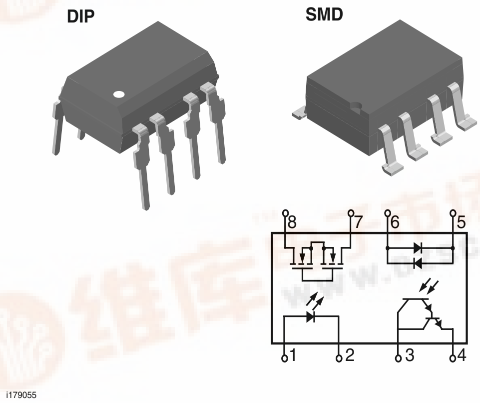
# 1 Form A Photo Darlington Telecomswitch




## Features

- Solid State Relay and Autopolarity Optocoupler in One 8-pin Package
- Isolation Test Voltage, 5300 $V_{RMS}$
- Surface Mountable
- Optocoupler
  - Bidirectional Current Detection
  - High CTR: ≥ 300 %
- Solid State Relay
  - Form A . LH1525 Type
  - Low Operating Current
  - Typical $R_{ON}$: 25 Ω
  - Load Voltage: 400 V
  - Load Current: 120 mA
  - Current-limit Protection
  - Linear, ac/dc Operation
  - Clean, Bounce-free Switching
  - Low Power Consumption

## Agency Approvals

- UL - File No. E52744
- CSA - Certification 093751
- BSI/BABT Cert. No. 7980

## Applications

General Telecom Switching
- On/off-hook Switching
- Dial Pulse
- Ring Current Detection
- Loop Current Sensing

## Description

The LH1539 telecom switch consists of an optically isolated solid state relay (SSR) Form A and a bidirectional input optocoupler in a single 8-pin package. The SSR is ideal for switch hook and dial-pulse switching while the optocoupler performs ring detect and loop current sensing functions. Both the SSR and optocoupler provide 5300 $V_{RMS}$ of input-to-output isolation voltage.

The SSR is integrated on a monolithic receptor die using smart power technology. The SSR features low ON resistance, high breakdown voltage, and current-limit circuitry that protects the relay from telephone line induced lightning surges.

The optocoupler provides bidirectional current sensing via two anti parallel GaAs infrared emitting diodes. Very high current transfer ratio (CTR) is achieved by coupling to a photodarlington transistor. This high CTR allows the user to minimize the size of the ring detector capacitor.

## Order Information

| Part | Remarks |
|---|---|
| LH1539AAC | Gullwing, Tubes, SMD-8 |
| LH1539AACTR | Gullwing, Tape and Reel, SMD-8 |
| LH1539AB | Tubes, DIP-8 |

## Absolute Maximum Ratings, $T_{amb}$ = 25 °C

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 time can adversely affect reliability.

### SSR

| Parameter | Test condition | Symbol | Value | Unit |
|---|---|---|---|---|
| LED continuous forward current | | $I_F$ | 50 | mA |
| LED reverse voltage | $I_R \le 10\ \mu A$ | $V_R$ | 8.0 | V |
| DC or peak AC load voltage | $I_L \le 50\ \mu A$ | $V_L$ | 400 | V |
| Continuous DC load current | | $I_L$ | 120 | mA |
| Ambient operating temperature range | | $T_A$ | - 40 to + 85 | °C |
| Storage temperature range | | $T_{stg}$ | - 40 to + 85 | °C |
| Pin soldering temperature | t = 10 s max | $T_{sld}$ | 260 | °C |
| Input/output isolation voltage | t = 60 s min | $V_{ISO}$ | 5300 | $V_{RMS}$ |
| Package power dissipation | | $P_{diss}$ | 600 | mW |

### Optocoupler

| Parameter | Test condition | Symbol | Value | Unit |
|---|---|---|---|---|
| LED continuous forward current | | $I_F$ | 50 | mA |
| LED reverse voltage | $I_R \le 10\ \mu A$ | $V_R$ | 3.0 | V |
| Collector-emitter breakdown voltage | | $BV_{CEO}$ | 30 | V |
| Phototransistor power dissipation | | $P_{diss}$ | 150 | mW |

## Electrical Characteristics, $T_{amb}$ = 25 °C

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.

### SSR

| Parameter | Test condition | Symbol | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| LED forward current for switch turn-on | $I_L$ = 100 mA, t = 10 ms | $I_{Fon}$ | | 0.5 | 1.0 | mA |
| LED forward current for switch turn-off | $V_L$ = ± 300 V | $I_{Foff}$ | 0.1 | 0.4 | | mA |
| LED forward voltage | $I_F$ = 3.0 mA | $V_F$ | 0.8 | 1.2 | 1.4 | V |
| ON-Resistance | $I_F$ = 3.0 mA, $I_L$ = ± 50 mA | $R_{ON}$ | 17 | 25 | 33 | Ω |
| OFF-Resistance | $I_F$ = 0 mA, $V_L$ = ± 100 V | $R_{OFF}$ | | 5000 | | GΩ |
| Current limit | $I_F$ = 5.0 mA, t = 5.0 ms | $I_{LMT}$ | 170 | 210 | 270 | mA |
| Output off-state leakage current | $I_F$ = 0 mA, $V_L$ = ± 100 V | $I_O$ | | 0.04 | 100 | nA |
| Output capacitance pin 4 to pin 6 | $I_F$ = 0 mA, $V_L$ = 1.0 V | $C_O$ | | 55 | | pF |
| | $I_F$ = 0 mA, $V_L$ = 50 V | $C_O$ | | 10 | | pF |
| Turn-on time | $I_F$ = 5.0 mA, $I_L$ = 50 mA | $t_{on}$ | | | 2.0 | ms |
| Turn-off time | $I_F$ = 5.0 mA, $I_L$ = 50 mA | $t_{off}$ | | | 0.5 | ms |

## Optocoupler

| Parameter | Test condition | Symbol | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| LED forward voltage | $I_F$ = 10 mA | $V_F$ | 0.9 | 1.2 | 1.5 | V |
| DC Current Transfer Ratio | $I_F$ = 0.05 mA, $V_{CE}$ = 0.9 V | $CTR_{DC}$ | 300 | | | % |
| Saturation voltage | $I_F$ = 0.05 mA, $I_C$ = 0.15 mA | $V_{CEsat}$ | | | 1.0 | V |
| Collector-emitter leakage current | $I_F$ = 0 mA, $V_{CE}$ = 5.0 V | $I_{CEO}$ | | | N/A | |

## Recommended Operating Conditions

| Parameter | Test condition | Symbol | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| LED forward current for switch turn-on | $T_A$ = - 40 °C to + 85 °C | $I_{Fon}$ | 3.0 | | 20 | mA |

## Typical Characteristics ($T_{amb}$ = 25 °C unless otherwise specified)

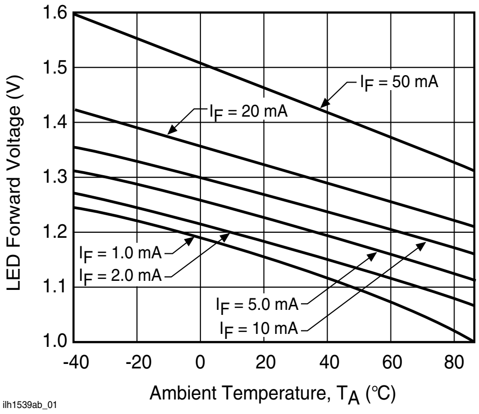



Fig. 1 LED Voltage vs. Temperature

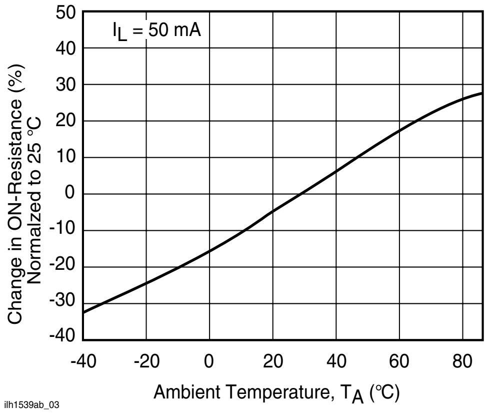



Fig. 3 ON-Resistance vs. Temperature

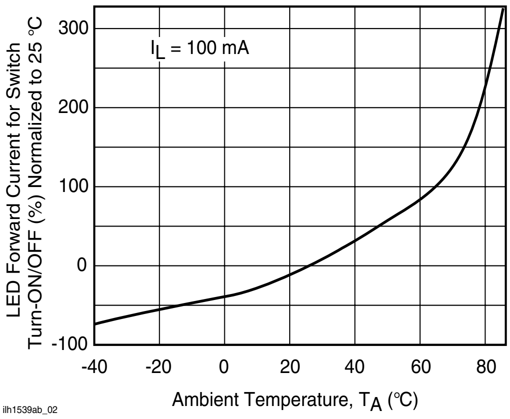



Fig. 2 LED Current for Switch Turn-on/off vs. Temperature

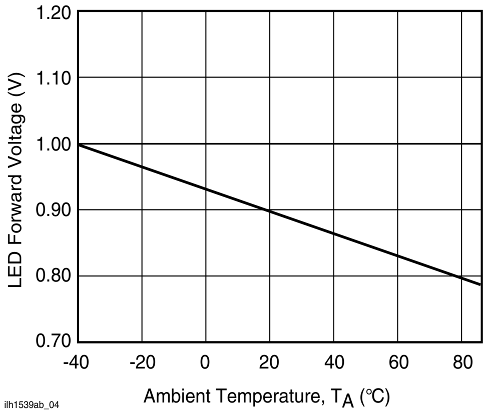



Fig. 4 LED Dropout Voltage vs. Temperature

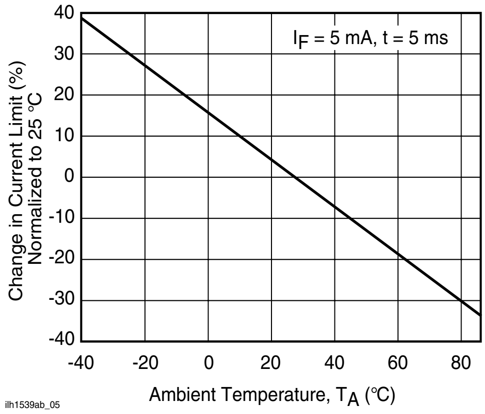



Fig. 5 Current Limit vs. Temperature

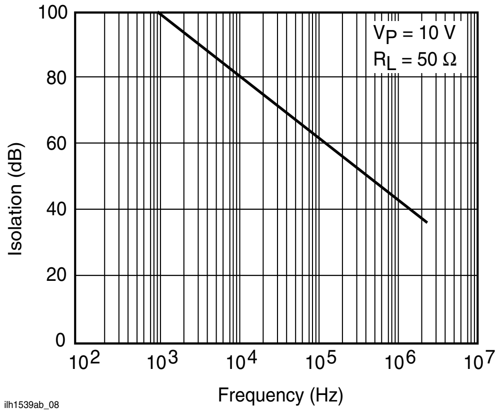



Fig. 8 Output Isolation

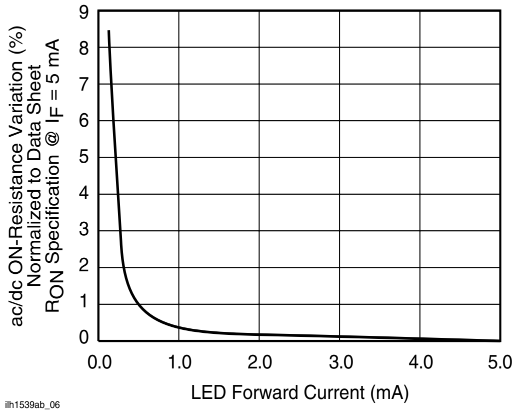



Fig. 6 Variation in ON-Resistance vs. LED Current

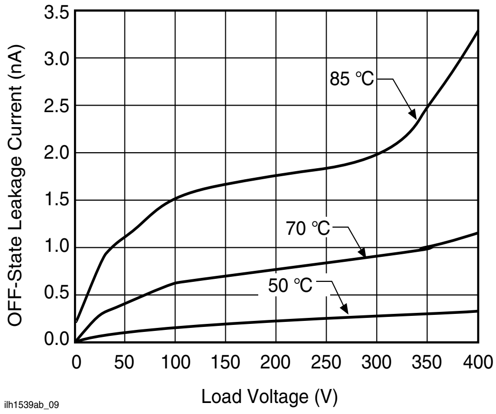



Fig. 9 Leakage Current vs. Applied Voltage at Elevated Temperatures

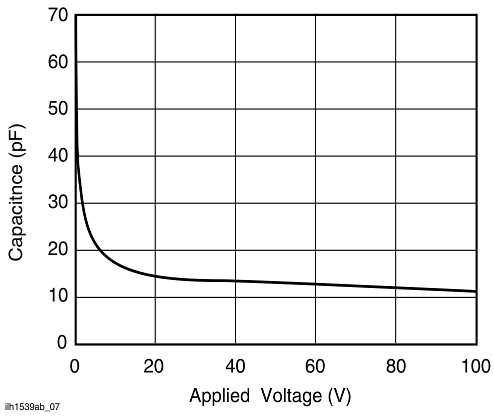



Fig. 7 Output Isolation

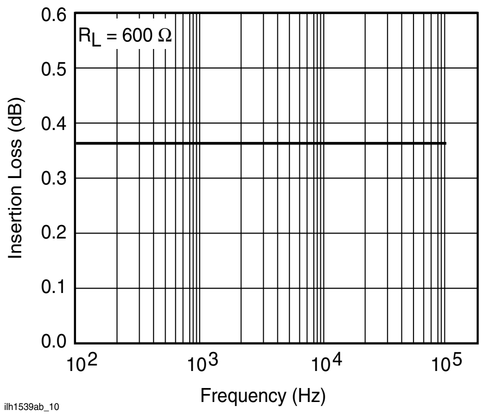



Fig. 10 Insertion Loss vs. Frequency

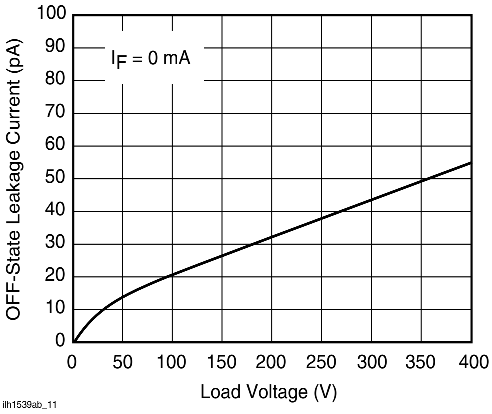



Fig. 11 Leakage Current vs. Applied Voltage

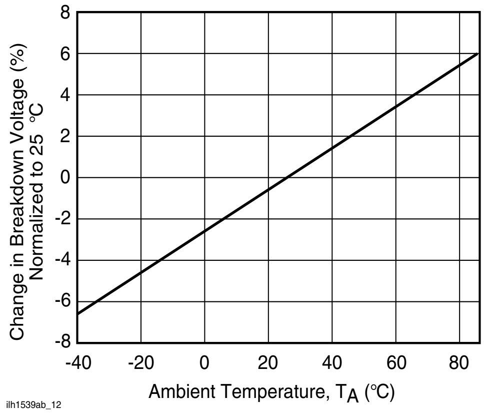
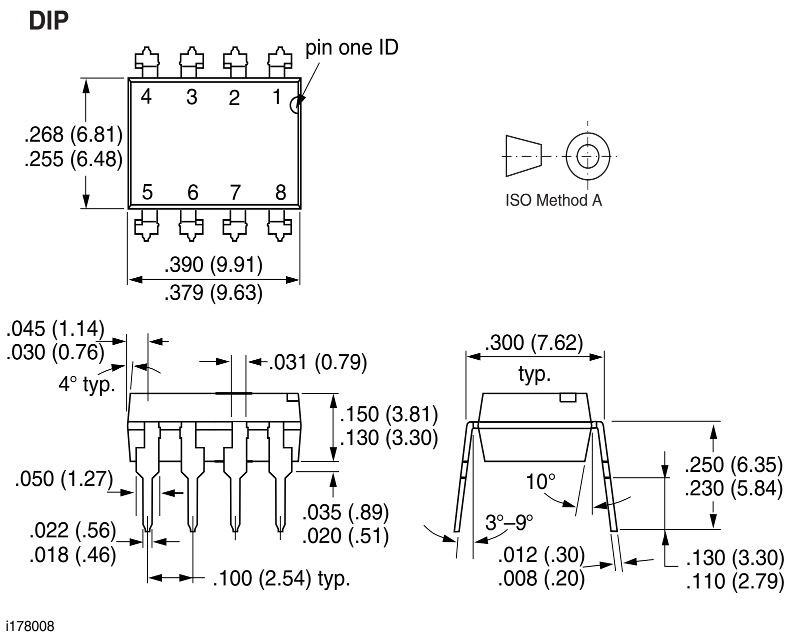


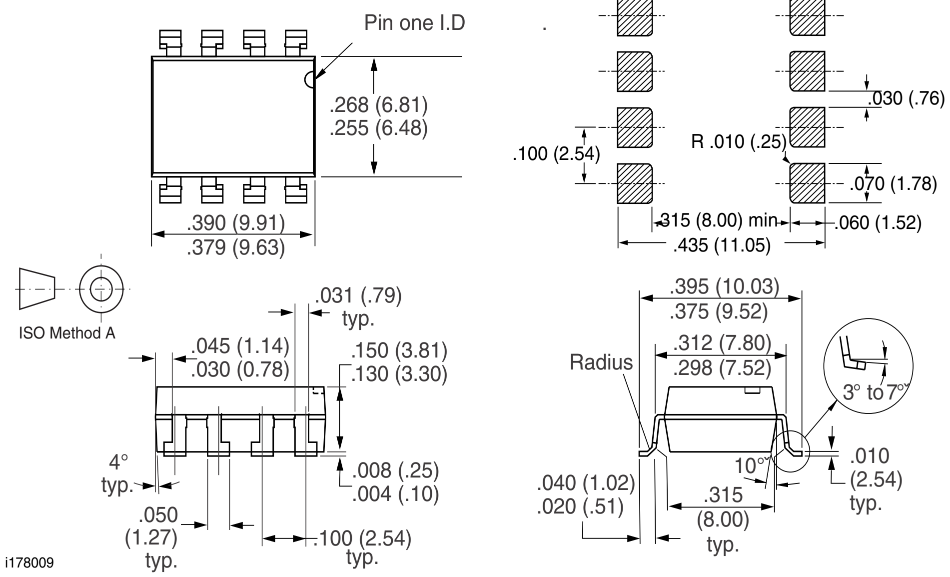

Fig. 12 Switch Breakdown Voltage vs. Temperature

## Package Dimensions in Inches (mm)



## Package Dimensions in Inches (mm)

SMD





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2. Regularly and continuously improve the performance of our products, processes, distribution and operatingsystems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

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**Vishay Semiconductor GmbH** has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

**Vishay Semiconductor GmbH** can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.



Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany
Telephone: 49 (0)7131 67 2831, Fax number: 49 (0)7131 67 2423

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