LINEAR TECHNOLOGY

Advanced Low Power 5V RS232 Dual Driver/Receiver with Small Capacitors

FEATURES

- 0.1μF Capacitors
- Absolutely No Latchup
- CMOS Comparable Low Power — 70mW
- Superior to CMOS
  - Improved Speed — Operates Over 64K Baud
  - Improved Protection — Outputs Can be Forced to ±30V Without Damage
  - Three-State Outputs are High Impedance When Off
  - Smaller Board Area Required
- 1μA Supply Current in Shutdown
- Available in SO Package
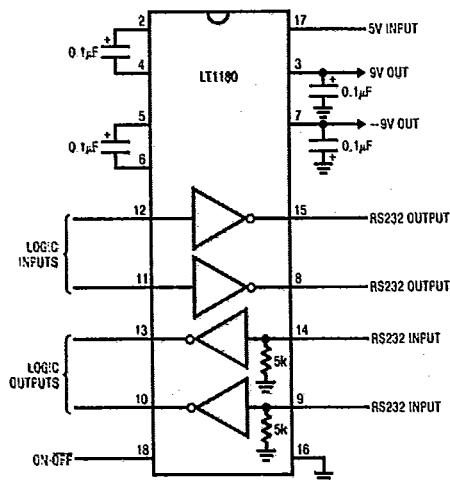- Available With or Without Shutdown

APPLICATIONS

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

DESCRIPTION
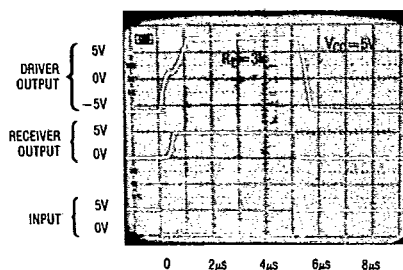
The LT1180 and LT1181 are the only dual RS232 driver/receiver with charge pump to guarantee absolutely no latchup. Requiring only 0.1μF charge pump capacitors, these interface optimized devices provide a realistic balance between CMOS levels of power dissipation and real world requirements for ruggedness. Small capacitors reduce cost as well as board size. The driver outputs are fully protected against overload and can be shorted to ±30V. Unlike CMOS, the advanced architecture of the LT1180/LT1181 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 5 drivers and 5 receivers with charge pump in one package see the LT1130 Series data sheet. A version of the LT1180/81, the LT1080 and LT1081 is available for applications requiring extra current from the charge pump to power other circuitry. All of Linear Technology's RS232 IC's are available in standard surface mount packages.

TYPICAL APPLICATION

Output Waveforms

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) 6V
V+ 13.2V
V- .... −13.2V
Input Voltage
  Driver............................... V− to V+
  Receiver............................ −30V to 30V
  On-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 Seconds
  V- ....30 Seconds
  Driver Output........................... Indefinite
  Receiver Output......................... Indefinite
Operating Temperature Range
  LT1180M/LT1181M .... −55°C to 125°C
  LT1180I/LT1181I .... −40°C to 85°C
  LT1180C/LT1181C.....................0°C to 70°C
Lead Temperature (Soldering, 10 sec.)...........300°C

PACKAGE/ORDER INFORMATION

TOP VIEW	ORDER PART NUMBER
NC [1] ON-OFF [18] C1+ [2] V_{CC} [17] V+ [3] GND [16] C1− [4] TR1 OUT [15] C2+ [5] LT1180 REC1 IN [14] C2− [6] REC1 OUT [13] V− [7] TR1 IN [12] TR2 OUT [8] TR2 IN [11] REC2 IN [9] REC2 OUT [10]	LT1180MJ LT1180IJ LT1180IN LT1180CJ LT1180CN
J PACKAGE N PACKAGE 18-LEAD CERAMIC DIP 18-LEAD PLASTIC DIP	

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NC [1] ON-OFF [18] C1+ [2] V_{CC} [17] V+ [3] GND [16] C1− [4] TR1 OUT [15] C2+ [5] LT1180 REC1 IN [14] C2− [6] REC1 OUT [13] V− [7] TR1 IN [12] TR2 OUT [8] TR2 IN [11] REC2 IN [9] REC2 OUT [10]	LT1180IS LT1180CS
S PACKAGE 18-LEAD PLASTIC SOL	

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J PACKAGE N PACKAGE 16-LEAD CERAMIC DIP 16-LEAD PLASTIC DIP	

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C1+ [1] V_{CC} [16] V+ [2] GND [15] C1− [3] TR1 OUT [14] C2+ [4] LT1181 REC1 IN [13] C2− [5] REC1 OUT [12] V− [6] TR1 IN [11] TR2 OUT [7] TR2 IN [10] REC2 IN [8] REC2 OUT [9]	LT1181IS LT1181CS
S PACKAGE 16-LEAD PLASTIC SOL	

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ELECTRICAL CHARACTERISTICS (Note 1)

PARAMETER	CONDITIONS			MIN	TYP	MAX	UNITS
Driver							
Output Voltage Swing	Load = 3k to GND	Positive	●	5.0	7.3		V
	Both Outputs.	Negative	●	-5.0	-6.5		V
Logic Input Voltage Level	Input Low Level (V_{OUT} = High)		●		1.4	0.8	V
	Input High Level (V_{OUT} = Low)		●	2.0	1.4		V
Logic Input Current	$V_{IN} \geq 2.0V$		●		5	20	μA
	$V_{IN} \leq 0.8V$		●		5	20	μA
Output Short Circuit Current	Sourcing Current, V_{OUT} = 0V			7	12		mA
	Sinking Current, V_{OUT} = 0V			-7	-12		mA
Output Leakage Current	SHUTDOWN (Note 2), $V_{OUT} = \pm 30V$		●		10	100	μA
Slew Rate	$R_L = 3k\Omega, C_L = 51pF$			4	15	30	V/μs
Receiver							
Input Voltage Thresholds	Input Low Threshold, LT1180C, LT1181C		●	0.8	1.3		V
	LT1180I, M/LT1181I, M		●	0.2	1.3		V
	Input High Threshold, LT1180C/LT1181C		●		1.7	2.4	V
	LT1180I, M/LT1181I, M		●		1.7	3.0	V
Hysteresis			●	0.1	0.4	1.0	V
Input Resistance				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 2), $0V \leq V_{OUT} \leq V_{CC}$		●		1	10	μA
Supply Current	(Note 3)				14	23	mA
	$T_A = 125°C$		●			30	mA
Supply Leakage Current (V_{CC})	SHUTDOWN (Note 2) (LT1180 Only)		●		1	100	μA
On-$\overline{OFF}$ Pin Current	$0V \leq V_{ON-\overline{OFF}} \leq 5V$ (LT1180 Only)		●	-15		80	μA

The ● denotes specifications which apply over the operating temperature range (0°C ≤ T_A ≤ 70°C for commercial grade, -40°C ≤ T_A ≤ 85°C for industrial grade or -55°C ≤ T_A ≤ 125°C for military grade devices).

Note 1: These parameters apply for $V_{ON-\overline{OFF}}$ = 3V, V_{CC} = 5V and C = 0.1μF unless otherwise specified.

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 (LT1180 only).

Note 3: Unless otherwise specified, V_{CC} = 5V, external loading of V + and V − equals zero and the driver outputs are low (inputs high).

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LT1180/LT1181

PIN FUNCTIONS (Pin numbers refer to LT1180)

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

GND (Pin 16): Ground pin.

On-Off (Pin 18): Controls the operation mode of the LT1180 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.

V+ (Pin 3): Positive supply for RS232 drivers. V+ ≈ $2V_{CC}$ – 1.5V. Requires an external capacitor (≥0.1μF) for charge storage. 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− ≈ –($2V_{CC}$ – 2.5V). Requires an external capacitor (≥0.1μF) for charge storage. With multiple transceivers, the V+ and V− pins may be paralleled into common capacitors.

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

TR1 OUT; TR2 OUT (Pins 15, 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_{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.

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

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

C1+; C1−; C2+; C2− (Pins 2, 4, 5, 6): Requires an external capacitor (≥0.1μF) 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.

TYPICAL PERFORMANCE CHARACTERISTICS

Supply Ripple vs Capacitor
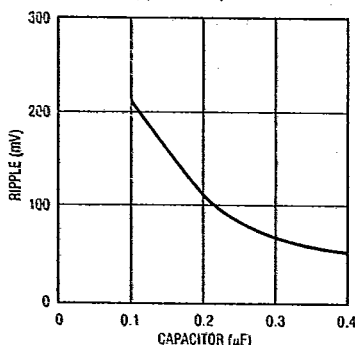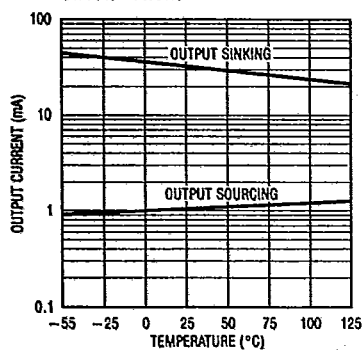

Supply Generation from V_{CC} or Shutdown
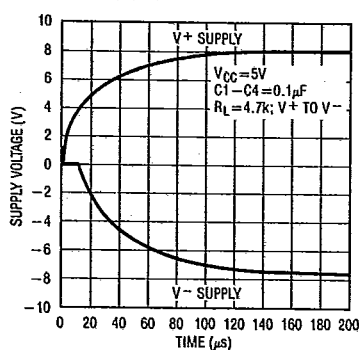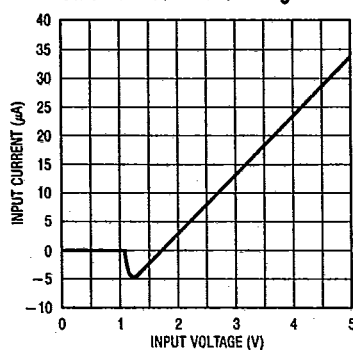

Receiver Input Thresholds

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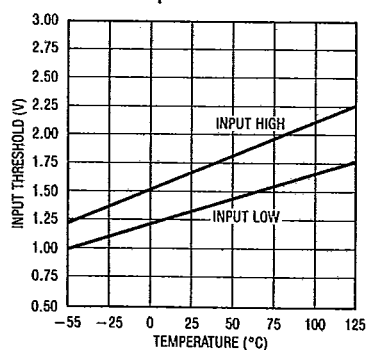
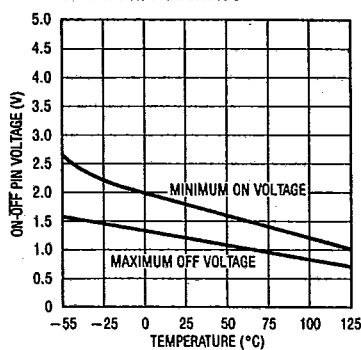# TYPICAL PERFORMANCE CHARACTERISTICS

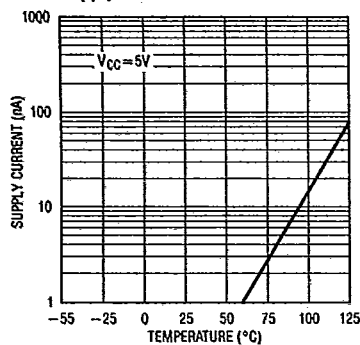**Receiver Output Short Circuit Current**
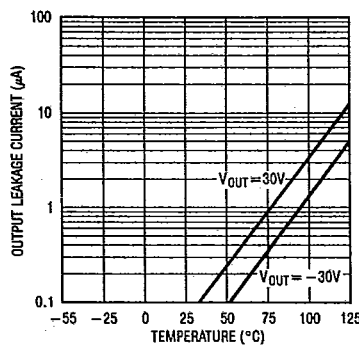

On-Off Pin Current vs Voltage
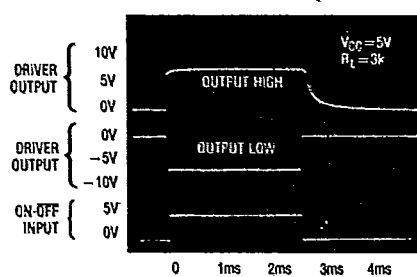

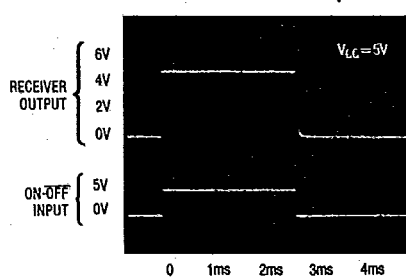**On-Off Pin Thresholds**

Supply Current in Shutdown

Driver Output Leakage in Shutdown

Shutdown to Driver Output


Shutdown to Receiver Output

LT1180/LT1181

APPLICATION HINTS

The driver output stage of the LT1180 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 LT1180 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.

LT1180/LT1181 Driver
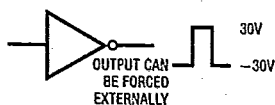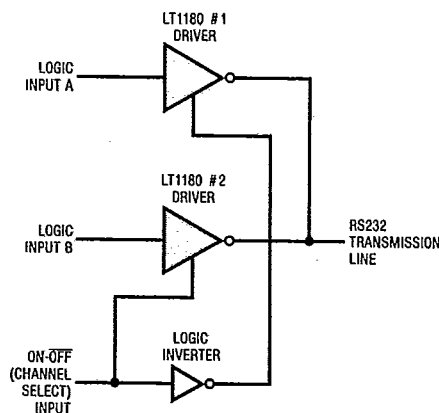

Transceiver

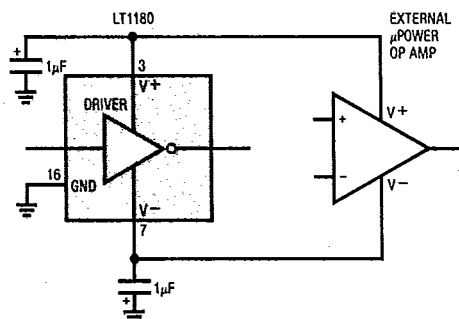Older RS232 Drivers and CMOS Drivers
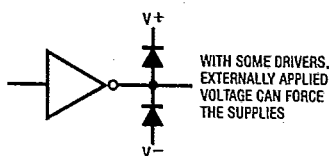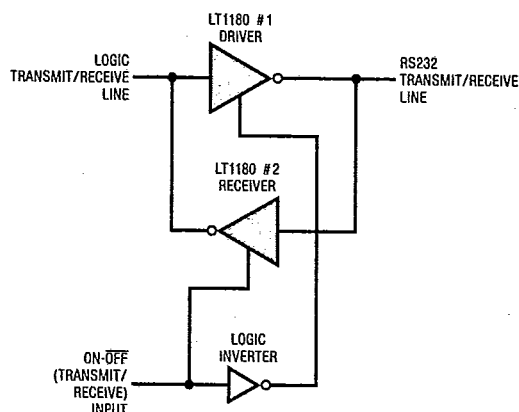
Sharing a Receiver Line
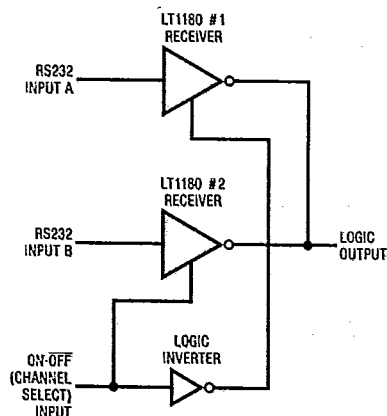
Sharing a Transmitter Line

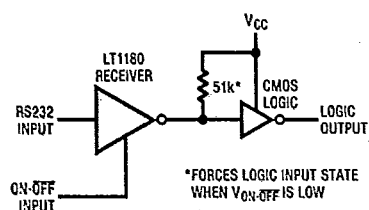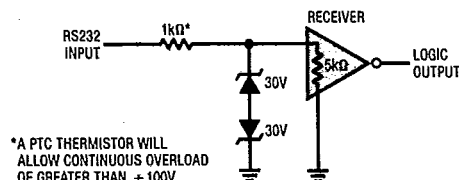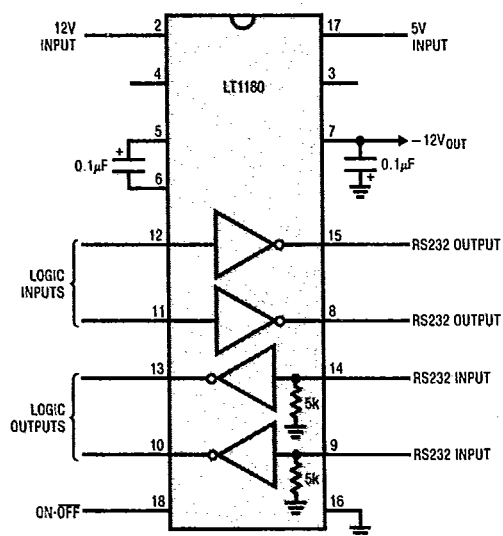LINEAR TECHNOLOGY

APPLICATION HINTS

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.

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.
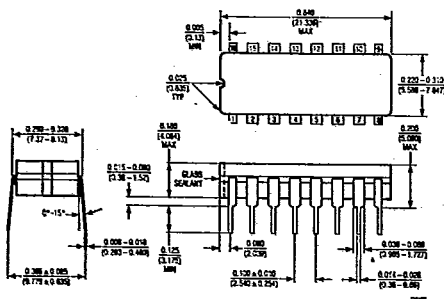

*A PTC THERMISTOR WILL ALLOW CONTINUOUS OVERLOAD OF GREATER THAN ±100V

*FORCES LOGIC INPUT STATE WHEN V_{ON-OFF} IS LOW

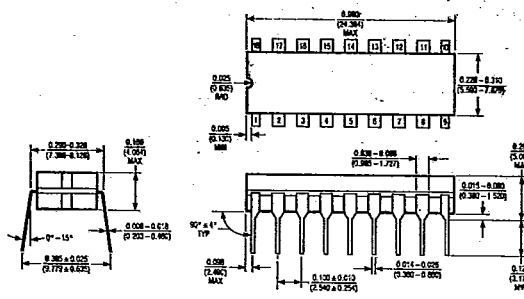# TYPICAL APPLICATION

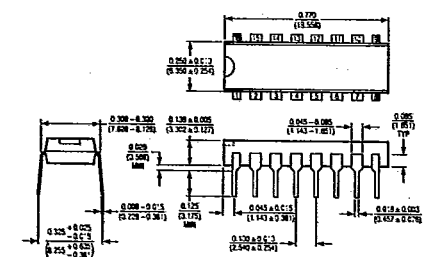**Operating with 12V and 5V Supplies**

LT1180/LT1181

PACKAGE DESCRIPTION Dimensions in inches (millimeters) unless otherwise noted.

J Package
16-Lead Ceramic DIP

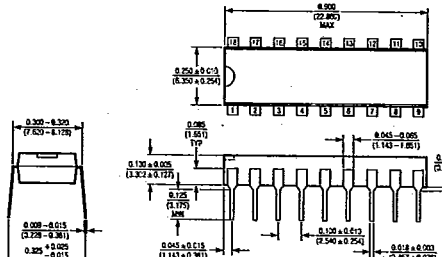|	T_{jmax}	θ_{ja}	θ_{jc}
LT1181MJ/NJ	150°C	100°C/W	40°C/W
LT1181CJ	150°C	100°C/W	40°C/W

J Package
18-Lead Ceramic DIP

	T_{jmax}	θ_{ja}	θ_{jc}
LT1180MJ/NJ	150°C	100°C/W	40°C/W
LT1180CJ	150°C	100°C/W	40°C/W

N Package
16-Lead Plastic DIP

	T_{jmax}	θ_{ja}	θ_{jc}
LT1181CN/IN	125°C	120°C/W	50°C/W

N Package
18-Lead Plastic DIP

	T_{jmax}	θ_{ja}	θ_{jc}
LT1180CN/IN	125°C	120°C/W	50°C/W

S Package
16-Lead Plastic SOL

S Package
18-Lead Plastic SOL