

SPECIFICATION FOR
FS SERIES GREEN TYPE HIGH CAPACITANCE CAPACITORS

Part No. : FS series

Description : Size ≤ 2225 , CAP $\geq 1\mu\text{F}$, $U_R < 1000\text{V}$, X7R/X5R/Y5V/X6S,

<u>DRAWN BY</u>	<u>CHECKED BY</u>	<u>APPROVED BY</u>
蕭敏珍	蔡永承	巫宏俊

1. DESCRIPTION

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 high capacitance MLCC offers low ESR and excellent frequency characteristics to be suited for coupling and decoupling applications in circuit. The high dielectric constant material X7R, X5R and Y5V are used for this series product.

2. FEATURES

- Realize high capacitance in small sizes.
- Capacitor with lead-free termination (pure Tin).
- RoHS compliant.
- HALOGEN compliant.
- Surface mount suited for wave and reflow soldering
- High reliability and no polarity.
- Excellent in high frequency characteristic.

3. APPLICATIONS

- Digital circuit coupling or decoupling applications.
- For high frequency and high-density type power suppliers.
- For bypassing.
- Ideal for smoothing circuits.
- Suitable for DC-DC converter, personal computer and peripherals, telecommunication and general electronic equipment

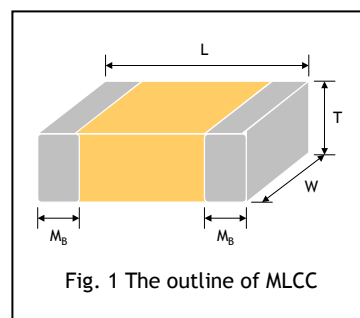
4. HOW TO ORDER

<u>FS</u>	<u>32</u>	<u>X</u>	<u>225</u>	<u>K</u>	<u>101</u>	<u>E</u>	<u>G</u>	<u>G</u>
PDC Family	Size	Dielectric	Capacitance	Tolerance	Rated voltage	Packaging	Thickness	Control Code
Table1.	Table2	Table3	Table4	Table5	Table6	Table7	Table8	Table9

Reference document with No.11 reference table detail.

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	Thickness Spec	M _B min (mm)
			T(mm) code	
0201 (0603)	0.60±0.05	0.30±0.05	See No.11 Reference Table	0.15±0.05
0402 (1005)	1.00+0.15/-1.0	0.50+0.15/-1.0		0.25+0.05/-0.10
0603 (1608)	1.60±0.20	0.80±0.15		0.40±0.15
0805 (2012)	2.10±0.20	1.25±0.20		0.50±0.20
1206 (3216)	3.30±0.30	1.60+0.30/-0.10		0.60±0.20
1210 (3225)	3.30±0.40	2.50±0.30		0.75±0.35
1808 (4520)	4.60±0.50	2.00±0.20		0.75±0.35
1812 (4532)	4.60±0.50	3.20±0.30		0.75±0.35
1825 (4563)	4.60±0.50	6.30±0.40		0.75±0.35
2220 (5750)	5.70±0.50	5.00±0.40		0.85±0.35
2225 (5763)	5.70±0.50	6.30±0.40		0.85±0.35



6. GENERAL ELECTRICAL DATA

Dielectric	X7R	X5R	Y5V	X6S
Size	0201, 0402, 0603, 0805, 1206, 1210, 1812, 1825, 2220, 2225			
Capacitance range*	1μF to 10μF	1μF to 100μF	1μF to 100μF	1μF to 100μF
Capacitance tolerance**	Reference to Table5	Reference to Table5	Reference to Table5	Reference to Table5
Rated voltage (WVDC)	6.3V, 10V, 16V, 25V, 35V, 50V, 100V, 250V, 500V, 630V			4V, 6.3V, 10V, 16V, 25V, 50V
Tan δ*	Note 1			
Insulation resistance at U _r	≥10GΩ or R•C≥100Ω•F whichever is smaller			
Operating temperature	-55 to +125°C	-55 to +85°C	-25 to +85°C	-55 to +105°C
Capacitance characteristic	±15%		+30/-80%	±22%
Termination	Ni/Sn (lead-free termination)			

* Measured at 1.0±0.2V_{rms}, 1.0kHz±10% for C≤10μF; 0.5±0.2V_{rms}, 120Hz±20% for C>10μF, 30-70% related humidity, 25°C ambient temperature for X7R, X5R, X6S and at 20°C for Y5V.

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

Note 1 : Follow 8.RELIABILITY TEST CONDITIONS AND REQUIREMENTS

7. CAPACITANCE RANGE

7-1 X7R Dielectric

Dimension		0402	0603					0805					1206						1210						
Cap(μF)	code	6.3V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	100V	6.3V	10V	16V	25V	35V	50V	100V
1.0	105	N	B	B	B	B	B		C	C	C	I		J	J	J	P	P		C	C	C		C	F
1.2	125																							G	G
1.5	155								I	I	I		J	J	J	P					E	E		G	G
1.8	185																							G	G
2.2	225		B	B	B			I	I	I	I	I	J	J	J	P	P	P			E	E		G	G
2.7	275																							G	
3.3	335													P	P	P					E	E			
4.7	475							I	I	I	I		P	P	P	P	P			F	F	F		G	
6.8	685																								
10.0	106							I	I	I			P	P	P	P				F	F	F	G	G	
22.0	226												P	P	P					G	G	G			
47.0	476																		G	G					

Dimension		1808		1812						1825				
Cap(μF)	code	50V	100V	10V	16V	25V	50V	100V	200V	250V	50V	100V	200V	250V
1.0	105	F	F	C	C	C	F	F	G	G	F	F	F	F
1.2	125	F					F	F			F	F	G	G
1.5	155						F	F			F	F	G	G
1.8	185						F	F			F	F	G	G
2.2	225						G	G			F	F	G	G
2.7	275						G	G			F	F	H	H
3.3	335						G	G			F	F		
3.9	395										F	F		
4.7	475										F	G		
5.6	565										G	G		
6.8	685										G	G		
8.2	825										G	G		
10.0	106										G	G		

Dimension		2220						2225					
Cap(μF)	code	50V	100V	200V	250V	500V	630V	50V	100V	200V	250V	500V	630V
1.0	105	F	F	F	F	H	H	F	F	F	F	G	G
1.2	125	F	F	G	G			F	F	G	G	H	H
1.5	155	F	F	G	G			F	F	G	G	H	H
1.8	185	F	F	G	G			F	F	G	G		
2.2	225	F	F	G	G			F	F	G	G		
2.7	275	F	F	H	H			F	F	G	G		
3.3	335	F	F					F	F	H	H		
3.9	395	F	F					F	F	H	H		
4.7	475	F	G					F	G				
5.6	565	G	G					F	G				
6.8	685	G	G					G	G				
8.2	825	G	G					G	G				
10.0	106	G	G					G	G				

7-2 X5R Dielectric

Dimension		0201		0402				0603					0805						1206					1210							
Cap(μF)	code	6.3V	10V	6.3V	10V	16V	25V	6.3V	10V	16V	25V	50V	4V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	4V	6.3V	10V	16V	25V	35V	50V	
1.0	105	L	L	N	N	N	N	B	B	B	B	B			C	C	C	I					P								
1.2	125																														
1.5	155							B						I	I	I	I			J	J					F	F	F			
1.8	185																														
2.2	225	L		N	N	K	K	B	B	B	B	B		I	I	I	I	I		J	J	P	P			F	F	F			
2.7	275																														
3.3	335							B	B					I	I	I	I			P	P	P									
3.9	395																														
4.7	475			K	K	K		B	B	B	B			I	I	I	I	I	P	P	P	P	P			F	F	F	F		
5.6	565																														
6.8	685																		P	P											
8.2	825																														
10.0	106			K	K			B	B	B	B			I	I	I	I	I	P	P	P	P	P			F	F	F	F	G	G
22.0	226							B	B					I	I	I	I		P	P	P	P				G	G	G	G		
47.0	476													I	I				P	P						G	G	G			
100.0	107												I						P							G	G				
220.0	227																							G							

7. CAPACITANCE RANGE(con.)

7-3 Y5V Dielectric

Dimension		0402		0603				0805					1206						1210						1812				
Cap(μF)	code	6.3V	10V	6.3V	10V	16V	25V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	35V	50V	6.3V	10V	16V	25V	35V	50V	10V	16V	25V	50V	100V
1.0	105	N	N		S	B	B		X	X	C	C		M	M	M		M		M	M	M		M	C	C	C	C	C
1.2	125																												
1.5	155				S				C	C				M	M	M				M	M	M			C	C	C	C	
1.8	185																												
2.2	225			S	S	B			C	C	I			M	M	M		J		M	M	M		E	C	C	C	C	
2.7	275																												
3.3	335								C	C				J	J	J				M	M	M			C	C	C	C	
3.9	395																												
4.7	475			B	B				C	C	I			J	J	J	J	P		M	M	C		E	C	C	C	C	
5.6	565																												
6.8	685								I					J	J					M	M	C		F	C	C	C	C	
8.2	825																												
10.0	106							I	I	I				J	J	P				C	C	E	F	F	C	C	C	F	
22.0	226							I	I					P	P					F	F								
47.0	476												P						F	F						G			
100.0	107																		G										

7-4 X6S Dielectric

Dimension		0201	0402					0603						0805						1206					1210			
Cap(μF)	code	4V	6.3V	10V	16V	25V	4V	6.3V	10V	16V	25V	50V	4V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	
1.0	105	L	N	K	K	K																						
1.2	125																											
1.5	155																											
1.8	185																											
2.2	225		N	K	K						B						I											
2.7	275																											
3.3	335																											
3.9	395																											
4.7	475							B		B	B						I	I										
5.6	565																											
6.8	685																											
8.2	825																											
10.0	106							B	B	B			I	I	I	I	I					E						
22.0	226						B	B						I	I	I				P	P						G	
47.0	476												I						P					G	G	G		
100.0	107																							G				

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements																																																																																								
1.	Visual and Dimensions	---	* 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%	NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C X7R, X5R: X6S <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></tr><tr><td rowspan="3">50V</td><td rowspan="3">2.5%</td><td>3.5%</td><td>0201(50V); 0603≥0.047μF; 0805≥0.10μF;1206≥0.47μF 0402≥0.01μF(X7R)</td></tr><tr><td>5%</td><td>0805≥1.0μF;1210≥4.7μF</td></tr><tr><td>10%</td><td>0402≥0.1μF;0603>0.22μF; 0805≥0.1μF;1206≥1.0μF, 1210≥4.7μF</td></tr><tr><td rowspan="2">35V</td><td rowspan="2">5%</td><td>5%</td><td>0402≥0.1μF;0603>1.0μF; 1210≥10μF</td></tr><tr><td>10%</td><td>0805≥2.2μF; 1210≥4.7μF</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">3.5%</td><td>5%</td><td>0201≥0.01μF;0805≥1μF; 1210≥10μF 0402≥0.01μF;0603≥1μF; 1206≥4.7μF</td></tr><tr><td>10%</td><td>0402≥0.10μF;0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF ; 1210≥10μF</td></tr><tr><td>12.5%</td><td>0402≥1.0μF</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; 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≥0.1μF,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><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;</td></tr><tr><td>20%</td><td>0402≥2.2μF</td></tr><tr><td>4V</td><td>15%</td><td>---</td><td>---</td></tr></table> Y5V: <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></tr><tr><td>≥ 50V</td><td>5%</td><td>7%</td><td>0603≥0.1μF; 0805≥0.22μF;1206≥2.2μF</td></tr><tr><td>35V</td><td>7%</td><td>9%</td><td>1206≥10μF</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</td><td rowspan="2">7%</td><td>9%</td><td>0402≥0.068μF; 0603≥0.68μF</td></tr><tr><td>C<1.0μF)</td><td>12.5%</td><td>0402≥0.22μF</td></tr><tr><td>16V</td><td rowspan="2">9%</td><td>16%</td><td>0603≥1.0μF; 0805≥3.3μF; 1206≥10μF; 1210≥22μF;1812≥47μF</td></tr><tr><td>C≥1.0μF)</td><td></td><td></td></tr><tr><td>10V</td><td>12.5%</td><td>20%</td><td>0402≥0.47μF; 0603≥1.0μF; 0805≥10μF; 1206≥22μF; 1210≥22μF;</td></tr><tr><td>6.3V</td><td>20%</td><td>---</td><td>---</td></tr></table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		50V	2.5%	3.5%	0201(50V); 0603≥0.047μF; 0805≥0.10μF;1206≥0.47μF 0402≥0.01μF(X7R)	5%	0805≥1.0μF;1210≥4.7μF	10%	0402≥0.1μF;0603>0.22μF; 0805≥0.1μF;1206≥1.0μF, 1210≥4.7μF	35V	5%	5%	0402≥0.1μF;0603>1.0μF; 1210≥10μF	10%	0805≥2.2μF; 1210≥4.7μF	25V	3.5%	5%	0201≥0.01μF;0805≥1μF; 1210≥10μF 0402≥0.01μF;0603≥1μF; 1206≥4.7μF	10%	0402≥0.10μF;0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF ; 1210≥10μF	12.5%	0402≥1.0μF	16V	3.5%	5%	0201≥0.01μF;0402≥0.033μF;0603≥0.15μF; 0805≥0.68μF;1206≥2.2μF;1210≥4.7μF	10%	0201≥0.1uF; 0402≥ 0.22uF; 0603≥0.68μF;0805≥2.2μF; 1206≥4.7μF; 1210≥22μF	10V	5%	10%	0201≥0.012μF;0402≥0.1μF,0603≥0.33μF; 0805≥2.2μF, 1206≥2.2μF;1210≥22μF	15%	0201≥0.1μF; 0402≥1μF	6.3V	10%	15%	0201≥0.1μF;0402≥1μF;0603≥10μF; 0805≥4.7μF; 1206≥47μF :1210≥100μF;	20%	0402≥2.2μF	4V	15%	---	---	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 50V	5%	7%	0603≥0.1μF; 0805≥0.22μF;1206≥2.2μF	35V	7%	9%	1206≥10μF	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	7%	9%	0402≥0.068μF; 0603≥0.68μF	C<1.0μF)	12.5%	0402≥0.22μF	16V	9%	16%	0603≥1.0μF; 0805≥3.3μF; 1206≥10μF; 1210≥22μF;1812≥47μF	C≥1.0μF)			10V	12.5%	20%	0402≥0.47μF; 0603≥1.0μF; 0805≥10μF; 1206≥22μF; 1210≥22μF;	6.3V	20%	---	---
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		25V		3.5%	5%	0201≥0.01μF;0805≥1μF; 1210≥10μF 0402≥0.01μF;0603≥1μF; 1206≥4.7μF																																																																																					
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		4V		15%	---	---																																																																																					
		Rated vol.		D.F. ≤	Exception of D.F. ≤																																																																																						
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6.3V	20%	---	---																																																																																								
4.	Temperature Coefficient	With no electrical load.																																																																																									
		T.C.	Operating Temp	T.C.	Capacitance Change																																																																																						
		X7R	-55~125℃ at 25℃	X7R	Within ±15%																																																																																						
		X5R	-55~85℃ at 25℃	X5R	Within ±15%																																																																																						
		Y5V	-25~85℃ at 20℃	Y5V	Within +30%/-80%																																																																																						
		X6S	-55~105℃ at 25℃	X6S	Within ±22%																																																																																						

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS(Con.)

No.	Item	Test Condition	Requirements																									
5.	Insulation Resistance	To apply rated voltage for max. 120 sec.	Class II ≥10GΩ or RxC≥100Ω-F whichever is smaller.																									
6.	Dielectric Strength	<table><tr><th>Rated vol.(V)</th><th>Condition</th></tr><tr><td>≤ 250</td><td>2.0 times of UR</td></tr><tr><td>250<V≤500</td><td>1.5 times of UR</td></tr><tr><td>630≤V≤3000V</td><td>1.2 times of UR</td></tr></table> * Duration: 1 to 5 sec. * Charge and discharge current less than 50Ma.	Rated vol.(V)	Condition	≤ 250	2.0 times of UR	250<V≤500	1.5 times of UR	630≤V≤3000V	1.2 times of UR	* No evidence of damage or flash over during test.																	
Rated vol.(V)	Condition																											
≤ 250	2.0 times of UR																											
250<V≤500	1.5 times of UR																											
630≤V≤3000V	1.2 times of UR																											
7.	Solderability	* Solder temperature: 235±5℃ for (0402~1210) * Solder temperature: 245±5℃ for (1808~2225) * Dipping time: 2±0.5 sec.	75% min. coverage of all metalized area.																									
8.	Resistance to Soldering Heat	* Solder temperature: 260±5℃ * Dipping time: 10±1 sec * Preheating: 120 to 150℃ for 1 minute before immerse the capacitor in a eutectic solder. * Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48±4 hrs at room temp. * Measurement to be made after keeping at room temp. for 48±4 hrs.	* No remarkable damage. <table><tr><th>Dielectric</th><th>Cap Change</th><th>Q/D.F. & IR</th></tr><tr><td>Class II(X7R,X6S)</td><td>within ±7.5%</td><td rowspan="2">To meet Initial requirement</td></tr><tr><td>Class II(Y5V)</td><td>within ±20%</td></tr></table> * 25% max. Leaching on each edge.	Dielectric	Cap Change	Q/D.F. & IR	Class II(X7R,X6S)	within ±7.5%	To meet Initial requirement	Class II(Y5V)	within ±20%																	
Dielectric	Cap Change	Q/D.F. & IR																										
Class II(X7R,X6S)	within ±7.5%	To meet Initial requirement																										
Class II(Y5V)	within ±20%																											
9.	Temperature Cycle	* Conduct the five cycles according to the temperatures and time. <table><tr><th>Step</th><th>Temp. (℃)</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℃ for 1 hr and then set for 48±4 hrs at room temp. * Measurement to be made after keeping at room temp. for 48±4 hrs.	Step	Temp. (℃)	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. <table><tr><th>Dielectric</th><th>I.R</th><th>Cap Change</th><th>D.F</th></tr><tr><td>ClassII (X7R,X6S)</td><td rowspan="2">To meet Initial requirement</td><td>within ±7.5%</td><td rowspan="2">≤ 1.5(D.F.) × Initial requirement</td></tr><tr><td>Class II(Y5V)</td><td>within ±20%</td></tr></table>	Dielectric	I.R	Cap Change	D.F	ClassII (X7R,X6S)	To meet Initial requirement	within ±7.5%	≤ 1.5(D.F.) × Initial requirement	Class II(Y5V)	within ±20%
Step	Temp. (℃)	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																										
Dielectric	I.R	Cap Change	D.F																									
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Class II(Y5V)		within ±20%																										

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS(Con.)

No.	Item	Test Condition	Requirements																																																																														
10.	Humidity (Damp Heat) Steady State	* Test temp.: 40±2℃ * Humidity: 90~95% RH * Test time: 500+24/-0hrs. * Measurement to be made after keeping at room temp. for 48±4 hrs.	* No remarkable damage. * Cap change: - X7R, X5R, X6S: ≥10V, within ±15%; ≤ 6.3V, within ±25% - Y5V: ≥10V, within ±30%; ≤ 6.3V, within +30/-40% * Q/D.F. value: - X7R, X5R, X6S:<table><tr><th>Rated vol.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr><tr><td>≥50V</td><td>≤3.0%</td><td>≤6.0%</td><td>0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF</td></tr><tr><td>35V</td><td>≤5.0%</td><td>≤10.0%</td><td>0805≥2.2μF; 1210≥10μF;</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">≤5.0%</td><td>≤10.0%</td><td>0805≥1μF; 1210≥10μF;</td></tr><tr><td>≤14.0%</td><td>0603≥0.33 μF;0805≥2.2μF; 1206≥4.7uF</td></tr><tr><td>≤15.0%</td><td>0402≥0.10μF; 0603≥0.47μF; 0805≥4.7μF; 1206≥6.8μF</td></tr><tr><td rowspan="2">16V</td><td rowspan="2">≤5.0%</td><td>≤10.0%</td><td>0603≥0.15μF; 0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF</td></tr><tr><td>≤15.0%</td><td>0402≥0.033μF; 0603≥0.68μF; 0805≥2.2uF; 1206≥6.8uF; 1210≥22uF</td></tr><tr><td rowspan="2">10V</td><td rowspan="2">≤7.5%</td><td>≤15.0%</td><td>0402≥0.33μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF</td></tr><tr><td>≤20.0%</td><td>0402≥1μF</td></tr><tr><td>6.3V</td><td>≤15.0%</td><td>≤30.0%</td><td>0402≥2.2uF;0603≥10μ;0805≥10μF 1210≥100μF</td></tr><tr><td>4V</td><td>≤20.0%</td><td></td><td></td></tr></table> - Y5V:<table><tr><th>Rated volt.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr><tr><td>≥50V</td><td>≤7.5%</td><td>≤10.0%</td><td>0603≥0.1uF;0805≥0.47uF</td></tr><tr><td>35V</td><td>≤10.0%</td><td>---</td><td>---</td></tr><tr><td rowspan="2">25V</td><td rowspan="2">≤7.5%</td><td>≤10.0%</td><td>0402≥0.047uF;0603≥0.1μF; 0805≥0.33μF;1206≥1μF; 1210≥4.7μF</td></tr><tr><td>≤15.0%</td><td>0402≥0.068μF; 0603≥0.47μF 1206≥4.7uF;1210≥22μF</td></tr><tr><td>16V (C<1.0μF)</td><td>≤10.0%</td><td>≤12.5%</td><td>0402≥0.068μF; 0603≥0.68μF</td></tr><tr><td></td><td></td><td>≤20.0%</td><td>0402≥0.22μF</td></tr><tr><td>16V (C≥1.0μF)</td><td>≤12.5%</td><td>≤20.0%</td><td>0805≥3.3μF; 1206≥10μF; 1210≥22μF; 1812≥47μF</td></tr><tr><td>10V</td><td>≤20.0%</td><td>---</td><td>---</td></tr><tr><td>6.3V</td><td>≤30.0%</td><td>---</td><td>---</td></tr></table> *I.R.: ≥1GΩ or 50 Ω-F whichever is smaller.	Rated vol.	D.F.	Exception of D.F.		≥50V	≤3.0%	≤6.0%	0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF	35V	≤5.0%	≤10.0%	0805≥2.2μF; 1210≥10μF;	25V	≤5.0%	≤10.0%	0805≥1μF; 1210≥10μF;	≤14.0%	0603≥0.33 μF;0805≥2.2μF; 1206≥4.7uF	≤15.0%	0402≥0.10μF; 0603≥0.47μF; 0805≥4.7μF; 1206≥6.8μF	16V	≤5.0%	≤10.0%	0603≥0.15μF; 0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF	≤15.0%	0402≥0.033μF; 0603≥0.68μF; 0805≥2.2uF; 1206≥6.8uF; 1210≥22uF	10V	≤7.5%	≤15.0%	0402≥0.33μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF	≤20.0%	0402≥1μF	6.3V	≤15.0%	≤30.0%	0402≥2.2uF;0603≥10μ;0805≥10μF 1210≥100μF	4V	≤20.0%			Rated volt.	D.F.	Exception of D.F.		≥50V	≤7.5%	≤10.0%	0603≥0.1uF;0805≥0.47uF	35V	≤10.0%	---	---	25V	≤7.5%	≤10.0%	0402≥0.047uF;0603≥0.1μF; 0805≥0.33μF;1206≥1μF; 1210≥4.7μF	≤15.0%	0402≥0.068μF; 0603≥0.47μF 1206≥4.7uF;1210≥22μF	16V (C<1.0μF)	≤10.0%	≤12.5%	0402≥0.068μF; 0603≥0.68μF			≤20.0%	0402≥0.22μF	16V (C≥1.0μF)	≤12.5%	≤20.0%	0805≥3.3μF; 1206≥10μF; 1210≥22μF; 1812≥47μF	10V	≤20.0%	---	---	6.3V	≤30.0%	---	---
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*I.R.: ≥1GΩ or 50 Ω-F whichever is smaller.

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS(Con.)

No.	Item	Test Condition	Requirements																																													
11.	Humidity (Damp Heat) Load	* Test temp.: 40±2℃ * Humidity: 90~95% RH * Test time: 500+24/-0hrs. * To apply voltage :rated voltage * Measurement to be made after keeping at room temp. for 48±4 hrs (Class II).	* No remarkable damage.																																													
			* Cap change: X7R, X5R, X6S: ≥10V, within ±15%; ≤ 6.3V, within ±25% Y5V: ≥10V, within ±30%; ≤ 6.3V, within +30/-40%																																													
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*I.R.: ≥500MΩ or 25 Ω-F whichever is smaller.																																																
12.	Temperature Humidity Bias test (THB)	* Test temp.: 85±2℃ * Humidity: 85% RH * Test time: 1000+24/-0hrs. (FQC: ≥168 hrs) * To apply voltage:200% rated voltage(Max 100Vdc) * Measurement to be made after keeping at room temp. for 48±4 hrs.(Class II)	* No remarkable damage.																																													
			* Cap change: X7R/X5R within ±12.5% ; X6S within ±20%																																													
			* D.F.: ≤ 200% × Initial requirement																																													
			* I.R.: ≥30% initial requirement.																																													

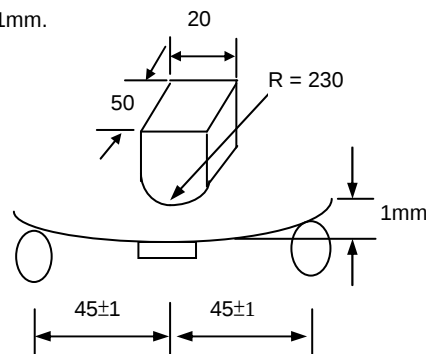
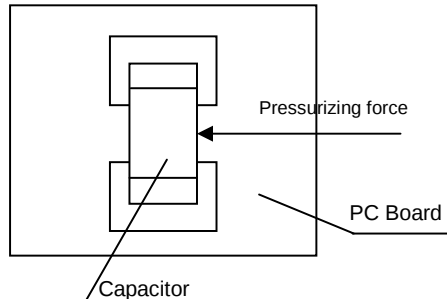
8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS(Con.)

No.	Item	Test Condition	Requirements																																																																																		
13.	High Temperature Load (Endurance)	* Test temp.: X7R: 125±3℃ X6S: 105±3℃ X5R, Y5V: 85±3℃	* Cap change: X7R, X5R,X6S: ≥10V**,within ±12.5%;6.3V within ±25%; **10V:0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25%; Y5V: ≥10V, within ±30%; 6.3V, within +30/-40%																																																																																		
		<table><tr><th>Rated vol.(V)</th><th>Apply Voltage</th></tr><tr><td>≤ 250</td><td>2 times of U_R</td></tr><tr><td>250 <V ≤ 500</td><td>1.5 times of U_R</td></tr><tr><td>= 630</td><td>1.2 times of U_R</td></tr></table>	Rated vol.(V)	Apply Voltage	≤ 250	2 times of U _R	250 <V ≤ 500	1.5 times of U _R	= 630	1.2 times of U _R	* Q/D.F Value: X7R, X5R,X6S:																																																																										
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		= 630	1.2 times of U _R																																																																																		
		Exception item:	<table><tr><th>Rated vol.(V)</th><th>D.F. ≤</th><th>Exception of D.F. ≤</th></tr><tr><td rowspan="3">≥ 50V</td><td rowspan="3">3%</td><td>6% 0201(50V);0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td></tr><tr><td>10% 1210 ≥ 4.7μF</td></tr><tr><td>20% 0603 ≥ 1μF; 0805 ≥ 1μF;1206 ≥ 4.7μF; 1210 ≥ 10μF</td></tr><tr><td>35V</td><td>5%</td><td>20% 0805≥2.2μF;1210 ≥ 10μF</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">5%</td><td>10% 0201 ≥ 0.01μF;0805 ≥ 1μF; 1210 ≥ 10μF</td></tr><tr><td>14% 0603 ≥ 0.33μF;1206 ≥ 4.7μF</td></tr><tr><td>15% 0402 ≥ 0.10μF;0603 ≥ 0.47μF;0805 ≥ 2.2μF;1206 ≥ 6.8μF; 1210 ≥ 22μF</td></tr><tr><td rowspan="2">16V</td><td rowspan="2">5%</td><td>10% 0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF</td></tr><tr><td>15% 0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.68μF;0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td></tr><tr><td rowspan="2">10V</td><td rowspan="2">7.5%</td><td>15% 0402 ≥ 0.33μF; 0603 ≥ 0.33μF;0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td></tr><tr><td>20% 0201 ≥ 0.1μF ;0402 ≥ 1μF</td></tr><tr><td>6.3V</td><td>15%</td><td>30% 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF</td></tr><tr><td>4V</td><td>20%</td><td>---</td></tr></table>	Rated vol.(V)	D.F. ≤	Exception of D.F. ≤	≥ 50V	3%	6% 0201(50V);0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	10% 1210 ≥ 4.7μF	20% 0603 ≥ 1μF; 0805 ≥ 1μF;1206 ≥ 4.7μF; 1210 ≥ 10μF	35V	5%	20% 0805≥2.2μF;1210 ≥ 10μF	25V	5%	10% 0201 ≥ 0.01μF;0805 ≥ 1μF; 1210 ≥ 10μF	14% 0603 ≥ 0.33μF;1206 ≥ 4.7μF	15% 0402 ≥ 0.10μF;0603 ≥ 0.47μF;0805 ≥ 2.2μF;1206 ≥ 6.8μF; 1210 ≥ 22μF	16V	5%	10% 0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF	15% 0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.68μF;0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	10V	7.5%	15% 0402 ≥ 0.33μF; 0603 ≥ 0.33μF;0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	20% 0201 ≥ 0.1μF ;0402 ≥ 1μF	6.3V	15%	30% 0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF	4V	20%	---																																																				
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<table><tr><th>Rated vol.(V)</th><th>Dielectric</th><th>Size</th><th>Cap. Range</th><th>Apply Voltage</th></tr><tr><td>4 & 6.3</td><td>X7R/X6S</td><td>All</td><td>All</td><td rowspan="17">150% times of U_R</td></tr><tr><td rowspan="4">10</td><td rowspan="4">X5R</td><td>0402</td><td>C ≥ 0.22μF</td></tr><tr><td>0603</td><td>C ≥ 1.0μF</td></tr><tr><td>0805</td><td>C ≥ 2.2μF</td></tr><tr><td>1206</td><td>C ≥ 4.7μF</td></tr><tr><td rowspan="6">16</td><td rowspan="3">X5R</td><td>0402</td><td>C ≥ 0.22μF</td></tr><tr><td>0603</td><td>C ≥ 1.0μF</td></tr><tr><td>0402</td><td>C ≥ 0.47μF</td></tr><tr><td rowspan="3">Y5V</td><td>0603</td><td>C ≥ 2.2μF</td></tr><tr><td>0805</td><td>C ≥ 4.7μF</td></tr><tr><td>0402</td><td>C ≥ 0.22μF</td></tr><tr><td rowspan="5">100</td><td rowspan="5">X7R/X6S</td><td>0805</td><td>C ≥ 0.22μF</td></tr><tr><td>1206</td><td rowspan="4">C ≥ 1.0μF</td></tr><tr><td>1210</td></tr><tr><td>1825</td></tr><tr><td>2220</td></tr><tr><td rowspan="6">200 & 250</td><td rowspan="2">X7R/X6S</td><td>1210</td><td>C ≥ 0.22μF</td></tr><tr><td>1812</td><td>C ≥ 0.47μF</td></tr><tr><td rowspan="3">X7R/X6S</td><td>1825</td><td rowspan="2">C ≥ 1.0μF</td></tr><tr><td>2220</td></tr><tr><td>2225</td></tr><tr><td rowspan="8">6.3</td><td rowspan="5">X5R</td><td>All</td><td>C ≥ 10μF</td></tr><tr><td>0201</td><td>C ≥ 0.1μF</td></tr><tr><td>0402</td><td>C ≥ 1.0μF</td></tr><tr><td>0603</td><td>C ≥ 4.7μF</td></tr><tr><td>0805</td><td>C ≥ 2.2μF</td></tr><tr><td rowspan="3">1206</td><td>C ≥ 47μF</td></tr><tr><td rowspan="2">Y5V</td><td>0402</td><td>C ≥ 1.0μF</td></tr><tr><td>C ≥ 0.1μF</td></tr><tr><td rowspan="4">10</td><td rowspan="3">X5R</td><td>0201</td><td>C ≥ 0.1μF</td></tr><tr><td>0402</td><td>C ≥ 1.0μF</td></tr><tr><td>0603</td><td>C ≥ 4.7μF</td></tr><tr><td>Y5V</td><td>0402</td><td>C ≥ 1.0μF</td></tr></table>	Rated vol.(V)	Dielectric	Size	Cap. Range	Apply Voltage	4 & 6.3	X7R/X6S	All	All	150% times of U _R	10	X5R	0402	C ≥ 0.22μF	0603	C ≥ 1.0μF	0805	C ≥ 2.2μF	1206	C ≥ 4.7μF	16	X5R	0402	C ≥ 0.22μF	0603	C ≥ 1.0μF	0402	C ≥ 0.47μF	Y5V	0603	C ≥ 2.2μF	0805	C ≥ 4.7μF	0402	C ≥ 0.22μF	100	X7R/X6S	0805	C ≥ 0.22μF	1206	C ≥ 1.0μF	1210	1825	2220	200 & 250	X7R/X6S	1210	C ≥ 0.22μF	1812	C ≥ 0.47μF	X7R/X6S	1825	C ≥ 1.0μF	2220	2225	6.3	X5R	All	C ≥ 10μF	0201	C ≥ 0.1μF	0402	C ≥ 1.0μF	0603	C ≥ 4.7μF	0805	C ≥ 2.2μF	1206	C ≥ 47μF	Y5V	0402	C ≥ 1.0μF	C ≥ 0.1μF	10	X5R	0201	C ≥ 0.1μF	0402	C ≥ 1.0μF	0603	C ≥ 4.7μF	Y5V	0402	C ≥ 1.0μF	
Rated vol.(V)	Dielectric	Size	Cap. Range	Apply Voltage																																																																																	
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	Y5V	0402	C ≥ 1.0μF																																																																																		

* Test time: 1000+24/-0 hrs.

* Measurement to be made after keeping at room temp. for 48±4 hrs (Class II).

RELIABILITY TEST CONDITIONS AND REQUIREMENTS(Con.)

No.	Item	Test Condition	Requirements										
14.	Resistance to Flexure of Substrate	* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1mm per second until the deflection becomes 1mm. 	* No remarkable damage. <table><tr><th>Dielectric</th><th>Cap Change</th></tr><tr><td>Class I(NPO)</td><td>within $\pm 3.0\%$ or $\pm 0.3\text{pF}$ whichever is larger</td></tr><tr><td>Class II(X7R)</td><td>within $\pm 12.5\%$</td></tr><tr><td>Class II(X6S)</td><td>within $\pm 20\%$</td></tr><tr><td>Class II(Y5V)</td><td>within $\pm 30\%$</td></tr></table> (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)	Dielectric	Cap Change	Class I(NPO)	within $\pm 3.0\%$ or $\pm 0.3\text{pF}$ whichever is larger	Class II(X7R)	within $\pm 12.5\%$	Class II(X6S)	within $\pm 20\%$	Class II(Y5V)	within $\pm 30\%$
Dielectric	Cap Change												
Class I(NPO)	within $\pm 3.0\%$ or $\pm 0.3\text{pF}$ whichever is larger												
Class II(X7R)	within $\pm 12.5\%$												
Class II(X6S)	within $\pm 20\%$												
Class II(Y5V)	within $\pm 30\%$												
15.	Adhesive Strength of Termination	* Capacitors mounted on a substrate. A force of 5N(≤ 0603) or 10N(> 0603) applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 ± 1 second. 	* No remarkable damage or removal of the terminations.										
16.	Vibration Resistance	* Vibration frequency: 10~55 Hz/min. * Total amplitude: 1.5mm * Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)	* No remarkable damage. * Cap change and Q/D.F.: To meet initial spec.										

9. PACKAGING STYLE AND QUANTITY

Size	Thickness (mm)	Paper tape		Plastic tape	
		7" reel	13" reel	7" reel	13" reel
0201 (0603)	0.30±0.05	15k	70K	-	-
0402 (1005)	0.50±0.05	10k	50k	-	-
0603 (1608)	0.80±0.07	4k	15k	-	-
	0.80+0.15/-0.10	4k	15k	-	-
0805 (2012)	0.80±0.10	4k	15k	-	-
	1.25±0.10	-	-	3k	10k
	1.25±0.20	-	-	3k	10k
1206 (3216)	0.95±0.10	-	-	3k	10k
	1.15±0.15	-	-	3K	10K
	1.25±0.10	-	-	3k	10k
	1.60±0.20	-	-	2k	-
	1.60+0.30/-0.10	-	-	2k	-
1210 (3225)	0.95±0.10	-	-	3k	10k
	1.25±0.10	-	-	3k	10k
	1.60±0.20	-	-	2k	-
	2.00±0.20	-	-	2k	-
	2.50±0.30	-	-	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)	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
2220 (5750)	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
	2.80±0.30	-	-	0.5k	-
2225 (5763)	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
	2.80±0.30	-	-	0.5k	-

Unit: pieces

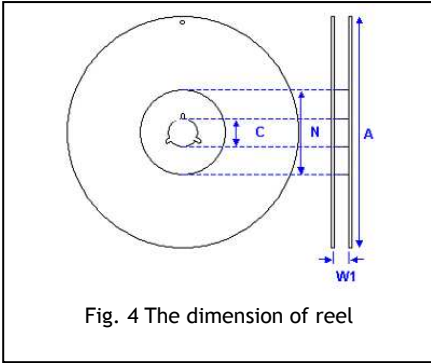


Fig. 4 The dimension of reel

Size	0201, 0402, 0603, 0805, 1206, 1210			1812, 1825, 2220, 2225
Reel size	7"	10"	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
W ₁	8.4+1.5/-0	8.4+1.5/-0	8.4+1.5/-0	12.4+2.0/-0
A	178.0±0.10	250.0±1.0	330.0±1.0	178.0±0.10
N	60.5±1.0	100.0±1.0	100±1.0	60.5±1.0

9-1 CARDBOARD TAPE DIMENSIONS

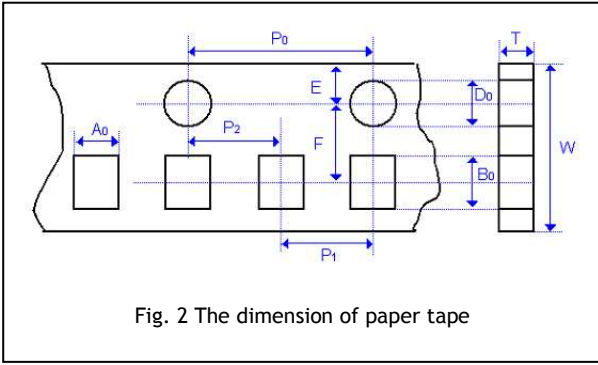


Fig. 2 The dimension of paper tape

9-2 EMBOSSED TAPE DIMENSIONS

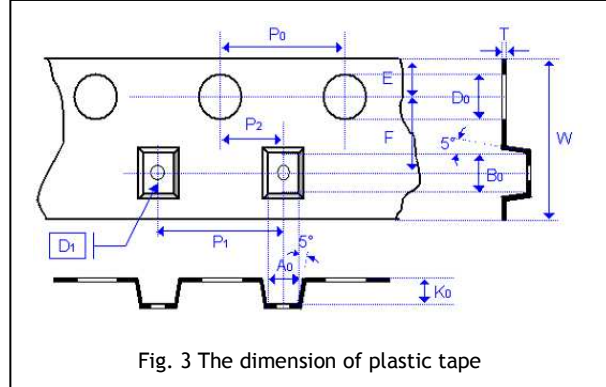


Fig. 3 The dimension of plastic tape

Size	0201	0402	0603		0805			1206			1210	
Chip Thickness	0.30 ± 0.03	0.50±0.05	0.80±0.07	0.80 +0.15/-0.10	0.60±0.10	0.80±0.10	1.25±0.10 1.25±0.20	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
A ₀	0.38±0.05	0.62±0.05	1.00 +0.05/-0.10	1.02 +0.05/-0.10	1.50±0.10	1.50±0.10	<1.65	2.00±0.10	<2.00	<2.00	<3.05	<3.10
B ₀	0.68±0.05	1.12±0.05	1.80±0.10	1.80±0.10	2.30±0.10	2.30±0.10	<2.40	3.50±0.10	<3.60	<3.70	<3.80	<4.00
T	0.42±0.05	0.60±0.05	0.95±0.05	0.97±0.05	0.75±0.05	0.95±0.05	0.23±0.05	0.95±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.23±0.05
K ₀	-	-	-	-	-	-	<2.50	-	<2.50	<2.50	<2.50	<3.50
W	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	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	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.100	4.00±0.10
10xP ₀	40.0±0.10	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	40.00±0.20	40.00±0.20	40.00±0.20	40.0±0.10
P ₁	2.00±0.05	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	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	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	1.55±0.05	1.50±0.10/-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
D ₁	-	-	-	-	-	-	1.00±0.10	-	1.00±0.10	1.00±0.10	1.00±0.10	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±0.05	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10
F	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±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	1.60±0.20 2.00±0.20	2.50±0.30	2.00±0.20	2.50±0.30 2.80±0.20	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	<3.00	<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	40.00±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	40.00±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	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
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±0.10	1.75±0.10	1.75±0.10	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

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 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 0201, 0402, 0603, 0805 and 1206, and within 50°C of the soldering temperature for bigger chips such as 1210, 1808, 1825, 1812, 2220 and 2225, etc.

SOLDERING

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

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 etc. wave soldering and hand soldering are not 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 below Table description.

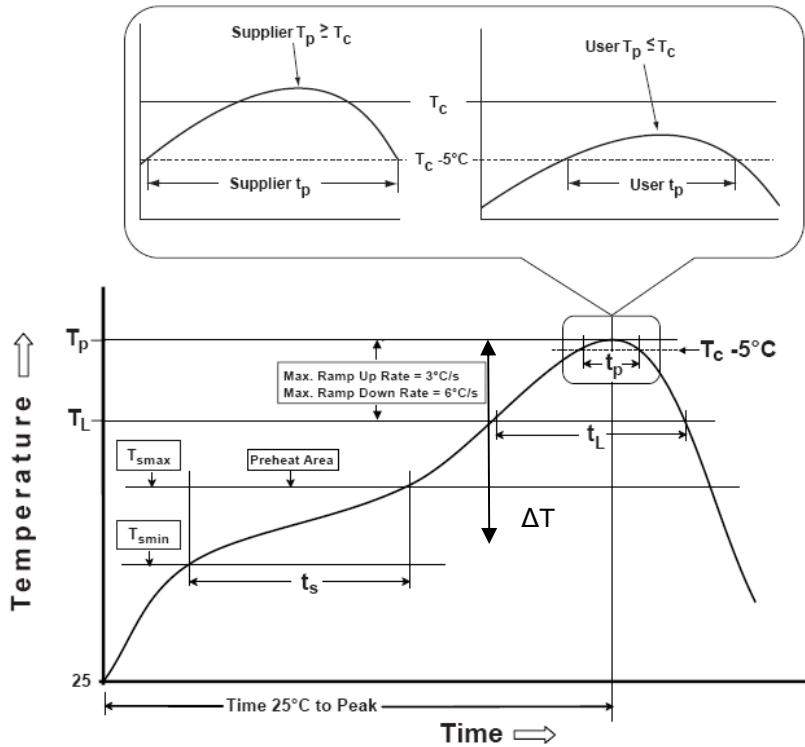
Profile Feature	Pb-Free Assembly
Preheat/Soak	
Temperature Min.(T _{smin})	150°C
Temperature Max.(T _{smax})	200°C
Time(t _s) from (T _{smin} to T _{smax})	60 to 120 seconds
Ramp-up rate(T _L to T _p)	3°C/second max.
Liquidous temperature(T _L)	217°C
Time(t _L) maintained above T _L	60 to 150 seconds
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 ~ 7°C)

Time at peak temperature = 10sec, Dwell above 217°C = 90sec, Ramping rate = 3°C/sec(heating) and 6°C/sec(heating).

Classification Reflow Profiles



Chip Size	ΔT
0201, 0402, 0603, 0805, 1206	100 °C
1210, 1808, 1812, 1825, 2220, 2225	50 °C

Soldering	Solder Temp. (T_c)	Soldering Time (t_p)
Reflow	235 – 260 °C	< 15 sec.
Wave	230 – 260 °C	< 5 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.

11.REFERENCE TABLE

<u>FS</u>	<u>32</u>	<u>X</u>	<u>225</u>	<u>K</u>	<u>101</u>	<u>E</u>	<u>G</u>	<u>G</u>
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	Code	Description
FS	Size ≤ 2225 , Ur < 1000V Capacitance $\geq 1.0 \mu F$ Series Product		

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

Table 3 Dielectric Material Characteristics			
Code	Description	Code	Description
N	C0G(NPO)	X	X7R
B	X5R	F	Y5V
S	X6S		

Table 4 Capacitance Rule Code					
Two significant digits followed by no. of zeros. And R is in place of decimal point.					
Code	Description	Code	Description	Code	Description
R47	0.47pF	100	$100=10 \times 10^0$ =10pF	104	$104=10 \times 10^4$ =100nF
0R5	0.5pF	102	$102=10 \times 10^2$ =1000pF	106	$106=10 \times 10^6$ =10μF

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

Table 6 Rated voltage

General Purpose							
Code	Description	Code	Description	Code	Description	Code	Description
6R3	6.3VDC	101	100VDC	102	1000VDC	402	4000VDC
100	10VDC	201	200VDC	152	1500VDC	502	5000VDC
160	16VDC	251	250VDC	202	2000VDC	602	6000VDC
250	25VDC	501	500VDC	252	2500VDC		
500	50VDC	631	630VDC	302	3000VDC		

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	Code	Description
G	RoHS Compliant		