

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



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_{RMS} 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				
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px;">S</div> <div style="border: 1px solid black; padding: 2px;">F</div> <div style="border: 1px solid black; padding: 2px;">H</div> <div style="border: 1px solid black; padding: 2px;">6</div> <div style="border: 1px solid black; padding: 2px;">1</div> <div style="border: 1px solid black; padding: 2px;">5</div> <div style="border: 1px solid black; padding: 2px;">A</div> <div style="border: 1px solid black; padding: 2px;">-</div> <div style="border: 1px solid black; padding: 2px;">#</div> <div style="border: 1px solid black; padding: 2px;">X</div> <div style="border: 1px solid black; padding: 2px;">0</div> <div style="border: 1px solid black; padding: 2px;">#</div> <div style="border: 1px solid black; padding: 2px;">#</div> <div style="border: 1px solid black; padding: 2px;">T</div> </div> <p style="text-align: center;">PART NUMBER</p>	<div style="border: 1px solid black; padding: 2px;">#</div> <p style="text-align: center;">CTR BIN</p>	<div style="border: 1px solid black; padding: 2px;">X</div> <div style="border: 1px solid black; padding: 2px;">0</div> <div style="border: 1px solid black; padding: 2px;">#</div> <div style="border: 1px solid black; padding: 2px;">#</div> <p style="text-align: center;">PACKAGE OPTION</p>	<div style="border: 1px solid black; padding: 2px;">T</div> <p style="text-align: center;">TAPE AND REEL</p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>DIP-4</p> <p>7.62 mm</p> </div> <div style="text-align: center;"> <p>Option 6</p> <p>10.16 mm</p> </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;"> <p>Option 7</p> <p>> 8 mm</p> </div> <div style="text-align: center;"> <p>Option 9</p> <p>8 mm typ.</p> </div> </div>
AGENCY CERTIFIED/PACKAGE	CTR (%)			
UL, cUL, BSI, FIMKO	40 to 80	63 to 125	100 to 200	160 to 320
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 ⁽¹⁾	-
SMD-4, option 9	-	SFH615A-2X009T	SFH615A-3X009T ⁽¹⁾	SFH615A-4X009
UL, cUL, VDE, BSI, FIMKO	40 to 80	63 to 125	100 to 200	160 to 320
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 ⁽¹⁾	SFH615A-2X017T ⁽¹⁾	SFH615A-3X017	SFH615A-4X017T ⁽¹⁾
SMD-4, option 9	-	SFH615A-2X019T	-	-
		SFH615A-2X019T3 ⁽²⁾		

Notes

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



ABSOLUTE MAXIMUM RATINGS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
INPUT				
Reverse voltage		V_R	6	V
DC forward current		I_F	60	mA
Forward surge current	$t_p \leq 10\text{ }\mu\text{s}$	I_{FSM}	2.5	A
LED power dissipation	at $25\text{ }^{\circ}\text{C}$	P_{diss}	70	mW
OUTPUT				
Collector emitter voltage		V_{CEO}	70	V
Emitter collector voltage		V_{ECO}	7	V
Collector current		I_C	50	mA
Collector peak current	$t_p/T = 0.5, t_p \leq 10\text{ ms}$	I_{CM}	100	mA
Output power dissipation	at $25\text{ }^{\circ}\text{C}$	P_{diss}	150	mW
COUPLER				
Operation temperature		T_{amb}	-55 to +100	$^{\circ}\text{C}$
Storage temperature range		T_{stg}	-55 to +150	$^{\circ}\text{C}$
Soldering temperature ⁽¹⁾	2 mm from case, $\leq 10\text{ s}$	T_{sld}	260	$^{\circ}\text{C}$

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).

ELECTRICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
INPUT							
Forward voltage	$I_F = 60\text{ mA}$		V_F		1.35	1.65	V
Reverse current	$V_R = 6\text{ V}$		I_R		0.01	10	μA
Capacitance	$V_R = 0\text{ V}, f = 1\text{ MHz}$		C_O		13		pF
OUTPUT							
Collector emitter capacitance	$V_{CE} = 5\text{ V}, f = 1\text{ MHz}$		C_{CE}		5.2		pF
Collector emitter leakage current	$V_{CE} = 10\text{ V}$	SFH615A-1	I_{CEO}		2	50	nA
		SFH615A-2	I_{CEO}		2	50	nA
		SFH615A-3	I_{CEO}		5	100	nA
		SFH615A-4	I_{CEO}		5	100	nA
COUPLER							
Collector emitter saturation voltage	$I_F = 10\text{ mA}, f = 1\text{ MHz}$		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 ($T_{amb} = 25\text{ }^{\circ}\text{C}$, 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		%

SWITCHING CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
NON-SATURATED							
Turn-on time	$I_F = 10\text{ mA}, V_{CC} = 5\text{ V}, R_L = 75\text{ }\Omega$		t_{on}		3		μs
Rise time	$I_F = 10\text{ mA}, V_{CC} = 5\text{ V}, R_L = 75\text{ }\Omega$		t_r		2		μs
Turn-off time	$I_F = 10\text{ mA}, V_{CC} = 5\text{ V}, R_L = 75\text{ }\Omega$		t_{off}		2.3		μs
Fall time	$I_F = 10\text{ mA}, V_{CC} = 5\text{ V}, R_L = 75\text{ }\Omega$		t_f		2		μs
Cut-off frequency	$I_F = 10\text{ mA}, V_{CC} = 5\text{ V}, R_L = 75\text{ }\Omega$		f_{CO}		208		kHz
SATURATED							
Turn-on time	$I_F = 20\text{ mA}$	SFH615A-1	t_{on}		3		μs
	$I_F = 10\text{ mA}$	SFH615A-2	t_{on}		4.2		μs
		SFH615A-3	t_{on}		4.2		μs
	$I_F = 5\text{ mA}$	SFH615A-4	t_{on}		6		μs
Rise time	$I_F = 20\text{ mA}$	SFH615A-1	t_r		2		μs
	$I_F = 10\text{ mA}$	SFH615A-2	t_r		3		μs
		SFH615A-3	t_r		3		μs
	$I_F = 5\text{ mA}$	SFH615A-4	t_r		4		μs
Turn-off time	$I_F = 20\text{ mA}$	SFH615A-1	t_{off}		18		μs
	$I_F = 10\text{ mA}$	SFH615A-2	t_{off}		23		μs
		SFH615A-3	t_{off}		23		μs
	$I_F = 5\text{ mA}$	SFH615A-4	t_{off}		25		μs
Fall time	$I_F = 20\text{ mA}$	SFH615A-1	t_f		11		μs
	$I_F = 10\text{ mA}$	SFH615A-2	t_f		14		μs
		SFH615A-3	t_f		14		μs
	$I_F = 5\text{ mA}$	SFH615A-4	t_f		15		μs



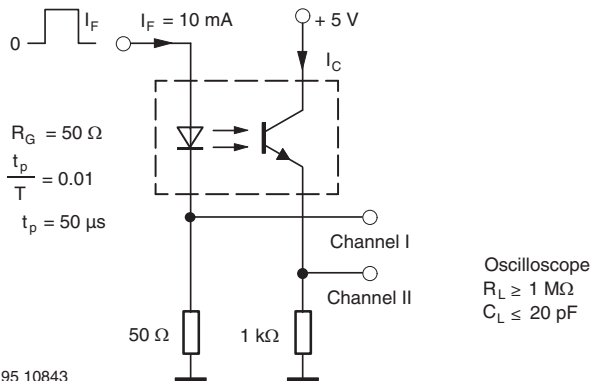
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Fig. 1 - Test Circuit, Non-Saturated Operation



t_p Pulse duration
 t_d Delay time
 t_r Rise time
 $t_{on} (= t_d + t_r)$ Turn-on time
 t_s Storage time
 t_f Fall time
 $t_{off} (= t_s + t_f)$ Turn-off time
 Storage time
 Fall time
 Turn-off time
 96 11698

Fig. 3 - Switching Times



95 10843

Fig. 2 - Test Circuit, Saturated Operation

SAFETY AND INSULATION RATINGS

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Climatic classification	According to IEC 68 part 1		55/115/21	
Pollution degree	According to DIN VDE 0109		2	
Comparative tracking index	Insulation group IIIa	CTI	175	
Maximum rated withstanding isolation voltage	According to UL1577, $t = 1$ min	V_{ISO}	4470	V_{RMS}
Tested withstanding isolation voltage	According to UL1577, $t = 1$ s	V_{ISO}	5300	V_{RMS}
Maximum transient isolation voltage	According to DIN EN 60747-5-5	V_{IOTM}	8000	V_{peak}
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	V_{IORM}	890	V_{peak}
Isolation resistance	$T_{amb} = 25\text{ }^{\circ}\text{C}$, $V_{IO} = 500\text{ V}$	R_{IO}	$\geq 10^{12}$	Ω
	$T_{amb} = 100\text{ }^{\circ}\text{C}$, $V_{IO} = 500\text{ V}$	R_{IO}	$\geq 10^{11}$	Ω
Output safety power		P_{SO}	700	mW
Input safety current		I_{SI}	400	mA
Input safety temperature		T_S	175	$^{\circ}\text{C}$
Creepage distance	DIP-4		≥ 7	mm
Clearance distance	DIP-4		≥ 7	mm
Creepage distance	DIP-4, 400 mil, option 6		≥ 8	mm
Clearance distance	DIP-4, 400 mil, option 6		≥ 8	mm
Creepage distance	SMD-4, option 7 and option 9		≥ 7	mm
Clearance distance	SMD-4, option 7 and option 9		≥ 7	mm
Insulation thickness		DTI	≥ 0.4	mm

Note

- As per DIN EN 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 ($T_{amb} = 25\text{ }^{\circ}\text{C}$, 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 (non-saturated)

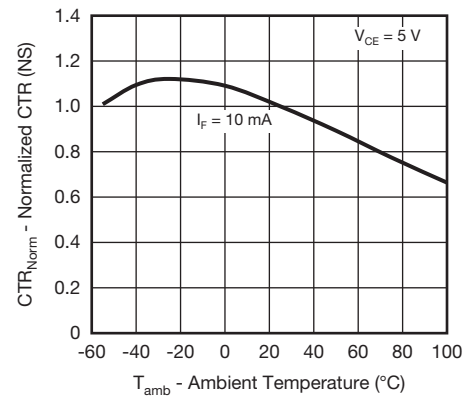


Fig. 8 - Normalized CTR (non-saturated) vs. Ambient Temperature



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

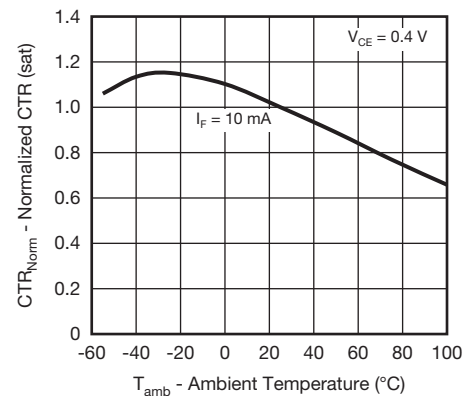


Fig. 9 - Normalized CTR (saturated) vs. Ambient Temperature



Fig. 10 - Normalized CTR (non-saturated) vs. Forward Current



Fig. 13 - Cut-Off Frequency vs. Collector Current



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



Fig. 14 - Switching Time vs. Load Resistance



Fig. 12 - Phase Angle vs. Frequency



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)

SOLDER PROFILES



Fig. 18 - Wave Soldering Double Wave Profile According to J-STD-020 for DIP-8 Devices

HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

Conditions: $T_{amb} < 30\text{ °C}$, RH < 85 %

Moisture sensitivity level 1, according to J-STD-020



Fig. 19 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD-8 Devices



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