# UMW 6N137

High Speed 10MBit/s Logic Gate Optocouplers

## 1.Description

The UMW 6N137 optocoupler consists of a 850 nm AlGaAS LED, optically coupled to a very high speed integra□ted photo-detector logic gate with astrobable output. This output features an open collector, thereby permitting wired OR outputs. The coupled parameters are guaranteed over the temp-erature range of -40°C to +85°C. A maximum input signal of 5mA will provide a minimum output sink current of 13mA (fan out of 8).An internal noise shield provides superior common mode rejection of typically 10kV/μs. The UMW 6N137 has a minimum CMR of 5kV/μs.

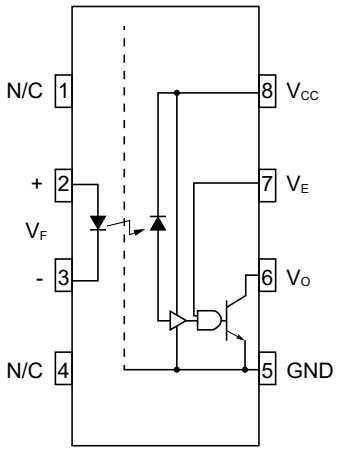
## 2.Features

- Very high speed - 10 MBit/s
- Superior CMR - 10 kV/μs
- Double working voltage-480V
- Fan-out of 8 over -40°C to +85°C
- Logic gate output
- Strobable output
- Wired OR-open collector
- UL approved: UL1577, file No. E492440

## 3.Applications

- Ground loop elimination
- LSTTL to TTL, LSTTL or 5-volt CMOS
- Line receiver, data transmission
- Data multiplexing
- Switching power supplies
- Pulse transformer replacement
- Computer-peripheral interface

## 4.Pinning Information




**DIP-8/SOP-8**

## 5.Truth Table (Positive Logic)

| Input | Enable | Output |
|---|---|---|
| H | H | L |
| L | H | H |
| H | L | H |
| L | L | H |
| H | NC | L |
| L | NC | H |

## 6.Absolute Maximum Ratings ($T_A$=25°C unless otherwise specified)

| Parameter | Symbol | Value | Units |
|---|---|---|---|
| Storage Temperature | $T_{STG}$ | -55 to +125 | °C |
| Operating | $T_{OPR}$ | -40 to +85 | °C |
| Lead Solder Temperature (for wave soldering only) | $T_{SOL}$ | 260 for 10 sec | °C |
| **EMITTER** | | | |
| DC/Average Forward Input Current | $I_F$ | 50 | mA |
| Enable Input Voltage Not to Exceed $V_{CC}$ by more than 500mV | $V_E$ | 5.5 | V |
| Reverse Input Voltage | $V_R$ | 5 | V |
| Power Dissipation | $P_I$ | 100 | mW |
| **DETECTOR** | | | |
| Supply Voltage | $V_{CC}$ | 7 | V |
| Output Current | $I_O$ | 50 | mA |
| Output Voltage | $V_O$ | 7 | V |
| Collector Output | $P_O$ | 85 | mW |

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only

## 7.Recommended Operating Conditions

| Parameter | Symbol | Min | Max | Units |
|---|---|---|---|---|
| Input Current, Low Level | $I_{FL}$ | 0 | 250 | μA |
| Input Current, High Level | $I_{FH}$ | *6.3 | 15 | mA |
| Supply Voltage, Output | $V_{CC}$ | 4.5 | 5.5 | V |
| Enable Voltage, Low Level | $V_{EL}$ | 0 | 0.8 | V |
| Enable Voltage, High Level | $V_{EH}$ | 2 | $V_{CC}$ | V |
| Low Level Supply Current | $T_A$ | -40 | 85 | °C |
| Fan Out (TTL load) | N | | 8 | |

Note: *6.3mA is a guard banded value which allows for at least 20% CTR degradation. Initial input current threshold value is 5.0mA or less.

## 8.Individual Component Characteristics

| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **EMITTER** | | | | | | |
| Input Forward Voltage | $V_F$ | $I_F$=10mA | | | 1.8 | V |
| | | $T_A$=25°C | | 1.4 | 1.75 | |
| Input Reverse Breakdown Voltage | $B_{VR}$ | $I_R$=10μA | 5 | | | |
| Input Capacitance | $C_{IN}$ | $V_F$=0, f=1MHz | | 60 | | pF |
| Input Diode Temperature Coefficient | $\Delta V_F/\Delta T_A$ | $I_F$=10mA | | -1.4 | | mV/°C |
| **DETECTOR** | | | | | | |
| High Level Supply Current | $I_{CCH}$ | $V_{CC}$=5.5V, $I_F$=0mA, $V_E$=0.5V | | 7 | 10 | mA |
| Low Level Supply Current | $I_{CCL}$ | $V_{CC}$=5.5V, $I_F$=10mA | | 9 | 13 | mA |
| Low Level Enable Current | $I_{EL}$ | $V_{CC}$=5.5V, $V_E$=0.5V | | -0.8 | -1.6 | mA |
| High Level Enable Current | $I_{EH}$ | $V_{CC}$=5.5V, $V_E$=2V | | -0.6 | -1.6 | mA |
| High Level Enable Voltage | $V_{EH}$ | $V_{CC}$=5.5V, $I_F$=10mA | 2 | | | V |
| Low Level Enable Voltage | $V_{EL}$ | $V_{CC}$=5.5V, $I_F$=10mA (3) | | | 0.8 | V |

## 9.Switching Characteristics

($T_A$=-40°C to +85°C, $V_{CC}$=5V, $I_F$=7.5mA unless otherwise specified)

| Parameter | Symbol | Conditions | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| Propagation Delay Time to Output HIGH Level | $T_{PLH}$ | $R_L$=350Ω | $T_A$=25°C | 20 | 45 | 75 | ns |
| | | $C_L$=15pF (4)(Fig. 12) | | | | 100 | ns |
| Propagation Delay Time to Output LOW Level | $T_{PHL}$ | $T_A$=25°C (5) | | 25 | 45 | 75 | ns |
| | | $R_L$=350Ω, $C_L$=15pF (Fig.12) | | | | 100 | ns |
| Pulse Width Distortion | $\|T_{PHL}-T_{PLH}\|$ | $R_L$=350Ω, $C_L$=15pF (Fig.12) | | | 3 | 35 | ns |
| Output Rise Time (10-90%) | $t_r$ | $R_L$=350Ω, $C_L$=15pF (6) (Fig.12) | | | 50 | | ns |
| Output Rise Time (90-10%) | $t_f$ | $R_L$=350Ω, $C_L$=15pF (7) (Fig.12) | | | 12 | | ns |
| Enable Propagation Delay Time to Output HIGH Leve | $t_{ELH}$ | $I_F$=7.5mA, $V_{EH}$=3.5V, $R_L$=350Ω $C_L$=15pF (8) (Fig. 13) | | | 20 | | ns |
| Enable Propagation Delay Time to Output LOW Level | $t_{EHL}$ | $I_F$=7.5mA, $V_{EH}$=3.5V, $R_L$=350Ω $C_L$=15pF (9) (Fig. 13) | | | 20 | | ns |
| Common Mode Transient Immunity (at Output HIGH Level) | $\|CM_H\|$ | $T_A$=25°C, $\|V_{CM}\|$=50V (Peak), $I_F$=0mA, $V_{OH\ (Min.)}$=2V $R_L$=350Ω (10) (Fig. 14) | | 5000 | 10000 | | V/μs |
| Common Mode Transient Immunity (at Output LOW Level) | $\|CM_L\|$ | $R_L$=350Ω, $I_F$=7.5mA $V_{OL\ (Max.)}$=0.8V $T_A$=25°C(11)(Fig. 14) | | 5000 | 10000 | | V/μs |

## 10.Transfer Characteristics

($T_A$=-40°C to +85°C, unless otherwise specified)

| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| HGH Level Output Current | $I_{OH}$ | $V_{CC}$=5.5V, $V_O$=5.5V<br>$I_F$=250μA, $V_E$=2.0V (2) | | | 100 | μA |
| LOW Level Output Current | $V_{OL}$ | $V_{CC}$=5.5V, $V_O$=5mA<br>$V_E$=2V, $I_{CL}$=13mA (2) | | 0.35 | 0.6 | V |
| Input Threshold Current | $I_{FT}$ | $V_{CC}$=5.5V, $V_O$=0.6V<br>$V_E$=2V, $I_{OL}$=13mA | | 3 | 5 | mA |

## 11.Isolation Characteristics

($T_A$=-40°C to +85°C, unless otherwise specified)

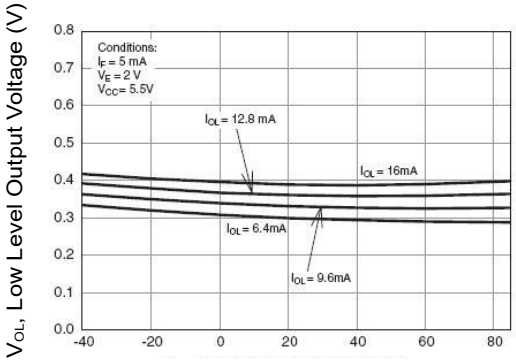
| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Input-Output Insulation Leakage Current | $I_{I-O}$ | Relative humidity = 45%, $T_A$=25°C t=5s,$V_{I-O}$=3000 VDC (12) | | | 10* | μA |
| Withstand Insulation Test Voltage | $V_{ISO}$ | RH<50%, $T_A$=25°C $I_{I-O}$≤2μA, t =1min (12) | 2500 | | | $V_{RMS}$ |
| Resistance (Input to Output) | $R_{I-O}$ | $V_{I-O}$=500V (12) | 10 | 12 | | Ω |
| Capacitance (Input to Output) | $C_{I-O}$ | f=1MHz (12) | | 0.6 | | pF |

All Typicalsat $V_{CC}$= 5V, * TA = 25°C

* Note:

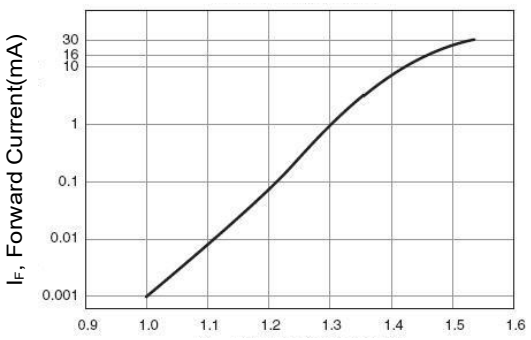
1. The $V_{CC}$ supply to each optoisolator must be bypassed by a 0.1μF capacitor or larger. This can be either a ceramic or solid tantalum capacitor with good high frequency characteristic and should be connected as close as possible to the package $V_{CC}$ and GND pins of each device.
2. One channel.
3. Enable Input – No pull up resistor required as the device has an internal pull up resistor.
4. $t_{PLH}$ – Propagation delay is measured from the 3.75mA level on the HIGH to LOW transition of the input current pulse to the 1.5 V level on the LOW to HIGH transition of the output voltage pulse.
5. $t_{PHL}$ – Propagation delay is measured from the 3.75mA level on the LOW to HIGH transition of the input current pulse to the 1.5 V level on the HIGH to LOW transition of the output voltage pulse.
6. $t_r$ – Rise time is measured from the 90% to the 10% levels on the LOW to HIGH transition of the output pulse.
7. $t_f$ – Fall time is measured from the 10% to the 90% levels on the HIGH to LOW transition of the output pulse.
8. $t_{ELH}$ – Enable input propagation delay is measured from the 1.5V level on the HIGH to LOW transition of the input voltage pulse to the 1.5V level on the LOW to HIGH transition of the output voltage pulse.
9. $t_{EHL}$ – Enable input propagation delay is measured from the 1.5V level on the LOW to HIGH transition of the input voltage pulse to the 1.5V level on the HIGH to LOW transition of the output voltage pulse.
10. $CM_H$ – The maximum tolerable rate of rise of the common mode voltage to ensure the output will remain in the HIGH state (i.e., $V_{OUT}$> 2.0V). Measured in volts per microsecond (V/μs).
11. $CM_L$ – The maximum tolerable rate of rise of the common mode voltage to ensure the output will remain in the LOW output state (i.e., $V_{OUT}$< 0.8V). Measured in volts per microsecond (V/μs).
12. Device considered a two-terminal device: Pins 1, 2, 3 and 4 shorted together, and Pins 5, 6, 7 and 8 shortedtogether

## 12.1Typical characteristic



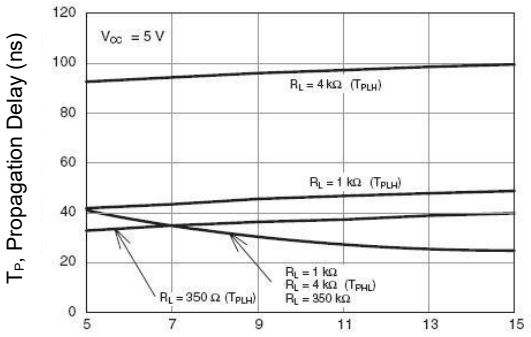

$T_A$, Ambient Temperature (°C)

Figure 1: Low Level Output Voltage vs. Ambient Temperature



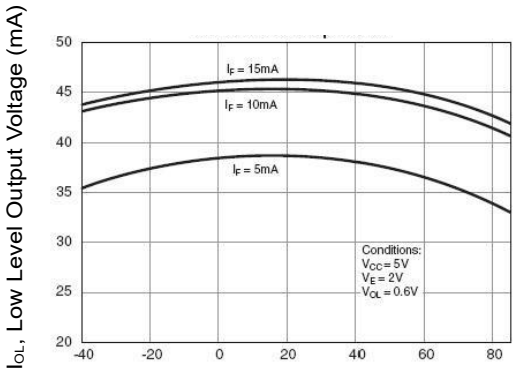

$V_F$, Forward Voltage (V)

Figure 2: Input Diode Forward Voltagevs. Forward Current



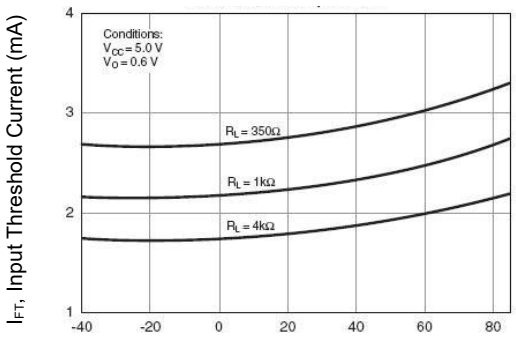

$I_F$, Forward Current(mA)

Figure 3: Switching Time vs. Forward Current



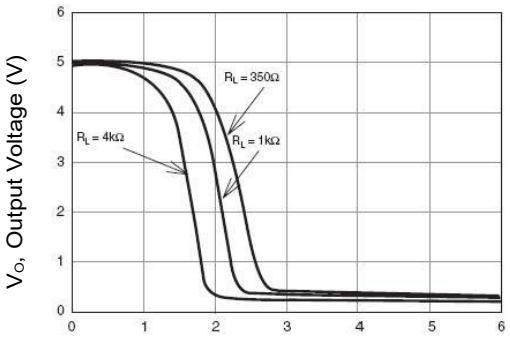

$T_A$, Ambient Temperature (°C)

Figure 4: Low Level Output Currentvs. Ambient Temperature




$T_A$, Ambient Temperature (°C)

Figure 5: Input Threshold Currentvs. Ambient Temperature




$I_F$, Forward Current(mA)

Figure 6: Output Voltage vs. Input Forward Current

## 12.2Typical characteristic

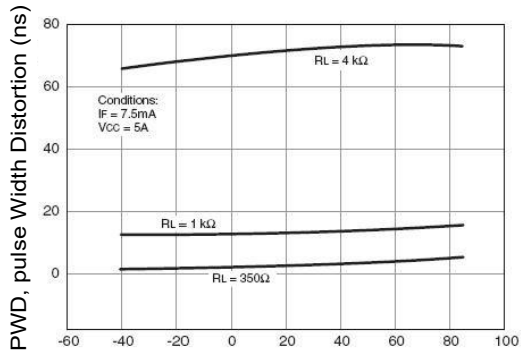



Figure 7: Pulse Width Distortion vs.Temperature

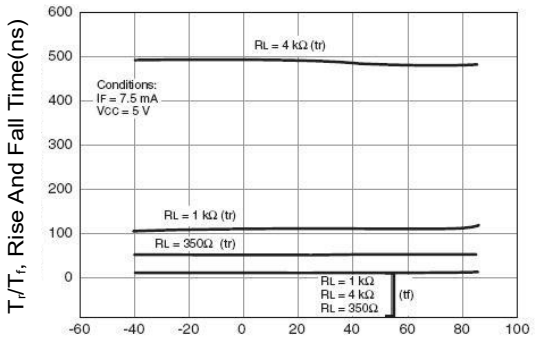



Figure 8: Rise and FallTime vs.Temperature

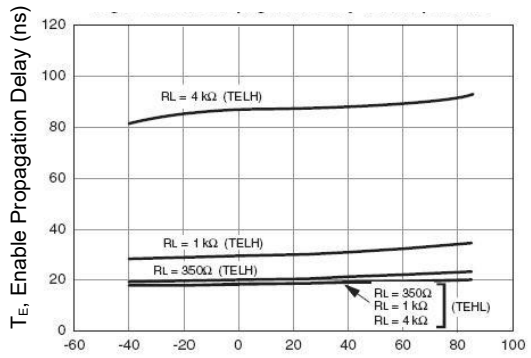



Figure 9: Enable Propagation Delay vs.Temperature

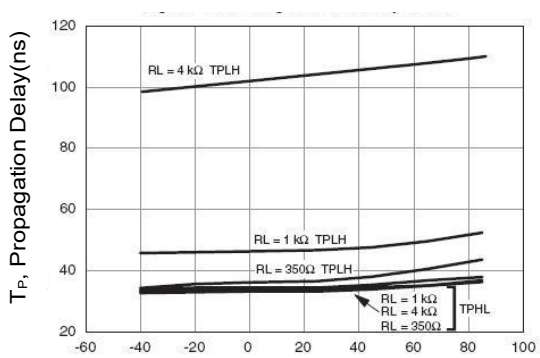



Figure 10: Switching Time vs.Temperature

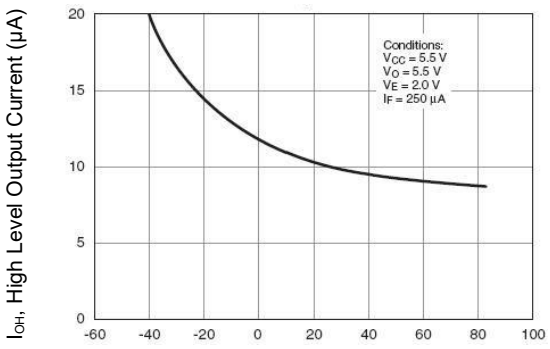



Figure 5: High Level Output Currentvs.Temperature

## 13.1Test Circuits

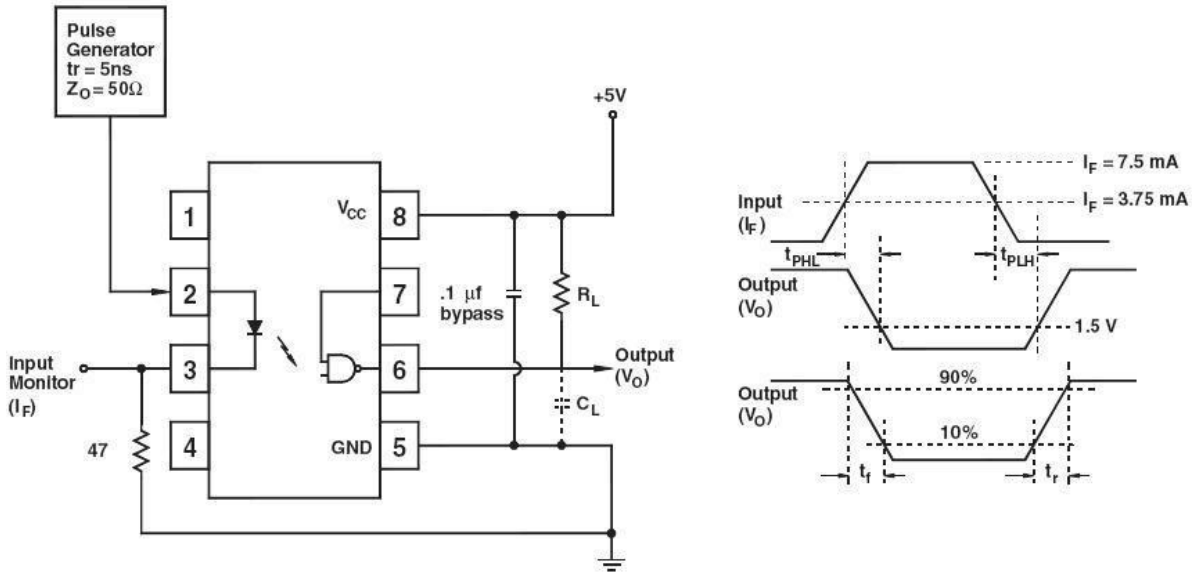



Fig. 12 Test Circuit and Waveforms for $t_{PLH}$, $t_{PHL}$, $t_r$ and $t_f$

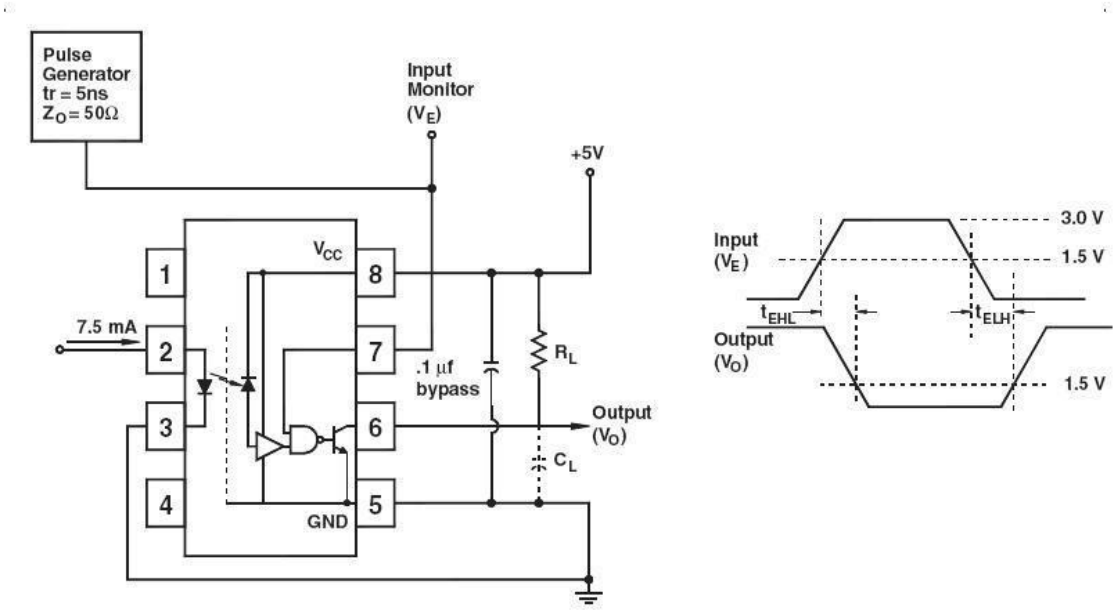



Fig. 13 Test Circuit $t_{EHL}$ and $t_{ELH}$

## 13.2Test Circuits (Continued)

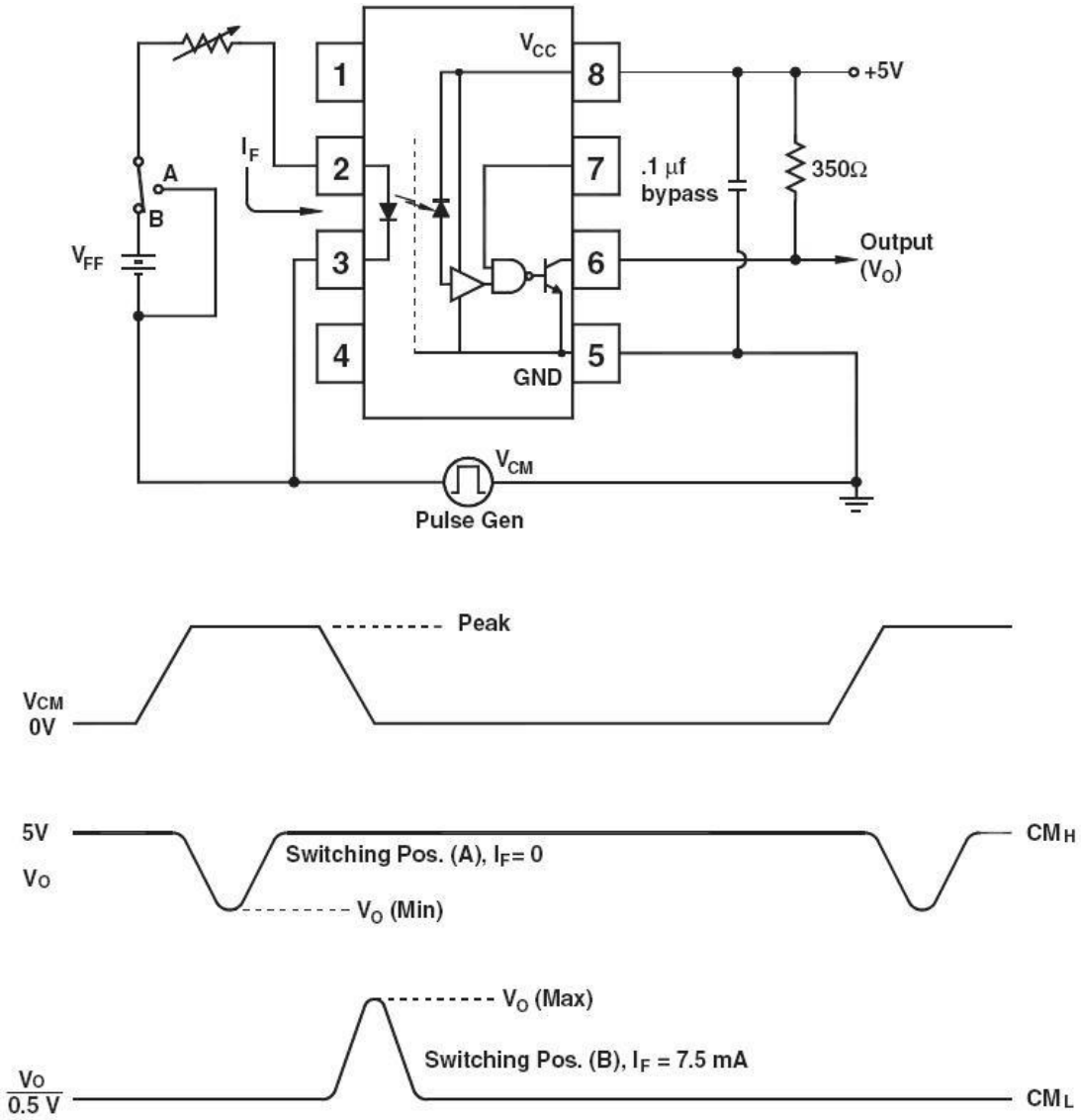
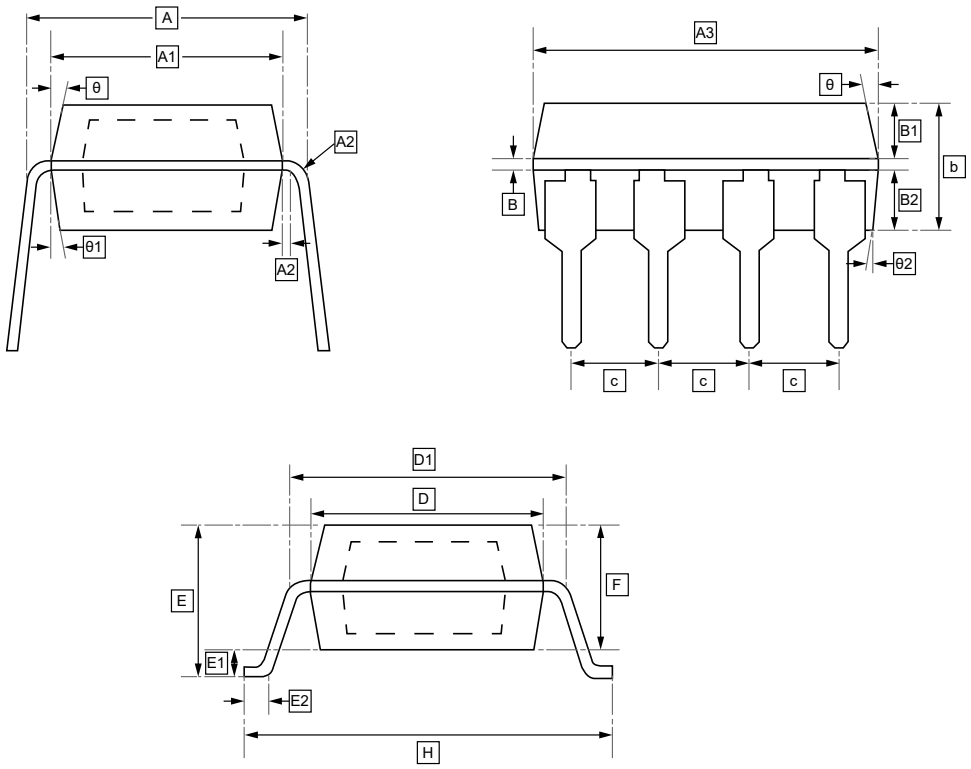



Fig. 14 Test Circuit Common Mode Transient Immunity

## 14.DIP-8/SOP-8 Package Outline Dimensions

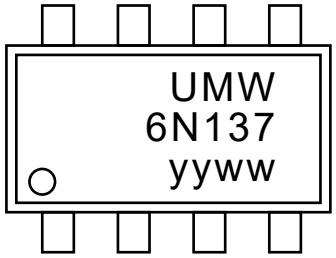



**DIMENSIONS (mm are the original dimensions)**

| Symbol | A | A1 | A2 | A3 | B | B1 | B2 | b | c | D | D1 | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min | 7.65 | 6.55 | 0.2 | 9.71 | 0.25 | 1.6 | 1.62 | 3.45 | 2.54 | 6.55 | 7.65 | 4.15 |
| Max | 7.95 | 6.65 | (typ.) | 9.78 | (typ.) | (typ.) | 1.68 | 3.55 | (typ.) | 6.65 | 7.95 | 4.35 |

| Symbol | E1 | E2 | F | H | θ | θ1 | θ2 |
|---|---|---|---|---|---|---|---|
| Min | 0.75 | 0.66 | 3.45 | 10.1 | 12° | 9° | 5° |
| Max | (typ.) | (typ.) | 3.55 | 10.5 | (typ.) | (typ.) | (typ.) |

## 15.Ordering information




yy: Year Code
ww: Week Code

| Order Code | Marking | Package | Base QTY | Delivery Mode |
|---|---|---|---|---|
| UMW 6N137M | 6N137 | DIP-8 | 2250 | Tube and box |
| UMW 6N137S | 6N137 | SOP-8 | 1000 | Tape and reel |

## 16.Disclaimer

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