Advanced Low Power 5V RS232 Dual Driver/Receiver

FEATURES

- **Superior to CMOS**
  - Improved Speed: Operates over 120kBaud
  - Improved Protection: Outputs Can Be Forced to ±30V without Damage
  - Three-State Outputs Are High Impedance When Off
  - Only Needs 1µF Capacitors
- Absolutely No Latchup
- CMOS Comparable Low Power: 60mW
- Can Power Additional RS232 Drivers: 10mA
- Supply Current in Shutdown: 1µA
- Available in SO Package
- Available with or without Shutdown

APPLICATIONS

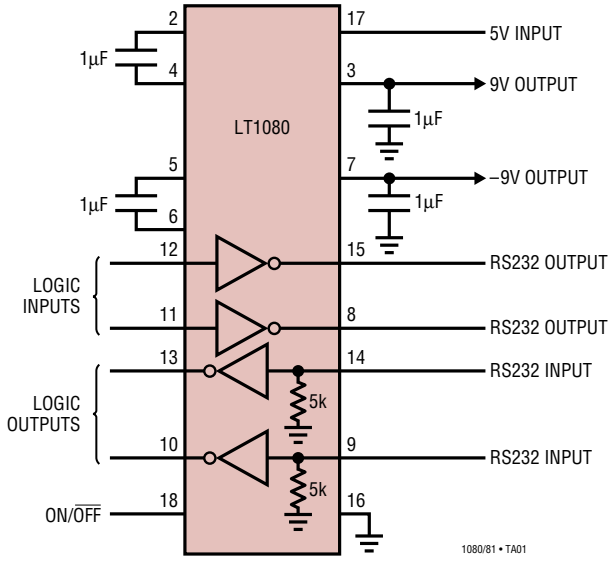
- Portable Computers
- Battery-Powered RS232 Systems
- Power Supply Generator
- Terminals
- Modems

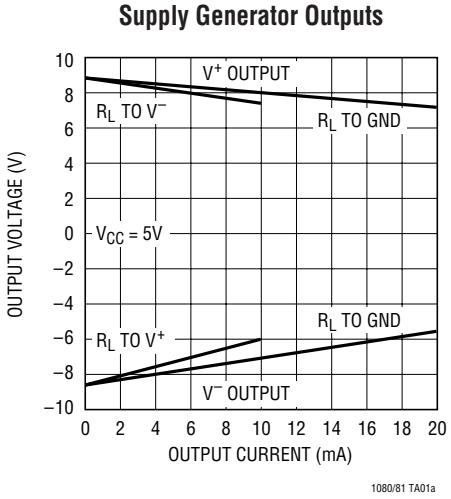
DESCRIPTION

The LT®1080/LT1081 are the only dual RS232 driver/receiver with charge pump to guarantee absolutely no latchup. These interface optimized devices provide a realistic balance between CMOS levels of power dissipation and real world requirements for ruggedness. The driver outputs are fully protected against overload and can be shorted to ±30V. Unlike CMOS, the advanced architecture of the LT1080/LT1081 does not load the signal line when "shut down" or when power is off. Both the receiver and RS232 outputs are put into a high impedance state. An advanced output stage allows driving higher capacitive loads at higher speeds with exceptional ruggedness against ESD.

For applications requiring up to five drivers and five receivers with charge pump in one package see the LT1130A Series data sheet. A version of the LT1080/LT1081, the LT1180A and LT1181A that use only 0.1µF capacitors, is also available. All of Linear Technology's RS232 ICs are available in standard surface mount packages.

TYPICAL APPLICATION





ABSOLUTE MAXIMUM RATINGS (Note 1)

Supply Voltage (V_{CC}) 6V
- V^+ 12V
- V^- ..... –12V

Input Voltage
- Driver ..... V^- to V^+
- Receiver ..... –30V to 30V
- ON/$\overline{OFF}$ Pin ..... GND to 12V

Output Voltage
- Driver ..... (V^- + 30V) to (V^+ – 30V)
- Receiver ..... –0.3V to (V_{CC} + 0.3V)

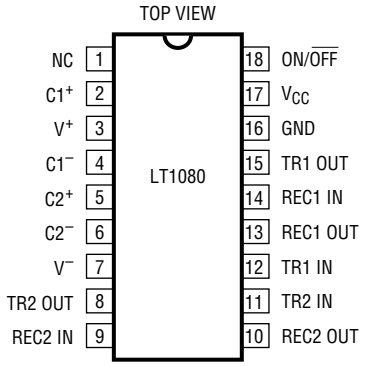
Short-Circuit Duration
- V^+ ..... 30 sec
- V^- ..... 30 sec
- Driver Output ..... Indefinite
- Receiver Output ..... Indefinite

Operating Temperature Range
- LT1080C/LT1081C ..... 0°C to 70°C
- LT1080I/LT1081I ..... –40°C to 85°C
- LT1080M/LT1081M **(OBSOLETE)** ... –55°C to 125°C

Storage Temperature Range ..... –65°C to 150°C

Lead Temperature (Soldering, 10 sec) ..... 300°C

PACKAGE/ORDER INFORMATION



N PACKAGE
18-LEAD PDIP

SW PACKAGE
18-LEAD PLASTIC SO WIDE

T_{JMAX} = 150°C, θ_{JA} = 120°C/W, θ_{JC} = 50°C/W (N)
T_{JMAX} = 150°C, θ_{JA} = 90°C/W, θ_{JC} = 26°C/W (SW)

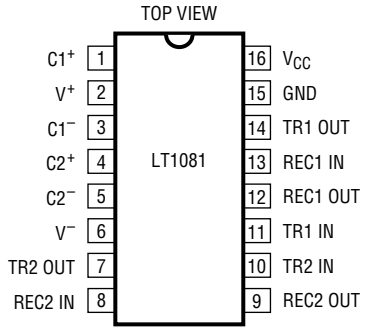
ORDER PART NUMBER

LT1080CN
LT1080CSW
LT1080IN
LT1080ISW

J PACKAGE
18-LEAD CERDIP
T_{JMAX} = 150°C, θ_{JA} = 100°C/W, θ_{JC} = 40°C/W (J)

LT1080CJ
LT1080MJ

OBSOLETE PACKAGE
Consider N Package for Alternate Source



N PACKAGE
16-LEAD PDIP

SW PACKAGE
16-LEAD PLASTIC SO WIDE

T_{JMAX} = 150°C, θ_{JA} = 120°C/W, θ_{JC} = 50°C/W (N)
T_{JMAX} = 150°C, θ_{JA} = 95°C/W, θ_{JC} = 27°C/W (SW)

ORDER PART NUMBER

LT1081CN
LT1081CSW
LT1081IN
LT1081ISW

J PACKAGE
16-LEAD CERDIP
T_{JMAX} = 150°C, θ_{JA} = 100°C/W, θ_{JC} = 40°C/W (J)

LT1081CJ
LT1081MJ

OBSOLETE PACKAGE
Consider N Package for Alternate Source

Consult LTC Marketing for parts specified with wider operating temperature ranges.

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at T_A = 25°C. (Note 2)

PARAMETER	CONDITIONS			MIN	TYP	MAX	UNITS
Driver							
Output Voltage Swing	Load = 3k to GND Both Outputs	Positive	●	5	7.3		V
		Negative	●	–5	–6.5		V
Logic Input Voltage Level	Input Low Level (V_{OUT} = High)		●		1.4	0.8	V
	Input High Level (V_{OUT} = Low)		●	2	1.4		V
Logic Input Current	$V_{IN} \geq 2V$		●		5	20	µA
	$V_{IN} \leq 0.8V$		●		5	20	µA
Output Short-Circuit Current	Sourcing Current, V_{OUT} = 0V			9	12		mA
	Sinking Current, V_{OUT} = 0V			–9	–12		mA
Output Leakage Current	SHUTDOWN (Note 3), $V_{OUT} = \pm 30V$		●		10	100	µA
Data Rate (Note 6)	R_L = 3k, C_L = 2500pF			120			kBd
	R_L = 3k, C_L = 1000pF			250			kBd
Slew Rate	R_L = 3k, C_L = 51pF			4	15	30	V/µs
Receiver							
Input Voltage Thresholds	Input Low Threshold	Commercial	●	0.8	1.3		V
		Industrial and Military	●	0.2	1.3		V
	Input High Threshold	Commercial	●		1.7	2.4	V
		Industrial and Military	●		1.7	3.0	V
Hysteresis			●	0.1	0.4	1	V
Input Resistance	$V_{IN} = \pm 10V$			3	5	7	kΩ
Output Voltage	Output Low, I_{OUT} = –1.6mA		●		0.2	0.4	V
	Output High, I_{OUT} = 160µA (V_{CC} = 5V)		●	3.5	4.8		V
Output Short-Circuit Current	Sinking Current, $V_{OUT} = V_{CC}$			–10	–20		mA
	Sourcing Current, V_{OUT} = 0V			0.6	1		mA
Output Leakage Current	SHUTDOWN (Note 3), $0V \leq V_{OUT} \leq V_{CC}$		●		1	10	µA
Power Supply Generator (Note 4)							
V^+ Output Voltage	I_{OUT} = 0mA			8.0	9.0		V
	I_{OUT} = 10mA			7.0	8.0		V
	I_{OUT} = 15mA			6.5	7.5		V
V^- Output Voltage	I_{OUT} = 0mA			–7.5	–8.5		V
	I_{OUT} = –10mA			–5.5	–6.5		V
	I_{OUT} = –15mA			–5.0	–6.0		V
Supply Current			●		12	22	mA
Supply Leakage Current (V_{CC})	SHUTDOWN (Note 3), LT1080 Only		●		1	100	µA
ON/$\overline{OFF}$ Pin Current	$0V \leq V_{ON/\overline{OFF}} \leq 5V$, LT1080 Only		●	–15		80	µA
Supply Rise Time	(Note 5), LT1080 Only				1		ms

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

Note 2: These parameters apply for $4.5V \leq V_{CC} \leq 5.5V$ and $V_{ON/\overline{OFF}}$ = 3V, unless otherwise specified.

Note 3: $V_{ON/\overline{OFF}}$ = 0.4V for $-55°C \leq T_A \leq 50°C$, and $V_{ON/\overline{OFF}}$ = 0.2V for $50°C \leq T_A \leq 125°C$. (LT1080 only)

Note 4: Unless otherwise specified, V_{CC} = 5V, external loading of V^+ and V^- equals zero and the driver outputs are low (inputs high).

Note 5: Time from either SHUTDOWN high or power on until $V^+ \geq 6V$ and $V^- \leq -6V$. All external capacitors are 1µF.

Note 6: Data rate operation guaranteed by slew rate, short-circuit current and propagation delay tests.

PIN FUNCTIONS (Pin numbers refer to LT1080)

$C1^+$; $C1^-$; $C2^+$; $C2^-$ (Pins 2, 4, 5, 6): Requires an external capacitor (≥1µF) from $C1^+$ to $C1^-$ and another from $C2^+$ to $C2^-$. Pin 2 can be used for connecting a second positive supply. When a separate positive supply is used, C1 can be deleted.

V^+ (Pin 3): Positive Supply for RS232 Drivers. $V^+ \approx 2V_{CC} - 1.5V$. Requires an exterenal capacitor (≥1µF) for charge storage. May be loaded (up to 15mA) for external system use. Loading does reduce V^+ voltage (see graphs). Capacitor may be tied to ground or +5V input supply. With multiple transceivers, the V^+ and V^- pins may be paralleled into common capacitors.

V^- (Pin 7): Negative Supply for RS232 Drivers. $V^- \approx -(2V_{CC} - 2.5V)$. Requires an external capacitor (≥1µF) for charge stroage. May be loaded (up to –15mA) for external system use. Loading does reduce V^- voltage (see graphs). With multiple transceivers, the V^+ and V^- pins may be paralleled into common capacitors.

TR2 OUT; TR1 OUT (Pins 8, 15): Driver Outputs with RS232 Voltage Levels. Outputs are in a high impedance state when in the SHUTDOWN mode or when power is off (V_{CC} = 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. Shorting one output will affect output from the other.

REC2 IN; REC1 IN (Pins 9, 14): Receiver Inputs. Accepts RS232 voltage levels (±30V) and has 0.4V of hysteresis to provide noise immunity. Input impedance is nominally 5kΩ.

REC2 OUT; REC1 OUT (Pins 10, 13): 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.

TR2 IN; TR1 IN (Pins 11, 12): RS232 Driver Input Pins. Inputs are TTL/CMOS compatible. Inputs should not be allowed to float. Tie unused inputs to V_{CC}.

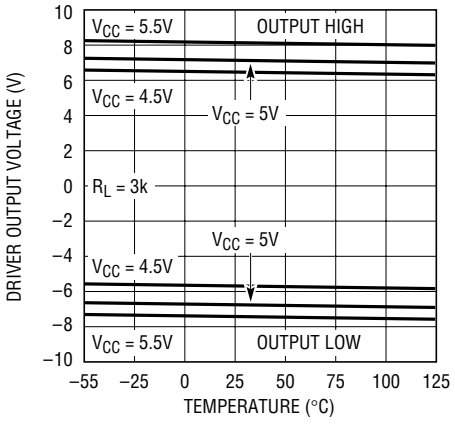
GND (Pin 16): Ground Pin.

V_{CC} (Pin 17): Input Supply Pin. Supply current drops to zero in the SHUTDOWN mode.

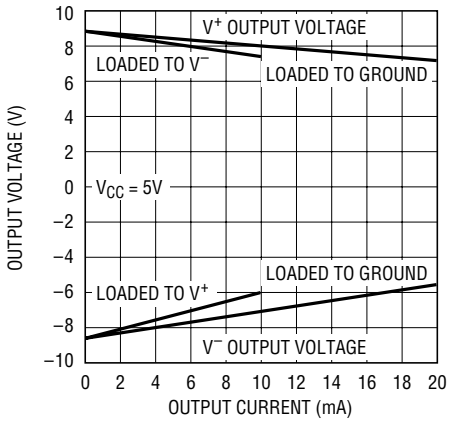
ON/$\overline{\text{OFF}}$ (Pin 18): Contols the operation mode of the LT1080 and is TTL/CMOS compatible. A logic low puts the device in the SHUTDOWN mode which reduces input supply current to zero and places both driver and receiver outputs in a high impedance state. A logic high fully enables the device.

TYPICAL PERFORMANCE CHARACTERISTICS

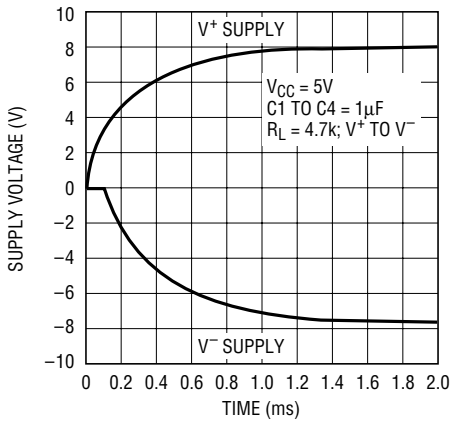
Driver Output Voltage



Supply Generator Outputs

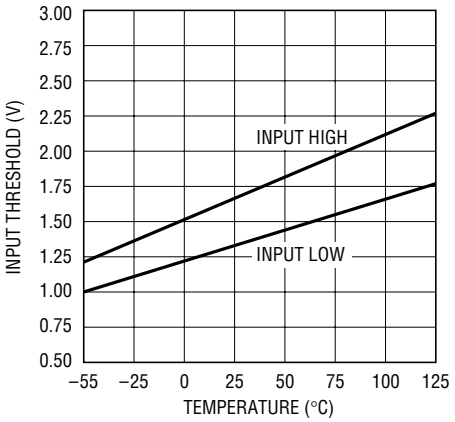


Supply Generation from V_{CC} or Shutdown

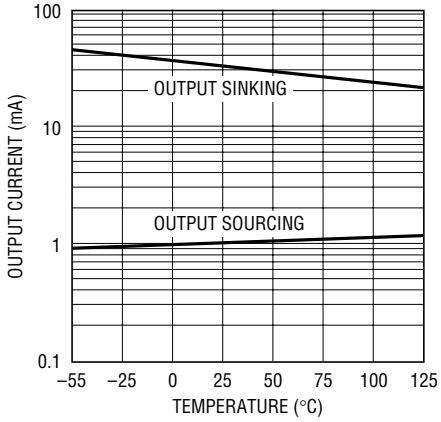


TYPICAL PERFORMANCE CHARACTERISTICS

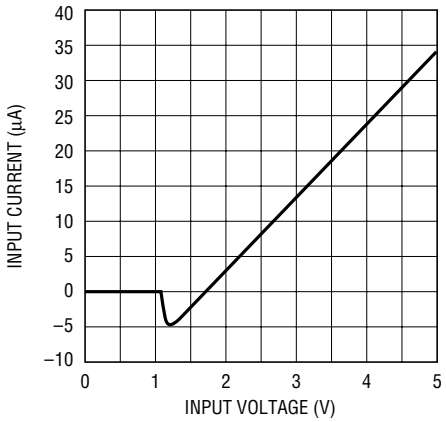
Receiver Input Thresholds



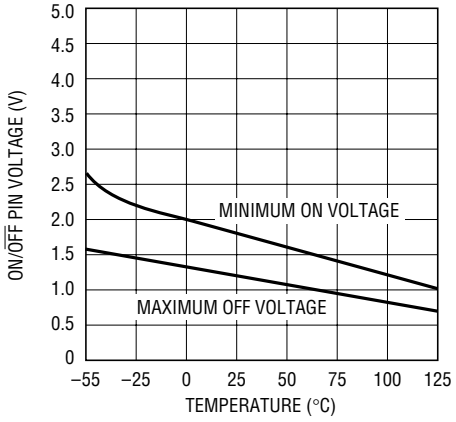
Receiver Output Short-Circuit Current



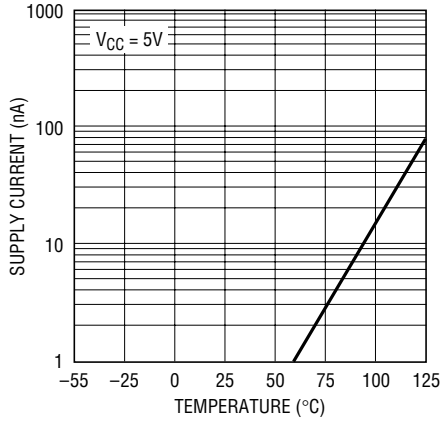
ON/$\overline{OFF}$ Pin Current vs Voltage



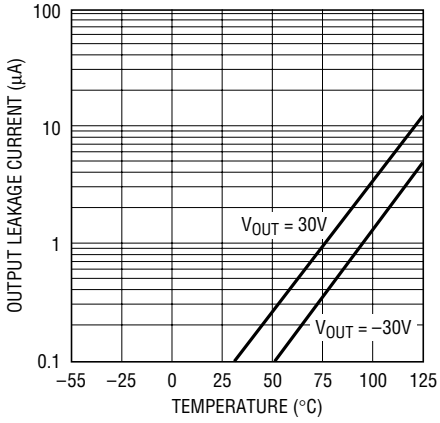
ON/$\overline{OFF}$ Pin Thresholds



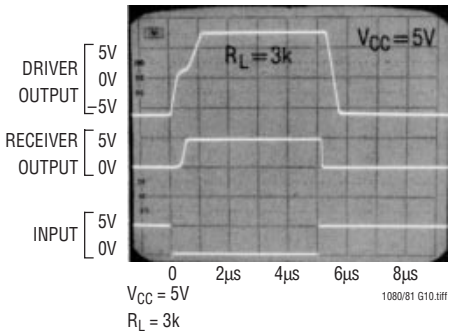
Supply Current in Shutdown



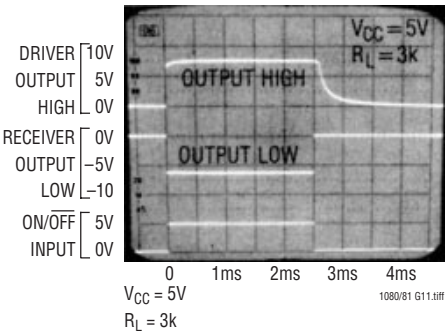
Driver Output Leakage in Shutdown



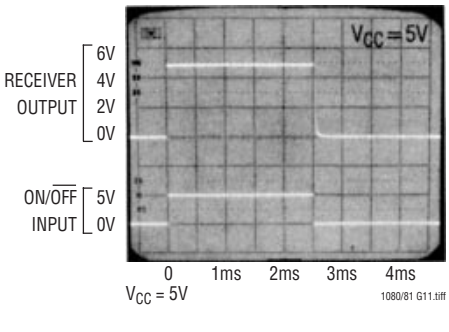
Output Waveforms



Shutdown to Driver Output



Shutdown to Receiver Output



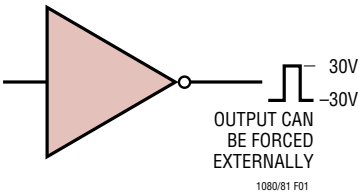
APPLICATIONS INFORMATION

The driver output stage of the LT1080 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, and will not disrupt the supplies. Some drivers have diodes connected between the outputs and the supplies, so externally applied voltages can cause excessive supply voltage to develop.

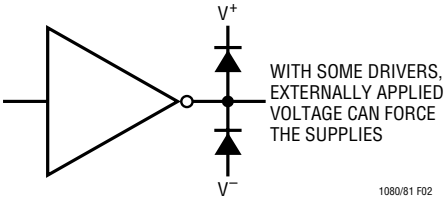
Placing the LT1080 in the SHUTDOWN mode (Pin 18 low) puts both the driver and receiver outputs in a high impedance state. This allows data line sharing and transceiver applications.

The SHUTDOWN mode also drops input supply current (V_{CC}; Pin 17) to zero for power-conscious systems.

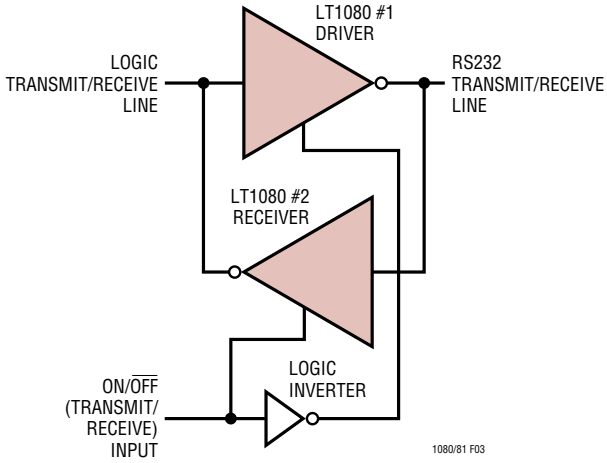
LT1080/LT1081 Driver



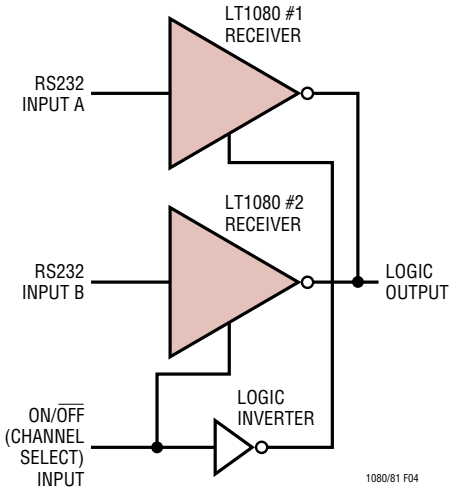
Older RS232 Drivers and CMOS Drivers



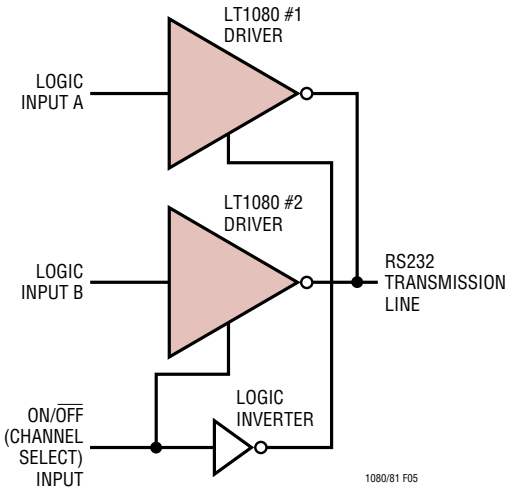
Transceiver



Sharing a Receiver Line

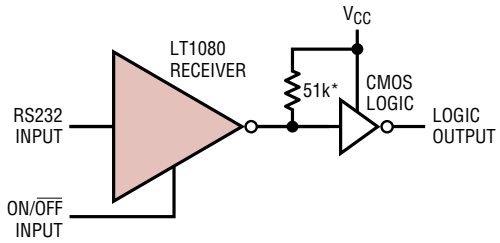


Sharing a Transmitter Line



APPLICATIONS INFORMATION

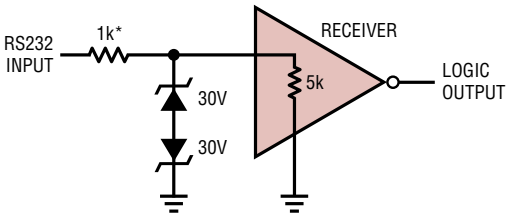
When driving CMOS logic from a receiver that will be used in the SHUTDOWN mode and there is no other active receiver on the line, a 51k resistor can be placed from the logic input to V_{CC} to force a definite logic level when the receiver output is in a high impedance state.



* FORCES LOGIC INPUT STATE WHEN $V_{ON/\overline{OFF}}$ IS LOW

1080/81 F06

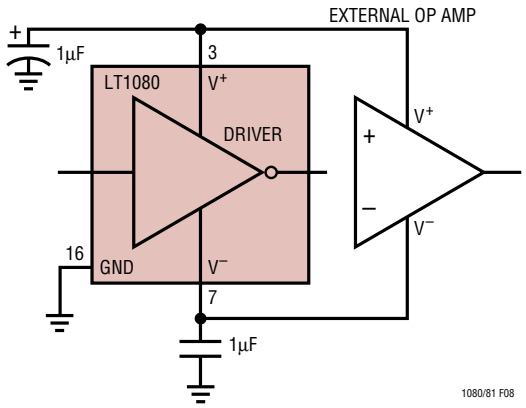
To protect against receiver input overloads in excess of ±30V, a voltage clamp can be placed on the data line and still maintain RS232 compatibility.



* A PTC THERMISTOR WILL ALLOW
CONTINUOUS OVERLOAD OF GREATER THAN ±100V

1080/81 F067

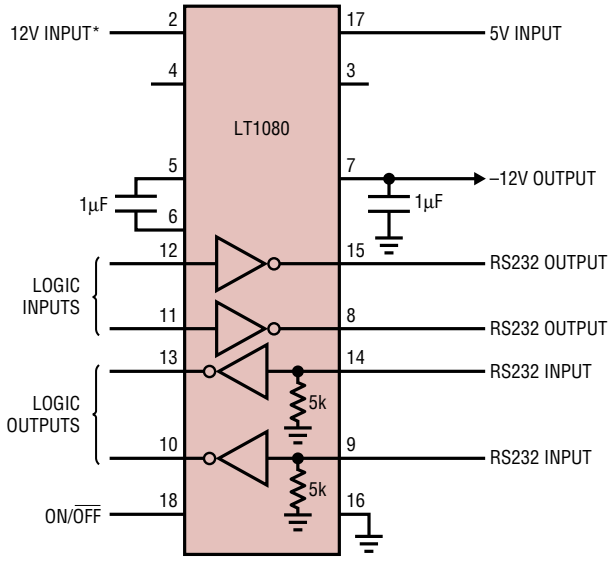
The generated driver supplies (V^+ and V^-) may be used to power external circuitry such as other RS232 drivers or op amps. They should be loaded with care, since excessive loading can cause the generated supply voltages to drop, causing the RS232 driver output voltages to fall below RS232 requirements. See the graph "Supply Generator Outputs" for a comparison of generated supply voltage versus supply current.



1080/81 F08

TYPICAL APPLICATION

Operating with 5V and 12V

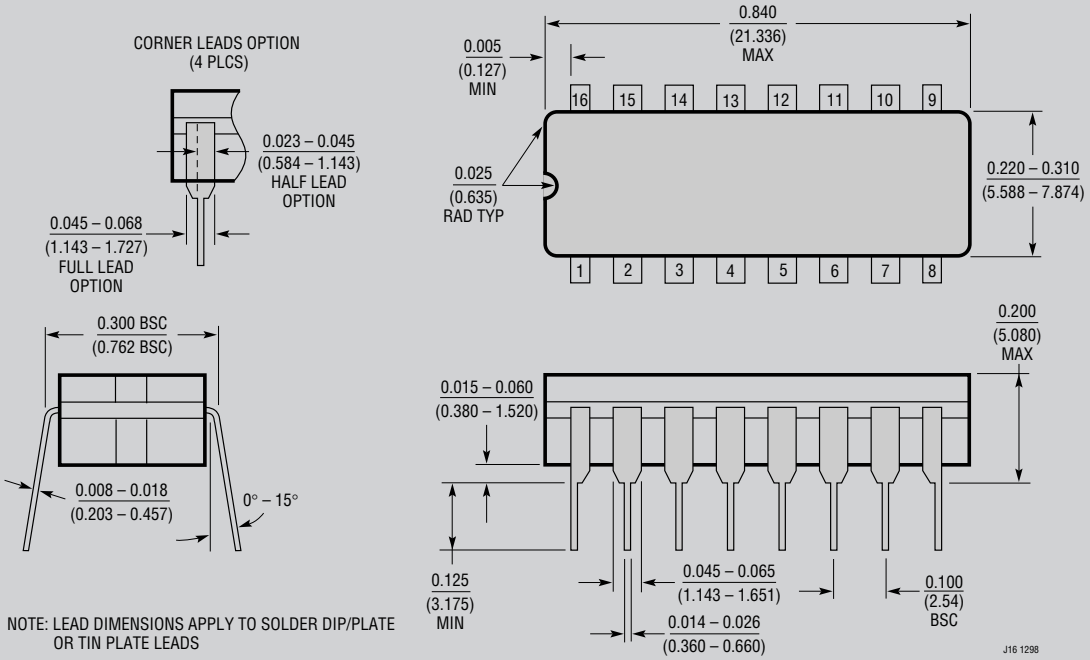


* PIN 1 USED ON LT1081.

1080/81 • TA03

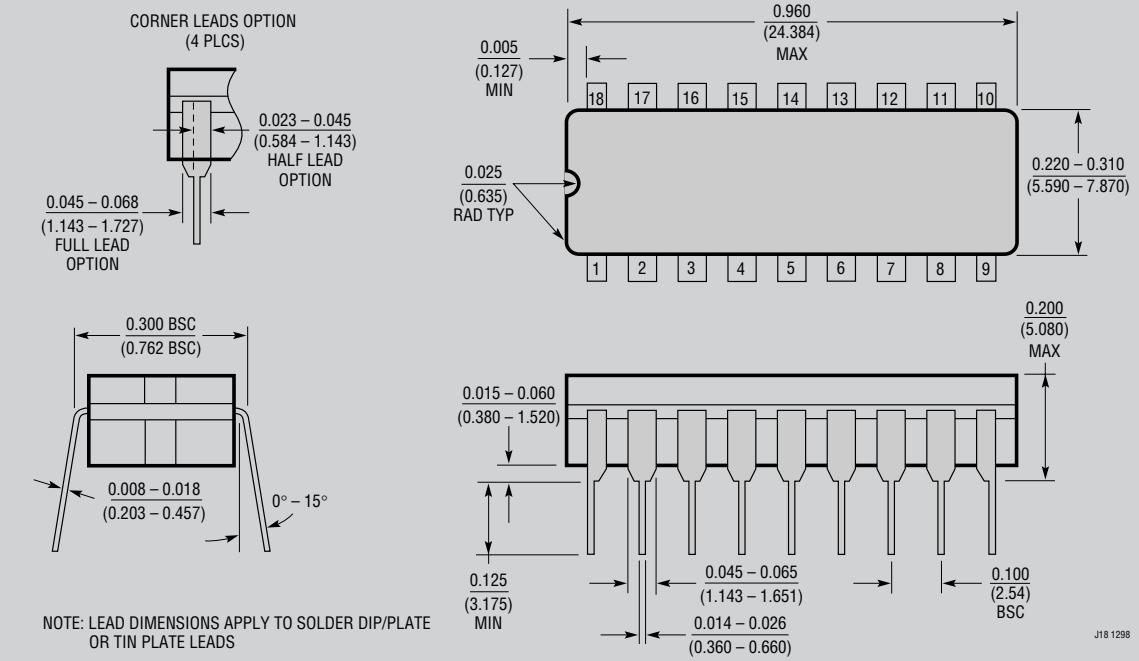
PACKAGE DESCRIPTION

J Package
16-Lead CERDIP (Narrow .300 Inch, Hermetic)
(Reference LTC DWG # 05-08-1110)



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

J Package
18-Lead CERDIP (Narrow .300 Inch, Hermetic)
(Reference LTC DWG # 05-08-1110)

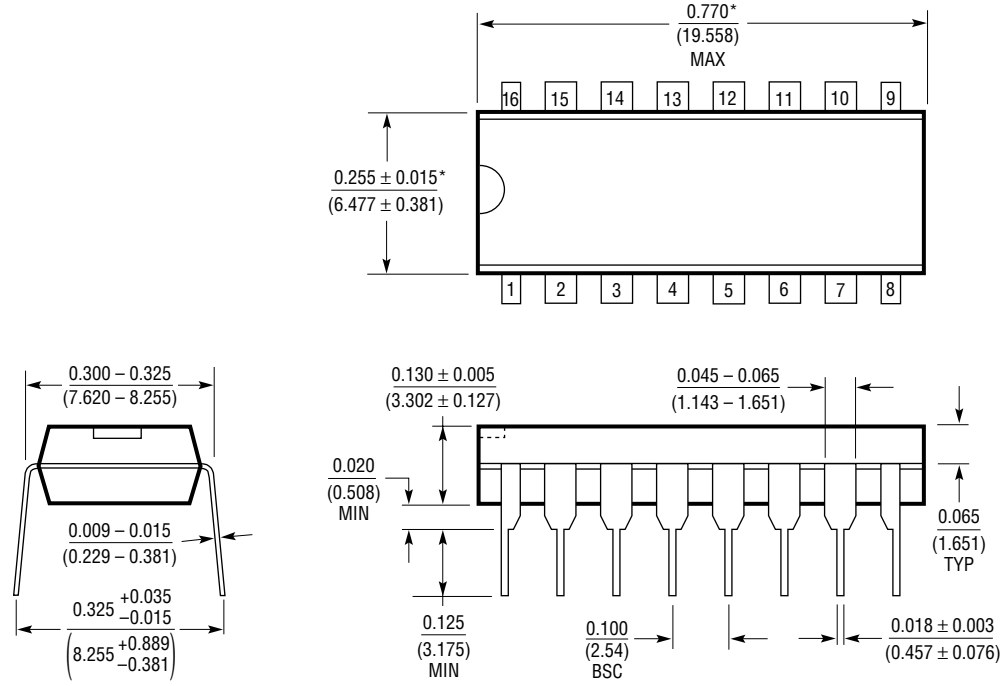


NOTE: LEAD DIMENSIONS APPLY TO SOLDER DIP/PLATE OR TIN PLATE LEADS

OBSOLETE PACKAGES

PACKAGE DESCRIPTION

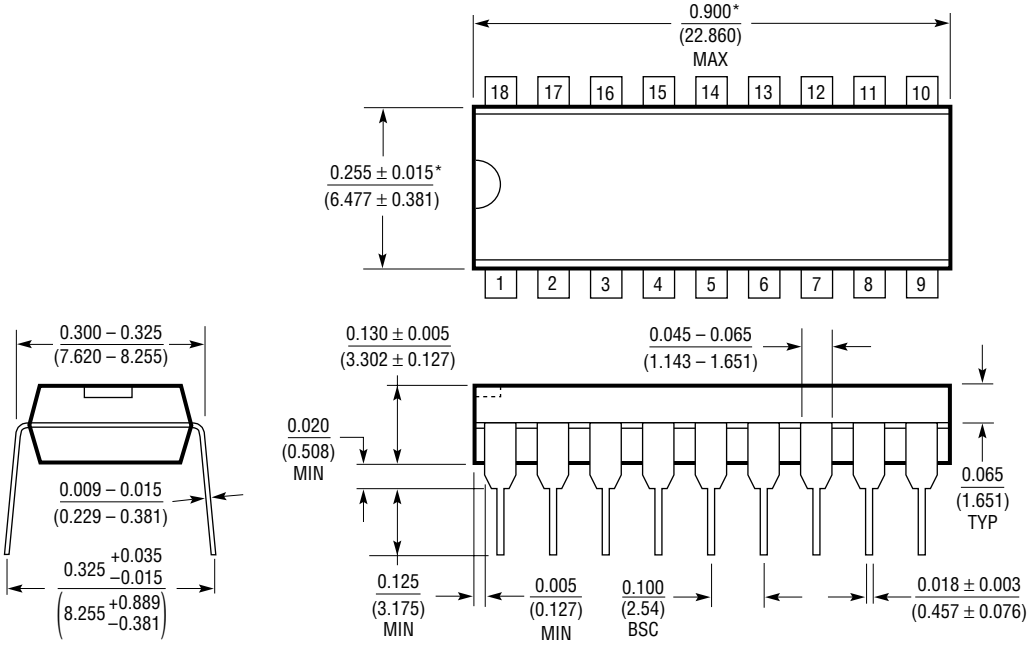
N Package
16-Lead PDIP (Narrow .300 Inch)
(Reference LTC DWG # 05-08-1510)



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

N16 1098

N Package
18-Lead PDIP (Narrow .300 Inch)
(Reference LTC DWG # 05-08-1510)

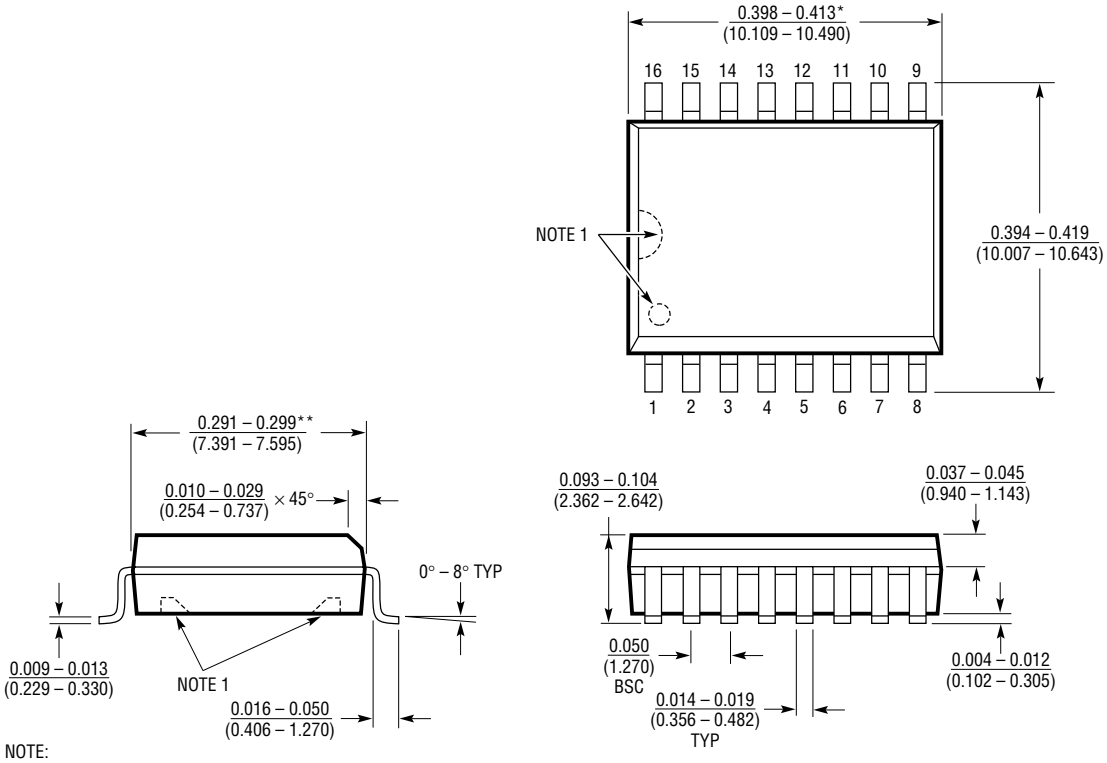


*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.010 INCH (0.254mm)

N18 1098

PACKAGE DESCRIPTION

SW Package
16-Lead Plastic Small Outline (Wide .300 Inch)
(Reference 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

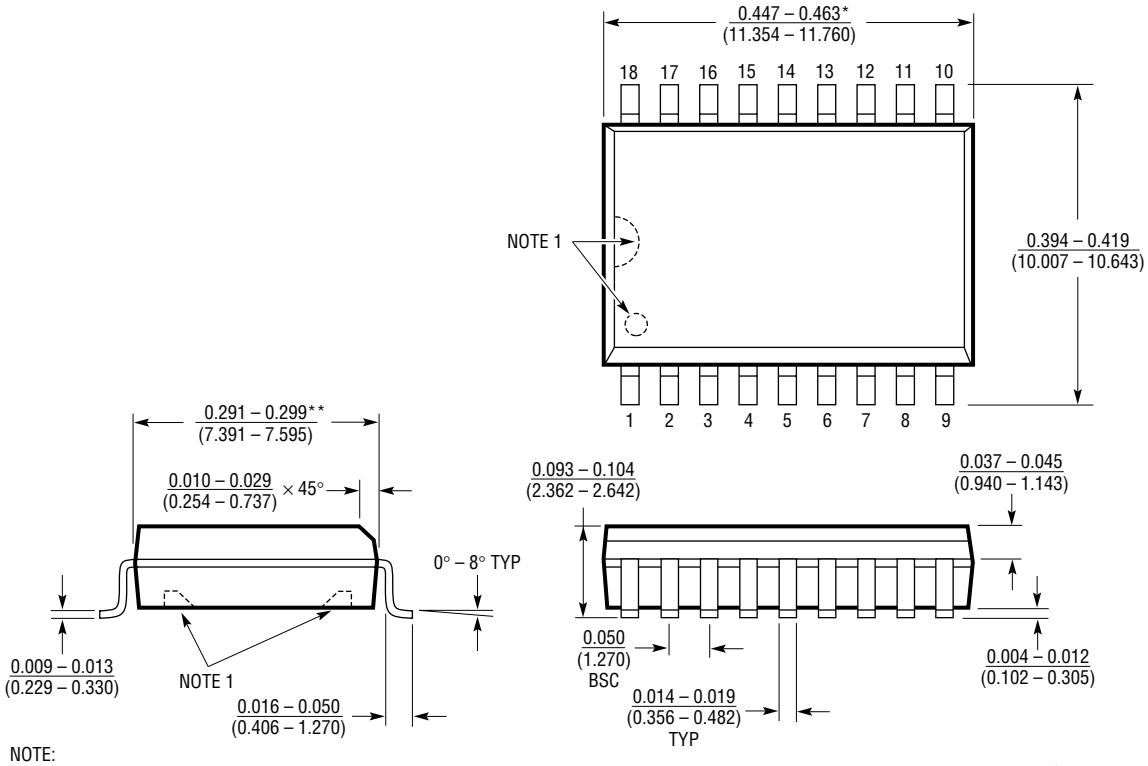
*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

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

S16 (WIDE) 1098

PACKAGE DESCRIPTION

SW Package
18-Lead Plastic Small Outline (Wide .300 Inch)
(Reference LTC DWG # 05-08-1620)



S18 (WIDE) 1098

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

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