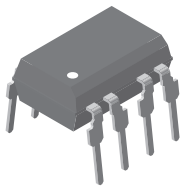
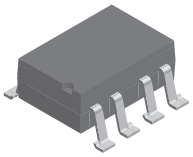
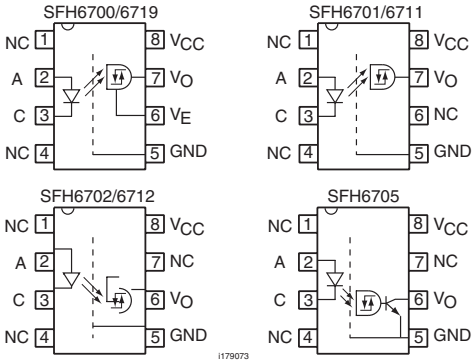
High Speed Optocoupler, 5 MBd, 1 kV/µs dV/dt







FEATURES

- Data rate 5.0 MBits/s (2.5 MBit/s over temperature)
- Buffer
- Isolation test voltage, 5300 V_{RMS} for 1.0 s
- TTL, LSTTL and CMOS compatible
- Internal shield for very high common mode transient immunity
- Wide supply voltage range (4.5 to 15 V)
- Low input current (1.6 mA to 5 mA)
- Three state output (SFH6700/19)
- Totem pole output (SFH6701/02/11/12)
- Open collector output (SFH6705)
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

Pb-free

e3

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 60747-5-2 (VDE 0884)/DIN EN 60747-5-5 pending available with option 1

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 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 SFH6700/01/02/05 and 2500 V/µ at V_{CM} = 400 V for SFH6711/12/19.

The SFH67xx uses an industry standard DIP-8 package. With standard lead bending, creepage distance and clearance of ≥ 7.0 mm with lead bending options 6, 7, and 9 ≥ 8 mm are achieved.

ORDER INFORMATION

PART	REMARKS
SFH6700	Three state output, DIP-8
SFH6701	Totem pole output, DIP-8
SFH6702	Totem pole output, DIP-8
SFH6705	Open collector output, DIP-8
SFH6711	Totem pole output, DIP-8
SFH6712	Totem pole output, DIP-8
SFH6719	Three state output, DIP-8
SFH6700-X009	Three state output, SMD-8 (option 9)
SFH6701-X006	Totem pole output, DIP-8 400 mil (option 6)
SFH6701-X007	Totem pole output, SMD-8 (option 7)
SFH6701-X009	Totem pole output, SMD-8 (option 9)
SFH6705-X006	Open collector output, DIP-8 400 mil (option 6)
SFH6705-X007	Open collector output, SMD-8 (option 7)
SFH6711-X007	Totem pole output, SMD-8 (option 7)

Note

For additional information on the available options refer to option information.

TRUTH TABLE (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

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
Reverse voltage		V_R	3.0	V
DC forward current		I_F	10	mA
Surge forward current	t ≤ 1.0 µs	I_{FSM}	1.0	A
Power dissipation		P_{diss}	20	mW
OUTPUT				
Supply voltage		V_{CC}	- 0.5 to + 15	V
Three state enable voltage (SFH6700/19 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
COUPLER				
Storage temperature range		T_{stg}	- 55 to + 125	°C
Ambient temperature range		T_{amb}	+ 85	°C
Lead soldering temperature	t = 10 s	T_{sld}	260	°C
Isolation test voltage		V_{ISO}	5300	V_{RMS}
Pollution degree			2.0	
Creepage distance and clearance	Standard lead bending		7.0	mm
	Options 6, 7, 9		8.0	mm
Comparative tracking index per DIN IEC 112/VDE 0303, part 1			175	
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

Note

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

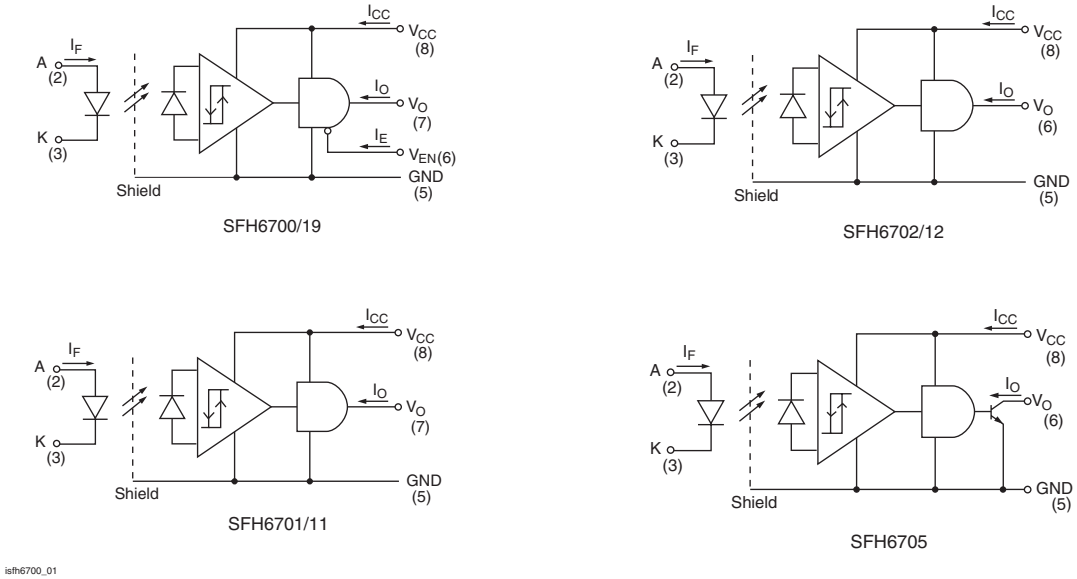


Fig. 1 - Schematics

RECOMMENDED OPERATING CONDITIONS (1)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Supply voltage			V_{CC}	4.5		15	V
Enable voltage high		SFH6700	V_{EH}	2.0		15	V
		SFH6719	V_{EH}	2.0		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 (2)		5.0	mA
			I_{Foff}			0.1	mA
Operating temperature			T_{amb}	- 40		85	°C
Output pull-up resistor		SFH6705	R_L	350		4	kΩ
Fan output	R_L = 1.0 kΩ	SFH6705	N			16	LS TTL loads

Notes

(1) A 0.1 µF 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 (1)

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
INPUT						
Forward voltage	I_F = 5.0 mA	V_F		1.6	1.75	V
	I_F = 5.0 mA	V_F			1.8	V
Input current hysteresis	V_{CC} = 5.0 V, $I_{HYS} = I_{Fon} - I_{Foff}$	I_{HYS}		0.1		mA
Reverse current	V_R = 3.0 V	I_R		0.5	10	µA
Capacitance	V_R = 0 V, f = 1 MHz	C_O		60		pF
Thermal resistance		R_{thJA}		700		K/W
OUTPUT						
Logic low output voltage	I_{OL} = 6.4 mA	V_{OL}			0.5	V
Logic high output voltage (except SFH6705)	I_{OH} = 2.6 mA, $V_{OH} = V_{CC}$ - 1.8 V		2.4			V
Output leakage current ($V_{OUT} > V_{CC}$) (except SFH6705)	V_O = 5.5 V, V_{CC} = 4.5 V, I_F = 5.0 mA	I_{OHH}		0.5	100	µA
	V_O = 15 V, V_{CC} = 4.5 V, I_F = 5.0 mA	I_{OHH}		1.0	500	µA
Output leakage current (SFH6705 only)	V_O = 5.5 V, V_{CC} = 5.5 V, I_F = 5.0 mA	I_{OHH}		0.5	100	µA
	V_O = 15 V, V_{CC} = 15 V, I_F = 5.0 mA	I_{OHH}		1.0	500	µA
Logic high enable voltage (SFH6700/19 only)		V_{EH}	2.0			V
Logic low enable voltage (SFH6700/19 only)		V_{EL}			0.8	V
Logic high enable current (SFH6700/19 only)	V_{EN} = 2.7 V	I_{EH}			20	µA
	V_{EN} = 5.5 V	I_{EH}			100	µA
	V_{EN} = 15 V	I_{EH}		0.001	250	µA
Logic low enable current (SFH6700/19 only)	V_{EN} = 0.4 V	I_{EL}	- 320	- 50		µA
High impedance state output current (SFH6700/19 only)	V_O = 0.4 V, V_{EN} = 2.0 V, I_F = 5.0 mA	I_{OZL}	- 20			µA
	V_O = 2.4 V, V_{EN} = 2.0 V, I_F = 0 mA	I_{OZH}			20	µA
	V_O = 5.5 V, V_{EN} = 2.0 V, I_F = 0 mA	I_{OZH}			100	µA
		I_{OZH}		0.001	500	µA
Logic low supply current	V_{CC} = 5.5 V, I_F = 0	I_{CCL}		3.7	6.0	mA
	V_{CC} = 15 V, I_F = 0	I_{CCL}		4.1	6.5	mA
Logic high supply current	V_{CC} = 5.5 V, I_F = 5.0 mA	I_{CCH}		3.4	4.0	mA
	V_{CC} = 15 V, I_F = 5.0 mA	I_{CCH}		3.7	5.0	mA
Logic low short circuit output current (2)	$V_O = V_{CC}$ = 5.5 V, I_F = 0	I_{OSL}	25			mA
	$V_O = V_{CC}$ = 15 V, I_F = 0	I_{OSL}	40			mA
Logic high short circuit output current (2)	V_{CC} = 5.5 V, V_O = 0 V, I_F = 5.0	I_{OSL}			- 10	mA
	V_{CC} = 15 V, V_O = 0 V, I_F = 5.0	I_{OSL}			- 25	mA
Thermal resistance		R_{thJA}		300		K/W
COUPLER						
Capacitance (input to output)	f = 1 MHz, pins 1 to 4 and 5 to 8 shorted together	C_{IO}		0.6		pF
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

Notes

(1) - 40 °C ≤ T_{amb} ≤ 85 °C; 4.5 V ≤ V_{CC} ≤ 15 V; 1.6 mA ≤ I_{Fon} ≤ 5.0 mA; 2.0 ≤ V_{EH} ≤ 15 V; 0 ≤ V_{EL} ≤ 0.8 V; 0 mA ≤ I_{Foff} ≤ 0.1 mA.
Typical values: T_{amb} = 25 °C; V_{CC} = 5.0 V; I_{Fon} = 3.0 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, SFH6700/01/02/11/12/19 (2)	Without peaking capacitor		t_{PHL}		120		ns
	With peaking capacitor		t_{PHL}		115	300	ns
			t_{PLH}		125		ns
			t_{PLH}		90	300	ns
Output enable time to logic high (SFH6700/19) (2)			t_{PZH}		20		ns
Output enable time to logic low (SFH6700/19) (2)			t_{PZL}		25		ns
Output disable time from logic low (SFH6700/19) (2)			t_{PLZ}		50		ns
Output rise time (2)	10 % to 90 %		t_r		40		ns
Output fall time (2)	90 % to 10 %		t_f		10		ns
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

(1) $0\ °C \le T_{amb} \le 85\ °C$; $4.5\ V \le V_{CC} \le 15\ V$; $1.6\ mA \le I_{Fon} \le 5.0\ mA$; $2.0 \le V_{EH} \le 15\ V$ (SFH6700/19); $0 \le V_{EL} \le 0.8\ V$ (SFH6700/19); $0\ mA \le I_{Foff} \le 0.1\ mA$

(2) Typical values: $T_{amb} = 25\ °C$; $V_{CC} = 5.0\ V$; $I_{Fon} = 3.0\ mA$ unless otherwise specified (4)

(3) Typical values: $T_{amb} = 25\ °C$, $V_{CC} = 5.0\ V$; $I_{Fon} = 3.0\ mA$; $R_L = 390\ \Omega$ unless otherwise specified (4)

(4) A 0.1 µF 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	$\|V_{CM}\| = 50\ V$, $I_F = 1.6\ mA$	SFH6700	$\|CM_H\|$ (2)	1000			V/µs
		SFH6701	$\|CM_H\|$ (2)	1000			V/µs
		SFH6702	$\|CM_H\|$ (2)	1000			V/µs
		SFH6705	$\|CM_H\|$ (2)	1000			V/µs
	$\|V_{CM}\| = 400\ V$, $I_F = 1.6\ mA$	SFH6711	$\|CM_H\|$ (2)	2500			V/µs
		SFH6712	$\|CM_H\|$ (2)	2500			V/µs
		SFH6719	$\|CM_H\|$ (2)	2500			V/µs
Logic Low common mode transient immunity	$\|V_{CM}\| = 50\ V$, $I_F = 0\ mA$	SFH6700	$\|CM_L\|$ (3)	1000			V/µs
	$\|V_{CM}\| = 50\ V$, $I_F = 0\ mA$	SFH6701	$\|CM_L\|$ (3)	1000			V/µs
		SFH6702	$\|CM_L\|$ (3)	1000			V/µs
		SFH6705	$\|CM_L\|$ (3)	1000			V/µs
	$\|V_{CM}\| = 400\ V$, $I_F = 0\ mA$	SFH6711	$\|CM_L\|$ (3)	2500			V/µs
		SFH6712	$\|CM_L\|$ (3)	2500			V/µs
		SFH6719	$\|CM_L\|$ (3)	2500			V/µs

Notes

(1) $T_{amb} = 25\ °C$, $V_{CC} = 5.0\ V$

(2) CM_H is the maximum slew rate of a common mode voltage V_{CM} at which the output voltage remains at logic high level ($V_O > 2.0\ V$)

(3) CM_L is the maximum slew rate of a common mode voltage V_{CM} at which the output voltage remains at logic high level ($V_O < 0.8\ V$)

TYPICAL CHARACTERISTICS

T_{amb} = 25 °C, unless otherwise specified

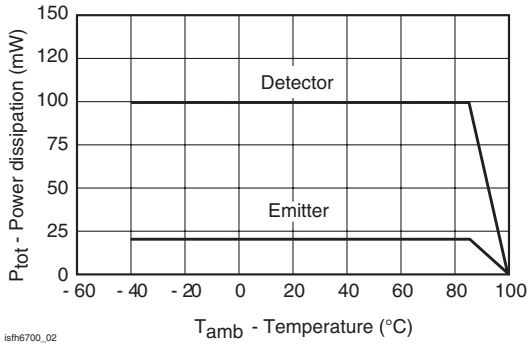


Fig. 2 - Permissible Total Power Dissipation vs. Temperature

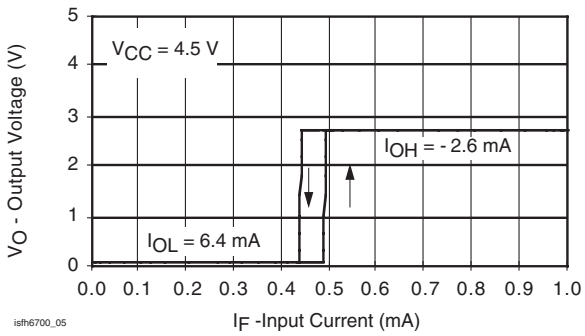


Fig. 5 - Typical Output Voltage vs. Forward Input Current (except SFH6705)

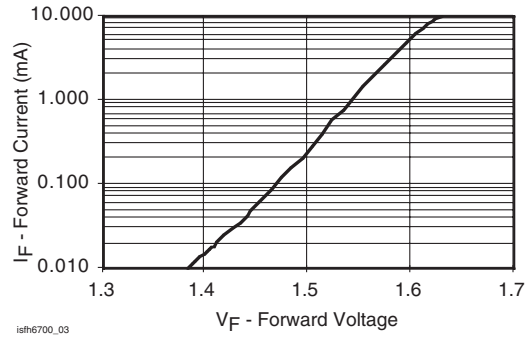


Fig. 3 - Typical Input Diode Forward Current vs. Forward Voltage

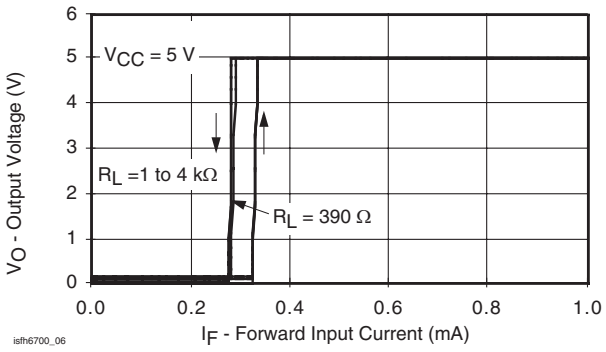


Fig. 6 - Typical Output Forward Voltage vs. Forward Input Current (only SFH6705)

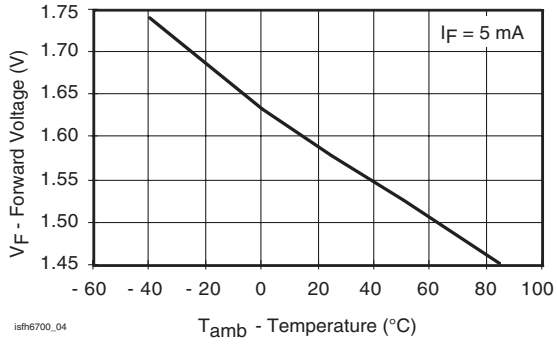


Fig. 4 - Typical Forward Input Voltage vs. Temperature

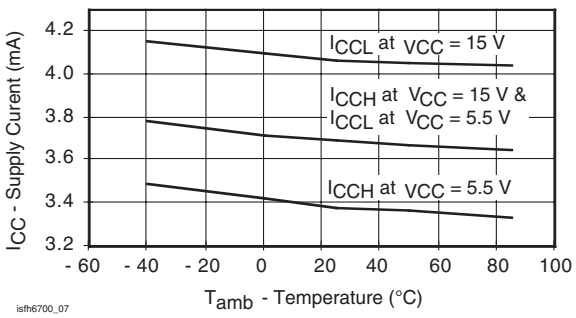


Fig. 7 - Typical Supply Current vs. Temperature

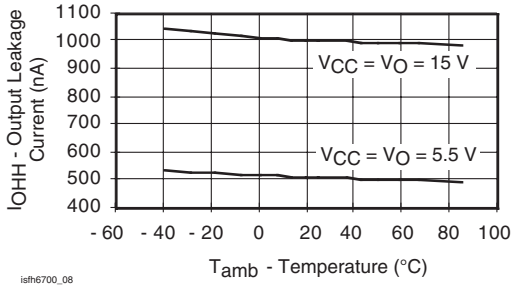


Fig. 8 - Typical Output Leakage Current vs. Temperature

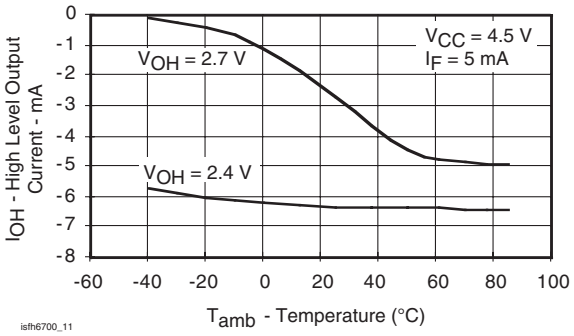


Fig. 11 - Typical High Level Output Current vs. Temperature (except SFH6705)

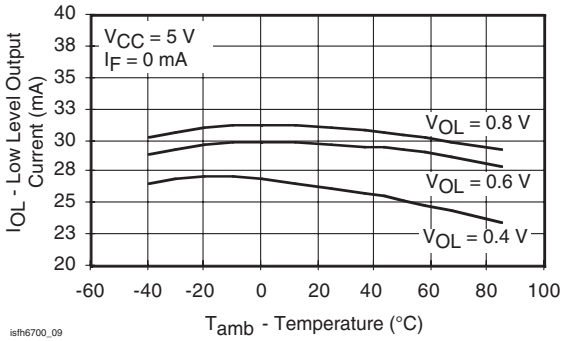


Fig. 9 - Typical Low Level Output Current vs. Temperature

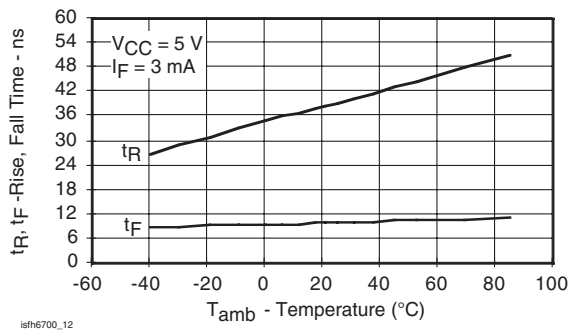


Fig. 12 - Typical Rise, Fall Time vs. Temperature (except SFH6705)

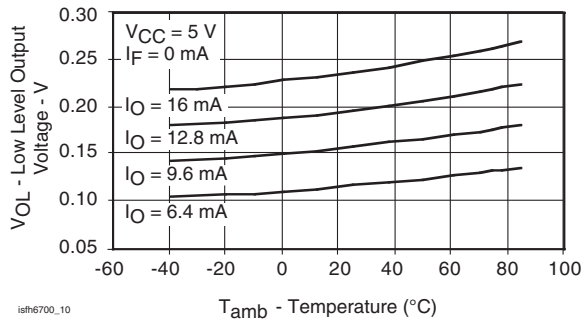


Fig. 10 - Typical Low Level Output Voltage vs. Temperature

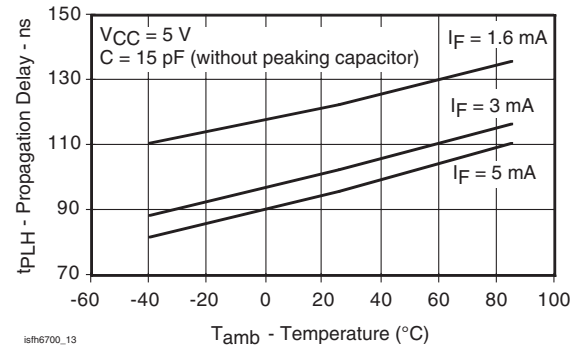


Fig. 13 - Typical Propagation Delay to Logic High vs. Temperature (except SFH6705)

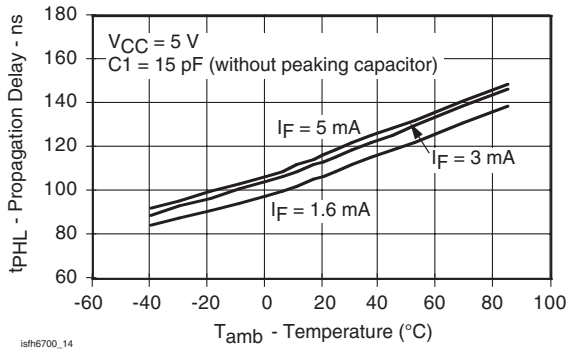


Fig. 14 - Typical Propagation Delay to Logic Low vs. Temperature (except SFH6705)

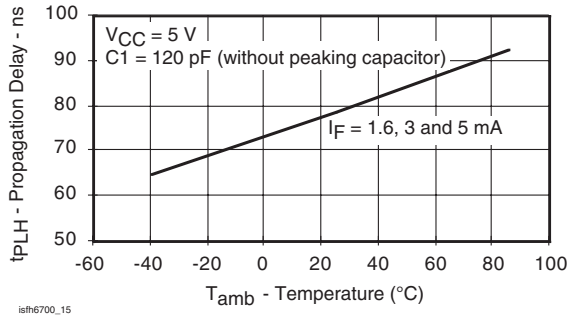


Fig. 15 - Typical Propagation Delays to Logic High vs. Temperature (except SFH6705)

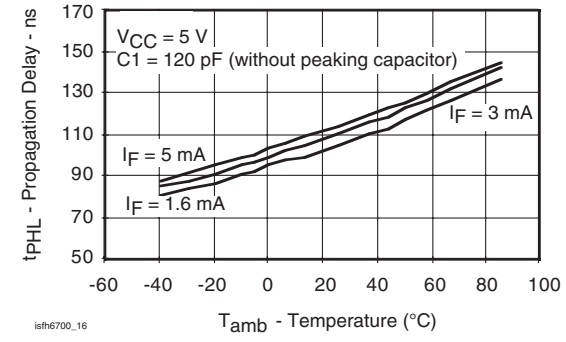


Fig. 16 - Typical Propagation Delay to Logic Low vs. Temperature

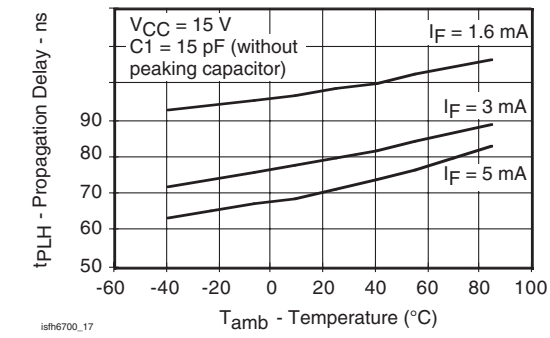


Fig. 17 - Typical Propagation Delays to Logic High vs. Temperature

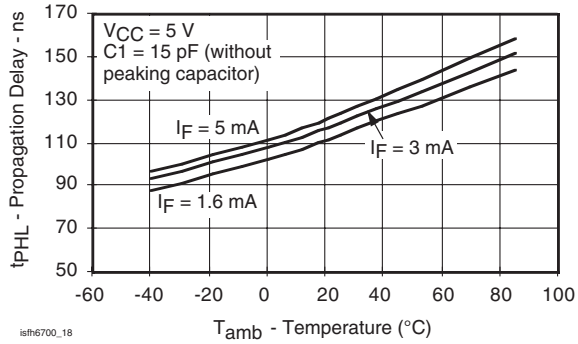


Fig. 18 - Typical Propagation Delays to Logic Low vs.Temperature

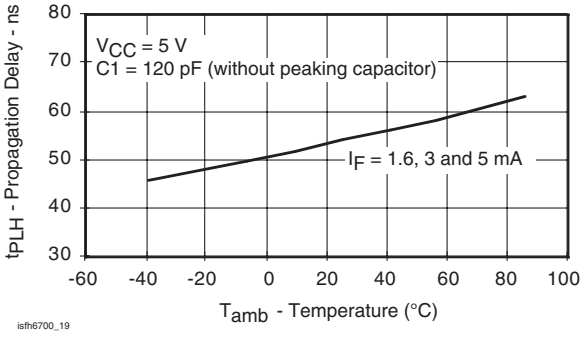


Fig. 19 - Typical Propagation Delays to Logic High vs. Temperature

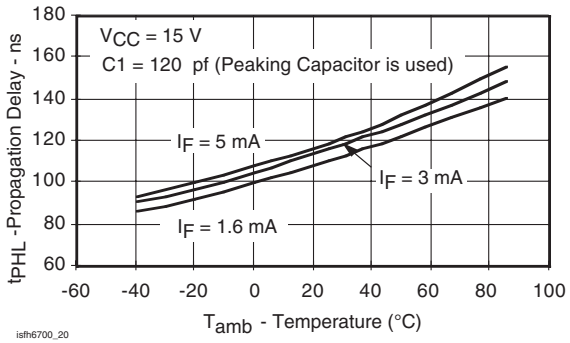


Fig. 20 - Typical Propagation Delays to Logic Low vs. Temperature (except SFH6705)

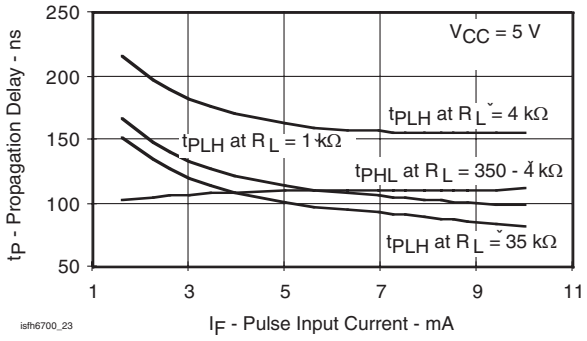


Fig. 23 - Typical Propagation Delays vs. Pulse Input Current (only SFH6705)

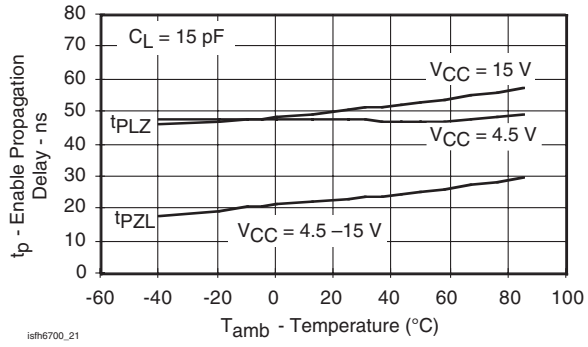


Fig. 21 - Typical Logic Low Enable Propagation Delays vs. Temperature (only SFH6700/11)

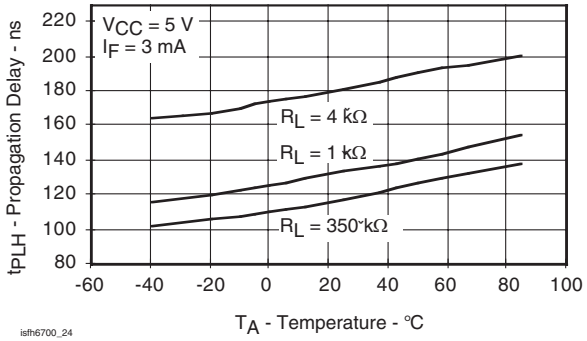


Fig. 24 - Typical Propagation Delays to High Level vs. Temperature (only SFH6705)

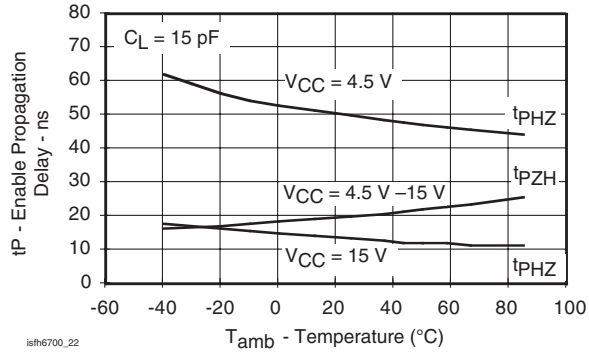


Fig. 22 - Typical Logic High Enable Propagation Delays vs. Temperature (only SFH6700/11)

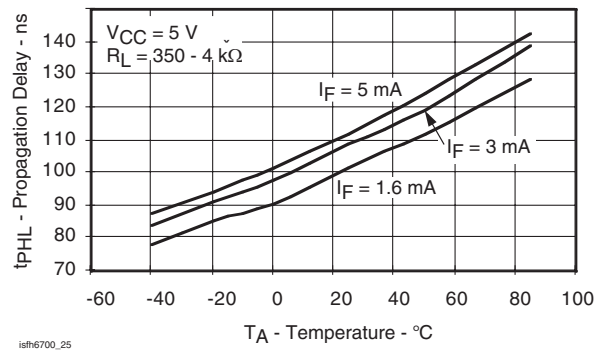


Fig. 25 - Typical Propagation Delays to Low Level vs. Temperature (only SFH6705)

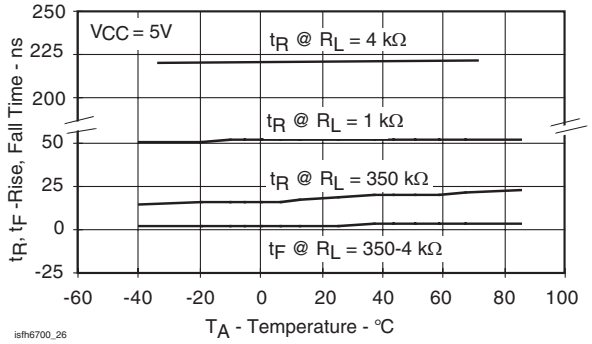


Fig. 26 - Typical Rise, Fall Time vs. Temperature (only SFH6705)

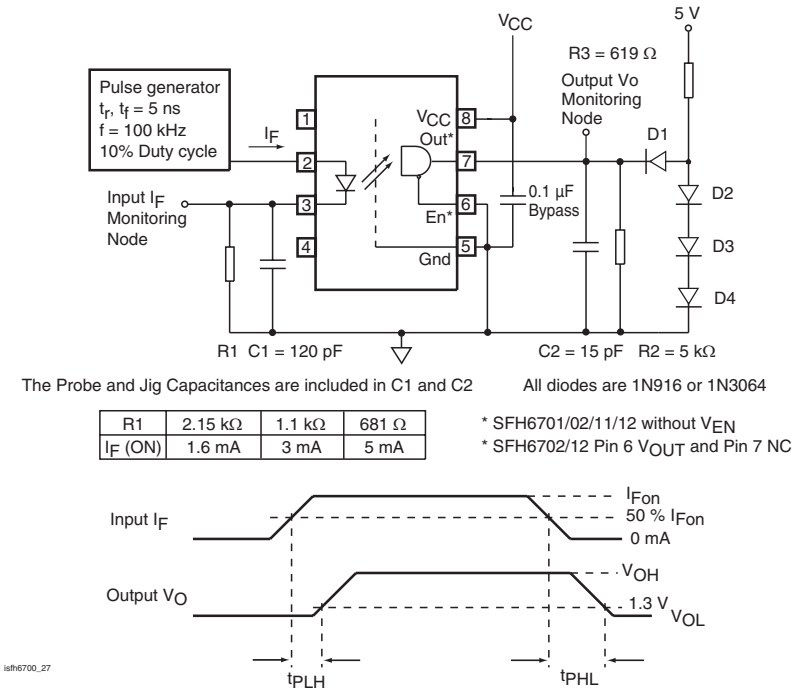
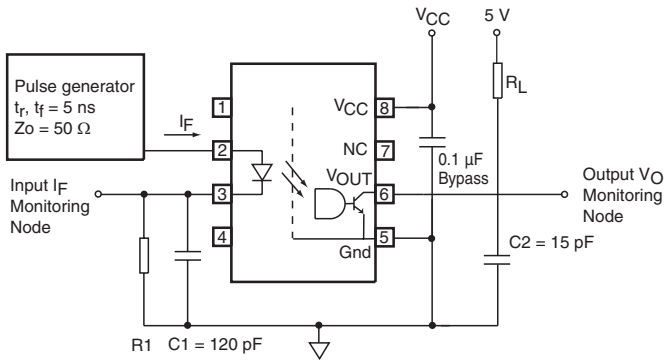


Fig. 27 Test Circuit for t_{PLH}, t_{PHL}, t_r and t_f



The Probe and Jig Capacitances are included in C1 and C2

R1	2.15 kΩ	1.1 kΩ	681 Ω
I_F (ON)	1.6 mA	3 mA	5 mA

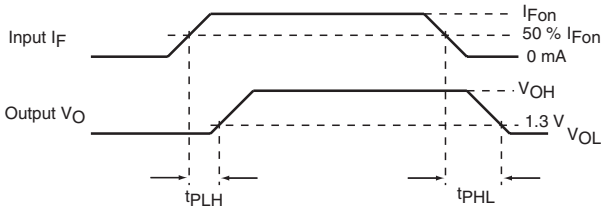
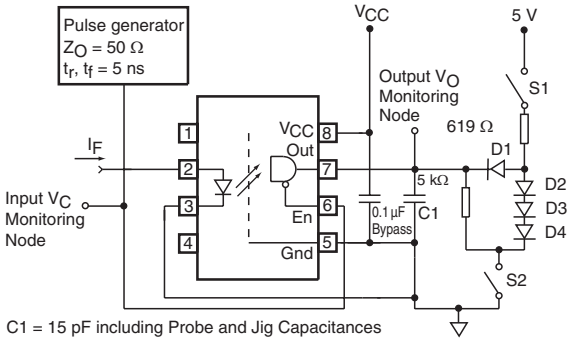


Fig. 28 Test Circuit for t_{PLH}, t_{PHL}, t_r and - SFH6705



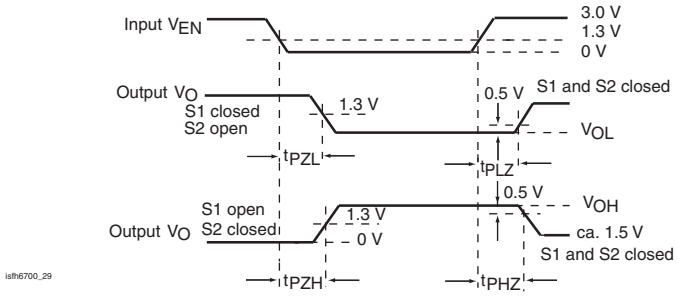


Fig. 29 Test Circuit for t_{PHZ}, t_{PZH}, t_{PLZ} and t_{PZL} - SFH6700/19

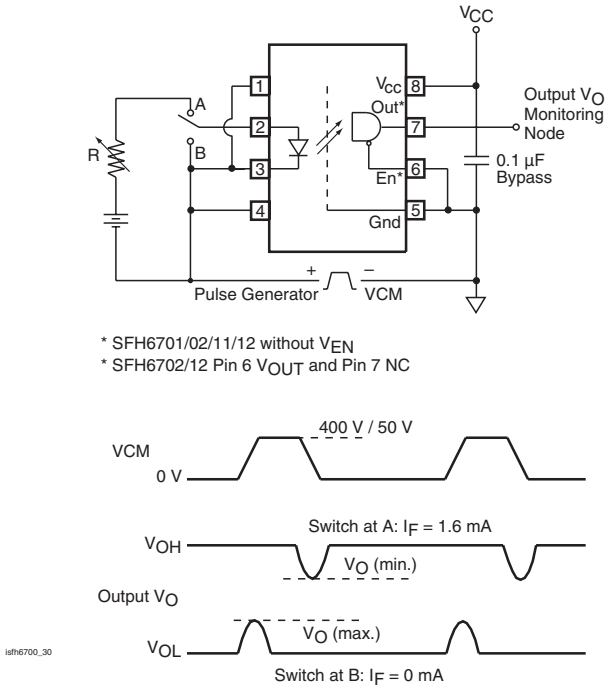


Fig. 30 Test Circuit for Common Mode Transient Immunity and Typical Waveforms - SFH6700/01/02/11/12/19

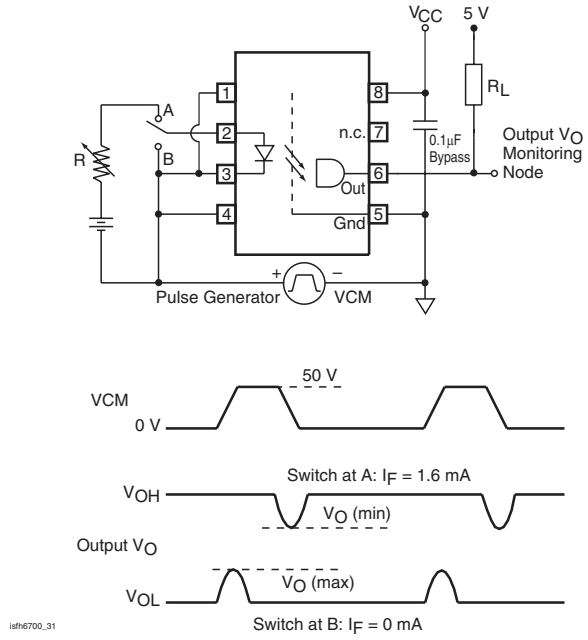
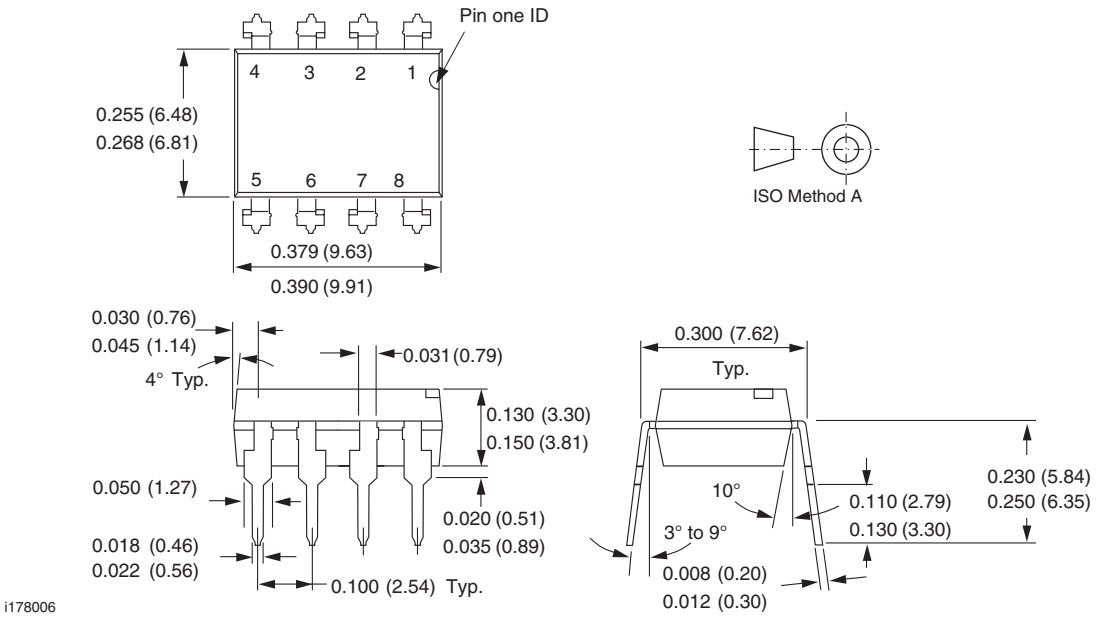
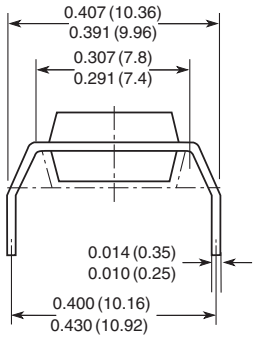


Fig. 31 Test Circuit for Common Mode Transient Immunity and Typical Waveforms - SFH6705

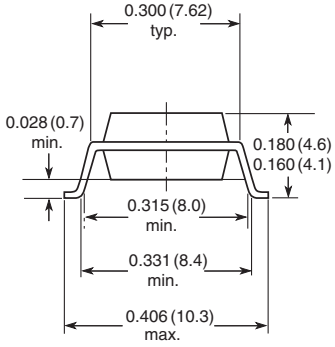
PACKAGE DIMENSIONS in inches (millimeters)



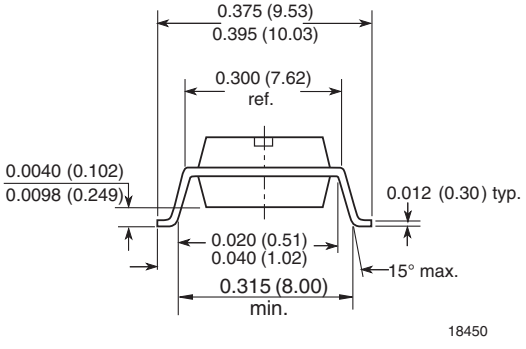
Option 6



Option 7



Option 9



OZONE DEPLETING SUBSTANCES POLICY STATEMENT

It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively.
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany

Disclaimer

All product specifications and data are subject to change without notice.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.