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

FEATURES

- **Low Supply Current: 300μA**
- **ESD Protection: Over ±10kV**
- 1μA Supply Current in Shutdown
- 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 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 300μA. The charge pump only requires four 0.1μF capacitors and can supply up to 12mA of extra current to power external circuitry.

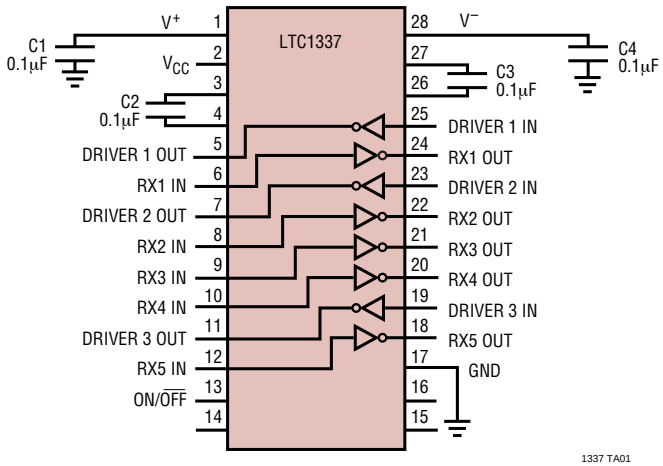
In Shutdown mode, the supply current is further reduced to 1μA. All RS232 outputs assume a high impedance state in Shutdown and with the power off.

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

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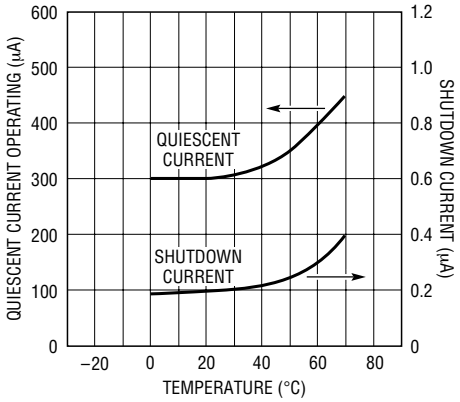
TYPICAL APPLICATION

3-Drivers/5-Receivers with Shutdown



1337 TA01

Supply Current



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

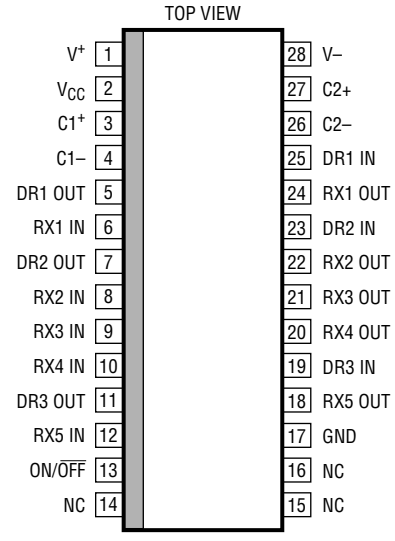
1337 TA02

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/$\overline{Off}$ 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
  Commercial (LTC1337C) ..... 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 PLASTIC 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

LTC1337CG
LTC1337CNW
LTC1337CSW

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	R_L = 3k to GND, Positive ●		5.0	7.0		V
	R_L = 3k to GND, 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} = 0 ●				–5	μA
Output Short-Circuit Current	V_{OUT} = 0V			±10		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	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, $I_{OUT} = 160\mu A$ (V_{CC} = 5V) ●		3.5	4.8		V
Output Short-Circuit Current	Sourcing Current, V_{OUT} = 0		15	20		mA
	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

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 –6.5		V 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/$\overline{\text{Off}}$ 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		 2	8 4	30	V/μs 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

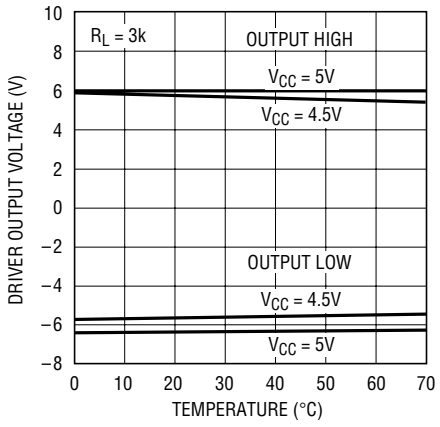
Note 1: Absolute Maximum Ratings are those values beyond which the life of the device may be impaired.

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.

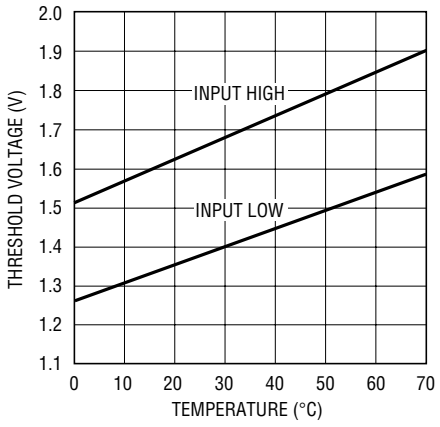
TYPICAL PERFORMANCE CHARACTERISTICS

Driver Output Voltage



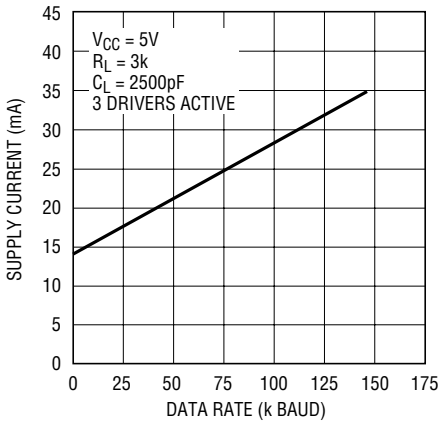
1337 G01

Receiver Input Thresholds



1337 G02

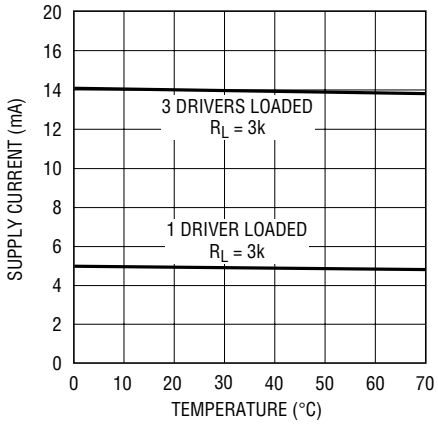
Supply Current vs Data Rate



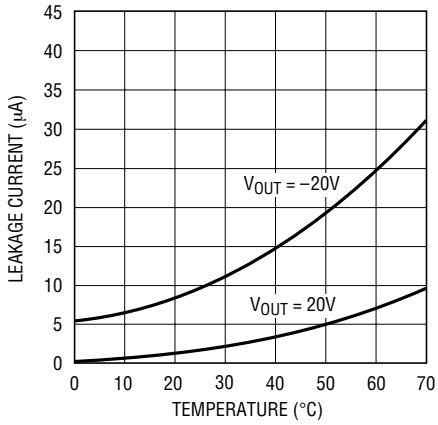
1337 G03

TYPICAL PERFORMANCE CHARACTERISTICS

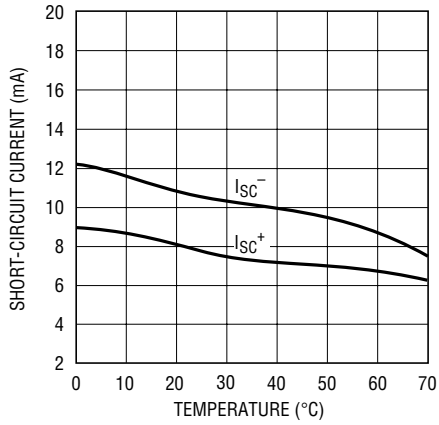
V_{CC} Supply Current



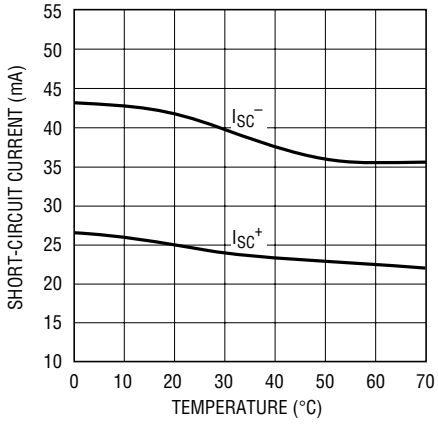
Driver Leakage in Shutdown



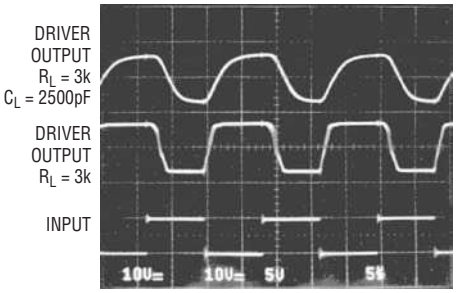
Driver Short-Circuit Current



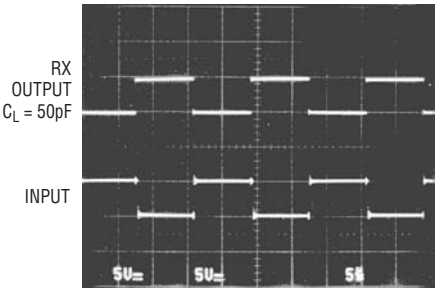
Receiver Short-Circuit Current



Driver Output Waveforms



Receiver Output Waveforms



PIN FUNCTIONS

V_{CC}: 5V Input Supply Pin. Supply current less than 1µA 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 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). $V^+ \cong 2V_{CC} – 1V$. 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 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 ±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. Outputs are in a high impedance state when in Shutdown mode to allow data line sharing.

SWITCHING TIME WAVEFORMS

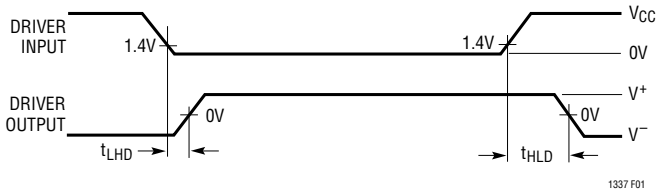


Figure 1. Driver Propagation Delay Timing

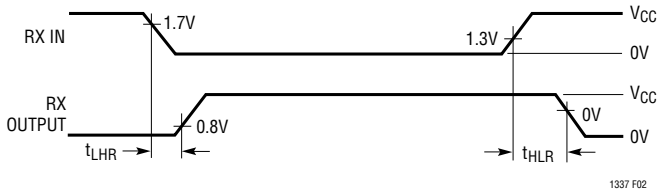


Figure 2. Receiver Propagation Delay Timing

TEST CIRCUITS

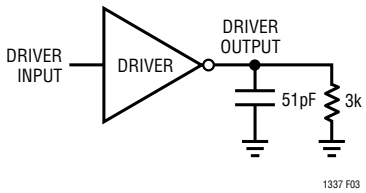


Figure 3. Driver Timing Test Load

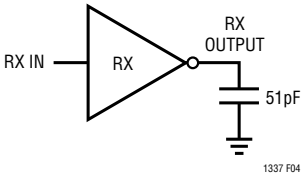
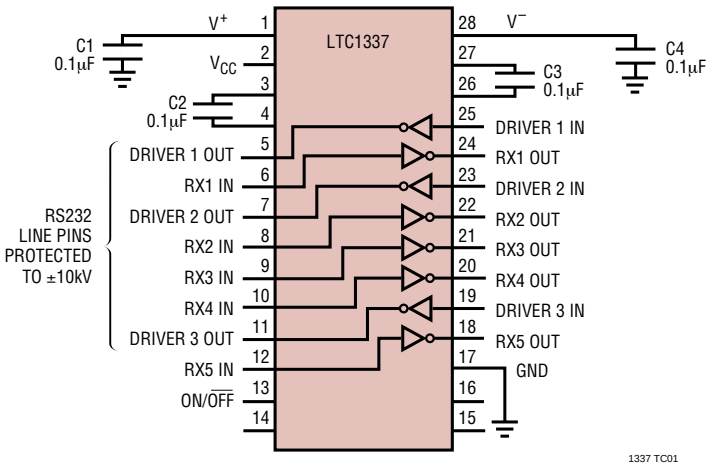


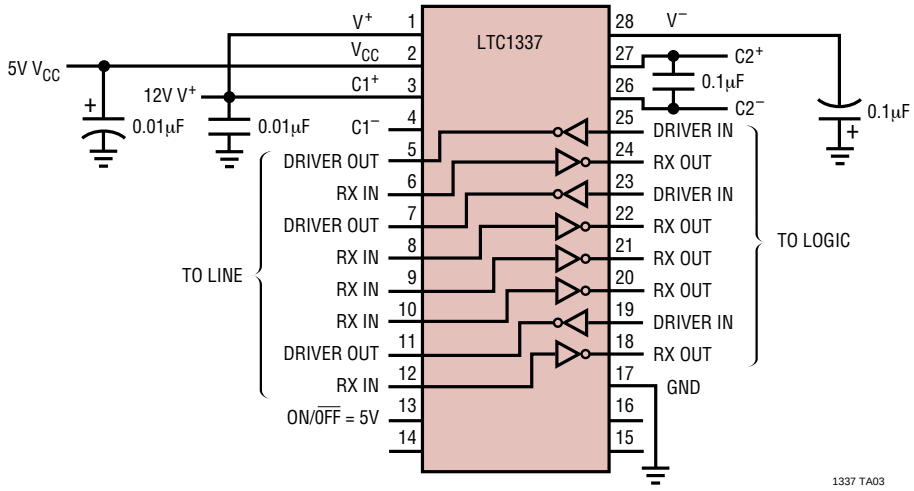
Figure 4. Receiver Timing Test Load

ESD Test Circuit

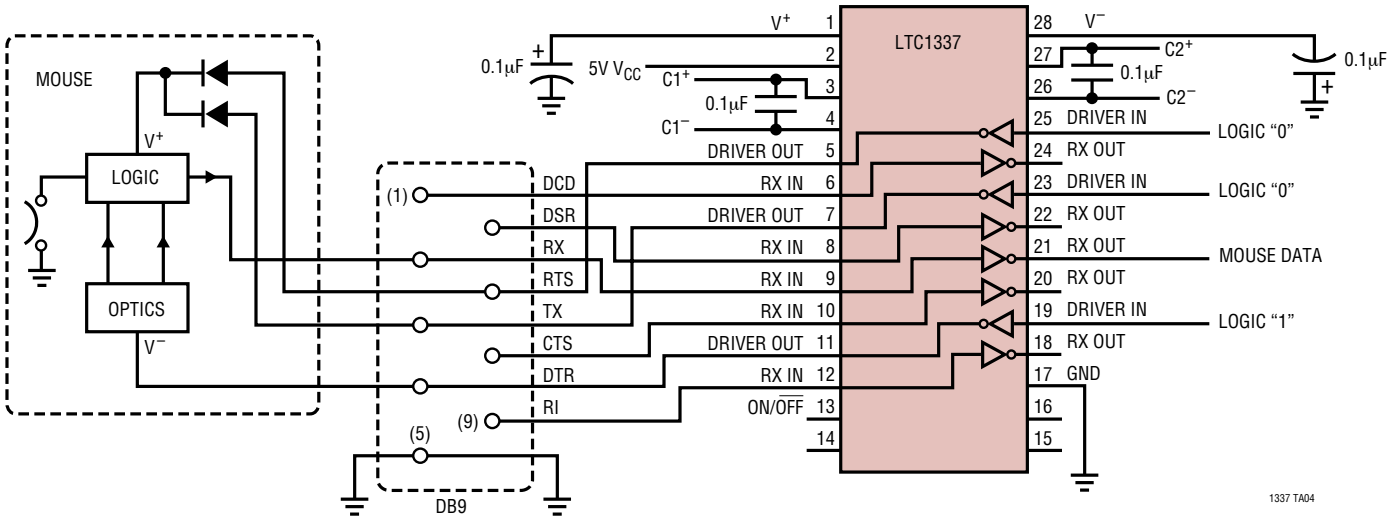


TYPICAL APPLICATIONS

Operation Using 5V and 12V Power Supplies

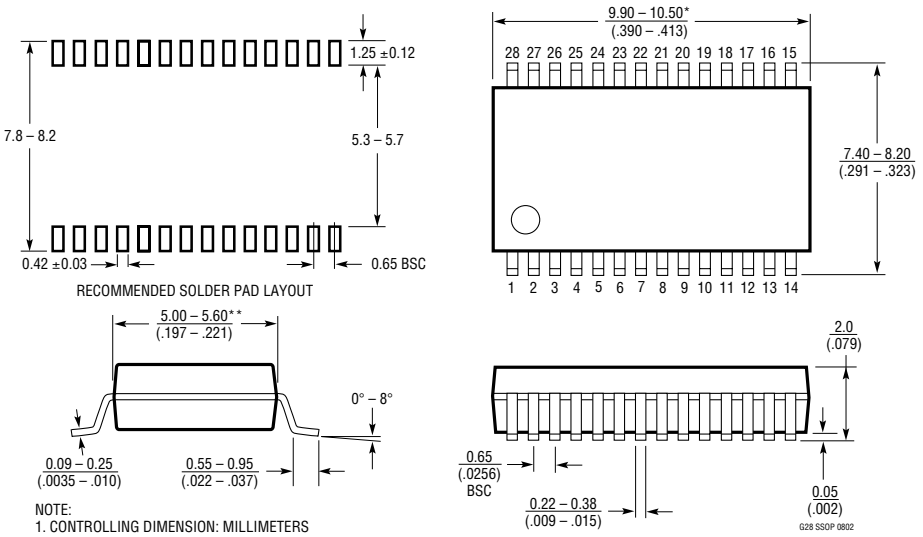


Typical Mouse Driving Application



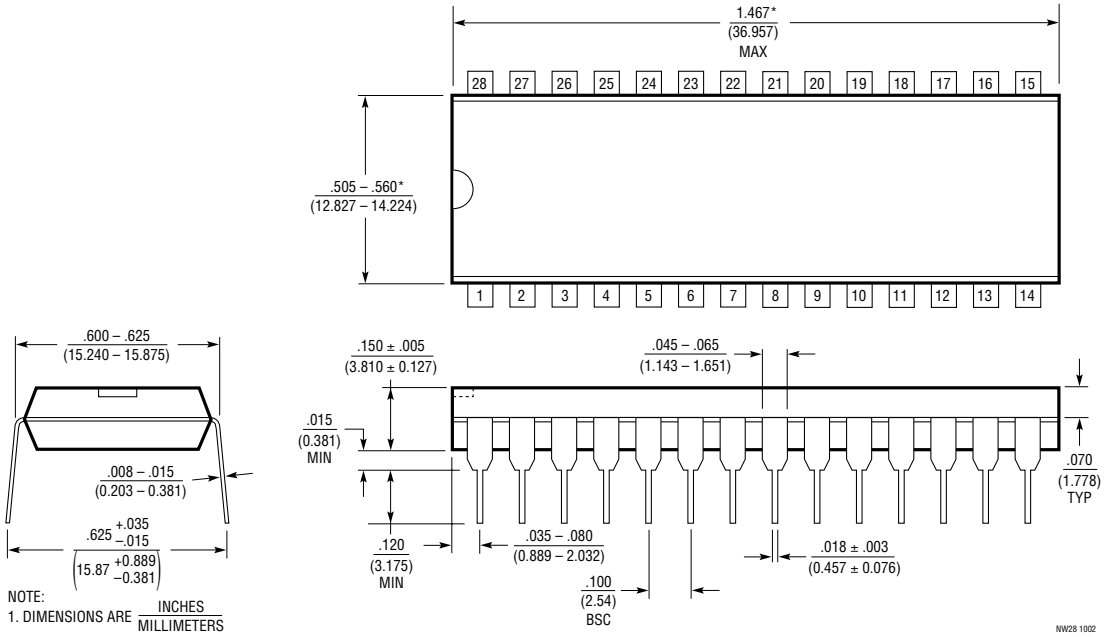
PACKAGE DESCRIPTION

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)

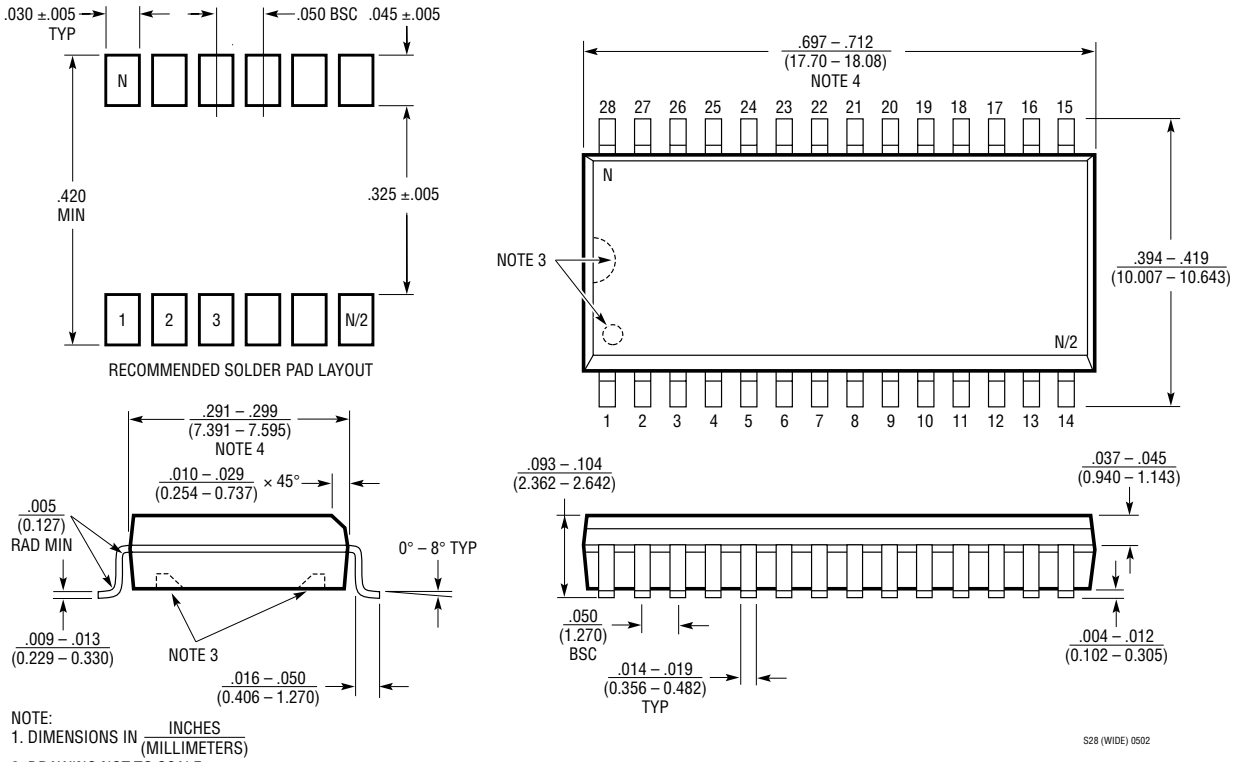


NOTE:
1. DIMENSIONS ARE $\frac{\text{INCHES}}{\text{MILLIMETERS}}$
*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCH (0.254mm)

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PACKAGE DESCRIPTION

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



NOTE:
1. DIMENSIONS IN INCHES (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
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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