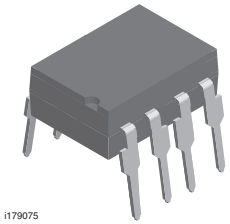
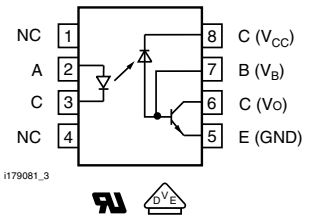
High Speed Optocoupler, 1 MBd, Transistor Output





FEATURES

- Isolation test voltage 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

AGENCY APPROVALS

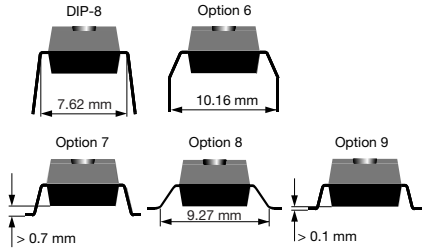
- UL1577, file no. E52744 system code H or J, double protection
- CSA 93751
- DIN EN 60747-5-5 (VDE 0884)

DESCRIPTION

The SFH6135 and SFH6136 optocouplers feature a high signal transmission rate and a high isolation resistance. They have 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.

ORDERING INFORMATION

S	F	H	6	1	3	#	-	X	0	#	#	T
PART NUMBER								PACKAGE OPTION				TAPE AND REEL



AGENCY CERTIFIED/PACKAGE	CTR (%)	
UL	**≥ 7**	**≥ 19**
DIP-8	SFH6135	SFH6136
DIP-8, 400 mil, option 6	SFH6135-X006	SFH6136-X006
SMD-8, option 7	SFH6135-X007T (1)	SFH6136-X007
SMD-8, option 9	-	SFH6136-X009T
VDE, UL	**≥ 7**	**≥ 19**
DIP-8	SFH6135-X001	SFH6136-X001
DIP-8, 400 mil, option 6	-	SFH6136-X016
SMD-8, option 7	-	SFH6136-X017T (1)
SMD-8, option 8	-	SFH6136-X018
SMD-8, option 9	SFH6135-X019	SFH6136-X019T (1)

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	3	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_{thja}	700	K/W
Power dissipation		P_{diss}	45	mW
OUTPUT				
Supply voltage		V_S	- 0.5 to 30	V
Output voltage		V_O	- 0.5 to 25	V
Emitter base voltage		V_{EBO}	5	V
Output current		I_O	8	mA
Maximum output current		I_O	16	mA
Base current		I_B	5	mA
Thermal resistance		R_{thja}	300	K/W
Power dissipation	T_{amb} = 70 °C	P_{diss}	100	mW
COUPLER				
Isolation test voltage		V_{ISO}	5300	V_{RMS}
Pollution degree (DIN VDE 0110)			2	
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
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 distance 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 wave profile for soldering conditions for through hole devices .

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		1.6	1.9	V
Breakdown voltage	I_R = 10 µA		V_{BR}	3			V
Reverse current	V_R = 3 V		I_R		0.5	10	µA
Capacitance	V_R = 0 V, f = 1 MHz		C_O		125		pF
Temperature coefficient of forward voltage	I_F = 16 mA		$\Delta V_F/\Delta T_{amb}$		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 V, 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	SFH6135	V_{OL}		0.1	0.4	V
	I_F = 16 mA, V_{CC} = 4.5 V, I_O = 2.4 mA	SFH6136	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

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
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	SFH6135	CTR	7	16		%
		SFH6136	CTR	19	35		%
	I_F = 16 mA, V_O = 0.5 V, V_{CC} = 4.5 V	SFH6135	CTR	5			%
		SFH6136	CTR	15			%

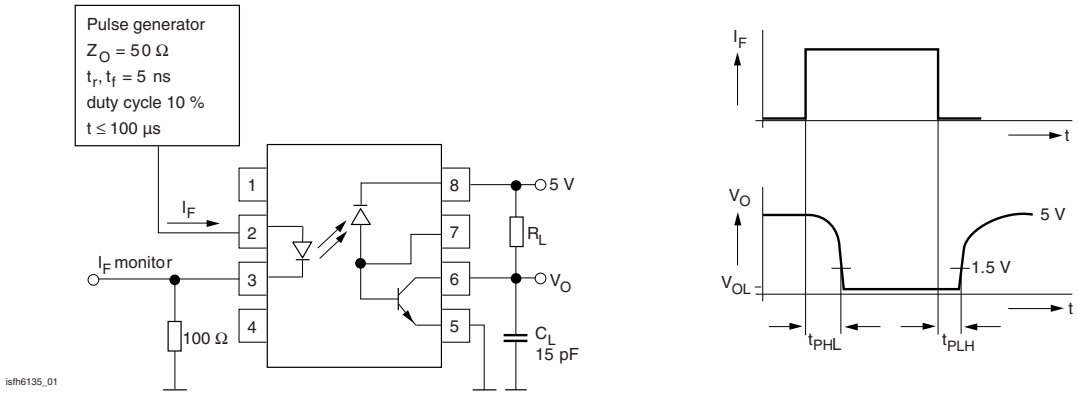


Fig. 1 - Schematics

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	SFH6135	t_{PHL}		0.3	1.5	µs
	I_F = 16 mA, V_{CC} = 5 V, R_L = 1.9 kΩ	SFH6136	t_{PHL}		0.2	0.8	µs
Low to high	I_F = 16 mA, V_{CC} = 5 V, R_L = 4.1 kΩ	SFH6135	t_{PLH}		0.3	1.5	µs
	I_F = 16 mA, V_{CC} = 5 V, R_L = 1.9 kΩ	SFH6136	t_{PLH}		0.2	0.8	µs

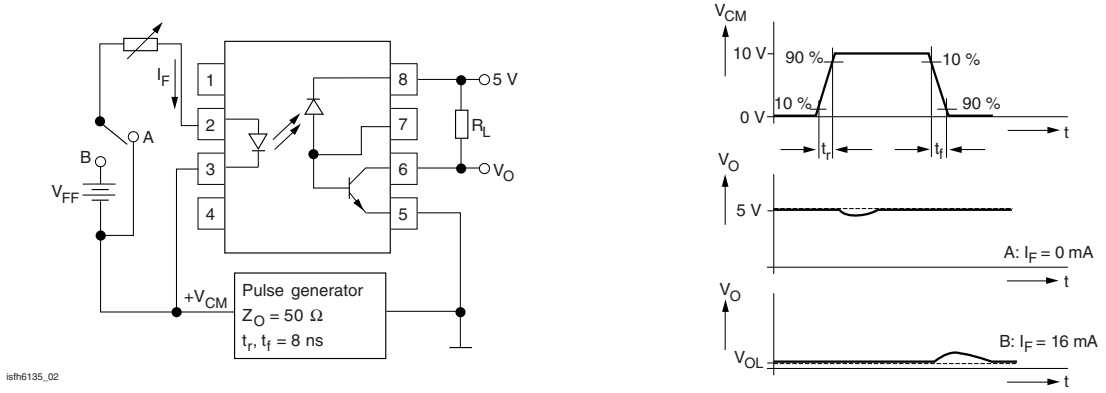


Fig. 2 - Common Mode Interference Immunity

COMMON MODE TRANSIENT IMMUNITY							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
High	V_{CM} = 10 V_{P-P}, V_{CC} = 5 V, I_F = 0 mA, R_L = 4.1 kΩ	SFH6135	CM_H		1000		V/µs
	V_{CM} = 10 V_{P-P}, V_{CC} = 5 V, I_F = 0 mA, R_L = 1.9 kΩ	SFH6136	CM_H		1000		V/µs
Low	V_{CM} = 10 V_{P-P}, V_{CC} = 5 V, I_F = 0 mA, R_L = 4.1 kΩ	SFH6135	CM_L		1000		V/µs
	V_{CM} = 10 V_{P-P}, V_{CC} = 5 V, I_F = 0 mA, R_L = 1.9 kΩ	SFH6136	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

- 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)

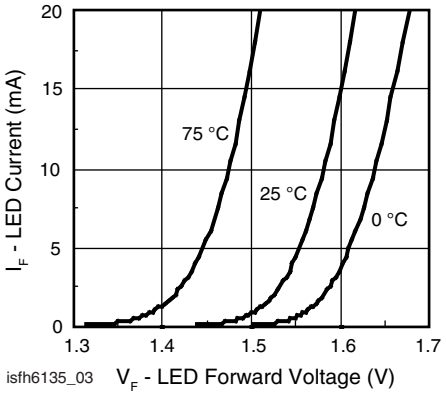


Fig. 3 - LED Forward Current vs. Forward Voltage

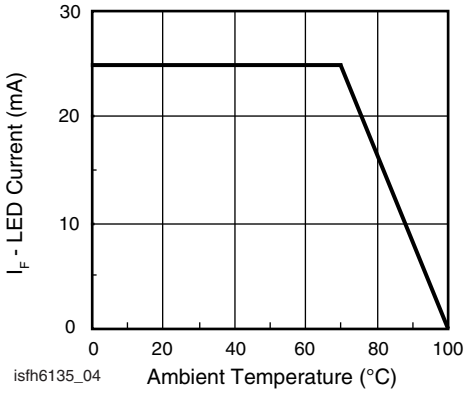


Fig. 4 - Permissible Forward LED Current vs. Temperature

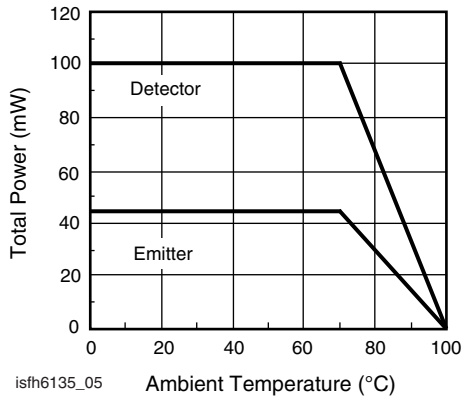


Fig. 5 - Permissible Power Dissipation vs. Temperature

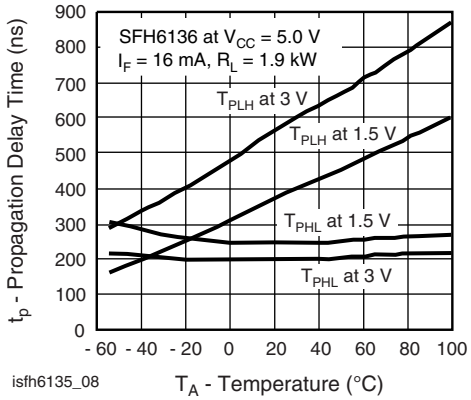


Fig. 8 - Propagation Delay vs. Ambient Temperature - SFH6136

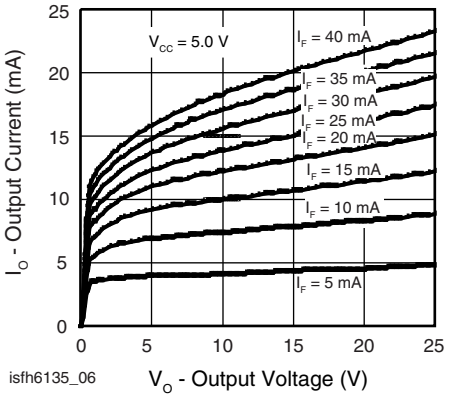


Fig. 6 - Output Current vs. Output Voltage

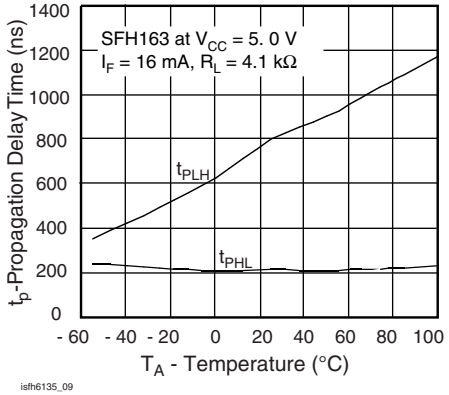


Fig. 9 - Propagation Delay vs. Ambient Temperature - SFH6135

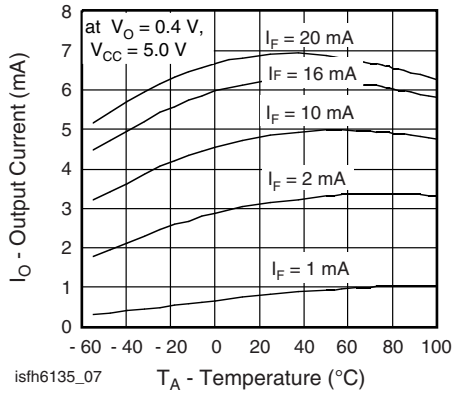


Fig. 7 - Output Current vs. Temperature

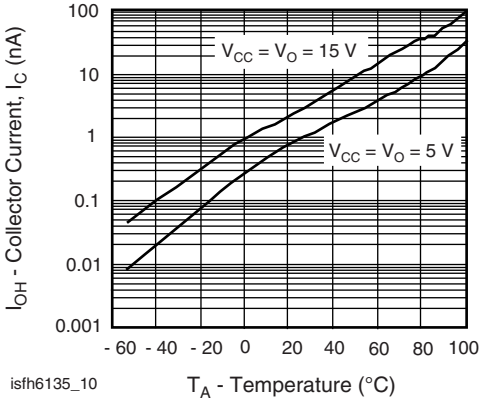


Fig. 10 - Logic High Output Current vs. Temperature

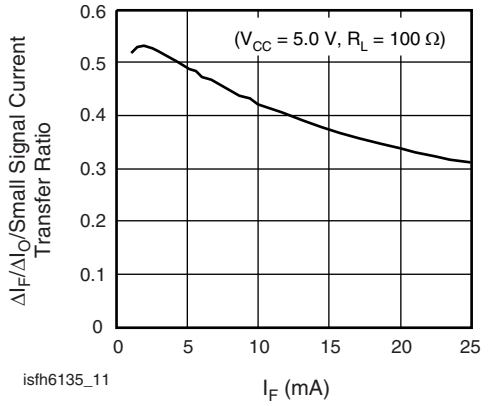
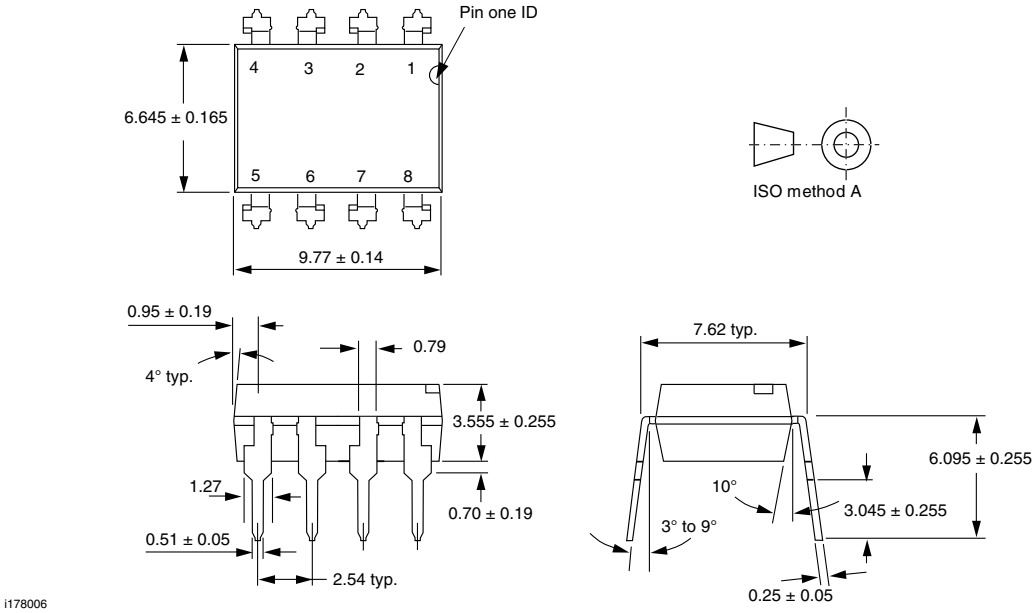
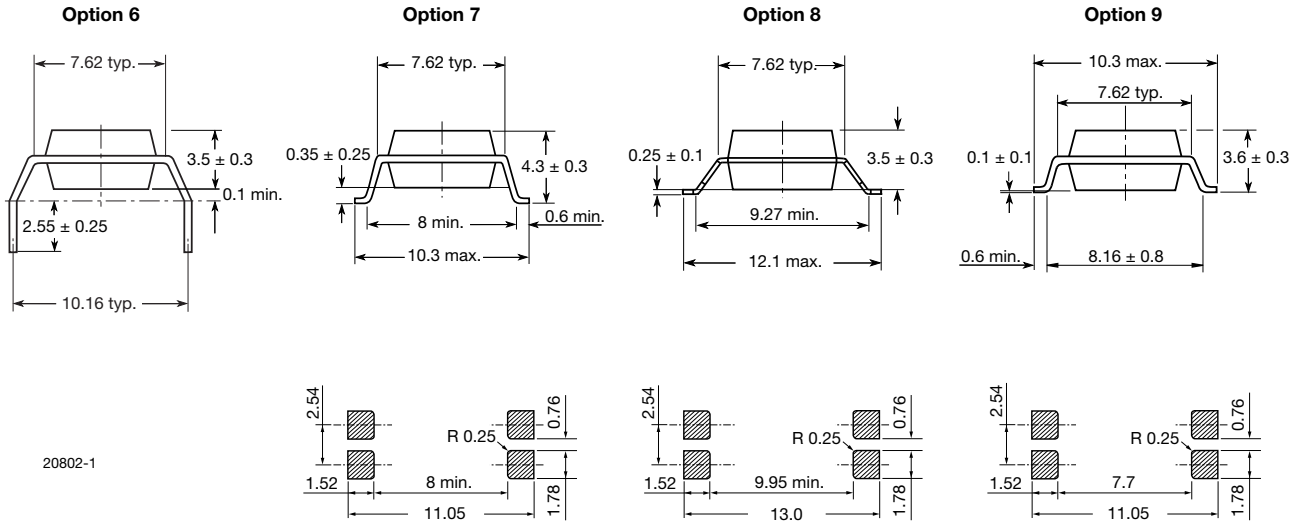


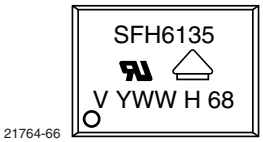
Fig. 11 - Small Signal Current Transfer Ratio vs. Quiescent Input Current

PACKAGE DIMENSIONS in millimeters





PACKAGE MARKING



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