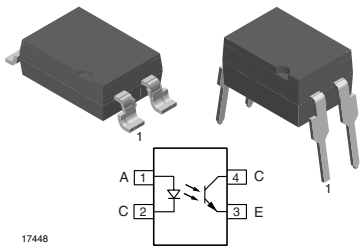
Optocoupler, Phototransistor Output, High Reliability, 5300 V_{RMS}



DESCRIPTION

The SFH615A (DIP) and SFH6156 (SMD) 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 or SMD 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.

FEATURES

- Excellent CTR linearity depending on forward current
- Isolation test voltage, 5300 V_{RMS}
- Fast switching times
- Low CTR degradation
- Low coupling capacitance
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC

Pb-free

e3

RoHS COMPLIANT

APPLICATIONS

- Switchmode power supply
- Telecom
- Battery powered equipment

AGENCY APPROVALS

- UL1577, file no. E52744 system code H or J, double protection
- DIN EN 60747-5-5 (VDE 0884) available with option 1

ORDER INFORMATION

PART	REMARKS
SFH615A-1	CTR 40 % to 80 %, DIP-4
SFH615A-2	CTR 63 % to 125 %, DIP-4
SFH615A-3	CTR 100 % to 200 %, DIP-4
SFH615A-4	CTR 160 % to 320 %, DIP-4
SFH6156-1	CTR 40 % to 80 %, SMD-4
SFH6156-2	CTR 63 % to 125 %, SMD-4
SFH6156-3	CTR 100 % to 200 %, SMD-4
SFH6156-4	CTR 160 % to 320 %, SMD-4
SFH615A-1X006	CTR 40 % to 80 %, DIP-4 400 mil (option 6)
SFH615A-1X007	CTR 40 % to 80 %, SMD-4 (option 7)
SFH615A-2X006	CTR 63 % to 125 %, DIP-4 400 mil (option 6)
SFH615A-2X007	CTR 63 % to 125 %, SMD-4 (option 7)
SFH615A-2X009	CTR 63 % to 125 %, SMD-4 (option 9)
SFH615A-3X006	CTR 100 % to 200 %, DIP-4 400 mil (option 6)
SFH615A-3X007	CTR 100 % to 200 %, SMD-4 (option 7)
SFH615A-3X008	CTR 100 % to 200 %, SMD-4 (option 8)
SFH615A-3X009	CTR 100 % to 200 %, SMD-4 (option 9)
SFH615A-4X006	CTR 160 % to 320 %, DIP-4 400 mil (option 6)
SFH615A-4X007	CTR 160 % to 320 %, SMD-4 (option 7)
SFH615A-4X008	CTR 160 % to 320 %, SMD-4 (option 8)
SFH615A-4X009	CTR 160 % to 320 %, SMD-4 (option 9)

Note

For additional information on the available options refer to option information. See tape and reel section for 4 pin optocouplers T0 with 90° rotation.

ABSOLUTE MAXIMUM RATINGS (1)				
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_{CE}	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				
Isolation test voltage between emitter and detector	t = 1 s	V_{ISO}	5300	V_{RMS}
Creepage distance			≥ 7	mm
Clearance distance			≥ 7	mm
Insulation thickness between emitter and detector			≥ 0.4	mm
Comparative tracking index per DIN IEC112/VDE 0303 part 1		CTI	≥ 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
Storage temperature range		T_{stg}	- 55 to + 150	°C
Ambient temperature range		T_{amb}	- 55 to +100	°C
Soldering temperature (2)	max. 10 s, dip soldering distance to seating plane ≥ 1.5 mm	T_{sld}	260	°C

Notes

(1) 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.

(2) Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

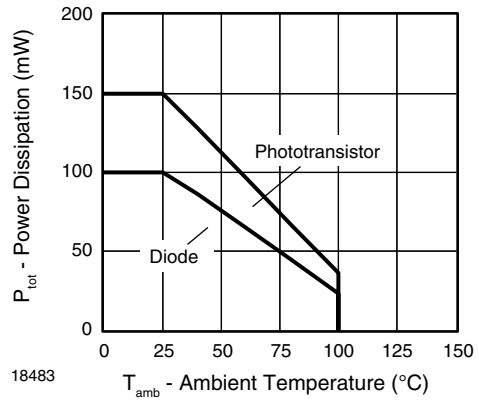
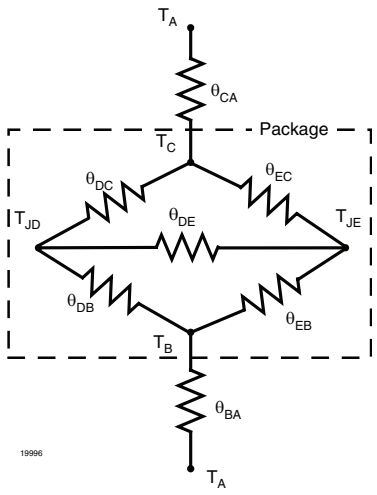


Fig. 1 - Permissible Power Dissipation vs. Ambient Temperature

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 (2)	θ_{BA}	195	°C/W
Thermal resistance, case to ambient (2)	θ_{CA}	3573	°C/W



Notes

(1) 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.

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

ELECTRICAL CHARACTERISTICS

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	SFH615A-1	I_{CEO}		2	50	nA
		SFH6156-1	I_{CEO}		2	50	nA
		SFH615A-2	I_{CEO}		2	50	nA
		SFH6156-2	I_{CEO}		2	50	nA
		SFH615A-3	I_{CEO}		5	100	nA
		SFH6156-3	I_{CEO}		5	100	nA
		SFH615A-4	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

T_{amb} = 25 °C, 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.

CURRENT TRANSFER RATIO							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
I_C/I_F	I_F = 10 mA, V_{CE} = 5 V	SFH615A-1	CTR	40		80	%
		SFH6156-1	CTR	40		80	%
		SFH615A-2	CTR	63		125	%
		SFH6156-2	CTR	63		125	%
		SFH615A-3	CTR	100		200	%
		SFH6156-3	CTR	100		200	%
		SFH615A-4	CTR	160		320	%
		SFH6156-4	CTR	160		320	%
	I_F = 1 mA, V_{CE} = 5 V	SFH615A-1	CTR	13	30		%
		SFH6156-1	CTR	13	30		%
		SFH615A-2	CTR	22	45		%
		SFH6156-2	CTR	22	45		%
		SFH615A-3	CTR	34	70		%
		SFH6156-3	CTR	34	70		%
		SFH615A-4	CTR	56	90		%
		SFH6156-4	CTR	56	90		%

SWITCHING CHARACTERISTICS							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
NON-SATURATED							
Rise time	I_F = 10 mA, V_{CC} = 5 V, T_A = 25 °C, R_L = 75 Ω		t_r		2		µs
Fall time	I_F = 10 mA, V_{CC} = 5 V, T_A = 25 °C, R_L = 75 Ω		t_f		2		µs
Turn-on time	I_F = 10 mA, V_{CC} = 5 V, T_A = 25 °C, R_L = 75 Ω		t_{on}		3		µs
Turn-off time	I_F = 10 mA, V_{CC} = 5 V, T_A = 25 °C, R_L = 75 Ω		t_{off}		2.3		µs
Cut-off frequency	I_F = 10 mA, V_{CC} = 5 V, T_A = 25 °C, R_L = 75 Ω		f_{ctr}		250		kHz
SATURATED							
Rise time	V_{CC} = 5 V, T_A = 25 °C, R_L = 1 kΩ, I_F = 20 mA	SFH615A-1	t_r		2		µs
		SFH6156-1					
	V_{CC} = 5 V, T_A = 25 °C, R_L = 1 kΩ, I_F = 10 mA	SFH615A-2	t_r		3		µs
		SFH6156-2					
		SFH615A-3	t_r		3		µs
		SFH6156-3					
	V_{CC} = 5 V, T_A = 25 °C, R_L = 1 kΩ, I_F = 5 mA	SFH615A-4	t_r		4		µs
		SFH6156-4					
Fall time	V_{CC} = 5 V, T_A = 25 °C, R_L = 1 kΩ, I_F = 20 mA	SFH615A-1	t_f		11		µs
		SFH6156-1					
	V_{CC} = 5 V, T_A = 25 °C, R_L = 1 kΩ, I_F = 10 mA	SFH615A-2	t_f		14		µs
		SFH6156-2					
		SFH615A-3	t_f		14		µs
		SFH6156-3					
	V_{CC} = 5 V, T_A = 25 °C, R_L = 1 kΩ, I_F = 5 mA	SFH615A-4	t_f		15		µs
		SFH6156-4					

SWITCHING CHARACTERISTICS

PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
SATURATED							
Turn-on time	V_{CC} = 5 V, T_A = 25 °C, R_L = 1 kΩ, I_F = 20 mA	SFH615A-1 SFH6156-1	t_{on}		3		µs
	V_{CC} = 5 V, T_A = 25 °C, R_L = 1 kΩ, I_F = 10 mA	SFH615A-2 SFH6156-2	t_{on}		4.2		µs
		SFH615A-3 SFH6156-3	t_{on}		4.2		µs
	V_{CC} = 5 V, T_A = 25 °C, R_L = 1 kΩ, I_F = 5 mA	SFH615A-4 SFH6156-4	t_{on}		6		µs
Turn-off time	V_{CC} = 5 V, T_A = 25 °C, R_L = 1 kΩ, I_F = 20 mA	SFH615A-1 SFH6156-1	t_{off}		18		µs
	V_{CC} = 5 V, T_A = 25 °C, R_L = 1 kΩ, I_F = 10 mA	SFH615A-2 SFH6156-2	t_{off}		23		µs
		SFH615A-3 SFH6156-3	t_{off}		23		µs
	V_{CC} = 5 V, T_A = 25 °C, R_L = 1 kΩ, I_F = 5 mA	SFH615A-4 SFH6156-4	t_{off}		25		µs

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	
V_{IOTM}			10 000			V
V_{IORM}			890			V
P_{SO}					400	mW
I_{SI}					275	mA
T_{SI}					175	°C
Creepage distance	standard DIP-4		7			mm
Clearance distance	standard DIP-4		7			mm
Creepage distance	400 mil DIP-4		8			mm
Clearance distance	400 mil DIP-4		8			mm
Insulation thickness, reinforced rated	per IEC 60950 2.10.5.1		0.4			mm

Note

As per IEC 60747-5-2, § 7.4.3.8.1, 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

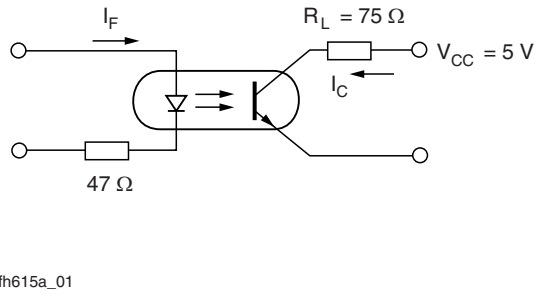


Fig. 2 - Linear Operation (without Saturation)

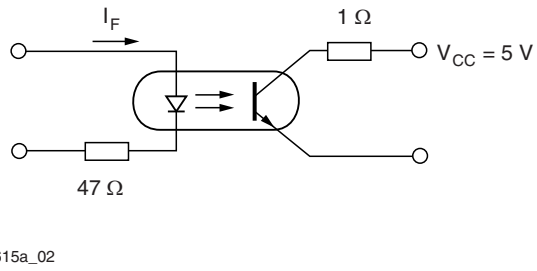


Fig. 3 - Switching Operation (with Saturation)

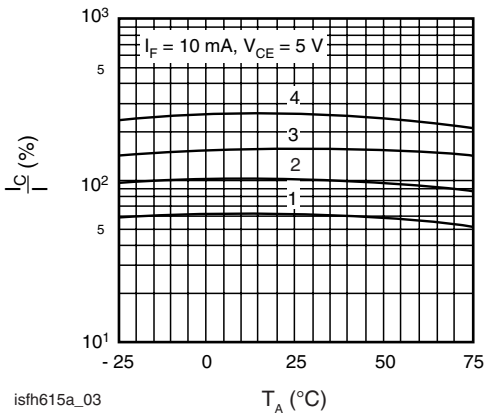


Fig. 4 - Current Transfer Ratio (Typ.) vs. Temperature

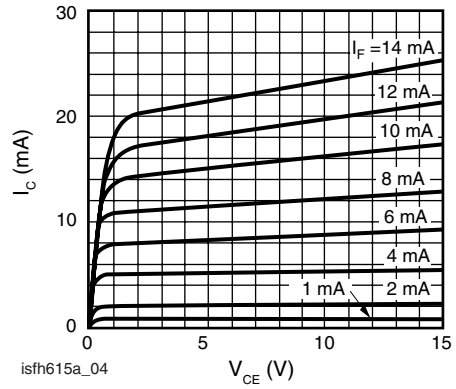


Fig. 5 - Output Characteristics (Typ.) Collector Current vs. Collector Emitter Voltage

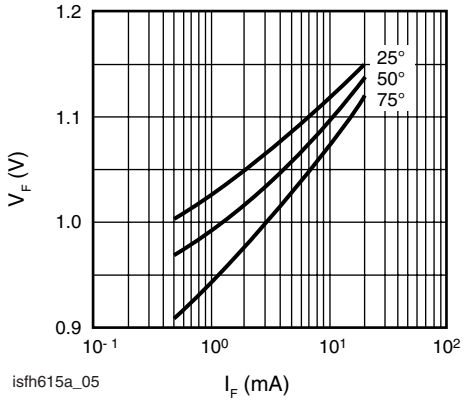


Fig. 6 - Diode Forward Voltage (Typ.) vs. Forward Current

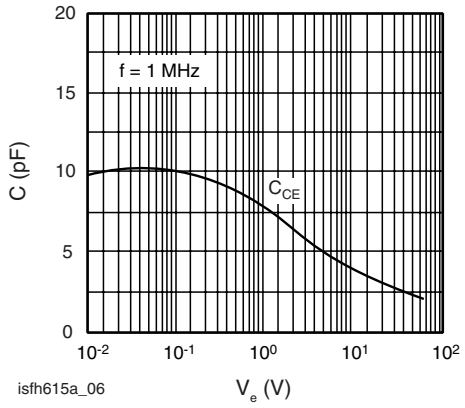


Fig. 7 - Transistor Capacitance (Typ.) vs. Collector Emitter Voltage

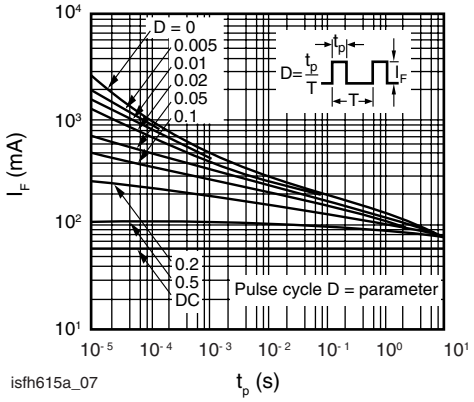
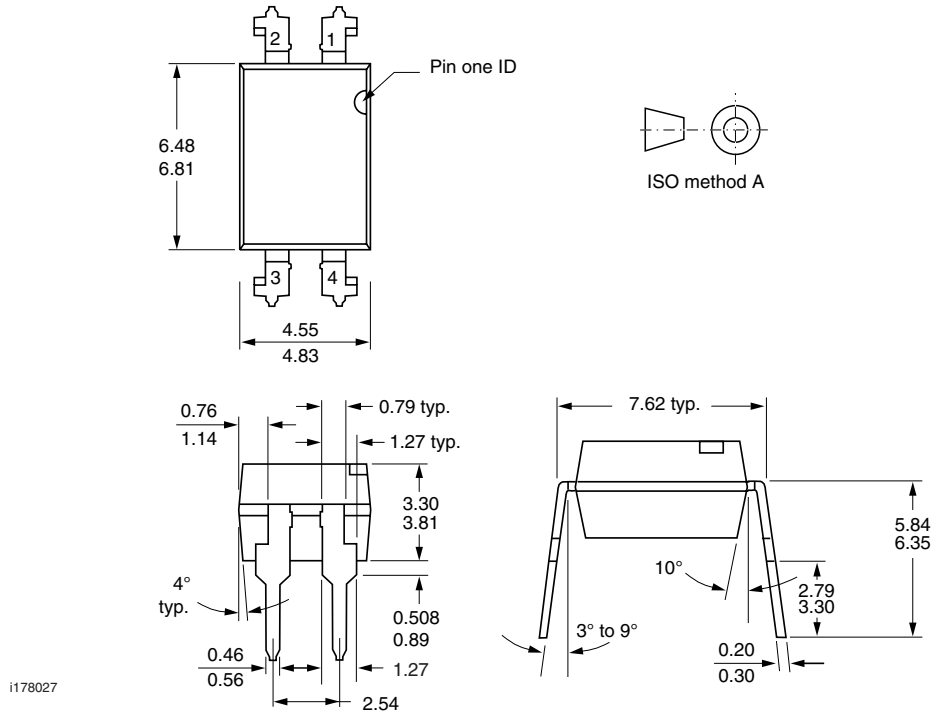
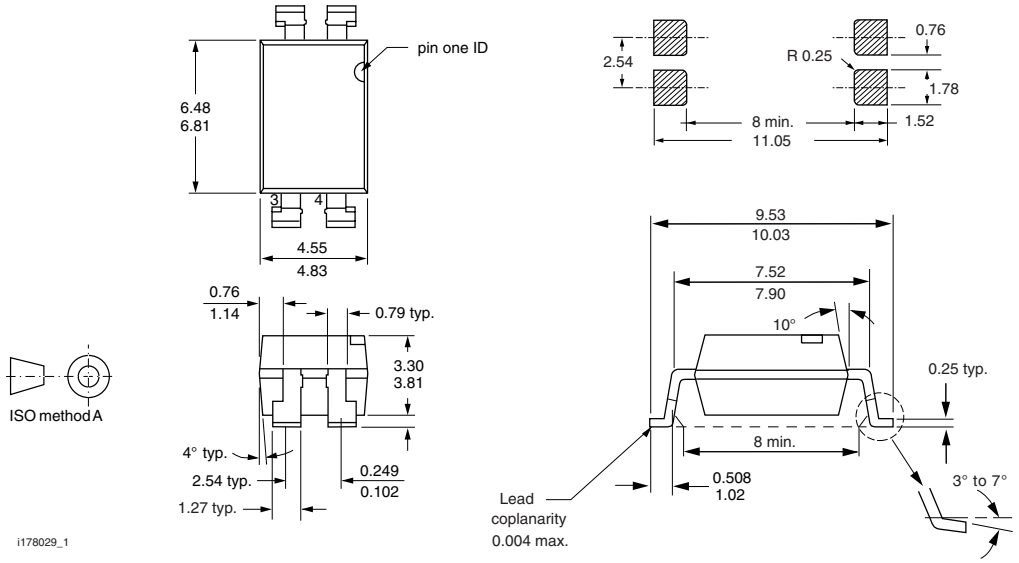


Fig. 8 - Permissible Pulse Handling Capability Forward Current vs. Pulse Width

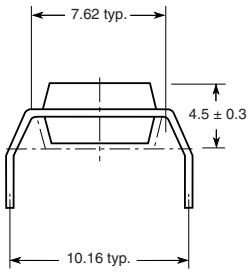
PACKAGE DIMENSIONS millimeters



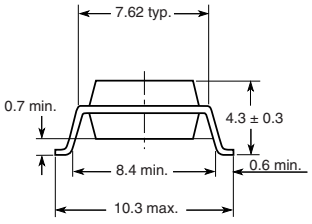
SMD, option 7 (only available on SFH615A products)



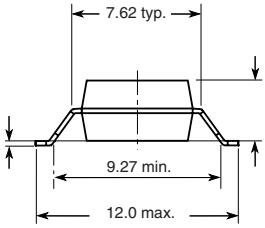
Option 6



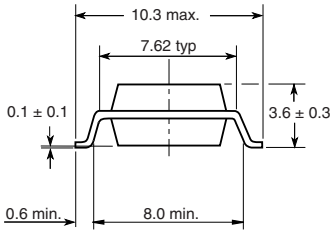
Option 7



Option 8



Option 9 or SFH6156



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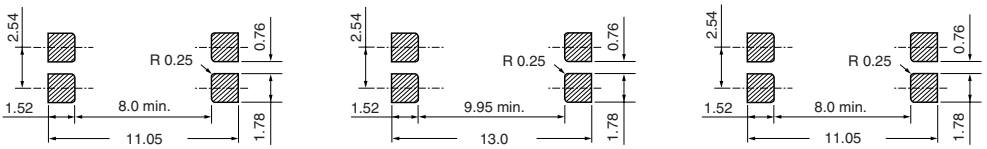
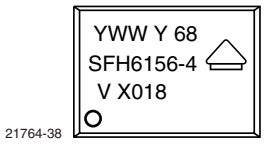


PACKAGE MARKING



This is an example of the marking used on the SFH6156-4X018T

Disclaimer

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