High ESD-Protected, Fail-Safe, Slew-Rate-Limited

RS-485 Transceivers

General Description

The BL3085A(H) is a half-duplex RS-485 transceiver with ±15kV IEC 61000-4-2 contact ESD protection. This device contains one driver and one receiver. The BL3085A(H) includes 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 BL3085A(H) 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 BL3085A(H) has a 1/8 unit load receiver input impedance that allows up to 256 transceivers on the bus.

Features

- +3.3V or +5V Operation
- True Fail-Safe Receiver
- Maximum Data Rate: 250kbps
- Allow Up to 256 Transceivers on the Bus
- I/O Pins ESD Protection:
    ±15kV IEC 61000-4-2, contact Discharge
- Available in SOP8 Package

Functional Block
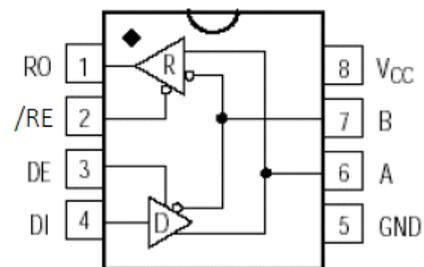
Applications

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

Ordering Information

Part Number	Package	Marking
BL3085A(H)	SOP8	BL3085A I47SSSSS

"SSSSS" : Product Trace Code

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_{CC}	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	>-50mV	1
0	X	<-200mV	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_{CC}	+7	V
Control Input Voltage	/RE, DE	-0.3 to V_{CC}+0.3	V
Transmitter Input Voltage	DI	-0.3 to V_{CC}+0.3	V
Transmitter Output Voltage	A, B	$\pm$13	V
Receiver Input Voltage	A, B	$\pm$13	V
Receiver Output Voltage	RO	-0.3 to V_{CC}+0.3	V
Operating Temperature		-40 to +85	℃

DC Electrical Characteristics（5V Operation）

（VCC=+5V$\pm$5％,TA=-40℃～+85℃, Typical Values are VCC=+5V and TA＝25℃）（Note1）

Parameter	Symbol	conditions	MIN	TYP	MAX	UNITS
Power Supply	Vcc		4.5		5.5	V
Driver						
Differential Driver Output(no load)	V_{OD1}	Figure 1			V_{CC}	V
Differential Driver Output	V_{OD2}	Figure 1，R=27Ω	1.5			V
Change in Magnitude of Differential Output Voltage（Note2）	ΔV_{OD}	Figure 1，R=27Ω			0.2	V
Driver Common-mode Output Voltage	V_{OC}	Figure 1，R=27Ω	1.0		3.0	V
Change in Magnitude of Common-Mode Voltage（Note2）	ΔV_{OC}	Figure 1，R=27Ω			0.2	V
Input High Voltage	V_{IH}	DE,DI,/RE	2.0			V

Input Low Voltage	V_{IL}	DE,DI,/RE				0.8	V
DI Input Hysteresis	V_{HYS}				100		mV
Input Current(A and B)	I_{IN4}	DE=GND V_{CC}=GND or 5.25V	V_{IN}=12V			125	μA
			V_{IN}=-7V	-75			
Driver Short-Circuit Output Current	I_{OSD}	A Pin Short to B Pin		-100		100	mA
Receiver							
Receiver Differential Threshold Voltage	V_{TH}	-7V≦V_{CM}≦12V		-200	-125	-50	mV
Receiver Input Hysteresis	$\triangle V_{TH}$				40		mV
Receiver Output High Voltage	V_{OH}	I_O=-8mA,V_{ID}=-50mV		4.0			V
Receiver Output Low Voltage	V_{OL}	I_O=8mA,V_{ID}=-200mV				0.4	V
Three-State Output Current at Receiver	I_{OZR}					±1	μA
Receiver Input Resistance	R_{IN}	-7V≦V_{CM}≦12V		96			KΩ
Receiver Output Short-Circuit Current	I_{OSR}	0V≦V_{RO}≦V_{CC}		±7		±95	mA
Supply Current							
Supply Current	I_{CC}	No load , /RE=DI = GND or V_{CC}	DE=V_{CC}		350	600	μA
			DE=GND		370	600	μA
Supply Current in Shutdown Mode	I_{SHDN}	DE=GND, /RE=VCC，DI=V_{CC} or GND				10	μA

DC Electrical Characteristics（3.3V Operation）

（VCC=+3.3V±5％,TA=-40℃～+85℃, Typical Values are VCC=+3.3V and TA＝25℃）（Note1）

Parameter	Symbol	conditions		MIN	TYP	MAX	UNITS
Power Supply	V_{CC}			3		3.6	V
Driver							
Differential Driver Output(no load)	V_{OD1}	Figure 1				V_{CC}	V
Differential Driver Output	V_{OD2}	Figure 1，R=27Ω		0.8	1.15		V
Change in Magnitude of Differential Output Voltage（Note 2）	ΔV_{OD}	Figure 1，R=27Ω				0.2	V
Driver Common-mode Output Voltage	V_{OC}	Figure 1，R=27Ω		1.0		3.0	V
Change in Magnitude of Common-Mode Voltage（Note 2）	ΔV_{OC}	Figure 1，R=27Ω				0.2	V
Input High Voltage	V_{IH}	DE,DI,/RE		2.0			V
Input Low Voltage	V_{IL}	DE,DI,/RE				0.8	V
DI Input Hysteresis	V_{HYS}				100		mV
Input Current(A and B)	I_{IN4}	DE=GND V_{CC}=GND or 3.6V	V_{IN}=12V			125	µA
			V_{IN}=-7V	-75			
Driver Short-Circuit Output Current	I_{OSD}	A Pin Short to B Pin		-100		100	mA
Receiver							
Receiver Differential Threshold Voltage	V_{TH}	-7V≦V_{CM}≦12V		-200	-125	-50	mV
Receiver Input Hysteresis	$\triangle V_{TH}$				40		mV
Receiver Output High Voltage	V_{OH}	I_O=-1.5mA,V_{ID}=-50 mV		V_{CC}-0.5			V
Receiver Output Low Voltage	V_{OL}	I_O=2.5mA,V_{ID}=-200 mV				0.4	V
Three-State Output Current at Receiver	I_{OZR}					±1	µA
Receiver Input	R_{IN}	-7V≦V_{CM}≦12V		96			KΩ

Resistance							
Receiver Output Short-Circuit Current	I_{OSR}	$0V \leqq V_{RO} \leqq V_{CC}$	±7		±95	mA

Supply Current

Supply Current	I_{CC}	No load，/RE=DI = GND or V_{CC}	DE=V_{CC}		270	600	µA
			DE=GND		290	600	µA
Supply Current in Shutdown Mode	I_{SHDN}	DE=GND，/RE=VCC，DI=V_{CC} or GND				10	µA

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：△VOD and △VOC are the changes in VOD and VOC, respectively, when the DI input changes state.

Switching Characteristics（5V Operation）

（VCC=+5V±5%,TA=-40℃～+85℃，Typical values are at VCC=+5V，TA＝25℃）

Parameter	Symbol	Conditions	MIN	TYP	MAX	UNITS
Driver Input to Output	t $_{DPLH}$	Figure 3 and 5，R_{DIFF}=54Ω C_{L1}=C_{L2}=100pF		300	800	ns
	t $_{DPHL}$			300	800	
Driver Output Skew |T_{DPLH} – T_{DPHL}|	t $_{DSKEW}$	Figure 3 and 5，R_{DIFF}=54Ω C_{L1}=C_{L2}=100pF			100	ns
Driver Rise or Fall Time	t_{DR}, t_{DF}	Figure 3 and 5，R_{DIFF}=54Ω C_{L1}=C_{L2}=100pF		420	900	ns
Maximum Data Rate	F $_{MAX}$		250			kbps
Driver Enable to Output High	t $_{DZH}$	Figure 4 and 6，C_L=100pF S2 Closed			300	ns
Driver Enable to Output Low	t $_{DZL}$	Figure 4 and 6，C_L=100pF S1 Closed			500	ns

Driver Disable Time from Low	t $_{DLZ}$	Figure 4 and 6，C$_L$=15pF S1 Closed			900	ns
Driver Disable Time from High	t $_{DHZ}$	Figure 4 and 6，C$_L$=15pF S2 Closed			800	ns
Receiver Input to Output	t $_{RPLH}$ t $_{RPHL}$	Figure 7 and 9，$|V_{ID}| \geq 2.0V$; rise and fall time of VID≦15ns	150	300		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≦15ns	10			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	30	60		ns
Receiver Disable Time from High	t $_{RHZ}$	Figure 2 and 8，C$_{RL}$=15pF S2 Closed	30	60		ns
Time to Shutdown	t $_{SHDN}$		500	1000		ns
Driver Enable from Shutdown to Output High	t $_{DZH(SHDN)}$	Figure 4 and6，C$_L$=100pF S2 Closed			2500	ns
Driver Enable from Shutdown to Output Low	t $_{DZL(SHDN)}$	Figure 4 and 6，C$_L$=100pF S1 Closed			2500	ns
Receiver Enable from Shutdown to Output High	t $_{RZH(SHDN)}$	Figure 2 and 8，C$_{RL}$=15pF S2 Closed			2500	ns
Receiver Enable from Shutdown to Output Low	t $_{RZL(SHDN)}$	Figure 2 and 8，C$_{RL}$=15pF S1 Closed			2500	ns

Switching Characteristics（3.3V Operation）

（VCC=+3.3V±5%,TA=-40℃～+85℃，Typical values are at VCC=+3.3V，TA＝25℃）

Parameter	Symbol	Conditions	MIN	TYP	MAX	UNITS
Driver Input to Output	t $_{DPLH}$	Figure 3 and 5，R_{DIFF}=54Ω C_{L1}=C_{L2}=100pF		280	800	ns
	t $_{DPHL}$			280	800	
Driver Output Skew |T_{DPLH} – T_{DPHL}|	t $_{DSKEW}$	Figure 3 and 5，R_{DIFF}=54Ω C_{L1}=C_{L2}=100pF			100	ns
Driver Rise or Fall Time	t_{DR}, t_{DF}	Figure 3 and 5，R_{DIFF}=54Ω C_{L1}=C_{L2}=100pF		450	900	ns
Maximum Data Rate	F $_{MAX}$		250			kbps
Driver Enable to Output High	t $_{DZH}$	Figure 4 and 6，C_L=100pF S2 Closed			300	ns
Driver Enable to Output Low	t $_{DZL}$	Figure 4 and 6，C_L=100pF S1 Closed			500	ns
Driver Disable Time from Low	t $_{DLZ}$	Figure 4 and 6，C_L=15pF S1 Closed			900	ns
Driver Disable Time from High	t $_{DHZ}$	Figure 4 and 6，C_L=15pF S2 Closed			800	ns
Receiver Input to Output	t $_{RPLH}$ t $_{RPHL}$	Figure 7 and 9，$\|V_{ID}\| \geq 2.0V$; rise and fall time of VID≤15ns		150	300	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≤15ns		10		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		30	60	ns
Receiver Disable Time from High	t $_{RHZ}$	Figure 2 and 8，C$_{RL}$=15pF S2 Closed		30	60	ns
Time to Shutdown	t $_{SHDN}$			500	1000	ns
Driver Enable from Shutdown to Output High	t $_{DZH(SHDN)}$	Figure 4 and6，C$_L$=100pF S2 Closed			2500	ns
Driver Enable from Shutdown to Output Low	t $_{DZL(SHDN)}$	Figure 4 and 6，C$_L$=100pF S1 Closed			2500	ns
Receiver Enable from Shutdown to Output High	t $_{RZH(SHDN)}$	Figure 2 and 8，C$_{RL}$=15pF S2 Closed			2500	ns
Receiver Enable from Shutdown to Output Low	t $_{RZL(SHDN)}$	Figure 2 and 8，C$_{RL}$=15pF S1 Closed			2500	ns

Test Circuits and Timing Diagrams
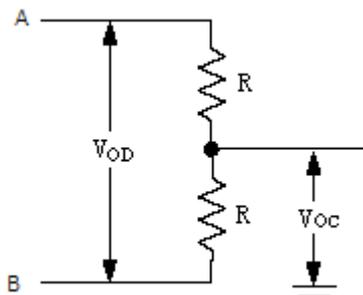
Figure 1：Driver DC Test Load
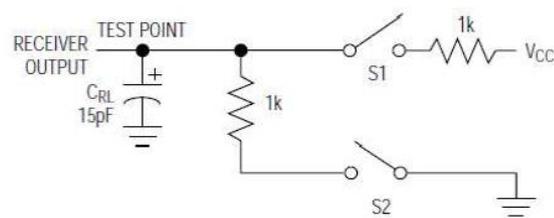
Figure 2：Receiver Enable/Disable Timing Test Load
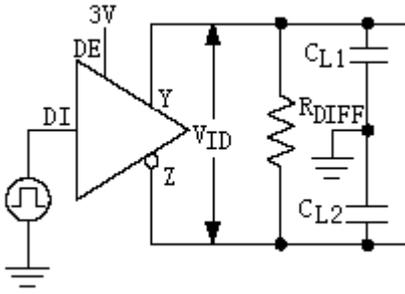
Figure 3：Driver Timing Test Circuit
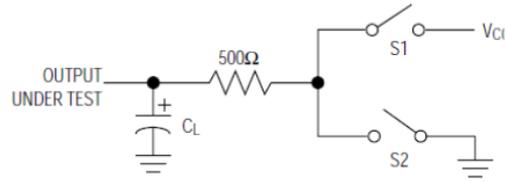
Figure 4：Driver Enable/Disable Timing Test Load
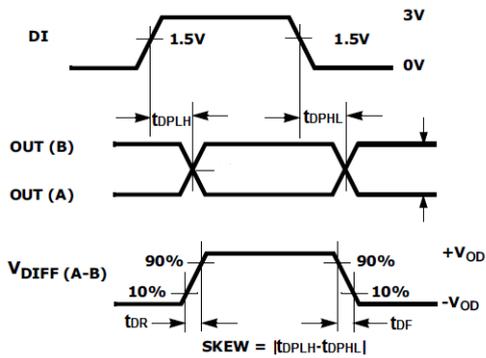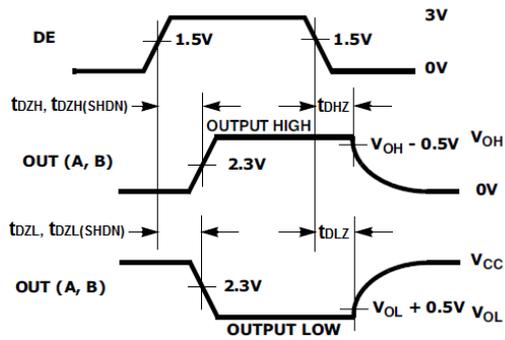

Figure 5：Driver Propagation Delays

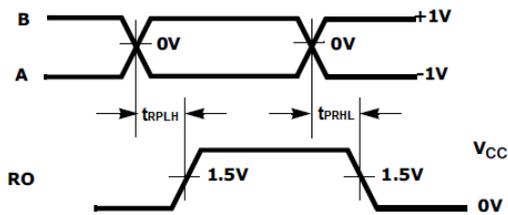Figure 6：Driver Enable and Disable Times

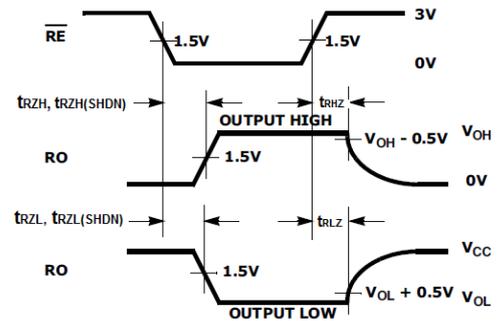Figure 7：Receiver Propagation Delays
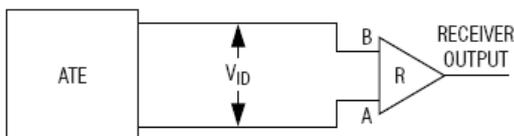

Figure 8：Receiver Enable and Disable Times

Figure 9：Receiver Propagation Delay Test Circuit
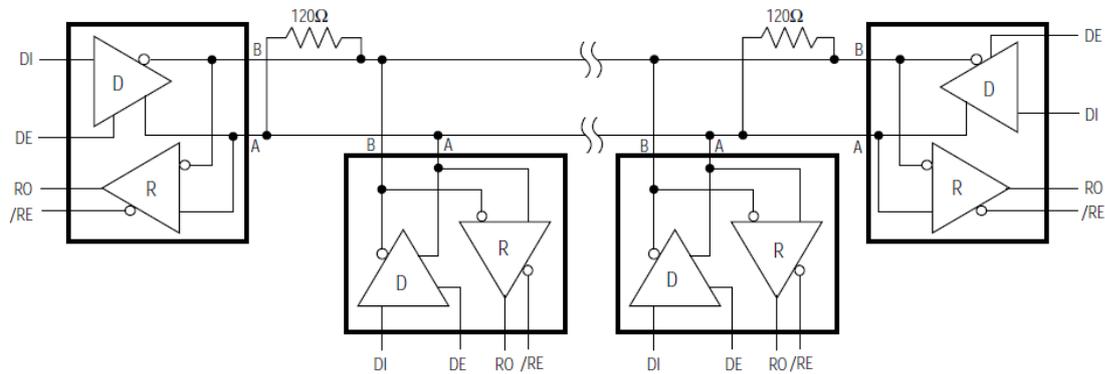
Typical Application

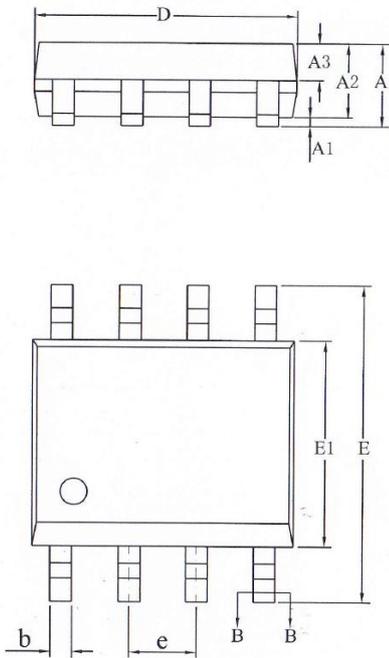Figure10 Typical Half-Duplex RS-485 Network

Package Information (SOP8)
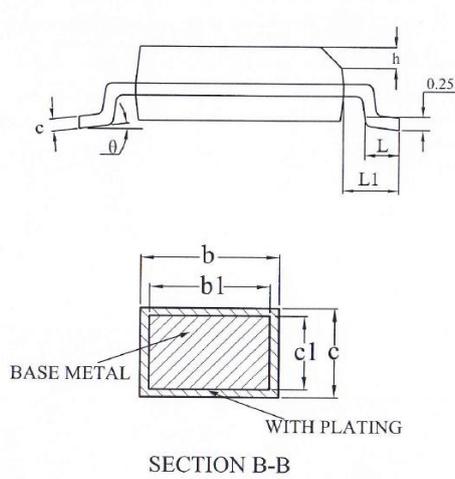
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.77
A1	0.08	0.18	0.28
A2	1.20	1.40	1.60
A3	0.55	0.65	0.75
b	0.39	—	0.48
b1	0.38	0.41	0.44
c	0.20	—	0.26
c1	0.19	0.20	0.21
D	4.70	4.90	5.10
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	1.27BSC		
h	0.25	—	0.50
L	0.50	—	0.80
L1	1.05REF		
θ	0	—	8°