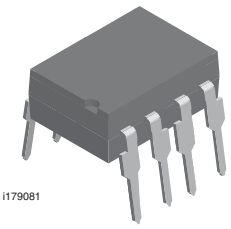
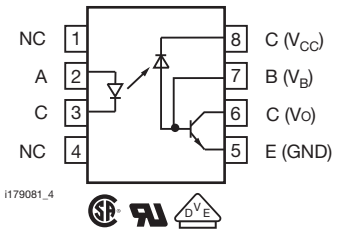
High Speed Optocoupler, 1 MBd, Photodiode with Transistor Output





FEATURES

- Isolation test voltages: 5300 V_{RMS}
- TTL compatible
- High bit rates: 1 Mbit/s
- High common-mode interference immunity
- 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 6N135 and 6N136 are 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.

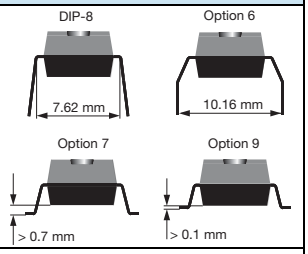
AGENCY APPROVALS

- UL1577, file no. E52744 system code H double protection
- DIN EN 60747-5-2 (VDE0884)/DIN EN 60747-5-5 (pending), available with option 1
- CSA 93751

ORDERING INFORMATION

6	N	1	3	#	-	X	0	#	#	T

PART NUMBER — PACKAGE OPTION — TAPE AND REEL



AGENCY CERTIFIED/PACKAGE	CTR (%)	
UL, CSA	**≥ 7**	**≥ 19**
DIP-8	6N135	6N136
DIP-8, 400 mil, option 6	-	6N136-X006
SMD-8, option 7	6N135-X007T (1)	6N136-X007T (1)
SMD-8, option 9	-	6N136-X009T (1)
VDE, UL, CSA	**≥ 7**	**≥ 19**
DIP-8	-	6N136-X001
DIP-8, 400 mil, option 6	-	6N136-X016
SMD-8, option 7	6N135-X017T (1)	6N136-X017T
SMD-8, option 9	-	6N136-X019T

Note

(1) Also available in tubes; do not add T to end

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_{FSM}	50	mA
Maximum surge forward current	t ≤ 1 µs, 300 pulses/s		1	A
Thermal resistance		R_{th}	700	K/W
Power dissipation	T_{amb} = 70 °C	P_{diss}	45	mW

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ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
OUTPUT				
Supply voltage		V_S	- 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
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	t = 1 s	V_{ISO}	5300	V_{RMS}
Pollution degree (DIN VDE 0109)			2	
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 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 = 16 mA		V_F		1.33	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_O		30		pF
Temperature coefficient, forward voltage	I_F = 16 mA		$\Delta V_F/\Delta T_A$		- 1.7		mV/°C
OUTPUT							
Logic low supply current	I_F = 16 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, I_O = 1.1 mA, V_{CC} = 4.5 V	6N135	V_{OL}		0.1	0.4	V
	I_F = 16 mA, I_O = 2.4 mA, V_{CC} = 4.5 V	6N136	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.

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CURRENT TRANSFER RATIO (T_{amb} = 25 °C, unless otherwise specified)							
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	6N135	CTR	7	16		%
		6N136	CTR	19	35		%
	I_F = 16 mA, V_O = 0.5 V, V_{CC} = 4.5 V	6N135	CTR	5			%
		6N136	CTR	15			%

SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
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	6N135	t_{PHL}		0.3	1.5	µs
	I_F = 16 mA, V_{CC} = 5 V, R_L = 1.9 kΩ	6N136	t_{PHL}		0.2	0.8	µs
Low to high	I_F = 16 mA, V_{CC} = 5 V, R_L = 4.1 kΩ	6N135	t_{PLH}		0.3	1.5	µs
	I_F = 16 mA, V_{CC} = 5 V, R_L = 1.9 kΩ	6N136	t_{PLH}		0.2	0.8	µs

COMMON MODE TRANSIENT IMMUNITY (T_{amb} = 25 °C, unless otherwise specified)							
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	6N135	$\|CM_H\|$		1000		V/µs
	I_F = 0 mA, V_{CM} = 10 V_{P-P}, V_{CC} = 5 V, R_L = 1.9 kΩ	6N136	$\|CM_H\|$		1000		V/µs
Low	I_F = 16 mA, V_{CM} = 10 V_{P-P}, V_{CC} = 5 V, R_L = 4.1 kΩ	6N135	$\|CM_L\|$		1000		V/µs
	I_F = 16 mA, V_{CM} = 10 V_{P-P}, V_{CC} = 5 V, R_L = 1.9 kΩ	6N136	$\|CM_L\|$		1000		V/µs

SAFETY AND INSULATION RATINGS						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Climatic classification (according to IEC 68 part 1)				55/100/21		
Comparative tracking index		CTI	175		399	
V_{IOTM}			8000			V
V_{IORM}			890			V
P_{SO}					500	mW
I_{SI}					300	mA
T_{SI}					175	°C
Creepage distance	Standard DIP-8		7			mm
Clearance distance	Standard DIP-8		7			mm
Creepage distance	400 mil DIP-8		8			mm
Clearance distance	400 mil DIP-8		8			mm

Note

- According to DIN EN 60747-5-2 (VDE 0884), 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.

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

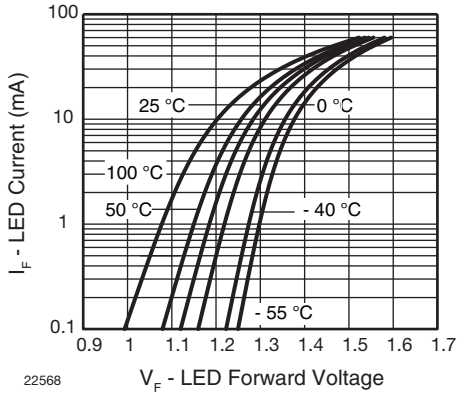

Fig. 1 - LED Forward Current vs. Forward Voltage

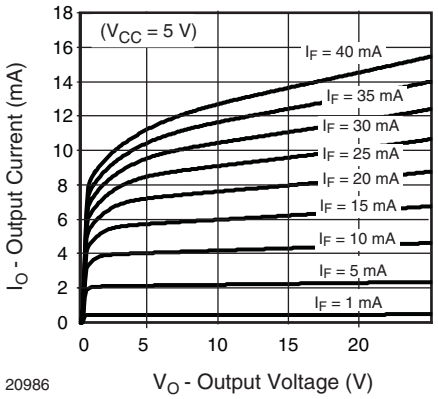

Fig. 4 - Output Current vs. Output Voltage

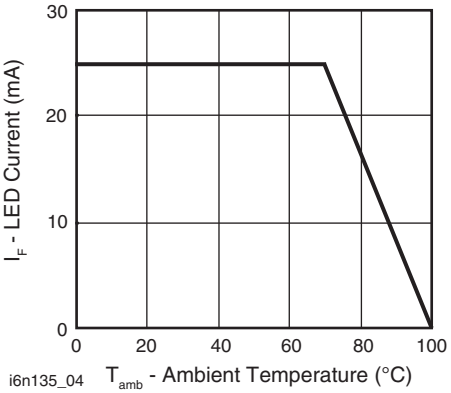

Fig. 2 - Permissible Forward LED Current vs. Temperature

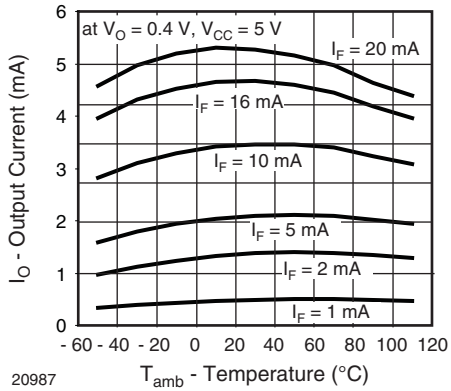

Fig. 5 - Output Current vs. Temperature

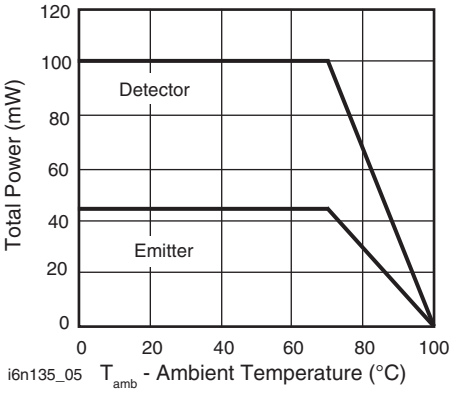

Fig. 3 - Permissible Power Dissipation vs. Temperature

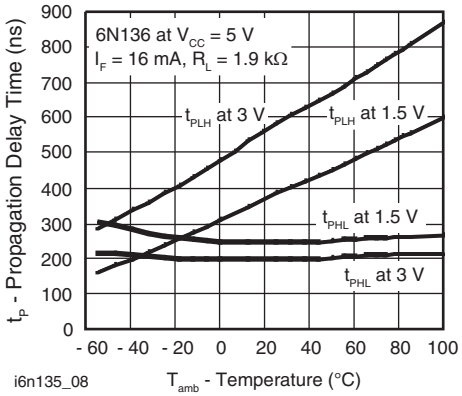

Fig. 6 - Propagation Delay vs. Ambient Temperature

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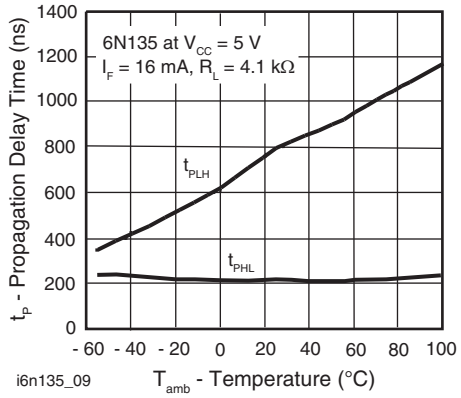


Fig. 7 - Propagation Delay vs. Ambient Temperature

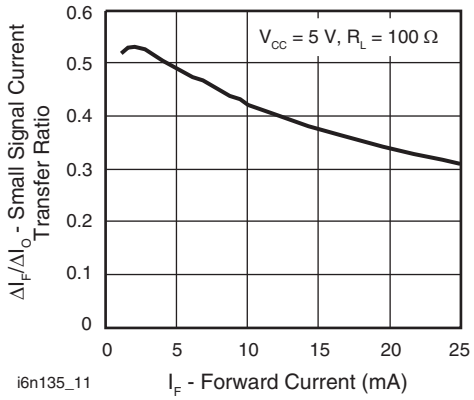


Fig. 9 - Small Signal Current Transfer Ratio vs. Quiescent Input Current

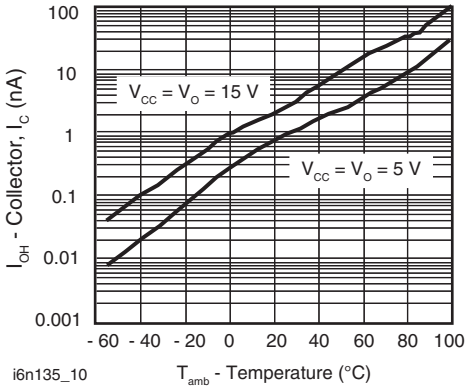
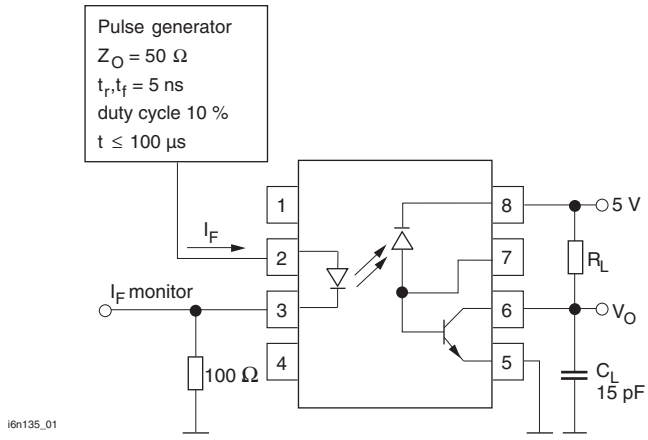


Fig. 8 - Logic High Output Current vs. Temperature



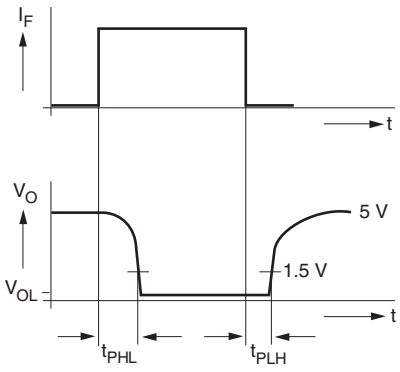


Fig. 10 - Switching Times

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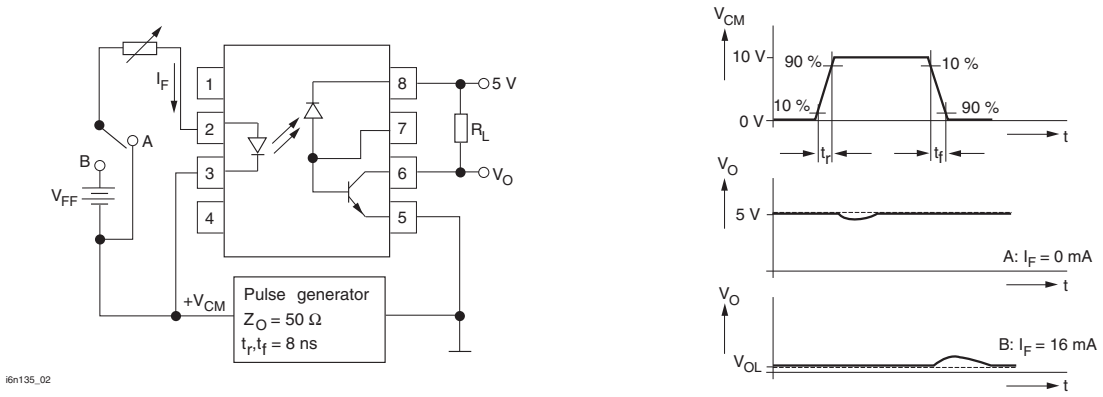
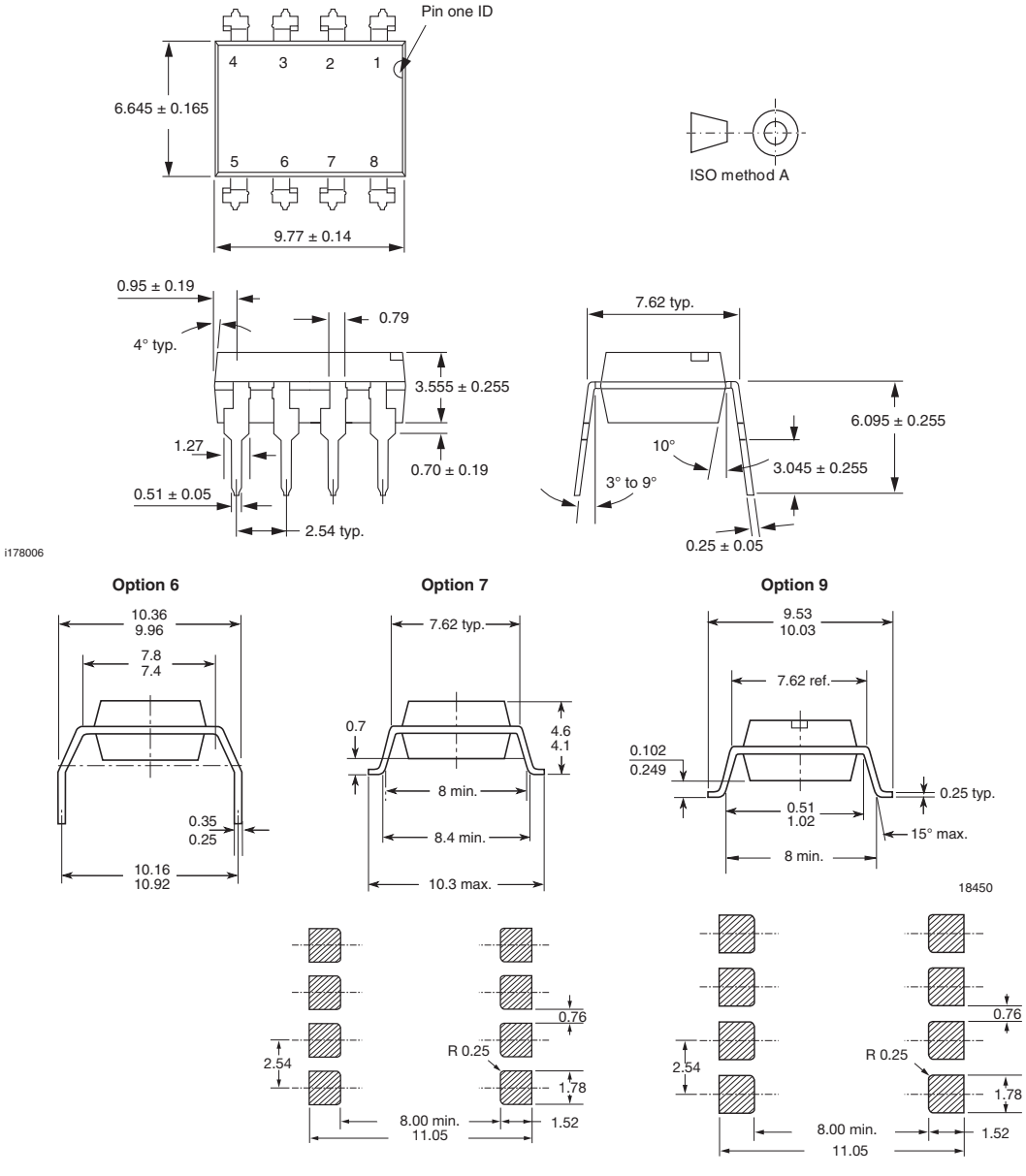


Fig. 11 - Common-Mode Interference Immunity

PACKAGE DIMENSIONS in millimeters



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PACKAGE MARKING



Notes

- Only options 1, and 7 are 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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