3.3V/5V Low Power RS232 3-Driver/5-Receiver Transceiver

FEATURES

- **Low Supply Current: 600μA at 3.3V**
- **Supply Current in Shutdown: 0.2μA**
- **Supply Current in Receiver Alive Mode: 15μA**
- **ESD Protection over ±10kV**
- **Operates from a Single 3V to 5.5V Supply**
- Operates to 120kBaud with 0.1μF Flying Capacitors
- Three-State Outputs Are High Impedance When Off
- Output Overvoltage Does Not Force Current Back into Supplies
- RS232 I/O Lines Can Be Forced to ±25V Without Damage
- Flowthrough Architecture

APPLICATIONS

- Notebook Computers
- Palmtop Computers
- Printers
- Portable Instruments

DESCRIPTION

The LTC®1348 is a 3-driver/5-receiver RS232 transceiver with very low supply current. The charge pump only requires five 0.1μF capacitors. The LTC1348 provides full RS232 output levels when operated over a wide supply range of 3V to 5.5V

The transceiver operates in one of four modes: Normal, Receiver Disable, Receiver Alive and Shutdown. In Normal or Receiver Disable mode, I_{CC} is only 600μA at 3.3V and 800μA at 5V in the no load condition. In Shutdown mode, the supply current is further reduced to 0.2μA. In Receiver Alive mode, all five receivers are kept alive and the supply current is 15μA. All RS232 outputs assume a high impedance state in Shutdown or Receiver Alive mode or with the power off. The receiver outputs assume a high impedance state in Receiver Disable or with the power off.

The LTC1348 is fully compliant with all data rate and overvoltage RS232 specifications. The transceiver operates up to 120kbaud with all drivers loaded with 1000pF, 3kΩ. Both driver outputs and receiver inputs can be forced to ±25V without damage and can survive multiple ±10kV ESD strikes.

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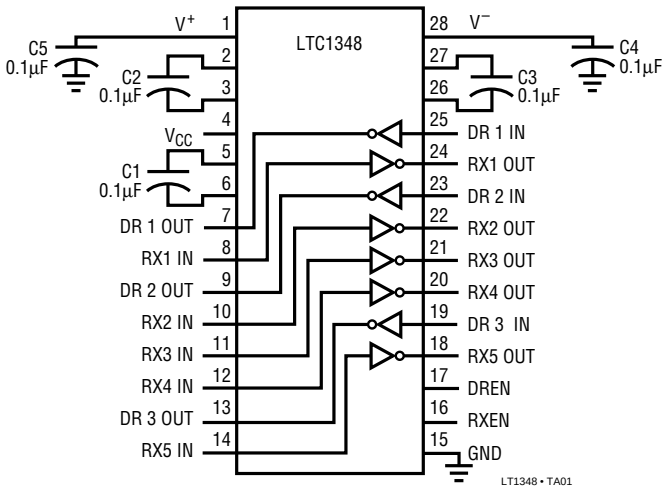
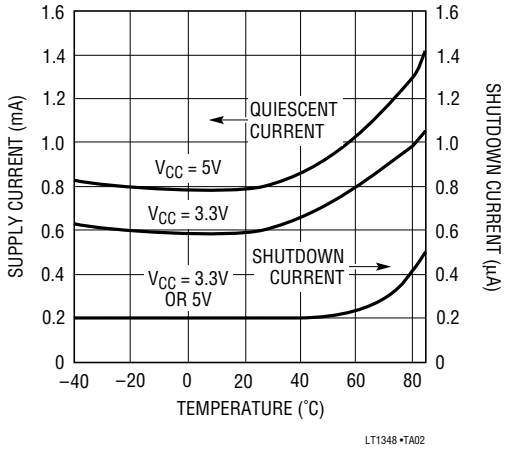
TYPICAL APPLICATION

3-Drivers/5-Receivers with Shutdown



Supply Current

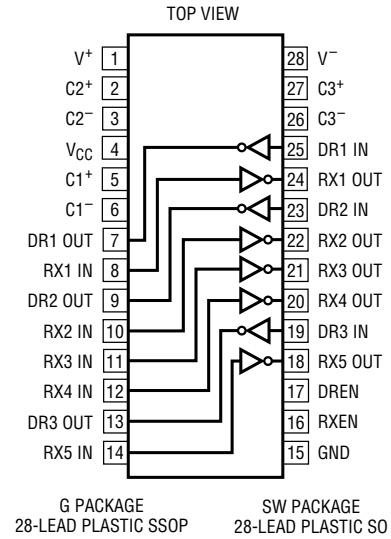


ABSOLUTE MAXIMUM RATINGS

(Note 1)

Supply Voltage (V_{CC}) 6V
Input Voltage
  Driver ..... –0.3V to V_{CC} + 0.3V
  Receiver ..... –25V to 25V
  Driver/Receiver Enable Pin ..... –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
  LTC1348C ..... 0°C to 70°C
  LTC1348I ..... –40°C to 85°C
Storage Temperature Range ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

PACKAGE/ORDER INFORMATION



G PACKAGE
28-LEAD PLASTIC SSOP

SW PACKAGE
28-LEAD PLASTIC SO

T_{JMAX} = 125°C, θ_{JA} = 96°C/W (G)
T_{JMAX} = 125°C, θ_{JA} = 85°C/W (SW)

ORDER PART NUMBER

LTC1348CG
LTC1348CSW
LTC1348IG
LTC1348ISW

Consult factory for Military grade parts.

DC ELECTRICAL CHARACTERISTICS

V_{CC} = 3V to 5.5V, C1 to C4 = 0.1μF, unless otherwise noted.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Any Driver						
Output Voltage Swing	V_{CC} = 3.3V, 3k to GND Positive	●	5.0	6.2		V
	Negative	●	–5.0	–6.0		V
Logic Input Voltage Level	Input Low Level (V_{OUT} = High)	●			0.8	V
	Input High Level (V_{OUT} = Low), V_{CC} = 3.3V	●	2.0			V
	Input High Level (V_{OUT} = Low), V_{CC} = 5V	●	2.4			V
Logic Input Current	V_{IN} = V_{CC}	●			5	μA
	V_{IN} = 0V	●		–5	–35	μA
Output Short-Circuit Current	V_{OUT} = 0V			±12		mA
Output Leakage Current	Shutdown (Note 3) or Receiver Alive Mode (Note 4), V_{OUT} = ±20V	●		±10	±500	μA
Any Receiver						
Input Voltage Thresholds	Input Threshold (Receiver Alive Mode)		0.8	1.5	2.4	V
	Input Low Threshold (Normal Mode)		0.8	1.3		V
	Input High Threshold (Normal Mode)			1.7	2.4	V
Hysteresis	Normal Mode			0.3		V
Input Resistance	V_{IN} = ±10V		3	5	7	kΩ
Output Voltage	Output Low, I_{OUT} = –1.6mA	●		0.2	0.4	V
	Output High, I_{OUT} = 160μA	●	V_{CC} – 0.6V			V
Output Short-Circuit Current	Sinking Current, V_{OUT} = V_{CC}		–3	–20		mA
Output Leakage Current	Shutdown (Note 3), 0V ≤ V_{OUT} ≤ V_{CC}	●		1	10	μA

DC ELECTRICAL CHARACTERISTICS

V_{CC} = 3V to 5.5V, C1 to C4 = 0.1μF, unless otherwise noted.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Power Supply Generator						
V^+ Output Voltage	I_{OUT} = 0mA			8.0		V
	I_{OUT} = 8mA			7.5		V
V^- Output Voltage	I_{OUT} = 0mA			–8.0		V
	I_{OUT} = –8mA			–7.0		V
Supply Rise Time	Shutdown to Turn-On			0.2		ms
Power Supply						
V_{CC} Supply Current	No Load (Note 2) V_{CC} = 3.3V	●		0.6	2.0	mA
	No Load (Note 2) V_{CC} = 5V	●		0.8	2.5	mA
	Receiver Alive Mode (Note 4) V_{CC} = 3.3V or 5V	●		15	30	μA
Supply Leakage Current (V_{CC})	Shutdown (Note 3)	●		0.2	10	μA
Driver/Receiver Enable Threshold Low		●			0.8	V
Driver/Receiver Enable Threshold High	V_{CC} = 3.3V	●	2.0			V
Driver/Receiver Enable Threshold High	V_{CC} = 5V	●	2.4			V

AC ELECTRICAL CHARACTERISTICS

V_{CC} = 3V to 5.5V, C1 to C4 = 0.1μF, unless otherwise noted.

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Maximum Data Rate	R_L = 3k, C_L = 1000pF, One Driver Switching		120	250		kbps
Slew Rate	V_{CC} = 5V, R_L = 3k, C_L = 51pF			8	30	V/μs
	V_{CC} = 3.3V, R_L = 3k, C_L = 2500pF		3			V/μs
Driver Propagation Delay (TTL to RS232)	t_{HLD} (Figure 1)	●		2.5	4	μs
	t_{LHD} (Figure 1)	●		2.5	4	μs
Receiver Propagation Delay (RS232 to TTL)	t_{HLR} (Figure 2) (Normal Mode)	●		0.3	1	μs
	t_{LHR} (Figure 2) (Normal Mode)	●		0.2	1	μs
	t_{HLR} (Figure 2) (Receiver Alive Mode)	●		1.0	4	μs
	t_{LHR} (Figure 2) (Receiver Alive Mode)	●		0.2	4	μs

The ● denotes specifications which apply over the full operating temperature range (0°C ≤ T_A ≤ 70°C for Commercial grade and –40°C ≤ T_A ≤ 85°C for Industrial grade).

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

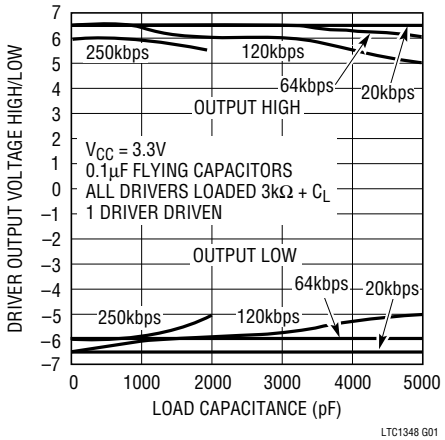
Note 2: Supply current is measured with driver and receiver outputs unloaded. The V_{DREN} and V_{RXEN} = V_{CC}.

Note 3: Supply current measurement in Shutdown is performed with V_{DREN} and V_{RXEN} = 0V.

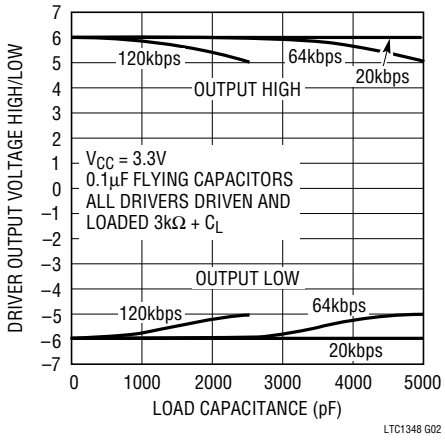
Note 4: Supply current measurement in Receiver Alive mode is performed with V_{DREN} = 0V and V_{RXEN} = V_{CC}.

TYPICAL PERFORMANCE CHARACTERISTICS

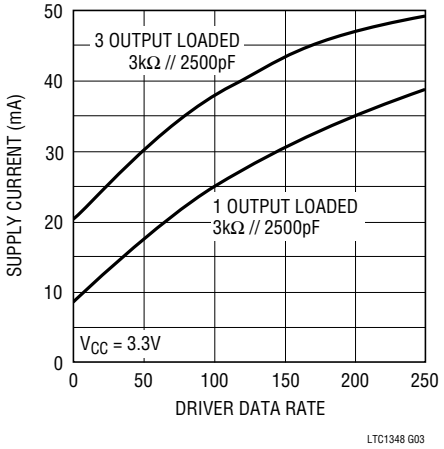
Driver Output Voltage High/Low vs Load Capacitance (C_L)



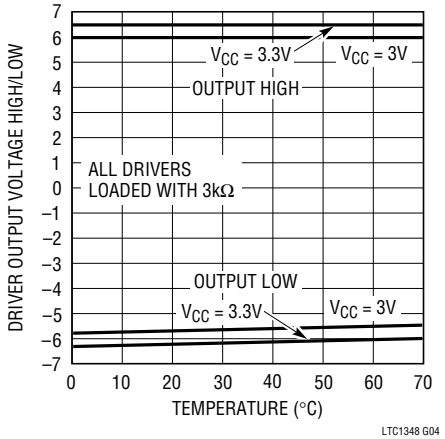
Driver Output Voltage High/Low vs Load Capacitance (C_L)



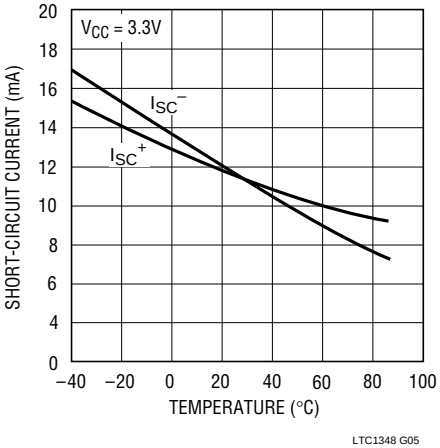
Supply Current vs Driver Data Rate



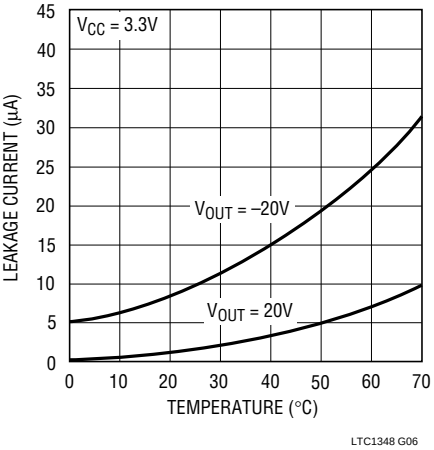
Driver Output Voltage High/Low vs Temperature (°C)



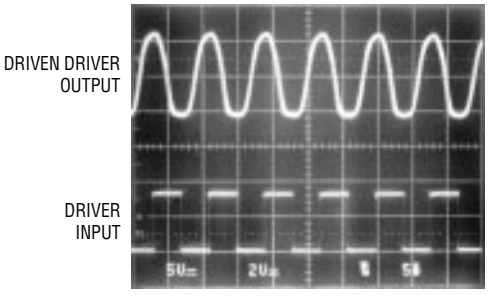
Driver Short-Circuit Current vs Temperature (°C)



Driver Leakage in SHUTDOWN vs Temperature (°C)



With V_{CC} = 3.3V
All Driver Outputs Loaded with 3kΩ, 1000pF. 1 Driven at 250kbps



PIN FUNCTIONS

V_{CC}: 3V to 5.5V Input Supply Pin. This pin should be decoupled with a 0.1μF ceramic capacitor.

GND: Ground Pin.

RXEN: TTL/CMOS Compatible Enable Pin. Refer to Table 1 for its functional description.

DREN: TTL/CMOS Compatible Enable Pin. Refer to Table 1 for its functional description.

V^+: Positive Supply Output (RS232 Drivers). 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 be paralleled into common capacitors. 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). This pin requires an external capacitor C = 0.1μF for charge storage.

$C1^+$, $C1^-$, $C2^+$, $C2^-$, $C3^+$, $C3^-$: Commutating Capacitor Inputs. These pins require three external capacitors C = 0.1μF: one from $C1^+$ to $C1^-$, another from $C2^+$ to $C2^-$ and another from $C3^+$ to $C3^-$. To maintain charge pump efficiency, the capacitor's effective series resistance should be less than 1Ω. Ceramic capacitors are recommended.

DR 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 or Receiver Alive mode.

DR OUT: Driver Outputs at RS232 Voltage Levels. Outputs are in a high impedance state when in the Shutdown, Receiver Alive mode 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. In Receiver Alive mode all receivers have no hysteresis.

RX OUT: Receiver Outputs with TTL/CMOS Voltage Levels. Outputs are in a high impedance state when in the Shutdown or Receiver Disable mode to allow data line sharing.

Table 1. Functional Description

MODE	RX ENABLE	DR ENABLE	DRIVERS	RECEIVERS	I_{CC} TYP
Shutdown	0	0	All Drivers Shutdown. All Driver Outputs Assume High Impedance. All Driver Pull-Up Resistors Disconnect From V_{CC}.	All Receivers Shutdown. All Receiver Outputs Assume High Impedance.	0.2μA
Receiver Disable	0	1	All Drivers Alive.	All Receiver Outputs in Three-State.	600μA at 3.3V, 800μA at 5V
Receiver Alive	1	0	All Drivers Shutdown. All Driver Outputs in Three-State. All Driver Pull-Up Resistors Disconnect From V_{CC}.	All Receivers Alive.	15μA
Normal	1	1	All Drivers Alive.	All Receivers Alive.	600μA at 3.3V, 800μA at 5V

SWITCHING TIME WAVEFORMS

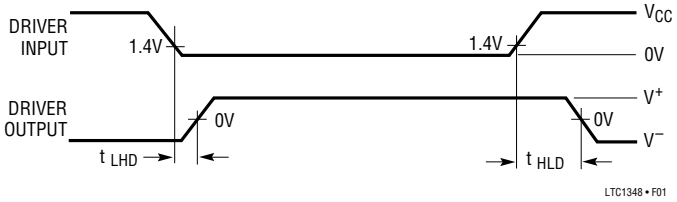


Figure 1. Driver Propagation Delay Timing

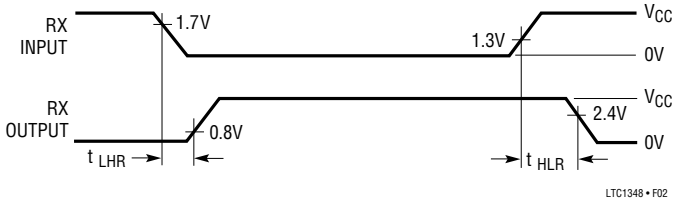


Figure 2. Receiver Propagation Delay Timing

TEST CIRCUITS

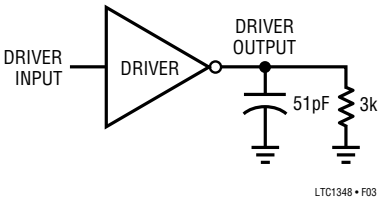


Figure 3. Driver Timing Test Load

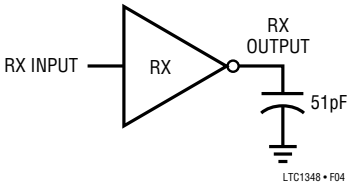
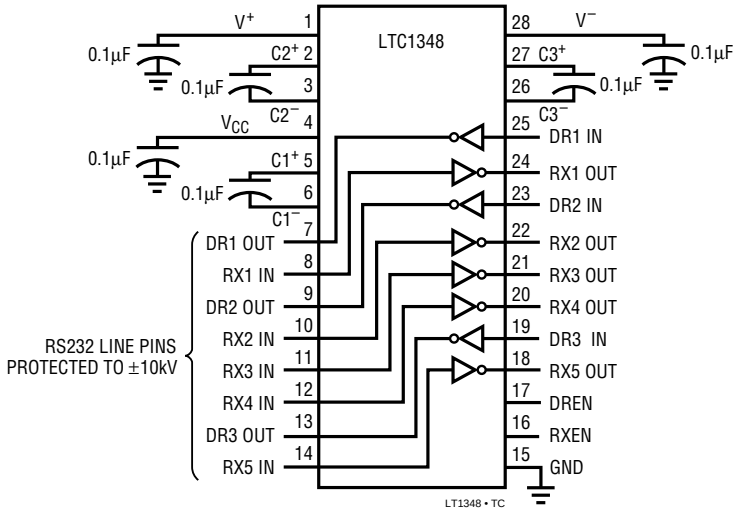


Figure 4. Receiver Timing Test Load

ESD Test Circuit



APPLICATIONS INFORMATION

Power Supply

The LTC1348 includes an onboard voltage-tripling charge pump capable of generating ±8V from a single 3.3V supply. This allows the LTC1348 drivers to provide guaranteed ±5V RS232-compliant voltage levels with a 3.3V supply. With all outputs loaded with 3kΩ, the LTC1348 can typically swing ±5V with voltages as low as 2.85V. It will meet the ±3.7V EIA562 levels with supply voltages as low as 2.2V. The charge pump requires three external flying capacitors to operate; 0.1µF ceramic capacitors are adequate for most applications. For applications requiring extremely high data rates or abnormally heavy output loads, 0.33µF flying capacitors are recommended. Bypass and output capacitor values should match those of the flying capacitors and all capacitors should be mounted as close to the package as possible.

APPLICATIONS INFORMATION

High Data Rates

The LTC1348 maintains true RS232 ±5V minimum driver output even at high data rates. Figure 5 shows a test circuit with 2m wires connecting the two test chips. Both chips are run from 3.3V supplies. Figure 6 shows the typical line waveforms with all three drivers, loaded with 1000pF and 3kΩ, toggling simultaneously at 120kbaud. Figure 7 shows the same circuit with a single 1000pF/3kΩ loaded driver driven at 250kbaud, and the other two drivers loaded but not toggling. This closely approximates the actual behavior of an RS232 serial port, with only one driver (TX) driven at high speed and the other two drivers (RTS and DTR) driven at a relatively low data rate or at DC. Under the same conditions, the LTC1348 can go as fast as 350kbaud and still meet EIA562 (±3.7V) minimum driver output levels.

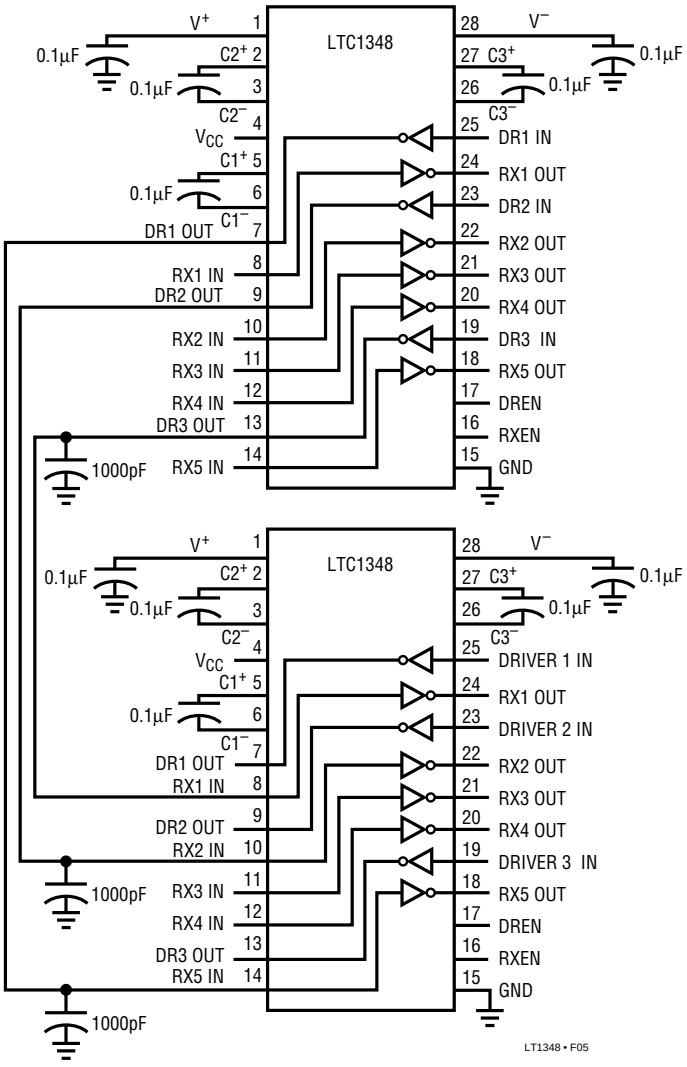


Figure 5. Data Rate Evaluation Circuit

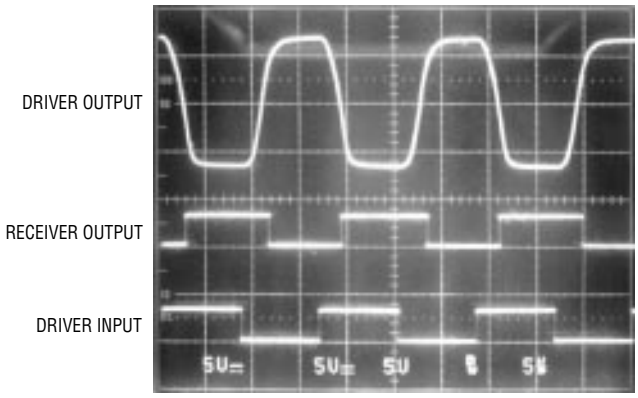


Figure 6. Driver Test Result at 120kbps

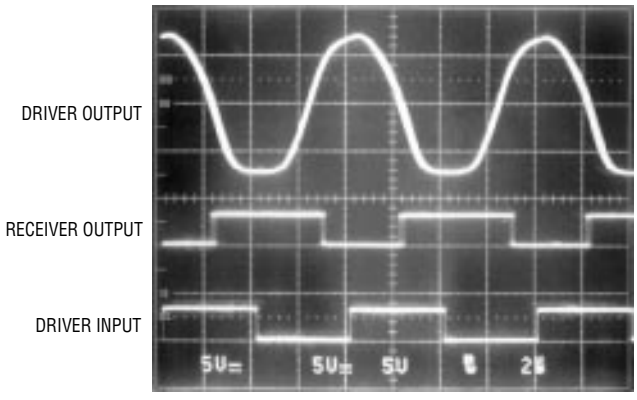


Figure 7. Driver Test Results at 250kbps

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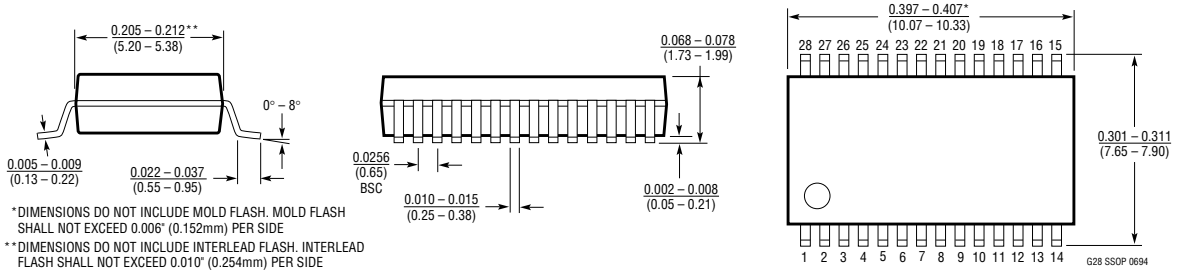
PACKAGE DESCRIPTION

Dimensions in inches (millimeters) unless otherwise noted.

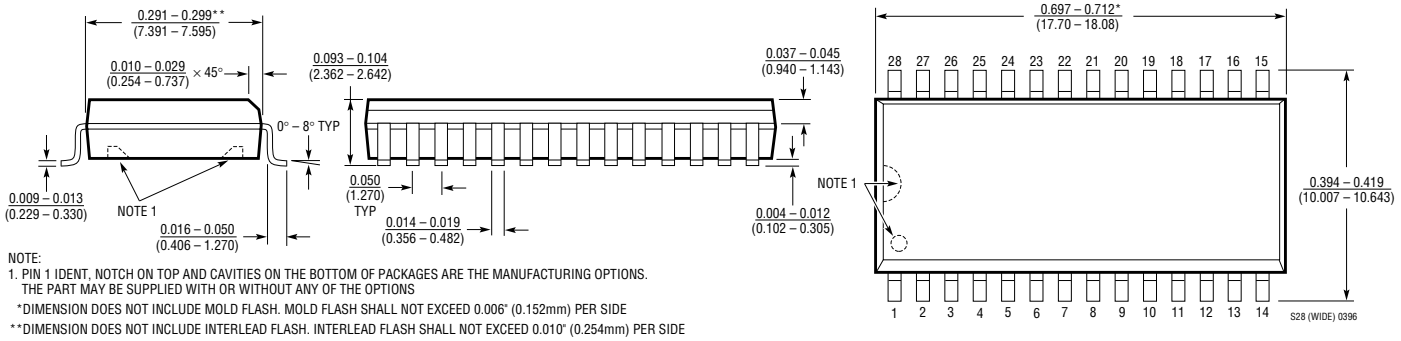
G Package
28-Lead Plastic SSOP (0.209)
(LTC DWG # 05-08-1640)



*DIMENSIONS DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

**DIMENSIONS DO NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

SW Package
28-Lead Plastic Small Outline (Wide 0.300)
(LTC DWG # 05-08-1620)



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

*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

**DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LT1137A	3-DR/5-RX RS232 Transceiver	±15kV IEC-801-2 ESD Protection
LTC1327	3-DR/5-RX RS562 Transceiver	3.3V Operation
LT1330	3-DR/5-RX RS232	3V Logic Interface
LT1331	3-DR/5-RX RS232/RS562 Transceiver	5V RS232 or 3V RS562 Operation
LTC1347	3-DR/5-RX Micropower RS232 Transceiver	5 Receivers Active in Shutdown

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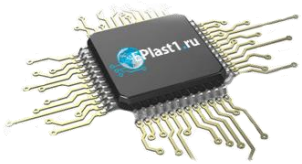
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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