PRELIMINARY

LT1137A

Advanced Low Power 5V RS232 Transceiver with Small Capacitors

June, 1992

FEATURES

- ESD Protection over **±10kV**
- Uses Small Capacitors (0.1μF, 0.2μF)
- 1μA Supply Current in SHUTDOWN
- Pin Compatible with LT1137
- Operates to 120kbaud
- CMOS Comparable Low Power-60mW
- Operates from a Single 5V Supply
- Easy PC layout-Flow Through Architecture
- Rugged Bipolar Design
- Outputs assume a High Impedance State When Off or Powered Down
- Improved Protection-RS232 I/O Lines Can be Forced to ±30V Without Damage
- Output Overvoltage Does Not Force Current Back Into Supplies
- Absolutely No Latchup
- Available in SO Package

APPLICATIONS

- Notebook Computers
- Palmtop Computers

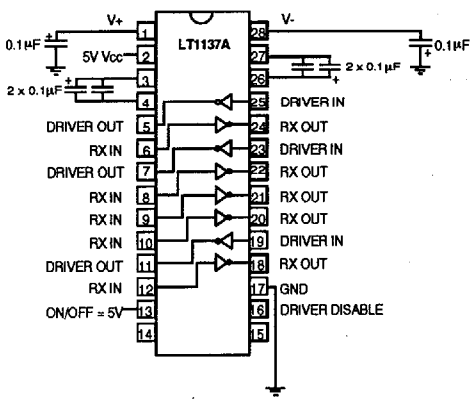
DESCRIPTION

The LT1137A is a 3 driver, 5 receiver RS232 transceiver, pin compatible with the LT1137 - offering performance improvements and two SHUTDOWN modes. The LT1137A's charge pump is designed for extended compliance, and can deliver over 40mA of load current. Supply current is typically 12mA - competitive with similar CMOS devices. An advanced driver output stage operates up to 120kbaud while driving heavy capacitive loads.

The LT1137A is fully compliant with all EIA-RS232 specifications. Special bipolar construction techniques protect the drivers and receivers beyond the fault conditions stipulated for RS232. Driver outputs and receiver inputs can be shorted to ±30V without damaging the device or the power supply generator. In addition, the RS232 I/O pins are resilient to multiple ±10kV ESD strikes.

The transceiver has two shutdown modes. One mode disables the drivers and the charge pump, the other shuts down all circuitry. While shut down, the drivers and receivers assume high impedance output states.

Typical Application

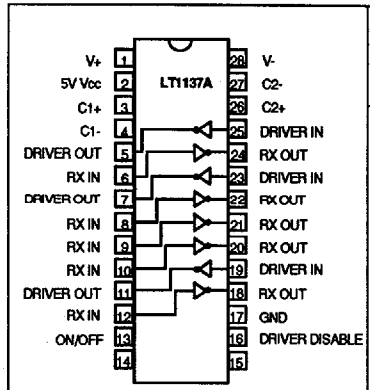


ABSOLUTE MAXIMUM RATINGS

(Note 1)

Supply Voltage (Vcc) 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
  LT1137AM ..... -55°C to 125°C
  LT1137AM ..... -40°C to 85°C
  LT1137AC ..... 0°C to 70°C
Storage Temperature Range ..... -65°C to 150°C
Lead Temperature (Soldering, 10 sec.) ..... 300°C

PACKAGE/ORDER INFORMATION



ORDER PART NUMBER
LT1137AMJ
LT1137ACJ
LT1137ACN
LT1137ACS

ELECTRICAL CHARACTERISTICS (Note 2)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Power Supply Generator						
V+ Output				8.6		V
V- Output				-7.8		V
Supply Current (V_{CC})	(Note 3)			12	17	mA
Supply Current when OFF (V_{CC})	SHUTDOWN -55°C ≤ T_A ≤ 125°C (Note 4)	●		0.001	0.10	mA
	SHUTDOWN 0°C ≤ T_A ≤ 70°C	●		0.001	0.010	mA
	DRIVER DISABLE			4		mA
Supply Rise Time	C1,C2,C+,C- = 1.0uF			2		ms
SHUTDOWN to Turn On	C+,C- = 0.1µF, C1, C2 = 0.2µF			0.2		ms
ON/OFF Pin Thresholds	Input Low Level (Device SHUTDOWN)	●		1.4	0.8	V
	Input High Level (Device Enabled)	●	2.0	1.4		V
ON/OFF Pin Current	0V ≤ $V_{ON/OFF}$ ≤ 5V	●	-15		80	µA
Driver Disable Pin Thresholds	Input Low Level (Drivers Enabled)	●		1.4	0.8	V
	Input High Level (Drivers Disabled)	●	2.0	1.4		V
DRIVER DISABLE Pin Current	0V ≤ $V_{DRIVER\ DISABLE}$ ≤ 5V	●	-10		500	µA

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ELECTRICAL CHARACTERISTICS (Note 2)

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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	$0.8V \le V_{IN} \le 2.0V$	●		5	20	µA
Output Short Circuit Current	V_{OUT} = 0V			±17		mA
Output Leakage Current	SHUTDOWN V_{OUT} = ±30V (Note 4)	●		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 5)			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 Voltage	Output Low, i_{OUT} = -1.6mA	●		0.2	0.4	V
	Output High, i_{OUT} = 160µA (V_{CC} = 5V)	●	3.5	4.2		V
Ouput Leakage Current	SHUTDOWN (Note) $0 \le V_{OUT} \le V_{CC}$	●		1	10	µA
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 6)			250	600	nS
	Output Transition t_{LH} Low to High			350	600	nS

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 with driver and receiver outputs unloaded and the driver inputs tied high.

Note 4: 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 5: For driver delay measurements, R_L = 3k and C_L = 51pF. 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 6: For receiver delay measurements, C_L = 51pF. 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)

T-52-30-90

PIN FUNCTIONS

V_{CC}: +5V Input supply pin. Supply current drops to zero in the SHUTDOWN mode. This pin should be decoupled with a 0.1μF ceramic capacitor.

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 the all of the drivers and receivers in high impedance state. A logic high fully enables the transceiver.

DRIVER DISABLE: This pin provides 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. Supply current drops to 4mA (typ) with Driver Disable active. All receivers remain active under these conditions. Floating the driver disable pin or driving it to a logic low level fully enables the transceiver.

V+: Positive supply output (RS232 drivers). V+ ~ $2V_{CC}$ - 1.5V. This pin requires an external capacitor C ≥0.1μF for charge storage. The capacitor may be tied to ground or +5V. The V+ output is short circuit proof for 30 seconds. With multiple transceivers, the V+ and V- pins may be paralleled into common capacitors. For large numbers of transceviers, increasing the size of the shared common storage capacitors is recommended to reduce ripple.

V-: Negative supply output (RS232 drivers). V- ~ -(2V_{CC}-2.5V). This pin requires an external capacitor C≥0.1μF for charge storage. V- is short circuit proof for 30 seconds.

C1+;C1-;C2+;C2-: Commutating capacitor inputs. These pins require two external capacitors C ≥ 0.2μF. One from C1+ to C1-, and another from C2+ to C2-. To maintain charge pump efficiency, the capacitor's effective series resistance should be less than 2 Ohms. For C≥1μF, low ESR tantalum capacitors work well in this application, although small value ceramic capacitors may be used with a minimal reduction in charge pump compliance. In applications where larger postive voltages are available, such as +12V, C1 may be omitted and the positive voltage may be connected directly to the C1+ pin. In this mode of operation, the V+ pin should be decoupled with a 0.1μF ceramic capacitor.

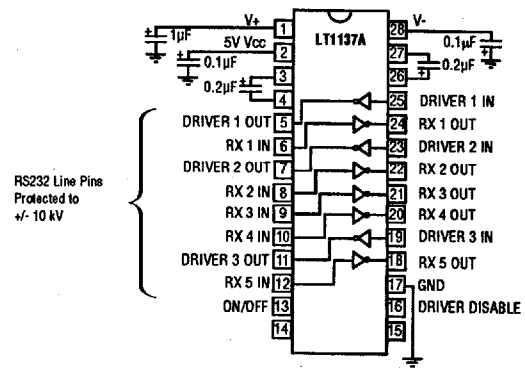
DRIVER IN: RS232 driver input pins. Inputs are TTL/CMOS compatible. Inputs should not be allowed to float. Tie unused inputs to V_{CC}.

DRIVER OUT: Driver outputs 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 from V- + 30V to V+ - 30V with power on, off, SHUTDOWN, or in disabled mode. Typical breakdowns are ±45V. Applying higher voltages will not damage the device if the overdrive is moderately current limited. Although the outputs are protected, 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 5kOhm 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 are fully short circuit protected to ground or V_{CC} with the power on, off, or in SHUTDOWN mode.

ESD Test Circuit



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