



C0G (NP0) Dielectrics

■ Features

- A monolithic structure ensures high reliability and mechanical strength.
- High capacitance density.
- A wide range of capacitance values in standard case size.
- Suitable for high speed SMT placement on PCBs.
- Ni barrier termination highly resistance to migration.
- Lead-free termination is in compliance with the requirement of green plan and ROHS.

■ Applications

- General electronic equipment.
- Custom Application

■ C0G (NP0) Dielectric Characteristics

Capacitance Range	0.20pF to 39nF
Size (mm) (EIA inch)	0603 1005 1608 2012 3216 (0201) (0402) (0603) (0805) (1206)
Test Voltage	1.0 ± 0.2Vrms
Test Frequency	1.0 ± 0.2MHz for cap ≤ 1,000pF, 1.0 ± 0.2KHz for cap > 1,000pF
Capacitance Tolerance	± 0.25pF, ± 0.50pF for cap < 5pF (± 0.1pF available on request) ± 0.50pF for 5pF ≤ cap < 10pF (± 0.1pF, ± 0.25pF available on request) ± 5%, ± 10% for cap ≥ 10pF (± 1%, ± 2% available on request)
Operating Temperature Range	-55°C to +125°C
Maximum Capacitance Change	0 ± 30 ppm/°C (EIA C0G)
Rated Voltage	16, 25, 50, 100 VDC
Dissipation Factor (DF)	1/(400 + 20 x C) for cap ≤ 30pF, C in pF ; 0.1% max. for cap > 30pF
Insulation Resistance (+25°C, RVDC)	10,000 MΩ min. or 500Ω-F min., whichever is smaller
Insulation Resistance (+125°C, RVDC)	1,000 MΩ min. or 50Ω-F min., whichever is smaller



■ **Product Range and Thickness**

CLASS	Class I																
TYPE	Standard																
T.C	COG (NP0)																
SIZE	*0603	1005				1608				2012				3216			
(EIA)	0201	0402				0603				0805				1206			
RV	25V	16V	25V	50V	100V	16V	25V	50V	100V	16V	25V	50V	100V	16V	25V	50V	100V
0.20 p		B	B	B		D	D	D									
0.50 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
0.75 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
1.0 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
1.2 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
1.5 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
1.8 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
2.2 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
2.7 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
3.3 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
3.9 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
4.7 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
5.6 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
6.8 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
8.2 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
10 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
12 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
15 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
18 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
22 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
27 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
33 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
39 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
47 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
56 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
68 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
82 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
100 p	A	B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
120 p		B	B	B	B	D	D	D	D	C	C	C	C	E	E	E	E
150 p		B	B	B		D	D	D	D	C	C	C	C	E	E	E	E
180 p		B	B	B		D	D	D	D	C	C	C	C	E	E	E	E
220 p		B	B	B		D	D	D	D	C	C	C	C	E	E	E	E
270 p		B	B	B		D	D	D	D	C	C	C	C	E	E	E	E
330 p		B	B	B		D	D	D	D	C	C	C	C	E	E	E	E
390 p		B	B	B		D	D	D	D	C	C	C	E	E	E	E	E
470 p		B	B	B		D	D	D	D	C	C	C	E	E	E	E	E
560 p						D	D	D	D	C	C	C	E	E	E	E	E
680 p						D	D	D		C	C	C	E	E	E	E	E
820 p						D	D	D		C	C	C	E	E	E	E	E
1.0 n						D	D	D		C	C	C	E	E	E	E	E
1.2 n						D	D	D		E	E	E	E	E	E	E	E
1.5 n						D	D	D		E	E	E	E	E	E	E	E
1.8 n						D				E	E	E	E	E	E	E	E
2.2 n						D				E	E	E	E	E	E	E	E
2.7 n						D				E	G	E	G	E	G	G	E
3.3 n						D				E	G	E	G	E	G	G	E
3.9 n										G	G	G		E	E	E	E
4.7 n										G	G	G		E	E	E	E
5.6 n										G	G	G		E	E	E	E
6.8 n										G	G	G		I	F	I	F
8.2 n										G	G	G		I	F	I	F
10 n										G	G	G		G	G	F	L
12 n										G				G			
15 n														G			
18 n														G			
22 n														G			
27 n														G			
33 n														G			
39 n														L			

Note : Thickness might be changed due to technology improvement.



Taping Amount

Thickness			Amount per reel					
			180 mm (7")		250 mm (10")		330 mm (13")	
Code	Spec	Size(EIA)	Paper	Embossed	Paper	Embossed	Paper	Embossed
A	0.30+/-0.03	0603 (0201)	15K					
B	0.50+/-0.05	1005 (0402)	10K				50K	
C	0.60+/-0.15	2012 (0805)	4K		10K		15K	
		3216 (1206)	4K		10K		15K	
D	0.80+/-0.10	1608 (0603)	4K		10K		15K	
D*	0.80+0.15/ -0.10	1608 (0603)	4K		10K		15K	
E	0.85+/-0.15	2012 (0805)	4K		10K		15K	
		3216 (1206)	4K		10K		15K	
		3225 (1210)		3K				10K
		4532 (1812)		1K				
I	0.95+/-0.15	2012 (0805)		3K				
		3216(1206)		3K				
F	1.15+/-0.20	3216 (1206)		3K				10K
		4520 (1808)		3K				
G	1.25 +/-0.20	2012 (0805)		2K/3K				10K
		3216 (1206)		3K				10K
		3225 (1210)		3K				
		4520 (1808)		3K				
		4532 (1812)		1K				
G	1.25+0.3/-0.2	2012 (0805)		2K/3K				10K
		3216 (1206)		3K				10K
		3225(1210)		3K				
H	1.50+/-0.20	3225 (1210)		2K				
		4520 (1808)		2K				
		4532 (1812)		1K				
L	1.60+/-0.20	3216 (1206)		2K				
		3225 (1210)		2K				
		4520 (1808)		2K				
		4532 (1812)		1K				
L	1.60+0.30/-0.20	3216 (1206)		2K				
		3225 (1210)		2K				
		4520 (1808)		2K				
		4532 (1812)		1K				
N	2.00+/-0.20	3216 (1206)		2K/3K				
		3225 (1210)		2K				
		4520 (1808)		1K				
		4532 (1812)		1K				
N	2.00+/-0.30	3225 (1210)		2K				
P	2.50+/-0.20	3225 (1210)		500pcs/1K				
P	2.50+/-0.30	3225 (1210)		500pcs/1K				
R	3.20+/-0.20			500pcs				
R	3.20+/-0.30			500pcs				

*: For some products, the thickness spec can be 0.8+0.15/-0.1mm.

■ **C0G (NP0) Specifications**

No.	Item	Specification	Test Method																								
1	Operating Temperature Range	-55°C to 125°C	-																								
2	Rated Voltage	16VDC, 25VDC, 50VDC, 100VDC	The rated voltage is defined as the maximum voltage, which may be applied continuously to the capacitor.																								
3	Appearance	No defects or abnormalities.	Visual inspection																								
4	Dimensions	Within the specified dimension.	Using calipers																								
5	Dielectric Strength (Flash)	No defects or abnormalities.	No failure shall be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, the charge and discharge current is less than 50mA.																								
6	Insulation Resistance (I.R.)	<table border="1"> <tr> <td>Rated Voltage: <500V</td> <td>To apply rated voltage.</td> <td rowspan="2">.R. ≥ 10G or R.C. ≥ 500Ω·F (whichever is smaller)</td> </tr> <tr> <td>Rated Voltage: ≥ 500V</td> <td>To apply 500V.</td> </tr> </table>	Rated Voltage: <500V	To apply rated voltage.	.R. ≥ 10G or R.C. ≥ 500Ω·F (whichever is smaller)	Rated Voltage: ≥ 500V	To apply 500V.	The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max, and within 1 minute of charging.																			
Rated Voltage: <500V	To apply rated voltage.	.R. ≥ 10G or R.C. ≥ 500Ω·F (whichever is smaller)																									
Rated Voltage: ≥ 500V	To apply 500V.																										
7	Capacitance	Within the specified tolerance.	The capacitance/D.F. shall be measured at 25°C at the frequency and voltage shown in the tables.																								
8	Dissipation Factor (D.F.)	If C > 30pF, DF ≤ 0.1% If C ≤ 30pF, DF ≤ 1/(400+20C), C in pF	<table border="1"> <tr> <td>Item</td> <td>C ≤ 1,000pF</td> <td>> 1,000pF</td> </tr> <tr> <td>Frequency</td> <td>1.0±0.2MHz</td> <td>1.0±0.2KHz</td> </tr> <tr> <td>Voltage</td> <td>1.0±0.2Vrms</td> <td>1.0±0.2Vrms</td> </tr> </table>	Item	C ≤ 1,000pF	> 1,000pF	Frequency	1.0±0.2MHz	1.0±0.2KHz	Voltage	1.0±0.2Vrms	1.0±0.2Vrms															
Item	C ≤ 1,000pF	> 1,000pF																									
Frequency	1.0±0.2MHz	1.0±0.2KHz																									
Voltage	1.0±0.2Vrms	1.0±0.2Vrms																									
9	Capacitance Temperature Characteristics	Capacitance change within 0±30ppm/°C under operating temperature range.	Temperature compensating type: The capacitance value at 25°C and 85°C shall be measured and calculated from the formula given below. $T.C. = (C_{85} - C_{25}) / C_{25} * \Delta T * 10^6 (PPM/°C)$																								
10	Termination Strength	No removal of the terminations or marking defect.	Apply a parallel force of 5N to a PCB mounted sample for 10±1sec. *2N for 0603 (EIA 0201).																								
11	Deflection (Bending Strength)	Appearance: No cracking or marking defects. Capacitance change: within ±5% or ± 0.5pF. (whichever is larger)	Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. a. using a eutectic solder. Then apply a force in the direction shown in Fig. b. The soldering shall be done with the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.																								
		(Unit in mm) <table border="1"> <thead> <tr> <th>Size</th> <th>a</th> <th>b</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>0603</td> <td>0.3</td> <td>0.9</td> <td>0.3</td> </tr> <tr> <td>1005</td> <td>0.4</td> <td>1.5</td> <td>0.5</td> </tr> <tr> <td>1608</td> <td>1.0</td> <td>3.0</td> <td>1.2</td> </tr> <tr> <td>2012</td> <td>1.2</td> <td>4.0</td> <td>1.65</td> </tr> <tr> <td>3216</td> <td>2.2</td> <td>5.0</td> <td>2.0</td> </tr> </tbody> </table> Fig. a.	Size	a	b	C	0603	0.3	0.9	0.3	1005	0.4	1.5	0.5	1608	1.0	3.0	1.2	2012	1.2	4.0	1.65	3216	2.2	5.0	2.0	Fig. b.
Size	a	b	C																								
0603	0.3	0.9	0.3																								
1005	0.4	1.5	0.5																								
1608	1.0	3.0	1.2																								
2012	1.2	4.0	1.65																								
3216	2.2	5.0	2.0																								
12	Solderability of Termination	90% of the termination is to be soldered evenly and continuously.	Immerse the test capacitor into a methanol solution containing rosin for 3 to 5 seconds, preheat it 150 to 180°C for 2 to 3 minutes and immerse it into molten solder of 230 ± 5°C for 5±1seconds.																								
13	Resistance to Soldering Heat	Appearance	No marking defects																								
		Cap. Change	NP0 within ±2.5% or ±0.25pF. (whichever is larger)																								
		D.F.	If C > 30pF, DF ≤ 0.1% If C ≤ 30pF, DF ≤ 1/(400+20C), C in pF																								
		I.R.	I.R. ≥ 10,000MΩ or R.C.R ≥ 500Ω·F. (whichever is smaller)																								
			Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in an eutectic solder solution at 270±5°C for 10±1 seconds. Let sit at room temperature for 24±2 hours, then measure. * Preheat at 150 to 200°C for size ≥ 3216																								



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14	Temperature Cycle (Thermal Shock)	Appearance	No marking defects	Solder the capacitor to supporting jig (glass epoxy board) and perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2hrs at room temperature, then measure. Step 1: Minimum operating temperature 30±3min Step 2: Room temperature 2~3 min Step 3: Maximum operating temperature 30±3min Step 4: Room temperature 2~3min
		Cap. Change	NP0 within ±2.5% or ±0.25pF. (whichever is larger)	
		D.F.	If C > 30pF, DF ≤ 0.1% If C ≤ 30pF, DF ≤ 1/(400+20C), C in pF	
		I.R.	More than 10,000MΩ or R _i C _R > 500Ω-F (whichever is smaller)	
15	Humidity Load	Appearance	No marking defects	Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.
		Cap. Change	NP0 within ±7.5% or ±0.75pF. (whichever is larger)	
		D.F.	If C > 30pF, DF ≤ 0.5% If C ≤ 30pF, DF ≤ 1/(100+10xC/3), C in pF	
		I.R.	More than 500MΩ or R _i C _R ≥ 25Ω-F. (whichever is smaller)	
16	High Temperature Load (Life Test)	Appearance	No marking defects	Apply 200% of the rated voltage for 500±12 hours at the maximum operating temperature ± 3°C. Let sit for 24± 2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.
		Cap. Change	NP0 within ±7.5% or ±0.75pF (whichever is large)	
		D.F.	If C > 30pF, DF ≤ 0.3% If 10pF < C ≤ 30pF, DF ≤ 1/(275+5xC/2) If C ≤ 10pF, DF ≤ 1/(200+10C), C in pF	
		I.R.	More than 1 GΩ or R _i C _R ≥ 50Ω-F. (whichever is smaller)	

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