KL481P

LSOP6 High CMR Intelligent Power Module and Gate Drive Interface Photocoupler

智能电源模块和栅极驱动接口光耦



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1. 产品特点 Product features

- 工作温度范围：-40°C 至 110°C Wide operating temperature range: –40°C to 110°C
- 保证工作电压为4.5V至20V Truth Table Guaranteed: V_{CC} from 4.5V to 20V
- 常见 IPM 应用的性能指标在工业温度范围内
  Performance Specified for Common IPM Applications Over Industrial Temperature Range
- 最短传播延迟 Short Maximum Propagation Delays
- 最小脉冲宽度失真 (PWD) Minimized Pulse Width Distortion (PWD)
- 超高共模抑制 (CMR) Very High Common Mode Rejection (CMR)
- 无Pb且符合ROHS标准 Pb free and RoHS compliant

2. 产品描述 Product Description

•高速KL481系列光耦合器包含一个AlGaAs LED、一个光检测器和一个施密特触发器，无需外部波形调节电路，也无需上拉电阻器，可直接驱动智能功率模块或栅极驱动。器件之间的传播延迟差异已降至最低，从而通过减少开关死区时间最大限度地提高了逆变器效率。

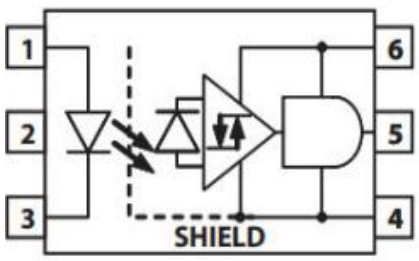
The high-speed KL481 optocoupler contains an AlGaAs LED, a photo detector, and a Schmitt trigger that eliminates the requirement for external waveform conditioning circuits and the need for a pull-up resistor, which allows for a direct-drive Intelligent Power Module or gate drive. Propagation delay difference between devices has been minimized to maximize inverter efficiency through reduced switching dead time.

3. 产品应用 Product Applications

- IPM 接口隔离 IPM Interface Isolation
- 隔离 IGBT/MOSFET 门驱动器 Isolated IGBT/MOSFET Gate Drive
- 交流和无刷直流电机驱动 AC and Brushless DC Motor Drives
- 数字隔离、逆变器 General Digital 、Inverters

4. 功能图 Functional Diagram

示意图 Schematic



引脚配置 Pin Configuration

1. 阳极 Anode
2. 无连接 No Connection
3. 阴极 Cathode
4. 接地 GND
5. 输出电压 V_O
6. 电源电压 V_{CC}

Truth Table

LED	OUT
ON	H
OFF	L

注意：引脚4和6之间必须连接一个 0.1μF 旁路电容器

Note： A 0.1μF bypass capacitor must be connected between pins 4 and 6

5. 光电特性 Electrical-Optical characteristics

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

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	10	mA
	正向脉冲电流 Pulse Forward current(1*)	I_{FP}	1.0	A
	反向电压 Reverse voltage	V_R	5	V
输出 Output	集电极输出电流 Output Collector Current	I_O	25	mA
	集电极输出电压 Output Collector Voltage	V_O	-0.5 to +25	V
	工作电压 Supply voltage	V_{CC}	25	V
隔离电压 (2*) Isolation Voltage		V_{ISO}	5000	Vrms
输入输出电阻 Input-Output Resistance		R_{I-O}	10^{12}	Ω
输入-输出电容 Input-Output Capacitance		C_{I-O}	0.6	pF
总功耗 Total Power Dissipation		P_T	210	mW
工作温度 Operating temperature		T_{OPR}	-40 to +110	℃
储存温度 Storage temperature		T_{STG}	-55 to +125	℃
焊接温度 (3*) Soldering temperature		T_{SOL}	260	℃

附注 (Notes):

1* 脉冲宽度 ≤ 1μs、300pps Pulse width ≤ 1μs, 300pps

2* 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和3脚短接在一起,, 4、5和6脚短接在一起

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

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

6. 电气特性(Ta=-40至100℃,除非另有规定)

Electrical Characteristics(Ta=-40 to 100℃ 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	-	1.5	1.85	V	I_F=6mA
	正向电压温度系数 Forward Voltage Temperature Coefficient	$\Delta V_F/\Delta Ta$	-	1.7	-	mV/°C	I_F=6mA
	反向电压 Reverse voltage	V_R	5.0	-	-	V	I_R=10μA
输出 Output	高电平电源电流 High level supply current	I_{CCH}	-	1.5	2.5	mA	I_F=10mA V_{CC}=5.5V I_O= Open
			-	1.6	2.5		I_F=10mA V_{CC}=20V I_O= Open
	低电平电源电流 Low level supply current	I_{CCL}	-	1.9	3.0	mA	V_F=0V V_{CC}=5.5V I_O=Open
			-	2.0	3.0		V_F=0V V_{CC}=20V I_O= Open

• 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
高电平输出电流(4*) HIGH Level Output Current	I_{OH}	-	-	-25	mA	V_{CC}=5.5V, I_F=10mA I_O= Open
		-	-	-50		V_{CC}=20V, I_F=10mA I_O= Open
低电平输出电流(4*) LOW Level Output Current	I_{OL}	25	-	-	mA	V_O=V_{CC}=5.5V, V_F=0V
		50	-	-		V_O=V_{CC}=20V, V_F=0V
高电平输出电压 HIGH Level Output Voltage	V_{OH}	V_{CC}-0.5	-	-	V	I_{OL}=-6.5mA V_{CC}=4.5V
		V_{CC}-0.3	-	-		I_{OL}=-3.5mA V_{CC}=4.5V
低电平输出电压 LOW Level Output Voltage	V_{OL}	-	-	V_{EE}+0.5	V	I_{OL}=6.5mA
输入阈值电流 Input Threshold Current	I_{FLH}	-	2.2	5.5	mA	-
输入电容 Input Capacitance	C_{IN}	-	60	-	pF	f =1MHz, V_F=0 V

开关特性 Switching 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
低电平传输延迟 Propagation Delay Time to output Low level	T_{PHL}	-	150	350	ns	tr / tf =5ns 10% duty cycle Z_O=50Ω,V_O=5V 带峰值电容
高电平传输延迟 Propagation Delay Time to output High level	T_{PLH}	-	110	350	ns	
脉冲宽度失真 Pulse width distortion	PWD	-	-	250	ns	
传播延迟差(5*) Propagation Delay Skew	PDD	-100	-	250	ns	
输出上升时间(10 to 90%) Output rise time (10 to 90%)	tr	-	16	-	ns	
输出下降时间(90 to 10%) Output fall time (90 to 10%)	tf	-	20	-	ns	
输出高电平共模抑制(6*) Common Mode Transient Immunity at Logic High	CM_H	20	-	-	kV/us	I_F=6mA,V_{CC}=5V, V_{CM}=1000V, T_A=25°C
输出低电平共模抑制(7*) Common Mode Transient Immunity at Logic Low	CM_L	20	-	-	kV/us	V_F=0V, V_{CC}=5V, V_{CM}=1000V, T_A=25°C

附注 (Notes):

4* 最大脉冲宽度10μs，最大占空比1% Max pulse width=10μs, max duty cycle =1%

5* 传输延迟差的定义是最大和最小传输延迟时间的差值(即 T_{PHL}或 T_{PLH}之差)，在相同的测试条件(电源电压、输入电流、温度等)下对产品进行评估。

Propagation delay skew is defined as the difference between the largest and smallest propagation delay times (i.e. T_{PHL} or T_{PLH}) of multiple samples. Evaluations of these samples are conducted under identical test conditions (supply voltage, input current, temperature, etc).

6* 输出高电平共模抑制是共模脉冲信号 V_{CM} 后沿的最大可容电压上升率 dv/dt，使输出保持高电平(即 V_O>2.0V)

Common mode transient immunity at output high is the maximum tolerable negative dv/dt on the trailing edge of the common mode impulse signal, V_{CM}, to assure that the output will remain high (i.e. V_O >2.0V)

7* 输出低电平共模抑制是共模脉冲信号 V_{CM} 前沿的最大可容电压上升率 dv/dt，使输出保持低电平(即 V_O <0.8V)

Common mode transient immunity at output low is the maximum tolerable positive dv/dt on the leading edge of the common mode pulse signal, VCM, to assure that the output will remain low (i.e. V_O <0.8V)

7. 特性曲线 Characteristic Curves

图1. 输出高压降和环境温度的关系

Fig 1. Output High Voltage Drop vs Temperature

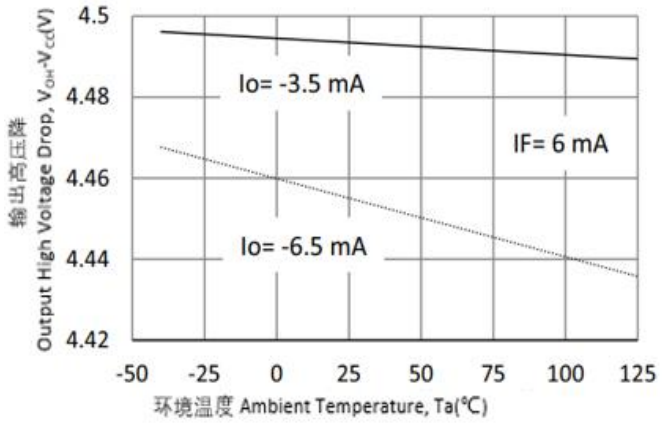


图2. 低电压输出和环境温度的关系

Fig 2. Output Low Voltage vs Temperature

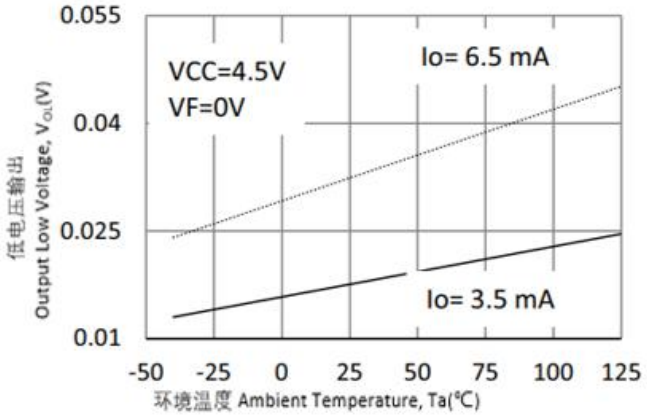


图3. 阈值输入电流和环境温度的关系

Fig 3. I_{FLH} vs Ambient Temperature

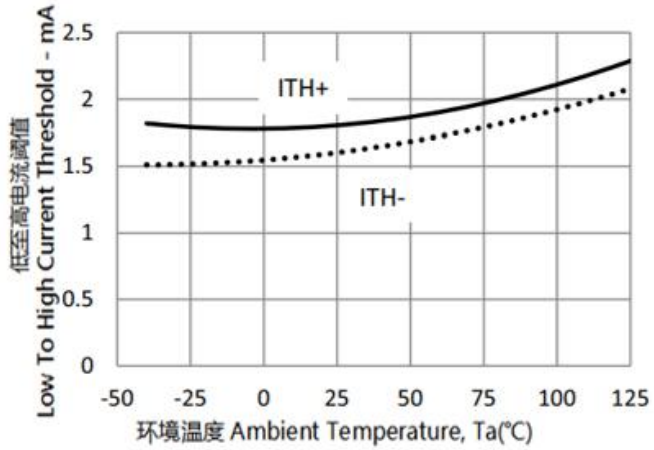


图4. 正向电流比与正向电压的关系

Fig 4. Forward Current vs Forward Voltage

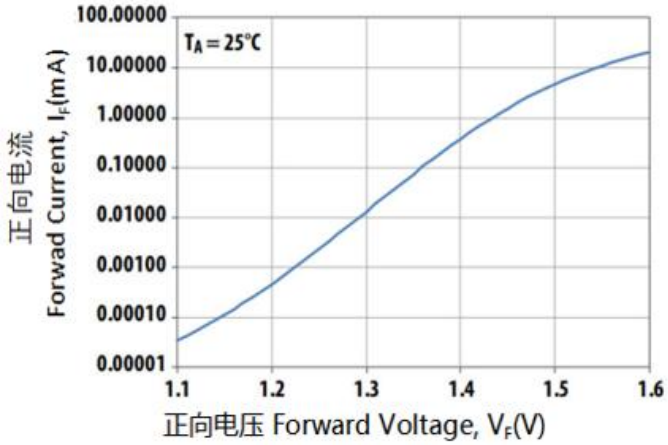


图5. 输出电压和电源电压的关系

Fig 5. Output voltage vs Supply voltage

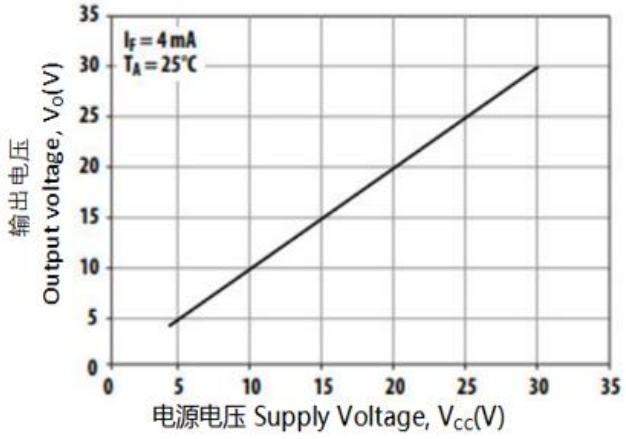


图6. 传播延迟和环境温度的关系

Fig 6. Propagation Delay vs Temperature

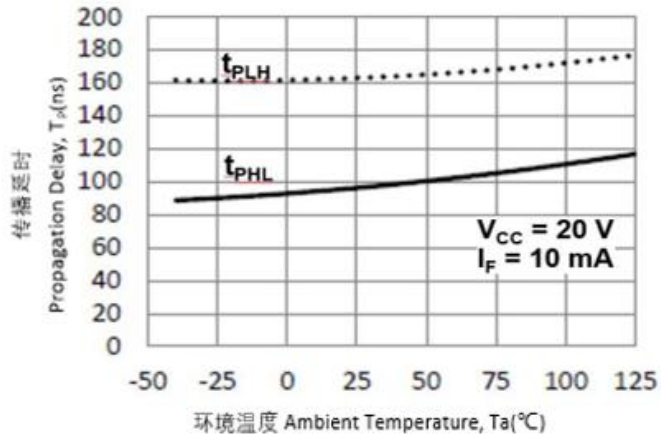


图7. 高电平输出电压和高电平输出电流的关系

Fig 7. V_{OH} vs I_{OH}

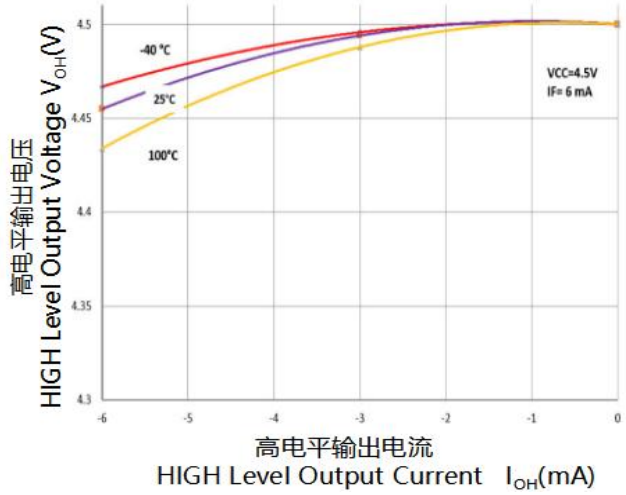


图8. 传播延迟和电源电压的关系

Fig 8. Propagation Delay vs Supply Voltage

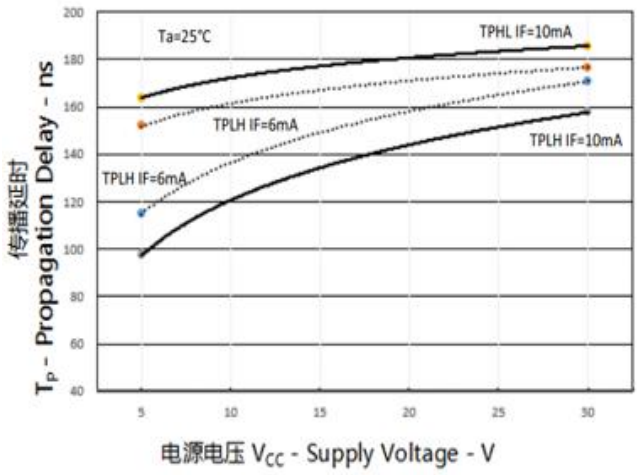


图9. 低电平输出电压和低电平输出电流的关系

Fig 9. V_{OL} vs I_{OL}

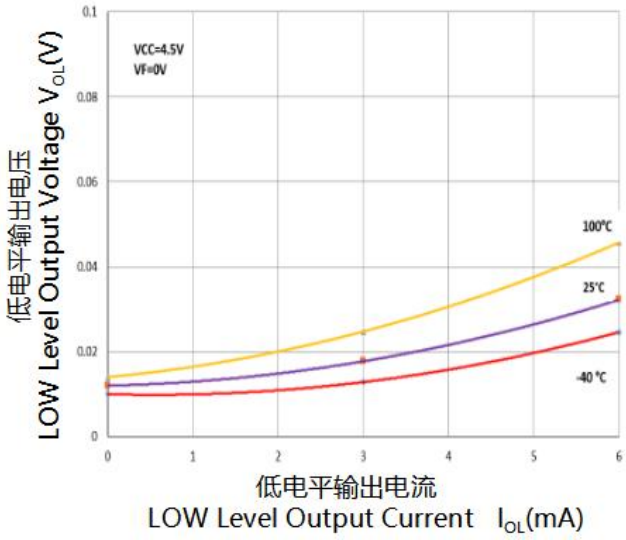


图10. tr、tf、t_{PLH} 和 t_{PHL} 测试电路和波形

Fig 10. tr、tf、t_{PLH} 和 t_{PHL} Test circuit

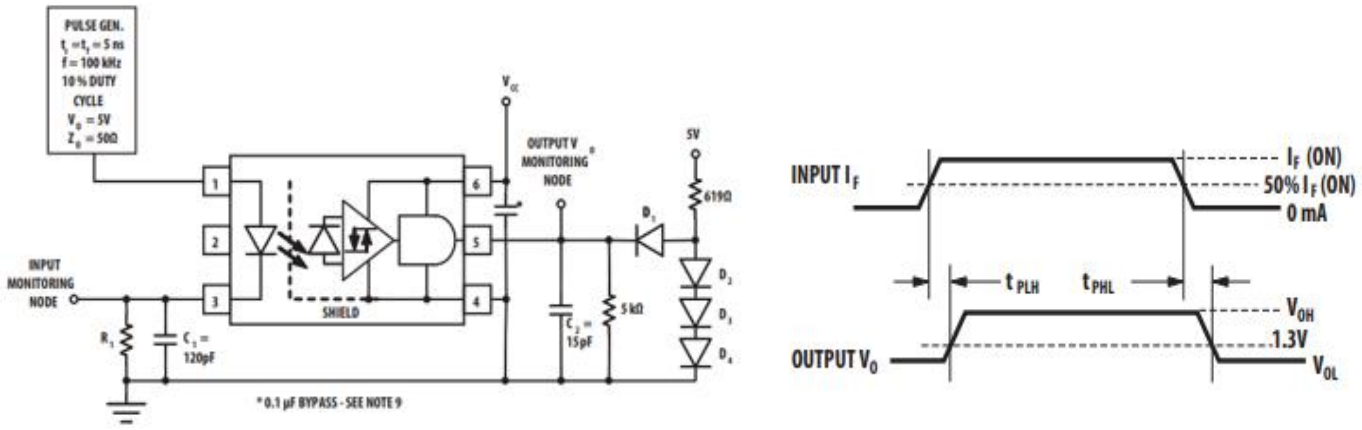
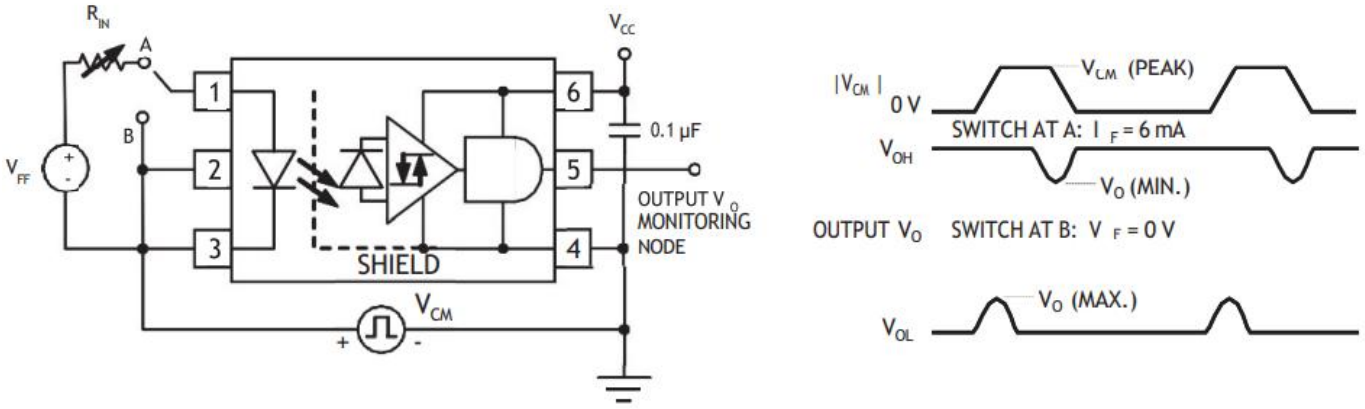


图11.CMR 测试电路

Fig 11. CMR Test circuit



8. 订单信息 Order Information

• 材料编号 Part Number

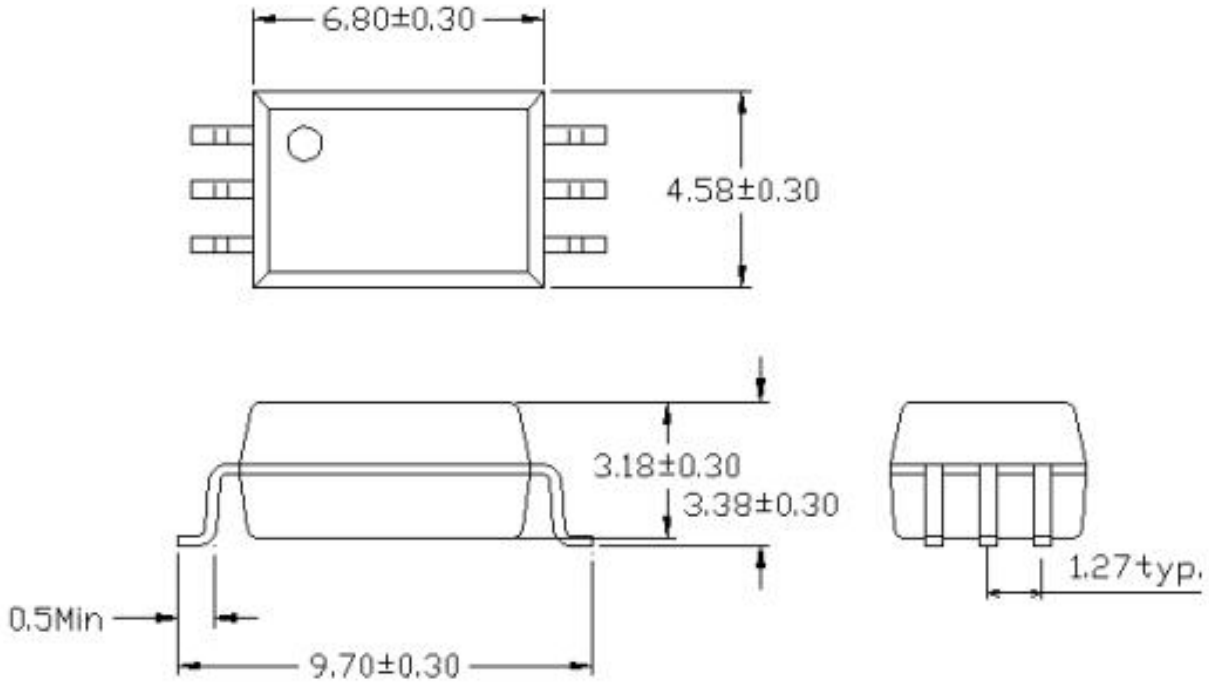
KL481P-Z-V

附注(Notes):

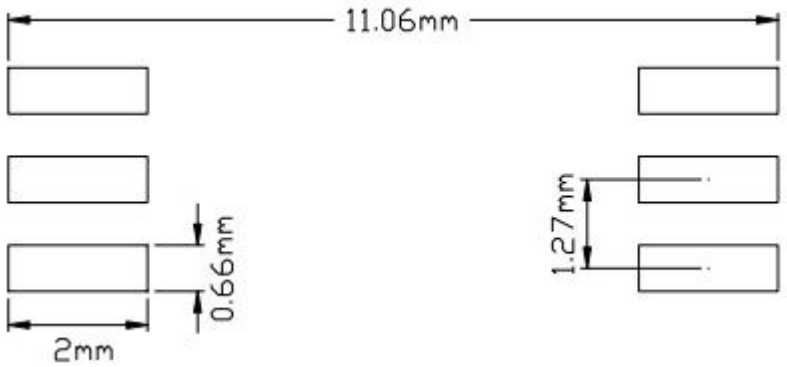
Z = 料带和卷轴选项(TA, TB或无)
Tape and reel option (TA、TB or none)
V = 表示VDE标识(客户指定镭射字符才加"V")
VDE (Only add "V" to laser characters specified by the customer)

选项 Option	描述 Description	包装数量 Packing quantity
TA	TA载带和卷轴选项 TA tape & reel option	每卷1000pcs 1000 units per reel
TB	TB载带和卷轴选项 TB tape & reel option	每卷1000pcs 1000 units per reel
TA-V	TA载带和卷轴选项+ VDE TA tape & reel option + VDE	每卷1000pcs 1000 units per reel
TB-V	TB载带和卷轴选项+ VDE TB tape & reel option + VDE	每卷1000pcs 1000 units per reel
/	内盒装：每盒3盘 Inner box packaging：3reels/box	每盒3000pcs 3000pcs per box
/	每箱装：10个内盒 Pack per Carton: 10inner boxes	每箱30000pcs 30000pcs 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



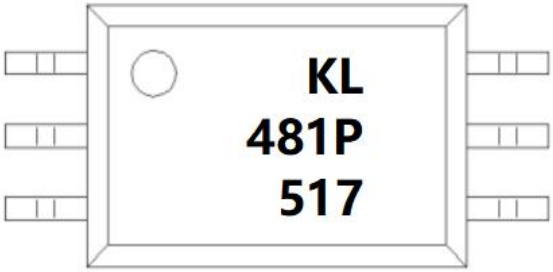
备注 Notes

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

481P = 表示材料部件号 Denotes Device Part Number

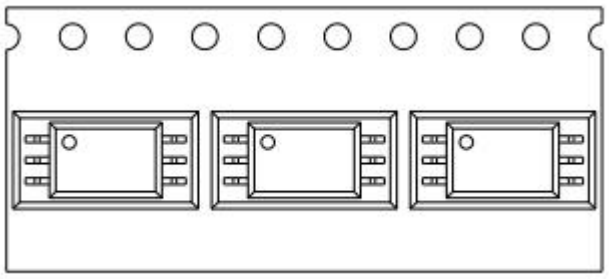
Y = 表示1位年份代码Denotes 1 digit Year code

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)

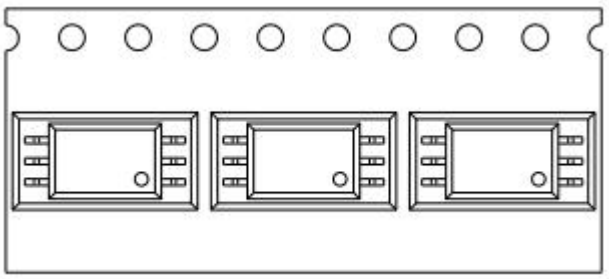
11.料带和卷轴包装规格 Tape & Reel Packing Specifications

• 选择TA Option TA



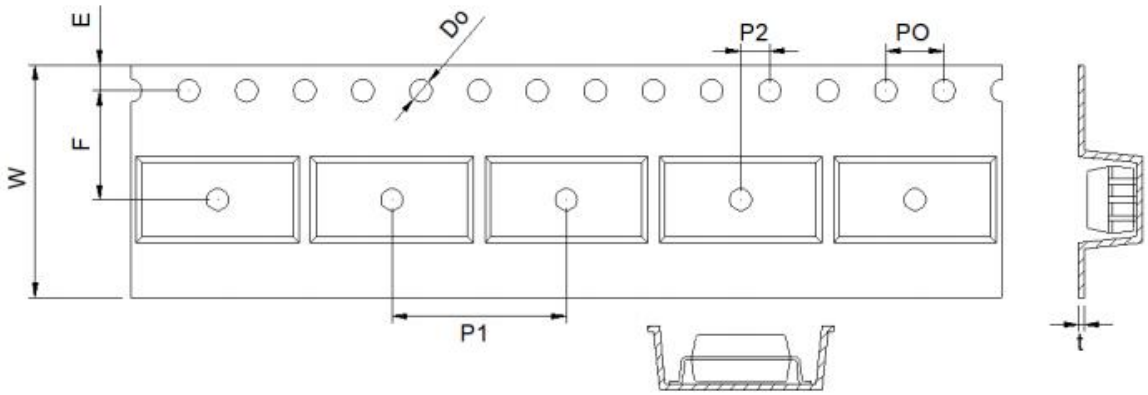
卷轴进给方向 Direction of feed from reel

• 选择TB Option TB



卷轴进给方向 Direction of feed from reel

料带尺寸Material belt size



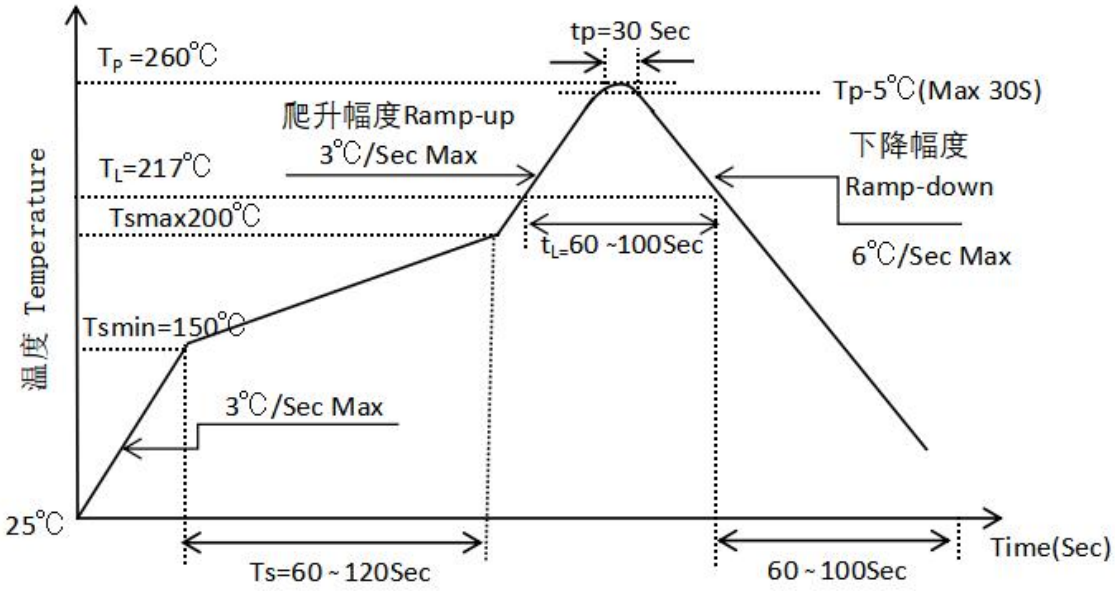
尺寸编号 Dimension No.	W	E	F	D0
尺寸(mm) Dimension(mm)	16.0±0.3	1.75±0.1	7.5±0.1	1.5±0.1
尺寸编号 Dimension No.	P_0	P1	P2	t
尺寸(mm) Dimension(mm)	4.0±0.1	12.0±0.1	2.0±0.1	0.4±0.1

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