



# 光电耦合器

## OPTOCOUPLER

产品规格书  
Product Data Sheet

# Si-M501 系列

## Si-M501 Series

Si DCC  
Release

贵州硅耐光电有限公司

GuiZhou Silicon Nice Optoelectronic Co., Ltd.

## 描述 Description

Si-M501 系列将一个 AlGaAs 红外发光二极管作为发射器，该发射器通过 SOP5 封装与硅高速光电晶体管进行光学耦合。凭借坚固的共面双模结构，Si-M501 系列提供了最稳定的隔离特性。

The Si-M501 series combine an AlGaAs infrared emitting diode as the emitter which is optically coupled to a silicon high speed photo transistor in a plastic SOP5 package. With the robust coplanar double mold structure, Si-M501 series provide the most stable isolation feature

## 典型应用 Typical Applications


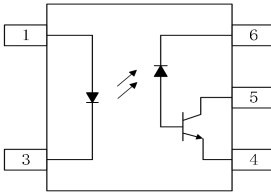
- 通信设备  
Telecommunication equipment
- CMOS-LSTTL-TTL 的输出接口  
Out interface to CMOS-LSTTL-TTL
- 计算机外围设备接口  
Computer-peripheral interface
- 电机驱动中的功率晶体管隔离  
Power transistor isolation in motor drives

## 特性 Features

- 高比特率：1MBit/s  
High Speed-1MBit/s
- 高隔离电压( $V_{ios}=3750V_{RMS}$ )  
High isolation( $V_{iso}=3750V_{RMS}$ )
- 集电极开路输出  
Open-Collector Output
- 宽工作温度：-40~100℃  
Wide operating temperature range: -40℃ to 100℃

真值表 Truth Table	
发光二极管 LED	$V_{CC}-V_{EE}$ POSITIVE GOING
OFF	HIGH
ON	LOW

## 封装与功能图 Package and Functional Diagram

封装 Package	内部连接图 Internal Connection Diagram	引脚分配 Pin Assignment
 SOP5		1: Anode                      5: VCC 4: $V_o$ 2: Cathode                    3: GND



## 安规与绝缘参数 Safety and Insulation Ratings

参数 Parameter		符号 Symbol	数值 Value	单位 Unit
最大额定隔离电压 Maximum Rated Withstanding Isolation Voltage	According to UL1577, t = 1 min	$V_{ISO}$	3700	$V_{RMS}$
最大瞬态隔离电压 Maximum Transient Isolation Voltage	According to DIN EN 60747-5-5	$V_{IOTM}$	5000	$V_{peak}$
最大峰值重复隔离电压 Maximum Repetitive Peak Isolation Voltage	According to DIN EN 60747-5-5	$V_{IORM}$	600	$V_{peak}$
爬电距离 Creepage Distance	/	L	5	mm

## 极限参数 Absolute Maximum Ratings

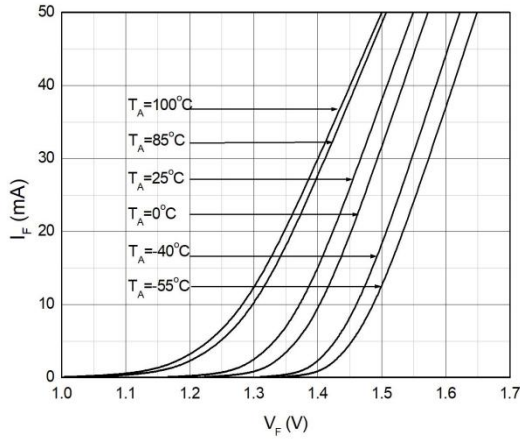
参数 Parameter		符号 Symbol	最小值 Min.	极限值 Rating	单位 Unit
输入端 Input	平均输入电流 Average Input Current	$I_{F(AVG)}$	-	25	mA
	反向电压 Reverse Voltage	$V_R$	-	5	V
	功耗 Power Dissipation	P	-	45	mW
	瞬态峰值输入电流(<1 $\mu$ s pulse width, 300 pps) Peak Transient Input Current (<1 $\mu$ s pulse width, 300 pps)	$I_{F(TRAN)}$	-	1	A
	结温 Junction Temperature	$T_J$	-	125	$^{\circ}C$
输出端 Output	电源电压 Supply Voltage	$V_{CC}$	-0.5	30	V
	输出电压 Output Voltage	$V_O$	-0.5	20	V
	输出电流 Output Current	$I_O$	-	8	mA
	峰值输出电流 Peak output current	$I_{O(PEAK)}$	-	16	mA
	输出功率 Output power dissipation	$P_O$	-	100	mW
	结温 Junction Temperature	$T_J$	-	125	$^{\circ}C$
工作温度 Operating Temperature	$T_{amb}$	-40	+100	$^{\circ}C$	
存储温度 Storage Temperature	$T_{stg}$	-55	+125	$^{\circ}C$	
焊接温度 Soldering Temperature	$T_{sld}$	-	260	$^{\circ}C$	



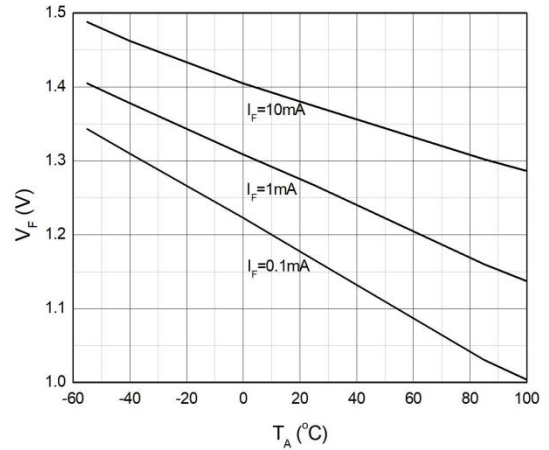
产品特性参数 Electro-optical Characteristics ( $T_{amb}=25^{\circ}C$ )

参数 Parameter		测试条件 Test Conditions	符号 Symbol	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Units
输入端 Input	输入端正向电压 Input Forward Voltage	$I_F=16mA$	$V_F$	-	1.45	1.8	V
	反向电 Input Reverse Breakdown Voltage	$V_R=5V$	$I_R$	-	-	10	$\mu A$
	输入端电容 Input capacitance	$V_F=0, f=1MHz$	$C_{IN}$	-	60	-	pF
输出端 Output	高电平电源电流 High Level Supply Current	$I_F=0mA, V_O = Open,$ $V_{CC}=15V, T_A=25^{\circ}C$	$I_{CCH}$	-	-	1	$\mu A$
		$T_A=0-70^{\circ}C$		-	-	2	
	高电平电源电流 Low Level Supply Current	$I_F=16mA, V_O = Open,$ $V_{CC}=15V$	$I_{CCL}$	-	200	-	$\mu A$
	低电平输出电压 Low Level Output Voltage	$I_F=0mA,$ $I_O=100mA$	$V_{OL}$	-	0.1	0.3	V
	高电平输出电流 High Level Output Current	$I_F=0mA$ $V_O=V_{CC}=5.5V$	$I_{OH}$	-	0.001	0.5	$\mu A$
		$I_F=0mA$ $V_O=V_{CC}=15V$		-	0.01	1	
$T_A=0-70^{\circ}C$		-		-	50		
传输特性 Transfer Characteristics	电流传输比 Current Transfer Ratio	$I_F=16mA, V_{CC}=4.5V$ $V_O=0.4V$	CTR	20	-	-	%
		$I_F=16mA, V_{CC}=4.5V$ $V_O=0.5V$		15	-	-	
	低电平输出电压 Low Level Output Voltage	$I_F=16mA, V_{CC}=4.5V$ $I_O=3.0mA$	$V_{OL}$	-	-	0.4	V
		$I_F=16mA, V_{CC}=4.5V$ $I_O=2.4mA$		-	-	0.5	
	输出高电平传输延迟 Propagation Delay Time to High Output Level	$I_F=16mA$ $V_{CC}=5V$	$t_{PHL}$	-	-	800	ns
	输出低电平传输延迟 Propagation Delay Time to Low Output Level	$R_L=1.9k\Omega$ $T_A=25^{\circ}C$	$t_{PLH}$	-	-	800	ns
	逻辑高电平共模瞬态抗扰度 Common Mode Transient Immunity (at Logic High)	$I_F = 0mA, V_{CC}=5V$ $R_L=1.9k\Omega, T_A=25^{\circ}C,$ $V_{CM}=1000V$	$ CM_H $	15	-	-	kv/ $\mu s$
	逻辑低电平共模瞬态抗扰度 Common Mode Transient Immunity (at Logic Low)	$I_F = 16mA, V_{CC} = 5V,$ $T_A=25^{\circ}C, V_{CM}=1000V$	$ CM_L $	15	-	-	kv/ $\mu s$
隔离电阻 Isolation Resistance	$V_{I-O}=500V$	$R_{ISO}$	$10^{12}$	-	-	$\Omega$	
隔离电容 Isolation capacitance	$f=1MHz$	$C_{ISO}$	-	0.3	-	pF	

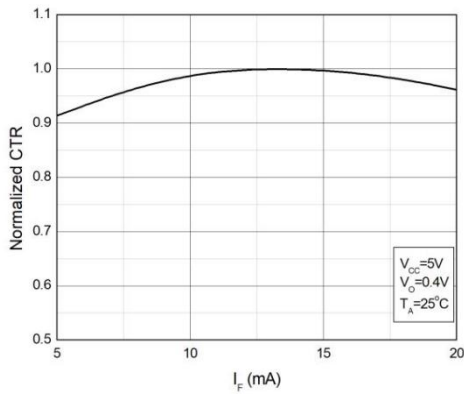
## 典型特性曲线 Typical Characteristics Curves



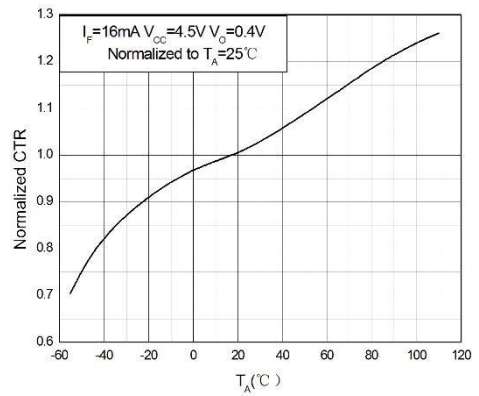
图例 1-正向电流与正向电压曲线图  
 Fig.1 Forward Current vs. Forward Voltage



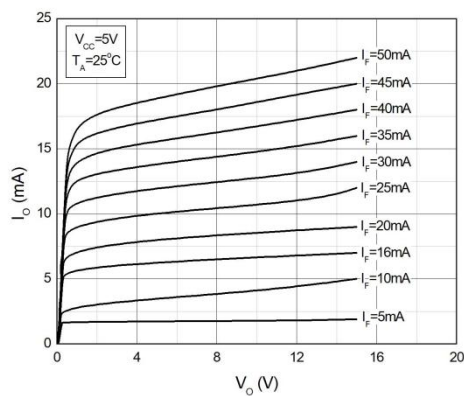
图例 2-正向电压与温度曲线图  
 Fig. 2 Forward Voltage vs. Temperature



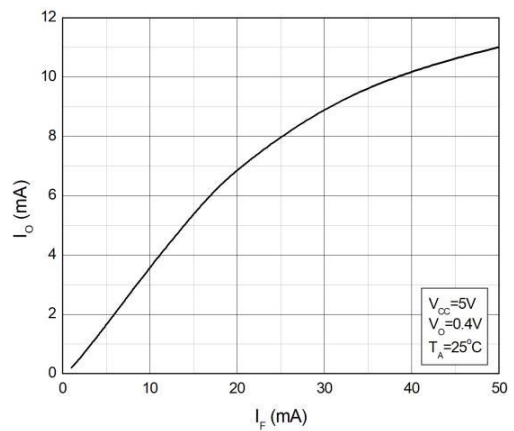
图例 3-归一化电流传输比与正向电流曲线图  
 Fig. 3 Normalized CTR vs. Input current



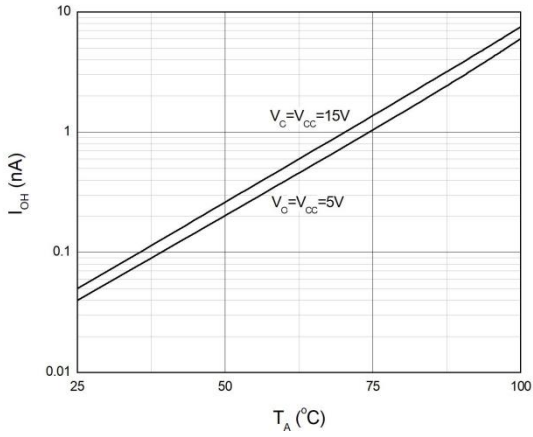
图例 4-归一化电流传输比与温度曲线图  
 Fig. 4 Normalized CTR vs. Temperature



图例 5-输出电流与输出电压曲线图  
 Fig.5 Output Current vs. Output Voltage

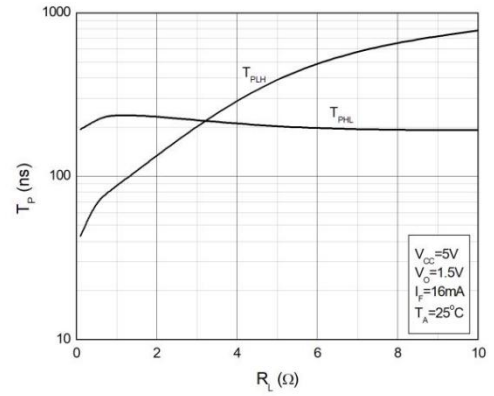


图例 6-输出电流与温度曲线图  
 Fig.6 Output Current vs. Forward Current



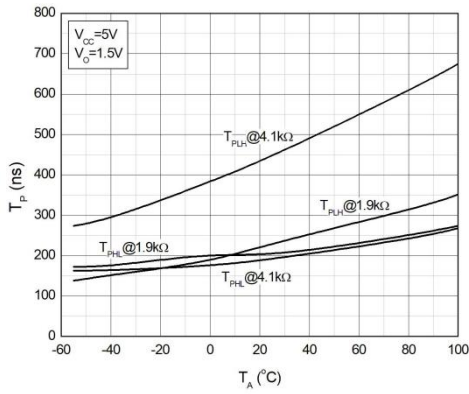
图例 7-高电平输出电流与温度曲线图

Fig.7 High Output Current VS. Temperature



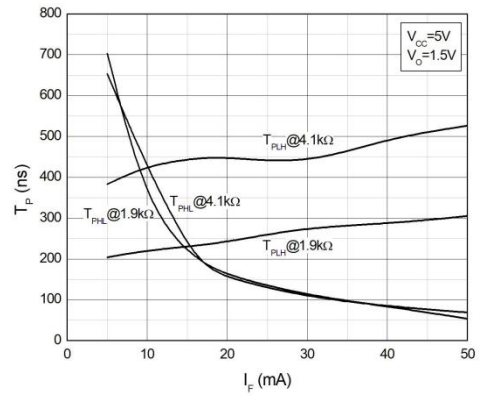
图例 8-传输延时与负载电阻曲线图

Fig.8 Propagation Delays vs. Load Resistance



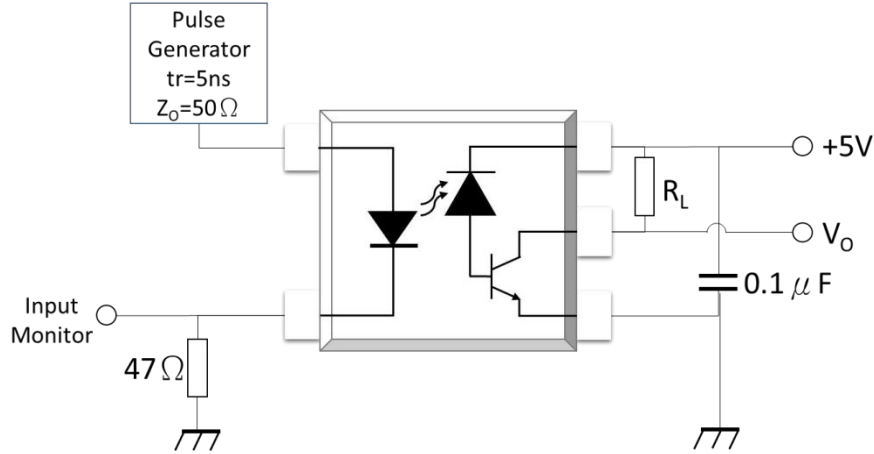
图例 9-传输延时与工作温度曲线图

Fig.9 Propagation Delays vs. Temperature



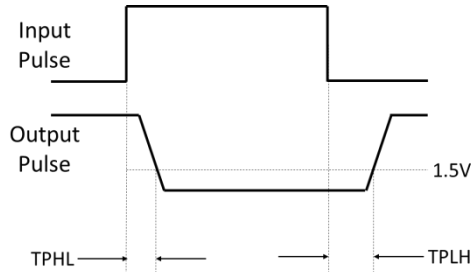
图例 10-传输延时与正向电流曲线图

Fig.10 Propagation Delays vs. Forward Current



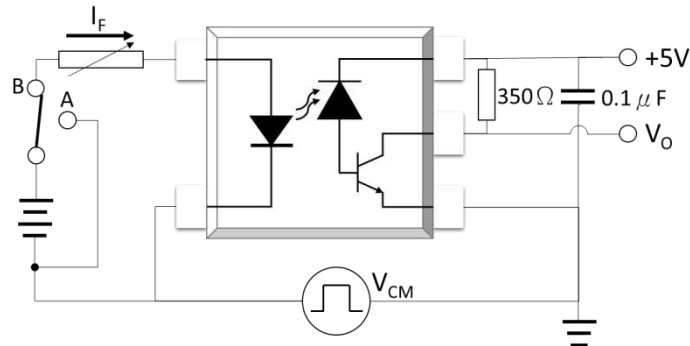
图例 11- $T_{PHL}, T_{PLH}$  测试电路

Fig.11  $T_{PHL}, T_{PLH}$  Test Circuit



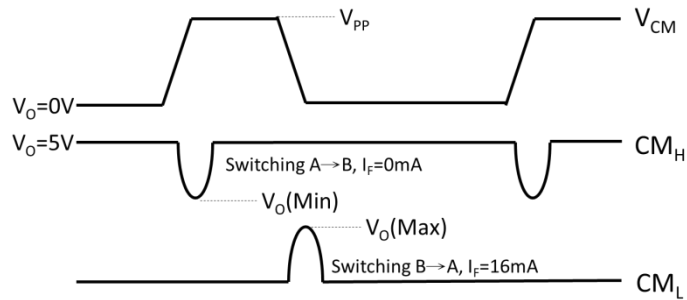
图例 12- $T_{PHL}, T_{PLH}$  波形

Fig.12 Waveforms of  $T_{PHL}, T_{PLH}$



图例 13-CMR 测试电路

Fig.16 Test Circuits for Common Mode Transient Immunity



图例 14-CMR 波形

Fig.17 Wave forms of Common Mode Transient Immunity



## 印字信息 Marking Information



- ◆ Si: 生产商代码 Manufacturer's Code Marking
- ◆ M501: 器件型号代码 Device Part Number
- ◆ Y: 年份代码 Last Digit of Year (ex: 4=2024,5=2025)
- ◆ WW: 周号代码 Week Code (01 to 53)
- ◆ N: 特殊代码或无 Special code Or None

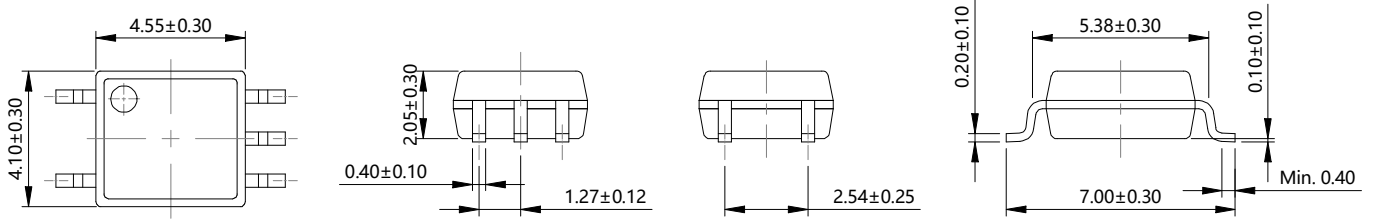
## 命名规则 Naming Rule

# Si-M501-WY-ZTT

- ◆ Si: 生产商代码 Manufacturer's Code Marking
- ◆ M501: 器件型号代码 Device Part Number
- ◆ W: 框架材质 (C=铜)
- ◆ Y: G/None (G=环保, None=非环保)
- ◆ Z: 封装 (Z=S:SOP5)
- ◆ TT: 补充码 A~Z or 0~9 or None

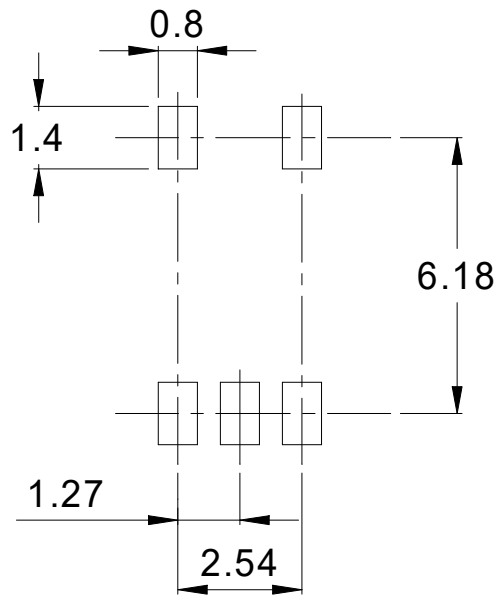
## 封装外形尺寸 Package Outline Dimensions

Si-M501



单位 Unit: mm

## 推荐焊盘尺寸 Recommended Footprint Patterns

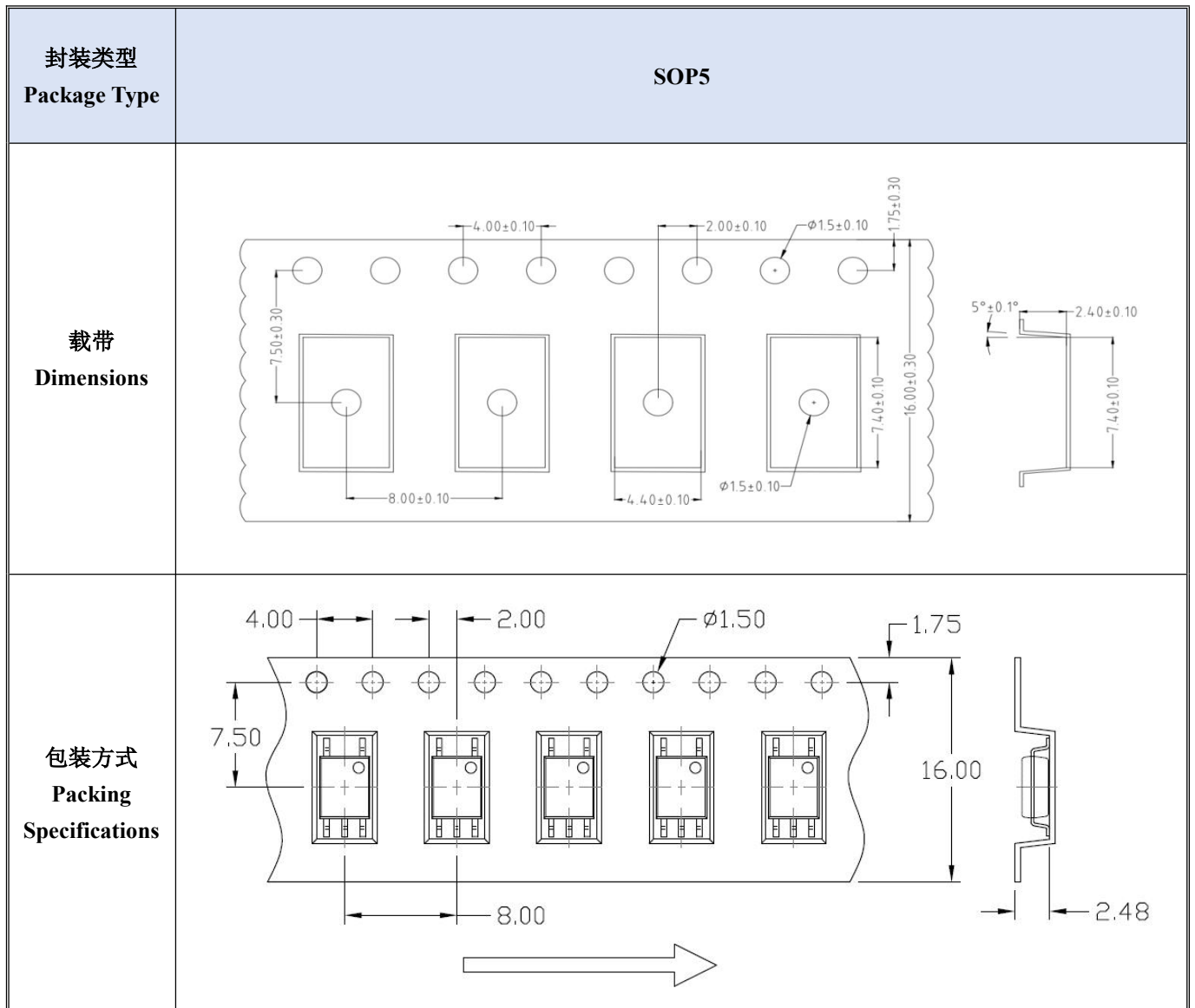


单位 Unit: mm

## 包装 Packing

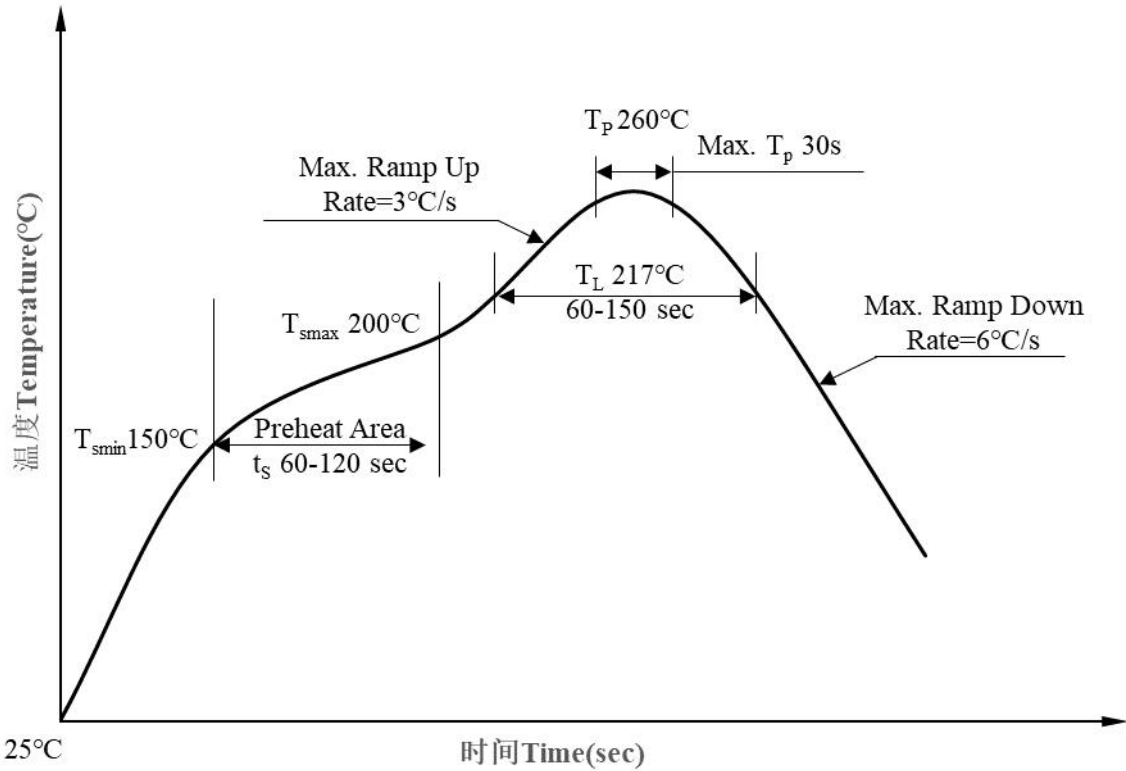
封装类型 Package Type	每盘数量 Quantity per Reel	内盒数量 Quantity per Inner Box	外箱数量 Quantity per Carton	内盒尺寸 Inner Box Dimensions	外箱尺寸 Carton Dimensions
SOP5	3000 pcs/reel	6000 pcs/inner box	60,000 pcs/carton	353*340*60mm	650*375*365mm

## 载带与卷盘 Tape and Reel



单位: mm

## 回流焊温度曲线 Solder Reflow Temperature Profile



曲线项目 Profile Item		符号 Symbol	数值 Value	单位 Unit
预热区 Preheat Area	最低温度 Temperature Min.	$T_{smin}$	150	°C
	最高温度 Temperature Max.	$T_{smax}$	200	°C
	时间 Time (min. to max.)	$t_s$	60~120	sec
焊接区 Soldering Area	温度 Temperature	$T_L$	217	°C
	时间 Time	$t_L$	60~150	sec
峰值温度 Peak Temperature		$T_p$	260	°C
峰值温度 $T_p$ 至 $T_p-5^\circ\text{C}$ 之间的时间 Time within $5^\circ\text{C}$ of Peak Temperature: $T_p - 5^\circ\text{C}$		$t_p$	30	sec max.
上升速率 Ramp-up rate			3	°C / sec max.
下降速率 Ramp-down rate			6	°C / sec max.

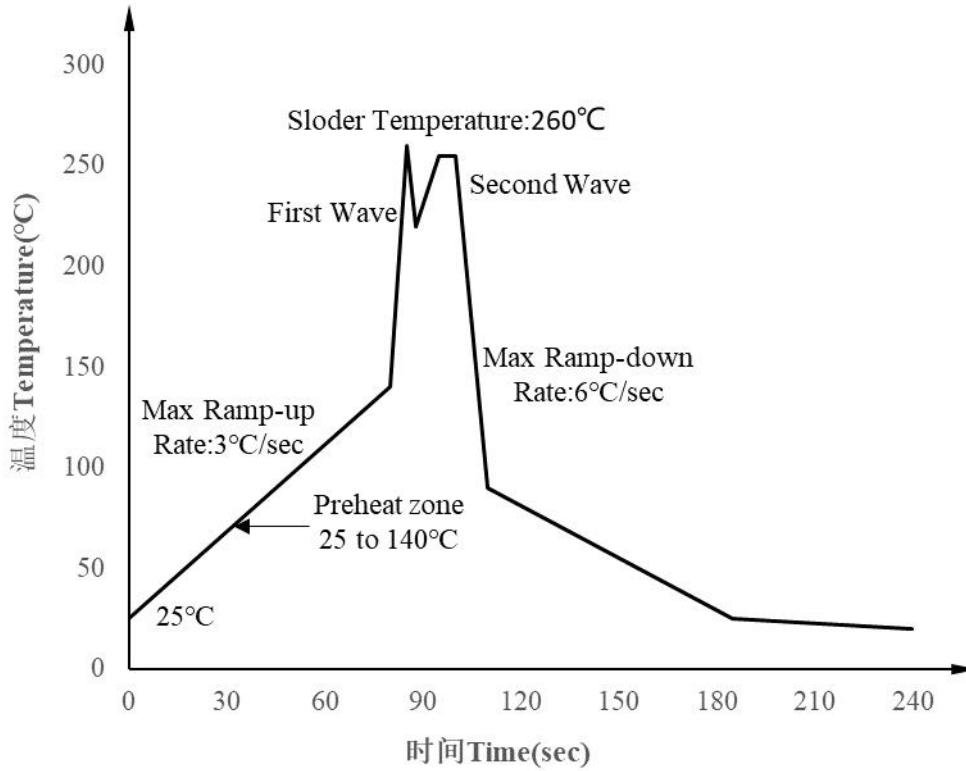
注：参考 IPC/JEDEC J-STD-020D 标准。

Note: Reference: IPC/JEDEC J-STD-020D.

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。

One time soldering reflow is recommended within the condition of temperature and time profile shown below. Do not solder more than three times.

## 波峰焊温度曲线 Wave soldering Temperature Profile



详情请参考 JEDEC 标准 JESD22-A111

For more details, please refer to the JESD22-A111 of JEDEC standards.

## 手工烙铁焊接 Hand soldering by soldering iron

- (1) 建议一次完成焊接。  
One time soldering is recommended.
- (2) 温度  $360^{\circ}\text{C} \pm 5^{\circ}\text{C}$ , 时间  $\leq 3\text{s}$ 。  
Temperature:  $360^{\circ}\text{C} \pm 5^{\circ}\text{C}$ , within 3s.

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