KLM302X

SOP4 RANDOM-PHASE TRIAC PHOTOCOUPLER

SOP4 随机相位双向可控硅光电耦合器(消费级)



* 本文档中包含的信息反映了具有代表性的使用场景，仅供技术参考。
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1. 产品特点 Product features

- 400V 峰值击穿电压 400V Peak breakdown voltage
- 输入与输出间高隔离电压(Viso=3750 V rms)
  High isolation voltage between input and output (Viso=3750 V rms)
- 紧凑型双列直插式封装 Compact dual-in-line package
- 符合欧盟REACH法规 Compliance with EU REACH
- 无Pb且符合ROHS标准 Pb free and RoHS compliant
- 安全审批 Safety approval
  CQC认证已批准(编号:CQC25001468788) CQC approved (No.CQC25001468788)
  UL认证已批准 (编号:UL-US-2555216-0) UL approved (No.UL-US-2555216-0)
  VDE认证已批准(编号:40061363) VDE approved (No.40061363)

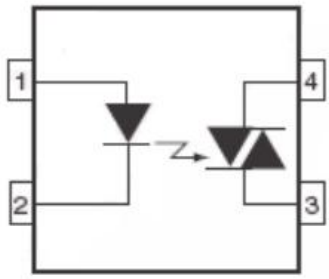
2. 产品描述 Product Description

- KLM302X 系列由一个砷化镓红外发光二极管和一个单晶硅芯片的随机相位光电双向晶闸管组成的可控硅光电耦合器
  Each KLM302X device consists of a GaAs infrared emitting diode optically coupled to a monolithic silicon random phase photo Triac
- 它被设计用于连接电子控制和功率双向可控硅开关，以控制 115 至 240 V AC 工作电压下的电阻和感应负载
  It is designed for interfacing between electronic controls and power triacs to control resistive and inductive loads for 115 to 240 V AC operations

3. 产品应用 Product Applications

- 电磁阀/阀门控制 Solenoid/valve controls
- 灯镇流器 Lamp ballasts
- 静态交流电源开关 Static AC power switch
- 微处理器与 115 至 240V AC 外围设备的接口
  Interfacing microprocessors to 115 to 240V AC peripherals
- 白炽灯调光器 Incandescent lamp dimmers
- 温度控制器 Temperature controls
- 电机控制 Motor controls

4. 功能图 Functional Diagram



引脚配置 Pin Configuration
1. 阳极Anode
2. 阴极Cathode
3. 终端Terminal
4. 终端Terminal

5. 光电特性 Electrical-Optical characteristics

• 最大限度额定值(温度=25ºC) Absolute Maximum Ratings(Ta=25℃)

参数 Parameter		符号 Symbol	额定值 Rated Value	单位 Unit
输入 Input	正向电流 Forward current	I_F	60	mA
	反向电压 Reverse voltage	V_R	6	V
	功耗Power dissipation	P_D	100	mW
输出 Output	断态输出端电压 Off-state Output Terminal Voltage	V_{DRM}	400	V
	峰值重复浪涌电流 Peak Repetitive Surge Current (pw=1ms,120pps)	I_{TSM}	1	A
	导通有效值电流 On-State RMS Current	$I_{T(RMS)}$	70	mA
	输出功耗 Output Power dissipation	Pc	300	mW
总消耗功率 Total Consume Power		P_{TOT}	200	mW
隔离电压 (1*) Isolation Voltage		V_{iso}	3750	Vrms
工作温度 Operating temperature		T_{OPR}	-40 to +110	℃
储存温度 Storage temperature		T_{STG}	-55 to +150	℃
焊接温度 (2*) Soldering temperature		T_{SOL}	260	℃

附注 (Notes):

1* 交流电源1分钟内, 相对湿度在40~60%RH环境下, 隔离电压测试时, 1&2脚短接, 3&4脚短接
AC for 1 minute, R.H.= 40 ~ 60% R.H. In this test, pins 1 and 2 are shorted together, and pins 3 and 4 are shorted together.

2* 焊接时间为10秒 Soldering time is 10 seconds

6. 电气特性(Ta=25℃,除非另有规定)

Electrical Characteristics(Ta=25℃ unless specified otherwise)

参数 Parameter		符号 Symbol	最小值 Min.	规格值 Typ.	最大值 Max.	单位 Unit	条件 Condition
输入 Input	正向电压 Forward voltage	V_F	-	1.2	1.5	V	I_F=10mA
	反向电流 Reverse current	I_R	-	-	10	μA	V_R=6V
输出 Output	断态峰值电流 Peak Blocking Current	I_{DRM}	-	-	100	nA	V_{DRM} = Rated V_{DRM} I_F = 0 mA 2*
	峰值导通电压 Peak On-state Voltage	V_{TM}	-	-	2.5	V	ITM=100 mA peak, I_F=Rated I_{FT}
	断态电压临界上升率 Critical Rate of Rise off-state Voltage	dv/dt	-	10	-	V/μs	V_{PEAK} =Rated V_{DRM}, I_F=0mA 3*

• 附注(Notes):

1*. Ta=25℃时的规格值 Typical values at Ta = 25°C

2*. 测试电压必须在dv/dt额定值范围内 Test voltage must be applied within dv/dt rating

3*. 这是静态的dv/dt，转换直流dv/dt只有负载驱动晶闸管的函数

This is static dv/dt,Commutating dv/dt is a function of the load-driving thyristor(s) only

• 传输特性 (Ta=25℃, 除非另有规定)
Transfer Characteristics (Ta=25℃ unless specified otherwise)

参数 Parameter		符号 Symbol	最小值 Min.	规格值 Typ.	最大值 Max.	单位 Unit	条件 Condition
LED触发电流 LED Trigger Current	KLM3020	I_{FT}	-	-	30	mA	主端子电压=3V Main terminal Voltage=3V 4*
	KLM3021	I_{FT}	-	-	15		
	KLM3022	I_{FT}	-	-	10		
	KLM3023	I_{FT}	-	-	5		
	KLM3024	I_{FT}	-	-	3		
保持电流 Holding Current		I_H	-	3	5	mA	

附注(Notes):

4*. 所有设备都保证在小于或等于最大IFT的IF值触发. 因此，建议操作IF在最大IFT(KLM3020 30mA、KLM3021 15mA、KLM3022 10mA、KLM3023 5mA、KLM3024 3mA)和绝对最大IF(60mA)之间
All devices are guaranteed to trigger at an IF value less than or equal to max IFT. Therefore, Recommended operating IF lies between max IFT (30 mA for KLM3020, 15 mA for KLM3021, 10 mA for KLM3022, 5 mA for KLM3023, 3 mA for KLM3024) and absolute maximum IF (60 mA).

7. 特性曲线 Characteristic Curves

图1. 正向电流与正向电压的关系

Figure 1. Forward Current vs Forward Voltage

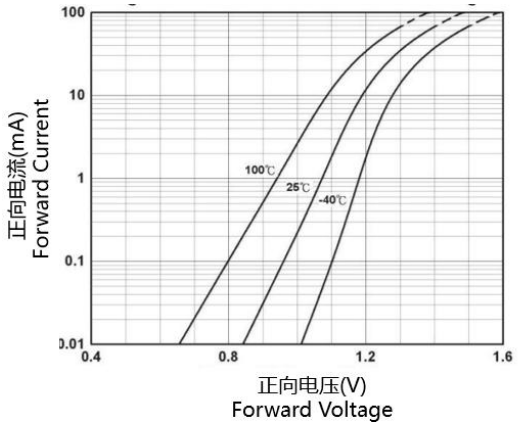


图2. 导通特性

Figure 2. On-State Characteristics

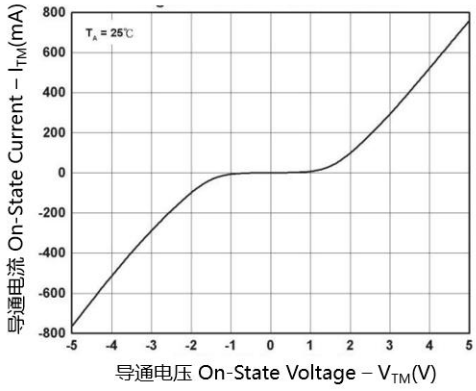


图3. 保持电流 vs 环境温度的关系

Figure 3. Normalized Holding Current vs Ambient Temperature

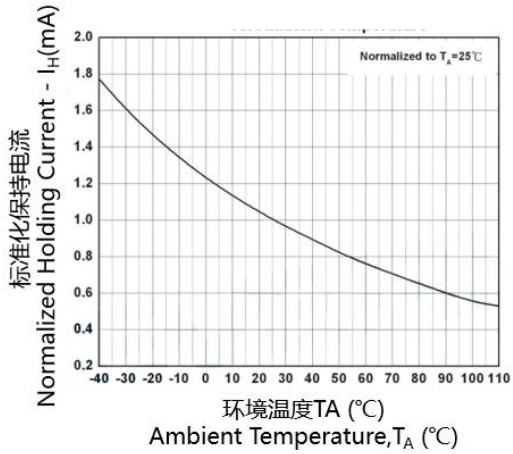


图4. 触发所需LED电流 vs LED脉冲宽度的关系

Figure 4. LED Current Required to Trigger vs LED Pulse Width

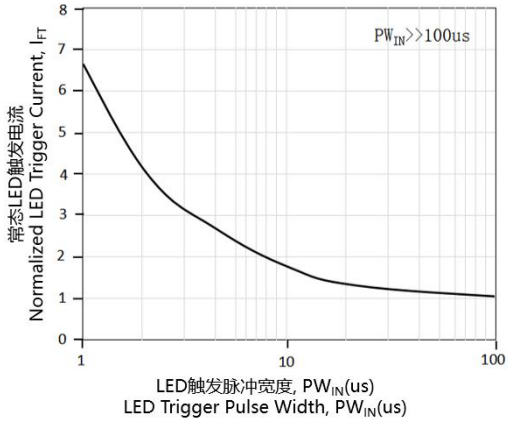


图5. 漏电流 vs 环境温度的关系

Figure 5. Leakage Current vs Ambient Temperature

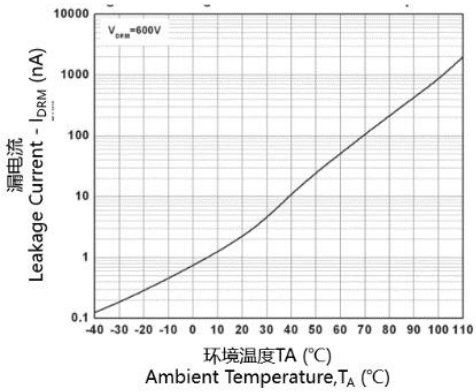


图6. LED触发电流 vs 环境温度的关系

Figure 6. Normalized LED Trigger Current vs Ambient Temperature

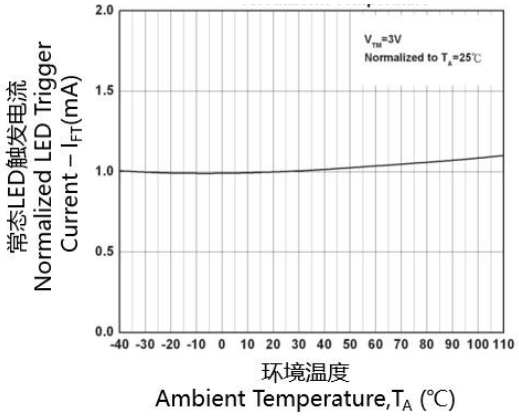


图7.关闭状态输出端电压 vs 环境温度的关系

Figure 7. Off-State Output Terminal Voltage vs Ambient Temperature

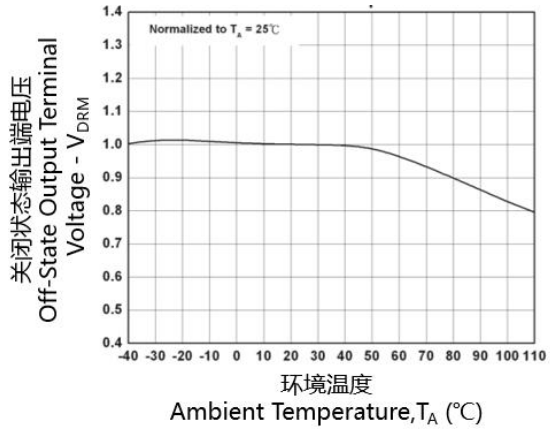
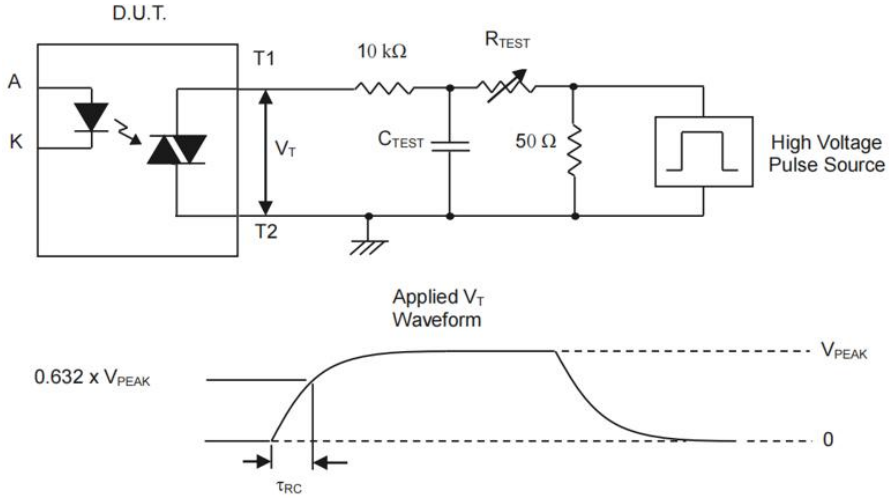


图8.静态dv/dt测试电流和波形 Static dv/dt Test Circuit & Waveform



测量方法 Measurement Method

高压脉冲设置为所需的V_{PEAK}值, 并通过上述RC电路应用于D.U.T输出值，不应用LED电流,使用X100范围探头监视波形V_T, 通过改变R_{TEST}, dv/dt(斜率)增加, 直到D.U.T被观察到触发(波形崩溃)。dv/dt随后下降,直到D.U.T.停止触发, 此时记录 τ_{RC}, 计算dv/dt=0.632*V_{PEAK}/τ_{RC}

The high voltage pulse is set to the required V_{PEAK} value and applied to the D.U.T. output side through the RC circuit above. LED current is not applied. The waveform V_T is monitored using a x100 scope probe. By varying R_{TEST}, the dv/dt (slope) is increased, until the D.U.T. is observed to trigger (waveform collapses). The dv/dt is then decreased until the D.U.T. stops triggering. At this point, τ_{RC} is recorded and the dv/dt calculated. dv/dt=0.632*V_{PEAK}/τ_{RC}

例如, KLM302X系列的V_{PEAK}=400V, dv/dt值的计算公式如下:

For example, V_{PEAK} = 400V for KLM302X series. The dv/dt value is calculated as follows:

dv/dt= 0.632*400/τ_{RC}

8. 订单信息 Order Information

• 材料编号 Part Number

KLM302X-Z-FV-AW

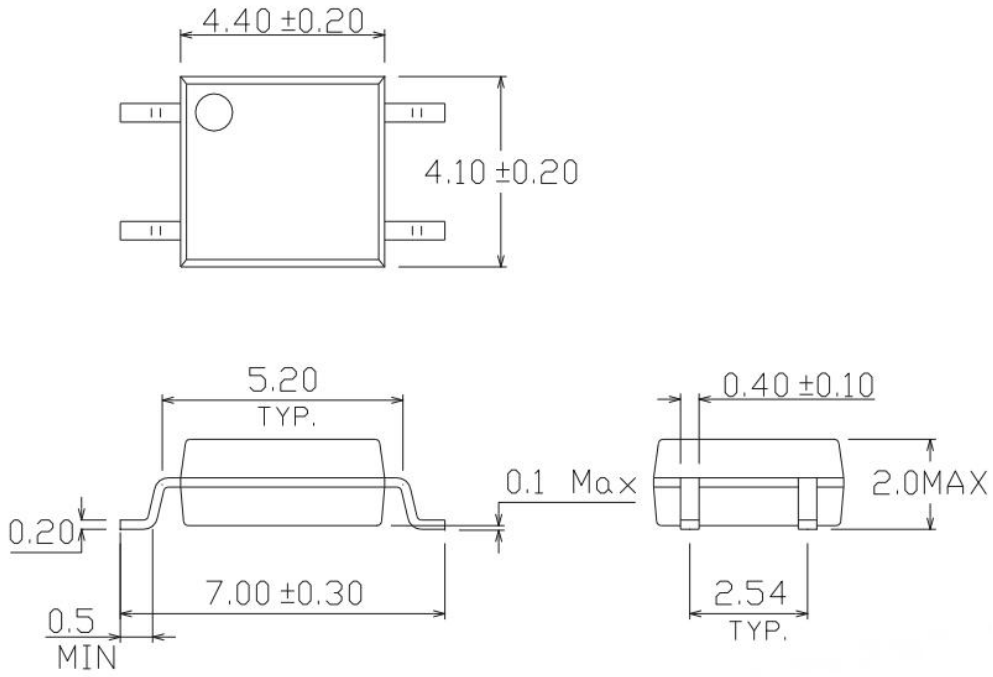
附注(Notes):

X = 零件编号(0、1、2、3 或 4) Part No. (0, 1, 2 , 3 or 4)
Z = 料带和卷轴选项(TA、TB 或 无)
Tape and reel option (TA, TB or None)
F = 表示支架框架选项(F:铁材、无:铜材)
Lead frame option (F : Iron , None : copper)
V = 表示VDE标识(客户指定镭射字符才加"V")
VDE (Only add "V" to laser characters specified by the customer)
AW =表示消费级 Consumer-grade

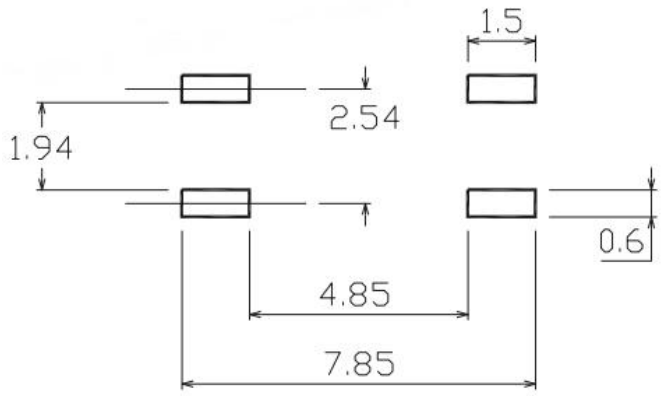
选项 Option	描述 Description	包装数量 Packing quantity
TA	TA载带和卷轴选项 TA Tape & reel option	每卷3500pcs 3500 units per reel
TB	TB载带和卷轴选项 TB Tape & reel option	每卷3500pcs 3500 units per reel
TA-V	TA载带和卷轴选项 + VDE TA Tape & reel option + VDE optional	每卷3500pcs 3500 units per reel
TB-V	TB载带和卷轴选项 + VDE TB Tape & reel option + VDE optional	每卷3500pcs 3500 units per reel
/	内盒装：每盒3盘 Inner box packaging：3reels/box	每盒10500pcs 10500pcs per box
/	每箱装：10个内盒 Pack per Carton: 10inner boxes	每箱105000pcs 105000pcs per Carton

选项 Option	描述 Description	包装数量(旧版) Packing quantity
TA	TA载带和卷轴选项 TA Tape & reel option	每卷3000pcs 3000 units per reel
TB	TB载带和卷轴选项 TB Tape & reel option	每卷3000pcs 3000 units per reel
TA-V	TA载带和卷轴选项 + VDE TA Tape & reel option + VDE optional	每卷3000pcs 3000 units per reel
TB-V	TB载带和卷轴选项 + VDE TB Tape & reel option + VDE optional	每卷3000pcs 3000 units per reel
/	内盒装：每盒3盘 Inner box packaging：3reels/box	每盒9000pcs 9000pcs per box
/	每箱装：10个内盒 Pack per Carton: 10inner boxes	每箱90000pcs 90000pcs per Carton

9. 封装尺寸(单位:毫米) Package Drawing(Unit:mm)



• 表面贴片类型PIN脚焊盘布局 Surface patch type PIN foot pad layout



备注 Notes

a. 建议焊盘尺寸仅供参考Suggested pad dimension is just for reference only

b.请根据个人需要修改焊盘尺寸Please modify the pad dimension based on individual needs

10. 设备标记 Device marking





(范本参考 Template reference)

附注(Notes):

KL = 表示晶台微电子有限公司 Denotes Kinglight Microelectronics

M302X = 表示材料部件号 Denotes Device Part Number
X表示零件编号(0、1、2、3 或 4) Part No. (0, 1, 2, 3 or 4)

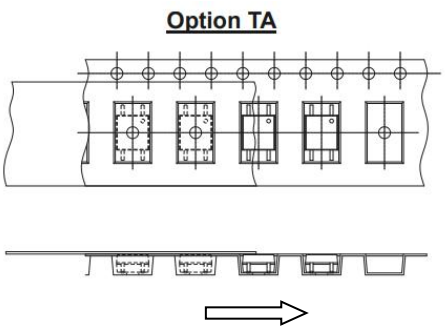
Y = 表示1位年份代码Denotes 1 digit Year code

WW = 表示2位周别代码Denotes 2 digit Week code

V = 表示VDE标识(客户指定镭射字符才加"V")
VDE (Only add "V" to laser characters specified by the customer)

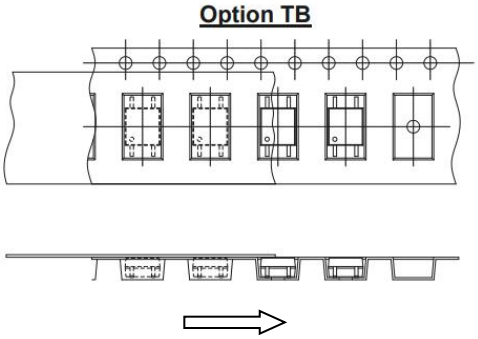
11. 料带和卷轴包装规格 Tape & Reel Packing Specifications

• 选择TA Option TA



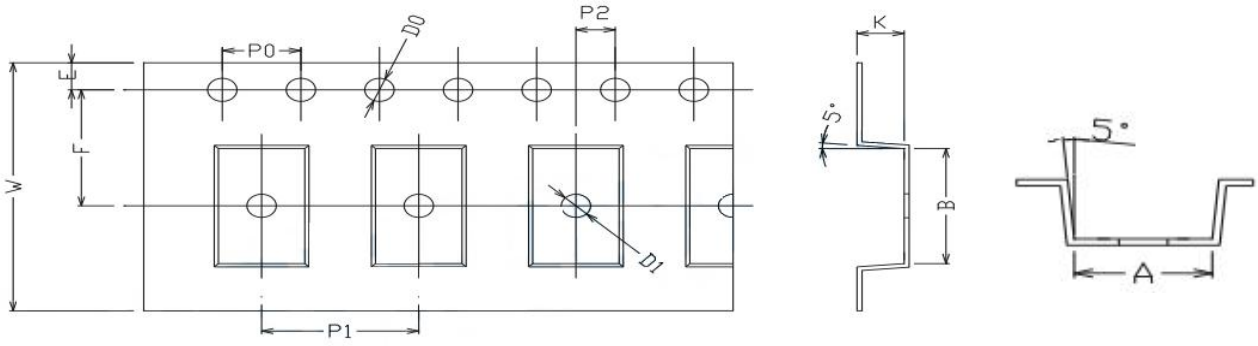
卷轴进给方向 Direction of feed from reel

• 选择TB Option TB



卷轴进给方向 Direction of feed from reel

料带尺寸Material belt size



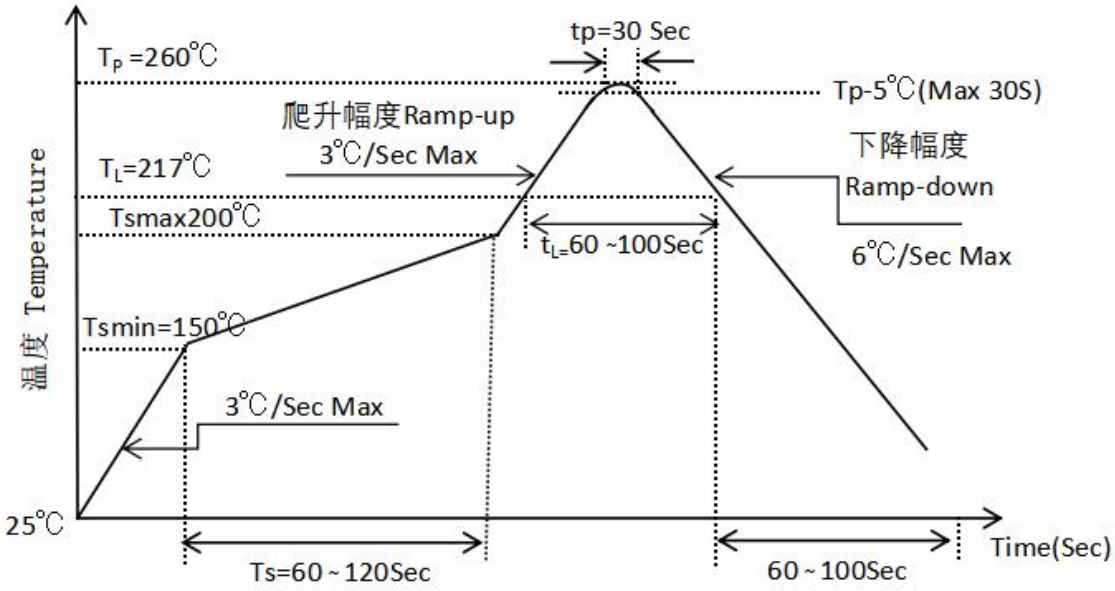
尺寸编号 Dimension No.	A	B	D0	D1	E	F
尺寸(mm) Dimension(mm)	4.4±0.1	7.4±0.1	1.5+0.1/-0	1.5±0.1	1.75±0.1	7.5±0.1
尺寸编号 Dimension No.	P0	P1	P2	t	W	K
尺寸(mm) Dimension(mm)	4.0±0.15	8.0±0.1	2.0±0.1	0.25±0.03	16.0±0.2	2.4±0.1

12. 焊接温度曲线 Temperature Profile Of Soldering

• 回流焊温度曲线 Reflow soldering

建议在下面所示的温度和时间分布条件下, 进行一次回流焊作业, 不得超过三次

One time soldering reflow is recommended within the condition of temperature and time profile shown below. Do not solder more than three times.



项目 Item	符号 Symbol	最小值 Min.	最大值 Max.	单位 Unit
预热温度 Preheat Temperature	T_s	150	200	℃
预热时间 Preheat Time	ts	60	120	s
升温速率 Ramp-Up Rate (T_L to T_P)	-	-	3	℃/s
液相线温度 Liquidus Temperature	T_L	217		℃
高于液相线温度(T_L)的时间 Time above Liquidus Temperature T_L	t_L	60	100	s
峰值温度 Peak Temperature	T_P	-	260	℃
T_c 在(T_P-5)和 T_P之间的时间 Time During Which T_c Is Between (T_P-5) and T_P	t_p	-	30	s
降温速率 Ramp-down Rate(T_P to T_L)	-	-	6	℃/s