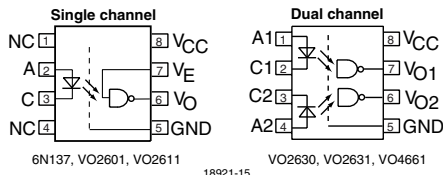
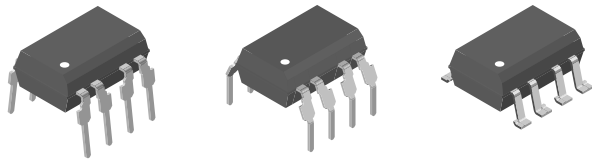


## High Speed Optocoupler, 10 MBd



### DESCRIPTION

The 6N137, VO2601 and VO2611 are single channel 10 Mbd optocouplers utilizing a high efficient input LED coupled with an integrated optical photodiode IC detector. The detector has an open drain NMOS-transistor output, providing less leakage compared to an open collector Schottky clamped transistor output. The VO2630, VO2631 and VO4661 are dual channel 10 MBd optocouplers. For the single channel type, an enable function on pin 7 allows the detector to be strobed. The internal shield provides a guaranteed common mode transient immunity of 5 kV/μs for the VO2601 and VO2631 and 15 kV/μs for the VO2611 and VO4661. The use of a 0.1 μF bypass capacitor connected between pin 5 and 8 is recommended.

### AGENCY APPROVALS

- UL1577, file no. E52744 system code H or J, double protection
- CUL - file no. E52744, equivalent to CSA bulletin 5A
- DIN EN 60747-5-5 available with option 1
- BSI IEC 60950

### FEATURES

- Choice of CMR performance of 15 kV/μs, 5 kV/μs, and 100 V/μs
- High speed: 10 Mbd typical
- + 5 V CMOS compatibility
- Pure tin leads
- Guaranteed AC and DC performance over temperature: - 40 °C to + 100 °C temperature range
- Meets IEC 60068-2-42 (SO<sub>2</sub>) and IEC 60068-2-43 (H<sub>2</sub>S) requirements
- Low input current capability: 5 mA
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



**RoHS**  
COMPLIANT

### APPLICATIONS

- Microprocessor system interface
- PLC, ATE input/output isolation
- Computer peripheral interface
- Digital fieldbus isolation: CC-link, DeviceNet, profibus, SDS
- High speed A/D and D/A conversion
- AC plasma display panel level shifting
- Multiplexed data transmission
- Digital control power supply
- Ground loop elimination

### ORDER INFORMATION

| PART        | REMARKS                                 |
|-------------|---|
| 6N137       | 100 V/μs, single channel, DIP-8         |
| 6N137-X006  | 100 V/μs, single channel, DIP-8 400 mil |
| 6N137-X007  | 100 V/μs, single channel, SMD-8         |
| VO2601      | 5 kV/μs, single channel, DIP-8          |
| VO2601-X006 | 5 kV/μs, single channel, DIP-8 400 mil  |
| VO2601-X007 | 5 kV/μs, single channel, SMD-8          |
| VO2611      | 15 kV/μs, single channel, DIP-8         |
| VO2611-X006 | 15 kV/μs, single channel, DIP-8 400 mil |
| VO2611-X007 | 15 kV/μs, single channel, SMD-8         |
| VO2630      | 100 V/μs, dual channel, DIP-8           |
| VO2630-X006 | 100 V/μs, dual channel, DIP-8 400 mil   |
| VO2630-X007 | 100 V/μs, dual channel, SMD-8           |
| VO2631      | 5 kV/μs, dual channel, DIP-8            |
| VO2631-X006 | 5 kV/μs, dual channel, DIP-8 400 mil    |



# 6N137/VO2601/VO2611/VO2630/VO2631/VO466

High Speed Optocoupler, 10 MBd Vishay Semiconductors

## ORDER INFORMATION

| PART        | REMARKS                                     |
|-------------|---|
| VO2631-X007 | 5 kV/ $\mu$ s, dual channel, SMD-8          |
| VO4661      | 15 kV/ $\mu$ s, dual channel, DIP-8         |
| VO4661-X006 | 15 kV/ $\mu$ s, dual channel, DIP-8 400 mil |
| VO4661-X007 | 15 kV/ $\mu$ s, dual channel, SMD-8         |

### Note

For additional information on the available options refer to option information.

## TRUTH TABLE (Positive Logic)

| LED | ENABLE | OUTPUT |
|-----|--------|--------|
| ON  | H      | L      |
| OFF | H      | H      |
| ON  | L      | H      |
| OFF | L      | H      |
| ON  | NC     | L      |
| OFF | NC     | H      |

## ABSOLUTE MAXIMUM RATINGS <sup>(1)</sup>

| PARAMETER   | TEST CONDITION  | SYMBOL     | VALUE            | UNIT        |
|---|-----------------|------------|------------------|-------------|
| <b>INPUT</b>  |                 |            |                  |             |
| Average forward current (single channel)                |                 | $I_F$      | 20               | mA          |
| Average forward current (per channel for dual channel)  |                 | $I_F$      | 15               | mA          |
| Reverse input voltage                                   |                 | $V_R$      | 5                | V           |
| Enable input voltage                                    |                 | $V_E$      | $V_{CC} + 0.5 V$ | V           |
| Enable input current                                    |                 | $I_E$      | 5                | mA          |
| Surge current   | $t = 100 \mu s$ | $I_{FSM}$  | 200              | mA          |
| Output power dissipation (single channel)               |                 | $P_{diss}$ | 35               | mW          |
| Output power dissipation (per channel for dual channel) |                 | $P_{diss}$ | 25               | mW          |
| <b>OUTPUT</b>   |                 |            |                  |             |
| Supply voltage  | 1 min maximum   | $V_{CC}$   | 7                | V           |
| Output current  |                 | $I_O$      | 50               | mA          |
| Output voltage  |                 | $V_O$      | 7                | V           |
| Output power dissipation (single channel)               |                 | $P_{diss}$ | 85               | mW          |
| Output power dissipation (per channel for dual channel) |                 | $P_{diss}$ | 60               | mW          |
| <b>COUPLER</b>  |                 |            |                  |             |
| Isolation test voltage                                  | $t = 1.0 s$     | $V_{ISO}$  | 5300             | $V_{RMS}$   |
| Storage temperature                                     |                 | $T_{stg}$  | - 55 to + 150    | $^{\circ}C$ |
| Operating temperature                                   |                 | $T_{amb}$  | - 40 to + 100    | $^{\circ}C$ |
| Lead solder temperature                                 | for 10 s        |            | 260              | $^{\circ}C$ |
| Solder reflow temperature <sup>(2)</sup>                |                 |            | 260              | $^{\circ}C$ |

### Notes

<sup>(1)</sup>  $T_{amb} = 25^{\circ}C$ , unless otherwise specified.

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute maximum ratings for extended periods of the time can adversely affect reliability.

<sup>(2)</sup> Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

**RECOMMENDED OPERATING CONDITIONS**

| PARAMETER                 | TEST CONDITION           | SYMBOL    | MIN. | MAX.     | UNIT |
|---------------------------|--------------------------|-----------|------|----------|------|
| Operating temperature     |                          | $T_{amb}$ | - 40 | 100      | °C   |
| Supply voltage            |                          | $V_{CC}$  | 4.5  | 5.5      | V    |
| Input current low level   |                          | $I_{FL}$  | 0    | 250      | μA   |
| Input current high level  |                          | $I_{FH}$  | 5    | 15       | mA   |
| Logic high enable voltage |                          | $V_{EH}$  | 2    | $V_{CC}$ | V    |
| Logic low enable voltage  |                          | $V_{EL}$  | 0    | 0.8      | V    |
| Output pull up resistor   |                          | $R_L$     | 330  | 4K       | Ω    |
| Fanout                    | $R_L = 1\text{ k}\Omega$ | N         |      | 5        | -    |

**ELECTRICAL CHARACTERISTICS**

| PARAMETER                                  | TEST CONDITION  | SYMBOL    | MIN. | TYP.  | MAX.  | UNIT |
|--|---|-----------|------|-------|-------|------|
| <b>INPUT</b>                               |   |           |      |       |       |      |
| Input forward voltage                      | $I_F = 10\text{ mA}$  | $V_F$     | 1.1  | 1.4   | 1.7   | V    |
| Reverse current                            | $V_R = 5\text{ V}$  | $I_R$     |      | 0.01  | 10    | μA   |
| Input capacitance                          | $f = 1\text{ MHz}, V_F = 0\text{ V}$  | $C_I$     |      | 55    |       | pF   |
| <b>OUTPUT</b>                              |   |           |      |       |       |      |
| High level supply current (single channel) | $V_E = 0.5\text{ V}, I_F = 0\text{ mA}$                                       | $I_{CCH}$ |      | 4.1   | 7.0   | mA   |
|  | $V_E = V_{CC}, I_F = 0\text{ mA}$   | $I_{CCH}$ |      | 3.3   | 6.0   | mA   |
| High level supply current (dual channel)   | $I_F = 0\text{ mA}$   | $I_{CCH}$ |      | 6.5   | 12.0  | mA   |
| Low level supply current (single channel)  | $V_E = 0.5\text{ V}, I_F = 10\text{ mA}$                                      | $I_{CCL}$ |      | 4.0   | 7.0   | mA   |
|  | $V_E = V_{CC}, I_F = 10\text{ mA}$  | $I_{CCL}$ |      | 3.3   | 6.0   | mA   |
| Low level supply current (dual channel)    | $I_F = 10\text{ mA}$  | $I_{CCL}$ |      | 6.5   | 12.0  | mA   |
| High level output current                  | $V_E = 2\text{ V}, V_O = 5.5\text{ V}, I_F = 250\text{ }\mu\text{A}$          | $I_{OH}$  |      | 0.002 | 1     | μA   |
| Low level output voltage                   | $V_E = 2\text{ V}, I_F = 5\text{ mA}, I_{OL}(\text{sinking}) = 13\text{ mA}$  | $V_{OL}$  |      | 0.2   | 0.6   | V    |
| Input threshold current                    | $V_E = 2\text{ V}, V_O = 5.5\text{ V}, I_{OL}(\text{sinking}) = 13\text{ mA}$ | $I_{TH}$  |      | 2.4   | 5.0   | mA   |
| High level enable current                  | $V_E = 2\text{ V}$  | $I_{EH}$  |      | - 0.6 | - 1.6 | mA   |
| Low level enable current                   | $V_E = 0.5\text{ V}$  | $I_{EL}$  |      | - 0.8 | - 1.6 | mA   |
| High level enable voltage                  |   | $V_{EH}$  | 2    |       |       | V    |
| Low level enable voltage                   |   | $V_{EL}$  |      |       | 0.8   | V    |

**Note**

$T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified.

Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements.

### SWITCHING CHARACTERISTICS <sup>(1)</sup>

| PARAMETER  | TEST CONDITION  | SYMBOL                | MIN. | TYP. | MAX.              | UNIT |
|--|---|-----------------------|------|------|-------------------|------|
| Propagation delay time to high output level                | $R_L = 350 \Omega$ , $C_L = 15 \text{ pF}$  | $t_{PLH}$             | 20   | 48   | 75 <sup>(2)</sup> | ns   |
|  |   | $t_{PLH}$             |      |      | 100               | ns   |
| Propagation delay time to low output level                 | $R_L = 350 \Omega$ , $C_L = 15 \text{ pF}$  | $t_{PHL}$             | 25   | 50   | 75 <sup>(2)</sup> | ns   |
|  |   | $t_{PHL}$             |      |      | 100               | ns   |
| Pulse width distortion                                     | $R_L = 350 \Omega$ , $C_L = 15 \text{ pF}$  | $ t_{PHL} - t_{PLH} $ |      | 2.9  | 35                | ns   |
| Propagation delay skew                                     | $R_L = 350 \Omega$ , $C_L = 15 \text{ pF}$  | $t_{PSK}$             |      | 8    | 40                | ns   |
| Output rise time (10 to 90 %)                              | $R_L = 350 \Omega$ , $C_L = 15 \text{ pF}$  | $t_r$                 |      | 23   |                   | ns   |
| Output fall time (90 to 10 %)                              | $R_L = 350 \Omega$ , $C_L = 15 \text{ pF}$  | $t_f$                 |      | 7    |                   | ns   |
| Propagation delay time of enable from $V_{EH}$ to $V_{EL}$ | $R_L = 350 \Omega$ , $C_L = 15 \text{ pF}$ ,<br>$V_{EL} = 0 \text{ V}$ , $V_{EH} = 3 \text{ V}$ | $t_{ELH}$             |      | 12   |                   | ns   |
| Propagation delay time of enable from $V_{EL}$ to $V_{EH}$ | $R_L = 350 \Omega$ , $C_L = 15 \text{ pF}$ ,<br>$V_{EL} = 0 \text{ V}$ , $V_{EH} = 3 \text{ V}$ | $t_{EHL}$             |      | 11   |                   | ns   |

#### Notes

- (1) Over recommended temperature ( $T_{amb} = -40^\circ\text{C}$  to  $+100^\circ\text{C}$ ),  $V_{CC} = 5 \text{ V}$ ,  $I_F = 7.5 \text{ mA}$  unless otherwise specified.  
All Typical at  $T_{amb} = 25^\circ\text{C}$ ,  $V_{CC} = 5 \text{ V}$ .
- (2) 75 ns applies to the 6N137 only, a JEDEC registered specification

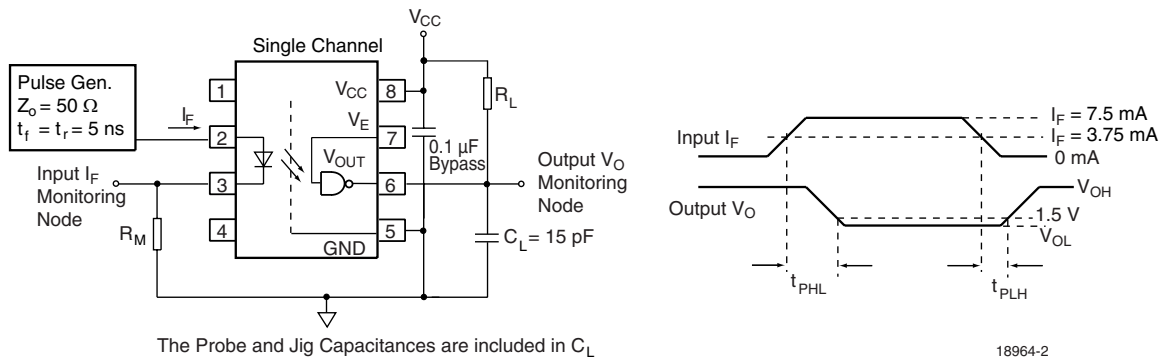


Fig. 1 - Single Channel Test Circuit for  $t_{PLH}$ ,  $t_{PHL}$ ,  $t_r$  and  $t_f$

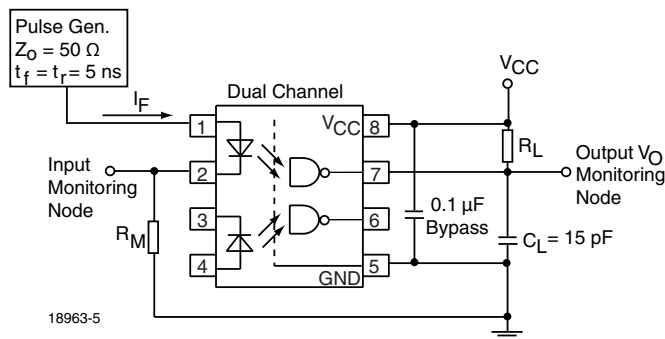


Fig. 2 - Dual Channel Test Circuit for  $t_{PLH}$ ,  $t_{PHL}$ ,  $t_r$  and  $t_f$

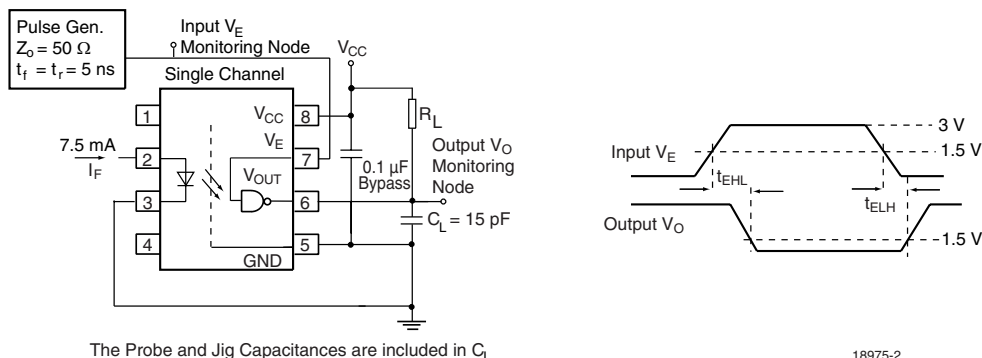


Fig. 3 - Single Channel Test Circuit for  $t_{EHL}$  and  $t_{ELH}$

| COMMON MODE TRANSIENT IMMUNITY        |   |          |       |       |      |                  |
|---------------------------------------|---|----------|-------|-------|------|------------------|
| PARAMETER                             | TEST CONDITION  | SYMBOL   | MIN.  | TYP.  | MAX. | UNIT             |
| Common mode transient immunity (high) | $ V_{CM}  = 10 \text{ V}$ , $V_{CC} = 5 \text{ V}$ , $I_F = 0 \text{ mA}$ , $V_{O(min)} = 2 \text{ V}$ , $R_L = 350 \text{ } \Omega$ , $T_{amb} = 25 \text{ } ^\circ\text{C}$ (1)     | $ CM_H $ | 100   |       |      | V/ $\mu\text{s}$ |
|                                       | $ V_{CM}  = 50 \text{ V}$ , $V_{CC} = 5 \text{ V}$ , $I_F = 0 \text{ mA}$ , $V_{O(min)} = 2 \text{ V}$ , $R_L = 350 \text{ } \Omega$ , $T_{amb} = 25 \text{ } ^\circ\text{C}$ (2)     | $ CM_H $ | 5000  | 10000 |      | V/ $\mu\text{s}$ |
|                                       | $ V_{CM}  = 1 \text{ kV}$ , $V_{CC} = 5 \text{ V}$ , $I_F = 0 \text{ mA}$ , $V_{O(min)} = 2 \text{ V}$ , $R_L = 350 \text{ } \Omega$ , $T_{amb} = 25 \text{ } ^\circ\text{C}$ (3)     | $ CM_H $ | 15000 | 25000 |      | V/ $\mu\text{s}$ |
|                                       | $ V_{CM}  = 10 \text{ V}$ , $V_{CC} = 5 \text{ V}$ , $I_F = 7.5 \text{ mA}$ , $V_{O(max)} = 0.8 \text{ V}$ , $R_L = 350 \text{ } \Omega$ , $T_{amb} = 25 \text{ } ^\circ\text{C}$ (1) | $ CM_L $ | 100   |       |      | V/ $\mu\text{s}$ |
|                                       | $ V_{CM}  = 50 \text{ V}$ , $V_{CC} = 5 \text{ V}$ , $I_F = 7.5 \text{ mA}$ , $V_{O(max)} = 0.8 \text{ V}$ , $R_L = 350 \text{ } \Omega$ , $T_{amb} = 25 \text{ } ^\circ\text{C}$ (2) | $ CM_L $ | 5000  | 10000 |      | V/ $\mu\text{s}$ |
|                                       | $ V_{CM}  = 1 \text{ kV}$ , $V_{CC} = 5 \text{ V}$ , $I_F = 7.5 \text{ mA}$ , $V_{O(max)} = 0.8 \text{ V}$ , $R_L = 350 \text{ } \Omega$ , $T_{amb} = 25 \text{ } ^\circ\text{C}$ (3) | $ CM_L $ | 15000 | 25000 |      | V/ $\mu\text{s}$ |

### Notes

- (1) For 6N137 and VO2630
- (2) For VO2601 and VO2631
- (3) For VO2611 and VO4661

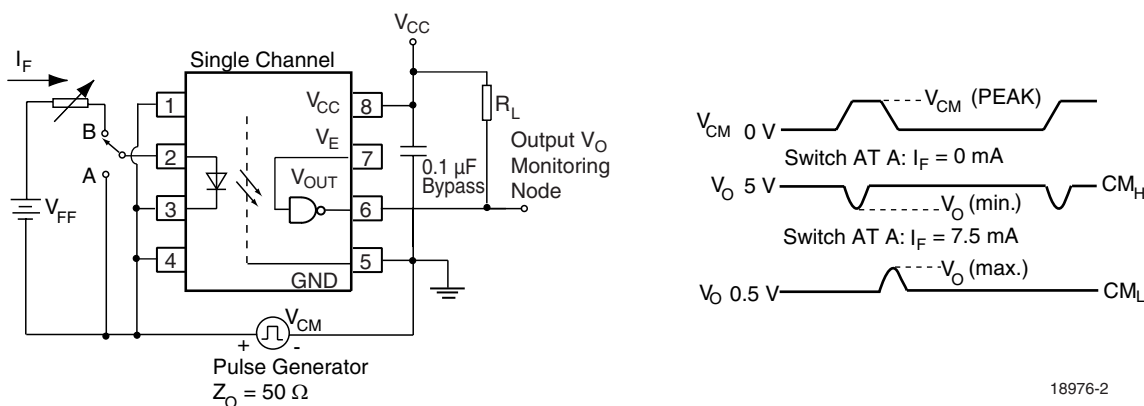


Fig. 4 - Single Channel Test Circuit for Common Mode Transient Immunity



# 6N137/VO2601/VO2611/VO2630/VO2631/VO466

High Speed Optocoupler, 10 MBd Vishay Semiconductors

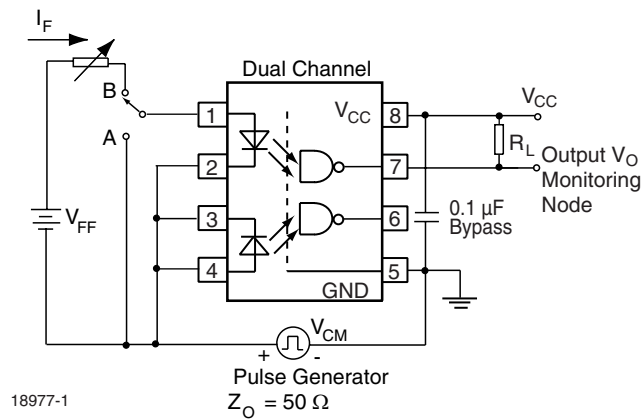


Fig. 5 - Dual Channel Test Circuit for Common Mode Transient Immunity

| SAFETY AND INSULATION RATINGS          |                            |            |      |           |      |      |
|--|----------------------------|------------|------|-----------|------|------|
| PARAMETER                              | TEST CONDITION             | SYMBOL     | MIN. | TYP.      | MAX. | UNIT |
| Climatic classification                | according to IEC 68 part 1 |            |      | 55/100/21 |      |      |
| Comparative tracking index             |                            | CTI        | 175  |           | 399  |      |
| Peak transient overvoltage             |                            | $V_{IOTM}$ | 8000 |           |      | V    |
| Peak insulation voltage                |                            | $V_{IORM}$ | 890  |           |      | V    |
| Safety rating - power output           |                            | $P_{SO}$   |      |           | 500  | mW   |
| Safety rating - input current          |                            | $I_{SI}$   |      |           | 300  | mA   |
| Safety rating - temperature            |                            | $T_{SI}$   |      |           | 175  | °C   |
| Creepage distance                      | standard DIP-8             |            | 7    |           |      | mm   |
| Clearance distance                     | standard DIP-8             |            | 7    |           |      | mm   |
| Creepage distance                      | 400 mil DIP-8              |            | 8    |           |      | mm   |
| Clearance distance                     | 400 mil DIP-8              |            | 8    |           |      | mm   |
| Insulation thickness, reinforced rated | per IEC 60950 2.10.5.1     |            | 0.2  |           |      | mm   |

## Note

As per IEC 60747-5-2, §7.4.3.8.1, this optocoupler is suitable for “safe electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

# TYPICAL CHARACTERISTICS

$T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified

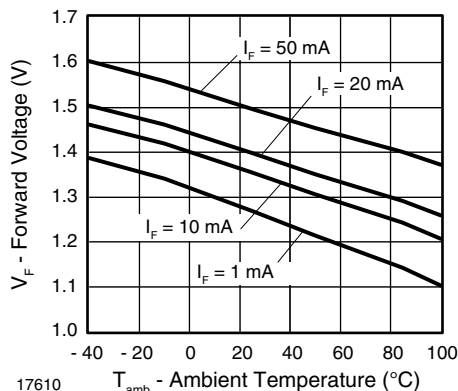


Fig. 6 - Forward Voltage vs. Ambient Temperature

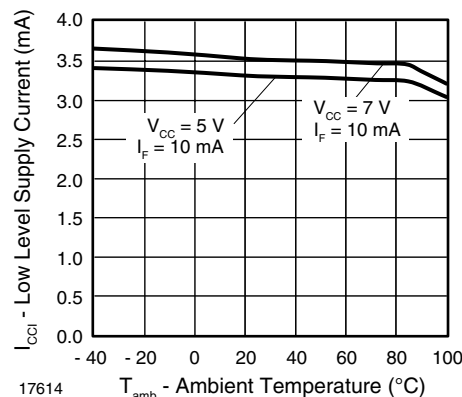


Fig. 9 - Low Level Supply Current vs. Ambient Temperature

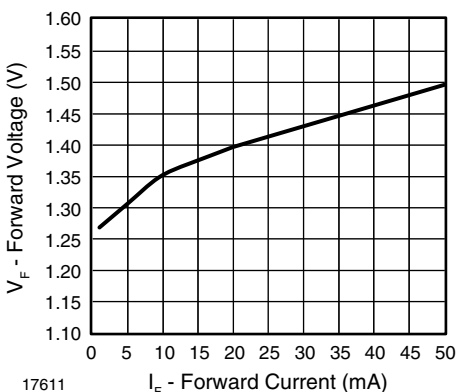


Fig. 7 - Forward Voltage vs. Forward Current

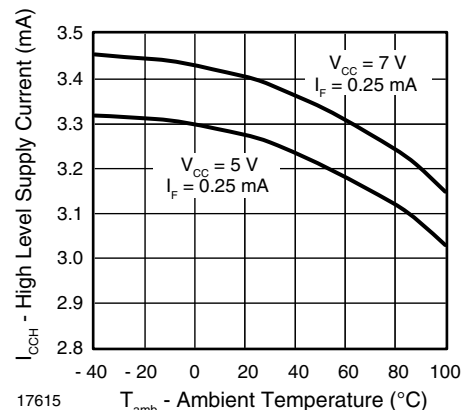


Fig. 10 - High Level Supply Current vs. Ambient Temperature

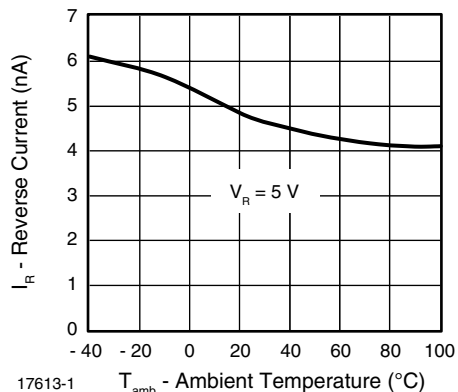


Fig. 8 - Reverse Current vs. Ambient Temperature

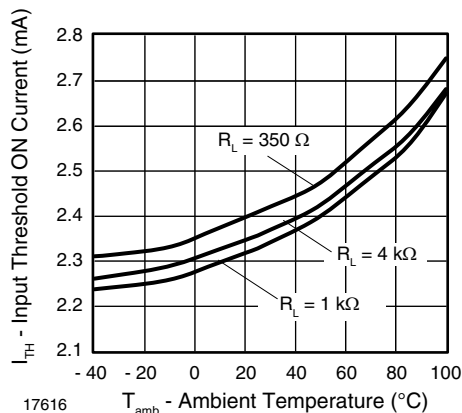


Fig. 11 - Input Threshold ON Current vs. Ambient Temperature

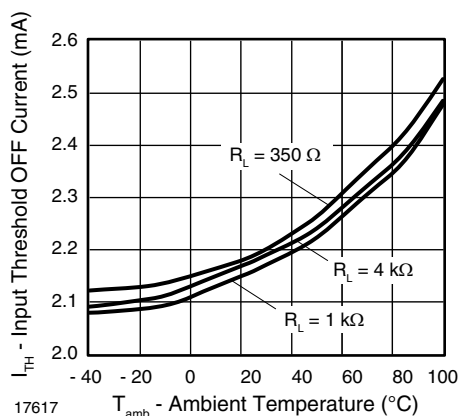


Fig. 12 - Input Threshold OFF Current vs. Ambient Temperature

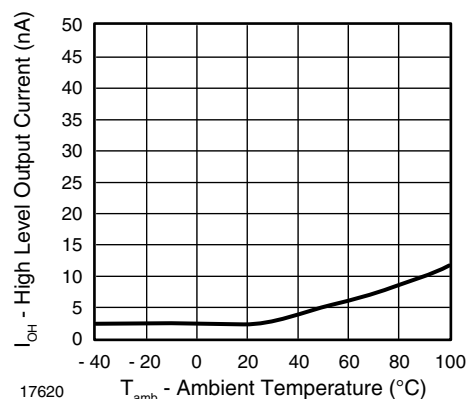


Fig. 15 - High Level Output Current vs. Ambient Temperature

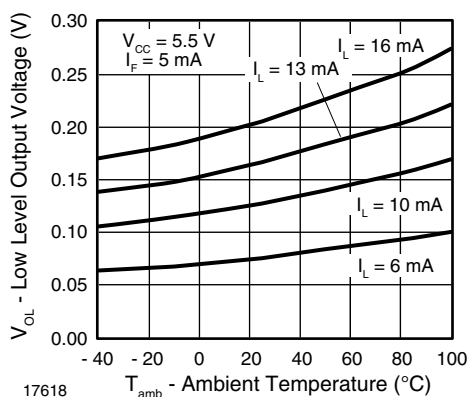


Fig. 13 - Low Level Output Voltage vs. Ambient Temperature

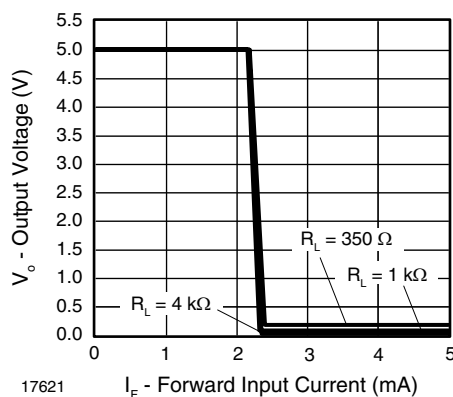


Fig. 16 - Output Voltage vs. Forward Input Current

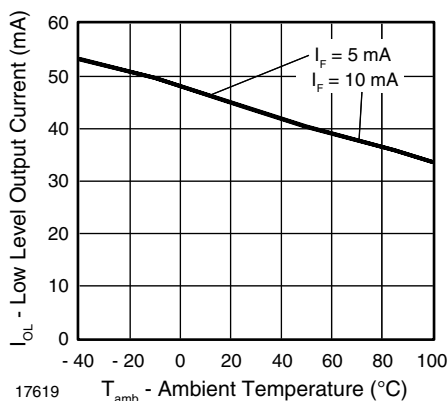


Fig. 14 - Low Level Output Current vs. Ambient Temperature

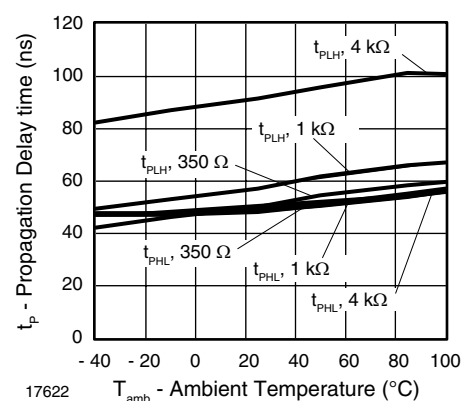


Fig. 17 - Propagation Delay vs. Ambient Temperature





# 6N137/VO2601/VO2611/VO2630/VO2631/VO466

High Speed Optocoupler, 10 MBd Vishay Semiconductors

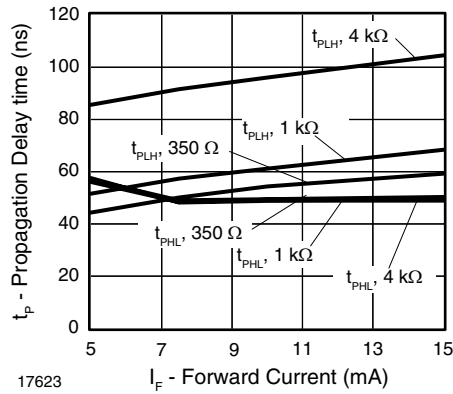


Fig. 18 - Propagation Delay vs. Forward Current

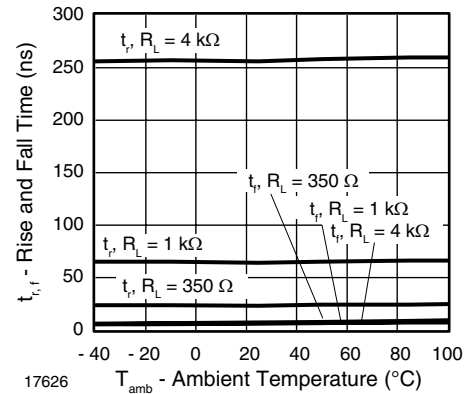


Fig. 21 - Rise and Fall Time vs. Ambient Temperature

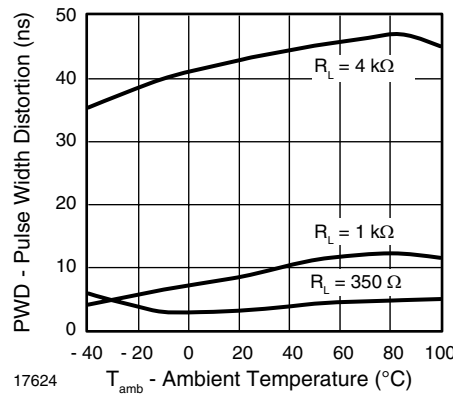


Fig. 19 - Pulse Width Distortion vs. Ambient Temperature

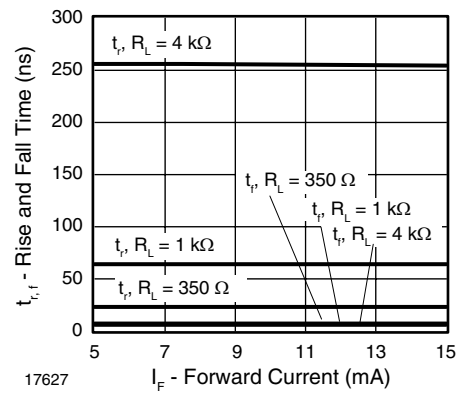


Fig. 22 - Rise and Fall Time vs. Forward Current

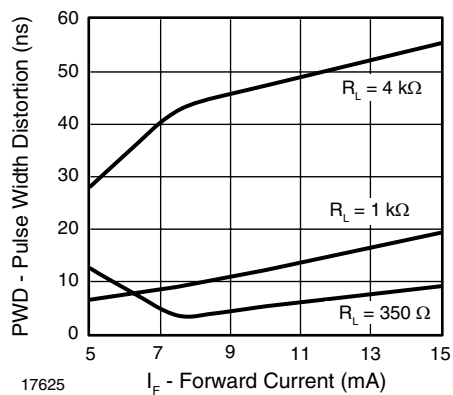


Fig. 20 - Pulse Width Distortion vs. Forward Current

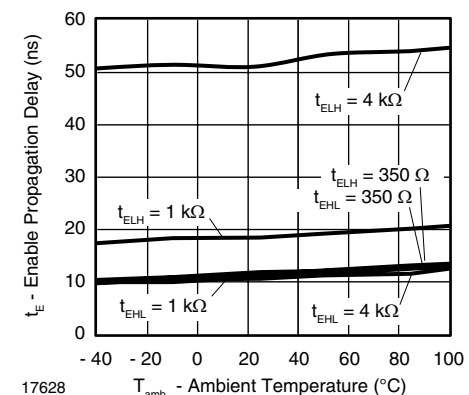
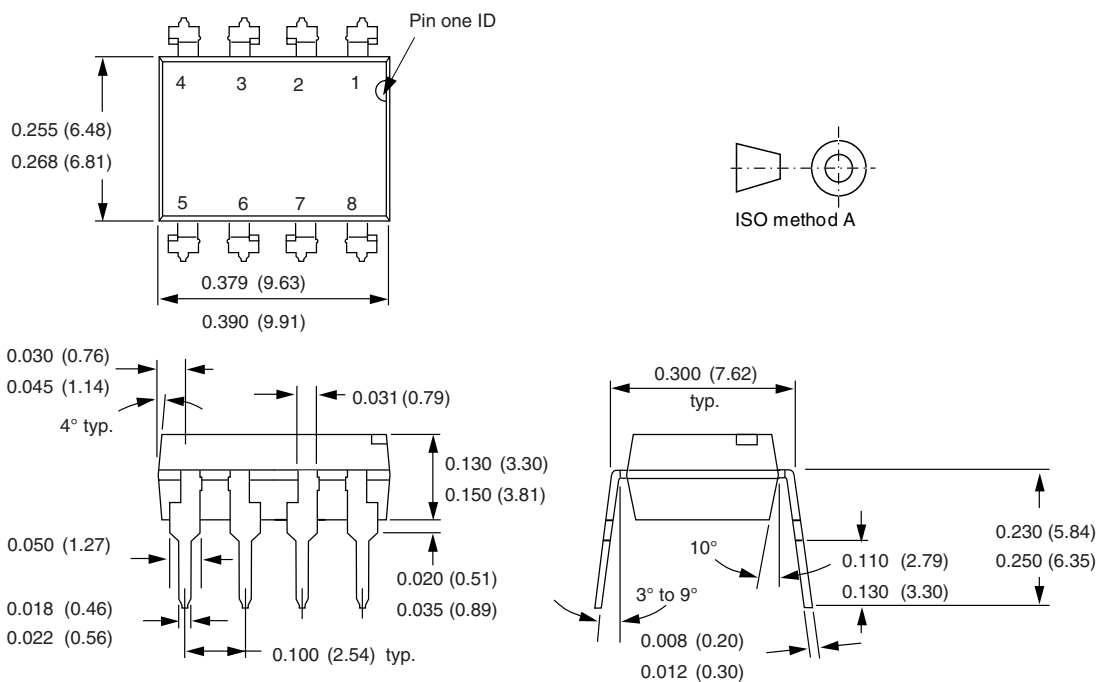


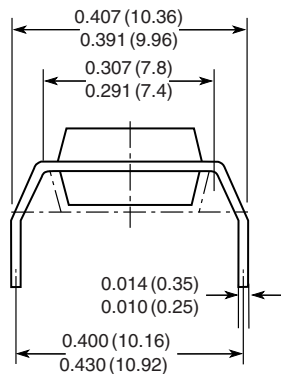
Fig. 23 - Enable Propagation Delay vs. Ambient Temperature

## PACKAGE DIMENSIONS in inches (millimeters)

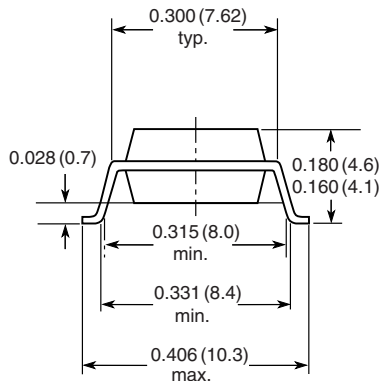


i178006

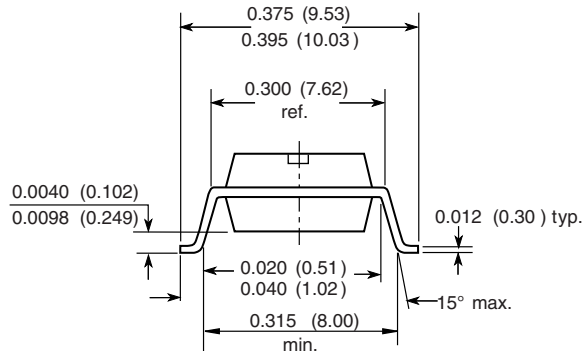
### Option 6



### Option 7



### Option 9



18450



### OZONE DEPLETING SUBSTANCES POLICY STATEMENT

It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively.
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA.
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

We reserve the right to make changes to improve technical design  
and may do so without further notice.

Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use Vishay Semiconductors products for any unintended or unauthorized application, the buyer shall indemnify Vishay Semiconductors against all claims, costs, damages, and expenses, arising out of, directly or indirectly, any claim of personal damage, injury or death associated with such unintended or unauthorized use.

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