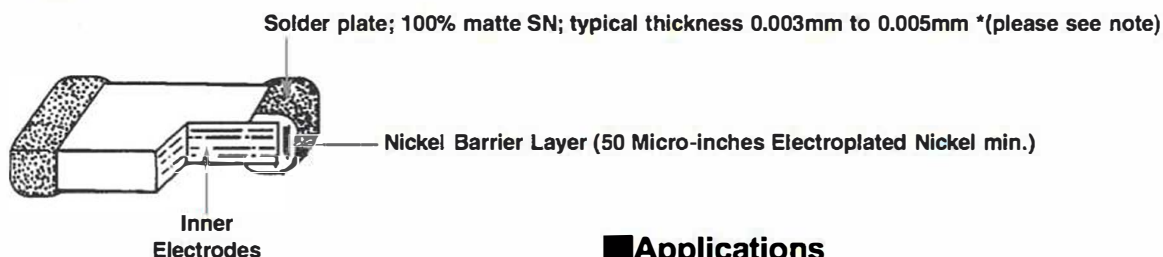




Construction



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=1.0Vrms ±0.2Vrms T=25°C • $C > 1000pF$ f=1KHz V=1.0Vrms ±0.2Vrms T=25°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 1000pF, whichever is less 125°C, V_{DCW}: $> 10\text{G}\Omega$ For 100pF, 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 100pF 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.

GMC	21	CG	102	J	50	NT	D
Product Type	Dimensions	Dielectric	Capacitance	Tolerance	Voltage DC	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 X5R Z5U Y5V	0R5: 0.5pF 5R0: 5.0pF 100: 10pF 101: 100pF 102: 1000pF 103: .01uF 104: .1uF 105: 1.0uF 106: 10uF 107: 100uF	B: +/- .1pF C: +/- .25pF D: +/- .5pF F: +/- 1% G: +/- 2% J: +/- 5% K: +/- 10% M: +/- 20% Z: -20%/+80%	4R0: 4.0V 6R3: 6.3V 10: 10V 16: 16V 25: 25V 35: 35V 50: 50V 63: 63V 100: 100V 200: 200V	NT: Sn/Ni PT: Pd/Ag	Blank: 7" reel D: See Below G: See Below Q: See Below

****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.

PACKAGING 10"/13" REELS ONLY

Type	D	G	Q
0201	50K		
0402	50K		
0603	10K	15K	
0805	10K	15K	20K
1206	10K	15K	20K
1210	4K	8K	10K
1808	8K		
1812	2K	8K	
1825			
2220			
2225			

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							
0.50F	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						

0201

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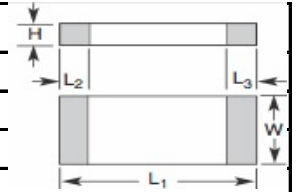
[illegible]

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	200	6.3	10	16	25	35	50	6.3/10	16/25	50	100	200	6.3	10	16	25	50		
Cap. Range																									
2.2	222																								
2.7	272																								
3.3	332																								
3.9	392																								
4.7	472																								
5.6	562																								
6.8	682																								
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220	224																								
270	274																								
390	394																								
47	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																								

****Please note L/W/H deviation for the 22uF is +/- .2mm****

0603

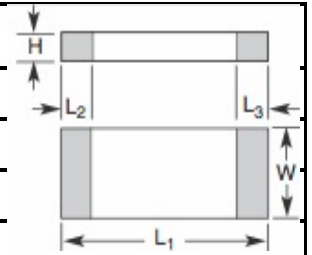
DIMENSION (MM)		GMC10																			
L(L1)		1.6 ± 0.2																			
W		0.8 ± 0.2																			
H		1.0 max																			
BW(L2/LW)		0.1 ~ 0.4																			
dielectric		COG				X5R				X7R						Y5V & Z5U					
Rated Voltage		25	50	100	200	6.3	10	16	25	6.3	10	16	25	50	100	200	6.3	10	16	25	50
Cap. Range																					
0.5pF	OR5																				
0.4	R40																				
0.47	R47																				
0.7	R70																				
0.75	R75																				
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																				
160	161																				
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	35	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																				
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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 capacitor. It shows a rectangular component with a central white area and two grey end caps. The overall length is labeled L₁. The distance from the center to each end cap is labeled L₂ and L₃. The width is labeled W, and the height 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														
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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)

DIMENSION (MM)		GMC40			GMC43			GMC45			GMC55			GMC57		
L(L1)		4.57 ± 0.25			4.5 ± 0.35			4.5 ± 0.35			5.7 ± 0.4			5.7 ± 0.4		
W		2.03 ± 0.25			3.2 ± 0.3			6.3 ± 0.4			5.0 ± 0.4			6.3 ± 0.4		
H		2.1			2.2			2.2			1.8			2.2		
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		50	100	200	50	100	200	50	100	200	50	100	200	50	100	200
Cap. Range																
10pF	100															
11	110															
12	120															
13	130															
15	150															
16	160															
18	180															
20	200															
22	220															
24	240															
27	270															
30	300															
33	330															
36	360															
39	390															
43	430															
47	470															
51pF	510															
56	560															
62	620															
68	680															
75	750															
82	820															
91	910															
100	101															
120	121															
130	131															
150	151															
160	161															
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220	221															
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330	331															
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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															
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47	473															
56	563															
68	683															
82	823															
100	104															
120	124															
150	154															
180	184															
220	224															
270	274															
330	334															
470	474															

0805 - 1210 X7R

[illegible]

1808 - 2225 (X7R) (cont)

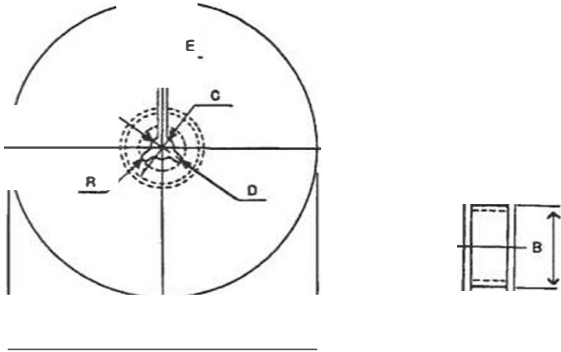
DIMENSION (MM)	GMC40	GMC43	GMC45	GMC55	GMC57
L(L1)	4.57 ± 0.25	4.5 ± 0.35	4.5 ± 0.35	5.7 ± 0.4	5.7 ± 0.4
W	4.57 ± 0.25	4.5 ± 0.35	6.3 ± 0.4	5.0 ± 0.4	6.3 ± 0.4
H	3	3	3.2	3.5	3.5
BW(L2/L3)	0.25 ~ 0.75	0.25 ~ 0.75	0.25 ~ 0.75	0.25 ~ 0.75	0.25 ~ 0.75
Rated Voltage	25 50 100 200	10 16 25 50 100 200	16 25 50 100 200	16 25 50 100 200	16 25 50 100 200
Cap. Range					
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					
150 154					
180 184					
220 224					
270 274					
330 334					
470 474					
560 564					
680 684					
820 824					
1.0 uF 105					
1.2 125					
1.5 155					
1.8 185					
2.2 225					
3.3 335					
4.7 475					
6.8 685					
10 106					
22 226					
33 336					
47 476					
68 686					
100 107					

A technical diagram illustrating the physical dimensions of the components shown in the table above. It features two rectangular outlines representing different component types. The top rectangle has its total length labeled as L₁, its width as W, and its height as H. Inside this rectangle, there are two vertical gray shaded regions at each end, each having a width labeled as L₂. The bottom rectangle also shows internal dimensions L₂ and L₃ (the distance between the inner edges of the shaded regions) and a total width W.

For GMC32X5R (1210) size (L) tolerance for values > 100uf, tolerance increases to 3.2mm +/- 0.4 mm.

For GMC32X5R (1210) size (L) tolerance for values > 100uf, tolerance increases to 3.2mm +/- 0.4 mm.

(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

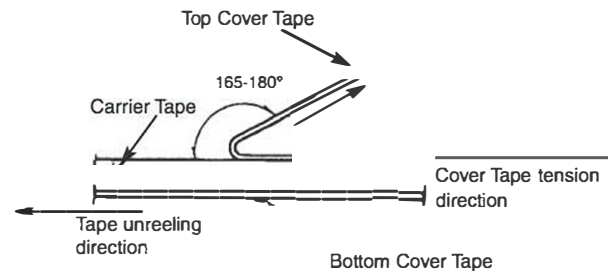
optional 10/13 inch reels

Unit:mm

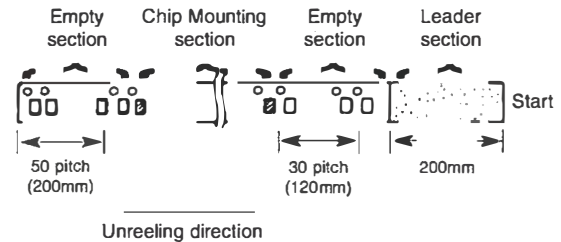
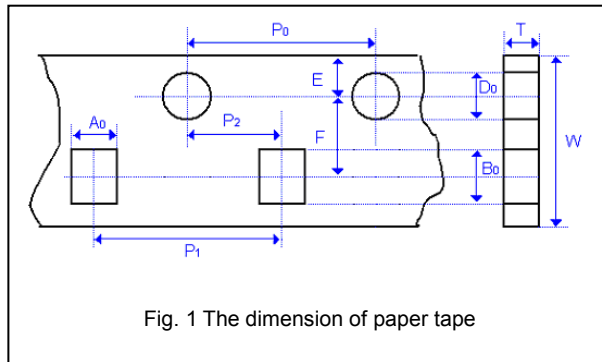
A	B	C	D	E	W	t	R
ø330 +2.0	ø50 min.	ø13.0 ±0.5	ø21.0 ±0.8	2.0 ±0.5	10.0 ±1.5	0.8 ±0.2	1.0

- 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.

Carrier Tape (Standard)



Tape & reel dimensions

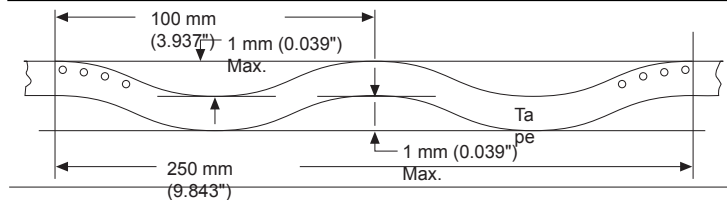
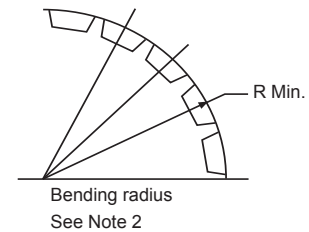


Cardboard carrier tape for 01005, 0201, 0402, 0603, 0805, 1206

Unit:mm

Type	A0	B0	T	Ko	W	P0	10xPo	P1	P2	D0	D1	E	F	Mounting Hole	Std Reel Qty 7"	Optional Reel Qty (10/13")
01005	0.25±0.04	0.45±0.04	0.36±0.05	*	8.0±0.30	4.0±0.10	40.0±0.10	2.0±0.05	2.0±0.05	1.5±0.1	*	1.75±0.1	3.5±0.05	Angular Punch Hole	20,000	50,000
0201	0.39±0.07	0.69±0.07	≤0.50	*	8.0±0.10	4.0±0.10	40.0±0.10	2.0±0.05	2.0±0.05	1.55±0.05	*	1.75±0.05	3.5±0.05		10,000 15,000	50,000
0402	0.7±0.20	1.2±0.20	≤0.80	*	8.0±0.10	4.0±0.10	40.0±0.10	2.0±0.05	2.0±0.05	1.55±0.05	*	1.75±0.05	3.5±0.05		10,000	40,000 50,000
0603	1.1±0.20	1.9±0.20	≤1.20	*	8.0±0.10	4.0±0.10	40.0±0.20	4.0±0.10	2.0±0.05	1.55±0.05	*	1.75±0.05	3.5±0.05		4,000	10,000 15,000
0805	1.65±0.20	2.4±0.20	≤01.30	*	8.0±0.10	4.0±0.10	40.0±0.20	4.0±0.10	2.0±0.05	1.55±0.05	*	1.75±0.05	3.5±0.05		4,000	10,000 15,000 20,000
1206	2.0±0.20	3.6±0.20	≤01.30	*	8.0±0.10	4.0±0.10	40.0±0.20	4.0±0.10	2.0±0.05	1.55±0.05	*	1.75±0.05	3.5±0.05		4,000	10,000 15,000 20,000

Cal-Chip
Electronics Inc.



Unit=mm

Type	A0	B0	T	Ko	W	P ₀	10xPo	P ₁	P ₂	D ₀	D1	E	F	Mounting Hole	Std Reel Qty 7"	Optional Reel Qty (10/13")
0805	<1.80	<2.70	0.23±0.10	<2.50	8.0±0.20	4.0±0.10	40.0±0.20	4.0±0.10	2.0±0.05	1.5±0.10	1.0±0.10	1.75±0.10	3.5±0.05	Angular Embossed Hole	2,000 3,000	10,000 15,000
1206	<2.30	<4.00	0.23±0.10	<2.50	8.0±0.20	4.0±0.10	40.0±0.20	4.0±0.10	2.0±0.05	1.5±0.10	1.0±0.10	1.75±0.10	3.5±0.05		2,000 3,000	8,000 10,000
1210	<3.20	<3.95	0.23±0.10	<3.00	8.0±0.20	4.0±0.10	40.0±0.20	4.0±0.10	2.0±0.05	1.5±0.10	1.0±0.10	1.75±0.10	3.5±0.05		500 1,000 2,000 3,000	4,000 8,000 10,000
1808	<2.50	<5.30	0.25±0.10	<2.50	12.0±0.20	4.0±0.10	40.0±0.20	4.0±0.10	2.0±0.05	1.5±0.10	1.0±0.10	1.75±0.10	5.5±0.10		1,000 2,000 3,000	6,000 8,000
1812	<3.90	<5.30	0.25±0.10	<3.50	12.0±0.20	4.0±0.10	40.0±0.20	8.0±0.10	2.0±0.05	1.5±0.10	1.5±0.10	1.75±0.10	5.5±0.10	Angular Embossed Hole	500 1,000	2,000
1825	<6.80	<5.30	0.30±0.10	<3.10	12.0±0.20	4.0±0.10	40.0±0.20	8.0±0.10	2.0±0.05	1.5±0.10	1.5±0.10	1.75±0.10	5.5±0.10		500 1,000	1,500
2220	<5.80	<6.50	0.30±0.10	<3.10	12.0±0.20	4.0±0.10	40.0±0.20	8.0±0.10	2.0±0.05	1.5±0.10	1.5±0.10	1.75±0.10	5.5±0.10		500 1,000	1,500
2225	<6.80	<6.50	0.30±0.10	<3.10	12.0±0.20	4.0±0.10	40.0±0.20	8.0±0.10	2.0±0.05	1.5±0.10	1.5±0.10	1.75±0.10	5.5±0.10		500 700	1,000

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.

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