



**THE DATASHEET OF  
1808HA680KAT1A**



# High Voltage MLC Chips

## For 600V to 5000V Applications



High value, low leakage and small size are difficult parameters to obtain in capacitors for high voltage systems. KYOCERA AVX special high voltage MLC chip capacitors meet these performance characteristics and are designed for applications such as snubbers in high frequency power converters, resonators in SMPS, and high voltage coupling/dc blocking. These high voltage chip designs exhibit low ESRs at high frequencies.

Larger physical sizes than normally encountered chips are used to make high voltage MLC chip products. Special precautions must be taken in applying these chips in surface mount assemblies. The temperature gradient during heating or cooling cycles should not exceed 4°C per second. The preheat temperature must be within 50°C of the peak temperature reached by the ceramic bodies through the soldering process. Chip sizes 1210 and larger should be reflow soldered only. Capacitors may require protective surface coating to prevent external arcing.

For 1825, 2225 and 3640 sizes, KYOCERA AVX offers leaded version in either thru-hole or SMT configurations (for details see section on high voltage leaded MLC chips)

### NEW 630V RANGE

#### HOW TO ORDER

| 1808  | A  | A                              | 271  | M   | A                 | T                                     | 2                             | A                   |
|---|--|--------------------------------|--|---|-------------------|---------------------------------------|-------------------------------|---------------------|
| <b>Style</b>  | <b>Voltage</b>   | <b>Temperature Coefficient</b> | <b>Capacitance Code</b>  | <b>Capacitance Tolerance</b>  | <b>Test Level</b> | <b>Termination*</b>                   | <b>Packaging</b>              | <b>Special Code</b> |
| 0805<br>1206<br>1210<br>1808<br>1812<br>1825<br>2220<br>2225<br>3640<br>*** | C = 600V/630V<br>A = 1000V<br>S = 1500V<br>G = 2000V<br>W = 2500V<br>H = 3000V<br>J = 4000V<br>K = 5000V | A = NPO (C0G)<br>C = X7R       | (2 significant digits + no. of zeros)<br>Examples:<br>10 pF = 100<br>100 pF = 101<br>1,000 pF = 102<br>22,000 pF = 223<br>220,000 pF = 224<br>1 μF = 105 | C0G: J = ±5%<br>K = ±10%<br>M = ±20%<br>X7R: K = ±10%<br>M = ±20%<br>Z = +80%, -20% | A = Standard      | T = Plated Ni and Sn (RoHS Compliant) | 2 = 7" Reel**<br>4 = 13" Reel | A = Standard        |

#### Notes:

- Capacitors with X7R dielectrics are not intended for applications across AC supply mains or AC line filtering with polarity reversal. Contact plant for recommendations. Contact factory for availability of Termination and Tolerance options for Specific Part Numbers.
- \*Terminations with 5% minimum lead (Pb) is available, see pages 100 and 101 for LD style. Leaded terminations are available, see pages 102-106.

\*\*The 3640 Style is not available on 7" Reels.

\*\*\* KYOCERA AVX offers nonstandard chip sizes. Contact factory for details.



#### DIMENSIONS: millimeters (inches)

| SIZE                   | 0805                           | 1206                           | 1210*                          | 1808*                          | 1812*                          | 1825*                          | 2220*                          | 2225*                          | 3640*                          |
|------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| (L) Length             | 2.10 ± 0.20<br>(0.083 ± 0.008) | 3.30 ± 0.30<br>(0.130 ± 0.012) | 3.30 ± 0.40<br>(0.130 ± 0.016) | 4.60 ± 0.50<br>(0.181 ± 0.020) | 4.60 ± 0.50<br>(0.181 ± 0.020) | 4.60 ± 0.50<br>(0.181 ± 0.020) | 5.70 ± 0.50<br>(0.224 ± 0.020) | 5.70 ± 0.50<br>(0.224 ± 0.020) | 9.14 ± 0.25<br>(0.360 ± 0.010) |
| (W) Width              | 1.25 ± 0.20<br>(0.049 ± 0.008) | 1.60 ± 0.20<br>(0.063 ± 0.008) | 2.50 ± 0.30<br>(0.098 ± 0.012) | 2.00 ± 0.20<br>(0.079 ± 0.008) | 3.20 ± 0.30<br>(0.126 ± 0.012) | 6.30 ± 0.40<br>(0.248 ± 0.016) | 5.00 ± 0.40<br>(0.197 ± 0.016) | 6.30 ± 0.40<br>(0.248 ± 0.016) | 10.2 ± 0.25<br>(0.400 ± 0.010) |
| (t) terminal min. max. | 0.50 ± 0.20<br>(0.020 ± 0.008) | 0.60 ± 0.20<br>(0.024 ± 0.008) | 0.75 ± 0.35<br>(0.030 ± 0.014) | 0.75 ± 0.35<br>(0.030 ± 0.014) | 0.75 ± 0.35<br>(0.030 ± 0.014) | 0.75 ± 0.35<br>(0.030 ± 0.014) | 0.85 ± 0.35<br>(0.033 ± 0.014) | 0.85 ± 0.35<br>(0.033 ± 0.014) | 0.76 (0.030)<br>1.52 (0.060)   |

\*Reflow Soldering Only

# High Voltage MLC Chips

## For 600V to 5000V Applications

### NPO (C0G) DIELECTRIC – PERFORMANCE CHARACTERISTICS

|  |   |
|--|---|
| Capacitance Range                          | 10 pF to 0.100 $\mu$ F (25°C, 1.0 $\pm$ 0.2 Vrms at 1kHz, for $\leq$ 1000 pF use 1 MHz) |
| Capacitance Tolerances                     | $\pm$ 5%, $\pm$ 10%, $\pm$ 20%  |
| Dissipation Factor                         | 0.1% max. (+25°C, 1.0 $\pm$ 0.2 Vrms, 1kHz, for $\leq$ 1000 pF use 1 MHz)               |
| Operating Temperature Range                | -55°C to +125°C   |
| Temperature Characteristic                 | 0 $\pm$ 30 ppm/°C (0 VDC)   |
| Voltage Ratings                            | 600, 630, 1000, 1500, 2000, 2500, 3000, 4000 & 5000 VDC (+125°C)                        |
| Insulation Resistance (+25°C, at 500 VDC)  | 100K M $\Omega$ min. or 1000 M $\Omega$ - $\mu$ F min., whichever is less               |
| Insulation Resistance (+125°C, at 500 VDC) | 10K M $\Omega$ min. or 100 M $\Omega$ - $\mu$ F min., whichever is less                 |
| Dielectric Strength                        | Minimum 120% rated voltage for 5 seconds at 50 mA max. current                          |

### NPO (C0G) CAPACITANCE RANGE – PREFERRED SIZES ARE SHADED

| Case Size<br>Soldering | 0805                                   |       |      |      |     |      | 1206  |      |      |     |      |      | 1210                                   |      |      |     |      |      | 1808                                   |      |      |      |      |     | 1812                                   |      |      |      |      |      |      |   |
|------------------------|--|-------|------|------|-----|------|---|------|------|-----|------|------|--|------|------|-----|------|------|--|------|------|------|------|-----|--|------|------|------|------|------|------|---|
|                        | Reflow/Wave                            |       |      |      |     |      | Reflow/Wave   |      |      |     |      |      | Reflow Only                            |      |      |     |      |      | Reflow Only                            |      |      |      |      |     | Reflow Only                            |      |      |      |      |      |      |   |
| (L) Length             | 2.10 $\pm$ 0.20<br>(0.085 $\pm$ 0.008) |       |      |      |     |      | 3.30 $\pm$ 0.30<br>(0.130 $\pm$ 0.012)              |      |      |     |      |      | 3.30 $\pm$ 0.40<br>(0.130 $\pm$ 0.016) |      |      |     |      |      | 4.60 $\pm$ 0.50<br>(0.181 $\pm$ 0.020) |      |      |      |      |     | 4.60 $\pm$ 0.50<br>(0.177 $\pm$ 0.012) |      |      |      |      |      |      |   |
| (W) Width              | 1.25 $\pm$ 0.20<br>(0.049 $\pm$ 0.008) |       |      |      |     |      | 1.60 $\pm$ 0.30/-0.10<br>(0.063 $\pm$ 0.012/-0.004) |      |      |     |      |      | 2.50 $\pm$ 0.30<br>(0.098 $\pm$ 0.012) |      |      |     |      |      | 2.00 $\pm$ 0.20<br>(0.079 $\pm$ 0.008) |      |      |      |      |     | 3.20 $\pm$ 0.30<br>(0.126 $\pm$ 0.008) |      |      |      |      |      |      |   |
| (t) Terminal           | 0.50 $\pm$ 0.20<br>(0.020 $\pm$ 0.008) |       |      |      |     |      | 0.60 $\pm$ 0.20<br>(0.04 $\pm$ 0.008)               |      |      |     |      |      | 0.75 $\pm$ 0.35<br>(0.030 $\pm$ 0.014) |      |      |     |      |      | 0.75 $\pm$ 0.35<br>(0.030 $\pm$ 0.014) |      |      |      |      |     | 0.75 $\pm$ 0.35<br>(0.030 $\pm$ 0.014) |      |      |      |      |      |      |   |
| Voltage (V)            | 600                                    | 630   | 1000 | 600  | 630 | 1000 | 1500  | 2000 | 600  | 630 | 1000 | 1500 | 2000                                   | 3000 | 600  | 630 | 1000 | 1500 | 2000                                   | 2500 | 3000 | 4000 | 600  | 630 | 1000                                   | 1500 | 2000 | 2500 | 3000 | 4000 |      |   |
| Cap (pF)               | .5                                     | 0R5   |      | A    | C   |      |   |      |      |     |      |      |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        | 1.0                                    | 1R0   |      | A    | C   |      |   |      |      |     |      |      |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        | 1.2                                    | 1R2   |      | A    | C   |      |   |      |      |     |      |      |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        | 1.5                                    | 1R5   | A    | A    | C   | X    | X   | X    | X    | X   | X    | X    |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        | 1.8                                    | 1R8   | A    | A    | C   | X    | X   | X    | X    | X   | X    | X    |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        | 2.2                                    | 2R2   | A    | A    | C   | X    | X   | X    | X    | X   | X    | X    |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        | 2.7                                    | 2R7   | A    | A    | C   | X    | X   | X    | X    | X   | X    | X    |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        | 3.3                                    | 3R3   | A    | A    | C   | X    | X   | X    | X    | X   | X    | X    |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        | 3.9                                    | 3R9   | A    | A    | C   | X    | X   | X    | X    | X   | X    | X    |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        | 4.7                                    | 4R7   | A    | A    | C   | X    | X   | X    | X    | X   | X    | X    |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        | 5.6                                    | 5R6   | A    | A    | C   | X    | X   | X    | X    | X   | X    | X    |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        | 6.8                                    | 6R8   | A    | A    | C   | X    | X   | X    | X    | X   | X    | X    |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        | 8.2                                    | 8R2   | A    | A    | C   | X    | X   | X    | X    | X   | X    | X    |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        | 10                                     | 100   | A    | A    | C   | C    | C   | C    | C    | C   | C    | C    | C                                      | C    | C    | C   | C    | C    | C                                      | C    | C    | C    | C    | C   | C                                      | C    | C    | C    | C    | C    | E    |   |
|                        | 12                                     | 120   | A    | A    | C   | C    | C   | C    | C    | C   | C    | C    | C                                      | C    | C    | C   | C    | C    | C                                      | C    | C    | C    | C    | C   | C                                      | C    | C    | C    | C    | C    | E    |   |
|                        | 15                                     | 150   | A    | A    | C   | C    | C   | C    | C    | C   | C    | C    | C                                      | C    | C    | C   | C    | C    | C                                      | C    | C    | C    | C    | C   | C                                      | C    | C    | C    | C    | C    | E    |   |
|                        | 18                                     | 180   | A    | A    | C   | C    | C   | C    | C    | C   | C    | C    | C                                      | C    | C    | C   | C    | C    | C                                      | C    | C    | C    | C    | C   | C                                      | C    | C    | C    | C    | C    | E    |   |
|                        | 22                                     | 220   | A    | A    | C   | C    | C   | C    | C    | C   | C    | C    | C                                      | C    | C    | C   | C    | C    | C                                      | C    | C    | C    | C    | C   | C                                      | C    | C    | C    | C    | C    | E    |   |
|                        | 27                                     | 270   | A    | A    | C   | C    | C   | C    | C    | C   | C    | C    | C                                      | C    | C    | C   | C    | C    | C                                      | C    | C    | C    | C    | C   | C                                      | C    | C    | C    | C    | C    | E    |   |
|                        | 33                                     | 330   | A    | A    | C   | C    | C   | C    | C    | C   | C    | C    | C                                      | C    | C    | C   | C    | C    | C                                      | C    | C    | C    | C    | C   | C                                      | C    | C    | C    | C    | C    | E    |   |
|                        | 39                                     | 390   | A    | A    | C   | C    | C   | C    | C    | C   | C    | C    | C                                      | C    | C    | C   | C    | C    | C                                      | C    | C    | C    | C    | C   | C                                      | C    | C    | C    | C    | C    | E    |   |
|                        | 47                                     | 470   | A    | A    | C   | C    | C   | C    | C    | C   | C    | C    | C                                      | C    | C    | C   | C    | C    | C                                      | C    | C    | C    | C    | C   | C                                      | C    | C    | C    | C    | C    | E    |   |
|                        | 56                                     | 560   | A    | A    | C   | C    | C   | C    | C    | C   | C    | C    | C                                      | C    | C    | C   | C    | C    | C                                      | C    | C    | C    | C    | C   | C                                      | C    | C    | C    | C    | C    | F    |   |
|                        | 68                                     | 680   | A    | A    | C   | C    | C   | C    | C    | C   | C    | C    | C                                      | C    | C    | C   | C    | C    | C                                      | C    | C    | C    | C    | C   | C                                      | C    | C    | C    | C    | C    | F    |   |
|                        | 82                                     | 820   | X    | X    | X   | X    | X   | X    | X    | X   | X    | X    | X                                      | X    | X    | X   | X    | X    | X                                      | X    | X    | X    | X    | X   | X                                      | X    | X    | X    | X    | X    | X    | F |
|                        | 100                                    | 101   | X    | X    | X   | X    | X   | X    | X    | X   | X    | X    | X                                      | X    | X    | X   | X    | X    | X                                      | X    | X    | X    | X    | X   | X                                      | X    | X    | X    | X    | X    | X    | F |
|                        | 120                                    | 121   | C    | C    | C   | C    | C   | C    | C    | C   | C    | C    | C                                      | C    | C    | C   | C    | C    | C                                      | C    | C    | C    | C    | C   | C                                      | C    | C    | C    | C    | C    | G    |   |
|                        | 150                                    | 151   | C    | C    | C   | C    | C   | C    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | G    |   |
|                        | 180                                    | 181   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 220                                    | 221   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 270                                    | 271   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 330                                    | 331   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 390                                    | 391   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 470                                    | 471   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 560                                    | 561   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 680                                    | 681   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 750                                    | 751   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 820                                    | 821   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 1000                                   | 102   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 1200                                   | 122   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 1500                                   | 152   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 1800                                   | 182   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 2200                                   | 222   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 2700                                   | 272   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 3300                                   | 332   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 3900                                   | 392   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 4700                                   | 472   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 5600                                   | 562   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 6800                                   | 682   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | 8200                                   | 822   | C    | C    | C   | C    | C   | E    | E    | E   | E    | E    | E                                      | E    | E    | E   | E    | E    | E                                      | E    | E    | E    | E    | E   | E                                      | E    | E    | E    | E    | E    | F    |   |
|                        | Cap ( $\mu$ F)                         | 0.010 | 103  |      |     |      |   |      |      |     |      |      |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        |  | 0.012 | 123  |      |     |      |   |      |      |     |      |      |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        |  | 0.015 | 153  |      |     |      |   |      |      |     |      |      |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        |  | 0.018 | 183  |      |     |      |   |      |      |     |      |      |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        |  | 0.022 | 223  |      |     |      |   |      |      |     |      |      |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        |  | 0.027 | 273  |      |     |      |   |      |      |     |      |      |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        |  | 0.033 | 333  |      |     |      |   |      |      |     |      |      |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        |  | 0.047 | 473  |      |     |      |   |      |      |     |      |      |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        |  | 0.056 | 563  |      |     |      |   |      |      |     |      |      |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        |  | 0.068 | 683  |      |     |      |   |      |      |     |      |      |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        |  | 0.100 | 104  |      |     |      |   |      |      |     |      |      |  |      |      |     |      |      |  |      |      |      |      |     |  |      |      |      |      |      |      |   |
|                        | Voltage (V)                            | 600   | 630  | 1000 | 600 | 630  | 1000  | 1500 | 2000 | 600 | 630  | 1000 | 1500                                   | 2000 | 3000 | 600 | 630  | 1000 | 1500                                   | 2000 | 2500 | 3000 | 4000 | 600 | 630                                    | 1000 | 1500 | 2000 | 2500 | 3000 | 4000 |   |
|                        | Case Size                              | 0805  |      |      |     |      |   | 1206 |      |     |      |      |  | 1210 |      |     |      |      |  | 1808 |      |      |      |     |  | 1812 |      |      |      |      |      |   |

|                |                 |                 |                 |   |   |   |   |
|----------------|-----------------|-----------------|-----------------|---|---|---|---|
| Letter         | A               | C               | E               | F | G | X | 7 |
| Max. Thickness | 0.81<br>(0.032) | 1.45<br>(0.057) | 1.80<br>(0.071) |   |   |   |   |



# High Voltage MLC Chips

## For 600V to 5000V Applications

### X7R Dielectric

#### Performance Characteristics

|  |  |
|--|--|
| Capacitance Range                          | 10 pF to 0.82 μF (25°C, 1.0 ±0.2 Vrms at 1kHz)                   |
| Capacitance Tolerances                     | ±10%; ±20%; +80%, -20%   |
| Dissipation Factor                         | 2.5% max. (+25°C, 1.0 ±0.2 Vrms, 1kHz)                           |
| Operating Temperature Range                | -55°C to +125°C  |
| Temperature Characteristic                 | ±15% (0 VDC)   |
| Voltage Ratings                            | 600, 630, 1000, 1500, 2000, 2500, 3000, 4000 & 5000 VDC (+125°C) |
| Insulation Resistance (+25°C, at 500 VDC)  | 100K MΩ min. or 1000 MΩ - μF min., whichever is less             |
| Insulation Resistance (+125°C, at 500 VDC) | 10K MΩ min. or 100 MΩ - μF min., whichever is less               |
| Dielectric Strength                        | Minimum 120% rated voltage for 5 seconds at 50 mA max. current   |

### X7R CAPACITANCE RANGE – PREFERRED SIZES ARE SHADED

| Case Size<br>Soldering    | 0805                           |     |      | 1206                                      |     |      |      |      | 1210                           |     |      |      |      | 1808                           |     |      |      |      |      |      |      | 1812                           |     |      |      |      |      |      |      |
|---------------------------|--------------------------------|-----|------|---|-----|------|------|------|--------------------------------|-----|------|------|------|--------------------------------|-----|------|------|------|------|------|------|--------------------------------|-----|------|------|------|------|------|------|
|                           | Reflow/Wave                    |     |      | Reflow/Wave                               |     |      |      |      | Reflow Only                    |     |      |      |      | Reflow Only                    |     |      |      |      |      |      |      | Reflow Only                    |     |      |      |      |      |      |      |
| (L) Length<br>mm<br>(in.) | 2.10 ± 0.20<br>(0.085 ± 0.008) |     |      | 3.30 ± 0.30<br>(0.130 ± 0.012)            |     |      |      |      | 3.30 ± 0.40<br>(0.130 ± 0.016) |     |      |      |      | 4.60 ± 0.50<br>(0.181 ± 0.020) |     |      |      |      |      |      |      | 4.60 ± 0.50<br>(0.177 ± 0.012) |     |      |      |      |      |      |      |
| W) Width<br>mm<br>(in.)   | 1.25 ± 0.20<br>(0.049 ± 0.008) |     |      | 1.60 +0.30/-0.10<br>(0.063 +0.012/-0.004) |     |      |      |      | 2.50 ± 0.30<br>(0.098 ± 0.012) |     |      |      |      | 2.00 ± 0.20<br>(0.079 ± 0.008) |     |      |      |      |      |      |      | 3.20 ± 0.30<br>(0.126 ± 0.008) |     |      |      |      |      |      |      |
| (t) Terminal<br>mm<br>max | 0.50 ± 0.20<br>(0.020 ± 0.008) |     |      | 0.60 ± 0.20<br>(0.024 ± 0.008)            |     |      |      |      | 0.75 ± 0.35<br>(0.030 ± 0.014) |     |      |      |      | 0.75 ± 0.35<br>(0.030 ± 0.014) |     |      |      |      |      |      |      | 0.75 ± 0.35<br>(0.030 ± 0.014) |     |      |      |      |      |      |      |
| Voltage (V)               | 600                            | 630 | 1000 | 600                                       | 630 | 1000 | 1500 | 2000 | 600                            | 630 | 1000 | 1500 | 2000 | 600                            | 630 | 1000 | 1500 | 2000 | 2500 | 3000 | 4000 | 600                            | 630 | 1000 | 1500 | 2000 | 2500 | 3000 | 4000 |
| Cap (pF) 100              | 101                            | X   | X    | C   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 120                       | 121                            | X   | X    | C   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 150                       | 151                            | X   | X    | C   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 180                       | 181                            | X   | X    | C   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 220                       | 221                            | X   | X    | C   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 270                       | 271                            | X   | X    | C   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 330                       | 331                            | X   | X    | C   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 390                       | 391                            | X   | X    | C   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 470                       | 471                            | X   | X    | C   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 560                       | 561                            | X   | X    | C   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 680                       | 681                            | X   | X    | C   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 750                       | 751                            | X   | X    | C   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 820                       | 821                            | X   | X    | C   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 1000                      | 102                            | X   | X    | X   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 1200                      | 122                            | X   | X    | X   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 1500                      | 152                            | X   | X    | X   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 1800                      | 182                            | X   | X    | C   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 2200                      | 222                            | X   | X    | X   | C   | C    | E    | E    | E                              | E   | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    | E    | E                              | E   | E    | E    | E    | E    | E    |      |
| 2700                      | 272                            | C   | C    |   | C   | C    | E    | E    |                                | E   | E    | E    | F    | E                              | E   | E    | F    | F    |      |      | F    | F                              | F   | F    | F    | F    | F    | G    |      |
| 3300                      | 332                            | C   | C    |   | C   | C    | E    |      |                                | E   | E    | E    | F    | E                              | E   | E    | F    | F    |      |      | F    | F                              | F   | F    | F    | F    | F    | G    |      |
| 3900                      | 392                            | C   | C    |   | C   | C    | E    |      |                                | E   | E    | E    | F    |                                | E   | E    | E    | F    |      |      | F    | F                              | F   | F    | F    | F    | F    | G    |      |
| 4700                      | 472                            | C   | C    |   | C   | C    | E    |      |                                | E   | E    | E    | F    |                                | E   | E    | E    | F    |      |      | F    | F                              | F   | F    | F    | F    | F    | G    |      |
| 5600                      | 562                            | C   | C    |   | C   | C    | E    |      |                                | E   | E    | E    | F    |                                | E   | E    | E    | F    |      |      | F    | F                              | F   | F    | F    | F    | F    | G    |      |
| 6800                      | 682                            | C   | C    |   | C   | C    | E    |      |                                | E   | E    | E    |      |                                | E   | E    | E    | F    |      |      | F    | F                              | F   | F    | F    | F    | F    | G    |      |
| 8200                      | 822                            | C   | C    |   | C   | C    | E    |      |                                | E   | E    | E    |      |                                | E   | E    | E    |      |      |      | F    | F                              | F   | F    | F    | F    | F    | G    |      |
| Cap (μF) 0.010            | 103                            | C   | C    |   | C   | C    | E    |      |                                | E   | E    | E    |      |                                | E   | E    | E    |      |      |      | F    | F                              | F   | F    | F    | F    | F    | G    |      |
| 0.015                     | 153                            | C   | C    |   | E   | E    | E    |      |                                | E   | E    | E    |      |                                | F   | F    | F    |      |      |      | F    | F                              | F   | F    | F    | F    | F    | G    |      |
| 0.018                     | 183                            | C   | C    |   | E   | E    |      |      |                                | E   | E    | E    |      |                                | F   | F    | F    |      |      |      | F    | F                              | F   | F    | F    | F    | F    | G    |      |
| 0.022                     | 223                            | C   | C    |   | E   | E    |      |      |                                | E   | E    | F    |      |                                | F   | F    | F    |      |      |      | F    | F                              | F   | F    | F    | F    | F    | G    |      |
| 0.027                     | 273                            |     |      |   | E   | E    |      |      |                                | E   | E    |      |      |                                | F   | F    |      |      |      |      | F    | F                              |     | F    | F    | F    | F    | G    |      |
| 0.033                     | 333                            |     |      |   | E   | E    |      |      |                                | E   | E    |      |      |                                | F   | F    |      |      |      |      | F    | F                              |     | F    | F    | F    | F    | G    |      |
| 0.039                     | 393                            |     |      |   |     |      |      |      |                                | E   | E    |      |      |                                | F   | F    |      |      |      |      | F    | F                              |     | F    | F    | F    | F    | G    |      |
| 0.047                     | 473                            |     |      |   |     |      |      |      |                                | E   | E    |      |      |                                | F   | F    |      |      |      |      | F    | F                              |     | F    | F    | F    | F    | G    |      |
| 0.056                     | 563                            |     |      |   |     |      |      |      |                                | F   | F    |      |      |                                | F   | F    |      |      |      |      | F    | F                              |     | F    | F    | F    | F    | G    |      |
| 0.068                     | 683                            |     |      |   |     |      |      |      |                                | F   | F    |      |      |                                | F   | F    |      |      |      |      | F    | F                              |     | F    | F    | F    | F    | G    |      |
| 0.082                     | 823                            |     |      |   |     |      |      |      |                                | F   | F    |      |      |                                | F   | F    |      |      |      |      | F    | F                              |     | F    | F    | F    | F    | G    |      |
| 0.100                     | 104                            |     |      |   |     |      |      |      |                                | F   | F    |      |      |                                | F   | F    |      |      |      |      | F    | F                              |     | F    | F    | F    | F    | G    |      |
| 0.150                     | 154                            |     |      |   |     |      |      |      |                                |     |      |      |      |                                |     |      |      |      |      |      |      |                                |     | G    | G    |      |      |      |      |
| 0.220                     | 224                            |     |      |   |     |      |      |      |                                |     |      |      |      |                                |     |      |      |      |      |      |      |                                |     | G    | G    |      |      |      |      |
| 0.270                     | 274                            |     |      |   |     |      |      |      |                                |     |      |      |      |                                |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |
| 0.330                     | 334                            |     |      |   |     |      |      |      |                                |     |      |      |      |                                |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |
| 0.390                     | 394                            |     |      |   |     |      |      |      |                                |     |      |      |      |                                |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |
| 0.470                     | 474                            |     |      |   |     |      |      |      |                                |     |      |      |      |                                |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |
| 0.560                     | 564                            |     |      |   |     |      |      |      |                                |     |      |      |      |                                |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |
| 0.680                     | 684                            |     |      |   |     |      |      |      |                                |     |      |      |      |                                |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |
| 0.820                     | 824                            |     |      |   |     |      |      |      |                                |     |      |      |      |                                |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |
| 1.000                     | 105                            |     |      |   |     |      |      |      |                                |     |      |      |      |                                |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |
| Voltage (V)               | 600                            | 630 | 1000 | 600                                       | 630 | 1000 | 1500 | 2000 | 600                            | 630 | 1000 | 1500 | 2000 | 600                            | 630 | 1000 | 1500 | 2000 | 2500 | 3000 | 4000 | 600                            | 630 | 1000 | 1500 | 2000 | 2500 | 3000 | 4000 |
| Case Size                 | 0805                           |     |      | 1206                                      |     |      |      |      | 1210                           |     |      |      |      | 1808                           |     |      |      |      |      |      |      | 1812                           |     |      |      |      |      |      |      |

| Letter         | A               | C               | E               | F               | G               | X               | 7               |
|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Max. Thickness | 0.81<br>(0.032) | 1.45<br>(0.057) | 1.80<br>(0.071) | 2.20<br>(0.087) | 2.80<br>(0.110) | 0.94<br>(0.037) | 3.30<br>(0.130) |

NOTE: Contact factory for non-specified capacitance values

# High Voltage MLC Chips

## For 600V to 5000V Applications



### X7R CAPACITANCE RANGE

#### PREFERRED SIZES ARE SHADED

| Case Size      | 1825                           |     |      |      |      |      |      |      | 2220                           |     |      |      |      |      |      |      | 2225                           |     |     |      |      |      |      |      | 3640                           |      |     |     |      |      |      |      |      |      |      |
|----------------|--------------------------------|-----|------|------|------|------|------|------|--------------------------------|-----|------|------|------|------|------|------|--------------------------------|-----|-----|------|------|------|------|------|--------------------------------|------|-----|-----|------|------|------|------|------|------|------|
| Soldering      | Reflow Only                    |     |      |      |      |      |      |      | Reflow Only                    |     |      |      |      |      |      |      | Reflow Only                    |     |     |      |      |      |      |      | Reflow Only                    |      |     |     |      |      |      |      |      |      |      |
| (L) Length     | 4.60 ± 0.50<br>(0.181 ± 0.020) |     |      |      |      |      |      |      | 5.70 ± 0.50<br>(0.224 ± 0.020) |     |      |      |      |      |      |      | 5.70 ± 0.50<br>(0.224 ± 0.020) |     |     |      |      |      |      |      | 9.14 ± 0.25<br>(0.360 ± 0.010) |      |     |     |      |      |      |      |      |      |      |
| (W) Width      | 6.30 ± 0.40<br>(0.248 ± 0.016) |     |      |      |      |      |      |      | 5.00 ± 0.40<br>(0.197 ± 0.016) |     |      |      |      |      |      |      | 6.30 ± 0.40<br>(0.248 ± 0.016) |     |     |      |      |      |      |      | 10.2 ± 0.25<br>(0.400 ± 0.010) |      |     |     |      |      |      |      |      |      |      |
| (t) Terminal   | 0.75 ± 0.35<br>(0.030 ± 0.014) |     |      |      |      |      |      |      | 0.85 ± 0.35<br>(0.033 ± 0.014) |     |      |      |      |      |      |      | 0.85 ± 0.35<br>(0.033 ± 0.014) |     |     |      |      |      |      |      | 0.76 (0.030)<br>1.52 (0.060)   |      |     |     |      |      |      |      |      |      |      |
| Voltage (V)    | 600                            | 630 | 1000 | 1500 | 2000 | 2500 | 3000 | 4000 | 600                            | 630 | 1000 | 1500 | 2000 | 2500 | 3000 | 4000 | 5000                           | 600 | 630 | 1000 | 1500 | 2000 | 2500 | 3000 | 4000                           | 5000 | 600 | 630 | 1000 | 1500 | 2000 | 2500 | 3000 | 4000 | 5000 |
| Cap (pF) 100   | 101                            |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |                                |     |     |      |      |      |      |      |                                |      |     |     |      |      |      |      |      |      |      |
| 120            | 121                            |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |                                |     |     |      |      |      |      |      |                                |      |     |     |      |      |      |      |      |      |      |
| 150            | 151                            |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |                                |     |     |      |      |      |      |      |                                |      |     |     |      |      |      |      |      |      |      |
| 180            | 181                            |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |                                |     |     |      |      |      |      |      |                                |      |     |     |      |      |      |      |      |      |      |
| 220            | 221                            |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |                                |     |     |      |      |      |      |      |                                |      |     |     |      |      |      |      |      |      |      |
| 270            | 271                            |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |                                |     |     |      |      |      |      |      |                                |      |     |     |      |      |      |      |      |      |      |
| 330            | 331                            |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |                                |     |     |      |      |      |      |      |                                |      |     |     |      |      |      |      |      |      |      |
| 390            | 391                            |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |                                |     |     |      |      |      |      |      |                                |      |     |     |      |      |      |      |      |      |      |
| 470            | 471                            |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |                                |     |     |      |      |      |      |      |                                |      |     |     |      |      |      |      |      |      |      |
| 560            | 561                            |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |                                |     |     |      |      |      |      |      |                                |      |     |     |      |      |      |      |      |      |      |
| 680            | 681                            |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |                                |     |     |      |      |      |      |      |                                |      |     |     |      |      |      |      |      |      |      |
| 750            | 751                            |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |                                |     |     |      |      |      |      |      |                                |      |     |     |      |      |      |      |      |      |      |
| 820            | 821                            |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |                                |     |     |      |      |      |      |      |                                |      |     |     |      |      |      |      |      |      |      |
| 1000           | 102                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 1200           | 122                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 1500           | 152                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 1800           | 182                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 2200           | 222                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 2700           | 272                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 3300           | 332                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 3900           | 392                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 4700           | 472                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 5600           | 562                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 6800           | 682                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 8200           | 822                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| Cap (µF) 0.010 | 103                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.015          | 153                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.018          | 183                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.022          | 223                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.027          | 273                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.033          | 333                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.039          | 393                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.047          | 473                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.056          | 563                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.068          | 683                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.082          | 823                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.100          | 104                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.150          | 154                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.220          | 224                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.270          | 274                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.330          | 334                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.390          | 394                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.470          | 474                            | F   | F    | F    | F    | F    | F    | F    | F                              | F   | F    | F    | F    | F    | F    | G    |                                | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.560          | 564                            | G   | G    | G    | G    | G    | G    | G    | G                              | G   | G    | G    | G    | G    | G    |      | F                              | F   | F   | F    | F    | F    | F    | F    | F                              | F    | F   | F   | F    | F    | F    | F    | F    |      |      |
| 0.680          | 684                            |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |                                | G   | G   | G    | G    | G    | G    | G    | G                              | G    | G   | G   | G    | G    | G    | G    | G    |      |      |
| 0.820          | 824                            |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |                                |     | G   | G    | G    | G    | G    | G    | G                              | G    | G   | G   | G    | G    | G    | G    | G    |      |      |
| 1.000          | 105                            |     |      |      |      |      |      |      |                                |     |      |      |      |      |      |      |                                |     | G   | G    | G    | G    | G    | G    | G                              | G    | G   | G   | G    | G    | G    | G    | G    |      |      |
| Voltage (V)    | 600                            | 630 | 1000 | 1500 | 2000 | 2500 | 3000 | 4000 | 600                            | 630 | 1000 | 1500 | 2000 | 2500 | 3000 | 4000 | 5000                           | 600 | 630 | 1000 | 1500 | 2000 | 2500 | 3000 | 4000                           | 5000 | 600 | 630 | 1000 | 1500 | 2000 | 2500 | 3000 | 4000 | 5000 |
| Case Size      | 1825                           |     |      |      |      |      |      |      | 2220                           |     |      |      |      |      |      |      | 2225                           |     |     |      |      |      |      |      | 3640                           |      |     |     |      |      |      |      |      |      |      |

| Letter         | A               | C               | E               | F               | G               | X               | 7               |
|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Max. Thickness | 0.81<br>(0.032) | 1.45<br>(0.057) | 1.80<br>(0.071) | 2.20<br>(0.087) | 2.80<br>(0.110) | 0.94<br>(0.037) | 3.30<br>(0.130) |

NOTE: Contact factory for non-specified capacitance values

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