

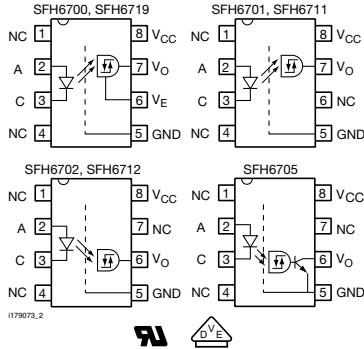
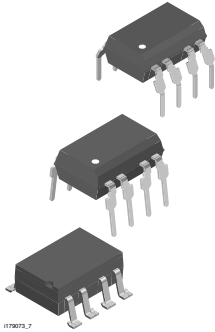


**THE DATASHEET OF  
SFH6705-X006**





## High Speed Optocoupler, 5 MBd, 1 kV/μs dV/dt



### DESCRIPTION

The SFH67xx high speed optocoupler series consists of a GaAlAs infrared emitting diode, optically coupled with an integrated photo detector. The detector incorporates a Schmitt-Trigger stage for improved noise immunity. Using the enable input, the output can be switched to the high ohmic state, which is necessary for data bus applications. A Faraday shield provides a common mode transient immunity of 1000 V/μ at  $V_{CM} = 50$  V for SFH6700, SFH6701, SFH6702, SFH6705 and 2500 V/μ at  $V_{CM} = 400$  V for SFH6711, SFH6712, SFH6719.

The SFH67xx uses an industry standard DIP-8 package. With standard lead bending, creepage distance and clearance of  $\geq 7$  mm with lead bending options 6, 7, and 9  $\geq 8$  mm are achieved.

### FEATURES

- Data rate 5 MBit/s (2.5 MBit/s over temperature)
- Buffer
- Isolation test voltage, 5300  $V_{RMS}$  for 1 s
- TTL, LSTTL and CMOS compatible
- Internal shield for very high common mode transient immunity
- Wide supply voltage range (4.5 V to 15 V)
- Low input current (1.6 mA to 5 mA)
- Three state output (SFH6700, SFH6719)
- Totem pole output (SFH6701, SFH6702, SFH6711, SFH6712)
- Open collector output (SFH6705)
- Compliant to RoHS Directive to 2002/95/EC and in accordance WEEE 2002/96/EC



RoHS COMPLIANT

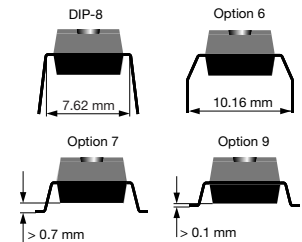
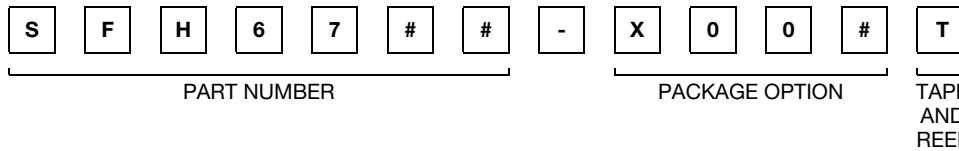
### APPLICATIONS

- Industrial control
- Replace pulse transformers
- Routine logic interfacing
- Motion/power control
- High speed line receiver
- Microprocessor system interfaces
- Computer peripheral interfaces

### AGENCY APPROVALS

- UL1577, file no. E52744 system code H or J, double protection
- DIN EN 60747-5-5 (VDE 0884) available with option 1

### ORDERING INFORMATION



AGENCY CERTIFIED/ PACKAGE	THREE STATE	TOTEM POLE	OPEN COLLECTOR
<b>UL</b>			
DIP-8	SFH6700 SFH6719	SFH6701 SFH6702	SFH6711 SFH6712 SFH6705
DIP-8, 400 mil, option 6	-	SFH6702-X006	SFH6705-X006
SMD-8, option 7	-	SFH6701-X007 SFH6702-X007	SFH6711-X007 SFH6712-X007
SMD-8, option 9	SFH6700-X009	SFH6702-X009T <sup>(1)</sup>	SFH6701-X009T <sup>(1)</sup>

### Note

- Also available in tubes. To order, do not add T on end

<b>TRUTH TABLE</b> (positive logic)			
PARTS	IR DIODE	ENABLE	OUTPUT
SFH6700	on	H	Z
	off	H	Z
SFH6719	on	L	H
	off	L	L
SFH6701	on		H
	off		L
SFH6702	on		H
	off		L
SFH6705	on		H
	off		L
SFH6711	on		H
	off		L
SFH6712	on		H
	off		L

<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		$V_R$	3	V
DC forward current		$I_F$	10	mA
Surge forward current	$t \leq 1\ \mu\text{s}$	$I_{FSM}$	1	A
Power dissipation		$P_{diss}$	20	mW
<b>OUTPUT</b>				
Supply voltage		$V_{CC}$	- 0.5 to + 15	V
Three state enable voltage (SFH6700, SFH6719 only)		$V_{EN}$	- 0.5 to + 15	V
Output voltage		$V_O$	- 0.5 to + 15	V
Average output current		$I_O$	25	mA
Power dissipation		$P_{diss}$	100	mW
<b>COUPLER</b>				
Storage temperature range		$T_{stg}$	- 55 to + 125	$^{\circ}\text{C}$
Ambient temperature range		$T_{amb}$	+ 85	$^{\circ}\text{C}$
Lead soldering temperature	$t = 10\ \text{s}$	$T_{sld}$	260	$^{\circ}\text{C}$
Isolation test voltage		$V_{ISO}$	5300	$V_{RMS}$
Pollution degree			2	
Creepage distance and clearance	Standard lead bending		7	mm
	Options 6, 7, 9		8	mm
Comparative tracking index per DIN IEC 112/VDE 0303, part 1			175	
Isolation resistance	$V_{IO} = 500\ \text{V}, T_{amb} = 25\text{ }^{\circ}\text{C}$	$R_{IO}$	$10^{12}$	$\Omega$
	$V_{IO} = 500\ \text{V}, T_{amb} = 100\text{ }^{\circ}\text{C}$	$R_{IO}$	$10^{11}$	$\Omega$

**Note**

- 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.



# SFH6700, SFH6701, SFH6702, SFH6705, SFH6711, SFH6712, SFH6719

High Speed Optocoupler, 5 MBd,  
1 kV/ $\mu$ s dV/dt

Vishay Semiconductors

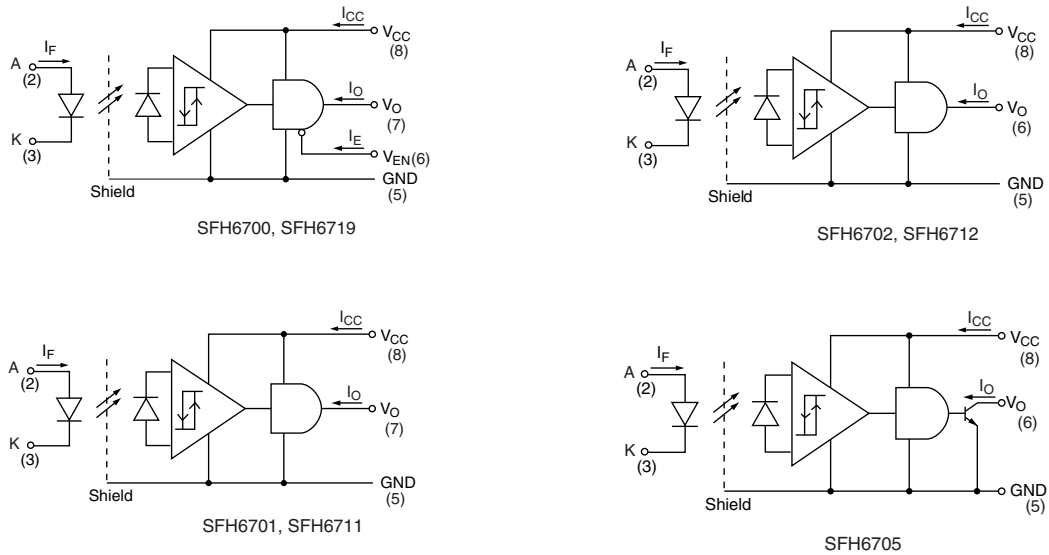


Fig. 1 - Schematics

RECOMMENDED OPERATING CONDITIONS <sup>(1)</sup>							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage			$V_{CC}$	4.5		15	V
Enable voltage high		SFH6700	$V_{EH}$	2		15	V
		SFH6719	$V_{EH}$	2		15	V
Enable voltage low		SFH6700	$V_{EL}$	0		0.8	V
		SFH6719	$V_{EL}$	0		0.8	V
Forward input current			$I_{Fon}$	1.6 <sup>(2)</sup>		5	mA
			$I_{Foff}$			0.1	mA
Operating temperature			$T_{amb}$	- 40		85	$^{\circ}$ C
Output pull-up resistor		SFH6705	$R_L$	350		4	k $\Omega$
Fan output	$R_L = 1\text{ k}\Omega$	SFH6705	N			16	LS TTL loads

**Notes**

- (1) A 0.1  $\mu$ F bypass capacitor connected between pins 5 and 8 must be used.
- (2) We recommended using a 2.2 mA to permit at least 20 % CTR degradation guard band.

ELECTRICAL CHARACTERISTICS <sup>(1)</sup>							
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT	
<b>INPUT</b>							
Forward voltage	$I_F = 5\text{ mA}$	$V_F$		1.6	1.75	V	
	$I_F = 5\text{ mA}$	$V_F$			1.8	V	
Input current hysteresis	$V_{CC} = 5\text{ V}, I_{HYS} = I_{Fon} - I_{Foff}$	$I_{HYS}$		0.1		mA	
Reverse current	$V_R = 3\text{ V}$	$I_R$		0.5	10	$\mu$ A	
Capacitance	$V_R = 0\text{ V}, f = 1\text{ MHz}$	$C_O$		60		pF	
Thermal resistance		$R_{thJA}$		700		K/W	
<b>OUTPUT</b>							
Logic low output voltage	$I_{OL} = 6.4\text{ mA}$	$V_{OL}$			0.5	V	
Logic high output voltage (except SFH6705)	$I_{OH} = 2.6\text{ mA}, V_{OH} = V_{CC} - 1.8\text{ V}$		2.4			V	
Output leakage current ( $V_{OUT} > V_{CC}$ ) (except SFH6705)	$V_O = 5.5\text{ V}, V_{CC} = 4.5\text{ V}, I_F = 5\text{ mA}$	$I_{OHH}$		0.5	100	$\mu$ A	
	$V_O = 15\text{ V}, V_{CC} = 4.5\text{ V}, I_F = 5\text{ mA}$	$I_{OHH}$		1	500	$\mu$ A	



ELECTRICAL CHARACTERISTICS (1)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>OUTPUT</b>						
Output leakage current (SFH6705 only)	$V_O = 5.5\text{ V}, V_{CC} = 5.5\text{ V}, I_F = 5\text{ mA}$	$I_{OHH}$		0.5	100	$\mu$ A
	$V_O = 15\text{ V}, V_{CC} = 15\text{ V}, I_F = 5\text{ mA}$	$I_{OHH}$		1	500	$\mu$ A
Logic high enable voltage (SFH6700/19 only)		$V_{EH}$	2			V
Logic low enable voltage (SFH6700/19 only)		$V_{EL}$			0.8	V
Logic high enable current (SFH6700/19 only)	$V_{EN} = 2.7\text{ V}$	$I_{EH}$			20	$\mu$ A
	$V_{EN} = 5.5\text{ V}$	$I_{EH}$			100	$\mu$ A
	$V_{EN} = 15\text{ V}$	$I_{EH}$		0.001	250	$\mu$ A
Logic low enable current (SFH6700/19 only)	$V_{EN} = 0.4\text{ V}$	$I_{EL}$	- 320	- 50		$\mu$ A
High impedance state output current (SFH6700/19 only)	$V_O = 0.4\text{ V}, V_{EN} = 2\text{ V}, I_F = 5\text{ mA}$	$I_{OZL}$	- 20			$\mu$ A
	$V_O = 2.4\text{ V}, V_{EN} = 2\text{ V}, I_F = 0\text{ mA}$	$I_{OZH}$			20	$\mu$ A
	$V_O = 5.5\text{ V}, V_{EN} = 2\text{ V}, I_F = 0\text{ mA}$	$I_{OZH}$		0.001	500	$\mu$ A
Logic low supply current	$V_{CC} = 5.5\text{ V}, I_F = 0$	$I_{CCL}$		3.7	6	mA
	$V_{CC} = 15\text{ V}, I_F = 0$	$I_{CCL}$		4.1	6.5	mA
Logic high supply current	$V_{CC} = 5.5\text{ V}, I_F = 5\text{ mA}$	$I_{CCH}$		3.4	4	mA
	$V_{CC} = 15\text{ V}, I_F = 5\text{ mA}$	$I_{CCH}$		3.7	5	mA
Logic low short circuit output current (2)	$V_O = V_{CC} = 5.5\text{ V}, I_F = 0$	$I_{OSL}$	25			mA
	$V_O = V_{CC} = 15\text{ V}, I_F = 0$	$I_{OSL}$	40			mA
Logic high short circuit output current (2)	$V_{CC} = 5.5\text{ V}, V_O = 0\text{ V}, I_F = 5$	$I_{OSL}$			- 10	mA
	$V_{CC} = 15\text{ V}, V_O = 0\text{ V}, I_F = 5$	$I_{OSL}$			- 25	mA
Thermal resistance		$R_{thJA}$		300		K/W
<b>COUPLER</b>						
Capacitance (input to output)	$f = 1\text{ MHz}$ , pins 1 to 4 and 5 to 8 shorted together	$C_{IO}$		0.6		pF
Isolation resistance	$V_{IO} = 500\text{ V}, T_{amb} = 25\text{ }^\circ\text{C}$	$R_{IO}$	$10^{12}$			$\Omega$
	$V_{IO} = 500\text{ V}, T_{amb} = 100\text{ }^\circ\text{C}$	$R_{IO}$	$10^{11}$			$\Omega$

**Notes**

(1) - 40 °C ≤ T<sub>amb</sub> ≤ 85 °C; 4.5 V ≤ V<sub>CC</sub> ≤ 15 V; 1.6 mA ≤ I<sub>Fon</sub> ≤ 5 mA; 2 ≤ V<sub>EH</sub> ≤ 15 V; 0 ≤ V<sub>EL</sub> ≤ 0.8 V; 0 mA ≤ I<sub>Foff</sub> ≤ 0.1 mA.  
 Typical values: T<sub>amb</sub> = 25 °C; V<sub>CC</sub> = 5 V; I<sub>Fon</sub> = 3 mA unless otherwise specified. 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.

(2) Output short circuit time ≤ 10 ms.

SWITCHING CHARACTERISTICS (1)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Propagation delay time to logic low output level, SFH6700, SFH6701, SFH6702, SFH6711, SFH6712, SFH6719 (2)	Without peaking capacitor		t <sub>PHL</sub>		120		ns
			t <sub>PHL</sub>		115	300	ns
	With peaking capacitor		t <sub>PLH</sub>		125		ns
			t <sub>PLH</sub>		90	300	ns
Output enable time to logic high (SFH6700, SFH6719) (2)			t <sub>PZH</sub>		20		ns
Output enable time to logic low (SFH6700, SFH6719) (2)			t <sub>PZL</sub>		25		ns
Output disable time from logic low (SFH6700, SFH6719) (2)			t <sub>PLZ</sub>		50		ns
Output rise time (2)	10 % to 90 %		t <sub>r</sub>		40		ns
Output fall time (2)	90 % to 10 %		t <sub>f</sub>		10		ns



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SWITCHING CHARACTERISTICS (1)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Propagation delay time to logic low output level (3)	Without peaking capacitor	SFH6705	$t_{PHL}$		115		ns
	With peaking capacitor	SFH6705	$t_{PHL}$		105	300	ns
	Without peaking capacitor	SFH6705	$t_{PLH}$		125		ns
	With peaking capacitor	SFH6705	$t_{PLH}$		90	300	ns
Output rise time (3)	10 % to 90 %		$t_r$		25		ns
	90 % to 10 %		$t_r$		4		ns

### Notes

- $0^\circ\text{C} \leq T_{amb} \leq 85^\circ\text{C}$ ;  $4.5\text{ V} \leq V_{CC} \leq 15\text{ V}$ ;  $1.6\text{ mA} \leq I_{Fon} \leq 5\text{ mA}$ ;  $2 \leq V_{EH} \leq 15\text{ V}$  (SFH6700/19);  $0 \leq V_{EL} \leq 0.8\text{ V}$  (SFH6700, SFH6719);  $0\text{ mA} \leq I_{Foff} \leq 0.1\text{ mA}$
- Typical values:  $T_{amb} = 25^\circ\text{C}$ ;  $V_{CC} = 5\text{ V}$ ;  $I_{Fon} = 3\text{ mA}$  unless otherwise specified (4)
- Typical values:  $T_{amb} = 25^\circ\text{C}$ ;  $V_{CC} = 5\text{ V}$ ;  $I_{Fon} = 3\text{ mA}$ ;  $R_L = 390\ \Omega$  unless otherwise specified (4)
- A  $0.1\ \mu\text{F}$  bypass capacitor connected between pins 5 and 8 must be used

COMMON MODE TRANSIENT IMMUNITY (1)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Logic high common mode transient immunity	$ V_{CM}  = 50\text{ V}$ , $I_F = 1.6\text{ mA}$	SFH6700	$ CM_H ^{(2)}$	1000			V/ $\mu$ s
		SFH6701	$ CM_H ^{(2)}$	1000			V/ $\mu$ s
		SFH6702	$ CM_H ^{(2)}$	1000			V/ $\mu$ s
		SFH6705	$ CM_H ^{(2)}$	1000			V/ $\mu$ s
	$ V_{CM}  = 400\text{ V}$ , $I_F = 1.6\text{ mA}$	SFH6711	$ CM_H ^{(2)}$	2500			V/ $\mu$ s
		SFH6712	$ CM_H ^{(2)}$	2500			V/ $\mu$ s
Logic Low common mode transient immunity	$ V_{CM}  = 50\text{ V}$ , $I_F = 0\text{ mA}$	SFH6700	$ CM_L ^{(3)}$	1000			V/ $\mu$ s
		SFH6701	$ CM_L ^{(3)}$	1000			V/ $\mu$ s
	$ V_{CM}  = 50\text{ V}$ , $I_F = 0\text{ mA}$	SFH6702	$ CM_L ^{(3)}$	1000			V/ $\mu$ s
		SFH6705	$ CM_L ^{(3)}$	1000			V/ $\mu$ s
	$ V_{CM}  = 400\text{ V}$ , $I_F = 0\text{ mA}$	SFH6711	$ CM_L ^{(3)}$	2500			V/ $\mu$ s
		SFH6712	$ CM_L ^{(3)}$	2500			V/ $\mu$ s
		SFH6719	$ CM_L ^{(3)}$	2500			V/ $\mu$ s

### Notes

- $T_{amb} = 25^\circ\text{C}$ ,  $V_{CC} = 5\text{ V}$
- $CM_H$  is the maximum slew rate of a common mode voltage  $V_{CM}$  at which the output voltage remains at logic high level ( $V_O > 2\text{ V}$ )
- $CM_L$  is the maximum slew rate of a common mode voltage  $V_{CM}$  at which the output voltage remains at logic low level ( $V_O < 0.8\text{ V}$ )

## TYPICAL CHARACTERISTICS ( $T_{amb} = 25^\circ\text{C}$ , unless otherwise specified)

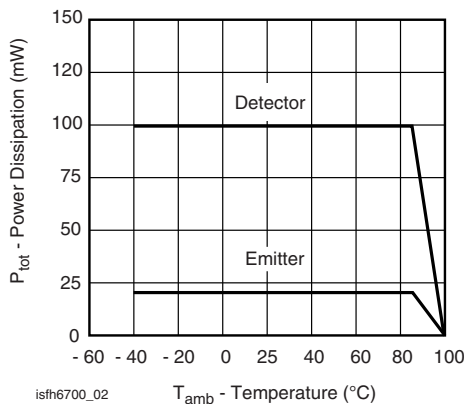


Fig. 2 - Permissible Total Power Dissipation vs. Temperature

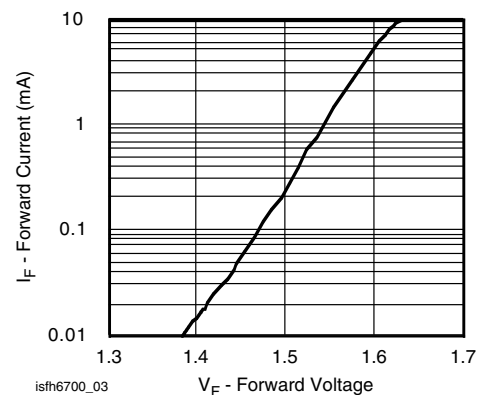


Fig. 3 - Typical Input Diode Forward Current vs. Forward Voltage

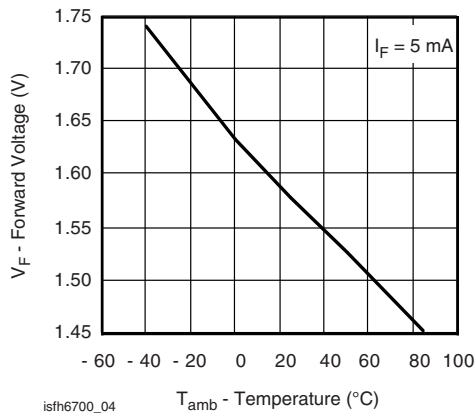


Fig. 4 - Typical Forward Input Voltage vs. Temperature

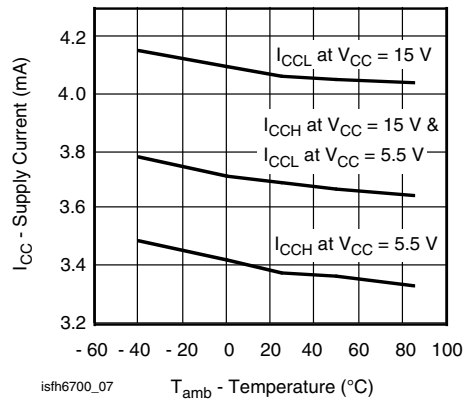


Fig. 7 - Typical Supply Current vs. Temperature

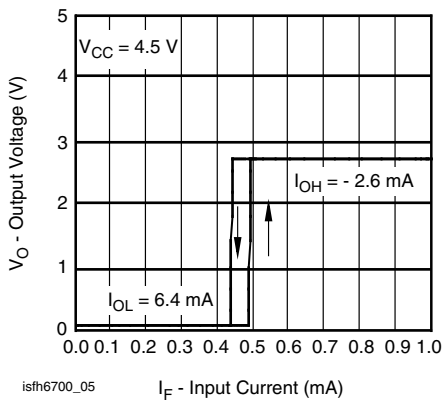


Fig. 5 - Typical Output Voltage vs. Forward Input Current (except SFH6705)

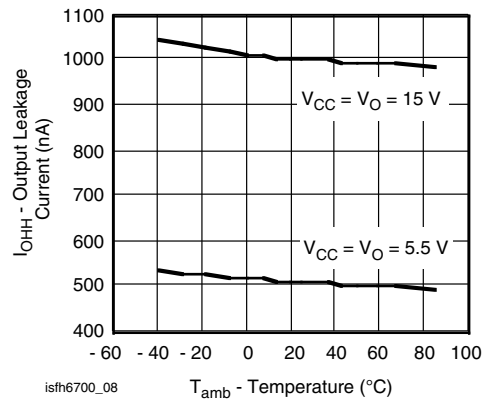


Fig. 8 - Typical Output Leakage Current vs. Temperature

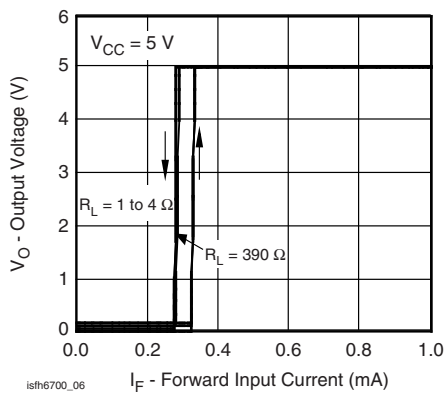


Fig. 6 - Typical Output Forward Voltage vs. Forward Input Current (only SFH6705)

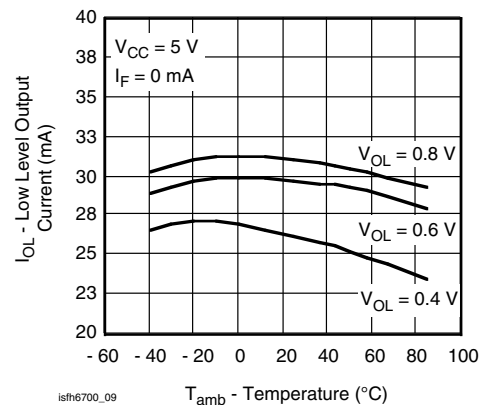


Fig. 9 - Typical Low Level Output Current vs. Temperature



# SFH6700, SFH6701, SFH6702, SFH6705, SFH6711, SFH6712, SFH6719

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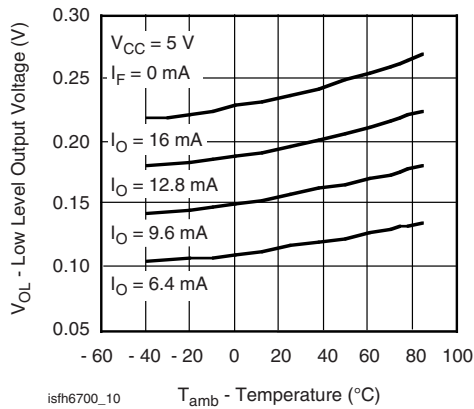


Fig. 10 - Typical Low Level Output Voltage vs. Temperature

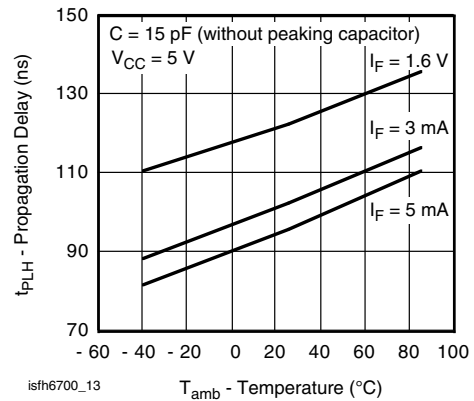


Fig. 13 - Typical Propagation Delay to Logic High vs. Temperature (except SFH6705)

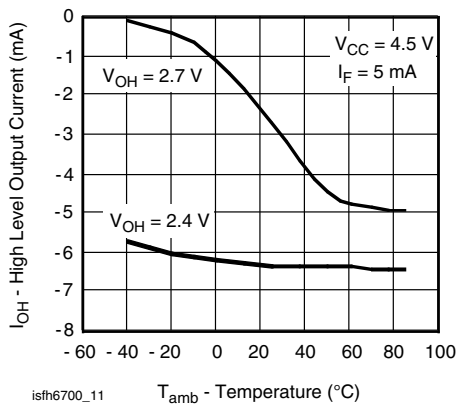


Fig. 11 - Typical High Level Output Current vs. Temperature (except SFH6705)

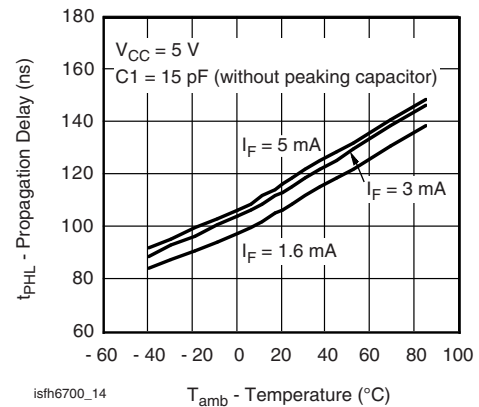


Fig. 14 - Typical Propagation Delay to Logic Low vs. Temperature (except SFH6705)

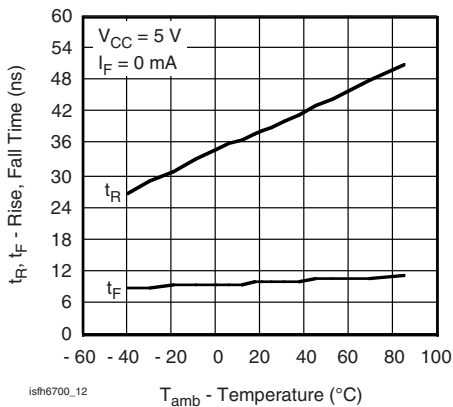


Fig. 12 - Typical Rise, Fall Time vs. Temperature (except SFH6705)

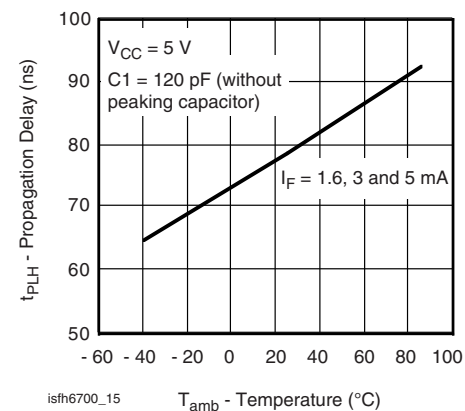


Fig. 15 - Typical Propagation Delays to Logic High vs. Temperature (except SFH6705)

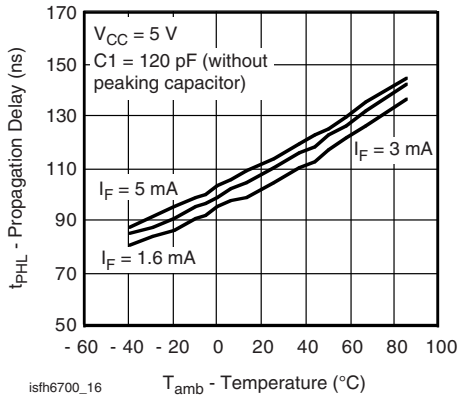


Fig. 16 - Typical Propagation Delay to Logic Low vs. Temperature

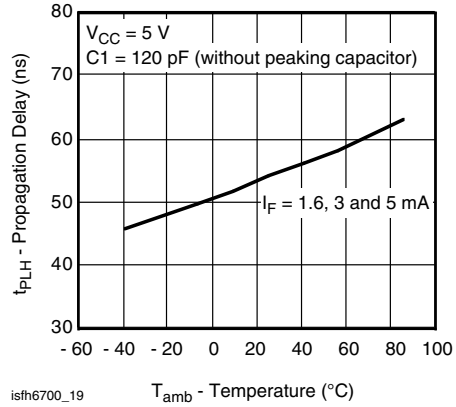


Fig. 19 - Typical Propagation Delays to Logic High vs. Temperature

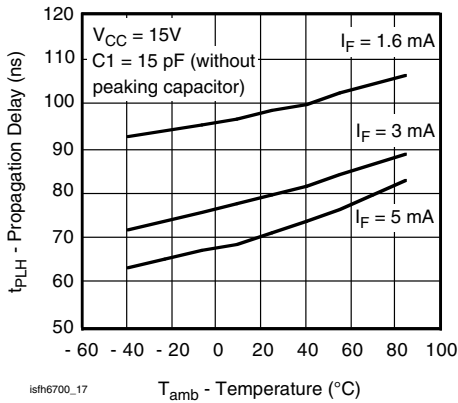


Fig. 17 - Typical Propagation Delays to Logic High vs. Temperature

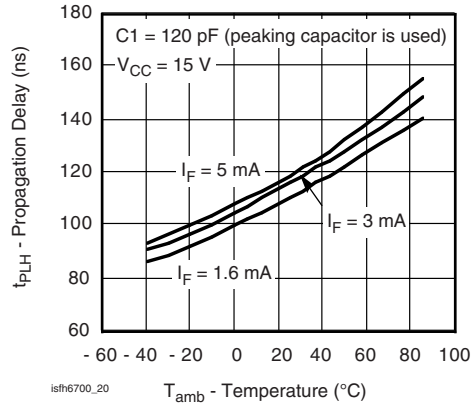


Fig. 20 - Typical Propagation Delays to Logic Low vs. Temperature (except SFH6705)

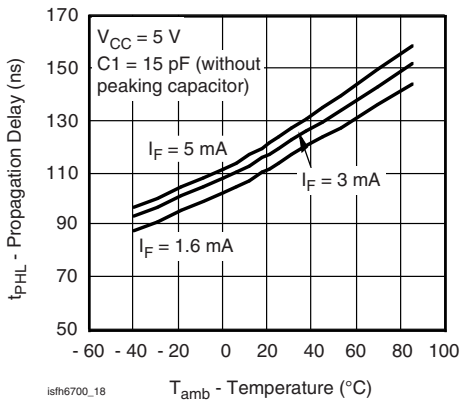


Fig. 18 - Typical Propagation Delays to Logic Low vs. Temperature

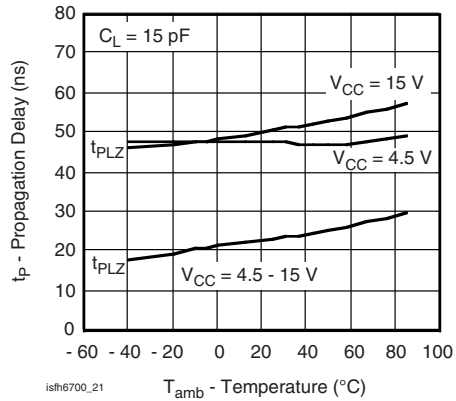


Fig. 21 - Typical Logic Low Enable Propagation Delays vs. Temperature (only SFH6700/11)



# SFH6700, SFH6701, SFH6702, SFH6705, SFH6711, SFH6712, SFH6719

High Speed Optocoupler, 5 MBd, 1 kV/ $\mu$ s dV/dt Vishay Semiconductors

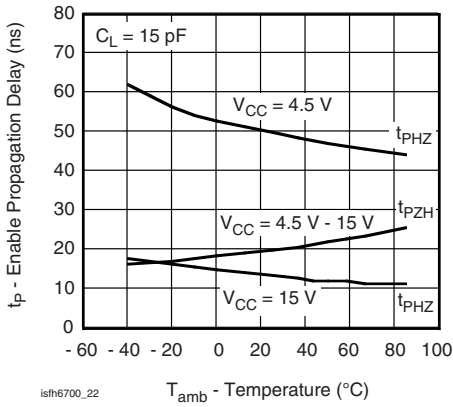


Fig. 22 - Typical Logic High Enable Propagation Delays vs. Temperature (only SFH6700/11)

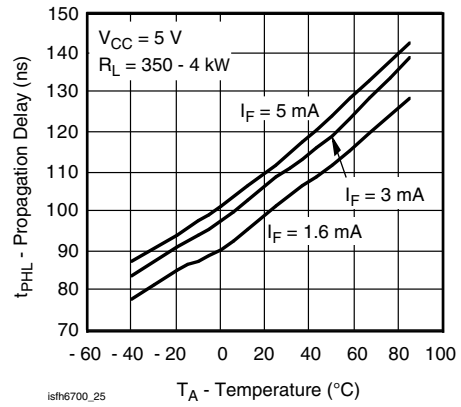


Fig. 25 - Typical Propagation Delays to Low Level vs. Temperature (only SFH6705)

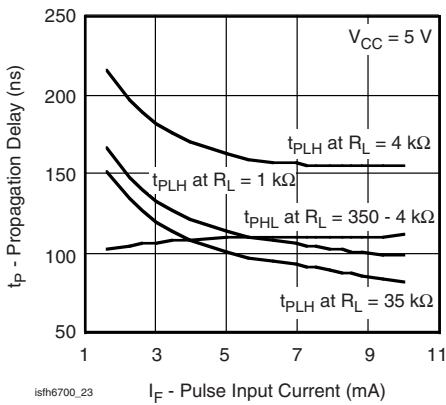


Fig. 23 - Typical Propagation Delays vs. Pulse Input Current (only SFH6705)

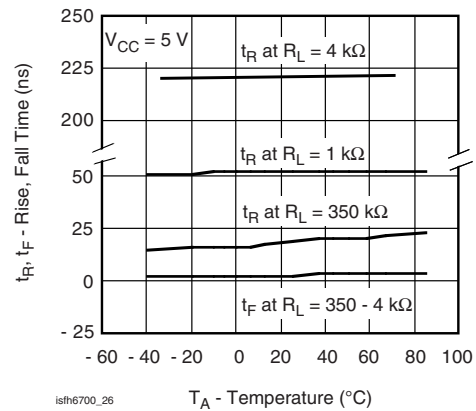


Fig. 26 - Typical Rise, Fall Time vs. Temperature (only SFH6705)

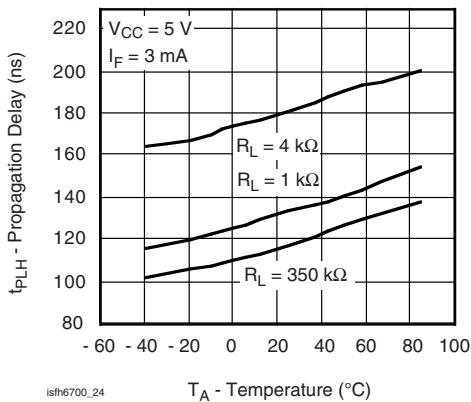
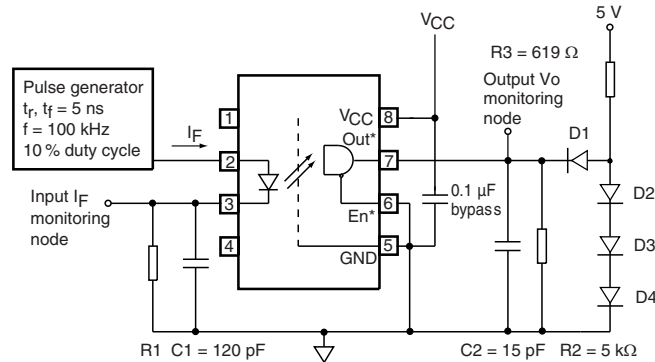


Fig. 24 - Typical Propagation Delays to High Level vs. Temperature (only SFH6705)

# SFH6700, SFH6701, SFH6702, SFH6705, SFH6711, SFH6712, SFH6719



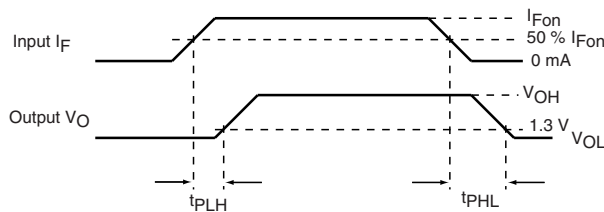
Vishay Semiconductors High Speed Optocoupler, 5 MBd,  
1 kV/ $\mu$ s dV/dt



The probe and jig capacitances are included in C1 and C2 All diodes are 1N916 or 1N3064

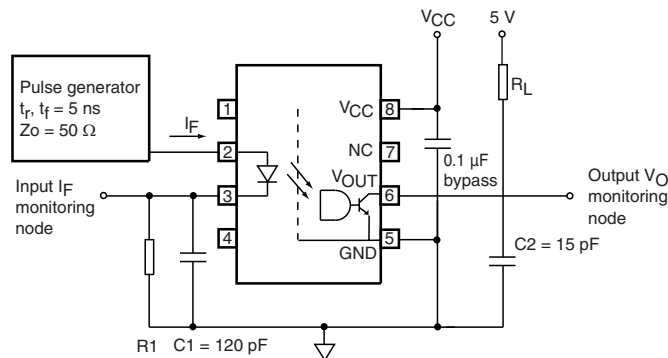
R1	2.15 k $\Omega$	1.1 k $\Omega$	681 $\Omega$
I <sub>Fon</sub>	1.6 mA	3 mA	5 mA

\* SFH6701, SFH6702, SFH6711, SFH6712 without V<sub>EN</sub>  
\* SFH6702, SFH6712 pin 6 V<sub>OUT</sub> and pin 7 NC



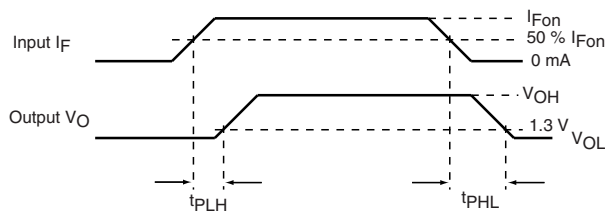
isfh6700\_27

Fig. 27 - Test Circuit for t<sub>PLH</sub>, t<sub>PHL</sub>, t<sub>r</sub> and t<sub>f</sub>



The probe and jig capacitances are included in C1 and C2

R1	2.15 k $\Omega$	1.1 k $\Omega$	681 $\Omega$
I <sub>Fon</sub>	1.6 mA	3 mA	5 mA



isfh6700\_28

Fig. 28 - Test Circuit for t<sub>PLH</sub>, t<sub>PHL</sub>, t<sub>r</sub> and - SFH6705

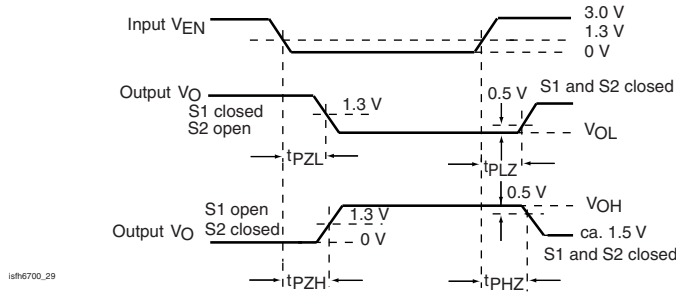
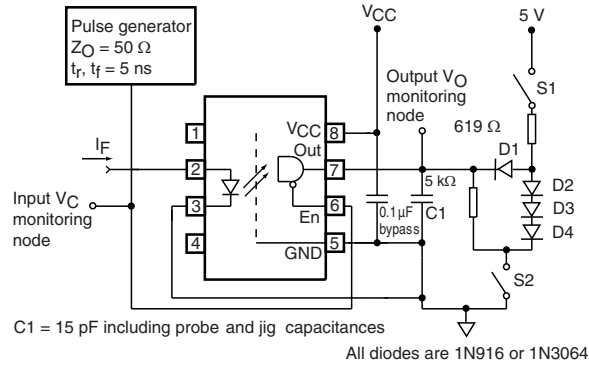
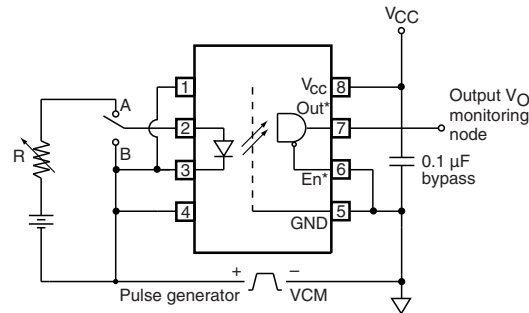


Fig. 29 - Test Circuit for  $t_{PHZ}$ ,  $t_{PZH}$ ,  $t_{PLZ}$  and  $t_{PZL}$  - SFH6700/19



\* SFH6701/02/11/12 without  $V_{EN}$   
 \* SFH6702/12 pin 6  $V_{OUT}$  and Pin 7 NC

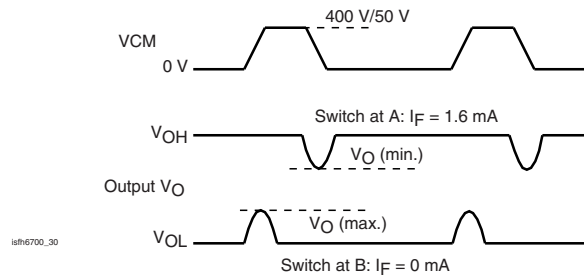


Fig. 30 - Test Circuit for Common Mode Transient Immunity and Typical Waveforms - SFH6700/01/02/11/12/19

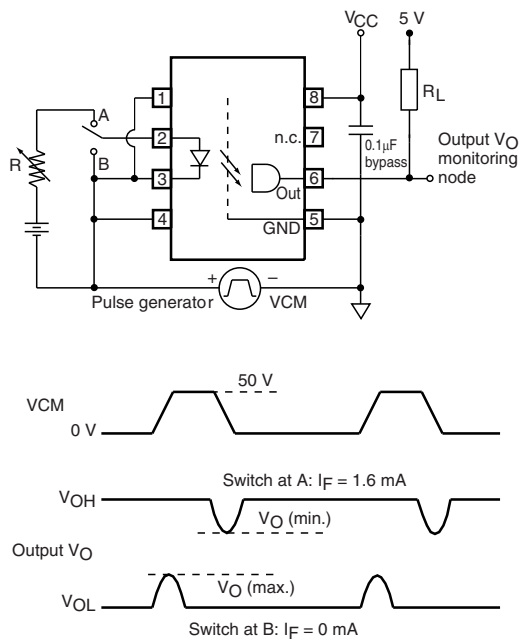


Fig. 31 - Test Circuit for Common Mode Transient Immunity and Typical Waveforms - SFH6705

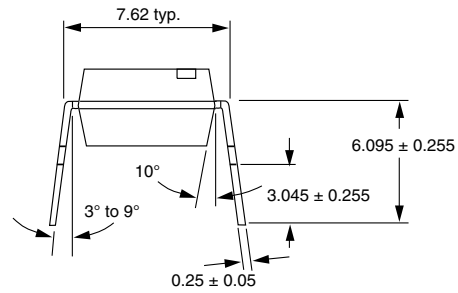
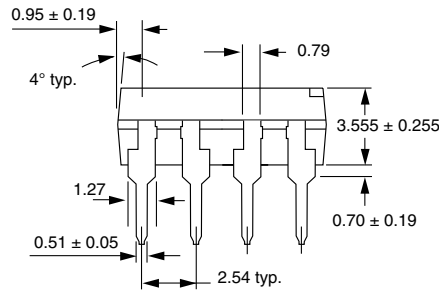
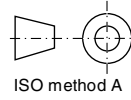
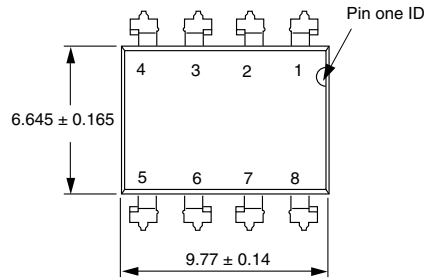


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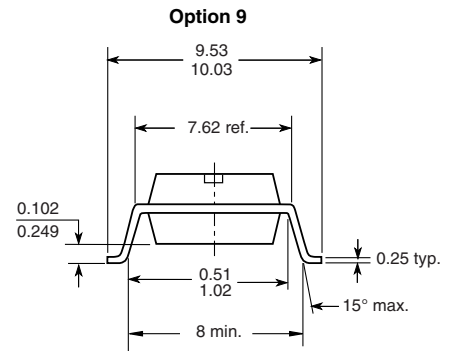
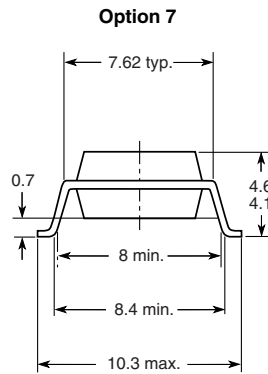
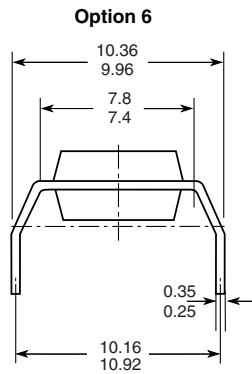
High Speed Optocoupler, 5 MBd,  
1 kV/ $\mu$ s dV/dt

Vishay Semiconductors

## PACKAGE DIMENSIONS in millimeters



i178006



18450



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