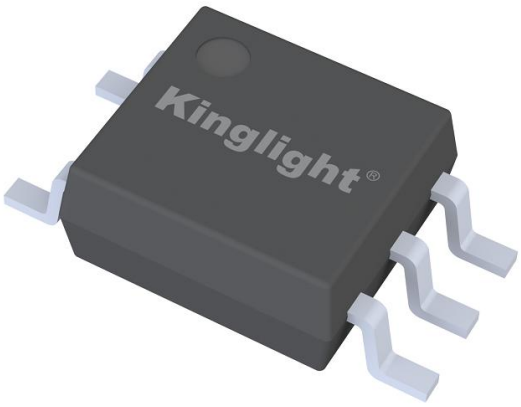
Kinglight® 晶台

KLM45X

SOP5 HIGH SPEED 1MBit/s TRANSISTOR PHOTOCOUPLER

SOP5 高速1MBit/s晶体管光耦



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The information contained in this document reflects representative usage scenarios and is intended for technical reference only.
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＊本文档中的信息适用于电子元器件应用中的典型用法。如有任何特殊用途，请向晶台咨询，以获得进一步的帮助。
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1. 产品特点 Product features

- 高速1MBit/s High speed 1MBit/s
- 宽工作温度范围(-40°C 至 85°C) Wide operating temperature range of -40°C to 85°C
- 可保证在0 至 70°C 温度范围内运行 Guaranteed performance from 0 to 70°C
- V_{CM}=1500V 时，高 CMR: 15KV/us（KLM453） High CMR 15KV/us at V_{CM}=1500V (KLM453)
- 无卤素 (溴<900ppm, 氯<900ppm, 溴+氯<1500ppm)
  Halogens free (Br < 900ppm, Cl < 900ppm, Br+Cl < 1500ppm)
- 输入与输出间高隔离电压(Viso=3750 V rms)
  High isolation voltage between inputs and output (Viso=3750 V rms)
- 符合欧盟REACH法规 Compliance with EU REACH
- 无Pb且符合ROHS标准 Pb free and RoHS compliant

2. 产品描述 Product Descripion

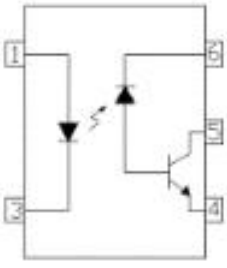
- KLM452 和 KLM453 器件均由一个红外发射二极管与一个高速光电检测晶体管组成，两者之间光学耦合。光电二极管偏置和输出晶体管集电极的独立连接可以通过减少输入晶体管的基极-集电极电容来使速度比传统的光电晶体管耦合器提高几个数量级
  The KLM452 and KLM453 devices each consist of an infrared emitting diode, optically coupled to a high speedphoto detector transistor. A separate connection for the photodiode bias and output-transistor collector increase the speed by several orders of magnitude over conventional phototransistor couplers by reducing the base-collector capacitance of the input transistor
- 它们采用行业内标准的 5 引脚 SOP 封装，适合表面帖装
  The devices are packaged in industry standard 5pin SOP packages and are suitable for surface mounting

3. 产品应用 Product Applications

- 线路接收器 Line receivers
- 现场总线通信和控制 Field bus communication and control
- 电机驱动器中的功率晶体管隔离 Power transistor isolation in motor drives
- 替代低速光电晶体管光电耦合器 Replacement for low speed phototransistor photo couplers
- 高速逻辑接地隔离 High speed logic ground isolation
- 模拟信号接地隔离 Analog signal ground isolation

4. 功能图 Functional Diagram

Schematic



引脚配置 Pin Configuration

1. 阳极 Anode
3. 阴极 Cathode
4. 接地 GND
5. 输出电压 V_{out}
6. 工作电压 V_{CC}

5. 光电特性 Electrical-Optical characteristics

• 最大限度额定值(温度=25℃) 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	25	mA
	峰值正向电流（50% 占空比，1ms P.W）Peak forward current(50% duty, 1ms P.W)	I_{FP}	50	mA
	峰值瞬态电流（≤1μs P.W，300pps) Peak transient current(≤1μs P.W,300pps)	I_{Ftrans}	1	A
	反向电压 Reverse voltage	V_R	5	V
	功耗 Power dissipation (T_A = 25°C)	P_{IN}	45	mW
输出 Output	功耗 Power dissipation (T_A = 25°C)	P_O	100	mW
	输出电流平均值 Average Output current	$I_{O(AVG)}$	8	mA
	峰值输出电流 Peak Output current	$I_{O(PK)}$	16	mA
	输出电压 Output voltage	V_O	-0.5 to 20	V
	电源电压 Supply voltage	V_{CC}	-0.5 to 30	V
隔离电压 (1*) Isolation Voltage		V_{iso}	3750	V rms
工作温度 Operating temperature		T_{OPR}	-40 to +85	℃
储存温度 Storage temperature		T_{STG}	-55 to +125	℃
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&3脚短接在一起, 4、5、&6脚短接在一起

AC for 1 minute, R.H.= 40 ~ 60% R.H. In this test, pins 1&3 are shorted together, and pins 4, 5&6 are shorted together.

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

6. 电气特性(Ta=0至70℃,除非另有规定)

Electrical Characteristics(Ta=0 to 70℃ 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 In put	正向电压 Forward voltage	V_F	-	1.45	1.8	V	I_F=16mA
	反向电压 Reverse voltage	V_R	5.0	-	-	V	I_R=10μA
	正向电压温度系数 Temperature coefficient of forward voltage	$\Delta V_F/\Delta T_A$	-	-1.6	-	mV/℃	I_F=16mA
输出 Out put	逻辑高电平供电电流 Logic High Supply Current	I_{CCH}	-	0.05	1	uA	I_F=0mA, V_O=Open, V_{CC}=15V, T_A=25°C
			-	-	2		I_F=0mA, V_O=Open, V_{CC}=15V
	逻辑低电平供电电流 Logic Low Supply Current	I_{CCL}	-	100	200	uA	I_F=16mA, V_O=Open, V_{CC}=15V
	逻辑高电平输出电流 Logic High Output Current	I_{OH}	-	0.001	0.5	uA	I_F=0mA, V_O=V_{CC}=5.5V, T_A=25°C
			-	0.001	1		I_F=0mA, V_O=V_{CC}=15V, T_A=25°C
			-	-	50		I_F=0mA, V_O=V_{CC}=15V

• 传输特性

Transfer Characteristics

参数 Parameter	符号 Symbol	最小值 Min.	规格值 Typ.*	最大值 Max.	单位 Unit	条件 Condition
电流转换比 Current Transfer Ratio	CTR	20	-	50	%	I_F=16mA, V_O=0.4V, V_{CC}=4.5V, T_A=25°C
		15	-	-		I_F=16mA, V_O=0.5V, V_{CC}=4.5V
逻辑低电平输出电压 Logic Low Output Voltage	V_{OL}	-	-	0.4	V	I_F = 16mA, I_O = 3mA, V_{CC}=4.5V, T_A=25°C
		-	-	0.5		I_F = 16mA, I_O =2.4mA, V_{CC}=4.5V

开关特性(Ta=0至70℃, V_{CC}=5V除非另有说明)

Switching Characteristics (Ta=0 to 70°C, V_{CC}=5V 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
逻辑低电平的传播延迟时间(3*) Propagation Delay Time to Logic Low (Fig.8)		T_{PHL}	-	0.4	0.8	us	I_F=16mA, R_L=1.9KΩ, T_A=25°C
			-	-	1.0		I_F=16mA, R_L=1.9KΩ
逻辑高电平的传播延迟时间(3*) Propagation Delay Time to Logic High (Fig.8)		T_{PLH}	-	0.35	0.8	us	I_F=16mA, R_L=1.9KΩ, T_A=25°C
			-	-	1.0		I_F=16mA, R_L=1.9KΩ
逻辑高电平时的共模瞬态抗扰度(4*) Common Mode Transient Immunity at Logic High (Fig.9)	KLM452	CM_H	5,000	-	-	V/us	I_F = 0mA, V_{CM}=10Vp-p, R_L=1.9KΩ, T_A =25°C
	KLM453		15,000	-	-		I_F = 0mA, V_{CM}=1500Vp-p, R_L=1.9KΩ, T_A =25°C
逻辑低电平时的共模瞬态抗扰度(3*) Common Mode Transient Immunity at Logic Low (Fig.9)	KLM452	CM_L	5,000	-	-	V/us	I_F = 16mA, V_{CM}=10Vp-p, R_L=1.9KΩ, T_A =25°C
	KLM453		15,000	-	-		I_F = 16mA, V_{CM}=1500Vp-p, R_L=1.9KΩ, T_A=25°C

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

7. 可靠性试验 Reliability Test

序号 NO.	试验项目 Test Items	参考标准 Reference	试验条件 Test conditions	试验过程 Test process	试验数 Qty.(pcs)	允收水准 LTPD
1	温度循环 TC	JESD22-A104C	H:125±5℃ 15min ∫5min L:-55±5℃ 15min	300cycle	45	0/45
2	高温操作寿命 HTOL	JESD22-A108C	HTOL@85±5°C IF=10mA I_O=5mA Vcc=5V	168、500、 1000hrs	45	0/45
3	温湿度寿命试验 HTHB	JESD22- A101-B	HTHB@85+5/-2℃、 85±5%RH I_F=10mA, Io=5mA, Vcc=5V	168、500、 1000hrs	45	0/45
4	压力锅 PCT	JESD22-A102-C	Ta=121±5℃, 100±5%RH, 2atm	96hrs	45	0/45
5	高温储存 HTS	JESD22-A103C	HTS@125±5℃	168、500、 1000hrs	45	0/45
6	低温储存 LTS	JESD22-A119	LTS@-40±5℃	168、500、 1000hrs	45	0/45
7	耐锡热试验 RSH	JESD22-B106C	RSH@260±5℃	10sec*3times	45	0/45
8	可焊性 SD	JESD22-B102D	Pb-free@ 245±5℃	3sec*1times	22	0/22
备注 Remarks	以上试验项目如与客户试验要求存在差异或者特殊客户特殊要求的,可根据实际情况按照客户的要求进行试作,客户未要求依我司试验标准试作,不同产品使用不同电流进行测试 All the tests should be performed according to customers' actual requirements, while difference of test standard or special requirements exist. Otherwise, all the tests are performed according to the standard listed above. Different current is applied to the tests of different product models					

8. 特性曲线 Characteristic Curves

图1. 正向电流 vs 正向电压的关系

Figure 1. Forward Current vs Forward Voltage

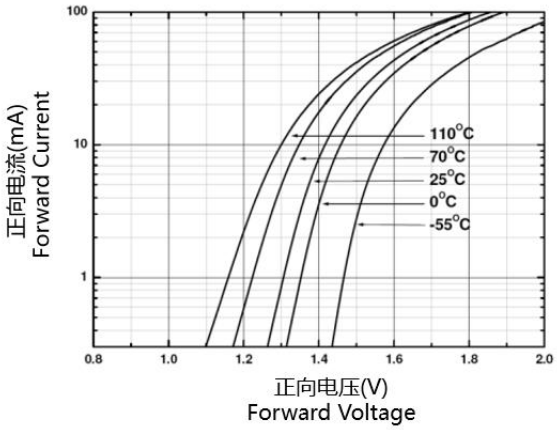


图2 电流转换比 vs 正向电流的关系

Fig.2 Current Transfer Ratio vs Forward Current

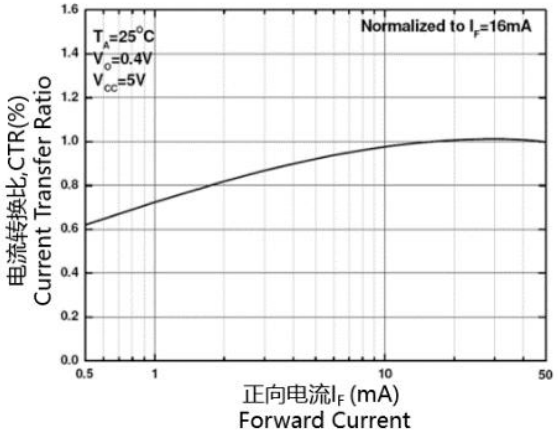


图3. 电流转换比 vs 环境温度的关系

Figure 3. Current Transfer Ratio vs Ambient Temperature

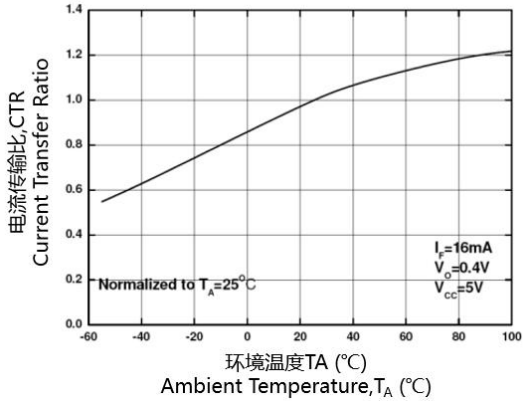


图4. 输出电流 vs 输出电压的关系

Figure 4. Output Current Vs Output Voltage

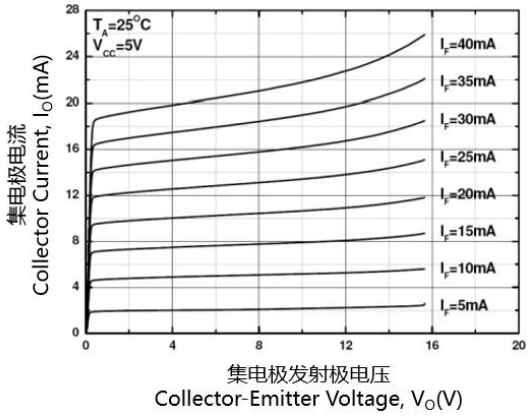


图5. 逻辑高电平输出电流 vs 环境温度的关系

Figure 5. Logic High Output Current vs Ambient Temperature

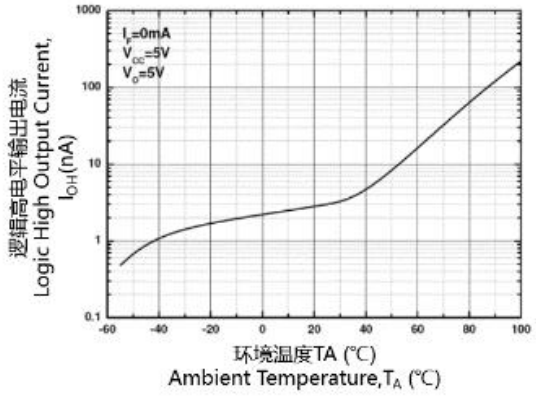


图6. 传播延迟 vs 负载电阻的关系

Figure 6. Propagation Delay vs Load Resistance

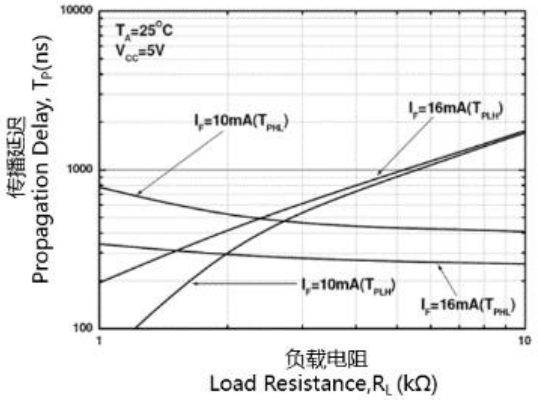


图7. 传播延迟 vs 温度的关系

Figure 7. Propagation Delay vs Temperature

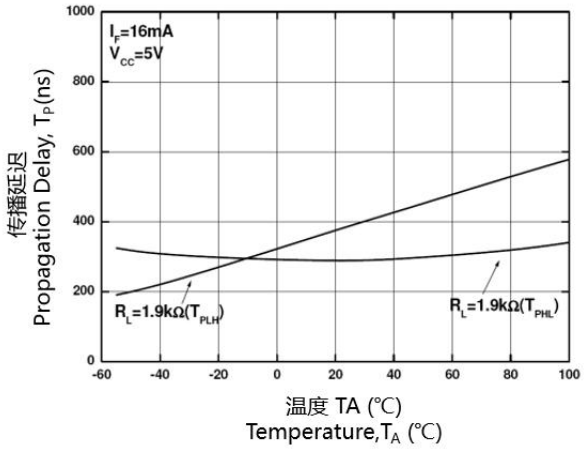


图8. 频率响应

Figure 8. Frequency Response

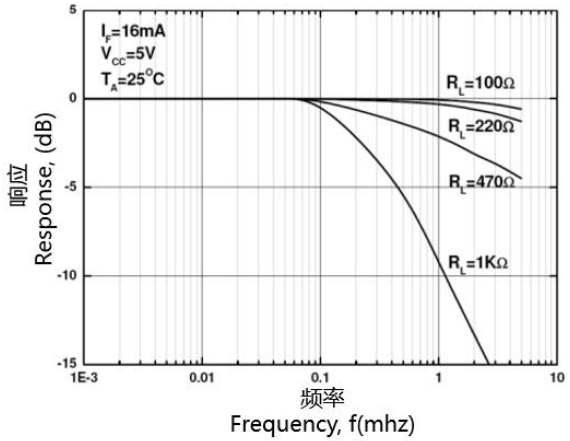


图9 开关时间测试电路及波形

Figure 9. Switching Time Test Circuit & Waveforms

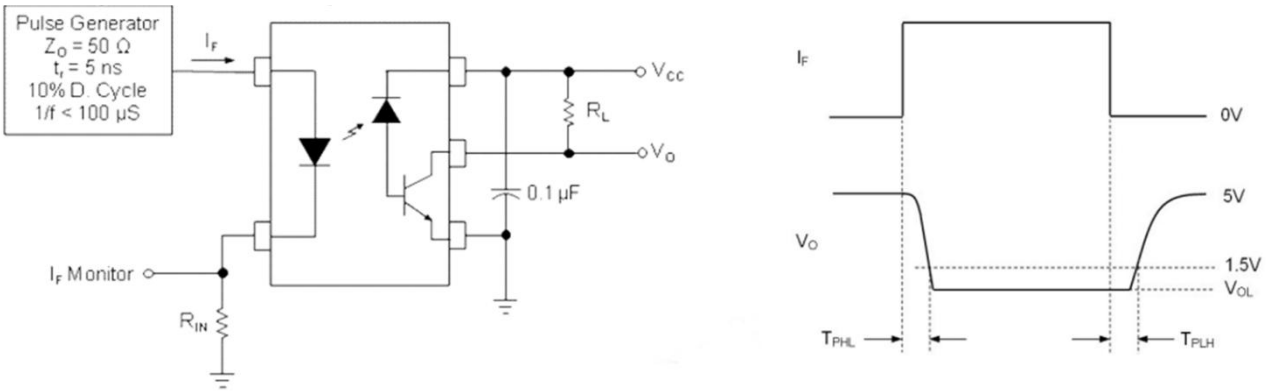
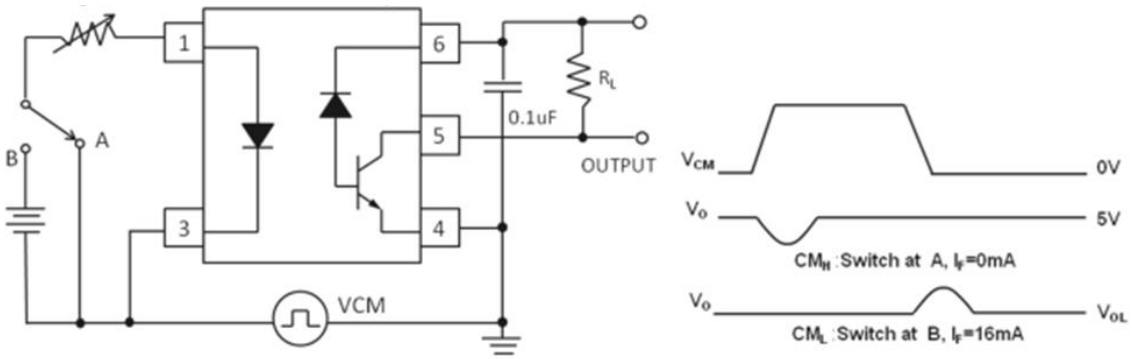


图10. 瞬态抗扰度测试电路及波形

Transient Immunity Test Circuit & Waveform



*3 逻辑高电平下的共模瞬态抗扰度是共模脉冲信号 V_{CM} 前沿的可容忍的最大值（正）dVcm/dt，以确保输出保持在逻辑高电平状态（即 V_O >2.0V）。逻辑低电平时的共模瞬态抗扰度是共模脉冲信号 V_{CM} 后缘上可容忍的最大值（负）dVcm/dt，以确保输出保持在逻辑低电平状态（即 V_O <0.8V)

*3 Common mode transient immunity in logic high level is the maximum tolerable (positive) dVcm/dt on the leadingedge of the common mode pulse signal V_{CM}, to assure that the output will remain in a logic high state (i.e., V_O >2.0V). Common mode transient immunity in logic low level is the maximum tolerable (negative) dVcm/dt on the trailingedge of the common mode pulse signal, V_{CM}, to assure that the output will remain in a logic low state (i.e., V_O <0.8V)

9. 订单信息 Order Information

• 材料编号 Part Number

KLM45X-Z-V

附注(Notes):

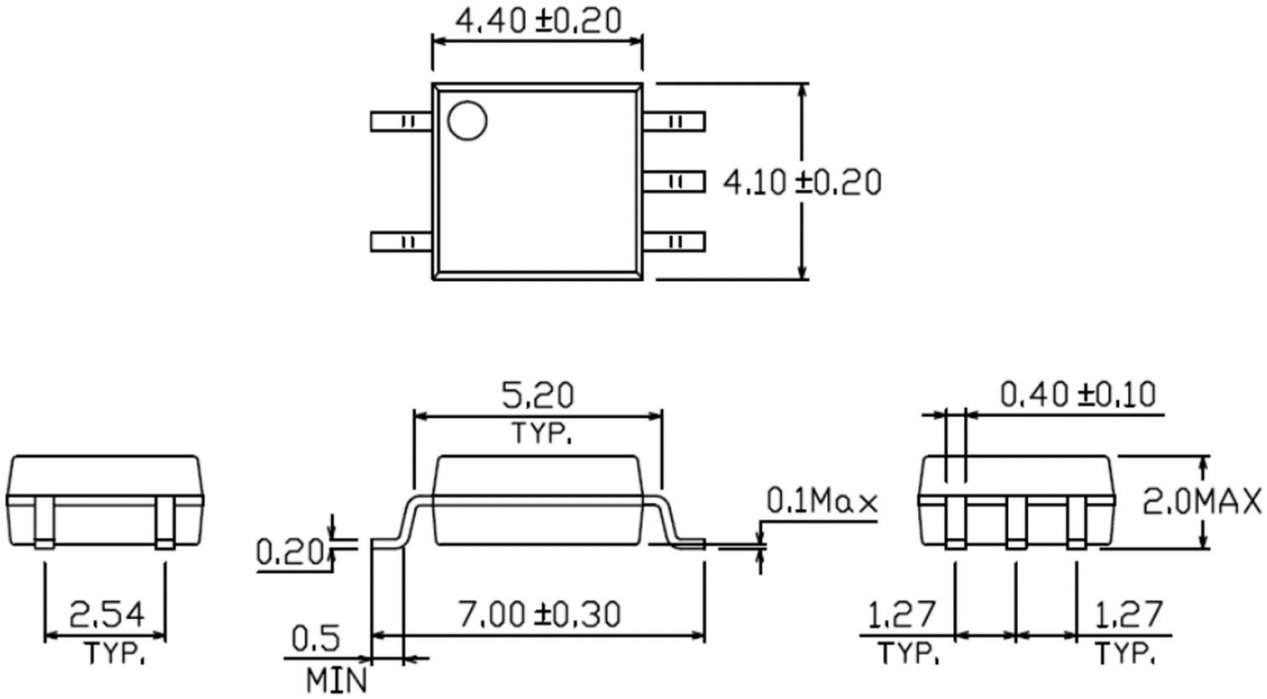
X =零件编号(2或3) Part No. (2 or 3)

Z = 料带和卷轴选项(TA、TB or none)
Tape and reel option (TA, TB或无)

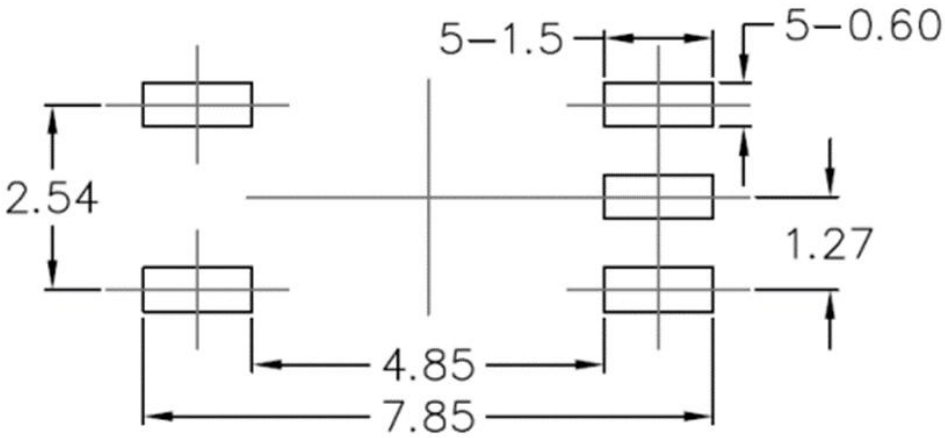
V = 表示VDE标识(客户指定镭射字符才加"V")
VDE (Only add "V" to laser characters specified by the customer)

选项 Option	描述 Description	包装数量 Packing quantity
无 None	标准 Standard	每管100pcs 100 units per tube
-V	标准+VDE Standard + VDE	每管100pcs 100 units per tube
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	每卷3000pcs 3000 units per reel
TB-V	TB载带和卷轴选项+ VDE TB tape & reel option + VDE	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

10.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 need

11.设备标记 Device marking

(范本参考 Template reference)

附注(Notes):

KL = 表示晶台光电有限公司 Denotes KingLight

M45X = 表示材料部件号 Denotes Device Part Number
X表示零件编号(2或3) Part No. (2 or 3)

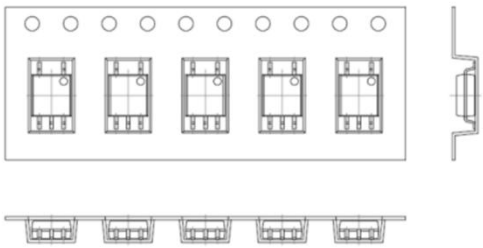
Y = 表示1位年份代码Denotes 1 digit Year code

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)

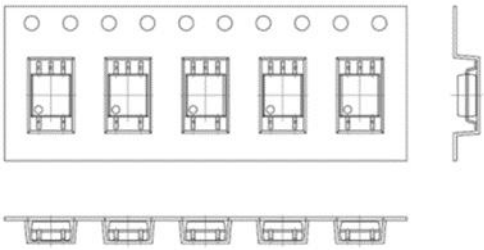
12.料带和卷轴包装规格 Tape & Reel Packing Specifications

• 选择TA Option TA



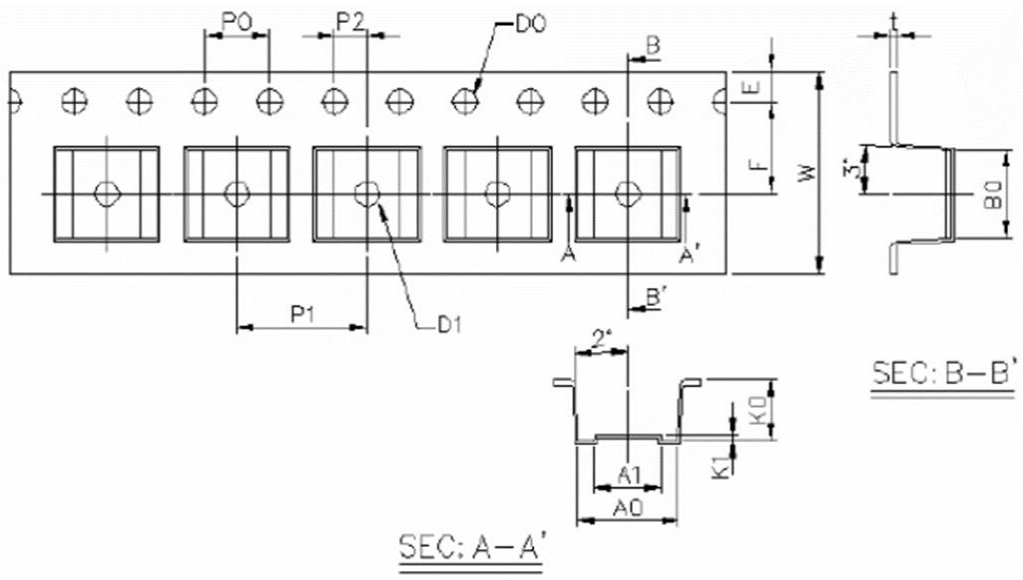
卷轴进给方向 Direction of feed from reel

• 选择TB Option TB



卷轴进给方向 Direction of feed from reel

料带尺寸Material belt size



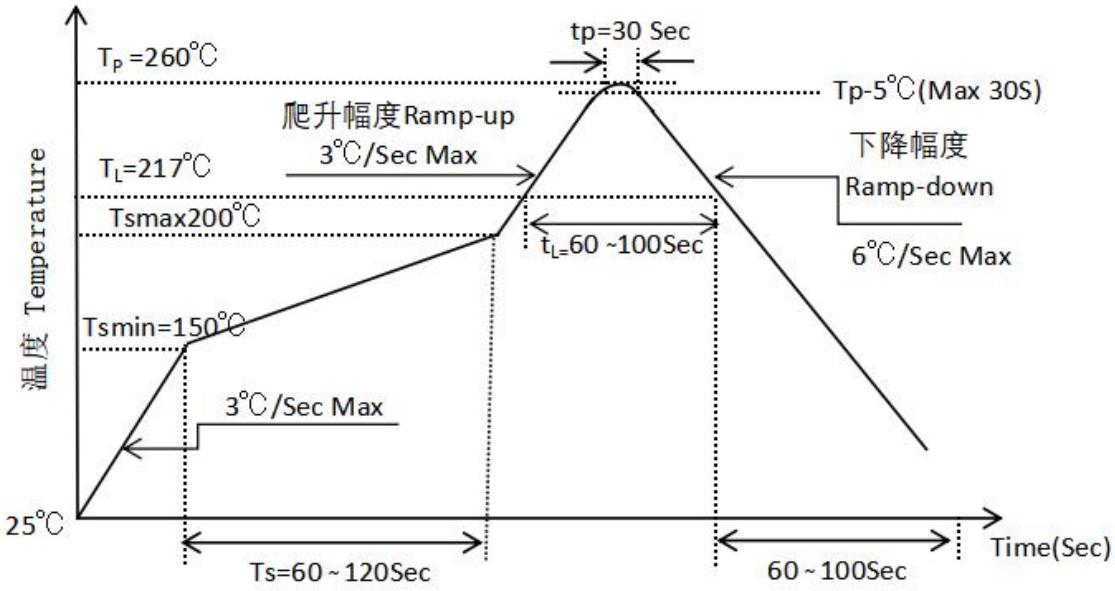
尺寸编号 Dimension No.	A0	A1	B0	D0	D1	E	F
尺寸(mm) Dimension(mm)	6.2±0.1	4.1±0.1	5.28±0.1	1.5±0.1	1.5±0.3	1.75±0.1	5.5±0.1
尺寸编号 Dimension No.	P0	P1	P2	t	W	K0	K1
尺寸(mm) Dimension(mm)	4.0±0.1	8.0±0.1	2.0±0.1	0.4±0.1	12.0+0.3/-0.1	3.7±0.1	0.3±0.1

13.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