



栅极驱动光耦
Gate Drive Optocoupler

QX350

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

概述 Description

QX350 是一种输出电流为 2.5A 的栅极驱动光电耦合器，具有一个砷化铝镓 (AlGaAs) 发光二极管，通过红外光耦合到光敏集成电路。这种光电耦合器可驱动大多数的小功率 IGBTs 和 MOSFETs。在电机控制逆变器以及高性能电力系统应用中，其非常适用于快速切换驱动功率 IGBTs 和 MOSFETs

The QX350 is a gate driven optocoupler with an output current of 2.5 A, with an GaAsP LED, which is coupled to a photosensitive integrated circuit through infrared light. This optocoupler can drive most low-power IGBTs and MOSFETs. In the motor control inverter and high-performance power system applications, it is very suitable for fast switching drive power IGBTs and MOSFETs.

特性 Features

- 2.5A 最小峰值输出电流
2.5A Minimum peak output current
- 25kV/us 最小共模抑制($V_{CM}=1500V$)
25kV/us minimum Common Mode Rejection ($V_{CM}= 1500V$)
- 带滞后欠压锁定(UVLO)
Locking with hysteresis (UVLO)
- 宽工作电压范围: 15V 到 32V
Wide operating V_{CC} Range: 15V ~ 32V
- 工作温度范围: $-40^{\circ}C$ to $+110^{\circ}C$
Operating temperature range: $-40^{\circ}C \sim +110^{\circ}C$
- 0.5V 最大低电平输出电压(V_{OL})
0.5V Maximum Low Level Output Voltage (V_{OL})
- 符合加强绝缘标准
Meet reinforced insulation standards

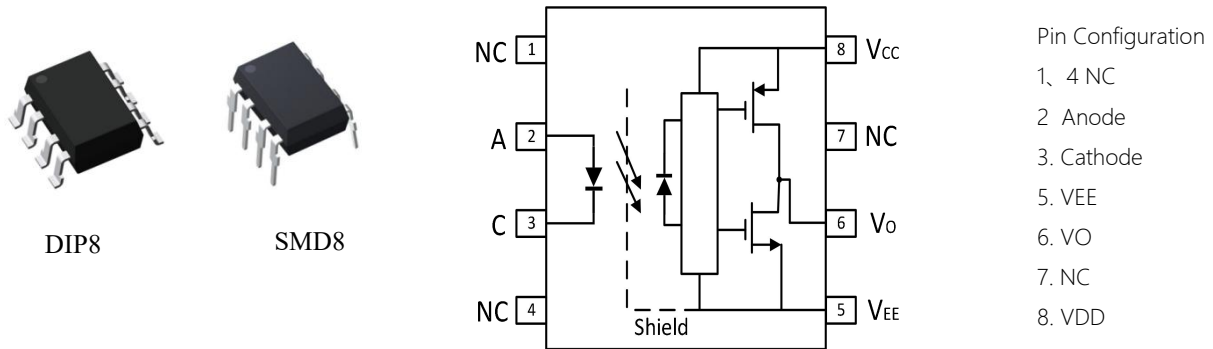
应用 Applications

- 隔离 IGBT/MOSFET 门驱动
Isolation of the IGBT / MOSFET gate drive
- 交流和无刷直流电机驱动
AC and brushless DC motor drive
- 感应炉顶
Induction furnace top
- 工业逆变器
Industrial inverter
- 开关电源(SMPS)
Switch power supply (SMPS)
- 不间断电源(UPS)
Uninterruptible power supply (UPS)

真值表 Truth table

LED	$V_{CC}-V_{EE}$ " POSITIVE GOING" (TURN-ON)	$V_{CC}-V_{EE}$ "NEGATIVE GOING" (TURN-OFF)	VO
OFF	0~30V	0~32V	LOW
ON	0~11V	0~9.5V	LOW
ON	11~13.5V	9.5~12V	TRANSITION
ON	13.5~32V	12~32V	HIGH

封装和原理图 Package and Schematic Diagram



注：在引脚 5 和 8 之间必须连接一个 0.1uF 的旁路电容器。

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

产品型号命名规则 Order Code

QX 350 - 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 (350)

③ 框架类型 Lead Frame (Cu: 铜框架 Copper)



④ 树脂类型 Epoxy (H: 无卤 Halogen-free, L: 有卤/无铅 Halogen/Lead-free)

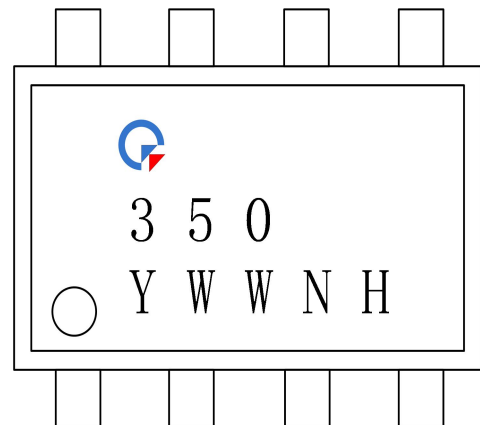
⑤ 封装形式 Package (S: SMD)

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 the day of the week
- 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.



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 Note
爬电距离 Creepage Distance	L	≥7	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	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	V_{ISO}	5000	V_{rms}	For 1 min

极限参数 Absolute Maximum Ratings ($T_A=25^{\circ}C$)

参数 Parameter		符号 Symbol	最小值 Min.	最大值 Max.	单位 Unit
输入 Input	正向输入电流 Forward Input Current	I_F	-	25	mA
	峰值瞬态输入电流 (<1 μs 脉冲宽度, 300 pps) Peak Transient Input Current (<1 μs Pulse Width, 300 pps)	$I_{F(TRAN)}$	-	1	A
	反向电压 Reverse Voltage	V_R	-	5	V
	输入功率 Power Dissipation	P_I	-	45	mW
输出 Output	高峰值输出电流 High Peak Output Current	$I_{OH(PEAK)}$	-	2.5	A
	低峰值输出电流 Low Peak Output Current	$I_{OL(PEAK)}$	-	2.5	A
	电源电压 Supply Voltage	$V_{CC}-V_{EE}$	0	35	V
	输出电压 Output Voltage	$V_{O(PEAK)}$	0	V_{CC}	V
	输出功率 Power Dissipation	P_O	-	250	mW
总功率耗散 Total Power Dissipation		P_{tot}	-	295	mW
存储温度 Storage Temperature		T_S	-55	+125	°C
工作温度 Operating Temperature		T_A	-40	+110	°C
焊接温度 Soldering Temperature		T_{sol}	-	260	°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	$V_{CC}-V_{EE}$	15	32	V
开启电流 Input Current (ON)	$I_{F(ON)}$	7	16	mA
关断电压 Input Voltage (OFF)	$V_{F(OFF)}$	-3	0.8	V
工作温度 Operating Temperature	T_A	-40	+110	°C

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

在推荐的工作条件下测试最小值和最大值，除非另有规定，所有典型值在 $T_A=25^\circ\text{C}$ ， $V_{CC}-V_{EE}=30\text{V}$ 时测得。

All minimum and maximum specifications are at recommended operating conditions, unless otherwise noted.

All typical values are at $T_A=25^\circ\text{C}$ ， $V_{CC}-V_{EE}=30\text{V}$.

参数 Parameter	符号 Symbol	条件 Condition	最小 Min.	典型 Typ.	最大 Max.	单位 Unit
高电平输出电流 High Level Peak Output Current	I_{OH}	$V_O=V_{CC}-4\text{V}$	0.5	-	-	A
		$V_O=V_{CC}-15\text{V}$	2.5	-	-	
低电平输出电流 Low Level Peak Output Current	I_{OL}	$V_O=V_{EE}+2.5\text{V}$	0.5	-	-	A
		$V_O=V_{EE}+15\text{V}$	2.5	-	-	
高电平输出电压 High Level Output Voltage	V_{OH}	$I_O=-100\text{mA}$	$V_{CC}-0.3$	$V_{CC}-0.1$	-	V
低电平输出电压 Low Level Output Voltage	V_{OL}	$I_O=100\text{mA}$	-	0.08	0.5	V
高电平电源电流 High Level Supply Current	I_{CCH}	输出开路， $I_F=7\text{mA}$ to 16mA	-	-	2.5	mA
低电平电源电流 Low Level Supply Current	I_{CCL}	输出开路， $V_F=-3\text{V}$ to $+0.8\text{V}$	-	-	2.5	mA
低到高输入阈值电流 Threshold Input Current Low to High	I_{FLH}	$I_O=0\text{mA}$ ， $V_O>5\text{V}$	-	-	5	mA
高到低输入阈值电压 Threshold Input Voltage High to Low	V_{FHL}	$I_O=0\text{mA}$ ， $V_O<5\text{V}$	0.8	-	-	V
输入正向电压 Input Forward Voltage	V_F	$I_F=10\text{mA}$	1	-	1.6	V
输入正向电压的温度系数 Temperature Coefficient of Input Forward Voltage	$\Delta V_F/\Delta T_A$	$I_F=10\text{mA}$	-	-1.4	-	mV/°C
输入反向电压 Input Reverse Voltage	B_{VR}	$I_R=10\mu\text{A}$	5	-	-	V
输入电容 Input Capacitance	C_{IN}	$f=1\text{MHz}$ ， $V_F=0\text{V}$	-	43	-	pF

参数 Parameter	符号 Symbol	条件 Condition	最小 Min.	典型 Typ.	最大 Max.	单位 Unit
欠压锁定阈值 UVLO Threshold	V_{UVLO+}	$V_O > 5V, I_F=10mA$	11	-	13.5	V
	V_{UVLO-}	$V_O < 5V, I_F=10mA$	9.5	-	12	
低电压锁定阈值迟滞 UVLO Hysteresis	$UVLO_{HYS}$	-	-	1.5	-	V
逻辑低电平传输延迟 Propagation Delay Time to Low Output Level	t_{PHL}	Rg=10Ω, Cg=10nF, f=10kHz, 占空比=50%	0.1	-	0.4	us
逻辑高电平传输延迟 Propagation Delay Time to High Output Level	t_{PLH}		0.1	-	0.4	
脉宽失真 Pulse Width Distortion	PWD		-	-	0.2	
输出上升时间 Output Rise Time	t_R		-	0.017	-	
输出下降时间 Output Fall Time	t_F		-	0.012	-	
UVLO 导通延迟 UVLO Turn on delay	$t_{UVLO ON}$	$V_O > 5V, I_F=10mA$	-	0.8	-	us
UVLO 关断延迟 UVLO Turn off delay	$t_{UVLO OFF}$	$V_O < 5V, I_F=10mA$	-	0.6	-	us
输出高电平共模瞬态抑制 Output High Level Common Mode Transient Immunity	$ CM_H $	$T_A=25^\circ C,$ $I_F=10 \sim 16mA,$ $V_{CM}=1500V, V_{CC}=30V$	25	35	-	kV/us
输出低电平共模瞬态抑制 Output Low Level Common Mode Transient Immunity	$ CM_L $	$T_A=25^\circ C, V_F=0V,$ $V_{CM}=1500V, V_{CC}=30V$	25	35	-	kV/us

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

Fig.1 High Output Voltage Drop vs Ambient Temperature

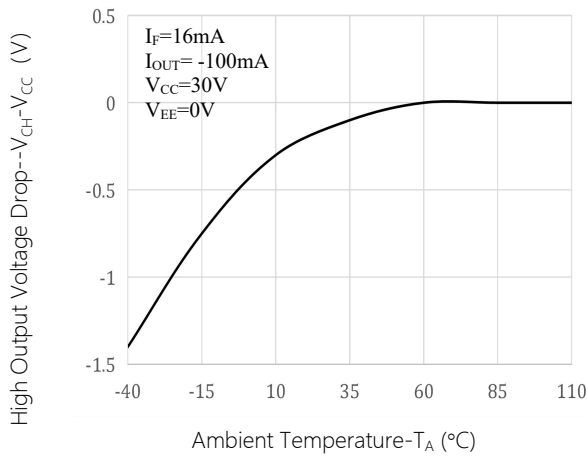


Fig.2 High Level Output Voltage vs Ambient Temperature

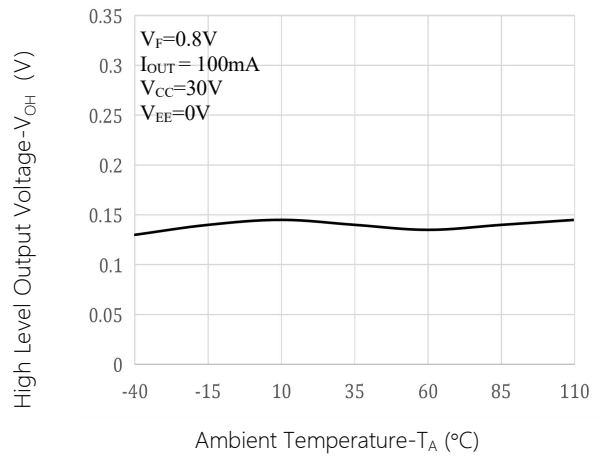


Fig.5 Low Level Output Voltage vs Low Level Output Current

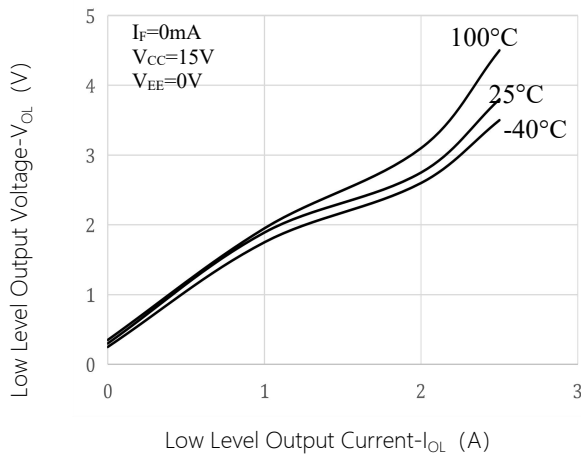


Fig.6 Supply Current vs Supply Voltage

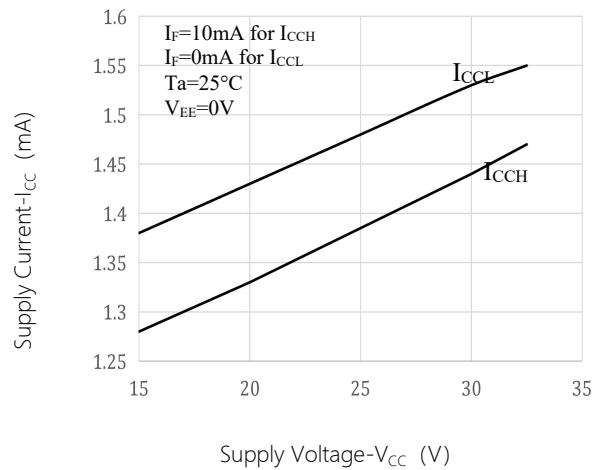


Fig.7 High Output Voltage Drop vs High Level Output Current

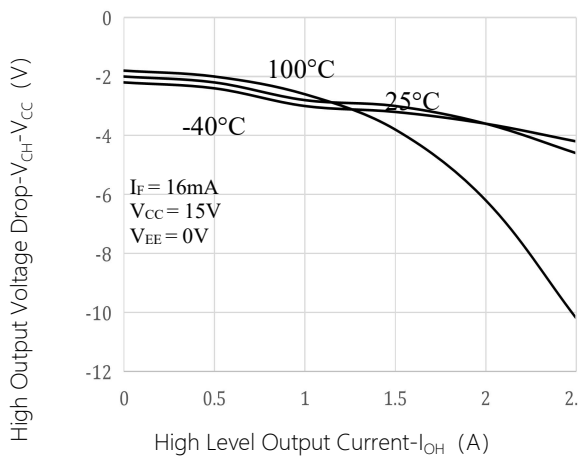


Fig.8 Threshold Input Current Low to High vs Ambient Temperature

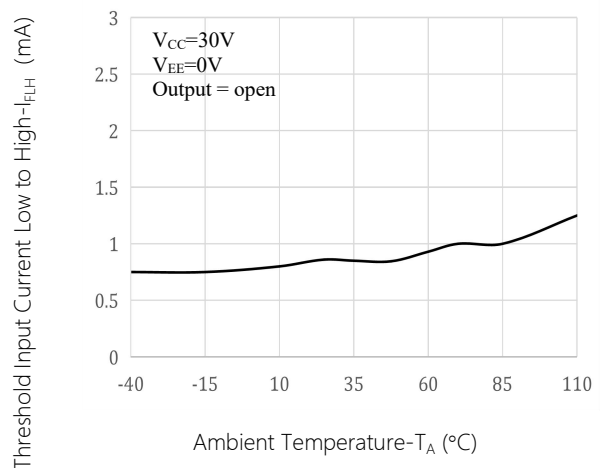


Fig.9 Supply Current vs Ambient Temperature

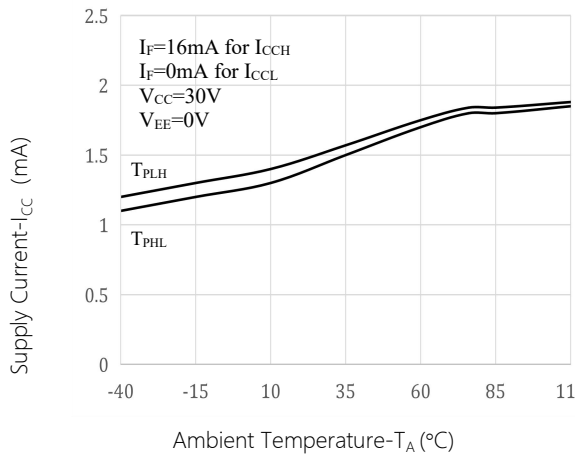


Fig.10 Transmission Characteristics

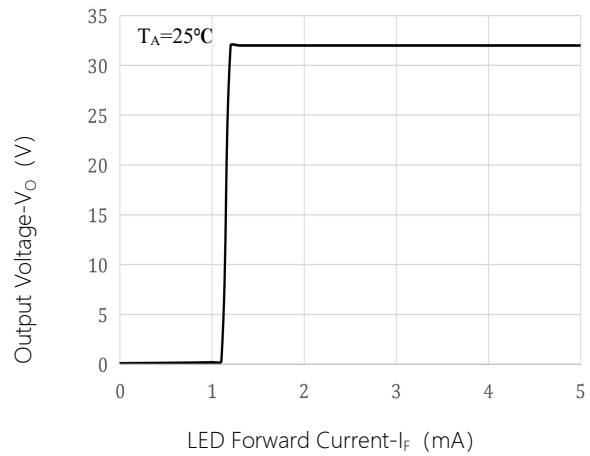


Fig.11 Propagation Delay vs Supply Current

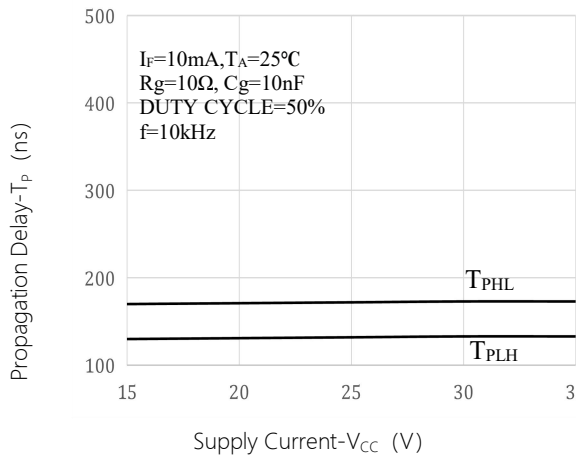


Fig.12 Propagation Delay vs Load Resistance

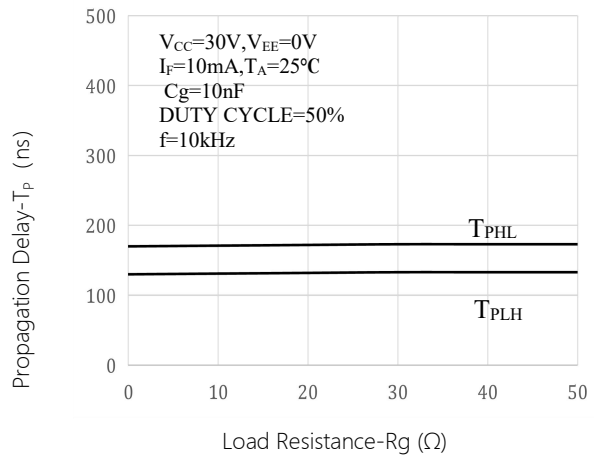


Fig.13 Propagation Delay vs Ambient Temperature

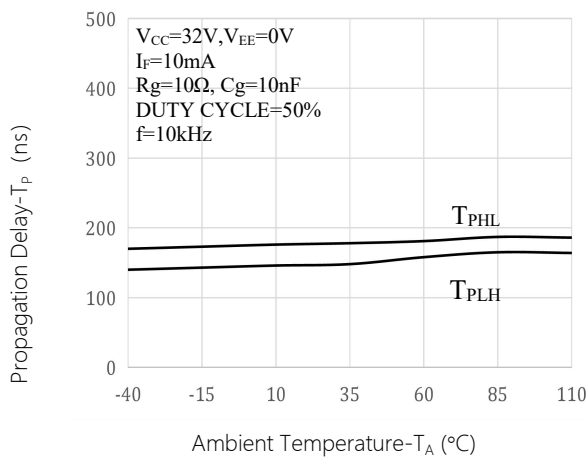


Fig.14 Propagation Delay vs Load Capacitor

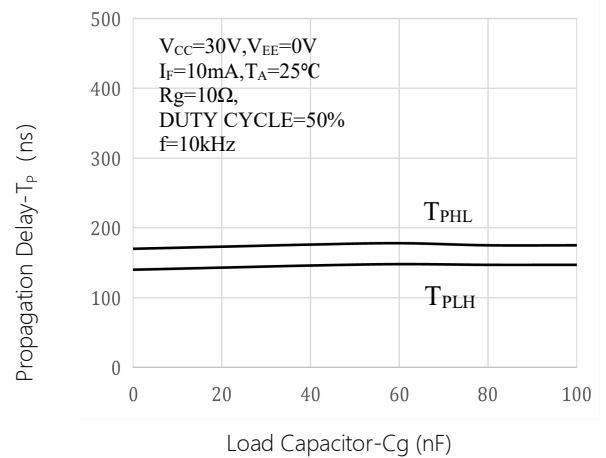
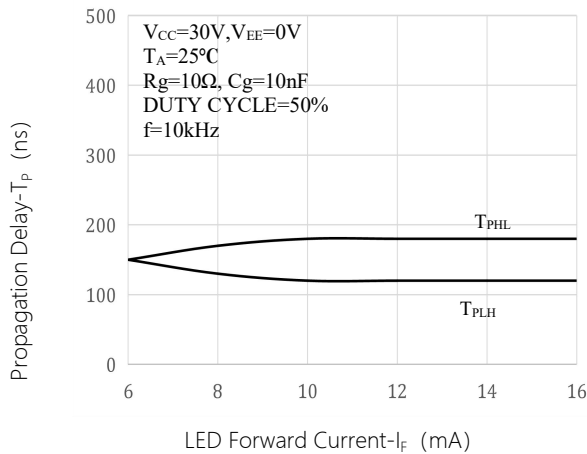


Fig.15 Propagation Delay vs LED Forward Current



测试电路 Test Circuit

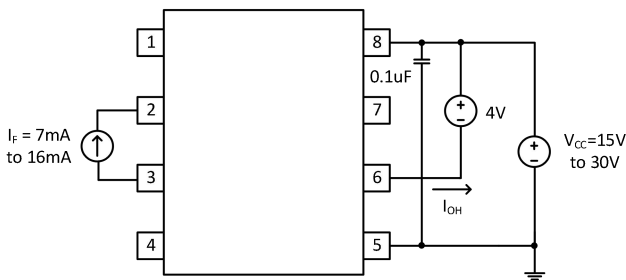


Fig.16 I_{OH} Pulsed Test Circuit

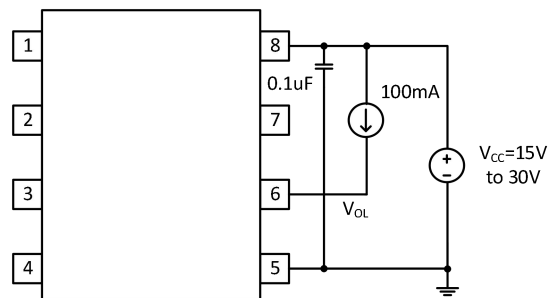


Fig.17 V_{OL} Pulsed Test Circuit

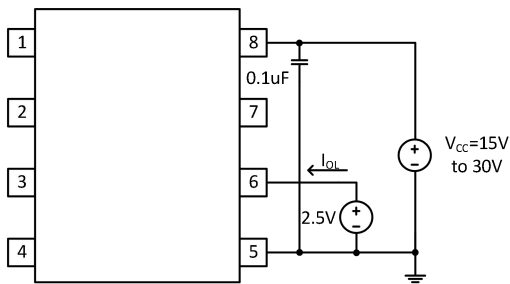


Fig.18 I_{OL} Pulsed Test Circuit

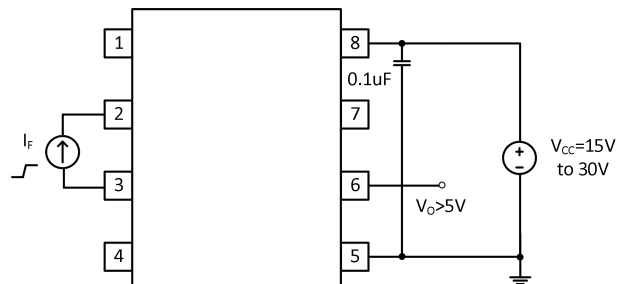


Fig.19 I_{FLH} Test Circuit

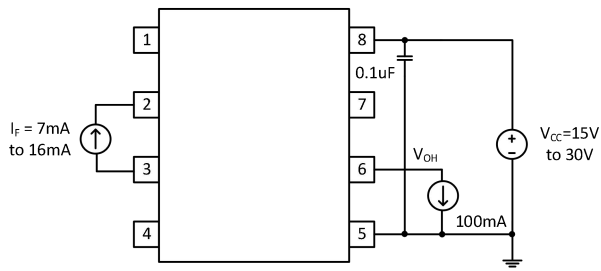


Fig.20 V_{OH} Pulsed Test Circuit

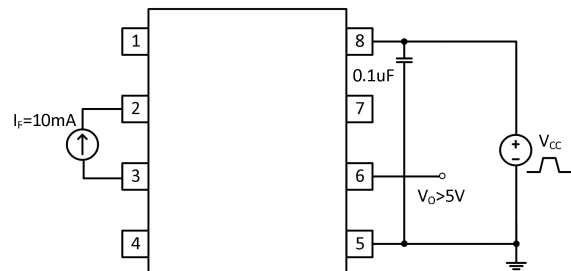


Fig.21 UVLO Test Circuit

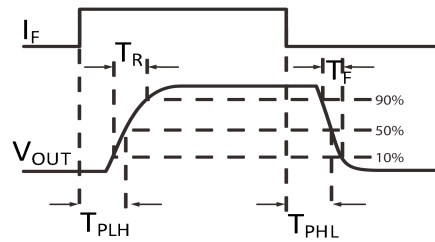
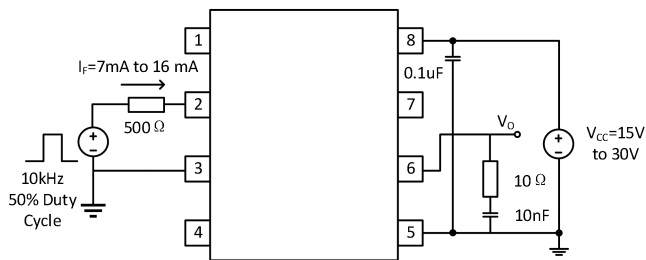


Fig.22 T_{PHL}、T_{PLH}、T_R、T_F Test Circuit

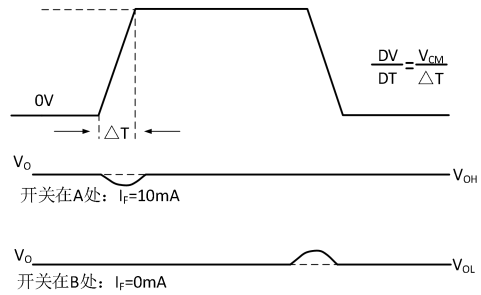
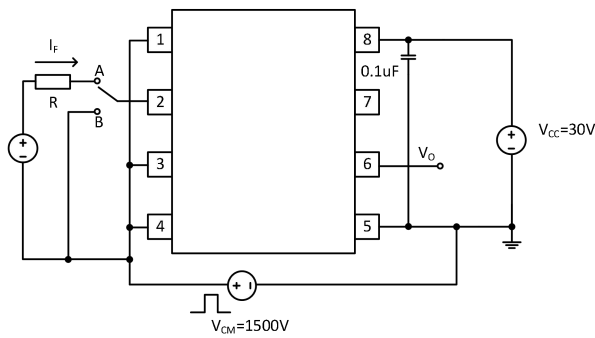
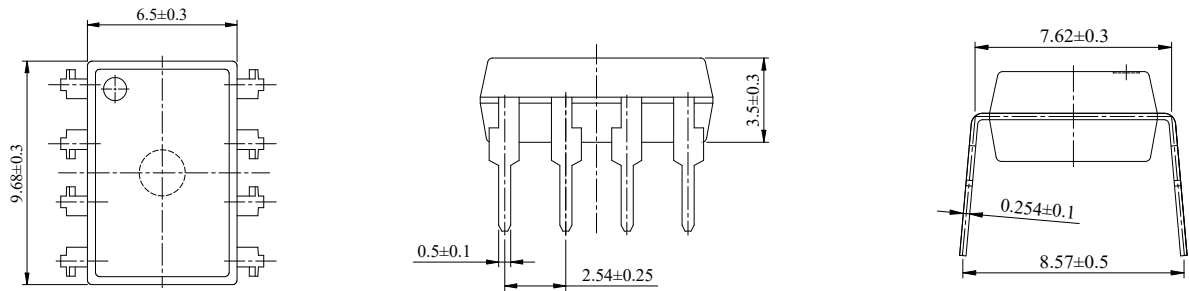


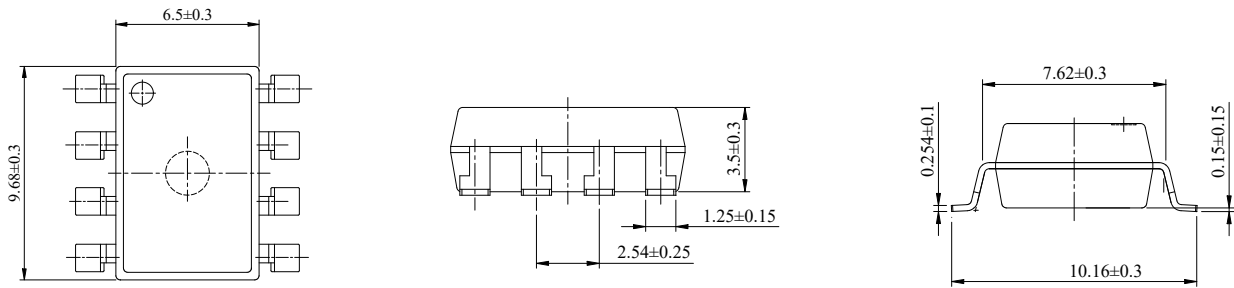
Figure.23 CMR Test Circuit

外形尺寸 Outline Dimensions

DIP8

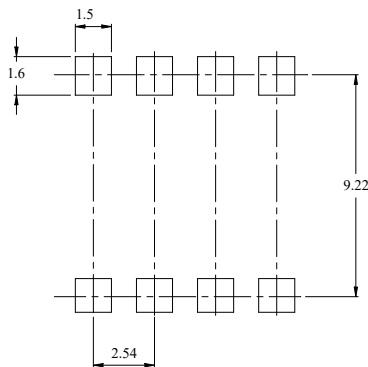


SMD8



单位 Unit: mm

建议焊盘布局 Recommended Pad Layout

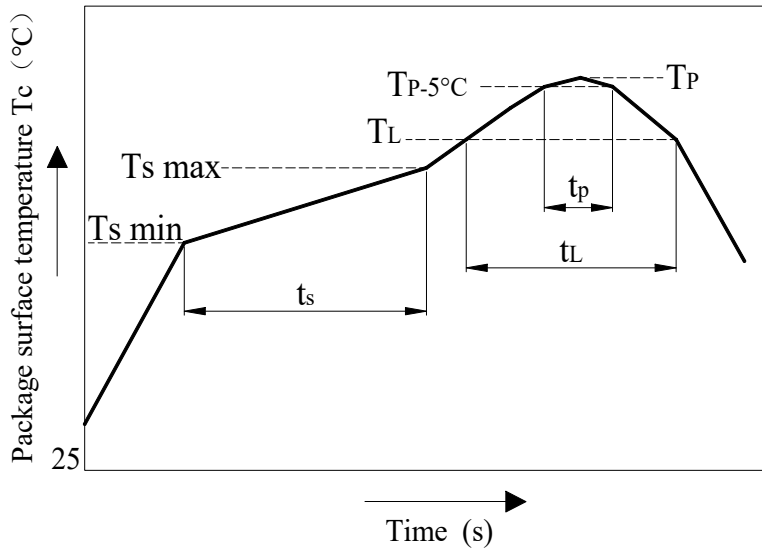


单位 Unit: mm

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

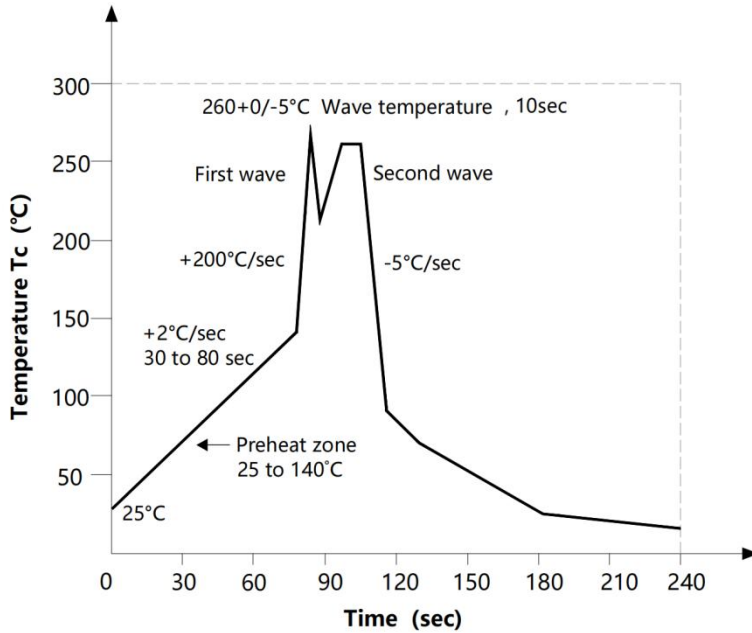


项目 Item	符号 Symbol	最小值 Min.	最大值 Max.	单位 Unit
预热温度 Preheat Temperature	T_s	150	200	°C
预热时间 Preheat Time	t_s	60	120	s
升温速率 Ramp-Up Rate (T_L to T_P)	-	-	3	°C/s
液相线温度 Liquidus Temperature	T_L	217		°C
时间高于 T_L Time Above T_L	t_L	60	150	s
峰值温度 Peak Temperature	T_P	-	260	°C
T_C 在 (T_P-5) 和 T_P 之间的时间 Time During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

注：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。

Note: 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°C ± 5°C, 时间 ≤ 3s.
Manual soldering method Temperature: 360°C ± 5°C, within 3s.

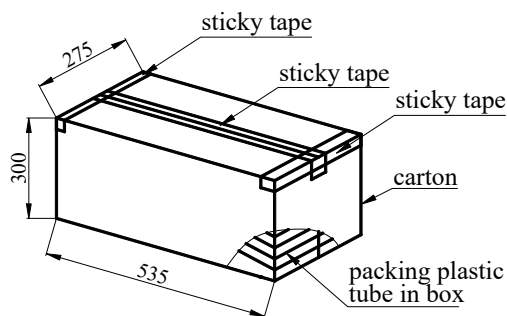
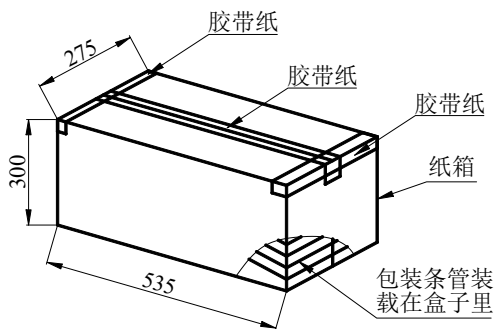
包装 Packing

■ 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
SMD8	卷盘 (φ330mm 蓝盘)	1k/盘	2 盘/盒	10 盒/箱	450*390*0.1mm	340*60*340mm	380*360*365mm	首端空 50 个空格, 末端空 100
DIP8	管装 (500*12*11mm)	45/管	50 管/盒	10 盒/箱	不适用	525*128*56mm	535*275*300mm	每管使用蓝白胶塞, 方向须一致
Package Type	Packing Form	Quantity per Reel	Quantity per Box	Quantity per Carton	Antistatic Bag Specification	Box Specification	Carton Specification	Note
SMD8	Tube (φ330mm Blue)	1k pcs/reel	2 reels /box	10 boxes /ctn	450*390*0.1mm	340*60*340mm	380*360*365mm	Leave 50 Spaces at the beginning and 100 Spaces at the end
DIP8	Reel (500*12*11mm)	45 pcs/Tube	50 Tubes/box	10 boxes/ctn	Not applicable	525*128*56mm	535*275*300mm	Use blue and white rubber stoppers for each tube, with the same direction

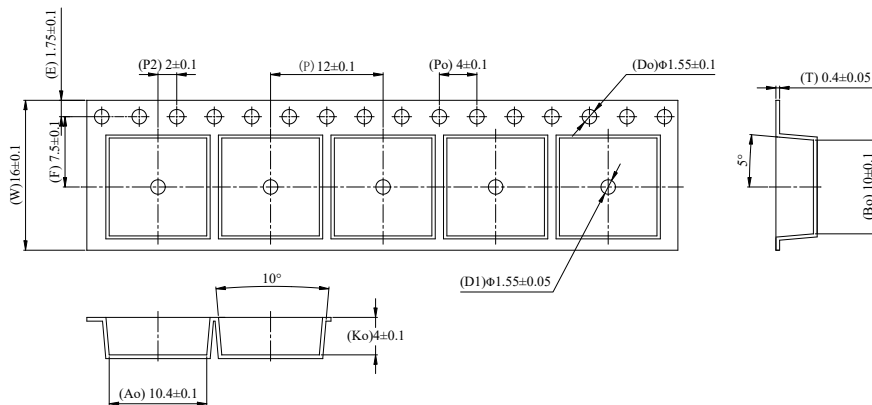
■ 管条包装 Tape & Tube

- 1) 每管数量: 45 只。
Qty/Tube: 45 pcs.
- 2) 每箱数量: 22500 只。
Qty/ctn: 22500 pcs.
- 3) 内包装: 每盒 50 管。
Inner packing: 50 Tubes/box.
- 4) 示意图 Schematic:



■ 编带包装 Tape & Reel

- 1) 每卷数量: 1000 只。
Qty/reel: 1000 pcs.
- 2) 每箱数量: 20000 只。
Qty/ctn: 20000 pcs.
- 3) 内包装: 每盒 2 盘。
Inner packing: 2 reels/box.
- 4) 示意图 Schematic:



单位 Unit: mm

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