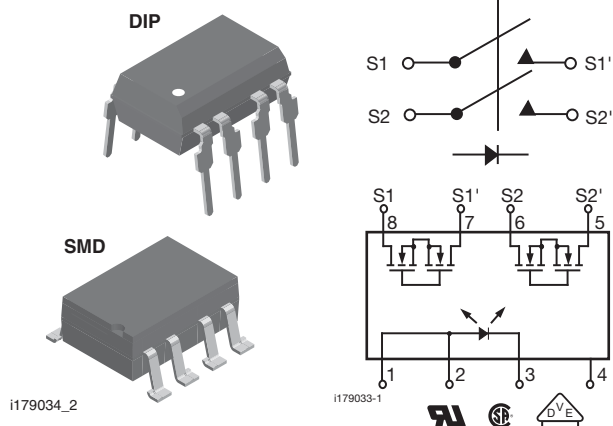


## 2 Form A Solid-State Relay



### FEATURES

- Current limit protection
- Isolation test voltage 5300 V<sub>RMS</sub>
- Typical R<sub>ON</sub> 20 Ω
- Load voltage 350 V
- Load current 110 mA
- High surge capability
- Clean bounce free switching
- Low power consumption
- High reliability monolithic receptor
- 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 LH1503 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

|                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |  |  |  |                |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|----------------|--|--|--|--|--|
| <div><div><div>L</div><div>H</div><div>1</div><div>5</div><div>0</div><div>3</div></div><div>PART NUMBER</div></div> <div><div>A</div><div>#</div><div>#</div><div>ELECTR. VARIATION</div></div> <div><div>T</div><div>R</div><div>PACKAGE CONFIG.</div></div> <div><div>TAPE AND REEL</div></div> <div><div>DIP</div><div></div><div>7.62 mm</div></div> <div><div>SMD</div><div></div><div>&gt; 0.1 mm</div></div> |  |  |  |  |  |                |  |  |  |  |  |
| <b>PACKAGE</b>                                                                                                                                                                                                                                                                                                                                                                                                       |  |  |  |  |  | <b>UL, CSA</b> |  |  |  |  |  |
| SMD-8, tubes                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |  |  |  | LH1503AAC      |  |  |  |  |  |
| SMD-8, tape and reel                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |  |  |  | LH1503AACTR    |  |  |  |  |  |
| DIP-8, tubes                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |  |  |  | LH1503AB       |  |  |  |  |  |



| <b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , 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                                                                             | $I_L \leq 50\text{ }\mu\text{A}$ | $V_L$      | 350           | V                  |
| Continuous DC load current one pole operating                                                          |                                  | $I_L$      | 150           | mA                 |
| Continuous DC load current two poles operating                                                         |                                  | $I_L$      | 110           | 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                                                                     | $V_L = \pm 300\text{ V}$                                         | $I_{Foff}$ | 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                                                                                            | $I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$                       | $R_{ON}$   | 12   | 20   | 25   | $\Omega$       |
| Pole-to-pole on-resistance matching (S1 to S2)                                                           | $I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$                       |            |      | 0.2  | 2    | $\Delta\Omega$ |
| Off-resistance                                                                                           | $I_F = 0\text{ mA}$ , $V_L = \pm 100\text{ V}$                   | $R_{OFF}$  | 0.5  | 5000 |      | $G\Omega$      |
| Current limit                                                                                            | $I_F = 5\text{ mA}$ , $t = 5\text{ ms}$ , $V_L = \pm 6\text{ V}$ | $I_{LMT}$  | 230  | 270  | 370  | mA             |
| Off-state leakage current                                                                                | $I_F = 0\text{ mA}$ , $V_L = \pm 100\text{ V}$                   | $I_O$      |      | 0.02 | 200  | nA             |
|                                                                                                          | $I_F = 0\text{ mA}$ , $V_L = \pm 350\text{ V}$                   | $I_O$      |      |      | 1    | $\mu\text{A}$  |
| Output capacitance                                                                                       | $I_F = 0\text{ mA}$ , $V_L = 1\text{ V}$                         | $C_O$      |      | 55   |      | pF             |
|                                                                                                          | $I_F = 0\text{ mA}$ , $V_L = 50\text{ V}$                        | $C_O$      |      | 10   |      | 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)                                                                            | $V_{ISO}$                                                        | $C_{ISO}$  |      | 1.1  |      | pF             |

**Note**

- 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.

| <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                                                                                            | $I_F = 10\text{ mA}$ , $I_L = 50\text{ mA}$ | $t_{on}$  |      | 1.6  | 2.5  | ms   |
| Turn-off time                                                                                           | $I_F = 10\text{ mA}$ , $I_L = 50\text{ mA}$ | $t_{off}$ |      | 0.65 | 2.5  | ms   |



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

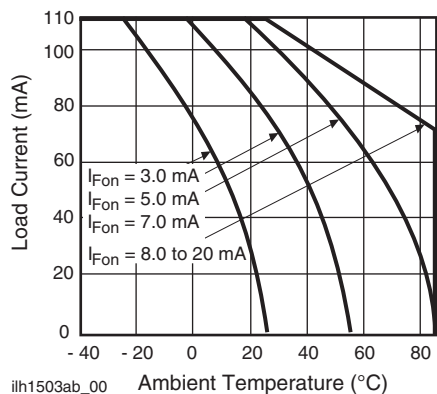


Fig. 1 - Recommended Operating Conditions

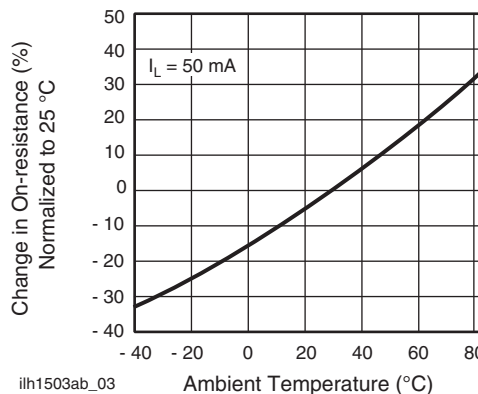


Fig. 4 - On-Resistance vs. Temperature

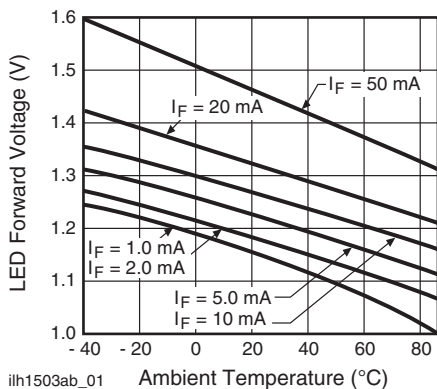


Fig. 2 - LED Voltage vs. Temperature

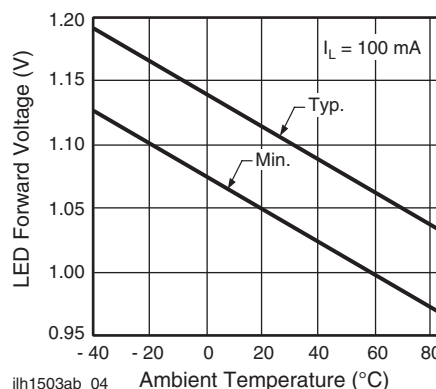


Fig. 5 - LED Dropout Voltage vs. Temperature

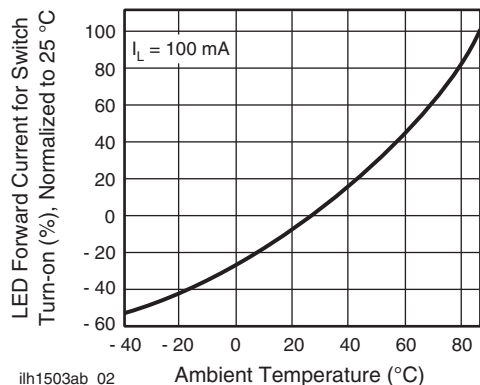


Fig. 3 - LED Current for Switch Turn-on vs. Temperature

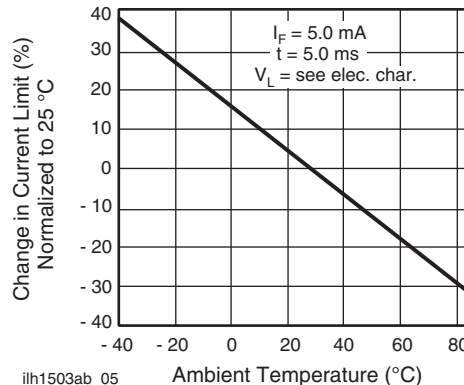


Fig. 6 - Current Limit vs. Temperature

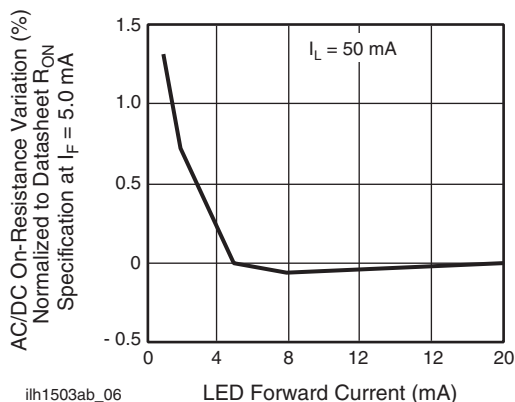


Fig. 7 - Variation in On-Resistance vs. LED Current

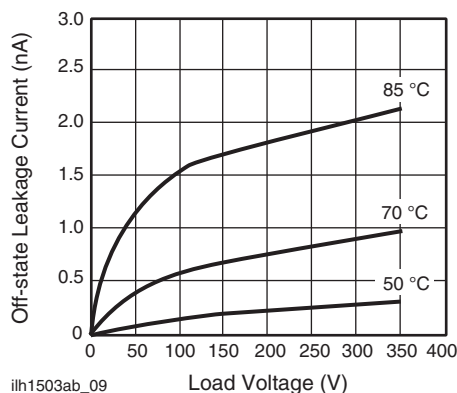


Fig. 10 - Leakage Current vs. Applied Voltage at Elevated Temperatures

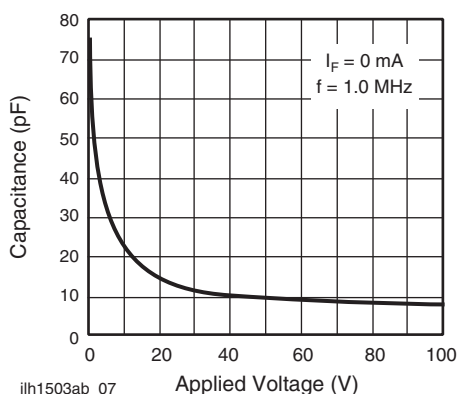


Fig. 8 - Switch Capacitance vs. Applied Voltage

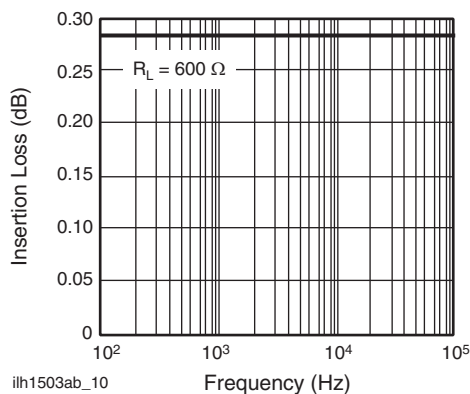


Fig. 11 - Insertion Loss vs. Frequency

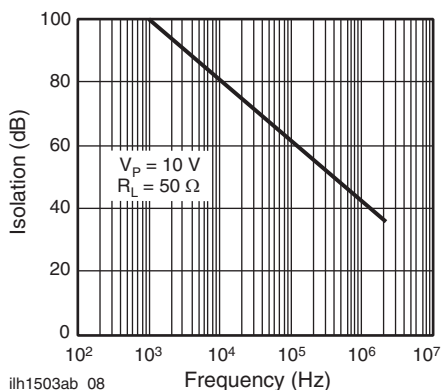


Fig. 9 - Output Isolation

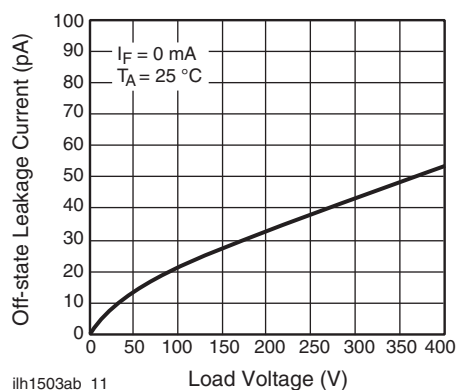


Fig. 12 - Leakage Current vs. Applied Voltage

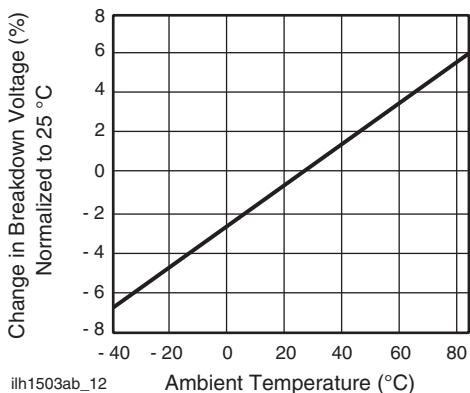


Fig. 13 - Switch Breakdown Voltage vs. Temperature

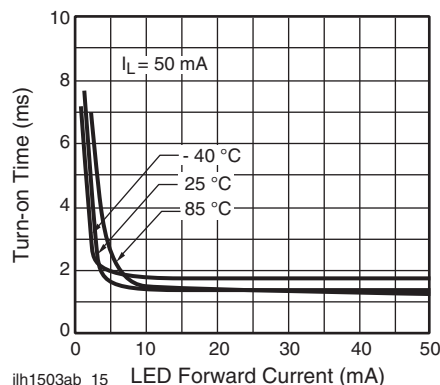


Fig. 16 - Turn-on Time vs. LED Current

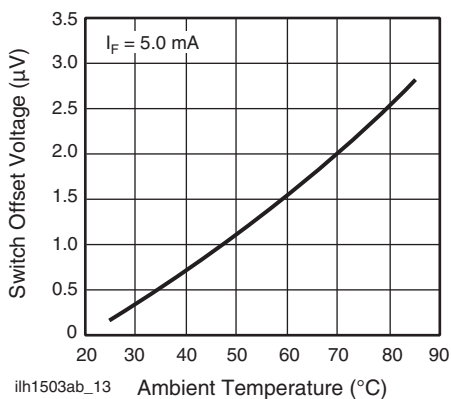


Fig. 14 - Switch Offset Voltage vs. Temperature

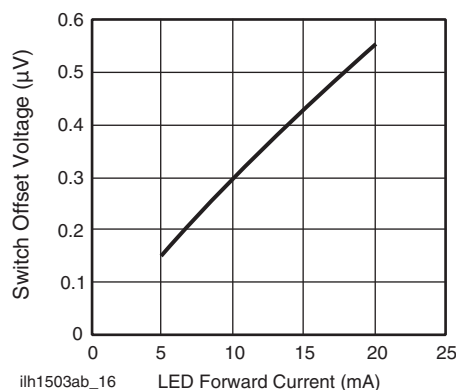


Fig. 17 - Switch Offset Voltage vs. LED Current

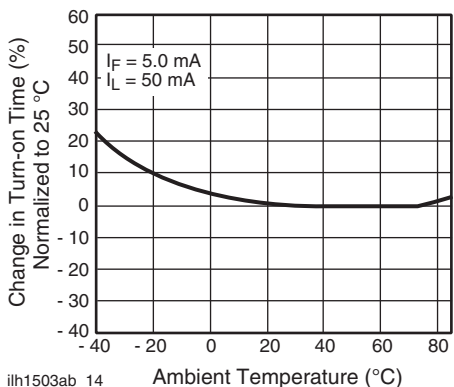


Fig. 15 - Turn-on Time vs. Temperature

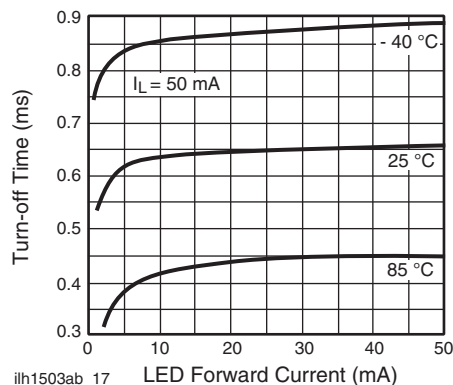
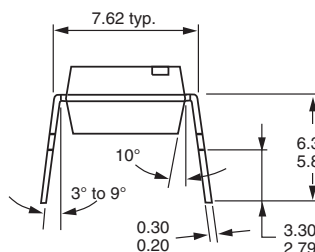
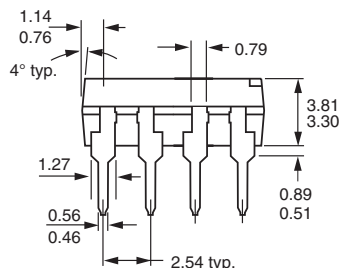
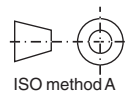
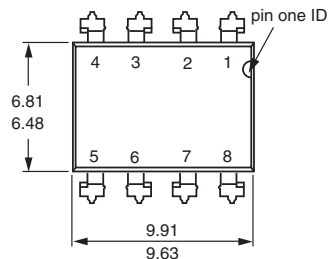


Fig. 18 - Turn-off Time vs. Temperature



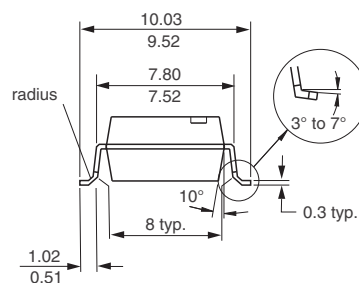
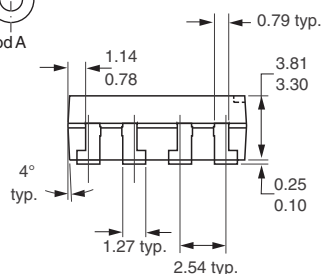
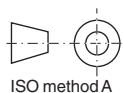
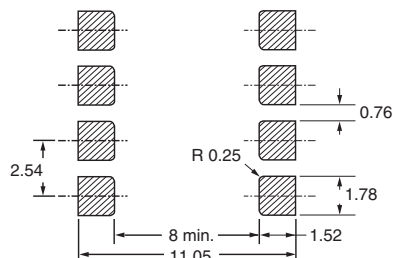
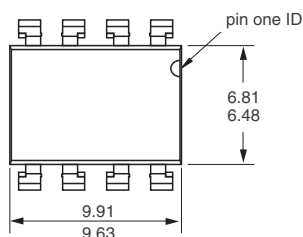
## PACKAGE DIMENSIONS in millimeters

### DIP



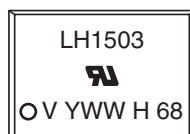
i178008

### SMD



i178009

## PACKAGE MARKING (example)



### Note

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



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