# ORIENT

# Photo coupler

# Product Data Sheet

Part Number: OR-6N137

Customer: _____

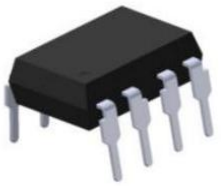
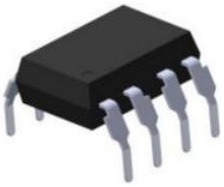
Date: _____

**SHENZHEN ORIENT COMPONENTS CO ., LTD**

Block A 3rd Floor No.4 Building,Tian'an Cyber Park,Huangge Rd,LongGang Dist,Shenzhen,GD

TEL：0755-29681816
FAX：0755-29681200
www.orient-opto.com

## 1. Features


(1) 3.3v / 5V supply voltage
(2) Low power consumption
(3) High speed: 15MBd(typical)
(4) $V_{CM}$=1000V, and the lowest common mode inhibition (CMR) is 10 kv/μs.
(5) - 40 ℃ ~ + 110 ℃ temperature of AC and DC performance.
(6) Safety approval

| | |
|---|---|
| UL | approved (No.E323844) |
| VDE | approved (No.40029733) |
| CQC | approved (No.CQC19001231254 ) |

(7) In compliance with RoHS, REACH standards
(8) MSL Class I

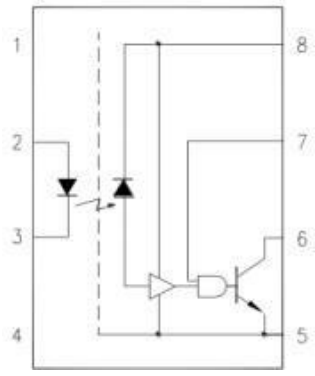
## 2. Instructions

6N137 is made up of an efficient AlGaAs light-emitting diode and high-speed optical detector. This design provides good ac and dc isolation between the input and output ends of the photoelectric coupler. The output characteristic of the photodetector is a collector open circuit schottky clamp transistor. The total mode transient immunity should reach 10 kv/pa at 3.3 v. The photoelectric couple operating temperature range: - 40 ℃ ~ + 110 ℃.

## 3. Application Range

1. line receiver isolation
2. A/ D, D/A converted digital signal isolation
3. eliminate noise from the ground loop
4. switching power supply
5. alternative pulse transformers
6. motor control system
7. interface of microprocessor system, computer and peripheral equipment

## 4. Functional Diagram




1. NC
2. Anode
3. Cathode
4. NC
5. GND
6. Output
7. $V_E$(Enable)
8. $V_{CC}$

Truth table

| Input（LED | Enable | Output |
|---|---|---|
| ON | H | L |
| OFF | H | H |
| ON | L | H |
| OFF | L | H |
| ON | NC | L |
| OFF | NC | H |

0.1 capacitor F bypass capacitance needs to be connected between A Pin8 and Pin5

## 5. Absolute Maximum Ratings (Ta=25℃)*1

| Parameter | | Symbol | Rated Value | Unit |
|---|---|---|---|---|
| Input | Average Forward Input Current | $I_F$ | 20 | mA |
| | Reverse Input Voltage | $V_R$ | 5 | V |
| | Power Dissipation | $P_I$ | 40 | mV |
| | Enable Input Voltage | $V_E$ | VCC+0.5 | V |
| | Enable Input current | $I_E$ | 5 | mA |
| Output | Output Collector Current | $I_O$ | 50 | mA |
| | Output Collector Voltage | $V_O$ | 7 | V |
| | Output Collector Power Dissipation | $P_O$ | 85 | mW |
| | Supply Voltage | $V_{CC}$ | 7 | V |
| | Insulation Voltage | $V_{iso}$ | 5000 | Vrms |
| | Working Temperature | $T_{opr}$ | -40 ~+ 110 | ℃ |
| | Storage Temperature | $T_{stg}$ | -55 ~ + 125 | |
| *2 | Soldering Temperature | $T_{sol}$ | 260 | |

*1. Room temperature = 25 ℃. Exceeding the maximum absolute rating can permanently damage the device.

Working long hours at the maximum absolute rating can affect reliability.

*2. soldering time is 10 seconds.

## 6. Recommended Operating Conditions

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Operating Temperature | $T_A$ | -40 | 110 | ℃ |
| Supply Voltage | $V_{CC}$ | 2.7 | 3.6 | V |
| | | 4.5 | 5.5 | |
| Low Level Input Current | $I_{FL}$ | 0 | 250 | μA |
| High Level Input Current | $I_{FH}$ | 5 | 15 | mA |
| Low Level Enable Voltage | $V_{EL}$ | 0 | 0.8 | V |
| High Level Enable Voltage | $V_{EH}$ | 2 | $V_{CC}$ | V |
| Output Pull-up Resistor | $R_L$ | 330 | 4000 | Ω |
| Fan Out (at RL=1kΩ per channel) | N | — | 5 | TTL Loads |

## 7. Opto-electronic Characteristics

| Parameter | | Symbol | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|---|
| Input | Forward Voltage | $V_F$ | — | 1.38 | 1.7 | V | $I_F$= 10mA |
| | Temperature Coefficient OF Forward Voltage | $\Delta V_F/\Delta T$ | — | -1.5 | — | mV/℃ | $I_F$= 10mA |
| | Reverse Voltage | $BV_R$ | 5 | — | — | V | $I_R$ = 10μA |
| | Input Threshold Current | $I_{TH}$ | — | 1.5 | 5 | mA | $V_E$=2V,$V_{CC}$=3.3V $V_O$=0.6V $I_{OL}$ (sinking) =13mA |
| | Input Capacitance | $C_{IN}$ | — | 34 | — | pF | f = 1MHz, VF = 0V |
| Detector | High Level Supply Current | $I_{CCH}$ | — | 3.8 | 10 | μA | $V_E$= 0.5V, $V_{CC}$=3.3V,$I_F$=0mA |
| | Low Level Supply Current | $I_{CCL}$ | — | 5.8 | 13 | mA | $V_E$= 0.5V, $V_{CC}$= 3.3V,$I_F$=10mA |
| | High Level Enable Current | $I_{EH}$ | — | -0.19 | -1.6 | mA | $V_{CC}$= 3.3V,$V_E$=2V |
| | Low Level Enable Current | $I_{EL}$ | — | -0.41 | -1.6 | mA | $V_{CC}$= 3.3V,$V_E$=0.5V |
| | High Level Enable Voltage | $V_{EH}$ | 2 | — | — | V | |
| | Low Level Enable Voltage | $V_{EL}$ | | — | 0.8 | V | |
| | High Level Output Current | $I_{OH}$ | — | 5 | 100 | μA | $V_E$=2V, $V_{CC}$=3.3V, $V_O$=3.2V,$I_F$=250μA |
| | Low Level Output Voltage | $V_{OL}$ | — | 0.3 | 0.6 | V | $V_E$=2V, $V_{CC}$=3.3V, $I_F$=5mA, $I_{OL}$ (sinking) = 13mA |

Recommended temperature range ($T_A$= -40℃—+110℃,2.7V≤$V_{CC}$≤3.6 V),$I_F$= 7.5mA Unless otherwise stated. Typical values$T_A$ =25℃,$V_{CC}$ = 3.3 V.

| Parameter | | Symbol | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|---|
| Input | Forward Voltage | $V_F$ | — | 1.38 | 1.7 | V | $I_F$= 10mA |
| | Temperature Coefficient OF Forward Voltage | $\Delta V_F/\Delta T$ | — | -1.5 | — | mV/°C | $I_F$= 10mA |
| | Reverse Voltage | $BV_R$ | 5 | — | — | V | $I_R$ = 10μA |
| | Input Threshold Current | $I_{TH}$ | — | 1.35 | 5 | mA | $V_{CC}$=5.5V,$V_O$=0.6V $I_{OL}$>13mA |
| | Input Capacitance | $C_{IN}$ | — | 34 | — | pF | f = 1MHz, $V_F$ = 0V |
| Detector | High Level Supply Current | $I_{CCH}$ | — | 6.1 | 10 | μA | $V_E$= 0.5V, $V_{CC}$=5.5V,$I_F$=0mA |
| | Low Level Supply Current | $I_{CCL}$ | — | 8.3 | 13 | mA | $V_E$= 0.5V, $V_{CC}$= 5.5V,$I_F$=10mA |
| | High Level Enable Current | $I_{EH}$ | — | -0.6 | -1.6 | mA | $V_{CC}$= 5.5V,$V_E$=2V |
| | Low Level Enable Current | $I_{EL}$ | — | -0.9 | -1.6 | mA | $V_{CC}$= 5.5V,$V_E$=0.5V |
| | High Level Enable Voltage | $V_{EH}$ | 2 | — | — | V | |
| | Low Level Enable Voltage | $V_{EL}$ | | — | 0.8 | V | |
| | High Level Output Current | $I_{OH}$ | — | 0.9 | 100 | μA | $V_E$=2V, $V_{CC}$=5.5V, $V_O$=5.5V,$I_F$=250μA |
| | Low Level Output Voltage | $V_{OL}$ | — | 0.3 | 0.6 | V | $V_E$=2V, $V_{CC}$=5.5V, $I_F$=5mA, $I_{OL}$ (sinking) = 13mA |

Recommended temperature range($T_A$= -40°C—+110°C,4.5V≤$V_{CC}$≤5.5V),$I_F$= 7.5mA Unless otherwise stated.

Typical values $T_A$ =25°C,$V_{CC}$ = 5.0V.

## 8. Switching Characteristics

| Parameter | Symbol | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|
| Propagation delay time to output High level | $t_{PLH}$ | 25 | 48 | 90 | ns | $R_L$=350Ω,$C_L$=15pF |
| Propagation delay time to output Low level | $t_{PHL}$ | 25 | 35 | 75 | ns | |
| Pulse Width Distortion | $\|t_{PLH}-t_{PHL}\|$ | — | 13 | — | ns | |
| Output Rise Time (10 to 90%) | $t_r$ | — | 21 | — | ns | |
| Output Fall Time (90 to 10%) | $t_f$ | — | 6.6 | — | ns | |
| Propagation Delay Time of Enable from $V_{EH}$ to $V_{EL}$ | $t_{ELH}$ | — | 27 | — | ns | $R_L$=350Ω,$C_L$=15pF $V_{EL}$=0V,$V_{EH}$=3V |
| Propagation Delay Time of Enable from $V_{EL}$ to $V_{EH}$ | $t_{EHL}$ | — | 9 | — | ns | |

Recommended temperature range ($T_A$= -40℃—+110℃,2.7V≤$V_{CC}$≤3.6 V),$I_F$= 7.5mA Unless otherwise stated.
Typical values $T_A$ =25℃,$V_{CC}$ = 3.3 V。

| Parameter | Symbol | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|
| Propagation delay time to output High Level | $t_{PLH}$ | 25 | 40 | 75 | ns | $T_A$=25℃, $R_L$=350Ω, $C_L$=15pF |
| | | — | — | 100 | | |
| Propagation delay time to output Low Level | $t_{PHL}$ | 25 | 32 | 75 | ns | |
| | | — | — | 100 | | |
| Pulse Width Distortion | $\|t_{PLH}-t_{PHL}\|$ | — | 8 | — | ns | $R_L$=350Ω $C_L$=15pF |
| Output Rise Time (10 to 90%) | tr | — | 22 | — | ns | |
| Output Fall Time (90 to 10%) | $t_f$ | — | 6.9 | — | ns | |
| Propagation Delay Time of Enable from $V_{EH}$ to $V_{EL}$ | $t_{ELH}$ | — | 28 | — | ns | $R_L$=350Ω $C_L$=15pF $V_{EL}$=0V $V_{EH}$=3V |
| Propagation Delay Time of Enable from $V_{EL}$ to $V_{EH}$ | $t_{EHL}$ | — | 12 | — | ns | |

Recommended temperature range ($T_A$= -40℃—+110℃,4.5V≤$V_{CC}$≤5.5V),$I_F$= 7.5mA Unless otherwise stated.
Typical values $T_A$ =25℃,$V_{CC}$ = 5.0 V。

| Parameter | Symbol | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|
| Logic High Common Mode Transient Immunity | $\|CM_H\|$ | 10 | 15 | — | kV/μs | $V_{CC}$=3.3V,$V_{CM}$=1000V,$R_L$=350Ω $I_F$=0mA,$T_A$=25℃ |
| | | 10 | 15 | — | | $V_{CC}$=5V,$V_{CM}$=1000V,$R_L$=350Ω $I_F$=0mA,$T_A$=25℃ |
| Logic Low Common Mode Transient Immunity | $\|CM_L\|$ | 10 | 15 | — | kV/μs | $V_{CC}$=3.3V,$V_{CM}$=1000V,$R_L$=350Ω $I_F$=10mA,$T_A$=25℃ |
| | | 10 | 15 | — | | $V_{CC}$=5V,$V_{CM}$=1000V,$R_L$=350Ω $I_F$=10mA,$T_A$=25℃ |

| Parameter | Symbol | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|
| Input-Output Insulation Leakage Current | $I_{I-O}$ | — | — | 1 | μA | 45% RH,t=5s, $V_{I-O}$ = 3KV DC,$T_A$ =25 C |
| Withstand Insulation Test Voltage | $V_{ISO}$ | 5000 | — | — | $V_{RMS}$ | RH ≤ 50%, t =1min,$T_A$=25℃ |
| Input-Output Resistance | $R_{I-O}$ | — | $10^{12}$ | — | Ω | $V_{I-O}$=500V DC |
| Input-Output Capacitance | $C_{I-O}$ | — | 1 | | p | f = 1MHz, $T_A$ = 25 C |

Recommended temperature range ($T_A$=40℃-110℃) Unless otherwise stated. Typical values $T_A$ =25℃.

# 9. Order Information

**Part Number**

# OR-6N137Y-Z

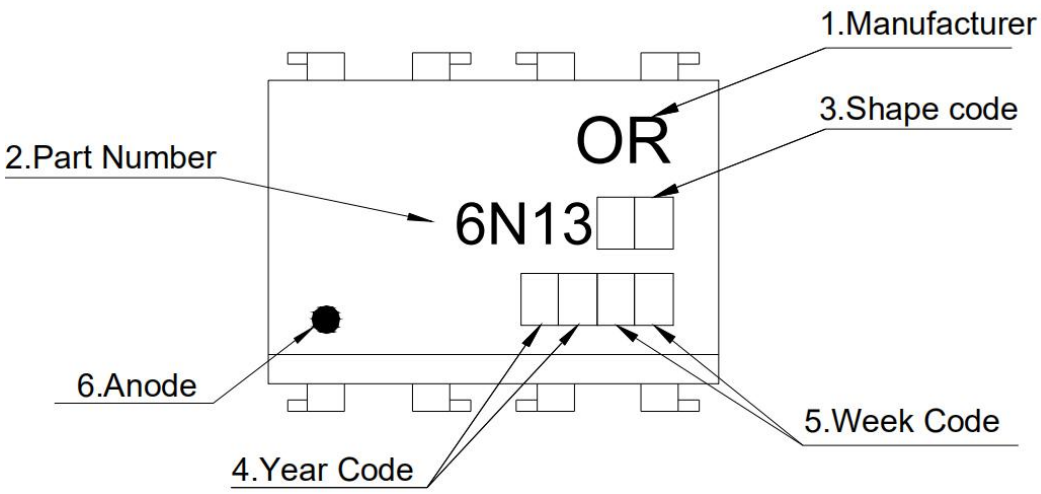
**Note**

Y = Lead form option (S, M or none)

Z = Tape and reel option ( TA,TA1 or none).

| Option | Description | Packing quantity |
|---|---|---|
| None | Standard SMD Option | 45 units per tube |
| M | Wide lead bend (0.4 inch spacing) | 45 units per tube |
| TA | Surface mount lead form (low profile) + TA tape & reel option | 1000 units per reel |
| TA1 | Surface mount lead form (low profile) + TA1 tape & reel option | 1000 units per reel |

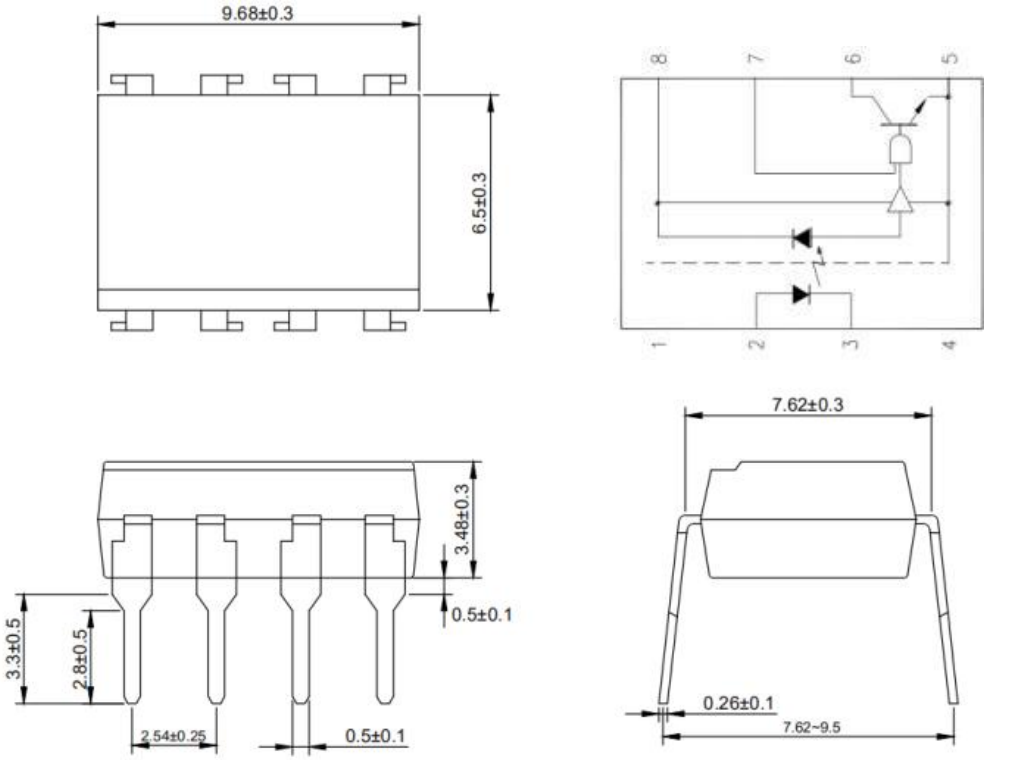
## 10. Naming Rule



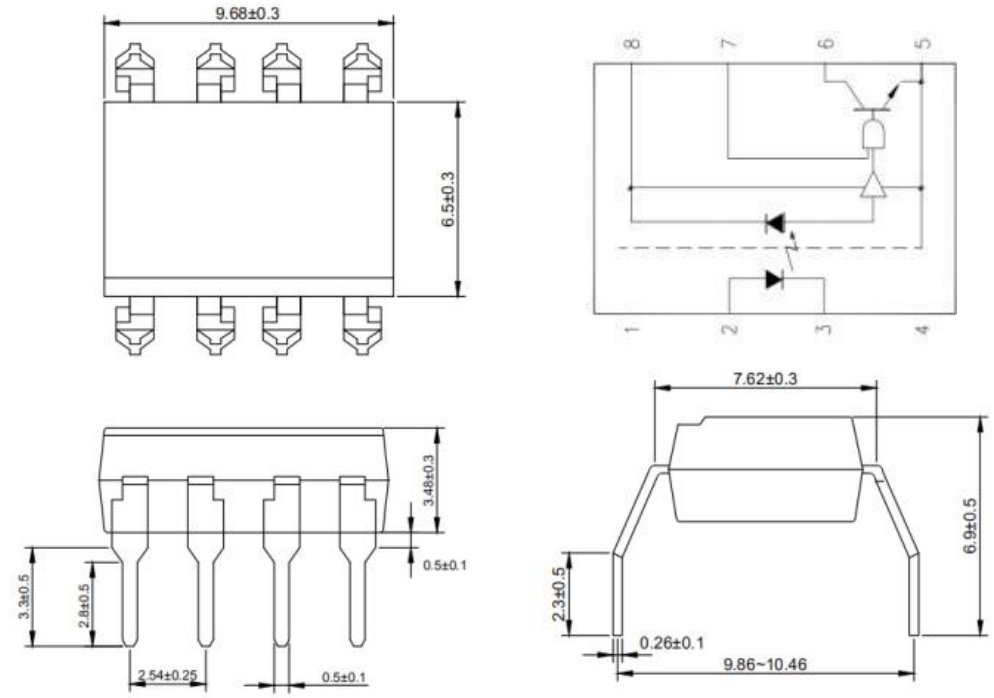

1. Manufacturer : ORIENT.
2. Part Number : 6N137.
3. Shape Code □.
4. Year Code □□ ： '21' means '2021' and so on.
5. Week Code □□： 01 means the first week, 02 means the second week and so on.
6. Anode.

# 11. Outer Dimension

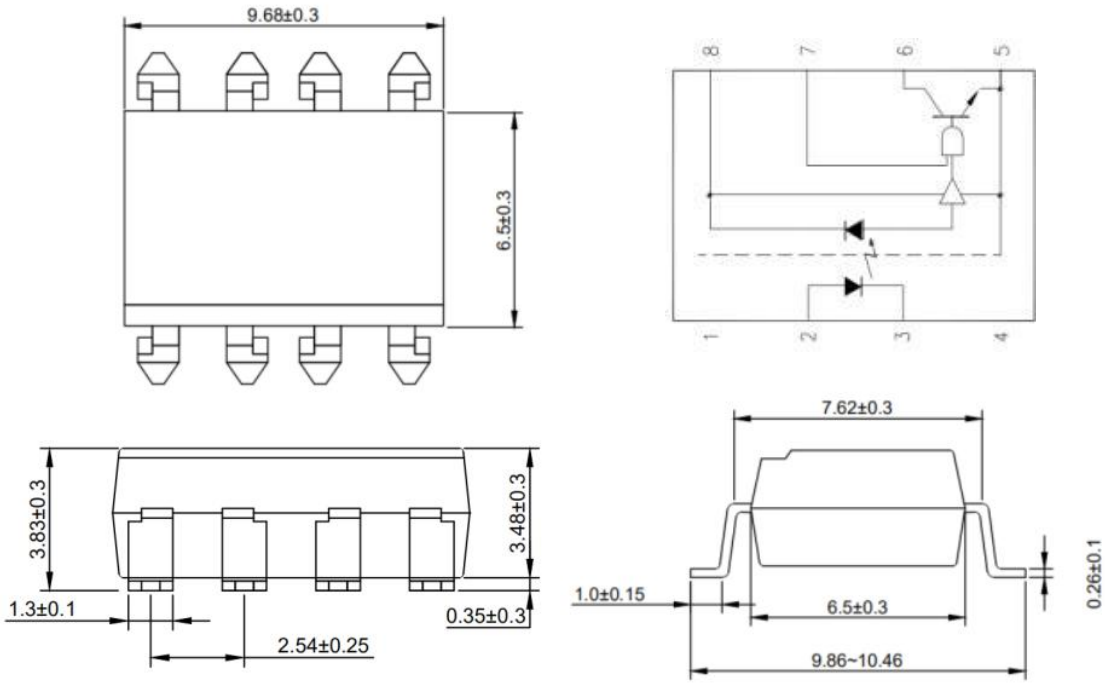
## (1) OR-6N137



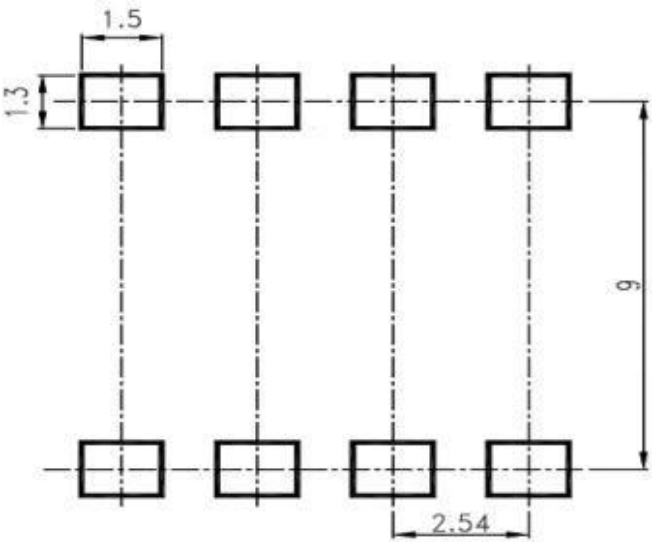

## (2) OR-6N137M



## (3) OR-6N137S



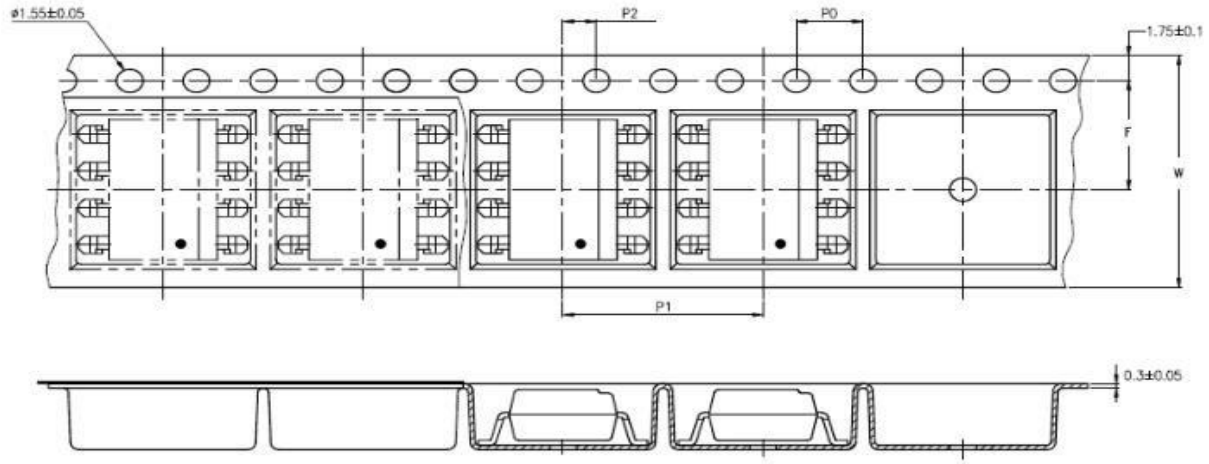

## 12、Recommended Foot Print Patterns (Mount Pad)



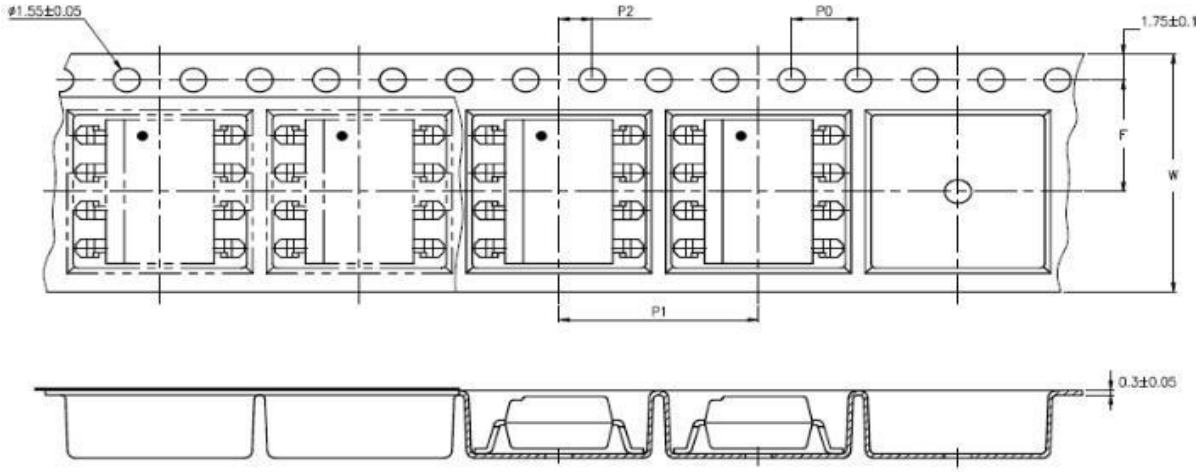

unit：mm

# 12. Taping Dimensions

## (1) OR-6N137S-TA




## (2) OR-6N137S-TA1




| type | symbol | Size: mm （inches） |
|---|---|---|
| bandwidth | W | 16±0.3 (0.63) |
| pitch | P0 | 4±0.1 (0.15) |
| pitch | F | 7.5±0.1 (0.295) |
| | P2 | 2±0.1 (0.079) |
| interval | P1 | 12±0.1 (0.472) |

| Encapsulation type | TA/TA1 |
|---|---|
| amount (pcs) | 1000 |

# 13. Package Dimension

## (1) package dimension

DIP Type

| Packing Information | |
|---|---|
| Packing type | Tube |
| Qty per Tube | 45pcs |
| Small box (Inner) Dimension | 525*128*60mm |
| Large box (Outer) Dimension | 545*290*335mm |
| The Amount per Inner Box | 2,250pcs |
| The Amount per Outer Box | 22,500pcs |

SOP Type

| Packing Information | |
|---|---|
| Packing type | Reel type |
| Tape Width | 16mm |
| Qty per Reel | 1,000pcs |
| Small box (inner) Dimension | 345*345*58.5mm |
| Large box (Outer) Dimension | 620x360x360mm |
| Max qty per small box | 2,000pcs |
| Max qty per large box | 20,000pcs |

## (2)Packing Label Sample


**Note:**

1. P/N :Contents with "Order Information" in the specification.
2. LOT NO : The production lot.
3. BATCH : The Electrical rank.
4. Quantity :Packaging quantity.
5. Product Data :Date of manufacture.

## 14. Reliability Test

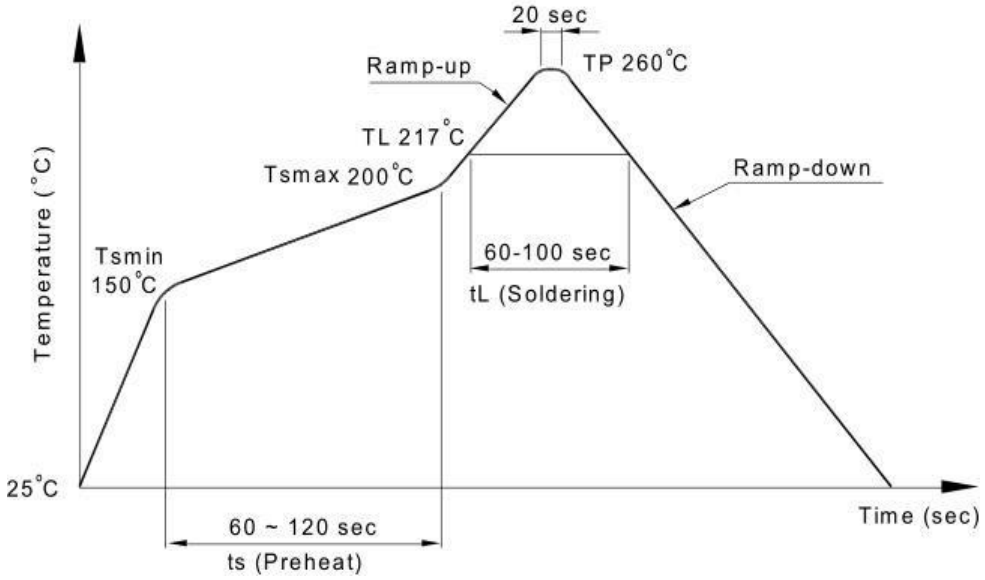
| NO. | ITEMS | Reliability Testing | | | | |
|---|---|---|---|---|---|---|
| | | QTY. (Pcs) | Condition | Process | Device | Standard |
| 1 | RSH<br>耐焊接热 | 22 | 260±5℃ | 5s/3 次 | 锡炉 | JESD22-A106 |
| 2 | HTSL<br>高温存储 | 77 | 125℃ | 168 hrs<br>500 hrs<br>1000 hrs | 高温烤箱测试仪 | JESD22-A103 |
| 3 | LTSL<br>低温存储 | 77 | -40℃ | 168 hrs<br>500 hrs<br>1000 hrs | 低温箱测试仪 | JESD22-A119 |
| 4 | TC<br>温度循环 | 77 | H:125℃ 15min<br>∫5min<br>L:-55℃ 15min | 300<br>cycle | 冷热冲击机 | JESD22-A104 |
| 5 | TS<br>温度冲击 | 77 | H:100℃ 5min<br>∫15s<br>L:-40℃ 5min | 300<br>cycle | 冷热冲击机 | JESD22-A106 |
| 6 | HTOL<br>高温操作 | 77 | 100℃<br>IF=10mA<br>Vcc=5V | 168 hrs<br>500 hrs<br>1000 hrs | 高温烤箱测试仪、老化电路板 | JESD22-A108 |
| 7 | ESD-HBM<br>人体模式 | 22 | ≥8KV 1Cycle | 1次 | ESD静电测试仪 | JESD22-A114 |
| 8 | SD<br>可焊性 | 22 | Pb-free<br>245±5℃ | 5s/1次 | 锡炉 | JESD22-B102 |
| 9 | HTHB<br>温湿寿命试验 | 77 | 85℃,85%RH<br>IF=10mA,Vcc=5V | 168 hrs<br>500 hrs<br>1000 hrs | 恒温恒湿机，测试仪 | JESD22-A101 |
| 10 | Autoclave<br>压力锅 | 77 | Ta=121<br>℃,100%RH,2atm | 96hrs | 压力锅 | JESD22-A102 |

# 15. Temperature Profile Of Soldering

(1) IR Reflow soldering (JEDEC-STD-020C compliant)

Note: one solder backflow is recommended under the conditions described below in the temperature and time profile. Do not weld more than three times.

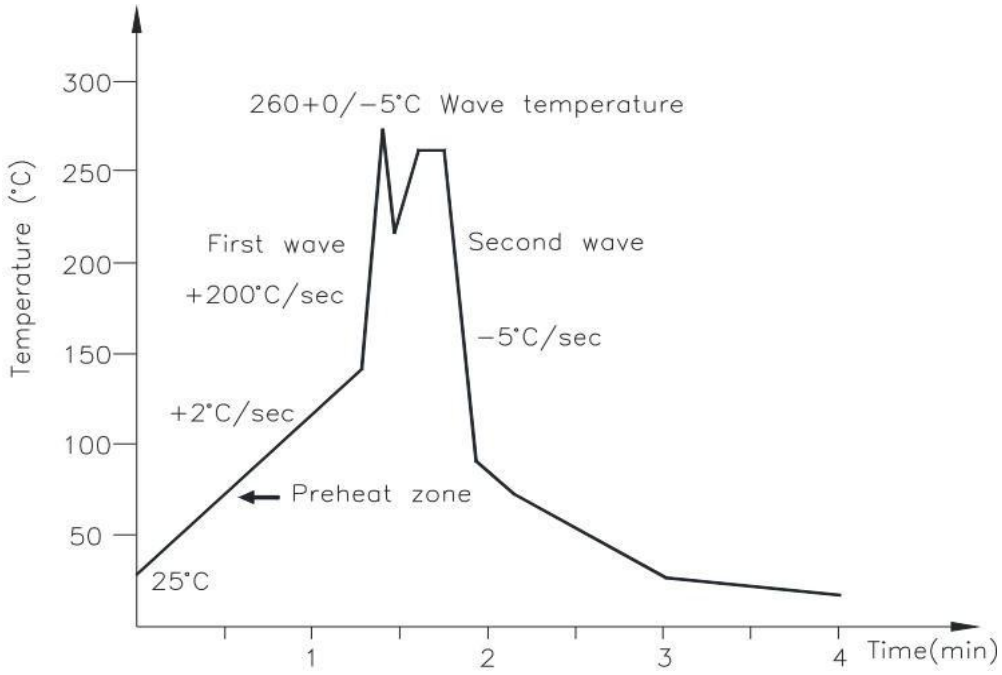
| Profile item | Conditions |
|---|---|
| Preheat<br>- Temperature Min (T Smin )<br>- Temperature Max (T Smax )<br>- Time (min to max) (ts) | <br>150˚C<br>200˚C<br>90±30 sec |
| Soldering zone<br>- Temperature (TL )<br>- Time (t L ) | <br>217˚C<br>60 sec |
| Peak Temperature | 260˚C |
| Peak Temperature time | 20 sec |
| Ramp-up rate | 3˚C / sec max. |
| Ramp-down rate from peak temperature | 3~6˚C / sec |
| Reflow times | ≤3 |



(2) Wave soldering (JEDEC22A111 compliant)

One-time welding is recommended under the temperature condition.

| | |
|---|---|
| Temperature<br>Time | 260+0/-5˚C<br>10 sec |
| Preheat temperature<br>Preheat time | 5 to 140˚C<br>30 to 80 sec |




(3) Hand soldering by soldering iron

Single lead welding is allowed in each process and one-time welding is recommended.

| | |
|---|---|
| Temperature<br>Time | 380+0/-5˚C<br>3 sec max |

# 16. Switching time test circuit

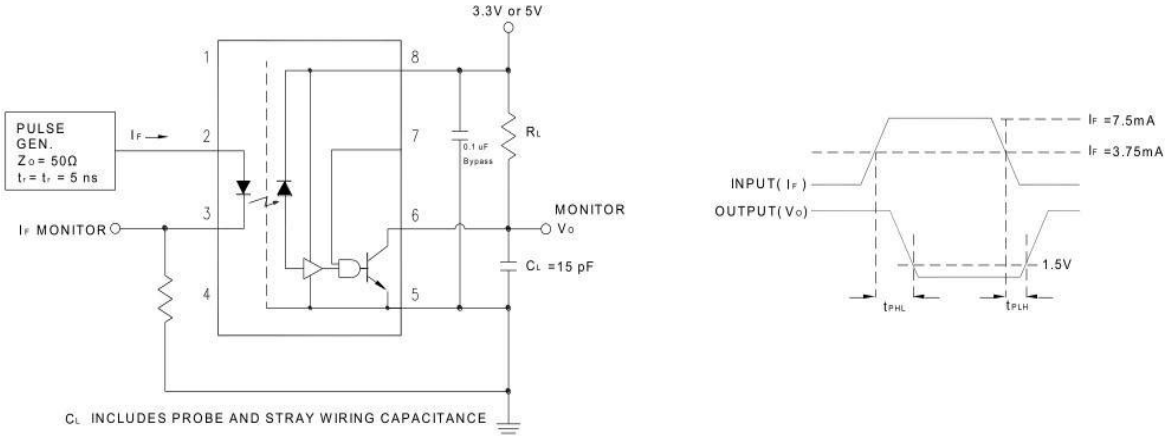



**Figure 1: Test Circuit for $t_{PHL}$ and $t_{PLH}$**

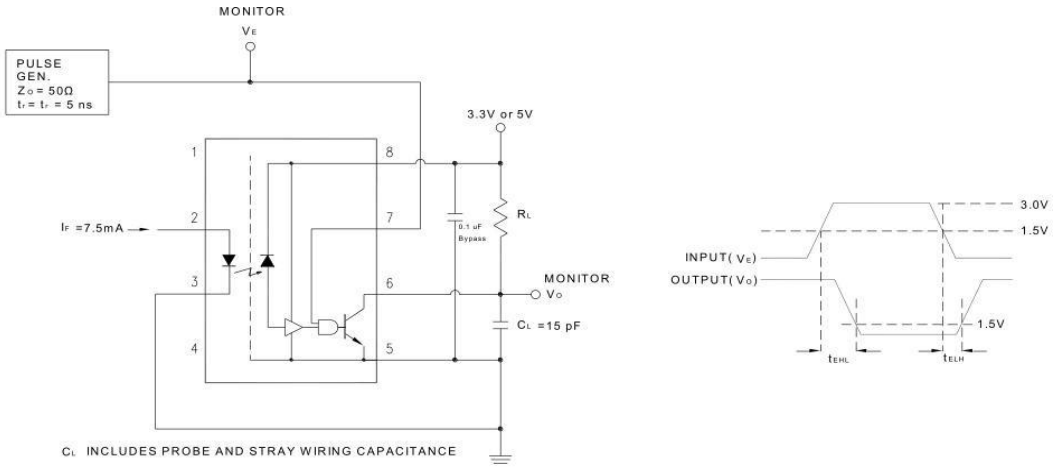



**Figure 2: Single Channel Test Circuit for Common Mode Transient Immunity**

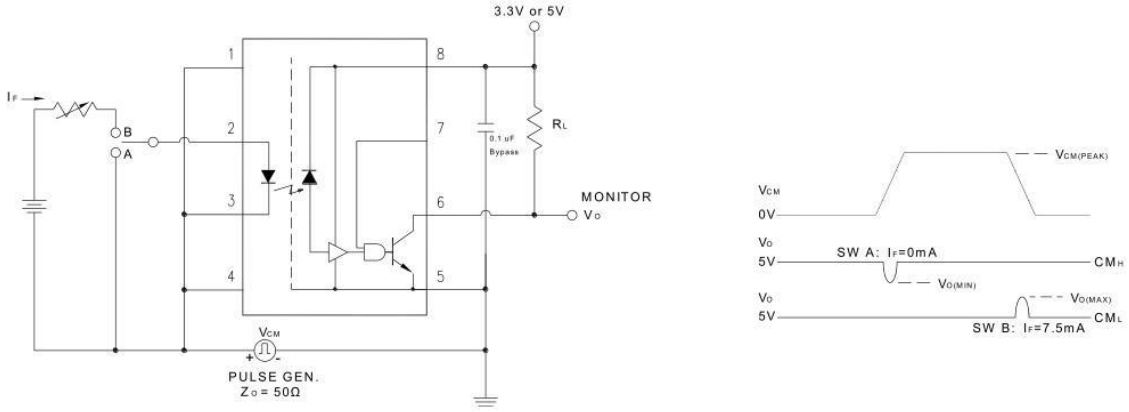



**Figure 3: Single Channel Test Circuit for Common Mode Transient Immunity**

# 17. Characteristics Curve

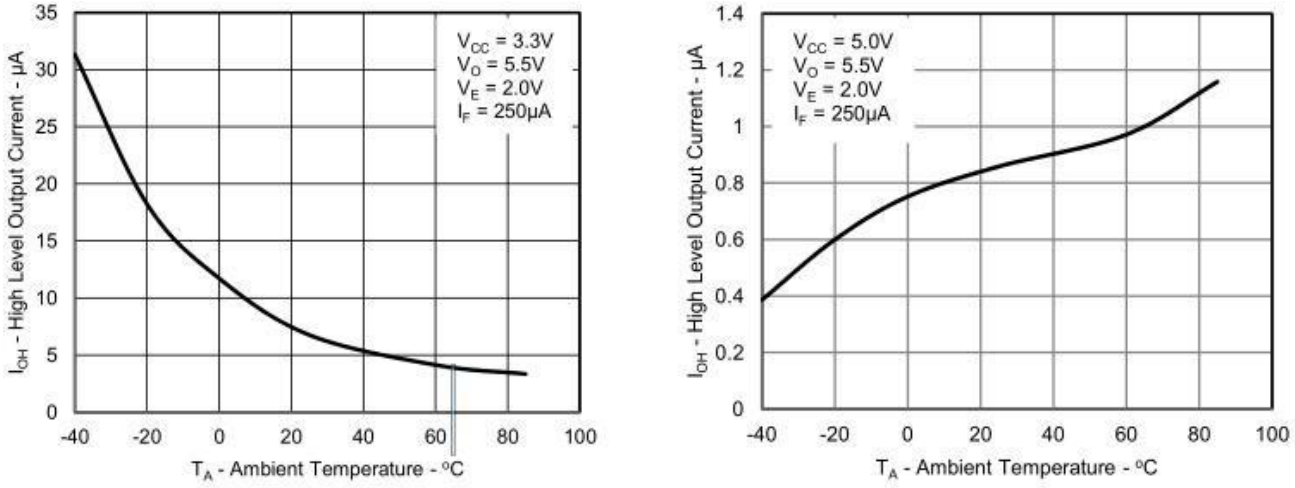



**Figure 4: Typical High Level Output Current vs. Ambient Temperature**

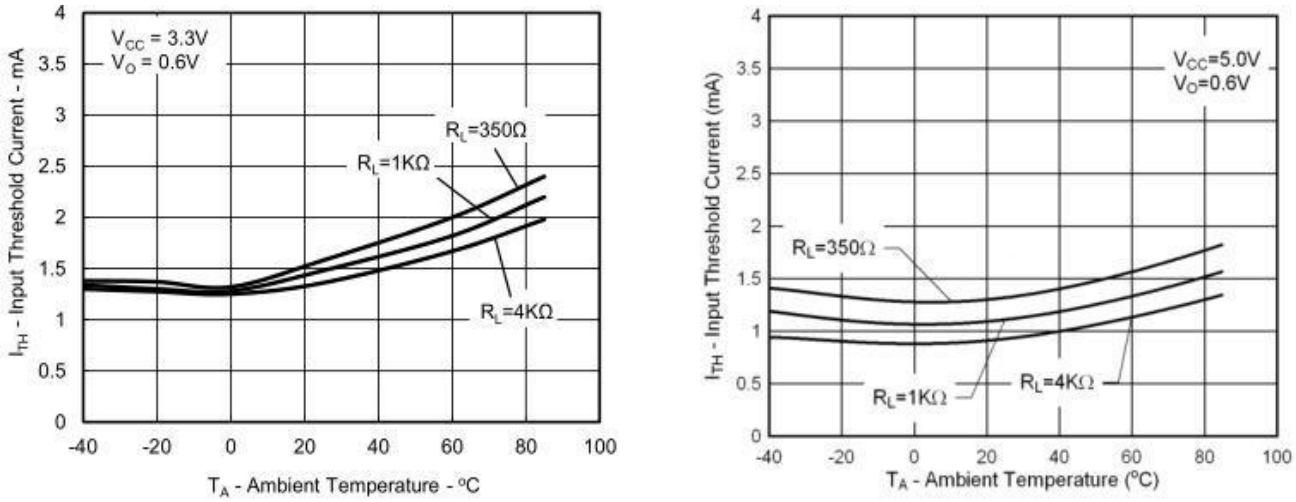



**Figure 5: Typical Input Diode Threshold Current vs. Ambient Temperature**

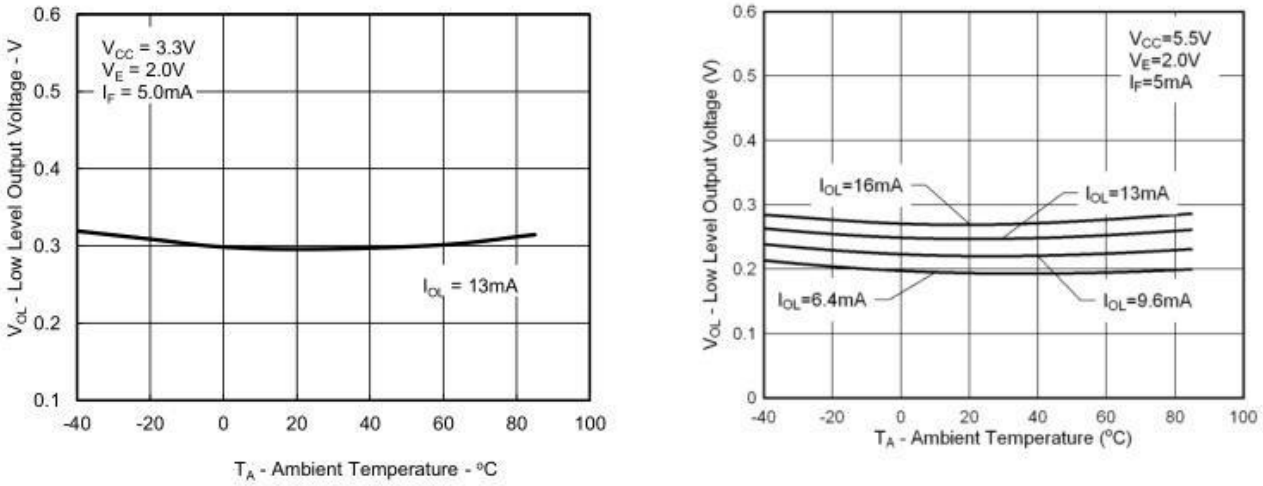



**Figure 6: Typical Low Level Output Voltage vs. Ambient Temperature**

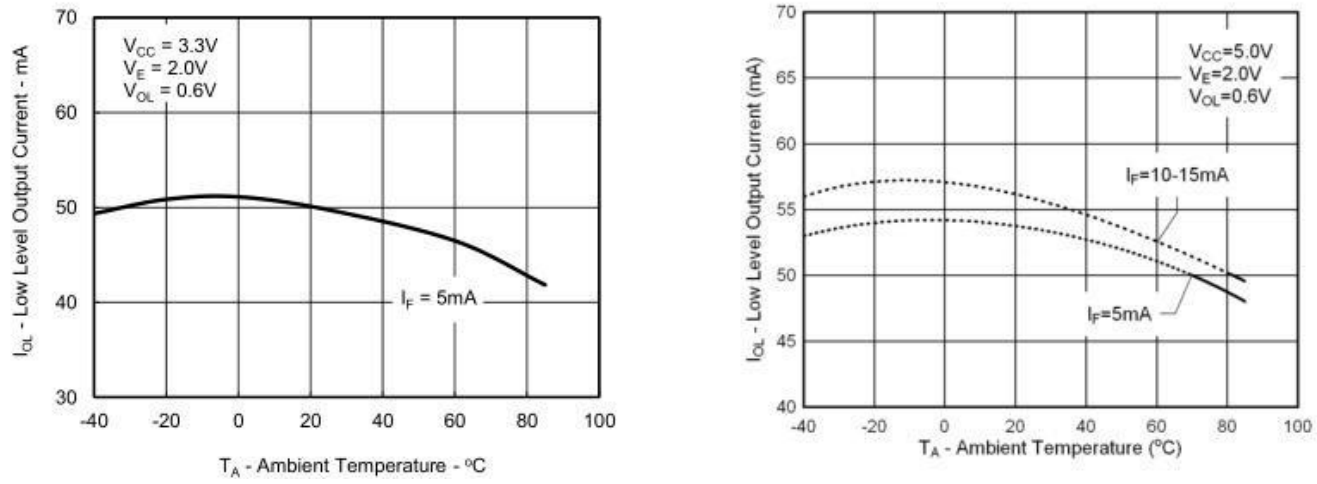



**Figure 7: Typical Low Level Output Current vs. temperature**

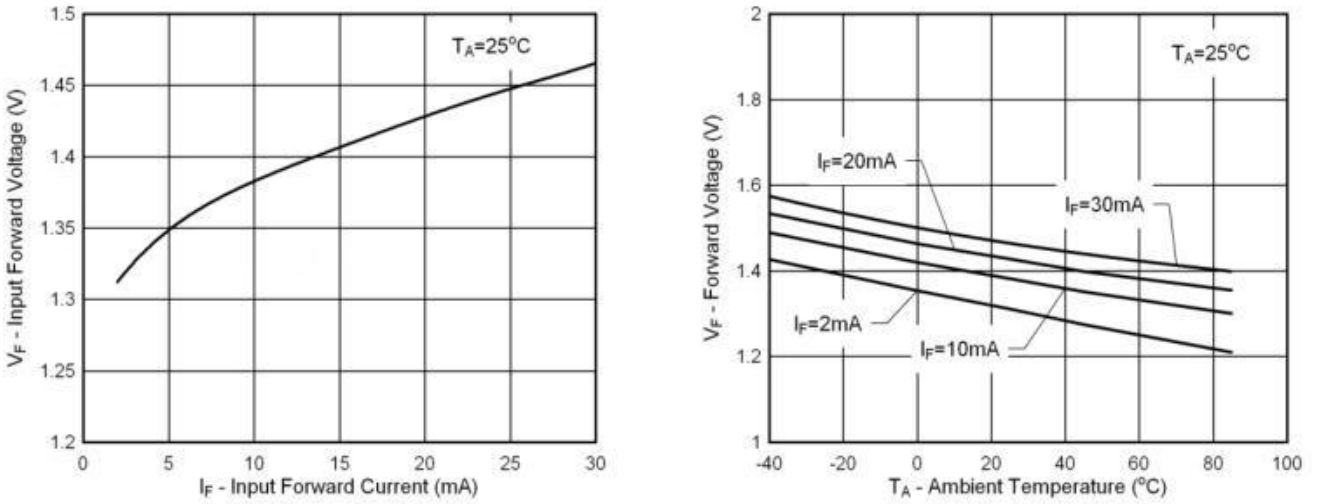



**Figure 8: Typical Input Diode Forward Characteristic**

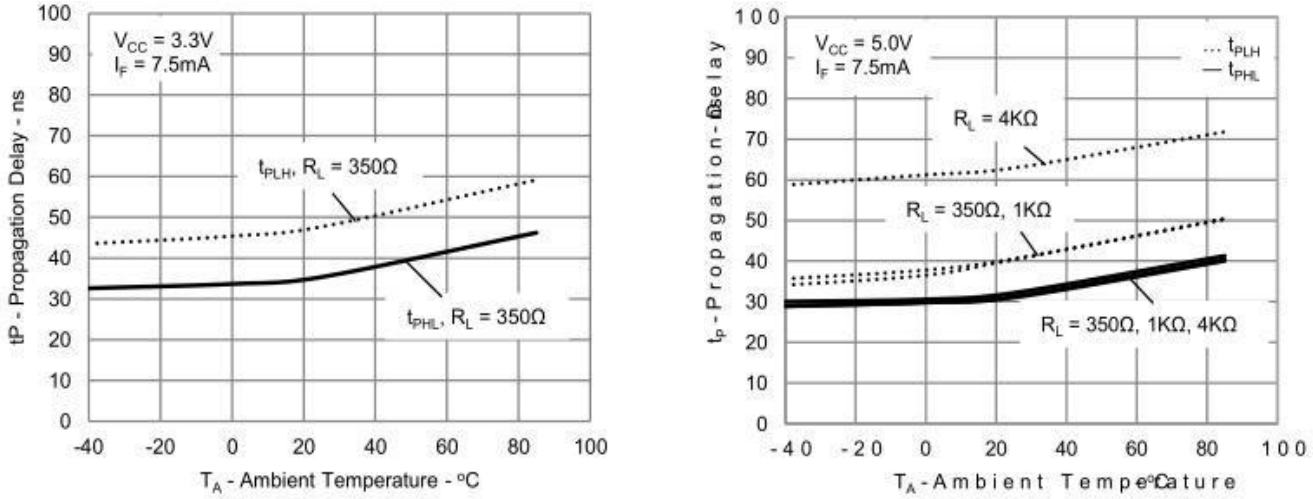



**Figure 9: Typical Propagation Delay vs. Ambient Temperature**

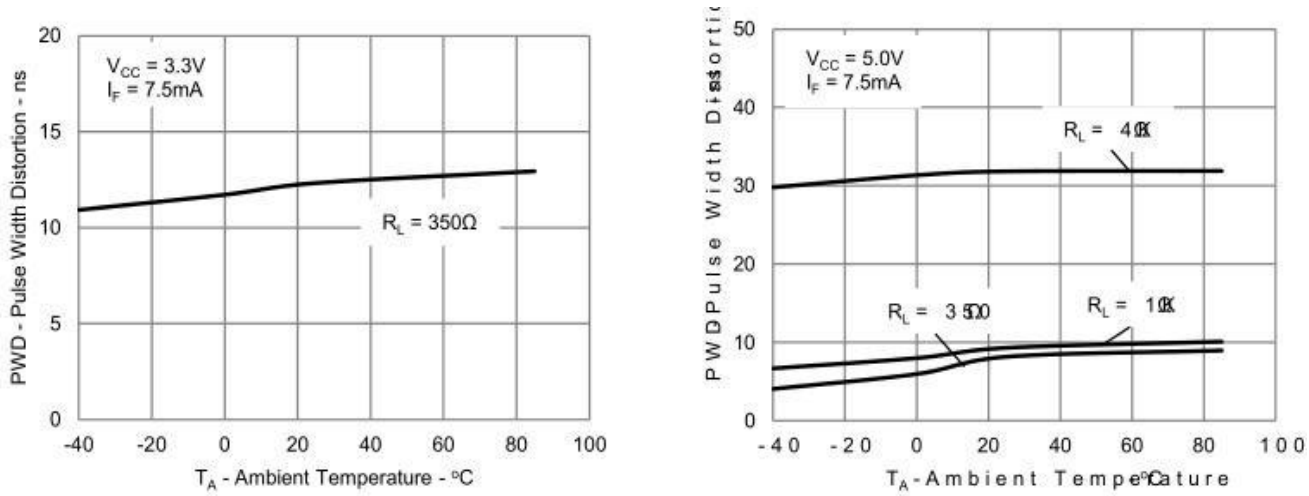



**Figure 10: Typical Pulse Width Distortion vs. Ambient Temperature**