# Ultra-Low Power RS485 Low EMI Transceiver with Shutdown

## FEATURES

- **Low Power: $I_{CC}$ = 120μA Max with Driver Disabled**
- $I_{CC}$ = 500μA Max with Driver Enabled, No Load
- **1μA Quiescent Current in Shutdown Mode**
- Controlled Slew Rate Driver for Reduced EMI
- Single 5V Supply
- **Drivers/Receivers Have ±10kV ESD Protection**
- –7V to 12V Common-Mode Range Permits ±7V Ground Difference Between Devices on the Data Line
- Thermal Shutdown Protection
- Power Up/Down Glitch-Free Driver Outputs Permit Live Insertion or Removal of Transceiver
- Driver Maintains High Impedance in Three-State or with the Power Off
- Up to 32 Transceivers on the Bus
- Pin Compatible with the LTC485

## APPLICATIONS

- Battery-Powered RS485/RS422 Applications
- Low Power RS485/RS422 Transceiver
- Level Translator

## DESCRIPTION

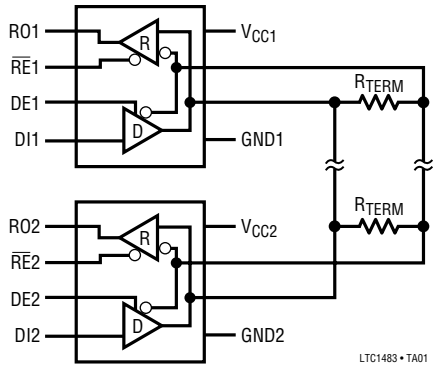
The LTC®1483 is an ultra-low power differential line transceiver designed for data transmission standard RS485 applications with extended common-mode range (–7V to 12V). It will also meet the requirements of RS422. The LTC1483 features output drivers with controlled slew rate, decreasing the EMI radiated from the RS485 lines, and improving signal fidelity with misterminated lines. The CMOS design offers significant power savings over its bipolar counterparts without sacrificing ruggedness against overload or ESD damage. Typical quiescent current is only 80μA while operating and less than 1μA in shutdown.

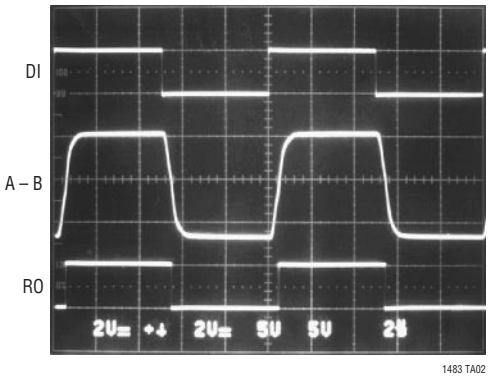
The driver and receiver feature three-state outputs, with the driver outputs maintaining high impedance over the entire common-mode range. Excessive power dissipation caused by bus contention or faults is prevented by a thermal shutdown circuit which forces the driver outputs into a high impedance state. The receiver has a fail-safe feature which guarantees a high output state when the inputs are left open. I/O pins are protected against multiple ESD strikes of over ±10kV.

The LTC1483 is fully specified over the commercial and extended industrial temperature range and is available in 8-pin DIP and SO packages.



## TYPICAL APPLICATION



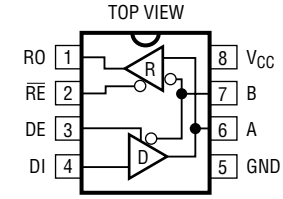



## ABSOLUTE MAXIMUM RATINGS

**(Note 1)**

Supply Voltage ($V_{CC}$) ..... 12V
Control Input Voltage ..... $-0.5V$ to $V_{CC} + 0.5V$
Driver Input Voltage ..... $-0.5V$ to $V_{CC} + 0.5V$
Driver Output Voltage ..... $\pm 14V$
Receiver Input Voltage ..... $\pm 14V$
Receiver Output Voltage ..... $-0.5V$ to $V_{CC} + 0.5V$
Operating Temperature Range
LTC1483C ..... $0°C \le T_A \le 70°C$
LTC1483I ..... $-40°C \le T_A \le 85°C$
Storage Temperature Range ..... $-65°C$ to $150°C$
Lead Temperature (Soldering, 10 sec) ..... 300°C

## PACKAGE/ORDER INFORMATION




N8 PACKAGE
8-LEAD PDIP

S8 PACKAGE
8-LEAD PLASTIC SO

$T_{JMAX} = 125°C$, $\theta_{JA} = 130°C/W$ (N8)
$T_{JMAX} = 125°C$, $\theta_{JA} = 150°C/W$ (S8)

| ORDER PART NUMBER |
|---|
| LTC1483CN8<br>LTC1483IN8<br>LTC1483CS8<br>LTC1483IS8 |
| **S8 PART MARKING** |
| 1483<br>1483I |

Consult factory for Military grade parts.

## ELECTRICAL CHARACTERISTICS

**$V_{CC}$ = 5V, (Notes 2, 3) unless otherwise noted.**

| SYMBOL | PARAMETER | CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| $V_{OD1}$ | Differential Driver Output Voltage (Unloaded) | $I_O = 0$ | ● | | | 5 | V |
| $V_{OD2}$ | Differential Driver Output Voltage (with Load) | R = 50Ω (RS422)<br>R = 27Ω (RS485), Figure 1 | ●<br>● | 2<br>1.5 | | <br>5 | V<br>V |
| $\Delta V_{OD}$ | Change in Magnitude of Driver Differential Output Voltage for Complementary Output States | R = 27Ω or R = 50Ω, Figure 1 | ● | | | 0.2 | V |
| $V_{OC}$ | Driver Common-Mode Output Voltage | R = 27Ω or R = 50Ω, Figure 1 | ● | | | 3 | V |
| $\Delta \lvert V_{OC} \rvert$ | Change in Magnitude of Driver Common-Mode Output Voltage for Complementary Output States | R = 27Ω or R = 50Ω, Figure 1 | ● | | | 0.2 | V |
| $V_{IH}$ | Input High Voltage | DE, DI, $\overline{RE}$ | ● | 2 | | | V |
| $V_{IL}$ | Input Low Voltage | DE, DI, $\overline{RE}$ | ● | | | 0.8 | V |
| $I_{IN1}$ | Input Current | DE, DI, $\overline{RE}$ | ● | | | ±2 | µA |
| $I_{IN2}$ | Input Current (A, B) | DE = 0, $V_{CC}$ = 0V or 5.25V, $V_{IN}$ = 12V<br>DE = 0, $V_{CC}$ = 0V or 5.25V, $V_{IN}$ = −7V | ●<br>● | | | 1.0<br>−0.8 | mA<br>mA |
| $V_{TH}$ | Differential Input Threshold Voltage for Receiver | $-7V \le V_{CM} \le 12V$ | ● | −0.2 | | 0.2 | V |
| $\Delta V_{TH}$ | Receiver Input Hysteresis | $V_{CM}$ = 0V | ● | | 45 | | mV |
| $V_{OH}$ | Receiver Output High Voltage | $I_O = -4mA$, $V_{ID}$ = 200mV | ● | 3.5 | | | V |
| $V_{OL}$ | Receiver Output Low Voltage | $I_O$ = 4mA, $V_{ID} = -200mV$ | ● | | | 0.4 | V |
| $I_{OZR}$ | Three-State (High Impedance) Output Current at Receiver | $V_{CC}$ = Max, $0.4V \le V_O \le 2.4V$ | ● | | | ±1 | µA |
| $R_{IN}$ | Receiver Input Resistance | $-7V \le V_{CM} \le 12V$ | ● | 12 | 25 | | kΩ |
| $I_{CC}$ | Supply Current | No Load, Output Enabled<br>No Load, Output Disabled | ●<br>● | | 300<br>80 | 500<br>120 | µA<br>µA |
| $I_{SHDN}$ | Supply Current in Shutdown Mode | DE = 0, $\overline{RE} = V_{CC}$ | | | 1 | 10 | µA |
| $I_{OSD1}$ | Driver Short-Circuit Current, $V_{OUT}$ = HIGH | $-7V \le V_O \le 12V$ | ● | 35 | | 250 | mA |
| $I_{OSD2}$ | Driver Short-Circuit Current, $V_{OUT}$ = LOW | $-7V \le V_O \le 12V$ | ● | 35 | | 250 | mA |
| $I_{OSR}$ | Receiver Short-Circuit Current | $0V \le V_O \le V_{CC}$ | ● | 7 | | 85 | mA |

## SWITCHING CHARACTERISTICS

**$V_{CC}$ = 5V, (Notes 2, 3) unless otherwise noted.**

| SYMBOL | PARAMETER | CONDITIONS | | LTC1483 MIN | LTC1483 TYP | LTC1483 MAX | UNITS |
|---|---|---|---|---|---|---|---|
| $t_{PLH}$ | Driver Input to Output | $R_{DIFF}$ = 54Ω, $C_{L1}$ = $C_{L2}$ = 100pF, (Figures 3, 5) | ● | 150 | | 1200 | ns |
| $t_{PHL}$ | Driver Input to Output | | ● | 150 | | 1200 | ns |
| $t_{SKEW}$ | Driver Output to Output | | ● | | 100 | 600 | ns |
| $t_r$, $t_f$ | Driver Rise or Fall Time | | ● | 150 | | 1200 | ns |
| $t_{ZH}$ | Driver Enable to Output High | $C_L$ = 100pF (Figures 4, 6), S2 Closed | ● | 100 | | 1500 | ns |
| $t_{ZL}$ | Driver Enable to Output Low | $C_L$ = 100pF (Figures 4, 6), S1 Closed | ● | 100 | | 1500 | ns |
| $t_{LZ}$ | Driver Disable Time from Low | $C_L$ = 15pF (Figures 4, 6), S1 Closed | ● | 150 | | 1500 | ns |
| $t_{HZ}$ | Driver Disable Time from High | $C_L$ = 15pF (Figures 4, 6), S2 Closed | ● | 150 | | 1500 | ns |
| $t_{PLH}$ | Receiver Input to Output | $R_{DIFF}$ = 54Ω, $C_{L1}$ = $C_{L2}$ = 100pF, (Figures 3, 7) | ● | 30 | 140 | 200 | ns |
| $t_{PHL}$ | Receiver Input to Output | | ● | 30 | 140 | 200 | ns |
| $t_{SKD}$ | $\lvert t_{PLH} - t_{PHL} \rvert$ Differential Receiver Skew | | ● | | 13 | | ns |
| $t_{ZL}$ | Receiver Enable to Output Low | $C_{RL}$ = 15pF (Figures 2, 8), S1 Closed | ● | | 20 | 50 | ns |
| $t_{ZH}$ | Receiver Enable to Output High | $C_{RL}$ = 15pF (Figures 2, 8), S2 Closed | ● | | 20 | 50 | ns |
| $t_{LZ}$ | Receiver Disable from Low | $C_{RL}$ = 15pF (Figures 2, 8), S1 Closed | ● | | 20 | 50 | ns |
| $t_{HZ}$ | Receiver Disable from High | $C_{RL}$ = 15pF (Figures 2, 8), S2 Closed | ● | | 20 | 50 | ns |
| $f_{MAX}$ | Maximum Data Rate | | ● | 250 | | | kbits/s |
| $t_{SHDN}$ | Time to Shutdown | DE = 0, $\overline{RE}$ = ⎍ | ● | 50 | 200 | 600 | ns |
| $t_{ZH(SHDN)}$ | Driver Enable from Shutdown to Output High | $C_L$ = 100pF (Figures 4, 6), S2 Closed | ● | | | 2000 | ns |
| $t_{ZL(SHDN)}$ | Driver Enable from Shutdown to Output Low | $C_L$ = 100pF (Figures 4, 6), S1 Closed | ● | | | 2000 | ns |
| $t_{ZH(SHDN)}$ | Receiver Enable from Shutdown to Output High | $C_L$ = 15pF (Figures 2, 8), S2 Closed | ● | | | 3500 | ns |
| $t_{ZL(SHDN)}$ | Receiver Enable from Shutdown to Output Low | $C_L$ = 15pF (Figures 2, 8), S1 Closed | ● | | | 3500 | ns |

The ● denotes specifications which apply over the full operating temperature range.

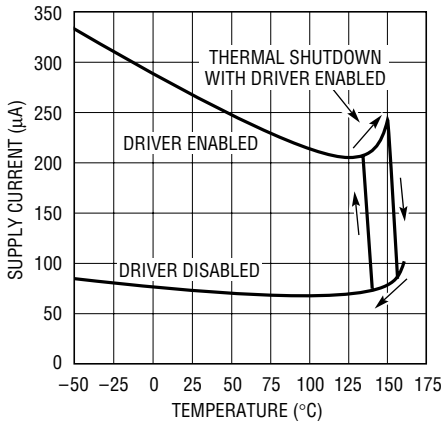
**Note 1:** Absolute maximum ratings are those beyond which the safety of the device cannot be guaranteed.

**Note 2:** All currents into device pins are positive; all currents out ot device pins are negative. All voltages are referenced to device ground unless otherwise specified.

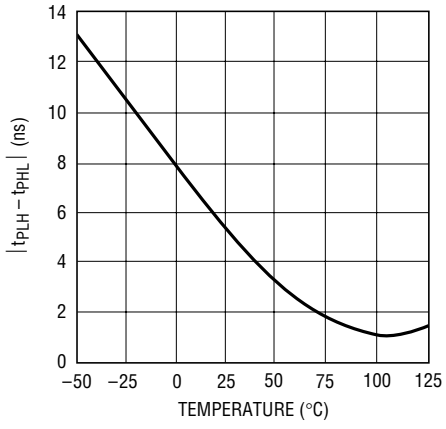
**Note 3:** All typicals are given for $V_{CC}$ = 5V and $T_A$ = 25°C.

## TYPICAL PERFORMANCE CHARACTERISTICS

**Supply Current vs Temperature**




**Receiver $\lvert t_{PLH} - t_{PHL} \rvert$ vs Temperature**




**Driver Differential Output Voltage vs Output Current**