

# COG (NP0) Dielectric



## General Specifications



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

COG (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 COG (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 COG (NP0), one-fifth that shown by most other dielectrics. COG (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**  
COG (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  
U = 4mm TR (01005)

**A**

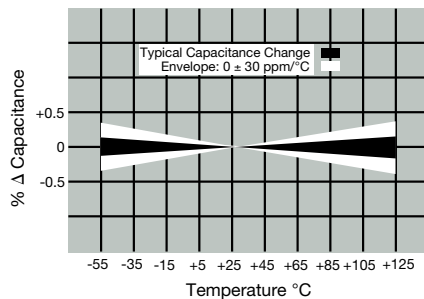
**Special Code**  
A = Std. Product

**Contact Factory For**  
**1 = Pd/Ag Term**

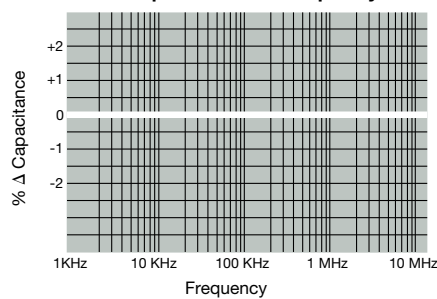
**Contact Factory For**  
**Multiples**

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

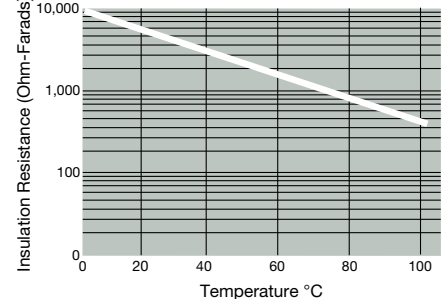
**Temperature Coefficient**



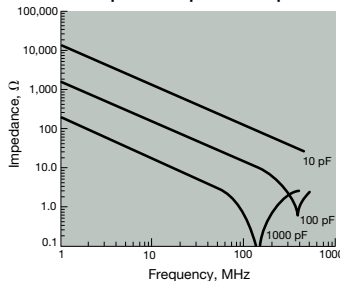
**Δ Capacitance vs. Frequency**



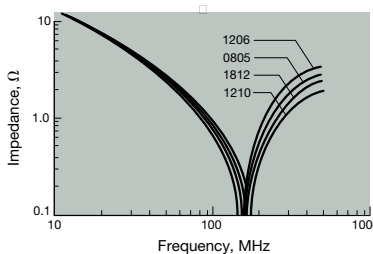
**Insulation Resistance vs Temperature**



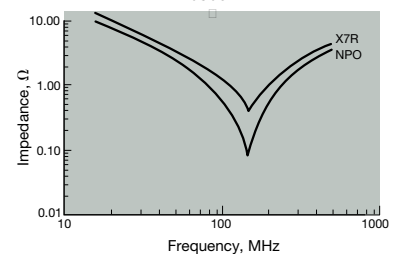
**Variation of Impedance with Cap Value**  
**Impedance vs. Frequency**  
0805 - COG (NP0)  
10 pF vs. 100 pF vs. 1000 pF



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



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



# COG (NP0) Dielectric



## Specifications and Test Methods

Parameter/Test		NP0 Specification Limits	Measuring Conditions	
<b>Operating Temperature Range</b>		-55°C to +125°C	Temperature Cycle Chamber	
<b>Capacitance</b>		Within specified tolerance	Freq.: 1.0 MHz ± 10% for cap ≤ 1000 pF 1.0 kHz ± 10% for cap > 1000 pF Voltage: 1.0Vrms ± .2V	
<b>Q</b>		<30 pF: Q ≥ 400+20 x Cap Value ≥30 pF: Q ≥ 1000	Charge device with rated voltage for 60 ± 5 secs @ room temp/humidity	
<b>Insulation Resistance</b>		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.	
<b>Dielectric Strength</b>		No breakdown or visual defects	Deflection: 2mm Test Time: 30 seconds 1mm/sec 	
<b>Resistance to Flexure Stresses</b>	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		
<b>Solderability</b>		≥ 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	
<b>Resistance to Solder Heat</b>	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)		
<b>Thermal Shock</b>	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
<b>Load Life</b>	Dielectric Strength	Meets Initial Values (As Above)	Remove from test chamber and stabilize at room temperature for 24 hours before measuring.	
	Appearance	No visual defects	Charge device with twice rated voltage in test chamber set at 125°C ± 2°C for 1000 hours (+48, -0).  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)		
Dielectric Strength	Meets Initial Values (As Above)			
<b>Load Humidity</b>	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.  Remove from chamber and stabilize at room temperature for 24 ± 2 hours before measuring.	
	Appearance	No visual defects		
	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	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 0.40 ± 0.02 (0.016 ± 0.0008)	mm 0.60 ± 0.03 (0.024 ± 0.001)		mm 1.00 ± 0.10 (0.040 ± 0.004)			mm 1.60 ± 0.15 (0.063 ± 0.006)				mm 2.01 ± 0.20 (0.079 ± 0.008)					mm 3.20 ± 0.20 (0.126 ± 0.008)						
(W) Width	mm 0.20 ± 0.02 (0.008 ± 0.0008)	mm 0.30 ± 0.03 (0.011 ± 0.001)		mm 0.50 ± 0.10 (0.020 ± 0.004)			mm 0.81 ± 0.15 (0.032 ± 0.006)				mm 1.25 ± 0.20 (0.049 ± 0.008)					mm 1.60 ± 0.20 (0.063 ± 0.008)						
(t) Terminal	mm 0.10 ± 0.04 (0.004 ± 0.016)	mm 0.15 ± 0.05 (0.006 ± 0.002)		mm 0.25 ± 0.15 (0.010 ± 0.006)			mm 0.35 ± 0.15 (0.014 ± 0.006)				mm 0.50 ± 0.25 (0.020 ± 0.010)					mm 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	J
	1.0	B	A	C	C	C	G	G	G	G	J	J	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	J	J
	1.5	B	A	A	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	1.8	B	A	A	C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	2.2	B	A	A	C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	2.7	B	A	A	C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	3.3	B	A	A	C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	3.9	B	A	A	C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	4.7	B	A	A	C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	5.6	B	A	A	C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	6.8	B	A	A	C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	8.2	B	A	A	C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	10	B	A	A	C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	12	B	A	A	C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	15	B	A	A	C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	18	B	A	A	C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	22	B	A	A	C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	27	B	A	A	C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	33	B	A	A	C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	39	B	A		C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	47	B	A		C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	56	B	A		C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	68	B	A		C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	82	B	A		C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	100	B	A		C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	120				C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	150				C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	180				C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J
	220				C	C	C	G	G	G	J	J	J	J	J	J	J	J	J	J	J	M
	270				C	C	C	G	G	G	J	J	J	J	J	M	J	J	J	J	J	M
	330				C	C	C	G	G	G	G	J	J	J	J	M	J	J	J	J	J	M
	390				C	C	C	G	G	G		J	J	J	J	M	J	J	J	J	J	M
	470				C	C	C	G	G	G		J	J	J	J	M	J	J	J	J	J	M
	560							G	G	G		J	J	J	J	M	J	J	J	J	J	M
	680							G	G	G		J	J	J	J		J	J	J	J	J	P
	820							G	G	G		J	J	J	J		J	J	J	J	J	M
	1000							G	G	G		J	J	J	J		J	J	J	J	J	Q
	1200											J	J	J	J		J	J	J	J	J	Q
	1500											J	J	J	J		J	J	J	M	J	Q
	1800											J	J	J			J	J	M	M		
	2200											J	J	N			J	J	M	P		
	2700											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				
	8200																M	M				
Cap (µF)	0.010																M	M				
	0.012																M	M				
	0.015																					
	0.018																					
	0.022																					
	0.027																					
	0.033																					
	0.039																					
	0.047																					
	0.068																					
	0.082																					
	0.1																					
WVDC	16	25	50	16	25	50	16	25	50	100	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	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															



\*EIA 01005



# 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			M	M	P			
	4700	J	J	M			K	K	K	P	Q	M	M	M				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			M	M	Y			
	0.022						M	M				P			X	X		X			M	Y	Y			
	0.027						M	M				P			X	X		X			P	Y	Y			
	0.033						M	M				P			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																			

