# KL480W

# LSOP6 Positive Logic 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





*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。
The information contained in this document reflects representative usage scenarios and is intended for technical reference only.
*本文档中提到的产品型号和规格如有更改或改进，恕不另行通知。在生产使用之前，客户应参考产品规格书的最新数据表。
Product models and specifications mentioned in this document are subject to change or improvement without notice. Customers should refer to the latest data sheets in the product specifications prior to production use.
*在使用本文档中引用的产品时，请确保产品在数据手册中规定的环境和电气限制范围内运行。如果客户使用超过指定的限制，晶台微电子将不会对任何后续问题负责。
When using the products referenced in this document, ensure that the products are operated within the environmental and electrical limits specified in the data sheet. If the customer uses the product beyond the specified limits, Kinglight Microelectronics will not be responsible for any subsequent problems.
*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，请向晶台微电子咨询，以获得进一步的帮助。
The information in this document applies to typical use in electronic component applications. For special applications, please contact Kinglight Microelectronics for further assistance.
*未经晶台微电子允许，不得复制或转载本文件的内容和信息。对于最新的信息，请参考官方网站 Http://www.klmicro.com。
The contents and information in this document may not be copied or reproduced without the permission of Kinglight Microelectronics. For the latest information, please visit the official website Http://www.klmicro.com.

## 1. 产品特点 Product features

- 正输出型(图腾柱输出) Positive output type (totem pole output)
- 保证工作电压为4.5V至30V Truth Table Guaranteed: $V_{CC}$ from 4.5V to 30V
- 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

- KL480系列高速光耦包含一个AlGaAs LED 和一个光电探测器，内置施密特触发器，提供逻辑兼容波形，可节省额外波形整型需求。图腾柱输出无需上拉电阻器，可直接驱动智能电源模块或栅极驱动。器件之间的传播延迟差最小化使这些光耦成为减少开关死区时间来提高逆变器效率出色的解决方案。

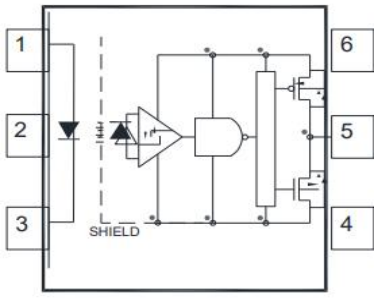
The KL480 series fast speed photocoupler contains a AlGaAs LED and photo detector with built-in Schmitt trigger to provide logic-compatible waveforms, eliminating the need for additional wave shaping. The totem pole output eliminates the need for a pull up resistor and allows for direct drive Intelligent Power Module or gate drive. Minimized propagation delay difference between devices makes these photocouplers excellent solutions for improving 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℃) 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 | $I_F$ | 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 | $I_O$ | 50 | mA |
| | 集电极输出电压 Output Collector Voltage | $V_O$ | -0.5 to +35 | V |
| | 工作电压 Supply voltage | $V_{CC}$ | 35 | 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 | | $C_{I-O}$ | 1.0 | pF |
| 总功耗 Total Power Dissipation | | $P_T$ | 145 | 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105℃,除非另有规定)

## Electrical Characteristics(Ta=-40 to 105℃ 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 | 1.33 | 1.6 | V | $I_F$=5mA |
| | 正向电压温度系数 Forward Voltage Temperature Coefficient | $\Delta V_F/\Delta Ta$ | - | -1.237 | - | mV/°C | $I_F$=5mA |
| | 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 | $I_{CCH}$ | - | - | 3.0 | mA | $I_F$=5mA $V_{CC}$=5.5V $I_O$=0mA |
| | | | - | 1.9 | 3.0 | | $I_F$=5mA $V_{CC}$=30V $I_O$=0mA |
| | 低电平电源电流 Low level supply current | $I_{CCL}$ | - | - | 3.0 | mA | $V_F$=0V $V_{CC}$=5.5V $I_O$=0mA |
| | | | - | 2.0 | 3.0 | | $V_F$=0V $V_{CC}$=30V $I_O$=0mA |

• 传输特性　Transfer Characteristics

| 参数<br>Parameter | 符号<br>Symbol | 最小值<br>Min. | 规格值<br>Typ.* | 最大值<br>Max. | 单位<br>Unit | 条件<br>Condition |
|---|---|---|---|---|---|---|
| 高电平输出电流( 4* )<br>HIGH Level Output Current | $I_{OH}$ | - | - | -160 | mA | $V_{CC}$=5.5V, $I_F$=5mA<br>$V_O$= GND |
| | | - | - | -200 | | $V_{CC}$=20V, $I_F$=5mA<br>$V_O$= GND |
| 低电平输出电流( 4* )<br>LOW Level Output Current | $I_{OL}$ | 160 | - | - | mA | $V_O$=$V_{CC}$=5.5V, $V_F$=0V |
| | | 200 | - | - | | $V_O$=$V_{CC}$=20V, $V_F$=0V |
| 高电平输出电压<br>HIGH Level Output Voltage | $V_{OH}$ | $V_{CC}$-0.5 | $V_{CC}$-0.025 | - | V | $I_{OL}$=-6.5mA |
| 低电平输出电压<br>LOW Level Output Voltage | $V_{OL}$ | - | $V_{EE}$+0.015 | $V_{EE}$+0.5 | V | $I_{OL}$=6.5mA |
| 输入阈值电流<br>Input Threshold Current | $I_{FLH}$ | - | 0.7 | 1.5 | mA | - |
| 输入阈值电压<br>Input Threshold Voltage | $V_{FLH}$ | 0.8 | - | - | V | - |
| 输入电容<br>Input Capacitance | $C_{IN}$ | - | 33 | - | pF | f =1MHz, $V_F$=0 V |

开关特性 Switching Characteristics

| 参数<br>Parameter | 符号<br>Symbol | 最小值<br>Min. | 规格值<br>Typ.* | 最大值<br>Max. | 单位<br>Unit | 条件<br>Condition |
|---|---|---|---|---|---|---|
| 低电平传输延迟<br>Propagation Delay Time to output Low level | $T_{PHL}$ | - | 130 | 220 | ns | $C_L$=100pF,<br>$V_F$=0V<br>$I_{F(ON)}$= 1.6mA |
| 高电平传输延迟<br>Propagation Delay Time to output High level | $T_{PLH}$ | - | 120 | 200 | ns | $C_L$=100pF,<br>$I_{F(ON)}$= 1.6 mA<br>$V_F$=0V |
| 脉冲宽度失真<br>Pulse width distortion | PWD | - | - | 120 | ns | $C_L$=100pF |
| 传播延迟差( 5* )<br>Propagation Delay Skew | PDD | -210 | - | 210 | ns | $C_L$=100pF |
| 输出上升时间(10 to 90%)<br>Output rise time (10 to 90%) | tr | - | 35 | - | ns | - |
| 输出下降时间(90 to 10%)<br>Output fall time (90 to 10%) | tf | - | 35 | - | ns | - |
| 输出高电平共模抑制( 6* )<br>Common Mode Transient Immunity at Logic High | $CM_H$ | 20 | - | - | kV/us | $I_F$=4mA,$V_{CC}$=5V,<br>$V_{CM}$=1500V,<br>$T_A$=25°C |
| 输出低电平共模抑制( 7* )<br>Common Mode Transient Immunity at Logic Low | $CM_L$ | 20 | - | - | kV/us | $V_F$=0V, $V_{CC}$=5V,<br>$V_{CM}$=1500V,<br>$T_A$=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

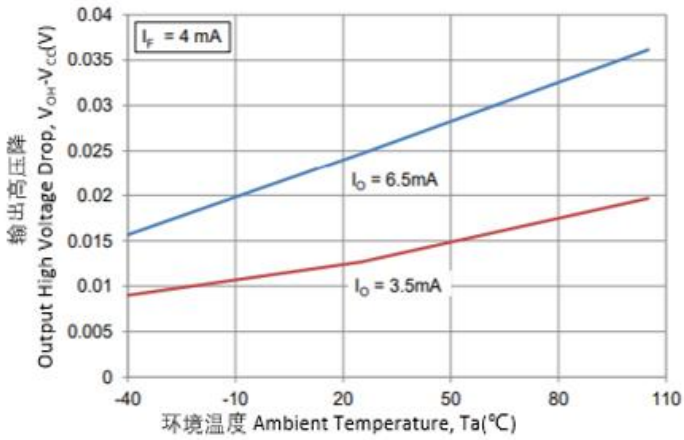



图2. 低电压输出和环境温度的关系

Fig 2. Output Low Voltage vs Temperature

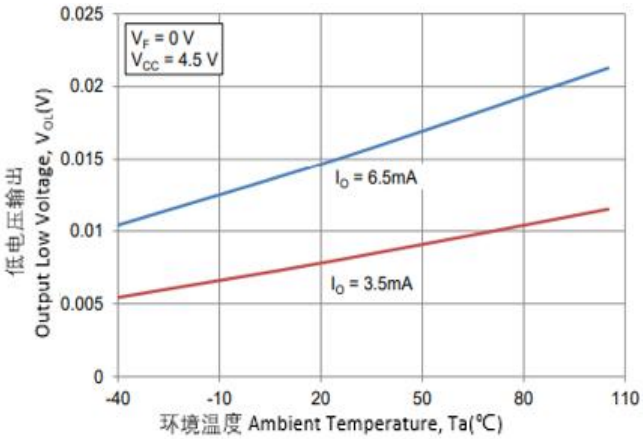



图3. 输入阈值电流滞后

Fig 3. $I_{FLH}$ hysteresis

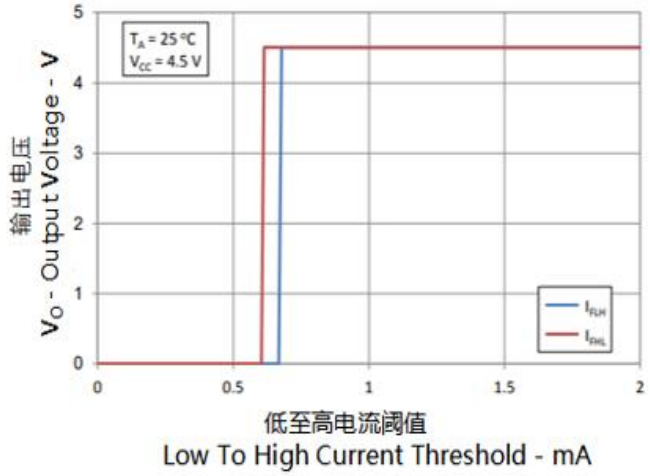



图4. 阈值输入电流和环境温度的关系

Fig 4. $I_{FLH}$ vs Ambient Temperature

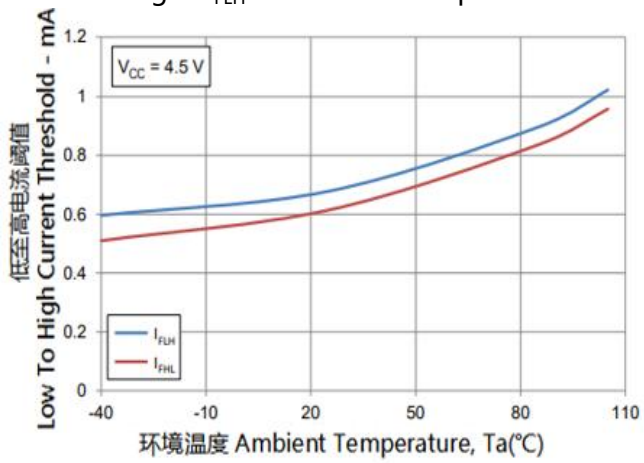



图5. 正向电流比与正向电压的关系

Fig 5. Forward Current vs Forward Voltage

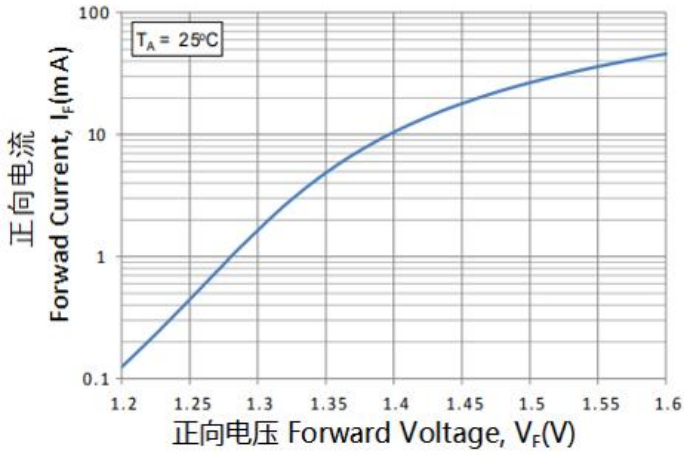



图6. 输出电压和电源电压的关系

Fig 6. Output voltage vs Supply voltage

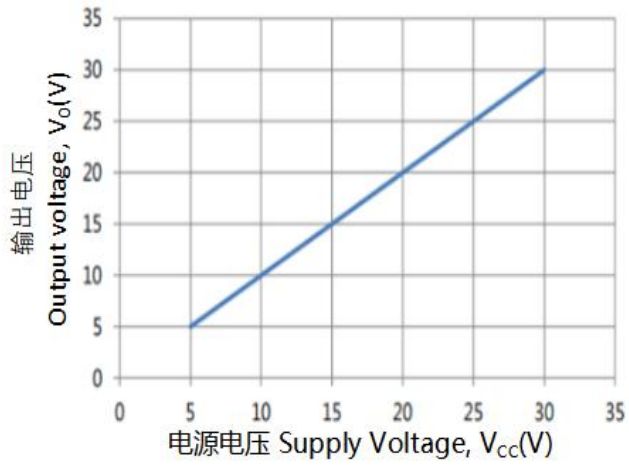


图7. 传播延迟和环境温度的关系

Fig 7. Propagation Delay vs Temperature

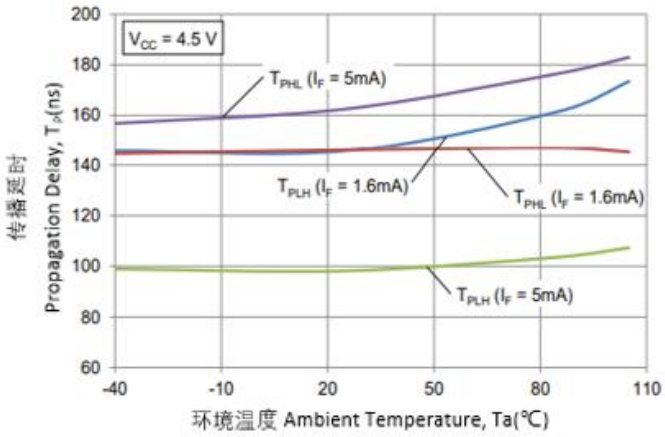



图8. 传播延迟和电源电压的关系

Fig 8. Propagation Delay vs Supply Voltage

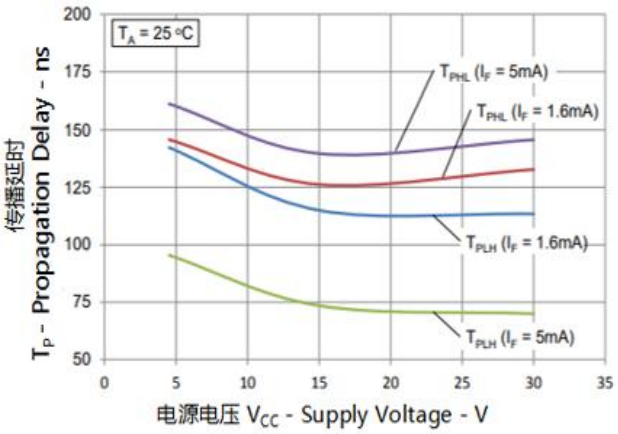



图9. 传播延迟和环境温度的关系

Fig 9. Propagation Delay vs Ambient Temperature

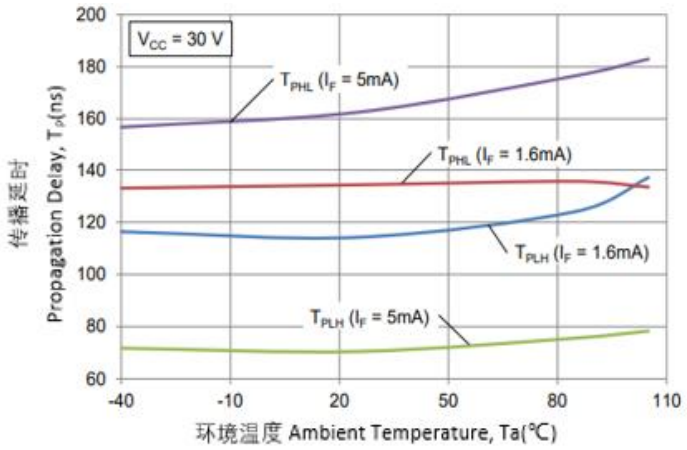


图10. tr、tf、$t_{PLH}$ 和 $t_{PHL}$ 测试电路和波形

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

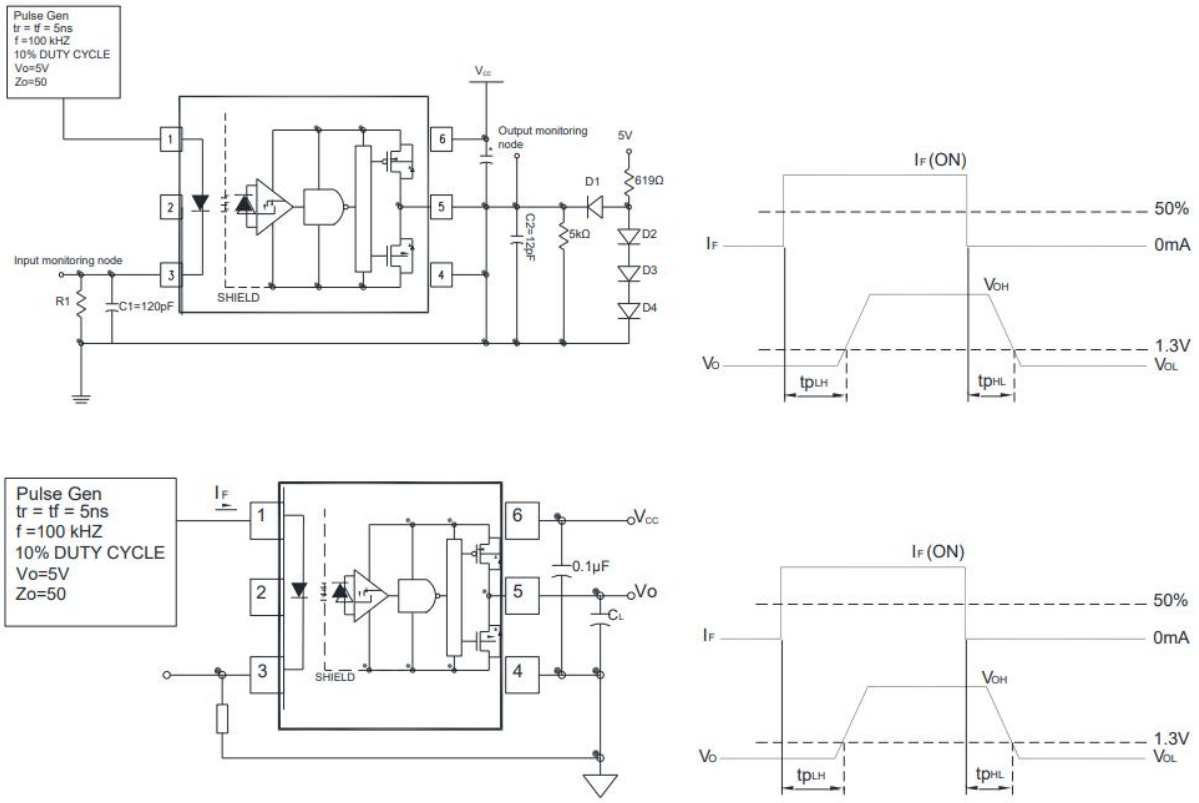
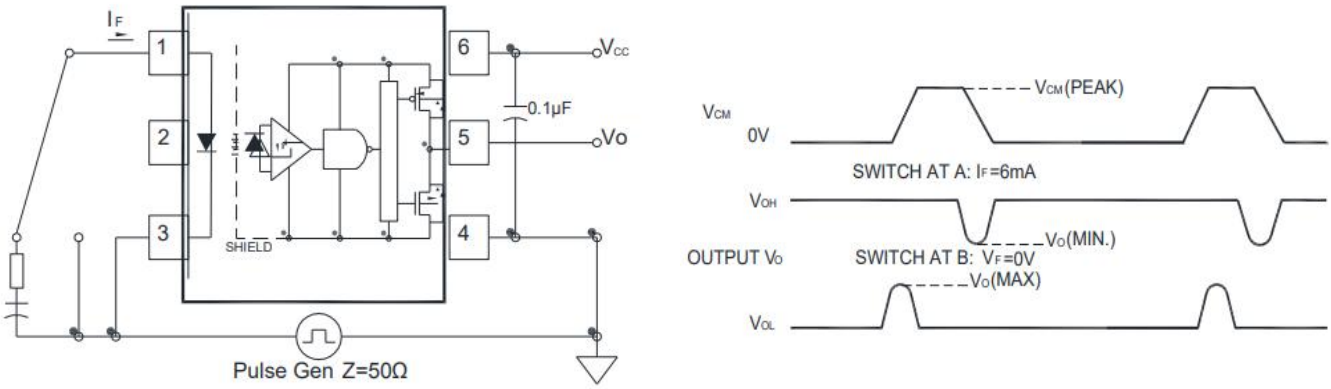



图11.CMR 测试电路

Fig 11. CMR Test circuit



## 8. 订单信息 Order Information

- 材料编号 Part Number

# KL480W-Z-V

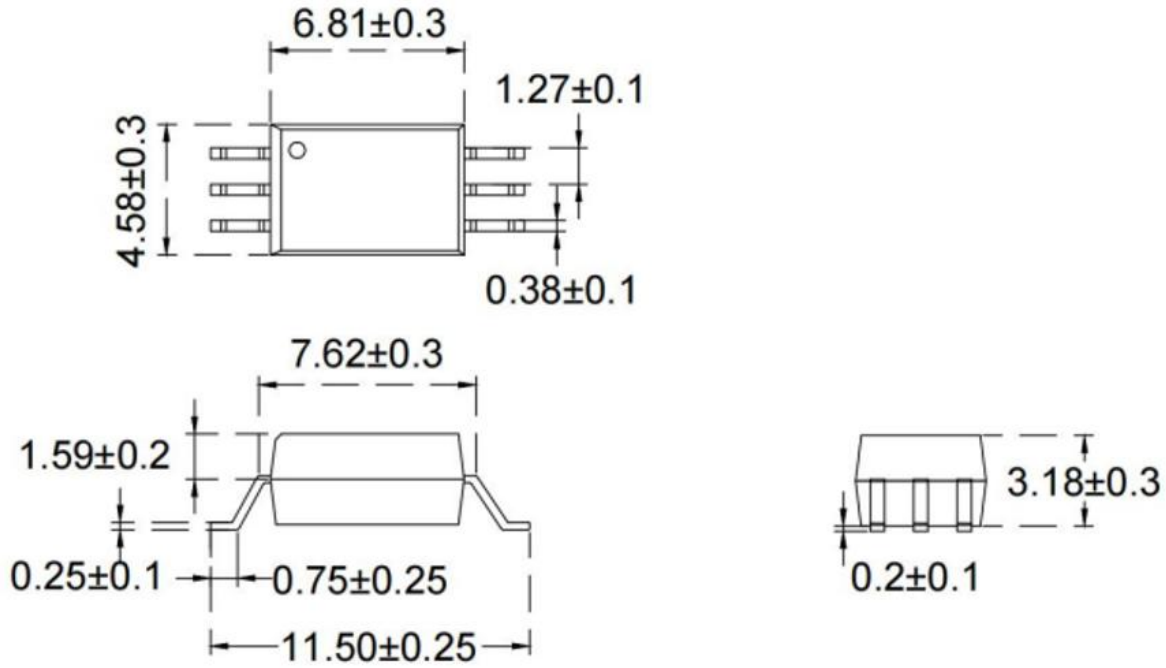
**附注(Notes):**

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

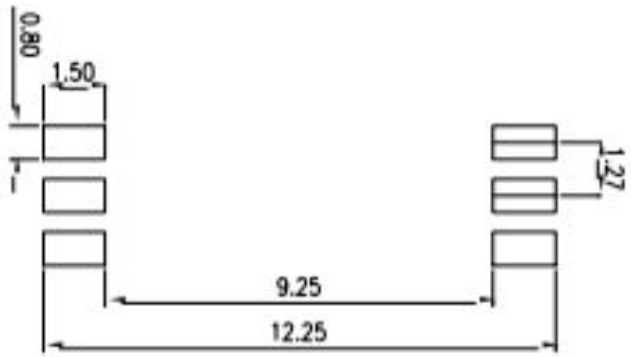
V = 表示VDE标识(客户指定镭射字符才加"V")
VDE (Only add "V" to laser characters specified by the customer)

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



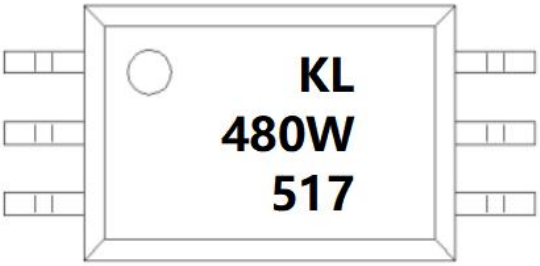

备注 Notes

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

480W = 表示材料部件号 Denotes Device Part Number

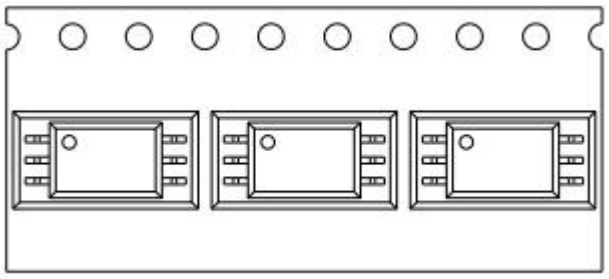
Y = 表示1位年份代码Denotes 1 digit Year code

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)

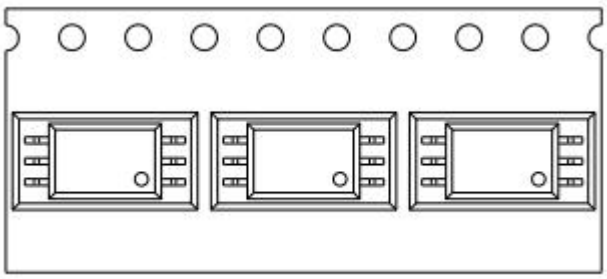
# 11.料带和卷轴包装规格 Tape & Reel Packing Specifications

• 选择TA Option TA



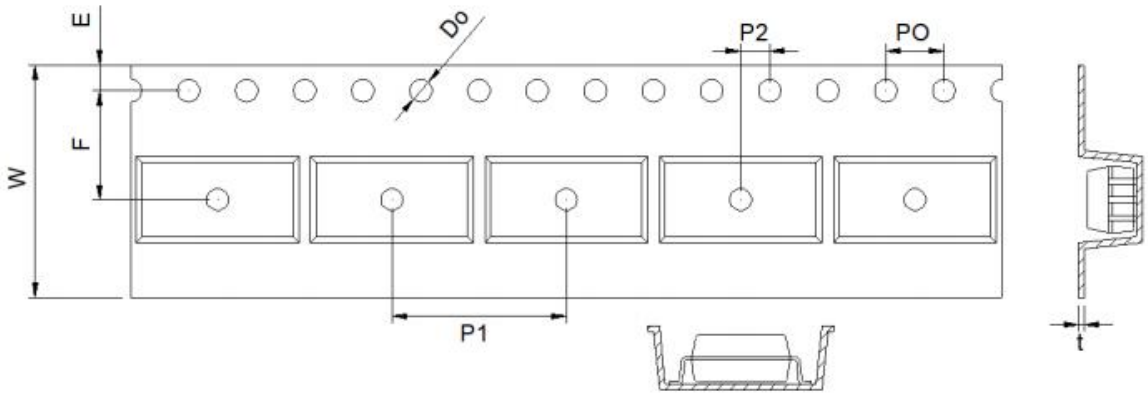
卷轴进给方向 Direction of feed from reel

• 选择TB Option TB



卷轴进给方向 Direction of feed from reel

## 料带尺寸Material belt size



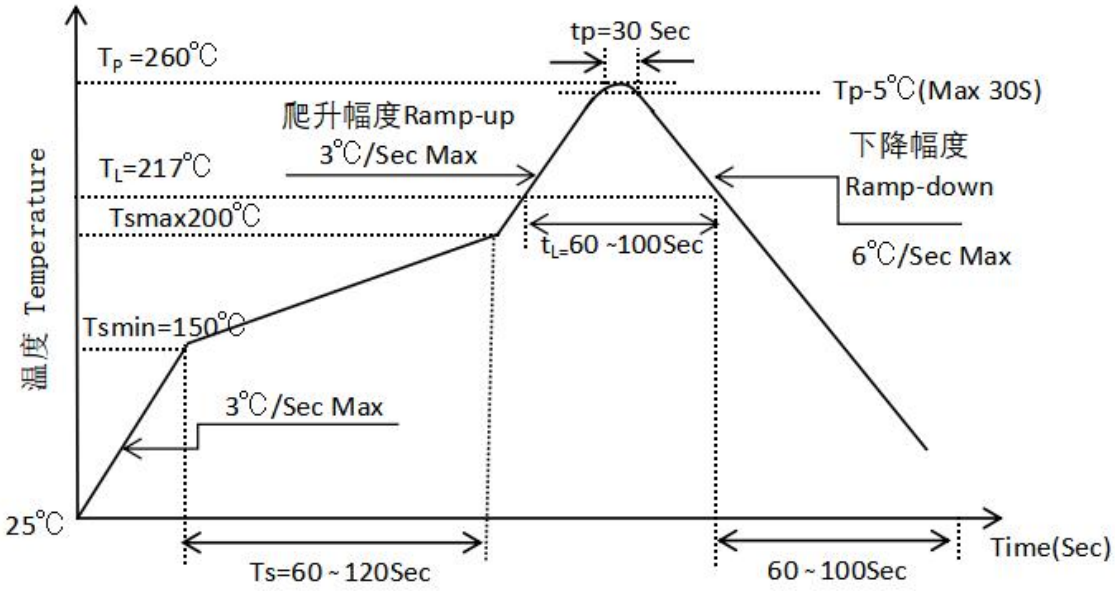

| 尺寸编号 Dimension No. | W | E | F | D0 |
|---|---|---|---|---|
| 尺寸(mm) Dimension(mm) | 16.0±0.3 | 1.75±0.1 | 7.5±0.1 | 1.5±0.1 |
| 尺寸编号 Dimension No. | $P_0$ | P1 | P2 | t |
| 尺寸(mm) Dimension(mm) | 4.0±0.1 | 16.0±0.1 | 2.0±0.1 | 0.4±0.1 |

# 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<br>Item | 符号<br>Symbol | 最小值<br>Min. | 最大值<br>Max. | 单位<br>Unit |
|---|---|---|---|---|
| 预热温度<br>Preheat Temperature | $T_s$ | 150 | 200 | ℃ |
| 预热时间<br>Preheat Time | ts | 60 | 120 | s |
| 升温速率<br>Ramp-Up Rate ($T_L$ to $T_P$) | - | - | 3 | ℃/s |
| 液相线温度<br>Liquidus Temperature | $T_L$ | 217 | | ℃ |
| 高于液相线温度($T_L$)的时间<br>Time above Liquidus Temperature $T_L$ | $t_L$ | 60 | 100 | s |
| 峰值温度<br>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<br>Ramp-down Rate($T_P$ to $T_L$ ) | - | - | 6 | ℃/s |