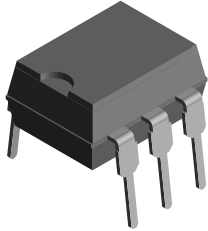
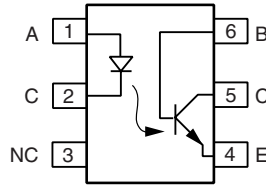


# Optocoupler, Phototransistor Output, with Base Connection



I179004



## DESCRIPTION

The SFH601 is an optocoupler with a gallium arsenide LED emitter which is optically coupled with a silicon planar phototransistor detector. The component is packaged in a plastic plug-in case 20 AB DIN 41866. The coupler transmits signals between two electrically isolated circuits.

## FEATURES

- Isolation test voltage (1.0 s), 5300 V<sub>RMS</sub>
- V<sub>CEsat</sub> 0.25 (≤ 0.4) V, I<sub>F</sub> = 10 mA, I<sub>C</sub> = 2.5 mA
- Built to conform to VDE requirements
- Highest quality premium device
- Long term stability
- Storage temperature, - 55 ° to + 150 °C
- 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 (VDE 0884) available with option 1
- CSA 93751
- BSI IEC 60950; IEC 60065

## ORDER INFORMATION

PART	REMARKS
SFH601-1	CTR 40 % to 80 %, DIP-6
SFH601-2	CTR 63 % to 125 %, DIP-6
SFH601-3	CTR 100 % to 200 %, DIP-6
SFH601-4	CTR 160 % to 320 %, DIP-6
SFH601-1X006	CTR 40 % to 80 %, DIP-6 400 mil (option 6)
SFH601-1X007	CTR 40 % to 80 %, SMD-6 (option 7)
SFH601-1X009	CTR 40 % to 80 %, SMD-6 (option 9)
SFH601-2X006	CTR 63 % to 125 %, DIP-6 400 mil (option 6)
SFH601-2X007	CTR 63 % to 125 %, SMD-6 (option 7)
SFH601-2X009	CTR 63 % to 125 %, SMD-6 (option 9)
SFH601-3X006	CTR 100 % to 200 %, DIP-6 400 mil (option 6)
SFH601-3X007	CTR 100 % to 200 %, SMD-6 (option 7)
SFH601-3X009	CTR 100 % to 200 %, SMD-6 (option 9)
SFH601-4X006	CTR 160 % to 320 %, DIP-6 400 mil (option 6)
SFH601-4X007	CTR % 160 to 320 %, SMD-6 (option 7)
SFH601-4X009	CTR % 160 to 320 %, SMD-6 (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>	6	V
DC forward current		I <sub>F</sub>	60	mA
Surge forward current	t = 10 μs	I <sub>FSM</sub>	2.5	A
Total power dissipation		P <sub>diss</sub>	100	mW

ABSOLUTE MAXIMUM RATINGS <sup>(1)</sup>				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>OUTPUT</b>				
Collector emitter voltage		$V_{CE}$	100	V
Emitter base voltage		$V_{EBO}$	7	V
Collector current		$I_C$	50	mA
	$t = 1.0 \text{ ms}$	$I_C$	100	mA
Power dissipation		$P_{diss}$	150	mW
<b>COUPLER</b>				
Isolation test voltage between emitter and detector	$t = 1.0 \text{ s}$	$V_{ISO}$	5300	$V_{RMS}$
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 range		$T_{stg}$	- 55 to + 150	$^\circ\text{C}$
Ambient temperature range		$T_{amb}$	- 55 to +100	$^\circ\text{C}$
Junction temperature		$T_j$	100	$^\circ\text{C}$
Soldering temperature <sup>(2)</sup>	max. 10 s, dip soldering: distance to seating plane $\geq 1.5 \text{ mm}$	$T_{sld}$	260	$^\circ\text{C}$

**Notes**

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

<sup>(2)</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).

ELECTRICAL CHARACTERISTICS							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>							
Forward voltage	$I_F = 60 \text{ mA}$		$V_F$		1.25	1.65	V
Breakdown voltage	$I_R = 10 \text{ } \mu\text{A}$		$V_{BR}$	6			V
Reverse current	$V_R = 6 \text{ V}$		$I_R$		0.01	10	$\mu\text{A}$
Capacitance	$V_F = 0 \text{ V}, f = 1 \text{ MHz}$		$C_O$		25		pF
Thermal resistance			$R_{thja}$		750		K/W
<b>OUTPUT</b>							
Collector emitter capacitance	$f = 1 \text{ MHz}, V_{CE} = 5 \text{ V}$		$C_{CE}$		6.8		pF
Collector base capacitance	$f = 1 \text{ MHz}, V_{CB} = 5 \text{ V}$		$C_{CB}$		8.5		pF
Emitter base capacitance	$f = 1 \text{ MHz}, V_{EB} = 5 \text{ V}$		$C_{EB}$		11		pF
Thermal resistance			$R_{thja}$		500		K/W
Collector emitter leakage current	$V_{CE} = 10 \text{ V}$	SFH601-1	$I_{CEO}$		2	50	nA
		SFH601-2	$I_{CEO}$		2	50	nA
		SFH601-3	$I_{CEO}$		5	100	nA
		SFH601-4	$I_{CEO}$		5	100	nA
<b>COUPLER</b>							
Saturation voltage collector emitter	$I_F = 10 \text{ mA}, I_C = 2.5 \text{ mA}$		$V_{CEsat}$		0.25	0.4	V
Capacitance (input to output)	$V_{I-O} = 0, f = 1 \text{ MHz}$		$C_{IO}$		0.6		pF

**Note**

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

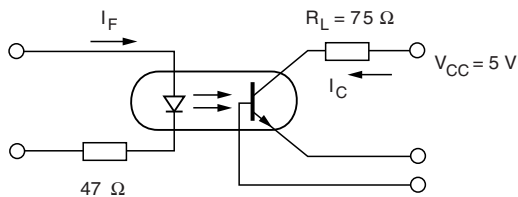
Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements.

CURRENT TRANSFER RATIO							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
$I_C/I_F$ at $V_{CE} = 5.0\text{ V}$	$I_F = 10\text{ mA}$	SFH601-1	CTR	40		80	%
		SFH601-2	CTR	63		125	%
		SFH601-3	CTR	100		200	%
		SFH601-4	CTR	160		320	%
	$I_F = 1\text{ mA}$	SFH601-1	CTR	13	30		%
		SFH601-2	CTR	22	45		%
		SFH601-3	CTR	34	70		%
		SFH601-4	CTR	56	90		%

**Note**

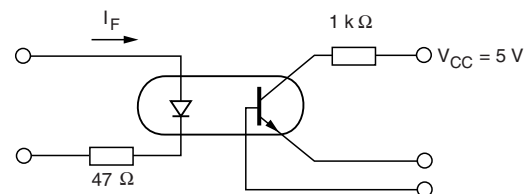
Current transfer ratio and collector emitter leakage current by dash number.

SWITCHING CHARACTERISTICS							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>NON-SATURATED</b>							
Current	$V_{CC} = 5\text{ V}, R_L = 75\ \Omega$		$I_F$		10		mA
Rise time	$V_{CC} = 5\text{ V}, R_L = 75\ \Omega$		$t_r$		2		$\mu\text{s}$
Fall time	$V_{CC} = 5\text{ V}, R_L = 75\ \Omega$		$t_f$		2		$\mu\text{s}$
Turn-on time	$V_{CC} = 5\text{ V}, R_L = 75\ \Omega$		$t_{on}$		3		$\mu\text{s}$
Turn-off time	$V_{CC} = 5\text{ V}, R_L = 75\ \Omega$		$t_{off}$		2.3		$\mu\text{s}$
<b>SATURATED</b>							
Current		SFH601-1	$I_F$		20		mA
		SFH601-2	$I_F$		10		mA
		SFH601-3	$I_F$		10		mA
		SFH601-4	$I_F$		0.5		mA
Rise time		SFH601-1	$t_r$		2		$\mu\text{s}$
		SFH601-2	$t_r$		3		$\mu\text{s}$
		SFH601-3	$t_r$		3		$\mu\text{s}$
		SFH601-4	$t_r$		4.6		$\mu\text{s}$
Fall time		SFH601-1	$t_f$		11		$\mu\text{s}$
		SFH601-2	$t_f$		14		$\mu\text{s}$
		SFH601-3	$t_f$		14		$\mu\text{s}$
		SFH601-4	$t_f$		15		$\mu\text{s}$
Turn-on time		SFH601-1	$t_{on}$		3		$\mu\text{s}$
		SFH601-2	$t_{on}$		4.2		$\mu\text{s}$
		SFH601-3	$t_{on}$		4.2		$\mu\text{s}$
		SFH601-4	$t_{on}$		6		$\mu\text{s}$
Turn-off time		SFH601-1	$t_{off}$		18		$\mu\text{s}$
		SFH601-2	$t_{off}$		23		$\mu\text{s}$
		SFH601-3	$t_{off}$		23		$\mu\text{s}$
		SFH601-4	$t_{off}$		25		$\mu\text{s}$



isfh601\_01

Fig. 1 - Linear Operation (without Saturation)



isfh601\_02

Fig. 2 - Switching Operation (with Saturation)

SAFETY AND INSULATION RATINGS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Climatic classification (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	°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, 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**

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

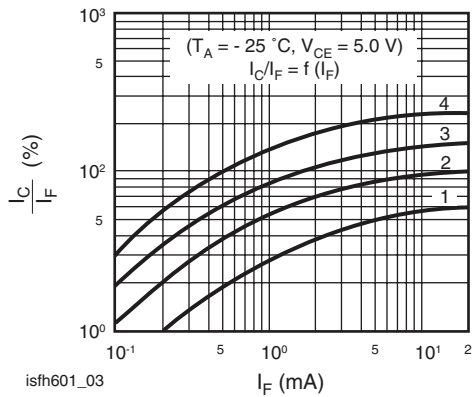


Fig. 3 - Current Transfer Ratio vs. Diode Current

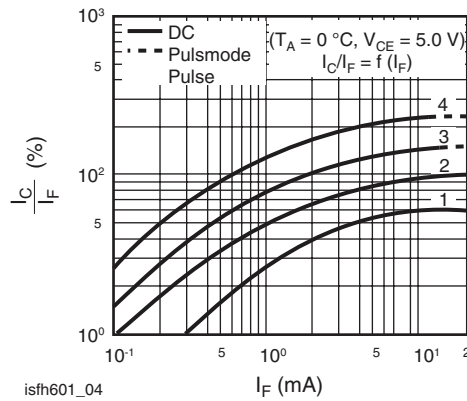


Fig. 4 - Current Transfer Ratio vs. Diode Current

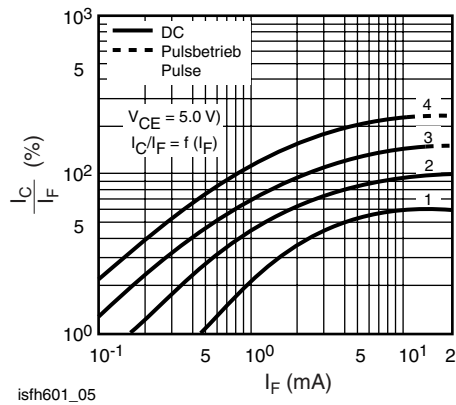


Fig. 5 - Current Transfer Ratio vs. Diode Current

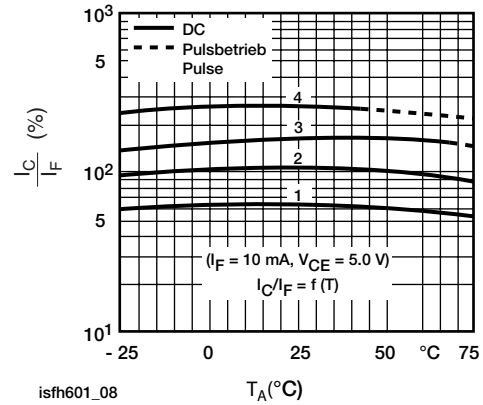


Fig. 8 - Current Transfer Ratio vs. Diode Current

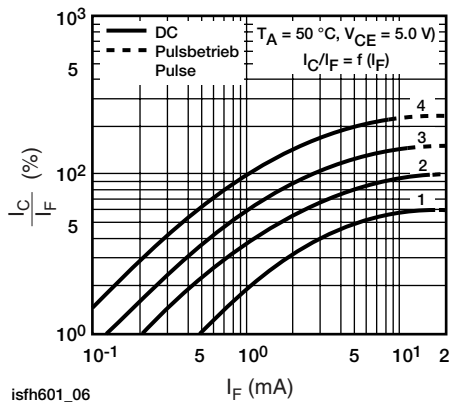


Fig. 6 - Current Transfer Ratio vs. Diode Current

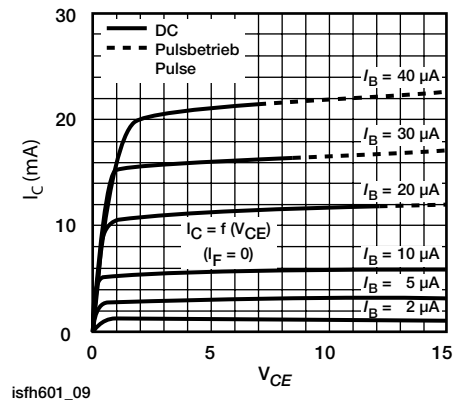


Fig. 9 - Transistor Characteristics

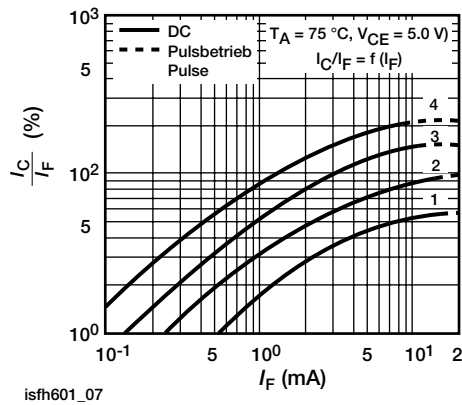


Fig. 7 - Current Transfer Ratio vs. Diode Current

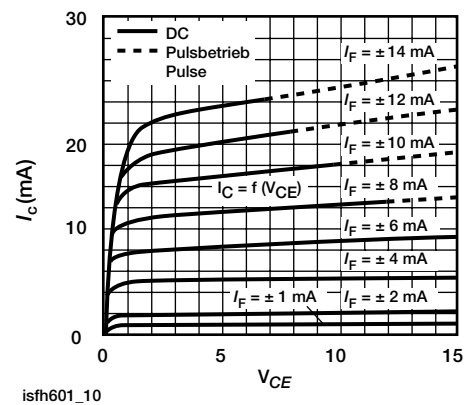


Fig. 10 - Output Characteristics

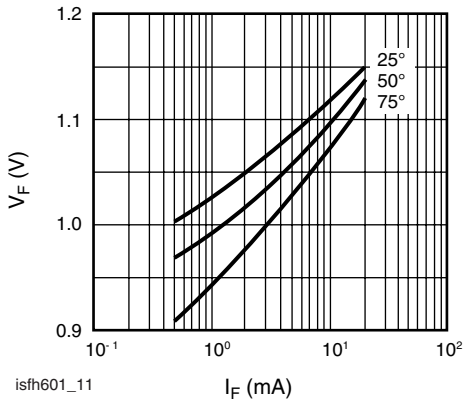


Fig. 11 - Forward Voltage

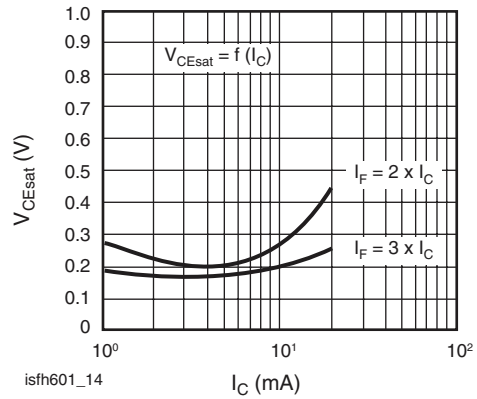


Fig. 14 - Saturation Voltage vs. Collector Current and Modulation Depth SFH601-2

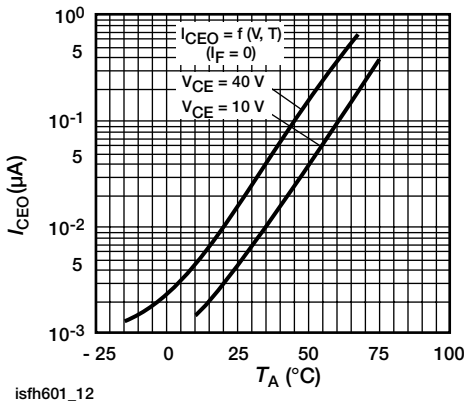


Fig. 12 - Collector Emitter Off-state Current

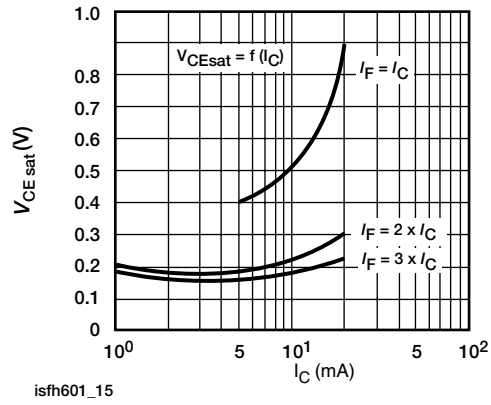


Fig. 15 - Saturation Voltage vs. Collector Current and Modulation Depth SFH601-3

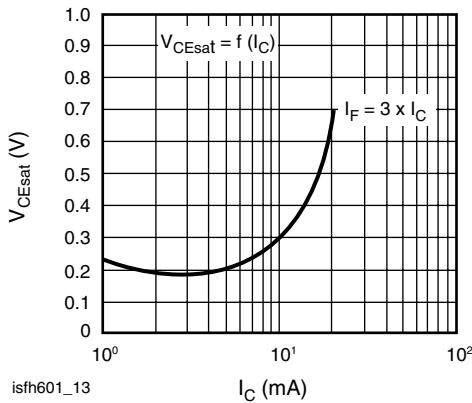


Fig. 13 - Saturation Voltage vs. Collector Current and Modulation Depth SFH601-1

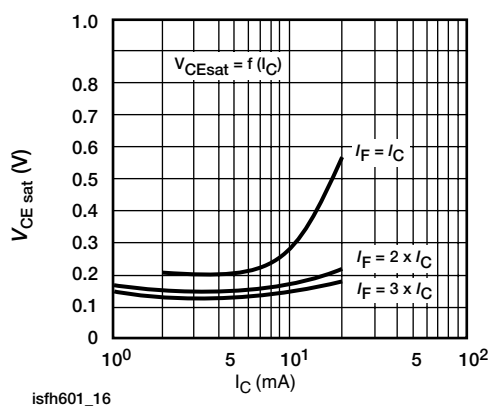
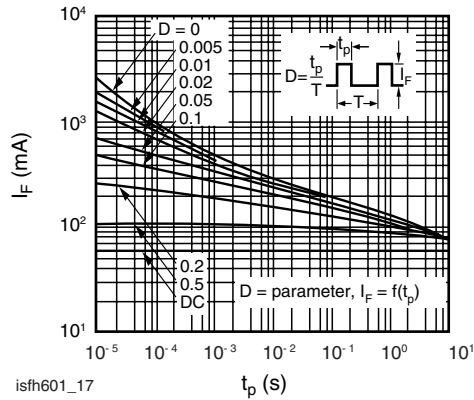
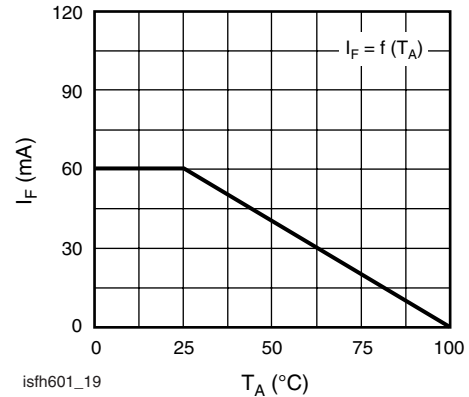


Fig. 16 - Saturation Voltage vs. Collector Current and Modulation Depth SFH601-4



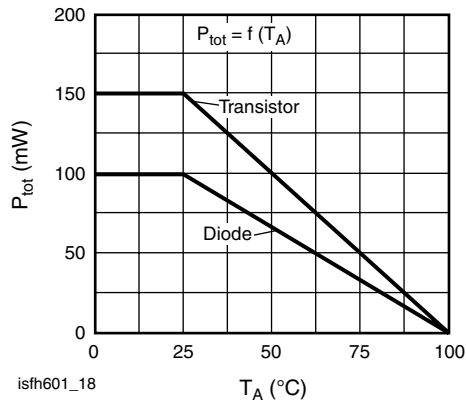
isfh601\_17

Fig. 17 - Permissible Pulse Load



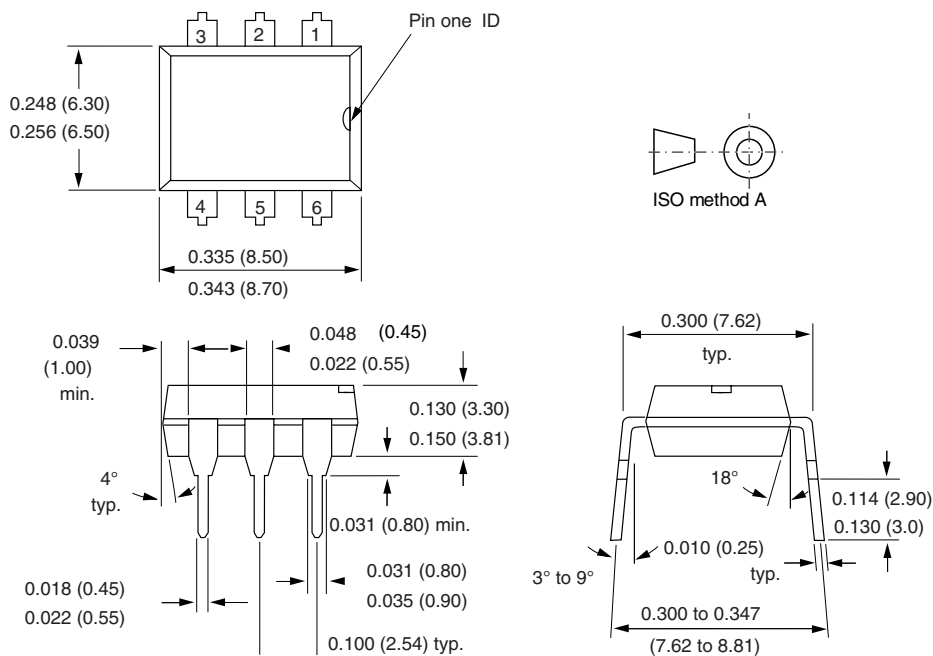
isfh601\_19

Fig. 19 - Permissible Forward Current Diode



isfh601\_18

Fig. 18 - Permissible Power Dissipation for Transistor and Diode

**PACKAGE DIMENSIONS** in inches (millimeters)


i178004

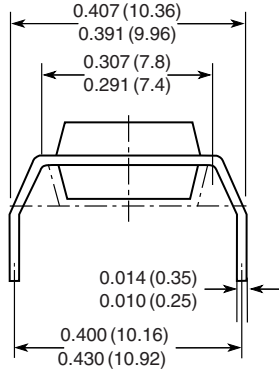
# SFH601

Vishay Semiconductors Optocoupler, Phototransistor  
Output, with Base Connection

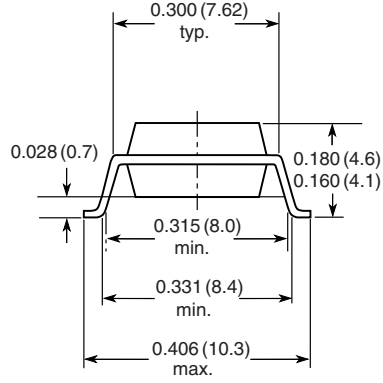


## PACKAGE DIMENSIONS in inches (millimeters)

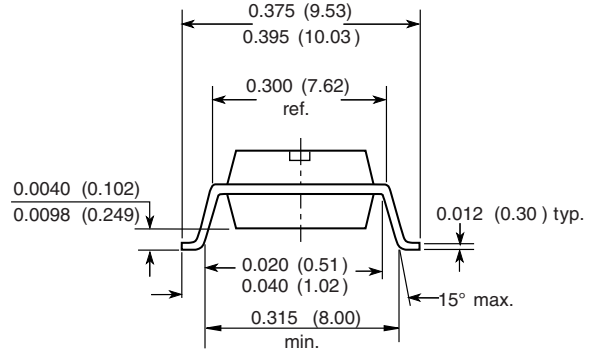
### Option 6



### Option 7



### Option 9



18450



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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.

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



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