

## High ESD-Protected, Fail-Safe, Slew-Rate-Limited RS-485 Transceivers

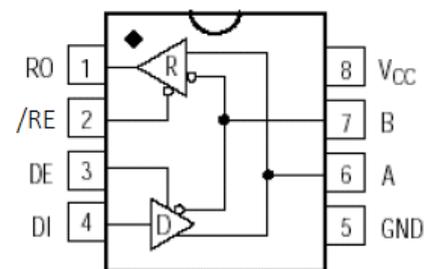
### General Description

The BL3085B is a half-duplex RS-485 transceiver with  $\pm 18\text{kV}$  IEC 61000-4-2 contact discharge protection. The BL3085B contains one driver and one receiver. The device features fail-safe circuitry, which guarantees a logic-high receiver output when the receiver inputs are open or shorted. This means that the receiver output will be logic high even if all transmitters on a terminated bus are disabled. The BL3085B features reduced slew-rate driver that minimizes EMI and reduces reflections caused by improperly terminated cables, allowing error-free data transmission up to 250kbps. The BL3085B has a 1/8 unit load receiver input impedance that allows up to 256 transceivers on the bus.

### Features

- +5V Operation
- True Fail-Safe Receiver
- Data transmission up to 250kbps
- Allow Up to 256 Transceivers on the Bus
- $\pm 18\text{kV}$  IEC 61000-4-2 ESD Protection on I/O Bus Pins
- Available in SOP8 Package

### Functional Block



### Applications

- RS-485 Communications
- Level Translators
- Transceivers for EMI-Sensitive Applications
- Industrial Control Local Area Networks
- Energy Meter Networks
- Lighting Systems

## Pin Function Description

Pin Number	Name	Function
1	RO	Receiver Output.
2	/RE	Receiver Output Enable. /RE is low to enable the Receiver; /RE is high to disable the Receiver.
3	DE	Driver Output Enable: DE is high to enable the Driver; DE is low to disable the Driver.
4	DI	Driver Input
5	GND	Ground.
6	A	Non-inverting Receiver Input and Non-inverting Driver Output.
7	B	Inverting Receiver Input and Inverting Driver Output.
8	V <sub>CC</sub>	Power Supply.

## Function Table (Transmitting)

Inputs			Outputs	
/RE	DE	DI	A	B
X	1	1	1	0
X	1	0	0	1
0	0	X	High-Z	High-Z
1	0	X	Shutdown (High-Z)	

## Function Table (Receiving)

Inputs			Outputs
/RE	DE	A-B	RO
0	X	$\geq -50\text{mV}$	1
0	X	$\leq -200\text{mV}$	0
0	X	Open/shorted	1
1	1	X	High-Z
1	0	X	Shutdown (High-Z)

## Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Power Supply	V <sub>CC</sub>	+7	V
Control Input Voltage	/RE, DE	-0.3 to V <sub>CC</sub> +0.3	V
Transmitter Input Voltage	DI	-0.3 to V <sub>CC</sub> +0.3	V
Transmitter Output Voltage	A, B	-8 to +13	V
Receiver Input Voltage	A, B	-8 to +13	V
Receiver Output Voltage	RO	-0.3 to V <sub>CC</sub> +0.3	V
Operating Temperature		-40 to +85	°C

## DC Electrical Characteristics

(V<sub>CC</sub>=+5V±5%, TA=-40°C~+85°C, Typical Values are V<sub>CC</sub>=+5V and TA=25°C) (Note1)

Parameter	Symbol	conditions	MIN	TYP	MAX	UNITS
Power Supply	V <sub>CC</sub>		4.5		5.5	V
<b>Driver</b>						
Differential Driver Output(no load)	V <sub>OD1</sub>	Figure 1			5	V
Differential Driver Output	V <sub>OD2</sub>	Figure 1, R=27Ω	1.5			V
Change in Magnitude of Differential Output Voltage (Note 2)	ΔV <sub>OD</sub>	Figure 1, R=27Ω			0.2	V
Driver Common-mode Output Voltage	V <sub>OC</sub>	Figure 1, R=27Ω	1.0		3.0	V
Change in Magnitude of Common-Mode Voltage (Note 2)	ΔV <sub>OC</sub>	Figure 1, R=27Ω			0.2	V
Input High Voltage	V <sub>IH</sub>	DE,DI,/RE	2.0			V
Input Low Voltage	V <sub>IL</sub>	DE,DI,/RE			0.8	V
DI Input Hysteresis	V <sub>HYS</sub>			100		mV
Input Current(A and B)	I <sub>IN4</sub>	DE=GND V <sub>CC</sub> =GND or 5.25V	V <sub>IN</sub> =12V		125	μA
			V <sub>IN</sub> =-7V	-75		
Driver Short-Circuit Output Current	I <sub>OSD</sub>	A Pin Short to B Pin	-100		100	mA
<b>Receiver</b>						
Receiver Differential Threshold Voltage	V <sub>TH</sub>	-7V≤V <sub>CM</sub> ≤12V	-200	-125	-50	mV

Receiver Input Hysteresis	$\Delta V_{TH}$			40		mV	
Receiver Output High Voltage	$V_{OH}$	$I_O=-4mA, V_{ID}=-50mV$	$V_{CC}-1.5$			V	
Receiver Output Low Voltage	$V_{OL}$	$I_O=4mA, V_{ID}=-200mV$			0.4	V	
Three-State Output Current at Receiver	$I_{OZR}$				$\pm 1$	$\mu A$	
Receiver Input Resistance	$R_{IN}$	$-7V \leq V_{CM} \leq 12V$	96			K $\Omega$	
Receiver Output Short-Circuit Current	$I_{OSR}$	$0V \leq V_{RO} \leq V_{CC}$	$\pm 7$		$\pm 95$	mA	
<b>Supply Current</b>							
Supply Current	$I_{CC}$	No load , /RE=DI= GND or $V_{CC}$	DE= $V_{CC}$		150	600	$\mu A$
			DE=GND		185	600	$\mu A$
Supply Current in Shutdown Mode	$I_{SHDN}$	DE=GND, /RE= $V_{CC}$ , DI= $V_{CC}$ or GND				10	$\mu A$

Note 1: All currents into the device are positive. All currents out of the device are negative. All voltages are referred to device ground unless otherwise noted.

Note 2:  $\Delta V_{OD}$  and  $\Delta V_{OC}$  are the changes in  $V_{OD}$  and  $V_{OC}$ , respectively, when the DI input changes state.

## Switching Characteristics

( $V_{CC}=+5V \pm 5\%$ ,  $T_A=-40^\circ C \sim +85^\circ C$ , Typical values are at  $V_{CC}=+5V$ ,  $T_A=25^\circ C$ )

Parameter	Symbol	Conditions	MIN	TYP	MAX	UNITS
Driver Input to Output	$t_{DPLH}$	Figure 3 and 5, $R_{DIFF}=54\Omega$		450	800	ns
	$t_{DPHL}$	$C_{L1}=C_{L2}=100pF$		450	800	
Driver Output Skew   $T_{DPLH} - T_{DPHL}$	$t_{DSKEW}$	Figure 3 and 5, $R_{DIFF}=54\Omega$ $C_{L1}=C_{L2}=100pF$			100	ns
Driver Rise or Fall Time	$t_{DR}, t_{DF}$	Figure 3 and 5, $R_{DIFF}=54\Omega$ $C_{L1}=C_{L2}=100pF$		150	500	ns

Maximum Data Rate	$F_{MAX}$		250			kbps
Driver Enable to Output High	$t_{DZH}$	Figure 4 and 6, $C_L=100pF$ S2 Closed			200	ns
Driver Enable to Output Low	$t_{DZL}$	Figure 4 and 6, $C_L=100pF$ S1 Closed			200	ns
Driver Disable Time from Low	$t_{DLZ}$	Figure 4 and 6, $C_L=15pF$ S1 Closed			300	ns
Driver Disable Time from High	$t_{DHZ}$	Figure 4 and 6, $C_L=15pF$ S2 Closed			300	ns
Receiver Input to Output	$t_{RPLH}$ $t_{RPHL}$	Figure 7 and 9, $ V_{ID}  \geq 2.0V$ ; rise and fall time of $VID \leq 15ns$		450	800	ns
$ T_{RPLH} - T_{RPHL} $ Differential Receiver Skew	$t_{RSKD}$	Figure 7 and 9, $ V_{ID}  \geq 2.0V$ ; rise and fall time of $VID \leq 15ns$		30		ns
Receiver Enable to Output Low	$t_{RZL}$	Figure 2 and 8, $C_{RL}=15pF$ S1 Closed		20	50	ns
Receiver Enable to Output High	$t_{RZH}$	Figure 2 and 8, $C_{RL}=15pF$ S2 Closed		20	50	ns
Receiver Disable Time from Low	$t_{RLZ}$	Figure 2 and 8, $C_{RL}=15pF$ S1 Closed		80	150	ns
Receiver Disable Time from High	$t_{RHZ}$	Figure 2 and 8, $C_{RL}=15pF$ S2 Closed		80	150	ns
Time to Shutdown	$t_{SHDN}$			50	300	ns
Driver Enable from Shutdown to Output High	$t_{DZH(SHDN)}$	Figure 4 and 6, $C_L=100pF$ S2 Closed			200	ns
Driver Enable from Shutdown to Output Low	$t_{DZL(SHDN)}$	Figure 4 and 6, $C_L=100pF$ S1 Closed			200	ns

Receiver Enable from Shutdown to Output High	$t_{RZH(SHDN)}$	Figure 2 and 8, $C_{RL}=15pF$ S2 Closed			300	ns
Receiver Enable from Shutdown to Output Low	$t_{RZL(SHDN)}$	Figure 2 and 8, $C_{RL}=15pF$ S1 Closed			300	ns

## Test Circuits and Timing Diagrams

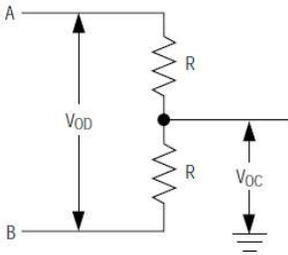


Figure 1: Driver DC Test Load

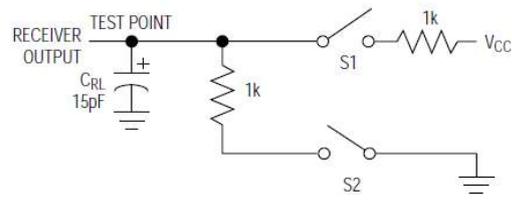


Figure 2: Receiver Enable/Disable Timing Test Load

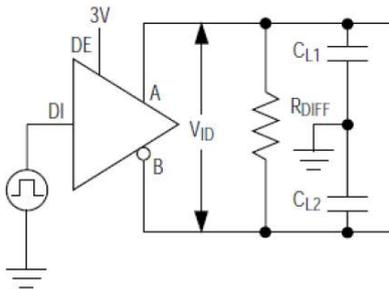


Figure 3: Driver Timing Test Circuit

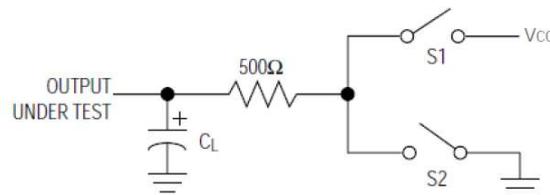


Figure 4: Driver Enable/Disable Timing Test Load

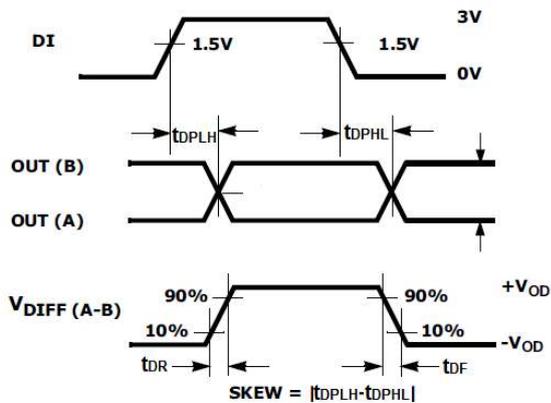


Figure 5: Driver Propagation Delays

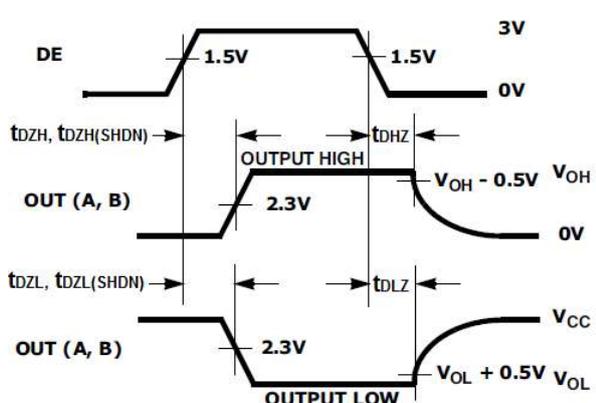


Figure 6: Driver Enable and Disable Times

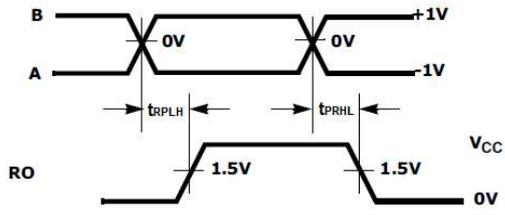


Figure 7: Receiver Propagation Delays

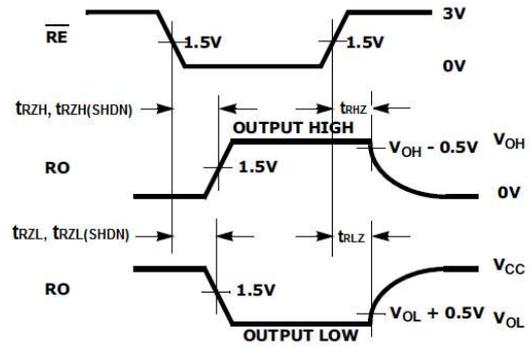


Figure 8: Receiver Enable and Disable Times

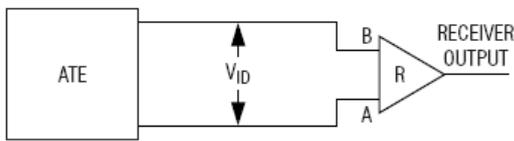


Figure 9: Receiver Propagation Delay Test Circuit

## Typical Application

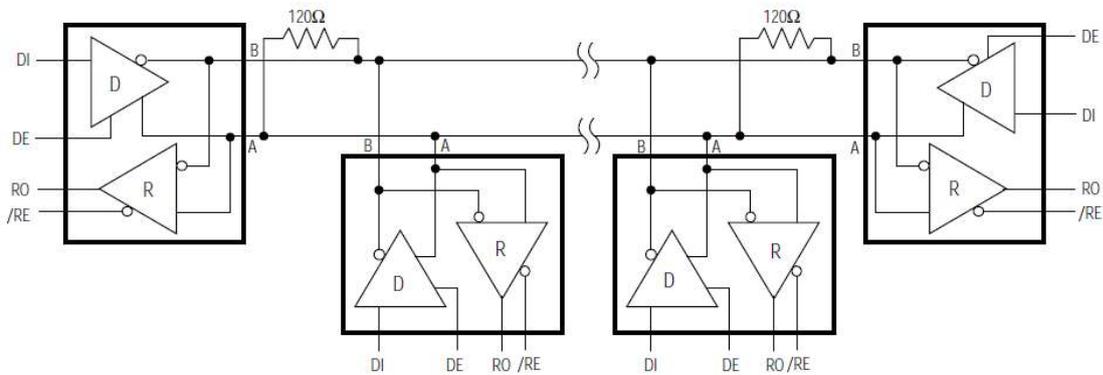
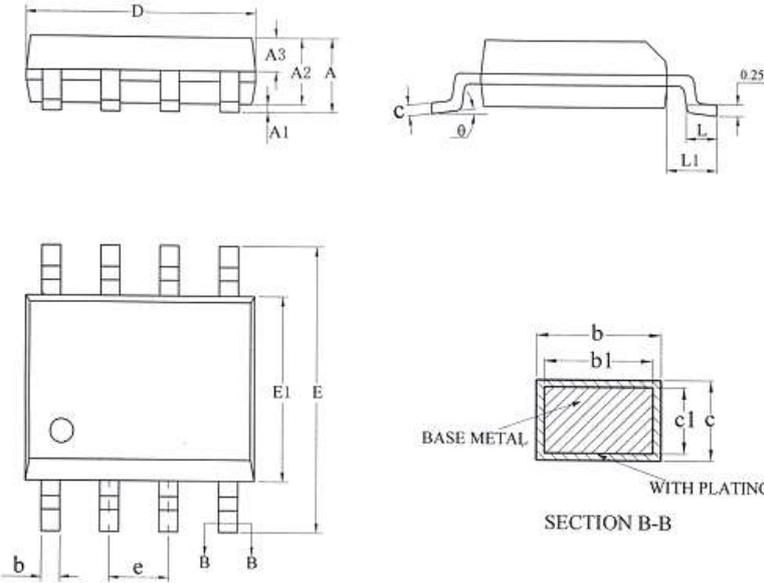


Figure10 Typical Half-Duplex RS-485 Network

**Package Information (SOP8)**


SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.77
A1	0.08	0.18	0.28
A2	1.20	1.40	1.60
A3	0.55	0.65	0.75
b	0.39	—	0.48
b1	0.38	0.41	0.43
c	0.21	—	0.26
c1	0.19	0.20	0.21
D	4.70	4.90	5.10
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	1.27BSC		
L	0.50	0.65	0.80
L1	1.05BSC		
theta	0	—	8°