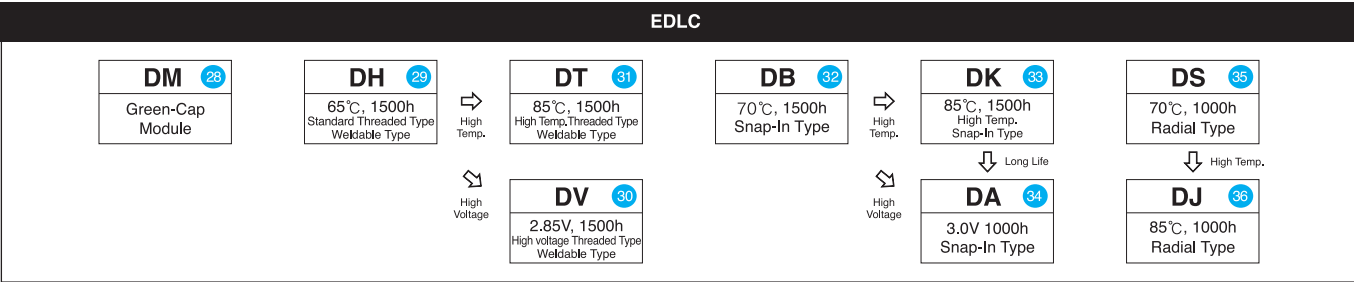
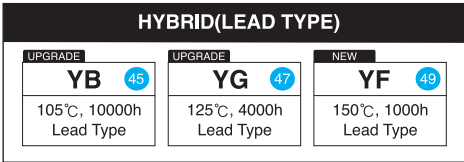
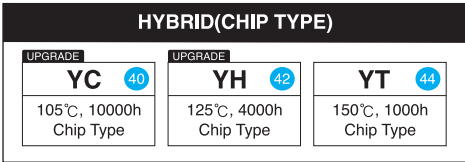


SERIES CHART

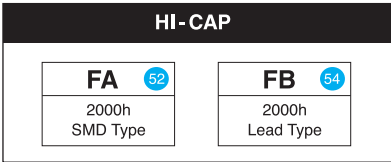
Green-Cap(ELECTRIC DOUBLE LAYER CAPACITORS)



Conductive polymer hybrid aluminum electrolytic capacitors

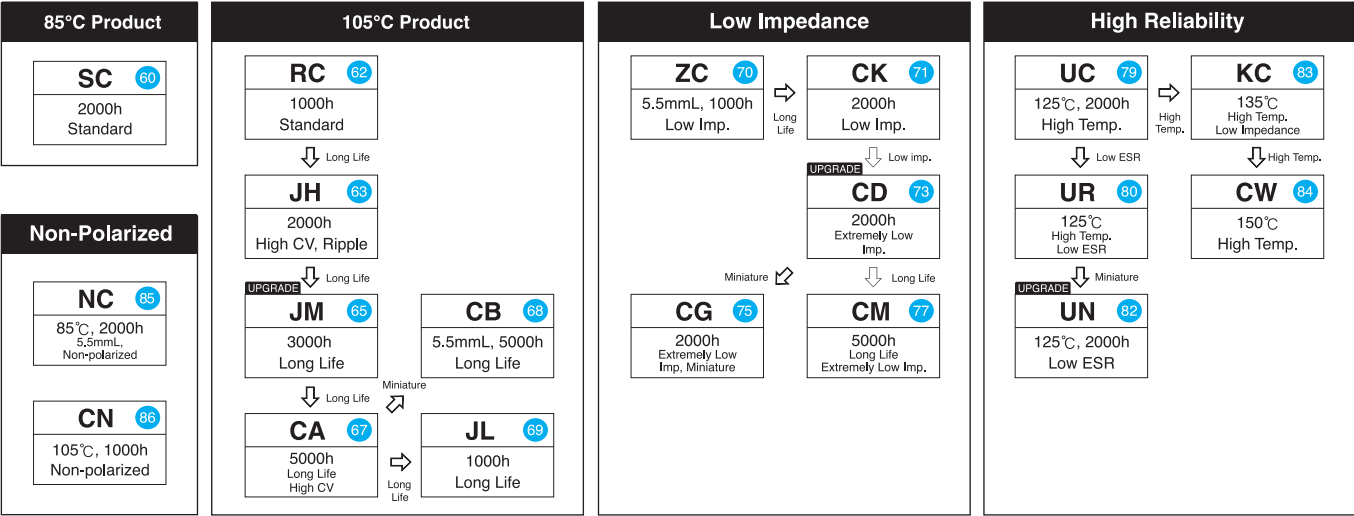


Conductive polymer aluminum electrolytic capacitors

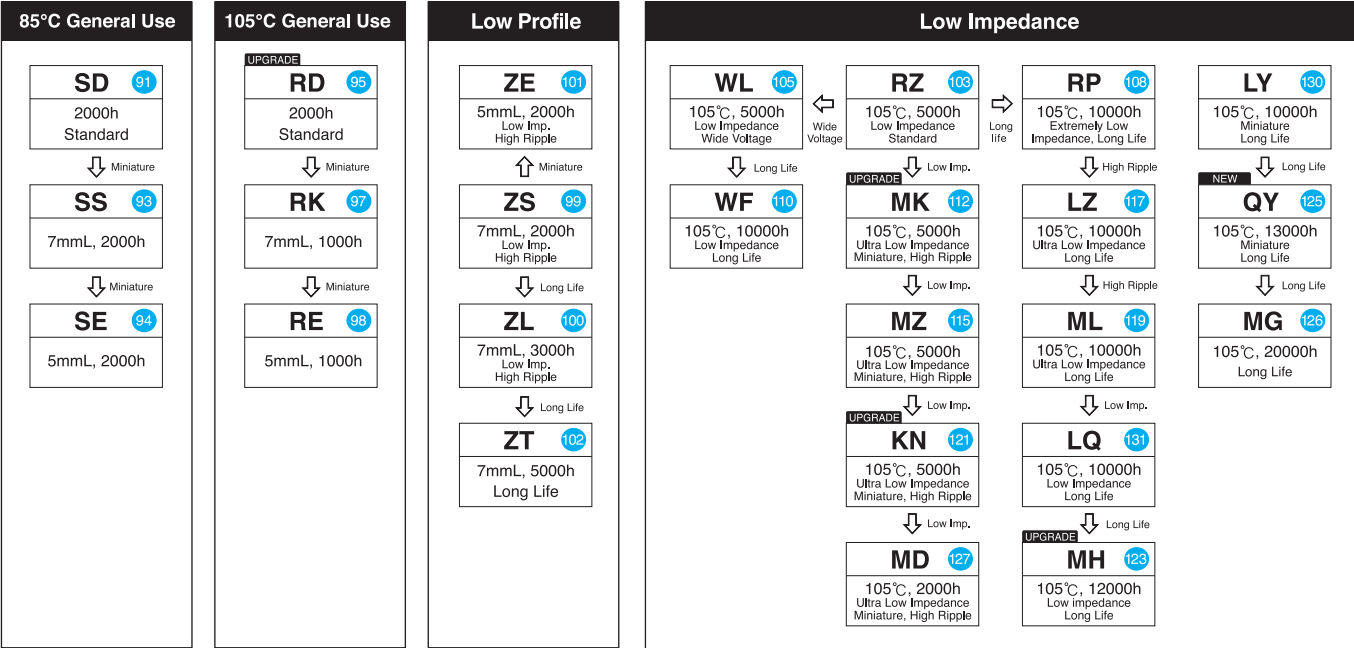


ALUMINUM ELECTROLYTIC CAPACITORS

CHIP TYPES

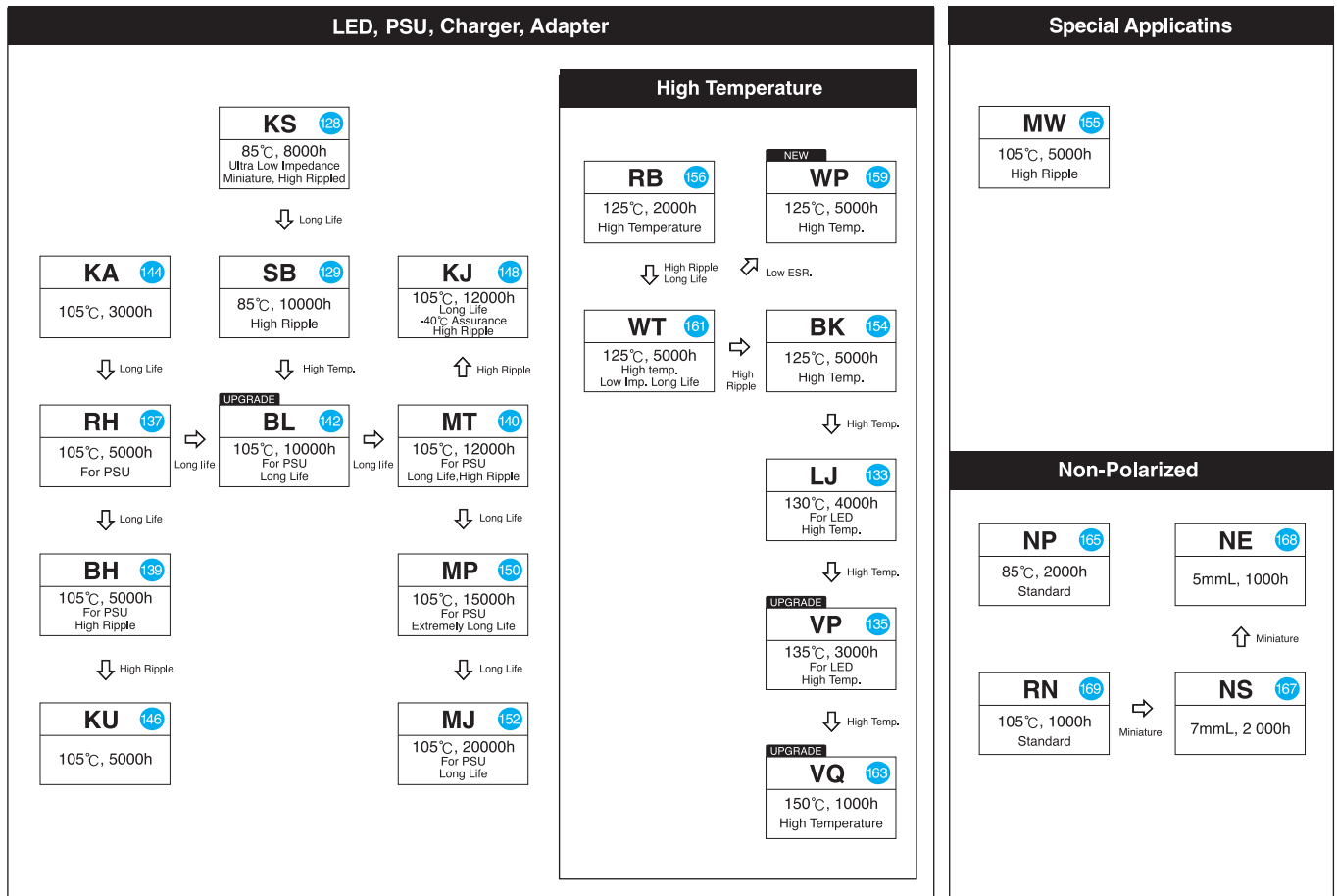


MINIATURE RADIAL LEAD TYPES

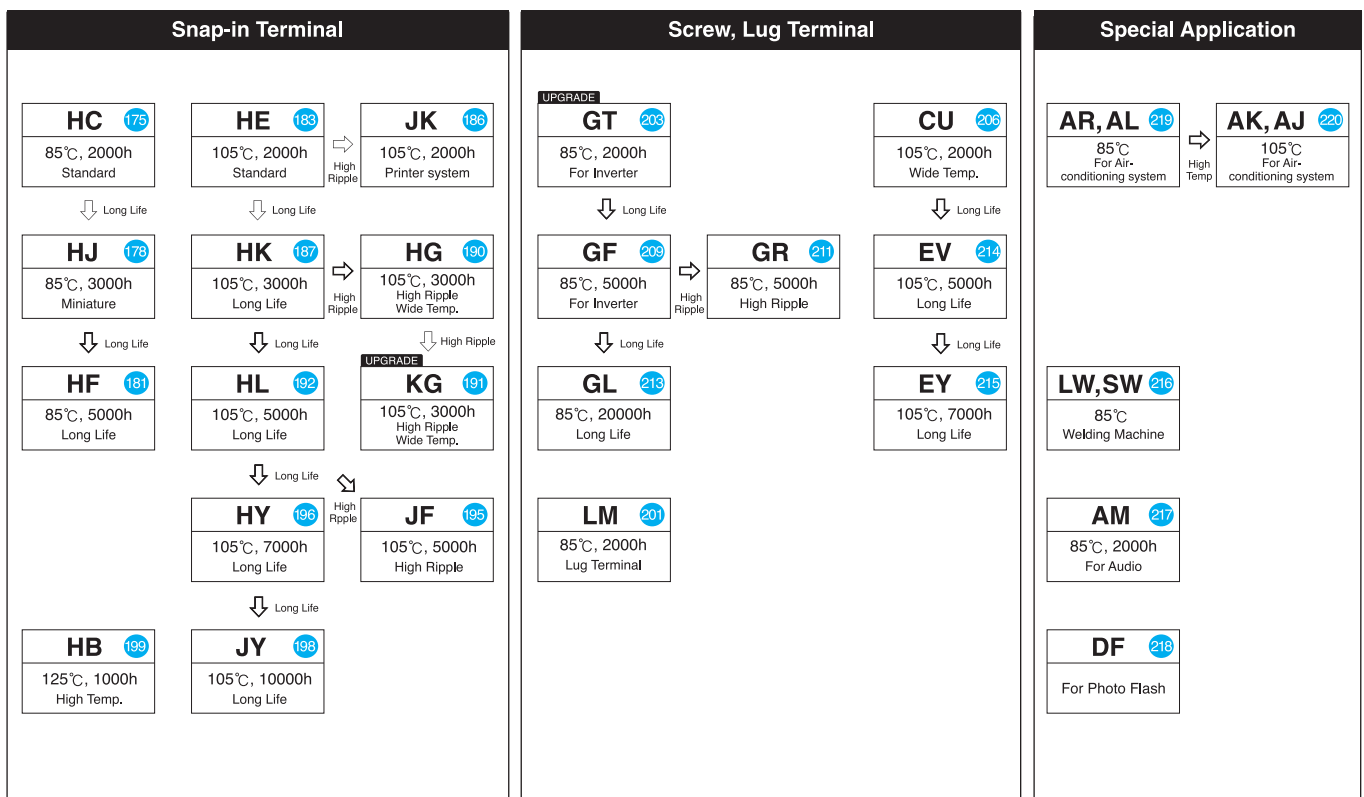


■ ALUMINUM ELECTROLYTIC CAPACITORS

● MINIATURE RADIAL LEAD TYPES



● LARGE TYPES



CONTENTS

1 Green-Cap(Electric Double Layer Capacitors)

★ New series
☆ Upgrade series

| Series | Features | Operating Temperature Range(°C) | Voltage Range (VDC) | Capacitance Range (F) | Load Life Time (hours) | Page |
|--------|--|--|---------------------|-----------------------|------------------------|------|
| DM | Green-Cap Module | Green-Cap modules are supplied on custom-made basis. | | | | 28 |
| DH | Axial type, high power density | -40 ~ 65 | 2.7 | 1200 ~ 3400 | 1500 | 29 |
| DV | Axial type, high power density, high voltage | -40 ~ 65 | 2.85, 3.0 | 1200 ~ 3400 | 1500 | 30 |
| DT | Axial type, high power density, high temp. | -40 ~ 85 | 2.5 | 1200 ~ 3000 | 1500 | 31 |
| DB | Snap-in type, standard series | -25(-40) ~ 70(65) | 2.5, 2.7 | 100 ~ 600 | 2000 | 32 |
| DK | Snap-in type, high temp. | -40 ~ 85 | 2.7 | 100 ~ 400 | 1500 | 33 |
| DA | Snap-in type, high voltage | -40 ~ 65 | 3.0 | 100 ~ 480 | 1500 | 34 |
| DS | Lead type | -30(-40) ~ 70(65) | 2.5, 2.7, 3.0 | 3 ~ 100 | 1000 | 35 |
| DJ | Lead type, high temp. | -40 ~ 85 | 2.5 | 3 ~ 50 | 1000 | 36 |

2 Conductive Polymer Hybrid Aluminum Electrolytic Capacitors

| Series | Features | Operating Temperature Range(°C) | Voltage Range (VDC) | Capacitance Range (μF) | Load Life Time (hours) | Page |
|--------|---|---------------------------------|---------------------|------------------------|------------------------|------|
| SMD | YC ☆ Chip type, Hybrid long life | -55 ~ 105 | 16 ~ 100 | 10 ~ 560 | 10000 | 40 |
| | YH ☆ Chip type, Hybrid high temp. | -55 ~ 125 | 16 ~ 100 | 10 ~ 560 | 4000 | 42 |
| | YT Chip type, Hybrid ultra high temp. | -55 ~ 150 | 25 ~ 63 | 15 ~ 270 | 1000 | 44 |
| LEAD | YB ☆ Lead type, Hybrid long life | -55 ~ 105 | 16 ~ 100 | 10 ~ 560 | 10000 | 45 |
| | YG ☆ Lead type, Hybrid high temp. | -55 ~ 125 | 16 ~ 100 | 10 ~ 560 | 4000 | 47 |
| | YF ★ Lead type, Hybrid ultra high temp. | -55 ~ 150 | 25 ~ 63 | 15 ~ 270 | 1000 | 49 |

3 Conductive Polymer Aluminum Electrolytic Capacitors

| Series | Features | Operating Temperature Range(°C) | Voltage Range (VDC) | Capacitance Range (μF) | Load Life Time (hours) | Page |
|--------|--|---------------------------------|---------------------|------------------------|------------------------|------|
| SMD | FA Chip type, with conductive polymer (Hi-CAP) | -55 ~ 105 | 2.5 ~ 16 | 39 ~ 2700 | 2000 | 52 |
| LEAD | FB Lead type, with conductive polymer (Hi-CAP) | -55 ~ 105 | 2.5 ~ 16 | 100 ~ 3500 | 2000 | 54 |

4 Surface Mount Aluminum Electrolytic Capacitors

| Series | Features | Operating Temperature Range(°C) | General | Miniature | Long Life | Solvent Proof | Voltage Range (VDC) | Capacitance Range (μF) | Load Life Time (hours) | Page |
|--------|--|---------------------------------|---------|-----------|-----------|---------------|---------------------|------------------------|------------------------|------|
| SMD | SC Standard | -40 ~ 85 | ● | | | ● | 4 ~ 450 | 1.0 ~ 2200 | 2000 | 60 |
| | RC Standard, wide temp. | -55 ~ 105 | ● | | | ● | 6.3 ~ 50 | 1.0 ~ 1000 | 1000 | 62 |
| | JH Chip type, high ripple | -55(-40) ~ 105 | | | | ● | 6.3 ~ 450 | 3.3 ~ 2200 | 2000 | 63 |
| | JM ☆ Chip type, long life | -40 ~ 105 | | | ● | ● | 6.3 ~ 450 | 3.3 ~ 2200 | 3000 | 65 |
| | CA Chip type, long life | -55(-40) ~ 105 | | | ● | ● | 6.3 ~ 50 | 10 ~ 1000 | 5000 | 67 |
| | CB Chip type, long life, 5.5mmL height | -40 ~ 105 | | ● | ● | ● | 4 ~ 50 | 1.0 ~ 100 | 5000 | 68 |
| | JL Chip type, long life, for ECU | -40 ~ 105 | | | ● | ● | 10 ~ 50 | 33 ~ 470 | 10000 | 69 |
| | ZC 5.5mmL chip type, low Impedance | -55 ~ 105 | | | | ● | 6.3 ~ 35 | 1.0 ~ 100 | 1000 | 70 |
| | CK Chip type, low Impedance, high CV | -55 ~ 105 | | | | ● | 6.3 ~ 100 | 10 ~ 1500 | 2000 | 71 |
| | CD ☆ Chip type, extremely low Impedance | -55 ~ 105 | | | | ● | 6.3 ~ 100 | 10 ~ 1500 | 2000 | 73 |
| | CG Chip type, extremely low Impedance, miniature | -55 ~ 105 | | ● | | ● | 6.3 ~ 50 | 100 ~ 2200 | 2000 | 75 |
| | CM Chip type, extremely low Impedance, long life | -55 ~ 105 | | | ● | ● | 6.3 ~ 100 | 10 ~ 1000 | 3000 ~ 5000 | 77 |
| | UC Chip type, high temp. for 125°C use | -40 ~ 125 | | | | ● | 10 ~ 400 | 3.3 ~ 1000 | 2000 | 79 |
| | UR Chip type, high temp. low ESR. for 125°C use | -40 ~ 125 | | ● | ● | ● | 10 ~ 400 | 1 ~ 470 | 1000 ~ 5000 | 80 |
| | UN ☆ Chip type, low ESR for 125°C use, Ø6.3×7.7 | -40 ~ 125 | | | | ● | 35 | 47 ~ 330 | 2000 | 82 |
| | KC Chip type, high temp. for 135°C use, low ESR | -40 ~ 135 | | | | ● | 10 ~ 50 | 47 ~ 470 | 2000 | 83 |
| | CW Chip type, high reliability | -40 ~ 150 | | | | ● | 10 ~ 50 | 33 ~ 1000 | 1000 ~ 2000 | 84 |
| | NC 5.3mmL chip, non-polarized | -40 ~ 85 | | | | ● | 6.3 ~ 50 | 1.0 ~ 47 | 2000 | 85 |
| | CN Chip type, wide temp. non-polarized | -55(-40) ~ 105 | | | | ● | 6.3 ~ 50 | 1.0 ~ 47 | 1000 | 86 |

5 Miniature Aluminum Electrolytic Capacitors

★ New series
☆ Upgrade series

| Series | Features | Operating Temperature Range (°C) | General | Miniature | Long Life | Solvent Proof | Voltage Range (VDC) | Capacitance Range (μF) | Load Life Time (hours) | Page |
|----------------------------|----------|---|--------------------|-----------|-----------|---------------|---------------------|------------------------|------------------------|------|
| General Type (85°C) | SD | Standard | -40(-25) ~ 85 | ● | | ● | 6.3 ~ 500 | 1.0 ~ 22000 | 2000 | 91 |
| | SS | Standard, height 7mmL | -40 ~ 85 | ● | | ● | 4 ~ 63 | 1.0 ~ 220 | 2000 | 93 |
| | SE | Standard, height 5mmL | -40 ~ 85 | ● | | ● | 4 ~ 63 | 1.0 ~ 330 | 2000 | 94 |
| General Type (105°C) | RD ☆ | Standard, wide temp | -55(-40,-25) ~ 105 | ● | | ● | 6.3 ~ 500 | 1.0 ~ 22000 | 1000 ~ 2000 | 95 |
| | RK | Wide temp. range, height 7mmL | -55 ~ 105 | ● | | ● | 4 ~ 63 | 1.0 ~ 68 | 1000 | 97 |
| | RE | Wide temp. range, height 5mmL | -55 ~ 105 | ● | | ● | 4 ~ 50 | 1.0 ~ 220 | 1000 | 98 |
| Low Impedance | ZS | Height 7mmL, low impedance, high ripple | -40 ~ 105 | ● | | ● | 6.3 ~ 50 | 2.2 ~ 330 | 2000 | 99 |
| | ZL | Height 7mmL, low impedance, high ripple | -40 ~ 105 | ● | ● | ● | 6.3 ~ 50 | 2.2 ~ 330 | 3000 | 100 |
| | ZE | Height 5mmL, low impedance, high ripple | -55 ~ 105 | ● | | ● | 6.3 ~ 35 | 1.0 ~ 100 | 2000 | 101 |
| | ZT | Height 7mmL, long life | -40 ~ 105 | ● | ● | ● | 6.3 ~ 50 | 2.2 ~ 330 | 5000 | 102 |
| | RZ | Extremely low impedance, high reliability | -55 ~ 105 | | ● | ● | 6.3 ~ 63 | 1.0 ~ 15000 | 2000 ~ 5000 | 103 |
| | WL | Extremely low impedance, miniaturized, wide voltage | -40(-25) ~ 105 | | ● | ● | 6.3 ~ 500 | 1.0 ~ 15000 | 2000 ~ 5000 | 105 |
| | RP | Extremely low impedance, long life | -55 ~ 105 | | ● | ● | 6.3 ~ 50 | 1.0 ~ 15000 | 4000 ~ 10000 | 108 |
| | WF | Extremely low impedance, miniaturized, long life | -40 ~ 105 | ● | ● | ● | 6.3 ~ 100 | 1.0 ~ 15000 | 5000 ~ 10000 | 110 |
| | MK ☆ | Ultra low impedance, miniaturized, high ripple | -40 ~ 105 | ● | ● | ● | 6.3 ~ 100 | 1.0 ~ 15000 | 2000 ~ 5000 | 112 |
| | MZ | Ultra low impedance, miniaturized, high ripple | -40 ~ 105 | ● | ● | ● | 6.3 ~ 100 | 1.0 ~ 15000 | 2000 ~ 5000 | 115 |
| | LZ | Ultra low impedance, long life | -40 ~ 105 | ● | ● | ● | 6.3 ~ 50 | 10 ~ 8200 | 6000 ~ 10000 | 117 |
| | ML | Ultra low impedance, long life | -40 ~ 105 | ● | ● | ● | 6.3 ~ 100 | 10 ~ 10000 | 6000 ~ 10000 | 119 |
| | KN ☆ | Ultra low impedance, high ripple | -40 ~ 105 | ● | ● | ● | 10 ~ 50 | 33 ~ 3300 | 2000 ~ 5000 | 121 |
| | MH ☆ | Ultra low impedance, long life | -40 ~ 105 | ● | ● | ● | 6.3 ~ 50 | 10 ~ 10000 | 7000 ~ 12000 | 123 |
| | QY ★ | For LED lighting applications, long life | -25 ~ 105 | ● | ● | ● | 35 ~ 50 | 22 ~ 560 | 13000 | 125 |
| | MG | For LED lighting applications, long life | -55 ~ 105 | | ● | ● | 10 ~ 35 | 100 ~ 4700 | 20000 | 126 |
| | MD | Ultra low impedance, high ripple | -40 ~ 105 | ● | | ● | 6.3 ~ 16 | 470 ~ 3300 | 2000 | 127 |
| | KS | For PSU applications, high ripple, long life | -25 ~ 85 | | ● | | 420 ~ 500 | 47 ~ 150 | 8000 | 128 |
| | SB | For PSU applications, high ripple, long life | -25 ~ 85 | | ● | | 420 ~ 500 | 47 ~ 150 | 10000 | 129 |
| | LY | For LED lighting applications, long life | -25 ~ 105 | ● | ● | ● | 10 ~ 100 | 1 ~ 330 | 10000 | 130 |
| PSU, Charger, Adapter, LED | LQ | For LED lighting applications, ultra low imp., high ripple | -40 ~ 105 | ● | ● | ● | 6.3 ~ 120 | 27 ~ 8200 | 6000 ~ 10000 | 131 |
| | LJ | For LED lighting applications, wide voltage, high temp. for 130°C use | -40(-25) ~ 130 | | | ● | 10 ~ 400 | 1.0 ~ 4700 | 1000 ~ 4000 | 133 |
| | VP ☆ | For LED lighting applications, high temp. for 135°C use | -40 ~ 135 | | | ● | 10 ~ 35 | 220 ~ 6800 | 3000 | 135 |
| | RH | For PSU applications, high ripple current | -40(-25) ~ 105 | | ● | | 160 ~ 500 | 1.0 ~ 220 | 5000 | 137 |
| | BH | For PSU applications, high ripple current | -25 ~ 105 | | ● | | 200 ~ 400 | 2.2 ~ 100 | 5000 | 139 |
| | MT | For Display applications, high reliability | -40 ~ 105 | | ● | | 160 ~ 500 | 10 ~ 470 | 12000 | 140 |
| | BL ☆ | For PSU applications, long life | -40(-25) ~ 105 | | ● | | 160 ~ 500 | 1.0 ~ 150 | 10000 | 142 |
| | KA | For PSU applications, high ripple current | -40(-25) ~ 105 | | ● | | 400 ~ 500 | 3.3 ~ 150 | 3000 | 144 |
| | KU | For PSU applications, long life, high ripple current | -40(-25) ~ 105 | | ● | | 400 ~ 500 | 1.0 ~ 150 | 5000 | 146 |
| | KJ | For PSU applications, extremely long life, high ripple current | -40(-25) ~ 105 | | ● | | 160 ~ 500 | 1 ~ 470 | 12000 | 148 |
| | MP | For Display applications, long life | -40 ~ 105 | | ● | | 160 ~ 500 | 10 ~ 470 | 12000 ~ 15000 | 150 |
| | MJ ☆ | For PSU applications, high ripple, long life | -40(-25) ~ 105 | | ● | | 160 ~ 500 | 3.3 ~ 470 | 20000 | 152 |
| | BK | For PSU applications, high temp. for 125°C use | -25 ~ 125 | | ● | | 160 ~ 450 | 2.2 ~ 47 | 2000 ~ 5000 | 154 |
| | MW | High ripple current, long life | -40(-25) ~ 105 | | ● | | 25 ~ 500 | 3.3 ~ 470 | 5000 | 155 |
| | RB | High temp. range, for 125°C use, miniaturized | -55(-40) ~ 125 | ● | | ● | 6.3 ~ 250 | 1.0 ~ 15000 | 1000 ~ 2000 | 156 |
| Special Applications | WP ★ | High temp. range, for 125°C use, long life | -40 ~ 125 | ● | ● | ● | 35 ~ 100 | 270 ~ 4700 | 5000 | 159 |
| | WT | High temp. range, for 125°C use, long life, low impedance | -40 ~ 125 | ● | ● | ● | 6.3 ~ 100 | 10 ~ 3300 | 2000 ~ 5000 | 161 |
| | VQ ☆ | High temp. range, for 150°C use, low impedance | -40 ~ 150 | | | ● | 10 ~ 100 | 33 ~ 5600 | 1000 | 163 |
| | NP | Standard | -40 ~ 85 | ● | | ● | 6.3 ~ 250 | 1.0 ~ 10000 | 2000 | 165 |
| | NS | Height 7mm | -40 ~ 85 | ● | | ● | 6.3 ~ 63 | 1.0 ~ 47 | 2000 | 167 |
| | NE | Height 5mm | -40 ~ 85 | ● | | ● | 6.3 ~ 50 | 1.0 ~ 47 | 1000 | 168 |
| | RN | Wide Temp. range | -40 ~ 105 | | | ● | 6.3 ~ 100 | 1.0 ~ 6800 | 1000 | 169 |
| | | | | | | | | | | |
| Non-polarize | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

CONTENTS

⑥ Large Aluminum Electrolytic Capacitors

★ New series
☆ Upgrade series

| Series | | Features | Operating Temperature Range (°C) | General | Miniature | Long life | Solvent Proof | Voltage Range (VDC) | Capacitance Range (μF) | Load Life Time (hours) | Page |
|------------------|-------|---|----------------------------------|---------|-----------|-----------|---------------|---------------------|------------------------|------------------------|------|
| Snap-in Terminal | HC | Standard | -40(-25) ~ 85 | ● | | | ● | 6.3 ~ 550 | 47 ~ 100000 | 2000 | 175 |
| | HJ | Miniaturized | -40(-25) ~ 85 | | ● | | ● | 10 ~ 500 | 56 ~ 56000 | 3000 | 178 |
| | HF | Long life | -40(-25) ~ 85 | | ● | | ● | 160 ~ 450 | 56 ~ 3300 | 5000 | 181 |
| | HE | Wide temp.range, standard | -40(-25) ~ 105 | ● | | | ● | 6.3 ~ 550 | 47 ~ 68000 | 2000 | 183 |
| | JK | Wide temp.range, high ripple current | -40(-25) ~ 105 | ● | | | | 250 ~ 450 | 82 ~ 1500 | 2000 | 186 |
| | HK | Wide temp.range, miniaturized | -40(-25) ~ 105 | | ● | | ● | 6.3 ~ 500 | 68 ~ 68000 | 3000 | 187 |
| | HG | Wide temp.range, high ripple current | -40(-25) ~ 105 | | ● | | | 250 ~ 450 | 150 ~ 680 | 3000 | 190 |
| | KG ☆ | Wide temp. High ripple current | -40 ~ 105 | | ● | | | 400 ~ 500 | 68 ~ 470 | 3000 | 191 |
| | HL | Wide temp.range, miniaturized, long life | -40(-25) ~ 105 | | ● | ● | ● | 10 ~ 500 | 68 ~ 56000 | 5000 | 192 |
| | JF | Wide temp. range, long life, high ripple current | -40 ~ 105 | | ● | ● | | 400 ~ 450 | 56 ~ 470 | 5000 | 195 |
| | HY | Wide temp.range, long life | -40(-25) ~ 105 | | | ● | | 160 ~ 500 | 68 ~ 1800 | 7000 | 196 |
| | JY | Wide temp.range, long life | -25 ~ 105 | | | ● | | 400 ~ 450 | 47 ~ 470 | 10000 | 198 |
| | HB | High temp. range, for 125°C use | -40 ~ 125 | | | | ● | 10 ~ 250 | 100 ~ 15000 | 1000 | 199 |
| Life minif | LM | For general use | -40(-25) ~ 85 | ● | | | ● | 16 ~ 450 | 68 ~ 150000 | 2000 | 201 |
| Screw Terminal | GT ☆ | Standard | -40(-25) ~ 85 | ● | | | | 16 ~ 500 | 180 ~ 680000 | 2000 | 203 |
| | CU | WideTemp. range, standard | -40(-25) ~ 105 | ● | | | | 16 ~ 500 | 1000 ~ 470000 | 2000 | 206 |
| | GF | For inverter circuits, long life | -25 ~ 85 | | | ● | | 350 ~ 600 | 1000 ~ 12000 | 5000 | 209 |
| | GR | For inverter circuits, long life, high ripple | -25 ~ 85 | | | ● | | 400 ~ 450 | 1000 ~ 10000 | 5000 | 211 |
| | GL | High ripple, long life | -25 ~ 85 | | | ● | | 350 ~ 450 | 1500 ~ 12000 | 20000 | 213 |
| | EV | For inverter circuits, long life | -25 ~ 105 | | | ● | | 400 ~ 500 | 1000 ~ 6800 | 2000 ~ 5000 | 214 |
| | EY | For inverter circuits, long life | -25 ~ 105 | | | ● | | 350 ~ 450 | 1500 ~ 12000 | 7000 | 215 |
| Special Type | LW,SW | For welding machine | -25 ~ 85 | | | ● | | 315, 475 | 225 ~ 2200 | - | 216 |
| | AM | For audio equipment | -40 ~ 55 | | | | | 16 ~ 100 | 470 ~ 33000 | 2000 | 217 |
| | DF | For photo flash | -20 ~ 85 | | | | | 330, 360 | 200 ~ 1500 | - | 218 |
| | AR,AL | For invertet air-conditioning system | -40(-25) ~ 85 | | | | | 400 ~ 450 | 560 ~ 1000 | 3000, 5000 | 219 |
| | AK,AJ | For inverter air-conditioning system, high ripple current,long life | -40 ~ 105 | | | | | 450 | 470 ~ 820 | 3000, 5000 | 220 |

● Part Number System

Diagram illustrating the marking code structure for a capacitor, showing 8 groups of digits and their corresponding labels:

- Group 1: Series Name
- Group 2: Rated Voltage
- Group 3: Capacitance
- Group 4: Cap. Tol.
- Group 5: Case Diameter
- Group 6: Case Height
- Group 7: Lead Taping Forming and Cutting
- Group 8: Internal Control Code

| | Type | Code |
|------|---------------------------|------|
| Chip | Reel | VR |
| | Vibration Resistance Reel | VG |
| Lead | Bulk | BB |

| | | | | | |
|----------------------|-----|-----|------------|------------|------------|
| Tolerance (%) | ±10 | ±20 | -10 +20 | -10 +30 | -10 +50 |
| Code | K | M | V | Q | T |

| | | | | |
|-----|------|----|-------|----|
| ex) | Ø4 | 04 | Ø12.5 | 12 |
| | Ø5 | 05 | Ø16 | 16 |
| | Ø6.3 | 6L | Ø18 | 18 |
| | Ø8 | 08 | Ø22 | 22 |
| | Ø10 | 10 | | |

ENVIRONMENTAL FRIENDLY CAPACITORS

- Production discontinuation of old series at Samwha is implemented as planned.
- Technical documents and samples are available upon the request to study alternative products.
- The following series are discontinued.
- Please use the recommended replacements in the table.

| Type | Characteristics | Discontinued Series | Obsolete Year | Substitute Series | Page |
|-------------------------------|--|------------------------|---------------|-------------------|------|
| SMD | 85°C Standard | MC | Year 2004 | SC | 60 |
| | | GC | | | |
| | 105°C Standard | TC | Year 2006 | JH | 63 |
| | 105°C 3000 hours | JC | Year 2019 | JM | 65 |
| | 105°C Impedance | CZ | Year 2019 | CD | 73 |
| | 130°C Standard | CF | Year 2019 | KC | 83 |
| MINIATURE RADIAL LEAD | 85°C Standard | SA | Year 1996 | SD | 91 |
| | | GA | | | |
| | | SG | Year 2004 | | |
| | | SV | | | |
| | Height 7mm, high CV | SK | Year 1996 | SS | 93 |
| | 105°C Standard | RA | Year 1994 | RD | 95 |
| | | RG | Year 2004 | | |
| | | RV | Year 2006 | | |
| | | RM | Year 2019 | | |
| | Low Impedance Standard | WD | Year 2006 | RZ | 103 |
| | | WA | Year 2009 | | |
| | | LK | Year 2018 | | |
| | Low Impedance | RT | Year 1996 | WL | 105 |
| | | RF | Year 2000 | | |
| | | RX | Year 2002 | | |
| | Extremely low Impedance, long life | RQ | Year 2006 | RP | 108 |
| | Low Impedance Standard | MQ | Year 2019 | MK | 112 |
| | Ultra Low Impedance | WB | Year 2009 | MZ | 115 |
| | | WK | | | |
| | | WH | | | |
| | Ultra Low Impedance | WN | Year 2009 | ML | 119 |
| | Ultra Low Impedance, high ripple | MN | Year 2018 | KN | 121 |
| | | MB | Year 2019 | | |
| | For PSU applications, long life | SJ | Year 2018 | KS | 128 |
| | High Temp. range, for 130°C, low impedance | VA | Year 2018 | VP | 135 |
| | Long life | BG | Year 2015 | BL | 142 |
| | | PF | Year 2019 | | |
| | For PSU 105°C high ripple, long life | BD | Year 2014 | KU | 146 |
| | | PQ | Year 2015 | | |
| | | RU | | | |
| | | BJ | Year 2018 | | |
| | | MU | | | |
| | 125°C 2000 hours, standard | RW | Year 2006 | BK | 154 |
| | High Temp. range, for 155°C | VB | Year 2018 | VQ | 163 |
| | | BM | Year 2019 | | |
| | 85°C 2000 hours non-polarized | BP | Year 2016 | NP | 165 |
| | LARGE | 85°C standard, snap-in | HS | Year 1994 | HC |
| KL | | | Year 1996 | | |
| HQ | | | | | |
| HM | | | Year 1999 | | |
| 105°C standard, snap-in | | HD | Year 1996 | HE | 183 |
| | | HA | Year 1999 | | |
| 105°C 3000 hours, high ripple | | HV | Year 2013 | HK | 187 |
| | | JG | Year 2017 | | |
| 105°C snap-in, long life | | HU | Year 2006 | HY | 196 |
| 85°C standard, screw terminal | | SX | Year 1994 | GT | 203 |
| | | SM | Year 2006 | | |
| | | GK | Year 2017 | | |
| | | GM | Year 2019 | | |
| 85°C 5000 hours, high ripple | | GN | Year 2016 | GF | 209 |
| | | GH | | | |
| For photo flash | | SF | Year 1996 | DF | 218 |

■ Eco-friendly activity

● Background of Environment friendly Products

Eu declared RoHS law to restrict the using of six hazardous substances. (February, 2003) July 1, 2011 Announces recast RoHS Directive (2011/65 / EU) that restructured the existing RoHS Directive (2002/95 / EC).

| Low | Contents | Enforcement Data |
|---------|---|----------------------------------|
| RoHS | Pb, Cd, Hg, Cr+6, PBBs, PBDEs | July 1, 2006. (2002/95/EC) |
| RoHS II | Pb, Cd, Hg, Cr+6, PBBs, PBDEs, DEHP, BBP, DBP, DIBP | January 3, 2013. (2011/65/EU) |

* RoHS : Restriction of Hazardous Substances

● Allowable criteria

| substance | Regulation |
|---|----------------------|
| 1) Pb - Lead | Less than 1000 mg/kg |
| 2) Cd - Cadmium | Less than 100 mg/kg |
| 3) Hg - Mercury | Less than 1000 mg/kg |
| 4) Cr(VI) - Hexavalent Chromium | Less than 1000 mg/kg |
| 5) PBBs - Polybrominated biphenyls | Less than 1000 mg/kg |
| 6) PBDEs - Polybrominated diphenyl ethers | Less than 1000 mg/kg |
| 7) DEHP - Bis(2-ethylhexyl) phthalate | Less than 1000 mg/kg |
| 8) BBP - Butyl benzyl phthalate | Less than 1000 mg/kg |
| 9) DBP - Dibutyl phthalate | Less than 1000 mg/kg |
| 10) DIBP - Diisobutyl phthalate | Less than 1000 mg/kg |

* Materials are not intentionally added and below limits by RoHS Directives

Label Marking

Packages containing products compliant with RoHS Directive are identified by the information "RoHS" (See sample label); these markings identify these products being fully compliant with the RoHS Directive

| |
|------|
| RoHS |
|------|

● Other eco-friendly activities

| Regulated substance | Related activities |
|-----------------------------|--|
| REACH_SVHC | Complies with Regulation (EC) No 1907/2006. |
| Halogen-Free | Voluntary reduction of harmful substances |
| Conflict Minerals Reporting | It follows the standardization template created by EICC® and GeSI. |

* Samhwa Electric is leading the production of eco-friendly products through continuous monitoring of hazardous substances.

Application Guidelines

Correct application and strict adherence to the important information listed below, will ensure optimum performance of the capacitors over their entire specified life.

1. POLARITY

If you should reverse the polarities of a aluminum electrolytic capacitor, it would lead to short-circuited circuitry and may further result in an explosion if the unit is kept energized. SAMWHA offers unit of Ø6.3 or more with safety vent design as the standard type in order to prevent possible accidents that may take place if the unit should be connected with its polarities reversed.

It is advisable to use non-polar capacitors for a DC circuit where the polarity is to be reversed.

2. OVERVOLTAGE

Do not apply overvoltage. When overvoltage is applied to the capacitor, leakage current increase drastically, causing heat generation, short-circuit or breakage.

3. RIPPLE LOAD

The rated ripple current given for certain conditions(Temperature, Frequency) shall not be exceeded. If so, early failure may result.

The sum of DC-bias and maximum amplitude of ripple voltage shall be within rated voltage and 0V. Electrolytic capacitors are not normally designed for AC application.

4. TEMPERATURE RANGE

Use the electrolytic capacitors according to the specified operating temperature range. Applying capacitors surpassing guaranteed conditions may cause destruction due to rapid characteristic deterioration. Usage at room temperature will ensure longer life.(when using the capacitors under -45°C, it's life equals that using capacitors at -45°C)

5. CHARGE/DISCHARGE

If used in circuits in which charge and discharge are frequently repeated, the capacitance value may drop, or the capacitor may be damaged. Please consult our technical department for assistance in these applications.

6. FOR SERIES CONNECTION

Aluminum electrolytic capacitors may be connected in series, but when doing so it should be noted that the voltage distribution will be according to their leakage currents. This phenomenon may induce irregularities in voltage load and cause maximum ratings to be exceeded, this could have drastic consequences especially with high voltage capacitors. Series connected electrolytic capacitors should therefore be supplied the voltages shall be proportionally distributed by balancing resistors.

전해 커패시터를 사용할 때 다음 사항에 주의하시기 바랍니다.

1. 극성

알루미늄 전해 커패시터의 극성을 역으로 사용하면 회로가 단락되거나 커패시터가 폭발할 수 있습니다. 극성이 역으로 사용될 경우 발생 가능한 사고를 방지하기 위하여 Ø6.3 이상의 표준품은 방폭 구조를 갖도록 설계됩니다.

극성이 불분명하거나, 때때로 극성이 반전되는 DC 회로에는 무극성 전해 커패시터를 사용하십시오.

2. 과전압

과전압을 인가하지 마십시오.

과전압이 커패시터에 인가되면 누설전류가 급격히 증가하며, 이것은 발열이나 회로 단락의 원인이 됩니다.

3. 리플 부하

정해진 조건(온도, 주파수)에 맞는 정격 리플전류를 초과하지 마십시오. 정격치 이상의 리플전류가 커패시터에 흐르게 되면 초기 고장이 발생할 수 있습니다.

직류 바이어스 전압과 리플전압의 합은 0V에서부터 정격전압 이내이어야 합니다.

전해 커패시터는 AC 응용을 할 수 없습니다.

4. 온도 범위

알루미늄 전해 커패시터는 정격사용온도범위 내에서 사용해야 합니다. 보증 범위를 초과하는 조건에서의 사용은 급격한 특성 열화가 발생되어 파손되는 경우가 있습니다. 상온에서 사용하면 수명을 연장시키는 효과를 얻을 수 있습니다.(-45°C 이하에서 커패시터를 사용시, -45°C 와 동일한 수명을 지니게 됩니다.)

5. 충방전

충방전이 계속 반복되는 회로에 사용하면 정전용량이 감소하고 커패시터가 폭발될 수 있습니다. 이러한 회로에 제품을 적용시킬 경우 저희 회사 기술연구소로 연락 바랍니다.

6. 직렬 연결

알루미늄 전해 커패시터는 직렬로 연결하여 사용할 수 있습니다. 그러나 직렬 연결 사용시 누설전류에 의한 전압의 배분에 주의하시기 바랍니다. 누설전류에 의한 전압의 배분은 불규칙한 부하전압을 유발할 수 있으며, 정격전압의 최고치를 초과할 수도 있습니다. 직렬로 연결된 커패시터에는 전위차조정저항(balancing resistor)으로 적절히 배분된 전압을 인가하십시오.

7. FOR PARALLEL CONNECTION

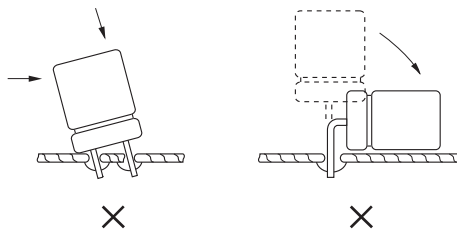
When you install more than 2 capacitors in parallel, consider the balance of current flowing into the capacitors.

8. MOUNTING

The distance between the terminal holes on the circuit board should be the same as that between the lead wires or terminals of the capacitor. Excessive force in mounting on circuit boards should be avoided.

Improper insertion of the lead wires in circuit board may cause electrolyte leakage, break the lead wires or impair their connection with the internal elements.

When the distance between the two terminal holes on the circuit board cannot be reduced to that between the lead wires, lead formed capacitors are recommended.



The main chemical solution of the electrolyte and the separator paper used in the capacitors are combustible. The electrolyte is conductive. When it comes in contact with the PC board, there is a possibility of pattern corrosion or short circuit between the circuit pattern which could in result smoking or catching fire. Do not locate any circuit pattern beneath the capacitor end seal.

In order to prevent possible damage by vibration on the circuit board, kindly bond our capacitors on the circuit board or use any fastening devices.

| | |
|--------------|-------------------|
| RADIAL TYPE | over Ø18 or 30mmL |
| SNAP-IN TYPE | over Ø22 or 40mmL |

There should not be any circuit pattern or circuit wire above the capacitor safety vent.

Unless otherwise specified, following space should be made above the capacitor safety vent.

| | | | |
|---------------|------------|-----------|----------|
| Case diameter | Ø6.3 ~ Ø16 | Ø18 ~ Ø35 | Ø40 ~ |
| Space | 2mm min. | 3mm min. | 5mm min. |

If the capacitor safety vent is placed toward circuit board, the hole should be made to match the capacitor vent position.

7. 병렬 연결

두 개 이상의 커패시터를 병렬로 연결할 때 커패시터에 흐르는 전류의 배분을 고려하여 주십시오.

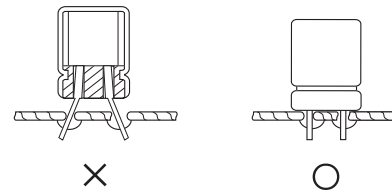
8. 기판 장착

회로기판에서 단자 홀(hole) 간격은 커패시터의 리드선이나 단자간의 간격과 같아야 합니다.

회로기판에 장착시 무리한 힘을 가하지 마십시오.

회로기판에 리드선을 무리하게 삽입할 경우 전해액의 누설, 리드선의 손상, 내부 요소와의 접촉부위의 파손 등이 발생할 수 있습니다.

회로기판의 홀(hole) 간격과 리드선의 간격이 맞지 않을 때에는 리드선이 가공된 커패시터를 사용하십시오.



커패시터에 사용된 전해액의 주 용매와 전해지는 가연성이며 전해액은 전도성 재질입니다.

회로기판에 전해액이 묻을 경우 패턴이 부식되거나 회로 패턴사이에 쇼트되어 발화될 수도 있으므로 커패시터 봉입구 밑에는 어떠한 회로 패턴도 설치하지 말아주십시오.

진동으로 문제시되는 회로기판에 장착하는 경우에는 반드시 기판과 제품 바닥면을 접촉시키거나 별도의 고정 장치를 사용하십시오.

| | |
|--------------|----------------------|
| RADIAL TYPE | Ø18, L치수 30mmL 이상 제품 |
| SNAP-IN TYPE | Ø22, L치수 40mmL 이상 제품 |

커패시터의 안전 변 위에 회로 패턴이나 배선이 없도록 하여 주십시오.

만약 그렇지 못하면 다음과 같이 안전 변이 작동할 수 있는 공간이 있어야 합니다.

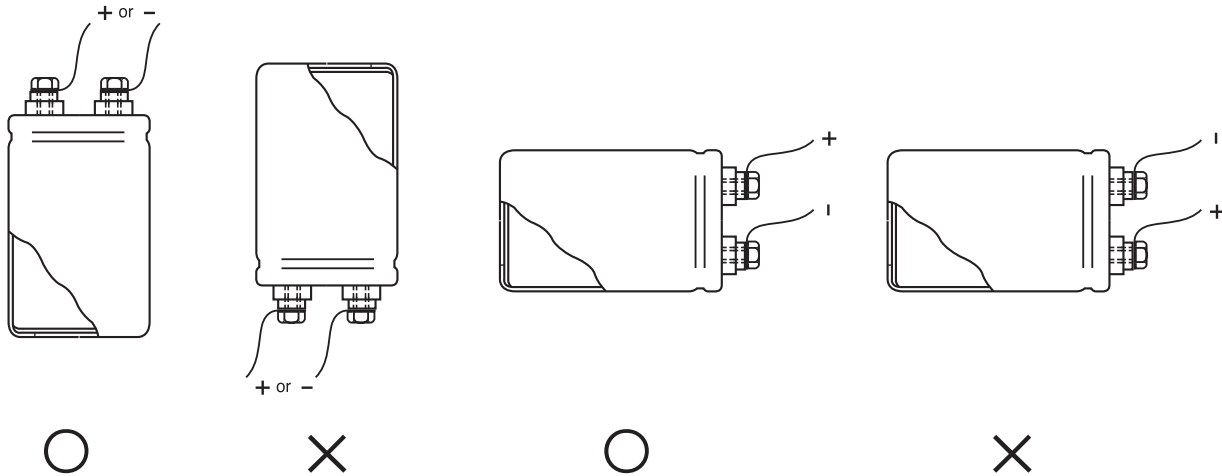
| | | | |
|---------------|------------|-----------|--------|
| Case diameter | Ø6.3 ~ Ø16 | Ø18 ~ Ø35 | Ø40 ~ |
| Space | 2mm 이상 | 3mm 이상 | 5mm 이상 |

만약 커패시터의 안전 변이 회로 기판으로 향한다면, 커패시터 안전 변 위치의 기판에 구멍을 설치해야 합니다.

ALUMINUM ELECTROLYTIC CAPACITORS

Do not install screw terminal capacitor with end seal side down. When you install a screw terminal capacitor in a horizontal mount, the positive terminal must be in the upper position.

Screw 단자형 커패시터의 봉입구를 아래로 향하게 하지 말아 주십시오. 제품을 옆으로 놓혀 사용할 경우에는 양극 단자를 위로 향하도록 하여 주십시오.



9. LEAD STRESS

Do not apply excessive force to the lead wires or terminals. If excessive force is applied to the lead wires and/or terminals, they may break and cause an open circuit. After mounting, avoid holding or applying force to the capacitor. Do not twist or carry the PC board by grasping the capacitor body after the capacitor are soldered to the PC board.

9. 리드 스트레스

커패시터의 리드선이나 단자에 무리한 힘을 가하지 마십시오. 리드선이나 단자의 단선 및 회로의 개방을 초래할 수 있습니다. 기판 장착 후에도 커패시터에 무리한 힘을 가하지 마십시오. 회로기판에 장착 후 커패시터를 잡고 이동하거나 비틀지 마십시오.

10. SOLDERING

In the dip soldering process of PC board with aluminum electrolytic capacitors mounted, secondary shrinking or crack of the sleeve may be observed when solder temperature is too high and/or dipping time is too long.

If the lead wire of other components or pattern of bothsided PC board is close to the capacitor terminal the similar failure may be also originated.

10. 납땜

알루미늄 전해 커패시터가 장착된 인쇄회로기판의 침적납땜 공정에서 납땜 온도가 너무 높거나, 지나치게 오랫동안 침적할 경우 슬리브의 2차 수축이나 갈라짐이 발생할 수 있습니다. 양면 인쇄회로기판의 패턴이나 다른 부품의 리드선과 커패시터의 단자가 아주 근접할 경우에도 위와 같은 슬리브의 이상이 발생할 수 있습니다.

Please avoid having flux adhere to any portion except the terminal. Solder iron does not touch any portion of capacitor body.

단자 이외의 부분에 플럭스가 묻지 않도록 하여 주시고 커패시터에 납땜 인두가 닿지 않도록 하여 주십시오.

11. Cleaning, Mounting of the PCB after soldering

1)When you clean a PCB, halogen cleaning agents can cause corrosion of aluminum foil and lead tab. If you need to clean, please replace Isopropyl Alcohol(IPA), Water as halogenated cleaning atents.

2)5minutes either by ultrasonic, vapor or immersion cleaning method.(chip type:2minutes) Becareful not to apply mechanical stress to the terminals or lead wires

11. 납땜 후 회로기판 세정

1)인쇄회로기판 세정시 할로겐계의 세정제가 커패시터의 내부에 침투하게 되면 알루미늄 호일과 리드에 부식의 원인이 될 수 있습니다. 세척이 필요한 경우에는 할로겐계 세정제 대신 이소프로필 알콜이나 물을 사용하십시오.

2)세정조건은 초음파, 증기, 침적 등의 세척 방법에 대하여 5분(단 chip type은 2분) 단자나 리드선에 기계적인 힘이 가해지지 않도록 주의 하십시오.

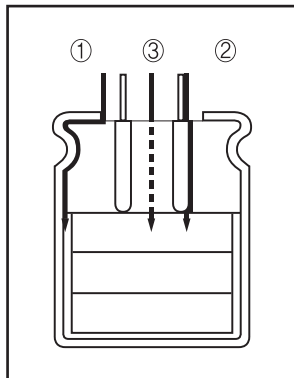
3) Common type of halogenated cleaning agents are listed below

| Chemical Name | Structural Formula | Representative Brand Name |
|--------------------------|--------------------|---------------------------|
| Trichlorotrifluoroethane | $C_2Cl_3F_3$ | Freon TF, Daiflon S-3 |
| Fluorotrichloromethane | CCl_3F | Freon-11, Daiflon S-1 |
| 1,1,1-Trichloroethane | $C_2H_3Cl_3$ | Chloroethene |
| Trichloroethylene | C_2HCl_3 | Trichlene |
| Methyl Chloride | CH_3Cl | MC |

Don't use the solvents listed above as cleaning solvent agents even for solvents proof capacitors, because it has strong chemical reaction.

4) When using a latex-based adhesive on the capacitor's rubber end seal for adhesion to a PCB, corrosion may occur depending on the kind of solvent in the adhesive. Select an adhesive as an organic solvent with dissolved polymer that is not halogenated hydrocarbon.

5) Penetration Channel of Solvent and Corrosion Mechanism

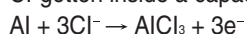


① Penetration between the rubber and the aluminum case

② Penetration between the rubber and the lead wires

③ Penetration through the rubber

Cl-gotten inside a capacitor reacts with aluminum.



Then, $AlCl_3$ resolves in water



Thus, the Cl^- ion is freed again and repeats the corrosion of aluminum.

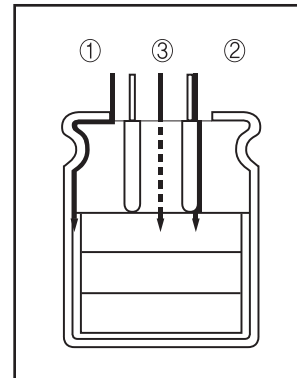
3) 할로겐계의 세정제의 일반적 유형은 아래의 표와 같다.

| 화 학 명 | 구조식 | 대표 상품명 |
|--------------------------|--------------|-----------------------|
| Trichlorotrifluoroethane | $C_2Cl_3F_3$ | Freon TF, Daiflon S-3 |
| Fluorotrichloromethane | CCl_3F | Freon-11, Daiflon S-1 |
| 1,1,1-Trichloroethane | $C_2H_3Cl_3$ | Chloroethene |
| Trichloroethylene | C_2HCl_3 | Trichlene |
| Methyl Chloride | CH_3Cl | MC |

위의 표에 열거한 물질들은 반응성이 매우 강하므로 내세척용 커패시터의 경우에도 세정제로 사용해선 안됩니다.

4) 커패시터의 밀폐용 고무에 고무계의 접착제를 사용하여 인쇄 회로 기판에 접착할 경우, 접착제의 종류에 따라 커패시터의 부식이 발생할 수 있습니다. 접착제로서는 할로겐화되지 않는 유용성 폴리머로 구성된 유기용제를 선택하십시오. 코팅(coating)을 행할 경우 제품과 기판간에 세정액이 남지 않도록 세정 직후 50~80℃에서 열풍 건조하여 주시기 바랍니다.

5) 용제의 침투경로 및 반응 메커니즘

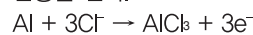


① 밀폐용 고무와 알루미늄 케이스 사이로 침투

② 밀폐용 고무와 리드선 사이로 침투

③ 밀폐용 고무를 통과하여 침투

커패시터의 내부로 침투한 염소 이온은 아래와 같이 알루미늄과 반응을 한다.



이때 $AlCl_3$ 는 물에 녹아 아래와 같이 된다.



그래서 염소이온(Cl^-)은 다시 자유전자가 되어 알루미늄을 부식시킨다.

12. Adhesive and Coating Materials

Do not use halogenated adhesives and coating materials to fix Aluminum Electrolytic Capacitors.

Flux between the surface of capacitors should be cleaned before using adhesives or coating materials. Solvents should be dried up before using adhesives or coating materials. Do not cover up all the sealing area of capacitors with adhesives or coating materials. Make coverage only partial. (The sealing area 30%)

13. INSULATION MATERIAL

Sleeve material

The standard sleeve material is P.V.C or P.E.T if exposed to xylene, toluene, etc. and then subjected to high heat, the sleeve may crack.

Case and cathode terminal

The case of capacitor is not insulated from the cathode terminal.

Dummy terminals for snap-in type

Dummy terminals are not insulated from the element. Dummy terminals are for added stability only, and should never be electrically connected to either the positive or negative terminal.

14. STORAGE

Do not store the capacitors in high temperature and high humidity conditions. Avoid direct sunlight.

(Recommendable conditions : 5 to 35°C, 75% or below RH)
Store the capacitors in the package.

Capacitors should not be direct contact with water, brine or oil. Capacitors must not be exposed to toxic gases such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, or ammonium.

Capacitors should be stored sealed in bag until they are actually used.

Once the sealed bag is cut open, all the parts should be used at one time. If not, then the remaining parts should be placed in a bag and sealed with tape.

In order to maintain a good solderability of the parts, shelf life of parts should not exceed 1 year.

When the capacitor is stored for a long time without applying voltage, leakage current tends to increase, due to deterioration of aluminum oxide film. This returns to normal by applying voltage. Apply voltage (Aging) before use if the capacitor is stored long time.

It is recommended to apply DC working voltage to the capacitor for 30 minutes through 1kΩ of protective series resistor.

12. 제품 고정제와 코팅

할로겐계 용제를 포함하는 고정제, 코팅제는 사용하지 않아 주십시오. 고정제, 코팅제를 사용하기 전에 기판과 콘덴서 봉구부 부분에 플럭스가 남거나 오염된 채로 놓아두지 않아주십시오.

기판 세척제는 고정제, 코팅제를 사용할 때 콘덴서 봉구부 전체를 밀봉시키지 않아 주십시오. (봉구부의 30% 이하)

13. 절연

슬리브 재질

표준 슬리브의 재질은 P.V.C 또는 P.E.T이며, 크실렌이나 톨루엔에 노출되거나, 커패시터가 고온의 환경에서 사용된다면 슬리브가 갈라질 수 있습니다.

케이스와 음극단자

커패시터의 케이스와 음극단자는 절연이 되지 않습니다.

SNAP-IN 단자형 제품의 보조단자

보조단자는 내부요소와 절연이 되지 않습니다.

보조단자는 커패시터를 견고하게 고정시키기 위한 것이므로 양극단자나 음극단자와 전기적인 연결이 없어야 합니다.

14. 보관

커패시터를 고온, 다습 또는 직사광선의 환경에서 저장하지 마십시오.

(적정 조건 : 5~35°C, 75% 이하의 상대습도)

커패시터를 포장된 상태로 보관하여 주십시오. 커패시터에 물, 소금물 또는 기름이 직접 닿지 않도록 주의하여 주십시오.

커패시터를 유화수소, 아황산, 질산 염소, 암모늄 등의 유해한 가스에 노출된 환경에서 보관하지 않아 주십시오.

커패시터를 실제 사용하기 전까지 밀봉된 Bag에 넣어 보관하세요. 밀봉된 포장을 뜯은 후 모든 부품을 즉시 사용하세요. 전부 사용하지 않는다면, 남은 부품은 Bag에 넣어 테이프로 밀봉해 보관하세요.

부품들의 수명과 우수한 납땜성을 유지하기 위해서는 방치 후 1년을 초과하지 않아야 합니다.

전압을 인가하지 않은 상태에서 장기간 보관된 커패시터는 누설 전류가 증가하는 경향이 있습니다.

그러나 커패시터에 전압을 인가하면 정상으로 환원됩니다. 장기간 보관되었던 커패시터는 전압처리 후 사용하여 주십시오.

전압처리는 1kΩ의 보호저항을 통해 직류 정격전압을 30분 동안 인가해야 합니다.

15. EMERGENCY ACTION

When the safety vent is Open and some gas blows out from the capacitor, please turn the main switch of the equipment off or pull out the plug the power outlet immediately.

During vent operation, extremely hot gas(over 100°C) and electrolyte may blow out from the capacitors. Do not stand close to the capacitors. In case of eye contact, flush the poen eyes with large amout or clean water immediately, do not swallow. do not touch electrlyte but wash skin with soap and water in case of skin contact.

16. DESTRUCTING CAPACITORS & OTHERS

In case of destructing our capacitors, Burn capacitors up after making holeson them or scrapping. When you try to destrory them by fire, you may expect explosion in the capacitors.

In order to prevent hazardous gas like chlorine gas, burn our capacitors on high temperature range. Burning sleeve on low temperature may cause producing chlorine gas.

When you do not have burning facilities, please contact special industrial wastes processing companies.

Capacitors may accumulate charge maturally during long storage time. In this case, the capacitors should be subject to voltage treatment through about 1k Ω resistor before use.

since it has possibilities for electric shock or burns, kindly, discharge it at the level of 1k Ω in advance.(sufficient and safe resistance values should be considered before applying)

For methods of testing, refer to KS C IEC 60384-4 (JIS C 5101-1, JIS C 5101-4)

Capacitors case size and other product standards specified in this catalog may be changed or modified without notice for improvement of quality.

15. 응급 조치

커패시터 사용 중 커패시터 안전 변이 열려 Gas가 분출될 경우 SET 의 전원 장치의 스위치를 끄거나 플러그를 즉시 뽑아 주십시오.

커패시터의 안전변 동작시 +100°C를 초과하는 Gas 분출 및 전해액 이 흘러 내릴 수 있으므로 가까이 다가가지 마십시오. 분출한 Gas가 눈에 들어가거나 흡입한 경우에는 즉시 물로 눈을 씻거나 삼키지 말고 입안을 닦아주시기 바랍니다. 전해액은 만지지 말고 만약 피부에 묻었을 경우 물이나 비누로 닦아 주십시오.

16. 커패시터 폐기 및 기타

커패시터를 폐기할 경우에는 구멍을 내거나 충분히 부순 후에 소각하여 주십시오. 소각시 커패시터가 폭발하는 경우도 있습니다.

커패시터는 외장 슬리브(PET)가 씌어져 있기 때문에 고온 소각을 하여 주십시오. 저온 소각을 하면 염소 Gas 등의 유해 Gas가 발생하는 원인이 됩니다.

커패시터를 소각하지 않은 경우에는 전문 산업폐기물 처리업체에 의뢰하여 주십시오.

커패시터는 재기 전압이 발생할 경우가 있습니다. 이런 경우에는 사용 전에 약 1k Ω 의 저항을 통해 방전 처리 후 사용하여 주십시오.

감전 및 화상의 우려가 있으므로 사용전에 1k Ω (전압, 용량에 따라 충분히 여유를 고려한 저항 선택)의 저항을 통해서 방전처리를 해 주십시오.

기타 시험규격에 대해서는 KS C IEC 60384-4 (JIS C 5101-1, JIS C 5101-4)를 참조 바랍니다.

카다로그에 규정된 제품 사이즈 및 제품 기준은 품질 개선의 필요 성으로 인하여 귀사에 통지없이 변경될 수 있습니다.

General introduction

Rated capacitance

The capacitance value for which the capacitor has been designed and which is usually indicated upon it.

Tolerance on rated capacitance

Preferred values of tolerance on rated capacitance are:
-20/+20%, -10/+20%, -10/+30%, -10/+50%, -10/+10%

Rated voltage

The maximum direct voltage, or peak value of pulse voltage which may be applied continuously to a capacitor at any temperature within operating temperature range.

Ripple voltage

An alternating voltage may be applied, provided that the peak voltage resulting from the alternating voltage, when superimposed on the direct voltage, does not exceed the value of rated voltage or fall under 0V and that the ripple current is not exceeded.

Surge voltage

The maximum instantaneous voltage which may be applied to the terminations of the capacitor for a specified time at any temperature with the operating temperature range.

| | | | | | | |
|---------------------|---|-----|----|----|----|----|
| Rated voltage (VDC) | 4 | 6.3 | 10 | 16 | 25 | 35 |
| Surge voltage (VDC) | 5 | 8 | 13 | 20 | 32 | 44 |

| | | | | | | |
|---------------------|----|----|----|-----|-----|-----|
| Rated voltage (VDC) | 40 | 50 | 63 | 80 | 100 | 160 |
| Surge voltage (VDC) | 50 | 63 | 79 | 100 | 125 | 200 |

| | | | | | | |
|---------------------|-----|-----|-----|-----|-----|-----|
| Rated voltage (VDC) | 200 | 250 | 275 | 315 | 350 | 375 |
| Surge voltage (VDC) | 250 | 300 | 316 | 365 | 400 | 425 |

| | | | | | | |
|---------------------|-----|-----|-----|-----|-----|-----|
| Rated voltage (VDC) | 400 | 420 | 450 | 500 | 550 | 600 |
| Surge voltage (VDC) | 450 | 470 | 500 | 550 | 600 | 650 |

Equivalent series resistance (ESR)

The ESR of an equivalent circuit having capacitance, inductance and resistance in series measured with alternating current of approximately sinusoidal waveform at a specified frequency.

$$ESR = \frac{\tan \delta}{2\pi fC}$$

where,

f = measurement frequency (120Hz)

C = measurement capacitance (F)

Dissipation factor ($\tan \delta$)

The power loss of the capacitor divided by the reactive power of the capacitor at a sinusoidal voltage of specified frequency.

Leakage current

Leakage current flows through a capacitor when DC voltage is applied in correct polarity. It is dependent on voltage, temperature and time.

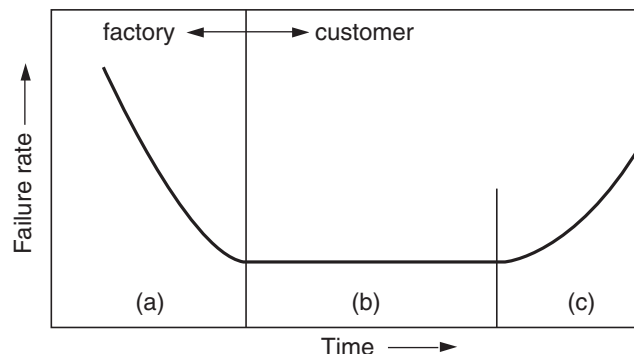
Ripple current

Any pulsating voltage (or ripple voltage superimposed on DC bias) across a capacitor results in an alternating current through the capacitor. Because of ohmic and dielectric losses in the capacitor, this alternating current produced an increase of temperature in the capacitor cell. The capacitor should be used within specified permissible ripple current in each standard products table.

In other condition of ambient temperature and frequency, ripple current multiplied by following multiplier can be applied as maximum permissible ripple current.

Failure rate

The failure rate of an aluminum electrolytic capacitor follows a bathtub curve.



- (a) initial failure period (infant mortality)
- (b) random failure period (useful life period)
- (c) wear-out failure period

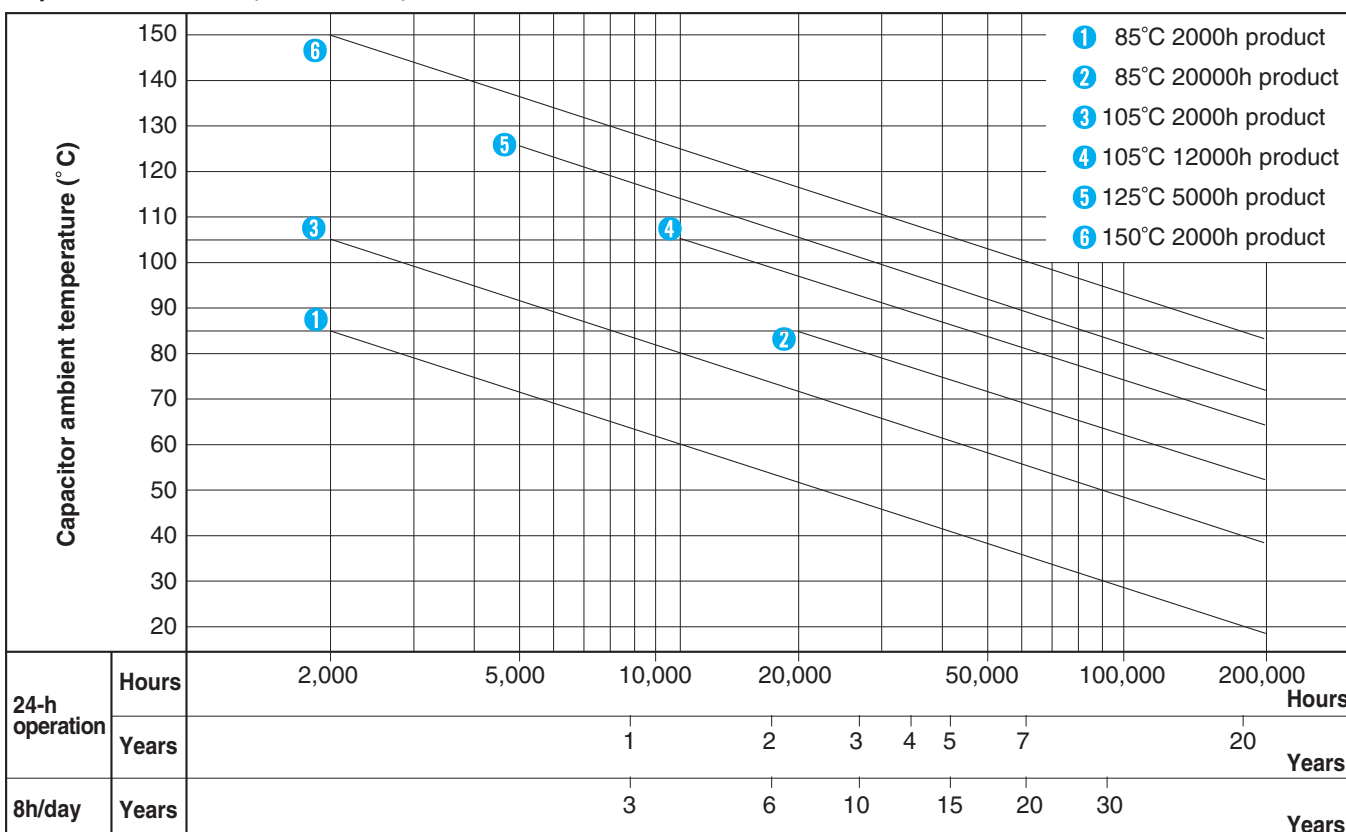
Expected life - (*for reference)

Temperature, humidity, ripple current and atmospheric pressure etc. have influence on the life of aluminum electrolytic capacitors. Among them, temperature has the greatest effect on life of capacitors. The relationship between ambient temperature and life of capacitor can be explained to so-called ARRHENIUS equation, generally the life of capacitor is reduced approximately by one-half for each temperature increase of 10°C. The life acceleration equation computes as shown below.

$$L = L_s \times 2^{\frac{T_s - (T + \Delta T)}{10}}$$

L : Lifetime of capacitor to be estimated (Hour)
L_s : Base life time of capacitor (Hour)
T_s : Maximum operating temperature shown in catalog (°C)
T : Ambient temperature (°C)
ΔT : An increase temperature produced by internal heating due to actual operating ripple current. (°C)

Expected life chart - (*for reference)



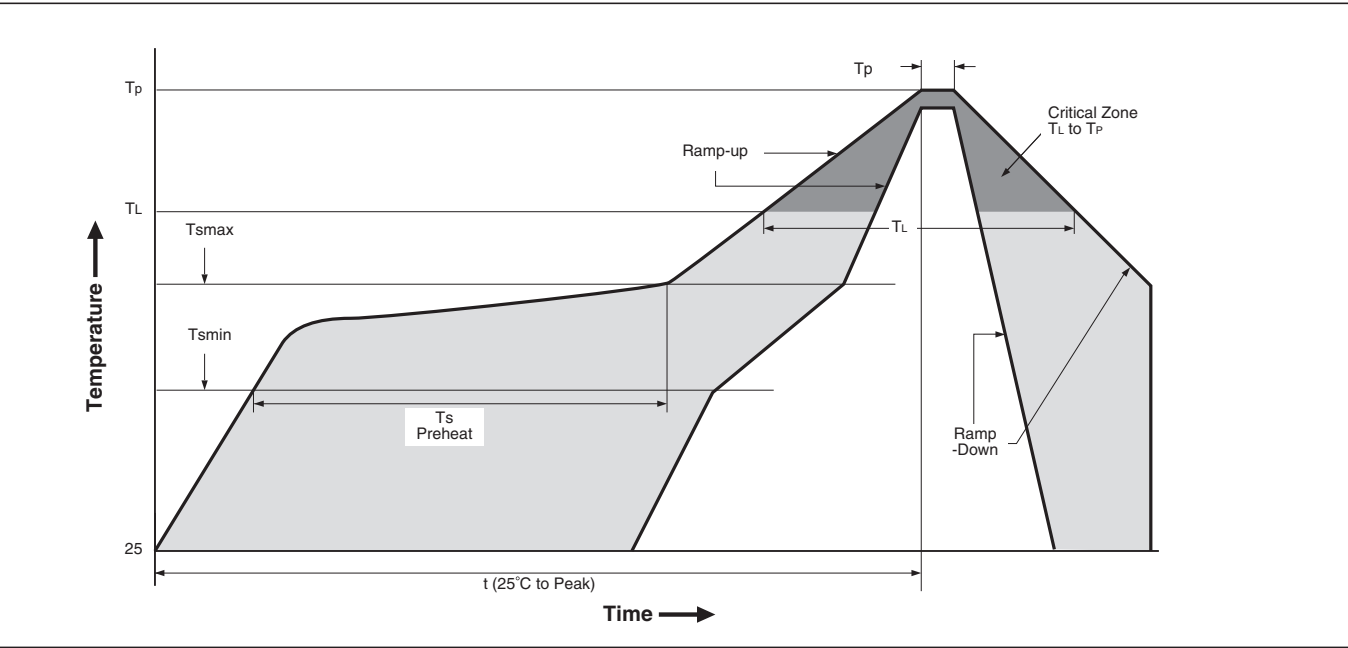
Reflow soldering method for the chip aluminum electrolytic capacitor

1. Recommended conditions for reflow soldering

The chip aluminum electrolytic capacitor is subjected to soldering by reflow method.
Temperature and time conditions of reflow soldering shall be set as per each temperature profile shown below as a standard. The following are recommended conditions in the case of reflow soldering method for the chip aluminum electrolytic capacitor.

- (1) The capacitor shall not be subjected to either flow or dip soldering method.
- (2) Avoid soldering twice by reflow. The number of reflow time for chip aluminum electrolytic capacitor shall be once basically. If this type of capacitor has to be inevitably subjected to the reflow twice, enough cooling time between the first and the second reflow (at least more than 30 minutes) shall be taken to avoid the consecutive reflows by all means.
- (3) The touch up work with a soldering iron is allowed after the reflow soldering (Temperature of soldering iron : MAX 400°C, Time : 5 sec.), provided that carefully attention shall be paid lest a soldering iron should directly touch the capacitor body or its resin bottom base.

2. RECOMMENDED REFLOW SOLDERING CONDITIONS



| Profile Feature | | Soldering condition | |
|--|---------------------------|---------------------|-------------------|
| | | ø4 ~ ø10 | ø12.5 |
| Average Ramp-up Rate (TL to TP) | | 3°C / second max. | 3°C / second max. |
| Preheat | Temperature Min. (Ts min) | 150°C | 150°C |
| | Temperature Max. (Ts max) | 200°C | 200°C |
| | Time (Ts min to Ts max) | 60 ~ 150 seconds | 40~120 seconds |
| Ts max to TL -Ramp-up Rate | | 3°C / second max. | 3°C / second max. |
| Time maintained above | Temperature (TL) | 217°C | 217°C |
| | Time (tL) | 60 ~ 90 seconds | 40 ~ 60 seconds |
| Peak/classification Temperature (TP) | | 250°C | 240°C |
| Time within 5°C of actual peak temperature(TP) | | 10 seconds max. | 10 seconds max. |
| Ramp-Down rate | | 3°C / second max. | 3°C / second max. |
| Time 25°C to peak temperature | | 8 minute max. | 8 minute max. |