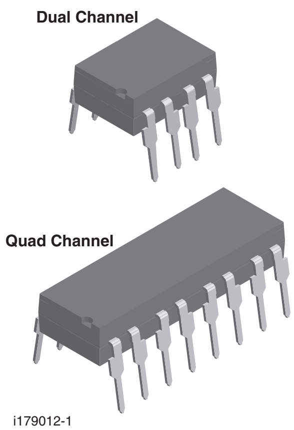
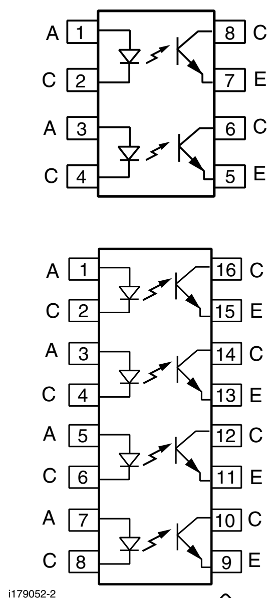
Optocoupler, Phototransistor Output (Dual, Quad Channel)





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}
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC

AGENCY APPROVALS

- UL1577, file no. E52744 system code H, double protection
- CSA 93751
- BSI IEC 60950; IEC 60065
- DIN EN 60747-5-2 (VDE0884)/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.

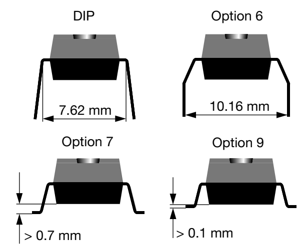
Because of guaranteed maximum non-saturated and saturated switching characteristics, the ILD615, ILQ615 can be used in medium speed data I/O and control systems. The binned min./max. CTR specification allow easy worst case interface calculations for both level detection and switching applications. Interfacing with a CMOS logic is enhanced by the guaranteed CTR at I_F = 1 mA.

ORDERING INFORMATION

I	L	x	6	1	5	-	#	X	0	#	#	T

PART NUMBER — CTR BIN — PACKAGE OPTION — TAPE AND REEL

x = D (Dual) or Q (Quad)



AGENCY CERTIFIED/PACKAGE	DUAL CHANNEL				QUAD CHANNEL			
	CTR (%)							
	10 mA							
UL, CSA, BSI, VDE	**40 to 80**	**63 to 125**	**100 to 200**	**160 to 320**	**40 to 80**	**63 to 125**	**100 to 200**	**160 to 320**
DIP-8	ILD615-1	ILD615-2	ILD615-3	ILD615-4	-	-	-	-
DIP-8, 400 mil, option 6	-	-	-	ILD615-4X006	-	-	-	-
SMD-8, option 7	ILD615-1X007T	-	-	-	-	-	-	-
SMD-8, option 9	ILD615-1X009	ILD615-2X009T[1]	ILD615-3X009T	ILD615-4X009T[1]	-	-	-	-
DIP-16	-	-	-	-	ILQ615-1	ILQ615-2	ILQ615-3	ILQ615-4
SMD-16, option 7	-	-	-	-	-	ILQ615-2X007	ILQ615-3X007T[1]	ILQ615-4X007
SMD-16, option 9	-	-	-	-	ILQ615-1X009	-	ILQ615-3X009T[1]	ILQ615-4X009T[1]
VDE	**40 to 80**	**63 to 125**	**100 to 200**	**160 to 320**	**40 to 80**	**63 to 125**	**100 to 200**	**160 to 320**
DIP-8	-	ILD615-2X001	-	ILD615-4X001	-	-	-	-
DIP-8, 400 mil, option 6	-	ILD615-2X016	ILD615-3X016	ILD615-4X016	-	-	-	-
SMD-8, option 7	-	-	ILD615-3X017T[1]	-	-	-	-	-
DIP-16	-	-	-	-	-	-	ILQ615-3X001	ILQ615-4X001
DIP-16, 400 mil, option 6	-	-	-	-	-	-	ILQ615-3X016	-
SMD-16, option 7	-	-	-	-	-	ILQ615-2X017	-	-

Notes
- Also available in tubes; do not add T to end.
- Additional options may be possible, please contact sales office.

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

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
INPUT				
Reverse voltage		V_R	6	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	V
Collector current		I_C	50	mA
	t < 1 ms	I_C	100	mA
Power dissipation		P_{diss}	150	mW
Derate linearly from 25 °C			2	mW/°C

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
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 (1)	2 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 s	V_{ISO}	5300	V_{RMS}
Isolation voltage		V_{IORM}	890	V_P
Total power dissipation		P_{tot}	250	mW
Creepage distance			≥ 7	mm
Clearance distance			≥ 7	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

- 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 CHARACTERISTCS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
INPUT						
Forward voltage	I_F = 10 mA	V_F	1	1.15	1.3	V
Breakdown voltage	I_R = 10 µA	V_{BR}	6	30		V
Reverse current	V_R = 6 V	I_R		0.01	10	µA
Capacitance	V_R = 0 V, f = 1 MHz	C_O		25		pF
Thermal resistance, junction to lead		R_{THJL}		750		K/W
OUTPUT						
Collector emitter capacitance	V_{CE} = 5 V, f = 1 MHz	C_{CE}		6.8		pF
Collector emitter leakage current, -1, -2	V_{CE} = 10 V	I_{CEO}		2	50	nA
Collector emitter leakage current, -3, -4	V_{CE} = 10 V	I_{CEO}		5	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			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 V	CTRX/CTRY	1 to 1		2 to 1	
COUPLER						
Capacitance (input to output)	V_{IO} = 0 V, f = 1 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

- 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 (T_{amb} = 25 °C, unless otherwise specified)							
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 mA, V_{CE} = 5 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 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					

SAFETY AND INSULATION RATED PARAMETERS						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Partial discharge test voltage - routine test	100 %, t_{test} = 1 s	V_{pd}	1.669			kV
Partial discharge test voltage - lot test (sample test)	t_{Tr} = 60 s, t_{test} = 10 s, (see figure 2)	V_{IOTM}	10			kV
		V_{pd}	1.424			kV
Insulation resistance	V_{IO} = 500 V	R_{IO}	10^{12}			Ω
	V_{IO} = 500 V, T_{amb} = 100 °C	R_{IO}	10^{11}			Ω
	V_{IO} = 500 V, T_{amb} = 175 °C (construction test only)	R_{IO}	10^{9}			Ω
Forward current		I_{SI}			275	mA
Power dissipation		P_{SO}			400	mW
Rated impulse voltage		V_{IOTM}			10	kV
Safety temperature		T_{SI}			175	°C

Note

- According to DIN EN 60747-5-2 (see figure 2). This optocoupler is suitable for safe electrical isolation only within the safety ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.

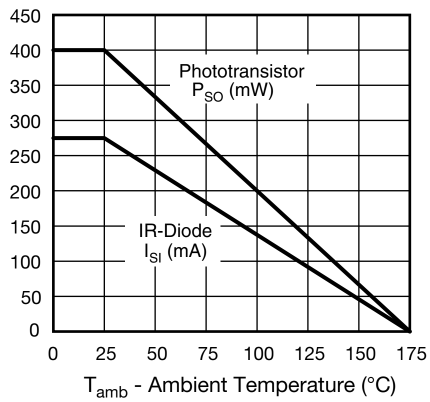


Fig. 1 - Derating Diagram

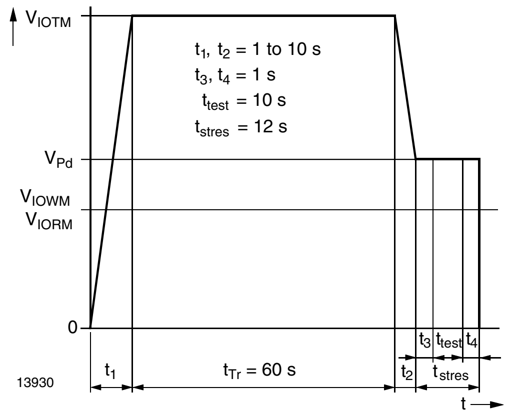


Fig. 2 - Test Pulse Diagram for Sample Test according to DIN EN 60747-5-2 (VDE0884); IEC60747-5-5

SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
NON-SATURATED							
Current	V_{CC} = 5 V, R_L = 75 Ω, 50 % of V_{PP}		I_F		10		mA
Turn-on time	V_{CC} = 5 V, R_L = 75 Ω, 50 % of V_{PP}		t_{on}		3		μs
Rise time	V_{CC} = 5 V, R_L = 75 Ω, 50 % of V_{PP}		t_r		2		μs
Turn-off time	V_{CC} = 5 V, R_L = 75 Ω, 50 % of V_{PP}		t_{off}		2.3		μs
Fall time	V_{CC} = 5 V, R_L = 75 Ω, 50 % of V_{PP}		t_f		2		μs
Propagation H to L	V_{CC} = 5 V, R_L = 75 Ω, 50 % of V_{PP}		t_{PHL}		1.1		μs
Propagation L to H	V_{CC} = 5 V, R_L = 75 Ω, 50 % of V_{PP}		t_{PLH}		2.5		μs
SATURATED							
Current	V_{CC} = 5 V, R_L = 1 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		mA
		ILQ615-4					
Turn-on time	V_{CC} = 5 V, R_L = 1 kΩ, V_{TH} = 1.5 V	ILD615-1	t_{on}		3		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		μs
		ILQ615-4					

SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
SATURATED							
Rise time	V_{CC} = 5 V, R_L = 1 kΩ, V_{TH} = 1.5 V	ILD615-1 ILQ1615-1	t_r		2		µs
		ILD615-2 ILQ615-2	t_r		2.8		µs
		ILD615-3 ILQ615-3	t_r		2.8		µs
		ILD615-4 ILQ615-4	t_r		4.6		µs
Turn-off time	V_{CC} = 5 V, R_L = 1 kΩ, V_{TH} = 1.5 V	ILD615-1 ILQ615-1	t_{off}		18		µs
		ILD615-2 ILQ615-2	t_{off}		25		µs
		ILD615-3 ILQ615-3	t_{off}		25		µs
		ILD615-4 ILQ615-4	t_{off}		25		µs
Fall time	V_{CC} = 5 V, R_L = 1 kΩ, V_{TH} = 1.5 V	ILD615-1 ILQ615-1	t_f		11		µs
		ILD615-2 ILQ615-2	t_f		14		µs
		ILD615-3 ILQ615-3	t_f		14		µs
		ILD615-4 ILQ615-4	t_f		15		µs
Propagation H to L	V_{CC} = 5 V, R_L = 1 kΩ, V_{TH} = 1.5 V	ILD615-1 ILQ615-1	t_{PHL}		1.6		µs
		ILD615-2 ILQ615-2	t_{PHL}		2.6		µs
		ILD615-3 ILQ615-3	t_{PHL}		2.6		µs
		ILD615-4 ILQ615-4	t_{PHL}		5.4		µs
Propagation L to H	V_{CC} = 5 V, R_L = 1 kΩ, V_{TH} = 1.5 V	ILD615-1 ILQ615-1	t_{PLH}		8.6		µs
		ILD615-2 ILQ615-2	t_{PLH}		7.2		µs
		ILD615-3 ILQ615-3	t_{PLH}		7.2		µs
		ILD615-4 ILQ615-4	t_{PLH}		7.4		µs

COMMON MODE TRANSIENT IMMUNITY (T_{amb} = 25 °C, unless otherwise specified)						
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 = 0 mA	CM_H		5000		V/µs
Common mode rejection output low	V_{CM} = 50 V_{P-P}, R_L = 1 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)

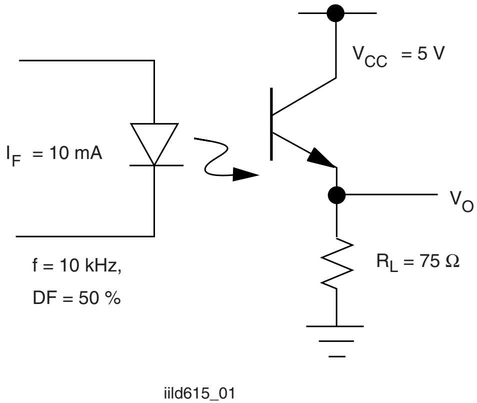


Fig. 3 - Non-Saturated Switching Timing

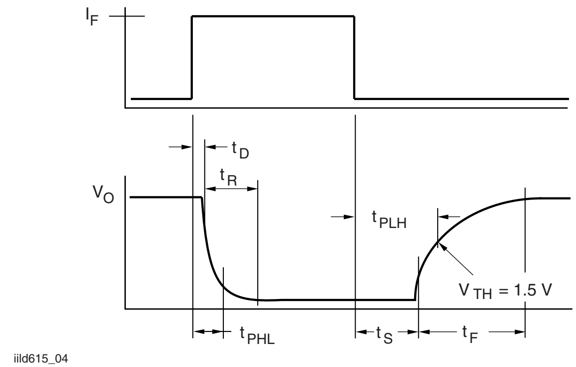


Fig. 6 - Saturated Switching Timing

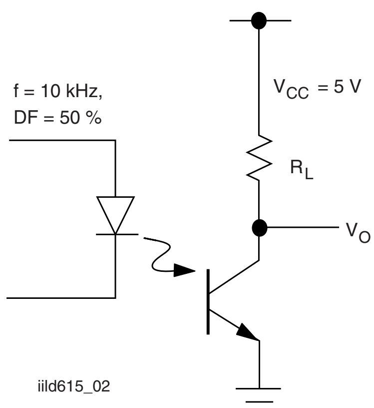


Fig. 4 - Saturated Switching Timing

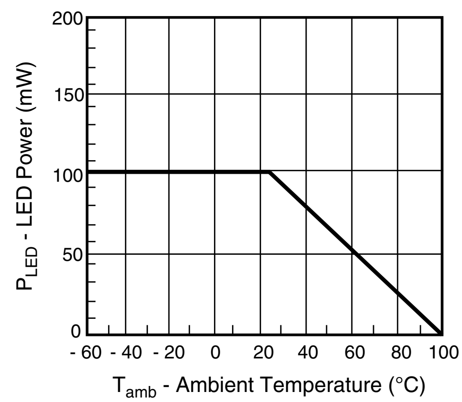


Fig. 7 - Maximum LED Power Dissipation

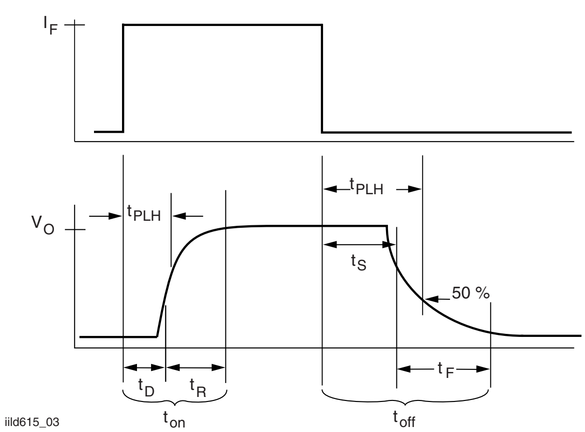


Fig. 5 - Non-Saturated Switching Timing

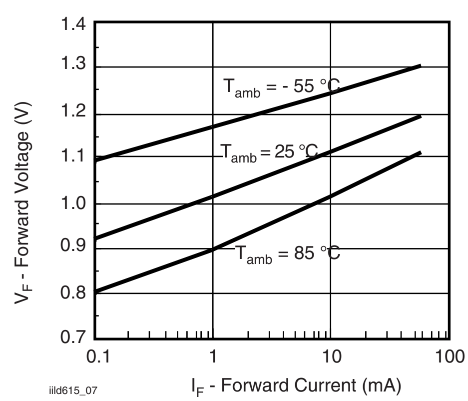


Fig. 8 - Forward Voltage vs. Forward Current

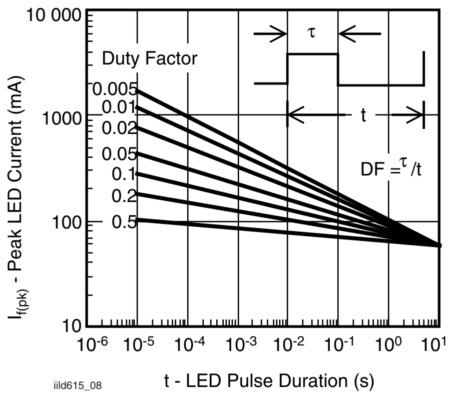


Fig. 9 - Peak LED Current vs. Pulse Duration, τ

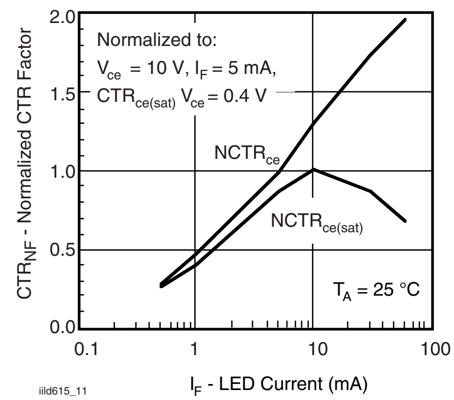


Fig. 12 - Normalization Factor for Non-Saturated and Saturated CTR vs. I_F

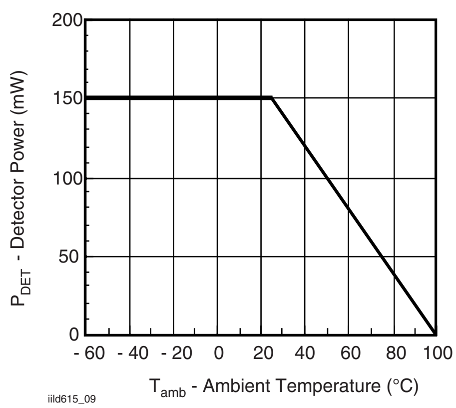


Fig. 10 - Maximum Detector Power Dissipation

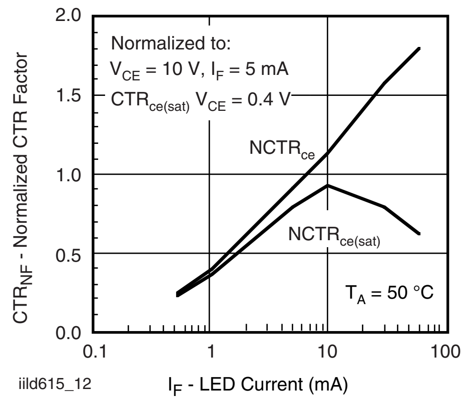


Fig. 13 - Normalization Factor for Non-Saturated and Saturated CTR vs. I_F

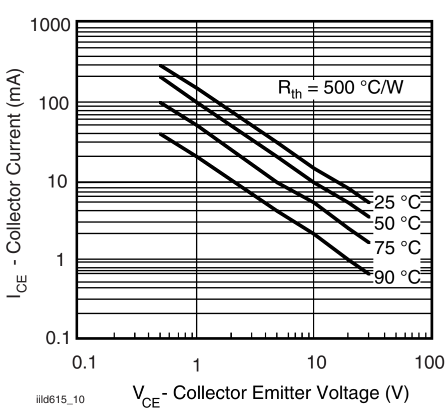


Fig. 11 - Maximum Collector Current vs. Collector Voltage

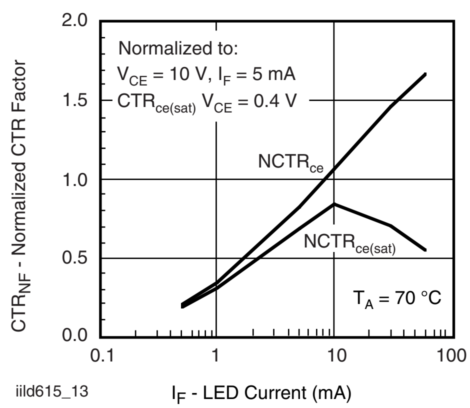


Fig. 14 - Normalization Factor for Non-Saturated and Saturated CTR vs. I_F

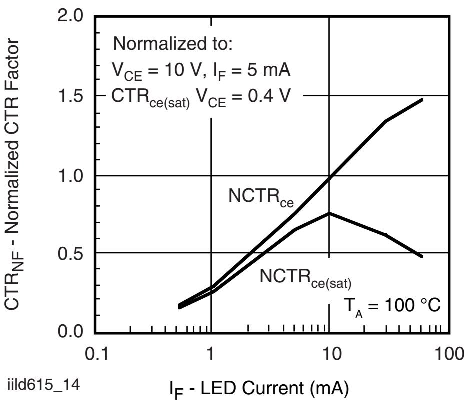


Fig. 15 - Normalization Factor for Non-Saturated and Saturated CTR vs. I_F

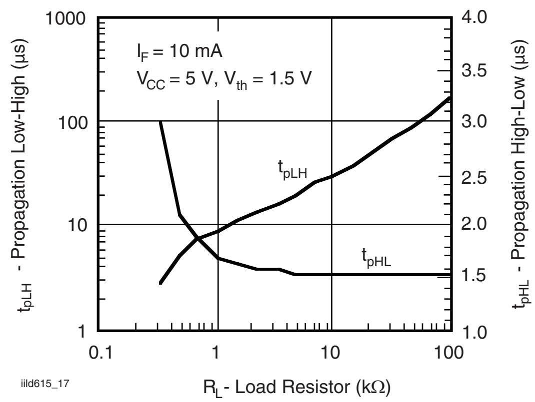


Fig. 18 - -1, Propagation Delay vs. Collector Load Resistor

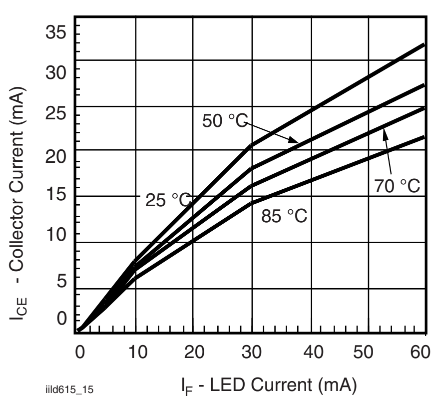


Fig. 16 - Collector Emitter Current vs. Temperature and LED Current

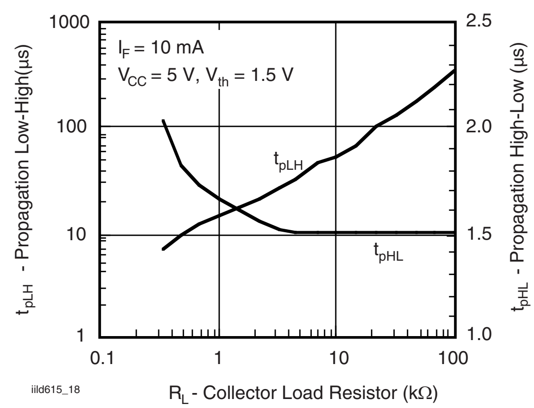


Fig. 19 - -2, -3, Propagation Delay vs. Collector Load Resistor

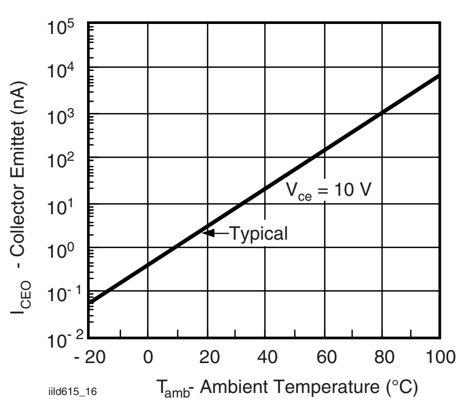


Fig. 17 - Collector Emitter Leakage vs. Temperature

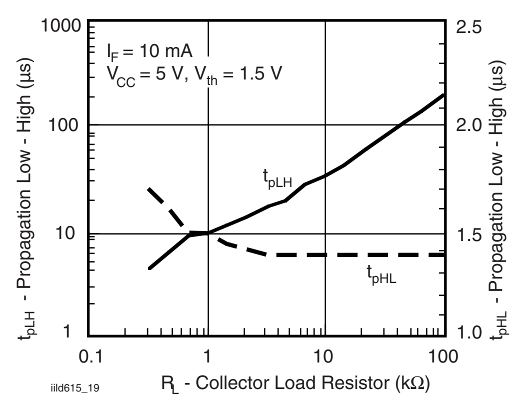
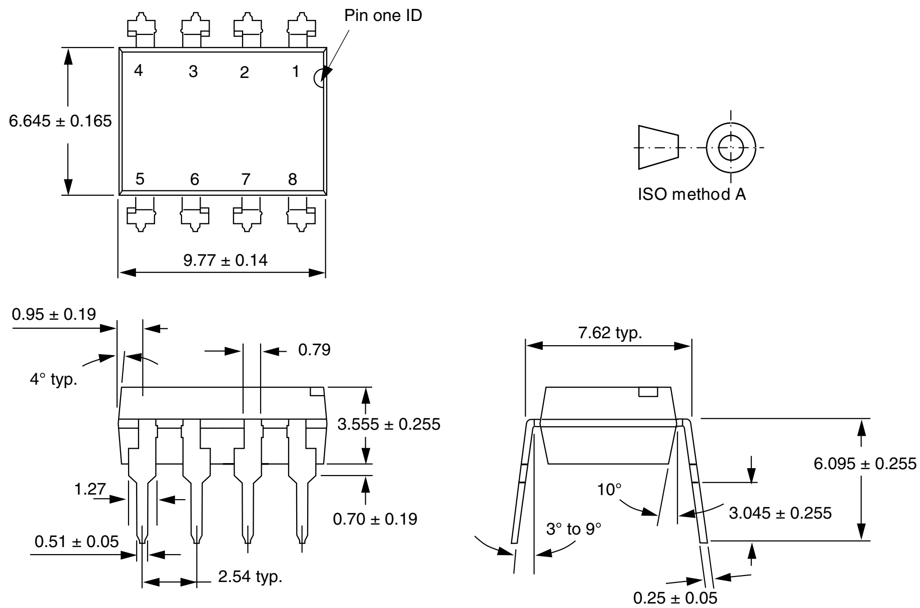
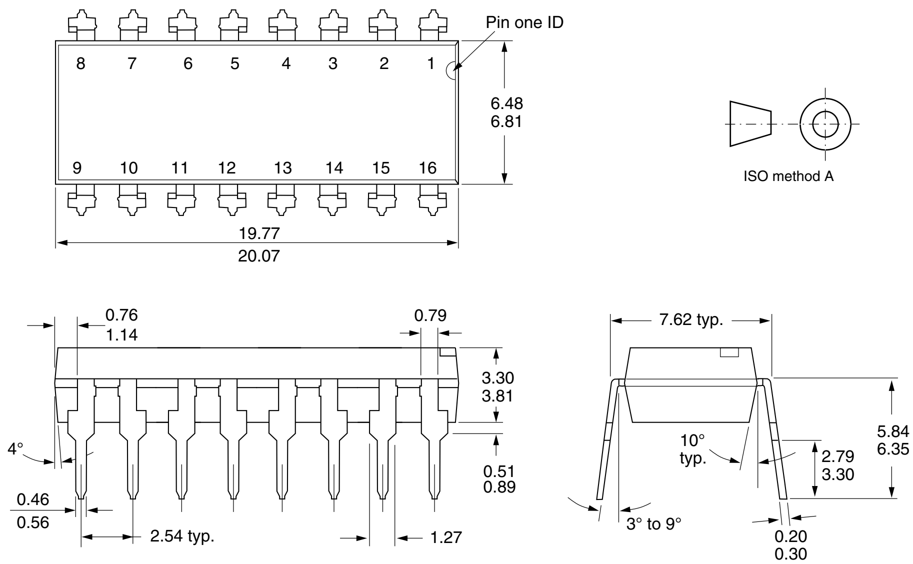


Fig. 20 - -4, Propagation Delay vs. Collector Load Resistor

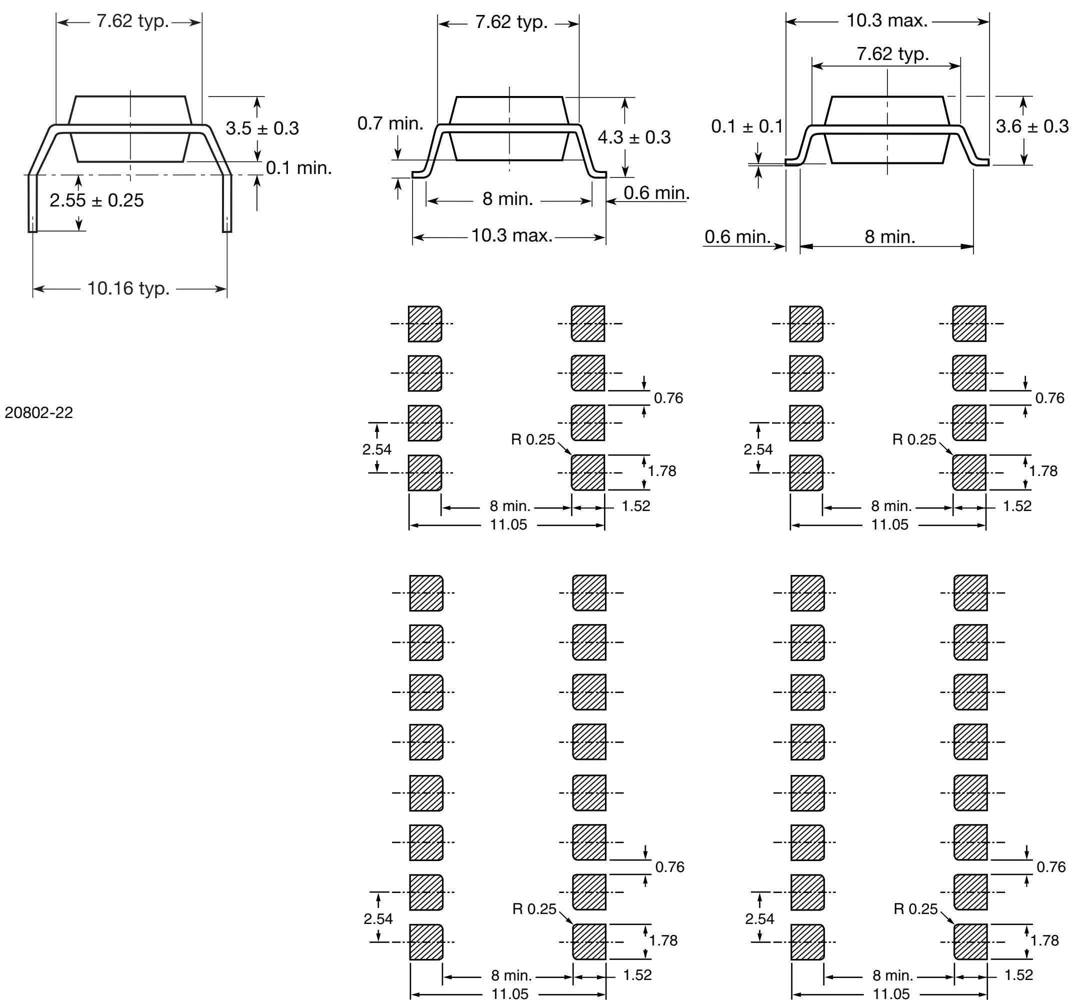
PACKAGE DIMENSIONS in millimeters



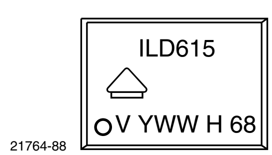
i178006



i178007



PACKAGE MARKING



Notes

- Only options 1 and 7 reflected in the package marking.
- The VDE Logo is only marked on option1 parts.
- Tape and reel suffix (T) is not part of the package marking.

Disclaimer

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