

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: \pm 10kV**
- **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 \pm 25V 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.

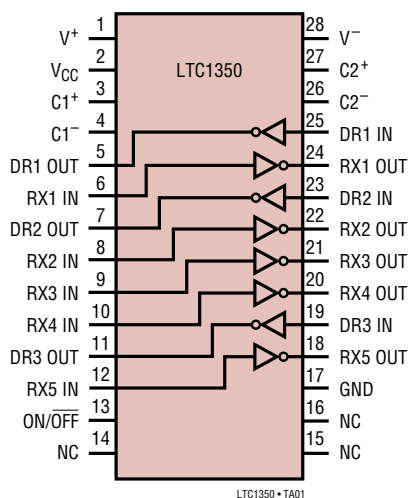
In Shutdown mode, two receivers are kept alive and the supply current is only 35 μ A. All RS232 outputs assume a high impedance state in Shutdown or with the power off.

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 \pm 25V without damage and can survive multiple \pm 10kV ESD strikes.

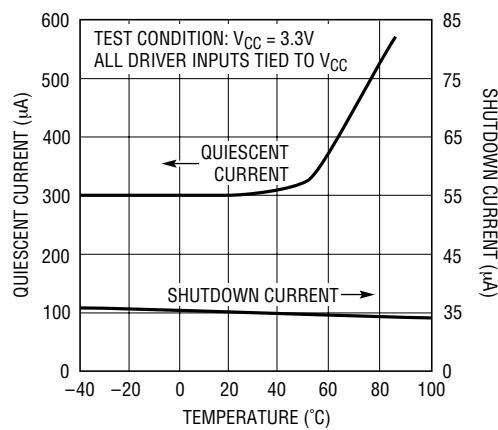
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TYPICAL APPLICATION

3-Drivers/5-Receivers with Shutdown



Quiescent and Shutdown Supply Current vs Temperature



LTC1350 • TA02

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

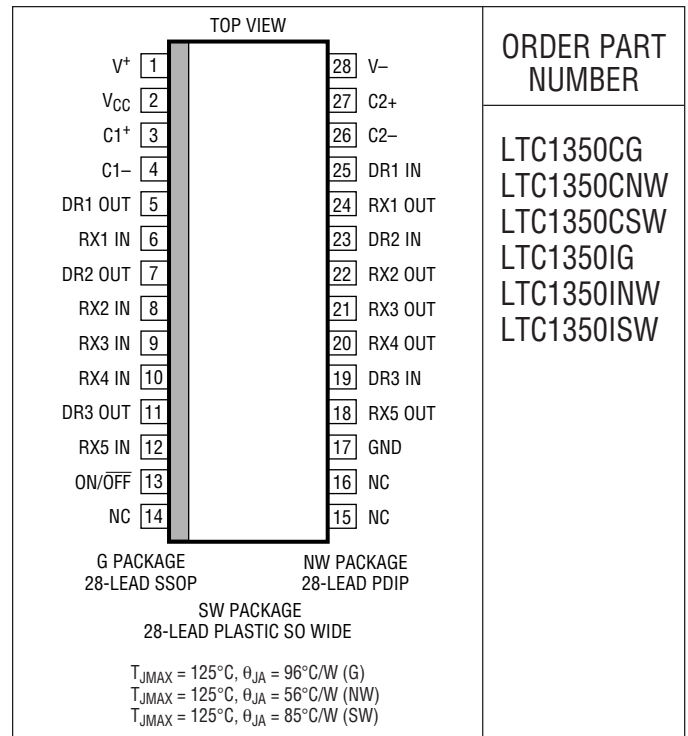
Commercial (LTC1350C) $0^{\circ}C$ to $70^{\circ}C$

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



ORDER PART NUMBER

- LTC1350CG
- LTC1350CNW
- LTC1350CSW
- LTC1350IG
- LTC1350INW
- LTC1350ISW

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	Positive ● Negative ●	3.7 4.5	4.5 -4.5	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	$V_{IN} = V_{CC}$ $V_{IN} = 0V$	● ●		5 -5	μA 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 Input High Threshold	● ●	0.8 1.3	1.3 2.4	V V	
Hysteresis		●	0.1	0.4	1	V
Input Resistance	$V_{IN} = \pm 10V$		3	5	7	k Ω
Output Voltage	Output Low, $I_{OUT} = -1.6mA$ ($V_{CC} = 3.3V$) Output High, $I_{OUT} = 160\mu A$ ($V_{CC} = 3.3V$)	● ●	3.0	0.2 3.2	0.4	V 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

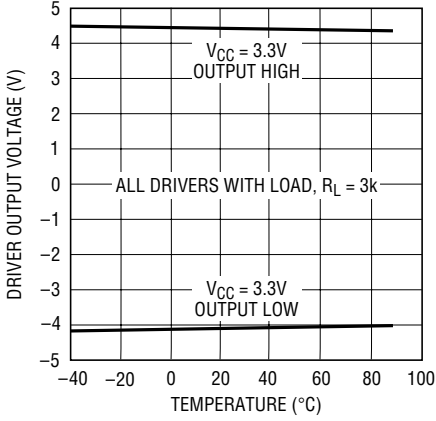
Note 1: Absolute Maximum Ratings are those values beyond which the life of the device may be impaired.

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

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

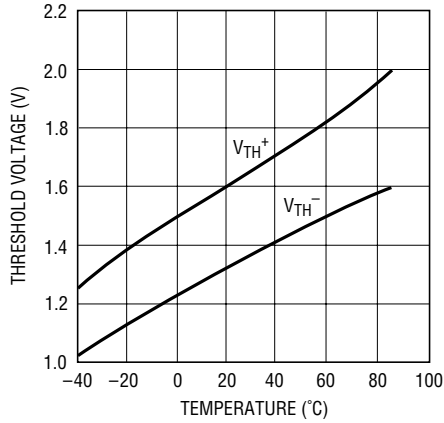
TYPICAL PERFORMANCE CHARACTERISTICS

Driver Output Voltage vs Temperature



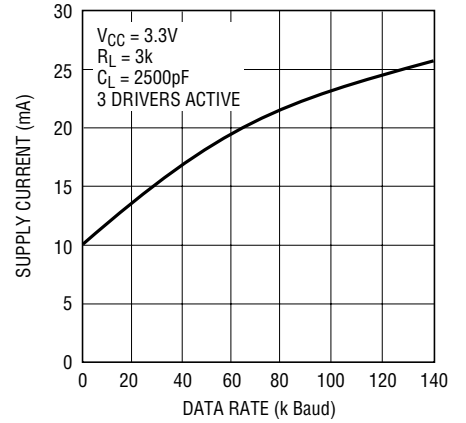
LTC1350 • TPC01

Receiver Input Thresholds vs Temperature



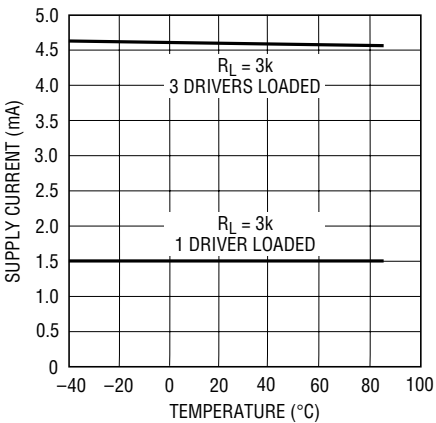
LTC1350 • TPC02

Supply Current vs Data Rate



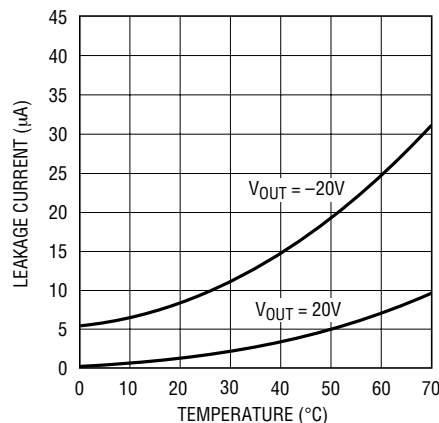
LTC1350 • TPC03

VCC Supply Current vs Temperature



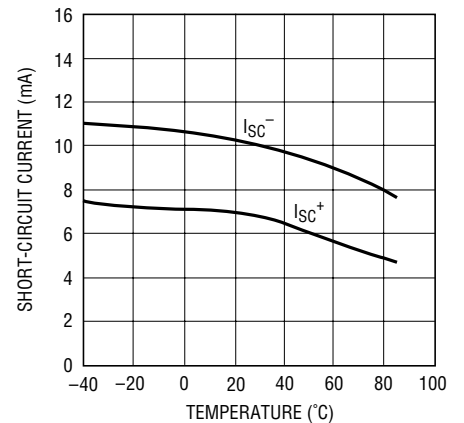
LTC1350 • TPC04

Driver Leakage in Shutdown vs Temperature



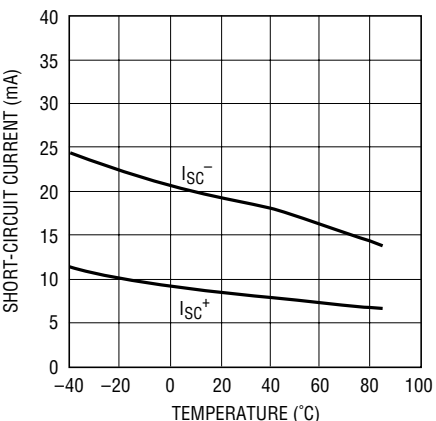
LTC1350 • TPC05

Driver Short-Circuit Current vs Temperature



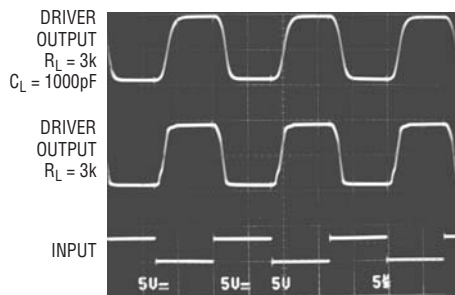
LTC1350 • TPC06

Receiver Short-Circuit Current vs Temperature



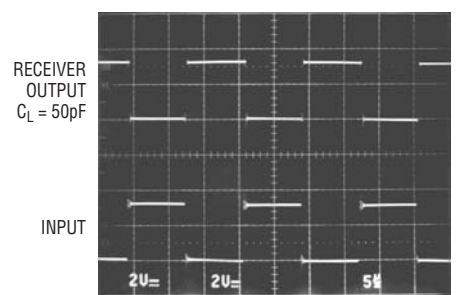
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Driver Output Waveforms



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. $V^+ \cong 2V_{CC} - 1V$. 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. $V^- \cong -(2V_{CC} - 1.3V)$. 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

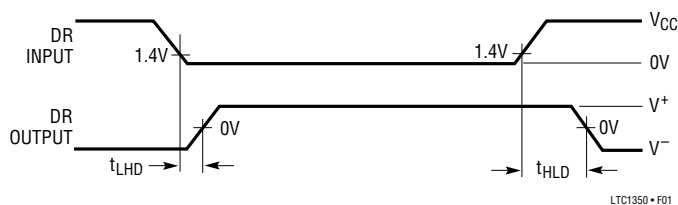


Figure 1. Driver Propagation Delay Timing

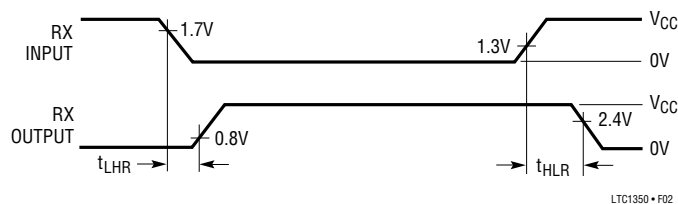
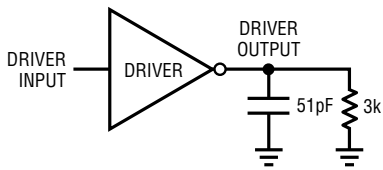


Figure 2. Receiver Propagation Delay Timing

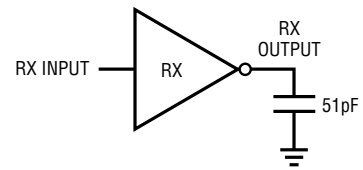
TEST CIRCUITS

Driver Timing Test Load



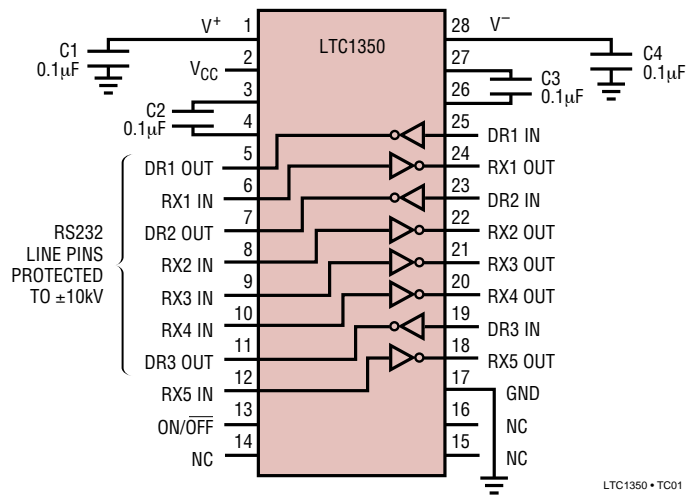
LTC1350 • TA03

Receiver Timing Test Load



LTC1350 • TA04

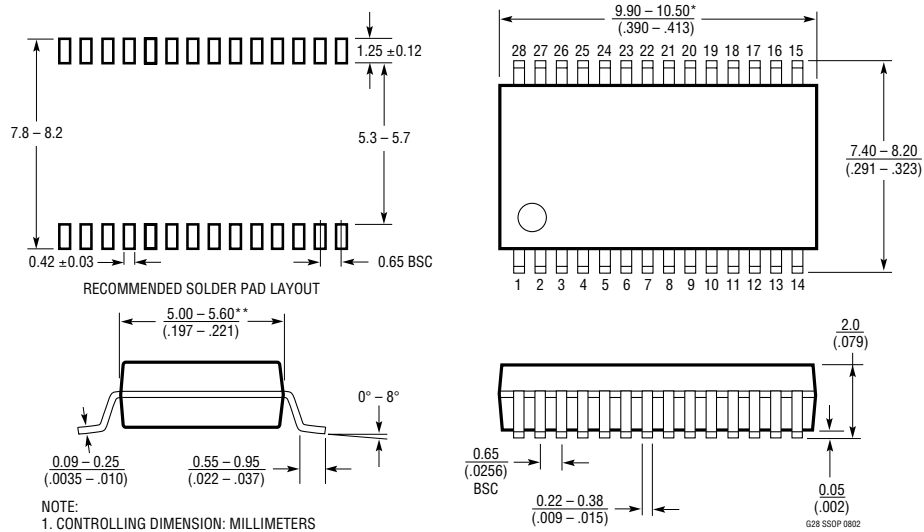
ESD Test Circuit



LTC1350 • TC01

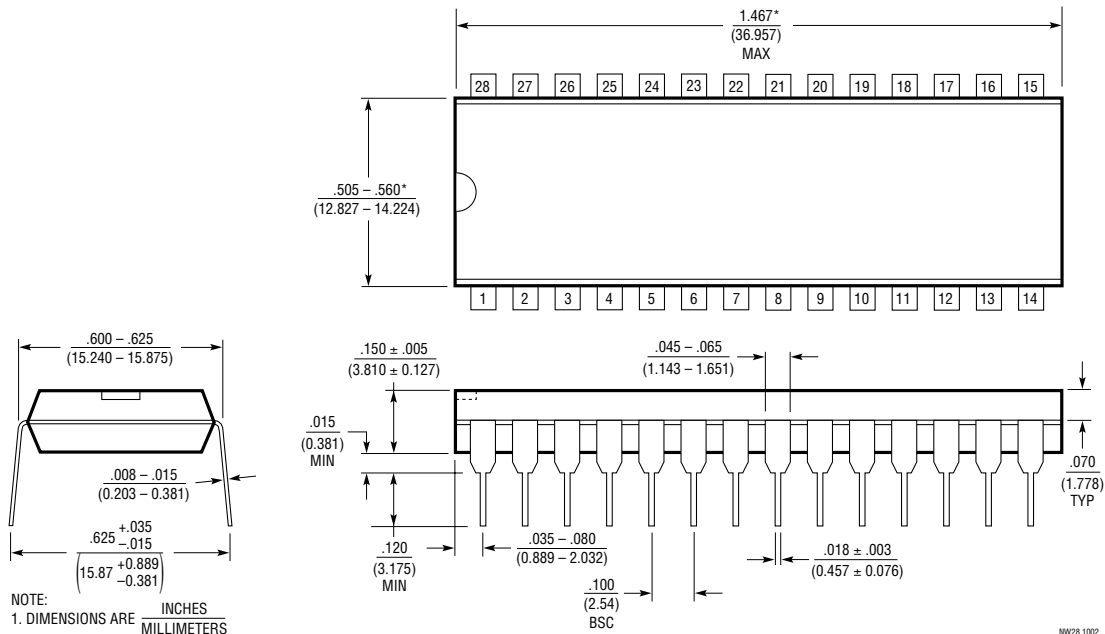
PACKAGE DESCRIPTION

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