Data Sheet
October 1997

microelectronics group

Lucent Technologies
Bell Labs Innovations

L7591 Subscriber Line Interface Circuit Protector

Features

- Shunts lightning pulses to ground
  - — Positive or negative 30 A, 10 x 1000 µs
  - — Positive or negative 40 A, 5 x 320 µs
  - — Positive or negative 80 A, 2 x 10 µs
- Power-cross protection
  - — 3.5 APEAK, 50 Hz to 60 Hz, 1 s
  - — 5.0 APEAK, 50 Hz to 60 Hz, 10 ms
- Gate trigger current, 15 mA max
- Up to –80 V capability
- Holding current, 150 mA min

Pin Information

Table 1. Pin Description
(Applies to DIP and SONB packages)

Pin	Symbol	Name/Function
1	TIP	Tip signal from customer.
2	VS	Supply voltage to gate (–20 V to –80 V).
3	—	Test Point, do not use.
4	RING	Ring signal from customer.
5	PR	Protected ring signal to line-feed-circuitry.
6	GND	Device ground/fault current return.
7	GND	Device ground/fault current return.
8	PT	Protected tip signal to line-feed circuitry.

Note: Pins 1 and 4 must always be connected to the protection resistors shown in Figures 4 and 5 (Line Feed Circuitry). The SLIC can be connected either to the protected outputs (pins 5 and 8) or to the inputs (pins 1 and 4).

Description

The L7591 Subscriber Line Interface Circuit (SLIC) Protector is designed to protect line-feed circuitry from fault-induced lightning and power-cross surge pulses. If a fault current forces TIP and/or RING to a more negative voltage than Vs, current is conducted through the trip circuit. When the specified trip current level is reached, transistors PNPN1 and/or PNPN2 will turn on and "crowbar" the majority of the current to ground. If similar pulses force TIP and/or RING to a more positive state than ground, diodes D1 and/or D2 will conduct the pulse to ground. The L7591 SLIC Protector is available in an 8-pin, plastic DIP (L7591AB) and in an 8-pin, plastic SONB package (L7591AS).

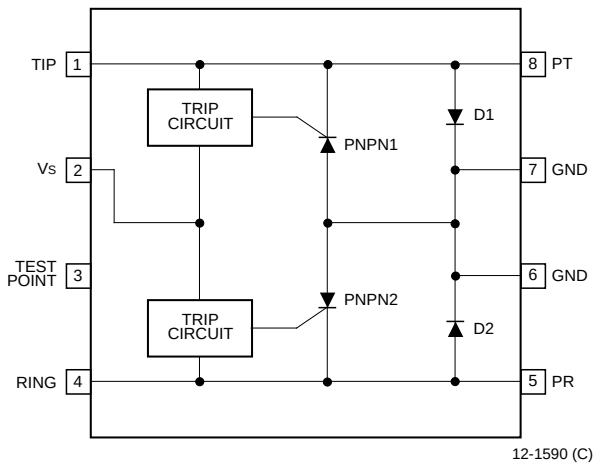


Figure 1. Functional and Pin Diagram

Absolute Maximum Ratings (At 25 °C)

Stresses in excess of the Absolute Maximum Ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to Absolute Maximum Ratings for extended periods can adversely affect the device reliability.

Parameter	Symbol	Value	Unit
Ambient Operating Temperature	T_A	–40 to +85	°C
Storage Temperature Range	T_{stg}	–40 to +125	°C
Pin Soldering Temperature (t = 15 s max)	—	300	°C
Supply Voltage	V_S	–83	V
Peak Pulse Current: * (See Figure 2.) 10 x 1000 µs 5 x 320 µs 2 x 10 µs	 — — —	 30 40 80	 A A A
Nonrepetitive Peak ON-state Current: t = 1 s, f = 50 Hz to 60 Hz t = 10 ms, f = 50 Hz to 60 Hz	 — —	 3.5 5	 A A
Maximum Gate Current (Half Sine Wave 10 ms)	—	2	A
Maximum Voltage: TIP or RING to Gnd V_S to Gnd	 — —	 –100 –80	 V V

*Pulse Waveform Data:

10 x 1000 µs	tr = 10 µs	tp = 1000 µs
5 x 320 µs	tr = 5 µs	tp = 320 µs
2 x 10 µs	tr = 2 µs	tp = 10 µs

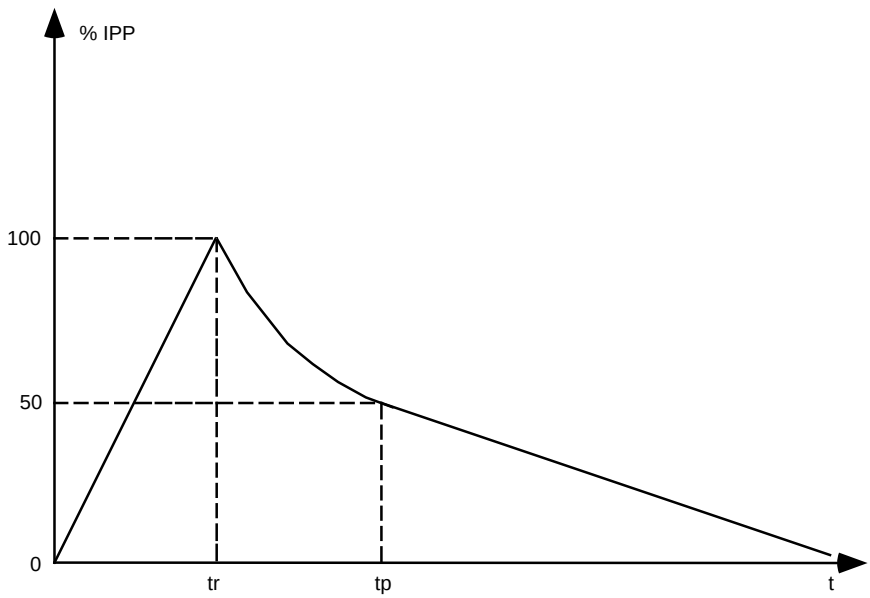


Figure 2. Pulse Waveform

Electrical Specifications (T_A = 25 °C)

The minimum and/or maximum limits specified for the parameters are based on the absolute system. The algebraic sign only applies to the direction of the parameter. These requirements apply to either the TIP or RING terminal; however, the device is capable of simultaneous Tip and Ring surges and continuous current, as noted below in Tip and Ring leads. See Figure 3 and Table 5 for symbol and test condition definition.

Table 2. Electrical Characteristics D1 and D2

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Forward Voltage	V_F	I_P = 5 A, t_P = 1 ms	—	1.6	3	V
Peak Forward Voltage	V_{FP}	I_{PP} = 30 A, 10 x 1000 µs	—	5.2	15	V

Table 3. Electrical Characteristics, PNPN Circuitry

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Gate Trigger Current	I_{GT}	V_S = 48 V	0.2	—	15	mA
Holding Current	I_H	t_P = 10 ms, V_S = 48 V	–150	–250	—	mA
Trip Voltage	V_T	dc	—	V_S –2.0	V_S –2.8	V
Dynamic Trip Voltage	V_{SGL}	I_{PP} = 30 A, V_S = –48 V, 10 x 1000 µs	—	–51	–63	V
Reverse Leakage Current: V_S to Tip or Ring	I_{RG}	V_S = –75 V				
T_A = 25 °C	—	—	—	0.12	5	µA
T_A = 70 °C	—	—	—	—	50	µA
dv/dt Sensitivity	—	Tip or Ring Lead	±1000	—	—	V/µs
On-state Voltage:	V_{ON}	t_P = 1 ms				
I_T = 0.5 A	—	—	—	–1.3	—	V
I_T = 3.0 A	—	—	—	–2.3	—	V

Table 4. Electrical Characteristics, Diode and PNPN Circuitry

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Reverse Leakage Current: (Gate Open)	I_R	V_R = –85 V				
T_A = 25 °C	—	—	—	0.14	5	µA
T_A = 70 °C	—	—	—	—	50	µA
Off-state Capacitance:	Coff	f = 1 MHz				
V_R = –3 V	—	—	—	50	—	pF
V_R = –48 V	—	—	—	40	—	pF

Characteristic Curves

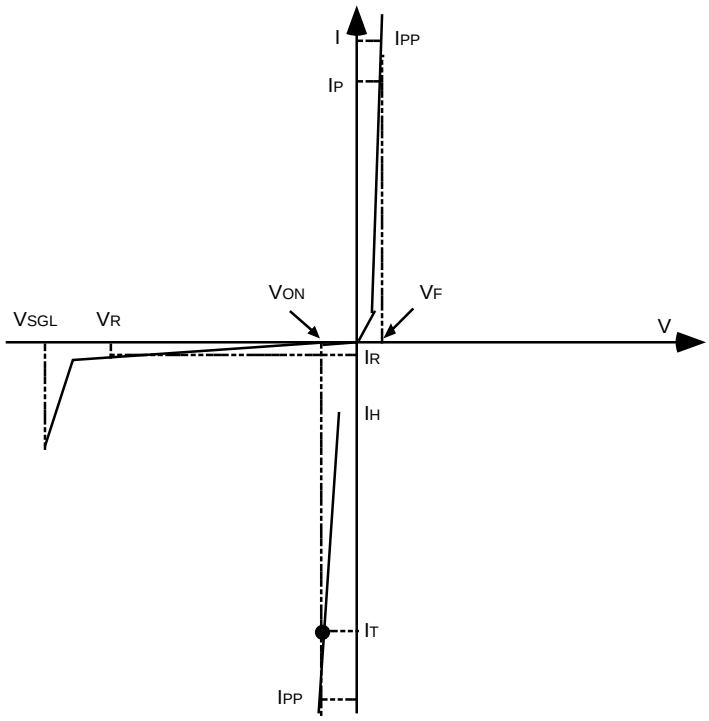
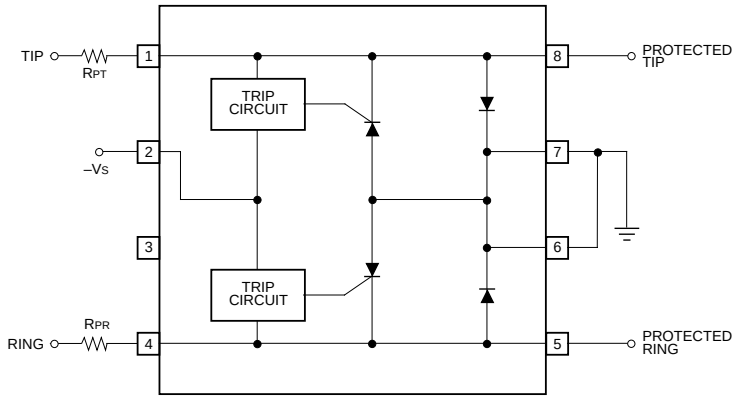


Figure 3. Typical Trip Characteristics of the SLIC Protector

Table 5. Symbols Definition

Symbol	Parameter
I_H	PNPN holding current
I_{GT}	Gate trigger current out of pin V_S
I_P	Pulse current
I_{PP}	Peak pulse current
I_{RG}	Reverse leakage current V_S to Tip or Ring
I_T	Tip or Ring current when PNPN is on
I_R	Reverse leakage current, Tip or Ring to Ground
V_F	Forward voltage, Tip or Ring to Ground
V_{FP}	Peak forward voltage, Tip or Ring to Ground
V_T	Trip voltage, Tip or Ring to V_S
V_{SGL}	Dynamic trip voltage, Tip or Ring to V_S
V_{ON}	PNPN on voltage at I_T
V_R	Tip or Ring voltage when PNPN is off
Coff	Off-state capacitance, Tip or Ring to Ground

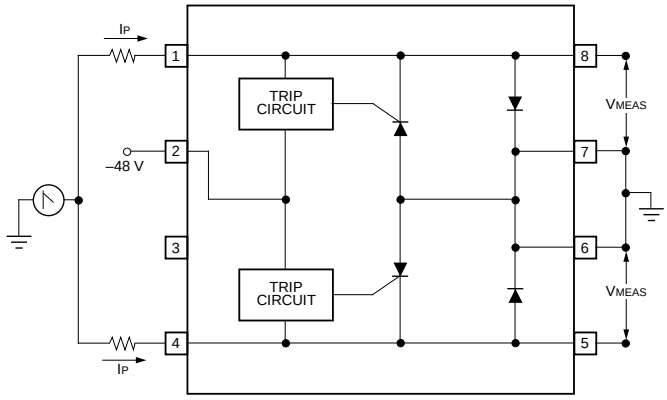
Applications



12-1632 (C)

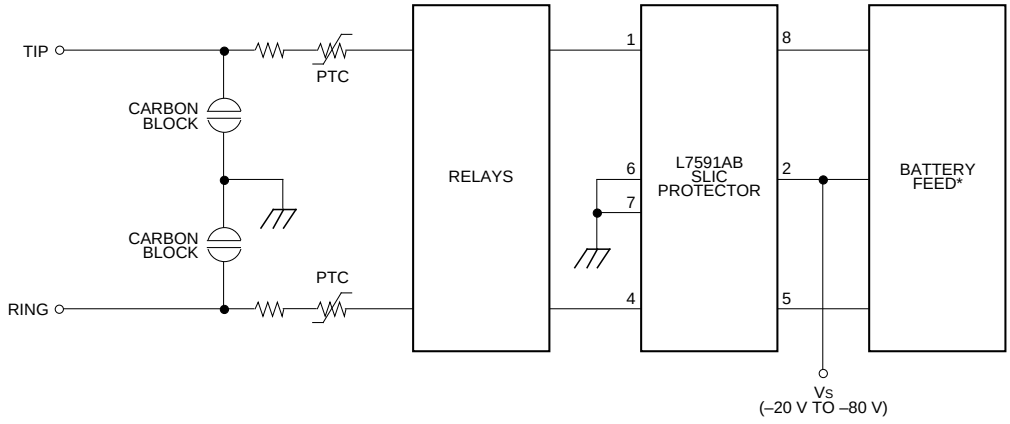
RPT and RPR must be properly selected for proper operation and/or response.

Figure 4. Standard Configuration



12-1596 (C)

Figure 5. Test Circuit



12-1598 (C)

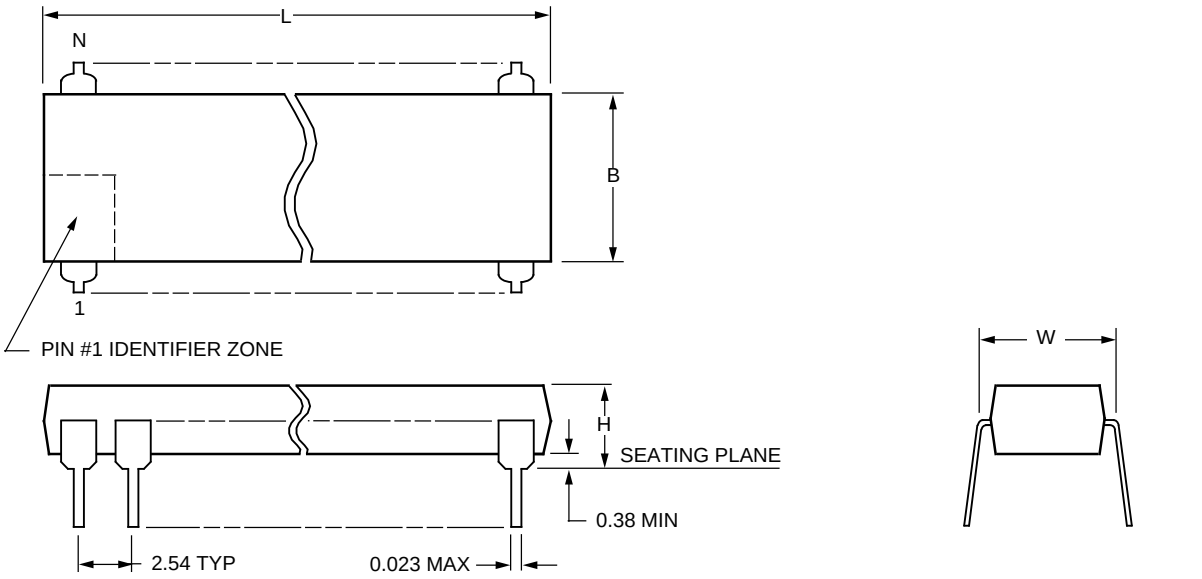
*An example device is Lucent Technologies Microelectronics Group's LB1276 High Balance SLIC.

Figure 6. Fully Protected Electronic TIP-RING Interface (Not all devices needed in all applications)

Outline Drawings

8-Pin DIP (L7591AB)

Dimensions are in millimeters.



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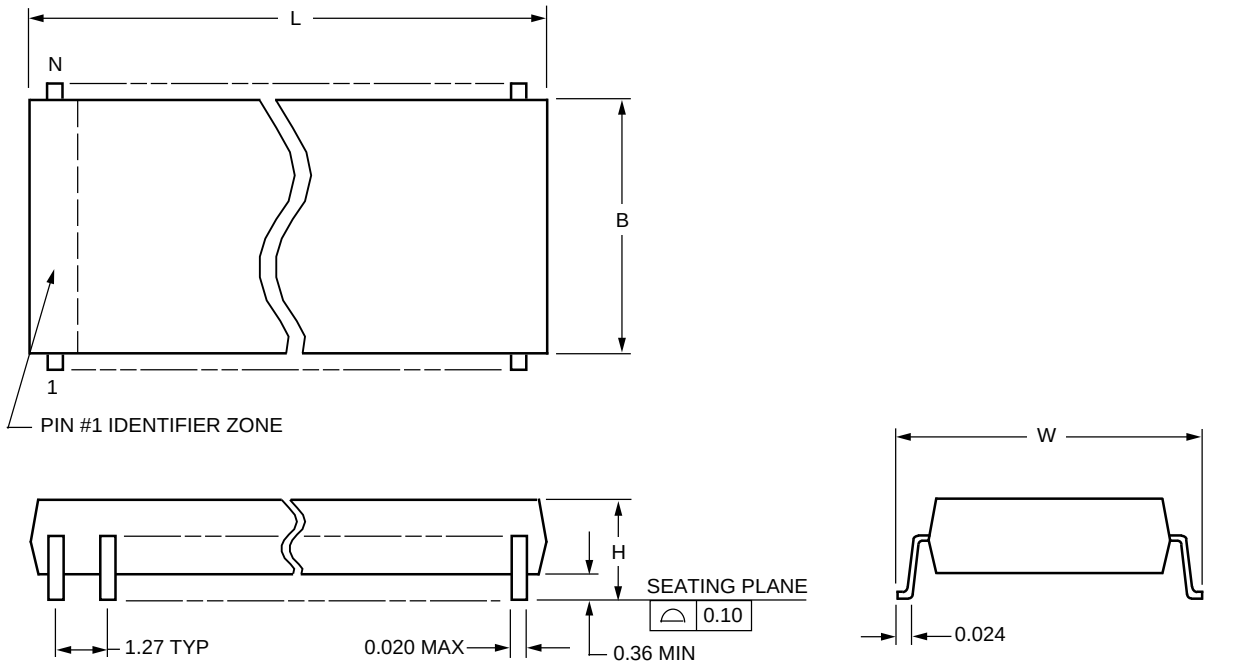
Package Description	Number of Pins (N)	Package Dimensions			
		Maximum Length (L)	Maximum Width Without Leads (B)	Maximum Width Including Leads (W)	Maximum Height Above Board (H)
PDIP3 (Plastic Dual-In-Line Package)	8	10.16	6.48	7.87	5.46

Outline Drawings (continued)

8-Pin, SONB (L7591AS)

Dimensions are in millimeters.



Package Description	Number of Pins (N)	Package Dimensions			
		Maximum Length (L)	Maximum Width Without Leads (B)	Maximum Width Including Leads (W)	Maximum Height Above Board (H)
SONB (Small Outline, Narrow Body)	8	5.08	4.01	6.17	1.73

Ordering Information

Device Part No.	Description	Package	Comcode
ATTL7591AB	SLIC Protector	8-Pin DIP	107056582
ATTL7591AS	SLIC Protector	8-Pin SONB	107056590
ATTL7591AS-TR	SLIC Protector	8-Pin SONB (Tape and Reel)	107232787

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