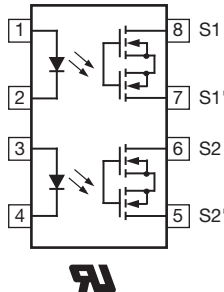
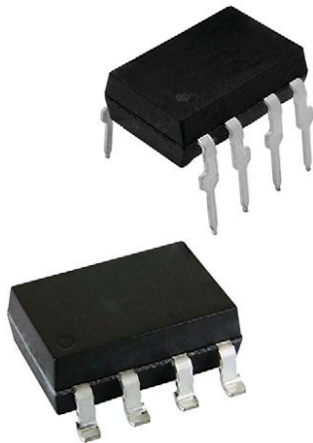


## Dual 1 Form A Solid-State Relay



### FEATURES

- Dual channel
- Current limit protection
- Isolation test voltage 5300 V<sub>RMS</sub>
- Typical R<sub>ON</sub> 22 Ω
- Load voltage 350 V
- Load current 140 mA
- Clean bounce free switching
- Low power consumption
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

### APPLICATIONS

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

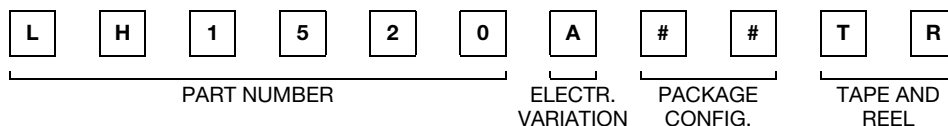
### AGENCY APPROVALS

- UL1577, file no. E52744

### DESCRIPTION

The LH1520 dual 1 Form A relays are SPST normally open switches that can replace electromechanical relays in many applications. They are constructed using a GaAlAs LED for actuation control and MOSFET switches for the output. In addition, the LH1520 SSRs employ current-limiting circuitry to provide overvoltage protection.

### ORDERING INFORMATION



| PACKAGE              | UL          |
|----------------------|-------------|
| SMD-8, tubes         | LH1520AAC   |
| SMD-8, tape and reel | LH1520AACTR |
| DIP-8, tubes         | LH1520AB    |



| ABSOLUTE MAXIMUM RATINGS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                        |            |             |      |
|---|------------------------|------------|-------------|------|
| PARAMETER   | CONDITIONS             | SYMBOL     | VALUE       | UNIT |
| <b>INPUT</b>  |                        |            |             |      |
| IRED continuous forward current   |                        | $I_F$      | 50          | mA   |
| IRED reverse voltage  |                        | $V_R$      | 5           | V    |
| Input power dissipation   |                        | $P_{diss}$ | 80          | mW   |
| <b>OUTPUT</b>   |                        |            |             |      |
| DC or peak AC load voltage  |                        | $V_L$      | 350         | V    |
| Continuous DC load current at 25 °C, one channel  |                        | $I_L$      | 140         | mA   |
| Continuous DC load current at 25 °C, two channels   |                        | $I_L$      | 100         | mA   |
| SSR output power dissipation  |                        | $P_{diss}$ | 550         | mW   |
| <b>SSR</b>  |                        |            |             |      |
| Ambient temperature range   |                        | $T_{amb}$  | -40 to +85  | °C   |
| Storage temperature range   |                        | $T_{stg}$  | -40 to +150 | °C   |
| Soldering temperature   | $t = 10\text{ s max.}$ | $T_{sld}$  | 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 ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |  |             |      |      |      |               |
|---|--|-------------|------|------|------|---------------|
| PARAMETER   | TEST CONDITION   | SYMBOL      | MIN. | TYP. | MAX. | UNIT          |
| <b>INPUT</b>  |  |             |      |      |      |               |
| IRED forward current, switch turn-on  | $I_L = 100\text{ mA}$ , $t = 10\text{ ms}$                       | $I_{Fon}$   | -    | 0.25 | 2    | mA            |
| IRED forward current, switch turn-off   | $V_L = \pm 350\text{ V}$   | $I_{Foff}$  | 0.05 | 0.15 | -    | mA            |
| IRED forward voltage  | $I_F = 10\text{ mA}$   | $V_F$       | -    | 1.36 | 1.5  | V             |
| IRED reverse current  | $V_R = 5\text{ V}$   | $I_R$       | -    | -    | 10   | $\mu\text{A}$ |
| <b>OUTPUT</b>   |  |             |      |      |      |               |
| On-resistance   | $I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$                       | $R_{ON}$    | -    | 22   | 27   | $\Omega$      |
| Off-resistance  | $I_F = 0\text{ mA}$ , $V_L = \pm 100\text{ V}$                   | $R_{OFF}$   | 0.5  | 5000 | -    | G $\Omega$    |
| Off-state leakage current   | $I_F = 0\text{ mA}$ , $V_L = \pm 100\text{ V}$                   | $I_O$       | -    | < 1  | 200  | nA            |
|   | $I_F = 0\text{ mA}$ , $V_L = \pm 350\text{ V}$                   | $I_O$       | -    | 6    | 1000 | nA            |
| Output capacitance  | $I_F = 0\text{ mA}$ , $V_L = 1\text{ V}$ , 1 MHz                 | $C_O$       | -    | 39   | -    | pF            |
|   | $I_F = 0\text{ mA}$ , $V_L = 50\text{ V}$ , 1 MHz                | $C_O$       | -    | 6    | -    | pF            |
| Current limit AC/DC   | $I_F = 5\text{ mA}$ , $t = 5\text{ ms}$ , $V_L = \pm 6\text{ V}$ | $I_{limit}$ | 170  | 300  | 450  | mA            |
| <b>TRANSFER</b>   |  |             |      |      |      |               |
| Capacitance (input to output)   | $V_{IO} = 1\text{ V}$  | $C_{IO}$    | -    | 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

| SWITCHING CHARACTERISTICS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |  |           |      |      |      |      |
|--|--|-----------|------|------|------|------|
| PARAMETER  | TEST CONDITION                             | SYMBOL    | MIN. | TYP. | MAX. | UNIT |
| Turn-on time   | $I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$ | $t_{on}$  | -    | 0.13 | 2    | ms   |
| Turn-off time  | $I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$ | $t_{off}$ | -    | 0.05 | 2    | ms   |

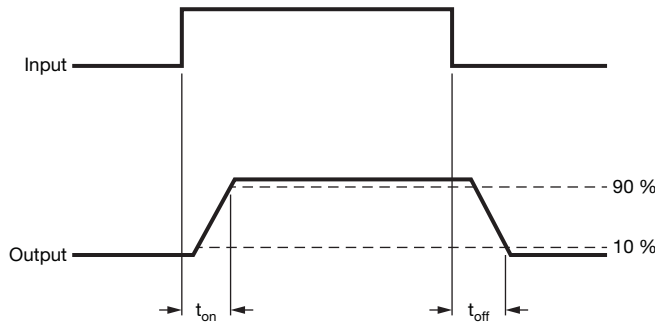
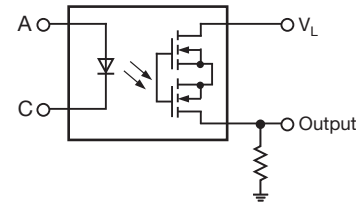


Fig. 1 - Timing Schematic



| 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                         | $V_{IO} = 500\text{ V}, T_{amb} = 25\text{ }^{\circ}\text{C}$  | $R_{IO}$   | $\geq 10^{12}$ | $\Omega$           |
|  | $V_{IO} = 500\text{ V}, T_{amb} = 100\text{ }^{\circ}\text{C}$   | $R_{IO}$   | $\geq 10^{11}$ | $\Omega$           |
| Output safety power                          |  | $P_{SO}$   | 600            | mW                 |
| Input safety current                         |  | $I_{SI}$   | 240            | mA                 |
| Safety temperature                           |  | $T_S$      | 175            | $^{\circ}\text{C}$ |
| Creepage distance                            |  |            | $\geq 7$       | mm                 |
| Clearance distance                           |  |            | $\geq 7$       | mm                 |
| Insulation thickness                         |  | DTI        | $\geq 0.4$     | mm                 |
| Input to output test voltage, method B       | $V_{IORM} \times 1.875 = V_{PR}$ , 100 % production test with $t_M = 1\text{ s}$ , partial discharge $< 5\text{ pC}$ | $V_{PR}$   | 1669           | $V_{peak}$         |
| Input to output test voltage, method A       | $V_{IORM} \times 1.6 = V_{PR}$ , 100 % sample test with $t_M = 10\text{ s}$ , partial discharge $< 5\text{ pC}$      | $V_{PR}$   | 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

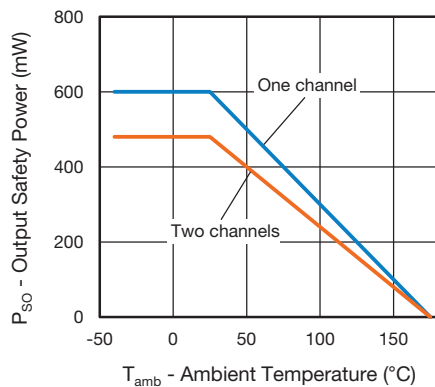


Fig. 2 - Safety Power Dissipation vs. Ambient Temperature

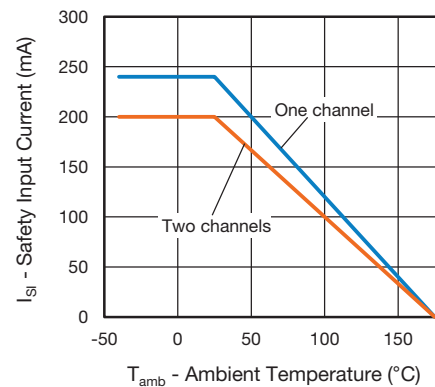


Fig. 3 - Safety Input Current vs. Ambient Temperature



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

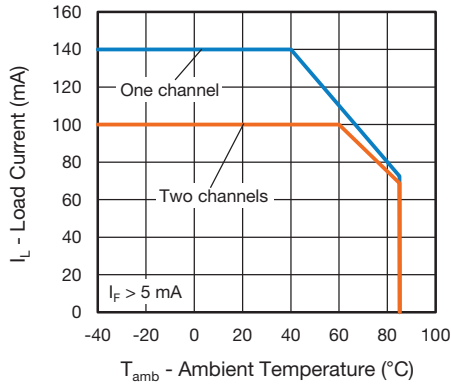


Fig. 4 - Maximum Load Current vs. Ambient Temperature

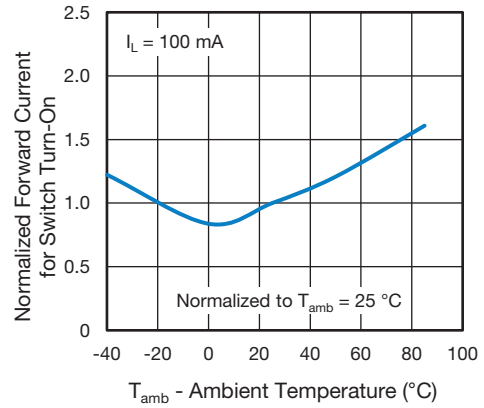


Fig. 7 - Normalized Forward Current for Switch Turn-On vs. Ambient Temperature

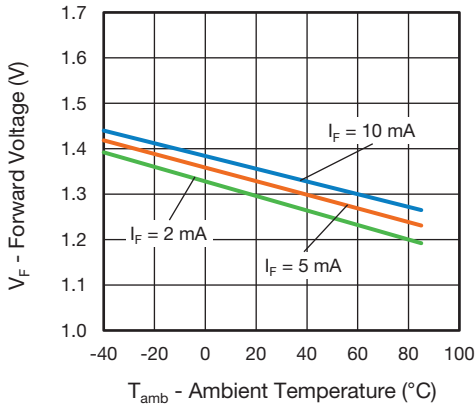


Fig. 5 - Forward Voltage vs. Ambient Temperature

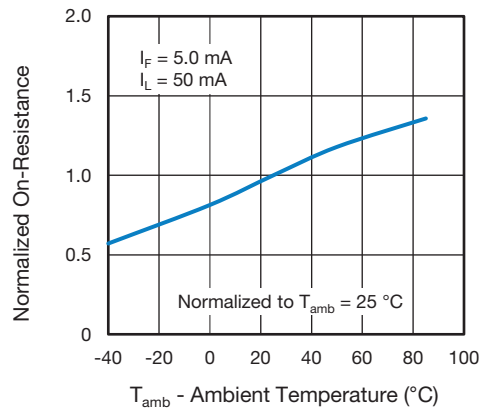


Fig. 8 - Normalized On-Resistance vs. Ambient Temperature

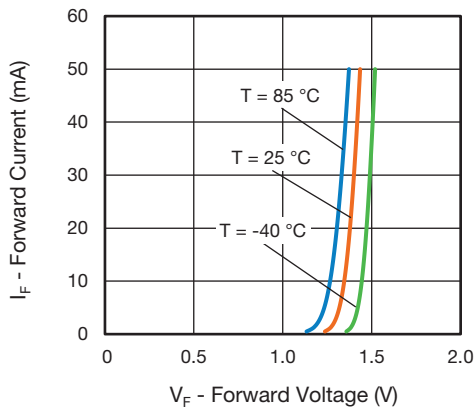


Fig. 6 - Forward Current vs. Forward Voltage

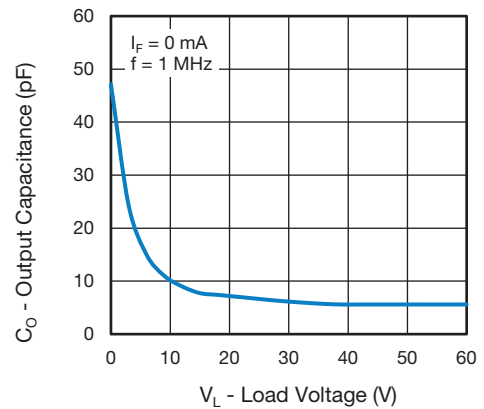


Fig. 9 - Output Capacitance vs. Load Voltage

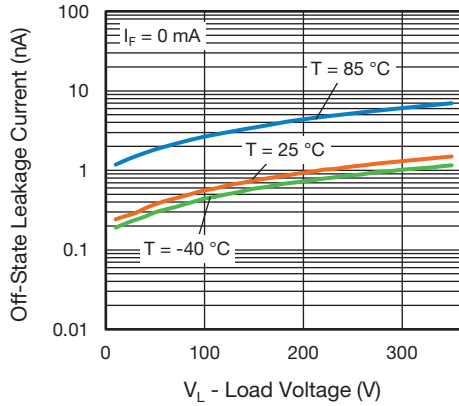


Fig. 10 - Off-State Leakage Current vs. Load Voltage

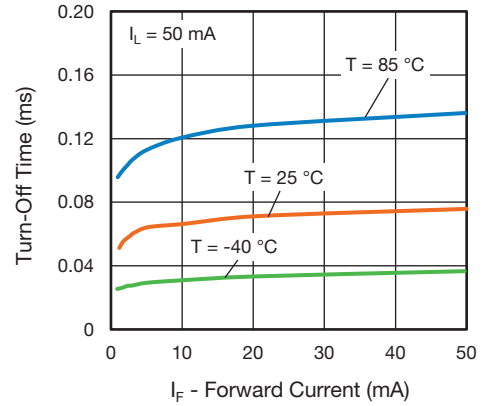


Fig. 13 - Turn-Off Time vs. Forward Current

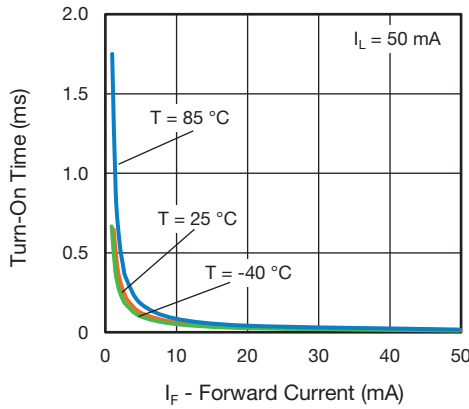


Fig. 11 - Turn-On Time vs. Forward Current

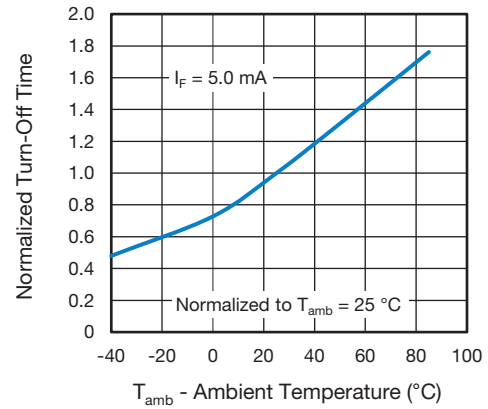


Fig. 14 - Normalized Turn-Off Time vs. Ambient Temperature

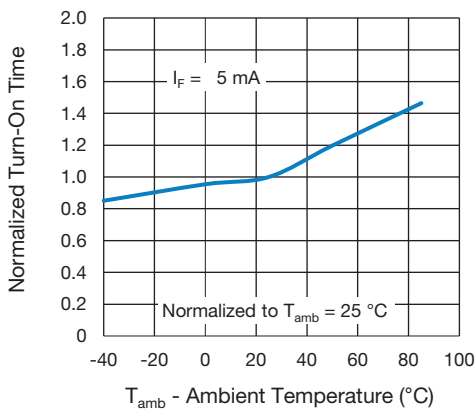
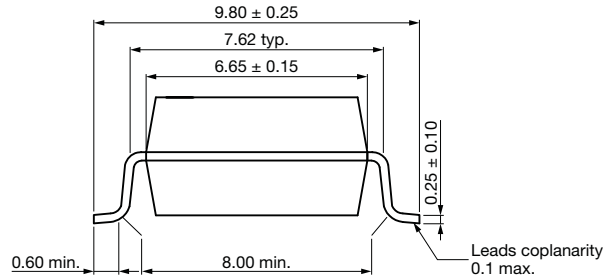
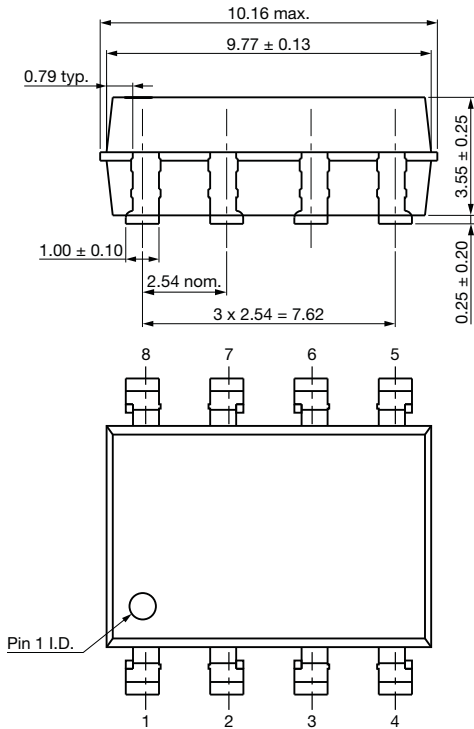


Fig. 12 - Normalized Turn-On Time vs. Ambient Temperature

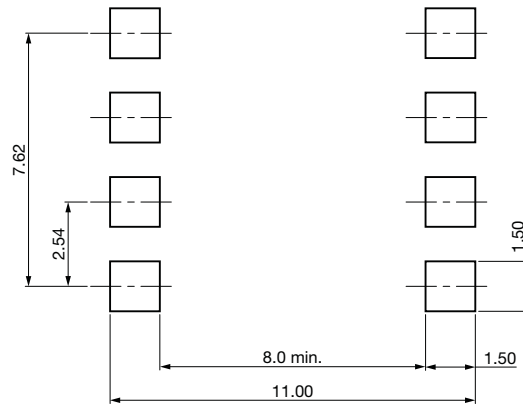


## PACKAGE DIMENSIONS (in millimeters)

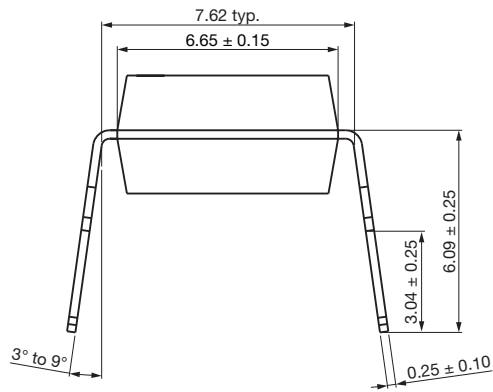
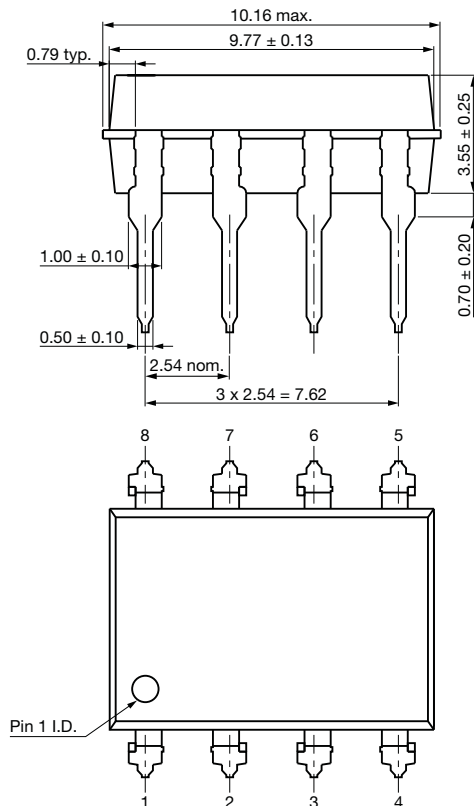
### SMD-8



### Recommended footprint



### DIP-8



## PACKAGE MARKING (example)

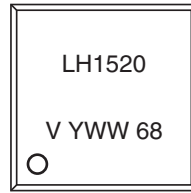


Fig. 15 - LH1520

### Note

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

## PACKING INFORMATION (in millimeters)

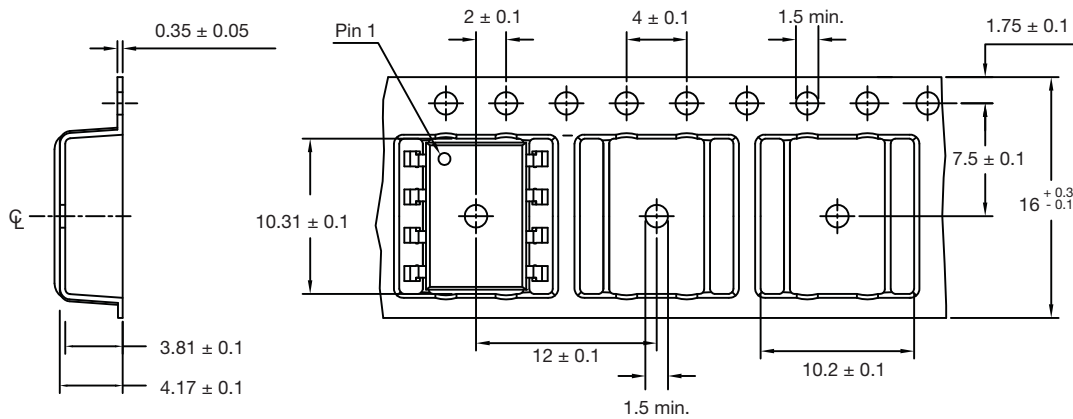


Fig. 16 - Tape and Reel Packing

| TAPE AND REEL PACKING |            |
|-----------------------|------------|
| TYPE                  | UNITS/REEL |
| SMD-8                 | 1000       |

| TUBE PACKING |            |           |           |
|--------------|------------|-----------|-----------|
| TYPE         | UNITS/TUBE | TUBES/BOX | UNITS/BOX |
| SMD-8        | 50         | 40        | 2000      |
| DIP-8        | 50         | 40        | 2000      |

## SOLDER PROFILES

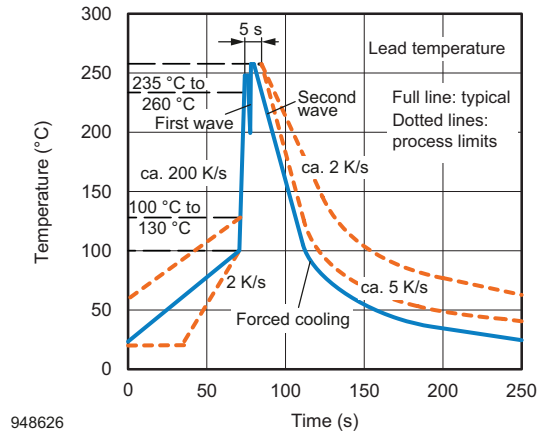


Fig. 17 - Wave Soldering Double Wave Profile According to J-STD-020 for DIP Devices

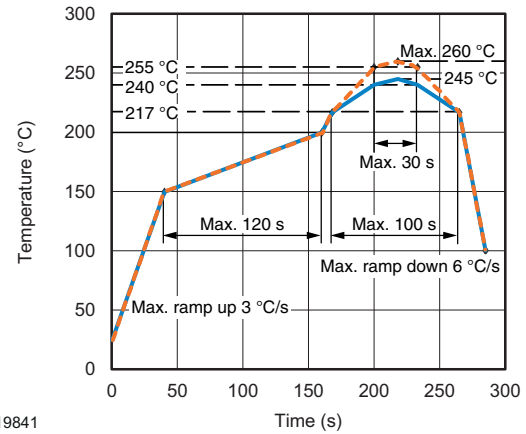


Fig. 18 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

## HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

Conditions:  $T_{amb} < 30\text{ °C}$ , RH < 60 %

Moisture sensitivity level 1, according to J-STD-020





## Footprint and Schematic Information for LH1520AAC, LH1520AACTR, LH1520AB

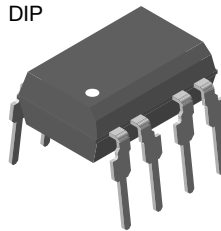
The footprint and schematic symbols for the following parts can be accessed using the associated links. They are available in Eagle, Altium, KiCad, OrCAD / Allegro, Pulsonix, and PADS.

Note that the 3D models for these parts can be found on the Vishay product page.

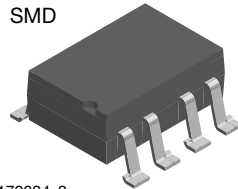
| PART NUMBER | FOOTPRINT / SCHEMATIC  |
|-------------|--|
| LH1520AAC   | <a href="http://www.snapeda.com/parts/LH1520AAC/Vishay/view-part">www.snapeda.com/parts/LH1520AAC/Vishay/view-part</a>     |
| LH1520AACTR | <a href="http://www.snapeda.com/parts/LH1520AACTR/Vishay/view-part">www.snapeda.com/parts/LH1520AACTR/Vishay/view-part</a> |
| LH1520AB    | <a href="http://www.snapeda.com/parts/LH1520AB/Vishay/view-part">www.snapeda.com/parts/LH1520AB/Vishay/view-part</a>       |

For technical issues and product support, please contact [optocoupleranswers@vishay.com](mailto:optocoupleranswers@vishay.com).

DIP



SMD



i179034\_2



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