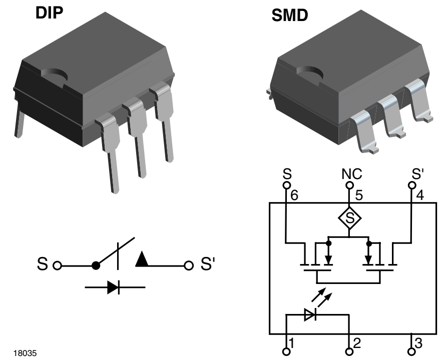
# 1 Form A Solid State Relay (Low Capacitance)

## Features

- Low Capacitance Switch (5.0 pF)
- Isolation Test Voltage 5300 $V_{RMS}$
- Extremely High OFF-resistance (100 GΩ)
- Load Voltage 200 V
- Clean Bounce Free Switching
- Low Power Consumption
- High Reliability Monolithic Receptor
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

Pb-free
e3
RoHS
COMPLIANT




## Agency Approvals

- UL1577, File No. E52744 System Code H or J, Double Protection
- CSA - Certification 093751
- BSI/BABT Cert. No. 7980
- DIN EN 60747-5-2 (VDE0884)
  DIN EN 60747-5-5 pending
- FIMKO Approval

## Applications

- Instrumentation
  - Thermocouple Switching
  - Analog Multiplexing
- Reed Relay Replacement
- Programmable Logic Controllers
- Data Acquisition
- Test Equipment

## Description

These SSRs (LH1541, 1 Form A) are SPST normally open switches which can replace electromechanical relays in many applications. The relays provide a low capacitance, high-voltage switch contact with high off resistance and low switch-offset voltage. These characteristics, combined with high-speed actuation, result an SSR which is ideal for small signal and dc instrumentation applications.

The relays are constructed by using a GaAIAs LED for actuation control and an integrated monolithic die for the switch output. The die is comprised of a photodiode array, switch-control circuity, and low-capacitance MOSFET switches.

## Order Information

| Part | Remarks |
|---|---|
| LH1541AAB1 | Tubes, SMD-6 |
| LH1541AAB1TR | Tape and Reel, SMD-6 |
| LH1541AT1 | Tubes, DIP-6 |

## Absolute Maximum Ratings

$T_{amb}$ = 25 °C, unless otherwise specified

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 | $I_R \leq 10$ µA | $V_R$ | 8.0 | V |
| DC or peak AC load voltage | $I_L \leq 50$ µA | $V_L$ | 200 | V |

| Parameter | Test condition | Symbol | Value | Unit |
|---|---|---|---|---|
| Continuous DC load current - bidirectional operation | | $I_L$ | 55 | mA |
| Peak load current (single shot) | t = 100 ms | $I_P$ | 100 | mA |
| Ambient temperature range | | $T_{amb}$ | - 40 to + 85 | °C |
| Storage temperature range | | $T_{stg}$ | - 40 to + 150 | °C |
| Pin soldering temperature | t = 10 s max | $T_{sld}$ | 260 | °C |
| Input/output isolation voltage | | $V_{ISO}$ | 5300 | $V_{RMS}$ |
| Output power dissipation (continuous) | | $P_{diss}$ | 550 | mW |

## Electrical Characteristics

$T_{amb}$ = 25 °C, unless otherwise specified

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.

## Input

| Parameter | Test condition | Symbol | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| LED forward current, switch turn-on | $I_L$ = 100 mA, t = 10 ms | $I_{Fon}$ | | 0.6 | 2.0 | mA |
| LED forward current, switch turn-off | $V_L$ = ± 150 V | $I_{Foff}$ | 0.1 | 0.5 | | mA |
| LED forward voltage | $I_F$ = 5 mA | $V_F$ | 1.10 | 1.26 | 1.45 | V |

## Output

| Parameter | Test condition | Symbol | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| ON-resistance ac/dc: Pin 4(±) to 6 (±) | $I_F$ = 5.0 mA, $I_L$ = 50 mA | $R_{ON}$ | 70 | 110 | 160 | Ω |
| Off-resistance | $I_F$ = 0 mA, $V_L$ = ± 100 V | $R_{OFF}$ | 0.5 | 10000 | | GΩ |
| Off-state leakage current | $I_F$ = 0 mA, $V_L$ = ± 100 V | $I_O$ | | 0.4 | 200 | nA |
| | $I_F$ = 0 mA, $V_L$ = ± 200 V | $I_O$ | | | 1.0 | µA |
| Output capacitance Pin 4 to 6 | $I_F$ = 0 mA, $V_L$ = 1.0 V | $C_O$ | | 4.8 | | pF |
| | $I_F$ = 0 mA, $V_L$ = 50 V | $C_O$ | | 36 | | pF |
| Switch offset | $I_F$ = 5.0 mA | $V_{OS}$ | | 0.15 | | µV |

## Transfer

| Parameter | Test condition | Symbol | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Capacitance (input-output) | $V_{ISO}$ = 1.0 V | $C_{IO}$ | | 0.8 | | pF |
| Turn-on time | $I_F$ = 5.0 mA, $I_L$ = 50 mA | $t_{on}$ | | 0.2 | 0.5 | ms |
| Turn-off time | $I_F$ = 5.0 mA, $I_L$ = 50 mA | $t_{off}$ | | 0.3 | 0.5 | ms |

## Typical Characteristics

$T_{amb}$ = 25 °C, unless otherwise specified

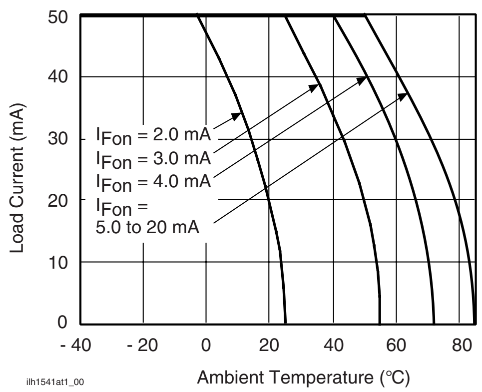



Figure 1. Recommended Operating Conditions

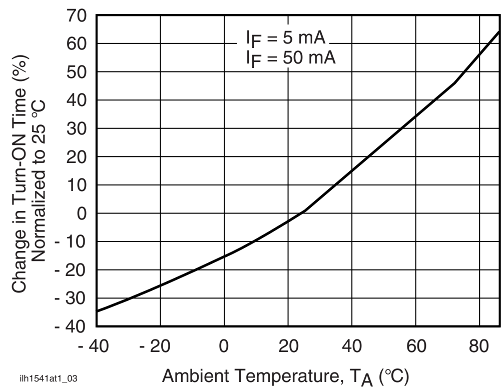



Figure 4. LED Dropout Voltage vs. Temperature

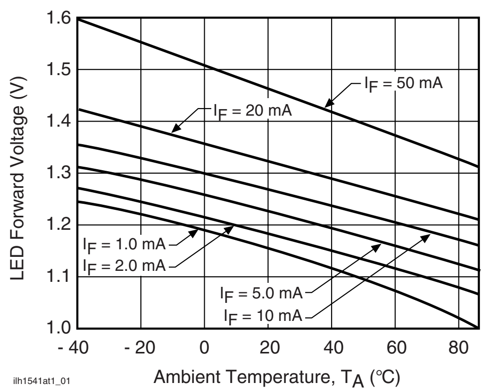



Figure 2. LED Voltage vs. Temperature

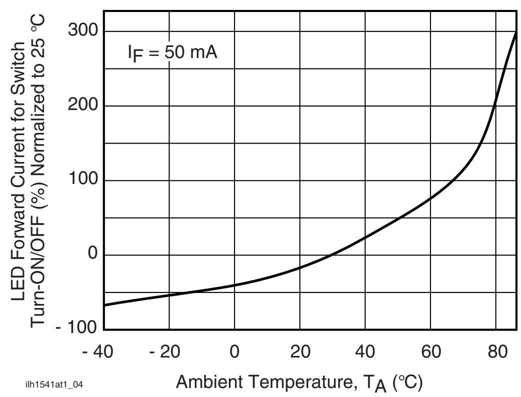



Figure 5. LED Current for Switch Turn-on vs. Temperature

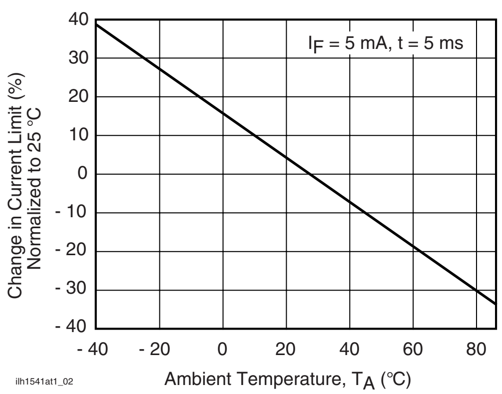



Figure 3. Current Limit vs. Temperature

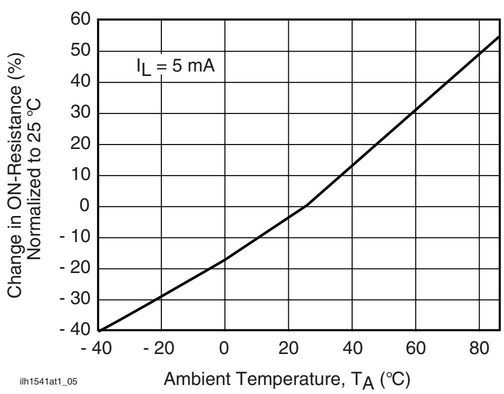



Figure 6. ON-Resistance vs. Temperature

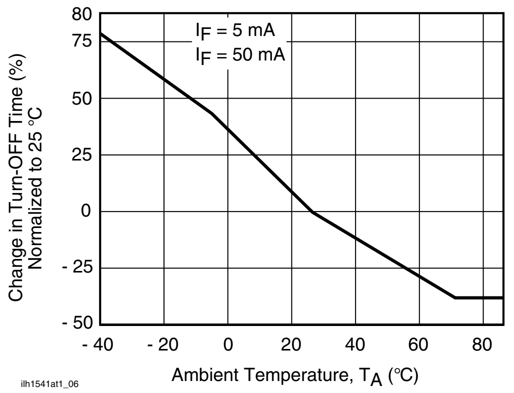



Figure 7. Switch Capacitance vs. Applied Voltage

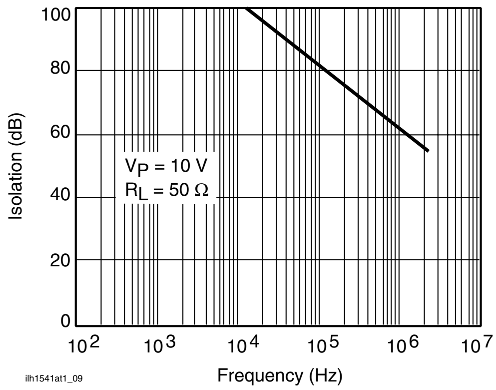



Figure 10. Output Isolation

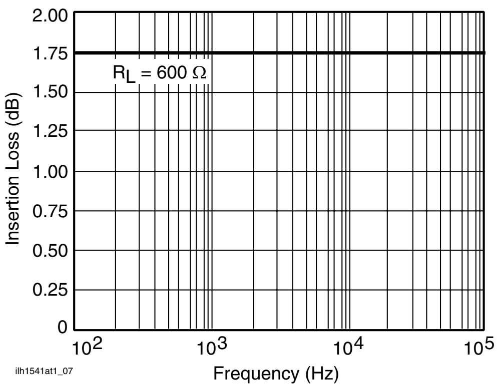



Figure 8. Insertion Loss vs. Frequency

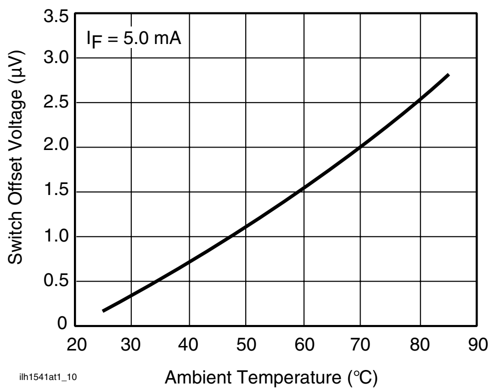



Figure 11. Switch Offset Voltage vs. Temperature

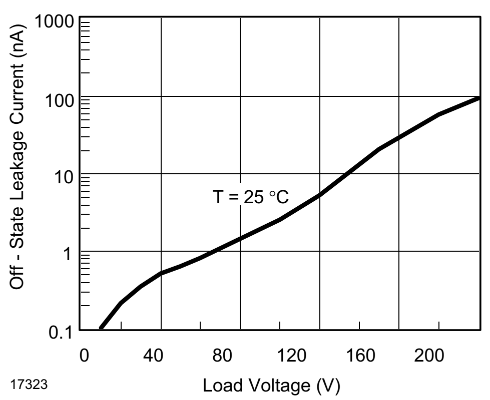



Figure 9. Leakage Current vs. Applied Voltage

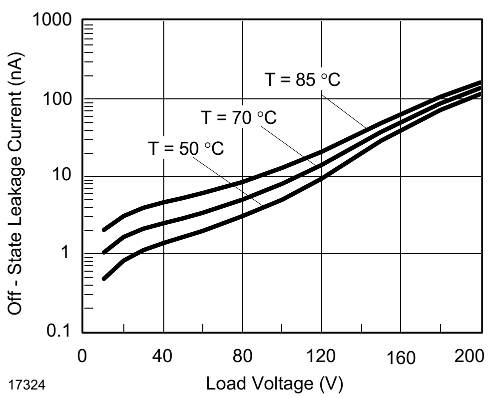



Figure 12. Leakage Current vs. Applied Voltage at Elevated Temperatures

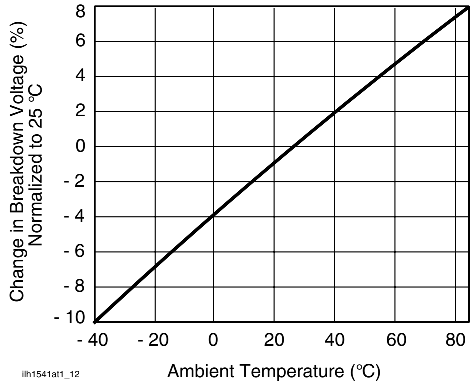



Figure 13. Switch Breakdown Voltage vs. Temperature

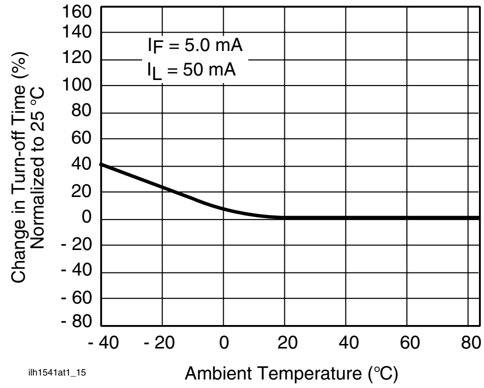



Figure 16. Turn-off Time vs. Temperature

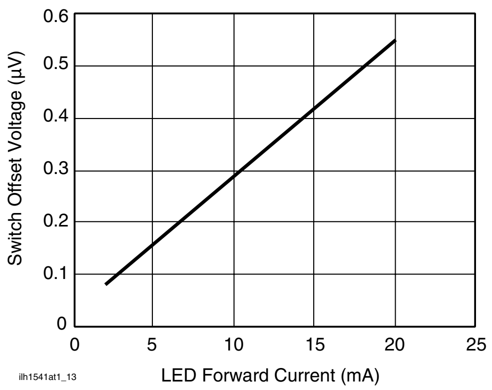



Figure 14. Switch Offset Voltage vs. LED Current

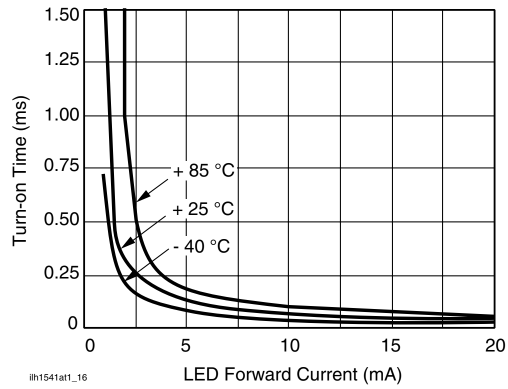



Figure 17. Turn-on Time vs. LED Current

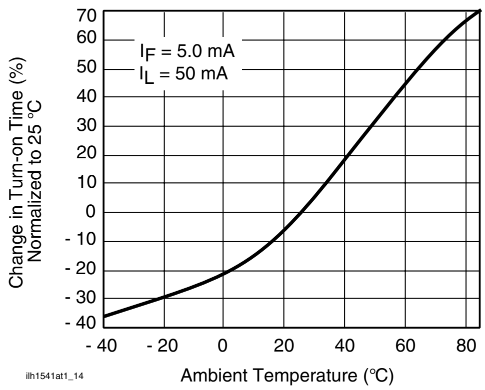



Figure 15. Turn-on Time vs. Temperature

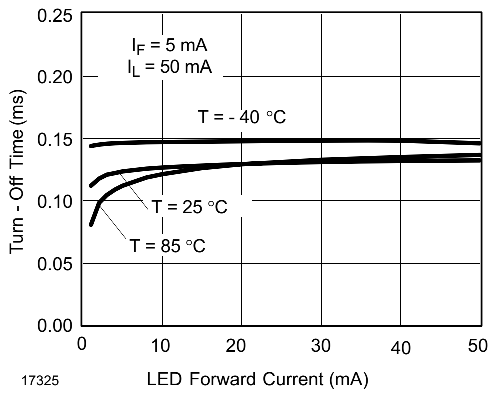
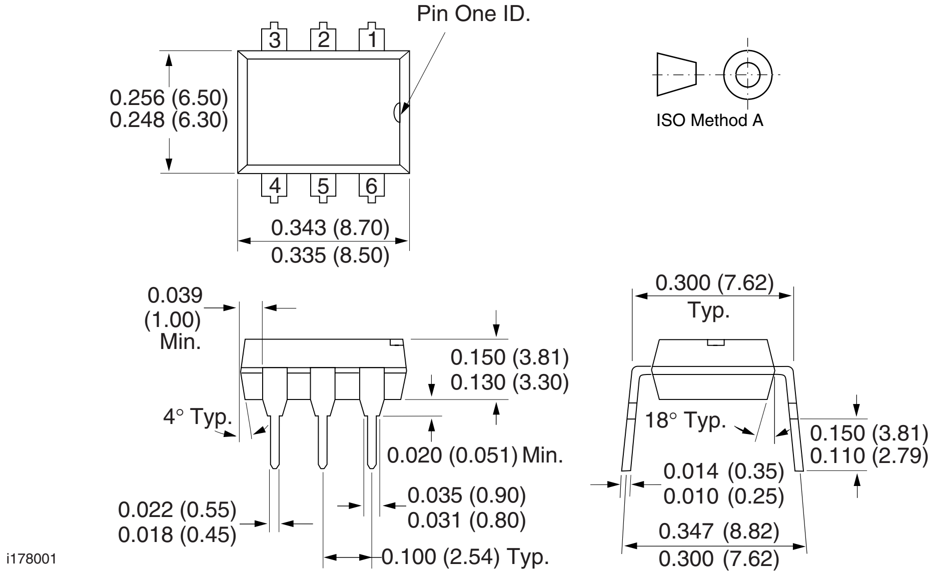



Figure 18. Turn-off Time vs. LED Current

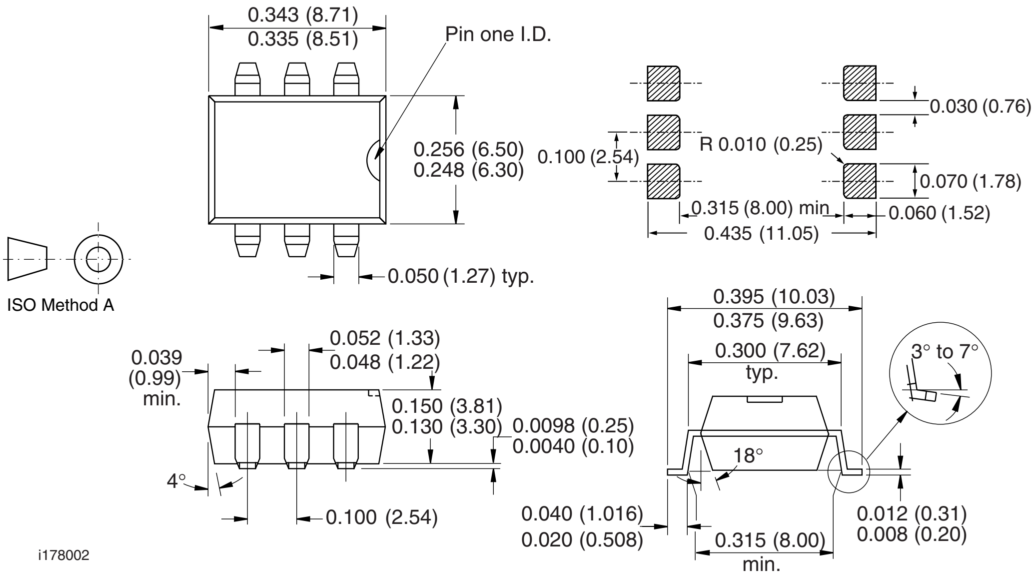
## Package Dimensions in Inches (mm)

**DIP**




## Package Dimensions in Inches (mm)

**SMD**



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It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

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.



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