

## Optocoupler, Phototransistor Output (Dual, Quad Channel)

### Features

- Current Transfer Ratio at  $I_F = 10 \text{ mA}$
- Isolation Test Voltage, 5300  $V_{RMS}$
- Lead-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

### Agency Approvals

- UL1577, File No. E52744 System Code H or J, Double Protection
- CSA 93751
- BSI IEC60950 IEC60065
- DIN EN 60747-5-2 (VDE0884)  
DIN EN 60747-5-5 pending  
Available with Option 1
- FIMKO

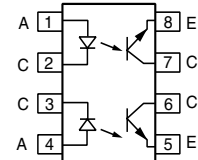
### Description

The ILD1/ 2/ 5/ ILQ1/ 2/ 5 are optically coupled isolated pairs employing GaAs infrared LEDs and silicon NPN phototransistor. Signal information, including a DC level, can be transmitted by the drive while maintaining a high degree of electrical isolation between input and output. The ILD1/ 2/ 5/ ILQ1/ 2/ 5 are especially

designed for driving medium-speed logic and can be used to eliminate troublesome ground loop and noise problems. Also these couplers can be used to replace relays and transformers in many digital interface applications such as CTR modulation.

The ILD1/ 2/ 5 has two isolated channels in a single DIP package and the ILQ1/ 2/ 5 has four isolated channels per package.

Dual Channel



Quad Channel



1179012



### Order Information

| Part      | Remarks                               |
|-----------|---------------------------------------|
| ILD1      | CTR > 20 %, DIP-8                     |
| ILQ1      | CTR > 20 %, DIP-16                    |
| ILD2      | CTR > 100 %, DIP-8                    |
| ILQ2      | CTR > 100 %, DIP-16                   |
| ILD5      | CTR > 50 %, DIP-8                     |
| ILQ5      | CTR > 50 %, DIP-16                    |
| ILD1-X007 | CTR > 20 %, SMD-8 (option 7)          |
| ILD1-X009 | CTR > 20 %, SMD-8 (option 9)          |
| ILD2-X006 | CTR > 100 %, DIP-8 400 mil (option 6) |
| ILD2-X007 | CTR > 100 %, SMD-8 (option 7)         |
| ILD2-X009 | CTR > 100 %, SMD-8 (option 9)         |
| ILD5-X009 | CTR > 50 %, SMD-8 (option 9)          |
| ILQ1-X009 | CTR > 20 %, SMD-16 (option 9)         |
| ILQ2-X009 | CTR > 100 %, SMD-16 (option 9)        |

For additional information on the available options refer to Option Information.

### Absolute Maximum Ratings

$T_{amb} = 25\text{ }^{\circ}\text{C}$ , 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 Rating for extended periods of the time can adversely affect reliability.

### Input

| Parameter                  | Test condition | Symbol     | Value | Unit  |
|----------------------------|----------------|------------|-------|-------|
| Reverse voltage            |                | $V_R$      | 6.0   | V     |
| Forward current            |                | $I_F$      | 60    | mA    |
| Surge current              |                | $I_{FSM}$  | 2.5   | A     |
| Power dissipation          |                | $P_{diss}$ | 100   | mW    |
| Derate linearly from 25 °C |                |            | 1.3   | mW/°C |

### Output

| Parameter                         | Test condition      | Part | Symbol     | Value | Unit  |
|-----------------------------------|---------------------|------|------------|-------|-------|
| Collector-emitter reverse voltage |                     | ILD1 | $V_{CER}$  | 50    | V     |
|                                   |                     | ILQ1 | $V_{CER}$  | 50    | V     |
|                                   |                     | ILD2 | $V_{CER}$  | 70    | V     |
|                                   |                     | ILQ2 | $V_{CER}$  | 70    | V     |
|                                   |                     | ILD5 | $V_{CER}$  | 70    | V     |
|                                   |                     | ILQ5 | $V_{CER}$  | 70    | V     |
| Collector current                 |                     |      | $I_C$      | 50    | mA    |
|                                   | $t < 1.0\text{ ms}$ |      | $I_C$      | 400   | mA    |
| Power dissipation                 |                     |      | $P_{diss}$ | 200   | mW    |
| Derate linearly from 25 °C        |                     |      |            | 2.6   | mW/°C |

### Coupler

| Parameter  | Test condition   | Symbol    | Value         | Unit      |
|--|--|-----------|---------------|-----------|
| Isolation test voltage (between emitter and detector referred to standard climate 25 °C/ 50 % RH, DIN 50014) |  | $V_{ISO}$ | 5300          | $V_{RMS}$ |
| Creepage   |  |           | $\geq 7.0$    | mm        |
| Clearance  |  |           | $\geq 7.0$    | mm        |
| Isolation resistance   | $V_{IO} = 500\text{ V}, T_{amb} = 25\text{ }^{\circ}\text{C}$  | $R_{IO}$  | $10^{12}$     | $\Omega$  |
|  | $V_{IO} = 500\text{ V}, T_{amb} = 100\text{ }^{\circ}\text{C}$ | $R_{IO}$  | $10^{11}$     | $\Omega$  |
| Package power dissipation  |  | $P_{tot}$ | 250           | mW        |
| Derate linearly from 25 °C   |  |           | 3.3           | mW/°C     |
| Storage temperature  |  | $T_{stg}$ | - 40 to + 150 | °C        |
| Operating temperature  |  | $T_{amb}$ | - 40 to + 100 | °C        |
| Junction temperature   |  | $T_j$     | 100           | °C        |
| Soldering temperature  | 2.0 mm from case bottom  | $T_{sld}$ | 260           | °C        |



### Electrical Characteristics

T<sub>amb</sub> = 25 °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.

### Input

| Parameter                            | Test condition                    | Symbol            | Min | Typ. | Max  | Unit |
|--------------------------------------|-----------------------------------|-------------------|-----|------|------|------|
| Forward voltage                      | I <sub>F</sub> = 60 mA            | V <sub>F</sub>    |     | 1.25 | 1.65 | V    |
| Reverse current                      | V <sub>R</sub> = 6.0 V            | I <sub>R</sub>    |     | 0.01 | 10   | μA   |
| Capacitance                          | V <sub>R</sub> = 0 V, f = 1.0 MHz | C <sub>O</sub>    |     | 25   |      | pF   |
| Thermal resistance, junction to lead |                                   | T <sub>thJL</sub> |     | 750  |      | K/W  |

### Output

| Parameter                             | Test condition                                   | Symbol             | Min | Typ. | Max  | Unit |
|---------------------------------------|--|--------------------|-----|------|------|------|
| Collector-emitter capacitance         | V <sub>CE</sub> = 5.0 V, f = 1.0 MHz             | C <sub>CE</sub>    |     | 6.8  |      | pF   |
| Collector-emitter leakage current     | V <sub>VCE</sub> = 10 V                          | I <sub>CEO</sub>   |     | 5.0  | 50   | nA   |
| Saturation voltage, collector-emitter | I <sub>CE</sub> = 1.0 mA, I <sub>B</sub> = 20 μA | V <sub>CEsat</sub> |     | 0.25 | 0.4  | V    |
| DC forward current gain               | V <sub>CE</sub> = 10 V, I <sub>B</sub> = 20 μA   | HFE                | 200 | 650  | 1800 |      |
| DC forward current gain saturated     | V <sub>CE</sub> = 0.4 V, I <sub>B</sub> = 20 μA  | HFE <sub>sat</sub> | 120 | 400  | 600  |      |
| Thermal resistance, junction to lead  |  | R <sub>thjl</sub>  |     | 500  |      | K/W  |

### Coupler

| Parameter                  | Test condition                     | Symbol          | Min | Typ. | Max | Unit |
|----------------------------|------------------------------------|-----------------|-----|------|-----|------|
| Capacitance (input-output) | V <sub>IO</sub> = 0 V, f = 1.0 MHz | C <sub>IO</sub> |     | 0.8  |     | pF   |

### Current Transfer Ratio

| Parameter  | Test condition                                  | Part         | Symbol               | Min | Typ. | Max | Unit |
|--|---|--------------|----------------------|-----|------|-----|------|
| Current Transfer Ratio (collector-emitter saturated) | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 0.4 V | ILD1<br>ILQ1 | CTR <sub>CEsat</sub> |     | 75   |     | %    |
|  |   | ILD2<br>ILQ2 | CTR <sub>CEsat</sub> |     | 170  |     | %    |
|  |   | ILD5<br>ILQ5 | CTR <sub>CEsat</sub> |     | 100  |     | %    |
| Current Transfer Ratio (collector-emitter)           | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10 V  | ILD1<br>ILQ1 | CTR <sub>CE</sub>    | 20  | 80   | 300 | %    |
|  |   | ILD2<br>ILQ2 | CTR <sub>CE</sub>    | 100 | 200  | 500 | %    |
|  |   | ILD5<br>ILQ5 | CTR <sub>CE</sub>    | 50  | 130  | 400 | %    |

### Typical Switching Times

#### Non-saturated Switching Timing

| Parameter      | Current   | Delay         | Rise time     | Storage       | Fall time     | Propagation H-L | Propagation L-H |
|----------------|---|---------------|---------------|---------------|---------------|-----------------|-----------------|
| Test condition | $V_{CE} = 5.0 \text{ V}, R_L = 75 \Omega, 50 \% \text{ of } V_{PP}$ |               |               |               |               |                 |                 |
| Symbol         | $I_F$   | $t_D$         | $t_r$         | $t_S$         | $t_f$         | $t_{PHL}$       | $t_{PLH}$       |
| Unit           | mA  | $\mu\text{s}$ | $\mu\text{s}$ | $\mu\text{s}$ | $\mu\text{s}$ | $\mu\text{s}$   | $\mu\text{s}$   |
| ILD1<br>ILQ1   | 20  | 0.8           | 1.9           | 0.2           | 1.4           | 0.7             | 1.4             |
| ILD2<br>ILQ2   | 5.0   | 1.7           | 2.6           | 0.4           | 2.2           | 1.2             | 2.3             |
| ILD5<br>ILQ5   | 10  | 1.7           | 2.6           | 0.4           | 2.2           | 1.1             | 2.5             |

#### Saturated Switching Timing

| Parameter      | Current   | Delay         | Rise time     | Storage       | Fall time     | Propagation H-L | Propagation L-H |
|----------------|---|---------------|---------------|---------------|---------------|-----------------|-----------------|
| Test condition | $V_{CE} = 0.4 \text{ V}, R_L = 1.0 \text{ k}\Omega, V_{CC} = 5.0 \text{ V}, V_{TH} = 1.5 \text{ V}$ |               |               |               |               |                 |                 |
| Symbol         | $I_F$   | $t_D$         | $t_r$         | $t_S$         | $t_f$         | $t_{PHL}$       | $t_{PLH}$       |
| Unit           | mA  | $\mu\text{s}$ | $\mu\text{s}$ | $\mu\text{s}$ | $\mu\text{s}$ | $\mu\text{s}$   | $\mu\text{s}$   |
| ILD1<br>ILQ1   | 20  | 0.8           | 1.2           | 7.4           | 7.6           | 1.6             | 8.6             |
| ILD2<br>ILQ2   | 5.0   | 1.0           | 2.0           | 5.4           | 13.5          | 5.4             | 7.4             |
| ILD5<br>ILQ5   | 10  | 1.7           | 7.0           | 4.6           | 20            | 2.6             | 7.2             |

#### Common Mode Transient Immunity

| Parameter                          | Test condition  | Symbol   | Min | Typ. | Max | Unit             |
|------------------------------------|---|----------|-----|------|-----|------------------|
| Common mode rejection, output high | $V_{CM} = 50 \text{ V}_{P-P}, R_L = 1.0 \text{ k}\Omega, I_F = 0 \text{ mA}$  | $CM_H$   |     | 5000 |     | V/ $\mu\text{s}$ |
| Common mode rejection, output low  | $V_{CM} = 50 \text{ V}_{P-P}, R_L = 1.0 \text{ k}\Omega, I_F = 10 \text{ mA}$ | $CM_L$   |     | 5000 |     | V/ $\mu\text{s}$ |
| Common mode coupling capacitance   |   | $C_{CM}$ |     | 0.01 |     | pF               |

## Typical Characteristics (Tamb = 25 °C unless otherwise specified)

ild1\_01

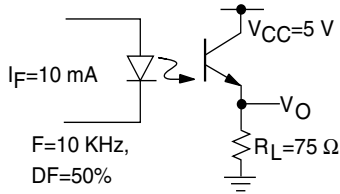


Figure 1. Non-saturated Switching Schematic



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Figure 4. Saturated Switching Timing

ild1\_02

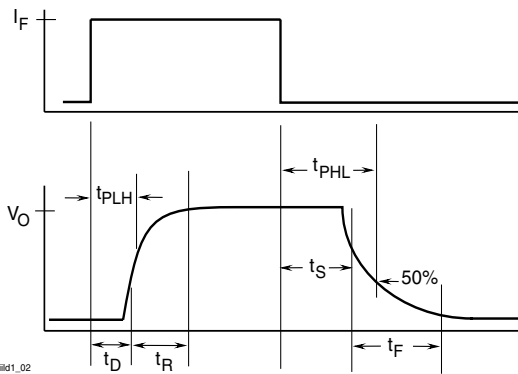
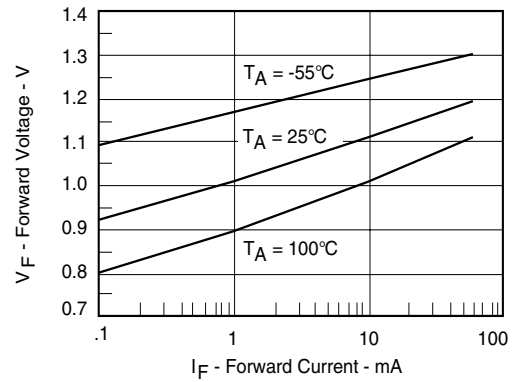


Figure 2. Non-saturated Switching Timing



ild1\_05

Figure 5. Normalized Non-Saturated and Saturated CTR vs. LED Current

ild1\_03

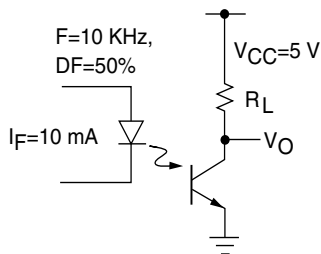
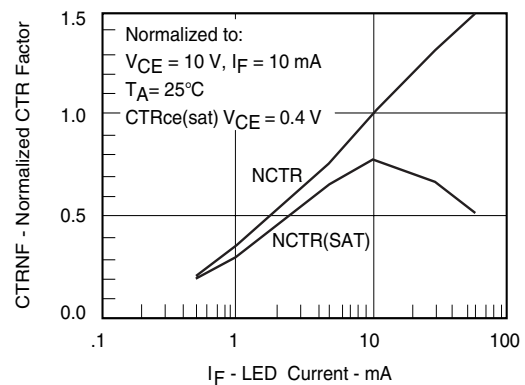
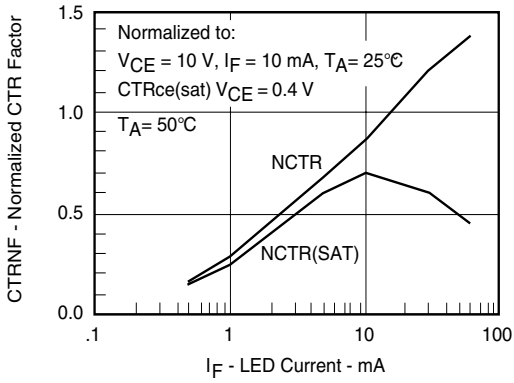


Figure 3. Saturated Switching Schematic



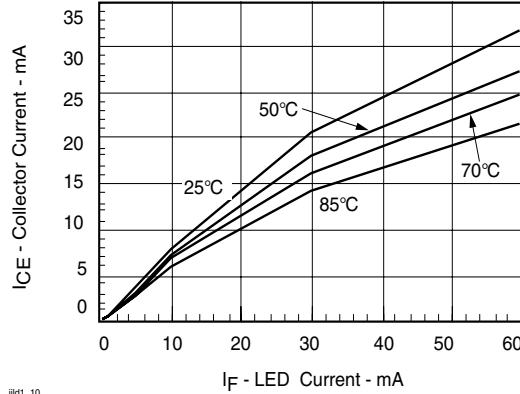
ild1\_06

Figure 6. Normalized Non-Saturated and Saturated CTR vs. LED Current



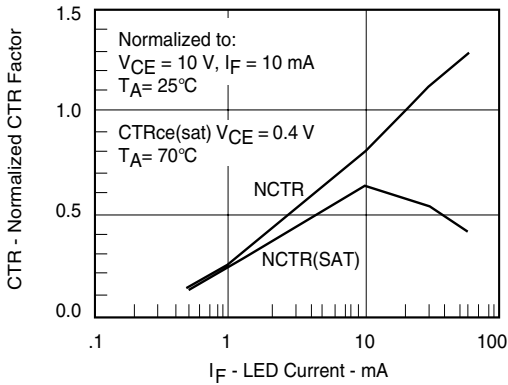
ild1\_07

Figure 7. Normalized Non-Saturated and Saturated CTR vs. LED Current



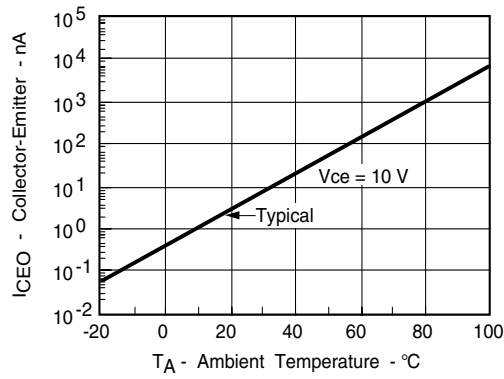
ild1\_10

Figure 10. Collector-Emitter Current vs. Temperature and LED Current



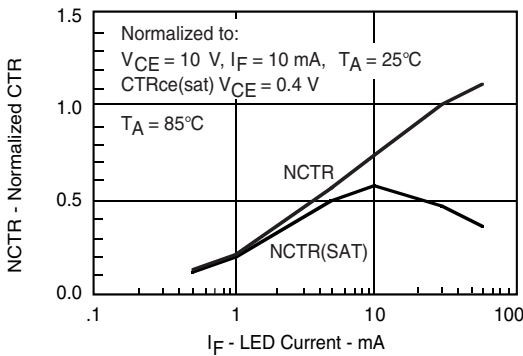
ild1\_08

Figure 8. Normalized Non-Saturated and Saturated CTR vs. LED Current



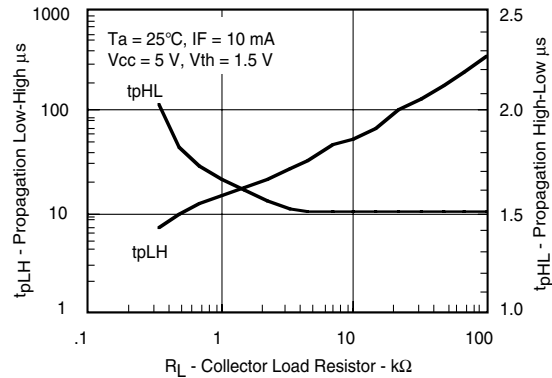
ild1\_11

Figure 11. Collector-Emitter Leakage Current vs. Temp.



ild1\_09

Figure 9. Normalized Non-Saturated and Saturated CTR vs. LED Current



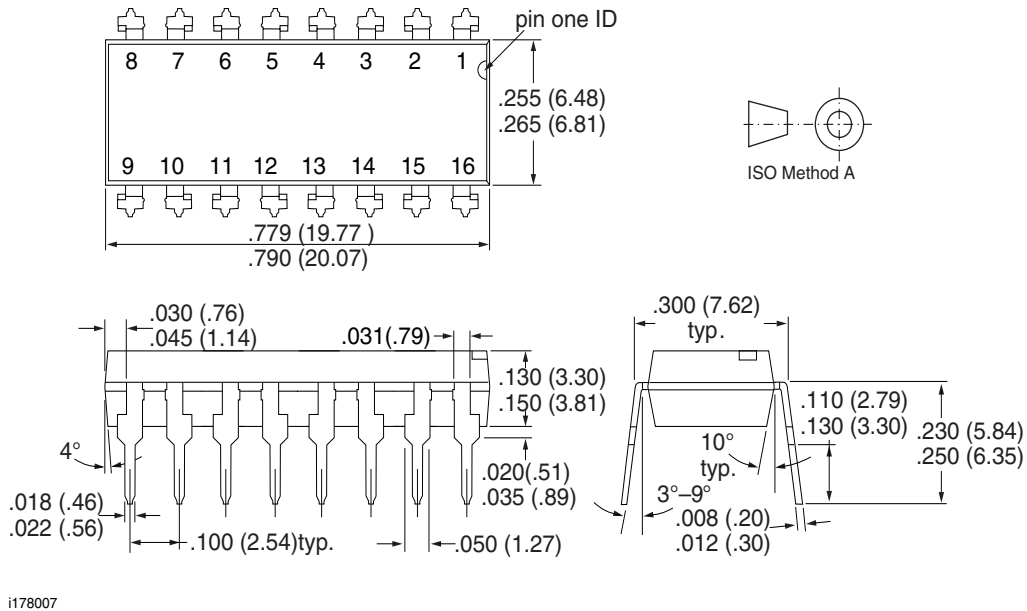
ild1\_12

Figure 12. Propagation Delay vs. Collector Load Resistor

## Package Dimensions in Inches (mm)



## Package Dimensions in Inches (mm)



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.

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- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
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#### Как с нами связаться

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