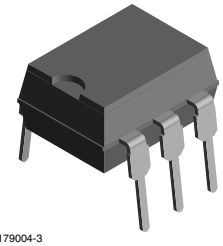
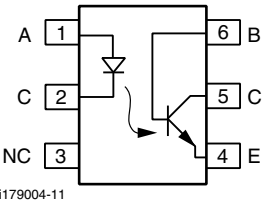
Optocoupler, Phototransistor Output, with Base Connection





FEATURES

- Isolation test voltage (1.0 s), 5300 V_{RMS}
- V_{CEsat} 0.25 (≤ 0.4) V, I_F = 10 mA, I_C = 2.5 mA
- Built to conform to VDE requirements
- Highest quality premium device
- Long term stability
- Storage temperature, - 55 ° to + 150 °C
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

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.

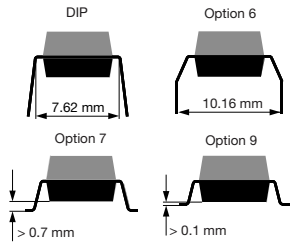
The coupler transmits signals between two electrically isolated circuits.

AGENCY APPROVALS

- UL1577, file no. E52744 system code H or J, double protection
- DIN EN 60747-5-5 (VDE 0884-5) available with option 1
- CSA 93751
- BSI IEC 60950; IEC 60065

ORDERING INFORMATION

S	F	H	6	0	1	-	#	X	0	#	#
PART NUMBER							CTR BIN	PACKAGE OPTION			



AGENCY CERTIFIED/PACKAGE	CTR (%)			
UL, BSI, CSA	**40 to 80**	**63 to 125**	**100 to 200**	**160 to 320**
DIP-6	SFH601-1	SFH601-2	SFH601-3	SFH601-4
DIP-6, 400 mil, option 6	SFH601-1X006	SFH601-2X006	SFH601-3X006	SFH601-4X006
SMD-6, option 7	SFH601-1X007	SFH601-2X007T	SFH601-3X007(T)	SFH601-4X007(T)
SMD-6, option 9	SFH601-1X009T	SFH601-2X009	SFH601-3X009	SFH601-4X009(T)
VDE, cUL, UL, BSI	**40 to 80**	**63 to 125**	**100 to 200**	**160 to 320**
DIP-6, option 1	SFH601-1X001	SFH601-2X001	-	SFH601-4X001
DIP-6, 400 mil, option 6	SFH601-1X016	-	SFH601-3X016	SFH601-4X016
SMD-6, option 7	SFH601-1X017	SFH601-2X017(T)	SFH601-3X017(T)	-
SMD-6, option 9	-	-	SFH601-3X019(T)	-

Note

- For additional information on the available options refer to option information.

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
INPUT				
Reverse voltage		V_R	6	V
DC forward current		I_F	60	mA
Surge forward current	t = 10 µs	I_{FSM}	2.5	A
Total power dissipation		P_{diss}	100	mW

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
OUTPUT				
Collector emitter voltage		V_{CEO}	100	V
Emitter base voltage		V_{EBO}	7	V
Collector current		I_C	50	mA
	t = 1.0 ms	I_C	100	mA
Power dissipation		P_{diss}	150	mW
COUPLER				
Isolation test voltage between emitter and detector	t = 1.0 s	V_{ISO}	5300	V_{RMS}
Isolation resistance	V_{IO} = 500 V, T_{amb} = 25 °C	R_{IO}	$\geq 10^{12}$	Ω
	V_{IO} = 500 V, T_{amb} = 100 °C	R_{IO}	$\geq 10^{11}$	Ω
Storage temperature range		T_{stg}	- 55 to + 150	°C
Ambient temperature range		T_{amb}	- 55 to +100	°C
Junction temperature		T_j	100	°C
Soldering temperature [1]	max. 10 s, dip soldering: distance to seating plane ≥ 1.5 mm	T_{sld}	260	°C

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.

(1) 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 (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT							
Forward voltage	I_F = 60 mA		V_F		1.25	1.65	V
Breakdown voltage	I_R = 10 µA		V_{BR}	6			V
Reverse current	V_R = 6 V		I_R		0.01	10	µA
Capacitance	V_F = 0 V, f = 1 MHz		C_O		25		pF
Thermal resistance			R_{thja}		750		K/W
OUTPUT							
Collector emitter capacitance	f = 1 mHz, V_{CE} = 5 V		C_{CE}		6.8		pF
Collector base capacitance	f = 1 mHz, V_{CB} = 5 V		C_{CB}		8.5		pF
Emitter base capacitance	f = 1 mHz, V_{EB} = 5 V		C_{EB}		11		pF
Thermal resistance			R_{thja}		500		K/W
Collector emitter leakage current	V_{CE} =10 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
COUPLER							
Saturation voltage collector emitter	I_F = 10 mA, I_C = 2.5 mA		V_{CEsat}		0.25	0.4	V
Capacitance (input to output)	V_{I-O} = 0, f = 1 MHz		C_{IO}		0.6		pF

Note

- 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 V	I_F = 10 mA	SFH601-1	CTR	40		80	%
		SFH601-2	CTR	63		125	%
		SFH601-3	CTR	100		200	%
		SFH601-4	CTR	160		320	%
	I_F = 1 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**
NON-SATURATED							
Current	V_{CC} = 5 V, R_L = 75 Ω		I_F		10		mA
Rise time	V_{CC} = 5 V, R_L = 75 Ω		t_r		2		µs
Fall time	V_{CC} = 5 V, R_L = 75 Ω		t_f		2		µs
Turn-on time	V_{CC} = 5 V, R_L = 75 Ω		t_{on}		3		µs
Turn-off time	V_{CC} = 5 V, R_L = 75 Ω		t_{off}		2.3		µs
SATURATED							
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		µs
		SFH601-2	t_r		3		µs
		SFH601-3	t_r		3		µs
		SFH601-4	t_r		4.6		µs
Fall time		SFH601-1	t_f		11		µs
		SFH601-2	t_f		14		µs
		SFH601-3	t_f		14		µs
		SFH601-4	t_f		15		µs
Turn-on time		SFH601-1	t_{on}		3		µs
		SFH601-2	t_{on}		4.2		µs
		SFH601-3	t_{on}		4.2		µs
		SFH601-4	t_{on}		6		µs
Turn-off time		SFH601-1	t_{off}		18		µs
		SFH601-2	t_{off}		23		µs
		SFH601-3	t_{off}		23		µs
		SFH601-4	t_{off}		25		µs

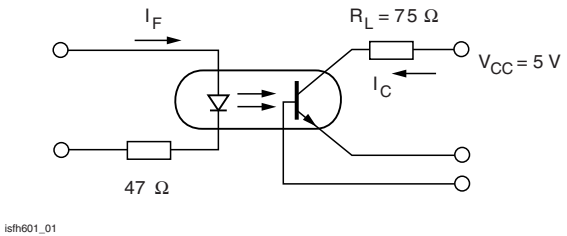


Fig. 1 - Linear Operation (without Saturation)

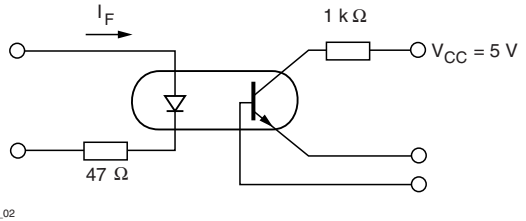


Fig. 2 - Switching Operation (with Saturation)

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 °C, unless otherwise specified)

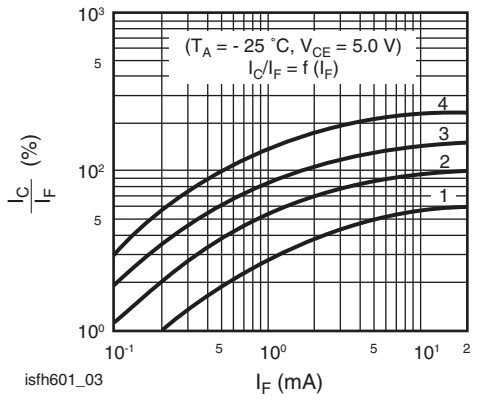


Fig. 3 - Current Transfer Ratio vs. Diode Current

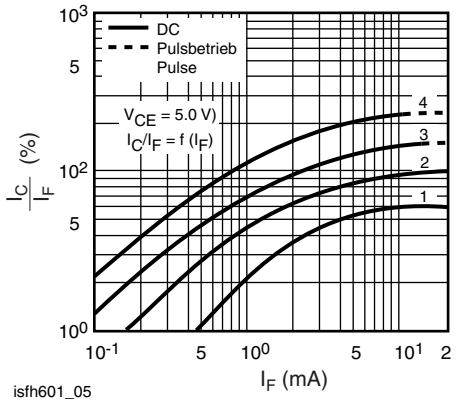


Fig. 5 - Current Transfer Ratio vs. Diode Current

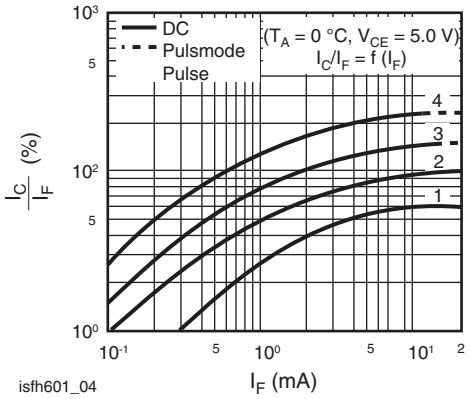


Fig. 4 - Current Transfer Ratio vs. Diode Current

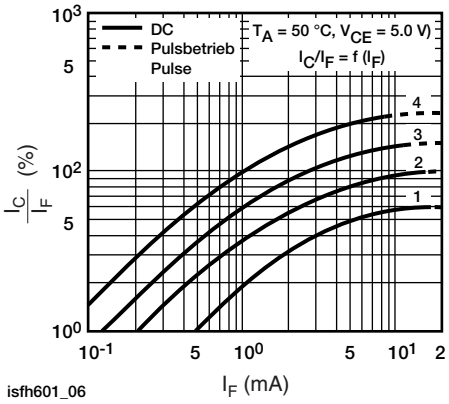


Fig. 6 - Current Transfer Ratio vs. Diode Current

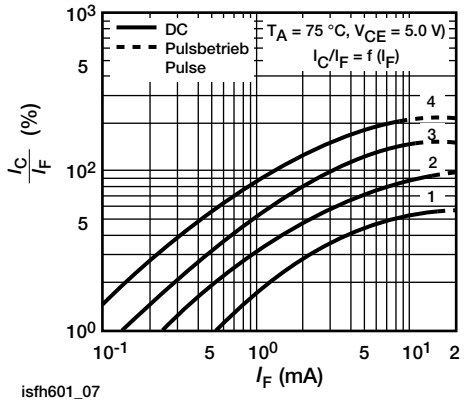


Fig. 7 - Current Transfer Ratio vs. Diode Current

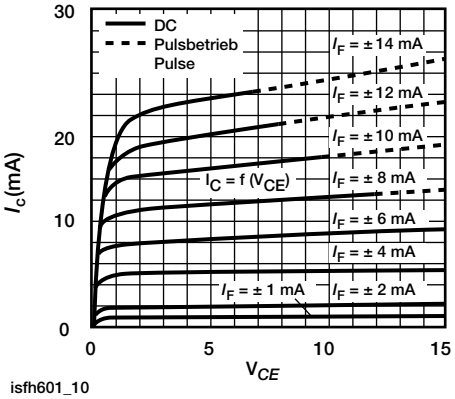


Fig. 10 - Output Characteristics

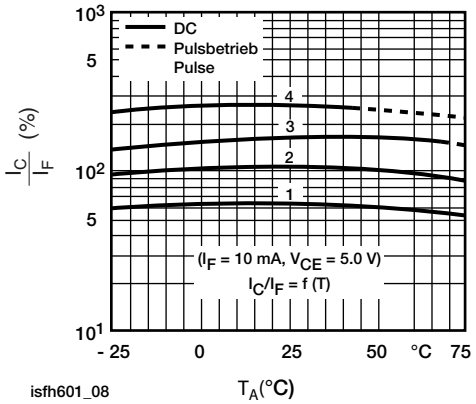


Fig. 8 - Current Transfer Ratio vs. Diode Current

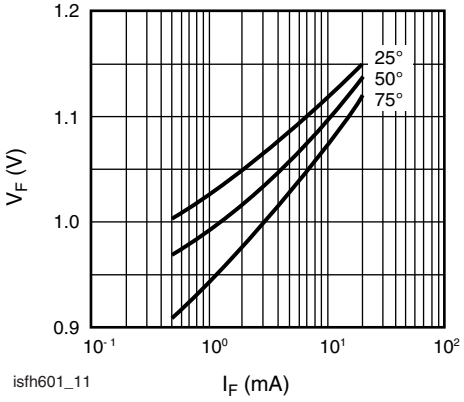


Fig. 11 - Forward Voltage

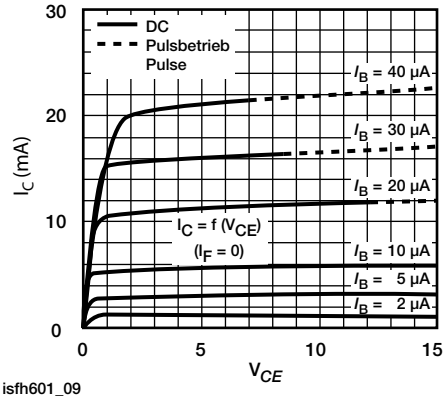


Fig. 9 - Transistor Characteristics

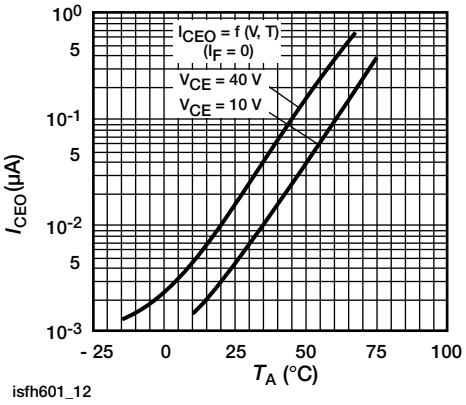


Fig. 12 - Collector Emitter Off-state Current

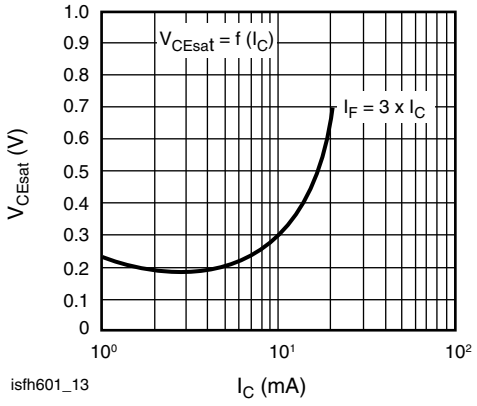


Fig. 13 - Saturation Voltage vs. Collector Current and Modulation Depth SFH601-1

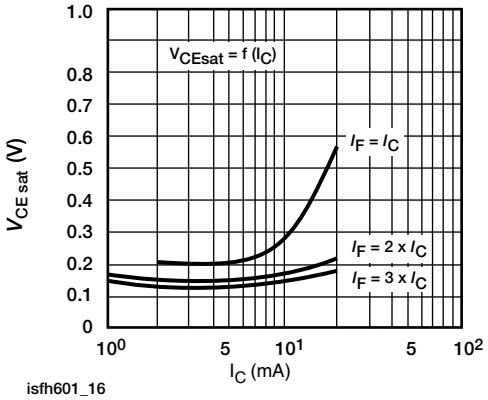


Fig. 16 - Saturation Voltage vs. Collector Current and Modulation Depth SFH601-4

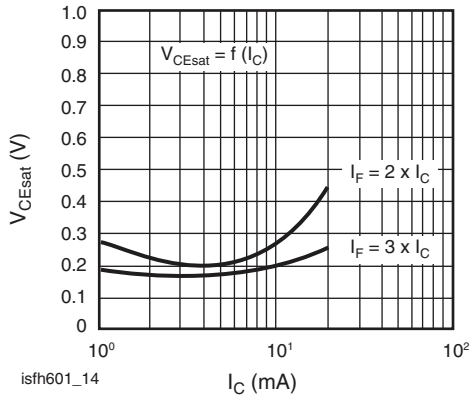


Fig. 14 - Saturation Voltage vs. Collector Current and Modulation Depth SFH601-2

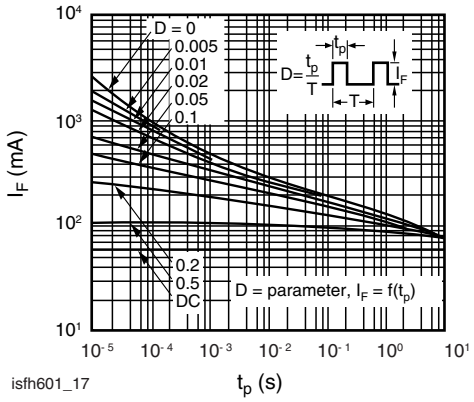


Fig. 17 - Permissible Pulse Load

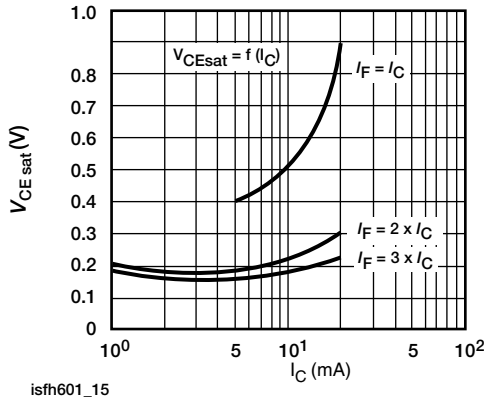


Fig. 15 - Saturation Voltage vs. Collector Current and Modulation Depth SFH601-3

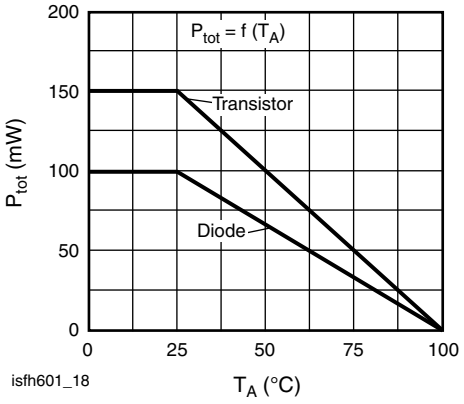


Fig. 18 - Permissible Power Dissipation for Transistor and Diode

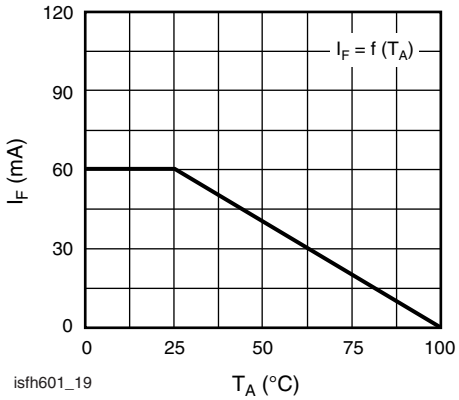
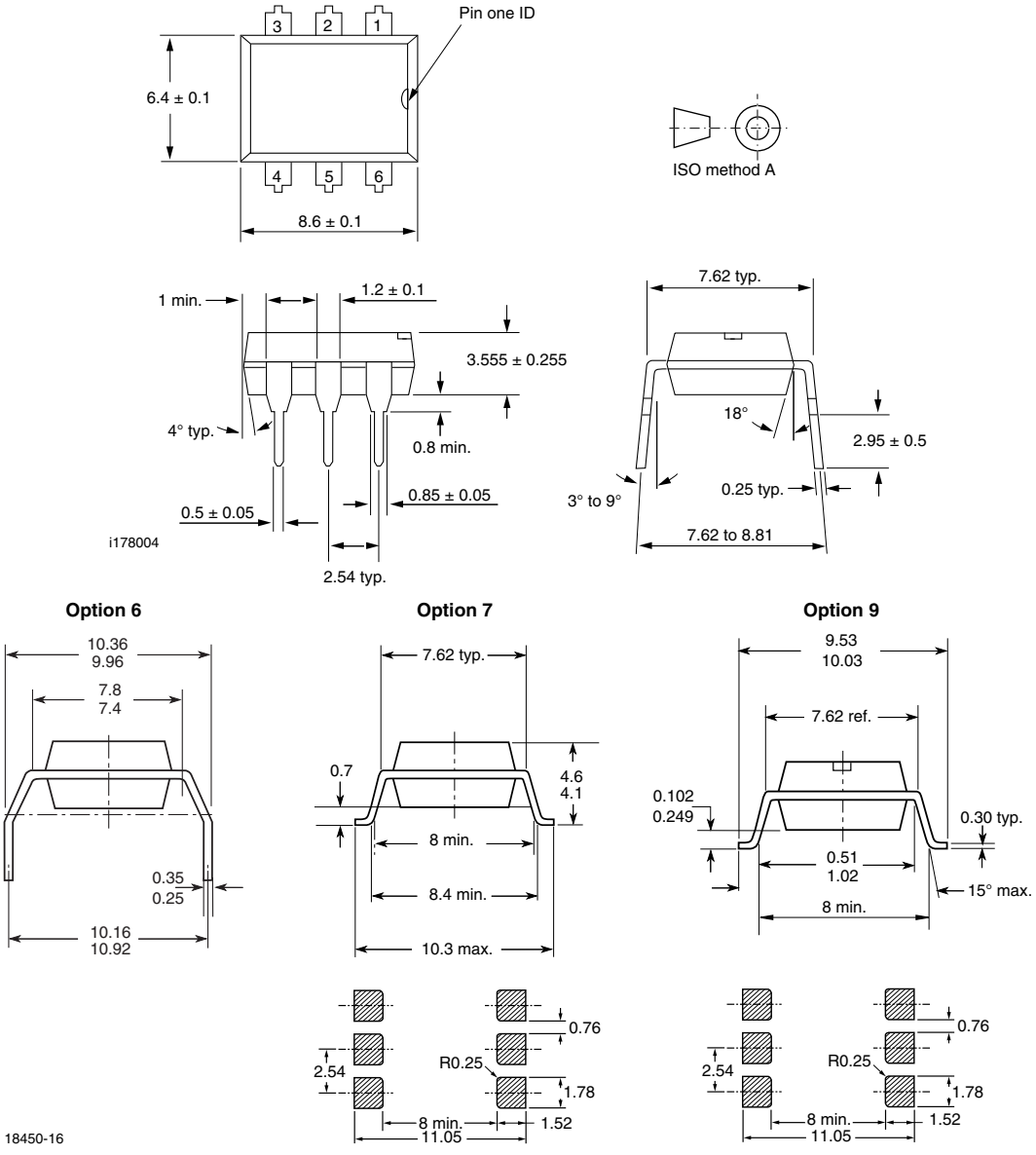


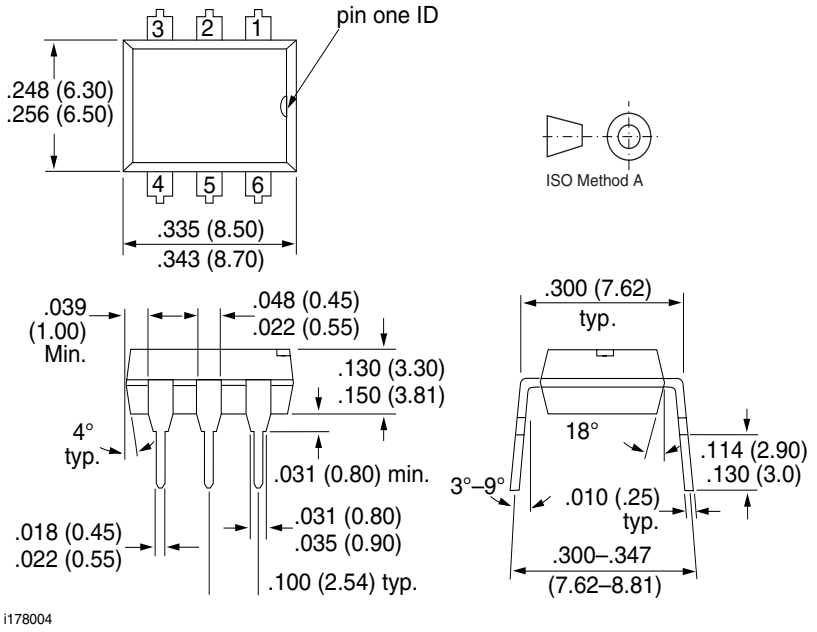
Fig. 19 - Permissible Forward Current Diode

PACKAGE DIMENSIONS in inches (millimeters)



DIP-6A

Package Dimensions in Inches (mm)



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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 operatingsystems 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.

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