

晶体管光耦

Photo Transistor

**QX101X**

# QX101X

## Photo Transistor

### 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:  $\geq 80\%$  ( $I_F=5\text{mA}$ ,  $V_{CE}=5\text{V}$ ,  $T_a=25^\circ\text{C}$ )  
Current transfer ratio:  $\geq 80\%$  ( $I_F=5\text{mA}$ ,  $V_{CE}=5\text{V}$ ,  $T_a=25^\circ\text{C}$ )
- 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

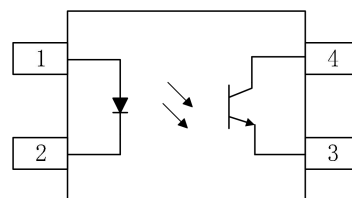
### 应用 Applications

- 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
- 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

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

项目 Item	符号 Symbol	数值 Value	单位 Unit	备注 Remark
爬电距离 Creepage Distance	L	> 8.0	mm	从输入端到输出端，沿本体最短距离路径 Measured from input terminals to output terminals, shortest distance path along body
电气间隙 Clearance Distance	L	> 8.0	mm	从输入端到输出端，通过空气的最短距离 Measured from input terminals to output terminals, shortest distance through air
绝缘距离 Insulation Thickness	DTI	> 0.4	mm	发射器和探测器之间的绝缘厚度 Insulation thickness between emitter and detector
峰值隔离电压 Peak Isolation Voltage	$V_{IORM}$	1500	$V_{peak}$	DIN/EN/IEC EN60747-5-5
瞬态隔离电压 Transient isolation voltage	$V_{IOTM}$	7000	$V_{peak}$	DIN/EN/IEC EN60747-5-5
隔离电压 Isolation Voltage	$V_{iso}$	> 5000	$V_{rms}$	For 1 min

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

参数 Parameter		符号 Symbol	额定值 Rating	单位 Unit
发射端 Input	正向电流 Forward Current	$I_F$	50	mA
	反向电压 Reverse Voltage	$V_R$	6	V
	功耗 Power Dissipation	$P_D$	70	mW
	热阻(结-环境) Thermal Resistance Junction to Ambient	$R_{thJ-A}$	250	$^{\circ}C/W$
	热阻(结-壳) Thermal Resistance Junction to Case	$R_{thJ-C}$	180	$^{\circ}C/W$
接收端 output	集电极功耗 Collector Power Dissipation	$P_C$	150	mW
	集电极电流 Collector Current	$I_C$	50	mA
	集电极-发射极电压 Collector-Emitter Voltage	$V_{CEO}$	80	V
	发射极-集电极电压 Emitter-Collector Voltage	$V_{ECO}$	6	V
总功耗 Total Power Dissipation		$P_{tot}$	250	mW
隔离电压 Isolation Voltage		$V_{iso}$	5000	$V_{rms}$
工作温度 Operating Temperature		$T_{opr}$	-55~+110	$^{\circ}C$
存储温度 Storage Temperature		$T_{stg}$	-55~+125	$^{\circ}C$
焊接温度		$T_{sol}$	260	$^{\circ}C$

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参数 Parameter	符号 Symbol	额定值 Rating	单位 Unit
Soldering Temperature			

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

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	$V_F$	$I_F=20mA$	-	1.2	1.4	V
	反向电流 Reverse Current	$I_R$	$V_R=4V$	-	-	10	$\mu A$
	输入电容 Terminal Capacitance	$C_t$	$V=0, f=1MHz$	-	30	250	pF
接收端 Output	集电极暗电流 Collector Dark Current	$I_{CEO}$	$V_{CE}=20V, I_F=0mA$	-	-	100	nA
	集电极-发射极击穿电压 Collector-Emitter Breakdown Voltage	$BV_{CEO}$	$I_C=0.1mA, I_F=0mA$	80	-	-	V
传输特性 Transfer Characteristics	发射极-集电极击穿电压 Emitter-Collector Breakdown Voltage	$BV_{ECO}$	$I_E=10\mu A, I_F=0mA$	6	-	-	V
	集电极-发射极饱和压降 Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_F=10mA, I_C=1mA$	-	-	0.3	V
	响应时间(ON) Response Time (ON)	$T_{on}$	$V_{CE}=5V, I_C=5mA$ $R_L=100\Omega$	-	4	-	$\mu s$
	响应时间(OFF) Response Time (OFF)	$T_{off}$	$V_{CE}=5V, I_C=5mA$ $R_L=100\Omega$	-	3	-	$\mu s$
	上升时间 Rise Time	$T_r$	$V_{CE}=5V, I_C=5mA$ $R_L=100\Omega$	-	2	18	$\mu s$
	下降时间 Fall Time	$T_f$	$V_{CE}=5V, I_C=5mA$ $R_L=100\Omega$	-	3	18	$\mu s$
	截止频率 Cut-off Frequency	$F_c$	$V_{CE}=5V, I_C=2mA$ $R_L=100\Omega, -3dB$	-	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 Parameter	符号 Symbol	条件 Condition	最小 Min.	标准值 Typ.	最大值 Max.	单位 Unit.	
传输特性 Transfer Characteristics	电流传输比 CTR*	QX1010	$I_F=5mA, V_{CE}=5V$	50	-	600	%
		QX1017	$I_F=5mA, V_{CE}=5V$	80	-	160	%
		QX1018	$I_F=5mA, V_{CE}=5V$	130	-	260	%
		QX1019	$I_F=5mA, V_{CE}=5V$	200	-	400	%
		QX1012	$I_F=10mA, V_{CE}=5V$	63	-	125	%
		QX1013	$I_F=10mA, V_{CE}=5V$	100	-	200	%
		QX1014	$I_F=10mA, V_{CE}=5V$	160	-	320	%
		QX1012	$I_F=1mA, V_{CE}=5V$	22	-	-	%
		QX1013	$I_F=1mA, V_{CE}=5V$	34	-	-	%
		QX1014	$I_F=1mA, V_{CE}=5V$	56	-	-	%
		QX1011	$I_F=5mA, V_{CE}=5V$	100	-	200	%
			$I_F=0.5mA, V_{CE}=5V$	15	-	90	%

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

Fig.1 Forward Current vs Forward Voltage

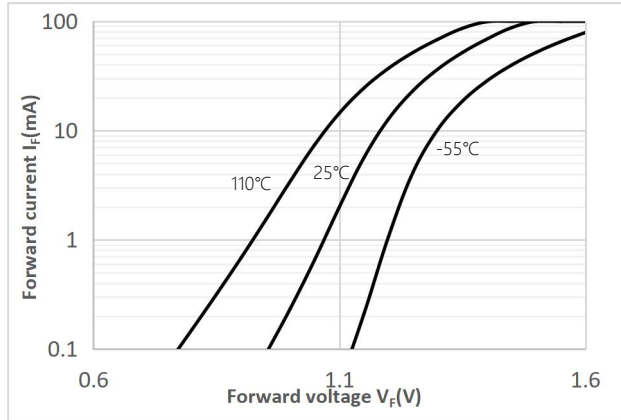


Fig.2 Collector Dark Current vs Ambient Temperature

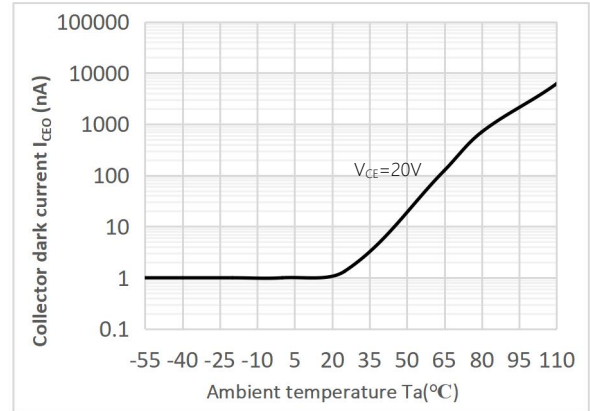


Fig.3 Collector Current vs. Collector-emitter Voltage

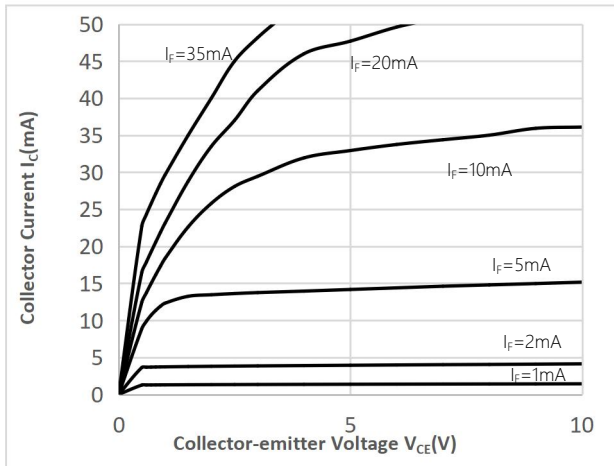


Fig.4 Relative Collector Current vs Forward Current

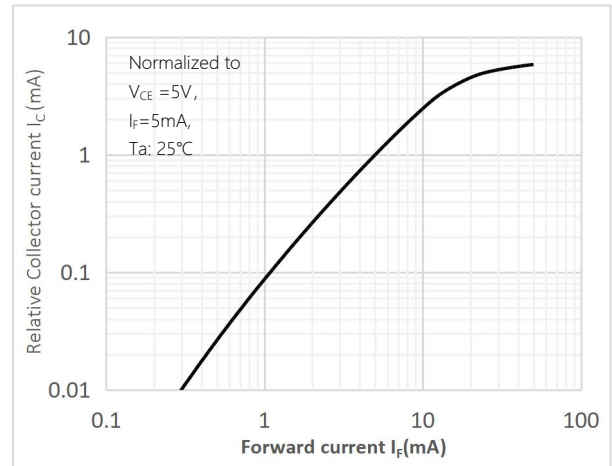


Fig.5 Relative Current Transfer Ratio vs. Forward Current

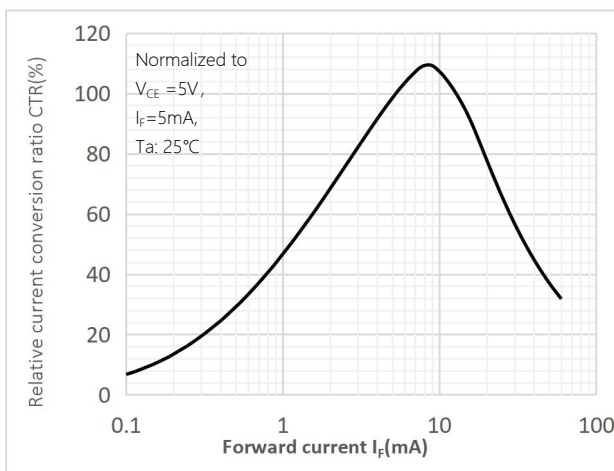
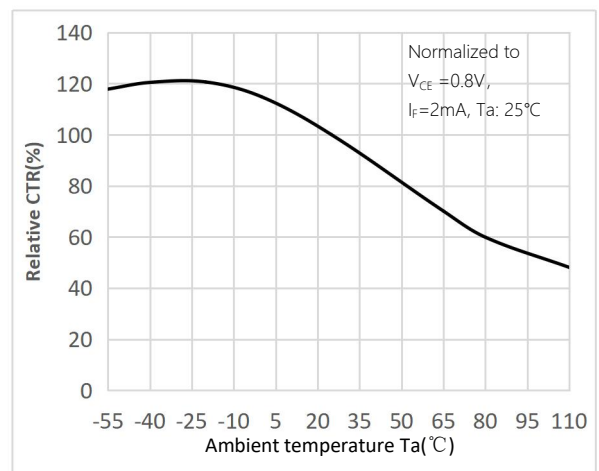


Fig.6 Relative Current transfer ratio vs Ambient temperature



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Fig.7 Relative Current transfer ratio vs Ambient temperature

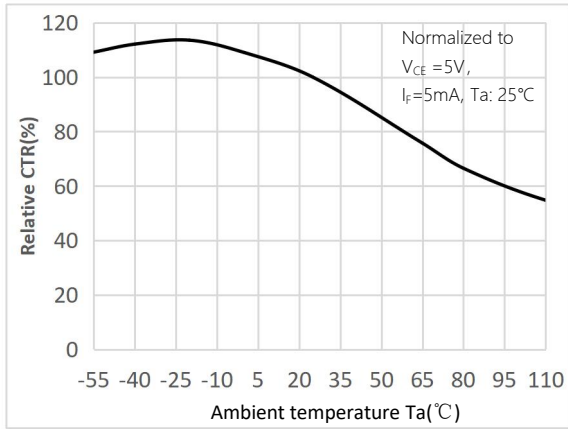


Fig.8 Collector-emitter Saturation Voltage vs. Ambient temperature

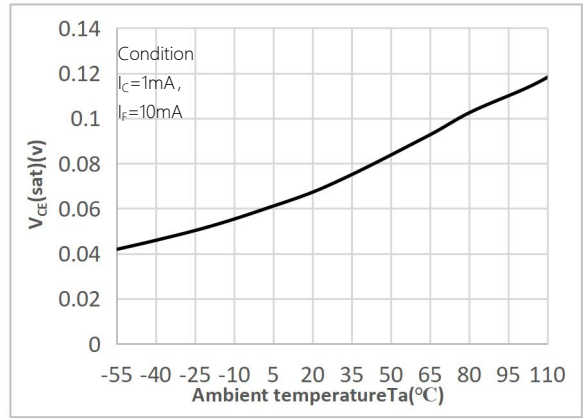


Fig.9 Turn on/Turn off vs. Collector Current

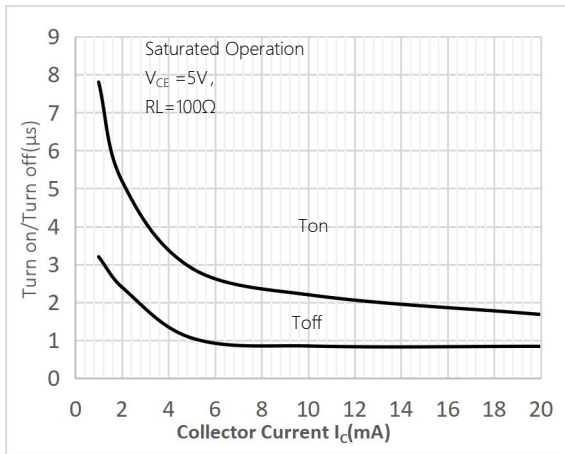


Fig.10 Turn on/Turn off vs Forward current

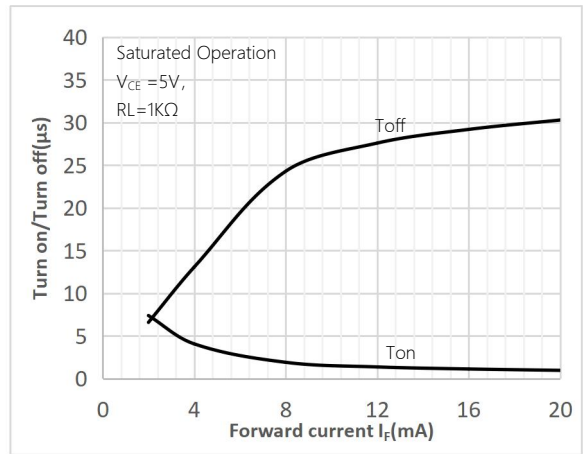
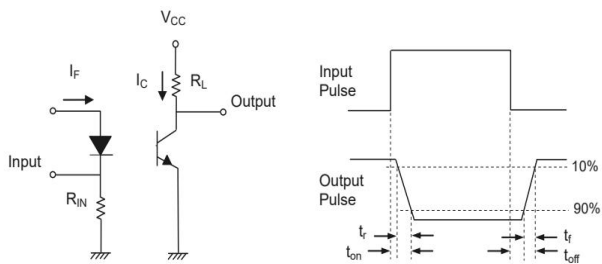


Fig.11 Switching Time Test Circuit & Waveforms



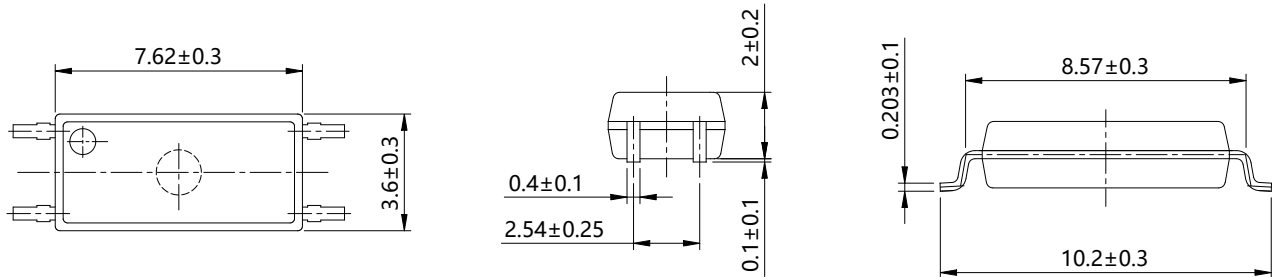


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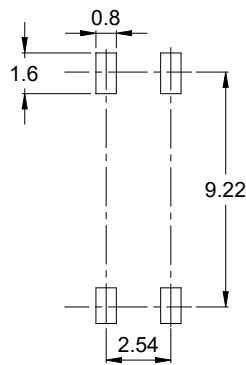
### 外形尺寸 Outline Dimensions

LSOP4



单位 Unit: mm

### 建议焊盘布局 Recommended Pad Layout

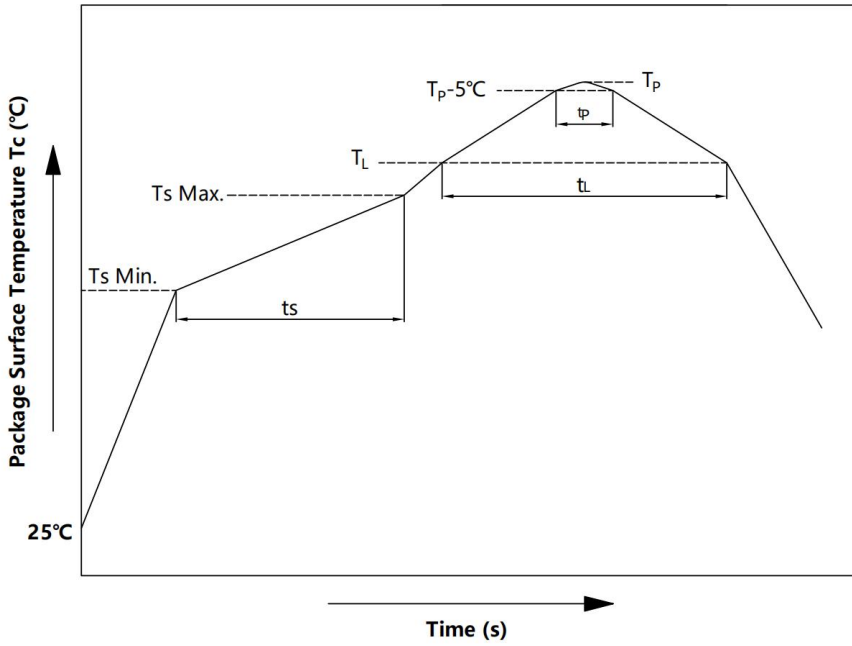


单位 Unit: mm

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



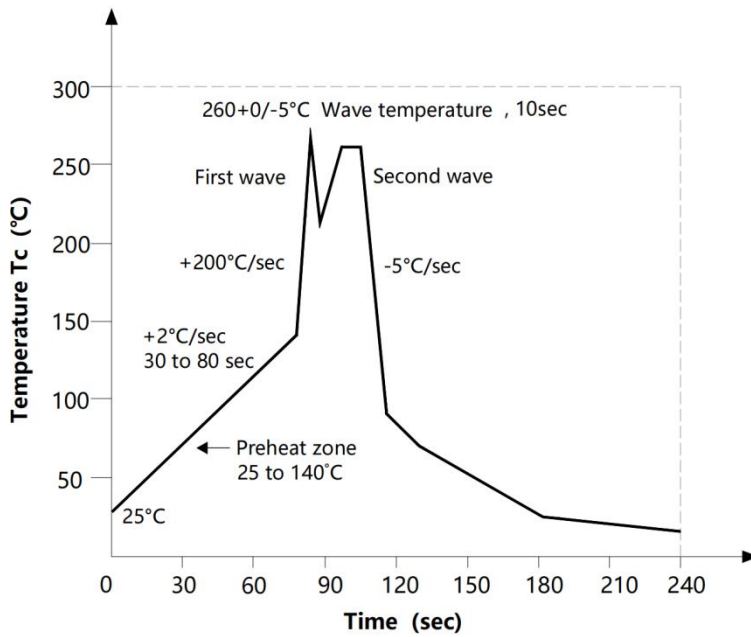
项目 Item	符号 Symbol	最小值 Min.	最大值 Max.	单位 Unit
预热温度 Preheat Temperature	$T_s$	150	200	$^\circ\text{C}$
预热时间 Preheat Time	$t_s$	60	120	s
升温速率 Ramp-Up Rate ( $T_L$ to $T_P$ )	-	-	3	$^\circ\text{C}/\text{s}$
液相线温度 Liquidus Temperature	$T_L$	217		$^\circ\text{C}$
时间高于 $T_L$ Time Above $T_L$	$t_L$	60	150	s
峰值温度 Peak Temperature	$T_P$	-	260	$^\circ\text{C}$
$T_c$ 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 Ramp-down Rate ( $T_P$ to $T_L$ )	-	-	6	$^\circ\text{C}/\text{s}$

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.

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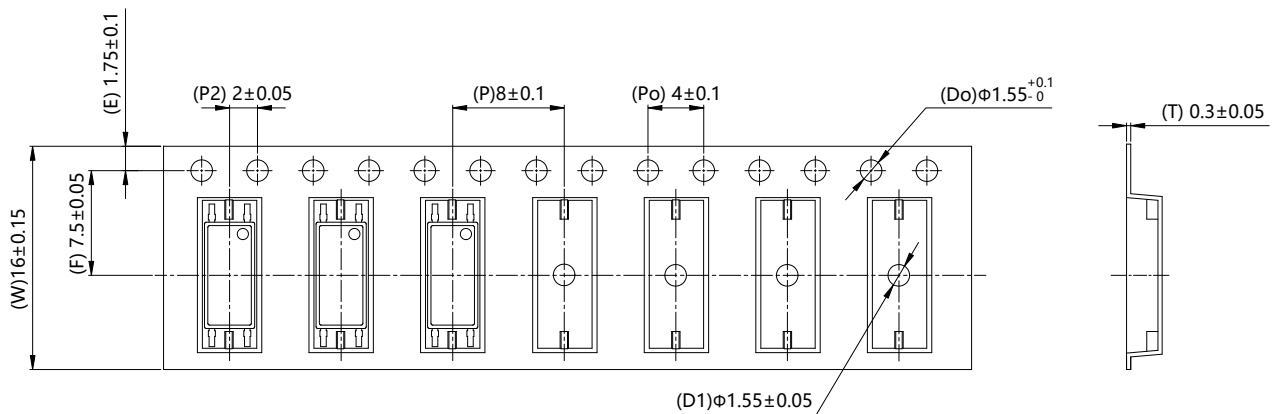
### 包装 Packing

#### ■ 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
LSOP4	卷盘 (φ330mm 蓝盘)	3000 只/盘	2 盘/盒	10 盒/箱	450*390*0.1mm	34*6*34cm	38*36*36.5cm	首端各空 50 个 空格, 末端空 100
Package Type	Packing Form	Quantity per Reel	Quantity per Box	Quantity per Carton	Antistatic Bag Specification	Box Specification	Carton Specification	Note
LSOP4	Reel (φ330mm Blue)	3000 pcs /reel	2 reels /box	10 boxes /ctn	450*390*0.1mm	34*6*34cm	38*36*36.5cm	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

### 注意 Attention

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