

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°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

Size
(L" x W")

5

Voltage
6.3V = 6
10V = Z
16V = Y
25V = 3
50V = 5
100V = 1
200V = 2
500V = 7

A

Dielectric
C0G (NP0) = A

101

Capacitance Code (In pF)
2 Sig. Digits +
Number of
Zeros

J

Capacitance Tolerance
B = $\pm 10 \text{ pF}$ ($< 10 \text{ pF}$)
C = $\pm 25 \text{ pF}$ ($< 10 \text{ pF}$)
D = $\pm 50 \text{ pF}$ ($< 10 \text{ pF}$)
F = $\pm 1\%$ ($\geq 10 \text{ pF}$)
G = $\pm 2\%$ ($\geq 10 \text{ pF}$)
J = $\pm 5\%$
K = $\pm 10\%$

A

Failure Rate
A = Not
Applicable

T

Terminations
T = Plated Ni
and Sn
7 = Gold Plated

2

Packaging
2 = 7" Reel
4 = 13" Reel
7 = Bulk Cass.
9 = Bulk

A

Special Code
A = Std.
Product

Contact Factory For
1 = Pd/Ag Term

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.

Temperature Coefficient



Δ Capacitance vs. Frequency



Insulation Resistance vs Temperature



Variation of Impedance with Cap Value
Impedance vs. Frequency
0805 - C0G (NP0)
10 pF vs. 100 pF vs. 1000 pF



Variation of Impedance with Chip Size
Impedance vs. Frequency
1000 pF - C0G (NP0)



Variation of Impedance with Ceramic Formulation
Impedance vs. Frequency
1000 pF - C0G (NP0) vs X7R
0805



COG (NP0) Dielectric



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 ± 10% for cap ≤ 1000 pF 1.0 kHz ± 10% for cap > 1000 pF Voltage: 1.0Vrms ± .2V | |
| Q | | <30 pF: Q ≥ 400+20 x Cap Value ≥30 pF: Q ≥ 1000 | Charge device with rated voltage for 60 ± 5 secs @ room temp/humidity | |
| Insulation Resistance | | 100,000MΩ or 1000MΩ - μF, whichever is less | Charge device with 300% of rated voltage for 1-5 seconds, w/charge and discharge current limited to 50 mA (max) Note: Charge device with 150% of rated voltage for 500V devices. | |
| Dielectric Strength | | No breakdown or visual defects | Deflection: 2mm Test Time: 30 seconds 1mm/sec  | |
| Resistance to Flexure Stresses | Appearance | No defects | | |
| | Capacitance Variation | ±5% or ±.5 pF, whichever is greater | | |
| | Q | Meets Initial Values (As Above) | | |
| | Insulation Resistance | ≥ Initial Value x 0.3 | | |
| Solderability | | ≥ 95% of each terminal should be covered with fresh solder | Dip device in eutectic solder at 230 ± 5°C for 5.0 ± 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 ± 2 hours before measuring electrical properties. | |
| | Capacitance Variation | ≤ ±2.5% or ±.25 pF, whichever is greater | | |
| | Q | Meets Initial Values (As Above) | | |
| | Insulation Resistance | Meets Initial Values (As Above) | | |
| Thermal Shock | Dielectric Strength | Meets Initial Values (As Above) | Repeat for 5 cycles and measure after 24 hours at room temperature | |
| | Appearance | No visual defects | Step 1: -55°C ± 2° | 30 ± 3 minutes |
| | Capacitance Variation | ≤ ±2.5% or ±.25 pF, whichever is greater | Step 2: Room Temp | ≤ 3 minutes |
| | Q | Meets Initial Values (As Above) | Step 3: +125°C ± 2° | 30 ± 3 minutes |
| | Insulation Resistance | Meets Initial Values (As Above) | Step 4: Room Temp | ≤ 3 minutes |
| Load Life | Dielectric Strength | Meets Initial Values (As Above) | Charge device with twice rated voltage in test chamber set at 125°C ± 2°C for 1000 hours (+48, -0). | |
| | Appearance | No visual defects | Remove from test chamber and stabilize at room temperature for 24 hours before measuring. | |
| | Capacitance Variation | ≤ ±3.0% or ± .3 pF, whichever is greater | | |
| | Q (C=Nominal Cap) | ≥ 30 pF: Q ≥ 350 ≥10 pF, <30 pF: Q ≥ 275 +5C/2 <10 pF: Q ≥ 200 +10C | | |
| | Insulation Resistance | ≥ Initial Value x 0.3 (See Above) | | |
| Load Humidity | Dielectric Strength | Meets Initial Values (As Above) | Store in a test chamber set at 85°C ± 2°C/ 85% ± 5% relative humidity for 1000 hours (+48, -0) with rated voltage applied. | |
| | Appearance | No visual defects | Remove from chamber and stabilize at room temperature for 24 ± 2 hours before measuring. | |
| | Capacitance Variation | ≤ ±5.0% or ± .5 pF, whichever is greater | | |
| | Q | ≥ 30 pF: Q ≥ 350 ≥10 pF, <30 pF: Q ≥ 275 +5C/2 <10 pF: Q ≥ 200 +10C | | |
| | Insulation Resistance | ≥ Initial Value x 0.3 (See Above) | | |
| | Dielectric Strength | Meets Initial Values (As Above) | | |

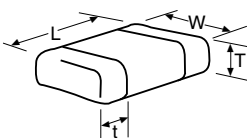
COG (NP0) Dielectric



Capacitance Range

PREFERRED SIZES ARE SHADED

| SIZE | 01005 | 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 (in.) | 0.40 ± 0.02 (0.016 ± 0.0008) | 0.60 ± 0.03 (0.024 ± 0.001) | 1.00 ± 0.10 (0.040 ± 0.004) | 1.60 ± 0.15 (0.063 ± 0.006) | 2.01 ± 0.20 (0.079 ± 0.008) | 3.20 ± 0.20 (0.126 ± 0.008) | | | | | | | | | |
| (W) Width mm (in.) | 0.20 ± 0.02 (0.008 ± 0.0008) | 0.30 ± 0.03 (0.011 ± 0.001) | 0.50 ± 0.10 (0.020 ± 0.004) | 0.81 ± 0.15 (0.032 ± 0.006) | 1.25 ± 0.20 (0.049 ± 0.008) | 1.60 ± 0.20 (0.063 ± 0.008) | | | | | | | | | |
| (t) Terminal mm (in.) | 0.10 ± 0.04 (0.004 ± 0.016) | 0.15 ± 0.05 (0.006 ± 0.002) | 0.25 ± 0.15 (0.010 ± 0.006) | 0.35 ± 0.15 (0.014 ± 0.006) | 0.50 ± 0.25 (0.020 ± 0.010) | 0.50 ± 0.25 (0.020 ± 0.010) | | | | | | | | | |
| WVDC | 16 | 25 50 | 16 25 50 | 16 25 50 100 | 16 25 50 100 200 | 16 25 50 100 200 500 | | | | | | | | | |
| Cap (pF) | 0.5 | A | C C C | G G G | J J J J J | J J J J J | | | | | | | | | |
| | 1.0 | B | A C C | G G G | J J J J J | J J J J J | | | | | | | | | |
| | 1.2 | B | A C C | G G G | J J J J J | J J J J J | | | | | | | | | |
| | 1.5 | B | A C C | G G G | J J J J J | J J J J J | | | | | | | | | |
| | 1.8 | B | A A C | C C C | G G G | J J J J J | | | | | | | | | |
| | 2.2 | B | A A C | C C C | G G G | J J J J J | | | | | | | | | |
| | 2.7 | B | A A C | C C C | G G G | J J J J J | | | | | | | | | |
| | 3.3 | B | A A C | C C C | G G G | J J J J J | | | | | | | | | |
| | 3.9 | B | A A C | C C C | G G G | J J J J J | | | | | | | | | |
| | 4.7 | B | A A C | C C C | G G G | J J J J J | | | | | | | | | |
| | 5.6 | B | A A C | C C C | G G G | J J J J J | | | | | | | | | |
| | 6.8 | B | A A C | C C C | G G G | J J J J J | | | | | | | | | |
| | 8.2 | B | A A C | C C C | G G G | J J J J J | | | | | | | | | |
| | 10 | B | A A C | C C C | G G G | J J J J J | | | | | | | | | |
| | 12 | B | A A C | C C C | G G G | J J J J J | | | | | | | | | |
| | 15 | B | A A C | C C C | G G G | J J J J J | | | | | | | | | |
| | 18 | B | A A C | C C C | G G G | J J J J J | | | | | | | | | |
| | 22 | B | A A C | C C C | G G G | J J J J J | | | | | | | | | |
| | 27 | B | A A C | C C C | G G G | J J J J J | | | | | | | | | |
| | 33 | A | A C C | C C C | G G G | J J J J J | | | | | | | | | |
| | 39 | A | A C C | C C C | G G G | J J J J J | | | | | | | | | |
| | 47 | A | A C C | C C C | G G G | J J J J J | | | | | | | | | |
| | 56 | A | A C C | C C C | G G G | J J J J J | | | | | | | | | |
| | 68 | A | A C C | C C C | G G G | J J J J J | | | | | | | | | |
| | 82 | A | A C C | C C C | G G G | J J J J J | | | | | | | | | |
| | 100 | A | A C C | C C C | G G G | J J J J J | | | | | | | | | |
| | 120 | | C C C | C C C | G G G | J J J J J | | | | | | | | | |
| | 150 | | C C C | C C C | G G G | J J J J J | | | | | | | | | |
| | 180 | | C C C | C C C | G G G | J J J J J | | | | | | | | | |
| | 220 | | C C C | C C C | G G G | J J J J J | | | | | | | | | |
| | 270 | | C C C | C C C | G G G | J J J J M | | | | | | | | | |
| | 330 | | C C C | C C C | G G G | J J J J M | | | | | | | | | |
| | 390 | | C C C | C C C | G G G | J J J J M | | | | | | | | | |
| | 470 | | C C C | C C C | G G G | J J J J M | | | | | | | | | |
| | 560 | | | | G G G | J J J J M | | | | | | | | | |
| | 680 | | | | G G G | J J J J M | | | | | | | | | |
| | 820 | | | | G G G | J J J J M | | | | | | | | | |
| | 1000 | | | | G G G | J J J J M | | | | | | | | | |
| | 1200 | | | | G G G | J J J J M | | | | | | | | | |
| | 1500 | | | | G G G | J J J J M | | | | | | | | | |
| | 1800 | | | | | J J J N | | | | | | | | | |
| | 2200 | | | | | J J J N | | | | | | | | | |
| | 2700 | | | | | J J J N | | | | | | | | | |
| | 3300 | | | | | J J J N | | | | | | | | | |
| | 3900 | | | | | J J J N | | | | | | | | | |
| | 4700 | | | | | J J J N | | | | | | | | | |
| | 5600 | | | | | J J J N | | | | | | | | | |
| | 6800 | | | | | J J J N | | | | | | | | | |
| | 8200 | | | | | J J J N | | | | | | | | | |
| Cap (µF) | 0.010 | | | | | | | | | | | | | | |
| | 0.012 | | | | | | | | | | | | | | |
| | 0.015 | | | | | | | | | | | | | | |
| | 0.018 | | | | | | | | | | | | | | |
| | 0.022 | | | | | | | | | | | | | | |
| | 0.027 | | | | | | | | | | | | | | |
| | 0.033 | | | | | | | | | | | | | | |
| | 0.039 | | | | | | | | | | | | | | |
| | 0.047 | | | | | | | | | | | | | | |
| | 0.068 | | | | | | | | | | | | | | |
| | 0.082 | | | | | | | | | | | | | | |
| | 0.1 | | | | | | | | | | | | | | |
| WVDC | 25 | 50 16 | 25 50 16 | 25 50 100 16 | 25 50 100 200 16 | 25 50 100 200 500 | | | | | | | | | |
| SIZE | 01005 | 0201 | 0402 | 0603 | 0805 | 1206 | | | | | | | | | |
| Letter | A | B | C | E | G | J | K | M | N | P | Q | X | Y | Z | |
| Max. Thickness | 0.33 (0.013) | 0.22 (0.009) | 0.56 (0.022) | 0.71 (0.028) | 0.90 (0.035) | 0.94 (0.037) | 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 | | | | | | | | |



COG (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 (in.) | 3.20 ± 0.20 (0.126 ± 0.008) | | | | | 4.50 ± 0.30 (0.177 ± 0.012) | | | | | 4.50 ± 0.30 (0.177 ± 0.012) | | | | | 5.70 ± 0.40 (0.225 ± 0.016) | | | | | 5.72 ± 0.25 (0.225 ± 0.010) | | | | |
| (W) Width | mm (in.) | 2.50 ± 0.20 (0.098 ± 0.008) | | | | | 3.20 ± 0.20 (0.126 ± 0.008) | | | | | 6.40 ± 0.40 (0.252 ± 0.016) | | | | | 5.00 ± 0.40 (0.197 ± 0.016) | | | | | 6.35 ± 0.25 (0.250 ± 0.010) | | | | |
| (t) Terminal | mm (in.) | 0.50 ± 0.25 (0.020 ± 0.010) | | | | | 0.61 ± 0.36 (0.024 ± 0.014) | | | | | 0.61 ± 0.36 (0.024 ± 0.014) | | | | | 0.64 ± 0.39 (0.025 ± 0.015) | | | | | 0.64 ± 0.39 (0.025 ± 0.015) | | | | |
| WVDC | | 25 | 50 | 100 | 200 | 500 | 25 | 50 | 100 | 200 | 500 | 50 | 100 | 200 | 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 | J | M | | | | | | | | | | | | | | | | | | | | | |
| 820 | J | J | J | J | M | | | | | | | | | | | | | | | | | | | | | |
| 1000 | J | J | J | J | M | K | K | K | K | M | M | M | M | | | | | | | M | M | P | | | | |
| 1200 | J | J | J | M | M | K | K | K | K | M | M | M | M | | | | | | | M | M | P | | | | |
| 1500 | J | J | J | M | M | K | K | K | K | M | M | M | M | | | | | | | M | M | P | | | | |
| 1800 | J | J | J | M | | K | K | K | K | M | M | M | M | | | | | | | M | M | P | | | | |
| 2200 | J | J | J | Q | | K | K | K | K | P | M | M | M | | | | | | | M | M | P | | | | |
| 2700 | J | J | J | Q | | K | K | K | P | Q | M | M | M | | | | | | | M | M | P | | | | |
| 3300 | J | J | J | | | K | K | K | P | Q | M | M | M | | | | X | | | M | M | P | | | | |
| 3900 | J | J | M | | | K | K | K | P | Q | M | M | M | | | | X | X | X | M | M | P | | | | |
| 4700 | J | J | M | | | K | K | K | P | Q | M | M | M | X | X | X | X | X | X | M | M | P | | | | |
| 5600 | J | J | | | | K | K | M | P | X | M | M | M | X | X | X | X | X | X | M | M | P | | | | |
| 6800 | J | J | | | | K | K | M | X | | M | M | M | X | X | X | X | X | X | M | M | P | | | | |
| 8200 | J | J | | | | K | M | M | | | M | M | M | X | X | X | X | X | X | M | M | P | | | | |
| Cap (µF) | 0.010 | J | J | | | K | M | M | | | M | M | M | X | X | X | X | X | X | M | M | P | | | | |
| 0.012 | J | J | | | | K | M | | | | M | M | M | X | X | X | X | X | X | M | M | P | | | | |
| 0.015 | | | | | | M | M | | | | M | M | M | X | X | X | X | X | X | M | M | Y | | | | |
| 0.018 | | | | | | M | M | | | | P | M | | X | X | X | X | X | X | M | M | Y | | | | |
| 0.022 | | | | | | M | M | | | | P | | | X | X | | X | X | | M | Y | Y | | | | |
| 0.027 | | | | | | M | M | | | | P | | | X | X | | X | X | | P | Y | Y | | | | |
| 0.033 | | | | | | M | M | | | | P | | | X | X | | X | X | | P | | | | | | |
| 0.039 | | | | | | M | M | | | | P | | | Y | | | Y | | | P | | | | | | |
| 0.047 | | | | | | M | M | | | | P | | | Y | | | Y | | | P | | | | | | |
| 0.068 | | | | | | M | M | | | | | | | | | | | | | P | | | | | | |
| 0.082 | | | | | | M | M | | | | | | | | | | | | | Q | | | | | | |
| 0.1 | | | | | | | | | | | | | | | | | | | | Q | | | | | | |
| WVDC | | 25 | 50 | 100 | 200 | 500 | 25 | 50 | 100 | 200 | 500 | 50 | 100 | 200 | 50 | 100 | 200 | 50 | 100 | 200 | 50 | 100 | 200 | | | |
| SIZE | | 1210 | | | | | 1812 | | | | | 1825 | | | | | 2220 | | | | | 2225 | | | | |
| Letter | | A | C | E | G | J | K | M | N | P | Q | X | Y | Z | | | | | | | | | | | | |
| Max. Thickness | | 0.33 (0.013) | 0.56 (0.022) | 0.71 (0.028) | 0.90 (0.035) | 0.94 (0.037) | 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 | | | | | EMBOSSSED | | | | | | | | | | | | | | | | | | | |

