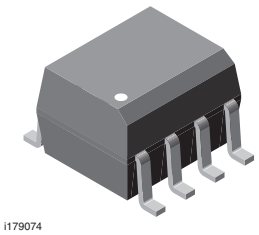
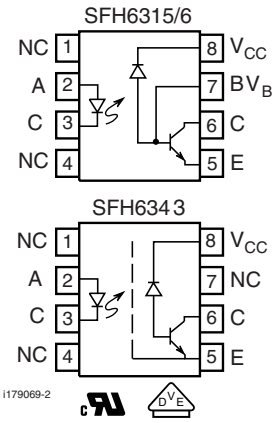
High Speed Optocoupler, 1 MBd, Transistor Output





FEATURES

- Surface mountable
- Industry standard SOIC-8 footprint
- Compatible with infrared vapor phase reflow and wave soldering processes
- Isolation test voltage, 4000 V_{RMS}
- Very high common mode transient immunity: 15000 V/µs at V_{CM} = 1500 V guaranteed (SFH6343)
- High speed: 1 MBd
- TTL compatible
- Guaranteed AC and DC performance temperature: 0 °C to 70 °C
- Open collector output
- Pin compatible with agilent (HP) optocouplers
  - SFH6315T - HCPL0500
  - SFH6316T - HCPL0501
  - SFH6343T - HCPL0453
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC

Pb-free

e3

RoHS COMPLIANT

DESCRIPTION

The SFH6315T, SFH6316T, SFH6343T, high speed optocouplers, each consists of a GaAlAs infrared emitting diode, optically coupled with an integrated photo detector and a high speed transistor. The photo detector is junction isolated from the transistor to reduce miller capacitance effects. The open collector output function allows circuit designers to adjust the load conditions when interfacing with different logic systems such as TTL, CMOS, etc.
Because the SFH6343T has a faraday shield on the detector chip, it can also reject and minimize high input to output common mode transient voltages. There is no base connection, further reducing the potential electrical noise entering the package.
The SFH6315T, SFH6316T, SFH6343T are packaged in industry standard SOIC-8 packages and are suitable for surface mounting.

APPLICATIONS

- Line receivers
- Logic ground isolation
- Analog signal ground isolation
- Replace pulse transformers

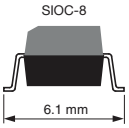
AGENCY APPROVALS

- UL1577, file no. E52744 system code Y
- cUL - file no. E52744, equivalent to CSA bulletin 5A
- DIN EN 60747-5-5 (VDE 0884) available with option 1

ORDERING INFORMATION

S	F	H	6	3	#	#	T

PART NUMBER



AGENCY CERTIFIED/ PACKAGE	CTR (%)		
UL, cUL	≥ 5	≥ 15	NO BASE CONNECTION
SOIC-8	SFH6315T (1)	SFH6316T (1)	SFH6343T (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
DC forward current		I_F	25	mA
Surge forward current	$t_p \leq 1$ µs, 300 pulses/s	I_{FSM}	1	A
Power dissipation	$T_{amb} \leq 70$ °C	P_{diss}	45	mW

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
OUTPUT				
Supply voltage		V_S	- 0.5 to 30	V
Output voltage		V_O	- 0.5 to 25	V
Output current		I_O	8	mA
Power dissipation	$T_{amb} \leq 70$ °C	P_{diss}	100	mW
COUPLER				
Isolation test voltage between emitter and detector		V_{ISO}	4000	V_{RMS}
Pollution degree (DIN VDE 0110)			2	
Creepage distance			≥ 4	mm
Clearance distance			≥ 4	mm
Comparative tracking index per DIN IEC 112/VDE 0303 part 1		CTI	175	
Isolation resistance	V_{IO} = 500 V, T_{amb} = 25 °C, R_{ISOL} (1)	R_{IO}	$\geq 10^{12}$	Ω
	V_{IO} = 500 V, T_{amb} = 100 °C, R_{ISOL} (1)	R_{IO}	$\geq 10^{11}$	Ω
Storage temperature range		T_{stg}	- 55 to + 150	°C
Ambient temperature range		T_{amb}	- 55 to + 100	°C
Junction temperature		T_j	100	°C
Soldering temperature (2)	max. 10 s, dip soldering distance to seating plane ≥ 1.5 mm		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) Device considered a two-terminal device: pins 1, 2, 3, and 4 shorted together and pins 5, 6, 7, and 8 shorted together.

(2) Refer to reflow profile for soldering conditions for surface mounted 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, 25 °C		V_F		1.6	1.8	V
			V_F		1.6	1.9	V
Reverse current	V_R = 3 V		I_R		0.5	10	µA
Capacitance	f = 1 MHz, V_F = 0 V		C_{IN}		75		pF
Temperature coefficient of	I_F = 16 mA		$\Delta V_F/$		- 1.7		mW/°C
OUTPUT							
Logic low supply current	I_F = 16 mA, V_O = open, V_{CC} = 15 V		I_{CCL}		200		µA
Logic high supply current	I_F = 0 mA, V_O = open, V_{CC} = 15 V; 25 °C		I_{CCH}		0.001	1	µA
			I_{CCH}		0.001	2	µA
Logic low output voltage	I_F = 16 mA, V_{CC} = 4.5 V, I_O = 1.1 mA,	SFH6315T	V_{OL}		0.15	0.4	V
	I_F = 16 mA, V_{CC} = 4.5 V, I_O = 0.8 mA	SFH6315T	V_{OL}		0.15	0.5	V
	I_F = 16 mA, V_{CC} = 4.5 V, I_O = 3 mA,	SFH6316T	V_{OL}		0.15	0.4	V
	I_F = 16 mA, V_{CC} = 4.5 V, I_O = 2.4 mA	SFH6343T	V_{OL}		0.15	0.5	V
	I_F = 16 mA, V_{CC} = 4.5 V, I_O = 2.4 mA	SFH6316T	V_{OL}		0.15	0.5	V
	I_F = 16 mA, V_{CC} = 4.5 V, I_O = 2.4 mA	SFH6343T	V_{OL}		0.15	0.5	V
Logic high output current	I_F = 0 mA, V_O = V_{CC} = 5.5 V, 25 °C		I_{OH}		0.003	0.5	µA
	I_F = 0 mA, V_O = V_{CC} = 15 V, 25 °C		I_{OH}		0.01	1	µA
	I_F = 0 mA, V_O = V_{CC} = 15 V		I_{OH}			50	µA

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
COUPLER							
Capacitance (input to output) (1)	f = 1 MHz		C_{IO}		0.4		pF

Notes

- 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.

(1) A 0.1 µF bypass capacitor connected between pins 5 and 8 is recommended.

CURRENT TRANSFER RATIO							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Current transfer ratio	V_O = 0.4 V, I_F = 16 mA, V_{CC} = 4.5 V, 25 °C	SFH6315T	CTR	7	16	50	%
	V_O = 0.5 V, I_F = 16 mA, V_{CC} = 4.5 V	SFH6315T	CTR	5	17		%
	V_O = 0.4 V, I_F = 16 mA, V_{CC} = 4.5 V, 25 °C	SFH6316T	CTR	19	35	50	%
	V_O = 0.4 V, I_F = 16 mA, V_{CC} = 4.5 V, 25 °C	SFH6343T	CTR	19	35	50	%
	V_O = 0.5 V, I_F = 16 mA, V_{CC} = 4.5 V	SFH6343T	CTR	15	36		%
	V_O = 0.5 V, I_F = 16 mA, V_{CC} = 4.5 V	SFH6316T	CTR	15	36		%

Note

- Current transfer ratio in percent equals the ratio of output collector current (I_O) to the forward LED input current (I_F) times 100. A 0.1 µF bypass capacitor connected between pins 5 and 8 is recommended.

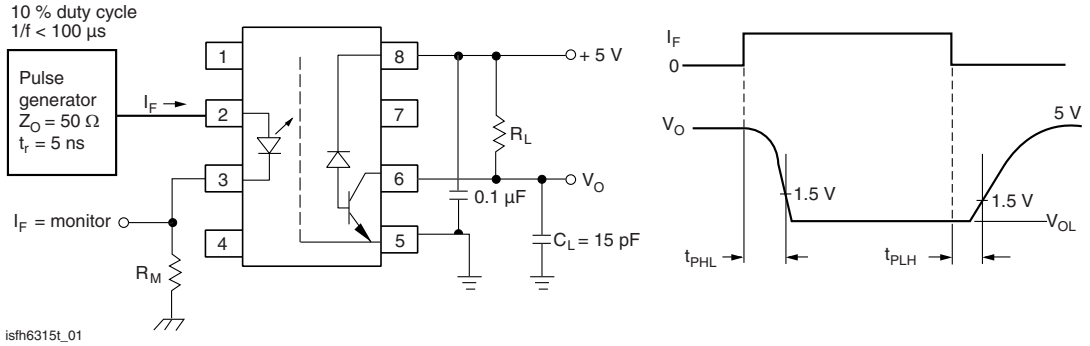


Fig. 1 - Test Circuit for Switching Times

SWITCHING CHARACTERISTICS							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Propagation delay time to logic low at output (see fig. 1)	R_L = 4.1 KΩ	SFH6315T	t_{PHL} (1)		0.5	1.5	µs
		SFH6315T	t_{PHL}		0.5	2	µs
	R_L = 1.9 KΩ	SFH6316T	t_{PHL}		0.25	0.8	µs
		SFH6343T	t_{PHL}		0.25	1	µs
Propagation delay time to logic high at output (see fig. 1)	R_L = 4.1 KΩ	SFH6315T	t_{PLH} (1)		0.5	1.5	µs
		SFH6315T	t_{PLH}		0.5	2	µs
	R_L = 1.9 KΩ	SFH6316T	t_{PLH}		0.5	0.8	µs
		SFH6343T	t_{PLH}		0.5	1	µs

Notes

- Over recommended temperature (T_{amb} = 0 °C to 70 °C), V_{CC} = 5 V, I_F = 16 mA unless otherwise specified. The 1.9 kW load represents 1 TTL unit load of 1.6 mA and the 5.6 kW pull-up resistor. The 4.1 kW load represents 1 LSTTL unit load of 0.36 mA and the 6.1 kW pull-up resistor.

(1) T_{amb} = 25 °C, unless otherwise specified.

COMMON MODE TRANSIENT IMMUNITY							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Common mode transient immunity at logic high level output (see fig. 2)	R_L = 4.1 kΩ, I_F = 0 mA, V_{CM} = 10 V_{P-P}	SFH6315T	$\|CM_H\|$		1		kV/µs
	R_L = 1.9 kΩ, I_F = 0 mA, V_{CM} = 1500 V_{P-P}	SFH6316T	$\|CM_H\|$		1		kV/µs
		SFH6343T	$\|CM_H\|$	15	30		kV/µs
Common mode transient immunity at logic low level output (see fig. 2)	R_L = 4.1 kΩ, I_F = 16 mA, V_{CM} = 10 V_{P-P}	SFH6315T	$\|CM_L\|$		1		kV/µs
	R_L = 1.9 kΩ, I_F = 16 mA, V_{CM} = 10 V_{P-P}	SFH6316T	$\|CM_L\|$		1		kV/µs
	R_L = 1.9 kΩ, I_F = 16 mA, V_{CM} = 1500 V_{P-P}	SFH6343T	$\|CM_L\|$	15	30		kV/µs

Note

- Common mode transient immunity in a logic high level is the maximum tolerable (positive) dV_{CM}/dt on the leading edge of the common mode pulse (V_{CM}) to assure that the output will remain in a logic high state (i.e., V_O > 2 V). Common mode transient immunity in a logic low level the maximum tolerable (negative) dV_{CM}/dt on the trailing edge of the common mode pulse signal (V_{CM} to assure that the output will remain in logic low state, i.e., V_O > 0.8 V).
  The 1.9 kΩ load represents 1 TTL unit load of 1.6 mA and the 5.6 kΩ pull-up resistor.
  The 4.1 kΩ load represents 1 LSTTL unit load of 0.36 mA and the 6.1 kΩ pull-up resistor.

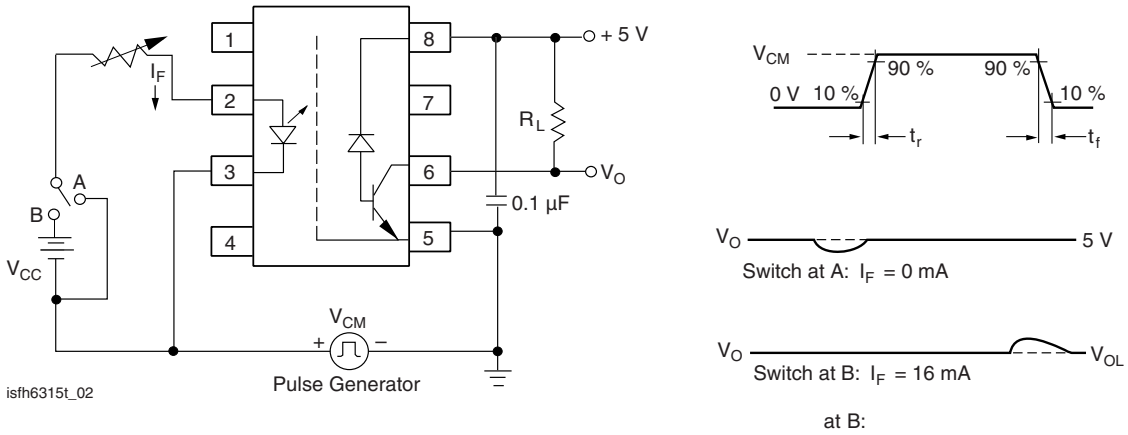


Fig. 2 - Test Circuit for Transient Immunity and Typical Waveforms

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}			6000			V
V_{IORM}			560			V
P_{SO}					350	mW
I_{SI}					150	mA
T_{SI}					165	°C
Creepage distance			4			mm
Clearance distance			4			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)

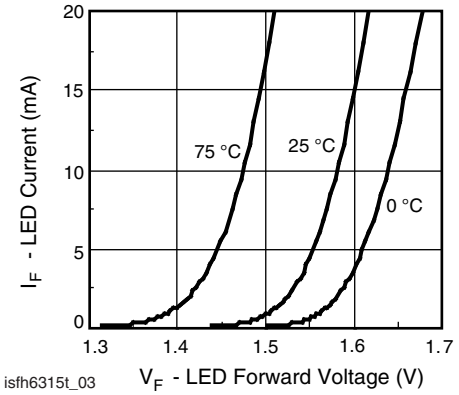


Fig. 3 - LED Forward Current vs. Forward Voltage

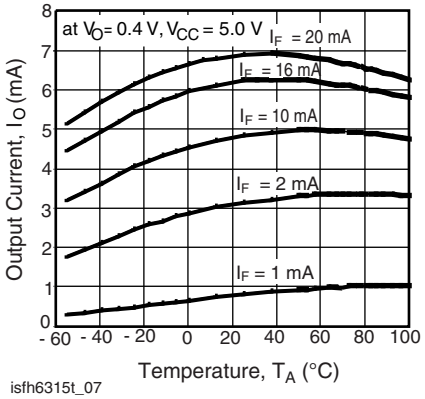


Fig. 6 - Output Current vs. Temperature

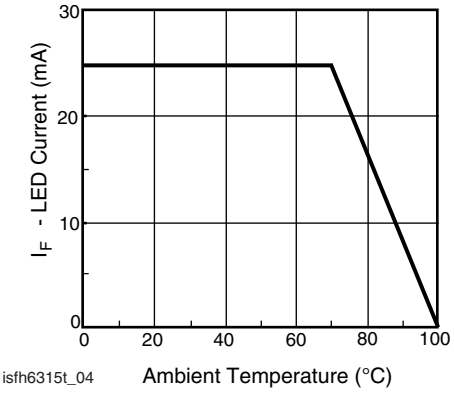


Fig. 4 - Permissible Forward LED Current vs. Temperature

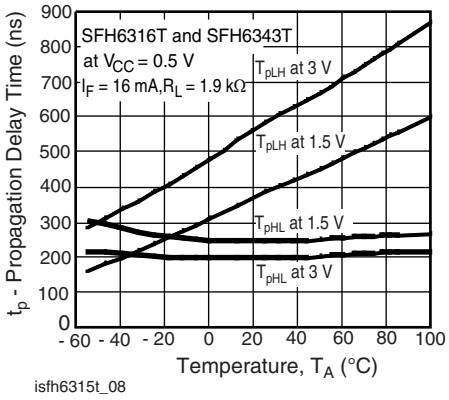


Fig. 7 - Propagation Delay vs. Temperature SFH6316T and SFH6343T

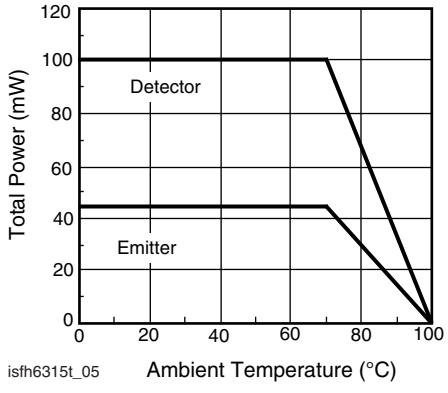


Fig. 5 - Permissible Power Dissipation vs. Temperature

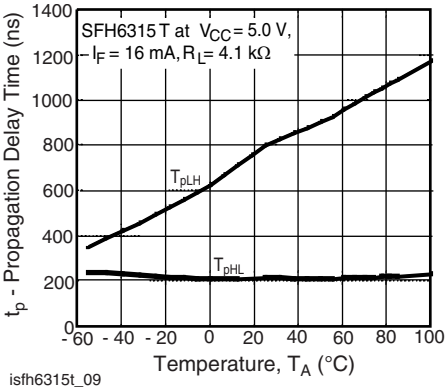


Fig. 8 - Propagation Delay vs. Temperature SFH6315T

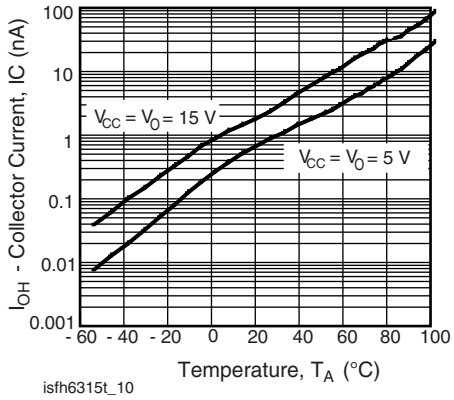


Fig. 9 - Logic High Output Current vs.Temperature

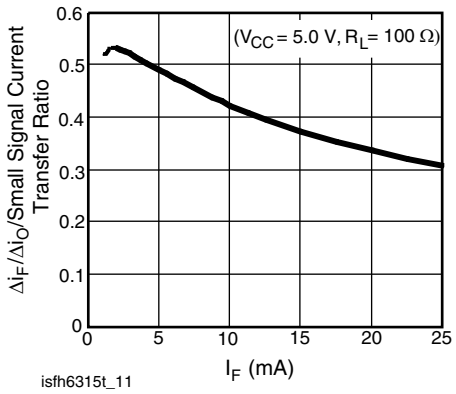
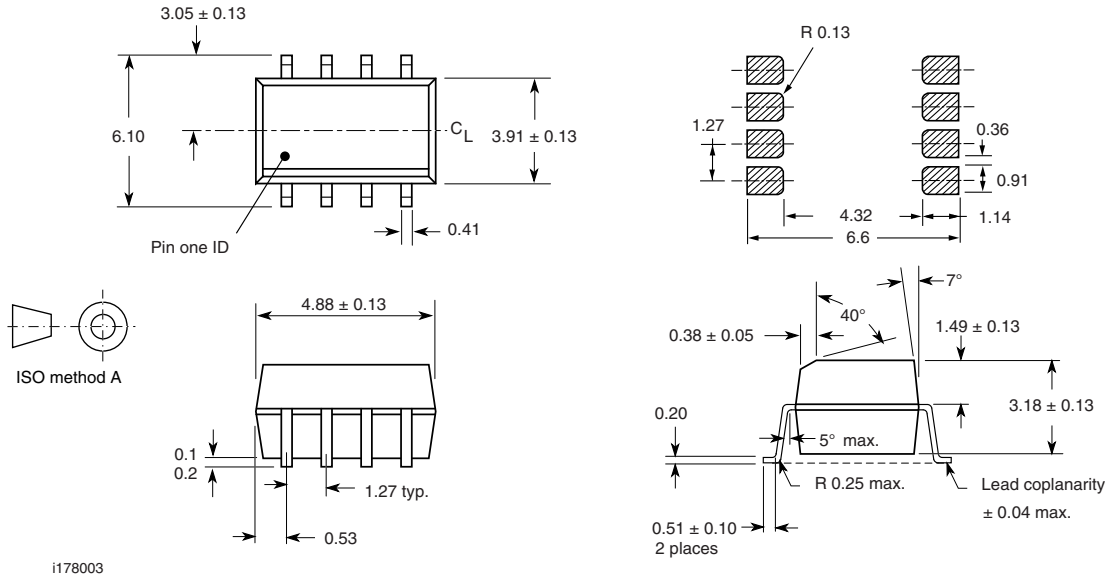
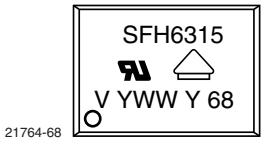


Fig. 10 - Small Signal Current Transfer Ratio vs. Input Current

PACKAGE DIMENSIONS in millimeters



PACKAGE MARKING



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