

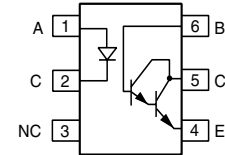
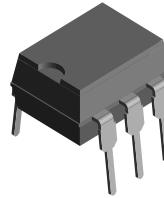
## Optocoupler, Photodarlington Output, High Gain, With Base Connection

### Features

- Very high current transfer ratio, 500 % Min.
- High isolation resistance,  $10^{11} \Omega$  Typical
- Standard plastic DIP package

### Agency Approvals

- UL File #E52744 System Code H or J
- DIN EN 60747-5-2(VDE0884)  
DIN EN 60747-5-5 pending  
Available with Option 1
- BSI IEC60950 IEC60965



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### 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.

### Order Information

Part	Remarks
4N32	CTR > 500 %, DIP-6
4N33	CTR > 500 %, DIP-6
4N32-X007	CTR > 500 %, SMD-6 (option 7)
4N32-X009	CTR > 500 %, SMD-6 (option 9)
4N33-X007	CTR > 500 %, SMD-6 (option 7)
4N33-X009	CTR > 500 %, SMD-6 (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
Peak reverse voltage		$V_R$	3.0	V
Forward continuous current		$I_F$	60	mA
Power dissipation		$P_{diss}$	100	mW
Derate linearly	from 55 $^\circ\text{C}$		1.33	mW/ $^\circ\text{C}$

### Output

Parameter	Test condition	Symbol	Value	Unit
Collector-emitter breakdown voltage		$BV_{CEO}$	30	V
Emitter-base breakdown voltage		$BV_{EBO}$	8.0	V
Collector-base breakdown voltage		$BV_{CBO}$	50	V
Emitter-collector breakdown voltage		$BV_{ECO}$	5.0	V

Parameter	Test condition	Symbol	Value	Unit
Collector (load) current		$I_C$	125	mA
Power dissipation		$P_{diss}$	150	mW
Derate linearly			2.0	mW/°C

### Coupler

Parameter	Test condition	Symbol	Value	Unit
Total dissipation		$P_{tot}$	250	mW
Derate linearly			3.3	mW/°
Isolation test voltage (between emitter and detector, Standard Climate: 23 °C/ 50 %RH, \nDIN 500 14)		$V_{ISO}$	5300	$V_{RMS}$
Leakage Path			7.0	mm min.
Air Path			7.0	mm min.
Isolation Resistance	$V_{IO} = 500 \text{ V}, T_{amb} = 25 \text{ °C}$	$R_{IO}$	$\geq 10^{12}$	$\Omega$
	$V_{IO} = 500 \text{ V}, T_{amb} = 100 \text{ °C}$	$R_{IO}$	$\geq 10^{11}$	$\Omega$
Storage temperature		$T_{amb}$	- 55 to + 150	°C
Operating temperature		$T_{stg}$	- 55 to + 100	°C
Lead soldering time	at 260 °C		10	s

### Electrical Characteristics

$T_{amb} = 25 \text{ °C}$ , 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	$I_F = 50 \text{ mA}$	$V_F$		1.25	1.5	V
Reverse current	$V_R = 3.0 \text{ V}$	$I_R$		0.1	100	$\mu$
Capacitance	$V_R = 0 \text{ V}$	$C_O$		25		pF

### Output

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
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>	$I_C = 100 \text{ }\mu\text{A}, I_F = 0$	$BV_{EBO}$	8.0			V
Emitter-collector breakdown voltage <sup>1)</sup>	$I_C = 100 \text{ }\mu\text{A}, I_F = 0$	$BV_{ECO}$	5.0	10		V
Collector-emitter leakage current	$V_{CE} = 10 \text{ V}, I_F = 0$	$I_{CEO}$		1.0	100	nA
	$I_C = 0.5 \text{ mA}, V_{CE} = 5.0 \text{ V}$	$h_{FE}$	13			

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

## Coupler

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Collector emitter saturation voltage		$V_{CEsat}$		1.0		V
Coupling capacitance				1.5		pF

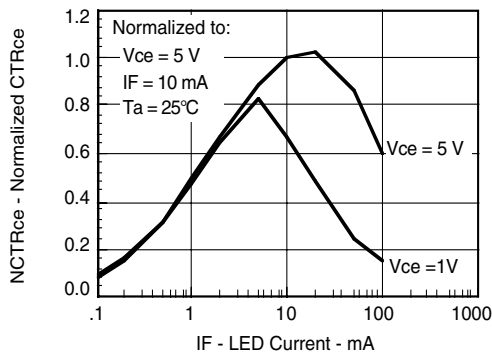
## Current Transfer Ratio

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

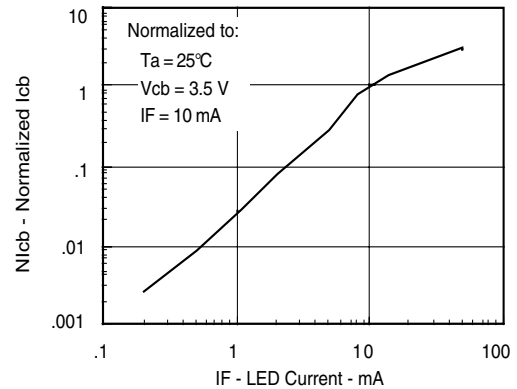
Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Turn on time	$V_{CC} = 10\text{ V}, I_C = 50\text{ mA}$	$t_{on}$			5.0	$\mu\text{s}$
Turn off time	$I_F = 200\text{ mA}, R_L = 180\ \Omega$	$t_{off}$			100	$\mu\text{s}$

## Typical Characteristics ( $T_{amb} = 25\text{ }^\circ\text{C}$ unless otherwise specified)



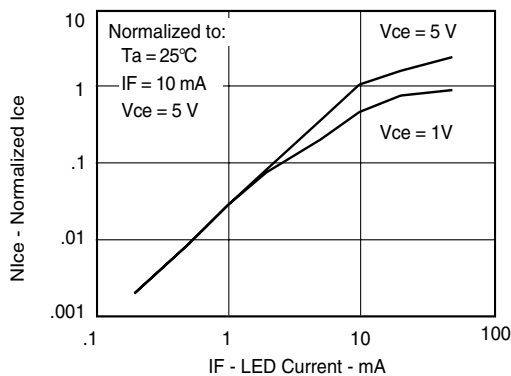
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Fig. 1 Normalized Non-saturated and Saturated  $CTR_{CE}$  vs. LED Current



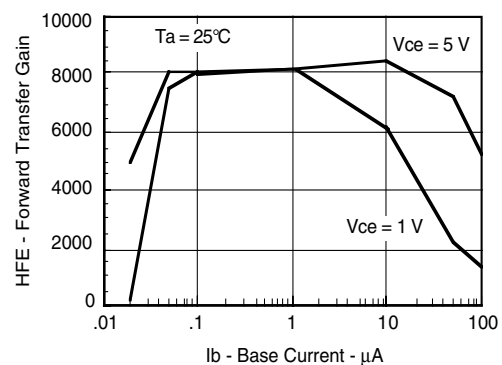
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Fig. 3 Normalized Collector-Base Photocurrent vs. LED Current



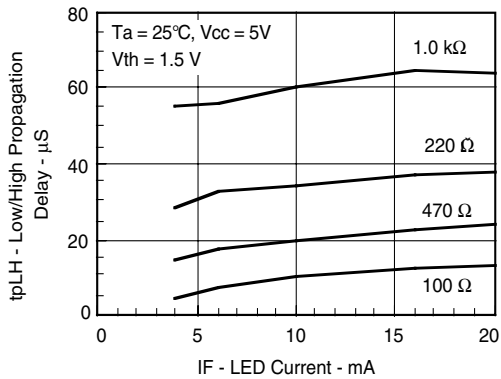
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Fig. 2 Normalized Non-Saturated and Saturated Collector-Emitter Current vs. LED Current



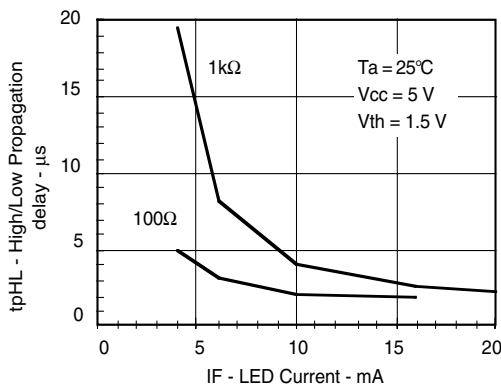
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Fig. 4 Non-Saturated and Saturated HFE vs. Base Current



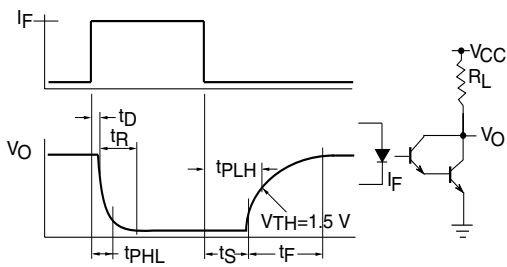
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Fig. 5 Low to High Propagation Delay vs. Collector Load Resistance and LED Current



4n32-33\_07

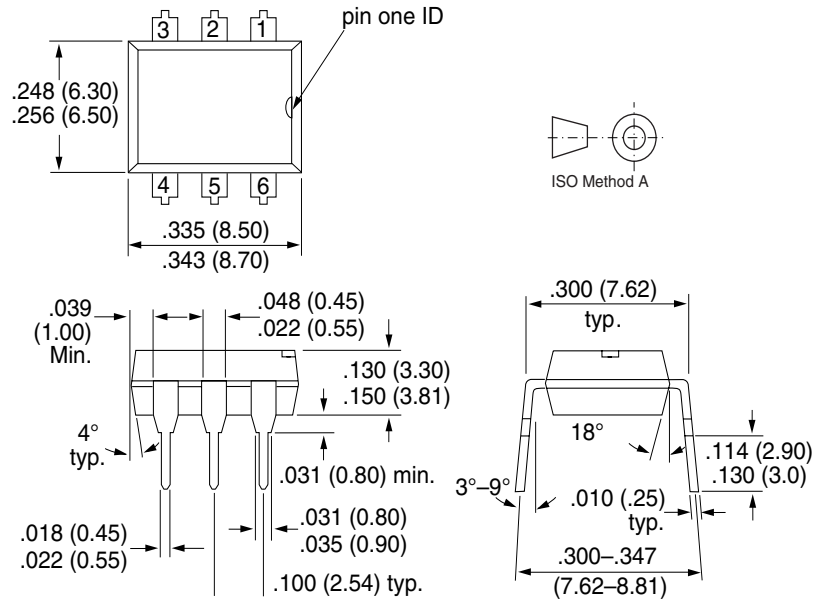
Fig. 6 High to low Propagation Delay vs. Collector Load Resistance and LED Current



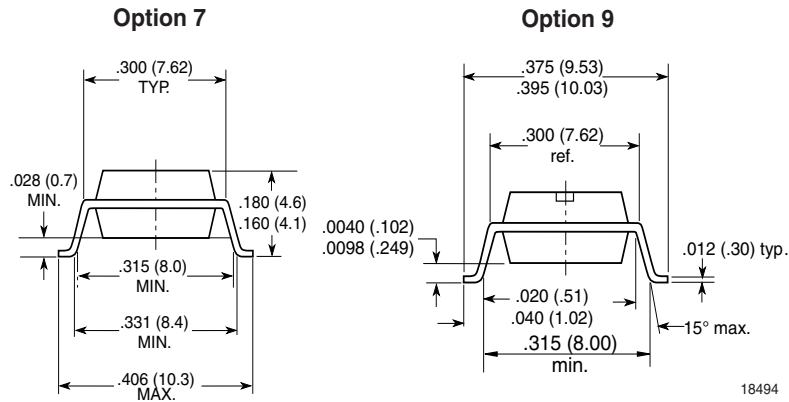
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Fig. 7 Switching Waveform and Switching Schematic

## Package Dimensions in Inches (mm)



i178004



18494

### 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.

**We reserve the right to make changes to improve technical design  
and may do so without further notice.**

Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use Vishay Semiconductors products for any unintended or unauthorized application, the buyer shall indemnify Vishay Semiconductors against all claims, costs, damages, and expenses, arising out of, directly or indirectly, any claim of personal damage, injury or death associated with such unintended or unauthorized use.

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