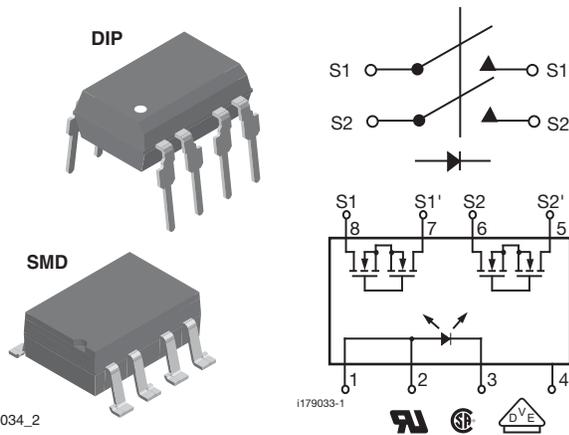


## 2 Form A Solid-State Relay



### FEATURES

- Current limit protection
- Isolation test voltage 5300 V<sub>RMS</sub>
- Typical R<sub>ON</sub> 10 Ω
- Load voltage 200 V
- Load current 140 mA
- High surge capability
- Clean bounce free switching
- Low power consumption
- High reliability monolithic output die
- 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 LH1513 relays are DPST normally open switches (2 form A) that can replace electromechanical relays in many applications. The relays are 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 DMOS switches. In addition, these relays employ current-limiting circuitry, enabling them to pass lightning surge testing as per ANSI/TIA-968-B and other regulatory voltage surge requirements when overvoltage protection is provided.

### APPLICATIONS

- General telecom switching
  - On/off hook control
  - Ring delay
  - Dial pulse
  - Ground start
  - Ground fault protection
- Instrumentation
- Industrial controls

### AGENCY APPROVALS

UL1577: file no. E52744 system code H, double protection  
 CSA: certification no. 093751  
 DIN EN: 60747-5-2 (VDE 0884)/60747-5-5 (pending), available with option 1

| ORDERING INFORMATION |   |   |   |   |   |                   |                 |               |   |   |  |  |
|----------------------|---|---|---|---|---|-------------------|-----------------|---------------|---|---|--|--|
| L                    | H | 1 | 5 | 1 | 3 | A                 | #               | #             | T | R |  |  |
| PART NUMBER          |   |   |   |   |   | ELECTR. VARIATION | PACKAGE CONFIG. | TAPE AND REEL |   |   |  |  |
| <b>PACKAGE</b>       |   |   |   |   |   | <b>UL, CSA</b>    |                 |               |   |   |  |  |
| SMD-8, tubes         |   |   |   |   |   | LH1513AAC         |                 |               |   |   |  |  |
| SMD-8, tape and reel |   |   |   |   |   | LH1513AACTR       |                 |               |   |   |  |  |
| DIP-8, tubes         |   |   |   |   |   | LH1513AB          |                 |               |   |   |  |  |

| ABSOLUTE MAXIMUM RATINGS (T <sub>amb</sub> = 25 °C, unless otherwise specified) |                        |                |       |      |
|---|------------------------|----------------|-------|------|
| PARAMETER   | TEST CONDITION         | SYMBOL         | VALUE | UNIT |
| <b>INPUT</b>  |                        |                |       |      |
| LED continuous forward current  |                        | I <sub>F</sub> | 50    | mA   |
| LED reverse voltage   | I <sub>R</sub> ≤ 10 μA | V <sub>R</sub> | 8     | V    |



| <b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                  |            |               |                    |
|--|----------------------------------|------------|---------------|--------------------|
| PARAMETER  | TEST CONDITION                   | SYMBOL     | VALUE         | UNIT               |
| <b>OUTPUT</b>  |                                  |            |               |                    |
| DC or peak AC load voltage   | $I_L \leq 50\text{ }\mu\text{A}$ | $V_L$      | 200           | V                  |
| Continuous DC load current, one pole operating   |                                  | $I_L$      | 200           | mA                 |
| Continuous DC load current two poles operating   |                                  | $I_L$      | 140           | mA                 |
| Peak load current (single shot)  | $t = 100\text{ ms}$              | $I_P$      | (1)           |                    |
| <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 voltage  |                                  | $V_{ISO}$  | 5300          | $V_{RMS}$          |
| Pole-to-pole isolation voltage (S1 to S2)  |                                  |            | 500           | V                  |
| Output power dissipation (continuous)  |                                  | $P_{diss}$ | 600           | 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).

| <b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |  |            |      |      |      |                |
|--|--|------------|------|------|------|----------------|
| PARAMETER  | TEST CONDITION   | SYMBOL     | MIN. | TYP. | MAX. | UNIT           |
| <b>INPUT</b>   |  |            |      |      |      |                |
| LED forward current, switch turn-on  | $I_L = 100\text{ mA}$ , $t = 10\text{ ms}$                       | $I_{Fon}$  |      | 2    | 3    | mA             |
| LED forward current, switch turn-off   | $V_L = \pm 150\text{ V}$   | $I_{Foff}$ | 0.2  | 0.8  |      | mA             |
| LED forward voltage  | $I_F = 10\text{ mA}$   | $V_F$      | 1.15 | 1.26 | 1.45 | V              |
| <b>OUTPUT</b>  |  |            |      |      |      |                |
| On-resistance  | $I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$                       | $R_{ON}$   | 6    | 10   | 15   | $\Omega$       |
| Pole-to-pole on-resistance matching (S1 to S2)   | $I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$                       |            |      | 0.1  | 1    | $\Delta\Omega$ |
| Off-resistance   | $I_F = 0\text{ mA}$ , $V_L = \pm 100\text{ V}$                   | $R_{OFF}$  | 0.5  | 5000 |      | $G\Omega$      |
| Current limit  | $I_F = 5\text{ mA}$ , $t = 5\text{ ms}$ , $V_L = \pm 5\text{ V}$ | $I_{LMT}$  | 300  | 360  | 460  | mA             |
| Off-state leakage current  | $I_F = 0\text{ mA}$ , $V_L = \pm 100\text{ V}$                   | $I_O$      |      | 0.02 | 200  | nA             |
|  | $I_F = 0\text{ mA}$ , $V_L = \pm 200\text{ V}$                   | $I_O$      |      |      | 1    | $\mu\text{A}$  |
| Output capacitance   | $I_F = 0\text{ mA}$ , $V_L = 1\text{ V}$                         | $C_O$      |      | 60   |      | pF             |
|  | $I_F = 0\text{ mA}$ , $V_L = 50\text{ V}$                        | $C_O$      |      | 15   |      | pF             |
| Pole-to-pole capacitance (S1 to S2)  | $I_F = 0\text{ mA}$  |            |      | 3    |      | pF             |
|  | $I_F = 5\text{ mA}$  |            |      | 4    |      | pF             |
| Switch offset  | $I_F = 5\text{ mA}$  | $V_{OS}$   |      | 0.15 |      | $\mu\text{V}$  |
| <b>TRANSFER</b>  |  |            |      |      |      |                |
| Capacitance (input to output)  | $V_{ISO} = 1\text{ V}$   | $C_{IO}$   |      | 1.1  |      | pF             |

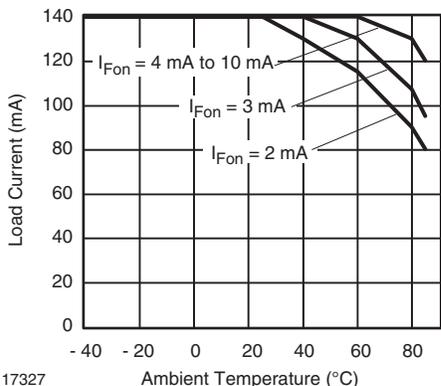
**Note**

- 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.

| <b>SWITCHING CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |   |           |      |      |      |      |
|---|---|-----------|------|------|------|------|
| PARAMETER   | TEST CONDITION                              | SYMBOL    | MIN. | TYP. | MAX. | UNIT |
| Turn-on time (NO)   | $I_F = 10\text{ mA}$ , $I_L = 50\text{ mA}$ | $t_{on}$  |      | 1.6  | 2.5  | ms   |
| Turn-off time (NO)  | $I_F = 10\text{ mA}$ , $I_L = 50\text{ mA}$ | $t_{off}$ |      | 0.65 | 2.5  | ms   |

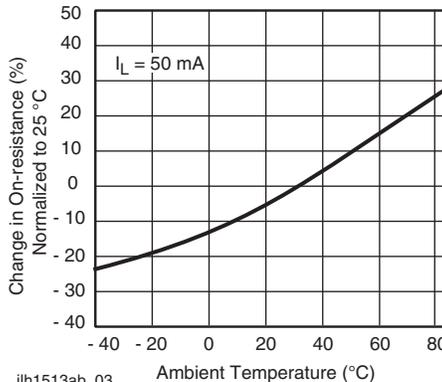


## TYPICAL CHARACTERISTICS (T<sub>amb</sub> = 25 °C, unless otherwise specified)



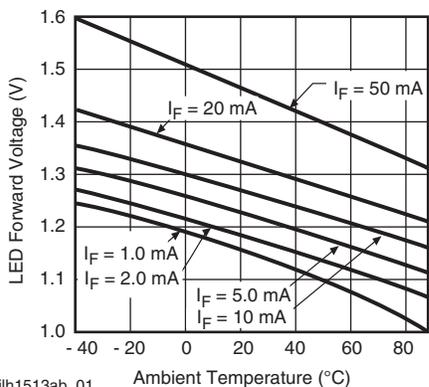
17327

Fig. 1 - Recommended Operating Conditions



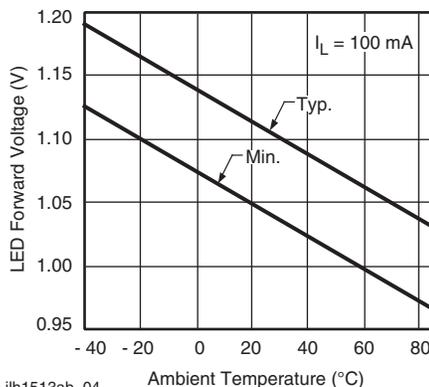
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Fig. 4 - On-Resistance vs. Temperature



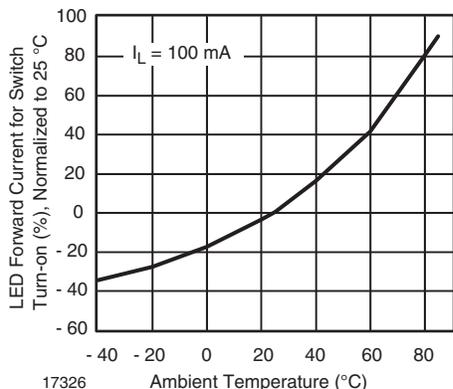
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Fig. 2 - LED Voltage vs. Temperature



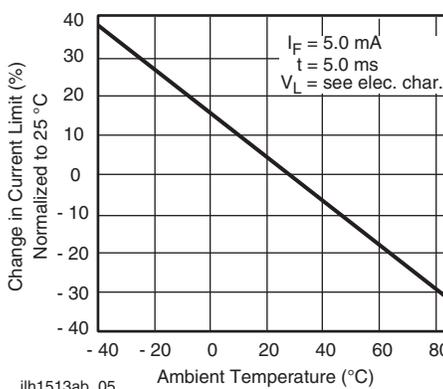
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Fig. 5 - LED Dropout Voltage vs. Temperature



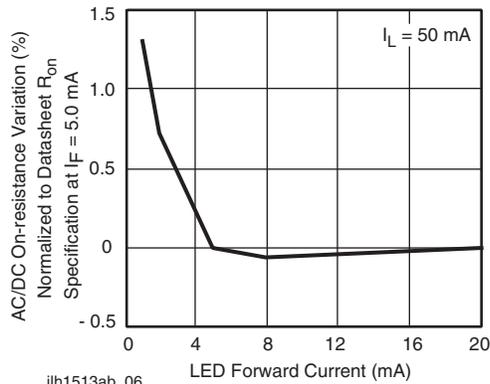
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Fig. 3 - LED Current for Switch Turn-on vs. Temperature



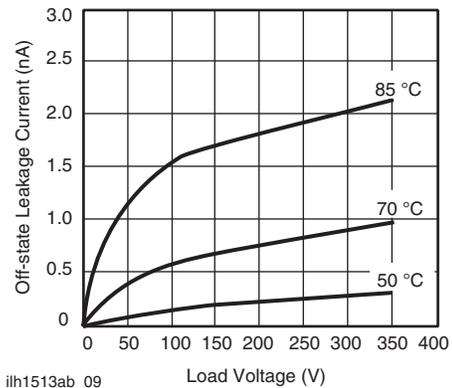
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Fig. 6 - Current Limit vs. Temperature



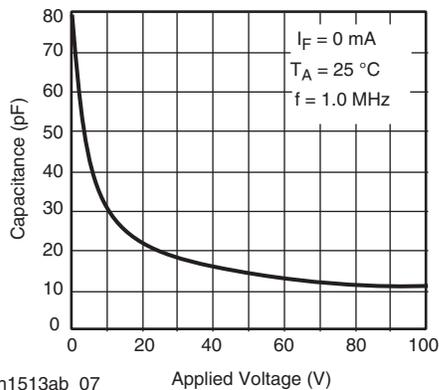
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Fig. 7 - Variation in On-Resistance vs. LED Current



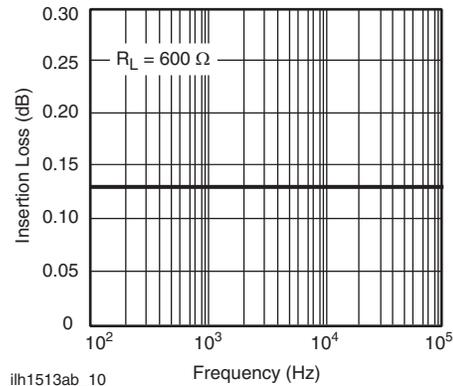
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Fig. 10 - Leakage Current vs. Applied Voltage at Elevated Temperatures



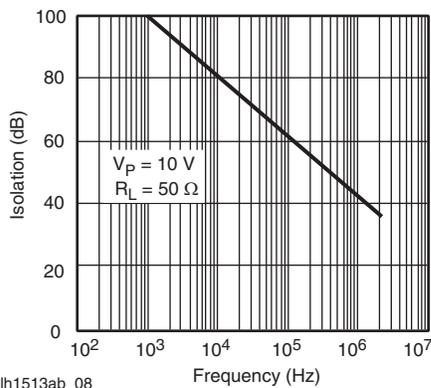
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Fig. 8 - Switch Capacitance vs. Applied Voltage



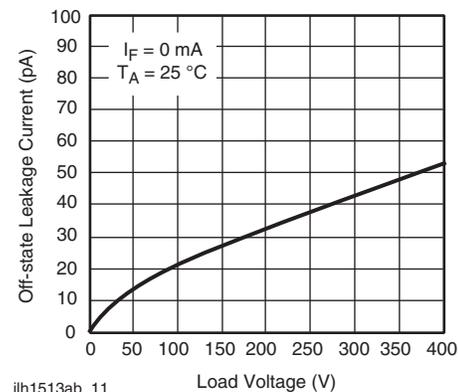
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Fig. 11 - Insertion Loss vs. Frequency



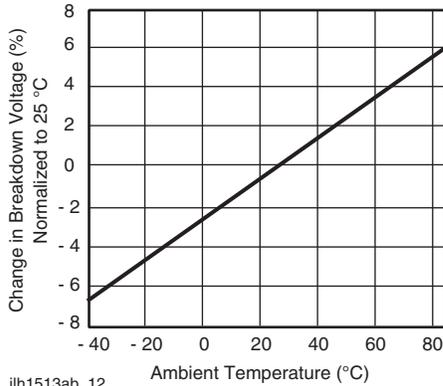
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Fig. 9 - Output Isolation



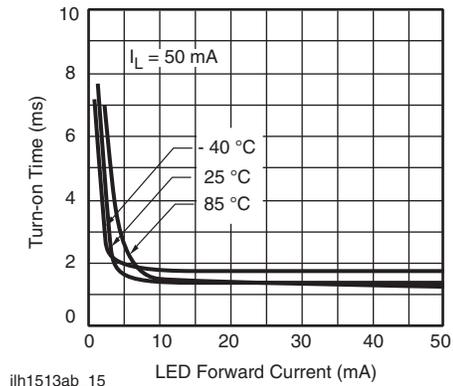
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Fig. 12 - Leakage Current vs. Applied Voltage



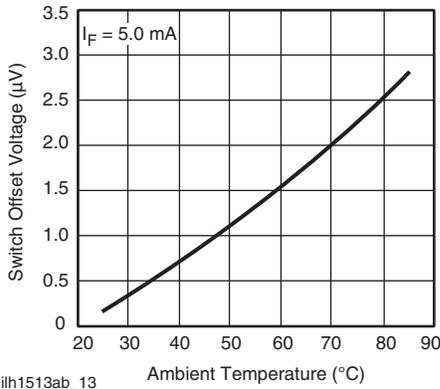
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Fig. 13 - Switch Breakdown Voltage vs. Temperature



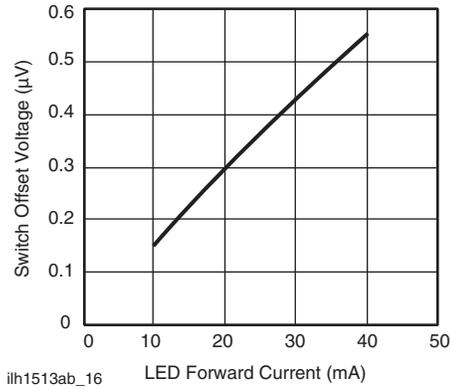
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Fig. 16 - Turn-on Time vs. LED Current



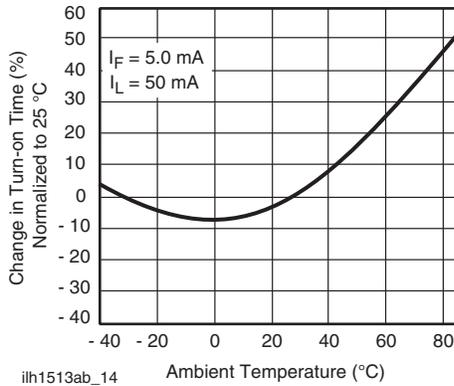
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Fig. 14 - Switch Offset Voltage vs. Temperature



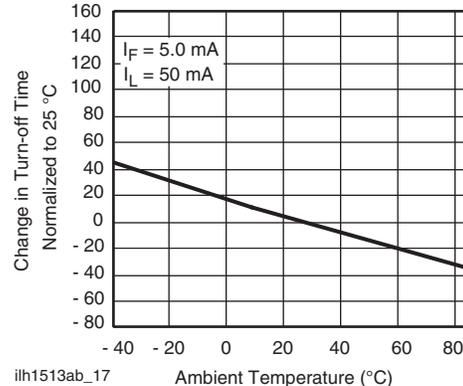
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Fig. 17 - Switch Offset Voltage vs. LED Current



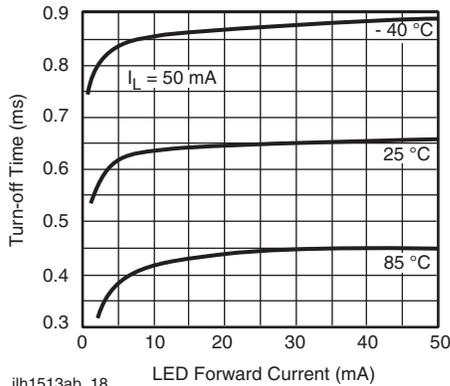
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Fig. 15 - Turn-on Time vs. Temperature



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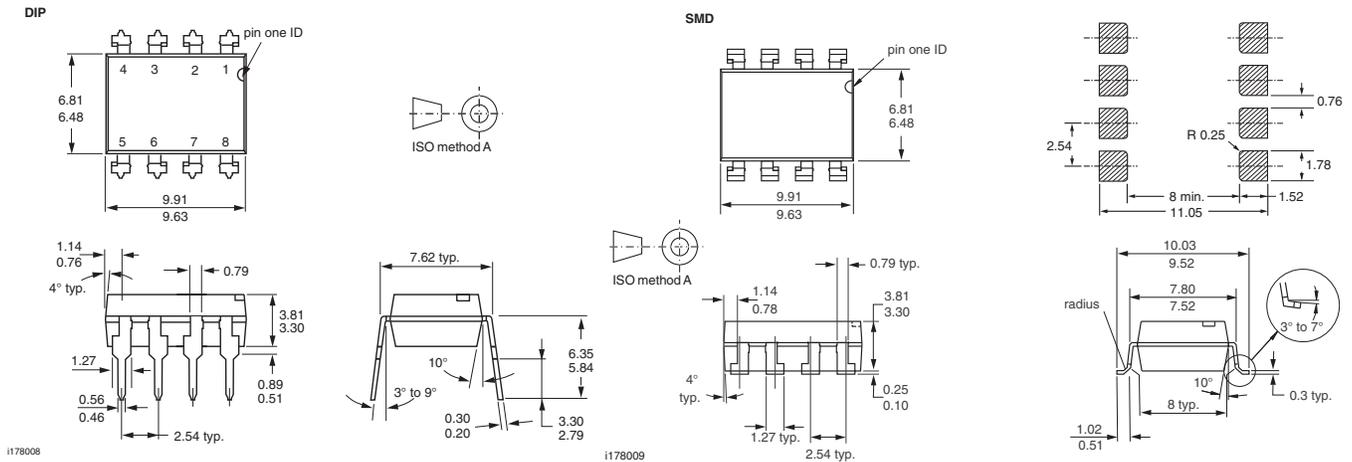
Fig. 18 - Turn-off Time vs. Temperature



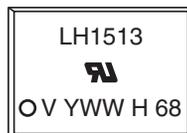
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Fig. 19 - Turn-off Time vs. LED Current

## PACKAGE DIMENSIONS in millimeters



## PACKAGE MARKING (example)



### Note

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



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