



## 5V Low Power RS232 Transceiver with Shutdown

### FEATURES

- Operates from a Single 5V Supply
- Low Supply Current:  $I_{CC} = 220\mu\text{A}$
- $I_{CC} = 0.2\mu\text{A}$  in Shutdown Mode
- ESD Protection Over  $\pm 10\text{kV}$
- Uses Small Capacitors:  $0.1\mu\text{F}$
- Operates to 120kBaud
- Output Overvoltage Does Not Force Current Back into Supplies
- RS232 I/O Lines Can Be Forced to  $\pm 25\text{V}$  Without Damage
- Pin Compatible with LT1180A

### APPLICATIONS

- Notebook Computers
- Palmtop Computers

### DESCRIPTION

The LTC<sup>®</sup>1382 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  $0.1\mu\text{F}$  capacitors.

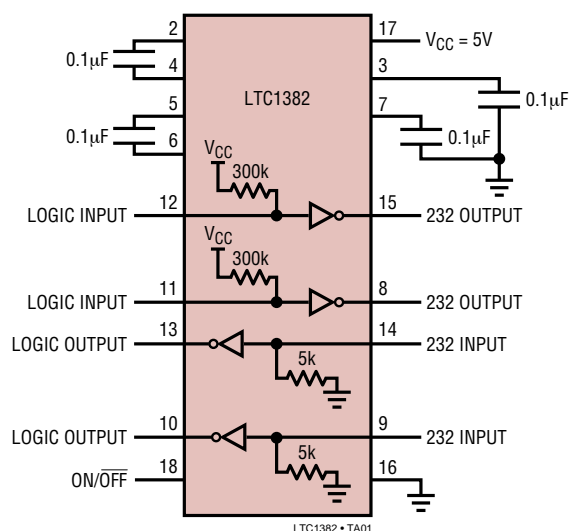
The transceiver operates in one of two modes, Normal and Shutdown. In the Normal mode,  $I_{CC}$  is only  $220\mu\text{A}$  with the driver outputs unloaded. In the Shutdown mode, the charge pump is turned off, the driver outputs are forced into three-state, both receivers are off and  $I_{CC}$  drops to  $0.2\mu\text{A}$ .

The LTC1382 is fully compliant with all data rate and overvoltage RS232 specifications. The transceiver can operate up to 120kbaud with a  $2500\text{pF}$ ,  $3\text{k}\Omega$  load. Both driver outputs and receiver inputs can be forced to  $\pm 25\text{V}$  without damage and can survive multiple  $\pm 10\text{kV}$  ESD strikes.

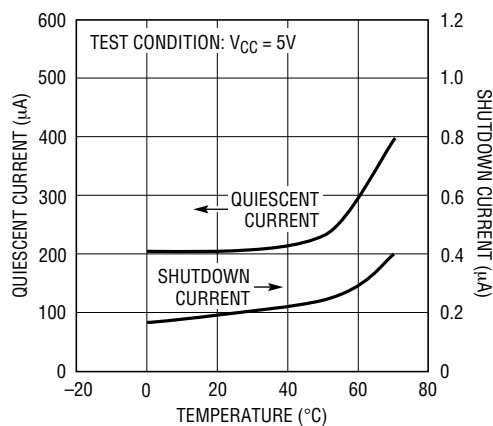
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### TYPICAL APPLICATION

2-Drivers/2-Receivers with Shutdown



Quiescent and Shutdown Supply Current vs Temperature

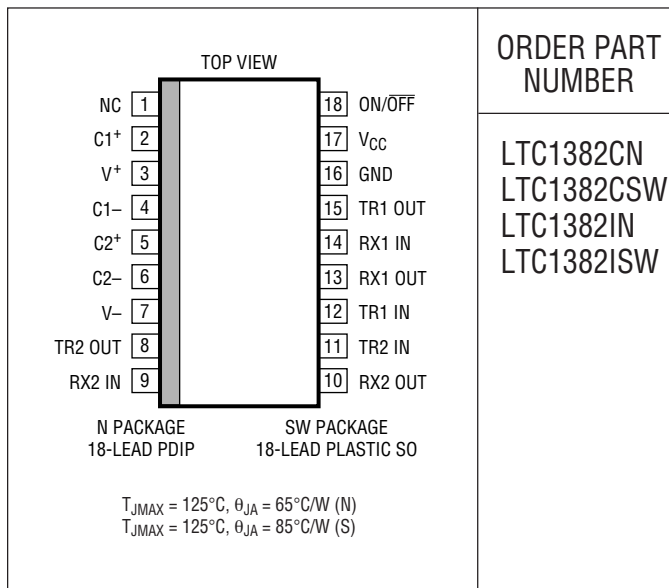


LTC1382 • TA02

### 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                |                          |
| LTC1382C .....                             | 0°C to 70°C              |
| LTC1382I .....                             | -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

- LTC1382CN
- LTC1382CSW
- LTC1382IN
- LTC1382ISW

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.  $V_{CC} = 5V, C1 = C2 = C3 = C4 = 0.1\mu F, V_{ON/OFF} = V_{CC}$ , unless otherwise noted.

| PARAMETER                    | CONDITIONS  | MIN                  | TYP    | MAX         | UNITS       |                      |
|------------------------------|---|----------------------|--------|-------------|-------------|----------------------|
| <b>Any Driver</b>            |   |                      |        |             |             |                      |
| Output Voltage Swing         | 3k to GND   | Positive<br>Negative | ●<br>● | 5.0<br>-5.0 | 7.0<br>-6.5 | V<br>V               |
| Logic Input Voltage Level    | Input Low Level ( $V_{OUT} = High$ )<br>Input High Level ( $V_{OUT} = Low$ )                            | ●<br>●               | ●<br>● | 1.4<br>2.0  | 1.4<br>1.4  | 0.8<br>V<br>V        |
| Logic Input Current          | $V_{IN} = V_{CC}$<br>$V_{IN} = 0V$  | ●<br>●               | ●      | -20         | 5<br>-40    | $\mu A$<br>$\mu A$   |
| Output Short-Circuit Current | $V_{OUT} = 0V$  | ●                    | ●      | ±9          | ±12         | mA                   |
| Output Leakage Current       | Shutdown or $V_{CC} = 0V$ (Note 3), $V_{OUT} = \pm 10V$   | ●                    | ●      | ±10         | ±500        | $\mu A$              |
| <b>Any Receiver</b>          |   |                      |        |             |             |                      |
| Input Voltage Thresholds     | Input Low Threshold<br>Input High Threshold   | ●<br>●               | ●      | 0.8         | 1.3<br>1.7  | 2.4<br>V<br>V        |
| Hysteresis                   |   | ●                    | ●      | 0.1         | 0.4         | 1<br>V               |
| Input Resistance             | $-10V \leq V_{IN} \leq 10V$   | ●                    | ●      | 3           | 5           | 7<br>kΩ              |
| Output Voltage               | Output Low, $I_{OUT} = -1.6mA$ ( $V_{CC} = 5V$ )<br>Output High, $I_{OUT} = 160\mu A$ ( $V_{CC} = 5V$ ) | ●<br>●               | ●      | 0.2         | 0.4         | V<br>V               |
| Output Short-Circuit Current | Sinking Current, $V_{OUT} = V_{CC}$<br>Sourcing Current $V_{OUT} = 0V$                                  | ●                    | ●      | -15         | -40         | 10<br>20<br>mA<br>mA |
| Output Leakage Current       | Shutdown (Note 3), $0V \leq V_{OUT} \leq V_{CC}$  | ●                    | ●      | 1           | 10          | $\mu A$              |

**DC ELECTRICAL CHARACTERISTICS** The ● denotes specifications which apply over the full operating temperature range.  $V_{CC} = 5V$ ,  $C1 = C2 = C3 = C4 = 0.1\mu F$ ,  $V_{ON/OFF} = V_{CC}$ , unless otherwise noted.

| PARAMETER                                 | CONDITIONS                      | MIN | TYP  | MAX | UNITS |
|---|---------------------------------|-----|------|-----|-------|
| <b>Power Supply Generator</b>             |                                 |     |      |     |       |
| V <sup>+</sup> Output Voltage             | $I_{OUT} = 0mA$                 |     | 8.0  |     | V     |
|   | $I_{OUT} = 8mA$                 |     | 7.5  |     | V     |
| V <sup>-</sup> Output Voltage             | $I_{OUT} = 0mA$                 |     | -8.0 |     | V     |
|   | $I_{OUT} = -8mA$                |     | -7.0 |     | V     |
| Supply Rise Time                          | Shutdown to Turn-On             |     | 0.2  |     | ms    |
| <b>Power Supply</b>                       |                                 |     |      |     |       |
| V <sub>CC</sub> Supply Current            | No Load (Note 2), 0°C to 70°C   | ●   | 0.22 | 0.5 | mA    |
|   | No Load (Note 2), -40°C to 85°C | ●   | 0.35 | 1.0 | mA    |
| Supply Leakage Current (V <sub>CC</sub> ) | Shutdown (Note 3)               | ●   | 0.2  | 10  | μA    |
| Digital Input Threshold Low               |                                 | ●   | 1.4  | 0.8 | V     |
| Digital Input 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 otherwise noted.

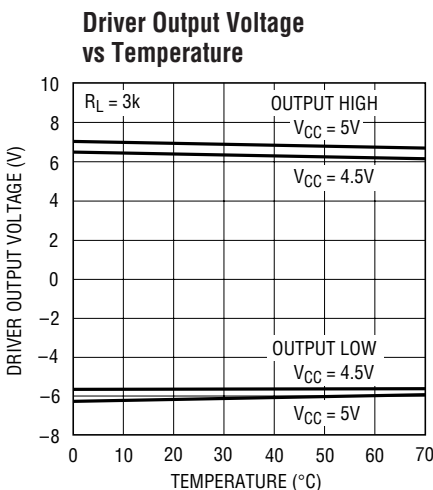
| PARAMETER                                 | CONDITIONS                  | MIN | TYP | MAX | UNITS |
|---|-----------------------------|-----|-----|-----|-------|
| Slew Rate                                 | $R_L = 3k$ , $C_L = 51pF$   |     | 8   | 30  | V/μS  |
|   | $R_L = 3k$ , $C_L = 2500pF$ | 3   | 5   |     | V/μS  |
| Driver Propagation Delay (TTL to RS232)   | $t_{HLD}$ (Figure 1)        | ●   | 2   | 3.5 | μS    |
|   | $t_{LHD}$ (Figure 1)        | ●   | 2   | 3.5 | μS    |
| Receiver Propagation Delay (RS232 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.

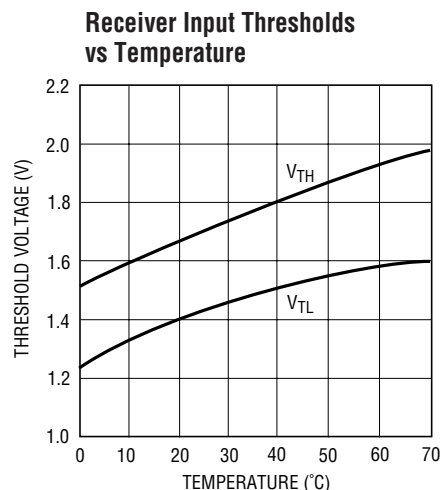
**Note 3:** Measurements made in the Shutdown mode are performed with  $V_{ON/OFF} = 0V$ .

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

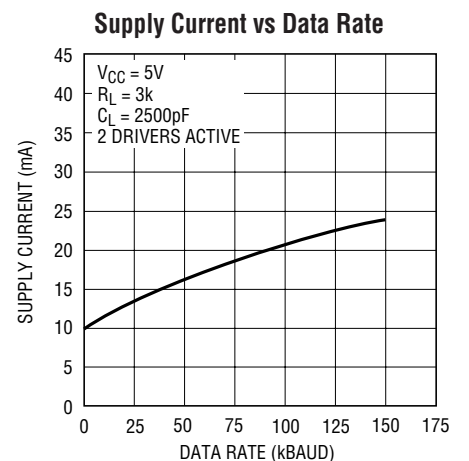
**TYPICAL PERFORMANCE CHARACTERISTICS**



LTC1382 • TPC01



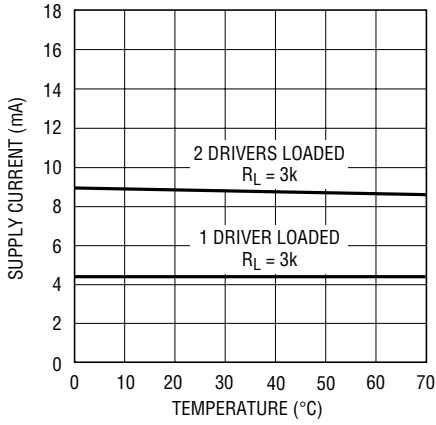
LTC1382 • TPC02



LTC1382 • TPC03

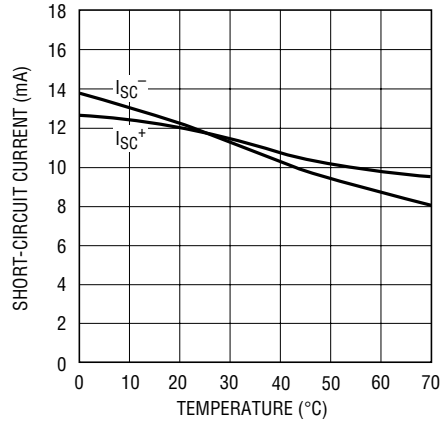
# TYPICAL PERFORMANCE CHARACTERISTICS

**V<sub>CC</sub> Supply Current vs Temperature**



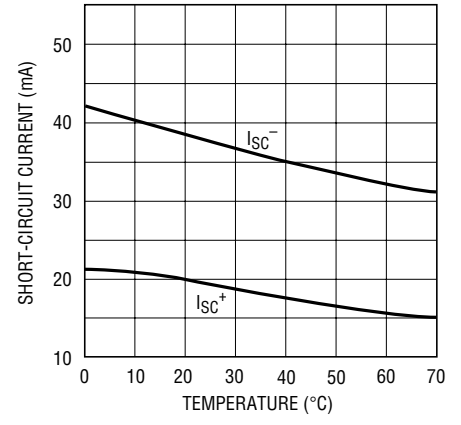
LTC1382 • TPC04

**Driver Short-Circuit Current vs Temperature**



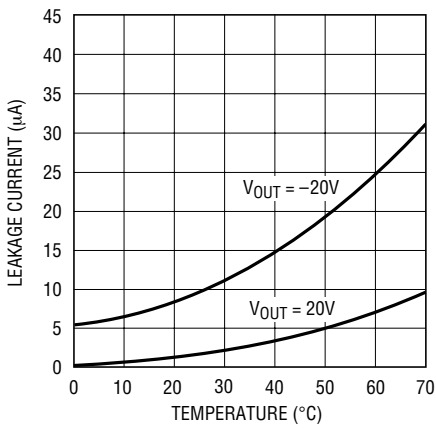
LTC1382 • TPC05

**Receiver Short-Circuit Current vs Temperature**



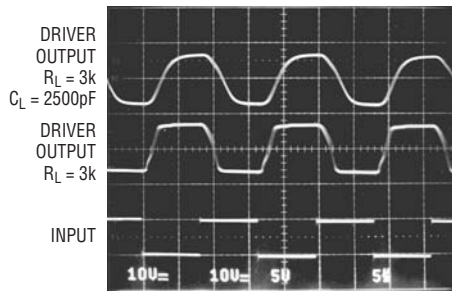
LTC1382 • TPC06

**Driver Leakage in Shutdown vs Temperature**



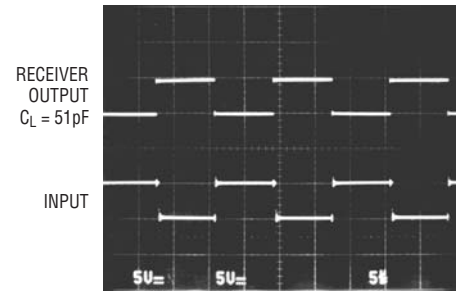
LTC1349 • TPC05

**Driver Output Waveforms**



LTC1382 • TPC08

**Receiver Output Waveforms**



LTC1382 • TPC09

## PIN FUNCTIONS

**V<sub>CC</sub>**: 5V Input Supply Pin. This pin should be decoupled with a 0.1μF ceramic capacitor.

**GND**: Ground Pin.

**ON/OFF**: TTL/CMOS Compatible Shutdown Pin. A logic low puts the device in the Shutdown mode. Both driver outputs are forced into three-state and the supply current is 0.2μA.

**V<sup>+</sup>**: Positive Supply Output (RS232 Drivers).  $V^+ \cong 2V_{CC} - 2V$ . 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 share a common capacitor. For large numbers of devices, increasing the size of the shared common storage capacitors is recommended to reduce ripple.

**V<sup>-</sup>**: Negative Supply Output (RS232 Drivers).  $V^- \cong -(2V_{CC} - 2V)$ . This pin requires an external capacitor  $C = 0.1\mu F$  for charge storage.

**C1<sup>+</sup>, C1<sup>-</sup>, C2<sup>+</sup>, C2<sup>-</sup>**: Commutating Capacitor Inputs. These pins require two external capacitors  $C = 0.1\mu F$ : one from C1<sup>+</sup> to C1<sup>-</sup> and another from C2<sup>+</sup> to C2<sup>-</sup>. 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. Outputs are in a high impedance state when in the Shutdown mode.

## SWITCHING TIME WAVEFORMS

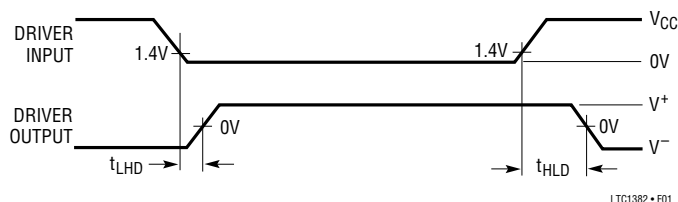


Figure 1. Driver Propagation Delay Timing

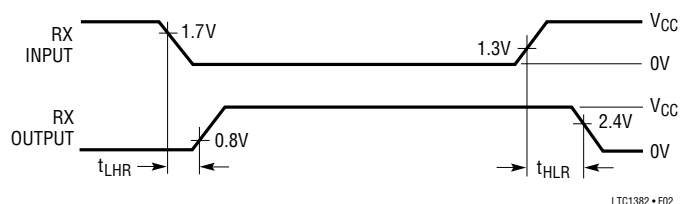
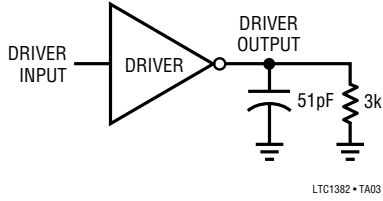


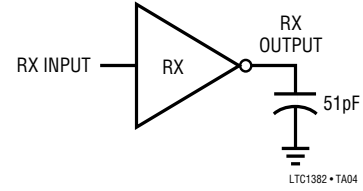
Figure 2. Receiver Propagation Delay Timing

## TEST CIRCUITS

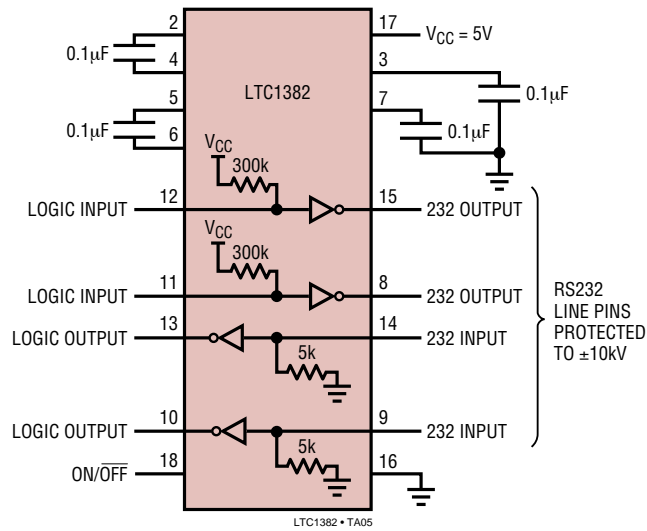
Driver Timing Test Load



Receiver Timing Test Load

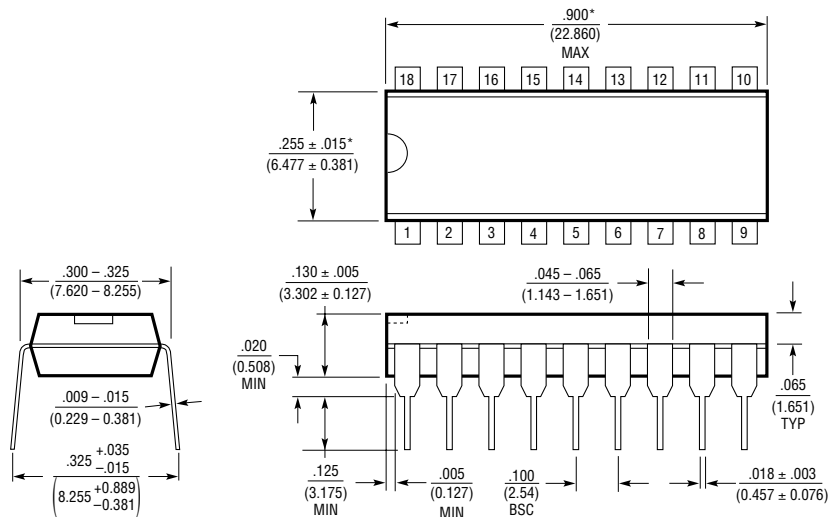


ESD Test Circuit



# PACKAGE DESCRIPTION

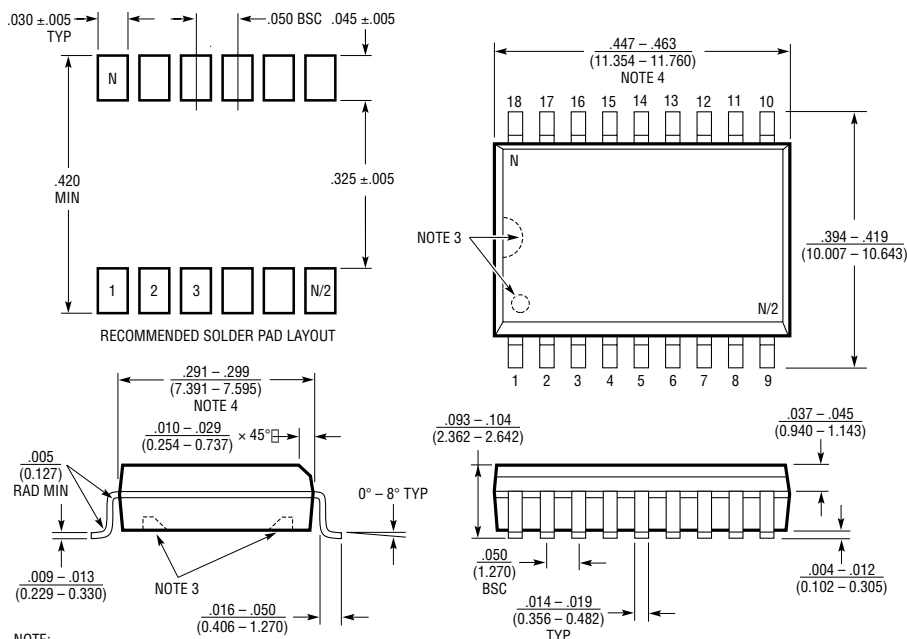
## N Package 18-Lead PDIP (Narrow .300 Inch) (Reference LTC DWG # 05-08-1510)



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

N18 0502

## SW Package 18-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)

S18 (WIDE) 0502

# LTC1382

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## RELATED PARTS

| PART NUMBER   | DESCRIPTION                                  | COMMENTS   |
|---------------|--|--|
| LT1780/LT1781 | 5V, 2 Driver, 2 Receiver RS232 Transceivers  | ±15kV ESD per IEC 1000-4                             |
| LTC1383       | 5V, 2 Driver, 2 Receiver RS232 Transceiver   | 220µA Supply Current, Narrow 16-pin SO               |
| LTC1384       | 5V, 2 Driver, 2 Receiver RS232 Transceiver   | 220µA Supply Current, 2 Receivers Active in Shutdown |
| LTC1385       | 3.3V, 2 Driver, 2 Receiver RS562 Transceiver | 220µA Supply Current, 2 Receivers Active in Shutdown |
| LTC1386       | 3.3V, 2 Driver, 2 Receiver RS562 Transceiver | 220µA Supply Current, Narrow 16-pin SO               |

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