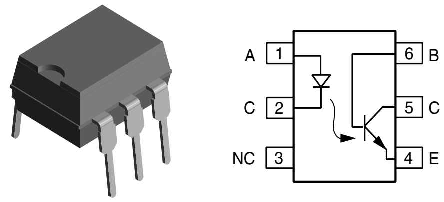
Optocoupler, Phototransistor Output, With Base Connection

Features

- Current Transfer Ratio (see order information)
- Isolation Test Voltage 5300 V_{RMS}
- Lead-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



i179004

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

Description

The IL1/ IL2/ IL5 are optically coupled isolated pairs employing GaAs infrared LEDs and silicon NPN phototransistor. Signal information, including a DC level, can be transmitted by the drive while maintaining a high degree of electrical isolation between input and output. The IL1/ IL2/ IL5 are especially designed for driving medium-speed logic and can be used to eliminate troublesome ground loop and noise problems These couplers can be used also to replace relays and transformers in many digital interface applications such as CRT modulation.

Order Information

Part	Remarks
IL1	CTR > 20 %, DIP-6
IL2	CTR > 100 %, DIP-6
IL5	CTR > 50 %, DIP-6
IL1-X006	CTR > 20 %, DIP-6 400 mil (option 6)
IL2-X006	CTR > 100 %, DIP-6 400 mil (option 6)
IL2-X009	CTR > 100 %, SMD-6 (option 9)
IL5-X009	CTR > 50 %, SMD-6 (option 9)

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
Reverse voltage		V_R	6.0	V
Forward current		I_F	60	mA
Surge current		I_{FSM}	2.5	A
Power dissipation		P_{diss}	100	mW
Derate linearly from 25 °C			1.33	mW/°C

Output

Parameter	Test condition	Part	Symbol	Value	Unit
Collector-emitter breakdown voltage		IL1	BV_{CEO}	50	V
		IL2	BV_{CEO}	70	V
		IL5	BV_{CEO}	70	V
Emitter-base breakdown voltage			BV_{EBO}	7.0	V
Collector-base breakdown voltage			BV_{CBO}	70	V
Collector current			I_C	50	mA
	t < 1.0 ms		I_C	400	mA
Power dissipation			P_{diss}	200	mW
Derate linearly from 25 °C				2.6	mW/°C

Coupler

Parameter	Test condition	Symbol	Value	Unit
Package power dissipation		P_{tot}	250	mW
Derate linearly from 25 °C			3.3	mW/°C
Isolation test voltage (between emitter and detector referred to standard climate 23 °/50 %RH, DIN 50014)		V_{ISO}	5300	V_{RMS}
Creepage			≥ 7.0	mm
Clearance			≥ 7.0	mm
Comparative tracking index per DIN IEC 112/VDE 0303, part 1			175	
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		T_{stg}	- 40 to + 150	°C
Operating temperature		T_{amb}	- 40 to + 100	°C
Junction temperature		T_j	100	°C
Soldering temperature	2.0 mm from case bottom	T_{sld}	260	°C

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 = 60 mA	V_F		1.25	1.65	V
Breakdown voltage	I_R = 10 μA	V_{BR}	6.0	30		V
Reverse current	V_R = 6.0 V	I_R		0.01	10	μA
Capacitance	V_R = 0 V, f = 1.0 MHz	C_O		40		pF
Thermal resistance junction to lead		R_{thjl}		750		K/W

Output

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Collector-emitter capacitance	V_{CE} = 5.0 V, f = 1.0 MHz	C_{CE}		6.8		pF
Collector - base capacitance	V_{CB} = 5.0 V, f = 1.0 MHz	C_{CB}		8.5		pF
Emitter - base capacitance	V_{EB} = 5.0 V, f = 1.0 MHz	C_{EB}		11		pF
Collector-emitter leakage current	V_{CE} = 10 V	I_{CEO}		5.0	50	nA
Collector-emitter saturation voltage	I_{CE} = 1.0 mA, I_B = 20 μA	V_{CESAT}		0.25		V
Base-emitter voltage	V_{CE} = 10 V, I_B = 20 μA	V_{BE}		0.65		V
DC forward current gain	V_{CE} = 10 V, I_B = 20 μA	HFE	200	650	1800	
DC forward current gain saturated	V_{CE} = 0.4 V, I_B = 20 μA	HFE_{sat}	120	400	600	
Thermal resistance junction to lead		R_{thjl}		500		K/W

Coupler

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Capacitance (input-output)	V_{I-O} = 0 V, f = 1.0 MHz	C_{IO}		0.6		pF
Insulation resistance	V_{I-O} = 500 V	R_S		10^{14}		Ω

Current Transfer Ratio

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Current Transfer Ratio (collector-emitter saturated)	I_F = 10 mA, V_{CE} = 0.4 V	IL1	CTR_{CEsat}		75		%
		IL2	CTR_{CEsat}		170		%
		IL5	CTR_{CEsat}		100		%
Current Transfer Ratio (collector-emitter)	I_F = 10 mA, V_{CE} = 10 V	IL1	CTR_{CE}	20	80	300	%
		IL2	CTR_{CE}	100	200	500	%
		IL5	CTR_{CE}	50	130	400	%
Current Transfer Ratio (collector-base)	I_F = 10 mA, V_{CB} = 9.3 V	IL1	CTR_{CB}		0.25		%
		IL2	CTR_{CB}		0.25		%
		IL5	CTR_{CB}		0.25		%

Switching Non-saturated

Parameter	Current	Delay	Rise time	Storage	Fall time	Propagation H-L	Propagation L-H
Test condition	V_{CE} = 5.0 V, R_L = 75 Ω, t_P measured at 50 % of output						
Symbol	I_F	t_D	t_r	t_S	t_f	t_{PHL}	t_{PLH}
Unit	mA	μs	μs	μs	μs	μs	μs
IL1	20	0.8	1.9	0.2	1.4	0.7	1.4
IL2	4.0	1.7	2.6	0.4	2.2	1.2	2.3
IL5	10	1.7	2.6	0.4	2.2	1.1	2.5

Switching Saturated

Parameter	Current	Delay	Rise time	Storage	Fall time	Propagation H-L	Propagation L-H
Test condition	V_{CE} = 0.4 V, R_L = 1.0 kΩ, V_{CL} = 5.0 V, V_{TH} = 1.5 V						
Symbol	I_F	t_D	t_r	t_S	t_f	t_{PHL}	t_{PLH}
Unit	mA	µs	µs	µs	µs	µs	µs
IL1	20	0.8	1.2	7.4	7.6	1.6	8.6
IL2	5.0	1.0	2.0	5.4	13.5	5.4	7.4
IL5	10	1.7	7.0	4.6	20	2.6	7.2

Common Mode Transient Immunity

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Common mode rejection output high	V_{CM} = 50 V_{P-P}, R_L = 1 kΩ, I_F = 10 mA	$\| CM_H \|$		5000		V/µs
Common mode rejection output low	V_{CM} = 50 V_{P-P}, R_L = 1 kΩ, I_F = 10 mA	$\| CM_L \|$		5000		V/µs
Common mode coupling capacitance		C_{CM}		0.01		pF

Typical Characteristics (Tamb = 25 °C unless otherwise specified)

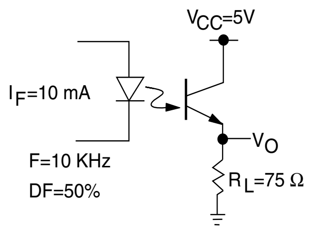


Figure 1. Non-saturated Switching Schematic

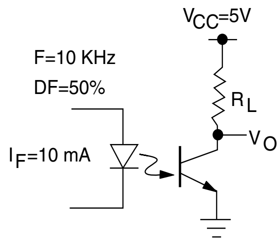


Figure 2. Saturated Switching Schematic

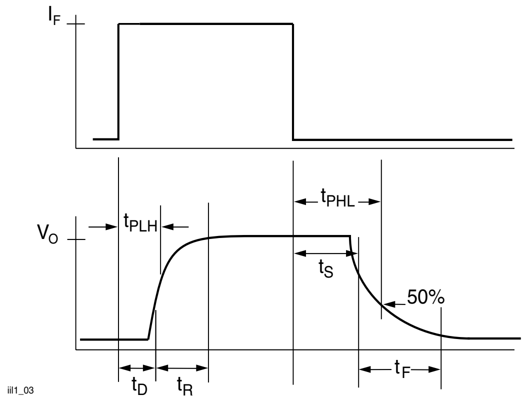


Figure 3. Non-saturated Switching Timing

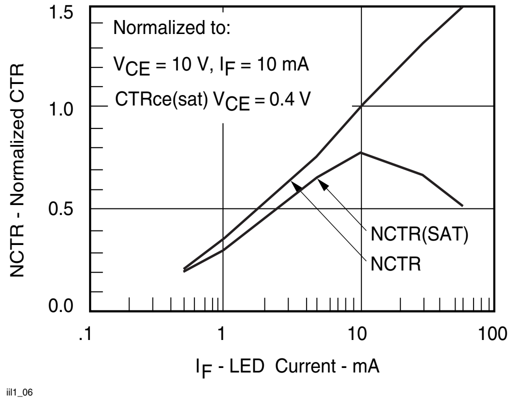


Figure 6. Normalized Non-Saturated and Saturated CTR vs. LED Current

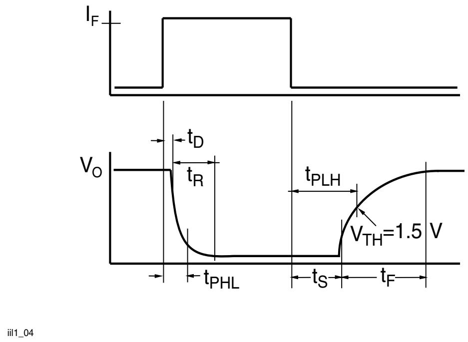


Figure 4. Saturated Switching Timing

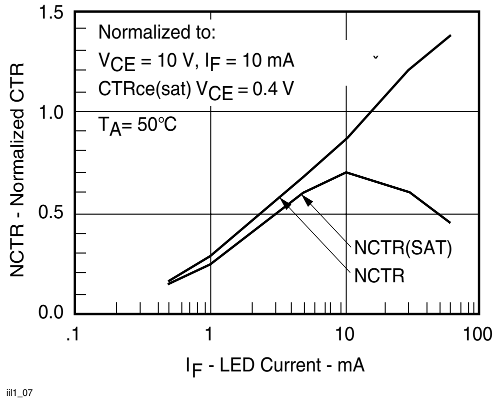


Figure 7. Normalized Non-saturated and Saturated CTR vs. LED Current

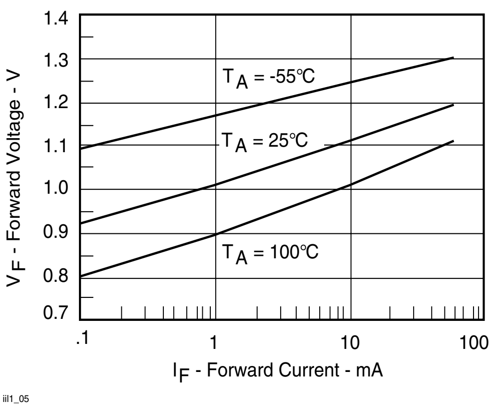


Figure 5. Forward Voltage vs. Forward Current

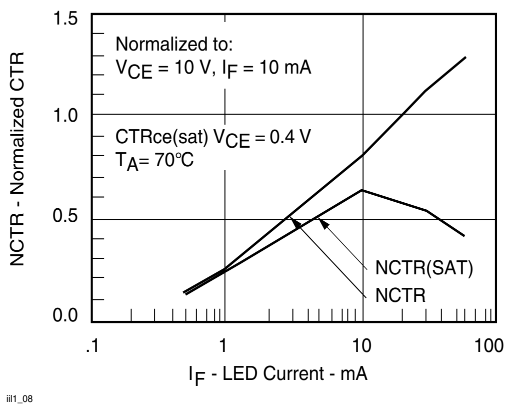


Figure 8. Normalized Non-saturated and saturated CTR vs. LED Current

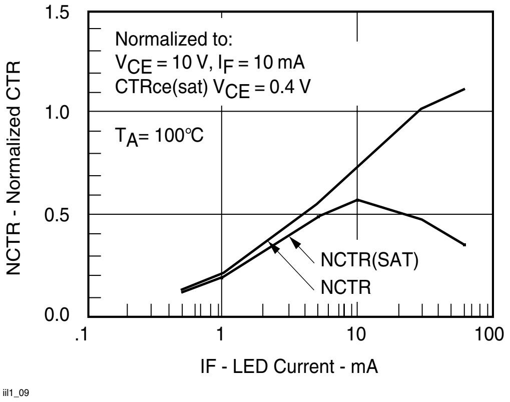


Figure 9. Normalized Non-Saturated and Saturated CTR, T_A = 100 °C vs. LED Current

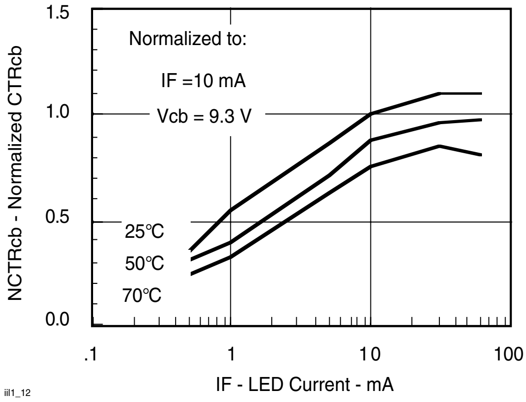


Figure 12. Normalized CTR_{cb} vs. LED Current and Temperature

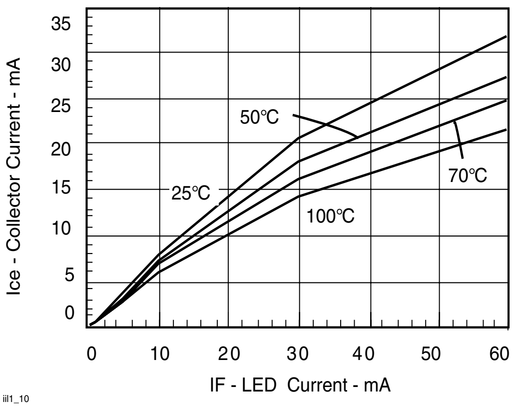


Figure 10. Collector-Emitter Current vs. Temperature and LED Current

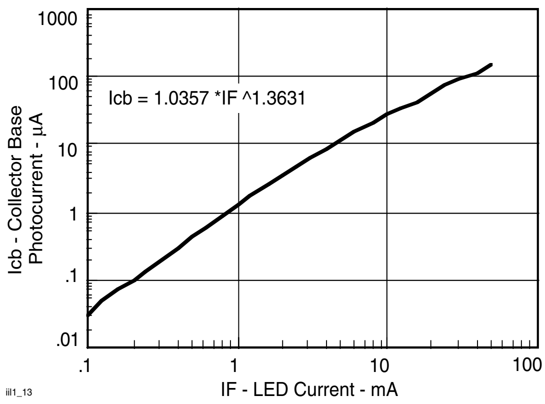


Figure 13. Collector-Base Photocurrent vs. LED Current

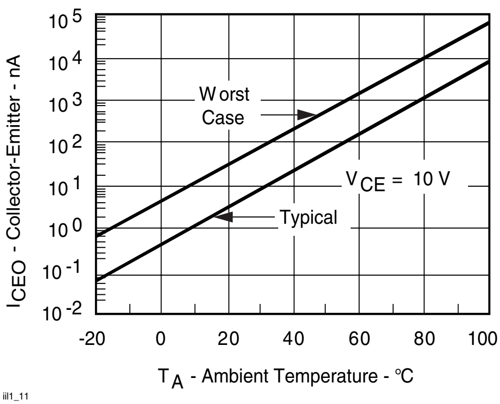


Figure 11. Collector-Emitter Leakage Current vs.Temp.

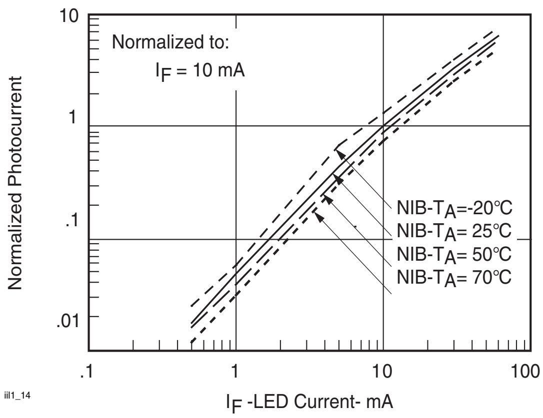


Figure 14. Normalized Photocurrent vs. I_F and Temp.

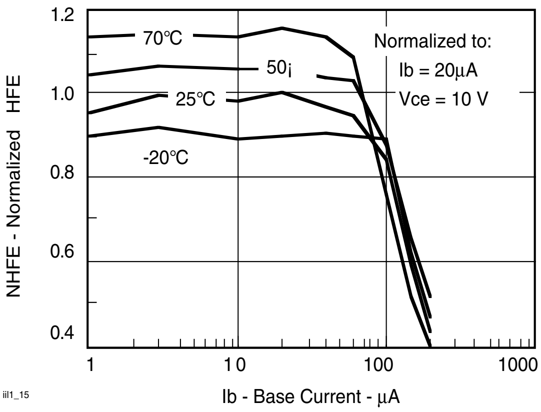


Figure 15. Normalized Non-saturated HFE vs. Base Current and Temperature

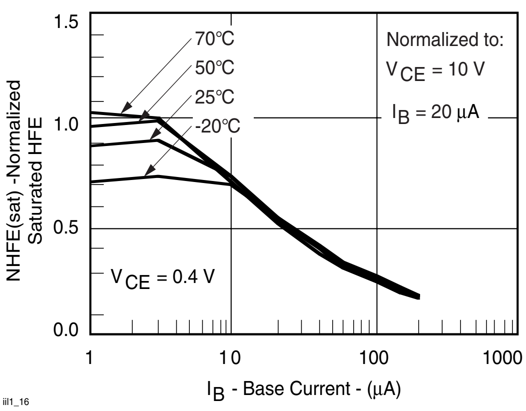


Figure 16. Normalized Saturated HFE vs. Base Current and Temperature

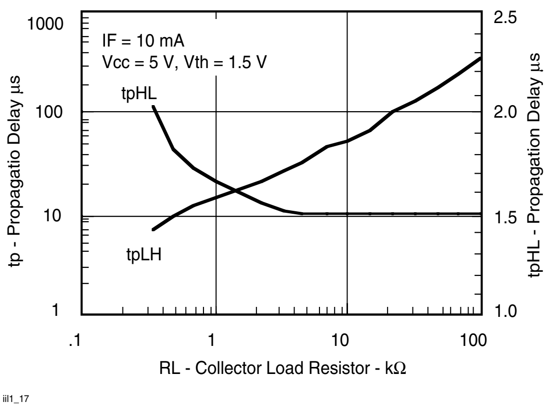
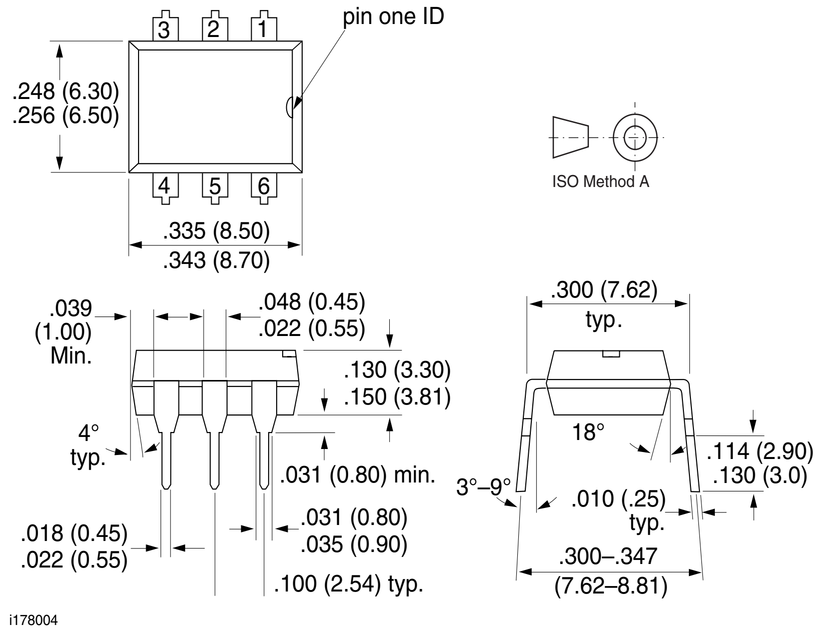
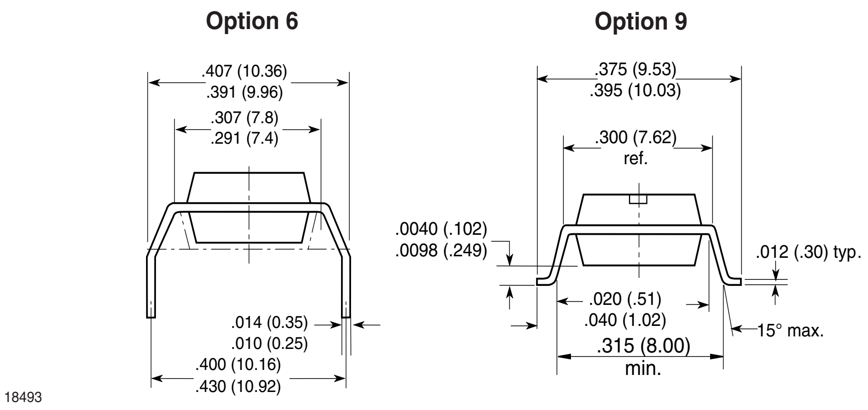


Figure 17. Propagation Delay vs. Collector Load Resistor

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 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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