



厦门华联电子股份有限公司

Xiamen Hualian Electronics Corp., Ltd.

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# 产品规格书

## SPECIFICATION

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产品名称：高速逻辑门输出型光耦合器

**DESCRIPTION: High Speed Logic Gate Opto-coupler**

产品型号：HPL6M237

**PART NO.: HPL6M237**

拟制 Prepared	审核 Verified	批准 Approved

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## 1 概述 General

光耦产品 HPL6M237 由 850nm 砷化铝镓红外发光二极管同超高速逻辑门光敏芯片耦合封装构成。产品输出端为集电极开路输出，从而允许线或输出。正常工作温度可达  $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$ 。输入端提供最大 5mA 的电流，输出端即可吸收最小 13mA 的电流。产品具有很强的共模抑制能力。

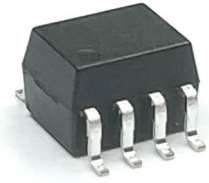


图 1 产品 Figure 1-Product

The HPL6M237 optocouplers consist of a 850 nm AlGaAS LED, optically coupled to a very high speed integrated photo-detector logic gate with a strobable output. This output features an open collector, thereby permitting wired or outputs. The coupled parameters are guaranteed over the temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ . A maximum input of 5mA will provide a minimum output sink current of 13mA. Products have strong common mode rejection capability.

## 2 特点 Features

- 数据传输速率快。High speed:15 Mbit/s.
- 逻辑门输出。Logic gate output.
- 输入、输出间绝缘电压高。The isolation voltage between input and output is high: VISO $\geq$ 3750Vrms.
- 双列贴片式 8L 塑料封装。8L SOP plastic package.
- TTL/LSTTL 双路兼容。TTL/LSTTL Compatible:3.3V/5V dual supply.
- 符合 RoHS 指令最新要求及 REACH 法规最新要求。Compliance with the latest requirements of the RoHS Directive and the latest REACH requirements.

## 3 应用 Applications

- 线接收器。Line receivers.
- 数据传输。Data transmission.
- 计算机外围接口。Computer-peripheral interface.
- 替代脉冲变压器。Pulse transformer replacement.
- 开关电源。Switching power supply.

## 4 真值表及电原理图 Truth Table and Schematic

表 1 真值表

Table 1-Truth Table

LED	OUTPUT
ON	L
OFF	H

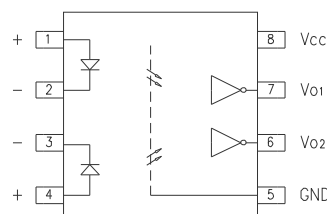


图 2 电原理图

Figure 2-Schematic

## 5 绝缘特性 IEC/EN/DIN EN 60747-5-5 Insulation Characteristics\*

表 2 绝缘特性

Table 2-Insulation Characteristics

Description	Symbol	Value	Unit
Installation classification per DIN VDE 0110, Table 1			
for rated mains voltage $\leq 150$ Vrms		I – IV	
for rated mains voltage $\leq 300$ Vrms		I – IV	
for rated mains voltage $\leq 600$ Vrms		I – IV	
Climatic Classification		40/85/21	
Pollution Degree (DIN VDE 0110/39)		2	
Maximum Working Insulation Voltage	$V_{IORM}$	565	Vpeak
Input to Output Test Voltage, Method b* $V_{IORM} \times 1.875 = V_{PR}$ , 100% Production Test with $t_m=1$ sec, Partial discharge $< 5$ pC	$V_{PR}$	1060	Vpeak
Input to Output Test Voltage, Method a* $V_{IORM} \times 1.6 = V_{PR}$ , Type and Sample Test, $t_m=10$ sec, Partial discharge $< 5$ pC	$V_{PR}$	904	Vpeak
Highest Allowable Overvoltage (Transient Overvoltage $t_{ini} = 60$ sec)	$V_{IOTM}$	4000	Vpeak
Case Temperature	$T_S$	150	°C
Input Current	$I_S$ , INPUT	50	mA
Output Power	$P_S$ , OUTPUT	250	mW
Insulation Resistance at $T_S$ , $V_{IO} = 500$ V	$R_S$	$\geq 10^9$	$\Omega$
Tracking Resistance (Comparative Tracking Index)	CTI	$>175$	V

\*请参阅当前目录中 IEC/EN/DIN EN 60747-5-5 《产品安全条例》章节的光耦合器部分前面的详细描述。

\*Refer to the front of the optocoupler section of the current catalog, under Product Safety Regulations section IEC/EN/DIN EN 60747-5-5, for a detailed description.

注:隔离特性只保证在安全最大额定值内,应用中的保护电路必须保证安全最大额定值。

Note: Isolation characteristics are guaranteed only within the safety maximum ratings which must be ensured by protective circuits in application.

## 6 极限参数 Absolute Maximum Ratings

表 3 极限参数

Table 3-Absolute Maximum Ratings

( $T_a=25^\circ\text{C}$ ,  $RH=30\sim 75\%$ )

参数名称 Characteristic	符号 Symbol	额定值 Rating	单位 Unit
正向电流 Forward Current	$I_F$	20	mA
正向脉冲电流 Pulse Forward Current ( $t=1\text{ms}$ , 50% duty cycle)	$I_{FP}$	40	mA
反向电压 Reverse Voltage	$V_R$	5	V
输入端功耗 Input Power Dissipation	$P_I$	40*	mW
节温 Junction Temperature	$T_J$	105	°C

输出端 output	输出电流 Output Current	$I_o$	50*	mA
	电源电压 Supply Voltage (1min Max)	$V_{CC}$	7	V
	输出电压 Output Voltage	$V_o$	7	V
	输出端功耗 Output Power Dissipation	$P_o$	60*	mW
	节温 Junction Temperature	$T_j$	105	°C
工作温度 Operating temp.		$T_{aop}$	-40 ~ +85	°C
贮存温度 Storage temp.		$T_{stg}$	-55 ~ +125	°C
焊接温度 Soldering Temperature	手工焊 Hand Soldering (3 Sec.)	$T_{sld}$	360	°C
	回流焊 Reflow Soldering (5 Sec.)		260	
绝缘电压 Isolation voltage (RH≤60%,交流 1 分钟) (RH≤60%, AC 1min.)		$V_{ISO}$	3750	$V_{rms}$

\*单个通道。

\*Each channel.

## 7 推荐工作条件 Recommended Operating Conditions

表 4 推荐工作条件

Table 4-Recommended Operating Conditions

参数名称 Characteristic	符号 Symbol	最小值 Min.	最大值 Max.	单位 Unit.
低电平输入电流 Input Current,Low Level	$I_{FL}$	0	250	$\mu A$
低电平输入电压 Input Current,Low Level	$V_{FL}$	0	0.8	V
高电平输入电流 Input Current,High Level	$I_{FH}$	7	20	mA
输出端电源电压 Power Supply Voltage	$V_{CC}$	4.5	5.5	V
	$V_{CC}$	2.7	3.6	V
扇出数 Fan Out (TTL Loads) $R_L = 1k \Omega$	N		5	TTL Loads
输出端上拉电阻 Output Pull-up Resistor	RL	330	4K	$\Omega$

## 8 光电参数 Opto-Electrical Characteristics

表 5 光电参数

Table 5-Opto-Electrical Characteristics (Ta=25°C, RH=30~75%)

参数 Parameters	符号 Symb.	测试条件 Test Conditions	最小 值 Min.	特征 值 Typ.	最大 值 Max.	单 位 Unit
正向电压 Forward Voltage	$V_F$	$I_F=10mA$		1.35	1.7	V
输入端反向击穿电压 Input Reverse Breakdown Voltage	$BV_R$	$I_R=10\mu A$	5			V

	反向电流 Reverse Current	$I_R$	$V_R=6V$			5	$\mu A$
	输入端电容 Input Capacitance	$C_{IN}$	$f=1MHz$		60		pF
输出端 Output	高电平电源电流 High Level Supply Current	$I_{CCH}$	$V_{CC}=5.5V,$ $I_F=0mA$			15	mA
	低电平电源电流 Low Level Supply Current	$I_{CCL}$	$V_{CC}=5.5V,$ $I_F=10mA$			21	mA
耦合 Coupler	高电平输出电流 High Level Output Current	$I_{OH}$	$I_F=0.25mA,$ $V_{CC}=5.5V$ $V_O=5.5V$		5.5	100	$\mu A$
	低电平输出电压 Low Level Output Voltage	$V_{OL}$	$I_F=5mA, V_{CC}=5.5V$ $I_{OL}=13mA$		0.35	0.6	V
	触发电流 Input Threshold Current	$I_{TH}$	$I_{OL}=13mA, V_{CC}=5.5V$ $V_O=0.6V$		2	5	mA
开关 Switching	输出端逻辑由低到高的传输延迟时间 Propagation Delay Time to Logic Low at Output	$t_{PHL}$	$R_L=350\Omega, C_L=15pF$ $I_F=7.5mA$			75	ns
	输出端逻辑由高到低的传输延迟时间 Propagation Delay Time to Logic High at Output	$t_{PLH}$	$R_L=350\Omega, C_L=15pF$ $I_F=7.5mA$			75	ns
	脉宽失真 Pulse Width Distortion	$ t_{PHL}-t_{PLH} $	$R_L=350\Omega, C_L=15pF$ $I_F=7.5mA$		10	35	ns
	输出端为高电平时的共模抑制能力 Common Mode Transient Immunity at Logic High Level Output	$ CM_H $	$R_L=350\Omega$ $I_F=0mA$ $V_{O(min)}=2.0V$ $ V_{CM} =10V_{P-P}$	15000			V/ $\mu s$
	输出端为低电平时的共模抑制能力 Common Mode Transient Immunity at Logic High Level Output	$ CM_L $	$R_L=350\Omega$ $I_F=7.5mA$ $V_{O(max)}=0.8V$ $ V_{CM} =10V_{P-P}$	15000			V/ $\mu s$
	输出端上升时间 Output Rise Time(10%~90%)	$t_r$	$R_L=350\Omega, C_L=15pF$ $I_F=7.5mA$		24	35	ns
	输出端下降时间 Output Fall Time(90%~10%)	$t_f$			10	25	
隔离 Isolation	绝缘电压 Isolation voltage	$V_{ISO}$	$I_{off}\leq 0.3mA,$ AC, 60s	3750			V
	常温绝缘电阻 Isolation Resistance between Input and Input	$R_{I-I}$	$V_{I-I}=500V DC$	$10^{11}$			$\Omega$
	常温绝缘电阻 Isolation Resistance between Input and Output	$R_{I-O}$	$V_{I-O}=500V DC$	$10^{12}$			$\Omega$
	输入-输出电容 Capacitance (Input to Output)	$C_{I-O}^a$	$f=1MHz$		0.6		pF

<sup>a</sup>  $C_{I-O}$ 测试是将PIN1,2,3,4短接在一起, PIN5,6,7,8短接在一起。Device considered a two-terminal device: Pins 1, 2, 3 and 4 shorted together, and Pins 5, 6, 7 and 8 shorted together.

## 9 特性曲线图 Characteristic Curve

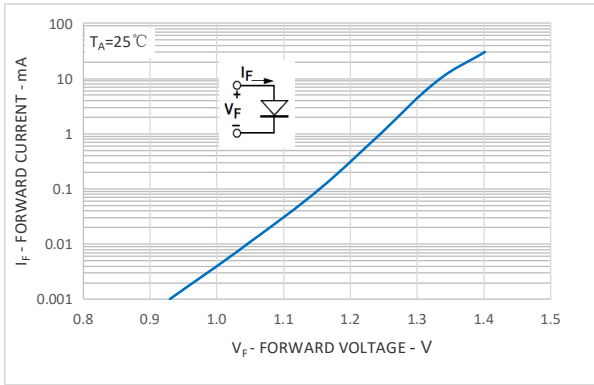


图 3  $V_F$ - $I_F$  特性曲线

Figure 3-Typical input diode forward characteristic

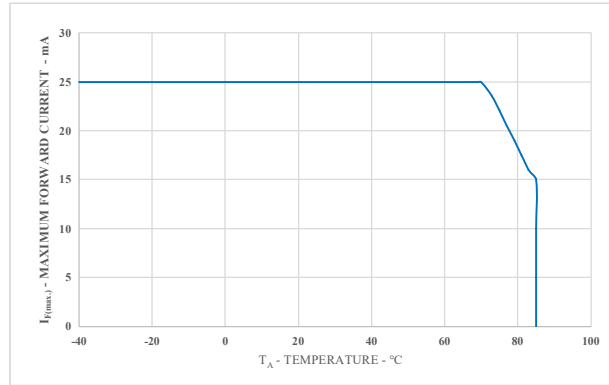


图 4  $I_{F(max)}$ - $T_A$  特性曲线

Figure 4- $I_{F(max)}$  vs. temperature

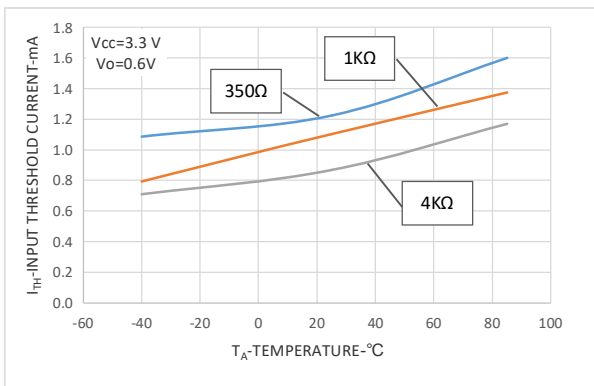


图 5  $I_{TH}$ - $T_A$  特性曲线 ( $V_{CC}=3.3V$ )

Figure 5-Input threshold current vs. Temperature

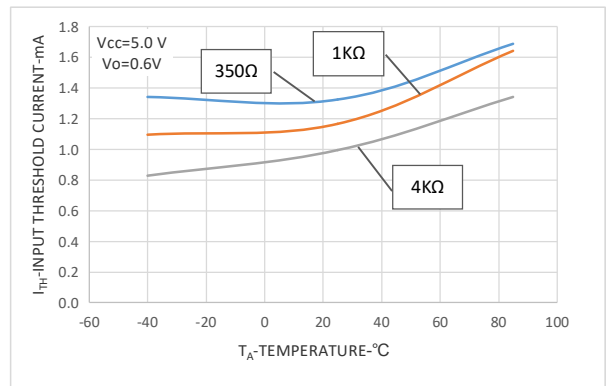


图 6  $I_{TH}$ - $T_A$  特性曲线 ( $V_{CC}=5V$ )

Figure 6-Input threshold current vs. Temperature

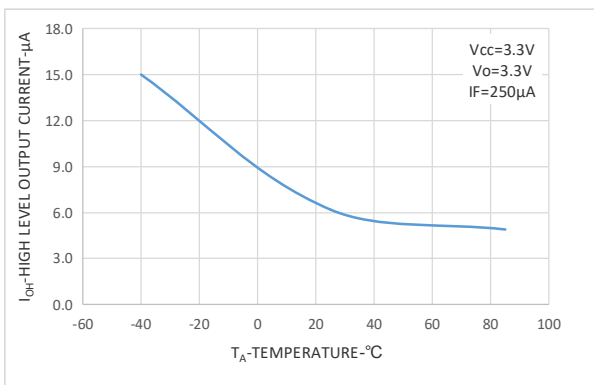


图 7  $I_{OH}$ - $T_A$  特性曲线 ( $V_{CC}=3.3V$ )

Figure 7-Typical high level output current vs. Temperature

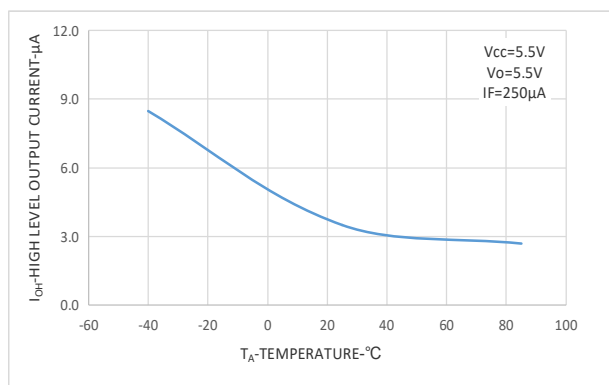


图 8  $I_{OH}$ - $T_A$  特性曲线 ( $V_{CC}=5V$ )

Figure 8-Typical high level output current vs. temperature

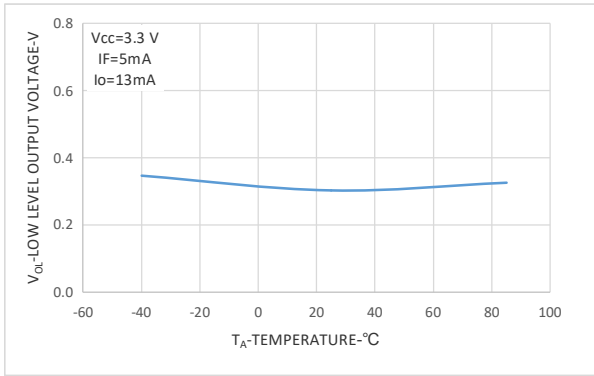


图 9  $V_{OL}$ - $T_A$  特性曲线 ( $V_{CC}=3.3V$ )  
Figure 9-Typical low level output voltage vs. Temperature

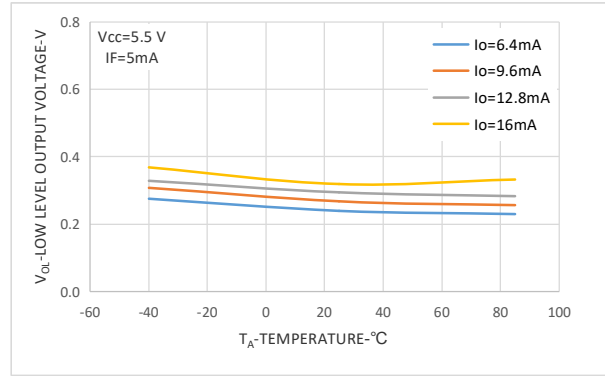


图 10  $V_{OL}$ - $T_A$  特性曲线 ( $V_{CC}=5.5V$ )  
Figure 10-Typical low level output voltage vs. temperature

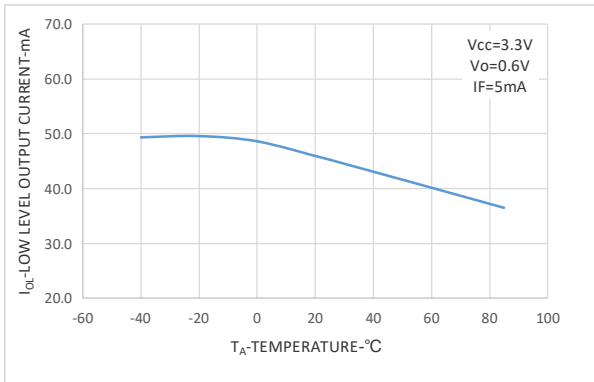


图 11  $I_{OL}$ - $T_A$  特性曲线 ( $V_{CC}=3.3V$ )  
Figure 11-Typical low level output current vs. Temperature

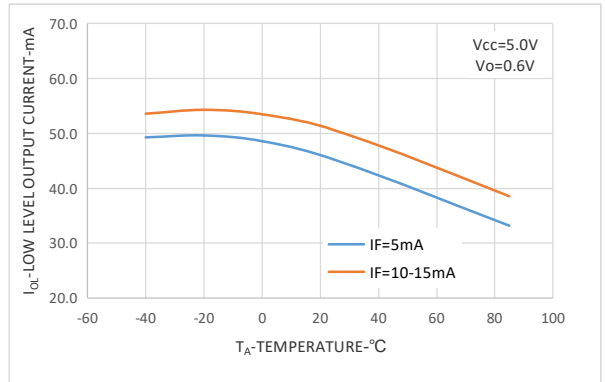


图 12  $I_{OL}$ - $T_A$  特性曲线 ( $V_{CC}=5V$ )  
Figure 12-Typical low level output current vs. vs. Temperature

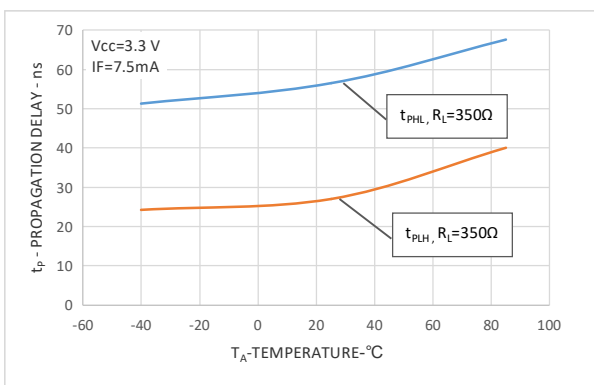


图 13  $t_p$ - $T_A$  特性曲线 ( $V_{CC}=3.3V$ )  
Figure 13-Typical propagation delay vs. temperature.

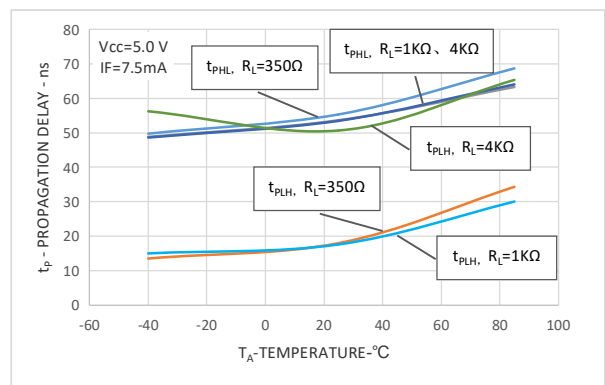


图 14  $t_p$ - $T_A$  特性曲线 ( $V_{CC}=5V$ )  
Figure 14-Typical propagation delay vs. temperature.

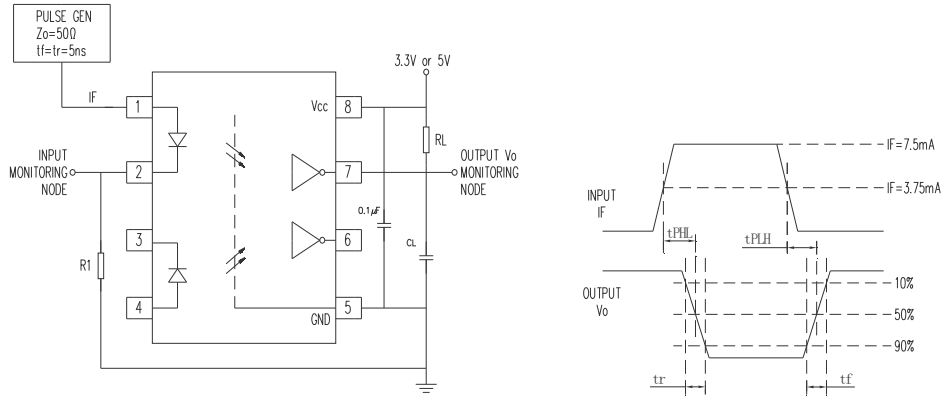


图 15  $t_{PHL}$ 、 $t_{PLH}$  测试方法

Figure 15- The test method of  $t_{PHL}$ 、 $t_{PLH}$

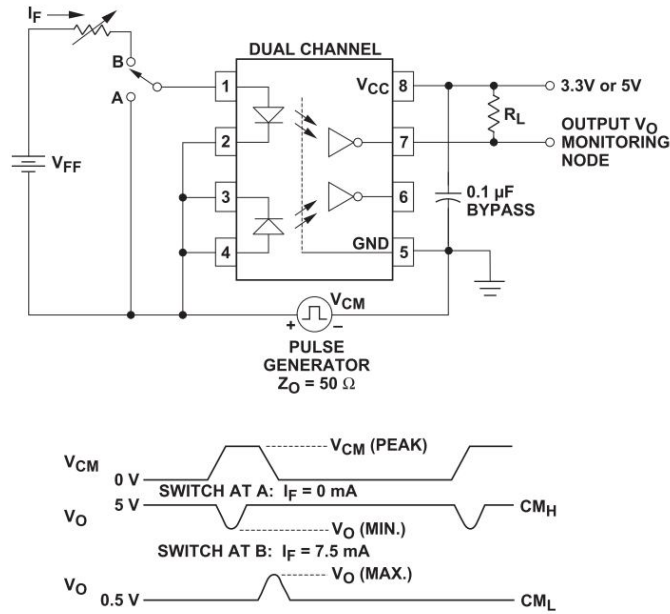


图 16 应用电路推荐

Figure 16- Recommended printed circuit board layout



## 10 外形尺寸 Dimensions

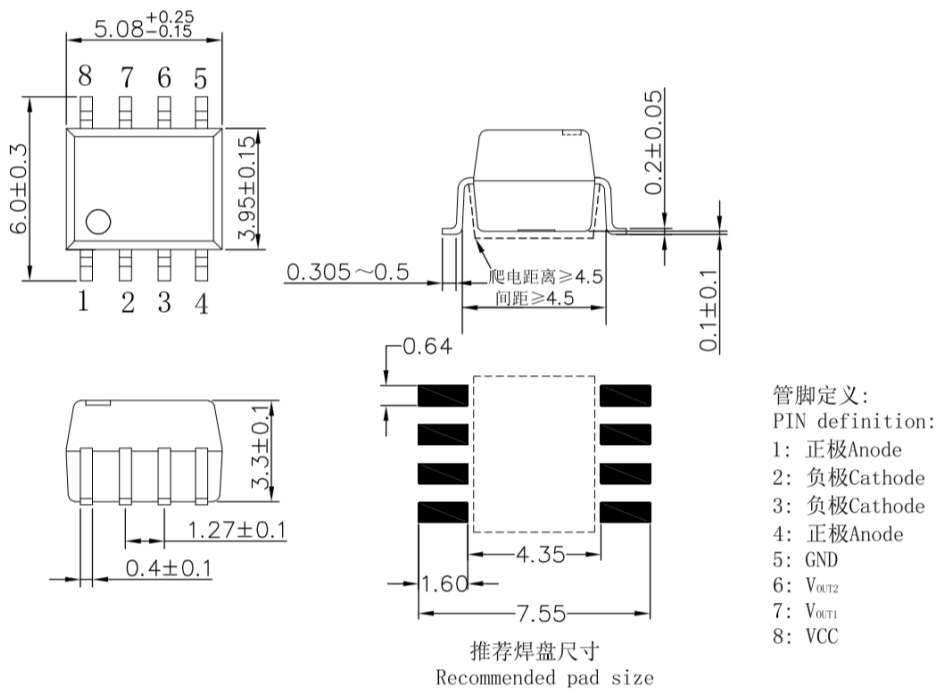


图 17 HPL6M237 外形尺寸

Figure 17- The dimensions of HPL6M237

## 11 标志 Mark

产品上应有型号、公司商标、生产日期代码、引出端识别标记。例如：HPL6M237 产品印章如图 18。

Print type characters, trade mark and Lot.No. on the Photo Coupler. For example the marking of product HPL6M237 is shown as Figure 18.

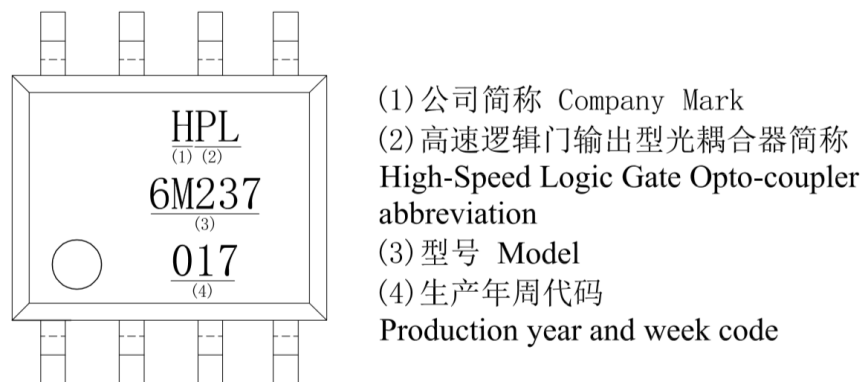


图 18 产品印章

Figure 18- Marking

## 12 包装方式 Packing

### 12.1 编带包装 (Tape and reel) : 适用于 For HPL6M237

12.1.1 每卷数量 (Qty/reel) : 2000 只 (pcs)。每箱数量 (Qty/ctn) : 40000 只 (pcs)。

### 12.1.2 内包装 (Inner packing) :

每卷盘 2000 只, 贴合格证 (型号、生产日期代号、检验员代号)。

2000pcs/reel, certificate on reel (model, code of product date, Inspector's code)

### 12.1.3 外包装(Outer packing):

公司名称、地址、商标、产品型号、数量等标志。

Indication of company name, address, trade mark, model and quantity.

### 12.1.4 示意图 (Schematic) :

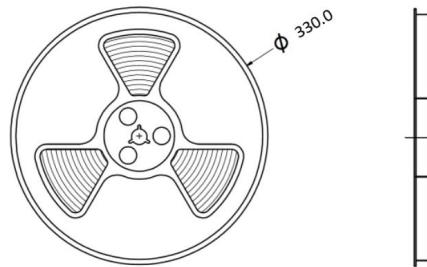
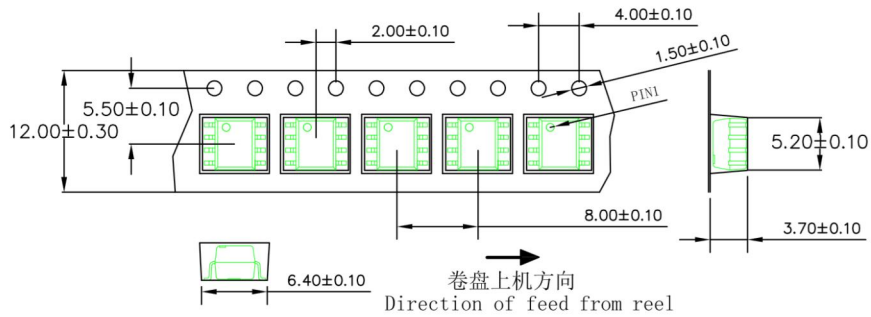


图 19 编带包装示意图

Figure 19- Taping Packing Schematic

## 12.2 标识 Label



图 20 标识 Figure 20-Label

## 13 使用注意事项 Note

13.1 推荐贮存温度 Recommend storage Temp.: 0~40°C;

推荐贮存湿度 Recommend storage humidity: <60%;

贮存有效期一年 Storage life: A year.

湿气敏感度等级 1 级。MSL level: MSL 1.

13.2 静电防护等级 (人体模式) ESD(HBM):  $\geq 2000V$ 。

13.3 引脚镀锡厚度: 大于等于  $3\mu m$ 。

Thickness of Sn which plated on lead frame:  $\geq 3\mu m$ .

### 13.4 推荐焊接条件 Recommended Soldering Conditions

#### 13.4.1 请勿使用超过最高贮存温度的物体直接接触环氧本体。

Do not contact the epoxy body directly with objects exceeding the maximum storage temperature.

#### 13.4.2 在高温下不要对环氧本体施加压力，特殊情况下施加的力不应超过2.5N。

Do not apply pressure to the epoxy at high temperatures, and in special cases do not apply more than 2.5N.

#### 13.4.3 回流焊 Reflow soldering

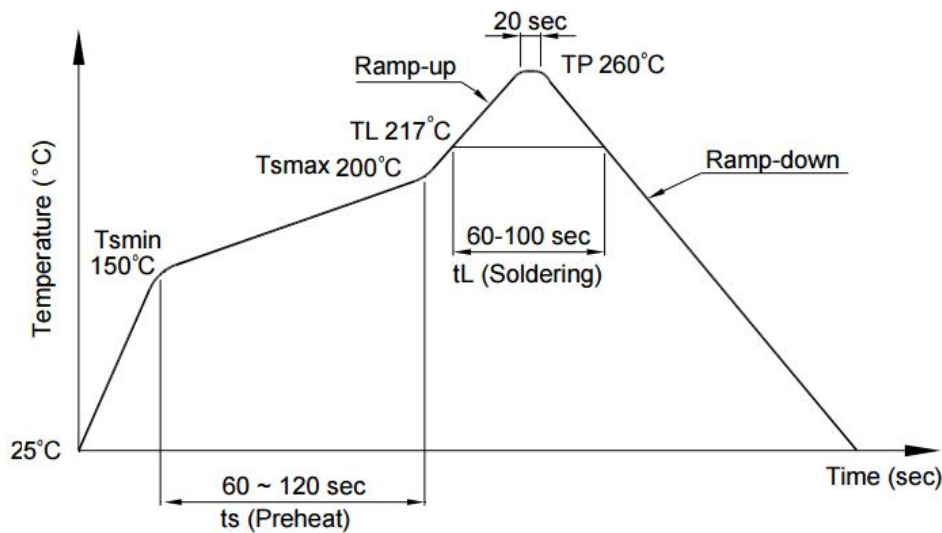
##### 1) 推荐锡膏规格 Recommend tin glue specifications:

a) 熔点 Melting temperature: 217°C

b) 组分 Contains: SnAg3Cu0.5

2) 回流焊工序必须在器件冷却至室温后进行。Never take next process until the component is cooled down to room temperature after reflow.

3) 推荐回流焊接参数，如下图所示：The recommended reflow soldering profile is following:



项目 Items		条件 Conditions
预热 Preheat	Temperature Min ( $T_{Smin}$ )	150°C
	Temperature Max ( $T_{Smax}$ )	200°C
	Time (min to max) ( $t_s$ )	90±30 sec
焊接区 Soldering zone	Temperature ( $T_L$ )	217°C
	Time ( $t_L$ )	60 ~ 100 sec
最高温度 Peak Temperature ( $T_P$ )		260°C
升温速率 Ramp-up rate		3°C / sec max.
降温速率 Ramp-down rate		3~6°C / sec

图 21 回流焊参数

Figure 21-Recommended reflow soldering profile

4) 建议在所示的温度和时间条件下进行一次回流焊，最多不能超过三次。One time soldering reflow is recommended within the condition of temperature and time profile shown below. Do not solder more than three times.

#### 13.4.4 手工烙铁焊 Manual soldering

1) 手工烙铁焊仅用于产品返修或样品测试。Manual soldering is only applicable to product repair.

2) 手工烙铁焊要求：温度 $360^{\circ}\text{C} \pm 5^{\circ}\text{C}$ ，时间 $\leq 3\text{s}$ ，返修次数 $\leq 2$ 次。Manual soldering requirements: temperature  $\leq (360^{\circ}\text{C} \pm 5^{\circ}\text{C})$ , time  $\leq 3\text{s}$ , repair times  $\leq 2$  times.

13.5 本说明书所展示的产品是为一般电子应用而设计的，如办公自动化设备、通讯设备、视听设备、电气

应用和仪器仪表等。对于需要高可靠性或安全性的设备，如空间应用、核动力控制设备、医疗设备等，请与我们的销售代表联系。The products shown in this publication are designed for the general use in electronic applications such as office automation equipment, communications devices, audio/visual equipment, electrical application and instrumentation. For equipment/devices where high reliability or safety is required, such as space applications, nuclear power control equipment, medical equipment, etc, please contact our sales representatives.

#### **14 产地 Production Place**

**14.1 产地 Production Place:** 中国厦门 Xiamen China;

**14.2 工厂名称 Production NO.:** 厦门华联电子股份有限公司; Xiamen Hualian Electronics Corp. , Ltd.;

**14.3 工厂地址 Production Add.:** 中国厦门市思明区前埔路 502 号 No.502, Qianpu Road, Siming District, Xiamen China.

更改记录表  
Engineering Change Notice-Record

版次 Edition	更改日期 Date	主要更改内容 Main Content	拟制 Prepared	确认 Checked
1.0	2020-03-13	新版发行 New edition	黄发宝	段果
1.1	2020-03-24	规格书内的型号由 HPL6N137-MS8 改为 HPL6N137D-MS8	黄发宝	段果
1.2	2020-04-14	表 4 推荐工作条件增加 Vcc: 2.7V~3.6V	黄发宝	段果
1.3	2020-04-24	1、产品型号由 HPL6N137-MS8 改为 HPL6M237; 2、第 7 页产品丝印做相应调整; 3、10.3.2 湿度敏感度等级由 MSL3 改为 MSL1。	黄发宝	段果
1.4	2020-05-18	1、图 9 产品外形图增加管脚定义描述。 2、图 11 增加卷盘图示。 3、推荐回流焊曲线参数调整。	黄发宝	段果
1.5	2020-06-19	1、数据传输速率由 10Mbps 变更为 15Mbps; 2、新增表 2 安规绝缘特性; 3、表 5 中增加 4 个项目: 1) 输入端电容 C <sub>IN</sub> ; 2) 常温绝缘电阻 R <sub>I-I</sub> ; 3) 常温绝缘电阻 R <sub>I-O</sub> ; 4) 脉宽失真 t <sub>PHL</sub> -t <sub>PLH</sub>  ; 4、第 10.3.1 项增加工作湿度范围; 5、新增第 10.3.3 项静电等级;	黄发宝	段果
1.6	2020-08-05	表 5 光电参数表“共模抑制能力”下限值由 10k 改为 15k。	黄发宝	段果
1.7	2020-09-17	图 9 外形图焊端尺寸由 min.0.305 改为 0.305~0.5。	黄发宝	段果
1.8	2020-12-30	1、补充完善极限参数表和光电参数表。 2、补充完善特性曲线。 3、外形图增加爬电距离和电气间隙, 端子尺寸公差, 增加推荐的焊盘尺寸; 4、增加印章说明; 5、增加编带示意图拉出方向; 6、修订标签图示; 7、更新推荐的回流焊曲线, 增加返修手工焊接要求; 8、修订部分使用注意事项。	黄发宝	段果