Company Profile

Established:	February	1956
Factory Area:	74,950M^2	(Mainland China factory / Suzhou)
	85,000M^2	(Mainland China factory / Dongguan)
Capial:	US$108,000,000	
Milestones:	1956	Set-up Aluminum Capacitor Division at SAMPO Electronic
	1965	Joint venture with Elna Japan
	1966	Joint venture with Hitachi Japan
	1971	Joint venture with Shinyei Japan
	1975	First development and mass production at Low ESR product in Taiwan
	1978	Foundation of Teapo Electronic Corporation at current Tu-cheng factory.
	1987	Certified by IECQ
	1988	Tu-cheng factory certified by ISO 9002
	1993	Established Teapo Thailand Factory
	1998	Company stock listed in OTC market Established Teapo Dongguan Factory
	2000	Tu-cheng factory certified by QS9000
	2001	2001 Dongguan factory certified by ISO9001
	2003	Established Teapo Suzhou Factory and certified by ISO9001
	2004	Suzhou Factory certified by ISO-14000
	2005	Merge G-LUXON Electronic Corporation

1-1 Precautions in Using Aluminum Electrolytic Capacitors

Please note the following recommendations when using capacitors:

1. Electrolytic capacitors for DC applications require polarization . Confirm the polarity before use . The circuit life may be shortened or the capacitor may be damaged if insert in reversed polarity . For use on circuits whose polarity is occasionally reversed , or whose polarity is unknown , use non-polar capacitors . Also note that the electrolytic capacitors cannot be used for AC applications .

2. Do not apply a voltage exceeding the capacitor's voltage rating . If a voltage exceeding the capacitor's voltage rating is applied , the capacitor may be damaged by increased leakage current . When using the capacitor with AC voltage do not exceed the rated voltage .

3. Do not allow excessive ripple current passing. Use the electrolytic capacitor at current value within the permissible ripple range . If the ripple exceeds the specified value , request capacitors for high ripple current applications .

4. Ascertain the operation temperature range . Use the electrolytic capacitors according to the specified operation temperature range . Use at room temperature will ensure a longer life .

5. The electrolytic capacitor is not suitable for circuits which are charged and discharged repeatedly . If used in circuits which are charged and discharged repeatedly , the capacitance value may drop or the capacitor may be damaged . Please consult our engineering department for assistance in these applications .

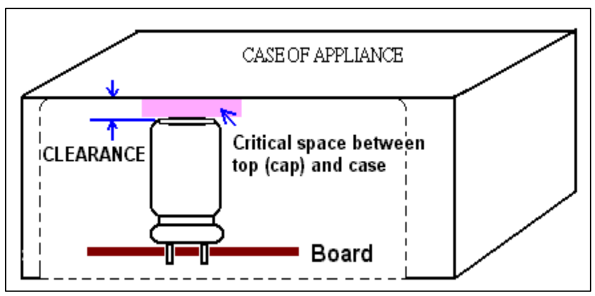
6. When capacitors have been left unused for long time , use them only after due voltage treatments . Long storage of capacitors tends to rise their leakage current levels . In such cases , be sure to provide the necessary voltage treatment before use .

7. Be careful of temperature and time when soldering . When soldering a printed circuit board with various components , care must be taken that the soldering temperature is not too high and that the dipping time is not too long . Otherwise , there will be adverse effect on the electrical characteristi and insulation sleeve of electrolytic capacitors . In the case of small -size electrolytic capacitors , nothing abnormal will be occurred if dipping is performed at less than 260℃ for less than 10 seconds .

8. Cleaning circuit boards after soldering . Halogenated hydrocarbon cleaning solvents are not recommended for use in cleaning capacitors supplied with exposed end seals . Where cleaning with a halogenated solvent is desired , capacitors should be ordered with an Epoxy-coated end seal .

9. Do not apply excessive force to the lead wires or terminals . If excessive force is applied to the lead wires and terminals , they may be broken or their connections on the internal elements may be affected . (For strength of terminals , please refer to JIS C5102 and C5141 .)

10. Keep the following clearance between the vent of the capacitor and the case of the appliance . Do not block the operation of the vent , unless otherwise described on the catalogues or product specifications . The narrower clearance may adversely affect the vent operation and result in an explosion of the capacitor .



Case diameter	Clearance
ϕ6.3 to ϕ16 mm	2 mm minimum
ϕ18 to ϕ 35 mm	3 mm minimum
ϕ40 mm & up	5 mm minimum

Fig.1-1

Attention

- The description in this catalogue is subject to change without prior notice for product improvement . Therefore , please confirm the specification before ordering products .
- The general characteristics , reliability data , etc ., described in this catalogue should not be construed as guaranteed values , they are merely standard values .
- Before using the products , please read the notes in this catalogue carefully for proper use .

1-2 Technical Concepts

1. The material and structure of Electrolytic Capacitors

Electrolytic Capacitor is a simple module . It simply contains an insulator between relative conductors in an electrode. The major internal raw material contains an element constructed by an separator paper wrap around the anode foil and cathode foil , which is then impregnated with the electrolyte , inserted into an aluminum case and sealed.

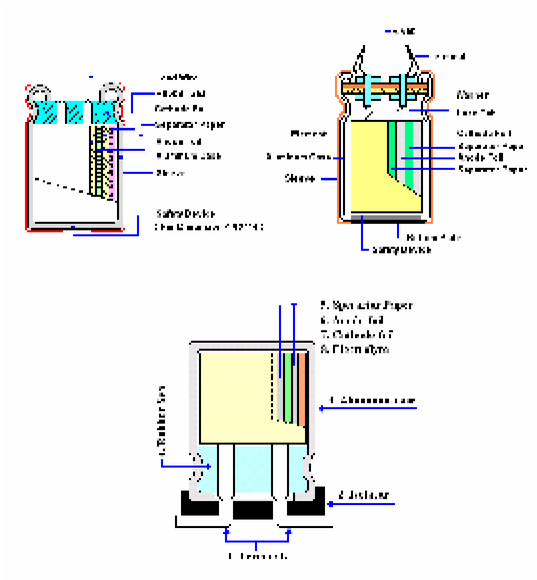


Fig.1-2

2. Production Processes

1. Etching : The process to increase surface area of aluminum foil by using chemical erosion or chemical corrosion method is called Etching . Normally chemical corrosion method uses the ripple current of electrolyte , combination of the liquid and temperature to determine the size, shape , and quantity of the dense network of microscopic channels on the aluminum foil surface .
2. Forming : The production process of the anode aluminum foil of electrolytic capacitors is by anodic oxidation of the etched aluminum foil . The production of the cathode aluminum foil sometimes involves oxidation in special purposes . This anodic oxidation process is called Forming . Boric acid or organic acid is used for high voltage forming and phosphoric acid or ammonium adipate is used for low voltage forming in order to obtain stable natural oxide layer of Al_2O_3 .
3. Slitting : The cutting of the aluminum foil and separator paper according to the required length .
4. Winding : The stitching or cold welding of cut anode and cathode foils and tab terminal , and wrap the electrolytic paper in between the anode and cathode , then fix the end with glue or sticky tape , and attached leads is called the capacitor "element" .
5. Impregnation : The process of eliminating water from the elements by pressurizes or vacuum in order to soak the element with the electrolyte is called Impregnation . The elements fully filled with electrolyte is then centrifuged to remove excess electrolyte .
6. Assembly : The elements seal with rubber to stop the leakage of electrolyte then slip into a sleeve to form the final product .
7. Aging : The purpose of Aging is to repair the oxide film damage by recharging and electrolyte .

1-3 The Function of Electrolytic Capacitors

The electrolytic capacitors could be widely used in appliance (ie. TV , radio , audio equipment , washing machine and air conditioner……etc .) , computer equipment (mother board, image device & the peripherals such as the printer , drawing device, scanner…etc) , communication equipment , estate equipment , measure instrument and also the industrial instrument , airplane , firebomb , satellite…etc. as a piloting equipment.

*According to the inflict electric wave & using purpose , it basically with some classified purposes as below :

1. DC Voltage :

a. For Momentary High Voltage : For using to the impulse generator such as the shock wave resistance test of the heavy electric machine .

b. For High Electric Current : For using to the welding machine , X- Ray facility , copy machine and discharge processing device .

c. For DC High Voltage : The electrolytic capacitor and rectifier composing , a special DC high voltage been happened after charged , for using to the power of electronic microscope and accelerator .

d. For Integration & Memory : For either memory circuit or compare circuit inside the calculator .

2. The DC voltage that with alternate ingredient :

a. For Wave Filter : Combination with the chip resistor & inductor as a internet , to be past by DC current or some frequency to closure or decline some other frequency .

b. For Bypass : A parallel track that outside from the circuit element , the IC (integrated circuit) has been rapidly developing in this years and thus a miniaturization or chip of electrolytic capacitors for by pass was conducted .

c. For Coupling : Combination of the electrolytic capacitor , chip resistor and inductor and thus coupling together .

d. For Arising of Toothed Wave : Composing of RC charge/ discharge circuit through the electrolytic capacitor as well as the resistor and a toothed wave to be created by the RC charge/discharge circuit .

e. For Reverse (Change) of Circuit : The equipment for change the AC voltage to DC voltage .

3. **F**or AC voltage :

a. For Power Improving : Connect the end loading of layout transporting & electrolytic capacitor for power improving .

b. For Wave Filter : Prevention of external interference in SCR circuit , use the LC wave filter circuit to inhibit or erase the interference .

c. For Phase Across : Phase change of the inductive electromotor (motor) with single phase .

1-4 Basic Electrical Characteristics

1. Capacitance (E.S.C.)

C : Capacitance(F)
R : Equivalent series resistance(Ω)
L : Equivalent aeries inductance(H)

Fig.1-3 Simplified equivalent circuit diagram of an electrolytic capacitor

The capacitive component of the equivalent series circuit (equivalent series capacitance ESC) is determined by applying an alternate voltage of 0.5V at a frequency of 120 Hz .

Temperature dependence of the capacitance
The capacitance of an electrolytic capacitor depends on the temperature : with decreasing temperature , the viscosity of the electrolyte increases reducing its conductivity . The capacitance will decrease if the temperature decreases . Furthermore temperature drifts cause armature dilatation and therefore capacitance changes (up to20% , depending on the series considered, from 0 to 80˚C) . This phenomenon is more evident for electrolytic capacitors than for other types .

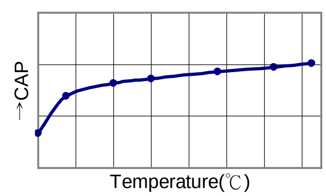


Fig 1-4 Capacitance change vs. temperature

Frequency dependence of the capacitance
The effective capacitance value is derived from the impedance curve , as long as the impedance is still in the range where the capacitance component is dominant .

$$C = \frac{1}{2\pi f Z}$$

C = Capacitance (F)
f = Frequency (Hz)
Z = Impedance (Ω)

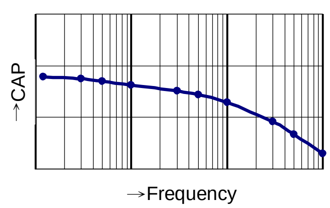


Fig 1-5 Capacitance change vs. frequency

2. Dissipation factor (tan δ)

The dissipation factor is the ratio between the active and the reactive power for a sinusoidal waveform voltage . It can be thought as a measurement of the gap between an actual and an ideal capacitor .

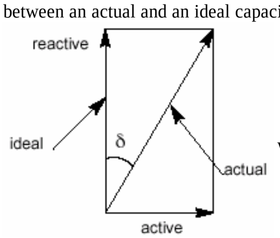


Fig 1-6

D.F. = tan δ x 100 (%) = ωCR x 100 (%)
= 2πfCR x 100 (%)

where: R = Equivalent Series Resistance
C = Equivalent Series Capacitance
ω = 2πf

The tan δ is measured with the same set up as for the series capacitance ESC .

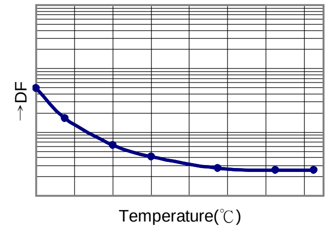


Fig 1-7 Dissipation factor vs. temperature

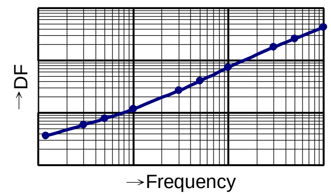


Fig 1-8 Dissipation factor vs. frequency

3. Equivalent series resistance (E.S.R.)

The equivalent series resistanceis the resistive component of the equivalent series circuit . The ESR value depends on frequency and temperature and is related to the tan δ by the following equation :

$$ESR = \frac{\tan\delta}{2\pi f\ ESC}$$

ESR = Equivalent Series Resistance (Ω)
tanδ = Dissipation Factor
ESC = Equivalent Series Capacitance (F)
f = Frequency (Hz)

The tolerance limits of the rated capacitance must be taken into account when calculating this value .

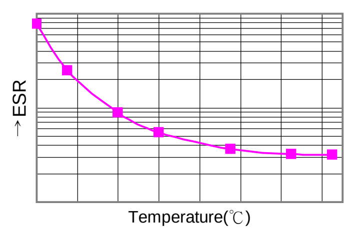


Fig 1-9 ESR change vs. temperature

The resistance of the electrolyte decreases strongly with increasing temperature.

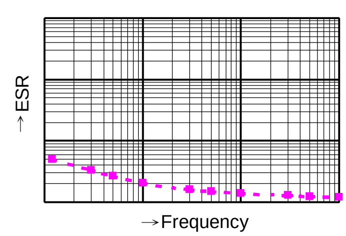


Fig 1-10 ESR change vs. frequency

4. Impedance (Z)

The impedance of an electrolytic capacitor results from here below circuit formed by the following individual equivalent series components :

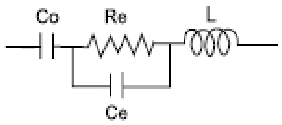


Fig 1-11

Co = Aluminum oxide capacitance (surface and thickness of the dielectric)
Re = Resistance of electrolyte and paper mixture (other resistances not depending on the frequency are not considered : tabs , plates , and so on)
Ce = Electrolyte soaked paper capacitance
L = Inductive reactance of the capacitor winding and terminals.

The impedance of an electrolytic capacitor is not a constant quantity that retains its value under all the conditions : it changes depending on the frequency and the temperature .

The impedance as a function of frequency (sinusoidal waveform) for a certain temperature can be represented as follows :

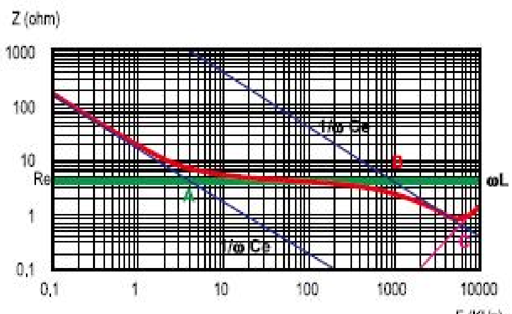


Fig 1-12

- Capacitive reactance predominates at low frequencies
- With increasing frequency , the Capacitive reactance $Xc=1/\omega Co$ decreases until it reaches the order of magnitude of the electrolyte resistance Re (A)
- At even higher frequencies , the resistance of the electrolyte predominates : Z= Re (A - B)
- When the capacitor's resonance frequency is reached ($\omega 0$) , capacitive and cancel each other $1/\omega$ Cinductive reactance mutually cancel each other $1/\omega Ce = \omega L$, $\omega 0$=SQR(1/LCe)(C) .
- Above this frequency , the inductive reactance of the winding and its terminals ($XL=Z=\omega L$) becomes effective and leads to an increase in impedance .

Generally speaking it can be estimated that Ce ≒ 0.01 Co .

The impedance as a function of frequency (sinusoidal waveform) for different temperature values can be represented as follows (typical values) :

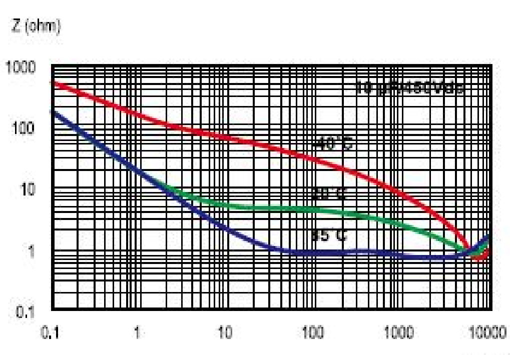


Fig 1-13

Re is the most temperature dependant component of electrolytic capacitor equivalent circuit . The electrolyte resistivity will decrease if the temperature rises In order to obtain a low impedance value all over the temperature range , Re must be as little as possible , but too low Re values means a very aggressive electrolyte and then a shorter life of the electrolytic capacitor at the high temperatures . A compromise must be reached .

5. Leakage current (L.C.)

Duetothealuminum oxidelayer that serves as adielectric , a small current will continueto flow even after a DC voltage has been applied for long periods . This current is called leakage current . A high leakage current flows after applying a voltage to the capacitor and then decreases in few minutes (e.g. after a prolonged storage without any applied voltage) . In the course of the continuous operation , the leakage current will decrease and reach an almost constant value .

After avoltage free storage the oxide layer may deteriorate , especially at high temperature . Since there are no leakage current to transport oxygen ions to the anode , the oxide layer is not regenerated . The result is that ahigher thannormal leakagecurrent will flow whenavoltageis appliedafter prolongedstorage . As the oxide layer is regenerated in use , the leakage current will gradually decrease to its normal level .

The relationship between the leakage current and the voltage applied at constant temperature can be shown schematically as follows :

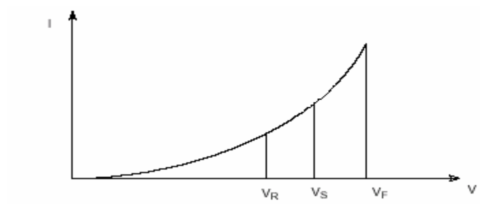


Fig 1-14

Where :
VF = Forming voltage
If this level is exceeded a large quantity of heat and gas will be generated and the capacitor could be damaged .
VR = Rated Voltage
This level represents the top of the linear part of the curve .
VS = Surge voltage
It lies between VR and VF: the capacitor can be subjected to VS for short periods only .

1-5 Reliability

(1)The bathtub curve：

Aluminum electrolytic capacitors feature failure rates shown by the following bathtub curve.

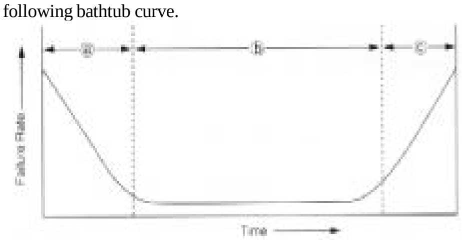


Fig.1-15 Bathtub curve

a. Initial failure period

Deficient Capacitors include any products before dispatch that may have some deficiency caused by the design, production process or used in inappropriate environments.

b. Random failure period

The capacitors have a low defect ratio in the period after it has been stabilized.

c. Wear out failure period

The performance of capacitors will decrease with an increase in usage period.The malfunction rate may vary due to the structural design.

1-6 Circuit Design

(1) Environmental and Mounting Conditions

★ Please make sure the environmental and mounting conditions to which the capacitor will be exposed to are within the conditions specified in TEAPO's catalog.

(2) Operating Temperature, Equivalent Series Resistance(ESR), Ripple Current and Load Life

★ MTTF(Mean-Time-TO-Failure) means the useful life at room temperature 25℃

Load life:

If the capacitor's max. operating temperature is at 105℃(85℃), then after applying capacitor's rated voltage (WV) for L_0 hours at 105℃(85℃), the capacitor shall meet the requirements in detail specification.

where L_0 is called "load life" or "useful life (lifetime) at 105℃(85℃)".

$$L_x = L_0 \times 2^{(To-Tx)/10} \times K^{-\triangle Tx/5}$$

where $\triangle Tx = \triangle T_0 \times (Ix / I_0)^2$, $Ix > I_0, K=4$; $Ix \leqq I_0, K=2$

Ripple life:

If the capacitor's max. operating temperature is at 105℃(85℃), then after applying capacitor's rated voltage (WV) with the ripple current for L_r hours at 105℃(85℃), the capacitor shall meet the requirements in detail specification. where L_r is called "ripple life" or "useful ripple life (ripple lifetime) at 105℃(85℃)".

$$L_x = L_r \times 2^{(To-Tx)/10} \times K^{(\triangle To - \triangle Tx)/5}$$

where $\triangle Tx = \triangle T_0 \times (Ix / I_0)^2$, $Ix > I_0, K=4$; $Ix \leqq I_0, K=2$

The (ripple) life expectancy at a lower temperature than the specified maximum temperature may be estimated by the following equation, but this expectancy formula does not apply for ambient below +40℃.

L_0 = Expected life period (hrs) at maximum operating temperature allowed

L_r = Expected ripple life period (hrs) at maximum operating temperature allowed

L_x = Expected life period (hrs) at actual operating temperature

T_0 = Maximum operating temperature (℃) allowed

T_x = Actual operating ambient temperature (℃)

I_x = Actual applied ripple current (mArms) at operating frequency f_0 (Hz)

I_0 = Rated maximum permissible ripple current I_R(mArms) x frequency multiplier (C_f) at f_0 (Hz)

※Ripple Current calculation: no need Temperature Multiplying Factor

※For Ripple life，Ix Should be 80% equal or more of Io,if less than 80%, calculate with 80%.

$\triangle T_0 \leqq 5$℃ = Maximum temperature rise (℃) for applying I_0 (mArms)

$\triangle Tc$ =Temperature rise (℃) of capacitor case for applying Ix (mA/rms)

$\triangle T_x$ = Temperature rise (℃) of capacitor element for applying I_x (mArms)

$= K_c \triangle T_c = K_c(T_c - T_x)$

where T_c is the surface temperature (℃) of capacitor case

T_x is ditto.

K_c is transfer coefficient between element and case of capacitor from table below：

Dia	≦8 φ	10 ,	12.5 φ 13 φ	16 φ	18 φ	22 φ	25 φ	30 φ	35 φ
K_c	1.10	###	1.20	1.25	1.30	1.35	1.40	1.50	1.65

※ The estimated life is limited to 15 years, if it exceeds 15 years, take 15 years as standard.

★ The formula of Equivalent Series Resistance (ESR)

The operating frequency of ESR, DF, f & C must be the same, usually, they test at 120 Hz.

$$ESR = DF / 2\pi f C \cdots\cdots\cdots\cdots (2)$$

Where DF: Dissipation Factor(tan δ)
f : Operating frequency(Hz)
C: Capacitance(F)

★ Estimation of life considering the ripple current

The ripple current affects the life of a capacitor because the internal loss (ESR) generates heat.The generated heat will be:

$$P = I^2 R \text{-------}(3)$$

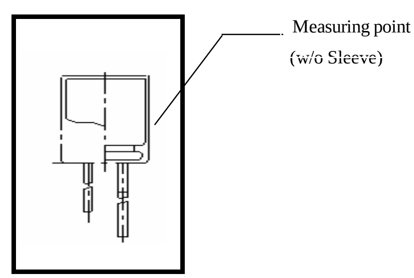
Where I : Ripple current(Arms.)
R: ESR(Ω)

At this time the increase in the capacitor temperature will be:

$$\triangle T = I^2 R / AH \text{------}(4)$$

Where $\triangle T$: Temperature increase in the capacitor core(degree)
I : Ripple current(Arms)
R: ESR(Ω)
A: Surface area of the capacitor (cm^2)
H: Radiation coefficient(Approx.$1.5 \sim 2.0 \times 10^{-3}$ W/ $cm^2 \cdot$ ℃)

The above equation (4) shows that the temperature of a capacitor increases in proportion to the square of the applied ripple current and ESR, and in inverse proportion to the surface area. Therefore, the amount of the ripple current determines the heat generation, which affects the life. The values of $\triangle T$ varies depending on the capacitor types and operating conditions. The usage is generally desirable if $\triangle T$ remains less than 5℃.The measuring point for temper-ature increase due to ripple current is shown below.



(3) Application

★ Aluminium Electrolytic Capacitors are normally polarized. Reverse voltage or AC Voltage should not be applied. When polarity may flip over, non-polar type capacitors should be used, but the non-polar type cannot be used for AC circuits.

(4) Applied Voltage

★ Do not exceed the rated voltage of capacitor.

(5) Insulation

★ Aluminum Electrolytic Capacitors should be electrically isolated from among the following points.

a. Aluminum case, cathode lead wire, anode lead wire and circuit pattern.
b. Auxiliary terminals of snap-in type, anode terminal, outward terminal and circuit pattern.

(6) Conditions of use

★ Aluminum Electrolytic Capacitors must not be used under the following conditions:
a. Damp conditions such as water, saltwater spray, or oil spray or fumes. High humidity or humidity condensation situations
b. Ambient conditions that include toxic gasses such as hydrogen sulfide, sulfurous acid , nitrous acid, chlorine, ammonium, etc.
c. Ambient conditions that expose the capacitors to ozone, ultraviolet rays and radiation.
d. Severe vibration or shock that exceeds the conditions specified in the catalog or specifications sheets.

(7) Recommended design considerations

★ When designing a circuit board. Please pay attention to the following:
a. Make the hole spacing on the PC board match the lead space of the capacitor.
b. There should not be any circuit pattern or circuit wire above the capacitors.
c. In case the capacitor's vent is facing the PC board, make a gas release hole on PC board.
d. 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.
e. Do not locate any wiring and circuit patterns directly above the capacitor's vent.

1-7 Caution for Mounting

(1) Caution before assembly

★ Aluminum Electrolytic Capacitors cannot be recycled after mounting and applying electricity in unit. The capacitors that are removed from PC board for the purpose of measuring electrical characteristics at a periodical inspection should only berecycled to the same position.
★ Aluminum Electrolytic Capacitors may accumulate charge naturally during storage. In this case, discharge through a 1KΩ resistor before use.
★ Leakage current of Aluminum Electrolytic Capacitors may be increase during long storage time. In this case, the capacitors should be subject to voltage treatment through a 1KΩ resistor before use.

(2) In the assembly process

★ Please confirm ratings before installing capacitors on the PC board.
★ Please confirm polarity before installing capacitors on the PC board.
★ Do not drop capacitors on the floor, nor use a capacitor that was dropped.
★ Be careful not to deform the capacitor during installation.
★ Please confirm that the lead spacing of the capacitor matches the hole spacing of the PC board prior to installation.
★ The snap-in type of capacitors should be mounted firmly on the PC board without a gap between the capacitor body and the surface of PC board.
★ Avoid excessive force when clinching lead wire during auto-insertion process.
★ Avoid excessive shock to capacitors by automatic insertion machine, during mounting, parts inspection or centering operations.
★ Please utilize supporting material such as strap or adhesive to mount capacitors to PC board when it is anticipated that vibration or shock is applied.

(3) Soldering

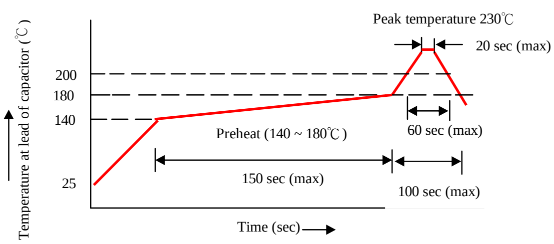
★ All TEAPO's cp wires of electrolytic capacitors are without lead (Pb).
★ Soldering conditions(temperatures, times) should be within the specified conditions which are described in the catalog or specification sheets.
★ If it is necessary that the leads must be formed due to a mismatch of the lead space to hole space on the board, bend the lead prior to soldering without applying too much stress to the capacitor.
★ If soldering capacitor has to be withdrawn from the PW board by soldering iron, the capacitor should be removed after the solder has melted sufficiently in order to avoid stress to the capacitor or lead wires.
★ Soldering iron should never touch the capacitor's body.

(4) Flow soldering

★ Do not dip capacitor's body into melted solder.
★ Din of flow soldering for the capacitors should be limited at 260℃,10sec.
★ Flux should not be adhered to capacitor's body but only to its terminals.
★ Other devices which are mounted near capacitors should not touch the capacitors.

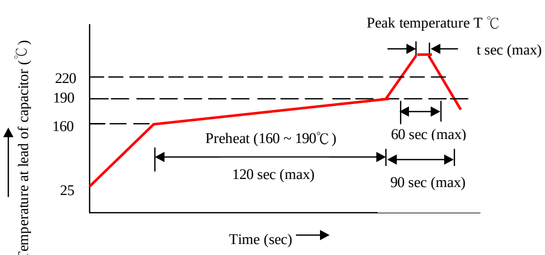
(5) Reflow soldering condition

★ For reflow, use a thermal condition system such as infrared radiation or hot blast. Vapor heat transfer systems are not recommended.
★ Observe proper soldering conditions(temperature, time, etc. Do not exceed the specified limits.
★ Repeated reflowing :
*Avoid reflowing twice if possible.
*If repeated reflowing is unavoidable,contact us after measuring the first and the second reflow profiles and reflow interval at your side.
*Do not attempt to reflow three times.



(6) Lead free type reflow soldering condition
For Aluminum Electrolytic Capacitors

★ For reflow, use a thermal condition system such as infrared radiation or hot blast. Vapor heat transfer systems are not recommended.
★ Observe proper soldering conditions(temperature, time, etc. Do not exceed the specified limits.
★ Repeated reflowing :
*Avoid reflowing twice if possible.
*If repeated reflowing is unavoidable,contact us after measuring the first and the second reflow profiles and reflow interval at your side.
*Do not attempt to reflow three times.



Size	T	t
φ4～φ5 (4V～50V)	250	10
	260	5
φ6.3～φ10 (4V～50V)	250	5
φ4～φ10 63～100V	250	5

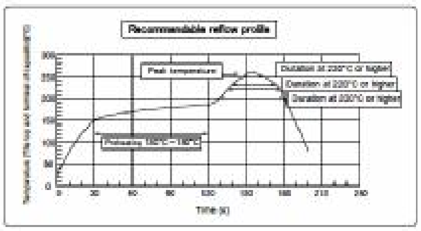
For Conductive Polymer Aluminum Solid Capacitors

Resistance to soldering heat condition
Test condition
A) Vapor phase soldering method
Solder paste should be applied to the printed wiring boards and then the capacitors are mounted on it. After that, the capacitor should be maintained in the vapor phase bath at a temperature of 230 ±2 ˚C for 75 ±1 seconds.in the vapor phase bath at a temperature of 230 ±2 ˚C for 75 ±1 seconds.
B) Soldering iron method
Temperature: 400 ±10 ˚C
Duration 3^{+1}_{-0} seconds

Performance: The capacitors shall meet the following specification after A or B test.

Item	Performance
Capacitance change	Within ±10 % of initial capacitance (2.5V: Within ±15 % of initial capacitance)
Tangent of loss angle	Less than or equal to 1.3 times of the value
E.S.R.	Less than or equal to 1.3 times of the value
Leakage current	Less than or equal to the value

Recommendable reflow condition
Reflow profile



Peak temperature of the top and terminals of a capacitor	250 °C or less	260 °C or less
Preheating	150°C to 180°C 90 ± 30 seconds	
Time of being at 200 °C and higher	Within 60 seconds	Within 40 seconds
Time of being at 220 °C and higher	Within 50 seconds	Within 40 seconds
Time of being at 230 °C and higher	Within 40 seconds	Within 40 seconds
The number of reflow	Twice or less	Only 1 time

Note:
*Measurement position of temperature: The top surface of capacitor and board's surface nearby terminal.
*Measurement method: Thermo-junction is fixed on measurement position by silver paste or an adhesive of resin.
Thermo-junction is Classification K, material CA with diameter 0.1mm.
*An interval of reflow: In case two times reflow is necessary, CP-CAP shall be taken into reflow when its return to normal temperature.
*Heat stress to CP-CAP will be influenced by the different of reflow equipment, board material, size, and numbers of mounting. The following action must be practice through a practical test mounting before mass-production.

(1) Check your reflow condition whether it is within the above TEAPO Recommendable Reflow Condition or not.

(2) Confirm CP-CAP's electric characteristic change before and after reflow.

(7) Cleaning
★ Satisfied characteristic of JIS C 5101.
★ Aluminum Electrolytic Capacitors may be damaged by corrosion which is caused by any halogenated hydrocarbon solvents (Ex:HCH(Cl)2…). All of our products are non-solvent-proof, we recommend cleaning method as following:
Applicable : Any type,any ratings
Cleaning agents : Pine Alpha ST-100S, Clean Through 750H/750L/710M,Sanelek B-12, Aqua Cleaner 210SEP, Techno Care FRW14~17 , Iso- propyl Alcohol

Cleaning conditions: Total cleaning time shall be within 5 minutes by immersion, ultrasonic or other method. (Temperature of the cleaning agent shall be 60℃ or lower.) After cleaning, capacitors should be dried using hot air for minimum of 10 minutes along with the PC board.
Hot air temperature should be below the maximum operating temperature of the capacitor. Insufficient dries dry after water rinse may cause appearance problems, sleeve may shrink, or the bottom-plate may bulge,etc…

Please let us know in advance the solvent name and conditions for your PWB Cleaning .

1-8 Emergency Action

(1) If you see smoke due to the operation of safety vent, turn off the main switch or pull out the plug from the outlet.

(2) Do not put your face near the safety vent as gas which in over 100℃ will be emitted when the safety vent operates. If the gas has entered your eyes, please flush your eyes immediately in pure water. If you breathed the gas, immediately wash out your mouth and throat with water. Do not ingest electrolyte. If your skin is exposed to electrolyte, please wash it away using soap and water.

1-9 Storage Condition

(1) Aluminum electrolytic capacitors should not be stored in high temperatures or where there is a high level of humidity. The suitable storage condition is 5~35℃ and less than 75% in relative humidity.

(2) Aluminum electrolytic capacitors should not be stored in damp conditions such as water, saltwater spray or oil spray.

(3) Do not store aluminum electrolytic capacitors in an environment full of hazardous gas (hydrogen sulfide , sulfurous acid gas, nitrous acid, chlorine gas, ammonium, etc.)

(4) Aluminum electrolytic capacitors should not be stored under exposure to ozone, ultraviolet rays or radiation.

(5) If a capacitor has been stored for more than one year under normal temperature (shorter if high temperature) and it shows increased leakage current, then a treatment by voltage application is recommended

1-10 Environment - Related Substances

All TEAPO's capacitors comply to RoHS (Restricition of Hazardous Substances) requirements where Chromium VI (Cr^{+6}),Cadmium(Cd), Mercury(Hg),Lead(pb),polybrominated biphenyls (PBBs) and Polybrominated bipheny1/dipheny1 ethers (PBBEs / PBDEs) have not detected (lower than MDL(Method Detection Limit)) per SGS certification test report.

1-11 Disposal

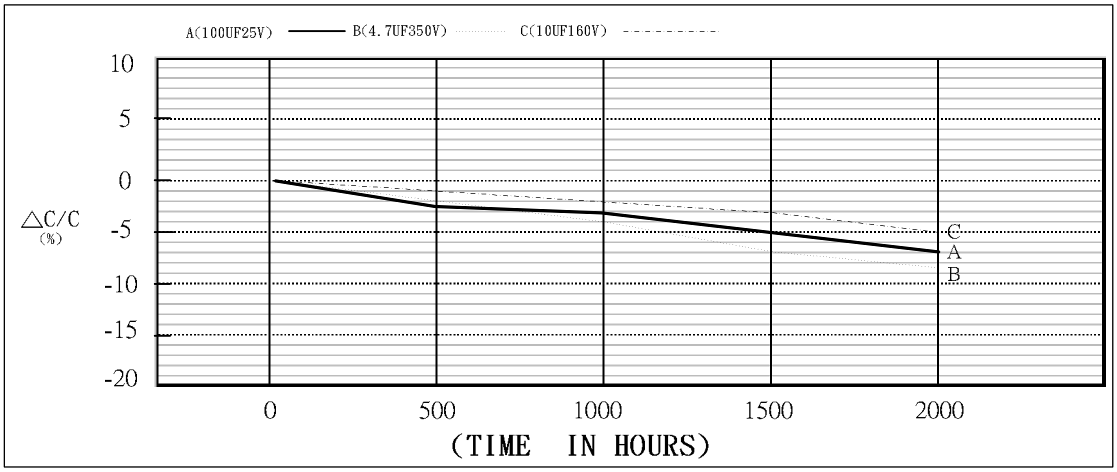
Please dispose capacitors in either of the following ways:

(1) Incinerate capacitors after crushing parts of making a hole on the capacitor body.

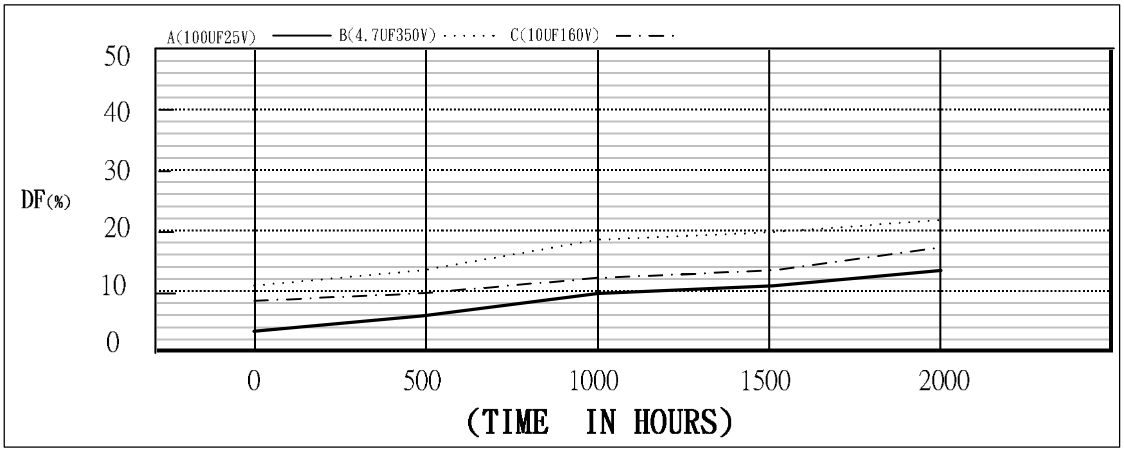
(2) Bury capacitors in the ground . Please have a disposal specialist do it.

The Characterisitics of Endurance Test

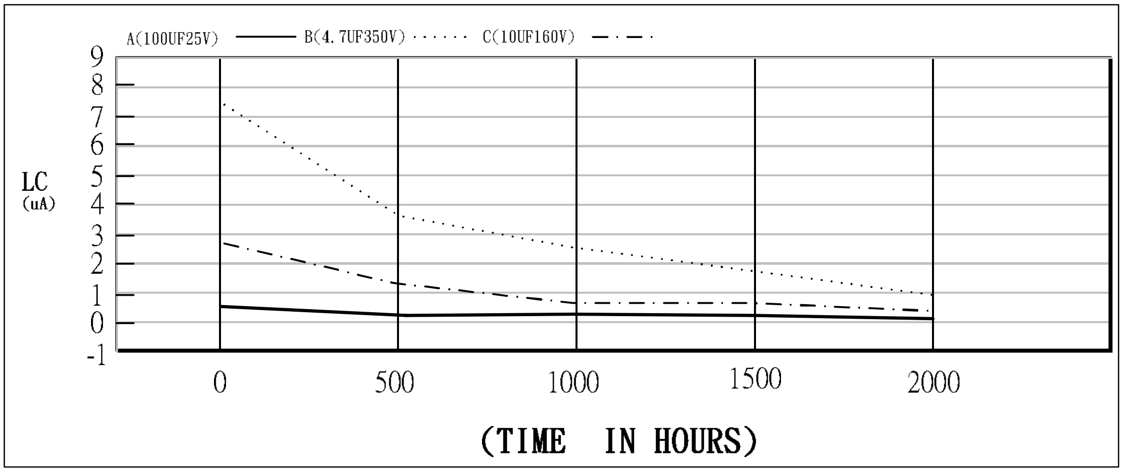
Capacitance Change Ratio



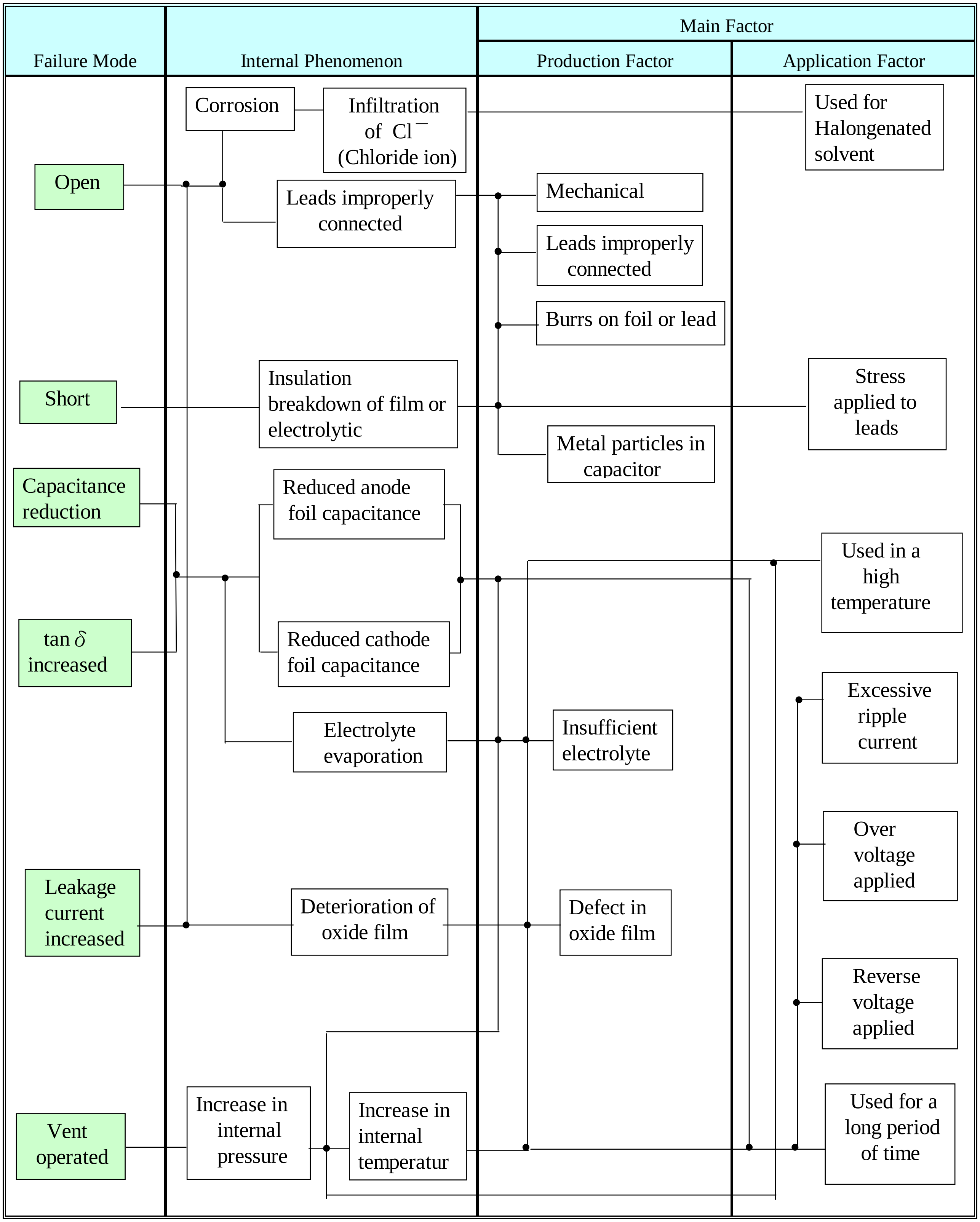
Dissipation Factor Change



Leakage Current Change



Typical Failure Modes and Their Factors



Part Number Instruction

1	2~3	4~6	7	8~10	11~12	13	14	15	16~17	18
D	**SK**	**107**	**M**	**6R3**	**S1**	**A**	**1**	**C**	**11**	**0**
TYPE	SERIES	CAP	TOL.	VOLTAGE	LEAD	SPEC.	SLEEVE	CASE SIZE	LENGTH	OTHERS

Code 1 Type

Code	Model Type
D	Standard Dip Type (PVC sleeve)
K	Standard Dip Type (PET sleeve)
V	SMD (V-chip) Type (Nylon coating)
L	Snap-in Type (PVC sleeve)
S	Snap-in Type (PET sleeve)
P	Conductive Polymer Solid Capacitor

Code 2~3 Series Name (as content page 5)

Code 4~6 Capacitance

0.47 μF = 474
4.7 μF = 475
47 μF = 476
470 μF = 477
4700 μF = 478

Code 7 Tolerance M = ±20% , K = ±10% ,V = +20～－10%

Code 8~10 Voltage

2.5V = 2R5 100V = 100
5V = 005 450V = 450
6.3V = 6R3
63V = 063

Code 11~12 Lead Process

Explanation for code 11

S : Standard T : Ammo tape R : Reel tape
C : Straight cut K : Kink(Crimp)cut F : Formed cut

Code 11&12		Description
S	0	Standard SMD type
	1	Standard Dip & Snap-in type
T	1	Standard ammo tape (pitch 5mm for dia .~ 13mm)
	2	Ammo tape with straight lead (available for dia. 4~8mm)
	4	Ammo formed tape with pitch 2.5mm (available for dia.4~5mm)
R	1	Standard reel tape (pitch 5mm for dia.~ 10mm)
	2	Reel tape with straight lead (available for dia. 4~8mm)
	3	Reel formed tape with pitch 2.5mm (available for dia.4~5mm)

Code 11&12		Description
C	3	Straight cut lead with L : 3.2+/-0.2mm
	5	Straight cut lead with L : 4.0+/-0.2mm
	7	Straight cut lead with L : 5.0+/-0.2mm
K	2	Kink cut lead with L : 4.5+/-0.5mm
F	6	Forming cut lead with L : 4.0+/-0.3 (Pitch : 5mm)

Code 13 Special specification

A : Standard
B : DF (tanδ)
C : ESR
D : Impedance
E : Ripple current
F : Leakage current

Code 14 Sleeve code

Code	Series	Color
1	SK	Dark blue with white printing
5	S5,D5,H5,S7,D7,H7,SH,SG,SP,SB,SY, SJ,RN,SN, RB,SR,BX,LH,LG,LJ,LF,SQ,LQ,AK,ST,TH,TG,TP	Black with white printing
B	SE	Brown with white printing
C	SC	Green with golden printing
H	SZ	Royal blue with golden printing
N	GV,FV,SV,DV,RV,ZV,EV,JV,CV, CG,CP,CR,CF,CY,CZ,CT,CX,CH,VP	(SMD standard pack & solid capacitor)

Code 15~17 Size code

Code 15：Case Size

CODE	A	B	C	D	E	F	G	H	J
Case Size	3	4	5	6	6.3	7	8	10	12

CODE	K	L	M	N	P	Q	R	S	T
Case Size	12.5	13	16	18	20	22	25	30	35

Code 16~17：Length

For ECAP-DIP & POLYMER-DIP & SNAP-IN

CODE	05	07	09	10	11	12	1C	13	14	15
LENGTH	05	07	09	10	11	12	12.5	13	14	15

CODE	16	17	20	25	30	32	35	36	40	50
LENGTH	16	17	20	25	30	32	35	36	40	50

Note: for the part hasn't been mentioned above, the CODE is the same with LENGTH.

For V-CHIP SMD

CODE	01	02	03	04
LENGTH	5.4	6.2	10.2	7.7

For POLYMER SMD

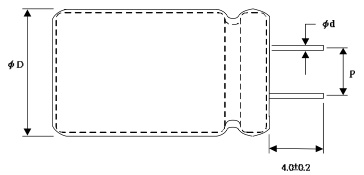
CODE	A1	A2	A3	A4	A5	A6	A7	A8
LENGTH	5.8	6.0	6.7	7.7	10.0	10.4	12.0	12.2

e.g.（For Code15~17）：

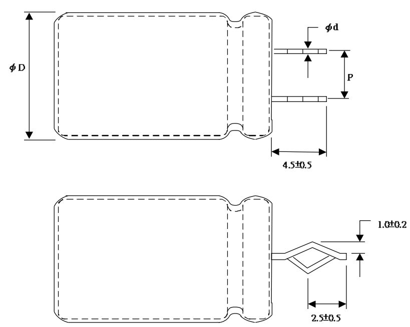
Code	Size	Description
B01	4*5.4	For V-CHIP SMD
C11	5*11	For ECAP-DIP & POLYMER-DIP
Q25	22*25	For SNAP-IN
EA1	6.3*5.8	For POLYMER SMD

Code 18 Other special instructions (“K”for TEAPO standard,“ 0 ” for LUXON standard)

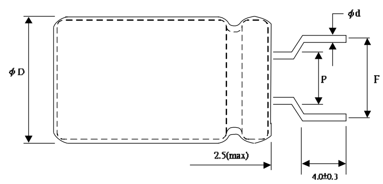
Code C5：Straight Cut



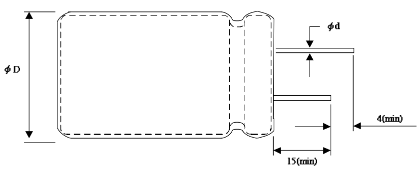
Code K2：Kink cut, & Crimping



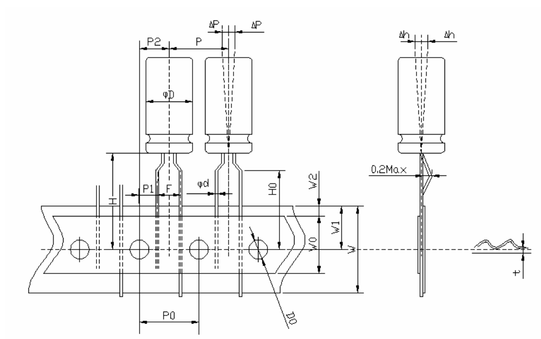
Code F6：Forming Cut(Φ4~Φ8)



Code S1：Standard Type

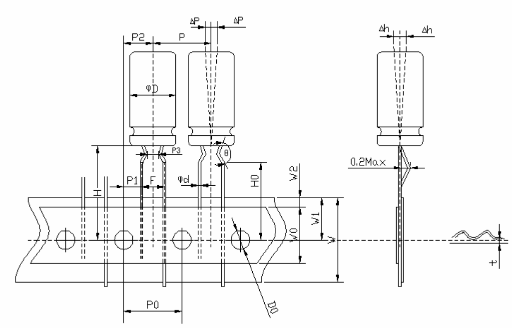


Code T1/R1 : Ammo / Reel Tape (φ 4 – φ 6.3)



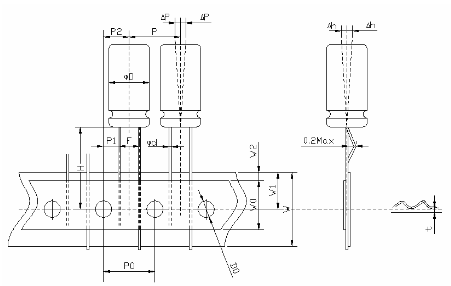
SYMBOL	CASE SIZE			TOLERANCE
	4x5	5x5~11	6.3x5~11	
φ d	0.45	0.45 or 0.5		±0.05
P	12.7			±1.0
P0	12.7			±0.3
P1	3.85			±0.5
P2	6.35			±1.0
F	5.0			+0.6 / –0.2
W	18.0			±0.5
W0	12.0 min			-
W1	9.0			±0.5
W2	2.0 max			-
H	18.5			±0.75
H0	16.0			±0.5
D0	4.0			±0.3
△P	0.2 max			-
△h	0.2 max			-
t	0.6			±0.3

Code T1/R1 : Ammo / Reel Tape (φ 8)



SYMBOL	CASE SIZE	TOLERANCE
	8x5~20	
φ d	0.45~0.6	±0.05
P	12.7	±1.0
P0	12.7	±0.3
P1	3.85	±0.7
P2	6.35	±1.0
P3	2.5	+0.2 / –0.5
θ	110°	±15°
F	5.0	+0.6 / –0.2
W	18.0	±0.5
W0	12.0 min	-
W1	9.0	±0.5
W2	2.0 max	-
H	18.5	±0.75
H0	16.0	±0.5
D0	4.0	±0.3
△P	0.2 max	-
△h	0.2 max	-
t	0.6	±0.3

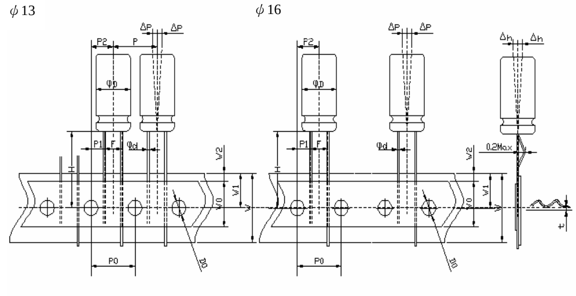
Code T1/R1 : Ammo / Reel Tape (ϕ 10)



SYMBOL	CASE SIZE	TOLERANCE
	10x10~30	
φ d	0.6	±0.05
P	12.7	±1.0
P0	12.7	±0.3
P1	3.85	±0.5
P2	6.35	±1.0
F	5.0	+0.6 / –0.2
W	18.0	±0.5
W0	12.0 min	-
W1	9.0	±0.5
W2	2.0 max	-
H	18.5	±0.75
D0	4.0	±0.3
△P	0.2 max	-
△h	0.2 max	-
t	0.7	±0.2

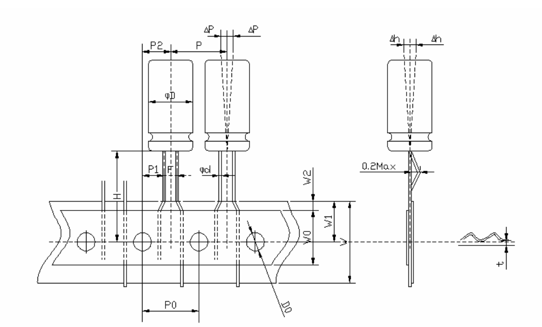
Code T1 : Ammo Tape (ϕ 13~ ϕ 16)

ϕ 13 ϕ 16



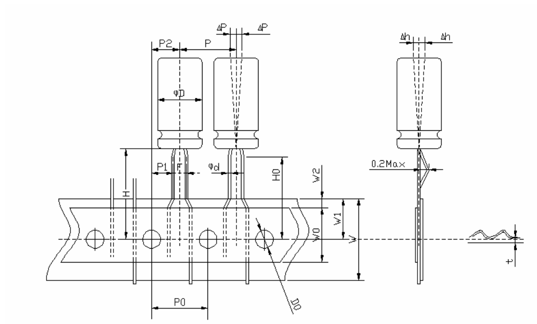
SYMBOL	CASE SIZE			TOLERANCE
	12.5x15~25	13x13~40	16x16~40	
φ d	0.6	0.6	0.8	±0.05
P	15.0		30.0	±1.0
P0	15.0			±0.3
P1	5.0		3.75	±0.7
P2	7.5			±1.3
F	5.0		7.5	+0.6 / –0.2
W	18			±0.5
W0	12.0 min			-
W1	9.0			±0.5
W2	2.0 max			-
H	18.5			±0.75
D0	4.0			±0.3
△P	0.2 max			-
△h	0.2 max			-
t	0.7			±0.3

Code T2/R2 : Ammo / Reel Tape with straight lead



SYMBOL	CASE SIZE				TOLERANCE
	4x5～7	5x5～11	6.3x5～11	8x7～14	
φ d	0.45	0.45 or 0.5		0.6	±0.05
F	1.5	2.0	2.5	3.5	+0.6 / –0.2
P1	5.6	5.35	5.1	4.6	±0.5
P0	12.7				±0.3
P	12.7				±1.0
P2	6.35				±1.0
W	18.0				±0.5
W0	12.0 min				-
W1	9.0				±0.5
W2	3.0 max				-
H	18.5				±0.75
D0	4.0				±0.3
△p	0.2 max				-
t	0.6				±0.2

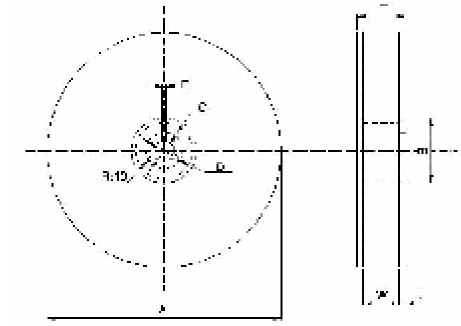
Code T4/R3 : Ammo / Reel Formed Tape (ϕ 4～ ϕ 5／pitch 2.5mm)



SYMBOL	Case SIZE		Tolerance
	4x5~4x7	5x5~5x11	
φ d	0.45	0.45 or 0.5	±0.05
P	12.7		±1.0
P0	12.7		±0.3
P1	5.1		±0.5
P2	6.35		±1.0
F	2.5		+0.6 / –0.2
W	18.0		±0.5
W0	12.0 min		-
W1	9.0		±0.5
W2	2.0 max		-
H	18.5		±0.75
H0	17.0		±0.5
D0	4.0		±0.3
△P	0.2 max		-
△h	0.2 max		-
t	0.6		±0.2

V-chip Packing Specifications

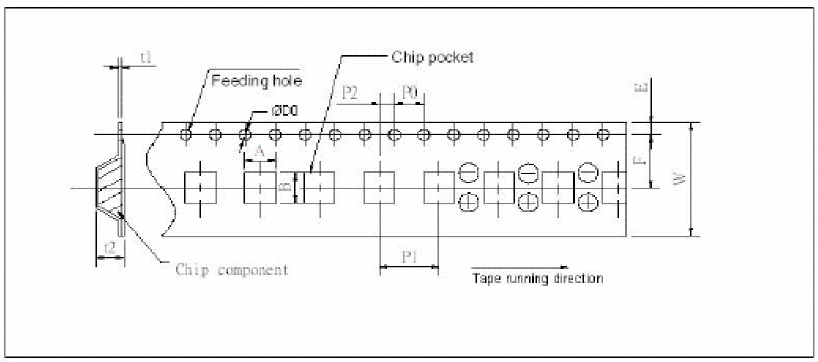
· **Reel Dimensions in mm(not to scale)**



Size	A	B	C	D	E	W	T	t
4 ϕ ~ 5 ϕ	380±2	50min	13.0±0.5	21.0±0.8	2.0±0.5	14±1	20±1	3.0
6.3 ϕ ~ 8x 6.2	380±2	50min	13.0±0.5	21.0±0.8	2.0±0.5	18±1	24±1	3.0
8×10.2 ~ 10 ϕ	380±2	50min	13.0±0.5	21.0±0.8	2.0±0.5	26±1	32±1	3.0

Reel Tape

Taping Dimensions in mm (not to scale)



***Ask factory for technical specifications.**

Symbol / Size	W	A	B	Po±0.1	P1	P2±0.1	F	ϕ Do	t1	E	t2
4x5.4	12.0	4.7	4.7	4.0	8.0	2.0	5.5	1.5+0.1-0	0.4	1.75	5.8
5x5.4	12.0	5.7	5.7	4.0	12.0	2.0	5.5	1.5+0.1-0	0.4	1.75	5.8
6.3x5.4	16.0	7.0	7.0	4.0	12.0	2.0	7.5	1.5+0.1-0	0.4	1.75	5.8
6.3x7.7	16.0	7.0	7.0	4.0	12.0	2.0	7.5	1.5+0.1-0	0.4	1.75	8.3
8x6.2	16.0	8.7	8.7	4.0	12.0	2.0	7.5	1.5+0.1-0	0.4	1.75	6.8
8x10.2	24.0	8.7	8.7	4.0	16.0	2.0	11.5	1.5+0.1-0	0.4	1.75	11.0
10x10.2	24.0	10.7	10.7	4.0	16.0	2.0	11.5	1.5+0.1-0	0.4	1.75	11.0

Packaging Specification

Size (mm)	Q'ty per reel	Inner box / measurement (mm)		Outer carton / measurement (mm)		Min. ordering amount
4x5.4	2000	20,000	390x195x395	40,000	420x410x414	10kpcs
5x5.4	1000	10,000	390x195x395	20,000	420x410x414	10kpcs
6.3x5.4 & 6.3x7.7	1000	10,000	390x235x405	20,000	420x410x492	10kpcs
8x6.2	1000	10,000	390x235x405	20,000	420x410x492	10kpcs
8x10.2	500	4,000	390x255x405	8,000	420x410x530	8kpcs
10x10.2	500	4,000	390x255x405	8,000	420x410x530	8kpcs

PACKAGING SPECIFICATION

Miniature Aluminum Electrolytic Capacitors

For Bulk: Standard Cutting & Forming

Classification	Standard Bulk				Cutting & Forming				Min. ordering amount
Case size D*L(mm)	Vinyl bag	inner box 289*168*279 (mm)	outer carton 355*297*290 (mm)	gross weight (kg)	Vinyl bag	inner box 289*168*135 (mm)	outer carton 355*297*290 (mm)	gross weight (kg)	kpcs
4×5	2,000	24,000	48,000	13	2,000	20,000	80,000	20	25
4×7	2,000	20,000	40,000	11	2,000	16,000	64,000	17	25
5×5	2,000	20,000	40,000	12	2,000	16,000	64,000	18	25
5×7	2,000	16,000	32,000	13	2,000	16,000	64,000	23	25
5×11	1,000	12,000	24,000	13	1,000	10,000	40,000	22	25
6.3×5	2,000	16,000	32,000	11	2,000	10,000	40,000	16	20
6.3×7	2,000	12,000	24,000	10	2,000	10,000	40,000	15	20
6.3×11	1,000	10,000	20,000	14	1,000	7,000	28,000	17	20
8x7	500	10,000	20,000	14	500	6,500	26,000	16	15
8×9,8×11	500	7,500	15,000	17	500	4,000	16,000	18	15
8×14	500	5,000	10,000	12	500	3,000	12,000	14	15
8×16	500	5,000	10,000	16	500	2,000	8,000	13	15
8×20	200	4,000	8,000	14	200	2,000	8,000	14	15
10×12.5	200	4,000	8,000	15	200	2,000	8,000	15	12
10×15	200	3,600	7,200	16	200	2,000	8,000	18	12
10×17	200	3,600	7,200	17	200	1,600	6,400	15	12
10×20	200	3,000	6,000	19	200	1,400	5,600	17	12
10×25	200	2,400	4,800	17	200	1,200	4,800	16	12
13×13,13×15	200	2,400	4,800	15	200	800	3,200	13	10
13×18,13×20	200	1,800	3,600	15	200	600	2,400	10	10
13×25	200	1,200	2,400	14	200	600	2,400	14	10
13×30	100	1,200	2,400	16	100	500	2,000	14	10
13×34,13×36	100	1,000	2,000	14	100	300	1,200	12	10
13×38,13×40	100	800	1,600	15	100	300	1,200	15	10

Classification	Standard Bulk				Cutting & Forming				Min. ordering amount
Case size D*L(mm)	Vinyl bag	inner box (mm)	outer carton (mm)	gross weight (kg)	Vinyl bag	inner box (mm)	outer carton (mm)	gross weight (kg)	kpcs
16X15、16X20	200	1000	2000	22	200	1000	2000	22	5
16X25	200	1000	2000	24	-	500	4000	44	5
16X30、16X32、	200	800	1600	20	-	500	3000	37	5
16X36、16X40	200	600	1200	22	-	500	3000	55	5
16X45	100	500	1000	22	-	-	-	-	5
18X15、18X20	200	800	1600	21	-	-	-	-	2.5
18X22、18X25	200	800	1600	23	-	500	2000	28	2.5
18X30	100	600	1200	25	-	-	-	-	2.5
18X32、18X36、18X40	100	500	1000	25	-	500	1000	25	2.5
18X45、18X50	100	300	600	21	-	600	1200	40	2.5
20X25	-	-	-	-	-	400	800	20	1.5
22X32	-	-	-	-	-	320	1920	55	1.5
22X30	-	-	-	-	-	400	800	25	1.5
22X35、22X40	100	300	600	21	-	400	800	27	1.5

ALUMINUM ELECTROLYTIC CAPACITORS

TEAPO

For Taping Ammo & Reel

Classification	Ammo Tape					Reel Tape			Min. ordering amount
Case size D φ (mm)	inner box (mm)	quantity (pcs)	outer carton (mm)	quantity (pcs)	gross weight (kg)	inner carton 350*350*110 (mm)	outer carton 370*370*600 (mm)	gross weight (kg)	kpcs
4 φ	340×275×50	3,000	355×297×290	15,000	6	3,000	15,000	8	25
5 φ	340×230×50	2,000	355×252×290	10,000	6 ~ 7	2,400	12,000	8	25
6.3 φ	340×275×50	2,000	355×297×290	10,000	8	2,000	10,000	6	20
8 φ ×5-16L	340×230×50	1,000	355×252×290	5,000	7	1,600	8,000	12	15
8 φ ×20L	340×230×58	1,000	355×252×315	5,000	7	1,000	5,000	12	15
10 φ x10~17L	340×230×50	600	355×252×290	3,000	7				12
10 φ x20~25L	340×230×58	600	355×252×315	3,000	7	-	-	-	12
10 φ x30L	340×230×65	600	355×252×290	2,400	7	-	-	-	12
13 φ x32L below	315×275×65	400	355×297×290	1,600	5	-	-	-	10
13 φ x36L above	315×275×74	400	355×297×337	1,600	5	-	-	-	10
16 φ x32L below	315×275×65	300	355×297×290	1,200	5	-	-	-	5
16 φ x36L above	315×275×74	300	355×297×337	1,200	5	-	-	-	5

Note：For 10 φ Reel Tape：

size	inner carton(pcs)	outer carton(pcs)
10 φ x10~16L	1,200	6,000
10 φ x17~20L	1,000	5,000

Large Can Type Aluminum Electrolytic Capacitors

Dimension D×L (mm)	weighe (g/pcs)	inner box 254*254*150 (mm)	outer carton 530*270*320 (mm)	Min. ordering amount
22×25 to 30	20 ~ 25	300	1200	1.5kpcs
22×35 to 50	25 ~ 30	200	800	1.5kpcs
25×25 to 30	25 ~ 30	240	960	1.2kpcs
25×35 to 50	30 ~ 35	160	640	1.2kpcs
30×25 to 30	30 ~ 35	135	540	1.0kpcs
30×35 to 50	35 ~ 40	90	360	1.0kpcs
30 x 70	45~50	80	320	1.0kpcs
35×25 to 30	40 ~ 45	105	420	1.0kpcs
35×35to 50	45 ~ 50	70	280	1.0kpcs

Note: The dimension of 30x70 inner box is 254*254*190, the dimension of 30x70 outer carton is 530*270*400

Conductive Polymer Aluminum Solid Capacitor

For Bulk: Standard Cutting & Forming

Classification	Standard Bulk				Cutting & Forming				Min. ordering amount
Case size D*L(mm)	Vinyl bag	inner box 289*168*279 (mm)	outer carton 355*297*290 (mm)	gross weight (kg)	Vinyl bag	inner box 289*168*135 (mm)	outer carton 355*297*290 (mm)	gross weight (kg)	kpcs
6.3×5.4	2,000	16,000	32,000	11	2,000	10,000	40,000	16	20
6.3×8	2,000	12,000	24,000	10	2,000	10,000	40,000	15	20
6.3×10.5	1,000	10,000	20,000	14	1,000	7,000	28,000	17	20
8×8, 8×10, 8x11.5	500	7,500	15,000	17	500	4,000	16,000	18	15
10×12.5	200	4,000	8,000	15	200	2,000	8,000	15	12

For Taping Ammo & Reel

Classification	Ammo Tape					Reel Tape			Min. ordering amount
Case size D φ (mm)	inner box (mm)	quantity (pcs)	outer carton (mm)	quantity (pcs)	gross weight (kg)	inner carton 350*350*110 (mm)	outer carton 370*370*600 (mm)	gross weight (kg)	kpcs
6.3 φ	340×275×50	2,000	355×297×290	10,000	8	2,000	10,000	6	20
8 φ ×5-16L	340×230×50	1,000	355×252×290	5,000	7	1,600	8,000	12	15
10 φ x10~17L	340×230×50	600	355×252×290	3,000	7	1,000	5,000	14	12