

5V Low Power RS232 3-Driver/5-Receiver Transceiver

FEATURES

- **Low Supply Current: 300 μ A**
- **ESD Protection: Over ± 10 kV**
- 1 μ A Supply Current in Shutdown
- Operates from a Single 5V Supply
- Uses Small Capacitors: 0.1 μ F
- 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 ± 25 V without Damage
- Pin Compatible with LT[®]1137A and LT1237
- Flowthrough Architecture

APPLICATIONS

- Notebook Computers
- Palmtop Computers

DESCRIPTION

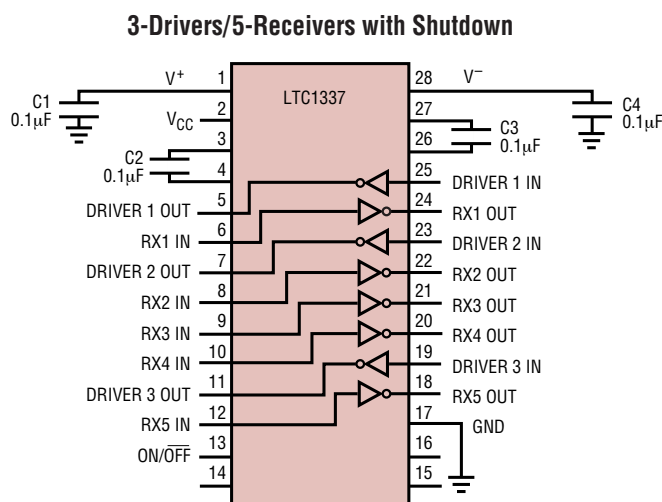
The LTC[®]1337 is a 3-driver/5-receiver RS232 transceiver with very low supply current. In the no load condition, the supply current is only 300 μ A. The charge pump only requires four 0.1 μ F capacitors and can supply up to 12mA of extra current to power external circuitry.

In Shutdown mode, the supply current is further reduced to 1 μ A. All RS232 outputs assume a high impedance state in Shutdown and with the power off.

The LTC1337 is fully compliant with all data rate and overvoltage RS232 specifications. The transceiver can operate up to 120k baud with a 1000pF//3k Ω load. Both driver outputs and receiver inputs can be forced to ± 25 V without damage, and can survive multiple ± 10 kV ESD strikes.

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TYPICAL APPLICATION



ABSOLUTE MAXIMUM RATINGS

(Note 1)

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 (LTC1337C)	$0^{\circ}C$ to $70^{\circ}C$
Storage Temperature Range	$-65^{\circ}C$ to $150^{\circ}C$
Lead Temperature (Soldering, 10 sec)	$300^{\circ}C$

PACKAGE/ORDER INFORMATION

TOP VIEW		ORDER PART NUMBER
V^+ [1]	[28] V^-	LTC1337CG LTC1337CNW LTC1337CSW
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 PLASTIC SSOP		NW PACKAGE 28-LEAD PDIP
SW PACKAGE 28-LEAD PLASTIC SO		
$T_{JMAX} = 125^{\circ}C$, $\theta_{JA} = 96^{\circ}C/W$ (G)		
$T_{JMAX} = 125^{\circ}C$, $\theta_{JA} = 56^{\circ}C/W$ (NW)		
$T_{JMAX} = 125^{\circ}C$, $\theta_{JA} = 85^{\circ}C/W$ (SW)		

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. $V_{CC} = 5V$, $C1 = C2 = C3 = C4 = 0.1\mu F$, unless otherwise noted.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Any Driver					
Output Voltage Swing	$R_L = 3k$ to GND $R_L = 3k$ to GND	● ●	5.0 -5.0	7.0 -6.5	V V
Logic Input Voltage Level	Input Low Level ($V_{OUT} = \text{High}$) Input High Level ($V_{OUT} = \text{Low}$)	● ●	1.4 2.0	0.8 1.4	V V
Logic Input Current	$V_{IN} = 5V$ $V_{IN} = 0$	● ●		5 -5	μA μA
Output Short-Circuit Current	$V_{OUT} = 0V$		±10		mA
Output Leakage Current	Shutdown, $V_{OUT} = \pm 20V$ (Note 3)	●	10	500	μA
Any Receiver					
Input Voltage Thresholds	Input Low Threshold Input High Threshold	● ●	0.8 1.7	1.3 2.4	V V
Hysteresis		●	0.1	0.4	1
Input Resistance	$-10V \leq V_{IN} \leq 10V$		3	5	7
Output Voltage	Output Low, $I_{OUT} = -1.6mA$ ($V_{CC} = 5V$) Output High, $I_{OUT} = 160\mu A$ ($V_{CC} = 5V$)	● ●	0.2 3.5	0.4 4.8	V V
Output Short-Circuit Current	Sourcing Current, $V_{OUT} = 0$ Sinking Current, $V_{OUT} = V_{CC}$		15 -15	20 -40	mA mA
Output Leakage Current	Shutdown, $0 \leq V_{OUT} \leq V_{CC}$ (Note 3)	●	1	10	μA

DC ELECTRICAL CHARACTERISTICS

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

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
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
	$I_{OUT} = 12mA$		-6.5		V
Supply Rise Time	Shutdown to Turn-On		0.2		ms
Power Supply					
V_{CC} Supply Current	No Load (Note 2)	●	0.3	0.5	mA
Supply Leakage Current (V_{CC})	Shutdown (Note 3)	●	1	10	μA
On/Off Threshold Low		●	1.4	0.8	V
On/Off Threshold High		●	2.0	1.4	V

AC CHARACTERISTICS

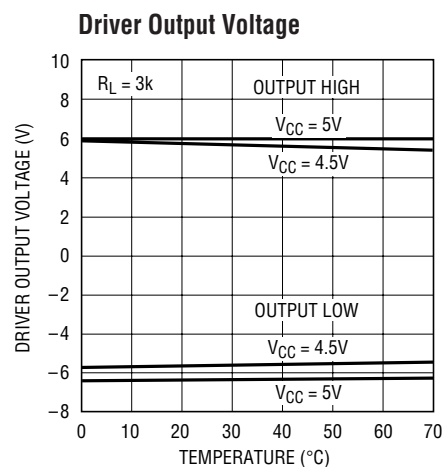
The ● denotes specifications which apply over the full operating temperature range. $V_{CC} = 5V$, $C1 = C2 = C3 = C4 = 0.1\mu F$, unless otherwise noted.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Slew Rate	$R_L = 3k$, $C_L = 51pF$		8	30	V/ μs
	$R_L = 3k$, $C_L = 2500pF$	2	4		V/ μs
Driver Propagation Delay	t_{HLD} (Figure 1)	●	2	3	μs
(TTL to RS232)	t_{LHD} (Figure 1)	●	2	3	μs
Receiver Propagation Delay	t_{HLR} (Figure 2)	●	0.3	0.6	μs
(RS232 to TTL)	t_{LHR} (Figure 2)	●	0.2	0.6	μs

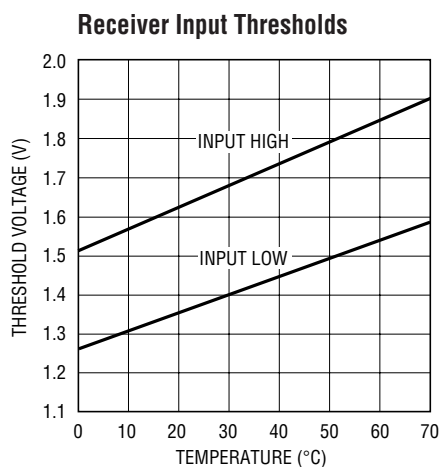
Note 1: Absolute Maximum Ratings are those values beyond which the life of the device may be impaired.

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

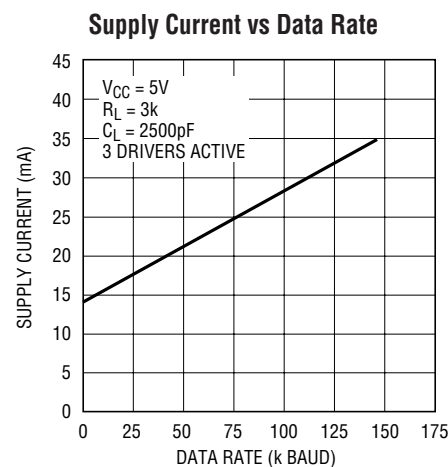
Note 3: Supply current and leakage measurements in Shutdown are performed with $V_{ON} = 0V$.

TYPICAL PERFORMANCE CHARACTERISTICS

1337 G01

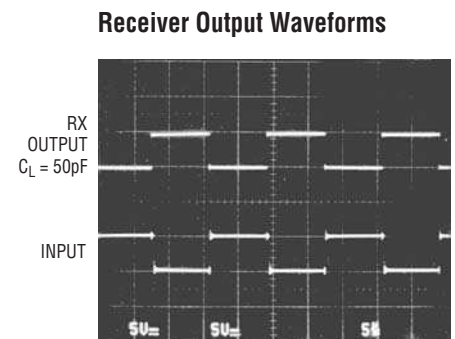
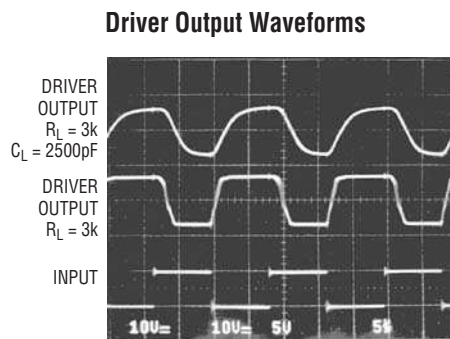
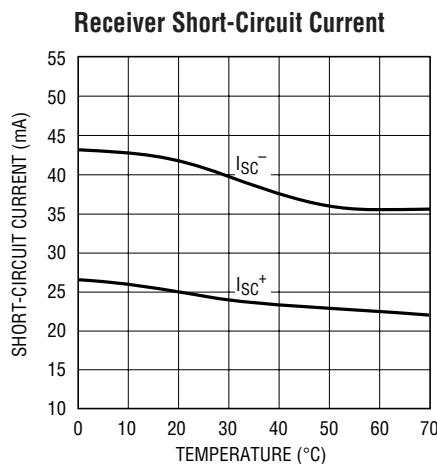
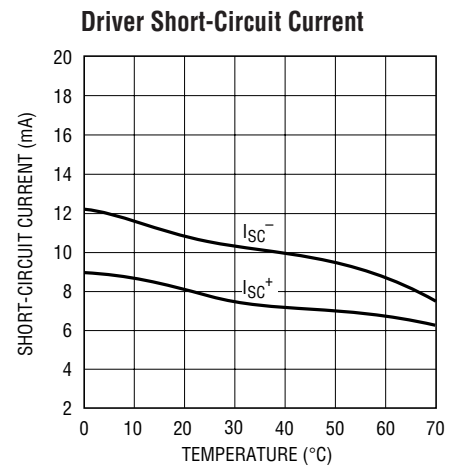
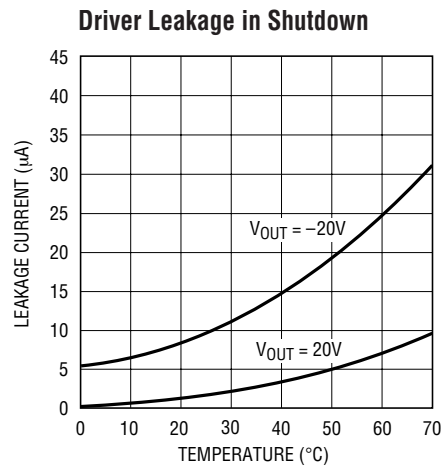
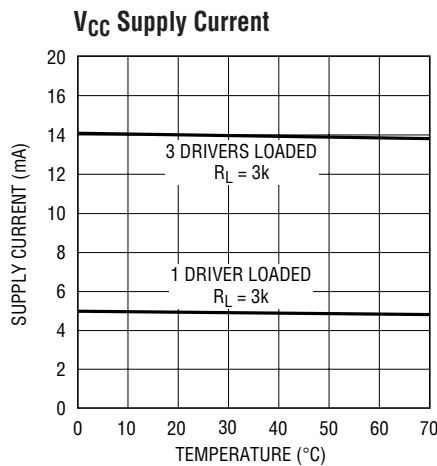


1337 G02



1337 G03

TYPICAL PERFORMANCE CHARACTERISTICS



PIN FUNCTIONS

V_{CC}: 5V Input Supply Pin. Supply current less than 1µA 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 the Shutdown mode which reduces input supply current to less than 1µA and places all drivers and receivers in high impedance state. This pin cannot float.

V⁺: Positive Supply Output (RS232 Drivers). $V^+ \approx 2V_{CC} - 1V$. This pin requires an external capacitor $C = 0.1\mu F$ 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). $V^- \approx (2V_{CC} - 1.5V)$. This pin requires an external capacitor $C = 0.1\mu F$ for charge storage.

C1⁺, C1⁻, C2⁺, C2⁻: Commutating Capacitor Inputs. These pins require two external capacitors $C = 0.1\mu F$. 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 50Ω.

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 $\pm 10kV$ for human body model discharges.

RX IN: Receiver Inputs. These pins can be forced to $\pm 25V$ without damage. The receiver inputs are protected against ESD to $\pm 10kV$ 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 state when in Shutdown mode to allow data line sharing.

SWITCHING TIME WAVEFORMS

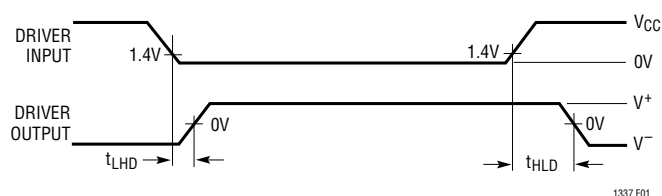


Figure 1. Driver Propagation Delay Timing

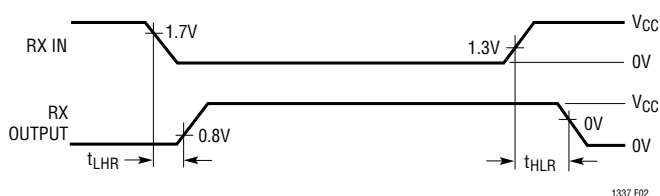


Figure 2. Receiver Propagation Delay Timing

TEST CIRCUITS

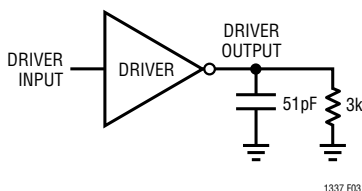


Figure 3. Driver Timing Test Load

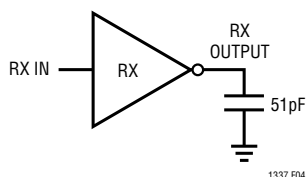
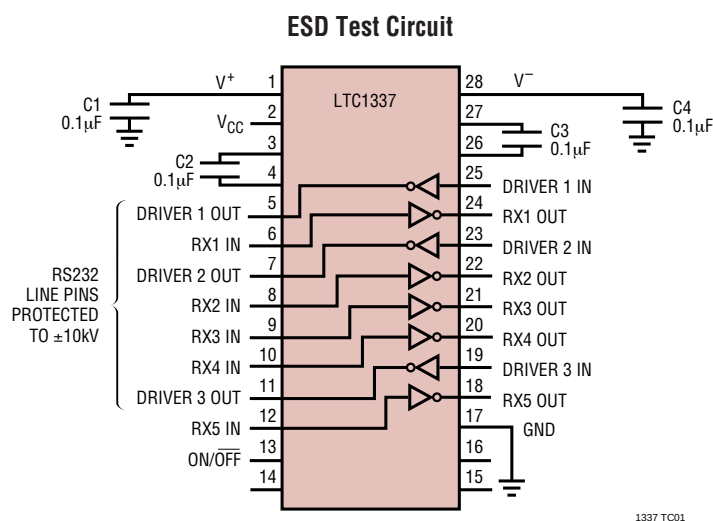


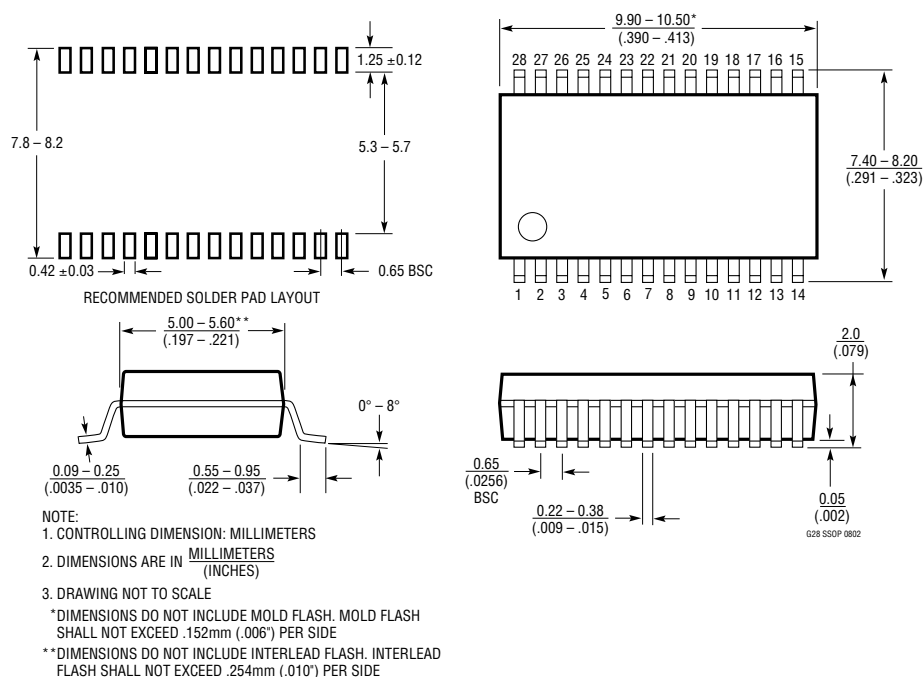
Figure 4. Receiver Timing Test Load



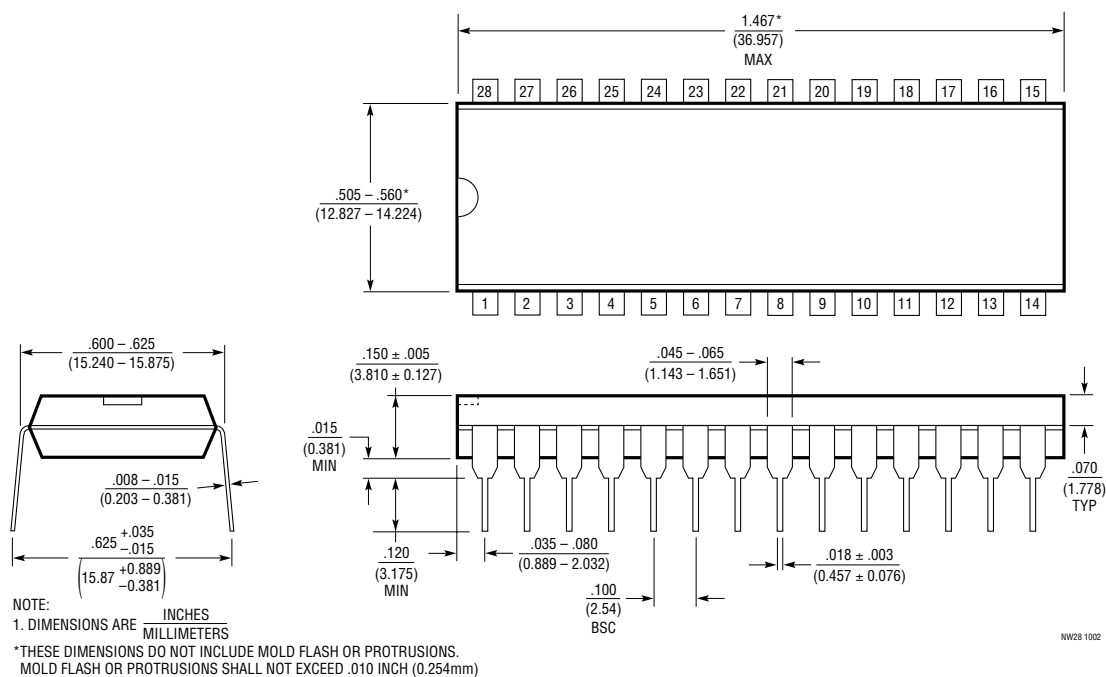
1337 TC01

PACKAGE DESCRIPTION

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



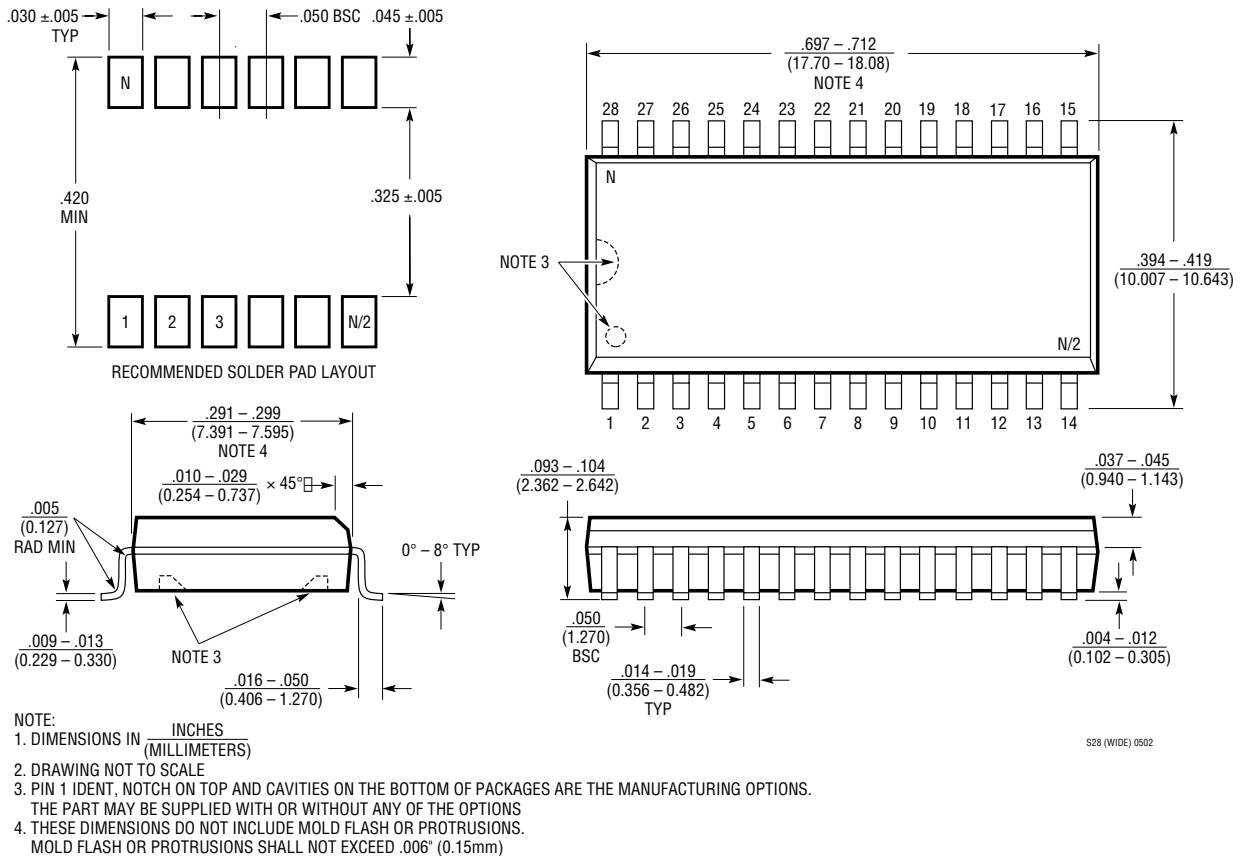
NW Package 28-Lead PDIP (Wide .600 Inch) (Reference LTC DWG # 05-08-1520)



1337fa

PACKAGE DESCRIPTION

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



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
LTC1348	3.3V to 5V, 3 Driver, 5 Receiver RS232 Transceiver	True RS232 on 3.3V, 5 Receivers Active in Shutdown