

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

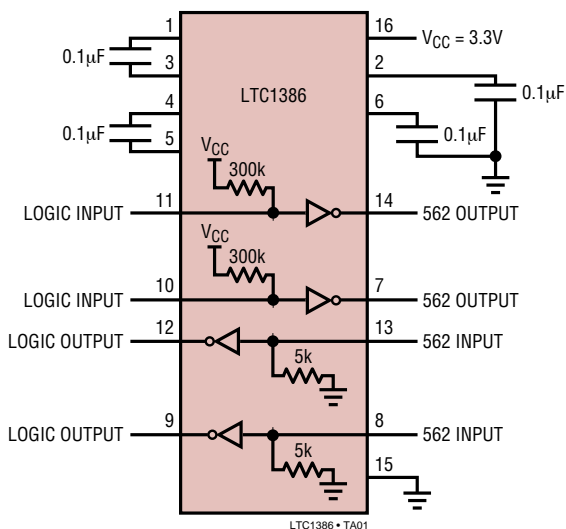
DESCRIPTION

The LTC[®]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.

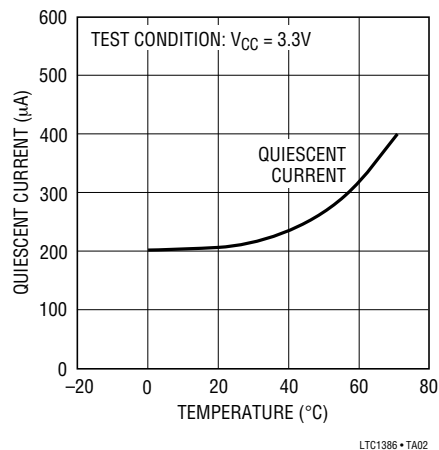
The LTC1386 is fully compliant with all data rate and overvoltage EIA/TIA562 specifications. The transceiver can operate up to 120kbaud with a $1000pF$, $3k\Omega$ load. Both driver outputs and receiver inputs can be forced to $\pm 25V$ without damage and can survive multiple $\pm 10kV$ ESD strikes.

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TYPICAL APPLICATION



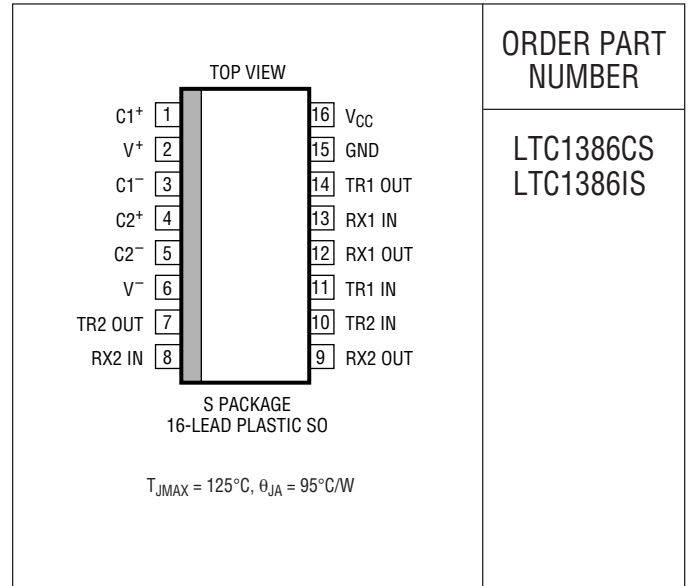
Quiescent Supply Current vs Temperature



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



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	
Any Driver						
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	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	$-10V \leq V_{IN} \leq 10V$		3	5	7	k Ω
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
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	

1386fa

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.

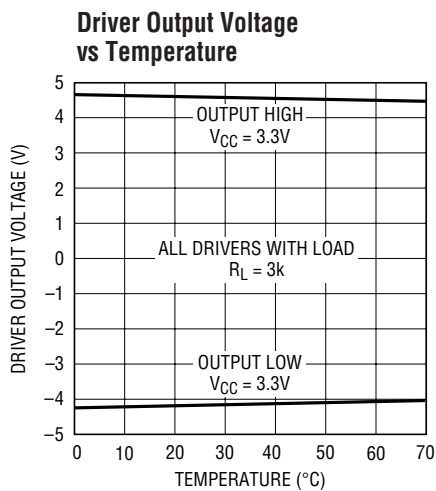
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Slew Rate	$R_L = 3k$, $C_L = 51pF$		8	30	$V/\mu S$
	$R_L = 3k$, $C_L = 1000pF$	3	5		$V/\mu S$
Driver Propagation Delay (TTL to EIA/TIA562)	t_{HLD} (Figure 1)	●	2	3.5	μS
	t_{LHD} (Figure 1)	●	2	3.5	μS
Receiver Propagation Delay (EIA/TIA562 to TTL)	t_{HLR} (Figure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

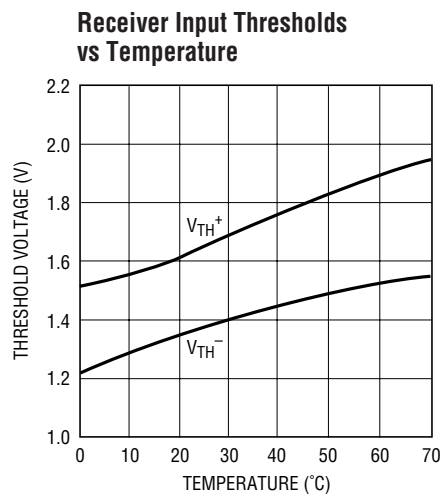
Note 3: Measurements made in the shutdown mode are performed with $V_{ON/OFF} = 0V$.

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

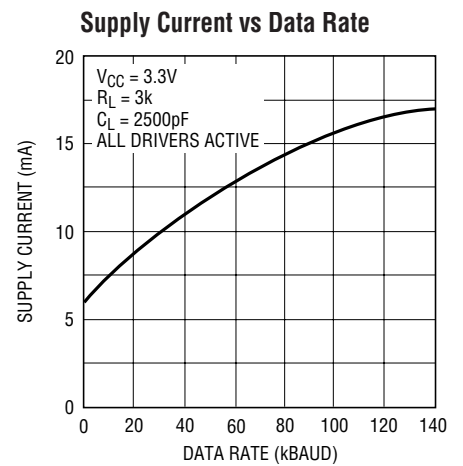
TYPICAL PERFORMANCE CHARACTERISTICS



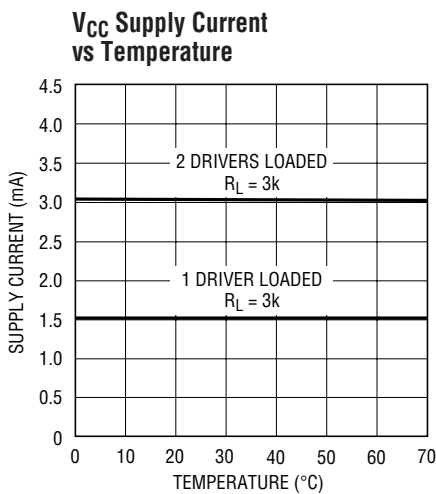
LTC1386 • TPC01



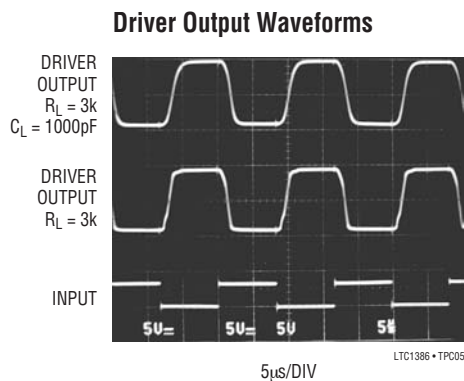
LTC1386 • TPC02



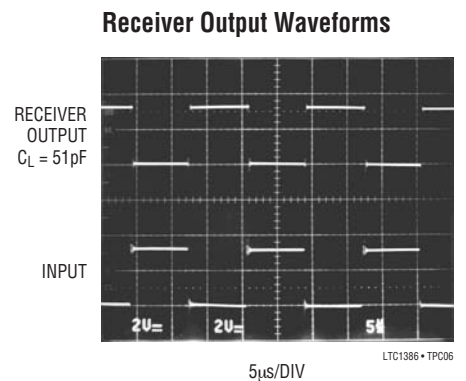
LTC1386 • TPC03



LTC1386 • TPC04



LTC1386 • TPC05



LTC1386 • TPC06

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 $C = 0.1\mu F$ 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⁻: 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⁺, 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 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

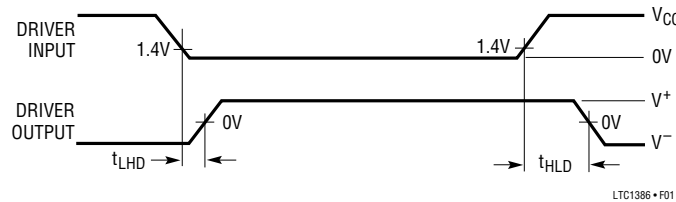


Figure 1. Driver Propagation Delay Timing

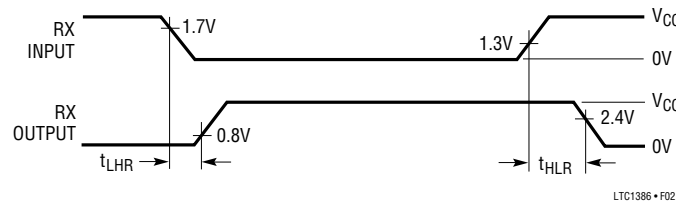
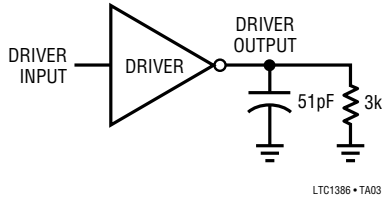


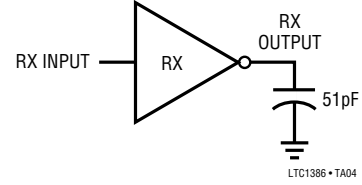
Figure 2. Receiver Propagation Delay Timing

TEST CIRCUITS

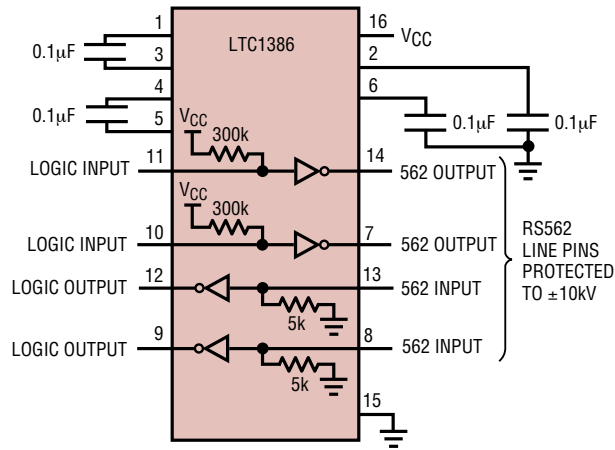
Driver Timing Test Load



Receiver Timing Test Load

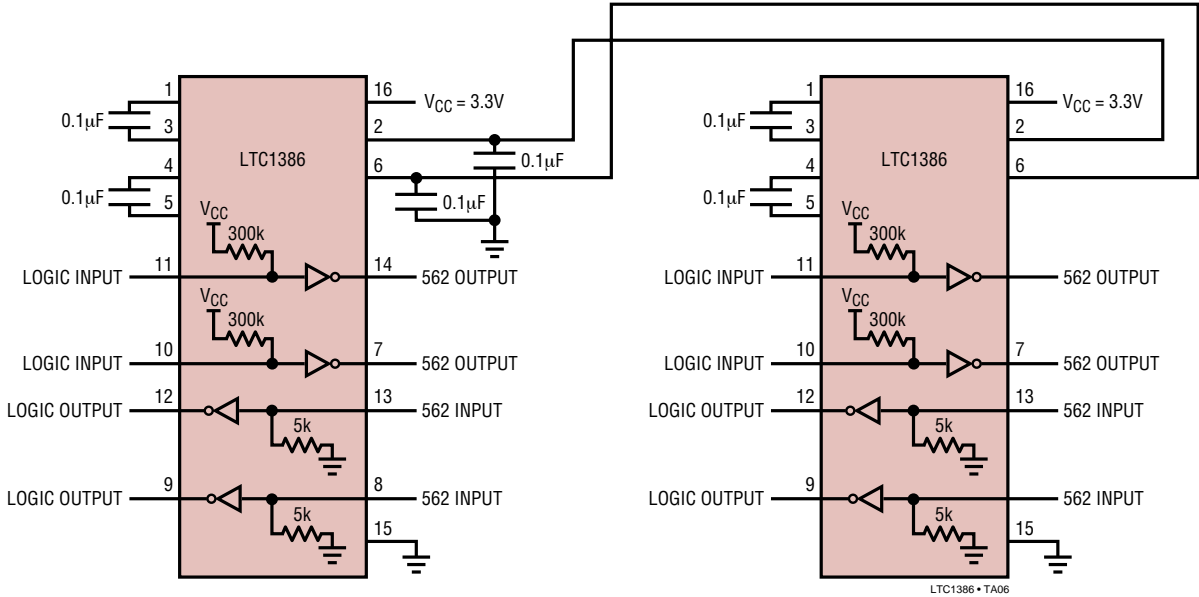


ESD Test Circuit



TYPICAL APPLICATIONS

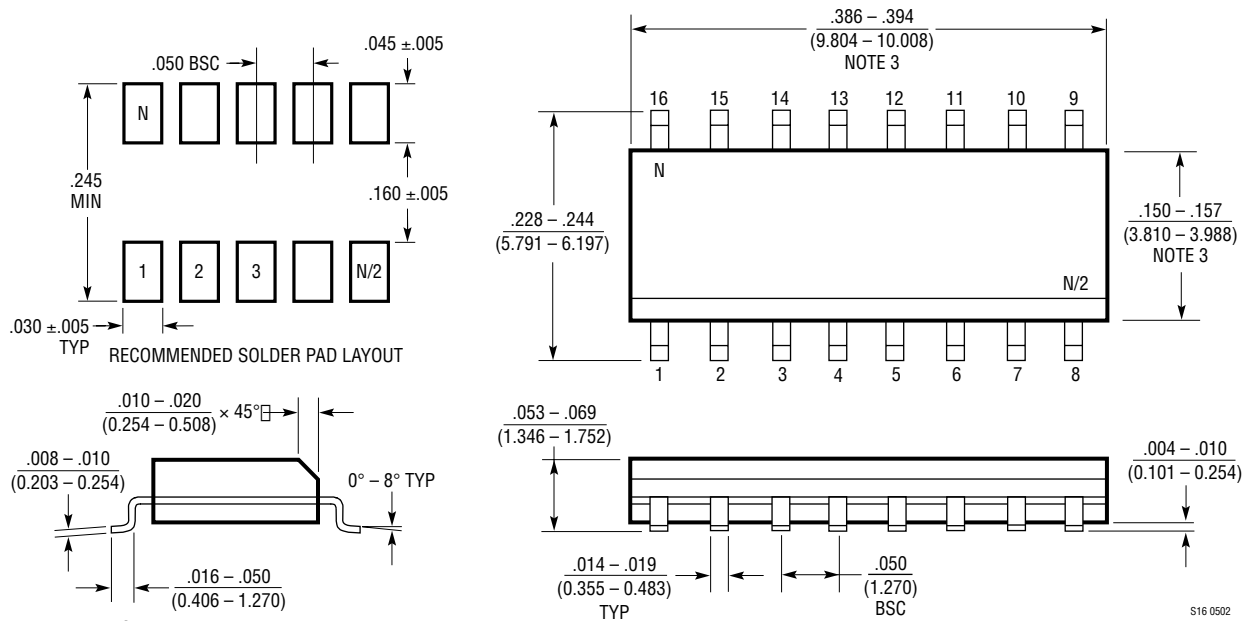
Paralleling Power Supply Generator with Common Storage Capacitors



LTC1386 • TA06

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)

S16 0502

LTC1386

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