

# 3.3V Low Power EIA/TIA562 Transceiver

## FEATURES

- Operates from a Single 3.3V Supply
- Low Supply Current:  $I_{CC} = 200\mu A$
- ESD Protection Over  $\pm 10kV$
- Available in 16-Pin SOIC Narrow Package
- Uses Small Capacitors:  $0.1\mu F$
- Operates to 120kbaud
- Output Overvoltage Does Not Force Current Back into Supplies
- EIA/TIA562 I/O Lines Can Be Forced to  $\pm 25V$  Without Damage
- Pin Compatible with LT1181A

## APPLICATIONS

- Notebook Computers
- Palmtop Computers

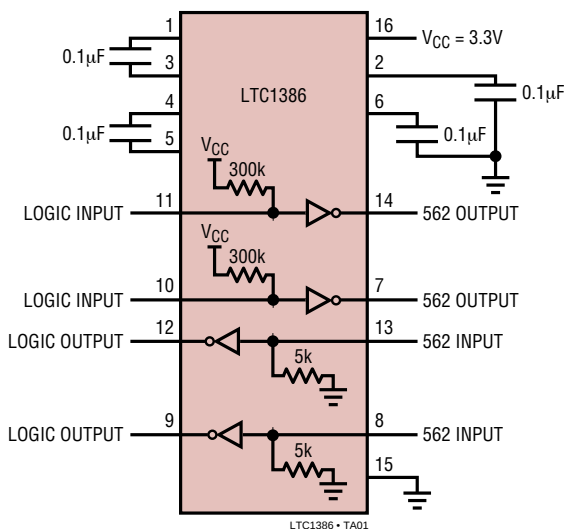
## DESCRIPTION

The LTC<sup>®</sup>1386 is an ultra-low power 2-driver/2-receiver EIA/TIA562 transceiver that operates from a single 3.3V supply. The charge pump requires only four space-saving  $0.1\mu F$  capacitors. The supply current ( $I_{CC}$ ) of the transceiver is only  $200\mu A$  with driver outputs unloaded.

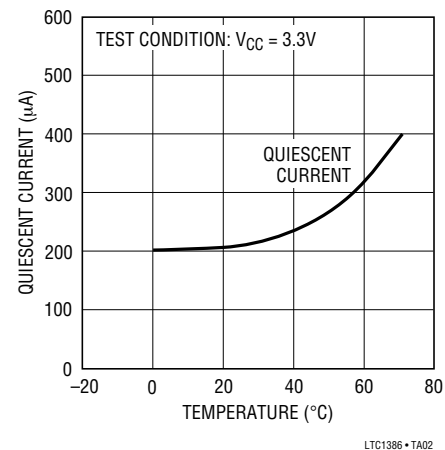
The LTC1386 is fully compliant with all data rate and overvoltage EIA/TIA562 specifications. The transceiver can operate up to 120kbaud with a  $1000pF$ ,  $3k\Omega$  load. Both driver outputs and receiver inputs can be forced to  $\pm 25V$  without damage and can survive multiple  $\pm 10kV$  ESD strikes.

 LTC and LT are registered trademarks of Linear Technology Corporation.

## TYPICAL APPLICATION



Quiescent 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 $25V$                  |
| 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          |                                  |
| LTC1386C                             | $0^{\circ}C$ to $70^{\circ}C$    |
| LTC1386I                             | $-40^{\circ}C$ 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

|                                                                                                                               |                        |
|-------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <p>S PACKAGE<br/>16-LEAD PLASTIC SO</p> <p><math>T_{JMAX} = 125^{\circ}C</math>, <math>\theta_{JA} = 95^{\circ}C/W</math></p> | ORDER PART NUMBER      |
|                                                                                                                               | LTC1386CS<br>LTC1386IS |

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 otherwise noted.

| PARAMETER                     | CONDITIONS                                            | MIN    | TYP  | MAX | UNITS      |
|-------------------------------|-------------------------------------------------------|--------|------|-----|------------|
| <b>Any Driver</b>             |                                                       |        |      |     |            |
| Output Voltage Swing          | 3k to GND                                             | ● 3.7  | 4.5  |     | V          |
|                               | Positive                                              | ● -3.7 | -4.5 |     | V          |
| Logic Input Voltage Level     | Input Low Level ( $V_{OUT} = \text{High}$ )           | ●      | 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   | $\mu A$    |
|                               | $V_{IN} = 0V$                                         | ●      | -20  | -40 | $\mu A$    |
| Output Short-Circuit Current  | $V_{OUT} = 0V$                                        | ±9     | ±10  |     | mA         |
| <b>Any Receiver</b>           |                                                       |        |      |     |            |
| 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              | $-10V \leq V_{IN} \leq 10V$                           |        | 3    | 5   | k $\Omega$ |
| Output Voltage                | Output Low, $I_{OUT} = -1.6mA$ ( $V_{CC} = 3.3V$ )    | ●      | 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, $V_{OUT} = V_{CC}$                   | -5     | -20  |     | mA         |
|                               | Sourcing Current, $V_{OUT} = GND$                     | 2      | 7    |     | mA         |
| <b>Power Supply Generator</b> |                                                       |        |      |     |            |
| $V^+$ 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          |
| <b>Power Supply</b>           |                                                       |        |      |     |            |
| $V_{CC}$ Supply Current       | No Load (Note 2), $0^{\circ}C$ to $70^{\circ}C$       | ●      | 0.2  | 0.5 | mA         |
|                               | No Load (Note 2), $-40^{\circ}C$ to $85^{\circ}C$     | ●      | 0.35 | 1.0 | mA         |

## AC CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range.  
 $V_{CC} = 3.3V$ ,  $C_1 = C_2 = C_3 = C_4 = 0.1\mu F$ , unless otherwise noted.

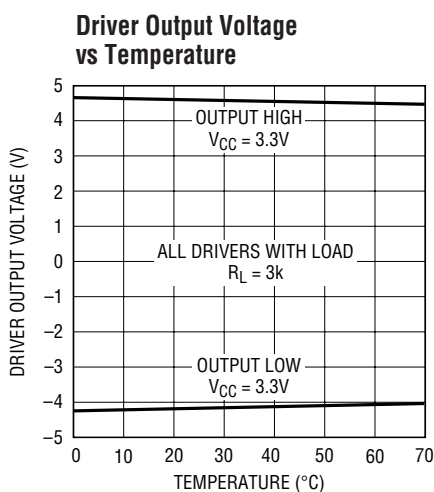
| PARAMETER                                         | CONDITIONS                                               | MIN    | TYP        | MAX        | UNITS                  |
|---------------------------------------------------|----------------------------------------------------------|--------|------------|------------|------------------------|
| Slew Rate                                         | $R_L = 3k$ , $C_L = 51pF$<br>$R_L = 3k$ , $C_L = 1000pF$ | 3      | 8<br>5     | 30         | $V/\mu s$<br>$V/\mu s$ |
| Driver Propagation Delay<br>(TTL to EIA/TIA562)   | $t_{HLD}$ (Figure 1)<br>$t_{LHD}$ (Figure 1)             | ●<br>● | 2<br>2     | 3.5<br>3.5 | $\mu s$<br>$\mu s$     |
| Receiver Propagation Delay<br>(EIA/TIA562 to TTL) | $t_{HLR}$ (Figure 2)<br>$t_{LHR}$ (Figure 2)             | ●<br>● | 0.3<br>0.3 | 0.8<br>0.8 | $\mu s$<br>$\mu s$     |

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

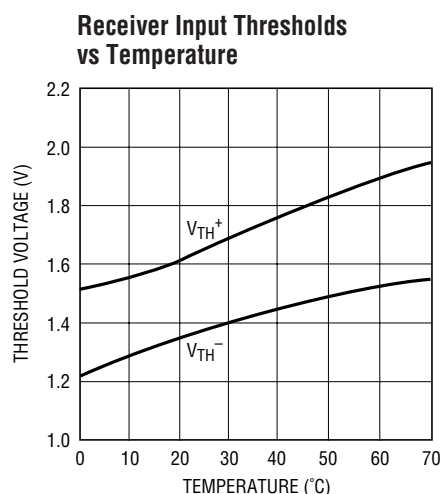
**Note 2:** Supply current is measured with driver and receiver outputs unloaded.

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

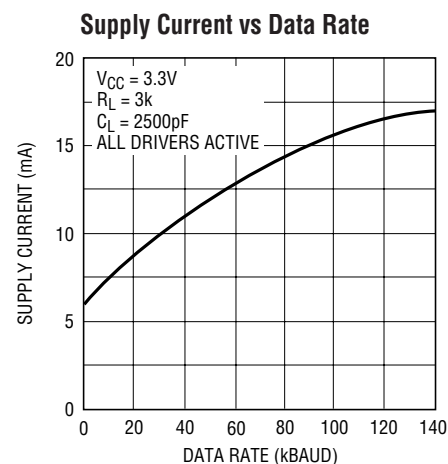
## TYPICAL PERFORMANCE CHARACTERISTICS



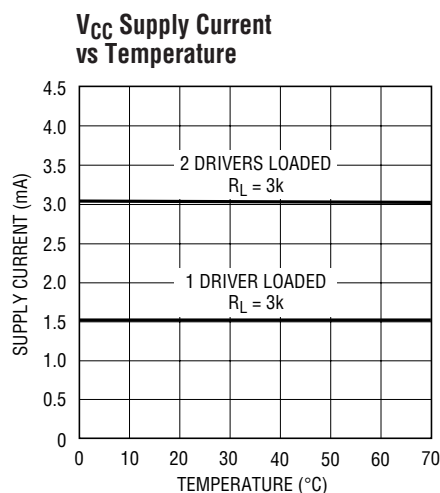
LTC1386 • TPC01



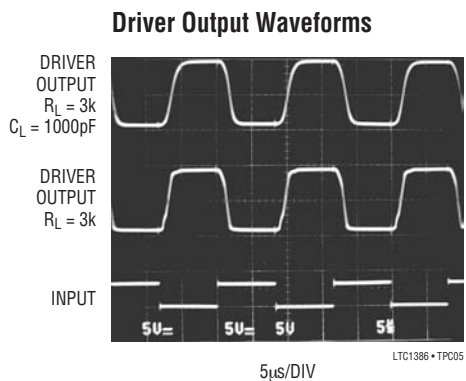
LTC1386 • TPC02



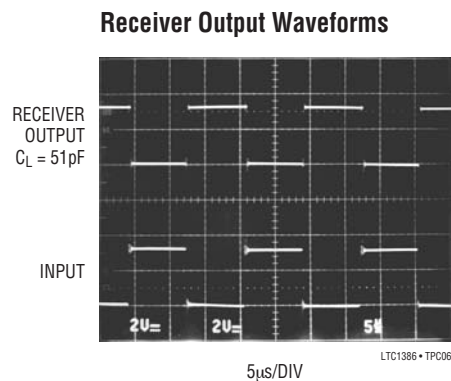
LTC1386 • TPC03



LTC1386 • TPC04



LTC1386 • TPC05



LTC1386 • TPC06

## PIN FUNCTIONS

**V<sub>CC</sub>**: 3.3V Input Supply Pin. This pin should be decoupled with a 0.1μF ceramic capacitor.

**GND**: Ground Pin.

**V<sup>+</sup>**: Positive Supply Output (EIA/TIA562 Drivers).  $V^+ \cong 2V_{CC} - 1V$ . 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 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).  $V^- \cong -(2V_{CC} - 1.3V)$ . 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**: EIA/TIA562 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.

**TR OUT**: Driver Outputs at EIA/TIA562 Voltage Levels. 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.

## SWITCHING TIME WAVEFORMS

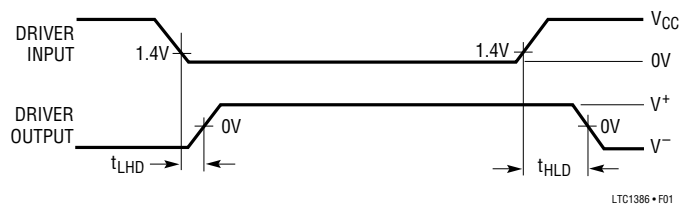


Figure 1. Driver Propagation Delay Timing

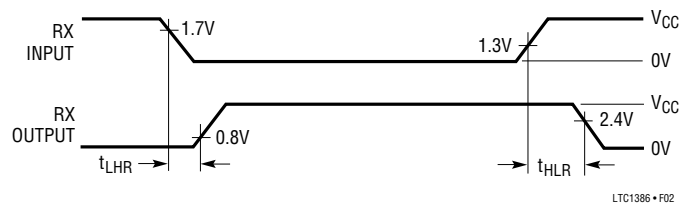
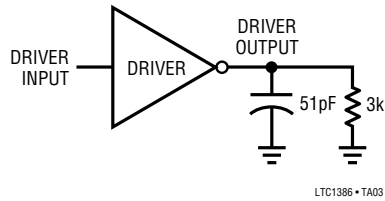


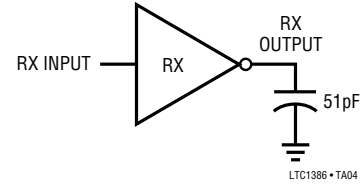
Figure 2. Receiver Propagation Delay Timing

## TEST CIRCUITS

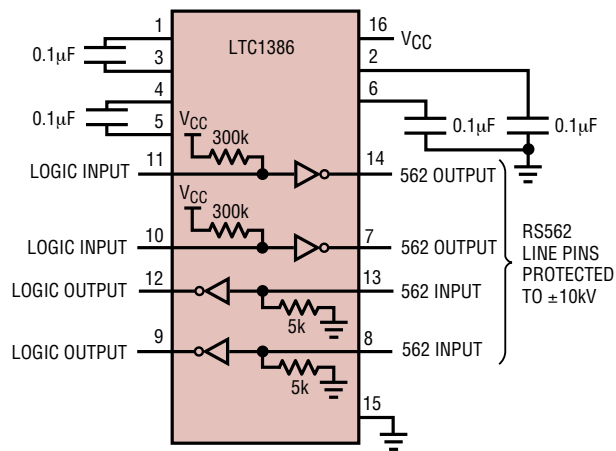
### Driver Timing Test Load



### Receiver Timing Test Load

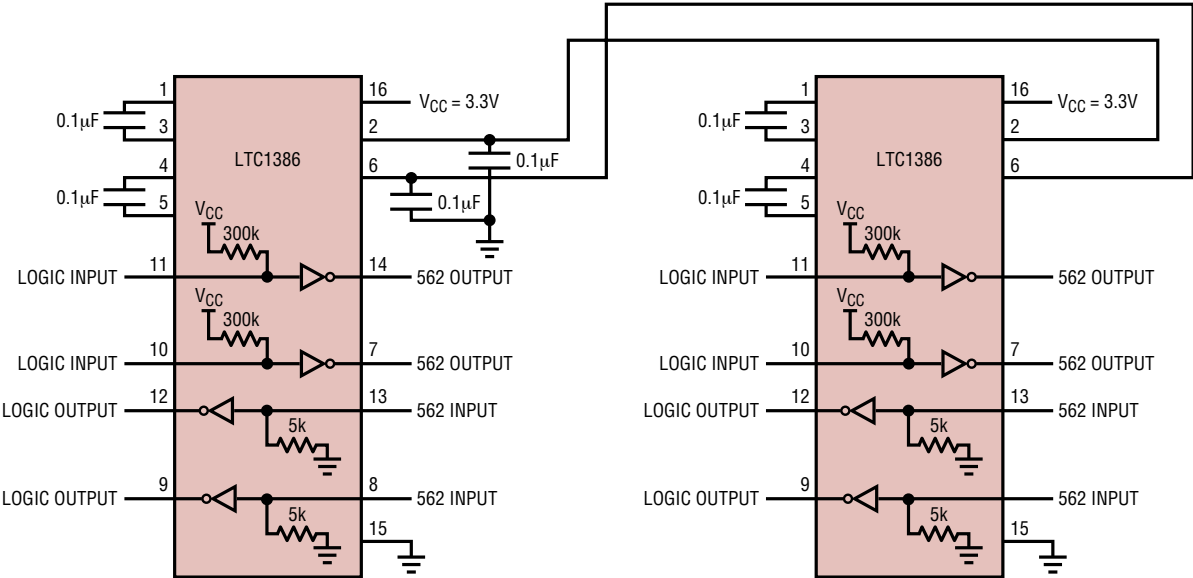


### ESD Test Circuit



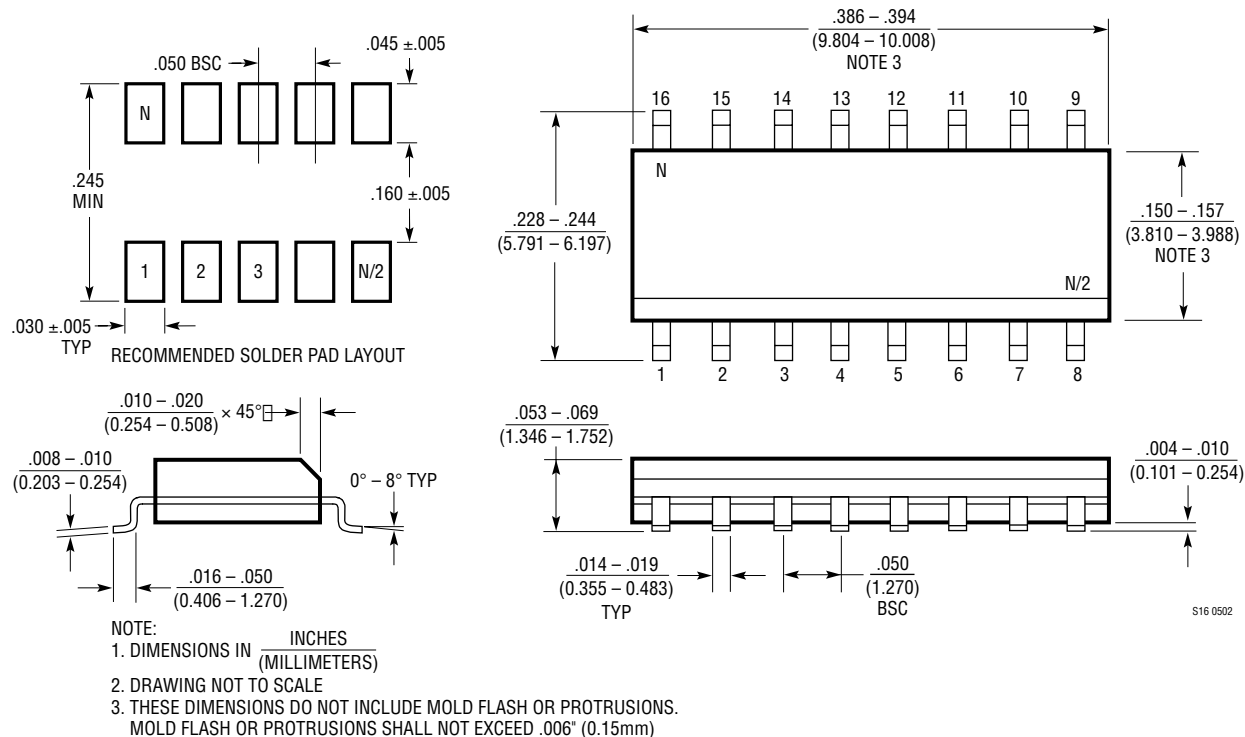
TYPICAL APPLICATIONS

Paralleling Power Supply Generator  
with Common Storage Capacitors



# PACKAGE DESCRIPTION

## S Package 16-Lead Plastic Small Outline (Narrow .150 Inch) (Reference LTC DWG # 05-08-1610)



S16 0502

**RELATED PARTS**

| PART NUMBER   | DESCRIPTION                                        | COMMENTS                                             |
|---------------|----------------------------------------------------|------------------------------------------------------|
| LT1780/LT1781 | 5V, 2 Driver, 2 Receiver RS232 Transceivers        | ±15kV ESD per IEC 1000-4                             |
| LTC1327       | 3.3V, 3 Driver, 5 Receiver RS562 Transceiver       | 300µA Supply Current, 0.2µA in Shutdown              |
| LTC1348       | 3.3V to 5V, 3 Driver, 5 Receiver RS232 Transceiver | True RS232 on 3.3V, 5 Receivers Active in Shutdown   |
| LTC1382       | 5V, 2 Driver, 2 Receiver RS232 Transceiver         | 220µA Supply Current, 0.2µA in Shutdown              |
| 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 |