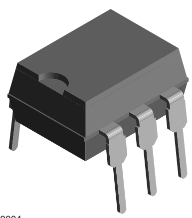
Optocoupler, Phototransistor Output, with Base Connection



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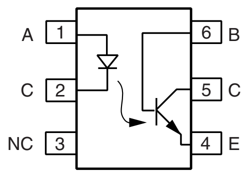

DESCRIPTION

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.

FEATURES

- Current transfer ratio (see order information)
- Isolation test voltage 5300 V_{RMS}
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

AGENCY APPROVALS

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

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)

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

ABSOLUTE MAXIMUM RATINGS (1)

PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT
INPUT					
Reverse voltage			V_R	6	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					
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	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

For technical questions, contact: optocoupler.answers@vishay.com
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ABSOLUTE MAXIMUM RATINGS (1)					
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**VALUE**	**UNIT**
COUPLER					
Package power dissipation			P_{tot}	250	mW
Derate linearly from 25 °C				3.3	mW/°C
Isolation test voltage between emitter and detector			V_{ISO}	5300	V_{RMS}
Creepage distance				≥ 7	mm
Clearance distance				≥ 7	mm
Comparative tracking index per DIN IEC 112/VDE 0303, part 1			CTI	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)	2.0 mm from case bottom		T_{sld}	260	°C

Notes

(1) 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 ratings for extended periods of the time can adversely affect reliability.

(2) 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**	**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	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						
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 voltage	V_{CE} = 10 V	I_{CEO}		5	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	h_{FE}	200	650	1800	
DC forward current gain saturated	V_{CE} = 0.4 V, I_B = 20 µA	h_{FEsat}	120	400	600	
Thermal resistance junction to lead		R_{thjl}		500		K/W
COUPLER						
Capacitance (input to 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

Note

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.

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 CHARACTERISTICS							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
NON-SATURATED							
Current time	V_{CE} = 5 V, R_L = 75 Ω, t_P measured at 50 % of output	IL1	I_F		20		mA
		IL2			4		
		IL5			10		
Delay time	V_{CE} = 5 V, R_L = 75 Ω, t_P measured at 50 % of output	IL1	t_D		0.8		µs
		IL2			1.7		
		IL5			1.7		
Rise time	V_{CE} = 5 V, R_L = 75 Ω, t_P measured at 50 % of output	IL1	t_r		1.9		µs
		IL2			2.6		
		IL5			2.6		
Storage time	V_{CE} = 5 V, R_L = 75 Ω, t_P measured at 50 % of output	IL1	t_s		0.2		µs
		IL2			0.4		
		IL5			0.4		
Fall time	V_{CE} = 5 V, R_L = 75 Ω, t_P measured at 50 % of output	IL1	t_f		1.4		µs
		IL2			2.2		
		IL5			2.2		
Propagation H to L	V_{CE} = 5 V, R_L = 75 Ω, t_P measured at 50 % of output	IL1	t_{PHL}		0.7		µs
		IL2			1.2		
		IL5			1.1		
Propagation L to H	V_{CE} = 5 V, R_L = 75 Ω, t_P measured at 50 % of output	IL1	t_{PLH}		1.4		µs
		IL2			2.3		
		IL5			2.5		
SATURATED							
Current time	V_{CE} = 0.4 V, R_L = 1.0 kΩ, V_{CL} = 5 V, V_{TH} = 1.5 V	IL1	I_F		20		mA
		IL2			5		
		IL5			10		
Delay time	V_{CE} = 0.4 V, R_L = 1.0 kΩ, V_{CL} = 5 V, V_{TH} = 1.5 V	IL1	t_D		0.8		µs
		IL2			1		
		IL5			1.7		
Rise time	V_{CE} = 0.4 V, R_L = 1.0 kΩ, V_{CL} = 5 V, V_{TH} = 1.5 V	IL1	t_r		1.2		µs
		IL2			2		
		IL5			7		
Storage time	V_{CE} = 0.4 V, R_L = 1.0 kΩ, V_{CL} = 5 V, V_{TH} = 1.5 V	IL1	t_S		7.4		µs
		IL2			5.4		
		IL5			4.6		

SWITCHING CHARACTERISTICS							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
SATURATED							
Fall time	V_{CE} = 0.4 V, R_L = 1.0 kΩ, V_{CL} = 5 V, V_{TH} = 1.5 V	IL1	t_f		7.6		µs
		IL2			13.5		
		IL5			20		
Propagation H to L	V_{CE} = 0.4 V, R_L = 1.0 kΩ, V_{CL} = 5 V, V_{TH} = 1.5 V	IL1	t_{PHL}		1.6		µs
		IL2			5.4		
		IL5			2.6		
Propagation L to H	V_{CE} = 0.4 V, R_L = 1.0 kΩ, V_{CL} = 5 V, V_{TH} = 1.5 V	IL1	t_{PLH}		8.6		µs
		IL2			7.4		
		IL5			7.2		

COMMON MODE TRANSIENT IMMUNITY							
PARAMETER	TEST CONDITION	PART	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

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

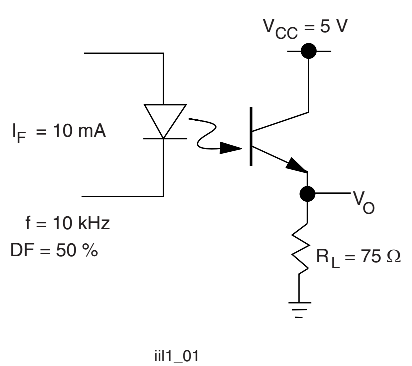


Fig. 1 - Non-Saturated Switching Schematic

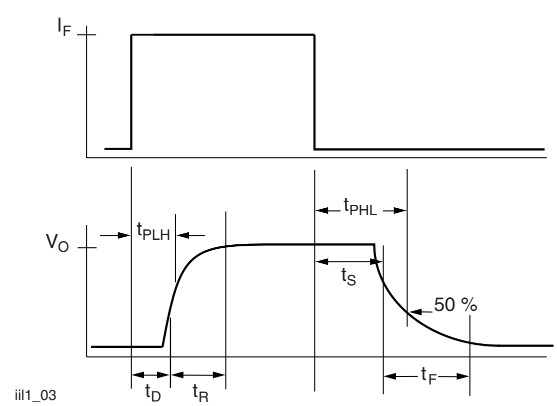


Fig. 3 - Non-Saturated Switching Timing

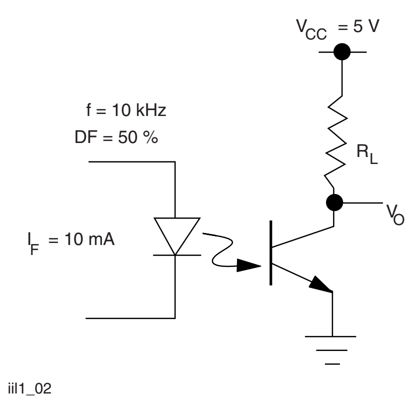


Fig. 2 - Saturated Switching Schematic

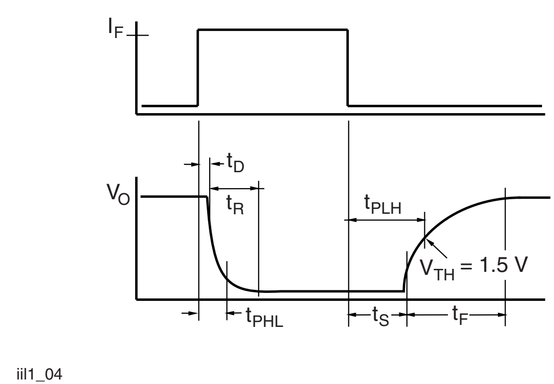


Fig. 4 - Saturated Switching Timing

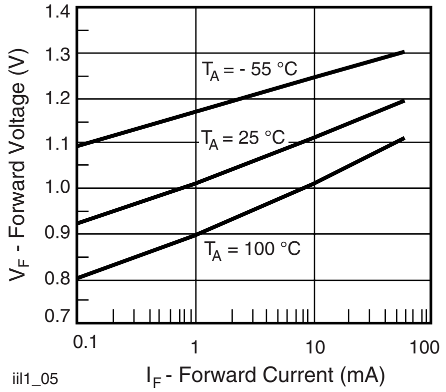


Fig. 5 - Forward Voltage vs. Forward Current

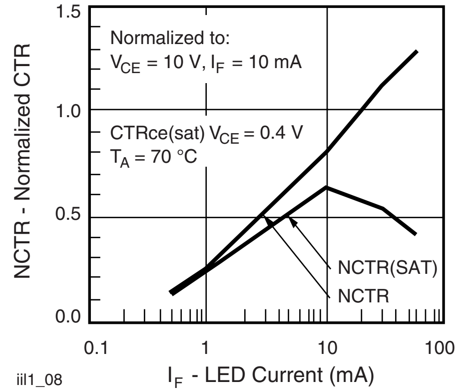


Fig. 8 - Normalized Non-Saturated and Saturated CTR vs. LED Current

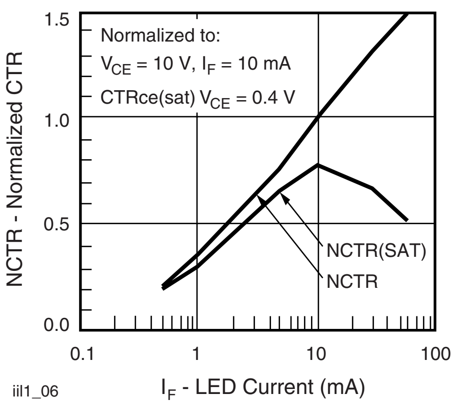


Fig. 6 - Normalized Non-Saturated and Saturated CTR vs. LED Current

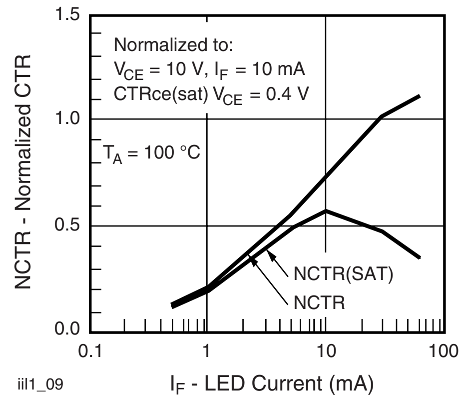


Fig. 9 - Normalized Non-Saturated and Saturated CTR, T_{amb} = 100 °C vs. LED Current

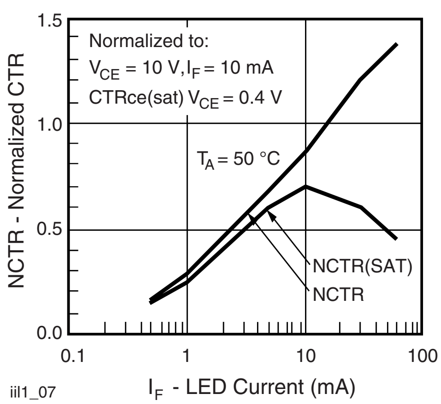


Fig. 7 - Normalized Non-Saturated and Saturated CTR vs. LED Current

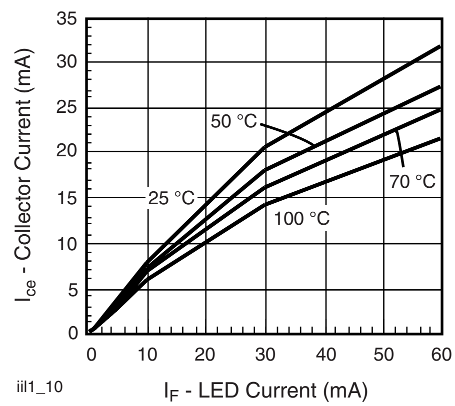


Fig. 10 - Collector Emitter Current vs. Temperature and LED Current

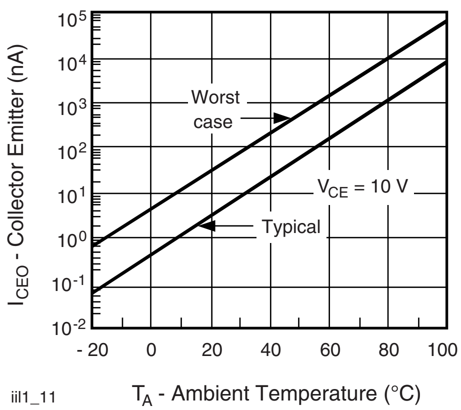


Fig. 11 - Collector Emitter Leakage Current vs.Temperature

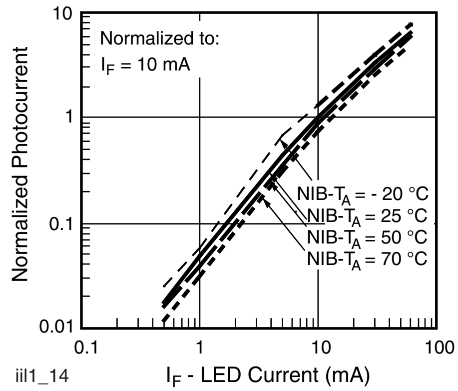


Fig. 14 - Normalized Photocurrent vs. I_F and Temperature

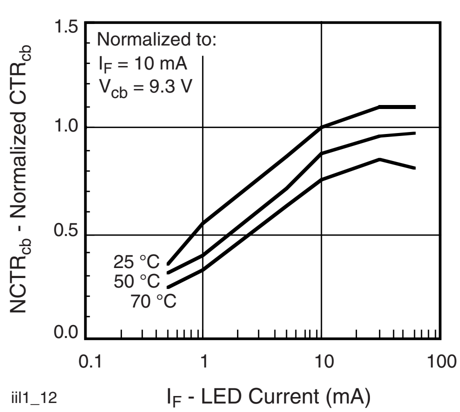


Fig. 12 - Normalized CTR_{cb} vs. LED Current and Temperature

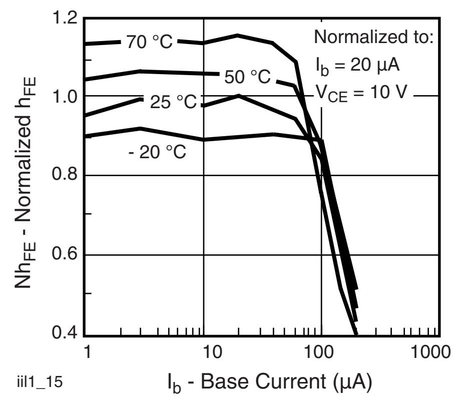


Fig. 15 - Normalized Non-Saturated h_{FE} vs. Base Current and Temperature

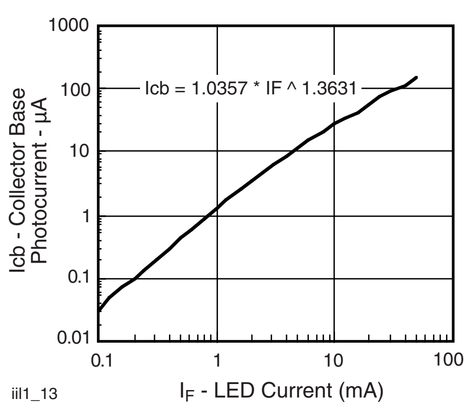


Fig. 13 - Collector Base Photocurrent vs. LED Current

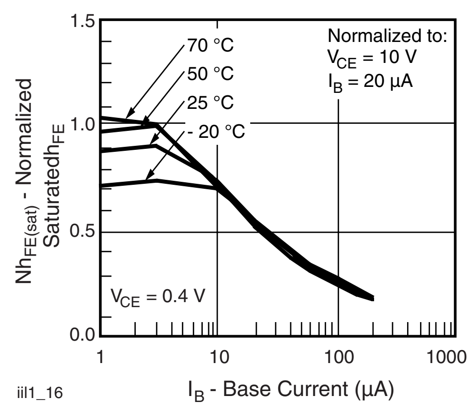


Fig. 16 - Normalized Saturated h_{FE} vs. Base Current and Temperature

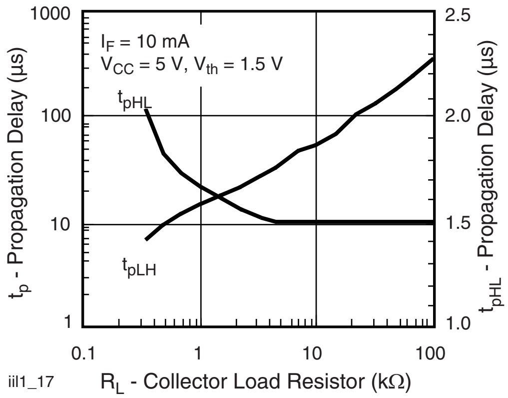
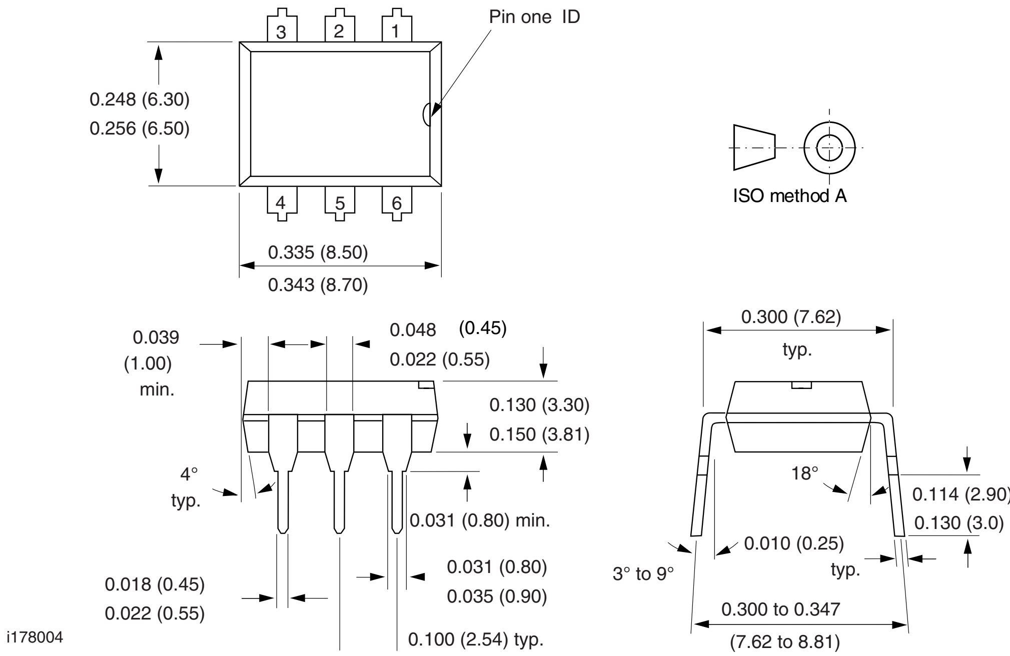
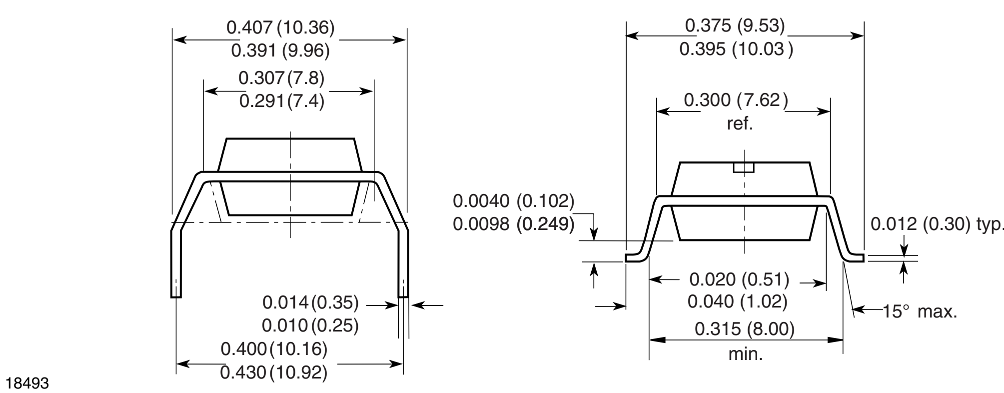


Fig. 17 - Propagation Delay vs. Collector Load Resistor

PACKAGE DIMENSIONS in inches (millimeters)



Option 6 **Option 9**



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

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