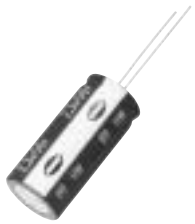
Radial lead Type

Series: HW

Country of Origin

Japan



■ Feature

- ●Miniaturized, high-capacitance, low-resistance
- ●Can be charged and discharged with more cycles compared to secondary batteries
- ●Pollution free: Has activated carbon and organic electrolyte
- ●Does not contain polyvinyl chloride and lead

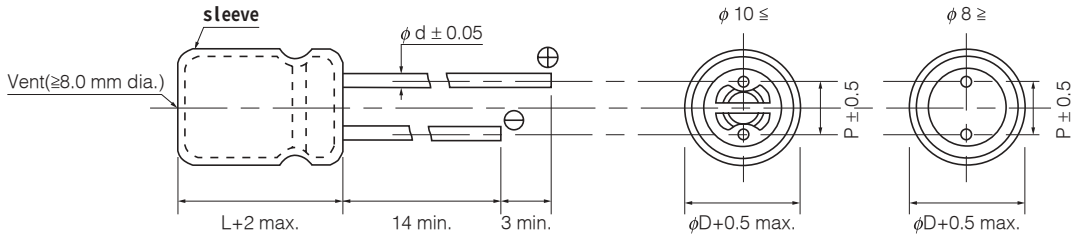
■ Recommended Applications

- ●Solar battery operated circuits (Road guidance flasher)
- ●Quick charging motor drives (Toy car)
- ●Back-up Power Supplies (UPS)

■ Specifications

Category temp. range	-25 to +70°C		-25 to +60°C
Maximum Operating Voltage	2.3 V .DC		2.3 V .DC
Nominal Cap. Range	1 to 22 F		30, 50 F
Capacitance Tolerance	-20 to +40%		
Characteristics at Low Temperature	Capacitance change	±30% of initial measured value at +20°C (-25 to +70°C, +60°C)	
	Internal resistance	≦ 4 times of initial measured value at +20°C (at -25°C)	
Endurance	After 1000 hours application of 2.3V. DC at +70°C(+60°C), the capacitor shall meet the following limits.		
	Capacitance change	±30% of initial measured value	
	Internal resistance	≦ 2 time of initial specified value	
Shelf Life	After 1000 hours storage at +70°C(+60°C) without load, the capacitor shall meet the specified limits for Endurance.		
Moisture Resistance	After 500 hours storage at +55°C, 90 to 95% R.H., the capacitor shall meet the specified limits for Endurance.		

■ Dimensions in mm (not to scale)



■ Standard Products

Category temp. range (°C)	Max. Operating Voltage (V.DC)	Capacitance (F)	Internal resistance (Ω) at 1kHz	Size(mm) φD	L	φd	P	Part number	Min. Packaging QTY (pcs)
-25 to +70	2.3	1.0	≦ 1.0	8.0	22.0	0.7	3.5	EECHW0D105	200
		3.3	≦ 0.3	12.5	23.0	0.8	5.0	EECHW0D335	200
		4.7	≦ 0.3	12.5	23.0	0.8	5.0	EECHW0D475	200
		10	≦ 0.2	12.5	35.0	0.8	5.0	EECHW0D106	100
		22	≦ 0.1	18.0	35.0	0.8	7.5	EECHW0D226	50
-25 to +60		30	≦ 0.1	18.0	35.0	0.8	7.5	EECHW0D306	50
		50	≦ 0.1	18.0	40.0	0.8	7.5	EECHW0D506	50

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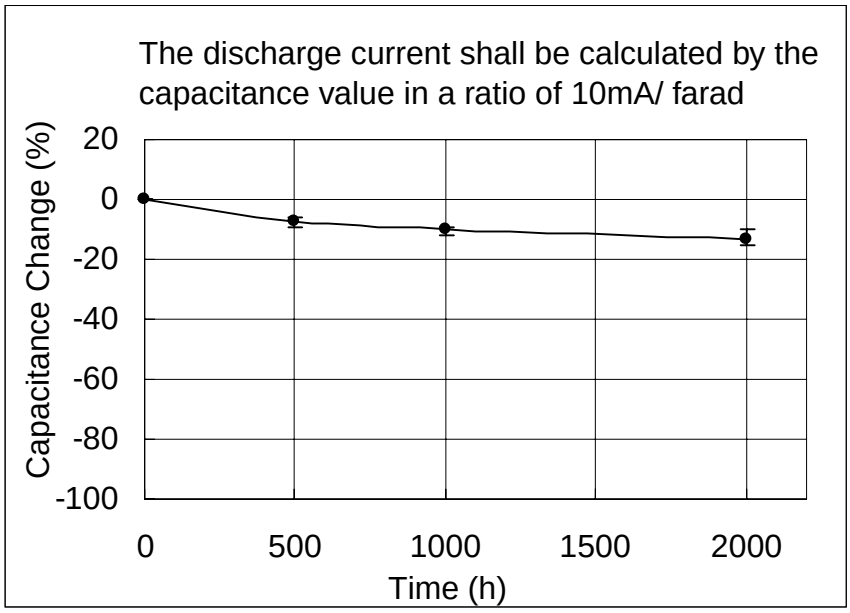
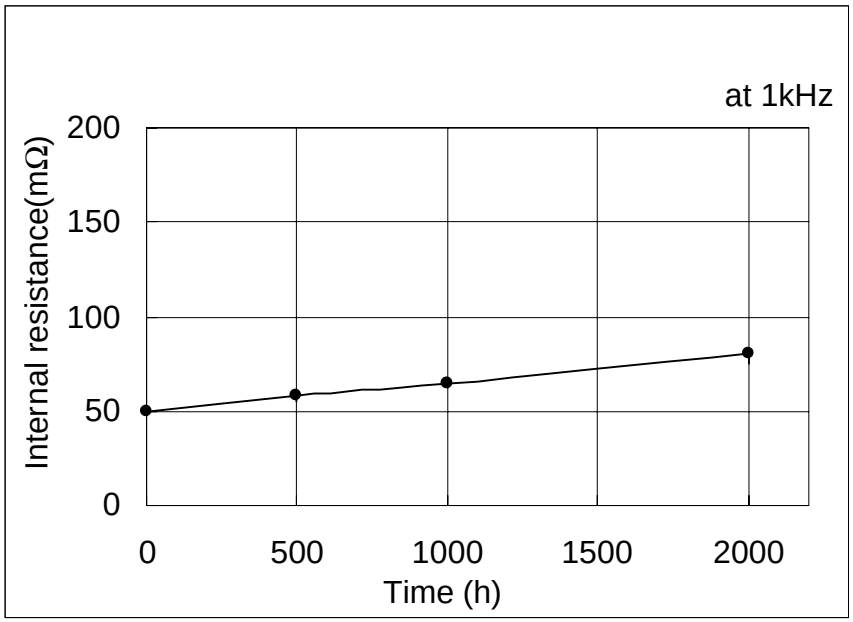
Load life characteristics

Part No.:EECHW0D106 (2.3V 10F) at +70°C 2.3V applied

n=20 Typical

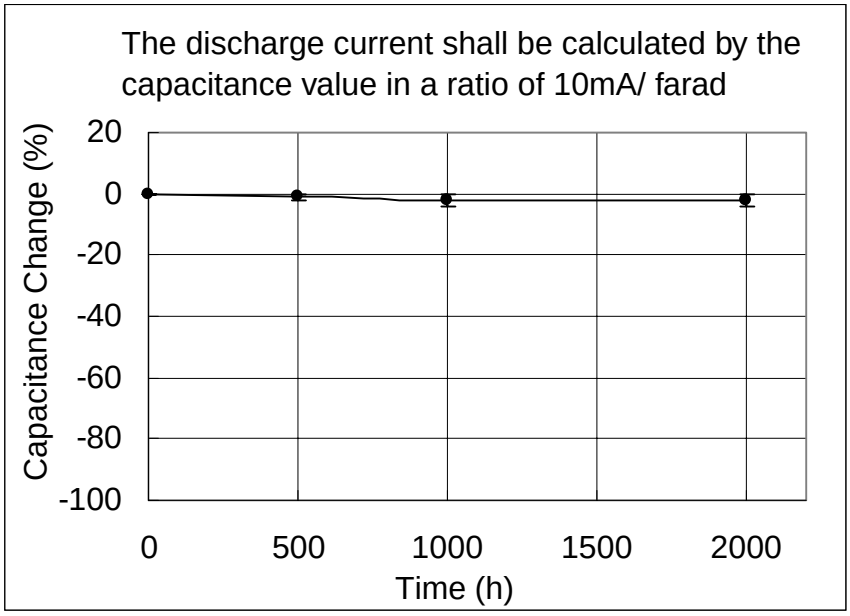


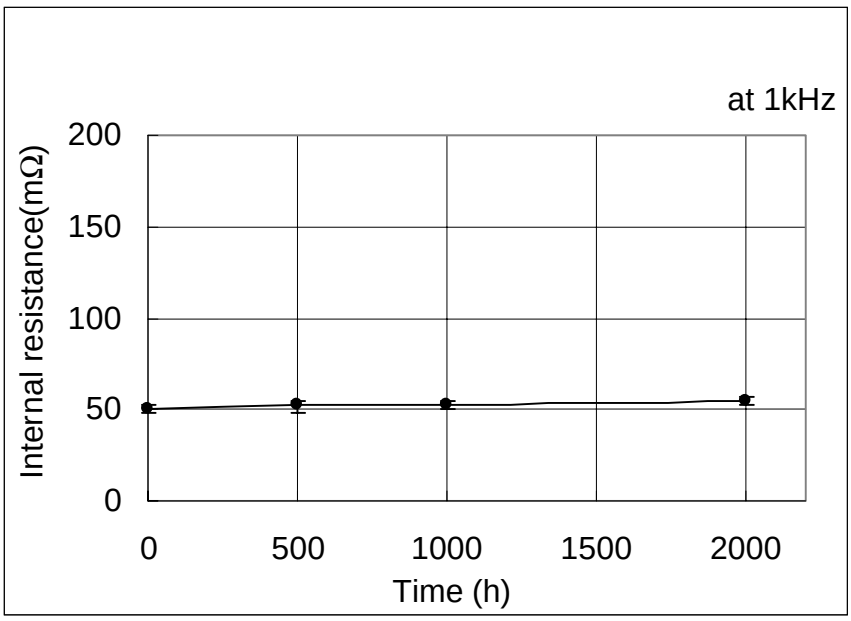


Shelf life characteristics

Part No.:EECHW0D106 (2.3V 10F) at +70°C applied

n=20 Typical

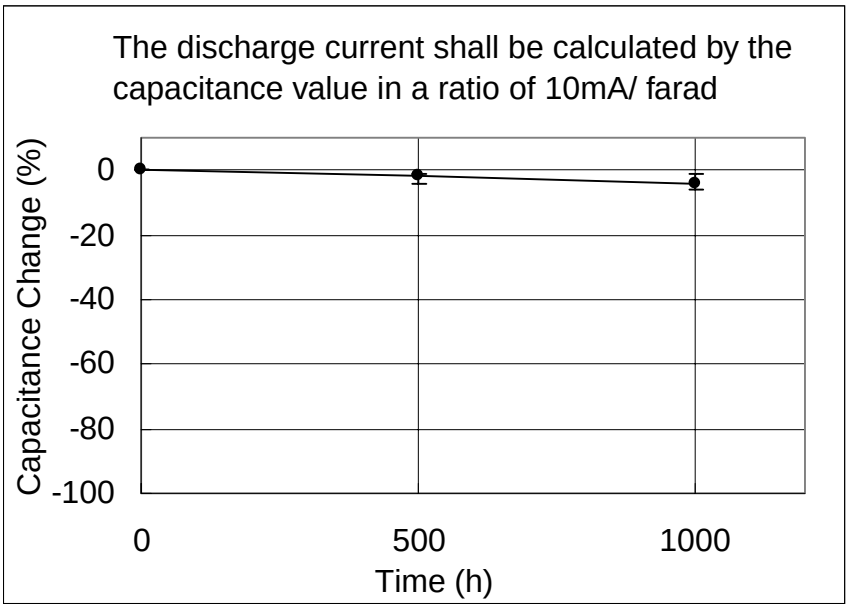


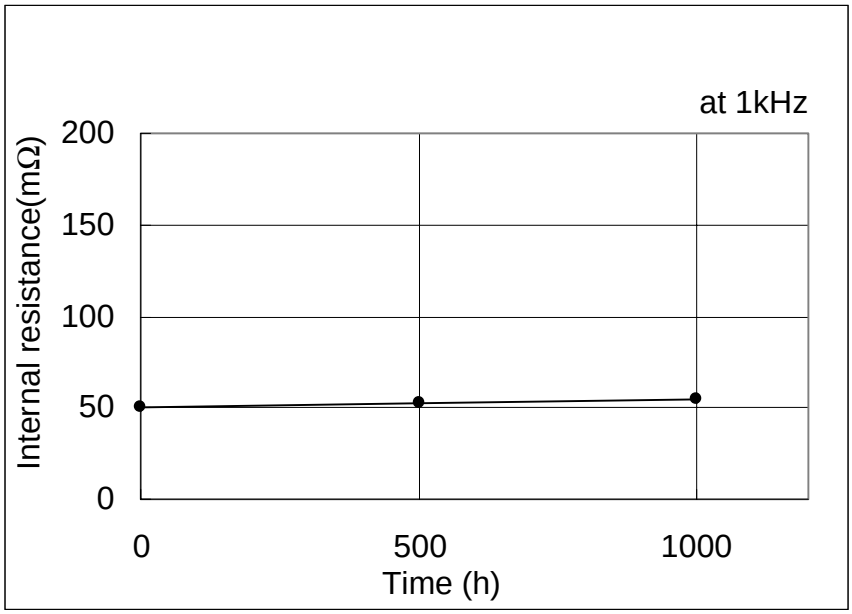


Shelf humidity characteristics

Part No.:EECHW0D106 (2.3V 10F) at +55°C 90 to 95%RH

n=20 Typical

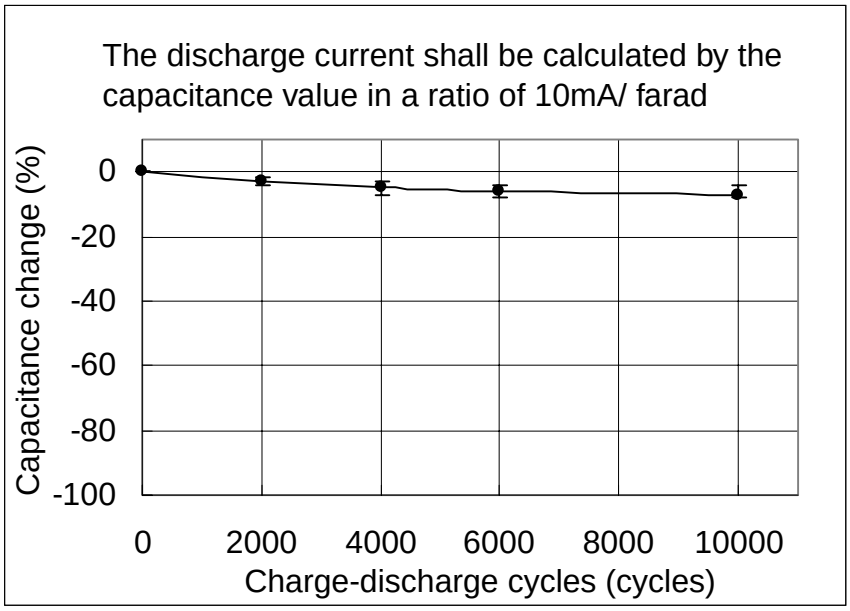


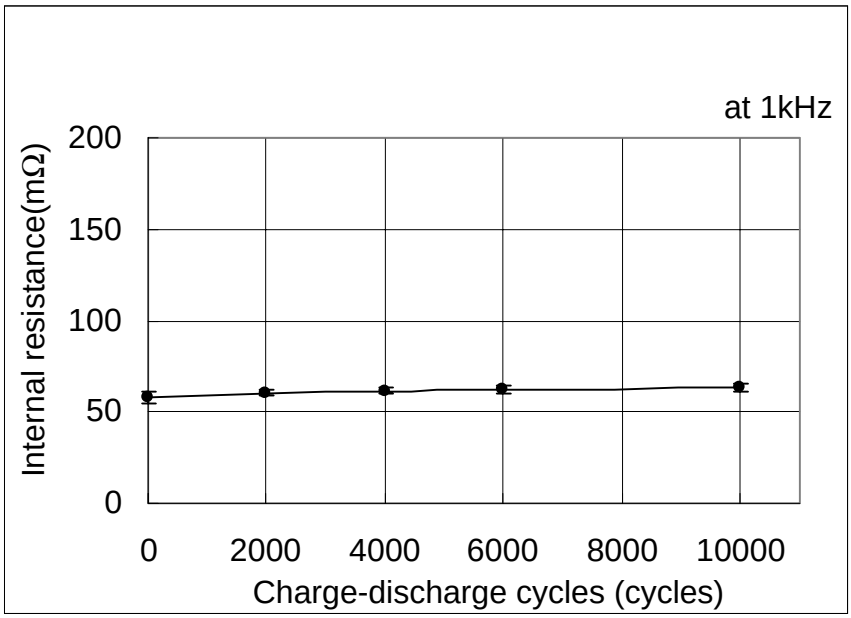


Charge-discharge life characteristics

Part No.:EECHW0D106 (2.3V 10F) at +20°C

Charging(2.3V)and discharging time : 15min. each
Constant resistance discharge : 0 ohm n=20 Typical

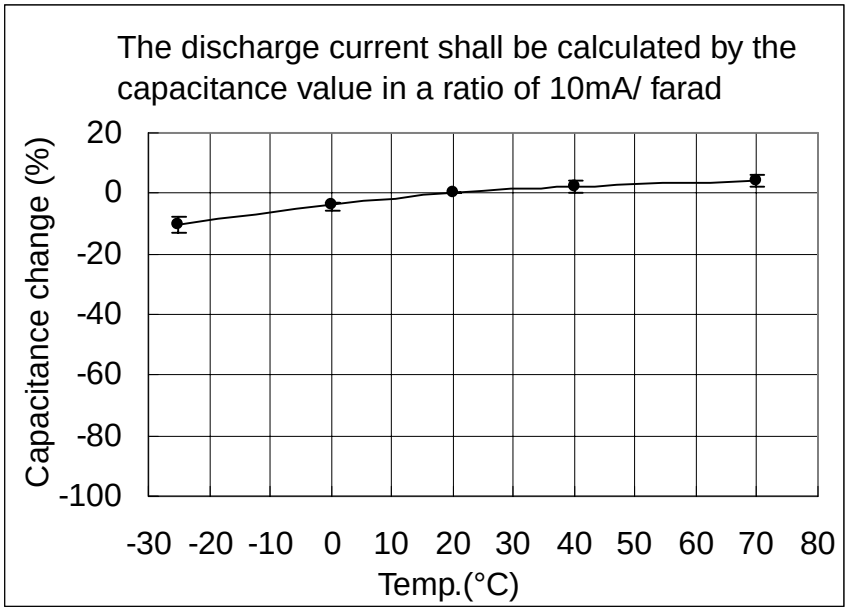


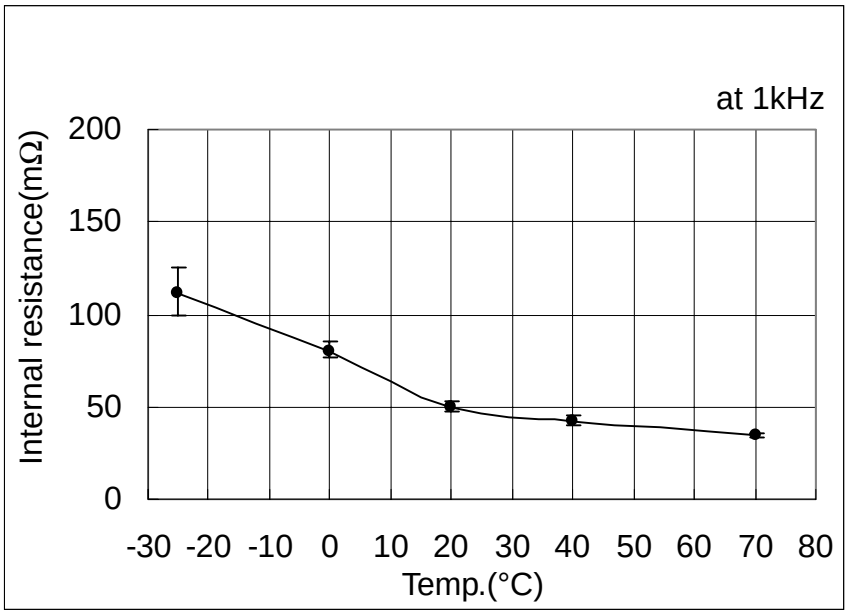


Temperature characteristics

Part No.:EECHW0D106 (2.3 V 10) at -25 to 70°C

n=20 Typical

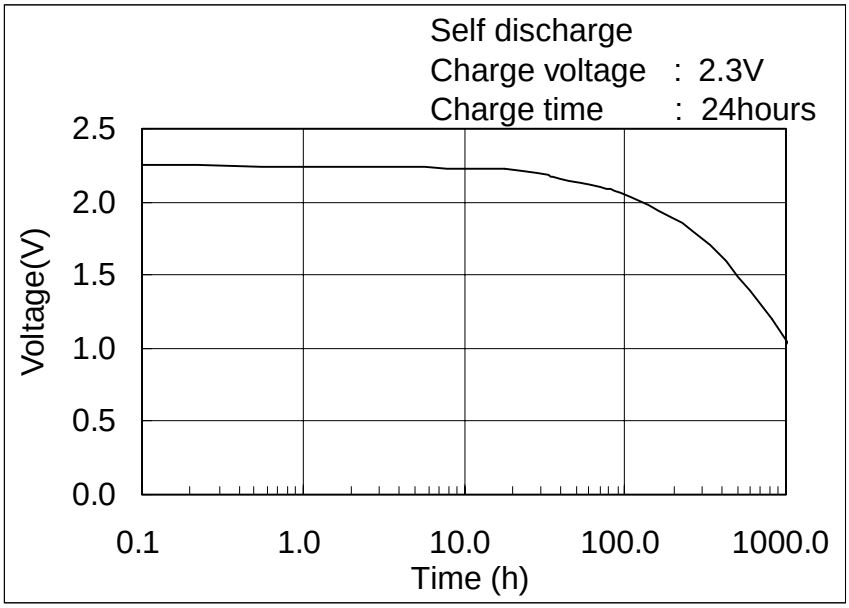


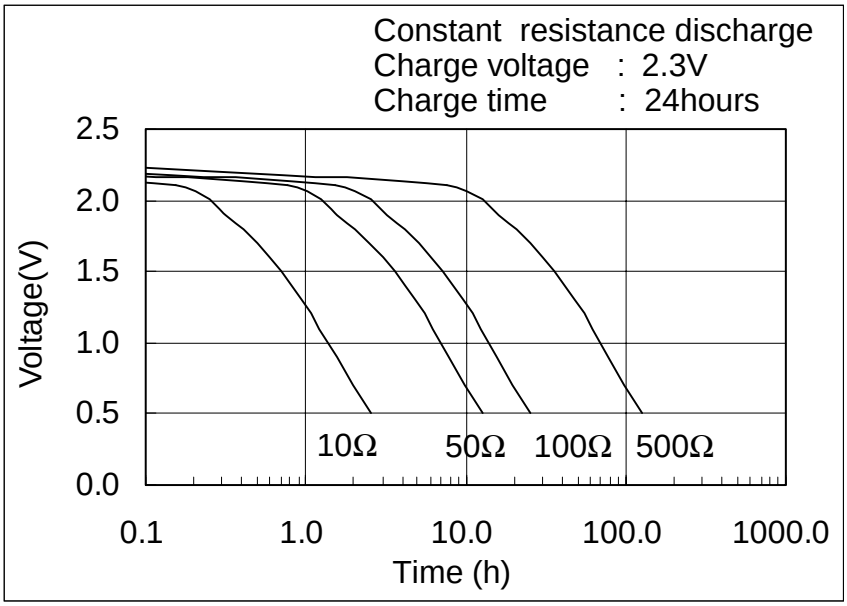


Discharging characteristics

Part No.:EECHW0D106V (2.3V 10F) at +20°C

n=20 Typical





⚠ Application Guidelines

1. Circuit Design

Ensure that operational and mounting conditions follow the specified conditions detailed in the catalog and specification sheets. Basically, Gold capacitors are designed for A/V devices, consumer electronics and O/A devices. Accordingly, when using gold capacitors for special applications like automotive on-board equipment or industrial equipment, please contact us first and let us know the environmental conditions and reliability required for your application.

1.1 Lifetime

Gold Capacitors have a longer lifetime than do secondary batteries, but their life is still limited. During use, capacitance decreases and internal resistance rises. The lifetime of a Gold Capacitor is greatly affected by ambient temperature, applied voltage and operating current. By reducing these factors as much as possible, capacitor lifetime can be lengthened.

1.2 Voltage

If a Gold Capacitor is used at a voltage exceeding its rated voltage, not only is its lifetime shortened, but depending on the actual voltage, gas generated by electrochemical reactions inside the capacitor may cause it to leak or rupture.

1.3 Polarity

Be sure to verify the polarity of the capacitor before use. If a reverse voltage is applied for a long time, capacitor lifetime is shortened and serious damage such as electrolyte leakage may occur.

Furthermore, there may be leftover electric charge from capacitor testing that could damage other circuit components such as the low-withstanding voltage parts of semiconductors, etc.

1.4 Ambient Temperature

(1)Capacitor life is affected by operating temperature. In general, lowering ambient temperature by 10°C will double the life of a capacitor. Use the capacitor at the lowest possible temperature under the maximum guaranteed temperature.

(2)Operation above the maximum specified temperature not only shortens capacitor life, but can also cause serious damage such as electrolyte leakage.

Verify the operating temperature of the capacitor by taking into consideration not only the ambient temperature and temperature inside the unit, but also the radiation from heat generating elements inside the unit(power transistors, ICs, resistors, etc.) and self-heating due to ripple current.

Be careful not to place heat-generating elements across from the capacitor on the opposite side of the PCB.

1.5 Characteristics of constant current and constant resistance discharging

The time required for the constant current and constant resistance discharging are respectively represented by the equation (1) and (2) below:

Discharging time (t) of constant current discharge

$t=C \times (V_0-V_1)/I$.....(1)

Discharging time (t) of constant resistance discharge

$t=-CR\ln(V_1/V_0)$·····(2)

t = discharging time (s)
V_0 = initial voltage (v)
V_1 = terminal voltage (v)
I = current during back-up (A)
R =resistance during back-up(Ω)

The above equations may not always be accurate, as the terminal down voltage must be considered after the start of discharge if load resistance or load current is present.

Back-up characteristics for IC

Also, if the capacitor is used to back-up an IC, the V-I characteristics of the IC must also be considered. It can therefore be said that if the voltage is low, the current is also low and the actual back-up time will be longer than that calculated. To be certain that if the capacitor selected is of sufficient value to maintain the necessary energy and time, it should be checked and measured under actual operating conditions.

1.6 Voltage Drop During Backup Operation

Take careful notice of the voltage drop caused by the instantaneous operating current and the internal resistance of the Gold Capacitor during the switch from power-failure-detection to backup mode. Because internal resistance varies by product, use the following table to decide the correct operating (discharge) current.

Series	Operating current				
	0.047 F or less	0.1 to 0.33 F	0.47 to 1.5 F	3.3 to 4.7 F	10 to 50F
SG,SD,SE,NF	200 µA or less	300 µA or less	1 mA or less	—	—
F	200µA or less	300 µA or less	300 µA or less	—	—
EL	—	300 µA or less	1 mA or less	—	—
EN	10µA or less				
AL,HW	—	—	100 mA or less	300 mA or less	1 A or less

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1.7 Ripple Current

Gold Capacitors have a higher internal resistance than do electrolytic capacitors and are more susceptible to internal heat generation when exposed to ripple current. When the temperature of the element rises, a reaction current flows inside the Gold Capacitor, generating reaction products and raising internal resistance even further. This makes it difficult to maintain capacitance. Set the allowable limit for the ripple current-induced rise in capacitor temperatureto 3°C measured at the surface of the capacitor.

1.8 Connecting Capacitors in Series

Taking into consideration the possibility of an imbalance in the voltages across the capacitors, make sure that the voltage applied to each capacitor will not exceed the Maximum operating voltage. If the voltage balance breaks down, an overvoltage condition could result.

To prevent this from occurring, add a voltage-dividing resistor in parallel with each capacitor, allowing for the capacitor's leakage current.

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

(1) Provide protection circuits and protection devices to allow safe failure modes.

(2) Design redundant or secondary circuits where possible to assure continued operation in case of main circuit failure.

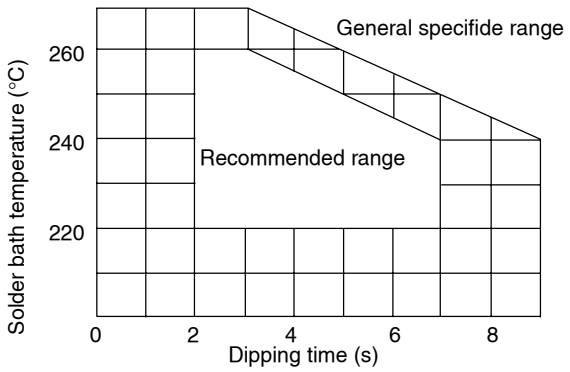
2. Mounting Considerations

2.1 Heat Stress During Soldering

Excessive heat stress may result in the deterioration of the electrical characteristics of the capacitor, loss of air-tightness, and electrolyte leakage due to the rise in internal pressure.

(1) If the tip of the soldering iron touches the capacitorís external sleeve, the sleeve will melt or break.

(2) Use the general reference chart below to set soldering temperature and time.



Pre-heating temperature: 110°C or under(on the surface of circuit)
: 100°C or under(on the surface of capacitor)
Pre-heating time : 60 seconds or under
Board thickness : 0.8 mm or more

(3) When soldering with a soldering iron, do not touch the tip to the body of the capacitor. Minimize the time that the soldering iron is in contact with the capacitor terminals.

(4) When using equipment such as a UV curing oven for pre-heating and adhesive hardening, set the temperature of the capacitorís surface 100°C or under and the time less than 60 seconds.(maximum temperature less than 105°C)

(5) When reflow soldering on gold capacitors using infrared heating or atmospheric heating method, use the general reference chart to set soldering temperature and time.

2.2 Circuit Board Patterns Under the Capacitor

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

2.3 Elevate the Gold Capacitor Above the PCB for Mounting

If the capacitor is soldered directly to a double-sided PCB, a short circuit may occur between the capacitor body and the wiring pattern. In the case of a through-hole board, flux or solder blowing out of the holes can shrink or break the external sleeve and possibly cause internal damage to the capacitor.

2.4 Series NF and F are not suitable for circuit board cleaning after mounting process.

For electrical connections: Series NF and F use the spring plate between the inner cells and add a space to connect them by pressure.

If the cleaning solution soaks into the connection and makes it wet, it is possible to increase the contact resistance between the inner cells due to rust on the case. If you need circuit board cleaning. Please use Series SG, SD.

2.5 Circuit Board Cleaning

Circuit boards can be immersed or ultrasonically cleaned using suitable cleaning solvents for up to 5 minutes and up to 60°C maximum temperatures.

The boards should be thoroughly rinsed and dried.

(Recommended cleaning solvent include)

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

❇ Consult with us if you are using a solvent other than any of those listed above.

❇ The use of ozone depleting cleaninig agents are not recommended in the interest of protecting the environment.

3. Precautions for using capacitors

Do not use or store the unit containing the capacitor in any of the following environments.

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(1) Environments where the capacitor is subject to direct contact with water, salt water or oil.
(2) Environments where capacitors are exposed to direct sunlight.
(3) A high temperature or humid environment where water vapor is condensing on the capacitor surfade.
(4) Environments where the capacitor is in contact with chemically active gases.
(5) Acid or alkaline environment.
(6) Environments subjected to excessive vibration and shock.

4. Emergency Procedures

If the capacitor overheats or starts to smell, immediately switch off the units main power supply to stop operation. Keep your face and hands away from the capacitor, since the temperature may be high enough to cause the capacitor to ignite and burn.

5. Long Term Storage

Do not store capacitors under any of the environmental conditions listed below:
(1) At high temperature and high humidity.
(2) Where the capacitor is subject to direct contact with water, salt water or oil.
(3) Where the capacitor is exposed to direct sunlight or to toxic gases.
(4) Where there is a lot of dust in the air.

6. Capacitor Disposal

When disposing of capacitors, follow the instructions below:
(1) Crush or make a hole in the capacitor before burning. If the capacitor is burned ìas is,î it can explode. If taking apart the capacitor before disposal, wear protective gear such as gloves and goggles.
(2) Because of the capacitorís plastic (polyvinyl chloride) sleeve, burn at high temperature. Low temperature burning will result in the production of toxic gases such as chlorine.
(3) If you choose not to burn used capacitors, consign them to a specialized industrial waste processor for disposal.

The application guidelines above are take from:

Technical Report EIAJ RCR-2370 issued by the Japan Electronic Industry Association, Inc.
Guideline of notabilia for fixed electric double layer capacitors with non-solid electrolyte for use in electronic equipment.

Refer to this Technical Report for additional details.

■ Environmental Management(Pb-free,PVC-free)

We are reducing environmentally harmful substances to do our part in global environmental conservation activities. We are moving ahead with products compatible with Pb-free soldering, products with Pb-free terminals and products with non-PVC encasing materials.

● Specialty Polymer Aluminum Electrolytic Capacitor

Body shape	Series/Type	P / N (standard)	Lead-free Solder Compatible P / N	Lead-free Terminal	Non-PVC Sleeve	page
Surface Mount Type	FD	EEFFD-----R	Case by case available (Please check with us for reflow conditions)	available	available as standard	014
	CD	EEFCD-----R				
		EEFCD-----XR				
	UD	EEFUD-----R				
		EEFUD-----XR				
	UE	EEFUE-----R				
		EEFUE-----XR				
	SL	EEFSL-----R				017
	SX	EEFSX-----R				
	SD	EEFSD-----R				
	SE	EEFSE-----R				
	HL	EEFHL-----R				019
	HD	EEFHD-----R				
	HE	EEFHE-----R				

● Aluminum Electrolytic Capacitor

Body shape	Series/Type	P / N (standard)	Lead-free Solder Compatible P / N	Lead-free Terminal	Non-PVC Sleeve	page
Surface Mount Type (V Type)	S	ECEV--S---S-	EEE--S---S-	available	available as standard	026
		ECEV--A---S-	EEE--A---S-			
		ECEV--A-----	EEE--A-----			
		ECEV--S---W-	EEE--S---W-			
		ECEV--A---W-	EEE--A---W-			
		ECEV--A---U-	EEE--A---U-			
		ECEV--A---N-	EEE--A---N-			
	HA	EEVHA-------	EEEHA-------			031
	HB	EEVHB-------	EEEHB-------			035
		EEVHP-------	EEEHP-------			
	HD	EEVHD-------		not available		038
	FC	EEVFC-------	EEEFC-------	available		040
	FK(φ10≧)	EEVFK-------	EEEFK-------			043
	FK(φ12.5≦)	EEVFK-------				
	TA	EEVTA-------		not available		048
	TB	EEVTB-------	EEETB-------	available		050
	TG(φ10≧)	EEVTG-------	EEETG-------			052
	TG(φ12.5≦)	EEVTG-------				
	EB	EEVEB-------				057

● Aluminum Electrolytic Capacitor

Body shape	Series/Type	P / N (standard)	P / N (Non-PVC)	Lead-free Terminal	Non-PVC Sleeve	page
Radial Lead Type (A Type)	FC	EEUFC - - - - - - -	Non-PVC:case by case available (P/N change)	available as standard	available	059
	FK	EEUFK - - - - - - -				069
	FM	EEUFM - - - - - - -				074
	NHG	ECA - - HG - - - - -				090
	EB	EEUEB - - - - - - -				079
	ED	EEUED - - - - - - -				084
	TA	EEUTA - - - - - - -	no P/N change		available as standard	087
	GA Bi-polar	ECA - - EN - - - - -	Non-PVC:case by case available (P/N change)	available as standard	available	097
	M	ECA - - M - - - - - -				099
	KS	ECA - - KS - - - - -				111
	KS Bi-polar	ECEA - - SN - - - -				114
	KA	ECEA - - KA - - - -				107
	KA Bi-polar	ECEA - - KN - - - -				109
	GA (L: 7mm)	EEAGA - - - - - - -				095
	SU-Bipolar	ECEA - - N - - - - -				104

● Aluminum Electrolytic Capacitor

Body shape	Series/Type	P / N (standard)	P / N (Non-PVC)	Lead-free Terminal	Non-PVC Sleeve	page
Snap-in Type (TS Type)	UP	ECOS - - P - - - - -	Pb-free: no P/N change Non-PVC:case by case available (P/N change)	available	available	128
		ECEC - - P - - - - -				
	UQ	EETUQ- - - - - - -				118
	HA	ECOS - - A - - - - -				158
		ECEC - - A - - - - -				
	HB	ECOS - - B - - - - -				153
		ECEC - - B - - - - -				
	HC	EETHC - - - - - - -				142
	XB	EETXB - - - - - - -				166
	ED	EETED - - - - - - -				172
	MD	EETMD - - - - - - -				177
		EETLD - - - - - - -				

● Electric Double Layer Capacitor

Body shape	Series/Type	P / N (standard)	P / N (Non-PVC)	Lead-free Terminal	Non-PVC Sleeve	page
Stacked Coin Type	SD	EECS0HD - - - - -	no P/N change	available	available	194
	SG	EECS5R5V - - - -				195
		EECS5R5H - - - -				
	SE	EECSE0H - - - - -				196
	NF	EECF5R5U - - - -				197
	F	EECF5R5H - - - -				198
Coin Type	EL	EECE0EL - - - - -			available as standard	199
Surface Mount Type	EN	EECEN - - - - - -				200
Rdial Lead Type	HW	EECHW0D - - - -			available	201