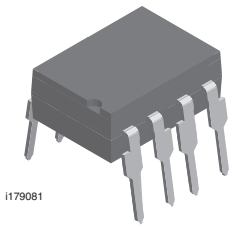
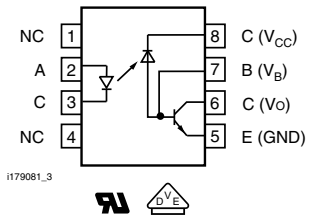
High Speed Optocoupler, 1 MBd, Photodiode with Transistor Output, 110 °C Rated





FEATURES

- Operating temperature from - 55 °C to + 110 °C
- Isolation test voltages: 5300 V_{RMS}
- TTL compatible
- High bit rates: 1 MBd
- Bandwidth 2 MHz
- Open-collector output
- External base wiring possible
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC

Pb-free

e3

RoHS COMPLIANT

DESCRIPTION

The 6N1135 and 6N1136 are 110 °C rated optocouplers with a GaAlAs infrared emitting diode, optically coupled with an integrated photo detector which consists of a photo diode and a high-speed transistor in a DIP-8 plastic package.

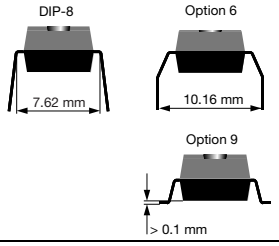
Signals can be transmitted between two electrically separated circuits up to frequencies of 2 MHz. The potential difference between the circuits to be coupled should not exceed the maximum permissible reference voltages.

AGENCY APPROVALS

- UL1577, file no. E52744 system code H or J
- DIN EN 60747-5-5 (VDE 0884)
- cUL - file no. E52744, equivalent to CSA bulletin 5A

ORDERING INFORMATION

6	N	1	1	3	#	-	X	0	0	#	T
PART NUMBER							PACKAGE OPTION				TAPE AND REEL



AGENCY CERTIFIED/PACKAGE	CTR (%)	
UL	**≥ 7**	**≥ 19**
DIP-8	6N1135	6N1136
DIP-8, 400 mil, option 6	6N1135-X006	6N1136-X006
SMD-8, option 9	6N1135-X009T	6N1136-X009T

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

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
INPUT				
Reverse voltage		V_R	5	V
Forward current		I_F	25	mA
Peak forward current	t = 1 ms, duty cycle 50 %	I_{FM}	50	mA
Maximum surge forward current	t ≤ 1 µs, 300 pulses/s	I_{FSM}	1	A
Thermal resistance		R_{th}	700	K/W
Power dissipation	T_{amb} = 70 °C	P_{diss}	45	mW
OUTPUT				
Supply voltage		V_{CC}	- 0.5 to 15	V
Output voltage		V_O	- 0.5 to 15	V
Emitter base voltage		V_{EBO}	5	V
Output current		I_O	8	mA
Maximum Output current			16	mA

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
OUTPUT				
Base current		I_B	5	mA
Thermal resistance			300	K/W
Power dissipation	T_{amb} = 70 °C	P_{diss}	100	mW
COUPLER				
Isolation test voltage (between emitter and detector climate per DIN 50014 part 2, Nov. 74)	t = 1 s	V_{ISO}	5300	V_{RMS}
Storage temperature range		T_{stg}	- 55 to + 125	°C
Ambient temperature range		T_{amb}	- 55 to + 100	°C
Soldering temperature [1]	max. ≤ 10 s, dip soldering ≥ 0.5 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 through hole devices (DIP).

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT							
Forward voltage	I_F = 1.6 mA		V_F		1.6	1.9	V
Breakdown voltage	I_R = 10 µA		V_{BR}	5			V
Reverse current	V_R = 5 V		I_R		0.5	10	µA
Capacitance	V_R = 0 V, f = 1 MHz		C_I		125		pF
Temperature coefficient, forward voltage	I_F = 1.6 mA		$\Delta V_F/\Delta T_A$		- 1.7		mV/°C
OUTPUT							
Logic low supply current	I_F = 1.6 mA, V_O = open, V_{CC} = 15 V		I_{CCL}		150		µA
Logic high supply current	I_F = 0 mA, V_O = open, V_{CC} = 15 V		I_{CCH}		0.01	1	µA
Output voltage, output low	I_F = 16 mA, V_{CC} = 4.5 V, I_O = 1.1 mA,	6N1135	V_{OL}		0.1	0.4	V
	I_F = 16 mA, V_{CC} = 4.5 V, I_O = 2.4 mA	6N1136	V_{OL}		0.1	0.4	V
Output current, output high	I_F = 0 mA, V_O = V_{CC} = 5.5 V		I_{OH}		3	500	nA
	I_F = 0 mA, V_O = V_{CC} = 15 V		I_{OH}		0.01	1	µA
COUPLER							
Capacitance (input to output)	f = 1 MHz		C_{IO}		0.6		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							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Current transfer ratio	I_F = 16 mA, V_O = 0.4 V, V_{CC} = 4.5 V	6N1135	CTR	7	16		%
		6N1136	CTR	19	35		%
	I_F = 16 mA, V_O = 0.5 V, V_{CC} = 4.5 V	6N1135	CTR	5			%
		6N1136	CTR	15			%

SWITCHING CHARACTERISTICS							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
High to low	I_F = 16 mA, V_{CC} = 5 V, R_L = 4.1 kΩ	6N1135	t_{PHL}		0.3	1.5	µs
	I_F = 16 mA, V_{CC} = 5 V, R_L = 1.9 kΩ	6N1136	t_{PHL}		0.2	0.8	µs
Low to high	I_F = 16 mA, V_{CC} = 5 V, R_L = 4.1 kΩ	6N1135	t_{PLH}		0.3	1.5	µs
	I_F = 16 mA, V_{CC} = 5 V, R_L = 1.9 kΩ	6N1136	t_{PLH}		0.2	0.8	µs

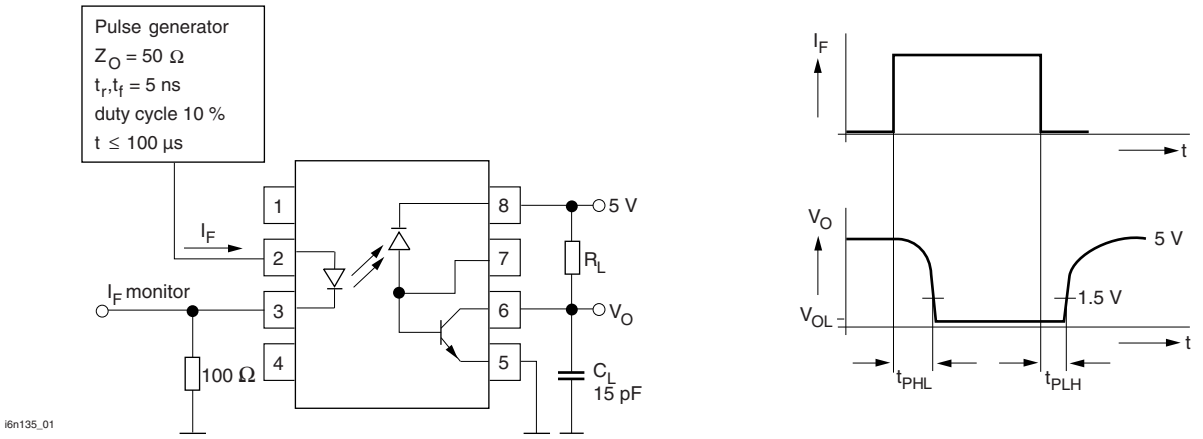


Fig. 1 - Switching Times

COMMON MODE TRANSIENT IMMUNITY							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
High	I_F = 0 mA, V_{CM} = 10 V_{P-P}, V_{CC} = 5 V, R_L = 4.1 kΩ	6N1135	$\|CM_H\|$		1000		V/µs
	I_F = 0 mA, V_{CM} = 10 V_{P-P}, V_{CC} = 5 V, R_L = 1.9 kΩ	6N1136	$\|CM_H\|$		1000		V/µs
Low	I_F = 16 mA, V_{CM} = 10 V_{P-P}, V_{CC} = 5 V, R_L = 4.1 kΩ	6N1135	$\|CM_L\|$		1000		V/µs
	I_F = 16 mA, V_{CM} = 10 V_{P-P}, V_{CC} = 5 V, R_L = 1.9 kΩ	6N1136	$\|CM_L\|$		1000		V/µs

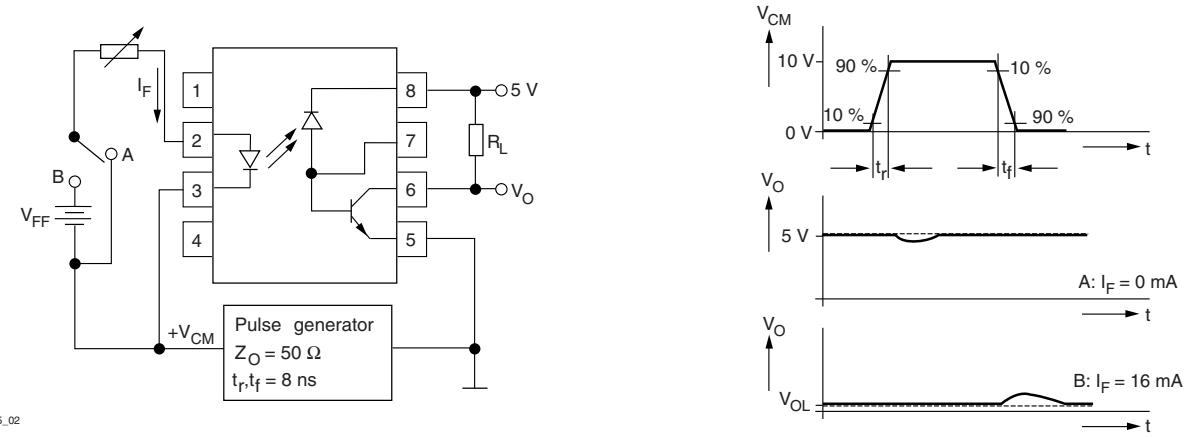


Fig. 2 - Common-Mode Interference Immunity

SAFETY AND INSULATION RATINGS						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Climatic classification (according to IEC 68 part 1)				55/110/21		
Pollution degree (DIN VDE 0109)				2		
Comparative tracking index per DIN IEC112/VDE 0303 part 1, group IIIa per DIN VDE 6110		CTI	175		399	
V_{IOTM}		V_{IOTM}	8000			V
V_{IORM}		V_{IORM}	630			V
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
P_{SI}		P_{SI}			500	mA
I_{SI}		I_{SI}			300	mW
T_{SI}		T_{SI}			175	°C
Creepage distance			7			mm
Clearance distance			7			mm
Insulation thickness			0.2			mm

Note

- As per IEC 60747-5-5, §7.4.3.8.1, this optocoupler is suitable for “safe electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

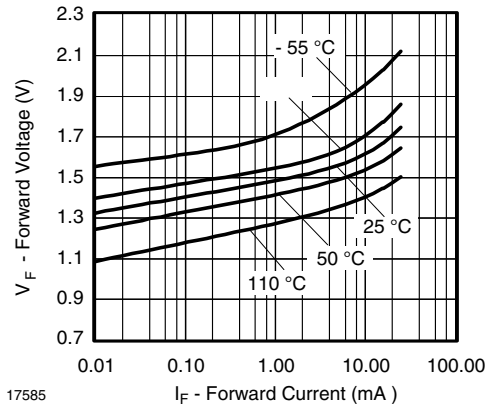


Fig. 3 - Forward Voltage vs. Forward Current

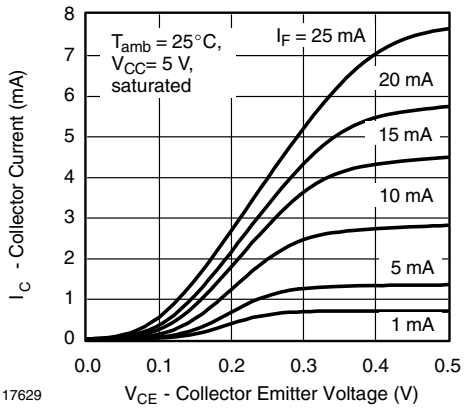


Fig. 5 - Collector Current vs. Collector Emitter Voltage

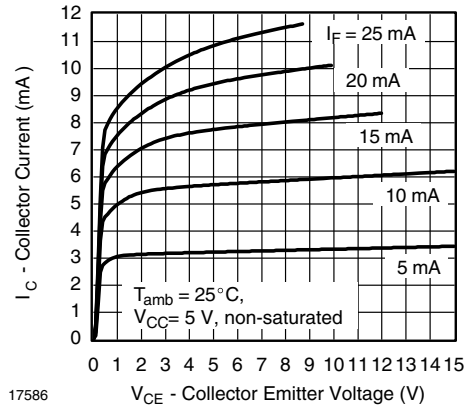


Fig. 4 - Collector Current vs. Collector Emitter Voltage

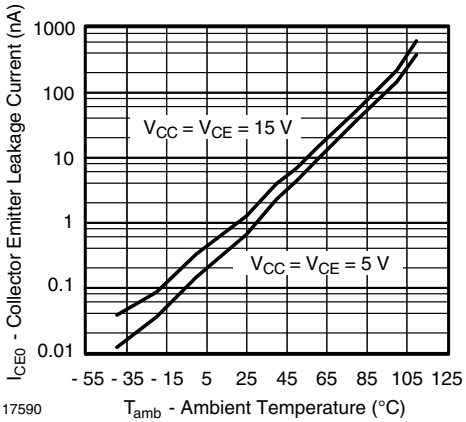


Fig. 6 - Collector Emitter Dark Current vs. Ambient Temperature

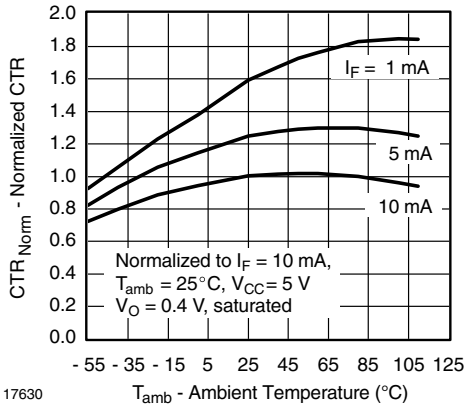


Fig. 7 - Normalized Current Transfer Ratio vs. Ambient Temperature

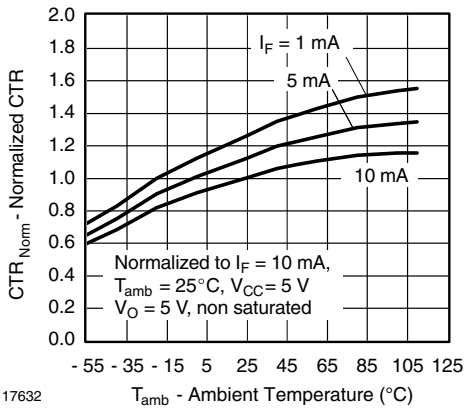


Fig. 10 - Normalized Current Transfer Ratio vs. Ambient Temperature

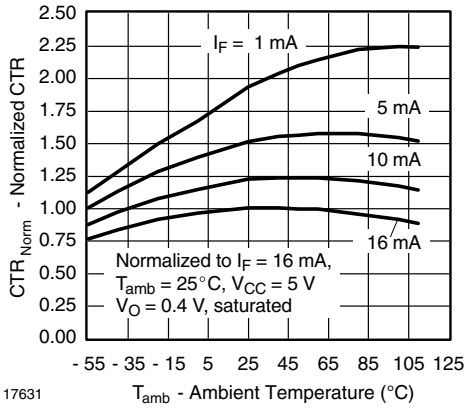


Fig. 8 - Normalized Current Transfer Ratio vs. Ambient Temperature

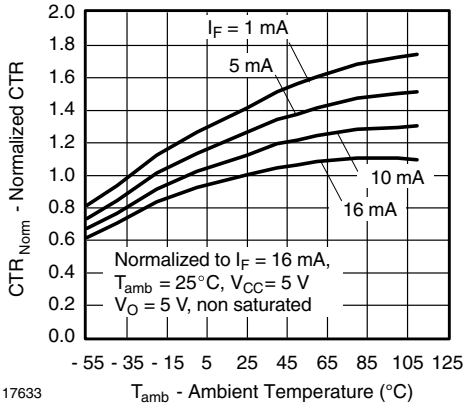


Fig. 11 - Normalized Current Transfer Ratio vs. Ambient Temperature

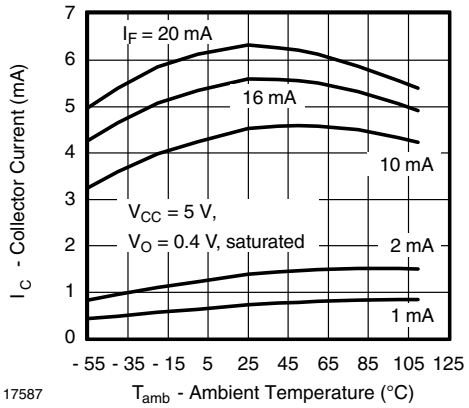


Fig. 9 - Output Current vs. Temperature

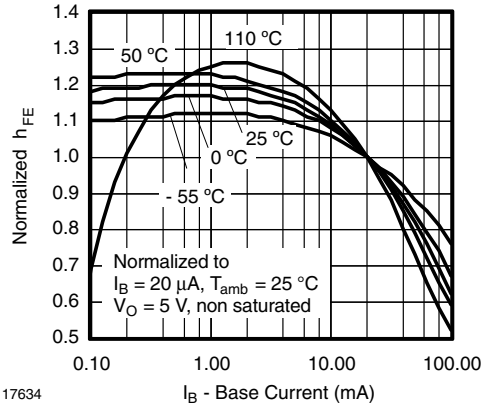


Fig. 12 - Normalized h_{FE} vs. Base Current

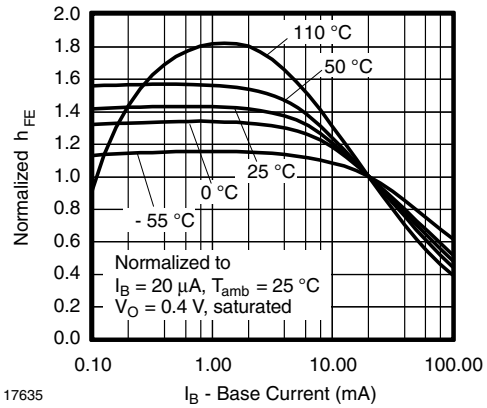


Fig. 13 - Normalized h_{FE} vs. Base Current

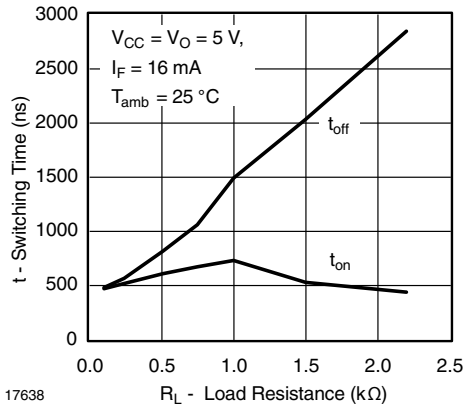


Fig. 16 - Switching Time vs. Load Resistance

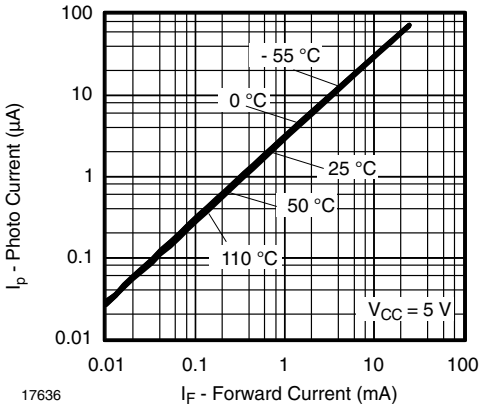


Fig. 14 - Photo Current vs. Forward Current

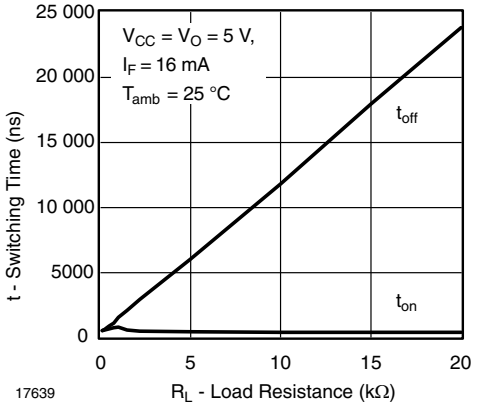


Fig. 17 - Switching Time vs. Load Resistance

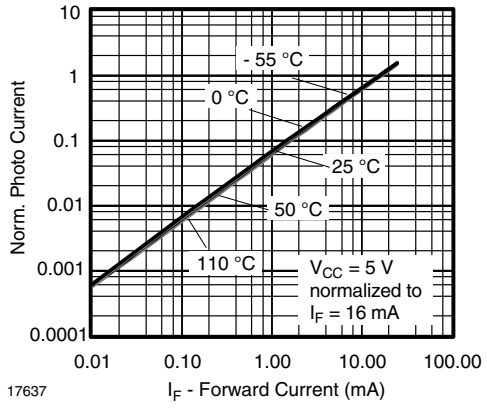


Fig. 15 - Photo Current vs. Forward Current

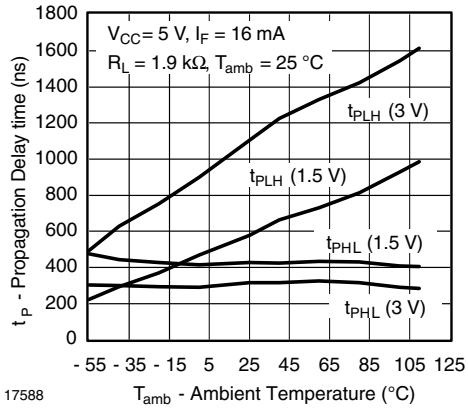


Fig. 18 - Propagation Delay vs. Ambient Temperature

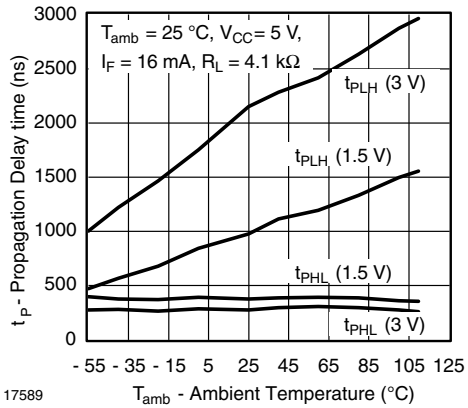


Fig. 19 - Propagation Delay vs. Ambient Temperature

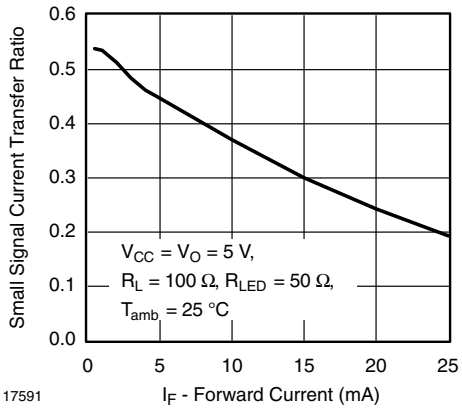


Fig. 20 - Small Signal CTR vs. Forward Current

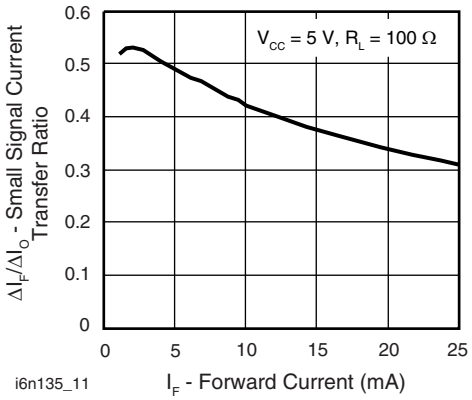
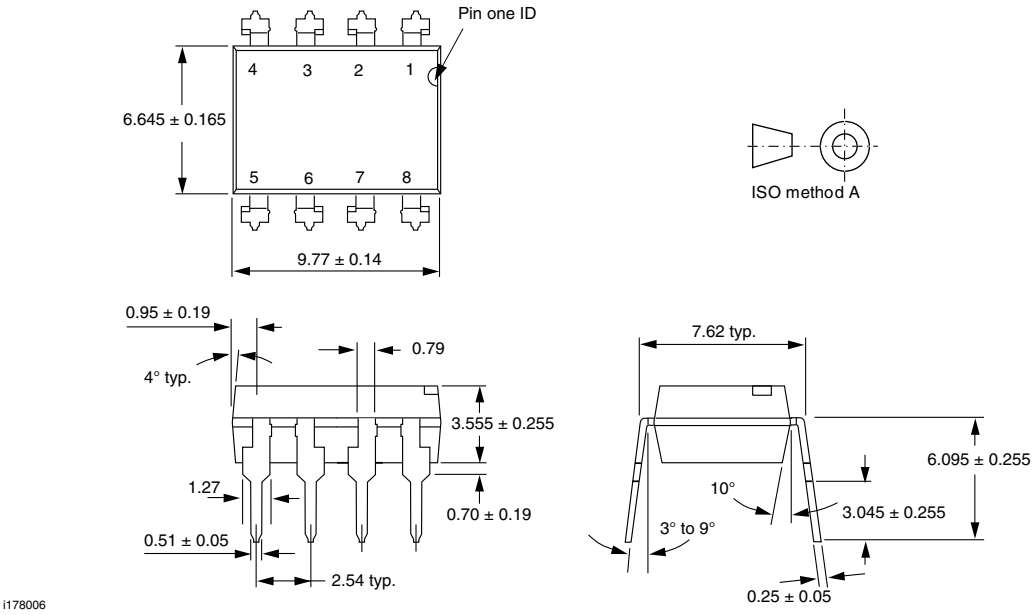
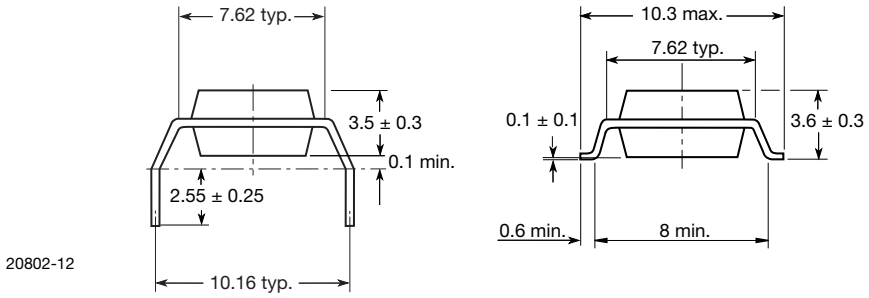


Fig. 21 - Small Signal Current Transfer Ratio vs. Quiescent Input Current

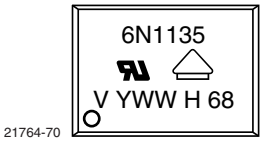
PACKAGE DIMENSIONS in millimeters



Option 6 **Option 9**



PACKAGE MARKING



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