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Messrs. : _____

Date : _____

APPROVAL SHEET

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

Part No. : _____ MG Series

Description : Size 0402 to 1812, C0G/X7R/X5R, 6.3Vdc to 630Vdc,
RoHS Compliant

PREPARED BY	APPROVED BY

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SPECIFICATION

FOR

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without AEC-Q200

Part No. : MG Series

Description : Size 0402 to 1812, C0G/X7R/X5R, 6.3Vdc to 630Vdc,
RoHS Compliant

SPEC. No.	: <u>MG-000-001-01</u>
DATE	:

RAWN BY	CHECEKED BY	APPROVED BY
Angel Liu	Yvens Chou	Ryan Chen

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 (0603 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.
- For Automotive electronic equipment.

4. HOW TO ORDER

MG	31	X	471	K	251	P	X	G
PDC Family	Size	Dielectric	Capacitance	Tolerance	Rated voltage	Packaging	Thickness	Control Code
Table1.	Table2	Table3	Table4	Table5	Table6	Table7	Table8	Table9

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

Table 2	Size					
Code	Description	Code	Description	Code	Description	
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)	
31	1206 (3216)	46	1825 (4563)			

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

Table 4	Table 4 Capacitance Rule Code			
Code	Description	Code	Description	
R47	0.47pF	102	102=10x10 ² =1000pF	
OR5	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 %			
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)	
0402 (1005)	1.00±0.10	0.50±0.10	See No.4 Reference Table 8	0.25 +0.05/0.10	
0603 (1608)	1.60±0.15	0.80±0.15		0.40±0.15	
0805 (2012)	2.00±0.20	1.25±0.20		0.50±0.20	
1206 (3216)	3.20±0.20	1.60±0.20		0.60±0.20	
1210 (3225)	3.20±0.30	2.50±0.30		0.75±0.35	
1808 (4520)	4.50±0.40	2.00±0.25		0.75±0.35	
1812 (4532)	4.50±0.40	3.20±0.30		0.75±0.35	

6. GENERAL ELECTRICAL DATA

Dielectric	NPO	X7R	X5R
Size	0402, 0603, 0805, 1206, 1210, 1812		
Capacitance range*	0.5pF 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%) 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, 50V
Tan δ*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000	Note 1	
Insulation resistance at Ur	≥10GΩ or RxC≥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	≤2.5%	≤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%	≤10% 0805 ≥ 2.2μF; 1210 ≥ 10μF
25V	≤3.5%	≤5% 0201 ≥ 0.01μF; 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	≤3.5%	≤5% 0201 ≥ 0.01μF; 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
		≤15% 0201 ≥ 0.012μF; 0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF
10V	≤5%	≤15% 0201 ≥ 0.1μF; 0402 ≥ 1μF
		≤15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF
		≤20% 0402 ≥ 2.2μF
6.3V	≤10%	---
4V	≤15%	---

7. CAPACITANCE RANGE

7-1 COG

DIELECTRIC	COG																
	0402					0603					0805						
SIZE	10	16	25	50	100	10	16	25	50	100	10	16	25	50	100	200	250
RATED VOLTAGE (VDC)	10	16	25	50	100	10	16	25	50	100	10	16	25	50	100	200	250
0.5pF (0R5)	N	N	N	N	N	S	S	S	S	S	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
0.7pF (0R7)	N	N	N	N	N	S	S	S	S	S	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
0.9pF (0R9)	N	N	N	N	N	S	S	S	S	S	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
1.2pF (1R2)	N	N	N	N	N	S	S	S	S	S	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
1.8pF (1R8)	N	N	N	N	N	S	S	S	S	S	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
2.7pF (2R7)	N	N	N	N	N	S	S	S	S	S	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
3.9pF (3R9)	N	N	N	N	N	S	S	S	S	S	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
5.6pF (5R6)	N	N	N	N	N	S	S	S	S	S	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
8.2pF (8R2)	N	N	N	N	N	S	S	S	S	S	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
12pF (120)	N	N	N	N	N	S	S	S	S	S	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
18pF (180)	N	N	N	N	N	S	S	S	S	S	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
27pF (270)	N	N	N	N	N	S	S	S	S	S	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
39pF (390)	N	N	N	N	N	S	S	S	S	S	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
56pF (560)	N	N	N	N	N	S	S	S	S	S	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
82pF (820)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	A
100pF (101)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	X
120pF (121)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	A	X
150pF (151)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	X	C
180pF (181)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	X	C
220pF (221)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	C	C
270pF (271)	N	N	N	N		S	S	S	S	S	A	A	A	A	A	C	C
330pF (331)	N	N	N	N		S	S	S	S	S	A	A	A	A	A	C	C
390pF (391)	N	N	N	N		S	S	S	S	S	X	X	X	X	X	C	C
470pF (471)	N	N	N	N		S	S	S	S	S	X	X	X	X	X	C	C
560pF (561)	N	N	N	N		S	S	S	S	S	X	X	X	X	X	C	C
680pF (681)	N	N	N	N		S	S	S	S	S	X	X	X	X	X	C	C
820pF (821)	N	N	N	N		S	S	S	S	S	X	X	X	X	X	C	C
1,000pF (102)	N	N	N	N		S	S	S	S	S	X	X	X	X	X	C	C
1,200pF (122)						B	B	B	B		X	X	X	X	X	C	C
1,500pF (152)						B	B	B	B		X	X	X	X	X	C	C
1,800pF (182)						B	B	B	B		X	X	X	X	X	C	C
2,200pF (222)						B	B	B	B		X	X	X	X	X	C	C
2,700pF (272)						B	B	B	B		C	C	C	C	C		
3,300pF (332)						B	B	B	B		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			
0.010uF (103)											C	C	C	C			
0.012uF (123)																	

7.CAPACITANCE RANGE

7-1 COG

DIELECTRIC	COG																			
	SIZE					1206					1210					1812				
	RATED VOLTAGE (VDC)					10	16	25	50	100	10	16	25	50	100	10	16	25	50	100
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
	12pF (120)	X	X	X	X	X									M					C
	15pF (150)	X	X	X	X	X									M					C
	18pF (180)	X	X	X	X	X									M					C
	22pF (220)	X	X	X	X	X	M	M	M	M	M									C
	27pF (270)	X	X	X	X	X	M	M	M	M	M									C
	33pF (330)	X	X	X	X	X	M	M	M	M	M									C
	39pF (390)	X	X	X	X	X	M	M	M	M	M									C
	47pF (470)	X	X	X	X	X	M	M	M	M	M									C
	56pF (560)	X	X	X	X	X	M	M	M	M	M									C
	68pF (680)	X	X	X	X	X	M	M	M	M	M									C
	82pF (820)	X	X	X	X	X	M	M	M	M	M									C
	100pF (101)	X	X	X	X	X	M	M	M	M	M									C
	120pF (121)	X	X	X	X	X	M	M	M	M	M									C
	150pF (151)	X	X	X	X	X	M	M	M	M	M									C
	180pF (181)	X	X	X	X	X	M	M	M	M	M									C
	220pF (221)	X	X	X	X	X	M	M	M	M	M									C
	270pF (271)	X	X	X	X	X	M	M	M	M	M									C
	330pF (331)	X	X	X	X	X	M	M	M	M	M									C
	390pF (391)	X	X	X	X	X	M	M	M	M	M									C
	470pF (471)	X	X	X	X	X	M	M	M	M	M									C
	560pF (561)	X	X	X	X	X	M	M	M	M	M									C
	680pF (681)	X	X	X	X	X	M	M	M	M	M									C
	820pF (821)	X	X	X	X	X	M	M	M	M	M									C
	1,000pF (102)	X	X	X	X	X	M	M	M	M	M	C	C	C	C	C	C	C	C	C
	1,200pF (122)	X	X	X	X	X	M	M	M	M	M	C	C	C	C	C	C	C	C	C
	1,500pF (152)	X	X	X	X	X	M	M	M	M	M	C	C	C	C	C	C	C	C	C
	1,800pF (182)	X	X	X	X	X	M	M	M	M	M	C	C	C	C	C	C	C	C	C
2,200pF (222)	X	X	X	X	X	M	M	M	M	M	C	C	C	C	C	C	C	C	C	
2,700pF (272)	X	X	X	X	X	M	M	M	M	M	C	C	C	C	C	C	C	C	C	
3,300pF (332)	X	X	X	X	X	M	M	M	M	M	C	C	C	C	C	C	C	C	C	
3,900pF (392)	X	X	X	X	X	M	M	M	M	M	C	C	C	C	C	C	C	C	C	
4,700pF (472)	X	X	X	X	X	M	M	M	M	M	C	C	C	C	C	C	C	C	C	
5,600pF (562)	X	X	X	X	X	M	M	M	M	M	C	C	C	C	C	C	C	C	C	
6,800pF (682)	M	M	M	M		M	M	M	M	M	C	C	C	C	C	C	C	C	C	
8,200pF (822)	C	C	C	C		M	M	M	M	M	C	C	C	C	C	C	C	C	C	
0.010μF (103)	C	C	C	C		M	M	M	M	M	C	C	C	C	C	C	C	C	C	
0.012μF (123)						M	M	C	C	C	C	C	C	C	C	C	C	C	C	
0.015μF (153)						M	M	C	C	C	C	C	C	C	C	C	C	C	C	
0.018μF (183)						F	F	F	F	F	C	C	C	C	C	C	C	C	C	
0.022μF (223)						F	F	F	F	F	C	C	C	C	C	C	C	C	C	
0.027μF (273)						F	F	F	F	F	C	C	C	C	C	C	C	C	C	
0.033μF (333)						F	F	F	F	F	C	C	C	C	C	C	C	C	C	
0.039μF (393)																				

7.CAPACITANCE RANGE

7-2 X7R

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
Capacitance	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			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					

7.CAPACITANCE RANGE

7-2 X7R

DIELECTRIC		X7R																				
SIZE		1206						1210						1812								
RATED VOLTAGE (VDC) (VDC)		10	16	25	50	100	200	250	10	16	25	50	100	200	250	10	16	25	50	100	200	250
Capacitance	100pF (101)																					
	120pF (121)																					
	150pF (151)	X	X	X	X	X	C	C														
	180pF (181)	X	X	X	X	X	C	C														
	220pF (221)	X	X	X	X	X	C	C														
	270pF (271)	X	X	X	X	X	C	C														
	330pF (331)	X	X	X	X	X	C	C														
	390pF (391)	X	X	X	X	X	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	M	M	M	M	M	M	M	C	C	C	C	C	C	C
	1,200pF (122)	X	X	X	X	X	C	C	M	M	M	M	M	M	M	C	C	C	C	C	C	C
	1,500pF (152)	X	X	X	X	X	C	C	M	M	M	M	M	M	M	C	C	C	C	C	C	C
	1,800pF (182)	X	X	X	X	X	C	C	M	M	M	M	M	M	M	C	C	C	C	C	C	C
	2,200pF (222)	X	X	X	X	X	C	C	M	M	M	M	M	M	M	C	C	C	C	C	C	C
	2,700pF (272)	X	X	X	X	X	C	C	M	M	M	M	M	M	M	C	C	C	C	C	C	C
	3,300pF (332)	X	X	X	X	X	C	C	M	M	M	M	M	M	M	C	C	C	C	C	C	C
	3,900pF (392)	X	X	X	X	X	C	C	M	M	M	M	M	M	M	C	C	C	C	C	C	C
	4,700pF (472)	X	X	X	X	X	C	C	M	M	M	M	M	M	M	C	C	C	C	C	C	C
	5,600pF (562)	X	X	X	X	X	C	C	M	M	M	M	M	M	M	C	C	C	C	C	C	C
	6,800pF (682)	X	X	X	X	X	C	C	M	M	M	M	M	M	M	C	C	C	C	C	C	C
	8,200pF (822)	X	X	X	X	X	C	C	M	M	M	M	M	M	M	C	C	C	C	C	C	C
	0.010μF (103)	X	X	X	X	X	C	C	M	M	M	M	M	M	M	C	C	C	C	C	C	C
	0.012μF (123)	X	X	X	X	X	C	C	M	M	M	M	M	M	M	C	C	C	C	C	C	C
	0.015μF (153)	X	X	X	X	X	C	C	M	M	M	M	M	M	M	C	C	C	C	C	C	C
	0.018μF (183)	X	X	X	X	X	C	C	M	M	M	M	M	M	M	C	C	C	C	C	C	C
	0.022μF (223)	X	X	X	X	X	C	C	M	M	M	M	M	M	M	C	C	C	C	C	C	C
	0.027μF (273)	X	X	X	X	X	C	C	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	M	C	C	C	C	C	C	C	C	
0.056μF (563)	X	X	X	X	X	E	E	M	M	M	M	M	M	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					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																	
	0.068μF (683)		N																	
	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	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)																				

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	Class I:NP0	* Shall not exceed the limits given in the detailed spec.																																																																																						
3.	Q/ D.F. (Dissipation Factor)	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%	NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C 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">≤ 2.5%</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 rowspan="3">35V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10%</td> <td>0805 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="2">≤ 5%</td> <td>0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>0603 ≥ 0.33μF; 1206 ≥ 4.7μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 3.5%</td> <td rowspan="2">≤ 10%</td> <td>0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td>0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 5%</td> <td>0402 ≥ 0.22μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤ 3.5%</td> <td rowspan="2">≤ 10%</td> <td>0201 ≥ 0.012μF; 0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤ 5%</td> <td rowspan="2">≤ 10%</td> <td>0201 ≥ 0.012μF; 0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤ 10%</td> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td>4V</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>16V (C≥1.0μF)</td> <td>9%</td> <td>12.5%</td> <td>0402 ≥ 0.22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">12.5%</td> <td>20%</td> <td>0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF</td> </tr> <tr> <td>---</td> <td>---</td> </tr> <tr> <td>6.3V</td> <td>20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 50V	≤ 2.5%	≤ 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%	≤ 10%	0805 ≥ 2.2μF; 1210 ≥ 10μF	≤ 5%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF	0603 ≥ 0.33μF; 1206 ≥ 4.7μF	25V	≤ 3.5%	≤ 10%	0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	≤ 5%	0402 ≥ 0.22μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series	16V	≤ 3.5%	≤ 10%	0201 ≥ 0.012μF; 0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; TT series	0201 ≥ 0.1μF; 0402 ≥ 1μF	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series	10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF; 0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; TT series	0201 ≥ 0.1μF; 0402 ≥ 1μF	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series	6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series	≤ 20%	0402 ≥ 2.2μF	4V	≤ 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	16V (C≥1.0μF)	9%	12.5%	0402 ≥ 0.22μF	10V	12.5%	20%	0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF	---	---	6.3V	20%	---	---
Rated vol.	D.F. ≤	Exception of D.F. ≤																																																																																							
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Rated vol.	D.F. ≤	Exception of D.F. ≤																																																																																							
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6.3V	20%	---	---																																																																																						
4.	Dielectric Strength	* To apply voltage (≤100V) 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.	10GΩ or RxC ≥ 500Ω-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 ≥ 100 Ω-F whichever is smaller.</td> </tr> <tr> <td>16V:0402≥0.22μF</td> </tr> <tr> <td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF; 0805≥2.2μF;1206≥4.7μF;1210≥47μF</td> </tr> <tr> <td>6.3V</td> </tr> </tbody> </table>	Rated voltage	Insulation Resistance	100V: X7R	10GΩ or RxC ≥ 100 Ω-F whichever is smaller.	16V:0402≥0.22μF	10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF; 0805≥2.2μF;1206≥4.7μF;1210≥47μF	6.3V																																																																															
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8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements															
7.	Adhesive Strength of Termination	Pressurizing force : 5N (≤ 0603) and 10N (>0603) Test time: 10 \pm 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 \pm 2 hrs.	* No remarkable damage. * Cap change and Q/D.F.: To meet initial spec.															
9.	Solderability	* Solder temperature: 235 \pm 5 $^{\circ}$ C * Dipping time: 2 \pm 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 \pm 1 sec. * Measurement to be made after keeping at room temp. for 24 \pm 2 hrs.	* No remarkable damage. * Cap change : NP0: within \pm 5% or 0.5pF whichever is larger X7R, X5R: within \pm 12.5% Y5V: within \pm 30% (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 \pm 5 $^{\circ}$ C * Dipping time: 10 \pm 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 24 \pm 2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24 \pm 2 hrs.	* No remarkable damage. * Cap change: NP0: within \pm 2.5% or 0.25pF whichever is larger X7R, X5R: within \pm 7.5% Y5V: within \pm 20% * 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" data-bbox="341 1200 778 1350"> <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> * Before initial measurement (Class II only): Perform 150+0/-10 $^{\circ}$ C for 1 hr and then set for 24 \pm 2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24 \pm 2 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	No remarkable damage. Cap change : NP0: within \pm 2.5% or 0.25pF whichever is larger X7R, X5R: within \pm 7.5% Y5V: within \pm 20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements.
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8.RELIABILITY TEST CONDITIONS AND REQUIREMENTS

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13.	Humidity (Damp Heat) Steady State	* Test temp.: 40±2°C	* No remarkable damage.																																												
		* Humidity: 90~95% RH	* Cap change:																																												
		* Test time: 500+24/-0hrs.	NP0: within ±5% or 0.5pF whichever is larger																																												
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		* Measurement to be made after keeping at room temp. for 24±2 hrs.	**10V:0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25%; Y5V: ≥10V, within ±30%; 6.3V, within +30/-40%																																												
			* Q/D.F. value:																																												
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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: 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% Q/D.F. value: NP0: C≥30pF,Q≥200;C<30pF, Q≥100+10/3C X7R, X5R:																																												
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8.RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No	Item	Test Condition	Requirements																																																									
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 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.	* 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 ≥ 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:																																																									
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		<p>*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.</p> <p>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="6">1GΩ or RxC ≥ 10 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: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF</td> </tr> <tr> <td>6.3V; 4V</td> <td></td> </tr> </tbody> </table>	Rated voltage	Insulation Resistance	100V: X7R	1GΩ or RxC ≥ 10 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: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF	6.3V; 4V																																																
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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

9.1. EMBOSSED TAPE DIMENSIONS

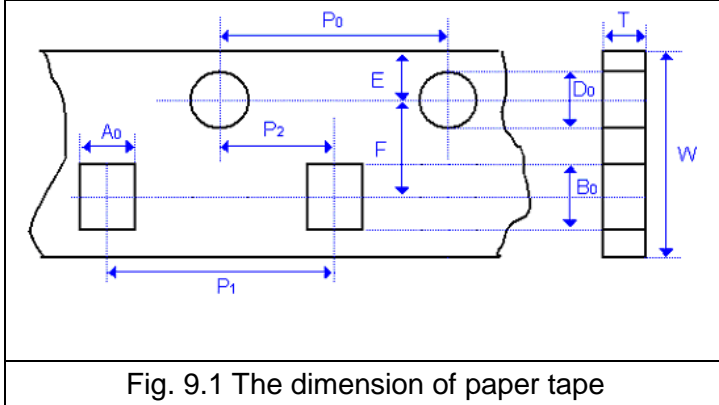


Fig. 9.1 The dimension of paper tape

9.2. EMBOSSED TAPE DIMENSIONS

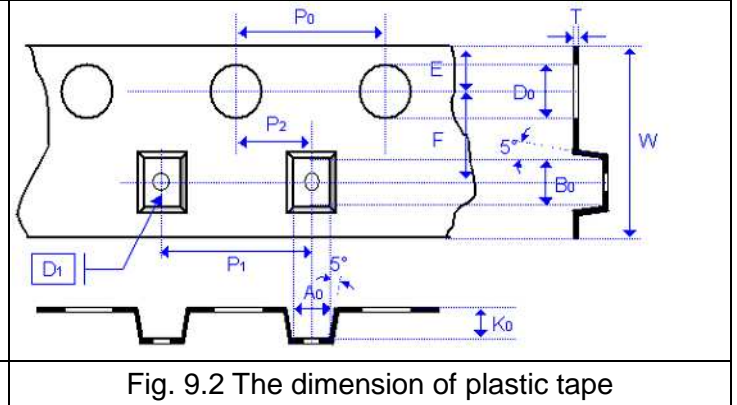


Fig. 9.2 The dimension of plastic tape

Size	0402	0603		0805	
Chip Thickness	0.50±0.10	0.80±0.07	0.80+0.15/-0.1	0.80±0.10	1.25±0.10 1.25±0.20
A ₀	0.70 +/-0.2	1.00+0.05/-0.1	1.02+0.05/-0.1	1.50±0.10	<1.65
B ₀	1.20 +/-0.2	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+/-0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10
P ₀	4+/-0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
10xP ₀	40+/-0.10	40.00±0.2	40.00±0.2	40.00±0.2	40.00±0.20
P ₁	2+/-0.05	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
P ₂	2+/-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	3.5+/-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±0.100	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	40.0±0.10	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+/-0.1
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
	7"	7"	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
W₁	8.4 +1.5/-0	12.4 +2.0/-0	8.4 +1.5/-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

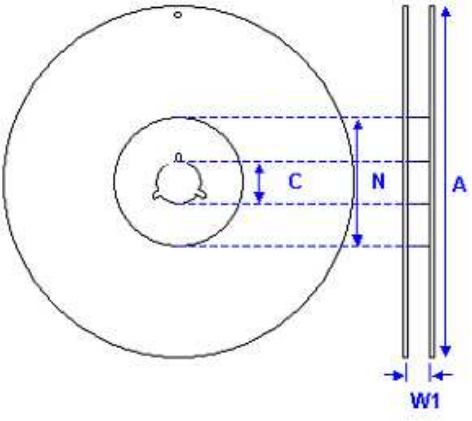


Fig. 4 The dimension of reel

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.

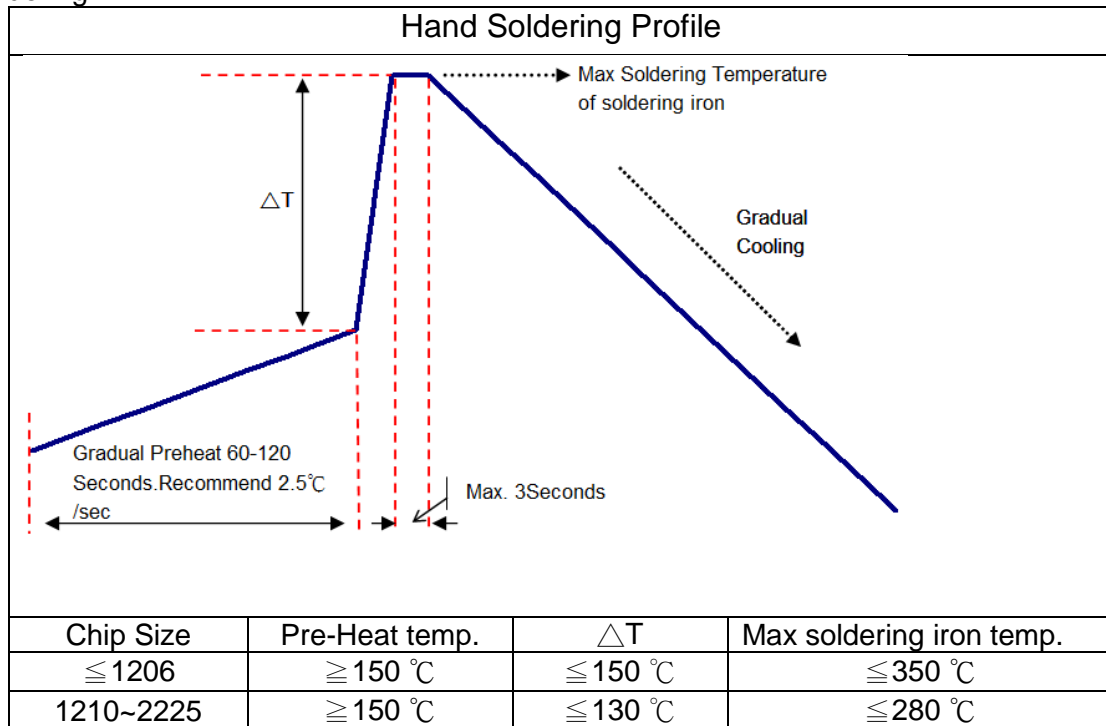
PREHEAT

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 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.

a.) Hand soldering:



*Soldering iron tip diameter $\leq 1.0\text{ mm}$ 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.

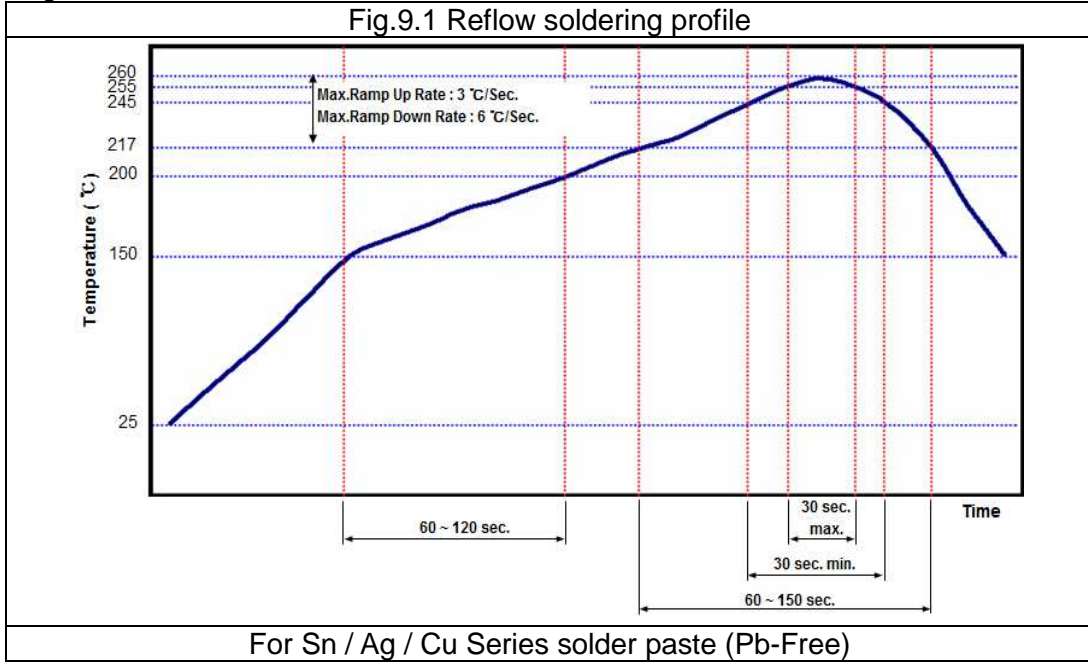
*The tip of iron should not contact the ceramic body directly.

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

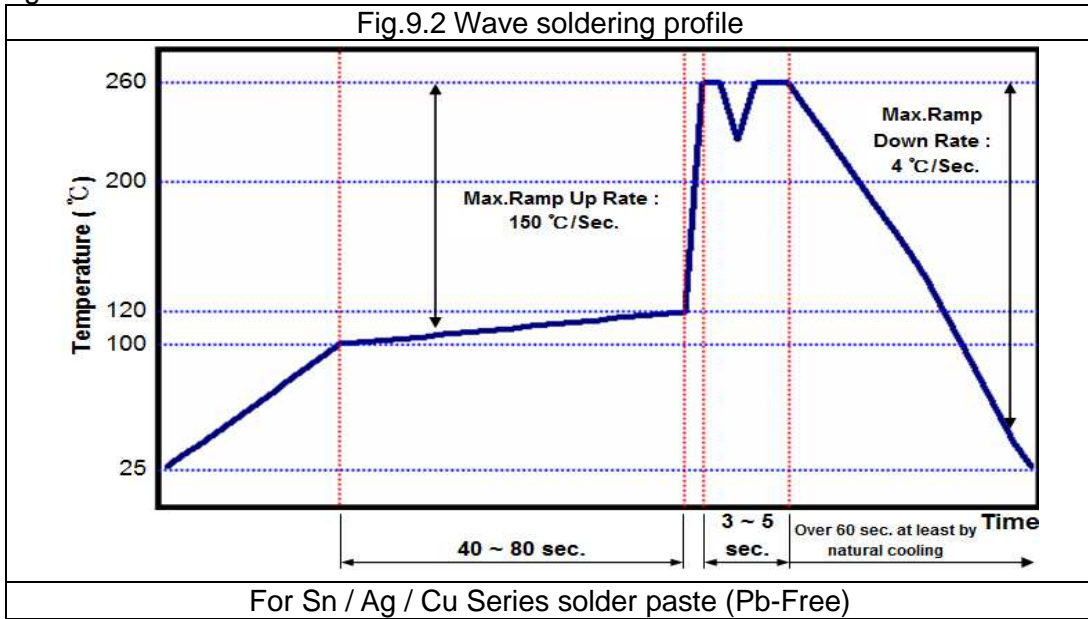
*Forced air cooling is not allowed.

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	○
0603 (1608)	Class I - C0G	All	○	○
0805 (2012)	Class I - C0G	All	○	○
1206 (3216)	Class I - C0G	All	○	○
≥ 1210 (3225)	Class I - C0G	All	X	○

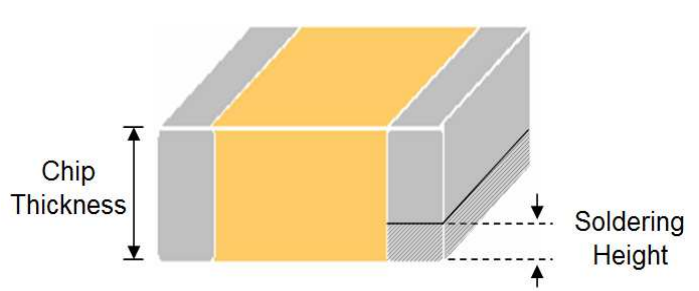
10. APPLICATION NOTES

Soldering conditions:

Class II:

Size Inch (mm)	Temper. Cher.	Capacitance	Condition	
			Wave	Reflow
0402 (1005)	Class II - X7R	All	X	○
0603 (1608)	Class II - X7R	Cap. < 2.2 μ F	○	○
		Cap. \geq 2.2 μ F	X	○
0805 (2012)	Class II - X7R	Cap. < 4.7 μ F	○	○
		Cap. \geq 4.7 μ F	X	○
1206 (3216)	Class II - X7R	Cap. < 4.7 μ F	○	○
		Cap. \geq 4.7 μ F	X	○
\geq 1210 (3225)	Class II - X7R	All	X	○

Soldering height:

<p>The solder climbing minimum height is suggesting to 25% of chip thickness or 500μm whichever is less. (Reference from IPC-610E)</p>	 <p>The diagram illustrates a cross-section of a chip (yellow) on a substrate (grey). A vertical double-headed arrow on the left indicates the 'Chip Thickness'. A horizontal dashed line with a vertical arrow pointing up from the substrate surface indicates the 'Soldering Height'.</p>
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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.