

# C0G (NP0) Dielectric



## General Specifications



C0G (NP0) is the most popular formulation of the "temperature-compensating," EIA Class I ceramic materials. Modern C0G (NP0) formulations contain neodymium, samarium and other rare earth oxides.

C0G (NP0) ceramics offer one of the most stable capacitor dielectrics available. Capacitance change with temperature is  $0 \pm 30 \text{ ppm}/^\circ\text{C}$  which is less than  $\pm 0.3\%$   $\Delta C$  from  $-55^\circ\text{C}$  to  $+125^\circ\text{C}$ . Capacitance drift or hysteresis for C0G (NP0) ceramics is negligible at less than  $\pm 0.05\%$  versus up to  $\pm 2\%$  for films. Typical capacitance change with life is less than  $\pm 0.1\%$  for C0G (NP0), one-fifth that shown by most other dielectrics. C0G (NP0) formulations show no aging characteristics.



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

| 0805                     | 5                                                                                                          | A                                  | 101                                                                | J                                                                                                                                                                                                                                                                                                      | A                                         | T                                           | 2                                                                     | A                                       |
|--------------------------|------------------------------------------------------------------------------------------------------------|------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|---------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------|
| <b>Size</b><br>(L" x W") | <b>Voltage</b><br>6.3V = 6<br>10V = Z<br>16V = Y<br>25V = 3<br>50V = 5<br>100V = 1<br>200V = 2<br>500V = 7 | <b>Dielectric</b><br>C0G (NP0) = A | <b>Capacitance Code (In pF)</b><br>2 Sig. Digits + Number of Zeros | <b>Capacitance Tolerance</b><br>B = $\pm 10 \text{ pF}$ ( $< 10 \text{ pF}$ )<br>C = $\pm 25 \text{ pF}$ ( $< 10 \text{ pF}$ )<br>D = $\pm 50 \text{ pF}$ ( $< 10 \text{ pF}$ )<br>F = $\pm 1\%$ ( $\geq 10 \text{ pF}$ )<br>G = $\pm 2\%$ ( $\geq 10 \text{ pF}$ )<br>J = $\pm 5\%$<br>K = $\pm 10\%$ | <b>Failure Rate</b><br>A = Not Applicable | <b>Terminations</b><br>T = Plated Ni and Sn | <b>Packaging</b><br>2 = 7" Reel<br>4 = 13" Reel<br>U = 4mm TR (01005) | <b>Special Code</b><br>A = Std. Product |

**Contact Factory For**  
1 = Pd/Ag Term  
7 = Gold Plated  
**NOT RoHS COMPLIANT**

**Contact Factory For Multiples**

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



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## Specifications and Test Methods

| Parameter/Test                 |                       | NP0 Specification Limits                                                                                  | Measuring Conditions                                                                                                                                                                                                                   |                    |
|--------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Operating Temperature Range    |                       | -55°C to +125°C                                                                                           | Temperature Cycle Chamber                                                                                                                                                                                                              |                    |
| Capacitance                    |                       | Within specified tolerance                                                                                | Freq.: 1.0 MHz $\pm$ 10% for cap $\leq$ 1000 pF<br>1.0 kHz $\pm$ 10% for cap $>$ 1000 pF<br>Voltage: 1.0Vrms $\pm$ .2V                                                                                                                 |                    |
| Q                              |                       | $<30$ pF: $Q \geq 400 + 20 \times \text{Cap Value}$<br>$\geq 30$ pF: $Q \geq 1000$                        |                                                                                                                                                                                                                                        |                    |
| Insulation Resistance          |                       | 100,000M $\Omega$ or 1000M $\Omega$ - $\mu$ F, whichever is less                                          | Charge device with rated voltage for 60 $\pm$ 5 secs @ room temp/humidity                                                                                                                                                              |                    |
| Dielectric Strength            |                       | No breakdown or visual defects                                                                            | Charge device with 300% of rated voltage for 1-5 seconds, w/charge and discharge current limited to 50 mA (max)<br>Note: Charge device with 150% of rated voltage for 500V devices.                                                    |                    |
| Resistance to Flexure Stresses | Appearance            | No defects                                                                                                | Deflection: 2mm<br>Test Time: 30 seconds<br>                                                                                                        |                    |
|                                | Capacitance Variation | $\pm 5\%$ or $\pm 5$ pF, whichever is greater                                                             |                                                                                                                                                                                                                                        |                    |
|                                | Q                     | Meets Initial Values (As Above)                                                                           |                                                                                                                                                                                                                                        |                    |
|                                | Insulation Resistance | $\geq$ Initial Value $\times$ 0.3                                                                         |                                                                                                                                                                                                                                        |                    |
| Solderability                  |                       | $\geq 95\%$ of each terminal should be covered with fresh solder                                          | Dip device in eutectic solder at 230 $\pm$ 5°C for 5.0 $\pm$ 0.5 seconds                                                                                                                                                               |                    |
| Resistance to Solder Heat      | Appearance            | No defects, $<25\%$ leaching of either end terminal                                                       | Dip device in eutectic solder at 260°C for 60 seconds. Store at room temperature for 24 $\pm$ 2 hours before measuring electrical properties.                                                                                          |                    |
|                                | Capacitance Variation | $\leq \pm 2.5\%$ or $\pm .25$ pF, whichever is greater                                                    |                                                                                                                                                                                                                                        |                    |
|                                | Q                     | Meets Initial Values (As Above)                                                                           |                                                                                                                                                                                                                                        |                    |
|                                | Insulation Resistance | Meets Initial Values (As Above)                                                                           |                                                                                                                                                                                                                                        |                    |
|                                | Dielectric Strength   | Meets Initial Values (As Above)                                                                           |                                                                                                                                                                                                                                        |                    |
| Thermal Shock                  | Appearance            | No visual defects                                                                                         | Step 1: -55°C $\pm$ 2°                                                                                                                                                                                                                 | 30 $\pm$ 3 minutes |
|                                | Capacitance Variation | $\leq \pm 2.5\%$ or $\pm .25$ pF, whichever is greater                                                    | Step 2: Room Temp                                                                                                                                                                                                                      | $\leq$ 3 minutes   |
|                                | Q                     | Meets Initial Values (As Above)                                                                           | Step 3: +125°C $\pm$ 2°                                                                                                                                                                                                                | 30 $\pm$ 3 minutes |
|                                | Insulation Resistance | Meets Initial Values (As Above)                                                                           | Step 4: Room Temp                                                                                                                                                                                                                      | $\leq$ 3 minutes   |
|                                | Dielectric Strength   | Meets Initial Values (As Above)                                                                           | Repeat for 5 cycles and measure after 24 hours at room temperature                                                                                                                                                                     |                    |
| Load Life                      | Appearance            | No visual defects                                                                                         | Charge device with twice rated voltage in test chamber set at 125°C $\pm$ 2°C for 1000 hours (+48, -0).<br><br>Remove from test chamber and stabilize at room temperature for 24 hours before measuring.                               |                    |
|                                | Capacitance Variation | $\leq \pm 3.0\%$ or $\pm .3$ pF, whichever is greater                                                     |                                                                                                                                                                                                                                        |                    |
|                                | Q (C=Nominal Cap)     | $\geq 30$ pF: $Q \geq 350$<br>$\geq 10$ pF, $<30$ pF: $Q \geq 275 + 5C/2$<br>$<10$ pF: $Q \geq 200 + 10C$ |                                                                                                                                                                                                                                        |                    |
|                                | Insulation Resistance | $\geq$ Initial Value $\times$ 0.3 (See Above)                                                             |                                                                                                                                                                                                                                        |                    |
|                                | Dielectric Strength   | Meets Initial Values (As Above)                                                                           |                                                                                                                                                                                                                                        |                    |
| Load Humidity                  | Appearance            | No visual defects                                                                                         | Store in a test chamber set at 85°C $\pm$ 2°C/ 85% $\pm$ 5% relative humidity for 1000 hours (+48, -0) with rated voltage applied.<br><br>Remove from chamber and stabilize at room temperature for 24 $\pm$ 2 hours before measuring. |                    |
|                                | Capacitance Variation | $\leq \pm 5.0\%$ or $\pm .5$ pF, whichever is greater                                                     |                                                                                                                                                                                                                                        |                    |
|                                | Q                     | $\geq 30$ pF: $Q \geq 350$<br>$\geq 10$ pF, $<30$ pF: $Q \geq 275 + 5C/2$<br>$<10$ pF: $Q \geq 200 + 10C$ |                                                                                                                                                                                                                                        |                    |
|                                | Insulation Resistance | $\geq$ Initial Value $\times$ 0.3 (See Above)                                                             |                                                                                                                                                                                                                                        |                    |
|                                | Dielectric Strength   | Meets Initial Values (As Above)                                                                           |                                                                                                                                                                                                                                        |                    |

# C0G (NP0) Dielectric

## Capacitance Range



PREFERRED SIZES ARE SHADED

| SIZE           | 0101*           | 0201                            | 0402                           | 0603                           | 0805                           | 1206                           |
|----------------|-----------------|---------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| Soldering      | Reflow Only     | Reflow Only                     | Reflow/Wave                    | Reflow/Wave                    | Reflow/Wave                    | Reflow/Wave                    |
| Packaging      | All Paper       | All Paper                       | All Paper                      | All Paper                      | Paper/Embossed                 | Paper/Embossed                 |
| (L) Length     | mm<br>(in.)     | 0.40 ± 0.02<br>(0.016 ± 0.0008) | 0.60 ± 0.03<br>(0.024 ± 0.001) | 1.00 ± 0.10<br>(0.040 ± 0.004) | 1.60 ± 0.15<br>(0.063 ± 0.006) | 2.01 ± 0.20<br>(0.079 ± 0.008) |
| (W) Width      | mm<br>(in.)     | 0.20 ± 0.02<br>(0.008 ± 0.0008) | 0.30 ± 0.03<br>(0.011 ± 0.001) | 0.50 ± 0.10<br>(0.020 ± 0.004) | 0.81 ± 0.15<br>(0.032 ± 0.006) | 1.25 ± 0.20<br>(0.049 ± 0.008) |
| (t) Terminal   | mm<br>(in.)     | 0.10 ± 0.04<br>(0.004 ± 0.016)  | 0.15 ± 0.05<br>(0.006 ± 0.002) | 0.25 ± 0.15<br>(0.010 ± 0.006) | 0.35 ± 0.15<br>(0.014 ± 0.006) | 0.50 ± 0.25<br>(0.020 ± 0.010) |
| WVDC           | 16              | 25 50                           | 16 25 50                       | 16 25 50 100 200               | 16 25 50 100 200               | 16 25 50 100 200 500           |
| Cap (pF)       | 0.5             | A                               | C C C                          | G G G G                        | J J J J J                      | J J J J J                      |
|                | 1.0             | B                               | C C C                          | G G G G                        | J J J J J                      | J J J J J                      |
|                | 1.2             | B                               | C C C                          | G G G G                        | J J J J J                      | J J J J J                      |
|                | 1.5             | B                               | A A                            | C C C                          | J J J J J                      | J J J J J                      |
|                | 1.8             | B                               | A A                            | C C C                          | J J J J J                      | J J J J J                      |
|                | 2.2             | B                               | A A                            | C C C                          | J J J J J                      | J J J J J                      |
|                | 2.7             | B                               | A A                            | C C C                          | J J J J J                      | J J J J J                      |
|                | 3.3             | B                               | A A                            | C C C                          | J J J J J                      | J J J J J                      |
|                | 3.9             | B                               | A A                            | C C C                          | J J J J J                      | J J J J J                      |
|                | 4.7             | B                               | A A                            | C C C                          | J J J J J                      | J J J J J                      |
|                | 5.6             | B                               | A A                            | C C C                          | J J J J J                      | J J J J J                      |
|                | 6.8             | B                               | A A                            | C C C                          | J J J J J                      | J J J J J                      |
|                | 8.2             | B                               | A A                            | C C C                          | J J J J J                      | J J J J J                      |
|                | 10              | B                               | A A                            | C C C                          | G G G G G                      | J J J J J                      |
|                | 12              | B                               | A A                            | C C C                          | G G G G G                      | J J J J J                      |
|                | 15              | B                               | A A                            | C C C                          | G G G G G                      | J J J J J                      |
|                | 18              | B                               | A A                            | C C C                          | G G G G G                      | J J J J J                      |
|                | 22              | B                               | A A                            | C C C                          | G G G G G                      | J J J J J                      |
|                | 27              | B                               | A A                            | C C C                          | G G G G G                      | J J J J J                      |
|                | 33              | B                               | A A                            | C C C                          | G G G G G                      | J J J J J                      |
|                | 39              | B                               | A A                            | C C C                          | G G G G G                      | J J J J J                      |
|                | 47              | B                               | A A                            | C C C                          | G G G G G                      | J J J J J                      |
|                | 56              | B                               | A A                            | C C C                          | G G G G G                      | J J J J J                      |
|                | 68              | B                               | A A                            | C C C                          | G G G G G                      | J J J J J                      |
|                | 82              | B                               | A A                            | C C C                          | G G G G G                      | J J J J J                      |
|                | 100             | B                               | A A                            | C C C                          | G G G G G                      | J J J J J                      |
|                | 120             |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 150             |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 180             |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 220             |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 270             |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 330             |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 390             |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 470             |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 560             |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 680             |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 820             |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 1000            |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 1200            |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 1500            |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 1800            |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 2200            |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 2700            |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 3300            |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 3900            |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 4700            |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 5600            |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 6800            |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 8200            |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
| Cap (µF)       | 0.010           |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 0.012           |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 0.015           |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 0.018           |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 0.022           |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 0.027           |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 0.033           |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 0.039           |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 0.047           |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 0.068           |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 0.082           |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
|                | 0.1             |                                 |                                | C C C                          | G G G G G                      | J J J J J                      |
| WVDC           | 16              | 25 50                           | 16 25 50                       | 16 25 50 100 200               | 16 25 50 100 200               | 16 25 50 100 200 500           |
| SIZE           | 0101*           | 0201                            | 0402                           | 0603                           | 0805                           | 1206                           |
| Letter         | A               | B                               | C                              | E                              | G                              | J                              |
| Max. Thickness | 0.33<br>(0.013) | 0.22<br>(0.009)                 | 0.56<br>(0.022)                | 0.71<br>(0.028)                | 0.90<br>(0.035)                | 0.94<br>(0.037)                |
|                | PAPER           |                                 |                                |                                |                                |                                |
| Letter         | K               | M                               | N                              | P                              | Q                              | X                              |
| Max. Thickness | 1.02<br>(0.040) | 1.27<br>(0.050)                 | 1.40<br>(0.055)                | 1.52<br>(0.060)                | 1.78<br>(0.070)                | 2.29<br>(0.090)                |
|                | EMBOSSED        |                                 |                                |                                |                                |                                |
| Letter         | Y               | Z                               |                                |                                |                                |                                |
| Max. Thickness | 2.54<br>(0.100) | 2.79<br>(0.110)                 |                                |                                |                                |                                |



\*EIA 01005



# C0G (NP0) Dielectric

## Capacitance Range



### PREFERRED SIZES ARE SHADED

| SIZE         |                | 1210            |    |     |     |     | 1812            |              |              |              |              | 1825            |              |              |  | 2220            |     |     |   | 2225            |     |     |   |
|--------------|----------------|-----------------|----|-----|-----|-----|-----------------|--------------|--------------|--------------|--------------|-----------------|--------------|--------------|--|-----------------|-----|-----|---|-----------------|-----|-----|---|
| Soldering    |                | Reflow Only     |    |     |     |     | Reflow Only     |              |              |              |              | Reflow Only     |              |              |  | Reflow Only     |     |     |   | Reflow Only     |     |     |   |
| Packaging    |                | Paper/Embossed  |    |     |     |     | All Embossed    |              |              |              |              | All Embossed    |              |              |  | All Embossed    |     |     |   | All Embossed    |     |     |   |
| (L) Length   | mm             | 3.20 ± 0.20     |    |     |     |     | 4.50 ± 0.30     |              |              |              |              | 4.50 ± 0.30     |              |              |  | 5.70 ± 0.40     |     |     |   | 5.72 ± 0.25     |     |     |   |
|              | (in.)          | (0.126 ± 0.008) |    |     |     |     | (0.177 ± 0.012) |              |              |              |              | (0.177 ± 0.012) |              |              |  | (0.225 ± 0.016) |     |     |   | (0.225 ± 0.010) |     |     |   |
| (W) Width    | mm             | 2.50 ± 0.20     |    |     |     |     | 3.20 ± 0.20     |              |              |              |              | 6.40 ± 0.40     |              |              |  | 5.00 ± 0.40     |     |     |   | 6.35 ± 0.25     |     |     |   |
|              | (in.)          | (0.098 ± 0.008) |    |     |     |     | (0.126 ± 0.008) |              |              |              |              | (0.252 ± 0.016) |              |              |  | (0.197 ± 0.016) |     |     |   | (0.250 ± 0.010) |     |     |   |
| (t) Terminal | mm             | 0.50 ± 0.25     |    |     |     |     | 0.61 ± 0.36     |              |              |              |              | 0.61 ± 0.36     |              |              |  | 0.64 ± 0.39     |     |     |   | 0.64 ± 0.39     |     |     |   |
|              | (in.)          | (0.020 ± 0.010) |    |     |     |     | (0.024 ± 0.014) |              |              |              |              | (0.024 ± 0.014) |              |              |  | (0.025 ± 0.015) |     |     |   | (0.025 ± 0.015) |     |     |   |
| WVDC         |                | 25              | 50 | 100 | 200 | 500 | 25              | 50           | 100          | 200          | 500          | 50              | 100          | 200          |  | 50              | 100 | 200 |   | 50              | 100 | 200 |   |
| Cap (pF)     | 0.5            |                 |    |     |     |     |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 1.0            |                 |    |     |     |     |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 1.2            |                 |    |     |     |     |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 1.5            |                 |    |     |     |     |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 1.8            |                 |    |     |     |     |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 2.2            |                 |    |     |     |     |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 2.7            |                 |    |     |     |     |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 3.3            |                 |    |     |     |     |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 3.9            |                 |    |     |     |     |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 4.7            |                 |    |     |     |     |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 5.6            |                 |    |     |     |     |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 6.8            |                 |    |     |     |     |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 8.2            |                 |    |     |     |     |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 10             |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 12             |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 15             |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 18             |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 22             |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 27             |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 33             |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 39             |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 47             |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 56             |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 68             |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 82             |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 100            |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 120            |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 150            |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 180            |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 220            |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 270            |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 330            |                 |    |     |     | J   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 390            |                 |    |     |     | M   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 470            |                 |    |     |     | M   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 560            | J               | J  | J   | J   | M   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 680            | J               | J  | J   | K   | P   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 820            | J               | J  | J   | K   | P   |                 |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |
|              | 1000           | J               | J  | P   | P   | P   | K               | K            | N            | N            | M            | M               | M            | M            |  |                 |     |     | M | M               | M   | P   | P |
|              | 1200           | P               | P  | P   | P   | P   | K               | K            | N            | N            | M            | M               | M            | M            |  |                 |     |     | M | M               | M   | P   | P |
|              | 1500           | P               | P  | P   | P   | P   | K               | K            | N            | N            | M            | M               | M            | M            |  |                 |     |     | M | M               | M   | P   | P |
|              | 1800           | P               | P  | P   | P   |     | K               | K            | N            | N            | M            | M               | M            | M            |  |                 |     |     | M | M               | M   | P   | P |
|              | 2200           | P               | P  | P   | P   |     | K               | K            | N            | N            | P            | X               | X            | M            |  |                 |     |     | M | M               | M   | P   | P |
|              | 2700           | P               | P  | P   | P   |     | K               | K            | N            | P            | Q            | X               | X            | M            |  |                 |     |     | M | M               | M   | P   | P |
|              | 3300           | P               | P  | P   |     |     | K               | K            | N            | P            | Q            | X               | X            | X            |  |                 | X   |     | M | M               | M   | P   | P |
|              | 3900           | P               | P  | P   |     |     | K               | K            | N            | P            | Q            | X               | X            | X            |  | X               | X   |     | M | M               | M   | P   | P |
|              | 4700           | P               | P  | P   |     |     | K               | K            | N            | P            | Q            | X               | X            | X            |  | X               | X   |     | M | M               | M   | P   | P |
|              | 5600           | P               | P  | P   |     |     | K               | K            | P            | P            | X            | X               | X            | X            |  | X               | X   |     | M | M               | M   | P   | P |
|              | 6800           | P               | P  | P   |     |     | K               | K            | X            | X            |              | X               | X            | X            |  | X               | X   |     | M | M               | M   | P   | P |
|              | 8200           | P               | P  |     |     |     | K               | M            |              |              |              | X               | X            | X            |  | X               | X   |     | M | M               | M   | P   | P |
| Cap (μF)     | 0.010          | P               | N  |     |     |     | K               | M            |              |              |              | X               | X            | X            |  | X               | X   |     | M | M               | M   | P   | P |
|              | 0.012          | P               | N  |     |     |     | K               | M            |              |              |              | X               | X            | X            |  | X               | X   |     | M | M               | M   | P   | P |
|              | 0.015          |                 |    |     |     |     | P               | P            |              |              |              | X               | X            | X            |  | X               | X   |     | M | M               | M   | Y   | Y |
|              | 0.018          |                 |    |     |     |     | P               | P            |              |              |              | X               | X            | X            |  | X               | X   | X   | M | M               | M   | Y   | Y |
|              | 0.022          |                 |    |     |     |     | P               | P            |              |              |              | X               | X            | X            |  | X               | X   |     | M | Y               | Y   | Y   | Y |
|              | 0.027          |                 |    |     |     |     | P               | P            |              |              |              | X               | X            | Y            |  | X               | X   |     | P | Y               | Y   | Y   | Y |
|              | 0.033          |                 |    |     |     |     | P               | P            |              |              |              | X               | X            |              |  | X               | X   |     | X | Y               | Y   | Y   | Y |
|              | 0.039          |                 |    |     |     |     | X               | X            |              |              |              | X               |              |              |  | Y               |     |     | X | Y               | Y   | Y   | Y |
|              | 0.047          |                 |    |     |     |     | X               | X            |              |              |              | X               |              |              |  | Y               |     |     | X | Z               |     |     |   |
|              | 0.068          |                 |    |     |     |     | Z               | Z            |              |              |              |                 |              |              |  | Z               |     |     | X | Z               |     |     |   |
|              | 0.082          |                 |    |     |     |     | Z               | Z            |              |              |              |                 |              |              |  | Z               |     |     | X | Z               |     |     |   |
|              | 0.1            |                 |    |     |     |     | Z               | Z            |              |              |              |                 |              |              |  | Z               |     |     | X | Z               |     |     |   |
| WVDC         |                | 25              | 50 | 100 | 200 | 500 | 25              | 50           | 100          | 200          | 500          | 50              | 100          | 200          |  | 50              | 100 | 200 |   | 50              | 100 | 200 |   |
| SIZE         |                | 1210            |    |     |     |     | 1812            |              |              |              |              | 1825            |              |              |  | 2220            |     |     |   | 2225            |     |     |   |
| Letter       | Max. Thickness | A               | C  | E   | G   | J   | K               | M            | N            | P            | Q            | X               | Y            | Z            |  |                 |     |     |   |                 |     |     |   |
|              | 0.33 (0.013)   |                 |    |     |     |     | 1.02 (0.040)    | 1.27 (0.050) | 1.40 (0.055) | 1.52 (0.060) | 1.78 (0.070) | 2.29 (0.090)    | 2.54 (0.100) | 2.79 (0.110) |  |                 |     |     |   |                 |     |     |   |
|              |                | PAPER           |    |     |     |     | EMBOSS          |              |              |              |              |                 |              |              |  |                 |     |     |   |                 |     |     |   |

