



# Optocoupler, Phototransistor Output, High Reliability, 5300 V<sub>RMS</sub>



### FEATURES

- Excellent CTR linearity depending on forward current
- Isolation test voltage, 5300 V<sub>RMS</sub>
- Fast switching times
- Low CTR degradation
- Low coupling capacitance
- Material categorization:  
For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### DESCRIPTION

The SFH615A feature a variety of transfer ratios, low coupling capacitance and high isolation voltage. These couplers have a GaAs infrared diode emitter, which is optically coupled to a silicon planar phototransistor detector, and is incorporated in a plastic DIP-4 package.

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

The couplers are end-stackable with 2.54 mm lead spacing. Creepage and clearance distances of > 8 mm are achieved with option 6. This version complies with IEC 60950 (DIN VDE 0805) for reinforced insulation up to an operation voltage of 400 V<sub>RMS</sub> or DC. Specifications subject to change.

### APPLICATIONS

- Switchmode power supply
- Telecom
- Battery powered equipment

### AGENCY APPROVALS

- UL file no. E52744
- cUL tested to CSA 22.2 bulletin 5A
- DIN EN 60747-5-5 (VDE 0884-5) available with option 1
- BSI EN 60950; EN 60065
- FIMKO
- CQC

### ORDERING INFORMATION

S	F	H	6	1	5	A	-	#	X	0	#	#	T
PART NUMBER								CTR BIN	PACKAGE OPTION				TAPE AND REEL
									DIP-4 7.62 mm	Option 6 10.16 mm	Option 7 > 8 mm	Option 9 8 mm typ.	

AGENCY CERTIFIED/PACKAGE	CTR (%)			
	40 to 80	63 to 125	100 to 200	160 to 320
<b>UL, cUL, BSI, FIMKO</b>				
DIP-4	SFH615A-1	SFH615A-2	SFH615A-3	SFH615A-4
DIP-4, 400 mil, option 6	SFH615A-1X006	SFH615A-2X006	SFH615A-3X006	-
SMD-4, option 7	-	-	SFH615A-3X007T <sup>(1)</sup>	-
SMD-4, option 9	-	SFH615A-2X009T	SFH615A-3X009T <sup>(1)</sup>	SFH615A-4X009
<b>UL, cUL, VDE, BSI, FIMKO</b>				
DIP-4	SFH615A-1X001	SFH615A-2X001	SFH615A-3X001	SFH615A-4X001
DIP-4, 400 mil, option 6	SFH615A-1X016	SFH615A-2X016	SFH615A-3X016	SFH615A-4X016
SMD-4, option 7	SFH615A-1X017T <sup>(1)</sup>	SFH615A-2X017T <sup>(1)</sup>	SFH615A-3X017	SFH615A-4X017T <sup>(1)</sup>
SMD-4, option 9	-	SFH615A-2X019T SFH615A-2X019T3 <sup>(2)</sup>	-	-

### Notes

- Additional options may be possible, please contact sales office.
- <sup>(1)</sup> Also available in tubes; do not add T to end.
- <sup>(2)</sup> T3 rotation in tape and reel packaging.



ABSOLUTE MAXIMUM RATINGS (T <sub>amb</sub> = 25 °C, unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		V <sub>R</sub>	6	V
DC forward current		I <sub>F</sub>	60	mA
Forward surge current	t <sub>p</sub> ≤ 10 μs	I <sub>FSM</sub>	2.5	A
LED power dissipation	at 25 °C	P <sub>diss</sub>	70	mW
<b>OUTPUT</b>				
Collector emitter voltage		V <sub>CEO</sub>	70	V
Emitter collector voltage		V <sub>ECO</sub>	7	V
Collector current		I <sub>C</sub>	50	mA
Collector peak current	t <sub>p</sub> /T = 0.5, t <sub>p</sub> ≤ 10 ms	I <sub>CM</sub>	100	mA
Output power dissipation	at 25 °C	P <sub>diss</sub>	150	mW
<b>COUPLER</b>				
Isolation test voltage between emitter and detector	t = 1 s	V <sub>ISO</sub>	5300	V <sub>RMS</sub>
Creepage distance			≥ 7	mm
Clearance distance			≥ 7	mm
Isolation thickness between emitter and detector			≥ 0.4	mm
Comparative tracking index per DIN IEC 112/VDE 0303, part 1		CTI	≥ 175	
Isolation resistance	V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 25 °C	R <sub>IO</sub>	≥ 10 <sup>12</sup>	Ω
	V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 100 °C	R <sub>IO</sub>	≥ 10 <sup>11</sup>	Ω
Operation temperature		T <sub>amb</sub>	-55 to +100	°C
Storage temperature range		T <sub>stg</sub>	-55 to +150	°C
Soldering temperature <sup>(1)</sup>	2 mm from case, ≤ 10 s	T <sub>slid</sub>	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.

<sup>(1)</sup> Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

ELECTRICAL CHARACTERISTICS (T <sub>amb</sub> = 25 °C, unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>							
Forward voltage	I <sub>F</sub> = 60 mA		V <sub>F</sub>		1.35	1.65	V
Reverse current	V <sub>R</sub> = 6 V		I <sub>R</sub>		0.01	10	μA
Capacitance	V <sub>R</sub> = 0 V, f = 1 MHz		C <sub>O</sub>		13		pF
<b>OUTPUT</b>							
Collector emitter capacitance	V <sub>CE</sub> = 5 V, f = 1 MHz		C <sub>CE</sub>		5.2		pF
Collector emitter leakage current	V <sub>CE</sub> = 10 V	SFH615A-1	I <sub>CEO</sub>		2	50	nA
		SFH615A-2	I <sub>CEO</sub>		2	50	nA
		SFH615A-3	I <sub>CEO</sub>		5	100	nA
		SFH615A-4	I <sub>CEO</sub>		5	100	nA
<b>COUPLER</b>							
Collector emitter saturation voltage	I <sub>F</sub> = 10 mA, f = 1 MHz		V <sub>CEsat</sub>		0.25	0.4	V
Coupling capacitance			C <sub>C</sub>		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.



<b>CURRENT TRANSFER RATIO</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
$I_C/I_F$	$I_F = 10\text{ mA}, V_{CE} = 5\text{ V}$	SFH615A-1	CTR	40		80	%
		SFH615A-2	CTR	63		125	%
		SFH615A-3	CTR	100		200	%
		SFH615A-4	CTR	160		320	%
	$I_F = 1\text{ mA}, V_{CE} = 5\text{ V}$	SFH615A-1	CTR	13	30		%
		SFH615A-2	CTR	22	45		%
		SFH615A-3	CTR	34	70		%
		SFH615A-4	CTR	56	90		%

<b>SWITCHING CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>NON-SATURATED</b>							
Turn-on time	$I_F = 10\text{ mA}, V_{CC} = 5\text{ V}, R_L = 75\text{ }\Omega$		$t_{on}$		3		$\mu\text{s}$
Rise time	$I_F = 10\text{ mA}, V_{CC} = 5\text{ V}, R_L = 75\text{ }\Omega$		$t_r$		2		$\mu\text{s}$
Turn-off time	$I_F = 10\text{ mA}, V_{CC} = 5\text{ V}, R_L = 75\text{ }\Omega$		$t_{off}$		2.3		$\mu\text{s}$
Fall time	$I_F = 10\text{ mA}, V_{CC} = 5\text{ V}, R_L = 75\text{ }\Omega$		$t_f$		2		$\mu\text{s}$
Cut-off frequency	$I_F = 10\text{ mA}, V_{CC} = 5\text{ V}, R_L = 75\text{ }\Omega$		$f_{CO}$		100		kHz
<b>SATURATED</b>							
Turn-on time	$I_F = 20\text{ mA}$	SFH615A-1	$t_{on}$		3		$\mu\text{s}$
	$I_F = 10\text{ mA}$	SFH615A-2	$t_{on}$		4.2		$\mu\text{s}$
		SFH615A-3	$t_{on}$		4.2		$\mu\text{s}$
	$I_F = 5\text{ mA}$	SFH615A-4	$t_{on}$		6		$\mu\text{s}$
Rise time	$I_F = 20\text{ mA}$	SFH615A-1	$t_r$		2		$\mu\text{s}$
	$I_F = 10\text{ mA}$	SFH615A-2	$t_r$		3		$\mu\text{s}$
		SFH615A-3	$t_r$		3		$\mu\text{s}$
	$I_F = 5\text{ mA}$	SFH615A-4	$t_r$		4		$\mu\text{s}$
Turn-off time	$I_F = 20\text{ mA}$	SFH615A-1	$t_{off}$		18		$\mu\text{s}$
	$I_F = 10\text{ mA}$	SFH615A-2	$t_{off}$		23		$\mu\text{s}$
		SFH615A-3	$t_{off}$		23		$\mu\text{s}$
	$I_F = 5\text{ mA}$	SFH615A-4	$t_{off}$		25		$\mu\text{s}$
Fall time	$I_F = 20\text{ mA}$	SFH615A-1	$t_f$		11		$\mu\text{s}$
	$I_F = 10\text{ mA}$	SFH615A-2	$t_f$		14		$\mu\text{s}$
		SFH615A-3	$t_f$		14		$\mu\text{s}$
	$I_F = 5\text{ mA}$	SFH615A-4	$t_f$		15		$\mu\text{s}$



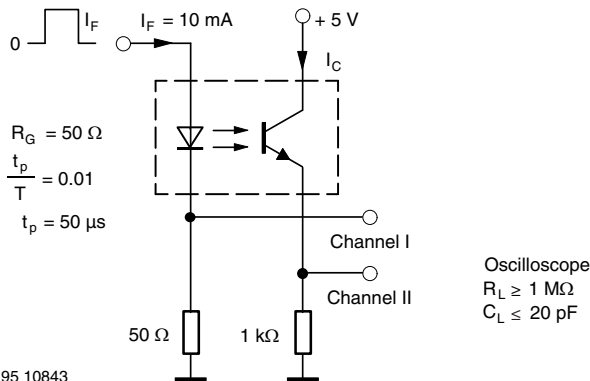
95 10804-3

Fig. 1 - Test Circuit, Non-Saturated Operation



Fig. 3 - Switching Times

96 11698



95 10843

Fig. 2 - Test Circuit, Saturated Operation

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	
Rated impulse voltage		$V_{IOTM}$			8	kV
Maximum working voltages	Recurring peak voltage	$V_{IORM}$			890	V
Forward current		$I_{SI}$			275	mA
Power dissipation		$P_{SO}$			400	mW
Safety temperature		$T_{SI}$			175	°C
Creepage distance			7.0			mm
Clearance distance			7.0			mm
Isolation distance	per IEC 60950 2.10.5.1		0.4			mm

**Note**

- According to DIN EN 60747-5-5 (VDE 0884-5). These optocouplers are 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** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)



Fig. 4 - Forward Voltage vs. Forward Current



Fig. 7 - Leakage Current vs. Ambient Temperature

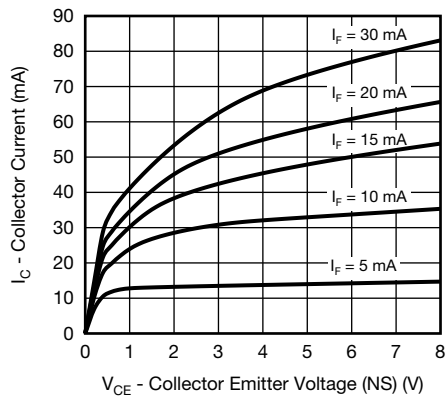


Fig. 5 - Collector Current vs. Collector Emitter Voltage (NS)



Fig. 8 - Normalized CTR (NS) vs. Ambient Temperature



Fig. 6 - Collector Current vs. Collector Emitter Voltage (sat)



Fig. 9 - Normalized CTR (sat) vs. Ambient Temperature



Fig. 10 - Normalized CTR (NS) vs. Forward Current



Fig. 13 - CTR Frequency vs. Collector Current



Fig. 11 - Normalized CTR (sat) vs. Forward Current



Fig. 14 - Switching Time vs. Load Resistance



Fig. 12 - CTR Frequency vs. Phase Angle



PACKAGE DIMENSIONS in millimeters



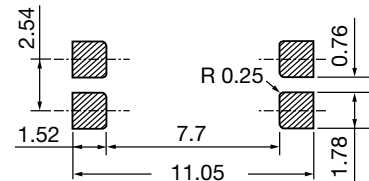
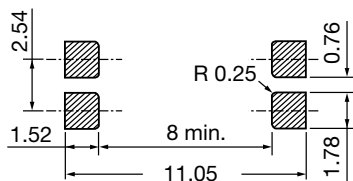
Option 6

Option 7

Option 9



20802-28



PACKAGE MARKING (Example)



Notes

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

**PACKING INFORMATION**

DEVICE PER TUBE			
TYPE	UNITS/TUBE	TUBES/BOX	UNITS/BOX
DIP-4	100	40	4000



Fig. 15 - Tape and Reel Shipping Medium

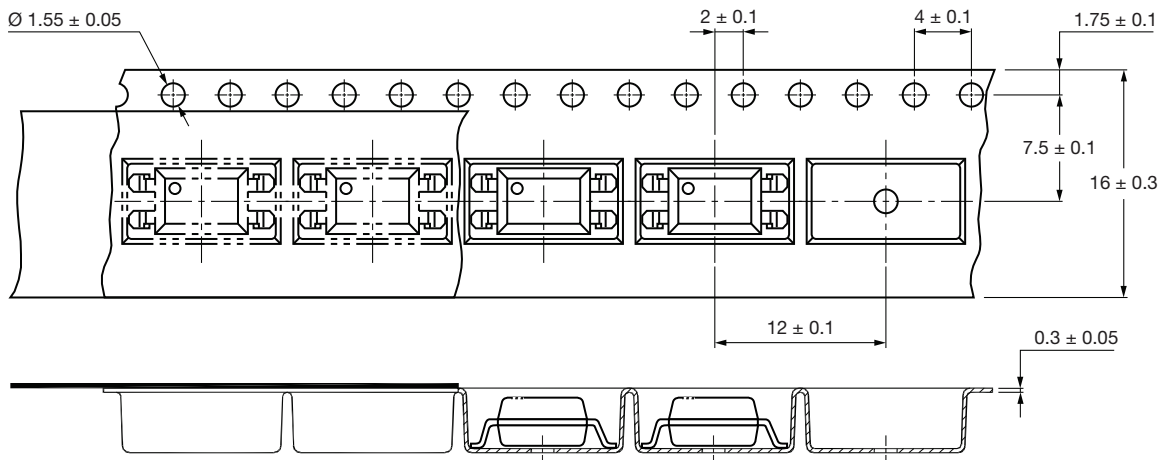


Fig. 16 - Tape and Packing for Option 7 and Option 9



Fig. 17 - Tape Packing for Option 7 and Option 9, T3 Rotation (2000 units per reel)





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