

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.

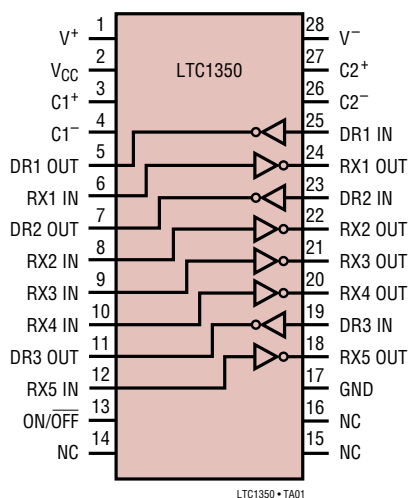
In Shutdown mode, two receivers are kept alive and the supply current is only 35 μ A. All RS232 outputs assume a high impedance state in Shutdown or with the power off.

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.

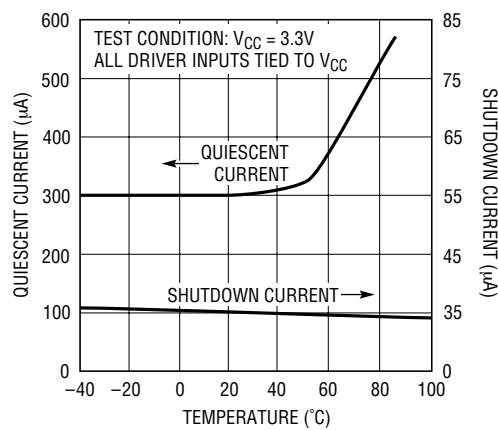
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TYPICAL APPLICATION

3-Drivers/5-Receivers with Shutdown



Quiescent and Shutdown Supply Current vs Temperature

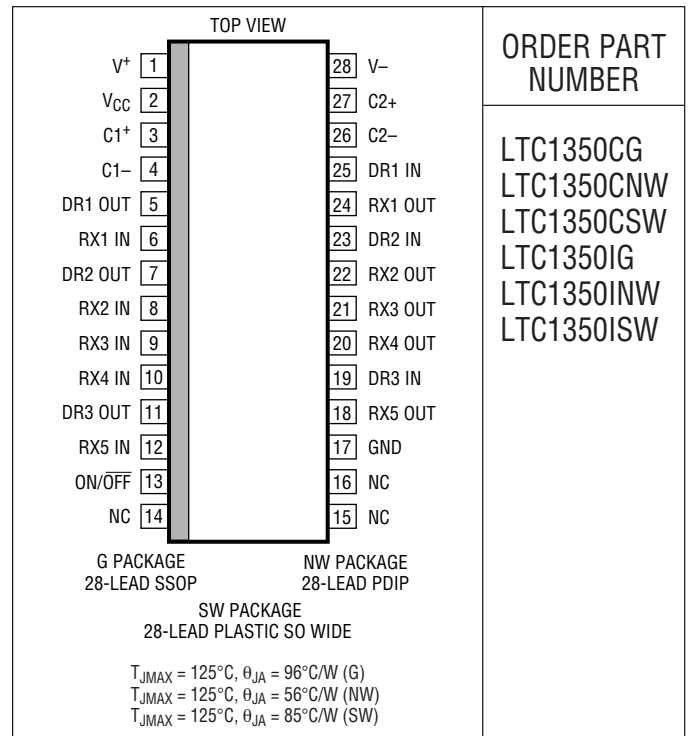


LTC1350 • TA02

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°C to 70°C |
| Industrial (LTC1350I) | -40°C to 85°C |
| Storage Temperature Range | -65°C to 150°C |
| Lead Temperature (Soldering, 10 sec) | 300°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 -3.7 | 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 1.7 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, $I_{OUT} = 160\mu A$ ($V_{CC} = 3.3V$) | ● ● | | | 0.2 3.0 3.2 | 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 |

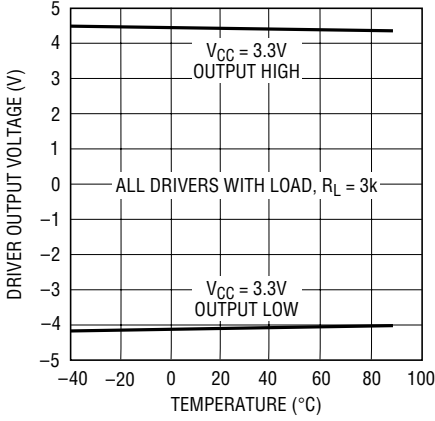
Note 1: Absolute Maximum Ratings are those values beyond which the life of the device may be impaired.

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

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

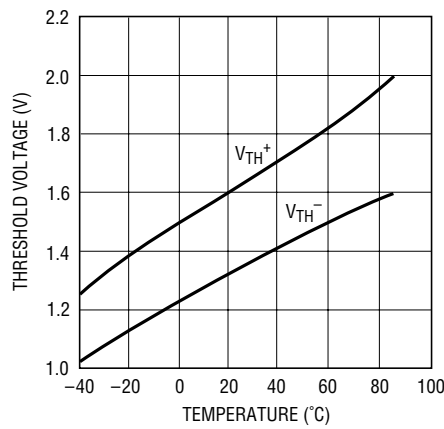
TYPICAL PERFORMANCE CHARACTERISTICS

Driver Output Voltage vs Temperature



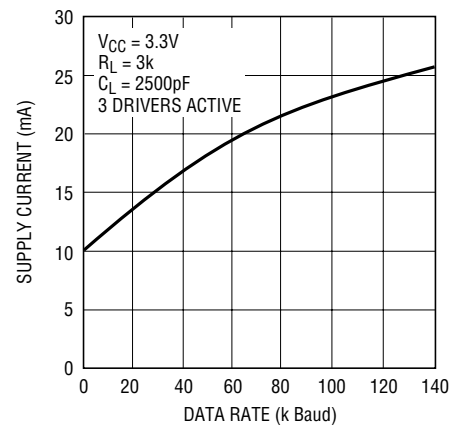
LTC1350 • TPC01

Receiver Input Thresholds vs Temperature



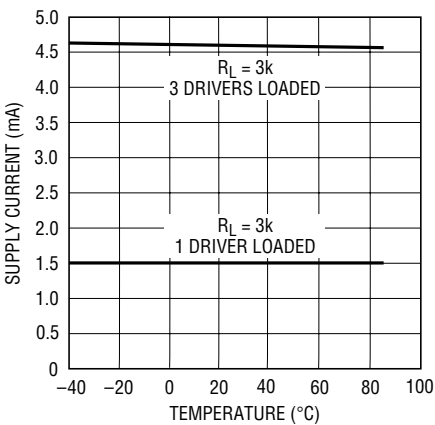
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Supply Current vs Data Rate



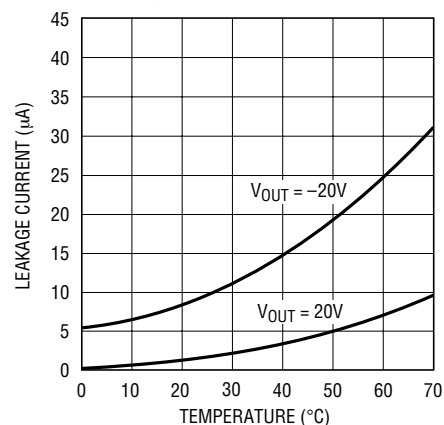
LTC1350 • TPC03

VCC Supply Current vs Temperature



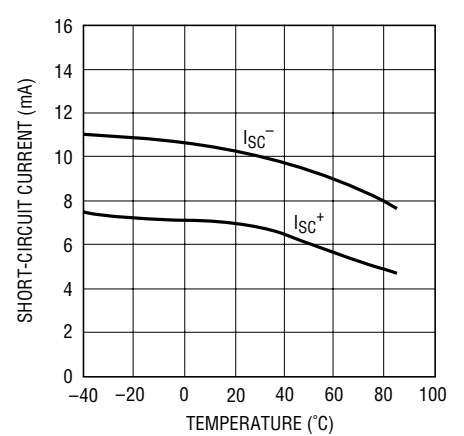
LTC1350 • TPC04

Driver Leakage in Shutdown vs Temperature



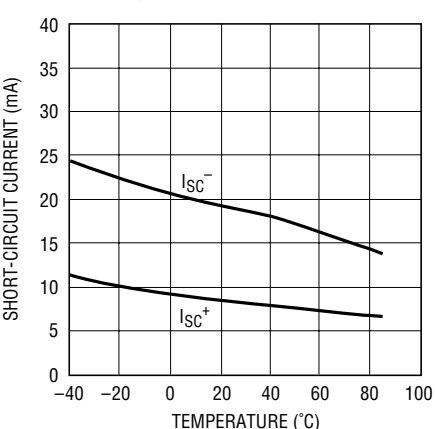
LTC1350 • TPC05

Driver Short-Circuit Current vs Temperature



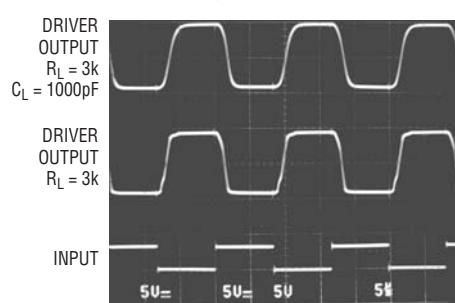
LTC1350 • TPC06

Receiver Short-Circuit Current vs Temperature



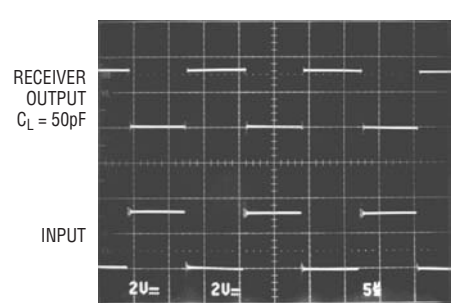
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Driver Output Waveforms



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

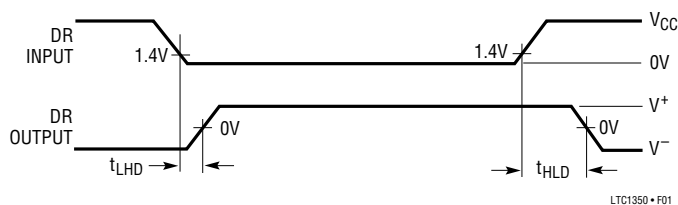


Figure 1. Driver Propagation Delay Timing

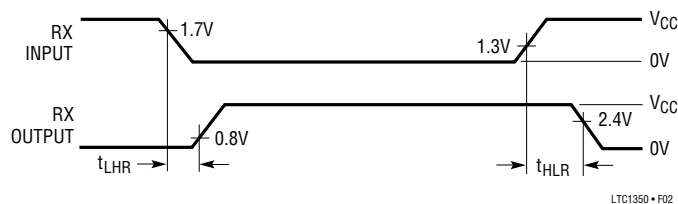
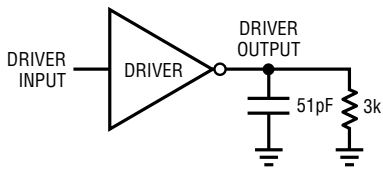


Figure 2. Receiver Propagation Delay Timing

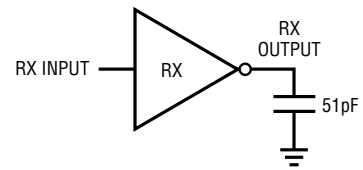
TEST CIRCUITS

Driver Timing Test Load



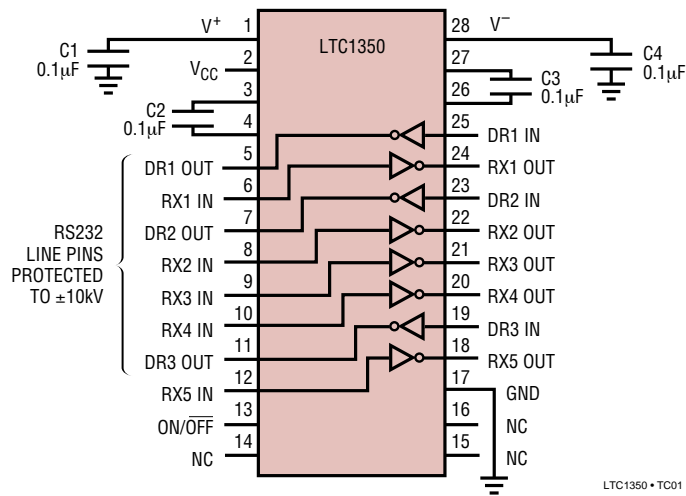
LTC1350 • TA03

Receiver Timing Test Load



LTC1350 • TA04

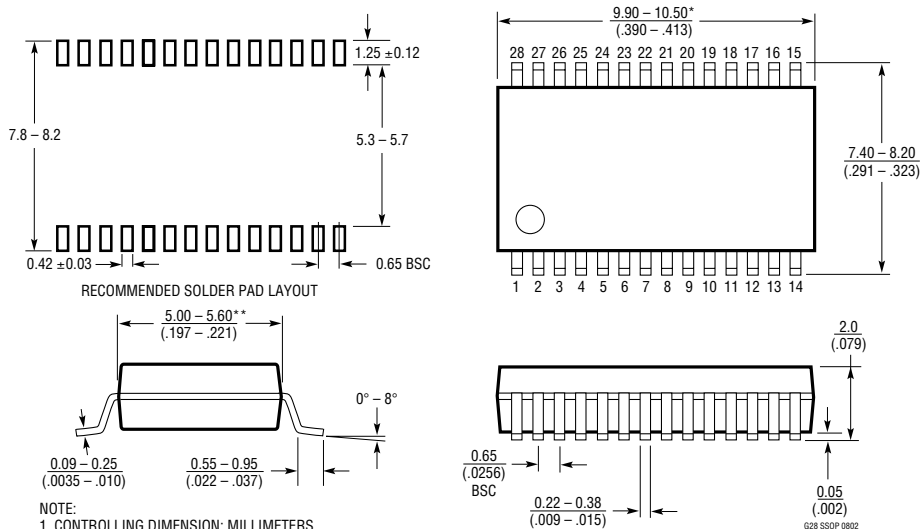
ESD Test Circuit



LTC1350 • TC01

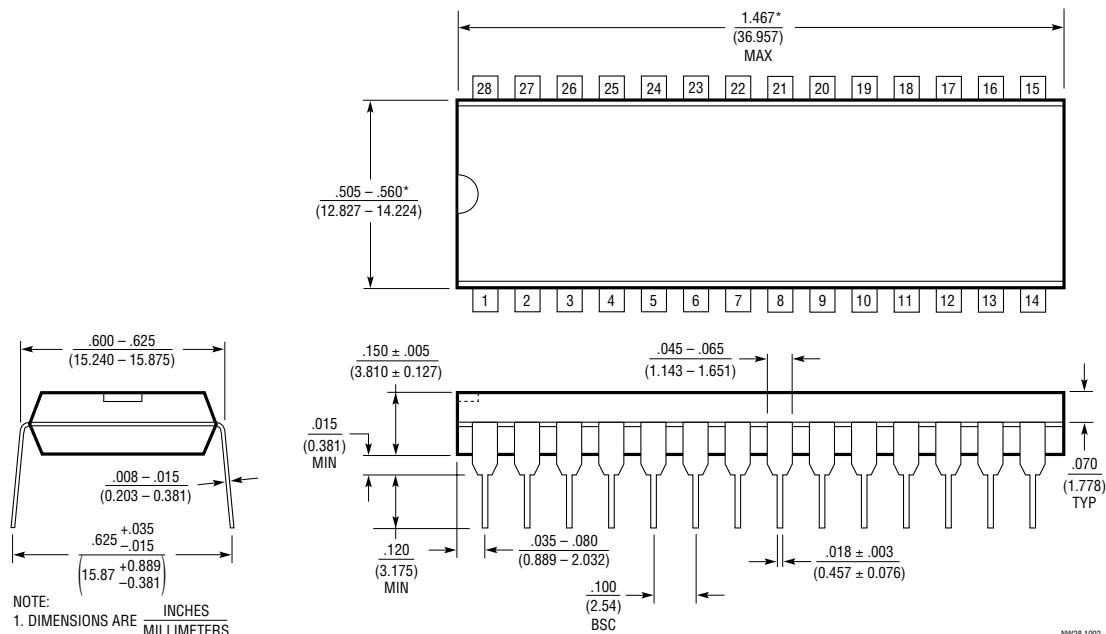
PACKAGE DESCRIPTION

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