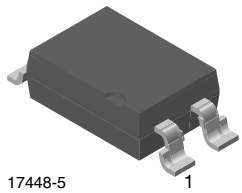
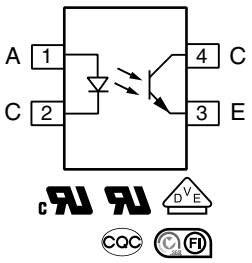
Optocoupler, Phototransistor Output, High Reliability, 5300 V_{RMS}





FEATURES

- Excellent CTR linearity depending on forward current
- Isolation test voltage, 5300 V_{RMS}
- Fast switching times
- Low CTR degradation
- Low coupling capacitance
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

LINKS TO ADDITIONAL RESOURCES

Related Documents

SPICE Models

DESCRIPTION

The SFH6156 features a variety of transfer ratios, low coupling capacitance and high isolation voltage. This coupler has a GaAs infrared diode emitter, which is optically coupled to a silicon planar phototransistor detector, and is incorporated in a plastic SMD package.

The coupling devices are designed for signal transmission between two electrically separated circuits.

APPLICATIONS

- Switchmode power supply
- Telecom
- Battery powered equipment

AGENCY APPROVALS

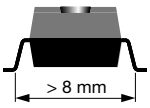
The safety application model number covering all products in this datasheet is SFH615A. This model number should be used when consulting safety agency documents.

- UL 1577
- cUL
- DIN EN 60747-5-5 (VDE 0884-5) available with option 1
- BSI
- CQC
- FIMKO

ORDERING INFORMATION

S	F	H	6	1	5	6	-	#	X	0	0	1	T
PART NUMBER								CTR BIN	PACKAGE OPTION				TAPE AND REEL

SMD-4



AGENCY CERTIFIED/PACKAGE	CTR (%)			
	10 mA			
UL, cUL, BSI, FIMKO, CQC	**40 to 80**	**63 to 125**	**100 to 200**	**160 to 320**
SMD-4, 100 mil, pitch	SFH6156-1	SFH6156-2	SFH6156-3	SFH6156-4
	SFH6156-1T	SFH6156-2T	SFH6156-3T	SFH6156-4T
VDE, UL, cUL, BSI, FIMKO, CQC	**40 to 80**	**63 to 125**	**100 to 200**	**160 to 320**
SMD-4, 100 mil, pitch	SFH6156-1X001	SFH6156-2X001	SFH6156-3X001	-
	SFH6156-1X001T	SFH6156-2X001T	SFH6156-3X001T	SFH6156-4X001T
	-	-	SFH6156-3X001T1 (1)	-

Notes

- • Additional options may be possible, please contact sales office

(1) T1 rotation in tape and reel packaging

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
Reverse voltage		V_R	6	V
DC forward current		I_F	60	mA
Surge forward current	$t_p \leq 10$ µs	I_{FSM}	2.5	A
OUTPUT				
Collector emitter voltage		V_{CEO}	70	V
Emitter collector voltage		V_{ECO}	7	V
Collector current		I_C	50	mA
	$t_p \leq 1$ ms	I_C	100	mA
COUPLER				
Storage temperature range		T_{stg}	-55 to +150	°C
Ambient temperature range		T_{amb}	-55 to +100	°C
Soldering temperature [1]	max. 10 s	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

(2) Refer to reflow profile for soldering conditions for surface mounted devices (SMD)

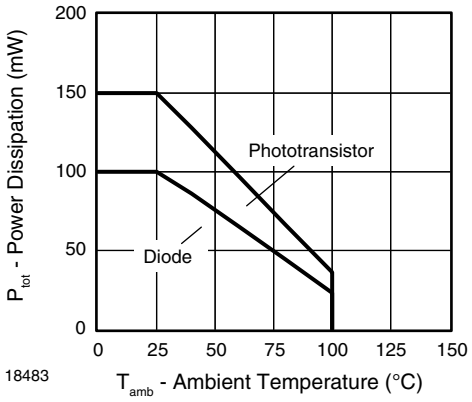
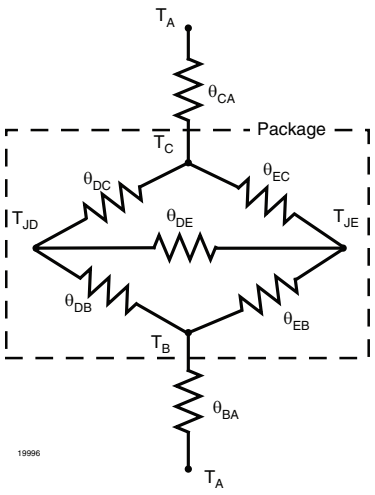


Fig. 1 - Permissible Power Dissipation vs. Ambient Temperature

THERMAL CHARACTERISTICS

PARAMETER	SYMBOL	VALUE	UNIT
LED power dissipation	P_{diss}	100	mW
Output power dissipation	P_{diss}	150	mW
Maximum LED junction temperature	$T_{jmax.}$	125	°C
Maximum output die junction temperature	$T_{jmax.}$	125	°C
Thermal resistance, junction emitter to board	θ_{EB}	173	°C/W
Thermal resistance, junction emitter to case	θ_{EC}	149	°C/W
Thermal resistance, junction detector to board	θ_{DB}	111	°C/W
Thermal resistance, junction detector to case	θ_{DC}	127	°C/W
Thermal resistance, junction emitter to junction detector	θ_{ED}	95	°C/W
Thermal resistance, board to ambient (1)	θ_{BA}	195	°C/W
Thermal resistance, case to ambient (1)	θ_{CA}	3573	°C/W



Notes

- The thermal model is represented in the thermal network below. Each resistance value given in this model can be used to calculate the temperatures at each node for a given operating condition. The thermal resistance from board to ambient will be dependent on the type of PCB, layout and thickness of copper traces. For a detailed explanation of the thermal model, please reference Vishay's thermal characteristics of optocouplers application note

(1) For 2 layer FR4 board (4" x 3" x 0.062")

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

PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
INPUT							
Forward voltage	I_F = 60 mA		V_F	-	1.25	1.65	V
Reverse current	V_R = 6 V		I_R	-	0.01	10	µA
Capacitance	V_R = 0 V, f = 1 MHz		C_O	-	13	-	pF
OUTPUT							
Collector emitter capacitance	V_{CE} = 5 V, f = 1 MHz		C_{CE}	-	5.2	-	pF
Collector emitter leakage current	V_{CE} = 10 V	SFH6156-1	I_{CEO}	-	2	50	nA
		SFH6156-2	I_{CEO}	-	2	50	nA
		SFH6156-3	I_{CEO}	-	5	100	nA
		SFH6156-4	I_{CEO}	-	5	100	nA
COUPLER							
Collector emitter saturation voltage	I_F = 10 mA, I_C = 2.5 mA		V_{CEsat}	-	0.25	0.4	V
Coupling capacitance			C_C	-	0.4	-	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							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
I_C/I_F	I_F = 10 mA, V_{CE} = 5 V	SFH6156-1	CTR	40	-	80	%
		SFH6156-2	CTR	63	-	125	%
		SFH6156-3	CTR	100	-	200	%
		SFH6156-4	CTR	160	-	320	%
	I_F = 1 mA, V_{CE} = 5 V	SFH6156-1	CTR	13	30	-	%
		SFH6156-2	CTR	22	45	-	%
		SFH6156-3	CTR	34	70	-	%
		SFH6156-4	CTR	56	90	-	%

SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
NON-SATURATED							
Turn-on time	I_F = 10 mA, V_{CC} = 5 V, R_L = 75 Ω		t_{on}	-	3	-	µs
Rise time	I_F = 10 mA, V_{CC} = 5 V, R_L = 75 Ω		t_r	-	2	-	µs
Turn-off time	I_F = 10 mA, V_{CC} = 5 V, R_L = 75 Ω		t_{off}	-	2.3	-	µs
Fall time	I_F = 10 mA, V_{CC} = 5 V, R_L = 75 Ω		t_f	-	2	-	µs
Cut-off frequency	I_F = 10 mA, V_{CC} = 5 V, R_L = 75 Ω		f_{CO}	-	250	-	kHz
SATURATED							
Turn-on time	I_F = 20 mA	SFH6156-1	t_{on}	-	3	-	µs
	I_F = 10 mA	SFH6156-2	t_{on}	-	4.2	-	µs
		SFH6156-3	t_{on}	-	4.2	-	µs
	I_F = 5 mA	SFH6156-4	t_{on}	-	6	-	µs
Rise time	I_F = 20 mA	SFH6156-1	t_r	-	2	-	µs
	I_F = 10 mA	SFH6156-2	t_r	-	3	-	µs
		SFH6156-3	t_r	-	3	-	µs
	I_F = 5 mA	SFH6156-4	t_r	-	4	-	µs
Turn-off time	I_F = 20 mA	SFH6156-1	t_{off}	-	18	-	µs
	I_F = 10 mA	SFH6156-2	t_{off}	-	23	-	µs
		SFH6156-3	t_{off}	-	23	-	µs
	I_F = 5 mA	SFH6156-4	t_{off}	-	25	-	µs
Fall time	I_F = 20 mA	SFH6156-1	t_f	-	11	-	µs
	I_F = 10 mA	SFH6156-2	t_f	-	14	-	µs
		SFH6156-3	t_f	-	14	-	µs
	I_F = 5 mA	SFH6156-4	t_f	-	15	-	µs

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}	$\geq 10^{12}$	Ω
	V_{IO} = 500 V, T_{amb} = 100 °C	R_{IO}	$\geq 10^{11}$	Ω
Output safety power		P_{SO}	400	mW
Input safety current		I_{SI}	275	mA
Input safety temperature		T_{SI}	175	°C
Creepage distance			≥ 7	mm
Clearance distance			≥ 7	mm
Insulation thickness		DTI	≥ 0.4	mm

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

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

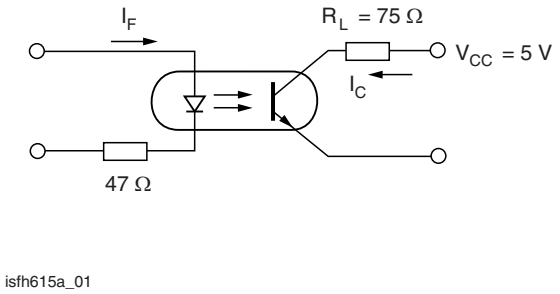


Fig. 2 - Linear Operation (without saturation)

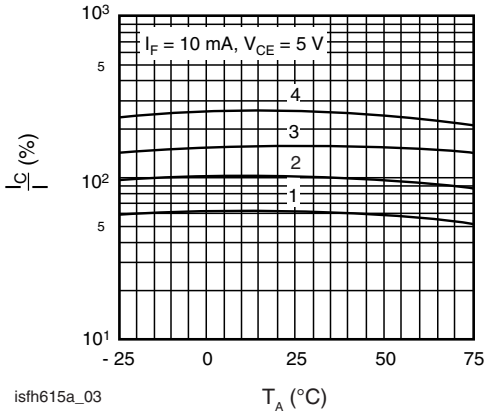


Fig. 4 - Current Transfer Ratio (typ.) vs. Temperature

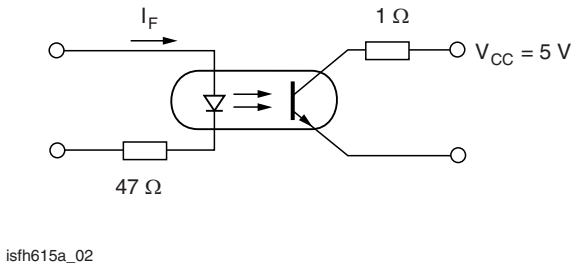


Fig. 3 - Switching Operation (with saturation)

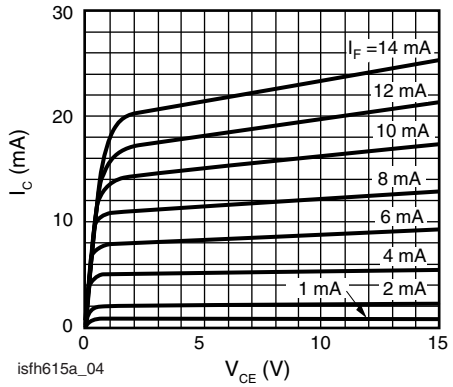


Fig. 5 - Output Characteristics (typ.) Collector Current vs. Collector Emitter Voltage

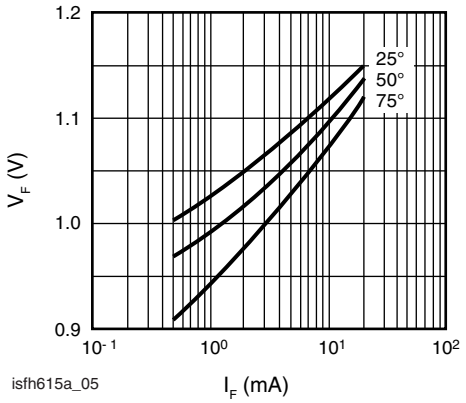


Fig. 6 - Diode Forward Voltage (typ.) vs. Forward Current

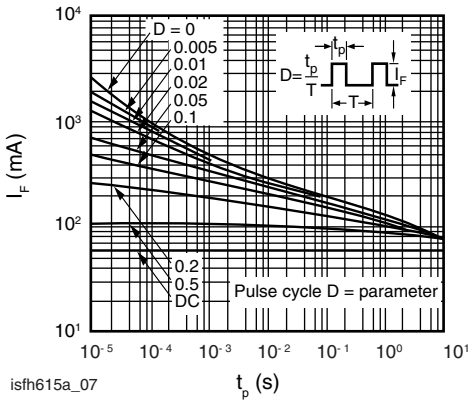


Fig. 8 - Permissible Pulse Handling Capability Forward Current vs. Pulse Width

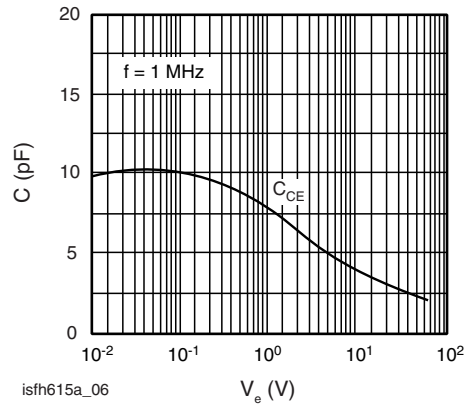
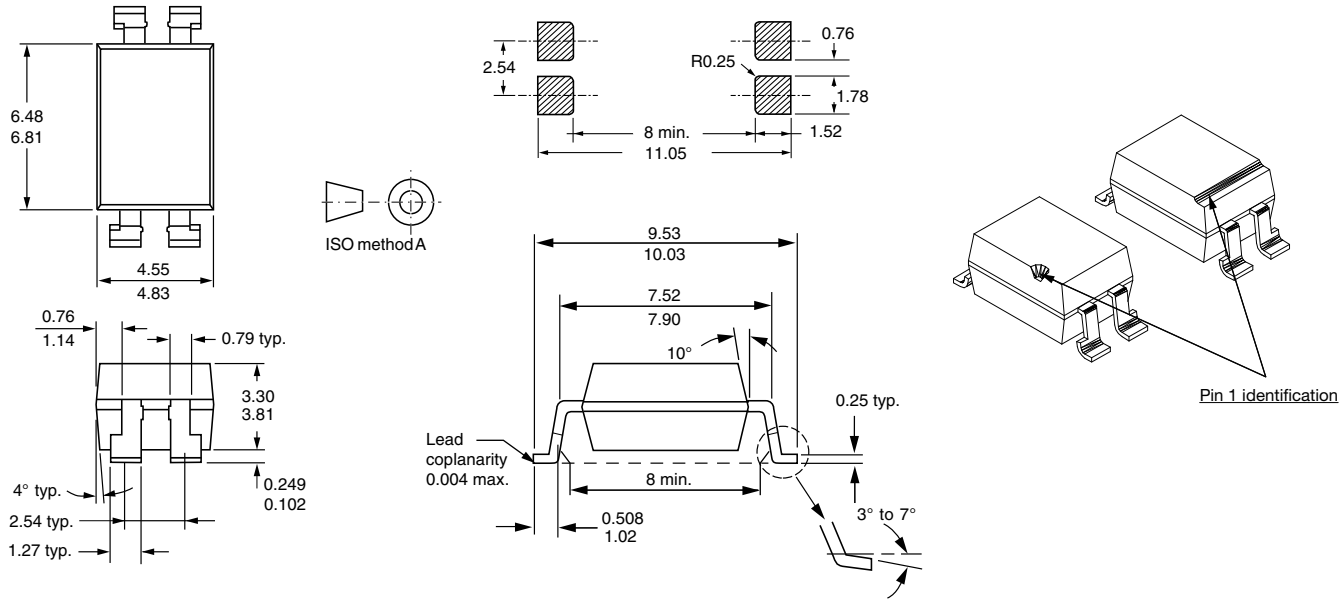
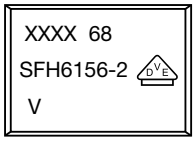


Fig. 7 - Transistor Capacitance (typ.) vs. Collector Emitter Voltage

PACKAGE DIMENSIONS (in millimeters)



PACKAGE MARKING (example of SFH6156-2X001T)



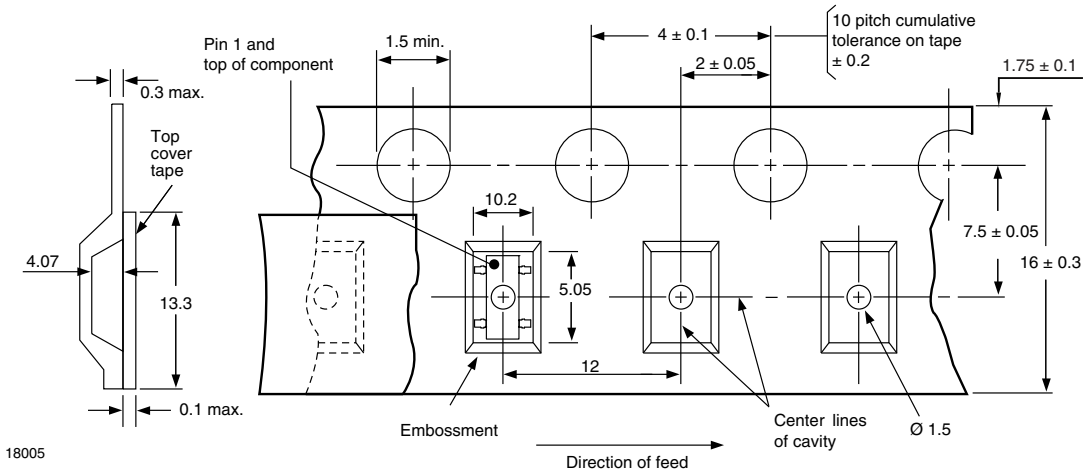
Notes

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

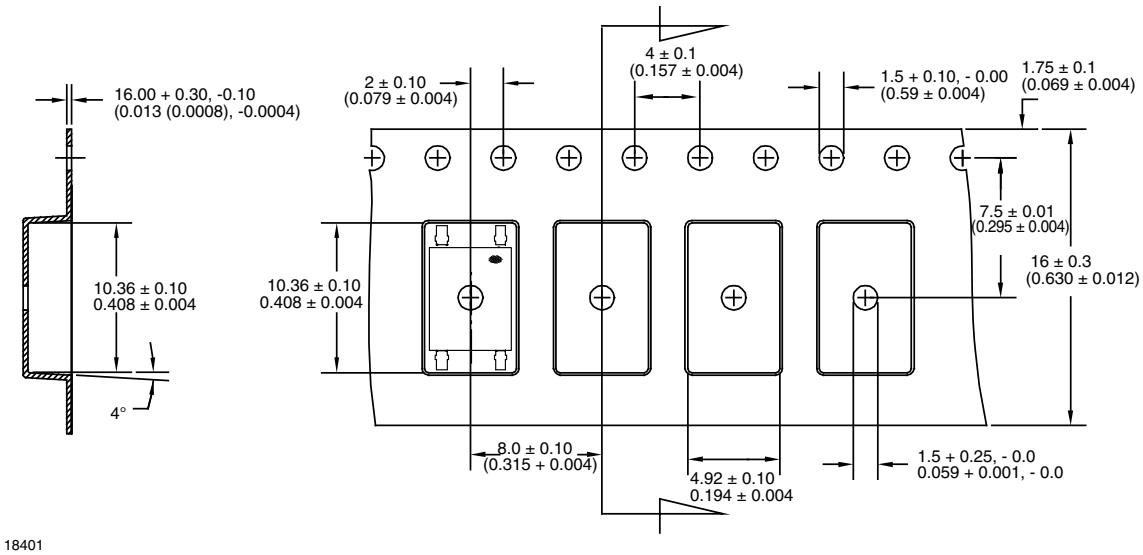
TAPE AND REEL PACKAGING (in millimeters)

The tape is 16 mm and is wound on a 33 cm reel. There are 1000 parts per reel. Taped and reeled 4 pin optocouplers conform to EIA-481-2 and IEC60286-3.

SMD-4 (“T”)



SMD-4, 90° Rotation (“T1”)



SOLDER PROFILES

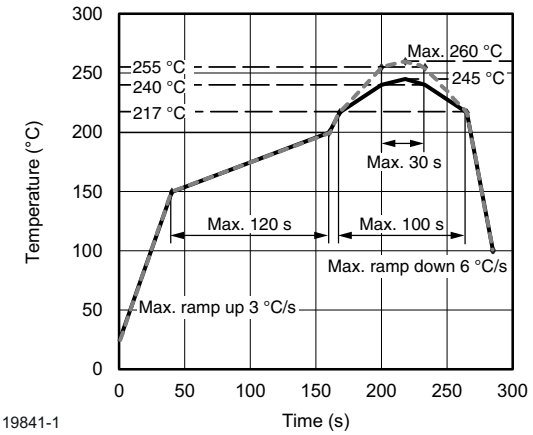


Fig. 9 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

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

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