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Messrs. : 一般共用

Date : 2019/04/30

APPROVAL SHEET

Product Name : AUTOMOTIVE Multilayer Ceramic Chip Capacitors without AEC-Q200 certification

Part No. : MG Series

Description : Size 0201 to 1812, C0G/X7R/X5R, 6.3Vdc to 1000Vdc

PREPARED BY	APPROVED BY

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SPECIFICATION

FOR

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Part No. : MG Series

Description : Size 0201 to 1812, C0G/X7R/X5R, 6.3Vdc to 1000Vdc

SPEC. No. : MG-000-001-03

DATE : 2019/04/30

DRAWN BY	CHECEKED BY	APPROVED BY
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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. A wide selection of sizes is available (0402 to 1812).
- b. High capacitance in given case size.
- c. Capacitor with lead-free termination (pure Tin).
- d. RoHS Compliant.
- e. HALOGEN compliant.

3. APPLICATIONS

- a. For Navigation & Information equipments.
- b. For entertainment equipments.
- c. For comfortable equipments.
- d. For Automotive electronic equipment.

4. HOW TO ORDER

<u>MG</u>	<u>31</u>	<u>X</u>	<u>471</u>	<u>K</u>	<u>251</u>	<u>P</u>	<u>X</u>	<u>G</u>
PDC Family	Size	Dielectric	Capacitance	Tolerance	Rated Voltage	Packaging	Thickness	Control Code
Table 1	Table 2	Table 3	Table 4	Table 5	Table 6	Table 7	Table 8	Table 9

Table 1 PDC Family	
Code	Description
MG	Automotive Caps without AEC-Q200 certification

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

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

Table 4 Capacitance Rule Code			
Code	Description	Code	Description
R47	0.47pF	102	102=10x10 ² =1000pF
0R5	0.5pF	104	104=10x10 ⁴ =100nF
100	100=10x10 ⁰ =10pF	106	106=10x10 ⁶ =10μF

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

Table 6 Rated Voltage					
Code	Description	Code	Description	Code	Description
6R3	6.3Vdc	201	200Vdc	152	1500Vdc
100	10Vdc	251	250Vdc	202	2000Vdc
160	16Vdc	401	400Vdc	302	3000Vdc
250	25Vdc	501	500Vdc	402	4000Vdc
500	50Vdc	631	630Vdc	502	5000Vdc
101	100Vdc	102	1000Vdc	602	6000Vdc

Table 7 Packaging Type			
Code	Description	Code	Description
B	Bulk	T	Tray package
E	Tape and 7" Reel, Embossed Tape	P	Tape and 7" Reel, Paper Tape
K	Tape and 10" Reel, Embossed Tape	D	Tape and 10" Reel, Paper Tape
L	Tape and 13" Reel, Embossed Tape	G	Tape and 13" Reel, Paper Tape

Table 8 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 9 Special Control Code	
Code	Description
G	RoHS Compliant
Q	Surface Coating (size 1206~2225)

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	Code / T (mm)	M _B (mm)	Outline
0201 (0603)	0.6±0.03	0.3±0.03		0.15±0.05	
	0.6±0.05 ^{#2}	0.3±0.05 ^{#2}		0.15±0.1/-0.0	
	0.6±0.09 ^{#3}	0.3±0.09 ^{#3}			
0402 (1005)	1.00±0.05	0.50±0.05		0.25	
	1.00±0.20	0.50±0.20		+0.05/-0.10	
0603 (1608)	1.60±0.10	0.80±0.10		0.40±0.15	
	1.60+0.15/-0.10	0.80+0.15/-0.10			
	1.60±0.20 ^{#1}	0.80±0.20 ^{#1}			
0805 (2012)	2.00±0.15	1.25±0.10		0.50±0.20	
	2.00±0.20	1.25±0.20			
1206 (3216)	3.20±0.15	1.60±0.15	See No.4 Reference Table 8	0.60±0.20 (0.5±0.25) ^{***}	
	3.20±0.20	1.60±0.20			
	3.20+0.30/-0.10	1.60+0.30/-0.10			
1210 (3225)	3.20±0.30	2.50±0.20		0.75±0.25	
	3.20±0.40	2.50±0.30			
	3.20±0.60 ^{#4}	2.50±0.50 ^{#4}			
1808 (4520)	4.50±0.40 (4.5+0.5/-0.3) ^{**}	2.03±0.25		0.75±0.25 (0.5±0.25) ^{***}	
1812 (4532)	4.50±0.40 (4.5+0.5/-0.3) ^{**}	3.20±0.30		0.75±0.25 (0.5±0.25) ^{***}	
		3.20±0.40			

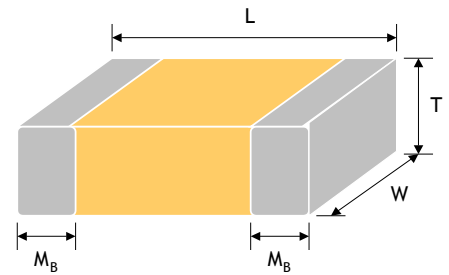


Fig. 5.1 The outline of MLCC

* R = Reflow soldering process ; W = Wave soldering process.

** For 1808/1812/1825_200V~4000V and safety certificated products.

*** For 1206_≥1000V, 1808/1812_200V~4000V and safety certificated products.

#1: For 0603/Cap ≥ 10μF or 0603(≤6.3V)/Cap ≥ 4.7μF for 0603(>10V)/Cap > 1μF products.

#2: For 0201/ 0.1μF < Cap < 0.68μF products.

#3: For 0201/Cap ≥ 0.68μF products.

#4: For 1210(100V)/Cap > 1μF or 1210(250V)/Cap > 0.47μF or 1210(400V~630V)/Cap > 0.22μF

Specification No. : MG-000-001-03

6. GENERAL ELECTRICAL DATA

Dielectric	NP0	X7R	X5R
Size	0201, 0402, 0603, 0805, 1206, 1210, 1812		
Capacitance range*	0.1pF to 0.033μF	100pF to 2.2μF	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%)		
Rated voltage (WVDC)	10V, 16V, 25V, 50V, 100V, 200V, 250V, 500V, 630V, 1000V		6.3V, 10V, 16V, 25V
Tan δ*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000	Note 1	
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.

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

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 ambient condition for 24±2 hours before measurement.

Note 1: X7R/X5R

Rated vol	D.F. ≤	Exception of D.F. ≤	
≥100V	≤2.5%	≤3%	1206≥0.47μF
		≤5%	0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series
		≤10%	0805 > 0.22μF; 1210 ≥ 3.3μF
50V	≤2.5%	≤3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF
		≤5%	0201 ≥ 0.01μF; 1210 ≥ 4.7μF
		≤10%	0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF (0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series
35V	≤3.5%	≤10%	0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF
25V	≤3.5%	≤5%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF
		≤7%	0603 ≥ 0.33μF
		≤10%	0201 ≥ 0.1μF; 0402 ≥ 0.10μF & (0402/X7R ≥ 0.056μF); TT series; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF
		≤12.5%	0402 ≥ 0.47μF
16V	≤3.5%	≤5%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF
		≤10%	0201 ≥ 0.1μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.22μF; TT series; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF
10V	≤5%	≤10%	0201 ≥ 0.012μF; 0402 ≥ 0.33μF (0402/X7R ≥ 0.22μF); TT series; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5
		≤15%	0201 ≥ 0.1μF; 0402 ≥ 1μF
		---	---
6.3V	≤10%	≤15%	0201 ≥ 0.1μF; 0402 ≥ 1μF (0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series
		≤20%	0402 ≥ 2.2μF
4V	≤15%	---	---

7. CAPACITANCE RANGE

7-1 COG

DIELECTRIC		NP0															
SIZE		0201				0402					0603						
RATED VOLTAGE (VDC)		10	16	25	50	10	16	25	50	100	10	16	25	50	100	200	250
Capacitance	0.1pF (0R1)	L	L	L	L	N	N	N	N	N							
	0.2pF (0R2)	L	L	L	L	N	N	N	N	N							
	0.3pF (0R3)	L	L	L	L	N	N	N	N	N							
	0.4pF (0R4)	L	L	L	L	N	N	N	N	N							
	0.5pF (0R5)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	0.6pF (0R6)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	0.7pF (0R7)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	0.8pF (0R8)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	0.9pF (0R9)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	1.0pF (1R0)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	1.2pF (1R2)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	1.5pF (1R5)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	1.8pF (1R8)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	2.0pF (2R0)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	2.2pF (2R2)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	2.7pF (2R7)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	3.0pF (3R0)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	3.3pF (3R3)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	3.9pF (3R9)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	4.0pF (4R0)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	4.7pF (4R7)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	5.0pF (5R0)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	5.6pF (5R6)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	6.0pF (6R0)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	6.8pF (6R8)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	7.0pF (7R0)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	8.0pF (8R0)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	8.2pF (8R2)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	9.0pF (9R0)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	10pF (100)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	12pF (120)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	15pF (150)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	18pF (180)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	22pF (220)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	27pF (270)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	33pF (330)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	39pF (390)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	47pF (470)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	56pF (560)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	68pF (680)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	82pF (820)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	100pF (101)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
120pF (121)					N	N	N	N	N	S	S	S	S	S	S	S	
150pF (151)					N	N	N	N	N	S	S	S	S	S	S	S	
180pF (181)					N	N	N	N	N	S	S	S	S	S	S	S	
220pF (221)					N	N	N	N	N	S	S	S	S	S	S	S	
270pF (271)					N	N	N	N	N	S	S	S	S	S	B	B	
330pF (331)					N	N	N	N	N	S	S	S	S	S	B	B	
390pF (391)					N	N	N	N	N	S	S	S	S	S	B	B	
470pF (471)					N	N	N	N	N	S	S	S	S	S	B	B	
560pF (561)					N	N	N	N	N	S	S	S	S	S			
680pF (681)					N	N	N	N	N	S	S	S	S	S			
820pF (821)					N	N	N	N	N	S	S	S	S	S			
1,000pF (102)					N	N	N	N	N	S	S	S	S	S			
1,200pF (122)										B	B	B	B				
1,500pF (152)										B	B	B	B				
1,800pF (182)										B	B	B	B				
2,200pF (222)										B	B	B	B				
2,700pF (272)										B	B	B	B				
3,300pF (332)										B	B	B	B				
3,900pF (392)																	
4,700pF (472)																	
5,600pF (562)																	
6,800pF (682)																	
8,200pF (822)																	
0.01μF (103)																	

7. CAPACITANCE RANGE

7-1 C0G

DIELECTRIC		NP0								
SIZE		0805								
RATED VOLTAGE		10	16	25	50	100	200	250	500	630
Capacitance	0.5pF (0R5)	A	A	A	A	A	A	A	A	A
	0.6pF (0R6)	A	A	A	A	A	A	A	A	A
	0.7pF (0R7)	A	A	A	A	A	A	A	A	A
	0.8pF (0R8)	A	A	A	A	A	A	A	A	A
	0.9pF (0R9)	A	A	A	A	A	A	A	A	A
	1.0pF (1R0)	A	A	A	A	A	A	A	A	A
	1.2pF (1R2)	A	A	A	A	A	A	A	A	A
	1.5pF (1R5)	A	A	A	A	A	A	A	A	A
	1.8pF (1R8)	A	A	A	A	A	A	A	A	A
	2.2pF (2R2)	A	A	A	A	A	A	A	A	A
	2.7pF (2R7)	A	A	A	A	A	A	A	A	A
	3.3pF (3R3)	A	A	A	A	A	A	A	A	A
	3.9pF (3R9)	A	A	A	A	A	A	A	A	A
	4.7pF (4R7)	A	A	A	A	A	A	A	A	A
	5.6pF (5R6)	A	A	A	A	A	A	A	A	A
	6.8pF (6R8)	A	A	A	A	A	A	A	A	A
	8.2pF (8R2)	A	A	A	A	A	A	A	A	A
	10pF (100)	A	A	A	A	A	A	A	A	A
	12pF (120)	A	A	A	A	A	A	A	A	A
	15pF (150)	A	A	A	A	A	A	A	A	A
	18pF (180)	A	A	A	A	A	A	A	A	A
	22pF (220)	A	A	A	A	A	A	A	A	A
	27pF (270)	A	A	A	A	A	A	A	A	A
	33pF (330)	A	A	A	A	A	A	A	A	A
	39pF (390)	A	A	A	A	A	A	A	A	A
	47pF (470)	A	A	A	A	A	A	A	A	A
	56pF (560)	A	A	A	A	A	A	A	A	A
	68pF (680)	A	A	A	A	A	A	A	A	A
	82pF (820)	A	A	A	A	A	A	A	X	X
	100pF (101)	A	A	A	A	A	X	X	X	X
	120pF (121)	A	A	A	A	A	X	X	C	C
	150pF (151)	A	A	A	A	A	C	C	C	C
	180pF (181)	A	A	A	A	A	C	C	C	C
	220pF (221)	A	A	A	A	A	C	C	C	C
	270pF (271)	A	A	A	A	A	C	C	C	C
	330pF (331)	A	A	A	A	A	C	C	C	C
	390pF (391)	X	X	X	X	X	C	C	C	C
	470pF (471)	X	X	X	X	X	C	C		
	560pF (561)	X	X	X	X	X	C	C		
	680pF (681)	X	X	X	X	X	C	C		
820pF (821)	X	X	X	X	X	C	C			
1,000pF (102)	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	C					
3,900pF (392)	C	C	C	C	C					
4,700pF (472)	C	C	C	C	C					
5,600pF (562)	C	C	C	C	C					
6,800pF (682)	C	C	C	C	C					
8,200pF (822)	C	C	C	C	C					
0.01μF (103)	C	C	C	C	C					

7. CAPACITANCE RANGE

7-1 C0G

DIELECTRIC		NP0									
SIZE		1206									
RATED VOLTAGE		10	16	25	50	100	200	250	500	630	1000
Capacitance	1.0pF (1R0)										
	1.2pF (1R2)	X	X	X	X	X	X	X	X	X	
	1.5pF (1R5)	X	X	X	X	X	X	X	X	X	X
	1.8pF (1R8)	X	X	X	X	X	X	X	X	X	X
	2.2pF (2R2)	X	X	X	X	X	X	X	X	X	X
	2.7pF (2R7)	X	X	X	X	X	X	X	X	X	X
	3.3pF (3R3)	X	X	X	X	X	X	X	X	X	X
	3.9pF (3R9)	X	X	X	X	X	X	X	X	X	X
	4.7pF (4R7)	X	X	X	X	X	X	X	X	X	X
	5.6pF (5R6)	X	X	X	X	X	X	X	X	X	X
	6.8pF (6R8)	X	X	X	X	X	X	X	X	X	X
	8.2pF (8R2)	X	X	X	X	X	X	X	X	X	X
	10pF (100)	X	X	X	X	X	X	X	X	X	X
	12pF (120)	X	X	X	X	X	X	X	X	X	X
	15pF (150)	X	X	X	X	X	X	X	X	X	X
	18pF (180)	X	X	X	X	X	X	X	X	X	X
	22pF (220)	X	X	X	X	X	X	X	X	X	C
	27pF (270)	X	X	X	X	X	X	X	X	X	C
	33pF (330)	X	X	X	X	X	X	X	X	X	C
	39pF (390)	X	X	X	X	X	X	X	X	X	C
	47pF (470)	X	X	X	X	X	X	X	X	X	C
	56pF (560)	X	X	X	X	X	X	X	X	X	C
	68pF (680)	X	X	X	X	X	X	X	X	X	C
	82pF (820)	X	X	X	X	X	X	X	X	X	C
	100pF (101)	X	X	X	X	X	X	X	X	X	C
	120pF (121)	X	X	X	X	X	X	X	X	X	C
	150pF (151)	X	X	X	X	X	X	X	X	X	C
	180pF (181)	X	X	X	X	X	X	X	X	X	E
	220pF (221)	X	X	X	X	X	X	X	X	X	E
	270pF (271)	X	X	X	X	X	X	M	M	M	E
	330pF (331)	X	X	X	X	X	X	M	M	M	E
	390pF (391)	X	X	X	X	X	X	M	M	M	E
	470pF (471)	X	X	X	X	X	M	M	M	M	E
	560pF (561)	X	X	X	X	X	M	C	C	C	E
	680pF (681)	X	X	X	X	X	M	C	C	C	E
	820pF (821)	X	X	X	X	X	M	E	E	E	E
	1,000pF (102)	X	X	X	X	X	M	E	E	E	E
	1,200pF (122)	X	X	X	X	X	M	E	E	E	
	1,500pF (152)	X	X	X	X	X	C	E	E	E	
	1,800pF (182)	X	X	X	X	X	C	E	E	E	
2,200pF (222)	X	X	X	X	X	C	E	E	E		
2,700pF (272)	X	X	X	X	X	C	E				
3,300pF (332)	X	X	X	X	X	C	E				
3,900pF (392)	X	X	X	X	X	C	E				
4,700pF (472)	X	X	X	X	X	C	E				
5,600pF (562)	X	X	X	X	X						
6,800pF (682)	M	M	M	M	M						
8,200pF (822)	C	C	C	C	C						
0.01μF (103)	C	C	C	C	C						

7. CAPACITANCE RANGE

7-1 C0G

DIELECTRIC		NPO									
SIZE		1210									
RATED VOLTAGE (VDC)		10	16	25	50	100	200	250	500	630	1000
Capacitance	10pF (100)	M	M	M	M	M	M	M	M	M	M
	12pF (120)	M	M	M	M	M	M	M	M	M	M
	15pF (150)	M	M	M	M	M	M	M	M	M	M
	18pF (180)	M	M	M	M	M	M	M	M	M	M
	22pF (220)	M	M	M	M	M	M	M	M	M	M
	27pF (270)	M	M	M	M	M	M	M	M	M	M
	33pF (330)	M	M	M	M	M	M	M	M	M	M
	39pF (390)	M	M	M	M	M	M	M	M	M	M
	47pF (470)	M	M	M	M	M	M	M	M	M	M
	56pF (560)	M	M	M	M	M	M	M	M	M	M
	68pF (680)	M	M	M	M	M	M	M	M	M	M
	82pF (820)	M	M	M	M	M	M	M	M	M	M
	100pF (101)	M	M	M	M	M	M	M	M	M	C
	120pF (121)	M	M	M	M	M	M	M	M	M	C
	150pF (151)	M	M	M	M	M	M	M	M	M	C
	180pF (181)	M	M	M	M	M	M	M	M	M	C
	220pF (221)	M	M	M	M	M	M	M	M	M	E
	270pF (271)	M	M	M	M	M	M	M	M	M	E
	330pF (331)	M	M	M	M	M	M	M	M	M	E
	390pF (391)	M	M	M	M	M	M	M	M	M	E
	470pF (471)	M	M	M	M	M	M	M	M	M	E
	560pF (561)	M	M	M	M	M	M	M	M	M	E
	680pF (681)	M	M	M	M	M	M	M	M	M	E
	820pF (821)	M	M	M	M	M	M	M	M	M	E
	1,000pF (102)	M	M	M	M	M	C	C	C	C	E
	1,200pF (122)	M	M	M	M	M	C	C	C	C	
	1,500pF (152)	M	M	M	M	M	C	C	C	C	
	1,800pF (182)	M	M	M	M	M	C	C	C	C	
	2,200pF (222)	M	M	M	M	M	C	C	C	C	
	2,700pF (272)	M	M	M	M	M	C	C	C	C	
	3,300pF (332)	M	M	M	M	M	C	C	C	C	
	3,900pF (392)	M	M	M	M	M	C	C	C	C	
	4,700pF (472)	M	M	M	M	M	E	E			
	5,600pF (562)	M	M	M	M	M	E	E			
6,800pF (682)	M	M	M	M	M	E	E				
8,200pF (822)	M	M	M	M	M	E	E				
0.010μF (103)	M	M	M	M	M	E	E				
0.012μF (123)	C	C	C	C	C						
0.015μF (153)	C	C	C	C	C						
0.018μF (183)	F	F	F	F	F						
0.022μF (223)	F	F	F	F	F						
0.027μF (273)	F	F	F	F	F						
0.033μF (333)	F	F	F	F	F						
0.039μF (393)	F	F	F	F	F						
0.047μF (473)	F	F	F	F	F						

7. CAPACITANCE RANGE

7-1 C0G

DIELECTRIC		NP0				
SIZE		1812				
RATED VOLTAGE		10	16	25	50	100
Capacitance	10pF (100)					C
	12pF (120)					C
	15pF (150)					C
	18pF (180)					C
	22pF (220)					C
	27pF (270)					C
	33pF (330)					C
	39pF (390)					C
	47pF (470)					C
	56pF (560)					C
	68pF (680)					C
	82pF (820)					C
	100pF (101)					C
	120pF (121)					C
	150pF (151)					C
	180pF (181)					C
	220pF (221)					C
	270pF (271)					C
	330pF (331)					C
	390pF (391)					C
	470pF (471)					C
	560pF (561)					C
	680pF (681)					C
	820pF (821)					C
	1,000pF (102)	C	C	C	C	C
	1,200pF (122)	C	C	C	C	C
	1,500pF (152)	C	C	C	C	C
	1,800pF (182)	C	C	C	C	C
	2,200pF (222)	C	C	C	C	C
	2,700pF (272)	C	C	C	C	C
	3,300pF (332)	C	C	C	C	C
	3,900pF (392)	C	C	C	C	C
	4,700pF (472)	C	C	C	C	C
	5,600pF (562)	C	C	C	C	C
	6,800pF (682)	C	C	C	C	C
8,200pF (822)	C	C	C	C	C	
0.010μF (103)	C	C	C	C	C	
0.012μF (123)	C	C	C	C	C	
0.015μF (153)	C	C	C	C	C	
0.018μF (183)	C	C	C	C	C	
0.022μF (223)	C	C	C	C	C	
0.027μF (273)	C	C	C	C	C	
0.033μF (333)	C	C	C	C	C	
0.039μF (393)						

7. CAPACITANCE RANGE

7-2 X7R

DIELECTRIC		X7R												
SIZE		0201				0402				0603				
RATED VOLTAGE		10	16	25	50	10	16	25	50	10	16	25	50	100
Capacitance	100pF (101)	L	L	L	L	N	N	N	N	S	S	S	S	S
	120pF (121)	L	L	L	L	N	N	N	N	S	S	S	S	S
	150pF (151)	L	L	L	L	N	N	N	N	S	S	S	S	S
	180pF (181)	L	L	L	L	N	N	N	N	S	S	S	S	S
	220pF (221)	L	L	L	L	N	N	N	N	S	S	S	S	S
	270pF (271)	L	L	L	L	N	N	N	N	S	S	S	S	S
	330pF (331)	L	L	L	L	N	N	N	N	S	S	S	S	S
	390pF (391)	L	L	L	L	N	N	N	N	S	S	S	S	S
	470pF (471)	L	L	L	L	N	N	N	N	S	S	S	S	S
	560pF (561)	L	L	L	L	N	N	N	N	S	S	S	S	S
	680pF (681)	L	L	L	L	N	N	N	N	S	S	S	S	S
	820pF (821)	L	L	L	L	N	N	N	N	S	S	S	S	S
	1,000pF (102)	L	L	L	L	N	N	N	N	S	S	S	S	S
	1,200pF (122)	L	L	L		N	N	N	N	S	S	S	S	S
	1,500pF (152)	L	L	L		N	N	N	N	S	S	S	S	S
	1,800pF (182)	L	L	L		N	N	N	N	S	S	S	S	S
	2,200pF (222)	L	L	L		N	N	N	N	S	S	S	S	S
	2,700pF (272)	L	L	L		N	N	N	N	S	S	S	S	S
	3,300pF (332)	L	L	L		N	N	N	N	S	S	S	S	S
	3,900pF (392)	L	L	L		N	N	N	N	S	S	S	S	S
	4,700pF (472)	L	L	L		N	N	N	N	S	S	S	S	S
	5,600pF (562)	L	L	L		N	N	N	N	S	S	S	S	S
	6,800pF (682)	L				N	N	N	N	S	S	S	S	S
	8,200pF (822)	L				N	N	N	N	S	S	S	S	S
	0.010μF (103)	L				N	N	N	N	S	S	S	S	S
	0.012μF (123)					N	N	N	N	S	S	S	S	B
	0.015μF (153)					N	N	N	N	S	S	S	S	B
	0.018μF (183)					N	N	N	N	S	S	S	S	B
	0.022μF (223)					N	N	N	N	S	S	S	S	B
	0.027μF (273)					N	N	N		S	S	S	S	
	0.033μF (333)					N	N	N		S	S	S	B	
	0.039μF (393)					N	N	N		S	S	S	B	
	0.047μF (473)					N	N	N		S	S	S	B	
	0.056μF (563)					N	N			S	S	S	B	
0.068μF (683)					N	N			S	S	S	B		
0.082μF (823)					N	N			S	S	S	B		
0.10μF (104)					N	N			S	S	S	B		
0.12μF (124)									S	S	B			
0.15μF (154)									S	S	B			
0.18μF (184)									S	S	B			
0.22μF (224)									S	S	B			
0.27μF (274)									B	B	B			
0.33μF (334)									B	B	B			
0.39μF (394)									B	B	B			
0.47μF (474)									B	B	B			

7. CAPACITANCE RANGE

7-2 X7R

DIELECTRIC	X7R																		
	SIZE	0805								1206									
	RATED VOLTAGE	10	16	25	50	100	200	250	500	630	10	16	25	50	100	200	250	500	630
100pF (101)	X	X	X	X	X	X	X	X	X	X						C	C	C	C
120pF (121)	X	X	X	X	X	X	X	X	X	X						C	C	C	C
150pF (151)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
180pF (181)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
220pF (221)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
270pF (271)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
330pF (331)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
390pF (391)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
470pF (471)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
560pF (561)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
680pF (681)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
820pF (821)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
1,000pF (102)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
1,200pF (122)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
1,500pF (152)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
1,800pF (182)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
2,200pF (222)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
2,700pF (272)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
3,300pF (332)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
3,900pF (392)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C	C	C	C	
4,700pF (472)	X	X	X	X	X	X	X	C	C	X	X	X	X	X	C	C	C	C	
5,600pF (562)	X	X	X	X	X	X	X	C	C	X	X	X	X	X	C	C	C	C	
6,800pF (682)	X	X	X	X	X	X	X	C	C	X	X	X	X	X	C	C	C	C	
8,200pF (822)	X	X	X	X	X	X	X	C	C	X	X	X	X	X	C	C	C	C	
0.010μF (103)	X	X	X	X	X	C	C	C	C	X	X	X	X	X	C	C	C	C	
0.012μF (123)	X	X	X	X	X	C	C			X	X	X	X	X	C	C			
0.015μF (153)	X	X	X	X	X	C	C			X	X	X	X	X	C	C			
0.018μF (183)	X	X	X	X	X	C	C			X	X	X	X	X	C	C			
0.022μF (223)	X	X	X	X	X	C	C			X	X	X	X	X	C	C			
0.027μF (273)	X	X	X	X	C					X	X	X	X	X	C	C			
0.033μF (333)	X	X	X	X	C					X	X	X	X	X	E	E			
0.039μF (393)	X	X	X	X	C					X	X	X	X	X	E	E			
0.047μF (473)	X	X	X	X	C					X	X	X	X	X	E	E			
0.056μF (563)	X	X	X	X	C					X	X	X	X	X	E	E			
0.068μF (683)	X	X	X	X	C					X	X	X	X	X	E	E			
0.082μF (823)	X	X	X	X	C					X	X	X	X	C	E	E			
0.10μF (104)	X	X	X	X	C					X	X	X	X	C	E	E			
0.12μF (124)	X	X	X	C						X	X	X	X	C					
0.15μF (154)	C	C	C	C						M	M	M	M	E					
0.18μF (184)	C	C	C	C						M	M	M	M	E					
0.22μF (224)	C	C	C	C						M	M	M	M	E					
0.27μF (274)	C	C	C							M	M	M	C						
0.33μF (334)	C	C	C							M	M	M	C						
0.39μF (394)	C	C	C							M	M	J	P						
0.47μF (474)	C	C	C							J	J	J	P						
0.56μF (564)	C	C	C							J	J	J	P						
0.68μF (684)	C	C	C							J	J	J	P						
0.82μF (824)	C	C	C							J	J	J	P						
1.0μF (105)	C	C	C							J	J	J	P						
1.5μF (155)										J	J	P							
2.2μF (225)										J	J	P							
4.7μF (475)																			
10μF (106)																			

7. CAPACITANCE RANGE

7-2 X7R

DIELECTRIC	X7R															
	1210									1812						
SIZE	10	16	25	50	100	200	250	500	1000	10	16	25	50	100	200	250
RATED VOLTAGE	10	16	25	50	100	200	250	500	1000	10	16	25	50	100	200	250
100pF (101)							C	C	C							
120pF (121)							C	C	C							
150pF (151)							C	C	C							
180pF (181)							C	C	C							
220pF (221)							C	C	C							
270pF (271)							C	C	C							
330pF (331)							C	C	C							
390pF (391)							C	C	C							
470pF (471)							C	C	C							
560pF (561)							C	C	C							
680pF (681)							M	C	C							
820pF (821)							M	C	C							
1,000pF (102)	M	M	M	M	M	M	M	C	C	C	C	C	C	C	C	C
1,200pF (122)	M	M	M	M	M	M	M	C	C	C	C	C	C	C	C	C
1,500pF (152)	M	M	M	M	M	M	M	C	C	C	C	C	C	C	C	C
1,800pF (182)	M	M	M	M	M	M	M	C	C	C	C	C	C	C	C	C
2,200pF (222)	M	M	M	M	M	M	M	C	C	C	C	C	C	C	C	C
2,700pF (272)	M	M	M	M	M	M	M	C	C	C	C	C	C	C	C	C
3,300pF (332)	M	M	M	M	M	M	M	C	C	C	C	C	C	C	C	C
3,900pF (392)	M	M	M	M	M	M	M	C	G	C	C	C	C	C	C	C
4,700pF (472)	M	M	M	M	M	M	M	C	E	C	C	C	C	C	C	C
5,600pF (562)	M	M	M	M	M	M	M	C	E	C	C	C	C	C	C	C
6,800pF (682)	M	M	M	M	M	M	M	C	E	C	C	C	C	C	C	C
8,200pF (822)	M	M	M	M	M	M	M	C	E	C	C	C	C	C	C	C
0.010μF (103)	M	M	M	M	M	M	M	C	E	C	C	C	C	C	C	C
0.012μF (123)	M	M	M	M	M	M	M	C		C	C	C	C	C	C	C
0.015μF (153)	M	M	M	M	M	M	M	C		C	C	C	C	C	C	C
0.018μF (183)	M	M	M	M	M	M	M	C		C	C	C	C	C	C	C
0.022μF (223)	M	M	M	M	M	M	M	C		C	C	C	C	C	C	C
0.027μF (273)	M	M	M	M	M	M	M			C	C	C	C	C	C	C
0.033μF (333)	M	M	M	M	M	M	M			C	C	C	C	C	C	C
0.039μF (393)	M	M	M	M	M	M	M			C	C	C	C	C	C	C
0.047μF (473)	M	M	M	M	M	C	C			C	C	C	C	C	C	C
0.056μF (563)	M	M	M	M	M	C	C			C	C	C	C	C	C	C
0.068μF (683)	M	M	M	M	M	E	E			C	C	C	C	C	C	C
0.082μF (823)	M	M	M	M	M	E	E			C	C	C	C	C	C	C
0.10μF (104)	M	M	M	M	M	E	E			C	C	C	C	C	C	C
0.12μF (124)	M	M	M	M	M	E	E			C	C	C	C	C	C	C
0.15μF (154)	C	C	C	C	C	G	G			C	C	C	C	C	F	F
0.18μF (184)	C	C	C	C	C	G	G			C	C	C	C	C	F	F
0.22μF (224)	C	C	C	C	C	G	G			C	C	C	C	C	F	F
0.27μF (274)	C	C	C	C	E	G	G			C	C	C	C	C	F	F
0.33μF (334)	C	C	C	C	E	G	G			C	C	C	C	C	F	F
0.39μF (394)	C	C	C	C	G	G	G			C	C	C	C	C	F	F
0.47μF (474)	C	C	C	C	G	G	G			C	C	C	C	F	F	F
0.56μF (564)	C	C	C	C	G					C	C	C	C	F		
0.68μF (684)	C	C	C	C	F					C	C	C	F	F		
0.82μF (824)	C	C	C	C	F					C	C	C	F	F		
1.00μF (105)	C	C	C	C	F					C	C	C	F	F		
1.50μF (155)	F	F	E											F		
2.20μF (225)	F	F	E											G		

7. CAPACITANCE RANGE

7-3 X5R

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																
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	0.082μF (823)		N																
	0.10μF (104)		N	N															
	0.15μF (154)		N	N															
	0.22μF (224)	N	N	N															
	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												
	0.82μF (824)	N					B	B											
	1.0μF (105)						B	B											
	1.5μF (155)										I	I			J	J	P	F	F
	2.2μF (225)										I	I			J	J	P	F	F
	3.3μF (335)														P	P	P	P	F
4.7μF (475)														P	P	P	P	F	F
6.8μF (685)														P					
10μF (106)														P					
22μF (226)																			

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements																																												
1.	Visual and Mechanical	---	* No remarkable defect. * Dimensions to conform to individual specification sheet.																																												
2.	Capacitance		* Shall not exceed the limits given in the detailed spec. * COG : Cap.≥30pF, Q≥1000; Cap.<30pF, Q≥400+20C. * X7R, X5R :																																												
3.	Q/ D.F. (Dissipation Factor)	* Class I : (COG) Cap.≤1000pF, 1.0±0.2Vrms, 1MHz±10%. Cap.>1000pF, 1.0±0.2Vrms, 1KHz±10%. * Class II : (X7R, X5R) Cap.≤10μF, 1.0±0.2Vrms, 1KHz±10%. Cap.>10μF, 0.5±0.2Vrms, 120Hz±20%.	<table border="1"> <thead> <tr> <th>Rated</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥100V</td> <td rowspan="3">≤2.5%</td> <td>≤3%</td> <td>1206≥0.47μF, 1812≥4.7μF</td> </tr> <tr> <td>≤5%</td> <td>0805>0.1μF, 0603≥0.068μF, 1206>1μF, 1210≥2.2μF</td> </tr> <tr> <td>≤10%</td> <td>0805>0.22μF, 1210≥3.3μF</td> </tr> <tr> <td rowspan="2">50V</td> <td rowspan="2">≤2.5%</td> <td>≤3%</td> <td>0201(50V), 0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF, 1210≥3.3μF, 1812≥4.7μF</td> </tr> <tr> <td>≤5%</td> <td>0201≥0.01uF, 1210≥4.7μF</td> </tr> <tr> <td rowspan="2">35V</td> <td rowspan="2">≤3.5%</td> <td>≤10%</td> <td>0402≥0.1μF, 0603>0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>≤5%</td> <td>0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤3.5%</td> <td>≤7%</td> <td>0201≥0.01μF, 0805≥1μF, 1210≥10μF</td> </tr> <tr> <td>≤10%</td> <td>0603≥0.33μF, 1206≥4.7μF</td> </tr> <tr> <td>≤12.5%</td> <td>0201≥0.1μF, 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">≤3.5%</td> <td>≤5%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤5%</td> <td>≤10%</td> <td>0201≥0.1uF(0201/X7R≥0.022μF), 0402≥0.22uF, 0603≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF</td> </tr> <tr> <td>≤15%</td> <td>0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF</td> </tr> </tbody> </table>	Rated	D.F.≤	Exception of D.F.≤		≥100V	≤2.5%	≤3%	1206≥0.47μF, 1812≥4.7μF	≤5%	0805>0.1μF, 0603≥0.068μF, 1206>1μF, 1210≥2.2μF	≤10%	0805>0.22μF, 1210≥3.3μF	50V	≤2.5%	≤3%	0201(50V), 0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF, 1210≥3.3μF, 1812≥4.7μF	≤5%	0201≥0.01uF, 1210≥4.7μF	35V	≤3.5%	≤10%	0402≥0.1μF, 0603>0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF	≤5%	0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V	≤3.5%	≤7%	0201≥0.01μF, 0805≥1μF, 1210≥10μF	≤10%	0603≥0.33μF, 1206≥4.7μF	≤12.5%	0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥6.8μF, 1210≥22μF	16V	≤3.5%	≤5%	0402≥0.47μF	≤10%	0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF	10V	≤5%	≤10%	0201≥0.1uF(0201/X7R≥0.022μF), 0402≥0.22uF, 0603≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF	≤15%	0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF
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8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements															
6.	Temperature Coefficient	* With no electrical load.	<table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>C0G</td> <td>Within ±30ppm/°C</td> </tr> <tr> <td>X7R</td> <td>Within ±15%</td> </tr> <tr> <td>X5R</td> <td>Within ±15%</td> </tr> </tbody> </table>	T.C.	Capacitance Change	C0G	Within ±30ppm/°C	X7R	Within ±15%	X5R	Within ±15%							
		T.C.		Capacitance Change														
		C0G		Within ±30ppm/°C														
		X7R		Within ±15%														
X5R	Within ±15%																	
T.C.	Operating Temp.																	
C0G	-55 ~ 125°C at 25°C																	
X7R	-55 ~ 125°C at 25°C																	
X5R	-55 ~ 85°C at 25°C																	
7.	Adhesive Strength of Termination	* Pressurizing force : 2N (0201) and 5N (≤0603) and 10N (>0603) * Test time : 10±1 sec.	* No remarkable damage or removal of the terminations.															
8.	Vibration Resistance	* 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±2 hrs.	* No remarkable damage. * Cap. change and Q/D.F. : To meet initial spec.															
9.	Solderability	* Solder temperature : 235±5°C. * Dipping time : 2±0.5 sec.	* 95% min. coverage of all metalized area.															
10.	Bending Test	* 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±1 sec. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Cap. change : C0G : Within ±5% or ±0.5pF, whichever is larger. X7R, X5R : Within ±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	* Solder temperature : 260±5°C. * Dipping time : 10±1 sec. * Preheating : 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder. * Before initial measurement (Class II only) : Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Cap. change : C0G : Within ±2.5% or ±0.25pF, whichever is larger. X7R, X5R : Within ±7.5%. * Q/D.F., I.R. and dielectric strength : To meet initial requirements. * 25% max. leaching on each edge.															
12.	Temperature Cycle	* Conduct the five cycles according to the temperatures and time. <table border="1"> <thead> <tr> <th>Step</th> <th>Temp.(°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> * Before initial measurement (Class II only) : Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.	Step	Temp.(°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	* No remarkable damage. * Cap. change : C0G : Within ±2.5% or ±0.25pF, whichever is larger. X7R, X5R : Within ±7.5%. * Q/D.F., I.R. and dielectric strength : To meet initial requirements.
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4	Room temp.	2~3																

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements						
13.	Humidity (Damp Heat) Steady State	* Test temp. : 40±2°C. * Humidity : 90~95% RH. * Test time : 500 +24/-0 hrs. * Before initial measurement (Class II only) : Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Cap. change : COG : Within ±5% or ±0.5pF, whichever is larger. X7R, X5R : ≥10V**, within ±12.5%; 6.3V within ±25%; Cap.≥1μF, within ±25%. **10V : 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25%. * Q/D.F. value : COG : Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF, Q≥200+10C for Cap.<10pF. X7R, X5R : ≤200% of initial requirement. * I.R. : ≥1GΩ or RxC≥50Ω-F, whichever is smaller. Class II (X7R, X5R)						
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25V : 0201≥0.1μF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF									
16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥4.7μF									
10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥4.7μF									
14.	Humidity (Damp Heat) Load	* Test temp. : 40±2°C. * Humidity : 90~95%RH * Test time : 500 +24/-0 hrs. * To apply voltage : Rated voltage (Max. 500V). * 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.	* No remarkable damage. * Cap. change : COG : Within ±7.5% or ±0.75pF, whichever is larger. X7R, X5R : ≥10V**, within ±12.5%; 6.3V within ±25%; Cap.≥1μF, within ±25%. **10V : 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25%. * Q/D.F. value : COG : Q≥200 for Cap. ≥30pF, Q≥100+10/3C for Cap.<30pF. X7R, X5R : ≤200% of initial requirement. * I.R. : ≥500MΩ or RxC≥25Ω-F, whichever is smaller. Class II (X7R, X5R)						
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8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements																																																																																			
15.	High Temperature Load (Endurance)	<p>* Test temp. : C0G, X7R : 125±3°C. X5R : 85±3°C.</p> <p>* Test time : 1000 +24/-0 hrs.</p> <p>* To apply voltage :</p> <p>(1) 6.3V or C≥10μF : 150% of rated voltage.</p> <p>(2) 10V≤Ur<500V : 200% of rated voltage.</p> <p>(3) 500V : 150% of rated voltage.</p> <p>(4) Ur≥630V : 120% of rated voltage.</p> <p>(5) 100% of rated voltage for below range.</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated</th> <th>Capacitanc</th> </tr> </thead> <tbody> <tr> <td>0402</td> <td>X5R/X7R</td> <td>6.3V,10V, 16V, 25V</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="2">0603</td> <td rowspan="2">X5R/X7R</td> <td>4V</td> <td>C≥22μF</td> </tr> <tr> <td>6.3V,10V, 25V, 35V</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X5R/X7R</td> <td>4V</td> <td>C≥47μF</td> </tr> <tr> <td>6.3V, 10V~50V</td> <td>C≥22μF</td> </tr> <tr> <td>1206</td> <td>X5R/X7R</td> <td>≤6.3V</td> <td>C≥47μF</td> </tr> <tr> <td rowspan="2">1210</td> <td>X5R/X7R</td> <td>16V</td> <td>C≥47μF</td> </tr> <tr> <td>X7R</td> <td>≥100V</td> <td>C≥3.3μF</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</th> <th>Capacitanc</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0402</td> <td rowspan="2">X5R/X7R</td> <td>50V</td> <td>C≥0.1μF</td> </tr> <tr> <td>10~25V</td> <td>C≥0.22μF</td> </tr> <tr> <td rowspan="2">0603</td> <td>X7R</td> <td>≥50V</td> <td>C≥0.082μF</td> </tr> <tr> <td>X5R/X7R</td> <td>10V,16V,</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="2">0805</td> <td>X5R/X7R</td> <td>10~50V</td> <td>C≥4.7μF</td> </tr> <tr> <td>X5R/X7R</td> <td>50V, ≥100V</td> <td>C≥0.47μF, C≥0.12μF</td> </tr> <tr> <td>1206</td> <td>X5R/X7R</td> <td>≥50V</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="2">1210</td> <td>X5R/X7R</td> <td>≤100V</td> <td>C≥1.0μF</td> </tr> <tr> <td>X7R</td> <td>>100V</td> <td>C≥0.22μF</td> </tr> <tr> <td rowspan="3">1812</td> <td rowspan="3">X7R</td> <td>≤50V</td> <td>C≥4.7μF</td> </tr> <tr> <td>100V</td> <td>C≥1.0μF</td> </tr> <tr> <td>200V~250V</td> <td>C≥0.47μF</td> </tr> </tbody> </table> <p>* Before initial measurement (Class II only) : To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp.</p> <p>* Measurement to be made after keeping at room temp. for 24±2 hrs.</p>	Size	Dielectric	Rated	Capacitanc	0402	X5R/X7R	6.3V,10V, 16V, 25V	C≥1.0μF	0603	X5R/X7R	4V	C≥22μF	6.3V,10V, 25V, 35V	C≥1.0μF	0805	X5R/X7R	4V	C≥47μF	6.3V, 10V~50V	C≥22μF	1206	X5R/X7R	≤6.3V	C≥47μF	1210	X5R/X7R	16V	C≥47μF	X7R	≥100V	C≥3.3μF	Size	Dielectric	Rated	Capacitanc	0402	X5R/X7R	50V	C≥0.1μF	10~25V	C≥0.22μF	0603	X7R	≥50V	C≥0.082μF	X5R/X7R	10V,16V,	C≥1.0μF	0805	X5R/X7R	10~50V	C≥4.7μF	X5R/X7R	50V, ≥100V	C≥0.47μF, C≥0.12μF	1206	X5R/X7R	≥50V	C≥1.0μF	1210	X5R/X7R	≤100V	C≥1.0μF	X7R	>100V	C≥0.22μF	1812	X7R	≤50V	C≥4.7μF	100V	C≥1.0μF	200V~250V	C≥0.47μF	<p>* No remarkable damage.</p> <p>* Cap. change : C0G : Within ±3% or ±0.3pF, whichever is larger. X7R, X5R : ≥10V**, within ±12.5%; 6.3V within ±25%; Cap.≥1μF, within ±25%.</p> <p>**10V : 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25%.</p> <p>* Q/D.F. value : C0G : Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF, Q≥200+10C for Cap.<10pF. X7R, X5R : ≤200% of initial requirement.</p> <p>* I.R. : ≥1GΩ or RxC≥50Ω-F, whichever is smaller. Class II (X7R, X5R)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>100V : All X7R</td> <td rowspan="6">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td> </tr> <tr> <td>50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> </tr> <tr> <td>35V : 0805≥2.2μF, 1206≥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> </tbody> </table>	Rated voltage	I.R.	100V : All X7R	≥1GΩ or RxC≥10Ω-F, whichever is smaller	50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V : 0805≥2.2μF, 1206≥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
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9. PACKAGE DIMENSION AND QUANTITY

Size	Thickness (mm)	Paper tape		Plastic tape	
		7" reel	13" reel	7" reel	13" reel
0402(1005)	0.50±0.05	10k	50k	-	-
	0.50 +0.02/-0.05	10k	50k	-	-
	0.50±0.20	10k	-	-	-
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	-
	2.80±0.30	-	-	0.5k	-
2220(5750)	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
	2.80±0.30	-	-	0.5k	-
2225(5763)	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
	2.80±0.30	-	-	0.5k	-

Unit : pcs

9. PACKAGE DIMENSION AND QUANTITY

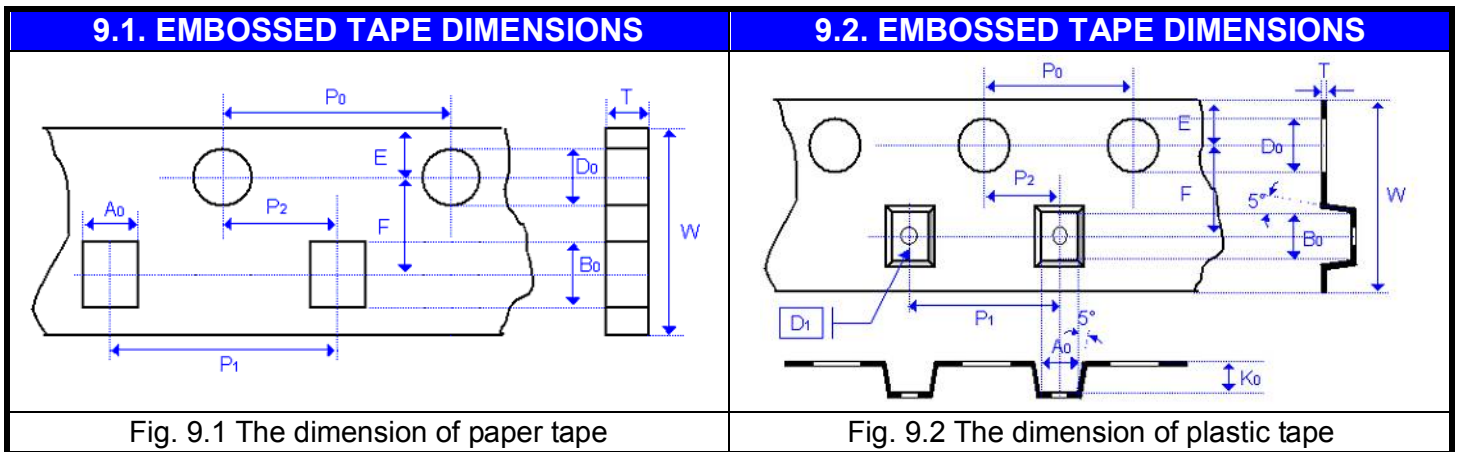


Fig. 9.1 The dimension of paper tape

Fig. 9.2 The dimension of plastic tape

Size	0402	0603		0805	
Chip Thickness	0.50±0.10	0.80±0.07	0.80 +0.15/-0.10	0.80±0.10	1.25±0.10 1.25±0.20
A ₀	0.70±0.20	1.00 +0.05/-0.10	1.02 +0.05/-0.10	1.50±0.10	<1.65
B ₀	1.20±0.20	1.80±0.10	1.80±0.10	2.30±0.10	<2.40
T	≤0.80	0.95±0.05	0.97±0.05	0.95±0.05	0.23±0.05
K ₀	-	-	-	-	<2.50
W	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
10xP ₀	40.00±0.10	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20
P ₁	2.00±0.05	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
D ₀	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.50+0.10/-0
D ₁	-	-	-	-	1.00±0.10
E	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.05	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
Unit :	mm	mm	mm	mm	mm

Size	1206			1210		1812	
Chip Thickness	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	1.25±0.10 1.60±0.20 2.00±0.20	2.50±0.30
A ₀	2.00±0.10	<2.00	<2.00	<3.05	<3.10	<3.90	<3.90
B ₀	3.50±0.10	<3.60	<3.70	<3.80	<4.00	<5.30	<5.30
T	0.95±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.25±0.05	0.25±0.05
K ₀	-	<2.50	<2.50	<2.50	<3.50	<2.50	<3.00
W	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	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
10xP ₀	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	4.00±0.10	4.00±0.10	4.00±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
D 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	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	1.50±0.10	1.50±0.10
E	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	5.50±0.05	5.50±0.05
Unit :	mm	mm	mm	mm	mm	mm	mm

9. PACKAGE DIMENSION AND QUANTITY

9.3. REEL DIMENSIONS

Size	0402, 0603, 0805, 1206, 1210			1808, 1812, 1825, 2220, 2225
Reel size	7"	7"	13"	7"
C	13.0 +0.5/-0.2	13.0 +0.5/-0.2	13.0 +0.7/-0.3	13.0 +0.5/-0.2
W ₁	8.4 +1.5/-0	12.4 +2.0/-0	8.4 +2.0/-0	8.4 +1.5/-0
A	178.0 ±0.10	178.0 ±0.10	330.0 ±1.0	178.0 ±0.10
N	60.0 +1.0/-0	80.0 ±1.0	100 ±1.0	60.0 +1.0/-0

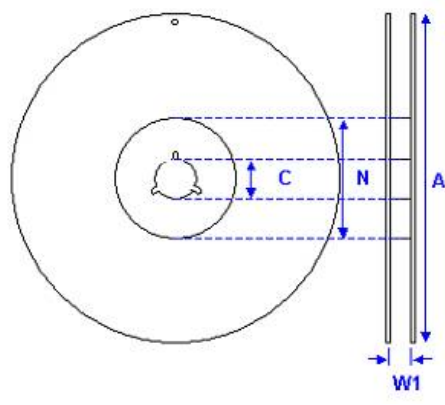
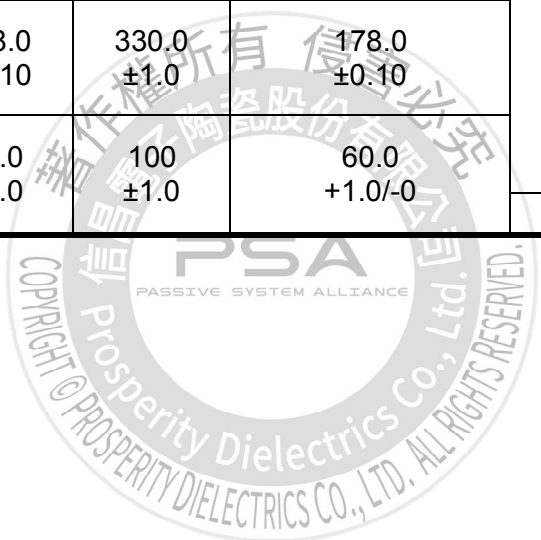


Fig. 9.3 The dimension of reel



10. 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 product is recommended to be used within 12 months after shipment 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.

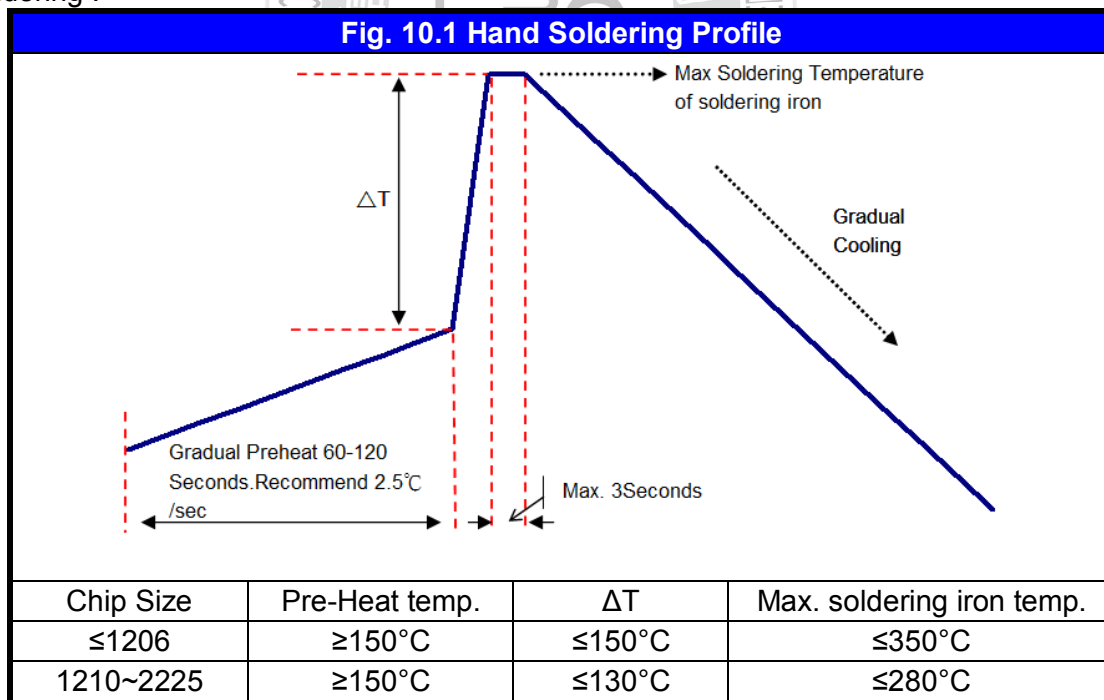
PREHEAT

In order to minimize the risk of thermal shock during soldering, a carefully controlled preheat is required. The rate of preheat should not exceed 3°C per second.

SOLDERING

Use mildly 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.

a.) Hand soldering :



* Soldering iron tip diameter ≤ 1.0 mm and wattage max. 20W.

* The Capacitors shall be pre-heated and that the temperature gradient between the devices and the tip of the soldering iron.

* The required amount of solder shall be melted on the soldering tip.

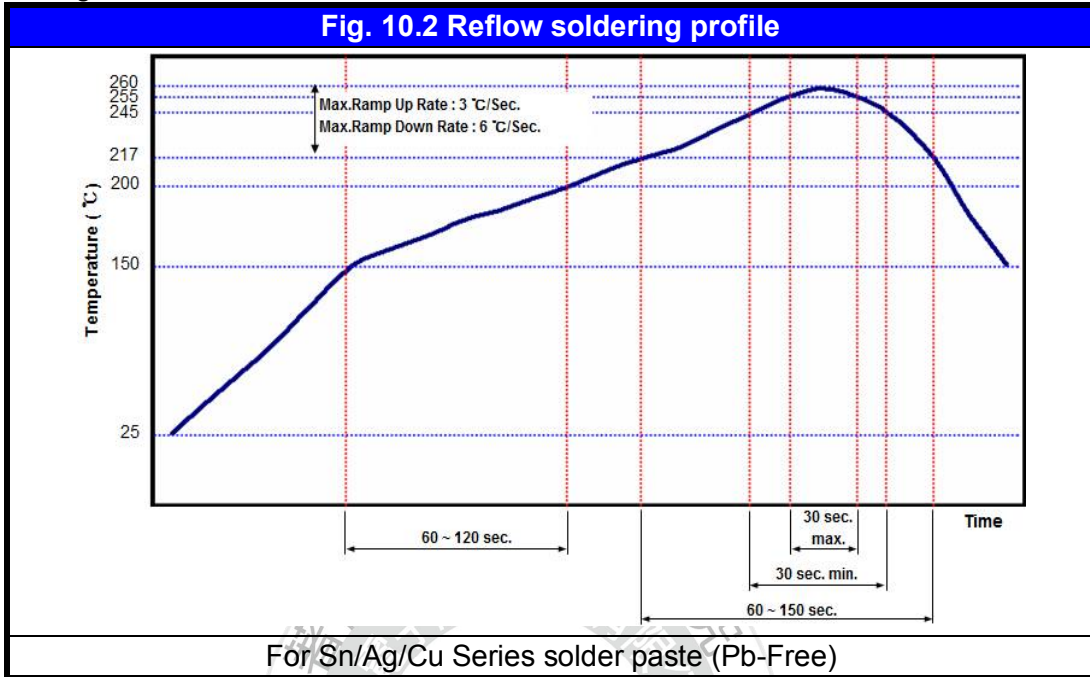
* The tip of iron should not contact the ceramic body directly.

* The Capacitors shall be cooled gradually at room temperature after soldering.

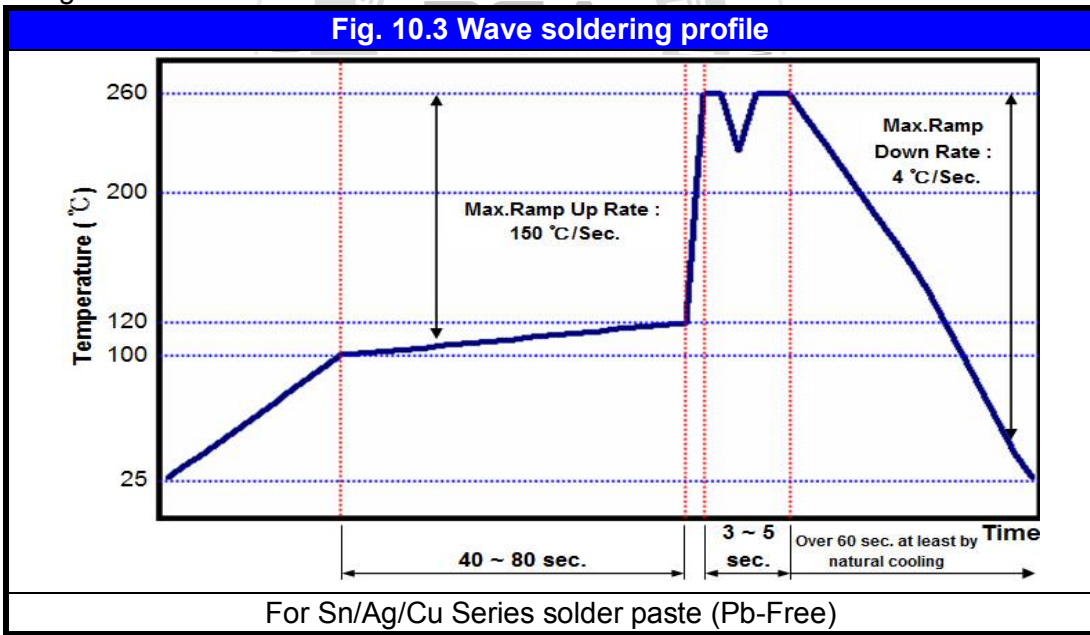
* Forced air cooling is not allowed.

10. APPLICATION NOTES

b.) Reflow soldering :



c.) Wave soldering :



Soldering conditions :

Class I :

Size Inch (mm)	Temper. Cher.	Capacitance	Condition	
			Wave	Reflow
≤0402(1005)	Class I - C0G	All	X	O
0603(1608)	Class I - C0G	All	O	O
0805(2012)	Class I - C0G	All	O	O
1206(3216)	Class I - C0G	All	O	O
≥1210(3225)	Class I - C0G	All	X	O

10. APPLICATION NOTES

Soldering conditions :

Class II :

Size Inch (mm)	Temper. Cher.	Capacitance	Condition	
			Wave	Reflow
≤0402(1005)	Class II - X7R	All	X	O
0603 (1608)	Class II - X7R	Cap. <2.2μF	O	O
		Cap. ≥2.2μF	X	O
0805 (2012)	Class II - X7R	Cap. <4.7μF	O	O
		Cap. ≥4.7μF	X	O
1206 (3216)	Class II - X7R	Cap. <4.7μF	O	O
		Cap. ≥4.7μF	X	O
≥1210 (3225)	Class II - X7R	All	X	O

Soldering height :

The solder climbing minimum height is suggesting to 25% of chip thickness or 500um whichever is less.
 (Reference from IPC-610E)

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.

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.

Notice of MG Series

The AUTOMOTIVE series capacitors are mainly used on general automotive equipment without safety considerations. Please select SAFETY concern type or contact our company in advanced if you intend to use capacitor for designing the equipment which may damage itself and the safety of third party. If necessary, please consider to add the protect circuit in devising process and obtaining fully safety evaluation. The contents of the acknowledgments only used for our parent company, marketing subsidiaries and official marketing agents who purchase our products. Not applicable for the other nonofficial channels.