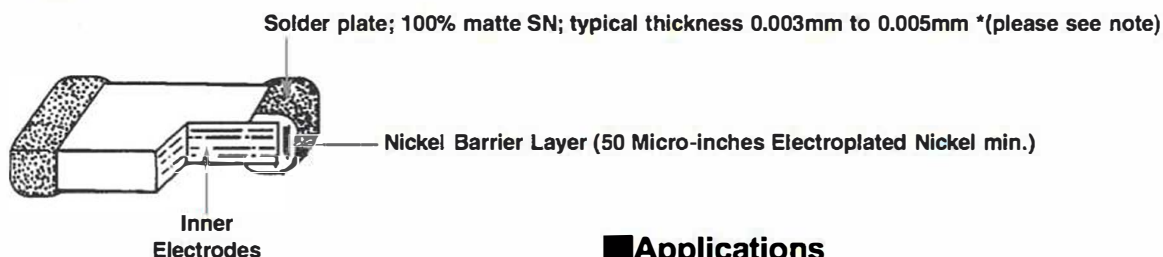




Construction



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 $1000\Omega\text{F}$, whichever is less • 125°C, V_{DCW}: $> 10\text{G}\Omega$ For $100\Omega\text{F}$, whichever is less	2.5 X V_{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 X V_{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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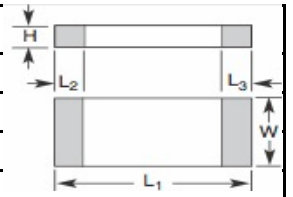
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DIMENSION (MM)		GMC04																						
L(L1)		1.0 ± 0.05																						
W		0.5 ± 0.05																						
H		0.5 ± 0.1																						
BW(L2/LW)		0.1 ~ 0.35																						
dielectric		COG						X5R						X7R						Y5V & Z5U				
Rated Voltage		6.3/10	16	25	50	100	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																							
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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****

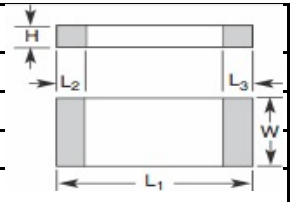
0603

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	0R5																				
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																				
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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																				



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																				
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330	334																				
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1.0 uF	105																				
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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 shaded rectangular pads on opposite long sides. The overall length is labeled L1. The distance from the left edge to the center of the left pad is L2, and the distance from the right edge to the center of the right pad is L3. The width of the component is W, and the height is 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														
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56	563														
68	683														
82	823														
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120	124														
150	154														
180	184														
220	224														

1808 - 2225 (COG/NPO)

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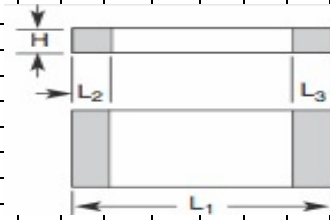
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0805 - 1210 X7R

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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
Cap. Range																					
82	820																				
100	101																				
120	121																				
150	151																				
180	181																				
220	221																				
270	271																				
330	331																				
390	391																				
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680	681																				
820	821																				
1.0nF	102																				
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1.5	152																				
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330	334																				
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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																				
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100	107																				

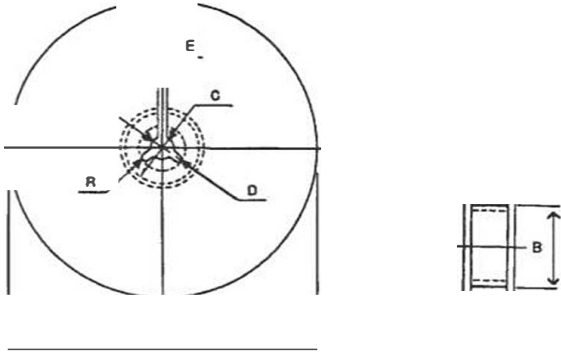


Cal-Chip
Electronics Inc.

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

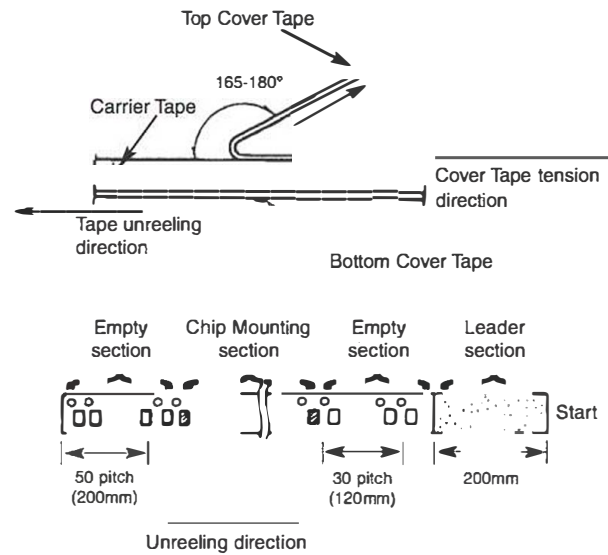
optional 10/13 inch reels

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

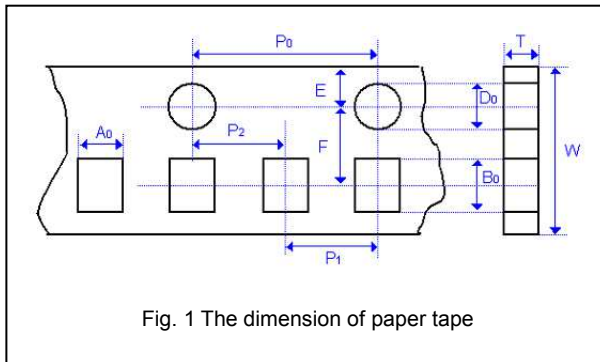


Fig. 1 The dimension of paper tape

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	2.0±0.05	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	2.0±0.05	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	2.0±0.05	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

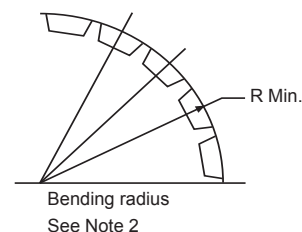
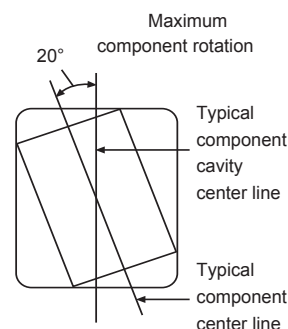
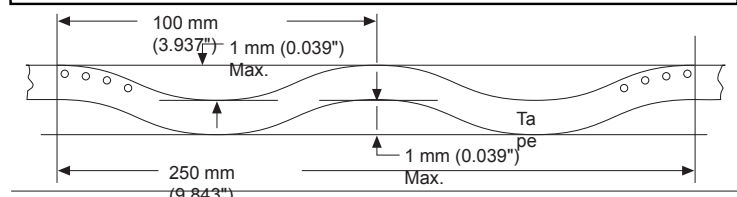


Fig. 2 The dimension of plastic tape



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.

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

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