5V Low Power RS232 3-Driver/5-Receiver Transceiver with 2 Receivers Active in Shutdown

FEATURES

- **Low Supply Current: 300µA**
- **Two Receivers Kept Alive in Shutdown**
- **ESD Protection Over ±10kV**
- **Operates from a Single 5V Supply**
- Uses Small Capacitors: 0.1µF
- Operates to 120k Baud
- 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®1349 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, two receivers are kept alive and the supply current is 35µA. All RS232 outputs assume a high impedance state in Shutdown and with the power off.
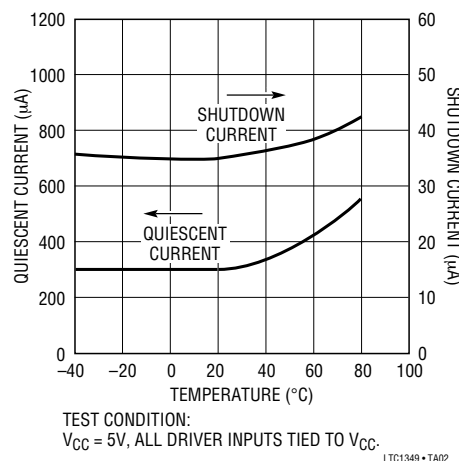
The LTC1349 is fully compliant with all data rate and overvoltage RS232 specifications. The transceiver can operate up to 120k baud with a 2500pF, 3kΩ load. Both driver outputs and receiver inputs can be forced to ±25V without damage, and can survive multiple ±10kV ESD strikes.

$\mathcal{LT}$, LTC and LT are registered trademarks of Linear Technology Corporation.
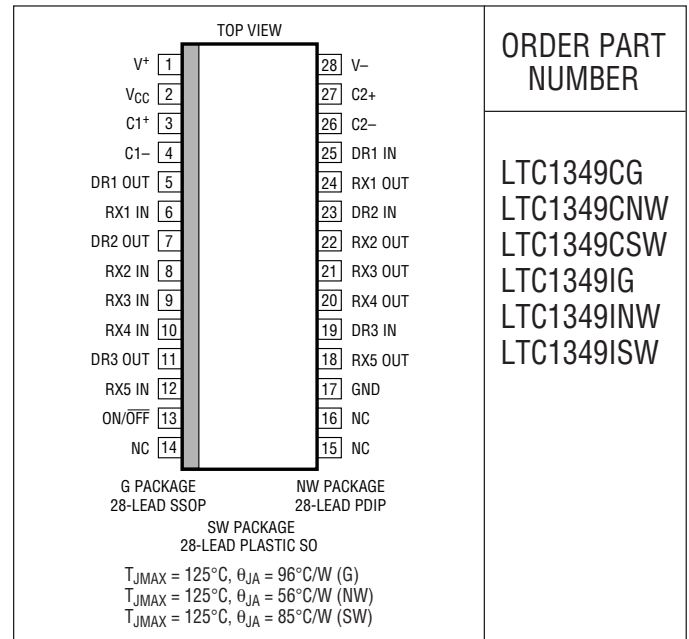
TYPICAL APPLICATION

3-Drivers/5-Receivers with Shutdown

LTC1349 • TA01
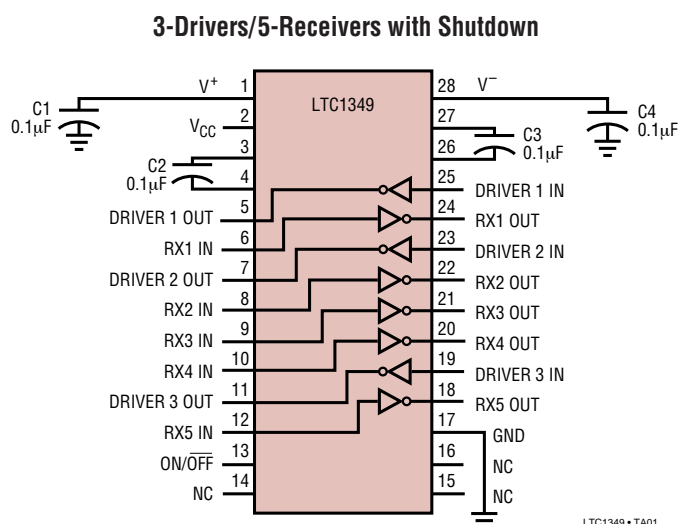
Quiescent and Shutdown Supply Current vs Temperature

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

LTC1349 • TA02

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) 6V
Input Voltage
  Driver .... −0.3V to V_{CC} + 0.3V
  Receiver .... − 25V to 25V
  On/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
  Commercial (LTC1349C) .... 0°C to 70°C
  Industrial (LTC1349I) .... −40°C to 85°C
Storage Temperature Range .... − 65°C to 150°C
Lead Temperature (Soldering, 10 sec) .... 300°C

PACKAGE/ORDER INFORMATION

TOP VIEW

V^+	1	28	V^-
V_{CC}	2	27	C2+
C1+	3	26	C2−
C1−	4	25	DR1 IN
DR1 OUT	5	24	RX1 OUT
RX1 IN	6	23	DR2 IN
DR2 OUT	7	22	RX2 OUT
RX2 IN	8	21	RX3 OUT
RX3 IN	9	20	RX4 OUT
RX4 IN	10	19	DR3 IN
DR3 OUT	11	18	RX5 OUT
RX5 IN	12	17	GND
ON/OFF	13	16	NC
NC	14	15	NC

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

LTC1349CG
LTC1349CNW
LTC1349CSW
LTC1349IG
LTC1349INW
LTC1349ISW

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 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	−10V ≤ 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
Output Leakage Current	Shutdown, 0 ≤ V_{OUT} ≤ V_{CC} (Note 3)		●		1	10	μA
Power Supply Generator							
V^+ Output Voltage	I_{OUT} = 0mA				8.0		V
	I_{OUT} = 12mA				7.5		V
V^- Output Voltage	I_{OUT} = 0mA				−8.0		V
	I_{OUT} = −12mA				−7.0		V
Supply Rise Time	Shutdown to Turn-On				0.2		ms

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LINEAR TECHNOLOGY

DC ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range. V_{CC} = 5V, C1 = C2 = C3 = C4 = 0.1μF, unless noted.
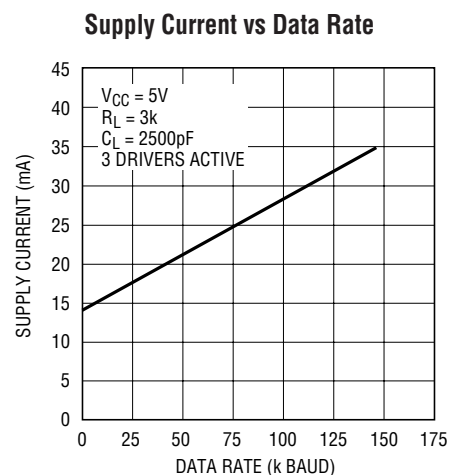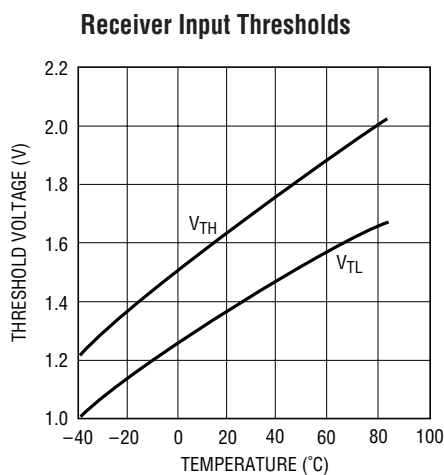
PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Power Supply						
V_{CC} Supply Current	No Load (All Drivers V_{IN} = V_{CC})(Note 2), 0°C ≤ T_A ≤ 70°C	●		0.3	0.8	mA
	No Load (All Drivers V_{IN} = 0V)(Note 2), 0°C ≤ T_A ≤ 70°C	●		0.5	1.0	mA
	No Load (All Drivers V_{IN} = V_{CC})(Note 2), 0°C ≤ T_A ≤ 85°C	●		0.3	1.0	mA
	No Load (All Drivers V_{IN} = V_{CC})(Note 2), −40°C ≤ T_A ≤ 0°C	●		0.3	1.5	mA
	No Load (All Drivers V_{IN} = 0V)(Note 2), −40°C ≤ T_A ≤ 85°C	●		0.5	1.5	mA
Supply Leakage Current (V_{CC})	Shutdown (Note 3)	●		35	50	μA
On/$\overline{Off}$ Threshold Low		●		1.4	0.8	V
On/$\overline{Off}$ 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 noted.
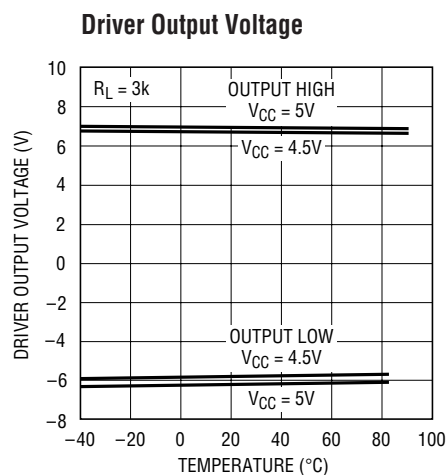
PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Slew Rate	R_L = 3k, C_L = 51pF			8	30	V/μs
	R_L = 3k, C_L = 2500pF		3	5		V/μs
Driver Propagation Delay	t_{HLD} (Figure 1)	●		2	3.5	μs
(TTL to RS232)	t_{LHD} (Figure 1)	●		2	3.5	μs
Receiver Propagation Delay	t_{HLR} (Figure 2)	●		0.3	0.8	μs
(RS232 to TTL)	t_{LHR} (Figure 2)	●		0.2	0.8	μs

Note 1: Absolute Maximum Ratings are those values beyond which the life of the device may be impaired.
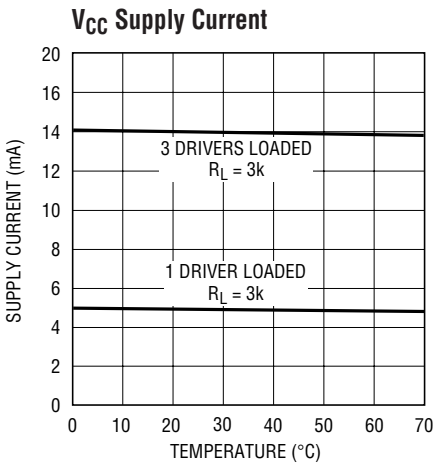
Note 2: Supply current is measured with driver and receiver outputs unloaded.

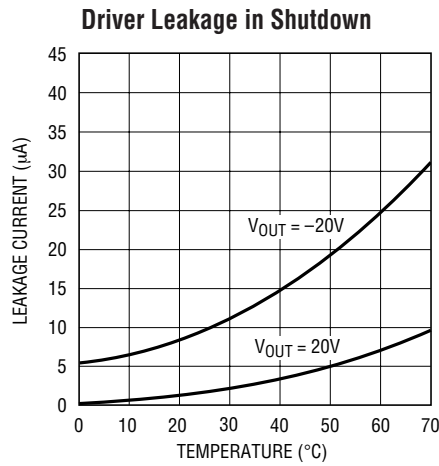**Note 3:** Supply current and leakage current measurements in Shutdown are performed with $V_{ON/\overline{OFF}}$ = 0V.
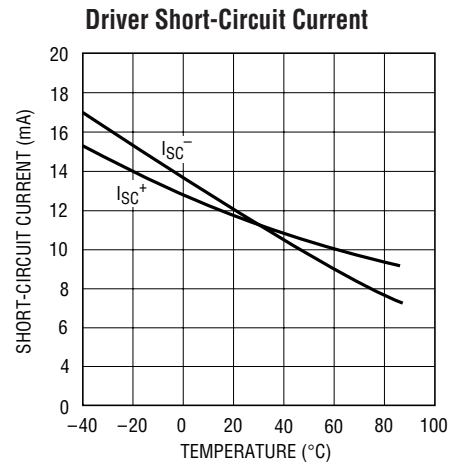
TYPICAL PERFORMANCE CHARACTERISTICS

Driver Output Voltage

LTC1349 • TPC01

Receiver Input Thresholds

LTC1349 • TPC02

Supply Current vs Data Rate

LTC1349 • TPC03

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TYPICAL PERFORMANCE CHARACTERISTICS

V_{CC} Supply Current

LTC1349 • TPC04

Driver Leakage in Shutdown

LTC1349 • TPC05

Driver Short-Circuit Current

LTC1349 • TPC06

Receiver Short-Circuit Current

LTC1349 • TPC07

Driver Output Waveforms

LTC1349 • TPC08

Receiver Output Waveforms
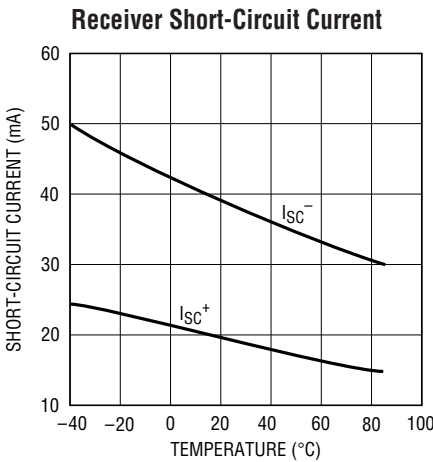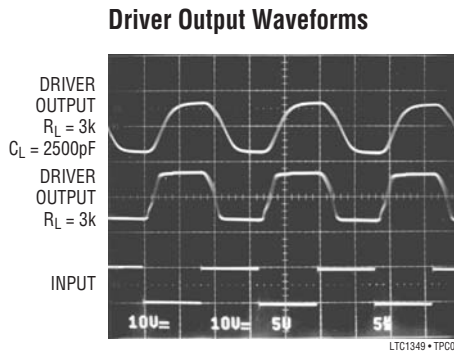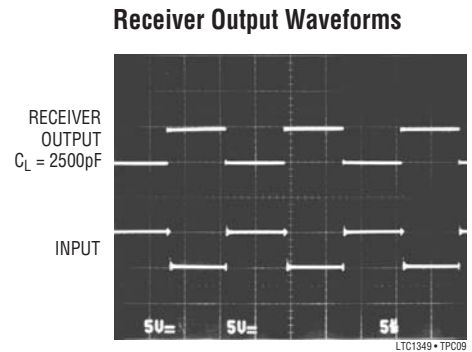
LTC1349 • TPC09

PIN FUNCTIONS

V_{CC}: 5V Input Supply Pin. Supply current is typically 35μA in the Shutdown mode. This pin should be decoupled with a 0.1μF ceramic capacitor.

GND: Ground Pin.

ON/OFF: TTL/CMOS Compatible Shutdown Pin. A logic low puts the device in Shutdown mode, with receivers 4 and 5 kept alive and the supply current equal to 35μA. All driver outputs and other receiver outputs are in high impedance state. This pin can not 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 5V.

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 charge pump efficiency, the capacitor's effective series resistance should be less than 20Ω.

PIN FUNCTIONS

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. Receiver 1, 2 and 3 outputs are in a high impedance state when in Shutdown mode to allow data line sharing. Receivers 4 and 5 are kept alive in Shutdown.
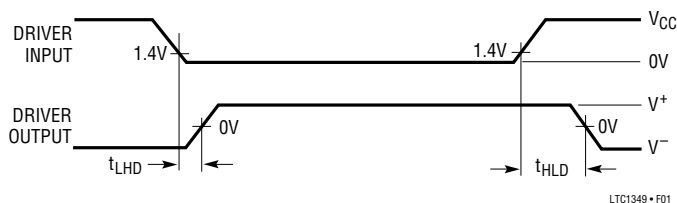
SWITCHING TIME WAVEFORMS

Figure 1. Driver Propagation Delay Timing
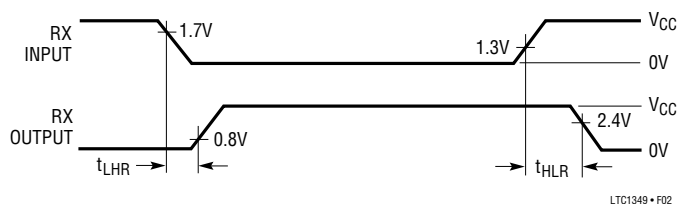
Figure 2. Receiver Propagation Delay Timing

TEST CIRCUITS

Driver Timing Test Load
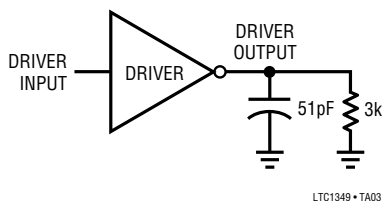
Receiver Timing Test Load
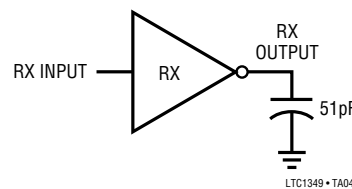
TEST CIRCUITS

ESD Test Circuit

V$^+$	1	LTC1349	28	V$^-$	
V$_{CC}$	2		27		
	3		26		
	4		25	DRIVER 1 IN
DRIVER 1 OUT	5		24	RX1 OUT
RX1 IN	6		23	DRIVER 2 IN
DRIVER 2 OUT	7		22	RX2 OUT
RX2 IN	8		21	RX3 OUT
RX3 IN	9		20	RX4 OUT
RX4 IN	10		19	DRIVER 3 IN
DRIVER 3 OUT	11		18	RX5 OUT
RX5 IN	12		17	GND
ON/OFF	13		16	NC
NC	14		15	NC

C1 0.1μF
C2 0.1μF
C3 0.1μF
C4 0.1μF

RS232 LINE PINS PROTECTED TO ±10kV

LTC1349 • TC
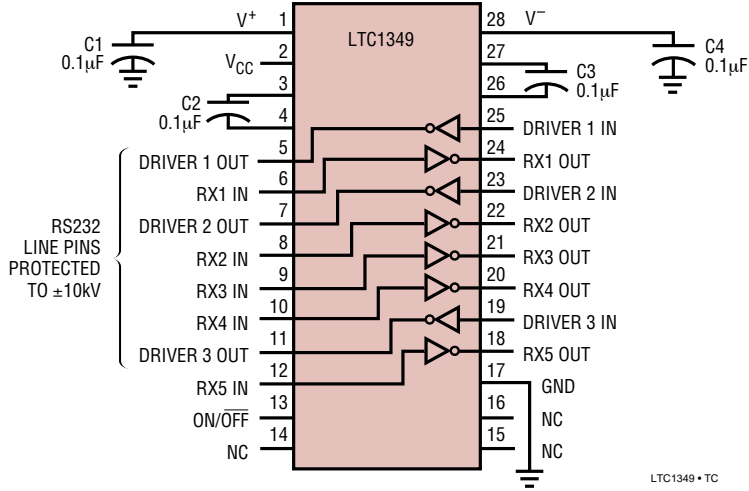
PACKAGE DESCRIPTION

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

1.25 ±0.12

7.8 – 8.2

5.3 – 5.7

0.42 ±0.03   0.65 BSC

RECOMMENDED SOLDER PAD LAYOUT

9.90 – 10.50*
(.390 – .413)

28 27 26 25 24 23 22 21 20 19 18 17 16 15

7.40 – 8.20
(.291 – .323)

1 2 3 4 5 6 7 8 9 10 11 12 13 14

5.00 – 5.60**
(.197 – .221)

0° – 8°

0.09 – 0.25
(.0035 – .010)

0.55 – 0.95
(.022 – .037)

2.0
(.079)

0.65
(.0256)
BSC

0.22 – 0.38
(.009 – .015)

0.05
(.002)

G28 SSOP 0802

NOTE:
1. CONTROLLING DIMENSION: MILLIMETERS

2. DIMENSIONS ARE IN $\frac{MILLIMETERS}{(INCHES)}$

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)

1.467*
(36.957)
MAX

28 27 26 25 24 23 22 21 20 19 18 17 16 15

.505 – .560*
(12.827 – 14.224)

1 2 3 4 5 6 7 8 9 10 11 12 13 14

.600 – .625
(15.240 – 15.875)

.008 – .015
(0.203 – 0.381)

.625 $^{+.035}_{-.015}$

$\left(15.87 ^{+0.889}_{-0.381}\right)$

.150 ± .005
(3.810 ± 0.127)

.015
(0.381)
MIN

.120
(3.175)
MIN

.045 – .065
(1.143 – 1.651)

.035 – .080
(0.889 – 2.032)

.100
(2.54)
BSC

.018 ± .003
(0.457 ± 0.076)

.070
(1.778)
TYP

NW28 1002

NOTE:
1. DIMENSIONS ARE $\frac{INCHES}{MILLIMETERS}$

*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCH (0.254mm)

1349fa

PACKAGE DESCRIPTION

SW Package
28-Lead Plastic Small Outline (Wide .300 Inch)
(Reference LTC DWG # 05-08-1620)

RECOMMENDED SOLDER PAD LAYOUT

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)
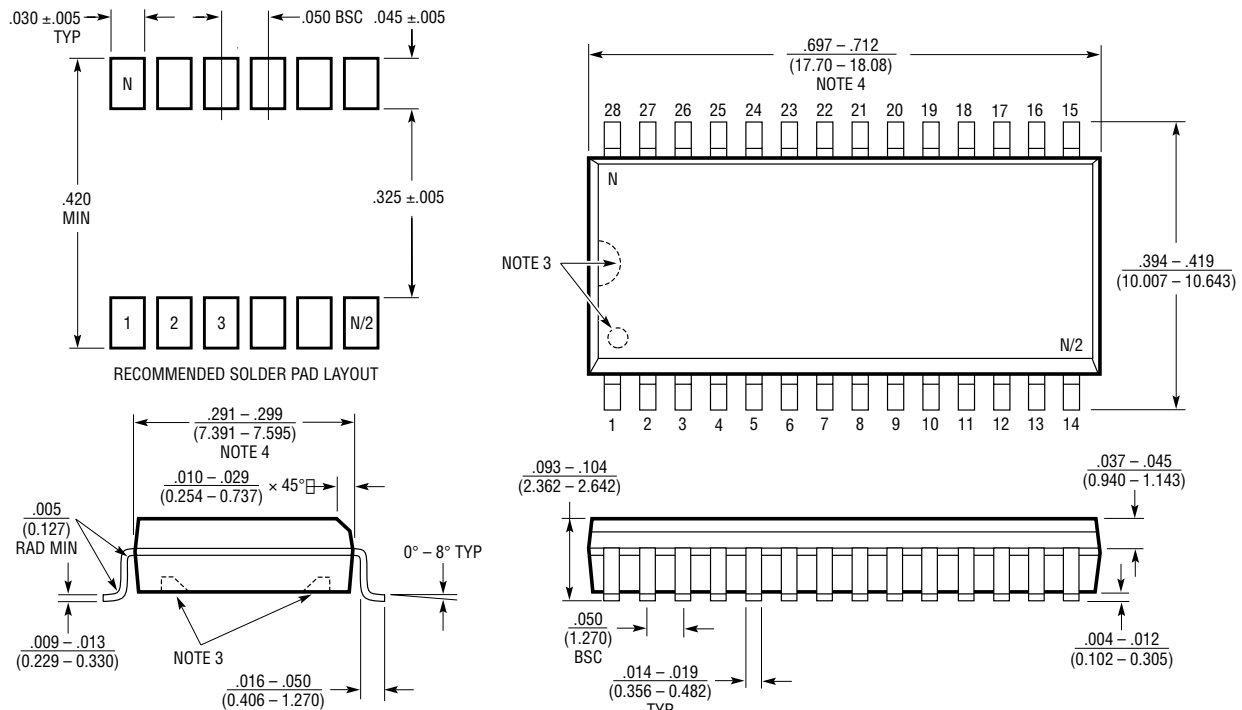
S28 (WIDE) 0502

RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LT®1137A	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

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