

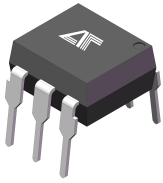
# 达林顿光耦 Darlington optocoupler

## AT4NXX

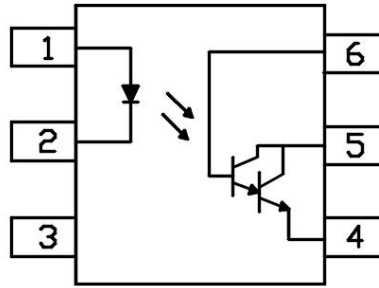
Product Data Sheet

AOTE DCC  
RELEASE

DIP6



SMD6



Pin Configuration

1. Anode
2. Cathode
3. NC
4. Emitter
5. Collector
6. Base

## ◆ 封装逻辑原理图 Encapsulation logic schematic

AT4NXX系列光耦采用高效光电转换技术, 结合先进封装工艺, 提供输入输出间的可靠隔离, 支持DIP6、SMD6封装形式, 适配多样化场景需求。

The AT4NXX series optocoupler adopts high-efficiency photoelectric conversion technology and advanced packaging processes, providing reliable input-output isolation. It supports three package types DIP6、SMD6 to meet diverse application requirements.

## ◆ 产品特征Product features

- 输入-输出隔离电压Vios=5000Vrms  
Input output isolation voltage: Vios=5000 Vrms
- 电流传输比CTR:50-500% Current Transfer Ratio: CTR:50-500%
- 峰值击穿电压:BVCEO=50V; Peak breakdown voltage:BVCEO=50V
- 爬电距离>7.0mm ; Creepage distance > 7.0mm;
- 输入-输出绝缘距离 >0.4mm ; Input-Output insulation Thickness > 0.4mm
- 防潮等级 class1; MSL class1
- 产品符合 ROHS、REACH 及 HF 等环保法规要求;  
The products comply with ROHS, REACH and HF;

## ◆ 应用领域 Applications

- 光伏储能系统Photovoltaic energy storage system  
数据采集、逆变器控制、保护电路Data collection, inverter control, protection circuit
- 工业自动化控制 industrial automation control  
继电器驱动、电机控制、PLC接口Relay drive, motor control, PLC interface
- 电源管理Power management  
开关电源反馈隔离、家用电器电源控制 Switching power supply feedback isolation、Home appliance power control
- 通信与数字电路Communication and Digital Circuits  
高频信号传输、逻辑电路驱动High frequency signal transmission、logic circuit driving



**◆ 极限参数 Absolute Maximum Ratings (Ta =25°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                              | IF           | 60            | mA         |
|                               | 峰值正向电流(1us, 脉冲)<br>Peak forward current (1us, pulse) | IFP          | 1000          | mA         |
|                               | 反向电压<br>Reverse Voltage                              | VR           | 6             | V          |
|                               | 功耗<br>Power Dissipation                              | PD           | 100           | mW         |
| 接收端<br>Output                 | 集电极功耗<br>Collector Power Dissipation                 | PC           | 150           | mW         |
|                               | 集电极电流<br>Collector Current                           | IC           | 100           | mA         |
|                               | 集电极-发射极电压<br>Collector-Emitter voltage               | VCEO         | 50            | V          |
|                               | 发射极-基极电压<br>Emitter-Base voltage                     | VEBO         | 8             | V          |
|                               | 集电极-基极电压<br>Collector-Base voltage                   | VCBO         | 30            | V          |
|                               | 发射极-集电极电压<br>Emitter-Collector voltage               | VECO         | 5             | V          |
| 隔离电压<br>Isolation Voltage     |                                                      | Viso         | 5000          | Vrms       |
| 工作温度<br>Operating Temperature |                                                      | Topr         | -55 ~+110     | °C         |
| 存储温度<br>Storage Temperature   |                                                      | Tstg         | -55 ~+125     | °C         |
| 焊接温度<br>Soldering Temperature |                                                      | Tsol         | 260           | °C         |

**◆ 推荐操作条件 Recommended Operating Conditions**

| 参数<br>Parameter                        | 符号<br>Symbol | 最小值<br>Min | 最大值<br>Max. | 单位<br>Unit |
|----------------------------------------|--------------|------------|-------------|------------|
| 正向电流<br>Forward Current                | IF           | 5          | 15          | mA         |
| 集电极-发射极电压<br>Collector-Emitter Voltage | VCEO         | 5          | 50          | V          |
| 集电极电流<br>Collector Current             | IC           | 5          | 75          | mA         |

**◆ 产品特性参数Product characteristic parameters (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                             |           | VF           | IF =10mA                           | -         | 1.3              | 1.5       | V          |
|                                  | 反向电流<br>Reverse Current                             |           | IR           | VR =3V                             | -         | -                | 10        | uA         |
|                                  | 输入电容<br>Terminal Capacitance                        |           | Ct           | V=0,<br>F =1KHz                    | -         | 50               | -         | pF         |
| 接收端<br>Output                    | 集电极暗电流<br>Collector Dark Current                    |           | ICEO         | VCE=10V                            | -         | -                | 50        | nA         |
|                                  | 集电极-发射极击穿电压<br>Collector-Emitter Breakdown Voltage  |           | BVCEO        | IC =0.1mA,<br>IF =0                | 50        | -                | -         | V          |
|                                  | 集电极-基极击穿电压<br>Collector-Base Breakdown Voltage      |           | BVCBO        | IB =0.1mA,<br>IF =0                | 40        | -                | -         | V          |
|                                  | 发射极-集电极击穿电压<br>Emitter-Collector Breakdown Voltage  |           | BVECO        | IE =0.1mA,<br>IF =0                | 7         | -                | -         | V          |
| 传输特性<br>Transfer Characteristics | 电流传输比<br>Current Transfer Ratio                     | 4N31      | CTR*         | IF=10mA,<br>VCE=10V                | 50        | -                | -         | %          |
|                                  |                                                     | 4N29、4N30 |              |                                    | 100       | -                | -         | %          |
|                                  |                                                     | 4N32、4N33 |              |                                    | 500       | -                | -         | %          |
|                                  | 集电极-发射极饱和压降<br>Collector-Emitter Saturation Voltage |           | VCE(sat)     | IF =8mA,<br>IC =2mA                | -         | -                | 1         | V          |
|                                  | 隔离电阻<br>Isolation Resistance                        |           | RISO         | DC=500V<br>40 ~60%R.H.             | -         | 10 <sup>11</sup> | -         | Ω          |
|                                  | 隔离电容<br>Isolation capacitance                       |           | CISO         | V=0 , f=1MHz                       | -         | 0.8              | -         | pF         |
|                                  | 开启时间<br>Turn-on Time                                |           | Ton          | VCE =10V,<br>IC =50mA,<br>RL =100Ω | -         | -                | 5         | μs         |
|                                  | 关断时间<br>Turn-off Time                               |           | Toff         |                                    | -         | -                | 100       | μs         |

注 电流传输比= $I_C/I_F \times 100\%$ 。

Note\*: CTR= $I_C/I_F \times 100\%$ 。

◆ 电性特性曲线 Electrical characteristic curve ( $T_A = 25^\circ\text{C}$ )

Fig.1 Forward Current vs. Forward Voltage

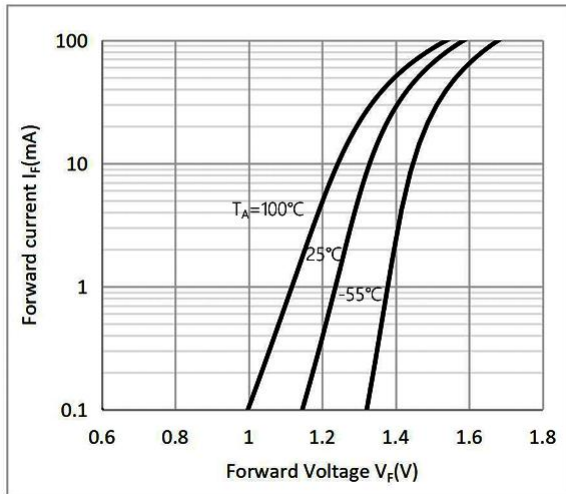


Fig.2 Current Transfer Ratio vs. Ambient Temperature

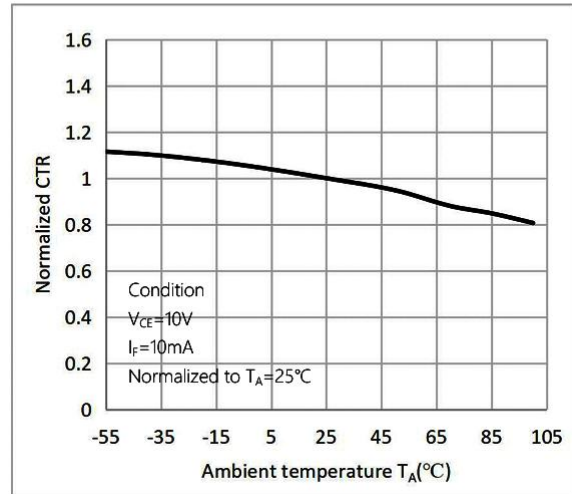


Fig.3 Normalized Current Transfer Ratio vs. Forward Current

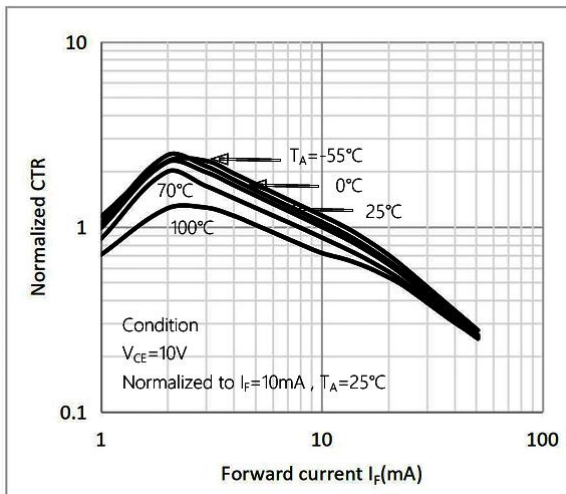


Fig.4 Collector Dark Current vs. Ambient Temperature

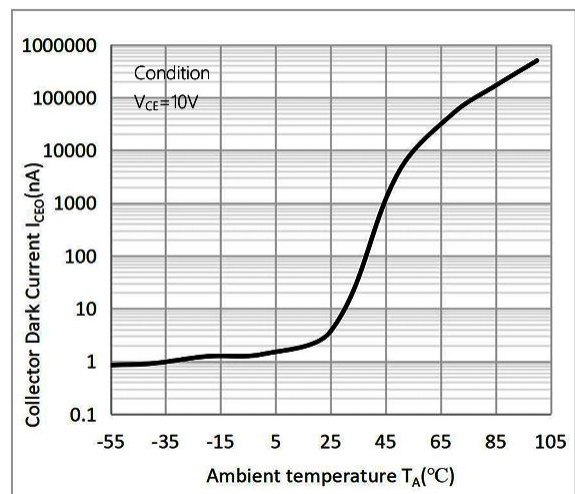


Fig 5. Turn-on Time vs Forward Current

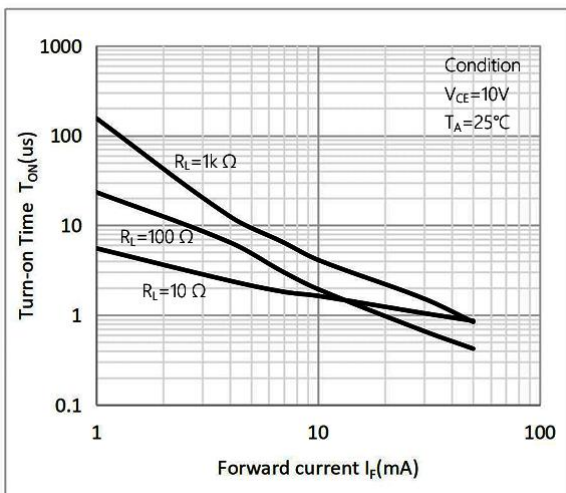
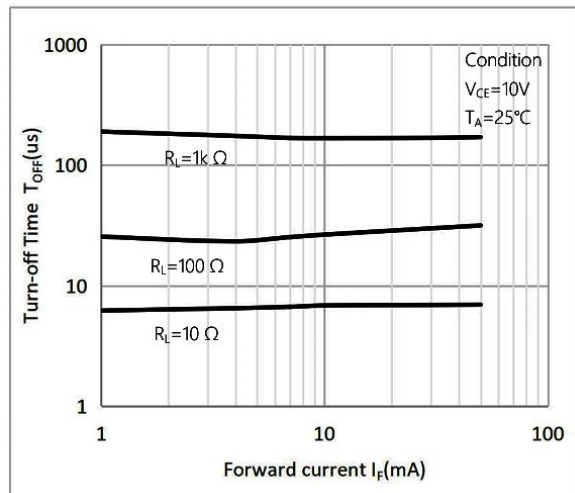
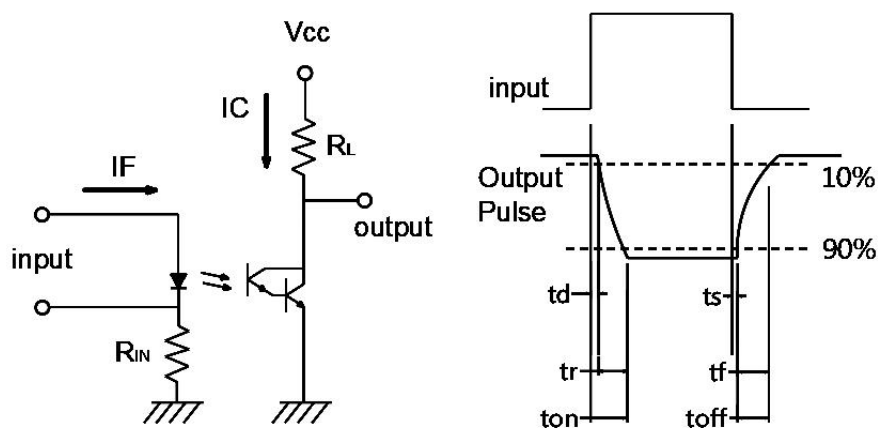


Fig 6. Turn-off Time vs Forward Current

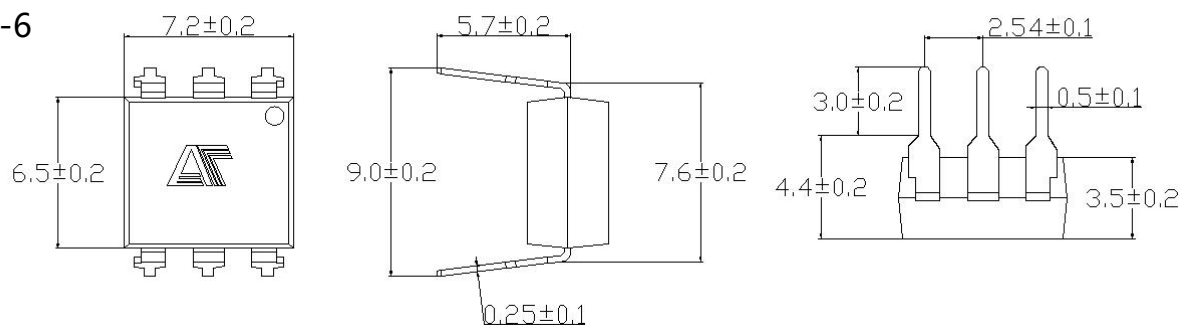


◆ 开关时间测试电路 Switching Time Test Circuit

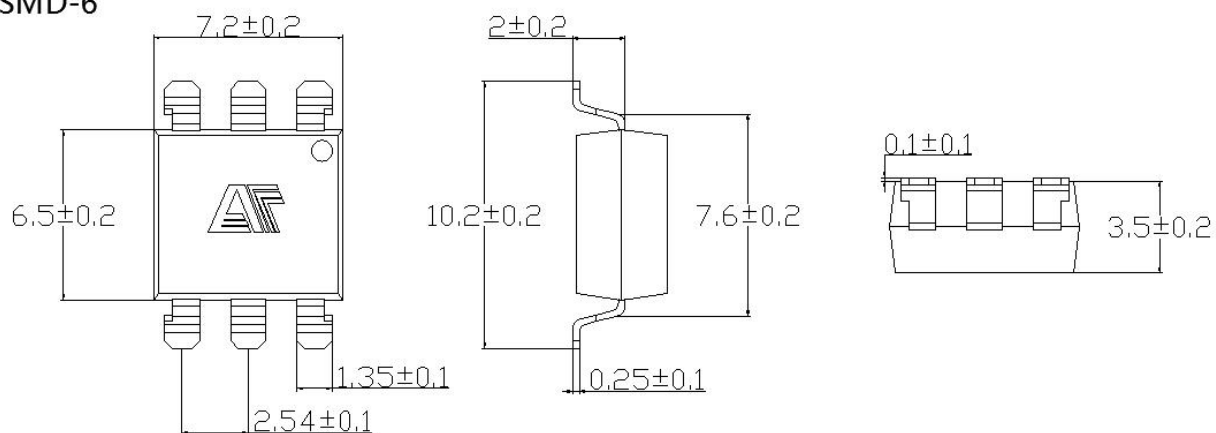


◆ 外形尺寸Overall dimension

DIP-6

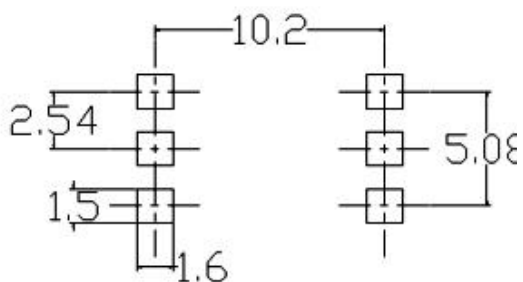


SMD-6



推荐焊盘:

Recommended Solder



单位: mm

# ◆ 产品型号命名规则 Order Code

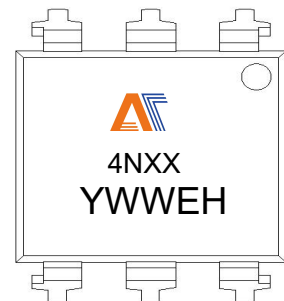
## AT 4NXX - UN Y - W (V) (ZZ)

①                      ②                      ③                      ④                      ⑤                      ⑥                      ⑦

- ① 公司代码 Company Code (AT: 奥特AOTE)
- ② 产品系列 Product Series (4NXX)
- ③ 框架类型 Lead Frame (Cu: 铜框架 Copper)
- ④ 树脂类型 Epoxy (H: 无卤 Halogen-free)
- ⑤ 封装形式 Package (D: DIP ; S: SMD)
- ⑥ 器件工作温度范围 Device Operating Temperature Range (特殊范围需填或者空白 Special Range or None)
- 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 “  ” 为奥特品牌LOGO  
“  ” denotes LOGO
- 印字中的 “XX” 代表产品分档: 25, 26, 27,28,35,36,37,38  
“XX” denotes the classification: 25, 26, 27,28,35,36,37,38
- 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” 代表内部代码  
“E” denotes Internal code
- 印字中的 “H” 代表无卤  
“H” denotes Halogen-free



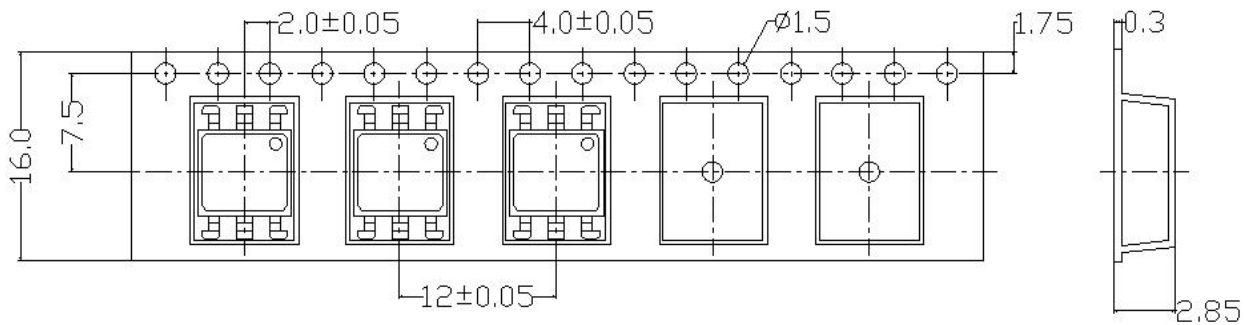
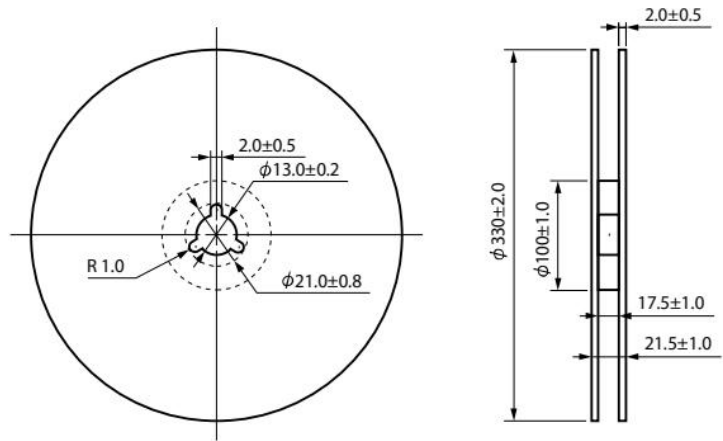


### ◆ 包装packing

| 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                                                             |
|--------------|-------------------------------------|-------------------|------------------|---------------------|------------------------------|-------------------|----------------------|----------------------------------------------------------------|
| SMD6         | 卷盘<br>( $\phi 330\text{mm}$ 蓝盘)     | 1000 只/盘          | 2 盘/盒            | 10 盒/箱              | 450*390*<br>0.1mm            | 340*60*<br>340mm  | 620*360*<br>365mm    | 首尾端空至少<br>200mm                                                |
| DIP6         | 管装<br>(500*12*11mm)                 | 65 只/管            | 50 管/盒           | 10 盒/箱              | 不适用                          | 525*128*<br>56mm  | 535*275*<br>300mm    | 每管使用蓝白胶 塞<br>, 方向须一致                                           |
| Package Type | Packing Form                        | Quantity per Reel | Quantity per Box | Quantity per Carton | Antistatic Bag Specification | Box Specification | Carton Specification | Note                                                           |
| SMD6         | Reel<br>( $\phi 330\text{mm}$ Blue) | 1000 pcs/reel     | 2 reels/box      | 10 boxes/ctn        | 450*390*<br>0.1mm            | 340*60*<br>340mm  | 620*360*<br>365mm    | Guard band<br>200mm min.                                       |
| DIP6         | Tube<br>(500*12*11mm)               | 65 pcs /tube      | 50 tubes/box     | 10 boxes/ctn        | NA                           | 525*128*<br>56mm  | 535*275*<br>300mm    | Endplug (blue)<br>and Endplug<br>(white) keep the<br>direction |

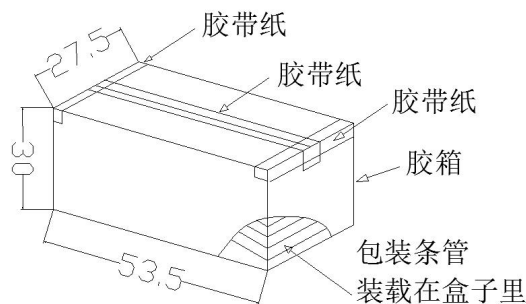
### • 编带包装 Tape & Reel

- 1) 每卷数量: 1000 只;  
Qty/reel: 1000 pcs.
- 2) 每箱数量: 20000 只;  
Qty/ctn: 20000 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: 65 只;  
Qty/Tube: 65 pcs.
- 2) 每箱数量: 32500 只;  
Qty/ctn: 32500 pcs.
- 3) 内包装: 每盒 50 管;  
Inner packing: 50 Tube/box.
- 4) 示意图 Schematic:

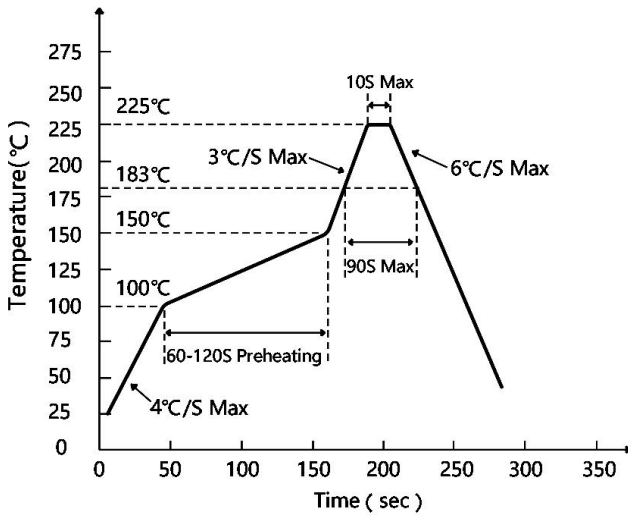


单位: mm

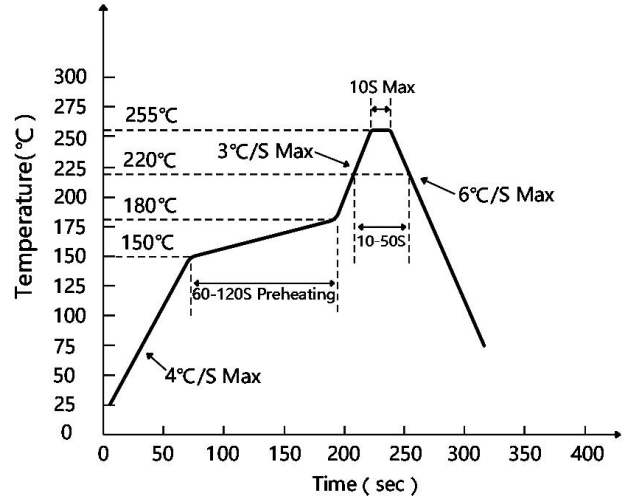
**◆ 可靠性测试 Reliability Test Items And Conditions**

| 实验项目<br>Test Items                                          | 参考标准<br>Reference | 实验条件<br>Test Conditions               | 时间<br>Time             | 样品数<br>Quantity | 判据<br>Criterion |
|-------------------------------------------------------------|-------------------|---------------------------------------|------------------------|-----------------|-----------------|
| 可焊性<br>Solderability                                        | JESD22-B102       | Tsol= (245±5) °C,<br>t=5s;            | 1 次1 times             | 22              | 0/22            |
| 耐焊接热Resistance to<br>Soldering Heat                         | JESD22-A106       | Tsol= (260±5) °C,<br>t=10s            | 3 次3 times             | 22              | 0/22            |
| 静电放电<br>ESD-HBM                                             | JESD22-A114       | Ta=25°C, HBM<br>(2000V)               | 正反各 3 次<br>P&N 3 times | 10              | 0/10            |
| 高温贮存High<br>emperature Storage                              | JESD22-A103       | Ta=125°C                              | 1000h                  | 22              | 0/22            |
| 低温贮存<br>Low Temperature<br>Storage                          | JESD22-A119       | Ta= -55°C                             | 1000h                  | 22              | 0/22            |
| 冷热冲击<br>Thermal Shock                                       | JESD22-A104       | -55°C(15min)↔<br>125°C(15min)         | 循环 300 次<br>300 cycles | 22              | 0/22            |
| 常温寿命试验<br>Lifespan Test                                     | JESD22-A108       | Ta=25°C, IF=50mA ,<br>Vcc=5V          | 1000h                  | 22              | 0/22            |
| 高温寿命试验<br>DC Operating Life                                 | JESD22-A108       | Ta=110°C, IF=20mA ,<br>Vcc=5V         | 1000h                  | 76              | 0/76            |
| 高温高湿偏压<br>High Temperature<br>High Humidity<br>bias Voltage | JESD22-A101       | Ta =85°C , RH=85%<br>IF=0mA , VCE=64V | 1000h                  | 22              | 0/22            |
| 高温偏压<br>High Temperature<br>bias Voltage                    | JESD22-A108       | Ta =110°C , IF=0mA ,<br>VCE=80V       | 1000h                  | 22              | 0/22            |
| 高压蒸汽试验<br>High pressure steam<br>test                       | JESD22-A102       | P=15PSIG , 121°C,<br>100%RH           | 96h                    | 22              | 0/22            |

### ◆ 回流焊温度曲线图 Solder Reflow Profile

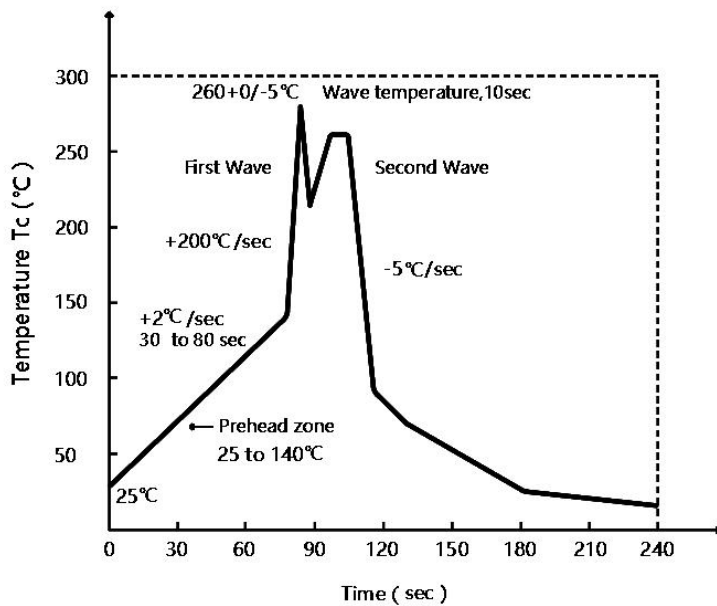


有铅制程 Lead Process



无铅制程 Lead Process

### ◆ 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  $350^{\circ}\text{C} \pm 5^{\circ}\text{C}$ , 时间  $\leq 3\text{s}$ 。

Hand soldering iron requirements: Temperature:  $350^{\circ}\text{C} \pm 5^{\circ}\text{C}$ , within 3s.

#### ◆ 注意 Attention

- 奥特半导体实施动态技术迭代机制，产品规格可能随工艺升级调整，最新技术参数以官网发布版本为准。

AOTE implements dynamic technical updates. Specifications are subject to change. Refer to the official website for the latest version.

- 用户需严格遵循本规格书限定的操作条件，因超范围使用（包括但不限于过载、高温、非兼容电路设计）导致的器件失效，不在质量保证范围内。

Users must strictly adhere to specified conditions. Failures caused by misuse (overload, high temperature, incompatible circuits) are excluded from warranty.

- 医疗设备、工业控制等关键场景应用前，需联系技术支持获取定制化验证方案。

Contact technical support for customized validation in critical applications (medical devices, industrial control).

- 本文档有效期至2025年12月31日，后续更新将通过官网公告推送。

This document is valid until Dec 31, 2025. Updates will be notified on the official website.

- 如需对技术参数或应用方案进行进一步确认，欢迎通过以下渠道获取官方支持：

For further clarification on technical specifications or application solutions, please contact us through official channels: