

Messrs.

Date:

APPROVAL SHEET

Product Name : AUTOMOTIVE Multilayer Ceramic Chip Capacitors
Part No. : MG Series
Description : Size 0402 to 1812, NPO(C0G)/X7R/X5R, 6.3Vdc to 250Vdc, RoHS Compliant

PREPARED BY	APPROVED BY

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SPECIFICATION FOR
AUTOMOTIVE MULTILAYER CERAMIC CHIP CAPACITORS

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250Vdc, RoHS Compliant

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1. INTRODUCTION

MLCC consists of a conducting material and electrodes. To manufacture a chip-type SMT and achieve miniaturization, high density and high efficiency, ceramic condensers are used.

PDC's MG series MLCC is made by NP0, X7R & X5R dielectrics and which provides product with high electrical precision, stability and reliability. Besides, MG series MLCC is tighten controlling in quality in line to assure quality performance in automotive applications.

2. FEATURES

- A wide selection of sizes is available (0402 to 1812).
- High capacitance in given case size.
- Capacitor with lead-free termination (pure Tin).
- RoHS Compliant
- HALOGEN compliant

3. APPLICATIONS

- For Navigation & Information equipments.
- For entertainment equipments
- For comfortable equipments.

4. HOW TO ORDER

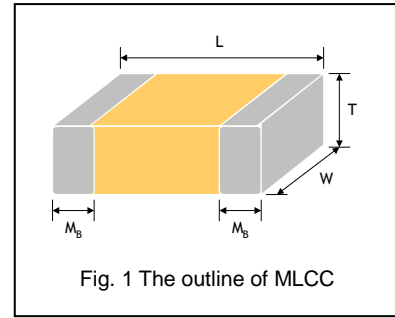
<u>MG</u>	<u>31</u>	<u>X</u>	<u>104</u>	<u>K</u>	<u>500</u>	<u>P</u>	<u>X</u>	<u>G</u>
Series	Size	Dielectric	Capacitance	Tolerance	Rated voltage	Packaging style	Thickness	Control Code
MG= Automotive (without AEC-Q200 qualification)	15=0402 (1005) 18=0603 (1608) 21=0805 (2012) 31=1206 (3216) 32=1210 (3225) 43=1812 (4532)	N=NP0 (C0G) X=X7R B=X5R	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 0R5=0.5pF 1R0=1.0pF 102=10x10 ² =1000pF	B=±0.1pF C=±0.25pF D=±0.5pF F=±1% G=±2% J=±5% K=±10% M=±20%	Two significant digits followed by no. of zeros. And R is in place of decimal point. 6R3=6.3 VDC 100=10 VDC 160=16 VDC 250=25 VDC 500=50 VDC 101=100 VDC 201=200 VDC 251=250 VDC	E=7" reeled , Embossed Tape P=7" reeled , Paper Tape L=13" reeled , Embossed Tape G=13" reeled , Paper Tape	*Reference to table1	G:RoHS compliant

Table 1 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

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Remark	M _B (mm)
0402 (1005)	1.00±0.05	0.50±0.05	0.50±0.05	N #	0.25 +0.05/-0.10
0603 (1608)	1.60±0.10	0.80±0.10	0.80±0.07	S	0.40±0.15
	1.60 +0.15/-0.10	0.80 +0.15/-0.10	0.80 +0.15/-0.10	B	
0805 (2012)	2.00±0.15	1.25±0.10	0.60±0.10	A	0.50±0.20
			0.80±0.10	X	
			1.25±0.10	C #	
	2.00±0.20	1.25±0.20	I #		
1206 (3216)	3.20±0.15	1.60±0.15	0.80±0.10	X	0.60±0.20
			0.95±0.10	M	
			1.15±0.15	J #	
			1.25±0.10	C #	
	3.20±0.20	1.60±0.20	1.60±0.20	E #	
	3.20+0.3/-0.1	1.60+0.3/0.1	1.60+0.30/-0.10	P #	
1210 (3225)	3.20±0.30	2.50±0.20	0.95±0.10	M #	0.75±0.25
			1.25±0.10	C #	
	3.20±0.40	2.50±0.30	1.60±0.20	E #	
			2.00±0.20	F #	
			2.50±0.30	G #	
1812 (4532)	4.50±0.40	3.20±0.30	1.25±0.10	C #	0.75±0.25
			2.00±0.20	F #	



Reflow soldering only is recommended.

6. GENERAL ELECTRICAL DATA

Dielectric	NPO	X7R	X5R
Size	0402, 0603, 0805, 1206, 1210, 1812		
Capacitance range*	0.5pF to 0.033μF	100pF to 4.7μF	0.056μF to 10μF
Capacitance tolerance**	Cap≤5pF: B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF: C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%)	J (±5%), K (±10%), M (±20%)	
Rated voltage (WVDC)	16V, 25V, 50V, 100V	10V, 16V, 25V, 50V, 100V, 200V, 250V	6.3V, 10V, 16V, 25V
Tan δ*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000	Note 1	
Insulation resistance at U _r	≥10GΩ or R _x C≥500Ω·F whichever is less		
Operating temperature	-55 to +125°C		-55 to +85°C
Capacitance characteristic	±30ppm/°C		±15%
Termination	Ni/Sn (lead-free termination)		

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

NPO: 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

Measured at 1.0±0.2Vrms, 1.0kHz±10% for C≤10μF; 0.5±0.2Vrms, 120Hz±20% for C>10μF, 30~70% related humidity, 25°C ambient temperature for X7R, X5R.

** Preconditioning for Class II MLCC: Perform a heat treatment at 150±10°C for 1 hour, then leave in a mbient condition for 24±2 hours before measurement.

Note 1: X7R, X5R

Rated vol.	D.F. ≤	Exception of D.F. ≤
≥50V	≤3%	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%	≤10% 0805 ≥ 2.2μF; 1210 ≥ 10μF
25V	≤5%	0805 ≥ 1μF; 1210 ≥ 10μF
	≤7%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF
	≤10%	0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF
16V	≤5%	0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF
	≤10%	0402 ≥ 0.22μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF
10V	≤10%	0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF
	≤15%	0402 ≥ 1μF
6.3V	≤10%	0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF
	≤20%	0402 ≥ 2.2μF
4V	≤15%	---

7. CAPACITANCE RANGE

7-1 0402, 0603, 0805 Sizes

DIELECTRIC		NP0																		
SIZE		0402					0603					0805								
RATED VOLTAGE		10	16	25	50	100	10	16	25	50	100	10	16	25	50	100	200	250	500	630
Capacitance	0.5pF (0R5)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	0.6pF (0R6)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	0.7pF (0R7)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	0.8pF (0R8)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	0.9pF (0R9)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	1.0pF (1R0)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	1.2pF (1R2)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	1.5pF (1R5)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	1.8pF (1R8)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	2.2pF (2R2)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	2.7pF (2R7)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	3.3pF (3R3)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	3.9pF (3R9)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	4.7pF (4R7)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	5.6pF (5R6)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	6.8pF (6R8)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	8.2pF (8R2)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	10pF (100)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	12pF (120)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	15pF (150)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	18pF (180)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	22pF (220)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	27pF (270)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	33pF (330)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	39pF (390)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	47pF (470)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	56pF (560)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	68pF (680)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	A	A
	82pF (820)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A	X	X
	100pF (101)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	X	X	X
	120pF (121)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	X	C	C
	150pF (151)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	X	C	C	C
	180pF (181)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	X	C	C	C
	220pF (221)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	C	C	C	C
	270pF (271)						S	S	S	S	S	A	A	A	A	A	C	C	C	C
	330pF (331)						S	S	S	S	S	A	A	A	A	A	C	C	C	C
	390pF (391)						S	S	S	S	S	X	X	X	X	X	C	C	C	C
	470pF (471)						S	S	S	S	S	X	X	X	X	X	C	C		
	560pF (561)						S	S	S	S	S	X	X	X	X	X	C	C		
	680pF (681)						S	S	S	S	S	X	X	X	X	X	C	C		
	820pF (821)						S	S	S	S	S	X	X	X	X	X	C	C		
	1,000pF (102)						S	S	S	S	S	X	X	X	X	X	C	C		
1,200pF (122)											X	X	X	X	X	C	C			
1,500pF (152)											X	X	X	X	X	C	C			
1,800pF (182)											X	X	X	X	X	C	C			
2,200pF (222)											X	X	X	X	X	C	C			
2,700pF (272)											C	C	C	C	C					
3,300pF (332)											C	C	C	C						
3,900pF (392)											C	C	C	C						
4,700pF (472)											C	C	C	C						
5,600pF (562)											C	C	C	C						
6,800pF (682)											C	C	C	C						
8,200pF (822)											C	C	C	C						
0.010uF (103)											C	C	C	C						
0.012uF (123)																				

1. For more information about products with special capacitance or other data, please contact PDC local representative.

7-2 1206, 1210, 1812 Sizes (Continued)

DIELECTRIC	NPO													
	1206					1210					1812			
	10	16	25	50	100	10	16	25	50	100	16	50	100	
SIZE														
RATED VOLTAGE														
Capacitance	1.0pF (1R0)													
	1.2pF (1R2)													
	1.5pF (1R5)	X	X	X	X	X								
	1.8pF (1R8)	X	X	X	X	X								
	2.2pF (2R2)	X	X	X	X	X								
	2.7pF (2R7)	X	X	X	X	X								
	3.3pF (3R3)	X	X	X	X	X								
	3.9pF (3R9)	X	X	X	X	X								
	4.7pF (4R7)	X	X	X	X	X								
	5.6pF (5R6)	X	X	X	X	X								
	6.8pF (6R8)	X	X	X	X	X								
	8.2pF (8R2)	X	X	X	X	X								
	10pF (100)	X	X	X	X	X					M	C	C	C
	12pF (120)	X	X	X	X	X					M	C	C	C
	15pF (150)	X	X	X	X	X					M	C	C	C
	18pF (180)	X	X	X	X	X					M	C	C	C
	22pF (220)	X	X	X	X	X	M	M	M	M	M	C	C	C
	27pF (270)	X	X	X	X	X	M	M	M	M	M	C	C	C
	33pF (330)	X	X	X	X	X	M	M	M	M	M	C	C	C
	39pF (390)	X	X	X	X	X	M	M	M	M	M	C	C	C
	47pF (470)	X	X	X	X	X	M	M	M	M	M	C	C	C
	56pF (560)	X	X	X	X	X	M	M	M	M	M	C	C	C
	68pF (680)	X	X	X	X	X	M	M	M	M	M	C	C	C
	82pF (820)	X	X	X	X	X	M	M	M	M	M	C	C	C
	100pF (101)	X	X	X	X	X	M	M	M	M	M	C	C	C
	120pF (121)	X	X	X	X	X	M	M	M	M	M	C	C	C
	150pF (151)	X	X	X	X	X	M	M	M	M	M	C	C	C
	180pF (181)	X	X	X	X	X	M	M	M	M	M	C	C	C
	220pF (221)	X	X	X	X	X	M	M	M	M	M	C	C	C
	270pF (271)	X	X	X	X	X	M	M	M	M	M	C	C	C
	330pF (331)	X	X	X	X	X	M	M	M	M	M	C	C	C
	390pF (391)	X	X	X	X	X	M	M	M	M	M	C	C	C
	470pF (471)	X	X	X	X	X	M	M	M	M	M	C	C	C
	560pF (561)	X	X	X	X	X	M	M	M	M	M	C	C	C
	680pF (681)	X	X	X	X	X	M	M	M	M	M	C	C	C
	820pF (821)	X	X	X	X	X	M	M	M	M	M	C	C	C
	1,000pF (102)	X	X	X	X	X	M	M	M	M	M	C	C	C
	1,200pF (122)	X	X	X	X	X	M	M	M	M	M	C	C	C
	1,500pF (152)	X	X	X	X	X	M	M	M	M	M	C	C	C
	1,800pF (182)	X	X	X	X	X	M	M	M	M	M	C	C	C
2,200pF (222)	X	X	X	X	X	M	M	M	M	M	C	C	C	
2,700pF (272)	X	X	X	X	X	M	M	M	M	M	C	C	C	
3,300pF (332)	X	X	X	X	X	M	M	M	M	M	C	C	C	
3,900pF (392)	X	X	X	X	X	M	M	M	M	M	C	C	C	
4,700pF (472)	X	X	X	X	X	M	M	M	M	M	C	C	C	
5,600pF (562)	X	X	X	X	X	M	M	M	M	M	C	C	C	
6,800pF (682)	M	M	M	M		M	M	M	M	M	C	C	C	
8,200pF (822)	C	C	C	C		M	M	M	M	M	C	C	C	
0.010μF (103)	C	C	C	C		M	M	M	M	M	C	C	C	
0.012μF (123)						M	M	C	C	C	C	C	C	
0.015μF (153)						M	M	C	C	C	C	C	C	
0.018μF (183)											C	C	C	
0.022μF (223)											C	C	C	
0.027μF (273)											C	C	C	
0.033μF (333)											C	C	C	
0.039μF (393)														

1. For more information about products with special capacitance or other data, please contact PDC local representative.

8. CAPACITANCE RANGE (X7R Dielectric)

8-1 X7R Dielectric 0402, 0603, 0805 Sizes

DIELECTRIC	X7R															
	SIZE	0402				0603					0805					
RATED VOLTAGE (VDC)	10	16	25	50	10	16	25	50	100	10	16	25	50	100	200	250
100pF (101)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
120pF (121)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
150pF (151)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
180pF (181)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
220pF (221)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
270pF (271)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
330pF (331)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
390pF (391)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
470pF (471)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
560pF (561)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
680pF (681)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
820pF (821)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
1,000pF (102)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
1,200pF (122)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
1,500pF (152)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
1,800pF (182)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
2,200pF (222)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
2,700pF (272)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
3,300pF (332)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
3,900pF (392)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
4,700pF (472)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X
5,600pF (562)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	C	C
6,800pF (682)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	C	C
8,200pF (822)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	C	C
0.010μF (103)	N	N	N	N	S	S	S	S	S	X	X	X	X	X	C	C
0.012μF (123)	N	N	N		S	S	S	S		X	X	X	X	X	C	C
0.015μF (153)	N	N	N		S	S	S	S		X	X	X	X	X	C	C
0.018μF (183)	N	N	N		S	S	S	S		X	X	X	X	X	C	C
0.022μF (223)	N	N	N		S	S	S	S		X	X	X	X	X	C	C
0.027μF (273)	N	N	N		S	S	S	S		X	X	X	X	C		
0.033μF (333)	N	N	N		S	S	S	B		X	X	X	X	C		
0.039μF (393)	N	N	N		S	S	S	B		X	X	X	X	C		
0.047μF (473)	N	N	N		S	S	S	B		X	X	X	X	C		
0.056μF (563)	N	N			S	S	S	B		X	X	X	X	C		
0.068μF (683)	N	N			S	S	S	B		X	X	X	X	C		
0.082μF (823)	N	N			S	S	S	B		X	X	X	X	C		
0.10μF (104)	N	N	N		S	S	S	B		X	X	X	X	C		
0.12μF (124)					S	S	B			C	C	C	C			
0.15μF (154)					S	S	B			C	C	C	C			
0.18μF (184)					S	S	B			C	C	C	C			
0.22μF (224)					S	S	B	B		C	C	C	C			
0.27μF (274)					B	B				C	C	C				
0.33μF (334)					B	B				C	C	C				
0.39μF (394)					B	B				C	C	C				
0.47μF (474)					B	B				C	C	C				
0.56μF (564)										C	C	C				
0.68μF (684)										C	C	C				
0.82μF (824)										C	C	C				
1.00μF (105)										C	C	C	I			
1.50μF (155)																
2.20μF (225)																
3.30μF (335)																
4.70μF (475)										I	I	I				

1. For more information about products with special capacitance or other data, please contact PDC local representative.

8-2 1206, 1210, 1812 Sizes(Continued)

DIELECTRIC	X7R																				
	1206							1210							1812						
	10	16	25	50	100	200	250	10	16	25	50	100	200	250	10	16	25	50	100	200	250
100pF (101)																					
120pF (121)																					
150pF (151)	X	X	X	X	X	X	X														
180pF (181)	X	X	X	X	X	X	X														
220pF (221)	X	X	X	X	X	X	X														
270pF (271)	X	X	X	X	X	X	X														
330pF (331)	X	X	X	X	X	X	X														
390pF (391)	X	X	X	X	X	X	X														
470pF (471)	X	X	X	X	X	X	X														
560pF (561)	X	X	X	X	X	X	X														
680pF (681)	X	X	X	X	X	X	X														
820pF (821)	X	X	X	X	X	X	X														
1,000pF (102)	X	X	X	X	X	X	X	M	M	M	M	M	M	M	C	C	C	C	C	C	C
1,200pF (122)	X	X	X	X	X	X	X	M	M	M	M	M	M	M	C	C	C	C	C	C	C
1,500pF (152)	X	X	X	X	X	X	X	M	M	M	M	M	M	M	C	C	C	C	C	C	C
1,800pF (182)	X	X	X	X	X	X	X	M	M	M	M	M	M	M	C	C	C	C	C	C	C
2,200pF (222)	X	X	X	X	X	X	X	M	M	M	M	M	M	M	C	C	C	C	C	C	C
2,700pF (272)	X	X	X	X	X	X	X	M	M	M	M	M	M	M	C	C	C	C	C	C	C
3,300pF (332)	X	X	X	X	X	X	X	M	M	M	M	M	M	M	C	C	C	C	C	C	C
3,900pF (392)	X	X	X	X	X	X	X	M	M	M	M	M	M	M	C	C	C	C	C	C	C
4,700pF (472)	X	X	X	X	X	X	X	M	M	M	M	M	M	M	C	C	C	C	C	C	C
5,600pF (562)	X	X	X	X	X	X	X	M	M	M	M	M	M	M	C	C	C	C	C	C	C
6,800pF (682)	X	X	X	X	X	X	X	M	M	M	M	M	M	M	C	C	C	C	C	C	C
8,200pF (822)	X	X	X	X	X	X	X	M	M	M	M	M	M	M	C	C	C	C	C	C	C
0.010μF (103)	X	X	X	X	X	X	X	M	M	M	M	M	M	M	C	C	C	C	C	C	C
0.012μF (123)	X	X	X	X	X	X	X	M	M	M	M	M	M	M	C	C	C	C	C	C	C
0.015μF (153)	X	X	X	X	X	M	M	M	M	M	M	M	M	M	C	C	C	C	C	C	C
0.018μF (183)	X	X	X	X	X	M	M	M	M	M	M	M	M	M	C	C	C	C	C	C	C
0.022μF (223)	X	X	X	X	X	M	M	M	M	M	M	M	M	M	C	C	C	C	C	C	C
0.027μF (273)	X	X	X	X	X	M	M	M	M	M	M	M	M	M	C	C	C	C	C	C	C
0.033μF (333)	X	X	X	X	X	E	E	M	M	M	M	M	M	M	C	C	C	C	C	C	C
0.039μF (393)	X	X	X	X	X	E	E	M	M	M	M	M	M	M	C	C	C	C	C	C	C
0.047μF (473)	X	X	X	X	X	E	E	M	M	M	M	M	C	C	C	C	C	C	C	C	C
0.056μF (563)	X	X	X	X	X	E	E	M	M	M	M	M	C	C	C	C	C	C	C	C	C
0.068μF (683)	X	X	X	X	X	E	E	M	M	M	M	M	E	E	C	C	C	C	C	C	C
0.082μF (823)	X	X	X	X	C	E	E	M	M	M	M	M	E	E	C	C	C	C	C	C	C
0.10μF (104)	X	X	X	X	C	E	E	M	M	M	M	M	E	E	C	C	C	C	C	C	C
0.12μF (124)	X	X	X	X	C			M	M	M	M	M	E	E	C	C	C	C	C	C	C
0.15μF (154)	M	M	M	M	E			M	M	M	M	C	G	G	C	C	C	C	C	F	F
0.18μF (184)	M	M	M	M	E			M	M	M	M	C	G	G	C	C	C	C	C	F	F
0.22μF (224)	M	M	M	M	E			M	M	M	M	C	G	G	C	C	C	C	C	F	F
0.27μF (274)	M	M	M	C				M	M	M	M	E	G	G	C	C	C	C	C	F	F
0.33μF (334)	M	M	M	C				M	M	M	C	E	G	G	C	C	C	C	C	F	F
0.39μF (394)	M	M	J	P				M	M	M	C	G	G	G	C	C	C	C	C	F	F
0.47μF (474)	J	J	J	P				M	M	M	C	G	G	G	C	C	C	C	F	F	F
0.56μF (564)	J	J	J	P				C	C	C	C	G			C	C	C	C	F		
0.68μF (684)	J	J	J	P				C	C	C	C	F			C	C	C	F	F		
0.82μF (824)	J	J	J	P				C	C	C	C	F			C	C	C	F	F		
1.00μF (105)	J	J	J	P				C	C	C	C	F			C	C	C	F	F		
1.50μF (155)	J	J	P					F	F	E									F		
2.20μF (225)	J	J	P	P				F	F	E									G		
3.30μF (335)																					
4.70μF (475)				P							G										
6.80μF (685)																					
10.0μF (106)		P	P								G										
22.0μF (226)	P							G	G	G											
47.0μF (476)	P							G													

1. For more information about products with special capacitance or other data, please contact PDC local representative.

9. CAPACITANCE RANGE (X5R Dielectric)

DIELECTRIC		X5R																	
SIZE		0402				0603				0805				1206				1210	
RATED VOLTAGE(VDC)		6.3	10	16	25	6.3	10	16	25	6.3	10	16	25	6.3	10	16	25	10	16
Capacitance	0.027μF (273)																		
	0.033μF (333)																		
	0.039μF (393)																		
	0.047μF (473)																		
	0.056μF (563)		N																
	0.068μF (683)		N																
	0.082μF (823)		N																
	0.10μF (104)		N	N															
	0.15μF (154)		N	N															
	0.22μF (224)	N	N	N					B										
	0.27μF (274)	N	N				B	B	B										
	0.33μF (334)	N	N				B	B	B										
	0.39μF (394)	N					B	B	B										
	0.47μF (474)	N					B	B	B										
	0.68μF (684)	N					B	B	B										
	0.82μF (824)	N				B	B	B	B										
	1.0μF (105)					B	B	B	B										
	1.5μF (155)									I	I				J	J	P	F	F
	2.2μF (225)									I	I	I	I		J	J	P	F	F
	3.3μF (335)											I	I	P	P	P	P	F	F
4.7μF (475)											I	I	P	P	P	P	F	F	
6.8μF (685)													P	P					
10μF (106)													P	P					
22μF (226)																			

1. For more information about products with special capacitance or other data, please contact PDC local representative.



10. PACKAGING STYLE AND QUANTITY

Size	Thickness (mm)/Symbol		Paper tape		Plastic tape	
			7" reel	13" reel	7" reel	13" reel
0402 (1005)	0.50±0.05	N	10k	50k	-	-
0603 (1608)	0.80±0.07	S	4k	15k	-	-
	0.80+0.15/-0.10	B	4k	15k	-	-
0805 (2012)	0.60±0.10	A	4k	15k	-	-
	0.80±0.10	X	4k	15k	-	-
	1.25±0.10	C	-	-	3k	10k
	1.25±0.20	I	-	-	3k	10k
1206 (3216)	0.80±0.10	X	4k	15k	-	-
	0.95±0.10	M	-	-	3k	10k
	1.15±0.15	J	-	-	3k	10k
	1.25±0.10	C	-	-	3k	10k
	1.60±0.20	E	-	-	2k	10k
	1.60+0.30/-0.10	P	-	-	2k	9k
1210 (3225)	0.95±0.10	M	-	-	3k	10k
	1.25±0.10	C	-	-	3k	10k
	1.60±0.20	E	-	-	2k	-
	2.00±0.20	F	-	-	1k	6k
	2.50±0.30	G	-	-	1k	6k
1812 (4532)	1.25±0.10	C	-	-	1k	5k
	2.00±0.20	F	-	-	1k	-

Unit: pieces

11. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements																																												
1.	Visual and Mechanical	---	<ul style="list-style-type: none"> * No remarkable defect. * Dimensions to conform to individual specification sheet. 																																												
2.	Capacitance	Class I:NP0	Shall not exceed the limits given in the detailed spec.																																												
3.	Q/ D.F. (Dissipation Factor)	Cap \leq 1000pF 1.0 \pm 0.2Vrms, 1MHz \pm 10% Cap $>$ 1000pF 1.0 \pm 0.2Vrms, 1KHz \pm 10% Class II:X7R, X5R, Cap \leq 10 μ F, 1.0 \pm 0.2Vrms, 1kHz \pm 10% Cap $>$ 10 μ F, 0.5 \pm 0.2Vrms, 120Hz \pm 20%	NP0: Cap \geq 30pF, Q \geq 1000; Cap $<$ 30pF,Q \geq 400+20C X7R, X5R: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. \leq</th> <th colspan="2">Exception of D.F. \leq</th> </tr> </thead> <tbody> <tr> <td rowspan="3">\geq 50V</td> <td rowspan="3">\leq 2.5%</td> <td>\leq 3%</td> <td>0603 \geq 0.047μF; 0805 \geq 0.18μF; 1206 \geq 0.47μF</td> </tr> <tr> <td>\leq 5%</td> <td>1210 \geq 4.7μF</td> </tr> <tr> <td>\leq 10%</td> <td>0603 \geq 1μF; 0805 \geq 1μF; 1206 \geq 4.7μF; 1210 \geq 10μF</td> </tr> <tr> <td>35V</td> <td>\leq 3.5%</td> <td>\leq 10%</td> <td>0805 \geq 2.2μF; 1210 \geq 10μF</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">\leq 3.5%</td> <td>\leq 5%</td> <td>0805 \geq 1μF; 1210 \geq 10μF</td> </tr> <tr> <td>\leq 7%</td> <td>0603 \geq 0.33μF; 1206 \geq 4.7μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">\leq 3.5%</td> <td>\leq 5%</td> <td>0402 \geq 0.10μF; 0603 \geq 0.47μF; 0805 \geq 2.2μF; 1206 \geq 6.8μF ; 1210 \geq 22μF</td> </tr> <tr> <td>\leq 10%</td> <td>0402 \geq 0.033μF; 0603 \geq 0.15μF; 0805 \geq 0.68MF; 1206 \geq 2.2μF; 1210 \geq 4.7μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">\leq 5%</td> <td>\leq 10%</td> <td>0402 \geq 0.22μF; 0603 \geq 0.68μF; 0805 \geq 2.2μF; 1206 \geq 4.7μF; 1210 \geq 22μF</td> </tr> <tr> <td>\leq 15%</td> <td>0402 \geq 0.33μF; 0603 \geq 0.33μF; 0805 \geq 2.2μF; 1206 \geq 2.2μF; 1210 \geq 22μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">\leq 10%</td> <td>\leq 15%</td> <td>0402 \geq 1μF; 0603 \geq 10μF; 0805 \geq 4.7μF; 1206 \geq 47μF ; 1210 \geq 100μF</td> </tr> <tr> <td>\leq 20%</td> <td>0402 \geq 2.2μF</td> </tr> <tr> <td>4V</td> <td>\leq 15%</td> <td>---</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	D.F. \leq	Exception of D.F. \leq		\geq 50V	\leq 2.5%	\leq 3%	0603 \geq 0.047 μ F; 0805 \geq 0.18 μ F; 1206 \geq 0.47 μ F	\leq 5%	1210 \geq 4.7 μ F	\leq 10%	0603 \geq 1 μ F; 0805 \geq 1 μ F; 1206 \geq 4.7 μ F; 1210 \geq 10 μ F	35V	\leq 3.5%	\leq 10%	0805 \geq 2.2 μ F; 1210 \geq 10 μ F	25V	\leq 3.5%	\leq 5%	0805 \geq 1 μ F; 1210 \geq 10 μ F	\leq 7%	0603 \geq 0.33 μ F; 1206 \geq 4.7 μ F	16V	\leq 3.5%	\leq 5%	0402 \geq 0.10 μ F; 0603 \geq 0.47 μ F; 0805 \geq 2.2 μ F; 1206 \geq 6.8 μ F ; 1210 \geq 22 μ F	\leq 10%	0402 \geq 0.033 μ F; 0603 \geq 0.15 μ F; 0805 \geq 0.68MF; 1206 \geq 2.2 μ F; 1210 \geq 4.7 μ F	10V	\leq 5%	\leq 10%	0402 \geq 0.22 μ F; 0603 \geq 0.68 μ F; 0805 \geq 2.2 μ F; 1206 \geq 4.7 μ F; 1210 \geq 22 μ F	\leq 15%	0402 \geq 0.33 μ F; 0603 \geq 0.33 μ F; 0805 \geq 2.2 μ F; 1206 \geq 2.2 μ F; 1210 \geq 22 μ F	6.3V	\leq 10%	\leq 15%	0402 \geq 1 μ F; 0603 \geq 10 μ F; 0805 \geq 4.7 μ F; 1206 \geq 47 μ F ; 1210 \geq 100 μ F	\leq 20%	0402 \geq 2.2 μ F	4V	\leq 15%	---	---
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		\leq 20%	0402 \geq 2.2 μ F																																												
4V	\leq 15%	---	---																																												
4.	Dielectric Strength	<ul style="list-style-type: none"> * To apply voltage (\leq100V) 250%. * Duration: 1 to 5 sec. * Charge and discharge current less than 50mA. 	No evidence of damage or flash over during test.																																												
5.	Insulation Resistance	To apply rated voltage for max. 120 sec.	10G Ω or RxC \geq 500 Ω -F whichever is smaller. Class II (X7R, X5R) <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="4">10GΩ or RxC \geq 100 Ω-F whichever is smaller.</td> </tr> <tr> <td>16V: 0402 \geq 0.22μF</td> </tr> <tr> <td>10V: 0402 \geq 0.47μF; 0603 \geq 0.47μF; 0805 \geq 2.2μF; 1206 \geq 4.7μF; 1210 \geq 47μF</td> </tr> <tr> <td>6.3V</td> </tr> </tbody> </table>	Rated voltage	Insulation Resistance	100V: X7R	10G Ω or RxC \geq 100 Ω -F whichever is smaller.	16V: 0402 \geq 0.22 μ F	10V: 0402 \geq 0.47 μ F; 0603 \geq 0.47 μ F; 0805 \geq 2.2 μ F; 1206 \geq 4.7 μ F; 1210 \geq 47 μ F	6.3V																																					
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6.	Temperature Coefficient	With no electrical load. <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> </thead> <tbody> <tr> <td>NP0</td> <td>-55~125$^{\circ}$C at 25$^{\circ}$C</td> </tr> <tr> <td>X7R</td> <td>-55~125$^{\circ}$C at 25$^{\circ}$C</td> </tr> <tr> <td>X5R</td> <td>-55~ 85$^{\circ}$C at 25$^{\circ}$C</td> </tr> </tbody> </table>	T.C.	Operating Temp	NP0	-55~125 $^{\circ}$ C at 25 $^{\circ}$ C	X7R	-55~125 $^{\circ}$ C at 25 $^{\circ}$ C	X5R	-55~ 85 $^{\circ}$ C at 25 $^{\circ}$ C	<table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>NP0</td> <td>Within \pm30ppm/$^{\circ}$C</td> </tr> <tr> <td>X7R</td> <td>Within \pm15%</td> </tr> <tr> <td>X5R</td> <td>Within \pm15%</td> </tr> </tbody> </table>	T.C.	Capacitance Change	NP0	Within \pm 30ppm/ $^{\circ}$ C	X7R	Within \pm 15%	X5R	Within \pm 15%																												
T.C.	Operating Temp																																														
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X7R	Within \pm 15%																																														
X5R	Within \pm 15%																																														

11. RELIABILITY TEST CONDITIONS AND REQUIREMENTS(Cont.)

No.	Item	Test Condition	Requirements															
7.	Adhesive Strength of Termination	<ul style="list-style-type: none"> * Pressurizing force : 5N (≤ 0603) and 10N (> 0603) * Test time: 10\pm1 sec. 	<ul style="list-style-type: none"> * No remarkable damage or removal of the terminations. 															
8.	Vibration Resistance	<ul style="list-style-type: none"> * Vibration frequency: 10~55 Hz/min. * Total amplitude: 1.5mm * Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.) * Measurement to be made after keeping at room temp. for 24\pm2 hrs. 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change and Q/D.F.: To meet initial spec. 															
9.	Solderability	<ul style="list-style-type: none"> * Solder temperature: 235\pm5$^{\circ}$C * Dipping time: 2\pm0.5 sec. 	95% min. coverage of all metalized area.															
10.	Bending Test	<ul style="list-style-type: none"> * The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5\pm1 sec. * Measurement to be made after keeping at room temp. for 24\pm2 hrs. 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change : NP0: within $\pm 5\%$ or 0.5pF whichever is larger X7R, X5R: within $\pm 12.5\%$ (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.) 															
11.	Resistance to Soldering Heat	<ul style="list-style-type: none"> * Solder temperature: 260\pm5$^{\circ}$C * Dipping time: 10\pm1 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 24\pm2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24\pm2 hrs. 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: NP0: within $\pm 2.5\%$ or 0.25pF whichever is larger X7R, X5R: within $\pm 7.5\%$ * Q/D.F., I.R. and dielectric strength: To meet initial requirements. * 25% max. leaching on each edge. 															
12.	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\pm3</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\pm3</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 24\pm2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24\pm2 hrs. 	Step	Temp. ($^{\circ}$ C)	Time (min.)	1	Min. operating temp. +0/-3	30 \pm 3	2	Room temp.	2~3	3	Max. operating temp. +3/-0	30 \pm 3	4	Room temp.	2~3	<ul style="list-style-type: none"> * No remarkable damage. * Cap change : NP0: within $\pm 2.5\%$ or 0.25pF whichever is larger X7R, X5R: within $\pm 7.5\%$ * Q/D.F., I.R. and dielectric strength: To meet initial requirements.
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11. RELIABILITY TEST CONDITIONS AND REQUIREMENTS(Cont.)

No	Item	Test Condition	Requirements																																									
14	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. * Before initial measurement (Class II only): To apply test voltage for 1hr at 40°C and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs. 	<p>* No remarkable damage.</p> <p>Cap change: NP0: ±7.5% or 0.75pF whichever is larger. X7R, X5R: ≥10V**, within ±12.5%; 6.3V within ±25%; C ≥ 1uF, within ±25% **10V:0603 ≥ 4.7µF; 0402 ≥ 1µF; 0201 ≥ 0.1µF, within ±25%;</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>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 50V</td> <td rowspan="3">≤ 3%</td> <td>≤ 6% 0603 ≥ 0.047µF; 0805 ≥ 0.18µF; 1206 ≥ 0.47µF</td> </tr> <tr> <td>≤ 10% 1210 ≥ 4.7µF</td> </tr> <tr> <td>≤ 20% 0603 ≥ 1µF; 0805 ≥ 1µF; 1206 ≥ 4.7µF; 1210 ≥ 10µF</td> </tr> <tr> <td rowspan="2">35V</td> <td rowspan="2">≤ 5%</td> <td>≤ 20% 0805 ≥ 2.2µF; 1210 ≥ 10µF</td> </tr> <tr> <td>≤ 10% 0805 ≥ 1µF; 1210 ≥ 10µF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 5%</td> <td>≤ 14% 0603 ≥ 0.33µF; 1206 ≥ 4.7µF</td> </tr> <tr> <td>≤ 15% 0402 ≥ 0.10µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 6.8µF; 1210 ≥ 22µF</td> </tr> <tr> <td>≤ 10% 0603 ≥ 0.15µF; 0805 ≥ 0.68µF; 1206 ≥ 2.2µF; 1210 ≥ 4.7µF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤ 5%</td> <td>≤ 15% 0201 ≥ 0.012µF; 0402 ≥ 0.033µF; 0603 ≥ 0.68µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF</td> </tr> <tr> <td>≤ 15% 0402 ≥ 0.33µF; 0603 ≥ 0.33µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 22µF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤ 7.5%</td> <td>≤ 20% 0402 ≥ 1µF</td> </tr> <tr> <td>≤ 30% 0402 ≥ 1µF; 0603 ≥ 10µF; 0805 ≥ 4.7µF; 1206 ≥ 47µF; 1210 ≥ 100µF</td> </tr> <tr> <td>6.3V</td> <td>≤ 15%</td> <td>---</td> </tr> <tr> <td>4V</td> <td>≤ 20%</td> <td>---</td> </tr> </tbody> </table> <p>*I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller. Class II (X7R, X5R)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="7">500MΩ or RxC ≥ 5 Ω-F whichever is smaller.</td> </tr> <tr> <td>50V: 0603 ≥ 1µF; 0805 ≥ 1µF; 1206 ≥ 4.7µF; 1210 ≥ 4.7µF</td> </tr> <tr> <td>35V: 0805 ≥ 2.2µF; 1210 ≥ 10µF</td> </tr> <tr> <td>25V: 0402 ≥ 1µF; 0603 ≥ 2.2µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 10µF</td> </tr> <tr> <td>16V: 0402 ≥ 0.22µF; 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 47µF</td> </tr> <tr> <td>10V: 0402 ≥ 0.47µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 47µF</td> </tr> <tr> <td>6.3V ; 4V</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥ 50V	≤ 3%	≤ 6% 0603 ≥ 0.047µF; 0805 ≥ 0.18µF; 1206 ≥ 0.47µF	≤ 10% 1210 ≥ 4.7µF	≤ 20% 0603 ≥ 1µF; 0805 ≥ 1µF; 1206 ≥ 4.7µF; 1210 ≥ 10µF	35V	≤ 5%	≤ 20% 0805 ≥ 2.2µF; 1210 ≥ 10µF	≤ 10% 0805 ≥ 1µF; 1210 ≥ 10µF	25V	≤ 5%	≤ 14% 0603 ≥ 0.33µF; 1206 ≥ 4.7µF	≤ 15% 0402 ≥ 0.10µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 6.8µF; 1210 ≥ 22µF	≤ 10% 0603 ≥ 0.15µF; 0805 ≥ 0.68µF; 1206 ≥ 2.2µF; 1210 ≥ 4.7µF	16V	≤ 5%	≤ 15% 0201 ≥ 0.012µF; 0402 ≥ 0.033µF; 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	10V	≤ 7.5%	≤ 20% 0402 ≥ 1µF	≤ 30% 0402 ≥ 1µF; 0603 ≥ 10µF; 0805 ≥ 4.7µF; 1206 ≥ 47µF; 1210 ≥ 100µF	6.3V	≤ 15%	---	4V	≤ 20%	---	Rated voltage	Insulation Resistance	100V: X7R	500MΩ or RxC ≥ 5 Ω-F whichever is smaller.	50V: 0603 ≥ 1µF; 0805 ≥ 1µF; 1206 ≥ 4.7µF; 1210 ≥ 4.7µF	35V: 0805 ≥ 2.2µF; 1210 ≥ 10µF	25V: 0402 ≥ 1µF; 0603 ≥ 2.2µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 10µF	16V: 0402 ≥ 0.22µF; 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 47µF	10V: 0402 ≥ 0.47µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 47µF	6.3V ; 4V
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11. RELIABILITY TEST CONDITIONS AND REQUIREMENTS(Cont.)

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15.	High Temperature Load (Endurance)	Test temp. : NP0, X7R: 125±3°C X5R: 85±3°C Test time: 1000+24/-0 hrs. To apply voltage: (1) 6.3V or C ≥ 10µF: 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. <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance range</th> </tr> </thead> <tbody> <tr> <td>0402</td> <td>X5R/X7R</td> <td>6.3V, 10V</td> <td>C ≥ 1.0µF</td> </tr> <tr> <td>0603</td> <td>X5R/X7R</td> <td>6.3V, 10V</td> <td>C ≥ 4.7µF</td> </tr> <tr> <td>0805</td> <td>X5R/X7R</td> <td>6.3V</td> <td>C ≥ 22µF</td> </tr> <tr> <td rowspan="2">1206</td> <td>X5R/X7R</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> (6) 150% of rated voltage for below range. <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance range</th> </tr> </thead> <tbody> <tr> <td>0402</td> <td>X5R/X7R</td> <td>10V, 16V, 25V</td> <td>C ≥ 0.22µF</td> </tr> <tr> <td>0603</td> <td>X5R/X7R</td> <td>10V, 16V</td> <td>C ≥ 1.0µF</td> </tr> <tr> <td>0805</td> <td>X5R/X7R</td> <td>10V</td> <td>C ≥ 4.7µF</td> </tr> </tbody> </table>	Size	Dielectric	Rated voltage	Capacitance range	0402	X5R/X7R	6.3V, 10V	C ≥ 1.0µF	0603	X5R/X7R	6.3V, 10V	C ≥ 4.7µF	0805	X5R/X7R	6.3V	C ≥ 22µF	1206	X5R/X7R	6.3V	C ≥ 47µF	NP0	3000V	C ≥ 1.5pF	Size	Dielectric	Rated voltage	Capacitance range	0402	X5R/X7R	10V, 16V, 25V	C ≥ 0.22µF	0603	X5R/X7R	10V, 16V	C ≥ 1.0µF	0805	X5R/X7R	10V	C ≥ 4.7µF	* 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%; C ≥ 1µF, within ±25% **10V: 0603 ≥ 4.7µF; 0402 ≥ 1µF; 0201 ≥ 0.1µF, within ±25%; 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>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 50V</td> <td rowspan="3">≤ 3%</td> <td>≤ 6% 0603 ≥ 0.047µF; 0805 ≥ 0.18µF; 1206 ≥ 0.47µF</td> </tr> <tr> <td>≤ 10% 1210 ≥ 4.7µF</td> </tr> <tr> <td>≤ 20% 0603 ≥ 1µF; 0805 ≥ 1µF; 1206 ≥ 4.7µF; 1210 ≥ 10µF</td> </tr> <tr> <td>35V</td> <td>≤ 5%</td> <td>≤ 20% 0805 ≥ 2.2µF; 1210 ≥ 10µF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 5%</td> <td>≤ 10% 0805 ≥ 1µF; 1210 ≥ 10µF</td> </tr> <tr> <td>≤ 14% 0603 ≥ 0.33µF; 1206 ≥ 4.7µF</td> </tr> <tr> <td>≤ 15% 0402 ≥ 0.10µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 6.8µF; 1210 ≥ 22µF</td> </tr> <tr> <td>16V</td> <td>≤ 5%</td> <td>≤ 10% 0603 ≥ 0.15µF; 0805 ≥ 0.68µF; 1206 ≥ 2.2µF; 1210 ≥ 4.7µF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤ 7.5%</td> <td>≤ 15% 0402 ≥ 0.33µF; 0603 ≥ 0.33µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 22µF</td> </tr> <tr> <td>≤ 20% 0402 ≥ 1µF</td> </tr> <tr> <td>6.3V</td> <td>≤ 15%</td> <td>≤ 30% 0402 ≥ 1µF; 0603 ≥ 10µF; 0805 ≥ 4.7µF; 1206 ≥ 47µF; 1210 ≥ 100µF</td> </tr> <tr> <td>4V</td> <td>≤ 20%</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥ 50V	≤ 3%	≤ 6% 0603 ≥ 0.047µF; 0805 ≥ 0.18µF; 1206 ≥ 0.47µF	≤ 10% 1210 ≥ 4.7µF	≤ 20% 0603 ≥ 1µF; 0805 ≥ 1µF; 1206 ≥ 4.7µF; 1210 ≥ 10µF	35V	≤ 5%	≤ 20% 0805 ≥ 2.2µF; 1210 ≥ 10µF	25V	≤ 5%	≤ 10% 0805 ≥ 1µF; 1210 ≥ 10µF	≤ 14% 0603 ≥ 0.33µF; 1206 ≥ 4.7µF	≤ 15% 0402 ≥ 0.10µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 6.8µF; 1210 ≥ 22µF	16V	≤ 5%	≤ 10% 0603 ≥ 0.15µF; 0805 ≥ 0.68µF; 1206 ≥ 2.2µF; 1210 ≥ 4.7µF	10V	≤ 7.5%	≤ 15% 0402 ≥ 0.33µF; 0603 ≥ 0.33µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 22µF	≤ 20% 0402 ≥ 1µF	6.3V	≤ 15%	≤ 30% 0402 ≥ 1µF; 0603 ≥ 10µF; 0805 ≥ 4.7µF; 1206 ≥ 47µF; 1210 ≥ 100µF	4V	≤ 20%	---
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APPENDICES

■ Tape & reel dimensions

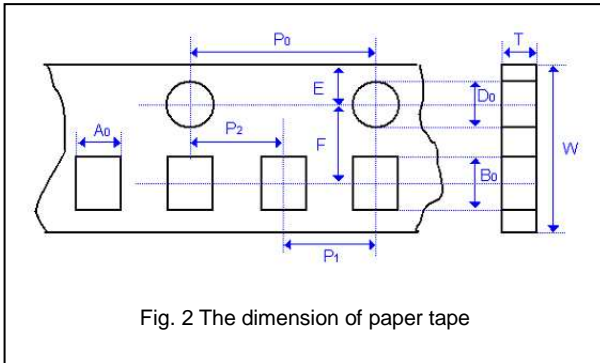


Fig. 2 The dimension of paper tape

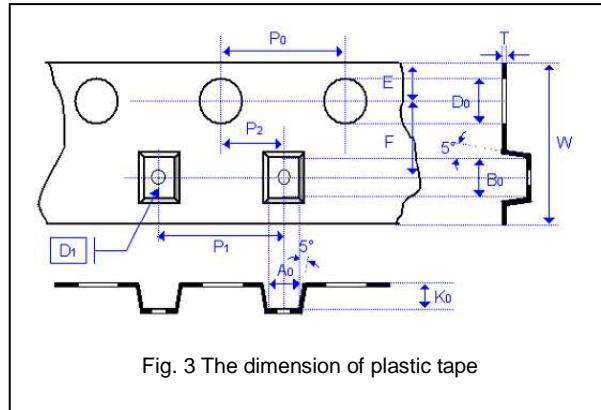


Fig. 3 The dimension of plastic tape

Size	0402	0603	0805			1206			1210		1812
Thickness	N	S, B	A	X	M, C, I	X	M, J, C	E	M, C, E	G	C, F
A ₀	0.62±0.05	1.02±0.05	1.50±0.10	1.50±0.10	<1.57	2.00±0.10	<1.85	<1.95	<2.97	<2.97	<3.81
B ₀	1.12±0.05	1.80±0.05	2.30±0.10	2.30±0.10	<2.40	3.50±0.10	<3.46	<3.67	<3.73	<3.73	<5.30
T	0.60±0.05	0.95±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	0.25±0.05
K ₀	-	-	-	-	<2.50	-	<2.50	<2.50	<2.50	<3.00	<2.50
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	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	4.00±0.10
10xP ₀	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	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	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	2.00±0.05
D ₀	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05
D ₁	-	-	-	-	1.00±0.10	-	1.00±0.10	1.00±0.10	1.00±0.10	1.00±0.10	1.50±0.10
E	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	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	5.50±0.05

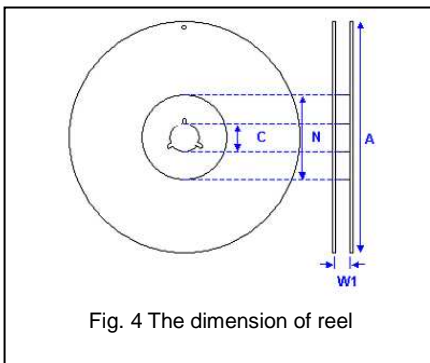


Fig. 4 The dimension of reel

Size	0402, 0603, 0805, 1206, 1210	1812
Reel size	7"	13"
C	13.0+0.5/-0.2	13.0+0.5/-0.2
W ₁	8.4+1.5/-0	8.4+1.5/-0
A	178.0±0.10	330.0±1.0
N	60.0+1.0/-0	100±1.0
		60.0+1.0/-0

Storage and handling conditions

- (1) To store products at 5 to 40°C ambient temperature and 20 to 70% related humidity conditions.
- (2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

Cautions:

- a. Don't store products in a corrosive environment such as sulfide, chloride gas, or acid. It may cause oxidization of electrode, which easily be resulted in poor soldering.
- b. To store products on the shelf and avoid exposure to moisture.
- c. Don't expose products to excessive shock, vibration, direct sunlight and so on.

Recommended soldering conditions

The lead-free termination MLCCs are not only to be used on SMT against lead-free solder paste, but also suitable against lead-containing solder paste. If the optimized solder joint is requested, increasing soldering time, temperature and concentration of N₂ within oven are recommended.

