Radial lead type

Discontinued

Series: HFQ Type : A

■ Features Endurance :105°C 1000 to 2000h
Low impedance (1/3 to 1/4 of Series HFE)

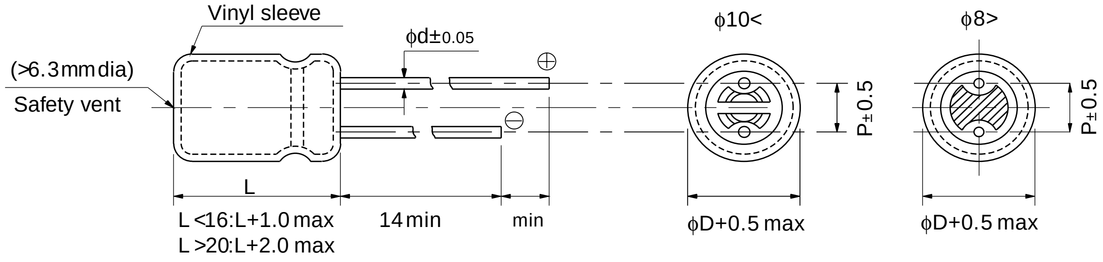
■Specification

<table>
<tr><td>Operating Temp. Range</td><td>-55 to + 105°C</td></tr>
<tr><td>Rated W.V. Range</td><td>6.3 to 63 V .DC</td></tr>
<tr><td>Nominal Cap. Range</td><td>6.8 to 15000 μ F</td></tr>
<tr><td>Capacitance</td><td>±20 % (120Hz/+20°C)</td></tr>
<tr><td>DC leakage current</td><td>I < 0.01 CV or 3 (μ A) after 3 minutes</td></tr>
<tr><td>Dissipation Factor</td><td><table><tr><td>W.V.</td><td>6.3</td><td>10</td><td>16</td><td>25</td><td>35</td><td>50</td><td>63</td></tr><tr><td>tan δ</td><td>0.22</td><td>0.19</td><td>0.16</td><td>0.14</td><td>0.12</td><td>0.10</td><td>0.08</td></tr></table> (max.) (120Hz /+20°C)
Add 0.02 per 1000μF for products of 1000μF or more</td></tr>
<tr><td>Characteristics at Low Temperature</td><td>Impedance at -10°C, 100kHz < 200 % of initial specified value at +20°C,100kHz.
(Impedance ratio at 100kHz)</td></tr>
<tr><td>Endurance</td><td>After following life test with DC voltage and +105±2°C ripple current value applied. (The sum of DC and ripple peak voltage shall not exceed the rated working voltage), the capacitors shall meet the limits specified below.
Duration:1000 hours (ϕ4 to 8), 2000 hours (ϕ10 to 18) post test requirements at +20°C<table><tr><td>Capacitance change</td><td>±20% of the initial measured value</td></tr><tr><td>D.F.</td><td><200% of the initial specified value</td></tr><tr><td>DC leakage current</td><td>< initial specified value</td></tr></table></td></tr>
<tr><td>Shelf life</td><td>After storage for 1000 hours at +105±2°C with no voltage applied and then being stabilized at +20°C, capacitor shall meet the limits specified in “Endurance”.</td></tr>
</table>

■ Explanation of Part Number

E	C	A			F	Q					
Product Code			R.W.V. code		Series Code		Capacitance code			Option	

■ Dimensions in mm (not to scale)



Body Dia. ϕD	4	5	6.3	8	10	12.5		16	18
Body Length L						15 to 25	30 to 40		
Lead Dia. ϕd	0.45	0.5	0.5	0.6	0.6	0.6	0.8	0.8	0.8
Lead space P	1.5	2	2.5	3.5	5	5	5	7.5	7.5

■ Frequency correction factor for ripple current

W.V. (V.DC)	Capacitance (μF)	Frequency(Hz)				
		60	120	1k	10k	100k
6.3 to 63	6.8 to 330	0.55	0.65	0.85	0.90	1.0
	390 to 1000	0.70	0.75	0.90	0.95	1.0
	1200 to 2200	0.75	0.80	0.90	0.95	1.0
	2700 to 15000	0.80	0.85	0.95	1.00	1.0

Mar. 2005

Discontinued

■ Case size / Impedance / Ripple current

W.V.(V.DC)	6.3 (0J)				10 (1A)			
Case size (φD×L)	Capacitance (µF)	Impedance (100kHz) (W)		Ripple current (100kHz) (+105°C) (mA)	Capacitance (µF)	Impedance (100kHz) (Ω)		Ripple current (100kHz) (+105°C) (mA)
		-10°C	+20°C			-10°C	+20°C	
4 × 11	68	2.000	1.000	120	47	2.000	1.000	120
5 × 11	100	1.300	0.650	175	82	1.300	0.650	175
5 × 15	150	0.920	0.460	235	100	0.920	0.460	235
6.3 × 11.2	220	0.600	0.300	290	180	0.600	0.300	290
6.3 × 15	330	0.400	0.200	400	220	0.400	0.200	400
8 × 11.5	470	0.340	0.170	445	330	0.340	0.170	445
8 × 15	680L❇	0.240	0.120	575	470L❇	0.240	0.120	575
8 × 20	1000	0.180	0.090	760	680	0.180	0.090	760
10 × 12.5	680	0.240	0.120	625	470	0.240	0.120	625
10 × 16	820	0.180	0.090	795	560	0.180	0.090	795
10 × 20	1200L❇	0.130	0.065	1015	1000L❇	0.130	0.065	1015
10 × 25	1500	0.110	0.055	1190	1200	0.110	0.055	1190
10 × 30	2200L❇	0.090	0.045	1440	1500L❇	0.090	0.045	1440
12.5 × 15	1200	0.130	0.065	1010	1000	0.130	0.065	1010
12.5 × 20	2200	0.084	0.042	1400	1800	0.084	0.042	1400
12.5 × 25	2700	0.068	0.034	1690	2200	0.068	0.034	1690
12.5 × 30	3900	0.060	0.030	1950	2700	0.060	0.030	1950
12.5 × 35	4700L❇	0.048	0.024	2220	3300L❇	0.048	0.024	2220
12.5 × 40	5600L❇	0.042	0.021	2390	3900L❇	0.042	0.021	2390
16 × 15	2700S❇	0.092	0.046	1360	1800S❇	0.092	0.046	1360
16 × 20	4700	0.068	0.034	1730	3300	0.068	0.034	1730
16 × 25	5600	0.056	0.028	2070	3900	0.056	0.028	2070
16 × 31.5	6800	0.050	0.025	2350	5600	0.050	0.025	2350
16 × 35.5	8200	0.044	0.022	2550	6800L❇	0.044	0.022	2550
16 × 40	12000	0.036	0.018	2900	8200L❇	0.036	0.018	2900
18 × 15	3300	0.076	0.038	1620	2200S❇	0.076	0.038	1620
18 × 20	5600S❇	0.056	0.028	2000	3900S❇	0.056	0.028	2000
18 × 25	6800S❇	0.050	0.025	2200	5600S❇	0.050	0.025	2200
18 × 31.5	10000	0.046	0.023	2800	6800	0.046	0.023	2800
18 × 35.5	12000S❇	0.042	0.021	2900	8200	0.042	0.021	2900
18 × 40	15000	0.034	0.017	3000	10000	0.034	0.017	3000

W.V.(V.DC)	16 (1C)				25 (1E)			
Case size (φD×L)	Capacitance (µF)	Impedance (100kHz) (Ω)		Ripple current (100kHz) (+105°C) (mA)	Capacitance (µF)	Impedance (100kHz) (Ω)		Ripple current (100kHz) (+105°C) (mA)
		-10°C	+20°C			-10°C	+20°C	
4 × 11	39	2.000	1.000	120	27	2.000	1.000	120
5 × 11	56	1.300	0.650	175	39	1.300	0.650	175
5 × 15	82	0.920	0.460	235	56	0.920	0.460	235
6.3 × 11.2	120	0.600	0.300	290	82	0.600	0.300	290
6.3 × 15	180	0.400	0.200	400	120	0.400	0.200	400
8 × 11.5	270	0.340	0.170	445	180	0.340	0.170	445
8 × 15	330L❇	0.240	0.120	575	220L❇	0.240	0.120	575
8 × 20	470	0.180	0.090	760	330	0.180	0.090	760
10 × 12.5	330	0.240	0.120	625	220	0.240	0.120	625
10 × 16	390	0.180	0.090	795	270	0.180	0.090	795
10 × 20	680L❇	0.130	0.065	1015	470L❇	0.130	0.065	1015
10 × 25	820	0.110	0.055	1190	560	0.110	0.055	1190
10 × 30	1200L❇	0.090	0.045	1440	820L❇	0.090	0.045	1440
12.5 × 15	680	0.130	0.065	1010	470	0.130	0.065	1010
12.5 × 20	1200	0.084	0.042	1400	820	0.084	0.042	1400
12.5 × 25	1500	0.068	0.034	1690	1000	0.068	0.034	1690
12.5 × 30	2200L❇	0.060	0.030	1950	1500L❇	0.060	0.030	1950
12.5 × 35	2700L❇	0.048	0.024	2220	1800L❇	0.048	0.024	2220
12.5 × 40	3300L❇	0.042	0.021	2390	2200L❇	0.042	0.021	2390
16 × 15	1500S❇	0.092	0.046	1360	820S	0.092	0.046	1360
16 × 20	2200	0.068	0.034	1730	1500	0.068	0.034	1730
16 × 25	2700	0.056	0.028	2070	1800	0.056	0.028	2070
16 × 31.5	3900	0.050	0.025	2350	2700	0.050	0.025	2350
16 × 35.5	4700L❇	0.044	0.022	2550	3300L❇	0.044	0.022	2550
16 × 40	5600	0.036	0.018	2900	3900L❇	0.036	0.018	2900
18 × 15	1800	0.076	0.038	1620	1200	0.076	0.038	1620
18 × 20	3300S❇	0.056	0.028	2000	2200S❇	0.056	0.028	2000
18 × 25	3900S❇	0.050	0.025	2200	2700S❇	0.050	0.025	2200
18 × 31.5	4700	0.046	0.023	2800	3300	0.046	0.023	2800
18 × 35.5	6800	0.042	0.021	2900	3900	0.042	0.021	2900
18 × 40	8200	0.034	0.017	3000	4700	0.034	0.017	3000

❇ L or S in case size table are optional codes.

Discontinued

■ Case size / Impedance / Ripple current

W.V.(V.DC)	35 (1V)				50 (1H)			
Case size (ϕD×L)	Capacitance (µF)•@	Impedance (100kHz) (Ω)		Ripple current (100kHz) (+105°C) (mA)	Capacitance (µF)	Impedance (100kHz) (Ω)		Ripple current (100kHz) (+105°C) (mA)
		-10°C	+20°C			-10°C	+20°C	
4 × 11	18	2.000	1.000	120	10	5.000	2.500	90
5 × 11	27	1.300	0.650	175	18	2.600	1.300	155
5 × 15	39	0.920	0.460	235	27	1.800	0.900	215
6.3 × 11.2	56	0.600	0.300	290	33	1.200	0.600	260
6.3 × 15	82	0.400	0.200	400	56	0.800	0.400	360
8 × 11.5	120	0.340	0.170	445	68	0.600	0.300	410
8 × 15	150L❇	0.240	0.120	575	100	0.460	0.230	500
8 × 20	220	0.180	0.090	760	150	0.320	0.160	670
10 × 12.5	150	0.240	0.120	625	82	0.460	0.230	510
10 × 16	180	0.180	0.090	795	120	0.320	0.160	640
10 × 20	330L❇	0.130	0.065	1015	220L❇	0.220	0.110	890
10 × 25	390	0.110	0.055	1190	270	0.180	0.090	1040
10 × 30	560L❇	0.090	0.045	1440	390L❇	0.150	0.075	1300
12.5 × 15	330	0.130	0.065	1010	220	0.260	0.130	920
12.5 × 20	560	0.084	0.042	1400	330	0.160	0.080	1200
12.5 × 25	680	0.068	0.034	1690	470	0.140	0.070	1440
12.5 × 30	1000L❇	0.060	0.030	1950	560	0.120	0.060	1680
12.5 × 35	1200L❇	0.048	0.024	2220	680L❇	0.100	0.050	1850
12.5 × 40	1500L❇	0.042	0.021	2390	820L❇	0.086	0.043	2010
16 × 15	560S❇	0.092	0.046	1360	390	0.168	0.084	1270
16 × 20	1000	0.068	0.034	1730	680	0.106	0.053	1470
16 × 25	1200	0.056	0.028	2070	820	0.088	0.044	1810
16 × 31.5	1800	0.050	0.025	2350	1000	0.066	0.033	2120
16 × 35.5	2200L❇	0.044	0.022	2550	1200L❇	0.056	0.028	2260
16 × 40	2700L❇	0.036	0.018	2900	1500L❇	0.052	0.026	2410
18 × 15	820	0.076	0.038	1620	470S❇	0.140	0.070	1470
18 × 20	1500	0.056	0.028	2000	680S❇	0.100	0.050	1810
18 × 25	1800S❇	0.050	0.025	2200	1000S❇	0.082	0.041	2000
18 × 31.5	2200	0.046	0.023	2800	1200	0.062	0.031	2220
18 × 35.5	2700	0.042	0.021	2900	1500	0.054	0.027	2460
18 × 40	3300	0.034	0.017	3000	1800	0.050	0.025	2560

W.V.(V.DC)	63 (1J)			
Case size (ϕD×L)	Capacitance (µF)	Impedance (100kHz) (Ω)		Ripple current (100kHz) (+105°C) (mA)
		-10°C	+20°C	
4 × 11	6.8	7.000	3.500	80
5 × 11	12	4.000	2.000	145
5 × 15	18	2.600	1.300	200
6.3 × 11.2	22	2.000	1.000	240
6.3 × 15	39	1.400	0.700	330
8 × 11.5	56	0.760	0.380	370
8 × 15	82	0.600	0.300	450
8 × 20	100L❇	0.380	0.190	600
10 × 12.5	68	0.600	0.300	470
10 × 16	100	0.380	0.190	580
10 × 20	150L❇	0.280	0.140	820
10 × 25	180	0.240	0.120	950
10 × 30	270L❇	0.190	0.095	1110
12.5 × 15	150	0.320	0.160	890
12.5 × 20	220	0.190	0.095	1140
12.5 × 25	330	0.180	0.090	1420
12.5 × 30	390	0.160	0.080	1620
12.5 × 35	470L❇	0.130	0.065	1780
12.5 × 40	560L❇	0.120	0.060	1950
16 × 15	270	0.200	0.100	1220
16 × 20	470	0.140	0.070	1450
16 × 25	560	0.120	0.060	1750
16 × 31.5	680	0.100	0.050	2050
16 × 35.5	820	0.084	0.042	2220
16 × 40	1000L❇	0.068	0.034	2370
18 × 15	330S❇	0.170	0.085	1410
18 × 20	560S❇	0.130	0.065	1750
18 × 25	680S❇	0.114	0.057	1940
18 × 31.5	1000	0.096	0.048	2110
18 × 35.5	1200	0.082	0.041	2300
18 × 40	1500	0.066	0.033	2510

⚠ Application Guidelines

1. Circuit Design

Ensure that operational and mounting conditions follw the specified conditions detailed in the catalog and specification sheets.

1.1 Operating Temperature and Frequency

Electrolytic capacitor electrical parameters are normally specified at 20°C temperature and 120Hz 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, ripple current generated heat 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°C reduction in temperature will double the expected life. Use capacitors at the lowest possible temperature below the maximum guaranteed temperature.

(2) If operating conditions exceed the maximum guaranteed limit, rapid electrical parameter deterioration will occur, and irreversible damage will result.

Check for maximum capacitor operating temperatures including ambient temperature, internal capacitor temperature rise caused by 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.

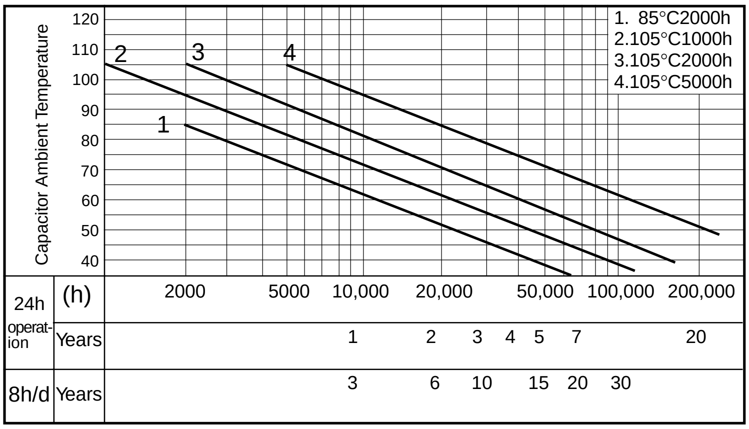
(3)The formula for calculating expected life at lower operating temperatures is as fllows;

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

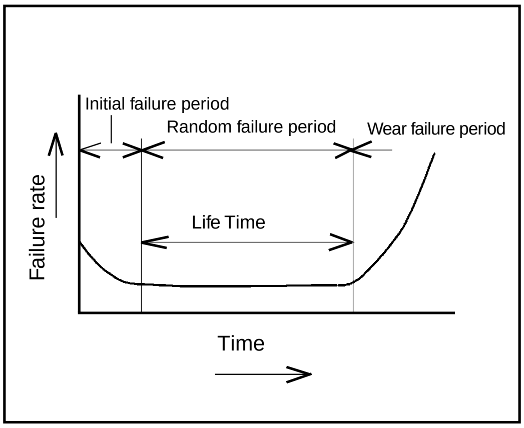
L_1: Guaranteed life (h) at temperature, T_1° C
L_2: Expected life (h) at temperature,T_2°C
T_1: Maximum operating temperature (°C)
T_2: Actual operating temperature, ambient temperature + temperature rise due to ripple currentheating(°C)

A quick eference capacitor guide for estimating exected life is included for your reference.

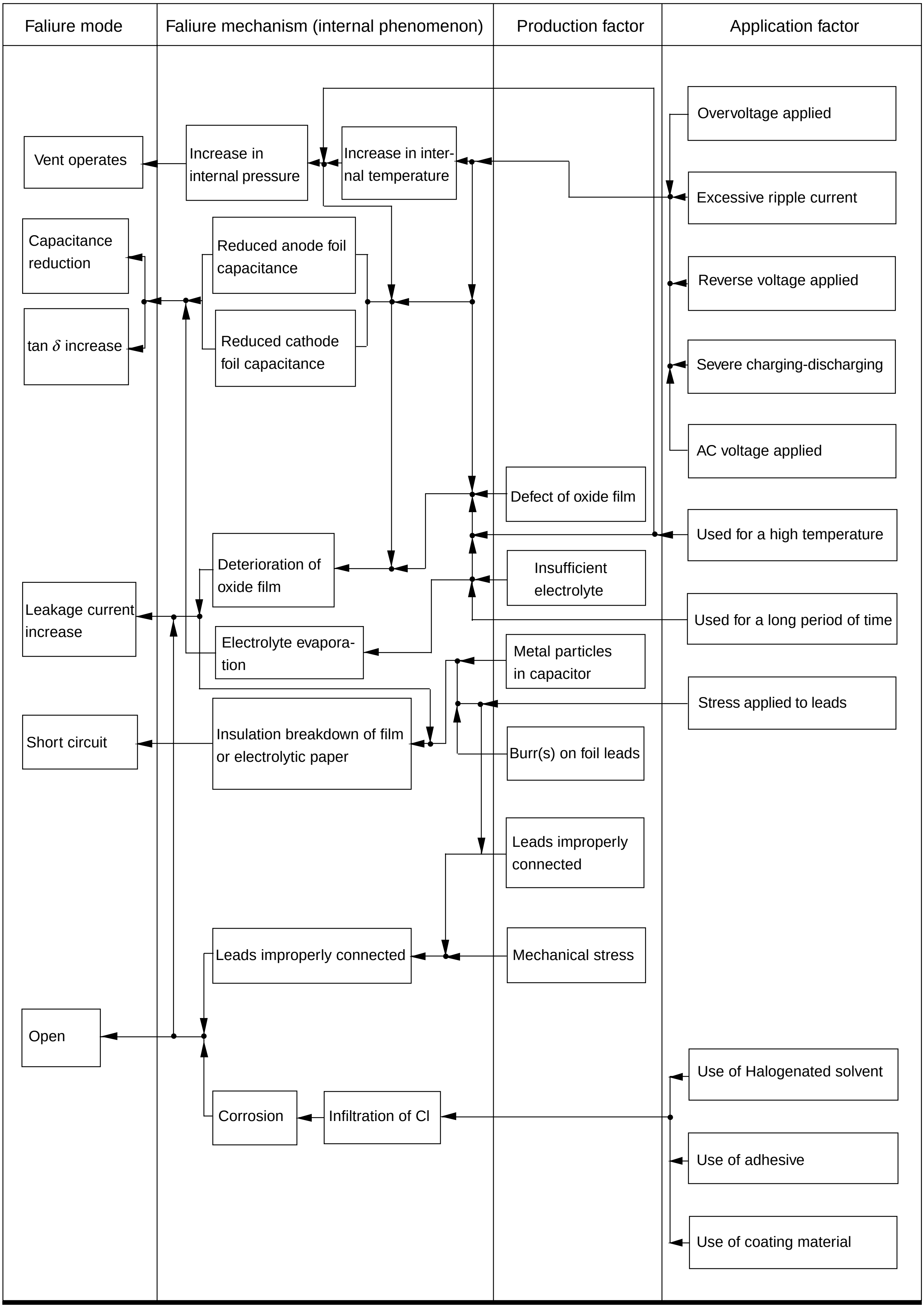
■ Expected Life Estimate Quick Reference Guide



■ Failure rate curve



■ Typical failure modes and their factors



1.3 Common Application Conditions to Avoid

The following misapplication load conditions will cause rapid deterioration to capacitor 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 could result. Leakinq electrolyte is combustible and electrically conductive.

(1) Reverse Voltaqe

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) Charqe/Discharqe Applications

Standard capacitors are not suitable for use in repeating charge/discharge applications. For charqe/discharqe applications consult us and advise actual conditions.

(3) Overvoltage

Do not apply voltaqes exceeding the maximum specified rated voltages. Voltage 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 or contact us with your requirements.

Ensure that allowable ripple currents 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 design of wiring methods can minimize the possibility of excessive ripple currents applied to a capacitor.

(2) Capacitors Connected in Series

Normal DC leakage current differences 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, excess solder may collect under the capacitor by capillary action and shortcircuit the 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 for subsequently processed parts. Special care when locating hole positions in proximity to capacitors is recommended.

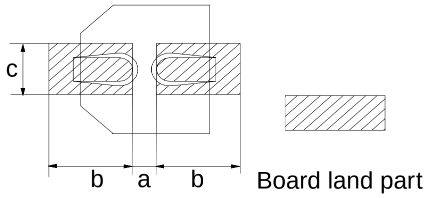
(3) Circuit Board Hole Spacing

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

(4)Land/Pad Pattern

The circuit board land/pad pattern size for chip capacitors is specified in the following table.

[Table of Board Land Size vs. Capacitor Size]



(mm)

Size	a	b	c
A(ϕ3)	0.6	2.2	1.5
B(ϕ4)	1.0	2.5.	1.6
C(ϕ5)	1.5	2.8	1.6
D(ϕ6.3)	1.8	3.2	1.6
E(ϕ8 x 6.2L)	2.2	4.0	1.6
F(ϕ8 x 10.2L)	3.1	4.0	2.0
G(ϕ10 x 10.2L)	4.6	4.1	2.0

Among others, when the size a is wide , back fillet can not be made, decreasing fitting strength.

❇ Decide considering mounting condition, solderability and fitting strength, etc. based on the design standards of your company.

(5) Clearance for Case Mounted Pressure Relief Vents

Capacitors with case mounted pressure relief vents require sufficient clearance to allow for proper vent operation. The minimum clearances are dependent on capacitor diameters as follows.

ϕ6.3 to ϕ16 mm : 2 mm minimum,
ϕ18 to ϕ35 mm : 3 mm minimum.
ϕ40 mm or greater: 5 mm minimum

(6) Clearance for Seal Mounted Pressure Relief Vents

A hole in the circuit board directly under the seal vent location is required to allow proper release of pressure.

(7) Wiring Near the Pressure Relief Vent

Avoid locating high voltage or high current wiring or circuit board paths above the pressure relief vent. Flammable, high temperature gas exceeding 100°C may be released which could dissolve the wire insulation and ignite.

(8) Circuit Board Patterns Under the Capacitor

Avoid circuit board runs under the capacitor as electrolyte leakage could cause an electrical short.

(9) Screw Terminal Capacitor Mounting

- Do not orient the capacitor with the screw terminal side of the capacitor facing downwards.
- 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.

- Between the cathode and the case (except for axially leaded B types) and between the anode terminal and other circuit paths.
- 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 sleeving may split or crack if immersed into solvents such as toluene or xylene, and then exposed to high temperatures.

Always consider safety when designing equipment and circuits. Plan for worst case failure modes such as short circuits and open circuits which could occur during use.

(1) Provide protection circuits and protection devices to allow safe failure modes.
(2) Design redundant or secondary circuits where possible to assure 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 1 kΩ.
(3) Capacitors stored for long periods 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 1 kΩ.
(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 compromised 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 inserting.
(3) Verify the correct hole spacing before insertion (land pattern size on chip type) to avoid stress on the terminals.
(4) Ensure that the auto insertion equipment lead clinching operation 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

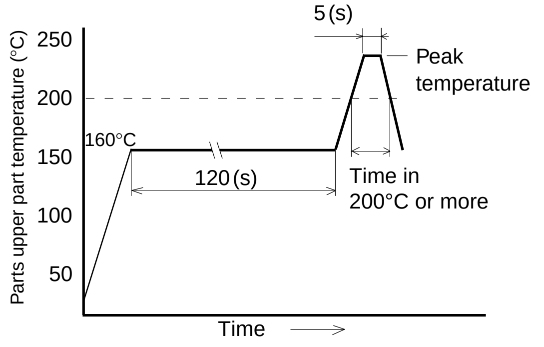
(1) Observe temperature and time soldering specifications or do not exceed temperatures of 350°C for 3 seconds or less.
(2) If lead wires must be formed to meet terminal board hole spacing, avoid stress on the leadwire where it enters the capacitor seal.
(3) If a soldered capacitor must be removed and reinserted, avoid excessive stress to the capacitor leads.
(4) Aviod touching the tip of the soldering iron to the capacitor, to prevent melting of the vinyl sleeve.

2.4 Flow Soldering

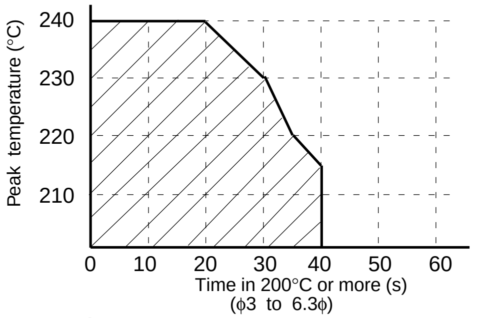
(1) Don not immerse the capacitor body into the solder bath as excessive internal pressure could result.
(2) Observe proper soldering conditions (temperature, time, etc.). Do not exceed the specified limits.
(3) Do not allow other parts or components to touch the capacitor during soldering.

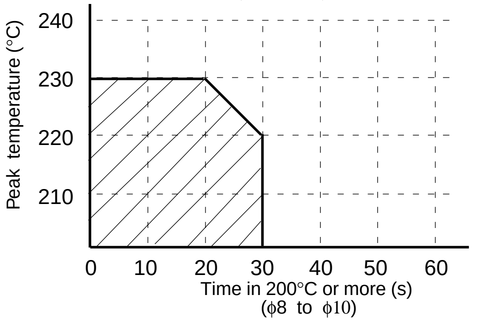
2.5 Reflow Soldering for Chip Capacitors

(1) For reflow, use a thermal conduction system such as infrared radiation (IR) or hot blast. Vapor heat transfer systems (VPS) are not recommended.
(2) Observe proper soldering conditions (temperature, time, etc.). Do not exceed the specified limits.
(3) Reflow should be performed one time. Consult us for additional reflow restrictions.

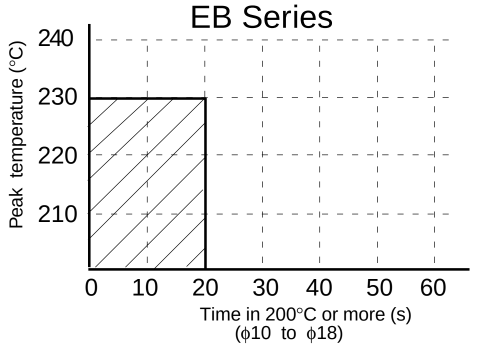


Chip capacitor reflow guaranteed condition





EB Series



2.6 Other Soldering Considerations

Rapid temperature rises during the preheat operation and resin bonding operation can cause cracking of the capacitor vinyl sleeve. For heat curing, do not exceed 150°C for a maximum time of 2 minutes.

2.7 Capacitor Handling after Soldering

(1) Avoid movement of the capacitor after soldering to prevent excessive stress on the leadwires 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.

2.8 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°C maximum temperatures. The boards should be thoroughly rinsed and dried.

Recommended cleaning solvents include Pine Alpha ST-100S, Sunelec B-12, DK Beclear CW-5790, Aqua Cleaner 210SEP, Cold Cleaner P3-375, Telpen Cleaner EC-7R, Clean-thru 750H, Clean-thru 750L, Clean thru 710M, Techno Cleaner 219, Techno Care FRW-17, Techno Care FRW-1, Techno Care FRV-1, IPA (isopropyl alcohol)

✻ The use of ozone depleting cleaning agents are not recommended in the interest of protecting the environment.

(2) Avoid using the following solvent groups unless specifically allowed for 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 of the specificaion. 1-1-1 trichloroe thane should never be used on any aluminium electrolytic capacitor.
- Alkali solvents: could attack 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.

✻ Temperature measuring method: Measure temperature in assuming quantitative production, by sticking the thermo-couple to the capacitor upper part with epoxy adhesives.

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

(4) Monitor the contamination levels of the cleaning solvents during use by 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 for additonal information about acceptable cleaning solvents or cleaning methods.

Type	Series	Cleaning permitted
Surface mount type	V(Except EB Series)	○
Lead type	Bi-polar SU	○
	M	○(~ 100V)
	KA	○
	Bi-polar KA	○
	FB	○
	FC	○
	GA	○
	NHG	○(~ 100V)
	EB	○(~ 100V)
	TA	○
Snap-in type	TS UP	○(~ 100V)
	TS HA	○(~ 100V)

2.9 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.

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

3. Precautions for using capacitors

3.1 Environmental Conditions

Capacitors should not be used in the following environments.

(1) Temperature exposure above the maximum rated or below the minimum rated 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, 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 the capacitor as possible electric shock could result. The exposed aluminium 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 vent of the capacitor operates, immediately turn off the equipment and disconnect from the power source. This will minimize additional damage caused by the vaporizing electrolyte.
(2) Avoid contact with the escaping electrolyte gas which can exceed 100°C 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 aluminium 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 current surge could cause the circuit or the capacitor to fail. Capacitor should be reconditioned by applying rated voltage in series with a 1000 Ω, current limiting resistor for a time period of 30 minutes.

5.1 Environmental Conditions (Storage)

Capacitors should not be stored in the following environments.

(1) Temperature exposure above 35°C or below 15 °C.
(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, or ammonia.
(5) Exposure to ozone, radiation, or ultraviolet rays.
(6) Vibration and shock conditions exceeding specified requirements.

6. Capacitor Disposal

When disposing of capacitors, use one of the following methods.

- 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.
- Dispose of as solid waste.
- Local laws may have specific disposal requirements which must be followed.

The application guidelines above are taken from:

Technical Report EIAJ RCR-2367 issued by the Japan Electronic Industry Association, Inc. -
Guideline of notabilia for aluminium electrolytic capacitors with non-solid electrolytic for use in electronic equipment.

Refer to this Technical Report for additional details.