

Messrs.

Date:

APPROVAL SHEET

Product Name : General Purpose Multilayer Ceramic Chip Capacitors

Part No. : FN Series

Description : Size 0201~2225, C0G(NPO)/X5R/X7R/Y5V, $U_R \leq 50V$

PREPARED BY	APPROVED BY

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SPECIFICATION FOR

GENERAL PURPOSE MULTILAYER CERAMIC CHIP CAPACITORS

Part No. : FN Series

Description : Size 0201~2225, C0G(NPO)/X5R/X7R/Y5V, $U_R \leq 50V$,

<u>DRAWN BY</u>	<u>CHECKED BY</u>	<u>APPROVED BY</u>
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1. INTRODUCTION

PROSPERITY Multilayer Ceramic Chip Capacitors supplied in bulk or tape & reel package are ideally suitable for thick-film hybrid circuits and automatic surface mounting on any printed circuit boards.

The nickel-barrier terminations are consisted of a nickel barrier layer over the silver metallization and then finished by electroplated solder layer to ensure the terminations have good solderability. The nickel barrier layer in terminations prevents the dissolution of termination when extended immersion in molten solder at elevated solder temperature.

2. FEATURES

- A wide selection of sizes is available (0201 to 2225).
- High capacitance in given case size.
- Capacitor with lead-free termination (pure Tin).
- RoHS & HALOGEN compliant

3. APPLICATIONS

- For general digital circuit.
- For power supply bypass capacitors.
- For consumer electronics.
- For telecommunication.
- DC to DC converter

4. HOW TO ORDER

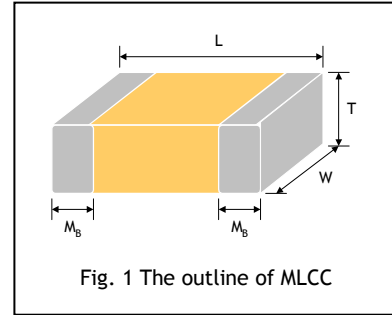
<u>FN</u>	<u>18</u>	<u>X</u>	<u>102</u>	<u>K</u>	<u>500</u>	<u>P</u>	<u>S</u>	<u>G</u>
PDC Family	Size	Dielectric	Capacitance	Tolerance	Rated voltage	Packaging	Thickness	Control Code
Table1.	Table2	Table3	*Below Ref.	Table4	Table5	Table6	Table7	Table8

* Two significant digits followed by no. of zeros. And R is in place of decimal point.
eg.: R47=0.47pF, 0R5=0.5pF, 101=10x10¹=100pF, 104=10x10⁴=100nF.

Reference document with No.14 reference table detail.

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	Thickness	
			T(mm)	M _B min (mm)
0201 (0603)	0.60±0.05	0.30±0.05	See No.14 Reference Table	0.15±0.05
0402 (1005)	1.00±0.05	0.50±0.05		0.25+0.05/-0.10
0603 (1608)	1.60±0.20	0.80±0.15		0.40±0.15
0805 (2012)	2.10±0.20	1.25±0.20		0.50±0.20
1206 (3216)	3.30±0.30	1.60+0.30/-0.10		0.60±0.20
1210 (3225)	3.30±0.40	2.50±0.30		0.75±0.35
1808 (4520)	4.60±0.50	2.00±0.20		0.75±0.35
1812 (4532)	4.60±0.50	3.20±0.30		0.75±0.35
1825 (4563)	4.60±0.50	6.30±0.40		0.75±0.35
2220 (5750)	5.70±0.50	5.00±0.40		0.85±0.35
2225 (5763)	5.70±0.50	6.30±0.40		0.85±0.35



6. GENERAL ELECTRICAL DATA

Dielectric	C0G(NP0)	X7R	Y5V	X5R
Size	0201, 0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225	0201, 0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225	0402, 0603, 0805, 1206, 1210, 1812	0201, 0402, 0603,
Capacitance range*	0.1pF to 150nF	100pF to 820nF	10nF to 820nF	100pF to 820nF
Capacitance tolerance	Reference to Table5	Reference to Table5	Reference to Table5	Reference to Table5
Rated voltage (WVDC)	10V, 16V, 25V, 50V	10V, 16V, 25V, 50V	6.3V, 10V, 16V, 25V, 50V	10V, 16V, 25V, 50V
Tan δ*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000	Note 1		
Insulation resistance at Ur	≥10GΩ	≥10GΩ or RxC≥100ΩxF whichever is less		
Operating temperature	-55 to +125°C		-25 to +85°C	-55 to +85°C
Capacitance characteristic	±30ppm	±15%	+30/-80%	±15%
Termination	Cu (or Ag)/Ni/Sn (lead-free termination)			

* Measured at the condition of 30~70% related humidity.

C0G(NP0): Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF, 25°C at ambient temperature

X7R: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 25°C ambient temperature.

Y5V: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 20°C ambient temperature.

Note 1:

X7R/X5R

Rated vol.	D.F.	Exception of D.F.	
≥50V	≤2.5%	≤3%	0603≥0.047μF; 0805≥0.18μF, 1206≥0.47μF
25V	≤3.5%	≤5%	0805≥1μF; 1210≥10μF
		≤7%	0603≥0.33μF
16V	≤3.5%	≤5%	0402≥0.033μF; 0603≥0.15μF; 0805≥0.68μF; 1206≥2.2μF
		≤10%	1210≥22μF; 0603≥0.68μF
10V	≤5.0%	≤10%	0603≥1μF; 0805≥2.2μF

Y5V

Rated vol.	D.F.	Exception of D.F.	
≥50V	≤5.0%	7.0%	0603≥0.1μF; 0805≥0.47μF
25V	≤5.0%	≤7%	0402≥0.047μF; 0603≥0.1μF; 0805≥0.33μF; 1206≥1μF
		≤9%	0402≥0.068μF; 0603≥0.47μF
		≤9%	0402≥0.068μF; 0603≥0.68μF
16V (C<1.0μF)	≤7.0%	≤9%	0805≥4.7μF; 1206≥10μF; 1210≥22μF; 1812≥47μF
16V (C≥1.0μF)	≤9.0%	≤12.5%	---
10V	≤12.5%	---	---

7.CAPACITANCE RANGE (C0G/NPO Dielectric)

7-2. 1812 ~2225 Sizes.

Dimension		1812				1825	2220	2225
Cap(pF)	code	10V	16V	25V	50V	50V	50V	50V
0.1	0R1							
0.2	0R2							
0.3	0R3							
0.4	0R4							
0.5	0R5							
1.0	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	C	C	C	C	E	E	E
12	120	C	C	C	C	E	E	E
15	150	C	C	C	C	E	E	E
18	180	C	C	C	C	E	E	E
22	220	C	C	C	C	E	E	E
27	270	C	C	C	C	E	E	E
33	330	C	C	C	C	E	E	E
39	390	C	C	C	C	E	E	E
47	470	C	C	C	C	E	E	E
56	560	C	C	C	C	E	E	E
68	680	C	C	C	C	E	E	E
82	820	C	C	C	C	E	E	E
100	101	C	C	C	C	E	E	E
120	121	C	C	C	C	E	E	E
150	151	C	C	C	C	E	E	E
180	181	C	C	C	C	E	E	E
220	221	C	C	C	C	E	E	E
270	271	C	C	C	C	E	E	E
330	331	C	C	C	C	E	E	E
390	391	C	C	C	C	E	E	E
470	471	C	C	C	C	E	E	E
560	561	C	C	C	C	E	E	E
680	681	C	C	C	C	E	E	E
820	821	C	C	C	C	E	E	E
1000	102	C	C	C	C	E	E	E
1200	122	C	C	C	C	E	E	E
1500	152	C	C	C	C	E	E	E
1800	182	C	C	C	C	E	E	E
2200	222	C	C	C	C	E	E	E
2700	272	C	C	C	C	E	E	E
3300	332	C	C	C	C	E	E	E
3900	392	C	C	C	C	E	E	E
4700	472	C	C	C	C	E	E	E
5600	562	C	C	C	C	E	E	E
6800	682	C	C	C	C	E	E	E
8200	822	C	C	C	C	E	E	E
10000	103	C	C	C	C	E	E	E
12000	123	C	C	C	C	E	E	E
15000	153	C	C	C	C	E	E	E
18000	183	C	C	C	C	E	E	E
22000	223	C	C	C	C	E	E	E
27000	273	C	C	C	C	E	E	E
33000	333	C	C	C	C	E	E	E
39000	393				F	E	E	E
47000	473				F	E	E	E
56000	563				G	E	E	E
68000	683				G	E	F	E
82000	823				G	F	G	F
100000	104				G	G	G	F
120000	124					G	G	G
150000	154						G	G
180000	184						G	G
220000	224							G
270000	274							G

8. CAPACITANCE RANGE (X7R Dielectric)

8.1 0201 ~ 2225 Sizes

Dimension		0201				0402				0603				0805				1206				1210				1808	1812				1825	2220	2225	
Cap(pF)	code	10V	16V	25V	50V	10V	16V	25V	50V	10V	16V	25V	50V	10V	16V	25V	50V	10V	16V	25V	50V	10V	16V	25V	50V	50V	10V	16V	25V	50V	50V	50V	50V	
100	101	L	L	L	L	N	N	N	N	S	S	S	S	X	X	X	X																	
120	121	L	L	L	L	N	N	N	N	S	S	S	S	X	X	X	X																	
150	151	L	L	L	L	N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X													
180	181	L	L	L	L	N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X													
220	221	L	L	L	L	N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X					M	C							
270	271	L	L	L	L	N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X					M	C							
330	331	L	L	L	L	N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X					M	C							
390	391	L	L	L	L	N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X					M	C							
470	471	L	L	L	L	N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X					M	C							
560	561	L	L	L	L	N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X					M	C							
680	681	L	L	L	L	N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X					M	C							
820	821	L	L	L	L	N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X					M	C							
1000	102	L	L	L	L	N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	C	C	C	C	C	C	F	F	F
1200	122	L	L	L		N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	C	C	C	C	C	C	F	F	F
1500	152	L	L	L		N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	C	C	C	C	C	C	F	F	F
1800	182	L	L			N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	C	C	C	C	C	C	F	F	F
2200	222	L	L			N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	C	C	C	C	C	C	F	F	F
2700	272	L	L			N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	C	C	C	C	C	C	F	F	F
3300	332	L	L	L		N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	C	C	C	C	C	C	F	F	F
3900	392	L	L			N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	C	C	C	C	C	C	F	F	F
4700	472	L	L			N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	C	C	C	C	C	C	F	F	F
5600	562	L				N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	E	C	C	C	C	C	F	F	F
6800	682	L				N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	E	C	C	C	C	C	F	F	F
8200	822	L				N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	E	C	C	C	C	C	F	F	F
10000	103	L	L			N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	E	C	C	C	C	C	F	F	F
12000	123					N	N	N		S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	E	C	C	C	C	C	F	F	F
15000	153					N	N	N		S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	E	C	C	C	C	C	F	F	F
18000	183					N	N	N		S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	E	C	C	C	C	C	F	F	F
22000	223					N	N	N	N	S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	E	C	C	C	C	C	F	F	F
27000	273					N	N	N		S	S	S	S	X	X	X	X	X	X	X	X	M	M	M	M	E	C	C	C	C	C	F	F	F
33000	333					N	N	N	N	S	S	S	B	X	X	X	X	X	X	X	X	M	M	M	M	E	C	C	C	C	C	F	F	F
39000	393					N	N	N		S	S	S	B	X	X	X	X	X	X	X	X	M	M	M	M	E	C	C	C	C	C	F	F	F
47000	473					N	N	N	N	S	S	S	B	X	X	X	X	X	X	X	X	M	M	M	M	E	C	C	C	C	C	F	F	F
56000	563					N	N	N	N	S	S	S	B	X	X	X	X	X	X	X	X	M	M	M	M	E	C	C	C	C	C	F	F	F
68000	683					N	N		N	S	S	S	B	X	X	X	X	X	X	X	X	M	M	M	M	E	C	C	C	C	C	F	F	F
82000	823					N	N			S	S	S	B	X	X	X	X	X	X	X	X	M	M	M	M	E	C	C	C	C	C	F	F	F
100000	104					N	N	N	N	S	S	S	B	X	X	X	X	X	X	X	X	M	M	M	M	E	C	C	C	C	C	F	F	F
120000	124									S	S	B		X	X	X	C	X	X	X	X	M	M	M	M	E	C	C	C	C	C	F	F	F
150000	154									S	S	B		C	C	C	C	M	M	M	M	M	M	M	E	C	C	C	C	C	F	F	F	
180000	184									S	S	B		C	C	C	C	M	M	M	M	M	M	M	E	C	C	C	C	C	F	F	F	
220000	224					N	N	N		S	S	B	B	C	C	C	C	M	M	M	M	M	M	M	E	C	C	C	C	C	F	F	F	
270000	274									B	B	B		C	C	C	I	M	M	M	C	M	M	M	F	C	C	C	C	C	F	F	F	
330000	334									B	B	B		C	C	C	I	M	M	M	C	M	M	M	C	F	C	C	C	C	F	F	F	
390000	394									B	B	B		C	C	C	I	M	M	J	P	M	M	M	C	F	C	C	C	C	F	F	F	
470000	474					N				B	B	B	B	C	C	C	I	J	J	J	P	M	M	M	C	F	C	C	C	C	F	F	F	
560000	564									B	B			C	C	C		J	J	J	P	C	C	C	C	F	C	C	C	C	F	F	F	
680000	684									B	B			C	C	C		J	J	J	P	C	C	C	C	F	C	C	C	C	F	F	F	
820000	824									B	B			C	C	C		J	J	J	P	C	C	C	C	F	C	C	C	C	F	F	F	

9. CAPACITANCE RANGE (X5R Dielectric)

9-1. 0201~0603 Sizes

Dimension		0201					0402					0603				
Cap (nF)	Code	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V
0.10	101			L	L	L										
0.12	121			L	L	L										
0.15	151			L	L	L										
0.18	181			L	L	L										
0.22	221			L	L	L										
0.27	271			L	L	L										
0.33	331			L	L	L										
0.47	471			L	L	L										
0.56	561			L	L	L										
0.68	681			L	L	L										
0.82	821			L	L	L										
1	102		L	L	L	L										
1.5	152		L	L												
2.2	222		L	L												
3.3	332		L	L												
4.7	472		L	L												
6.8	682		L													
10	103	L	L	L	L											
27	273	L	L						N							
33	333	L	L						N							
39	393	L	L						N							
47	473	L	L						N							
56	563	L	L					N	N							
68	683	L	L					N	N							
82	823	L	L				N	N	N							
100	104	L	L	L	L		N	N	N	N	N			S		
150	154						N	N	N	N						
220	224	L	L				N	N	N	N	N		B	B	B	B
270	274							N					B	B	B	
330	334						N	N				B	B	B	B	
390	394												B	B	B	
470	474	L					N	N	K	K	K	B	B	B	B	B
680	684						N	N				B	B	B	B	
820	824											B	B	B		

10. CAPACITANCE RANGE (Y5V Dielectric)

10-1. 0402, 0603, 0805 Sizes

Dimension		0402				0603					0805			
Cap (nF)	Code	10	16	25	50	6.3	10	16	25	50	10	16	25	50
10	103	N	N	N	N		S	S	S	S	A	A	A	A
15	153	N	N	N	N		S	S	S	S	A	A	A	A
22	223	N	N	N	N		S	S	S	S	A	A	A	A
33	333	N	N	N	N		S	S	S	S	A	A	A	A
47	473	N	N	N			S	S	S	S	A	A	A	A
68	683	N	N	N			S	S	S	S	A	A	A	A
100	104	N	N	N			S	S	S	S	A	A	A	A
150	154	N	N				S	S	S	S	A	A	A	A
220	224	N	N			S	S	S	S	S	A	A	A	A
330	334	N	N			S	S	S	S	B	X	X	X	X
470	474	N	N			S	S	S	B	B	X	X	X	X/C
680	684	N				S	S	B	B		X	X	C	C

10-2. 1206, 1210, 1812 Sizes

Dimension		1206				1210				1812			
Cap (nF)	Code	10	16	25	50	10	16	25	50	10	16	25	50
10	103	X	X	X	X								
15	153	X	X	X	X								
22	223	X	X	X	X								
33	333	X	X	X	X								
47	473	X	X	X	X								
68	683	X	X	X	X								
100	104	X	X	X	X	M	M	M	M	C	C	C	C
150	154	X	X	X	X	M	M	M	M	C	C	C	C
220	224	X	X	X	X	M	M	M	M	C	C	C	C
330	334	X	X	X	X	M	M	M	M	C	C	C	C
470	474	X	X	X	X	M	M	M	M	C	C	C	C
680	684	X	X	X	X	M	M	M	M	C	C	C	C

11.RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements																																																																																										
1.	Visual and Dimensions	---	* No remarkable defect. * Dimensions to conform to individual specification sheet.																																																																																										
2.	Capacitance	Class I: NP0 Cap≤1000pF 1.0±0.2Vrms, 1MHz±10%	* Shall not exceed the limits given in the detailed spec.																																																																																										
3.	Q/ D.F. (Dissipation Factor)	Cap>1000pF 1.0±0.2Vrms, 1KHz±10% Class II: X7R,X7E, X5R,Y5V Cap≤10μF, 1.0±0.2Vrms, 1kHz±10% ** Cap>10μF, 0.5±0.2Vrms, 120Hz±20% ** Test condition: 0.5±0.2Vrms · 1KHz±10% X7R: 0603 ≥ 225(10V), 0805=106(6.3V&10V) X5R: 01R5 ≥ 103, 0201 ≥ 224 (6.3V), 0402 ≥ 475 (6.3V), 0402 ≥ 225(10V), 0603=106 (6.3V), 0603 ≥ 475(10V)	NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C X7R, X5R: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>X7R D.F. ≤</th> <th>X5R D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 50V</td> <td rowspan="3">2.5%</td> <td rowspan="3">3 %</td> <td>≤ 3%</td> <td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10%</td> <td>0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF</td> </tr> <tr> <td>35V</td> <td>3.5%</td> <td>3.5%</td> <td>≤ 10%</td> <td>0805 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">3.5%</td> <td rowspan="2">3.5%</td> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 7%</td> <td>0603 ≥ 0.33μF; 1206 ≥ 4.7μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">3.5%</td> <td rowspan="2">3.5%</td> <td>≤ 10%</td> <td>0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">5%</td> <td rowspan="2">5%</td> <td>≤ 10%</td> <td>0402 ≥ 0.47μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 15%</td> <td>0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">10%</td> <td rowspan="2">10%</td> <td>≤ 10%</td> <td>0402 ≥ 0.1μF; 0603 ≥ 0.1μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 20%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td>4V</td> <td>15%</td> <td>15%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> Y5V: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td>≥ 50V</td> <td>5%</td> <td>7%</td> <td>0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF</td> </tr> <tr> <td>35V</td> <td>7%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">5%</td> <td>7%</td> <td>0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>9%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>16V (C<1.0μF)</td> <td>7%</td> <td>9%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.68μF</td> </tr> <tr> <td></td> <td></td> <td>12.5%</td> <td>0402 ≥ 0.22μF</td> </tr> <tr> <td>16V (C ≥ 1.0μF)</td> <td>9%</td> <td>12.5%</td> <td>0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF</td> </tr> <tr> <td>10V</td> <td>12.5%</td> <td>20%</td> <td>0402 ≥ 0.47μF</td> </tr> <tr> <td>6.3V</td> <td>20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	X7R D.F. ≤	X5R D.F. ≤	Exception of D.F. ≤		≥ 50V	2.5%	3 %	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤ 5%	1210 ≥ 4.7μF	≤ 10%	0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF	35V	3.5%	3.5%	≤ 10%	0805 ≥ 2.2μF; 1210 ≥ 10μF	25V	3.5%	3.5%	≤ 5%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF	≤ 7%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF	16V	3.5%	3.5%	≤ 10%	0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF	≤ 5%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	10V	5%	5%	≤ 10%	0402 ≥ 0.47μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 15%	0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	6.3V	10%	10%	≤ 10%	0402 ≥ 0.1μF; 0603 ≥ 0.1μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 20%	0201 ≥ 0.1μF; 0402 ≥ 1μF	4V	15%	15%	---	---	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 50V	5%	7%	0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF	35V	7%	---	---	25V	5%	7%	0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF	9%	0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	16V (C<1.0μF)	7%	9%	0402 ≥ 0.068μF; 0603 ≥ 0.68μF			12.5%	0402 ≥ 0.22μF	16V (C ≥ 1.0μF)	9%	12.5%	0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF	10V	12.5%	20%	0402 ≥ 0.47μF	6.3V	20%	---	---
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11.RELIABILITY TEST CONDITIONS AND REQUIREMENTS(Con.)

No.	Item	Test Condition	Requirements															
6.	Dielectric Strength	<ul style="list-style-type: none"> * To apply voltage ($\leq 50V$) 250%. * Duration: 1 to 5 sec. * Charge and discharge current less than 50mA. 	<ul style="list-style-type: none"> * No evidence of damage or flash over during test. 															
7.	Solderability	<ul style="list-style-type: none"> * Solder temperature: $235\pm 5^{\circ}C$ for (0201~1210) * Solder temperature: $245\pm 5^{\circ}C$ for (1808~2225) * Dipping time: 2 ± 0.5 sec. 	<ul style="list-style-type: none"> 75% min. coverage of all metalized area. 															
8.	Resistance to Soldering Heat	<ul style="list-style-type: none"> * Solder temperature: $260\pm 5^{\circ}C$ * Dipping time: 10 ± 1 sec * Preheating: 120 to $150^{\circ}C$ for 1 minute before immerse the capacitor in a eutectic solder. * Before initial measurement (Class II only): Perform $150+0/-10^{\circ}C$ for 1 hr and then set for 48 ± 4 hrs (Class II only) at room temp. * Measurement to be made after keeping at room temp. for 24 ± 2hrs (Class I) or 48 ± 4 hrs (Class II). 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: NP0: within $\pm 2.5\%$ or $\pm 0.25pF$ whichever is larger. X7R, X5R: within $\pm 7.5\%$ Y5V: within $\pm 20\%$ * 25% max. leaching on each edge. 															
9.	Temperature Cycle	<ul style="list-style-type: none"> * Conduct the five cycles according to the temperatures and time. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Step</th> <th>Temp. ($^{\circ}C$)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. $+0/-3$</td> <td>30 ± 3</td> </tr> <tr> <td>2</td> <td>Room temp.</td> <td>2~3</td> </tr> <tr> <td>3</td> <td>Max. operating temp. $+3/-0$</td> <td>30 ± 3</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>2~3</td> </tr> </tbody> </table> <ul style="list-style-type: none"> * Before initial measurement (Class II only): Perform $150+0/-10^{\circ}C$ for 1 hr and then set for 48 ± 4 hrs at room temp. * Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II). 	Step	Temp. ($^{\circ}C$)	Time (min.)	1	Min. operating temp. $+0/-3$	30 ± 3	2	Room temp.	2~3	3	Max. operating temp. $+3/-0$	30 ± 3	4	Room temp.	2~3	<ul style="list-style-type: none"> * No remarkable damage. * Cap change : NP0: within $\pm 2.5\%$ or $\pm 0.25pF$ whichever is larger. X7R, X5R: within $\pm 7.5\%$ Y5V: within $\pm 20\%$ * Q/D.F. \leq initial requirement * I.R. $\geq 0.25 \times$ initial requirements.
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No.	Item	Test Condition	Requirements																																																																																										
10.	Humidity (Damp Heat) Steady State	* Test temp.: 40±2°C * Humidity: 90~95% RH * Test time: 500+24/-0hrs. * Measurement to be made after keeping at room temp. for 24±2 hrs. (Class I) or 48±4 hrs. (Class II).	* No remarkable damage. * Cap change: NP0: within ±5% or 0.5pF whichever is larger X7R, X7E, X5R: ≥10V**, within ±12.5%; 6.3V within ±25%; TT series & C ≥ 1uF, within ±25% **10V:0603 ≥ 4.7μF; 0402 ≥ 1μF; 0201 ≥ 0.1μF, within ±25%; Y5V: ≥10V, within ±30%; 6.3V, within +30/-40% * Q/D.F. value: NP0: More than 30pF Q ≥ 350, 10pF ≤ C ≤ 30pF, Q ≥ 275 + 2.5C Less than 10pF Q ≥ 200 + 10C X7R, X5R: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥50V</td> <td rowspan="3">3%</td> <td>6%</td> <td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>10%</td> <td>1210 ≥ 4.7μF</td> </tr> <tr> <td>20%</td> <td>0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF</td> </tr> <tr> <td>35V</td> <td>5%</td> <td>20%</td> <td>0805 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">5%</td> <td>10%</td> <td>0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>14%</td> <td>0603 ≥ 0.33μF; 1206 ≥ 4.7μF</td> </tr> <tr> <td>15%</td> <td>0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">5%</td> <td>10%</td> <td>0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>15%</td> <td>0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">7.5%</td> <td>15%</td> <td>0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td>20%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td>6.3V</td> <td>15%</td> <td>30%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>4V</td> <td>20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> Y5V: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>7.5%</td> <td>10%</td> <td>0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF</td> </tr> <tr> <td>35V</td> <td>10%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">7.5%</td> <td>10%</td> <td>0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>15%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">16V (C < 1.0μF)</td> <td rowspan="2">10%</td> <td>12.5%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.68μF</td> </tr> <tr> <td>20%</td> <td>0402 ≥ 0.22μF</td> </tr> <tr> <td>16V (C ≥ 1.0μF)</td> <td>12.5%</td> <td>20%</td> <td>0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF</td> </tr> <tr> <td>10V</td> <td>20%</td> <td>30%</td> <td>0402 ≥ 0.47μF</td> </tr> <tr> <td>6.3V</td> <td>30%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> *I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller. 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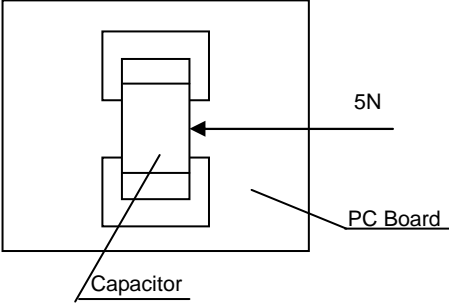
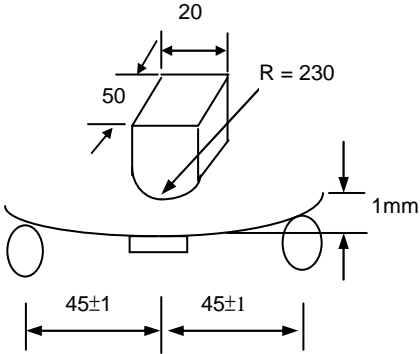
11.RELIABILITY TEST CONDITIONS AND REQUIREMENTS(Con.)

No.	Item	Test Condition	Requirements																																																																																										
11.	Humidity (Damp Heat) Load	<ul style="list-style-type: none"> * Test temp.: 40±2°C * Humidity: 90~95%RH * Test time: 500+24/-0 hrs. * To apply voltage : rated voltage. * Measurement to be made after keeping at room temp. for 24±2 hrs. (Class I) or 48±4 hrs. (Class II). 	<p>* No remarkable damage.</p> <p>Cap change: NP0: ±7.5% or 0.75pF whichever is larger. X7R, X7E, X5R: ≥10V**, within ±12.5%; 6.3V within ±25%; TT series & C≥ 1uF, within ±25% **10V:0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25%; Y5V: ≥10V, within ±30%; 6.3V, within +30/-40%</p> <p>Q/D.F. value: NP0: C≥30pF,Q≥200;C<30pF, Q≥100+10/3C X7R, X5R:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥50V</td> <td rowspan="3">3%</td> <td>6%</td> <td>0201(50V);0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF</td> </tr> <tr> <td>10%</td> <td>1210≥4.7μF</td> </tr> <tr> <td>20%</td> <td>0603≥1μF; 0805≥1μF;1206≥4.7μF; 1210≥10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">5%</td> <td>20%</td> <td>0805≥2.2μF;1210≥10μF</td> </tr> <tr> <td rowspan="2">10%</td> <td>0201≥0.01μF;0805≥1μF; 1210≥10μF</td> </tr> <tr> <td>14%</td> <td>0603≥0.33μF;1206≥4.7μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">5%</td> <td>15%</td> <td>0402≥0.10μF;0603≥0.47μF;0805≥2.2μF;1206≥6.8μF; 1210≥22μF</td> </tr> <tr> <td rowspan="2">10%</td> <td>0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF</td> </tr> <tr> <td>15%</td> <td>0201≥0.01μF;0402≥0.033μF;0603≥0.68μF;0805≥2.2μF; 1206≥4.7μF; 1210≥22μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">5%</td> <td>15%</td> <td>0402≥0.33μF; 0603≥0.33μF;0805≥2.2μF; 1206≥2.2μF; 1210≥22 F</td> </tr> <tr> <td>20%</td> <td>0201≥0.1μF ;0402≥1μF</td> </tr> <tr> <td>30%</td> <td>0201≥0.1μF;0402≥1μF;0603≥10μF; 0805≥4.7μF;1206≥47μF;1210≥100μF</td> </tr> <tr> <td>6.3V</td> <td>15%</td> <td>---</td> <td>---</td> </tr> <tr> <td>4V</td> <td>20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>7.5%</td> <td>10%</td> <td>0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF</td> </tr> <tr> <td>35V</td> <td>10%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">7.5%</td> <td>10%</td> <td>0402≥0.047μF;0603≥0.1μF; 0805≥0.33μF;1206≥1μF; 1210≥4.7μF</td> </tr> <tr> <td>15%</td> <td>0402≥0.068μF;0603≥0.47μF; 1206≥4.7μF; 1210≥22μF</td> </tr> <tr> <td rowspan="2">16V (C<1.0μF)</td> <td rowspan="2">10%</td> <td>12.5%</td> <td>0402≥0.068μF; 0603≥0.68μF</td> </tr> <tr> <td>20%</td> <td>0402≥0.22μF</td> </tr> <tr> <td>16V (C≥1.0μF)</td> <td>12.5%</td> <td>20%</td> <td>0603≥2.2μF; 0805≥3.3μF; 1206≥10μF;1210≥22μF; 1812≥47μF;</td> </tr> <tr> <td>10V</td> <td>20%</td> <td>30%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>6.3V</td> <td>30%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p>*I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller. 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11.RELIABILITY TEST CONDITIONS AND REQUIREMENTS(Con.)

No.	Item	Test Condition	Requirements																																																																																																																																														
12.	High Temperature Load (Endurance)	<p>*Test temp. : NP0, X7R/X7E: 125±3°C X5R, Y5V: 85±3°C *Test time: 1000+24/-0 hrs. *To apply voltage: (1) 6.3V or C≥10μF or TT series: 150% of rated voltage. (2) 10V ≤ Ur<500V: 200% of rated voltage. (3) 500V: 150% of rated voltage. (4) Ur ≥ 630V: 120% of rated voltage. (5) 100% of rated voltage for below range.</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance range</th> </tr> </thead> <tbody> <tr> <td>0201</td> <td>X5R</td> <td>6.3V,10V</td> <td>C ≥ 0.1μF</td> </tr> <tr> <td>0402</td> <td>X5R,</td> <td>6.3V,10V</td> <td>C ≥ 1.0μF</td> </tr> <tr> <td>0603</td> <td>X5R</td> <td>6.3V,10V</td> <td>C ≥ 4.7μF</td> </tr> <tr> <td>0805</td> <td>X5R</td> <td>6.3V</td> <td>C ≥ 22μF</td> </tr> <tr> <td rowspan="2">1206</td> <td>X5R</td> <td>6.3V</td> <td>C ≥ 47μF</td> </tr> <tr> <td>NP0</td> <td>3000V</td> <td>C ≥ 1.5pF</td> </tr> </tbody> </table> <p>(6)150% of rated voltage for below range.</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance range</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0402</td> <td>X5R</td> <td>10V,16V,25V</td> <td>C ≥ 0.22μF</td> </tr> <tr> <td>Y5V</td> <td>16V</td> <td>C ≥ 0.47μF</td> </tr> <tr> <td rowspan="2">0603</td> <td>X5R</td> <td>10V,16V</td> <td>C ≥ 1.0μF</td> </tr> <tr> <td>Y5V</td> <td>16V</td> <td>C ≥ 2.2μF</td> </tr> <tr> <td rowspan="2">0805</td> <td>X5R</td> <td>10V</td> <td>C ≥ 4.7μF</td> </tr> <tr> <td>Y5V</td> <td>16V</td> <td>C ≥ 4.7μF</td> </tr> </tbody> </table> <p>* Measurement to be made after keeping at room temp. for 24±2 hrs. (Class I) or 48±4 hrs. (Class II).</p>	Size	Dielectric	Rated voltage	Capacitance range	0201	X5R	6.3V,10V	C ≥ 0.1μF	0402	X5R,	6.3V,10V	C ≥ 1.0μF	0603	X5R	6.3V,10V	C ≥ 4.7μF	0805	X5R	6.3V	C ≥ 22μF	1206	X5R	6.3V	C ≥ 47μF	NP0	3000V	C ≥ 1.5pF	Size	Dielectric	Rated voltage	Capacitance range	0402	X5R	10V,16V,25V	C ≥ 0.22μF	Y5V	16V	C ≥ 0.47μF	0603	X5R	10V,16V	C ≥ 1.0μF	Y5V	16V	C ≥ 2.2μF	0805	X5R	10V	C ≥ 4.7μF	Y5V	16V	C ≥ 4.7μF	<p>* No remarkable damage. Cap change: NP0: ±3.0% or ±0.3pF whichever is larger X7R, X7E, X5R: ≥10V**, within ±12.5%;6.3V within ±25%; TT series & C ≥ 1uF, within ±25% **10V:0603 ≥ 4.7μF;0402 ≥ 1μF;0201 ≥ 0.1μF, within ±25%; Y5V: ≥10V, within ±30%; 6.3V, within +30/-40% Q/D.F. value: NP0: More than 30pF, Q≥350 10pF≤C<30pF, Q≥275+2.5C Less than 10pF, Q≥200+10C X7R, X5R:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 50V</td> <td rowspan="3">3%</td> <td>6%</td> <td>0201(50V);0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>10%</td> <td>1210 ≥ 4.7μF</td> </tr> <tr> <td>20%</td> <td>0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF</td> </tr> <tr> <td>35V</td> <td>5%</td> <td>20%</td> <td>0805 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">5%</td> <td>10%</td> <td>0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>14%</td> <td>0603 ≥ 0.33μF; 1206 ≥ 4.7μF</td> </tr> <tr> <td>15%</td> <td>0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">5%</td> <td>10%</td> <td>0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>15%</td> <td>0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">7.5%</td> <td>15%</td> <td>0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td> </tr> <tr> <td>20%</td> <td>0201 ≥ 0.1μF ; 0402 ≥ 1μF</td> </tr> <tr> <td>6.3V</td> <td>15%</td> <td>30%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF</td> </tr> <tr> <td>4V</td> <td>20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td>≥ 50V</td> <td>7.5%</td> <td>10%</td> <td>0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF</td> </tr> <tr> <td>35V</td> <td>10%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">7.5%</td> <td>10%</td> <td>0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>15%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">16V (C<1.0μF)</td> <td rowspan="2">10%</td> <td>12.5%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.68μF</td> </tr> <tr> <td>20%</td> <td>0402 ≥ 0.22μF</td> </tr> <tr> <td>16V (C ≥ 1.0μF)</td> <td>12.5%</td> <td>20%</td> <td>0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF;</td> </tr> <tr> <td>10V</td> <td>20%</td> <td>30%</td> <td>0402 ≥ 0.47μF</td> </tr> <tr> <td>6.3V</td> <td>30%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p>*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller. 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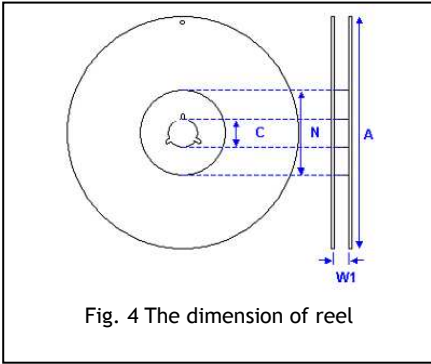
11.RELIABILITY TEST CONDITIONS AND REQUIREMENTS(Con.)

No.	Item	Test Condition	Requirements
13.	Adhesive Strength of Termination	<p>* Capacitors mounted on a substrate. A force of 5N(\leq0603) or 10N($>$ 0603) applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 ± 1 second.</p>  <p>* Pressurizing force : 0201 :2N / 0402 & 0603 : 5N >0603 : 10N * Test time: 10 ± 1 sec.</p>	<p>* No remarkable damage or removal of the terminations.</p>
14.	Bending Test	<p>* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1mm per second until the deflection becomes 1mm.</p> 	<p>* No remarkable damage. * Cap change: C0G(NPO): within $\pm 5.0\%$ or $\pm 0.5\text{pF}$ whichever is larger. X7R/X5R: within $\pm 12.5\%$ Y5V: within $\pm 30\%$</p> <p>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)</p>
15.	Vibration Resistance	<p>* Vibration frequency: 10~55 Hz/min. * Total amplitude: 1.5mm * Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)</p>	<p>* No remarkable damage. * Cap change and Q/D.F.: To meet initial spec.</p>

12. PACKAGE DIMENSION AND QUANTITY

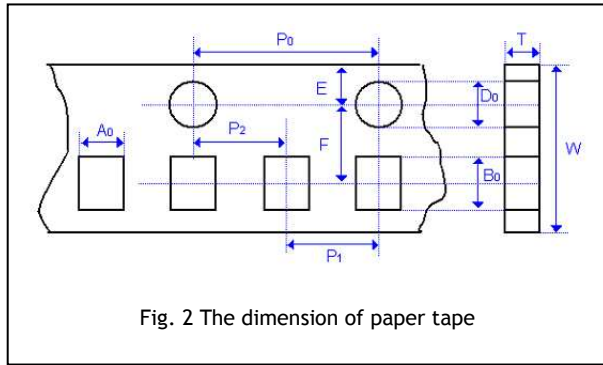
Size	Thickness (mm)	Paper tape		Plastic tape	
		7" reel	13" reel	7" reel	13" reel
0201 (0603)	0.30±0.05	15k	70K	-	-
0402 (1005)	0.50±0.05	10k	50K	-	-
0603 (1608)	0.80±0.07	4k	15k	-	-
	0.80+0.15/-0.10	4k	15k	-	-
0805 (2012)	0.60±0.10	4k	15k	-	-
	0.80±0.10	4k	15k	-	-
	1.25±0.10	-	-	3k	10k
	1.25±0.20	-	-	3k	-
1206 (3216)	0.80±0.10	4k	15k	-	-
	0.95±0.10	-	-	3k	10k
	1.25±0.10	-	-	3k	10k
	1.60±0.20	-	-	2k	-
1210 (3225)	0.95±0.10	-	-	3k	10k
	1.25±0.10	-	-	3k	10k
	1.60±0.20	-	-	2k	-
	2.50±0.30	-	-	1k	-
1808 (4520)	1.25±0.10	-	-	2k	-
	1.60±0.20	-	-	2k	-
	2.00±0.20	-	-	1k	-
1812 (4532)	1.25±0.10	-	-	1k	-
	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
1825 (4563)	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
2220 (5750)	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
2225 (5763)	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-

Unit: pieces

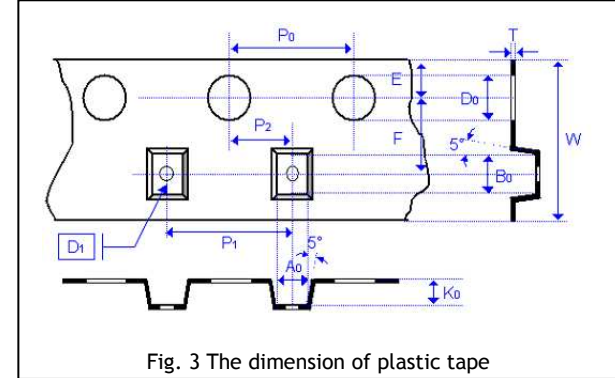


Size	0201, 0402, 0603, 0805, 1206, 1210			1812, 1825, 2220, 2225
Reel size	7"	10"	13"	7"
C	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2
W ₁	8.4+1.5/-0	8.4+1.5/-0	8.4+1.5/-0	12.4+2.0/-0
A	178.0±0.10	250.0±1.0	330.0±1.0	178.0±0.10
N	60.5±1.0	100.0±1.0	100±1.0	60.5±1.0

12-1. CARDBOARD TAPE DIMENSIONS



12-2. EMBOSSED TAPE DIMENSIONS



Size	0201	0402	0603		0805			1206			1210	
Chip Thickness	0.30 ± 0.03	0.50±0.05	0.80±0.07	0.80 +0.15/-0.10	0.60±0.10	0.80±0.10	1.25±0.10 1.25±0.20	0.80±0.10	0.95±0.10 1.25±0.10	1.60±0.20 1.60+0.3/-0/1	0.95±0.10 1.25±0.10 1.60±0.20	2.50±0.30
A ₀	0.38±0.05	0.62±0.05	1.00 +0.05/-0.10	1.02 +0.05/-0.10	1.50±0.10	1.50±0.10	<1.65	2.00±0.10	<2.00	<2.00	<3.05	<3.10
B ₀	0.68±0.05	1.12±0.05	1.80±0.10	1.80±0.10	2.30±0.10	2.30±0.10	<2.40	3.50±0.10	<3.60	<3.70	<3.80	<4.00
T	0.42±0.05	0.60±0.05	0.95±0.05	0.97±0.05	0.75±0.05	0.95±0.05	0.23±0.05	0.95±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.23±0.05
K ₀	-	-	-	-	-	-	<2.50	-	<2.50	<2.50	<2.50	<3.50
W	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10
P ₀	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
10xP ₀	40.0±0.10	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.0±0.10
P ₁	2.00±0.05	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
P ₂	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05
D ₀	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.50±0.10/-0	1.55±0.05	1.50±0.10/-0	1.50±0.10/-0	1.50±0.10/-0	1.50±0.10/-0
D ₁	-	-	-	-	-	-	1.00±0.10	-	1.00±0.10	1.00±0.10	1.00±0.10	1.00±0.10
E	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10
F	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05

Size	1808		1812		1825		2220		2225	
Chip Thickness	1.25±0.10 1.60±0.20	2.00±0.20	1.25±0.10 1.60±0.20 2.00±0.20	2.50±0.30	1.60±0.20 2.00±0.20	2.50±0.30	1.40±0.15 1.60±0.20 2.00±0.20	2.50±0.30	2.00±0.20	2.50±0.30
A ₀	<2.50	<2.50	<3.90	<3.90	<6.80	<6.80	<5.80	<5.80	<6.80	<6.80
B ₀	<5.30	<5.30	<5.30	<5.30	<5.30	<5.30	<6.50	<6.50	<6.50	<6.50
T	0.25±0.05	0.25±0.05	0.25±0.05	0.25±0.05	0.30±0.10	0.30±0.10	0.30±0.10	0.30±0.10	0.30±0.10	0.30±0.10
K ₀	<2.50	<2.50	<2.50	<3.00	<2.50	<3.10	<2.50	<3.10	<2.50	<3.10
W	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20
P ₀	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
10xP ₀	40.0±0.20	40.0±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20
P ₁	4.00±0.10	4.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10
P ₂	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05
D ₀	1.50±0.10/-0	1.50+0.10/-0	1.50+0.10/-0	1.50+0.10/-0	1.50+0.10/-0	1.50+0.10/-0	1.50+0.10/-0	1.50+0.10/-0	1.50+0.10/-0	1.50+0.10/-0
D ₁	1.50±0.10	1.50±0.10	1.50±0.10	1.50+/-0.10	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10
E	1.75±0.10	1.75±0.10	1.75±0.10	1.75+/-0.1	1.75±0.1	1.75±0.10	1.75±0.1	1.75±0.10	1.75±0.10	1.75±0.10
F	5.50±0.05	5.50±0.05	5.50±0.05	5.50+/-0.05	5.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05

13.APPLICATION NOTES

STORAGE

To prevent the damage of solderability of terminations, the following storage conditions are recommended:
Indoors under 5 ~ 40°C and 20% ~ 70% RH.

No harmful gases containing sulfuric acid, ammonia, hydrogen sulfide or chlorine.

Packaging should not be opened until the capacitors are required for use. If opened, the pack should be re-sealed as soon as is practicable. Taped product should be stored out of direct sunlight, which might promote deterioration in tape or adhesion performance. The capacitors should be used within 6 months and checked the solderability before use.

HANDLING

Chip capacitors are dense, hard, brittle, and abrasive materials. They are liable to suffer mechanical damage, in the form of cracks or chips. Chip Capacitors should be handled with care to avoid contamination or damage. To use vacuum or plastic tweezers to pick up or plastic tweezers is recommended for manual placement. Tape and reeled packages are suitable for automatic pick and placement machine.

PREHEAT

In order to minimize the risk of thermal shock during soldering, a carefully controlled preheat is required. The rate of preheat should not exceed 4°C per second and the final preheat temperature should be within 100°C of the soldering temperature for small chips such as 0201, 0402, 0603, 0805 and 1206, within 50°C of the soldering temperature for bigger chips such as 1210, 1808, 1812, 1825, 2220 and 2225, etc.

SOLDERING

Use middy activated rosin RA and RMA fluxes do not use activated flux. The amount of solder in each solder joint should be controlled to prevent the damage of chip capacitors caused by the stress between solder, chips, and substrate.

Hand soldering with temperature-controlled iron not exceeding 30 watts and diameter of tip less than 1.2 mm is recommended, tip of iron should not contact the ceramic body directly, and the temperature of iron should be set to not more than 260°C.

For bigger chips such as 1210, 1808, 1812, 2220 and 2225, etc. wave soldering and hand soldering are not recommended.

Refer IPC/JEDEC J-STD-020D Method recommended soldering profiles :

Reflow not sooner than 15 minutes and not longer than 4 hrs after removal from the temperature/humidity chamber, subject the sample to 3 cycle of the appropriate reflow conditions as defined as blow Table description.

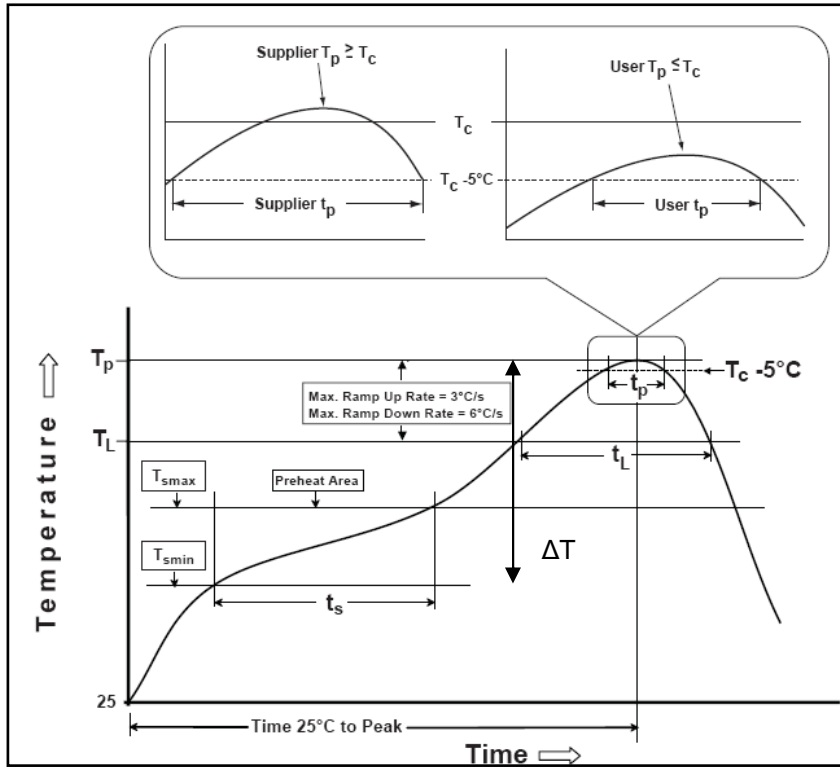
Profile Feature	Pb-Free Assembly
Preheat/Soak	
Temperature Min.(T _{smin})	150°C
Temperature Max.(T _{smax})	200°C
Time(t _s) from (T _{smin} to T _{smax})	60 to 120 seconds
Ramp-up rate(T _L to T _p)	3°C/second max.
Liquidous temperature(T _L)	217°C
Time(t _L) maintained above T _L	60 to 150 seconds
Peak package body temperature(T _p)	For user T _p must not exceed the Classification temp 260°C For suppliers T _p must equal or exceed the Classification temp 260°C
Time(T _p)* within 5°C of the specified classification temperature(T _c)	30* second
Ramp-down rate (T _p to T _L)	6°C/second max.
Time 25°C to peak temperature 260°C	8 minutes max.

Lead-free : Soldering temperature = 235 to 260°C, depending on product.

Maximum temperature = Minimum temperature (235°C)+ ΔT + Tolerance for oven process and measurement(5 ~ 7°C)

Time at peak temperature = 10sec, Dwell above 217°C = 90sec, Ramping rate = 3°C/sec(heating) and 6°C/sec(heating).

Classification Reflow Profiles



Chip Size	ΔT
0201,0402,0603,0805,1206	100 °C
1210, 1808, 1812, 2211, 2220, 2225	50 °C

Soldering	Solder Temp.(T _c)	Soldering Time (t _p)
Reflow	235 – 260 °C	< 15 sec.
Wave	230 – 260 °C	< 5 sec.

Note : For example , T_c is 260°C and time t_p is 15sec.
for user : The peak temperature must not exceed 260°C . The time above 255°C must not exceed 15 seconds.

COOLING

After soldering, cool the chips and the substrate gradually to room temperature. Natural cooling in air is recommended to minimize stress in the solder joint. A cooling rate not exceeding 4°C per second should be used when forced cooling is necessary.

CLEANING

All flux residues must be removed by using suitable electronic-grade vapor-cleaning solvents to eliminate contamination that could cause electrolytic surface corrosion. Good results can be obtained by using ultrasonic cleaning of the solvent. The choice of the proper system is depends upon many factors such as component mix, flux, and solder paste and assembly method. The ability of the cleaning system to remove flux residues and contamination from under the chips is very important.

14.REFERENCE TABLE

<u>FN</u>	<u>18</u>	<u>X</u>	<u>102</u>	<u>K</u>	<u>500</u>	<u>P</u>	<u>S</u>	<u>G</u>
PDC Family	Size	Dielectric	Capacitance	Tolerance	Rated voltage	Packaging	Thickness	Control Code
Table1.	Table2	Table3	*Below Ref.	Table4	Table5	Table6	Table7	Table8

Table 1 PDC family			
Code	Description	Code	Description
FN	General Purpose product \leq 50Vdc		

Table 2 EIA size			
General Purpose			
Code	Description	Code	Description
03	0201(0603)	42	1808 (4520)
15	0402(1005)	43	1812 (4532)
18	0603 (1608)	46	1825 (4563)
21	0805 (2012)	52	2211 (5728)
31	1206 (3216)	55	2220 (5750)
32	1210 (3225)	56	2225 (5763)

Table 3 Dielectric Material Characteristics			
Code	Description	Code	Description
N	C0G(NPO)	X	X7R
B	X5R	F	Y5V

Table 4 Tolerance							
Code	Description	Code	Description	Code	Description	Code	Description
A	± 0.05 pF	F	± 1 %	J	± 5 %	N	-5% ~ +10%
B	± 0.10 pF	G	± 2 %	K	± 10 %	P	± 0.02 pF
C	± 0.25 pF	H	± 3 %	L	0% ~ +10%	Q	± 0.03 pF
D	± 0.50 pF	I	-10% ~ 0%	M	± 20 %	Z	-20% ~ 80%

Table 5 Rated voltage

General Purpose							
Code	Description	Code	Description	Code	Description	Code	Description
6R3	6.3VDC	101	100VDC	102	1000VDC	402	4000VDC
100	10VDC	201	200VDC	152	1500VDC	502	5000VDC
160	16VDC	251	250VDC	202	2000VDC	602	6000VDC
250	25VDC	501	500VDC	252	2500VDC		
500	50VDC	631	630VDC	302	3000VDC		

Table 6 Packaging Type

Code	Description	Code	Description
E	Tape and 7" Reel, Embossed Tape	P	Tape and 7" Reel, Paper Tape
B	Bulk	T	Tray package
L	Tape and 13" Reel, Embossed Tape	G	Tape and 13" Reel, Paper Tape

Table 7 Thickness Description

Code	Description	Code	Description	Code	Description
A	0.60 ± 0.10 mm	I	1.25 ± 0.20 mm	Q	0.50 + 0.02/-0.05 mm
B	0.8 + 0.15/-0.10 mm	J	1.15 ± 0.15 mm	R	3.10 ± 0.30 mm
C	1.25 ± 0.10 mm	K	0.50 ± 0.20 mm	S	0.80 ± 0.07 mm
D	1.40 ± 0.15 mm	L	0.30 ± 0.03 mm	T	0.85 ± 0.10 mm
E	1.60 ± 0.20 mm	M	0.95 ± 0.10 mm	U	0.50 ± 0.10 mm
F	2.00 ± 0.20 mm	N	0.50 ± 0.05 mm	V	0.20 ± 0.02 mm
G	2.50 ± 0.30 mm	O	3.50 ± 0.20 mm	X	0.80 ± 0.10 mm
H	2.80 ± 0.30 mm	P	1.60 +0.3/-0.10 mm	Z	0.25 ± 0.03 mm

Table 8 Special Control Code

Code	Description	Code	Description
G	RoHS Compliant		