Triple RS232 Driver/Receiver with Shutdown

FEATURES

- **On-Chip ESD Protection:**
  ±15kV Human Body Model
  ±15kV IEC-1000-4-2 Air Gap Test**
  ±8kV IEC-1000-4-2 Contact Test
- 125kBd Operation with 3kΩ/2500pF Load
- **250kBd Operation with 3kΩ/1000pF Load**
- Operates from ±5V to ±15V Supplies
- Fully Protected Against Overload
- **Outputs Can Be Driven ±30V Without Damage**
- Three-State Outputs; Outputs Open When Off
- Bipolar Circuit—No Latchup
- ±30V Input Range
- Triple Driver/Receiver
- **No Supply Current in Shutdown**
- 30kΩ Input Impedance
- Meets All RS232 Specifications
- 16-Pin Version—Pin Compatible with MC145406
- Available in SO Package

APPLICATIONS

- RS232 Interface
- Terminals
- Modems

DESCRIPTION

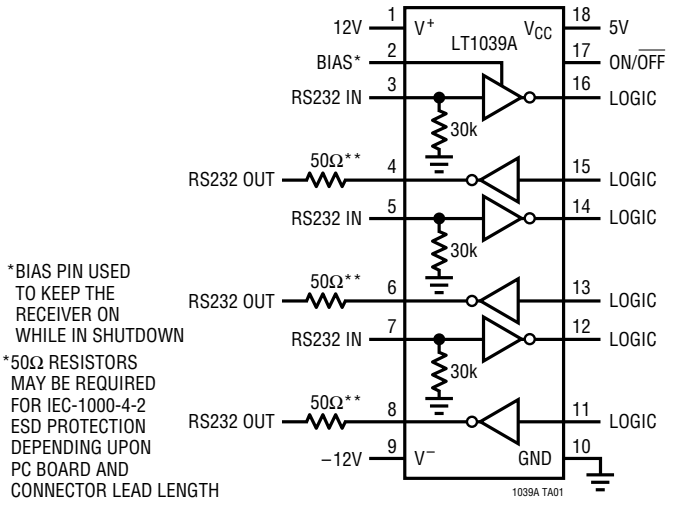
The LT®1039A is a triple RS232 driver/receiver that includes shutdown. Each receiver will accept up to ±30V input and can drive either TTL or CMOS logic. The RS232 drivers accept TTL logic inputs and output RS232 voltage levels. The outputs are fully protected against overload and can be shorted to ground or up to ±30V without damage to the drivers. Additionally, when the system is shut down or power is off, the outputs are in a high impedance state allowing data line sharing. On-chip ESD protection eliminates the need for external protection devices.

A bias pin allows one receiver to be kept on while the rest of the part is shut down.

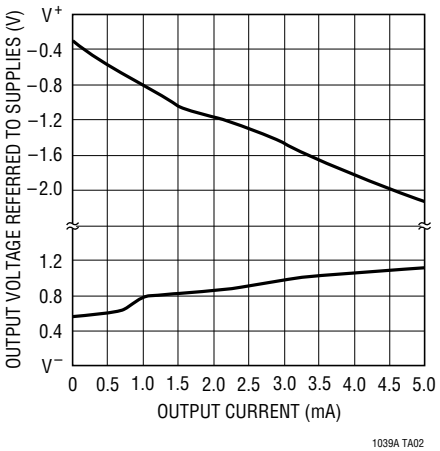
The LT1039A is also available in the 16-pin version, without shutdown or bias pin functions.

For applications requiring operation from a single 5V supply, see the LT1180A/LT1181A and LT1130A data sheets.

TYPICAL APPLICATION



Driver Output Swing



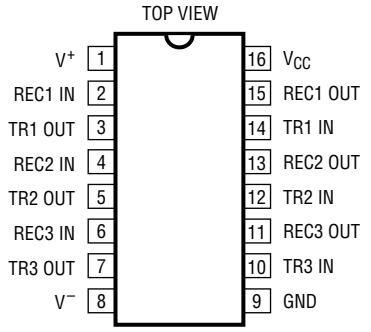
ABSOLUTE MAXIMUM RATINGS

Supply Voltage
- Driver (V^+, V^-) ..... ±16V
- Receiver (V_{CC}) 7V

Logic Inputs ..... V^- to 25V
Receiver Inputs ..... ±30V
ON/OFF Input ..... GND to 12V
Driver Outputs ..... V^- + 30V to V^+ – 30V
Short-Circuit Duration ..... Indefinite
Operating Temperature Range
- LT1039AC ..... 0°C to 70°C
- LT1039AI ..... –40°C to 85°C
- LT1039AM ..... –55°C to 125°C

Storage Temperature Range ..... – 65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

PACKAGE/ORDER INFORMATION



J PACKAGE
16-LEAD CERDIP

N PACKAGE
16-LEAD PDIP

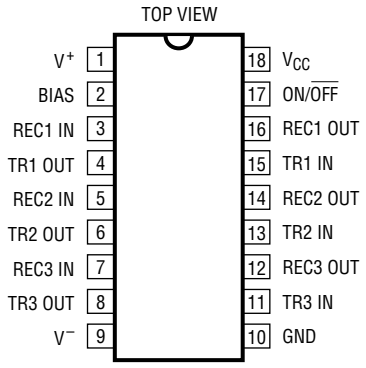
SW PACKAGE
16-LEAD PLASTIC SO WIDE

T_{JMAX} = 150°C, θ_{JA} = 105°C/W, θ_{JC} = 30°C/W (J)
T_{JMAX} = 125°C, θ_{JA} = 90°C/W, θ_{JC} = 50°C/W (N)
T_{JMAX} = 125°C, θ_{JA} = 95°C/W, θ_{JC} = 27°C/W (SW)

ORDER PART NUMBER

LT1039ACN16
LT1039ACSW16
LT1039AIN16
LT1039AISW16
LT1039AMJ16

Consult Factory for Availability



J PACKAGE
18-LEAD CERDIP

N PACKAGE
18-LEAD PDIP

SW PACKAGE
18-LEAD PLASTIC SO WIDE

T_{JMAX} = 150°C, θ_{JA} = 88°C/W, θ_{JC} = 22°C/W (J)
T_{JMAX} = 125°C, θ_{JA} = 79°C/W, θ_{JC} = 36°C/W (N)
T_{JMAX} = 125°C, θ_{JA} = 90°C/W, θ_{JC} = 26°C/W (SW)

ORDER PART NUMBER

LT1039ACN
LT1039ACSW
LT1039AIN
LT1039AISW
LT1039AMJ

ELECTRICAL CHARACTERISTICS

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Driver V^+ = 12V, V^- = –12V, $V_{ON/\overline{OFF}}$ = 2.5V (Note 1)						
Output Voltage Swing	Load = 3k to Ground					
	Positive	●	V^+ – 2.0	V^+ – 1.3		V
	Negative	●	V^- + 1.5	V^- + 1.0		V
Logic Input Voltage Levels	Input Low Level (V_{OUT} = High)	●		1.4	0.8	V
	Input High Level (V_{OUT} = Low)	●	2.0	1.4		V
Logic Input Current	$V_{IN} \geq$ 2.0V			1	20	µA
	$V_{IN} \leq$ 0.8V			5	20	µA
Output Short-Circuit Current	Sourcing Current, V_{OUT} = 0V		20	30		mA
	Sinking Current, V_{OUT} = 0V		–15	–30		mA
Output Leakage Current	Shutdown (Notes 2, 3), V_{OUT} = ±18V, V_{IN} = 0V	●		10	200	µA
Supply Leakage Current	Shutdown (Note 2)	●		1	100	µA
Slew Rate	R_L = 3k, C_L = 51pF to 2500pF		4	15	30	V/µs
Supply Current	V_{OUT} = Low			1	5	mA

ELECTRICAL CHARACTERISTICS

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Prop Delay (t_{PLH}) (t_{PHL})				0.6 0.8	1.2 1.2	µs µs
Receiver V_{CC} = 5V, $V_{ON/\overline{OFF}}$ = 2.5V (Note 1)						
Input Voltage Thresholds	Input Low Level (V_{OUT} = High) Input High Level (V_{OUT} = Low)	● ●	0.5	1.3 1.7	 2.8	V V
Hysteresis		●	0.1	0.4	1.0	V
Input Resistance		●		30		kΩ
Output Voltage	Output Low, I_{OUT} = –1.6mA Output High, I_{OUT} = 160µA	● ●	 3.5	0.4 4.8	0.5	V V
Output Short-Circuit Current	Sourcing Current, V_{OUT} = V_{CC} Sinking Current, V_{OUT} = 0V	● ●	–10 15	–30 25		mA mA
Output Leakage Current	Shutdown (Note 1), 0V ≤ V_{OUT} ≤ V_{CC}, V_{IN} = 0V	●		1	10	µA
Supply Current	(Note 4)	●		2	5	mA
Supply Leakage Current	Shutdown (Note 2)	●		1	100	µA
ON/$\overline{OFF}$ Pin Current	0V ≤ $V_{ON/\overline{OFF}}$ ≤ 5V	●	–15		80	µA
Prop Delay (t_{PLH}) (t_{PHL})				200 300	600 600	ns ns

The ● denotes specifications which apply over the full operating temperature range.

Note 1: $V_{ON/\overline{OFF}}$ = 5V for LT1039AM grade devices.

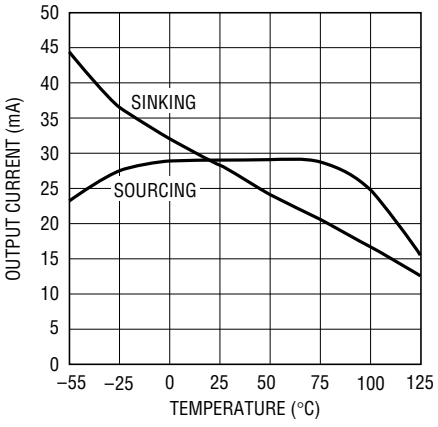
Note 2: $V_{ON/\overline{OFF}}$ = 0.4V for –55°C ≤ T_A ≤ 100°C and $V_{ON/\overline{OFF}}$ = 0.2V for 100°C ≤ T_A ≤ 125°C. Does not apply to LT1039A-16 part.

Note 3: For T_A ≥ 100°C leakage current is 350µA max.

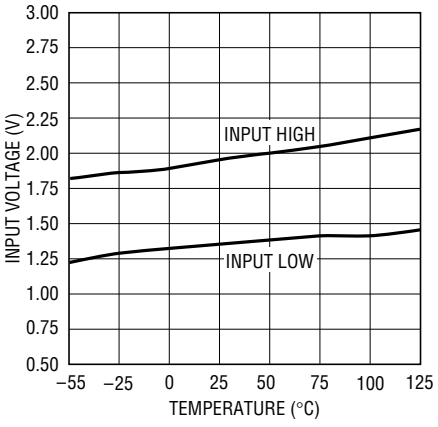
Note 4: Bias pin open on 18-pin version.

TYPICAL PERFORMANCE CHARACTERISTICS

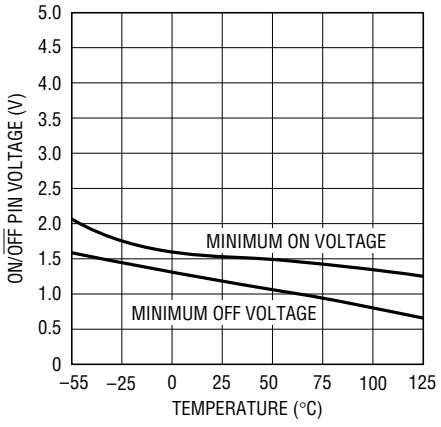
Driver Output Short-Circuit Current



Receiver Input Thresholds

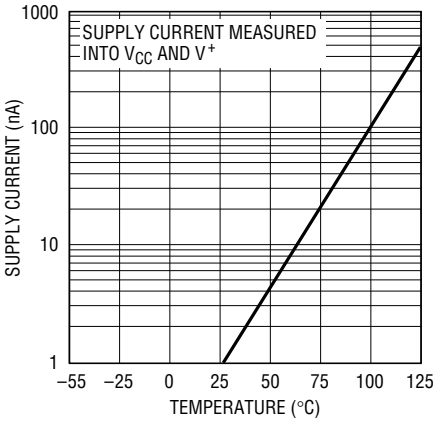


ON/$\overline{OFF}$ Pin Thresholds



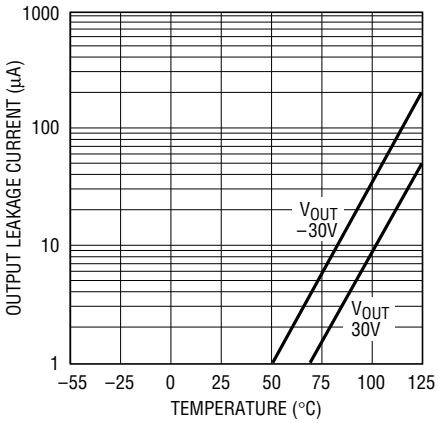
TYPICAL PERFORMANCE CHARACTERISTICS

Supply Current in Shutdown



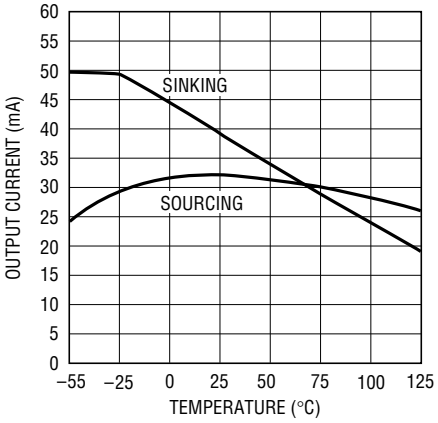
1039A G04

Driver Output Leakage in Shutdown



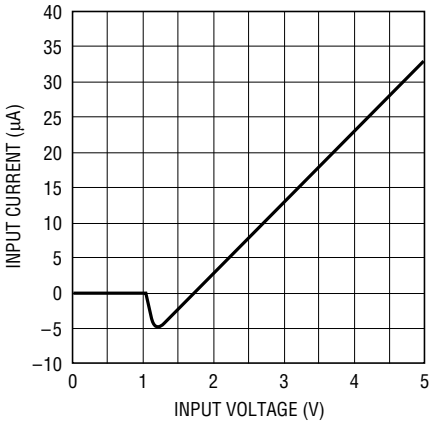
1039A G05

Receiver Output Short-Circuit Current



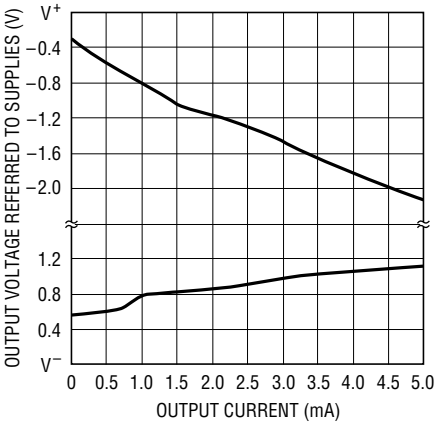
1039A G06

ON/$\overline{OFF}$ Pin Current vs Voltage



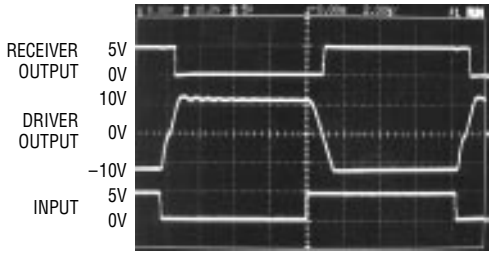
1039A G07

Driver Output Swing vs Current



1039A TA02

Output Waveforms

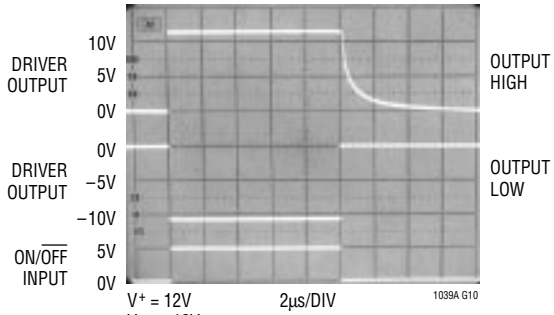


1039A G09

V^+ = 12V
V^- = –12V
V_{CC} = 5V
R_L = 3k
2µs/DIV

DRIVER OUTPUT CONNECTED TO RECEIVER INPUT

Shutdown to Driver Output

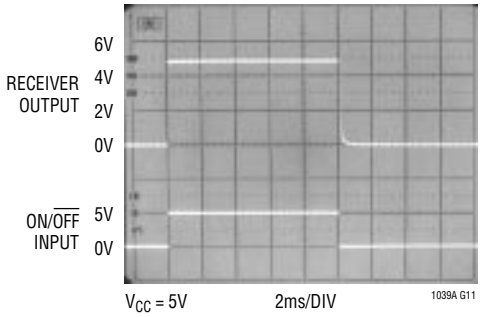


1039A G10

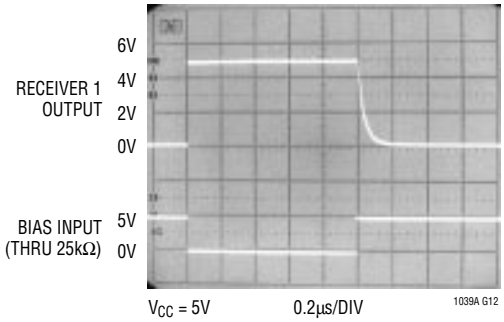
V^+ = 12V
V^- = –12V
R_L = 3k
2µs/DIV

TYPICAL PERFORMANCE CHARACTERISTICS

Shutdown to Receiver Output



BIAS Pin Response Time



PIN FUNCTIONS (Pin numbers listed are for 18-pin device)

V^+, V^- (Pins 1, 9): Driver Supply Pins. Supply current drops to zero in shutdown mode. Driver outputs are in a high impedance state when V^+ and V^- = 0V.

BIAS (Pin 2): Keeps receiver 1 on while the LT1309A is in the shutdown mode. Leave BIAS pin open when not in use. See Applications Information for proper use.

REC IN (Pins 3, 5, 7): Receiver Input Pins. Accepts RS232 voltage levels (±30V) and has 0.4V of hysteresis to provide noise immunity. Input impedance is nominally 30kΩ. Receiver input pins are internally protected from ESD transients. In order to insure proper functioning of the ESD protection devices, the V_{CC} and V^- supply pins must be bypassed with low ESR capacitors located close to the pins. A 0.1µF ceramic capacitor works well.

TR OUT (Pins 4, 6, 8): Driver Outputs with RS232 Voltage Levels. Outputs are in a high impedance state when in the shutdown mode or when power is off (V^+ and V^- = 0V) to allow data line sharing. Outputs are fully short-circuit protected from V^- + 30V to V^+ – 30V with power on, off or in the shutdown mode. Typical output breakdowns are greater than ±45V and higher applied voltages will not damage the device if moderately current limited. Driver output pins are internally protected from ESD transients. In order to insure proper functioning of the ESD protection devices, the V^+ and V^- supply pins must be bypassed with low ESR capacitors located close to the pins. 0.1µF ceramic capacitors work well.

GND (Pin 10): Ground Pin.

TR IN (Pins 11, 13, 15): RS232 Driver Input Pins. Inputs are TTL/CMOS compatible. Inputs should not be allowed to float. Tie unused inputs to V_{CC}.

REC OUT (Pins 12, 14, 16): Receiver Outputs with TTL/CMOS Voltage Levels. Outputs are in a high impedance state when in the shutdown mode to allow data line sharing. Outputs are fully short-circuit protected to ground or V_{CC} with power on, off or in the shutdown mode.

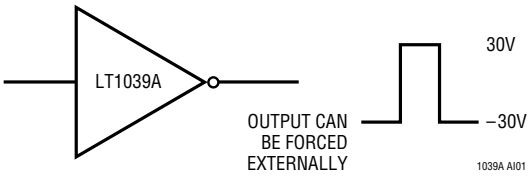
$\overline{\text{ON/OFF}}$ (Pin 17): Controls the operation mode of the LT1039A and is TTL/CMOS compatible. A logic low puts the device in the shutdown mode which reduces input supply current to zero and places both driver and receiver outputs in a high impedance state.

V_{CC} (Pin 18): 5V Power for Receivers.

APPLICATIONS INFORMATION

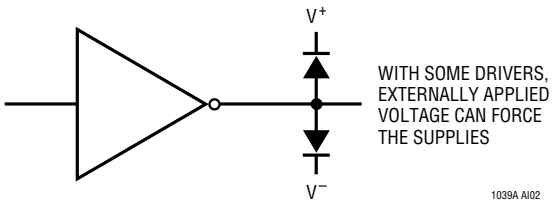
The driver output stage of the LT1039A offers significantly improved protection over older bipolar and CMOS designs. In addition to current limiting, the driver output can be externally forced to ±30V with no damage or excessive current flow.

LT1039A Driver



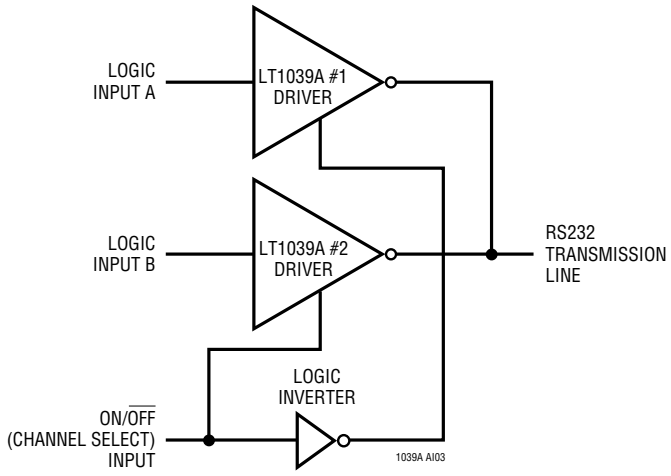
The driver outputs utilize high impedance overvoltage protection, eliminating the flow of fault currents into supplies, as will happen with conventional diode clamp configurations.

Older RS232 Drivers and Other CMOS Drivers

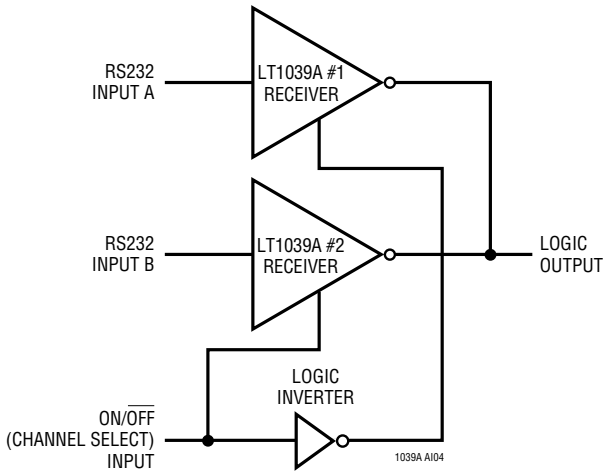


Placing the LT1039A in the shutdown mode (Pin 17 low) puts both the driver and receiver outputs in a high impedance state. This allows data line sharing and transceiver applications.

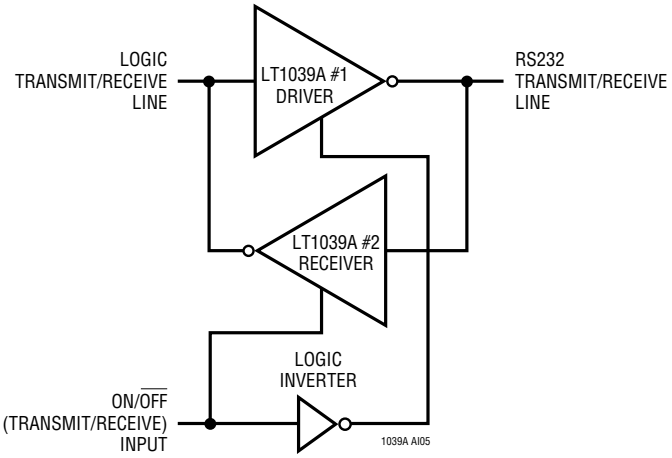
Sharing a Transmitter Line



Sharing a Receiver Line



Transceiver

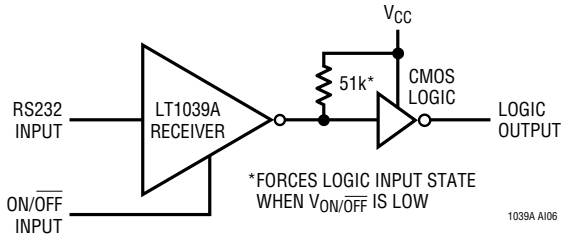


The shutdown mode also drops all supply currents (V_{CC}, V^+, V^-) to zero for power conscious systems.

APPLICATIONS INFORMATION

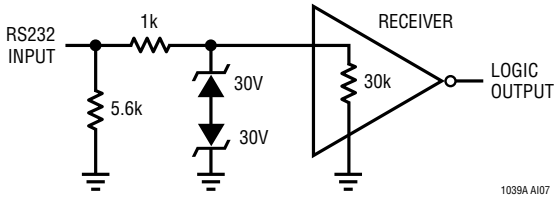
When driving CMOS logic from a receiver that will be used in the shutdown mode and there is no other active receiver on the line, a 51k resistor can be placed from the logic input to V_{CC} to force a definite logic level when the receiver output is in a high impedance state.

Driving CMOS Logic from a Receiver



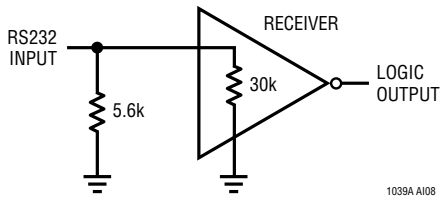
To protect against receiver input overloads in excess of ±30V, a voltage clamp can be placed on the data line and still maintain RS232 compatibility.

Input Overvoltage Protection



The receiver input impedance of the LT1039A is nominally 30kΩ. For applications requiring a 5kΩ input impedance, a 5.6k resistor can be connected from the receiver input to ground.

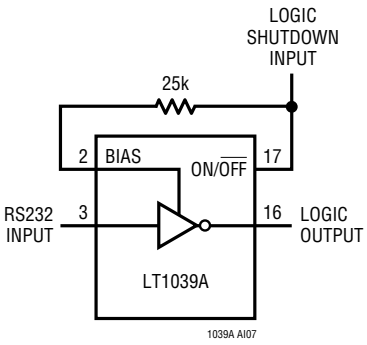
5kΩ Impedance Matching



Driver inputs should not be allowed to float. Any unused inputs should be tied to V_{CC}.

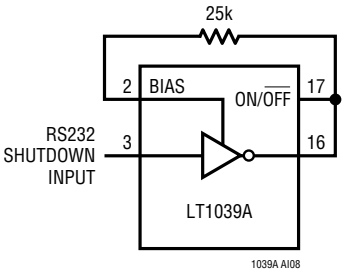
The BIAS pin is used to "keep alive" one receiver while in the shutdown mode (all other circuitry being inactive). This allows a system to be in shutdown and still have one active receiver for transferring data.

Keeping Alive One Receiver While in Shutdown



It can also be used to make an RS232 compatible shutdown control line. Driving the BIAS pin low through a resistance of 24k to 30k keeps the receiver active. Do not drive the BIAS pin directly from a logic output without the series resistor. An unused BIAS pin should be left open.

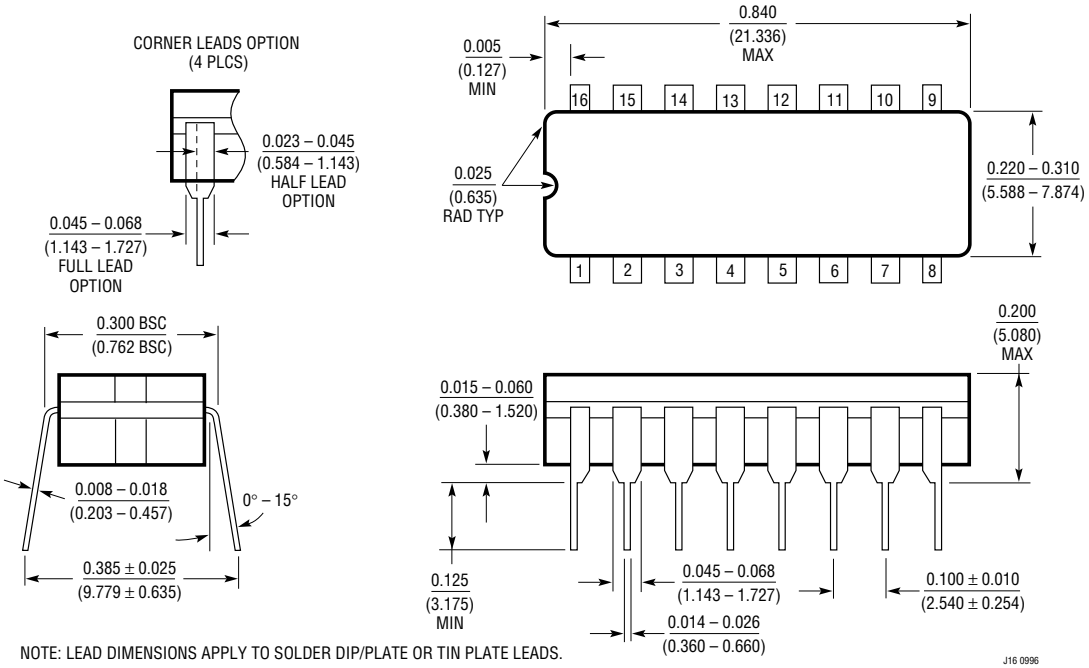
RS232 Compatible Shutdown Control Line



PACKAGE DESCRIPTION

Dimensions in inches (millimeters) unless otherwise noted.

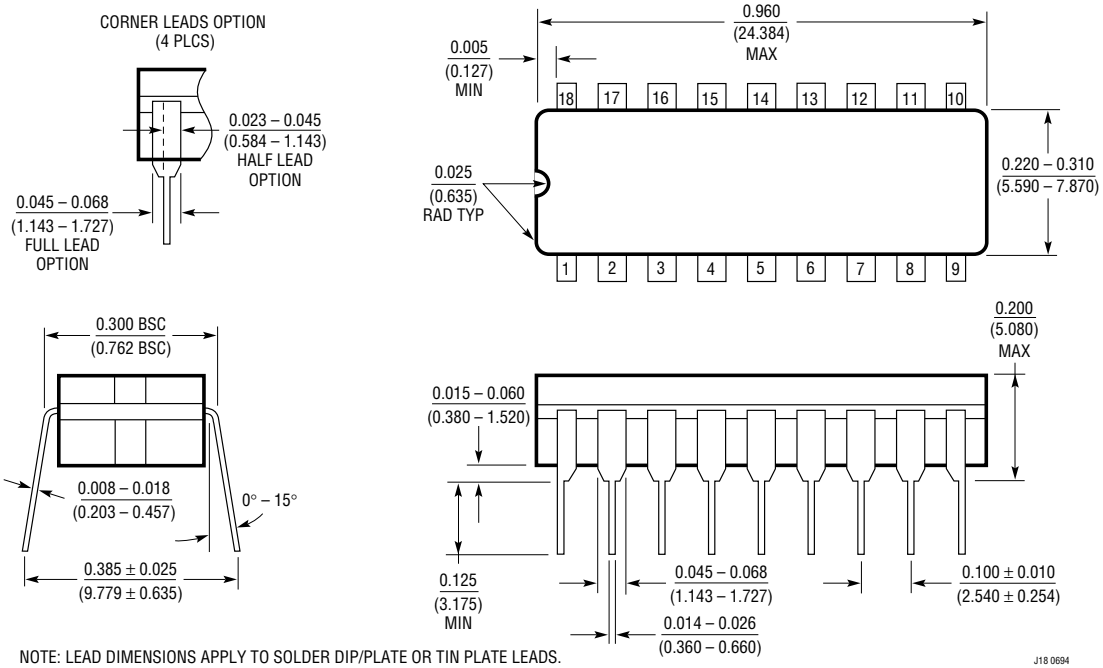
J Package
16-Lead CERDIP (Narrow 0.300, Hermetic)
(LTC DWG # 05-08-1110)



NOTE: LEAD DIMENSIONS APPLY TO SOLDER DIP/PLATE OR TIN PLATE LEADS.

J16 0996

J Package
18-Lead CERDIP (Narrow 0.300, Hermetic)
(LTC DWG # 05-08-1110)



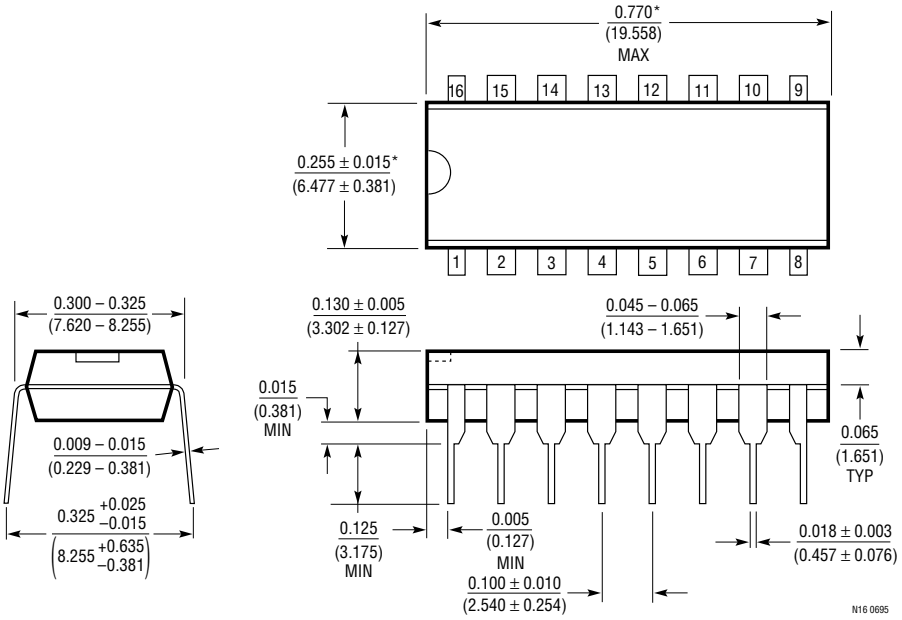
NOTE: LEAD DIMENSIONS APPLY TO SOLDER DIP/PLATE OR TIN PLATE LEADS.

J18 0694

PACKAGE DESCRIPTION

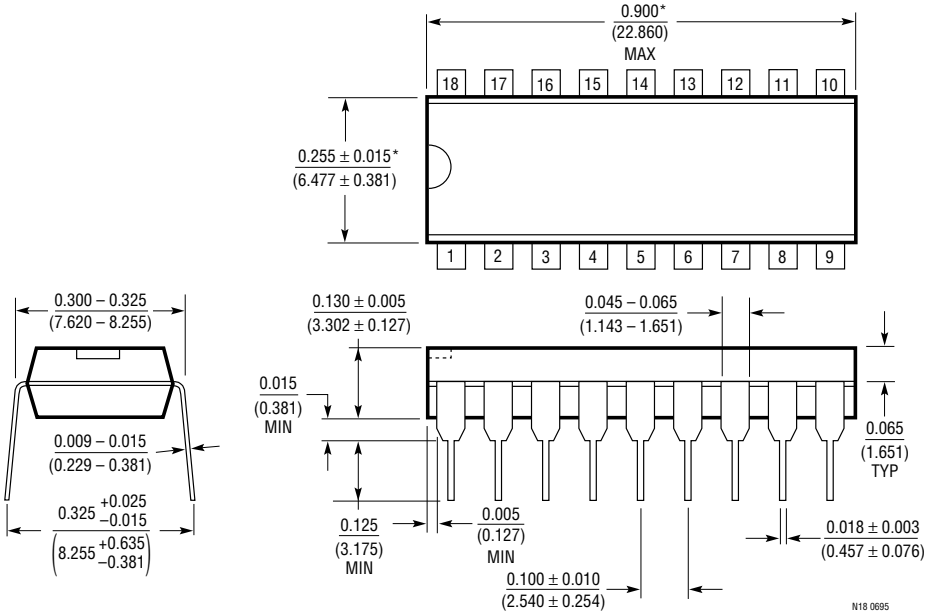
Dimensions in inches (millimeters) unless otherwise noted.

N Package
16-Lead PDIP (Narrow 0.300)
(LTC DWG # 05-08-1510)



*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.010 INCH (0.254mm)

N Package
18-Lead PDIP (Narrow 0.300)
(LTC DWG # 05-08-1510)

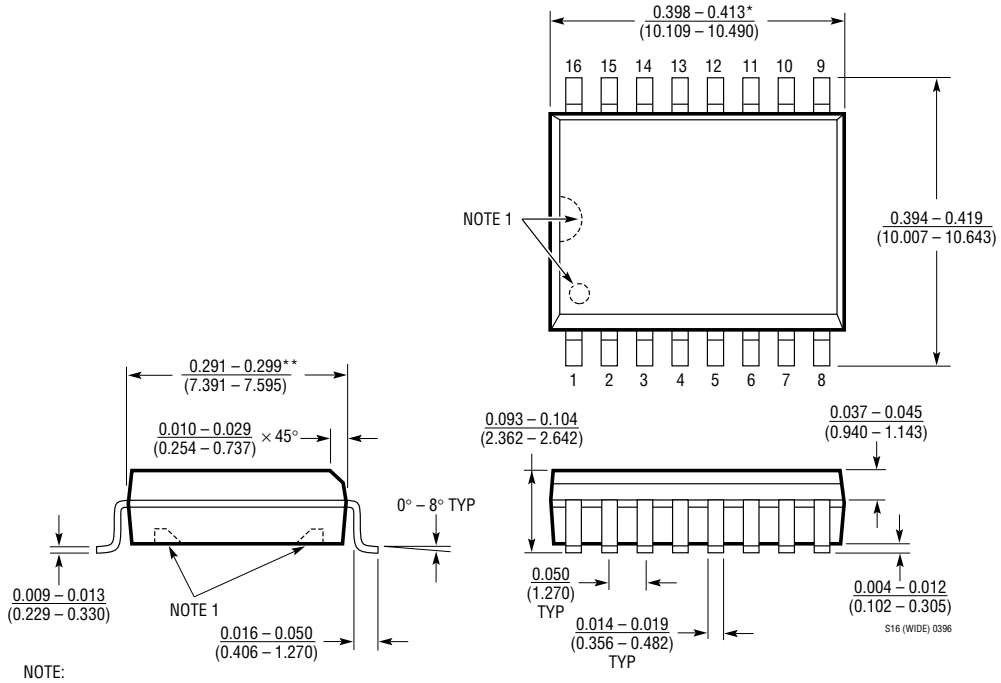


*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.010 INCH (0.254mm)

PACKAGE DESCRIPTION

Dimensions in inches (millimeters) unless otherwise noted.

SW Package
16-Lead Plastic Small Outline (Wide 0.300)
(LTC DWG # 05-08-1620)



NOTE:
1. PIN 1 IDENT, NOTCH ON TOP AND CAVITIES ON THE BOTTOM OF PACKAGES ARE THE MANUFACTURING OPTIONS. THE PART MAY BE SUPPLIED WITH OR WITHOUT ANY OF THE OPTIONS

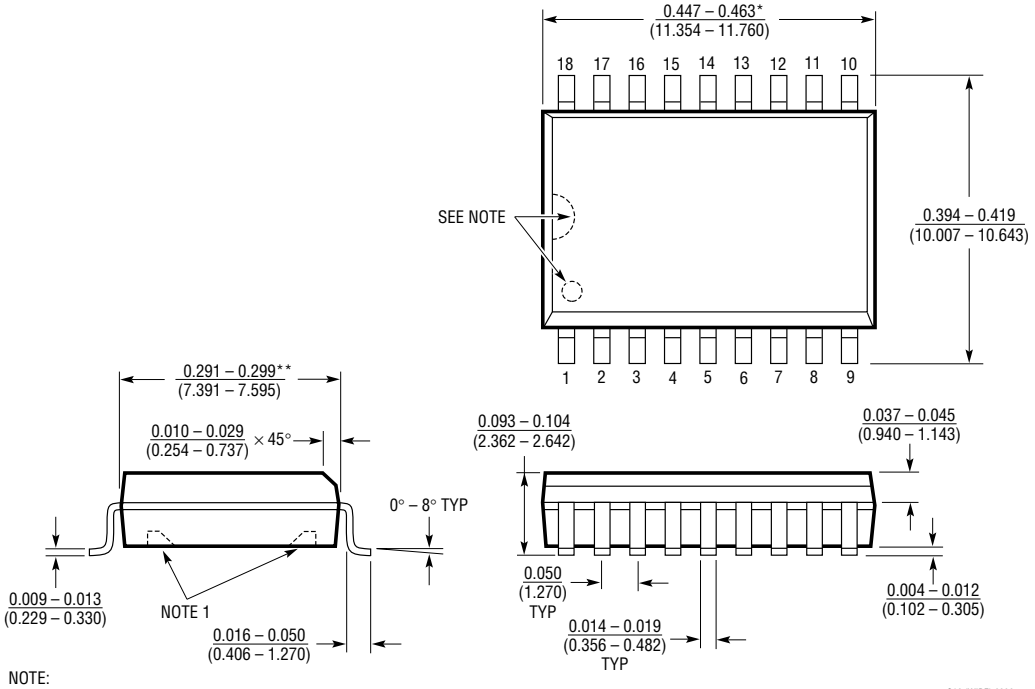
*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

**DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

PACKAGE DESCRIPTION

Dimensions in inches (millimeters) unless otherwise noted.

SW Package
18-Lead Plastic Small Outline (Wide 0.300)
(LTC DWG # 05-08-1620)



NOTE:
1. PIN 1 IDENT, NOTCH ON TOP AND CAVITIES ON THE BOTTOM OF PACKAGES ARE THE MANUFACTURING OPTIONS. THE PART MAY BE SUPPLIED WITH OR WITHOUT ANY OF THE OPTIONS

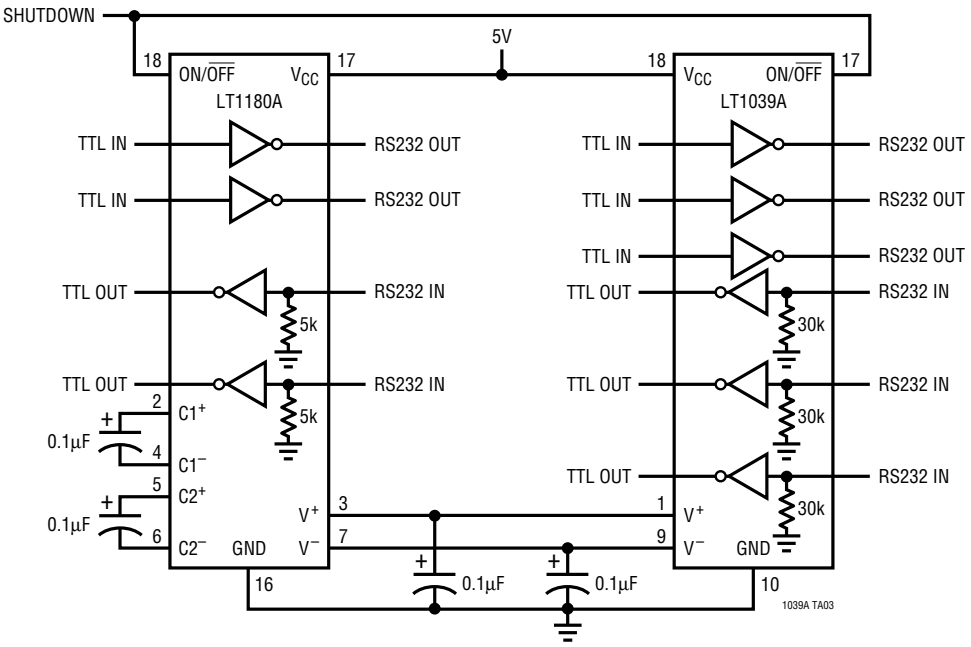
*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

**DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

S18 (WIDE) 0396

TYPICAL APPLICATION

LT1180A (Driver/Receiver with Power Supply) Driving an LT1039A



RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LTC®485	Low Power RS485 Transceiver	Industry Standard
LT1137A	5V 3 Driver/5 Receiver RS232 Transceiver	±15kV ESD Protection
LT1180A/81A	5V 2 Driver/2 Receiver RS232 Transceiver	Industry Standard, 0.1µF Capacitors
LTC1345	V.35 Transceiver	Single 5V Supply Using 0.1µF Capacitors
LTC1348	3.3V 3 Driver/5 Receiver RS232 Transceiver	Operates from 3.3V to 5V Supplies, 5 Receivers Active in Shutdown

Linear Technology Corporation
1630 McCarthy Blvd., Milpitas, CA 95035-7417• (408)432-1900
FAX: (408) 434-0507•TELEX: 499-3977 • www.linear-tech.com
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