

# X7R Dielectric

## General Specifications



X7R formulations are called "temperature stable" ceramics and fall into EIA Class II materials. X7R is the most popular of these intermediate dielectric constant materials. Its temperature variation of capacitance is within  $\pm 15\%$  from  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ . This capacitance change is non-linear.

Capacitance for X7R varies under the influence of electrical operating conditions such as voltage and frequency.

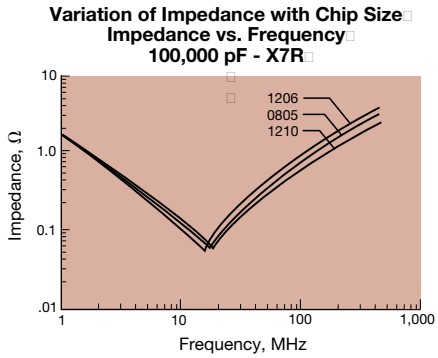
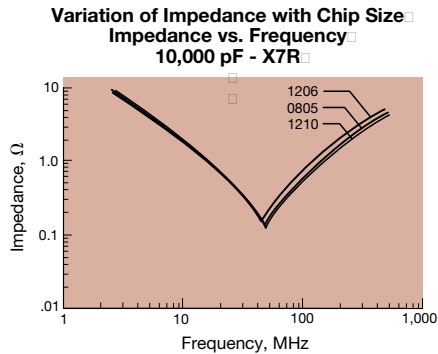
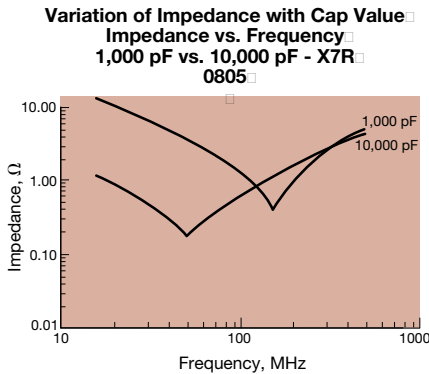
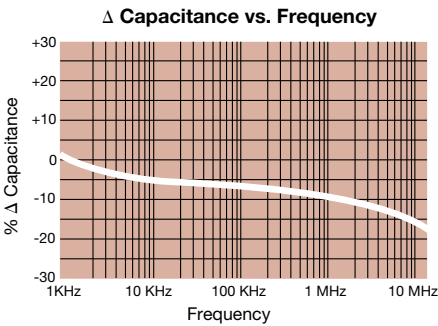
X7R dielectric chip usage covers the broad spectrum of industrial applications where known changes in capacitance due to applied voltages are acceptable.



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

| 0805                     | 5                                                                                                                    | C                            | 103                                                                | M                                                                                                                                                            | A                                         | T                                                                                                                                                | 2                                                                                                                         | A                                       |
|--------------------------|----------------------------------------------------------------------------------------------------------------------|------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| <b>Size</b><br>(L" x W") | <b>Voltage</b><br>4V = 4<br>6.3V = 6<br>10V = Z<br>16V = Y<br>25V = 3<br>50V = 5<br>100V = 1<br>200V = 2<br>500V = 7 | <b>Dielectric</b><br>X7R = C | <b>Capacitance Code (In pF)</b><br>2 Sig. Digits + Number of Zeros | <b>Capacitance Tolerance</b><br>J = $\pm 5\%$ *<br>K = $\pm 10\%$<br>M = $\pm 20\%$<br><br>* $\leq 1\mu\text{F}$ only, contact factory for additional values | <b>Failure Rate</b><br>A = Not Applicable | <b>Terminations</b><br>T = Plated Ni and Sn<br>7 = Gold Plated*<br>Z = FLEXITERM®**<br><br>*Optional termination<br>**See FLEXITERM® X7R section | <b>Packaging</b><br>2 = 7" Reel<br>4 = 13" Reel<br>7 = Bulk Cass.<br>9 = Bulk<br><br><b>Contact Factory For Multiples</b> | <b>Special Code</b><br>A = Std. Product |

NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers.  
Contact factory for non-specified capacitance values.



## Specifications and Test Methods

| Parameter/Test                       |                       | X7R Specification Limits                                                                                                                                   | Measuring Conditions                                                                                                                                                                                                                                            |                    |
|--------------------------------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Operating Temperature Range          |                       | -55°C to +125°C                                                                                                                                            | Temperature Cycle Chamber                                                                                                                                                                                                                                       |                    |
| Capacitance                          |                       | Within specified tolerance                                                                                                                                 | Freq.: 1.0 kHz $\pm$ 10%<br>Voltage: 1.0Vrms $\pm$ .2V                                                                                                                                                                                                          |                    |
| Dissipation Factor                   |                       | $\leq 2.5\%$ for $\geq 50V$ DC rating<br>$\leq 3.0\%$ for 25V DC rating<br>$\leq 3.5\%$ for 25V and 16V DC rating<br>$\leq 5.0\%$ for $\leq 10V$ DC rating |                                                                                                                                                                                                                                                                 |                    |
| 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<br>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 125°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<br>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)                                                                                                                            |                                                                                                                                                                                                                                                                 |                    |

# X7R Dielectric

## Capacitance Range



### PREFERRED SIZES ARE SHADED

| SIZE         |             | 0101*                           |   | 0201                           |    |    | 0402                           |     |    |    | 0603                           |    |     |    |    |    |    | 0805                           |     |     |    |    |    |    | 1206                           |     |     |    |    |    |    |     |     |     |
|--------------|-------------|---------------------------------|---|--------------------------------|----|----|--------------------------------|-----|----|----|--------------------------------|----|-----|----|----|----|----|--------------------------------|-----|-----|----|----|----|----|--------------------------------|-----|-----|----|----|----|----|-----|-----|-----|
| Soldering    |             | Reflow Only                     |   | Reflow Only                    |    |    | Reflow/Wave                    |     |    |    | Reflow/Wave                    |    |     |    |    |    |    | Reflow/Wave                    |     |     |    |    |    |    | Reflow/Wave                    |     |     |    |    |    |    |     |     |     |
| Packaging    |             | Paper/Embossed                  |   | All Paper                      |    |    | All Paper                      |     |    |    | All Paper                      |    |     |    |    |    |    | Paper/Embossed                 |     |     |    |    |    |    | Paper/Embossed                 |     |     |    |    |    |    |     |     |     |
| (L) Length   | mm<br>(in.) | 0.40 ± 0.02<br>(0.016 ± 0.0008) |   | 0.60 ± 0.03<br>(0.024 ± 0.001) |    |    | 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) |     |     |    |    |    |    |     |     |     |
| (W) Width    | mm<br>(in.) | 0.20 ± 0.02<br>(0.008 ± 0.0008) |   | 0.30 ± 0.03<br>(0.011 ± 0.001) |    |    | 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) |     |     |    |    |    |    |     |     |     |
| (t) Terminal | mm<br>(in.) | 0.20 ± 0.02<br>(0.008 ± 0.0008) |   | 0.15 ± 0.05<br>(0.006 ± 0.002) |    |    | 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) |     |     |    |    |    |    |     |     |     |
| WVDC         |             | 10                              |   | 10                             | 16 | 25 | 50                             | 6.3 | 10 | 16 | 25                             | 50 | 6.3 | 10 | 16 | 25 | 50 | 100                            | 200 | 6.3 | 10 | 16 | 25 | 50 | 100                            | 200 | 6.3 | 10 | 16 | 25 | 50 | 100 | 200 | 500 |
| Cap          | 100         | 101                             | A | A                              | A  | A  | A                              |     |    | C  | C                              |    |     |    |    |    | G  | G                              | G   |     |    |    |    |    |                                |     |     |    |    |    |    |     |     |     |
| (pF)         | 150         | 151                             | A | A                              | A  | A  | A                              |     |    | C  | C                              |    |     |    |    |    | G  | G                              | G   |     |    |    |    |    |                                |     |     |    |    |    |    |     |     |     |
|              | 220         | 221                             | A | A                              | A  | A  | A                              |     |    | C  | C                              |    |     |    |    |    | G  | G                              | G   |     |    |    |    |    |                                |     |     |    |    |    |    |     |     |     |
|              | 330         | 331                             | A | A                              | A  | A  | A                              |     |    | C  | C                              |    |     |    |    |    | G  | G                              | G   |     | J  | J  | J  | J  | J                              | J   |     |    |    |    |    | K   |     |     |
|              | 470         | 471                             | A | A                              | A  | A  | A                              | A   |    |    | C                              | C  |     |    |    |    | G  | G                              | G   |     | J  | J  | J  | J  | J                              | J   |     |    |    |    |    | K   |     |     |
|              | 680         | 681                             | A | A                              | A  | A  | A                              |     |    |    | C                              | C  |     |    |    |    | G  | G                              | G   |     | J  | J  | J  | J  | J                              | J   |     |    |    |    |    | K   |     |     |
|              | 1000        | 102                             | A | A                              | A  | A  |                                |     | C  | C  | C                              |    |     |    |    |    | G  | G                              | G   |     | J  | J  | J  | J  | J                              | J   |     |    |    |    |    | K   |     |     |
|              | 1500        | 152                             |   | A                              | A  |    |                                |     | C  | C  | C                              |    |     |    |    |    | G  | G                              |     |     | J  | J  | J  | J  | J                              | J   |     | J  | J  | J  | J  | J   | M   |     |
|              | 2200        | 222                             |   | A                              | A  |    |                                |     | C  | C  | C                              |    |     |    |    |    | G  | G                              |     |     | J  | J  | J  | J  | J                              | J   |     | J  | J  | J  | J  | J   | M   |     |
|              | 3300        | 332                             |   | A                              | A  |    |                                |     | C  | C  | C                              |    |     |    |    |    | G  | G                              |     |     | J  | J  | J  | J  | J                              | J   |     | J  | J  | J  | J  | J   | M   |     |
|              | 4700        | 472                             |   | A                              | A  |    |                                |     | C  | C  | C                              |    |     |    |    |    | G  | G                              |     |     | J  | J  | J  | J  | J                              | J   |     | J  | J  | J  | J  | J   | M   |     |
|              | 6800        | 682                             |   | A                              | A  |    |                                |     | C  | C  | C                              |    |     |    |    |    | G  | G                              |     |     | J  | J  | J  | J  | J                              | J   |     | J  | J  | J  | J  | J   | P   |     |
| Cap          | 0.01        | 103                             |   | A                              | A  |    |                                |     | C  | C  | C                              |    |     |    |    |    | G  | G                              | G   |     | J  | J  | J  | J  | J                              | J   |     | J  | J  | J  | J  | J   | P   |     |
| (µF)         | 0.015       | 153                             |   |                                |    |    |                                |     | C  | C  | C                              |    |     |    |    |    | G  | G                              | G   |     | J  | J  | J  | J  | J                              | J   |     | J  | J  | J  | J  | M   |     |     |
|              | 0.022       | 223                             |   |                                |    |    |                                |     | C  | C  | C                              |    |     |    |    |    | G  | G                              | G   |     | J  | J  | J  | J  | J                              | N   |     | J  | J  | J  | J  | M   |     |     |
|              | 0.033       | 333                             |   |                                |    |    |                                |     | C  | C  | C                              |    |     |    |    |    | G  | G                              |     |     | J  | J  | J  | J  | N                              |     |     | J  | J  | J  | J  | M   |     |     |
|              | 0.047       | 473                             |   |                                |    |    |                                |     | C  | C  | C                              |    |     |    |    |    | G  | G                              | G   |     | J  | J  | J  | J  | N                              |     |     | J  | J  | J  | J  | M   |     |     |
|              | 0.068       | 683                             |   |                                |    |    |                                |     | C  | C  | C                              |    |     |    |    |    | G  | G                              | G   |     | J  | J  | J  | J  | N                              |     |     | J  | J  | J  | J  | P   |     |     |
|              | 0.1         | 104                             |   |                                |    |    |                                |     | C  | C  | C                              |    |     |    |    |    | G  | G                              | G   | G   | J  | J  | J  | J  | N                              |     |     | J  | J  | J  | M  |     |     |     |
|              | 0.15        | 154                             |   |                                |    |    |                                |     |    |    |                                |    |     |    |    |    | G  | G                              | G   | G   | J  | J  | J  | N  | N                              |     |     | J  | J  | J  | Q  |     |     |     |
|              | 0.22        | 224                             |   |                                |    |    |                                |     |    |    |                                |    |     |    |    |    | G  | G                              | J   | J   | J  | N  | N  | N  | N                              |     |     | J  | J  | J  | Q  |     |     |     |
|              | 0.33        | 334                             |   |                                |    |    |                                |     |    |    |                                |    |     |    |    |    | J  | J                              | J   | J   | N  | N  | N  | N  | N                              |     |     | J  | J  | M  | P  | Q   |     |     |
|              | 0.47        | 474                             |   |                                |    |    |                                |     |    |    |                                |    |     |    |    |    | J  | J                              | J   | J   | N  | N  | N  | N  | N                              |     |     | M  | M  | M  | P  | Q   |     |     |
|              | 0.68        | 684                             |   |                                |    |    |                                |     |    |    |                                |    |     |    |    |    | J  | J                              | J   | J   | N  | N  | N  | N  | N                              |     |     | M  | M  | Q  | Q  | Q   |     |     |
|              | 1.0         | 105                             |   |                                |    |    |                                |     |    |    |                                |    |     |    |    |    | J  | J                              | J   | J   | N  | N  | N  | N  | N                              |     |     | M  | M  | Q  | Q  | Q   |     |     |
|              | 2.2         | 225                             |   |                                |    |    |                                |     |    |    |                                |    |     |    |    |    | J  | J                              | J   |     |    |    |    |    |                                |     |     | Q  | Q  | Q  | Q  | Q   |     |     |
|              | 4.7         | 475                             |   |                                |    |    |                                |     |    |    |                                |    |     |    |    |    |    |                                |     | P   | P  | P  | P  |    |                                |     |     | Q  | Q  | Q  | Q  |     |     |     |
|              | 10          | 106                             |   |                                |    |    |                                |     |    |    |                                |    |     |    |    |    |    |                                |     |     | P  | P  |    |    |                                |     |     | Q  | Q  | Q  |    |     |     |     |
|              | 22          | 226                             |   |                                |    |    |                                |     |    |    |                                |    |     |    |    |    |    |                                |     |     |    |    |    |    |                                |     |     | Q  | Q  |    |    |     |     |     |
|              | 47          | 476                             |   |                                |    |    |                                |     |    |    |                                |    |     |    |    |    |    |                                |     |     |    |    |    |    |                                |     |     |    |    |    |    |     |     |     |
|              | 100         | 107                             |   |                                |    |    |                                |     |    |    |                                |    |     |    |    |    |    |                                |     |     |    |    |    |    |                                |     |     |    |    |    |    |     |     |     |
| WVDC         |             | 10                              |   | 10                             | 16 | 25 | 50                             | 6.3 | 10 | 16 | 25                             | 50 | 6.3 | 10 | 16 | 25 | 50 | 100                            | 200 | 6.3 | 10 | 16 | 25 | 50 | 100                            | 200 | 6.3 | 10 | 16 | 25 | 50 | 100 | 200 | 500 |
| SIZE         |             | 0101                            |   | 0201                           |    |    | 0402                           |     |    |    | 0603                           |    |     |    |    |    |    | 0805                           |     |     |    |    |    |    | 1206                           |     |     |    |    |    |    |     |     |     |

| Letter         | A               | B               | C               | E               | G               | J               | K               | M               | N               | P               | Q               | X               | Y               | Z               |
|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Max. Thickness | 0.33<br>(0.013) | 0.22<br>(0.009) | 0.56<br>(0.022) | 0.71<br>(0.028) | 0.90<br>(0.035) | 0.94<br>(0.037) | 1.02<br>(0.040) | 1.27<br>(0.050) | 1.40<br>(0.055) | 1.52<br>(0.060) | 1.78<br>(0.070) | 2.29<br>(0.090) | 2.54<br>(0.100) | 2.79<br>(0.110) |
| PAPER          |                 |                 |                 |                 |                 |                 | EMBOSS          |                 |                 |                 |                 |                 |                 |                 |

NOTE: Contact factory for non-specified capacitance values

\*EIA 01005



# X7R Dielectric

## Capacitance Range



### PREFERRED SIZES ARE SHADED

| SIZE                  |          | 1210                        |                |                |                |                |                |     | 1812                        |    |    |     |     |     |                | 1825                        |                |                | 2220                        |                |                |                |    | 2225                        |     |   |  |
|-----------------------|----------|-----------------------------|----------------|----------------|----------------|----------------|----------------|-----|-----------------------------|----|----|-----|-----|-----|----------------|-----------------------------|----------------|----------------|-----------------------------|----------------|----------------|----------------|----|-----------------------------|-----|---|--|
| Soldering             |          | Reflow Only                 |                |                |                |                |                |     | Reflow Only                 |    |    |     |     |     |                | Reflow Only                 |                |                | Reflow Only                 |                |                |                |    | Reflow Only                 |     |   |  |
| Packaging             |          | Paper/Embossed              |                |                |                |                |                |     | All Embossed                |    |    |     |     |     |                | All Embossed                |                |                | All Embossed                |                |                |                |    | All Embossed                |     |   |  |
| (L) Length            | mm (in.) | 3.20 ± 0.20 (0.126 ± 0.008) |                |                |                |                |                |     | 4.50 ± 0.30 (0.177 ± 0.012) |    |    |     |     |     |                | 4.50 ± 0.30 (0.177 ± 0.012) |                |                | 5.70 ± 0.40 (0.225 ± 0.016) |                |                |                |    | 5.72 ± 0.25 (0.225 ± 0.010) |     |   |  |
| (W) Width             | mm (in.) | 2.50 ± 0.20 (0.098 ± 0.008) |                |                |                |                |                |     | 3.20 ± 0.20 (0.126 ± 0.008) |    |    |     |     |     |                | 6.40 ± 0.40 (0.252 ± 0.016) |                |                | 5.00 ± 0.40 (0.197 ± 0.016) |                |                |                |    | 6.35 ± 0.25 (0.250 ± 0.010) |     |   |  |
| (t) Terminal          | mm (in.) | 0.50 ± 0.25 (0.020 ± 0.010) |                |                |                |                |                |     | 0.61 ± 0.36 (0.024 ± 0.014) |    |    |     |     |     |                | 0.61 ± 0.36 (0.024 ± 0.014) |                |                | 0.64 ± 0.39 (0.025 ± 0.015) |                |                |                |    | 0.64 ± 0.39 (0.025 ± 0.015) |     |   |  |
|                       | WVDC     | 10                          | 16             | 25             | 50             | 100            | 200            | 500 | 16                          | 25 | 50 | 100 | 200 | 500 | 50             | 100                         | 200            | 25             | 50                          | 100            | 200            | 500            | 50 | 100                         | 200 |   |  |
| Cap                   | 100      | 101                         |                |                |                |                |                |     |                             |    |    |     |     |     |                |                             |                |                |                             |                |                |                |    |                             |     |   |  |
| (pF)                  | 150      | 151                         |                |                |                |                |                |     |                             |    |    |     |     |     |                |                             |                |                |                             |                |                |                |    |                             |     |   |  |
|                       | 220      | 221                         |                |                |                |                |                |     |                             |    |    |     |     |     |                |                             |                |                |                             |                |                |                |    |                             |     |   |  |
|                       | 330      | 331                         |                |                |                |                |                |     |                             |    |    |     |     |     |                |                             |                |                |                             |                |                |                |    |                             |     |   |  |
|                       | 470      | 471                         |                |                |                |                |                |     |                             |    |    |     |     |     |                |                             |                |                |                             |                |                |                |    |                             |     |   |  |
|                       | 680      | 681                         |                |                |                |                |                |     |                             |    |    |     |     |     |                |                             |                |                |                             |                |                |                |    |                             |     |   |  |
|                       | 1000     | 102                         |                |                |                |                |                |     |                             |    |    |     |     |     |                |                             |                |                |                             |                |                |                |    |                             |     |   |  |
|                       | 1500     | 152                         | J              | J              | J              | J              | J              | J   | M                           |    |    |     |     |     |                |                             |                |                |                             |                |                |                |    |                             |     |   |  |
|                       | 2200     | 222                         | J              | J              | J              | J              | J              | J   | M                           |    |    |     |     |     |                |                             |                |                |                             |                |                |                |    |                             |     |   |  |
|                       | 3300     | 332                         | J              | J              | J              | J              | J              | J   | M                           |    |    |     |     |     |                |                             |                |                |                             |                |                |                |    |                             |     |   |  |
|                       | 4700     | 472                         | J              | J              | J              | J              | J              | J   | M                           |    |    |     |     |     |                |                             |                |                |                             |                |                |                |    |                             |     |   |  |
|                       | 6800     | 682                         | J              | J              | J              | J              | J              | J   | M                           |    |    |     |     |     |                |                             |                |                |                             |                |                |                |    |                             |     |   |  |
| Cap                   | 0.01     | 103                         | J              | J              | J              | J              | J              | J   | M                           |    | K  | K   | K   | K   | K              | M                           | M              | M              |                             | X              | X              | X              | X  | M                           | P   | P |  |
| (μF)                  | 0.015    | 153                         | J              | J              | J              | J              | J              | J   | P                           |    | K  | K   | K   | K   | P              | M                           | M              | M              |                             | X              | X              | X              | X  | M                           | P   | P |  |
|                       | 0.022    | 223                         | J              | J              | J              | J              | J              | J   | Q                           |    | K  | K   | K   | K   | P              | M                           | M              | M              |                             | X              | X              | X              | X  | M                           | P   | P |  |
|                       | 0.033    | 333                         | J              | J              | J              | J              | J              | J   | Q                           |    | K  | K   | K   | K   | X              | M                           | M              | M              |                             | X              | X              | X              | X  | M                           | P   | P |  |
|                       | 0.047    | 473                         | J              | J              | J              | J              | J              | J   | Q                           |    | K  | K   | K   | K   | Z              | M                           | M              | M              |                             | X              | X              | X              | X  | M                           | P   | P |  |
|                       | 0.068    | 683                         | J              | J              | J              | J              | J              | M   | Q                           |    | K  | K   | K   | K   | Z              | M                           | M              | M              |                             | X              | X              | X              | X  | M                           | P   | P |  |
|                       | 0.1      | 104                         | J              | J              | J              | J              | J              | M   |                             |    | K  | K   | K   | K   | Z              | M                           | M              | M              |                             | X              | X              | X              | X  | M                           | P   | P |  |
|                       | 0.15     | 154                         | J              | J              | J              | J              | M              | Z   |                             |    | K  | K   | K   | P   | Z              | M                           | M              | M              |                             | X              | X              | X              | X  | M                           | P   | X |  |
|                       | 0.22     | 224                         | J              | J              | J              | J              | P              | Z   |                             |    | K  | K   | K   | P   |                | M                           | M              | M              |                             | X              | X              | X              | X  | M                           | P   | X |  |
|                       | 0.33     | 334                         | J              | J              | J              | J              | Q              |     |                             |    | K  | K   | M   | X   |                | M                           | M              |                |                             | X              | X              | X              | X  | M                           | P   | X |  |
|                       | 0.47     | 474                         | M              | M              | M              | M              | Q              |     |                             |    | K  | K   | P   |     |                | M                           | M              |                |                             | X              | X              | X              | X  | M                           | P   | X |  |
|                       | 0.68     | 684                         | M              | M              | P              | X              | X              |     |                             |    | M  | M   | Q   |     |                | M                           | P              |                |                             | X              | X              |                |    | M                           | P   | X |  |
|                       | 1.0      | 105                         | N              | N              | P              | X              | Z              |     |                             |    | M  | M   | X   | Z   |                | M                           | P              |                |                             | X              | X              |                |    | M                           | P   | X |  |
|                       | 1.5      | 155                         | N              | N              | Z              | Z              | Z              |     |                             |    | Z  | Z   | Z   |     |                | M                           |                |                |                             | X              | X              |                |    | M                           | X   |   |  |
|                       | 2.2      | 225                         | X              | X              | Z              | Z              | Z              |     |                             |    | Z  | Z   | Z   |     |                |                             |                |                |                             | X              | X              |                |    | M                           | X   |   |  |
|                       | 3.3      | 335                         | X              | X              | Z              | Z              |                |     |                             |    | Z  | Z   | Z   |     |                |                             |                |                |                             | X              | Z              |                |    |                             |     |   |  |
|                       | 4.7      | 475                         | X              | X              | Z              | Z              |                |     |                             |    | Z  | Z   |     |     |                |                             |                |                |                             | X              | Z              |                |    |                             |     |   |  |
|                       | 10       | 106                         | Z              | Z              | Z              | Z              |                |     | Z                           |    |    |     |     |     |                |                             |                |                |                             | Z              | Z              |                |    |                             |     |   |  |
|                       | 22       | 226                         | Z              | Z              | Z              |                |                |     |                             |    |    |     |     |     |                |                             |                |                | Z                           |                |                |                |    |                             |     |   |  |
|                       | 47       | 476                         | Z              |                |                |                |                |     |                             |    |    |     |     |     |                |                             |                |                |                             |                |                |                |    |                             |     |   |  |
|                       | 100      | 107                         |                |                |                |                |                |     |                             |    |    |     |     |     |                |                             |                |                |                             |                |                |                |    |                             |     |   |  |
|                       | WVDC     | 10                          | 16             | 25             | 50             | 100            | 200            | 500 | 16                          | 25 | 50 | 100 | 200 | 500 | 50             | 100                         | 200            | 25             | 50                          | 100            | 200            | 500            | 50 | 100                         | 200 |   |  |
| SIZE                  |          | 1210                        |                |                |                |                |                |     | 1812                        |    |    |     |     |     |                | 1825                        |                |                | 2220                        |                |                |                |    | 2225                        |     |   |  |
| Letter Max. Thickness |          | A 0.33 (0.013)              | B 0.22 (0.009) | C 0.56 (0.022) | E 0.71 (0.028) | G 0.90 (0.035) | J 0.94 (0.037) |     |                             |    |    |     |     |     | K 1.02 (0.040) | M 1.27 (0.050)              | N 1.40 (0.055) | P 1.52 (0.060) | Q 1.78 (0.070)              | X 2.29 (0.090) | Y 2.54 (0.100) | Z 2.79 (0.110) |    |                             |     |   |  |
|                       |          | PAPER                       |                |                |                |                |                |     | EMBOSSED                    |    |    |     |     |     |                |                             |                |                |                             |                |                |                |    |                             |     |   |  |

NOTE: Contact factory for non-specified capacitance values