# KL357NU

# PHOTO TRANSISTOR

## SOP4 晶体管光耦(车规)





* 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

- 不含卤素 Halogens free
  (Br <900 ppm , Cl <900 ppm , Br+Cl < 1500 ppm)
- 电流转换率 Current transfer ratio
  CTR: 100~400% at $I_F$ =0.5mA, $V_{CE}$ =5V
- 工作温度-55℃~+125℃
  Operating temperature -55℃~+125℃
- 输入与输出高隔离电压($V_{iso}$=3750 V rms)
  High isolation voltage between input and output ($V_{iso}$=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
- AEC-Q102认证 (编号：AEQ240066-R1) AEC-Q102 qualified(No. AEQ240066-R1)
- 安全审批 Safety approval
  CQC认证已批准(编号:CQC23001408001) CQC approved (No.CQC23001408001)
  UL认证已批准(编号：UL-CA-2340753-0) UL approved (No. UL-CA-2340753-0)
  VDE认证已批准(编号:40059021) VDE approved (No.40059021)

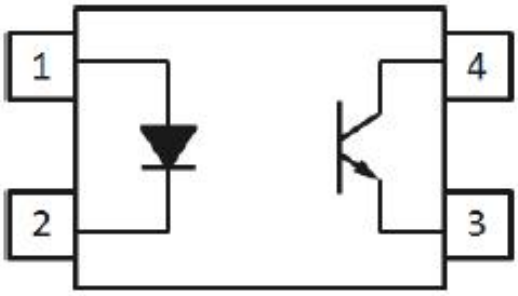
# 2. 产品描述 Product Description

- KL357NU系列包含一个红外发射二极管,光耦合到一个光电晶体管构成光电耦合器
  KL357NU series contains an infrared emitting diode, optically coupled to a phototransistor detector
- 采用4引脚小外形SMD封装
  The devices in a 4-pin small outline SMD package

# 3. 产品应用 Product Applications

- 直流转换器、可编程控制器 DC- DC Converters、Programmable controllers
- 电信设备 Telecommunication equipment
- 不同电位和阻抗电路间的信号传输
  Signal transmission between circuits of different potentials and impedance

# 4. 功能图 Functional Diagram




引脚配置 Pin Configuration
1. 阳极 Anode
2. 阴极 Cathode
3. 发射极 Emitter
4. 集电极 Collector

## 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 | $I_F$ | 60 | mA |
| | 峰值正向电流(1us脉冲) Peak forward current (1us pulse) | $I_{FP}$ | 1 | A |
| | 反向电压 Reverse voltage | $V_R$ | 6 | V |
| | 输入功耗 Input Power dissipation | $P_D$ | 70 | mW |
| 输出 Output | 集电极电流 Collector current | $I_C$ | 30 | mA |
| | 集电极与发射极间电压 Collector and emitter Voltage | $V_{CEO}$ | 80 | V |
| | 发射极与集电极间电压 Emitter and Collector Voltage | $V_{ECO}$ | 5 | V |
| | 输出功耗 Output Power dissipation | Pc | 150 | 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 | | $T_{OPR}$ | -55 to +125 | ℃ |
| 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40~60%环境下, 隔离电压测试方法, 引脚1&2短接在一起, 引脚3&4短接在一起
AC for 1 minute, 40~60%RH 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 | $V_F$ | - | 1.3 | 1.6 | V | $I_F$=1mA |
| | 反向电流 Reverse current | $I_R$ | - | - | 10 | μA | $V_R$=6V |
| | 输入电容 Input capacitance | $C_{in}$ | - | 30 | 250 | pF | V=0, f=1kHz |
| 输出 Output | 集电极与发射极间暗电流 Collector-Emitter dark current | $I_{CEO}$ | - | - | 100 | nA | $V_{CE}$=20V $I_F$ =0mA |
| | 集电极与发射极间击穿电压 Collector-Emitter breakdown voltage | $V_{CEO}$ | 80 | - | - | V | $I_C$=0.1mA $I_F$=0mA |
| | 发射极与集电极间击穿电压 Emitter-Collector breakdown voltage | $V_{ECO}$ | 5 | - | - | V | $I_E$=0.01mA $I_F$=0mA |
| 传输特性 Transfer Characteristics | 集电极与发射极间饱和电压 Collector-Emitter saturation voltage | $V_{CE(sat)}$ | - | - | 0.35 | V | $I_F$=3mA $I_C$=1.6mA |
| | KL357NU 电流传输比 Current transfer ratio | CTR | 50 | | 600 | % | $I_F$=0.5mA $V_{CE}$=5V |
| | KL357NU-A 电流传输比 Current transfer ratio | | 100 | | 200 | | |
| | KL357NU-B 电流传输比 Current transfer ratio | | 150 | | 300 | | |
| | KL357NU-C 电流传输比 Current transfer ratio | | 200 | - | 400 | | |
| | 隔离电阻 Isolation resistance | $R_{ISO}$ | $5\times10^{10}$ | - | - | Ω | $V_{IO}$=500Vdc 40~60% R.H. |
| | 浮动电容 Floating capacitance | $C_f$ | - | 0.6 | 1.0 | pF | $V_{IO}$=0, f=1MHz |
| | 开启时间 Turn-on time | $t_{on}$ | - | 1 | - | μs | $V_{CC}$=5V, $I_F$=16mA, $R_L$=1.9KΩ |
| | 关闭时间 Turn-off time | $t_{off}$ | - | 50 | - | | |

• 温度Ta=25℃下规格值 Typical values at Ta = 25℃

# 7. 特性曲线 Characteristic Curves

图 1.正向电流与正向电压曲线图
Figure1.Forward Current vs Forward Voltage

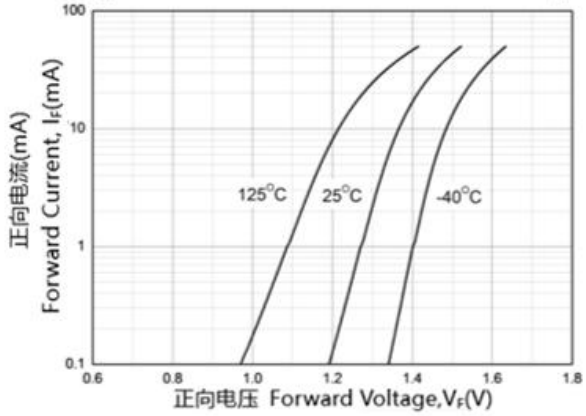



图 2.集电极电流与正向电流曲线图
Figure2.Collector Current vs Forward Current

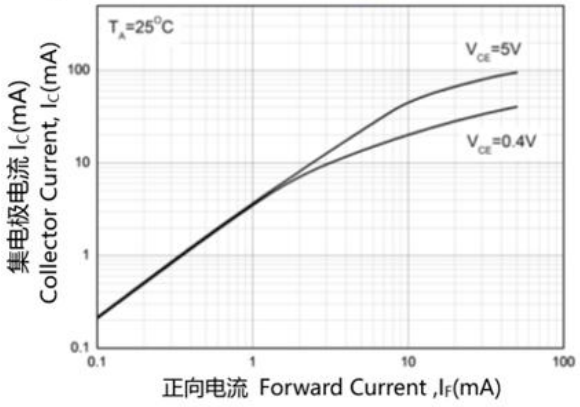



图 3.电流传输比与正向电流曲线图
Figure3. Normalized Current Transfer Ration vs Forward Current

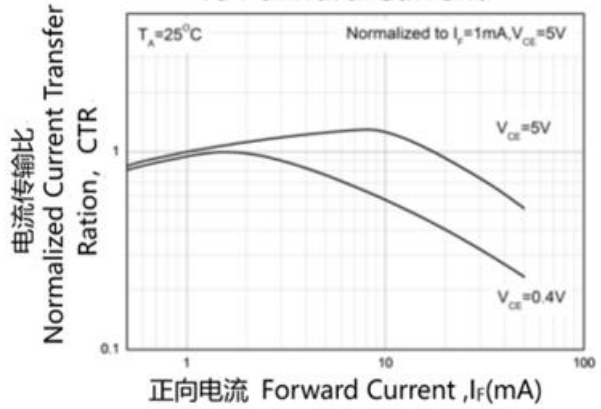



图4. 集电极电流 vs 集电极-发射极电压曲线图
Figure4. Collector Current vs Collector-Emission Voltage

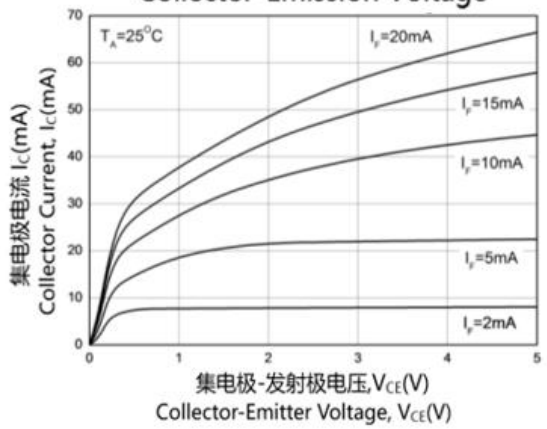



图 5. 集电极电流 vs 集电极-发射极电压曲线图
Figure5. Collector Current vs Collector-Emission Voltage

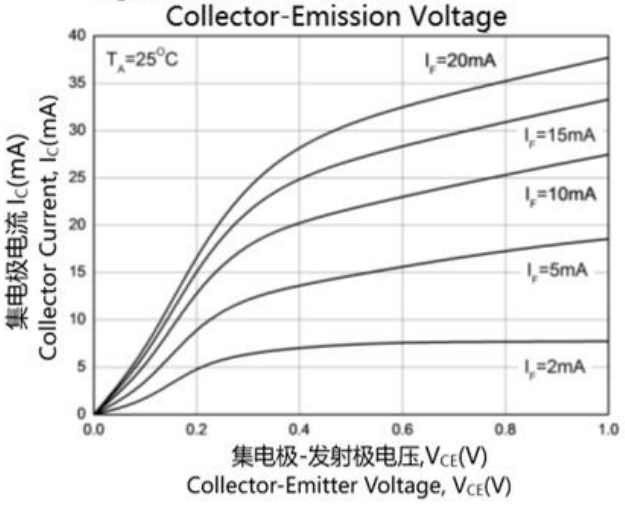



图 6.集电极电流与环境温度曲线图
Figure6. Collector Current vs Ambient Temperature,

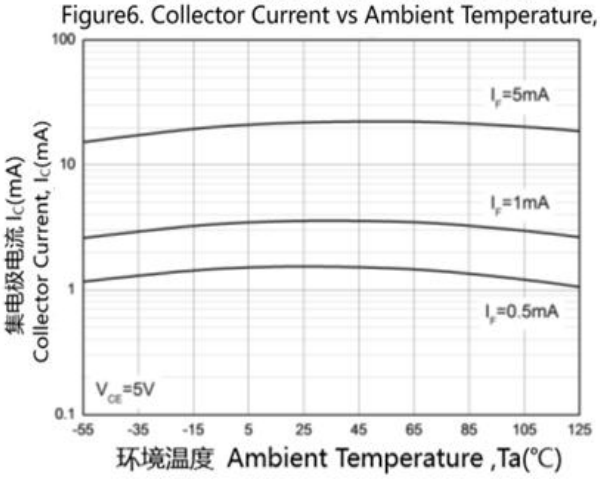


图 7.电流传输比与环境温度曲线图
Figure7. Current Transfer Ration vs Ambient Temperature

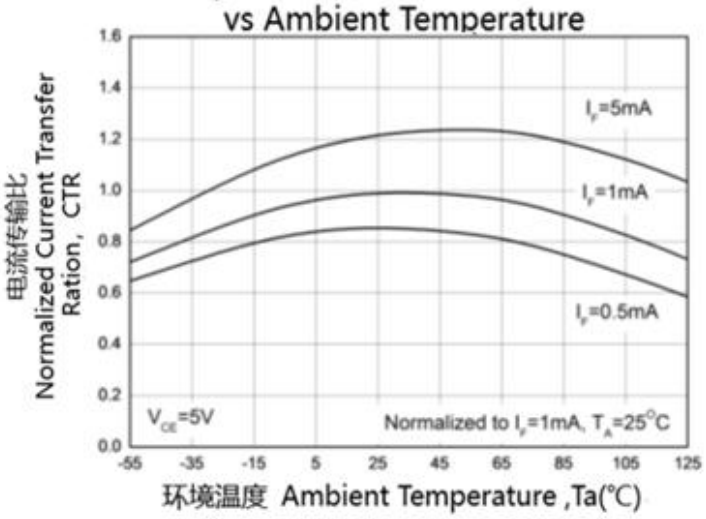



图 8. 集电极暗电流与环境温度曲线图
Figure8. Dark Current vs Ambient Temperature

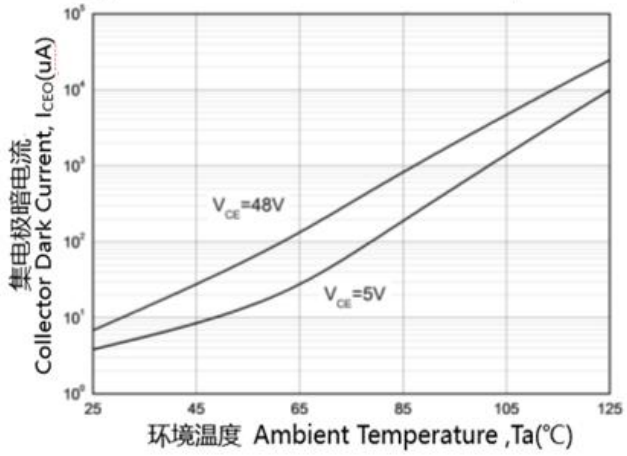



图 9.开关速度和负载电阻曲线图
Figure9.Switching Speed vs Load Resistance

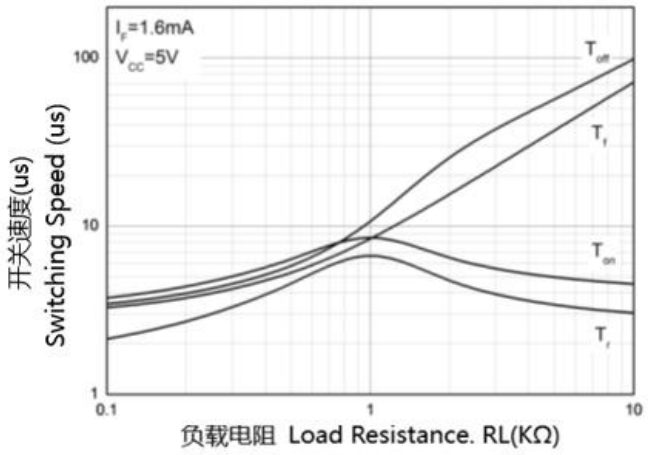



图 10. 集电极-发射极饱和电压与环境温度曲线图
Figure10. Collector-Emitter Saturation Voltage vs Ambient Temperature

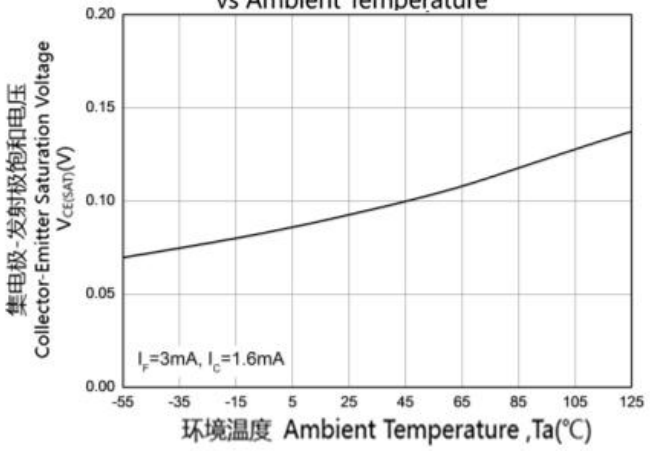
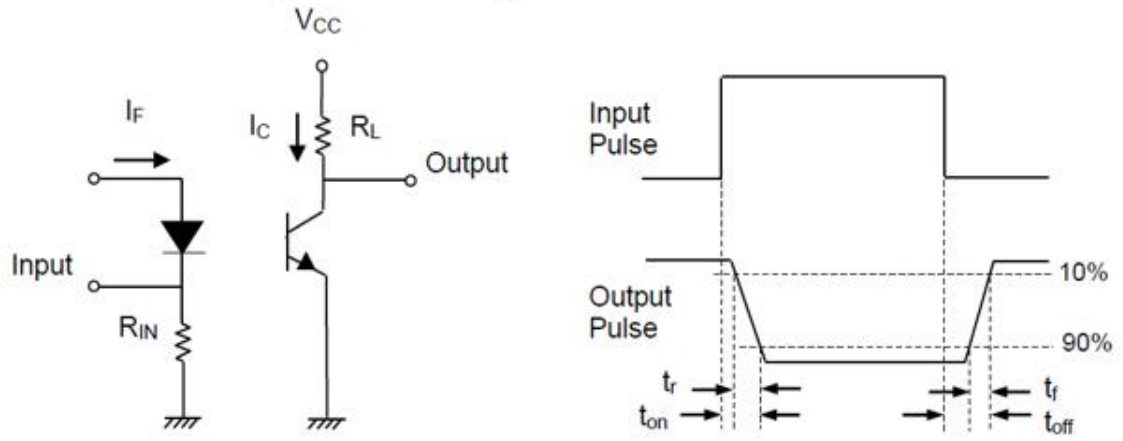



图 11. 开关时间测试电路及波形
Figure11. Switching Time Test Circuit & Waveforms



# 8. 订单信息 Order Information

• 零件编号 Part Number

## KL357NU-X-Y-V-W

**附注(Notes):**

U =高温小电流工作(高温小电流特规)
High temperature low current operation

X = 表示CTR等级(A、B、C 或 无)
CTR Rank (A, B, C or none)

Y = 载带和卷轴包装方式(TA、TB 或 无)
Tape and reel option (TA, TB or none)

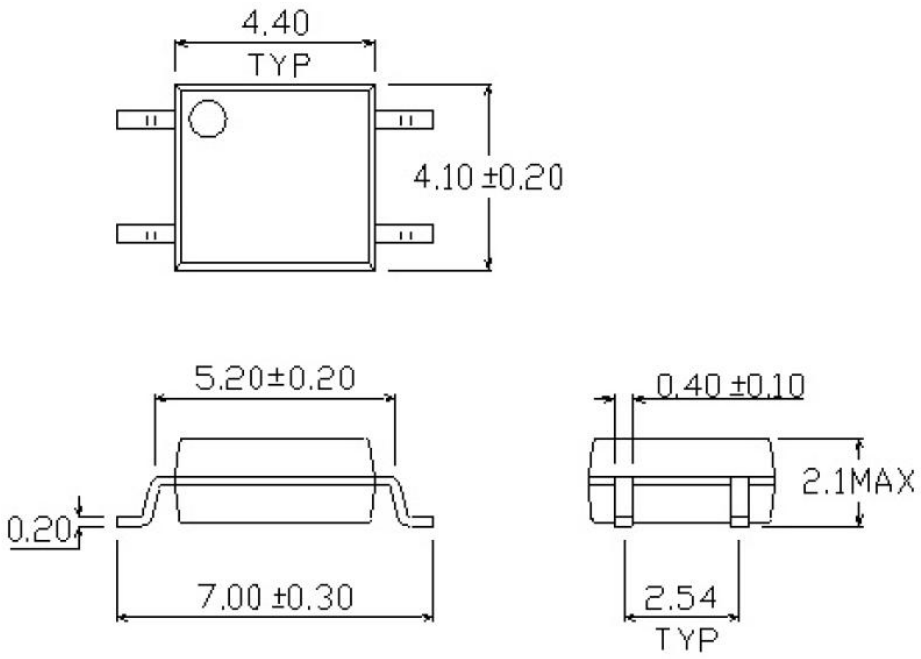
V = 表示VDE标识(客户指定镭射字符才加"V")
VDE (Only add "V" to laser characters specified by the customer)

W = 表示包装数量(无或T04) Packaging Quantity(none or T04)

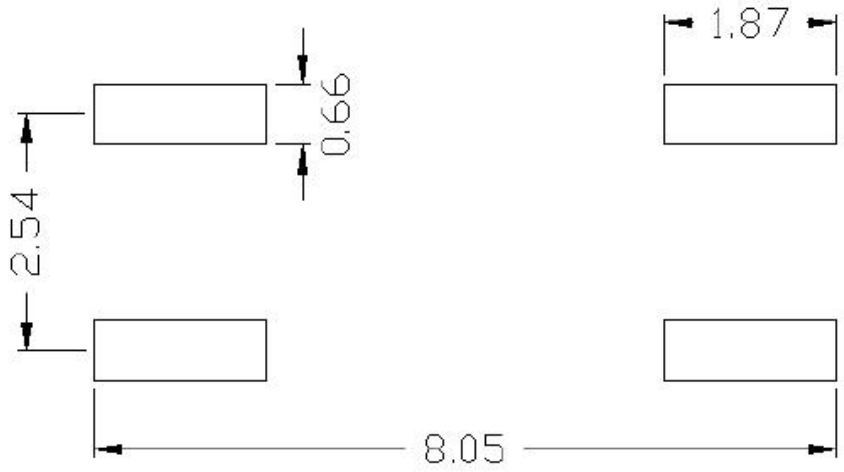
| 选项<br>Option | 描述<br>Description | 包装数量<br>Packing quantity |
|---|---|---|
| TA-T04 | TA载带和卷轴选项<br>TA Tape & reel option | 每卷3500pcs<br>3500 units per reel |
| TB-T04 | TB载带和卷轴选项<br>TB Tape & reel option | 每卷3500pcs<br>3500 units per reel |
| TA-V-T04 | TA载带和卷轴选项 +VDE<br>TA Tape & reel option + VDE | 每卷3500pcs<br>3500 units per reel |
| TB-V-T04 | TB载带和卷轴选项 + VDE<br>TB Tape & reel option + VDE | 每卷3500pcs<br>3500 units per reel |
| / | 内盒装:每盒3盘<br>Inner box packaging:3 reels/box | 每盒10500pcs<br>10500 pcs per box |
| / | 每箱装:10个内盒<br>Pack per Carton:10 inner boxes | 每箱105000pcs<br>105000 pcs per reel Carton |

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

• 包装尺寸 (尺寸单位为mm)
Package Dimension (Dimensions in mm)




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




附注(Notes):
a. 推荐焊盘尺寸仅供参考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

357N = 表示设备部件号
denotes Device Part Number

U =高温小电流工作(高温小电流特规)
High temperature low current operation

R = 表示CTR等级(A、B、C 或 无)
CTR Rank (A, B, C or none)

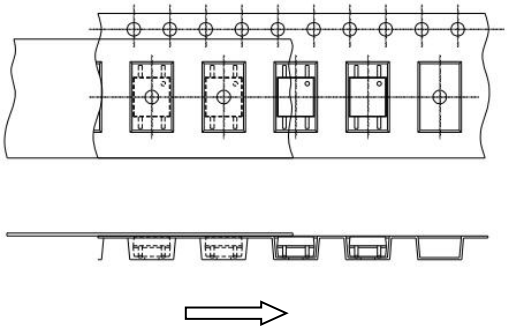
Y = 表示1位年份代码
denotes 1 digit Year code

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)

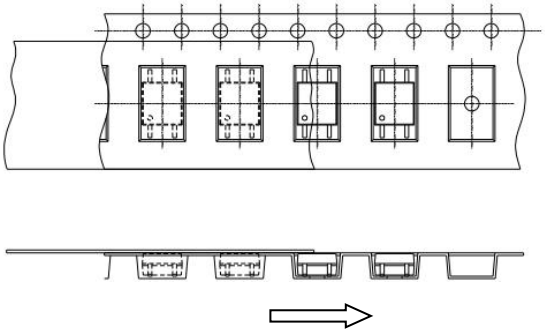
# 11. 料带和卷轴包装规格 Tape & Reel Packing Specifications

• 选择TA Option TA



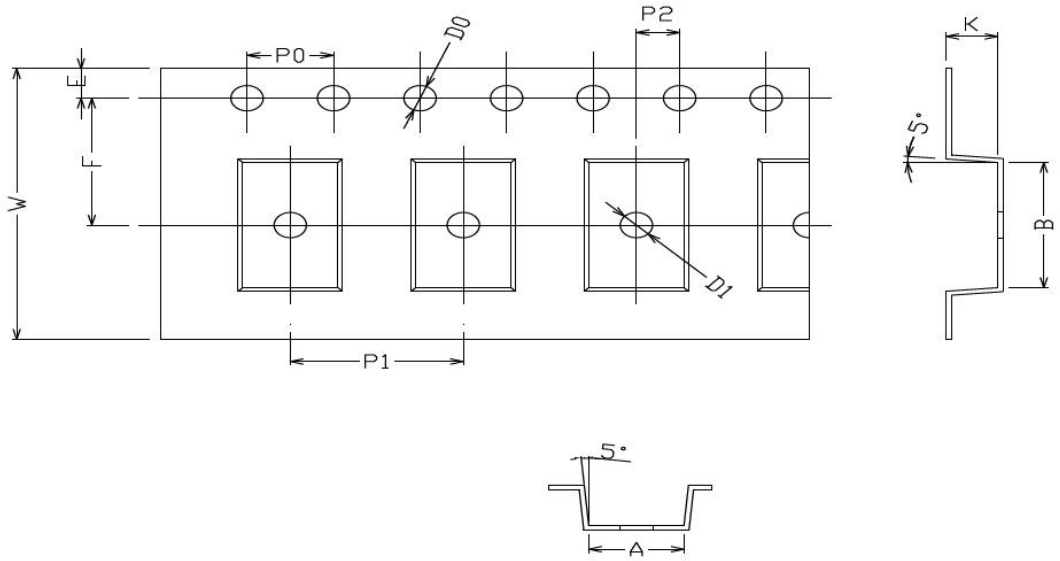
卷轴进给方向 Direction of feed from reel

• 选择TB Option TB



卷轴进给方向 Direction of feed from reel

## 料带尺寸Material belt size



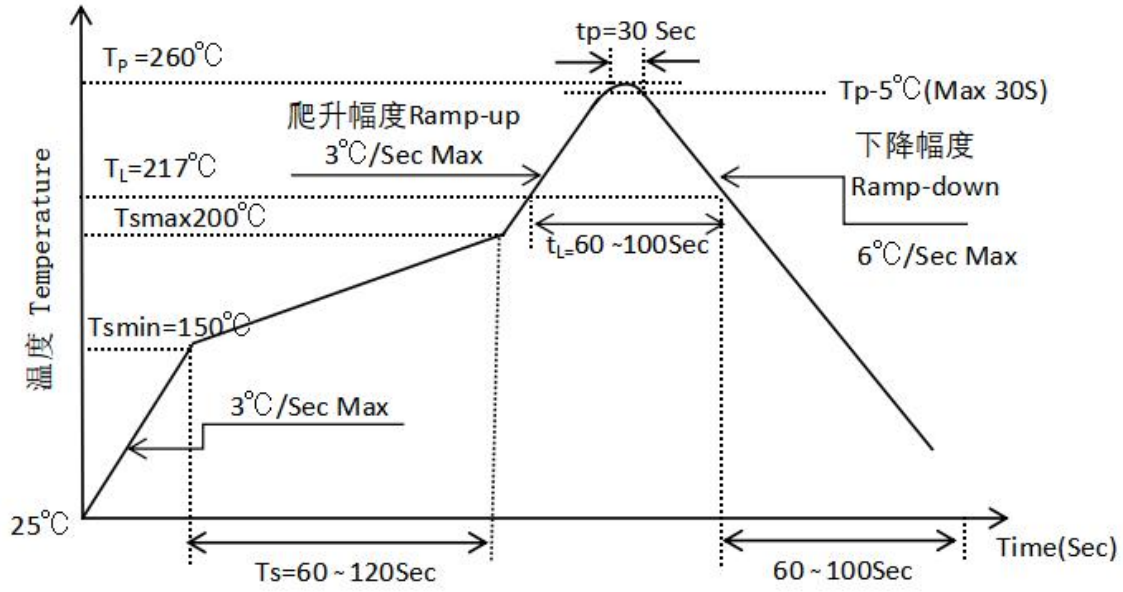

| 尺寸编号 Dimension No. | A | B | D0 | D1 | E | F |
|---|---|---|---|---|---|---|
| 尺寸(mm) Dimension(mm) | 4.4±0.1 | 7.6±0.1 | 1.5+0.1/-0 | 1.5±0.1 | 1.75±0.1 | 7.5±0.05 |
| 尺寸编号 Dimension No. | P0 | P1 | P2 | t | W | K |
| 尺寸(mm) Dimension(mm) | 4.0±0.05 | 8.0±0.1 | 2.0±0.1 | 0.3±0.03 | 16.0±0.2 | 2.4±0.1 |

# 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<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 |