



## 高速光耦

High Speed Photo  
Coupler

# AT0531

Product Data Sheet

**AOTE DCC**  
**RELEASE**

**台湾奥特半导体科技有限公司**

TAIWAN AOTE SEMICONDUCTOR TECHNOLOGY CO.,LTD

[www.aotesemi.com](http://www.aotesemi.com)

## 概述 Description

AT0531双通道光电耦合器包含输入和输出间具有电气绝缘的一对发光二极管和光检测器。光二极管偏压和输出晶体管集电极的独立接线可以通过降低基极到集电极电容将速度提高到传统光晶体管耦合器的百倍以上。

The AT0531 dual channel optocouplers contain a pair of light emitting diodes and integrated photodetectors with electrical insulation between input and output. Separate connection for the photodiode bias and output transistor collectors increase the speed up to a hundred times that of a conventional phototrans.

## 特性 Features

- 高速响应 1 MBit/s  
High speed – 1 MBit/s
- TTL 电平兼容  
TTL Compatible
- 高密度封装  
High Density Packaging
- 3MHz 带宽  
3MHz Bandwidth
- 集电极开路输出  
Open Collector Outputs
- 符合安规标准：UL 1577，VDE DIN EN60747-5-5 (VDE 0884-5)，CQC11-471543-2022  
Meet Safety standard：UL 1577, VDE DIN EN60747-5-5 (VDE 0884-5)，CQC11-471543-2022

## 应用 Applications

- 高速逻辑接地隔离  
High Speed Logic Ground Isolation
- 取代脉冲变压器  
Pulse Transformers
- 模拟信号接地隔离  
Analog Signal Ground Isolation
- 极性感应  
Polarity Sensing
- 隔离模拟放大器  
Isolated Analog Amplifier

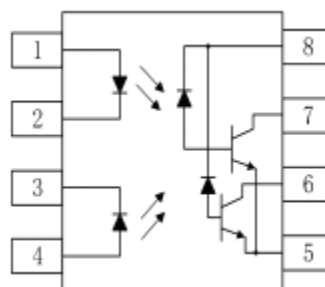
## 真值表 Truth table

LED	VO
OFF	H
ON	L

## 封装和原理图 Package and Schematic Diagram



SOP8



### Pin Configuration

- 1. Anode 1      8.VCC
- 2. Cathode 1    7.VO 1
- 3. Cathode 2    6.VO 2
- 4. Anode 2      5.GND

注：在引脚 5 和 8 之间必须连接一个 0.1uF 的旁路电容器。

Note: - 0.1uF bypass capacitor must be connected between pins 5 and 8.



## 产品型号命名规则 Order Code

# AT 053X - 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 (X: 0 , 1 , 4)
- 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 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)
- 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：0、1、4  
“XX” denotes the classification : 0、1、4
- 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



**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	>4.6	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	>4.6	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 <sub>IORM</sub>	600	V <sub>peak</sub>	DIN/EN/DIN EN60747-5-5
瞬态隔离电压 Transient isolation voltage	V <sub>IOTM</sub>	5000	V <sub>peak</sub>	DIN/EN/DIN EN60747-5-5
隔离电压 Isolation Voltage	V <sub>iso</sub>	> 3750	V <sub>rms</sub>	For 1 min

**极限参数 Absolute Maximum Ratings (Ta = 25°C)**

参数 Parameter		符号 Symbol	额定值 Rating	单位 Unit
发射端 Input	正向电流(平均) DC/Average Forward Input Current	I <sub>F(avg)</sub>	25	mA
	正向峰值电流 (50%占空比, 1ms p.w.) Peak forward input current (50% duty cycle, 1 ms p.w.)	I <sub>F(pk)</sub>	50	mA
	反向电压 Reverse Voltage	V <sub>R</sub>	5	V
	正向瞬态峰值电流(≤1μs p.w., 300pps) Peak transient input current (≤1μs p.w., 300 pps)	I <sub>F(trans)</sub>	1	A
	输入功耗 Input Power Dissipation	P <sub>D</sub>	45	mW
接收端 Output	电源电压 Supply Voltage	V <sub>CC</sub>	-0.5 ~ 30	V
	输出电流 Output Current	I <sub>O</sub>	8	mA
	输出电流峰值 Peak Output Current	I <sub>O(pk)</sub>	16	mA
	输出电压 Output Voltage	V <sub>O</sub>	-0.5 to 20	V
	输出功耗 Power Dissipation	P <sub>O</sub>	35	mW
工作温度 Operating Temperature	T <sub>opr</sub>	-55 ~ +100	°C	
存储温度 Storage Temperature	T <sub>stg</sub>	-55 ~ +125	°C	
焊接温度 Lead Solder Temperature	T <sub>sol</sub>	260	°C	

**产品特性参数 Electro-optical Characteristics (Ta = 25°C, V<sub>DD</sub> = 3.3V)**

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 <sub>F</sub>	I <sub>F</sub> = 16mA	1.0	1.35	1.7	V
	反向击穿电压 Reverse Breakdown Voltage	B <sub>VR</sub>	I <sub>R</sub> = 10μA	5	-	-	V
	输入电容 Input Capacitance	C <sub>IN</sub>	V = 0, f = 1MHz	-	60	-	pF
接收端 Output	低电平输出电压 Logic Low Output Voltage	0530	I <sub>F</sub> = 16mA, V <sub>CC</sub> = 4.5V, I <sub>O</sub> = 11mA	-	0.1	0.5	V
		0531 / 0534	I <sub>F</sub> = 16mA, V <sub>CC</sub> = 4.5V, I <sub>O</sub> = 3mA	-	-	-	-
	高电平输出电流 Logic High Output Current	I <sub>OH</sub>	V <sub>CC</sub> = V <sub>O</sub> = 5.5V, I <sub>F</sub> = 0mA	-	0.003	0.5	μA
			V <sub>CC</sub> = V <sub>O</sub> = 15V, I <sub>F</sub> = 0mA	-	-	50	μA
	高电平电源电流 Logic High Supply Current	I <sub>CH</sub>	V <sub>CC</sub> = 15V, I <sub>F</sub> = 0mA	-	0.05	4	μA
低电平电源电流 Logic Low Supply Current	I <sub>CL</sub>	V <sub>CC</sub> = 15V, I <sub>F</sub> = 16mA	-	100	400	μA	
传输特性 Transfer Characteristics	电流传输比 Current Transfer Ratio	0530	I <sub>F</sub> = 16mA, V <sub>CC</sub> = 4.5V, V <sub>O</sub> = 0.5V	7	-	-	%
		0531 / 0534		19	-	-	%
隔离电阻 <sup>①</sup> Isolation Resistance		R <sub>I-O</sub>	V <sub>I-I</sub> = 500V, 40 ~ 60% R.H.	-	10 <sup>2</sup>	-	Ω
隔离电容 <sup>①</sup> Isolation Capacitance		C <sub>I-O</sub>	V = 0, f = 1MHz	-	0.6	-	pF
输入隔离电阻 <sup>②</sup> Input Isolation Resistance		R <sub>I-I</sub>	V <sub>I-I</sub> = 500V, 40 ~ 60% R.H.	-	10 <sup>11</sup>	-	Ω
输入隔离电容 <sup>②</sup> Input Isolation Capacitance		C <sub>I-I</sub>	V = 0, f = 1MHz	-	0.25	-	pF

注 : Note:

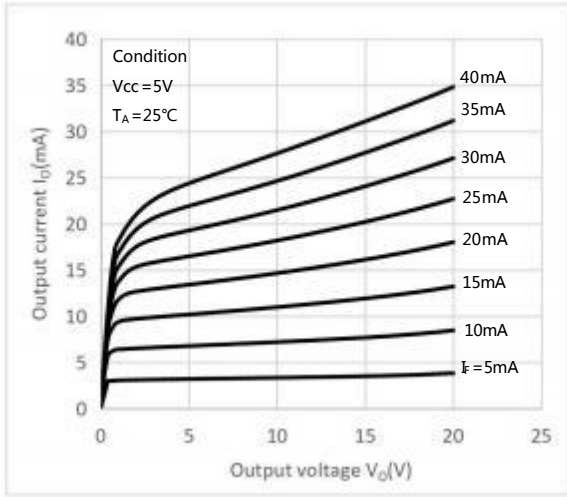
- 测量时将 PIN1,2,3,4 短接 , PIN5,6,7,8 短接。  
When measuring, short-circuit PIN1, 2, 3, and 4, and short-circuit PIN5, 6, 7, and 8.
- 测量时将 PIN1,2 短接 , PIN3,4 短接。  
When measuring, short-circuit PIN1, 2, and short-circuit PIN3, 4.

## 开关特性 Switching Specification

参数 Parameter		符号 Symbol	条件 Condition	最小 Min.	典型 Typ.	最大 Max.	单位 Unit
输出高电平传播延迟 Propagation Delay Time to High Output Level		$T_{PLH}$	$R_L = 4.1k\Omega$	-	1.3	1.5	us
			$R_L = 1.9k\Omega$	-	0.6	0.8	us
输出低电平传播延迟 Propagation Delay Time to Low Output Level		$T_{PHL}$	$R_L = 4.1k\Omega$	-	0.2	1.5	us
			$R_L = 1.9k\Omega$	-	0.2	0.8	us
输出高电平共模瞬态抑制 Common Mode Transient Immunity at High Output Level		$ CM_H $	$I_F = 0mA$ $R_L = 4.1k\Omega$ $T_A = 25^\circ C$ $ V_{CM}  = 10V$	1	10	-	kV/ $\mu s$
			$I_F = 0mA$ $R_L = 1.9k\Omega$ $T_A = 25^\circ C$ $ V_{CM}  = 10V$	1	10	-	kV/ $\mu s$
				15	30	-	
输出低电平共模瞬态抑制 Common Mode Transient Immunity at Low Output Level		$ CM_L $	$I_F = 16mA$ $R_L = 4.1k\Omega$ $T_A = 25^\circ C$ $ V_{CM}  = 10V$	1	10	-	kV/ $\mu s$
			$I_F = 16mA$ $R_L = 1.9k\Omega$ $T_A = 25^\circ C$ $ V_{CM}  = 10V$	1	10	-	kV/ $\mu s$
				15	30	-	

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

Fig.1 Output current vs. Output voltageFig.



2 Normalized CTR vs. Input current

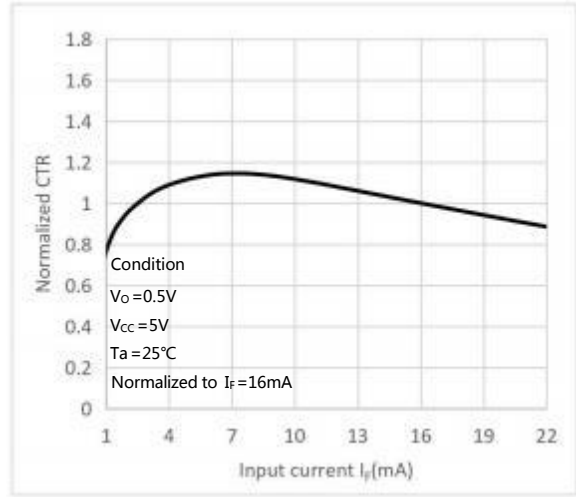
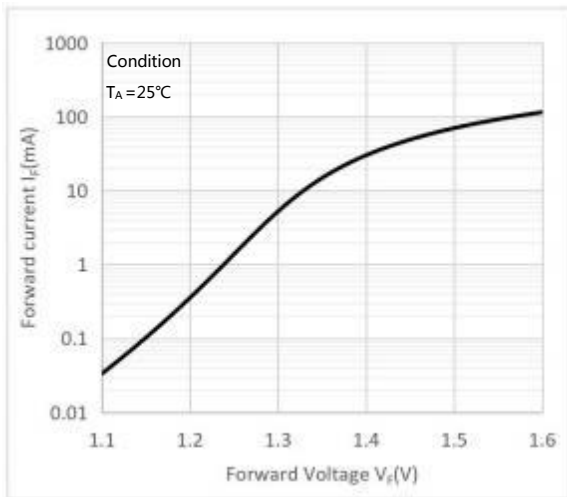


Fig.3 Forward current vs. Forward voltageFig.



4 Normalized CTR vs. Ambient temperature

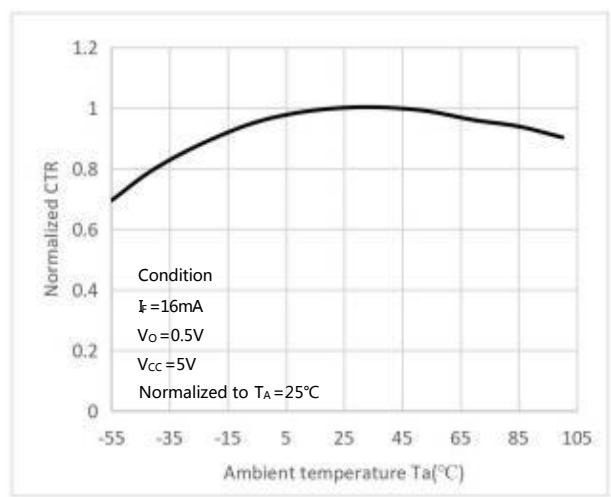


Fig.5 Propagation delay vs. Ambient temperature

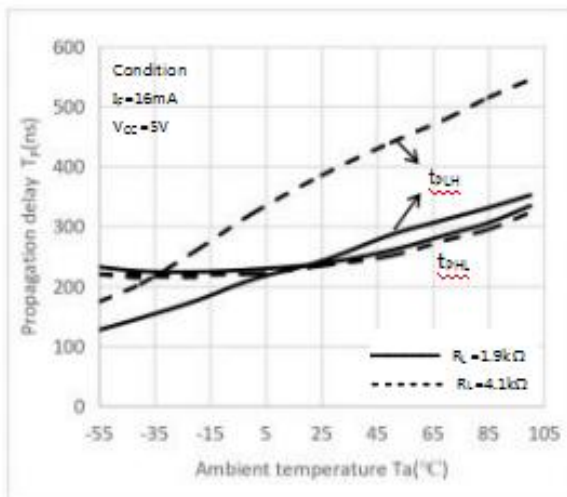


Fig.6 Propagation delay vs. Load resistance

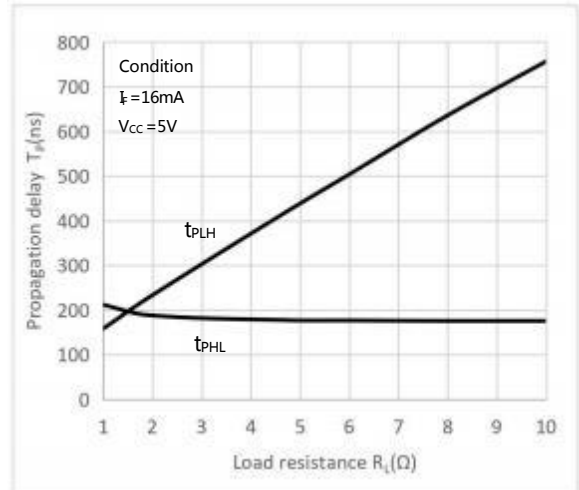


Fig.7 High level output current vs. Ambient temperature

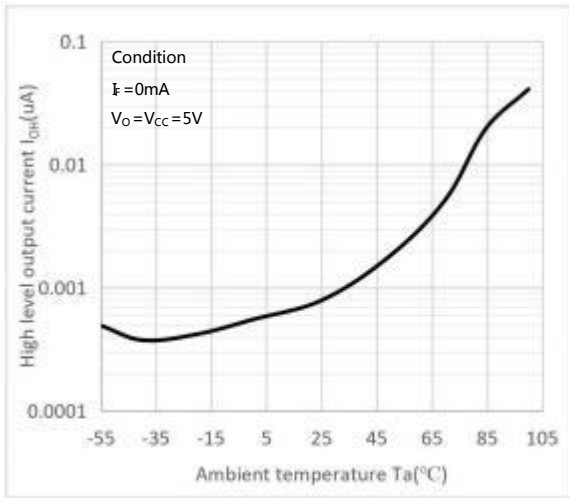
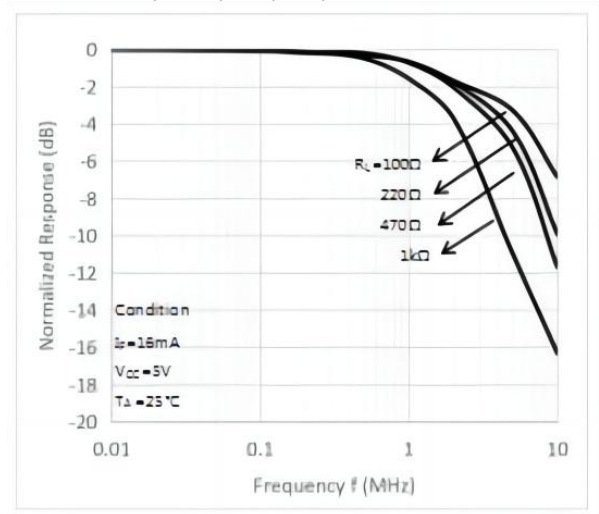
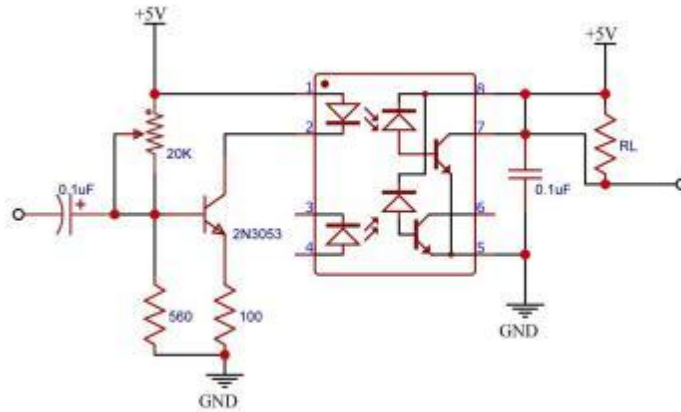


Fig.8 Frequency Response

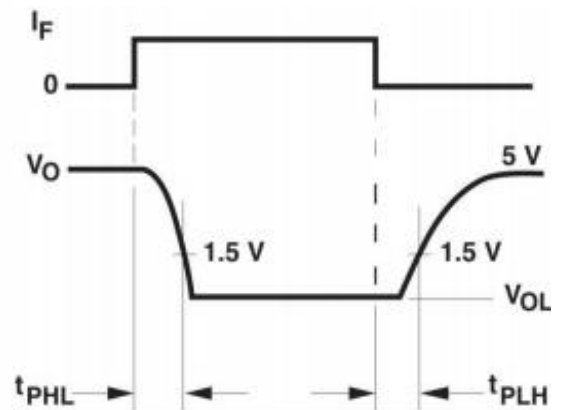
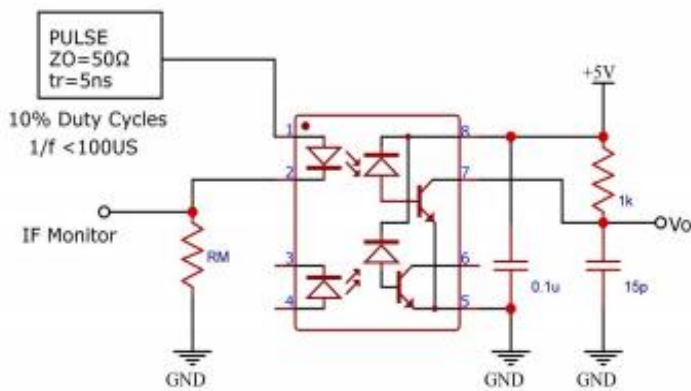




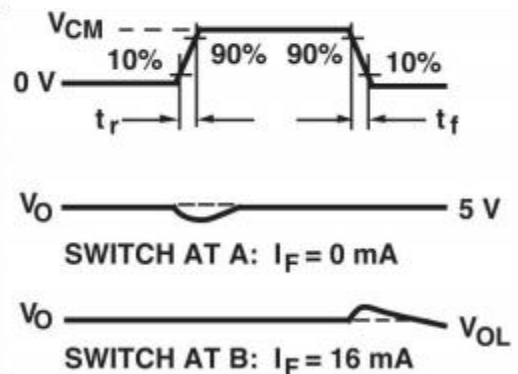
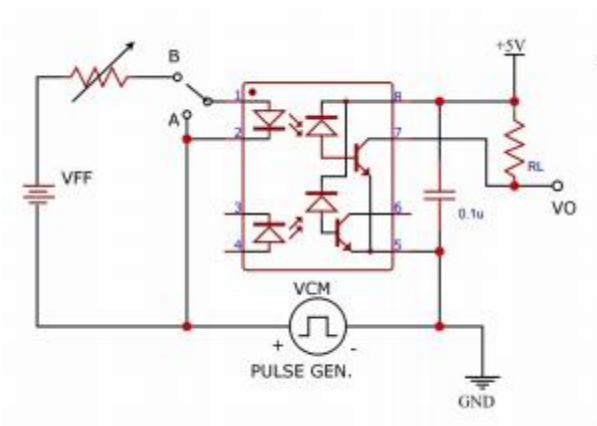
**频率响应测试电路 Test Circuit for Frequency Response**



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

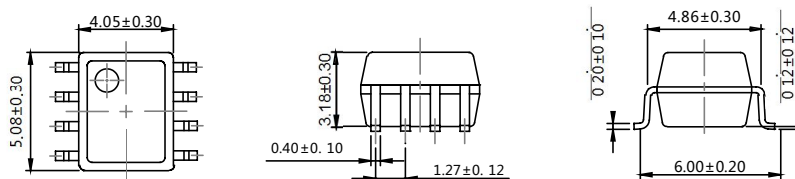


**CMR 测试电路 Test Circuit for Common Mode Transient Immunity**



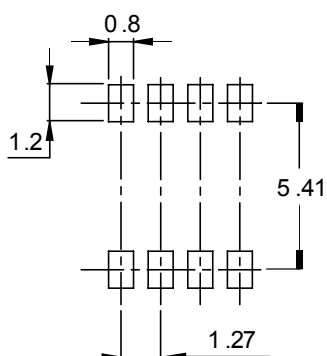
## 外形尺寸 Outline Dimensions

### SOP8



单位 Unit: mm

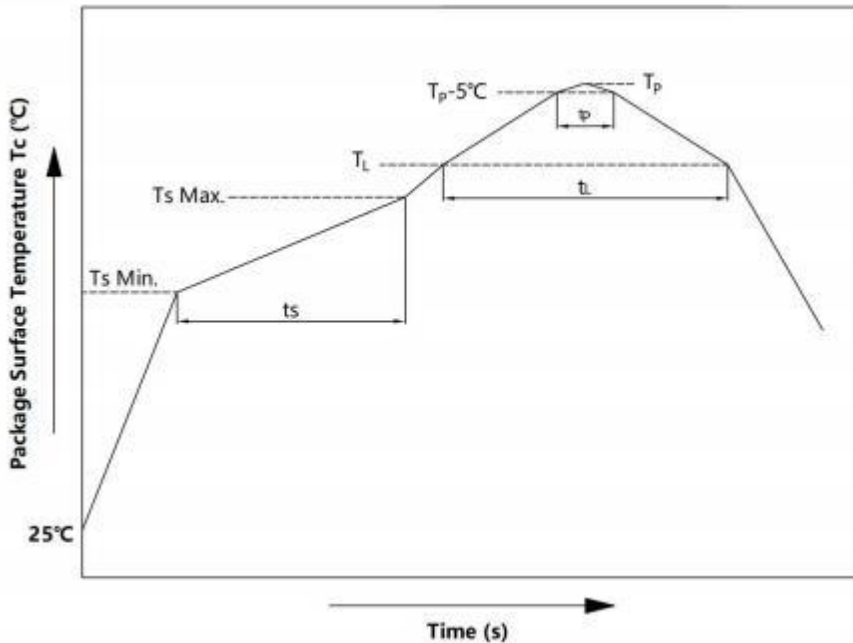
## 建议焊盘布局 Recommended Pad Layout



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**


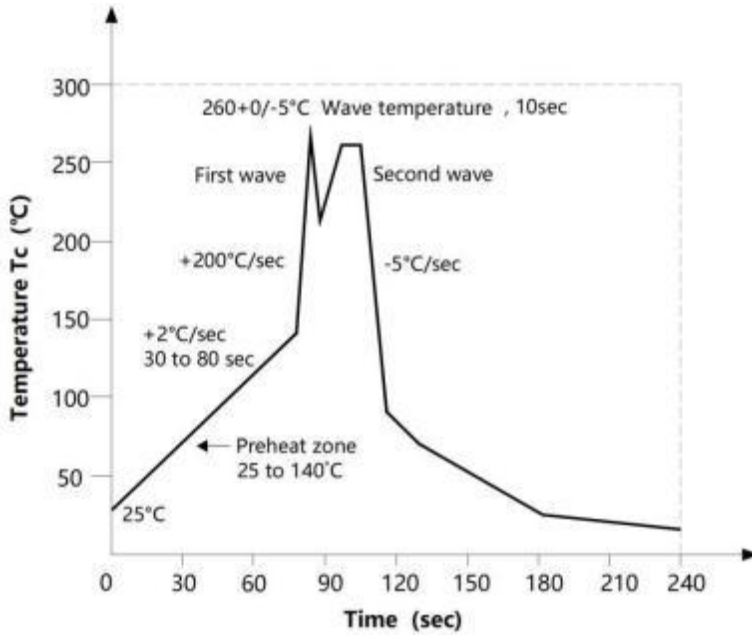
项目 Item	符号 Symbol	最小值 Min.	最大值 Max.	单位 Unit
预热温度 Preheat Temperature	Ts	150	200	°C
预热时间 Preheat Time	ts	60	120	s
升温速率 Ramp-Up Rate (T <sub>L</sub> to T <sub>P</sub> )	-	-	3	°C/s
液相线温度 Liquidus Temperature	T <sub>L</sub>	217		°C
时间高于 T <sub>L</sub> Time Above T <sub>L</sub>	t <sub>L</sub>	60	150	s
峰值温度 Peak Temperature	T <sub>P</sub>	-	260	°C
Tc 在(T <sub>P</sub> -5)和 T <sub>P</sub> 之间的时间 Time During Which Tc Is Between (T <sub>P</sub> -5) and T <sub>P</sub>	t <sub>p</sub>	-	30	s
降温速率 Ramp-down Rate(T <sub>P</sub> to T <sub>L</sub> )	-	-	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.

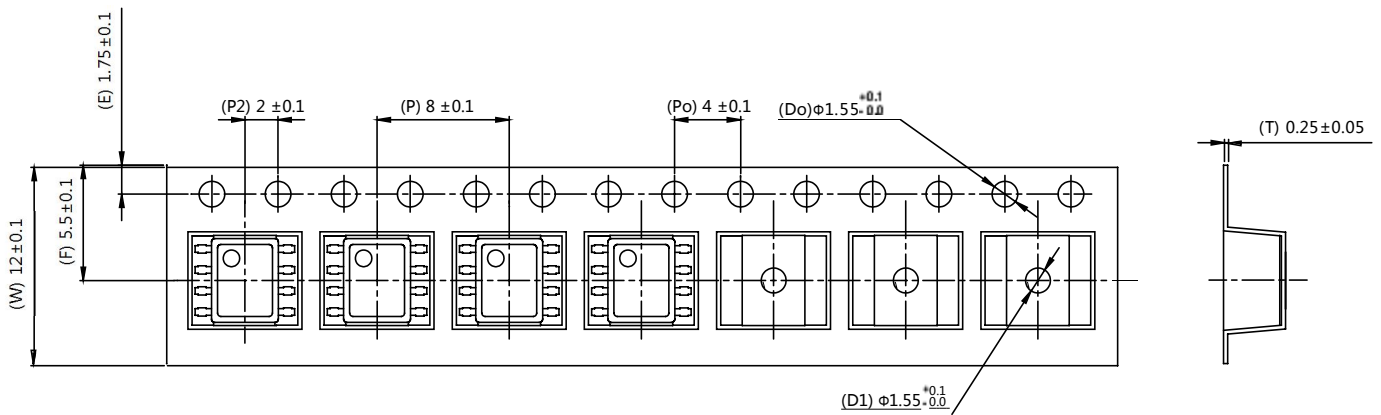
## 包装 Packing

### ■ 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
SOP8	编带 ( $\phi 330\text{mm}$ 蓝盘)	2k /盘	2 盘/盒	10 盒/箱	450*390*0.1mm	340*60*340mm	620*360*365mm	首尾端空至少 200mm
Package Type	Packing Form	Quantity per Reel	Quantity per Box	Quantity per Carton	Antistatic Bag Specification	Box Specification	Carton Specification	Note
SOP8	Reel ( $\phi 330\text{mm}$ Blue)	2k pcs/reel	2 reels /box	10 boxes /ctn	450*390*0.1mm	340*60*340mm	620*360*365mm	Guard band 200mm min.

### ■ 编带包装 Tape & Reel

- 1) 每卷数量：2000 只。  
Qty/reel：2000 pcs.
- 2) 每箱数量：40000 只。  
Qty/ctn：40000 pcs.
- 3) 内包装：每盒 2 盘。  
Inner packing：2reels/box
- 4) 示意图 Schematic：



单位 Unit：mm

## 注意 Attention

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