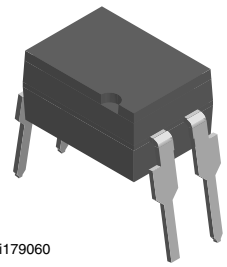
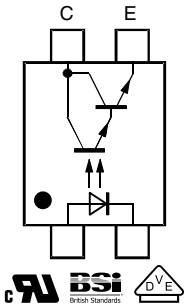
Optocoupler, Photodarlington Output





FEATURES

- High isolation test voltage 5300 V_{RMS}
- Standard plastic DIP-4 package
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free
e3
RoHS COMPLIANT

AGENCY APPROVALS

- UL - file no. E52744 system code H, double protection
- DIN EN 60747-5-2 (VDE 0884), IEC 60747-5-5
- DIN EN 60747-5-5 (VDE 0884) pending
- BSI IEC 60950; IEC 60065

DESCRIPTION

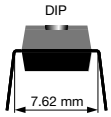
The SFH655A is optically coupled isolators with a gallium arsenide infrared LED and a silicon photodarlington detector. Switching can be achieved while maintaining a high degree of isolation between driving and load circuits.

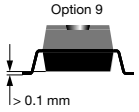
This optocouplers can be used to replace reed and mercury relays with advantages of long life, high speed switching and elimination of magnetic fields.

ORDERING INFORMATION

S	F	H	6	#	#	A	-	#	#	#	#

PART NUMBER — PACKAGE OPTION





AGENCY CERTIFIED/PACKAGE	CTR (%)
cUL, VDE	**> 600**
DIP-4	SFH655A
SMD-4, option 9	SFH655A-X009

Note

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

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
INPUT				
Peak reverse voltage		V_{RM}	6	V
Forward continuous current		I_F	60	mA
Surge forward current	$t_p \leq 10\mu s$	I_{FSM}	2.5	A
Derate linearly from 25 °C			1.33	mW/°C
Power dissipation		P_{diss}	100	mW
OUTPUT				
Collector emitter breakdown voltage		BV_{CEO}	55	V
Emitter collector breakdown voltage		BV_{ECO}	6	V
Collector (load) current		I_C	125	mA
Derate linearly from 25 °C			2	mW/°C
Power dissipation		P_{diss}	150	mW

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
COUPLER				
Derate linearly from 25 °C			3.33	mW/°C
Total power dissipation		P_{tot}	250	mW
Storage temperature range		T_{stg}	-55 to +150	°C
Operating temperature range		T_{amb}	-55 to +100	°C
Soldering temperature (1)	max. 10 s, dip soldering distance to seating plane ≥ 1.5 mm	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 reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP)

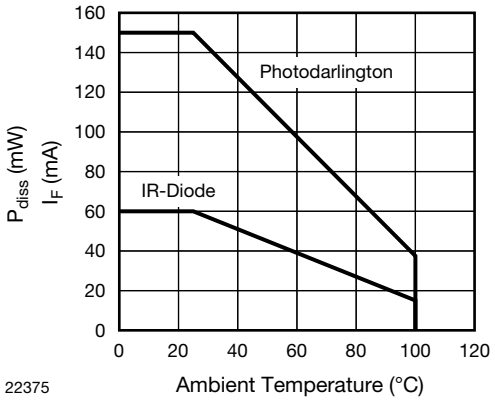


Fig. 1 - Power Dissipation vs. Ambient Temperature

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT							
Forward voltage	I_F = 10 mA		V_F	-	1.15	1.5	V
Reverse current	V_R = 6 V		I_R	-	0.02	10	µA
Capacitance	V_R = 0 V, f = 1 MHz		C_O	-	50	-	pF
OUTPUT							
Collector emitter breakdown voltage	I_{CE} = 100 µA		BV_{CEO}	55	-	-	V
Emitter collector breakdown voltage	I_{EC} = 10 µA		BV_{ECO}	6	-	-	V
Collector emitter dark current	V_{CE} = 40 V		I_{CEO}	-	12	400	nA
Collector emitter capacitance	V_{CE} = 0 V, f = 1 MHz		C_{CE}	-	13.5	-	pF
COUPLER							
Collector emitter saturation voltage	I_F = 20 mA, I_C = 5 mA	SFH655A	V_{CEsat}	-	-	1	V
Coupling capacitance	V_{I-O} = 0 V, f = 1 MHz		C_C	-	0.45	-	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 (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Current transfer ratio	I_F = 1 mA, V_{CE} = 2 V	SFH655A	CTR	600	-	-	%

SAFETY AND INSULATION RATINGS				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Climatic classification	According to IEC 68 part 1		55 / 100 / 21	
Comparative tracking index		CTI	175	
Maximum rated withstanding isolation voltage	t = 1 min	V_{ISO}	4420	V_{RMS}
Maximum transient isolation voltage		V_{IOTM}	10 000	V
Maximum repetitive peak isolation voltage		V_{IORM}	890	V
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
	V_{IO} = 500 V, T_{amb} = 150 °C (construction test only)	R_{IO}	≥ 10^{9}	Ω
Output safety power		P_{SO}	400	mW
Input safety current		I_{SI}	275	mA
Input safety temperature		T_{SI}	175	°C
Creepage distance	Standard DIP-4		≥ 7	mm
Clearance distance	Standard DIP-4		≥ 7	mm
Insulation thickness		DTI	≥ 0.4	mm
Partial discharge test voltage - routine test	100 %, t_{test} = 1 s	V_{pd}	1.669	kV
Partial discharge test voltage - lot test (sample test)	t_{Tr} = 60 s, t_{test} = 10 s, (see fig. 2)	V_{pd}	1.424	kV

Note

- As per IEC 60747-5-5, § 7.4.3.8.2, 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

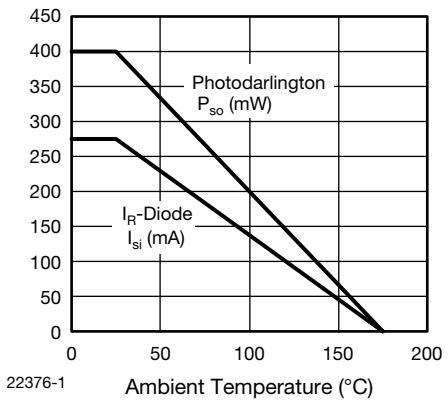


Fig. 2 - Derating Diagram

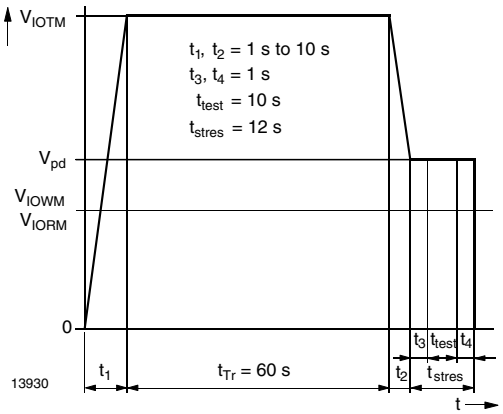


Fig. 3 - Test Pulse Diagram for Sample Test according to DIN EN 60747-5-2 (VDE 0884); IEC 60747-5-5

SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Turn-on time (fig. 10, test circuit 1)	V_{CC} = 10 V, I_C = 2 mA, R_L = 100 Ω	SFH612A	t_{on}		16		µs
Turn-off time (fig. 10, test circuit 1)	V_{CC} = 10 V, I_C = 2 mA, R_L = 100 Ω	SFH612A	t_{off}		15		µs
Rise time (fig. 10, test circuit 1)	V_{CC} = 10 V, I_C = 2 mA, R_L = 100 Ω	SFH612A	t_r		14		µs
Fall time (fig. 10, test circuit 1)	V_{CC} = 10 V, I_C = 2 mA, R_L = 100 Ω	SFH612A	t_f		14		µs
Turn-on time (fig. 11, test circuit 2)	V_{CC} = 2 V, I_C = 10 mA, R_L = 100 Ω	SFH655A	t_{on}		31		µs
Turn-off time (fig. 11, test circuit 2)	V_{CC} = 2 V, I_C = 10 mA, R_L = 100 Ω	SFH655A	t_{off}		55		µs
Rise time (fig. 11, test circuit 2)	V_{CC} = 2 V, I_C = 10 mA, R_L = 100 Ω	SFH655A	t_r		27	250	µs
Fall time (fig. 11, test circuit 2)	V_{CC} = 2 V, I_C = 10 mA, R_L = 100 Ω	SFH655A	t_f		56	200	µs

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

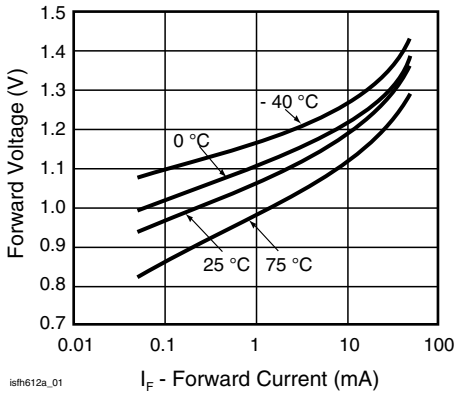


Fig. 4 - Forward Voltage vs. Forward Current

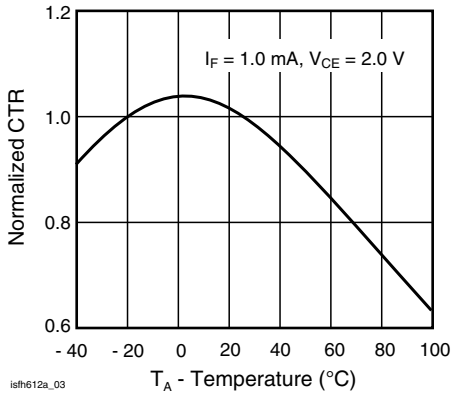


Fig. 6 - Normalized CTR vs. Temperature

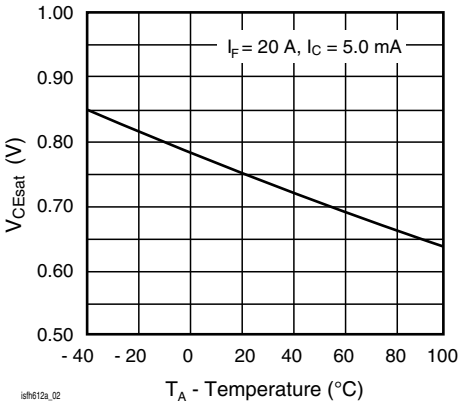


Fig. 5 - Collector Emitter Saturation Voltage vs. Temperature

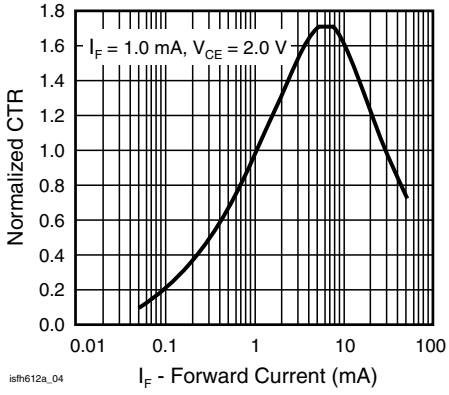


Fig. 7 - Normalized CTR vs. Forward Current

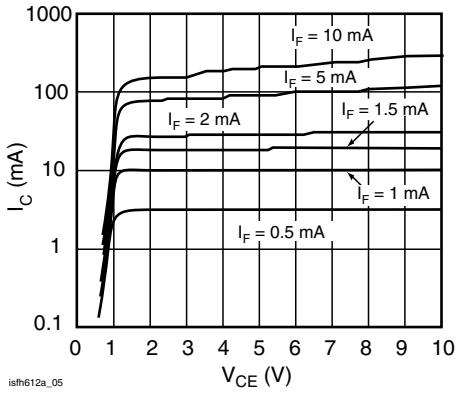


Fig. 8 - Collector Current vs. Collector Emitter Voltage

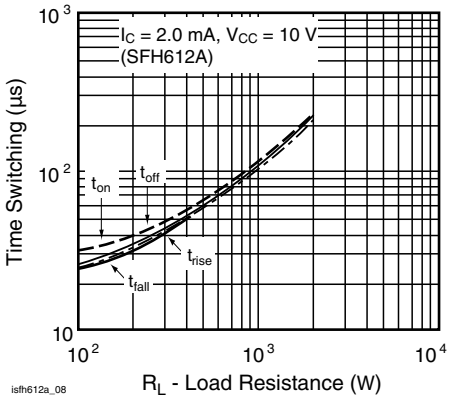


Fig. 11 - Switching Time vs. Load Resistor

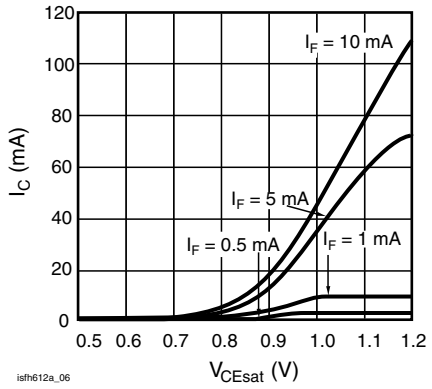


Fig. 9 - Collector Current vs. Collector Emitter Saturation Voltage

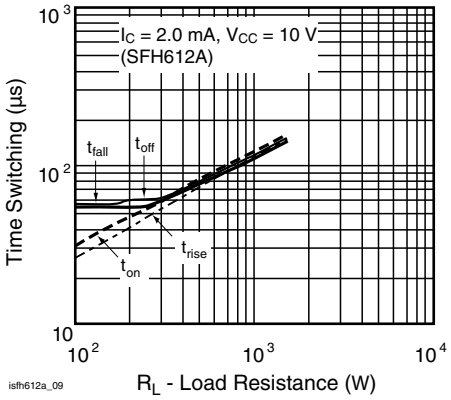


Fig. 12 - Switching Time vs. Load Resistor

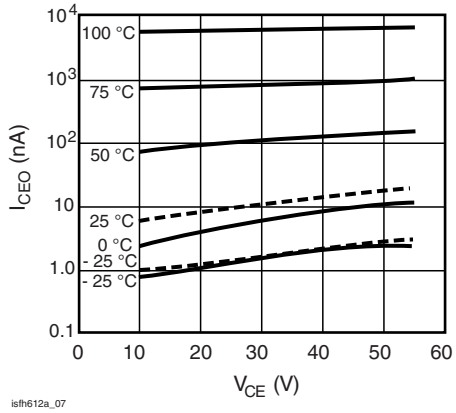


Fig. 10 - Collector Emitter Dark Current vs.
Collector Emitter Voltage over Temperature

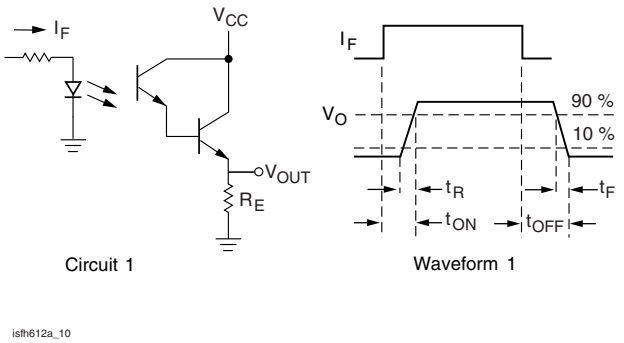


Fig. 13 - Switching Time Test Circuit and Waveforms

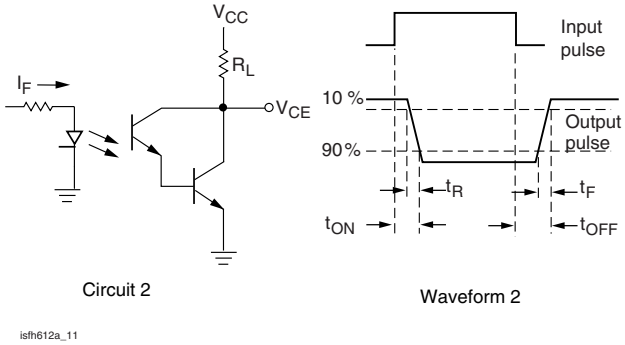
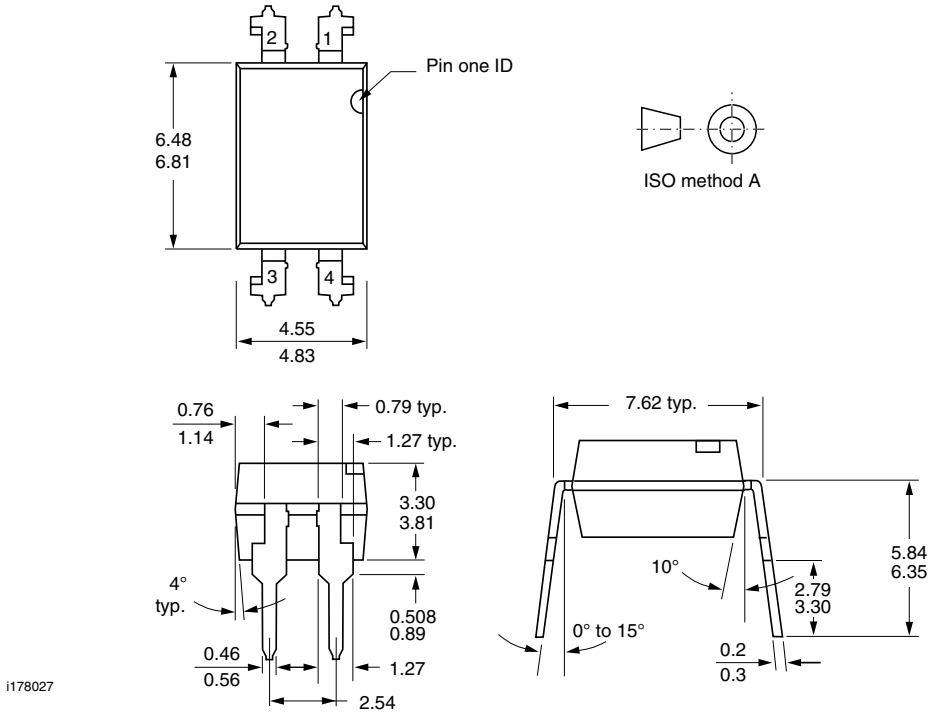
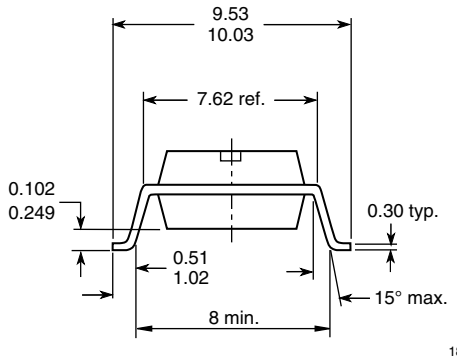


Fig. 14 - Switching Time Test Circuit and Waveforms

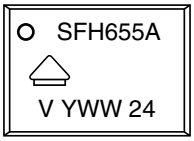
PACKAGE DIMENSIONS in millimeters



Option 9



PACKAGE MARKING



Note

- VDE logo is only printed on option 1 parts. Option information is not marked on the part

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