± 15 kV _ ESD Protection, 16 Mbps, with fail - safe (Fail - Safe)

RS-485 transceiver

product description

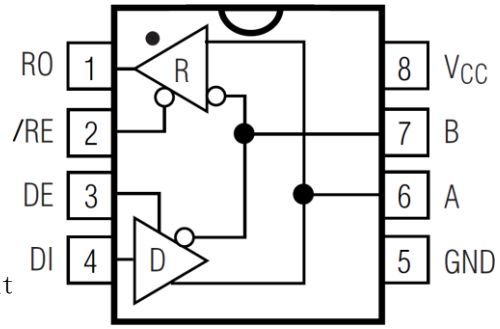
BL1590 is a 3~5.5V wide power supply, half-duplex RS-485 transceiver, the chip contains a driver and a receiver. Can achieve up to 16Mbps error-free data transmission. The BL1590 has a built-in fail-safe circuit to ensure that the output of the receiver is in a logic high state when the input of the receiver is open or shorted.

BL1590 has excellent driving capability, and the driver can provide a differential output voltage of 3.4V under the condition of 5V power supply and 54Ω load. BL1590 supports hot-swapping function, the driver and receiver are in the off state during power-on, to avoid conflicts on the bus when plugging and unplugging.

The BL1590 has a 1 -unit load receiver input impedance, allowing up to 32 transceivers on the bus . The I/O pin ESD protection capability reaches ± 15KV IEC 61000-4-2 , contact discharge.

Product Features Block Diagram

- Working voltage: 3~5.5V
- Maximum transfer rate: 16Mbps
- Built-in fail-safe circuit
- Bus allows up to 32 transceivers to be attached
- Support hot swap function
- I/O pin ESD protection: ± 15KV IEC 61000-4-2 , cont
- SOP8 package



Application field

- industrial control
- smart meter
- Collection terminal
- security monitor

Pin definition

serial number	name	function
1	RO	receiver output
2	/RE	Receiver output enable. RO output is valid when /RE is low level; RO is high impedance state when /RE is high level
3	DE	Driver output enable. The driver output is valid when DE is high level, and the output is high impedance state when DE is low level
4	DI	drive input
5	GND	grounding
6	A	Receiver non-inverting input and driver non-inverting output
7	B	Receiver inverting input and driver inverting output
8	V_{CC}	power supply

Driver Truth Table

enter			output	
/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 ）	

Receiver Truth Table

enter			output
/RE	DE	AB	RO
0	x	>-10mV	1
0	x	<-200mV	0

0	x	open / short	1
1	1	x	High-Z
1	0	x	Shutdown（ High-Z ）

Limit parameter

parameters	the symbol	limit value	unit
Operating Voltage	V_{CC}	+7	V
Control input voltage	/RE, DE	-0.3 to V_{CC}+0.3	V
Driver input voltage	DI	-0.3 to V_{CC}+0.3	V
Driver output voltage	A, B	±13	V
Receiver input voltage	A, B	±13	V
Receiver output voltage	RO	-0.3 to V_{CC}+0.3	V
range of working temperature		-40~+125	℃

DC Electrical Characteristics

(V_{CC}= + 3.0V~+5.5V, TA=-40℃ ~ +125℃, unless otherwise specified, the typical value is at V_{CC}= + 5V, T_A=25℃ (Note 1)

parameter	symbol	Test Conditions	minimum value	typical value	maximum value	unit
driver						
Differential driver output (no load)	V_{OD1}	Figure 1			V_{CC}	V
Differential Driver Output	V_{OD2}	V_{CC}=5V Figure 1, R=27Ω	2.7	3.4		V
		V_{CC}=3V Figure 1, R=27Ω	1.5	1.8		
The magnitude of the differential output voltage Variation (Note 2)	ΔV_{OD}	Figure 1, R=27Ω	-0.2		0.2	V
Driver Common Mode Output Voltage	VOC_	Figure 1, R=27Ω		V_{CC}/2	3.0	V
Amplitude variation of common mode voltage (Note 2)	ΔV_{OC}	Figure 1, R=27Ω	-0.2		0.2	V

input high voltage	V_{IH}	DE,DI,/RE		2.0			V
input low voltage	VIL	DE,DI,/RE				0.8	V
DI input hysteresis	V_{HYS}				100		mV
Input Current (A, B)	I_{IN4}	DE=GND V_{CC} =GND or V_{CC}	V_{IN} =12V			800	μA
			V_{IN} =-7V	-800			
Driver short circuit output current	I_{OSD}	A Pin Short to B Pin		-250		250	mA
receiver							
Receiver Differential Threshold Voltage	V_{TH}	-7V ≤ VCM ≤ 12V		-200	-125	-10	mV

Receiver Input Hysteresis	△ V_{TH}			25		mV
Receiver output high voltage	V_{OH}	V_{CC}=5V,I_O=-8mA	4.0			V
		V_{CC}=3V,I_O=-4mA	2.45			V
Receiver output low voltage	V_{OL}	V_{CC}=5V,I_O=8mA			0.4	V
		V_{CC}=3V,I_O=4mA			0.4	V
Receiver Tri-State Output Current	QUR_				±1	μA
Receiver input impedance	R_{IN}	-7V ≤ VCM ≤ 12V_	12			KΩ
Receiver output short circuit current	OSR_	0V ≤ V_{RO} ≤ V_{CC}			±100	mA
supply current						
supply current	I_{CC}	No load , /RE=DI= GND or V_{CC} DE=V_{CC}		1.5	2	mA
		No load , /RE=DI= GND or V_{CC} DE=GND		1.2	2	mA
Standby Mode Supply Current	I_{SHDN}	DE=GND, /RE=V_{CC}, DI=V_{CC} or GND			2	μA

Note 1: All currents into the device are positive and all currents out of the device are negative; all voltages are to ground unless otherwise specified. Note 2: When DI input changes state, △ V_{OD} and △ V_{OC} V_{OD}_ and V_{OC} amount of change.

transmission characteristics

(V_{CC}= + 3.0V~+5.5V, TA=-40℃～ +125℃, unless otherwise specified, the typical value is at V_{CC}= + 5V, TA=25℃)

parameter	symbol	condition	minimum value	typical value	maximum value	unit
Driver input to output delay	wxya_	Figures 3 and 5, R_{DIFF} =54Ω C_{L1}=C_{L2}=100pF		11	28	ns
	t_{DPHL}			16	35	
Driver output delay Difference |T_{DPLH} − T_{DPHL}|	tDSKEW_	Figures 3 and 5, R_{DIFF} =54Ω C_{L1}=C_{L2}=100pF		5		ns

Driver Rise or Fall Time	t_{DR}, t_{DF}	Figures 3 and 5, R_{DIFF} =54Ω C_{L1}=C_{L2}=100pF		6.5		ns
maximum rate	F_{MAX}		16			Mbps
Driver Enable to Output High	wxya_	Figure 4 6, C_L=100pF S2 and Closed		25	50	ns
Driver Enable to Input low level	wxya_	Figure 4 6, C_L=100pF S1 and Closed		28	80	ns
drives the output low from the to off time	lm_w	Figure 4 6, C_L=15pF S1 and Closed		twenty two	45	ns

drives the output high from the to off time	wxya _	Figure 4 6 , C_L=15pF S2 and Closed		twenty one	80	ns
Receiver input and output delay	t_{RPLH} tRPHL _	Figures 7 and 9 , $\|V_{ID}\|$≥2.0V; rise and fall time of V_{ID} ≦ 15ns		45	70	ns
$\|T_{RPLH} - T_{RPHL}\|$ Difference between receiver input and output delay	t_{RSKD}	Figures 7 and 9 , $\|V_{ID}\|$≥2.0V; rise and fall time of V_{ID} ≦ 15ns		5		ns
Receiver Enable to Input out low	wxya _	Figure 2 8 , C_{RL}=15pF S1 and Closed		12	25	ns
Receiver Enable to Input high	wxya _	Figure 2 8 , C_{RL}=15pF S2 and Closed		8	25	ns
receiver outputs low from the to shutdown	lm_w	Figure 2 8 , C_{RL}=15pF S1 and Closed		9	25	ns
Receiver output high from to shutdown	wxya _	Figure 2 8 , C_{RL}=15pF S2 and Closed		10	25	ns
circuit off time	t_{SHDN}				500	ns
Driver Enable from Standby to Output High	$t_{DZH(SHDN)}$	Figures 4 and 6 , C_L =100pF S2 Closed		3	5	μs
from standby to output low driver enable	$t_{DZL(SHDN)}$	Figure 4 6 , C_L=100pF S1 and Closed		3	5	μs
Receiver Enable from Standby to Output High	$t_{RZH(SHDN)}$	Figure 2 8 , C_{RL}=15pF S2 and Closed		3	5	μs

Receiver Enable from Standby to Output Low	$t_{RZL(SHDN)}$	Figure 2 8, C_{RL}=15pF S1 and Closed		3	5	μs

test circuit

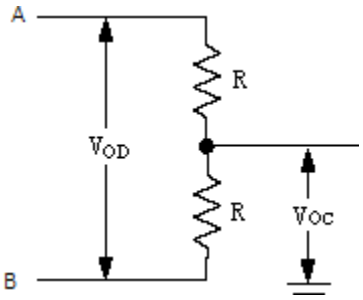


图 1：Driver DC Test Load

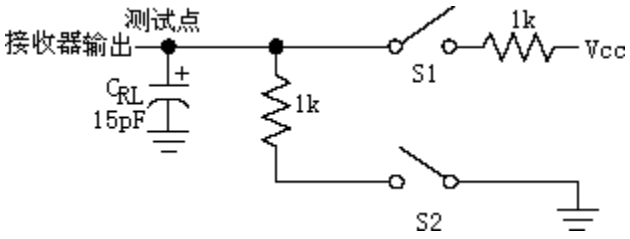


图 2：Receiver Enable/Disable Timing Test Load

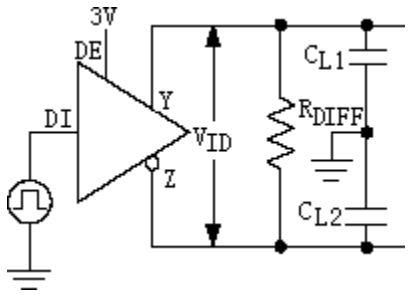


图 3：Driver Timing Test Circuit

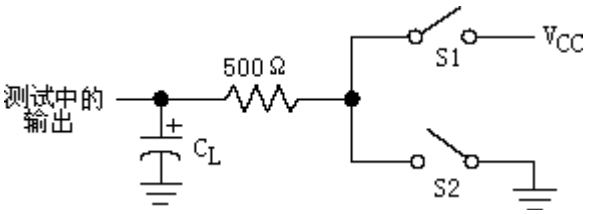


图 4：Driver Enable/Disable Timing Test Load

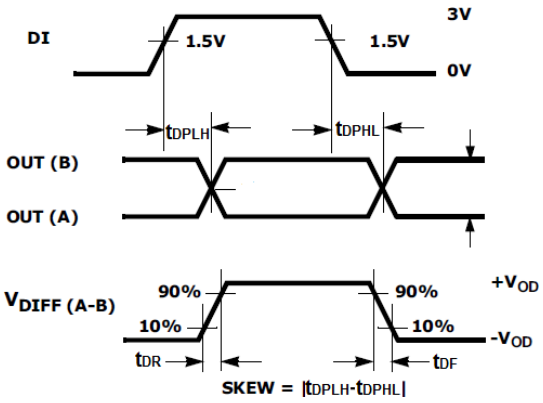


Figure 5： Driver Propagation Delays

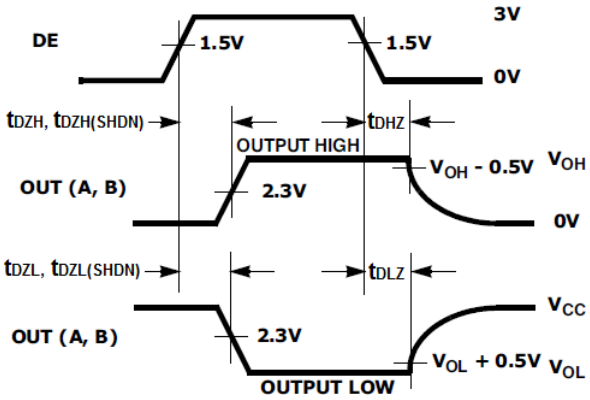


Figure 6： Driver Enable and Disable Times

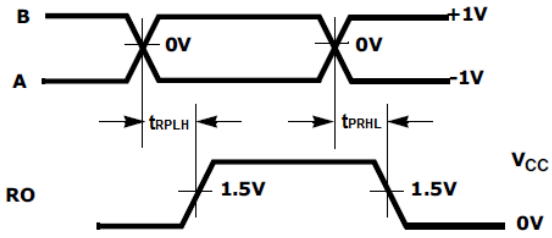


Figure 7： Receiver Propagation Delays

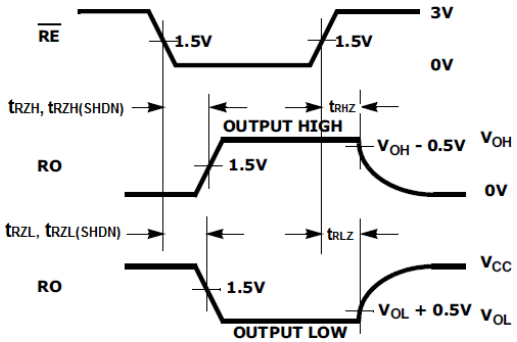


Figure 8： Receiver Enable and Disable Times

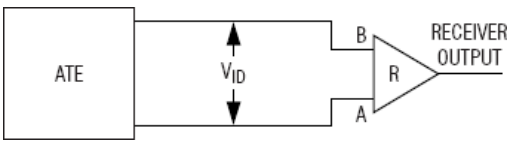


Figure 9： Receiver Propagation Delay Test Circuit

Typical Application Diagram

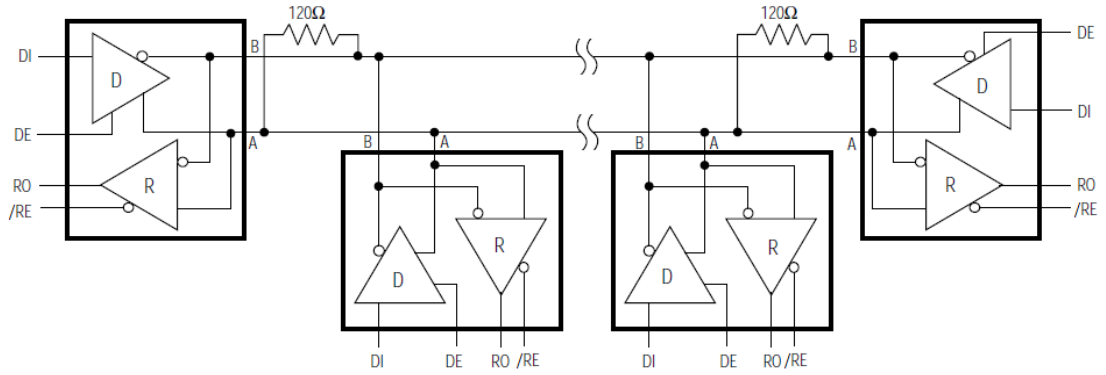
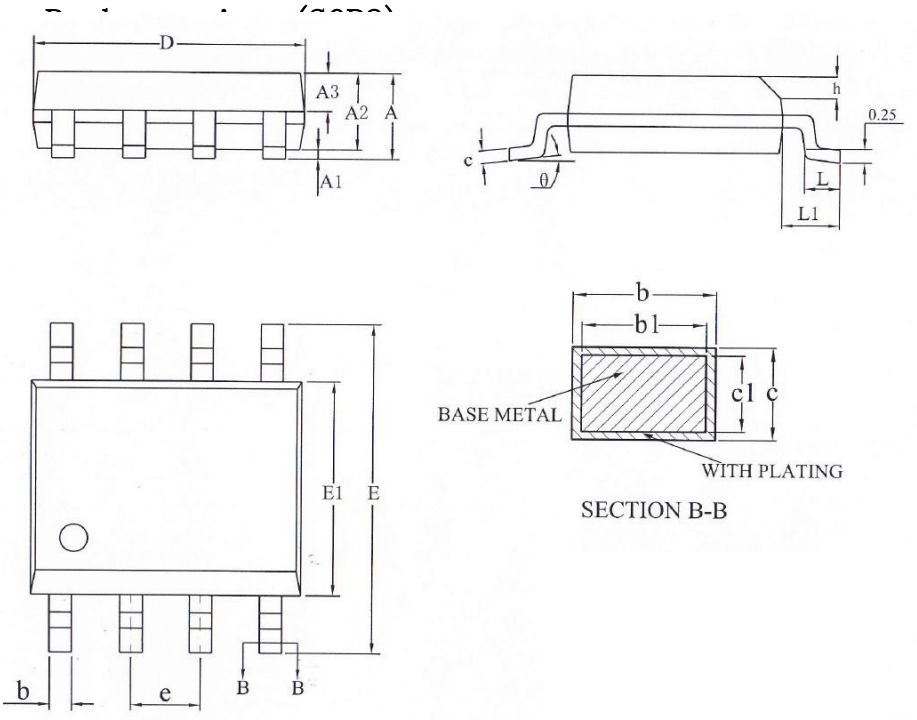


Figure 10 Typical half-duplex RS-485 network



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°