

Reference No. :

Customer:

承 認 書

APPROVAL SHEET

零件名稱：積層陶瓷電容

Description : Multi-Layer Chip Capacitor

DATE : 2014/02/01

宸遠科技料號 CCT Part Numbers	客戶料號 Customer's Part Numbers

宸 遠 科 技 ChipCera Technology Co., LTD			客 戶 承 認 Customer's Approval
製表 Prepared by	審查 Checked by	核准 Approved by	
Bella		G. Chan	
QA Engineer	QA Manager	Vice G.M.	

深圳市宸遠電子科技有限公司

ChipCera Technology CO., LTD

<http://www.chipcera.com.cn>

深圳寶安西鄉寶源第二工業區 4 棟

TEL : +86-755-29120592

FAX : +86-755-29120593

使用注意事項

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2. 如將本目錄內的產品用於可能對人身與社會安全造成重大損失的用途時，請與我司工程師聯繫。
3. 產品若有變更與途中停產恕不另行通知，請以實際產品為準。請在訂購之前向我司銷售代表查詢。
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5. 本目錄中的產品內容未經允許不得擅自轉載與複製。
6. 如規格書參數與實際產品參數衝突以實際產品為準。
7. 注：產品規格書內相關資料僅供參考，如有更新恕不另行通知，最終解釋權歸宸遠科技！

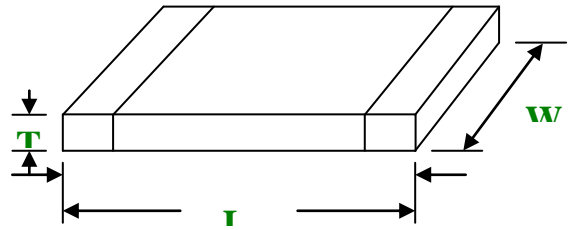
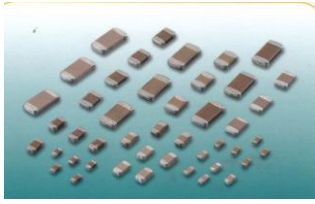
1 Part Number Information

How to order

CC	0805	NP0	8	J	102	R	L
Type CC = Chip Capacitor	Size 0402 0603 0805 1206 1210 1808 1812 2220 1825 2225	Dielectric NP0 X7R Y5V X5R X7E X6S	Dielectric VoltageVDC 1=6.3VDC 2 = 10VDC 3 = 16VDC 4 = 25VDC L=35VDC 5 = 50VDC E=63VDC 6 = 100VDC 7 = 200VDC 8 =250VDC I=400VDC 9 = 500VDC H=630VDC P= 1 KVDC R= 2 KVDC T= 3 KVDC W=5KVDC	Tolerance A=±0.05pF B=±0.10pF C=±0.25pF D=±0.50pF F=±1.0% G=±2.0% J=±5.0% K=±10% M=±20% Z=-20~+80%	Capacitance 1st two digits are significant; third digit denotes number of zeros, And A is in place of decimal point. example : 47A=4.7pF 102=10*10 ² pF =1000pF =1nF	Packing Quantity B : Bulk P : 4K/reel 3K/reel R { 2K/reel 1K/reel	RoHS compliance

Tolerance	Capacitance for dielectric				
	NP0		X7R	X5R	Y5V
A=±0.05pF B=±0.10pF C=±0.25pF D=±0.50pF F=±1.0% G=±2.0% J=±5.0% K=±10% M=±20%	10pF and below	More than 10pF	100pF~1 μF (101~105)	1uf~100uf (105~107)	10nF~10uF (103~106)
	B,C,D	G,J	J,K,M	K,M	M,Z

2 Dimension Specification



Product dimensions in mm.

Case size	Length(L)	Width(W)	Thickness(T)	Symbol
0402	1.0±0.05	0.50±0.05	0.50±0.05	A
0603	1.6±0.10	0.80±0.10	0.80±0.10	C
0805	2.0±0.10	1.25±0.10	0.60±0.10	B
			0.80±0.10	C
			1.25±0.20	E
1206	3.20±0.15	1.60±0.15	0.80±0.10	C
			1.25±0.20	E
			1.60±0.20	D
1210	3.2±0.15	2.50±0.20	1.25±0.20	E
			1.60±0.20	D
			2.00±0.20	K
			2.40±0.20	G
1808	4.60±0.30	2.00±0.30	1.25±0.20	E
			1.60±0.20	D
			2.00±0.20	K
1812	4.60±0.30	3.20±0.30	1.25±0.20	E
			1.60±0.20	D
			2.00±0.20	K
			2.40±0.20	G
			2.80±0.20	H
2220	5.70±0.40	5.00±0.40	1.25±0.20	E
			1.60±0.20	G
			2.00±0.20	K
			2.40±0.20	G
			2.80±0.20	H
2225	5.70±0.30	6.35±0.40	1.25±0.20	E
			1.60±0.20	D
			2.00±0.20	K
			2.80±0.20	H



X7R Series

DIELECTRIC		X7R																											
SIZE		0402			0603			0805			1206			1210			1808			1812			2220			2225			
CAP	CODE	16V	25V	50V	50V	100V	250V	50V	100V	200V	50V	100V	250V	50V	100V	250V	50V	100V	250V	50V	100V	250V	50V	100V	250V	50V	100V	250V	
180pF	181																												
220pF	221																												
270pF	271																												
330pF	331																												
390pF	391																												
470pF	471																												
560pF	561																												
680pF	681																												
820pF	821																												
1nF	102																												
1.2nF	122																												
1.5nF	152																												
1.8nF	182																												
2.2nF	222																												
2.7nF	272																												
3.3nF	332																												
3.9nF	392																												
4.7nF	472																												
5.6nF	562																												
6.8nF	682																												
10nF	103																												
12nF	123																												
15nF	153																												
18nF	183																												
22nF	223																												
27nF	273																												
33nF	333																												
39nF	393																												
47nF	473																												
56nF	563																												
68nF	683																												
100nF	104																												
120nF	124																												
150nF	154																												
180nF	184																												
220nF	224																												
270nF	274																												
330nF	334																												
390nF	394																												
470nF	474																												
560nF	564																												
680nF	684																												
820nF	824																												
1uF	105																												
1.5uF	155																												
2.2uF	225																												
4.7uF	475																												
10uF	106																												

DIELECTRIC		X7R																														
SIZE		0805		1206				1210				1808					1812					2220					2225					
CAP	CODE	250V	500V	500V	630V	1000V	2KV	500V	630V	1KV	2KV	500V	630V	1KV	2KV	3KV	500V	630V	1KV	2KV	3KV	500V	630V	1KV	2KV	3KV	500V	630V	1KV	2KV	3KV	
100pF	101																															
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180pF	181																															
220pF	221																															
270pF	271																															
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18nF	183																															
22nF	223																															
27nF	273																															
33nF	333																															
39nF	393																															
47nF	473																															
56nF	563																															

X7R/X5R Series

DIELECTRIC		X7R/X5R																																
SIZE		0402			0603			0805					1206					1210					1812					2220						
CAP	CODE	6.3V	10V	10V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	16V	25V	35V	50V	6.3V	10V	16V	25V	35V	50V	6.3V	10V	16V	25V	50V		
1uF	105																																	
1.5uF	155																																	
2.2uF	225																																	
3.3uF	335																																	
4.7uF	475																																	
10uF	106																																	
22uF	226																																	
47uF	476																																	
100uF	107																																	
220uF	227																																	

Y5V Series

DIELECTRIC		Y5V																					
SIZE		0402			0603				0805				1206				1210						
CAP	CODE	10V	16V	25V	10V	16V	25V	50V	10V	16V	25V	50V	10V	16V	25V	50V	10V	16V	25V	50V	16V	25V	50V
10nF	103	A	A	A	C	C	C	C			C	C		C	C	C		C	C	C	E	E	E
15nF	153	A	A	A	C	C	C	C			C	C		C	C	C		C	C	C	E	E	E
22nF	223	A	A	A	C	C	C	C			C	C		C	C	C		C	C	C	E	E	E
33nF	333	A	A		C	C	C	C			C	C		C	C	C		C	C	C	E	E	E
47nF	473	A	A		C	C	C	C			C	C		C	C	C		C	C	C	E	E	E
68nF	683	A	A		C	C	C	C			C	C		C	C	C		C	C	C	E	E	E
100nF	104	A	A		C	C	C	C			C	C		C	C	C		C	C	C	E	E	E
150nF	154	A			C	C	C				C	C		E	E	E		E	E	E	E	E	E
180nF	184	A			C	C	C				C	C		E	E	E		E	E	E	E	E	E
220nF	224	A			C	C	C				C	C		E	E	E		E	E	E	E	E	D
330nF	334	A			C	C	C			C	C	E		E	E	E		E	E	E	E	D	D
470nF	474	A			C	C				C	E	E		E	E	E		E	E	E	D	D	D
680nF	684				C	C			E	C	E	E		E	E	E		E	E	E	D	D	D
820nF	824				C	C			E	C	E	E		E	E			E	E		D	D	D
1uF	105				C	C			E	E	E	E		D	E			D	E		D	D	D
1.5uF	155								E	E	E			D	E			D	E		D	D	D
2.2uF	225								E	E	E		E	D	E			D	E		D	D	D
3.3uF	335								E	E	E		E	D	E			D	E		D	D	D
4.7uF	475								E	E	E		E	D	E			D	E		D	D	D
10uF	106								D	D	D		E	D				D			D	D	D
22uF	226								D				D	D				D			D	D	
47uF	476								D				D					D			D		

4. About 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: NPO Cap≤1000pF 1.0±0.2Vrms, 1MHz±10% Cap>1000pF 1.0±0.2Vrms, 1KHz±10%	* Shall not exceed the limits given in the detailed spec.																																																																																												
3.	Q/ D.F. (Dissipation Factor)	Class II * : X7R,X7E, X6S, X5R,Y5V Cap≤10μF, 1.0±0.2Vrms, 1kHz±10% ** Cap>10μF, 0.5±0.2Vrms, 120Hz±20% ** Test condition: 0.5±0.2Vrms, 1KHz±10% X7R: 0603≥225(10V), 0805=106(6.3V&10V) X5R: 01R5≥103, 0201≥224 (6.3V,10V), 0402≥475 (6.3V), 0402≥225(10V), 0603=106 (6.3V,10V), TT18X≥475(10V) , TT15X series X6S:0201≥224 (6.3V),0402≥225 (6.3V), * 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.	NPO: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C X7R,, X6S, X5R: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td>≥100V</td> <td>≤2.5%</td> <td>≤3%</td> <td>1206±0.47μF</td> </tr> <tr> <td></td> <td></td> <td>≤5%</td> <td>0805±0.1μF, 0603±0.068μF</td> </tr> <tr> <td rowspan="2">50V</td> <td rowspan="2">≤2.5%</td> <td>≤3%</td> <td>0201(50V); 0603±0.047μF; 0805±0.18μF; 1206±0.47μF</td> </tr> <tr> <td>≤5%</td> <td>1210±4.7μF</td> </tr> <tr> <td rowspan="2">35V</td> <td rowspan="2">≤2.5%</td> <td>≤10%</td> <td>0402±0.1μF; 0603±1μF; 0805±1μF; 1206±2.2μF; 1210±10μF; TT series</td> </tr> <tr> <td>≤10%</td> <td>0603±1μF; 0805±2.2μF; 1210±10μF</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</td> </tr> <tr> <td>≤7%</td> <td>0603±0.33μF; 1206±4.7μF</td> </tr> <tr> <td>≤10%</td> <td>0402±0.1μF; 0603±0.47μF; 0805±2.2μF; 1206±6.8μF; 1210±22μF; TT series</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤3.5%</td> <td>≤12.5%</td> <td>0402±1μF</td> </tr> <tr> <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 rowspan="2">10V</td> <td rowspan="2">≤5%</td> <td>≤10%</td> <td>0201±0.1μF; 0402±0.22μF; 0603±0.68μF; 0805±2.2μF; 1206±4.7μF; 1210±22μF; TT series</td> </tr> <tr> <td>≤15%</td> <td>0201±0.012μF; 0402±0.33μF; 0603±0.33μF; 0805±2.2μF; 1206±2.2μF; 1210±22μF; TT series</td> </tr> <tr> <td 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±4.7μF; 1210±100μF; TT series</td> </tr> <tr> <td>≤20%</td> <td>0402±2.2μF</td> </tr> <tr> <td>4V</td> <td>≤15%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> X7R/X7E, LD series : 100V: DF≤1.4%; ≤200V:DF≤1.0% Y5V: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F.s</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>≤5%</td> <td>≤7%</td> <td>0603±0.1μF; 0805±0.47μF; 1206±4.7μF; TT series & Cap≥1μF</td> </tr> <tr> <td>35V</td> <td>≤7%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">≤5%</td> <td>≤7%</td> <td>0402±0.047μF; 0603±0.1μF; 0805±0.33μF; 1206±1μF; 1210±4.7μF</td> </tr> <tr> <td>≤9%</td> <td>0402±0.068μF; 0603±0.47μF; 1206±4.7μF; 1210±22μF; TT series & Cap≥1μF</td> </tr> <tr> <td>16V (C<1.0μF)</td> <td>≤7%</td> <td>≤9%</td> <td>0402±0.068μF; 0603±0.68μF</td> </tr> <tr> <td></td> <td></td> <td>≤12.5%</td> <td>0402±0.22μF</td> </tr> <tr> <td>16V (C≥1.0μF)</td> <td>≤9%</td> <td>≤12.5%</td> <td>0603±2.2μF; 0805±3.3μF; 1206±10μF; 1210±22μF; 1812±47μF; TT series & Cap≥1μF</td> </tr> <tr> <td>10V</td> <td>≤12.5%</td> <td>≤20%</td> <td>0402±0.47μF</td> </tr> <tr> <td>6.3V</td> <td>≤20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	D.F.≤	Exception of D.F. ≤		≥100V	≤2.5%	≤3%	1206±0.47μF			≤5%	0805±0.1μF, 0603±0.068μF	50V	≤2.5%	≤3%	0201(50V); 0603±0.047μF; 0805±0.18μF; 1206±0.47μF	≤5%	1210±4.7μF	35V	≤2.5%	≤10%	0402±0.1μF; 0603±1μF; 0805±1μF; 1206±2.2μF; 1210±10μF; TT series	≤10%	0603±1μF; 0805±2.2μF; 1210±10μF	25V	≤3.5%	≤5%	0201±0.01μF; 0805±1μF; 1210±10μF	≤7%	0603±0.33μF; 1206±4.7μF	≤10%	0402±0.1μF; 0603±0.47μF; 0805±2.2μF; 1206±6.8μF; 1210±22μF; TT series	16V	≤3.5%	≤12.5%	0402±1μF	≤5%	0201±0.01μF; 0402±0.033μF; 0603±0.15μF; 0805±0.68μF; 1206±2.2μF; 1210±4.7μF	10V	≤5%	≤10%	0201±0.1μF; 0402±0.22μF; 0603±0.68μF; 0805±2.2μF; 1206±4.7μF; 1210±22μF; TT series	≤15%	0201±0.012μF; 0402±0.33μF; 0603±0.33μF; 0805±2.2μF; 1206±2.2μF; 1210±22μF; TT series	6.3V	≤10%	≤15%	0201±0.1μF; 0402±1μF; 0603±10μF; 0805±4.7μF; 1206±4.7μF; 1210±100μF; TT series	≤20%	0402±2.2μF	4V	≤15%	---	---	Rated vol.	D.F. ≤	Exception of D.F.s		≥50V	≤5%	≤7%	0603±0.1μF; 0805±0.47μF; 1206±4.7μF; TT series & Cap≥1μF	35V	≤7%	---	---	25V	≤5%	≤7%	0402±0.047μF; 0603±0.1μF; 0805±0.33μF; 1206±1μF; 1210±4.7μF	≤9%	0402±0.068μF; 0603±0.47μF; 1206±4.7μF; 1210±22μF; TT series & Cap≥1μF	16V (C<1.0μF)	≤7%	≤9%	0402±0.068μF; 0603±0.68μF			≤12.5%	0402±0.22μF	16V (C≥1.0μF)	≤9%	≤12.5%	0603±2.2μF; 0805±3.3μF; 1206±10μF; 1210±22μF; 1812±47μF; TT series & Cap≥1μF	10V	≤12.5%	≤20%	0402±0.47μF	6.3V	≤20%	---	---
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4a.	Dielectric Strength	*To apply voltage(≤100V) 250%. *Duration: 1 to 5 sec. *Charge & discharge current less than 50mA. *To apply voltage: 200V ~300V & LD series ≥2 times V DC 500V ~ 999V ≥1.5 times V DC 1000V ~ 3000V ≥1.2 times V DC *Cut-off, set at 10mA *TEST= 15 sec. *RAMP=0	*No evidence of damage or flash over during test.																																																																																												
4b.	Dielectric Strength (for X1/Y2 & X2/Y3)	* To apply 1500 VAC voltage. * Duration: 60 sec.	* No evidence of damage or flash over during test.																																																																																												
5.	Insulation Resistance	To apply rated voltage for max. 120 sec.	10GΩ or RxC≥500Ω-F whichever is smaller. Class II (X7R, X7E, X6S, X5R, Y5V) <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="5">10GΩ or RxC≥100 Ω-F whichever is smaller.</td> </tr> <tr> <td>50V:0603±1μF;0805±1μF;1206±2.2μF;1210±4.7μF</td> </tr> <tr> <td>35V:0805±2.2μF;1210±10μF</td> </tr> <tr> <td>25V:0402±1μF;0603±2.2μF;0805±2.2μF;1206±10μF;1210±10μF</td> </tr> <tr> <td>16V:0201±0.1μF;0402±0.22μF;0603±1μF;0805±2.2μF;1206±10μF;1210±47μF</td> </tr> <tr> <td>10V:0201±47nF;0402±0.47μF;0603±0.47μF; 0805±2.2μF; 1206±4.7μF;1210±47μF</td> <td rowspan="4">RxC≥50 Ω-F</td> </tr> <tr> <td>6.3V ; 4V ; TT series</td> </tr> <tr> <td>50V: 0402±0.1μF</td> </tr> <tr> <td>35V:0603±1μF</td> </tr> <tr> <td>10V:0603±10μF</td> <td></td> </tr> </tbody> </table> Rated Voltage: 200V ~ 630V To apply rated voltage (500V max.) for 60 sec. >10GΩ or 100Ω-F whichever is smaller. Rated Voltage: >630V To apply 500V for 60sec. >10GΩ	Rated voltage	Insulation Resistance	100V: X7R	10GΩ or RxC≥100 Ω-F whichever is smaller.	50V:0603±1μF;0805±1μF;1206±2.2μF;1210±4.7μF	35V:0805±2.2μF;1210±10μF	25V:0402±1μF;0603±2.2μF;0805±2.2μF;1206±10μF;1210±10μF	16V:0201±0.1μF;0402±0.22μF;0603±1μF;0805±2.2μF;1206±10μF;1210±47μF	10V:0201±47nF;0402±0.47μF;0603±0.47μF; 0805±2.2μF; 1206±4.7μF;1210±47μF	RxC≥50 Ω-F	6.3V ; 4V ; TT series	50V: 0402±0.1μF	35V:0603±1μF	10V:0603±10μF																																																																														
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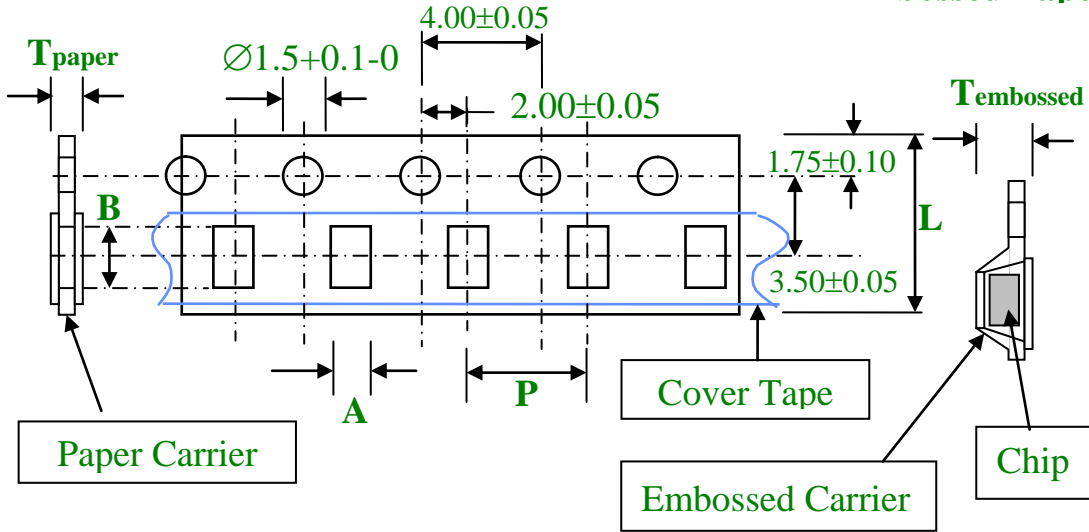
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8.	Vibration Resistance	<ul style="list-style-type: none"> * Vibration frequency: 10~55 Hz/min. * Total amplitude: 1.5mm * Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.) * Measurement to be made after keeping at room temp. for 24±2 hrs.	<ul style="list-style-type: none"> * No remarkable defect. * Dimensions to conform to individual specification sheet. 																																																																									
9.	Solderability	<ul style="list-style-type: none"> * Solder temperature: 235±5°C * Dipping time: 2±0.5 sec. 	95% min. coverage of all metalized area.																																																																									
10.	Bending Test	<ul style="list-style-type: none"> *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 / SH series: 5 mm** & 3 mm*** and then the pressure shall be maintained for 5±1 sec. *Measurement to be made after keeping at room temp. for 24±2 hrs. (** Thickness >1.0mm; *** Thickness≤1.0mm) 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: NP0: within ±5% or 0.5pF whichever is larger X7R, X7E, X6S, X5R: within ±12.5% , Y5V: within ±30% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.) 																																																																									
11.	Resistance to Soldering Heat	<ul style="list-style-type: none"> * Solder temperature: 260±5°C * Dipping time: 10±1 sec * Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder. * Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs. 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: NP0: within ±2.5% or 0.25pF whichever is larger X7R, X7E, X6S, X5R: within ±7.5% Y5V: within ±20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements. * 25% max. leaching on each edge. 																																																																									
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Humidity (Damp Heat) Steady State	<ul style="list-style-type: none"> * Test temp.: 40±2°C * Humidity: 90~95% RH * Test time: 500+24/-0hrs. *Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs. 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: NP0: within ±5% or 0.5pF whichever is larger X7R, X7E, X6S, X5R: ≥10V**, within ±12.5%; 6.3V within ±25%; TT series, within ±25% **10V:0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25%; Y5V: ≥10V, within ±30%; 6.3V, within +30/-40% * Q/D.F. value: NP0: More than 30pF Q≥350, 10pF≤C≤30pF, Q≥275+2.5C, Less than 10pF Q≥200+10C X7R, X6S, X5R: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">≥100V</td> <td rowspan="2">≤3%</td> <td>≤6% 1206≥0.47μF</td> </tr> <tr> <td>≤7.5% 0805≥0.1μF, 0603≥0.068μF</td> </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% 0402≥0.1μF;0603≥1μF; 0805≥1μF; 1206≥2.2μF; 1210≥10μF; TT series</td> </tr> <tr> <td rowspan="2">35V</td> <td rowspan="2">≤5%</td> <td>≤20% 0603≥1μF; 0805≥2.2μF;1210≥10μF</td> </tr> <tr> <td>≤10% 0201≥0.01μF;0805≥1μF; 1210≥10μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤5%</td> <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; TT series</td> </tr> <tr> <td>≤20% 0402≥1μF</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; TT series</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤7.5%</td> <td>≤15% 0201≥0.012μF;0402≥0.33μF; 0603≥0.33μF;0805≥2.2μF 1206≥2.2μF; 1210≥22μF</td> </tr> <tr> <td>≤20% 0201≥0.1μF ;0402≥1μF; TT series</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;TT series</td> </tr> <tr> <td>4V</td> <td>≤20%</td> <td>---</td> </tr> </tbody> </table> <p>X7R/X7E, LD series : DF≤3%</p> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.≤</th> <th>Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>≤7.5%</td> <td>≤10% 0603≥0.1μF;0805≥0.47μF;1206≥4.7μF</td> </tr> <tr> <td>35V</td> <td>≤10%</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">≤7.5%</td> <td>≤10% 0402≥0.047μF;0603≥0.1μF;0805≥0.33μF;1206≥1μF; 1210≥4.7μF</td> </tr> <tr> <td>≤15% 0402≥0.068μF;0603≥0.47μF;1206≥4.7μF; 1210≥22μF; TT series & Cap≥1μF</td> </tr> <tr> <td>16V(C<1.0μF)</td> <td>≤10%</td> <td>≤12.5% 0402≥0.068μF; 0603≥0.68μF</td> </tr> <tr> <td></td> <td></td> <td>≤20% 0402≥0.22μF</td> </tr> <tr> <td>16V(C≥1.0μF)</td> <td>≤12.5%</td> <td>≤20% 0603≥2.2μF;0805≥3.3μF;1206≥10μF;1210≥22μF; 1812≥47μF; TT series & Cap≥1μF</td> </tr> <tr> <td>10V</td> <td>≤20%</td> <td>≤30% 0402≥0.47μF</td> </tr> <tr> <td>6.3V</td> <td>≤30%</td> <td>---</td> </tr> </tbody> </table> <p>*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller. 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<p>14. Humidity (Damp Heat) Load</p>	<p>* Test temp.: 40±2°C * Humidity: 90~95%RH * Test time: 500+24-0 hrs. * To apply voltage: Rated voltage.(Max.500V) * Before initial measurement(Class II only): To apply test voltage for 1hr at 40°C and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.</p>	<p>* No remarkable damage. Cap change: NP0: ±7.5% or 0.75pF whichever is larger. X7R, X7E, X6S, X5R: ≥10V**, within ±12.5%; 6.3V within ±25%; TT series, within ±25% **10V:0603≥4.7µF;0402≥1µF;0201≥0.1µF, within ±25%; Y5V: ≥10V, within ±30%; 6.3V, within +30/-40% Q/D.F. value: NP0: C≥30pF,Q≥200;C<30pF, Q≥100+10/3C X7R, X6S, X5R:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.s</th> <th>Exception of D.F. s</th> </tr> </thead> <tbody> <tr> <td rowspan="2">≥100V</td> <td rowspan="2">≤3%</td> <td>≤6%</td> <td>1206±0.47µF</td> </tr> <tr> <td>≤7.5%</td> <td>0805±0.1µF, 0603±0.068µF</td> </tr> <tr> <td rowspan="3">≥50V</td> <td rowspan="3">≤3%</td> <td>≤6%</td> <td>0201(50V)0603±0.047µF; 0805±0.18µF; 1206±0.47µF</td> </tr> <tr> <td>≤10%</td> <td>1210±4.7µF</td> </tr> <tr> <td>≤20%</td> <td>0402±0.1µF;0603±1µF; 0805±1µF;1206±2.2µF; 1210±10µF; TT series</td> </tr> <tr> <td rowspan="4">35V</td> <td rowspan="4">≤5%</td> <td>≤20%</td> <td>0603±1µF; 0805±2.2µF;1210±10µF</td> </tr> <tr> <td>≤10%</td> <td>0201±0.01µF;0805±1µF; 1210±10µF</td> </tr> <tr> <td>≤14%</td> <td>0603±0.33µF;1206±4.7µF</td> </tr> <tr> <td>≤15%</td> <td>0402±0.10µF;0603±0.47µF;0805±2.2µF;1206±6.8µF;1210±22µF; TT series</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤5%</td> <td>≤20%</td> <td>0402±1µF</td> </tr> <tr> <td>≤10%</td> <td>0603±0.15µF;0805±0.68µF;1206±2.2µF;1210±4.7µF</td> </tr> <tr> <td>≤15%</td> <td>0201±0.01µF;0402±0.033µF;0603±0.68µF;0805±2.2µF; 1206±4.7µF; 1210±22µF; TT series</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤5%</td> <td>≤15%</td> <td>0201±0.012µF; 0402±0.33µF; 0603±0.33µF;0805±2.2µF;1206±2.2µF; 1210±22µF</td> </tr> <tr> <td>≤20%</td> <td>0201±0.1µF ;0402±1µF; TT series</td> </tr> <tr> <td>10V</td> <td>≤7.5%</td> <td>≤15%</td> <td>0201±0.012µF; 0402±0.33µF; 0603±0.33µF;0805±2.2µF;1206±2.2µF; 1210±22µF</td> </tr> <tr> <td>6.3V</td> <td>≤15%</td> <td>≤30%</td> <td>0201±0.1µF;0402±1µF;0603±10µF; 0805±4.7µF;1206±4.7µF;1210±100µF;TT series</td> </tr> <tr> <td>4V</td> <td>≤20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p>X7R/X7E, LD series : DF≤3% Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.s</th> <th>Exception of D.F.s</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>≤7.5%</td> <td>≤10%</td> <td>0603±0.1µF; 0805±0.47µF;1206±4.7µF; TT series & Cap≥1µF</td> </tr> <tr> <td>35V</td> <td>≤10%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">≤7.5%</td> <td>≤10%</td> <td>0402±0.047µF;0603±0.1µF;0805±0.33µF;1206±1µF; 1210±4.7µF</td> </tr> <tr> <td>≤15%</td> <td>0402±0.068µF;0603±0.47µF;1206±4.7µF;1210±22µF; TT series & Cap≥1µF</td> </tr> <tr> <td>16V (C<1.0µF)</td> <td>≤10%</td> <td>≤12.5%</td> <td>0402±0.068µF; 0603±0.68µF</td> </tr> <tr> <td rowspan="2">16V (C≥1.0µF)</td> <td rowspan="2">≤12.5%</td> <td>≤20%</td> <td>0402±0.22µF</td> </tr> <tr> <td>≤20%</td> <td>0603±2.2µF;0805±3.3µF;1206±10µF;1210±22µF;1812±47µF; TT series & Cap≥1µF</td> </tr> <tr> <td>10V</td> <td>≤20%</td> <td>≤30%</td> <td>0402±0.47µF</td> </tr> <tr> <td>6.3V</td> <td>≤30%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p>*I.R.: ≥10V, 500MΩ or 25 Q-F whichever is smaller. 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<p>15. High Temperature Load (Endurance)</p>	<p>*Test temp.: NP0, X7R/X7E: 125±3°C X6S: 105±3°C X5R, Y5V: 85±3°C *Test time: 1000+24/-0 hrs. *To apply voltage: (1) 6.3V or C≥10µF or TT series: 150% of rated voltage. (2) 10V≤Ur<500V: 200% of rated voltage. (3) 500V: 150% of rated voltage. (4) Ur≥630V: 120% of rated voltage. (5) 100% of rated voltage for below range.</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance range</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td rowspan="2">X7R/ X6S/ X5R</td> <td>6.3V,10V</td> <td>C≥0.1µF</td> </tr> <tr> <td>6.3V,10V</td> <td>C≥1.0µF</td> </tr> <tr> <td rowspan="2">0402</td> <td rowspan="2">X7R/ X6S/ X5R</td> <td>4V</td> <td>C≥22µF</td> </tr> <tr> <td>6.3V,10V</td> <td>C≥4.7µF</td> </tr> <tr> <td rowspan="2">0603</td> <td rowspan="2">X7R/ X6S/ X5R</td> <td>35V</td> <td>C≥1.0µF</td> </tr> <tr> <td>4V</td> <td>C≥47µF</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X7R/ X6S/ X5R</td> <td>6.3V</td> <td>C≥22µF</td> </tr> <tr> <td>6.3V</td> <td>C≥47µF</td> </tr> <tr> <td>1206</td> <td>NP0</td> <td>3000V</td> <td>C≥1.5pF</td> </tr> <tr> <td>TT18</td> <td>Y5V</td> <td>6.3V,10V</td> <td>C≥2.2µF</td> </tr> <tr> <td>TT21</td> <td>Y5V</td> <td>6.3V</td> <td>C≥10µF</td> </tr> <tr> <td>TT31</td> <td>Y5V</td> <td>6.3V</td> <td>C≥22µF</td> </tr> </tbody> </table> <p>(6)150% of rated voltage for below range.</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td rowspan="2">X5R/X7R/X6S</td> <td>16V</td> <td>C≥0.1µF</td> </tr> <tr> <td>50V</td> <td>C≥0.1µF</td> </tr> <tr> <td rowspan="2">0402</td> <td rowspan="2">X5R/X7R/X6S</td> <td>10~25V</td> <td>C≥0.22µF</td> </tr> <tr> <td>16V</td> <td>C≥0.47µF</td> </tr> <tr> <td rowspan="2">0603</td> <td rowspan="2">X5R/X7R/</td> <td>10~50V</td> <td>C≥1.0µF</td> </tr> <tr> <td>16V</td> <td>C≥2.2µF</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X5R/X7R/</td> <td>10~50V</td> <td>C≥4.7µF</td> </tr> <tr> <td>50V</td> <td>C≥2.2µF</td> </tr> <tr> <td rowspan="2">100V</td> <td rowspan="2">X7R</td> <td>100V</td> <td>C≥0.47µF</td> </tr> <tr> <td>16V</td> <td>C≥4.7µF</td> </tr> <tr> <td>2220</td> <td>X7R</td> <td>100V</td> <td>C≥8.8µF</td> </tr> </tbody> </table> <p>*Before initial measurement (Class II only): To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp. *Measurement to be made after keeping at room temp. for 24±2 hrs</p>	Size	Dielectric	Rated voltage	Capacitance range	0201	X7R/ X6S/ X5R	6.3V,10V	C≥0.1µF	6.3V,10V	C≥1.0µF	0402	X7R/ X6S/ X5R	4V	C≥22µF	6.3V,10V	C≥4.7µF	0603	X7R/ X6S/ X5R	35V	C≥1.0µF	4V	C≥47µF	0805	X7R/ X6S/ X5R	6.3V	C≥22µF	6.3V	C≥47µF	1206	NP0	3000V	C≥1.5pF	TT18	Y5V	6.3V,10V	C≥2.2µF	TT21	Y5V	6.3V	C≥10µF	TT31	Y5V	6.3V	C≥22µF	Size	Dielectric	Rated voltage	Capacitance	0201	X5R/X7R/X6S	16V	C≥0.1µF	50V	C≥0.1µF	0402	X5R/X7R/X6S	10~25V	C≥0.22µF	16V	C≥0.47µF	0603	X5R/X7R/	10~50V	C≥1.0µF	16V	C≥2.2µF	0805	X5R/X7R/	10~50V	C≥4.7µF	50V	C≥2.2µF	100V	X7R	100V	C≥0.47µF	16V	C≥4.7µF	2220	X7R	100V	C≥8.8µF	<p>* No remarkable damage. Cap change: NP0: ±3.0% or ±0.3pF whichever is larger X7R, X7E, X6S, X5R: ≥10V**, within ±12.5%; 6.3V within ±25%; TT series, within ±25% **10V:0603≥4.7µF;0402≥1µF;0201≥0.1µF, within ±25%; Y5V: ≥10V, within ±30%; 6.3V, within +30/-40% Q/D.F. value: NP0: More than 30pF, Q≥350; 10pF≤C<30pF, Q≥275+2.5C; Less than 10pF, Q≥200+10C X7R, X6S, X5R:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.s</th> <th>Exception of D.F. s</th> </tr> </thead> <tbody> <tr> <td rowspan="2">≥100V</td> <td rowspan="2">≤3%</td> <td>≤6%</td> <td>1206±0.47µF</td> </tr> <tr> <td>≤7.5%</td> <td>0805±0.1µF, 0603±0.068µF</td> </tr> <tr> <td rowspan="3">≥50V</td> <td rowspan="3">≤3%</td> <td>≤6%</td> <td>0201(50V)0603±0.047µF; 0805±0.18µF; 1206±0.47µF</td> </tr> <tr> <td>≤10%</td> <td>1210±4.7µF</td> </tr> <tr> <td>≤20%</td> <td>0402±0.1µF;0603±1µF; 0805±1µF;1206±2.2µF; 1210±10µF; TT series</td> </tr> <tr> <td rowspan="4">35V</td> <td rowspan="4">≤5%</td> <td>≤20%</td> <td>0603±1µF; 0805±2.2µF;1210±10µF</td> </tr> <tr> <td>≤10%</td> <td>0201±0.01µF;0805±1µF; 1210±10µF</td> </tr> <tr> <td>≤14%</td> <td>0603±0.33µF;1206±4.7µF</td> </tr> <tr> <td>≤15%</td> <td>0402±0.10µF;0603±0.47µF;0805±2.2µF;1206±6.8µF;1210±22µF; TT series</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤5%</td> <td>≤20%</td> <td>0402±1µF</td> </tr> <tr> <td>≤10%</td> <td>0603±0.15µF;0805±0.68µF;1206±2.2µF;1210±4.7µF</td> </tr> <tr> <td>≤15%</td> <td>0201±0.01µF;0402±0.033µF;0603±0.68µF;0805±2.2µF; 1206±4.7µF; 1210±22µF; TT series</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤5%</td> <td>≤15%</td> <td>0201±0.012µF; 0402±0.33µF; 0603±0.33µF;0805±2.2µF;1206±2.2µF; 1210±22µF</td> </tr> <tr> <td>≤20%</td> <td>0201±0.1µF ;0402±1µF; TT series</td> </tr> <tr> <td>10V</td> <td>≤7.5%</td> <td>≤15%</td> <td>0201±0.012µF; 0402±0.33µF; 0603±0.33µF;0805±2.2µF;1206±2.2µF; 1210±22µF</td> </tr> <tr> <td>6.3V</td> <td>≤15%</td> <td>≤30%</td> <td>0201±0.1µF;0402±1µF;0603±10µF; 0805±4.7µF;1206±4.7µF;1210±100µF;TT series</td> </tr> <tr> <td>4V</td> <td>≤20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p>X7R/X7E, LD series : DF≤3% Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.s</th> <th>Exception of D.F.s</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>≤7.5%</td> <td>≤10%</td> <td>0603±0.1µF; 0805±0.47µF;1206±4.7µF; TT series & Cap≥1µF</td> </tr> <tr> <td>35V</td> <td>≤10%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">≤7.5%</td> <td>≤10%</td> <td>0402±0.047µF;0603±0.1µF;0805±0.33µF;1206±1µF; 1210±4.7µF</td> </tr> <tr> <td>≤15%</td> <td>0402±0.068µF;0603±0.47µF;1206±4.7µF;1210±22µF; TT series & Cap≥1µF</td> </tr> <tr> <td>16V(C<1.0µF)</td> <td>≤10%</td> <td>≤12.5%</td> <td>0402±0.068µF; 0603±0.68µF</td> </tr> <tr> <td rowspan="2">16V(C≥1.0µF)</td> <td rowspan="2">≤12.5%</td> <td>≤20%</td> <td>0402±0.22µF</td> </tr> <tr> <td>≤20%</td> <td>0603±2.2µF;0805±3.3µF;1206±10µF;1210±22µF;1812±47µF;TT series & Cap≥1µF</td> </tr> <tr> <td>10V</td> <td>≤20%</td> <td>≤30%</td> <td>0402±0.47µF</td> </tr> <tr> <td>6.3V</td> <td>≤30%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p>*I.R.: ≥10V, 1GΩ or 50 Q-F whichever is smaller. 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		≤15%	0201±0.01µF;0402±0.033µF;0603±0.68µF;0805±2.2µF; 1206±4.7µF; 1210±22µF; TT series																																																																																																																																																																																				
16V	≤5%	≤15%	0201±0.012µF; 0402±0.33µF; 0603±0.33µF;0805±2.2µF;1206±2.2µF; 1210±22µF																																																																																																																																																																																				
		≤20%	0201±0.1µF ;0402±1µF; TT series																																																																																																																																																																																				
10V	≤7.5%	≤15%	0201±0.012µF; 0402±0.33µF; 0603±0.33µF;0805±2.2µF;1206±2.2µF; 1210±22µF																																																																																																																																																																																				
6.3V	≤15%	≤30%	0201±0.1µF;0402±1µF;0603±10µF; 0805±4.7µF;1206±4.7µF;1210±100µF;TT series																																																																																																																																																																																				
4V	≤20%	---	---																																																																																																																																																																																				
Rated vol.	D.F.s	Exception of D.F.s																																																																																																																																																																																					
≥50V	≤7.5%	≤10%	0603±0.1µF; 0805±0.47µF;1206±4.7µF; TT series & Cap≥1µF																																																																																																																																																																																				
35V	≤10%	---	---																																																																																																																																																																																				
25V	≤7.5%	≤10%	0402±0.047µF;0603±0.1µF;0805±0.33µF;1206±1µF; 1210±4.7µF																																																																																																																																																																																				
		≤15%	0402±0.068µF;0603±0.47µF;1206±4.7µF;1210±22µF; TT series & Cap≥1µF																																																																																																																																																																																				
16V(C<1.0µF)	≤10%	≤12.5%	0402±0.068µF; 0603±0.68µF																																																																																																																																																																																				
16V(C≥1.0µF)	≤12.5%	≤20%	0402±0.22µF																																																																																																																																																																																				
		≤20%	0603±2.2µF;0805±3.3µF;1206±10µF;1210±22µF;1812±47µF;TT series & Cap≥1µF																																																																																																																																																																																				
10V	≤20%	≤30%	0402±0.47µF																																																																																																																																																																																				
6.3V	≤30%	---	---																																																																																																																																																																																				
Rated voltage	Insulation Resistance																																																																																																																																																																																						
100V: X7R	1GΩ or RxCa5 Q-F whichever is smaller.																																																																																																																																																																																						
50V:0603±1µF;0805±1µF;1206±2.2µF;1210±4.7µF																																																																																																																																																																																							
35V:0805±2.2µF;1210±10µF																																																																																																																																																																																							
25V:0402±1µF;0603±2.2µF;0805±2.2µF;1206±10µF;1210±10µF																																																																																																																																																																																							
16V:0201±0.1µF;0402±0.22µF;0603±1µF;0805±2.2µF;1206±10µF;1210±47µF																																																																																																																																																																																							
10V:0201±47nF;0402±0.47µF;0603±0.47µF;0805±2.2µF; 1206±4.7µF;1210±47µF																																																																																																																																																																																							
6.3V : 4V : TT series																																																																																																																																																																																							
<p>16. ESR</p>	<p>For RF Series only, refer to data sheet.</p>	<p>---</p>																																																																																																																																																																																					

5 Packing

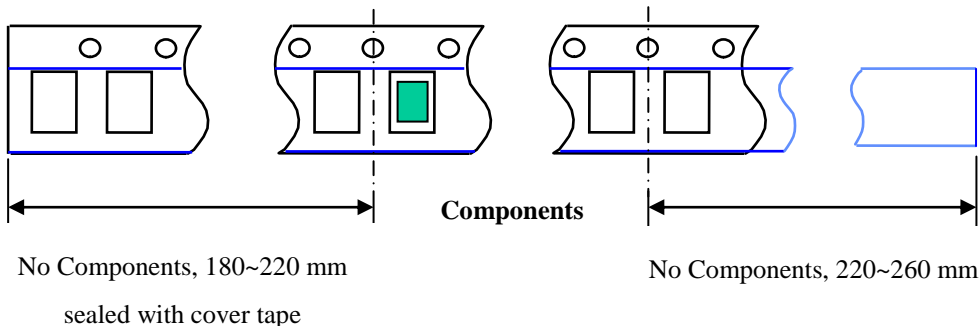
Paper Tape $T \leq 1.1 \text{ mm}$

Embossed Tape $T \leq 2.60 \text{ mm}$

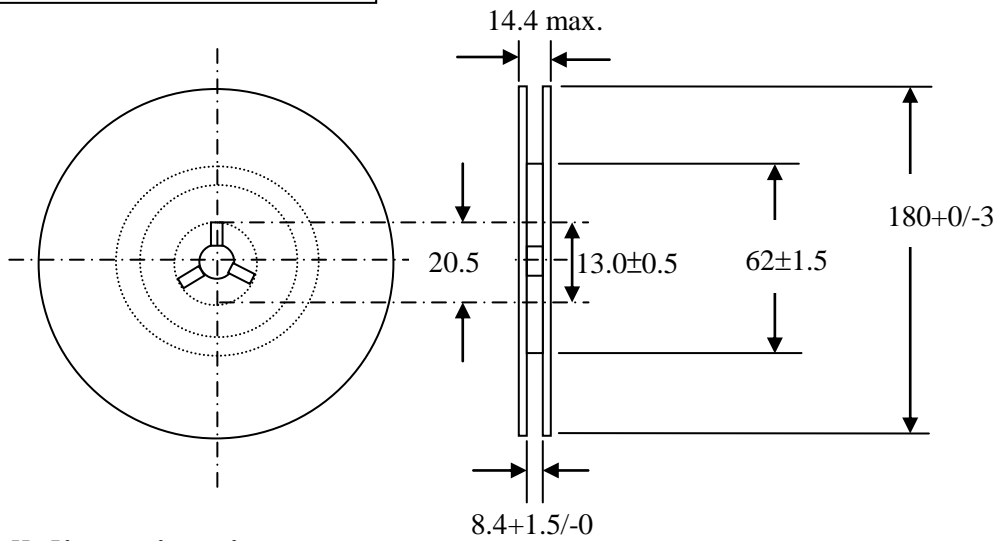


All dimensions in mm

Size	Symbol					
	A	B	P	L	T(Paper)	T(Embossed)
0402	0.62 ± 0.05	1.12 ± 0.05	2.00 ± 0.05	8.00 ± 0.20	0.60 ± 0.05	N/A
0603	1.10 ± 0.10	1.90 ± 0.10	4.00 ± 0.10	8.00 ± 0.20	1.00 ± 0.05	N/A
0805	1.65 ± 0.05	2.40 ± 0.05	4.00 ± 0.10	8.00 ± 0.20	1.00 ± 0.05	N/A
1206	2.00 ± 0.10	3.50 ± 0.10	4.00 ± 0.10	8.00 ± 0.20	1.00 ± 0.05	Max.2.0
1210	2.80 ± 0.20	3.70 ± 0.20	4.00 ± 0.10	8.00 ± 0.20	N/A	Max.2.0
1808	2.50 ± 0.30	4.90 ± 0.30	4.00 ± 0.10	12.0 ± 0.20	N/A	Max.2.5
1812	3.60 ± 0.30	4.90 ± 0.30	8.00 ± 0.10	12.0 ± 0.20	N/A	Max.2.5



EIA Reel Dimension



All dimensions in mm

Standard Packing Quantity per Reel

Chip Size	Thickness(mm)	Code	Amount per reel	
			Paper	Embossed
0402	0.50±0.05	A	10K	—
0603	0.80±0.10	C	4K	—
0805	0.60±0.10	B	4K	—
	0.80±0.10	C	4K	—
	1.25±0.20	E	—	2K/3K
1206	0.60±0.10	B	4K	—
	0.80±0.10	C	4K	—
	1.25±0.20	E	—	2K/3K
	1.60±0.20	D	—	2K
1210	1.25±0.20	E	—	2K/3K
	1.60±0.20	D	—	2K
	2.00±0.20	K	—	2K
1808	1.25±0.20	E	—	2K/3K
	1.60±0.20	D	—	2K
	2.00±0.20	K	—	2K
1812/2220/2225	1.25±0.20	E	—	1K
	1.60±0.20	D	—	1K
	2.00±0.20	K	—	1K
	2.40±0.20	G	—	700PCS
	2.80±0.20	H	—	500PCS

6.1 Capacitor Classification

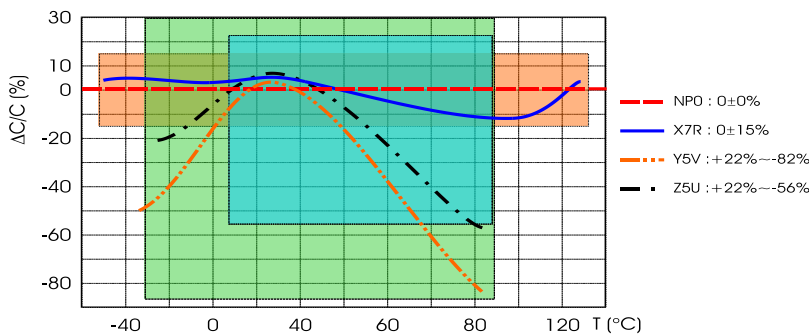
Multi-layer ceramic capacitors are available in wide range of characteristics. Electronic Industries Association (EIA) and the military have established categories to help divide the basic characteristics into more easily specified classes. The basic industry specification for ceramic capacitor is EIA specification RS-198 and as noted in the general section, it specifies temperature-compensating capacitors as class I capacitors. These are specified by the military under specification MIL-C-20. General-purpose capacitors with non-linear temperature coefficients are called Class II capacitors by EIA and specified by military under MIL-C-11015 and MIL-C-39014. The new high reliability military specification, MIL-C-123 covers both class I and class II dielectrics.

Class I — Class I capacitors or temperature-compensating capacitors are usually made from mixtures of titanates where barium titanate is normally not a major part of mix. They have predictable temperature coefficients and in general, do not have an aging characteristic. Thus they are the most stable capacitor available. Normally the T.C.s of Class I temperature-compensating capacitors are NP0 (± 30 ppm/ $^{\circ}\text{C}$).

Class II — General-purpose ceramic capacitors are called Class II capacitors and have become extremely popular because of the high capacitance values available in very small size. These capacitors are ferroelectrics and vary in capacitance value under the influence of the environmental and electrical operating conditions. Class II capacitors are affected by temperature, voltage, frequency and time. Temperature effects for Class II ceramic capacitors are exhibited as non-linear capacitance changes with temperature. Industry standards for Mid-K dielectrics, such as X7R/X5R and High-K dielectrics, such as Z5U.

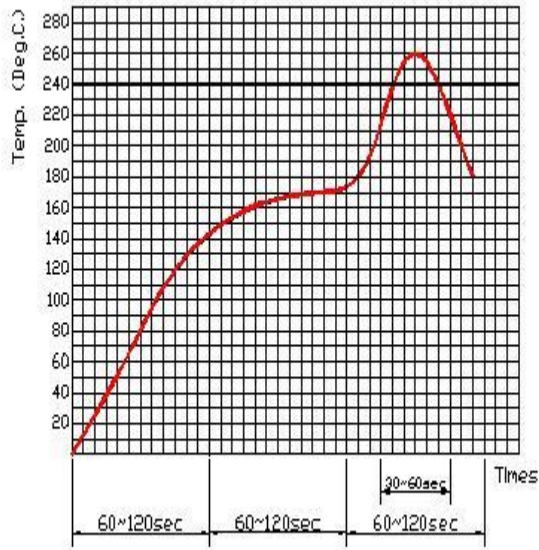
6.2 The Characterization of Materials

Designation	Class	Temperature Range ($^{\circ}\text{C}$)	Temp. Characteristics
NPO(COG)	I	-55 ~ +125	± 30 ppm/ $^{\circ}\text{C}$
X7R	II	-55 ~ +125	± 15 %
X5R	II	-55 ~ +85	± 15 %
Y5V	II	-25 ~ +85	-82 ~ +22 %

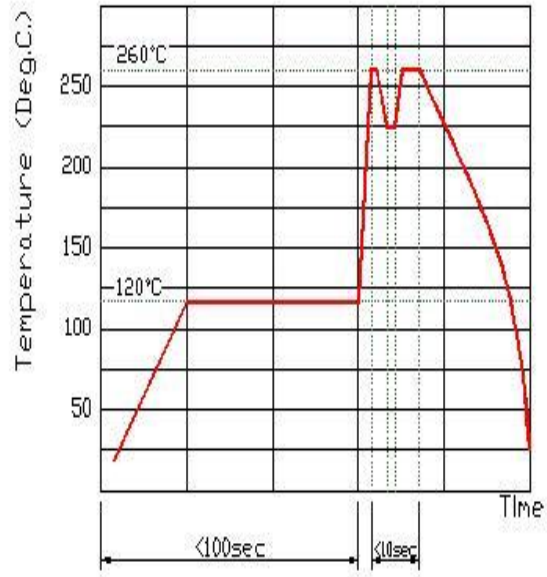


The T.C curve of each material (for reference)

6.3 Recommend IR reflow and wave solderng profile(Pb-Free)



Typical profile band of IR reflow



Typical profile band of wave soldering

1. 电路设计

注意事项

- ◆使用环境、电气规定值和产品性能的确证
如果医疗器械、航天器和原子核反应堆等设备出现故障，会对人的生命乃至整个社会造成严重的危害。因此用于这些设备的电容器与一般用途不同，在设计上必须具有很高的安全性和可靠性。
- ◆工作电压（额定电压的确证）
 1. 电容器的工作电压必须低于其额定电压值。
如果在一个直流电压上加载一个交流电压，那么两个峰值电压之和应小于所选择的电容器的额定值。
对于同时使用交流电压和脉冲电压的电路，它们的峰值电压之和也应低于电容器的额定电压。
 2. 即使外加电压低于额定电压值，如果电路中使用的高频交流电压或脉冲电压升高的时间过快，那么电容器的性能会因此被削弱。

2. 印刷电路板设计

注意事项

- ◆安装定位设计（焊盘图案设计）
 1. 当电容器被安装在印刷电路板上后，所使用的焊料量（焊脚尺寸）会直接影响电容器的性能。因此在设计焊盘图案时必须考虑到以下几点：
 - (1) 所用焊料量的大小会影响晶片抗机械应力的能力，从而可能导致电容器破损或开裂。因此在设计印刷电路板时，为了有合适的焊料量，必须正确设定形状和尺寸。
 - (2) 如果两个以上的元件被焊接在同一印刷电路板上时，焊盘的设计应可以使每个元件的焊接点被阻焊剂隔离开。
- ◆安装定位设计（分割印刷电路板上电容器配置）
安装电容器至印刷电路板后，在连续生产工序中（印刷电路板分割、线路板检测、其它部件安装、底盘组装、波峰焊与回流焊等等）或在操作过程中会产生印刷电路板弯曲、晶片破裂等情况，因此请将电容器配置在印刷电路板弯曲时所受应力最小处。

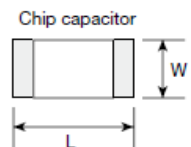
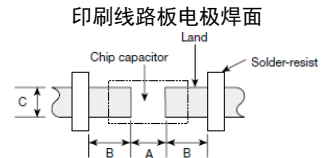
管理要点

- ◆安装定位设计（焊盘图案设计）
为防止焊料量过多，按如下推荐示例所示设置焊盘尺寸，并避免不合理的印刷电路板设计。

(1) 推荐使用的印刷电路板上焊盘的尺寸

●推荐用于多层陶瓷电容器的焊盘尺寸（单位：mm）

形状		107	212	316	325
尺寸	L	1.6	2.0	3.2	3.2
	W	0.8	1.25	1.6	2.5
A		0.8~1.0	1.0~1.4	1.8~2.5	1.8~2.5
B		0.5~0.8	0.8~1.5	0.8~1.7	0.8~1.7
C		0.6~0.8	0.9~1.2	1.2~1.6	1.8~2.5



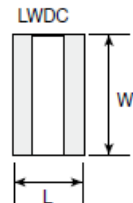
回流焊

形状		042	063	105	107	212	316	325	432
尺寸	L	0.4	0.6	1.0	1.6	2.0	3.2	3.2	4.5
	W	0.2	0.3	0.5	0.8	1.25	1.6	2.5	3.2
A		0.15~0.25	0.20~0.30	0.45~0.55	0.8~1.0	0.8~1.2	1.8~2.5	1.8~2.5	2.5~3.5
B		0.15~0.20	0.20~0.30	0.40~0.50	0.6~0.8	0.8~1.2	1.0~1.5	1.0~1.5	1.5~1.8
C		0.15~0.30	0.25~0.40	0.45~0.55	0.6~0.8	0.9~1.6	1.2~2.0	1.8~3.2	2.3~3.5

注：推荐焊盘尺寸根据产品尺寸公差可能会有不同。

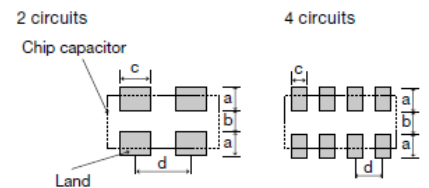
●推荐用于 LW 逆转型多层电容的焊盘尺寸（单位：mm）

形状		105	107	212
尺寸	L	0.52	0.8	1.25
	W	1.0	1.6	2.0
A		0.18~0.22	0.25~0.3	0.5~0.7
B		0.2~0.25	0.3~0.4	0.4~0.5
C		0.9~1.1	1.5~1.7	1.9~2.1



●推荐用于多连型多层电容器的焊盘尺寸（单位：mm）

形状		096 (2 连型)	110 (2 连型)	212 (2 连型)	212 (4 连型)
尺寸	L	0.9	1.37	2.0	2.0
	W	0.6	1.0	1.25	1.25
a		0.25~0.35	0.35~0.45	0.5~0.6	0.5~0.6
b		0.15~0.25	0.55~0.65	0.5~0.6	0.5~0.6
c		0.15~0.25	0.3~0.4	0.5~0.6	0.2~0.3
d		0.45	0.64	1.0	0.5



(2) 防止及推荐事例

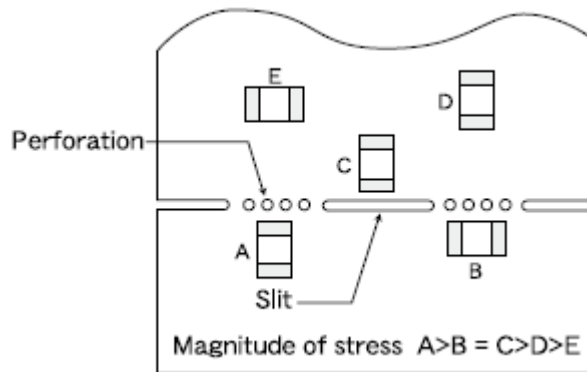
项目	防止事例	推荐事例
和引线元件混合安装		
靠近底盘的元件安装		
引线元件后安装		
水平安装元件		

◆安装定位设计（分割印刷线路板上电容器配置）

1-1. 要对印刷线路板的弯曲处不施加过度的机械应力，推荐如下所示配置电容器。

项目	防止事例	推荐事例
线路板弯曲		将元件对着机械应力的方向横放

1-2. 将电容器安装在切割线路板上时，机械应力的大小由电容器的布局而定。请参考下图：



1-3. 分割印刷线路板时，电容器所受机械应力的大小为：推板<割裂<V形凹槽<接缝孔。因此，在配置电容器时必须同时考虑到印刷线路板的分割方法。

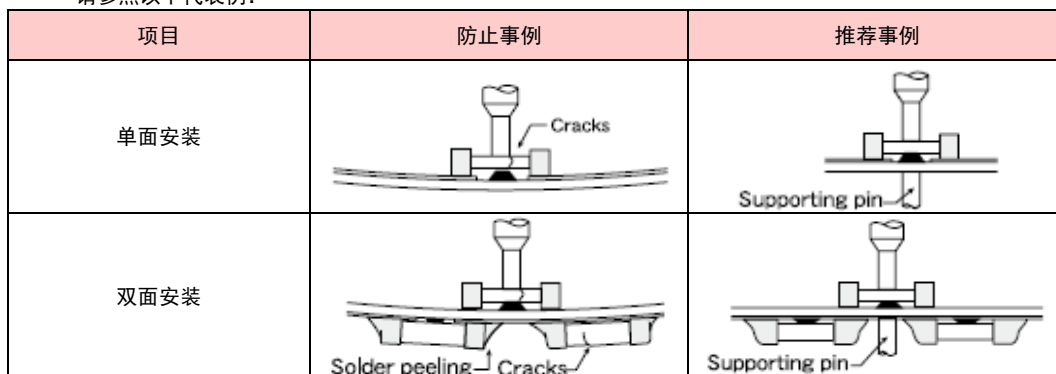
3. 自动装配

注意事项	<p>◆调整贴片机</p> <ol style="list-style-type: none"> 1. 在将电容器安装在印刷线路板上时，不能让电容器承受过量的冲击力。 2. 应定期对贴片机进行维修和点检。 <p>◆粘合剂的选用</p> <p>在焊接安装电容器之前，用粘合剂将电容器暂时固定在印刷线路板上时，如果没有正确设置焊盘尺寸、粘合剂的类型和涂布量、硬</p>
------	--

化的温度和时间等，将可能导致电容器的特性劣化，因此，在操作时请先确认或咨询。

◆调整贴片机

- 吸拾管下限较低の場合在自动安装时，过度压力将作用于电感器从而导致其损坏。请参照下述要点：
 - 请调整吸拾管的下限至弯曲校正后印刷线路板的表面水平位置。
 - 自动安装时，请设定喷嘴压力为 1~ 3N 以下。
 - 为了减少吸拾管对印刷线路板的压力作用从而导致的线路板弯曲量，在线路板下方应使用支撑脚或挡块。请参照以下代表例：



- 如果定位爪磨损，在定位时，会对电容器的局部造成机械冲击，导致电容器缺口或开裂。为了避免上述情况的发生，请确定停止位置定位爪之间的宽度，并定期执行定位爪的保养、点检及更新。

管理要点

◆粘合剂的选用

一些粘合剂会降低电容器的绝缘阻抗。粘合剂和电容器收缩率的不同会在电容器上产生应力并导致开裂。甚至粘合剂涂布的过多或过少会影响元件的安装，导致故障发生。

因此在使用时应注意以下事项：

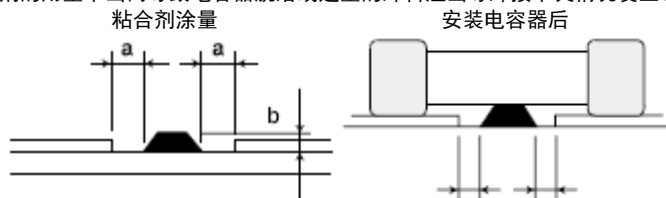
- 粘合剂的选定：
 - 粘合剂应具有足够强度保证贴片过程中部品不致脱落。
 - 高温下粘合剂应具有足够强度。
 - 粘合剂应具有良好涂层及厚度的保持性。
 - 粘合剂应具有足够长的贮存期。
 - 粘合剂应具有短时间内快速硬化的特性。
 - 粘合剂应无腐蚀性。
 - 粘合剂应具有优良的绝缘特性。
 - 粘合剂应无害且不会发出对人体有害气体。

- 粘合剂推荐用量如下所示。

在印刷线路板上焊接电容器时，注意不要因粘合剂的用量不当而导致电容器脱落或过量的焊料溢出等焊接不良情况发生。

[推荐条件]

标记	以 212/316 尺寸为例
a	0.3mm min
b	100 ~ 120 μm
c	不要使粘合剂接触到底盘



4. 焊接

◆助焊剂的选用

由于助焊剂可能对电容器性能有显著影响，因此在使用之前必须确认符合以下条件：

- 所用助焊剂的卤化物含量不应多于 0.1wt% (Cl 换算)。不能使用高酸性的助焊剂。
- 在线路板上焊接电容器时，助焊剂应使用必要的最小量。
- 使用水溶性助焊剂时，要先将底板清洗干净。

注意事项

◆焊接

请按照以下推荐的条件设定温度、时间、焊料量等。
使用 Sn-Zn 系焊接材料将影响多层陶瓷片状电容的可靠性。
若要使用 Sn-Zn 系焊接材料，请事先与本公司联系。

管理要点

◆助焊剂的选用

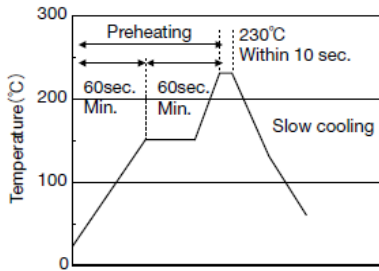
- 1-1. 如果活化助焊剂中的卤化物过多或使用了高酸性的助焊剂，那么电容器端子电极或使电容器表面的绝缘阻抗降低。
- 1-2. 在波峰焊接过程中使用助焊剂是为了增强电容器的可焊性，但如使用过多的助焊剂，助焊剂大量的雾气会射到电容器上，从而使电容器可焊性受到破坏性的影响。应尽可能减少助焊剂的用量，推荐使用发泡方式。
- 1-3. 由于水溶性助焊剂的残留物有易溶于湿气的物质，因此高湿条件下电容器表面上的残留物会导致电容器绝缘下降并影响电容器的可靠性。当选用了水溶性助焊剂时，要特别留意清洗方法和所使用的机器的能力。

◆焊接

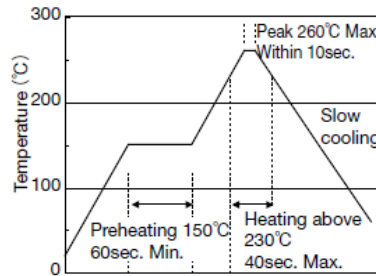
- 电感器在急冷、急热或局部加热的情况下易于破损，焊接时请充分注意由于热冲击等所导致的产品故障。
- 为使电容器和焊料温度差小于 100~130°C，在焊接前应进行充分地预热。
- 同时，焊接后清洗等急速冷却温度与电感器温度差不能超过 100°C。

[回流焊接]

【共晶焊接推荐条件】

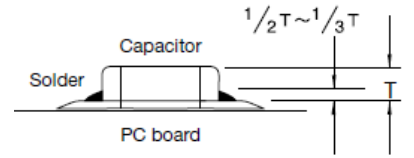


【无铅焊接推荐条件】



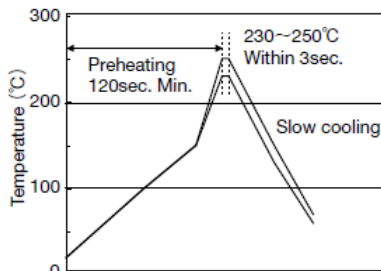
注意事项

- ①理想的焊料量如右图所示，应为电容器厚度的 1/2~1/3。
- ②请尽可能缩短焊接熔融时间。

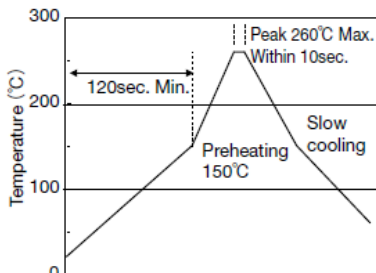


[波峰焊接]

【共晶焊接推荐条件】



【无铅焊接推荐条件】

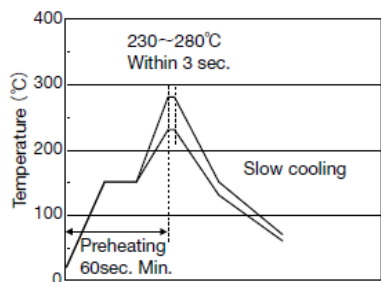


注意事项

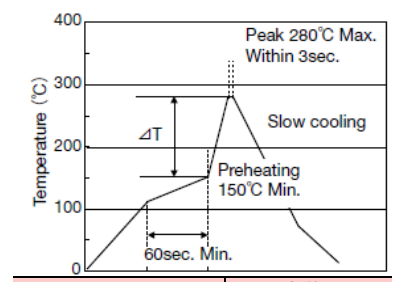
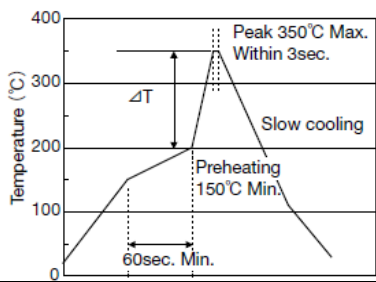
- ①指定仅可用回流焊接的电容器不能用波峰焊接。

[手工焊接]

【共晶焊接推荐条件】



【无铅焊接推荐条件】



316 形状以下	温度差 ΔT ΔT ≤ 150°C
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325 形状以下	温度差 ΔT ΔT ≤ 130°C
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注意事项

- ①推荐使用 50W 以下（带温度控制）的焊枪,且焊头为 1φ 以下的产品。
- ②注意焊头不能直接接触到电容器上。

5. 清洗

注意事项	<p>◆印刷线路板清洗</p> <ol style="list-style-type: none"> 1. 在安装完所有的电容器后，在清洗印刷线路板时，应根据所使用的助焊剂和清洗的目的（如为了除掉焊接时残留的助焊剂还是生产过程中的其它材料）来选用适当的清洗溶剂。 2. 应对清洗条件进行核对和确认清洗过程不影响电容器的特性。
管理要点	<p>◆印刷线路板清洗</p> <ol style="list-style-type: none"> 1. 如果使用不恰当的溶剂，会使其它物质如助焊剂残留物粘到电容器或破坏电容器的外部涂层，从而导致电容器的电性能下降(特别是绝缘阻抗)。 2. 清洗条件不恰当（清洗不足，过度清洗）可能导致电容器性能受损。 超音波清洗条件下，过大功率输出可能导致印刷线路板过度震动从而使电容器本体及焊接部分断裂，或降低端子电极强度。因此请慎重考虑以下条件： 超音波输出： 20W / ℓ 以下 超音波频率： 40kHz 以下 超音波清洗时间： 5 分钟以下

6. 树脂涂装及成型

注意事项	<ol style="list-style-type: none"> 1. 一些类型的树脂在硬化过程及自然放置状态下所产生的树脂分解废气及化学反应气体会停留在树脂内部从而导致电容器性能的劣化。 2. 当树脂硬化温度超过电容器使用温度条件时，由于受到过热膨胀收缩应力作用从而导致电容器破损。
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7. 处理

注意事项	<p>◆印刷线路板分割</p> <ol style="list-style-type: none"> 1. 在安装完电容器和其它元件后，分割印刷线路板时，注意不在板上施加任何弯曲及扭转力。 2. 线路板的分割不能用手分割，应使用专用夹具。 <p>◆机械冲击</p> <p>注意不能让电容器承受过量的机械冲击</p> <ol style="list-style-type: none"> (1) 如果电容器因掉落等原因受到过度的机械冲击，则不能再进行使用。 (2) 当处理已安装有电容器的印刷线路板时，请避免使电感器触碰其它印刷线路板等部品。
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8. 储存・保管

注意事项	<p>◆储存・保管</p> <ol style="list-style-type: none"> 1. 为防止包装材料的质量以及外部电极可焊性受损，请充分管理保存场所的温度和湿度条件，尤其对于湿度条件，请尽可能降低环境中的湿度条件。 · 请将本产品贮存于温度 40℃以下且湿度为 70%RH 以下的环境中（推荐环境温度为 30℃以下）。注意，即使处于良好的保存环境下，焊接特性也会随时间劣化。因此，请本公司发货后 6 个月以内使用。 · 请在空气中无氯和硫磺之处保管。 2. 高介电常数的电容器的容量将随着时间的推移而下降，因此在设计电路时要考虑到这一点。如果电容器的容量值减少了，在 150℃ 的条件下对电容器进行 1 小时预热，那么电容器的容量值会恢复到初期规定值。
管理要点	<p>◆储存・保管</p> <p>如果将电容器存放在高温和高湿的环境下，电容器的端电极就会被氧化，从而导致其可焊性下降；另外，在这种储存条件下，电容器的编带/包装材料会受到破坏。出于这个原因，电容器应在自发货之日算起 6 个月内使用。如果超出了这个期限，在使用电容器之前要对其可焊性进行检验。</p>

※关于使用注意事项，自 JEITA 发行《RCR-2335B 电子设备用固定陶瓷电容器的安全应用指南》。记载有关印刷线路板弯曲量的注意事项以及根据专用电热器焊接安装等信息，请确认。