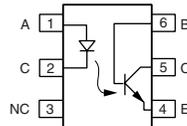


## Optocoupler, Phototransistor Output, With Base Connection



1179004



### DESCRIPTION

The 4N25 family is an Industry Standard Single Channel Phototransistor Coupler. This family includes the 4N25/4N26/4N27/4N28. Each optocoupler consists of gallium arsenide infrared LED and a silicon NPN phototransistor.

These couplers are Underwriters Laboratories (UL) listed to comply with a 5300 V<sub>RMS</sub> isolation test voltage. This isolation performance is accomplished through special Vishay manufacturing process.

Compliance to DIN EN 60747-5-2 (VDE0884)/DIN EN 60747-5-5 pending partial discharge isolation specification is available by ordering option 1.

These isolation processes and the Vishay ISO9001 quality program results in the highest isolation performance available for a commercial plastic phototransistor optocoupler.

The devices are also available in lead formed configuration suitable for surface mounting and are available either on tape and reel, or in standard tube shipping containers.

Note:

For additional design information see Application Note 45 Normalized Curves

### AGENCY APPROVALS

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

### FEATURES

- Isolation Test Voltage 5300 V<sub>RMS</sub>
- Interfaces with Common Logic Families
- Input-output Coupling Capacitance < 0.5 pF
- Industry Standard Dual-in-line 6-pin Package
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



### APPLICATIONS

- AC Mains Detection
- Reed relay driving
- Switch Mode Power Supply Feedback
- Telephone Ring Detection
- Logic Ground Isolation
- Logic Coupling with High Frequency Noise Rejection

### ORDER INFORMATION

PART	REMARKS
4N25	CTR > 20 %, DIP-6
4N26	CTR > 20 %, DIP-6
4N27	CTR > 10 %, DIP-6
4N28	CTR > 10 %, DIP-6
4N25-X006	CTR > 20 %, DIP-6 400 mil (option 6)
4N25-X007	CTR > 20 %, SMD-6 (option 7)
4N25-X009	CTR > 20 %, SMD-6 (option 9)
4N26-X006	CTR > 20 %, DIP-6 400 mil (option 6)
4N26-X007	CTR > 20 %, SMD-6 (option 7)
4N26-X009	CTR > 20 %, SMD-6 (option 9)
4N27-X007	CTR > 10 %, SMD-6 (option 7)
4N27-X009	CTR > 10 %, SMD-6 (option 9)
4N28-X009	CTR > 10 %, SMD-6 (option 9)

Note:

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



ABSOLUTE MAXIMUM RATINGS <sup>1, 2)</sup>				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		$V_R$	6.0	V
Forward current		$I_F$	60	mA
Surge current	$t < 10 \mu s$	$I_{FSM}$	2.5	A
Power dissipation		$P_{diss}$	100	mW
<b>OUTPUT</b>				
Collector-emitter breakdown voltage		$V_{CEO}$	70	V
Emitter-base breakdown voltage		$V_{EBO}$	7.0	V
Collector current		$I_C$	50	mA
Collector current	$t < 1.0 ms$	$I_C$	100	mA
Power dissipation		$P_{diss}$	150	mW
<b>COUPLER</b>				
Isolation test voltage		$V_{ISO}$	5300	$V_{RMS}$
Creepage			$\geq 7.0$	mm
Clearance			$\geq 7.0$	mm
Isolation thickness between emitter and detector			$\geq 0.4$	mm
Comparative tracking index	DIN IEC 112/VDE0303, part 1		175	
Isolation resistance	$V_{IO} = 500 V, T_{amb} = 25 \text{ }^\circ C$	$R_{IO}$	$10^{12}$	$\Omega$
	$V_{IO} = 500 V, T_{amb} = 100 \text{ }^\circ C$	$R_{IO}$	$10^{11}$	$\Omega$
Storage temperature		$T_{stg}$	- 55 to + 150	$^\circ C$
Operating temperature		$T_{amb}$	- 55 to + 100	$^\circ C$
Junction temperature		$T_j$	100	$^\circ C$
Soldering temperature	max.10 s, dip soldering; distance to seating plane $\geq 1.5 mm$	$T_{sld}$	260	$^\circ C$

Note:

1)  $T_{amb} = 25 \text{ }^\circ C$  unless otherwise specified.

2) 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.

ELECTRICAL CHARACTERISTICS <sup>1, 2)</sup>							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN	TYP.	MAX	UNIT
<b>INPUT</b>							
Forward voltage <sup>3)</sup>	$I_F = 50 mA$		$V_F$		1.3	1.5	V
Reverse current <sup>3)</sup>	$V_R = 3.0 V$		$I_R$		0.1	100	$\mu A$
Capacitance	$V_R = 0 V$		$C_O$		25		pF
<b>OUTPUT</b>							
Collector-base breakdown voltage <sup>3)</sup>	$I_C = 100 \mu A$		$BV_{CBO}$	70			V
Collector-emitter breakdown voltage <sup>3)</sup>	$I_C = 1.0 mA$		$BV_{CEO}$	30			V
Emitter-collector breakdown voltage <sup>3)</sup>	$I_E = 100 \mu A$		$BV_{ECO}$	7.0			V
$I_{CEO}(\text{dark})^3)$	$V_{CE} = 10 V, (\text{base open})$	4N25			5.0	50	nA
		4N26			5.0	50	nA
		4N27			5.0	50	nA
		4N28			10	100	nA



ELECTRICAL CHARACTERISTICS <sup>1, 2)</sup>						
PARAMETER	TEST CONDITION	SYMBOL	MIN	TYP.	MAX	UNIT
$I_{CBO}(\text{dark})^3)$	$V_{CB} = 10 \text{ V}$ , (emitter open)			2.0	20	nA
Collector-emitter capacitance	$V_{CE} = 0$	$C_{CE}$		6.0		pF
COUPLER						
Isolation test voltage <sup>3)</sup>	Peak, 60 Hz	$V_{IO}$	5300			V
Saturation voltage, collector-emitter	$I_{CE} = 2.0 \text{ mA}$ , $I_F = 50 \text{ mA}$	$V_{CE(\text{sat})}$			0.5	V
Resistance, input output <sup>3)</sup>	$V_{IO} = 500 \text{ V}$	$R_{IO}$	100			GΩ
Capacitance (input-output)	$f = 1.0 \text{ MHz}$	$C_{IO}$		0.5		pF

Note:

1)  $T_{\text{amb}} = 25 \text{ °C}$  unless otherwise specified.

2) 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.

3) JEDEC registered values are 2500 V, 1500 V, 1500 V and 500 V for the 4N25, 4N26, 4N27 and 4N28 respectively.

CURRENT TRANSFER RATIO							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN	TYP.	MAX	UNIT
DC Current Transfer Ratio <sup>1)</sup>	$V_{CE} = 10 \text{ V}$ , $I_F = 10 \text{ mA}$	4N25	$CTR_{DC}$	20	50		%
		4N26	$CTR_{DC}$	20	50		%
		4N27	$CTR_{DC}$	10	30		%
		4N28	$CTR_{DC}$	10	30		%

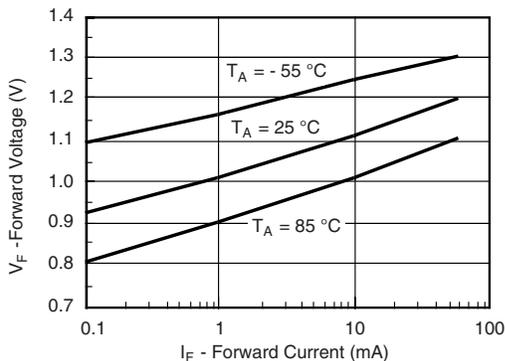
Note:

1) Indicates JEDEC registered values.

SWITCHING CHARACTERISTICS							
PARAMETER	TEST CONDITION	SYMBOL	MIN	TYP.	MAX	UNIT	
Rise and fall times	$V_{CE} = 10 \text{ V}$ , $I_F = 10 \text{ mA}$ , $R_L = 100 \text{ } \Omega$	$t_r, t_f$		2.0		$\mu\text{s}$	

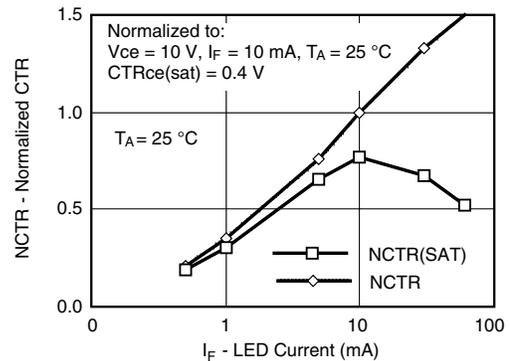
**TYPICAL CHARACTERISTICS**

$T_{\text{amb}} = 25 \text{ °C}$  unless otherwise specified



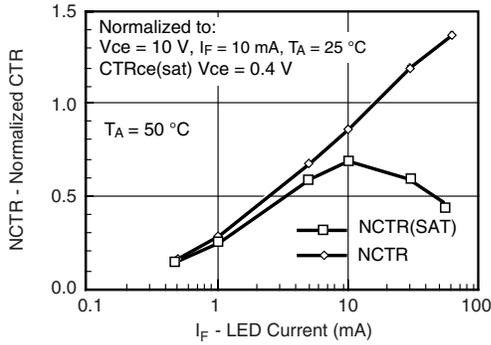
i4n25\_01

Figure 1. Forward Voltage vs. Forward Current



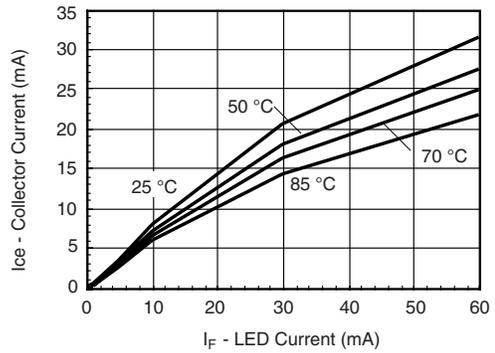
i4n25\_02

Figure 2. Normalized Non-Saturated and Saturated CTR vs. LED Current



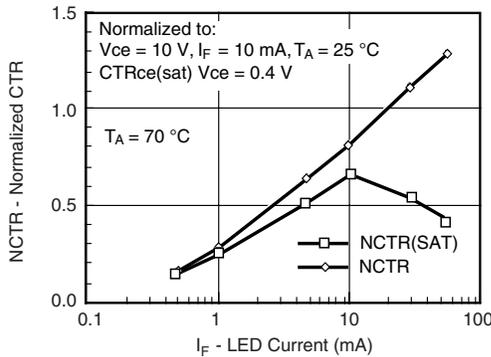
i4n25\_03

Figure 3. Normalized Non-saturated and Saturated CTR vs. LED Current



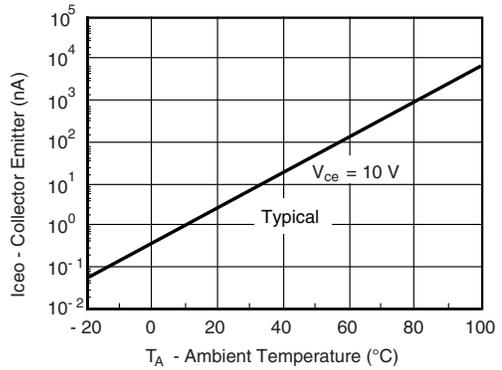
i4n25\_06

Figure 6. Collector-Emitter Current vs. Temperature and LED Current



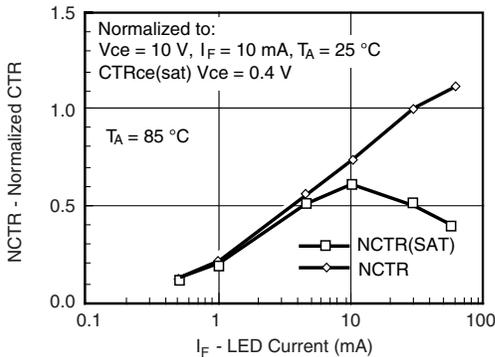
i4n25\_04

Figure 4. Normalized Non-saturated and saturated CTR vs. LED Current



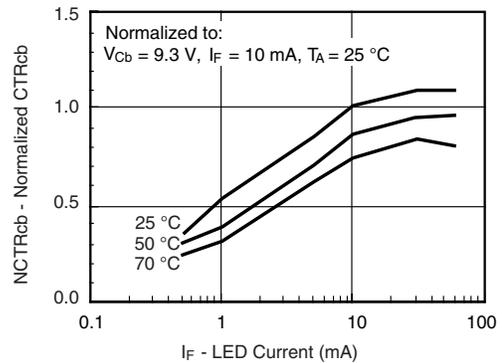
i4n25\_07

Figure 7. Collector-Emitter Leakage Current vs. Temp.



i4n25\_05

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



i4n25\_08

Figure 8. Normalized CTRcb vs. LED Current and Temp.

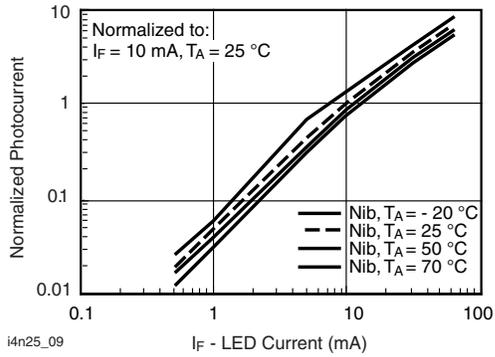


Figure 9. Normalized Photocurrent vs.  $I_F$  and Temp.

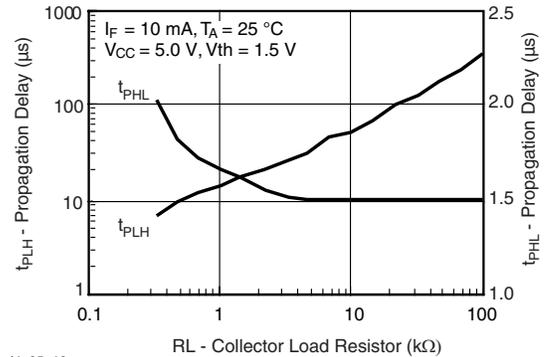


Figure 12. Propagation Delay vs. Collector Load Resistor

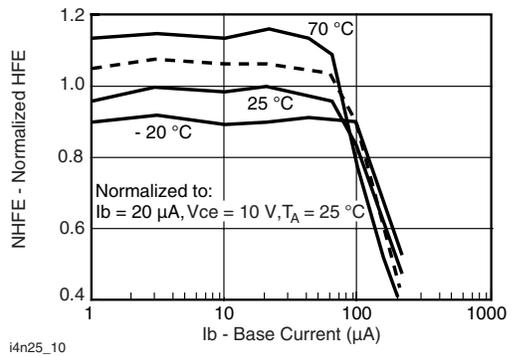


Figure 10. Normalized Non-saturated HFE vs. Base Current and Temperature

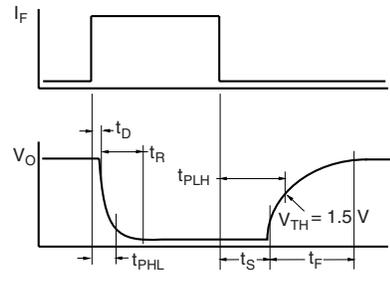


Figure 13. Switching Timing

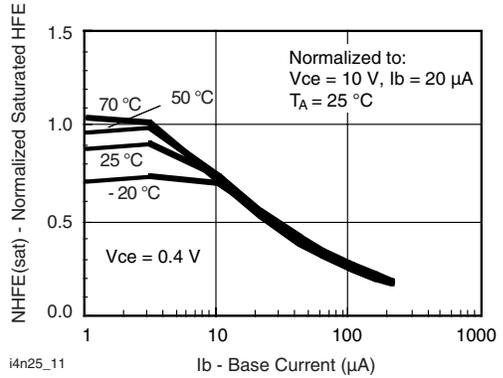


Figure 11. Normalized HFE vs. Base Current and Temp.

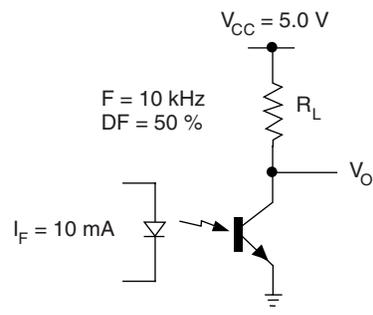


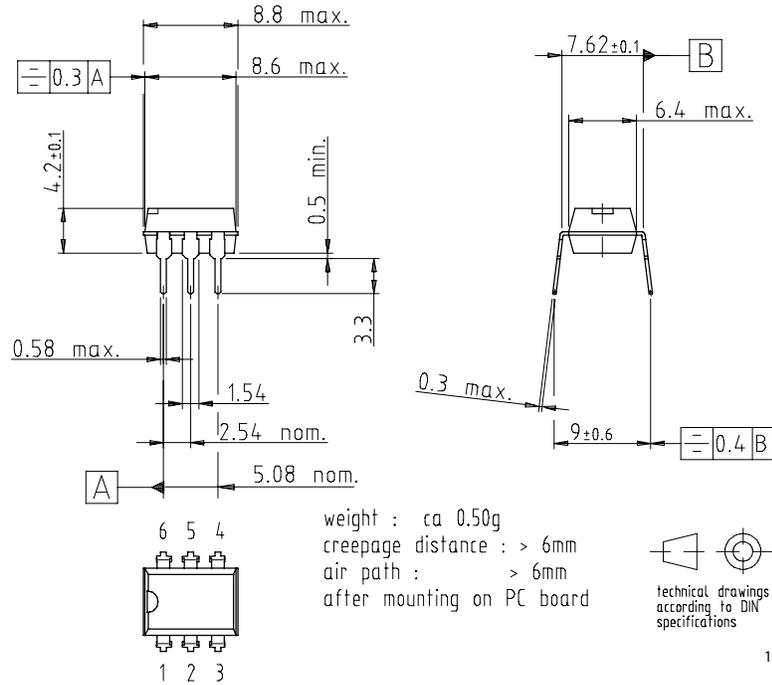
Figure 14. Switching Schematic

### PACKAGE DIMENSIONS in inches (millimeters)

For 4N25/26/27..... see DIL300-6 Package dimension in the Package Section.

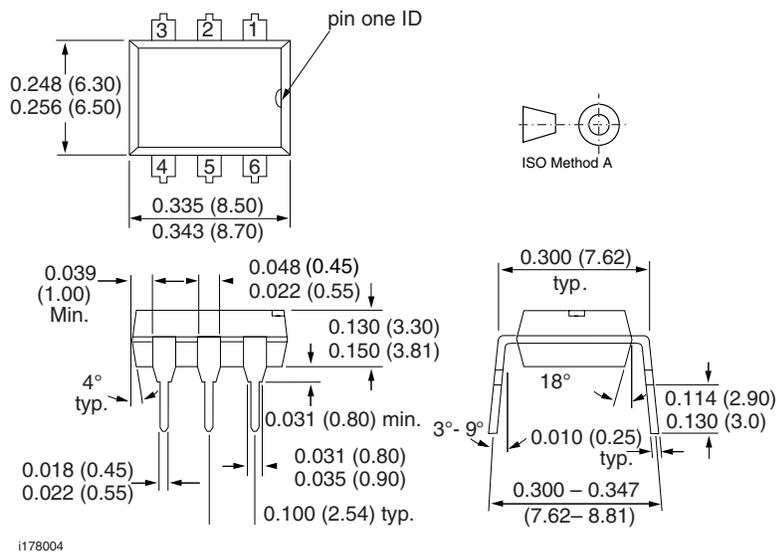
For 4N28 and for products with an option designator (e.g. 4N25-X001 or 4N26-X007)..... see DIP-6 Package dimensions in the Package Section.

### DIL300-6 Package Dimensions



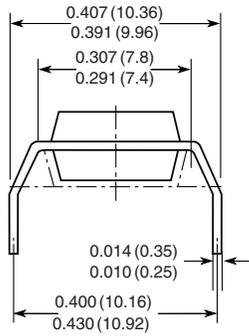
14770

### DIP-6 Package Dimensions

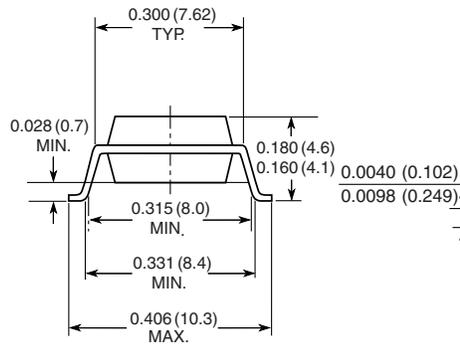


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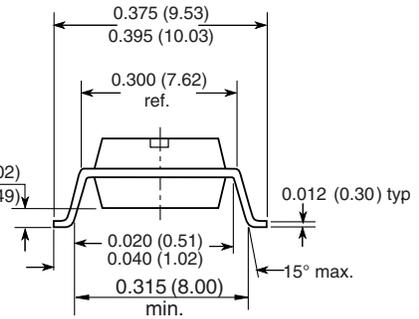
**Option 6**



**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.

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.

Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany



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