

# PRODUCT SPECIFICATION

**PRODUCT: MULTILAYER CERAMIC CAPACITOR**

**TYPE: RADIAL-LEADED TYPE CAPACITOR**

**CUSTOMER:** \_\_\_\_\_

**DOC. NO.:** D13-00-E-14

**Ver.:** 14

**APPROVED BY CUSTOMER**

**VENDOR :**

**WALSIN TECHNOLOGY CORPORATION**

566-1, KAO SHI ROAD, YANG-MEI  
TAO-YUAN, TAIWAN

**PAN OVERSEAS (GUANGZHOU) ELECTRONIC CO.,LTD.**

NO.277,HONG MING ROAD,EASTERN SECTION,  
GUANG ZHOU ECONOMIC AND TECHNOLOGY  
DEVELOPMENT ZONE,CHINA

**MAKER : PAN OVERSEAS (GUANGZHOU) ELECTRONIC CO.,LTD.**

NO.277,HONG MING ROAD,EASTERN SECTION,  
GUANG ZHOU ECONOMIC AND TECHNOLOGY  
DEVELOPMENT ZONE,CHINA



SPECIFICATION OF MULTI-LAYER RADIAL-LEADED TYPE CAPACITOR	D13-00-E-14	Ver: 14 Page: 2 / 18
---	-------------	-------------------------

### Record of change

Date	Version	Description	page
2009.6.24	3	1. Add voltage code in Marking.	14
2009.8.17	4	1. Change PSA & POE logo to Walsin & POE logo.	all
2012/5/31	5	1. Review the capacitance range.	13~14
2012/11/20	6	1. Add "Table of contents". 2. Review the body size W/H/T according to the chip size. 3. Review the contents of description. 4. Correct the size of P1 for type RD20.	3 4 11 13
2013/5/6	7	1. Review the Lead diameter $\phi$ from $0.55\pm 0.05\text{mm}$ to $0.5\pm 0.05\text{mm}$ 2. Add "H1 max" to lead configuration and size form. 3. Review the Solderability temperature from $235\pm 5^{\circ}\text{C}$ to $245\pm 5^{\circ}\text{C}$ .,Solderability time from $2\pm 0.5\text{s}$ to $5\pm 0.5\text{s}$ "	4,12,13 4 8
2014/8/8	8	1. Review the item 8 from "Storing condition and term" to be "Operating and storage environment" 2. Delete the 1206size for RD20 type. 3. Delete the 500V ~630V type of 0805 size. 4. Review the D.F. spec according to MLCC spec of Walsin.	11 4 14 6,8,9,10
2015/11/24	9	1. Review the Part number defining. 2. Add the 1812 size for the D.F. spec according to MLCC spec of Walsin. 3. Review the Packing quantity. 4. Add voltage code in Marking for 2000V & 3000V.	4 6,8,9,10 14 15
2016/9/19	10	1. Review the Part number defining. 2. Review the Size code and capacitance (pF) available	4 15~17
2017/3/23	11	1. Delete the C Tolerance Code 2. Review the Packing specification	4 15
2017/7/7	12	1. Review the Part number defining 2. Complete Marking statement(Add 2-figure code Marking)	4 18
2017/11/8	13	1. Review the Part number defining ( add the 2220 size ) . 2. Review the D.F. spec according to MLCC spec of Walsin. 3. Add voltage code in Marking for 1500V & 2500V.	4 6,8,9,10 15
2018/12/19	14	1. Review the D.F. spec according to MLCC spec of Walsin. 2. Review the Size code and capacitance (pF) available	6,8,9,10 15~17

## Table of Contents 目錄

No.	Item 項目	Page
1	Scope	4
2	Part number defining	4
3	Lead configuration and size	4
4	Product structure	5
5	Specification and test method	5~11
6	Storing condition and term	11
7	Description	11
8	Taping Figure and Specification	12~14
9	Packing specification	15
10	Size code and capacitance (pF) available	16~18
11	Marking	18



SPECIFICATION OF MULTI-LAYER RADIAL-LEADED TYPE CAPACITOR	D13-00-E-14	Ver: 14 Page: 4 / 18
---	-------------	-------------------------

**1. Scope:**

Its specification applies to Radial Series Ceramic Capacitor.


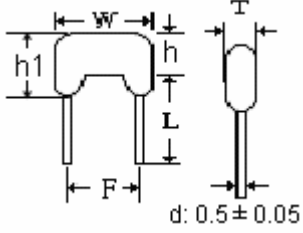

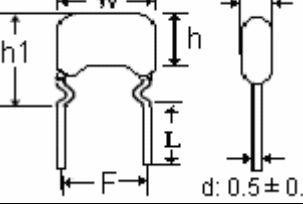

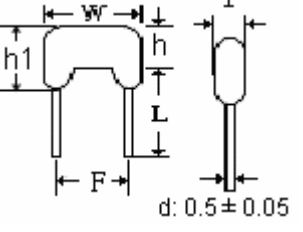
**2. Part number defining (SAP):**

RD21	B				102	K	500	B	5	C	07	B
Product Type	Dielectric Code				Capacitance Code	Tolerance Code	Rated Voltage	Packaging Code	Chip Size	Termination	Lead length	Lead length Tolerance
RD20	Code	T.C.	Operating Temperature	Capacitance Change( $\Delta^{\circ}\text{C}$ )	100=10 pF 102=1000 pF	D= $\pm 0.5\text{pF}$ J= $\pm 5\%$	100=10V 250=25V	B=Bulk	5=0805	L=Ag/Ni/Sn AN=Ammo	Tapping: AN=Ammo	D=Tapping
RD21	N	NPO	-55 ~ +125 $^{\circ}\text{C}$	0 $\pm 30$ (PPM/ $^{\circ}\text{C}$ )	103=10000 pF 1R5=1.5 pF	K= $\pm 10\%$ M= $\pm 20\%$	500=50V 101=100V 201=200V	A=Ammo	6=1206	C=Cu/Ni/Sn A=Ag/Ni/Sn Halogen free	Bulk (ex): 07=7.0 mm	A= $\pm 0.5\text{mm}$
RD30	B	X7R	-55 ~ +125 $^{\circ}\text{C}$	$\pm 15\%$	101=100 pF 472=4700 pF 104=100000 pF	Z= $+80\%$ /-20%	251=250V 501=500V 631=630V 102=1000V 202=2000V 302=3000V		0=1210 2=1812 8=1808 B=2220	H=Cu/Ni/Sn Halogen free		B= $\pm 1\text{mm}$ C=Min
	F	Y5V	-25 ~ +85 $^{\circ}\text{C}$	+30% ~ -80%								

\* Remark about tolerance code:

NPO: Cap<10pF: D tolerance / Cap $\geq 10\text{pF}$ : J, K, M, Z, X7R: K、M, Y5V: M、Z

**3. Lead configuration and size: (Unit: mm)**

Type Code	Chip size	Dimensions (Unit:mm)						Lead spacing(F)		Lead Configuration
		Width (W)Max.	Height (Max.)		Thickness (T)Max.	Lead length (L)	Taping	Bulk		
			h	h1						
RD20	0805	5.0	4.5	6.0	3.5	2.5 $\pm 0.8$	2.54 $\pm 1.0$	 		
RD21	0805	5.0	4.5	6.5	3.5	Refer to the item "2. SAP Part Number"	5.0 $\pm 0.8$	5.08 $\pm 1.0$	 	
	1206	6.5	5.0	7.0	4.0					
	1210 (Special size)	6.5	5.5	7.5	5.0					
RD30	1808	8.0	6.0	7.5	5.5	5.0 $\pm 0.8$	5.08 $\pm 1.0$	 		
	1812	8.0	6.5	8.0	5.5					
	2220 (Special size)	9.0	9.0	10.0	6.0					

\* Lead diameter  $\Phi d$ : 0.5  $\pm 0.05\text{mm}$

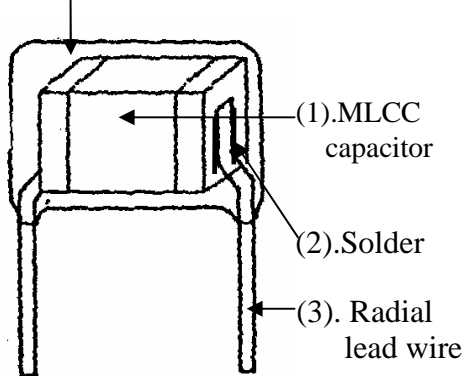
\* Special size : Customized

SPECIFICATION OF MULTI-LAYER RADIAL-LEADED TYPE CAPACITOR	D13-00-E-14	Ver: 14 Page: 5 / 18
---	-------------	-------------------------

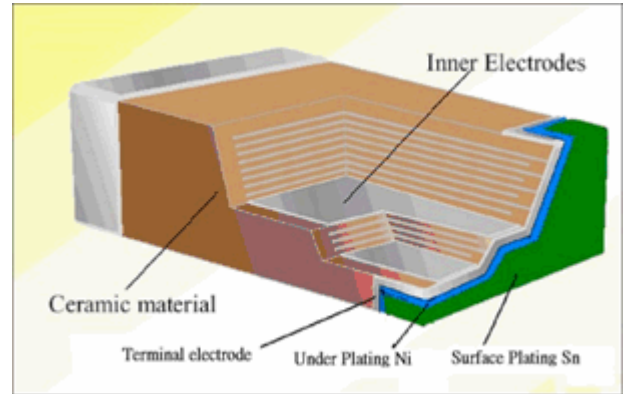
**4. Product structure:**

Radial capacitor

(4) Epoxy coating



(1). MLCC capacitor



NO	Part name	Material	
(1)	MLCC capacitor	Ceramic dielectric	
		Internal Electrode	Ag-Pd or Ni (BME)
		Terminal electrode	Ag or Cu (BME) layer
		Under Plating	Ni layer
		Surface Plating	Sn layer
(2)	Solder	Tin-silver	
(3)	Radial Lead Wire	Tined CP wire	
(4)	Coating	Epoxy resin(Blue)	

**5. Specification and test method :**

**5.1 Test conditions:**

Tests shall, unless otherwise specified, be carried out at 15 to 35°C and RH 45 to 75%. If any doubt and argument has been encounter in judgement, the final test shall be done at 25±2°C, RH45 to 55% and 860~1060mbar. (Based on JIS standard)

**5.2 Handle procedure:**

To avoid unexpected testing results from occurring, the tested capacitor must be kept at room temperature for at least 30 minutes and completely discharged.

SPECIFICATION OF MULTI-LAYER RADIAL-LEADED TYPE CAPACITOR	D13-00-E-14	Ver: 14 Page: 6 / 18
---	-------------	-------------------------

**5.3 Performance:**

No.	Item	Performance	Test or inspection method																																																															
(1)	Appearance structure size	No defects which may affect performance.	As section 3																																																															
(2)	Withstand Voltage	Withstand test voltage without Insulation breakdown or other damage.	DC Tested voltage shall be applied for 1~5sec. Charge/discharge current shall not exceed 50 mA . <table border="1" style="margin-left: 20px;"> <tr> <th>Rated Voltage</th> <th>Tested Voltage</th> </tr> <tr> <td>&lt;100V</td> <td>2.5Ra</td> </tr> <tr> <td>100V</td> <td>3.0Ra</td> </tr> <tr> <td>200~300V</td> <td>2.0 Ra</td> </tr> <tr> <td>500~999V</td> <td>1.5 Ra</td> </tr> <tr> <td>1000~3000V</td> <td>1.2 Ra</td> </tr> </table>	Rated Voltage	Tested Voltage	<100V	2.5Ra	100V	3.0Ra	200~300V	2.0 Ra	500~999V	1.5 Ra	1000~3000V	1.2 Ra																																																			
Rated Voltage	Tested Voltage																																																																	
<100V	2.5Ra																																																																	
100V	3.0Ra																																																																	
200~300V	2.0 Ra																																																																	
500~999V	1.5 Ra																																																																	
1000~3000V	1.2 Ra																																																																	
(3)	Insulation resistance	NPO: 10,000MΩ Min. or 500Ω *F Min X7R、Y5V: 10GΩ Min or R · C ≥ 500Ω · F (Whichever is smaller)	Insulation resistance shall be measured at 120±5 seconds after rated voltage applied. <table border="1" style="margin-left: 20px;"> <tr> <th>Rated Voltage</th> <th>Tested Voltage</th> </tr> <tr> <td>&lt;500V</td> <td>1.0 Ra</td> </tr> <tr> <td>≥ 500V</td> <td>500V</td> </tr> </table>	Rated Voltage	Tested Voltage	<500V	1.0 Ra	≥ 500V	500V																																																									
Rated Voltage	Tested Voltage																																																																	
<500V	1.0 Ra																																																																	
≥ 500V	500V																																																																	
(4)	Capacitance	Within the specified tolerance.	Measuring frequency & voltage: NPO : > 1000pF : 1KHz±10% 1.0±0.2 Vrms ≤ 1000pF : 1MHz±10% 1.0±0.2 Vrms X7R、Y5V : C ≤ 10uF 1.0±0.2 Vrms 1KHz±10% C > 10 uF 0.5±0.2 Vrms 120Hz±20%																																																															
(5)	Dissipation Factor	<table border="1" style="width: 100%;"> <tr> <td rowspan="2">NPO</td> <td colspan="3">More than 30pF: Q ≥ 1000</td> </tr> <tr> <td colspan="3">Less than 30pF: Q ≥ 400+20C</td> </tr> <tr> <td rowspan="6">X7R</td> <td>Rated vol.</td> <td>DF ≤</td> <td>Special chip size and capacitance</td> </tr> <tr> <td>&gt;1000V</td> <td>≤ 3%</td> <td></td> </tr> <tr> <td rowspan="3">≥ 100V ≤ 1000V</td> <td>≤ 2.5%</td> <td></td> </tr> <tr> <td>≤ 3%</td> <td>1206 ≥ 0.47μF 1812 &amp; 1808 &amp; 2220</td> </tr> <tr> <td>≤ 5%</td> <td>0805 &gt; 0.1μF, 1206 &gt; 1μF, 1210 ≥ 2.2μF</td> </tr> <tr> <td rowspan="3">50V</td> <td>≤ 10%</td> <td>0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 2.5%</td> <td></td> </tr> <tr> <td>≤ 3%</td> <td>0805 ≥ 0.18μF, 1206 ≥ 0.47μF</td> </tr> <tr> <td rowspan="3"></td> <td>≤ 5%</td> <td>1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10%</td> <td>0805 ≥ 1μF, 1206 ≥ 2.2μF, 1210 ≥ 10μF</td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td rowspan="7">Y5V</td> <td>Rated vol.</td> <td>DF ≤</td> <td>Special chip size and capacitance</td> </tr> <tr> <td rowspan="3">≥ 50V</td> <td>≤ 5%</td> <td></td> </tr> <tr> <td>≤ 7%</td> <td>0805 ≥ 0.47μF, 1206 ≥ 4.7μF</td> </tr> <tr> <td>≤ 12.5%</td> <td>1210 ≥ 6.8μF</td> </tr> <tr> <td rowspan="3">25V</td> <td>≤ 5%</td> <td></td> </tr> <tr> <td>≤ 7%</td> <td>0805 ≥ 0.33μF, 1206 ≥ 1μF, 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 9%</td> <td>1206 ≥ 4.7μF, 1210 ≥ 22μF</td> </tr> <tr> <td>16V (C &lt; 1.0μF)</td> <td>≤ 7%</td> <td></td> </tr> <tr> <td rowspan="2">16V (C ≥ 1.0μF)</td> <td>≤ 9%</td> <td></td> </tr> <tr> <td>≤ 12.5%</td> <td>0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF</td> </tr> <tr> <td>10V</td> <td>≤ 12.5%</td> <td></td> </tr> </table>		NPO	More than 30pF: Q ≥ 1000			Less than 30pF: Q ≥ 400+20C			X7R	Rated vol.	DF ≤	Special chip size and capacitance	>1000V	≤ 3%		≥ 100V ≤ 1000V	≤ 2.5%		≤ 3%	1206 ≥ 0.47μF 1812 & 1808 & 2220	≤ 5%	0805 > 0.1μF, 1206 > 1μF, 1210 ≥ 2.2μF	50V	≤ 10%	0805 > 0.22μF; 1210 ≥ 3.3μF	≤ 2.5%		≤ 3%	0805 ≥ 0.18μF, 1206 ≥ 0.47μF		≤ 5%	1210 ≥ 4.7μF	≤ 10%	0805 ≥ 1μF, 1206 ≥ 2.2μF, 1210 ≥ 10μF			Y5V	Rated vol.	DF ≤	Special chip size and capacitance	≥ 50V	≤ 5%		≤ 7%	0805 ≥ 0.47μF, 1206 ≥ 4.7μF	≤ 12.5%	1210 ≥ 6.8μF	25V	≤ 5%		≤ 7%	0805 ≥ 0.33μF, 1206 ≥ 1μF, 1210 ≥ 4.7μF	≤ 9%	1206 ≥ 4.7μF, 1210 ≥ 22μF	16V (C < 1.0μF)	≤ 7%		16V (C ≥ 1.0μF)	≤ 9%		≤ 12.5%	0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF	10V	≤ 12.5%
NPO	More than 30pF: Q ≥ 1000																																																																	
	Less than 30pF: Q ≥ 400+20C																																																																	
X7R	Rated vol.	DF ≤	Special chip size and capacitance																																																															
	>1000V	≤ 3%																																																																
	≥ 100V ≤ 1000V	≤ 2.5%																																																																
		≤ 3%	1206 ≥ 0.47μF 1812 & 1808 & 2220																																																															
		≤ 5%	0805 > 0.1μF, 1206 > 1μF, 1210 ≥ 2.2μF																																																															
	50V	≤ 10%	0805 > 0.22μF; 1210 ≥ 3.3μF																																																															
≤ 2.5%																																																																		
≤ 3%		0805 ≥ 0.18μF, 1206 ≥ 0.47μF																																																																
	≤ 5%	1210 ≥ 4.7μF																																																																
	≤ 10%	0805 ≥ 1μF, 1206 ≥ 2.2μF, 1210 ≥ 10μF																																																																
Y5V	Rated vol.	DF ≤	Special chip size and capacitance																																																															
	≥ 50V	≤ 5%																																																																
		≤ 7%	0805 ≥ 0.47μF, 1206 ≥ 4.7μF																																																															
		≤ 12.5%	1210 ≥ 6.8μF																																																															
	25V	≤ 5%																																																																
		≤ 7%	0805 ≥ 0.33μF, 1206 ≥ 1μF, 1210 ≥ 4.7μF																																																															
		≤ 9%	1206 ≥ 4.7μF, 1210 ≥ 22μF																																																															
16V (C < 1.0μF)	≤ 7%																																																																	
16V (C ≥ 1.0μF)	≤ 9%																																																																	
	≤ 12.5%	0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF																																																																
10V	≤ 12.5%																																																																	

SPECIFICATION OF MULTI-LAYER RADIAL-LEADED TYPE CAPACITOR	D13-00-E-14	Ver: 14 Page: 7 / 18
---	-------------	-------------------------

No.	Item	Performance			Test or inspection method		
(6)	Temperature Characteristic of Capacitance	Temperatures Coefficient			The temperature coefficient is determined using the capacitance measured at base temperature as a reference. Test the specimen in a range of maximum and minimum operation temperature that shown as left table. * Base Temp $25 \pm 2^\circ\text{C}$ * Base Temp for Y5V: $20 \pm 2^\circ\text{C}$		
		T.C.	Operating Temperature	Capacitance Change ( $\Delta C$ )			
		NPO	-55~+125 $^\circ\text{C}$	$0 \pm 30(\text{ppm}/^\circ\text{C})$			
		X7R	-55~+125 $^\circ\text{C}$	$\pm 15\%$	Step	Temperature( $^\circ\text{C}$ )	
		Y5V	-25~+85 $^\circ\text{C}$	+30%~ -80%	1	Base Temp.(25 $^\circ\text{C}$ ) $\pm 2^\circ\text{C}$	
					2	Min. Operation Temp. $\pm 2^\circ\text{C}$	
					3	Base Temp.(25 $^\circ\text{C}$ ) $\pm 2^\circ\text{C}$	
			4	Max. Operation Temp. $\pm 2^\circ\text{C}$			
			5	Base Temp.(25 $^\circ\text{C}$ ) $\pm 2^\circ\text{C}$			
(7)	Terminal strength	Tensile strength: No breakdown			Loading weight 0.5 Kgs is applied for 10 $\pm 1$ seconds		
		Bending strength: No breakdown			Loading weight 0.25 Kgs is applied Bending back and forth 90 degrees twice		
(8)	Soldering heat resistance	External appearance	No mechanical damage.			Lead wire or terminals shall be immersed (A) up to 2.0 mm from body (B) into the Molten solder of which temperature is 260+5 -0 $^\circ\text{C}$ for 3 $\pm 0.5$ sec. Then leave at standard test conditions for 24 $\pm 2$ hours, then measured.  *Preconditioning : (only for Class 2): Perform a heat treatment at 150 +0/-10 $^\circ\text{C}$ for one hour and then let sit for 48 $\pm 4$ hours at room temperature.	
		Cap. change ( $\Delta C/C$ )	NPO	$\pm 2.5\%$ or $\pm 0.25 \text{ pF max.}$ Whichever is larger			
			X7R	$\pm 7.5\%$			
			Y5V	$\pm 20\%$			
	D.F.	To meet initial standard value					
	I.R.	To meet initial standard value					

SPECIFICATION OF MULTI-LAYER RADIAL-LEADED TYPE CAPACITOR	D13-00-E-14	Ver: 14 Page: 8 / 18
---	-------------	-------------------------

No.	Item	Performance	Test or inspection method																																																																																		
(9)	Solderability	Lead wire shall be soldered over 75% of the circumfluent direction	To comply with JIS-C-5102 8.4 , the soldering temperature is 245±5°C and dipping time is 5±0.5 seconds. Flux: weight ratio of Rosin 25%																																																																																		
(10)	Humidity (Steady state)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">External appearance</td> <td colspan="2">No mechanical damage.</td> </tr> <tr> <td>Cap. change (ΔC/C)</td> <td colspan="2">NPO: ± 5% or ±0.5 pFmax. (Whichever is larger) X7R: ±12.5% Y5V: ±30%</td> </tr> <tr> <td>D.F.:</td> <td colspan="2">NPO:</td> </tr> <tr> <td></td> <td colspan="2">C ≥ 30pF: D.F. ≤ <math>\frac{1}{350}</math></td> </tr> <tr> <td></td> <td colspan="2">10pF ≤ C &lt; 30pF: D.F. ≤ <math>\frac{1}{275+2.5 * C}</math></td> </tr> <tr> <td></td> <td colspan="2">C &lt; 10pF: D.F. ≤ <math>\frac{1}{200+10 * C}</math></td> </tr> <tr> <td></td> <td colspan="2">PS: C: Nominal Capacitance (pF)</td> </tr> <tr> <td></td> <td style="text-align: center;">X7R</td> <td> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>Rated vol.</th> <th>DF ≤</th> <th>Special chip size and capacitance</th> </tr> <tr> <td rowspan="3">≥ 100V</td> <td>≤ 3%</td> <td>1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 6%</td> <td>1812 &amp; 1808 &amp; 2220</td> </tr> <tr> <td>≤ 7.5%</td> <td>0805 &gt; 0.1μF, 1206 &gt; 1μF, 1210 ≥ 2.2μF</td> </tr> <tr> <td rowspan="3">50V</td> <td>≤ 20%</td> <td>0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 3%</td> <td></td> </tr> <tr> <td>≤ 6%</td> <td>0805 ≥ 0.18μF, 1206 ≥ 0.47μF</td> </tr> <tr> <td></td> <td>≤ 10%</td> <td>1210 ≥ 4.7μF</td> </tr> <tr> <td></td> <td>≤ 20%</td> <td>0805 ≥ 1μF, 1206 ≥ 2.2μF, 1210 ≥ 10μF</td> </tr> </table> </td> </tr> <tr> <td></td> <td style="text-align: center;">Y5V</td> <td> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>Rated vol.</th> <th>DF ≤</th> <th>Special chip size and capacitance</th> </tr> <tr> <td rowspan="3">≥ 50V</td> <td>≤ 7.5%</td> <td></td> </tr> <tr> <td>≤ 10%</td> <td>0805 ≥ 0.47μF, 1206 ≥ 4.7μF</td> </tr> <tr> <td>≤ 20%</td> <td>1210 ≥ 6.8μF</td> </tr> <tr> <td rowspan="3">25V</td> <td>≤ 7.5%</td> <td></td> </tr> <tr> <td>≤ 10%</td> <td>0805 ≥ 0.33μF, 1206 ≥ 1μF, 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 15%</td> <td>1206 ≥ 4.7μF, 1210 ≥ 22μF</td> </tr> <tr> <td>16V (C &lt; 1.0μF)</td> <td>≤ 10%</td> <td></td> </tr> <tr> <td rowspan="2">16V (C ≥ 1.0μF)</td> <td>≤ 12.5%</td> <td></td> </tr> <tr> <td>≤ 20%</td> <td>0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF;</td> </tr> <tr> <td>10V</td> <td>≤ 20%</td> <td></td> </tr> </table> </td> </tr> <tr> <td></td> <td>I.R.</td> <td>1GΩ min. or 50Ω *F (Whichever is smaller)</td> <td></td> </tr> </table>	External appearance	No mechanical damage.		Cap. change (ΔC/C)	NPO: ± 5% or ±0.5 pFmax. (Whichever is larger) X7R: ±12.5% Y5V: ±30%		D.F.:	NPO:			C ≥ 30pF: D.F. ≤ $\frac{1}{350}$			10pF ≤ C < 30pF: D.F. ≤ $\frac{1}{275+2.5 * C}$			C < 10pF: D.F. ≤ $\frac{1}{200+10 * C}$			PS: C: Nominal Capacitance (pF)			X7R	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>Rated vol.</th> <th>DF ≤</th> <th>Special chip size and capacitance</th> </tr> <tr> <td rowspan="3">≥ 100V</td> <td>≤ 3%</td> <td>1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 6%</td> <td>1812 &amp; 1808 &amp; 2220</td> </tr> <tr> <td>≤ 7.5%</td> <td>0805 &gt; 0.1μF, 1206 &gt; 1μF, 1210 ≥ 2.2μF</td> </tr> <tr> <td rowspan="3">50V</td> <td>≤ 20%</td> <td>0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 3%</td> <td></td> </tr> <tr> <td>≤ 6%</td> <td>0805 ≥ 0.18μF, 1206 ≥ 0.47μF</td> </tr> <tr> <td></td> <td>≤ 10%</td> <td>1210 ≥ 4.7μF</td> </tr> <tr> <td></td> <td>≤ 20%</td> <td>0805 ≥ 1μF, 1206 ≥ 2.2μF, 1210 ≥ 10μF</td> </tr> </table>	Rated vol.	DF ≤	Special chip size and capacitance	≥ 100V	≤ 3%	1206 ≥ 0.47μF	≤ 6%	1812 & 1808 & 2220	≤ 7.5%	0805 > 0.1μF, 1206 > 1μF, 1210 ≥ 2.2μF	50V	≤ 20%	0805 > 0.22μF; 1210 ≥ 3.3μF	≤ 3%		≤ 6%	0805 ≥ 0.18μF, 1206 ≥ 0.47μF		≤ 10%	1210 ≥ 4.7μF		≤ 20%	0805 ≥ 1μF, 1206 ≥ 2.2μF, 1210 ≥ 10μF		Y5V	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>Rated vol.</th> <th>DF ≤</th> <th>Special chip size and capacitance</th> </tr> <tr> <td rowspan="3">≥ 50V</td> <td>≤ 7.5%</td> <td></td> </tr> <tr> <td>≤ 10%</td> <td>0805 ≥ 0.47μF, 1206 ≥ 4.7μF</td> </tr> <tr> <td>≤ 20%</td> <td>1210 ≥ 6.8μF</td> </tr> <tr> <td rowspan="3">25V</td> <td>≤ 7.5%</td> <td></td> </tr> <tr> <td>≤ 10%</td> <td>0805 ≥ 0.33μF, 1206 ≥ 1μF, 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 15%</td> <td>1206 ≥ 4.7μF, 1210 ≥ 22μF</td> </tr> <tr> <td>16V (C &lt; 1.0μF)</td> <td>≤ 10%</td> <td></td> </tr> <tr> <td rowspan="2">16V (C ≥ 1.0μF)</td> <td>≤ 12.5%</td> <td></td> </tr> <tr> <td>≤ 20%</td> <td>0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF;</td> </tr> <tr> <td>10V</td> <td>≤ 20%</td> <td></td> </tr> </table>	Rated vol.	DF ≤	Special chip size and capacitance	≥ 50V	≤ 7.5%		≤ 10%	0805 ≥ 0.47μF, 1206 ≥ 4.7μF	≤ 20%	1210 ≥ 6.8μF	25V	≤ 7.5%		≤ 10%	0805 ≥ 0.33μF, 1206 ≥ 1μF, 1210 ≥ 4.7μF	≤ 15%	1206 ≥ 4.7μF, 1210 ≥ 22μF	16V (C < 1.0μF)	≤ 10%		16V (C ≥ 1.0μF)	≤ 12.5%		≤ 20%	0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF;	10V	≤ 20%			I.R.	1GΩ min. or 50Ω *F (Whichever is smaller)		Humidity (Steady state): At temperature 40±2 °C and humidity 90 to 95%RH for 500 + 24/ - 0 hours. Leave the capacitors in ambient condition for the following time before measurement. Class 1 : 24±2 hours. Class 2 : 48±4 hours. * Charge / discharge current shall. not exceed 50 mA. * Preconditioning : (only for Class 2): Apply the rated DC voltage for 1hour at 150 ±5°C. Remove and let sit for 48±4 hours at room temperature. Perform initial measurement.
External appearance	No mechanical damage.																																																																																				
Cap. change (ΔC/C)	NPO: ± 5% or ±0.5 pFmax. (Whichever is larger) X7R: ±12.5% Y5V: ±30%																																																																																				
D.F.:	NPO:																																																																																				
	C ≥ 30pF: D.F. ≤ $\frac{1}{350}$																																																																																				
	10pF ≤ C < 30pF: D.F. ≤ $\frac{1}{275+2.5 * C}$																																																																																				
	C < 10pF: D.F. ≤ $\frac{1}{200+10 * C}$																																																																																				
	PS: C: Nominal Capacitance (pF)																																																																																				
	X7R	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>Rated vol.</th> <th>DF ≤</th> <th>Special chip size and capacitance</th> </tr> <tr> <td rowspan="3">≥ 100V</td> <td>≤ 3%</td> <td>1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 6%</td> <td>1812 &amp; 1808 &amp; 2220</td> </tr> <tr> <td>≤ 7.5%</td> <td>0805 &gt; 0.1μF, 1206 &gt; 1μF, 1210 ≥ 2.2μF</td> </tr> <tr> <td rowspan="3">50V</td> <td>≤ 20%</td> <td>0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 3%</td> <td></td> </tr> <tr> <td>≤ 6%</td> <td>0805 ≥ 0.18μF, 1206 ≥ 0.47μF</td> </tr> <tr> <td></td> <td>≤ 10%</td> <td>1210 ≥ 4.7μF</td> </tr> <tr> <td></td> <td>≤ 20%</td> <td>0805 ≥ 1μF, 1206 ≥ 2.2μF, 1210 ≥ 10μF</td> </tr> </table>	Rated vol.	DF ≤	Special chip size and capacitance	≥ 100V	≤ 3%	1206 ≥ 0.47μF	≤ 6%	1812 & 1808 & 2220	≤ 7.5%	0805 > 0.1μF, 1206 > 1μF, 1210 ≥ 2.2μF	50V	≤ 20%	0805 > 0.22μF; 1210 ≥ 3.3μF	≤ 3%		≤ 6%	0805 ≥ 0.18μF, 1206 ≥ 0.47μF		≤ 10%	1210 ≥ 4.7μF		≤ 20%	0805 ≥ 1μF, 1206 ≥ 2.2μF, 1210 ≥ 10μF																																																												
Rated vol.	DF ≤	Special chip size and capacitance																																																																																			
≥ 100V	≤ 3%	1206 ≥ 0.47μF																																																																																			
	≤ 6%	1812 & 1808 & 2220																																																																																			
	≤ 7.5%	0805 > 0.1μF, 1206 > 1μF, 1210 ≥ 2.2μF																																																																																			
50V	≤ 20%	0805 > 0.22μF; 1210 ≥ 3.3μF																																																																																			
	≤ 3%																																																																																				
	≤ 6%	0805 ≥ 0.18μF, 1206 ≥ 0.47μF																																																																																			
	≤ 10%	1210 ≥ 4.7μF																																																																																			
	≤ 20%	0805 ≥ 1μF, 1206 ≥ 2.2μF, 1210 ≥ 10μF																																																																																			
	Y5V	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>Rated vol.</th> <th>DF ≤</th> <th>Special chip size and capacitance</th> </tr> <tr> <td rowspan="3">≥ 50V</td> <td>≤ 7.5%</td> <td></td> </tr> <tr> <td>≤ 10%</td> <td>0805 ≥ 0.47μF, 1206 ≥ 4.7μF</td> </tr> <tr> <td>≤ 20%</td> <td>1210 ≥ 6.8μF</td> </tr> <tr> <td rowspan="3">25V</td> <td>≤ 7.5%</td> <td></td> </tr> <tr> <td>≤ 10%</td> <td>0805 ≥ 0.33μF, 1206 ≥ 1μF, 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 15%</td> <td>1206 ≥ 4.7μF, 1210 ≥ 22μF</td> </tr> <tr> <td>16V (C &lt; 1.0μF)</td> <td>≤ 10%</td> <td></td> </tr> <tr> <td rowspan="2">16V (C ≥ 1.0μF)</td> <td>≤ 12.5%</td> <td></td> </tr> <tr> <td>≤ 20%</td> <td>0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF;</td> </tr> <tr> <td>10V</td> <td>≤ 20%</td> <td></td> </tr> </table>	Rated vol.	DF ≤	Special chip size and capacitance	≥ 50V	≤ 7.5%		≤ 10%	0805 ≥ 0.47μF, 1206 ≥ 4.7μF	≤ 20%	1210 ≥ 6.8μF	25V	≤ 7.5%		≤ 10%	0805 ≥ 0.33μF, 1206 ≥ 1μF, 1210 ≥ 4.7μF	≤ 15%	1206 ≥ 4.7μF, 1210 ≥ 22μF	16V (C < 1.0μF)	≤ 10%		16V (C ≥ 1.0μF)	≤ 12.5%		≤ 20%	0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF;	10V	≤ 20%																																																								
Rated vol.	DF ≤	Special chip size and capacitance																																																																																			
≥ 50V	≤ 7.5%																																																																																				
	≤ 10%	0805 ≥ 0.47μF, 1206 ≥ 4.7μF																																																																																			
	≤ 20%	1210 ≥ 6.8μF																																																																																			
25V	≤ 7.5%																																																																																				
	≤ 10%	0805 ≥ 0.33μF, 1206 ≥ 1μF, 1210 ≥ 4.7μF																																																																																			
	≤ 15%	1206 ≥ 4.7μF, 1210 ≥ 22μF																																																																																			
16V (C < 1.0μF)	≤ 10%																																																																																				
16V (C ≥ 1.0μF)	≤ 12.5%																																																																																				
	≤ 20%	0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF;																																																																																			
10V	≤ 20%																																																																																				
	I.R.	1GΩ min. or 50Ω *F (Whichever is smaller)																																																																																			



SPECIFICATION OF MULTI-LAYER RADIAL-LEADED TYPE CAPACITOR	D13-00-E-14	Ver: 14 Page: 9 / 18
---	-------------	-------------------------

No.	Item	Performance	Test or inspection method																																																						
(11)	Humidity load	External appearance	Humidity load: ( apply for the product with rated voltage 500V-Max): Apply the rated voltage at temperature 40±2 °C and humidity 90 to 95%RH for 500 + 24/ - 0 hours. Leave the capacitors in ambient condition for the following time before measurement. Class 1 : 24±2 hours. Class 2 : 48±4 hours. * Charge / discharge current shall. not exceed 50 mA. * Preconditioning : (only for Class 2): Apply the rated DC voltage for 1hour at 150 ±5 °C . Remove and let sit for 48±4 hours at room temperature. Perform initial measurement.																																																						
		Cap. change (ΔC/C)		No mechanical damage.  NPO: ± 5% or ±0.5 pFmax. (Whichever is larger) X7R: ±12.5% Y5V: ±30%																																																					
		D.F.:		NPO: $C \geq 30\text{pF}$ : D.F. $\leq \frac{1}{350}$ $10\text{pF} \leq C < 30\text{pF}$ : D.F. $\leq \frac{1}{275+2.5 * C}$ $C < 10\text{pF}$ : D.F. $\leq \frac{1}{200+10 * C}$ PS: C: Nominal Capacitance (pF)																																																					
		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2"></th> <th rowspan="2">Rated vol.</th> <th rowspan="2">DF ≤</th> <th>Special chip size and capacitance</th> </tr> </thead> <tbody> <tr> <td></td> </tr> <tr> <td rowspan="5">X7R</td> <td rowspan="5">≥ 100V</td> <td>≤ 3%</td> <td></td> </tr> <tr> <td>≤ 6%</td> <td>1206 ≥ 0.47μF 1812 &amp; 1808 &amp; 2220</td> </tr> <tr> <td>≤ 7.5%</td> <td>0805 &gt; 0.1μF, 1206 &gt; 1μF</td> </tr> <tr> <td>≤ 20%</td> <td>0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td rowspan="5">50V</td> <td rowspan="5"></td> <td>≤ 3%</td> <td></td> </tr> <tr> <td>≤ 6%</td> <td>0805 ≥ 0.18μF, 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 10%</td> <td>1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 20%</td> <td>0805 ≥ 1μF, 1206 ≥ 2.2μF, 1210 ≥ 10μF</td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td rowspan="10">Y5V</td> <td rowspan="3">≥ 50V</td> <td>≤ 7.5%</td> <td></td> </tr> <tr> <td>≤ 10%</td> <td>0805 ≥ 0.47μF, 1206 ≥ 4.7μF</td> </tr> <tr> <td>≤ 20%</td> <td>1210 ≥ 6.8μF</td> </tr> <tr> <td rowspan="3">25V</td> <td>≤ 7.5%</td> <td></td> </tr> <tr> <td>≤ 10%</td> <td>0805 ≥ 0.33μF, 1206 ≥ 1μF, 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 15%</td> <td>1206 ≥ 4.7μF, 1210 ≥ 22μF</td> </tr> <tr> <td>16V (C &lt; 1.0μF)</td> <td>≤ 10%</td> <td></td> </tr> <tr> <td rowspan="2">16V (C ≥ 1.0μF)</td> <td>≤ 12.5%</td> <td></td> </tr> <tr> <td>≤ 20%</td> <td>0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF;</td> </tr> <tr> <td>10V</td> <td>≤ 20%</td> <td></td> </tr> </tbody> </table>		Rated vol.	DF ≤	Special chip size and capacitance		X7R	≥ 100V	≤ 3%		≤ 6%	1206 ≥ 0.47μF 1812 & 1808 & 2220	≤ 7.5%	0805 > 0.1μF, 1206 > 1μF	≤ 20%	0805 > 0.22μF; 1210 ≥ 3.3μF			50V		≤ 3%		≤ 6%	0805 ≥ 0.18μF, 1206 ≥ 0.47μF	≤ 10%	1210 ≥ 4.7μF	≤ 20%	0805 ≥ 1μF, 1206 ≥ 2.2μF, 1210 ≥ 10μF			Y5V	≥ 50V	≤ 7.5%		≤ 10%	0805 ≥ 0.47μF, 1206 ≥ 4.7μF	≤ 20%	1210 ≥ 6.8μF	25V	≤ 7.5%		≤ 10%	0805 ≥ 0.33μF, 1206 ≥ 1μF, 1210 ≥ 4.7μF	≤ 15%	1206 ≥ 4.7μF, 1210 ≥ 22μF	16V (C < 1.0μF)	≤ 10%		16V (C ≥ 1.0μF)	≤ 12.5%		≤ 20%	0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF;	10V	≤ 20%	
	Rated vol.	DF ≤				Special chip size and capacitance																																																			
X7R	≥ 100V	≤ 3%																																																							
		≤ 6%	1206 ≥ 0.47μF 1812 & 1808 & 2220																																																						
		≤ 7.5%	0805 > 0.1μF, 1206 > 1μF																																																						
		≤ 20%	0805 > 0.22μF; 1210 ≥ 3.3μF																																																						
50V		≤ 3%																																																							
		≤ 6%	0805 ≥ 0.18μF, 1206 ≥ 0.47μF																																																						
		≤ 10%	1210 ≥ 4.7μF																																																						
		≤ 20%	0805 ≥ 1μF, 1206 ≥ 2.2μF, 1210 ≥ 10μF																																																						
Y5V	≥ 50V	≤ 7.5%																																																							
		≤ 10%	0805 ≥ 0.47μF, 1206 ≥ 4.7μF																																																						
		≤ 20%	1210 ≥ 6.8μF																																																						
	25V	≤ 7.5%																																																							
		≤ 10%	0805 ≥ 0.33μF, 1206 ≥ 1μF, 1210 ≥ 4.7μF																																																						
		≤ 15%	1206 ≥ 4.7μF, 1210 ≥ 22μF																																																						
	16V (C < 1.0μF)	≤ 10%																																																							
	16V (C ≥ 1.0μF)	≤ 12.5%																																																							
		≤ 20%	0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF;																																																						
	10V	≤ 20%																																																							
	I.R.	500MΩ min. or 25 Ω *F (Whichever is smaller)																																																							

SPECIFICATION OF MULTI-LAYER RADIAL-LEADED TYPE CAPACITOR	D13-00-E-14	Ver: 14 Page: 10 / 18
---	-------------	--------------------------

No.	Item	Performance	Test or inspection method																																																																																					
(12)	Temperature Load	<table border="1" style="width: 100%;"> <tr> <td style="width: 30%;">External appearance</td> <td>No mechanical damage.</td> </tr> <tr> <td>Cap. change (<math>\Delta C/C</math>)</td> <td>                     NPO: <math>\pm 3\%</math> or <math>\pm 0.3\text{pFmax.}</math>                      (Whichever is larger)                      X7R: <math>\geq 10\text{V}, \pm 12.5\%</math>                       Y5V: <math>\geq 10\text{V}, \pm 30\%</math> </td> </tr> </table>	External appearance	No mechanical damage.	Cap. change ( $\Delta C/C$ )	NPO: $\pm 3\%$ or $\pm 0.3\text{pFmax.}$ (Whichever is larger) X7R: $\geq 10\text{V}, \pm 12.5\%$  Y5V: $\geq 10\text{V}, \pm 30\%$	<table border="1" style="width: 100%;"> <tr> <th style="width: 50%;">Rated Voltage</th> <th style="width: 50%;">Tested Voltage</th> </tr> <tr> <td>&lt; 500V</td> <td>2.0Ra</td> </tr> <tr> <td>500V</td> <td>1.5Ra</td> </tr> <tr> <td><math>\geq 630\text{V}</math></td> <td>1.2Ra</td> </tr> <tr> <td><math>\geq 1000\text{V}</math></td> <td>1.2Ra</td> </tr> </table>	Rated Voltage	Tested Voltage	< 500V	2.0Ra	500V	1.5Ra	$\geq 630\text{V}$	1.2Ra	$\geq 1000\text{V}$	1.2Ra																																																																							
External appearance	No mechanical damage.																																																																																							
Cap. change ( $\Delta C/C$ )	NPO: $\pm 3\%$ or $\pm 0.3\text{pFmax.}$ (Whichever is larger) X7R: $\geq 10\text{V}, \pm 12.5\%$  Y5V: $\geq 10\text{V}, \pm 30\%$																																																																																							
Rated Voltage	Tested Voltage																																																																																							
< 500V	2.0Ra																																																																																							
500V	1.5Ra																																																																																							
$\geq 630\text{V}$	1.2Ra																																																																																							
$\geq 1000\text{V}$	1.2Ra																																																																																							
		<p>D.F.:</p> <p>NPO:</p> $C \geq 30\text{pF: D.F.} \leq \frac{1}{350}$ $10\text{pF} \leq C < 30\text{pF: D.F.} \leq \frac{1}{275 + 2.5 * C}$ $C < 10\text{pF: D.F.} \leq \frac{1}{200 + 10 * C}$ <p>PS: C: Nominal Capacitance (pF)</p> <table border="1" style="width: 100%;"> <tr> <th rowspan="2" style="width: 10%;">X7R</th> <th style="width: 10%;">Rated vol.</th> <th style="width: 10%;">DF <math>\leq</math></th> <th style="width: 70%;">Special chip size and capacitance</th> </tr> <tr> <td><math>\geq 100\text{V}</math></td> <td><math>\leq 3\%</math></td> <td>1206 <math>\geq 0.47\mu\text{F}</math> 1812 &amp; 1808 &amp; 2220</td> </tr> <tr> <td></td> <td></td> <td><math>\leq 6\%</math></td> <td>0805 <math>&gt; 0.1\mu\text{F}, 1206 &gt; 1\mu\text{F}</math></td> </tr> <tr> <td></td> <td></td> <td><math>\leq 7.5\%</math></td> <td>0805 <math>&gt; 0.22\mu\text{F}; 1210 \geq 3.3\mu\text{F}</math></td> </tr> <tr> <td></td> <td></td> <td><math>\leq 20\%</math></td> <td>0805 <math>&gt; 0.22\mu\text{F}; 1210 \geq 3.3\mu\text{F}</math></td> </tr> <tr> <td rowspan="5" style="text-align: center;">50V</td> <td></td> <td><math>\leq 3\%</math></td> <td></td> </tr> <tr> <td></td> <td><math>\leq 6\%</math></td> <td>0805 <math>\geq 0.18\mu\text{F}, 1206 \geq 0.47\mu\text{F}</math></td> </tr> <tr> <td></td> <td><math>\leq 10\%</math></td> <td>1210 <math>\geq 4.7\mu\text{F}</math></td> </tr> <tr> <td></td> <td><math>\leq 20\%</math></td> <td>0805 <math>\geq 1\mu\text{F}, 1206 \geq 2.2\mu\text{F}, 1210 \geq 10\mu\text{F}</math></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td rowspan="7" style="text-align: center;">Y5V</td> <td>Rated vol.</td> <td>DF <math>\leq</math></td> <td>Special chip size and capacitance</td> </tr> <tr> <td><math>\geq 50\text{V}</math></td> <td><math>\leq 7.5\%</math></td> <td></td> </tr> <tr> <td></td> <td><math>\leq 10\%</math></td> <td>0805 <math>\geq 0.47\mu\text{F}, 1206 \geq 4.7\mu\text{F}</math></td> </tr> <tr> <td></td> <td><math>\leq 20\%</math></td> <td>1210 <math>\geq 6.8\mu\text{F}</math></td> </tr> <tr> <td>25V</td> <td><math>\leq 7.5\%</math></td> <td></td> </tr> <tr> <td></td> <td><math>\leq 10\%</math></td> <td>0805 <math>\geq 0.33\mu\text{F}, 1206 \geq 1\mu\text{F}, 1210 \geq 4.7\mu\text{F}</math></td> </tr> <tr> <td></td> <td><math>\leq 15\%</math></td> <td>1206 <math>\geq 4.7\mu\text{F}, 1210 \geq 22\mu\text{F}</math></td> </tr> <tr> <td>16V (C &lt; 1.0<math>\mu\text{F}</math>)</td> <td><math>\leq 10\%</math></td> <td></td> </tr> <tr> <td>16V (C <math>\geq 1.0\mu\text{F}</math>)</td> <td><math>\leq 12.5\%</math></td> <td></td> </tr> <tr> <td></td> <td><math>\leq 20\%</math></td> <td>0805 <math>\geq 3.3\mu\text{F}; 1206 \geq 10\mu\text{F}; 1210 \geq 22\mu\text{F}; 1812 \geq 47\mu\text{F};</math></td> </tr> <tr> <td></td> <td>10V</td> <td><math>\leq 20\%</math></td> <td></td> </tr> </table>	X7R	Rated vol.	DF $\leq$	Special chip size and capacitance	$\geq 100\text{V}$	$\leq 3\%$	1206 $\geq 0.47\mu\text{F}$ 1812 & 1808 & 2220			$\leq 6\%$	0805 $> 0.1\mu\text{F}, 1206 > 1\mu\text{F}$			$\leq 7.5\%$	0805 $> 0.22\mu\text{F}; 1210 \geq 3.3\mu\text{F}$			$\leq 20\%$	0805 $> 0.22\mu\text{F}; 1210 \geq 3.3\mu\text{F}$	50V		$\leq 3\%$			$\leq 6\%$	0805 $\geq 0.18\mu\text{F}, 1206 \geq 0.47\mu\text{F}$		$\leq 10\%$	1210 $\geq 4.7\mu\text{F}$		$\leq 20\%$	0805 $\geq 1\mu\text{F}, 1206 \geq 2.2\mu\text{F}, 1210 \geq 10\mu\text{F}$				Y5V	Rated vol.	DF $\leq$	Special chip size and capacitance	$\geq 50\text{V}$	$\leq 7.5\%$			$\leq 10\%$	0805 $\geq 0.47\mu\text{F}, 1206 \geq 4.7\mu\text{F}$		$\leq 20\%$	1210 $\geq 6.8\mu\text{F}$	25V	$\leq 7.5\%$			$\leq 10\%$	0805 $\geq 0.33\mu\text{F}, 1206 \geq 1\mu\text{F}, 1210 \geq 4.7\mu\text{F}$		$\leq 15\%$	1206 $\geq 4.7\mu\text{F}, 1210 \geq 22\mu\text{F}$	16V (C < 1.0 $\mu\text{F}$ )	$\leq 10\%$		16V (C $\geq 1.0\mu\text{F}$ )	$\leq 12.5\%$			$\leq 20\%$	0805 $\geq 3.3\mu\text{F}; 1206 \geq 10\mu\text{F}; 1210 \geq 22\mu\text{F}; 1812 \geq 47\mu\text{F};$		10V	$\leq 20\%$		<p>PS: The test voltage is 150% of rated voltage for below range.</p> <table border="1" style="width: 100%;"> <tr> <th style="width: 15%;">Size</th> <th style="width: 35%;">Rated voltage</th> <th style="width: 50%;">Capacitance</th> </tr> <tr> <td>0805</td> <td>50V(X7R)</td> <td><math>C \geq 2.2\mu\text{F}</math></td> </tr> <tr> <td></td> <td>100V(X7R)</td> <td><math>C \geq 0.47\mu\text{F}</math></td> </tr> <tr> <td></td> <td>16V(Y5V)</td> <td><math>C \geq 0.47\mu\text{F}</math></td> </tr> <tr> <td>1206</td> <td>100V(X7R)</td> <td><math>C \geq 1.0\mu\text{F}</math></td> </tr> </table> <p>at maximum operating temperature <math>\pm 2^\circ\text{C}</math> for 1000 + 48 / - 0 hours. Leave the capacitors in ambient condition for the following time before measurement. Class I: 24 <math>\pm</math> 2 hours Class II: 48 <math>\pm</math> 4 hours</p> <p>* Charge / discharge current shall not exceed 50 mA. * Preconditioning : (only for Class 2): Apply 200% of the rated DC voltage for 1 hour at the maximum operating temperature <math>\pm 3^\circ\text{C}</math>. Remove and let sit for 48 <math>\pm</math> 4 hours at room temperature. Perform initial measurement.</p>	Size	Rated voltage	Capacitance	0805	50V(X7R)	$C \geq 2.2\mu\text{F}$		100V(X7R)	$C \geq 0.47\mu\text{F}$		16V(Y5V)	$C \geq 0.47\mu\text{F}$	1206	100V(X7R)	$C \geq 1.0\mu\text{F}$
X7R	Rated vol.	DF $\leq$		Special chip size and capacitance																																																																																				
	$\geq 100\text{V}$	$\leq 3\%$	1206 $\geq 0.47\mu\text{F}$ 1812 & 1808 & 2220																																																																																					
		$\leq 6\%$	0805 $> 0.1\mu\text{F}, 1206 > 1\mu\text{F}$																																																																																					
		$\leq 7.5\%$	0805 $> 0.22\mu\text{F}; 1210 \geq 3.3\mu\text{F}$																																																																																					
		$\leq 20\%$	0805 $> 0.22\mu\text{F}; 1210 \geq 3.3\mu\text{F}$																																																																																					
50V		$\leq 3\%$																																																																																						
		$\leq 6\%$	0805 $\geq 0.18\mu\text{F}, 1206 \geq 0.47\mu\text{F}$																																																																																					
		$\leq 10\%$	1210 $\geq 4.7\mu\text{F}$																																																																																					
		$\leq 20\%$	0805 $\geq 1\mu\text{F}, 1206 \geq 2.2\mu\text{F}, 1210 \geq 10\mu\text{F}$																																																																																					
Y5V	Rated vol.	DF $\leq$	Special chip size and capacitance																																																																																					
	$\geq 50\text{V}$	$\leq 7.5\%$																																																																																						
		$\leq 10\%$	0805 $\geq 0.47\mu\text{F}, 1206 \geq 4.7\mu\text{F}$																																																																																					
		$\leq 20\%$	1210 $\geq 6.8\mu\text{F}$																																																																																					
	25V	$\leq 7.5\%$																																																																																						
		$\leq 10\%$	0805 $\geq 0.33\mu\text{F}, 1206 \geq 1\mu\text{F}, 1210 \geq 4.7\mu\text{F}$																																																																																					
		$\leq 15\%$	1206 $\geq 4.7\mu\text{F}, 1210 \geq 22\mu\text{F}$																																																																																					
16V (C < 1.0 $\mu\text{F}$ )	$\leq 10\%$																																																																																							
16V (C $\geq 1.0\mu\text{F}$ )	$\leq 12.5\%$																																																																																							
	$\leq 20\%$	0805 $\geq 3.3\mu\text{F}; 1206 \geq 10\mu\text{F}; 1210 \geq 22\mu\text{F}; 1812 \geq 47\mu\text{F};$																																																																																						
	10V	$\leq 20\%$																																																																																						
Size	Rated voltage	Capacitance																																																																																						
0805	50V(X7R)	$C \geq 2.2\mu\text{F}$																																																																																						
	100V(X7R)	$C \geq 0.47\mu\text{F}$																																																																																						
	16V(Y5V)	$C \geq 0.47\mu\text{F}$																																																																																						
1206	100V(X7R)	$C \geq 1.0\mu\text{F}$																																																																																						
		I.R. 1000M $\Omega$ or 50 $\Omega$ *F (Whichever is smaller)																																																																																						

SPECIFICATION OF MULTI-LAYER RADIAL-LEADED TYPE CAPACITOR	D13-00-E-14	Ver: 14 Page: 11 / 18
---	-------------	--------------------------

No.	Item	Performance		Test or inspection method			
(13)	Temperature cycle	External appearance	No mechanical damage.		The capacitor shall be subject 5 cycles according to four heat treatments listed in the following table. Then Leave the capacitors in ambient condition for the following time before measurement. Class I: 24±2 hours Class II: 48±4 hours		
		Cap. change (ΔC/C)	NPO: ±2.5% or ±0.25pFmax. ( Whichever is larger) X7R: ±7.5% Y5V: ±20%				
		D.F.	To meet initial standard value				
		I.R.	10000MΩ min. or 500Ω *F (Whichever is smaller)				
				Step	Temperature (°C)	Duration (min.)	
				1	Min. Operation Temp.±3	30±3	
				2	Room Temp. (25°C)	2 ~ 3	
				3	Max. Operation Temp.±3	30±2	
				4	Room Temp. (25°C)	2 ~ 3	
				*Preconditioning : (only for Class 2): Perform a heat treatment at 150 +0-10°C for one hour and then let sit for 48±4 hours at room			

## 6. Operating and storage environment:

The insulating coating of capacitors does not form a perfect seal; therefore, do not use or store capacitors in a corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. Also avoid exposure to moisture. Before cleaning, bonding or molding this product, verify that these processes do not affect product quality by testing the performance of a cleaned, bonded or molded product in the intended equipment. Store the capacitors where the temperature and relative humidity do not exceed 5 to 40 degrees centigrade and 20 to 70%. Use capacitors within 6 months after delivery.

## 7. Description:

Radial-Leaded, Epoxy-Dipped Multilayer ceramic capacitors are built by superior moisture and shock resistant Epoxy coating, can be supplied in both bulk or tape package for automatic insertion in printed circuit board. But must to avoid effect of external force when the capacitors are used automatic insertion because the inner chips are very weak and easy broken.

Our RD series capacitors have wide application in computer, data Processor, telecom communication, industrial control, and instrumentation equipment, etc.

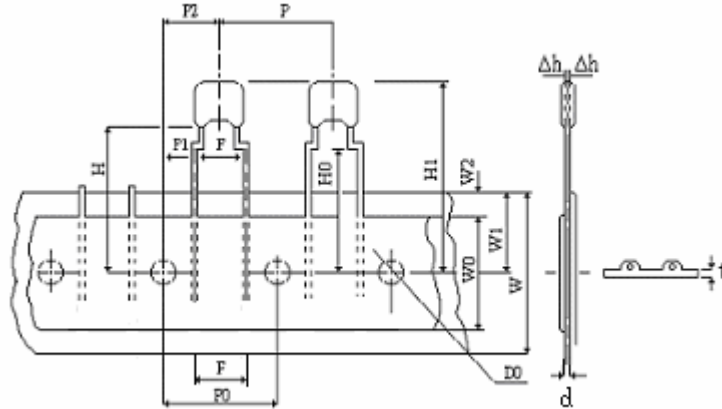
(Epoxy coated: Flame resistance for UL94 V-0 Approved)

SPECIFICATION OF MULTI-LAYER RADIAL-LEADED TYPE CAPACITOR	D13-00-E-14	Ver: 14 Page: 12 / 18
---	-------------	--------------------------

**8. Taping Figure and Specification:**

**8.1 RD21 Type Taping Figure and Specification**

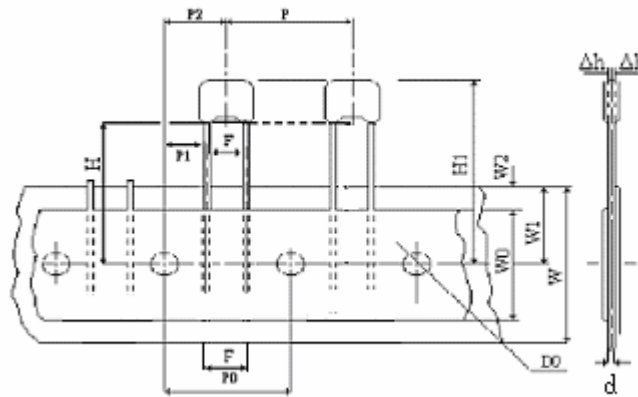
(Unit: mm)



Description	Symbol	Dimension	Remarks
Pitch Of Component	P	12.7±1.0	
Feed Hold Pitch	P0	12.7±0.3	Cumulative Pitch Error : ±1.0 Mm/20 Pitches
Feed Hold Center to Lead	P1	3.85±0.7	
Feed Hold Center to Component Center	P2	6.35±1.3	
Lead diameter	d	0.5±0.05	
Lead To Lead Spacing	F	5.0 ±0.8	To Lead Tip Within Tolerance
Component Alignment, F-R	Δh	2.0 Max	The Alignment From The Center Of The Lead Is±1.0mm
Tape Width	W	18.0+1.0/-0.5	
Adhesive Tape Width	W0	11.0 Min.	
Hole Position	W1	9.0±0.5	
Adhesive Tape Position	W2	3.0 max.	
Height Of Bottom Body From Tape Center	H	18.0+2.0/-0	H+12.5mm≤H1
Lead-Wire Clinch Height	H0	16.0±0.5	6.5≤H0-W1
Component Height	H1	32.25 Max.	
Feed Hole Diameter	D0	4.0±0.2	
Tape Thickness	t	0.6±0.3	

## 8.2 RD20 Type Taping Figure and Specification

(Unit: mm)

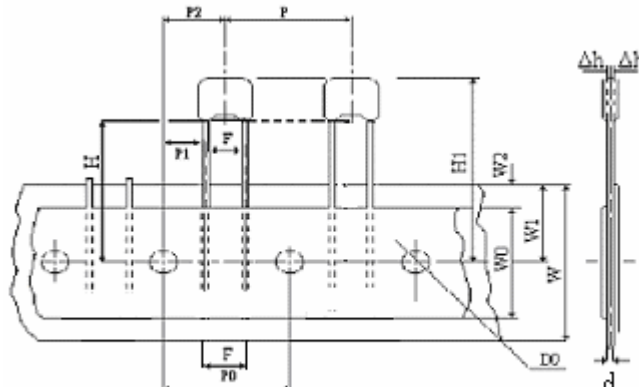


Unit: mm

Description	Symbol	Dimension	Remarks
Pitch Of Component	P	12.7±1.0	
Feed Hold Pitch	P0	12.7±0.3	Cumulative Pitch Error : ±1.0 Mm/20 Pitches
Feed Hold Center to Lead	P1	5.1±0.7	
Feed Hold Center to Component Center	P2	6.35±1.3	
Lead diameter	d	0.5±0.05	
Lead To Lead Spacing	F	2.5 ±0.8	To Lead Tip Within Tolerance
Component Alignment, F-R	Δh	2.0 Max	The Alignment From The Center Of The Lead Is±1.0mm
Tape Width	W	18.0+1.0/-0.5	
Adhesive Tape Width	W0	11.0 Min.	
Hole Position	W1	9.0±0.5	
Adhesive Tape Position	W2	3.0 max.	
Lead-Wire Clinch Height from bottom of capacitor to the hold center	H	18.0±0.5	
Component Height	H1	32.25 Max.	
Feed Hole Diameter	D0	4.0±0.2	
Tape Thickness	t	0.6±0.3	

### 8.3 RD30 Type Taping Figure and Specification

(Unit: mm)



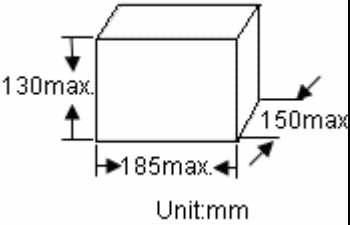
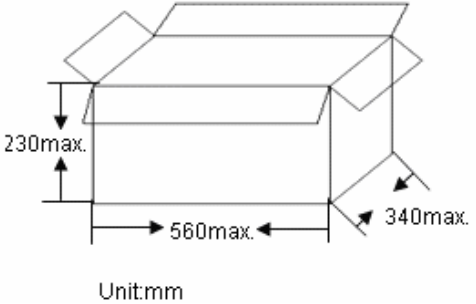
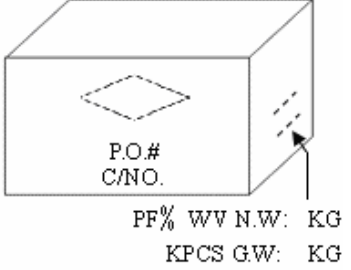
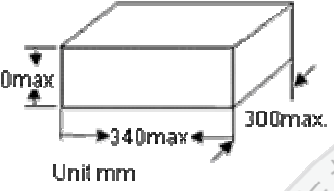
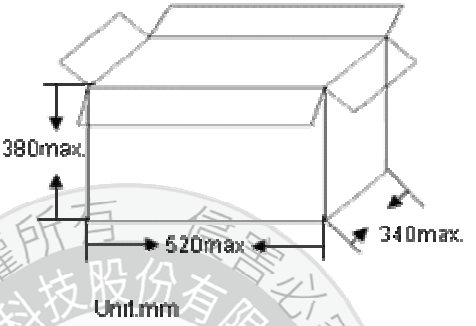
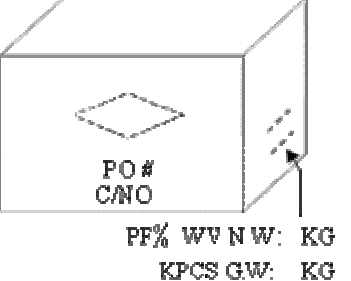
Unit: mm

Description	Symbol	Dimension	Remarks
Pitch Of Component	P	12.7±1.0	
Feed Hold Pitch	P0	12.7±0.3	Cumulative Pitch Error : ±1.0 Mm/20 Pitches
Feed Hold Center to Lead	P1	3.85±0.7	
Feed Hold Center to Component Center	P2	6.35±1.3	
Lead diameter	d	0.5±0.05	
Lead To Lead Spacing	F	5.0 ±0.8	To Lead Tip Within Tolerance
Component Alignment, F-R	Δh	2.0 Max	The Alignment From The Center Of The Lead Is±1.0mm
Tape Width	W	18.0+1.0/-0.5	
Adhesive Tape Width	W0	11.0 Min.	
Hole Position	W1	9.0±0.5	
Adhesive Tape Position	W2	3.0 max.	
Lead-Wire Clinch Height from bottom of capacitor to the hold center	H	18.0±0.5	
Component Height	H1	32.25 Max.	
Feed Hole Diameter	D0	4.0±0.2	
Tape Thickness	t	0.6±0.3	

SPECIFICATION OF MULTI-LAYER RADIAL-LEADED TYPE CAPACITOR	D13-00-E-14	Ver: 14 Page: 15 / 18
---	-------------	--------------------------

**9. Packing specification :**

9.1 Packing size:

Type	Box	Carton
Bulk	 <p>Unit:mm</p>	 <p>Unit:mm</p>  <p>P.O.# C/NO. PF% WV N.W: KG KPCS G.W: KG</p>
Ammo taping	 <p>Unit:mm</p>	 <p>Unit:mm</p>  <p>PO# C/NO. PF% WV N.W: KG KPCS G.W: KG</p>

9.2 Packing quantity:

Chipsize	Taping type		Bulk type
	Quantity per reel	Quantity per box	Quantity per bag
0805	2,000	2,000	1,000
1206,1210,1808,1812	1,500	1,500	1,000





10.2 X7R Dielectric

Dielectric	X7R																											
	Size	0805				1206						1210						1808					1812					
Voltage (VDC)	50	100	200	250	50	100	200	250	500	630	1000	50	100	200	250	500	630	1000	500	630	1000	2000	3000	500	630	1000	2000	3000
100pF (101)	B	B	B	B																								
120pF (121)	B	B	B	B																								
150pF (151)	B	B	B	B	B	B	B	B	B	B	B								B	B	B	B	B					
180pF (181)	B	B	B	B	B	B	B	B	B	B	B								B	B	B	B	B					
220pF (221)	B	B	B	B	B	B	B	B	B	B	B								B	B	B	B	B					
270pF (271)	B	B	B	B	B	B	B	B	B	B	B								B	B	B	B	B				B	B
330pF (331)	B	B	B	B	B	B	B	B	B	B	B								B	B	B	B	B			B	B	B
390pF (391)	B	B	B	B	B	B	B	B	B	B	B								B	B	B	B	B			B	B	B
470pF (471)	B	B	B	B	B	B	B	B	B	B	B								B	B	B	B	B			B	B	B
560pF (561)	B	B	B	B	B	B	B	B	B	B	B								B	B	B	B	B			B	B	B
680pF (681)	B	B	B	B	B	B	B	B	B	B	B								B	B	B	B	B			B	B	B
820pF (821)	B	B	B	B	B	B	B	B	B	B	B								B	B	B	B	B			B	B	B
1000pF (102)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
1200pF (122)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
1500pF (152)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
1800pF (182)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
2200pF (222)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
2700pF (272)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
3300pF (332)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
3900pF (392)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
4700pF (472)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
5600pF (562)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
6800pF (682)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
8200pF (822)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0.01uF (103)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0.012uF (123)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0.015uF (153)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0.018uF (183)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0.022uF (223)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0.027uF (273)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0.033uF (333)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0.039uF (393)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0.047uF (473)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0.056uF (563)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0.068uF (683)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0.082uF (823)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0.1uF (104)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0.12uF (124)	B	B			B	B	B	B				B	B	B	B	B	B											
0.15uF (154)	B	B			B	B	B	B				B	B	B	B	B	B											
0.18uF (184)	B	B			B	B	B	B				B	B	B	B	B	B											
0.22uF (224)	B	B			B	B	B	B				B	B	B	B	B	B											
0.27uF (274)	B				B	B						B	B	B	B	B	B											
0.33uF (334)	B				B	B						B	B	B	B	B	B											
0.39uF (394)	B				B	B						B	B	B	B	B	B											
0.47uF (474)	B	B			B	B						B	B	B	B	B	B											
0.56uF (564)					B	B						B	B	B	B	B	B											
0.68uF (684)					B	B						B	B	B	B	B	B											
0.82uF (824)					B	B						B	B															
1.0uF (105)	B				B	B						B	B															
1.5uF (155)												B	B															
2.2uF (225)	B				B	B						B	B															
4.7uF (475)					B							B																
10uF (106)												B																

- ☆ The letter in cell is expressed the symbol of product terminations. B: (Cu/Ni/Sn)
- ☆ RD30 type can use Mlcc size 1808 and 1812, RD21 type can use Mlcc size 0805 and 1206, but RD20 type can only use Mlcc size 0805.

**10.3 Y5V Dielectric**

Dielectric		Y5V																										
Capacitance	Size	0805						1206						1210						1812								
	Voltage (VDC)	10	16	25	50	100	200	250	10	16	25	50	100	200	250	10	16	25	50	100	200	250	50	100	200	250		
Capacitance	0.01uF (103)	B	B	B	B	B	B	B	B	B	B	B	B	B	B						B	B	B			B	B	B
	0.015uF (153)	B	B	B	B	B	B	B	B	B	B	B	B	B	B						B	B	B			B	B	B
	0.022uF (223)	B	B	B	B	B	B	B	B	B	B	B	B	B	B						B	B	B			B	B	B
	0.033uF (333)	B	B	B	B	B	B	B	B	B	B	B	B	B	B						B	B	B			B	B	B
	0.047uF (473)	B	B	B	B	B	B	B	B	B	B	B	B	B	B						B	B	B			B	B	B
	0.068uF (683)	B	B	B	B	B	B	B	B	B	B	B	B	B	B						B	B	B			B	B	B
	0.1uF (104)	B	B	B	B	B			B	B	B	B	B	B	B		B	B	B	B	B	B	B	B	B	B	B	B
	0.15uF (154)	B	B	B	B				B	B	B	B	B	B	B		B	B	B	B	B	B	B	B	B	B	B	B
	0.22uF (224)	B	B	B	B				B	B	B	B	B	B	B		B	B	B	B	B	B	B	B	B	B	B	B
	0.33uF (334)	B	B	B	B				B	B	B	B					B	B	B	B	B			B	B	B	B	B
	0.47uF (474)	B	B	B	B				B	B	B	B					B	B	B	B	B			B	B	B	B	B
	0.68uF (684)	B	B	B	B				B	B	B	B					B	B	B	B	B			B	B	B	B	B
	1.0uF (105)	B	B	B	B				B	B	B	B					B	B	B	B			B	B		B	B	
	1.5uF (155)	B	B						B	B	B						B	B	B					B				
	2.2uF (225)	B	B						B	B	B						B	B	B	B				B				
	3.3uF (335)	B	B						B	B	B						B	B	B	B	B			B				
	4.7uF (475)	B	B						B	B	B						B	B	B	B	B			B				
	6.8uF (685)	B							B	B							B	B	B					B				
	10uF (106)	B							B	B							B	B	B					B				
	22uF (226)								B																			

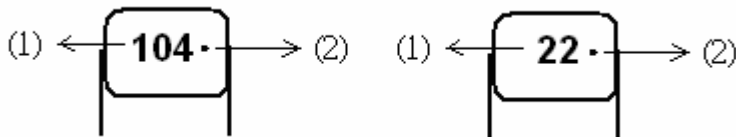
- ☆ The letter in cell is expressed the symbol of product terminations. B: (Cu/Ni/Sn)
- ☆ RD30 type can use Mlcc size 1808 and 1812, RD21 type can use Mlcc size 0805 and 1206, but RD20 type can only use Mlcc size 0805.

**11. Marking:**

Rated voltage (VDC)	10	16	25	50	100	200	250	500	630	1000	1500	2000	2500	3000
3-figure code Marking	$\overline{104}$	$10\overline{4}$	$\overline{\overline{104}}$	104	$\underline{104}$	$\underline{104}$	$\underline{104}$	$\underline{104}$	$\overline{104}$	$\sim 104$	$< 104$	$\sim 104$	$104^{\vee}$	$\wedge 104$
2-figure code Marking	$\overline{22}$	$2\overline{2}$	$\overline{\overline{22}}$	22	$\underline{22}$	$\underline{22}$	$\underline{22}$	$\underline{22}$	$\overline{22}$	$\sim 22$	$< 22$	$\sim 22$	$22^{\vee}$	$\wedge 22$

3-figure code Marking

2-figure code Marking



(1) Rated capacitance:

Two significant digits followed by no. of zeros. And R is in place of decimal point.

ex.: 0R5=0.5pF 1R0=1.0pF 104=10x10<sup>4</sup> =100nF

(2) Halogen and Pb free: There is a “.” beside the capacitance code when the coating resin is

Halogen and Pb free Epoxy.