

## 6N137 – High Speed 10MBd Optocouplers

Aug 2008

### DESCRIPTION

These diode-transistor photocouplers consist of an AlGaAs LED optically coupled to a high speed photodetector. The output features is an open collector and coupler parameters are guaranteed over the temperature range from  $-40^{\circ}\text{C} \sim 85^{\circ}\text{C}$ . The internal shield provides a guaranteed Common Mode Transient Immunity (typical)  $10\text{KV}/\mu\text{s}$

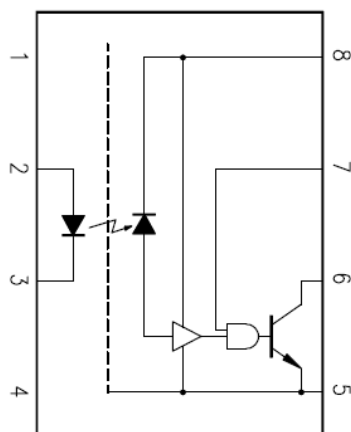
### FEATURES

- \* High speed – 10MBd
- \* Common mode rejection -  $10\text{KV}/\mu\text{s}$
- \* UL, CSA, IEC/EN/DIN EN60747-5-2 – Pending
- \* Dual-in-line package- 6N137
- \* Wide lead spacing package- 6N137M
- \* Surface mounting package- 6N137S
- \* Tape and reel packaging- 6N137S-TA/6N137S-TA1

### APPLICATIONS

- \* High Voltage Isolation
- \* Line receivers
- \* Feedback Element in Switching Mode Power Supplies
- \* High Speed Logic Ground Isolation – TTL/TTL, TTL/CMOS, TTL/LSTTL
- \* Pulse transformer replacement
- \* Power transistor isolation in motor drives
- \* Microprocessor system interfaces
- \* Ground loop elimination

### Schematic



### Pin Define

1. NC
2. Anode
3. Cathode
4. NC
5. GND
6. Vo
7. VE
8. Vcc

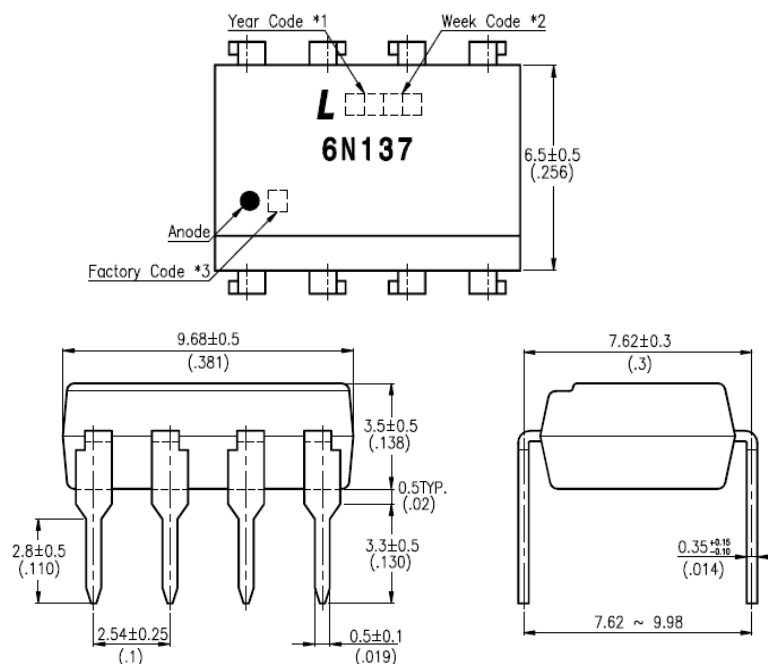
### Truth Table (Positive Logic)

| Input | EN | Output |
|-------|----|--------|
| ON    | H  | L      |
| OFF   | H  | H      |
| ON    | L  | H      |
| OFF   | L  | H      |
| ON    | NC | L      |
| OFF   | NC | H      |

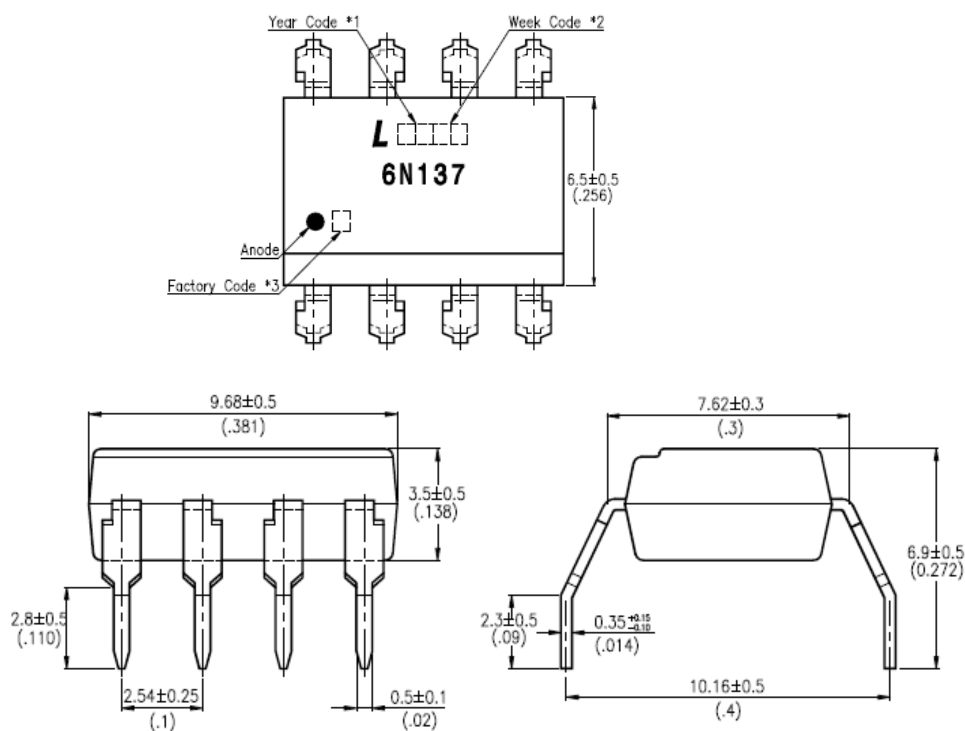
A 0.1uF bypass capacitor must be connected between pin8 and pin5.

## OUTLINE DIMENSIONS

### 6N137:

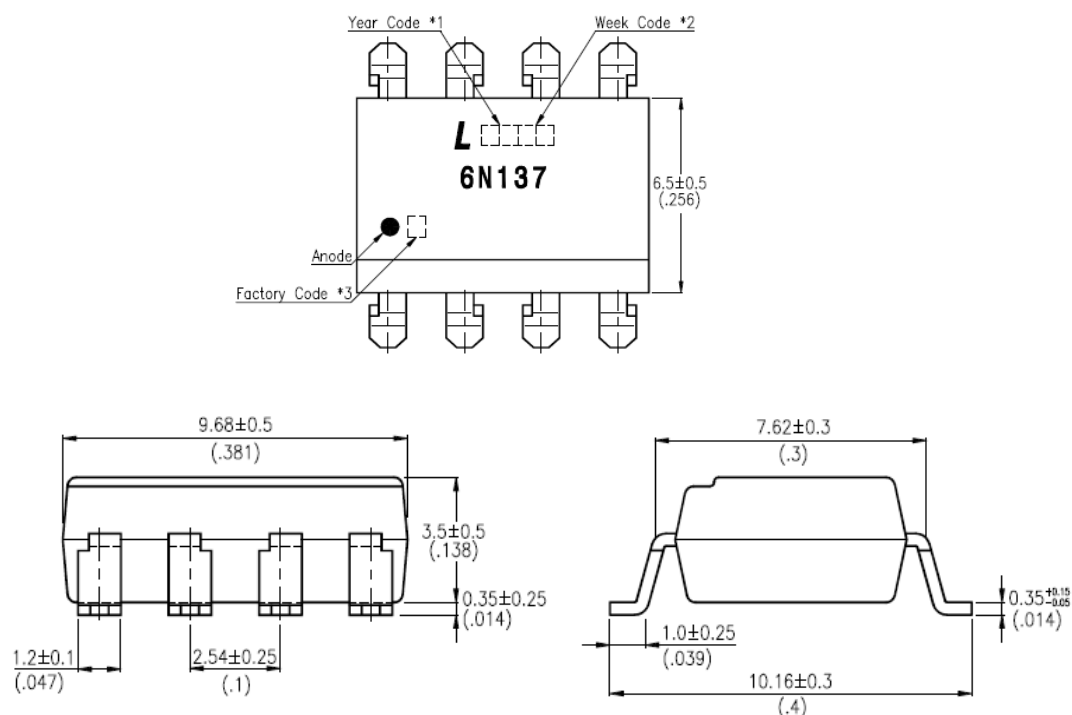


### 6N137M



# **OUTLINE DIMENSIONS**

## **6N137S**

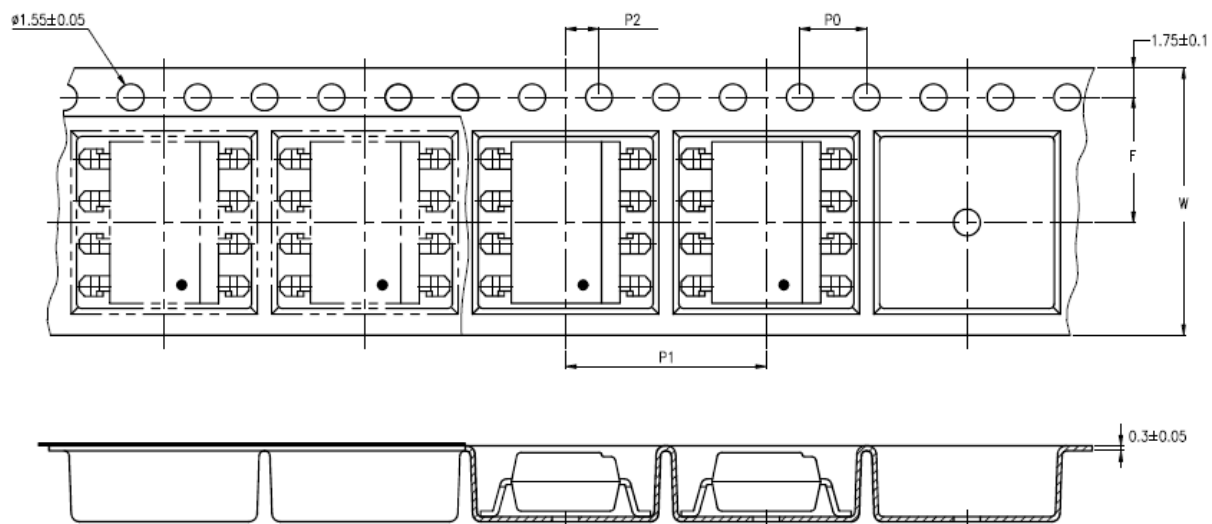
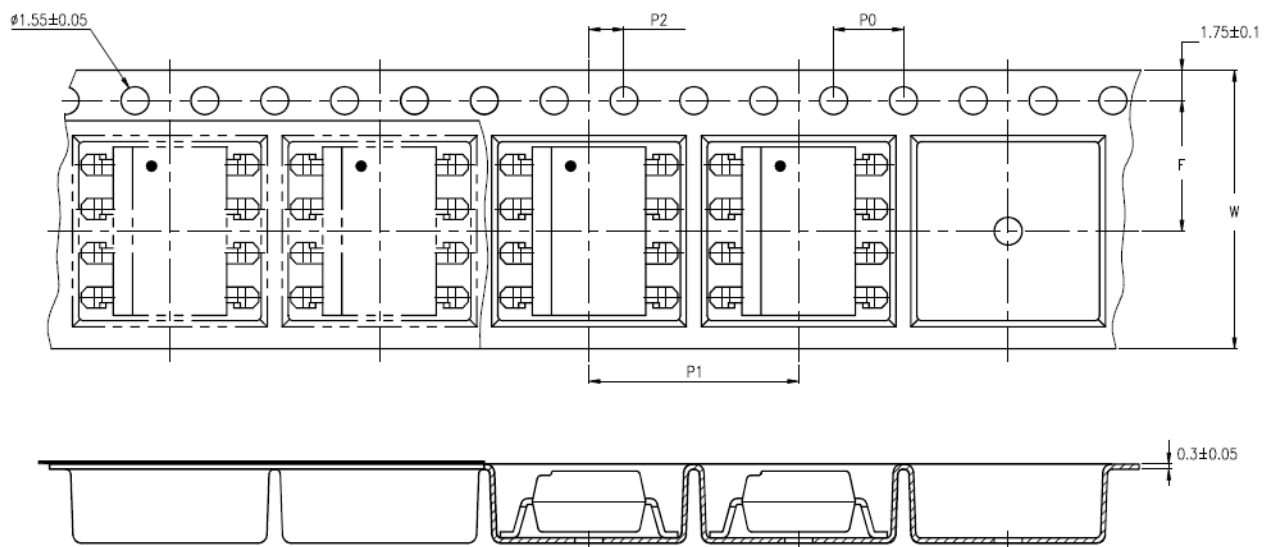


\*1. Year date code.

\*2. 2-digit work week.

\*3. Factory identification mark shall be marked (Z: Taiwan, Y: Thailand).

## TAPING DIMENSIONS

**6N137S-TA**

**6N137S-TA1**


| Description                            | Symbol | Dimensions in mm ( inches ) |
|----------------------------------------|--------|-----------------------------|
| Tape wide                              | W      | $16 \pm 0.3$ ( .63 )        |
| Pitch of sprocket holes                | $P_0$  | $4 \pm 0.1$ ( .15 )         |
| Distance of compartment                | F      | $7.5 \pm 0.1$ ( .295 )      |
| Distance of compartment to compartment | $P_1$  | $2 \pm 0.1$ ( .079 )        |
|                                        |        | $12 \pm 0.1$ ( .472 )       |

## ABSOLUTE MAXIMUM RATING

( Ta = 25°C unless otherwise specified)

| PARAMETER |                              | SYMBOL           | RATING         | UNIT             |
|-----------|------------------------------|------------------|----------------|------------------|
| INPUT     | Forward Current              | I <sub>F</sub>   | 25             | mA               |
|           | Reverse Voltage              | V <sub>R</sub>   | 5              | V                |
|           | Power Dissipation            | P                | 40             | mW               |
| OUTPUT    | Supply Voltage (1minute max) | V <sub>CC</sub>  | 7              | V                |
|           | Output Voltage               | V <sub>O</sub>   | 7              | V                |
|           | Output Current               | I <sub>O</sub>   | 50             | mA               |
|           | Power Dissipation            | P <sub>O</sub>   | 85             | mW               |
|           | Isolation Voltage            | V <sub>iso</sub> | 5000           | V <sub>rms</sub> |
|           | Operating Temperature        | T <sub>opr</sub> | -40 ~ +85      | °C               |
|           | Storage Temperature          | T <sub>stg</sub> | -55 ~ +125     | °C               |
|           | Soldering Temperature        | T <sub>sol</sub> | 260 for 10 sec | °C               |

### Note

- AC For 1 Minute, R.H. = 40 ~ 60%  
Isolation voltage shall be measured using the following method.  
 (1) Short Pin 1 to Pin4 on the primary side and Pin 5 to Pin 8 on the secondary side.  
 (2) The isolation voltage tester with zero-cross circuit shall be used.  
 (3) The waveform of applied voltage shall be a sine wave.
- For 10 sec.

# **ELECTRICAL - OPTICAL CHARACTERISTICS**

( T<sub>A</sub> = 0~70°C, unless otherwise specified )

| PARAMETER                                     | SYMBOL                  | MIN. | TYP.** | MAX. | UNIT  | CONDITIONS                                                          |
|-----------------------------------------------|-------------------------|------|--------|------|-------|---------------------------------------------------------------------|
| <b>Input</b>                                  |                         |      |        |      |       |                                                                     |
| Input Forward Voltage                         | V <sub>F</sub>          | —    | 1.45   | 1.7  | V     | Ta=25°C, I <sub>F</sub> =10mA                                       |
| Input Forward Voltage Temperature Coefficient | Δ V <sub>F</sub> / Δ Ta | —    | -1.6   | —    | mV/°C | I <sub>F</sub> =10mA                                                |
| Input Reverse Voltage                         | BV <sub>R</sub>         | 5.0  | —      | —    | V     | Ta=25°C , I <sub>R</sub> =10 μ A                                    |
| <b>Output</b>                                 |                         |      |        |      |       |                                                                     |
| High Level Supply Current                     | I <sub>CCH</sub>        | —    | 7      | 10   | mA    | I <sub>F</sub> =0mA, V <sub>E</sub> =0.5V<br>V <sub>CC</sub> =5.5V  |
| Low Level Supply Current                      | I <sub>CCL</sub>        | —    | 9      | 13   | mA    | I <sub>F</sub> =10mA, V <sub>E</sub> =0.5V<br>V <sub>CC</sub> =5.5V |
| Low Level Enable Current                      | I <sub>EL</sub>         | —    | -0.8   | -1.6 | mA    | V <sub>CC</sub> =5.5V,<br>V <sub>E</sub> =0.5V                      |
| High Level Enable Current                     | I <sub>EH</sub>         | —    | -0.6   | -1.6 | mA    | V <sub>CC</sub> =5.5V,<br>V <sub>E</sub> =2.0V                      |
| High Level Enable Voltage                     | V <sub>EH</sub>         | 2.0  |        |      | V     | I <sub>F</sub> =10mA, V <sub>CC</sub> =5.5V                         |
| Low Level Enable Voltage                      | V <sub>EL</sub>         |      |        | 0.8  | V     | I <sub>F</sub> =10mA, V <sub>CC</sub> =5.5V                         |

\*\* All typical at T<sub>A</sub> = 25°C

**SWITCHING SPECIFICATIONS (AC)**

 (  $T_A = -40 \sim 85^\circ\text{C}$ ,  $V_{CC} = 5\text{V}$ ,  $I_F = 7.5\text{mA}$  unless otherwise specified )

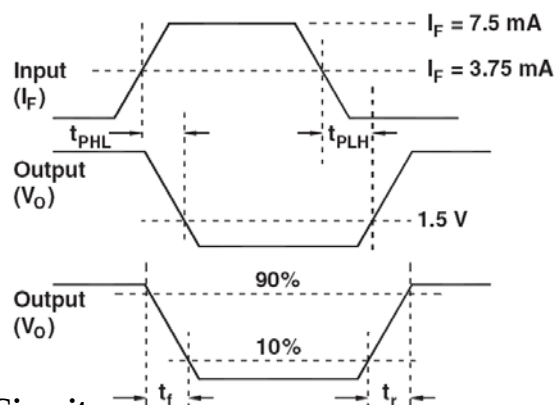
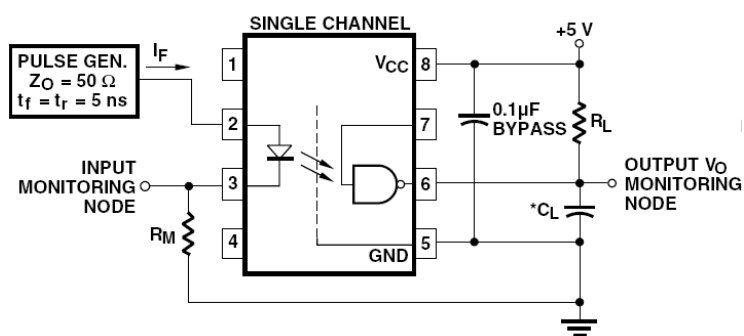
| PARAMETER                                                    | SYM.                  | MIN. | TYP** | MAX. | UNIT               | CONDITIONS                                                                                                  |
|--------------------------------------------------------------|-----------------------|------|-------|------|--------------------|-------------------------------------------------------------------------------------------------------------|
| Propagation Delay time to Logic Low Output (1)→(0)           | $t_{PHL}$             | 25   | 30    | 75   | ns                 | $R_L = 350\Omega$<br>$C_L = 15\text{pF}$                                                                    |
|                                                              |                       |      |       | 100  |                    |                                                                                                             |
| Propagation Delay time to Logic High Output (0)→(1)          | $t_{PLH}$             | 25   | 40    | 75   | ns                 | $R_L = 350\Omega$<br>$C_L = 15\text{pF}$                                                                    |
|                                                              |                       |      |       | 100  |                    |                                                                                                             |
| Pulse Width Distortion                                       | $ t_{PHL} - t_{PLH} $ |      | 10    |      | ns                 | $R_L = 350\Omega$<br>$C_L = 15\text{pF}$                                                                    |
| Output Rise Time (10%~90%)                                   | $t_r$                 |      | 50    |      | ns                 | $R_L = 350\Omega$<br>$C_L = 15\text{pF}$                                                                    |
| Output Fall time (90%~10%)                                   | $t_f$                 |      | 12    |      | ns                 | $R_L = 350\Omega$<br>$C_L = 15\text{pF}$                                                                    |
| Enable Propagation Delay Time at high level output(1)        | $t_{ELH}$             |      | 20    |      | ns                 | $I_F = 7.5\text{mA}$<br>$V_{EH} = 3.5\text{V}$<br>$R_L = 350\Omega$<br>$C_L = 15\text{pF}$                  |
| Enable Propagation Delay Time at low level output(0)         | $t_{EHL}$             |      | 20    |      | ns                 | $I_F = 7.5\text{mA}$<br>$V_{EH} = 3.5\text{V}$<br>$R_L = 350\Omega$<br>$C_L = 15\text{pF}$                  |
| Instantaneous common mode rejection at high logic output (1) | $ CM_H $              | 1    | 10    | —    | KV / $\mu\text{s}$ | $I_F = 0\text{mA}$<br>$V_{OH}(\text{Min}) = 2.0\text{V}$<br>$ V_{CM}  = 50V_{P-P}$ ,<br>$R_L = 350\Omega$   |
| Instantaneous common mode rejection at low logic output (0)  | $ CM_L $              | 1    | 10    | —    | KV / $\mu\text{s}$ | $I_F = 7.5\text{mA}$<br>$V_{OH}(\text{Max}) = 0.8\text{V}$<br>$ V_{CM}  = 50V_{P-P}$ ,<br>$R_L = 350\Omega$ |

 \*\* All typical at  $T_A = 25^\circ\text{C}$

## SWITCHING TEST CIRCUITS (AC)

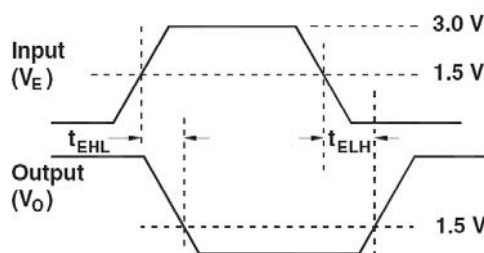
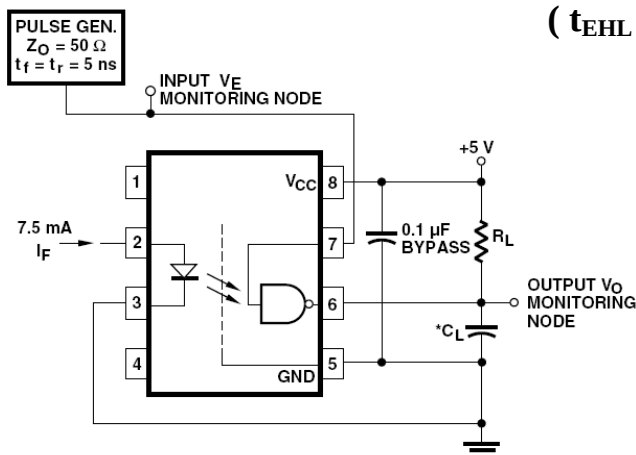
### Switching Time Test Circuit

( $t_{PHL}$   $t_{PLH}$ ,  $t_r$  and  $t_f$ )

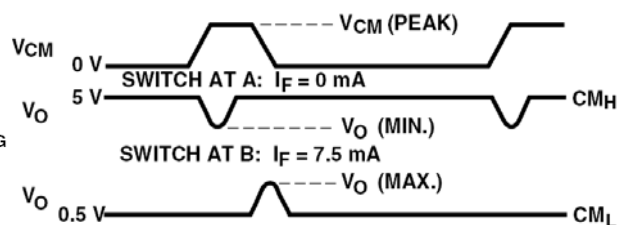
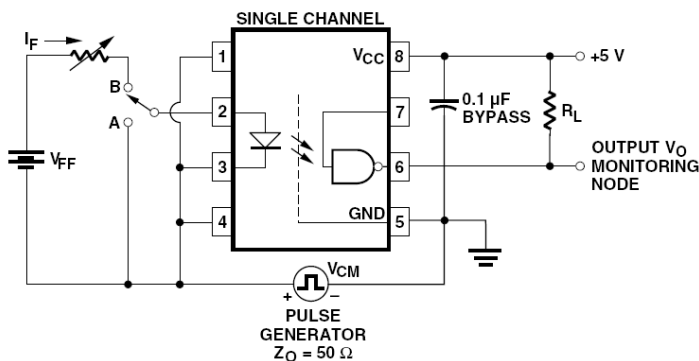


### Switching Time Test Circuit

( $t_{EHL}$   $t_{ELH}$ )



### Common Mode Immunity Test Circuit





## ISOLATION CHARACTERISTICS

( $T_A = -40 \sim 85^\circ\text{C}$ ,  $V_{CC} = 5\text{V}$ ,  $I_F = 7.5\text{mA}$  unless otherwise specified)

| PARAMETER                                     | SYMBOL    | MIN. | TYP.**    | MAX. | UNIT | CONDITIONS                                                             |
|-----------------------------------------------|-----------|------|-----------|------|------|------------------------------------------------------------------------|
| Isolation Resistance (Input-output)<br>Note4. | $R_{I-O}$ | —    | $10^{12}$ | —    |      | $T_a = 25^\circ\text{C}$ , $RH < 45\%$ ,<br>$V_{I-O} = 500\text{V DC}$ |
| Capacitance (Input-output) Note4.             | $C_{I-O}$ | —    | 0.6       | —    | pF   | $f = 1\text{MHz}$                                                      |

## TRANSFER CHARACTERISTICS(DC)

( $T_A = -40 \sim 85^\circ\text{C}$ ,  $V_{CC} = 5\text{V}$ ,  $I_F = 7.5\text{mA}$  unless otherwise specified)

| PARAMETER                 | SYMBOL    | MIN. | TYP.** | MAX. | UNIT          | CONDITIONS                                                                                          |
|---------------------------|-----------|------|--------|------|---------------|-----------------------------------------------------------------------------------------------------|
| High Level Output Current | $I_{OH}$  |      |        | 100  | $\mu\text{A}$ | $V_{CC} = 5.5\text{V}$ ,<br>$V_o = 0.5\text{V}$<br>$I_F = 250 \mu\text{A}$ ,<br>$V_E = 2.0\text{V}$ |
| Low Level Output Voltage  | $V_{OL}$  |      | 0.35   | 0.6  | V             | $V_{CC} = 5.5\text{V}$ ,<br>$I_F = 5\text{mA}$ ,<br>$V_E = 2.0\text{V}$<br>$I_{OL} = 13\text{mA}$   |
| Input Threshold Current   | $I_{FTH}$ |      | 3      | 5    | mA            | $V_{CC} = 5.5\text{V}$ ,<br>$V_o = 0.5\text{V}$<br>$I_{OL} = 13\text{mA}$ ,<br>$V_E = 2.0\text{V}$  |

\*\* All typical at  $V_{CC} = 5\text{V}$ ,  $T_A = 25^\circ\text{C}$

### Note:

- AC For 1 Minute, R.H. = 40 ~ 60%  
Isolation voltage shall be measured using the following method.  
(1) Considered a two-terminal device: Pin 1,2,3,4 shorted together and Pin 5,6,7,8 shorted together.  
(2) The isolation voltage tester with zero-cross circuit shall be used.  
(3) The waveform of applied voltage shall be a sine wave.
- For 10 sec.
- Pin5 and Pin8 must connect a bypass 0.1 $\mu\text{F}$  capacitor.

**Notes:**

- Lite-On is continually improving the quality, reliability, function or design and Lite-On reserves the right to make changes without further notices.
- 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.
- When requiring a device for any "specific" application, please contact our sales in advice.
- If there are any questions about the contents of this publication, please contact us at your convenience.
- The contents described herein are subject to change without prior notice.
- Do not immerse unit's body in solder paste.