



T-75-45-05 LT1130 Series

Advanced Low Power 5V RS232 Drivers/Receivers with Charge Pump

FEATURES

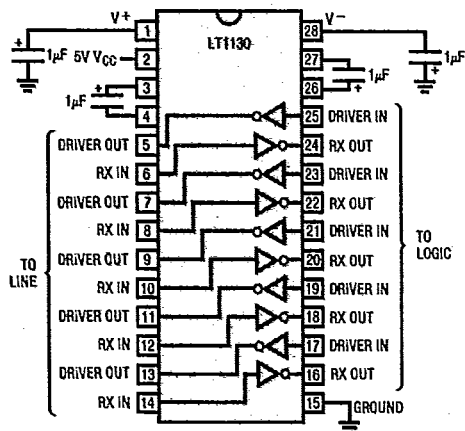
- Absolutely No Latchup
- CMOS Comparable Low Power — 80mW
- Operates from a Single 5V Supply
- Superior to CMOS
 - Easy PC Layout — Flow Through Architecture
 - Improved Speed — Operates Over 64K Baud
 - Improved Protection — Outputs Can be Forced to $\pm 30V$ Without Damage
 - Three-State Outputs are High Impedance When Off
 - Only Needs $1\mu F$ Capacitors
 - Output Overvoltage Does Not Force Current Back Into Supplies
- $1\mu A$ Supply Current in Shutdown
- Available in SO Package

DESCRIPTION

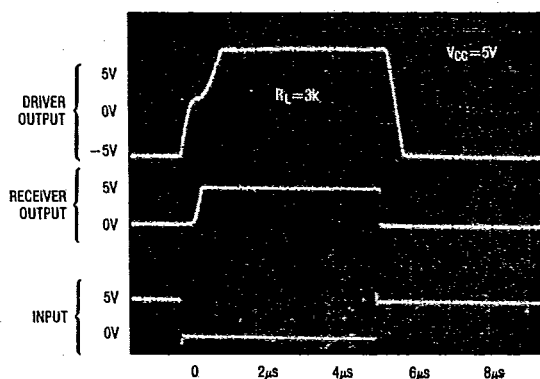
The LT1130 Series are the only RS232 drivers/receivers with charge pump to guarantee absolutely no latchup. These interface optimized devices provide a realistic balance between CMOS levels of power dissipation and real world requirements for ruggedness. The driver outputs are fully protected against overload and can be shorted to $\pm 30V$. Unlike CMOS, the advanced architecture of the LT1130 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.

For applications requiring only 2 drivers and 2 receivers with charge pump in one package see the LT1180 Series data sheet. All of Linear Technology's RS232 IC's are available in standard surface mount packages.

Basic Operation



Output Waveform



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- LT1130 5-Driver/5-Receiver RS232 Transceiver
- LT1131 5-Driver/4-Receiver RS232 Transceiver w/Shutdown
- LT1132 5-Driver/3-Receiver RS232 Transceiver
- LT1133 3-Driver/5-Receiver RS232 Transceiver
- LT1134 4-Driver/4-Receiver RS232 Transceiver
- LT1135 5-Driver/3-Receiver RS232 Transceiver w/o Charge Pump

- LT1136 4-Driver/5-Receiver RS232 Transceiver w/Shutdown
- LT1137 3-Driver/5-Receiver RS232 Transceiver w/Shutdown
- LT1138 5-Driver/3-Receiver RS232 Transceiver w/Shutdown
- LT1139 4-Driver/4-Receiver RS232 Transceiver w/Shutdown
- LT1140 5-Driver/3-Receiver RS232 Transceiver w/o Charge Pump
- LT1141 3-Driver/5-Receiver RS232 Transceiver w/o Charge Pump

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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
 Military (LT113XM/LT114XM) -55°C to 125°C
 Industrial (LT113XI/LT114XI) -40°C to 85°C
 Commercial (LT113XC/LT114XC) 0°C to 70°C

PRODUCT SELECTION TABLE

Part Number	Power Supply Voltages*	Shutdown	Drivers	Receivers	External Components
LT1130	+5	No	5	5	4 Capacitors
LT1131	+5	Yes	5	4	4 Capacitors
LT1132	+5	No	5	3	4 Capacitors
LT1133	+5	No	3	5	4 Capacitors
LT1134	+5	No	4	4	4 Capacitors
LT1135	+5, +12, -12	No	5	3	None
LT1136	+5	Yes	4	5	4 Capacitors
LT1137	+5	Yes	3	5	4 Capacitors
LT1138	+5	Yes	5	3	4 Capacitors
LT1139	+5, +12	Yes	4	4	2 Capacitors
LT1140	+5, +12, -12	Yes	5	3	None
LT1141	+5, +12, -12	Yes	3	5	None

*The LT1130, LT1131, LT1132, LT1133, LT1134, LT1136, LT1137, and LT1138 can operate with +5V and +12V supplies and two external capacitors.

PACKAGE/ORDER INFORMATION

5-DRIVER/5-RECEIVER TOP VIEW LT1130	ORDER PART NUMBER	5-DRIVER/4-RECEIVER WITH SHUTDOWN TOP VIEW LT1131	ORDER PART NUMBER
	<p>LT1130MJ LT1130CJ LT1130CN LT1130IJ LT1130IN LT1130CS</p>		<p>LT1131MJ LT1131CJ LT1131CN LT1131IJ LT1131IN LT1131CS</p>
<p>J PACKAGE 28-LEAD CERAMIC DIP (600*WIDE) S PACKAGE 28-LEAD PLASTIC SOL (600*WIDE) N PACKAGE 28-LEAD PLASTIC DIP (600*WIDE)</p>		<p>J PACKAGE 28-LEAD CERAMIC DIP (600*WIDE) S PACKAGE 28-LEAD PLASTIC SOL (600*WIDE) N PACKAGE 28-LEAD PLASTIC DIP (600*WIDE)</p>	

PACKAGE/ORDER INFORMATION

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<p>5-DRIVER/3-RECEIVER TOP VIEW</p> <p>J PACKAGE 24-LEAD CERAMIC DIP (.300" WIDE)</p> <p>S PACKAGE 24-LEAD PLASTIC SOL (.300" WIDE)</p> <p>N PACKAGE 24-LEAD PLASTIC DIP (.300" WIDE)</p>	<p>ORDER PART NUMBER</p> <p>LT1132MJ LT1132CJ LT1132CN LT1132IJ LT1132IN LT1132CS</p>	<p>3-DRIVER/5-RECEIVER TOP VIEW</p> <p>J PACKAGE 24-LEAD CERAMIC DIP (.300" WIDE)</p> <p>S PACKAGE 24-LEAD PLASTIC SOL (.300" WIDE)</p> <p>N PACKAGE 24-LEAD PLASTIC DIP (.300" WIDE)</p>	<p>ORDER PART NUMBER</p> <p>LT1133MJ LT1133CJ LT1133CN LT1133IJ LT1133IN LT1133CS</p>
<p>4-DRIVER/4-RECEIVER TOP VIEW</p> <p>J PACKAGE 24-LEAD CERAMIC DIP (.300" WIDE)</p> <p>S PACKAGE 24-LEAD PLASTIC SOL (.300" WIDE)</p> <p>N PACKAGE 24-LEAD PLASTIC DIP (.300" WIDE)</p>	<p>ORDER PART NUMBER</p> <p>LT1134MJ LT1134CJ LT1134CN LT1134IJ LT1134IN LT1134CS</p>	<p>5-DRIVER/3-RECEIVER WITHOUT CHARGE PUMP TOP VIEW</p> <p>J PACKAGE 20-LEAD CERAMIC DIP (.300" WIDE)</p> <p>S PACKAGE 20-LEAD PLASTIC SOL (.300" WIDE)</p> <p>N PACKAGE 20-LEAD PLASTIC DIP (.300" WIDE)</p>	<p>ORDER PART NUMBER</p> <p>LT1135MJ LT1135CJ LT1135CN LT1135IJ LT1135IN LT1135CS</p>
<p>4-DRIVER/5-RECEIVER WITH SHUTDOWN TOP VIEW</p> <p>J PACKAGE 28-LEAD CERAMIC DIP (.600" WIDE)</p> <p>S PACKAGE 28-LEAD PLASTIC SOL (.600" WIDE)</p> <p>N PACKAGE 28-LEAD PLASTIC DIP (.600" WIDE)</p>	<p>ORDER PART NUMBER</p> <p>LT1136MJ LT1136CJ LT1136CN LT1136IJ LT1136IN LT1136CS</p>	<p>3-DRIVER/5-RECEIVER WITH SHUTDOWN TOP VIEW</p> <p>J PACKAGE 28-LEAD CERAMIC DIP (.600" WIDE)</p> <p>S PACKAGE 28-LEAD PLASTIC SOL (.600" WIDE)</p> <p>N PACKAGE 28-LEAD PLASTIC DIP (.600" WIDE)</p>	<p>ORDER PART NUMBER</p> <p>LT1137MJ LT1137CJ LT1137CN LT1137IJ LT1137IN LT1137CS</p>

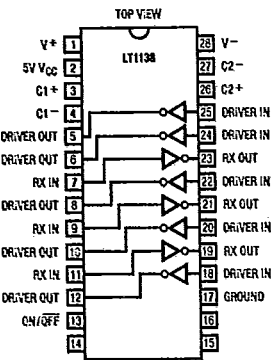
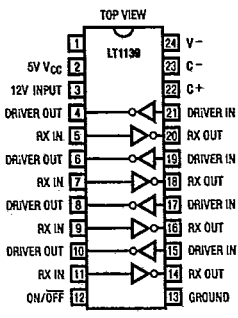
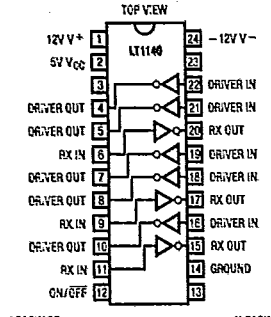
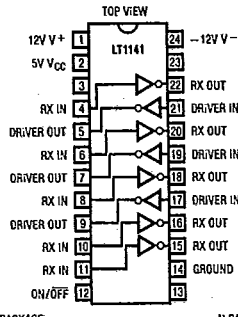
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PACKAGE/ORDER INFORMATION

<p>5-DRIVER/3-RECEIVER WITH SHUTDOWN</p>  <p>TOP VIEW LT1138</p> <p>1 V+ 2 5V V_{CC} 3 C1+ 4 C1- 5 DRIVER OUT 6 DRIVER OUT 7 RX IN 8 DRIVER OUT 9 RX IN 10 DRIVER OUT 11 RX IN 12 DRIVER OUT 13 ON/OFF 14 15 16 GROUND 17 18 DRIVER IN 19 RX OUT 20 DRIVER IN 21 RX OUT 22 DRIVER IN 23 RX OUT 24 DRIVER IN 25 C2- 26 C2+ 27 V- 28</p> <p>J PACKAGE 28-LEAD CERAMIC DIP (.600" WIDE)</p> <p>S PACKAGE 28-LEAD PLASTIC SOL (.600" WIDE)</p> <p>N PACKAGE 28-LEAD PLASTIC DIP (.600" WIDE)</p>	<p>ORDER PART NUMBER</p> <p>LT1138MJ LT1138CJ LT1138CN LT1138IJ LT1138IN LT1138CS</p>	<p>4-DRIVER/4-RECEIVER WITH SHUTDOWN WITH +12V AND +5V SUPPLIES</p>  <p>TOP VIEW LT1139</p> <p>1 5V V_{CC} 2 12V INPUT 3 DRIVER OUT 4 RX IN 5 DRIVER OUT 6 RX IN 7 DRIVER OUT 8 RX IN 9 DRIVER OUT 10 RX IN 11 ON/OFF 12 13 GROUND 14 RX OUT 15 DRIVER IN 16 RX OUT 17 DRIVER IN 18 RX OUT 19 DRIVER IN 20 RX OUT 21 DRIVER IN 22 C+ 23 C- 24 V-</p> <p>J PACKAGE 24-LEAD CERAMIC DIP (.300" WIDE)</p> <p>S PACKAGE 24-LEAD PLASTIC SOL (.300" WIDE)</p> <p>N PACKAGE 24-LEAD PLASTIC DIP (.300" WIDE)</p>	<p>ORDER PART NUMBER</p> <p>LT1139MJ LT1139CJ LT1139CN LT1139IJ LT1139IN LT1139CS</p>
<p>5-DRIVER/3-RECEIVER WITHOUT CHARGE PUMP</p>  <p>TOP VIEW LT1140</p> <p>1 12V V+ 2 5V V_{CC} 3 DRIVER OUT 4 DRIVER OUT 5 DRIVER OUT 6 RX IN 7 DRIVER OUT 8 DRIVER OUT 9 RX IN 10 DRIVER OUT 11 RX IN 12 ON/OFF 13 14 GROUND 15 RX OUT 16 DRIVER IN 17 RX OUT 18 DRIVER IN 19 RX OUT 20 DRIVER IN 21 DRIVER IN 22 DRIVER IN 23 -12V V- 24</p> <p>J PACKAGE 24-LEAD CERAMIC DIP (.300" WIDE)</p> <p>S PACKAGE 24-LEAD PLASTIC SOL (.300" WIDE)</p> <p>N PACKAGE 24-LEAD PLASTIC DIP (.300" WIDE)</p>	<p>ORDER PART NUMBER</p> <p>LT1140MJ LT1140CJ LT1140CN LT1140IJ LT1140IN LT1140CS</p>	<p>3-DRIVER/5-RECEIVER WITHOUT CHARGE PUMP</p>  <p>TOP VIEW LT1141</p> <p>1 12V V+ 2 5V V_{CC} 3 RX IN 4 DRIVER OUT 5 DRIVER OUT 6 RX IN 7 DRIVER OUT 8 RX IN 9 DRIVER OUT 10 RX IN 11 ON/OFF 12 13 GROUND 14 RX OUT 15 RX OUT 16 DRIVER IN 17 DRIVER IN 18 RX OUT 19 DRIVER IN 20 RX OUT 21 DRIVER IN 22 RX OUT 23 24 -12V V-</p> <p>J PACKAGE 24-LEAD CERAMIC DIP (.300" WIDE)</p> <p>S PACKAGE 24-LEAD PLASTIC SOL (.300" WIDE)</p> <p>N PACKAGE 24-LEAD PLASTIC DIP (.300" WIDE)</p>	<p>ORDER PART NUMBER</p> <p>LT1141MJ LT1141CJ LT1141CN LT1141IJ LT1141IN LT1141CS</p>

For 2-Driver/2-Receiver devices, see LT1080/81 and LT1180/81 data sheet.

ELECTRICAL CHARACTERISTICS (Note 1)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Any Driver						
Output Voltage Swing	Load = 3k to GND	Positive Negative	5.0 -5.0	7.3 -6.5		V V
Logic Input Voltage Level	Input Low Level (V _{OUT} = High) Input High Level (V _{OUT} = Low)		2.0	1.4 1.4	0.8	V V
Logic Input Current	0.8V ≤ V _{IN} ≤ 2.0V			5	20	μA
Output Short Circuit Current	V _{OUT} = 0V			12		mA
Output Leakage Current	SHUTDOWN (Note 2), V _{OUT} = ±30V (Note 3)			10	100	μA
Slew Rate	R _L = 3kΩ, C _L = 51pF		4	15	30	V/μs

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ELECTRICAL CHARACTERISTICS (Note 1)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Any Receiver					
Input Voltage Thresholds	Input Low Threshold, ($V_{OUT} = \text{High}$)	0.8	1.3		V
	Input High Threshold, ($V_{OUT} = \text{Low}$)		1.7	2.4	V
Hysteresis		0.1	0.4	1.0	V
Input Resistance		3	5	7	k Ω
Output Voltage	Output Low, $I_{OUT} = -1.6\text{mA}$		0.2	0.4	V
	Output High, $I_{OUT} = 160\mu\text{A}$ ($V_{CC} = 5\text{V}$)	3.5	4.8		V
Output Short Circuit Current	Sinking Current, $V_{OUT} = V_{CC}$	-10	-20		mA
	Sourcing Current, $V_{OUT} = 0\text{V}$	0.4	1		mA
Output Leakage Current	SHUTDOWN (Note 2), $0\text{V} \leq V_{OUT} \leq V_{CC}$		1	10	μA
Power Supply Generator					
V^+ Output			8		V
V^- Output			-7.5		V
Supply Current			17	27	mA
Supply Leakage Current	SHUTDOWN, $-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		1	100	μA
	SHUTDOWN, $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$		1	10	μA
Supply Rise Time	SHUTDOWN To Turn On		2		ms
On/Off Pin Current	SHUTDOWN, $0\text{V} \leq V_{ON/OFF} \leq 5\text{V}$	-15		80	μA

The ● denotes the specifications which apply over the full operating temperature range, ($0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ for commercial grade, $-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$ for industrial grade, and $-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$ for military grade).

Note 1: Testing done at $V_{CC} = 5\text{V}$ and $V_{ON/OFF} = 3\text{V}$

Note 2: $V_{ON/OFF} \leq 0.1\text{V}$

Note 3: For LT1139, 40, and 41 with 12V supplies, V_{OUT} leakage is $200\mu\text{A}$ and V_{OUT} is forced to $\pm 25\text{V}$.

PIN FUNCTIONS

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

GND: Ground pin.

On/Off: Controls the operation mode of the device 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^+ : Positive supply (RS232 drivers). $V^+ \approx 2V_{CC} - 1.5\text{V}$. Requires an external capacitor ($\geq 1\mu\text{F}$) for charge storage. Capacitor may be tied to ground or +5V input supply. V^+ voltage is short circuit proof for 30 seconds. With multiple transceivers, the V^+ and V^- pins may be paralleled into common capacitors.

V^- : Negative supply (RS232 drivers). $V^- \approx -(2V_{CC} - 2.5\text{V})$. Requires an external capacitor ($\geq 1\mu\text{F}$) for charge storage.

Loading does reduce V^- voltage. V^- is short circuit proof for 30 seconds. With multiple transceivers, the V^+ and V^- pins may be paralleled into common capacitors.

DRIVER IN: RS232 driver input pins. Inputs are TTL/CMOS compatible. Inputs should not be allowed to float. Tie unused inputs to V_{CC} .

DRIVER OUT: Driver outputs with RS232 voltage levels. Outputs are in a high impedance state when in the SHUTDOWN mode or when power is off ($V_{CC} = 0\text{V}$) to allow data line sharing. Outputs are fully short circuit protected from $V^- + 30\text{V}$ to $V^+ - 30\text{V}$ with power on, off, or in the SHUTDOWN mode. Typical output breakdowns are greater than $\pm 45\text{V}$ and higher applied voltages will not damage the device if moderately current limited. Although the outputs are protected, short circuits on one output can load the power supply generators disrupting the signal level from other outputs.

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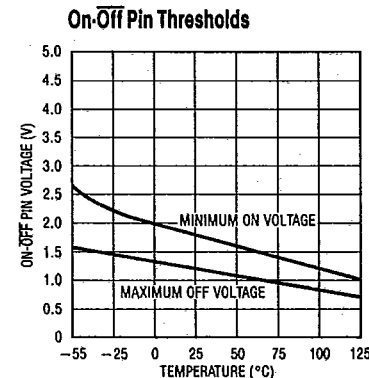
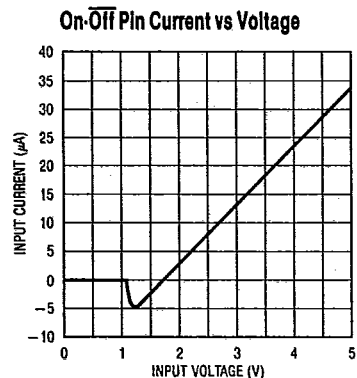
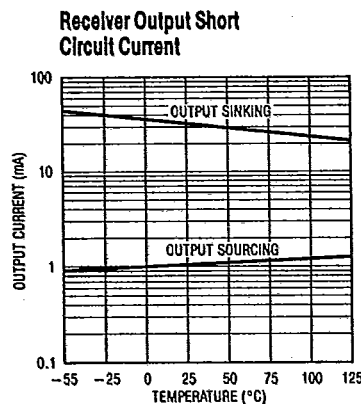
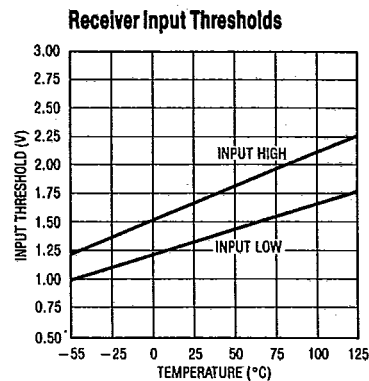
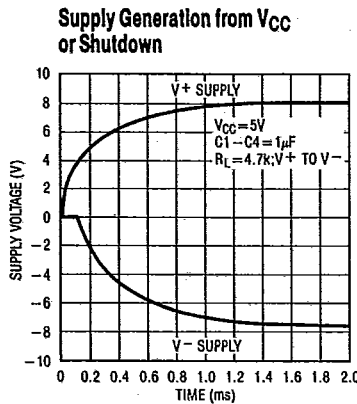
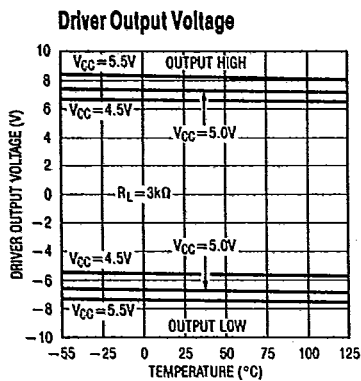
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RX IN: Receiver inputs. Accepts RS232 voltage levels ($\pm 30V$) and has 0.4V of hysteresis to provide noise immunity. Input impedance is nominally 5k Ω .

C1 +; C1 -; C2 +; C2 -: Requires an external capacitor ($\geq 1\mu F$) from C1 + to C1 - and another from C2 + to C2 -. In applications where larger positive voltages are available, such as +12V, C1 can be eliminated and the positive voltage connected directly to the C1 + terminal.

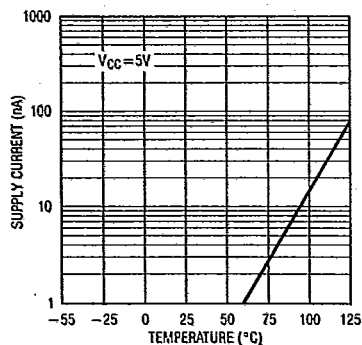
RX OUT: Receiver outputs with TTL/CMOS voltage levels. Outputs are in a high impedance state when in the SHUTDOWN mode to allow data line sharing. Outputs are fully short circuit protected to ground or V_{CC} with power on, off, or in the SHUTDOWN mode.

TYPICAL PERFORMANCE CHARACTERISTICS

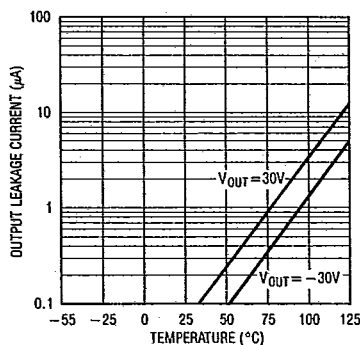


TYPICAL PERFORMANCE CHARACTERISTICS

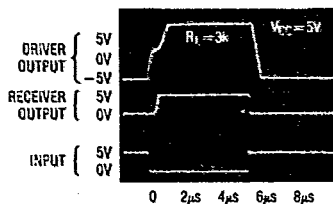
Supply Current in Shutdown



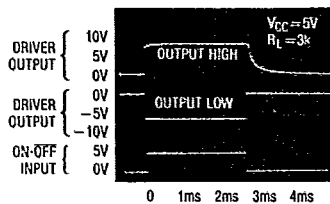
Driver Output Leakage in Shutdown



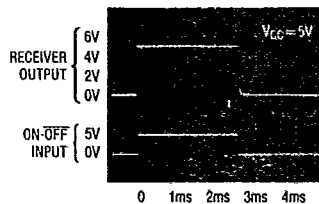
Output Waveforms



Shutdown to Driver Output



Shutdown to Receiver Output



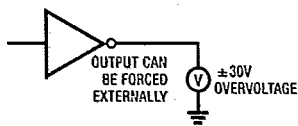
APPLICATION HINTS

The driver output stage of the LT1130 offers significantly improved protection over older bipolar and CMOS designs. In addition to current limiting, the driver output can be externally forced to $\pm 30V$ with no damage or excessive cur-

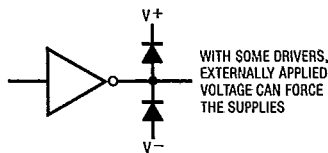
rent flow, and will not disrupt the supplies. Some drivers have diodes connected between the outputs and the supplies, so externally applied voltages can cause excessive supply voltage to develop.

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LT1130 Driver



Older RS232 Drivers and CMOS Drivers



LT1130 Series

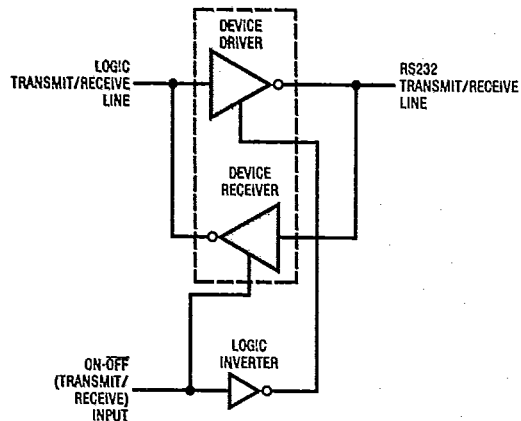
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APPLICATION HINTS

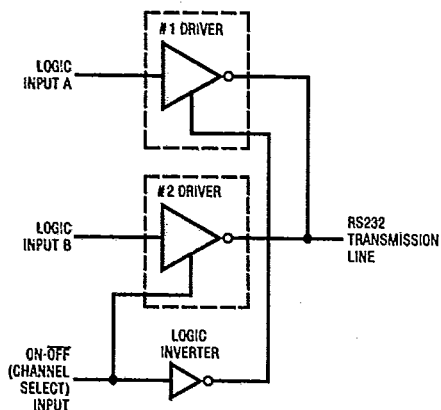
Placing the LT1130 type device in the SHUTDOWN mode puts both the driver and receiver outputs in a high impedance state. This allows data line sharing and transceiver applications.

The SHUTDOWN mode also drops input supply current to zero for power-conscious systems.

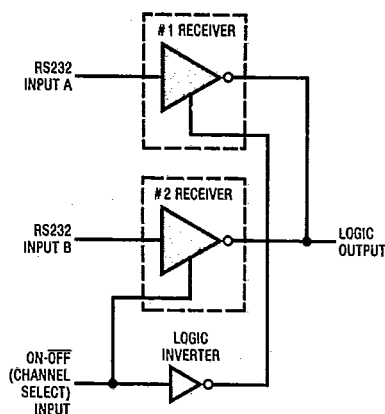
Transceiver



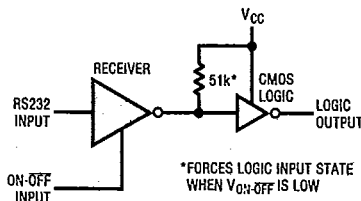
Sharing a Receiver Line



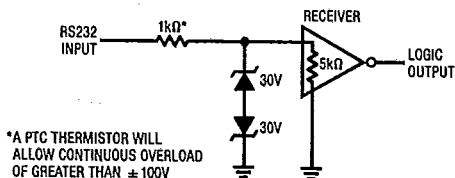
Sharing a Transmitter Line



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.

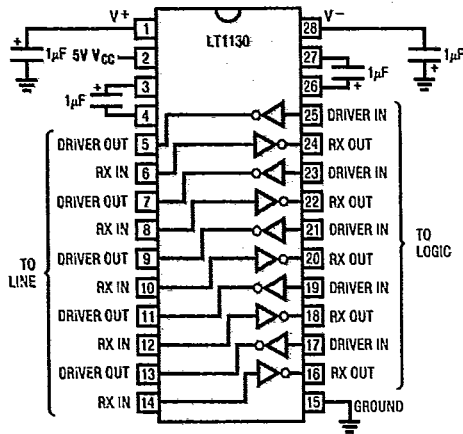


LT1130 Series

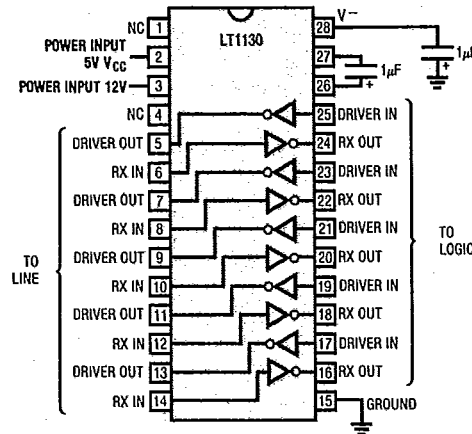
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TYPICAL APPLICATIONS

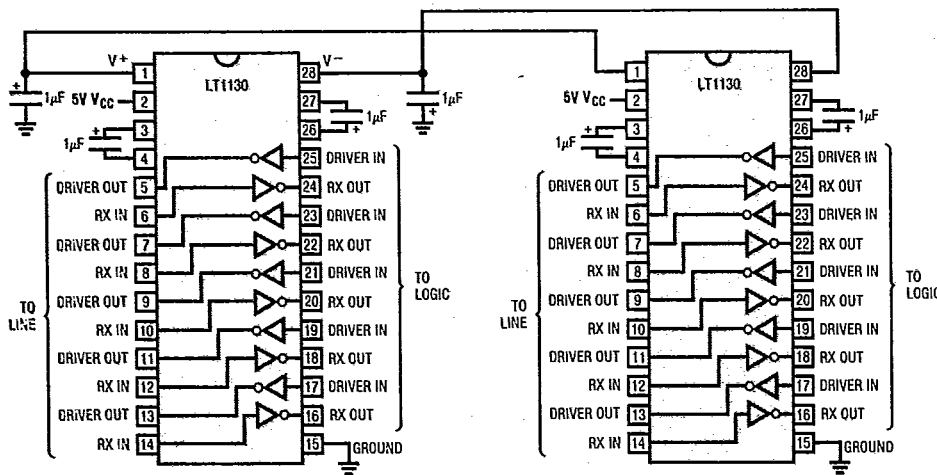
Basic Operation



Operating with +5V and +12V Supplies



Paralleling Power Supply Generator with Common Storage Capacitors

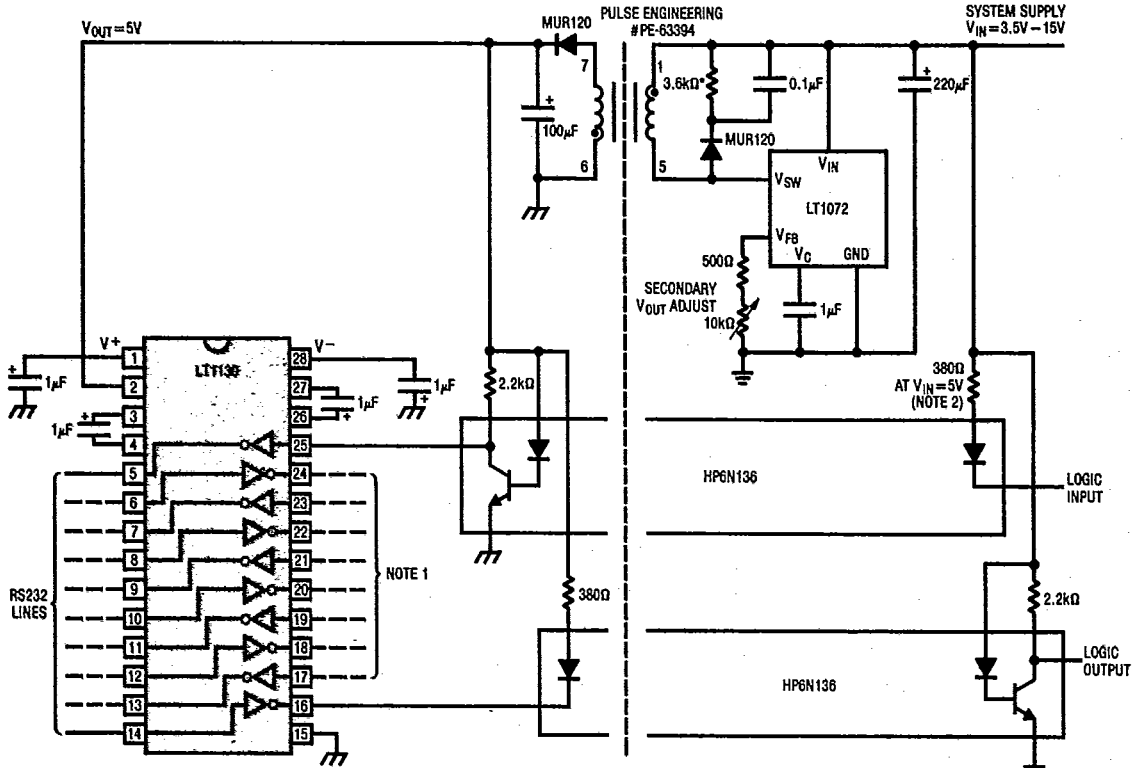


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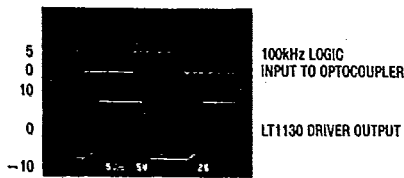
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2500V Isolated 5-Driver/5-Receiver RS232 Transceiver

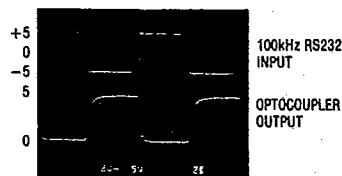


= SYSTEM GROUND
 = FLOATING COMMON
 NOTE 1: REPEAT THE OPTOCOUPLER CONNECTIONS FOR EACH LINE.
 NOTE 2: SELECT FOR 10mA THROUGH LED.
 *FOR IMPROVED EFFICIENCY, REPLACE THE 3.6kΩ RESISTOR WITH A 30V ZENER DIODE.

RS232 Driver Signals



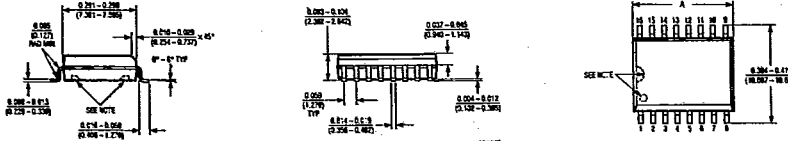
RS232 Receiver Signals



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

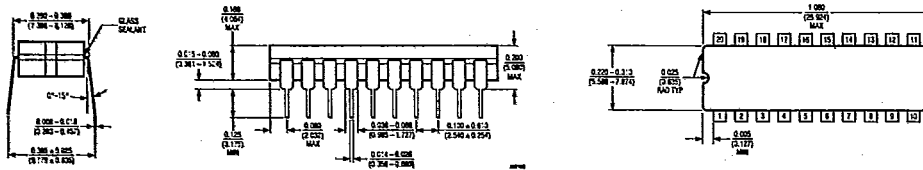
S Package
20-, 24- and 28-Lead Plastic SOL
(.300" / .300" / .600" Wide)

NO. OF LEADS	A DIM.
20	0.280 ± 0.15 (7.125 ± 3.81)
24	0.280 ± 0.15 (7.125 ± 3.81)
28	0.280 ± 0.15 (7.125 ± 3.81)
24	0.280 ± 0.15 (7.125 ± 3.81)
28	0.280 ± 0.15 (7.125 ± 3.81)

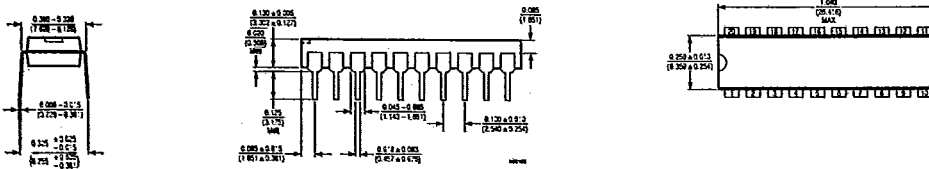


NOTE:
PIN 1 IDENT. NOTCH ON TOP AND CARRIER ON THE BOTTOM OF PACKAGE ARE THE MANUFACTURER'S OPTION. THE PART MAY BE SUPPLIED WITH OR WITHOUT ANY OF THE OPTIONS.

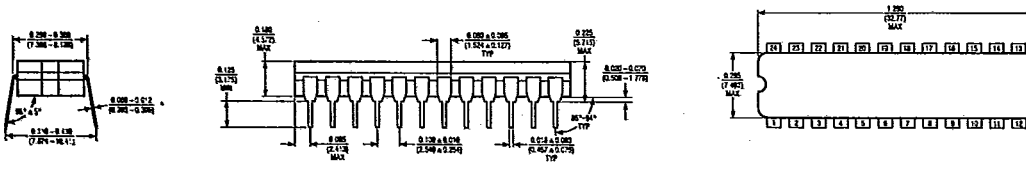
J Package
20-Lead Ceramic DIP
(.300" Wide)



N Package
20-Lead Plastic DIP
(.300" Wide)



J Package
24-Lead Ceramic DIP
(.300" Wide)



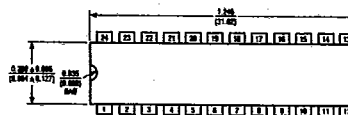
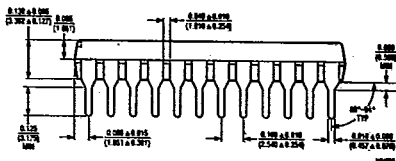
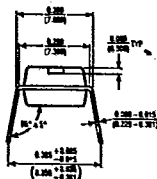
10

LT1130 Series

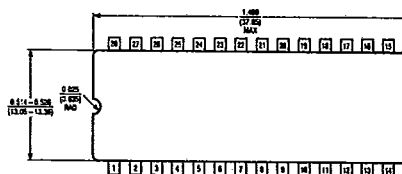
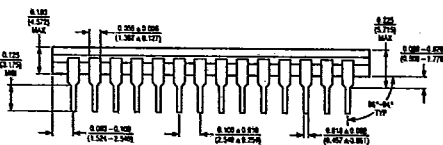
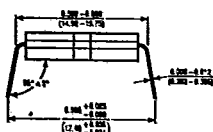
T-75-45-05

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

**N Package
24-Lead Plastic DIP
(.300" Wide)**



**J Package
28-Lead Ceramic DIP
(.600" Wide)**



**N Package
28-Lead Plastic DIP
(.600" Wide)**

