

# 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%<br>K = ±10%<br>M = ±20%<br>X7R: K = ±10%<br>M = ±20%<br>Z = +80%, -20% | 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<br>100 pF = 101<br>1,000 pF = 102<br>22,000 pF = 223<br>220,000 pF = 224<br>1 µF = 105 |                                                                                                              |                            |                                                                          |                                            |                              |
| 1206      | 1000V = A     | X7R = C                 |                                                                                                                 |                                                                                                              |                            |                                                                          |                                            |                              |
| 1210      | 1500V = S     |                         |                                                                                                                 |                                                                                                              |                            |                                                                          |                                            |                              |
| 1808      | 2000V = G     |                         |                                                                                                                 |                                                                                                              |                            |                                                                          |                                            |                              |
| 1812      | 2500V = W     |                         |                                                                                                                 |                                                                                                              |                            |                                                                          |                                            |                              |
| 1825      | 3000V = H     |                         |                                                                                                                 |                                                                                                              |                            |                                                                          |                                            |                              |
| 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

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## NP0 (C0G) Dielectric Performance Characteristics

|                                            |                                                                                         |
|--------------------------------------------|-----------------------------------------------------------------------------------------|
| Capacitance Range                          | 10 pF to 0.047 $\mu$ 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                          |

## NP0 (C0G) 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    | 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     | 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 | 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  | 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    | X                              |     |      |      |      |      |      |                                |     |     |      |      |      |      |      |      |
|               | 1.8                            | 1R8 | A    | A   |                                |      |      |      | X                              | X   | X    | X    | X    | X                              |     |      |      |      |      |      |                                |     |     |      |      |      |      |      |      |
|               | 2.2                            | 2R2 | A    | A   |                                |      |      |      | X                              | X   | X    | X    | X    | X                              |     |      |      |      |      |      |                                |     |     |      |      |      |      |      |      |
|               | 2.7                            | 2R7 | A    | A   |                                |      |      |      | X                              | X   | X    | X    | X    | X                              |     |      |      |      |      |      |                                |     |     |      |      |      |      |      |      |
|               | 3.3                            | 3R3 | A    | A   |                                |      |      |      | X                              | X   | X    | X    | X    | X                              |     |      |      |      |      |      |                                |     |     |      |      |      |      |      |      |
|               | 3.9                            | 3R9 | A    | A   |                                |      |      |      | X                              | X   | X    | X    | X    | X                              |     |      |      |      |      |      |                                |     |     |      |      |      |      |      |      |
|               | 4.7                            | 4R7 | A    | A   |                                |      |      |      | X                              | X   | X    | X    | X    | X                              |     |      |      |      |      |      |                                |     |     |      |      |      |      |      |      |
|               | 5.6                            | 5R6 | A    | A   |                                |      |      |      | X                              | X   | X    | X    | X    | X                              |     |      |      |      |      |      |                                |     |     |      |      |      |      |      |      |
|               | 6.8                            | 6R8 | A    | A   |                                |      |      |      | X                              | X   | X    | X    | X    | X                              |     |      |      |      |      |      |                                |     |     |      |      |      |      |      |      |
|               | 8.2                            | 8R2 | A    | A   |                                |      |      |      | X                              | X   | X    | X    | X    | X                              |     |      |      |      |      |      |                                |     |     |      |      |      |      |      |      |
|               | 10                             | 100 | A    | A   |                                |      |      |      | X                              | X   | X    | X    | X    | X                              | C   | C    | D    | D    | D    | D    | C                              | C   | C   | C    | C    | C    | C    | C    | C    |
|               | 12                             | 120 | A    | A   |                                |      |      |      | X                              | X   | X    | X    | X    | X                              | C   | C    | D    | D    | D    | D    | C                              | C   | C   | C    | C    | C    | C    | C    | C    |
|               | 15                             | 150 | A    | A   |                                |      |      |      | X                              | X   | X    | X    | X    | X                              | C   | C    | D    | D    | D    | D    | C                              | C   | C   | C    | C    | C    | C    | C    | C    |
|               | 18                             | 180 | A    | A   |                                |      |      |      | X                              | X   | X    | X    | X    | X                              | C   | C    | D    | D    | D    | D    | C                              | C   | C   | C    | C    | C    | C    | C    | C    |
|               | 22                             | 220 | A    | A   |                                |      |      |      | X                              | X   | X    | X    | X    | X                              | C   | C    | D    | D    | D    | D    | C                              | C   | C   | C    | C    | C    | C    | C    | C    |
|               | 27                             | 270 | A    | A   |                                |      |      |      | X                              | X   | X    | X    | X    | X                              | C   | C    | D    | D    | D    | D    | C                              | C   | C   | C    | C    | C    | C    | C    | C    |
|               | 33                             | 330 | A    | A   |                                |      |      |      | X                              | X   | X    | D    | D    | D                              | C   | C    | D    | D    | D    | D    | C                              | C   | C   | C    | C    | C    | C    | C    | C    |
|               | 39                             | 390 | A    | A   |                                |      |      |      | X                              | X   | X    | D    | D    | D                              | C   | C    | D    | D    | D    | D    | C                              | C   | C   | C    | C    | C    | C    | C    | C    |
|               | 47                             | 470 | A    | A   |                                |      |      |      | X                              | X   | M    | D    | D    | D                              | C   | C    | D    | D    | D    | D    | C                              | C   | C   | C    | C    | C    | C    | C    | C    |
|               | 56                             | 560 | A    | A   |                                |      |      |      | X                              | X   | M    | C    | C    | C                              | C   | C    | D    | C    | C    | C    | C                              | C   | C   | C    | C    | C    | C    | C    | C    |
|               | 68                             | 680 | A    | A   |                                |      |      |      | X                              | X   | M    | C    | C    | C                              | C   | C    | D    | C    | C    | C    | C                              | C   | C   | C    | C    | C    | C    | C    | C    |
|               | 82                             | 820 | X    | X   |                                |      |      |      | X                              | X   | C    | C    | C    | C                              | C   | C    | D    | C    | C    | C    | C                              | C   | C   | C    | C    | C    | C    | C    | C    |
|               | 100                            | 101 | X    | X   |                                |      |      |      | X                              | X   | C    | C    | C    | C                              | C   | C    | C    | C    | C    | C    | C                              | C   | C   | F    | F    | C    | C    | C    | C    |
|               | 120                            | 121 | C    | C   |                                |      |      |      | X                              | X   | C    | E    | E    | E                              | C   | C    | C    | C    | C    | C    | C                              | C   | F   | F    | F    | C    | C    | C    | C    |
|               | 150                            | 151 | C    | C   |                                |      |      |      | X                              | X   | C    | E    | E    | E                              | C   | C    | C    | E    | E    | E    | C                              | C   | C   | F    | F    | F    | C    | C    | C    |
|               | 180                            | 181 | C    | C   |                                |      |      |      | X                              | X   | E    | E    | E    | E                              | C   | C    | E    | E    | E    | E    | C                              | C   | C   | F    | F    | F    | F    | C    | C    |
|               | 220                            | 221 | C    | C   |                                |      |      |      | X                              | X   | E    | E    | E    | E                              | C   | C    | E    | E    | E    | E    | C                              | C   | C   | F    | F    | F    | F    | C    | C    |
|               | 270                            | 271 | C    | C   |                                |      |      |      | C                              | C   | E    | E    | E    | E                              | C   | C    | E    | E    | E    | E    | C                              | C   | C   | F    | F    | F    | F    | C    | C    |
|               | 330                            | 331 | C    | C   |                                |      |      |      | C                              | C   | E    | E    | E    | E                              | C   | C    | E    | E    | E    | E    | C                              | C   | F   | F    | F    | F    | F    | C    | C    |
|               | 390                            | 391 | C    | C   |                                |      |      |      | C                              | C   | E    | E    | E    | E                              | C   | C    | E    | E    | E    | E    | C                              | C   | F   | F    | F    | F    | F    | C    | C    |
|               | 470                            | 471 | C    | C   |                                |      |      |      | C                              | C   | E    | E    | E    | E                              | C   | C    | E    | E    | E    | E    | C                              | C   | F   | F    | F    | F    | F    | C    | C    |
|               | 560                            | 561 | C    | C   |                                |      |      |      | C                              | C   | E    | E    | E    | E                              | C   | C    | E    | E    | E    | E    | C                              | C   | F   | F    | F    | F    | F    | C    | C    |
|               | 680                            | 681 | C    | C   |                                |      |      |      | C                              | C   | E    | E    | E    | E                              | C   | C    | E    | E    | E    | E    | C                              | C   | F   | F    | F    | F    | F    | C    | C    |
|               | 750                            | 751 | C    | C   |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | F   | F    | F    | F    | F    | C    | C    |
|               | 820                            | 821 | C    | C   |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | F   | F    | F    | F    | F    | C    | C    |
|               | 1000                           | 102 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | F   | F    | F    | F    | F    | C    | C    |
|               | 1200                           | 122 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | F   | F    | F    | F    | F    | C    | C    |
|               | 1500                           | 152 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | F   | F    | F    | F    | F    | C    | C    |
|               | 1800                           | 182 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | F   | F    | F    | F    | F    | C    | C    |
|               | 2200                           | 222 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
|               | 2700                           | 272 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
|               | 3300                           | 332 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
|               | 3900                           | 392 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
|               | 4700                           | 472 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
|               | 5600                           | 562 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
|               | 6800                           | 682 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
|               | 8200                           | 822 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
| Cap (µF)      | 0.010                          | 103 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
|               | 0.012                          | 123 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
|               | 0.015                          | 153 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
|               | 0.018                          | 183 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
|               | 0.022                          | 223 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
|               | 0.033                          | 333 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
|               | 0.047                          | 473 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
|               | 0.056                          | 563 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
|               | 0.068                          | 683 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
|               | 0.100                          | 104 |      |     |                                |      |      |      | E                              | E   | E    | E    | E    | E                              | C   | C    | E    | G    | G    | G    | C                              | C   | E   | E    | E    | E    | E    | C    | C    |
| 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



## 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 |      |      |      |      |      |      |
| Case Size              | 1825                        |     |      |      |      |      |      |      | 2220                        |     |      |      |      |      |      |      | 2225                        |     |     |      |      |      |      |      | 3640                        |      |     |     |      |      |      |      |      |      |      |

# High Voltage MLC Chips



For 600V to 5000V Applications

## X7R Dielectric Performance Characteristics

|                                                   |                                                                           |
|---------------------------------------------------|---------------------------------------------------------------------------|
| <b>Capacitance Range</b>                          | 10 pF to 0.56 $\mu$ F (25°C, 1.0 $\pm$ 0.2 Vrms at 1kHz)                  |
| <b>Capacitance Tolerances</b>                     | $\pm$ 10%; $\pm$ 20%; +80%, -20%                                          |
| <b>Dissipation Factor</b>                         | 2.5% max. (+25°C, 1.0 $\pm$ 0.2 Vrms, 1kHz)                               |
| <b>Operating Temperature Range</b>                | -55°C to +125°C                                                           |
| <b>Temperature Characteristic</b>                 | $\pm$ 15% (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            |

## 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          | 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          | 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         | 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)      | 100         | 101                            | X    | X   | C   | C           | C                              | E    | E   | E   | E           | E                              | E    |     |     |             |                                |      |      |      |      |     |     |             |                                |      |      |      |      |  |  |  |
|               | 120         | 121                            | X    | X   | C   | C           | C                              | E    | E   | E   | E           | E                              | E    |     |     |             |                                |      |      |      |      |     |     |             |                                |      |      |      |      |  |  |  |
|               | 150         | 151                            | X    | X   | C   | C           | C                              | E    | E   | E   | E           | E                              | E    |     |     |             |                                |      |      |      |      |     |     |             |                                |      |      |      |      |  |  |  |
|               | 180         | 181                            | X    | X   | C   | C           | C                              | E    | E   | E   | E           | E                              | E    |     |     |             |                                |      |      |      |      |     |     |             |                                |      |      |      |      |  |  |  |
|               | 220         | 221                            | X    | X   | C   | C           | C                              | E    | E   | E   | E           | E                              | E    |     |     |             |                                |      |      |      |      |     |     |             |                                |      |      |      |      |  |  |  |
|               | 270         | 271                            | X    | X   | C   | C           | C                              | 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    | 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    | F    |      |     | E   | E           | E                              | E    | E    |      |      |  |  |  |
|               | 470         | 471                            | X    | X   | C   | C           | C                              | E    | E   | E   | E           | E                              | E    | E   | E   | E           | E                              | E    | F    |      |      | 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    | F    | F    |      |     | 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    | F    | F    |      |     | E   | E           | E                              | E    | E    | F    | F    |  |  |  |
|               | 750         | 751                            | X    | X   | C   | C           | C                              | E    | E   | E   | E           | E                              | E    | E   | E   | E           | E                              | E    | F    | F    |      |     | E   | E           | E                              | E    | E    | F    | F    |  |  |  |
|               | 820         | 821                            | X    | X   | C   | C           | C                              | E    | E   | E   | E           | E                              | E    | E   | E   | E           | E                              | E    | F    | F    |      |     | E   | E           | E                              | E    | E    | F    | F    |  |  |  |
|               | 1000        | 102                            | X    | X   | C   | C           | C                              | E    | E   | E   | E           | E                              | E    | E   | E   | E           | E                              | E    | F    | F    |      |     | E   | E           | E                              | E    | E    | F    | F    |  |  |  |
|               | 1200        | 122                            | X    | X   | C   | C           | C                              | E    | E   | E   | E           | E                              | E    | E   | E   | E           | E                              | E    | F    | F    |      |     | E   | E           | E                              | E    | E    | F    | F    |  |  |  |
|               | 1500        | 152                            | X    | X   | C   | C           | C                              | E    | E   | E   | E           | E                              | E    | E   | E   | E           | E                              | E    | F    | F    |      |     | E   | E           | E                              | E    | E    | G    | G    |  |  |  |
|               | 1800        | 182                            | X    | X   |     |             | C                              | C    | E   | E   | E           | E                              | E    | E   | E   | E           | E                              | E    | F    | F    |      |     | E   | E           | E                              | E    | E    | G    | G    |  |  |  |
|               | 2200        | 222                            | X    | X   |     |             | C                              | C    | E   | E   | E           | E                              | E    | F   | E   | E           | E                              | F    | F    | F    |      |     | E   | E           | E                              | E    | E    | G    | G    |  |  |  |
|               | 2700        | 272                            | X    | X   |     |             | C                              | C    | E   | E   |             |                                | E    | E   | E   | F           | E                              | E    | F    | F    |      |     | E   | E           | E                              | E    | E    | G    | G    |  |  |  |
|               | 3300        | 332                            | X    | X   |     |             | C                              | C    | E   |     |             |                                | E    | E   | E   | F           | E                              | E    | F    | F    |      |     | E   | E           | E                              | F    | F    | G    | G    |  |  |  |
|               | 3900        | 392                            | X    | X   |     |             | C                              | C    | E   |     |             |                                | E    | E   | E   | G           |                                |      | F    |      |      |     | E   | E           | E                              | F    | F    | G    | G    |  |  |  |
|               | 4700        | 472                            | X    | X   |     |             | C                              | C    | E   |     |             |                                | E    | E   | E   | G           |                                |      | F    |      |      |     | E   | E           | E                              | F    | F    | G    | G    |  |  |  |
|               | 5600        | 562                            | X    | X   |     |             | C                              | C    | E   |     |             |                                | E    | E   | E   | G           |                                |      | F    |      |      |     | E   | E           | E                              | G    | G    |      |      |  |  |  |
|               | 6800        | 682                            | X    | X   |     |             | C                              | C    | E   |     |             |                                | E    | E   | E   |             |                                |      | F    |      |      |     | E   | E           | E                              | G    | G    |      |      |  |  |  |
|               | 8200        | 822                            | X    | X   |     |             | C                              | C    | 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           | 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   |     |             |                                |      | F    | F    |      |     | E   | E           | G                              |      |      |      |      |  |  |  |
|               | 0.047       | 473                            |      |     |     |             |                                |      |     |     |             |                                | E    | E   |     |             |                                |      | F    | F    |      |     | E   | E           | G                              |      |      |      |      |  |  |  |
|               | 0.056       | 563                            |      |     |     |             |                                |      |     |     |             |                                | F    | F   |     |             |                                |      | F    | F    |      |     | F   | F           |                                |      |      |      |      |  |  |  |
|               | 0.068       | 683                            |      |     |     |             |                                |      |     |     |             |                                | F    | F   |     |             |                                |      | F    | F    |      |     | F   | F           |                                |      |      |      |      |  |  |  |
|               | 0.082       | 823                            |      |     |     |             |                                |      |     |     |             |                                | F    | F   |     |             |                                |      | F    | F    |      |     | F   | F           |                                |      |      |      |      |  |  |  |
|               | 0.100       | 104                            |      |     |     |             |                                |      |     |     |             |                                | 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<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     | 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 | 2.54<br>(0.100)                |     |      |      |      |      |      |      | 3.30<br>(0.130)                |     |      |      |      |      |      |      | 2.54<br>(0.100)                |     |     |      |      |      |      |      | 2.54<br>(0.100)                |      |     |     |      |      |      |      |      |      |      |
| (t) Terminal  | 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)   |      |     |     |      |      |      |      |      |      |      |
| 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    | G                              | 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    | G    | 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    | G    | 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    | G    | G    | 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    | G    | G    | G    | G    | 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    | G    | G    | G    | G    | 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    | G    | G    | G    | G    | 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    | G    | G    | G    | G    | 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    | G    | G    | G    | G    | 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    | G    | G    | G    | G    | 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    | G    | G    | G    | G    | 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<br>(0.032) | 1.448<br>(0.057) | 1.8034<br>(0.071) | 2.2098<br>(0.087) | 2.794<br>(0.110) | 3.048<br>(0.120) | 0.940<br>(0.037) |

NOTE: Contact factory for non-specified capacitance values

