HIGH-VOLTAGE SOLID-STATE RELAY

LH1191AT

PRELIMINARY

T-41-83

Description

The LH1191AT Solid-State Relay is a single-pole, normally open switch (1 Form A), which can replace mechanical relays in many applications. The relay features logic level input control of isolated high-voltage switch outputs. The outputs are rated at 280 V and can handle loads up to 100 mA. The relay will switch both ac and dc loads, but is primarily intended for audio frequency or dc applications. Typical ON-Resistance is 25 ohms at 25 mA.

The LH1191AT relay consists of a GaAlAs LED which optically couples control signals to a monolithic integrated circuit. Optical coupling provides 1500 Vrms of input/output isolation. The integrated circuit is a dielectrically isolated high-voltage die comprised of photodiode arrays, switch control circuitry, and high-voltage DMOS transistor switches.

In operation the device is exceptionally linear up to 55 mA. Beyond 55 mA, the incremental resistance decreases, thereby minimizing internal power dissipation. Overload currents are clamped at 210 mA by internal current limiting. An extended clamp condition, which increases relay temperature, results in a reduction in clamp current thereby further reducing internal power dissipation and preserving the relay's integrity. The relay is available in a 6-pin plastic DIP.

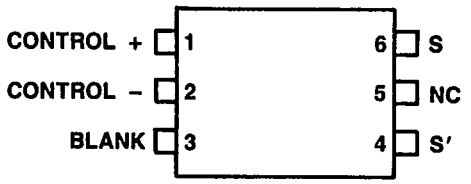
Features

- Low ON-Resistance
- Clean, bounce-free switching
- 1500 Vrms input/output isolation
- dv/dt typically better than 500 V/μs
- High-surge capability
- Low power consumption
- Noise-free operation
- No electromagnetic interference
- Monolithic IC reliability

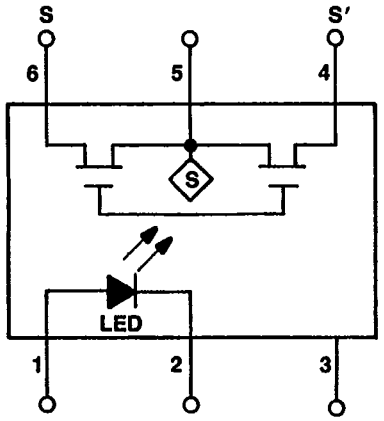
Applications

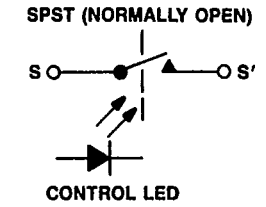
- High-voltage testers
- Industrial controls
- Isolation switching

Pin Diagram



Functional Diagram





EQUIVALENT RELAY DIAGRAM

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Maximum Ratings

At 25 °C

Stresses exceeding the values listed under Maximum Ratings may cause permanent damage to the device. This is an absolute stress rating only. Functional operation of the device at these or any other conditions in excess of those indicated in the operational sections of this data sheet is not implied. Exposure to maximum-rating conditions for extended periods of time may adversely affect device reliability.

Rating	Value	Unit
Ambient Operating Temperature Range	−40 to +85	°C
Storage Temperature Range	−40 to +100	°C
Pin Soldering Temperature (t = 15 s max.)	300	°C
Input/Output Voltage Isolation	1500	Vrms
LED Input Ratings:		
Continuous Forward Current	20	mA
Reverse Voltage	10	V
Output Operation:		
Operating Voltage	280	V
dc or Peak Load Current	100	mA

Pin Descriptions

(Also see Functional and Pin Diagrams.)

Pin	Symbol	Name/Function
1 2	Control + Control −	These pins are the positive and negative inputs, respectively, to the input control LED. An appropriate amount of current through the LED will close the circuit path between S and S'.
6 4	S S'	These pins are the outputs. The pin designated as S represents one side of a relay pole. The pin designated as S' (S Prime) is the complementary side of a relay pole. This relay pole is normally open unless sufficient control current is flowing.
3	Blank	This pin may be used as a tie-point for external components. Voltage on this pin should not exceed 300 V.
5	NC	This pin is connected to internal circuitry. It should **not** be used as a tie-point for external circuitry.

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Characteristics

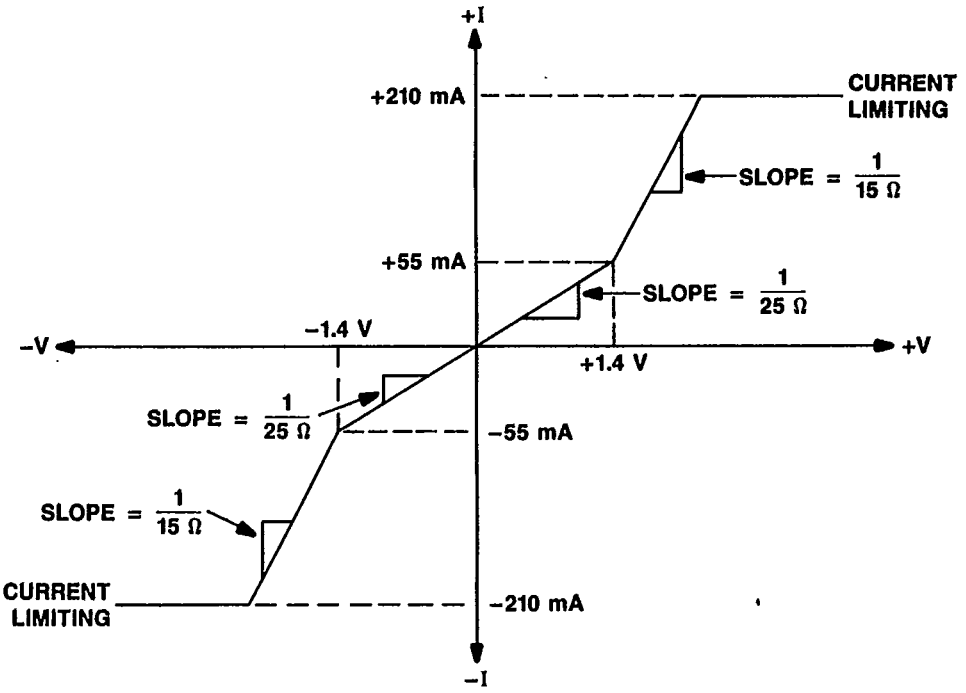

Figure 1. Typical ON Characteristics

Electrical Characteristics

T_A = 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 also for information purposes only and are not part of the testing requirements.

Characteristic	Test Condition	Min	Typ	Max	Unit
LED Forward Current for Turn-On*	I_{LOAD} = 100 mA, 25°C	—	1.5	2.5	mA
	I_{LOAD} = 80 mA, 70°C	—	2.5	5.0	
LED ON Voltage @ 10 mA	—	1.15	1.30	1.45	V
ON Resistance @ 25 mA	Figure 2	11	25	33	Ω
Breakdown Voltage @ 50 μA	Figure 2	280	330	—	V
Current Limit @ 7 V	Figure 3	160	210	260	mA
Output Off-State Leakage Current	100 V, I_{LED} = 0 μA, Figure 3	—	1.0	200	nA
	100 V, I_{LED} = 200 μA, Figure 3	—	0.1	2.0	μA
Turn-On Time	Figure 4	—	1.5	—	ms
Turn-Off Time	Figure 4	—	1.0	—	
Feedthrough Capacitance, Pin 4 to 6 (4 V p-p, 1 kHz)	—	—	24	—	pF

* Supply a minimum of 6 mA LED current to ensure proper operation over the full operating temperature range.

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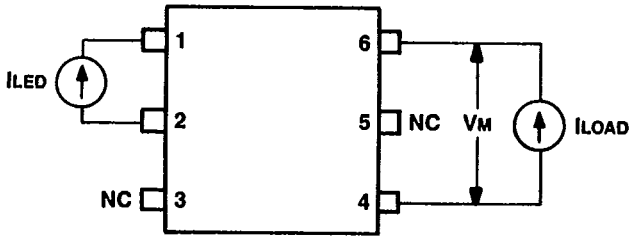
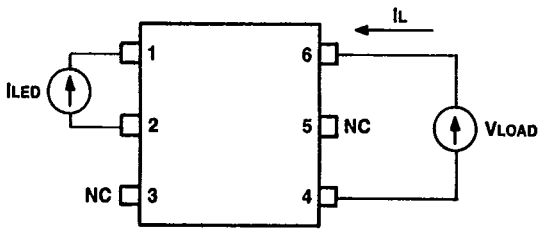
Test Circuits



ILED	ILOAD	Measure	Parameter
5.0 mA	±25 mA	±VM	ON Resistance = $\frac{V_M}{25\ mA}$
0	±50 μA	±VM	Breakdown Voltage = VM

Figure 2. Test Circuit for ON-Resistance and Breakdown Voltage



ILED	VLOAD	Measure	Parameter
0, 200 μA	±100 V	IL	Leakage, = IL
5.0 mA	±7 V	IL	Current Limit = IL

Figure 3. Test Circuit for Leakage and Current Limit

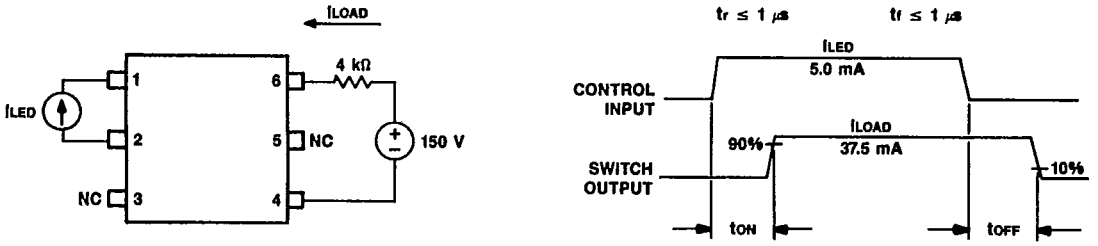


Figure 4. tON/tOFF Test Circuit and Waveform

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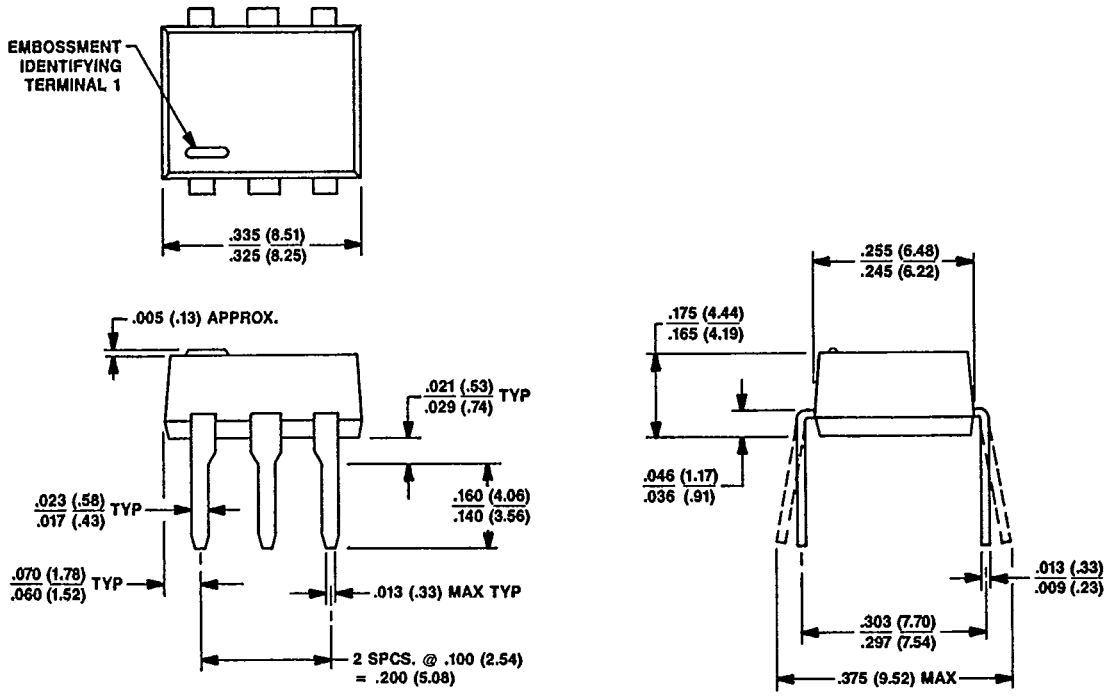
Outline Drawings

6-Pin Plastic DIP

Dimensions are in inches and (millimeters).



Ordering Information

Device	Comcode
LH1191AT	105486294