Issue	:CE-E-AFJ-07
Date of Issue	:23 May ,2002
Classification	New , Changed , Revised

ENGINEERING DRAFT

Product Description	:Aluminum Electrolytic Capacitor
Product Part Number	:Radial lead type (JIS:04 type) FJ series
Country of Origin	:Malaysia
Marking of the Origin	:Printed on the packaging label(The name of Country of English)
Classification of Spec.	:Product specification
Recommended Applications	:MOTHER BOARD FOR PERSONAL COMPUTER For other application, contact our person signed below.
Term of Validity	22 May ,2003 from the date of issue

CUSTOMER USE ONLY	Receipt Record #:
This was certainly received by us. One copy is being returned to the manufacturer.	Date of Receipt : Received by:

- No Ozone Depleting Chemicals(ODC's), controlled under the Montreal Protocol Agreement, are used in producing this product.
- This product does not contain PBBOs or PBBs.
- All the materials that are used for this product are registered as "Known Chemicals" in the Japanese act "Law Concerning the Examination and Regulation of Manufacture, etc.of Chemical Substances".
- For the products, which are controlled items subject to the Foreign Exchange and Foreign. Trade Control Law, the export permission according to the Law is necessary.

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No.

Contents

Remarks

Matsushita Electronic Components Co.,Ltd. LCR Device Company
Capacitor Business Unit

1. Scope

Fixed capacitors for use in electronic equipment, Aluminum electrolytic capacitors with non-solid electrolyte.

2. Parts Number

EEU	FJ	○○	○○○	□□
2-1	2-2	2-3	2-4	2-5

2-1 Aluminum Electrolytic Capacitor Type : Radial lead type (JIS : 04 type)

2-2 FJ series

2-3 Rated Voltage Code

Voltage Code	0J	1A	1C	1E	1V	1H
Rated Voktage (V.DC)	6.3	10	16	25	35	50

2-4 Capacitance Code : Indicating capacitance in uF by 3 letters.
The first 2 figures are actual values and the third denotes the number of zeros.
"R" denotes the decimal point and all figures are the actual number with "R".
For example, 1uF is expressed as 1R0 in this case.

ex. 0.1μF→ R10 , 10μF→ 100 , 1000μF→ 102

2-5 Suffix Code for Appearance : Special Code for Appearance

Blank	Standard Long Lead
E	Snap-in lead
B	Lead taping

Refer to page 12 for snap-in lead, page 13 ～ 14 for lead taping dimensions,
And page 15 ～ 18 for lead taping specifications.

Remarks

Capacitance and Can Size Table

[μF] at 120Hz 20℃

V.DC / Can Size(φD×L)	6.3	10	16	25	35	50
8X11.5	560 820 U 1000 U	470 680 U	330 470 U	220 330 U	150 220 U	100 120 U
8X15	1200 Y		680 Y			
8X20	1500 L 1800 Y 2200 Y	1000 L 1500 Y	680 L 1000 Y	470 L 680 Y	330 L 390 Y	220 L 270 Y
10X12.5	1000 1500 U	680 1000 U	470 680 U	330 470 U	220 330 U	150 180 U
10X16	1500 1800 U 2200 U	1000 1500 U	680 1000 U	470 680 U	330 390 U	220 270 U
10X20	2200 2700 U 3300 U	1500 2200 U	1000 1500 U	680 1000 U	470 560 U	270 330 U
10X25	3300 Y		1800 Y			
12.5X20	3300 4700 U					

＊ L, S = the last letter of part numbers.

Examples : EEUFJ0J102U… φ8×11.5

EEUFJ0J102 … φ10×12.5

EEUFJ0J222U… φ10×16

Remarks

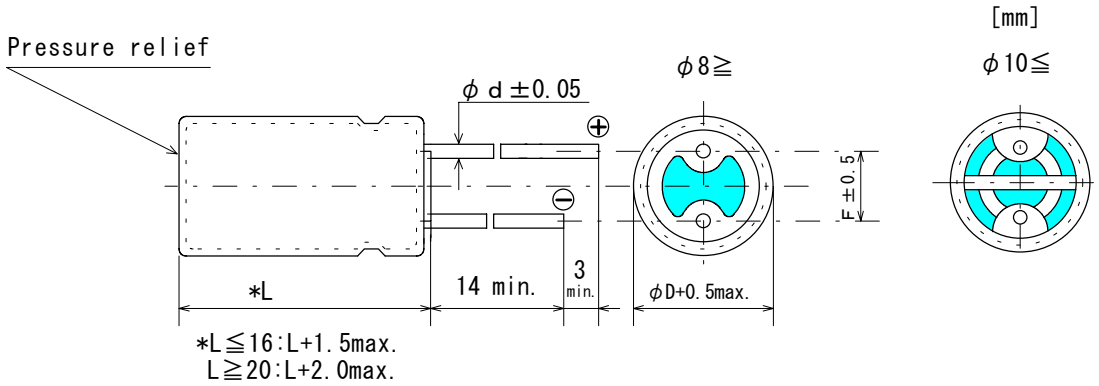
3. Standard Ratings

No.	Item	Ratings							
1	Category Temperature Range	−25 ～ +105℃							
2	Rated Voltage Range	6.3 ～ 50 V.DC							
3	Capacitance Range	100 ～ 4700 μF (120Hz 20℃)							
4	Capacitance Tolerance	± 20% (120Hz 20℃)							
5	Surge Voltage	R.V.	6.3	10	16	25	35	50	
	(V.DC)	S.V.	8	13	20	32	44	63	
6	Rated Ripple Current	Page 10 ～ Page 11,Table3							
7	Impedance	Page 10 ～ Page 11,Table3							

4. Dimensions and Appearance

Body Color (Black) , Marking (Gold)

Standard Long Lead (Suffix : Blank)



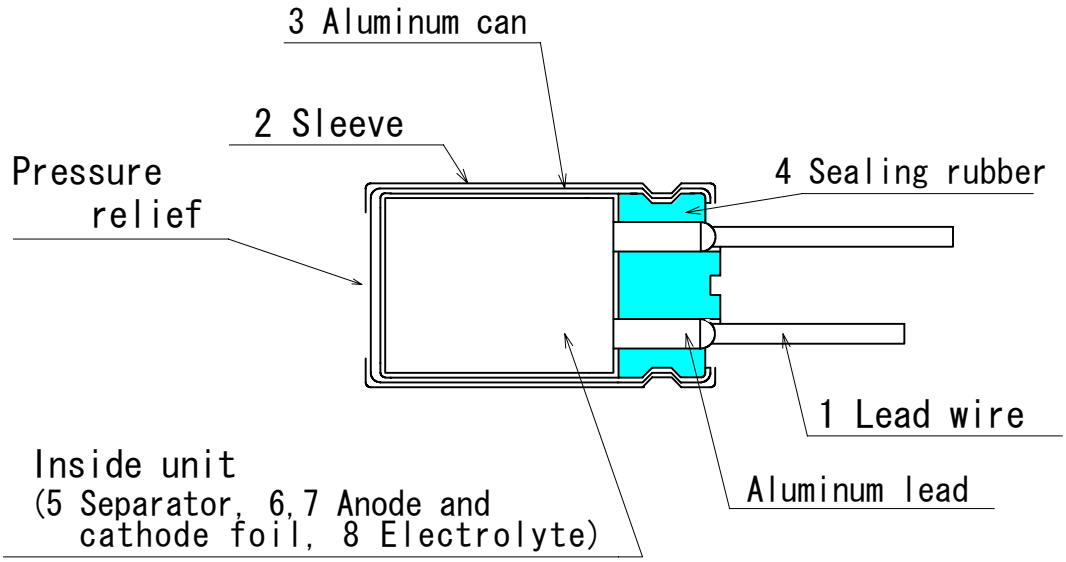
[mm]

Body Dia. ΦD	8	10	12.5
Lead Space F	3.5	5.0	5.0
Lead Dia. Φd	0.6	0.6	0.6

Remarks

5. Constructions

5-1 Inside Construction



5-2 Construction Parts

	Parts	Materials		Parts	Materials
1	Lead Wire	Solid tinned copper weld steel wire	5	Separator	Manila hemp
2	Vinyl Sleeve	Thermoplastic Resin	6	Anode Foil	High purity Aluminum foil
3	Aluminum Can	Aluminum	7	Cathode Foil	Aluminum foil
4	Sealing Rubber	Synthetic rubber	8	Electrolyte	—

Remarks

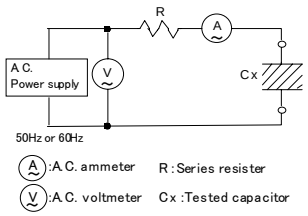
6. Performance Characteristics

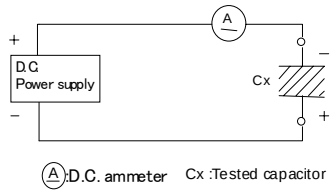
No	Item	Performance Characteristics	Test
1	Leakage Current	≦ I = 0.01CV I : Leakage current C : Capacitance V : Rated voltage	Series Resistor : 1000±10 Ω Applied Voltage : Rated voltage Measuring : After 2 minutes
2	Capacitance	Within the specified capacitance tolerance.	Measuring Frequency : 120 Hz±20% Measuring Circuit : Equivalent series circui Measuring Voltage : +1.5 ～ 2 V. DC (≦0.5V for AC.)
3	Tangent of Loss Angle (tan δ)	Less than the table 1 value of page 9. Added 0.02 per 1000 μF for items with over 1000 μF.	Measuring Frequency : 120 Hz±20% Measuring Circuit : Equivalent series circui Measuring Voltage : +1.5 ～ 2 V. DC (≦0.5V for AC.)
4	Impedance	20℃ Less than the initial limit. -10℃ (See page 10 ～ 11)	Measuring Frequency : 100 kHz Measuring Temperature : 20±2℃,-10±2℃ Measuring Point : Impedance shall be measured at a point (2mm max. from the surface of a sealing rubber) of the lead wire.
5	Characteristics at High and Low Temperature	Step 2 Impedance Ratio : Ratio for the value in step 1 shall be less than the value from table 2 in page 9. Step 4 Leakage Current : ≦ 800% of the value of item 6. 1. Capacitance Change : Within ±25% of the value in step 1 Tangent of Loss Angle (tan δ): ≦ the value of item 6. 3.	Step / Test Temperature / Time 1 / 20± 2℃ / ——— 2 / -25± 3℃ / ——— ＊ 3 / 20± 2℃ / 15 minutes 4 / 105± 2℃ / 2 hours 5 / 20± 2℃ / ——— ＊ Impedance should be measured at the frequency of 120 Hz±10%. ＊ Capacitors should be stored at each temperature until measured impedance or capacitance is stabilized.
6	Surge	Leakage Current : ≦ the value of item 6.1. Capacitance Change : Within ±15% of the initially measured value. Tangent of Loss Angle (tan δ): ≦ the value of item 6. 3. Appearance : No significant change can be observed.	Test Temperature : 15 ～ 35 ℃ Series Protective Resistance : $R = \frac{100 \pm 50}{C}$ [R = Series protective resistance (kΩ) C =Capacitance (μF)] Test Voltage : Surge voltage item 3. 5 Applied Voltage : 1000 cycles of 30±5 sec. "ON" and 5 min. 30 sec. "OFF"

Remarks

No	Item	Performance Characteristics	Test
7	Robustness of Terminations Tensile	There is no damage or breakage after test.	<table><tr><th>Diameter [mm]</th><th>Pull Strength</th></tr><tr><td>φ0.6</td><td>10 N</td></tr></table> Applied above steady pull axially for a 10±1 seconds.
	Bending		<table><tr><th>Diameter [mm]</th><th>Static Load</th></tr><tr><td>φ0.6</td><td>5 N</td></tr></table> At first, a capacitor is placed in vertical position with the weight specified above being applied to one of leads. Then the capacitor is slowly rotated 90° to horizontal position and subsequently returned to vertical position. The above bending procedure takes for 2 ～ 3 seconds. An additional bending is done in the opposite direction.
8	Vibration	Capacitance : Measured value is to be stabilized during test. (Measured several times within 30 min. before completion of test) Appearance : No significant change can be observed. Capacitance Change : Within ±5% of the initially measured value.	Frequency : 10 ～ 55 Hz (1 minute per cycle.) Total Amplitude : 1. 5 mm Direction and Duration of Vibration : It is done in the X, Y, Z axis direction for 2 hours each, with a total of 6 hours. Mounting Method : The capacitor shall be fixed with its lead wires at the point of 4 mm from the bottom of capacitor body. The capacitor with diameter greater than 12. 5 mm or longer than 25 mm must be fixed in place with a bracket.
9	Solderability	More than 3/4 of the terminal surface shall be covered with new solder.	Solder Type : H60A, H60S, or H63A (JIS Z3282) Solder Temperature : 235±5 ℃ Immersing Time : 2±0. 5 sec. Immersing Depth : 1. 5 ～ 2. 0 mm from the root. Flux : Approx. 25% rosin (JIS K5902) in ETHANOL (JIS K8101)
10	Resistance to Soldering Heat	Leakage Current : ≦ the value of item 6.1. Capacitance Change : Within ±10% of the initially measured value. Tangent of Loss Angle (tan δ): ≦ the value of item 6. 3. Appearance : No significant change can be observed.	Solder Type : H60A, H60S, or H63A (JIS Z3282) Solder Temperature : 260±5 ℃ Immersing Time : 10±1 sec. Immersing Depth : 1. 5 ～ 2. 0 mm from the root.

Remarks

<table>
<tr><th>No</th><th>Item</th><th>Performance Characteristics</th><th>Test</th></tr>
<tr><td>11</td><td>Solvent Resistance of Marking</td><td>There shall be no damage and legible marking. Marking can be easily comprehended.</td><td>Class of Reagent : Isopropyl Alcohol
Test Temperature : 20 ～ 25 ℃
Immersing Time : 30±5 sec.</td></tr>
<tr><td>12</td><td>Pressure Relief</td><td>Pressure relief shall be operated without any hazardous expulsion or emission of flame.
No emission of gas after 30 minutes of the voltage application also meets the specification.</td><td>AC Current Method
 

Applied Voltage :
AC voltage equals to rated W. V. × 0. 7 or 250 V (rms), whichever is smaller.
<table>
<tr><th>Capacitance (μF)</th><th>DC Resistance (Ω)</th></tr>
<tr><td>≦1</td><td>1000±100</td></tr>
<tr><td>＞1 ≦10</td><td>100±10</td></tr>
<tr><td>＞10 ≦100</td><td>10±1</td></tr>
<tr><td>＞100 ≦1000</td><td>1±0.1</td></tr>
<tr><td>＞1000 ≦10000</td><td>0.1±0.01</td></tr>
<tr><td>＞10000</td><td>*</td></tr>
</table>
* When capacitance is over 10000 μF,the value of series resistance equals to the half of the tested capacitor's impedance.
Reverse Voltage Method
 

<table>
<tr><th>Nominal Diameter [mm]</th><th>DC Current (A)</th></tr>
<tr><td>≦22.4</td><td>1 (const)</td></tr>
<tr><td>＞22.4</td><td>10 (const)</td></tr>
</table>
</td></tr>
</table>

Remarks

No	Item	Performance Characteristics	Test
13	Damp Heat (Steady state)	Leakage Current : ≦ the value of item 6.1. Capacitance Change : Within ±20% of the initially measured value. Tangent of Loss Angle (tan δ): ≦ 120% the value of item 6. 3. Appearance : No significant change can be observed.	Test Temperature : 40±2 ℃ Relative Humidity : 90 ～ 95% Test Duration : 240±8 hours After subjected to the test, capacitors shall be left for 2 hours at room temperature and room humidity prior to the measurement.
14	Endurance	Leakage Current : ≦ the value of item 6.1. Capacitance Change : Under 12.5mm Height Within ±25% of the initially measured value. (code"U","Y":±30%) Over 15mm Height Within ±35% of the initially measured value. Tangent of Loss Angle (tan δ): ≦ 200% of the value of item 6. 3. Appearance : No significant change can be observed.	Under 12.5mm Height Test Temperature : 105±2 ℃ Test Duration : 2000 $^{+72}_{0}$ hours Applied Voltage : Rated voltage Over 15mm Height Test Temperature : 105±2 ℃ Test Duration : 3000 $^{+72}_{0}$ hours Applied Voltage : Rated voltage After subjected to the test, capacitors shall be left at room temperature and room humidity for 2 hours prior to the measurement.
15	Shelf Life	Leakage Current : ≦ the value of item 6.1. Capacitance Change : Under 12.5mm Height Within ±25% of the initially measured value. (code"U","Y":±30%) Over 15mm Height Within ±35% of the initially measured value. Tangent of Loss Angle (tan δ): ≦ 200% of the value of item 6. 3. Appearance : No significant change can be observed.	Test Temperature : 105±2 ℃ Test Duration : 1000 $^{+48}_{0}$ hours After subjected to the test with no voltage applied, capacitors shall undergo voltage treatment* and be left for 1～2 hours at room temperature and humidity prior to the measurement.

Remarks ＊Voltage treatment : The rated voltage shall be applied to the capacitors, which are connected to series protective resistors (1000±10 Ω), for 30 minutes as a posttest treatment (performing discharge).

7. Marking

(1) Markings indicated on the products :

a) Rated Voltage.
b) Capacitance
c) Negative Polarity
d) Matsushita Electric Trademark
e) Upper Category Temperature
f) Series Code
g) Lot No.

(2) Label On the Packaging Box by English

a) Rated Voltage, Capacitance
b) Matsushita Electric Trademark
c) Part Number
d) Packing Quantity
e) Serial No.
f) Manufacturer's Name
g) Country of Origin

8. Others

Unless otherwise specified, the product shall conform to JIS C 5141.

■ Table 1. Tangent of Loss Angle(tan δ)

V.DC	6.3	10	16	25	35	50
D.F.(max.)	0.22	0.19	0.16	0.14	0.12	0.10

Added 0. 02 per 1000 μF for items with over 1000 μF items.

■ Table 2.Characteristics at low temperature Impedance ratio (at 120 Hz)

V.DC	6.3	10	16	25	35	50
Z(−25℃)/Z(20℃)(max.)	3	3	3	3	3	3

■ Table 3.Frequency Correction Factor of Rated Ripple Current

Cap. (μF)	Frequency (Hz)			
	120	1k	10k	100k～
100～330	0.40	0.75	0.93	1.00
390～1000	0.50	0.85	0.95	1.00
1200～4700	0.55	0.90	0.98	1.00

＊ Rated ripple current shall be calculated as below :

Where

$I_p = I \times k_f$

I_p = Rated Ripple Current
I = Specified Ripple Current at 100 kHz
k_f = Frequency Correction Factor

In case the calculated ripple current is too high and the peak-to-peak ripple voltage exceeds its rated voltage, the rated ripple current shall be calculated by the following formula.

Where

$I_p' = \pi \times f \times C \times VN / \sqrt{2} \times 10^{-6}$

I_p' = Rated Ripple Current [A rms]
f = Frequency [Hz]
C = Capacitance [uF]
VN = Rated Voltage [V]

Remarks

A type FJ series

	Part No.	V.DC	Cap. μF	Leakage Current μA max.	Rated Ripple Current mA rms max.*1	ESR (Ω max.) 100kHz +20℃	ESR (Ω max.) 100kHz −10℃	Dim. [mm] φD	Dim. [mm] L	Dim. [mm] φd	Endurance (hours) h
	EEUFJ0J561	6.3	560	35.2	1140	0.030	0.090	8	11.5	0.6	2000
	EEUFJ0J821U	6.3	820	51.6	1140	0.030	0.090	8	11.5	0.6	2000
	EEUFJ0J102U	6.3	1000	63.0	1140	0.030	0.090	8	11.5	0.6	2000
	EEUFJ0J102	6.3	1000	63.0	1540	0.025	0.075	10	12.5	0.6	2000
	EEUFJ0J122Y	6.3	1200	75.6	1490	0.028	0.084	8	15	0.6	3000
	EEUFJ0J152L	6.3	1500	94.5	1870	0.016	0.048	8	20	0.6	3000
	EEUFJ0J152U	6.3	1500	94.5	1540	0.025	0.075	10	12.5	0.6	2000
	EEUFJ0J152	6.3	1500	94.5	2000	0.018	0.054	10	16	0.6	3000
	EEUFJ0J182Y	6.3	1800	113.4	1870	0.016	0.048	8	20	0.6	3000
	EEUFJ0J182U	6.3	1800	113.4	2000	0.018	0.054	10	16	0.6	3000
	EEUFJ0J222Y	6.3	2200	138.6	1870	0.016	0.048	8	20	0.6	3000
	EEUFJ0J222U	6.3	2200	138.6	2000	0.018	0.054	10	16	0.6	3000
	EEUFJ0J222	6.3	2200	138.6	2550	0.013	0.039	10	20	0.6	3000
	EEUFJ0J272U	6.3	2700	170.1	2550	0.013	0.039	10	20	0.6	3000
	EEUFJ0J332U	6.3	3300	207.9	2550	0.013	0.039	10	20	0.6	3000
	EEUFJ0J332Y	6.3	3300	207.9	2800	0.012	0.036	10	25	0.6	3000
	EEUFJ0J332	6.3	3300	207.9	2800	0.012	0.036	12.5	20	0.6	3000
	EEUFJ0J472U	6.3	4700	296.1	2800	0.012	0.036	12.5	20	0.6	3000
	EEUFJ1A471	10	470	47.0	1140	0.030	0.090	8	11.5	0.6	2000
	EEUFJ1A681U	10	680	68.0	1140	0.030	0.090	8	11.5	0.6	2000
	EEUFJ1A681	10	680	68.0	1540	0.025	0.075	10	12.5	0.6	2000
	EEUFJ1A102L	10	1000	100.0	1870	0.016	0.048	8	20	0.6	3000
	EEUFJ1A102U	10	1000	100.0	1540	0.025	0.075	10	12.5	0.6	2000
	EEUFJ1A102	10	1000	100.0	2000	0.018	0.054	10	16	0.6	3000
	EEUFJ1A152Y	10	1500	150.0	1870	0.016	0.048	8	20	0.6	3000
	EEUFJ1A152U	10	1500	150.0	2000	0.018	0.054	10	16	0.6	3000
	EEUFJ1A152	10	1500	150.0	2550	0.013	0.039	10	20	0.6	3000
	EEUFJ1A222U	10	2200	220.0	2550	0.013	0.039	10	20	0.6	3000
	EEUFJ1C331	16	330	52.8	1140	0.030	0.090	8	11.5	0.6	2000
	EEUFJ1C471U	16	470	75.2	1140	0.030	0.090	8	11.5	0.6	2000
	EEUFJ1C471	16	470	75.2	1540	0.025	0.075	10	12.5	0.6	2000
	EEUFJ1C681Y	16	680	108.8	1490	0.028	0.084	8	15	0.6	3000
	EEUFJ1C681L	16	680	108.8	1870	0.016	0.048	8	20	0.6	3000
	EEUFJ1C681U	16	680	108.8	1540	0.025	0.075	10	12.5	0.6	2000
	EEUFJ1C681	16	680	108.8	2000	0.018	0.054	10	16	0.6	3000
	EEUFJ1C102Y	16	1000	160.0	1870	0.016	0.048	8	20	0.6	3000
	EEUFJ1C102U	16	1000	160.0	2000	0.018	0.054	10	16	0.6	3000
	EEUFJ1C102	16	1000	160.0	2550	0.013	0.039	10	20	0.6	3000
	EEUFJ1C152U	16	1500	240.0	2550	0.013	0.039	10	20	0.6	3000
	EEUFJ1C182Y	16	1800	288.0	2800	0.012	0.036	10	25	0.6	3000

Remarks *1 100kHz 105℃

Matsushita Electronic Components Co.,Ltd. LCR Device Company
Capacitor Business Unit

A type FJ series

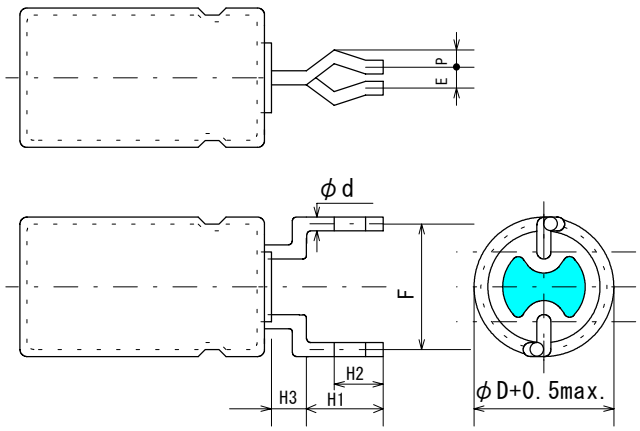
	Part No.	V.DC	Cap. μF	Leakage Current μA max.	Rated Ripple Current mA rms max.*1	ESR (Ω max.) 100kHz +20℃	ESR (Ω max.) 100kHz −10℃	Dim. [mm] φD	Dim. [mm] L	Dim. [mm] φd	Endurance (hours) h
	EEUFJ1E221	25	220	55.0	1110	0.030	0.090	8	11.5	0.6	2000
	EEUFJ1E331U	25	330	82.5	1080	0.032	0.096	8	11.5	0.6	2000
	EEUFJ1E331	25	330	82.5	1440	0.025	0.075	10	12.5	0.6	2000
	EEUFJ1E471L	25	470	117.5	1820	0.018	0.054	8	20	0.6	3000
	EEUFJ1E471U	25	470	117.5	1390	0.027	0.081	10	12.5	0.6	2000
	EEUFJ1E471	25	470	117.5	1920	0.020	0.060	10	16	0.6	3000
	EEUFJ1E681Y	25	680	170.0	1720	0.020	0.060	8	20	0.6	3000
	EEUFJ1E681U	25	680	170.0	1830	0.022	0.066	10	16	0.6	3000
	EEUFJ1E681	25	680	170.0	2180	0.016	0.048	10	20	0.6	3000
	EEUFJ1E102U	25	1000	250.0	2060	0.018	0.054	10	20	0.6	3000
	EEUFJ1V151	35	150	52.5	1110	0.030	0.090	8	11.5	0.6	2000
	EEUFJ1V221U	35	220	77.0	1080	0.032	0.096	8	11.5	0.6	2000
	EEUFJ1V221	35	220	77.0	1440	0.025	0.075	10	12.5	0.6	2000
	EEUFJ1V331L	35	330	115.5	1820	0.018	0.054	8	20	0.6	3000
	EEUFJ1V331U	35	330	115.5	1390	0.027	0.081	10	12.5	0.6	2000
	EEUFJ1V331	35	330	115.5	1920	0.020	0.060	10	16	0.6	3000
	EEUFJ1V391Y	35	390	136.5	1720	0.020	0.060	8	20	0.6	3000
	EEUFJ1V391U	35	390	136.5	1830	0.022	0.066	10	16	0.6	3000
	EEUFJ1V471	35	470	164.5	2180	0.016	0.048	10	20	0.6	3000
	EEUFJ1V561U	35	560	196.0	2060	0.018	0.054	10	20	0.6	3000
	EEUFJ1H101	50	100	50.0	920	0.046	0.138	8	11.5	0.6	2000
	EEUFJ1H121U	50	120	60.0	890	0.049	0.147	8	11.5	0.6	2000
	EEUFJ1H151	50	150	75.0	1230	0.036	0.108	10	12.5	0.6	2000
	EEUFJ1H181U	50	180	90.0	1180	0.039	0.117	10	12.5	0.6	2000
	EEUFJ1H221L	50	220	110.0	1680	0.023	0.069	8	20	0.6	3000
	EEUFJ1H221	50	220	110.0	1720	0.026	0.078	10	16	0.6	3000
	EEUFJ1H271Y	50	270	135.0	1610	0.025	0.075	8	20	0.6	3000
	EEUFJ1H271U	50	270	135.0	1630	0.029	0.087	10	16	0.6	3000
	EEUFJ1H271	50	270	135.0	1890	0.021	0.063	10	20	0.6	3000
	EEUFJ1H331U	50	330	165.0	1800	0.023	0.069	10	20	0.6	3000

Remarks *1 100kHz 105℃

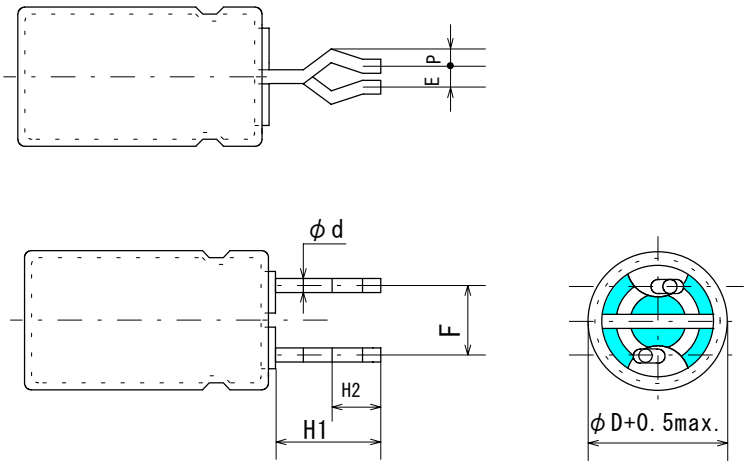
Matsushita Electronic Components Co.,Ltd. LCR Device Company
Capacitor Business Unit

Snap-In Lead Formed Type (Matsushita Part No. Suffix : E)

φ8



φ10～φ12.5



＊Direction of bending is random.

[mm]

φD	H1±0.5	H2	H3 max.	F±0.5	P	E max.	φd±0.05	P.W.B	
								φ	t
8	4.5	2.7	2.5	5.0	1.00	1.0	0.60	1.0	1.6
10	4.5	2.7	—	5.0	1.00	1.0	0.60	1.0	1.6
12.5	4.5	2.7	—	5.0	1.00	1.0	0.60	1.0	1.6

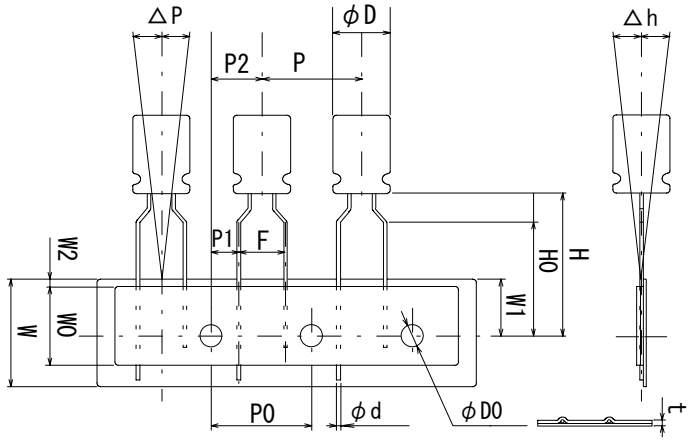
Remarks　＊The lead forming dimensions above shall only be subjected to our outgoing inspection and not to the customer's incoming inspection.
Due to the application of mechanical stress during transportation, actual dimensions might not meet the specification.

Lead Taping (Body Diameter φ8) The Suffix of Matsushita Taping Part Number : B

1) Applicable Range

This specification is applied to products, which are Aluminum Electrolytic Capacitors (JIS04 type) that taped with single tape.

2) Taping Shape & Dimensions



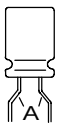
[mm]

Item	Symbol	Dimensions	Tolerance	Remarks
Body diameter	φD	8	+0.5	
Body length	L	11.5 ～ 20.0	—	
Lead wire diameter	φd	0.6	±0.05	
Body pitch	P	12.7	±1.0	
Feed hole pitch *1	P0	12.7	±0.2	
Hole center to lead	P1	3.85	±0.5	Specified by the contact surface between tape & lead
Feed hole center to product center	P2	6.35	±1.00	
Lead to lead distance	F	5.0	+0.8 −0.2	Specified by the contact surface between tape & lead
Mount tape	W	18.0	±0.5	
Adhesive tape	W0	6.0 ≦	—	
Hole position	W1	9.0	±0.5	
Adhesive tape slipping	W2	0 ～ 1.5	—	
Height of product from the center	H	20.0	+0.75 −0.50	
Lead wire clinch height	H0	16.0	±0.5	
Feed hole diameter	φD0	4.0	±0.2	
Inclination of body	△h	1.0 ≧	—	Specified by the top of an aluminum can
Inclination of body	△P	1.0 ≧	—	Specified by the top of an aluminum can
Total tape thickness	t	0.6	±0.3	CP wire is excluded

*1 Cumulative deviation of “feed hole pitch” shall be less than 1 mm in 20 sections.

*2 Lead forming angle

A=90° min



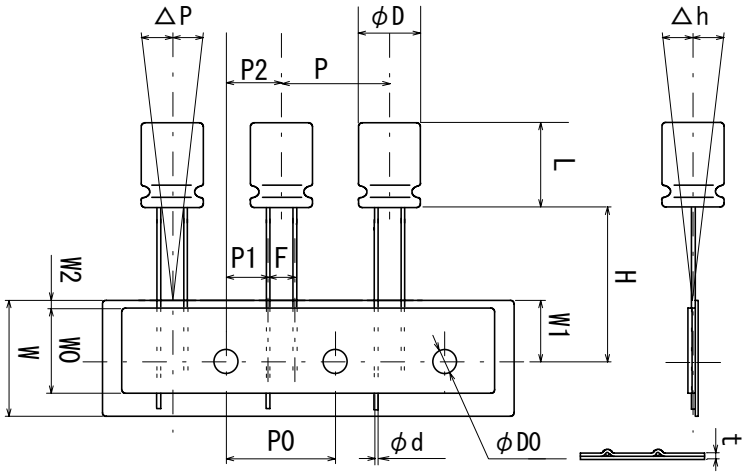
Remarks

Lead Taping (Body Diameter　ϕ10,ϕ12.5)　The Suffix of Matsushita Taping Part Number : B

1) Applicable Range

This specification is applied to products, which are Aluminum Electrolytic Capacitors (JIS04 type) that taped with single tape.

2) Taping Shape & Dimensions



[mm]

Item	Symbol	Dimensions		Tolerance	Remarks
Body diameter	ϕD	10	12.5	+0.5	
Body length	L	12.5 ～ 25.0		—	
Lead wire diameter	ϕd	0.60		±0.05	
Body pitch	P	12.7	15.0	±1.0	
Feed hole pitch　*1	P0	12.7	15.0	±0.2	
Hole center to lead	P1	3.85	5.00	±0.5	Specified by the contact surface between tape & lead
Feed hole center to product center	P2	6.35	7.50	±1.00	
Lead to lead distance	F	5.0		+0.8 −0.20	Specified by the contact surface between tape & lead
Mount tape	W	18.0		±0.5	
Adhesive tape	W0	6.0 ≦		—	
Hole position	W1	9.0		±0.5	
Adhesive tape slipping	W2	0 ～ 1.5		—	
Height of product from the center	H	18.50		+0.75 −0.50	
Feed hole diameter	ϕD0	4.0		±0.2	
Inclination of body	△h	1.0 ≧		—	Specified by the top of an aluminum can
Inclination of body	△P	1.0 ≧		—	Specified by the top of an aluminum can
Total tape thickness	t	0.6		±0.3	CP wire is excluded

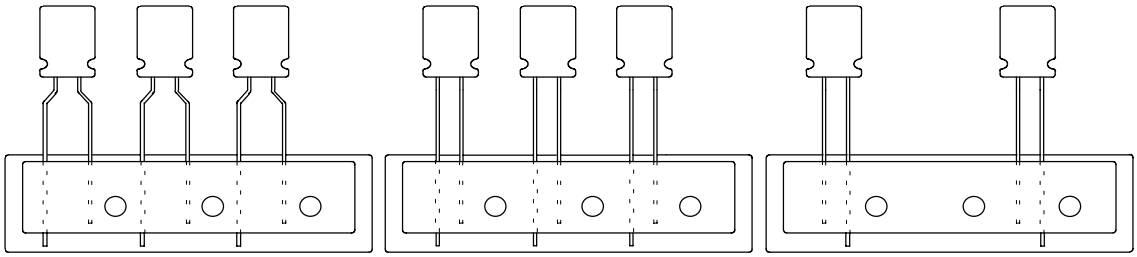
*1 Cumulative deviation of “feed hole pitch” shall be less than 1 mm in 20 sections.

Remarks

1. Taping Method

1-1　The capacitors shall be placed vertically on the base tape, and their lead wires are fixed with the adhesive tape. In addition, the direction of polarity is standardized as the base tape is situated underneath of an adhesive tape, and lead wires with the same polarity are placed on the right hand side (the direction of polarity for bipolar products is not specified).

(Examples)

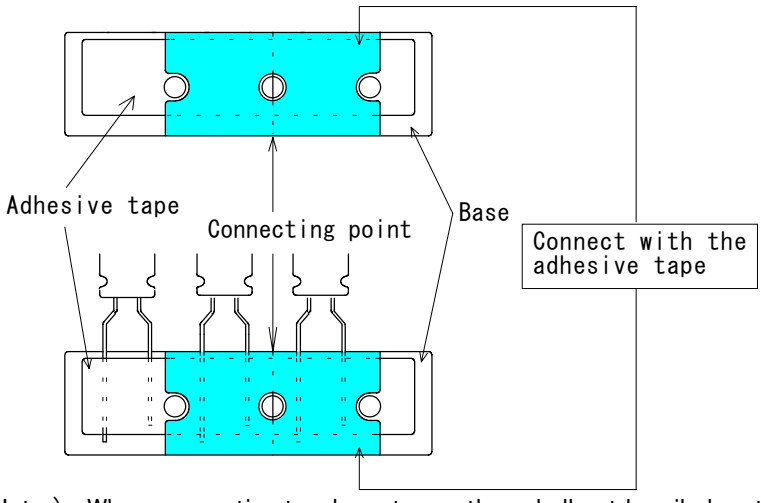


*Polarity direction

φ8 ～φ12.5 : Negative polarity on the right.

1-2　After taping, there shall be no more than three blank spaces without lead wires on the base tape. The number of blank spaces within a packing unit (an inner carton) is not restricted, however, the specified packing quantity must be satisfied.

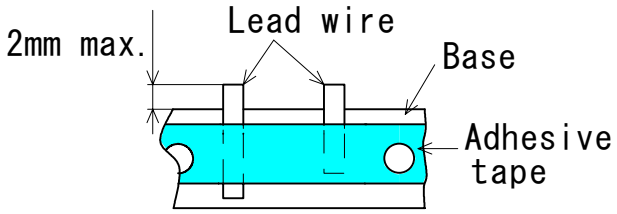
1-3　The connection method is as follows.　The portion shall meet the general taping specification. The position of connection shall not be restricted.



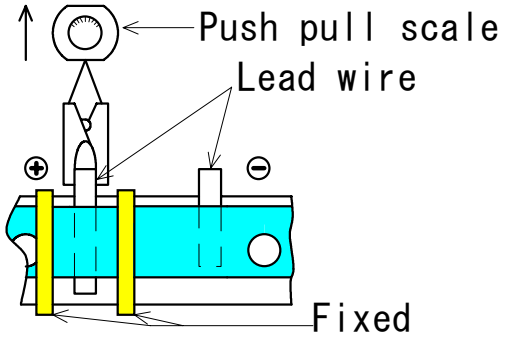
Note)　When connecting two base tapes, they shall not be piled on top of each other. Base tapes shall not be connected with each other by using staples.

Remarks

1-4 In case of removing the products after taping, lead wires shall be cut or the capacitor shall be pulled out.
The length of remaining lead wire shall be less than 2.0 mm from the upper edge of the base tape.



1-5 Tensile strength of lead wire after taping (specified for the positive lead wire only) :
Fix the tape as below and pull the positive lead wire to the vertical direction by using the push pull scale.
The tensile strength shall be greater than 2. 94 N.



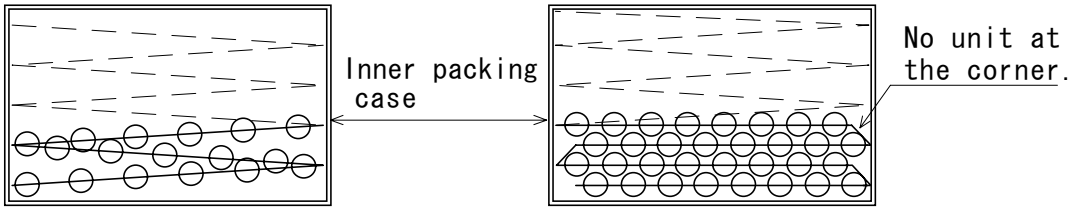
After continuously storing in an atmosphere of 40±2℃ and 90 ～ 98% R. H. for 250 hours, the taped products shall meet the specification above, and there shall be no inclination of the capacitors or covering of holes with the adhesive.

Remarks

2. Packing Method

2-1 Taped products shall be packed in an inner carton (the smallest packing unit) in the zigzag pattern. In an inner carton, the lead wires with positive polarity are not to be placed on the top of lead wires with negative polarity and vice versa (however, the last sentence does not apply to bipolar products).

(Examples)

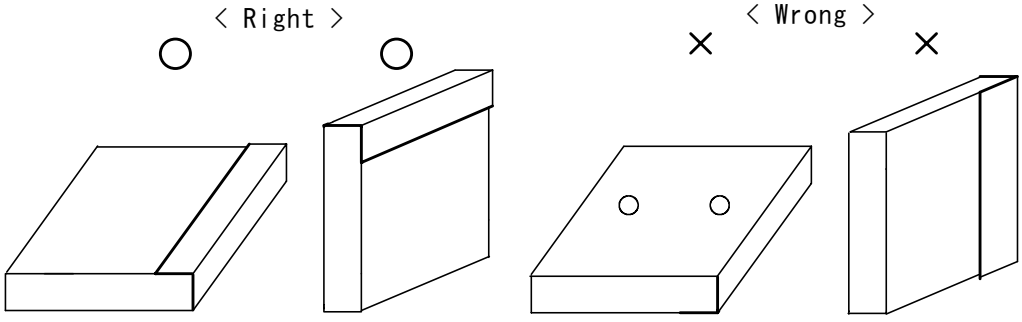


φ4～φ8　　φ10～φ18

2-2 Polarity identifications on an inner carton shall match the polarity of products situated inside the inner carton.

2-3 Inner cartons shall be handled as follows.

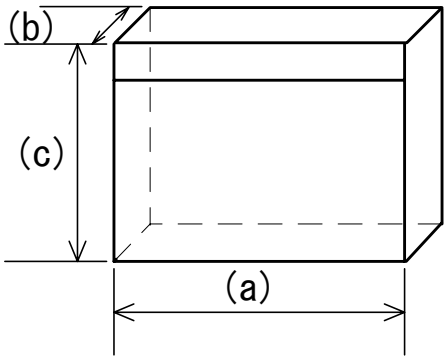
* No more than 10 inner cartons shall be piled on top of each other.
* In case of situating cartons in upright position, the indication of polarity shall be faced upward.
* The products shall be handled with care.



2-4 The inner cartons shall be packed in a cardboard box for transportation. Products with various part numbers can be packed in an outer carton upon request. However, each inner carton (the smallest packing unit) shall only contain products with the same part number.

Remarks

2-5 The shape & dimensions of inner cartons shall be as follows.



Can size		(a)	(b)	(c)
φD	L			
φ8	～20	340	55	320
φ10	～16	340	55	320
	20	340	62	320
	25	340	66	320
φ12.5	20	340	65	320

Note : The dimensions listed above are subject to change without notice, depending on the auto-insert machine.

2-6 Packing quantity

Product diameter (mm)	Inner carton quantity Min. packing quantity (pcs)	Outer carton quantity (pcs)
φ 8	1,000	5,000
φ 10	500	2,000
φ 12.5	500	2,000

3. Storage

3-1 With respect to the handling method, follow Item 2-3 in this specification.

3-2 Products shall be out of direct sun light. In addition, the temperature and humidity shall be normal.

4. Ordering Unit

The order shall be placed with a multiple of the inner carton quantity.

Examples : φ8 : minimum 1000 pcs
φ10 ～φ12. 5 : minimum 500 pcs

Remarks

＊Label On the Packaging Box by English

1. Circuit Design

1.1 Operating Temperature and Frequency

Electrical parameters for electrolytic capacitors are normally specified at 20 ℃ temperature and 120 Hz frequency.
These parameters vary with changes in temperature and frequency. Circuit designers should take these changes into consideration.

(1) Effects of operating temperature on electrical parameters
- a) At higher temperatures, leakage current and capacitance increase while equivalent series resistance (ESR) decreases.
- b) At lower temperatures, leakage current and capacitance decrease while equivalent series resistance (ESR) increases.

(2) Effects of frequency on electrical parameters
- a) At higher frequencies, capacitance and impedance decrease while tan δ increases.
- b) At lower frequencies, heat generated by ripple current will rise due to an increase in equivalent series resistance (ESR).

1.2 Operating Temperature and Life Expectancy

(1) Expected life is affected by operating temperature. Generally, each 10 ℃ reduction in temperature will double the expected life. Use capacitors at the lowest possible temperature below the upper category temperature.

(2) If operating temperatures exceed the upper category limit, rapid deterioration of electrical parameter will occur and irreversible damage will result.
Check for the maximum capacitor operating temperatures including ambient temperature, internal capacitor temperature rise due to ripple current, and the effects of radiated heat from power transistors, IC's or resistors.
Avoid placing components, which could conduct heat to the capacitor from the back side of the circuit board.

(3) The formula for calculating expected life at lower operating temperatures is as follows ;

$$L_2 = L_1 \times 2^{\frac{T_1 - T_2}{10}}$$

- L_1 : Guaranteed life (h) at temperature, T_1℃
- L_2 : Expected life (h) at temperature, T_2℃
- T_1 : Upper category temperature (℃)
- T_2 : Actual operating temperature, ambient temperature + temperature rise due to ripple current heating(℃)

1.3 Common Application Conditions to Avoid

The following misapplication load conditions will cause rapid deterioration of a capacitor's electrical parameters.
In addition, rapid heating and gas generation within the capacitor can occur, causing the pressure relief vent to operate and resultant leakage of electrolyte. Under extreme conditions, explosion and fire ignition could result.
The leaked electrolyte is combustible and electrically conductive.

(1) Reverse Voltage
DC capacitors have polarity. Verify correct polarity before insertion. For circuits with changing or uncertain polarity, use DC bipolar capacitors. DC bipolar capacitors are not suitable for use in AC circuits.

(2) Charge / Discharge Applications
Standard capacitors are not suitable for use in repeating charge/discharge applications. For charge/discharge applications, consult us with your actual application condition.

(3) Over voltage
Do not apply voltages exceeding the maximum specified rated voltage. Voltages up to the surge voltage rating are acceptable for short periods of time. Ensure that the sum of the DC voltage and the superimposed AC ripple voltage does not exceed the rated voltage.

(4) Ripple Current
Do not apply ripple currents exceeding the maximum specified value. For high ripple current applications, use a capacitor designed for high ripple currents. In addition, consult us if the applied ripple current is to be higher than the maximum specified value. Ensure that rated ripple currents that superimposed on low DC bias voltages do not cause reverse voltage conditions.

1.4 Using Two or More Capacitors in Series or Parallel

(1) Capacitors Connected in Parallel
The circuit resistance can closely approximate the series resistance of the capacitor, causing an imbalance of ripple current loads within the capacitors. Careful wiring methods can minimize the possible application of an excessive ripple current to a capacitor.

(2) Capacitors Connected in Series
Differences in normal DC leakage current among capacitors can cause voltage imbalances. The use of voltage divider shunt resistors with consideration to leakage currents can prevent capacitor voltage imbalances.

1.5 Capacitor Mounting Considerations

(1) Double-Sided Circuit Boards

Avoid wiring pattern runs, which pass between the mounted capacitor and the circuit board. When dipping into a solder bath, an excess solder may deposit under the capacitor by capillary action, causing short circuit between anode and cathode terminals.

(2) Circuit Board Hole Positioning

The vinyl sleeve of the capacitor can be damaged if solder passes through a lead hole into the subsequently processed parts. Special care when locating hole positions in proximity to capacitors is recommended.

(3) Circuit Board Hole Spacing

The spacing of circuit board holes should match the lead wire spacing of capacitors within the specified tolerances. Incorrect spacing can cause an excessive lead wire stress during the insertion process. This may result in premature capacitor failure due to the short or open circuit, increased leakage current, or electrolyte leakage.

(4) Clearance for Case Mounted Pressure Relief

Capacitors with case mounted pressure relief require sufficient clearance to allow proper pressure relief operation. The minimum clearances are dependent of capacitor diameters as follows.
ϕ6.3 ～ ϕ16 mm : 2 mm minimum, ϕ18 ～ ϕ35 mm : 3 mm minimum, ϕ40 mm or greater : 5 mm minimum.

(5) Clearance for Seal Mounted Pressure Relief

Provide a hole on a circuit board to relieve gas when a pressure relief of a capacitor is situated underneath of the circuit board.

(6) Wiring Near the Pressure Relief

Avoid locating high voltage, high current wiring, or circuit board paths above the pressure relief . Flammable, high temperature gas that exceeds 100 ℃ may be released and could dissolve the wire insulation and ignite.

(7) Circuit Board Patterns Under the Capacitor

Avoid circuit board runs underneath the capacitor, as an electrical short can occur due to an electrolyte leakage.

(8) Screw Terminal Capacitor Mounting

Do not orient the capacitor with the screw terminal side of the capacitor facing downward. Tighten the terminal and mounting bracket screws within the torque range specified in the specification.

1.6 Electrical Isolation of the Capacitor

Completely isolate the capacitor as follows.
(1) Between the cathode and the case (except for axially leaded B types) and between the anode terminal and other circuit paths.
(2) Between the extra mounting terminals (on T types) and the anode terminal, cathode terminal, and other circuit paths.

1.7 Capacitor Sleeve

The vinyl sleeve or laminate coating is intended for marking and identification purposes and is not meant to electrically insulate the capacitor.
The sleeve may split or crack if immersed into solvents such as toluene or xylene and then subsequently exposed to high temperatures.

CAUTION!

Always consider safety when designing equipment and circuits.
Plan for the worst case failure modes such as short circuits and open circuits, which could occur use.
(1) Provide protection circuits and protection devices to allow safe failure modes.
(2) Design redundant or secondary circuits where possible to assure the continued operation in case of main circuit failure.

2. Capacitor Handling Techniques

2.1 Considerations Before Using

(1) Capacitors have a finite life. Do not reuse or recycle capacitors from used equipment.
(2) Transient recovery voltage may be generated in the capacitor due to dielectric absorption.
If required, this voltage can be discharged with a resistor with a value of about 1k Ω.
(3) Capacitors stored for a long period of time may exhibit an increase in leakage current.
This can be corrected by gradually applying rated voltage in series with a resistor of approximately 1k Ω.
(4) If capacitors are dropped, they can be damaged mechanically or electrically. Avoid using dropped capacitors.
(5) Dented or crushed capacitors should not be used. The seal integrity can be damaged and loss of electrolyte/shortened life can result.

2.2 Capacitor Insertion

(1) Verify the correct capacitance and rated voltage of the capacitor.
(2) Verify the correct polarity of the capacitor before insertion.
(3) Verify the correct hole spacing before insertion (land pattern size on chip type) to avoid stress on the terminals.
(4) Ensure that the lead clinching operation done by auto insertion equipments does not stress the capacitor leads where they enter the seal of the capacitor. For chip type capacitors, excessive mounting pressure can cause high leakage current, short circuit, or disconnection.

2.3 Manual Soldering

(1) Apply soldering conditions (temperature and time) based on the specification, or do not exceed temperature of 350 ℃ for 3 seconds or less.
(2) If lead wires must be modified to meet terminal board hole spacing, avoid stress on the lead wire where it enters the capacitor seal.
(3) If a soldered capacitor must be removed and reinserted, avoid excessive stress on the capacitor leads.
(4) Avoid physical contacts between the tip of the soldering iron and capacitors to prevent melting of the vinyl sleeve.

2.4 Flow Soldering

(1) Do not immerse the capacitor body into the solder bath as excessive internal pressure could result.
(2) Apply proper soldering conditions (temperature, time, etc.). Do not exceed the specified limits.
(3) Do not allow other parts or components to touch the capacitor during soldering.

2.5 Other Soldering Considerations

Rapid temperature rise during the preheat operation and resin bonding operation can cause cracking of the capacitor's vinyl sleeve. For heat curing, do not exceed 150 ℃ for the maximum time of 2 minutes.

2.6 Capacitor Handling after Soldering

(1) Avoid moving the capacitor after soldering to prevent excessive stress on the lead wires where they enter the seal.
(2) Do not use the capacitor as a handle when moving the circuit board assembly.
(3) Avoid striking the capacitor after assembly to prevent failure due to excessive shock.

2.7 Circuit Board Cleaning

(1) Circuit boards can be immersed or ultrasonically cleaned using suitable cleaning solvents for up to 5 minutes and up to 60 ℃ maximum temperatures. The boards should be thoroughly rinsed and dried.

The use of ozone depleting cleaning agents is not recommended for the purpose of protecting our environment.

(2) Avoid using the following solvent groups unless specifically allowed in the specification ;

- Halogenated cleaning solvents : except for solvent resistant capacitor types, halogenated solvents can permeate the seal and cause internal capacitor corrosion and failure. For solvent resistant capacitors, carefully follow the temperature and time requirements based on the specification. 1-1-1 trichloroethane should never be used on any aluminum electrolytic capacitor.
- Alkaline solvents : could react and dissolve the aluminum case.
- Petroleum based solvents : deterioration of the rubber seal could result.
- Xylene : deterioration of the rubber seal could result.
- Acetone : removal of the ink markings on the vinyl sleeve could result.

(3) A thorough drying after cleaning is required to remove residual cleaning solvents that may be trapped between the capacitor and the circuit board. Avoid drying temperatures, which exceed the Upper category temperature of the capacitor.

(4) Monitor the contamination levels of the cleaning solvents during use in terms of electrical conductivity, pH, specific gravity, or water content. Chlorine levels can rise with contamination and adversely affect the performance of the capacitor.

Please consult us if you are not certain about acceptable cleaning solvents or cleaning methods.

2.8 Mounting Adhesives and Coating Agents

When using mounting adhesives or coating agents to control humidity, avoid using materials containing halogenated solvents. Also, avoid the use of chloroprene based polymers.
Harden on dry adhesive or coating agents well lest the solvent should be left.

After applying adhesives or coatings, dry thoroughly to prevent residual solvents from being trapped between the capacitor and the circuit board.

2.9 Fumigation

In exporting electronic appliances with aluminum electrolytic capacitors, in some cases fumigation treatment using such halogen compound as methyl bromide is conducted for wooden boxes.
If such boxes are not dried well, the halogen left in the box is dispersed while transported and enters in the capacitors inside.
This possibly causes electrical corrosion of the capacitors. Therefore, after performing fumigation and drying make sure that no halogen is left.
Don't perform fumigation treatment to the whole electronic appliances packed in a box.

3. Precautions for using capacitors

3.1 Environmental Conditions

Capacitors should not be stored or used in the following environments.

(1) Exposure to temperatures above the upper category or below the lower category temperature of the capacitor.
(2) Direct contact with water, salt water, or oil.
(3) High humidity conditions where water could condense on the capacitor.
(4) Exposure to toxic gases such as hydrogen sulfide, sulfuric acid, nitric acid, chlorine, Chlorine compound, Bromine, Bromine compound or ammonia.
(5) Exposure to ozone, radiation, or ultraviolet rays.
(6) Vibration and shock conditions exceeding specified requirements.

3.2 Electrical Precautions

(1) Avoid touching the terminals of a capacitor as a possible electric shock could result. The exposed aluminum case is not insulated and could also cause electric shock if touched.
(2) Avoid short circuiting the area between the capacitor terminals with conductive materials including liquids such as acids or alkaline solutions.

4. Emergency Procedures

(1) If the pressure relief of the capacitor operates, immediately turn off the equipment and disconnect from the power source. This will minimize an additional damage caused by the vaporizing electrolyte.
(2) Avoid contact with the escaping electrolyte gas, which can exceed 100 ℃ temperatures.
If electrolyte or gas enters the eye, immediately flush the eye with large amounts of water.
If electrolyte or gas is ingested by mouth, gargle with water.
If electrolyte contacts the skin, wash with soap and water.

5. Long Term Storage

Leakage current of a capacitor increases with long storage times. The aluminum oxide film deteriorates as a function of temperature and time. If used without reconditioning, an abnormally high current will be required to restore the oxide film.
This surge current could cause the circuit or the capacitor to fail. After one year, a capacitor should be reconditioned by applying the rated voltage in series with a 1000 Ω current limiting resistor for a time period of 30 minutes.

5.1 Environmental Conditions

(1) Exposure to temperatures above the upper category or below the lower category temperature of the capacitor.
(2) Direct contact with water, salt water, or oil.
(3) High humidity conditions where water could condense on the capacitor.
(4) Exposure to toxic gases such as hydrogen sulfide, sulfuric acid, nitric acid, chlorine, Chlorine compound, Bromine, Bromine compound or ammonia.
(5) Exposure to ozone, radiation, or ultraviolet rays.
(6) Vibration and shock conditions exceeding specified requirements.

6. Capacitor Disposal

When disposing capacitors, use one of the following methods.

(1) Incinerate after crushing the capacitor or puncturing the can wall (to prevent explosion due to internal pressure rise). Capacitors should be incinerated at high temperatures to prevent the release of toxic gases such as chlorine from the polyvinyl chloride sleeve, etc.
(2) Dispose as solid waste.

NOTE : Local laws may have specific disposal requirements which must be followed.