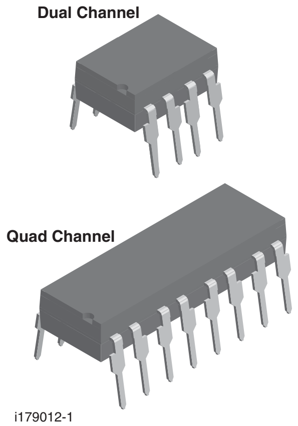
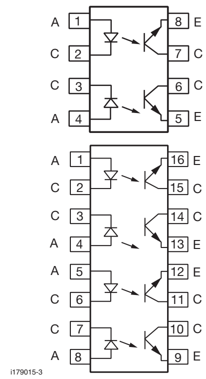
Optocoupler, Phototransistor Output (Dual, Quad Channel)





FEATURES

- Current transfer ratio at I_F = 10 mA
- Isolation test voltage, 5300 V_{RMS}
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC

Pb-free
e3
RoHS
COMPLIANT

AGENCY APPROVALS

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

DESCRIPTION

The ILD1, ILD2, ILD5, ILQ1, ILQ2, ILQ5 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.

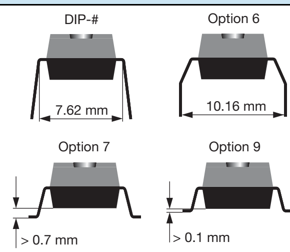
The ILD1, ILD2, ILD5, ILQ1, ILQ2, ILQ5 are especially designed for driving medium-speed logic and can be used to eliminate troublesome ground loop and noise problems. Also these couplers can be used to replace relays and transformers in many digital interface applications such as CTR modulation.

The ILD1, ILD2, ILD5 has two isolated channels in a single DIP package and the ILQ1, ILQ2, ILQ5 has four isolated channels per package.

ORDERING INFORMATION

I	L	x	#	-	X	0	#	#	T
PART NUMBER					PACKAGE OPTION				TAPE AND REEL

x = D (Dual) or Q (Quad)



AGENCY CERTIFIED/PACKAGE	DUAL CHANNEL			QUAD CHANNEL		
	CTR (%)					
UL, CSA, BSI, FIMKO	**20 to 300**	**100 to 500**	**50 to 400**	**20 to 300**	**100 to 500**	**50 to 400**
DIP-8	ILD1	ILD2	ILD5	-	-	-
DIP-8, 400 mil, option 6	-	ILD2-X006	-	-	-	-
SMD-8, option 7	ILD1-X007T (1)	ILD2-X007T (1)	-	-	-	-
SMD-8, option 9	ILD1-X009T (1)	ILD2-X009T (1)	ILD5-X009T (1)	-	-	-
DIP-16	-	-	-	ILQ1	ILQ2	ILQ5
DIP-16, 400 mil, option 6	-	-	-	ILQ1-X006	ILQ2-X006	-
SMD-16, option 7	-	-	-	ILQ1-X007	ILQ2-X007T (1)	-
SMD-16, option 9	-	-	-	ILQ1-X009T (1)	ILQ2-X009T (1)	ILQ5-X009T (1)

AGENCY CERTIFIED/PACKAGE	DUAL CHANNEL			QUAD CHANNEL		
	CTR (%)					
VDE, UL, CSA, BSI, FIMKO	**20 to 300**	**100 to 500**	**50 to 400**	**20 to 300**	**100 to 500**	**50 to 400**
DIP-8	ILD1-X001	ILD2-X001	ILD5-X001	-	-	-
DIP-8, 400 mil, option 6	-	ILD2-X016	-	-	-	-
SMD-8, option 7	-	ILD2-X017	-	-	-	-
SMD-8, option 9	ILD1-X019T	-	-	-	-	-
DIP-16	-	-	-	-	ILQ2-X001	-
DIP-16, 400 mil, option 6	-	-	-	-	ILQ2-X016	-
SMD-16, option 7	-	-	-	-	ILQ2-X017T (1)	-

Notes

- Additional options may be possible, please contact sales office.

(1) Also available in tubes; do not put T on end.

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)					
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				1.3	mW/°C
OUTPUT					
Collector emitter reverse voltage		ILD1	V_{CEO}	50	V
		ILQ1	V_{CEO}	50	V
		ILD2	V_{CEO}	70	V
		ILQ2	V_{CEO}	70	V
		ILD5	V_{CEO}	70	V
		ILQ5	V_{CEO}	70	V
Collector current			I_C	50	mA
	t < 1 ms		I_C	400	mA
Power dissipation			P_{diss}	200	mW
Derate lineary from 25 °C				2.6	mW/°C
COUPLER					
Isolation test voltage between emitter and detector			V_{ISO}	5300	V_{RMS}
Creepage distance				≥ 7	mm
Clearance distance				≥ 7	mm
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}	$\geq 10^{11}$	
Package power dissipation			P_{tot}	250	mW
Derate linearly from 25 °C				3.3	mW/°C
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 mm from case bottom		T_{sld}	260	°C

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 throught hole devices (DIP).

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
Forward voltage	I_F = 60 mA	V_F		1.25	1.65	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		T_{thJL}		750		K/W
OUTPUT						
Collector emitter capacitance	V_{CE} = 5 V, f = 1 MHz	C_{CE}		6.8		pF
Collector emitter leakage current	V_{VCE} = 10 V	I_{CEO}		5	50	nA
Saturation voltage, collector emitter	I_C = 1 mA, I_B = 20 µA	V_{CESAT}		0.25	0.4	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_{IO} = 0 V, f = 1 MHz	C_{IO}		0.8		pF

Note

- 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 (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
I_C/I_F (collector emitter saturated)	I_F =10 mA, V_{CE} = 0.4 V	ILD1	CTR_{CEsat}		75		%
		ILQ1	CTR_{CEsat}		75		%
		ILD2	CTR_{CEsat}		170		%
		ILQ2	CTR_{CEsat}		170		%
		ILD5	CTR_{CEsat}		100		%
		ILQ5	CTR_{CEsat}		100		%
	I_F =10 mA, V_{CE} = 10 V	ILD1	CTR_{CE}	20	80	300	%
		ILQ1	CTR_{CE}	20	80	300	%
		ILD2	CTR_{CE}	100	200	500	%
		ILQ2	CTR_{CE}	100	200	500	%
		ILD5	CTR_{CE}	50	130	400	%
		ILQ5	CTR_{CE}	50	130	400	%

SAFETY AND INSULATION RATINGS						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Isolation test voltage between emitter and detector		V_{ISO}	5300			V_{RMS}
Isolation resistance	V_{IO} = 500 V, T_{amb} = 25 °C	R_{IO}	10^{12}			Ω
	V_{IO} = 500 V, T_{amb} = 100 °C		10^{11}			
Climatic classification (according to IEC 68 part 1)				55/100/21		
Comparative tracking index		CTI	175			
Rated impulse voltage		V_{IOTM}			10	kV
Maximum working voltage	Recurring peak voltage	V_{IORM}			890	V
Forward current		I_{SI}			275	mA
Power dissipation		P_{SO}			400	mW
Safety temperature		T_{SI}			175	°C
Creepage distance			7.0			mm
Clearance distance			7.0			mm
Insulation distance	per IEC 60950 2.10.5.1		0.4			mm

Note

- According to DIN EN 60747-5-2 (VDE 0884) (see figure 2). These optocouplers are suitable for “safety electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.

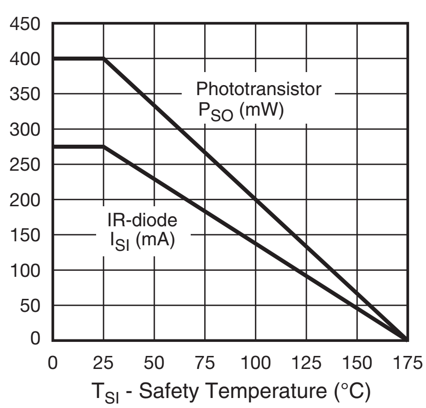


Fig. 1 - Derating Diagram

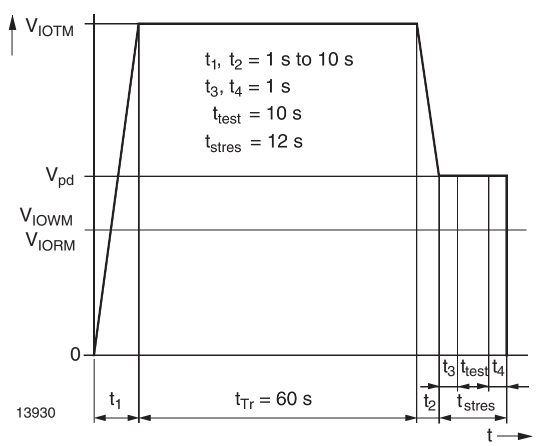


Fig. 2 - Test Pulse Diagram for Sample Test according to DIN EN 60747-5-2 (VDE 0884); IEC 60747-5-5

SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
NON-SATURATED							
Current	V_{CE} = 5 V, R_L = 75 Ω, 50 % of V_{PP}	ILD1	I_F		20		mA
		ILQ1	I_F		20		mA
		ILD2	I_F		5		mA
		ILQ2	I_F		5		mA
		ILD5	I_F		10		mA
		ILQ5	I_F		10		mA
Delay	V_{CE} = 5 V, R_L = 75 Ω, 50 % of V_{PP}	ILD1	t_D		0.8		μs
		ILQ1	t_D		0.8		μs
		ILD2	t_D		1.7		μs
		ILQ2	t_D		1.7		μs
		ILD5	t_D		1.7		μs
		ILQ5	t_D		1.7		μs
Rise time	V_{CE} = 5 V, R_L = 75 Ω, 50 % of V_{PP}	ILD1	t_r		1.9		μs
		ILQ1	t_r		1.9		μs
		ILD2	t_r		2.6		μs
		ILQ2	t_r		2.6		μs
		ILD5	t_r		2.6		μs
		ILQ5	t_r		2.6		μs
Storage	V_{CE} = 5 V, R_L = 75 Ω, 50 % of V_{PP}	ILD1	t_s		0.2		μs
		ILQ1	t_s		0.2		μs
		ILD2	t_s		0.4		μs
		ILQ2	t_s		0.4		μs
		ILD5	t_s		0.4		μs
		ILQ5	t_s		0.4		μs
Fall time	V_{CE} = 5 V, R_L = 75 Ω, 50 % of V_{PP}	ILD1	t_f		1.4		μs
		ILQ1	t_f		1.4		μs
		ILD2	t_f		2.2		μs
		ILQ2	t_f		2.2		μs
		ILD5	t_f		2.2		μs
		ILQ5	t_f		2.2		μs
Propagation H to L	V_{CE} = 5 V, R_L = 75 Ω, 50 % of V_{PP}	ILD1	t_{PHL}		0.7		μs
		ILQ1	t_{PHL}		0.7		μs
		ILD2	t_{PHL}		1.2		μs
		ILQ2	t_{PHL}		1.2		μs
		ILD5	t_{PHL}		1.1		μs
		ILQ5	t_{PHL}		1.1		μs
Propagation L to H	V_{CE} = 5 V, R_L = 75 Ω, 50 % of V_{PP}	ILD1	t_{PLH}		1.4		μs
		ILQ1	t_{PLH}		1.4		μs
		ILD2	t_{PLH}		2.3		μs
		ILQ2	t_{PLH}		2.3		μs
		ILD5	t_{PLH}		2.5		μs
		ILQ5	t_{PLH}		2.5		μs

SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
SATURATED							
Current	V_{CE} = 0.4 V, R_L = 1 kΩ, V_{CC} = 5 V, V_{TH} = 1.5 V	ILD1	I_F		20		mA
		ILQ1	I_F		20		mA
		ILD2	I_F		5		mA
		ILQ2	I_F		5		mA
		ILD5	I_F		10		mA
		ILQ5	I_F		10		mA
Delay	V_{CE} = 0.4 V, R_L = 1 kΩ, V_{CC} = 5 V, V_{TH} = 1.5 V	ILD1	t_D		0.8		μs
		ILQ1	t_D		0.8		μs
		ILD2	t_D		1		μs
		ILQ2	t_D		1		μs
		ILD5	t_D		1.7		μs
		ILQ5	t_D		1.7		μs
Rise time	V_{CE} = 0.4 V, R_L = 1 kΩ, V_{CC} = 5 V, V_{TH} = 1.5 V	ILD1	t_r		1.2		μs
		ILQ1	t_r		1.2		μs
		ILD2	t_r		2		μs
		ILQ2	t_r		2		μs
		ILD5	t_r		7		μs
		ILQ5	t_r		7		μs
Storage	V_{CE} = 0.4 V, R_L = 1 kΩ, V_{CC} = 5 V, V_{TH} = 1.5 V	ILD1	t_s		7.4		μs
		ILQ1	t_s		7.4		μs
		ILD2	t_s		5.4		μs
		ILQ2	t_s		5.4		μs
		ILD5	t_s		4.6		μs
		ILQ5	t_s		4.6		μs
Fall time	V_{CE} = 0.4 V, R_L = 1 kΩ, V_{CC} = 5 V, V_{TH} = 1.5 V	ILD1	t_f		7.6		μs
		ILQ1	t_f		7.6		μs
		ILD2	t_f		13.5		μs
		ILQ2	t_f		13.5		μs
		ILD5	t_f		20		μs
		ILQ5	t_f		20		μs
Propagation H to L	V_{CE} = 0.4 V, R_L = 1 kΩ, V_{CC} = 5 V, V_{TH} = 1.5 V	ILD1	t_{PHL}		1.6		μs
		ILQ1	t_{PHL}		1.6		μs
		ILD2	t_{PHL}		5.4		μs
		ILQ2	t_{PHL}		5.4		μs
		ILD5	t_{PHL}		2.6		μs
		ILQ5	t_{PHL}		2.6		μs
Propagation L to H	V_{CE} = 0.4 V, R_L = 1 kΩ, V_{CC} = 5 V, V_{TH} = 1.5 V	ILD1	t_{PLH}		8.6		μs
		ILQ1	t_{PLH}		8.6		μs
		ILD2	t_{PLH}		7.4		μs
		ILQ2	t_{PLH}		7.4		μs
		ILD5	t_{PLH}		7.2		μs
		ILQ5	t_{PLH}		7.2		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 = 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)

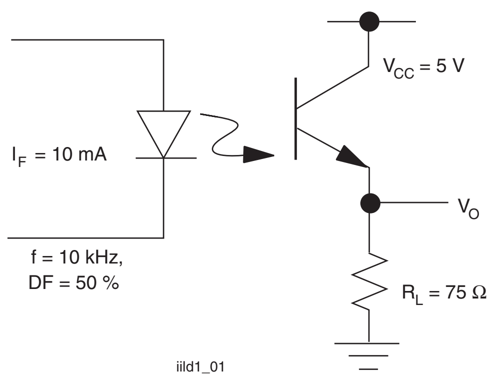


Fig. 3 - Non-Saturated Switching Schematic

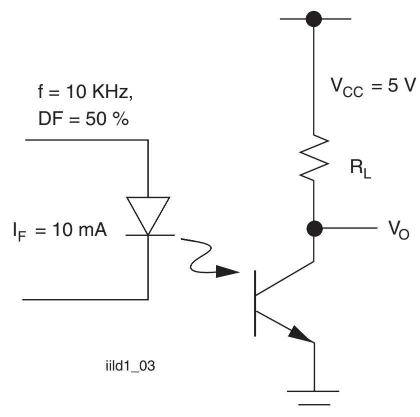


Fig. 5 - Saturated Switching Schematic

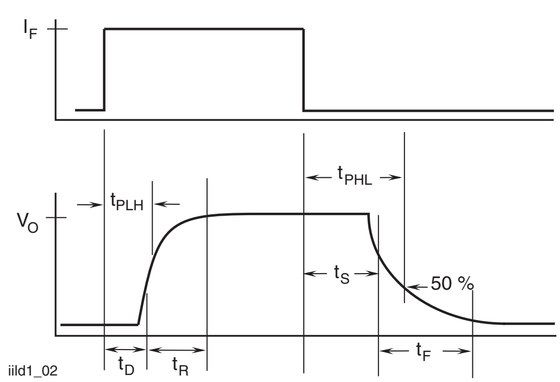


Fig. 4 - Non-Saturated Switching Timing

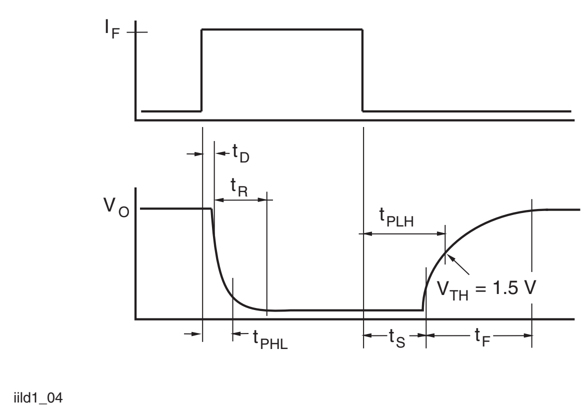


Fig. 6 - Saturated Switching Timing

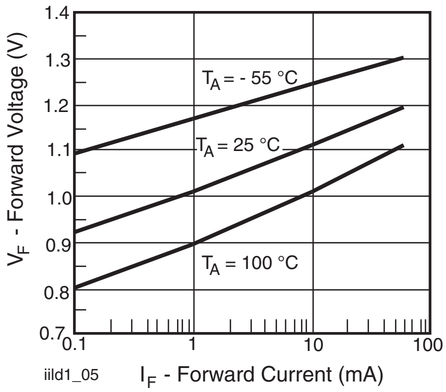


Fig. 7 - Normalized Non-Saturated and Saturated CTR vs. LED Current

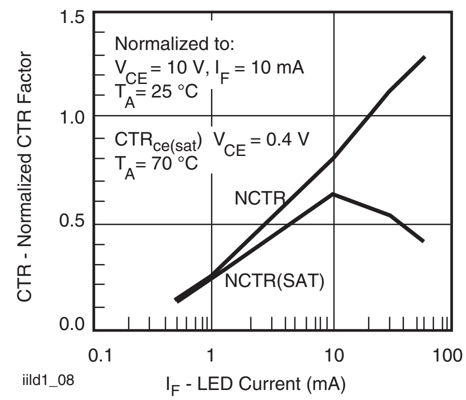


Fig. 10 - Normalized Non-Saturated and Saturated CTR vs. LED Current

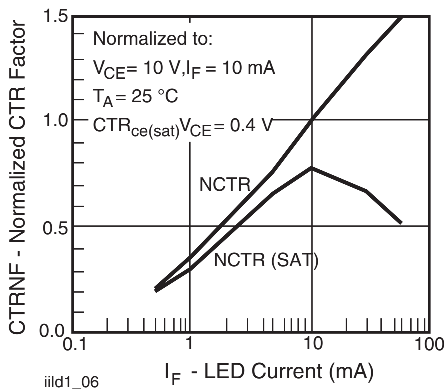


Fig. 8 - Normalized Non-Saturated and Saturated CTR vs. LED Current

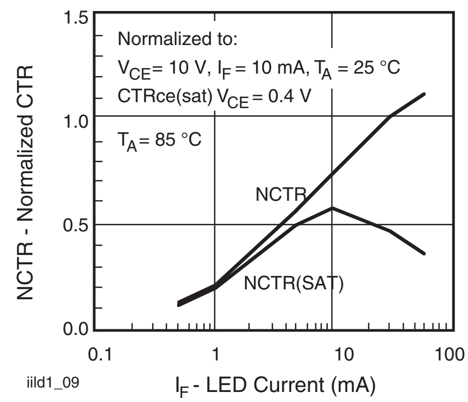


Fig. 11 - Normalized Non-Saturated and Saturated CTR vs. LED Current

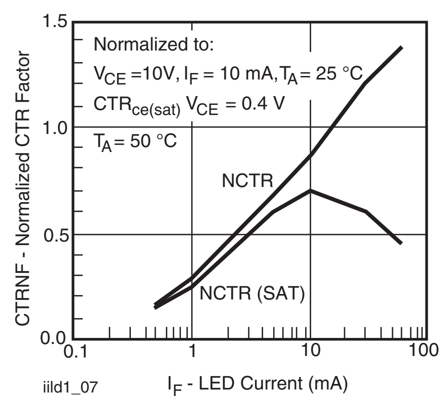


Fig. 9 - Normalized Non-Saturated and Saturated CTR vs. LED Current

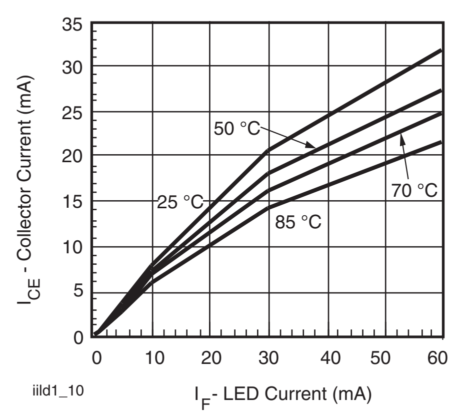


Fig. 12 - Collector Emitter Current vs. Temperature and LED Current

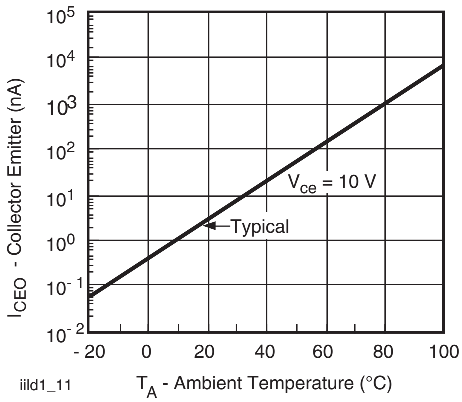


Fig. 13 - Collector Emitter Leakage Current vs.Temperature

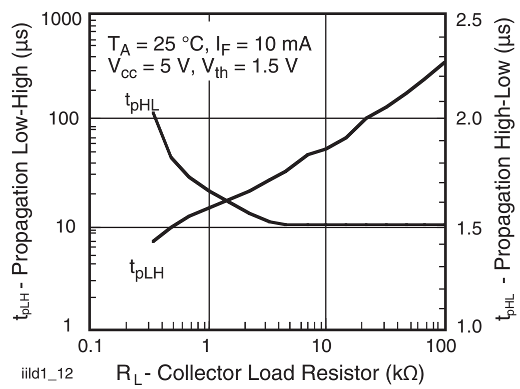
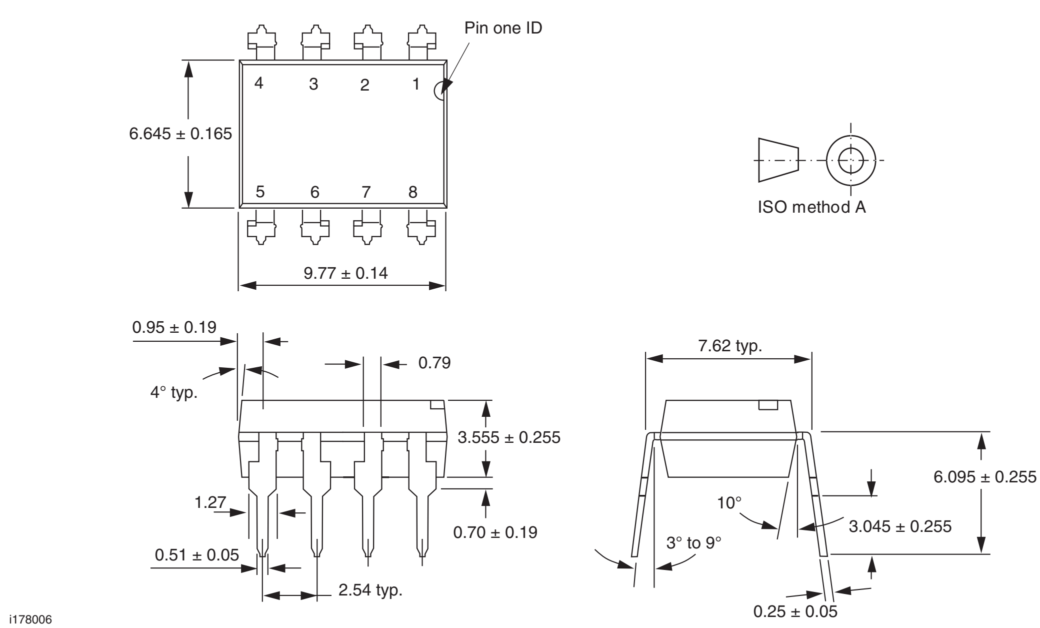
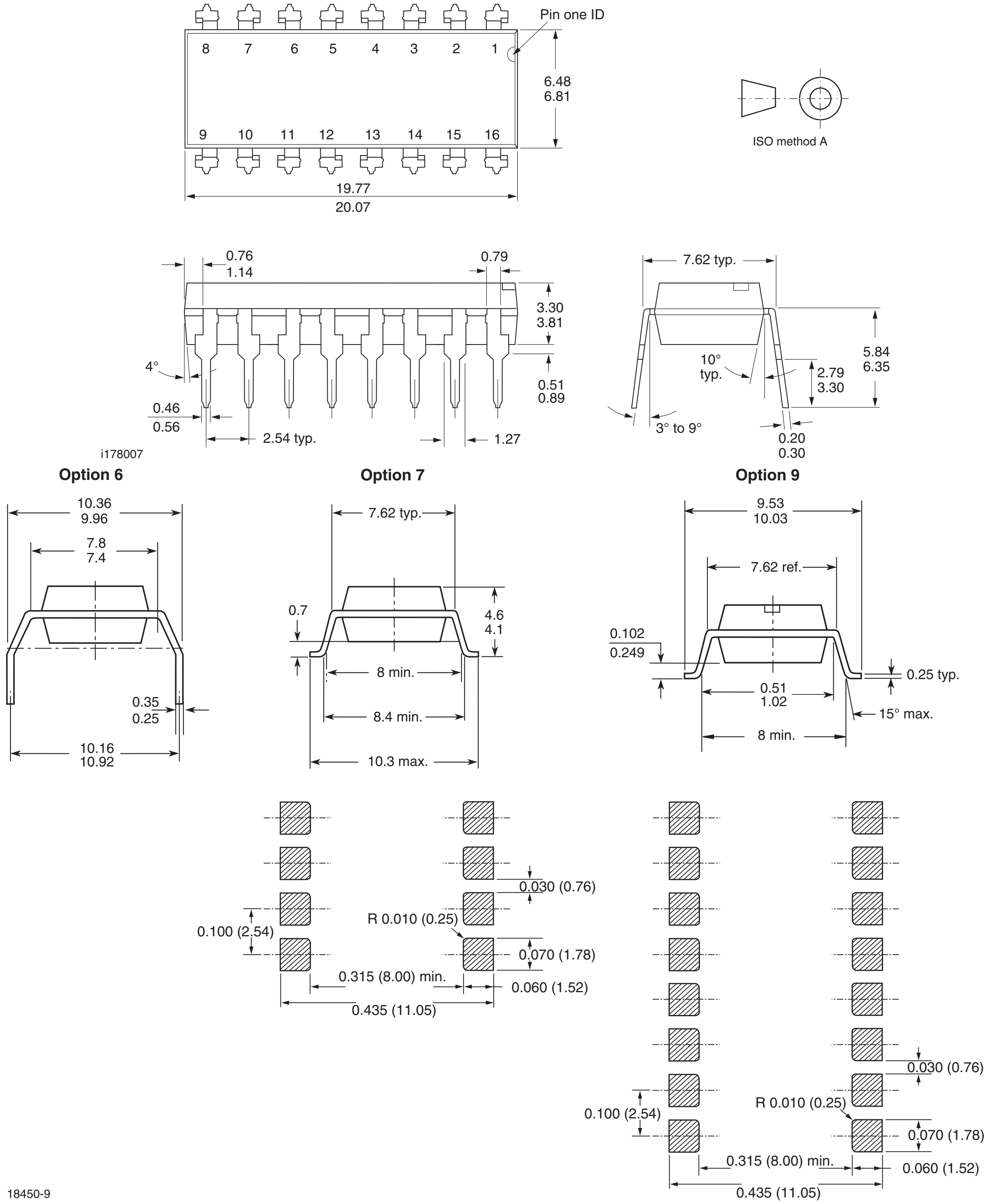


Fig. 14 - Propagation Delay vs. Collector Load Resistor

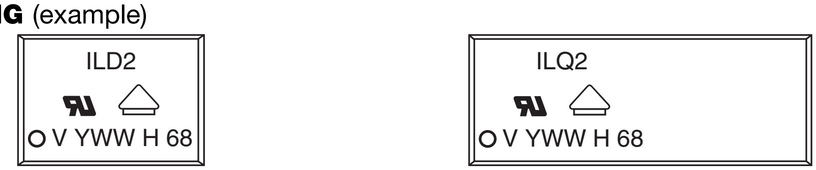
PACKAGE DIMENSIONS in millimeters



PACKAGE DIMENSIONS in millimeters



PACKAGE MARKING (example)



Notes

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

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