



晶体管光耦 Photo Transistor

AT451

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

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概述 Description

AT451是一款由发光二极管和光电晶体管组成的高耐压($V_{CEO} \geq 350V$)光电耦合器。 四引脚封装 (SOP)。
 The AT451 is a photoelectric coupler composed of light-emitting diode and phototransistor. It is high voltage resistance($V_{CEO} \geq 350V$). It is packaged in a 4-pin small outline SOP package.

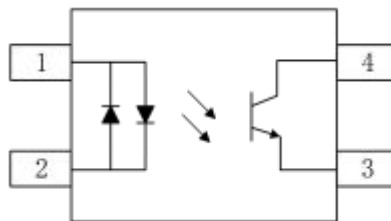
特性 Features

- 电流转换比(CTR)范围: 50% ~600% ($I_F = 5mA$, $V_{CE} = 5V$)
 Current transfer ratio: 50% ~600% ($I_F = 5mA$, $V_{CE} = 5V$)
- 输入-输出隔离电压 ($V_{ISO} = 3750$ Vrms)
 High isolation voltage between input and output($V_{ISO} = 3750$ Vrms)
- 集电极-发射极击穿电压 $BV_{CEO} \geq 350V$
 Collector - emitter breakdown voltage $BV_{CEO} \geq 350V$
- 工作温度: $-40^{\circ}C \sim +100^{\circ}C$
 Operating Temperature: $-40^{\circ}C \sim +100^{\circ}C$
- 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



Pin Configuration



1. Anode
2. Cathode
3. Emitter
4. Collector

产品型号命名规则 Order Code
AT 451 - 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 (451: 451)
- 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 “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.



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	>5.0	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	>5.0	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}	600	V_{peak}	DIN/EN/IEC EN60747-5-5
瞬态隔离电压 Transient isolation voltage	V_{IOTM}	5000	V_{peak}	DIN/EN/IEC EN60747-5-5
隔离电压 Isolation Voltage	V_{iso}	>3750	Vrms	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 Forward Current	I_F	60	mA
	反向电压 Reverse Voltage	V_R	6	V
	功耗 Power Dissipation	P_D	100	mW
	额定值降低因子(在 Ta = 100°C 以上) Power dissipation Derating factor (above Ta = 100°C)	P_{DD}	2.9	mW/°C
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}	350	V
	发射极-集电极电压 Emitter-Collector Voltage	V_{ECO}	7	V
总功耗 Total Power Dissipation	P_{tot}	200	mW	
隔离电压 Isolation Voltage	V_{iso}	3750	Vrms	
工作温度 Operating Temperature	T_{opr}	-40 ~ +100	°C	
存储温度 Storage Temperature	T_{stg}	-55 ~ +125	°C	
焊接温度 Soldering Temperature	T_{sol}	260	°C	

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	$I_F=10mA$	-	1.2	1.4	V
	反向电流 Reverse Current	I_R	$V_R=5V$	-	-	10	μA
	输入电容 Terminal Capacitance	C_t	$V=0, f=1KHz$	-	-	250	pF
接收端 Output	集电极暗电流 Collector Dark Current	I_{CEO}	$V_{CE}=200V$	-	-	100	nA
	集电极-发射极击穿电压 Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C=0.1mA, I_F=0mA$	350	394	-	V
	发射极-集电极击穿电压 Emitter-Collector Breakdown Voltage	BV_{ECO}	$I_C=0.1mA, I_F=0mA$	7	-	-	V
传输特性 Transfer Characteristics	电流传输比 Current Transfer Ratio	CTR^*	$I_F=5mA, V_{CE}=5V$	50	-	600	%
	集电极-发射极饱和压降 Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_F=20mA, I_C=1mA$	-	-	0.4	V
	隔离电阻 Isolation Resistance	R_{ISO}	DC500V, 40 ~ 60%R.H.	5×10^{10}	1×10^{11}	-	Ω
	隔离电容 Isolation capacitance	C_{ISO}	$V=0, f=1MHz$	-	0.9	-	pF
	截止频率 Cut-off Frequency	F_C	$V_{CE}=5V, I_C=2mA,$ $R_L=100\Omega$	-	80	-	kHz
	上升时间 Rise Time	T_r	$V_{CE}=2V, I_C=2mA,$ $R_L=100\Omega$	-	4	18	μs
下降时间 Fall Time	T_f	$V_{CE}=2V, I_C=2mA,$ $R_L=100\Omega$	-	6	18	μs	

 注*：电流传输比= $I_C/I_F \times 100\%$ 。

 Note*：CTR= $I_C/I_F \times 100\%$ 。

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

Fig.1 Relative Current Transfer Ratio vs. Forward Current

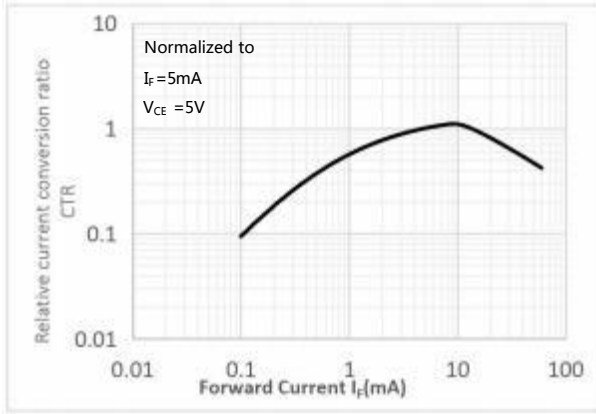


Fig.2 Forward Current vs. Forward Voltage

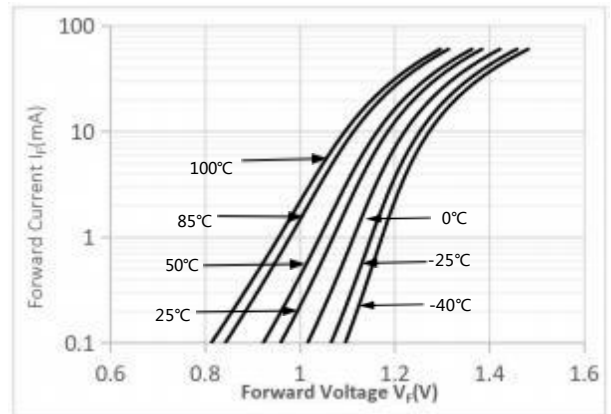


Fig.3 Collector Current vs. Collector-emitter Voltage

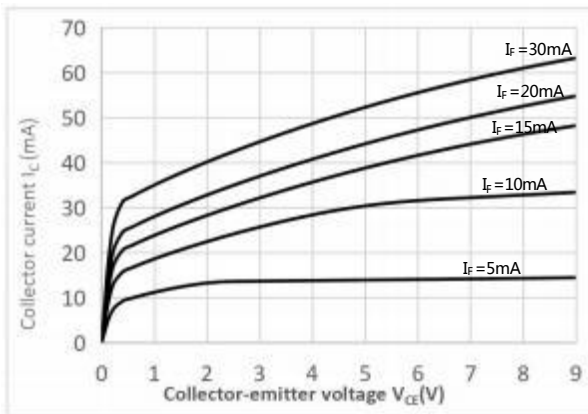


Fig.4 Relative Current Transfer Ratio vs. Ambient Temperature

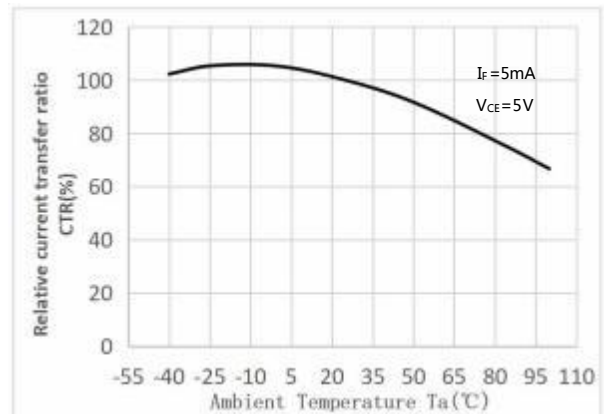


Fig.5 Collector-emitter Saturation Voltage vs. Ambient Temperature

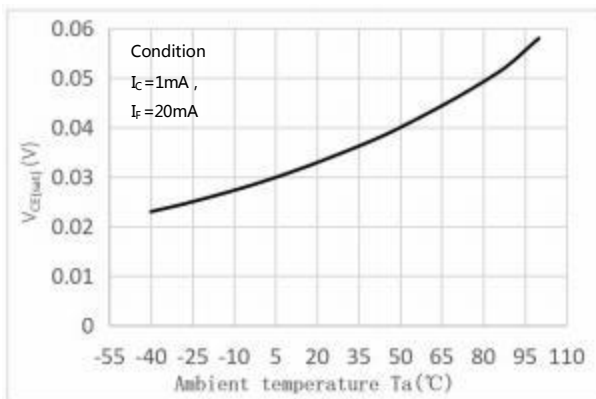


Fig.6 Collector Dark Current vs Ambient Temperature

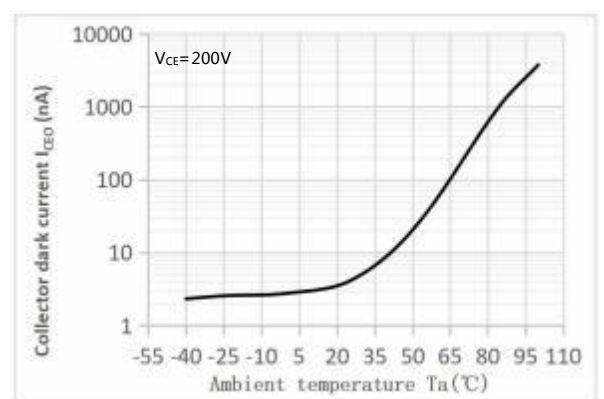


Fig.7 Response Time vs. Load Resistance

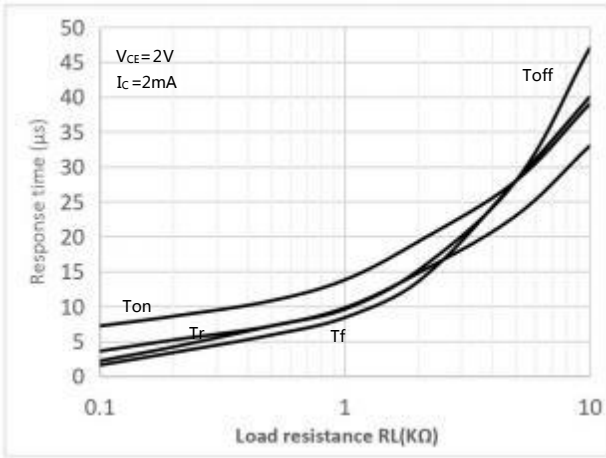


Fig.8 Collector-emitter Saturation Voltage vs Forward Current

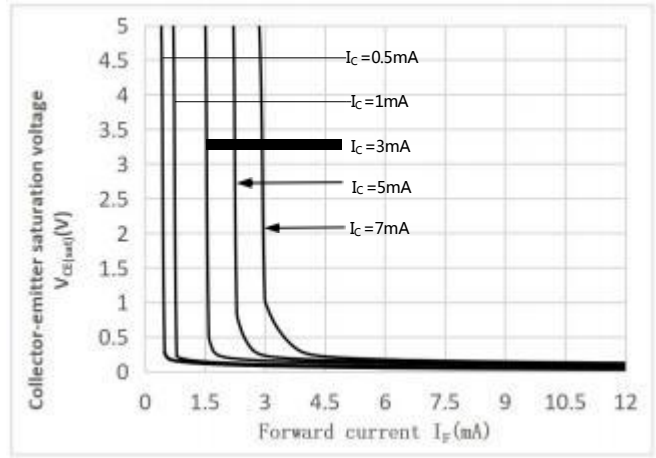
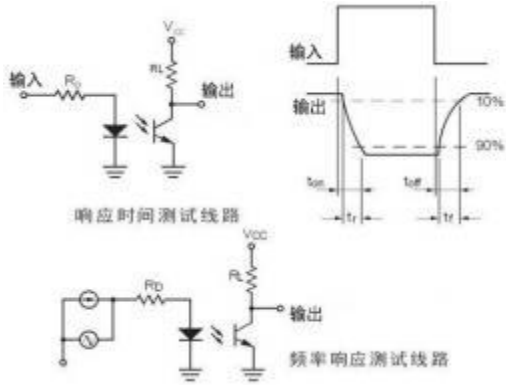
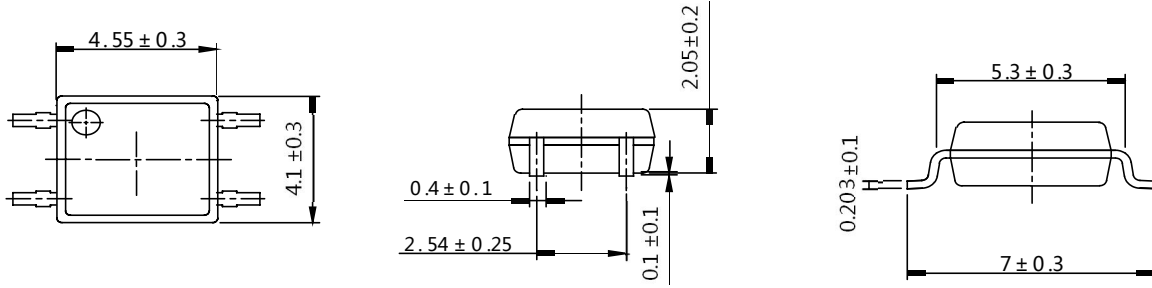


Fig.9 Switching Time Test Circuit & Waveforms



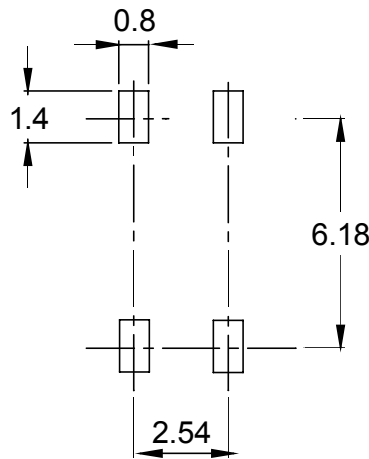
外形尺寸 Outline Dimensions

SOP4



单位 Unit: mm

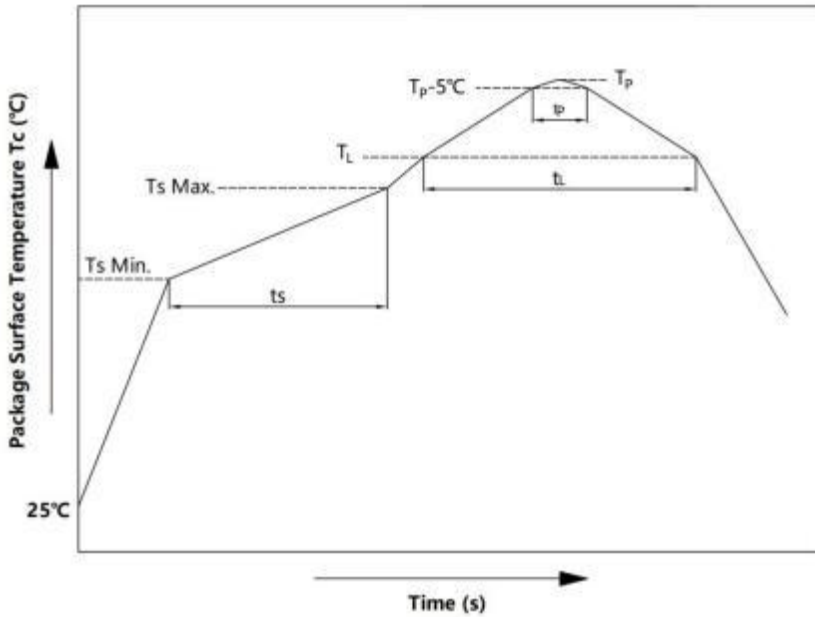
建议焊盘布局 Recommended Pad Layout



单位 Unit: mm

注：上图为产品正视图。

Note : The picture above is the front view of the product.

回流焊温度曲线图 Solder Reflow Profile


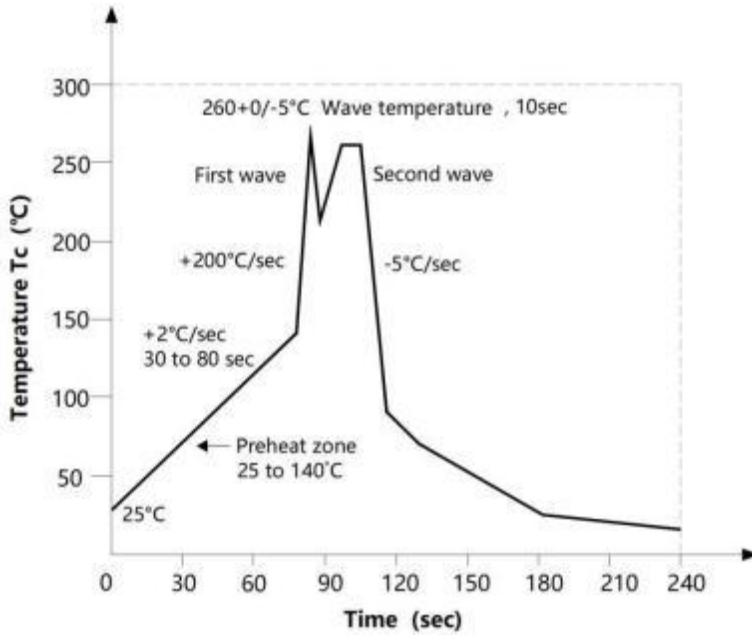
项目 Item	符号 Symbol	最小值 Min.	最大值 Max	单位 Unit
预热温度 Preheat Temperature	Ts	150	200	°C
预热时间 Preheat Time	ts	60	120	s
升温速率 Ramp-Up Rate (T _l to T _p)	-	-	3	°C/s
液相线温度 Liquidus Temperature	T _l	217		°C
时间高于 T _l Time Above T _l	t _l	60	150	s
峰值温度 Peak Temperature	T _p	-	260	°C
Tc 在(T _p -5)和 T _p 之间的时间 Time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

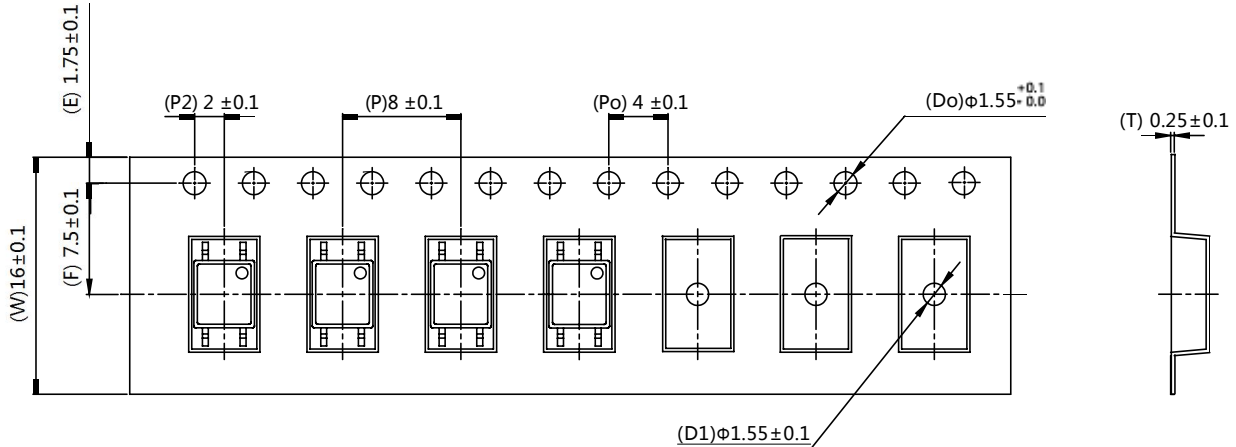
包装 Packing

■ 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
SOP4	卷盘 ($\phi 330\text{mm}$ 蓝盘)	3000 只/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
SOP4	Reel ($\phi 330\text{mm}$ Blue)	3000 pcs /reel	2 reels /box	10 boxes /ctn	450*390*0.1mm	340*60*340mm	620*360*365mm	Leave at least 200mm of blank space at both ends

■ 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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