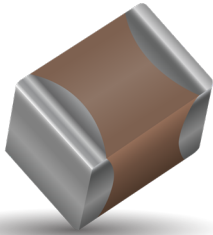


# COG (NP0) Dielectric, KGM Series

## 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  $\pm 0.3\%$  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.

### HOW TO ORDER

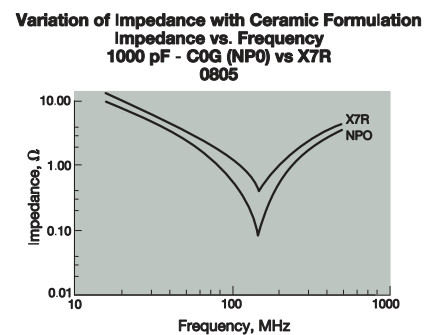
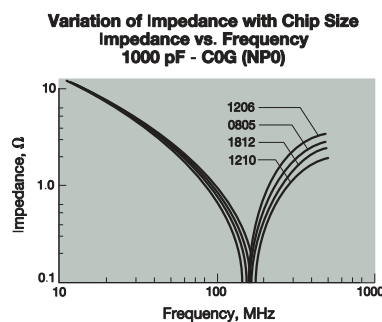
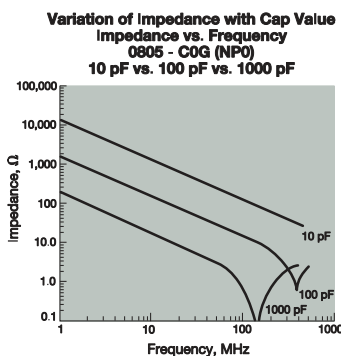
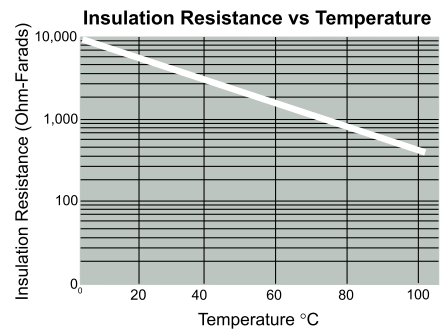
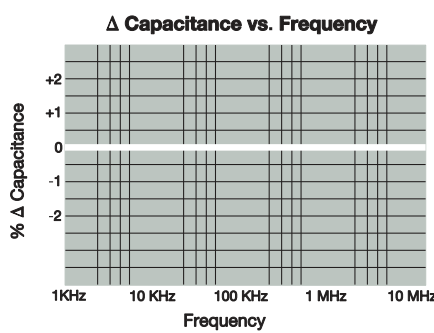
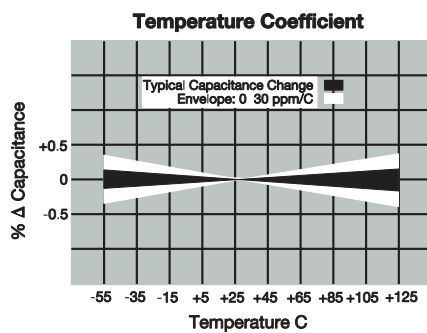
<b>KGM</b>	<b>21</b>	<b>A</b>	<b>CG</b>	<b>2J</b>	<b>102</b>	<b>F</b>	<b>L</b>
General Purpose Tin/Nickel Finish	Size	See Cap Chart	CG = COG	Voltage	Capacitance Code Code (in pF)	Capacitance Tolerance	See Table Below
	02 = 0101    32 = 1210 03 = 0201    43 = 1812 05 = 0402    44 = 1825 15 = 0603    55 = 2220 21 = 0805    56 = 2225 31 = 1206			0G = 4.0V    1H = 50V 0J = 6.3V    2A = 100V 1A = 10V    2D = 200V 1C = 16V    2E = 250V 1E = 25V    2H = 500V	2 Significant Digits +Number of zeros eg. 10 $\mu\text{F}$ = 106 10nF = 103 47pF = 470	B = $\pm 10\text{pF}$ (<10pF)* C = $\pm 25\text{pF}$ (<10pF)* D = $\pm 50\text{pF}$ (<10pF)* F = $\pm 1\%$ ( $\geq 10\text{pF}$ )* G = $\pm 2\%$ ( $\geq 10\text{pF}$ )* J = $\pm 5\%$ ( $\geq 10\text{pF}$ )* K = $\pm 10\%$ ( $\geq 10\text{pF}$ )* M = $\pm 20\%$	



### PACKAGING CODES

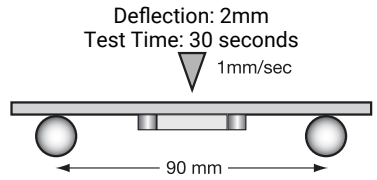
Code	EIA (inch)	IEC(mm)	7" Paper	7" Embossed	13" Paper	13" Embossed
02	0101	0402	H		n/a	
03	0201	0603	H		N	
05	0402	1005	H		N	
15	0603	1608	T		M	
21	0805	2012	T	U	M	L
31	1206	3216	T	U	M	L
32	1210	3225		U		L
43	1812	4532		V		S
44	1825	4564		V		S
55	2220	5750		V		S
56	2225	5763		V		S

\*thickness determines paper or plastic embossed packaging



# COG (NP0) Dielectric, KGM Series

## 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 x Cap Value $\geq$ 30 pF: Q $\geq$ 1000		
Insulation Resistance		10,000M $\Omega$ or 500M $\Omega$ - $\mu$ 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 250% 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		
	Capacitance Variation	$\pm$ 5% or $\pm$ .5 pF, whichever is greater		
	Q	Meets Initial Values (As Above)		
	Insulation Resistance	$\geq$ Initial Value x 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 60sec- onds. 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)	$\geq$ 30 pF: Q $\geq$ 350 $\geq$ 10 pF, $<$ 30 pF: Q $\geq$ 275 +5C/2 $<$ 10 pF: Q $\geq$ 200 +10C		
	Insulation Resistance	$\geq$ Initial Value x 0.3 (See 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	$\geq$ 30 pF: Q $\geq$ 350 $\geq$ 10 pF, $<$ 30 pF: Q $\geq$ 275 +5C/2 $<$ 10 pF: Q $\geq$ 200 +10C		
	Insulation Resistance	$\geq$ Initial Value x 0.3 (See Above)		
	Dielectric Strength	Meets Initial Values (As Above)		

# COG (NP0) Dielectric, KGM Series

## Capacitance Range



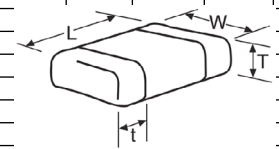
SIZE	0101*		0201			0402			0603				0805					1206				
Soldering	Reflow Only		Reflow Only			Reflow/Wave			Reflow/Wave				Reflow/Wave					Reflow/Wave				
Packaging	All Paper		All Paper			All Paper			All Paper				Paper/Embossed					Paper/Embossed				
(L) Length	0.4 ± 0.02		0.60 ± 0.03			1.0 ± 0.10			1.60 ± 0.15				2.01 ± 0.20					3.20 ± 0.20				
(L) Length	(0.016 ± 0.0008)		(0.024 ± 0.001)			(0.040 ± 0.004)			(0.063 ± 0.006)				(0.079 ± 0.008)					(0.126 ± 0.008)				
(W) Width	0.20 ± 0.02		0.30 ± 0.03			0.50 ± 0.10			0.81 ± 0.15				1.25 ± 0.20					1.60 ± 0.20				
(W) Width	(0.008 ± 0.0008)		(0.011 ± 0.001)			(0.020 ± 0.004)			(0.032 ± 0.006)				(0.049 ± 0.008)					(0.063 ± 0.008)				
(t) Terminal	0.10 ± 0.04		0.15 ± 0.05			0.25 ± 0.15			0.35 ± 0.15				0.50 ± 0.25					0.50 ± 0.25				
(t) Terminal	(0.004 ± 0.0016)		(0.006 ± 0.002)			(0.010 ± 0.006)			(0.014 ± 0.006)				(0.02 ± 0.010)					(0.020 ± 0.010)				
Cap	0.5		1.0			1.5			2.2				3.3					4.7				
(pF)	1.0		1.5			2.2			3.3				4.7					6.8				
(pF)	1.5		2.2			3.3			4.7				6.8					10				
(pF)	2.2		3.3			4.7			6.8				10					15				
(pF)	3.3		4.7			6.8			10				15					22				
(pF)	4.7		6.8			10			15				22					33				
(pF)	6.8		10			15			22				33					47				
(pF)	10		15			22			33				47					68				
(pF)	15		22			33			47				68					100				
(pF)	22		33			47			68				100					150				
(pF)	33		47			68			100				150					220				
(pF)	47		68			100			150				220					330				
(pF)	68		100			150			220				330					470				
(pF)	100		150			220			330				470					560				
(pF)	150		220			330			470				560					680				
(pF)	220		330			470			560				680					820				
(pF)	330		470			560			680				820					1000				
(pF)	470		560			680			820				1000					1200				
(pF)	560		680			820			1000				1200					1500				
(pF)	680		820			1000			1200				1500					1800				
(pF)	820		1000			1200			1500				1800					2200				
(pF)	1000		1200			1500			1800				2200					2700				
(pF)	1200		1500			1800			2200				2700					3300				
(pF)	1500		1800			2200			2700				3300					3900				
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(pF)	2200		2700			3300			3900				4700					5600				
(pF)	2700		3300			3900			4700				5600					6800				
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(pF)	4700		5600			6800			8200				10000					12000				
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(pF)	6800		8200			10000			12000				15000					18000				
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(pF)	10000		12000			15000			18000				22000					27000				
(pF)	12000		15000			18000			22000				27000					33000				
(pF)	15000		18000			22000			27000				33000					39000				
(pF)	18000		22000			27000			33000				39000					47000				
(pF)	22000		27000			33000			39000				47000					56000				
(pF)	27000		33000			39000			47000				56000					68000				
(pF)	33000		39000			47000			56000				68000					82000				
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(pF)	47000		56000			68000			82000				100000					120000				
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(pF)	68000		82000			100000			120000				150000					180000				
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(pF)	6800000000		8200000000			10000000000			12000000000				15000000000					18000000000				
(pF)	8200000000																					

# COG (NP0) Dielectric, KGM Series

## Capacitance Range



SIZE		1210					1812					1825			2220			2225		
Soldering		Reflow Only					Reflow Only					Reflow Only			Reflow Only			Reflow Only		
Packaging		All Embossed					All Embossed					All Embossed			All Embossed			All Embossed		
(L)	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)	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)		
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 3.9																				
(pF) 4.7																				
5.6																				
6.8																				
8.2																				
10	E	E	E	E	E	B	B	B	B	B										
12	E	E	E	E	E	B	B	B	B	B										
15	E	E	E	E	E	B	B	B	B	B										
18	E	E	E	E	E	B	B	B	B	B										
22	E	E	E	E	E	B	B	B	B	B										
27	E	E	E	E	E	B	B	B	B	B										
33	E	E	E	E	E	B	B	B	B	B										
39	E	E	E	E	E	B	B	B	B	B										
47	E	E	E	E	E	B	B	B	B	B										
56	E	E	E	E	E	B	B	B	B	B										
68	E	E	E	E	E	B	B	B	B	B										
82	E	E	E	E	E	B	B	B	B	B										
100	E	E	E	E	E	B	B	B	B	B										
120	E	E	E	E	E	B	B	B	B	B										
150	E	E	E	E	E	B	B	B	B	B										
180	E	E	E	E	E	B	B	B	B	B										
220	E	E	E	E	E	B	B	B	B	B										
270	E	E	E	E	E	B	B	B	B	B										
330	E	E	E	E	E	B	B	B	B	B										
390	E	E	E	E	E	B	B	B	B	B										
470	E	E	E	E	E	B	B	B	B	B										
560	E	E	E	E	E	B	B	B	B	B										
680	E	E	E	E	E	B	B	B	B	B										
820	E	E	E	E	E	B	B	B	B	B										
1,000	E	E	E	E	E	B	B	B	B	B	C	C	C	Z	Z	Z	D	D	D	
1200	E	E	E	E	E	B	B	B	B	B	C	C	C	Z	Z	Z	D	D	D	
1500	E	E	E	E	E	B	B	B	B	B	C	C	C	Z	Z	Z	D	D	D	
1800	E	E	E	E	E	B	B	B	B	B	C	C	C	Z	Z	Z	D	D	D	
2200	E	E	E	E	E	B	B	B	B	B	C	C	C	Z	Z	Z	D	D	D	
2700	E	E	E	E	E	B	B	B	B	B	C	C	C	Z	Z	Z	D	D	D	
3300	E	E	E	E	E	B	B	B	B	B	C	C	C	Z	Z	Z	D	D	D	
3900	E	E	E	E	E	B	B	B	B	B	C	C	C	Z	Z	Z	D	D	D	
4700	E	E	E	H	H	B	B	B	B	B	C	C	C	Z	Z	Z	D	D	D	
5600	E	E	E	H	H	B	B	B	B	B	C	C	C	Z	Z	Z	D	D	D	
6800	E	E	E	H	H	B	B	B	B	B	C	C	C	Z	Z	Z	D	D	D	
8200	E	E	E	H	H	B	B	B	B	B	C	C	C	Z	Z	Z	D	D	D	
Cap 0.010	E	E	H	J	J	B	B	B	B	B	C	C	C	Z	Z	Z	D	D	D	
(µF) 0.012	H	H	H	J	J	B	B	B	E	E	C	C	C	Z	Z	Z	D	D	D	
0.015	H	H	J	L	L	B	B	B	E	E	C	C	C	Z	Z	Z	D	D	D	
0.018	J	J	L	L		B	B	E	F	F	C	C	C	Z	Z	Z	D	D	D	
0.022	J	L	L	L		B	B	E	F	F	C	C	C	Z	Z	Z	D	D	D	
0.027	L	L	L	L		E	E	F	J		C	C	C	Z	Z	Z	D	D	D	
0.033	L	L	L	L		E	E	F			C	C	C	Z	Z	Z	D	D	D	
0.039	L	L	L			J	J	J			C	C	C	Z	Z	Z	D	D	D	
0.047	L	L	L			J	J	J			C	C	C	Z	Z	C	D	D	D	
0.068						J	J	J			C	C	F	Z	Z	C	D	D	G	
0.082						J	J	J			C	F		Z	C		D	D	G	
0.100						J	J	J			F	F		C	C		D	G	G	
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		



Case Size	1210 (KGM 32)				1812 (KGM 43)					1825 (KGM 44)		2220 (KGM 55)			2225 (KGM56)	
Thickness Letter	E	H	J	L	B	E	F	J	C	F	Z	C	D	G	E	G
Max Thickness (mm)	1.45	1.8	2.21	2.80	1.45	1.8	2.21	2.80	2.21	2.80	2.21	2.80	2.21	2.80	2.29	2.80
Carrier Tape	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB
Packaging Code 7"reel	U	U	U	U	V	V	V	V	V	V	V	V	V	V	V	V
Packaging Code 13"reel	L	L	L	L	S	S	S	S	S	S	S	S	S	S	S	S
EMBOSS (EMB)																

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