PRODUCT SPECIFICATION

PRODUCT: CERAMIC DISC CAPACITOR

TYPE: 1KV, 2KV, 3KV LOW DISSIPATION CERAMIC DISC CAPACITOR

CUSTOMER: _____

DOC. NO.: POE-D06-00-E-12

Ver.: 12

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

Record of change

<table>
<tr><th>Date</th><th>Version</th><th>Description</th><th>page</th></tr>
<tr><td>2008.6.3</td><td>1</td><td>1. D19-00-E-03(before) → POE-D06-00-E-01(1st edition)</td><td></td></tr>
<tr><td>2008.8.22</td><td>2</td><td>1. Revised diameter as below :
<table>
<tr><th>Before</th><th>Now</th></tr>
<tr><td>LB202471K060*</td><td>LB202471K050*</td></tr>
<tr><td>LB202681K070*</td><td>LB202681K060*</td></tr>
</table>
2. Add last SAP code “ H” for halogen and Pb free , epoxy resin..</td><td>7

6</td></tr>
<tr><td>2008.12.12</td><td>3</td><td>1. Complete the 13th to 17th codes of SAP P/N.
2. Page layout adjustment.
3. Add marking when the coating resin is Halogen and Pb free Epoxy.</td><td>4-5</td></tr>
<tr><td>2009.8.5</td><td>4</td><td>1. Change PSA & POE logo to Walsin & POE logo.</td><td></td></tr>
<tr><td>2011/12/21</td><td>5</td><td>Review the “LB” & “LR” to be “LB(Y5P)” & “LR(Y5R)”;</td><td>4</td></tr>
<tr><td>2012/9/14</td><td>6</td><td>1. Review TCC of LR(Y5R) type.
2. Review the condition of “life test”
3. Review the Item 8.1 Caution (Rating)</td><td>4,6,15
17
19~20</td></tr>
<tr><td>2012/12/27</td><td>7</td><td>1. Review the Item 8.1 Caution (Rating): Allowable conditions at high frequency --- (Fig.2：Allowable Voltage (Sine Wave Voltage) – Frequency Characteristics (At Ambient Temperature of 105℃ or less))</td><td>18~20</td></tr>
<tr><td>2013/5/6</td><td>8</td><td>1. Review the Lead diameter φ from 0.60 +/-0.06mm to 0.55+/-0.05mm
2. Review the “DΦ≤6.0mm shall be omitted.” to “ DΦ≤060 shall be omitted.”
3. Review the Solderability temperature from 260(+5/-0)℃ to 245±5℃solderability time from 2±0.5s to 5±0.5s.</td><td>5,13
10

15</td></tr>
<tr><td>2013/10/18</td><td>9</td><td>1. Review the packing specification</td><td>11</td></tr>
<tr><td>2016/3/3</td><td>10</td><td>1. Review the Available lead code of Lead Configuration.
2. Delete the definition about “Old Part No”.
3. Review the size Dφ for the item LR202681K from “070” to be “080”.</td><td>5
5-6
8</td></tr>
<tr><td>2017/5/4</td><td>11</td><td>1. Delete LB series products.</td><td></td></tr>
<tr><td>2018/4/19</td><td>12</td><td>1. Add “Lead in dielectric ceramic in capacitors for a rated voltage of 125 V AC or 250 V DC or higher” of the 8.6 Note.</td><td>19</td></tr>
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Table of Contents

1. Part number for SAP system(total eighteen code)：

LR	102	471	K	050	B	20	C	5	B
❶	❷	❸	❹	❺	❻	❼	❽	❾	❿

❶ Material code: Low Dissipation Factor (LDF), Operating Temperature Range : –25℃ to +125℃

Code	LR(Y5R)
Cap. change	±15%（-25℃ to +85℃） + 15 ~ -30%（+85℃to+125℃）
D.F.	≤0.2%

❷ Rated voltage (Vdc)：

Voltage	1000V	2000V	3000V
Code	102	202	302

❸Capacitance(pF)：

Capacitors (pF)	100	470	1000	2200	3300
Code	101	471	102	222	332

❹Capacitance tolerance：±10%，Code is “K”

❺ Nominal body diameter dimension (Ref. to page.7~9 D max. & T max. spec.) .

❻ Code of lead type：Please refer to Item “2. Mechanical”.

❼Packing mode and lead’s length (identified by 2-figure code)

Taping Code	Description	The limit of body size
AN	Ammo / Pitch of component:12.7 mm	Only for 1
AF	Ammo / Pitch of component:15.0 mm	
AM	Ammo / Pitch of component:25.4 mm	

Bulk Code	Description
3E	Lead’s length L：3.5mm
04	Lead’s length L：4mm
4E	Lead’s length L：4.5mm
20	Lead’s length L：20mm

❽Length tolerance

Code	Description
A	±0.5 mm(Only for short kink lead code “D / X / H”)
B	±1.0 mm
C	Min.
D	Taping special purpose

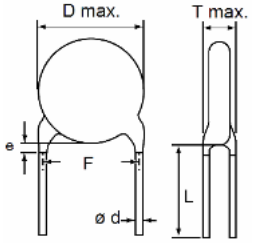
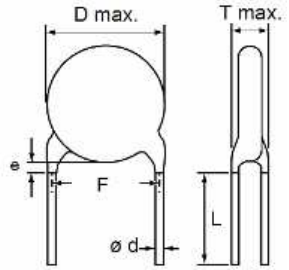
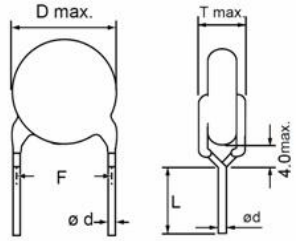
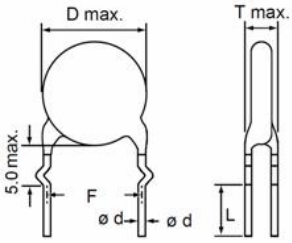
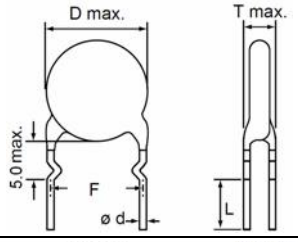
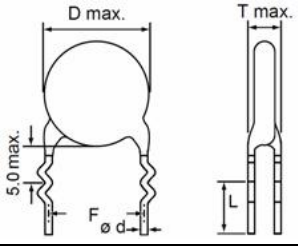
❾Pitch

Code	Description			Code	Description
5	5.0±0.8mm (For Bulk)	Rated voltage ≤2000Vdc		7	7.5 ±1mm
5	5.0+0.8mm-0.2mm (For Taping)			0	10.0 ±1mm

❿Epoxy Resin Code

Code	Description
B	Epoxy resin, Pb free
H	Halogen and Pb free , epoxy resin

2. Mechanical: **Available lead code (Epoxy resin coating)- (unit: mm)**

Lead code	SAP P/N (13-17)digits	Pitch (F)	Lead Length(L)	Packing	Lead Configuration
Lead style：B Straight long lead	B20C5	5.0±0.8	20 MIN.	Bulk	
	B20C7	7.5±1.0	20 MIN.		
	B20C0	10±1.0	20 MIN.		
	BAND5	5.0+0.8-0.2	Taping Spec. (Ref.to page.12)	Tap. Ammo	
	BAFD7	7.5±1.0			
	BAMD0	10±1.0			
Lead style：L Straight short lead	L04B5	5.0±0.8	4.0 ± 1.0	Bulk	
	L03B7	7.5 ± 1.0	3.0 ± 1.0		
	L4EB7	7.5 ± 1.0	4.5 ± 1.0		
	L05B7	7.5 ± 1.0	5.0 ± 1.0		
	L10B7	7.5 ± 1.0	10.0 ± 1.0		
	L03B0	10 ± 1.0	3.0 ± 1.0		
	L4EB0	10 ± 1.0	4.5 ± 1.0		
	L05B0	10 ± 1.0	5.0 ± 1.0		
	L10B0	10 ± 1.0	10.0 ± 1.0		
Lead style：D Vertical kink lead	D04A5	5.0±0.8	4.0 ± 0.5	Bulk	
	D3EA7	7.5 ± 1.0	3.5 ± 0.5		
	D04A7	7.5 ± 1.0	4.0 ± 0.5		
	D3EA0	10 ± 1.0	3.5 ± 0.5		
	D04A0	10 ± 1.0	4.0 ± 0.5		
	DAND5	5.0+0.8-0.2	Taping Spec. (Ref.to page.12)	Tap. Ammo	
	DAFD7	7.5 ± 1.0			
	DAMD0	10 ± 1.0			
Lead style：X Outside kink lead	X04A5	5.0±0.8	4.0 ± 0.5	Bulk	
	X3EA7	7.5 ± 1.0	3.5 ± 0.5		
	X04A7	7.5 ± 1.0	4.0 ± 0.5		
	X05B7	7.5 ± 1.0	5.0 ± 1.0		
	X3EA0	10 ± 1.0	3.5 ± 0.5		
	X04A0	10 ± 1.0	4.0 ± 0.5		
	X05B0	10 ± 1.0	5.0 ± 1.0		
	XAFD7	7.5 ± 1.0	Taping Spec (Ref.to page.12)	Tap. Ammo	
	XAMD0	10 ± 1.0			
Lead style：H Inside kink lead	H04A5	5.0±0.8	4.0 ± 0.5	Bulk	
	H04A7	7.5 ± 1.0	4.0 ± 0.5		
	H04A0	10 ± 1.0	4.0 ± 0.5		
	H4EB0	10 ± 1.0	4.5 ± 1.0		
	HAND5	5.0+0.8-0.2	Taping Spec. (Ref.to page.12)	Tap. Ammo	
	HAFD7	7.5 ± 1.0			
	HAMD0	10 ± 1.0			
Lead style：M Double Outside Kink Lead	M04A5	5.0±0.8	4.0 ± 0.5	Bulk	
	M04A7	7.5 ± 1.0	4.0 ± 0.5		
	M04A0	10 ± 1.0	4.0 ± 0.5		

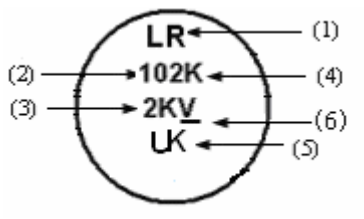
※ Lead type – Inside kink lead is not available for 2KV & 3 KV, and Pitch 5.0mm is not available for 3KV.
※ Lead diameter φ= 0.55+/-0.05 mm
※e (Coating extension on leads): 3.0mmMax for straight lead style, not exceed the kink for kink lead.
※When Dφ≥11mm, only for bulk, but Dφ≤10mm can do Bulk or Taping.

3. Capacitance value vs. rated voltage, product diameter:

3.1 LR Series：

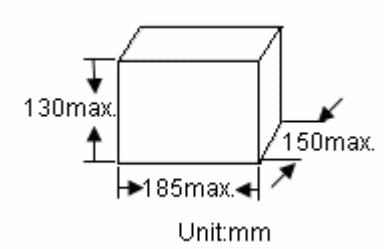
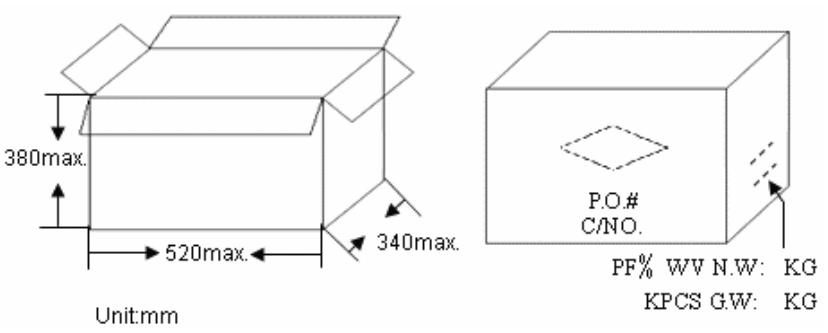
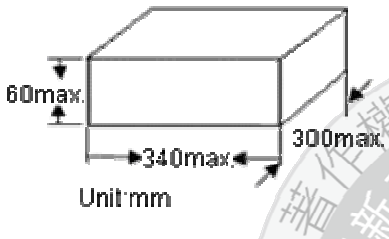
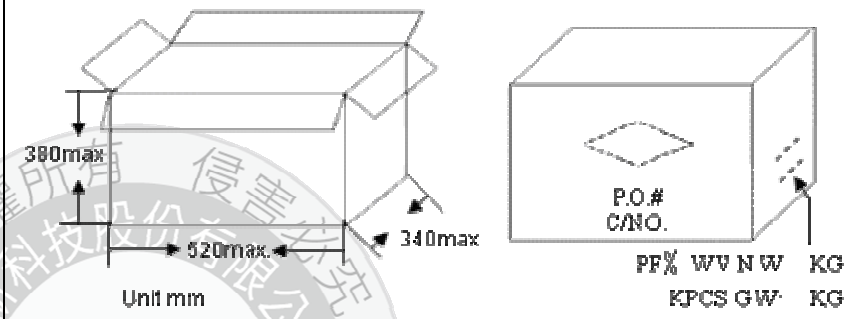
Part Number	Rated Volt.	Cap. in pF	Cap. Tol.(%)	Dimensions in mm	
				D max.	T max.
LR102101K050□□□□□	1000VDC	100	±10%	6.5	4.5
LR102151K050□□□□□	1000VDC	150	±10%	6.5	4.5
LR102221K050□□□□□	1000VDC	220	±10%	6.5	4.5
LR102271K050□□□□□	1000VDC	270	±10%	6.5	4.5
LR102331K050□□□□□	1000VDC	330	±10%	6.5	4.5
LR102391K050□□□□□	1000VDC	390	±10%	6.5	4.5
LR102471K050□□□□□	1000VDC	470	±10%	6.5	4.5
LR102561K060□□□□□	1000VDC	560	±10%	7.5	4.5
LR102681K060□□□□□	1000VDC	680	±10%	7.5	4.5
LR102821K070□□□□□	1000VDC	820	±10%	8.5	4.5
LR102102K070□□□□□	1000VDC	1000	±10%	8.5	4.5
LR102152K090□□□□□	1000VDC	1500	±10%	10.5	4.5
LR102222K100□□□□□	1000VDC	2200	±10%	11.5	4.5
LR102332K130□□□□□	1000VDC	3300	±10%	14.5	4.5
LR202101K050□□□□□	2000VDC	100	±10%	6.5	5.0
LR202151K050□□□□□	2000VDC	150	±10%	6.5	5.0
LR202221K050□□□□□	2000VDC	220	±10%	6.5	5.0
LR202271K050□□□□□	2000VDC	270	±10%	6.5	5.0
LR202331K060□□□□□	2000VDC	330	±10%	7.5	5.0
LR202391K060□□□□□	2000VDC	390	±10%	7.5	5.0
LR202471K060□□□□□	2000VDC	470	±10%	7.5	5.0
LR202561K070□□□□□	2000VDC	560	±10%	8.5	5.0
LR202681K080□□□□□	2000VDC	680	±10%	9.5	5.0
LR202821K080□□□□□	2000VDC	820	±10%	9.5	5.0
LR202102K090□□□□□	2000VDC	1000	±10%	10.5	5.0
LR202122K100□□□□□	2000VDC	1200	±10%	11.5	5.0
LR202152K110□□□□□	2000VDC	1500	±10%	12.5	5.0
LR202182K120□□□□□	2000VDC	1800	±10%	13.5	5.0
LR202222K130□□□□□	2000VDC	2200	±10%	14.5	5.0
LR202332K160□□□□□	2000VDC	3300	±10%	17.5	5.0
LR302101K050□□□□□	3000VDC	100	±10%	6.5	6.0
LR302151K050□□□□□	3000VDC	150	±10%	6.5	6.0
LR302221K050□□□□□	3000VDC	220	±10%	6.5	6.0
LR302331K060□□□□□	3000VDC	330	±10%	7.5	6.0
LR302391K070□□□□□	3000VDC	390	±10%	8.5	6.0
LR302471K080□□□□□	3000VDC	470	±10%	9.5	6.0
LR302561K080□□□□□	3000VDC	560	±10%	9.5	6.0
LR302681K090□□□□□	3000VDC	680	±10%	10.5	6.0
LR302821K100□□□□□	3000VDC	820	±10%	11.5	6.0
LR302102K100□□□□□	3000VDC	1000	±10%	11.5	6.0
LR302152K130□□□□□	3000VDC	1500	±10%	14.5	6.0
LR302222K150□□□□□	3000VDC	2200	±10%	16.5	6.0

4. Marking:

Temp. Char. / Marking / Nominal body diameter	LR	
		
(1). Temp. char. and D.F.	Cap. change: ±15%(-25℃ to +85℃) +15~-30%(+85℃to+125℃) D.F.：0.2% Max.	
(2). Nominal capacitance	Identified by 3-Figure Code. Ex. 100pf→"101"，1000 Pf→"102"	
(3). Rated voltage	1000V	Marked with code (In case of DC 1000V marked with 1KV)
	2000V	Marked with code (In case of DC 2000V marked with 2KV)
	3000V	Marked with code (In case of DC 3000V marked with 3KV)
(4). Capacitance tolerance	K=±10%	
(5). Manufacturer's identification	Shall be marked as "UK", but DΦ≤060 shall be omitted.	
(6). Halogen and Pb free	When the epoxy resin is Halogen and Pb free, there is a "_"marking.	

5. Packing Baggage：

5.1 Packing size:

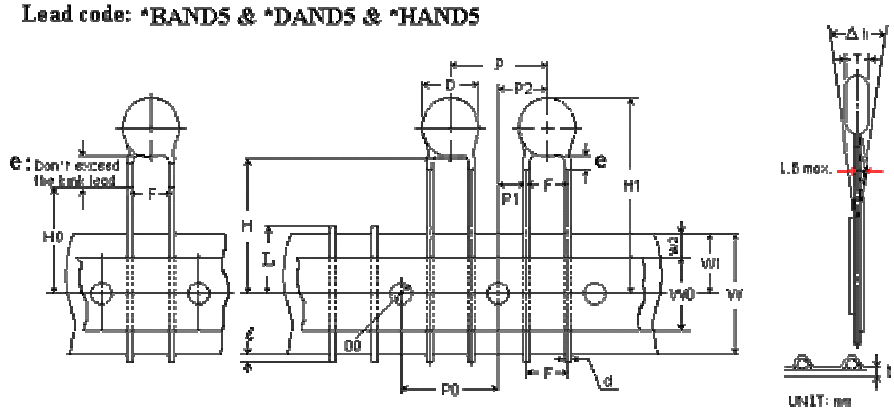
Type	Box	Carton
Bulk		
Ammo taping		

5.2 Packing quantity:

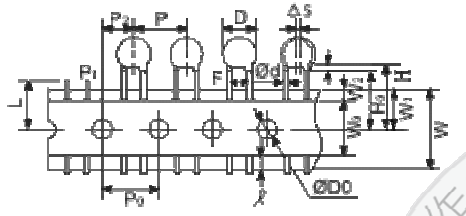
Packing Type	The code of 14th to15th in SAP P/N		MPQ (Kpcs/Box)	
Taping	AN		1.5	
	AF		1	
	AM		0.5	
Packing Type	**Lead length**	**Size code of 10th to 12th in SAP P/N**	**MPQ (Kpcs/Bag)**	**Kpcs/Box**
Bulk	Long lead (L≧ 16mm)	050~100	1	2
		110~120	0.5	1.5
		130~170	0.5	1
	Short lead (L＜ 16mm)	050~060	1	6
		070~080	1	4
		090~100	1	3
		110~140	1	2
		150~160	0.5	1

6. Taping Specifications:

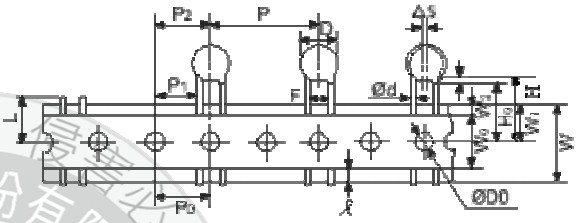
- **12.7mm pitch/lead spacing 5.0mm taping**
  Lead code: *BAND5 & *DAND5 & *HAND5

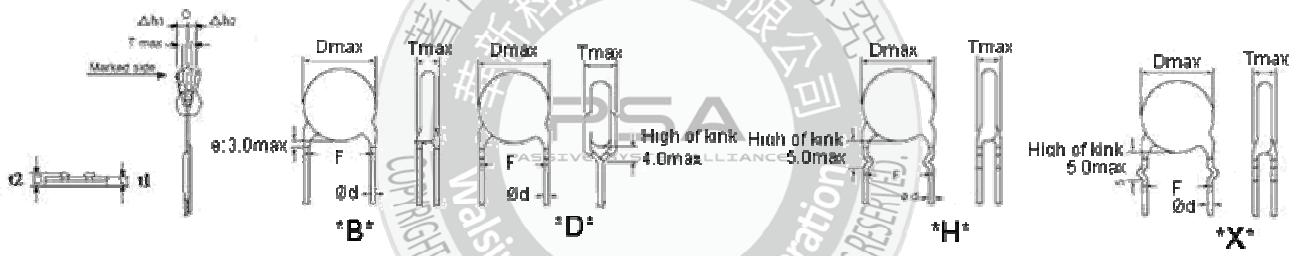


- **15mm pitch/lead spacing 7.5mm taping**
  Lead code: *BAFD7 & *DAFD7 & * HAFD7 & *XAFD7



- **25.4mm pitch/lead spacing 10.0mm taping**
  Lead code: *DAMD0 & *XAMD0 & *HAMD0 & *BAMD0





POE Part Number		***BAND5 *D AND5 *H AND5**	***BAFD7 *DAFD7 *HAFD7 *XAFD7**	***BAMD0 *DAMD0 *HAMD0 *XAMD0**
Item	Symbol	Dimensions (mm)	Dimensions (mm)	Dimensions (mm)
Pitch of component	P	12.7±1.0	15.0±1.0	25.4±2
Pitch of sprocket	P0	12.7±0.3	15.0±0.3	12.7±0.3
Lead spacing	F	5.0+0.8-0.2	7.5±1.0	10.0±1.0
Length from hole center to component center	P2	6.35±1.3	7.5±1.5	12.7 ± 1.5
Length from hole center to lead	P1	3.75±0.7	3.75±1.0	7.7±1.5
Body diameter	D	See the "3. Capacitance value vs. Rate voltage, product diameter"		
Deviation along tape, left or right	△S	---	0±2.0	
Carrier tape width	W	18.0 +1/-0.5		
Position of sprocket hole	W1	9.0±0.5		
Lead distance between the kink and center of sprocket hole	H0	16.0±0.5 For: *DAND5 *HAND5 *XAND5	18.0+2/-0 For: *DAFD7 *HAFD7 *XAFD7	18.0+2/-0 For: *DAMD0 *HAMD0 *XAMD0
Lead distance between the bottom of body and the center of sprocket hole	H	20.0+1.5/-1.0 For: *BAND5	20.0+1.5/-1.0 For: *BAFD7	20.0+1.5/-1.0 For: *BAMD0
Component Height	H1	32.25Max		
Lead-Wire Protrusion length	ℓ	2.0Max (Or the end of lead wire may be inside the tape.)		
Diameter of sprocket hole	D0	4.0±0.2		
Lead diameter	φd	0.55 ±0.05		
Total tape thickness	t1	0.6±0.3		
Total thickness, tape and lead wire	t2	1.5 max.		
Deviation across tape	△h	2.0 max.		
Portion to cut in case of defect	L	11.0 max.		
Hole-down tape width	W0	8.0min		
Hole-down tape distortion	W2	1.5±1.5		
Coating extension on leads	e	3.0 max for straight lead style; Not exceed the kink leads for kink lead.		
Body thickness	T	See the "3. Capacitance value vs. Rate voltage, product diameter"		

7. Specification and test method:

7.1 Scope: This specification applies to Low Dissipation Ceramic Disc Capacitor.

7.2 Test Conditions:

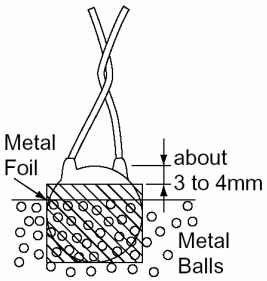
Unless otherwise specified, all tests shall be operated at the standard test conditions of temperature 5℃ to 35℃ and relative humidity 45% to 85%.
When fails a test, retest be operated at the conditions of temperature 25℃ ± 2℃, relative humidity of 60% to 70% and barometric pressure 860 to 1060 mbar.

7.3 Handle procedure: to avoid unexpected testing results from occurring, the tested capacitor must be kept at room condition for at least 30 minutes and completely discharged.

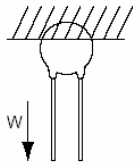
7.4 Applications：Ideal for use on high frequency pulse circuits such as a horizontal resonance circuit for CTV and snubber circuits for switching power supplies.

7.5 Test items:

ITEM	POST-TEST REQUIREMENTS	TESTING PROCEDURE
Operating Temperature Range	-25 To +125℃ (Including capacitor's self-heating temperature 20℃Max)	
Appearance Structure size	No abnormalities	As stated in section 3.
Marking	To be easily legible.	As stated in section 4
Dielectric Strength	Between Lead Wire：No failure	The capacitor should not be damaged when DC voltage of 200% of the rated voltage (DC1 to 3KV) is applied between the lead wires for 1 to 5 sec. (Charge/Discharge current ≦50mA.)
	Body Insulation：No failure	First, the terminals of the capacitor should be connected together. Then, as shown in figure at right, a metal foil should be closely wrapped around the body of the capacitor to the distance of about 3 to 4mm from each terminal. Then, the capacitor should be inserted into a container filled with metal balls of about 1mm diameter. Finally, AC1250Vrms <50/60Hz> is applied for 1 to 5 sec. between the capacitor lead wires and metal balls. (Charge/Discharge current ≦50mA.)
Insulation Resistance	10000 M Ω min.	Insulation resistance should be measured at 60±5 seconds after applied voltage ((DC500V)
Capacitance	Tolerance: K: ±10%	Testing Frequency: 1 KHz ± 20% Testing Voltage: 1.0 Vrms
Dissipation Factor (D.F.)	LR：0.2% Max.	The dissipation factor should be measured at 25℃ with 1±0.2KHz and 1.0Vrms Max.



"room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

<table>
<tr><th>Item</th><th colspan="4">Post-Test Requirements</th><th>Testing Procedure</th></tr>
<tr><td rowspan="3">Temperature Characteristic</td><td rowspan="2">T.C.</td><td colspan="2">Temp. Char</td><td rowspan="3">According to step 1 to 5 in order, measured capacitance when temperature reaches balance and CAP. change shall be calculated on the following formula:
CAP. change =(C2-C1)×100%/C1
<table><tr><td>Step</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>LR Temp. (℃)</td><td>25±2</td><td>-25±3</td><td>25±2</td><td>125±2</td><td>25±2</td></tr></table>Note: C1 = Capacitance as step 3
C2 = Capacitance as step 2 or 4
T1 =Temperature as step 3
T2 = Temperature as step 2 or 4</td></tr>
<tr><td>-25 to +85˚C</td><td>+85 to +125˚C</td></tr>
<tr><td>LR</td><td>Within ±15%</td><td>Within +15%/-30%</td></tr>
<tr><td rowspan="2">Strength of Lead</td><td colspan="2">Pull：</td><td rowspan="2">Lead wire should not be cut off.
Capacitor should not be broken.</td><td>As shown in the figure at right, fix the body of the capacitor and apply a tensile weight gradually to each lead wire in the radial direction of the capacitor up to 10N (5N for lead diameter 0.5mm), and keep it for 10±1 sec.
  </td></tr>
<tr><td colspan="2">Bending：</td><td>Each lead wire should be subjected to 5N (2.5N for lead diameter 0.5mm) of weight and bent 90° at the point of egress, in one direction, then returned to its original position and bent 90° in the opposite direction at the rate of one bend in 2 to 3 sec.</td></tr>
<tr><td rowspan="3">Vibration Resistance</td><td colspan="3">Appearance:
No abnormalities</td><td rowspan="3">The capacitor should be firmly soldered to the supporting lead wire and vibrated at a frequency range of 10 to 55Hz, 1.5mm in total amplitude, with about a 1minute rate of vibration change from 10Hz to 55Hz and back to 10Hz. apply for a total of 6 hrs., 2hrs. each in 3 mutually perpendicular directions.</td></tr>
<tr><td colspan="3">Capacitance:
Within specified tolerance.</td></tr>
<tr><td colspan="3">D.F.：
LR：0.2% Max.</td></tr>
<tr><td>Solder ability Of Leads</td><td colspan="3">Lead wire should be soldered with uniform coating on the axial direction over 75％ of the circumferential direction.</td><td>The lead wire of a capacitor should be dipped into a ethanol solution of 25wt% rosin and then into molten solder of 245±5℃ for 5±0.5 sec. In both cases the depth of dipping is up to about 1.5 to 2mm from the root of lead wires.</td></tr>
<tr><td rowspan="3">Soldering Effect</td><td colspan="3">Appearance：No marked defect.</td><td rowspan="3">The lead wire should be immersed up to 2.0 mm form the root of lead wires.
(A) Body Dia.≦6.0mm: Into the molten solder of which temperature: 260(+5/-0)℃ for 3.0±0.5 seconds.
(B) Body Dia.＞6.0mm: Into the molten solder of which temperature 260(+5/-0)℃ for 5~10 seconds.
Then leave at standard test conditions for 24±2 hours, then measured.
(Continued on the following page.)</td></tr>
<tr><td colspan="3">Capacitance Change：
Within ±10%</td></tr>
<tr><td colspan="3">Dielectric Strength (between Lead Wires)：Per. Item Dielectric Strength</td></tr>
</table>

<table>
<tr><th>Item</th><th>Post-Test Requirements</th><th>Testing Procedure</th></tr>
<tr><td rowspan="3">Soldering Effect</td><td>Appearance：No marked defect.</td><td rowspan="3">※When soldering capacitor with a soldering iron, it should be performed in following conditions.
Temperature of iron-tip: 350~400 ℃
Soldering iron wattage : 50w max.
Soldering time : 3.5 sec. Max.
Pre-treatment:
Capacitor should be stored at 125±3°C for 1 hr., then placed at *room condition for 24±2 hrs. before initial measurements.
Post-treatment:
Capacitor should be stored for 24±2 hrs. at *room condition.
Measurement order:
Dielectric strength -> Pre-treatment -> Capacitance -> Soldering effect test -> Post-treatment -> Capacitance</td></tr>
<tr><td>Capacitance Change：
Within ±10%</td></tr>
<tr><td>Dielectric Strength (between Lead Wires)：Per. Item Dielectric Strength</td></tr>
<tr><td rowspan="4">Temperature Cycle</td><td>Appearance:
No Abnormalities</td><td rowspan="4">The capacitor should be subjected to 5 temperature cycles.
<Temperature cycle>
<table><tr><th>Step</th><th>Temperature(℃)</th><th>Time (min)</th></tr><tr><td>1</td><td>-25±3</td><td>30</td></tr><tr><td>2</td><td>25±2</td><td>3</td></tr><tr><td>3</td><td>125±3</td><td>30</td></tr><tr><td>4</td><td>25±2</td><td>3</td></tr></table>
Pre-treatment:
Capacitor should be stored at 125±3°C for 1 hr., then placed at *1room condition for 24±2 hrs. before initial measurements.
Post-treatment:
Capacitor should be stored for 24±2 hrs. at *room condition.
Measurement order:
I.R. • Dielectric strength -> Pre-treatment -> Capacitance • D.F. -> Temperature cycle test -> Post-treatment -> Capacitance • D.F. • I.R. • Dielectric strength ◦</td></tr>
<tr><td>Cap. Change:
Within ±10%</td></tr>
<tr><td>D.F.：LR：0.6% max.</td></tr>
<tr><td>Insulation Resistance:
1000MΩ Min.</td></tr>
<tr><td rowspan="4">Humidity
(Under Steady State)</td><td>Appearance:
No Abnormalities</td><td rowspan="4">Set the capacitor for 500 +24/-0 hrs. at 40±2°C in 90 to 95% relative humidity.
Pre-treatment:
Capacitor should be stored at 125±3°C for 1 hr., then placed at *1room condition for 24±2 hrs. before initial measurements.
Post-treatment:
Capacitor should be stored for 1 to 2 hrs. at *room condition.
Measurement order:
I.R. -> Pre-treatment -> Capacitance • D.F. -> Humidity test ->Post-treatment -> Capacitance • D.F. • I.R.</td></tr>
<tr><td>Cap. Change:
Within ±10%</td></tr>
<tr><td>D.F.：
LR：0.6% max.</td></tr>
<tr><td>Insulation Resistance:
1000MΩ Min.</td></tr>
</table>

* "room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

Item	Post-Test Requirements	Testing Procedure
Humidity Loading	Appearance: No Abnormalities	Apply the rated voltage for 500 +24/-0 hrs. at 40±2°C in 90 to 95% relative humidity. (Charge/Discharge current<50mA.) Pre-treatment: Capacitor should be stored at 125±3°C for 1 hr., then placed at *1room condition for 24±2 hrs. before initial measurements. Post-treatment: Capacitor should be stored for 1 to 2 hrs. at *1 room condition. Post-treatment: Capacitor should be stored at 125±3°C for 1 hr., then placed at *1 room condition for 24±2 hrs. Measurement order: I.R. -> Pre-treatment -> Capacitance • D.F. ->Humidity loading test -> *2 I.R. -> Post-treatment ->Capacitance • D.F.
	Cap. Change: Within ±10%	
	D.F.： LR：0.6% max.	
	Insulation Resistance: 500MΩ Min.	
Life	Appearance: No Abnormalities	Apply a DC voltage of 150% of the rated voltage (DC1kV to 3kV) for 1000 +48/-0 hrs. at 125±2°C with a relative humidity of 50% max. (Charge/Discharge currentV50mA.) Pre-treatment: Capacitor should be stored at 125±3°C for 1 hr., then placed at *1room condition for 24±2 hrs. before initial measurements. Post-treatment : Capacitor should be stored at 125±3°C for 1 hr., then placed at *1room condition for 24±2 hrs. Measurement order: I.R. -> Pre-treatment -> Capacitance • D.F. -> Life test ->*3 I.R. -> Post-treatment -> Capacitance • D.F.
	Cap. Change: Within ±10%	
	D.F.： LR：0.6% max.	
	Insulation Resistance: LR：2000MΩ Min.	

*1 "room condition" Temperature: 15 to 35°C, Relative humidity: 45 to 75%, Atmospheric pressure: 86 to 106kPa

*2 The measurement of I.R. will be held in 1 to 2 hrs. after Humidity loading test.

*3 The measurement of I.R. will be held in 12 to 24 hrs. after Life test.

8. Notices:

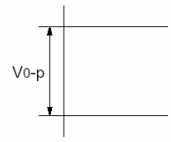
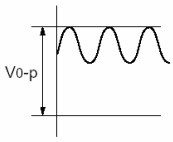
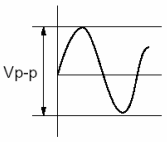
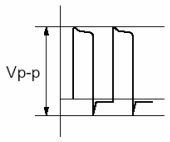
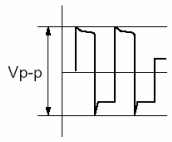
8.1 Caution (Rating)

I. Operating Voltage

When dc-rated capacitors are to be used in ac or ripple current circuits, be sure to maintain the Vp-p value of the applied voltage or the Vo-p which contains dc bias within the rated voltage range.

When the voltage is applied to the circuit, starting or stopping may generate irregular voltage for a transit period because of resonance or switching. Be sure to use a capacitor with a rated voltage range that includes these irregular voltages.

When using the low-dissipation (LR Char.) series in a high-frequency and high-voltage circuit, be sure to read the instructions in item 4.

Voltage	DC Voltage	DC+AC Voltage	AC Voltage	Pulse Voltage (1)	Pulse Voltage (2)
Positional measurement					

II. Operating Temperature And Self-Generated Heat

Keep the surface temperature of a capacitor below the upper limit of its rated operating temperature range. be sure to take into account the heat generated by the capacitor itself. When the capacitor is used in a high frequency current, pulse current or similar current, it may self-generate heat due to dielectric loss. The applied voltage load (*) should be such that the capacitor's self-generated heat is within 15°c at an atmosphere temperature of 25°c. When measuring, use a thermocouple of small thermal capacity-k of ø0.1mm in conditions where the capacitor is not affected by radiant heat from other components or surrounding ambient fluctuations.

Excessive heat may lead to deterioration of the capacitor's characteristics and reliability. (Never attempt to perform measurement with the cooling fan running. otherwise, accurate measurement cannot be ensured.)

III. Fail-Safe

When capacitor is broken, failure may result in a short circuit. Be sure to provide an appropriate fail-safe function like a fuse on your product if failure would follow an electric shock, fire or fume.

IV. Load Reduction and Self-generated Heat During Application of High-frequency and High-voltage

Due to the low self-heating characteristics of low dissipation capacitors, the allowable electric power of these capacitors is generally much higher than that of B characteristic capacitors. However, in case the self heating temperature is 15°C under a high-frequency voltage whose peak-to-peak value equals the capacitor's rated voltage, the capacitor's power consumption may exceed it's allowable electric power.

Allowable conditions at high frequency:

*1 Fig. 1 show the dependence of allowable self-heating temperature on ambient temperature. When the ambient temperature is 85 to 125℃, the applied voltage needs to be further reduced.
*2 Fig. 2 shows reference data on the allowable voltage-frequency characteristic for a sine wave voltage when the ambient temperature is 105℃or less.

Failure to follow the above cautions (items 1to 4) may result, worst case, in a short circuit and cause fuming or partial dispersion when the product is used.

Fig 1：Dependence of Allowable Self-heating Temperature on Ambient Temperature.

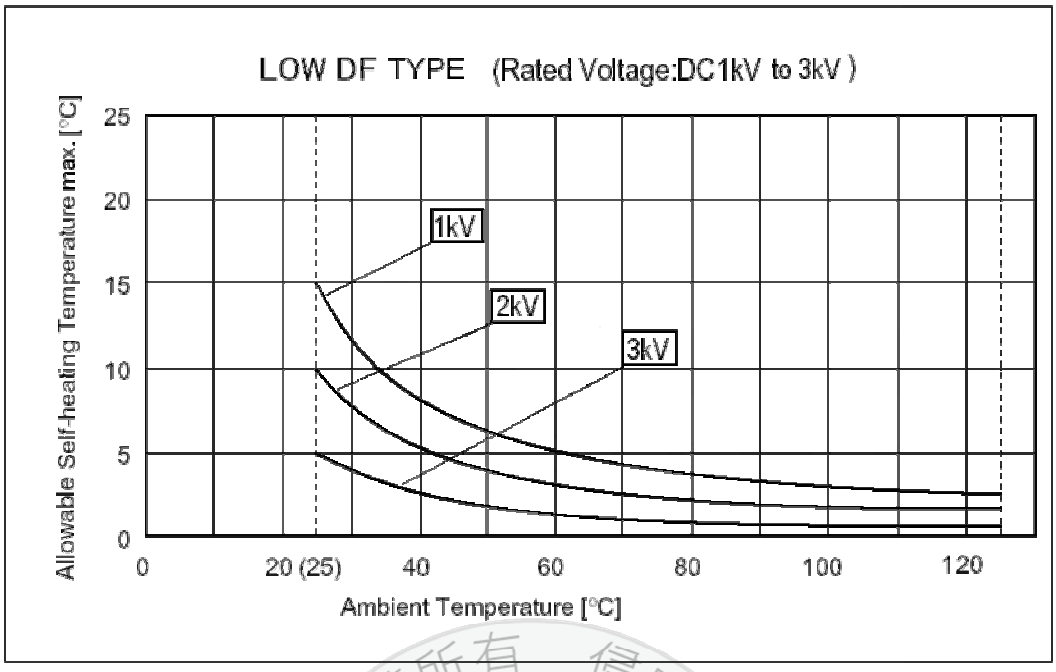
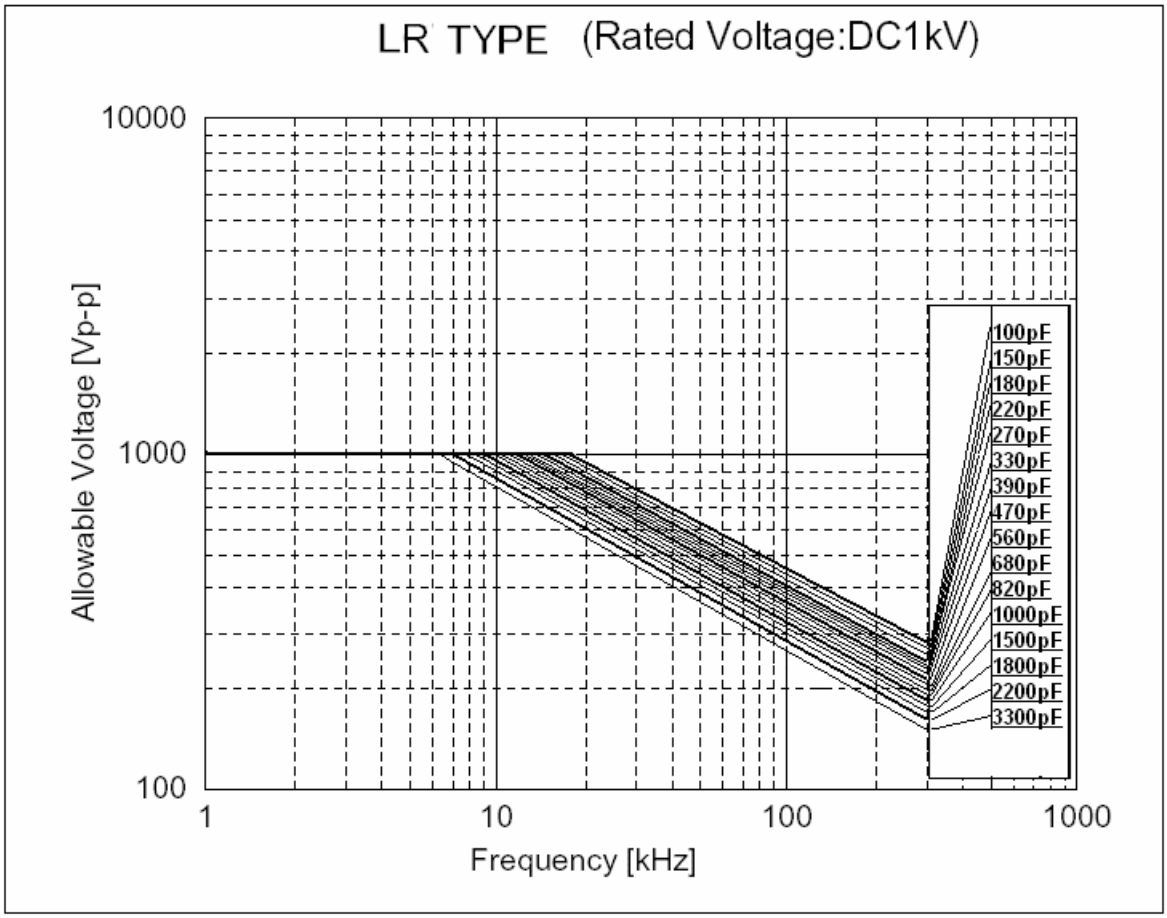
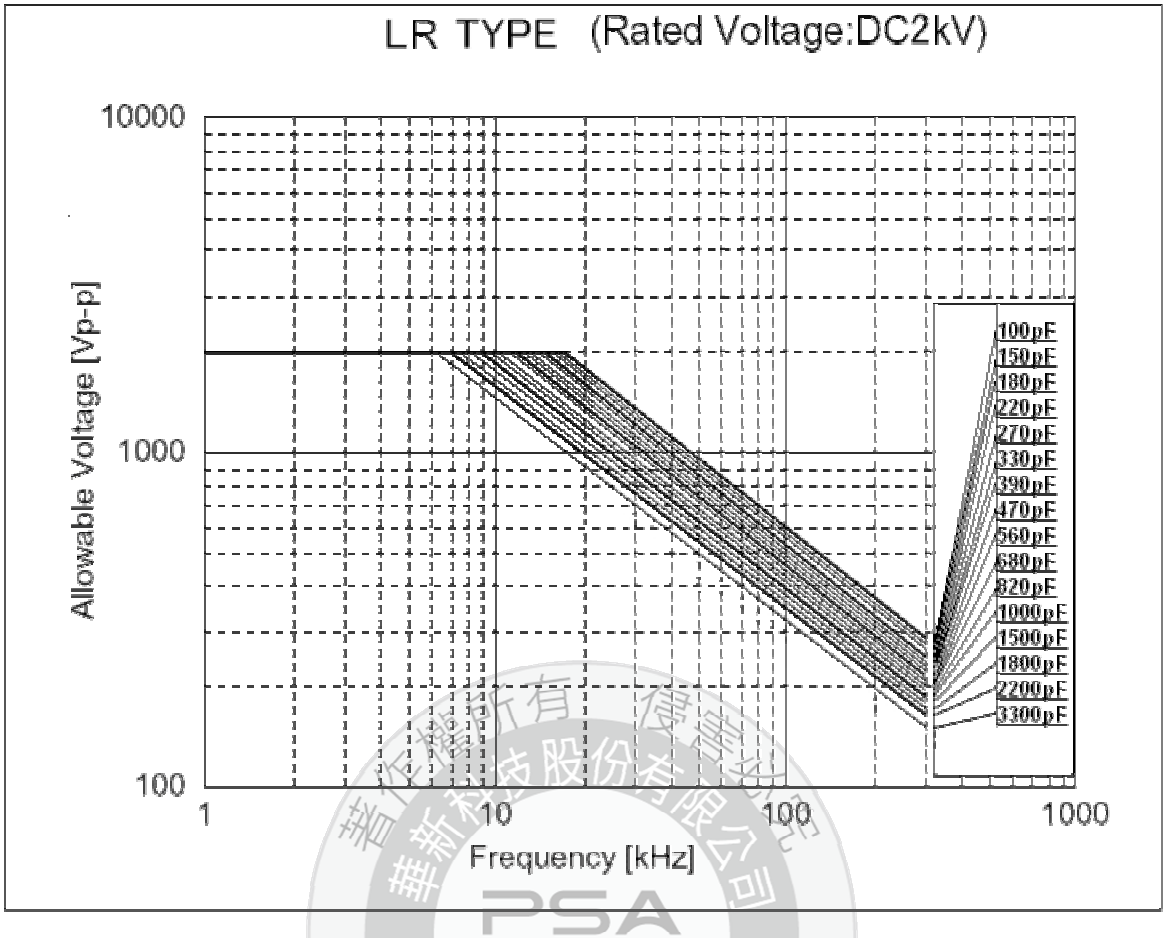
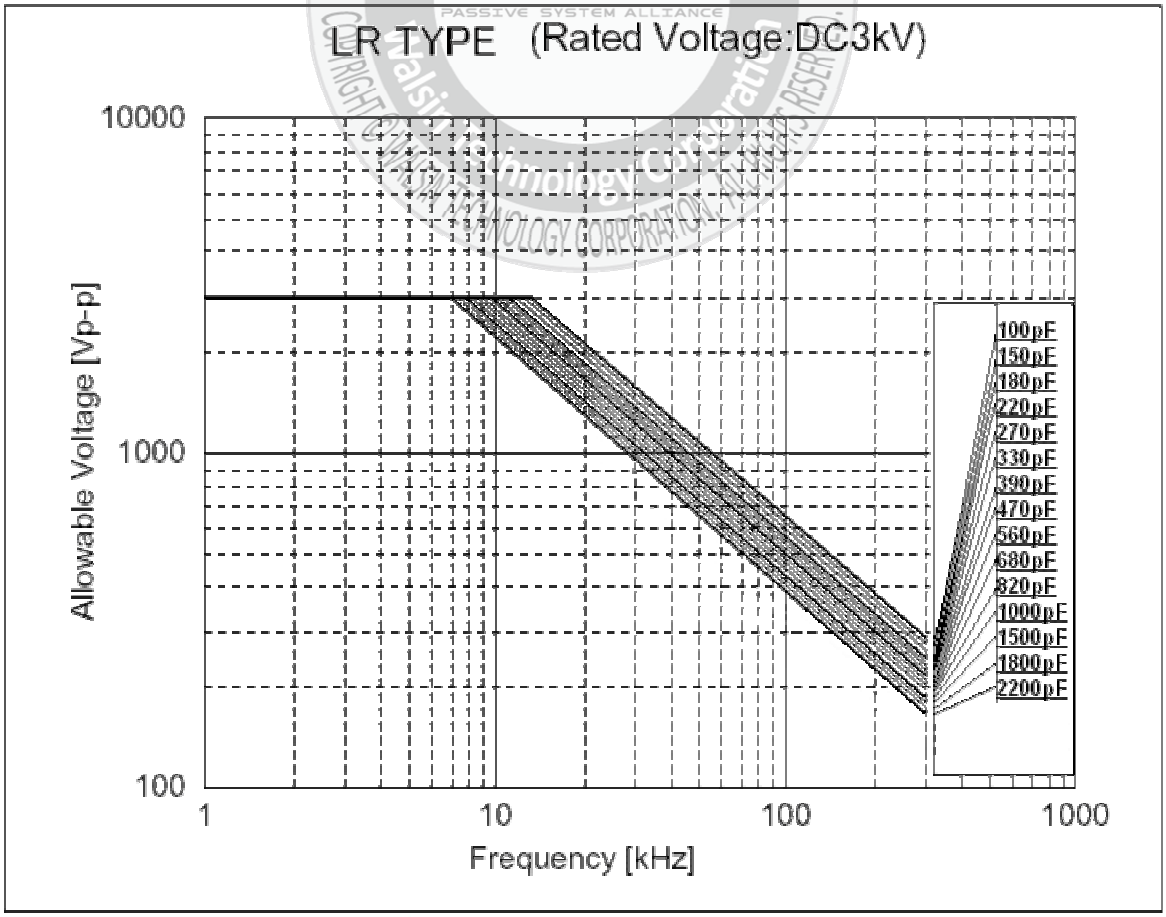


Fig 2：Allowable Voltage (Sine Wave Voltage) – Frequency Characteristics (At Ambient Temperature of 105℃ or less)







Because of influence of harmonics, when the applied voltage is a rectangular wave or pulse wave voltage (instead of a sine wave voltage), the heat generated by the capacitor is higher than the value obtained by application of the sine wave with the same fundamental frequency.
Roughly calculated for reference, the allowable voltage for a rectangular wave or pulse wave corresponds approximately to the allowable voltage for a sine wave whose fundamental frequency is twice as large as that of the rectangular wave or pulse wave. This allowable voltage, however, varies depending on the voltage and current waveforms.

8.2 Storage and Operating Condition:

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. And 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 –10 to 40 degrees centigrade and 15 to 85 % for 6 months maximum and use within the period after receiving the capacitors.

Failure to follow the above cautions may result, worst case, in a short circuit and cause fuming or partial dispersion when the product is used.

8.3 Soldering and Mounting:

I. Vibration And Impact

Do not expose a capacitor or its leads to excessive shock or vibration during use.

II. Soldering

When soldering this product to a Pcb / Pwb, do not exceed the solder heat resistance specification of the capacitor. Subjecting this product to excessive heating could melt the internal junction solder and may result in thermal shocks that can crack the ceramic element. When soldering capacitor with a soldering iron, it should be performed in following conditions.
Temperature of iron-tip: 400 ℃ Max.
Soldering iron wattage: 50W Max.
Soldering time: 3.5 sec. Max.
Failure to follow the above cautions may result, worst case, in a short circuit and cause fuming or partial dispersion when the product is used.

8.4 Cleaning (ultrasonic cleaning):

To perform ultrasonic cleaning, observe the following conditions.
Rinse bath capacity: output of 20-watts per liter or less.
Rinsing time: 5 min. Maximum.
Do not vibrate the Pcb/Pwb directly.
Excessive ultrasonic cleaning may lead to fatigue destruction of the lead wires.

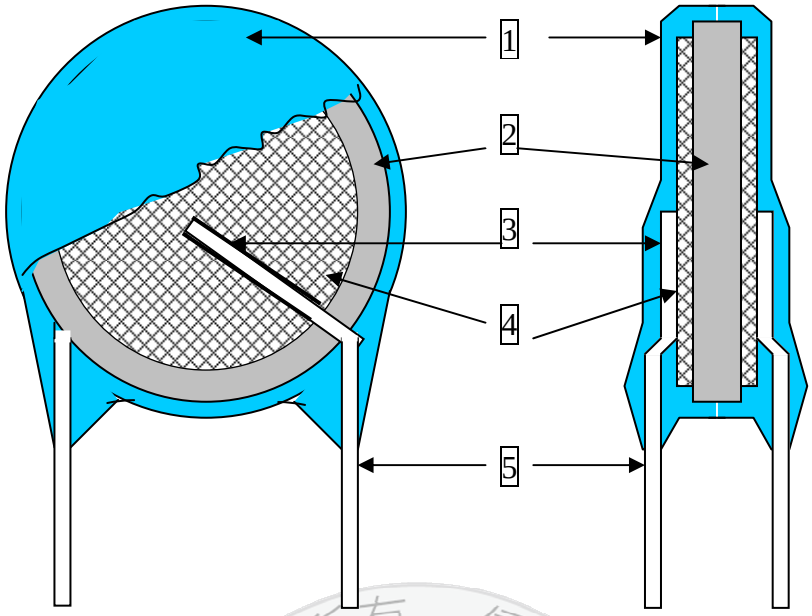
8.5 Caution (Handling)

Vibration And Impact
Do not expose a capacitor or its leads to excessive shock or vibration during use.
Failure to follow the above cautions may result, worst case, in a short circuit and cause fuming or partial dispersion when the product is used.

8.6 Note

7(c)-II	Lead in dielectric ceramic in capacitors for a rated voltage of 125 V AC or 250 V DC or higher	Does not apply to applications covered by point 7(c)-I and 7(c)-IV of this Annex. Expires on: –21 July 2021 for categories 1-7 and 10; –21 July 2021 for categories 8 and 9 other than in vitro diagnostic medical devices and industrial monitoring and control instruments; –21 July 2023 for category 8 in vitro diagnostic medical devices; –21 July 2024 for category 9 industrial monitoring and control instruments, and for category 11."

9. Drawing of Internal Structure and material list：（LR）



Remarks：

No.	Part name	Material	Model/Type	Component
1	Insulation Coating	Epoxy polymer	1.EF-150 2.PCE-210 3.PCE-300	Epoxy resin、Pigment (Blue / UL 94 V-0 /)
2	Dielectric Element	Ceramic	Y5R	$BaTiO_3$
3	Solder	Tin-silver	Sn97.5-Ag2.5	Sn97.5-Ag2.5
4	Electrodes	Ag	1.SP-160PL 2.SP-260PL	Silver、Glass frit
5	Leads wire	Tinned copper clad steel wire	0.55+/-0.05mm	Substrate metal: Fe & Cu Surface plating: Sn 100%(3~7μm)

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