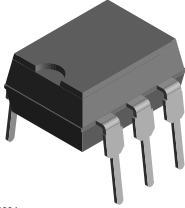
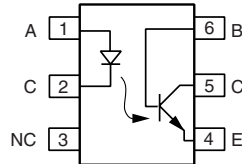


## Optocoupler, Phototransistor Output, with Base Connection



I179004



### 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  $V_{RMS}$  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

### FEATURES

- Isolation test voltage 5300  $V_{RMS}$
- 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


**RoHS  
COMPLIANT**

### 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

### AGENCY APPROVALS

- UL1577, file no. E52744 system code H or J, double protection
- DIN EN 60747-5-2 (VDE 0884)  
DIN EN 60747-5-5 pending  
available with option 1

### 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				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		$V_R$	6	V
Forward current		$I_F$	60	mA
Surge current	$t \leq 10 \mu\text{s}$	$I_{FSM}$	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	V
Collector current		$I_C$	50	mA
	$t \leq 1.0 \text{ ms}$	$I_C$	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	$V_{IO} = 500 \text{ V}, T_{amb} = 25 \text{ }^\circ\text{C}$	$R_{IO}$	$10^{12}$	$\Omega$
	$V_{IO} = 500 \text{ V}, T_{amb} = 100 \text{ }^\circ\text{C}$	$R_{IO}$	$10^{11}$	$\Omega$
Storage temperature		$T_{stg}$	- 55 to + 150	$^\circ\text{C}$
Operating temperature		$T_{amb}$	- 55 to + 100	$^\circ\text{C}$
Junction temperature		$T_j$	100	$^\circ\text{C}$
Soldering temperature	max.10 s dip soldering: distance to seating plane $\geq 1.5 \text{ mm}$	$T_{sld}$	260	$^\circ\text{C}$

**Note**

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

ELECTRICAL CHARACTERISTICS <sup>(1)</sup>							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>							
Forward voltage <sup>(2)</sup>	$I_F = 50 \text{ mA}$		$V_F$		1.3	1.5	V
Reverse current <sup>(2)</sup>	$V_R = 3.0 \text{ V}$		$I_R$		0.1	100	$\mu\text{A}$
Capacitance	$V_R = 0 \text{ V}$		$C_O$		25		pF
<b>OUTPUT</b>							
Collector base breakdown voltage <sup>(2)</sup>	$I_C = 100 \mu\text{A}$		$BV_{CBO}$	70			V
Collector emitter breakdown voltage <sup>(2)</sup>	$I_C = 1.0 \text{ mA}$		$BV_{CEO}$	30			V
Emitter collector breakdown voltage <sup>(2)</sup>	$I_E = 100 \mu\text{A}$		$BV_{ECO}$	7			V
$I_{CEO}(\text{dark})^{(2)}$	$V_{CE} = 10 \text{ V}, (\text{base open})$	4N25			5	50	nA
		4N26			5	50	nA
		4N27			5	50	nA
		4N28			10	100	nA



ELECTRICAL CHARACTERISTICS (1)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
$I_{CBO}(\text{dark})^{(2)}$	$V_{CB} = 10 \text{ V}$ , (emitter open)				2.0	20	nA
Collector emitter capacitance	$V_{CE} = 0$		$C_{CE}$		6.0		pF
COUPLER							
Isolation test voltage <sup>(2)</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>(2)</sup>	$V_{IO} = 500 \text{ V}$		$R_{IO}$	100			$G\Omega$
Capacitance, input output	$f = 1 \text{ MHz}$		$C_{IO}$		0.5		pF

**Notes**

(1)  $T_{amb} = 25 \text{ }^\circ\text{C}$ , 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.

(2) 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	$V_{CE} = 10 \text{ V}$ , $I_F = 10 \text{ mA}$	4N25	$CTR_{DC}$	20	50		%
		4N26	$CTR_{DC}$	20	50		%
		4N27	$CTR_{DC}$	10	30		%
		4N28	$CTR_{DC}$	10	30		%

**Note**

Indicates JEDEC registered values.

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

**TYPICAL CHARACTERISTICS**

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

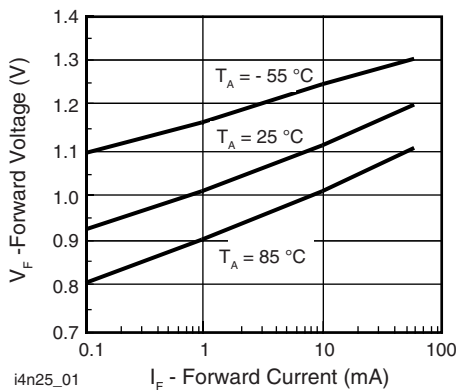


Fig. 1 - Forward Voltage vs. Forward Current

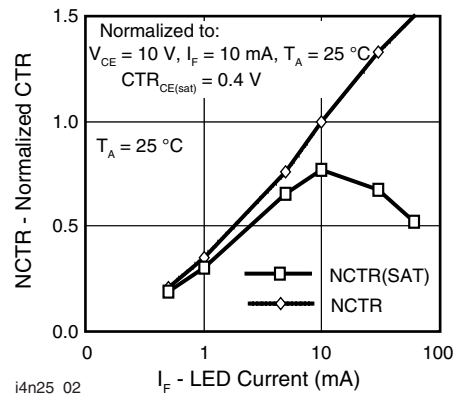


Fig. 2 - Normalized Non-Saturated and Saturated CTR vs. LED Current

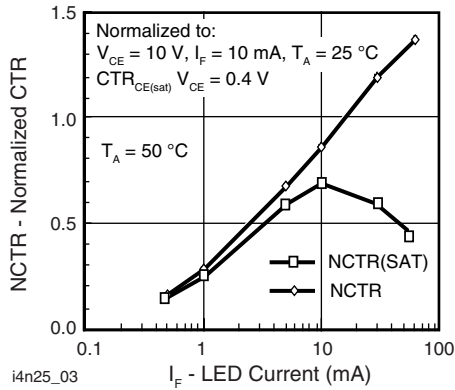


Fig. 3 - Normalized Non-Saturated and Saturated CTR vs. LED Current

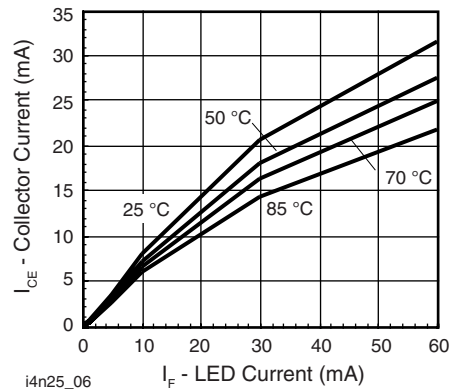


Fig. 6 - Collector Emitter Current vs. Temperature and LED Current

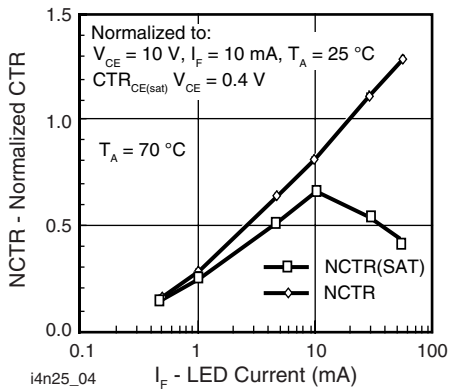


Fig. 4 - Normalized Non-Saturated and Saturated CTR vs. LED Current

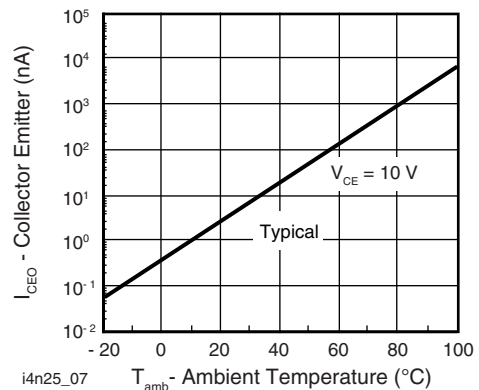


Fig. 7 - Collector Emitter Leakage Current vs. Temperature

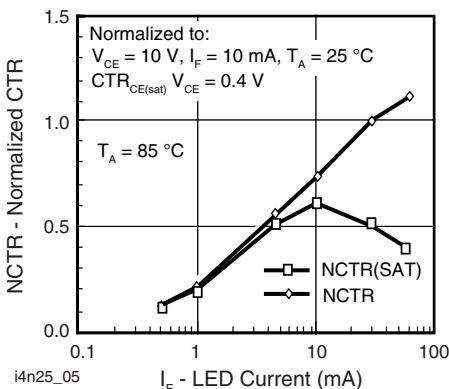


Fig. 5 - Normalized Non-Saturated and Saturated CTR vs. LED Current

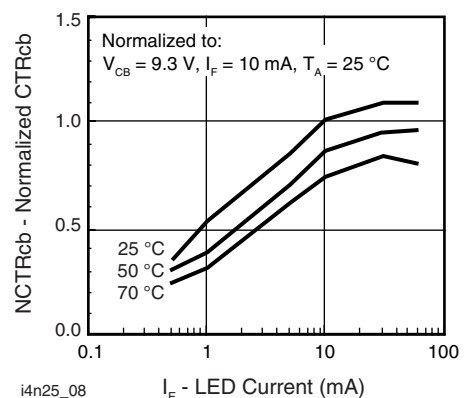


Fig. 8 - Normalized CTRcb vs. LED Current and Temperature

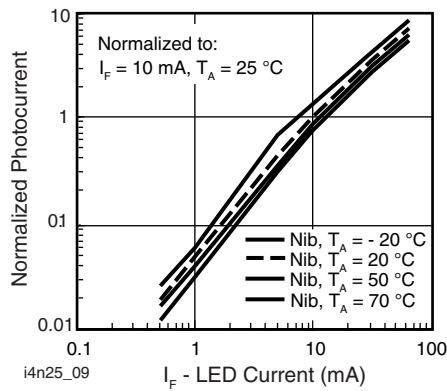


Fig. 9 - Normalized Photocurrent vs.  $I_F$  and Temperature

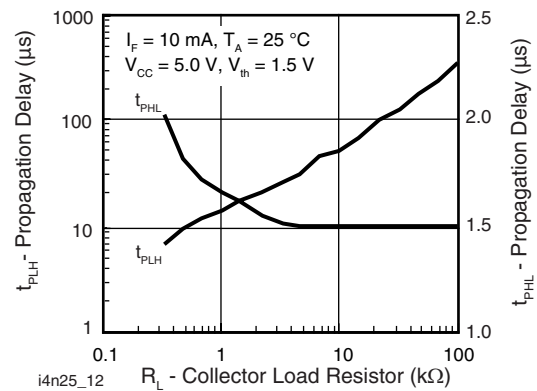


Fig. 12 - Propagation Delay vs. Collector Load Resistor

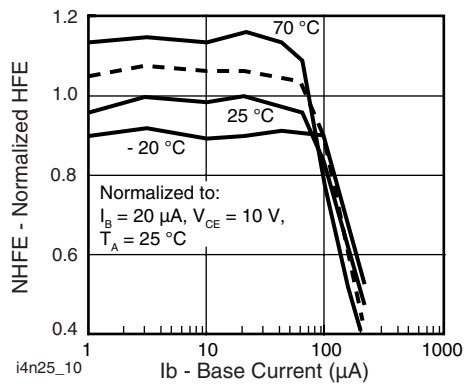


Fig. 10 - Normalized Non-Saturated HFE vs. Base Current and Temperature

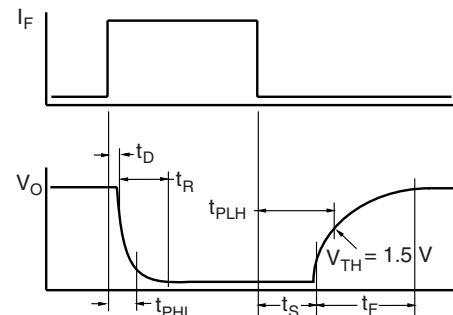


Fig. 13 - Switching Timing

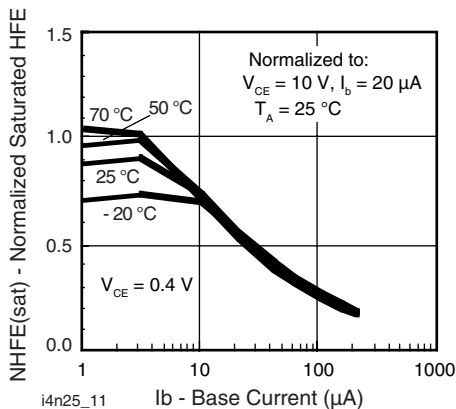


Fig. 11 - Normalized HFE vs. Base Current and Temperature

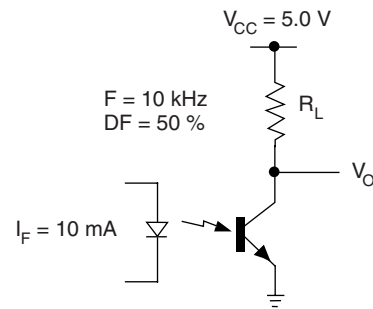


Fig. 14 - Switching Schematic

# 4N25/4N26/4N27/4N28



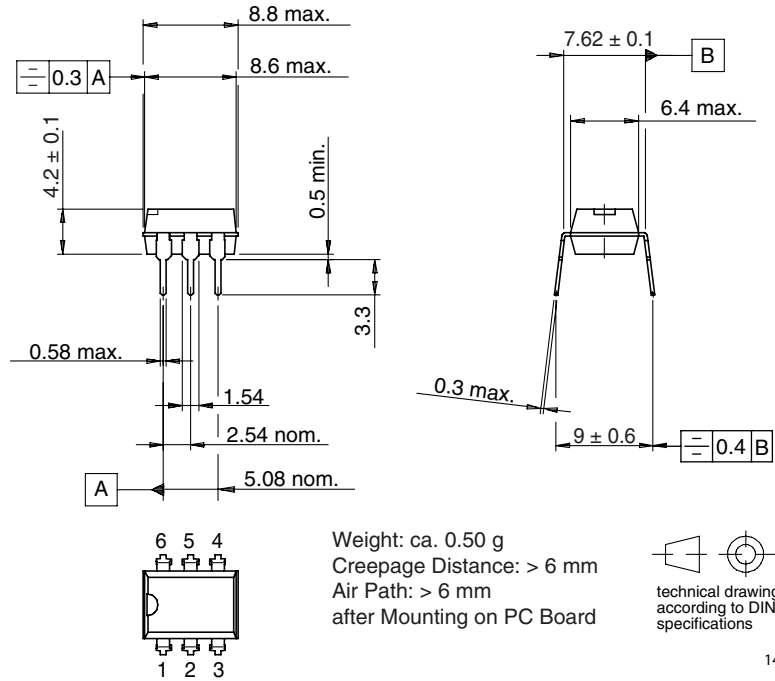
Vishay Semiconductors Optocoupler, Phototransistor Output,  
with Base Connection

## PACKAGE DIMENSIONS in millimeters

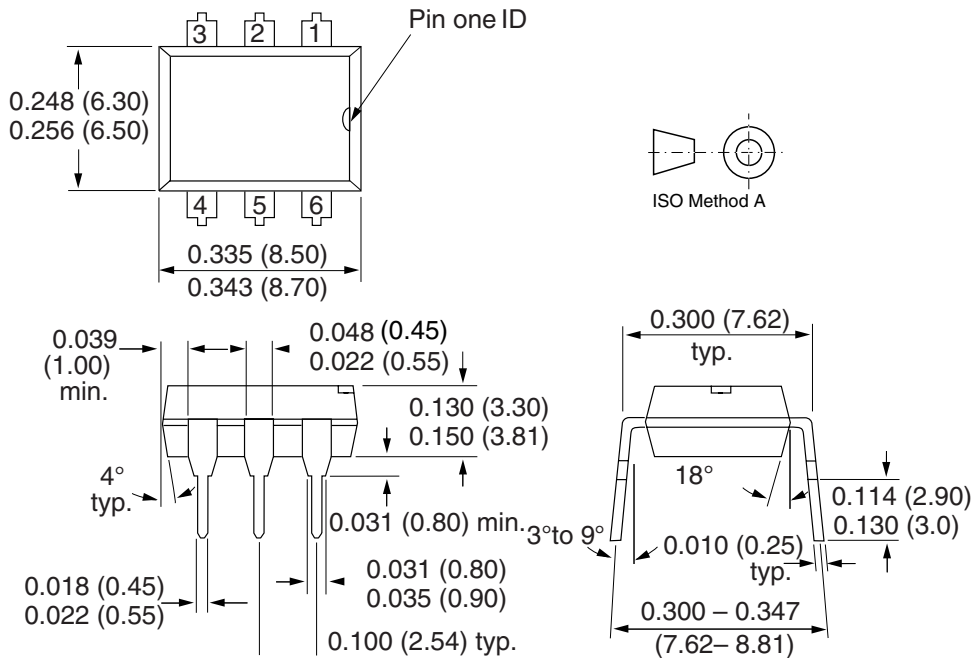
For 4N25/26/27..... see DIL300-6 Package dimension in the Package Section.

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

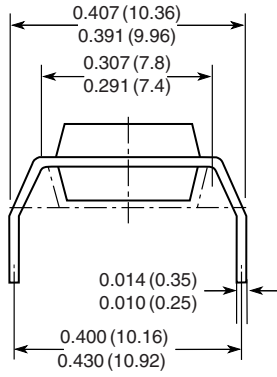


### DIP-6 Package Dimensions

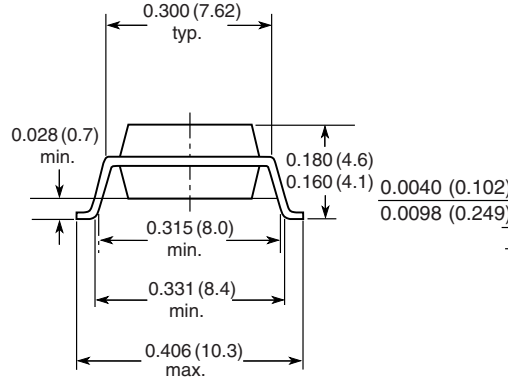




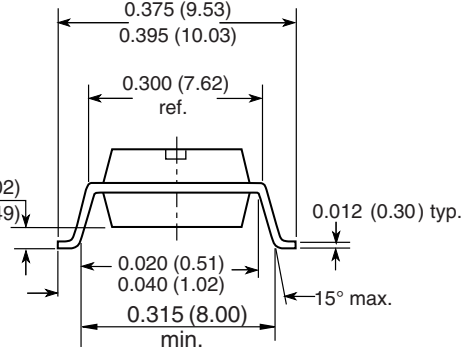
Option 6



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





## Notice

Specifications of the products displayed herein are subject to change without notice. Vishay Intertechnology, Inc., or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

Information contained herein is intended to provide a product description only. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Vishay's terms and conditions of sale for such products, Vishay assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of Vishay products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Vishay for any damages resulting from such improper use or sale.