# LB1019

PRELIMINARY DATA

AN AT&T PRODUCT

## POWER CONTROLLER

- DIGITALLY CONTROLLED POWER SWITCH
- CONTROLS −48V POWER TO TELEPHONE SETS OR OTHER LOADS
- POWER CAN BE TURNED ON AND OFF USING $\overline{ON}$ INPUT
- CURRENT LIMITING DURING A FAULT CONDITION
- THERMAL SHUTDOWN DURING EXTENDED FAULT CONDITIONS
- ISOLATION OF THE LOAD FROM THE POWER SUPPLY UNTIL THE POWER SUPPLY'S MAGNITUDE EXCEEDS −33 VOLTS (TYPICALLY)
- INTERRUPTION OF POWER TO THE LOAD WHEN THE POWER SUPPLY'S MAGNITUDE FALLS BELOW −30.5V (TYPICALLY)
- INDICATES AN OVERCURRENT CONDITION WHEN THE LOAD CURRENT EXCEEDS 300mA (TYPICALLY)
- INQUIRE ABOUT AVAILABILITY OF DEVICES WITH 200, 450, 600 mA (±15%) OF OVERCURRENT THRESHOLD
- INDICATES CURRENT FLOW TO CONFIRM CIRCUIT CONTINUITY
- EO INPUT ALLOWS SMOOTH POWER UP SEQUENCE
- SMALL 8-PIN DUAL-IN-LINE PACKAGE


Minidip-A Plastic

ORDERING NUMBER: LB1019AB

The LB1019 integrated circuit provides control functions and maintenance monitoring for −48-volt power supplied via a single output to a telephone set or other load. It is able to turn the power on and off under manual control, indicate a 300mA overcurrent condition on the circuit, and provide an indication that some current is flowing to confirm circuit continuity. The device includes two safety features: an output current limit to protect against large current surges on a direct short-circuit and thermal shutdown of the chip if an overload persists without being manually turned off.

An "EO" input is provided to allow for smooth power-up sequences. This lead is connected to an RC network (R from +5.0V to EO and C from EO to ground) and holds the circuit in an off state for a predetermined amount of time after the +5.0V is applied.

Power will not be applied to the controlled circuit unless the nominally −48-volt supply is more negative than −33 volts and power will be interrupted to the load when the power supply is more positive than −30.5 volts.

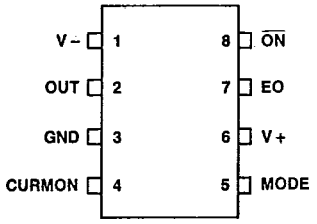
### ABSOLUTE MAXIMUM RATINGS (at 25°C unless otherwise specified)

| Parameter | Value | Unit |
|---|---|---|
| Ambient Operating Temperature Range | −20 to +70 | °C |
| Storage Temperature Range | −40 to +125 | °C |
| Pin Soldering Temperature (r = 15 sec.) | 300 | °C |
| Power Dissipation (Package Limitation) | 1 | W |
| Power Instantaneous ($T \leq 2\mu$sec) | 50 | W |
| Operating Voltage V+ | +5.5 | V |
| Operating Voltage V− | −54 | V |

Stresses in excess of those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions in excess of those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

# LB1019

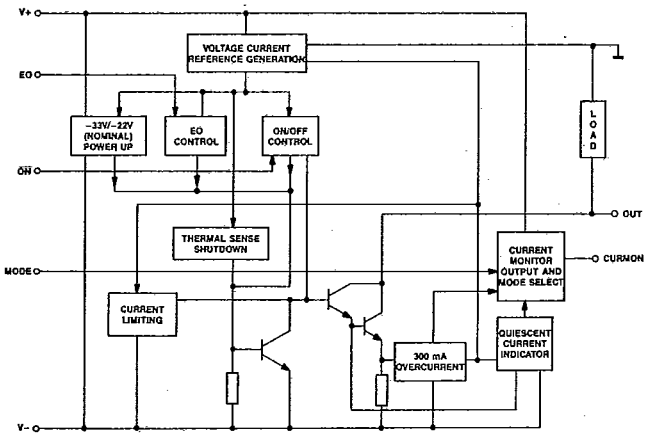
## PIN CONFIGURATION




## PIN DESCRIPTION

| Pin | Name | Description |
|---|---|---|
| 1 | V– | Connection for "most negative" external power supply. |
| 2 | OUT | The output pin supplies a "controlled" voltage to a telephone set or other types of loads. |
| 3 | GND | Ground or circuit common (not necessarily physical or system ground). |
| 4 | CURMON | Current monitor. CURMON is a TTL compatible output signal. It indicates whether the output load current is either less than of greather than a predetermined threshold reference level. |
| 5 | MODE | Mode is an LSTTL-Compatible input signals (Table 1). A logic HIGH sets the CURMON thresold reference level to a typical level of 300mA. A logic LOW sets the CURMON threshold level to a typical level of 3mA (Table 2). |
| 6 | V+ | Connection for the "most positive" external power supply. |
| 7 | EO | EO is a high impedance input used to force the chip to ignore all other inputs and hold the −48-volt output off until the voltage on EO exceeds 3.0 volts. This input can be used to eliminate logic power-up "sanity" problems by use of an external R-C network, as shown in the Block Diagram (Fig. 1). This input has substantial hysteresis (1.0 ± 0.5 volts) to prevent noise problems since the voltage may ramp up slowly. A diode is included on the chip between EO and +5.0Vdc to insure quick discarge of the capacitor upon power down. The leakage current into or out of EO is tested to be less than 5.0μA under all conditions. |
| 8 | $\overline{ON}$ | This terminal is an LSTTL compatible input. When held LOW, it turns on power to the −48V load as long as EO is HIGH and LB1019 is not in a thermal overload condition. |

*Fig. 1 - Functional Diagram*



# LB1019

## ELECTRICAL CHARACTERISTICS (At 25°C and with V+ = 5.0V, V− = −48V unless otherwise noted)

| Symbol | Parameter | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{PS}$ | Power Supply Current | V+ = 5.5V, V− = −48V (See Fig. 4) | — | — | 4.4 | mA |
| | | V+ = 5.5V, V− = −54V (See Fig. 5) | — | — | 2.8 | |
| | | V+ = Open, V− = −54V (See Fig. 6) | — | — | 3.0 | |
| $V_{\overline{THON}}$ | V− Turn-On Thereshold | (See Fig. 7) | −26.0 | −33 | −37 | V |
| $V_{\overline{THOFF}}$ | V− Turn-Off Thereshold | (See Fig. 7) | −27.5 | −30.5 | −35.2 | |
| $V_{DROP}$ | Output Voltage Drop | $I_{OUT}$ = 300mA (See Fig. 8) | — | — | 2.0 | |
| $EO_{THON}$ | EO Turn-On Threshold | (See Fig. 9) | 1.5 | 2.0 | 2.5 | |
| $EO_{THOFF}$ | EO Turn-Off Threshold | (See Fig. 9) | 2.5 | 3.0 | 3.5 | |
| $I_{THLO}$ | Low Output Current Threshold | (See Fig. 10) | 1.5 | 3.0 | 7.0 | mA |
| | Low Output Current Threshold | $T_j$ = 100°C (See Fig. 10) | 1.5 | — | 10 | |
| $I_{THHI}$ | High Output Current Threshold | (See Fig. 10) | 258 | 300 | 340 | |
| $I_{LIM}$ | Output Current Limit | (See Fig. 11) | 0.6 | 0.8 | 1.1 | A |

*Table 1 - TTL-Compatible Input/Output Characteristics*

| Symbol | Parameter | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{IL}$ | Single LSTTL input: ($\overline{ON}$ & MODE) | $V_{IN}$ = 0.4V, V+ = 5.5V | — | — | −400 | μA |
| $I_{IH}$ | | $V_{IN}$ = 2.7V, V+ = 5.5V | — | — | 20 | |
| $V_{OL}$ | TTL Output: (CURMON) | $I_{OL}$ = 1mA V+ = 4.5V | — | — | 0.45 | V |
| $V_{OH}$ | | $I_{OH}$ = −250μA V+ = 4.5V | 2.4V | — | — | |
| $V_I$ | Input Clamp Diode (see EO Pin Description) | $I_I$ = −18mA V+ = 4.5V | — | — | 1.5 | V |

*Fig. 2 - Output Characteristics at 25°C*

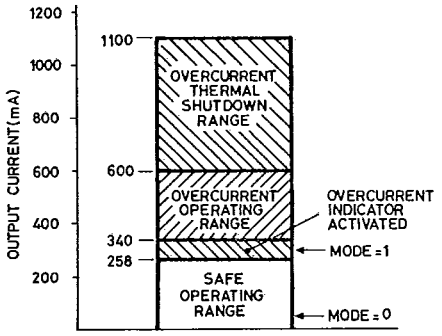


*Fig. 3 - Logical Diagram*

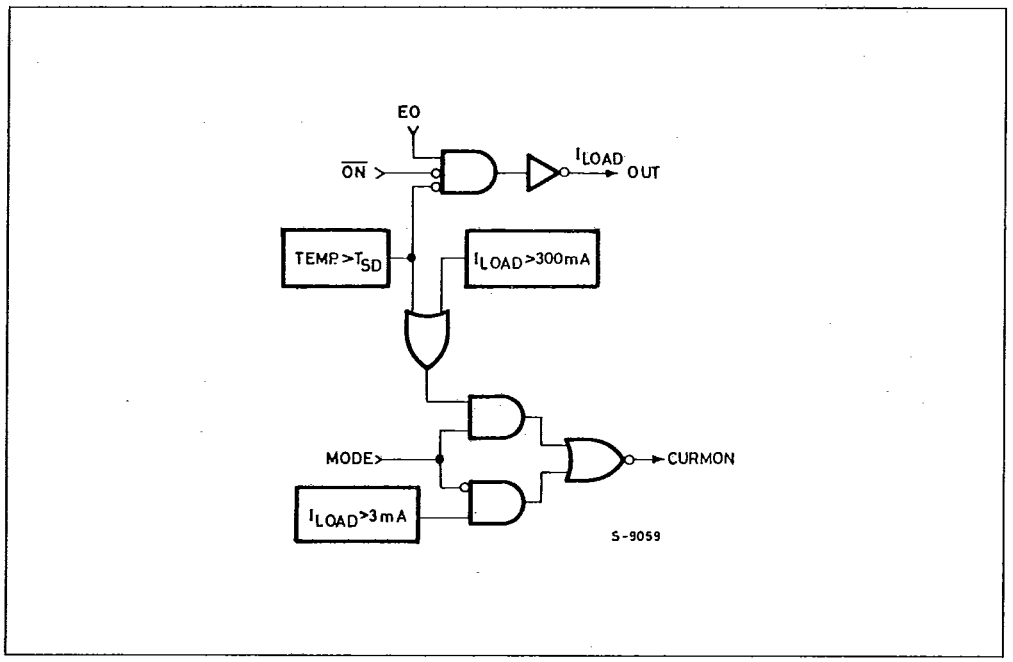



*Table 2 - Output Status Logic Table*

| $E_O$ | $\overline{ON}$ | Thermal Shutdown | OUT |
|---|---|---|---|
| 0 | X | X | OFF |
| X | X | 1 | OFF |
| 1 | 1 | 0 | OFF |
| 1 | 0 | 0 | ON |

*Table 3 - Current Monitor Status Logic Table*

| MODE | $I_{LOAD}$ >3mA | $I_{LOAD}$ >300mA | Thermal Shutdown | CURMON |
|---|---|---|---|---|
| 0 | 0 | X | X | 1 |
| 0 | 1 | X | X | 0 |
| 1 | X | 0 | 0 | 1 |
| 1 | X | X | 1 | 0 |
| 1 | X | 1 | 0 | 0 |

## TEST CIRCUITS

*Fig. 4 - Power Supply Current*

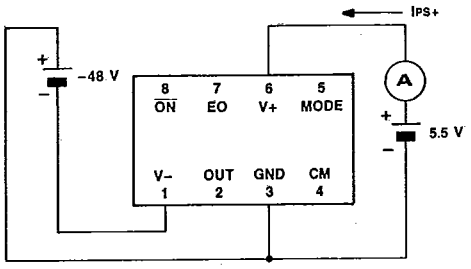



*Fig. 5 - Power Supply Current*

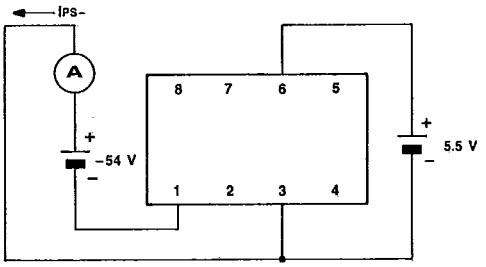



*Fig. 6 - Power Supply Current*

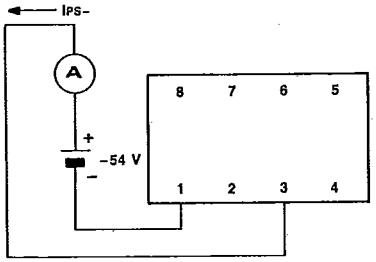



*Fig. 8 - Output Voltage Drop ($V_{OUT}$)*

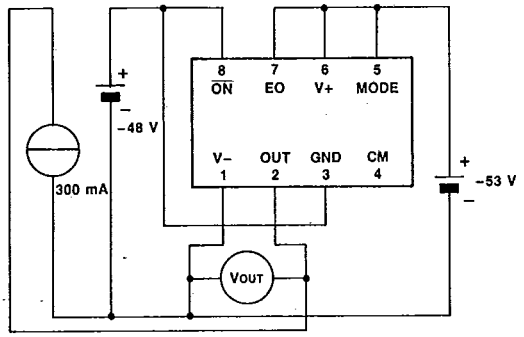
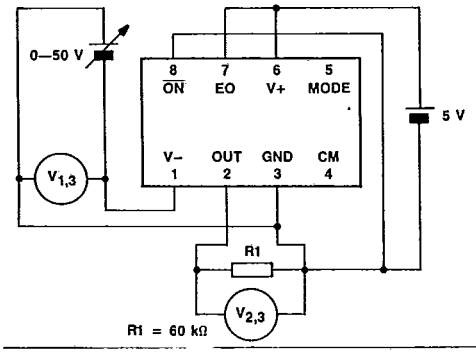
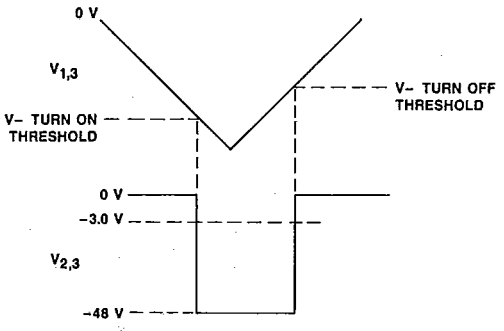



*Fig. 7 - V-Turn ON & V-Turn OFF Threshold*



**TEST CIRCUITS** (Continued)

*Fig. 9 - EO Turn ON & EO Turn OFF Threshold*

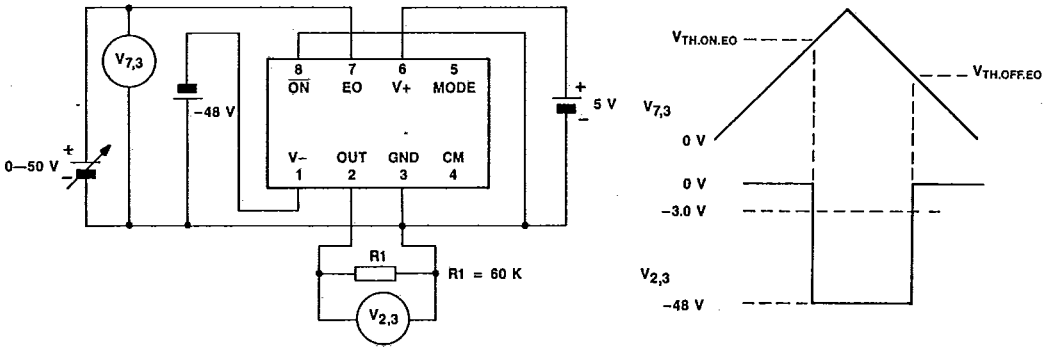



*Fig. 10 - Low Output Current Threshold ($I_2$)*

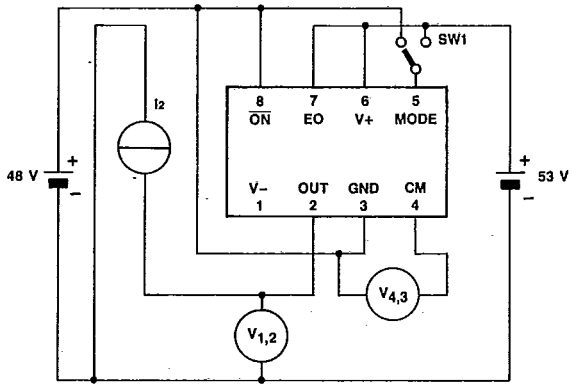
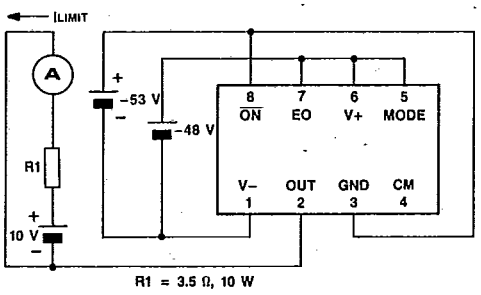



*Fig. 11 -Output Current Limit ($I_{LIMIT}$)*



## APPLICATION

Power will not be applied to the load which is connected to the output of the LB1019 Power Controller unless the V– supply is more negative than a nominal –33 volts. This condition is described as the V– turn-on threshold. Conversely, power will be interrupted to an operating load when the V– supply becomes more positive than a nominal –30.5 volt. This condition is described as the V– Turn-OFF threshold. The LB1019 Power Controller has been designed to operate with a nominal power supply of –48 volts.

Table 4 is a summary of the device operation. Specifically, the device may be interrogated (either with a microprocessor or with manual control) to determine the status of the load connected to the output of the LB1019. Voltage on the EO pin should be greather than +3.5 volts for the interrogation process.

If the LB1019 Power Controller is overloaded for a significant period of time and is in danger of destruction due to thermal runaway, the internal shutdown mechanism will act to protect the device and remove power from the load. An indication of this is that CURMON will be a logic LOW when MODE is a logic HIGH.

If desired, the user can differentiate between an overcurrent indication and thermal shutdown by examining CURMON with MODE being a logic HIGH and $\overline{ON}$ being a logic LOW. Then force $\overline{ON}$ to a logic HIGH and examine CURMON again. If CURMON remains LOW under both conditions, the device is in thermal shutdown and no current is flowing. If the state of CURMON changes under this test, the device was not shutdown, but was in an overcurrent condition.

Another special interrogation feature is the quiescent current indicator (MODE is set to zero). This feature indicates that the output of the controller is connected to the load.

*Table 4 - Device Operation Summary*

| EO (in) | $\overline{ON}$ (in) | MODE (in) | CURMON (out) | DEVICE STATE |
|---|---|---|---|---|
| 0 | X | X | 1 | Disabled, output turned OFF |
| 1 | 1 | X | 1 | Output OFF, device not in thermal Shutdown |
| 1 | 1 | 1 | 0 | Output OFF, device in thermal shutdown from previous overload |
| 1 | 0 | 0 | 1 | Output ON, connection from controller output to the load is open |
| 1 | 0 | 0 | 0 | Output ON, load is connected to the controller output |
| 1 | 0 | 1 | 1 | Output ON, current less than overload thereshold |
| 1 | 0 | 1 | 0 | Output ON, current greater than overload thereshold, device may be in danger of going into thermal shutdown, or is in thermal shutdown |

The application diagram shown in Figure 12 illustrates the connections and external components which are necessary for the basic operation of the LB1019 Power Controller. The RC network ($R_{EXT}$ and $C_{EXT}$) holds the device in an OFF-state condition for a predetermined amount of time after V+ is applied.

*Fig. 12 - Power Controller Application Diagram*