

3.3V Low Power EIA/TIA-562 3-Driver/ 5-Receiver Transceiver

FEATURES

- **Low Supply Current: 300 μ A**
- **Receivers 4 and 5 Kept Alive in Shutdown: 35 μ A**
- **ESD Protection: ± 10 kV**
- **Operates from a Single 3.3V Supply**
- **Uses Small Capacitors: 0.1 μ F**
- **Operates to 120kBaud**
- **Three-State Outputs are High Impedance When Off**
- **Output Overvoltage Does Not Force Current Back into Supplies**
- **EIA/TIA-562 I/O Lines Can Be Forced to ± 25 V Without Damage**
- **Flowthrough Architecture**

APPLICATIONS

- Notebook Computers
- Palmtop Computers

DESCRIPTION

The LTC[®]1350 is a 3-driver/5-receiver EIA/TIA-562 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.

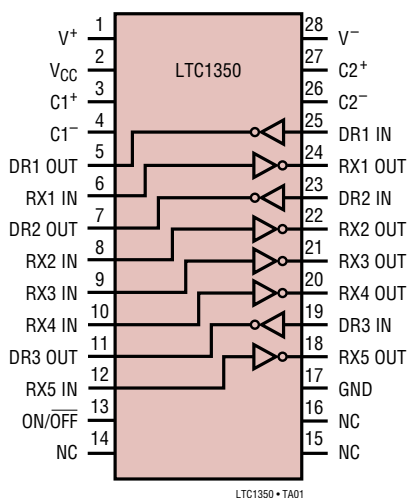
In Shutdown mode, two receivers are kept alive and the supply current is only 35 μ A. All RS232 outputs assume a high impedance state in Shutdown or with the power off.

The LTC1350 is fully compliant with all data rate and overvoltage EIA/TIA-562 specifications. The transceiver can operate up to 120kbaud with a 1000pF and 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.

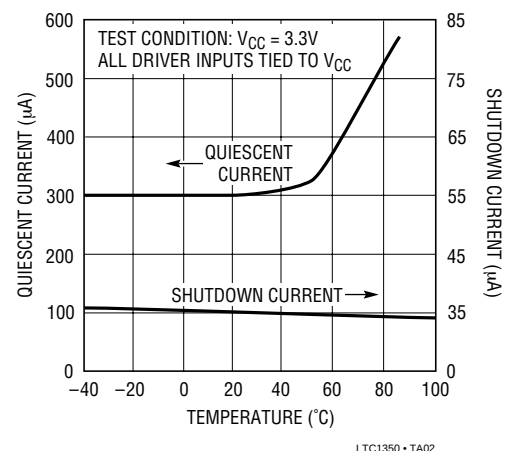
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TYPICAL APPLICATION

3-Drivers/5-Receivers with Shutdown



Quiescent and Shutdown Supply Current vs Temperature



ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC})	5V
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 (LTC1350C)	$0^{\circ}C$ to $70^{\circ}C$
Industrial (LTC1350I)	$-40^{\circ}C$ to $85^{\circ}C$
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 V_{CC} 2 $C1^+$ 3 $C1^-$ 4 DR1 OUT 5 RX1 IN 6 DR2 OUT 7 RX2 IN 8 RX3 IN 9 RX4 IN 10 DR3 OUT 11 RX5 IN 12 ON/OFF 13 NC 14	28 V^- 27 $C2^+$ 26 $C2^-$ 25 DR1 IN 24 RX1 OUT 23 DR2 IN 22 RX2 OUT 21 RX3 OUT 20 RX4 OUT 19 DR3 IN 18 RX5 OUT 17 GND 16 NC 15 NC	
G PACKAGE 28-LEAD SSOP NW PACKAGE 28-LEAD PDIP SW PACKAGE 28-LEAD PLASTIC SO WIDE		LTC1350CG LTC1350CNW LTC1350CSW LTC1350IG LTC1350INW LTC1350ISW
$T_{JMAX} = 125^{\circ}C$, $\theta_{JA} = 96^{\circ}C/W$ (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. $V_{CC} = 3.3V$, $C1 = C2 = C3 = C4 = 0.1\mu F$, unless noted.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Any Driver					
Output Voltage Swing	3k to GND	● 3.7	4.5		V
	Positive	● -3.7	-4.5		V
Logic Input Voltage Level	Input Low Level ($V_{OUT} = \text{High}$)	● 2.0	1.4	0.8	V
	Input High Level ($V_{OUT} = \text{Low}$)	● 2.0	1.4		V
Logic Input Current	$V_{IN} = V_{CC}$	●		5	μA
	$V_{IN} = 0V$	●		-5	μA
Output Short-Circuit Current	$V_{OUT} = 0V$	±9	±10		mA
Output Leakage Current	Shutdown (Note 3), $V_{OUT} = \pm 20V$		10	500	μA
Any Receiver					
Input Voltage Thresholds	Input Low Threshold	● 0.8	1.3		V
	Input High Threshold	● 0.8	1.7	2.4	V
Hysteresis		● 0.1	0.4	1	V
Input Resistance	$V_{IN} = \pm 10V$	3	5	7	k Ω
Output Voltage	Output Low, $I_{OUT} = -1.6mA$ ($V_{CC} = 3.3V$)	● 3.0	0.2	0.4	V
	Output High, $I_{OUT} = 160\mu A$ ($V_{CC} = 3.3V$)	● 3.0	3.2		V
Output Short-Circuit Current	Sinking Current, $V_{OUT} = V_{CC}$	-3	-20		mA
Output Leakage Current	Shutdown (Note 3), $0V \leq V_{OUT} \leq V_{CC}$	●	1	10	μA

DC ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range. $V_{CC} = 3.3V$, $C1 = C2 = C3 = C4 = 0.1\mu F$, unless noted.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Power Supply Generator						
V^+ Output Voltage	$I_{OUT} = 0mA$			5.7		V
	$I_{OUT} = 5mA$			5.5		V
V^- Output Voltage	$I_{OUT} = 0mA$			-5.3		V
	$I_{OUT} = -5mA$			-5.0		V
Supply Rise Time	Shutdown to Turn-On			0.2		ms
Power Supply						
V_{CC} Supply Current	No Load (All Drivers $V_{IN} = V_{CC}$)(Note 2) $0^\circ C \leq T_A \leq 70^\circ C$	●		0.3	0.6	mA
	No Load (All Drivers $V_{IN} = 0$)(Note 2) $0^\circ C \leq T_A \leq 70^\circ C$	●		0.5	1.0	mA
	No Load (All Drivers $V_{IN} = V_{CC}$)(Note 2) $0^\circ C \leq T_A \leq 85^\circ C$	●		0.3	1.0	mA
	No Load (All Drivers $V_{IN} = V_{CC}$)(Note 2) $-40^\circ C \leq T_A \leq 0^\circ C$	●		0.3	1.5	mA
	No Load (All Drivers $V_{IN} = 0$)(Note 2) $-40^\circ C \leq T_A \leq 85^\circ C$	●		0.5	1.5	mA
	Shutdown (Note 3)	●		35	50	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 noted.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Slew Rate	$R_L = 3k, C_L = 51pF$			8	30	V/ μs
	$R_L = 3k, C_L = 1000pF$		3	5		V/ μs
Driver Propagation Delay (TTL to EIA/TIA-562)	t_{HLD} (Figure 1)	●		2	3.5	μs
	t_{LHD} (Figure 1)	●		2	3.5	μs
Receiver Propagation Delay (EIA/TIA-562 to TTL)	t_{HLR} (Figure 2)	●		0.3	0.8	μs
	t_{LHR} (Figure 2)	●		0.3	0.8	μs

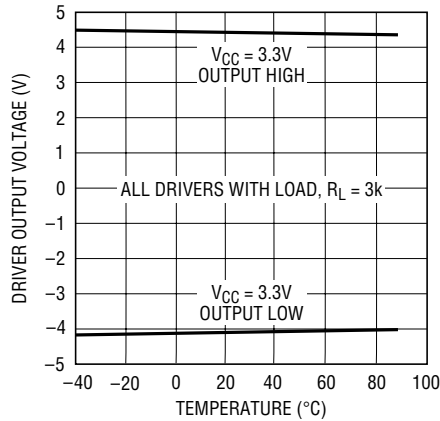
Note 1: Absolute Maximum Ratings are those values beyond which the life of the device may be impaired.

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

Note 3: Supply current measurement in Shutdown mode is performed with $V_{ON/OFF} = 0V$.

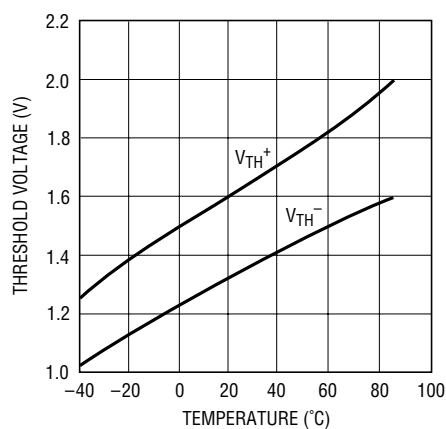
TYPICAL PERFORMANCE CHARACTERISTICS

Driver Output Voltage vs Temperature



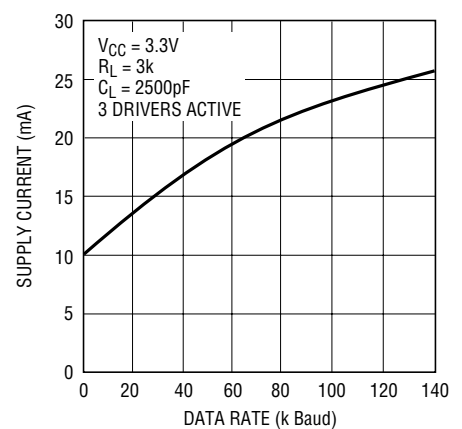
LTC1350 • TPC01

Receiver Input Thresholds vs Temperature



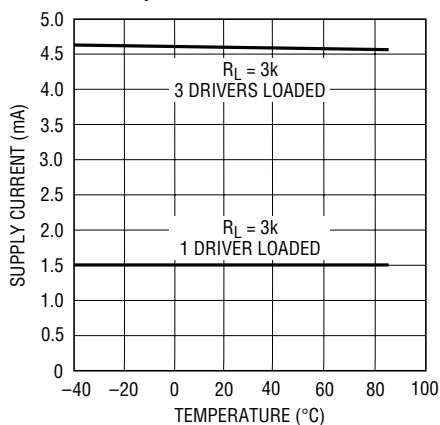
LTC1350 • TPC02

Supply Current vs Data Rate



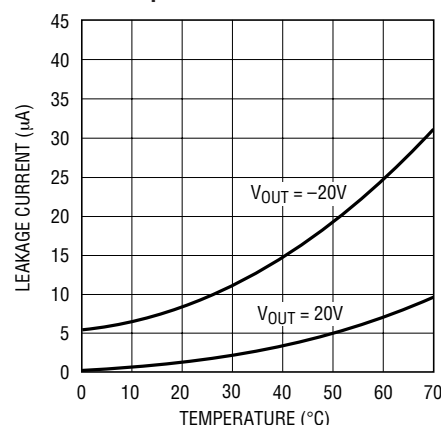
LTC1350 • TPC03

VCC Supply Current vs Temperature



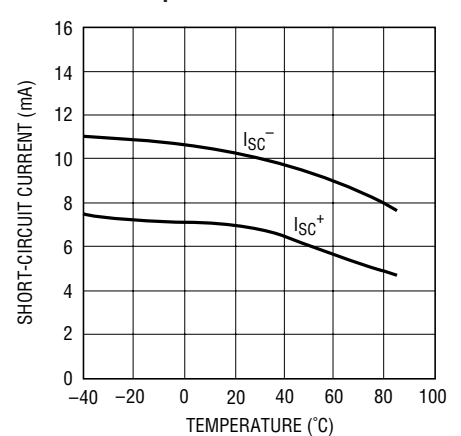
LTC1350 • TPC04

Driver Leakage in Shutdown vs Temperature



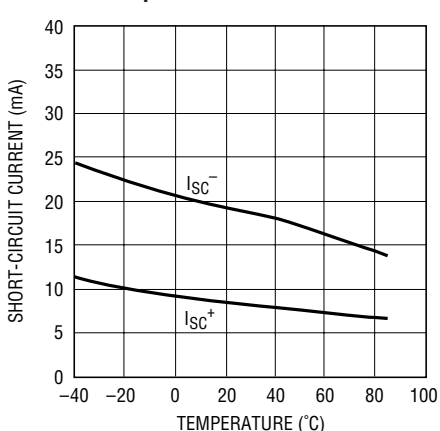
LTC1350 • TPC05

Driver Short-Circuit Current vs Temperature



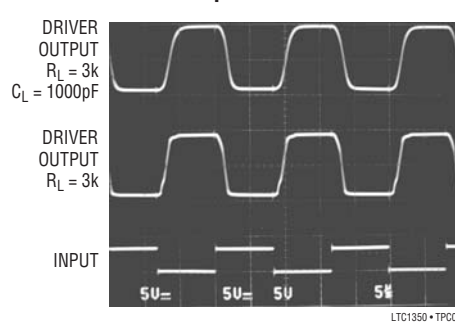
LTC1350 • TPC06

Receiver Short-Circuit Current vs Temperature



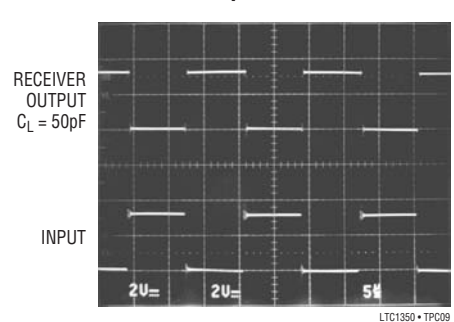
LTC1350 • TPC07

Driver Output Waveforms



LTC1350 • TPC08

Receiver Output Waveform



LTC1350 • TPC09

PIN FUNCTIONS

V_{CC}: 3.3V Input Supply Pin. Supply current is typically 35 μ A in the Shutdown mode. This pin should be decoupled with a 0.1 μ F ceramic capacitor.

GND: Ground Pin.

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

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

V⁻: Negative Supply Output. $V^- \approx -(2V_{CC} - 1.3V)$. 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 20 Ω .

DR IN: EIA/TIA-562 Driver Input Pins. Inputs are TTL/CMOS compatible. Inputs should not be allowed to float. Tie unused inputs to V_{CC} .

DR OUT: Driver Outputs at EIA/TIA-562 Voltage Levels. Outputs are in a high impedance state when in the 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. 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

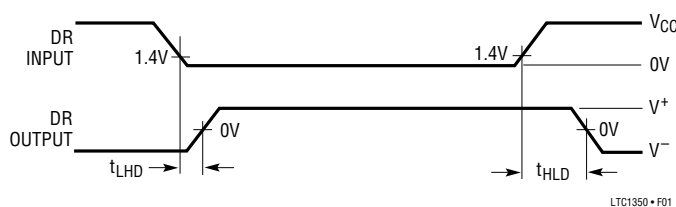


Figure 1. Driver Propagation Delay Timing

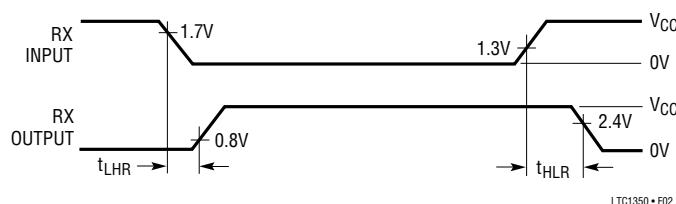
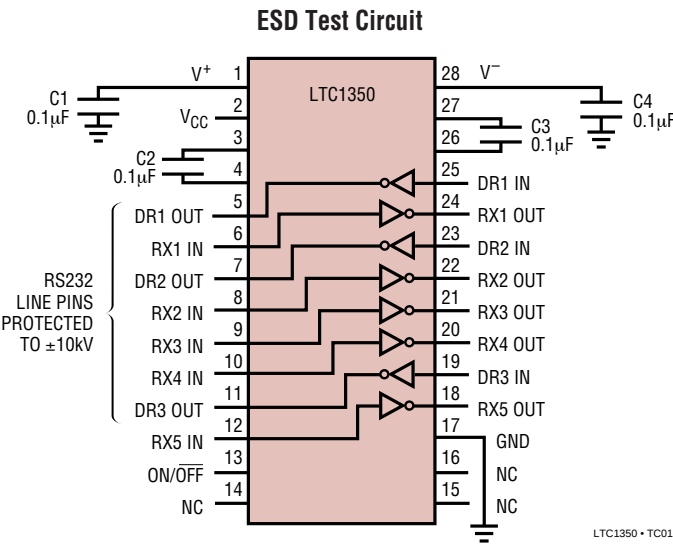


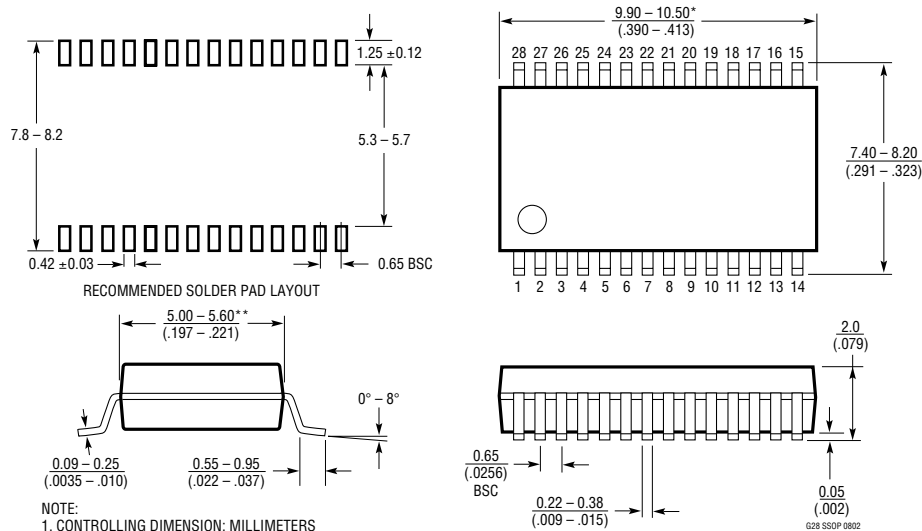
Figure 2. Receiver Propagation Delay Timing

TEST CIRCUITS



PACKAGE DESCRIPTION

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



NOTE:

1. CONTROLLING DIMENSION: MILLIMETERS

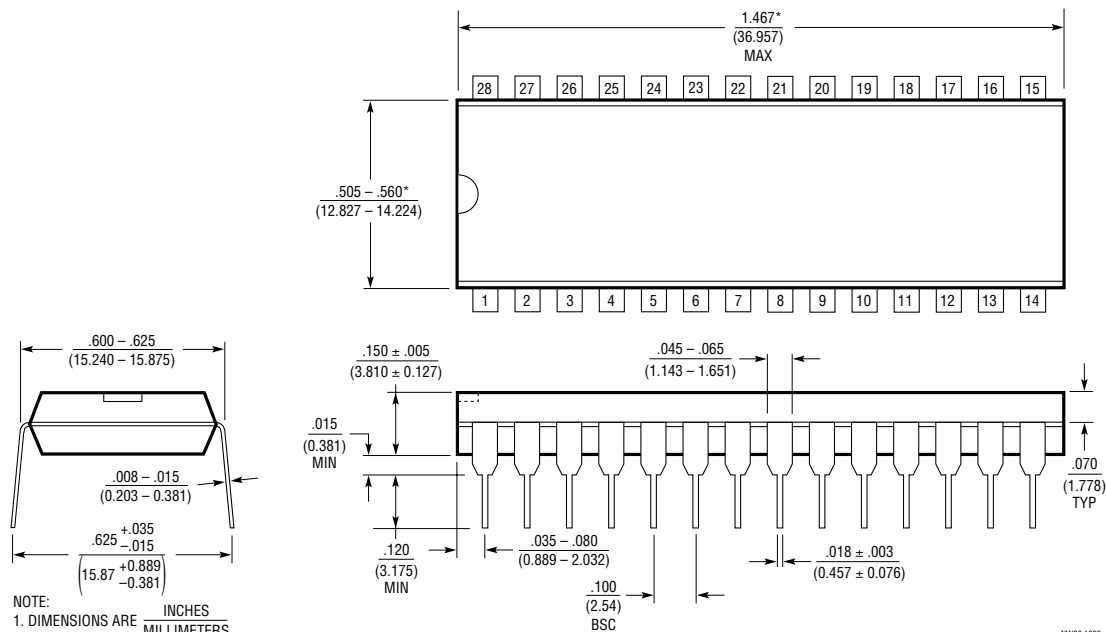
2. DIMENSIONS ARE IN MILLIMETERS
(INCHES)

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)



NOTE:

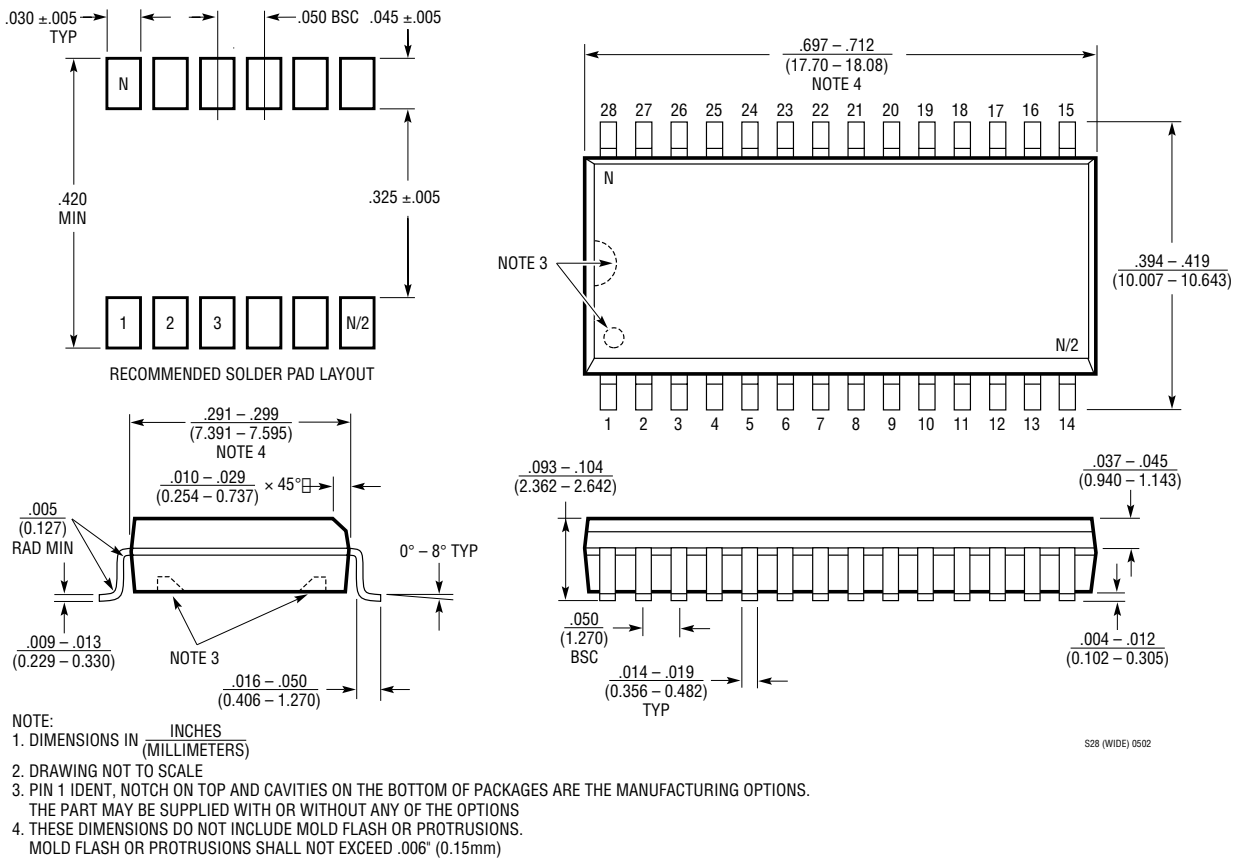
1. DIMENSIONS ARE INCHES
MILLIMETERS

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

NW28 1002

PACKAGE DESCRIPTION

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



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
LTC1385	3.3V, 2 Driver, 2 Receiver RS562 Transceiver	200μA Supply Current, 2 Receivers Active in Shutdown
LTC1386	3.3V, 2 Driver, 2 Receiver RS562 Transceiver	200μA Supply Current, Narrow 16-Pin SO
LTC2844	3.3V, Software-Selectable Multiprotocol Transceiver	4 Drivers, 4 Receivers for Control Signals Including LL
LTC2845	3.3V, Software-Selectable Multiprotocol Transceiver	5 Drivers, 5 Receivers for Control Signals Including LL, RL and TM
LTC2846	3.3V, Software-Selectable Multiprotocol Transceiver	4 Drivers, 4 Receivers with Termination for Data/Clock