

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°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

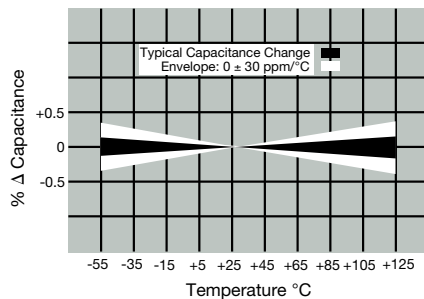
Special Code
A = Std. Product

Contact Factory For
1 = Pd/Ag Term

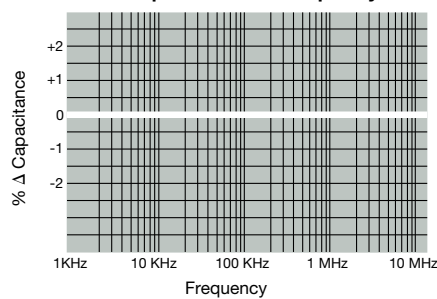
Contact Factory For
Multiples

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

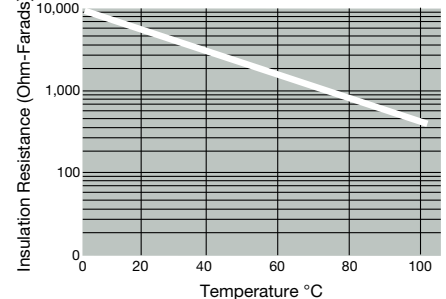
Temperature Coefficient



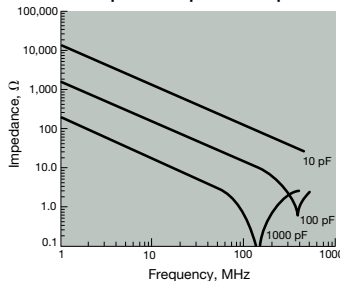
Δ Capacitance vs. Frequency



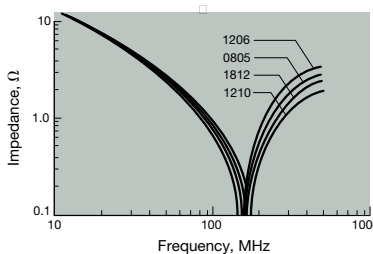
Insulation Resistance vs Temperature



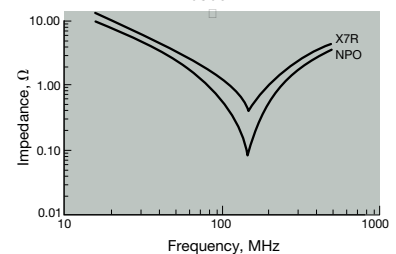
Variation of Impedance with Cap Value
Impedance vs. Frequency
0805 - COG (NP0)
10 pF vs. 100 pF vs. 1000 pF



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	
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	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
	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 ± 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)		
Load Humidity	Appearance	No visual defects	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.	
	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)	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	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	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)	
WWDC	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 1.0 1.2 1.5	A A A	C C C	C G G G	J J J J	J J J J	
1.8	B	A	C	G	J	J	
2.2	B	A	C	G	J	J	
2.7	B	A	C	G	J	J	
3.3	B	A	C	G	J	J	
3.9	B	A	C	G	J	J	
4.7	B	A	C	G	J	J	
5.6	B	A	C	G	J	J	
6.8	B	A	C	G	J	J	
8.2	B	A	C	G	J	J	
10	B	A	C	G	J	J	
12	B	A	C	G	J	J	
15	B	A	C	G	J	J	
18	B	A	C	G	J	J	
22	B	A	C	G	J	J	
27	B	A	C	G	J	J	
33	B	A	C	G	J	J	
39	B	A	C	G	J	J	
47	B	A	C	G	J	J	
56	B	A	C	G	J	J	
68	B	A	C	G	J	J	
82	B	A	C	G	J	J	
100	B	A	C	G	J	J	
120			C	G	J	J	
150			C	G	J	J	
180			C	G	J	J	
220			C	G	J	J	
270			C	G	J	M	
330			C	G	J	M	
390			C	G	J	M	
470			C	G	J	M	
560				G	J	M	
680				G	J	J	
820				G	J	J	
1000				G	J	J	
1200				G	J	J	
1500				G	J	J	
1800					J	J	
2200					J	N	
2700					J	N	
3300					J	J	
3900					J	J	
4700					J	J	
5600						J	
6800						M	
8200						M	
Cap (µF)	0.010					M	
0.012						M	
0.015							
0.018							
0.022							
0.027							
0.033							
0.039							
0.047							
0.068							
0.082							
0.1							
WWDC	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	
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)	K 1.02 (0.040)
							M 1.27 (0.050)
							N 1.40 (0.055)
							P 1.52 (0.060)
							Q 1.78 (0.070)
							X 2.29 (0.090)
							Y 2.54 (0.100)
							Z 2.79 (0.110)
	PAPER				EMBOSSSED		



*EIA 01005



COG (NP0) Dielectric



Capacitance Range

PREFERRED SIZES ARE SHADED

SIZE	1210					1812					1825				2220			2225				
	Reflow Only					Reflow Only					Reflow Only				Reflow Only			Reflow Only				
Packaging	Paper/Embossed					All Embossed					All Embossed				All Embossed			All Embossed				
(L) Length	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	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	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	X	M	M	P
	5600	J	J				K	K	M	P	X	M	M	M			X	X	X	M	M	P
	6800	J	J				K	K	M	X		M	M	M			X	X	X	M	M	P
	8200	J	J				K	M	M			M	M	M			X	X	X	M	M	P
Cap (µF)	0.010	J	J				K	M	M			M	M	M			X	X	X	M	M	P
	0.012	J	J				K	M				M	M	M			X	X	X	M	M	P
	0.015						M	M				M	M	M			X	X	X	M	M	Y
	0.018						M	M				P	M			X	X	X	M	M	Y	
	0.022						M	M				P				X	X		M	Y	Y	
	0.027						M	M				P				X	X		P	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	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																

