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APPROVAL SHEET

Product Name : Ultra High Voltage Multilayer Ceramic Chip Capacitors

Part No. : FV Series

Description : Size 1206~2225, C0G/X7R, 1KVdc to 6KVdc, RoHS Complinat

PREPARED BY	APPROVED BY

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SPECIFICATION FOR

ULTRA HIGH VOLTAGE MULTILAYER CERAMIC CHIP CAPACITORS

Part No. : FV Series

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Compliant

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

PDC FV Series green type capacitors are manufactured by using environmental friendly material without lead or cadmium. These capacitors feature series connection of multi-layer capacitor units in a MLCC to realize high voltage performance. This special design can distribute voltage gradients throughout the entire capacitor, so as to prevent short circuit failure. It is a safety design for LCD back-lighting inverter application.

2. FEATURES

- Special interior design offers high voltage rating in a given case size.
- High reliability and stability.
- RoHS compliant

3. APPLICATIONS

- DC to DC converter.
- High voltage coupling/DC blocking.
- Back-lighting inverters.
- LAN/WLAN interface.
- Modem.
- Power supplies.

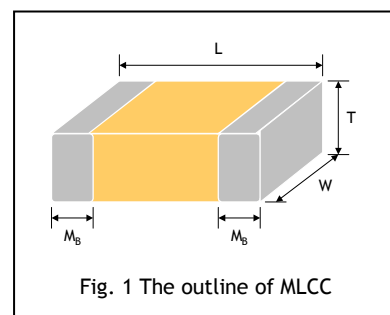
4. HOW TO ORDER

FV	31	X	102	K	202	E	C	G
PDC	Size	Dielectric	Capacitance	Tolerance	Rated voltage	Packaging	Thickness	Control Code
Family	Inch (mm)	N: COG(NPO)	Two significant digits followed by no. of zeros. And R is in place of decimal point.	B=±0.1pF C=±0.25pF D=±0.5pF F=±1% G=±2% J=±5% K=±10% M=±20% Z=-20/+80%	Two significant digits followed by no. of zeros. And R is in place of decimal point.	E: Tape and Reel, Embossed Tape P: Tape and Reel, Paper Tape No Code: Bulk	A: 0.60±0.10mm B: 0.80 ^{+0.15} / _{-0.10} mm C: 1.25±0.20mm E: 1.60±0.20mm F: 2.00±0.20mm G: 2.50±0.30mm N: 0.50±0.05mm S: 0.80±0.07mm X: 0.80±0.10mm	G: RoHS compliant P: Pb/Sn plating(Tin/lead with min. 5% lead)*
	31:							
	1206 (3216)	X: X7R						
	32:							
	1210 (3225)							
	42:				102 = 1000 VDC			
	1808 (4520)		eg.: R47=0.47pF		152 = 1000 VDC			
	43:		0R5=0.5pF		202= 2000 VDC			
	1812 (4532)		1R0=1.0pF		302= 3000 VDC			
	46:		100=10x10 ⁰		402= 4000 VDC			
	1825 (4563)		=10pF		602= 6000 VDC			
	52:							
	2211 (5728)							
	55:							
	2220 (5750)							
	56:							
	2225 (5763)							

* For more information, please contact with PDC local representative.

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	Thickness (Max)mm	M ₀ min (mm)
1206 (3216)	3.20±0.20	1.60±0.20	1.80	0.30
1210 (3225)	3.20±0.30	2.50±0.20	2.80	0.30
	3.20±0.40	2.50±0.30		
1808 (4520)	4.50±0.40	2.00±0.20	1.80	0.26
1812 (4532)	4.50±0.40	3.20±0.30	2.80	0.26
1825 (4563)	4.60±0.30	6.30±0.40	2.80	0.26
2211 (5728)	5.70±0.40	5.70±0.40	2.80	0.30
2220 (5750)	5.70±0.40	5.00±0.40	2.80	0.30
2225 (5763)	5.70±0.40	6.30±0.40	2.80	0.30



6. GENERAL ELECTRICAL DATA

Dielectric	C0G(NPO)	X7R
Size	1206, 1210, 1808, 1812, 2211, 1825, 2220, 2225	1206, 1210, 1812, 1808, 1825, 2211, 2220, 2225
Rated voltage (WVDC)	1KV, 1.5KV, 2KV, 3KV, 4KV, 5KV, 6KV	1KV, 1.5KV, 2KV, 3KV, 4KV
Capacitance range*	1.5pF ~ 10.0nF	100pF ~ 100.0nF
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%), K (±10%)	J (±5%), K (±10%), M (±20%)
Tan δ*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000	≤2.5%
Insulation resistance at 500Vdc for 60 seconds	≥100GΩ or R•C≥1000 whichever is smaller	≥10GΩ or R•C≥500Ω•F whichever is smaller
Operating temperature	-55 to +125°C	
Temperature coefficient	±30ppm / °C	±15%
Termination	Ag (or Cu)/Ni/Sn (lead-free termination)	

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

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

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

7. CAPACITANCE RANGE

7.1 C0G(NPO)

DIELECTRIC		C0G(NP0)											
SIZE		1206			1210			1808			1812		
RATED VOLTAGE (VDC)		1000	1500 2000	3000	1000	1500 2000	3000	1000	1500 2000	3000	1000	1500 2000	3000
Capacitance	1.5pF (1R5)												
	1.8pF (1R8)												
	2.2pF (2R2)												
	2.7pF (2R7)												
	3.3pF (3R3)												
	3.9pF (3R9)												
	4.7pF (4R7)												
	5.6pF (5R6)												
	6.8pF (6R8)												
	8.2pF (8R2)												
	10pF (100)												
	12pF (120)												
	15pF (150)												
	18pF (180)												
	22pF (220)												
	27pF (270)												
	33pF (330)												
	39pF (390)												
	47pF (470)												
	56pF (560)												
	68pF (680)												
	82pF (820)												
	100pF (101)												
	120pF (121)												
	150pF (151)												
	180pF (181)												
	220pF (221)												
	270pF (271)												
	330pF (331)												
	390pF (391)												
	470pF (471)												
	560pF (561)												
	680pF (681)												
	820pF (821)												
	1,000pF (102)												
	1,200pF (122)												
	1,500pF (152)												
	1,800pF (182)												
	2,200pF (222)												
	2,700pF (272)												
	3,300pF (332)												
	3,900pF (392)												
	4,700pF (472)												
	5,600pF (562)												
	6,800pF (682)												
	8,200pF (822)												
	0.010μF (103)												

7. CAPACITANCE RANGE(Con.)

7.1 C0G(NPO)

DIELECTRIC		C0G(NP0)											
SIZE		1825			2211			2220			2225		
RATED VOLTAGE (VDC)		1000	1500 2000	3000	4000	5000	6000	1000	1500 2000	3000	1000	1500 2000	3000
Capacitance	4.7pF (4R7)												
	5.6pF (5R6)												
	6.8pF (6R8)												
	8.2pF (8R2)												
	10pF (100)												
	12pF (120)												
	15pF (150)												
	18pF (180)												
	22pF (220)												
	27pF (270)												
	33pF (330)												
	39pF (390)												
	47pF (470)												
	56pF (560)												
	68pF (680)												
	82pF (820)												
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	390pF (391)												
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	560pF (561)												
	680pF (681)												
	820pF (821)												
	1,000pF (102)												
	1,200pF (122)												
	1,500pF (152)												
	1,800pF (182)												
	2,200pF (222)												
	2,700pF (272)												
	3,300pF (332)												
	3,900pF (392)												
	4,700pF (472)												
	5,600pF (562)												
	6,800pF (682)												
	8,200pF (822)												
	0.010μF (103)												
	0.012μF (123)												

7.CAPACITANCE RANGE(Con.)

7.2 X7R

DIELECTRIC		X7R									
SIZE		1206		1210		1808			1812		
RATED VOLTAGE (VDC)		1000	1500 2000	1000	1500 2000	1000	1500 2000	3000	1000	1500 2000	3000
Capacitance	100pF (101)										
	120pF (121)										
	150pF (151)										
	180pF (181)										
	220pF (221)										
	270pF (271)										
	330pF (331)										
	390pF (391)										
	470pF (471)										
	560pF (561)										
	680pF (681)										
	820pF (821)										
	1,000pF (102)										
	1,200pF (122)										
	1,500pF (152)										
	1,800pF (182)										
	2,200pF (222)										
	2,700pF (272)										
	3,300pF (332)										
	3,900pF (392)										
	4,700pF (472)										
	5,600pF (562)										
	6,800pF (682)										
	8,200pF (822)										
	0.010μF (103)										
	0.012μF (123)										
	0.015μF (153)										
	0.018μF (183)										
	0.022μF (223)										
	0.027μF (273)										
	0.033μF (333)										
	0.039μF (393)										
	0.047μF (473)										
	0.056μF (563)										

7.CAPACITANCE RANGE(Con.)

7.2 X7R

DIELECTRIC		X7R											
SIZE		2211		1825			2220			2225			
RATED VOLTAGE (VDC)		3000	4000	1000	1500 2000	3000	1000	1500 2000	3000	1000	1500 2000	3000	
Capacitance	100pF (101)												
	120pF (121)												
	150pF (151)												
	180pF (181)												
	220pF (221)												
	270pF (271)												
	330pF (331)												
	390pF (391)												
	470pF (471)												
	560pF (561)												
	680pF (681)												
	820pF (821)												
	1,000pF (102)												
	1,200pF (122)												
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	4,700pF (472)												
	5,600pF (562)												
	6,800pF (682)												
	8,200pF (822)												
	0.010μF (103)												
	0.012μF (123)												
	0.015μF (153)												
	0.018μF (183)												
	0.022μF (223)												
	0.027μF (273)												
0.033μF (333)													
0.039μF (393)													
0.047μF (473)													
0.056μF (563)													
0.068μF (683)													
0.082μF (823)													
0.100μF (104)													

8. PACKAGE DIMENSION AND QUANTITY

Size	Thickness (mm)	Paper tape		Plastic tape	
		7" reel	13" reel	7" reel	13" reel
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	-
	2.00±0.20	-	-	1k	-
1808 (4520)	2.50±0.30	-	-	1k	-
	1.25±0.10	-	-	2k	-
	1.40±0.15	-	-	2k	-
	1.60±0.20	-	-	2k	-
1812 (4532)	2.00±0.20	-	-	1k	-
	1.25±0.10	-	-	1k	-
	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
1825 (4563)	2.50±0.30	-	-	0.5k	3k
	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
2211 (5728)	1.25±0.10	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	3k
2220 (5750)	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
2225 (5763)	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-

Unit: pieces

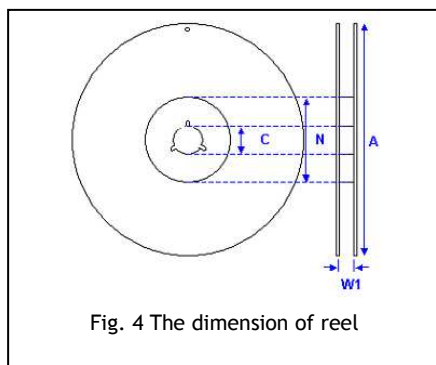
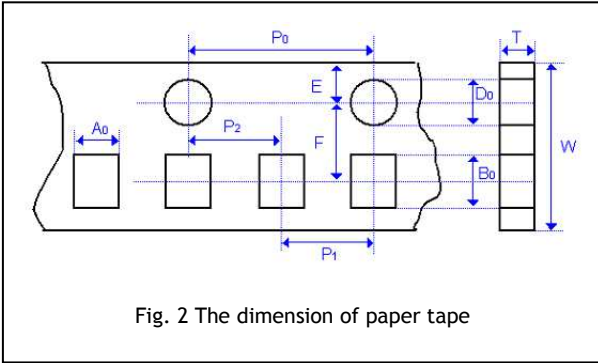


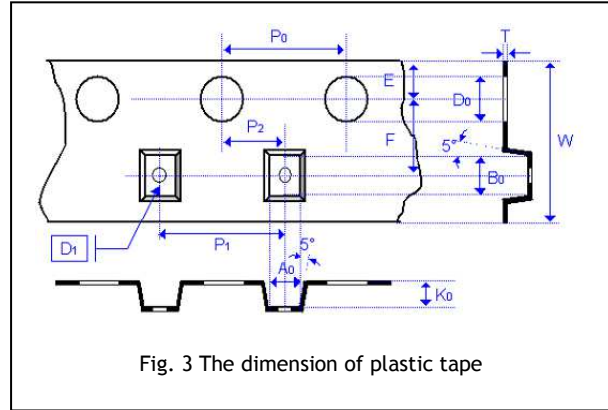
Fig. 4 The dimension of reel

Size	1206, 1210, 1812			1808, 1812, 1825,	2211
Reel size	7"	10"	7"	7"	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	13.0+0.5/-0.2
W ₁	8.4+1.5/-0	8.4+1.5/-0	12.4+2.0/-0	12.4+2.0/-0	12.4+2.0/-0
A	178.0±0.10	250.0±1.0	178.0±0.10	178.0±0.10	178.0±0.10
N	60.5±1.0	100.0±1.0	80.0±1.0	60.5±1.0	80.0±1.0

8-1. CARDBOARD TAPE DIMESIONS



8-2. EMBOSSED TAPE DIMENSIONS



Size	1206			1210		1808		2211		
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 2.00±0.20	2.50±0.30	1.25±0.10 1.40±0.15 1.60±0.20	2.00±0.20	1.60±0.20	2.00±0.20	2.50±0.20
A ₀	2.00±0.10	<2.00	<2.00	<3.05	<3.10	<2.50	<2.50	< 3.30	< 3.30	< 3.30
B ₀	3.50±0.10	<3.60	<3.70	<3.80	<4.00	<5.30	<5.30	< 6.50	< 6.50	< 6.50
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	0.30±0.10	0.30±0.10	0.30±0.10
K ₀	-	<2.50	<2.50	<2.50	<3.50	<2.50	<2.50	< 2.50		< 3.10
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	12.0±0.20	12.0±0.20	12.0±0.20
P ₀	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
10xP ₀	40.0±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.0±0.20	40.0±0.20	40.0±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	4.00±0.10	4.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10
P ₂	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05
D ₀	1.50±0.05	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	1.50±0.10/-0.00	1.50±0.10/-0.00	1.50±0.10/-0.00
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	1.50±0.10	1.50±0.10	1.50±0.10
E	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.1	1.75±0.1	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	5.50±0.05	5.50±0.05	5.50±0.05

Size	1812		1825		2220		2225	
Chip Thickness	1.25±0.10 1.60±0.20 2.00±0.20	2.50±0.30	2.00±0.20	2.50±0.30	1.40±0.15 1.60±0.20 2.00±0.20	2.50±0.30	2.00±0.20	2.50±0.30
A ₀	<3.90	<3.90	<6.80	<6.80	<5.80	<5.80	<6.80	<6.80
B ₀	<5.30	<5.30	<5.30	<5.30	<6.50	<6.50	<6.50	<6.50
T	0.25±0.05	0.25±0.05	0.30±0.10	0.30±0.10	0.30±0.10	0.30±0.10	0.30±0.10	0.30±0.10
K ₀	<2.50	<3.0	<2.50	<3.10	<2.50	<3.10	<2.50	<3.10
W	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20
P ₀	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
10xP ₀	40.0±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.0±0.20	40.0±0.20	40.0±0.20	40.0±0.20
P ₁	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10
P ₂	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05
D ₀	1.50±0.10/-0.00	1.50±0.10/-0.00	1.50±0.10/-0.00	1.50±0.10/-0.00	1.50±0.10/-0.00	1.50±0.10/-0.00	1.50±0.10/-0	1.50±0.10/-0
D ₁	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10
E	1.75±0.10	1.75±0.10	1.75±0.1	1.75±0.10	1.75±0.1	1.75±0.10	1.75±0.10	1.75±0.10
F	5.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05

9.APPLICATION NOTES

STORAGE

To prevent the damage of solderability of terminations, the following storage conditions are recommended:

Indoors under 5 ~ 40°C and 20% ~ 70% RH.

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

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

HANDLING

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

PREHEAT

In order to minimize the risk of thermal shock during soldering, a carefully controlled preheat is required. The rate of preheat should not exceed 4°C per second and the final preheat temperature should be within 100°C of the soldering temperature for small chips such as 1206, within 50°C of the soldering temperature for bigger chips such as 1210, 1808, 1812, 1825, 2211, 2220 and 2225, etc.

SOLDERING

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

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

For bigger chips such as 1210, 1808, 1812, 2211, 2220 and 2225, etc. wave soldering and hand soldering are no recommended.

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

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

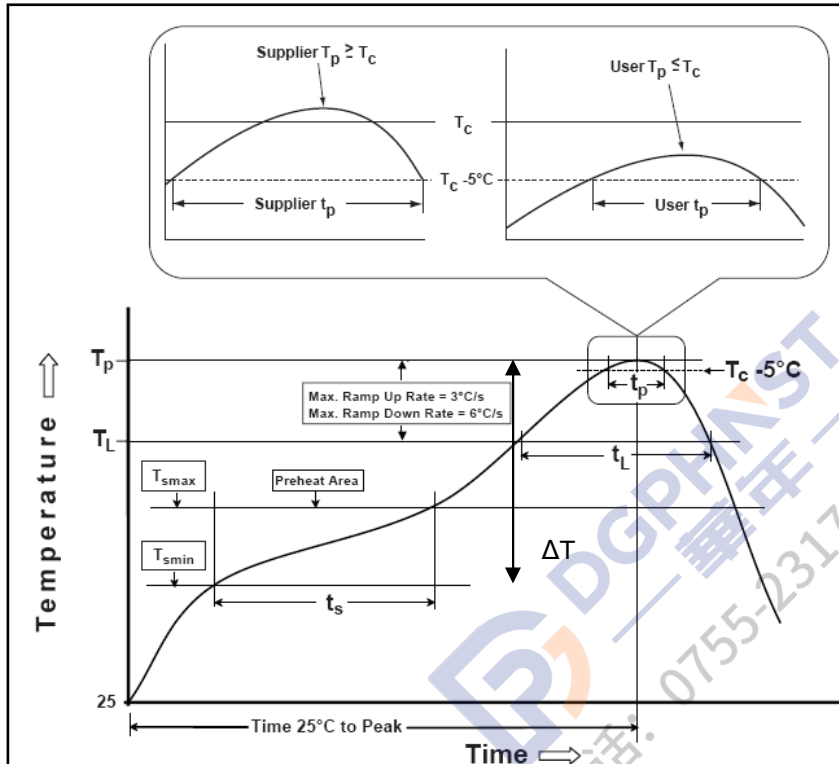
Profile Feature	Pb-Free Assembly
Preheat/Soak	
Temperature Min.(T _{smin})	150°C
Temperature Max.(T _{smax})	200°C
Time(t _s) from (T _{smin} to T _{smax})	60 to 120 seconds
Ramp-up rate(T _L to T _p)	3°C/second max.
Liquidous temperature(T _L)	217°C
Time(t _L) maintained above T _L	60 to 150 seconds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

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

Maximum temperature = Minimum temperature (235°C) + ΔT + Tolerance for oven process and measurement ($5 \sim 7^{\circ}\text{C}$)

Time at peak temperature = 10sec, Dwell above 217°C = 90sec, Ramping rate = $3^{\circ}\text{C}/\text{sec}$ (heating) and $6^{\circ}\text{C}/\text{sec}$ (heating).

Classification Reflow Profiles



Chip Size	ΔT
1206	100°C
1210, 1808, 1812, 1825, 2211, 2220, 2225	50°C

Soldering	Solder Temp. (T_c)	Soldering Time (t_p)
Reflow	$235 - 260^{\circ}\text{C}$	$< 15 \text{ sec.}$
Wave	$230 - 260^{\circ}\text{C}$	$< 5 \text{ sec.}$

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

COOLING

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

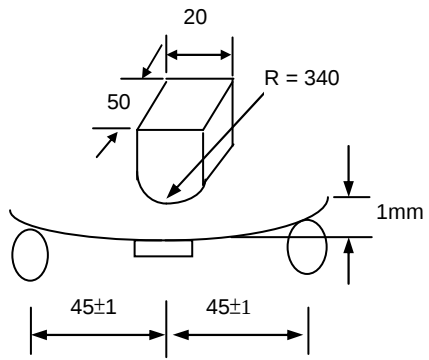
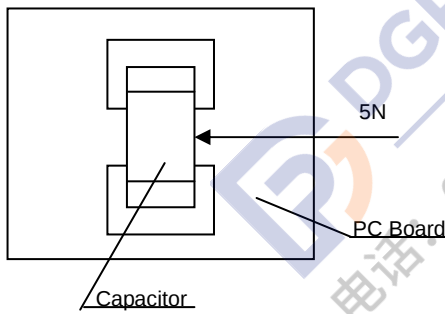
CLEANING

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

10.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: (C0G)	* 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) 1.0±0.2Vrms, 1kHz±10%	C0G: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C X7R: ≤2.5%															
4.	Temperature Coefficient	With no electrical load. <table><tr><th>T.C.</th><th>Operating Temp</th></tr><tr><td>C0G</td><td>-55~125°C at 25°C</td></tr><tr><td>X7R</td><td>-55~125°C at 25°C</td></tr></table>	T.C.	Operating Temp	C0G	-55~125°C at 25°C	X7R	-55~125°C at 25°C	<table><tr><th>T.C.</th><th>Capacitance Change</th></tr><tr><td>C0G</td><td>Within ±30ppm/°C</td></tr><tr><td>X7R</td><td>Within ±15%</td></tr></table>	T.C.	Capacitance Change	C0G	Within ±30ppm/°C	X7R	Within ±15%			
T.C.	Operating Temp																	
C0G	-55~125°C at 25°C																	
X7R	-55~125°C at 25°C																	
T.C.	Capacitance Change																	
C0G	Within ±30ppm/°C																	
X7R	Within ±15%																	
5.	Insulation Resistance	To apply voltage at 500VDC for 60 sec.	Class I (C0G) : ≥100GΩ or RxC≥1000Ω-F whichever is smaller. Class II (X7R) : ≥10GΩ or RxC≥500Ω-F whichever is smaller.															
6.	Dielectric Strength	* To apply voltage: UR ≤ 5KV : 1.1 times of UR UR > 5KV : 1.0 time of UR * Duration: 1 to 5 sec.	* No evidence of damage or flashover during test.															
7.	Solderability	* Solder temperature: 245±5°C * Dipping time: 5±0.5 sec.	75% min. coverage of all metalized area.															
8.	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 48±4 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).	* No remarkable damage. * Cap change: C0G : within ±2.5% or ±0.25pF whichever is larger. X7R : within ±7.5% * 25% max. leaching on each edge.															
9.	Temperature Cycle	* Conduct the five 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>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></table> * Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 48±4 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).	Step	Temp. (°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 : within ±15% * Q/D.F.: C0G : ≤2.0 × Initial requirement X7R : ≤1.5 × Initial requirement * I.R.≥ 0.25 × initial requirements.
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																
10.	Humidity (Damp Heat) Steady State	* Test temp.: 40±2°C * Humidity: 90~95% RH * Test time: 500+24/-0hrs. * Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).	* No remarkable damage. * Cap change: C0G : within ±5% or ±2pF whichever is larger X7R : within ±15% * Q/D.F Value: C0G : Cap ≥30pF : Q≥350; 10pF ≤ Cap < 30pF : Q≥275+2.5C Cap < 10pF : Q≥200+10C X7R : ≤7.0% * I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.															
11.	High Temperature Load (Endurance)	* Test temp.: 125±3°C * To apply voltage: 100% of rated voltage. Exception item: <table><tr><th>UR</th><th>Size</th><th>Cap</th><th>Voltage</th></tr><tr><td>2000V</td><td>1210</td><td>≥ 222</td><td rowspan="2">1.1 times of UR</td></tr><tr><td>3000V</td><td>2220</td><td>≥ 472</td></tr></table> * Test time: 1000+24/-0 hrs. * Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).	UR	Size	Cap	Voltage	2000V	1210	≥ 222	1.1 times of UR	3000V	2220	≥ 472	* No remarkable damage. * Cap change: C0G : within ±3% or ±3pF whichever is larger. X7R : within ±20% * Q/D.F Value: C0G : Cap ≥30pF : Q≥350; 10pF ≤ Cap < 30pF : Q≥275+2.5C Cap < 10pF : Q≥200+10C X7R : ≤7.0% * I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.				
UR	Size	Cap	Voltage															
2000V	1210	≥ 222	1.1 times of UR															
3000V	2220	≥ 472																

10.RELIABILITY TEST CONDITIONS AND REQUIREMENTS(Cont.)

No.	Item	Test Condition	Requirements
12.	Resistance to Flexure of Substrate	* 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. 	* No remarkable damage. * Cap change: within $\pm 10\%$ (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)
13.	Adhesive Strength of Termination	Capacitors mounted on a substrate. A force of 5N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 ± 1 sec. 	* No remarkable damage or removal of the terminations.