钍地半导体
Tudi Semiconductor

Product Specification

TUDI-LTC1487

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用芯智造·卓越品质

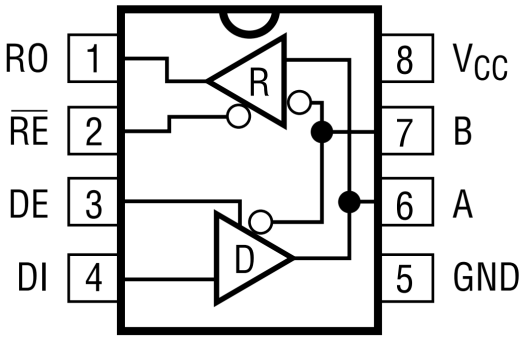
semiconductor device manufacturer

- Design
- research and development
- production
- and sales

FEATURES

- High Input Impedance: Up to 256 Transceivers on the Bus
- Low Power: ICC = 120μA Max with Driver Disabled
- ICC = 200μA Max with Driver Enabled, No Load
- 1μA Quiescent Current in Shutdown Mode
- Controlled Slew Rate Driver for Reduced EMI
- Single 5V Supply
- ESD Protection to ±10kV On Receiver Inputs and Driver outputs
- – 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
- Pin Compatible with the LTC485

TOP VIEW



N8 PACKAGE
8-LEAD PDIP

S8 PACKAGE
8-LEAD PLASTIC SO

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

APPLICATIONS

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

DESCRIPTION

The LTC1487 is an ultra-low power differential line trans-ceiver designed with high impedance inputs allowing up to 256 transceivers to share a single bus. It meets the requirements of RS485 and RS422. The LTC1487 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 without sacrificing ruggedness against overload or ESD damage. Typical quiescent cur-rent is only 80μA while operating and 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 using the Human Body Model.
The LTC1487 is fully specified over the commercial tem-perature range and is available in 8-pin DIP 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 ..... ±14V
Receiver Input Voltage ..... ±14V
Receiver Output Voltage ..... −0.5V to V_{CC} + 0.5V
Operating Temperature Range ..... $0°C \le T_A \le 70°C$
Storage Temperature Range ..... −65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

ELECTRICAL CHARACTERISTICS

0°C ≤ T_A ≤ 70°C, 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) R = 27Ω (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 = 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 DE = 0, V_{CC} = 0V or 5.25V, V_{IN} = −7V	● ●			0.30 −0.15	mA mA
V_{TH}	Differential Input Threshold Voltage for Receiver	−7V ≤ V_{CM} ≤ 12V	●	−0.2		0.2	V
ΔV_{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 ≤ V_O ≤ 2.4V	●			±1	µA
R_{IN}	Receiver Input Resistance	−7V ≤ V_{CM} ≤ 12V	●	70	96		kΩ
I_{CC}	Supply Current	No Load, Output Enabled No Load, Output Disabled	● ●		120 80	200 120	µA µA
I_{SHDN}	Supply Current in Shutdown Mode	DE = 0V, $\overline{RE}$ = V_{CC}			1	10	µA
I_{OSD1}	Driver Short-Circuit Current, V_{OUT} = HIGH	−7V ≤ V_O ≤ 12V	●	35		250	mA
I_{OSD2}	Driver Short-Circuit Current, V_{OUT} = LOW	−7V ≤ V_O ≤ 12V	●	35		250	mA
I_{OSR}	Receiver Short-Circuit Current	0V ≤ V_O ≤ V_{CC}	●	7		85	mA

ELECTRICAL CHARACTERISTICS

$-40°C \le T_A \le 85°C$, $V_{CC} = 5V$ (Note 4) 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)	●	2.0			V
		R = 27Ω (RS485), Figure 1	●	1.5		5	V
V_{OC}	Driver Common-Mode Output Voltage	R = 27Ω or R = 50Ω, Figure 1	●			3	V
V_{TH}	Differential Input Threshold Voltage for Receiver	$-7V \le V_{CM} \le 12V$	●	−0.2		0.2	V
ΔV_{TH}	Receiver Input Hysteresis	$V_{CM} = 0V$	●		45		mV
I_{CC}	Supply Current	No Load, Output Enabled	●		120	200	µA
		No Load, Output Disabled	●		80	120	µA
I_{SHDN}	Supply Current in Shutdown Mode	DE = 0V, $\overline{RE} = V_{CC}$			1	10	µA
t_{PLH}	Driver Input to Output	$R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pF$, (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		2000	ns
t_{PLH}	Receiver Input to Output	$R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pF$, (Figures 3, 7)	●	30	140	250	ns
t_{PHL}	Receiver Input to Output		●	30	140	250	ns
t_{SKD}	$\lvert t_{PLH} - t_{PHL} \rvert$ Differential Receiver Skew		●		13		ns
f_{MAX}	Maximum Data Rate		●	250			kbps

SWITCHING CHARACTERISTICS

$0°C \le T_A \le 70°C$, $V_{CC} = 5V$ (Notes 2, 3) unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
t_{PLH}	Driver Input to Output	$R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pF$, (Figures 3, 5)	●	150		1200	ns
t_{PHL}	Driver Input to Output		●	150		1200	ns
t_{SKEW}	Driver Output to Output		●		250	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	$R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pF$, (Figures 3, 7)	●	30	140	250	ns
t_{PHL}	Receiver Input to Output		●	30	140	250	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			kbps
t_{SHDN}	Time to Shutdown	DE = 0, $\overline{RE}$ = ⌐↑	●	50	200	600	ns

SWITCHING CHARACTERISTICS

0°C ≤ TA ≤ 70°C, V_{CC} = 5V (Notes 2, 3) unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
$t_{ZH(SHDN)}$	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	●			2000	ns
$t_{ZL(SHDN)}$	Receiver Enable from Shutdown to Output Low	C_L = 15pF (Figures 2, 8), S1 Closed	●			2000	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.

Note 4: The LTC1487 is not tested and is not quality-assurance sampled at –40°C and at 85°C. These specifications are guaranteed by design, correlation, and/or inference from 0°C, 25°C and/or 70°C tests.

FUNCTION TABLES

LTC1487 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

LTC1487 Receiving

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

*Shutdown mode

SWITCHING TIME WAVEFORMS

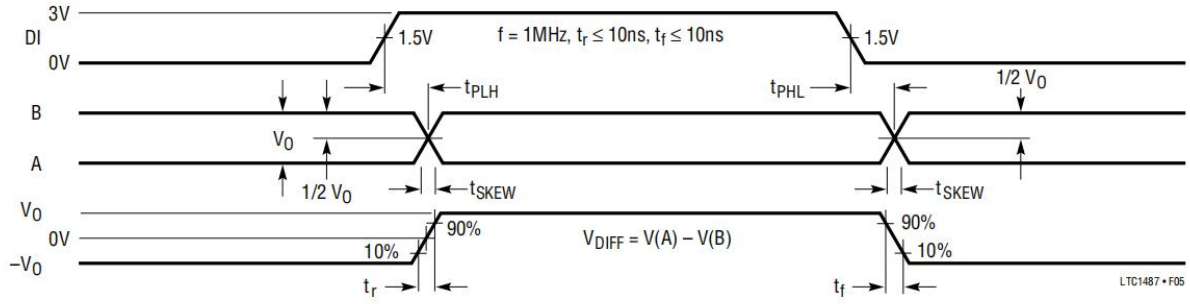


Figure 5. Driver Propagation Delays

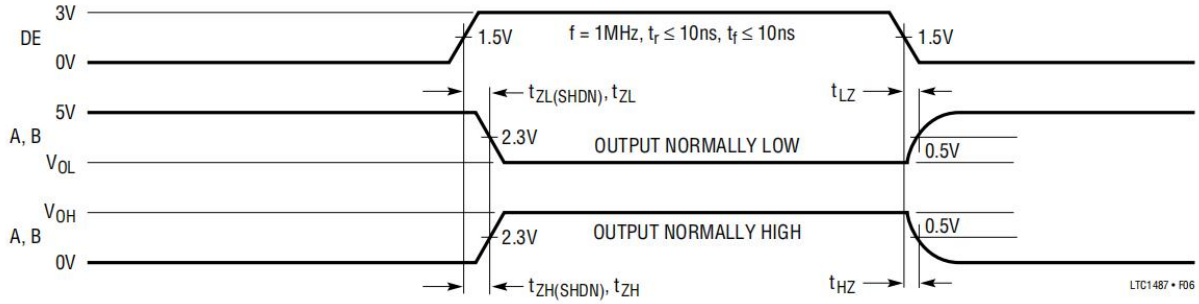


Figure 6. Driver Enable and Disable Times

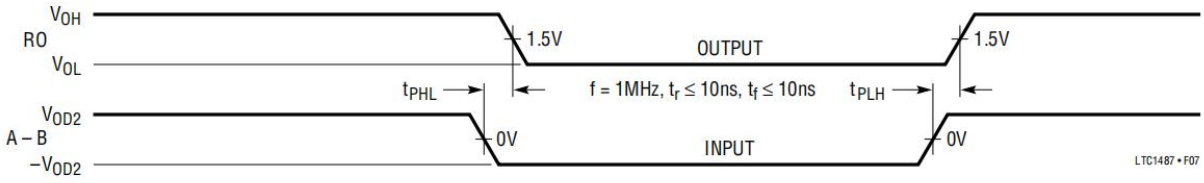


Figure 7. Receiver Propagation Delays

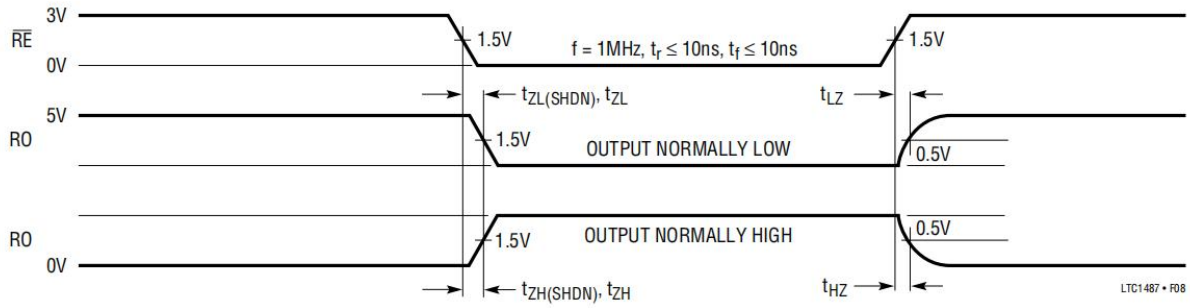
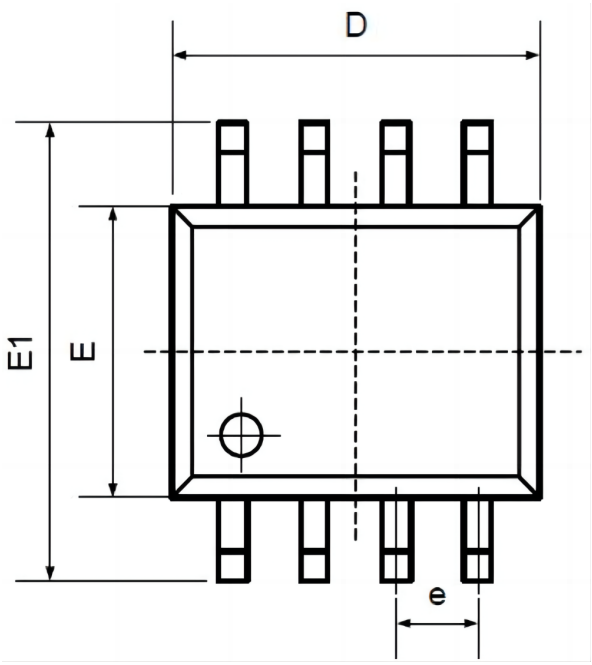


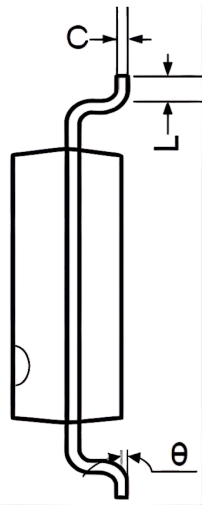
Figure 8. Receiver Enable and Disable Times

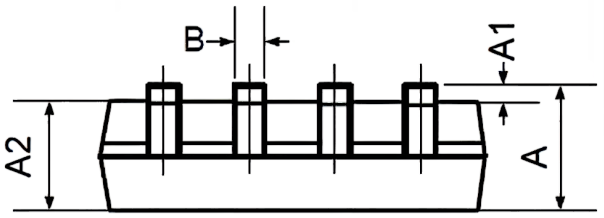
ORDERING INFORMATION

Order Number	Package	Package Quantity	Marking On The park
LTC1487CN8-TUDI	DIP8	Tube,50,A box of 2000	LTC1487CN8
LTC1487CS8-TUDI	SOP8	Tape,Reel,2500	1487
LTC1487IN8-TUDI	DIP8	Tube,50,A box of 2000	LTC1487IN8
LTC1487IS8-TUDI	SOP8	Tape,Reel,2500	1487I

Package SOP8

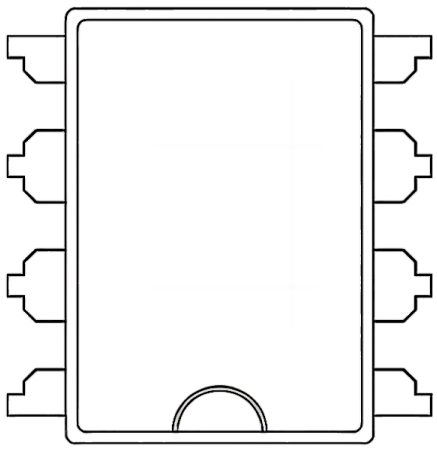


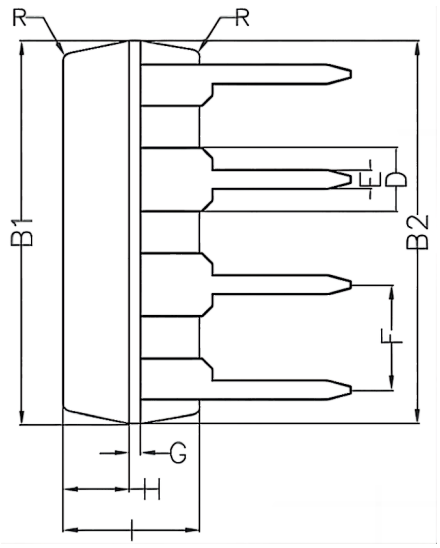


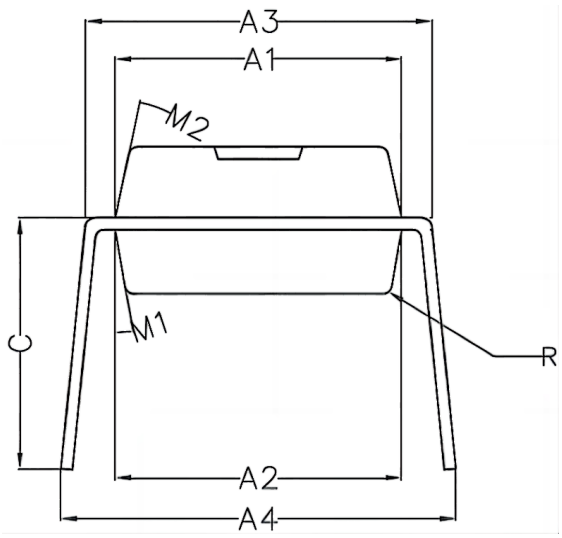


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP	
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
工	3.22	3.27	3.32
R		0.20	
M1	9°	10°	11°
M2	11°	12°	13°

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