

5V RS232 Transceiver with 3V Logic Interface and One Receiver Active in SHUTDOWN

June, 1992

FEATURES

- 3V Logic Interface
- ESD Protection over $\pm 10\text{kV}$
- Uses Small Capacitors (0.1 μF , 0.2 μF , 1.0 μF)
- One Low Power Receiver Remains Active while in SHUTDOWN
- Pin Compatible with LT1137 and LT1237
- Operates to 120kbaud
- CMOS Comparable Low Power: 30mW
- Easy PC Layout Flow Through Architecture
- Rugged Bipolar Design
- Outputs Assume a High Impedance State When Off or Powered Down
- Absolutely No Latchup
- 60 μA Supply Current in SHUTDOWN
- Available in SO Package

DESCRIPTION

The LT1330 is a three driver, five receiver RS232 transceiver with low supply current. Designed to interface with new 3V logic, the LT1330 operates with both a +5V power supply and a 3V logic power supply. The chip may be shut down to micropower operation with one receiver remaining active to monitor RS232 inputs such as ring detect from a modem.

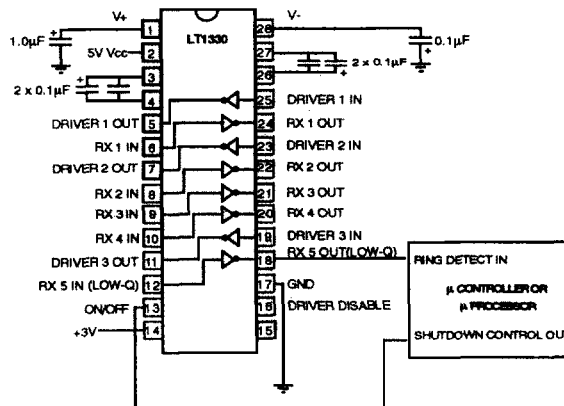
The LT1330 is fully compliant with all EIA RS232 specifications. Additionally, the RS232 line input and output pins are resilient to multiple ESD strikes. This eliminates the need for costly transorbs on the pins for the RS232 package.

The LT1330 operates to 120 kbaud even while driving high capacitive loads. During shutdown, driver and receiver outputs are at a high impedance state allowing devices to be paralleled.

APPLICATIONS

- Notebook Computers
- Palmtop Computers

 REFER TO TABLE OF CONTENTS
 FOR REVISED DATA LOCATION

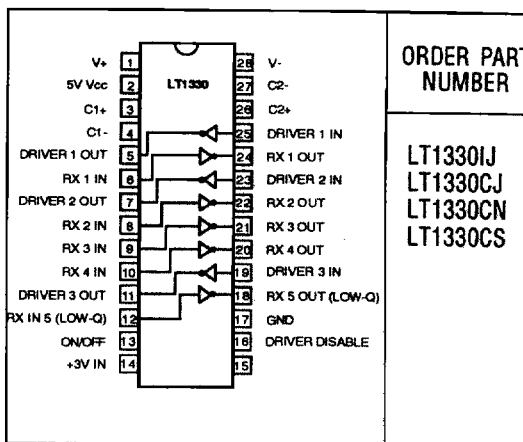
Typical Application

13

ABSOLUTE MAXIMUM RATINGS

(Note 1)

Supply Voltage (V _{CC})	6V
Supply Voltage (+3V _{IN})	6V
V+	+13.2V
V-	-13.2V
Input Voltage	
Driver	V+ to V-
Receiver	+30V to -30V
Output Voltage	
Driver	-55°C to 125°C
Receiver	0°C to 70°C
Short Circuit Duration	
V+	30s
V-	30s
Driver Output	Indefinite
Receiver Output	Indefinite
Operating Temperature Range	
LT1330I	-40°C to 85°C
LT1330C	0°C to 70°C
Storage Temperature Range	
	-65°C to 150°C
Lead Temperature (Soldering, 10 sec.)	
	300°C

PACKAGE/ORDER INFORMATION



ELECTRICAL CHARACTERISTICS (Note 2)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Power Supply Generator					
V+ Output			8.6		V
V- Output			-7.0		V
Supply Current (V _{CC})	(Note 3)		6	9	mA
Supply Current (+3V)	(Note 4)		0.1	1	mA
Supply Current when OFF (V _{CC})	SHUTDOWN (Note 5) DRIVERDISABLE	●	0.06 3	0.150	mA mA
Supply Rise Time SHUTDOWN to TurnOn	C1=C2=0.2μF C+=1.0μF, C-=0.1μF		2 0.2		ms ms
ON/OFF Pin Thresholds	Input Low Level (Device SHUTDOWN) Input High Level (Device Enabled)	● ●	1.4 2.0	0.8 1.4	V V
ON/OFF Pin Current	0V ≤ V _{ON/OFF} ≤ 5V	●	-15	80	μA
Driver Disable Pin Thresholds	Input Low Level (Drivers Enabled) Input High Level (Drivers Disabled)	● ●	2.0 1.4	1.4 0.8	V V
DRIVERDISABLE Pin Current	0V ≤ V _{DRIVER DISABLE} ≤ 5V	●	-10	500	μA

ELECTRICAL CHARACTERISTICS (Note 2)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Any Driver						
Output Voltage Swing	Load = 3k to GND	Positive	● 5.0	7.3		V
		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	0.8V ≤ V _{IN} ≤ 2.0V		●	5	20	μA
Output Short Circuit Current	V _{OUT} = 0V			17		mA
Output Leakage Current	SHUTDOWN V _{out} = ±30V (Note 5)	●		10	100	μA
Slew Rate	R _L =3k, C _L =51pF			15	30	V/μs
	R _L =3k, C _L =2500pF		4	15		V/μs
Propagation Delay	Output Transition t _{HL} High to Low (Note 6)			0.6	1.3	μS
	Output Transition t _{LH} Low to High			0.5	1.3	μS
Any Receiver						
Input Voltage Thresholds	Input Low Threshold (V _{OUT} = High)		0.8	1.3		V
	Input High Threshold (V _{OUT} = Low)			1.7	2.4	V
Hysteresis		●	0.1	0.4	1.0	V
Input Resistance			3	5	7	kΩ
Output Leakage Current	SHUTDOWN (Note) 0 ≤ V _{OUT} ≤ V _{CC}	●		1	10	μA
Receivers 1 Through 4						
Output Voltage	Output Low, I _{OUT} = -1.6mA	●		0.2	0.4	V
	Output High, I _{OUT} = 160μA (Pin 14 = 3V)	●	2.7	2.9		V
Output Short Circuit Current	Sinking Current, V _{OUT} = V _{CC}		-10	-20		mA
	Sourcing Current, V _{OUT} = 0V		10	20		mA
Propagation Delay	Output Transition t _{HL} High to Low (Note 7)			250	600	nS
	Output Transition t _{LH} Low to High			350	600	nS
Receiver 5 (LOW CURRENT RX)						
Output Voltage	Output Low, I _{OUT} = -500μA	●		0.2	0.4	V
	Output High, I _{OUT} = 160μA (Pin 14 = 3V)	●	2.7	2.9		V
Output Short Circuit Current	Sinking Current, V _{OUT} = V _{CC}		-2	-4		mA
	Sourcing Current, V _{OUT} = 0V		2	4		mA
Propagation Delay	Output Transition t _{HL} High to Low (Note 7)			1.0	3	μS
	Output Transition t _{LH} Low to High			1.0	3	μS

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, and -55°C ≤ T_A ≤ 125°C for military grade.)

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

Note 2: Testing done at V_{CC} = 5V and V_{ON/OFF} = 3V.

Note 3: Supply current is measured as the average over sever charge pump burst cycles. C+ = 1.0μF, C- = 0.1μF, C1 = C2 = 0.2μF. All outputs are open, with all driver inputs tied high.

Note 4: +3V supply current is measured with all receiver outputs low.

Note 5: Supply current measurements in SHUTDOWN are performed with V_{ON/OFF} ≤ 0.1V. Supply current measurements using DRIVER DISABLE are performed with V_{DRIVER DISABLE} ≥ 3V.

Note 6: For driver delay measurements, R_L = 3k and C_L = 51 pF. Trigger points are set between the driver's input logic threshold and the output transition to the zero crossing. (t_{HL} = 1.4V to 0V and t_{LH} = 1.4V to 0V)

Note 7: For receiver delay measurements, C_L = 51 pF. Trigger points are set between the receiver's input logic threshold and the output transition to standard TTL/CMOS logic threshold. (t_{HL} = 1.3V to 2.4V and t_{LH} = 1.7V to 0.8V)

PIN FUNCTIONS

V_{CC}: +5V Input supply pin. This pin should be decoupled with a 0.1μF ceramic capacitor.

+3V Input: Logic supply pin for all RS232 receivers. Like V_{CC}, the +3V input should be decoupled with a 0.1μF ceramic capacitor. May also be connected to +5V.

GND: Ground Pin.

On/Off: TTL/CMOS compatible operating mode control. A logic low puts the device in the low power SHUTDOWN mode with all drivers and four receivers in a high impedance state. A logic high fully enables the transceiver.

DRIVER DISABLE: An alternate control for the charge pump and RS232 drivers. A logic high on this pin shuts down the charge pump and places all drivers in a high impedance state. All receivers remain active under these conditions. Floating the pin or forcing a logic low level fully enables the transceiver.

V₊: Positive supply output. V₊ = 2V_{CC} - 1.5V. This pin requires an external storage capacitor, C ≥ 1.0μF, tied to ground or +5V. Larger value capacitors may be used to reduce supply ripple. The ratio of the capacitors on V₊ and V₋ should be greater than 5 to 1.

V₋: Negative supply output. V₋ = -(2V_{CC}-2.5V). This pin requires an external storage capacitor, C ≥ 0.1μF. To reduce supply ripple, increase the size of the storage capacitor.

C1+;C1-;C2+;C2-: Commutating capacitor inputs require two external capacitors, C ≥ 0.2μF. One from C1+ to C1- and another from C2+ to C2-. The capacitor's effective series resistance should be less than 2Ω. For C ≥ 1μF, low ESR tantalum capacitors work well, although ceramic capacitors may be used with a minimal reduction in charge pump compliance.

DRIVER IN: RS232 driver input pins. These inputs are TTL/CMOS compatible. Unused inputs should be connected to V_{CC}.

DRIVER OUT: Driver outputs at RS232 voltage levels. Outputs are in a high impedance state when in SHUTDOWN mode, V_{CC} = 0V, or when the driver disable pin is active. Outputs are fully short circuit protected for V_{out}

from V₋ + 30V to V₊ - 30V. Higher voltages will not damage the device if the overdrive is moderately current limited. Short circuits on one output can load the power supply generator and may disrupt the signal levels of the other outputs. The driver outputs are protected against ESD to ±10kV for human body model discharges.

RX IN: Receiver inputs. These pins accept RS232 level signals (±30V) into a protected 5kΩ terminating resistor. The receiver inputs are protected against ESD to ±10kV for human body model discharges. Each receiver provides 0.4V of hysteresis for noise immunity.

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

LOW Q-CURRENT RX IN: Low power receiver input. This special receiver remains active when the part is in SHUTDOWN mode, consuming typically 60μA. This receiver has the same input and protection characteristics as the other receivers.

LOW Q-CURRENT RX OUT: Low power receiver output. This pin produces the same TTL/CMOS output voltage levels with slightly decreased speed and drive current.

ESD Test Circuit

