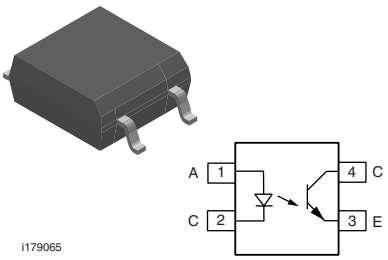
Optocoupler, Phototransistor Output, SOP-4, Mini-Flat Package, 110 °C Rated

Features

- Operating temperature from - 55 °C to + 110 °C
- SOP (Small Outline Package)
- Isolation Test Voltage, 3750 V_{RMS} (1.0 s)
- High Collector-Emitter Breakdown Voltage, V_{CEO} = 70 V
- Low Saturation Voltage
- Fast Switching Times
- Temperature Stable
- Low Coupling Capacitance
- End-Stackable, 0.100" (2.54 mm) Spacing
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



Agency Approvals

- UL File #E52744 System Code U
- CUL - File No. E52744, equivalent to CSA bulletin 5A
- DIN EN 60747-5-2(VDE0884) Available with Option 1

Applications

- High density mounting or space sensitive PCBs
- PLCs
- Telecommunication

Description

The 110 °C rated SFH1690AT/BT/CT/ABT family has a GaAs infrared emitting diode emitter, which is optically coupled to a silicon planar phototransistor detector, and is incorporated in a 4 pin 100 mil lead pitch miniflat package. It features a high current transfer ratio, low coupling capacitance, and high isolation voltage.

The coupling devices are designed for signal transmission between two electrically separated circuits. The SFH1690 series is available only on tape and reel. There are 2000 parts per reel. Marking for SFH1690AT is SFH690A; SFH1690BT is SFH690B; SFH1690CT is SFH690C; SFH1690ABT will be marked as SFH1690A or SFH1690B.

Order Information

Part	Remarks
SFH1690ABT	CTR 50 - 300 %, SOP-4
SFH1690AT	CTR 50 - 150 %, SOP-4
SFH1690BT	CTR 100 - 300 %, SOP-4
SFH1690CT	CTR 100 - 200 %, SOP-4

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

Absolute Maximum Ratings

T_{amb} = 25 °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
DC Forward current		I_F	50	mA
Reverse voltage		V_R	6.0	V
Surge forward current	$t_p \leq 10$ µs	I_{FSM}	2.5	A
Power dissipation		P_{diss}	80	mW
Derate linearly from 25 °C			0.7	mW/C°

Output

Parameter	Test condition	Symbol	Value	Unit
Collector-emitter voltage		V_{CE}	70	V
Emitter-collector voltage		V_{EC}	7.0	V
Collector current		I_C	50	mA
	$t_p \leq 1.0$ ms	I_C	100	mW
Power dissipation		P_{diss}	150	mW
Derate linearly from 25 °C			1.5	mW/C°

Coupler

Parameter	Test condition	Symbol	Value	Unit
Isolation test voltage between emitter and detector	t = 1.0 s	V_{ISO}	3750	V_{RMS}
Operating temperature range		T_{amb}	- 55 to + 110	°C
Storage temperature range		T_{stg}	- 55 to + 150	°C
Soldering temperature	max. 10 s Dip soldering distance to seating plane ≥ 1.5 mm	T_{sld}	260	°C

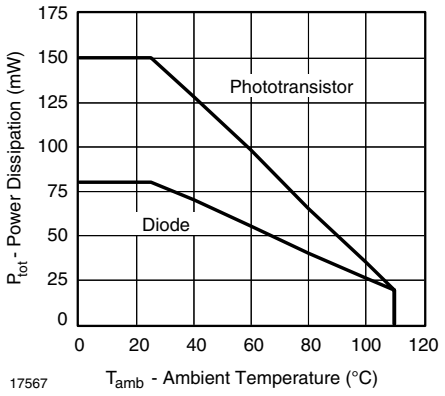


Figure 1. Permissible Power Dissipation vs. Temperature

Electrical Characteristics

T_{amb} = 25 °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 = 5 mA	V_F		1.15	1.4	V
Reverse current	V_R = 6.0 V	I_R		0.01	10	µA
Capacitance	V_R = 0.0 V, f = 1.0 MHz	C_I		14		pF

Output

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Collector-emitter leakage current	V_{CE} = 20 V	I_{CEO}			100	nA
Collector-emitter breakdown voltage	I_C = 100 µA	BV_{CEO}	70			V
Emitter-collector breakdown voltage	I_E = -10 µA	BV_{ECO}	70			V
Collector-emitter saturation voltage	I_F = 10 mA, I_C = 2.5 mA	V_{CEsat}		0.25	0.40	V
Collector-emitter capacitance	V_{CE} = 5.0 V, f = 1.0 MHz	C_{CE}		2.8		pF

Coupler

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
I_C/I_F	I_F = 5.0 mA, V_{CE} = 5.0 V	SFH1690ABT	CTR	50		300	%
		SFH1690AT	CTR	50		150	%
		SFH1690BT	CTR	100		300	%
		SFH1690CT	CTR	100		200	%
Coupling capacitance	f = 1.0 MHz		C_C		0.3		pF
Capacitance (input-output)			C_{IO}		0.5		pF

Switching Characteristics

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Rise time	I_C = 2.0 mA, V_{CC} = 5.0 V, R_L = 100 Ω	t_r		3.0		µs
Fall time	I_C = 2.0 mA, V_{CC} = 5.0 V, R_L = 100 Ω	t_f		4.0		µs
Turn-on time	I_C = 2.0 mA, V_{CC} = 5.0 V, R_L = 100 Ω	t_{on}		5.0		µs
Turn-off time	I_C = 2.0 mA, V_{CC} = 5.0 V, R_L = 100 Ω	t_{off}		3.0		µs

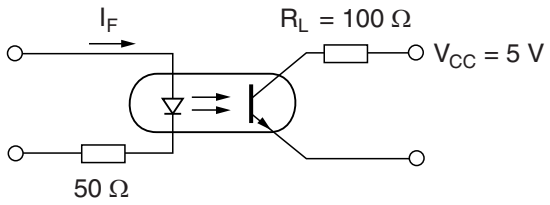


Figure 2. Switching Operation (without Saturation)

Safety and Insulation Ratings

As per IEC60747-5-2 §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.

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Climatic Classification (according to IEC 68 part 1)				55/110/21		
Polution Degree (DIN VDE 0109)				2.0		mm
Comparative tracking index per DIN IEC112/VDE 0303 part 1, group IIIa per DIN VDE 6110 175 399			175		399	
V_{IOTM}		V_{IOTM}	6000			V
V_{IORM}		V_{IORM}	707			V
Isolation resistance	V_{IO} = 500 V, T_{amb} = 25 °C	R_{IO}			≥ 10^{12}	Ω
	V_{IO} = 500 V, T_{amb} = 100 °C	R_{IO}			≥ 10^{11}	Ω
P_{SO}					350	mW
I_{SI}					150	mA
T_{SI}					165	°C
Creepage			5.0			mm
Clearance			5.0			mm
Insulation thickness between emitter and detector			≥ 0.4			mm

Typical Characteristics

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

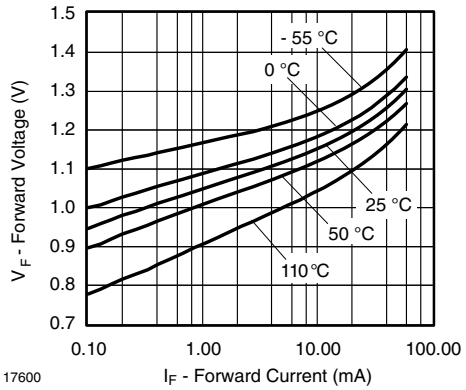


Figure 3. Forward Voltage vs. Forward Current

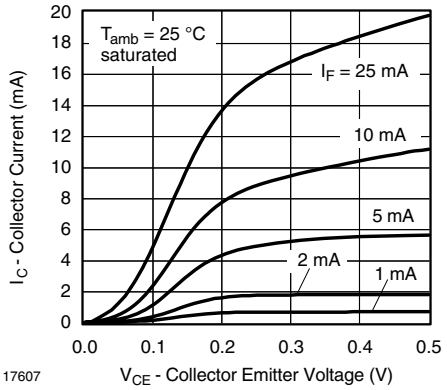


Figure 6. Collector Current vs. Collector Emitter Voltage

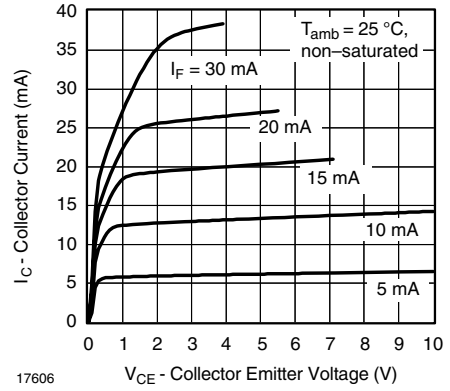


Figure 4. Collector Current vs. Collector Emitter Voltage

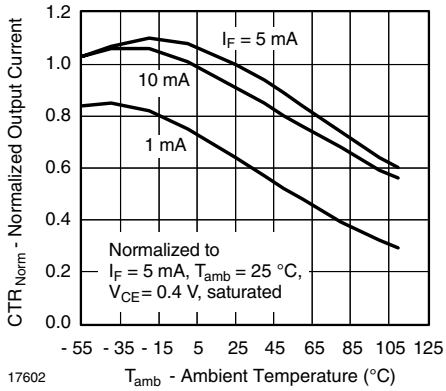


Figure 7. Normalized Current Transfer Ratio vs. Ambient Temperature

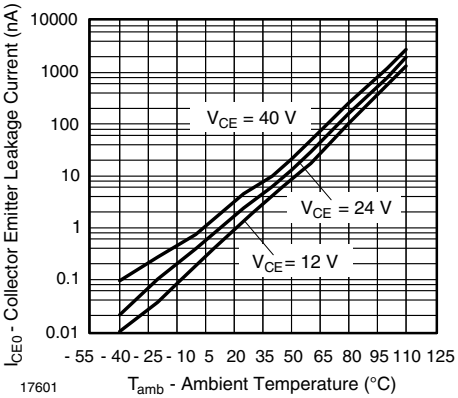


Figure 5. Collector-Emitter Dark Current vs. Ambient Temperature

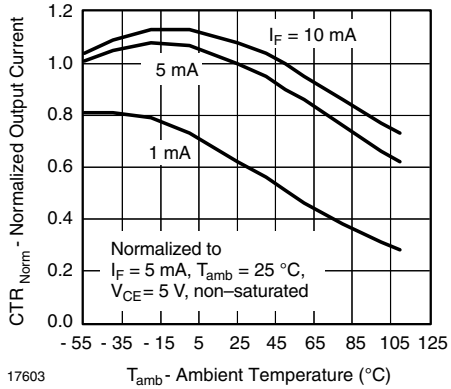


Figure 8. Normalized Current Transfer Ratio vs. Ambient Temperature

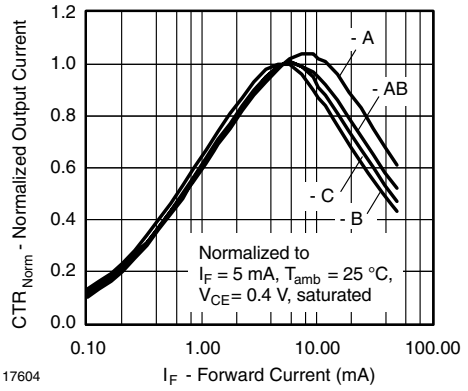


Figure 9. Normalized CTR vs. Forward Current

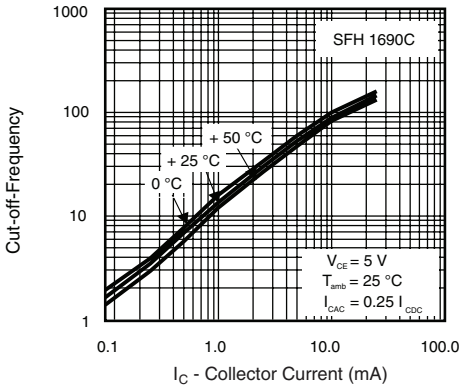


Figure 12. Cut-off-Frequency (- 3 dB) vs. Collector Current

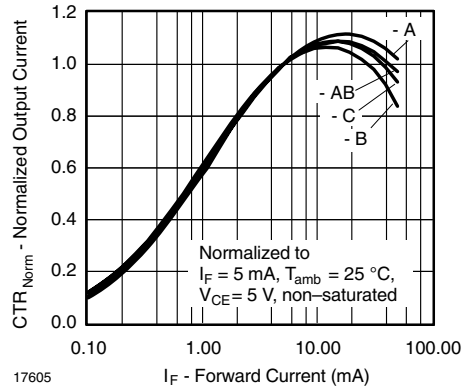


Figure 10. Normalized CTR vs. Forward Current

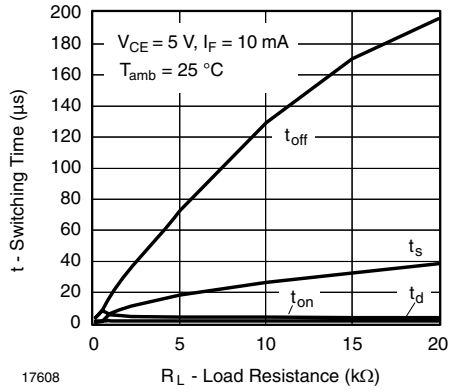
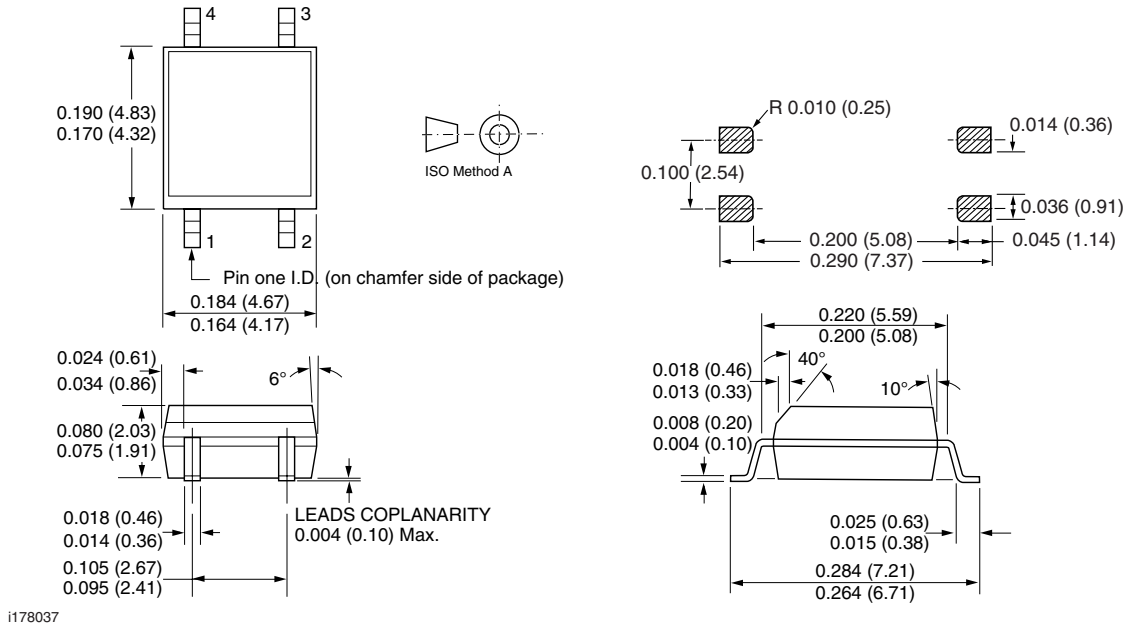


Figure 11. Switching Time vs. Load Resistance

Package Dimensions in Inches (mm)



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.

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

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