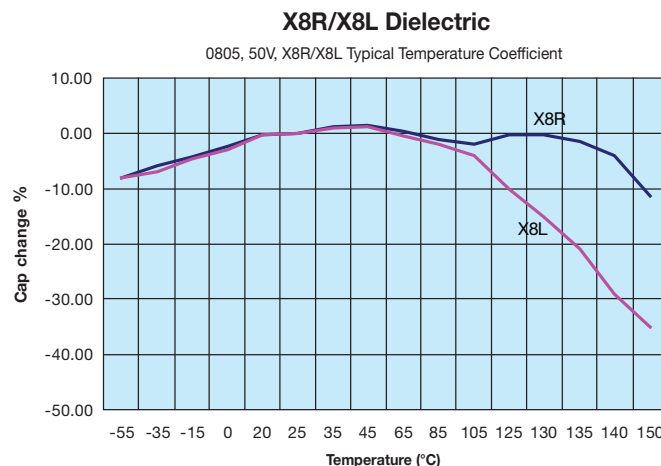


### ADVANTAGES OF X8R AND X8L MLC CAPACITORS

- 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
- Epoxy termination for hybrid available
- 100V range available

### ENGINEERING TOOLS FOR HIGH VOLTAGE MLC CAPACITORS

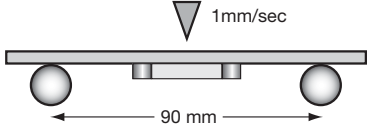
- Samples
- Technical Articles
- Application Engineering
- Application Support



# X8R/X8L Dielectric



## Specifications and Test Methods

| Parameter/Test                       |                       | X8R/X8L Specification Limits                                                       | Measuring Conditions                                                                                                                                                                                                                                            |                    |
|--------------------------------------|-----------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Operating Temperature Range          |                       | -55°C to +150°C                                                                    | Temperature Cycle Chamber                                                                                                                                                                                                                                       |                    |
| Capacitance                          |                       | Within specified tolerance                                                         | Freq.: 1.0 kHz $\pm$ 10%                                                                                                                                                                                                                                        |                    |
| Dissipation Factor                   |                       | $\leq 2.5\%$ for $\geq 50V$ DC rating<br>$\leq 3.5\%$ for 25V DC and 16V DC rating | Voltage: 1.0Vrms $\pm$ .2V                                                                                                                                                                                                                                      |                    |
| Insulation Resistance                |                       | 100,000M $\Omega$ or 1000M $\Omega$ - $\mu$ F,<br>whichever is less                | Charge device with rated voltage for<br>120 $\pm$ 5 secs @ room temp/humidity                                                                                                                                                                                   |                    |
| Dielectric Strength                  |                       | No breakdown or visual defects                                                     | Charge device with 300% of rated voltage for<br>1-5 seconds, w/charge and discharge current<br>limited to 50 mA (max)<br>Note: Charge device with 150% of rated<br>voltage for 500V devices.                                                                    |                    |
| Resistance to<br>Flexure<br>Stresses | Appearance            | No defects                                                                         | Deflection: 2mm<br>Test Time: 30 seconds<br>                                                                                                                                 |                    |
|                                      | Capacitance Variation | $\leq \pm 12\%$                                                                    |                                                                                                                                                                                                                                                                 |                    |
|                                      | Dissipation Factor    | Meets Initial Values (As Above)                                                    |                                                                                                                                                                                                                                                                 |                    |
|                                      | Insulation Resistance | $\geq$ Initial Value x 0.3                                                         |                                                                                                                                                                                                                                                                 |                    |
| Solderability                        |                       | $\geq 95\%$ of each terminal should be covered<br>with fresh solder                | Dip device in eutectic solder at 230 $\pm$ 5°C<br>for 5.0 $\pm$ 0.5 seconds                                                                                                                                                                                     |                    |
| Resistance to<br>Solder Heat         | Appearance            | No defects, <25% leaching of either end terminal                                   | Dip device in eutectic solder at 260°C for 60<br>seconds. Store at room temperature for 24 $\pm$ 2<br>hours before measuring electrical properties.                                                                                                             |                    |
|                                      | Capacitance Variation | $\leq \pm 7.5\%$                                                                   |                                                                                                                                                                                                                                                                 |                    |
|                                      | Dissipation Factor    | Meets Initial Values (As Above)                                                    |                                                                                                                                                                                                                                                                 |                    |
|                                      | Insulation Resistance | Meets Initial Values (As Above)                                                    |                                                                                                                                                                                                                                                                 |                    |
|                                      | Dielectric Strength   | Meets Initial Values (As Above)                                                    |                                                                                                                                                                                                                                                                 |                    |
| Thermal Shock                        | Appearance            | No visual defects                                                                  | Step 1: -55°C $\pm$ 2°                                                                                                                                                                                                                                          | 30 $\pm$ 3 minutes |
|                                      | Capacitance Variation | $\leq \pm 7.5\%$                                                                   | Step 2: Room Temp                                                                                                                                                                                                                                               | $\leq 3$ minutes   |
|                                      | Dissipation Factor    | Meets Initial Values (As Above)                                                    | Step 3: +125°C $\pm$ 2°                                                                                                                                                                                                                                         | 30 $\pm$ 3 minutes |
|                                      | Insulation Resistance | Meets Initial Values (As Above)                                                    | Step 4: Room Temp                                                                                                                                                                                                                                               | $\leq 3$ minutes   |
|                                      | Dielectric Strength   | Meets Initial Values (As Above)                                                    | Repeat for 5 cycles and measure after<br>24 $\pm$ 2 hours at room temperature                                                                                                                                                                                   |                    |
| Load Life                            | Appearance            | No visual defects                                                                  | Charge device with 1.5 rated voltage ( $\leq 10V$ ) in<br>test chamber set at 150°C $\pm$ 2°C<br>for 1000 hours (+48, -0)<br><br>Remove from test chamber and stabilize<br>at room temperature for 24 $\pm$ 2 hours<br>before measuring.                        |                    |
|                                      | Capacitance Variation | $\leq \pm 12.5\%$                                                                  |                                                                                                                                                                                                                                                                 |                    |
|                                      | Dissipation Factor    | $\leq$ Initial Value x 2.0 (See Above)                                             |                                                                                                                                                                                                                                                                 |                    |
|                                      | Insulation Resistance | $\geq$ Initial Value x 0.3 (See Above)                                             |                                                                                                                                                                                                                                                                 |                    |
|                                      | Dielectric Strength   | Meets Initial Values (As Above)                                                    |                                                                                                                                                                                                                                                                 |                    |
| Load Humidity                        | Appearance            | No visual defects                                                                  | Store in a test chamber set at 85°C $\pm$ 2°C/<br>85% $\pm$ 5% relative humidity for 1000 hours<br>(+48, -0) with rated voltage applied.<br><br>Remove from chamber and stabilize at<br>room temperature and humidity for<br>24 $\pm$ 2 hours before measuring. |                    |
|                                      | Capacitance Variation | $\leq \pm 12.5\%$                                                                  |                                                                                                                                                                                                                                                                 |                    |
|                                      | Dissipation Factor    | $\leq$ Initial Value x 2.0 (See Above)                                             |                                                                                                                                                                                                                                                                 |                    |
|                                      | Insulation Resistance | $\geq$ Initial Value x 0.3 (See Above)                                             |                                                                                                                                                                                                                                                                 |                    |
|                                      | Dielectric Strength   | Meets Initial Values (As Above)                                                    |                                                                                                                                                                                                                                                                 |                    |