

# High Speed Optocoupler, 1 MBd, Phtodiode with Transistor Output



## DESCRIPTION

The 6N135 and 6N136 are optocouplers with a GaAlAs infrared emitting diode, optically coupled with an integrated photo detector which consists of a photo diode and a high-speed transistor in a DIP-8 plastic package. Signals can be transmitted between two electrically separated circuits up to frequencies of 2.0 MHz. The potential difference between the circuits to be coupled should not exceed the maximum permissible reference voltages.

## FEATURES

- Isolation test voltages: 5300 V<sub>RMS</sub>
- TTL compatible
- High bit rates: 1.0 Mbit/s
- High common-mode interference immunity
- Bandwidth 2.0 MHz
- Open-collector output
- External base wiring possible
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



RoHS COMPLIANT

## AGENCY APPROVALS

- UL1577, file no. E52744 system code H or J, double protection
- DIN EN 60747-5-5 available with option 1
- CSA 93751

| ORDER INFORMATION |                                      |
|-------------------|--------------------------------------|
| PART              | REMARKS                              |
| 6N135             | CTR ≥ 7 %, DIP-8                     |
| 6N136             | CTR ≥ 19 %, DIP-8                    |
| 6N135-X007        | CTR ≥ 7 %, SMD-8 (option 7)          |
| 6N136-X006        | CTR ≥ 19 %, DIP-8 400 mil (option 6) |
| 6N136-X007        | CTR ≥ 19 %, SMD-8 (option 7)         |
| 6N136-X009        | CTR ≥ 19 %, SMD-8 (option 9)         |

### Note

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

| ABSOLUTE MAXIMUM RATINGS (1)  |                             |                   |             |      |
|-------------------------------|-----------------------------|-------------------|-------------|------|
| PARAMETER                     | TEST CONDITION              | SYMBOL            | VALUE       | UNIT |
| <b>INPUT</b>                  |                             |                   |             |      |
| Reverse voltage               |                             | V <sub>R</sub>    | 5.0         | V    |
| Forward current               |                             | I <sub>F</sub>    | 25          | mA   |
| Peak forward current          | t = 1.0 ms, duty cycle 50 % | I <sub>FSM</sub>  | 50          | mA   |
| Maximum surge forward current | t ≤ 1.0 μs, 300 pulses/s    |                   | 1.0         | A    |
| Thermal resistance            |                             | R <sub>th</sub>   | 700         | K/W  |
| Power dissipation             | T <sub>amb</sub> = 70 °C    | P <sub>diss</sub> | 45          | mW   |
| <b>OUTPUT</b>                 |                             |                   |             |      |
| Supply voltage                |                             | V <sub>S</sub>    | - 0.5 to 15 | V    |
| Output voltage                |                             | V <sub>O</sub>    | - 0.5 to 15 | V    |
| Emitter base voltage          |                             | V <sub>EBO</sub>  | 5.0         | V    |
| Output current                |                             | I <sub>O</sub>    | 8.0         | mA   |
| Maximum Output current        |                             |                   | 16          | mA   |
| Base current                  |                             | I <sub>B</sub>    | 5.0         | mA   |
| Thermal resistance            |                             |                   | 300         | K/W  |
| Power dissipation             | T <sub>amb</sub> = 70 °C    | P <sub>diss</sub> | 100         | mW   |



| ABSOLUTE MAXIMUM RATINGS (1)  |   |                   |                    |                  |
|---|---|-------------------|--------------------|------------------|
| PARAMETER   | TEST CONDITION  | SYMBOL            | VALUE              | UNIT             |
| <b>COUPLER</b>  |   |                   |                    |                  |
| Isolation test voltage (between emitter and detector climate per DIN 50014 part 2, Nov. 74) | t = 1.0 s   | V <sub>ISO</sub>  | 5300               | V <sub>RMS</sub> |
| Pollution degree (DIN VDE 0109)   |   |                   | 2.0                |                  |
| Isolation resistance  | V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 25 °C       | R <sub>IO</sub>   | ≥ 10 <sup>12</sup> | Ω                |
|   | V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 100 °C      | R <sub>IO</sub>   | ≥ 10 <sup>11</sup> | Ω                |
| Storage temperature range   |   | T <sub>stg</sub>  | - 55 to + 125      | °C               |
| Ambient temperature range   |   | T <sub>amb</sub>  | - 55 to + 100      | °C               |
| Soldering temperature (2)   | max. ≤ 10 s, dip soldering<br>≥ 0.5 mm from case bottom | T <sub>slid</sub> | 260                | °C               |

**Notes**

- (1) T<sub>amb</sub> = 25 °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.
- (2) Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

| ELECTRICAL CHARACTERISTICS (1)           |   |       |                                  |      |       |      |       |
|--|---|-------|----------------------------------|------|-------|------|-------|
| PARAMETER                                | TEST CONDITION  | PART  | SYMBOL                           | MIN. | TYP.  | MAX. | UNIT  |
| <b>INPUT</b>                             |   |       |                                  |      |       |      |       |
| Forward voltage                          | I <sub>F</sub> = 1.6 mA   |       | V <sub>F</sub>                   |      | 1.6   | 1.9  | V     |
| Breakdown voltage                        | I <sub>R</sub> = 10 μA  |       | V <sub>BR</sub>                  | 5.0  |       |      | V     |
| Reverse current                          | V <sub>R</sub> = 5.0 V  |       | I <sub>R</sub>                   |      | 0.5   | 10   | μA    |
| Capacitance                              | V <sub>R</sub> = 0 V, f = 1.0 MHz   |       | C <sub>O</sub>                   |      | 125   |      | pF    |
| Temperature coefficient, forward voltage | I <sub>F</sub> = 1.6 mA   |       | ΔV <sub>F</sub> /ΔT <sub>A</sub> |      | - 1.7 |      | mV/°C |
| <b>OUTPUT</b>                            |   |       |                                  |      |       |      |       |
| Logic low supply current                 | I <sub>F</sub> = 1.6 mA, V <sub>O</sub> = open,<br>V <sub>CC</sub> = 15 V   |       | I <sub>CCL</sub>                 |      | 150   |      | μA    |
| Logic high supply current                | I <sub>F</sub> = 0 mA, V <sub>O</sub> = open,<br>V <sub>CC</sub> = 15 V     |       | I <sub>CCH</sub>                 |      | 0.01  | 1    | μA    |
| Output voltage, output low               | I <sub>F</sub> = 16 mA, I <sub>O</sub> = 1.1 mA,<br>V <sub>CC</sub> = 4.5 V | 6N135 | V <sub>OL</sub>                  |      | 0.1   | 0.4  | V     |
|  | I <sub>F</sub> = 16 mA, I <sub>O</sub> = 2.4 mA,<br>V <sub>CC</sub> = 4.5 V | 6N136 | V <sub>OL</sub>                  |      | 0.1   | 0.4  | V     |
| Output current, output high              | I <sub>F</sub> = 0 mA, V <sub>O</sub> = V <sub>CC</sub> = 5.5 V             |       | I <sub>OH</sub>                  |      | 3.0   | 500  | nA    |
|  | I <sub>F</sub> = 0 mA, V <sub>O</sub> = V <sub>CC</sub> = 15 V              |       | I <sub>OH</sub>                  |      | 0.01  | 1    | μA    |
| <b>COUPLER</b>                           |   |       |                                  |      |       |      |       |
| Capacitance (input to output)            | f = 1.0 MHz   |       | C <sub>IO</sub>                  |      | 0.6   |      | pF    |

**Note**

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.

| CURRENT TRANSFER RATIO |   |       |        |      |      |      |      |
|------------------------|---|-------|--------|------|------|------|------|
| PARAMETER              | TEST CONDITION  | PART  | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| Current transfer ratio | $I_F = 16 \text{ mA}$ , $V_O = 0.4 \text{ V}$ ,<br>$V_{CC} = 4.5 \text{ V}$ | 6N135 | CTR    | 7    | 16   |      | %    |
|                        |   | 6N136 | CTR    | 19   | 35   |      | %    |
|                        | $I_F = 16 \text{ mA}$ , $V_O = 0.5 \text{ V}$ ,<br>$V_{CC} = 4.5 \text{ V}$ | 6N135 | CTR    | 5    |      |      | %    |
|                        |   | 6N136 | CTR    | 15   |      |      | %    |

| SWITCHING CHARACTERISTICS |  |       |           |      |      |      |               |
|---------------------------|--|-------|-----------|------|------|------|---------------|
| PARAMETER                 | TEST CONDITION   | PART  | SYMBOL    | MIN. | TYP. | MAX. | UNIT          |
| High to low               | $I_F = 16 \text{ mA}$ , $V_{CC} = 5.0 \text{ V}$ , $R_L = 4.1 \text{ k}\Omega$ | 6N135 | $t_{PHL}$ |      | 0.3  | 1.5  | $\mu\text{s}$ |
|                           | $I_F = 16 \text{ mA}$ , $V_{CC} = 5.0 \text{ V}$ , $R_L = 1.9 \text{ k}\Omega$ | 6N136 | $t_{PHL}$ |      | 0.2  | 0.8  | $\mu\text{s}$ |
| Low to high               | $I_F = 16 \text{ mA}$ , $V_{CC} = 5.0 \text{ V}$ , $R_L = 4.1 \text{ k}\Omega$ | 6N135 | $t_{PLH}$ |      | 0.3  | 1.5  | $\mu\text{s}$ |
|                           | $I_F = 16 \text{ mA}$ , $V_{CC} = 5.0 \text{ V}$ , $R_L = 1.9 \text{ k}\Omega$ | 6N136 | $t_{PLH}$ |      | 0.2  | 0.8  | $\mu\text{s}$ |

| COMMON MODE TRANSIENT IMMUNITY |  |       |          |      |      |      |                        |
|--------------------------------|--|-------|----------|------|------|------|------------------------|
| PARAMETER                      | TEST CONDITION   | PART  | SYMBOL   | MIN. | TYP. | MAX. | UNIT                   |
| High                           | $I_F = 0 \text{ mA}$ , $V_{CM} = 10 \text{ V}_{P-P}$ , $V_{CC} = 5.0 \text{ V}$ , $R_L = 4.1 \text{ k}\Omega$  | 6N135 | $ CM_H $ |      | 1000 |      | $\text{V}/\mu\text{s}$ |
|                                | $I_F = 0 \text{ mA}$ , $V_{CM} = 10 \text{ V}_{P-P}$ , $V_{CC} = 5.0 \text{ V}$ , $R_L = 1.9 \text{ k}\Omega$  | 6N136 | $ CM_H $ |      | 1000 |      | $\text{V}/\mu\text{s}$ |
| Low                            | $I_F = 16 \text{ mA}$ , $V_{CM} = 10 \text{ V}_{P-P}$ , $V_{CC} = 5.0 \text{ V}$ , $R_L = 4.1 \text{ k}\Omega$ | 6N135 | $ CM_L $ |      | 1000 |      | $\text{V}/\mu\text{s}$ |
|                                | $I_F = 16 \text{ mA}$ , $V_{CM} = 10 \text{ V}_{P-P}$ , $V_{CC} = 5.0 \text{ V}$ , $R_L = 1.9 \text{ k}\Omega$ | 6N136 | $ CM_L $ |      | 1000 |      | $\text{V}/\mu\text{s}$ |

| SAFETY AND INSULATION RATINGS                           |                |        |      |           |      |      |                    |
|---|----------------|--------|------|-----------|------|------|--------------------|
| PARAMETER   | TEST CONDITION | SYMBOL | MIN. | TYP.      | MAX. | UNIT |                    |
| Climatic classification<br>(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  |      | $^{\circ}\text{C}$ |
| 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 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.

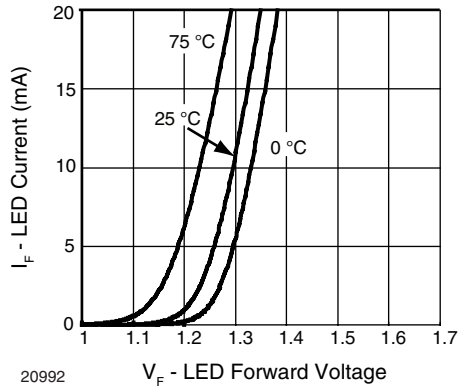
**TYPICAL CHARACTERISTICS**
 $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified


Fig. 1 - LED Forward Current vs. Forward Voltage



Fig. 4 - Output Current vs. Output Voltage

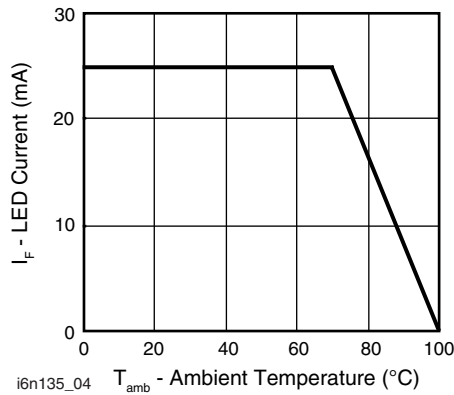


Fig. 2 - Permissible Forward LED Current vs. Temperature



Fig. 5 - Output Current vs. Temperature

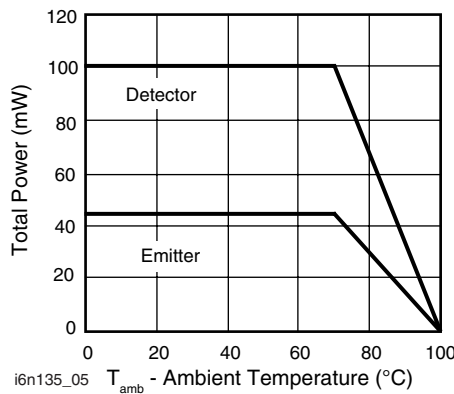


Fig. 3 - Permissible Power Dissipation vs. Temperature



Fig. 6 - Propagation Delay vs. Ambient Temperature



Fig. 7 - Propagation Delay vs. Ambient Temperature



Fig. 9 - Small Signal Current Transfer Ratio vs. Quiescent Input Current



Fig. 8 - Logic High Output Current vs. Temperature

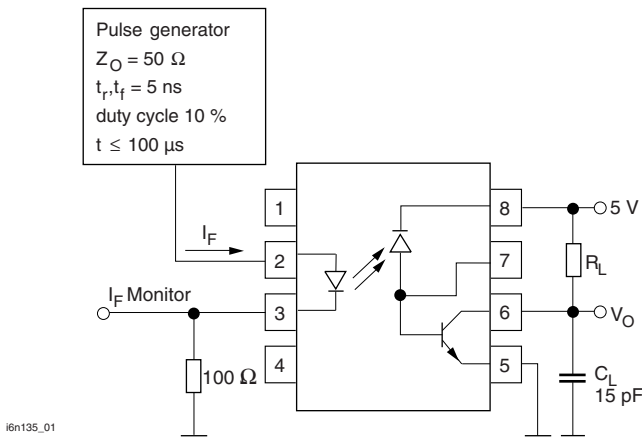


Fig. 10 - Switching Times



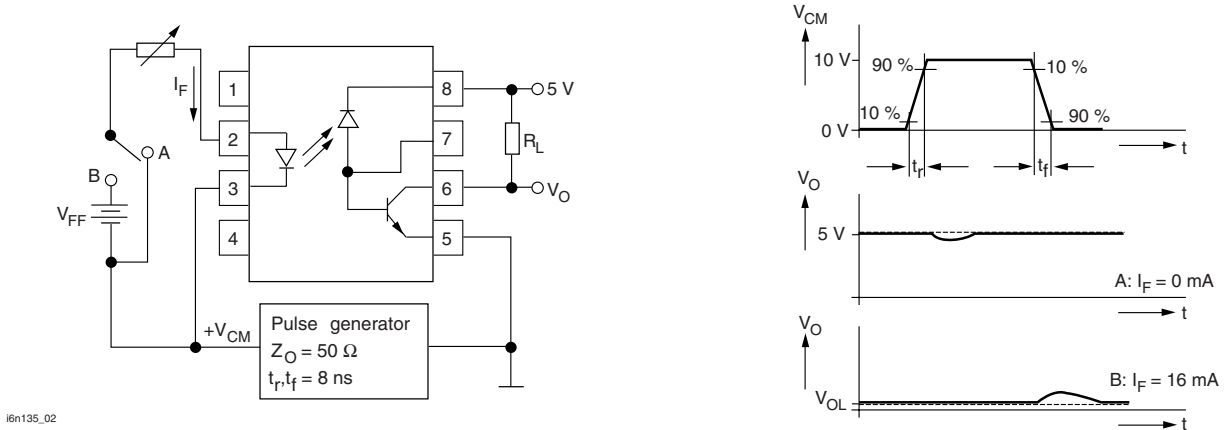
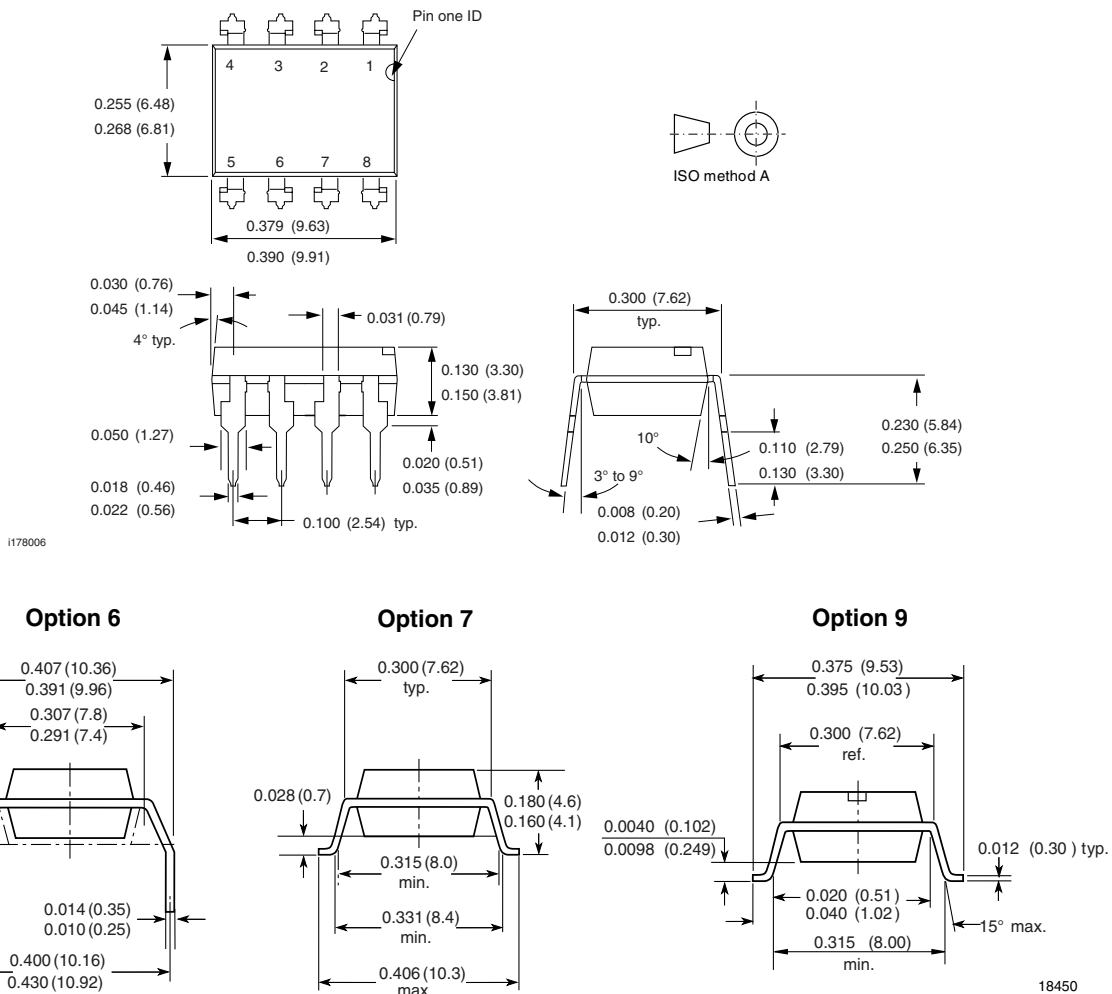


Fig. 11 - Common-Mode Interference Immunity

### PACKAGE DIMENSIONS in inches (millimeters)



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It is the policy of Vishay Semiconductor GmbH to

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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.
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3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.