

五、使用薄膜电容器的注意事项

5.1、工作电压

薄膜电容器的选用取决于施加的最高电压，并受施加的电压波形、电流波形、频率、环境温度（电容器表面温度）、电容量等因素的影响。使用前请先检查电容器两端的电压波形、电流波形和频率（在高频场合，允许电压随着电容器类型的不同而改变，详细资料请参阅说明书）是否在额定值内。MTF(CL21X)、MTB(CL21B)、MPC(MKP35)、MPH(C37)、MPD(C37F)系列电容不适合用于交流场合。

5.2、工作电流

通过电容器的脉冲（或交流）电流等于电容量 C 与电压上升速率的乘积，即 $I=C \cdot dv/dt$ 。

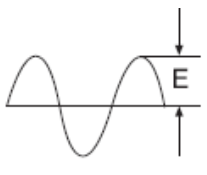
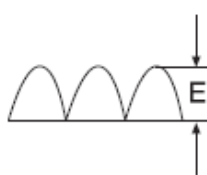
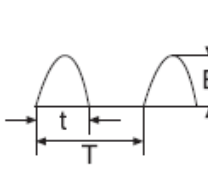
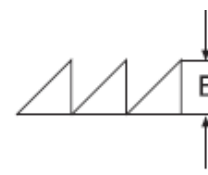
由于电容器存在损耗，在高频或高脉冲条件下使用时，通过电容器的脉冲（或交流）电流会使电容器自身发热而有升温，将会有热击穿（冒烟、起火）的危险。因此，电容器安全使用条件不仅受额定电压（或类别电压）的限制，而且受额定电流的限制。

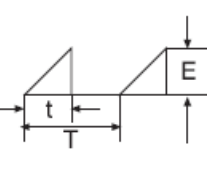
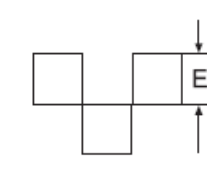
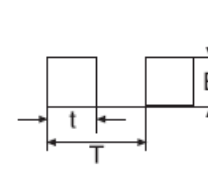
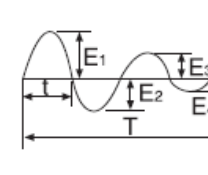
额定电流被认为是由击穿模式决定的脉冲流（峰值电流，即由 dv/dt 指标所限制的）和连续电流（以峰值或有效值表示）组成，当使用时，需确认这两个电流都在允许范围之内。

在高频或高脉冲条件下使用的电容器，我们推荐聚丙烯薄膜电容器。

5.3、各种波形的有效值转换关系

不同的波形有效值按下面的公式计算。

种类 (type)	1	2	3	4
波形 (waveform)				
有效值 (rms)	$E / \sqrt{2}$	$E / \sqrt{2}$	$E / \sqrt{t(2T)}$	$E / \sqrt{3}$

种类 (type)	5	6	7	8
波形 (waveform)				
有效值 (rms)	$E \sqrt{t(3T)}$	E	$E \sqrt{t/T}$	$\sqrt{\frac{t}{2T} (I_1^2 + I_2^2 + I_3^2 + I_4^2)}$

五 .Caution Items In Using Plastic Film Capacitor

5.1 Operation Voltage

The film capacitor varies in the maximum applicable voltage depending on the applied voltage waveform,current waveform, frequency, ambient temperature(capacitor surface temperature), capacitance, etc. Be sure to use capacitors within the specified values by checking the voltage waveform, current waveform, and frequency applied to them(in the application of high frequency, the permissible voltage varies with the type of the capacitor. For detail see the specification). MTF(CL21X) 、 MTB(CL21B) 、 MPC(MKP35) 、 MPH(C37)、 MPD(C37F)series are not suitable for AC applications.

5.2. Operating Current

The pulse(or AC)current flowing through the capacitor is expressed as: $I=C \cdot dv/dt$.

Due to the fact that dissipation factor of the capacitor will generate the internal heat under the application of high frequency or high pulse current, temperature rise in it will occur and may cause deterioration of with standing voltage, even lead to break down(smoking or firing).Therefore, the safety use of capacitor must be within the rated voltage(or category voltage) and the permissible current.

The rated current must be considered by dividing into pulse current(peak current) and continuous current (rms current) depending on the break down mode, are when using, should make sure the both current are within the permissible values. Under the application of high frequency or high pulse, we recommend to use polypropylene film capacitor.

5.3. Calculation of Rms In Various Waveforms

In each waveform, calculate the rms value in the following formula.

5.4、抑制电源电磁干扰用电容器

5.4.1 当在电源跨线电路中使用电容器来消除噪音时，不仅仅是只有正常电压，还会有异常脉冲电压（如闪电）发生，这可能会导致电容器冒烟或者起火。所以，跨线电容器其安全标准在不同国家有严格规定。请使用经过安全认证型电容器。不允许将直流电容器用作跨线电容器。

5.4.2 X 类抑制电源电磁干扰用电容器
适用于在电容器失效时不会导致电击穿危险的场合，分为 X1、X2、X3 三个类别（参见下表）。

5.4.3 Y 类抑制电源电磁干扰用电容器
适用于在电容器失效时会导致电击穿危险的场合，分为 Y1、Y2、Y3、Y4 等四个类别（参加下表）。

5.4.Capacitor for electromagnetic interference suppression of AC power supply.

5.4.1 When using a capacitor across-the-line as means for prevention of noise, not only the supply voltage is always applied, but also abnormal surge such as lightning is applied, which may lead to smoking or firing. Therefore, the across-the-line capacitor is strictly regulated in safety standard in each country. Please use those approved products, which confirm to corresponding safety Standard of different countries. The DC capacitor will not be used in across-the-line circuits.

5.4.2 Capacitor for electromagnetic interference suppression of AC power supply(Class X).
It is suitable for being used in situation where failure of the capacitor could not lead to danger of electronics shock, classified as class X1, X2 and X3 (refer to the table below).

5.4.3 Capacitor for electromagnetic interference suppression of AC power supply(Class Y)
It is suitable for being used in situation where failure of the capacitor could lead to danger of electronic shock, classified as class Y1, Y2, Y3 and Y4 (refer to the table below).

类别 Class	使用时的峰值脉冲电压 Peak pulse voltage in service(KV)	应用 Application	耐久性实验前施加的峰值脉冲电压 U_p (KV) Peak impulse voltage U_p before endurance test (KV)
X1	$>2.5, \leq 4.0$	高脉冲应用 High pulse Application	$C_R \leq 1.0\mu F, 4.0$ $C_R > 1.0\mu F, 4/\sqrt{C_R}$
X2	≤ 2.5	一般用途 General purpose	$C_R \leq 1.0\mu F, 2.5$ $C_R > 1.0\mu F, 2.5/\sqrt{C_R}$
X3	≤ 1.2	一般用途 General purpose	-----

类别 Class	额定电压(Vac) Rated Voltage (Vac)	耐久性实验前施加的峰值脉冲电压 U_p (KV) Peak impulse voltage U_p before endurance test (KV)
Y1	≤ 500	8.0
Y2	$\geq 150, \leq 300$	4.0
Y3	$\geq 150, \leq 250$	-----
Y4	< 150	2.5

类别 Class	额定电压(Vac) Rated Voltage (Vac)	耐电压 (Voltage Proof)	
		引线之间 Terminal to terminal	极壳之间 Terminal to case
X1、 X2、 X3	≤ 760	$4.3U_R(\text{d.c.})$	$2U_R+1500\text{V}(\text{a.c.})$ with a minimum of $2000\text{V}(\text{a.c.})$
Y1	≤ 500	$4000\text{V}(\text{a.c.})$	$4000\text{V}(\text{a.c.})$
Y2	$\geq 150, \leq 300$	$1500\text{V}(\text{a.c.})^{*1}$	$2U_R+1500\text{V}(\text{a.c.})$ with a minimum of $2000\text{V}(\text{a.c.})$
Y3	$\geq 150, \leq 250$		
Y4	<150	$900\text{V}(\text{a.c.})^{*1}$	$900\text{V}(\text{a.c.})^{*1}$

*1) Y2 类、Y3 类、Y4 类电容器的逐批试验，交流试验电压可以用规定交流电压 1.5 倍的直流电压代替。
For lot-by-lot tests of Class Y2-,Y3- and Y4- capacitors, the a.c. test voltage may be replaced by a d.c. voltage of 1.5 times the prescribed a.c. voltage.

5.5、电容器充放电

由于电容器充放电电流取决于电容量和电压上升速率的乘积，即使是低电压充放电，也可能产生大的瞬间充放电电流，这可能会导致电容器性能的损害，比如说短路或开路。当进行充放电时，请串联一个 $20\Omega/\text{V} \sim 1000\Omega/\text{V}$ 或更高的限流电阻，将充放电电流限制在规定的范围内。
当多个薄膜电容器并联进行耐电压测试或寿命测试时，请为每个电容器串联一个 $20\Omega/\text{V} \sim 1000\Omega/\text{V}$ 或更高的限流电阻。详见电容器标准。

5.6、因薄膜振动产生的嗡鸣声

电容器的嗡鸣声是由于电容器薄膜受到两极间库仑力的作用，产生的振动而发出的声音，施加的电压和频率波形失真越严重，所产生的嗡鸣声越大。但这种嗡鸣声对电容器不会产生任何破坏作用。

5.7、表面升温 (ΔT)

5.7.1 当电容器用于交流及脉冲场合时，流经电容器的电流使其发热，如果发热量过大，会导致电容器短路甚至燃烧。所以流经电容器的电流不能超过产品目录所规定的最大值，及电容器在加载时监测温升就显得尤为重要。

5.7.2 测量电容器表面温升的反复发如图 1，被测试电容器必须施加工作交流、脉冲电压及工作频率。

5.5 Charging and discharging

Due to the charging and discharging current of capacitor is obtained by the product of voltage rise rate(dV/dt) and capacitance, low voltage charging and discharging may also cause deterioration of capacitor such as shorting and open due to sudden charging and discharging current. When charging and discharging, pass though a resistance of $20\Omega/\text{V} \sim 1000\Omega/\text{V}$ or more to limit current.

When connecting multiple film capacitors in parallel in withstand voltage test or life test, connect a resistance of $20\Omega/\text{V} \sim 1000\Omega/\text{V}$ or more in series to each capacitor.(For detail see the specification)

5.6. Buzzing noise

Any buzzing noise produced by capacitor is caused by the vibration of the film due to the coulomb force that is generated between the electrodes with opposite poles. If the wave-form with a high distortion rate or frequency is applied across the capacitor, the buzzing noise will become louder. However the buzzing noise is of no damage to capacitor.

5.7. Surface over-temperature(ΔT)

5.7.1 When capacitor is used in A.C. or pulse applications the current that flows through the capacitor makes it heat up. If the capacitor heats up too much it might deteriorate causing a short circuit or fire. It is essential that the limits described in the catalogue are not exceeded, and that a temperature check on the capacitor is made whenever it is under load.

5.7.2 Method for determining the surface over-temperature of the capacitor is showed in fig.1. The capacitor being tested must be supplied by the working AC or pulse voltage and frequency.

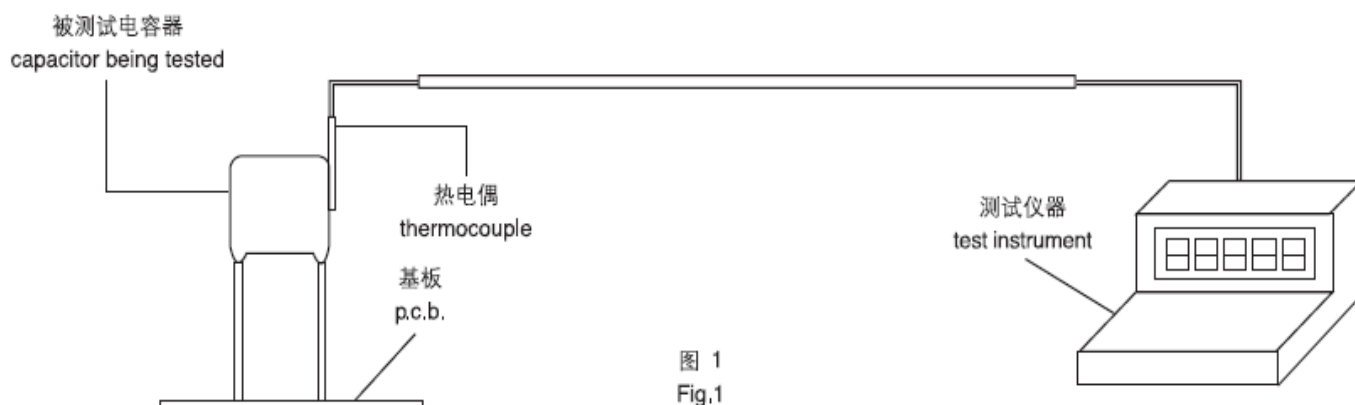
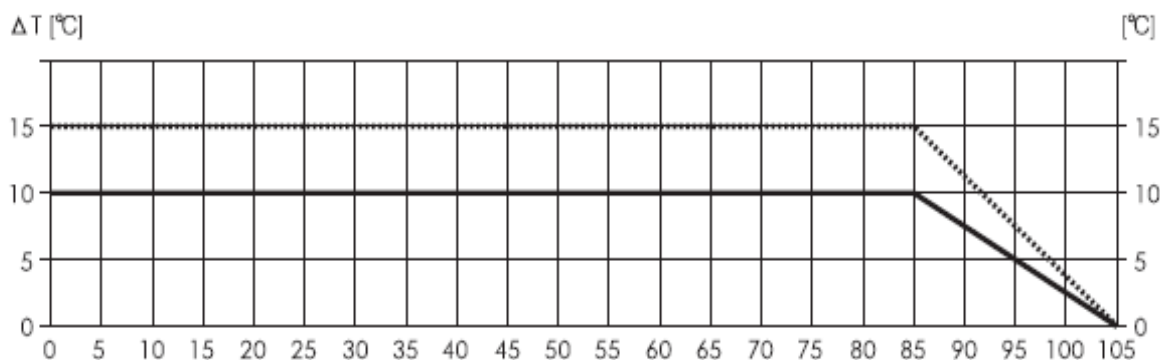


图 1
Fig.1

5.7.3 各型号电容表面允许的最大温升 Maximum self temperature rise for all series

-----MEF, MTF, MTB, MEC, MSC, MSF, MMT, MEA/MET, PEN, PEI, MEV, MEK

——MPX, MPF, MPH, MPC, MPD, DMB, DMS, DPC, DPS, PPN, PPS, MPA/MPT, MPV, MPK



注：如果有超出要求的请联系我们技术工程师。

Note: If you need the temperature more than above, please contact our engineer.

5.8、阻燃性

尽管在薄膜电容器外封装中使用了耐火性阻燃材料--阻燃环氧树脂或塑壳，但外部的持续高温或火焰仍可使电容器芯子变形而产生外封破裂，导致电容器芯子融化或燃烧。

5.8. Passive flammability

Although flame retardation epoxy resin or plastic case is used in the coating or encapsulating of plastic film capacitor, continuous outer high temperature or firing will break the coating layer or plastic case of the capacitor, and may lead to melting and firing of the capacitor element.

有焰燃烧等级 Category of flammability	针对电容器体积范围 (mm³)施加火焰时间 (s)				最大燃烧时间 (S)
	体积 ≤ 250	250 < 体积 ≤ 500	500 < 体积 ≤ 1750	1750 < 体积	
A	15	30	60	120	3
B	10	20	30	60	10
C	5	10	20	30	30

5.9、几种特殊工作环境

5.9. Special working conditions

5.9.1 高湿环境

如果长时间使用在高湿环境下，但电容器可能会吸收潮气、电极被氧化，导致电容器损坏。如果在 AC 条件下使用，高湿环境将会加剧电晕的影响，从而引起电容值下降、损耗值增加。在 AC 应用情况下，如果超出下表的条件，影响将会更严重，对于详细的信息请联系我们的技术工程师。

5.9.1 Humid ambient

If used for long time in a humid ambient, the capacitor might absorb humidity and oxidize the electrodes causing breakage of the capacitor. If case of AC application, high humidity would increase the corona effect. This phenomenon causes a drop in the capacitance value. In case of working condition in AC application is more severe than following table, please contact our engineers for detailed informations.

	Working Temperature	Relative Humidity
Average for year	25°C	70%
2 weeks continuously	30°C	90%

5.9.2 灌胶

如果电容器有被灌树脂，下列的情况将可能会发生：

- 树脂里的溶剂可能会影响电容器的特性；
- 在聚合过程中产生的热将会损坏电容器。

5.9.3 点胶固化

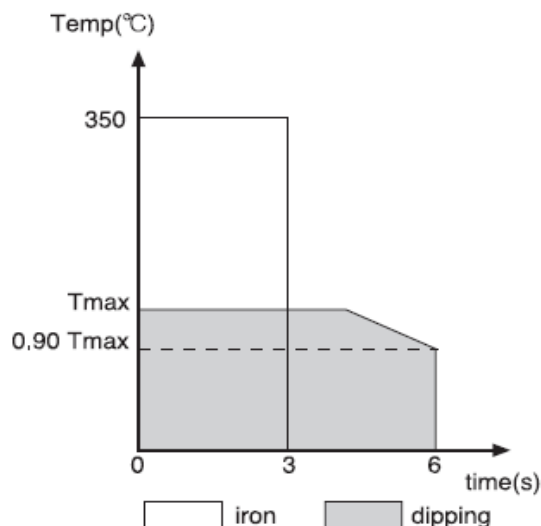
我们建议 SMD 产品点胶固化后再插件，因为胶的固化温度过高可能会破坏插件电容器，对于必须在 SMD 的产品，请评估 SMD 产品的点胶固化温度是否适合插件产品。

5.10、焊接建议

为达到更好的可焊性，我们建议遵照下列的标准。

5.10.1 最大焊接温度

焊接条件按下面的焊接图表：



5.9.2 Resin

If the capacitor is placed in resin, the following situations might occur:

- The solvent contained the resin might deteriorates the characteristics of the capacitor;
- The heat generated during the polymerization might damage the capacitor.

5.9.3 Adhesive curing oven

Insert leaded parts only after the adhesive curing process of SMD parts, because the high temperature in curing oven will damage the capacitor.If leaded parts must be fixed before the SMD gluing process, please estimate if the curing temperature is suitable for leaded parts.

5.10Soldering suggestions

In order to obtain a good solderability, we suggest to observe the following rules.

5.10.1 Max soldering temperature

Solder within the conditions mentioned in the following diagram.

	T max	Time	Note
预热 Pre-heating	110°C	1min	
	100°C	2min	OPP P ≤ 7.5mm
焊接 Soldering	270°C	4S	
	260	4S	OPP P ≤ 7.5mm

5.10.2 如果需要焊接两次，第二次焊接必须等到电容器恢复到常温。

5.10.2 If re-working or dipping twice is necessary, it should be done after the capacitor returned to the normal temperature.

5.10.3 避免插件产品和 SMD 产品一起做回流焊接。

5.10.3 Avoiding to reflow soldering by combining the lead type with SMD parts.

5.11、储存条件

5.11.1 由于大气中存在氯化物、硫化物、硫酸物质等，所以产品储存在大气中，必须注意引出端的可焊性会变化。

5.11.2 产品不能暴露在高温和高湿状态，必须保存在以下环境中：（在不拆开原包装的基础上）

高温：不超过 35℃

湿度：不超过 80%RH

引线式产品储存时间（从产品包装或产品本体上的日期算起）：

对于散装产品，不超过 24 个月。

对于径编产品，不超过 12 个月。

5.11 Storage Conditions:

5.11.1. It must be noted that the solderability of the terminals may be deteriorated when stored in an atmosphere filled with moisture, dust, or a reactive oxidizing gas.(hydrogen chloride, hydrogen sulfide, sulfuric acid, etc.)

5.11.2 It should not be located in particularly high temperature and high humidity, it must submit to the following conditions(under the uncharging primal package):

Temperature: not exceeding 35℃

Humidity: not exceeding 80%RH

Storage time for tinned lead wire: (from the date marked on the capacitor's body or the label glued to the package):

Bulk: -24 months

Taping: -12 months

六、绿色产品

RoHS 符合性

在此产品目录中，国灿公司的产品均符合 RoHS 指令和《电子信息产品污染控制管理办法》的要求。

六.Green Products

RoHS compliance

Kwok Tran products in the catalogue are RoHS compliant.

七、在订购或索要样品之前，请尽可能多地提供以下信息：

7.1. 额定工作电压：DC, AC;

7.2. 电容量及电容量允许偏差：J、K、M 等；

7.3. 最终产品种类：彩色电视机、显示器、开关电源，电子节能灯、镇流器、变频器、ADSL、UPS 等等；

7.4. 用途或电路图：直流回路、交流脉冲回路（S 校正电路、行逆程电路、尖峰吸收回路），电源跨线噪音抑制电路、高稳定性电路、DC-link、DC-filter、降压、PFC 等等；

7.5. 使用条件：脉冲峰值，频率，波形，电流等等；

7.6. 使用温度；

7.7. 外形尺寸：电容器本体尺寸，引出线尺寸等等；

7.8. 形状：封装形式（浸渍型、盒式等），引出线（直脚、成型、编带）；

7.9. 安全性：当电容短路或开路时对其他部件的影响，当其他部件或电路工作异常时对电容器的影响

7.10. 焊接条件：SMD、引线式；

7.11. 安装方式：PCB 板、绝缘引线等。

七. When placing an order or inquiring Sample, please specify the following, as much as you can.

7.1. Rated voltage: DC, AC.

7.2. Capacitance value and capacitance tolerance: J, K, M etc.

7.3. Finished product: Color TV, Monitor, Switching power, light, ballast, transducer, ADSL, UPS etc.

7.4. Application or circuit diagram: DC circuit, AC pulse circuit (S-shape correction, horizontal resonance circuit, peak absorption circuit), interface noise suppression circuit, high stability circuit DC-link, DC-filter, PFC etc.

7.5. Condition of operation: pulse peak, frequency, waveform, current etc.

7.6. Operating temperature.

7.7. Dimensions: Body, lead space, etc.

7.8. Shape: enclosure (dip, case, etc) lead wire (straight, crimped, taping etc).

7.9. Safety: Influence to the other component, when the capacitor gets short-circuited or open. Influence to the capacitor, when the other component or the circuit worked irregularly.

7.10. Welding Condition: SMD or tinned-lead-wire type.

7.11. Fixed style: PCB, insulated lead wire etc.