

## LH1193AB/AAC High-Voltage, Solid-State Relay

### Description

The LH1193AB/AAC High-Voltage, Solid-State Relay is a double-pole, single-throw, normally open switch (2 Form A) that can replace electromechanical relays in many applications. The relay features logic-level input control of isolated high-voltage switch outputs. The output is rated at 280 V and can handle loads up to 100 mA. The relay can switch both ac and dc loads and is ideal for audio frequency or dc applications. Typical ON-resistance at 50 mA is 25  $\Omega$ .

The LH1193AB/AAC Relay consists of a GaAlAs LED that 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 60 mA. Beyond 60 mA, the incremental resistance decreases, thereby minimizing internal power dissipation. Overload currents are clamped at 250 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. This relay is packaged in an 8-pin, plastic DIP (LH1193AB) or in an 8-pin, surface-mount, gull-wing configuration (LH1193AAC).

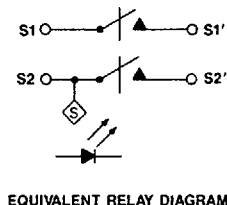
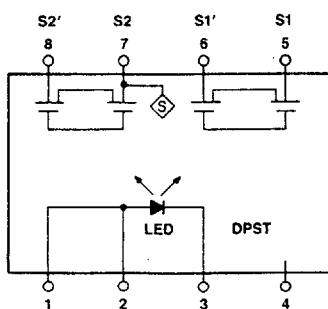
### Features

- 1500 Vrms input/output isolation
- High-surge capability
- Low ON-resistance
- Clean, bounce-free switching
- Low power consumption
- Monolithic IC reliability

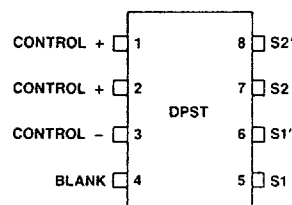
### Applications

- Telephone switchhook
- High-voltage testers
- Industrial controls
- Isolation switching

### Functional Diagram



### Pin Diagram



## Absolute Maximum Ratings

At 25 °C

Stresses exceeding the values listed under Absolute Maximum Ratings can 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 can adversely affect the device reliability.

Rating	Symbol	Value	Unit
Ambient Operating Temperature Range	TA	-40 to +85	°C
Storage Temperature Range	Tstg	-40 to +100	°C
Pin Soldering Temperature (t = 7 s max.)	TS	270	°C
Input/Output Isolation Voltage (t = 60 s min.)	VISO	1500	Vrms
LED Input Ratings:			
Continuous forward current	IF	20	mA
Reverse voltage	VR	10	V
Output Operation:			
dc or peak ac load voltage (IL ≤ 50 μA)	VL	280	V
Continuous dc load current	IL	100	mA
Power Dissipation	PDiss	600	mW

## Recommended Operating Conditions

TA = 25 °C unless otherwise specified

Parameter	Symbol	Min	Typ	Max	Unit
LED Forward Current for Switch Turn-on (TA = -40 °C to +85 °C)	IFon	6	10	20	mA
Continuous dc Load Current (each pole operating independently)	IL	—	60	150	mA
Continuous dc Load Current (each pole, two poles operating simultaneously)	IL	—	60	100	mA

## Pin Descriptions

Pin	Symbol	Name/Function
1 2 3	Control + Control + Control -	These pins are the positive and negative inputs respectively to the control LED. An appropriate amount of current through the LED closes the circuit path between S and S'.
5, 6 7, 8	S S'	These pins are the switch outputs. The pin designated as S represents one side of a relay pole. The pin designated as S' is the complementary side of a relay pole. S2 is electrically connected to the device substrate. To achieve lowest dv/dt sensitivity and optimum turn-on/off performance, connect S2 to the lowest circuit potential.
4	Blank	This pin can be used as a tie-point for external components. Voltage on this pin should not exceed 300 V.

## Characteristics

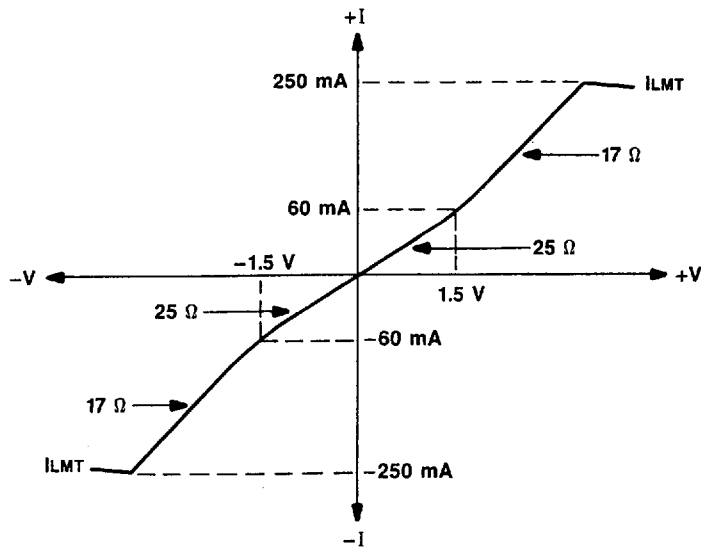


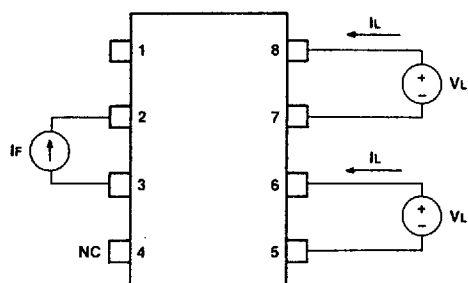
Figure 1. Typical ON Characteristics

## Electrical Characteristics $T_A = 25^\circ\text{C}$

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 purposes only and are not part of the testing requirements.

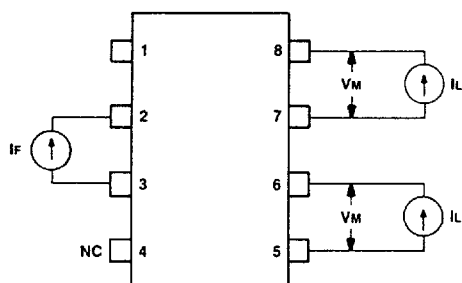
Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit
LED Forward Current for Switch Turn-on	$I_{Fon}$	$I_L$ (min) = 110 mA, $V_L = \pm 7\text{ V}$ , $t = 10\text{ ms}$ (See Figure 2.)	—	1.5	2.5	mA
LED Forward Current for Switch Turn-off	$I_{Foff}$	$I_F = 0.2\text{ mA}$ , $V_L = \pm 250\text{ V}$ (See Figure 2.)	0.2	1.4	—	mA
LED Forward Voltage	$V_F$	$I_F = 10\text{ mA}$	1.15	1.22	1.45	V
ON-resistance	$R_{ON}$	$I_F = 5\text{ mA}$ , $I_L = \pm 50\text{ mA}$ (See Figure 3.)	8	25	33	$\Omega$
Current Limit	$I_{LMT}$	$I_F = 5\text{ mA}$ , $V_L = \pm 7\text{ V}$ , $t = 10\text{ ms}$ (See Figure 4.)	220	250	350	mA
Output Off-state Leakage Current	—	$I_F = 0$ , $V_L = \pm 100\text{ V}$ (See Figure 4.)	—	0.03	200	nA
Turn-on Time	$t_{on}$	$I_F = 5\text{ mA}$ , $V_L = +150\text{ V}$ , $R_L = 4\text{ k}\Omega$ (See Figure 5.)	—	2.0	3.0	ms
Turn-off Time	$t_{off}$	$I_F = 5\text{ mA}$ , $V_L = +150\text{ V}$ , $R_L = 4\text{ k}\Omega$ (See Figure 5.)	—	1.5	3.0	ms
Feedthrough Capacitance Pin 5 to 6, Pin 7 to 8	—	$I_F = 0$ , $V_L = 4\text{ V}_{p-p}$ , 1 kHz	—	35	—	pF
Pole-to-Pole Capacitance (S1 - S2)	—	$I_F = 0\text{ mA}$ , $f = 1\text{ MHz}$	—	4.5	—	pF
Pole-to-Pole ON-resistance Matching (S1 - S2)	—	$I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$	—	0.1	0.4	$\Delta\Omega$

## Test Circuits



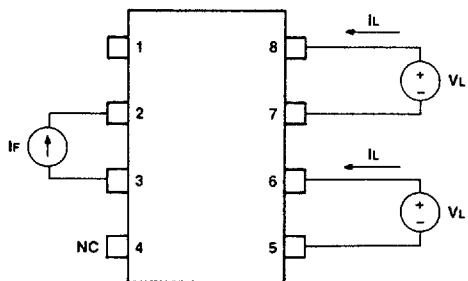
IF	VL	Measure	Parameter
2.5 mA	±7 V	IL	If $ IL  \geq I_L(\text{min})$ , then IFon is good.
0.2 mA	±250 V	IL	If $ IL  < 5 \mu\text{A}$ , then IOff is good.

Figure 2. Test Circuit for LED Forward Current for Switch Turn-On/Turn-Off



IF	IL	Measure	Parameter
5.0 mA	±50 mA	±VM	ON-resistance = $\frac{ VM }{50 \text{ mA}}$

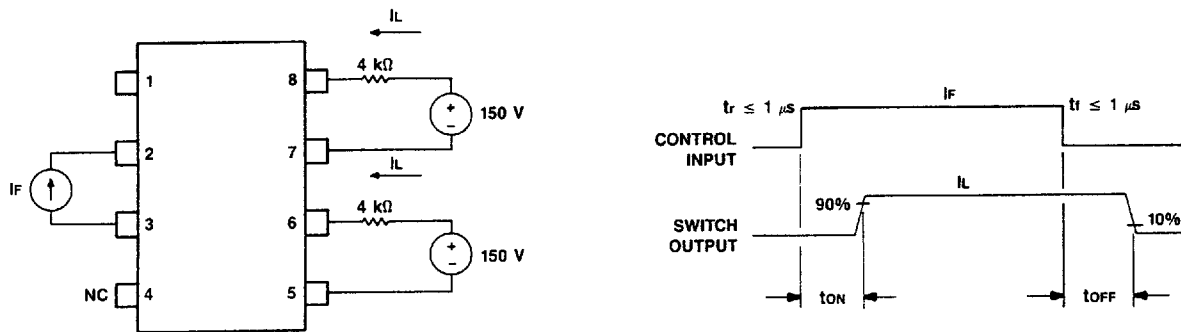
Figure 3. Test Circuit for ON-Resistance



IF	VL	Measure	Parameter
0	±100 V	IL	Leakage = $ IL $
5.0 mA	±7 V	IL	Current Limit = $ IL $ , $t = 10 \text{ ms}$

Figure 4. Test Circuit for Leakage and Current Limit

### Test Circuits (continued)



IF	VL	Measure	Parameter
5.0 mA	+150 V	IL	ton/toff = $\Delta t$ IF to IL

Figure 5. ton/toff Test Circuits and Waveforms

### Applications

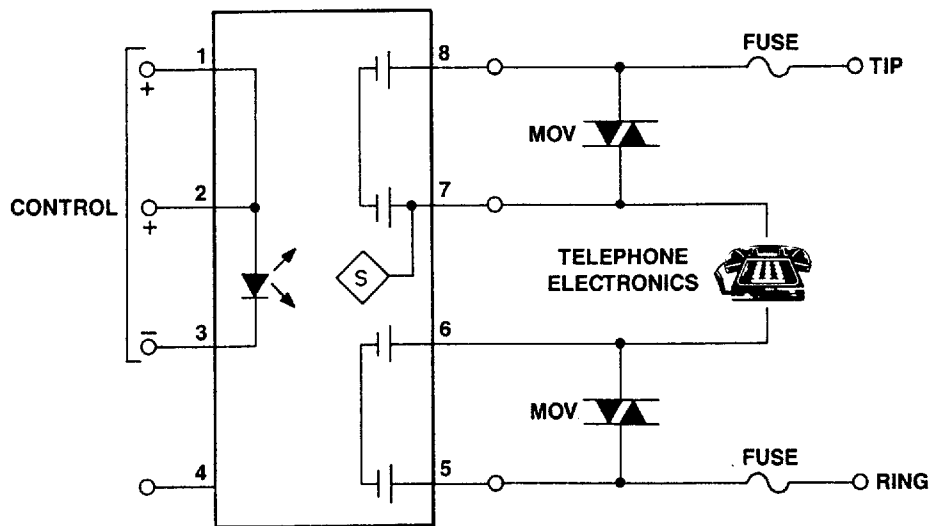


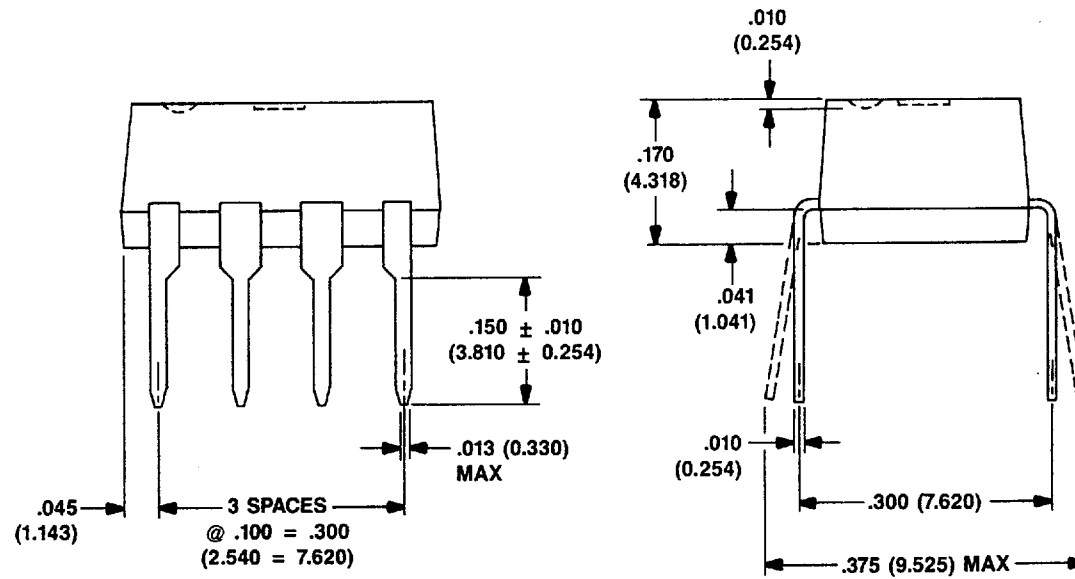
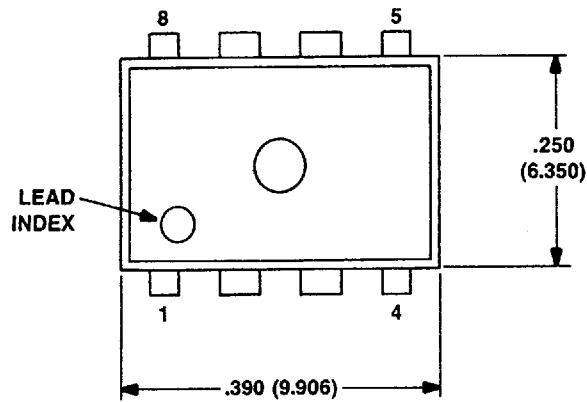
Figure 6. Balanced Switchhook Application

# LH1193AB/AAC High-Voltage, Solid-State Relay

## Outline Drawings

### 8-Pin, Plastic DIP (LH1193AB)

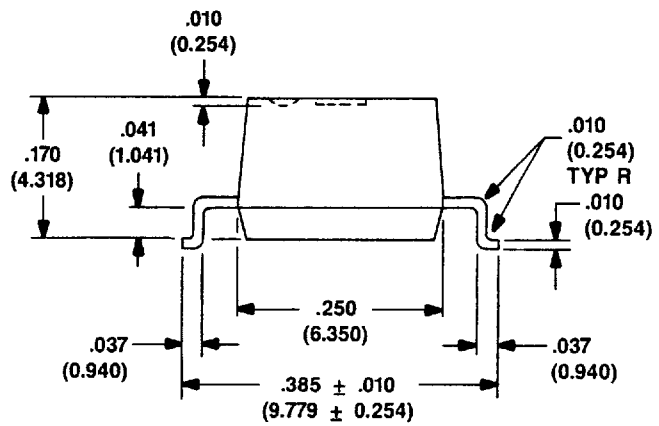
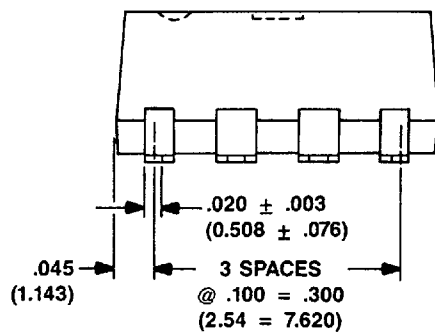
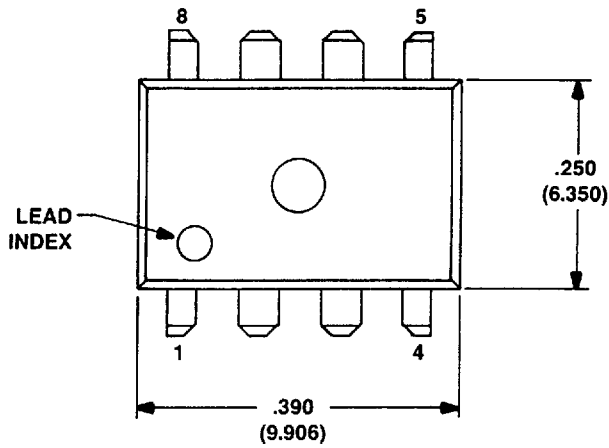
Dimensions are in inches and (millimeters).



# Outline Drawings (continued)

## 8-Pin, Plastic Gull-Wing (LH1193AAC)

Dimensions are in inches and (millimeters).



## LH1193AB/AAC High-Voltage, Solid-State Relay

### Ordering Information

Device	Package	Comcode
LH1193AB	8-Pin, Plastic DIP	105486336
LH1193AAC	8-Pin, Plastic Gull-Wing	105739171

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