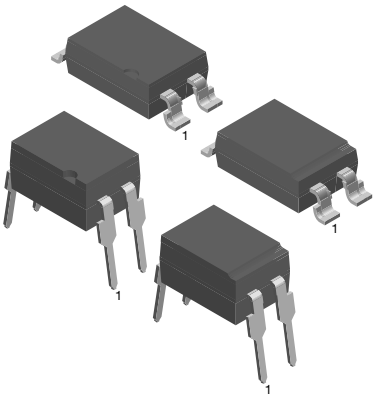
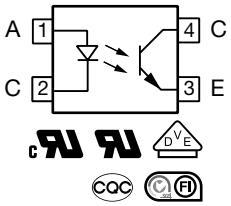
Optocoupler, Phototransistor Output, Low Input Current





FEATURES

- Good CTR linearity depending on forward current
- Low CTR degradation
- High collector emitter voltage, V_{CEO} = 55 V
- Isolation test voltage, 5300 V_{RMS}
- Low coupling capacitance
- End stackable, 0.100" (2.54 mm) spacing
- High common mode transient immunity
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

APPLICATIONS

- Telecom
- Industrial controls
- Battery powered equipment
- Office machines

LINKS TO ADDITIONAL RESOURCES

3D Models | Design Tools | SPICE Models | Footprints | Schematics

DESCRIPTION

The SFH618A (DIP) and SFH6186 (SMD) feature a high current transfer ratio, low coupling capacitance and high isolation voltage. These couplers have a GaAs infrared diode emitter, which is optically coupled to 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 achieved with option 6.

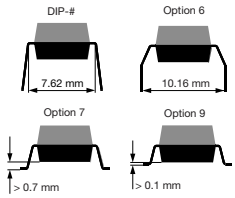
AGENCY APPROVALS

The safety application model number covering all products in this datasheet is SFH618A. This model number should be used when consulting safety agency documents.

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

ORDERING INFORMATION

S	F	H	6	1	8	#	-	#	X	0	#	#	T
PART NUMBER								CTR BIN	PACKAGE OPTION				TAPE AND REEL



AGENCY CERTIFIED / PACKAGE	CTR (%) 1 mA			
UL, cUL, BSI, FIMKO	**63 to 125**	**100 to 200**	**160 to 320**	**250 to 500**
DIP-4	SFH618A-2	SFH618A-3	SFH618A-4	SFH618A-5
DIP-4, 400 mil, option 6	-	SFH618A-3X006	-	-
SMD-4, option 7	-	-	-	SFH618A-5X007T (1)
SMD-4, option 9	SFH6186-2T (1)	SFH6186-3T (1), SFH6186-3T1	SFH6186-4T (1)	SFH6186-5T (1), SFH6186-5T1
UL, cUL, BSI, FIMKO, VDE (option 1)	**63 to 125**	**100 to 200**	**160 to 320**	**250 to 500**
DIP-4	-	SFH618A-3X001	SFH618A-4X001	-
DIP-4, 400 mil, option 6	-	SFH618A-3X016	SFH618A-4X016	SFH618A-5X016
SMD-4, option 7	-	SFH618A-3X017T (1)	-	SFH618A-5X017T (1)
SMD-4, option 9	-	SFH6186-3X001T (1), SFH6186-3X001T1	SFH6186-4X001T	SFH6186-5X001T (1)

Notes

- Additional options may be possible, please contact sales office

(1) Also available in tubes, do not put T to the end

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ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
Reverse voltage		V_R	6	V
Power dissipation		P_{diss}	70	mW
Forward current		I_F	60	mA
OUTPUT				
Collector emitter voltage		V_{CEO}	55	V
Emitter collector voltage		V_{ECO}	7	V
Collector current		I_C	50	mA
	$t_p \leq 1$ ms	I_C	100	mA
Power dissipation		P_{diss}	150	mW
COUPLER				
Storage temperature range		T_{stg}	-55 to +150	°C
Ambient temperature range		T_{amb}	-55 to +100	°C
Junction temperature		T_j	125	°C
Soldering temperature	max. 10 s, dip soldering distance to seating plane ≥ 1.5 mm	T_{sld}	260	°C

Note

- 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.

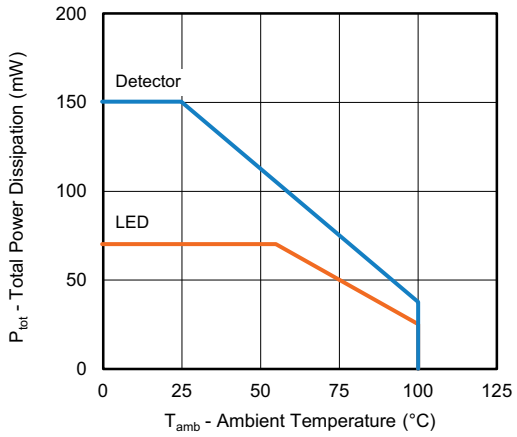

Fig. 1 - Permissible Power Dissipation vs. Ambient Temperature

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ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT							
Forward voltage	I_F = 5 mA		V_F	-	1.1	1.5	V
Reverse current	V_R = 6 V		I_R	-	0.01	10	µA
Capacitance	V_R = 0 V, f = 1 MHz		C_O	-	25	-	pF
Thermal resistance			R_{thja}	-	1070	-	K/W
OUTPUT							
Collector emitter leakage current	V_{CE} = 10 V		I_{CEO}	-	10	200	nA
Collector emitter capacitance	V_{CE} = 5 V, f = 1 MHz		C_{CE}	-	7	-	pF
Thermal resistance			R_{thja}	-	500	-	K/W
COUPLER							
Collector emitter saturation voltage	I_C = 0.32 mA, I_F = 1 mA	SFH618A-2	V_{CEsat}	-	0.25	0.4	V
		SFH6186-2	V_{CEsat}	-	0.25	0.4	V
	I_C = 0.5 mA, I_F = 1 mA	SFH618A-3	V_{CEsat}	-	0.25	0.4	V
		SFH6186-3	V_{CEsat}	-	0.25	0.4	V
	I_C = 0.8 mA, I_F = 1 mA	SFH618A-4	V_{CEsat}	-	0.25	0.4	V
		SFH6186-4	V_{CEsat}	-	0.25	0.4	V
	I_C = 1.25 mA, I_F = 1 mA	SFH618A-5	V_{CEsat}	-	0.25	0.4	V
		SFH6186-5	V_{CEsat}	-	0.25	0.4	V
Coupling capacitance			C_C	-	0.25	-	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**
I_C/I_F	I_F = 1 mA, V_{CE} = 0.5 V	SFH618A-2	CTR	63	-	125	%
		SFH6186-2	CTR	63	-	125	%
	I_F = 0.5 mA, V_{CE} = 1.5 V	SFH618A-2	CTR	32	75	-	%
		SFH6186-2	CTR	32	75	-	%
	I_F = 1 mA, V_{CE} = 0.5 V	SFH618A-3	CTR	100	-	200	%
		SFH6186-3	CTR	100	-	200	%
	I_F = 0.5 mA, V_{CE} = 1.5 V	SFH618A-3	CTR	50	120	-	%
		SFH6186-3	CTR	50	120	-	%
	I_F = 1 mA, V_{CE} = 0.5 V	SFH618A-4	CTR	160	-	320	%
		SFH6186-4	CTR	160	-	320	%
	I_F = 0.5 mA, V_{CE} = 1.5 V	SFH618A-4	CTR	80	200	-	%
		SFH6186-4	CTR	80	200	-	%
	I_F = 1 mA, V_{CE} = 0.5 V	SFH618A-5	CTR	250	-	500	%
		SFH6186-5	CTR	250	-	500	%
	I_F = 0.5 mA, V_{CE} = 1.5 V	SFH618A-5	CTR	125	300	-	%
		SFH6186-5	CTR	125	300	-	%

SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Turn on time	V_{CC} = 5 V, I_C = 2 mA, R_L = 100 Ω	t_{on}	-	6	-	µs
Rise time	V_{CC} = 5 V, I_C = 2 mA, R_L = 100 Ω	t_r	-	3.5	-	µs
Turn off time	V_{CC} = 5 V, I_C = 2 mA, R_L = 100 Ω	t_{off}	-	5.5	-	µs
Fall time	V_{CC} = 5 V, I_C = 2 mA, R_L = 100 Ω	t_f	-	5	-	µs

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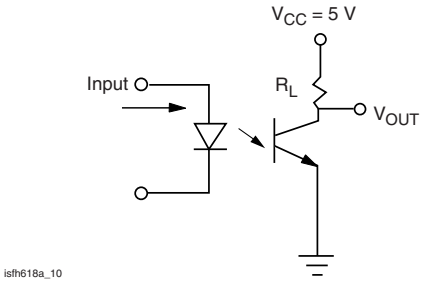

Fig. 2 - Test Circuit

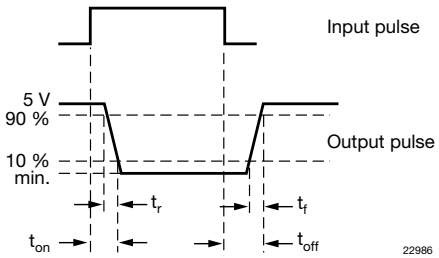

Fig. 3 - Parameter and Limit Definition

SAFETY AND INSULATION RATINGS				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Climatic classification	According to IEC 68 part 1		55 / 100 / 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}	4420	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}	10 000	V_{peak}
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	V_{IORM}	890	V_{peak}
Isolation resistance	T_{amb} = 25 °C, V_{IO} = 500 V	R_{IO}	≥ 10^{12}	Ω
	T_{amb} = 100 °C, V_{IO} = 500 V	R_{IO}	≥ 10^{11}	Ω
Output safety power		P_{SO}	400	mW
Input safety current		I_{SI}	400	mA
Input safety temperature		T_{SI}	275	°C
Creepage distance	DIP-4		≥ 7	mm
Clearance distance			≥ 7	mm
Creepage distance	DIP-4, 400 mil, option 6		≥ 8	mm
Clearance distance			≥ 8	mm
Creepage distance	SMD-4, option 7 and option 9		≥ 7	mm
Clearance distance			≥ 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 °C, unless otherwise specified)

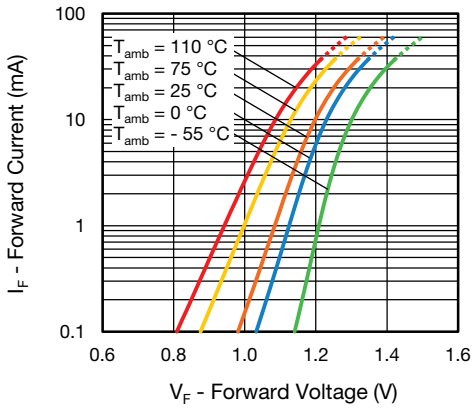

Fig. 4 - Forward Voltage vs. Forward Current

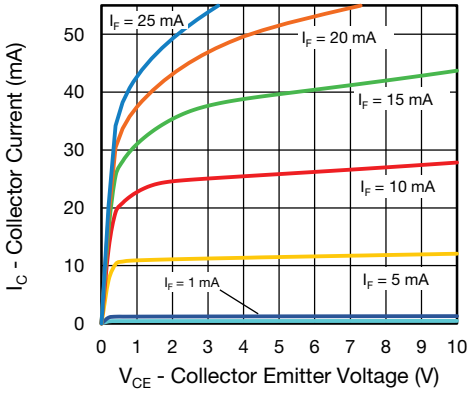

Fig. 5 - Collector Current vs. Collector Emitter Voltage

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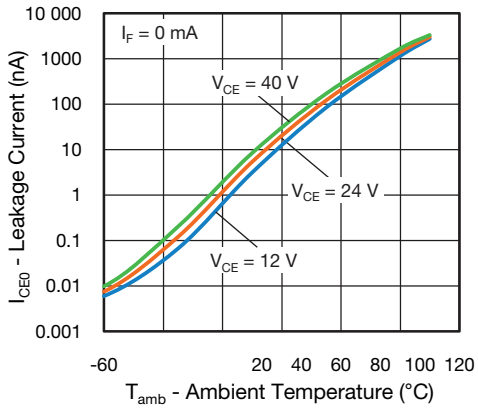

Fig. 6 - Collector Emitter Current vs. Ambient Temperature

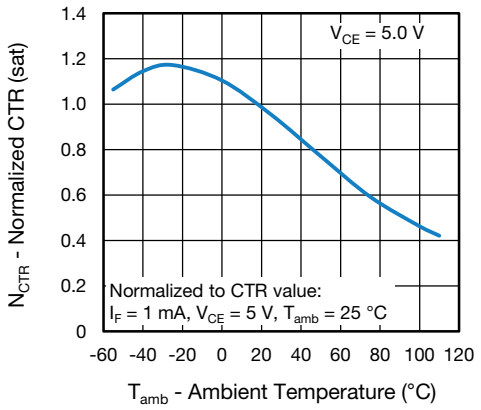

Fig. 9 - Normalized Current Transfer Ratio vs. Ambient Temperature (sat.)

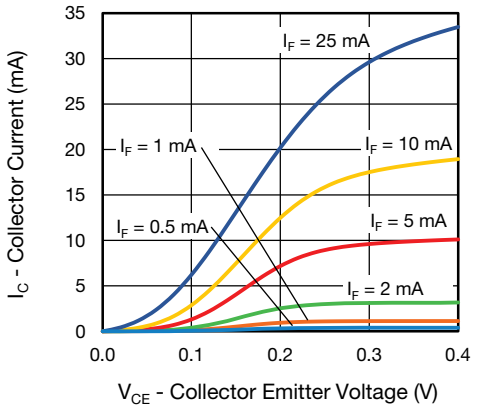

Fig. 7 - Collector Current vs. Collector Emitter Voltage

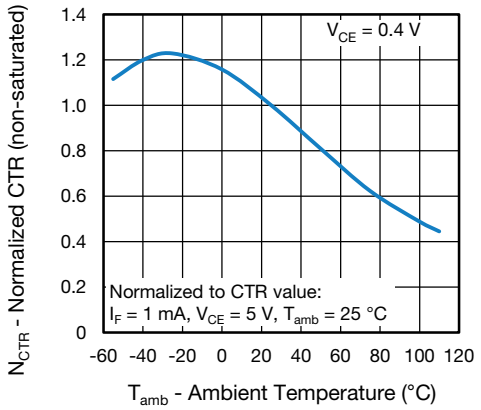

Fig. 10 - Normalized Current Transfer Ratio vs. Ambient Temperature (non-sat.)

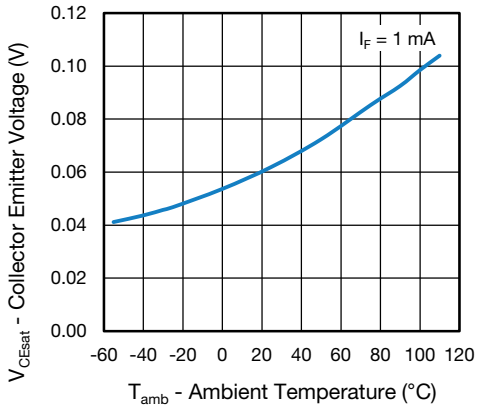

Fig. 8 - Collector Emitter Voltage vs. Ambient Temperature

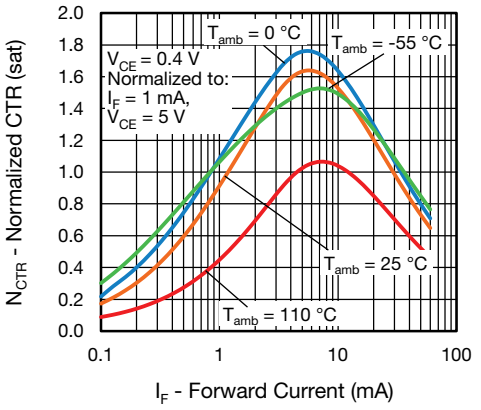

Fig. 11 - Current Transfer Ratio vs. Forward Current (sat.)

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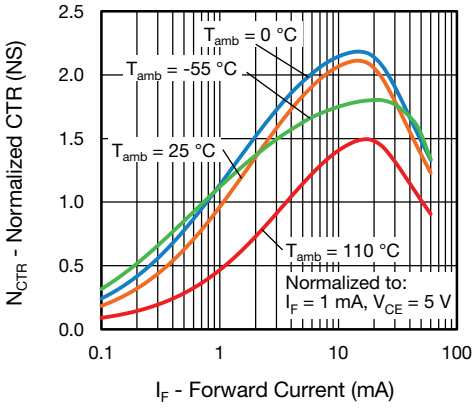

Fig. 12 - Current Transfer Ratio vs. Forward Current (non-sat.)

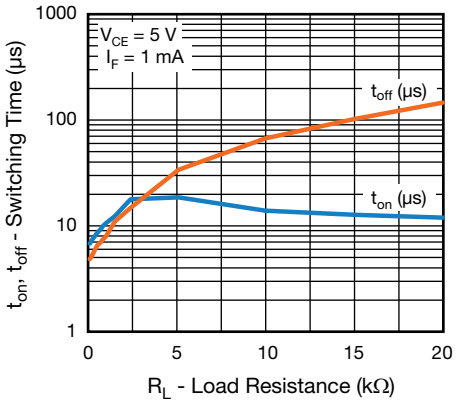

Fig. 15 - Switching Time vs. Load Resistance

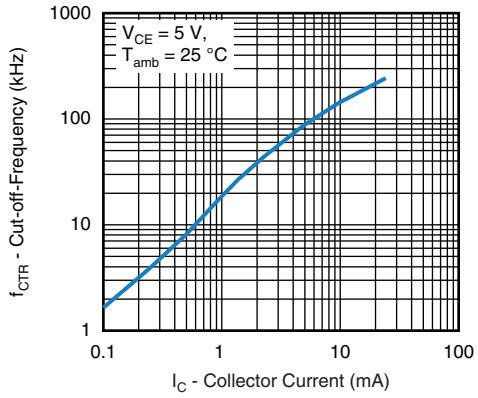

Fig. 13 - Cut-Off Frequency vs. Collector Current

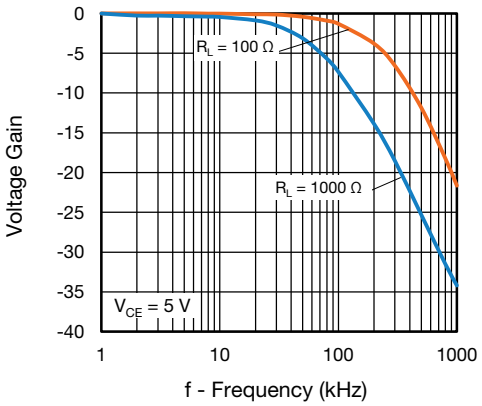

Fig. 16 - Voltage Gain vs. Frequency

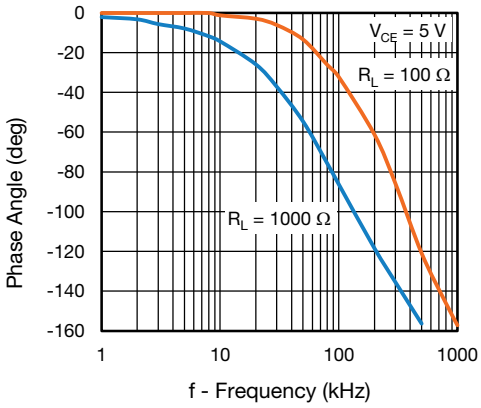

Fig. 14 - Phase Angle vs. Frequency

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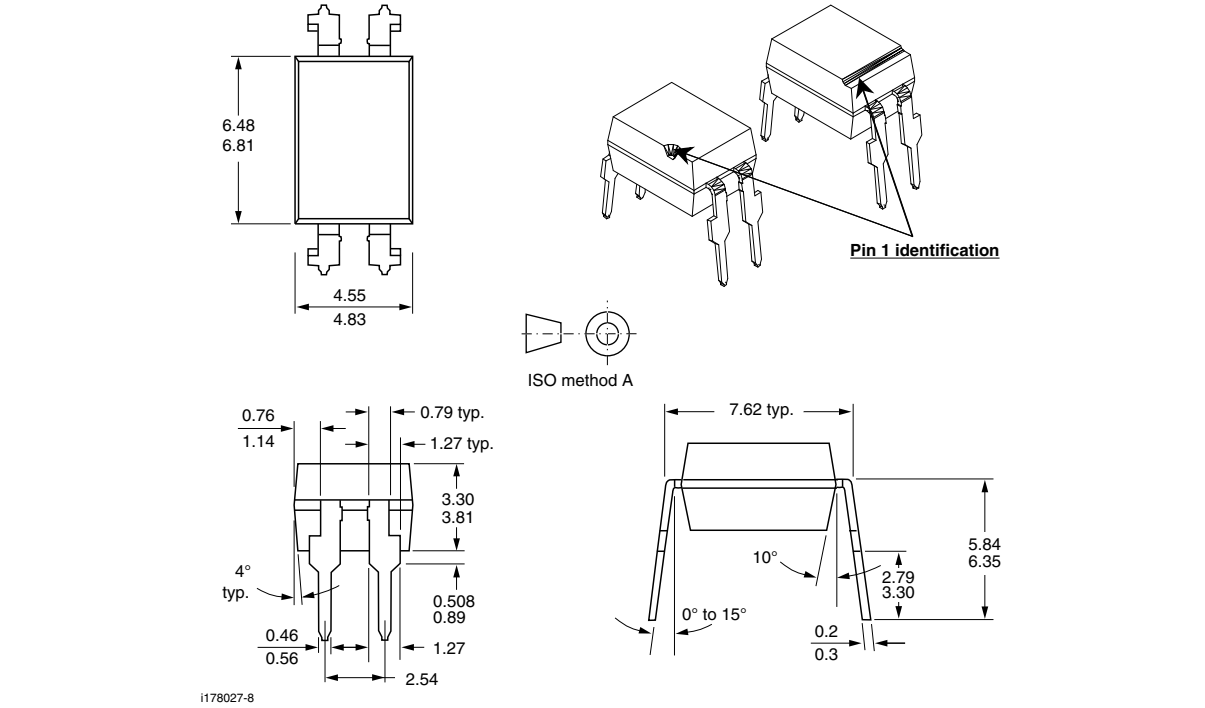
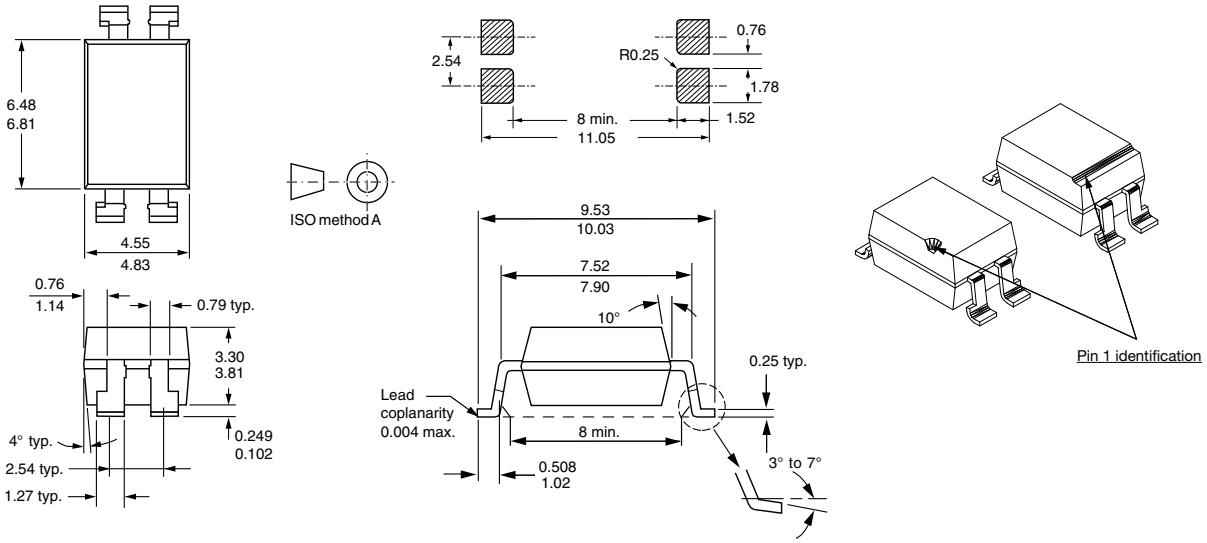
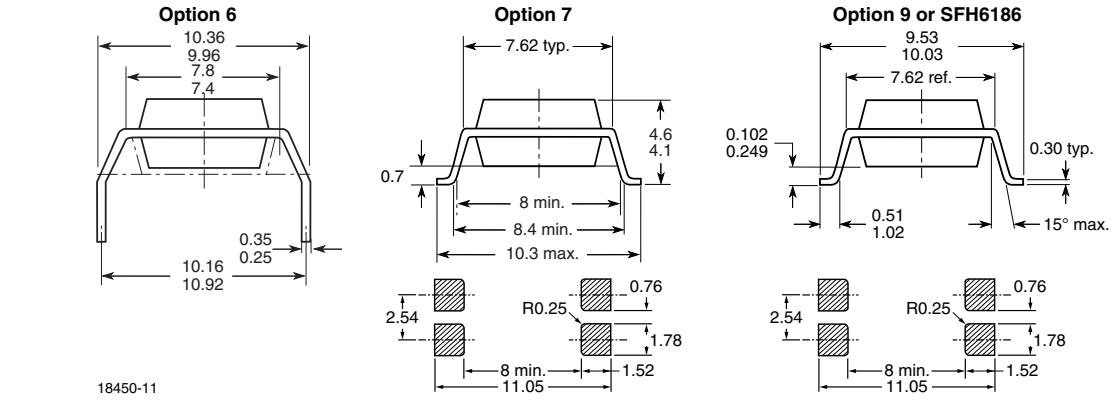
PACKAGE DIMENSIONS (in millimeters)







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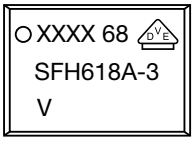
PACKAGE MARKING (example of SFH618A-3X001)



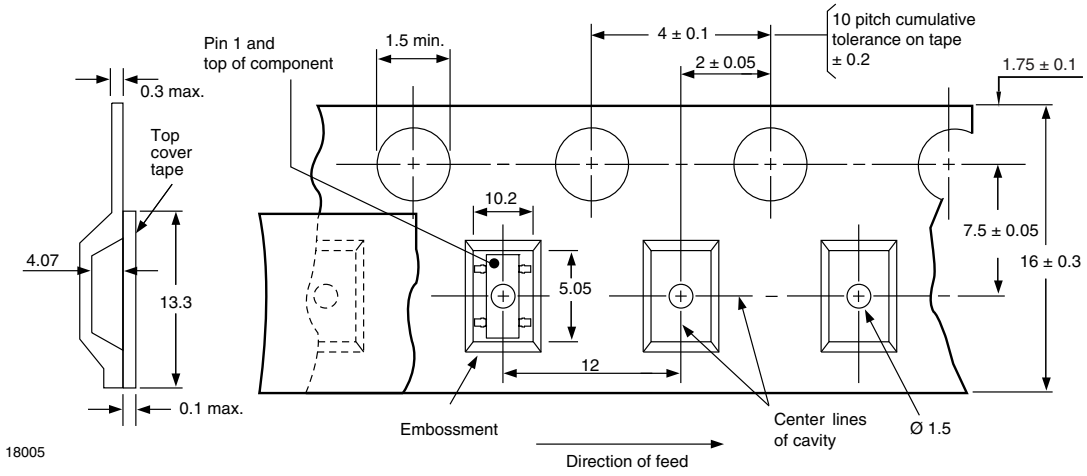
Notes

- 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

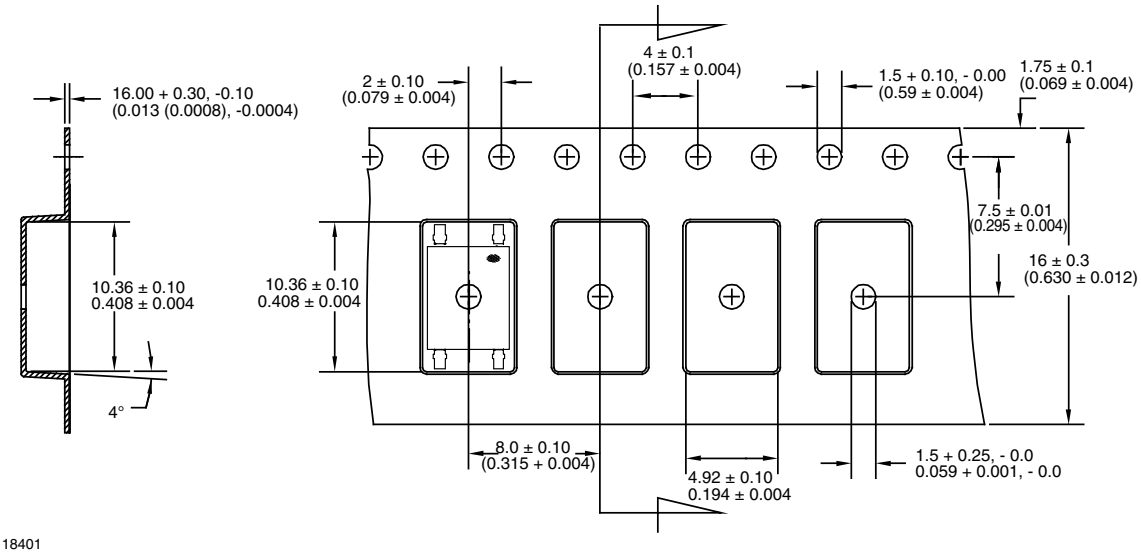
TAPE AND REEL PACKAGING (in millimeters)

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”)



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SOLDER PROFILES

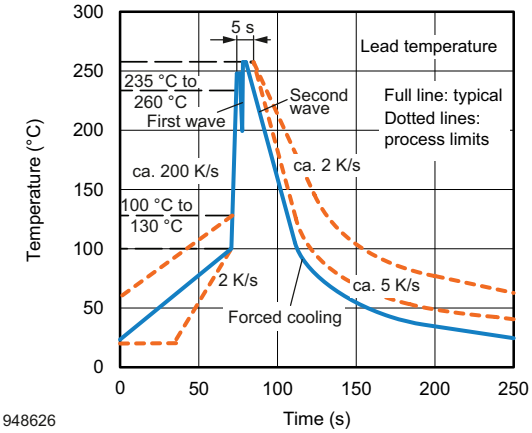

Fig. 17 - Recommended Wave Soldering Double Wave Profile for DIP Devices

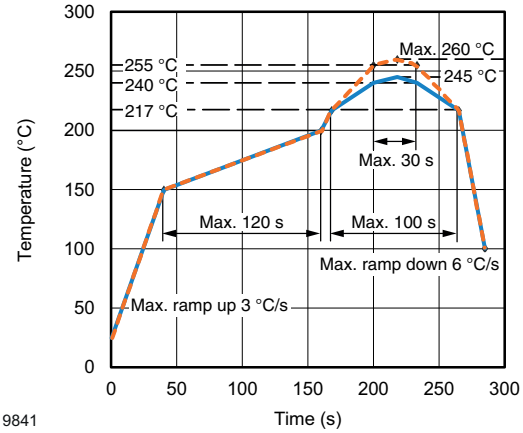

Fig. 18 - Recommended Lead (Pb)-free Reflow Solder Profile for SMD Devices

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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