

Technical note

As aluminum solid capacitor with conductive polymer is different as the common capacitors which use electrolyte as cathode. Please note the following points in order to take full advantages of the aluminum solid capacitor with conductive polymer and ensure the most stable quality possible.

Crucial precautions

1. Polarity

The solid aluminum electrolytic capacitor with positive and negative electrodes.

Do not reverse the polarity when using. If happened, increased leakage current or a decreased life span may result.

2. Prohibited circuits

The leakage current may become greater even if the soldering conditions adhere to the specification requirements. Therefore, do not use the capacitors in the following circuits because trouble or failure may occur.

- a) High impedance circuits
- b) Coupling circuits
- c) Time constant circuits
- d) Do not use the capacitors in circuits except those above if changes in the leakage current affects circuit operations.

3. Compliance with rated performance

The aluminum solid capacitor with conductive polymer must be used under the rated voltage.

Over-voltage exceeding the rated voltage should not be applied since it may cause a short circuit.

4. Considerations when soldering

The soldering conditions are to be within the range prescribed in specifications.

If the specifications are not followed, there is a possibility of the cosmetic deflection, the intensive increase of leakage current, and the capacitance reduction.

5. Things to be noted before mounting

The aluminum solid capacitors with conductive polymer is sealed well, because of sealing the rubble may protrude, please conform to the dimensional tolerance stipulated in the specifications.

Application Guidelines

1. Considerations when circuit design

(a) Confirm the characteristic before using

Please confirm the using and mounting conditions before circuit design. Please confirm the using and mounting conditions which are to be within the range prescribed in the specification.

(b) Operating temperature and ripple current

Please confirm operating temperature is in the specification. Do not apply current that exceeds the rated ripple current. When excessive ripple current is applied, the solid capacitor may result in shorter life due to the internal heat increases.

(c) Leakage current

Heat pressure from soldering and mechanical stress from transportation may cause the leakage current to become large.

In such a case, leakage current will gradually decreased by applying voltage less than or to the rated voltage at a temperature within the upper category temperature.

使用注意事项

固体铝电解电容器具有不同于一般电解液作为阴极的铝电解电容器。为使导电性高分子铝电解电容器在电路中发挥其优越的性能，在使用中请特别注意以下内容。

使用中需要特别注意的事项

1. 极性

导电性高分子型固体铝电解电容器的引出端子有正负极之分。

在电路中使用切勿将正负极接反，否则将会导致电容器漏电流增加并将严重影响电容器的使用寿命。

2. 不推荐使用的电路

导电性高分子型固体铝电解电容器在电路使用中由于焊接等原因会导致漏电流增大，因此不推荐应用于以下电路。

- a) 高阻抗电路
- b) 耦合电路
- c) 时间常数电路
- d) 受漏电流影响较大的电路

3. 禁止在过电压状态下使用

导电性高分子型固体铝电解电容器必须在低于额定工作电压下使用。

瞬间的超过额定电压的过电压可能会导致电容器的短路。

4. 电容器焊接时的注意事项

电容器的焊接条件请在本公司所规定的范围内进行。

强烈的焊接条件，可能会造成电容器电气性能的劣化甚至外观不良，严重时更会导致电容器漏电流的急剧增加和容量急剧下降。

5. 线路板焊接时的注意事项

导电性高分子型固体铝电解电容器的封口皮塞具有较好的密封效果，由于封口的原因皮塞可能会有一定程度的鼓起，电路设计时请考虑本公司规格书的L尺寸和引线的位置公差范围。

固体电容器应用指南

1. 电路设计的注意事项

(a) 额定电性能的使用确认

在电路设计前，请先确认电容器的使用及安装环境，请在本公司的技术手册或者规格书的规定条件范围内正确使用。

(b) 使用温度和纹波电流

使用温度请设定在规格书规定的范围之内。

使用电容器过程中切勿施加超过额定纹波电流的电流。如有此现象的发生将会导致电容器内部急剧发热而严重缩短电容器的使用寿命。

(c) 漏电流

对于高温无负荷、高温高湿无负荷及温度急剧变化等试验也会导致漏电流的增大。

这种情况下，在最高使用温度范围内施加额定使用电压，漏电流会有一定程度的降低。

(d) Applied voltage when circuit design

It can be applied with the rated voltage.

Sum of the DC voltage value and the ripple voltage peak value must not exceed the rated voltage.

When DC voltage is low, negative ripple voltage peak value must not become a reverse voltage that exceeds 10% of the rated voltage.

Using the capacitors within 20% of the rated for applications which may cause the reserve voltage during the transient when the power is turned off or the source is switched.

(e) Capacitor insulation

Insulation in the laminate resin is not guaranteed. Be sure to completely separate the case, negative lead terminal, positive lead terminal and PC patterns with each other.

(f) Prohibited circuits

The leakage current may become greater even if the soldering conditions adhere to the specification requirements. Therefore, do not use the capacitors in the following circuits because trouble or failure may occur.

a) High impedance circuits

b) Coupling circuits

c) Time constant circuits

d) Do not use the capacitors in circuits except those above if changes in the leakage current affects circuit operations.

(g) Things to be noted before mounting

The aluminum solid capacitors with conductive polymer is sealed well, because of sealing the rubble may protrude, please conform to the dimensional tolerance stipulated in the specifications.

(h) Operating environmental restrictions

Do not use the capacitors in the following environments:

(1) Places where water, salt water, or oil can directly fall on it.

(2) Places filled with noxious gas such as hydrogen sulfide, sulfide acid, chlorine, ammonia, etc.

(3) Place susceptible to Ozone, ultraviolet rays and radiation.

(i) others

Design circuits after checking the following.

Electric characteristics are affected by temperature and frequency fluctuations. Design circuits after checking the following items.

2. Mounting precautions

(a) Considerations before mounting

Do not reuse the capacitors that have been assembled and energized.

Leakage current may increase when the capacitors are stored for a period of time. In this case, we recommend that you apply the rated voltage for 1 hour at 60~70°C with a resistor load of 1kΩ.

(b) Considerations when mounting

Mount after checking the capacitance and the rated voltage, please confirm the polarity.

Do not drop the capacitors on the floor. Do not use the capacitors that have been dropped.

Mount after checking that radial lead types of the capacitors terminal pitch and diameter of PCB holes.

(c) Soldering with a soldering iron

Set the soldering temperature and time in the specifications.

Do not subject the capacitors itself to excessive stress when soldering. Do not let the tip of the soldering iron touch the capacitors itself.

(d) 电路设计时的施加电压

可以施加100%的额定电压。请在直流电压与纹波电压的最大值不超过额定电压的范围内使用。

直流电压偏低时，纹波电压的负的最大值不能超过额定电压的10%的反向电压。

在切断电源等造成的过渡现象中产生的反电压，应在额定电压的20%以内使用。

(e) 电容器的绝缘性

电容器的表面喷塑涂层不保证完全绝缘。

使用电容器时请将外壳、负极引线、正极引线周围组件之间的线路完全分开。

(f) 不推荐使用

导电性高分子型固体铝电解电容器在电路使用中由于焊接等原因会导致漏电流增大，因此禁止应用于以下电路，防止故障的发生。

a) 高阻抗电路

b) 耦合电路

c) 时间常数电路

d) 受漏电流影响较大的电路

(g) 关于安装

导电性高分子型固体铝电解电容器的封口皮塞具有较好的密封效果，由于封口的原因皮塞可能会有一定程度的鼓起，电路设计时请考虑本公司规格书的L尺寸和引线的位置公差范围。

(h) 工作环境限制

电容器在下列环境中禁止使用

(1) 在有水、卤水、油的地方

(2) 充满有害气体的地方，如硫化氢、亚硫酸、氯气、氨气等

(3) 容易受臭氧氧化、紫外线及放射线辐射的地方

(i) 其它

设计电路前请先确认以下内容

电容器的电性能会受到温度和频率的影响，在设计前请先确认波动量。

2. 安装注意事项

(a) 安装前的注意事项

使用过的电容器不能再使用。

长期保存的电容器其漏电流会有不同程度的升高，此情况下请通过1kΩ的电阻进行施加额定电压处理。

处理方法：在60~70°C温度下施加额定电压1h。

(b) 安装时的注意事项

安装时注意电容器的标称容量和额定电压，并确认极性。

安装过程中切勿将电容器掉落地面，此电容器不能再使用，安装过程中防止电容器变形。

安装前请确认电容器的引线间距是否与线路板孔间隔吻合。

(c) 电烙铁焊接

焊接温度、时间等请保持在本公司规格书规定的范围内。

焊接时不要给电容器施加过度的应力，通电的电烙铁不要触及电容器本身。

The leakage current value after soldering may increase a little, from a few μA to several hundred μA , depending on the soldering conditions (preheating and solder temperature and time, PCB material and thickness, etc.). The leakage current can be reduced through self-repair by applying voltage.

(d) Handling after soldering

Do not subject the capacitors itself to excessive stress after soldering.

Do not tilt, bend or twist the capacitors after it has been soldered on the PCB.

(e) Circuit board cleaning

Check the following items before washing PC board with these detergents: high quality alcohol-based cleaning fluid such as Pine-a ST-100S, clean thru 750H, 750L, 710M, 750K or Techno Care FRW 14 through 17 or detergents including substitute freon as AK-225AES or IPA.

- (1) Use immersion or ultrasonic waves to clean within 2 minutes.
- (2) The temperature of the cleaning fluid should be less than 60°C
- (3) Watch the contamination of the detergent such as conductivity, pH, specific gravity, water content, etc.
- (4) Do not store the capacitors in a location subject to gases from the cleaning fluid or in an airtight container after cleaning.
- (5) Dry the PCB or OS-CON with hot air that should be less than the upper category temperature.
- (6) Please note that indication may disappear when rubbing print side after washing depending on a cleaner.
- (7) Please contact us for details about detergents, cleaning methods and detergents other than those listed above.

3. Precautions with completed board

- (1) Do not touch the lead terminals of the capacitors directly.
- (2) Do not use electric conductive to cause short circuit between the capacitors lead terminal. Do not subject the capacitors to conductive solutions such as acid and alkaline water solutions.
- (3) Check the installation environment of the board the capacitor is installed in.
- (4) Age the board at conditions that fall below the capacitors ratings.

4. Contingency failure

The electrolyte, electrolytic paper, sealing rubber, and sleeve used in the capacitors are all combustible. When the current is extraordinarily large after a short circuit, in the worst case, the shorted-out section in the lead terminal or inside the capacitor may ignite the rubber. Pay attention to the capacitor mounting method, mounting position, pattern design, etc.

5. Storage conditions

- (1) Do not store the capacitor at high temperature and high humidity. Store it in a location that is not subject to direct sunlight and that has temperatures less than 5 to 35°C and a relative humidity less than 75%.
- (2) To keep good solder ability, store the in its plastic under shipping condition.
Sealed up in specifically designed aluminum laminate bags to prevent deterioration in characteristic and solder ability before and after resulting from moisture absorption.
- (3) To keep good solder ability, store radial lead types packed in bags for not more than one year.
Radial lead types with SMD type for not more than one year.
- (4) Open the bags just before mounting, and use up all products once opened. In case of leftovers, put the products packed in bags and sealed up with adhesive tape.
- (5) Do not store the capacitors in damp conditions such as water, salt spray, or oil.

焊接后电容器的漏电流因焊接预热条件、焊接温度、时间、线路板的材质及材质不同而发生很大的变化，几十甚至几百微安，但是在施加额定电压后处于稳定状态时电容器由于自愈能力而会使其漏电流逐渐减小。

(d) 后处理

电容器焊接在线路板后，请不要施加外力。

禁止将电容器倾斜、弯折、扭曲。

(e) 清洗线路板

可以使用Pine-aST-100S, Cleanthru 750H, 750L, 710M, 750K, Techno Care FRW14-17等高级乙醇类清洗剂AK-225AES等氟利昂代替品或IPA等清洗剂清洗，在清洗线路板时请先确认以下内容。

- (1) 采用浸渍，超声波等清洗方法时，导电性高分子型的清洗时间应控制在2分钟以内。
- (2) 洗液温度请控制在 60°C 以下。
- (3) 需要对清洗液进行防污管理，如导电度，pH值，比重，含水量等。
- (4) 清洗后不要在清洗液环境中或密封容器中保管。
- (5) 烘干线路板和电容器是电容器时请在使用温度范围内进行。
- (6) 清洗后擦拭电容时有可能抹去电容表面的标记应予以注意。
- (7) 关于清洗剂和清洗方法等详细情况或者试用其他清洗剂时请另行咨询。

3. 电容器在设备中安装时的注意事项

- (1) 安装过程中切勿直接接触电容器的引线端子。
- (2) 禁止将电容器的正负极之间用导线短路，不要将导电性的酸性或碱性溶液洒落在电容器表面。
- (3) 安装前确认电容器在设备中的安装环境。
- (4) 设备的试验温度要在电容器的额定范围内使用。

4. 意外情况的处理

导电性高分子型固体铝电解电容器组成材料包括电解质、电解纸、皮塞和套管属于可燃性物质，电容器短路后电流值急剧增加，导致引线端子和电容器内部短路部分会产生电火花，情况严重时会引起皮塞和套管燃烧，所以在电路设计中应对电容器的安装方法和安装位置谨慎对待。

5. 电容器的保管条件

- (1) 导电性高分子型固体铝电解电容器的保存要避免高温、高湿的环境，并避免阳光直射。
常温常湿（一般情况温度为 35°C 以下，湿度保持在75%RH以下）
- (2) 为保持电容器具有良好的可焊性，应在产品出厂状态下（塑料袋包装）保管。
为防止吸潮而导致焊接性劣化，产品出厂时密封在专用的包装袋内。
- (3) 为保持良好的焊接性，引线式产品保管期限为（购入后）一年，SMD型的保管期限为（购入后）一年，SMD型产品打开包装后，需在4周内使用完。
- (4) 使用时，应在即刻安装前开封，开封后尽量全部用完。出现剩余时，散装产品重新放入原包装袋内，并用胶带封好开口部分。
- (5) 不要将电容器直接保管在有水、卤水及有油等有机物的环境中。

(6) Do not store the capacitor in places filled with hydrogen sulfide, sulfurous acid, chlorine, ammonia, etc.).

(7) Do not store the capacitors in places susceptible to ozone, ultraviolet rays and radiation.

6. About RoHS Directive

RoHS Directive

[Restriction of the use of certain hazardous substances in electrical and electrical equipment]

RoHS aims to improve the regulations for hazardous substances in electrical and electrical equipment, and to minimize the hazardous effects on environment and to people's health from the production process up to and including the disposal process.

RoHS prohibits the use of 6 substances including cadmium, lead, hexavalent chromium, mercury, polybrominated biphenyls (PBBs), and polybrominated diphenyl (PBDEs).

(6) 不要将电容器保存在充满有害气体环境中，如硫化氢、亚硫酸、氯气、氨气等。

(7) 不要将电容器保存在易受臭氧氧化、紫外线及放射线辐射的环境中。

6. 关于RoHS指令

[RoHS指令]

[电子及电子设备中某些危险物质使用的限制]

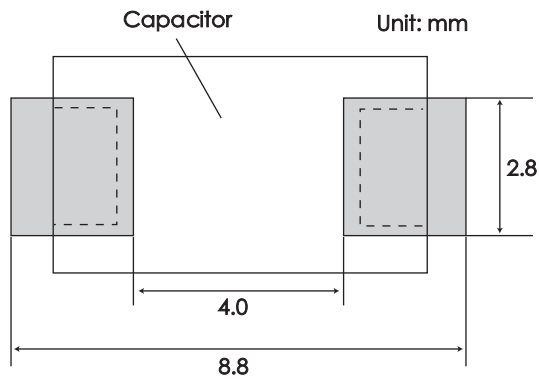
[RoHS指令是为了减少电子及电子设备中有毒有害物质的使用，而降低这些物质对人类环境和人体健康的危害而采取的相应程序。

RoHS指令中限制使用的6种有毒有害物质包括镉（Cd）、铅（Pb）、汞（Hg）、六价铬（Cr6+）、聚溴联苯类（PBB）、聚溴二联苯醚类（PBDE）。

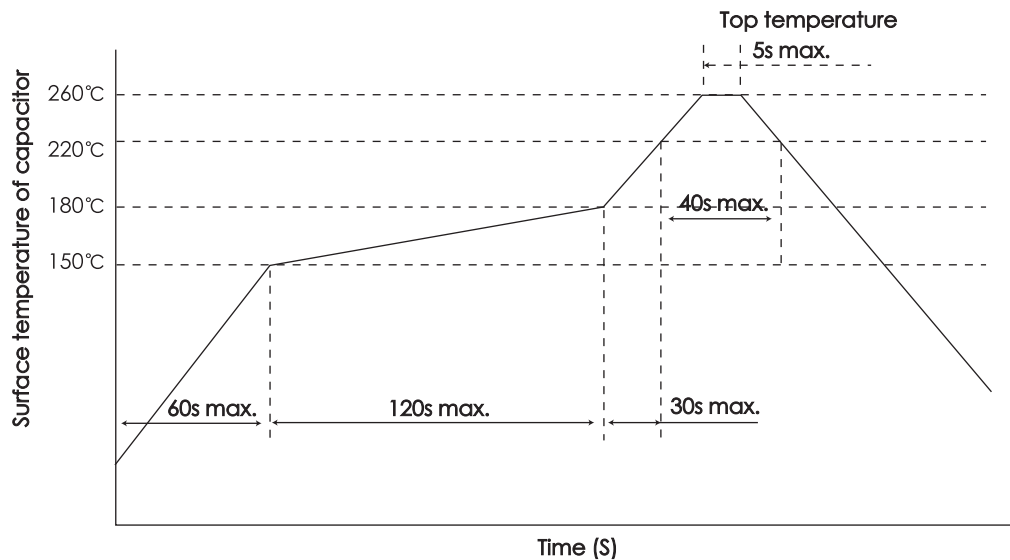
如有特殊需要，可与我公司联系。

SMD type (Flat)

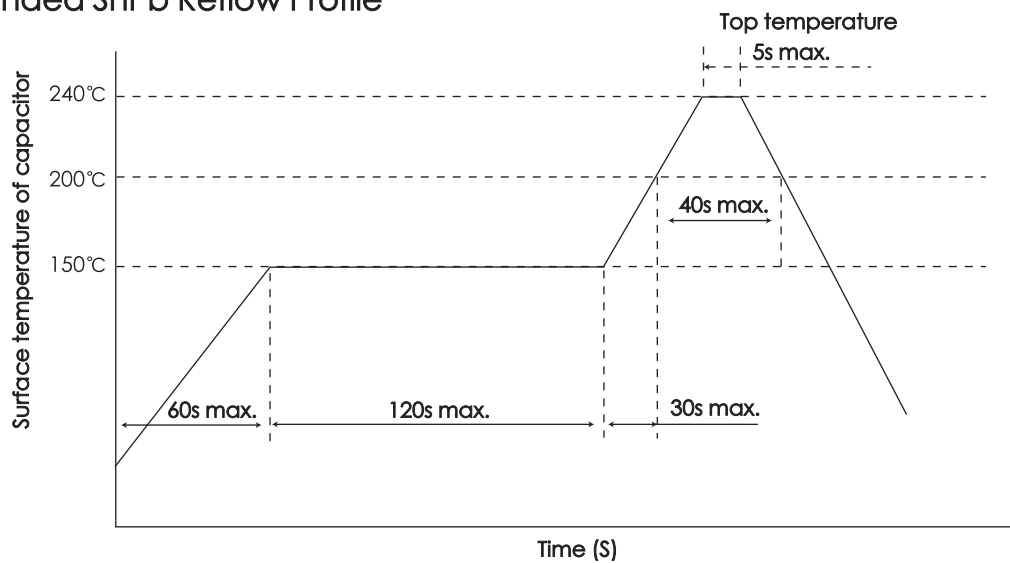
Land Pattern Design



Recommended Pb-Free Reflow Profile



Recommended SnPb Reflow Profile



MSL:3

General introduction of polymer capacitors

Features

● Long life

20000h life at 85°C can be expected (HCN, HEN,HEL,HPN,HPNA HVC, HVM,HVX series), suitable for long-operating industrial equipments.

● Stable temperature characteristics

Its ESR has stable characteristics from -55°C to 105°C (partly 125°C), suitable for applications used at low temperature (under 0°C)

● Low ESR obtained by using conductive polymer electrolyte

Suitable as a smoothing capacitor, enabling miniaturizing switching power supplies, because it allows large ripple current.
Suitable as a backup capacitor for the circuits that consume large current at a high speed.
Suitable as a decoupling capacitor, because its impedance has ideal frequency characteristics.

● RoHS Compliant

All the models are RoHS compliant products.

● High safety

More difficult to ignite and "smoke" than a tantalum electrolytic capacitor.

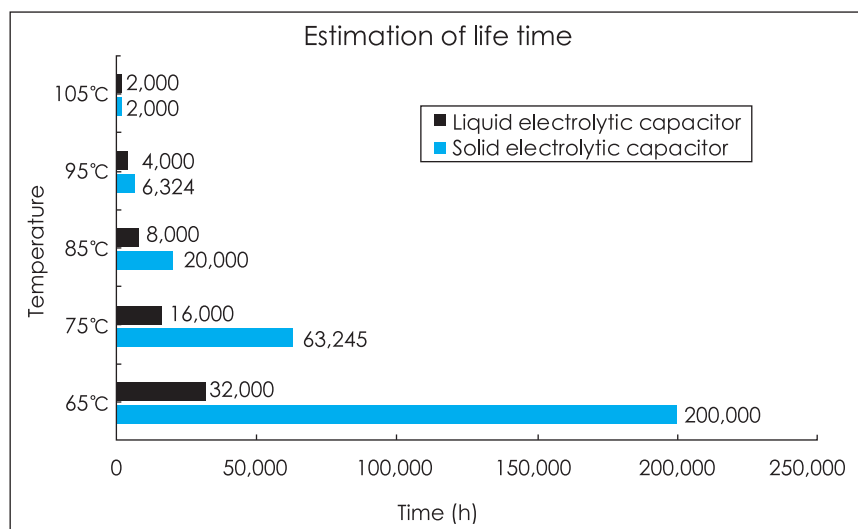
Estimation of life time

Liquid electrolytic capacitor: Life will finish when electrolyte is drying out, $L=L_0 \times 2^{\frac{T_0-T}{10}}$ (L_0 : Life at 105° C)

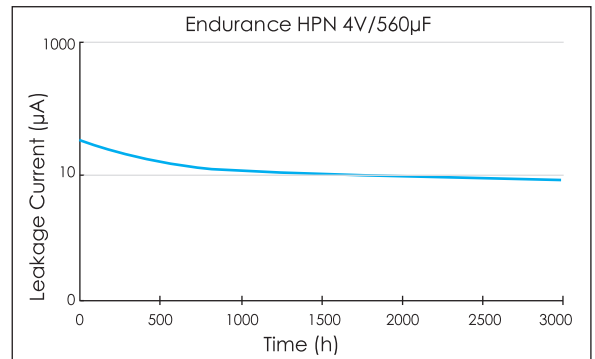
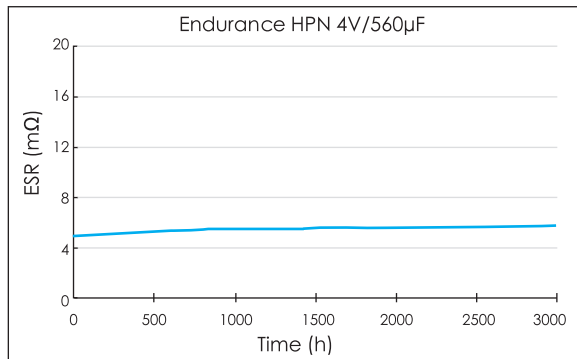
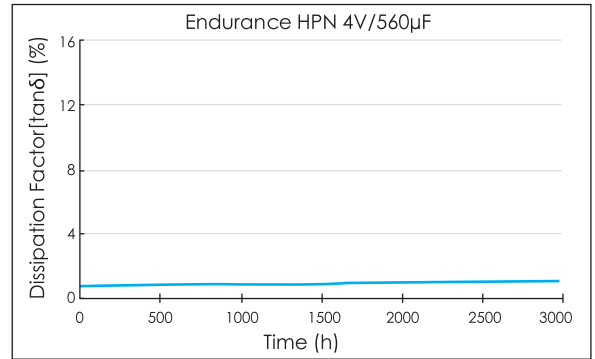
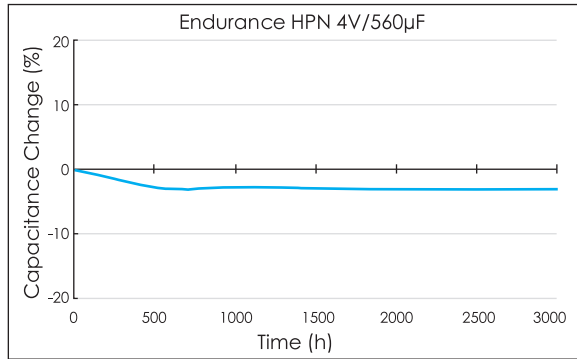
Solid electrolytic capacitor: Long life, solid electrolyte, no drying concern. $L=L_0 \times 10^{\frac{T_0-T}{20}}$ (L_0 : Life at 105° C)

Liquid electrolytic capacitor		Solid electrolytic capacitor	
105°C	2000h	105°C	2000h
95°C	4000h	95°C	6324h
85°C	8000h	85°C	20000h
75°C	16000h	75°C	63245h
65°C	32000h	65°C	200000h

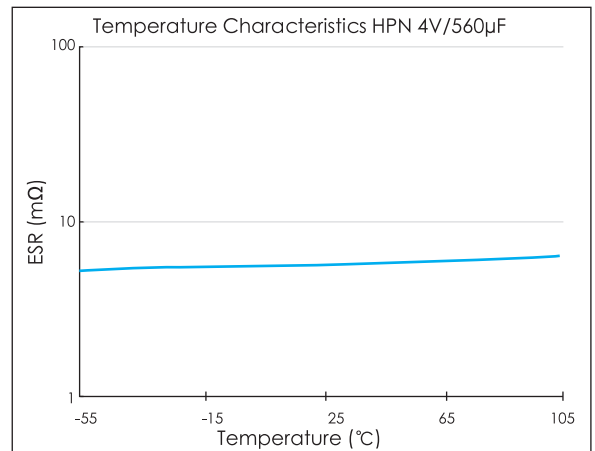
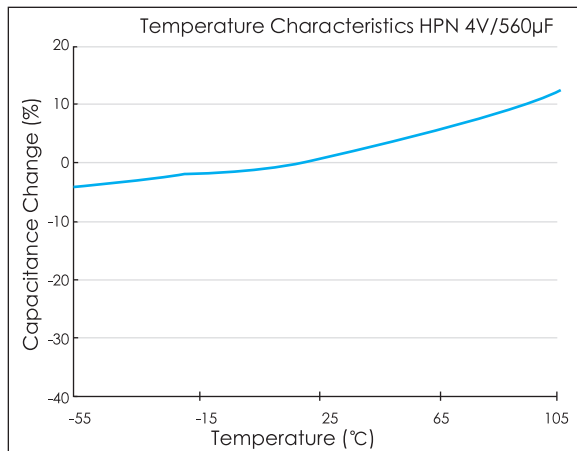
*These <105°C values are not guaranteed but presumptive values.



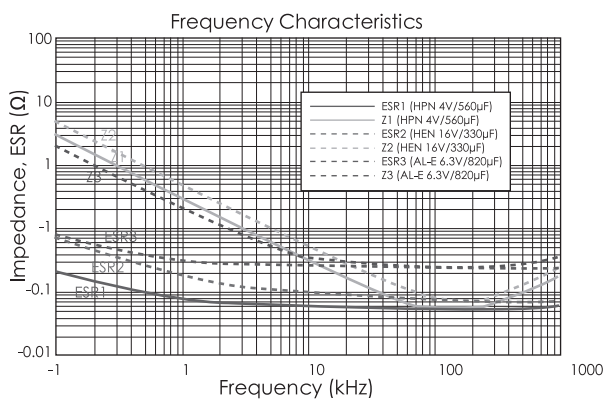
Endurance (With rated voltage applied at +105°C)



Temperature Characteristics



Frequency Characteristics



导电性高分子固体铝电解电容器简介

电容器在三个基本无源元件(L-电感、C-电容、R-电阻)中使用量最大, 是任何电子线路不可缺少的充放电、通交隔直的元件。电容器的种类因电介质的不同而各有所长, 根据应用目的不同而被广泛用于滤波、定时、旁路、耦合、改善马达启动功率等方面。

铝电解电容器的电解质以往采用电解液, 随着技术的发展, 将导电性高分子材料技术应用到铝电解电容器中, 由于它的电解质的导电性高, 接近金属导电性能(见图1), 导电性受温度的影响小, 带来铝电解电容器性能的革新。因而导电性高分子固体铝电解电容器具有卓越的性能:

- 高频下极低的等效串联电阻(ESR)和极低阻抗特性(Z)
- 稳定的温度特性
- 允许通过更大的纹波电流, 降低纹波电压能力强
- 适合片式化表面贴装工艺
- 优越的电压特性
- 工作寿命长, 可靠性高
- 使用安全性高, 不易燃烧或冒烟, 没有爆浆可能
- 卓越的自愈能力

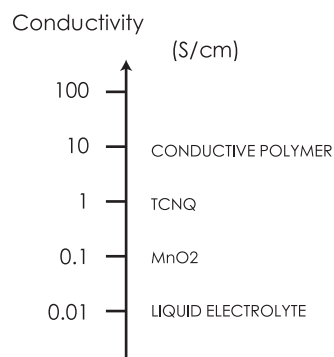
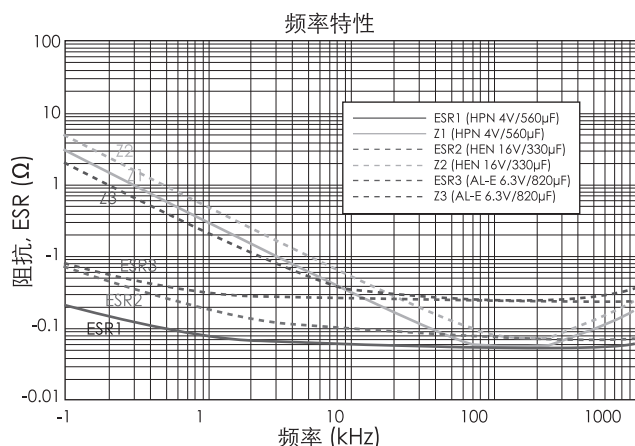


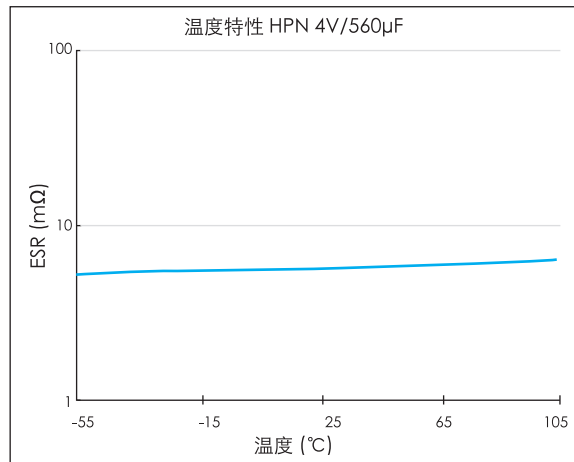
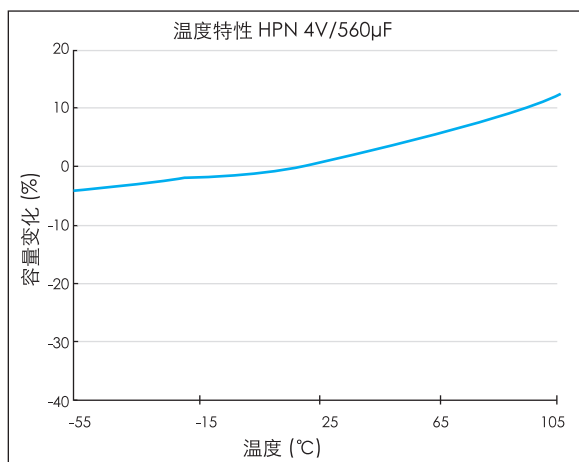
图1

高频下极低的等效串联电阻(ESR)和极低阻抗特性(Z)



导电性固体高分子电解电容器, 通过使用高导电性聚合物做电解质, 大幅度地降低了等效串联电阻(ESR), 达到了聚酯电容器那样的卓越频率特性, 又具有电解液式电容器大的容量。

稳定的温度特性

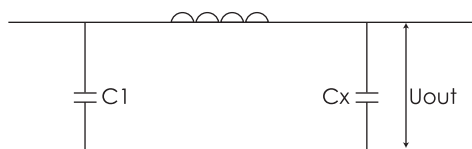


固体铝电解电容器的等效串联电阻(ESR)基本上不受温度的影响, ESR对于高频段的阻抗(振荡点附近)起着决定性的作用, ESR直接关系到降噪的能力, ESR受温度的影响小意味着降噪能力受温度影响小, 可以得到整个保证温度段的稳定的降噪效果, 特别适用于会在低温环境下使用的设备。

允许通过更大的纹波电流, 降低纹波电压能力强

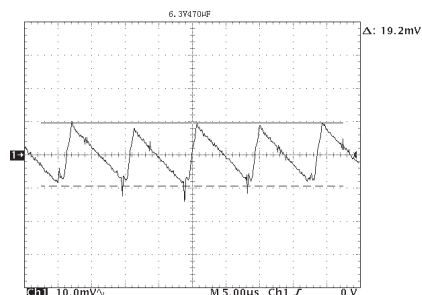
允许通过电容器的纹波电流依电容器的发热量而定, 发热的主要因素取决于ESR。ESR大则发热量大, 使纹波电流受到限制。

固体铝电解电容器在开关电源滤波电路中的应用:

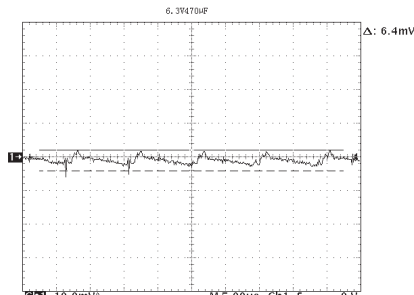


PC机滤波电路简单原理图

选用不同类型的电容器在200kHz的工作频率下, π 型滤波电路的滤波效果比较。



低阻抗铝电解电容器 6.3V/470



HCN 6.3V/470

适合片式化表面贴装工艺

导电性高分子材料的耐热性好, 可以达到无铅化回流焊的温度要求, 在通过回流焊时, 电容器不会鼓凸。

优越的电压特性

固体铝电解电容器在电压使用下, 容量基本上没有变化, 因而使用固体铝电解电容器不需考虑施加电压后的容值下降问题。

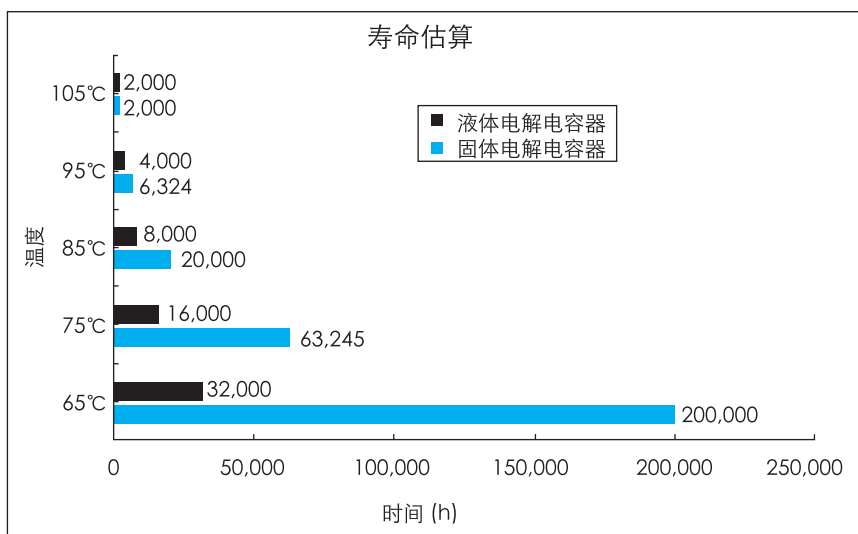
工作寿命长, 可靠性高

液体电解电容器, 寿命决定于电解液干涸。推算法则: 温度每下降 10°C , 寿命增倍。 $L=L_0 \times 2^{\frac{T_0-T}{10}}$ (L_0 : 105°C 的寿命)。固体电解电容器, 固体电解质, 无电解液干涸之虞, 寿命长。推算法则: 温度每下降 20°C , 寿命增加10倍。 $L=L_0 \times 10^{\frac{T_0-T}{20}}$ (L_0 : 105°C 的寿命)

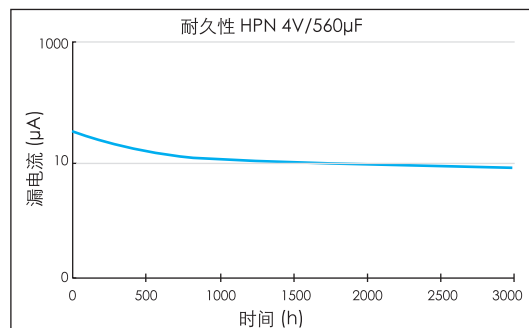
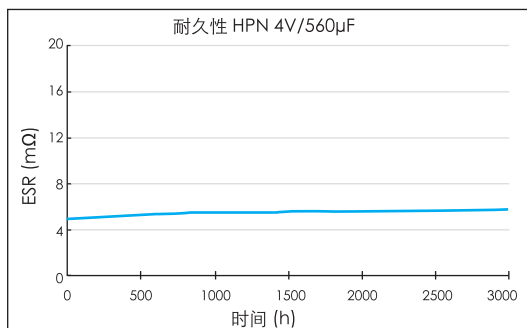
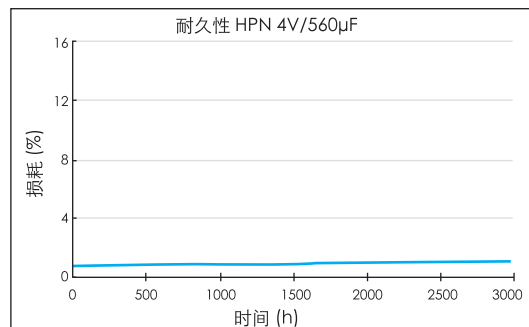
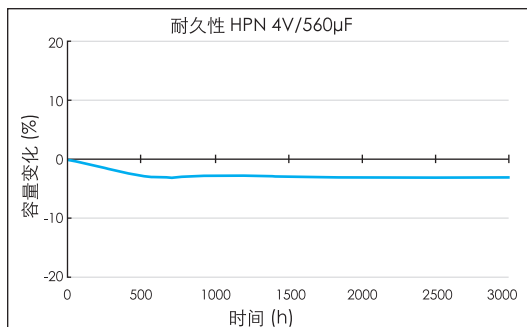
寿命对比: 105°C 相同寿命的液体电解和固体电解电容器, 65°C 时, 固体电解电容器约为液体电解电容器的6倍。计算: 105°C 2000h, 在 65°C 时, 液体电解电容器寿命 $L_{\text{液}}=2000 \times 16=32000\text{h}$, 固体电解电容器寿命 $L_{\text{固}}=2000 \times 100=200000\text{h}$, $200000 \div 32000=6.25$ 。

液体电解电容器		固体电解电容器	
105 $^{\circ}\text{C}$	2000h	105 $^{\circ}\text{C}$	2000h
95 $^{\circ}\text{C}$	4000h	95 $^{\circ}\text{C}$	6324h
85 $^{\circ}\text{C}$	8000h	85 $^{\circ}\text{C}$	20000h
75 $^{\circ}\text{C}$	16000h	75 $^{\circ}\text{C}$	63245h
65 $^{\circ}\text{C}$	32000h	65 $^{\circ}\text{C}$	200000h

*表中 $<105^{\circ}\text{C}$ 数值为推测值不是保证值。



耐久性(105°C 施加额定电压):



使用安全性高，不易燃烧或冒烟，不易爆炸

固体铝电解电容器与普通电容器、钽固体电容器的比较，具有更高的安全性。液体铝电解电容器电解液易干涸；电解液具有腐蚀性，易老化，过负荷的情况下，电容器内部高温并气压增大，有爆浆的可能。钽电容器在过负荷的情况下，电容器产生高温，二氧化锰被加热到一定的温度时释放出大量的氧，缺陷上的钽受热吸收氧发生剧烈的氧化还原反应即燃烧。高分子固体铝电解电容器中高分子材料本身具有较高的耐热性、难燃烧，即使在过负荷的情况下，过高的温度使高分子材料绝缘化，不易燃烧，不易爆炸。

卓越的自愈能力

高分子固体电容器与二氧化锰电容器相近有自愈功能，但是与之不同的是它不会形成氧，故不会燃烧，具有更高的可靠性。自愈机理在缺陷处局部较大的漏电流产生热量，聚合物受热形成高阻抗物或蒸发。固体电容器在自愈过程中不会释放氧气，故固体电容器很难发生自燃，具有很高的安全性和可靠性。