

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 $\pm 0.3\%$ ΔC 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

Contact Factory For
1 = Pd/Ag Term

2

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

A

Special Code
A = Std. Product

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



C0G (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 $\pm$ 10% for cap $\leq$ 1000 pF 1.0 kHz $\pm$ 10% for cap > 1000 pF Voltage: 1.0Vrms $\pm$.2V	
Q		<30 pF: $Q \geq 400 + 20 \times \text{Cap Value}$ ≥ 30 pF: $Q \geq 1000$		
Insulation Resistance		100,000M Ω or 1000M Ω - μ 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) Note: Charge device with 150% of rated voltage for 500V devices.	
Resistance to Flexure Stresses	Appearance	No defects	Deflection: 2mm Test Time: 30 seconds 	
	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). 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)	≥ 30 pF: $Q \geq 350$ ≥ 10 pF, <30 pF: $Q \geq 275 + 5C/2$ <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. 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	≥ 30 pF: $Q \geq 350$ ≥ 10 pF, <30 pF: $Q \geq 275 + 5C/2$ <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		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	G	J	J	J	J	J	J	J	J	J	J	J
	1.0	B		A		C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	1.2	B		A		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	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	1.8	B		A	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	2.2	B		A	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	2.7	B		A	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	3.3	B		A	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	3.9	B		A	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	4.7	B		A	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	5.6	B		A	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	6.8	B		A	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	8.2	B		A	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	10	B		A	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	12	B		A	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	15	B		A	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	18	B		A	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	22	B		A	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	27			A	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	33			A	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	39			A		C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	47					C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	56			A		C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	68			A		C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	82			A		C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	100			A		C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	120					C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	150					C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	180					C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	
	220					C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	M	
	270					C	C	C	G	G	G	G	J	J	J	J	M	J	J	J	J	M	
	330					C	C	C	G	G	G	G	J	J	J	J	M	J	J	J	J	M	
	390					C	C	C	G	G	G	G	J	J	J	J	M	J	J	J	J	M	
	470					C	C	C	G	G	G	G	J	J	J	J	M	J	J	J	J	M	
	560								G	G	G	G	J	J	J	J	M	J	J	J	J	M	
	680								G	G	G	G	J	J	J	J		J	J	J	J	P	
	820								G	G	G	G	J	J	J	J		J	J	J	J		
	1000								G	G	G	G	J	J	J	J		J	J	J	J		
	1200												J	J	J	J		J	J	J	Q		
	1500												J	J	J	J		J	J	J	M	Q	
	1800												J	J	J	N		J	J	M	M		
	2200												J	J	J	N		J	J	M	P		
	2700												J	J	J	N		J	J	M	P		
	3300												J	J				J	J	M	P		
	3900												J	J				J	J	M	P		
	4700												J	J				J	J	M	P		
	5600																	J	J	M			
	6800																	M	M				
Cap (μF)	8200																	M	M				
	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						EMBOSSED																



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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	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	P
	1200	J	J	J	M	M	K	K	K	K	M	M	M	M						M	M	M	P
	1500	J	J	J	M	M	K	K	K	K	M	M	M	M						M	M	M	P
	1800	J	J	J	M		K	K	K	K	M	M	M	M						M	M	M	P
	2200	J	J	J	Q		K	K	K	K	P	M	M	M						M	M	M	P
	2700	J	J	J	Q		K	K	K	P	Q	M	M	M						M	M	M	P
	3300	J	J	J			K	K	K	P	Q	M	M	M			X			M	M	M	P
	3900	J	J	M			K	K	K	P	Q	M	M	M			X	X		M	M	M	P
	4700	J	J	M			K	K	K	P	Q	M	M	M			X	X	X	M	M	M	P
	5600	J	J				K	K	M	P	X	M	M	M			X	X	X	M	M	M	P
	6800	J	J				K	K	M	X		M	M	M			X	X	X	M	M	M	P
	8200	J	J				K	M	M			M	M				X	X	X	M	M	M	P
Cap (µF)	0.010	J	J				K	M	M			M	M				X	X	X	M	M	M	P
	0.012	J	J				K	M				M	M				X	X	X	M	M	M	P
	0.015						M	M				M	M				X	X	X	M	M	M	Y
	0.018						M	M				P	M				X	X	X	M	M	M	Y
	0.022						M	M				P					X	X		M	Y	Y	Y
	0.027						M	M				P					X	X		P	Y	Y	Y
	0.033						M	M				P					X	X		P			
	0.039						M	M				P					Y			P			
	0.047						M	M				P					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	
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)	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)									
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