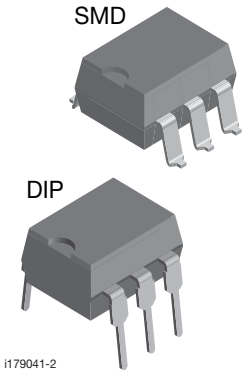
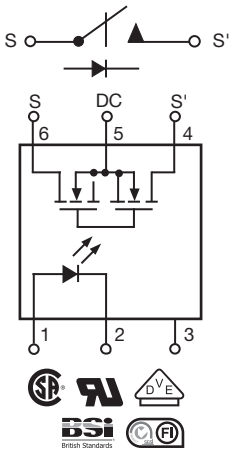
1 Form A Solid-State Relay





FEATURES

- Current limit protection
- Isolation test voltage 5300 V_{RMS}
- Typical R_{ON} 20 Ω, max. 25 Ω
- Load voltage 350 V
- Load current 120 mA
- High surge capability
- Clean bounce free switching
- Low power consumption
- SMD lead available on tape and reel
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC

Pb-free

e3

RoHS COMPLIANT

DESCRIPTION

The LH1540 is robust, ideal for telecom and ground fault applications. It is an SPST normally open switch (form A) that replaces electromechanical relays in many applications. It is constructed using a GaAlAs LED for actuation control and an integrated monolithic die for the switch output. The die, fabricated in a high-voltage dielectrically isolated technology, is comprised of a photodiode array, switch control circuitry and MOSFET switches. In addition, it employs current-limiting circuitry which meets lightning surge testing as per ANSI/TIA-968-B and other regulatory voltage surge requirements when overvoltage protection is provided.

APPLICATIONS

- General telecom switching
- Instrumentation
- Industrial controls

Note

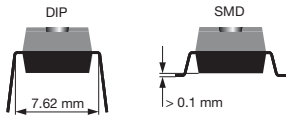
- See “solid-state relays” (application note 56)

AGENCY APPROVALS

UL1577: file no. E52744 system code H, double protection
CSA: certification no. 093751
BSI: certification no. 7979/7980
FIMKO: 25419
DIN EN: 60747-5-2 (VDE 0884)/60747-5-5 (pending), 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, CSA, BSI, FIMKO
SMD-6	LH1540AAB
SMD-6, tape and reel	LH1540AABTR
DIP-6, thru hole	LH1540AT

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
LED continuous forward current		I_F	50	mA
LED reverse voltage	$I_R \leq 10$ µA	V_R	8	V
OUTPUT				
DC or peak AC load voltage	$I_L \leq 50$ µA	V_L	350	V
Continuous DC load current - bidirectional operation		I_L	120	mA
Continuous DC load current - unidirectional operation		I_L	250	mA
Peak load current (single shot)	t = 100 ms	I_P	(1)	mA
SSR				
Ambient temperature range		T_{amb}	- 40 to + 85	°C
Storage temperature range		T_{stg}	- 40 to + 150	°C
Pin soldering temperature (2)	t = 10 s max.	T_{sld}	260	°C
Input to output isolation voltage		V_{ISO}	5300	V_{RMS}
Output power dissipation (continuous)		P_{diss}	550	mW

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 current limit performance application note for a discussion on relay operation during transient currents.

(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).

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
LED forward current, switch turn-on	I_L = 100 mA, t = 10 ms	I_{Fon}		1	2	mA
LED forward current, switch turn-off	V_L = ± 300 V	I_{Foff}	0.2	0.9		mA
LED forward voltage	I_F = 10 mA	V_F	1.15	1.26	1.45	V
OUTPUT						
On-resistance AC/DC: pin 4 (±) to 6 (±)	I_F = 5 mA, I_L = 50 mA	R_{ON}	12	20	25	Ω
On-resistance DC: pin 4, 6 (+) to 5 (±)	I_F = 5 mA, I_L = 100 mA	R_{ON}	3	5	6.25	Ω
Off-resistance	I_F = 0 mA, V_L = ± 100 V	R_{OFF}	0.5	5000		GΩ
Current limit AC (1): pin 4 (±) to 6 (±)	I_F = 5 mA, V_L = ± 6 V, t = 5 ms	I_{LMT}	175	210	250	mA
Off-state leakage current	I_F = 0 mA, V_L = ± 100 V	I_O		0.32	200	nA
	I_F = 0 mA, V_L = ± 350 V	I_O			1	µA
Output capacitance pin 4 to 6	I_F = 0 mA, V_L = 1 V	C_O		55		pF
	I_F = 0 mA, V_L = 50 V	C_O		10		pF
Switch offset	I_F = 5 mA	V_{OS}		0.15		µV
TRANSFER						
Capacitance (input to output)	V_{ISO} = 1 V	C_{IO}		0.8		pF

Notes

- 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.

(1) No DC mode current limit available.

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}		1.2	2	ms
Turn-off time	I_F = 5 mA, I_L = 50 mA	t_{off}		0.5	2	ms

SAFETY AND INSULATION RATINGS					
PARAMETER		**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Climatic classification		IEC 68 part 1		40/85/21	
Pollution degree		DIN VDE 0109		2	
Tracking resistance (comparative tracking index)		Insulation group IIIa	CTI	175	
Highest allowable overvoltage		Transient overvoltage	V_{IOTM}	8000	V_{peak}
Max. working insulation voltage		Recurring peak voltage	V_{IORM}	890	V_{peak}
Insulation resistance at 25 °C		V_{IO} = 500 V	R_{IS}	$\geq 10^{12}$	Ω
Insulation resistance at T_S			R_{IS}	$\geq 10^{9}$	Ω
Insulation resistance at 100 °C			R_{IS}	$\geq 10^{11}$	Ω
Partial discharge test voltage		Methode a, $V_{pd} = V_{IORM}$ x 1.875	V_{pd}	1669	V_{peak}
Safety limiting values - maximum values allowed in the event of a failure	Case temperature		T_{SI}	175	°C
	Input current		I_{SI}	300	mA
	Output power		P_{SO}	700	mW
Minimum external air gap (clearance)		Measured from input terminals to output terminals, shortest distance through air		≥ 7	mm
Minimum external tracking (creepage)		Measured from input terminals to output terminals, shortest distance path along body		≥ 7	mm

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

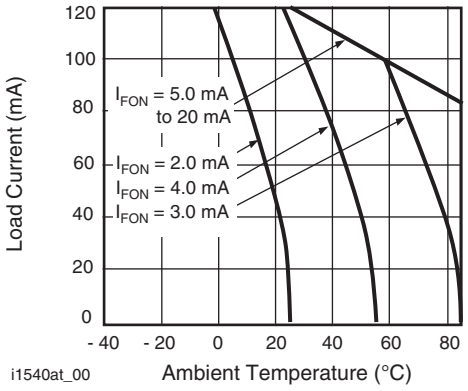


Fig. 1 - Recommended Operating Conditions

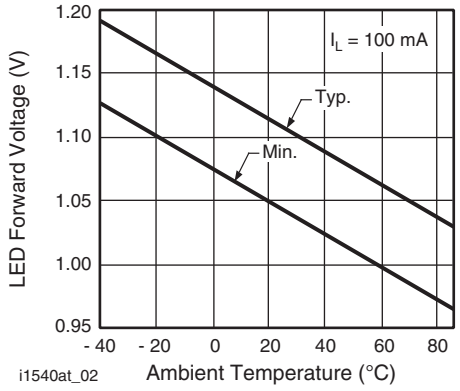


Fig. 3 - LED Dropout Voltage vs. Temperature

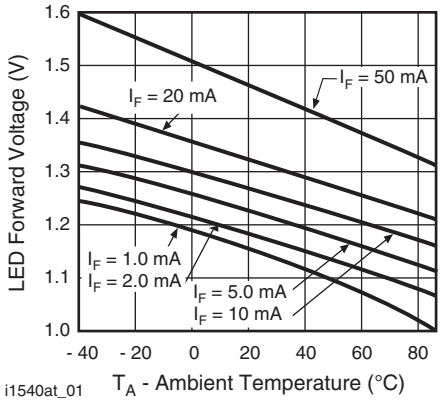


Fig. 2 - LED Voltage vs. Temperature

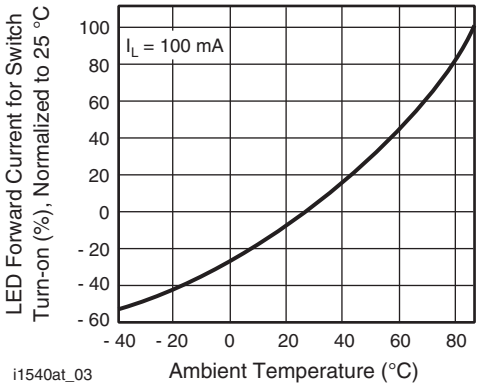


Fig. 4 - LED Current for Switch Turn-on vs. Temperature

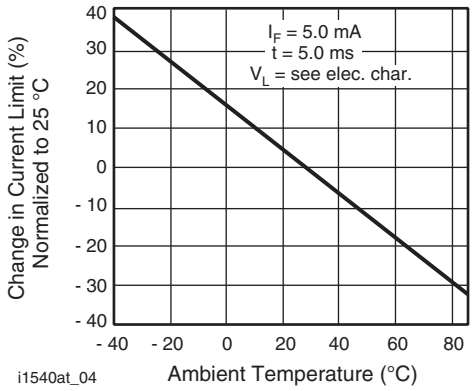


Fig. 5 - Current Limit vs. Temperature

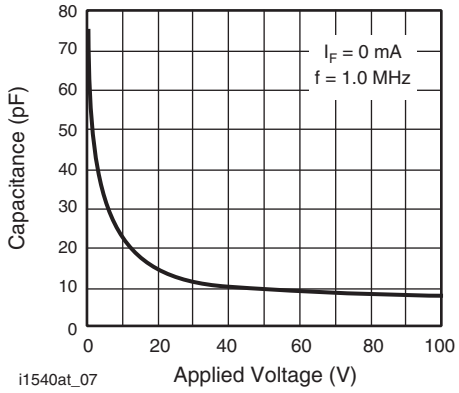


Fig. 8 - Switch Capacitance vs. Applied Voltage

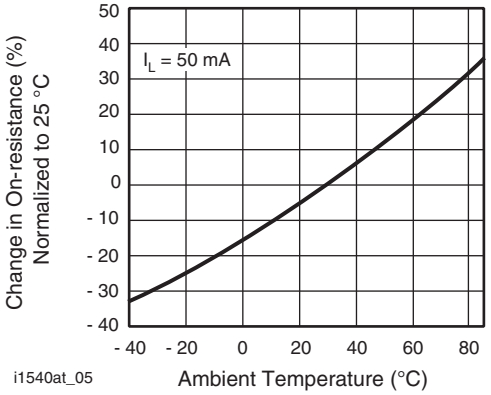


Fig. 6 - On-resistance vs. Temperature

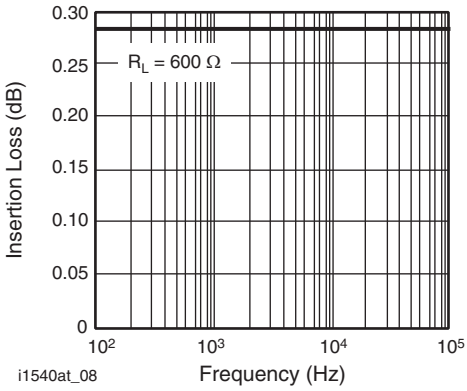


Fig. 9 - Insertion Loss vs. Frequency

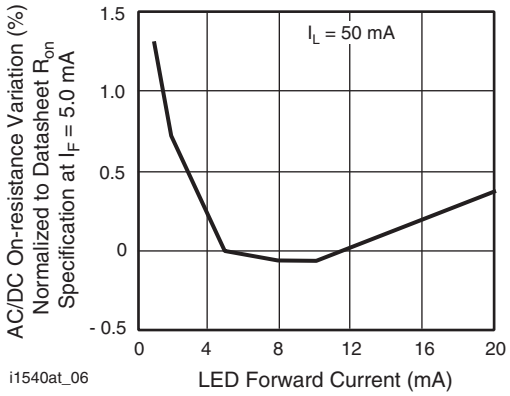


Fig. 7 - Variation in On-resistance vs. LED Current

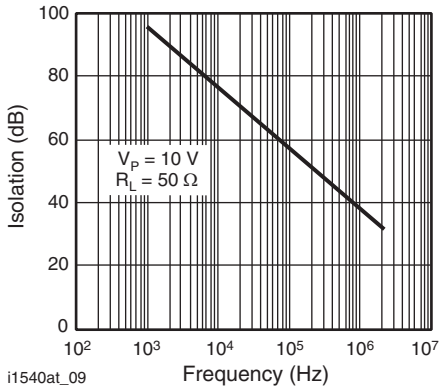


Fig. 10 - Output Isolation

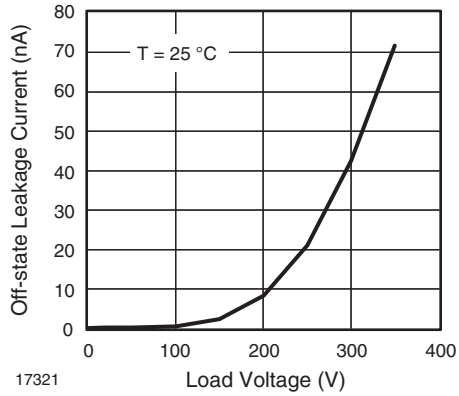


Fig. 11 - Leakage Current vs. Applied Voltage

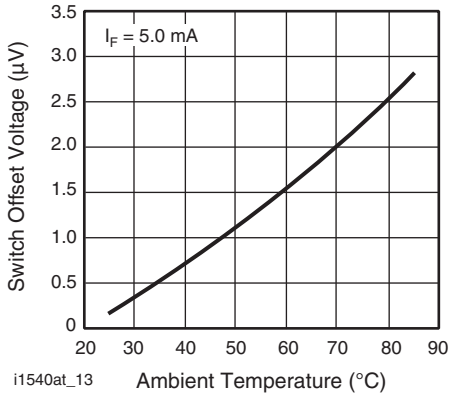


Fig. 14 - Switch Offset Voltage vs. Temperature

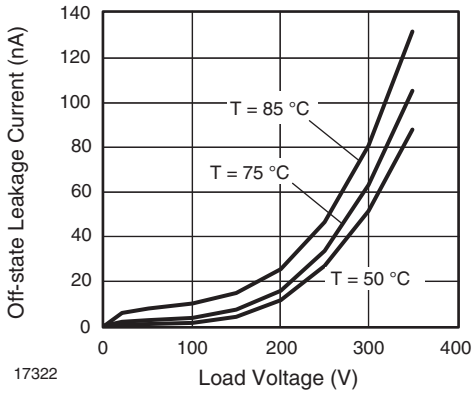


Fig. 12 - Leakage Current vs.
Applied Voltage at Elevated Temperatures

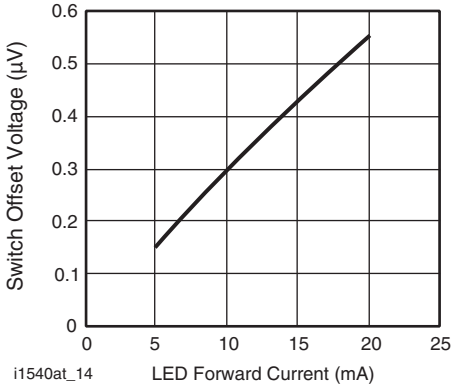


Fig. 15 - Switch Offset Voltage vs. LED Current

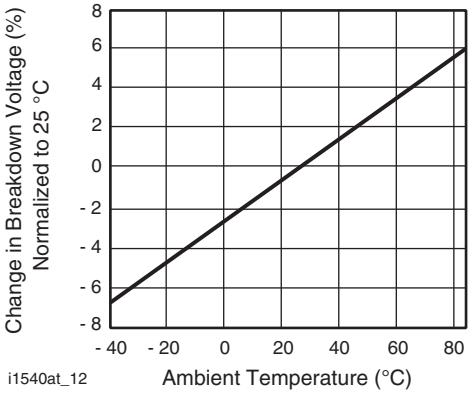


Fig. 13 - Switch Breakdown Voltage vs. Temperature

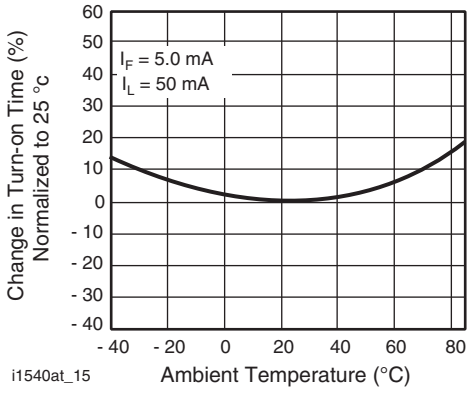


Fig. 16 - Turn-on Time vs. Temperature

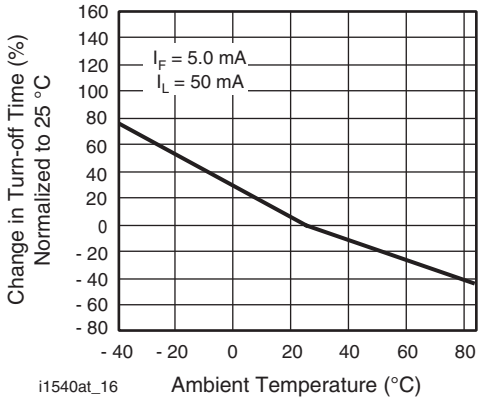


Fig. 17 - Turn-off Time vs. Temperature

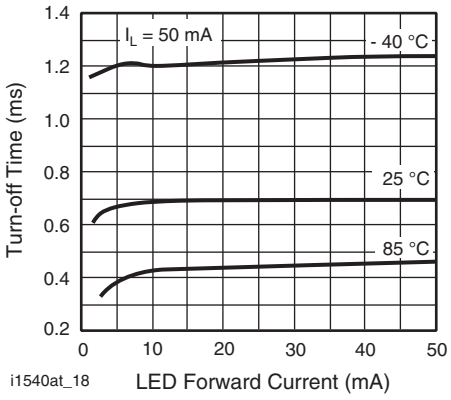


Fig. 19 - Turn-off Time vs. LED Current

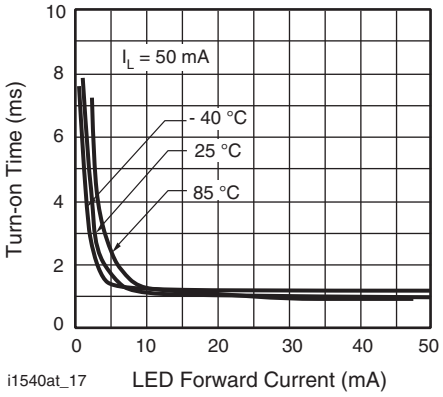
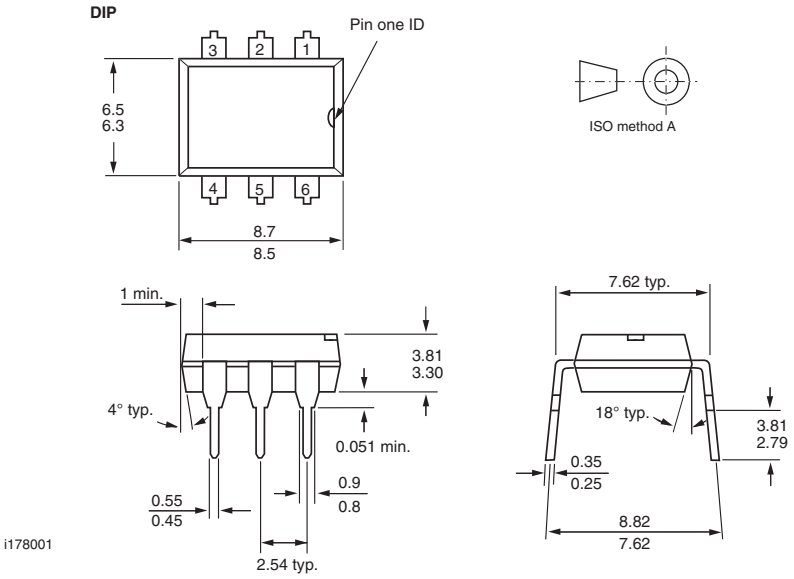
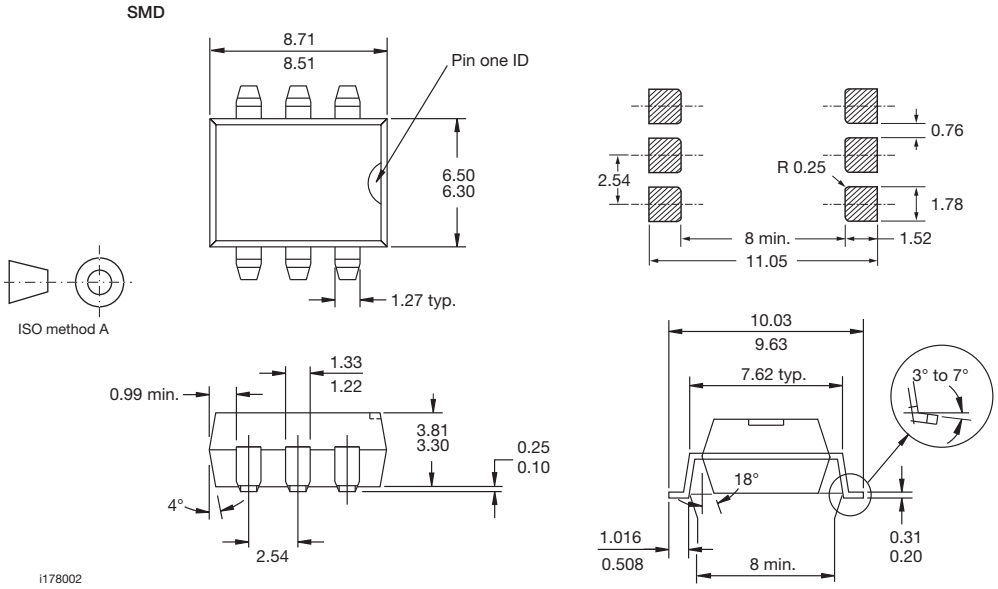


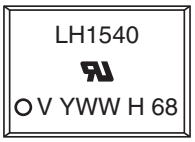
Fig. 18 - Turn-on Time vs. LED Current

PACKAGE DIMENSIONS in millimeters





PACKAGE MARKING



Note

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

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