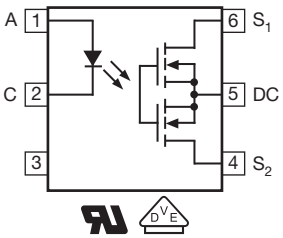
1 Form A Solid-State Relay (Normally Open)





FEATURES

- Current limit protection
- Isolation test voltage 5300 V_{RMS}
- Typical R_{ON} 22 Ω
- Load voltage 350 V
- Load current 120 mA / 250 mA
- Clean bounce free switching
- Low power consumption
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

HALOGEN FREE GREEN (5-2008)

DESCRIPTION

The LH1540 is robust, ideal for telecom and ground fault applications. It is an SPST normally open switch (1 Form A) that replaces electromechanical relays in many applications. It is constructed using a GaAlAs LED for actuation control and MOSFETs for the switch output. In addition, it employs current-limiting circuitry to provide overvoltage protection.

APPLICATIONS

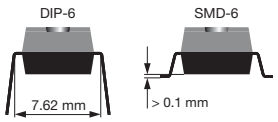
- General telecom switching
- Security equipment
- Instrumentation
- Industrial controls

AGENCY APPROVALS

- UL1577, file no. E52744
- DIN EN 60747-5-5 (VDE0884-5), available with option 1

ORDERING INFORMATION

L	H	1	5	4	0	#	#	#	T	R
PART NUMBER						ELECTR. VARIATION	PACKAGE CONFIG.		TAPE AND REEL	



PACKAGE	UL	UL, VDE (OPTION 1)
SMD-6, tube	LH1540AAB	LH1540AAB-X001
SMD-6, tape and reel	LH1540AABTR	-
DIP-6, tube	LH1540AT	LH1540AT-X001

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ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
IRED continuous forward current		I_F	50	mA
IRED reverse voltage		V_R	5	V
Input power dissipation		P_{diss}	80	mW
OUTPUT				
DC or peak AC load voltage		V_L	350	V
Continuous load current (AC/DC configuration)		I_L	120	mA
Continuous load current (DC only configuration)		I_L	250	mA
SSR output power dissipation (continuous)		P_{diss}	550	mW
SSR				
Ambient temperature range		T_{amb}	-40 to +85	°C
Storage temperature range		T_{stg}	-40 to +150	°C
Soldering temperature	t = 10 s max.	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

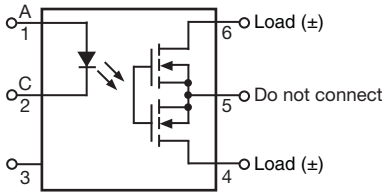
ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
IRED forward current, switch turn-on	I_L = 100 mA, t = 10 ms	I_{Fon}	-	0.3	2	mA
IRED forward current, switch turn-off	V_L = 350 V	I_{Foff}	0.05	0.15	-	mA
IRED forward voltage	I_F = 10 mA	V_F	-	1.36	1.45	V
OUTPUT						
On-resistance (AC/DC configuration)	I_F = 5 mA, I_L = 50 mA	R_{ON}	-	22	27	Ω
On-resistance (DC only configuration)	I_F = 5 mA, I_L = 100 mA	R_{ON}	-	5.2	7	Ω
Off-resistance	I_F = 0 mA, V_L = ± 100 V	R_{OFF}	0.5	5000	-	GΩ
Off-state leakage current	I_F = 0 mA, V_L = ± 100 V	I_O	-	< 1	200	nA
	I_F = 0 mA, V_L = ± 350 V	I_O	-	6	1000	nA
Output capacitance (AC/DC configuration)	I_F = 0 mA, V_L = 1 V, 1 MHz	C_O	-	39	-	pF
	I_F = 0 mA, V_L = 50 V, 1 MHz	C_O	-	6	-	pF
Current limit (AC/DC configuration)	I_F = 5 mA, t = 5 ms, V_L = ± 6 V	I_{limit}	170	300	450	mA
TRANSFER						
Capacitance (input to output)	V_{ISO} = 1 V	C_{IO}	-	0.4	-	pF

Note

- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluations. Typical values are for information only and are not part of the testing requirements

PIN CONFIGURATION

AC/DC configuration



DC only configuration

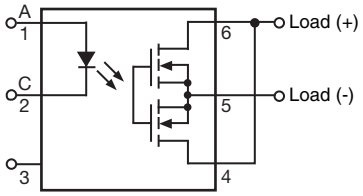


Fig. 1 - Pin Configuration

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SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Turn-on time	I_F = 5 mA, I_L = 50 mA	t_{on}	-	0.13	2	ms
Turn-off time	I_F = 5 mA, I_L = 50 mA	t_{off}	-	0.05	2	ms

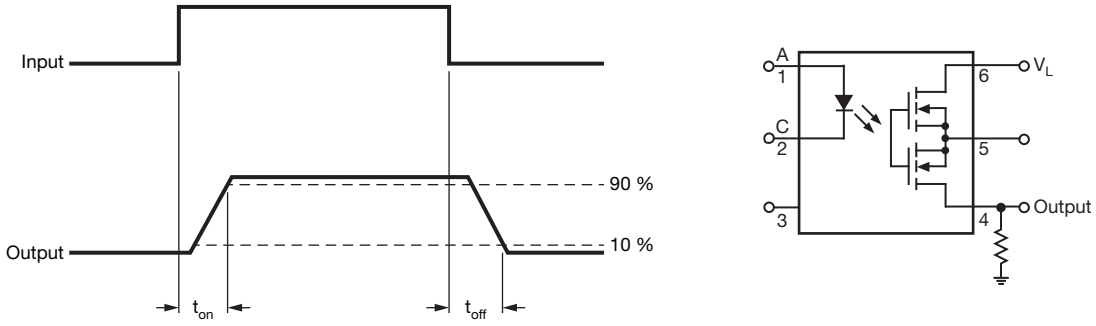

Fig. 2 - Timing Schematic

SAFETY AND INSULATION RATINGS				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Climatic classification	According to IEC 68 part 1		40 / 85 / 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}	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	V_{IO} = 500 V, T_{amb} = 25 °C	R_{IO}	$\geq 10^{12}$	Ω
	V_{IO} = 500 V, T_{amb} = 100 °C	R_{IO}	$\geq 10^{11}$	Ω
Output safety power		P_{SO}	700	mW
Input safety current		I_{SI}	240	mA
Safety temperature		T_S	175	°C
Creepage distance			≥ 7	mm
Clearance distance			≥ 7	mm
Insulation thickness		DTI	≥ 0.4	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}	1669	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}	1424	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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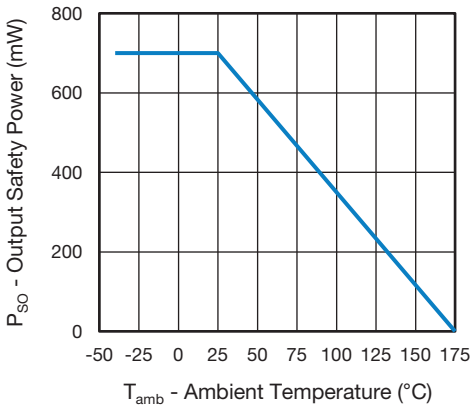

Fig. 3 - Safety Power Dissipation vs. Ambient Temperature

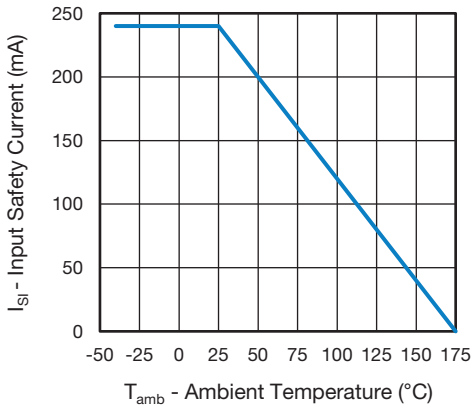

Fig. 4 - Safety Input Current vs. Ambient Temperature

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

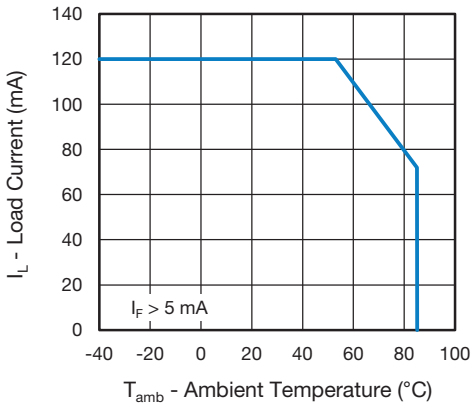

Fig. 5 - Maximum Load Current vs. Ambient Temperature

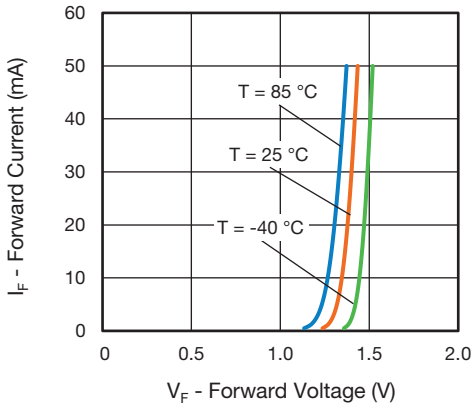

Fig. 7 - Forward Current vs. Forward Voltage

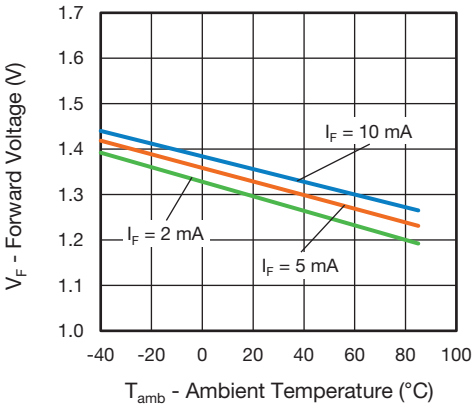

Fig. 6 - Forward Voltage vs. Ambient Temperature

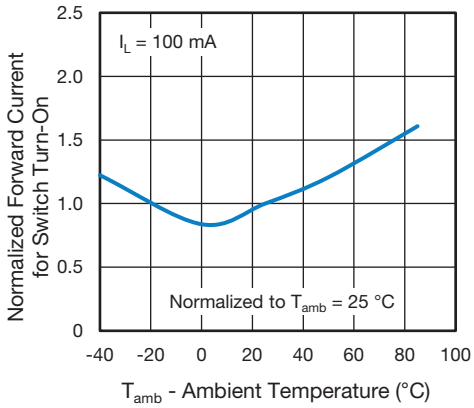

Fig. 8 - Normalized Forward Current for Switch Turn-On vs. Ambient Temperature

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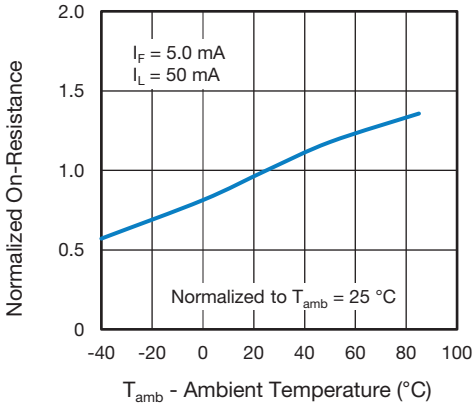

Fig. 9 - Normalized On-Resistance vs. Ambient Temperature

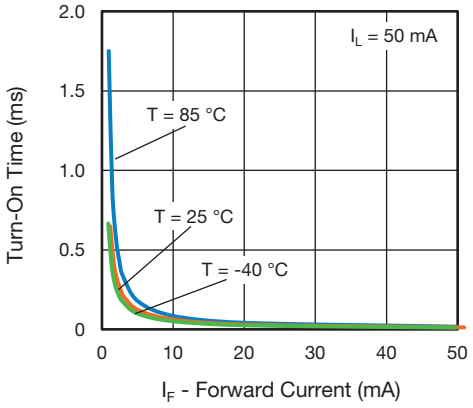

Fig. 12 - Turn-On Time vs. Forward Current

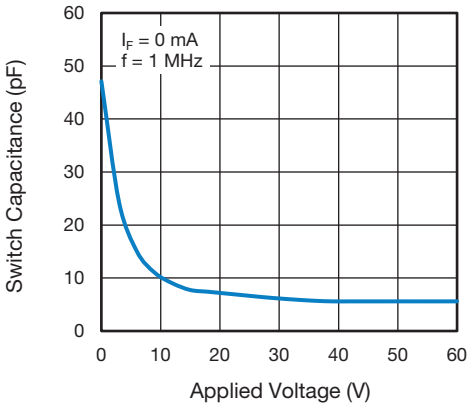

Fig. 10 - Switch Capacitance vs. Applied Voltage

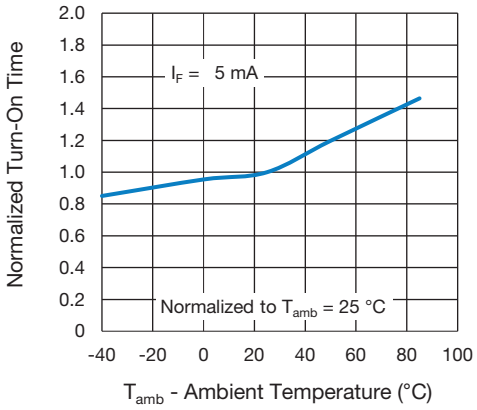

Fig. 13 - Normalized Turn-On Time vs. Ambient Temperature

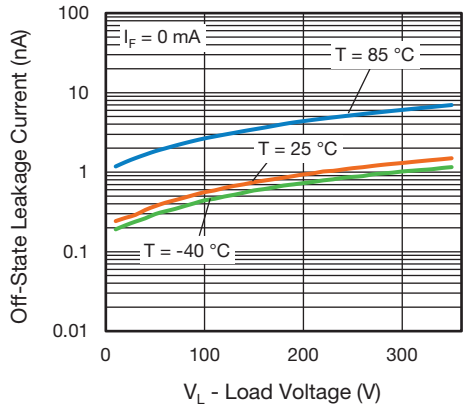

Fig. 11 - Off-State Leakage Current vs. Load Voltage

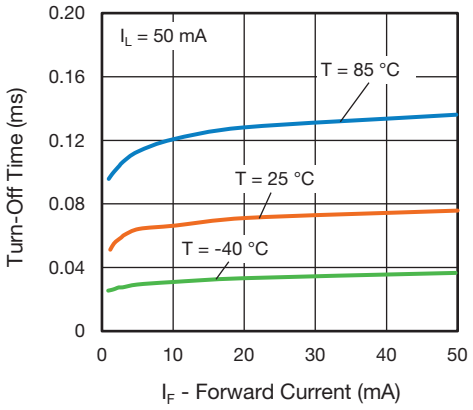

Fig. 14 - Turn-Off Time vs. Forward Current

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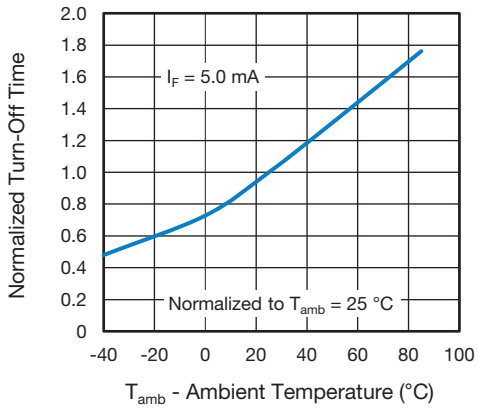
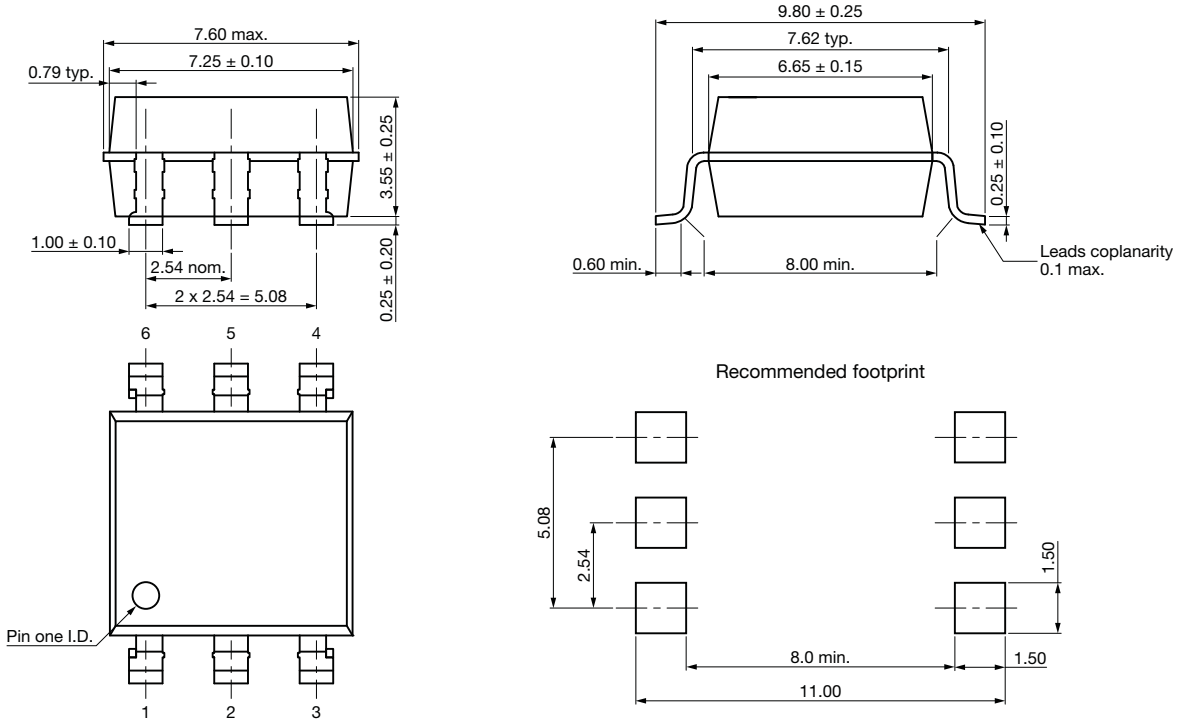


Fig. 15 - Normalized Turn-Off Time vs. Ambient Temperature

PACKAGE DIMENSIONS (in millimeters)

SMD-6



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DIP-6

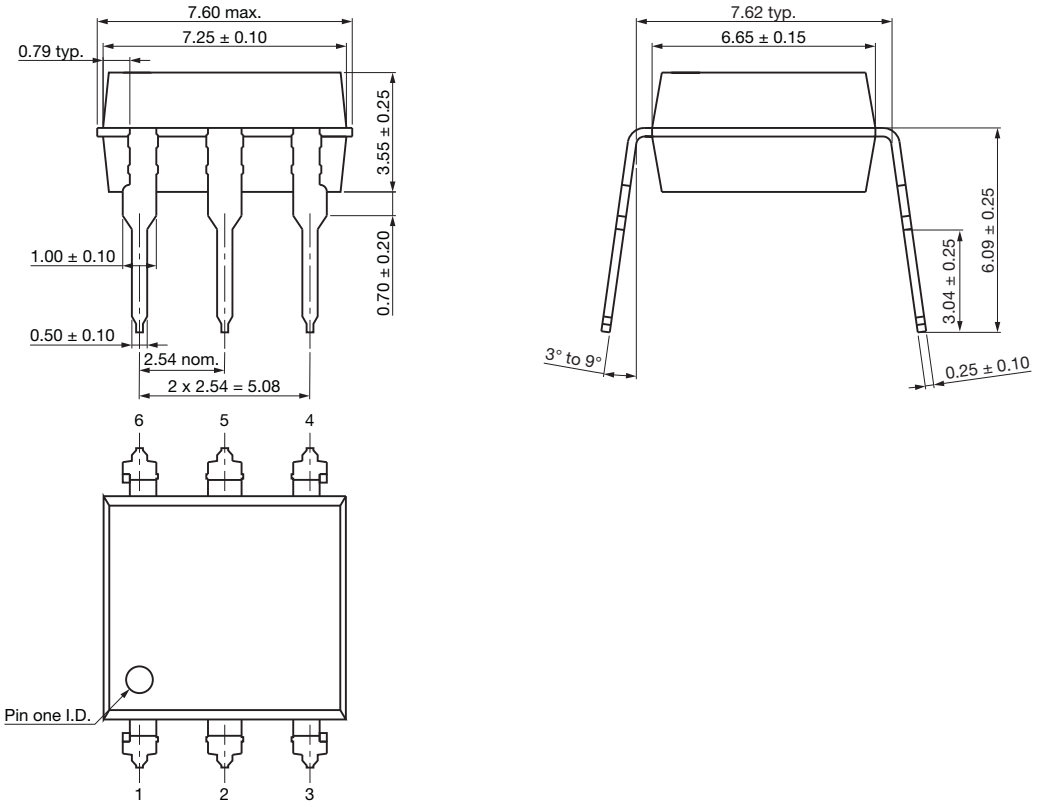

Fig. 16 - Package Drawings

PACKAGE MARKING

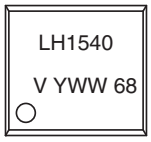

Fig. 17 - LH1540

Note

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

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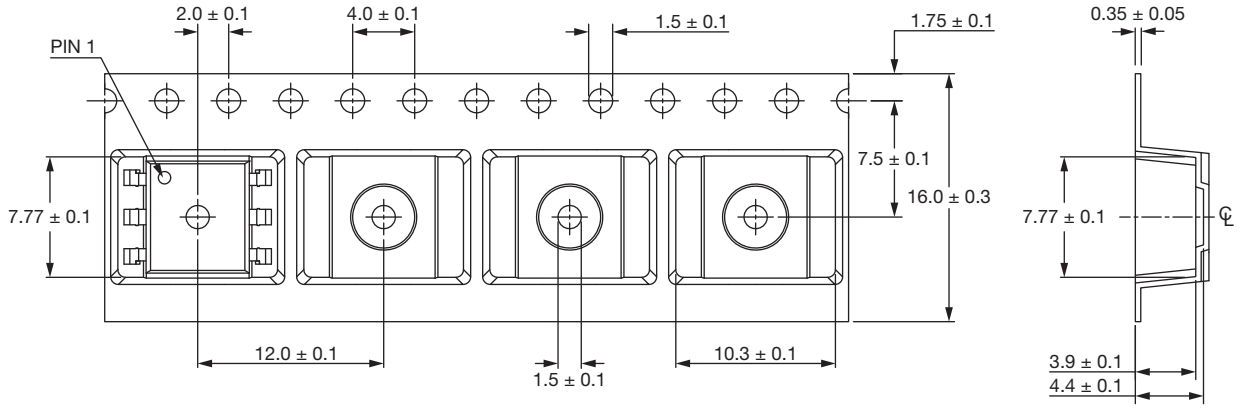
PACKING INFORMATION (in millimeters)



Note:
- Cummulative tolerance of 10 spocket holes is 0.20 mm

Fig. 18 - Tape and Reel Packing

TAPE AND REEL PACKING	
TYPE	**UNITS/REEL**
SMD-6	1000

TUBE PACKING			
TYPE	**UNITS/TUBE**	**TUBES/BOX**	**UNITS/BOX**
SMD-6	50	40	2000
DIP-6	50	40	2000

SOLDER PROFILES

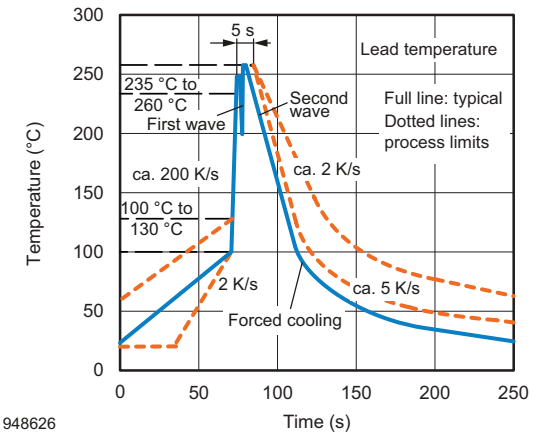


Fig. 19 - Wave Soldering Double Wave Profile
According to J-STD-020 for DIP Devices

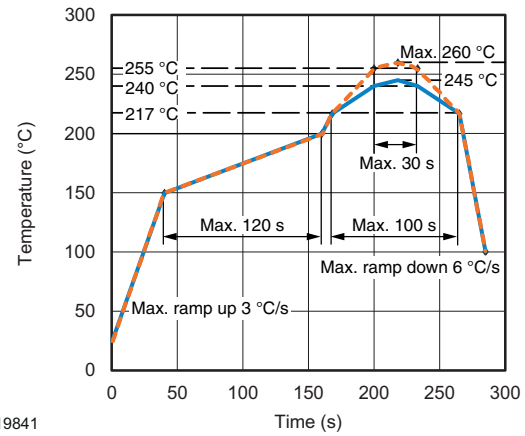


Fig. 20 - Lead (Pb)-free Reflow Solder Profile
According to J-STD-020 for SMD Devices

HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

Conditions: T_{amb} < 30 °C, RH < 60 %

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

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Footprint and Schematic Information for LH1540

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
LH1540AAB	www.snapeda.com/parts/LH1540AAB/Vishay/view-part
LH1540AABTR	www.snapeda.com/parts/LH1540AABTR/Vishay/view-part
LH1540ACD	www.snapeda.com/parts/LH1540ACD/Vishay/view-part
LH1540ACDTR	www.snapeda.com/parts/LH1540ACDTR/Vishay/view-part
LH1540AT	www.snapeda.com/parts/LH1540AT/Vishay/view-part

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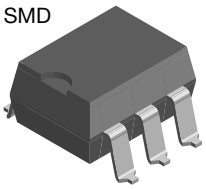
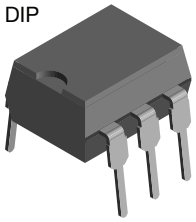
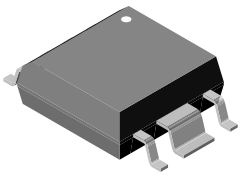
SMD



DIP





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