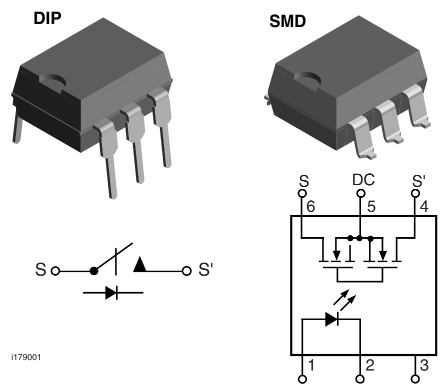
1 Form A Solid State Relay



FEATURES

- Extremely low operating current
- High speed operation
- Isolation test voltage 5300 V_{RMS}
- Current limit protection
- High surge capability
- DC only option
- Clean bounce free switching
- Low power consumption
- High reliability monolithic output die
- Surface mountable
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

Pb-free

e3

RoHS
COMPLIANT

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 GaAIAs LED for actuation control and an integrated monolithic die for the switch output. The die, fabricated in a high-voltage dielectrically isolated technology, comprised of a photodiode array, switch-control circuitry, and MOSFET switches. In addition, the relay employs current-limiting circuitry, enabling it to pass FCC 68.302 and other regulatory surge requirements when overvoltage protection is provided. The relay can be configured for AC/DC or DC-only operation.

APPLICATIONS

- General telecom switching
  - Telephone line interface
  - On/off hook
  - Ring relay
  - Break switch
  - Ground start
- Battery powered switch applications
- Industrial controls
  - Microprocessor control of solenoids, lights, motors, heaters, etc.
- Programmable controllers
- Instrumentation

Note:
See "solid state relays" (application note 56)

AGENCY APPROVALS

UL1577:	file no. E52744 system code H or J, double protection
CSA:	certification no. 093751
BSI/BABT:	certification no. 7980
FIMKO:	approval

ORDER INFORMATION		
PART	**REMARKS**	**PACKAGE**
LH1525AAB	Tubes	SMD-6
LH1525AABTR	Tape and reel	SMD-6
LH1525AT	Tubes	DIP-6

ABSOLUTE MAXIMUM RATINGS (1)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
SSR				
LED input ratings: continuous forward current		I_F	50	mA
LED input ratings: reverse voltage		V_R	8.0	V
Output operation (each channel): DC or peak AC load voltage	$I_L \leq 50$ µA	V_L	400	V
Continuous DC load current, bidirectional operation pin 4 to 6		I_L	125	mA
Continuous DC load current, unidirectional operation pins 4, 6 (+) to pin 5 (-)		I_L	250	mA
Ambient operating temperature range		T_{amb}	- 40 to + 85	°C
Storage temperature range		T_{stg}	- 40 to + 150	°C
Pin soldering temperature (2)	t = 10 s max.	T_{sld}	260	°C
Input to output isolation test voltage	t = 1.0 s	V_{ISO}	5300	V_{RMS}
Power dissipation		P_{diss}	550	mW

Notes

(1) 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 the time can adversely affect reliability.

(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).

ELECTRICAL CHARACTERISTICS						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
LED forward current, switch turn-on	I_L = 100 mA, t = 10 ms	I_{Fon}		0.33	0.5	mA
LED forward current, switch turn-off	V_L = ± 350 V, t = 100 ms	I_{Foff}	0.001	0.23		mA
LED forward voltage	I_F = 1.5 mA	V_F	0.8	1.16	1.40	V
OUTPUT						
On-resistance, AC/DC, each pole	I_F = 1.5 mA, I_L = ± 50 mA	R_{ON}	17	26	36	Ω
On-resistance, DC: pin 4, 6 (+) to 5 (-)	I_F = 1.5 mA, I_L = 100 mA	R_{ON}	4.25	7.0	8.25	Ω
Off-resistance	I_F = 0 mA, V_L = ± 100 V	R_{OFF}		2000		GΩ
Current limit	I_F = 1.5 mA, t = 5.0 ms, V_L = 7.0 V	I_{LMT}	170	185	270	mA
Off-state leakage current	I_F = 0 mA, V_L = ± 100 V	I_O		0.67	200	nA
	I_F = 0 mA, V_L = ± 400 V	I_O		0.096	1.0	µA
Output capacitance	I_F = 0 mA, V_L = 1.0 V	C_O		22		pF
	I_F = 0 mA, V_L = 50 V	C_O		6.42		pF
Switch offset	I_F = 5.0 mA	V_{OS}		0.2		µV
TRANSFER						
Capacitance (input to output)	V_{ISO} = 1.0 V	C_{IO}		0.75		pF
Turn-on time	I_F = 1.5 mA, I_L = 50 mA	t_{on}		1.25		ms
	I_F = 5.0 mA, I_L = 50 mA	t_{on}		0.22	1.0	ms
Turn-off time	I_F = 1.5 mA, I_L = 50 mA	t_{off}		0.6		ms
	I_F = 5.0 mA, I_L = 50 mA	t_{off}		1.1	1.5	ms

Note

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 evaluation. Typical values are for information only and are not part of the testing requirements.

TYPICAL CHARACTERISTICS

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

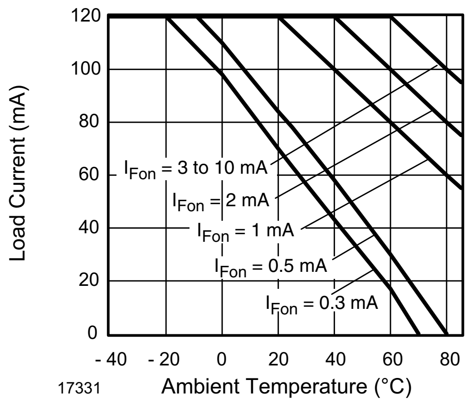


Fig. 1 - Recommended Operating Conditions

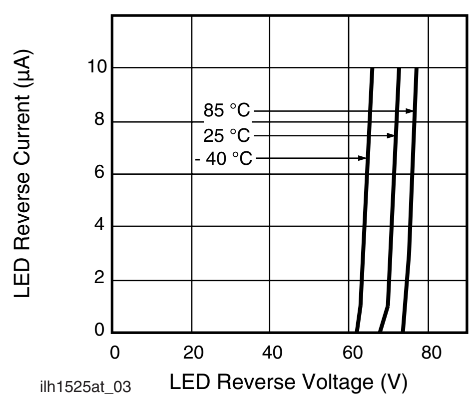


Fig. 4 - LED Reverse Current vs. LED Reverse Voltage

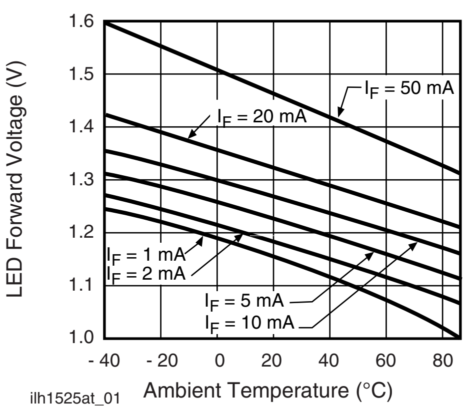


Fig. 2 - LED Voltage vs. Temperature

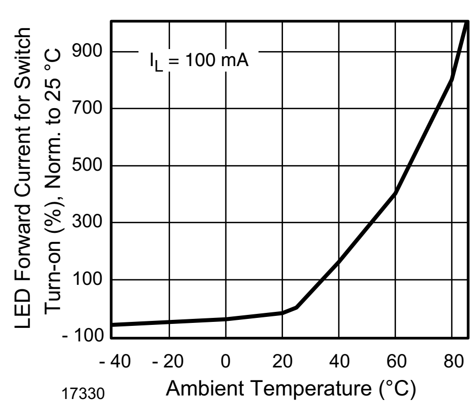


Fig. 5 - LED Current for Switch Turn-on vs. Temperature

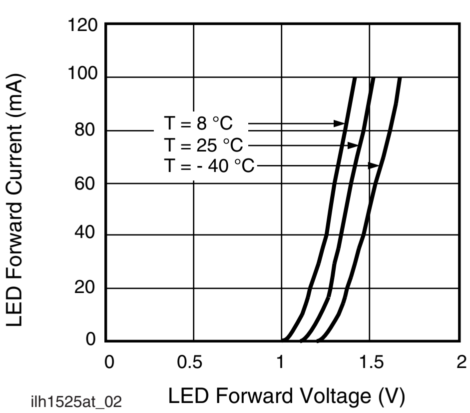


Fig. 3 - LED Forward Current vs. Forward Voltage

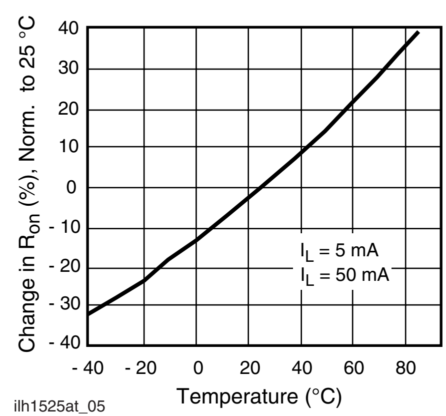


Fig. 6 - On-resistance vs. Temperature

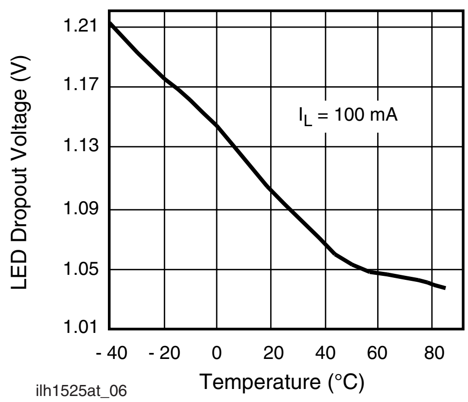


Fig. 7 - LED Dropout Voltage vs. Temperature

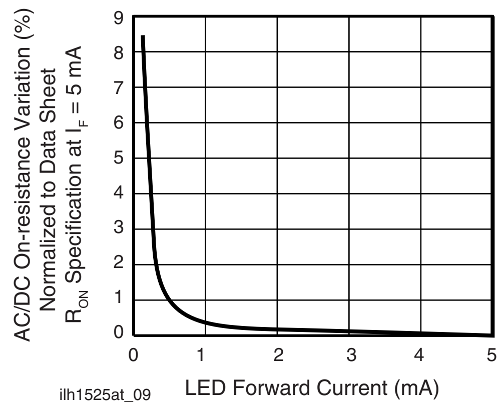


Fig. 10 - Variation in On-resistance vs. LED Current

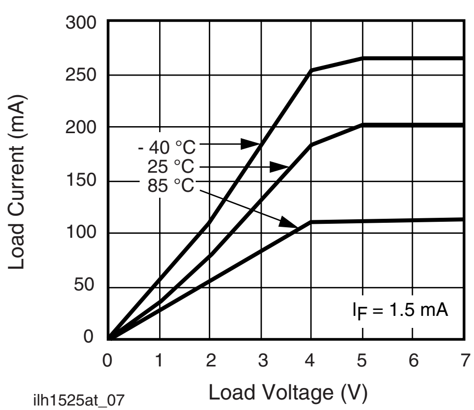


Fig. 8 - Load Current vs. Load Voltage

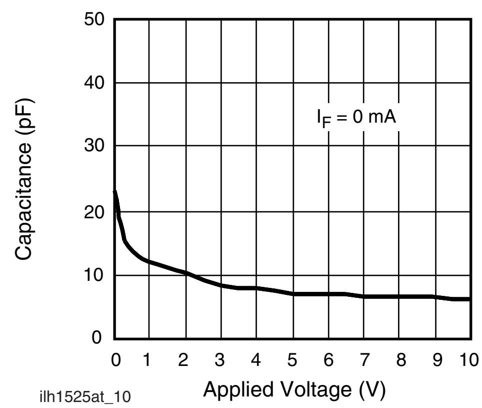


Fig. 11 - Switch Capacitance vs. Applied Voltage

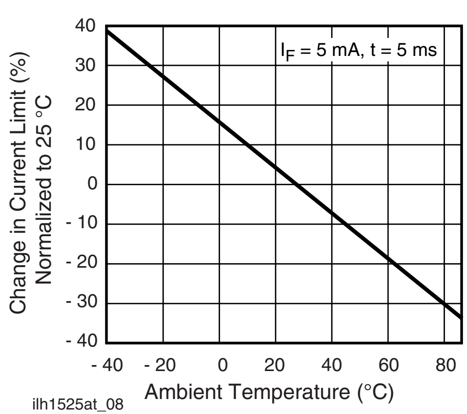


Fig. 9 - Current Limit vs. Temperature

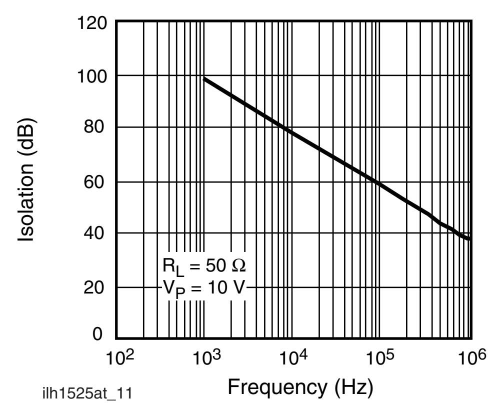


Fig. 12 - Output Isolation

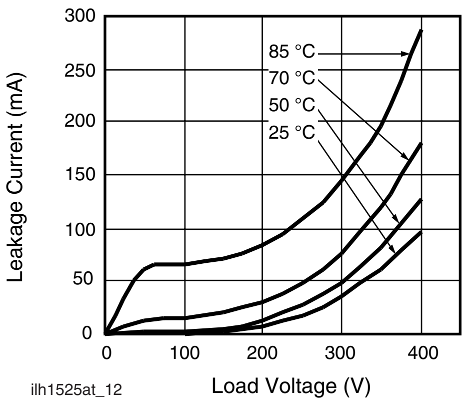


Fig. 13 - Leakage Current vs. Applied Voltage at Elevated Temperatures

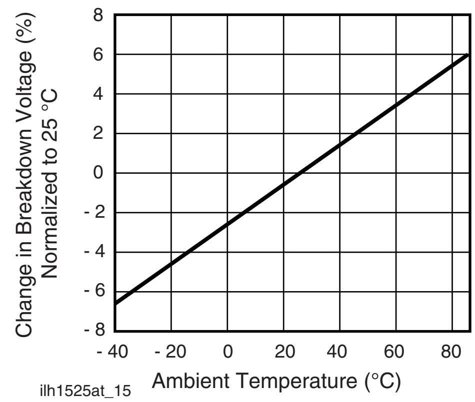


Fig. 16 - Switch Breakdown Voltage vs. Temperature

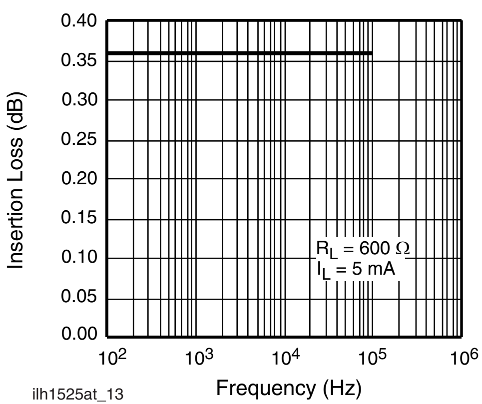


Fig. 14 - Insertion Loss vs. Frequency

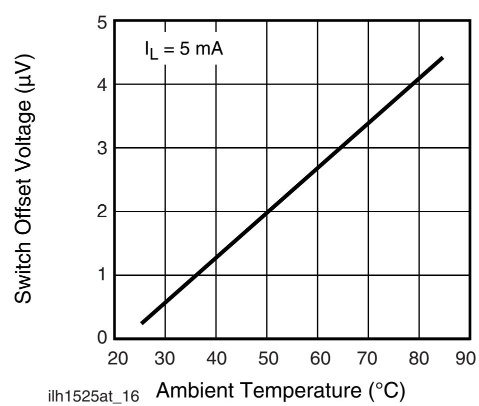


Fig. 17 - Switch Offset Voltage vs. Temperature

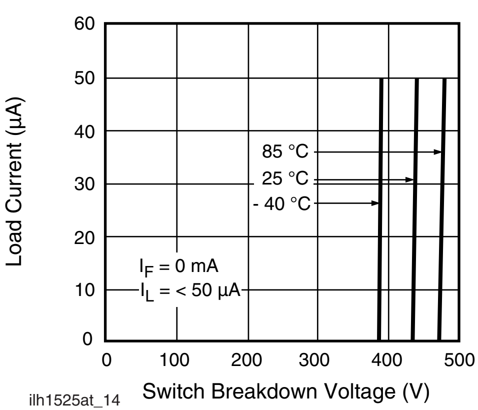


Fig. 15 - Switch Breakdown Voltage vs. Load Current

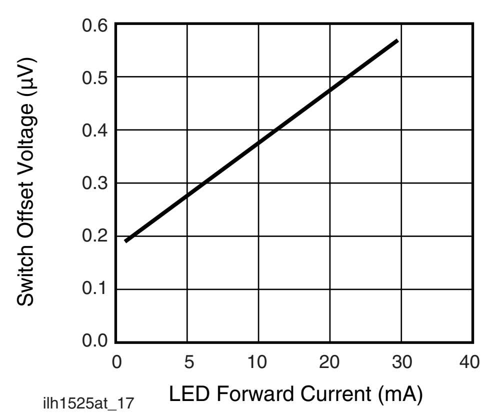


Fig. 18 - LED Offset Voltage vs. LED Current

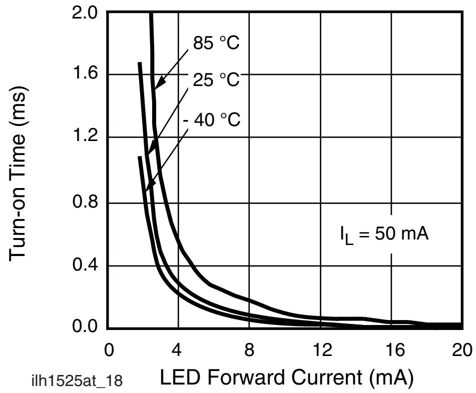


Fig. 19 - Turn-on Time vs. LED Current

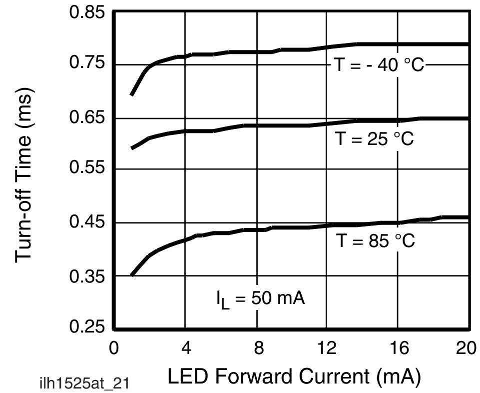


Fig. 22 - Turn-off Time vs. LED Current

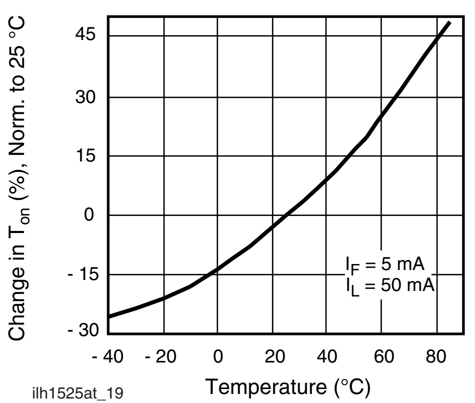


Fig. 20 - Turn-off Time vs. Temperature

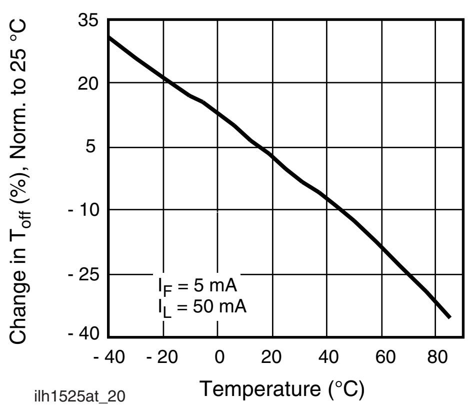


Fig. 21 - Turn-on Time vs. LED Temperature

APPLICATIONS

INPUT CONTROL

The LH1525 low turn-on current SSR has highly sensitive photodetection circuits that will detect even the most minute currents flowing through the LED. Leakage current must be considered when designing a circuit to turn on and off these relays.

Figure 23 shows a typical logic circuit for providing LED drive current. R_1 is the input resistor that limits the amount of current flowing through the LED. For 5.0 V operation, a 2700 Ω resistor will limit the drive current to about 1.4 mA. Where high-speed actuation is desirable, use a lower value resistor for R_1. An additional RC peaking circuit is not required with the LH1525 relay.

R_2 is an optional pull-up resistor which pulls the logic level high output (V_{OH}) up toward the VS potential. The pull-up resistance is set at a high value to minimize the overall current drawn from the VS. The primary purpose of this resistor is to keep the differential voltage across the LED below its turn-on threshold. LED dropout voltage is graphed vs. temperature in the typical performance characteristics section. When the logic gate is high, leakage current will flow through R_2. R_2 will draw up to 8 mA before developing a voltage potential which may possibly turn on the LED.

Each application should be evaluated, over the full operating temperature range to make sure that leakage current through the input control LED is kept to a value less than the minimum LED forward current for switch turn-off specification.

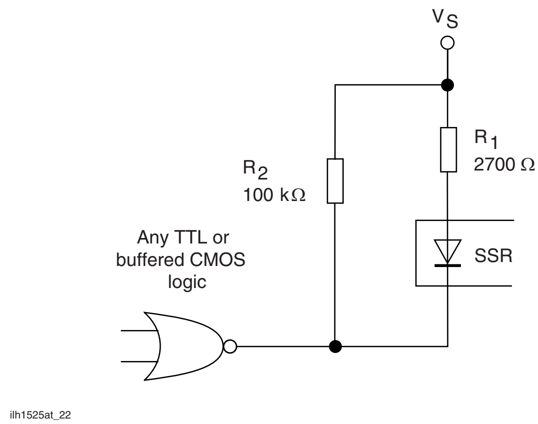
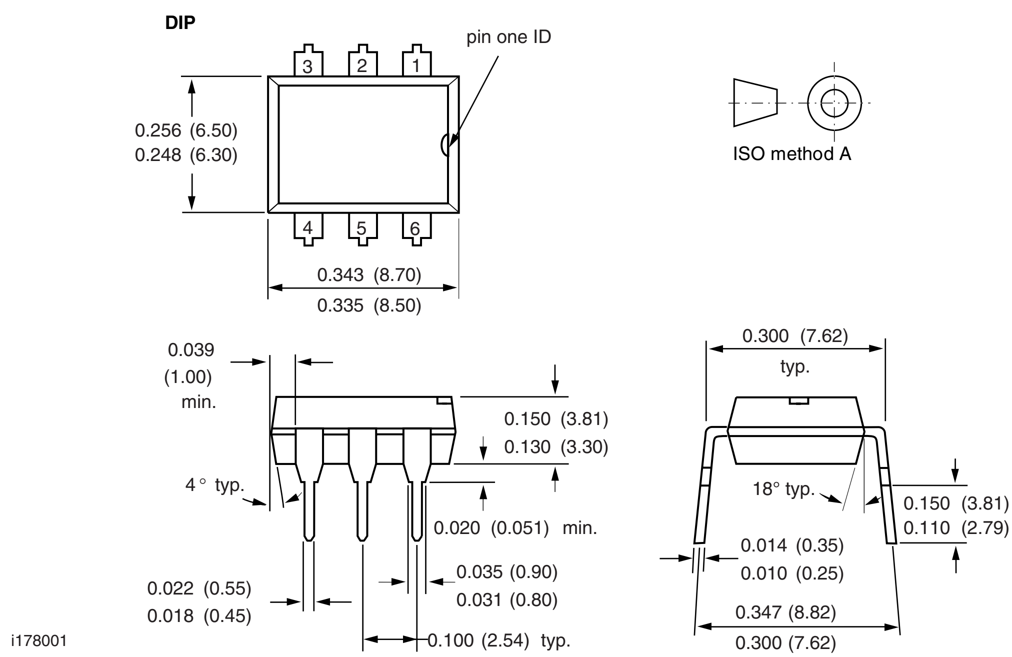
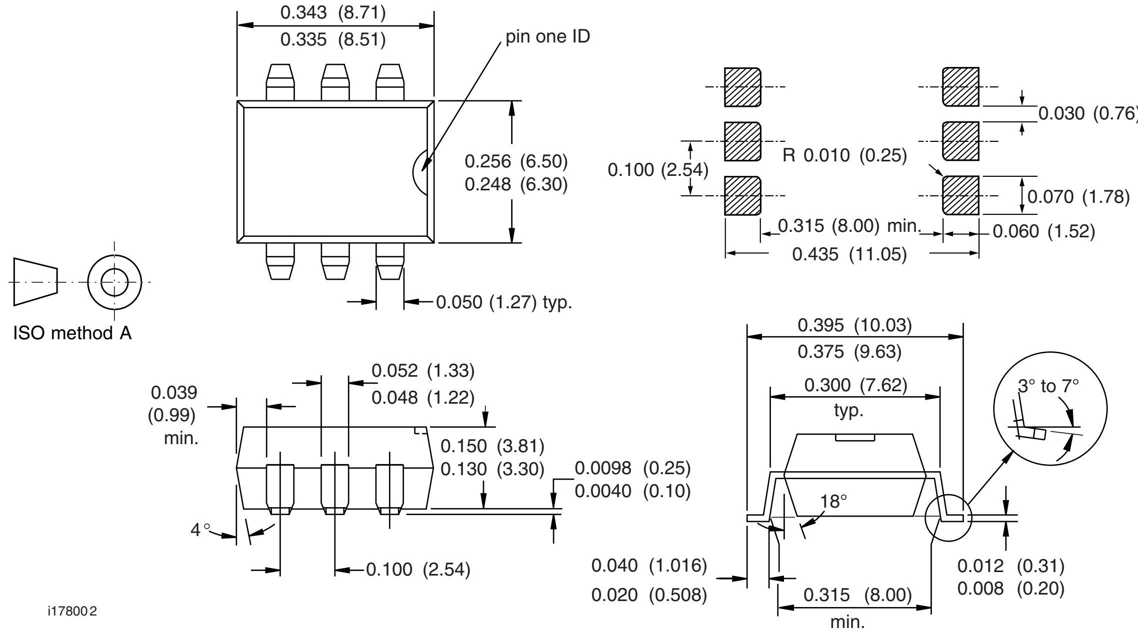


Fig. 23 - Input Control Circuit

PACKAGE DIMENSIONS in inches (millimeters)



SMD


0.343 (8.71)
0.335 (8.51)
pin one ID
0.256 (6.50)
0.248 (6.30)
0.050 (1.27) typ.
ISO method A
0.030 (0.76)
R 0.010 (0.25)
0.100 (2.54)
0.070 (1.78)
0.315 (8.00) min.
0.060 (1.52)
0.435 (11.05)
0.039
(0.99)
min.
0.052 (1.33)
0.048 (1.22)
0.150 (3.81)
0.130 (3.30)
0.0098 (0.25)
0.0040 (0.10)
4°
0.100 (2.54)
0.395 (10.03)
0.375 (9.63)
0.300 (7.62)
typ.
3° to 7°
18°
0.040 (1.016)
0.020 (0.508)
0.315 (8.00)
min.
0.012 (0.31)
0.008 (0.20)
i178002

OZONE DEPLETING SUBSTANCES POLICY STATEMENT

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.

Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany

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