5V Low Power RS232 3-Driver/5-Receiver Transceiver with 5 Receivers Active in Shutdown

FEATURES

- **Low Supply Current: 300μA**
- **Five Receivers Kept Alive in Shutdown**
- ESD Protection Over ±10kV
- Operates from a Single 5V Supply
- Uses Small Capacitors: 0.1μF
- Operates to 120kBaud
- Three-State Outputs Are High Impedance When Off
- Output Overvoltage Does Not Force Current Back into Supplies
- RS232 I/O Lines Can Be Forced to ±25V Without Damage
- Pin Compatible with LT1137A and LT1237
- Flowthrough Architecture

APPLICATIONS

- Notebook Computers
- Palmtop Computers

DESCRIPTION

The LTC®1347 is a 3-driver/5-receiver RS232 transceiver with very low supply current. In the no load condition, the supply current is only 300μA. The charge pump only requires four 0.1μF capacitors.

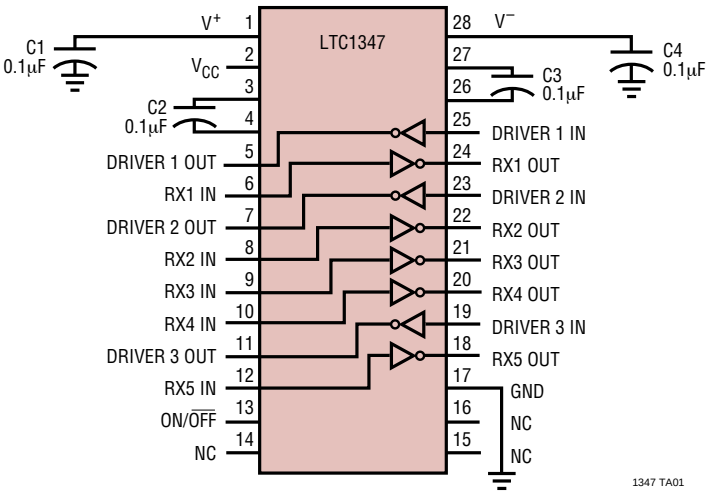
In Shutdown mode, all five receivers are kept alive and the supply current is 80μA. All RS232 outputs assume a high impedance state in Shutdown and with the power off.

The LTC1347 is fully compliant with all data rate and overvoltage RS232 specifications. The transceiver can operate up to 120kbaud with a 2500pF, 3kΩ load. Both driver outputs and receiver inputs can be forced to ±25V without damage, and can survive multiple ±10kV ESD strikes.

LT, LTC and LT are registered trademarks of Linear Technology Corporation.

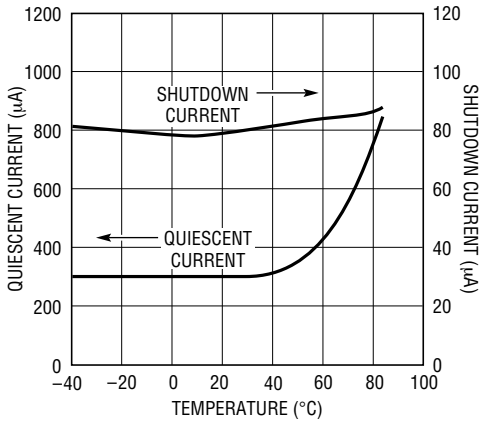
TYPICAL APPLICATION

3-Drivers/5-Receivers with Shutdown



1347 TA01

Quiescent and Shutdown Supply Current vs Temperature



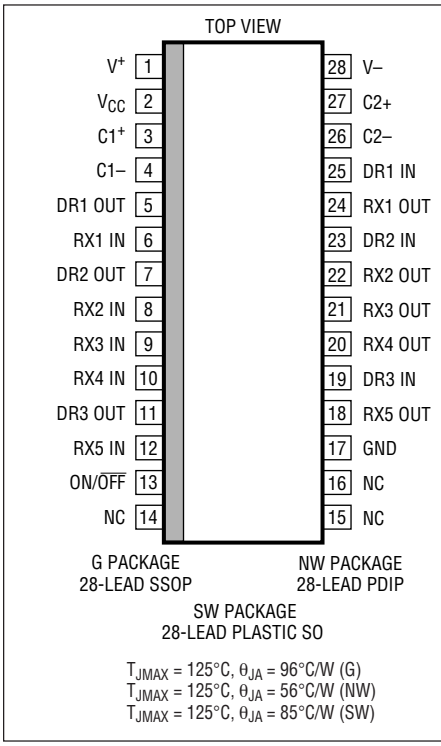
TEST CONDITION:
V_{CC} = 5V, ALL DRIVER INPUTS TIED TO V_{CC}.

1347 TA02

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) 6V
Input Voltage
  Driver ..... –0.3V to V_{CC} + 0.3V
  Receiver ..... –25V to 25V
  On/$\overline{Off}$ Pin ..... –0.3V to V_{CC} + 0.3V
Output Voltage
  Driver ..... –25V to 25V
  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 ..... 0°C to 70°C
Storage Temperature Range ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

PACKAGE/ORDER INFORMATION



G PACKAGE
28-LEAD SSOP

NW PACKAGE
28-LEAD PDIP

SW PACKAGE
28-LEAD PLASTIC SO

T_{JMAX} = 125°C, θ_{JA} = 96°C/W (G)
T_{JMAX} = 125°C, θ_{JA} = 56°C/W (NW)
T_{JMAX} = 125°C, θ_{JA} = 85°C/W (SW)

ORDER PART NUMBER

LTC1347CG
LTC1347CNW
LTC1347CSW

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

DC ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range. V_{CC} = 5V, C1 = C2 = C3 = C4 = 0.1µF, unless otherwise noted.

PARAMETER	CONDITIONS			MIN	TYP	MAX	UNITS
Any Driver							
Output Voltage Swing	3k to GND	Positive	●	5.0	7.0		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	V_{IN} = 5V		●			5	µA
	V_{IN} = 0V		●			–5	µA
Output Short-Circuit Current	V_{OUT} = 0V			±9	±12		mA
Output Leakage Current	Shutdown, V_{OUT} = ±20V (Note 3)			±10	±500	µA	
Any Receiver							
Input Voltage Thresholds	Input Low Threshold		●	0.8	1.3		V
	Input High Threshold		●		1.7	2.4	V
Hysteresis			●	0.1	0.4	1.0	V
Input Resistance	V_{IN} = ±10V			3	5	7	kΩ
Output Voltage	Output Low, I_{OUT} = –1.6mA (V_{CC} = 5V)		●		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}			–15	–40		mA
	Sourcing Current, V_{OUT} = 0V			10	20		mA

DC ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range. V_{CC} = 5V, C1 = C2 = C3 = C4 = 0.1μF, unless otherwise noted.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Power Supply Generator						
V^+ Output Voltage	I_{OUT} = 0mA I_{OUT} = 12mA			8.0 7.5		V V
V^- Output Voltage	I_{OUT} = 0mA I_{OUT} = –12mA			–8.0 –7.0		V V
Supply Rise Time	Shutdown to Turn-On			0.2		ms
Power Supply						
V_{CC} Supply Current	No Load (All Drivers V_{IN} = 5V)(Note 2) No Load (All Drivers V_{IN} = 0V) (Note 2) Shutdown (Note 3)	● ● ●		0.6 0.8 80.0	1.1 1.3 120.0	mA mA μA
On/$\overline{\text{Off}}$ Threshold Low		●		1.4	0.8	V
On/$\overline{\text{Off}}$ Threshold High		●	2.0	1.4		V

AC CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range. V_{CC} = 5V, C1 = C2 = C3 = C4 = 0.1μF, unless otherwise noted.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Slew Rate	R_L = 3k, C_L = 51pF R_L = 3k, C_L = 2500pF		 3	8 5	30	V/μs V/μs
Driver Propagation Delay (TTL to RS232)	t_{HLD} (Figure 1) t_{LHD} (Figure 1)	● ●		2 2	3.5 3.5	μs μs
Receiver Propagation Delay (RS232 to TTL)	t_{HLR} (Figure 2) t_{LHR} (Figure 2)	● ●		0.3 0.2	0.8 0.8	μs μs

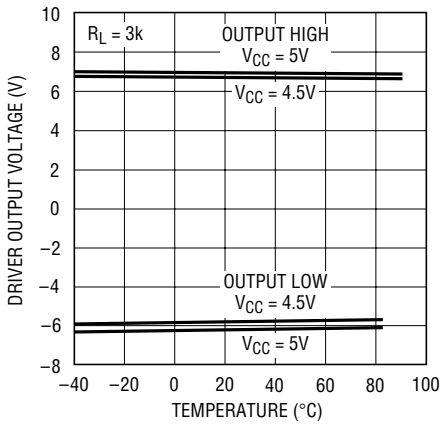
Note 1: Absolute Maximum Ratings are those values beyond which the life of the device may be impaired.

Note 2: Supply current is measured with driver and receiver outputs unloaded.

Note 3: Supply current and leakage current measurements in Shutdown are performed with $V_{ON/\overline{OFF}}$ = 0V.

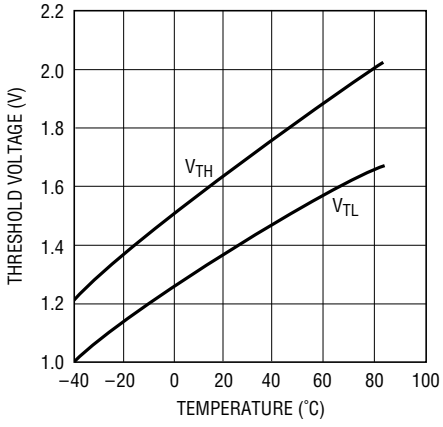
TYPICAL PERFORMANCE CHARACTERISTICS

Driver Output Voltage



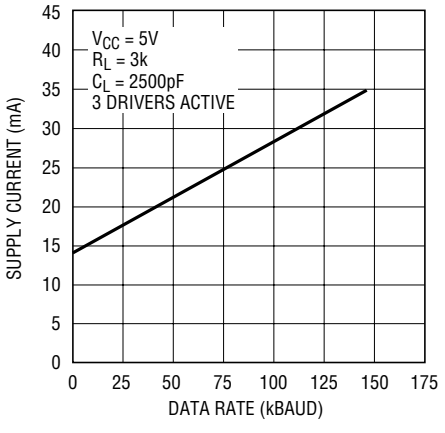
1347 G01

Receiver Input Thresholds



1347 G02

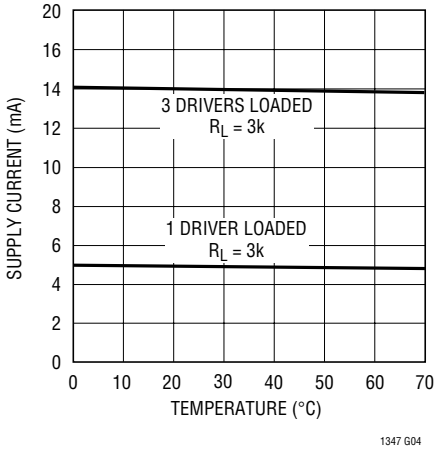
Supply Current vs Data Rate



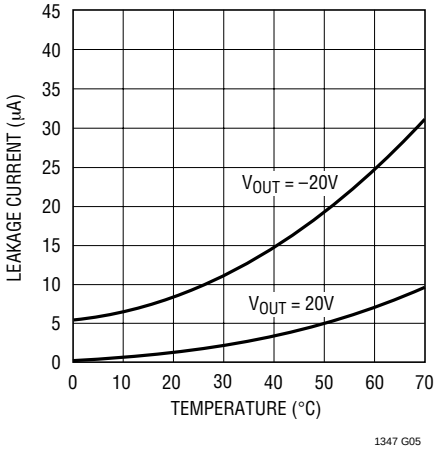
1347 G03

TYPICAL PERFORMANCE CHARACTERISTICS

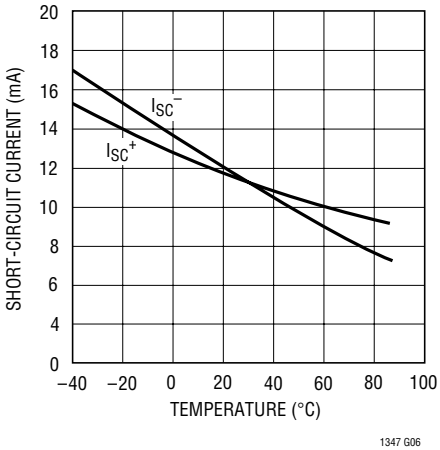
V_{CC} Supply Current



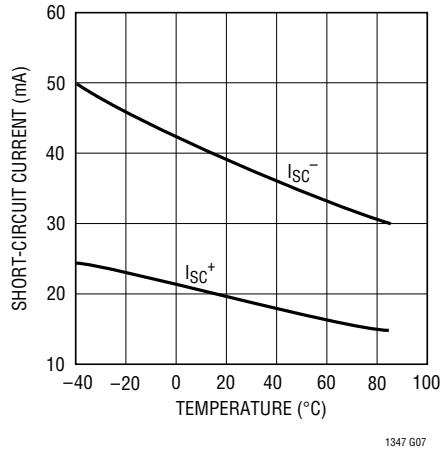
Driver Leakage in Shutdown



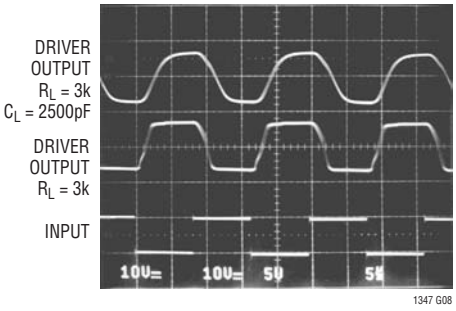
Driver Short-Circuit Current



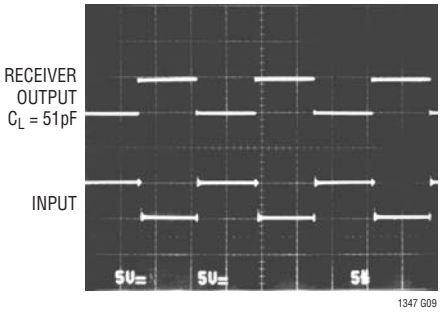
Receiver Short-Circuit Current



Driver Output Waveforms



Receiver Output Waveforms



PIN FUNCTIONS

V_{CC}: 5V Input Supply Pin. Supply current is typically 80µA in the Shutdown mode. This pin should be decoupled with a 0.1µF ceramic capacitor.

GND: Ground Pin.

ON/$\overline{OFF}$: TTL/CMOS Compatible Shutdown Pin. A logic low puts the device in the Shutdown mode with all receivers kept alive, and the supply current is 80µA. All driver outputs are in high impedance state. This pin cannot float.

V^+: Positive Supply Output (RS232 Drivers). $V^+ \cong 2V_{CC} – 1V$. This pin requires an external capacitor C = 0.1µF for charge storage. The capacitor may be tied to ground or V_{CC}. With multiple devices, the V^+ and $V^–$ pins may be paralleled into common capacitors. For large numbers of devices, increasing the size of the shared common storage capacitors is recommended to reduce ripple.

$V^–$: Negative Supply Output (RS232 Drivers). $V^– \cong – (2V_{CC} – 1.5V)$. This pin requires an external capacitor C = 0.1µF for charge storage.

$C1^+$, $C1^–$, $C2^+$, $C2^–$: Commutating Capacitor Inputs. These pins require two external capacitors C = 0.1µF: one from $C1^+$ to $C1^–$, and another from $C2^+$ to $C2^–$. To maintain

PIN FUNCTIONS

charge pump efficiency, the capacitor's effective series resistance should be less than 2Ω.

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 or V_{CC} = 0V. The driver outputs are protected against ESD to ±10kV for human body model discharges.

RX IN: Receiver Inputs. These pins can be forced to ±25V without damage. 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. All receivers are kept alive in Shutdown.

SWITCHING TIME WAVEFORMS

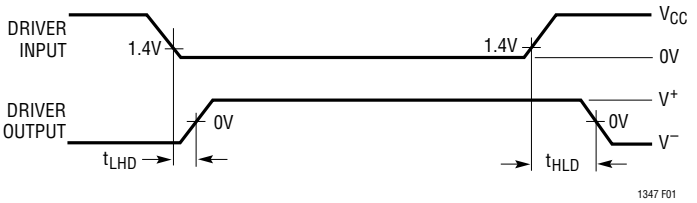


Figure 1. Driver Propagation Delay Timing

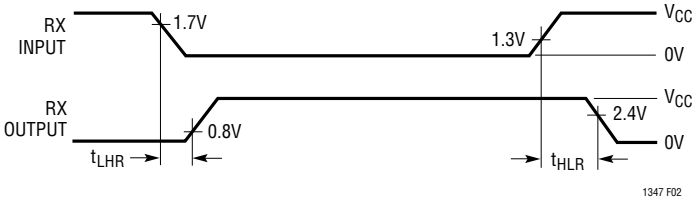


Figure 2. Receiver Propagation Delay Timing

TEST CIRCUITS

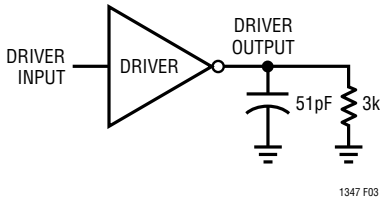


Figure 3. Driver Timing Test Load

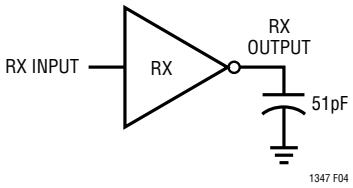


Figure 4. Receiver Timing Test Load

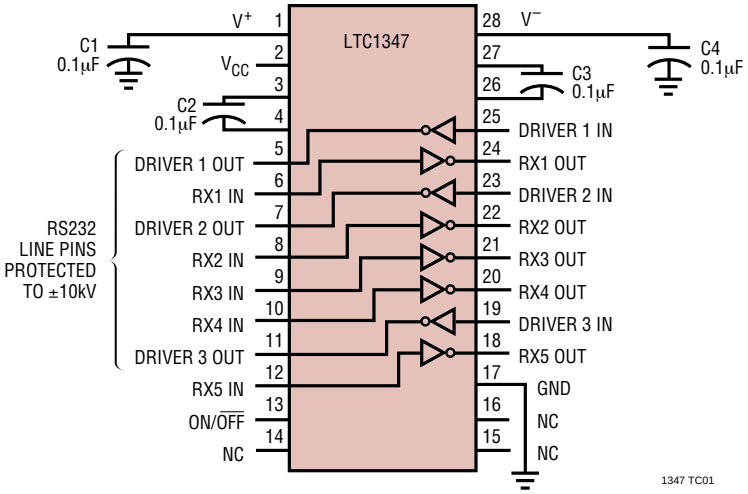
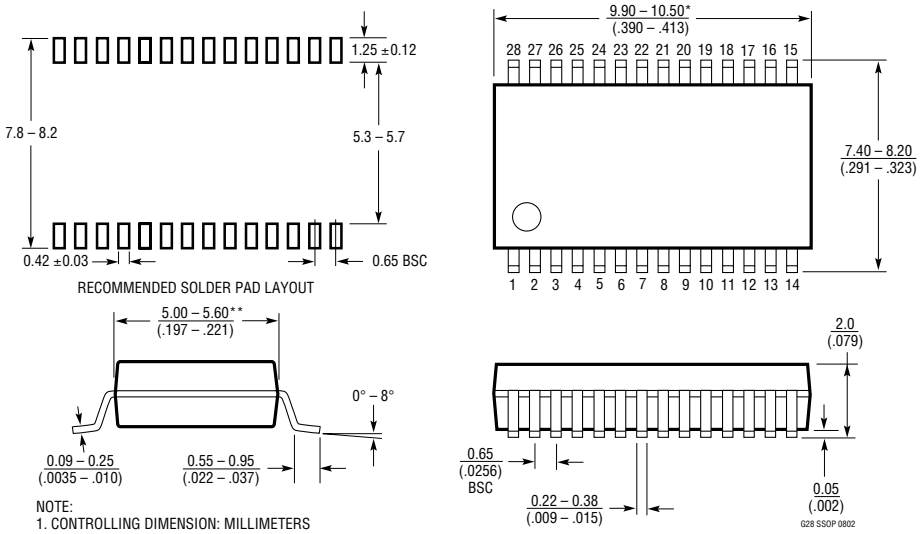


Figure 5. ESD Test Circuit

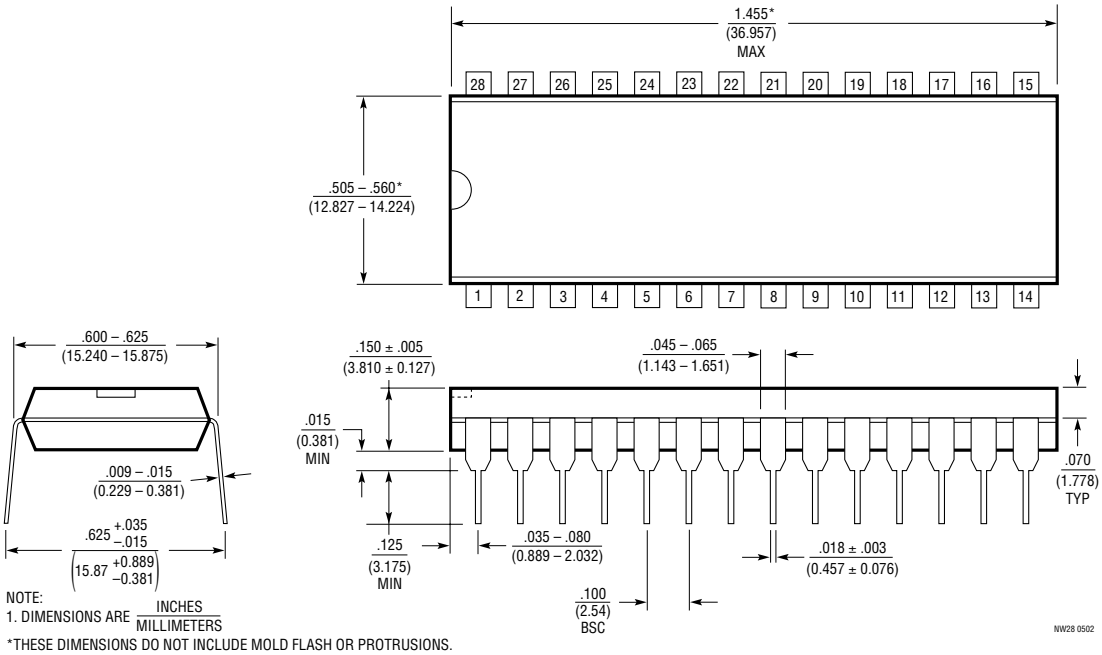
PACKAGE DESCRIPTION

G Package
28-Lead Plastic SSOP (5.3mm)
(Reference LTC DWG # 05-08-1640)



NOTE:
1. CONTROLLING DIMENSION: MILLIMETERS
2. DIMENSIONS ARE IN $\frac{\text{MILLIMETERS}}{(\text{INCHES})}$
3. DRAWING NOT TO SCALE
*DIMENSIONS DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .152mm (.006") PER SIDE
**DIMENSIONS DO NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED .254mm (.010") PER SIDE

NW Package
28-Lead PDIP (Wide .600 Inch)
(Reference LTC DWG # 05-08-1520)



NOTE:
1. DIMENSIONS ARE $\frac{\text{INCHES}}{\text{MILLIMETERS}}$
*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCH (0.254mm)

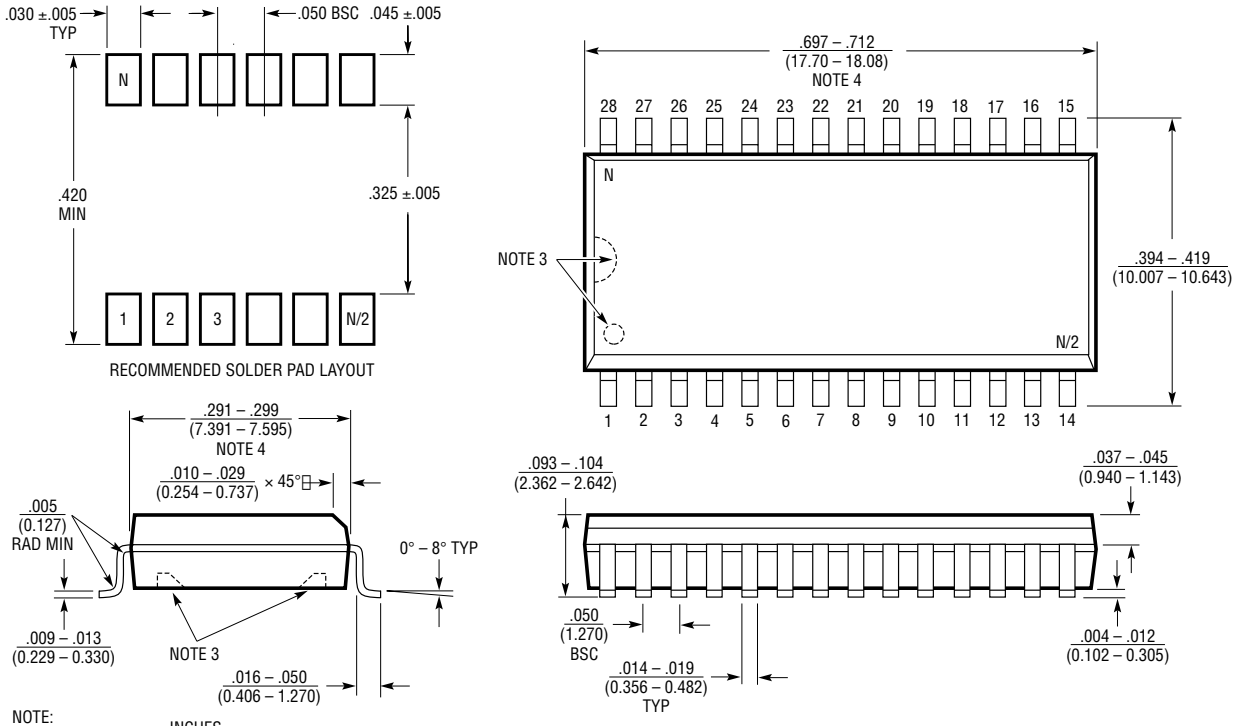
Information furnished by Linear Technology Corporation is believed to be accurate and reliable. However, no responsibility is assumed for its use. Linear Technology Corporation makes no representation that the interconnection of its circuits as described herein will not infringe on existing patent rights.

PACKAGE DESCRIPTION

SW Package

28-Lead Plastic Small Outline (Wide .300 Inch)

(Reference LTC DWG # 05-08-1620)



NOTE:
1. DIMENSIONS IN $\frac{\text{INCHES}}{(\text{MILLIMETERS})}$
2. DRAWING NOT TO SCALE
3. 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
4. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .006" (0.15mm)

RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LT1137A	5V, 3 Driver, 5 Receiver RS232 Transceiver	±15kV ESD per IEC 1000-4
LTC1327	3.3V, 3 Driver, 5 Receiver RS562 Transceiver	300μA Supply Current, 0.2μA in Shutdown
LTC1337	5V, 3 Driver, 5 Receiver RS232 Transceiver	300μA Supply Current, 1μA in Shutdown
LTC1348	3.3V to 5V, 3 Driver, 5 Receiver RS232 Transceiver	True RS232 on 3.3V, 5 Receivers Active in Shutdown

Linear Technology Corporation
1630 McCarthy Blvd., Milpitas, CA 95035-7487
(408) 432-1900 • FAX: (408) 434-0507 • www.linear.com

LW/TP 1002 1K REV A • PRINTED IN USA

© LINEAR TECHNOLOGY CORPORATION 1994