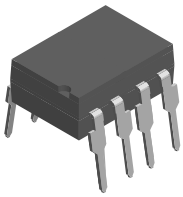
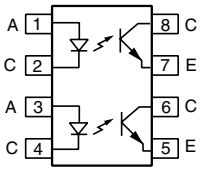
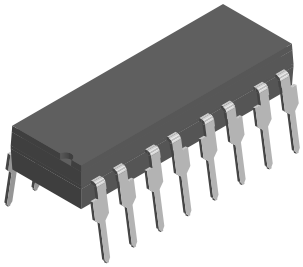
Optocoupler, Phototransistor Output (Dual, Quad Channel)

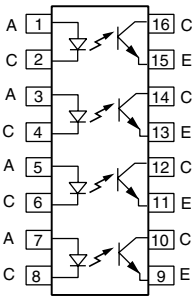
Dual Channel





Quad Channel





i179052

FEATURES

- Identical channel to channel footprint
- Dual and quad packages feature:
  - Reduced board space
  - Lower pin and parts count
  - Better channel to channel CTR match
  - Improved common mode rejection
- Isolation test voltage from double molded package, 5300 V_{RMS}
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

Pb-free

e3

RoHS COMPLIANT

AGENCY APPROVALS

- UL1577, file no. E52744 system code H or J, double protection
- CSA 93751
- BSI IEC 60950; IEC 60065
- DIN EN 60747-5-2 (VDE 0884)/DIN EN 60747-5-5 pending available with option 1

DESCRIPTION

The ILD615/ILQ615 are multi-channel phototransistor optocouplers that use GaAs IRLED emitters and high gain NPN phototransistors. These devices are constructed using over/under leadframe optical coupling and double molded insulation technology resulting a withstand test voltage of 7500 VAC_{PEAK} and a working voltage of 1700 V_{RMS}.

The binned min./max. and linear CTR characteristics make these devices well suited for DC or AC voltage detection. Eliminating the phototransistor base connection provides added electrical noise immunity from the transients found in many industrial control environments.

Because of guaranteed maximum non-saturated and saturated switching characteristics, the ILD615/ILQ615 can be used in medium speed data I/O and control systems. The binned min./max. CTR specification allow easy worst case interface calculations for both level detection and switching applications. Interfacing with a CMOS logic is enhanced by the guaranteed CTR at I_F = 1.0 mA.

ORDER INFORMATION	
PART	**REMARKS**
ILD615-1	CTR 40 to 80 %, dual channel, DIP-8
ILD615-2	CTR 63 to 125 %, dual channel, DIP-8
ILD615-3	CTR 100 to 200 %, dual channel, DIP-8
ILD615-4	CTR 160 to 320 %, dual channel, DIP-8
ILQ615-1	CTR 40 to 80 %, quad channel, DIP-16
ILQ615-2	CTR 63 to 125 %, quad channel, DIP-16
ILQ615-3	CTR 100 to 200 %, quad channel, DIP-16
ILQ615-4	CTR 160 to 320 %, quad channel, DIP-16
ILD615-1X007	CTR 40 to 80 %, dual channel, SMD-8 (option 7)
ILD615-2X006	CTR 63 to 125 %, dual channel, DIP-8 400 mil (option 6)
ILD615-2X009	CTR 63 to 125 %, dual channel, SMD-8 (option 9)
ILD615-3X006	CTR 100 to 200 %, dual channel, DIP-8 400 mil (option 6)
ILD615-3X007	CTR 100 to 200 %, dual channel, SMD-8 (option 7)
ILD615-3X009	CTR 100 to 200 %, dual channel, SMD-8 (option 9)
ILD615-4X006	CTR 160 to 320 %, dual channel, DIP-8 400 mil (option 6)
ILD615-4X009	CTR 160 to 320 %, dual channel, SMD-8 400 mil (option 9)
ILQ615-1X009	CTR 40 to 80 %, quad channel, SMD-16 (option 9)
ILQ615-2X007	CTR 63 to 125 %, quad channel, SMD-16 (option 7)
ILQ615-3X006	CTR 100 to 200 %, quad channel, DIP-16 400 mil (option 6)
ILQ615-3X009	CTR 100 to 200 %, quad channel, SMD-16 (option 9)
ILQ615-4X007	CTR 160 to 320 %, quad channel, SMD-16 (option 7)
ILQ615-4X009	CTR 160 to 320 %, quad channel, SMD-16 (option 9)

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

ABSOLUTE MAXIMUM RATINGS (1)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
Reverse voltage		V_R	6.0	V
Forward current		I_F	60	mA
Surge current		I_{FSM}	1.5	A
Power dissipation		P_{diss}	100	mW
Derate linearly from 25 °C			1.33	mW/°C
OUTPUT				
Collector emitter breakdown voltage		BV_{CEO}	70	V
Emitter collector breakdown voltage		BV_{ECO}	7.0	V
Collector current		I_C	50	mA
	t < 1.0 ms	I_C	100	mA
Power dissipation		P_{diss}	150	mW
Derate linearly from 25 °C			2.0	mW/°C

ABSOLUTE MAXIMUM RATINGS (1)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
COUPLER				
Storage temperature		T_{stg}	- 55 to + 150	°C
Operating temperature		T_{amb}	- 55 to + 100	°C
Junction temperature		T_j	100	°C
Soldering temperature (2)	2.0 mm distance from case bottom	T_{sld}	260	°C
Package power dissipation ILD615			400	mW
Derate linearly from 25 °C			5.33	mW/°C
Package power dissipation ILQ615			500	mW
Derate linearly from 25 °C			6.67	mW/°C
Isolation test voltage	t = 1.0 s	V_{ISO}	5300	V_{RMS}
Creepage distance			≥ 7.0	mm
Clearance distance			≥ 7.0	mm
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

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 CHARACTERISTCS						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
Forward voltage	I_F = 10 mA	V_F	1.0	1.15	1.3	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		25		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 emitter leakage current, -1, -2	V_{CE} = 10 V	I_{CEO}		2.0	50	nA
Collector emitter leakage current, -3, -4	V_{CE} = 10 V	I_{CEO}		5.0	100	nA
Collector emitter breakdown voltage	I_{CE} = 0.5 mA	BV_{CEO}	70			V
Emitter collector breakdown voltage	I_E = 0.1 mA	BV_{ECO}	7.0			V
Thermal resistance, junction to lead		R_{THJL}		500		K/W
PACKAGE TRANSFER CHARACTERISTICS						
Channel/channel CTR match	I_F = 10 mA, V_{CE} = 5.0 V	CTRX/CTRY	1 to 1		2 to 1	
COUPLER						
Capacitance (input to output)	V_{IO} = 0 V, f = 1.0 MHz	C_{IO}		0.8		pF
Insulation resistance	V_{IO} = 500 V, T_A = 25 °C	R_S	10^{12}	10^{14}		Ω
Channel to channel isolation			500			VAC

Note

T_{amb} = 25 °C, unless otherwise specified.
Minimum and maximum values are tested requierements. Typical values are characteristics of the device and are the result of engineering evaluations. 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	ILD615-1	CTR_{CEsat}		25		%
		ILQ615-1					
		ILD615-2	CTR_{CEsat}		40		%
		ILQ615-2					
		ILD615-3	CTR_{CEsat}		60		%
		ILQ615-3					
		ILD615-4	CTR_{CEsat}		100		%
		ILQ615-4					
Current transfer ratio (collector emitter)	I_F = 1.0 mA, V_{CE} = 5.0 V	ILD615-1	CTR_{CE}	13	30		%
		ILQ615-1					
		ILD615-2	CTR_{CE}	22	45		%
		ILQ615-2					
		ILD615-3	CTR_{CE}	34	70		%
		ILQ615-3					
		ILD615-4	CTR_{CE}	56	90		%
		ILQ615-4					
	I_F = 10 mA, V_{CE} = 5.0 V	ILD615-1	CTR_{CE}	40	60	80	%
		ILQ615-1					
		ILD615-2	CTR_{CE}	63	80	125	%
		ILQ615-2					
		ILD615-3	CTR_{CE}	100	150	200	%
		ILQ615-3					
		ILD615-4	CTR_{CE}	160	200	320	%
		ILQ615-4					

SWITCHING CHARACTERISTICS

PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
NON-SATURATED							
Current	V_{CC} = 5.0 V, R_L = 75 Ω, 50 % of V_{PP}		I_F		10		mA
Turn-on time	V_{CC} = 5.0 V, R_L = 75 Ω, 50 % of V_{PP}		t_{on}		3.0		µs
Rise time	V_{CC} = 5.0 V, R_L = 75 Ω, 50 % of V_{PP}		t_r		2.0		µs
Turn-off time	V_{CC} = 5.0 V, R_L = 75 Ω, 50 % of V_{PP}		t_{off}		2.3		µs
Fall time	V_{CC} = 5.0 V, R_L = 75 Ω, 50 % of V_{PP}		t_f		2.0		µs
Propagation H to L	V_{CC} = 5.0 V, R_L = 75 Ω, 50 % of V_{PP}		t_{PHL}		1.1		µs
Propagation L to H	V_{CC} = 5.0 V, R_L = 75 Ω, 50 % of V_{PP}		t_{PLH}		2.5		µs
SATURATED							
Current	V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{TH} = 1.5 V	ILD615-1	I_F		20		mA
		ILQ615-1					
		ILD615-2	I_F		10		mA
		ILQ615-2					
		ILD615-3	I_F		10		mA
		ILQ615-3					
		ILD615-4	I_F		5.0		mA
		ILQ615-4					

SWITCHING CHARACTERISTICS							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
SATURATED							
Turn-on time	V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{TH} = 1.5 V	ILD615-1	t_{on}		3.0		µs
		ILQ615-1					
		ILD615-2	t_{on}		4.3		µs
		ILQ615-2					
		ILD615-3	t_{on}		4.3		µs
		ILQ615-3					
		ILD615-4	t_{on}		6.0		µs
		ILQ615-4					
Rise time	V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{TH} = 1.5 V	ILD615-1	t_r		2.0		µs
		ILQ1615-1					
		ILD615-2	t_r		2.8		µs
		ILQ615-2					
		ILD615-3	t_r		2.8		µs
		ILQ615-3					
		ILD615-4	t_r		4.6		µs
		ILQ615-4					
Turn-off time	V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{TH} = 1.5 V	ILD615-1	t_{off}		18		µs
		ILQ615-1					
		ILD615-2	t_{off}		25		µs
		ILQ615-2					
		ILD615-3	t_{off}		25		µs
		ILQ615-3					
		ILD615-4	t_{off}		25		µs
		ILQ615-4					
Fall time	V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{TH} = 1.5 V	ILD615-1	t_f		11		µs
		ILQ615-1					
		ILD615-2	t_f		14		µs
		ILQ615-2					
		ILD615-3	t_f		14		µs
		ILQ615-3					
		ILD615-4	t_f		15		µs
		ILQ615-4					
Propagation H to L	V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{TH} = 1.5 V	ILD615-1	t_{PHL}		1.6		µs
		ILQ615-1					
		ILD615-2	t_{PHL}		2.6		µs
		ILQ615-2					
		ILD615-3	t_{PHL}		2.6		µs
		ILQ615-3					
		ILD615-4	t_{PHL}		5.4		µs
		ILQ615-4					

SWITCHING CHARACTERISTICS							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
SATURATED							
Propagation L to H	V_{CC} = 5.0 V, R_L = 1.0 kΩ, V_{TH} = 1.5 V	ILD615-1	t_{PLH}		8.6		µs
		ILQ615-1					
		ILD615-2	t_{PLH}		7.2		µs
		ILQ615-2					
		ILD615-3	t_{PLH}		7.2		µs
		ILQ615-3					
		ILD615-4	t_{PLH}		7.4		µs
		ILQ615-4					

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 = 1.0 kΩ, I_F = 0 mA	CM_H		5000		V/µs
Common mode rejection output low	V_{CM} = 50 V_{P-P}, R_L = 1.0 kΩ, I_F = 0 mA	CM_L		5000		V/µs
Common mode coupling capacitance		C_{CM}		0.01		pF

TYPICAL CHARACTERISTICS

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

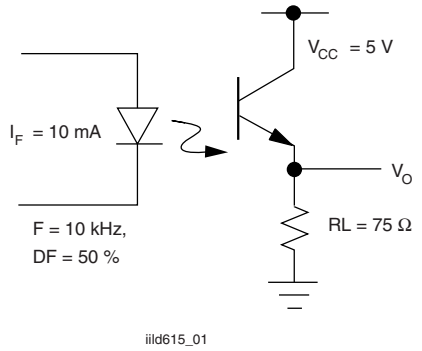


Fig. 1 - Non-Saturated Switching Timing

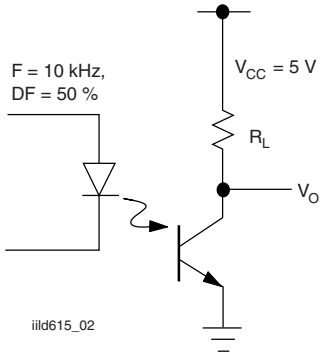


Fig. 2 - Saturated Switching Timing

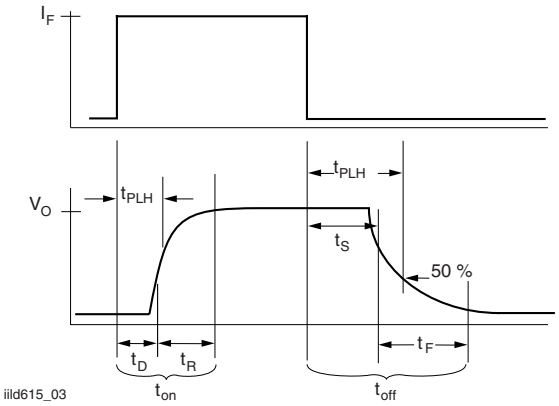


Fig. 3 - Non-Saturated Switching Timing

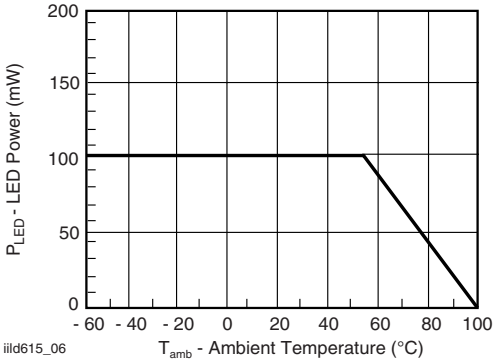


Fig. 6 - Maximum LED Power Dissipation

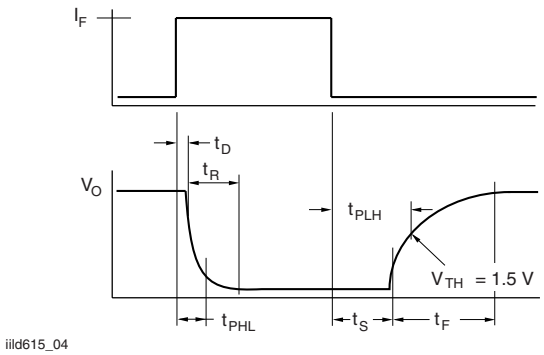


Fig. 4 - Saturated Switching Timing

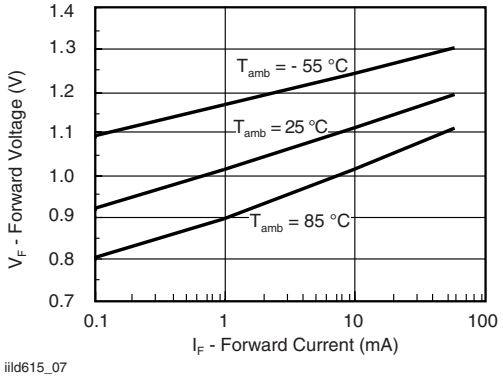


Fig. 7 - Forward Voltage vs. Forward Current

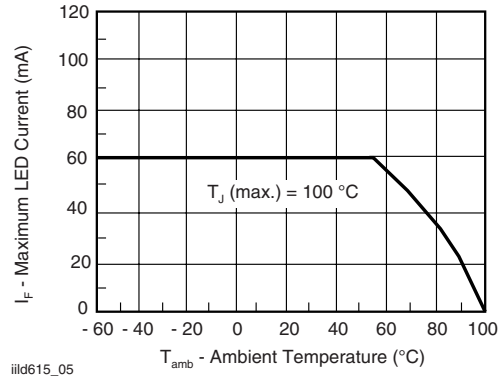


Fig. 5 - Maximum LED Current vs. Ambient Temperature

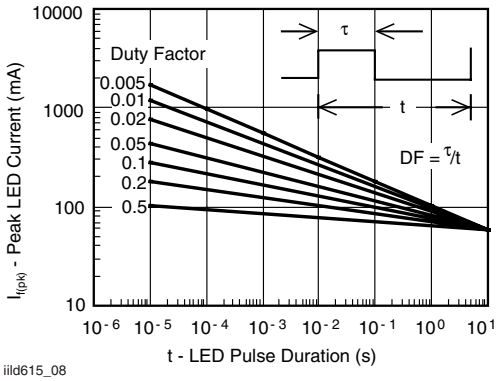


Fig. 8 - Peak LED Current vs. Pulse Duration, τ

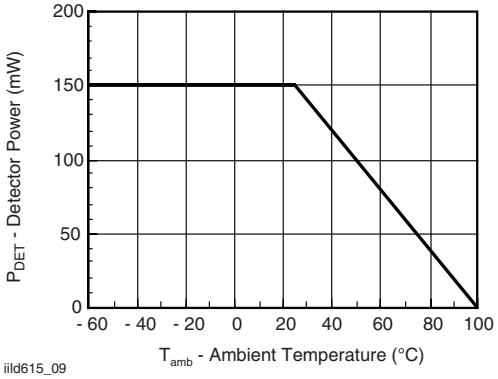


Fig. 9 - Maximum Detector Power Dissipation

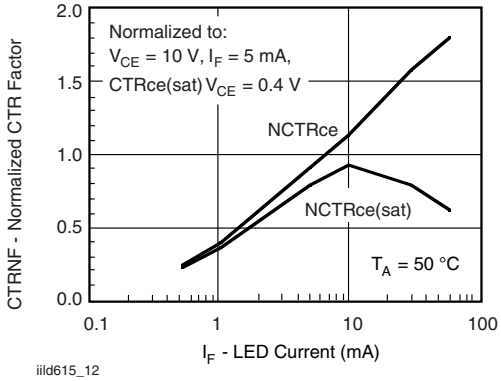


Fig. 12 - Normalization Factor for Non-Saturated and Saturated CTR vs. I_F

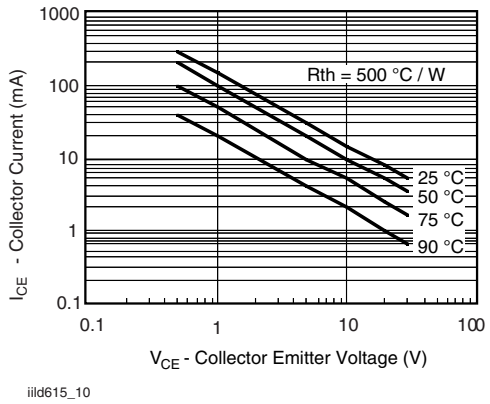


Fig. 10 - Maximum Collector Current vs. Collector Voltage

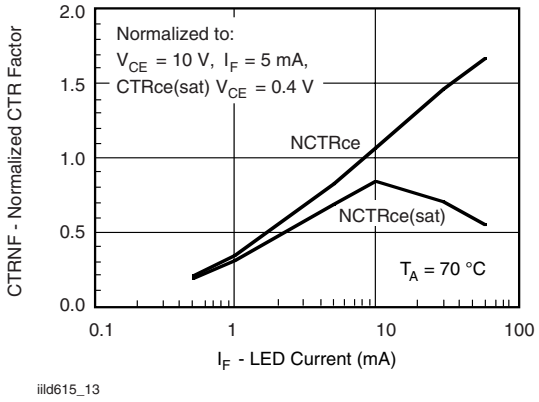


Fig. 13 - Normalization Factor for Non-Saturated and Saturated CTR vs. I_F

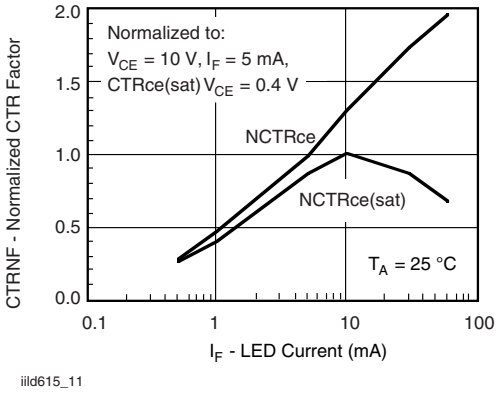


Fig. 11 - Normalization Factor for Non-Saturated and Saturated CTR vs. I_F

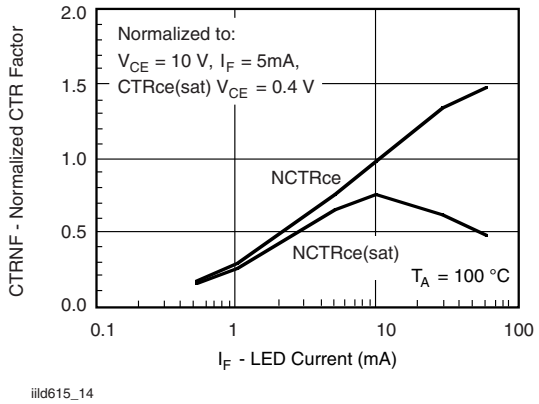


Fig. 14 - Normalization Factor for Non-Saturated and Saturated CTR vs. I_F

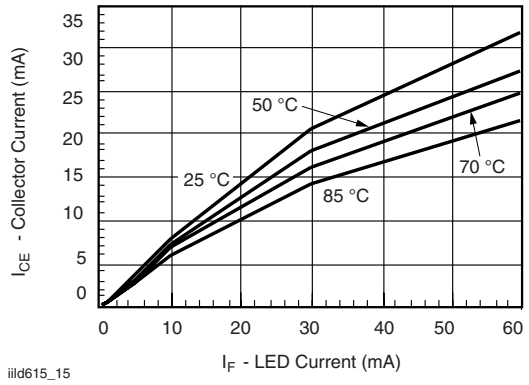


Fig. 15 - Collector Emitter Current vs. Temperature and LED Current

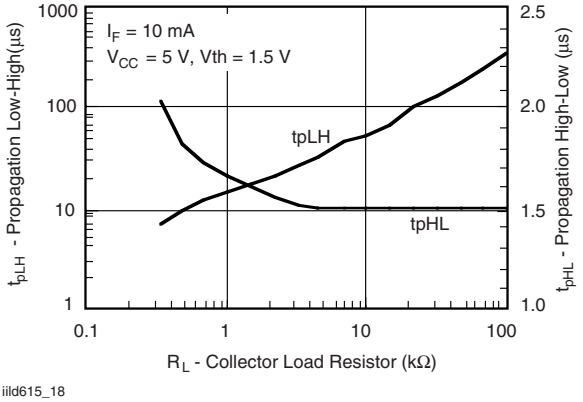


Fig. 18 - -2, -3, Propagation Delay vs. Collector Load Resistor

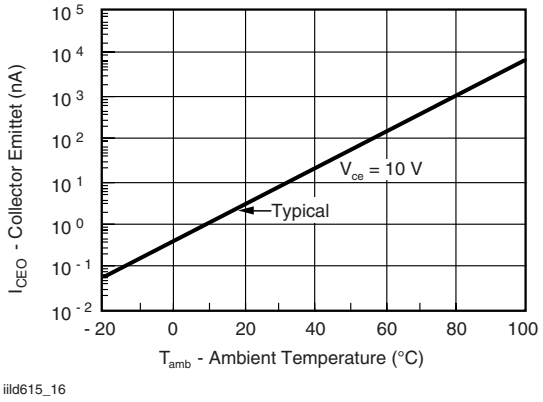


Fig. 16 - Collector Emitter Leakage vs. Temperature

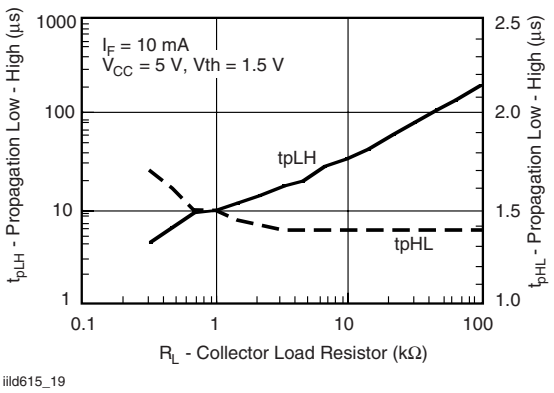


Fig. 19 - -4, Propagation Delay vs. Collector Load Resistor

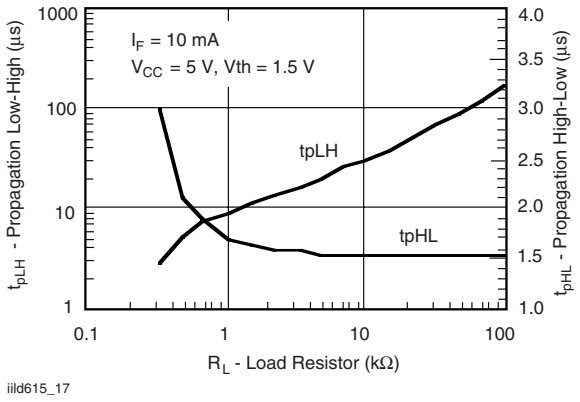
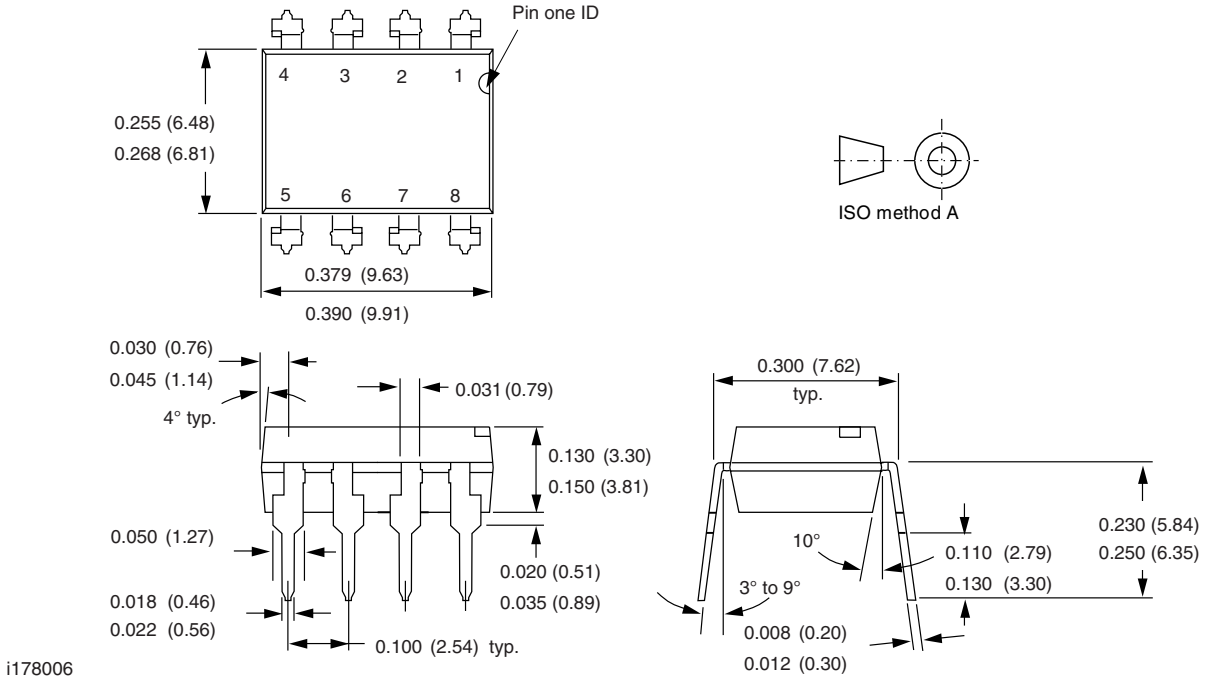
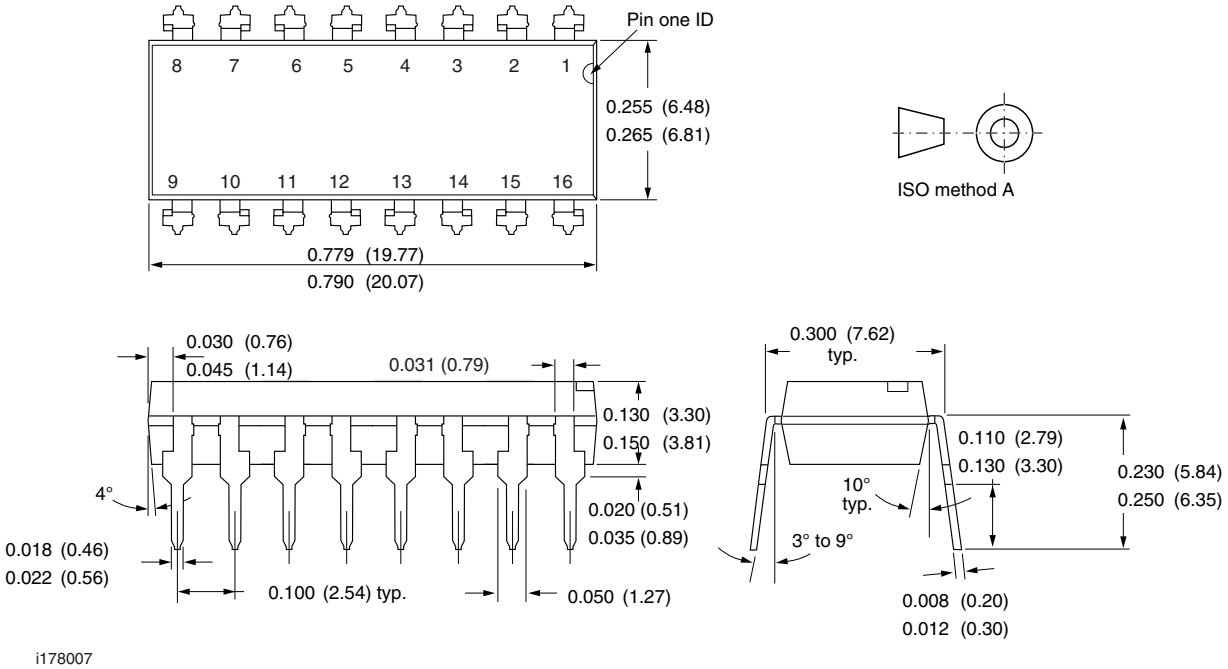


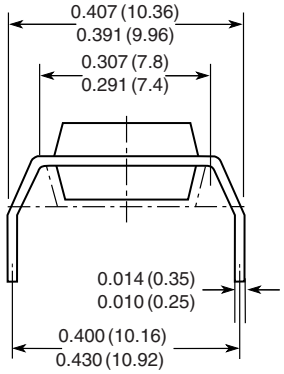
Fig. 17 - -1, Propagation Delay vs. Collector Load Resistor

PACKAGE DIMENSIONS in inches (millimeters)

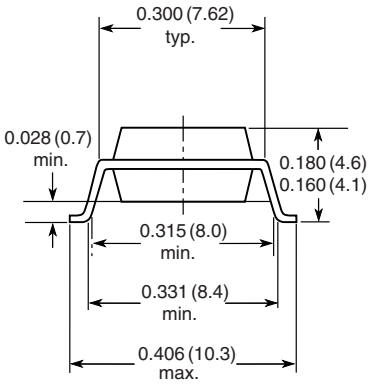




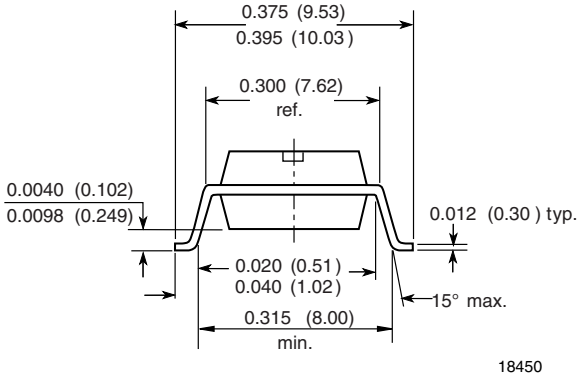
Option 6



Option 7



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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В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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