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Messrs. : 一般共用

Date : 2020/01/31

APPROVAL SHEET

Product Name : Automotive General Multilayer Ceramic Capacitors

Part No. : MT Series

Description : AEC-Q200 Size 0201~1210, C0G/X7R, 10Vdc~1000Vdc

PREPARED BY	APPROVED BY

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SPECIFICATION

FOR

Product Name : Automotive General Multilayer Ceramic Capacitors

Part No. : MT Series

Description : AEC-Q200 Size 0201~1210, C0G/X7R, 10Vdc~1000Vdc

SPEC. No. : MT-000-002-07
DATE : 2020/01/31

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 MT series MLCC is made by X7R dielectrics and which provides product with high electrical precision, stability and reliability. Besides, MT series MLCC is tighten controlling in quality in line to assure quality performance in automotive applications and qualified to AEC-Q200.

2. FEATURES

a. A wide selection of sizes is available (0201 to 1210).
b. High capacitance in given case size.
c. Capacitor with lead-free termination (pure Tin).
d. The MT series meet AEC-Q200 requirement.

3. APPLICATIONS

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

4. HOW TO ORDER

MT	31	X	471	K	251	E	C	G
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
MT	Automotive Capacitor Qualified to AEC-Q200

Table 2 Size

Code	Description	Code	Description	Code	Description
03	0201(0603)	18	0603(1608)	31	1206(3216)
15	0402(1005)	21	0805(2012)	32	1210(3225)

Table 3 Dielectric Material Characteristics

Code	Description	Code	Description
N	C0G	X	X7R

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	$106=10x10^6=10\mu F$

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	500	50Vdc	401	400Vdc
100	10Vdc	101	100Vdc	501	500Vdc
160	16Vdc	201	200Vdc	631	630Vdc
250	25Vdc	251	250Vdc	102	1000Vdc

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)
0201(0603)	0.60±0.03	0.30±0.03	See No.4 Reference Table 8	0.15±0.05
0402(1005)	1.00±0.10	0.50±0.10		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 3.30±0.30*	1.60±0.20 1.60 +0.3/-0.1#		0.60±0.20
1210(3225)	3.20±0.30 3.30±0.40*	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

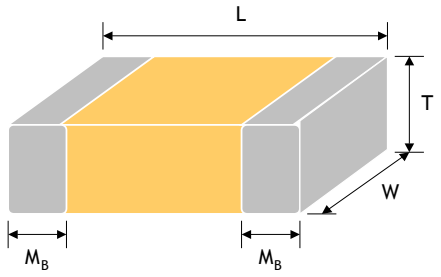

Fig. 5.1 The outline of MLCC

"*" for ≥ 1KV products. "#" for P thickness products.

6. GENERAL ELECTRICAL DATA

Dielectric	C0G	X7R
Size	0201, 0402, 0603, 0805, 1206, 1210	0402, 0603, 0805, 1206, 1210
Rated voltage (WVDC)	10V, 16V, 25V, 50V, 100V, 200V, 250V, 500V, 630V, 1000V	
Capacitance range*	0.1pF ~ 47nF	100pF ~ 2.2μF
Capacitance tolerance	Reference to Table 5	
Tan δ	**Cap. Range** / **Q Spec.** Cap.<30pF: Q≥400+20C Cap.≥30pF: Q≥1000	Follow No.17 of 8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS
Capacitance & Tan δ Test condition	Measured at the condition of 30~70% related humidity	
	For 25°C at ambient temperature	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
	Cap. Range / **Test Condition** Cap.≤1000pF: 1.0±0.2Vrms, 1.0MHz±10% Cap.>1000pF: 1.0±0.2Vrms, 1.0KHz±10%	1.0±0.2Vrms, 1.0KHz±10%, at 25°C ambient temperature
Insulation resistance at Ur	≥10GΩ or RxC≥500Ω-F, whichever is smaller	Follow No.17 of 8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS
Operating temperature	-55°C to +125°C	
Capacitance characteristic	±30ppm/°C	±15%
Termination	Cu/Ni/Sn (lead-free termination)	

7. CAPACITANCE RANGE

7-1. C0G

Cap(pF)	EIA Size	0201					0402					0603							0805								
	Code	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V	200V	250V	10V	16V	25V	50V	100V	200V	250V	500V	630V
0.1	0R1	L	L	L	L	L	N	N	N	N	N																
0.2	0R2	L	L	L	L	L	N	N	N	N	N																
0.3	0R3	L	L	L	L	L	N	N	N	N	N																
0.4	0R4	L	L	L	L	L	N	N	N	N	N																
0.5	0R5	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
1.0	1R0	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
1.2	1R2	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
1.5	1R5	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
1.8	1R8	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
2.2	2R2	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
2.7	2R7	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
3.3	3R3	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
3.9	3R9	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
4.7	4R7	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
5.6	5R6	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
6.8	6R8	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
8.2	8R2	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
10	100	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
12	120	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
15	150	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
18	180	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
22	220	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
27	270	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
33	330	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
39	390	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
47	470	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
56	560	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
68	680	L	L	L	L		N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A
82	820	L	L	L	L		N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	A	A	X	X
100	101	L	L	L	L		N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	X	X	X	X
120	121	L	L	L	L		N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	X	X	C	C
150	151						N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	C	C	C	C
180	181						N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	C	C	C	C
220	221						N	N	N	N	N	S	S	S	S	S	S	S	A	A	A	A	A	C	C	C	C
270	271						N	N	N	N		S	S	S	S	S	B	B	A	A	A	A	A	C	C	C	C
330	331						N	N	N	N		S	S	S	S	S	B	B	A	A	A	A	A	C	C	C	C
390	391						N	N	N	N		S	S	S	S	S	B	B	X	X	X	X	X	C	C	C	C
470	471						N	N	N	N		S	S	S	S	S	B	B	X	X	X	X	X	C	C	I	I
560	561						N	N	N	N		S	S	S	S	S			X	X	X	X	X	C	C	I	I
680	681						N	N	N	N		S	S	S	S	S			X	X	X	X	X	C	C	I	I
820	821						N	N	N	N		S	S	S	S	S			X	X	X	X	X	C	C	I	I
1000	102						N	N	N	N		S	S	S	S	S			X	X	X	X	X	C	C	I	I
1200	122											B	B	B	B				X	X	X	X	X	C	C		
1500	152											B	B	B	B				X	X	X	X	X	C	C		
1800	182											B	B	B	B				X	X	X	X	X	C	C		
2200	222											B	B	B	B				X	X	X	X	X	C	C		
2700	272											B	B	B	B				C	C	C	C	C				
3300	332											B	B	B	B				C	C	C	C	C				
3900	392																		C	C	C	C	C				
4700	472																		C	C	C	C	C				
5600	562																		C	C	C	C	C				
6800	682																		C	C	C	C	C				
8200	822																		C	C	C	C					
10000	103																		C	C	C	C					
12000	123																										
15000	153																										
18000	183																										
22000	223																										
27000	273																										
33000	333																										
39000	393																										
47000	473																										
56000	563																										
68000	683																										
82000	823																										
100000	104																										

7. CAPACITANCE RANGE

7-1. C0G

Cap(pF)	EIA Size	1206										1210									
	Code	10V	16V	25V	50V	100V	200V	250V	500V	630V	1000V	10V	16V	25V	50V	100V	200V	250V	500V	630V	1000V
1.2	1R2	X	X	X	X	X	X	X	X	X											
1.5	1R5	X	X	X	X	X	X	X	X	X	X										
1.8	1R8	X	X	X	X	X	X	X	X	X	X										
2.2	2R2	X	X	X	X	X	X	X	X	X	X										
2.7	2R7	X	X	X	X	X	X	X	X	X	X										
3.3	3R3	X	X	X	X	X	X	X	X	X	X										
3.9	3R9	X	X	X	X	X	X	X	X	X	X										
4.7	4R7	X	X	X	X	X	X	X	X	X	X										
5.6	5R6	X	X	X	X	X	X	X	X	X	X										
6.8	6R8	X	X	X	X	X	X	X	X	X	X										
8.2	8R2	X	X	X	X	X	X	X	X	X	X										
10	100	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M
12	120	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M
15	150	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M
18	180	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M
22	220	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M
27	270	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M
33	330	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M
39	390	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M
47	470	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M
56	560	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M
68	680	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M
82	820	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	M
100	101	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	C
120	121	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	C
150	151	X	X	X	X	X	X	X	X	X	C	M	M	M	M	M	M	M	M	M	C
180	181	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	C
220	221	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	E
270	271	X	X	X	X	X	X	M	M	M	E	M	M	M	M	M	M	M	M	M	E
330	331	X	X	X	X	X	X	M	M	M	E	M	M	M	M	M	M	M	M	M	E
390	391	X	X	X	X	X	X	M	M	M	E	M	M	M	M	M	M	M	M	M	E
470	471	X	X	X	X	X	M	M	M	M	E	M	M	M	M	M	M	M	M	M	E
560	561	X	X	X	X	X	M	C	C	C	E	M	M	M	M	M	M	M	M	M	E
680	681	X	X	X	X	X	M	C	C	C	E	M	M	M	M	M	M	M	M	M	E
820	821	X	X	X	X	X	M	E	E	E	E	M	M	M	M	M	M	M	M	M	E
1000	102	X	X	X	X	X	M	E	E	E	E	M	M	M	M	M	C	C	C	C	E
1200	122	X	X	X	X	X	M	E	E	E		M	M	M	M	M	C	C	C	C	
1500	152	X	X	X	X	X	C	E	E	E		M	M	M	M	M	C	C	C	C	
1800	182	X	X	X	X	X	C	E	E	E		M	M	M	M	M	C	C	C	C	
2200	222	X	X	X	X	X	C	E	E	E		M	M	M	M	M	C	C	C	C	
2700	272	X	X	X	X	X	C	E	E	E		M	M	M	M	M	C	C	C	C	
3300	332	X	X	X	X	X	C	E	E	E		M	M	M	M	M	C	C	C	C	
3900	392	X	X	X	X	X	C	E	E	E		M	M	M	M	M	C	C	C	C	
4700	472	X	X	X	X	X	C	E	E	E		M	M	M	M	M	E	E			
5600	562	X	X	X	X	X						M	M	M	M	M	E	E			
6800	682	M	M	M	M	M						M	M	M	M	M	E	E			
8200	822	C	C	C	C	C						M	M	M	M	M	E	E			
10000	103	C	C	C	C	C						M	M	M	M	M	E	E			
12000	123											C	C	C	C	C					
15000	153											C	C	C	C	C					
18000	183											F	F	F	F	F					
22000	223											F	F	F	F	F					
27000	273											F	F	F	F	F					
33000	333											F	F	F	F	F					
39000	393											F	F	F	F	F					
47000	473											F	F	F	F	F					
56000	563																				
68000	683																				
82000	823																				
100000	104																				

7. CAPACITANCE RANGE

7-2. X7R

Cap(pF)	EIA Size	0201				0402				0603					0805								
	Code	10V	16V	25V	50V	10V	16V	25V	50V	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V	200V	250V	500V	630V
100	101	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
120	121	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
150	151	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
180	181	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
220	221	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
270	271	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
330	331	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
390	391	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
470	471	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
560	561	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
680	681	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
820	821	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
1000	102	L	L	L	L	N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
1200	122	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
1500	152	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
1800	182	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
2200	222	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
2700	272	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
3300	332	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
3900	392	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	X	X
4700	472	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	X	X	C	C
5600	562	L	L	L		N	N	N	N	S	S	S	S	S	X	X	X	X	X	C	C	C	C
6800	682	L				N	N	N	N	S	S	S	S	S	X	X	X	X	X	C	C	C	C
8200	822	L				N	N	N	N	S	S	S	S	S	X	X	X	X	X	C	C	C	C
10000	103	L				N	N	N	N	S	S	S	S	S	X	X	X	X	X	C	C	C	C
12000	123					N	N	N		S	S	S	S	B	X	X	X	X	X	C	C		
15000	153					N	N	N		S	S	S	S	B	X	X	X	X	X	C	C		
18000	183					N	N	N		S	S	S	S	B	X	X	X	X	X	C	C		
22000	223					N	N	N		S	S	S	S	B	X	X	X	X	X	C	C		
27000	273					N	N	N		S	S	S	S	B	X	X	X	X	C				
33000	333					N	N	N		S	S	S	B	B	X	X	X	X	C				
39000	393					N	N	N		S	S	S	B	B	X	X	X	X	C				
47000	473					N	N	N		S	S	S	B	B	X	X	X	X	C				
56000	563					N	N			S	S	S	B		X	X	X	X	C				
68000	683					N	N			S	S	S	B		X	X	X	X	C				
82000	823					N	N			S	S	S	B		X	X	X	C	C				
100000	104					N	N			S	S	S	B		X	X	X	C	C				
120000	124									B	B	B			X	X	X	C					
150000	154									B	B	B	B		C	C	C	C					
180000	184									B	B	B			C	C	C	C					
220000	224									B	B	B	B		C	C	C	C/I					
270000	274														C	C	C						
330000	334									B	B	B	B		C	C	C						
390000	394														C	C	C						
470000	474														C	C	C						
560000	564														C	C	C						
680000	684														C	C	C						
820000	824														C	C	C						
1000000	105														C	C	C						

7. CAPACITANCE RANGE

7-2. X7R

Cap(pF)	EIA Size	1206									1210							
	Code	10V	16V	25V	50V	100V	200V	250V	500V	630V	10V	16V	25V	50V	100V	250V	500V	1000V
100	101						C	C	C	C						C	C	C
120	121						C	C	C	C						C	C	C
150	151	X	X	X	X	X	C	C	C	C						C	C	C
180	181	X	X	X	X	X	C	C	C	C						C	C	C
220	221	X	X	X	X	X	C	C	C	C						C	C	C
270	271	X	X	X	X	X	C	C	C	C						C	C	C
330	331	X	X	X	X	X	C	C	C	C						C	C	C
390	391	X	X	X	X	X	C	C	C	C						C	C	C
470	471	X	X	X	X	X	C	C	C	C						C	C	C
560	561	X	X	X	X	X	C	C	C	C						C	C	C
680	681	X	X	X	X	X	C	C	C	C						C	C	C
820	821	X	X	X	X	X	C	C	C	C						C	C	C
1000	102	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	C
1200	122	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	C
1500	152	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	C
1800	182	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	C
2200	222	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	C
2700	272	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	C
3300	332	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	C
3900	392	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	E
4700	472	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	E
5600	562	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	E
6800	682	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	E
8200	822	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	E
10000	103	X	X	X	X	X	C	C	C	C	M	M	M	M	M	M	C	E
12000	123	X	X	X	X	X	C	C			M	M	M	M	M	M	C	
15000	153	X	X	X	X	X	C	C			M	M	M	M	M	M	C	
18000	183	X	X	X	X	X	C	C			M	M	M	M	M	M	C	
22000	223	X	X	X	X	X	C	C			M	M	M	M	M	M	C	
27000	273	X	X	X	X	X					M	M	M	M	M	M		
33000	333	X	X	X	X	X					M	M	M	M	M	M		
39000	393	X	X	X	X	X					M	M	M	M	M	M		
47000	473	X	X	X	X	X					M	M	M	M	M	C		
56000	563	X	X	X	X	X					M	M	M	M	M			
68000	683	X	X	X	X	X					M	M	M	M	M			
82000	823	X	X	X	X	C					M	M	M	M	M			
100000	104	X	X	X	X	C					M	M	M	M	M			
120000	124	X	X	X	X	C					M	M	M	M				
150000	154	M	M	M	M	E					M	M	M	M				
180000	184	M	M	M	M	E					M	M	M	M				
220000	224	M	M	M	M	E					M	M	M	M				
270000	274	M	M	M	C						M	M	M	M				
330000	334	M	M	M	C						M	M	M	C				
390000	394	M	M	J	P						M	M	M	C				
470000	474	J	J	J	P						M	M	M	C				
560000	564	J	J	J	P						C	C	C	C				
680000	684	J	J	J	P						C	C	C	C				
820000	824	J	J	J	P						C	C	C	C				
1000000	105	J	J	J	P						C	C	C	C				
1500000	155											F						
2200000	225											F						

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>1</td><td>Pre-and Post-Stress Electrical Test</td><td>---</td><td></td></tr>
<tr><td>2</td><td>High Temperature Exposure (Storage)
MIL-STD-202
Method 108</td><td>* Test temp. : 150±3°C.
* Unpowered.
* Test time : 1000 +24/-0 hrs.
* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
* Cap. change : C0G within ±2.5% or ±0.25pF, whichever is larger.
X7R within ±12.5%.
* Q/D.F. value :
C0G : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF.
X7R : D.F.≤200% of initial requirement.
* I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller.
Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>I.R.</th></tr>
<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 : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td></tr>
<tr><td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td></tr>
</table></td></tr>
<tr><td>3</td><td>Destructive Physical Analysis
EIA-469</td><td>Per EIA-469.</td><td>* No defects or abnormalities.</td></tr>
<tr><td>4</td><td>Temperature Cycling
JESD22
Method JA-104</td><td>* Conduct 1000 cycles according to the temperatures and time.
<table>
<tr><th>Step</th><th>Temp.(°C)</th><th>Time(min.)</th></tr>
<tr><td>1</td><td>-55°C +0/-3</td><td>30±1</td></tr>
<tr><td>2</td><td>+125°C +3/-0</td><td>30±1</td></tr>
</table>
* Before initial measurement (X7R 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.</td><td>* No remarkable damage.
* Cap. change : C0G within ±2.5% or 0.25pF, whichever is larger.
X7R within ±10.0%.
* Q/D.F. value :
C0G : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF.
X7R : D.F.≤200% of initial requirement.
* I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller.
Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>I.R.</th></tr>
<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 : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td></tr>
<tr><td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td></tr>
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8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>5</td><td>Moisture Resistance
MIL-STD-202
Method 106</td><td>* Test temp. : 25~65°C.
* Humidity : 80~100% RH.
* Test time : 10 cycles, t=24hrs/cycle.
* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
* Cap. change : C0G within ±3.0% or 0.30pF, whichever is larger.
X7R within ±12.5%.
* 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 : D.F.≤200% of initial requirement.
* I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller.
Class II (X7R)
<table><tr><th>Rated voltage</th><th>I.R.</th></tr><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 : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td></tr><tr><td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td></tr></table></td></tr>
<tr><td>6</td><td>Biased Humidity
MIL-STD-202
Method 103</td><td>* Test temp. : 85±3°C.
* Humidity : 85±5%RH.
* Test time : 1000 +24/-0 hrs.
* To apply voltage : Rated voltage (max. 100Vdc) and 1.3~1.5Vdc (add 100k ohm resistor).
* 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.
* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
* Cap. change : C0G within ±3.0% or 0.30pF, whichever is larger.
X7R within ±12.5%.
* Q/D.F. value :
C0G : Q≥200 for Cap.≥30pF, Q≥100+10/3C for Cap.<30pF.
X7R : D.F.≤200% of initial requirement.
* I.R. : ≥1GΩ or RxC≥50Ω-F, whichever is smaller.
Class II (X7R) for rated voltage test
<table><tr><th>Rated voltage</th><th>I.R.</th></tr><tr><td>≥100V : All X7R</td><td rowspan="6">≥500MΩ or RxC≥5Ω-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 : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td></tr><tr><td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td></tr></table>Class II (X7R) for 1.3~1.5Vdc test
<table><tr><th>Rated voltage</th><th>I.R.</th></tr><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 : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td></tr><tr><td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td></tr></table></td></tr>
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8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>7</td><td>Operational Life
MIL-STD-202
Method 108</td><td>* Test temp. : 125±3°C.
* To apply voltage : Full rated voltage.
* Test time : 1000 +24/-0 hrs.
* Before initial measurement (X7R only) : Apply rated voltage for 1 hr at 125°C. Remove and let set for 24±2 hrs at room temp.
* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
* Cap. change : C0G within ±3.0% or ±0.3pF, whichever is larger.
X7R within ±12.5%.
* 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 : D.F.≤200% of initial requirement.
* I.R. : ≥1GΩ or RxC≥50Ω-F, whichever is smaller.
Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>I.R.</th></tr>
<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 : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td></tr>
<tr><td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td></tr>
</table></td></tr>
<tr><td>8</td><td>External Visual
MIL-STD-883
Method 2009</td><td>* Visual inspection.</td><td>* No remarkable defect.</td></tr>
<tr><td>9</td><td>Physical Dimension
JESD22
Method JB-100</td><td>* Using by calipers.</td><td>* Within the specified dimensions.</td></tr>
<tr><td>10</td><td>Resistance to Solvents
MIL-STD-202
Method 215</td><td>* Temperature : 25±5°C.
* Time : 3 +0.5/-0 min.
* Solvent : Iso-propyl alcohol.</td><td>* No remarkable damage.
* Cap. : Within the specified tolerance.
* Q/D.F. value :
C0G : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF.
X7R : D.F.≤100% of initial requirement.
* I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller.
Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>I.R.</th></tr>
<tr><td>≥100V : All X7R</td><td rowspan="6">≥10GΩ or RxC≥100Ω-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 : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td></tr>
<tr><td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td></tr>
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8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>11</td><td>Mechanical Shock
MIL-STD-202
Method 213</td><td>* Peak value : 1500g's.
* Wave : 1/2 sine.
* Velocity : 15.4 ft/sec.
* Three shocks in each direction should be applied along 3 mutually perpendicular axes of the test specimen (18 shocks).</td><td>* No remarkable damage.
* Cap. : Within the specified tolerance.
* Q/D.F. value :
C0G : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF.
X7R : D.F.≤100% of initial requirement.
* I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller.
Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>I.R.</th></tr>
<tr><td>≥100V : All X7R</td><td rowspan="7">≥10GΩ or RxC≥100Ω-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 : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td></tr>
<tr><td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td></tr>
</table></td></tr>
<tr><td>12</td><td>Vibration
MIL-STD-202
Method 204</td><td>* Vibration frequency : 10~2000 Hz/min. (5g's for 20 min.).
* Total amplitude : 1.5mm.
* 12 cycles each of 3 orientations (36 times).</td><td>* No remarkable damage.
* Cap. : Within the specified tolerance.
* Q/D.F. value :
C0G : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF.
X7R : D.F.≤100% of initial requirement.
* I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller.
Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>I.R.</th></tr>
<tr><td>≥100V : All X7R</td><td rowspan="7">≥10GΩ or RxC≥100Ω-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 : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td></tr>
<tr><td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td></tr>
</table></td></tr>
</table>

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>13</td><td>Resistance to Soldering Heat
MIL-STD-202
Method 210</td><td>* Solder temperature : 260±5°C.
* Dipping time : 10±1 sec.
* Before initial measurement (X7R 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.</td><td>* No remarkable damage.
* Cap. change : C0G within ±2.5% or 0.25pF, whichever is larger.
X7R within ±7.5%.
* Q/D.F. value :
C0G : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF.
X7R : D.F.≤100% of initial requirement.
* I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller.
Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>I.R.</th></tr>
<tr><td>≥100V : All X7R</td><td rowspan="6">≥10GΩ or RxC≥100Ω-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 : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td></tr>
<tr><td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td></tr>
</table></td></tr>
<tr><td>14</td><td>Thermal Shock
MIL-STD-202
Method 107</td><td>* Conduct 300 cycles according to the temperatures and time.
<table>
<tr><th>Step</th><th>Temp.(°C)</th><th>Time(min.)</th></tr>
<tr><td>1</td><td>-55°C +0/-3</td><td>15±3</td></tr>
<tr><td>2</td><td>+125°C +3/-0</td><td>15±3</td></tr>
</table>
* Max. transfer time : 20 sec.
* Before initial measurement (X7R 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.</td><td>* No remarkable damage.
* Cap. change : C0G within ±2.5% or 0.25pF, whichever is larger.
X7R within ±10.0%.
* Q/D.F. value :
C0G : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF.
X7R : D.F.≤200% of initial requirement.
* I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller.
Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>I.R.</th></tr>
<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 : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td></tr>
<tr><td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td></tr>
</table></td></tr>
</table>

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>AEC-Q200
Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td>15</td><td>ESD
AEC-Q200-002</td><td>* Per AEC-Q200-002.</td><td>* No remarkable damage.
* Cap. : Within the specified tolerance.
* Q/D.F. value :
C0G : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF.
X7R : D.F.≤100% of initial requirement.
* I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller.
Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>I.R.</th></tr>
<tr><td>≥100V : All X7R</td><td rowspan="6">≥10GΩ or RxC≥100Ω-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 : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td></tr>
<tr><td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td></tr>
</table></td></tr>
<tr><td>16</td><td>Solderability
J-STD-002
JESD22-B102E</td><td>* Condition A
Un-mounted chips 4hrs / 155°C*dry then completely immersed for 5±0.5 sec in solder bath at 245±5°C.
* Condition B
Un-mounted chips steam 8 hrs then completely immersed for 10±1sec in solder bath at 220 +5/-0°C.
* Condition C
Un-mounted chips steam 8 hrs then completely immersed for 10±1 sec. in solder bath at 260 +0/-5°C.</td><td>* All terminations shall exhibit a continuous solder coating free from defects from a minimum of 95% of the critical surface area of any individual termination.</td></tr>
</table>

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>AEC-Q200 Test Condition</th><th>Requirements</th></tr>
<tr><td rowspan="4">17</td><td rowspan="4">Electrical Characterization</td><td>* Capacitance.
* Q/D.F. (Dissipation Factor).
C0G :
Cap.≤1000pF : 1.0±0.2Vrms, 1MHz±10%.
Cap.>1000pF : 1.0±0.2Vrms, 1KHz±10%.
X7R :
Apply 1.0±0.2Vrms, 1.0KHz±10%, at 25°C ambient temperature.</td><td>* Capacitance within the specified tolerance.
* Q/D.F. value :
C0G : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF.
X7R :
<table>
<tr><th>Rated</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<tr><td rowspan="3">≥100V</td><td rowspan="3">≤2.5%</td><td>≤3%</td><td>1206≥0.47μF</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="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>0201≥0.01uF, 1210≥4.7μF</td></tr>
<tr><td>≤10%</td><td>0402≥0.012μF, 0603>0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF</td></tr>
<tr><td>35V</td><td>≤3.5%</td><td>≤10%</td><td>0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≤3.5%</td><td>≤5%</td><td>0201≥0.01μF, 0805≥1μF, 1210≥10μF</td></tr>
<tr><td>≤7%</td><td>0603≥0.33μF, 1206≥4.7μF</td></tr>
<tr><td>≤10%</td><td>0201≥0.1μF, 0402≥0.056μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥6.8μF, 1210≥22μF</td></tr>
<tr><td>≤12.5%</td><td>0402≥0.47μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≤3.5%</td><td>≤5%</td><td>0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF</td></tr>
<tr><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 rowspan="2">10V</td><td rowspan="2">≤5%</td><td>≤10%</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>
<tr><td>≤15%</td><td>0201≥0.1μF, 0402≥1μF</td></tr>
</table></td></tr>
<tr><td>* Insulation Resistance.
To apply rated voltage for max. 120 sec.</td><td>* I.R. : ≥10GΩ or RxC≥500Ω-F, whichever is smaller.
Class II (X7R)
<table>
<tr><th>Rated voltage</th><th>I.R.</th></tr>
<tr><td>≥100V : All X7R</td><td rowspan="6">≥10GΩ or RxC≥100Ω-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 : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td></tr>
<tr><td>10V : 0201≥0.047μF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td></tr>
</table></td></tr>
<tr><td>* Dielectric Strength.
<table>
<tr><th>Rated Vol.(V)</th><th>Condition</th></tr>
<tr><td>≤100</td><td>2.5 times of U_R</td></tr>
<tr><td>100<V≤250</td><td>2.0 times of U_R</td></tr>
<tr><td>250<V≤500</td><td>1.5 times of U_R</td></tr>
<tr><td>630≤V≤1000</td><td>1.2 times of U_R</td></tr>
</table>
* Duration 1~5 sec, charge and discharge current less than 50mA.</td><td>* No evidence of damage or flash over during test.</td></tr>
<tr><td>* Temperature Coefficient (With no electrical load) Operation temperature : -55~125°C at 25°C.</td><td>* Capacitance Change : C0G within ±30ppm/°C.
X7R within ±15%.</td></tr>
</table>

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	AEC-Q200 Test Item	AEC-Q200 Test Condition	Requirements
18	**Board Flex** AEC-Q200-005	* 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 2mm 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 within ±12.5%. (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)
19	**Terminal Strength** AEC-Q200-006	* Pressurizing force : 2N (0402), 5N(0603), 10N(0805), 17.7N(≥1206). * Test time : 60±1 sec.	* No remarkable damage or removal of the terminations. * Capacitance within the specified tolerance. * Q/D.F. value : C0G : Q≥1000 for Cap.≥30pF, Q≥400+20C for Cap.<30pF. X7R : D.F.≤100% of initial requirement.
20	**Beam Load Test** AEC-Q200-003	* Break strength test. * Beam speed : 2.5±0.25 mm/sec.	* The chip endure following force : Chip length ≤2.5mm : Thickness >0.5mm (20N), ≤0.5mm (8N). Chip length ≥3.2mm : Thickness ≥1.25mm (54.5N), <1.25mm (15N).

9. PACKAGE DIMENSION AND QUANTITY

Size	Thickness (mm)	Paper tape		Plastic tape	
		7" reel	13" reel	7" reel	13" reel
0201(0603)	0.30±0.03	15k	70k	-	-
	0.30±0.05	15k	-	-	-
	0.30±0.09	15k	-	-	-
0402(1005)	0.50±0.05	10k	50k	-	-
	0.50 +0.02/-0.05	10k	50k	-	-
	0.50±0.20	10k	-	-	-
0603(1608)	0.50±0.10	4k	-	-	-
	0.80±0.07	4k	15k	-	-
	0.80 +0.15/-0.10	4k	15k	-	-
0805(2012)	0.50±0.10	4k	15k	-	-
	0.60±0.10	4k	15k	-	-
	0.80±0.10	4k	15k	-	-
	0.85±0.10	4k	15k	-	-
	1.25±0.10	-	-	3k	10k
	1.25±0.20	-	-	3k	10k
1206(3216)	0.80±0.10	4k	15k	-	-
	0.85±0.10	4k	15k	-	-
	0.95±0.10	-	-	3k	10k
	1.15±0.15	-	-	3k	10k
	1.25±0.10	-	-	3k	10k
	1.60±0.20	-	-	2k	10k
	1.60 +0.30/-0.10	-	-	2k	9k
1210(3225)	0.85±0.10	-	-	3k	10k
	0.95±0.10	-	-	3k	10k
	1.25±0.10	-	-	3k	10k
	1.60±0.20	-	-	2k	-
	2.00±0.20	-	-	1k	6k
	2.50±0.30	-	-	1k	6k
1808(4520)	1.25±0.10	-	-	2k	10k
	1.60±0.20	-	-	2k	8k
	2.00±0.20	-	-	1k	6k
1812(4532)	1.25±0.10	-	-	1k	5k
	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	3k
	2.80±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

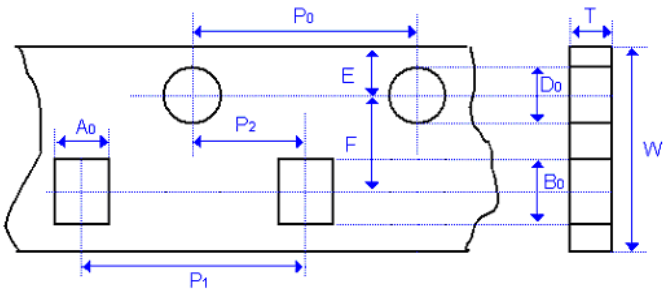


Fig. 9.1 The dimension of paper tape

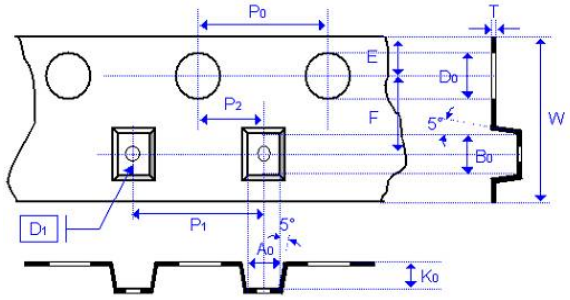


Fig. 9.2 The dimension of plastic tape

Size	0201	0402	0603		0805	
Chip Thickness	0.30±0.03	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	0.39±0.07	0.70±0.20	1.00 +0.05/-0.1	1.02 +0.05/-0.1	1.50±0.10	<1.65
B_0	0.69±0.07	1.20±0.20	1.80±0.10	1.80±0.10	2.30±0.10	<2.40
T	≤0.50	≤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	8.00±0.10
P_0	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
$10xP_0$	40.00±0.10	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	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	2.00±0.05
D_0	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.50 +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±0.05	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	3.50±0.05
Unit :	mm	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	12.00±0.20	12.00±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

9.2. REEL DIMENSIONS

Size	0201, 0402, 0603, 0805, 1206, 1210		
Reel size	7”	7”	13”
C	13.0 +0.5/-0.2	13.0 +0.5/-0.2	13.0 +0.7/-0.3
W_1	8.4 +1.5/-0	12.4 +2.0/-0	8.4 +2.0/-0
A	178.0 ±0.10	178.0 ±0.10	330.0 ±1.0
N	60.0 +1.0/-0	80.0 ±1.0	100 ±1.0

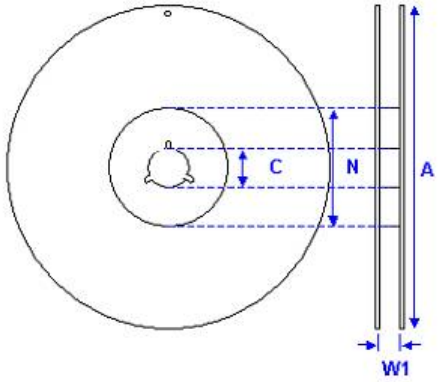


Fig. 9.3 The dimension of reel

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

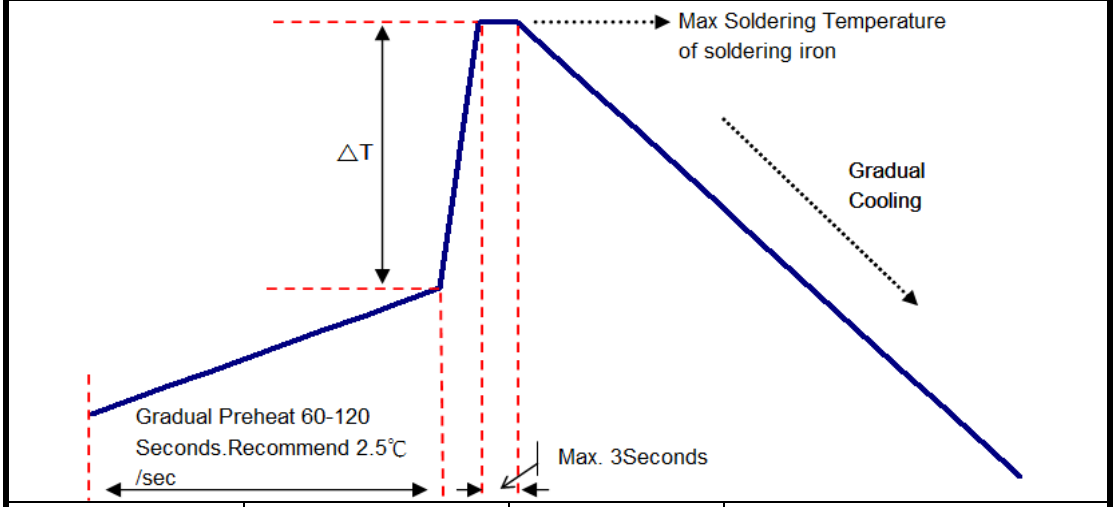
In order to minimize the risk of thermal shock during soldering, a carefully controlled preheat is required. The rate of preheat should not exceed 3°C per second.

SOLDERING

Use 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 :

Fig. 10.1 Hand Soldering Profile



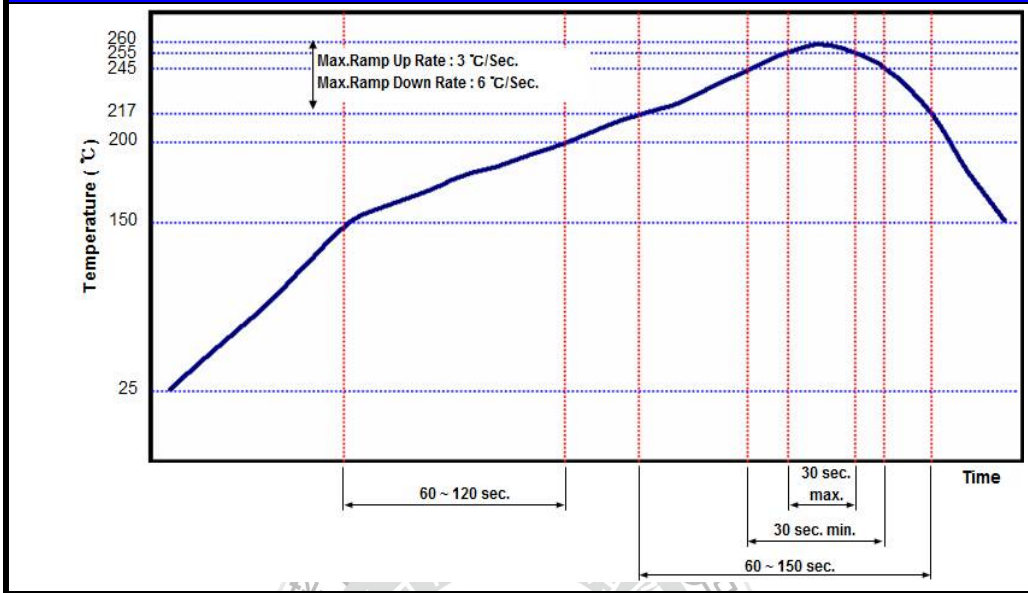
Chip Size	Pre-Heat temp.	ΔT	Max. soldering iron temp.
≤1206	≥150°C	≤150°C	≤350°C
1210~2225	≥150°C	≤130°C	≤280°C

* 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 :

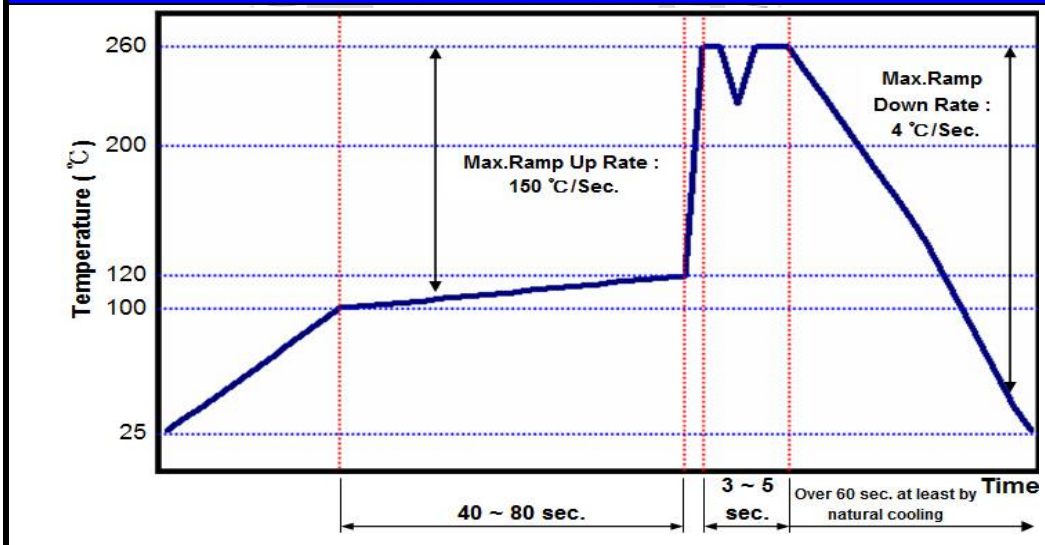
Fig. 10.2 Reflow soldering profile



For Sn/Ag/Cu Series solder paste (Pb-Free)

c.) Wave soldering :

Fig. 10.3 Wave soldering profile



For Sn/Ag/Cu Series solder paste (Pb-Free)

Soldering conditions :

Class I :

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

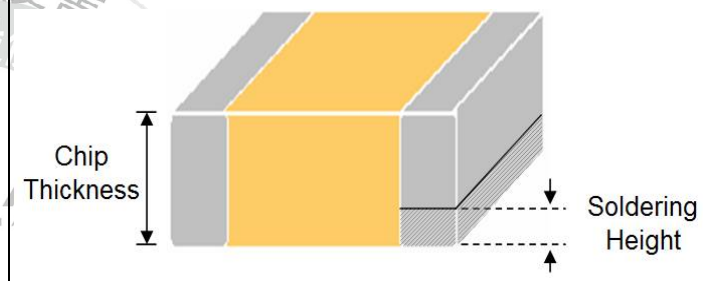
10. APPLICATION NOTES

Soldering conditions :
Class II :

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

The standard AEC-Q200 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.

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