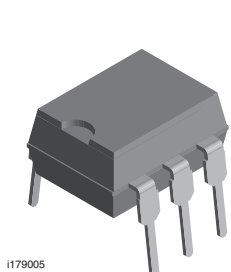
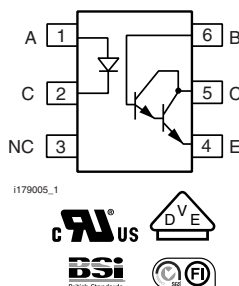


## Optocoupler, Photodarlington Output, High Gain, with Base Connection



1179005



1179005\_1



### FEATURES

- Very high current transfer ratio, 500 % min.
- High isolation resistance,  $10^{11} \Omega$  typical
- Standard plastic DIP package
- Compliant to RoHS Directive to 2002/95/EC and in accordance WEEE 2002/96/EC



**RoHS**  
COMPLIANT

### AGENCY APPROVALS

- UL1577, file no. E52744 system code H
- DIN EN 60747-5-2 (VDE 0884)/DIN EN 60747-5-5 (pending), available with option 1
- BSI IEC60950; IEC60065
- FIMKO

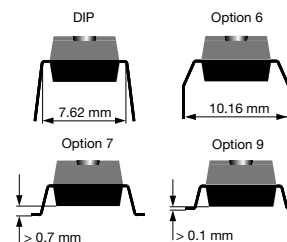
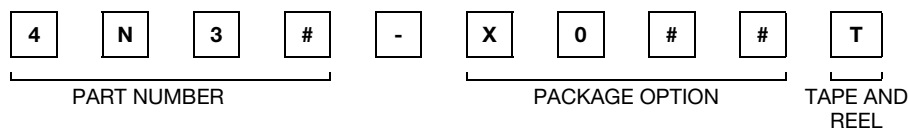
### DESCRIPTION

The 4N32 and 4N33 are optically coupled isolators with a gallium arsenide infrared LED and a silicon photodarlington sensor.

Switching can be achieved while maintaining a high degree of isolation between driving and load circuits.

These optocouplers can be used to replace reed and mercury relays with advantages of long life, high speed switching and elimination of magnetic fields.

### ORDERING INFORMATION



| AGENCY CERTIFIED/PACKAGE   | CTR (%)                   |                           |
|----------------------------|---------------------------|---------------------------|
| <b>UL, BSI, FIMKO</b>      | <b>≥ 500</b>              | <b>≥ 500</b>              |
| DIP-6                      | 4N32                      | 4N33                      |
| DIP-6, 400 mil, option 6   | 4N32-X006                 | -                         |
| SMD-6, option 7            | 4N32-X007T <sup>(1)</sup> | 4N33-X007T <sup>(1)</sup> |
| SMD-6, option 9            | 4N32-X009T <sup>(1)</sup> | 4N33-X009T <sup>(1)</sup> |
| <b>VDE, UL, BSI, FIMKO</b> | <b>≥ 500</b>              | <b>≥ 500</b>              |
| DIP-6                      | 4N32-X001                 | 4N33-X001                 |
| SMD-6, option 7            | 4N32-X017T                | 4N33-X017T <sup>(1)</sup> |

### Notes

- Additional options may be possible, please contact sales office.
- <sup>(1)</sup> Also available in tubes, do not put T on the end.

| <b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                                                   |            |                |                        |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|------------|----------------|------------------------|
| PARAMETER                                                                                              | TEST CONDITION                                                    | SYMBOL     | VALUE          | UNIT                   |
| <b>INPUT</b>                                                                                           |                                                                   |            |                |                        |
| Reverse voltage                                                                                        |                                                                   | $V_R$      | 3              | V                      |
| Forward current                                                                                        |                                                                   | $I_F$      | 60             | mA                     |
| Power dissipation                                                                                      |                                                                   | $P_{diss}$ | 100            | mW                     |
| Derate linearly                                                                                        | from 55 $^{\circ}\text{C}$                                        |            | 1.33           | mW/ $^{\circ}\text{C}$ |
| <b>OUTPUT</b>                                                                                          |                                                                   |            |                |                        |
| Collector emitter breakdown voltage                                                                    |                                                                   | $BV_{CEO}$ | 30             | V                      |
| Emitter base breakdown voltage                                                                         |                                                                   | $BV_{EBO}$ | 8              | V                      |
| Collector base breakdown voltage                                                                       |                                                                   | $BV_{CBO}$ | 50             | V                      |
| Emitter collector breakdown voltage                                                                    |                                                                   | $BV_{ECO}$ | 5              | V                      |
| Collector (load) current                                                                               |                                                                   | $I_C$      | 100            | mA                     |
| Power dissipation                                                                                      |                                                                   | $P_{diss}$ | 150            | mW                     |
| Derate linearly                                                                                        |                                                                   |            | 2              | mW/ $^{\circ}\text{C}$ |
| <b>COUPLER</b>                                                                                         |                                                                   |            |                |                        |
| Total dissipation                                                                                      |                                                                   | $P_{tot}$  | 250            | mW                     |
| Derate linearly                                                                                        |                                                                   |            | 3.3            | mW/ $^{\circ}\text{C}$ |
| Isolation test voltage (between emitter                                                                | 1 s                                                               | $V_{ISO}$  | 5300           | $V_{RMS}$              |
| Leakage path                                                                                           |                                                                   |            | 7              | mm min.                |
| Air path                                                                                               |                                                                   |            | 7              | mm min.                |
| Isolation resistance                                                                                   | $V_{IO} = 500\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$  | $R_{IO}$   | $\geq 10^{12}$ | $\Omega$               |
|                                                                                                        | $V_{IO} = 500\text{ V}$ , $T_{amb} = 100\text{ }^{\circ}\text{C}$ | $R_{IO}$   | $\geq 10^{11}$ | $\Omega$               |
| Storage temperature                                                                                    |                                                                   | $T_{stg}$  | - 55 to + 150  | $^{\circ}\text{C}$     |
| Operating temperature                                                                                  |                                                                   | $T_{amb}$  | - 55 to + 100  | $^{\circ}\text{C}$     |
| Lead soldering time <sup>(1)</sup>                                                                     | at 260 $^{\circ}\text{C}$                                         |            | 10             | s                      |

**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 (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

| <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>                                                                                             |                                               |             |      |      |      |               |
| Forward voltage                                                                                          | $I_F = 50\text{ mA}$                          | $V_F$       |      | 1.25 | 1.5  | V             |
| Reverse current                                                                                          | $V_R = 3\text{ V}$                            | $I_R$       |      | 0.1  | 100  | $\mu\text{A}$ |
| Capacitance                                                                                              | $V_R = 0\text{ V}$                            | $C_O$       |      | 25   |      | pF            |
| <b>OUTPUT</b>                                                                                            |                                               |             |      |      |      |               |
| Collector emitter breakdown voltage <sup>(1)</sup>                                                       | $I_C = 100\text{ }\mu\text{A}$ , $I_F = 0$    | $BV_{CEO}$  | 30   |      |      | V             |
| Collector base breakdown voltage <sup>(1)</sup>                                                          | $I_C = 100\text{ }\mu\text{A}$ , $I_F = 0$    | $BV_{CBO}$  | 50   |      |      | V             |
| Emitter base breakdown voltage <sup>(1)</sup>                                                            | $I_C = 100\text{ }\mu\text{A}$ , $I_F = 0$    | $BV_{EBO}$  | 8    |      |      | V             |
| Emitter collector breakdown voltage <sup>(1)</sup>                                                       | $I_C = 100\text{ }\mu\text{A}$ , $I_F = 0$    | $BV_{ECO}$  | 5    | 10   |      | V             |
| Collector emitter leakage current                                                                        | $V_{CE} = 10\text{ V}$ , $I_F = 0$            | $I_{CEO}$   |      | 1    | 100  | nA            |
|                                                                                                          | $I_C = 0.5\text{ mA}$ , $V_{CE} = 5\text{ V}$ | $h_{FE}$    | 13   |      |      |               |
| <b>COUPLER</b>                                                                                           |                                               |             |      |      |      |               |
| Collector emitter saturation voltage                                                                     |                                               | $V_{CEsat}$ |      | 1    |      | V             |
| Coupling capacitance                                                                                     |                                               |             |      | 1.5  |      | 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.

<sup>(1)</sup> Indicates JEDEC registered values.

| CURRENT TRANSFER RATIO |                                               |        |      |      |      |      |
|------------------------|-----------------------------------------------|--------|------|------|------|------|
| PARAMETER              | TEST CONDITION                                | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| Current transfer ratio | $V_{CE} = 10\text{ V}$ , $I_F = 10\text{ mA}$ | CTR    | 500  |      |      | %    |

| SWITCHING CHARACTERISTICS |                                               |           |      |      |      |               |
|---------------------------|-----------------------------------------------|-----------|------|------|------|---------------|
| PARAMETER                 | TEST CONDITION                                | SYMBOL    | MIN. | TYP. | MAX. | UNIT          |
| Turn-on time              | $V_{CC} = 10\text{ V}$ , $I_C = 50\text{ mA}$ | $t_{on}$  |      |      | 5    | $\mu\text{s}$ |
| Turn-off time             | $I_F = 200\text{ mA}$ , $R_L = 180\ \Omega$   | $t_{off}$ |      |      | 100  | $\mu\text{s}$ |

| 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                  |
| $P_{SO}$                                                |                        |        |      |           | 700  | mW                 |
| $I_{SI}$                                                |                        |        |      |           | 400  | mA                 |
| $T_{SI}$                                                |                        |        |      |           | 175  | $^{\circ}\text{C}$ |
| Creepage distance                                       | Standard DIP-6         |        | 7    |           |      | mm                 |
| Clearance distance                                      | Standard DIP-6         |        | 7    |           |      | mm                 |
| Creepage distance                                       | 400 mil DIP-6          |        | 8    |           |      | mm                 |
| Clearance distance                                      | 400 mil DIP-6          |        | 8    |           |      | mm                 |
| Insulation thickness,<br>reinforced rated               | per IEC 60950 2.10.5.1 |        | 0.4  |           |      | 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** ( $T_{amb} = 25\ ^{\circ}\text{C}$ , unless otherwise specified)

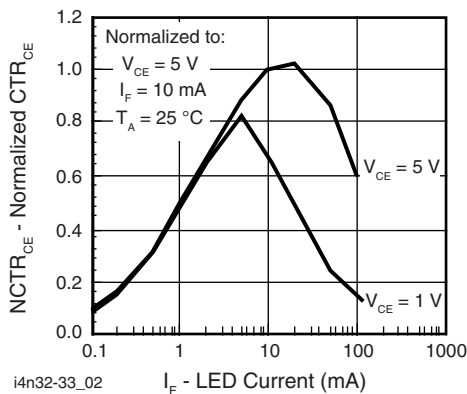


Fig. 1 - Normalized Non-Saturated and Saturated  $CTR_{CE}$  vs. LED Current

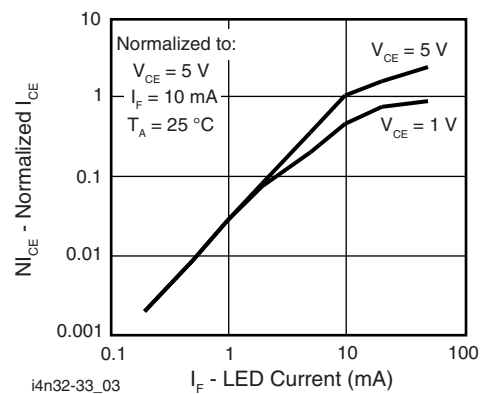


Fig. 2 - Normalized Non-Saturated and Saturated Collector Emitter Current vs. LED Current

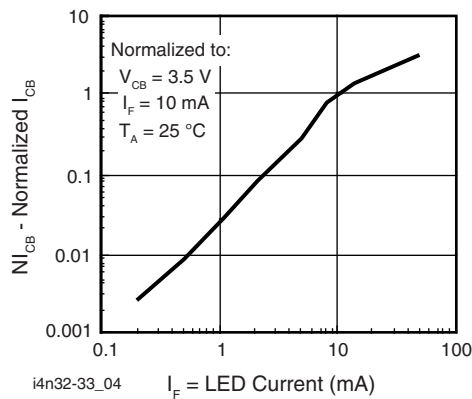


Fig. 3 - Normalized Collector Base Photocurrent vs. LED Current

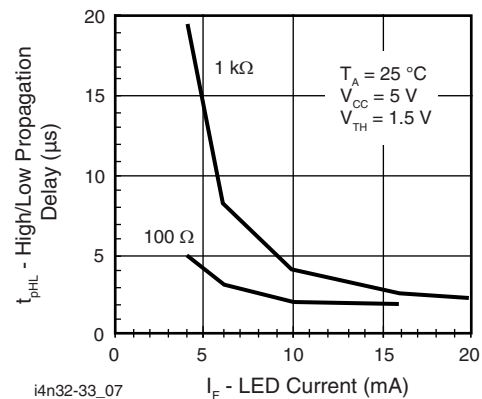


Fig. 6 - High to Low Propagation Delay vs. Collector Load Resistance and LED Current

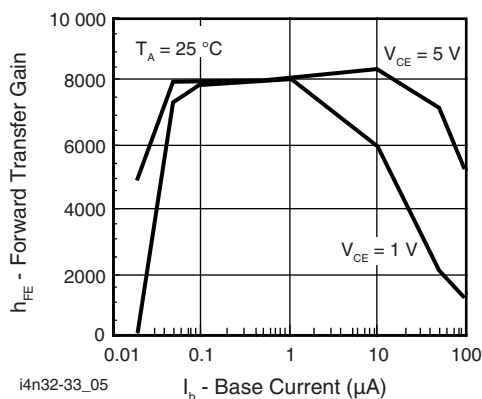


Fig. 4 - Non-Saturated and Saturated  $h_{FE}$  vs. Base Current

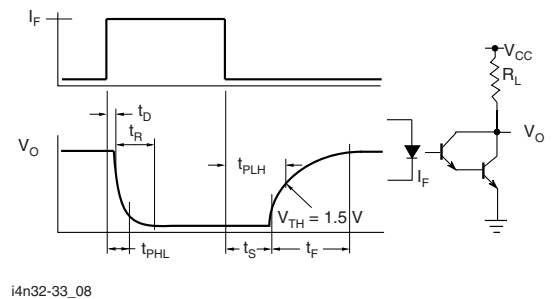


Fig. 7 - Switching Waveform and Switching Schematic

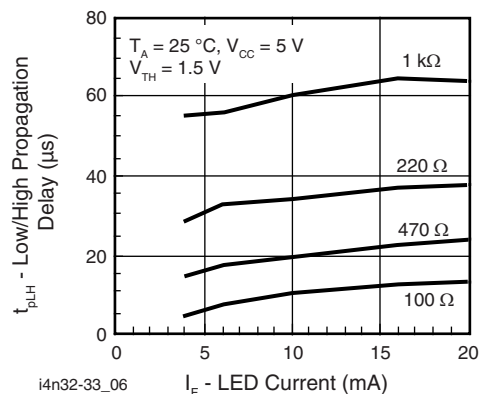


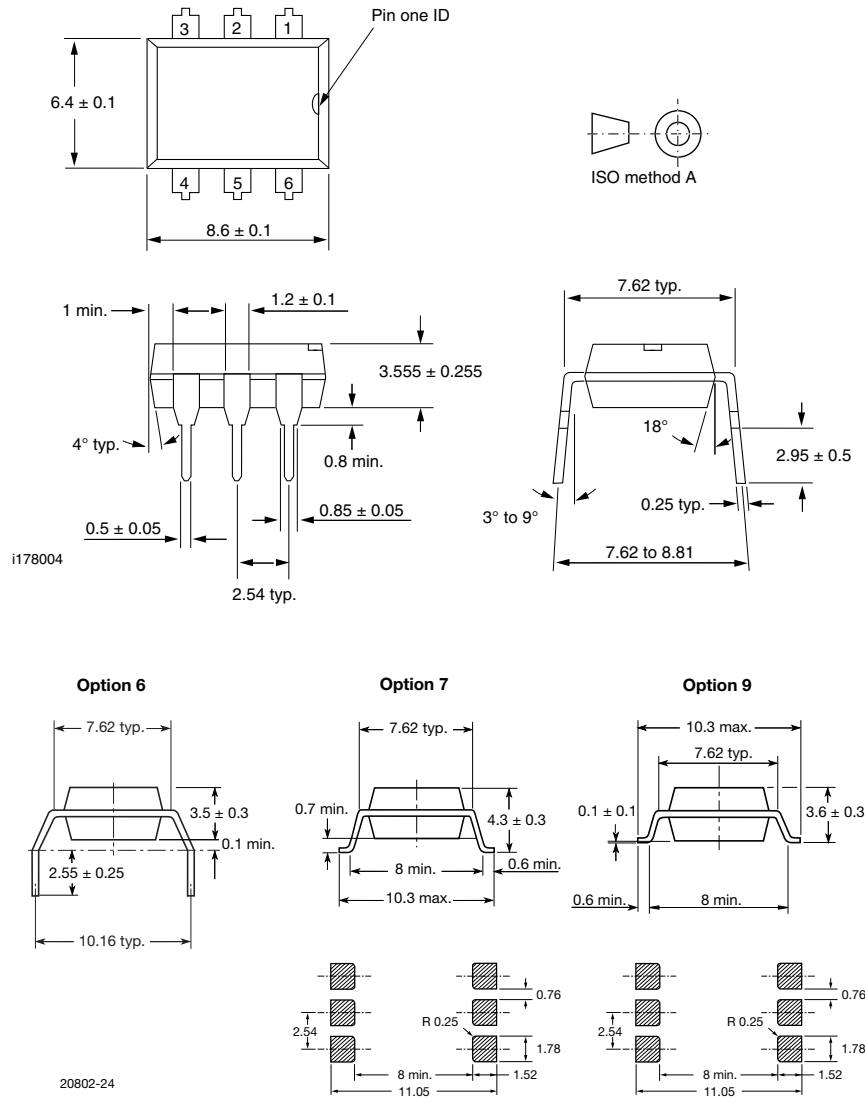
Fig. 5 - Low to High Propagation Delay vs. Collector Load Resistance and LED Current

# Optocoupler, Photodarlington Output, High Gain, with Base Connection

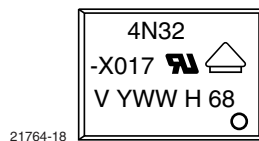
Vishay Semiconductors

## PACKAGE DIMENSIONS in millimeters

### DIP-6 Package Dimensions



## PACKAGE MARKING



### Notes

- Example marking for 4N32-X017T.
- Only options 1, and 7 reflected in the package marking.
- 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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