



钜地半导体
Tudi Semiconductor

Product Specification

TUDI-LTC1481

Ultralow Power RS485 Transceiver
with Shutdown

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**semiconductor device
manufacturer**

- Design
- research and development
- production
- and sales



FEATURES

- Low Power: $I_{CC} = 120 \mu A$ Max with Driver Disabled
- Drivers/Receivers Have $\pm 10kV$ ESD Protection
- $1 \mu A$ Quiescent Current in Shutdown Mode
- High Speed: Up to 2.5Mbps/s Data Rate
- $I_{CC} = 500 \mu A$ Max with Driver Enabled, No Load
- Single 5V Supply
- $-7V$ to $12V$ Common Mode Range Permits $\pm 7V$ 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
- 30ns Typical Driver Propagation Delays with 5ns Skew
- Pin Compatible with the LTC485

APPLICATIONS

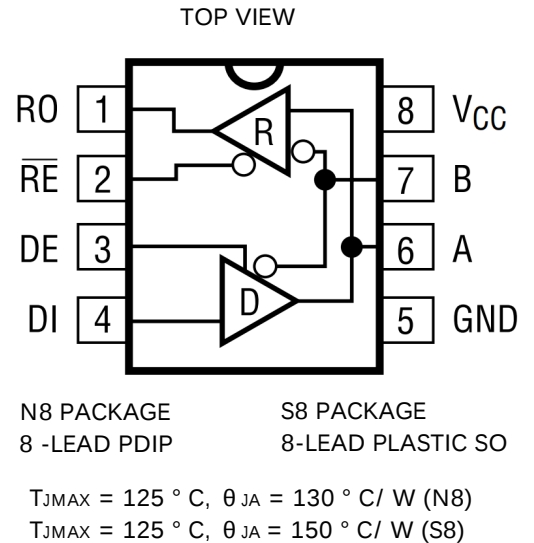
- Battery-Powered RS485/RS422 Applications
- Low Power RS485/RS422 Transceiver
- Level Translator

DESCRIPTION

The LTC1481 is an ultralow power differential line transceiver designed for data transmission standard RS485 applications. It will also meet the requirements of RS422. The CMOS design offers significant power savings over its bipolar counterparts without sacrificing ruggedness against overload or ESD damage. Typical quiescent current is only $80 \mu A$ while operating and less than $1 \mu A$ 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.

The LTC1481 is fully specified over the commercial and extended industrial temperature range and is available in 8-pin PDIP and SO packages.





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	
LTC1481C	$0^{\circ}C \leq T_A \leq 70^{\circ}C$
LTC1481I	$-40^{\circ}C \leq T_A \leq 85^{\circ}C$
Storage Temperature Range	$-65^{\circ}C$ to $150^{\circ}C$
Lead Temperature (Soldering, 10 sec)	$300^{\circ}C$

FUNCTION TABLES

LTC1481 Transmitting

INPUTS			OUTPUTS	
$\overline{RE}$	DE	DI	B	A
X	1	1	0	1
X	1	0	1	0
0	0	X	Z	Z
1	0	X	Z*	Z*

*Shutdown mode for LTC1481

LTC1481 Receiving

INPUTS			OUTPUTS
$\overline{RE}$	DE	A – B	RO
0	0	$\geq 0.2V$	1
0	0	$\leq -0.2V$	0
0	0	Inputs Open	1
1	0	X	Z*

*Shutdown mode for LTC1481



ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at $T_A = 25^\circ\text{C}$. $V_{CC} = 5\text{V}$ (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)	$R = 50\Omega$ (RS422) $R = 27\Omega$ (RS485), Figure 1	● ●	2.0 1.5		5	V V
ΔV_{OD}	Change in Magnitude of Driver Differential Output Voltage for Complementary Output States	$R = 27\Omega$ or $R = 50\Omega$, Figure 1	●			0.2	V
V_{OC}	Driver Common Mode Output Voltage	$R = 27\Omega$ or $R = 50\Omega$, Figure 1	●			3	V
$\Delta V_{OC} $	Change in Magnitude of Driver Common Mode Output Voltage for Complementary Output States	$R = 27\Omega$ or $R = 50\Omega$, 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, $V_{CC} = 0\text{V}$ or 5.25V , $V_{IN} = 12\text{V}$ DE = 0, $V_{CC} = 0\text{V}$ or 5.25V , $V_{IN} = -7\text{V}$	● ●			1.0 -0.8	mA mA
V_{TH}	Differential Input Threshold Voltage for Receiver	$-7\text{V} \leq V_{CM} \leq 12\text{V}$	●	-0.2		0.2	V
ΔV_{TH}	Receiver Input Hysteresis	$V_{CM} = 0\text{V}$	●		45		mV
V_{OH}	Receiver Output High Voltage	$I_O = -4\text{mA}$, $V_{ID} = 200\text{mV}$	●	3.5			V
V_{OL}	Receiver Output Low Voltage	$I_O = 4\text{mA}$, $V_{ID} = -200\text{mV}$	●			0.4	V
I_{OZR}	Three-State (High Impedance) Output Current at Receiver	$V_{CC} = \text{Max}$, $0.4\text{V} \leq V_O \leq 2.4\text{V}$	●			± 1	μA
R_{IN}	Receiver Input Resistance	$-7\text{V} \leq V_{CM} \leq 12\text{V}$	●	12			$\text{k}\Omega$
I_{CC}	Supply Current	No Load, Output Enabled No Load, Output Disabled	● ●		300 80	500 120	μA μA
I_{SHDN}	Supply Current in Shutdown Mode	DE = 0, $\overline{RE} = V_{CC}$			1	10	μA
I_{OSD1}	Driver Short-Circuit Current, $V_{OUT} = \text{HIGH}$	$-7\text{V} \leq V_O \leq 12\text{V}$	●	35		250	mA
I_{OSD2}	Driver Short-Circuit Current, $V_{OUT} = \text{LOW}$	$-7\text{V} \leq V_O \leq 12\text{V}$	●	35		250	mA
I_{OSR}	Receiver Short-Circuit Current	$0\text{V} \leq V_O \leq V_{CC}$	●	7		85	mA



SWITCHING CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at $T_A = 25^\circ\text{C}$. $V_{CC} = 5\text{V}$ (Notes 2, 3) unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
t_{PLH}	Driver Input to Output	$R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100\text{pF}$, (Figures 3, 5)	●	10	30	60	ns
t_{PHL}	Driver Input to Output		●	10	30	60	ns
t_{SKEW}	Driver Output to Output		●		5	10	ns
t_r, t_f	Driver Rise or Fall Time		●	3	15	40	ns
t_{ZH}	Driver Enable to Output High	$C_L = 100\text{pF}$ (Figures 4, 6), S2 Closed	●		40	70	ns
t_{ZL}	Driver Enable to Output Low	$C_L = 100\text{pF}$ (Figures 4, 6), S1 Closed	●		40	70	ns
t_{LZ}	Driver Disable Time from Low	$C_L = 15\text{pF}$ (Figures 4, 6), S1 Closed	●		40	70	ns
t_{HZ}	Driver Disable Time from High	$C_L = 15\text{pF}$ (Figures 4, 6), S2 Closed	●		40	70	ns
t_{PLH}	Receiver Input to Output	$R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100\text{pF}$, (Figures 3, 7)	●	30	140	200	ns
t_{PHL}	Receiver Input to Output		●	30	140	200	ns
t_{SKD}	$ t_{PLH} - t_{PHL} $ Differential Receiver Skew		●		13		ns
t_{ZL}	Receiver Enable to Output Low	$C_{RL} = 15\text{pF}$ (Figures 2, 8), S1 Closed	●		20	50	ns
t_{ZH}	Receiver Enable to Output High	$C_{RL} = 15\text{pF}$ (Figures 2, 8), S2 Closed	●		20	50	ns
t_{LZ}	Receiver Disable from Low	$C_{RL} = 15\text{pF}$ (Figures 2, 8), S1 Closed	●		20	50	ns
t_{HZ}	Receiver Disable from High	$C_{RL} = 15\text{pF}$ (Figures 2, 8), S2 Closed	●		20	50	ns
f_{MAX}	Maximum Data Rate		●	2.5			Mbits/s
t_{SHDN}	Time to Shutdown	$DE = 0$, $\overline{RE} = \text{⏏}$	●	50	200	600	ns
$t_{ZH(SHDN)}$	Driver Enable from Shutdown to Output High	$C_L = 100\text{pF}$ (Figures 4, 6), S2 Closed	●		40	100	ns
$t_{ZL(SHDN)}$	Driver Enable from Shutdown to Output Low	$C_L = 100\text{pF}$ (Figures 4, 6), S1 Closed	●		40	100	ns
$t_{ZH(SHDN)}$	Receiver Enable from Shutdown to Output High	$C_L = 15\text{pF}$ (Figures 2, 8), S2 Closed	●			3500	ns
$t_{ZL(SHDN)}$	Receiver Enable from Shutdown to Output Low	$C_L = 15\text{pF}$ (Figures 2, 8), S1 Closed	●			3500	ns

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

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

Note 3: All typicals are given for $V_{CC} = 5\text{V}$ and $T_A = 25^\circ\text{C}$.

TEST CIRCUITS

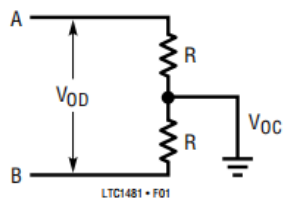


Figure 1. Driver DC Test Load

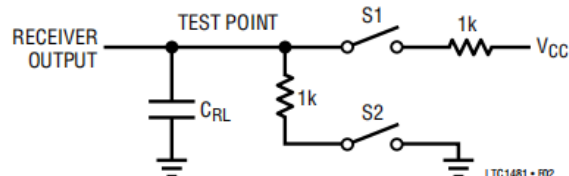


Figure 2. Receiver Timing Test Load

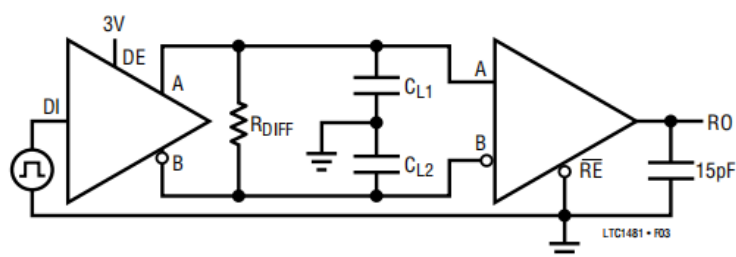


Figure 3. Driver/Receiver Timing Test Circuit

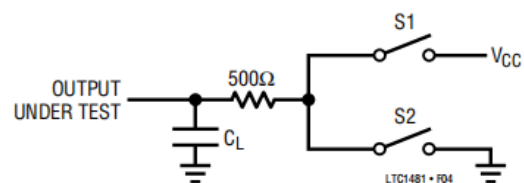


Figure 4. Driver Timing Test Load

SWITCHING TIME WAVEFORMS

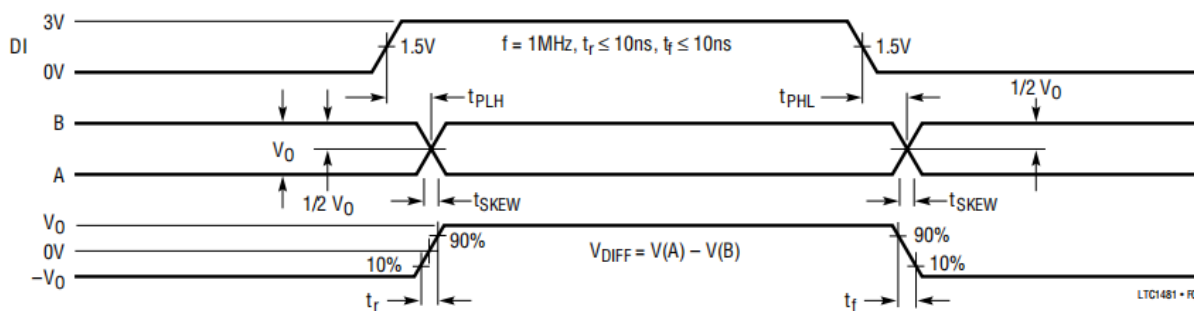


Figure 5. Driver Propagation Delays

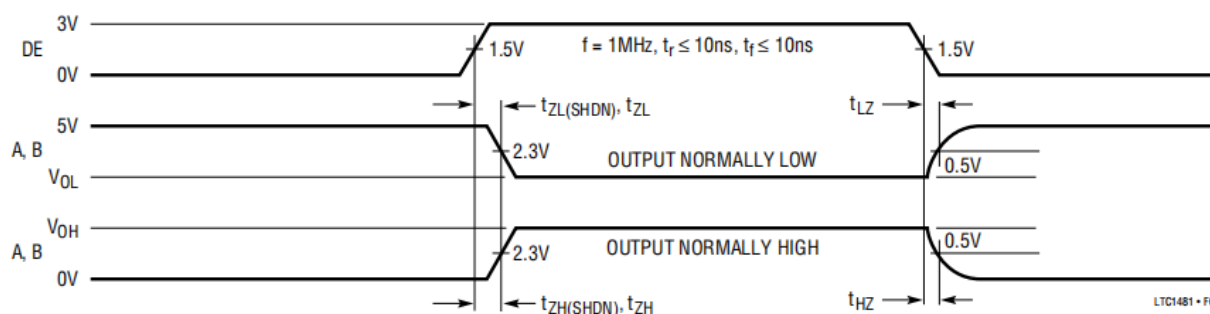


Figure 6. Driver Enable and Disable Times



SWITCHING TIME WAVEFORMS

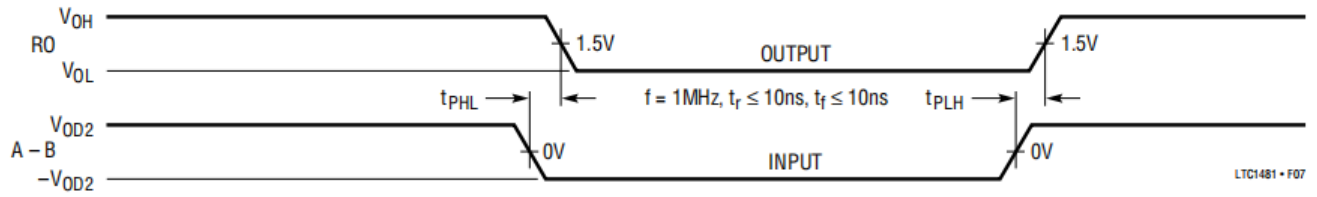


Figure 7. Receiver Propagation Delays

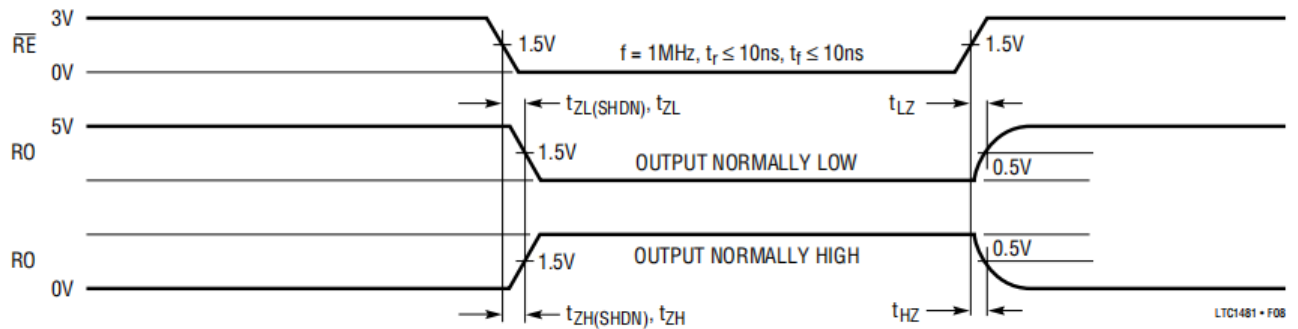


Figure 8. Receiver Enable and Disable Times

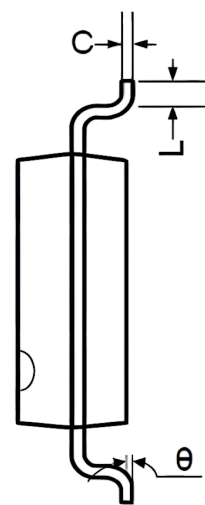
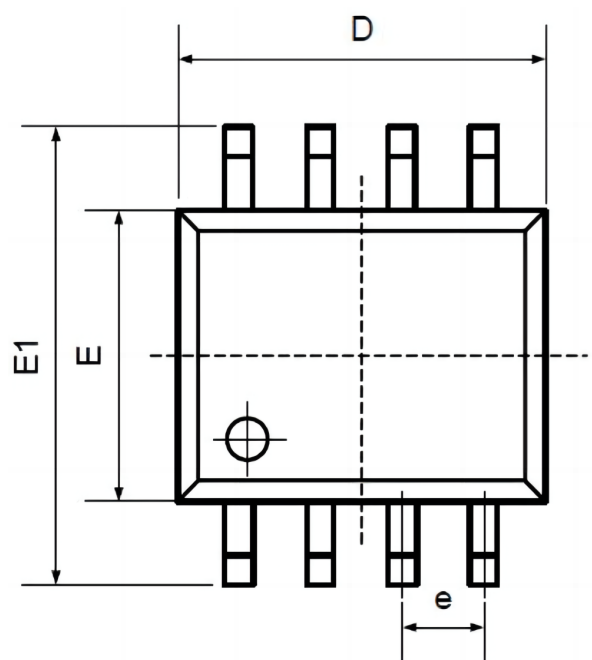


ORDERING INFORMATION

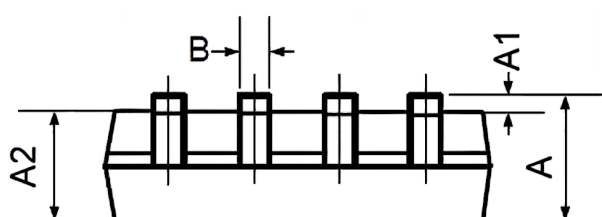
Order Number	Package	Package Quantity	Marking On The park
LTC1481CN8-TUDI	DIP8	Tube,50,A box of 2000	LTC1481CN8
LTC1481CS8-TUDI	SOP8	Tape,Reel,2500	1481
LTC1481IN8-TUDI	DIP8	Tube,50,A box of 2000	LTC1481IN8
LTC1481IS8-TUDI	SOP8	Tape,Reel,2500	1481I



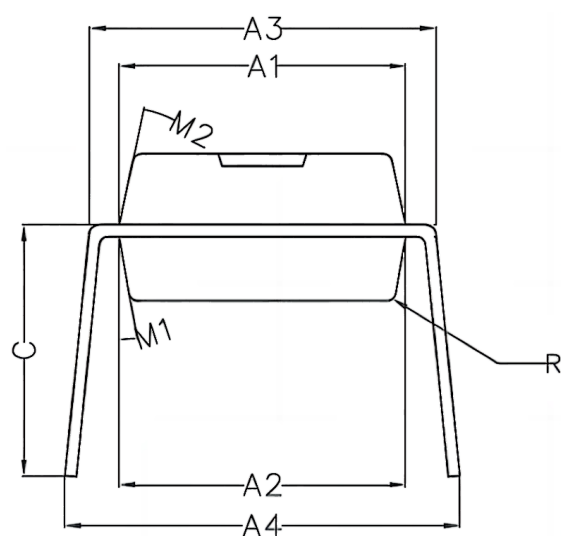
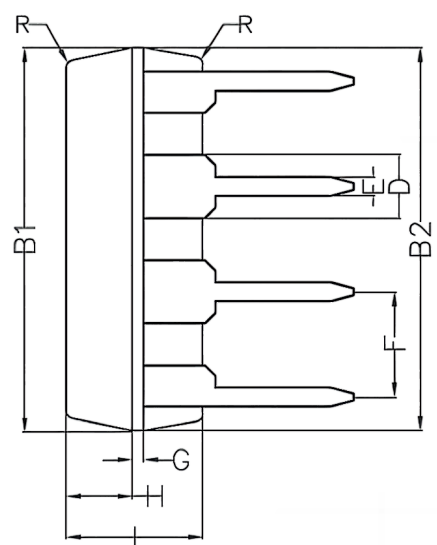
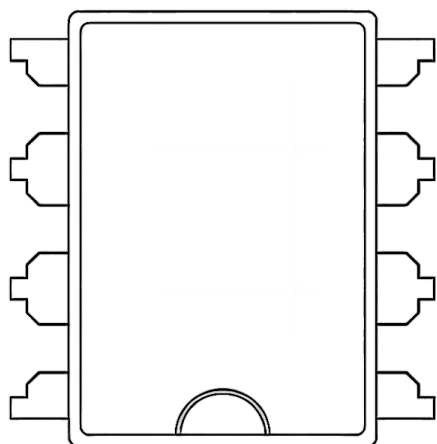
Package SOP8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°



Package DIP8



Symbol	Min	Non	Max
A1	6.28	6.33	6.38
A2	6.33	6.38	6.43
A3	7.52	7.62	7.72
A4	7.80	8.40	9.00
B1	9.15	9.20	9.25
B2	9.20	9.25	9.30
C		5.57	
D		1.52	
E	0.43	0.45	0.47
F		2.54	
G		0.25	
H	1.54	1.59	1.64
I	3.22	3.27	3.32
R		0.20	
M1	9°	10°	11°
M2	11°	12°	13°



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