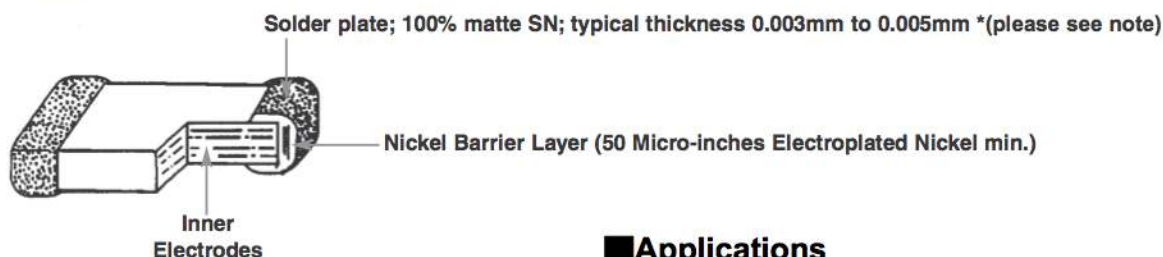




Construction



Introduction

- Constructed by screen printing alternative layers of internal metallic electrodes onto ceramic dielectric materials and firing into a concrete monolithic body, then completed by application of metal end terminations which are fired to assure permanent bonding with the individual internal electrodes

Applications

- Can be used on surface mount assembly equipment
- Our fully integrated manufacturing and total quality control systems ensure unprecedented high standards of quality and reliability.

Features

- Large capacitance values in small sizes
- Excellent high frequency characteristics

Chip Capacitor Selection

DIELECTRIC TYPE

COG (NPO)

Capacitance change with temperature is 0-30ppm/°C which is less than -0.3%/°C from -55°C to +125°C. Typical capacitance change with life is less than -0.1% for NPOs, one-fifth that shown by most other dielectrics. NPO formulations show no aging characteristics.

Ultra stable class I dielectric: linear temperature coefficient, low loss, negligible change of electrical properties with time, voltage and frequency.

Operating Temperature Range	Temperature Coefficient	Temperature Voltage Coefficient (ΔC_{Max} @ V_{DCW})	Dissipation Factor	Insulation Resistance	Dielectric withstanding Voltage	Aging Rate	Test Parameters
-55°C to +125°C	0±30ppm/°C	0±30ppm/°C	0.1% Max, 0.02% Typical	• 25°C, V_{DCW}: >100GΩF or 1000ΩF, whichever is less • 125°C, V_{DCW}: >10GΩF or 100ΩF, whichever is less	3 X V_{DCW}	0% per decade hour	• $C \leq 1000pF$ $f = 1MHz$ $V = 1.0V_{rms}$ $\pm 0.2V_{rms}$ $T = 25^\circ C$ • $C > 1000pF$ $f = 1KHz$ $V = 1.0V_{rms}$ $\pm 0.2V_{rms}$ $T = 25^\circ C$

X7R/X5R Its temperature variation of capacitance is within $\pm 15\%$ from -55°C to $+125^{\circ}\text{C}$ (-55°C to $+85^{\circ}\text{C}$ for X5R). The capacitance change is non-linear.

Stable class II dielectric

Operating Temperature Range	Temperature Coefficient	Temperature Voltage Coefficient (ΔC_{Max} @ V_{DCW})	Dissipation Factor	Insulation Resistance	Dielectric withstanding Voltage	Aging Rate	Test Parameters
X7R = -55°C to $+125^{\circ}\text{C}$ X5R = -55°C to $+85^{\circ}\text{C}$	$\pm 15\%$	X7R/X5R Not Applicable	2.5% Max, 1.8% Typical	• 25°C, V_{DCW}: $>100\text{G}\Omega$ For $1000\Omega\text{F}$, whichever is less • 125°C, V_{DCW}: $>10\text{G}\Omega$ or $100\Omega\text{F}$ whichever is less	$2.5 \times V_{\text{DCW}}$	$<2\%$ per decade hour	1KHz, 1.0Vrms $\pm 0.2\text{Vrms}$ 25°C values $>$ or $=$ to $10\mu\text{F}$ 1.0Vrms 120Hz

Z5U Despite their capacitance instability, Z5U formulations are very popular because of their small size, temperature range low ESL, low ESR and excellent frequency response. These features are particularly important for decoupling application where only a minimum capacitance value is required.

Y5V Y5V formulations are for general purpose use in a limited temperature range. They have a wide temperature characteristic of $+22\%$ - 82% capacitance change over the operating temperature range of -30°C to $+85^{\circ}\text{C}$. Y5Vs high dielectric constant allows the manufacture of very high capacitance values (up to 22MF) in small physical sizes.

High capacitance per unit volume: general purpose product

Operating Temperature Range	Temperature Coefficient	Dissipation Factor	Insulation Resistance	Dielectric withstanding Voltage	Aging Rate	Test Parameters
-30°C to $+85^{\circ}\text{C}$	$+22\%$ - -82%	3.0% Max, 2.0% Typical	$10\text{G}\Omega$ or $100\Omega\text{F}$ whichever is less, 25°C , V_{DCW}	$2.5 \times V_{\text{DCW}}$	3.0% per decade hour	1KHz, 1Vrms 25°C values $>$ or $=$ to $10\mu\text{F}$ 1.0Vrms 120Hz

CAPACITANCE VALUE & TOLERANCE

Determined by circuit requirements. Note that chip prices decrease with lower capacitance value and looser tolerance.

VOLTAGE

Determined by circuit requirements. Units are designed to exceed the withstanding voltage specification, i.e., the user need not incorporate an additional safety margin.

CAPACITOR SIZE

Select the smallest unit permitted by the circuit constraints that provides the required capacitance and voltage rating. All Cal-Chip capacitors conform to EIA specifications.

CAPACITOR TERMINATION

Nickel barrier is standard and recommended for units exposed to repeated solder cycles, to minimize leaching of the termination.

Part Numbering

GMC	21	CG	102	J	50	NT
Product Type	Dimensions	Dielectric	Capacitance (pF)	Capacitance Tolerance	Voltage	Termination & Packaging Code
	01: 01005 02: 0201 04: 0402 10: 0603 21: 0805 31: 1206 32: 1210 40: 1808 43: 1812 45: 1825 55: 2220 57: 2225	CG: COG/NPO X7R or X5R Z5U Y5V	0R5: 0.5pF 5R0: 5pF 100: 10pF 101: 100pF 102: 1000pF 103: 0.01uF 104: .1uF 105: 1.0uF 106: 10uF	B: ±0.1pF (for ≥ 10pF) C: ±0.25pF (for ≥ 10pF) D: ±0.5pF (for ≥ 10pF) F: ±1% G: ±2% J: ±5% K: ±10% M: ±20% Z: -20% - +80%	6R3: 6.3 DC 10: 10 DC 16: 16 DC 25: 25 DC 50: 50 DC 100: 100DC 200: 200 DC	NT: Nickel Barrier, Taping Reel

NX* - Optional "Soft Term"
P = Optional Palladium Silver (Pd/Ag) termination
G = Optional Gold termination
(All 3 available in select values, contact your sales associate for more information)

Optional "TD" designates large
10 inch or 13 inch reels
(see section on Packaging)

**Note: Cal-Chip has completed the Lead-Free transition. All parts shipped will be lead-free. The customer designator of "LF" is no longer available. Lead-Free material will continue to have a green RoHS symbol on the label.

01005

DIMENSION (MM)		GMC01					
L(L1)		0.4 ± 0.02					
W		0.2 ± 0.02					
H		0.2 ± 0.02					
BW(L2/L3)		0.07 ~ 0.14					
dielectric		NPO/COG		X7R		X5R	Y5V/Z5U
Rated Voltage		6.3	10/16	6.3	10	10	16
Cap. Range							
0.5pF	0R5						
1	1R0						
1.2	1R2						
1.5	1R5						
1.8	1R8						
2.2	2R2						
2.7	2R7						
3.3	3R3						
3.9	3R9						
4.7	4R7						
5.6	5R6						
6.8	6R8						
8.2	8R2						
10	100						
11	110						
12	120						
15	150						
18	180						
20	200						
22	220						
27	270						
30	300						
33	330						
39	390						
43	430						
47	470						
51	510						
56	560						
62	620						
68	680						
82	820						
100	101						
120	121						
150	151						
180	181						
220	221						
270	271						
330	331						
390	391						
470	471						
560	561						
680	681						
820	821						
1.0nF	102						
1.2	122						
1.5	152						
1.8	182						
2.2	222						
2.7	272						
3.3	332						
3.9	392						
4.7	472						
5.6	562						
6.8	682						
8.2	822						
10	103						
12	123						
15	153						
18	183						
22	223						
27	273						
33	333						
39	393						
47	473						
56	563						
68	683						
82	823						
100	104						
120	124						

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DIMENSION (MM)		GMC04																				
L(L1)		1.0 ± 0.05																				
W		0.5 ± 0.05																				
H		0.5 ± 0.1																				
BW(L2/LW)		0.1 ~ 0.35																				
dielectric		COG						X5R					X7R					Y5V & Z5U				
Rated Voltage		6.3	10	16	25	50	100	6.3	10	16	25	50	6.3/10	16	25	50	100	6.3	10	16	25	50
Cap. Range																						
0.5	0R5																					
0.75	R75																					
1	1R0																					
1.2	1R2																					
1.5	1R5																					
1.8	1R8																					
2	2R0																					
2.2	2R2																					
2.4	2R4																					
2.7	2R7																					
3	3R0																					
3.3	3R3																					
3.5	3R5																					
3.6	3R6																					
3.9	3R9																					
4	4R0																					
4.3	4R3																					
4.7	4R7																					
5	5R0																					
5.1	5R1																					
5.6	5R6																					
6	6R0																					
6.3	6R2																					
6.8	6R8																					
7	7R0																					
7.5	7R5																					
8	8R0																					
8.2	8R2																					
9	9R0																					
9.1	9R1																					
10	100																					
11	110																					
12	120																					
13	130																					
15	150																					
18	180																					
20	200																					
22	220																					
24	240																					
27	270																					
30	300																					
33	330																					
39	390																					
36	360																					
43	430																					
47	470																					
51	510																					
56	560																					
62	620																					
68	680																					
75	750																					
82	820																					
91	910																					
100	101																					
110	111																					
120	121																					
130	131																					
150	151																					
180	181																					
200	201																					
220	221																					
240	241																					
270	271																					
300	301																					
330	331																					
390	391																					
430	431																					
470	471																					
560	561																					
680	681																					
820	821																					
1.0nF	102																					
1.2	122																					
1.5	152																					
1.8	182																					

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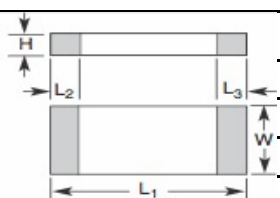
0603

DIMENSION (MM)		GMC10																				
L(L1)		1.6 ± 0.2																				
W		0.8 ± 0.2																				
H		1.0 max																				
BW(L2/LW)		0.1 ~ 0.4																				
dielectric		COG				X5R				X7R								Y5V & Z5U				
Rated Voltage		25	50	100	200	6.3	10	16	25	6.3	10	16	25	50	100	200	6.3	10	16	25	50	
Cap. Range																						
0.5pF	0R5																					
0.75	0R75																					
1	1R0																					
1.2	1R2																					
1.3	1R3																					
1.5	1R5																					
1.8	1R8																					
2	2R0																					
2.2	2R2																					
2.4	2R4																					
2.7	2R7																					
3	3R0																					
3.3	3R3																					
3.6	3R6																					
3.9	3R9																					
4	4R0																					
4.3	4R3																					
4.7	4R7																					
5	5R0																					
5.1	5R1																					
5.6	5R6																					
6	6R0																					
6.2	6R2																					
6.8	6R8																					
7	7R0																					
7.5	7R5																					
8	8R0																					
8.2	8R2																					
9	9R0																					
9.1	9R1																					
10	100																					
11	110																					
12	120																					
13	130																					
15	150																					
18	180																					
20	200																					
22	220																					
24	240																					
27	270																					
30	300																					
33	330																					
36	360																					
39	390																					
43	430																					
47	470																					
51	510																					
56	560																					
62	620																					
68	680																					
75	750																					
82	820																					
91	910																					
100	101																					
120	121																					
130	131																					
150	151																					
180	181																					
200	201																					
220	221																					
240	241																					
270	271																					
300	301																					
330	331																					
390	391																					
430	431																					
470	471																					
510	511																					
560	561																					
620	621																					
680	681																					
750	751																					
820	821																					
910	911																					

0603

DIMENSION (MM)		GMC10																		
L(L1)		1.6 ± 0.2																		
W		0.8 ± 0.2																		
H		1.0 max																		
BW(L2/LW)		0.1 ~ 0.4																		
dielectric		COG				X5R			X7R						Y5V & Z5U					
Rated Voltage		25	50	100	200	6.3	10	16/25	6.3	10	16	25	50	100	200	6.3	10	16	25	50
Cap. Range																				
1.0nF	102																			
1.2	122																			
1.5	152																			
1.8	182																			
2.2	222																			
2.7	272																			
3.3	332																			
3.9	392																			
4.7	472																			
5.6	562																			
6.8	682																			
7.5	752																			
8.2	822																			
10	103																			
12	123																			
15	153																			
18	183																			
22	223																			
27	273																			
33	333																			
39	393																			
47	473																			
56	563																			
68	683																			
82	823																			
100	104																			
120	124																			
150	154																			
220	224																			
270	274																			
330	334																			
470	474																			
560	564																			
680	684																			
820	824																			
1.0 uF	105																			
2.2	225																			
2.7	275																			
3.3	335																			
3.9	395																			
4.7	475																			
5.6	565																			
6.8	685																			
8.2	825																			
10	106																			
15	156																			
22	226																			
33	336																			
47	476																			

The diagram illustrates the physical dimensions of the GMC10 component. It is a rectangular component with two vertical end caps. The overall length is labeled L1. The distance between the inner vertical lines is labeled L2. The distance between the outer vertical lines is labeled L3. The width of the component is labeled W. The height of the component is labeled H.



0805 through 1210 (COG/NPO)

[illegible]

DIMENSION (MM)		GMC21					GMC31				GMC32				
L(L1)		2.0 ± 0.3					3.2 ± 0.3				3.2 ± 0.3				
W		1.25 ± 0.2					1.6 ± 0.2				2.5 ± 0.3				
H		1.4					1.8				2.2				
BW(L2/L3)		0.25 ~ 0.75					0.25 ~ 0.75				0.25 ~ 0.75				
Rated Voltage		16	25	50	100	200	25	50	100	200	16	25	50	100	200
Cap. Range															
51pF	510														
56	560														
62	620														
68	680														
75	750														
82	820														
91	910														
100	101														
120	121														
130	131														
150	151														
160	161														
180	181														
200	201														
220	221														
240	241														
270	271														
300	301														
330	331														
360	361														
390	391														
430	431														
470	471														
510	511														
560	561														
680	681														
750	751														
820	821														
910	911														
1.0nF	102														
1.2	122														
1.5	152														
1.8	182														
2.2	222														
2.4	242														
2.7	272														
3.3	332														
3.9	392														
4.7	472														
5.6	562														
6.8	682														
8.2	822														
10	103														
12	123														
15	153														
18	183														
22	223														
27	273														
33	333														
39	393														
47	473														
56	563														
68	683														
82	823														
100	104														
120	124														
150	154														
180	184														
220	224														

1808 - 2225 (COG/NPO)

[illegible]

1808 - 2225 (COG/NPO) (cont)

[illegible]

0805 - 1210 (X7R)

[illegible]

[illegible]

0805- 2220 (X5R)

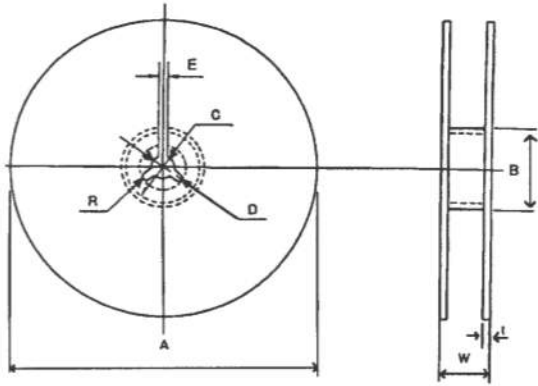
DIMENSION (MM)		GMC21						GMC31						GMC32						GMC43				GMC55				
L(L1)		2.0 ± 0.3						3.2 ± 0.3						3.2 ± 0.3						4.5 ± 0.35				5.7 ± 0.4				
W		1.25 ± 0.2						1.6 ± 0.2						2.5 ± 0.3						3.2 ± 0.3				5.0 ± 0.4				
H		1.5						1.8						2.8						3				3.5				
BW(L2/L3)		0.25 ~ 0.75						0.25 ~ 0.75						0.25 ~ 0.75						0.25 ~ 0.75				0.25 ~ 0.75				
Rated Voltage		4	6.3	10	16	25	50	4	6.3	10	16	25	50	4	6.3	10	16	25	50	6	10	16	25	6	10	16	25	50
Cap. Range																												
180 nF	184																											
220	224																											
270	274																											
390	394																											
470	474																											
560	564																											
680	684																											
820	824																											
1.0 uF	105																											
2.2	225																											
3.3	335																											
4.7	475																											
6.8	685																											
10	106																											
15	156																											
22	226																											
33	336																											
47	476																											
100	107																											
150	157																											
220	227																											
330	337																											

0805- 2220 (Y5V/Z5U)

[illegible]

Packaging (Taping)

(Reel Type-Size)



Standard Reel

Unit:mm

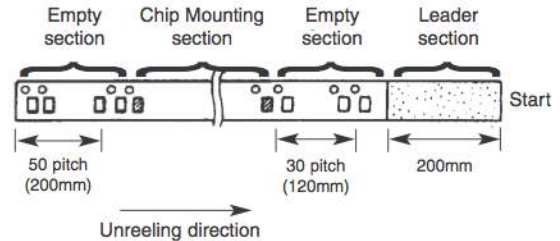
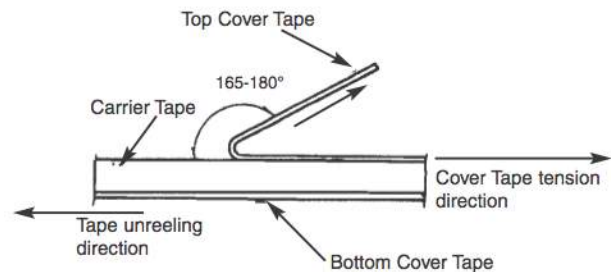
A	B	C	D	E	W	t	R
ø178 ±2.0	ø50 min.	ø13.0 ±0.5	ø21.0 ±0.8	2.0 ±0.5	10.2 - 8mm 14.0 - 12mm +1.5	0.8 ±0.2	1.0

"TD" designator for optional 10/13 inch reels

Unit:mm

A	B	C	D	E	W	t	R
ø330 +2.0	ø50 min.	ø13.0 ±0.5	ø21.0 ±0.8	2.0 ±0.5	10.0 ±1.5	0.8 ±0.2	1.0

Carrier Tape (Standard)



- To peel off the cover tape by the method shown in the right figure apply a peel-off force of 20 gf - 60 gf (card board); 10 gf - 75 gf (plastic tape).
- The cover tape should not touch the top or bottom of the chip.
- If the cover tape has been peeled off it may be difficult to remove the chip due to punch-hole clearance, dirt, and debris. Make sure therefore that no paper waste will adhere to and block the absorption nozzle.
- If the cover tape has been peeled off from the top, stick it back on with a suitable adhesive.
- Follow the illustration for the start and end of the winding operation.

- Cardboard carrier tape for 0402,0603 type and 0805/1206 type

Unit: mm

Type	A	B	W	F	E	P ₁	P ₂	P ₀	D ₀	t ₁	t ₂	Mounting Hole	Std Reel Qty. 7in (10/13in)*
0402	0.7±0.2	1.3±0.2	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	ø1.5±0.1	1.1 max	1.4 max	Angular Punch Hole	10,000 (20,000)
0603	1.1±0.2	1.9±0.2											4,000 (10,000)
0805	1.65±0.2	2.4±0.2											4,000 (10,000)
1206	2.0±0.2	3.6±0.2											4,000 (10,000)

*quantities listed are considered as "standard" and subject to change

- Embossed plastic carrier tape for 0805/1206 type and 1210 type

Unit:mm

Type	A	B	W	F	E	P ₁	P ₂	P ₀	D ₀	t ₁	t ₂	Mounting Hole	Std Reel Qty 7"	Optional Reel Qty (10/13")
0805	1.45±0.2	2.3±0.2	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	ø1.5±1/-0	0.6 max	2.5 max	Angular Embossed Hole	2,000	3,000
1206	2.0±0.2	3.6±0.2											2,000	3,000
1210	2.9±0.2	3.6±0.2											1,000	2,000
1812	3.6±0.2	4.9±0.2	12.0±0.3	5.5±0.05	1.75±0.1	8.0±0.1	2.0±0.05	4.0±0.1	ø1.5±0.1	0.6 max	6.5 max	Angular Embossed Hole	500	1,000
1825	6.8±0.3	4.9±0.2											500	1,000
2220	5.5±0.3	6.2±0.3											500	1,000
2225	6.8±0.3	6.2±0.3											500	700

*quantities listed are considered as "standard" and subject to change

WARRANTY: All passive components supplied by Calchip Electronics, 59 Steamwhistle Drive, Ivyland, PA. 18974, are under warranty for a period of 2 years from the date of manufacture. Product will meet or exceed all reliability and test specifications expressed by Calchip for the above mentioned time period provided storage conditions (stated below) are met.

Product Storage Instructions:

- 1) Product must be kept away from direct sunlight.
- 2) Product must be stored in the following conditions - Temperature; 5 to 35 degrees Celsius/40 to 95 degrees Fahrenheit
Humidity; 45 to 85%
- 3) Product to be kept free of moisture, dirt and debris.

*******WHEN THESE CONDITIONS ARE NOT MET, PRODUCT LIFE COULD BE SHORTENED*******

NOTICE: Specifications are subject to change without notice. Contact your nearest Cal-Chip Sales Office for the latest specifications. All statements, information and data given herein are believed to be accurate and reliable, but are presented without guarantee, warranty, or responsibility of any kind, expressed or implied. Statements or suggestions concerning possible use of our products are made without representation or warranty that any such use is free of patent infringement and are not recommendations to infringe any patent. The user should not assume that all safety measures are indicated or that other measures may not be required. Specifications are typical and may not apply to all applications.