

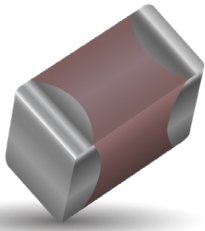


**THE DATASHEET OF  
12103D226MAT2A**



# X5R Dielectric

## General Specifications



### GENERAL DESCRIPTION

- General Purpose Dielectric for Ceramic Capacitors
- EIA Class II Dielectric
- Temperature variation of capacitance is within  $\pm 15\%$  from  $-55^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- Well suited for decoupling and filtering applications
- Available in High Capacitance values (up to  $100\mu\text{F}$ )

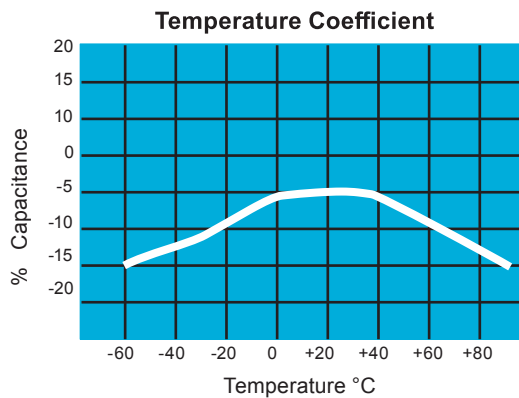
### PART NUMBER (SEE PAGE 4 FOR COMPLETE PART NUMBER EXPLANATION)

| 1210  | 4   | D                            | 107  | M  | A                              | T   | 2   | A                               |
|---|---|------------------------------|--|--|--------------------------------|---|---|---------------------------------|
| <b>Size</b><br>(L" x W")<br>0101**<br>0201<br>0402<br>0603<br>0805<br>1206<br>1210<br>1812<br>**EIA 01005 | <b>Voltage</b><br>4 = 4V<br>6 = 6.3V<br>Z = 10V<br>Y = 16V<br>3 = 25V<br>D = 35V<br>5 = 50V<br>1 = 100V | <b>Dielectric</b><br>D = X5R | <b>Capacitance Code (In pF)</b><br>2 Sig. Digits + Number of Zeros | <b>Capacitance Tolerance</b><br>K = $\pm 10\%$<br>M = $\pm 20\%$ | <b>Failure Rate</b><br>A = N/A | <b>Terminations</b><br>T = Plated Ni and Sn | <b>Packaging</b><br>2 = 7" Reel<br>4 = 13" Reel<br>U = 4mm TR (01005) | <b>Special Code</b><br>A = Std. |



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

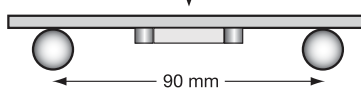
### TYPICAL ELECTRICAL CHARACTERISTICS



# X5R Dielectric

## Specifications and Test Methods



| Parameter/Test                 |                       | X5R Specification Limits  | Measuring Conditions  |                    |
|--------------------------------|-----------------------|---|---|--------------------|
| Operating Temperature Range    |                       | -55°C to +85°C  | Temperature Cycle Chamber   |                    |
| Capacitance                    |                       | Within specified tolerance  |   |                    |
| Dissipation Factor             |                       | $\leq 2.5\%$ for $\geq 50V$ DC rating<br>$\leq 12.5\%$ for 25V, 35V DC rating<br>$\leq 12.5\%$ Max. for 16V DC rating and lower<br>Contact Factory for DF by PN | Freq.: 1.0 kHz $\pm 10\%$<br>Voltage: 1.0Vrms $\pm .2V$<br>For Cap > 10 $\mu F$ , 0.5Vrms @ 120Hz   |                    |
| Insulation Resistance          |                       | 10,000M $\Omega$ or 500M $\Omega$ - $\mu F$ , whichever is less   | Charge device with rated voltage for 120 $\pm 5$ secs @ room temp/humidity  |                    |
| Dielectric Strength            |                       | No breakdown or visual defects  | Charge device with 250% of rated voltage for 1-5 seconds, w/charge and discharge current limited to 50 mA (max)   |                    |
| Resistance to Flexure Stresses | Appearance            | No defects  | Deflection: 2mm<br>Test Time: 30 seconds<br>1mm/sec<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 with fresh solder  | Dip device in eutectic solder at 230 $\pm 5^\circ C$ for 5.0 $\pm 0.5$ seconds  |                    |
| Resistance to Solder Heat      | Appearance            | No defects, <25% leaching of either end terminal  | Dip device in eutectic solder at 260°C for 60seconds. Store at room temperature for 24 $\pm$ 2hours 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 $\pm 2^\circ$   | 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: +85°C $\pm 2^\circ$   | 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 24 $\pm 2$ hours at room temperature  |                    |
| Load Life                      | Appearance            | No visual defects   | Charge device with 1.5X rated voltage in test chamber set at 85°C $\pm 2^\circ C$ for 1000 hours (+48, -0).<br>Note: Contact factory for *optional specification part numbers that are tested at < 1.5X rated voltage.<br>Remove from test chamber and stabilize at room temperature for 24 $\pm 2$ hours |                    |
|                                | 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 $\pm 2^\circ C$ / 85% $\pm 5\%$ relative humidity for 1000 hours (+48, -0) with rated voltage applied.<br>Remove from chamber and stabilize at room temperature and humidity for 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)   |   |                    |

# X5R Dielectric Capacitance Range



PREFERRED SIZES ARE SHADED

| Case Size    | 0101*          |                  | 0201            |   |    |    | 0402            |    |   |    |    | 0603            |    |    |   |    | 0805            |    |    |    |    |   |    |    |    |    |    |    |
|--------------|----------------|------------------|-----------------|---|----|----|-----------------|----|---|----|----|-----------------|----|----|---|----|-----------------|----|----|----|----|---|----|----|----|----|----|----|
| Soldering    | Reflow Only    |                  | Reflow Only     |   |    |    | Reflow/Wave     |    |   |    |    | Reflow/Wfeve    |    |    |   |    | Reflow/Wfeve    |    |    |    |    |   |    |    |    |    |    |    |
| Packaging    | Paper/Embossed |                  | All Paper       |   |    |    | All Paper       |    |   |    |    | All Paper       |    |    |   |    | Paper/Embossed  |    |    |    |    |   |    |    |    |    |    |    |
| (L) Length   | mm             | 0.40 ± 0.02      | 0.60 ± 0.09     |   |    |    | 1.00 ± 0.15     |    |   |    |    | 1.60 ± 0.15     |    |    |   |    | 2.01 ± 0.20     |    |    |    |    |   |    |    |    |    |    |    |
| (W) Width    | mm             | 0.20 ± 0.02      | 0.30 ± 0.09     |   |    |    | 0.50 ± 0.15     |    |   |    |    | 0.81 ± 0.15     |    |    |   |    | 1.25 ± 0.20     |    |    |    |    |   |    |    |    |    |    |    |
| (t) Terminal | mm             | 0.10 ± 0.04      | 0.15 ± 0.05     |   |    |    | 0.25 ± 0.15     |    |   |    |    | 0.35 ± 0.15     |    |    |   |    | 0.50 ± 0.25     |    |    |    |    |   |    |    |    |    |    |    |
|              | (in.)          | (0.004 ± 0.0016) | (0.006 ± 0.002) |   |    |    | (0.010 ± 0.006) |    |   |    |    | (0.014 ± 0.006) |    |    |   |    | (0.020 ± 0.010) |    |    |    |    |   |    |    |    |    |    |    |
| Voltage:     |                | 63               | 16              | 4 | 63 | 10 | 16              | 25 | 4 | 63 | 10 | 16              | 25 | 50 | 4 | 63 | 10              | 16 | 25 | 35 | 50 | 4 | 63 | 10 | 16 | 25 | 35 | 50 |
| Cap (pF)     | 100            | 101              | B               |   |    |    |                 | A  |   |    |    |                 |    |    |   |    |                 |    |    |    |    |   |    |    |    |    |    |    |
|              | 150            | 151              | B               |   |    |    |                 | A  |   |    |    |                 |    |    |   |    |                 |    |    |    |    |   |    |    |    |    |    |    |
|              | 220            | 221              | B               |   |    |    |                 | A  |   |    |    |                 |    | C  |   |    |                 |    |    |    |    |   |    |    |    |    |    |    |
|              | 330            | 331              | B               |   |    |    |                 | A  |   |    |    |                 |    | C  |   |    |                 |    |    |    |    |   |    |    |    |    |    |    |
|              | 470            | 471              | B               |   |    |    |                 | A  |   |    |    |                 |    | C  |   |    |                 |    |    |    |    |   |    |    |    |    |    |    |
|              | 680            | 681              | B               |   |    |    |                 | A  |   |    |    |                 |    | C  |   |    |                 |    |    |    |    |   |    |    |    |    |    |    |
|              | 1000           | 102              | B               |   |    |    |                 | A  | A |    |    |                 |    | C  |   |    |                 |    |    |    |    |   |    |    |    |    |    |    |
|              | 1500           | 152              | B               | B |    |    |                 | A  | A |    |    |                 |    | C  |   |    |                 |    |    |    |    |   |    |    |    |    |    |    |
|              | 2200           | 222              | B               | B |    |    |                 | A  | A | A  |    |                 |    | C  |   |    |                 |    |    |    |    |   |    |    |    |    |    |    |
|              | 3300           | 332              | B               | B |    |    |                 | A  | A | A  |    |                 |    | C  |   |    |                 |    |    |    |    |   |    |    |    |    |    |    |
|              | 4700           | 472              | B               | B |    |    |                 | A  | A | A  |    |                 |    | C  |   |    |                 |    |    |    |    |   |    |    |    |    |    |    |
|              | 6800           | 682              | B               | B |    |    |                 | A  | A | A  |    |                 |    | C  |   |    |                 |    |    |    |    |   |    |    |    |    |    | G  |
| Cap (µF)     | 0.01           | 103              | B               | B |    |    |                 | A  | A | A  |    |                 |    | C  |   |    |                 |    |    |    |    |   |    |    |    |    |    | G  |
|              | 0.015          | 150              | B               |   |    |    |                 | A  | A | A  |    |                 |    | C  |   |    |                 |    |    |    |    |   |    |    |    |    |    | G  |
|              | 0.022          | 223              | B               |   |    |    |                 | A  | A | A  |    |                 |    | C  | C |    |                 |    |    |    |    |   |    |    |    |    |    | G  |
|              | 0.033          | 333              | B               |   |    |    |                 |    |   |    |    |                 |    | C  |   |    |                 |    |    |    |    |   |    |    |    |    |    | G  |
|              | 0.047          | 473              | B               |   |    |    |                 | A  | A | A  | A  |                 |    | C  | C |    |                 |    |    |    |    |   |    |    |    |    |    | G  |
|              | 0.068          | 689              | B               |   |    |    |                 |    |   |    |    |                 |    | C  |   |    |                 |    |    |    |    |   |    |    |    |    |    | G  |
|              | 0.1            | 104              | B               |   |    |    |                 | A  | A | A  | A  |                 |    | C  | C | C  | C               |    |    |    |    |   |    |    |    |    |    | G  |
|              | 0.15           | 154              |                 |   |    |    |                 |    |   |    |    |                 |    | C  | C | C  | C               |    |    |    |    |   |    |    |    |    |    | G  |
|              | 0.22           | 224              | B               |   |    |    |                 | A  | A | A  |    |                 |    | C  | C | C  | C               |    |    |    |    |   |    |    |    |    |    | G  |
|              | 0.33           | 334              |                 |   |    |    |                 |    |   |    |    |                 |    | C  | C | C  | C               |    |    |    |    |   |    |    |    |    |    | G  |
|              | 0.47           | 474              | B               |   |    |    |                 | A  | A |    |    |                 |    | C  | C | C  | C               |    |    |    |    |   |    |    |    |    |    | G  |
|              | 0.68           | 684              |                 |   |    |    |                 |    |   |    |    |                 |    | C  | C | C  | C               |    |    |    |    |   |    |    |    |    |    | J  |
|              | 1.0            | 105              |                 |   |    |    |                 | A  | A | C  | C  |                 |    | C  | C | C  | C               |    |    |    |    |   |    |    |    |    |    | G  |
|              | 1.5            | 155              |                 |   |    |    |                 |    |   |    |    |                 |    | C  | C | C  | C               |    |    |    |    |   |    |    |    |    |    | J  |
|              | 2.2            | 225              |                 |   |    |    |                 | C  | C | C  |    |                 |    | C  | C | C  | C               |    |    |    |    |   |    |    |    |    |    | G  |
|              | 3.3            | 335              |                 |   |    |    |                 |    |   |    |    |                 |    | C  | C | C  | C               |    |    |    |    |   |    |    |    |    |    | J  |
|              | 4.7            | 475              |                 |   |    |    |                 | C  |   |    |    |                 |    | E  | E | E  | E               |    |    |    |    |   |    |    |    |    |    | J  |
|              | 10             | 106              |                 |   |    |    |                 |    |   |    |    |                 |    | E  | E | E  |                 |    |    |    |    |   |    |    |    |    |    | J  |
|              | 22             | 226              |                 |   |    |    |                 |    |   |    |    |                 |    | E  | E |    |                 |    |    |    |    |   |    |    |    |    |    | K  |
|              | 47             | 476              |                 |   |    |    |                 |    |   |    |    |                 |    |    |   |    |                 |    |    |    |    |   |    |    |    |    |    | K  |
|              | 100            | 107              |                 |   |    |    |                 |    |   |    |    |                 |    |    |   |    |                 |    |    |    |    |   |    |    |    |    |    | K  |
| Voltage:     |                | 63               | 16              | 4 | 63 | 10 | 16              | 25 | 4 | 63 | 10 | 16              | 25 | 50 | 4 | 63 | 10              | 16 | 25 | 35 | 50 | 4 | 63 | 10 | 16 | 25 | 35 | 50 |

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

PAPER and EMBOSSSED available for 01005

NOTE: Contact factory for non-specified capacitance values

\*EIA 01005



# X5R Dielectric Capacitance Range



PREFERRED SIZES ARE SHADED

| Case Size         | 1206                           |     |    |    |    |    |    |   | 1210                           |    |    |    |    |    |   |     | 1812                           |    |    |    |    |  |  |  |
|-------------------|--------------------------------|-----|----|----|----|----|----|---|--------------------------------|----|----|----|----|----|---|-----|--------------------------------|----|----|----|----|--|--|--|
| Soldering         | Reflow/Wave                    |     |    |    |    |    |    |   | Reflow Only                    |    |    |    |    |    |   |     | Reflow Only                    |    |    |    |    |  |  |  |
| Packaging         | Paper/Embossed                 |     |    |    |    |    |    |   | Paper/Embossed                 |    |    |    |    |    |   |     | All Embossed                   |    |    |    |    |  |  |  |
| (L) Length        | 3.20 ± 0.20<br>(0.126 ± 0.008) |     |    |    |    |    |    |   | 3.20 ± 0.40<br>(0.126 ± 0.016) |    |    |    |    |    |   |     | 4.50 ± 0.30<br>(0.177 ± 0.012) |    |    |    |    |  |  |  |
| (W) Width         | 1.60 ± 0.20<br>(0.063 ± 0.008) |     |    |    |    |    |    |   | 2.50 ± 0.30<br>(0.098 ± 0.012) |    |    |    |    |    |   |     | 3.20 ± 0.20<br>(0.126 ± 0.008) |    |    |    |    |  |  |  |
| (t) Terminal      | 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) |    |    |    |    |  |  |  |
| Voltage:          | 4                              | 6.3 | 10 | 16 | 25 | 35 | 50 | 4 | 6.3                            | 10 | 16 | 25 | 35 | 50 | 4 | 6.3 | 10                             | 16 | 25 | 35 | 50 |  |  |  |
| Cap (pF) 100 101  |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 150 151           |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 220 221           |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 330 331           |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 470 471           |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 680 681           |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 1000 102          |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 1500 152          |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 2200 222          |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 3300 332          |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 4700 472          |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 6800 682          |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| Cap (µF) 0.01 103 |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 0.015 150         |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 0.022 223         |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 0.033 333         |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 0.047 473         |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 0.068 689         |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 0.1 104           |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 0.15 154          |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 0.22 224          |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 0.33 334          |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 0.47 474          |                                |     |    |    | Q  | Q  |    |   |                                |    |    |    |    | X  | X |     |                                |    |    |    |    |  |  |  |
| 0.68 684          |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 1.0 105           |                                |     |    |    | Q  | Q  | Q  |   |                                |    |    |    |    | X  | X | X   |                                |    |    |    |    |  |  |  |
| 1.5 155           |                                |     |    |    |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 2.2 225           |                                |     |    | Q  | Q  | Q  | Q  | Q |                                |    |    |    |    | X  | Z | Z   |                                |    |    |    |    |  |  |  |
| 3.3 335           |                                |     | Q  | Q  |    |    |    |   |                                |    |    |    |    |    |   |     |                                |    |    |    |    |  |  |  |
| 4.7 475           | X                              | X   | X  | X  | X  | X  | X  | X |                                |    | Z  | Z  | Z  | Z  | Z |     |                                |    |    |    |    |  |  |  |
| 10 106            | X                              | X   | X  | X  | X  | X  | X  | X |                                | X  | X  | Z  | Z  | Z  | Z |     |                                |    |    |    | Z  |  |  |  |
| 22 226            | X                              | X   | X  | X  | X  |    |    |   |                                | Z  | Z  | Z  | Z  | Z  | Z |     |                                | Z  | Z  | Z  | Z  |  |  |  |
| 47 476            | X                              | X   | X  | X  |    |    |    |   |                                | Z  | Z  | Z  | Z  | Z  |   |     |                                |    |    |    |    |  |  |  |
| 100 107           | X                              | X   |    |    |    |    |    |   |                                | Z  | Z  | Z  | Z  |    |   |     |                                |    |    |    |    |  |  |  |
| Voltage:          | 4                              | 6.3 | 10 | 16 | 25 | 35 | 50 | 4 | 6.3                            | 10 | 16 | 25 | 35 | 50 | 4 | 6.3 | 10                             | 16 | 25 | 35 | 50 |  |  |  |
| Case Size         | 1206                           |     |    |    |    |    |    |   | 1210                           |    |    |    |    |    |   |     | 1812                           |    |    |    |    |  |  |  |

| 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           |                 |                 |                 |                 |                 | EMBOSSSED       |                 |                 |                 |                 |                 |                 |                 |

PAPER and EMBOSSSED available for 01005

NOTE: Contact factory for non-specified capacitance values  
\*EIA 01005

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