NQUNXIN
群芯微电子

中国芯 光电梦



可控硅光耦

Photo triac

QX5VX

(Rev.E)

宁波群芯微电子股份有限公司

NINGBO QUNXIN MICROELECTRONICS CO., LTD.

中国 浙江省宁波杭州湾新区玉海东路 68 号

68 Yuhaidong Road, Hangzhou Bay New District, Ningbo, Zhejiang, China

QX53X QX54X QX56X

ZC Photo triac

概述 Description

- QX53X，QX54X，QX56X 系列器件中系由一个 GaAs 红外发光二极管和一个单晶硅芯片的过零相位光电双向晶闸管组成的光电耦合器。

The QX53X，QX54X，QX56X series devices are optical couplers composed of GaAs infrared light emitting diodes and zero-crossing phase photoelectric bidirectional thyristor of single crystal silicon chip.

特性 Features

- 峰值击穿电压
  Peak breakdown voltage
  250V：QX53X；
  400V：QX54X；
  600V：QX56X；
- 输入-输出隔离电压 (V_{ISO}=5000 Vrms)
  High isolation voltage between input and output(V_{ISO}=5000 Vrms)
- 工作温度：-55℃~100℃
  Operating Temperature: -55℃~100℃
- 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
  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.

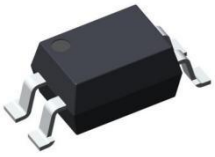
封装和原理图 Package and Schematic Diagram



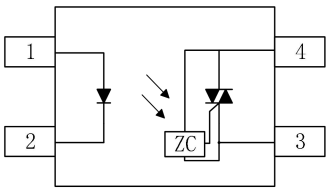
DIP4



DIP4-M



SMD4



Pin Configuration
1. Anode
2. Cathode
3. Terminal
4. Terminal

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产品型号命名规则 Order Code

QX 5VX - 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（5VX: 53X, 54X,56X）
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（D: DIP, M:DIP-M, S: SMD）
⑥ 产品版本 Product Versions：E
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
- 印字中的“X”代表产品分档：1、2、3
- “X”denotes the classification：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“E”代表产品版本号
  “E”denotes product versions
- 印字中的“H”代表无卤：而当产品有卤/无铅时，此处空白
  “H”denotes Halogen-free, when the product has halogen/lead-free,leave this blank.



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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	> 7.0	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	> 7.0	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	Viso	> 5000	Vrms	For 1 min

极限参数 Absolute Maximum Ratings (Ta=25℃)

参数 Parameter			符号 Symbol	额定值 Rated	单位 Unit
发射端 Input	正向电流 Forward Current		I_F	60	mA
	反向电压 Backward Voltage		V_R	6	V
	功耗 Power Dissipation		P_D	100	mW
	额定值降低因子(在 Ta = 85°C 以上) Power dissipation Derating factor (above Ta = 85°C)		P_{DD}	3.8	mW/°C
接收端 output	断态输出端电压 Off-state output terminal voltage	QX53X	V_{DRM}	250	V
		QX54X		400	
		QX56X		600	
	峰值重复浪涌电流(pw=100μs,120pps) Peak repetitive surge current (pw=100μs,120pps)		I_{TSM}	1	A
	开启态电流（均方根值） On-state current (root mean square value)		$I_{T(RMS)}$	100	mA
	功耗 Power Dissipation		P_C	300	mW
	额定值降低因子(在 Ta = 85°C 以上) Power dissipation Derating factor (above Ta = 85°C)			7.4	mW/°C
总功耗 Total Power Dissipation			P_{tot}	330	mW
输入输出瞬时耐受电压 Isolation Voltage Input/output transient withstand voltage			Viso	5000	V

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参数 Parameter	符号 Symbol	额定值 Rated	单位 Unit
工作温度 Operating Temperature	T_{opr}	-55~100	℃
存储温度 Storage Temperature	T_{stg}	-55~125	℃
焊接温度 Soldering Temperature	T_{sol}	260	℃

* 在相对湿度 40% ~ 60%下的进行交流电测试，此时 1、2 脚短接，3、4 脚短接。

* Conduct AC test at 40%~60% relative humidity. At this time, pins 1and 2 are short-circuited, and pins 3 and 4 are short-circuited.

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产品特性参数 Electro-optical Characteristics (Ta=25℃)

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	-	1.25	1.5	V
	反向电流 Back current		I_R	V_R=6V	-	-	10	uA
接收端 Output	断态峰值电流 Off-state peak current	QX53X	I_{DRM}	V_{DRM} = 额定 V_{DRM}， I_F = 0mA	-	-	100	nA
		QX54X						
		QX56X			-	-	500	
	通态峰值电压 On-state peak voltage		V_{TM}	I_{TM}=100mA 峰值, I_F= 额定 I_{FT}	-	-	2.5	V
	断态电压临界上升率 Critical rise rate of off-state voltage	QX53X	dv/dt	$V_{峰值}$ =额定值 V_{DRM}， I_F=0	-	100	-	V/μs
		QX54X						
		QX56X						
	抑制电压（MT1-MT2 高于多少电压不会触发） Suppression voltage (MT1-MT2 will not be triggered if it is higher than this voltage)		V_{Inh}	I_F= Rated I_{FT}	-	-	20	V
	抑制状态的漏电流 Leakage current in suppression state		I_{DRM2}	I_F= Rated I_{FT}, V_{DRM}=Rated V_{DRM}， Off state	-	-	500	uA
传输特性 Transfer Characteristics	LED 触发电流 LED trigger current	QX531	I_{FT}	主端 电压=3V	-	10	15	mA
		QX541						
		QX561						
		QX532			-	5	10	
		QX542						
		QX562						
		QX533			-	3	5	
		QX543						
		QX563						
	维持电流 Maintain current		I_H	-	-	250	-	uA

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

图 1 LED 正向电压 vs 正向电流
Fig.1 LED forward voltage vs Forward current

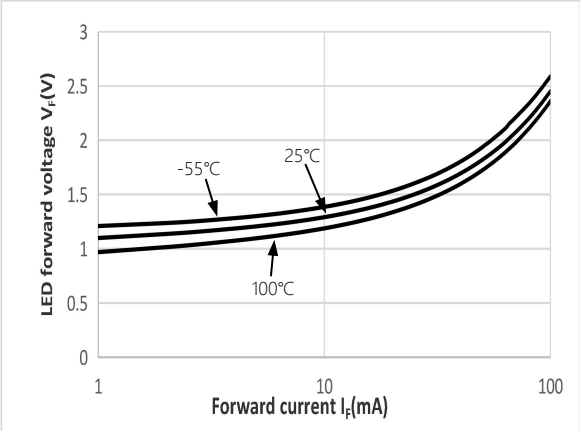

图 2 通态特性图
Fig.2 On-state characteristic diagram

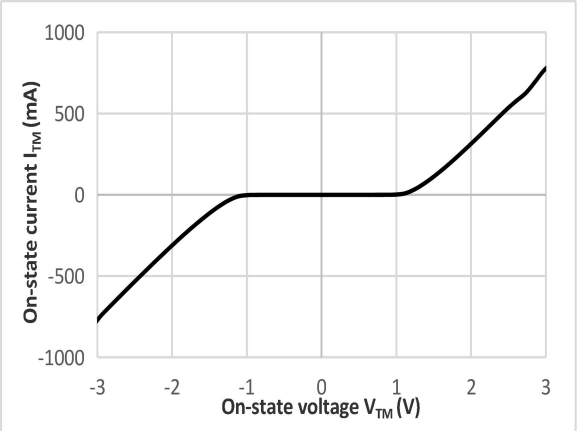

图 3 触发电流 vs 环境温度
Fig.3 Trigger current vs Ambient temperature

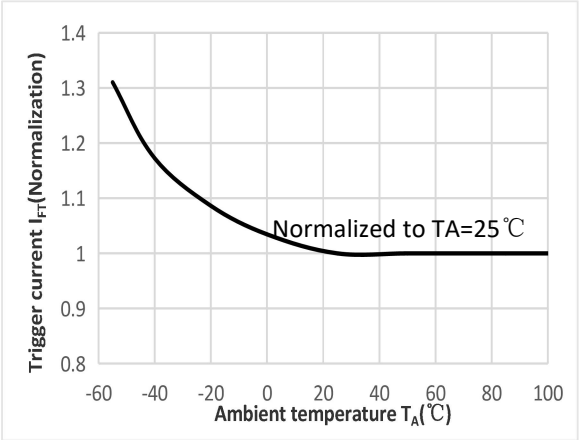

图 4 触发电流 vs LED 脉冲宽度
Fig.4 Trigger current vs LED pulse width

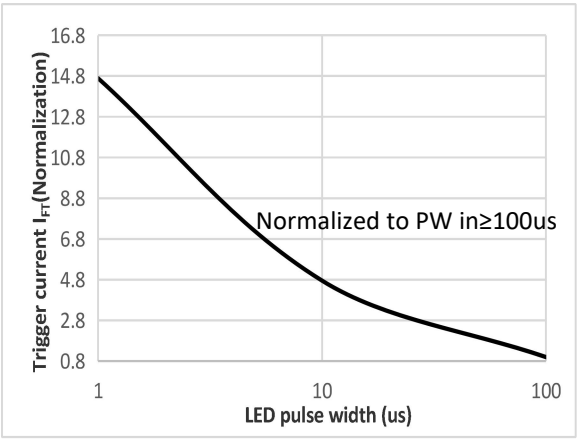

图 5 维持电流 vs 环境温度
Fig.5 Maintenance current vs Ambient temperature

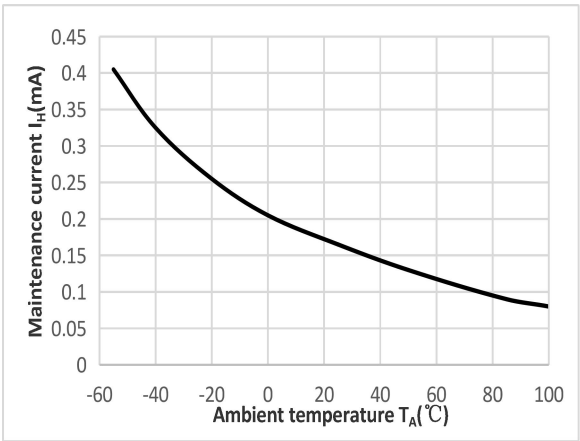

图 6 泄漏电流 vs 环境温度
Fig.6 Leakage current vs Ambient temperature

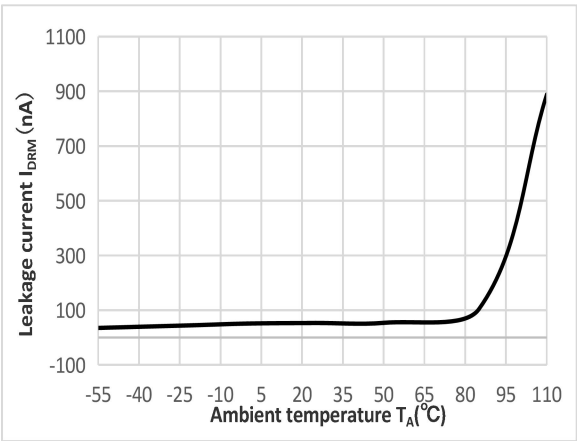

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图 7 抑制状态泄漏电流 vs 环境温度

Fig.7 Suppressed state leakage current vs Ambient temperature

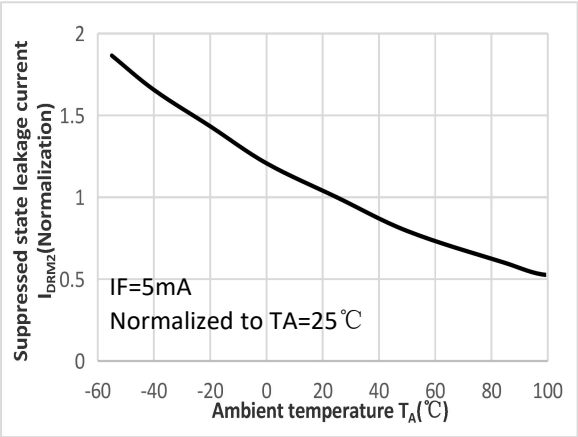


图 8 抑制电压 vs 环境温度

Fig.8 Suppression voltage vs Ambient temperature

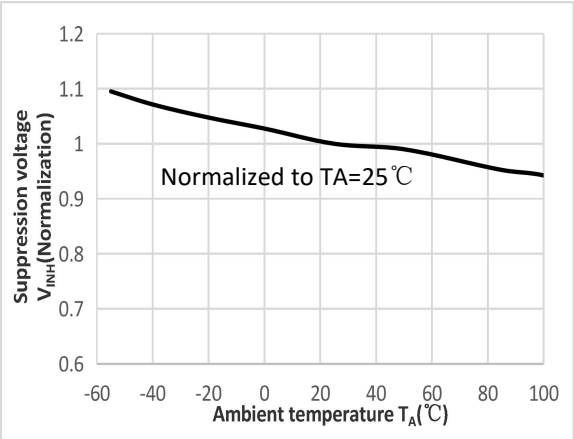
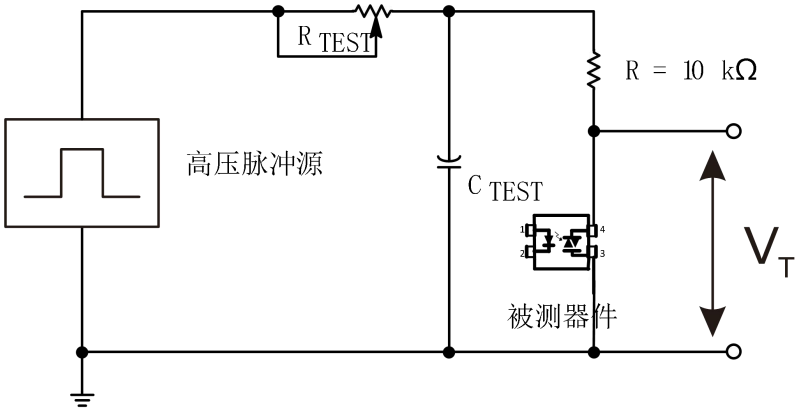
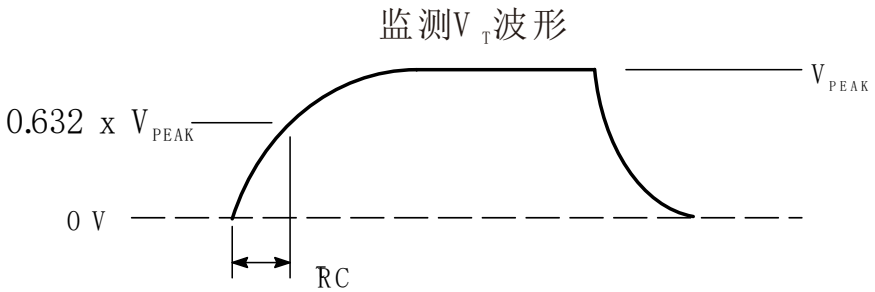


Fig.9 静态 dv/dt 测试电路和波形 Static dv/dt test circuit and waveform





通过 RC 电路施加于被测器件的输出端的高电压脉冲设置到所需的 V_{PEAK} 值上。LED 电流无需加上。波形 V_T 使用 X100 探头监测。通过调节 R_{TEST} 值，dv/dt（斜度）增加，直到被测器件观察到被触发（波形崩溃）。dv/dt 然后下降，直到被测器件停止被触发。此时，记录 τ_{RC} 值并可计算 dv/dt 了。

The high voltage pulse applied to the output end of the device under test through the RC circuit is set to the desired V_{PEAK} value. LED current does not need to be added. Waveform V_T is monitored with X100 probe. By adjusting the R_{TEST} value, dv/dt (slope) increases until the device under test is observed to be triggered (waveform collapse). Dv/dt then drops until the device under test stops being triggered. At this time, dv/dt can be calculated by recording the value of τRC.

$$dv/dt = \frac{0.632 \times V_{PEAK}}{\tau_{RC}}$$

例如，QX54X 系列的电压峰值 V_{PEAK} = 400V。 dv/dt 值的计算方式如下：

For example, the voltage peak of QX54X series V_{PEAK}=400V. Then the dv/dt value can be calculated as follows:

$$dv/dt = \frac{0.632 \times 400}{\tau_{RC}} = \frac{252}{\tau_{RC}}$$

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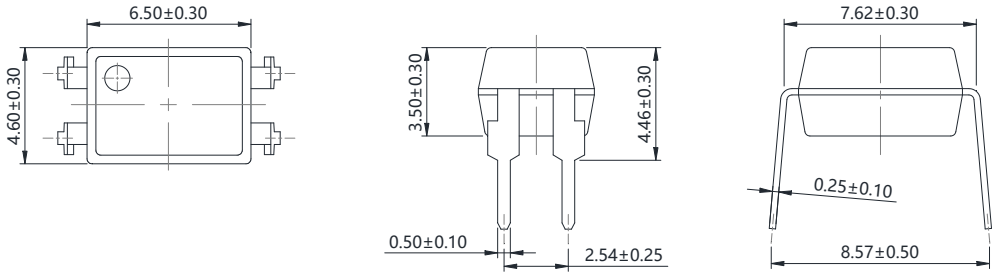
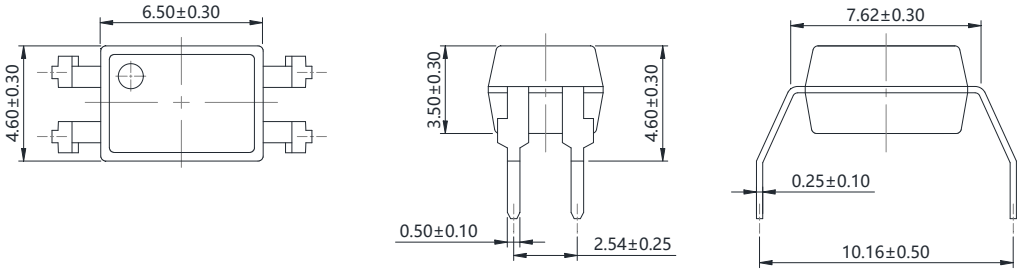
外形尺寸 Outline Dimensions

DIP4



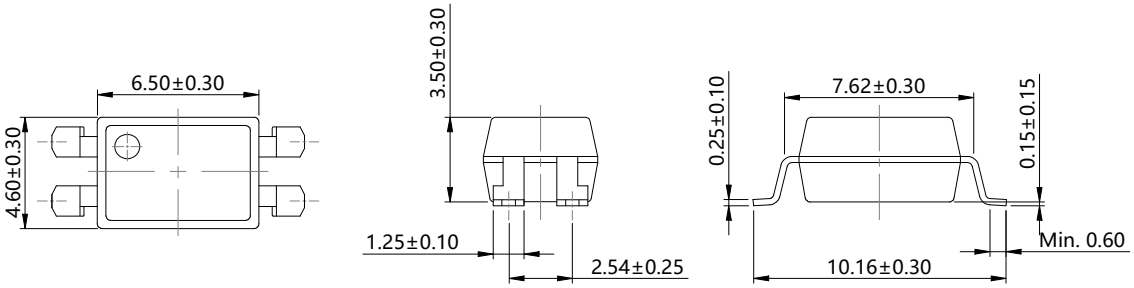
单位 Unit: mm

DIP4-M



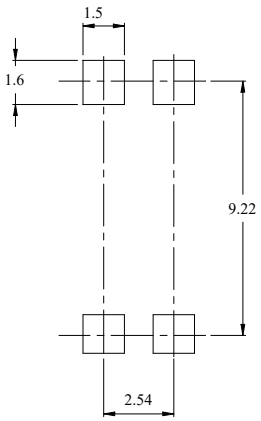
单位 Unit: mm

SMD4



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.

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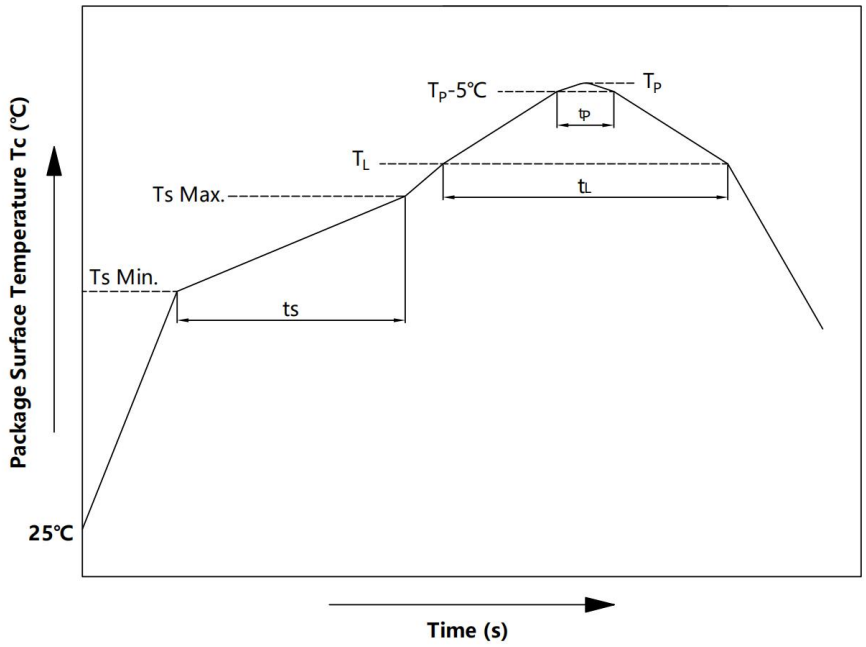
回流焊温度曲线图 Solder Reflow Profile



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	℃
预热时间 Preheat Time	ts	60	120	s
升温速率 Ramp-Up Rate (T_L to T_P)	-	-	3	℃/s
液相线温度 Liquidus Temperature	T_L	217		℃
时间高于 T_L Time Above T_L	t_L	60	150	s
峰值温度 Peak Temperature	T_P	-	260	℃
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	℃/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;

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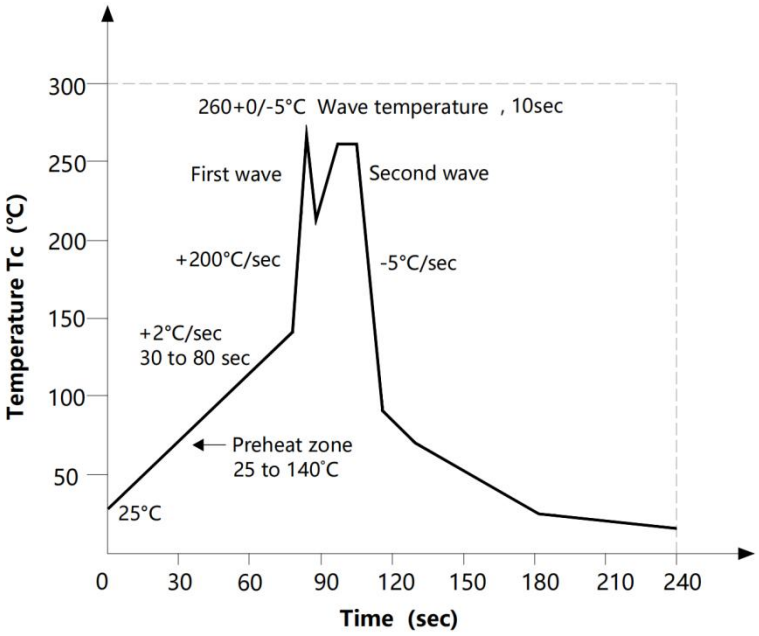
波峰焊温度曲线图 Wave Soldering Profile



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℃ ± 5℃，时间≤3s。

Hand soldering iron requirements：Temperature：360℃ ± 5℃, within 3s

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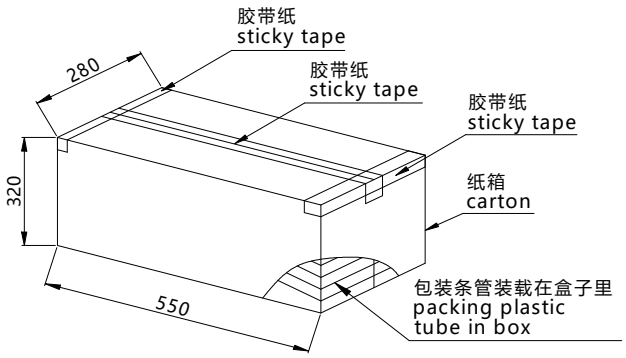
包装 Packing

■ 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
DIP4	管装 (500*12*11mm)	100 只/管	50 管/盒	10 盒/箱	不适用	525*130*57mm	550*280*320mm	每管使用蓝白胶塞，方向须一致
DIP4-M	管装 (500*12*11mm)	100 只/管	45 管/盒	10 盒/箱	不适用	525*130*57mm	550*280*320mm	
SMD4	卷盘 (ϕ330mm 蓝盘)	2000 只/盘	2 盘/盒	10 盒/箱	450*390*0.1mm	353*340*60mm	650*375*365mm	首端空 50 个空格，末端空 100 个空格
Package Type	Packing Form	Quantity per Reel	Quantity per Box	Quantity per Carton	Antistatic Bag Specification	Box Specification	Carton Specification	Note
DIP4	Tube (500*12*11mm)	100pcs /tube	50 tubes/box	10 boxes /ctn	NA	525*130*57mm	550*280*320mm	Use blue and white rubber stoppers for each tube, with the same direction
DIP4-M	Tube (500*12*11mm)	100pcs /tube	45 tubes/box	10 boxes /ctn	NA	525*130*57mm	550*280*320mm	
SMD4	Reel (ϕ330mm Blue)	2000 pcs /reel	2 reels /box	10 boxes /ctn	450*390*0.1mm	353*340*60mm	650*375*365mm	Leave 50 Spaces at the beginning and 100 Spaces at the end

■ 管条包装 Tape & Tube

1) 每管数量：100 只。
   Qty/Tube：100 pcs.
2) 每箱数量 DIP4/DIP4-M：50000/45000 只。
   Qty/ctn DIP4/DIP4-M：50000/45000 pcs.
3) 内包装 DIP4/DIP4-M：每盒 50/45 管。
   Inner packing DIP4/DIP4-M：50/45 Tube/box.
4) 示意图 Schematic：



单位/Unit：mm

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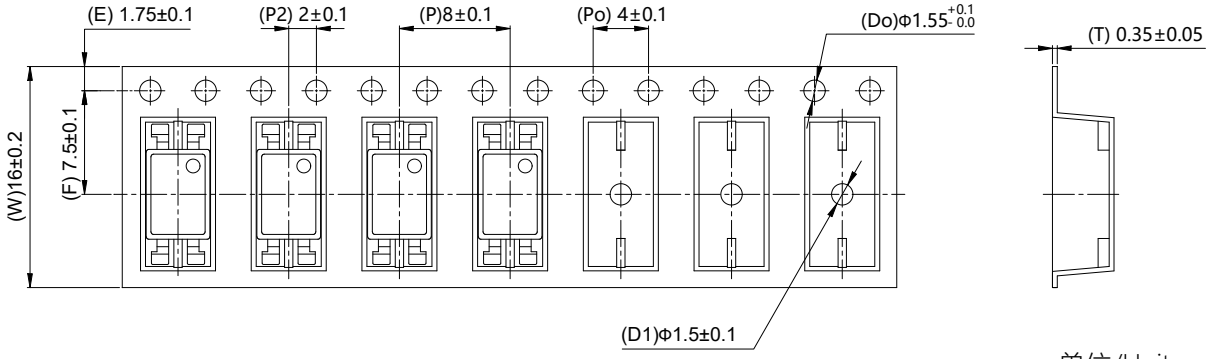
■ 编带包装 Tape & Reel

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：2 reels/box.
4) 示意图 Schematic：



单位/Unit：mm

注意 Attention

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QUNXIN continuously improve quality, reliability, function and design. We reserve the right to change this product without prior notice.

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Please use in accordance with the product specification. QUNXIN is not responsible for the quality problems caused by non-compliance with the product specifications.

■ 对于需要高可靠性或安全性的设备/装置需求，请联系我们的销售人员。
For equipment/devices requiring high reliability or safety, please contact our sales representatives.

■ 当需要用于任何"特定"应用时，请咨询我们的销售人员。
When requiring a device for any "specific" application, please contact our sales in advice.

■ 如对文件中表述的内容有疑问，欢迎联系我们。
If you have any questions about the contents of the document, please contact us.

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