



晶体管光耦

Photo Transistor

**QX817X**

宁波群芯微电子股份有限公司

NINGBO QUNXIN MICROELECTRONICS CO., LTD.

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## 概述 Description

QX817X是一款由发光二极管和光电晶体管组成的光电耦合器。四引脚封装，四种形式（DIP、DIP-M、SMD、SLM）。

The QX817X is a photoelectric coupler composed of light-emitting diode and phototransistor. It is packaged in a 4-pin package at DIP、DIP-M、SMD、SLM.

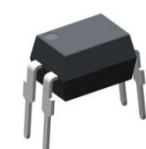
## 特性 Features

- 电流转换比(CTR)范围: 80%-600% ( $I_F=5\text{mA}$ ,  $V_{CE}=5\text{V}$ ,  $T_a=25^\circ\text{C}$ )  
Current transfer ratio: 80%-600% ( $I_F=5\text{mA}$ ,  $V_{CE}=5\text{V}$ ,  $T_a=25^\circ\text{C}$ )
- 输入-输出隔离电压 ( $V_{ISO}=5000\text{ Vrms}$ )  
High isolation voltage between input and output( $V_{ISO}=5000\text{ Vrms}$ )
- 集电极-发射极击穿电压  $BV_{CEO}\geq 80\text{V}$   
Collector - emitter breakdown voltage  $BV_{CEO}\geq 80\text{V}$
- 工作温度:  $-55^\circ\text{C}\sim 110^\circ\text{C}$   
Operating Temperature:  $-55^\circ\text{C}\sim 110^\circ\text{C}$
- 符合加强绝缘标准  
Meet reinforced insulation standards
- 符合安规标准 (SLM4 除外): UL 1577, VDE DIN EN60747-5-5 (VDE 0884-5), CQC11-471543-2022  
Meet safety standard approval (SLM4 Pending Approval): UL 1577, VDE DIN EN60747-5-5 (VDE 0884-5), CQC11-471543-2022

## 应用 Applications

- 开关电源, 智能电表  
Switching power supply, intelligent meter
- 工业控制, 测量仪器  
Industrial control, measuring instruments
- 办公设备, 比如复印机  
Office equipment such as copiers
- 家用电器, 比如空调、风扇、热水器等  
Household appliances: such as air conditioners, fans, water heaters, etc.

## 封装和原理图 Package and Schematic Diagram



DIP4



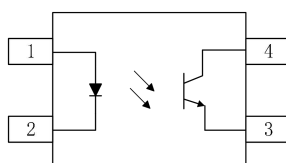
SMD4



DIP4-M



SLM4



Pin Configuration

1. Anode
2. Cathode
3. Emitter
4. Collector

## 产品型号命名规则 Order Code

### QX 817 X - UN Y - W (V) (ZZ)

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

- ① 公司代码 Company Code (QX: 群芯 Qunxin)
- ② 产品系列 Product Series (817: 817)
- ③ CTR 档位 Classification (代码 Code: A、B、C、D、Q、M or None)
- ④ 框架类型 Lead Frame (Cu: 铜框架 Copper, Fe: 铁框架 Ferrum)
- ⑤ 树脂类型 Epoxy Type (H: 无卤 Halogen-free)
- ⑥ 封装形式 Package (D:DIP, S:SMD, M:DIP-M, L:SLM)
- ⑦ 特殊范围细分档位 (T: D1, Y: D2) 或无 Special Range Subdivision Code (T: D1, Y: D2) or none
- ⑧ 内部补充代码 Internal Supplementary Code (数字或者空白 Number or None)

## 印字信息 Marking Information

- 印字中“”为群芯品牌 LOGO  
“”denotes LOGO
- 印字中的“X”代表产品分档: A、B、C、D 或空白  
“X”denotes the classification: A、B、C、D or None
- 印字中“Y”代表年份; A(2018),B(2019),C(2020).....  
“Y”denotes YEAR: A(2018), B(2019), C(2020).....
- 印字中“WW”代表周号  
“WW”denotes Week's number
- 印字中“N”代表星期几  
“N”denotes day of the week
- 印字中的“H”代表无卤  
“H”denotes Halogen-free



### 绝缘和安规信息 Insulation and Safety related specifications

| 项目<br>Item                            | 符号<br>Symbol | 数值<br>Value | 单位<br>Unit | 备注<br>Remark                                                                                               |
|---------------------------------------|--------------|-------------|------------|------------------------------------------------------------------------------------------------------------|
| 爬电距离<br>Creepage Distance             | L            | > 7.0       | mm         | 从输入端到输出端，沿本体最短距离路径<br>Measured from input terminals to output terminals, shortest distance path along body |
| 电气间隙<br>Clearance Distance            | L            | > 7.0       | mm         | 从输入端到输出端，通过空气的最短距离<br>Measured from input terminals to output terminals, shortest distance through air     |
| 绝缘距离<br>Insulation Thickness          | DTI          | > 0.4       | mm         | 发射器和探测器之间的绝缘厚度<br>Insulation thickness between emitter and detector                                        |
| 峰值隔离电压<br>Peak Isolation Voltage      | $V_{IORM}$   | 1500        | $V_{peak}$ | DIN/EN/IEC EN60747-5-5                                                                                     |
| 瞬态隔离电压<br>Transient isolation voltage | $V_{IOTM}$   | 7000        | $V_{peak}$ | DIN/EN/IEC EN60747-5-5                                                                                     |
| 隔离电压<br>Isolation Voltage             | $V_{iso}$    | > 5000      | $V_{rms}$  | For 1 min, RH < 60%                                                                                        |

### 极限参数 Absolute Maximum Ratings ( $T_a=25^{\circ}C$ )

| 参数<br>Parameter               |                                                      | 符号<br>Symbol | 额定值<br>Rating | 单位<br>Unit  |
|-------------------------------|------------------------------------------------------|--------------|---------------|-------------|
| 发射端<br>Input                  | 正向电流<br>Forward Current                              | $I_F$        | 50            | mA          |
|                               | 峰值正向电流(1us, 脉冲)<br>Peak forward current (1us, pulse) | $I_{FP}$     | 1000          | mA          |
|                               | 反向电压<br>Reverse Voltage                              | $V_R$        | 6             | V           |
|                               | 功耗<br>Power Dissipation                              | $P_D$        | 70            | mW          |
| 接收端<br>output                 | 集电极功耗<br>Collector Power Dissipation                 | $P_C$        | 150           | mW          |
|                               | 集电极电流<br>Collector Current                           | $I_C$        | 50            | mA          |
|                               | 集电极-发射极电压<br>Collector-Emitter Voltage               | $V_{CEO}$    | 80            | V           |
|                               | 发射极-集电压<br>Emitter - Collector Voltage               | $V_{ECO}$    | 6             | V           |
| 工作温度<br>Operating Temperature |                                                      | $T_{opr}$    | -55~+110      | $^{\circ}C$ |
| 存储温度<br>Storage Temperature   |                                                      | $T_{stg}$    | -55~+125      | $^{\circ}C$ |
| 焊接温度<br>Soldering Temperature |                                                      | $T_{sol}$    | 260           | $^{\circ}C$ |

### 产品特性参数 Electro-optical Characteristics (Ta=25°C)

| 参数<br>Parameter                     |                                                     | 符号<br>Symbol  | 条件<br>Condition                                                     | 最小<br>Min.         | 典型<br>Typ. | 最大<br>Max. | 单位<br>Unit    |
|-------------------------------------|-----------------------------------------------------|---------------|---------------------------------------------------------------------|--------------------|------------|------------|---------------|
| 发射端<br>Input                        | 正向电压<br>Forward Voltage                             | $V_F$         | $I_F=20\text{mA}$                                                   | -                  | 1.2        | 1.4        | V             |
|                                     | 反向电流<br>Reverse Current                             | $I_R$         | $V_R=4\text{V}$                                                     | -                  | -          | 10         | $\mu\text{A}$ |
|                                     | 输入电容<br>Terminal Capacitance                        | $C_t$         | $V=0, F=1\text{kHz}$                                                | -                  | 30         | 250        | pF            |
| 接收端<br>Output                       | 集电极暗电流<br>Collector Dark Current                    | $I_{CEO}$     | $V_{CE}=20\text{V}$                                                 | -                  | -          | 100        | nA            |
|                                     | 集电极-发射极击穿电压<br>Collector-Emitter Breakdown Voltage  | $BV_{CEO}$    | $I_C=0.1\text{mA}, I_F=0$                                           | 80                 | -          | -          | V             |
|                                     | 发射极-集电极击穿电压<br>Emitter-Collector Breakdown Voltage  | $BV_{ECO}$    | $I_E=10\mu\text{A}, I_F=0$                                          | 6                  | -          | -          | V             |
| 传输特性<br>Transfer<br>Characteristics | 电流传输比<br>Current Transfer Ratio                     | CTR*          | $I_F=5\text{mA}, V_{CE}=5\text{V}$                                  | 80                 | -          | 600        | %             |
|                                     | 集电极-发射极饱和压降<br>Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_F=20\text{mA}, I_C=1\text{mA}$                                   | -                  | 0.1        | 0.2        | V             |
|                                     | 隔离电阻<br>Isolation Resistance                        | $R_{ISO}$     | $V_{I-O}=DC500\text{V}$<br>40~60%R.H.                               | $1 \times 10^{12}$ | -          | -          | $\Omega$      |
|                                     | 隔离电容<br>Isolation capacitance                       | $C_{ISO}$     | $V=0, F=1\text{MHz}$                                                | -                  | 0.6        | 1.0        | pF            |
|                                     | 截至频率<br>Cut-off Frequency                           | $F_c$         | $V_{CE}=5\text{V}, I_C=2\text{mA},$<br>$R_L=100\Omega, -3\text{dB}$ | -                  | 80         | -          | KHz           |
|                                     | 上升时间<br>Rise Time                                   | $T_r$         | $V_{CE}=2\text{V}, I_C=2\text{mA}$<br>$, R_L=100\Omega$             | -                  | 4          | 18         | $\mu\text{s}$ |
|                                     | 下降时间<br>Fall Time                                   | $T_f$         | $V_{CE}=2\text{V}, I_C=2\text{mA},$<br>$R_L=100\Omega$              | -                  | 3          | 18         | $\mu\text{s}$ |

注\*: 电流传输比= $I_C/I_F \times 100\%$ 。

Note\*:  $CTR=I_C/I_F \times 100\%$ 。

### 电流传输比分档表 CTR Classification Table ( $I_F=5\text{mA}, V_{CE}=5\text{V}, T_a=25^\circ\text{C}$ )

| 代码 Code | 最小值 Min. | 最大值 Max. |
|---------|----------|----------|
| None    | 80       | 600      |
| A       | 80       | 160      |
| B       | 130      | 260      |
| C       | 200      | 400      |
| D       | 300      | 600      |
| D1      | 300      | 450      |
| D2      | 380      | 600      |
| Q       | 100      | 200      |
| M       | 200      | 300      |

## 典型光电特性曲线 Typical Electro-Optical Characteristics Curves

Fig.1 Allowable Forward Current VS Ambient Temperature

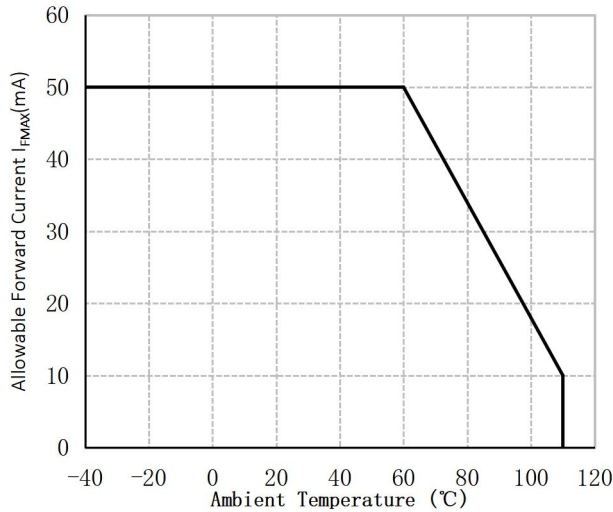


Fig.2 Allowable collector power dissipation VS Ambient Temperature(°C)

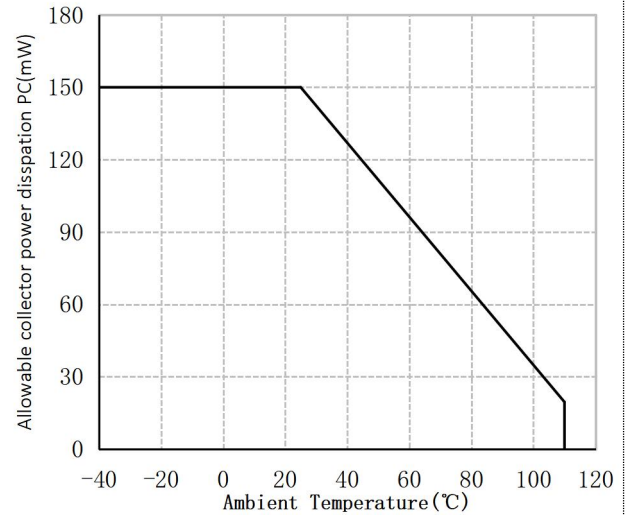


Fig.3 Relative Current Transfer Ratio vs. Forward Current

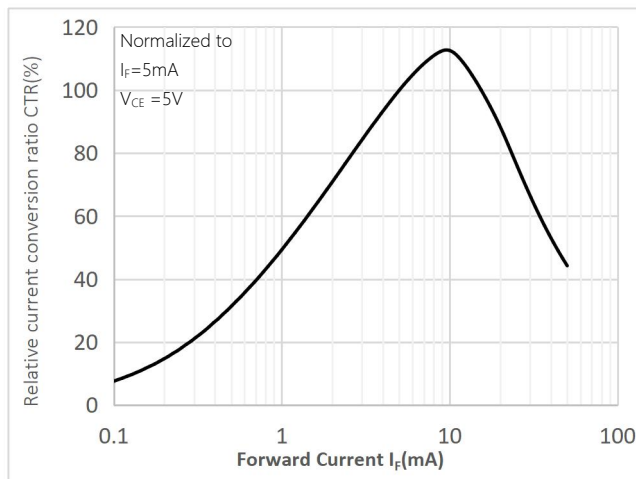


Fig.4 Forward Current vs. Forward Voltage

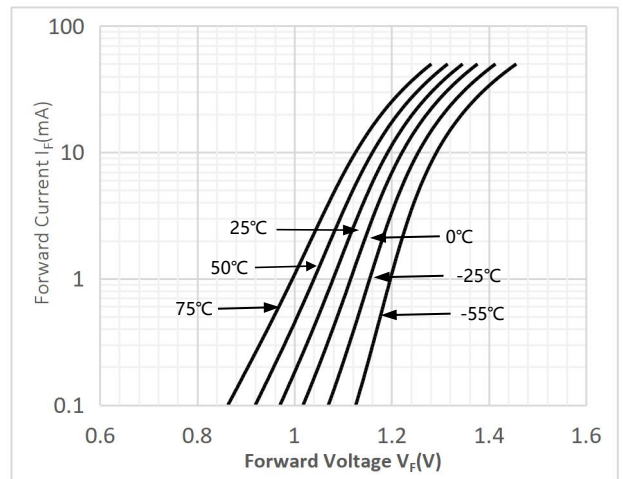


Fig.5 Collector Current vs. Collector-emitter Voltage

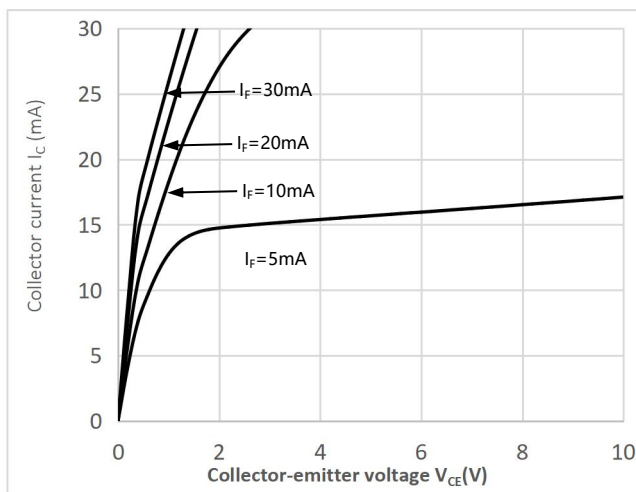


Fig.6 Relative Current Transfer Ratio vs. Ambient Temperature

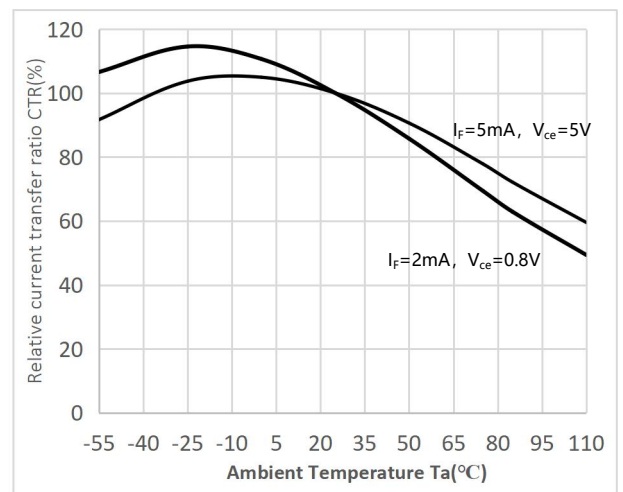


Fig.7 Collector-emitter Saturation Voltage vs. Ambient Temperature

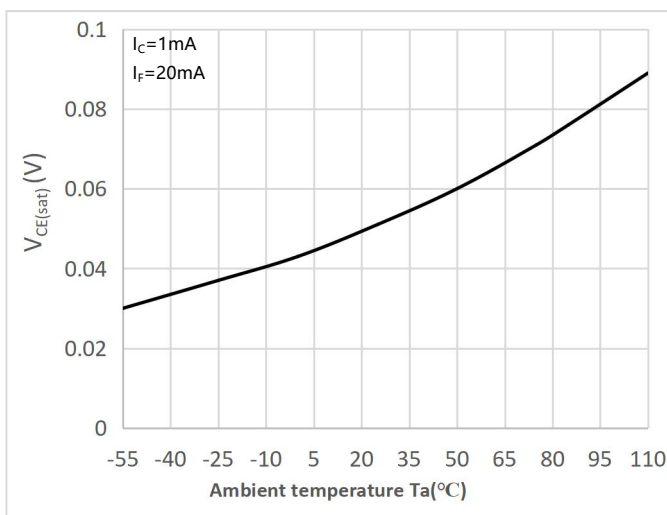


Fig.8 Collector Dark Current vs Ambient Temperature

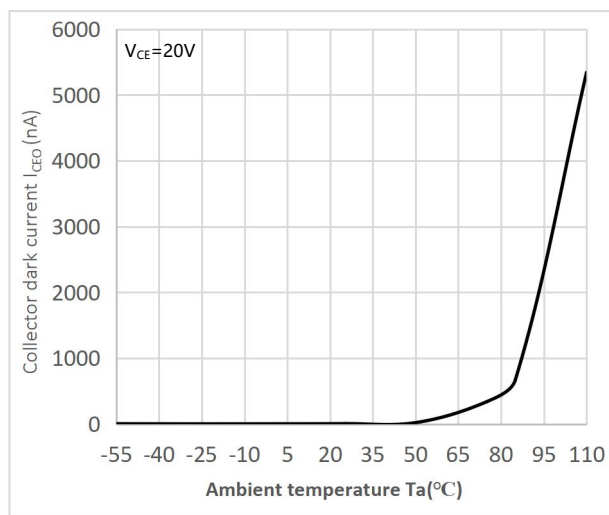


Fig.9 Response Time vs. Load Resistance

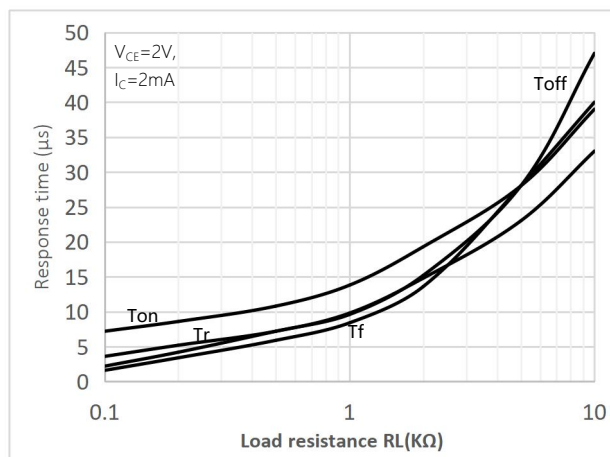


Fig.10 Frequency Response

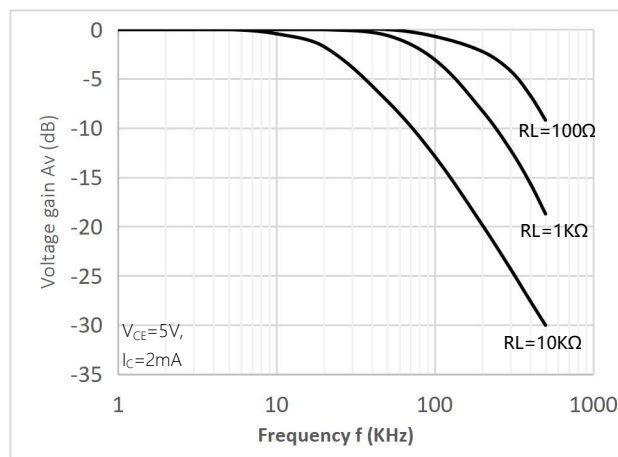


Fig.11 Collector-emitter Saturation Voltage vs Forward Current

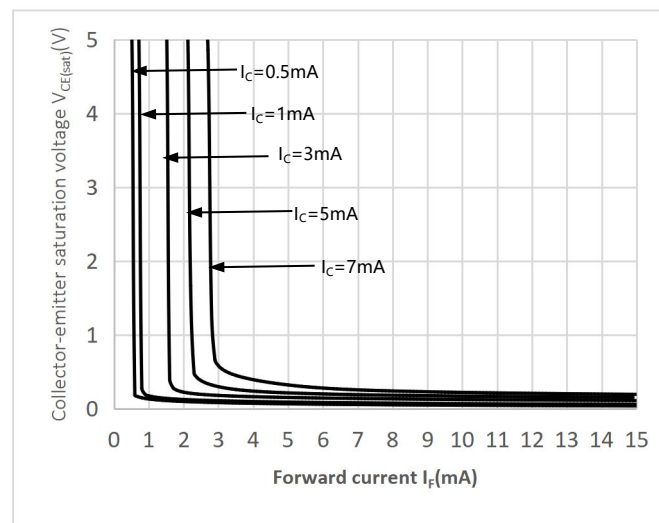
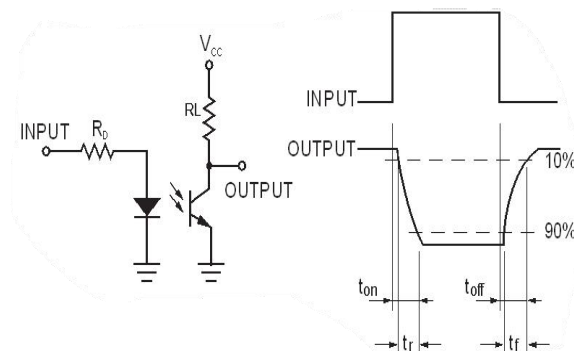
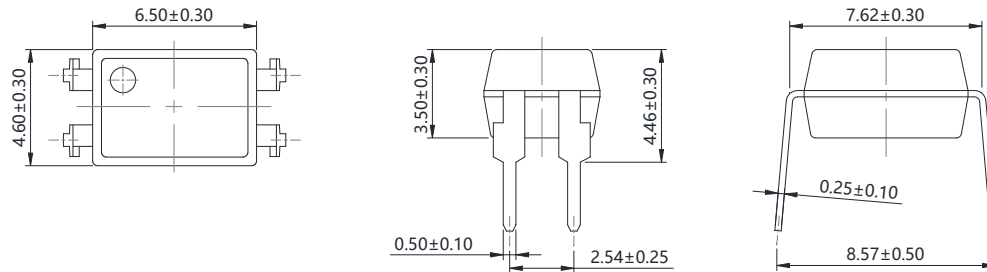


Fig.12 Switching Time Test Circuit & Waveforms

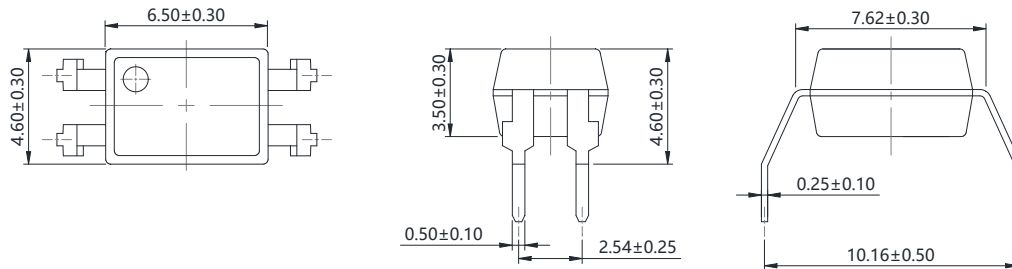


## 外形尺寸 Outline Dimensions

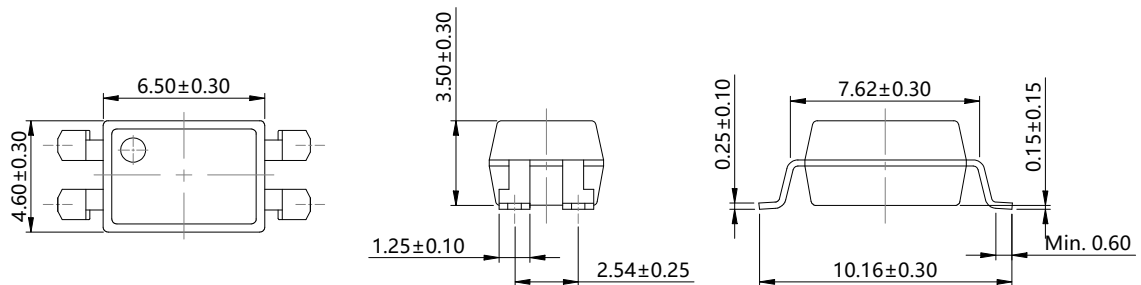
DIP4



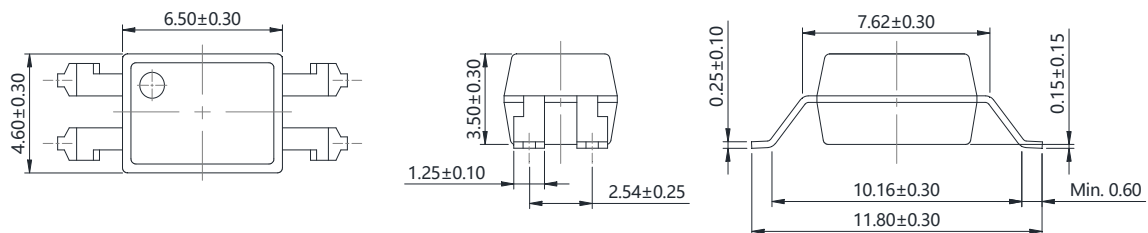
DIP4-M



SMD4

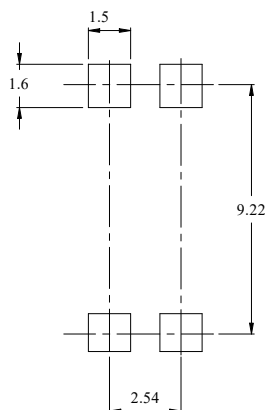


SLM4

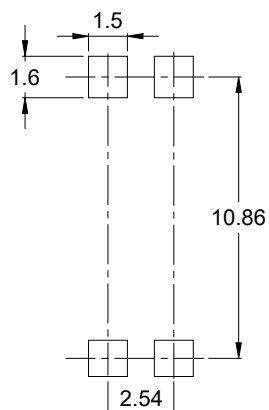


单位 Unit: mm

## 建议焊盘布局 Recommended Pad Layout



SMD-4



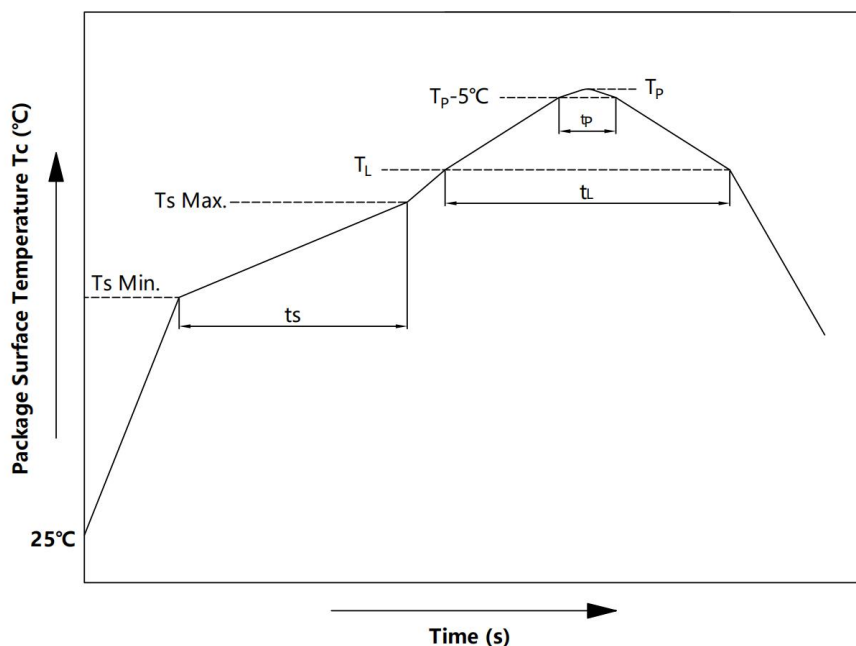
SLM-4

单位 Unit: mm

注：上图为产品正视图。

Note: The picture above is the front view of the product.

## 回流焊温度曲线图 Solder Reflow Profile



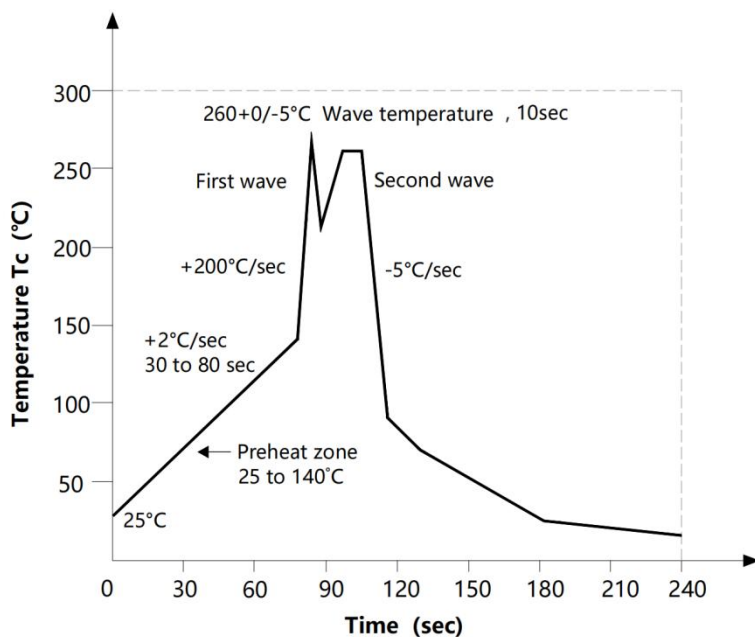
| 项目<br>Item                                                                                    | 符号<br>Symbol | 最小值<br>Min. | 最大值<br>Max. | 单位<br>Unit           |
|-----------------------------------------------------------------------------------------------|--------------|-------------|-------------|----------------------|
| 预热温度<br>Preheat Temperature                                                                   | $T_s$        | 150         | 200         | $^{\circ}\text{C}$   |
| 预热时间<br>Preheat Time                                                                          | $t_s$        | 60          | 120         | s                    |
| 升温速率<br>Ramp-Up Rate ( $T_L$ to $T_P$ )                                                       | -            | -           | 3           | $^{\circ}\text{C/s}$ |
| 液相线温度<br>Liquidus Temperature                                                                 | $T_L$        | 217         |             | $^{\circ}\text{C}$   |
| 时间高于 $T_L$<br>Time Above $T_L$                                                                | $t_L$        | 60          | 150         | s                    |
| 峰值温度<br>Peak Temperature                                                                      | $T_P$        | -           | 260         | $^{\circ}\text{C}$   |
| $T_c$ 在 $(T_P - 5)$ 和 $T_P$ 之间的时间<br>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           | $^{\circ}\text{C/s}$ |

注 Note:

建议在所示的温度和时间条件下进行回流焊，最多不能超过三次；

Reflow soldering is recommended at the temperatures and times shown, no more than three times;

## 波峰焊温度曲线图 Wave Soldering Profile



## 手工烙铁焊接 Soldering with hand soldering iron

A. 手工烙铁焊仅用于产品返修或样品测试;

Hand soldering iron is only used for product rework or sample testing;

B. 手工烙铁焊要求: 温度  $360^{\circ}\text{C} \pm 5^{\circ}\text{C}$ , 时间  $\leq 3\text{s}$ 。

Hand soldering iron requirements: Temperature:  $360^{\circ}\text{C} \pm 5^{\circ}\text{C}$ , within 3s.

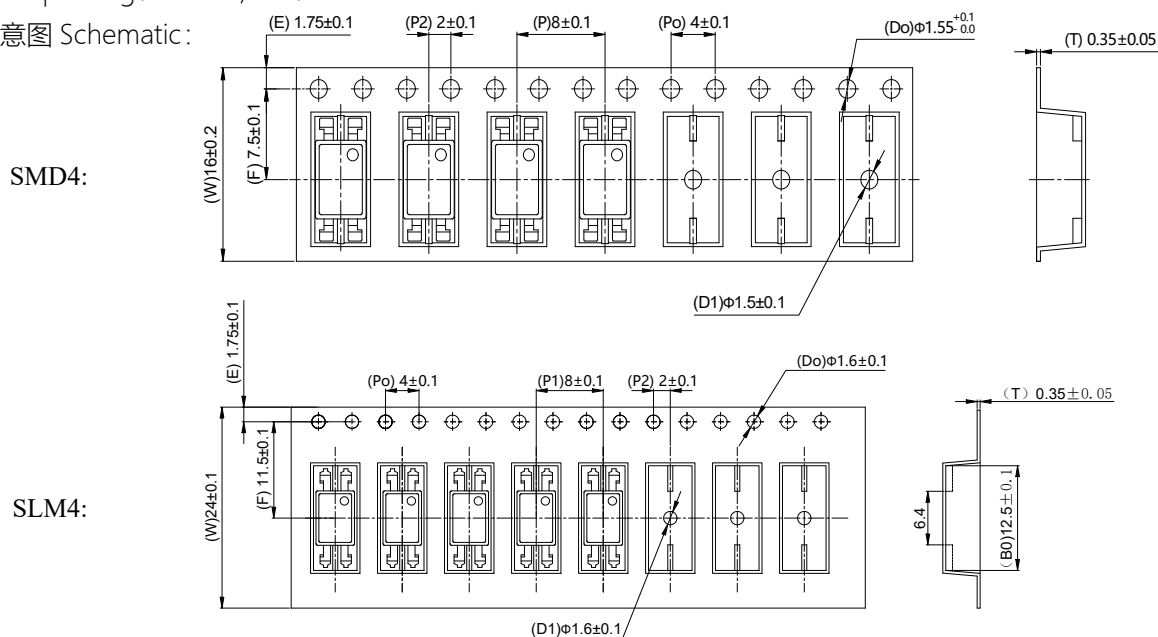
## 包装 Packing

### ■ 汇总表 Summary table

| 封装形式         | 包装方式                                | 盘数量               | 盒数量              | 箱数量                 | 静电袋规格                        | 盒规格               | 箱(双瓦楞)规格             | 备注                                                         |
|--------------|-------------------------------------|-------------------|------------------|---------------------|------------------------------|-------------------|----------------------|------------------------------------------------------------|
| SMD4         | 卷盘<br>( $\phi 330\text{mm}$ 蓝盘)     | 2000 只/盘          | 2 盘/盒            | 10 盒/箱              | 450*390*0.1mm                | 353*340*60mm      | 650*375*365mm        | 首端空 50 个空格, 末端空 100 个空格                                    |
| SLM4         | 卷盘<br>( $\phi 330\text{mm}$ 蓝盘)     | 2000 只/盘          | 2 盘/盒            | 8 盒/箱               | 450*390*0.1mm                | 340*340*75mm      | 650*375*365mm        |                                                            |
| DIP4         | 管装<br>(500*12*11mm)                 | 100 只/管           | 50 管/盒           | 10 盒/箱              | 不适用                          | 525*130*57mm      | 550*280*320mm        | 每管使用蓝白胶塞, 方向须一致                                            |
| DIP4-M       | 管装<br>(500*13*11mm)                 | 100 只/管           | 45 管/盒           | 10 盒/箱              | 不适用                          | 525*130*57mm      | 550*280*320mm        |                                                            |
| Package Type | Packing Form                        | Quantity per Reel | Quantity per Box | Quantity per Carton | Antistatic Bag Specification | Box Specification | Carton Specification | Note                                                       |
| SMD4         | Reel<br>( $\phi 330\text{mm}$ Blue) | 2000 pcs/reel     | 2 reels/box      | 10 boxes/ctn        | 450*390*0.1mm                | 353*340*60mm      | 650*375*365mm        | Leave 50 Spaces at the beginning and 100 Spaces at the end |
| SLM4         | Reel<br>( $\phi 330\text{mm}$ Blue) | 2000 pcs/reel     | 2 reels/box      | 8 boxes/ctn         | 450*390*0.1mm                | 340*340*75mm      | 650*375*365mm        |                                                            |
| DIP4         | Tube<br>(500*12*11mm)               | 100 pcs /tube     | 50 tubes/box     | 10 boxes/ctn        | NA                           | 525*130*57mm      | 550*280*320mm        | End plug (blue) and End plug (white) keep the direction    |
| DIP4-M       | Tube<br>(500*13*11mm)               | 100 pcs /tube     | 45 tubes/box     | 10 boxes/ctn        | NA                           | 525*130*57mm      | 550*280*320mm        |                                                            |

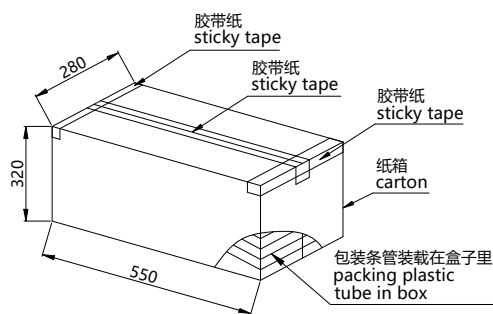
### ■ 编带包装 Tape & Reel

- 1) 每卷数量: 2000 只。  
Qty/reel: 2000 pcs.
- 2) 每箱数量 SMD4/SLM4: 40000/32000 只。  
Qty/ctn SMD4/SLM4: 40000/32000 pcs.
- 3) 内包装: 每盒 2 盘。  
Inner packing: 2 reels/box.
- 4) 示意图 Schematic:



■ 管条包装 Tape & Tube

- 1) 每管数量: 100 只。  
Qty/Tube: 100 pcs.
- 2) 每箱数量 DIP4/DIP4-M: 50000/45000 只。  
Qty/ctn DIP4/DIP4-M: 50000/45000 pcs.
- 3) 内包装 DIP4/DIP4-M: 每盒 50/45 管。  
Inner packing DIP4/DIP4-M: 50/45 Tube/box.
- 4) 示意图 Schematic:



单位/Unit: mm

## 注意 Attention

- 群芯持续不断改进质量、可靠性、功能或设计，保留此文件更改的权利恕不另行通知。  
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