



智能功率模块接口光耦

Intelligent Power Module

QXM481

宁波群芯微电子股份有限公司

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概述 Description

QXM481 高速光耦合器包含一个 GaAsP LED 和一个光电探测器，内置施密特触发器，提供逻辑兼容波形，可节省额外波形整形需求。

The high-speed QX-M481 optocoupler contains a GaAsP LED and a photodetector, built-in Schmitt trigger, and provides logic compatible waveforms, which can save additional waveform shaping requirements.

特性 Features

- 较宽的工作温度：-40°C to 100°C
Operating temperature: -40°C to 100°C
- 较宽的工作电压：4.5V to 20V
Operating voltage: 4.5V to 20V
- 传播延迟时间 $t_{PHL}/t_{PLH} \leq 350$ ns
Propagation Delay Time $t_{PHL}/t_{PLH} \leq 350$ ns
- 最大脉冲宽度失真(PWD)=250ns
Pulse Width Distortion(PWD)=250ns(max)
- 传输延迟的差异-100ns < PDD < 250ns
Propagation Delay Difference:
-100ns < PDD < 250ns
- VCM=1000V 时，最低 20kV/μs 共模抑制能力
CMR(min):20kV/μs (VCM=1000V)
- 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

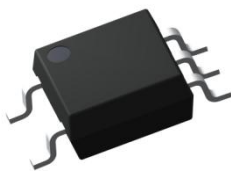
应用 Applications

- IPM 接口隔离
IPM Interface Isolation
- 隔离 IGBT/MOSFET 门驱动器
Isolated IGBT/MOSFET Gate Drive
- 交流和无刷直流电机驱动
AC and Brushless DC Motor Drives
- 工业变频器
Industrial Inverters
- 通用数字隔离
General Digital Isolation

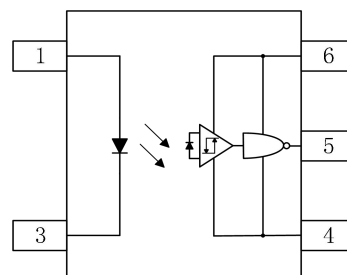
真值表 Truth table

LED	VO
OFF	H
ON	L

封装和原理图 Package and Schematic Diagram



SOP5



Pin Configuration

1. Anode
3. Cathode
4. GND
5. VO
6. VCC

注：4，6脚之间必须连接0.1uF的旁路电容。

Note: A 0.1 μF bypass capacitor must be connected between pins 4 and 6.



产品型号命名规则 Order Code

QX M481 - UN Y - W (V) (ZZ)

① ② ③ ④ ⑤ ⑥ ⑦

- ① 公司代码 Company Code (QX: 群芯 Qunxin)
- ② 产品系列 Product Series (M481)
- 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“”为群芯品牌 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/DIN EN60747-5-5
瞬态隔离电压 Transient isolation voltage	V_{IOTM}	5000	V_{peak}	DIN/EN/DIN EN60747-5-5
隔离电压 Isolation Voltage	V_{iso}	> 3750	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	平均输入电流 Average Input Current	$I_{F(AVG)}$	10	mA	
	峰值瞬态输入电流 Peak Transient Input Current	$I_{F(TRAN)}$	脉宽<1 us, 300pps pulse width<1 us, 300pps	1.0	A
			脉宽<200 us 占空比<1% pulse width<200 us Duty Cycle<1%	40	mA
	反向电压 Reverse Input Voltage		V_R	5	V
	输入功耗 Input Power Dissipation		P_I	45	mW
接收端 output	平均输出电流 Average Output Current	I_O	25	mA	
	电源电压 Supply Voltage	V_{CC}	25	V	
	输出电压 Output Voltage	V_O	-0.5~ V_{CC}	V	
总功耗 Total Power Dissipation		P_{tot}	210	mW	
隔离电压 Isolation voltage		V_{ISO}	5000	V_{rms}	
工作温度 Operating Temperature		T_{opr}	-40~+100	$^{\circ}C$	
存储温度 Storage Temperature		T_{stg}	-55~+125	$^{\circ}C$	

推荐操作条件 Recommended Operating Conditions

参数 Parameter	符号 Symbol	最小值 Min	最大值 Max.	单位 Unit
电源电压 Power Supply Voltage	V_{CC}	4.5	20	V
开启电流 Forward Input Current (ON)	$I_{F(ON)}$	6.0	10.0	mA
关断电压 Forward Input Voltage (OFF)	$V_{F(OFF)}$	-	0.8	V
操作温度 Operating Temperature	T_A	-40	+100	°C

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

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	$I_F=6\text{mA}$		1.35	1.7	V
	反向击穿电压 Reverse Voltage	BV_R	$I_R=10\mu\text{A}$	5			V
	开启电流 Open the current	I_{FLH}		-	3.0	5	mA
	输入电容 Capacitance	C_{IN}	$V=0, f=1\text{MHz}$	-	60	-	pF
接收端 Output	输出漏电流 Output leakage current	I_{OHH}	$V_{CC}=V_O=5\text{V}, V_F=0\text{V}$	-	-	200	uA
			$V_{CC}=V_O=20\text{V}, V_F=0\text{V}$	-	-	500	
	低电平输出短路电流 Low level output Short-circuit power	I_{OSL}	$V_O=V_{CC}=5.5\text{V}, I_F=10\text{mA}$	25	-	-	mA
			$V_O=V_{CC}=20\text{V}, I_F=10\text{mA}$	50	-	-	
	高电平输出短路电流 High level output Short-circuit power	I_{OSH}	$V_{CC}=5.5\text{V}$ $V_F=0\text{V}, V_O=\text{GND}$	-	-	-25	mA
			$V_{CC}=20\text{V}$ $V_F=0\text{V}, V_O=\text{GND}$	-	-	-50	mA
	高电平电源电流 High Level Supply Current	I_{CCH}	$V_{CC}=5.5\text{V}$ $V_F=0\text{V}, I_O=0\text{mA}$	-	1.0	2.5	mA
			$V_{CC}=20\text{V}$ $V_F=0\text{V}, I_O=0\text{mA}$	-	1.2	2.5	
	低电平电源电流 Low Level Supply Current	I_{CCL}	$V_{CC}=5.5\text{V}$ $I_F=10\text{mA}, I_O=0\text{mA}$	-	1.0	3	mA
			$V_{CC}=20\text{V}$ $I_F=10\text{mA}, I_O=0\text{mA}$	-	1.2	3	
低电平输出电压 Low Level Output Voltage	V_{OL}	$I_{OL}=6.5\text{mA}$	-	-	0.5	V	
高电平输出电压 High Level Output Voltage	V_{OH}	$I_{OH}=-6.5\text{mA}$	$V_{CC}-2.5$	$V_{CC}-1.1$	-	V	

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
逻辑低电平传输延迟 Propagation Delay Time to Low Output Level	t_{PHL}	$T_R/T_F=5ns$ 100%duty cycle $Z_O=50\Omega, V_O=5V$ 带峰值电容	-	110	350	ns
逻辑高电平传输延迟 Propagation Delay Time to High Output Level	t_{PLH}		-	100	350	ns
脉宽失真 Pulse Width Distortion $ t_{PHL}-t_{PLH} $	PWD		-	-	250	ns
传输延迟差 Propagation Delay Diference Between Any Two Parts $(t_{PHL}-t_{PLH})^*$	PDD		-100	-	250	ns
输出上升时间 Output Rise Time (10%~90%)	t_R		-	10	-	ns
输出下降时间 Output Fall Time (90%~10%)	t_F		-	10	-	ns
输出高电平共模抑制 Output High Level Common Mode Transient Immunity	$ CM_H $		$T_A=25^\circ C$ $ V_{CM} =1000V$ $I_F=6.0mA, V_{CC}=5V$	20	-	-
输出低电平共模抑制 Output Low Level Common Mode Transient Immunity	$ CM_L $	$T_A=25^\circ C,$ $ V_{CM} =1000V$ $V_F=0V, V_{CC}=5V$	20	-	-	kV/ μs
隔离电阻 Input-Output Resistance	R_{ISO}	$V_{I-O} \leq 500V$	-	10^{12}	-	Ω
隔离电容 Input-Output Capacitance	C_{ISO}	$V_{I-O} = 0V$ Freq=1.0MHz	-	0.6	-	pF

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

Fig.1 Low level voltage vs. Ambient temperature

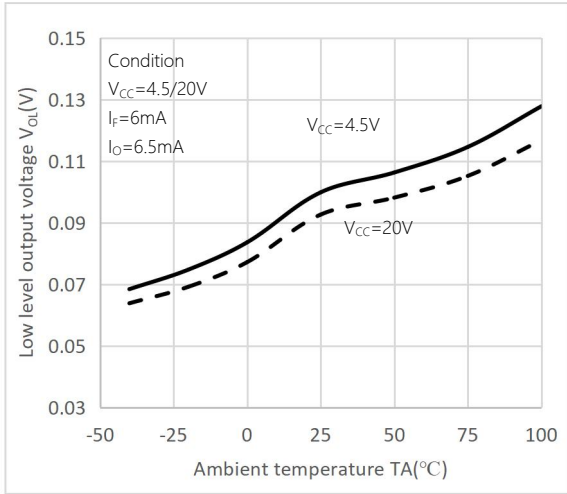


Fig.2 High level output current $I_{OH}(mA)$ vs. Ambient temperature

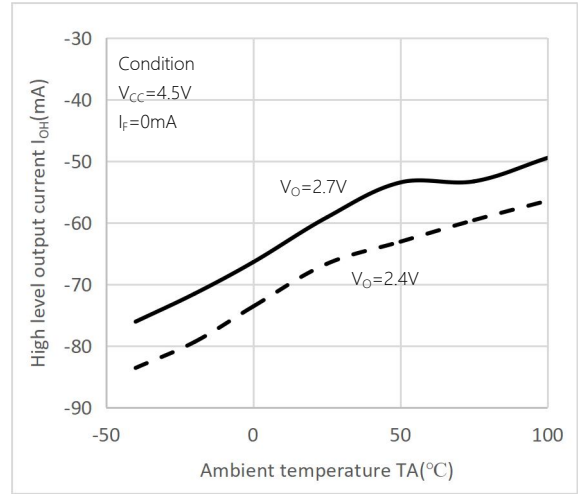


Fig.3 Output voltage vs. Input current

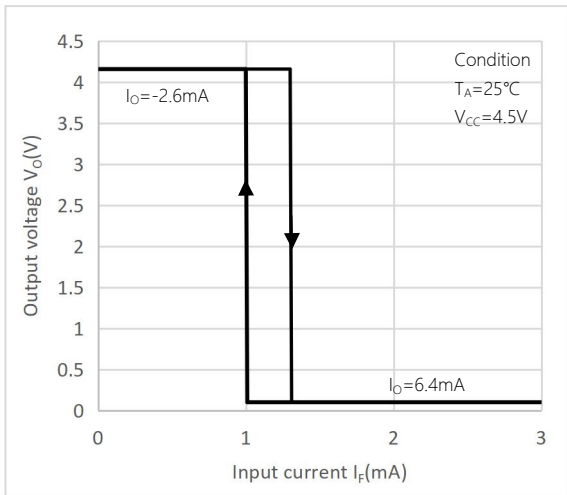


Fig.4 Input current vs. Forward Voltage

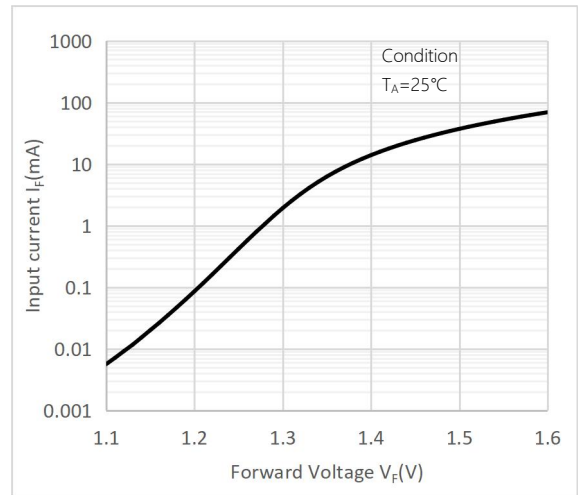


Fig.5 Propagation delay $T_P(ns)$ vs. Ambient temperature

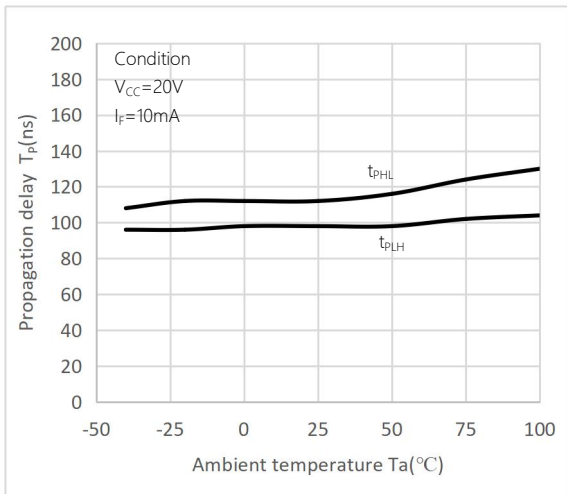


Fig.6 Output voltage vs. Supply Voltage

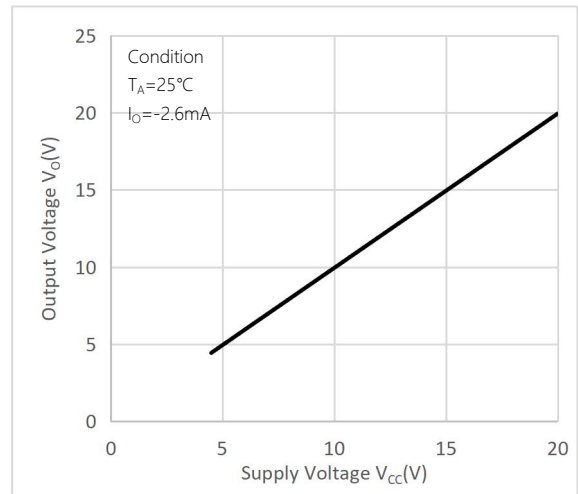
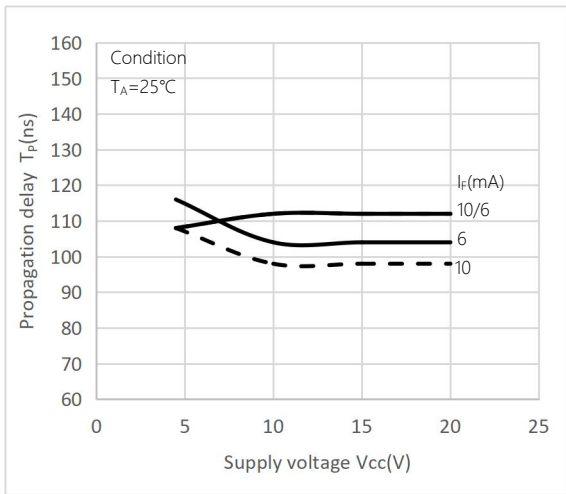
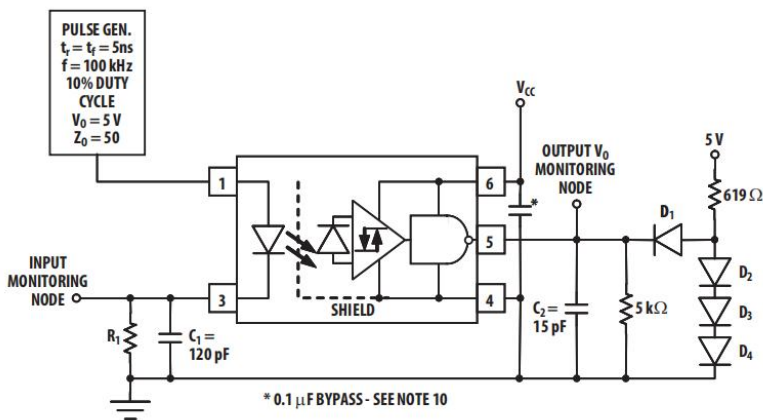


Fig.7 Propagation delay vs. Supply voltage



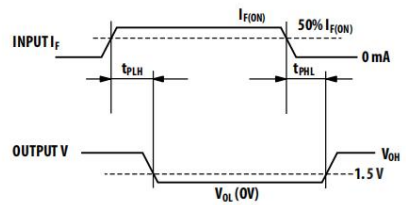
延迟时间测试电路 Propagation Delay Time Test Circuit



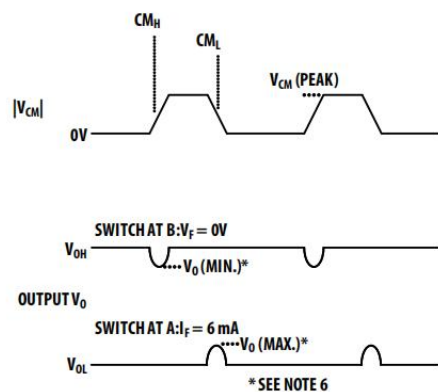
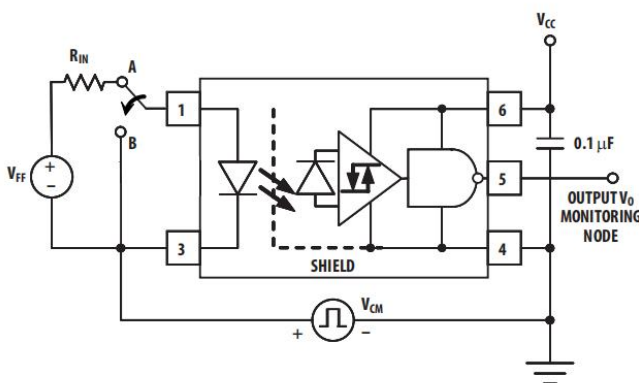
THE PROBE AND JIG CAPACITANCES ARE INCLUDED IN C_1 AND C_2 .

R_1	660 Ω	330 Ω
$I_{F(ON)}$	6 mA	10 mA

ALL DIODES ARE EITHER 1N916 OR 1N3064

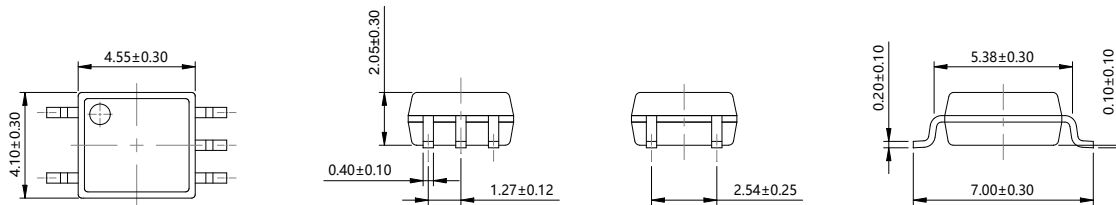


CMR 测试电路 Test Circuit for Common Mode Transient Immunity



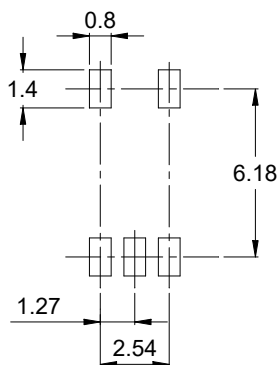
外形尺寸 Outline Dimensions

SOP5



单位 Unit: mm

建议焊盘布局 Recommended Pad Layout

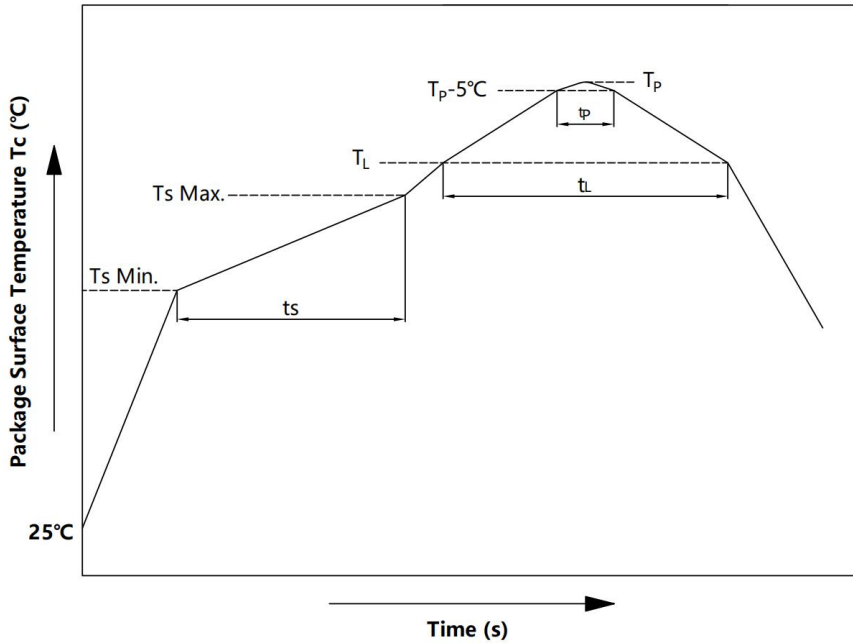


单位 Unit: mm

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



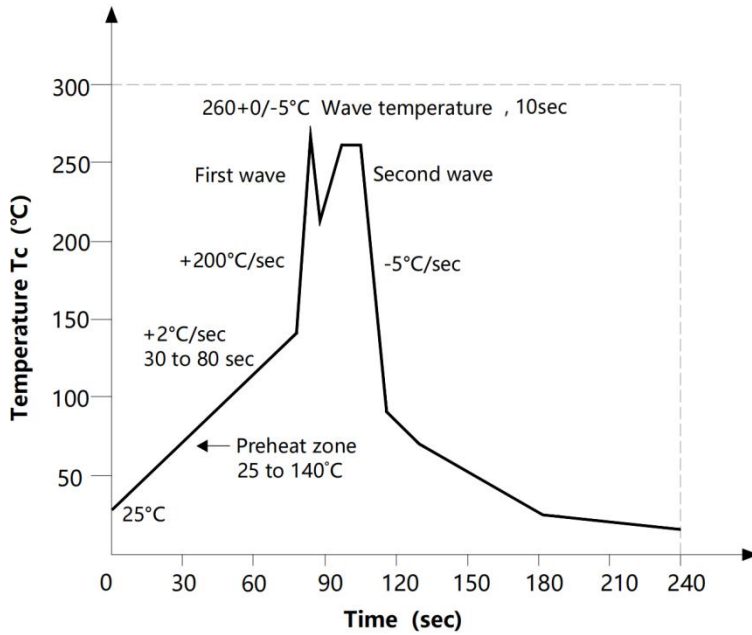
项目 Item	符号 Symbol	最小值 Min.	最大值 Max.	单位 Unit
预热温度 Preheat Temperature	T_s	150	200	$^\circ\text{C}$
预热时间 Preheat Time	t_s	60	120	s
升温速率 Ramp-Up Rate (T_L to T_P)	-	-	3	$^\circ\text{C}/\text{s}$
液相线温度 Liquidus Temperature	T_L	217		$^\circ\text{C}$
时间高于 T_L Time Above T_L	t_L	60	150	s
峰值温度 Peak Temperature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

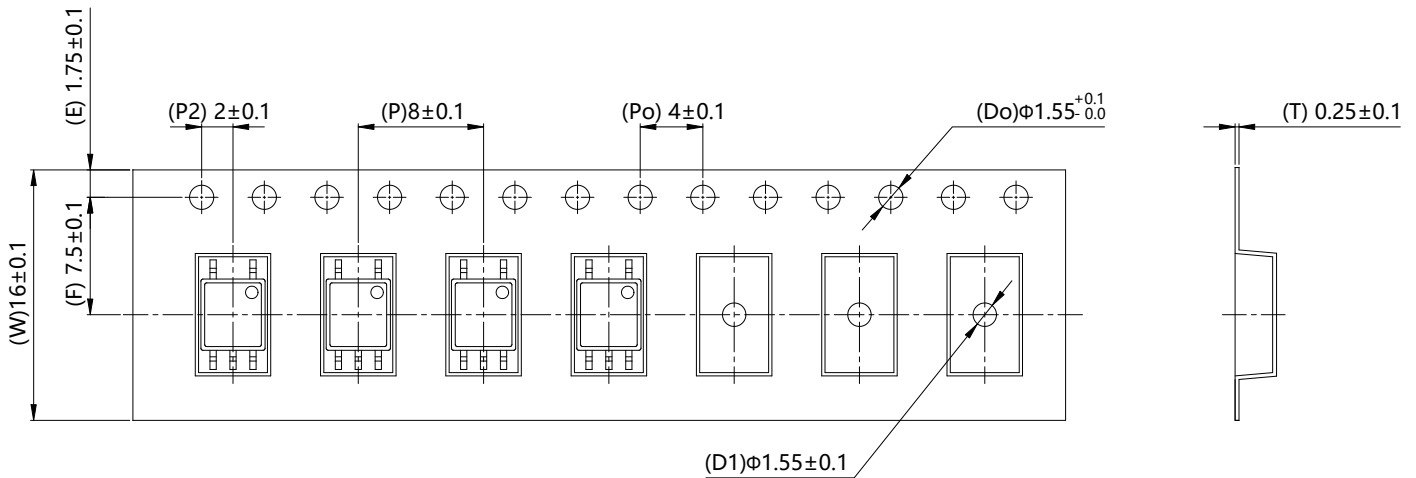
包装 Packing

■ 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
SOP5	编带 (φ330mm 蓝)	3k /盘	2 盘/盒	10 盒/箱	450*390*0.1mm	340*60*340mm	620*360*365mm	保护带 200mm (min)
Package Type	Packing Form	Quantity per Reel	Quantity per Box	Quantity per Carton	Antistatic Bag Specification	Box Specification	Carton Specification	Note
SOP5	Reel(φ330mm Blue)	3k 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: 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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