# 3.3V Low Power EIA/TIA562 Transceiver

## FEATURES

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

## APPLICATIONS

- Notebook Computers
- Palmtop Computers

## DESCRIPTION

The LTC®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 0.1μF capacitors. The supply current ($I_{CC}$) of the transceiver is only 200μA 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, 3kΩ load. Both driver outputs and receiver inputs can be forced to ±25V without damage and can survive multiple ±10kV ESD strikes.

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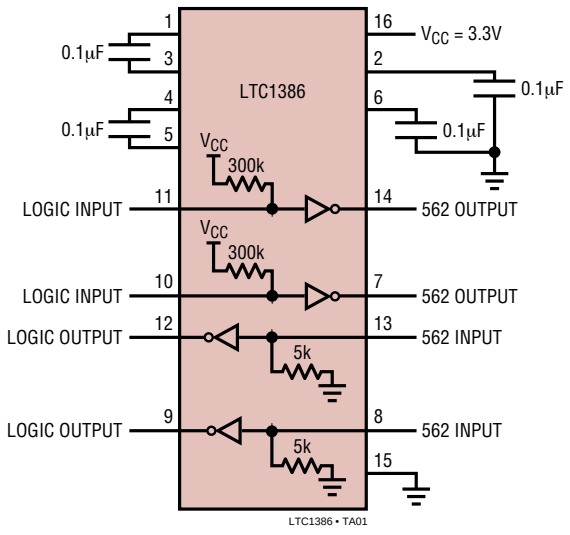
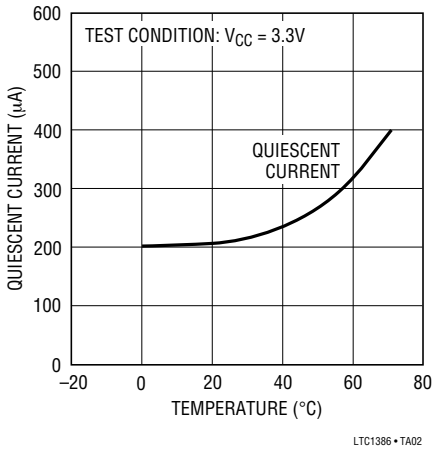
## TYPICAL APPLICATION



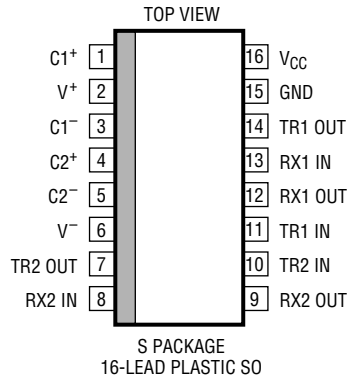

**Quiescent Supply Current vs Temperature**



## 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°C to 70°C
  LTC1386I ..... $-40°C$ to 85°C
Storage Temperature Range ..... $-65°C$ to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

## PACKAGE/ORDER INFORMATION




S PACKAGE
16-LEAD PLASTIC SO

$T_{JMAX} = 125°C$, $\theta_{JA} = 95°C/W$

| ORDER PART NUMBER |
|---|
| LTC1386CS |
| 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 = 0.1µF, unless otherwise noted.**

| PARAMETER | CONDITIONS | | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| **Any Driver** | | | | | | | |
| Output Voltage Swing | 3k to GND | Positive | ● | 3.7 | 4.5 | | V |
| | | Negative | ● | –3.7 | –4.5 | | 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 | | | ±9 | ±10 | | mA |
| **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, $I_{OUT} = -1.6mA$ ($V_{CC}$ = 3.3V) | | ● | | 0.2 | 0.4 | V |
| | Output High, $I_{OUT} = 160µA$ ($V_{CC}$ = 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 |
| **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 |
| **Power Supply** | | | | | | | |
| $V_{CC}$ Supply Current | No Load (Note 2), 0°C to 70°C | | ● | | 0.2 | 0.5 | mA |
| | No Load (Note 2), –40°C to 85°C | | ● | | 0.35 | 1.0 | mA |

## AC CHARACTERISTICS

**The ● denotes specifications which apply over the full operating temperature range.**
**$V_{CC}$ = 3.3V, C1 = C2 = C3 = C4 = 0.1µF, unless otherwise noted.**

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

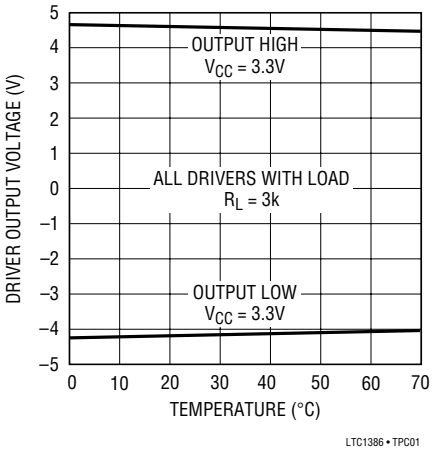
**Note 1:** Absolute Maximum Ratings are those values beyond which the life of the device may be impaired.

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

**Note 3:** 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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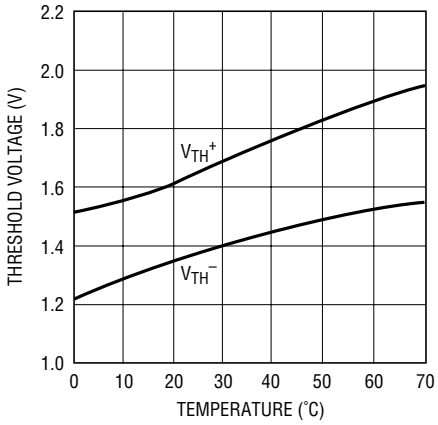
**Receiver Input Thresholds vs Temperature**

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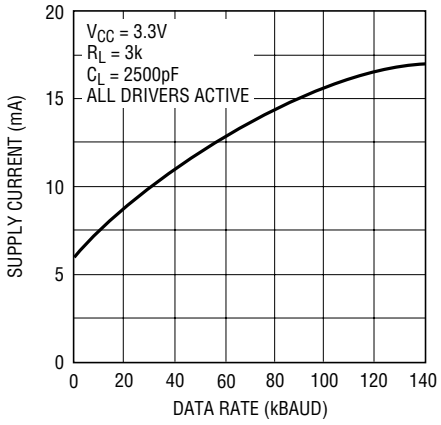
**Supply Current vs Data Rate**

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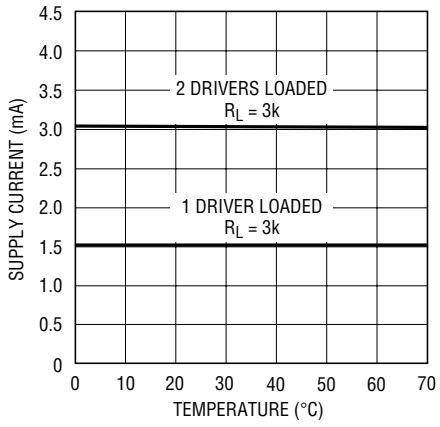
**$V_{CC}$ Supply Current vs Temperature**

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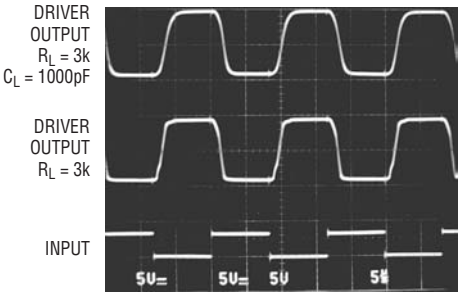
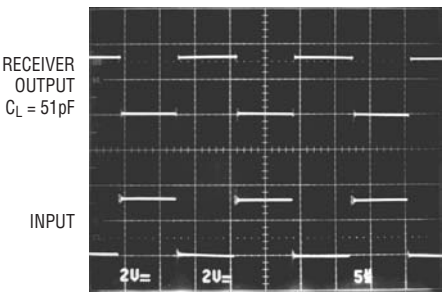
**Driver Output Waveforms**




LTC1386 • TPC05

5µs/DIV

**Receiver Output Waveforms**




LTC1386 • TPC06

5µs/DIV

## PIN FUNCTIONS

**$V_{CC}$:** 3.3V Input Supply Pin. This pin should be decoupled with a 0.1μF ceramic capacitor.

**GND:** Ground Pin.

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

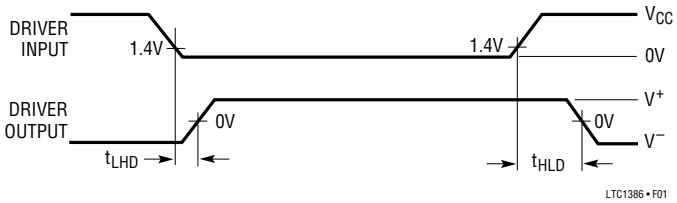



**Figure 1. Driver Propagation Delay Timing**

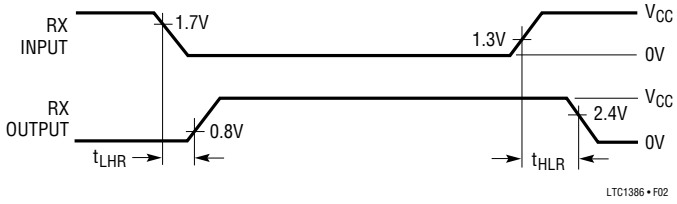
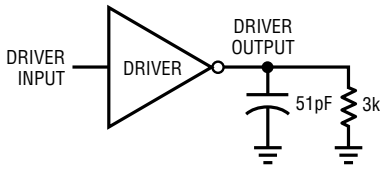



**Figure 2. Receiver Propagation Delay Timing**

# TEST CIRCUITS

### Driver Timing Test Load

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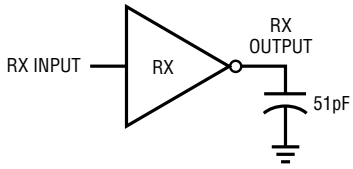
### Receiver Timing Test Load

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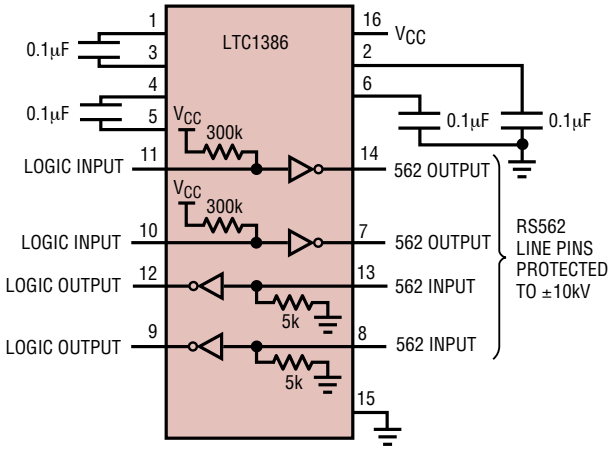
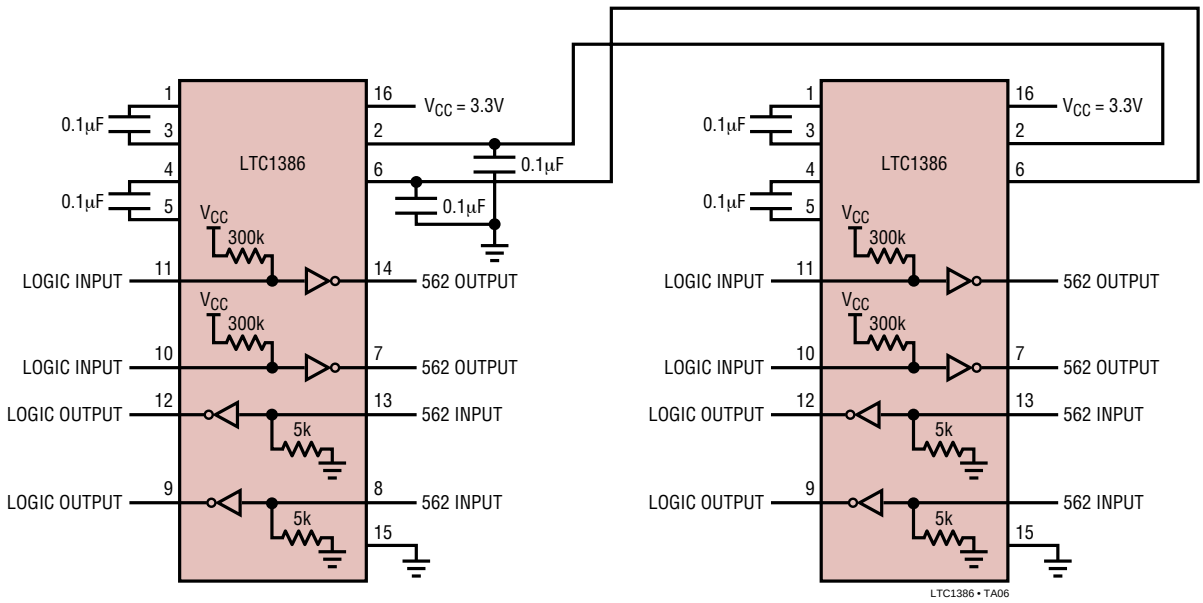
### ESD Test Circuit




1386 TA05

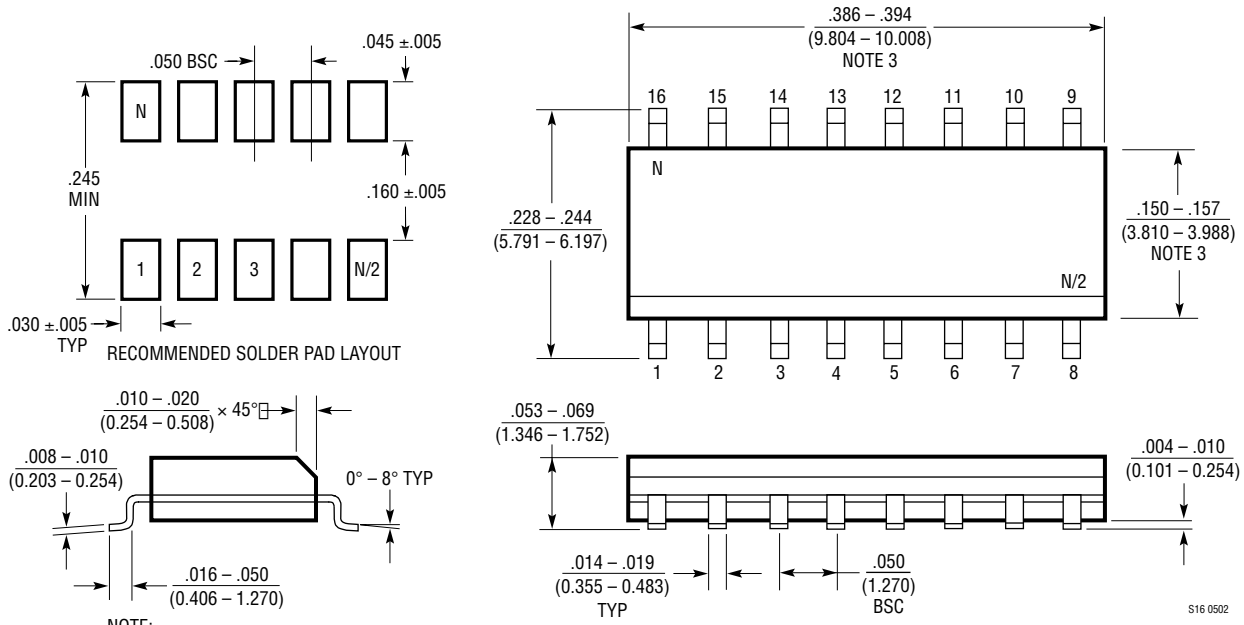
## TYPICAL APPLICATIONS

**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)




NOTE:
1. DIMENSIONS IN $\frac{\text{INCHES}}{(\text{MILLIMETERS})}$
2. DRAWING NOT TO SCALE
3. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
   MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .006" (0.15mm)



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## RELATED PARTS

| PART NUMBER | DESCRIPTION | COMMENTS |
|---|---|---|
| LT1780/LT1781 | 5V, 2 Driver, 2 Receiver RS232 Transeivers | ±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 |



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