

■ M2 系列铝电解电容器

M2 Series Aluminum Electrolytic Capacitor

◆ 特征 Features

- * 寿命: 105℃ 2000 小时
Load life: 105℃ 2000 hours.
- * 符合 RoHS
Compliant to the RoHS Directive.
- * 低阻抗, 耐高纹波电流, 小型化
Super low ESR, high ripple current, miniaturized

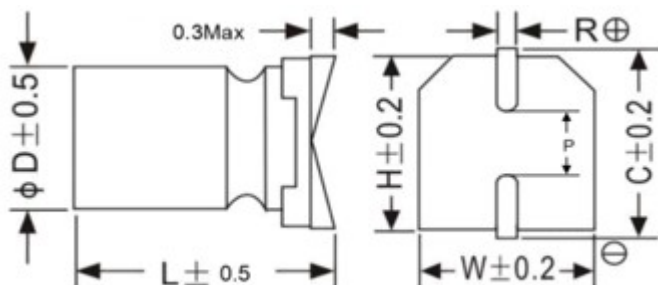


◆ 应用 Application

- * 适用于开关电源、通信设备及其它各种电子产品
Ideally suited for switching power supplies, telecommunication and other electronic products.
- * 适用于自动表面贴装技术和高密度电路
Ideally suited for automatic SMT and high density circuits.

◆ 型号表示法 Part Number

8	100	LF	M	0810	M2	F	R	0	0	T																																													
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◆产品结构 Product Structure


ϕD	W	H	C	R	P
5	5.3	5.3	5.9	0.5~0.8	1.4
6.3*4~7.7	6.5	6.5	7.2	0.5~0.8	2.2
6.3*8~15	6.5	6.5	7.2	0.7~1.1	2.2
8	8.3	8.3	9.0	0.7~1.1	3.1
10	10.3	10.3	11.0	0.7~1.1	4.5

◆主要特性表 Main specifications

项目 Item	主要特性 Performance Characteristics		
额定工作电压范围 Rated Voltage Range	2.5~160V.DC		
使用温度范围 Operating Temperature Range	-55℃~+105℃		
标称静电容量范围 Nominal Capacitance Range	4.7~220μF		
静电容量允许偏差 Capacitance Tolerance	±20% (M, +20℃, 120Hz)		
漏电流 Leakage Current (20℃)	额定工作电压(V) Rated working voltage	2.5~25	35~160
	漏电流 Leakage current	2 分钟后 $I \leq 0.2CV$ 或 500μA, 取较大值 After 2 min, $I \leq 0.2CV$ or 500μA, whichever is greater.	2 分钟后 $I \leq 0.1CV$ 或 299μA, 取较大值 After 2 min, $I \leq 0.1CV$ or 299μA, whichever is greater
C: 标称静电容量 (μF) Nominal Capacitance in μF V: 额定工作电压 (V) Rated working voltage in V			
损耗角正切值 Dissipation Factor	额定工作电压(V) Rated working voltage	2.5~6.3	10~160
	DF(MAX) (20℃, 120Hz)	0.08	0.12

温度特性 Low temperture characteristics (Max.impedance Ratio)	<table><tr><td>Z(-25℃)/Z(+20℃)</td><td>≤ 2.0</td><td rowspan="2">(100KHz)</td></tr><tr><td>Z(-55℃)/Z(+20℃)</td><td>≤ 2.5</td></tr></table>			Z(-25℃)/Z(+20℃)	≤ 2.0	(100KHz)	Z(-55℃)/Z(+20℃)	≤ 2.5
Z(-25℃)/Z(+20℃)	≤ 2.0	(100KHz)						
Z(-55℃)/Z(+20℃)	≤ 2.5							
耐久性 Endurance	105℃施加额定工作电压2000小时，恢复到20℃后，产品性能应满足以下要求 The specifications listed below shall be satisfied when the capacitors are restored to 20℃ after application of rated voltage for 2000 hours at 105℃							
	Appearance	No significant damage						
	Capacitance change	≤±20% of the initial value						
	D.F.(tanδ)	≤ 150% of the specified value						
	ESR	≤ 150% of the specified value						
	Leakage current	≤The specified value						
耐湿负荷特性 Damp heat (Steady state)	在60℃ 温度，湿度90%~95%RH的环境中，施加额定电压1000小时后，恢复到20℃后，产品性能应满足以下要求 The specifications listed below shall be satisfied when the capacitors are restored to 20℃ after application of rated voltage for 1000 hours at 60℃ ,90%~ 95% RH.							
	Appearance	No significant damage						
	Capacitance change	≤±20% of the initial value						
	D.F.(tanδ)	≤ 150% of the specified value						
	ESR	≤ 150% of the specified value						
	Leakage current	≤The specified value						

◆尺寸表、允许纹波电流、纹波电流频率因子

Dimensions and ripple current and frequency coefficient

*纹波电流频率因子

Ripple current frequency coefficient

频率 Frequency(Hz)	120≤频率<1k	1k≤频率<10k	10k≤频率<100k	100k≤频率<500k
系数 Coefficient	0.05	0.30	0.70	1.00

*尺寸表与允许纹波电流

Dimensions and ripple current

Rated voltage	Rated capacitance	Case size	ESR(mΩ)	Rated ripple current
额定电压(V)	标称容量(uF)	尺寸ΦD×L(mm)	等效串联电阻	额定纹波电流
			at 20°C ,100 KHz	(m Arms/105°C/100kHz)
2.5	470	6.3×9	18	4100
	560	6.3×9	18	4100
	680	6.3×9	18	4100
	820	6.3×9	18	4100
	560	6.3×9	18	4100
	680	6.3×9	18	4100
	820	6.3×9	18	4100
	1000	6.3×9	18	4100

Rated voltage	Rated capacitance	Case size	ESR(mΩ)	Rated ripple current
额定电压(V)	标称容量(uF)	尺寸ΦD×L(mm)	等效串联电阻	额定纹波电流
			at 20°C ,100 KHz	(m Arms/105°C/100kHz)
	1200	6.3×9	18	4100
4	220	6.3×5.8	30	2690
	220	6.3×7.7	25	2900
	330	6.3×5.8	30	2690
	330	6.3×7.7	25	2900
	470	6.3×7.7	25	3500
	560	6.3×7.7	25	3500
	680	6.3×9	18	3800
	820	6.3×9	18	3800
	1000	6.3×10	18	4200
	1000	8×9.5	15	4900
	1500	8×12.6	15	5200
	1500	10×13.5	15	5700
	2200	10×13.5	15	5700
6.3	220	6.3×5.8	30	2500
	220	6.3×7.7	30	2650
	330	6.3×7.7	30	2650
	470	6.3×7.7	30	2700
	470	6.3×9	30	2900
	560	6.3×9	20	3100
	680	8×9.5	18	4700
	820	8×12.6	16	4900
	820	10×10.5	15	4900
	1000	8×12.6	16	4900
	1000	10×13.5	15	5300
	1500	8×12.6	16	4900
	1500	10×13.5	15	5300
	2200	10×13.5	15	5300
10	220	6.3×5.8	30	2500
	220	6.3×7.7	30	2650
	330	6.3×7.7	30	2650
	470	6.3×7.7	30	2700
	470	6.3×9	30	2900
	560	6.3×9	20	3100
	680	8×9.5	18	4700
	820	8×12.6	16	4900
	820	10×10.5	15	4900
	1000	8×12.6	16	4900

Rated voltage	Rated capacitance	Case size	ESR(mΩ)	Rated ripple current
额定电压(V)	标称容量(uF)	尺寸ΦD×L(mm)	等效串联电阻	额定纹波电流
			at 20°C ,100 KHz	(m Arms/105°C/100kHz)
	1000	10×13.5	15	5300
	1500	8×12.6	16	4900
	1500	10×13.5	15	5300
	2200	10×13.5	15	5300
	47	6.3×5.8	40	1900
16	68	6.3×5.8	40	1900
	100	6.3×5.4	45	1850
	100	6.3×5.8	40	1900
	100	6.3×7.7	35	2100
	220	6.3×5.8	35	2260
	220	6.3×7.7	30	2500
	220	8×9.5	20	3400
	270	6.3×7.7	30	2260
	330	6.3×7.7	30	2260
	330	6.3×9	25	2900
	330	8×9.5	18	3700
	470	6.3×10	25	3500
	470	8×9.5	18	3700
	470	8×12.6	18	4100
	470	10×10.5	15	4800
	680	8×12.6	18	4100
	820	8×12.6	18	4100
	1000	8×12.6	18	4100
	1000	10×13.5	15	4900
	1500	10×13.5	15	4900
25	47	6.3×5.8	50	1870
	47	6.3×5.4	50	1700
	100	6.3×5.8	45	1870
	100	6.3×7.7	45	1950
	180	6.3×5.8	40	1900
	220	6.3×7.7	40	2100
	220	6.3×8.5	40	2100
	220	8×9.5	30	3100
	330	6.3×10	35	2500
	330	8×9.5	30	3100
	470	6.3×10.8	35	2900
	470	8×9.5	30	3100
	470	8×12.6	25	3800

Rated voltage	Rated capacitance	Case size	ESR(mΩ)	Rated ripple current
额定电压(V)	标称容量(uF)	尺寸ΦD×L(mm)	等效串联电阻	额定纹波电流
			at 20°C ,100 KHz	(m Arms/105°C/100kHz)
	470	10×10.5	25	4500
	560	10×10.5	25	4500
	680	8×12.6	25	4200
	680	10×13.5	20	4800
	820	10×13.5	20	4800
	1000	10×13.5	20	4800
35	22	6.3×5.8	100	1200
	47	6.3×5.4	80	1200
	47	6.3×5.8	80	1200
	100	6.3×5.8	60	1400
	100	6.3×7.7	60	1500
	100	6.3×9	50	1700
	100	8×9.5	40	2400
	150	6.3×10	50	1700
	220	6.3×10.5	40	1900
	220	8×9.5	40	2500
	220	8×12.6	40	2900
	220	10×10.5	40	3100
	330	8×12.6	35	2900
	330	10×10.5	35	3100
	330	10×13.5	30	3500
	470	10×13.5	30	3500
	560	10×13.5	30	3500
	680	10×13.5	30	3900
50	22	6.3×5.8	100	780
	22	6.3×9	100	850
	33	6.3×9	100	850
	47	6.3×7.7	80	850
	47	6.3×9	80	900
	47	8×9.5	50	1100
	100	8×9.5	50	1150
	100	8×12.6	40	1550
	100	10×13.5	35	2100
	150	8×12.6	40	1550
	150	10×13.5	35	2400
	220	10×10.5	35	2100
	220	10×13.5	35	2450
	330	10×13.5	35	2500

Rated voltage	Rated capacitance	Case size	ESR(mΩ)	Rated ripple current
额定电压(V)	标称容量(uF)	尺寸ΦD×L(mm)	等效串联电阻	额定纹波电流
			at 20°C ,100 KHz	(m Arms/105°C/100kHz)
63	10	6.3×7.7	120	700
	22	6.3×5.8	100	650
	22	6.3×7.7	100	700
	22	6.3×9	100	750
	33	6.3×9	100	820
	47	8×9.5	45	950
	47	8×12.6	40	1300
	47	8×12.6	40	1300
	100	10×10.5	40	1700
	100	10×13.5	35	2100
	150	10×13.5	35	2200
	220	10×13.5	35	2200
80	10	6.3×9	120	550
	22	8×9.5	60	1100
	33	8×9.5	60	1100
	47	8×12.6	60	1300
	47	10×10.5	50	1400
	68	10×13.5	45	1800
	100	10×13.5	45	1900
100	10	6.3×9	120	550
	22	8×9.5	60	850
	22	8×12.6	60	1190
	33	8×12.6	60	1190
	47	10×13.5	50	1550
	68	10×13.5	50	1600
	82	10×13.5	50	1600
160	4.7	8×9.5	350	550
	10	8×12.6	250	750
	15	8×12.6	250	750
	15	10×10.5	300	750
	18	10×13.5	200	950
	22	10×13.5	200	950

◆包装 Packaging

* 包装标签内容 Package label content

- | | | | |
|--------------|-----------------------|------------|--------------------------------|
| 1) 客户物料号 P/N | Customer Material P/N | 6) 容量偏差 | Tolerance on Rated Capacitance |
| 2) 风华物料号 P/N | FENGHUA Material P/N | 7) 规格尺寸 | Specification |
| 3) 批号 | Lot number | 8) 日期 | Date |
| 4) 数量 | Quantity | 9) RoHS 标识 | RoHS |
| 5) 系列 | Series | 10) 二维码 | QR code |

其中批号的填写 Lot number

1
2
3
4
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6
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8
9
10
11
12
13
14

类别 年份 月份 日期 区别号

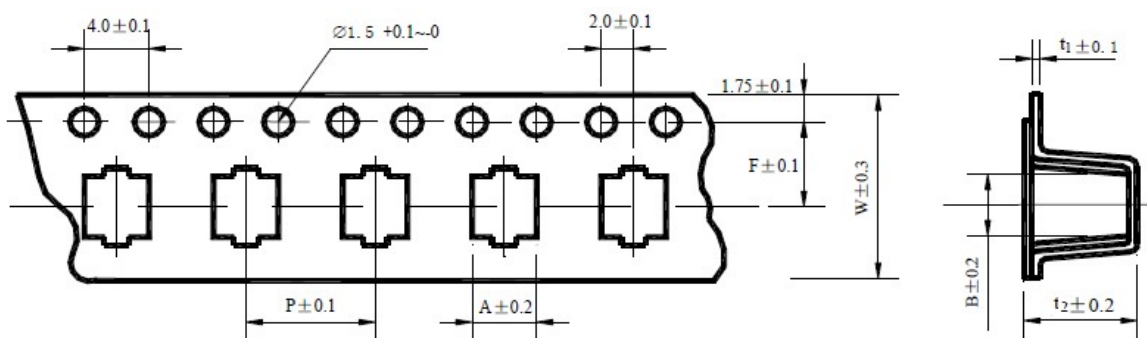
流传单号码

Sort Year Month Date Discriminate mark

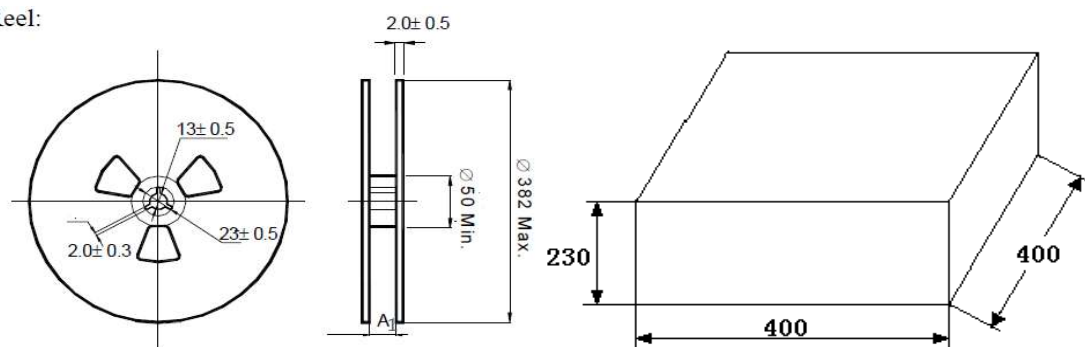
Sequence number

* 编带产品按下图包装方式

Taped capacitors are packed into carton, according to the following drawing



Reel:



系列 Series	尺寸 Size	W	A	B	P	t ₂	F	t ₁
MA	Φ4×5.5	12.0	4.7	4.7	8	5.7	5.5	0.4
	Φ5×5.5	12.0	5.7	5.7	12	5.7	5.5	0.4
	Φ6.3×5.5	16.0	7.0	7.0	12	5.7	7.5	0.4
	Φ6.3×7.7	16.0	7.0	7.0	12	8.3	7.5	0.4
	Φ8×10.5	24.0	8.7	8.7	16	11	11.5	0.4
	Φ10×10.5	24.0	10.7	10.7	16	11.0	11.5	0.4

垂直安装 Vertical Mount

尺寸 Size	A ₁	数量 Quantity/reel
Φ4×5.5	14	2000pcs
Φ5×5.5	14	1000pcs
Φ6.3×5.5	18	1000pcs
Φ6.3×7.7	18	1000pcs
Φ8×10.5	26	500pcs
Φ10×10.5	26	500pcs

◆贮存方法 Storage Methods

* 请保管在室温 5℃～35℃，湿度 75%RH 以下的环境

* (1)产品储存期限：≤12 个月；

* (2)产品储存期限超 12 个月时，需充电后再使用

* (3)产品储存时间超过 3 年的应报废处理

* (4)库存有效期以套管上印刷的时间开始计算

* (5)请尽量以包装状态保管

* (6)避免在下列环境中保管

① 溅水、高温高湿及结露的环境;

② 溅油、或者充满气体油成分的环境;

③ 充满酸性有毒气体（硫化氢、亚硫酸、亚硝酸、氯、溴、溴化甲烷等）的环境;

* We recommend the following conditions for storage:

Ambient temperature: 5℃～35℃, Ambient humidity: Less than 75% RH.

* (1) Storage life: ≤12 months;

* (2) If storage life time is over 12 months, the products need to be recharged;

* (3) If storage life time is over three years, the products need to be discarded;

* (4) Expiry date: calculating from the date marked on the sleeve;

* (5) Please keep capacitors in the original package;

* (6) Avoid storing the capacitors under such circumstances:

①Environment of water splashing, high temperature, high humidity and dewing;

②The environment that splashes oil, or is filled with gas oil;

③With full of acid toxic gases environment such as(hydrogen sulfide , sulfurous acid, nitrous acid, chlorine , bromine, methyl bromide, etc.

◆铝电解电容器使用注意事项

Important information on the application of aluminum electrolytic capacitors

* (1)直流铝电解电容器应按正确的极性使用

当直流铝电解电容器被反极性接入电路时，电容器会导致电子线路短路，由此产生的电流会引致电容器损坏。若电路中有可能在负引线施加正极电压，请选用无极性产品

* (2)在额定工作电压以下作用

当电容器上所施加电压高于额定工作电压时，电容器的漏电流将上升，其电气特性将在短小时内劣化直至损坏。注意电压峰值请勿超出额定工作电压

* (3)常规产品禁止作快速充放电使用

当常规电容器被用作快速充电用途。其使用寿命可能会因为容量下降，温度急剧上升等而缩减。

* (4) 施加纹波电流应小于额定值

施加纹波电流超过额定值后，会导致电容器体过热，容量下降，寿命缩短。所施加纹波电压的峰值应小于额定工作电压。

* (5) 使用环境温度

铝电解电容器的使用寿命会受到环境温度的影响。据科学统计，使用环境温度下降 10℃ 其使用寿命增加 1 倍。

* (6) 引出线强度

当拉力施加到电容器引出线，该拉力将作用于电容器内部，这将导致电容器内部短路，开路或漏电流上升。在电容器焊装到电路板，请勿强烈摇动电容器。

* (7) 焊接过程耐热性

铝电解电容器装至电路板进行浸焊或波峰焊时，其塑料套管可能因焊接时间过长、温度过高而发生破裂或二次收缩。

* (8) 电路板的安装孔距及安装位置

电路板安装孔的设计应与产品说明书的引线脚距一致，如果将电容器强行插入孔距不配套的电路板，那么会有应力作用于引出线，这将导致短路或漏电流上升。

* (9) 铝电解电容可能会有残留电压，请在使用前对电容器进行放电。

(1) DC aluminum electrolytic capacitors should be used according to the correct polarity

When a DC aluminum electrolytic capacitor is connected to a circuit with reverse polarity, the capacitor will cause a short circuit in the electronic circuit, and the resulting current will cause damage to the capacitor. If it is possible to apply positive voltage to the negative lead in the circuit, please choose a non-polar product.

(2) Function below rated operating voltage

When capacitor is used at higher voltage than the rated voltage, leakage current increases, characteristics drastically deteriorate and damage in a short period may occur as a result. Please take extra caution that the peak voltage should not exceed the rated voltage.

(3) Conventional capacitors are prohibited from being used for fast charging and discharging

When aluminum electrolytic capacitors for general purpose are employed in rapid charge and discharge application, its life may be shorted by capacitance decreasing, heat rising, etc.

(4) The applied ripple current should be less than the rated value

Excessive heat will reduce capacitance and result in shortened life of capacitor if ripple currents exceeding the specified rated value are applied. The peak value of the ripple voltage should be less than the rated voltage.

(5) Operating ambient temperature

Its ambient temperature closely affects the life of an aluminum electrolytic capacitor. It is generally stated, that life doubles for each 10℃ decrease in temperature.

(6) Terminal Strength

When a strong force is applied to the lead wires or terminals, stress is put on the internal connections. This may result in short circuit, open circuit or increased leakage current. It is not advisable to bend or handle a capacitor after it has been soldered to the PCB board.

(7) Heat resistance during welding process

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

(8) Installation pitch-row and installation position of circuit boards

PCB board must be designed so its hole coincides with the lead pitch (lead spacing) of the capacitor specified by the catalog or specifications. When a capacitor is forcibly inserted into an unmatched hole, a stress is put on the leads. This could result in a short circuit or increased leakage current.

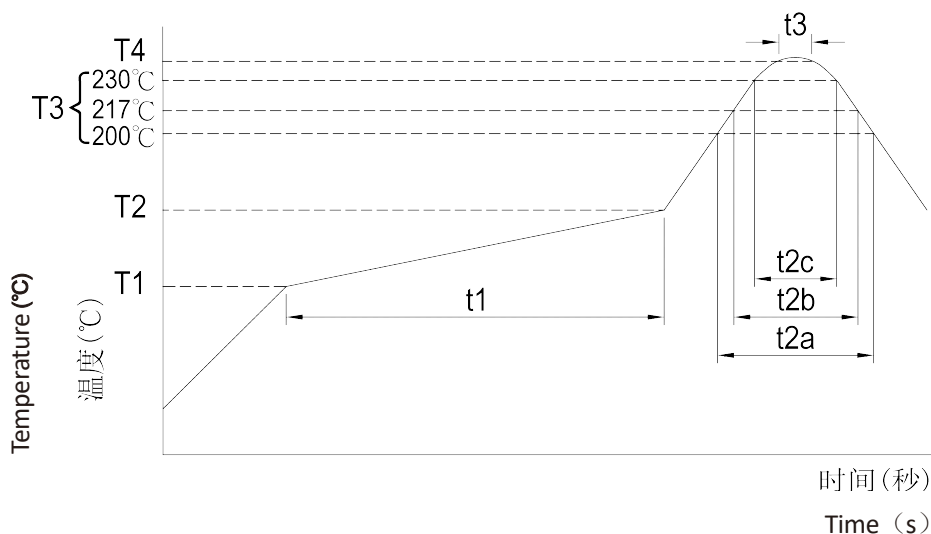
(9) Aluminum electrolytic capacitors may have residual voltage, please discharge the capacitor before use.

◆ **推荐安装/焊接方法 Recommended Installation/Welding Methods**

* (1) 焊接方法之适用性 Applicability of Soldering Methods

焊接方法 Soldering Method	回流焊 Reflow Soldering	烙铁 Soldering Iron	波峰焊 Wave Soldering
可行性 Feasibility	可行 Feasible	可行 Feasible	不可行 Not Feasible

* (2) 无铅回流焊使用条件 Operating Conditions for Lead-Free Reflow Soldering



* (3) 测试条件 Test Conditions

制品别 Product Category	非固态电容器 Non-Solid Capacitor					高分子固态电 容器 Polymer Solid Capacitor	高分子固液混 合电容器 Polymer Solid- Liquid Hybrid Capacitor
额定电压(V) Rated Voltage (V)	4 ~ 50	4 ~ 50	≥ 63	4 ~ 100	≥ 160	---	---
制品尺寸(φ) Product Dimension (φ)	4 ~ 6.3φ × 4.5L	4 ~ 6.3	4 ~ 6.3	8 ~ 18	≥ 12.5	---	---

预热 Preheating	温度 (T1 ~ T2, °C) Temperature (T1 ~ T2, °C)	150 ~ 180							150 ~ 200		150 ~ 180			
	时间(t1) (最大, 秒) Time (t1) (Max, s)	120	180							180		120		
持续时间 Soaking Period	温度 (T3, °C) Temperature (T3, °C)	230	217	230	217	217	230	217	217	230	200	217	280	
	时间(t2) (最大, 秒) Time (t2) (Max, s)	t2c	t2b	t2c	t2b	t2b	t2c	t2b	t2b	t2c	t2a	t2b	t2c	
		30	90	60	60	60	30	90	70	60	70	50	40	
最高温度 Peak Temperature	温度 (T4, °C) Temperature (T4, °C)	250	260*		250	250		240	250	260	250		260	
	时间 (t3, 秒) Time (t3, s)	5							5		5			
回流次数 Reflow Times		1	≤2							2	1	2	1	

① 如使用条件较上表所列为高时, 请与我们联系。

② 在执行第 2 次回流焊时, 请确认电容器之温度已冷却至 5 ~ 35°C。

① If the operating conditions exceed those listed in the above table, please contact us.

② When performing the second reflow soldering, please confirm that the capacitor has cooled down to 5 ~ 35°C.

* (4) OP-CAP 回流焊注意事项

回流焊会降低制品额定静电容量, 应确认回流焊条件是否满足建议回流焊之规范。

虽然实际的回流焊条件变更仍依据回各项回流焊焊接方法, 请注意制品铝壳底部之最高温度及电极端子不可超过最高温度。

请特别注意: OP-CAP 制品在回流焊加热过程之温度应提高至 200°C 以上。

若回流焊条件(温度或持续时间)大于上表所列, 则 OP-CAP 制品会受损: 制品静电容量降低约 50%、漏电流变大(上升至数毫安/mA), 以及损坏电容器外部。

(4) OP-CAP Reflow Soldering Precautions

Reflow soldering will reduce the rated capacitance of the product. It is necessary to confirm whether the reflow soldering conditions comply with the recommended specifications.

Although changes to actual reflow soldering conditions shall still be based on the respective reflow soldering methods, please note that the maximum temperature at the bottom of the product's aluminum case and the electrode terminals must not exceed the specified maximum temperature.

Important Note: The temperature of OP-CAP products during the reflow soldering heating process shall be raised to above 200°C.

If the reflow soldering conditions (temperature or duration) exceed those listed in the above table, OP-CAP products will be damaged: the product's capacitance will decrease by approximately 50%, the leakage current will increase significantly (rising to several milliamperes/mA), and the exterior of the capacitor will be damaged.

◆其它说明 Others

*本产品不含铅、镉等元素

This product does not include Plumbum or Cadmium.

[illegible]

Note: The content provided above is the product specification. Fenghua reserves the right to modify this content without prior notice when the product remains unchanged. Any product changes will be notified to customers via PCN.