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

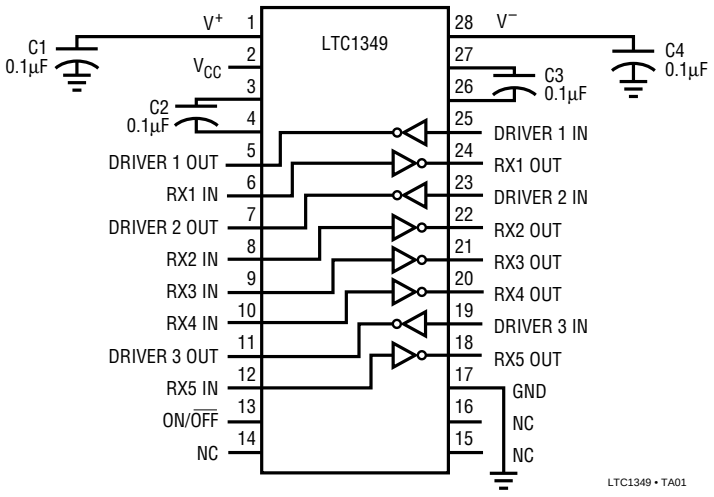
The LTC1349 is a 3-driver/5-receiver RS232 transceiver with very low supply current. In the no load condition, the supply current is only 300μA. The charge pump only requires four 0.1μF capacitors.

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.

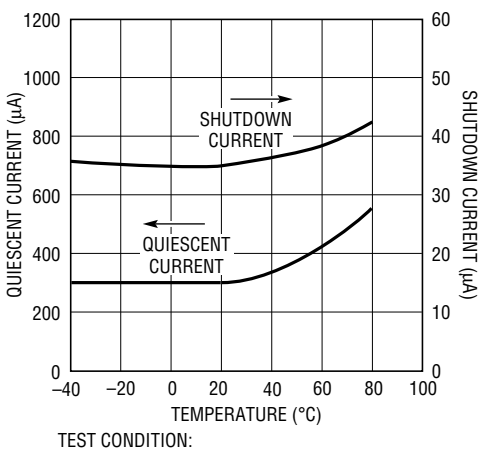
TYPICAL APPLICATION

3-Drivers/5-Receivers with SHUTDOWN



LTC1349 • TA01

Quiescent and SHUTDOWN Supply Current vs Temperature



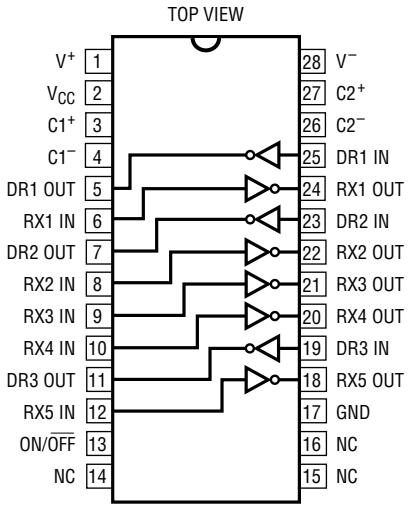
TEST CONDITION:
V_{CC} = 5V, ALL DRIVER INPUTS TIED TO V_{CC}.

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/$\overline{\text{Off}}$ 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



G PACKAGE
28-LEAD SSOP

N PACKAGE
28-LEAD PLASTIC DIP

S PACKAGE
28-LEAD PLASTIC SOL

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

ORDER PART NUMBER
LTC1349CG
LTC1349CN
LTC1349CS
LTC1349IG
LTC1349IN
LTC1349IS

Consult factory for Military Grade parts.

DC ELECTRICAL CHARACTERISTICS

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				±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	$-10V \le V_{IN} \le 10V$			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, $0 \le V_{OUT} \le V_{CC}$ (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

DC ELECTRICAL CHARACTERISTICS

V_{CC} = 5V, C1 = C2 = C3 = C4 = 0.1μF, unless otherwise 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/$\overline{\text{Off}}$ Threshold Low		●		1.4	0.8	V
On/$\overline{\text{Off}}$ Threshold High		●	2.0	1.4		V

AC CHARACTERISTICS

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

The ● denotes specifications which apply over the operating temperature range (0°C ≤ T_A ≤ 70°Cfor commercial grade, –40°C ≤ T_A ≤ 85°C for industrial grade).

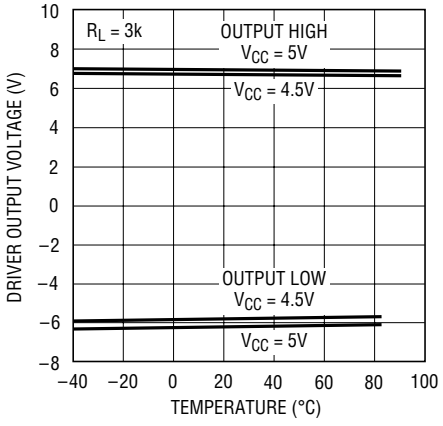
Note 1: Absolute Maximum Ratings are those values beyond which the life of the device may be impaired.

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.

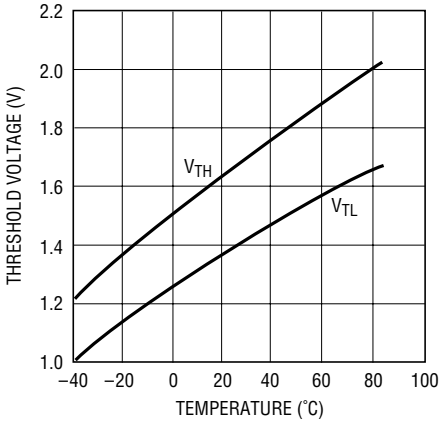
TYPICAL PERFORMANCE CHARACTERISTICS

Driver Output Voltage



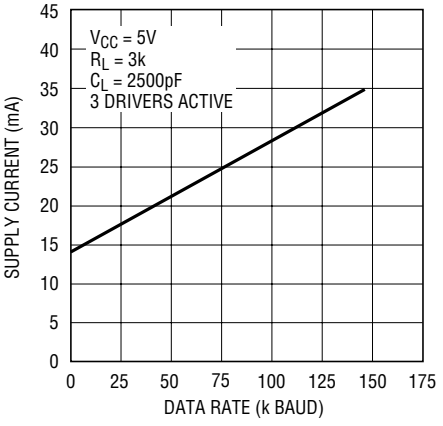
LTC1349 • TPC01

Receiver Input Thresholds



LTC1349 • TPC02

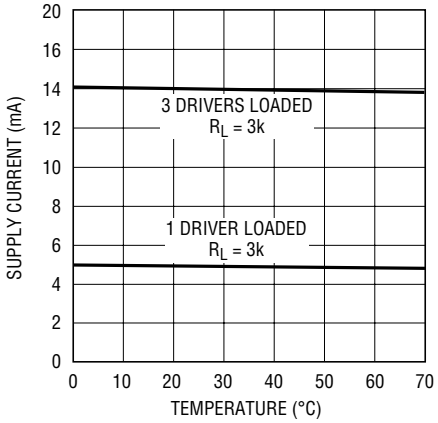
Supply Current vs Data Rate



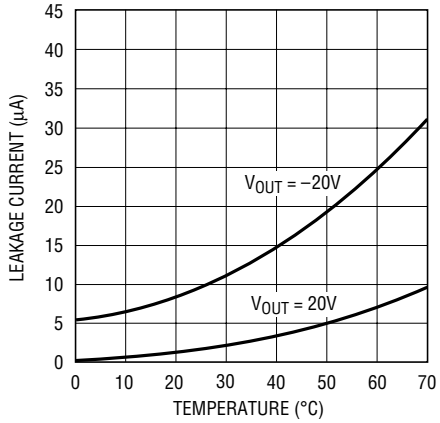
LTC1349 • TPC03

TYPICAL PERFORMANCE CHARACTERISTICS

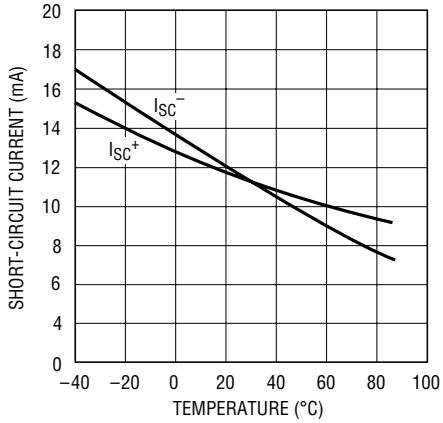
V_{CC} Supply Current



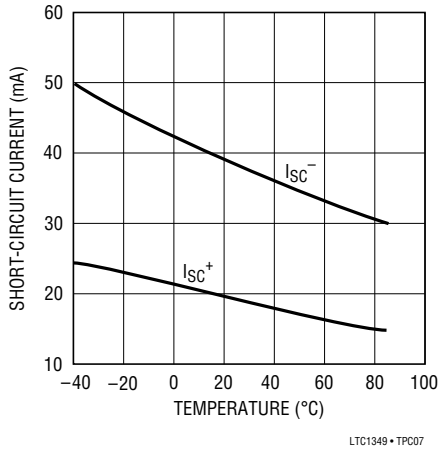
Driver Leakage in SHUTDOWN



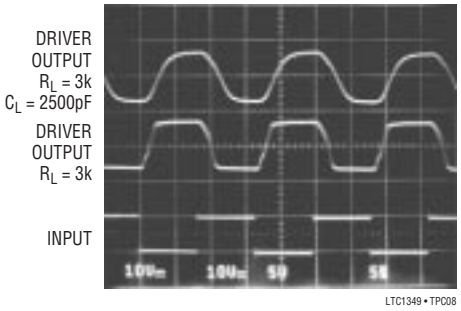
Driver Short-Circuit Current



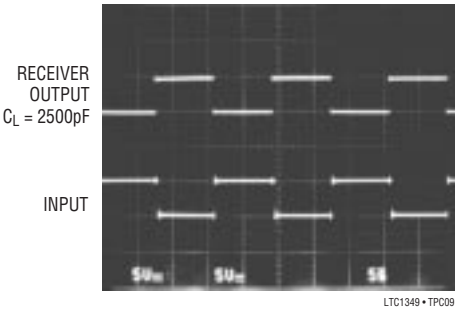
Receiver Short-Circuit Current



Driver Output Waveforms



Receiver Output Waveforms



PIN FUNCTIONS

V_{CC}: 5V Input Supply Pin. Supply current is typically 35µA 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 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

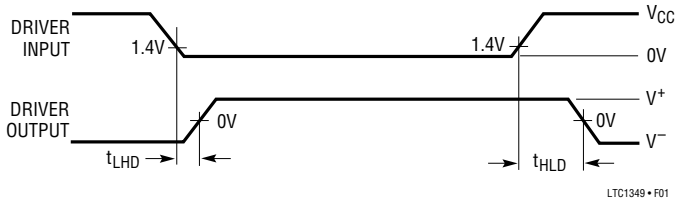


Figure 1. Driver Propagation Delay Timing

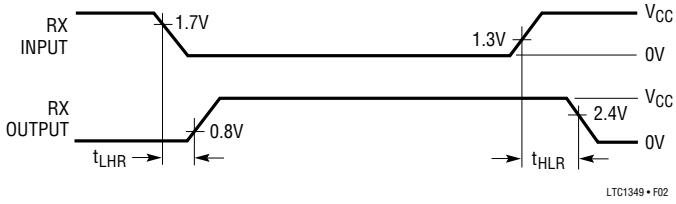
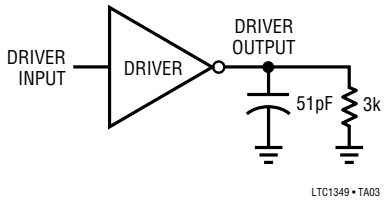


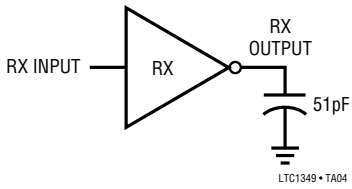
Figure 2. Receiver Propagation Delay Timing

TEST CIRCUITS

Driver Timing Test Load

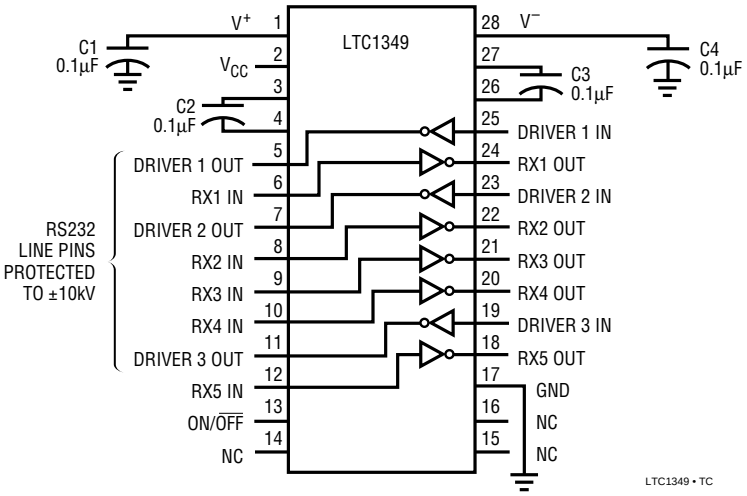


Receiver Timing Test Load



TEST CIRCUITS

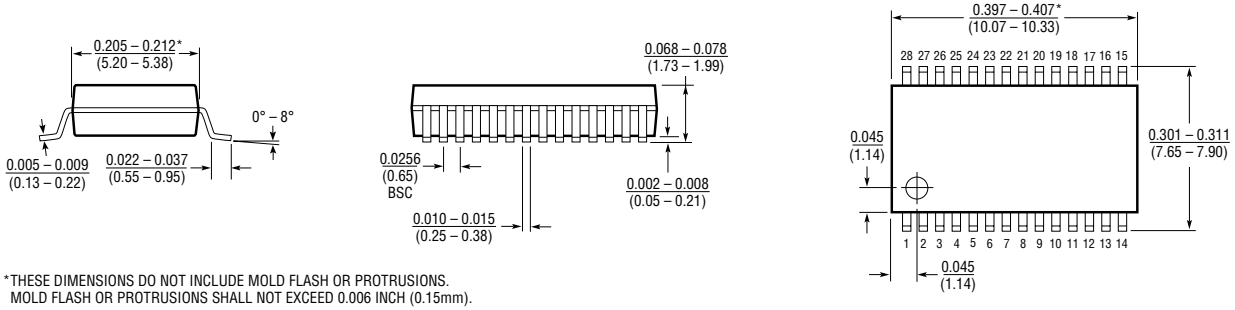
ESD Test Circuit



PACKAGE DESCRIPTION

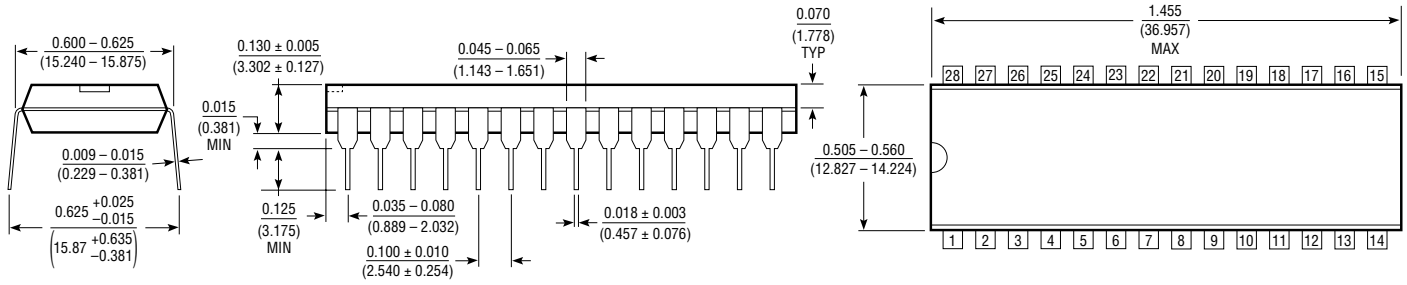
Dimensions in inches (millimeters) unless otherwise noted.

G Package
28-Lead SSOP

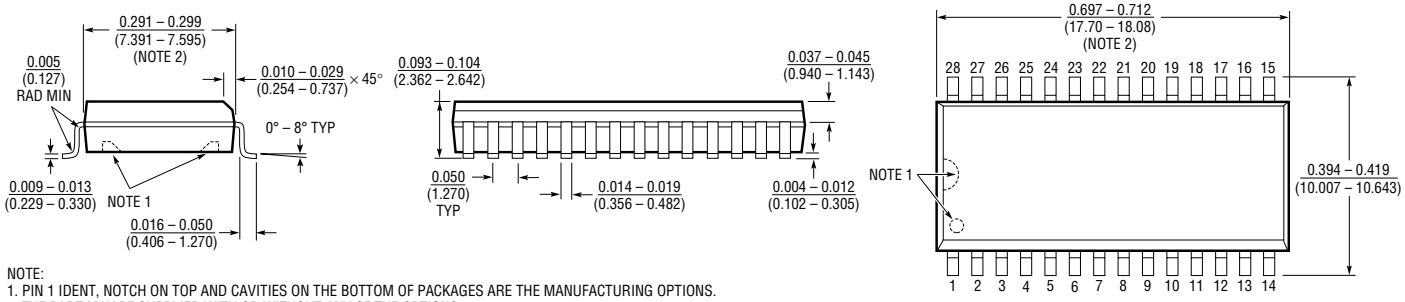


*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.006 INCH (0.15mm).

N Package
28-Lead Plastic DIP



S Package
28-Lead SOL



NOTE:
1. 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.
2. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.006 INCH (0.15mm).

LINEAR TECHNOLOGY

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.

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