NQUNXIN
群芯微电子

中国芯 光电梦



# 可控硅光耦

Photo Triac

# QXM30VX

**(Rev.E)**


宁波群芯微电子股份有限公司

NINGBO QUNXIN MICROELECTRONICS CO., LTD.

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# QXM301X QXM302X QXM305X

## NZC photo triac

## 概述 Description

- QXM301X、 QXM302X、QXM305X 系列器件是由一个 GaAs 红外发光二极管和一个单晶硅芯片的随机相位光电双向晶闸管组成的光电耦合器。

The QXM301X、QXM302X、 QXM305X series devices are optocouplers composed of a GaAs infrared light emitting diode and a single-crystal silicon chip random phase photoelectric bidirectional thyristor.

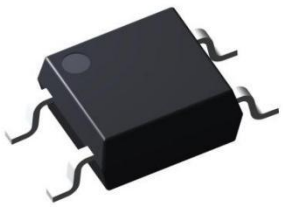
## 特性 Features

- 峰值击穿电压
  Peak breakdown voltage
  250V：QXM301X；
  400V：QXM302X；
  600V：QXM305X；
- 输入-输出隔离电压 ($V_{ISO}$=3750 Vrms )
  High isolation voltage between input and output($V_{ISO}$=3750 Vrms )
- 工作温度：-55℃~110℃
  Operating Temperature: -55℃~110℃
- 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
  Safety standard approval: UL 1577, VDE DIN EN60747-5-5 (VDE 0884-5），CQC11-471543-2022

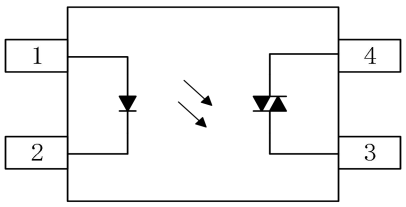
## 应用 Applications

- 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



SOP4




Pin Configuration
1. Anode
2. Cathode
3. Terminal
4. Terminal

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## 产品型号命名规则 Order Code

**QX M30VX - UN Y - W V (ZZ)**

① ② ③ ④ ⑤ ⑥ ⑦

① 公司代码 Company Code（QX: 群芯 Qunxin）
② 产品系列 Product Series（M30VX: M301X, M302X, M305X）
③ 框架类型 Lead Frame（Cu: 铜框架 Copper）
④ 树脂类型 Epoxy Type（H: 无卤 Halogen-free）
⑤ 封装形式 Package（ S: SOP）
⑥ 产品版本 Product Versions：E
⑦ 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“V”代表 $V_{DRM}$ 分档：1、2、5
  “V”denotes the VDRM digissr：1、2、5
- 印字中的“X”代表 IFT 分档：0、1、2、3
  “X”denotes the IFT digissr：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“E”代表产品版本号
  “E”denotes product versions
- 印字中的“H”代表无卤
  “H”denotes Halogen-free




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## 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 | > 5.0 | 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 | > 5.0 | 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 | $V_{IORM}$ | 600 | $V_{peak}$ | DIN/EN/IEC EN60747-5-5 |
| 瞬态隔离电压<br>Transient isolation voltage | $V_{IOTM}$ | 5000 | $V_{peak}$ | DIN/EN/IEC EN60747-5-5 |
| 隔离电压<br>Isolation Voltage | Viso | > 3750 | Vrms | For 1 min |

## 极限参数 Absolute Maximum Ratings (Ta=25℃)

| 参数<br>Parameter | | | 符号<br>Symbol | 额定值<br>Rated | 单位<br>Unit |
|---|---|---|---|---|---|
| 发射端<br>Input | 正向电流<br>Forward Current | | $I_F$ | 60 | mA |
| | 反向电压<br>Backward Voltage | | $V_R$ | 6 | V |
| | 功耗<br>Power Dissipation | | $P_D$ | 100 | mW |
| | 额定值降低因子(在 Ta = 85°C 以上)<br>Power dissipation<br>Derating factor (above Ta = 85°C) | | $P_{DD}$ | 3.8 | mW/°C |
| 接收端<br>output | 断态输出端电压<br>Off-state output terminal voltage | QXM301X | $V_{DRM}$ | 250 | V |
| | | QXM302X | | 400 | |
| | | QXM305X | | 600 | |
| | 峰值重复浪涌电流(pw=100μs,120pps)<br>Peak repetitive surge current<br>(pw=100μs,120pps) | | $I_{TSM}$ | 1 | A |
| | 开启态电流（均方根值）<br>On-state current (root mean square value) | | $I_{T(RMS)}$ | 100 | mA |
| | 功耗<br>Power Dissipation | | $P_C$ | 300 | mW |
| | 额定值降低因子(在 Ta = 85°C 以上)<br>Power dissipation<br>Derating factor (above Ta = 85°C) | | | 7.4 | mW/°C |
| 总功耗<br>Total Power Dissipation | | | $P_{tot}$ | 330 | mW |
| 隔离电压<br>Isolation Voltage | | | Viso | 3750 | V |

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| 参数<br>Parameter | 符号<br>Symbol | 额定值<br>Rated | 单位<br>Unit |
|---|---|---|---|
| 工作温度<br>Operating Temperature | $T_{opr}$ | -55~110 | ℃ |
| 存储温度<br>Storage Temperature | $T_{stg}$ | -55~125 | ℃ |
| 焊接温度<br>Soldering Temperature | $T_{sol}$ | 260 | ℃ |

* 在相对湿度 40% ~ 60%下的进行交流电测试，此时 1、2 脚短接，3、4 脚短接。

* Conduct AC test at 40%~60% relative humidity. At this time, pins 1 and 2 are short-circuited, and pins 3 and 4 are short-circuited.

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

| 参数 Parameter | | | 符号 Symbol | 条件 Condition | 最小 Min. | 典型 Typ. | 最大 Max. | 单位 Unit |
|---|---|---|---|---|---|---|---|---|
| 发射端 Input | 正向电压 Forward Voltage | | $V_F$ | $I_F$=20mA | - | 1.23 | 1.5 | V |
| | 反向电流 Back current | | $I_R$ | $V_R$=6V | - | - | 10 | uA |
| 接收端 Output | 断态峰值电流 Off-state peak current | | $I_{DRM}$ | $V_{DRM}$ =Rated $V_{DRM}$ $I_F$ = 0mA | - | - | 100 | nA |
| | 通态峰值电压 On-state peak voltage | | $V_{TM}$ | $I_{TM}$=100mA peak $I_F$= Rated $I_{FT}$ | - | - | 2.5 | V |
| | 断态电压临界上升率 Critical rise rate of off-state voltage | QXM301X | dv/dt | $V_{PEAK}$ =Rated $V_{DRM}$, $I_F$=0 | - | 100 | - | V/μs |
| | | QXM302X | | | | | | |
| | | QXM305X | | $V_{PEAK}$ =400V, $I_F$=0 | 1000 | - | - | |
| 传输特性 Transfer Characteristics | LED 触发电流 LED trigger current | QXM3020 | $I_{FT}$ | 主端电压 Main terminal Voltage =3V | - | - | 30 | mA |
| | | QXM3011 | | | - | - | 15 | |
| | | QXM3021 | | | | | | |
| | | QXM3051 | | | | | | |
| | | QXM3012 | | | - | - | 10 | |
| | | QXM3022 | | | | | | |
| | | QXM3052 | | | | | | |
| | | QXM3013 | | | - | - | 5 | |
| | | QXM3023 | | | | | | |
| | | QXM3053 | | | | | | |
| | 维持电流 Maintain current | | $I_H$ | - | - | 250 | - | uA |

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

图 1 LED 正向电压 vs 正向电流
Fig.1 LED forward voltage vs Forward current

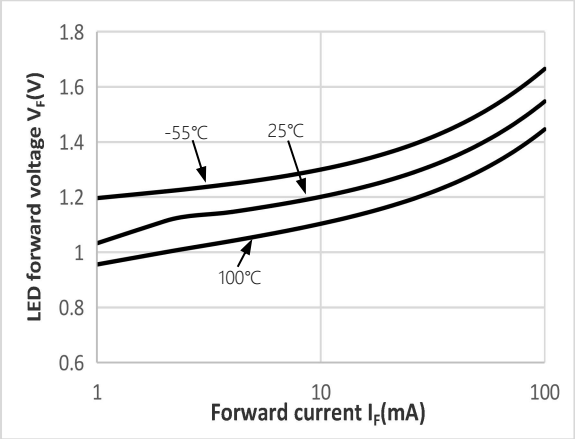


图 2 通态特性图
Fig.2 On-state characteristic diagram

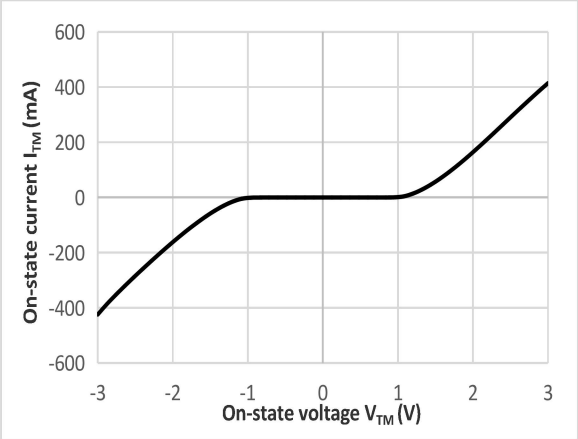


图 3 触发电流 vs 环境温度
Fig.3 Trigger current vs Ambient temperature

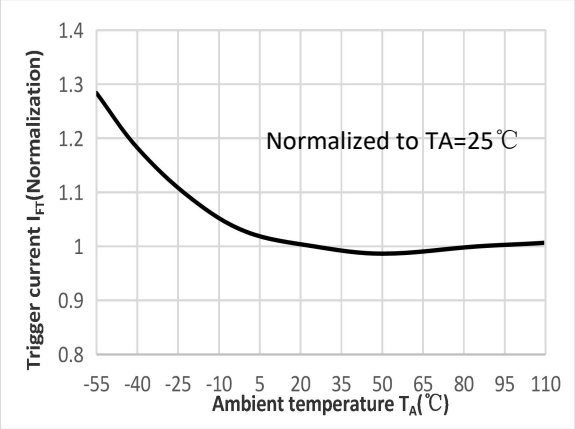


图 4 触发电流 vs LED 脉冲宽度
Fig.4 Trigger current vs LED pulse width

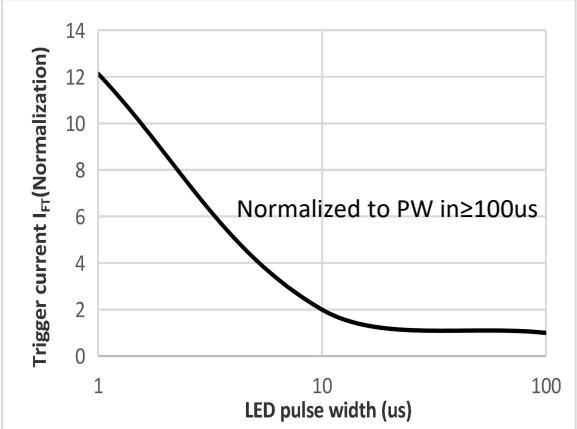


图 5 维持电流 vs 环境温度
Fig.5 Maintenance current vs Ambient temperature

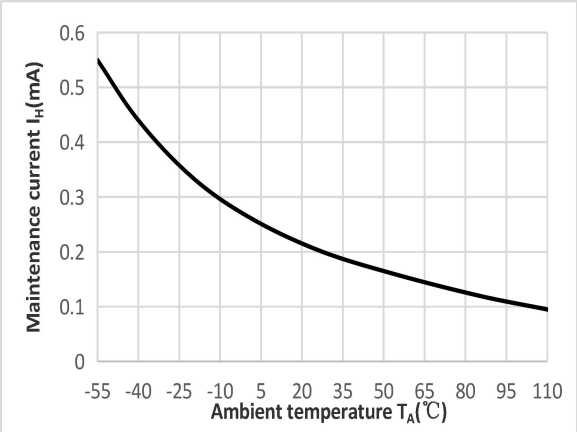


图 6 泄漏电流 vs 环境温度
Fig.6 Leakage current vs Ambient temperature

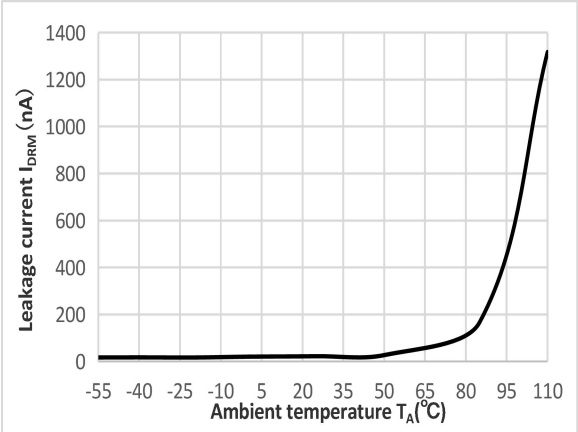


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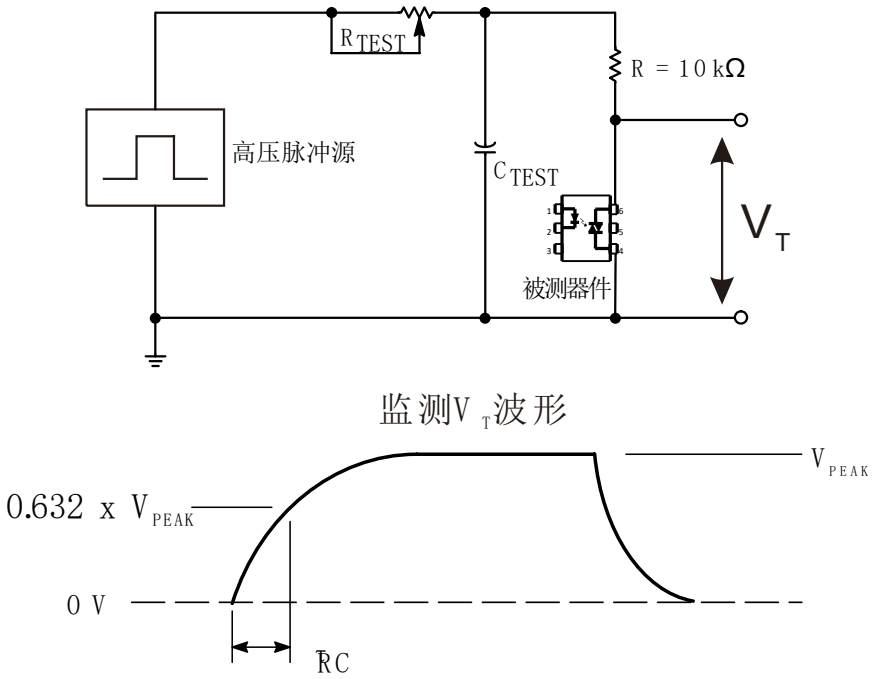
Fig.7 静态 dv/dt 测试电路和波形 Static dv/dt test circuit and waveform




通过 RC 电路施加于被测器件的输出端的高电压脉冲设置到所需的 $V_{PEAK}$ 值上。LED 电流无需加上。波形 $V_T$ 使用 X100 探头监测。通过调节 $R_{TEST}$ 值，dv/dt（斜度）增加，直到被测器件观察到被触发（波形崩溃）。dv/dt 然后下降，直到被测器件停止被触发。此时，记录 $\tau_{RC}$ 值并可计算 dv/dt 了。

The high voltage pulse applied to the output end of the device under test through the RC circuit is set to the desired $V_{PEAK}$ value. LED current does not need to be added. Waveform $V_T$ is monitored with X100 probe. By adjusting the $R_{TEST}$ value, dv/dt (slope) increases until the device under test is observed to be triggered (waveform collapse). Dv/dt then drops until the device under test stops being triggered. At this time, dv/dt can be calculated by recording the value of τRC.

$$dv/dt = \frac{0.632 \times V_{PEAK}}{\tau_{RC}}$$

例如，QXM305X 系列的电压峰值 = 400V。 dv/dt 值的计算方式如下：

For example, the voltage peak of QXM305X series $V_{PEAK}$=400V. Then the dv/dt value can be calculated as follows:

$$dv/dt = \frac{0.632 \times 400}{\tau_{RC}} = \frac{252}{\tau_{RC}}$$

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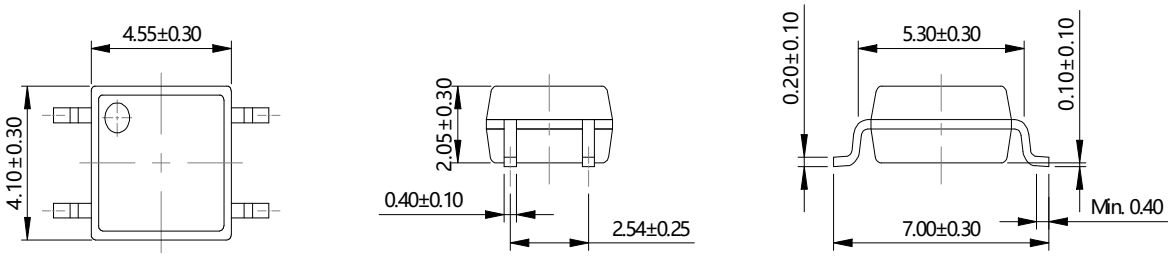
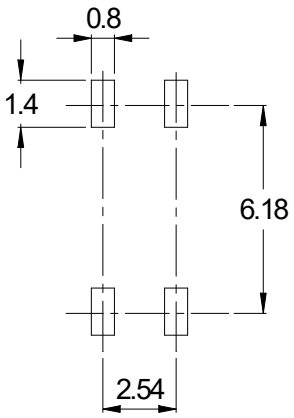
## 外形尺寸 Outline Dimensions

SOP4




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.

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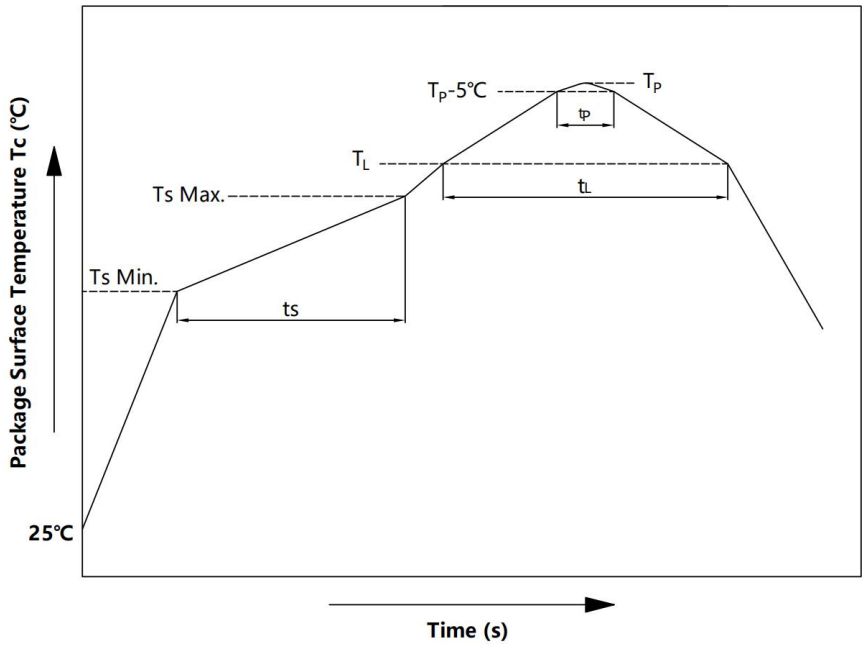
## 回流焊温度曲线图 Solder Reflow Profile




| 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 | Ts | 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 | | ℃ |
| 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 | ℃ |
| Tc 在($T_P$-5)和 $T_P$ 之间的时间<br>Time During Which Tc 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 |

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;

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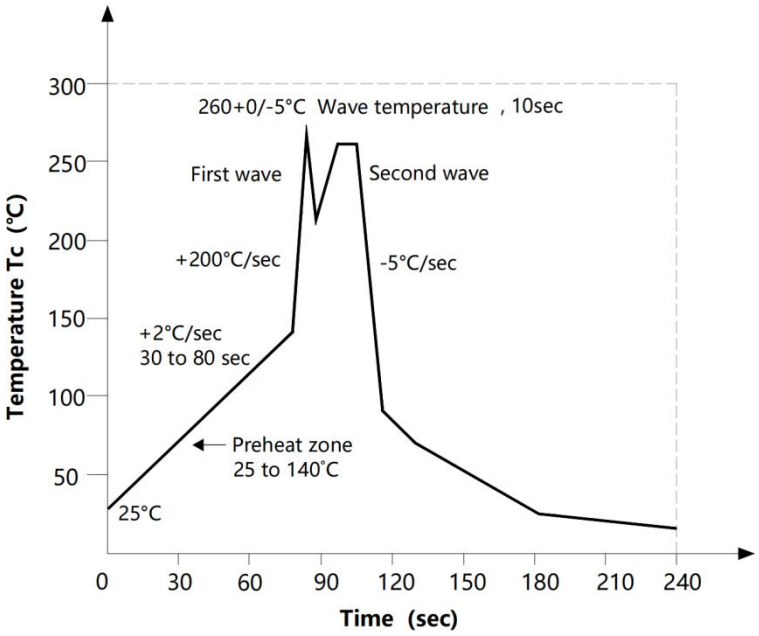
## 波峰焊温度曲线图 Wave Soldering Profile




## 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℃ ± 5℃，时间≤3S。

Hand soldering iron requirements：Temperature：360℃ ± 5℃, within 3s

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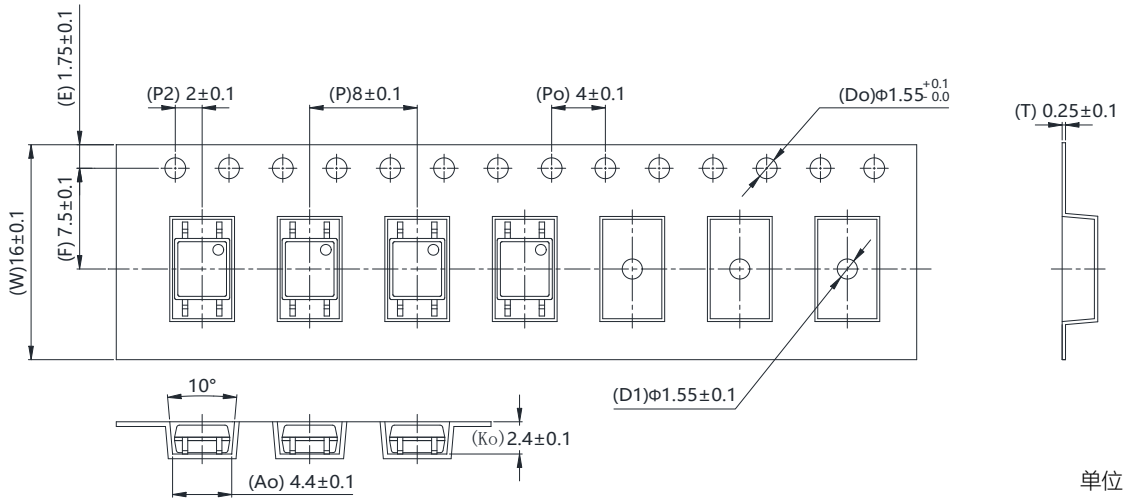
## 包装 Packing

■ 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 |
|---|---|---|---|---|---|---|---|---|
| SOP4 | 卷盘<br>(ϕ330mm 蓝盘) | 3000 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<br>末端空 100 个空格 |
| Package Type | Packing Form | Quantity per Reel | Quantity per Box | Quantity per Carton | Antistatic Bag Specification | Box Specification | Carton Specification | Note |
| SOP4 | Reel<br>(ϕ330mm Blue) | 3000 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 |

■ 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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