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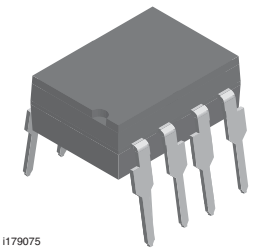
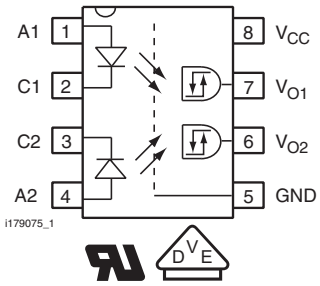
# High Speed Optocoupler, Dual, 5 MBd




## FEATURES

- Data rate 5 MBits/s (2.5 MBit/s over temperature)
- Buffer
- Isolation test voltage, 5300 $V_{RMS}$
- TTL, LSTTL and CMOS compatible
- Internal shield for very high common mode transient immunity
- Wide supply voltage range (4.5 V to 15 V)
- Low input current (1.6 mA to 5 mA)
- Specified from 0 °C to 85 °C
- Compliant to RoHS Directive to 2002/95/EC and in accordance WEEE 2002/96/EC

Pb-free

e3

RoHS COMPLIANT

## DESCRIPTION

The dual channel 5 Mb/s SFH6731 and SFH6732 high speed optocoupler consists of a GaAlAs infrared emitting diode, optically coupled with an integrated photo detector. The detector incorporates a Schmitt-Trigger stage for improved noise immunity. A Faraday shield provides a common mode transient immunity of 1000 V/µs at $V_{CM}$ = 50 V for SFH6731 and 500 V/µs at $V_{CM}$ = 300 V for SFH6732.

The SFH6731 and SFH6732 uses an industry standard DIP-8 package. With standard lead bending, creepage distance and clearance of ≥ 7 mm with lead bending options 6, 7 and 9 ≥ 8 mm are achieved.

## AGENCY APPROVALS

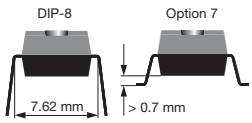
- UL1577, file no. E52744 system code H, double protection
- DIN EN 60747-5-2 (VDE 0884)/DIN EN 60747-5-5 (pending), available with option 1

## APPLICATIONS

- Industrial control
- Replace pulse transformers
- Routine logic interfacing
- Motion/power control
- High speed line receiver
- Microprocessor system interfaces
- Computer peripheral interfaces

## ORDERING INFORMATION

| S | F | H | 6 | 7 | 3 | # | - | X | 0 | # | # | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PART NUMBER | | | | | | | | PACKAGE OPTION | | | | TAPE AND REEL |




| AGENCY CERTIFIED/PACKAGE | CMR (kV/µs) | CMR (kV/µs) |
|---|---|---|
| **UL** | **1** | **5** |
| DIP-8 | SFH6731 | SFH6732 |
| SMD-8, option 7 | - | SFH6732-X007T |
| **VDE, UL** | **1** | **5** |
| SMD-8, option 7 | SFH6731-X017T | - |

## TRUTH TABLE (positive logic)

| PARTS | IR DIODE | OUTPUT |
|---|---|---|
| SFH6731 | On | H |
| | Off | L |
| SFH6732 | On | H |
| | Off | L |

| **ABSOLUTE MAXIMUM RATINGS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | |
|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **VALUE** | **UNIT** |
| **INPUT** | | | | |
| Reverse voltage | | $V_R$ | 3 | V |
| DC Forward current | | $I_F$ | 10 | mA |
| Surge forward current | $t_p \leq 1$ µs, 300 pulses/s | $I_{FSM}$ | 1 | A |
| Power dissipation | | $P_{diss}$ | 20 | mW |
| **OUTPUT** | | | | |
| Supply voltage | | $V_{CC}$ | - 0.5 to + 15 | V |
| Output voltage | | $V_O$ | - 0.5 to + 15 | V |
| Average output current | | $I_O$ | 25 | mA |
| Power dissipation | | $P_{diss}$ | 100 | mW |
| **COUPLER** | | | | |
| Storage temperature range | | $T_{stg}$ | - 55 to + 125 | °C |
| Ambient temperature range | | $T_{amb}$ | - 40 to + 85 | °C |
| Lead soldering temperature | t = 10 s | $T_s$ | 260 | °C |
| Isolation test voltage | t = 1 s | $V_{ISO}$ | 5300 | $V_{RMS}$ |
| Pollution degree | | | 2 | |
| Creepage distance and clearance | Standard lead bending | | 7 | mm |
| | Option 6, 7, 9 | | 8 | mm |
| Comparative tracking index per DIN IEC 112/VDE 0303, part 1 | | CTI | 175 | |
| Isolation resistance | $V_{IO}$ = 500 V, $T_{amb}$ = 25 °C | $R_{IO}$ | $10^{12}$ | Ω |
| | $V_{IO}$ = 500 V, $T_{amb}$ = 100 °C | $R_{IO}$ | $10^{11}$ | Ω |

**Note**

- 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.

| **ELECTRICAL CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **INPUT** (1) | | | | | | |
| Forward voltage | $I_F$ = 5 mA | $V_F$ | | 1.6 | 1.75 | V |
| | | $V_F$ | | | 1.8 | V |
| Input current hysteresis | $V_{CC}$ = 5 V, $I_{HYS} = I_{Fon} - I_{Foff}$ | | | 01 | | mA |
| Reverse current | $V_R$ = 3 V | $I_R$ | | 0.5 | 10 | µA |
| Capacitance | $V_R$ = 0 V, f = 1MHz | $C_O$ | | 60 | | pF |
| Thermal resistance | | $R_{thja}$ | | 700 | | K/W |
| **OUTPUT** (1) | | | | | | |
| Logic low output voltage | $I_{OL}$ = 6.4 mA | $V_{OL}$ | | | 0.5 | V |
| Logic high output voltage | $I_{OH}$ = - 2.6 mA, $V_{OH} = V_{CC}$ - 1.8 V (2) | $V_{OH}$ | 2.4 | (2) | | V |
| Output leakage current ($V_{OUT} > V_{CC}$) | $V_O$ = 5.5 V, $V_{CC}$ = 4.5 V, $I_F$ = 5 mA | $I_{OHH}$ | | 0.5 | 100 | µA |
| | $V_O$ = 15 V, $V_{CC}$ = 4.5 V, $I_F$ = 5 mA | $I_{OHH}$ | | 1 | 500 | µA |
| Logic low supply current | $V_{CC}$ = 5.5 V, $I_F$ = 0 A | $I_{CCL}$ | | 3.7 | 6 | mA |
| | $V_{CC}$ = 15 V, $I_F$ = 0 A | $I_{CCL}$ | | 4.1 | 6.5 | mA |
| Logic high supply current | $V_{CC}$ = 5.5 V, $I_F$ = 5 mA | $I_{CCH}$ | | 3.4 | 4 | mA |
| | $V_{CC}$ = 15 V, $I_F$ = 5 mA | $I_{CCH}$ | | 3.7 | 5 | mA |
| Logic low short circuit output current | $V_O = V_{CC}$ = 5.5 V, $I_F$ = 0 A | $I_{OSL}$ | 25 | | | mA |
| | $V_O = V_{CC}$ = 15 V, $I_F$ = 0 A | $I_{OSL}$ | 40 | | | mA |

| ELECTRICAL CHARACTERISTICS ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **OUTPUT** | | | | | | |
| Logic high short circuit output current | $V_{CC}$ = 5.5 V, $V_O$ = 0 V, $I_F$ = 5 mA | $I_{OSH}$ | | | - 10 | mA |
| | $V_{CC}$ = 15 V, $V_O$ = 0 V, $I_F$ = 5 mA | $I_{OSH}$ | | | - 25 | mA |
| Thermal resistance | | | | 300 | | K/W |
| **COUPLER** | | | | | | |
| Capacitance (input to output) | f = 1 MHz, pins 1 to 4 and 5 to 8 shorted together | $C_{IO}$ | | 0.6 | | pF |

**Notes**

- 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.

(1) 0 °C ≤ $T_{amb}$ ≤ 85 °C; 4.5 V ≤ $V_{CC}$ ≤ 15 V; 1.6 mA ≤ $I_{Fon}$ ≤ 5 mA; 2 ≤ $V_{EH}$ ≤ 15 V; 0 ≤ $V_{EL}$ ≤ 0.8 V; 0 mA ≤ $I_{Foff}$ ≤ 0.1 mA. Typical values: $T_{amb}$ = 25 °C; $V_{CC}$ = 5 V; $I_{Fon}$ = 3 mA unless otherwise specified.

(2) Output short circuit time ≤ 10 ms.

| SWITCHING CHARACTERISTICS | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Propagation delay time to logic low output level | without peaking capacitor | $t_{PHL}$ | | 120 | | ns |
| | with peaking capacitor | $t_{PHL}$ | | 115 | 300 | ns |
| | without peaking capacitor | $t_{PLH}$ | | 125 | | ns |
| | with peaking capacitor | $t_{PLH}$ | | 90 | 300 | ns |
| Output rise time | 10 % to 90 % | $t_r$ | | 40 | | ns |
| Output fall time | 90 % to 10 % | $t_f$ | | 10 | | ns |

**Note**

- 0 °C ≤ $T_{amb}$ ≤ 85 °C; 4.5 V ≤ $V_{CC}$ ≤ 15 V; 1.6 mA ≤ $I_{Fon}$ ≤ 5 mA; 0 mA ≤ $I_{Foff}$ ≤ 0.1 mA. Typical values: $T_{amb}$ = 25 ° C; $V_{CC}$ = 5 V; $I_{Fon}$ = 3 mA unless otherwise specified.

| RECOMMENDED OPERATING CONDITIONS | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Supply voltage | | $V_{CC}$ | 4.5 | | 15 | V |
| Forward input current | | $I_{Fon}$ | 1.6 (1) | | 5 | mA |
| | | $I_{Foff}$ | | | 0.1 | mA |
| Operating temperature | | $T_A$ | 0 | | 85 | °C |

**Notes**

- A 0.1 µF bypass capacitor connected between pins 5 and 8 must be used.

(1) We recommend using a 2.2 mA to permit at least 20 % CTR degradation guard band.

| COMMON MODE TRANSIENT IMMUNITY | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Logic high common mode transient immunity (1) | $\|V_{CM}\|$ = 50 V, $I_F$ = 1.6 mA | SFH6731 | $\|CM_H\|$ | 1000 | | | V/µs |
| | $\|V_{CM}\|$ = 300 V, $I_F$ = 1.6 mA | SFH6732 | $\|CM_H\|$ | 5000 | | | V/µs |
| Logic low common mode transient immunity (1) | $\|V_{CM}\|$ = 50 V, $I_F$ = 0 mA | SFH6731 | $\|CM_L\|$ | 1000 | | | V/µs |
| | $\|V_{CM}\|$ = 1000 V, $I_F$ = 0 mA | SFH6732 | $\|CM_L\|$ | 10 000 | | | V/µs |

**Notes**

- $T_{amb}$ = 25 °C, $V_{CC}$ = 5 V (1)

(1) CMH is the maximum slew rate of a common mode voltage VCM at which the output voltage remains at logic high level ($V_O$ > 2 V). CML is the maximum slew rate of a common mode voltage VCM at which the output voltage remains at logic low level ($V_O$ < 0.8 V).

| 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 | |
| $V_{IOTM}$ | | | 8000 | | | V |
| $V_{IORM}$ | | | 890 | | | V |
| $P_{SO}$ | | | | | 500 | mW |
| $I_{SI}$ | | | | | 300 | mA |
| $T_{SI}$ | | | | | 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 |

**Note**

- As per DIN EN 60747-5-2 (VDE 0884), § 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 °C, unless otherwise specified)

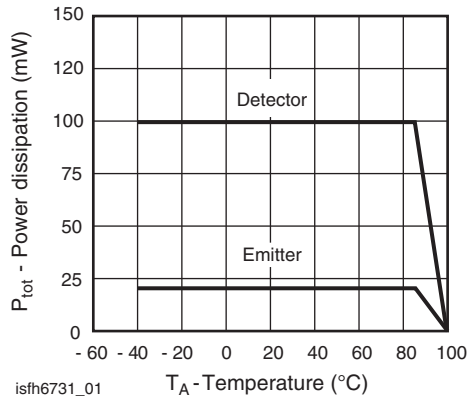



Fig. 1 - Permissible Total Power Dissipation vs. Temperature

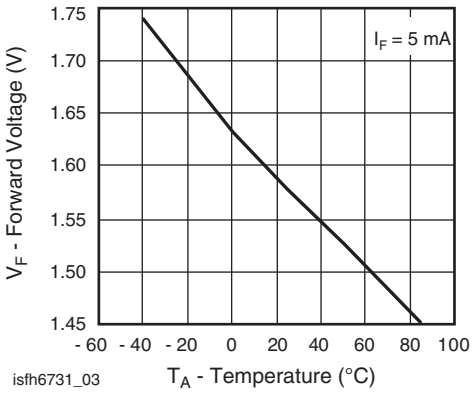



Fig. 3 - Typical Forward Input Voltage vs. Temperature

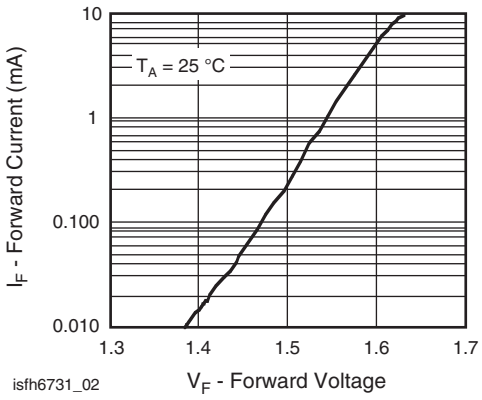



Fig. 2 - Typical Input Diode Forward Current vs. Forward Voltage

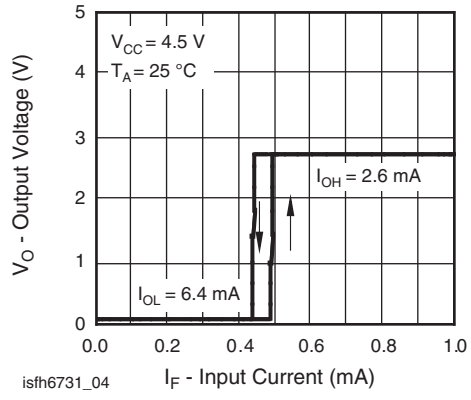



Fig. 4 - Typical Output Voltage vs. Forward Input Current

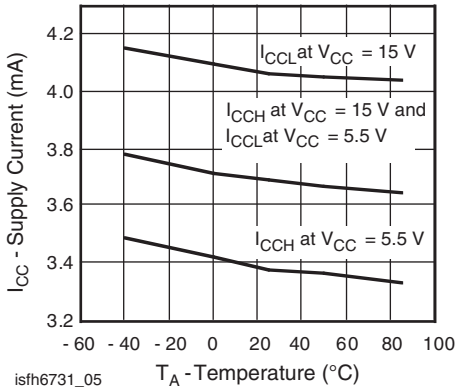



Fig. 5 - Typical Supply Current vs. Temperature

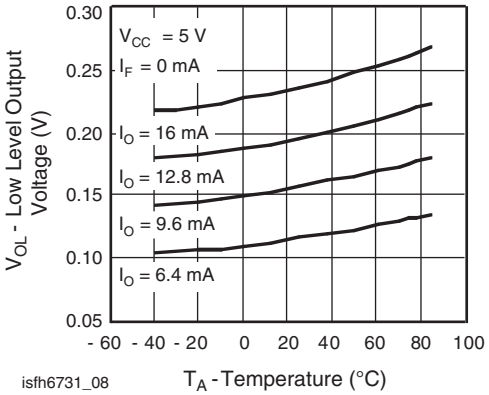



Fig. 8 - Typical Low Level Output Voltage vs. Temperature

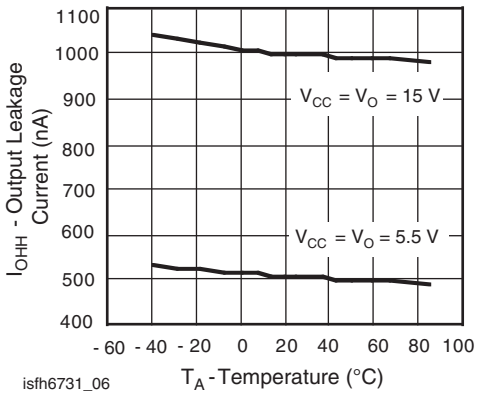



Fig. 6 - Typical Output Leakage Current vs. Temperature

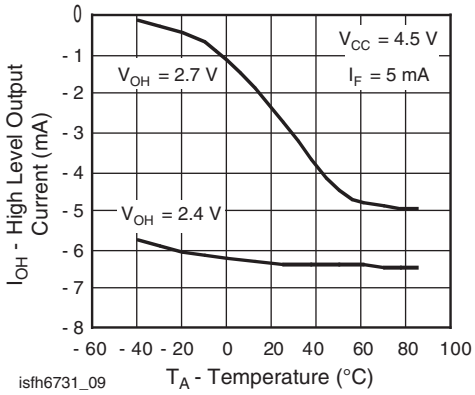



Fig. 9 - Typical High Level Output Current vs. Temperature

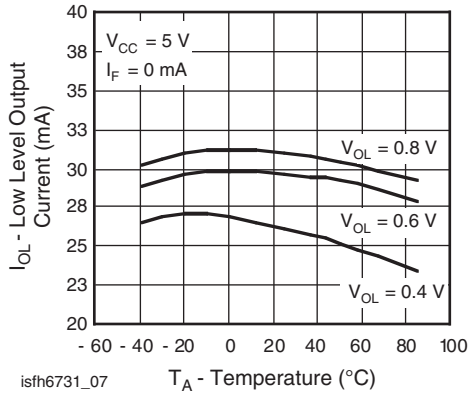



Fig. 7 - Typical Low Level Output Current vs. Temperature

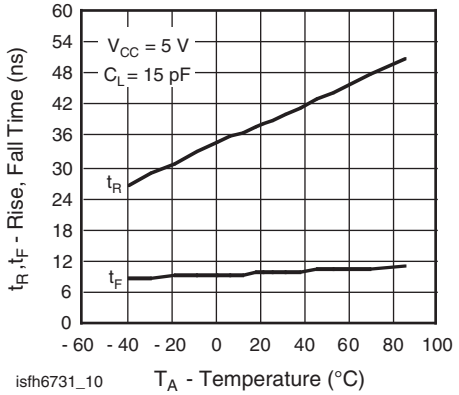



Fig. 10 - Rise and Fall Time vs. Ambient Temperature

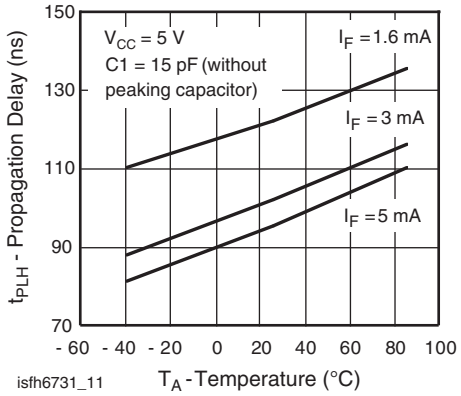



Fig. 11 - Typical Propagation Delays to Logic High vs. Temperature

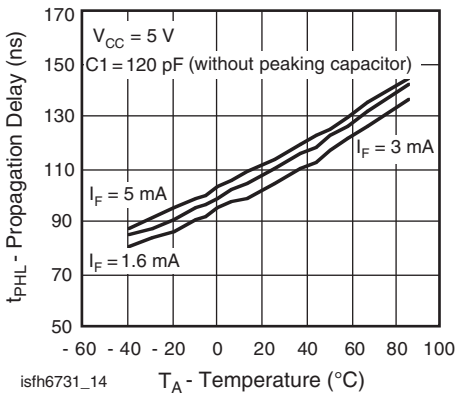



Fig. 14 - Typical Propagation Delays to Logic Low vs.Temperature

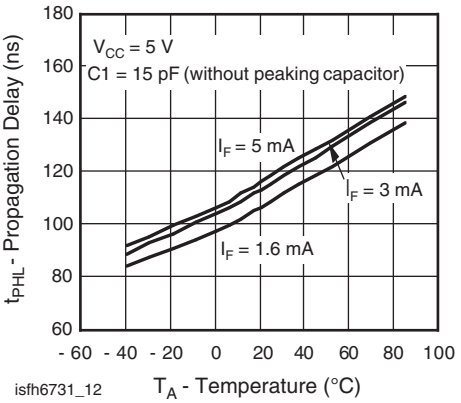



Fig. 12 - Typical Propagation Delays to Logic Low vs.Temperature

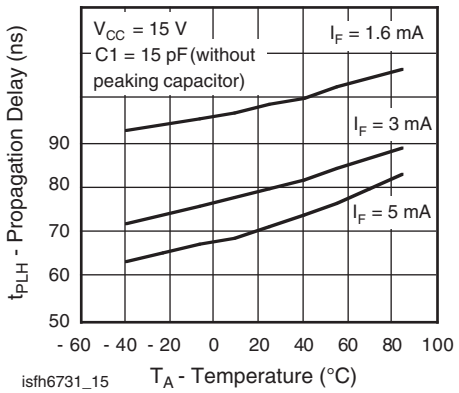



Fig. 15 - Typical Propagation Delays to Logic High vs. Temperature

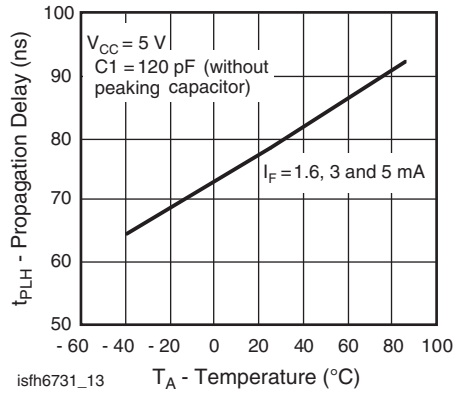



Fig. 13 - Typical Propagation Delays to Logic High vs. Temperature

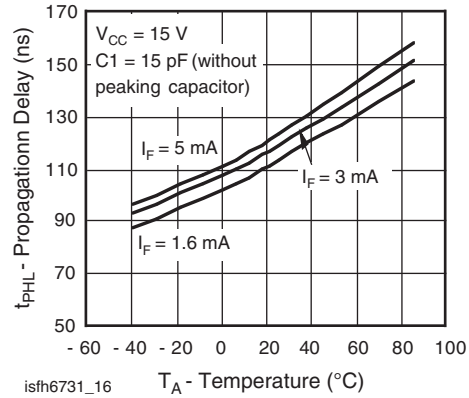



Fig. 16 - Typical Propagation Delays to Logic Low vs.Temperature

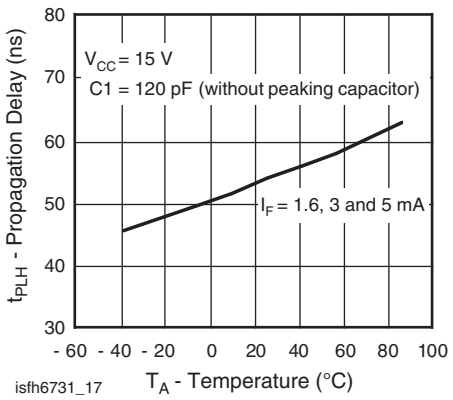



Fig. 17 - Typical Propagation Delays to Logic High vs. Temperature

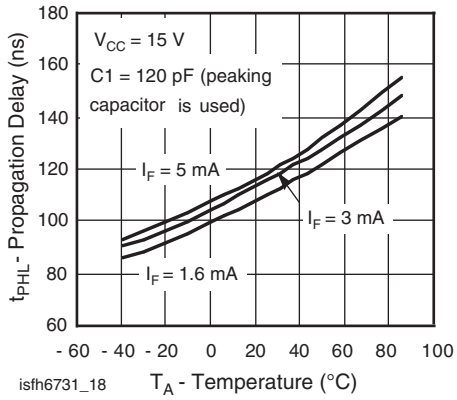
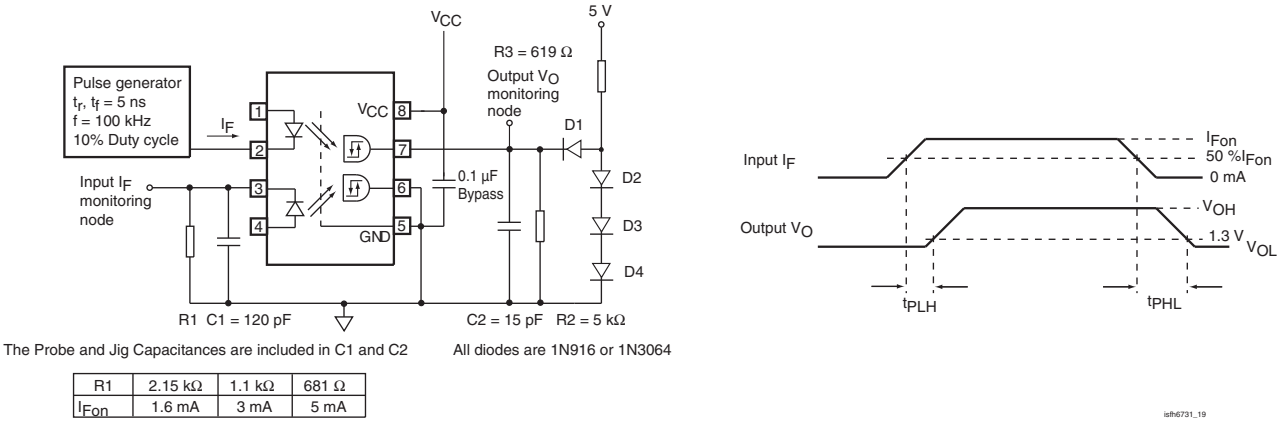



Fig. 18 - Typical Propagation Delays to Logic Low vs.Temperature




| R1 | 2.15 kΩ | 1.1 kΩ | 681 Ω |
|---|---|---|---|
| $I_{Fon}$ | 1.6 mA | 3 mA | 5 mA |

Fig. 19 - Test Circuit for $t_{PLH}$

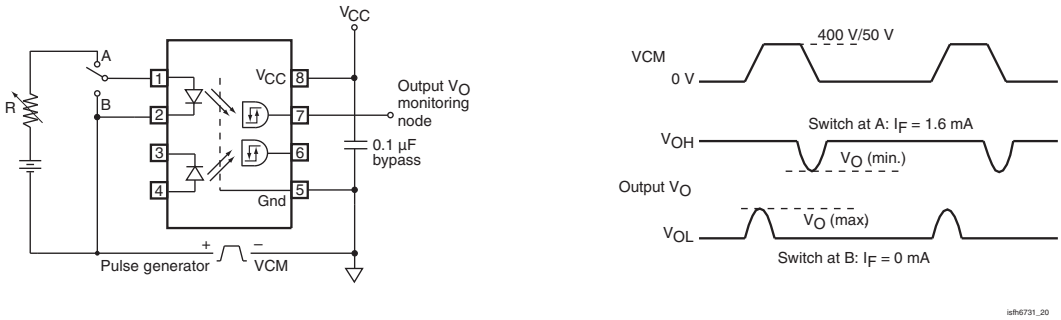
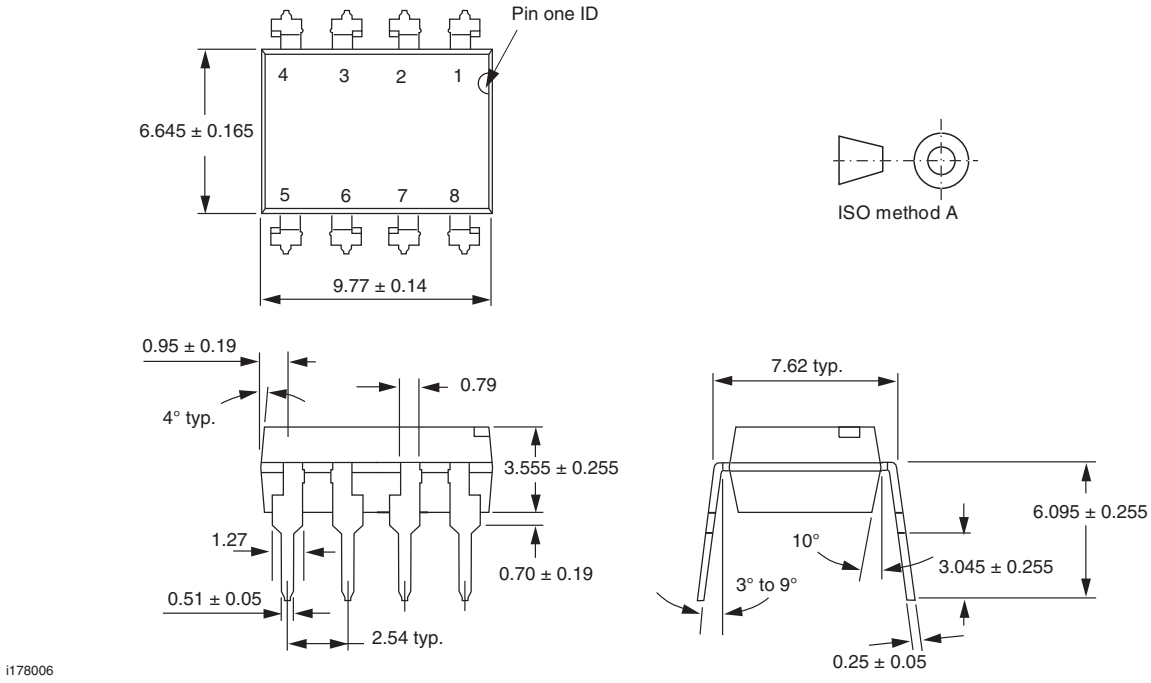
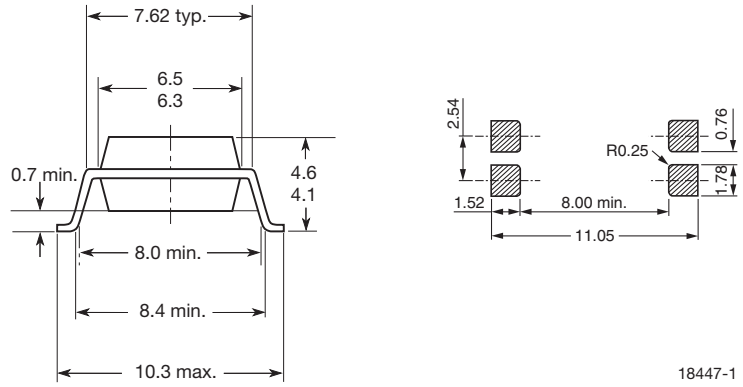



Fig. 20 - Test Circuit for Common Mode Transient Immunity and Typical Waveforms

## PACKAGE DIMENSIONS in millimeters




**Option 7**




## PACKAGE MARKING (example)


**Notes**

- The VDE logo is only marked on option 1 parts.
- Tape and reel suffix (T) is not part of the package marking.

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