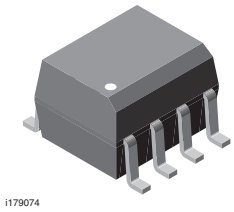
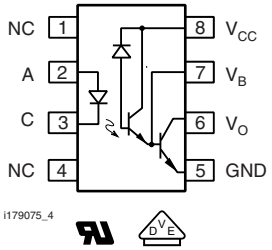
High Speed Optocoupler, 100 kBd, Low Input Current, High Gain





FEATURES

- High current transfer ratio, 300 %
- Low input current, 0.5 mA
- High output current, 60 mA
- TTL compatible output, V_{OL} = 0.1 V
- Adjustable bandwidth access to base
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

DESCRIPTION

Very high current ratio together with 4000 V_{RMS} isolation are achieved by coupling an LED with an integrated high gain photo detector in a SOIC-8 package. Separate pins for the photo diode and output stage enable TTL compatible saturation voltages with high speed operation. Photodarlington operation is achieved by tying the V_{CC} and V_O terminals together. Access to the base terminal allows adjustment to the gain bandwidth.

The SFH6318 is ideal for TTL applications since the 300 % minimum current transfer ratio with an LED current of 1.6 mA enables operation with one unit load-in and one unit load-out with a 2.2 kΩ pull-up resistor.

The SFH6319 is best suited for low power logic applications involving CMOS and low power TTL. A 400 % current transfer ratio with only 0.5 mA of LED current is guaranteed from 0 °C to 70 °C.

Caution:

Due to the small geometries of this device, it should be handled with electrostatic discharge (ESD) precautions. Proper grounding would prevent damage further and / or degradation which may be induced by ESD.

APPLICATIONS

- Logic ground isolation - TTL / TTL, TTL / CMOS, CMOS / CMOS, CMOS / TTL
- EIA RS 232C line receiver
- Low input current line receiver long lines, party lines
- Telephone ring detector
- Line voltage status indication - low input power dissipation
- Low power systems - ground isolation

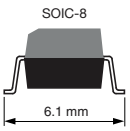
AGENCY APPROVALS

- UL1577, file no. E52744
- cUL, file no. E52744
- DIN EN 60747-5-5 (VDE 0884-5) available with option 1
- CSA 93751

ORDERING INFORMATION

S	F	H	6	3	#	#	T

PART NUMBER



AGENCY CERTIFIED / PACKAGE	CTR (%)	
UL, CSA	**≥ 300**	**≥ 500**
SOIC-8	SFH6318T	SFH6319T
SOIC-8, tube	SFH6318	SFH6319

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ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)					
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**VALUE**	**UNIT**
INPUT					
Reverse voltage			V_R	3	V
Supply and output voltage	V_{CC} (pin 8 to 5), V_O (pin 6 to 5)	SFH6318	V_{CC}, V_O	-0.5 to 7	V
		SFH6319	V_{CC}, V_O	-0.5 to 18	V
Input power dissipation			P_{diss}	35	mW
Derate linearly above				50	°C
Free air temperature				0.7	mW/°C
Average input current			$I_{F(AVG)}$	20	mA
Peak input current	50 % duty cycle; 1 ms pulse width		I_{FRM}	40	mA
Peak transient input current	$t_p \leq 1$ µs, 300 pps		I_{FSM}	1	A
OUTPUT					
Output current (pin 6)			I_O	60	mA
Emitter-base reverse current (pin 5 to 7)				0.5	V
Output power dissipation			P_{diss}	150	mW
Derate linearly from 25 °C				2	mW/°C
COUPLER					
Storage temperature			T_{stg}	-55 to +125	°C
Lead soldering temperature	t = 10 s		T_{sld}	260	°C
Junction temperature			T_j	100	°C
Ambient temperature range			T_{amb}	-55 to +100	°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.

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
Forward voltage	I_F = 1.6 mA	V_F	-	1.4	1.7	V
Temperature coefficient, forward voltage	I_F = 1.6 mA	$\Delta V_F/\Delta T_{amb}$	-	-1.8	-	mV/°C
OUTPUT						
Logic low output voltage (1)	I_F = 1.6 mA, I_O = 4.8 mA, V_{CC} = 4.5 V	V_{OL}	-	0.1	0.4	V
	I_F = 1.6 mA, I_O = 8 mA, V_{CC} = 4.5 V	V_{OL}	-	0.1	0.4	V
	I_F = 5 mA, I_O = 15 mA, V_{CC} = 4.5 V	V_{OL}	-	0.15	0.4	V
	I_F = 12 mA, I_O = 24 mA, V_{CC} = 4.5 V	V_{OL}	-	0.25	0.4	V
Logic high output current (1)	I_F = 0 mA, V_O = V_{CC} = 7 V	I_{IO}	-	0.1	250	µA
	I_F = 0 mA, V_O = V_{CC} = 18 V	I_{IO}	-	0.05	100	µA
Logic low supply current (1)	I_F = 1.6 mA, V_O = OPEN, V_{CC} = 18 V	I_{CCL}	-	0.2	1.5	mA
Logic high supply current (1)	I_F = 0 mA, V_O = OPEN, V_{CC} = 18 V	I_{CCH}	-	0.01	10	µA
COUPLER						
Capacitance (input to output) (2)	f = 1 MHz	C_{IO}	-	0.6	-	pF
Input capacitance	f = 1 MHz, V_F = 0	C_{IN}	-	25	-	pF

Notes

- 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.
  T_{amb} = 0 °C to 70 °C. Typical values are specified at T_{amb} = 25 °C.

(1) Pin 7 open.

(2) Device considered a two-terminal device: pins 1, 2, 3, and 4 shorted together and pins 5, 6, 7, and 8 shorted together.

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CURRENT TRANSFER RATIO							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Current transfer ratio (1)	I_F = 1.6 mA, V_O = 0.4 V, V_{CC} = 4.5 V	SFH6318	CTR	300	1600	2600	%
	I_F = 0.5 mA, V_O = 0.4 V, V_{CC} = 4.5 V	SFH6319	CTR	400	2000	3500	%
	I_F = 1.6 mA, V_O = 0.4 V, V_{CC} = 4.5 V	SFH6319	CTR	500	1600	2600	%

Notes

- T_{amb} = 0 °C to 70 °C. Typical values are specified at T_{amb} = 25 °C.
  DC current transfer ratio is defined as the ratio of output collector current, I_O, to the forward LED input current, I_F times 100 %. Pin 7 open.

(1) Pin 7 open

SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Propagation delay time to logic low at output	I_F = 1.6 mA, R_L = 2.2 kΩ	SFH6318	t_{PHL}	-	2	10	µs
Propagation delay time to logic low at output (1)	I_F = 0.5 mA, R_L = 4.7 kΩ	SFH6319	t_{PHL}	-	6	25	µs
Propagation delay time to logic low at output (1)	I_F = 12 mA, R_L = 270 Ω	SFH6319	t_{PHL}	-	0.6	1	µs
Propagation delay time to logic high at output	I_F = 1.6 mA, R_L = 2.2 kΩ	SFH6318	t_{PLH}	-	2	35	µs
Propagation delay time to logic high at output (1)	I_F = 0.5 mA, R_L = 4.7 kΩ	SFH6319	t_{PLH}	-	4	60	µs
Propagation delay time to logic high at output (1)	I_F = 12 mA, R_L = 270 Ω	SFH6319	t_{PLH}	-	1.5	7	µs

Note

(1) Pin 7 open. Using a resistor between pin 5 and 7 will decrease gain and delay time.

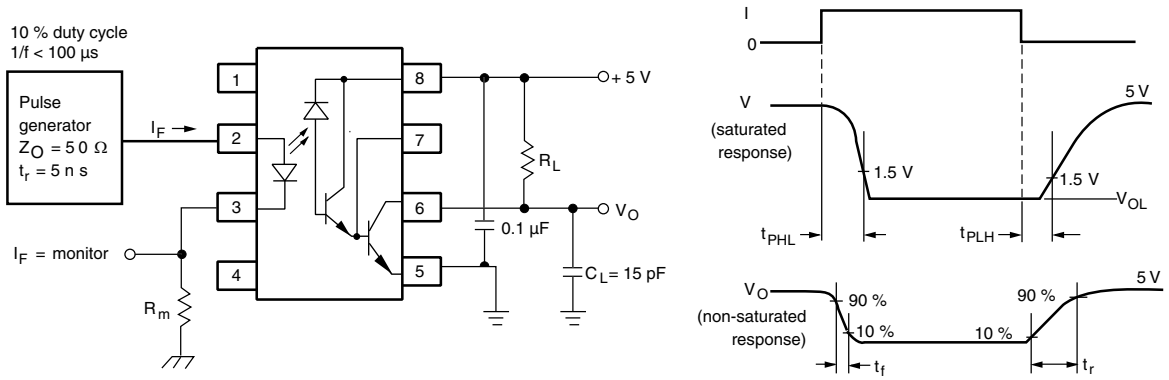

Fig. 1 - Switching Test Circuit

COMMON MODE TRANSIENT IMMUNITY						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Common mode transient immunity at logic high level output (1)(2)	I_F = 0 mA, R_L = 2.2 kΩ, V_{CM} = 10 V_{P-P}	$\|CM_H\|$	-	1000	-	V/µs
Common mode transient immunity at logic low level output (1)(2)	I_F = 1.6 mA, R_L = 2.2 kΩ, V_{CM} = 10 V_{P-P}	$\|CM_L\|$	-	1000	-	V/µs

Notes

(1) Common mode transient immunity in logic high level is the maximum tolerable (positive) dV_{cm}/dt_{on} the leading edge of the common mode pulse, V_{CM}, to assure that the output will remain in a logic high state (i.e. V_O > 2 V) common mode transient immunity in logic low level is the maximum tolerable (negative) dV_{cm}/dt_{on} the trailing edge of the common mode pulse signal, V_{CM}, to assure that the output will remain in a logic low state (i.e.V_O < 0.8 V).

(2) In applications where dv/dt may exceed 50 000 V/µs (such as state discharge) a series resistor, R_{CC} should be included to protect I_C from destructively high surge currents. The recommended value is refer to figure 2.
$R_{CC} \cong [(IV)/0.15\ I_F\ (mA)]$ kΩ.

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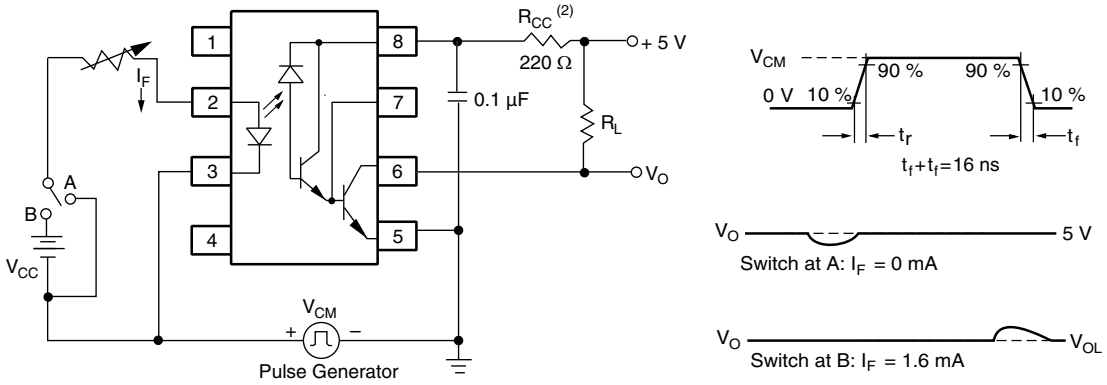

Fig. 2 - Test Circuit for Transient Immunity and Typical Waveforms

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}	3333	V_{RMS}
Tested withstanding isolation voltage	According to UL1577, t = 1 s	V_{ISO}	4000	V_{RMS}
Maximum transient isolation voltage	According to DIN EN 60747-5-5	V_{IOTM}	6000	V_{peak}
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	V_{IORM}	560	V_{peak}
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
	V_{IO} = 500 V, T_{amb} = T_S	R_{IO}	≥ 10^{9}	Ω
Output safety power		P_{SO}	350	mW
Input safety current		I_{SI}	150	mA
Safety temperature		T_S	165	°C
Creepage distance			≥ 4	mm
Clearance distance			≥ 4	mm
Input to output test voltage, method B	V_{IORM} x 1.875 = V_{PR}, 100 % production test with t_M = 1 s, partial discharge < 5 pC	V_{PR}	1050	V_{peak}
Input to output test voltage, method A	V_{IORM} x 1.6 = V_{PR}, 100 % sample test with t_M = 10 s, partial discharge < 5 pC	V_{PR}	896	V_{peak}

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.

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PACKAGE DIMENSIONS (in millimeters)

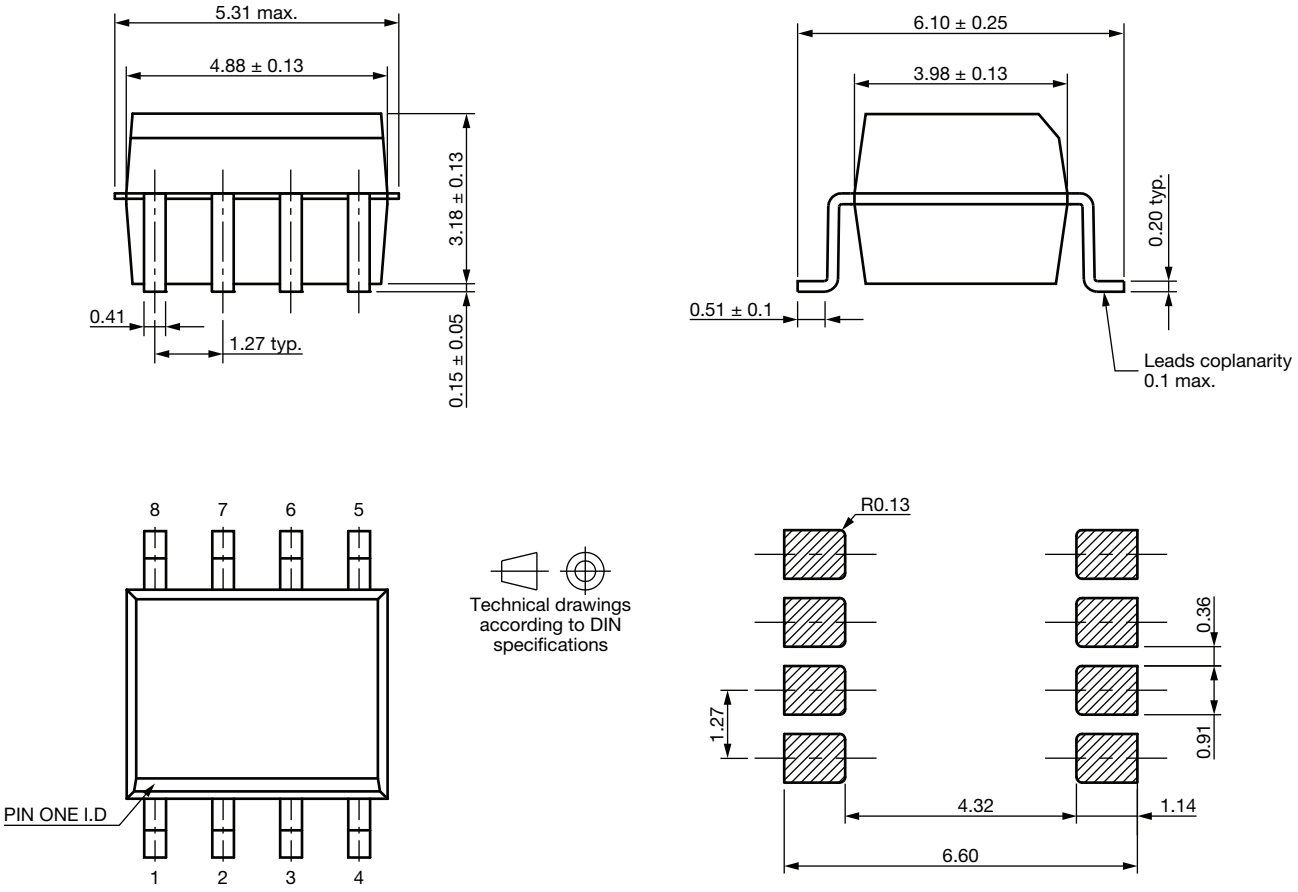

Fig. 3 - Package Drawing

PACKAGE MARKING

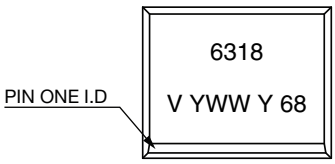

Fig. 4 - SFH6138

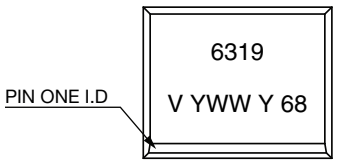

Fig. 5 - SFH6139

Note

- Tape and reel suffix (T) is not part of the package marking.

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PACKING INFORMATION

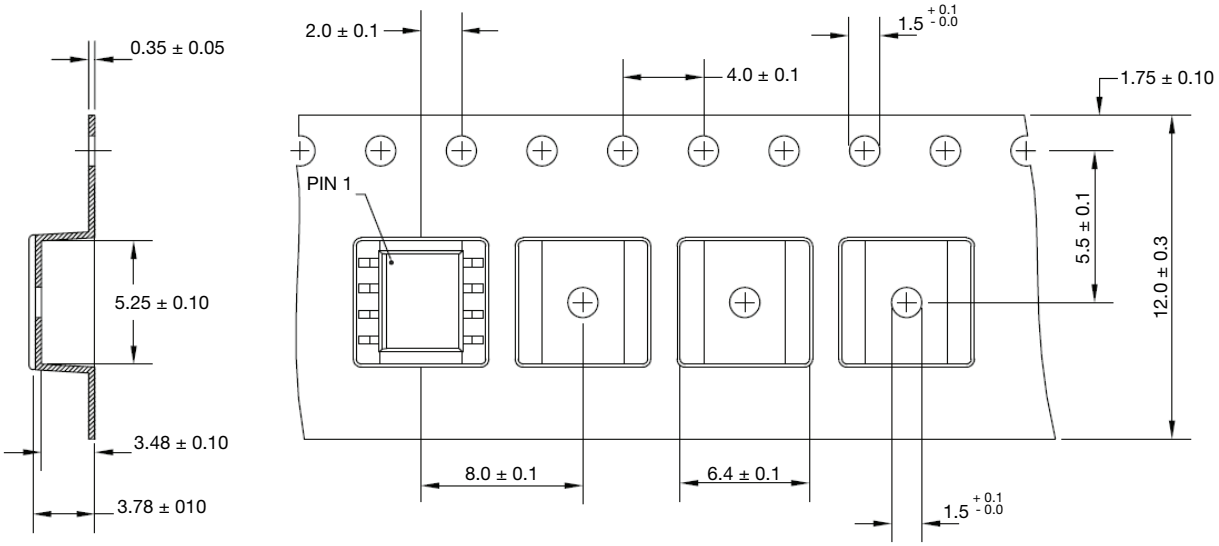

Fig. 6 - Tape and Reel Packing (2000 pieces on reel)

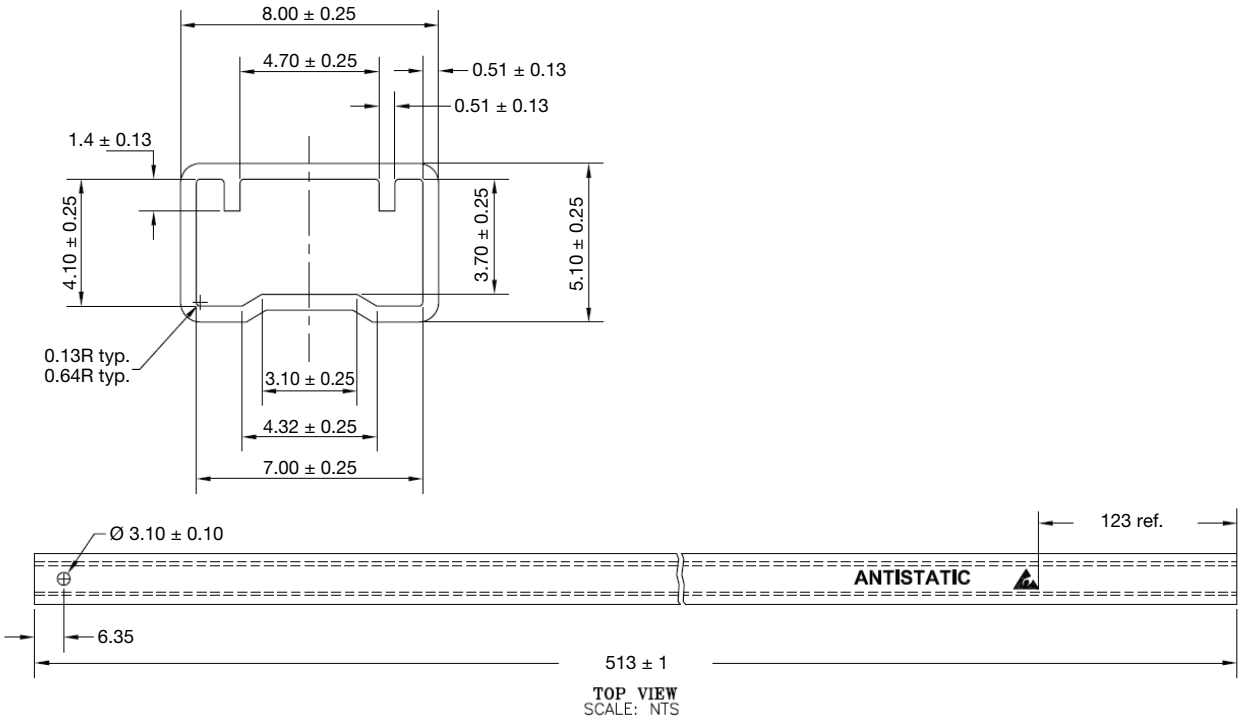

Fig. 7 - Tube Packing

DEVICE PER TUBE			
TYPE	**UNITS/TUBE**	**TUBES/BOX**	**UNITS/BOX**
SOIC-8	100	30	3000

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SOLDER PROFILE

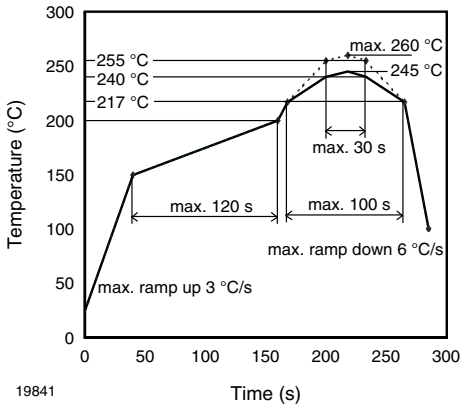

Fig. 8 - Lead (Pb)-free Reflow Solder Profile according to J-STD-020

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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Footprint and Schematic Information for SFH6318, SFH6319

The footprint and schematic symbols for the following parts can be accessed using the associated links. They are available in Eagle, Altium, KiCad, OrCAD / Allegro, Pulsonix, and PADS.

Note that the 3D models for these parts can be found on the Vishay product page.

PART NUMBER	FOOTPRINT / SCHEMATIC
SFH6318	www.snapeda.com/parts/SFH6318/Vishay/view-part
SFH6318T	www.snapeda.com/parts/SFH6318T/Vishay/view-part
SFH6319	www.snapeda.com/parts/SFH6319/Vishay/view-part
SFH6319T	www.snapeda.com/parts/SFH6319T/Vishay/view-part

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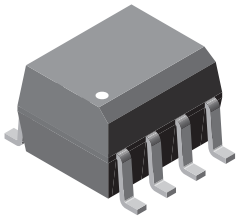

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