



晶体管光耦

Photo Transistor

**QX101X**

宁波群芯微电子股份有限公司

NINGBO QUNXIN MICROELECTRONICS CO., LTD.

中国 浙江省宁波杭州湾新区玉海东路 68 号

68 Yuhaidong Road, Hangzhou Bay New District, Ningbo, Zhejiang, China

## 概述 Description

QX101X是一款由一个GaAs发光二极管和一个NPN光电晶体管组成的光电耦合器。

The QX101X is a photoelectric coupler composed of a GaAs light-emitting diode and a NPN photo transistor.

## 特性 Features

- 电流转换比(CTR)范围:  $\geq 50\%$  ( $I_F=5\text{mA}$ ,  $V_{CE}=5\text{V}$ ,  $T_a=25^\circ\text{C}$ )  
Current transfer ratio:  $\geq 50\%$  ( $I_F=5\text{mA}$ ,  $V_{CE}=5\text{V}$ ,  $T_a=25^\circ\text{C}$ )
- 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: UL 1577, VDE DIN EN60747-5-5 (VDE 0884-5) , CQC11-471543-2022  
Meet safety standard approval: UL 1577, VDE DIN EN60747-5-5 (VDE 0884-5) , CQC11-471543-2022

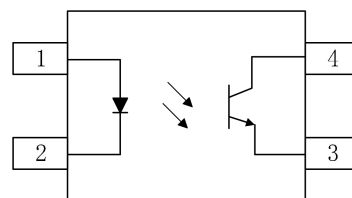
## 应用 Applications

- 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



LSOP4



Pin Configuration

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

## 产品型号命名规则 Order Code

### QX 101 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 (101: 101)
- ③ CTR 档位 Classification (代码 Code: 0,1,2,3....)
- ④ 框架类型 Lead Frame (Cu: 铜框架 Copper)
- ⑤ 树脂类型 Epoxy Type (H: 无卤 Halogen-free)
- ⑥ 封装形式 Package (L: LSOP)
- ⑦ 器件工作温度范围 Device Operating Temperature Range (特殊范围需填或者空白 Special Range need to be filled in or left blank)
- 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: 0、1、2、3....  
“X”denotes the classification: 0、1、2、3....
- 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            | > 8.0       | 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            | > 8.0       | 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                                                                                                  |
| 电痕指数<br>CTI                           | CTI          | > 175       | V          | /                                                                                                          |

### 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            |
|                                | 反向电压<br>Reverse Voltage                            | $V_R$        | 6             | V             |
|                                | 功耗<br>Power Dissipation                            | $P_D$        | 70            | mW            |
|                                | 热阻(结-环境)<br>Thermal Resistance Junction to Ambient | $R_{thJ-A}$  | 250           | $^{\circ}C/W$ |
|                                | 热阻(结-壳)<br>Thermal Resistance Junction to Case     | $R_{thJ-C}$  | 180           | $^{\circ}C/W$ |
| 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-集电极电压<br>Emitter-Collector Voltage             | $V_{ECO}$    | 6             | V             |
| 总功耗<br>Total Power Dissipation |                                                    | $P_{tot}$    | 250           | mW            |
| 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                        | $C_t$         | $V=0, f=1\text{MHz}$                                               | -          | 30         | 250        | pF            |
| 接收端<br>Output                       | 集电极暗电流<br>Collector Dark Current                    | $I_{CEO}$     | $V_{CE}=20\text{V}, I_F=0\text{mA}$                                | -          | -          | 100        | nA            |
|                                     | 集电极-发射极击穿电压<br>Collector-Emitter Breakdown Voltage  | $BV_{CEO}$    | $I_C=0.1\text{mA}, I_F=0\text{mA}$                                 | 80         | -          | -          | V             |
|                                     | 发射极-集电极击穿电压<br>Emitter-Collector Breakdown Voltage  | $BV_{ECO}$    | $I_E=10\mu\text{A}, I_F=0\text{mA}$                                | 6          | -          | -          | V             |
| 传输特性<br>Transfer<br>Characteristics | 集电极-发射极饱和压降<br>Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_F=10\text{mA}, I_C=1\text{mA}$                                  | -          | -          | 0.3        | V             |
|                                     | 响应时间(ON)<br>Response Time (ON)                      | $T_{on}$      | $V_{CE}=5\text{V}, I_C=5\text{mA}$<br>$R_L=100\Omega$              | -          | 4          | -          | $\mu\text{s}$ |
|                                     | 响应时间(OFF)<br>Response Time (OFF)                    | $T_{off}$     | $V_{CE}=5\text{V}, I_C=5\text{mA}$<br>$R_L=100\Omega$              | -          | 3          | -          | $\mu\text{s}$ |
|                                     | 上升时间<br>Rise Time                                   | $T_r$         | $V_{CE}=5\text{V}, I_C=5\text{mA}$<br>$R_L=100\Omega$              | -          | 2          | 18         | $\mu\text{s}$ |
|                                     | 下降时间<br>Fall Time                                   | $T_f$         | $V_{CE}=5\text{V}, I_C=5\text{mA}$<br>$R_L=100\Omega$              | -          | 3          | 18         | $\mu\text{s}$ |
|                                     | 截止频率<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           |

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 (Ta=25°C)

| 参数<br>Parameter                     | 符号<br>Symbol | 条件<br>Condition                      | 最小值<br>Min. | 标准值<br>Typ. | 最大值<br>Max. | 单位<br>Unit. |
|-------------------------------------|--------------|--------------------------------------|-------------|-------------|-------------|-------------|
| 传输特性<br>Transfer<br>Characteristics | QX1010       | $I_F=5\text{mA}, V_{CE}=5\text{V}$   | 50          | -           | 600         | %           |
|                                     | QX1011       |                                      | 100         | -           | 200         | %           |
|                                     | QX1017       |                                      | 80          | -           | 160         | %           |
|                                     | QX1018       |                                      | 130         | -           | 260         | %           |
|                                     | QX1019       |                                      | 200         | -           | 400         | %           |
|                                     | QX1012       | $I_F=10\text{mA}, V_{CE}=5\text{V}$  | 63          | -           | 125         | %           |
|                                     | QX1013       |                                      | 100         | -           | 200         | %           |
|                                     | QX1014       |                                      | 160         | -           | 320         | %           |
|                                     | QX1011       | $I_F=0.5\text{mA}, V_{CE}=5\text{V}$ | 15          | -           | 90          | %           |
|                                     | QX1012       |                                      | 5           | -           | 55          | %           |
|                                     | QX1013       |                                      | 10          | -           | 80          | %           |
|                                     | QX1014       |                                      | 20          | -           | 130         | %           |

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

Fig.1 Forward Current vs Forward Voltage

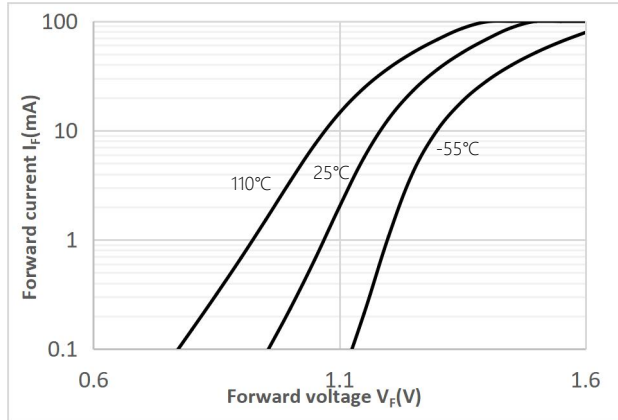


Fig.2 Collector Dark Current vs Ambient Temperature

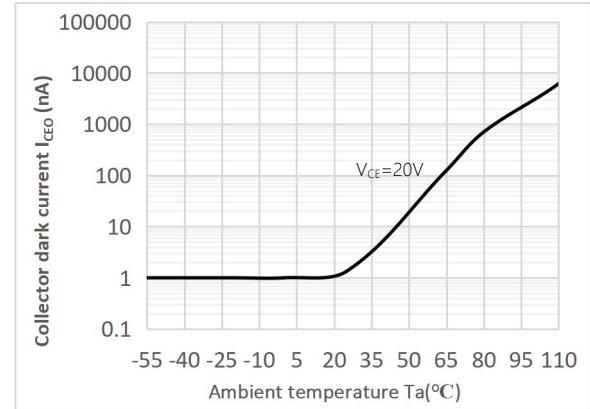


Fig.3 Collector Current vs. Collector-emitter Voltage

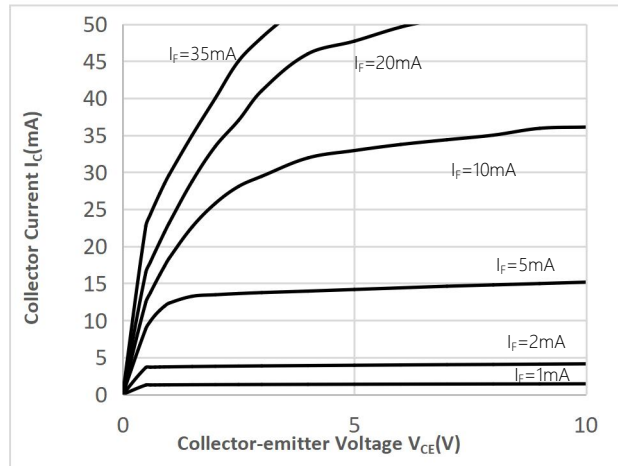


Fig.4 Relative Collector Current vs Forward Current

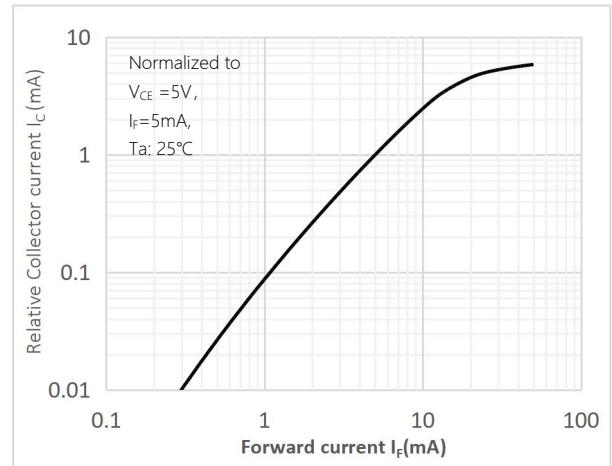


Fig.5 Relative Current Transfer Ratio vs. Forward Current

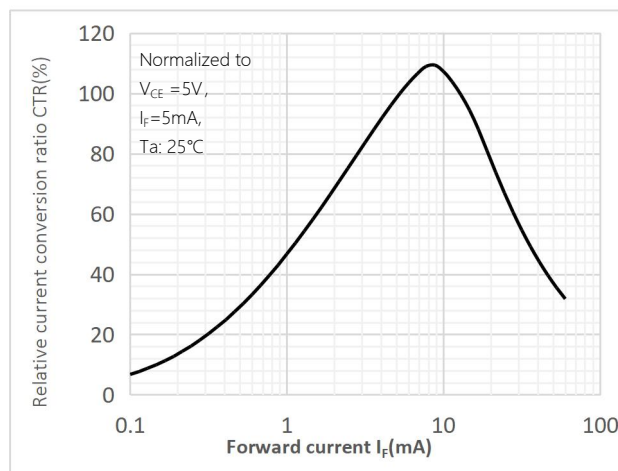


Fig.6 Relative Current transfer ratio vs Ambient temperature

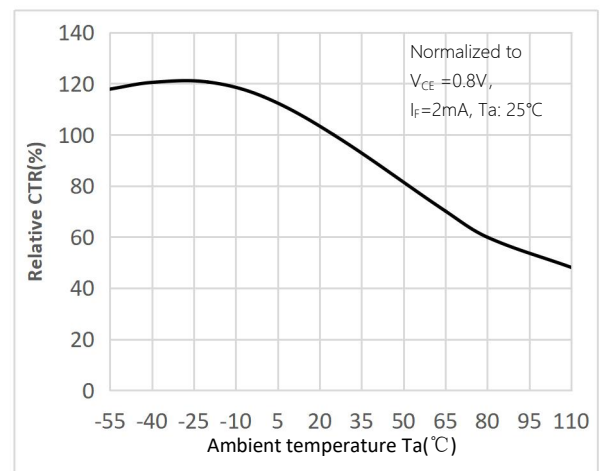


Fig.7 Relative Current transfer ratio vs Ambient temperature

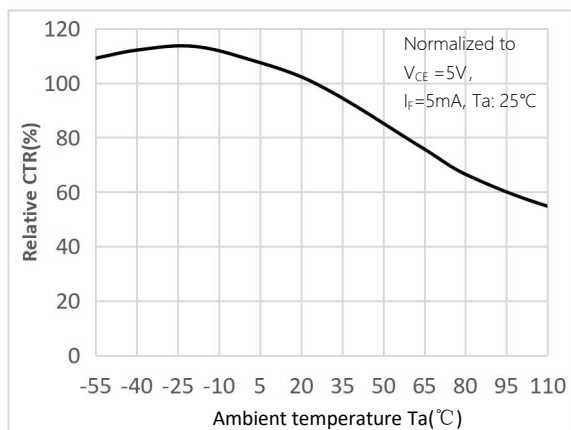


Fig.8 Collector-emitter Saturation Voltage vs. Ambient temperature

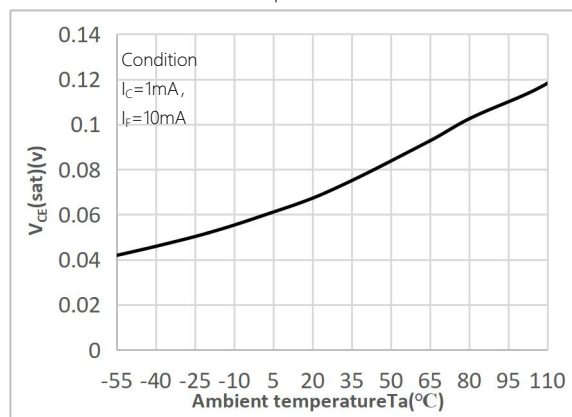


Fig.9 Turn on/Turn off vs. Collector Current

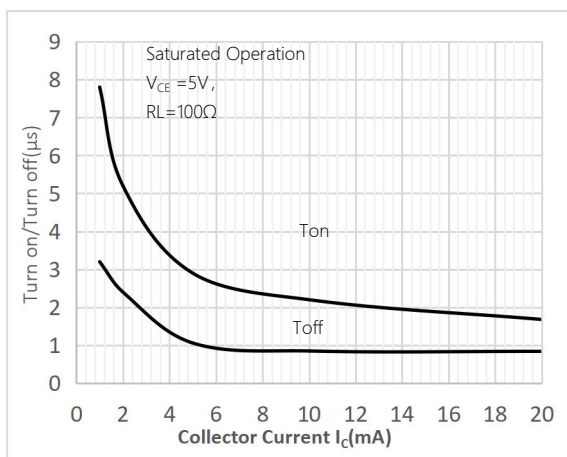


Fig.10 Turn on/Turn off vs Forward current

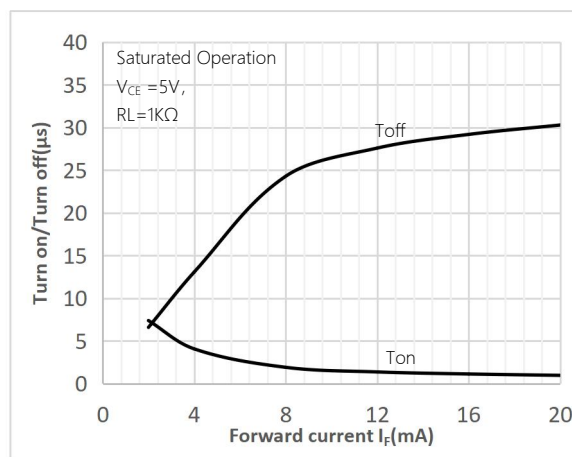
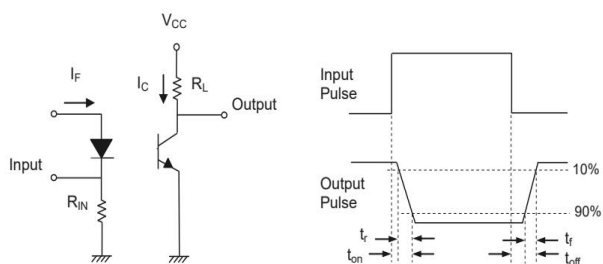
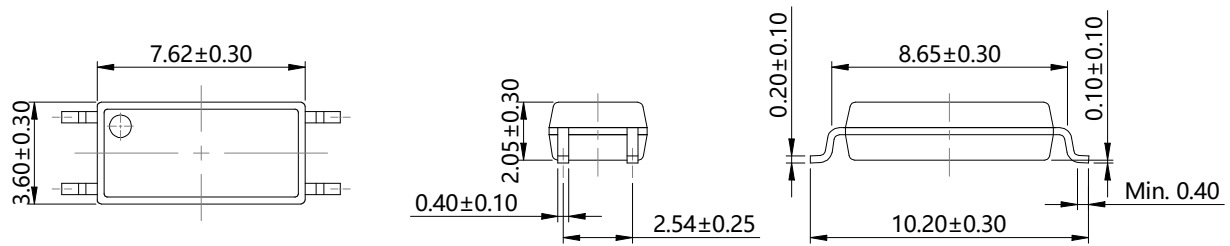


Fig.11 Switching Time Test Circuit & Waveforms



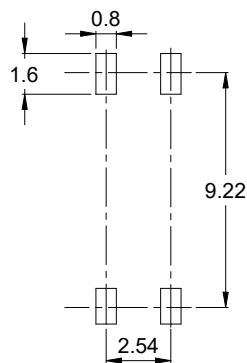
## 外形尺寸 Outline Dimensions

LSOP4



单位 Unit: mm

## 建议焊盘布局 Recommended Pad Layout

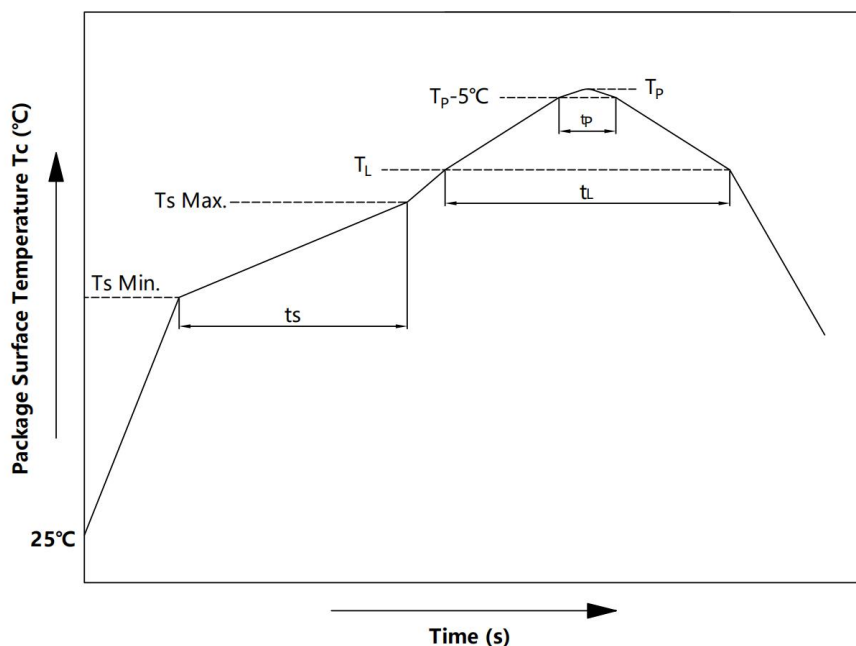


单位 Unit: mm

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



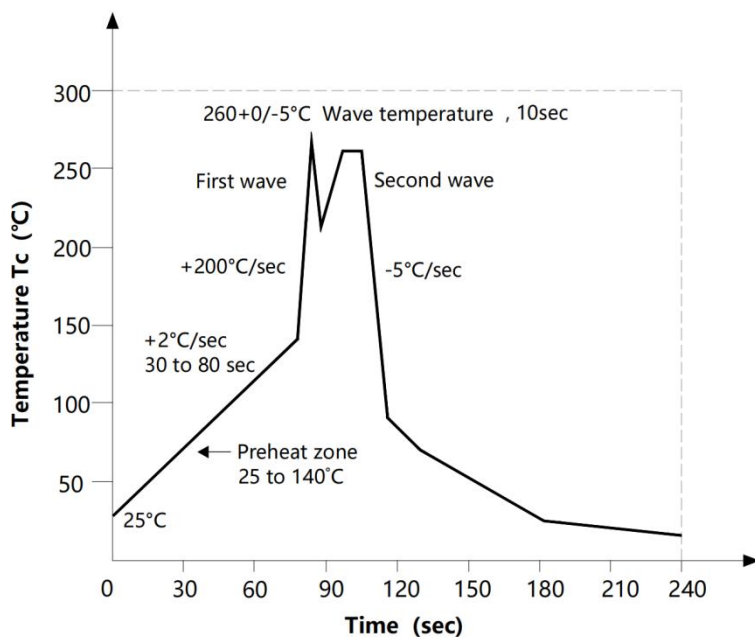
| 项目<br>Item                                                                                | 符号<br>Symbol | 最小值<br>Min. | 最大值<br>Max. | 单位<br>Unit |
|-------------------------------------------------------------------------------------------|--------------|-------------|-------------|------------|
| 预热温度<br>Preheat Temperature                                                               | $T_s$        | 150         | 200         | °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           | °C/s       |
| 液相线温度<br>Liquidus Temperature                                                             | $T_L$        | 217         |             | °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         | °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           | °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.

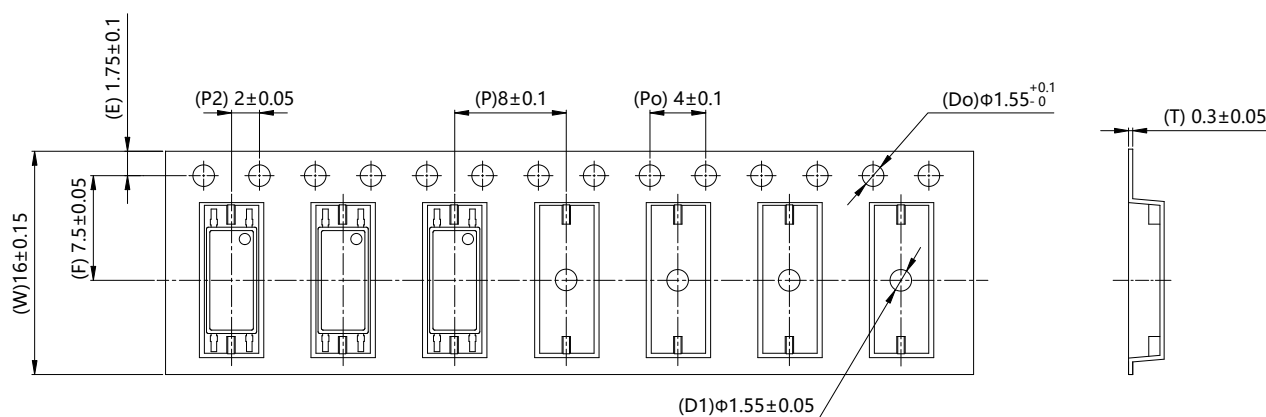
## 包装 Packing

### ■ 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                                                                     |
|--------------|-------------------------------|-------------------|------------------|---------------------|------------------------------|-------------------|----------------------|------------------------------------------------------------------------|
| LSOP4        | 卷盘<br>( $\phi 330$ mm 蓝盘)     | 3000 只/盘          | 2 盘/盒            | 10 盒/箱              | 450*390*0.1mm                | 353*340*60mm      | 650*375*365mm        | 首端各空 50 个<br>空格, 末端空<br>100                                            |
| Package Type | Packing Form                  | Quantity per Reel | Quantity per Box | Quantity per Carton | Antistatic Bag Specification | Box Specification | Carton Specification | Note                                                                   |
| LSOP4        | Reel<br>( $\phi 330$ mm Blue) | 3000 pcs<br>/reel | 2 reels<br>/box  | 10 boxes<br>/ctn    | 450*390*0.1mm                | 353*340*60mm      | 650*375*365mm        | Leave 50<br>Spaces at the<br>beginning and<br>100 Spaces at<br>the end |

### ■ 编带包装 Tape & Reel

- 1) 每卷数量: 3000 只。  
Qty/reel: 3000 pcs.
- 2) 每箱数量: 60000 只。  
Qty/ctn: 60000 pcs.
- 3) 内包装: 每盒 2 盘。  
Inner packing: 2 reels/box.
- 4) 示意图 Schematic:



单位/unit: mm

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## 注意 Attention

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