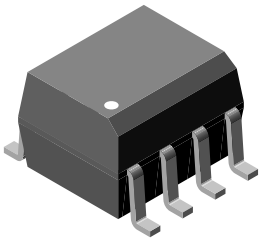
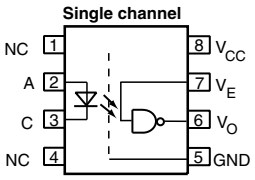
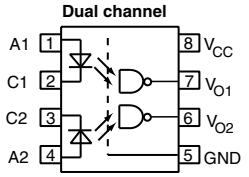
High Speed Optocoupler, 10 MBd, SOIC-8 Package





SFH6747



SFH6755, SFH6756, SFH6757

FEATURES

- Choice of CMR performance of 10 kV/µs, 5 kV/µs, and 0.1 kV/µs
- High speed: 10 MBd typical
- + 5 V CMOS compatibility
- Pure tin leads
- Guaranteed AC and DC performance over temperature: -40 °C to +100 °C temperature range
- Meets IEC 60068-2-42 (SO_2) and IEC 60068-2-43 (H_2S) requirements
- Low input current capability: 5 mA
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

APPLICATIONS

- Microprocessor system M interface
- PLC, ATE input / output isolation
- Computer peripheral interface: SPI
- Digital fieldbus isolation: CC-Link, DeviceNet, profibus, SDS
- High speed A/D and D/A conversion
- AC plasma display panel level shifting
- Multiplexed data transmission
- Digital control power supply
- Ground loop elimination

DESCRIPTION

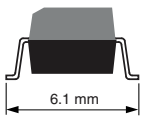
The SFH6747, SFH6755, SFH6756, and SFH6757 family are single and dual channel 10 MBd optocoupler utilizing a high efficient input LED coupled with an integrated optical photodiode IC detector. The detector has an open drain NMOS-transistor output, providing less leakage compared to an open collector Schottky clamped transistor output. For the single channel type, an enable function on pin 7 allows the detector to be strobed. The use of a 0.1 µF bypass capacitor connected between pin 5 and 8 is recommended.

AGENCY APPROVALS

- UL1577, file no. E52744
- cUL-file no. E52744, equivalent to CSAkm bulletin 5A

ORDERING INFORMATION

S	F	H	6	7	#	#	T
PART NUMBER							TAPE AND REEL



AGENCY CERTIFIED/PACKAGE	1 CHANNEL	2 CHANNELS		
	CMR (kV/µs)	CMR (kV/µs)		
UL, cUL	10	0.1	5	10
SOIC-8	SFH6747T	SFH6755T	SFH6756T	SFH6757T

TRUTH TABLE (positive logic)		
LED	**ENABLE (1)**	**OUTPUT**
On	H	L
Off	H	H
On	L	H
Off	L	H
On	NC	L
Off	NC	H

Note

(1) Only applicable for single channel devices

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
Average forward current (single channel)		I_F	20	mA
Average forward current (dual channel)		I_F	15	mA
Reverse input voltage		V_R	5	V
Enable input voltage (single channel)		V_E	V_{CC} + 0.5 V	V
Enable input current (single channel)		I_E	5	mA
Surge current	t = 100 µs	I_{FSM}	200	mA
Input power dissipation (single channel)		P_{diss}	35	mW
Input power dissipation (per channel for dual channel)		P_{diss}	25	mW
OUTPUT				
Supply voltage	1 min maximum	V_{CC}	7	V
Output current		I_O	50	mA
Output voltage		V_O	7	V
Output power dissipation (single channel)		P_{diss}	85	mW
Output power dissipation (per channel for dual channel)		P_{diss}	60	mW
COUPLER				
Isolation test voltage	t = 1 s	V_{ISO}	4000	V_{RMS}
Storage temperature		T_{stg}	-55 to +150	°C
Operating temperature		T_{amb}	-40 to +100	°C
Lead solder temperature	for 10 s		260	°C
Solder reflow temperature (1)	for 1 min		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.

RECOMMENDED OPERATING CONDITION						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Operating temperature		T_{amb}	-40	-	100	°C
Supply voltage		V_{CC}	4.5	-	5.5	V
Input current low level		I_{FL}	0	-	250	µA
Input current high level		I_{FH}	5	-	15	mA
Output pull up resistor		R_L	330	-	4000	Ω
Logic high enable voltage		V_{EH}	2	-	V_{CC}	V
Logic low enable voltage		V_{EL}	0.0	-	0.8	V
Fanout	R_L = 1 kΩ	N	-	-	5	-

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
Input forward voltage	I_F = 10 mA	V_F	1.1	1.4	1.7	V
Reverse current	V_R = 5 V	I_R	-	0.01	10	µA
Input capacitance	f = 1 MHz, V_F = 0 V	C_I	-	55	-	pF
OUTPUT						
High level supply current (single channel)	V_E = 0.5 V, I_F = 0 mA	I_{CCH}	-	4.1	7	mA
	V_E = V_{CC}, I_F = 0 mA	I_{CCH}	-	3.3	6	mA
High level supply current (dual channel)	I_F = 10 mA	I_{CCH}	-	6.5	12	mA
Low level supply current (single channel)	V_E = 0.5 V, I_F = 10 mA	I_{CCL}	-	4	7	mA
	V_E = V_{CC}, I_F = 10 mA	I_{CCL}	-	3.3	6	mA
Low level supply current (dual channel)	I_F = 10 mA	I_{CCL}	-	6.5	12	mA
High level output current	V_E = 2 V, V_O = 5.5 V, I_F = 250 µA	I_{OH}	-	0.002	1	µA
Low level output voltage	V_E = 2 V, I_F = 5 mA, I_{OL} (sinking) = 13 mA	V_{OL}	-	0.2	0.6	V
Input threshold current	V_E = 2 V, V_O = 5.5 V, I_{OL} (sinking) = 13 mA	I_{TH}	-	2.4	5	mA
High level enable current		I_{EH}	-	-0.6	-1.6	mA
Low level enable current		I_{EL}	-	-0.8	-1.6	mA
High level enable voltage		V_{EH}	2	-	-	V
Low level enable voltage		V_{EL}	-	-	0.8	V

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.

SWITCHING CHARACTERISTICS						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Propagation delay time to high output level	R_L = 350 Ω, C_L = 15 pF	t_{PLH}	20	48	100	ns
Propagation delay time to low output level	R_L = 350 Ω, C_L = 15 pF	t_{PHL}	25	50	100	ns
Pulse width distortion	R_L = 350 Ω, C_L = 15 pF	$\lvert t_{PHL} - t_{PLH} \rvert$	-	2.9	35	ns
Propagation delay skew	R_L = 350 Ω, C_L = 15 pF	t_{PSK}	-	8	40	ns
Output rise time (10 to 90 %)	R_L = 350 Ω, C_L = 15 pF	t_r	-	23	-	ns
Output fall time (90 to 10 %)	R_L = 350 Ω, C_L = 15 pF	t_f	-	7	-	ns
Propagation delay time of enable from V_{EH} to V_{EL}	R_L = 350 Ω, C_L = 15 pF, V_{EL} = 0 V, V_{EH} = 3 V	t_{ELH}	-	12	-	ns
Propagation delay time of enable from V_{EL} to V_{EH}	R_L = 350 Ω, C_L = 15 pF, V_{EL} = 0 V, V_{EH} = 3 V	t_{EHL}	-	11	-	ns

Note

- Over recommended temperature (T_A = -40 °C to +100 °C), V_{CC} = 5 V, I_F = 7.5 mA unless otherwise specified. All typicals at T_A = 25 °C, V_{CC} = 5 V.

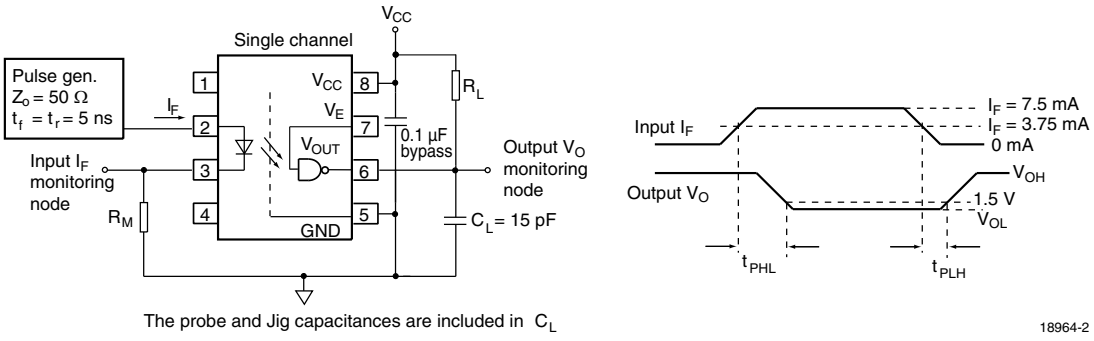


Fig. 1 - Single Channel Test Circuit for t_{PLH}, t_{PHL}, t_r, and t_f

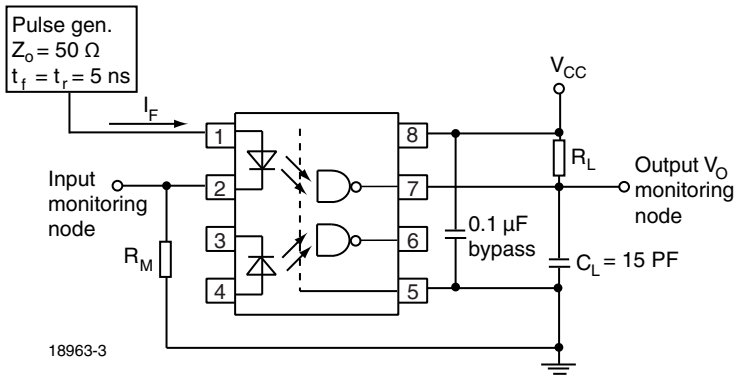


Fig. 2 - Dual Channel Test Circuit for t_{PLH}, t_{PHL}, t_r, and t_f

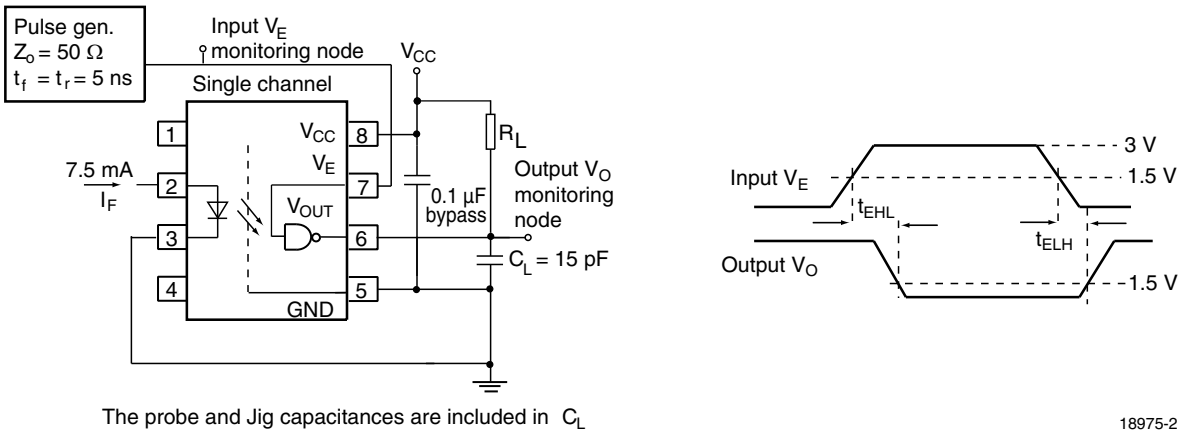


Fig. 3 - Single Channel Test Circuit for t_{EHL}, t_{ELH}

COMMON MODE TRANSIENT IMMUNITY						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Common mode transient immunity (high)	$\|V_{CM}\|$ = 10 V, V_{CC} = 5 V, I_F = 0 mA, $V_{O(min)}$ = 2 V, R_L = 350 Ω, T_{amb} = 25 °C (1)	$\|CM_H\|$	-	10 000	-	V/µs
	$\|V_{CM}\|$ = 50 V, V_{CC} = 5 V, I_F = 0 mA, $V_{O(min)}$ = 2 V, R_L = 350 Ω, T_{amb} = 25 °C (2)	$\|CM_H\|$	5000	10 000	-	V/µs
	$\|V_{CM}\|$ = 1 kV, V_{CC} = 5 V, I_F = 0 mA, $V_{O(min)}$ = 2 V, R_L = 350 Ω, T_{amb} = 25 °C (3)	$\|CM_H\|$	10 000	15 000	-	V/µs
Common mode transient immunity (low)	$\|V_{CM}\|$ = 10 V, V_{CC} = 5 V, I_F = 7.5 mA, $V_{O(max)}$ = 0.8 V, R_L = 350 Ω, T_{amb} = 25 °C (1)	$\|CM_L\|$	-	10 000	-	V/µs
	$\|V_{CM}\|$ = 50 V, V_{CC} = 5 V, I_F = 7.5 mA, $V_{O(max)}$ = 0.8 V, R_L = 350 Ω, T_{amb} = 25 °C (2)	$\|CM_L\|$	5000	10 000	-	V/µs
	$\|V_{CM}\|$ = 1 kV, V_{CC} = 5 V, I_F = 7.5 mA, $V_{O(max)}$ = 0.8 V, R_L = 350 Ω, T_{amb} = 25 °C (3)	$\|CM_L\|$	10 000	15 000	-	V/µs

Notes

(1) For SFH6755

(2) For SFH6756

(3) For SFH6747 and SFH6757

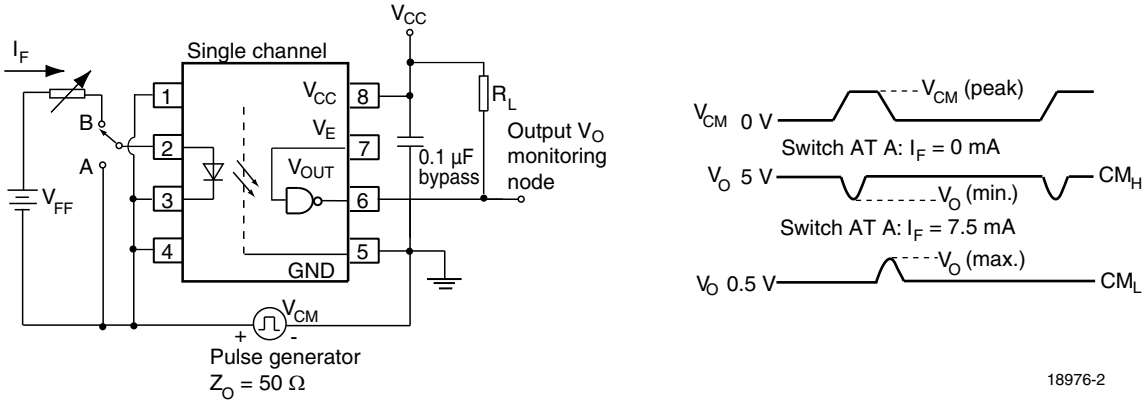


Fig. 4 - Single Channel Test Circuit for Common Mode Transient Immunity

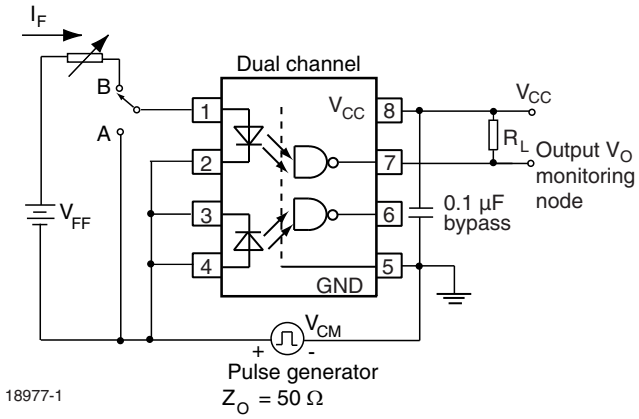


Fig. 5 - Dual Channel Test Circuit for Common Mode Transient Immunity

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	
P_{SO}			-	-	350	mW
I_{SI}			-	-	150	mA
T_{SI}			-	-	165	°C
Creepage			4	-	-	mm
Clearance			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 prodective circuits.

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

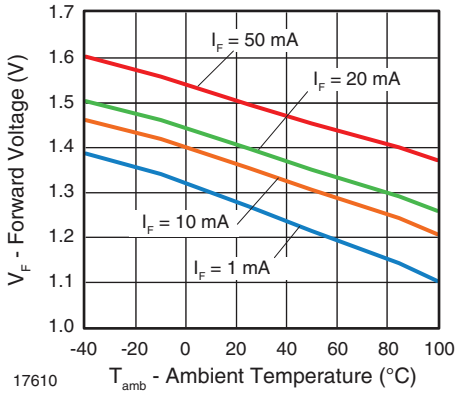


Fig. 6 - Forward Voltage vs. Ambient Temperature

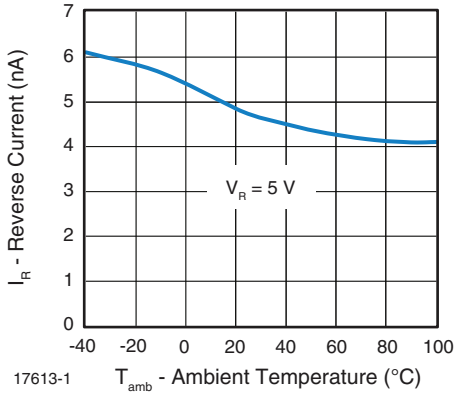


Fig. 8 - Reverse Current vs. Ambient Temperature

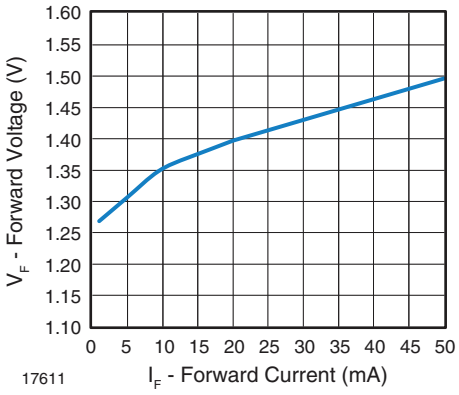


Fig. 7 - Forward Voltage vs. Forward Current

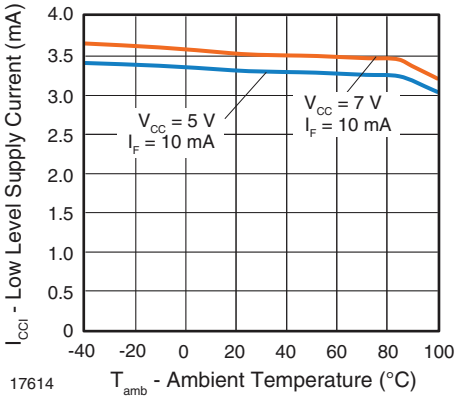


Fig. 9 - Low Level Supply Current vs. Ambient Temperature

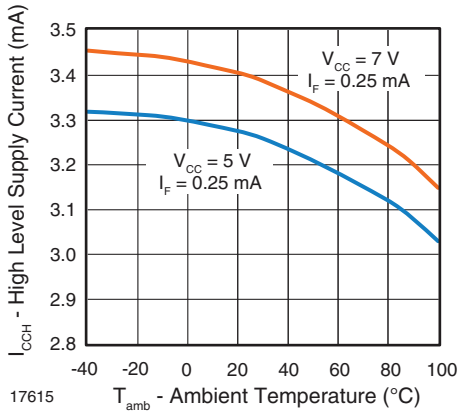


Fig. 10 - High Level Supply Current vs. Ambient Temperature

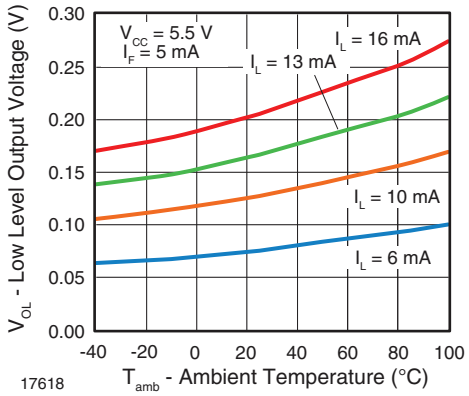


Fig. 13 - Low Level Output Voltage vs. Ambient Temperature

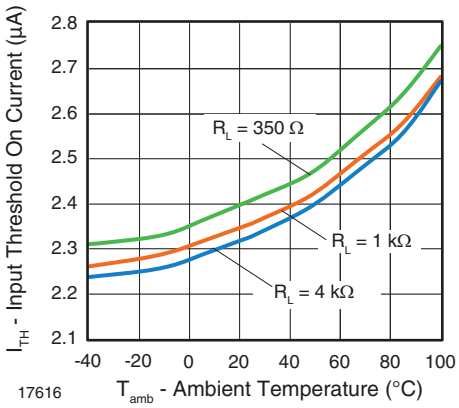


Fig. 11 - Input Threshold On Current vs. Ambient Temperature

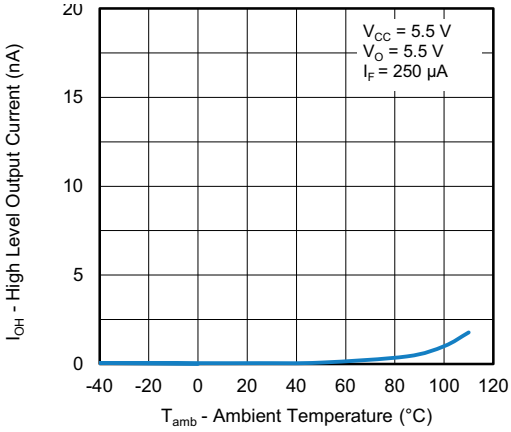


Fig. 14 - Low Level Output Current vs. Ambient Temperature

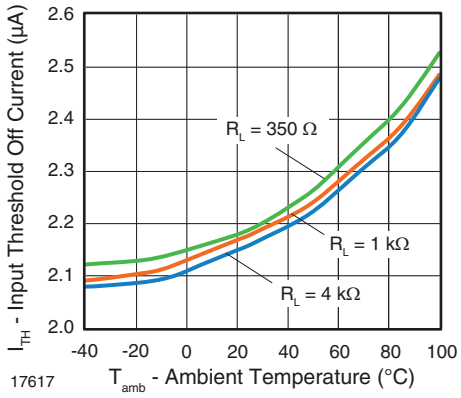


Fig. 12 - Input Threshold Off Current vs. Ambient Temperature

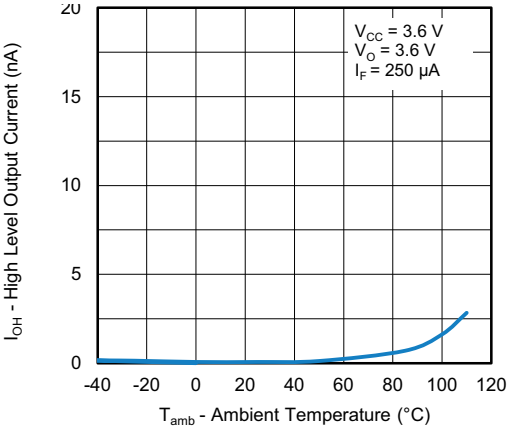


Fig. 15 - High Level Output Current vs. Ambient Temperature

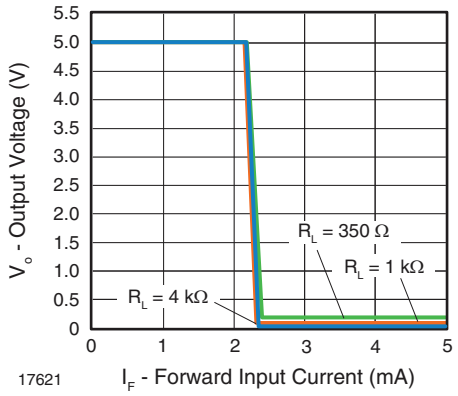


Fig. 16 - Output Voltage vs. Forward Input Current

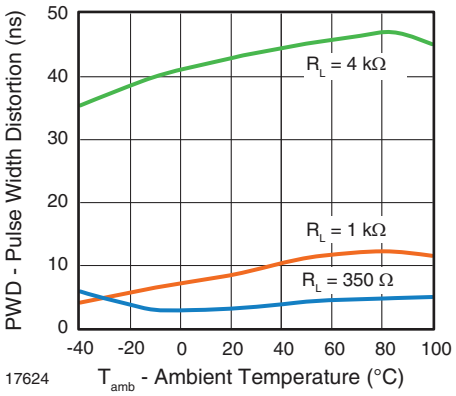


Fig. 19 - Pulse Width Distortion vs. Ambient Temperature

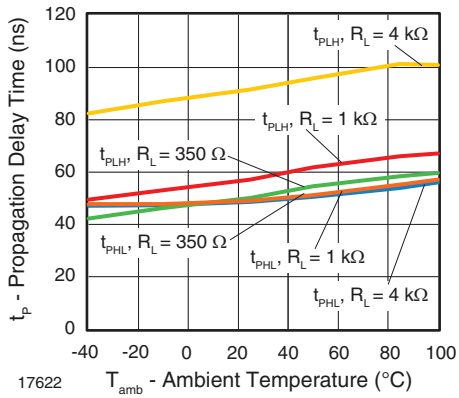


Fig. 17 - Propagation Delay vs. Ambient Temperature

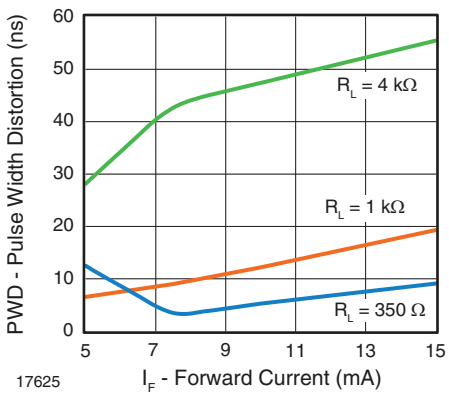


Fig. 20 - Pulse Width Distortion vs. Forward Current

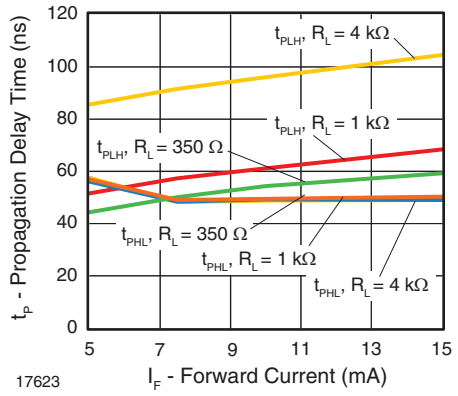


Fig. 18 - Propagation Delay vs. Forward Current

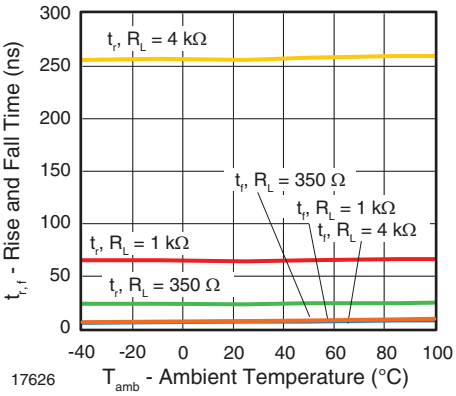


Fig. 21 - Rise and Fall Time vs. Ambient Temperature

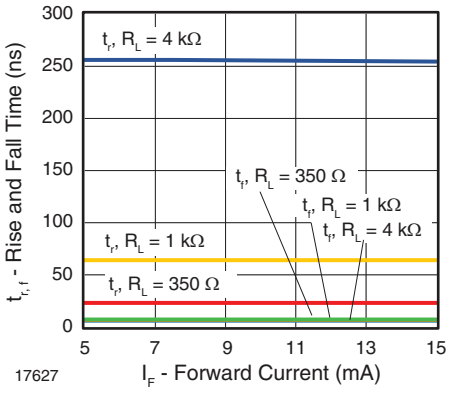


Fig. 22 - Rise and Fall Time vs. Forward Current

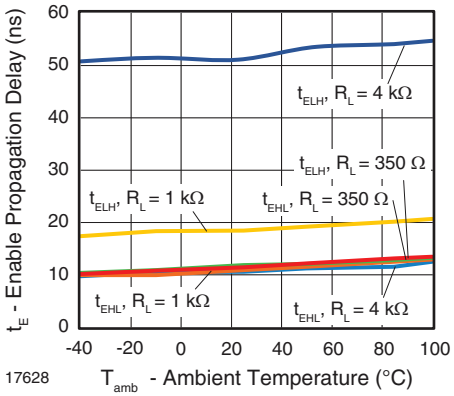
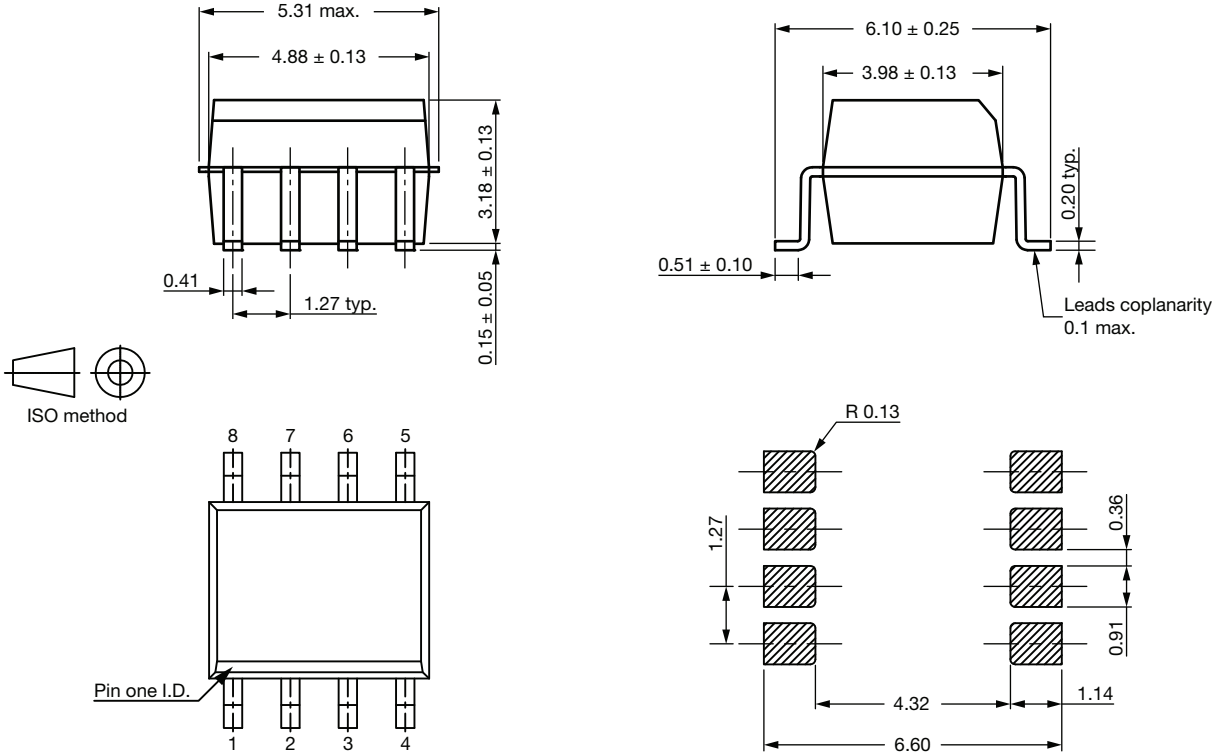


Fig. 23 - Enable Propagation Delay vs. Ambient Temperature

PACKAGE DIMENSIONS (in millimeters)



PACKAGE MARKING (example of SFH6755T)

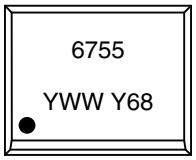


Fig. 24 - SFH6755T

Notes

- VDE logo is only marked on option 1 parts
- Tape and reel suffix (T) is not part of the package marking

SOLDER PROFILES

J-STD-020 for SMD Devices

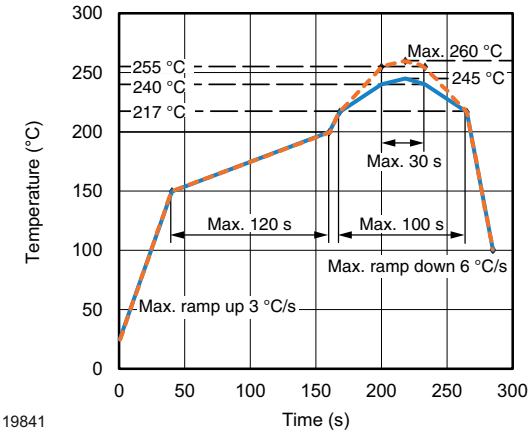


Fig. 25 - Lead (Pb)-Free Reflow Solder Profile According to

HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

Conditions: T_{amb} < 30 °C, RH < 85 %

Moisture sensitivity level 1, according to J-STD-020

ESD CAUTION

This is an ESD (electro static discharge) sensitive device. Electrostatic charges accumulate on the human body and test equipment and can discharge without detection. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality. ESD withstand voltage of this device is up to 1500 V according to JESD22-A114-B.

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