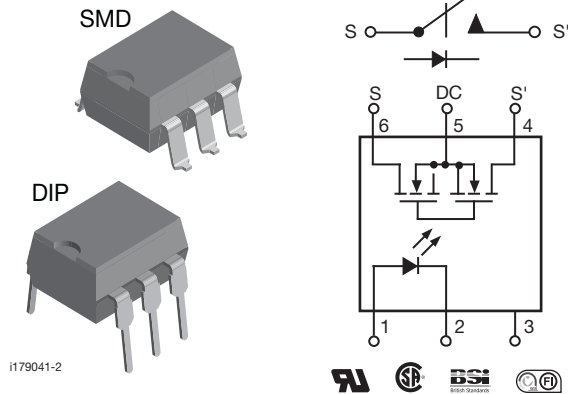


## 1 Form A Solid State Relay



### FEATURES

- Current limit protection
- Isolation test voltage 5300 V<sub>RMS</sub>
- Typical R<sub>ON</sub> 20 Ω, max. 25 Ω
- Load voltage 400 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



**RoHS**  
COMPLIANT

### DESCRIPTION

The LH1535 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 FCC 68.302 and other regulatory voltage surge requirements when overvoltage protection is provided.

### APPLICATIONS

- General telecom switching
- Instrumentation
- Industrial controls

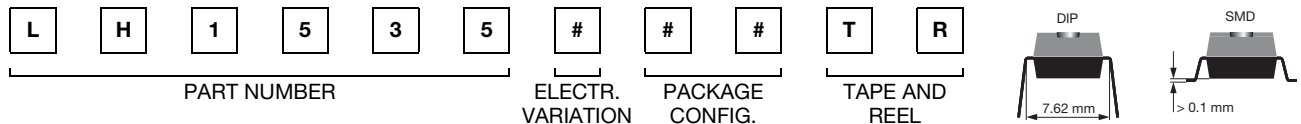
### Note

- 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

### ORDERING INFORMATION



PACKAGE	UL, CSA, BSI, FIMKO
SMD-6	LH1535AAB
SMD-6, tape and reel	LH1535AABTR
DIP-6, thru hole	LH1535AT

ABSOLUTE MAXIMUM RATINGS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
LED continuous forward current		$I_F$	50	mA
LED reverse voltage	$I_R \leq 10\text{ }\mu\text{A}$	$V_R$	8	V
<b>OUTPUT</b>				
DC or peak AC load voltage	$I_L \leq 50\text{ }\mu\text{A}$	$V_L$	400	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)	$t = 100\text{ ms}$	$I_P$	(1)	mA
<b>SSR</b>				
Ambient temperature range		$T_{amb}$	- 40 to + 85	$^{\circ}\text{C}$
Storage temperature range		$T_{stg}$	- 40 to + 150	$^{\circ}\text{C}$
Pin soldering temperature (2)	$t = 10\text{ s max.}$	$T_{sld}$	260	$^{\circ}\text{C}$
Input to output isolation test 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 ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
LED forward current, switch turn-on	$I_L = 100\text{ mA}$ , $t = 10\text{ ms}$	$I_{Fon}$		0.75	2	mA
LED forward current, switch turn-off	$V_L = \pm 150\text{ V}$ , $t = 100\text{ ms}$	$I_{Foff}$	0.2	0.65		mA
LED forward voltage, switch turn-on	$I_F = 10\text{ mA}$	$V_F$	1.15	1.27	1.45	V
<b>OUTPUT</b>						
On-resistance AC/DC	$I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$	$R_{ON}$	12	20	25	$\Omega$
On-resistance DC	$I_F = 5\text{ mA}$ , $I_L = 100\text{ mA}$	$R_{ON}$	3	6	6.25	$\Omega$
Off-resistance	$I_F = 0\text{ mA}$ , $V_L = \pm 100\text{ V}$	$R_{OFF}$	0.5	200		$G\Omega$
Current limit AC (1): pin 4 ( $\pm$ ) to 6 ( $\pm$ )	$I_F = 5\text{ mA}$ , $V_L = \pm 6\text{ V}$ , $t = 5\text{ ms}$	$I_{LMT}$	175	210	250	mA
Off-state leakage current	$I_F = 0\text{ mA}$ , $V_L = \pm 100\text{ V}$	$I_O$		0.5	200	nA
	$I_F = 0\text{ mA}$ , $V_L = \pm 400\text{ V}$	$I_O$		136		nA
Output capacitance	$I_F = 0\text{ mA}$ , $V_L = 1\text{ V}$	$C_O$		21.6		pF
	$I_F = 0\text{ mA}$ , $V_L = 50\text{ V}$	$C_O$		9		pF
Switch offset	$I_F = 5\text{ mA}$	$V_{OS}$		0.4		V
Breakdown voltage	$I_F = 0\text{ mA}$	$V_{BR}$		433		$\mu\text{V}$
<b>TRANSFER</b>						
Capacitance (input to output)	$V_{ISO} = 1\text{ V}$	$C_{IO}$		0.75		pF

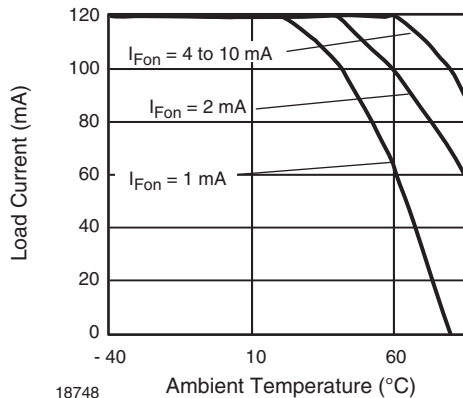
**Notes**

- 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.

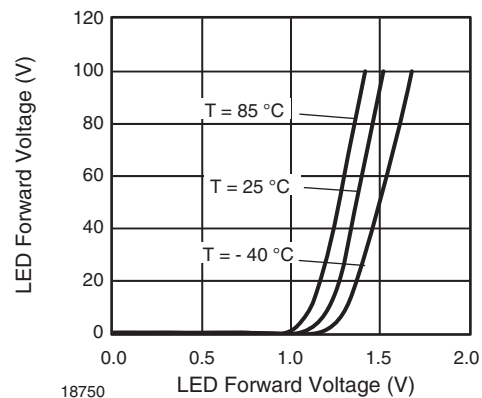
SWITCHING CHARACTERISTICS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Turn-on time	$I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$	$t_{on}$		0.7	2	ms
Turn-off time	$I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$	$t_{off}$		0.6	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	$V_{IO} = 500 V$	$R_{IS}$	$\geq 10^{12}$	$\Omega$
Insulation resistance at $T_S$		$R_{IS}$	$\geq 10^9$	$\Omega$
Insulation resistance at 100 °C		$R_{IS}$	$\geq 10^{11}$	$\Omega$
Partial discharge test voltage	Methode a, $V_{pd} = V_{IORM} \times 1.875$	$V_{pd}$	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		$\geq 7$	mm
Minimum external tracking (creepage)	Measured from input terminals to output terminals, shortest distance path along body		$\geq 7$	mm

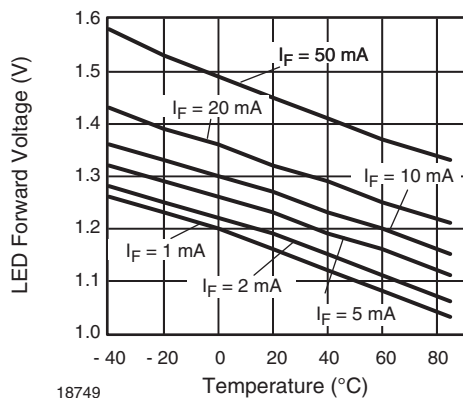
### TYPICAL CHARACTERISTICS ( $T_{amb} = 25\text{ °C}$ , unless otherwise specified)



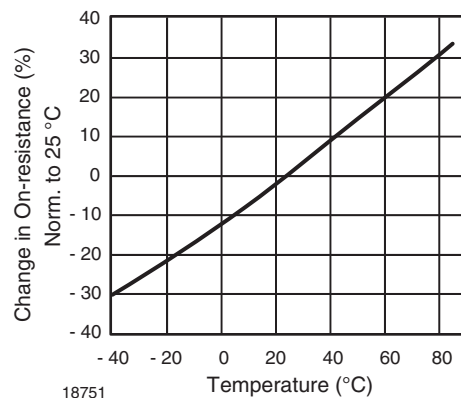
18748 Fig. 1 - Recommended Operating Conditions



18750 Fig. 3 - LED Forward Current vs. LED Forward Voltage



18749 Fig. 2 - LED Voltage vs. Temperature



18751 Fig. 4 - On-resistance vs. Temperature

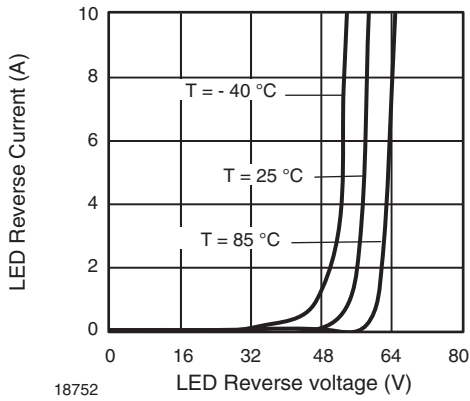


Fig. 5 - LED Reverse Current vs. LED Reverse Voltage

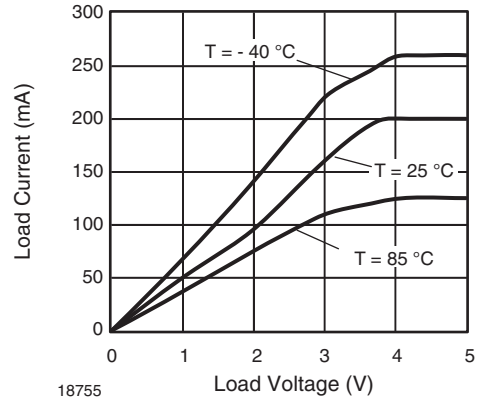


Fig. 8 - Load Current vs. Load Voltage

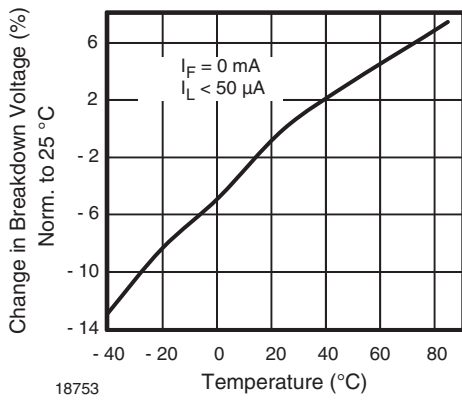


Fig. 6 - Switch Breakdown Voltage vs. Temperature

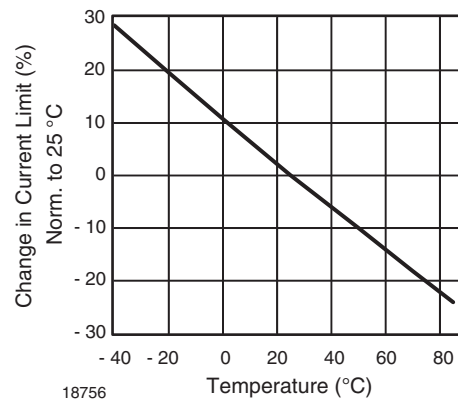


Fig. 9 - Current Limit vs. Temperature

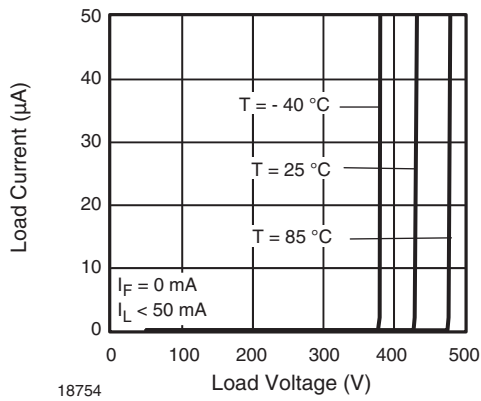


Fig. 7 - Switch Breakdown Voltage vs. Load Current

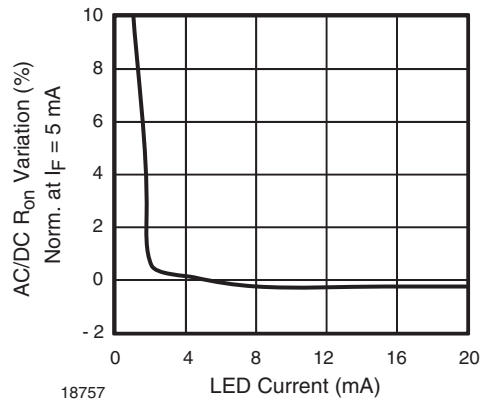


Fig. 10 - Variation in On-resistance vs. LED Current

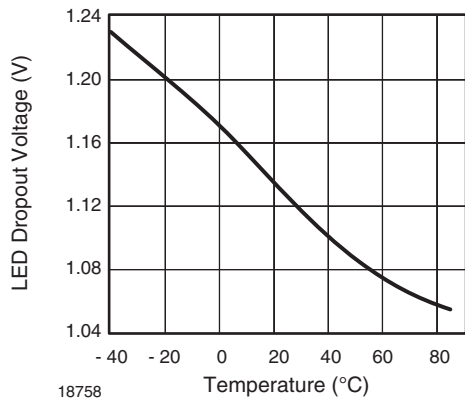


Fig. 11 - LED Dropout Voltage vs. Temperature

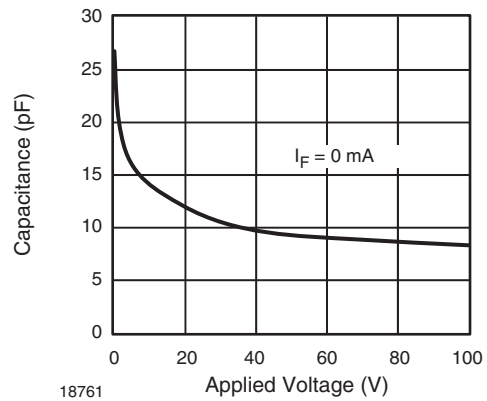


Fig. 14 - Switch Terminal Capacitance vs. Applied Voltage

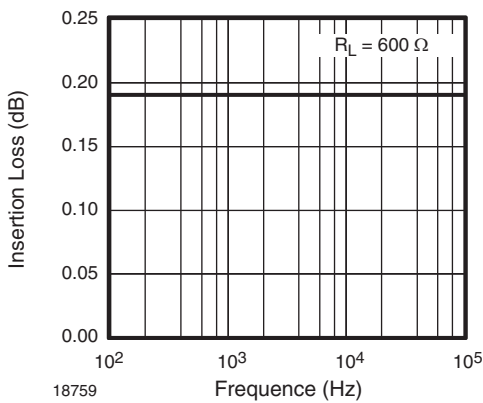


Fig. 12 - Insertion Loss vs. Frequency

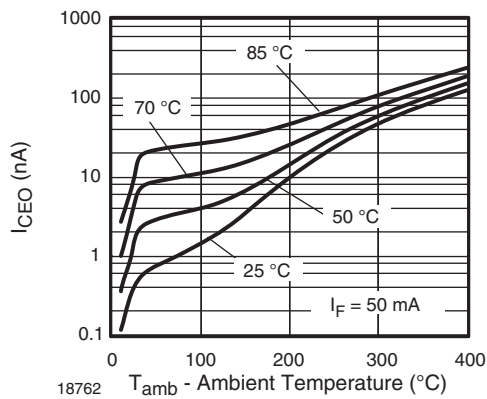


Fig. 15 - Leakage Current vs. Applied Voltage

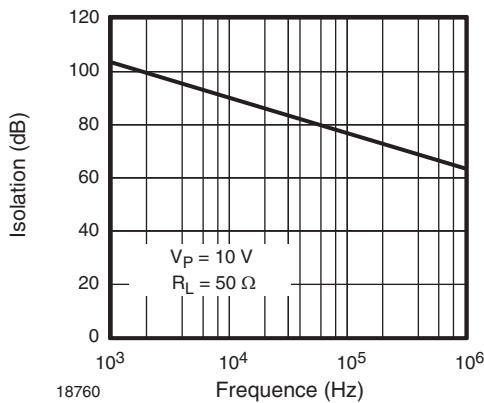


Fig. 13 - Output Isolation

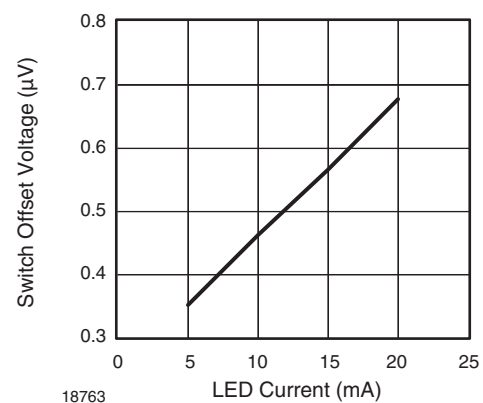


Fig. 16 - Switch Offset Voltage vs. LED Current

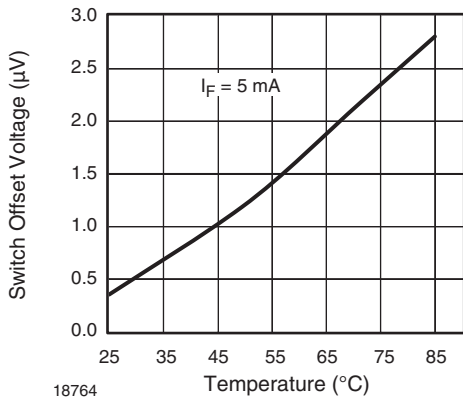


Fig. 17 - Switch Offset Voltage vs. Temperature

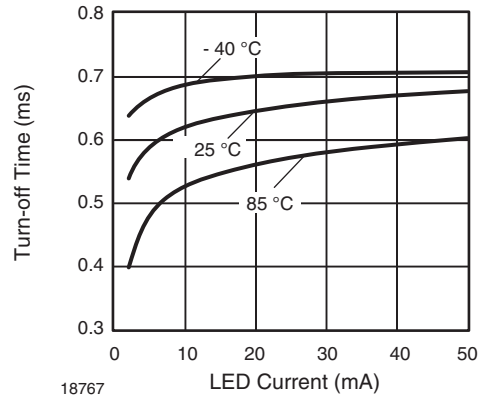


Fig. 20 - Turn-off Time vs. LED Current

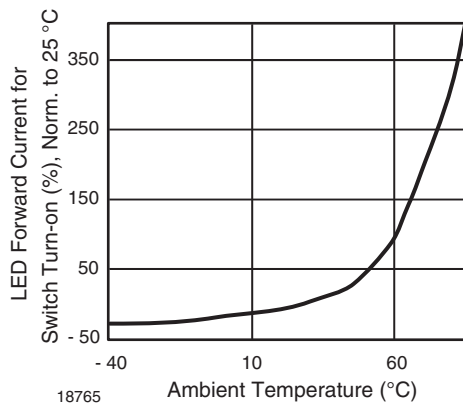


Fig. 18 - LED Current for Switch Turn-on vs. Temperature

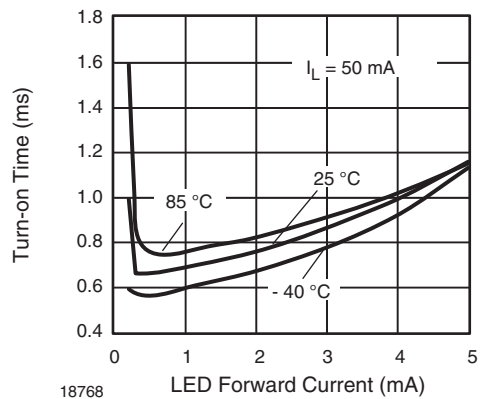


Fig. 21 - Turn-on Time vs. LED Current

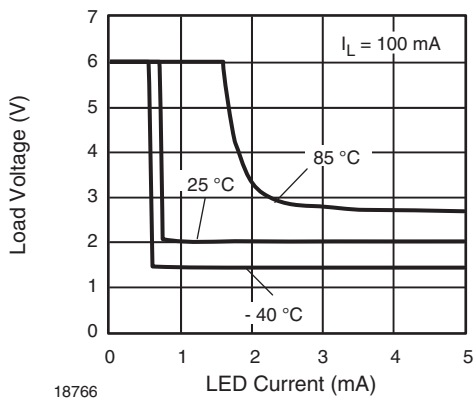


Fig. 19 - LED Current vs. Load Voltage

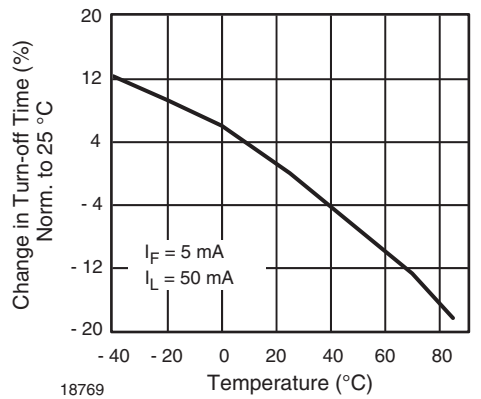


Fig. 22 - Turn-off Time vs. Temperature

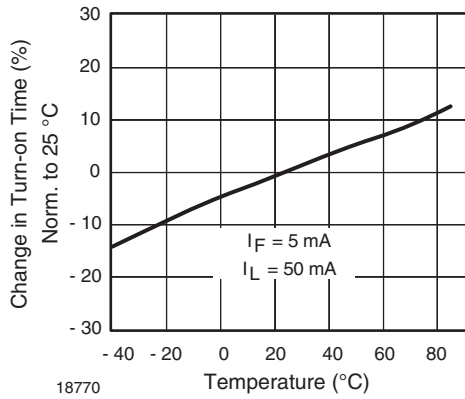
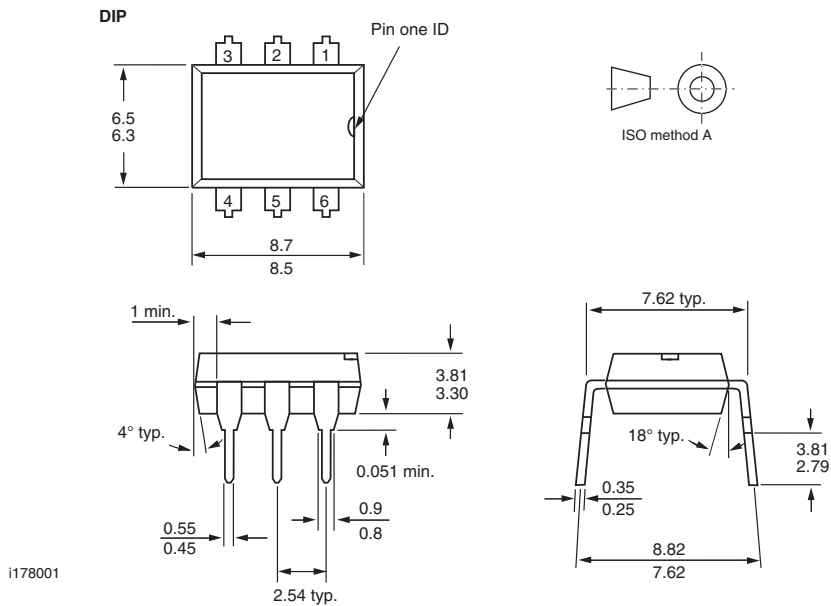


Fig. 23 - Turn-on Time vs. Temperature

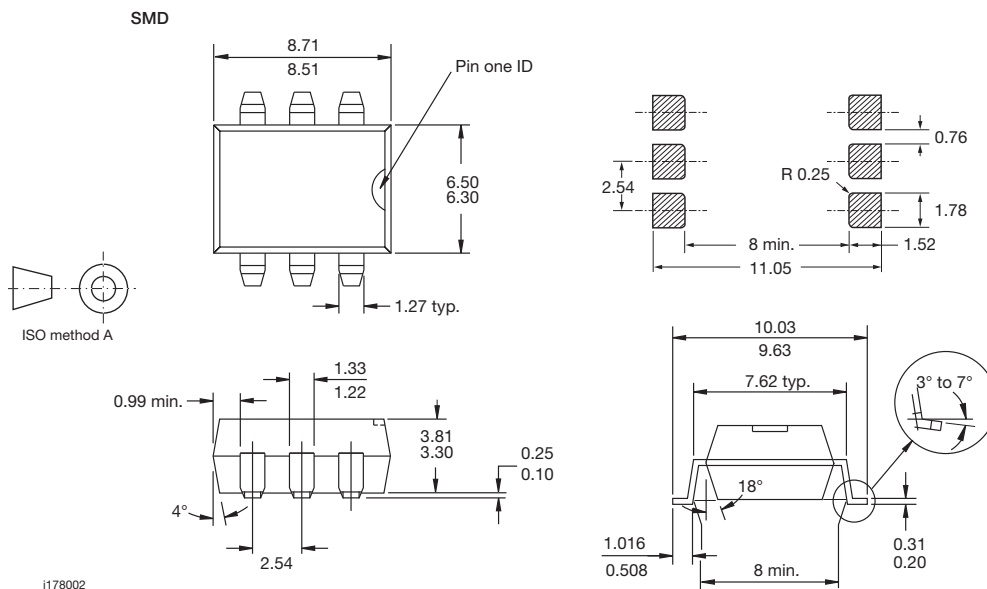
## PACKAGE DIMENSIONS in millimeters



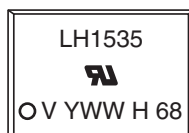
# LH1535AAB, LH1535AABTR, LH1535AT

Vishay Semiconductors

1 Form A Solid State Relay



## PACKAGE MARKING



### Note

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





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