钍地半导体
Tudi Semiconductor

Product Specification

TUDI-LTC1484

Low Power RS485 Transceiver with Receiver Fail-Safe

网址 www.sztdbdt.com

用芯智造·卓越品质

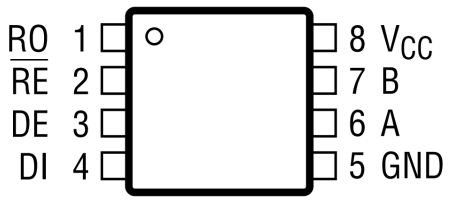
semiconductor device manufacturer

- Design
- research and development
- production
- and sales

FEATURES

- No Damage or Latchup to ±15kV ESD (Human Body Model), IEC-1000-4-2 Level 4 Contact (±8kV) and Level 3 (±8kV) Air Gap Specifications
- Guaranteed High Receiver Output State for Floating, Shorted or Terminated Inputs with No Signal Present
- Drives Low Cost Residential Telephone Wires
- Low Power: ICC = 700µA Max with Driver Disabled
- ICC = 900µA Max for Driver Enable with No Load
- 20µA Max Quiescent Current in Shutdown Mode
- Single 5V Supply
- –7V to 12V Common Mode Range Permits ±7V Ground Difference Between Devices on the Data Line
- Power Up/Down Glitch-Free Driver Outputs
- Up to 32 Transceivers on the Bus
- Pin Compatible with the LTC485
- Available in 8-Lead MSOP, PDIP and SO Packages

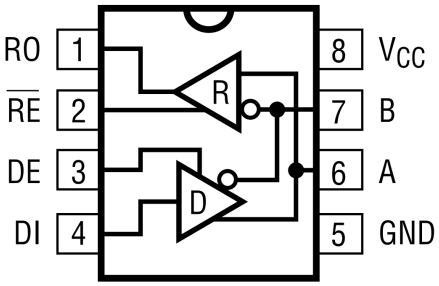
TOP VIEW



MS8 PACKAGE
8-LEAD PLASTIC MSOP

T_{JMAX} = 125°C, θ_{JA} = 200°C/ W

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} = 135°C/ W (S8)

APPLICATIONS

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

DESCRIPTION

The LTC® 1484 is a low power RS485 compatible trans-ceiver. In receiver mode, it offers a fail-safe feature which guarantees a high receiver output state when the inputs are left open, shorted together or terminated with no signal present. No external components are required to ensure the high receiver output state.

Both driver and receiver feature three-state outputs with separate receiver and driver control pins. The driver outputs maintain high impedance over the entire com-mon mode range when three-stated. Excessive power dissipation caused by bus contention or faults is pre-vented by a thermal shutdown circuit that forces the driver outputs into a high impedance state. Enhanced ESD protection allows the LTC1484 to with-stand ±15kV (human body model), IEC-1000-4-2 level 4 (±8kV) contact and level 3 (±8kV) air discharge ESD without latchup or damage.

The LTC1484 is fully specified over the commercial and industrial temperature ranges and is available in 8-lead MSOP, PDIP and SO packages.

PIN FUNCTIONS

RO (Pin 1): Receiver Output. If the receiver output is enabled ($\overline{RE}$ low) and the part is not in shutdown, RO is high if (A – B) > $V_{TH(MAX)}$ and low if (A – B) < $V_{TH(MIN)}$. RO is also high if the receiver inputs are open or shorted together, with or without a termination resistor.

$\overline{RE}$ (Pin 2): Receiver Output Enabled. A high on this pin three-states the receiver output (RO) and a low enables it.

DE (Pin 3): Driver Enable Input. DE = high enables the output of the driver with the driver outputs determined by the DI pin. DE = low forces the driver outputs into a high impedance state. The LTC1484 enters shutdown when both receiver and driver outputs are disabled ($\overline{RE}$ is high and DE is low).

DI (Pin 4): Driver Input. When the driver outputs are enabled (DE high), DI high takes the A output high and the B output low. DI low takes the A output low and the B output high.

GND (Pin 5): Ground.

A (Pin 6): Driver Output/Receiver Input. The input resistance is typically 22k when the driver is disabled (DE = 0). When the driver is enabled, the A output follows the logic level at the DI pin.

B (Pin 7): Driver Output/Receiver Input. The input resistance is typically 22k when the driver is disabled (DE = 0). When the driver is enabled, the B output is inverted from the logic level at the DI pin.

V_{CC} (Pin 8): Positive Supply. 4.75V ≤ V_{CC} ≤ 5.25V. A 0.1µF bypass capacitor is recommended.

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at T_A = 25°C. V_{CC} = 5V ±5% (Notes 2 and 3) unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
V_{OD1}	Differential Driver Output Voltage (Unloaded)	I_{OUT} = 0	●			V_{CC}	V
V_{OD2}	Differential Driver Output Voltage (with Load)	R = 50Ω (RS422) R = 27Ω (RS485) Figure 1 R = 22Ω, Figure 1	● ● ●	2 1.5 1.5		 5 5	V V V
V_{OD3}	Differential Driver Output Voltage (with Common Mode)	V_{TST} = –7V to 12V, Figure 2	●	1.5		5	V
ΔV_{OD}	Change in Magnitude of Driver Differential Output Voltage for Complementary Output States	R = 22Ω, 27Ω or R = 50Ω, Figure 1 V_{TST} = –7V to 12V, Figure 2	●			0.2	V
V_{OC}	Driver Common Mode Output Voltage	R = 22Ω, 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 = 22Ω, 27Ω or R = 50Ω, Figure 1	●			0.2	V
V_{IH}	Input High Voltage	DE, DI, $\overline{RE}$	●	2.0			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 or 5V, V_{IN} = 12V DE = 0, V_{CC} = 0 or 5V, V_{IN} = –7V	● ●			1.0 –0.8	mA mA
V_{TH}	Differential Input Threshold Voltage for Receiver	–7V ≤ V_{CM} ≤ 12V, DE = 0	●	–0.20		–0.015	V

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at T_A = 25°C. V_{CC} = 5V ±5% (Notes 2 and 3) unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
ΔV_{TH}	Receiver Input Hysteresis	V_{CM} = 0V, DE = 0	●		±30		mV
V_{OH}	Receiver Output High Voltage	I_{OUT} = –4mA, (V_A – V_B) = 200mV	●	3.5			V
V_{OL}	Receiver Output Low Voltage	I_{OUT} = 4mA, (V_A – V_B) = –200mV	●			0.4	V
I_{OZR}	Three-State (High Impedance) Output Current at Receiver	V_{CC} = Max, 0.4V ≤ V_{OUT} ≤ 2.4V, DE = 0	●			±1	µA
R_{IN}	Receiver Input Resistance	–7V ≤ V_{CM} ≤ 12V	●	12	22		kΩ
I_{CC}	Supply Current	No Load, Output Enabled (DE = V_{CC}) No Load, Output Disabled (DE = 0)	● ●		600 400	900 700	µA µA
I_{SHDN}	Supply Current in Shutdown Mode	DE = 0, $\overline{RE}$ = V_{CC}, DI = 0	●		1	20	µA
I_{OSD1}	Driver Short-Circuit Current, V_{OUT} = High (Note 4)	–7V ≤ V_{OUT} ≤ 10V		35		250	mA
I_{OSD2}	Driver Short-Circuit Current, V_{OUT} = Low (Note 4)	–7V ≤ V_{OUT} ≤ 10V		35		250	mA
I_{OSR}	Receiver Short-Circuit Current	0V ≤ V_{OUT} ≤ V_{CC}	●	7		85	mA

ABSOLUTE MAXIMUM RATINGS

(Note 1)

Supply Voltage (V_{CC}) 6.5V
Control Input Voltages ..... –0.3V to (V_{CC} + 0.3V)
Driver Input Voltage ..... –0.3V to (V_{CC} + 0.3V)
Driver Output Voltages ..... –7V to 10V
Receiver Input Voltages (Driver Disabled) .. –12V to 14V
Receiver Output Voltage ..... –0.3V to (V_{CC} + 0.3V)

Junction Temperature ..... 125°C
Operating Temperature Range
LTC1484C ..... 0°C ≤ T_A ≤ 70°C
LTC1484I ..... –40°C ≤ T_A ≤ 85°C
Storage Temperature Range ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec)..... 300°C

SWITCHING CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at T_A = 25°C.

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
t_{PLH}	Driver Input to Output	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF (Figures 4, 6)	●	10	28.5	60	ns
t_{PHL}	Driver Input to Output	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF (Figures 4, 6)	●	10	31	60	ns
t_{SKEW}	Driver Output to Output	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF (Figures 4, 6)	●		2.5	10	ns
t_r, t_f	Driver Rise or Fall Time	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF (Figures 4, 6)	●	3	15	40	ns
t_{ZH}	Driver Enable to Output High	C_L = 100pF (Figures 5, 7) S2 Closed	●		40	70	ns
t_{ZL}	Driver Enable to Output Low	C_L = 100pF (Figures 5, 7) S1 Closed	●		40	100	ns
t_{LZ}	Driver Disable Time from Low	C_L = 15pF (Figures 5, 7) S1 Closed	●		40	70	ns
t_{HZ}	Driver Disable Time from High	C_L = 15pF (Figures 5, 7) S2 Closed	●		40	70	ns
t_{PLH}	Receiver Input to Output	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF, (Figures 4, 8)	●	30	160	200	ns
t_{PHL}	Receiver Input to Output	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF, (Figures 4, 8)	●	30	140	200	ns
t_{SKD}	$\|t_{PLH} - t_{PHL}\|$ Differential Receiver Skew	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF, (Figures 4, 8)			20		ns
t_{ZL}	Receiver Enable to Output Low	C_{RL} = 15pF (Figures 3, 9) S1 Closed	●		20	50	ns
t_{ZH}	Receiver Enable to Output High	C_{RL} = 15pF (Figures 3, 9) S2 Closed	●		20	50	ns
t_{LZ}	Receiver Disable from Low	C_{RL} = 15pF (Figures 3, 9) S1 Closed	●		20	50	ns
t_{HZ}	Receiver Disable from High	C_{RL} = 15pF (Figures 3, 9) S2 Closed	●		20	50	ns
t_{DZR}	Driver Enable to Receiver Valid	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF (Figures 4, 10)	●		1600	3000	ns
f_{MAX}	Maximum Data Rate (Note 5)		●	4	5		Mbps
t_{SHDN}	Time to Shutdown (Note 6)	DE = 0, $\overline{RE}$↑	●	50	300	600	ns

SWITCHING CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at T_A = 25°C. V_{CC} = 5V ±5% (Notes 2 and 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 5, 7) S2 Closed, DI = DE	●		40	100	ns
$t_{ZL(SHDN)}$	Driver Enable from Shutdown to Output Low	C_L = 100pF (Figures 5, 7) S1 Closed, DI = 0	●		40	100	ns
$t_{ZH(SHDN)}$	Receiver Enable from Shutdown to Output High	C_L = 15pF (Figures 3, 9) S2 Closed, DE = 0	●			10	µs
$t_{ZL(SHDN)}$	Receiver Enable from Shutdown to Output Low	C_L = 15pF (Figures 3, 9) S1 Closed, DE = 0	●			10	µs

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

Note 2: All typicals are given for V_{CC} = 5V and T_A = 25°C.

Note 3: 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 4: For higher ambient temperatures, the part may enter thermal shutdown during short-circuit conditions.

Note 5: Guaranteed by design.

Note 6: Time for I_{CC} to drop to I_{CC}/2 when the receiver is disabled.

FUNCTION TABLES

Driver

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*

Note: Z = high impedance, X = don't care

*Shutdown mode for LTC1484

Receiver

INPUTS			OUTPUTS
$\overline{RE}$	DE	A – B	RO
0	0	$\geq V_{TH(MAX)}$	1
0	0	$\leq V_{TH(MIN)}$	0
0	0	Inputs Open	1
0	0	Inputs Shorted	1
1	X	X	Z†

†Shutdown mode for LTC1484 if DE = 0. Table valid with or without termination resistors.

TEST CIRCUITS

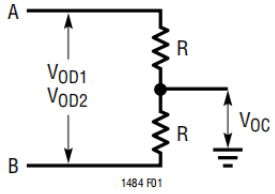


Figure 1

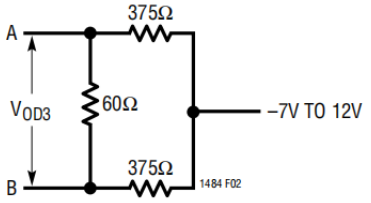


Figure 2

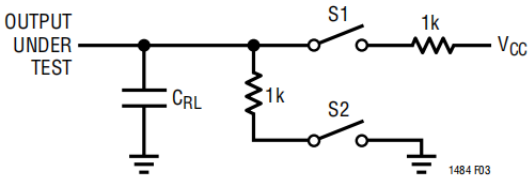


Figure 3

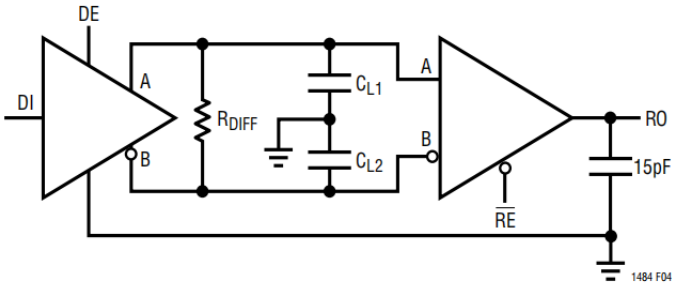


Figure 4

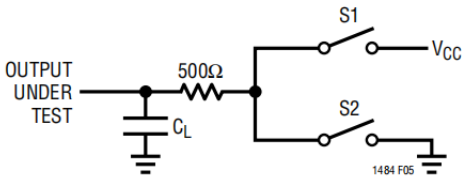
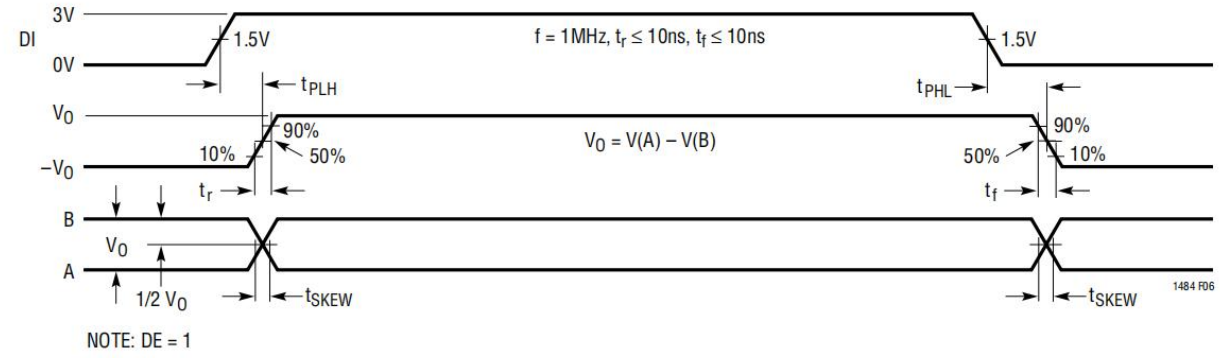


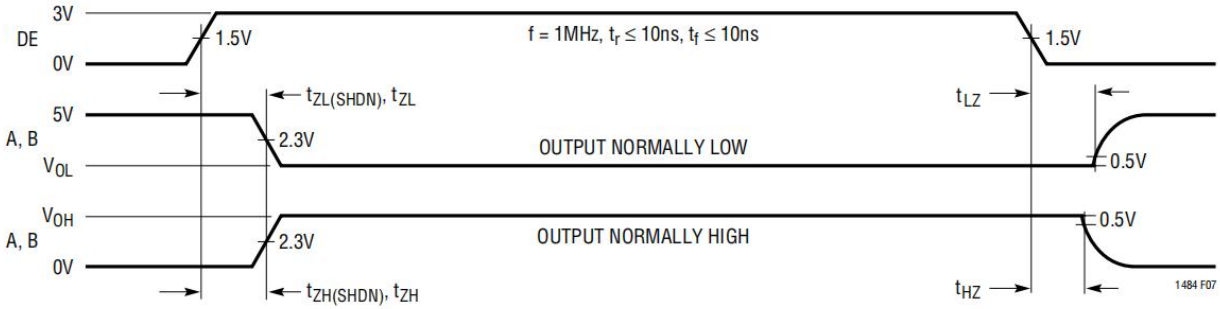
Figure 5

SWITCHING TIME WAVEFORMS



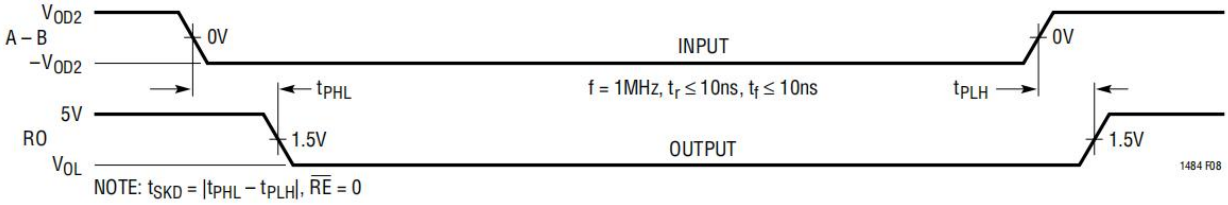
NOTE: DE = 1

Figure 6. Driver Propagation Delays



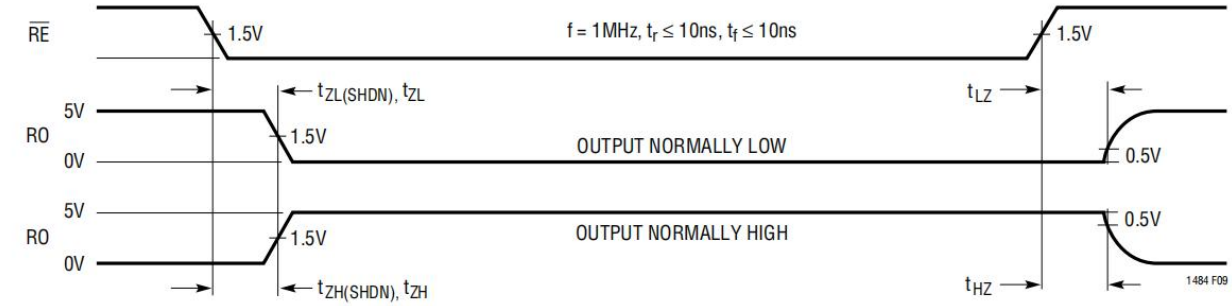
NOTE: A, B ARE THREE-STATED WHEN DE = 0, 1kΩ PULL-UP OR 1kΩ PULL-DOWN

Figure 7. Driver Enable and Disable Timing



NOTE: $t_{SKD} = |t_{PHL} - t_{PLH}|$, $\overline{RE}$ = 0

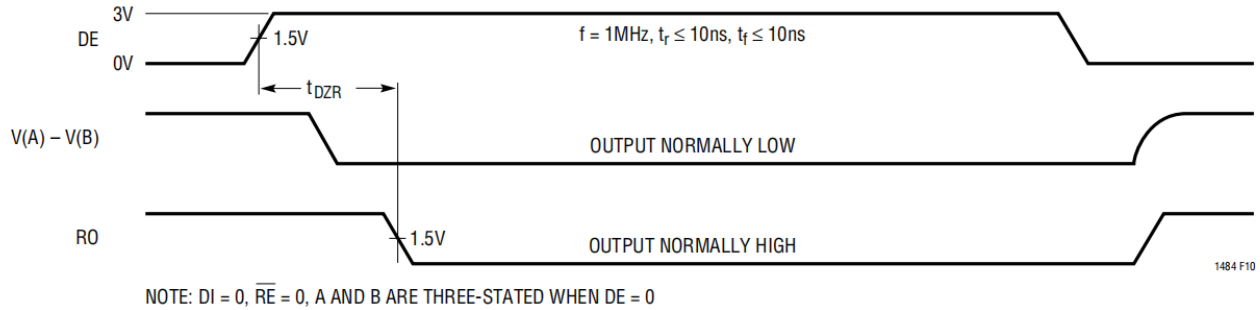
Figure 8. Receiver Propagation Delays



NOTE: DE = 0, RO IS THREE-STATED IN SHUTDOWN, 1kΩ PULL-UP FOR NORMALLY LOW OUTPUT, 1kΩ PULL-DOWN FOR NORMALLY HIGH OUTPUT

Figure 9. Receiver Enable and Shutdown Timing

SWITCHING TIME WAVEFORMS



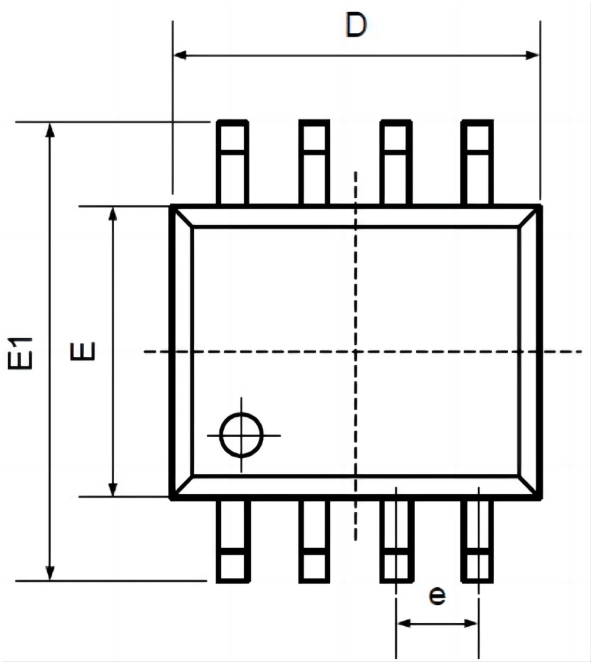
NOTE: DI = 0, $\overline{RE}$ = 0, A AND B ARE THREE-STATED WHEN DE = 0

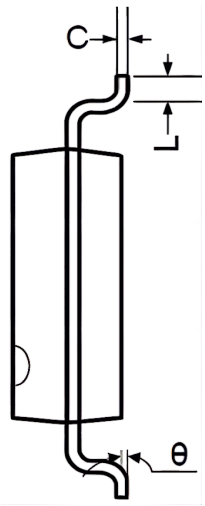
Figure 10. Driver Enable to Receiver Valid Timing

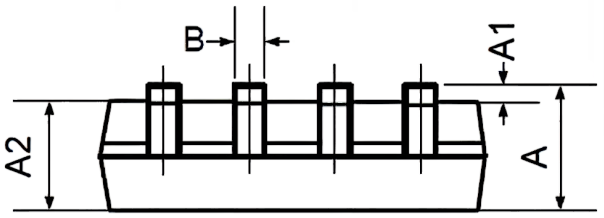
ORDERING INFORMATION

Order Number	Package	Package Quantity	Marking On The park
LTC1484CMS8-TUDI	MSOP8	Tape,Reel,2500	LTDX
LTC1484CS8-TUDI	SOP8	Tape,Reel,2500	1484
LTC1484IS8-TUDI	SOP8	Tape,Reel,2500	1484I

Package SOP8

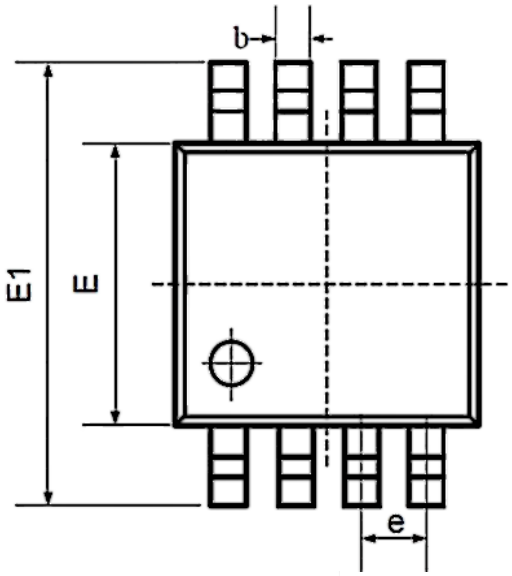


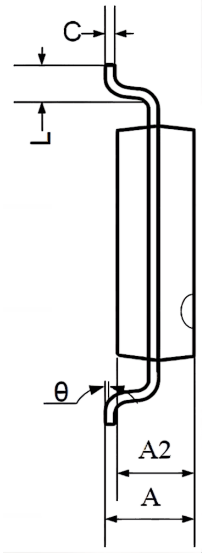


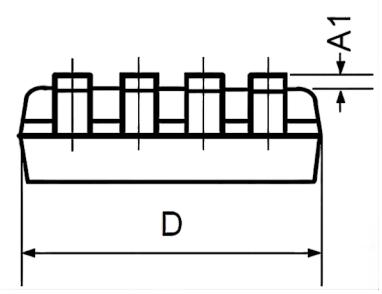


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP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

Package MSOP8

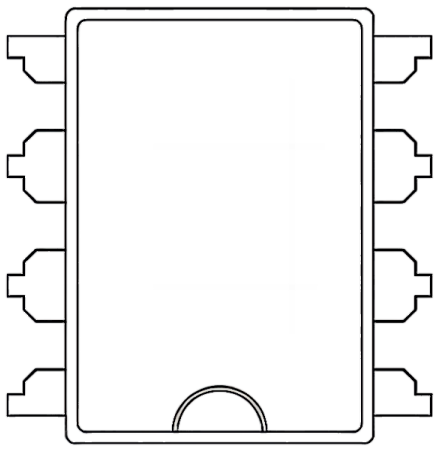


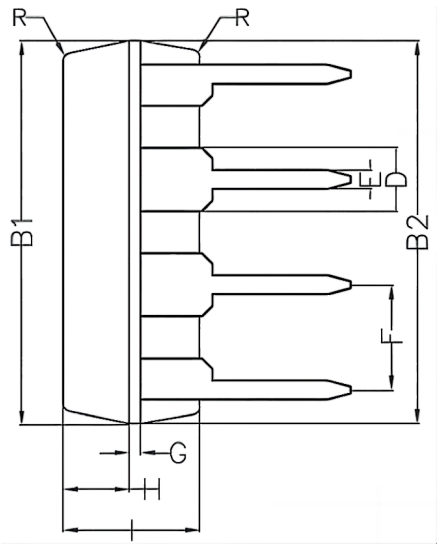


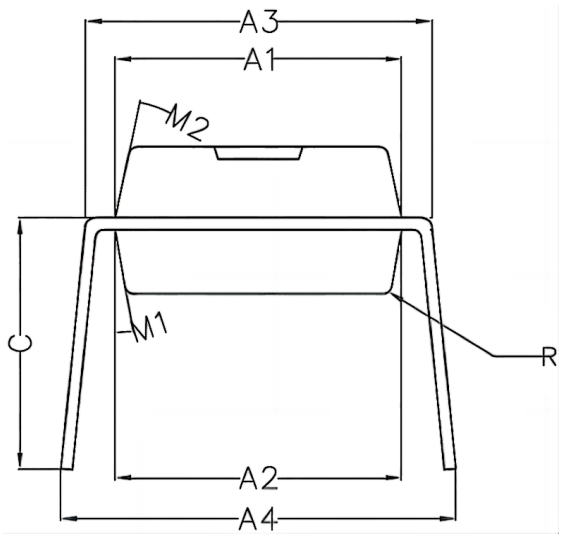


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.800	1.200	0.031	0.047
A1	0.000	0.200	0.000	0.008
A2	0.760	0.970	0.030	0.038
b	0.30 TYP		0.012 TYP	
C	0.15 TYP		0.006 TYP	
D	2.900	3.100	0.114	0.122
e	0.65 TYP		0.026 TYP	
E	2.900	3.100	0.114	0.122
E1	4.700	5.100	0.185	0.201
L	0.410	0.650	0.016	0.026
θ	0°	6°	0°	6°

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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