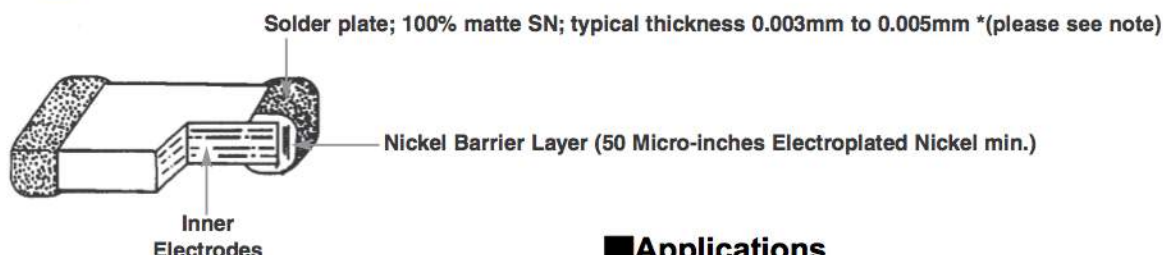




Construction



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	OR5																								
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 (cont)

[illegible]

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]

[illegible]

[illegible]

0805- 2220 (X5R)

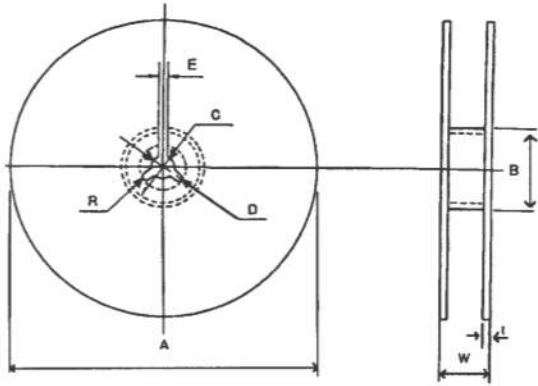
[illegible]

0805- 2220 (Y5V/Z5U)

[illegible]

Packaging (Taping)

(Reel Type-Size)



Standard Reel

Unit:mm

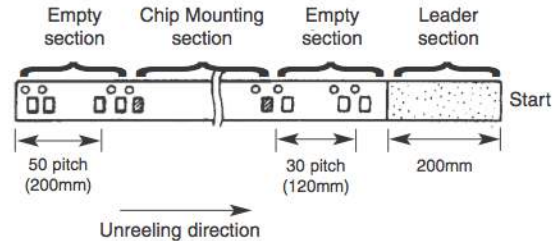
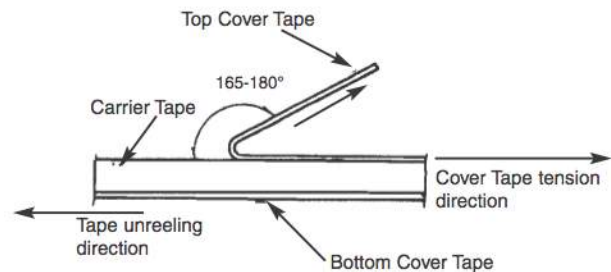
A	B	C	D	E	W	t	R
ø178 ±2.0	ø50 min.	ø13.0 ±0.5	ø21.0 ±0.8	2.0 ±0.5	10.2 - 8mm 14.0 - 12mm +1.5	0.8 ±0.2	1.0

"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	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.