

钍地半导体
Tudi Semiconductor

Product Specification

TUDI-LTC1685

52Mbps, Precision Delay, RS485 Fail-Safe Transceiver

网址 www.sztdbdt.com

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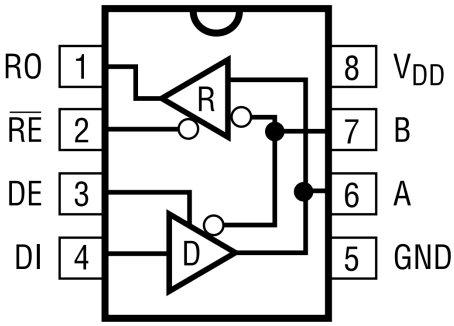
semiconductor device manufacturer

- Design
- research and development
- production
- and sales

FEATURES

- Precision Propagation Delay Over Temperature: Receiver/Driver: 18.5ns ±3.5ns
- High Data Rate: 52Mbps
- Low tPLH/tPHL Skew: Receiver/Driver: 500ps Typ
- –7V to 12V RS485 Input Common Mode Range
- Guaranteed Fail-Safe Receiver Operation Over the Entire Common Mode Range
- High Receiver Input Resistance: ≥22k, Even When Unpowered
- Short-Circuit Protected
- Thermal Shutdown Protected
- Driver Maintains High Impedance in Three-State or with Power Off
- Single 5V Supply
- Pin Compatible with LTC485
- 45dB CMRR at 26MHz

TOP VIEW



S8 PACKAGE
8-LEAD PLASTIC SO

T_{JMAX} = 125°C, θ_{JA} = 150°C/W

APPLICATIONS

- High Speed RS485/RS422 Transceivers
- Level Translator
- Backplane Transceiver
- STS-1/OC-1 Data Transceiver
- Fast-20, Fast-40 SCSI Transceivers

DESCRIPTION

The LTC1685 is a high speed, precision delay RS485 transceiver that can operate at data rates as high as 52Mbps. The device also meets the requirements of RS422.

A unique architecture provides very stable propagation delays and low skew over a wide common mode and ambient temperature range.

The driver and receiver feature three-state outputs, with disabled driver outputs maintaining high impedance over the entire common mode range. A short circuit feature detects shorted outputs and substantially reduces driver output current. A similar feature also protects the receiver output from short circuits. Thermal shutdown circuitry protects from excessive power dissipation.

The receiver has a fail-safe feature that guarantees a high output state when the inputs are shorted or are left floating. The LTC1685 RS485 transceiver guarantees receiver failsafe operation over the entire common mode range (–7V to 12V). Input resistance will remain ≥22k when the device is unpowered or disabled.

The LTC1685 operates from a single 5V supply and draws only 7mA of supply current.

PIN FUNCTIONS

RO (Pin 1): Receiver Output. If A ≥ B by 300mV, then RO will be high. If A ≤ B by 300mV, then RO will be low.

$\overline{RE}$ (Pin 2): Receiver Enable. $\overline{RE}$ = Low enables the receiver. $\overline{RE}$ = High forces receiver output into high impedance state. Do not float.

DE (Pin 3): Driver Enable. DE = High enables the driver. DE = Low will force the driver output into a high impedance state and the device will function as a line receiver if $\overline{RE}$ is also low. Do not float.

DI (Pin 4): Driver Input. Controls the states of the A and B outputs only if DE = High. If DE = Low, DI will have no effect on A and B pins. Do not float.

GND (Pin 5): Ground.

A (Pin 6): Noninverting Receiver Input/Driver Output.

B (Pin 7): Inverting Receiver Input/Driver Output.

V_{DD} (Pin 8): Positive Supply, 5V to ±5%. Bypass with 0.1µF ceramic capacitor.

ABSOLUTE MAXIMUM RATINGS

(Note 1)

Supply Voltage (V_{DD}) 10V
Control Input Currents ..... –100mA to 100mA
Control Input Voltages ..... –0.5V to V_{DD} + 0.5V
Driver Input Voltages ..... –0.5V to V_{DD} + 0.5V
Driver Output Voltages ..... +12V/–7V
Receiver Input Voltages ..... +12V/–7V
Receiver Output Voltages ..... –0.5V to V_{DD} + 0.5V
Receiver Input Differential 10V
Short-Circuit Duration (Driver V_{OUT}: –7V to 10V,
Receiver V_{OUT}: 0V to V_{DD}) ..... Indefinite
Operating Temperature Range
LTC1685C ..... 0°C to 70°C
LTC1685I ..... –40°C to 85°C
Storage Temperature Range ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

DC ELECTRICAL CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
V_{OD1}	Differential Driver Output (Unloaded)	I_{OUT} = 0	●			V_{DD}	V
V_{OD2}	Differential Driver Output (With Load)	R = 50Ω (RS422) R = 27Ω (RS485), Figure 1	 ●	2 1.5		 V_{DD}	V V
ΔV_{OD}	Change in Magnitude of Driver Differential Output Voltage for Complementary Output States	R = 27Ω or 50Ω, Figure 1	●			0.2	V
V_{OC}	Driver Common Mode Output Voltage	R = 27Ω or 50Ω, V_{DD} = 5V, Figure 1	●	2		3	V
$\Delta \lvert V_{OC} \rvert$	Change in Magnitude of Driver Common Mode Output Voltage for Complementary Output States	R = 27Ω or 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, $\overline{RE}$	●	−1		1	µA
I_{IN2}	Input Current (A, B)	V_A, V_B = 12V, DE = 0, V_{DD} = 0V or 5.25V V_A, V_B = −7V, DE = 0, V_{DD} = 0V or 5.25V	● ●	 −500		500 	µA µA
V_{TH}	Differential Input Threshold Voltage for Receiver	−7V ≤ V_{CM} ≤ 12V	●	−0.3		0.3	V
ΔV_{TH}	Receiver Input Hysteresis	V_{CM} = 0V			25		mV
V_{OH}	Receiver Output High Voltage	I_{OUT} = −4mA, V_{ID} = 300mV	●	3.5	4.8		V
V_{OL}	Receiver Output Low Voltage	I_{OUT} = 4mA, V_{ID} = −300mV	●			0.4	V
I_{OZR}	Three-State (High Impedance) Output Current at Receiver	0.4V ≤ V_{OUT} ≤ 2.4V	●	−1		1	µA
I_{DD}	Supply Current	No Load, Pins 2, 3, 4 = 0V or V_{DD}	●		7	12	mA
I_{OSD1}	Driver Short-Circuit Current, V_{OUT} = HIGH	V_{OUT} = −7V or 10V (Note 5)	●			20	mA

DC ELECTRICAL CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
I_{OSD2}	Driver Short-Circuit Current, V_{OUT} = LOW	V_{OUT} = −7V or 10V (Note 5)	●			20	mA
I_{OSR}	Receiver Short-Circuit Current	V_{OUT} = 0V or V_{DD} (Note 5)	●			20	mA
R_{IN}	Input Resistance	−7V ≤ V_{CM} ≤ 12V	●	22			kΩ
C_{IN}	Input Capacitance	A, B Inputs, D, DE, $\overline{RE}$			3		pF
	Open-Circuit Input Voltage, Figure 5	V_{DD} = 5V (Note 4)	●	3.2	3.3	3.4	V
Fail-Safe Time	Time to Detect Fail-Safe Condition				2		µs
CMRR	Receiver Input Common Mode Rejection Ratio	V_{CM} = 2.6V, f = 26MHz			45		dB
C_{LOAD}	Receiver and Driver Output Load Capacitance	(Note 4)	●			500	pF

SWITCHING CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
t_{PLH}, t_{PHL}	Driver Input-to-Output Propagation Delay	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF, Figures 3, 5, LTC1685C LTC1685I	 ● ●	 15 13	 18.5 18.5	 22 25	 ns ns
t_{SKEW}	Driver Output A-to-Output B Skew	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF, Figures 3, 5			500		ps
t_r, t_f	Driver Rise/Fall Time	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF, Figures 3, 5			3.5		ns
t_{ZH}	Driver Enable to Output High	C_L = 100pF, S2 Closed, Figures 4, 6	●		25	50	ns
t_{ZL}	Driver Enable to Output Low	C_L = 100pF, S1 Closed, Figures 4, 6	●		25	50	ns
t_{LZ}	Driver Disable from Low	C_L = 15pF, S1 Closed, Figures 4, 6	●		25	50	ns
t_{HZ}	Driver Disable from High	C_L = 15pF, S2 Closed, Figures 4, 6	●		25	50	ns
t_{PLH}, t_{PHL}	Receiver Input-to-Output Propagation Delay	C_L = 15pF, Figures 3, 7 LTC1685C LTC1685I	 ● ●	 15 13	 18.5 18.5	 22 25	 ns ns
t_{SQD}	Receiver Skew $\lvert t_{PLH} - t_{PHL} \rvert$	C_L = 15pF, Figures 3, 7			500		ps
t_{ZL}	Receiver Enable to Output Low	C_L = 15pF, S1 Closed, Figures 2, 8	●		25	50	ns
t_{ZH}	Receiver Enable to Output High	C_L = 15pF, S2 Closed, Figures 2, 8	●		25	50	ns
t_{LZ}	Receiver Disable from Low	C_L = 15pF, S1 Closed, Figures 2, 8	●		25	50	ns
t_{HZ}	Receiver Disable from High	C_L = 15pF, S2 Closed, Figures 2, 8	●		25	50	ns
	Maximum Receiver Input Rise/Fall Times	(Note 4)	●			2000	ns
$t_{PKG-PKG}$	Package-to-Package Skew	Same Temperature (Note 4)			1.5		ns
	Minimum Input Pulse Width	V_{DD} = 5V ± 5% (Note 4) LTC1685C LTC1685I	 ● ●	 	 17 20	 19.2 25	 ns ns
	Maximum Data Rate	V_{DD} = 5V ± 5% (Note 4) LTC1685C LTC1685I	 ● ●	 52 40	 60 50	 	 Mbps Mbps
	Maximum Input Frequency	V_{DD} = 5V ± 5% (Note 4) LTC1685C LTC1685I	 ● ●	 26 20	 30 25	 	 MHz MHz

SWITCHING CHARACTERISTICS

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

Note 2: All currents into the device pins are positive; all currents out of the device pins are negative.

Note 3: All typicals are given for V_{DD} = 5V, T_A = 25°C.

Note 4: Guaranteed by design, but not tested.

Note 5: Short-circuit current does not represent output drive capability. When the output detects a short-circuit condition, output drive current is significantly reduced (from hundreds of mA to 20mA max) until the short is removed.

FUNCTION TABLES

Transmitting

INPUTS $\overline{RE}$	INPUTS DE	INPUTS DI	LINE CONDITION	OUTPUTS B	OUTPUTS A
X	1	1	No Fault	0	1
X	1	0	No Fault	1	0
X	0	X	X	Hi-Z	Hi-Z
X	1	X	Fault	±10mA Current Source	

Receiving

INPUTS $\overline{RE}$	INPUTS DE	A – B	OUTPUT RO
0	0	≥ 300mV	1
0	0	≤ –300mV	0
0	0	Inputs Open	1
0	0	Inputs Shorted Together A = B = –7V to 12V	1
1	X	X	Hi-Z

TEST CIRCUITS

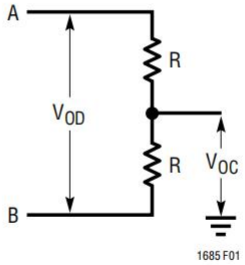


Figure 1. Driver DC Test Load

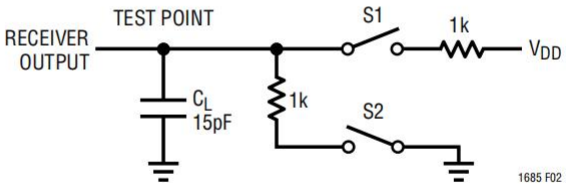


Figure 2. Driver DC Test Load

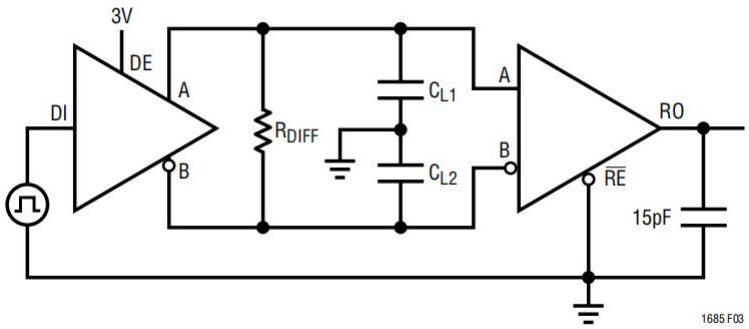


Figure 3. Driver/Receiver Timing Test Circuit

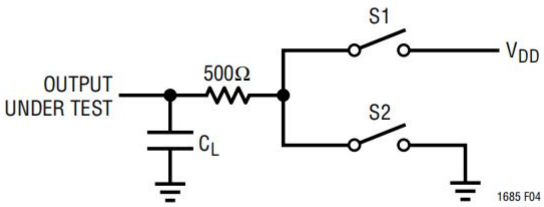


Figure 4. Driver Timing Test Load #2

SWITCHING TIME WAVEFORMS

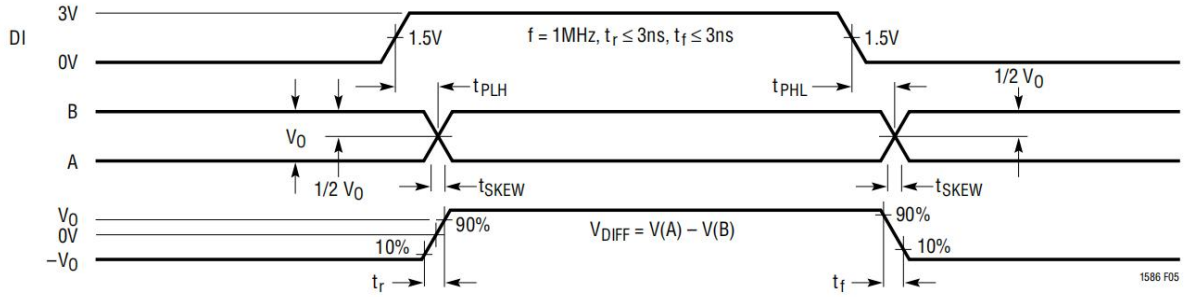


Figure 5. Driver Propagation Delays

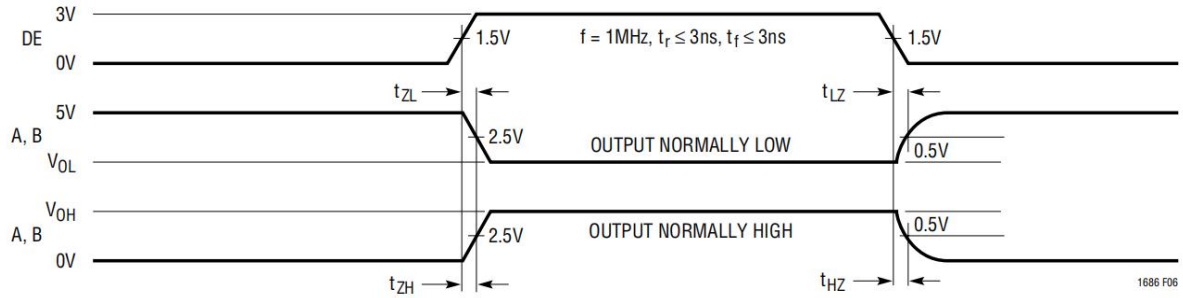


Figure 6. Driver Enable and Disable Times

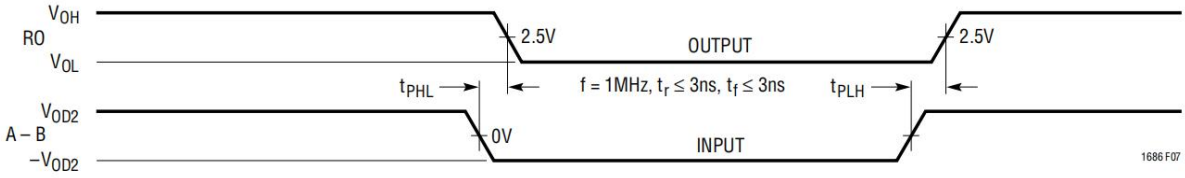


Figure 7. Receiver Propagation Delays

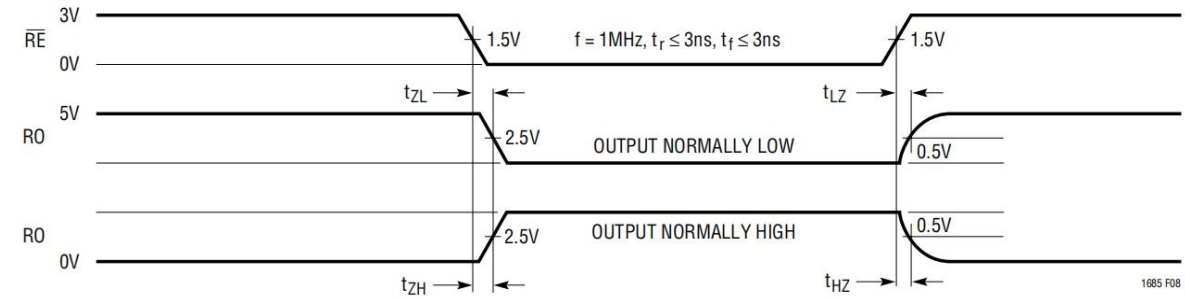


Figure 8. Receiver Enable and Disable Times

EQUIVALENT INPUT NETWORKS

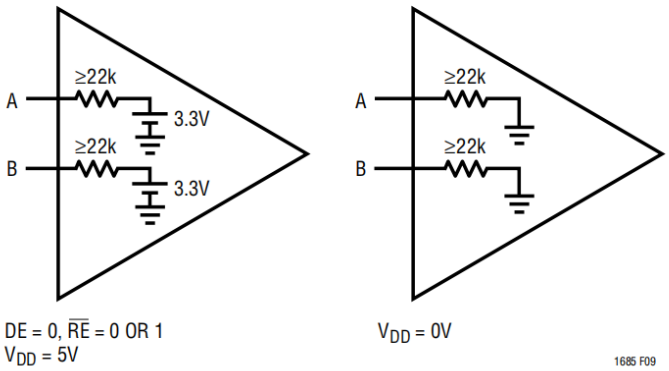
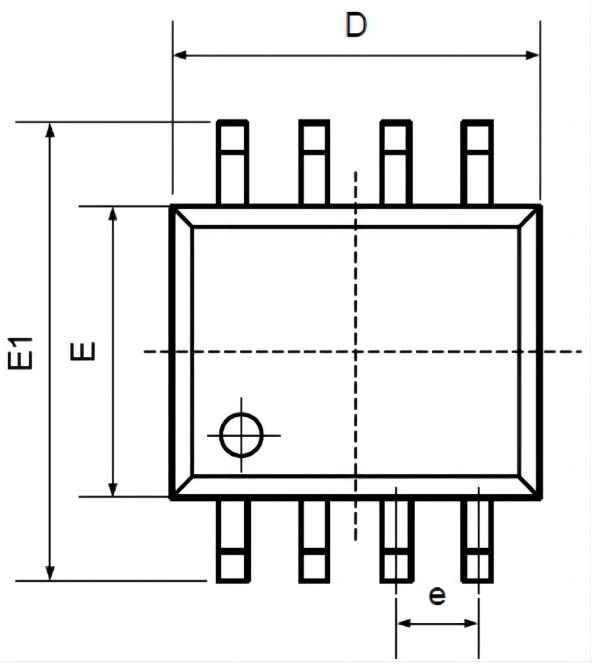


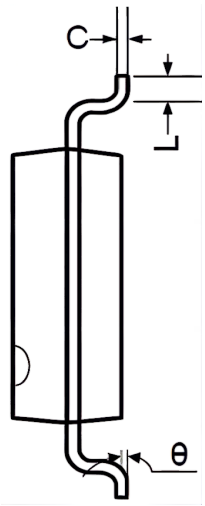
Figure 9. Input Thevenin Equivalent

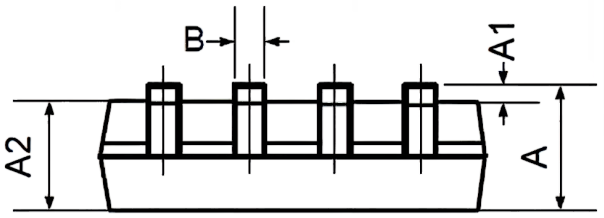
ORDERING INFORMATION

Order Number	Package	Package Quantity	Marking On The park
LTC1685CS8-TUDI	SOP8	Tape,Reel,2500	1685
LTC1685IS8-TUDI	SOP8	Tape,Reel,2500	1685I

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°

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