

# High Voltage MLC Chips



For 600V to 5000V Applications



## NEW 630V RANGE

High value, low leakage and small size are difficult parameters to obtain in capacitors for high voltage systems. 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, AVX offers leaded version in either thru-hole or SMT configurations (for details see section on high voltage leaded MLC chips).

## HOW TO ORDER

| 1808      | A             | A                       | 271                                                       | K                                     | A                          | 1                                                                        | 1                                          | A                            |
|-----------|---------------|-------------------------|-----------------------------------------------------------|---------------------------------------|----------------------------|--------------------------------------------------------------------------|--------------------------------------------|------------------------------|
| AVX Style | Voltage       | Temperature Coefficient | Capacitance Code<br>(2 significant digits + no. of zeros) | Capacitance Tolerance<br>C0G: J = ±5% | Test Level<br>A = Standard | Termination*<br>1 = Pd/Ag<br>T = Plated<br>Ni and Sn<br>(RoHS Compliant) | Packaging<br>1 = 7" Reel**<br>3 = 13" Reel | Special Code<br>A = Standard |
| 0805      | 600V/630V = C | NPO (C0G) = A           | Examples:<br>10 pF = 100                                  | K = ±10%                              |                            |                                                                          |                                            |                              |
| 1206      | 1000V = A     | X7R = C                 | 100 pF = 101                                              | M = ±20%                              |                            |                                                                          |                                            |                              |
| 1210      | 1500V = S     |                         | 1,000 pF = 102                                            | X7R: K = ±10%                         |                            |                                                                          |                                            |                              |
| 1808      | 2000V = G     |                         | 22,000 pF = 223                                           | M = ±20%                              |                            |                                                                          |                                            |                              |
| 1812      | 2500V = W     |                         | 220,000 pF = 224                                          | Z = +80%,<br>-20%                     |                            |                                                                          |                                            |                              |
| 1825      | 3000V = H     |                         | 1 µF = 105                                                |                                       |                            |                                                                          |                                            |                              |
| 2220      | 4000V = J     |                         |                                                           |                                       |                            |                                                                          |                                            |                              |
| 2225      | 5000V = K     |                         |                                                           |                                       |                            |                                                                          |                                            |                              |
| 3640      |               |                         |                                                           |                                       |                            |                                                                          |                                            |                              |
| ***       |               |                         |                                                           |                                       |                            |                                                                          |                                            |                              |

**\*Note:** Terminations with 5% minimum lead (Pb) is available, see pages 87 and 88 for LD style. Leaded terminations are available, see pages 89 and 90.

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.

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

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



## DIMENSIONS

|                              | millimeters (inches)           |                                |                                |                                |                                |                                |                                |                                |                                |
|------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| SIZE                         | 0805                           | 1206                           | 1210*                          | 1808*                          | 1812*                          | 1825*                          | 2220*                          | 2225*                          | 3640*                          |
| (L) Length                   | 2.01 ± 0.20<br>(0.079 ± 0.008) | 3.20 ± 0.20<br>(0.126 ± 0.008) | 3.20 ± 0.20<br>(0.126 ± 0.008) | 4.57 ± 0.25<br>(0.180 ± 0.010) | 4.50 ± 0.30<br>(0.177 ± 0.012) | 4.50 ± 0.30<br>(0.177 ± 0.012) | 5.70 ± 0.40<br>(0.224 ± 0.016) | 5.72 ± 0.25<br>(0.225 ± 0.010) | 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 ± 0.20<br>(0.098 ± 0.008) | 2.03 ± 0.25<br>(0.080 ± 0.010) | 3.20 ± 0.20<br>(0.126 ± 0.008) | 6.40 ± 0.30<br>(0.252 ± 0.012) | 5.00 ± 0.40<br>(0.197 ± 0.016) | 6.35 ± 0.25<br>(0.250 ± 0.010) | 10.2 ± 0.25<br>(0.400 ± 0.010) |
| (T) Thickness<br>Max.        | 1.30<br>(0.051)                | 1.52<br>(0.060)                | 1.70<br>(0.067)                | 2.03<br>(0.080)                | 2.54<br>(0.100)                | 2.54<br>(0.100)                | 3.30<br>(0.130)                | 2.54<br>(0.100)                | 2.54<br>(0.100)                |
| (t) terminal<br>min.<br>max. | 0.50 ± 0.25<br>(0.020 ± 0.010) | 0.25 (0.010)<br>0.75 (0.030)   | 0.25 (0.010)<br>0.75 (0.030)   | 0.25 (0.010)<br>1.02 (0.040)   | 0.25 (0.010)<br>1.02 (0.040)   | 0.25 (0.010)<br>1.02 (0.040)   | 0.25 (0.010)<br>1.02 (0.040)   | 0.25 (0.010)<br>1.02 (0.040)   | 0.76 (0.030)<br>1.52 (0.060)   |

\*Reflow Soldering Only



## NP0 (C0G) Dielectric Performance Characteristics

|                                                   |                                                                                         |
|---------------------------------------------------|-----------------------------------------------------------------------------------------|
| <b>Capacitance Range</b>                          | 10 pF to 0.047 $\mu$ F (25°C, 1.0 $\pm$ 0.2 Vrms at 1kHz, for $\leq$ 1000 pF use 1 MHz) |
| <b>Capacitance Tolerances</b>                     | $\pm$ 5%, $\pm$ 10%, $\pm$ 20%                                                          |
| <b>Dissipation Factor</b>                         | 0.1% max. (+25°C, 1.0 $\pm$ 0.2 Vrms, 1kHz, for $\leq$ 1000 pF use 1 MHz)               |
| <b>Operating Temperature Range</b>                | -55°C to +125°C                                                                         |
| <b>Temperature Characteristic</b>                 | 0 $\pm$ 30 ppm/°C (0 VDC)                                                               |
| <b>Voltage Ratings</b>                            | 600, 630, 1000, 1500, 2000, 2500, 3000, 4000 & 5000 VDC (+125°C)                        |
| <b>Insulation Resistance</b> (+25°C, at 500 VDC)  | 100K M $\Omega$ min. or 1000 M $\Omega$ - $\mu$ F min., whichever is less               |
| <b>Insulation Resistance</b> (+125°C, at 500 VDC) | 10K M $\Omega$ min. or 100 M $\Omega$ - $\mu$ F min., whichever is less                 |
| <b>Dielectric Strength</b>                        | Minimum 120% rated voltage for 5 seconds at 50 mA max. current                          |

| Case Size     |             |                                | 0805                           |     |      | 1206                           |     |      |      | 1210                           |     |     |      | 1808                           |      |     |                                |      |      |      | 1812        |      |      |     |     |      |      |      |      |      |      |
|---------------|-------------|--------------------------------|--------------------------------|-----|------|--------------------------------|-----|------|------|--------------------------------|-----|-----|------|--------------------------------|------|-----|--------------------------------|------|------|------|-------------|------|------|-----|-----|------|------|------|------|------|------|
| Soldering     |             |                                | Reflow/Wave                    |     |      | Reflow/Wave                    |     |      |      | Reflow Only                    |     |     |      | Reflow Only                    |      |     |                                |      |      |      | Reflow Only |      |      |     |     |      |      |      |      |      |      |
| (L) Length    | mm<br>(in.) | 2.01 ± 0.20<br>(0.079 ± 0.008) | 3.20 ± 0.20<br>(0.126 ± 0.008) |     |      | 3.20 ± 0.20<br>(0.126 ± 0.008) |     |      |      | 4.57 ± 0.25<br>(0.180 ± 0.010) |     |     |      | 4.50 ± 0.30<br>(0.177 ± 0.012) |      |     |                                |      |      |      |             |      |      |     |     |      |      |      |      |      |      |
| (W) Width     | mm<br>(in.) | 1.25 ± 0.20<br>(0.049 ± 0.008) | 1.60 ± 0.20<br>(0.063 ± 0.008) |     |      | 2.50 ± 0.20<br>(0.098 ± 0.008) |     |      |      | 2.03 ± 0.25<br>(0.080 ± 0.010) |     |     |      |                                |      |     | 3.20 ± 0.20<br>(0.126 ± 0.008) |      |      |      |             |      |      |     |     |      |      |      |      |      |      |
| (T) Thickness | mm<br>(in.) | 1.30<br>(0.051)                | 1.52<br>(0.060)                |     |      | 1.70<br>(0.067)                |     |      |      | 2.03<br>(0.080)                |     |     |      |                                |      |     | 2.54<br>(0.100)                |      |      |      |             |      |      |     |     |      |      |      |      |      |      |
| (t) Terminal  | min<br>max  | 0.50 ± 0.25<br>(0.020 ± 0.010) | 0.25 (0.010)<br>0.75 (0.030)   |     |      | 0.25 (0.010)<br>0.75 (0.030)   |     |      |      | 0.25 (0.010)<br>1.02 (0.040)   |     |     |      |                                |      |     | 0.25 (0.010)<br>1.02 (0.040)   |      |      |      |             |      |      |     |     |      |      |      |      |      |      |
| 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)      | 1.5         | 1R5                            | A                              | A   |      | X                              | X   | X    | X    | X                              |     |     |      |                                |      |     |                                |      |      |      |             |      |      |     |     |      |      |      |      |      |      |
|               | 1.8         | 1R8                            | A                              | A   |      | X                              | X   | X    | X    | X                              |     |     |      |                                |      |     |                                |      |      |      |             |      |      |     |     |      |      |      |      |      |      |
|               | 2.2         | 2R2                            | A                              | A   |      | X                              | X   | X    | X    | X                              |     |     |      |                                |      |     |                                |      |      |      |             |      |      |     |     |      |      |      |      |      |      |
|               | 2.7         | 2R7                            | A                              | A   |      | X                              | X   | X    | X    | X                              |     |     |      |                                |      | C   | C                              | C    | C    | C    | C           |      |      |     |     |      |      |      |      |      |      |
|               | 3.3         | 3R3                            | A                              | A   |      | X                              | X   | X    | X    | X                              |     |     |      |                                |      | C   | C                              | C    | C    | C    | C           |      |      |     |     |      |      |      |      |      |      |
|               | 3.9         | 3R9                            | A                              | A   |      | X                              | X   | X    | X    | X                              |     |     |      |                                |      | C   | C                              | C    | C    | C    | C           |      |      |     |     |      |      |      |      |      |      |
|               | 4.7         | 4R7                            | A                              | A   |      | X                              | X   | X    | X    | X                              |     |     |      |                                |      | C   | C                              | C    | C    | C    | C           |      |      |     |     |      |      |      |      |      |      |
|               | 5.6         | 5R6                            | A                              | A   |      | X                              | X   | X    | X    | X                              |     |     |      |                                |      | C   | C                              | C    | C    | C    | C           |      |      |     |     |      |      |      |      |      |      |
|               | 6.8         | 6R8                            | A                              | A   |      | X                              | X   | X    | X    | X                              |     |     |      |                                |      | C   | C                              | C    | C    | C    | C           |      |      |     |     |      |      |      |      |      |      |
|               | 8.2         | 8R2                            | A                              | A   |      | X                              | X   | X    | X    | X                              |     |     |      |                                |      | C   | C                              | C    | C    | C    | C           |      |      |     |     |      |      |      |      |      |      |
|               | 10          | 100                            | A                              | A   |      | X                              | X   | X    | X    | X                              | C   | C   | D    | D                              | D    | C   | C                              | C    | C    | C    | C           |      | C    | C   | C   | G    | C    | C    | C    | C    |      |
|               | 12          | 120                            | A                              | A   |      | X                              | X   | X    | X    | X                              | C   | C   | D    | D                              | D    | C   | C                              | C    | C    | C    | C           |      | C    | C   | C   | C    | C    | C    | C    | C    |      |
|               | 15          | 150                            | A                              | A   |      | X                              | X   | X    | X    | X                              | C   | C   | D    | D                              | D    | C   | C                              | C    | C    | C    | C           |      | C    | C   | C   | C    | C    | C    | C    | C    |      |
|               | 18          | 180                            | A                              | A   |      | X                              | X   | X    | X    | X                              | C   | C   | D    | D                              | D    | C   | C                              | C    | C    | C    | C           |      | C    | C   | C   | C    | C    | C    | C    | C    |      |
|               | 22          | 220                            | A                              | A   |      | X                              | X   | X    | X    | X                              | C   | C   | D    | D                              | D    | C   | C                              | C    | C    | C    | C           |      | C    | C   | C   | C    | C    | C    | C    | C    |      |
|               | 27          | 270                            | A                              | A   |      | X                              | X   | X    | X    | X                              | C   | C   | D    | D                              | D    | C   | C                              | C    | C    | C    | C           |      | C    | C   | C   | C    | C    | C    | C    | C    |      |
|               | 33          | 330                            | A                              | A   |      | X                              | X   | X    | D    | D                              | C   | C   | D    | D                              | D    | C   | C                              | C    | C    | C    | C           |      | C    | C   | C   | C    | C    | C    | C    | C    |      |
|               | 39          | 390                            | A                              | A   |      | X                              | X   | X    | D    | D                              | C   | C   | D    | D                              | D    | C   | C                              | C    | C    | C    | C           |      | C    | C   | C   | C    | C    | C    | C    | C    |      |
|               | 47          | 470                            | A                              | A   |      | X                              | X   | M    | D    | D                              | C   | C   | D    | D                              | D    | C   | C                              | C    | C    | C    | C           |      | C    | C   | C   | C    | C    | C    | C    | C    |      |
|               | 56          | 560                            | A                              | A   |      | X                              | X   | M    | C    | C                              | C   | C   | D    | C                              | C    | C   |                                |      |      |      |             |      |      |     |     |      |      |      |      |      |      |

# High Voltage MLC Chips

For 600V to 5000V Applications



## NP0 (C0G) CAPACITANCE RANGE PREFERRED SIZES ARE SHADED

| Case Size              | 1825                        |     |      |      |      |      |      |      | 2220                        |     |      |      |      |      |      |      | 2225                        |     |     |      |      |      |      |      | 3640                        |      |     |     |      |      |      |      |      |      |      |
|------------------------|-----------------------------|-----|------|------|------|------|------|------|-----------------------------|-----|------|------|------|------|------|------|-----------------------------|-----|-----|------|------|------|------|------|-----------------------------|------|-----|-----|------|------|------|------|------|------|------|
| Soldering              | Reflow Only                 |     |      |      |      |      |      |      | Reflow Only                 |     |      |      |      |      |      |      | Reflow Only                 |     |     |      |      |      |      |      | Reflow Only                 |      |     |     |      |      |      |      |      |      |      |
| (L) Length mm (in.)    | 4.50 ± 0.30 (0.177 ± 0.012) |     |      |      |      |      |      |      | 5.70 ± 0.40 (0.224 ± 0.016) |     |      |      |      |      |      |      | 5.72 ± 0.25 (0.225 ± 0.010) |     |     |      |      |      |      |      | 9.14 ± 0.25 (0.360 ± 0.010) |      |     |     |      |      |      |      |      |      |      |
| (W) Width mm (in.)     | 6.40 ± 0.30 (0.252 ± 0.012) |     |      |      |      |      |      |      | 5.00 ± 0.40 (0.197 ± 0.016) |     |      |      |      |      |      |      | 6.35 ± 0.25 (0.250 ± 0.010) |     |     |      |      |      |      |      | 10.2 ± 0.25 (0.400 ± 0.010) |      |     |     |      |      |      |      |      |      |      |
| (T) Thickness mm (in.) | 2.54 (0.100)                |     |      |      |      |      |      |      | 3.30 (0.130)                |     |      |      |      |      |      |      | 2.54 (0.100)                |     |     |      |      |      |      |      | 2.54 (0.100)                |      |     |     |      |      |      |      |      |      |      |
| (t) Terminal min max   | 0.25 (0.010) 1.02 (0.040)   |     |      |      |      |      |      |      | 0.25 (0.010) 1.02 (0.040)   |     |      |      |      |      |      |      | 0.25 (0.010) 1.02 (0.040)   |     |     |      |      |      |      |      | 0.76 (0.030) 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)               | 1.5 1R5                     |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             |     |     |      |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 1.8 1R8                     |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             |     |     |      |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 2.2 2R2                     |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             |     |     |      |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 2.7 2R7                     |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             |     |     |      |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 3.3 3R3                     |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             |     |     |      |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 3.9 3R9                     |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             |     |     |      |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 4.7 4R7                     |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             |     |     |      |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 5.6 5R6                     |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             |     |     |      |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 6.8 6R8                     |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             |     |     |      |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 8.2 8R2                     | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 10 100                      | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 12 120                      | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 15 150                      | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 18 180                      | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 22 220                      | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 27 270                      | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 33 330                      | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 39 390                      | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 47 470                      | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 56 560                      | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 68 680                      | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 82 820                      | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 100 101                     | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 120 121                     | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 150 151                     | 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                     | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 220 221                     | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 270 271                     | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 330 331                     | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 390 391                     | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 470 471                     | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 560 561                     | E   | E    | E    | E    | E    | E    | E    | E                           | E   | E    | E    | E    | E    | E    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 680 681                     | E   | E    | E    | E    | E    | F    | F    | E                           | E   | E    | E    | E    | F    | F    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 750 751                     | E   | E    | E    | E    | E    | F    | F    | E                           | E   | E    | E    | E    | F    | F    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 820 821                     | E   | E    | E    | E    | E    | F    | F    | E                           | E   | E    | E    | E    | F    | F    | E    |                             | E   | E   | E    | E    | E    | F    | E    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 1000 102                    | E   | E    | E    | E    | E    | F    | F    | E                           | E   | E    | E    | E    | F    | F    | E    |                             | E   | E   | E    | E    | E    | E    | E    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 1200 122                    | E   | E    | E    | E    | E    | G    | G    | E                           | E   | E    | E    | E    | G    | G    | E    |                             | E   | E   | E    | E    | E    | F    | F    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 1500 152                    | E   | E    | E    | F    | F    | G    | G    | E                           | E   | E    | F    | F    | G    | G    | E    |                             | E   | E   | E    | E    | E    | F    | F    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 1800 182                    | E   | E    | E    | F    | F    | G    | G    | E                           | E   | E    | F    | F    | G    | G    | E    |                             | E   | E   | E    | E    | E    | G    | G    |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 2200 222                    | E   | E    | E    | G    | G    |      |      | E                           | E   | E    | G    | G    |      |      | E    |                             | E   | E   | E    | E    |      |      |      |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 2700 272                    | E   | E    | E    | G    | G    |      |      | E                           | E   | E    | G    | G    |      |      | E    |                             | E   | E   | F    | F    |      |      |      |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 3300 332                    | E   | E    | E    | G    | G    |      |      | E                           | E   | E    | G    | G    |      |      | E    |                             | E   | E   | F    | F    |      |      |      |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 3900 392                    | E   | E    | E    | G    | G    |      |      | E                           | E   | E    | G    | G    |      |      | E    |                             | E   | E   | G    | G    |      |      |      |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 4700 472                    | E   | E    | E    | G    | G    |      |      | E                           | E   | E    | G    | G    |      |      | F    |                             | F   | F   | G    | G    |      |      |      |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 5600 562                    | F   | F    | F    | G    | G    |      |      | F                           | F   | F    | G    | G    |      |      | F    |                             | F   | F   | G    | G    |      |      |      |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 6800 682                    | F   | F    | F    |      |      |      |      | F                           | F   | F    |      |      |      |      | F    |                             | F   | F   | F    | G    | G    |      |      |                             |      |     |     |      |      |      |      |      | G    |      |
|                        | 8200 822                    | G   | G    | G    |      |      |      |      | G                           | G   | G    |      |      |      |      | G    |                             | G   | G   | G    |      |      |      |      |                             |      |     |     |      |      |      |      |      |      | G    |
| Cap (µF)               | 0.010 103                   |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             | G   | G   | G    |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 0.012 123                   |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             | G   | G   | G    |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 0.015 153                   |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             | G   | G   | G    |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 0.018 183                   |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             | G   | G   | G    |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 0.022 223                   |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             | G   | G   | G    |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 0.033 333                   |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             | G   | G   | G    |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 0.047 473                   |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             | G   | G   | G    |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 0.056 563                   |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             | G   | G   | G    |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 0.068 683                   |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             | G   | G   | G    |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |      |
|                        | 0.100 104                   |     |      |      |      |      |      |      |                             |     |      |      |      |      |      |      |                             | 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                        |      |     |     |      |      |      |      |      |      |      |

# High Voltage MLC Chips



For 600V to 5000V Applications

## X7R Dielectric Performance Characteristics

|                                            |                                                                           |
|--------------------------------------------|---------------------------------------------------------------------------|
| Capacitance Range                          | 10 pF to 0.56 $\mu$ F (25°C, 1.0 $\pm$ 0.2 Vrms at 1kHz)                  |
| Capacitance Tolerances                     | $\pm$ 10%; $\pm$ 20%; +80%, -20%                                          |
| Dissipation Factor                         | 2.5% max. (+25°C, 1.0 $\pm$ 0.2 Vrms, 1kHz)                               |
| Operating Temperature Range                | -55°C to +125°C                                                           |
| Temperature Characteristic                 | $\pm$ 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 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            |

## X7R CAPACITANCE RANGE PREFERRED SIZES ARE SHADED

| Case Size     |          |     | 0805                        |     |      | 1206                        |     |      |      | 1210                        |     |     |      | 1808                        |      |     |     |      |      |      |      | 1812                        |      |     |     |      |      |      |      |      |      |   |
|---------------|----------|-----|-----------------------------|-----|------|-----------------------------|-----|------|------|-----------------------------|-----|-----|------|-----------------------------|------|-----|-----|------|------|------|------|-----------------------------|------|-----|-----|------|------|------|------|------|------|---|
| Soldering     |          |     | Reflow/Wave                 |     |      | Reflow/Wave                 |     |      |      | Reflow Only                 |     |     |      | Reflow Only                 |      |     |     |      |      |      |      | Reflow Only                 |      |     |     |      |      |      |      |      |      |   |
| (L) Length    | mm (in.) |     | 2.01 ± 0.20 (0.079 ± 0.008) |     |      | 3.20 ± 0.20 (0.126 ± 0.008) |     |      |      | 3.20 ± 0.20 (0.126 ± 0.008) |     |     |      | 4.57 ± 0.25 (0.180 ± 0.010) |      |     |     |      |      |      |      | 4.50 ± 0.30 (0.177 ± 0.012) |      |     |     |      |      |      |      |      |      |   |
| (W) Width     | mm (in.) |     | 1.25 ± 0.20 (0.049 ± 0.008) |     |      | 1.60 ± 0.20 (0.063 ± 0.008) |     |      |      | 2.50 ± 0.20 (0.098 ± 0.008) |     |     |      | 2.50 ± 0.20 (0.098 ± 0.008) |      |     |     |      |      |      |      | 3.20 ± 0.20 (0.126 ± 0.008) |      |     |     |      |      |      |      |      |      |   |
| (T) Thickness | mm (in.) |     | 1.30 (0.051)                |     |      | 1.52 (0.060)                |     |      |      | 1.70 (0.067)                |     |     |      | 2.03 (0.080)                |      |     |     |      |      |      |      | 2.54 (0.100)                |      |     |     |      |      |      |      |      |      |   |
| (t) Terminal  | min max  |     | 0.50 ± 0.25 (0.020 ± 0.010) |     |      | 0.25 (0.010) 0.75 (0.030)   |     |      |      | 0.25 (0.010) 0.75 (0.030)   |     |     |      | 0.25 (0.010) 1.02 (0.040)   |      |     |     |      |      |      |      | 0.25 (0.010) 1.02 (0.040)   |      |     |     |      |      |      |      |      |      |   |
| 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    |     |     |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |   |
|               | 120      | 121 | X                           | X   | C    | C                           | C   | E    | E    | E                           | E   | E   | E    | E                           | E    |     |     |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |   |
|               | 150      | 151 | X                           | X   | C    | C                           | C   | E    | E    | E                           | E   | E   | E    | E                           | E    |     |     |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |   |
|               | 180      | 181 | X                           | X   | C    | C                           | C   | E    | E    | E                           | E   | E   | E    | E                           | E    |     |     |      |      |      |      |                             |      |     |     |      |      |      |      |      |      |   |
|               | 220      | 221 | X                           | X   | C    | C                           | C   | 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    |      |      |      |   |
|               | 330      | 331 | X                           | X   | C    | C                           | C   | E    | E    | E                           | E   | E   | E    | E                           | E    | E   | E   | E    | E    | E    | E    | F                           |      | 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    | F                           |      | 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    | F                           |      | 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    | F                           | F    |     | 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    | F                           | F    |     | E   | E    | E    | E    | E    | F    | F    | F |
|               | 750      | 751 | X                           | X   | C    | C                           | C   | E    | E    | E                           | E   | E   | E    | E                           | E    | E   | E   | E    | E    | E    | E    | F                           | F    |     | E   | E    | E    | E    | E    | F    | F    | F |
|               | 820      | 821 | X                           | X   | C    | C                           | C   | E    | E    | E                           | E   | E   | E    | E                           | E    | E   | E   | E    | E    | E    | E    | F                           | F    |     | E   | E    | E    | E    | E    | F    | F    | F |
|               | 1000     | 102 | X                           | X   | C    | C                           | C   | E    | E    | E                           | E   | E   | E    | E                           | E    | E   | E   | E    | E    | E    | E    | F                           | F    |     | E   | E    | E    | E    | E    | F    | F    | F |
|               | 1200     | 122 | X                           | X   | C    | C                           | C   | E    | E    | E                           | E   | E   | E    | E                           | E    | E   | E   | E    | E    | E    | E    | F                           | F    |     | E   | E    | E    | E    | E    | F    | F    | F |
|               | 1500     | 152 | X                           | X   | C    | C                           | C   | E    | E    | E                           | E   | E   | E    | E                           | E    | E   | E   | E    | E    | E    | E    | F                           | F    |     | E   | E    | E    | E    | E    | G    | G    | G |
|               | 1800     | 182 | X                           | X   |      |                             | C   | C    | E    | E                           | E   | E   | E    | E                           | E    | E   | E   | E    | E    | E    | E    | F                           | F    |     | E   | E    | E    | E    | E    | G    | G    | G |
|               | 2200     | 222 | X                           | X   |      |                             | C   | C    | E    | E                           | E   | E   | E    | E                           | F    | E   | E   | E    | E    | F    | F    | F                           |      | E   | E   | E    | E    | E    | G    | G    | G    |   |
|               | 2700     | 272 | X                           | X   |      |                             | C   | C    | E    | E                           |     |     | E    | E                           | E    | F   | E   | E    | E    | E    | F    | F                           |      | E   | E   | E    | E    | E    | G    | G    | G    |   |
|               | 3300     | 332 | X                           | X   |      |                             | C   | C    | E    |                             |     |     | E    | E                           | E    | F   | E   | E    | E    | E    | F    | F                           |      | E   | E   | E    | E    | F    | F    | G    | G    |   |
|               | 3900     | 392 | X                           | X   |      |                             | C   | C    | E    |                             |     |     | E    | E                           | E    | G   |     |      | E    | E    | F    |                             |      | E   | E   | E    | E    | F    | F    | G    | G    |   |
|               | 4700     | 472 | X                           | X   |      |                             | C   | C    | E    |                             |     |     | E    | E                           | E    | G   |     |      | E    | E    | E    | F                           |      | E   | E   | E    | E    | F    | F    | G    | G    |   |
|               | 5600     | 562 | X                           | X   |      |                             | C   | C    | E    |                             |     |     | E    | E                           | E    | G   |     |      | E    | E    | E    | F                           |      | E   | E   | E    | E    | G    | G    |      |      |   |
|               | 6800     | 682 | X                           | X   |      |                             | C   | C    | E    |                             |     |     | E    | E                           | E    |     |     |      | E    | E    | E    | F                           |      | E   | E   | E    | E    | G    | G    |      |      |   |
|               | 8200     | 822 | X                           | X   |      |                             | C   | C    | E    |                             |     |     | E    | E                           | E    |     |     |      | E    | E    | E    |                             |      | E   | E   | E    | E    | G    | G    |      |      |   |
| Cap (µF)      | 0.010    | 103 | C                           | C   |      |                             | C   | C    | E    |                             |     |     | E    | E                           | E    |     |     |      | E    | E    | E    |                             |      | E   | E   | F    | G    | G    |      |      |      |   |
|               | 0.015    | 153 | C                           | C   |      |                             | E   | E    | E    |                             |     |     | E    | E                           | E    |     |     |      | F    | F    | F    |                             |      | E   | E   | F    | G    |      |      |      |      |   |
|               | 0.018    | 183 | C                           | C   |      |                             | E   | E    |      |                             |     |     | E    | E                           | E    |     |     |      | F    | F    | F    |                             |      | E   | E   | G    |      |      |      |      |      |   |
|               | 0.022    | 223 | C                           | C   |      |                             | E   | E    |      |                             |     |     | E    | E                           | E    |     |     |      | F    | F    |      |                             |      | E   | E   | G    |      |      |      |      |      |   |
|               | 0.027    | 273 |                             |     |      |                             | E   | E    |      |                             |     |     | E    | E                           |      |     |     |      | F    | F    |      |                             |      | E   | E   | G    |      |      |      |      |      |   |
|               | 0.033    | 333 |                             |     |      |                             | E   | E    |      |                             |     |     | E    | E                           |      |     |     |      | F    | F    |      |                             |      | E   | E   | G    |      |      |      |      |      |   |
|               | 0.039    | 393 |                             |     |      |                             | E   | E    |      |                             |     |     | E    | E                           |      |     |     |      | F    | F    |      |                             |      | E   | E   | G    |      |      |      |      |      |   |
|               | 0.047    | 473 |                             |     |      |                             | E   | E    |      |                             |     |     | E    | E                           |      |     |     |      | F    | F    |      |                             |      | E   | E   | G    |      |      |      |      |      |   |
|               | 0.056    | 563 |                             |     |      |                             | F   | F    |      |                             |     |     | F    | F                           |      |     |     |      | F    | F    |      |                             |      | F   | F   |      |      |      |      |      |      |   |
|               | 0.068    | 683 |                             |     |      |                             | F   | F    |      |                             |     |     | F    | F                           |      |     |     |      | F    | F    |      |                             |      | F   | F   |      |      |      |      |      |      |   |
|               | 0.082    | 823 |                             |     |      |                             | F   | F    |      |                             |     |     | F    | F                           |      |     |     |      | F    | F    |      |                             |      | F   | F   |      |      |      |      |      |      |   |
|               | 0.100    | 104 |                             |     |      |                             | F   | F    |      |                             |     |     | F    | F                           |      |     |     |      | F    | F    |      |                             |      | F   | F   |      |      |      |      |      |      |   |
|               | 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                        |      |     |     |      |      |      |      |      |      |   |



# 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    | 4.50 ± 0.30     |     |      |      |      |      |      |      | 5.70 ± 0.40     |     |      |      |      |      |      |      | 5.72 ± 0.25     |     |     |      |      |      |      |      | 9.14 ± 0.25     |      |     |     |      |      |      |      |      |      |      |
| mm (in.)      | (0.177 ± 0.012) |     |      |      |      |      |      |      | (0.224 ± 0.016) |     |      |      |      |      |      |      | (0.225 ± 0.010) |     |     |      |      |      |      |      | (0.360 ± 0.010) |      |     |     |      |      |      |      |      |      |      |
| (W) Width     | 6.40 ± 0.30     |     |      |      |      |      |      |      | 5.00 ± 0.40     |     |      |      |      |      |      |      | 6.35 ± 0.25     |     |     |      |      |      |      |      | 10.2 ± 0.25     |      |     |     |      |      |      |      |      |      |      |
| mm (in.)      | (0.252 ± 0.012) |     |      |      |      |      |      |      | (0.197 ± 0.016) |     |      |      |      |      |      |      | (0.250 ± 0.010) |     |     |      |      |      |      |      | (0.400 ± 0.010) |      |     |     |      |      |      |      |      |      |      |
| (T) Thickness | 2.54            |     |      |      |      |      |      |      | 3.30            |     |      |      |      |      |      |      | 2.54            |     |     |      |      |      |      |      | 2.54            |      |     |     |      |      |      |      |      |      |      |
| mm (in.)      | (0.100)         |     |      |      |      |      |      |      | (0.130)         |     |      |      |      |      |      |      | (0.100)         |     |     |      |      |      |      |      | (0.100)         |      |     |     |      |      |      |      |      |      |      |
| (t) Terminal  | 0.25 (0.010)    |     |      |      |      |      |      |      | 0.25 (0.010)    |     |      |      |      |      |      |      | 0.25 (0.010)    |     |     |      |      |      |      |      | 0.76 (0.030)    |      |     |     |      |      |      |      |      |      |      |
| min max       | 1.02 (0.040)    |     |      |      |      |      |      |      | 1.02 (0.040)    |     |      |      |      |      |      |      | 1.02 (0.040)    |     |     |      |      |      |      |      | 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    | F               | F   | F   | F    | F    | F    | F    | F    | F               | F    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 1200            | 122 | F    | F    | F    | F    | F    | F    | F               | F   | F    | F    | F    | F    | F    | F    | F               | F   | F   | F    | F    | F    | F    | F    | F               | F    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 1500            | 152 | F    | F    | F    | F    | F    | F    | F               | F   | F    | F    | F    | F    | F    | F    | F               | F   | F   | F    | F    | F    | F    | F    | F               | F    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 1800            | 182 | F    | F    | F    | F    | F    | F    | F               | F   | F    | F    | F    | F    | F    | F    | F               | F   | F   | F    | F    | F    | F    | F    | F               | F    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 2200            | 222 | F    | F    | F    | F    | F    | F    | F               | F   | F    | F    | F    | F    | F    | F    | F               | F   | F   | F    | F    | F    | F    | F    | F               | F    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 2700            | 272 | F    | F    | F    | F    | F    | F    | F               | F   | F    | F    | F    | F    | F    | F    | F               | F   | F   | F    | F    | F    | F    | F    | F               | F    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 3300            | 332 | F    | F    | F    | F    | F    | F    | F               | F   | F    | F    | F    | F    | F    | F    | F               | F   | F   | F    | F    | F    | F    | F    | F               | F    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 3900            | 392 | F    | F    | F    | F    | F    | F    | F               | F   | F    | F    | F    | F    | F    | F    | F               | F   | F   | F    | F    | F    | F    | F    | F               | F    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 4700            | 472 | F    | F    | F    | F    | F    | F    | F               | F   | F    | F    | F    | F    | F    | F    | F               | F   | F   | F    | F    | F    | F    | F    | F               | F    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 5600            | 562 | F    | F    | F    | F    | F    | F    | F               | F   | F    | F    | F    | F    | F    | F    | F               | F   | F   | F    | F    | F    | F    | F    | F               | F    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 6800            | 682 | F    | F    | F    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | F    | F    | F    | F    | F    | F               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 8200            | 822 | F    | F    | F    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | F    | F    | F    | F    | F    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
| Cap (µF)      | 0.010           | 103 | F    | F    | F    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | F    | F    | F    | F    | F    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.015           | 153 | F    | F    | F    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | F    | F    | F    | F    | F    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.018           | 183 | F    | F    | F    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | F    | F    | F    | F    | F    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.022           | 223 | F    | F    | F    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | F    | F    | F    | F    | F    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.027           | 273 | F    | F    | F    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | F    | F    | F    | F    | F    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.033           | 333 | F    | F    | F    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | F    | F    | F    | F    | F    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.039           | 393 | F    | F    | F    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | F    | F    | F    | F    | F    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.047           | 473 | F    | F    | F    | P    | P    | P    | P               | P   | P    | P    | P    | P    | P    | P    | P               | F   | F   | F    | F    | F    | F    | F    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.056           | 563 | F    | F    | F    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | F    | F    | F    | F    | F    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.068           | 683 | F    | F    | G    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | G    | G    | G    | G    | G    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.082           | 823 | F    | F    | G    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | G    | G    | G    | G    | G    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.100           | 104 | F    | F    | G    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | G    | G    | G    | G    | G    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.150           | 154 | F    | F    | G    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | G    | G    | G    | G    | G    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.220           | 224 | F    | F    | G    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | G    | G    | G    | G    | G    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.270           | 274 | F    | F    | G    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | G    | G    | G    | G    | G    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.330           | 334 | F    | F    | G    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | G    | G    | G    | G    | G    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.390           | 394 | F    | F    | G    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | G    | G    | G    | G    | G    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.470           | 474 | F    | F    | G    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | G    | G    | G    | G    | G    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.560           | 564 | G    | G    | G    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | F   | F   | G    | G    | G    | G    | G    | G               | G    | G   | G   | G    | G    | G    | G    | G    | G    |      |
|               | 0.680           | 684 | G    | G    | G    | G    | G    | G    | G               | G   | G    | G    | G    | G    | G    | G    | G               | G   | 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               | G   | G   | 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               | G   | G   | 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             | P             | X             |
| Max. Thickness | 0.813 (0.032) | 1.448 (0.057) | 1.8034 (0.071) | 2.2098 (0.087) | 2.794 (0.110) | 3.048 (0.120) | 0.940 (0.037) |

NOTE: Contact factory for non-specified capacitance values