5V Low Power RS232 Transceiver with 2 Receivers Active in Shutdown

FEATURES

- **Operates from a Single 5V Supply**
- **Low Supply Current: I_{CC} = 220µA**
- **I_{CC} = 35µA in Shutdown Mode with Both Receivers Kept Alive**
- **ESD Protection Over ±10kV**
- Uses Small Capacitors: 0.1µF
- Operates to 120kBaud
- Output Overvoltage Does Not Force Current Back into Supplies
- RS232 I/O Lines Can Be Forced to ±25V Without Damage
- Pin Compatible with LT1180A

APPLICATIONS

- Notebook Computers
- Palmtop Computers

DESCRIPTION

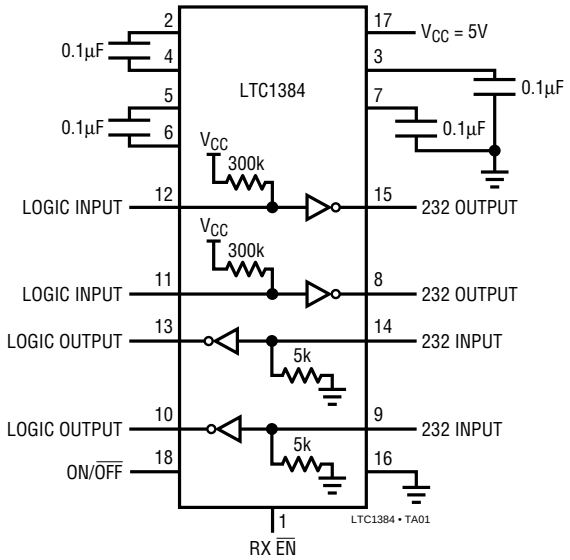
The LTC1384 is an ultra-low power 2-driver/2-receiver RS232 transceiver that operates from a single 5V supply. The charge pump requires only four space-saving 0.1µF capacitors.

The transceiver operates in one of two modes, Normal and Shutdown. In the Normal mode, I_{CC} is only 220µA with the driver outputs unloaded. In the Shutdown mode, the charge pump is turned off, the driver outputs are forced into three-state, both receivers are kept active and I_{CC} drops to 35µA. The receiver outputs may be forced into three-state at any time using the receiver enable ($\overline{EN}$) pin.

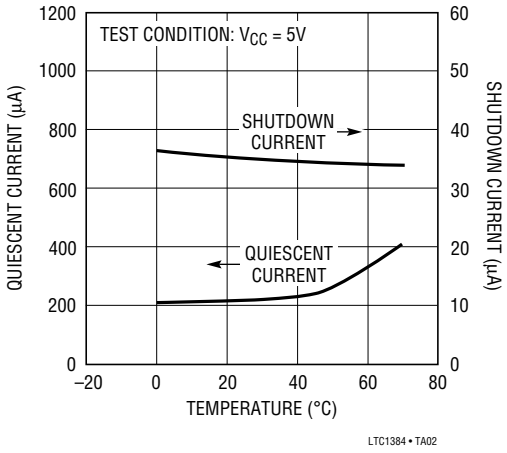
The LTC1384 is fully compliant with all data rate and overvoltage RS232 specifications. The transceiver can operate up to 120kbaud with a 2500pF, 3kΩ load. Both driver outputs and receiver inputs can be forced to ±25V without damage and can survive multiple ±10kV ESD strikes.

TYPICAL APPLICATION

2-Drivers/2-Receivers with Shutdown and Receiver Enable



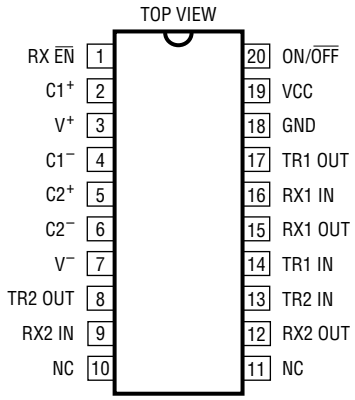
Quiescent and Shutdown Supply Current vs Temperature



ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) 6V
Input Voltage
  Driver ..... $-0.3V$ to $V_{CC} + 0.3V$
  Receiver ..... $-25V$ to $25V$
  Digital Input ..... $-0.3V$ 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 ..... 0°C to 70°C
Storage Temperature Range ..... $-65°C$ to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

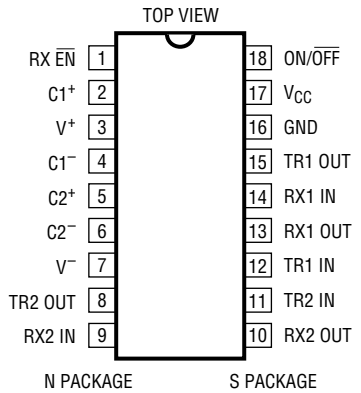
PACKAGE/ORDER INFORMATION



G PACKAGE
20-LEAD SSOP

$T_{JMAX} = 125°C$, $\theta_{JA} = 135°C/W$

ORDER PART NUMBER
LTC1384CG



N PACKAGE
18-LEAD PLASTIC DIP

S PACKAGE
18-LEAD PLASTIC SOL

$T_{JMAX} = 125°C$, $\theta_{JA} = 56°C/W$

ORDER PART NUMBER
LTC1384CN LTC1384CS

Consult factory for Industrial and Military grade parts.

DC ELECTRICAL CHARACTERISTICS

V_{CC} = 5V, C1 = C2 = C3 = C4 = 0.1µF, $V_{ON/\overline{OFF}} = V_{CC}$, $\overline{EN}$ = 0V, unless otherwise noted.

PARAMETER	CONDITIONS			MIN	TYP	MAX	UNITS
Any Driver							
Output Voltage Swing	3k to GND	Positive	●	5.0	7.0		V
		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	$V_{IN} = V_{CC}$		●			5	µA
	V_{IN} = 0V		●		–20	–40	µA
Output Short-Circuit Current	V_{OUT} = 0V				±12		mA
Output Leakage Current	Shutdown or V_{CC} = 0V (Note 3), V_{OUT} = ±20V		●		±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} = 160µA (V_{CC} = 5V)		●	3.0	3.2		V

DC ELECTRICAL CHARACTERISTICS

V_{CC} = 5V, C1 = C2 = C3 = C4 = 0.1µF, $V_{ON/\overline{OFF}}$ = V_{CC}, $\overline{EN}$ = 0V, unless otherwise noted.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Output Short-Circuit Current	Sinking Current, V_{OUT} = V_{CC} Sourcing Current, V_{OUT} = 0V		–15 10	–40 20		mA mA
Output Leakage Current	$\overline{EN}$ = V_{CC}, 0V ≤ V_{OUT} ≤ V_{CC}	●		1	10	µA
Power Supply Generator						
V^+ Output Voltage	I_{OUT} = 0mA I_{OUT} = 8mA			8.0 7.5		V V
V^- Output Voltage	I_{OUT} = 0mA I_{OUT} = –8mA			–8.0 –7.0		V V
Supply Rise Time	Shutdown to Turn-On			0.2		ms
Power Supply						
V_{CC} Supply Current	No Load (Note 2)	●		0.22	0.5	mA
Supply Leakage Current (V_{CC})	Shutdown (Note 3)	●		35	50	µA
Digital Input Threshold Low		●		1.4	0.8	V
Digital Input Threshold High		●	2.0	1.4		V

AC CHARACTERISTICS

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		 3	8 5	30	V/µs V/µs
Driver Propagation Delay (TTL to RS232)	t_{HLD} (Figure 1) t_{LHD} (Figure 1)	● ●		2 2	3.5 3.5	µs µs
Receiver Propagation Delay (RS232 to TTL)	t_{HLR} (Figure 2) t_{LHR} (Figure 2)	● ●		0.3 0.3	0.8 0.8	µs µs

The ● denotes specifications which apply over the operating temperature range of 0°C ≤ T_A ≤ 70°C.

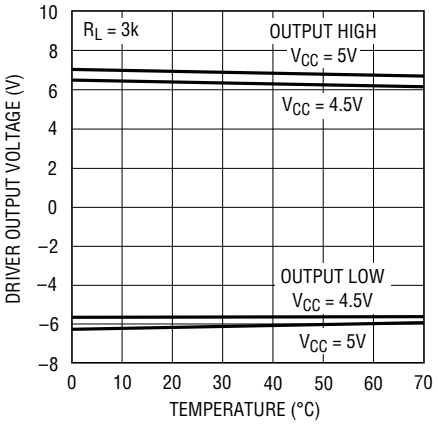
Note 1: Absolute maximum ratings are those values beyond which the life of the device may be impaired.

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

Note 3: Measurements made in the Shutdown mode are performed with $V_{ON/\overline{OFF}}$ = 0V.

TYPICAL PERFORMANCE CHARACTERISTICS

Driver Output Voltage vs Temperature



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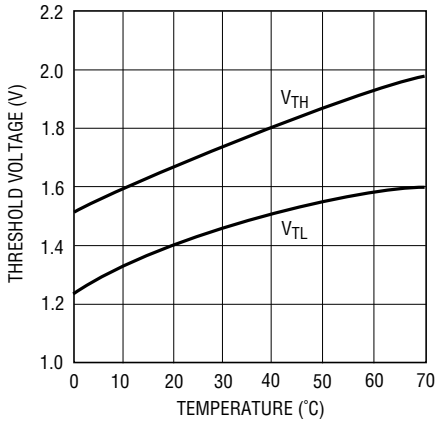
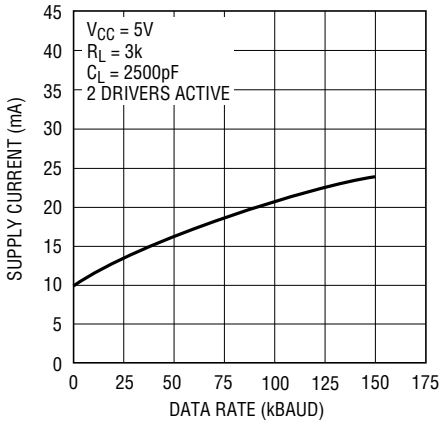
Receiver Input Thresholds vs Temperature



LTC1384 • TPC02

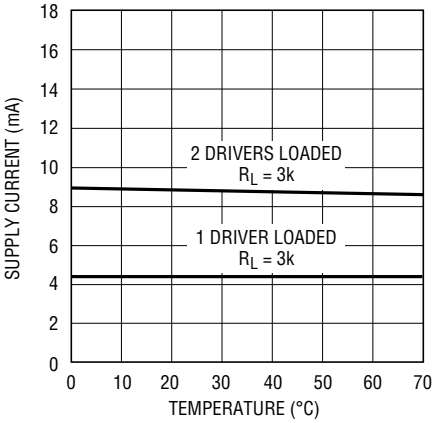
Supply Current vs Data Rate



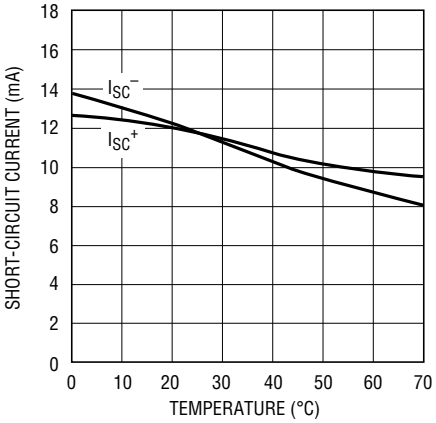
LTC1384 • TPC03

TYPICAL PERFORMANCE CHARACTERISTICS

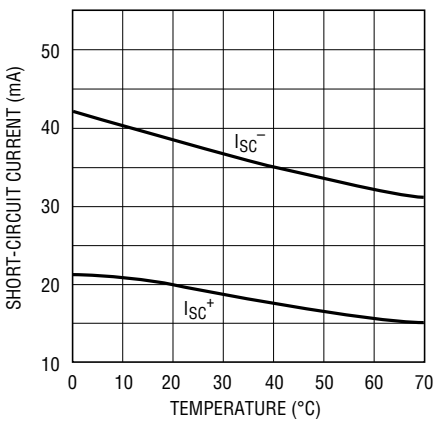
V_{CC} Supply Current vs Temperature



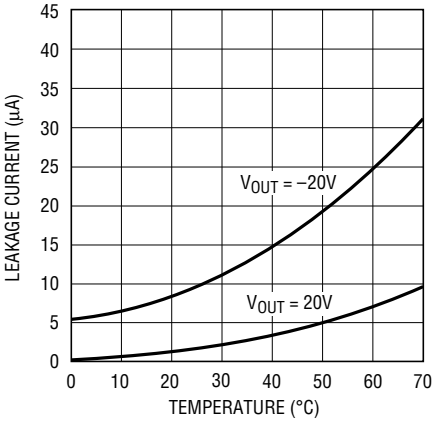
Driver Short-Circuit Current vs Temperature



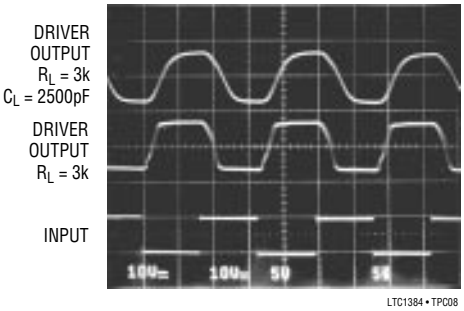
Receiver Short-Circuit Current vs Temperature



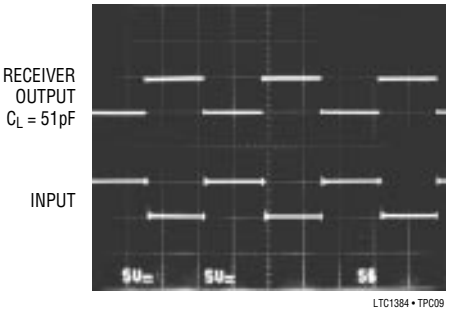
Driver Leakage in Shutdown vs Temperature



Driver Output Waveforms



Receiver Output Waveforms



PIN FUNCTIONS

V_{CC}: 5V Input Supply Pin. 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 independent of the $\overline{EN}$ pin. The supply current of the device drops to 35µA (two receivers alive) and both driver outputs are forced into three-state.

$\overline{EN}$: TTL/CMOS Compatible Receiver Enable Pin. A logic high forces the receiver outputs into three-state. A logic low enables the receiver outputs.

V^+: Positive Supply Output (RS232 Drivers). $V^+ \cong 2V_{CC} - 2V$. This pin requires an external capacitor C = 0.1µF for charge storage. The capacitor may be tied to ground or V_{CC}. With multiple devices, the V^+ and V^- pins may share a common capacitor. 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). $V^- \cong -(2V_{CC} - 2V)$. 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 2Ω.

TR IN: RS232 Driver Input Pins. Inputs are TTL/CMOS compatible. The inputs of unused drivers can be left unconnected since 300k input pull-up resistors to V_{CC} are included on chip. To minimize power consumption, the internal driver pull-up resistors are disconnected from V_{CC} in the Shutdown mode.

TR OUT: Driver Outputs at RS232 Voltage Levels. Outputs are in a high impedance state when in the Shutdown 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. A logic high at $\overline{EN}$ puts the outputs into three-state.

SWITCHING TIME WAVEFORMS

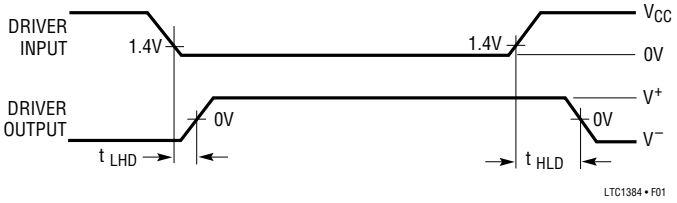


Figure 1. Driver Propagation Delay Timing

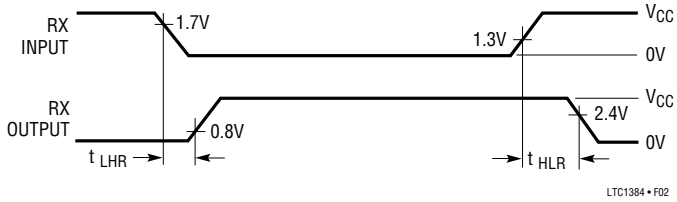
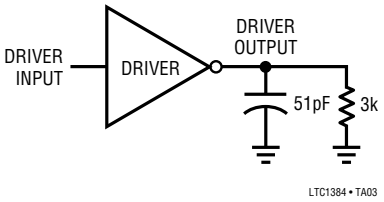


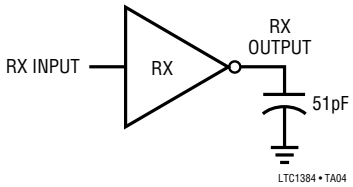
Figure 2. Receiver Propagation Delay Timing

TEST CIRCUITS

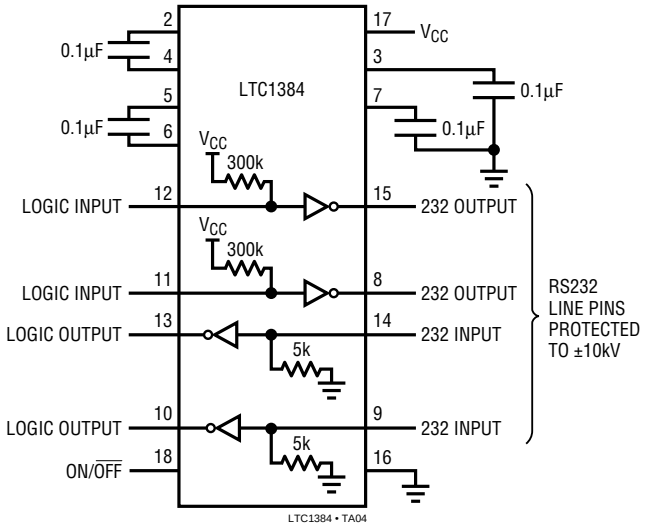
Driver Timing Test Load



Receiver Timing Test Load



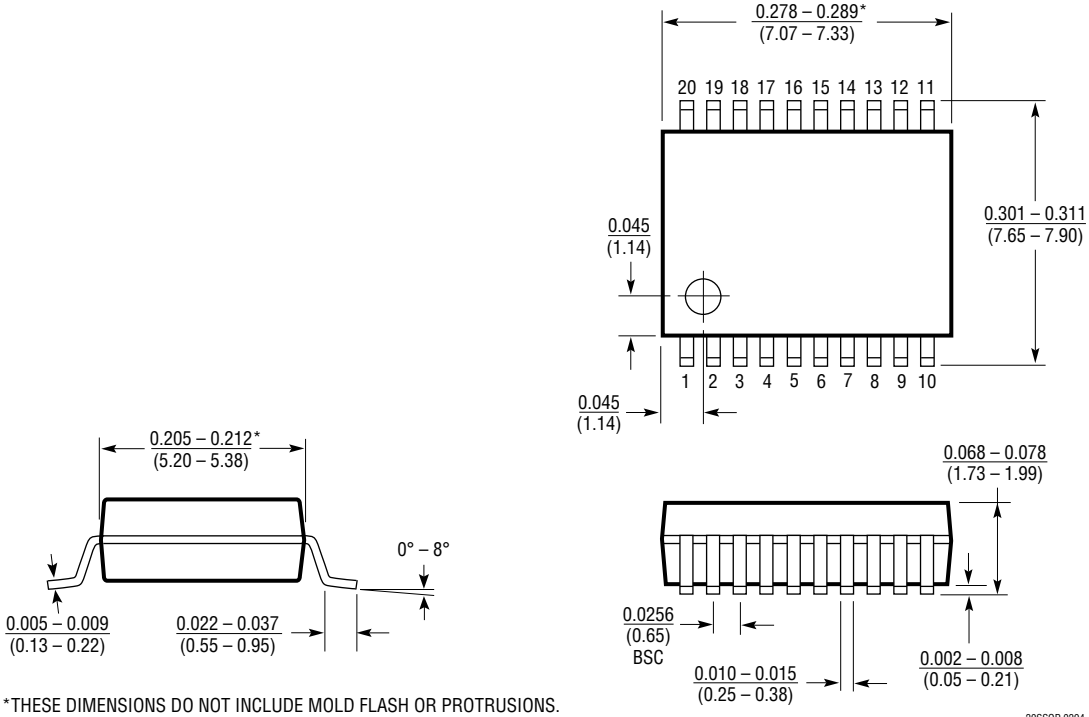
ESD Test Circuit



PACKAGE DESCRIPTION

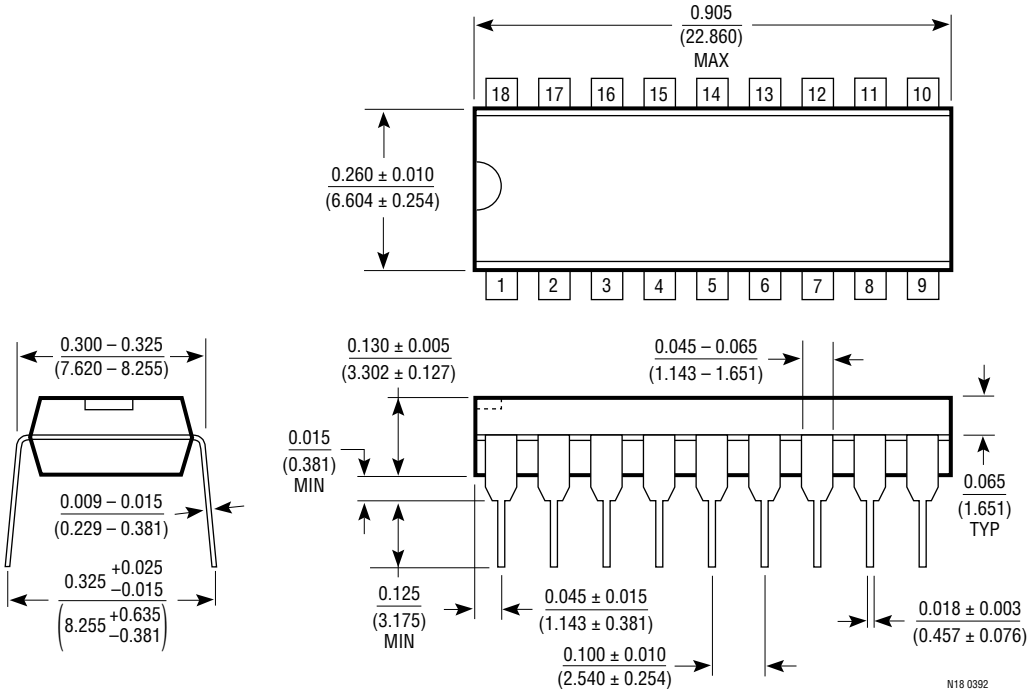
Dimensions in inches (millimeters) unless otherwise noted.

G Package
20-Lead SSOP



*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.006 INCH (0.15mm).

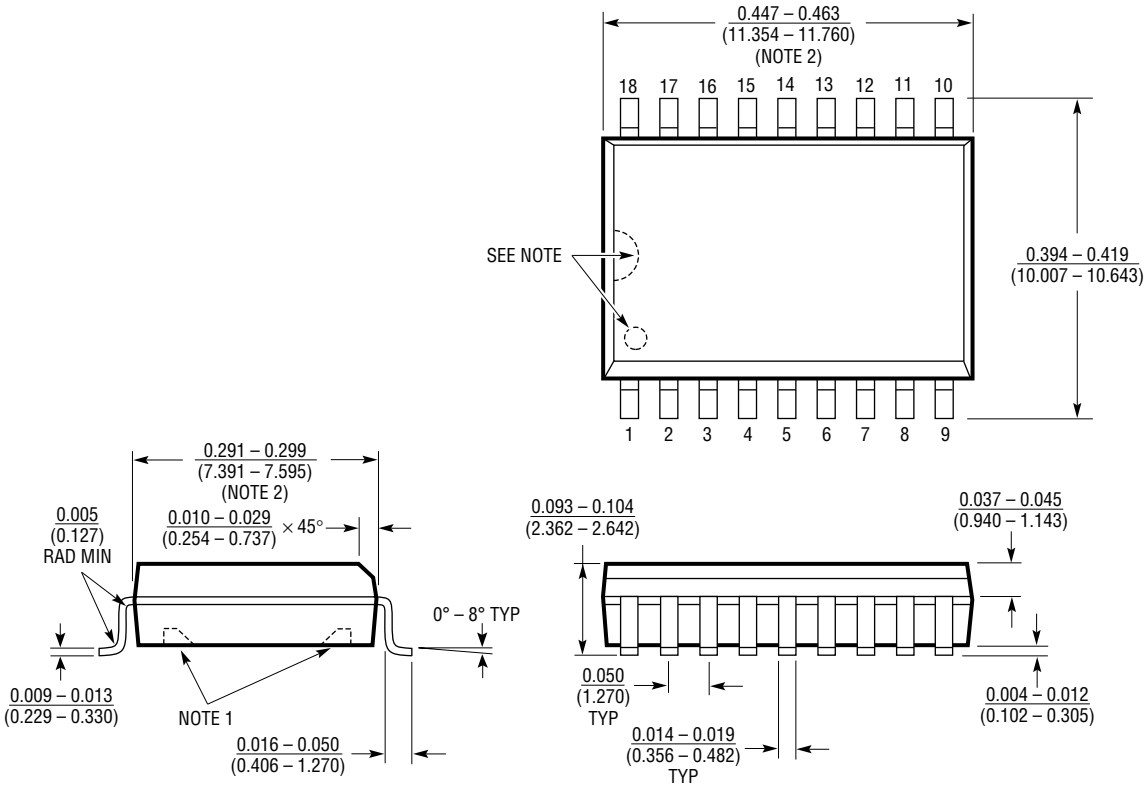
N Package
18-Lead Plastic DIP



PACKAGE DESCRIPTION

Dimensions in inches (millimeters) unless otherwise noted.

S Package
18-Lead Plastic SOL



NOTE:
1. 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.
2. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.006 INCH (0.15mm).

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