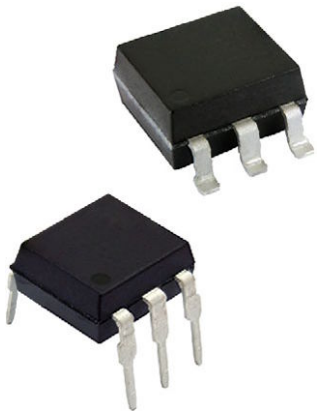
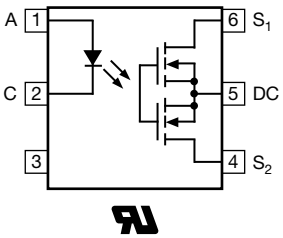
## 1 Form A Solid-State Relay (Normally Open)






### FEATURES

- Low operating current
- High speed operation
- Isolation test voltage 5300 $V_{RMS}$
- Current limit protection
- DC only option
- Clean bounce free switching
- Low power consumption
- Surface mountable
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT
HALOGEN FREE
GREEN (5-2008)

### LINKS TO ADDITIONAL RESOURCES

Related Documents | 3D Models | Models | Footprints | Schematics

### DESCRIPTION

The LH1525 relay are SPST normally open switches (1 Form A) that can replace electromechanical relays in many applications. The relay requires a minimal amount of LED drive current to operate, making it ideal for battery powered and power consumption sensitive applications. The relay is constructed using a GaAlAs LED for actuation control and MOSFETs for the switching output. The relay employs current-limiting circuitry and can be configured for AC/DC or DC-only operation.

### APPLICATIONS

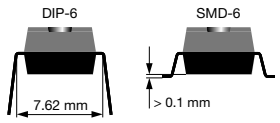
- General telecom switching
- Battery powered switch applications
- Industrial controls
- Programmable controllers
- Instrumentation

### AGENCY APPROVALS

- UL
- cUL
- VDE

### ORDERING INFORMATION

| L | H | 1 | 5 | 2 | 5 | # | # | # | T | R |
|---|---|---|---|---|---|---|---|---|---|---|
| PART NUMBER | | | | | | ELECTR. VARIATION | PACKAGE CONFIG. | | TAPE AND REEL | |




| PACKAGE | UL |
|---|---|
| SMD-6, tube | LH1525AAB |
| SMD-6, tape and reel | LH1525AABTR |
| DIP-6, tube | LH1525AT |

| **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 | | $V_L$ | 400 | V |
| Continuous load current (AC/DC configuration) | | $I_L$ | 125 | 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 | $I_{Fon}$ | - | - | 0.9 | mA |
| IRED forward current, switch turn-off | $V_L$ = 350 V | $I_{Foff}$ | 0.001 | 0.15 | - | mA |
| IRED forward voltage | $I_F$ = 1.5 mA | $V_F$ | 0.8 | 1.28 | 1.4 | V |
| **OUTPUT** | | | | | | |
| On-resistance (AC/DC configuration) | $I_F$ = 1.5 mA, $I_L$ = 50 mA | $R_{ON}$ | - | 22 | 36 | Ω |
| On-resistance (DC only configuration) | $I_F$ = 5 mA, $I_L$ = 100 mA | $R_{ON}$ | - | 5 | 8.25 | 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, $V_L$ = ± 400 V | $I_O$ | - | 6 | 1000 | nA |
| Output capacitance (AC/DC configuration) | $I_F$ = 0 mA, $V_L$ = 1 V, f = 1 MHz | $C_O$ | - | 39 | - | pF |
| | $I_F$ = 0 mA, $V_L$ = 50 V, f = 1 MHz | $C_O$ | - | 6 | - | pF |
| Current limit (AC/DC configuration) (1) | $I_F$ = 1.5 mA, t = 5 ms, $V_L$ = ± 6 V | $I_{limit}$ | 170 | 350 | 450 | mA |
| **TRANSFER** | | | | | | |
| Capacitance (input to output) | $V_{IO}$ = 1 V, f = 1 MHz | $C_{IO}$ | - | 0.7 | - | 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

## PIN CONFIGURATION

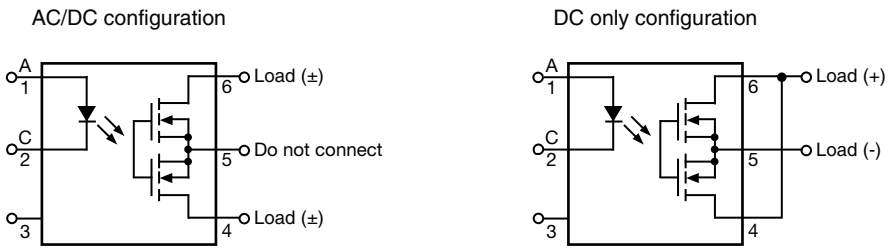



Fig. 1 - Pin Configuration

| SWITCHING CHARACTERISTICS ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Turn-on time | $I_F$ = 1.5 mA, $I_L$ = 50 mA, $R_L$ = 1 kΩ | $t_{on}$ | - | 0.6 | - | ms |
| | $I_F$ = 5 mA, $I_L$ = 50 mA, $R_L$ = 1 kΩ | $t_{on}$ | - | 0.15 | 1 | ms |
| Turn-off time | $I_F$ = 1.5 mA, $I_L$ = 50 mA, $R_L$ = 1 kΩ | $t_{off}$ | - | 0.04 | - | ms |
| | $I_F$ = 5 mA, $I_L$ = 50 mA, $R_L$ = 1 kΩ | $t_{off}$ | - | 0.05 | 1.5 | ms |

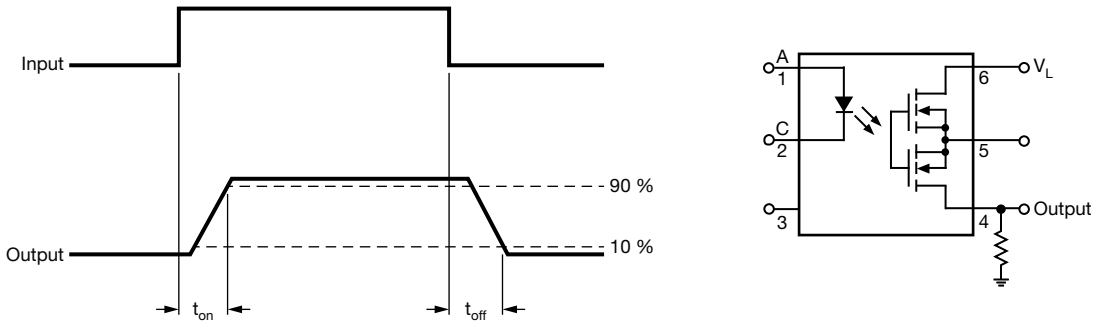



Fig. 2 - Timing Schematic

| 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 | $R_{IO}$ | ≥ $10^{12}$ | Ω |
| | $V_{IO}$ = 500 V, $T_{amb}$ = 100 °C | $R_{IO}$ | ≥ $10^{11}$ | 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

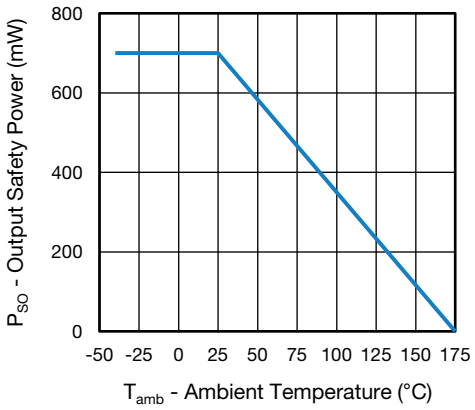



Fig. 3 - Safety Power Dissipation vs. Ambient Temperature

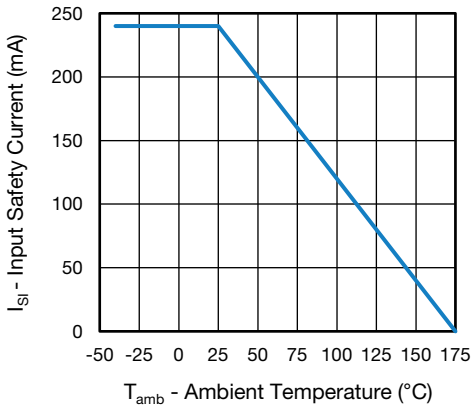



Fig. 4 - Safety Input Current vs. Ambient Temperature

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

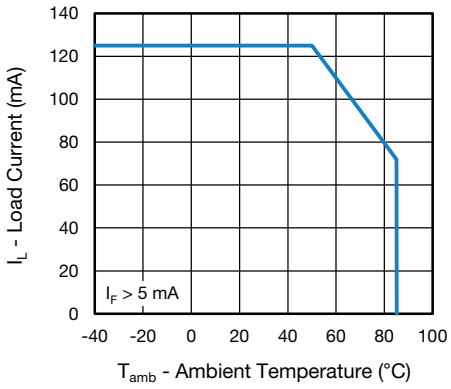



Fig. 5 - Maximum Load Current vs. Ambient Temperature

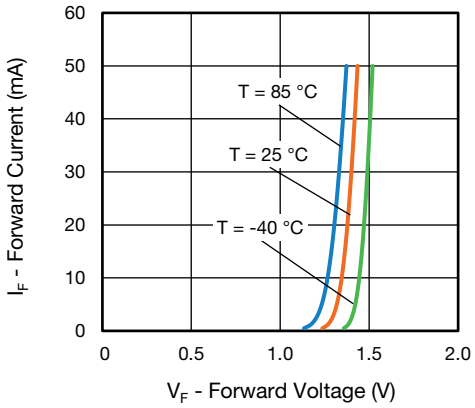



Fig. 7 - Forward Current vs. Forward Voltage

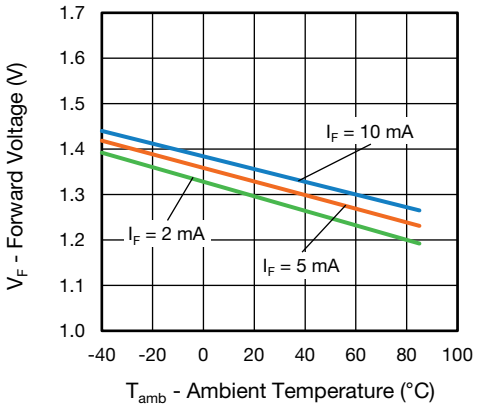



Fig. 6 - Forward Voltage vs. Ambient Temperature

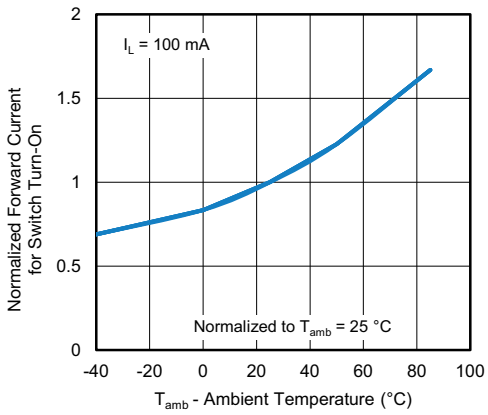



Fig. 8 - Normalized Forward Current for Switch Turn-On vs. Ambient Temperature

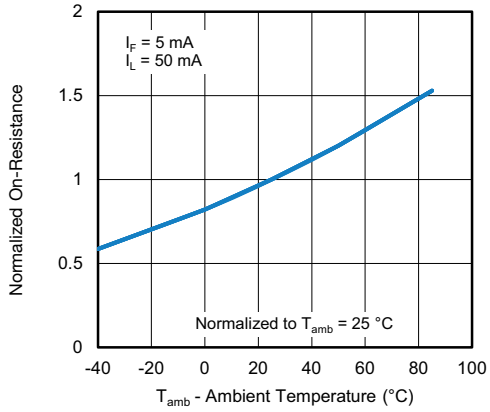



Fig. 9 - Normalized On-Resistance vs. Ambient Temperature

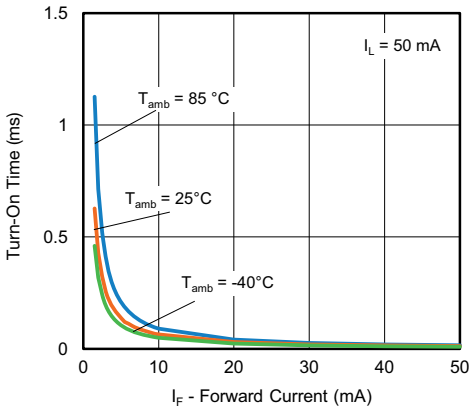



Fig. 12 - Turn-On Time vs. Forward Current

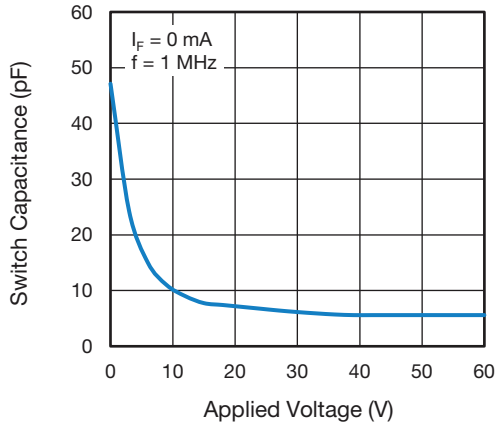



Fig. 10 - Switch Capacitance vs. Applied Voltage

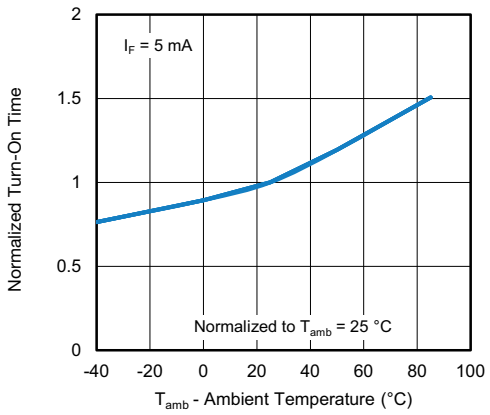



Fig. 13 - Normalized Turn-On Time vs. Ambient Temperature

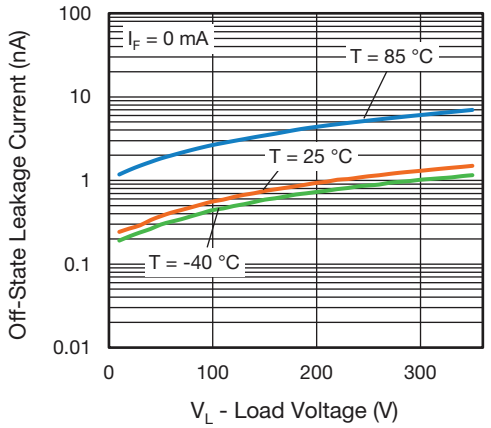



Fig. 11 - Off-State Leakage Current vs. Load Voltage

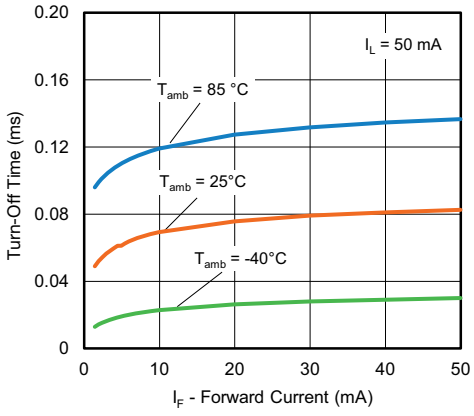



Fig. 14 - Turn-Off Time vs. Forward Current

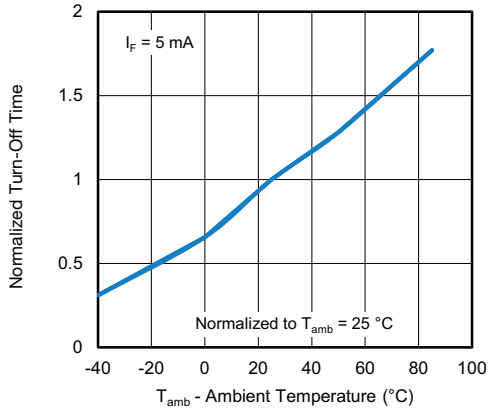
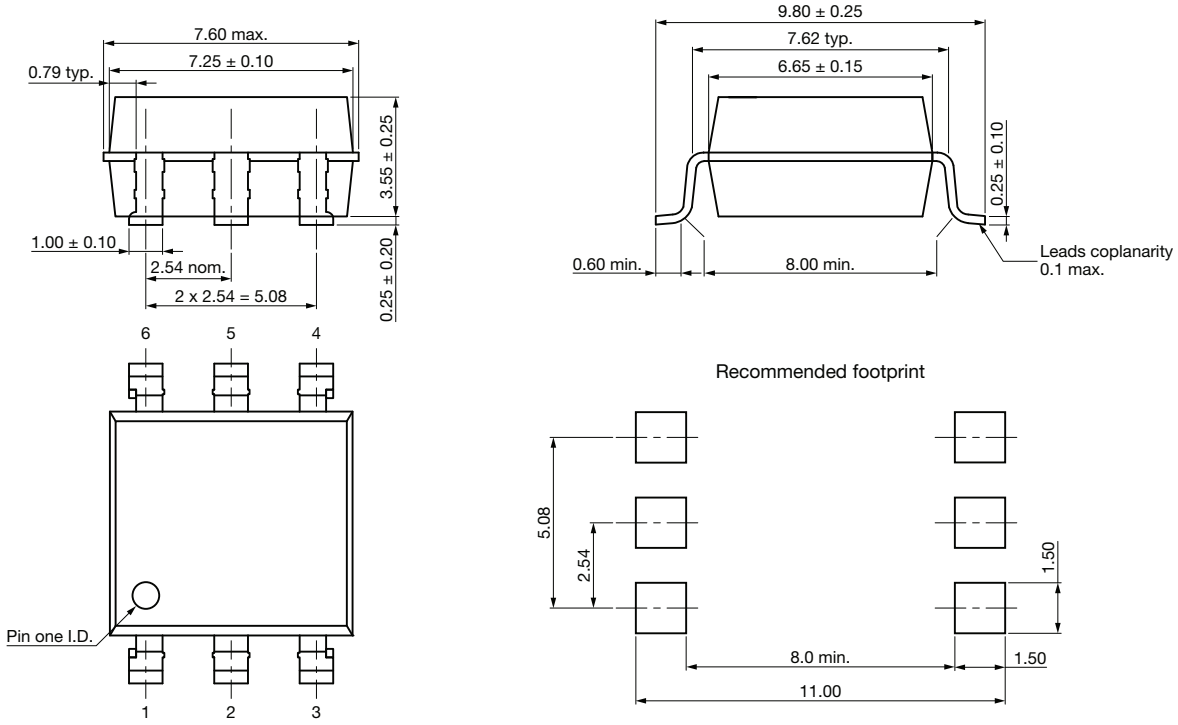



Fig. 15 - Normalized Turn-Off Time vs. Ambient Temperature

## **PACKAGE DIMENSIONS** (in millimeters)

### SMD-6



**DIP-6**

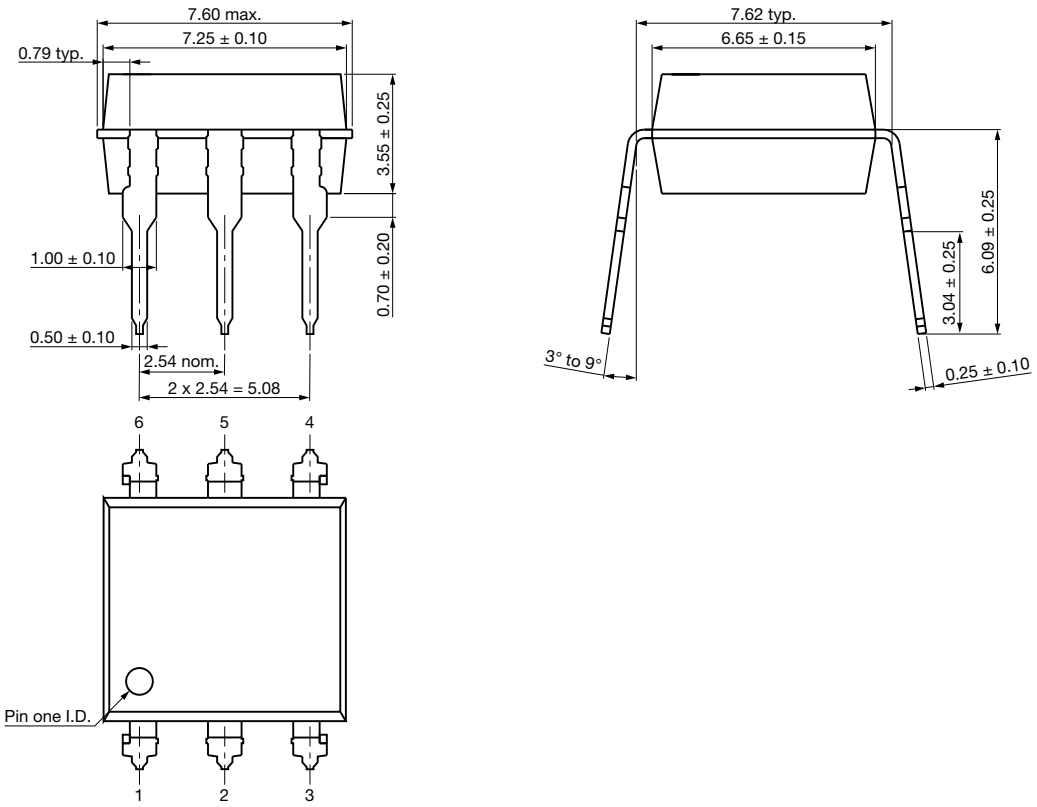



Fig. 16 - Package Drawings

## PACKAGE MARKING

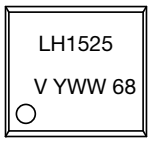
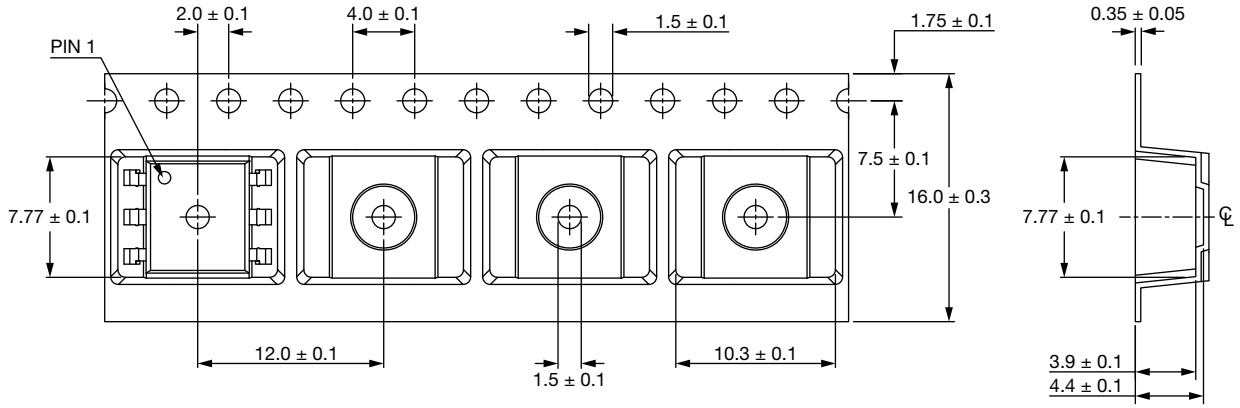



Fig. 17 - LH1525

**Note**

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

## 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

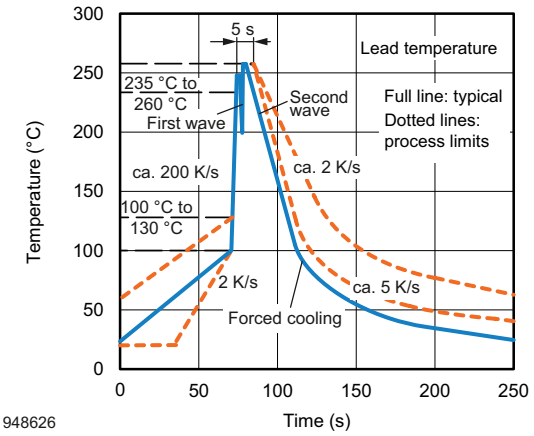



Fig. 19 - Wave Soldering Double Wave Profile
According to J-STD-020 for DIP Devices

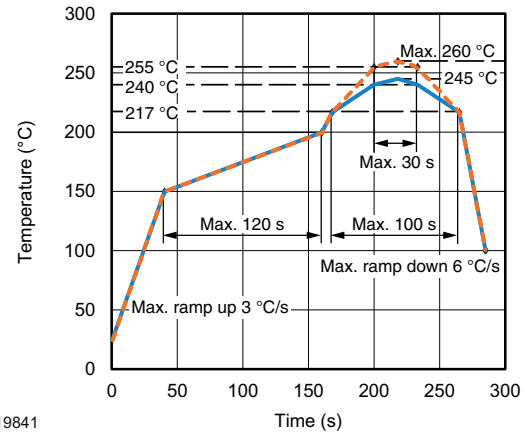



Fig. 20 - Lead (Pb)-free Reflow Solder Profile
According to J-STD-020 for SMD Devices

## 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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