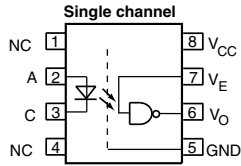




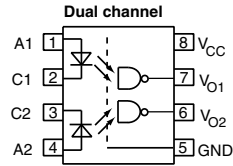
## High Speed Optocoupler, 10 MBd, SOIC-8 Package



18921-17



VO0600T, VO0601T, VO0611T



VO0630T, VO0631T, VO0661T

18921-26



### FEATURES

- Choice of CMR performance of 15 kV/μs, 5 kV/μs, and 1 kV/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 temp. 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
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT

### DESCRIPTION

The VO06xxT family are single and dual channel 10 MBd optocoupler 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. 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 VO0601T and VO0631T and 15 kV/μs for the VO0611T and VO0661T. The use of a 0.1 μF bypass capacitor connected between pin 5 and 8 is recommended.

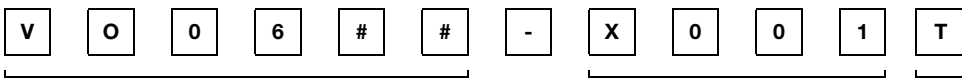
### AGENCY APPROVALS

- UL1577, file no. E52744
- cUL-file no. E52744, equivalent to CSA bulletin 5A
- DIN EN 60747-5-5 (VDE 0884-5), available with option 1

### APPLICATIONS

- Microprocessor system M interface
- PLC, ATE input/output isolation
- Computer peripheral interface: SPI
- 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

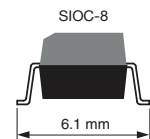
### ORDERING INFORMATION



PART NUMBER

PACKAGE OPTION

TAPE AND REEL



| AGENCY CERTIFIED/PACKAGE | 1 CHANNEL   |              |           | 2 CHANNELS  |              |           |
|--------------------------|-------------|--------------|-----------|-------------|--------------|-----------|
|                          | CMR (kV/μs) |              |           | CMR (kV/μs) |              |           |
| <b>UL, cUL</b>           | <b>1</b>    | <b>5</b>     | <b>15</b> | <b>1</b>    | <b>5</b>     | <b>15</b> |
| SOIC-8                   | VO0600T     | VO0601T      | VO0611T   | VO0630T     | VO0631T      | VO0661T   |
| <b>UL, cUL, VDE</b>      | <b>1</b>    | <b>5</b>     | <b>15</b> | <b>1</b>    | <b>5</b>     | <b>15</b> |
| SOIC-8                   | -           | VO0601-X001T | -         | -           | VO0631-X001T | -         |



| <b>TRUTH TABLE</b> (positive logic) |                       |        |
|-------------------------------------|-----------------------|--------|
| LED                                 | ENABLE <sup>(1)</sup> | OUTPUT |
| On                                  | H                     | L      |
| Off                                 | H                     | H      |
| On                                  | L                     | H      |
| Off                                 | L                     | H      |
| On                                  | NC                    | L      |
| Off                                 | NC                    | H      |

**Note**

<sup>(1)</sup> Only applicable for single channel devices

| <b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                              |            |                         |                    |
|--|------------------------------|------------|-------------------------|--------------------|
| PARAMETER  | TEST CONDITION               | SYMBOL     | VALUE                   | UNIT               |
| <b>INPUT</b>   |                              |            |                         |                    |
| Average forward current (single channel)   |                              | $I_F$      | 20                      | mA                 |
| Average forward current (dual channel)   |                              | $I_F$      | 15                      | mA                 |
| Reverse input voltage  |                              | $V_R$      | 5                       | V                  |
| Enable input voltage (single channel)  |                              | $V_E$      | $V_{CC} + 0.5\text{ V}$ | V                  |
| Enable input current (single channel)  |                              | $I_E$      | 5                       | mA                 |
| Surge current  | $t = 100\text{ }\mu\text{s}$ | $I_{FSM}$  | 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   | $t = 1\text{ s}$             | $V_{ISO}$  | 4000                    | $V_{RMS}$          |
| Storage temperature  |                              | $T_{stg}$  | - 55 to + 150           | $^{\circ}\text{C}$ |
| Operating temperature  |                              | $T_{amb}$  | - 40 to + 100           | $^{\circ}\text{C}$ |
| Lead solder temperature  | for 10 s                     |            | 260                     | $^{\circ}\text{C}$ |
| Solder reflow temperature <sup>(1)</sup>   | for 1 min                    |            | 260                     | $^{\circ}\text{C}$ |

**Notes**

- 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>(1)</sup> Refer to reflow profile for soldering conditions for surface mounted devices.

| <b>RECOMMENDED OPERATING CONDITION</b> |                          |           |      |      |          |                    |
|--|--------------------------|-----------|------|------|----------|--------------------|
| PARAMETER                              | TEST CONDITION           | SYMBOL    | MIN. | TYP. | MAX.     | UNIT               |
| Operating temperature                  |                          | $T_{amb}$ | - 40 |      | 100      | $^{\circ}\text{C}$ |
| Supply voltage                         |                          | $V_{CC}$  | 4.5  |      | 5.5      | V                  |
| Input current low level                |                          | $I_{FL}$  | 0    |      | 250      | $\mu\text{A}$      |
| Input current high level               |                          | $I_{FH}$  | 5    |      | 15       | mA                 |
| Output pull up resistor                |                          | $R_L$     | 330  |      | 4K       | $\Omega$           |
| Logic high enable voltage              |                          | $V_{EH}$  | 2    |      | $V_{CC}$ | V                  |
| Logic low enable voltage               |                          | $V_{EL}$  | 0.0  |      | 0.8      | V                  |
| Fanout                                 | $R_L = 1\text{ k}\Omega$ | N         |      |      | 5        | -                  |



| <b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |   |           |      |       |      |               |
|--|---|-----------|------|-------|------|---------------|
| 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   | $\mu\text{A}$ |
| 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    | mA            |
|  | $V_E = V_{CC}, I_F = 0\text{ mA}$   | $I_{CCH}$ |      | 3.3   | 6    | mA            |
| High level supply current (dual channel)   | $I_F = 10\text{ mA}$  | $I_{CCH}$ |      | 6.5   | 12   | mA            |
| Low level supply current (single channel)  | $V_E = 0.5\text{ V}, I_F = 10\text{ mA}$                                      | $I_{CCL}$ |      | 4     | 7    | mA            |
|  | $V_E = V_{CC}, I_F = 10\text{ mA}$  | $I_{CCL}$ |      | 3.3   | 6    | mA            |
| Low level supply current (dual channel)  | $I_F = 10\text{ mA}$  | $I_{CCL}$ |      | 6.5   | 12   | 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    | $\mu\text{A}$ |
| 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    | mA            |
| High level enable current  |   | $I_{EH}$  |      | -0.6  | -1.6 | mA            |
| Low level enable current   |   | $I_{EL}$  |      | -0.8  | -1.6 | mA            |
| High level enable voltage  |   | $V_{EH}$  | 2    |       |      | V             |
| Low level enable voltage   |   | $V_{EL}$  |      |       | 0.8  | V             |

**Note**

- 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.

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

**Note**

- Over recommended temperature ( $T_A = -40\text{ }^{\circ}\text{C}$  to  $+100\text{ }^{\circ}\text{C}$ ),  $V_{CC} = 5\text{ V}, I_F = 7.5\text{ mA}$  unless otherwise specified. All typicals at  $T_A = 25\text{ }^{\circ}\text{C}, V_{CC} = 5\text{ V}$ .

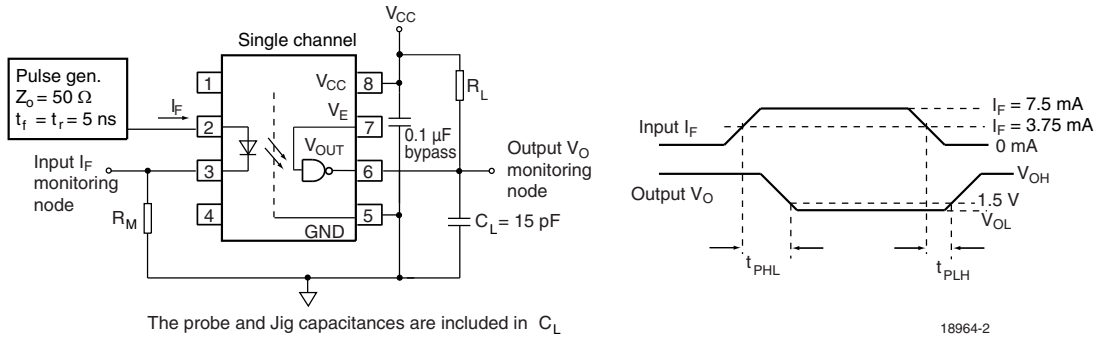


Fig. 1 - Single Channel Test Circuit for  $t_{PLH}$ ,  $t_{PHL}$ ,  $t_r$  and  $t_f$



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

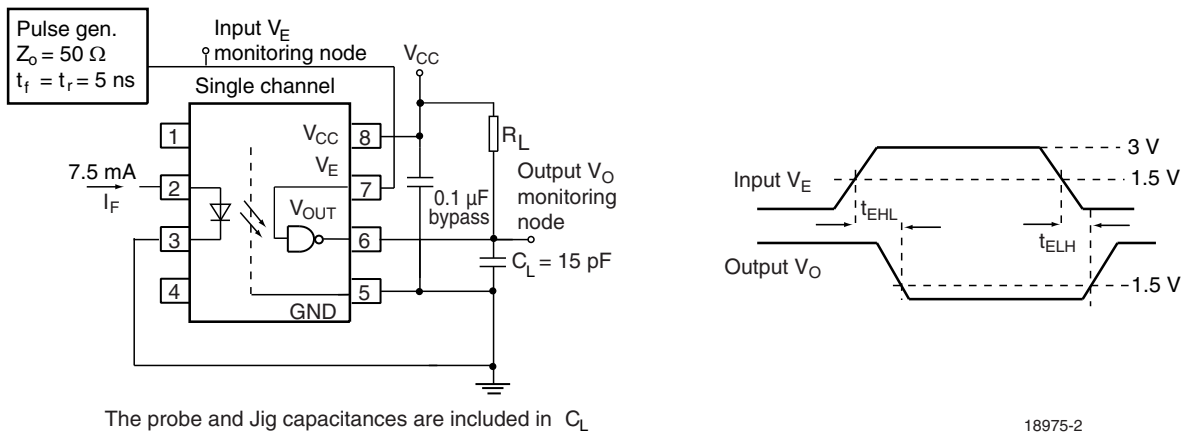


Fig. 3 - Single Channel Test Circuit for  $t_{EHL}$ ,  $t_{ELH}$



| COMMON MODE TRANSIENT IMMUNITY        |   |          |        |        |      |                        |
|---------------------------------------|---|----------|--------|--------|------|------------------------|
| PARAMETER                             | TEST CONDITION  | SYMBOL   | MIN.   | TYP.   | MAX. | UNIT                   |
| Common mode transient immunity (high) | $ V_{CM}  = 10\text{ V}$ , $V_{CC} = 5\text{ V}$ , $I_F = 0\text{ mA}$ , $V_{O(\min)} = 2\text{ V}$ , $R_L = 350\ \Omega$ , $T_{\text{amb}} = 25\text{ }^\circ\text{C}^{(1)}$     | $ CM_H $ | 1000   |        |      | $\text{V}/\mu\text{s}$ |
|                                       | $ V_{CM}  = 50\text{ V}$ , $V_{CC} = 5\text{ V}$ , $I_F = 0\text{ mA}$ , $V_{O(\min)} = 2\text{ V}$ , $R_L = 350\ \Omega$ , $T_{\text{amb}} = 25\text{ }^\circ\text{C}^{(2)}$     | $ CM_H $ | 5000   | 10 000 |      | $\text{V}/\mu\text{s}$ |
|                                       | $ V_{CM}  = 1\text{ kV}$ , $V_{CC} = 5\text{ V}$ , $I_F = 0\text{ mA}$ , $V_{O(\min)} = 2\text{ V}$ , $R_L = 350\ \Omega$ , $T_{\text{amb}} = 25\text{ }^\circ\text{C}^{(3)}$     | $ CM_H $ | 15 000 | 25 000 |      | $\text{V}/\mu\text{s}$ |
| Common mode transient immunity (low)  | $ V_{CM}  = 10\text{ V}$ , $V_{CC} = 5\text{ V}$ , $I_F = 7.5\text{ mA}$ , $V_{O(\max)} = 0.8\text{ V}$ , $R_L = 350\ \Omega$ , $T_{\text{amb}} = 25\text{ }^\circ\text{C}^{(1)}$ | $ CM_L $ | 1000   |        |      | $\text{V}/\mu\text{s}$ |
|                                       | $ V_{CM}  = 50\text{ V}$ , $V_{CC} = 5\text{ V}$ , $I_F = 7.5\text{ mA}$ , $V_{O(\max)} = 0.8\text{ V}$ , $R_L = 350\ \Omega$ , $T_{\text{amb}} = 25\text{ }^\circ\text{C}^{(2)}$ | $ CM_L $ | 5000   | 10 000 |      | $\text{V}/\mu\text{s}$ |
|                                       | $ V_{CM}  = 1\text{ kV}$ , $V_{CC} = 5\text{ V}$ , $I_F = 7.5\text{ mA}$ , $V_{O(\max)} = 0.8\text{ V}$ , $R_L = 350\ \Omega$ , $T_{\text{amb}} = 25\text{ }^\circ\text{C}^{(3)}$ | $ CM_L $ | 15 000 | 25 000 |      | $\text{V}/\mu\text{s}$ |

**Notes**

- (1) For VO0600T and VO0630T
- (2) For VO0601T and VO0631T
- (3) For VO0611T and VO0661T



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

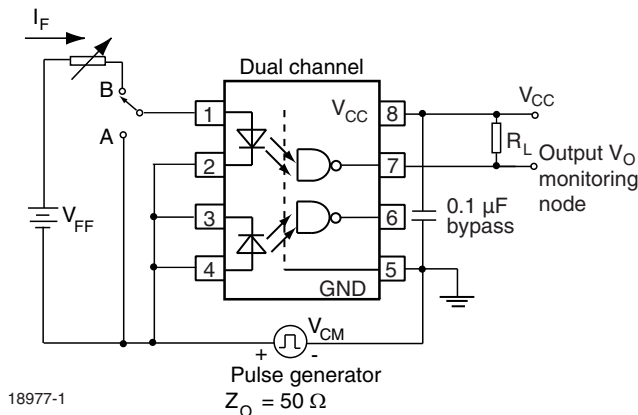


Fig. 5 - Dual Channel Test Circuit for Common Mode Transient Immunity



| 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  |      |
| $V_{IOTM}$                    |                            |        | 6000 |           |      | V    |
| $V_{IORM}$                    |                            |        | 560  |           |      | V    |
| $P_{SO}$                      |                            |        |      |           | 350  | mW   |
| $I_{SI}$                      |                            |        |      |           | 150  | mA   |
| $T_{SI}$                      |                            |        |      |           | 165  | °C   |
| Creepage                      |                            |        | 4    |           |      | mm   |
| Clearance                     |                            |        | 4    |           |      | mm   |
| Insulation thickness          |                            |        | 0.2  |           |      | mm   |

**Note**

- As per IEC 60747-5-5, 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

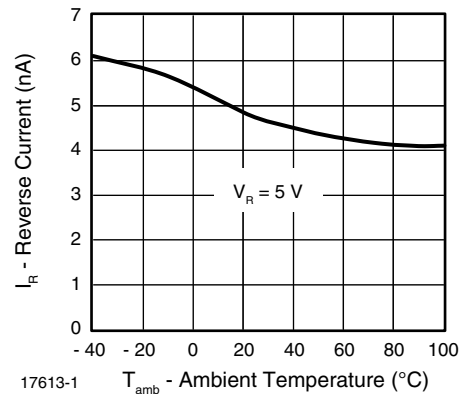


Fig. 8 - Reverse Current vs. Ambient Temperature



Fig. 7 - Forward Voltage vs. Forward Current



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

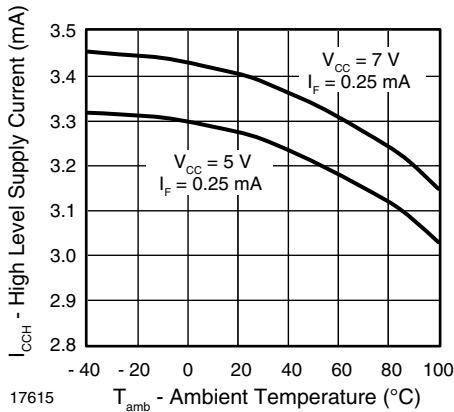


Fig. 10 - High Level Supply Current vs. Ambient Temperature



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

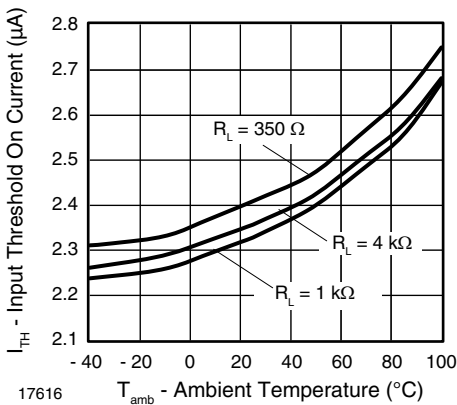


Fig. 11 - Input Threshold On Current vs. Ambient Temperature

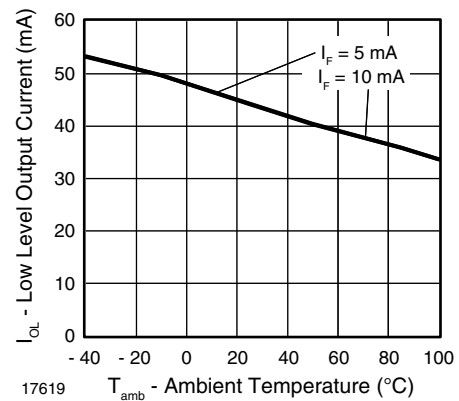


Fig. 14 - Low Level Output Current vs. Ambient Temperature

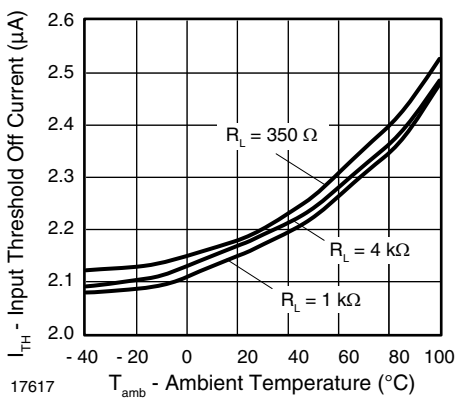


Fig. 12 - Input Threshold Off Current vs. Ambient Temperature



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



Fig. 16 - Output Voltage vs. Forward Input Current



Fig. 19 - Pulse Width Distortion vs. Ambient Temperature



Fig. 17 - Propagation Delay vs. Ambient Temperature



Fig. 20 - Pulse Width Distortion vs. Forward Current



Fig. 18 - Propagation Delay vs. Forward Current



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





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

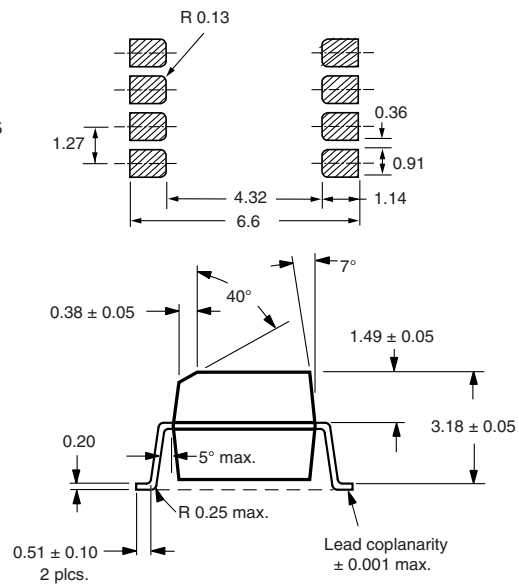


Fig. 23 - Enable Propagation Delay vs. Ambient Temperature

**PACKAGE DIMENSIONS** in millimeters



i178020-3



**PACKAGE MARKING** (example)



**Notes**

- The VDE Logo is only marked on option1 parts.
- Tape and reel suffix (T) is not part of the package marking.

**ESD CAUTION**

This is an ESD (electro static discharge) sensitive device. Electrostatic charges accumulate on the human body and test equipment and can discharge without detection. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality. ESD withstand voltage of this device is up to 1500 V acc. to JESD22-A114-B.



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