DESCRIPTION

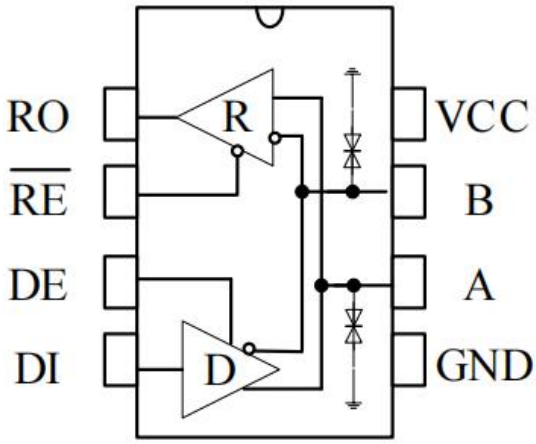
SP3485EN-L/TR is a RS-485 transceiver with 3.0V~5.5V wide power supply, bus port ESD protection capacity of over 15kV HBM ,bus withstand voltage range of ±15V,half duplex, low power consumption, and fully meet the requirements of TIA / EIA-485 standard.

SP3485EN-L/TR includes a driver and a receiver , both of which can be enabled and closed independently. When both are disabled, both the driver and the receiver output are high resistance state. SSP3485EN-L/TR has 1/8 load, which allows 256 SP3485EN-L/TR transceivers to be connected to the same communication bus. It can realize error -free data transmission up to 12Mbps.

FEATURES

- 3.0V~5.5V Wide Power Range, Half-Duplex
- ESD Protection for RS-485 I/O Pins ±15kV, Human Body Model
- Bus Fault Tolerance and Withstand Voltage Reach ±15V
- 1/8 Unit Load ， Allow Up to 256 Transceivers on the Bus
- Driver Short-Circuit Output Protection
- Low Power Off Function
- Receiver Open-Circuit Failure Protection
- Strong Anti-Noise Ability
- Integrated Transient Voltage Suppression Function
- Data transmission up to 12Mbps in an electric noise environment

Reference News

PIN CONFIGURATION	Marking
	

ORDERING INFORMATION

TYPE NUMBER	TEMPERATURE	PACKAGE
SP3485EN-L/TR	-40C~125C	SOP8

Tapered package is 2500 pcs/reel.

Important statement

VCC reserves the right to change the above-mentioned information without prior notice.

PINNING

PIN	SYMBOL	DESCRIPTION
1	RO	Receiver Output. When /RE is low and if A - B≥- 10mV, RO will be high; if A - B≤-200mV, RO will be low.
2	/RE	Receiver Output Enable. Drive /RE low to enable RO; RO is high impedance when /RE is high. Drive /RE high and DE low to enter low-power shutdown mode.
3	DE	Driver Output Enable. Drive DE high to enable driver outputs. These outputs are high impedance when DE is low. Drive /RE high and DE low to enter low-power shutdown mode.
4	DI	Driver Input. With DE high, a low on DI forces non-inverting output low and inverting output high. Similarly, a high on DI forces non-inverting output high and inverting output low.
5	GND	Ground
6	A	non-inverting Receiver Input and non-inverting Driver Output
7	B	Inverting Receiver Input and Inverting Driver Output
8	VCC	Positive Supply

LIMITING VALUES

PARAMETER	SYMBOL	VALUE	UNIT
Supply voltage	VCC	+7	V
Control Input Voltage	/RE，DE，DI	-0.3~VCC+0.5	V
Receiver Input Voltage	A，B	-15~+15	V
Receiver Output Voltage	RO	-0.3~VCC+0.5	V
Operating Temperature Ranges		-40~125	℃
Storage Temperature Range		-60~150	℃
Lead Temperature		300	℃
Continuous Power Dissipation	SOP8	470	mW
	MSOP8	830	mW
	DIP8	700	mW

The maximum limit parameters means that exceeding these values may cause irreversible damage to the device. Under these conditions, it is not conducive to the normal opration of the device. The continuous operation of the device at the maximum allowable rating may affect the reliability of the device. The reference point for all voltages is ground.

DRIVER DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Differential Driver Output （No load）	V_{OD1}		3		5.5	V
Differential Driver Output	V_{OD2}	Figure 2 ， RL = 54 Ω, VCC=3.3V	1.5		VCC	V
		Figure 2 ， RL = 54 Ω, VCC=5V	1.5		VCC	
Change in Magnitude of Driver Differential Output Voltag（NOTE1）	ΔV_{OD}	Figure 2 ， RL = 54 Ω			0.2	V
Driver Common-Mode Output Voltage	V_{OC}	Figure 2 ， RL = 54 Ω			3	V
Change in Magnitude of Common-Mode Output Voltage （NOTE1）	ΔV_{OC}	Figure 2 ， RL = 54 Ω			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
Logic Input Current	I_{IN1}	DE ， DI ， /RE	-2		2	μA
Output short-circuit current, short-circuit to high	I_{OSD1}	short-circuit to 0V~12V			250	mA
Output short-circuit current, short-circuit to low	I_{OSD2}	short-circuit to -7V~0V	-250			mA

（Unless otherwise noted ， Temp=T_{MIN}~T_{MAX} ， Temp＝25℃）

NOTE1 ： ΔV_{OD} and ΔV_{OC} are the changes in V_{OD} and V_{OC}, respectively, when the DI input changes state.

RECEIVER DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Input current （A ， B）	I_{IN2}	DE = 0 V ， VCC=0 或 3.3/5V V_{IN} = 12 V			125	μA
		DE = 0 V ， VCC=0 或 3.3/5V V_{IN} = -7 V	- 100			μA

Positive input threshold voltage	V_{IT+}	-7V≦V_{CM} ≦ 12V			-10	mV
Reverse input threshold voltage	V_{IT-}	-7V≦V_{CM} ≦ 12V	-200			mV
Input hysteresis voltage	V_{hys}	-7V≦V_{CM} ≦ 12V	10	30		mV
Receiver Output High Voltage	V_{OH}	I_{OUT} = −2.5mA， V_{ID} = +200 mV	VCC-1.5			V
Receiver Output Low Voltage	V_{OL}	I_{OUT} = +2.5mA， V_{ID} = -200 mV			0.4	V
Three-State Output Current at Receiver	I_{OZR}	0.4 V < V_O < 2.4 V			±1	μA
Receiver Input Resistance	R_{IN}	-7V≦V_{CM} ≦ 12V	96			kΩ
Receiver Short-Circuit Output Current	I_{OSR}	0 V≤V_O≤VCC	±8		±90	mA

（Unless otherwise noted ， Temp=T_{MIN}~T_{MAX} ， Temp＝25℃）

SUPPLY CURRENT

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	I_{CC1}	/RE=0V，DE = 0 V，VCC=3.3V		240	650	μA
		/RE=0V，DE = 0 V VCC=5V		270	750	μA
	I_{CC2}	/RE=VCC，DE=VCC，VCC=3.3V		250	650	μA
		/RE=VCC，DE=VCC，VCC=5V		280	750	μA
Shutdown current	I_{SHDN}	/RE=VCC，DE=0V，VCC=3.3V		0.2	10	μA
		/RE=VCC，DE=0V，VCC=5V		0.2	10	μA

DRIVER SWITCHING CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Driver differential Output delay	tDD	R_L = 60 Ω, C_{L1}=C_{L2}=100pF (figure3 、4)		20	40	ns
Driver differential output Transition time	tTD			12	28	ns
Drive propagation delay From low to high	tPLH	R_L = 27 Ω, (figure3 、4)		20	40	ns
Drive propagation delay From high to low	tPHL			20	40	ns
$\lvert t_{PLH}-t_{PHL} \rvert$	tPDS			1	8	ns
Driver Enable to Output High	tPZH	R_L = 110Ω, （figure5 、6）			55	ns
Driver Enable to Output low	tPZL				55	ns
Driver Disable Time from Low	tPLZ	R_L = 110Ω ， （figure 5 、6）			85	ns
Driver Disable Time from high	tPHZ				85	ns
In Shutdown mode，Enable to Output High	tDSH	R_L = 110Ω ， （figure 5 、6）		20	100	ns
In Shutdown mode ，Enable to Output low	tDSL	R_L = 110Ω ， （figure 5 、6）		20	100	ns

RECEIVER SWITCHING CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Receiver Input to output from low to high	tRPLH	C_L=15pF Figure7 & Figure8		60		ns
Receiver Input to output from high to low	tRPHL			60		ns

$\lvert t_{RPLH} - t_{RPHL} \rvert$	tRPDS			3	10	ns
Receiver Enable to Output Low	tRPZL	C_L=15pF Figure7& Figure 8		15	40	ns
Receiver Enable to Output high	tRPZH	C_L=15pF Figure7 & Figure8		15	40	ns
Receiver Disable Time from Low	tPRLZ	C_L=15pF Figure7 & Figure8		25	55	ns
Receiver Disable Time from high	tPRHZ	C_L=15pF Figure7 & Figure8		25	55	ns
In Shutdown mode，Enable to Output High	tRPSH	C_L=15pF Figure7 & Figure8		150	500	ns
In Shutdown mode ，Enable to Output low	tRPSL	C_L=15pF Figure7 & Figure8		150	500	ns
Time to Shutdown	tSHDN	NOTE2	50		300	ns

NOTE2 ： If the enable inputs are RE=high and DE=low for less than 50ns, the device is guaranteed not To enter shutdown. If the enable inputs are in this state for at least 300ns, the device is guaranteed to have entered shutdown.

FUNCTION TABLE

Driver Function

CONTROL		INPUT	OUTPUT	
/RE	DE	DI	A	B
X	1	1	H	L
X	1	0	L	H
0	0	X	Z	Z
1	0	X	Z(shutdown)	
X=irrelevant; Z=high impedance				

Receiver Function

CONTROL		INPUT	OUTPUT
/RE	DE	A-B	RO
0	X	≥- 10mV	H
0	X	≤-200mV	L
0	X	Open/short circuit	H
1	X	X	Z
X=irrelevant; Z=high impedance			

TEST CIRCUIT

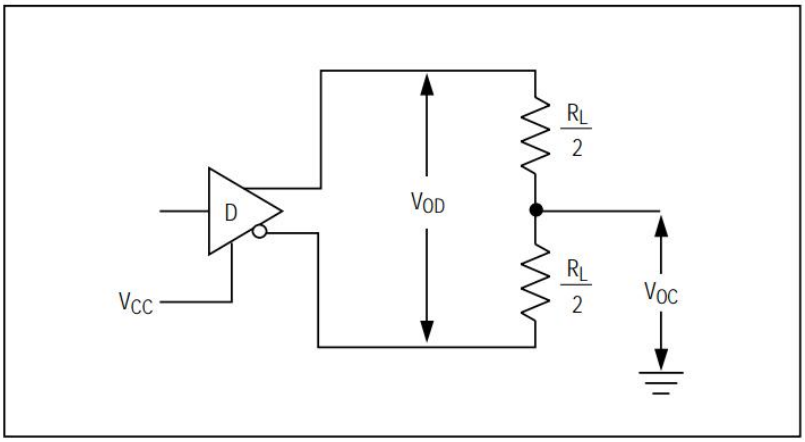
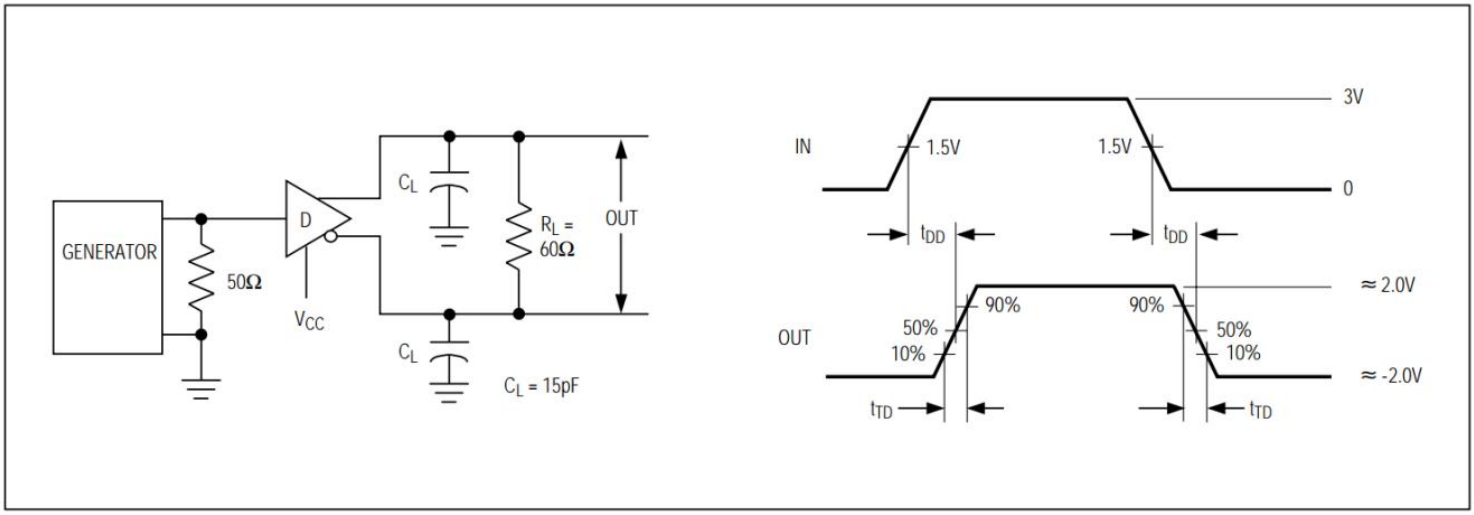


Figure 2 Driver DC test load



CL includes probe and stray capacitance (the same below)

Figure 3 Differential delay and transit time of driver

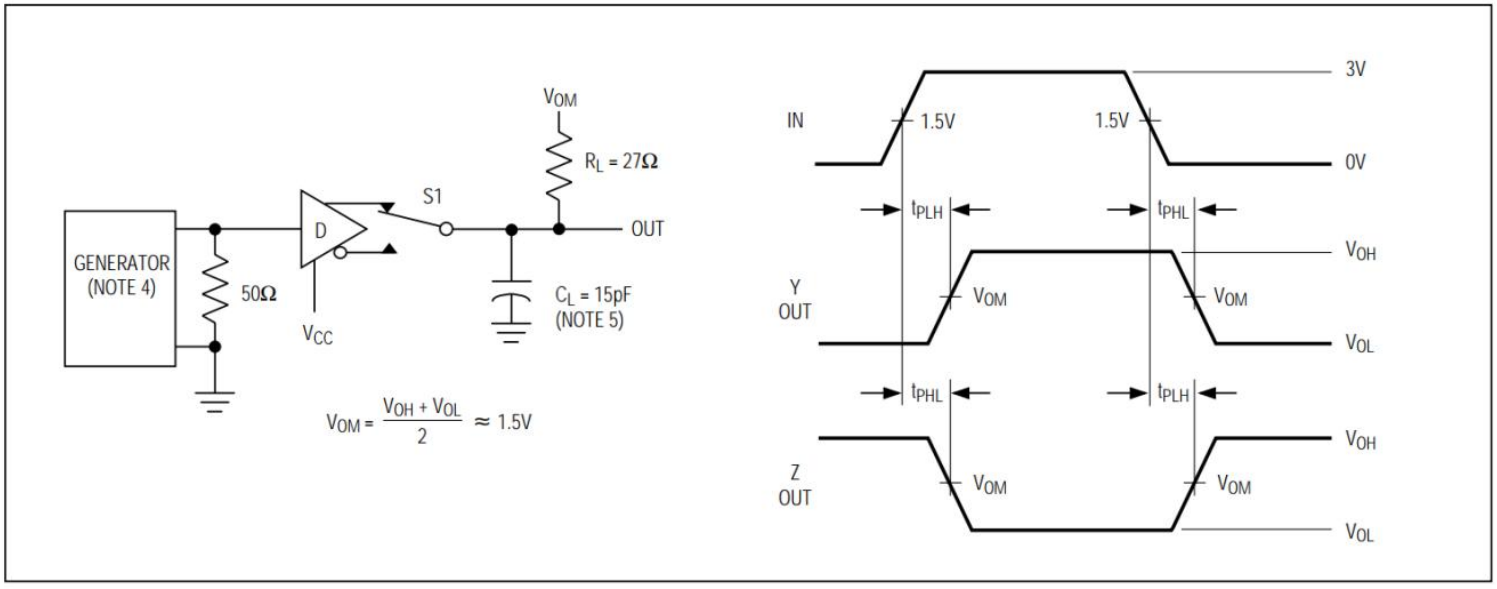


Figure 4 Drive propagation delay

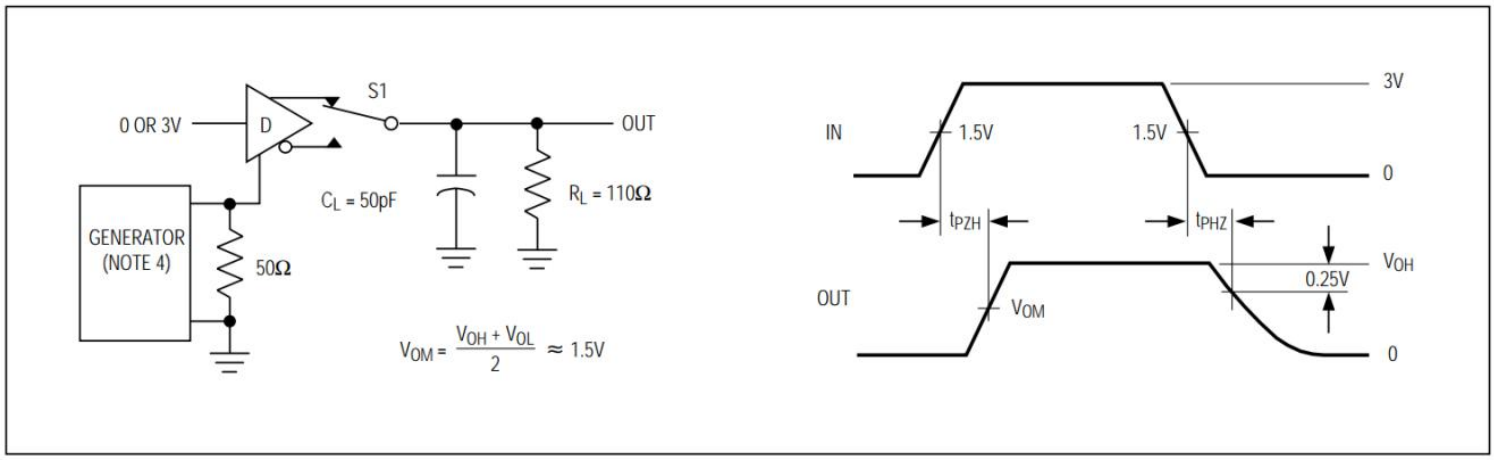


Figure 5 Drive enable and disable time

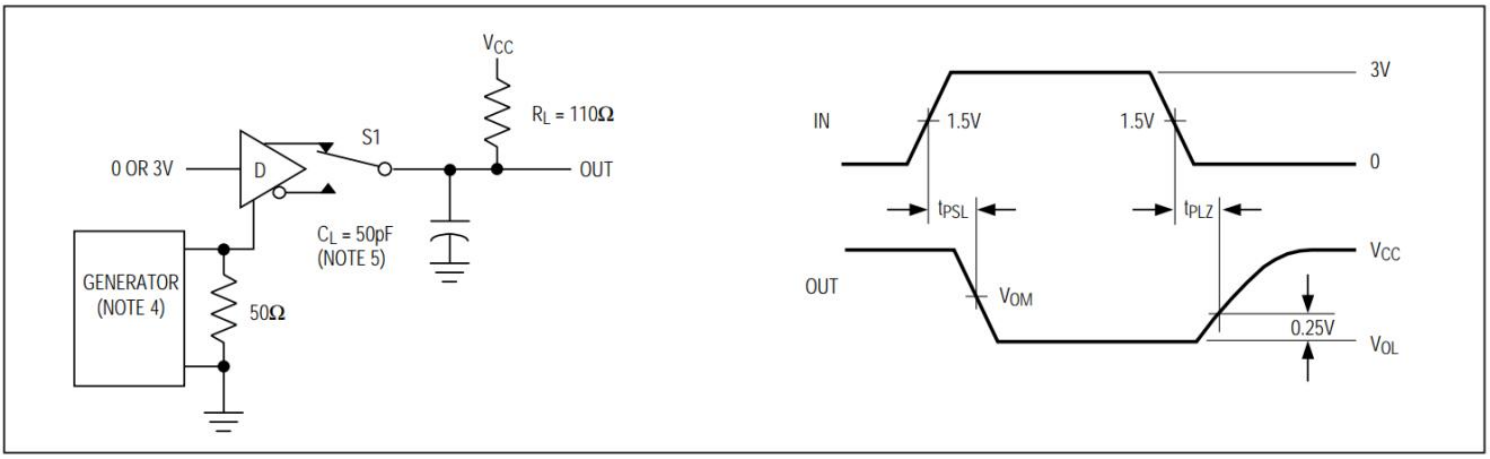


Figure 6 Drive enable and disable time

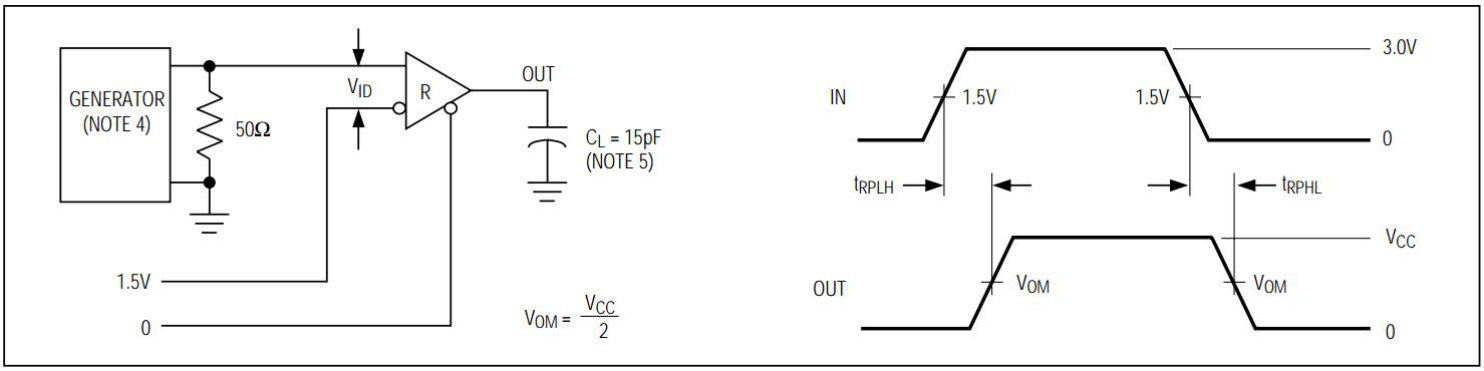


Figure 7 Receiver propagation delay test circuit

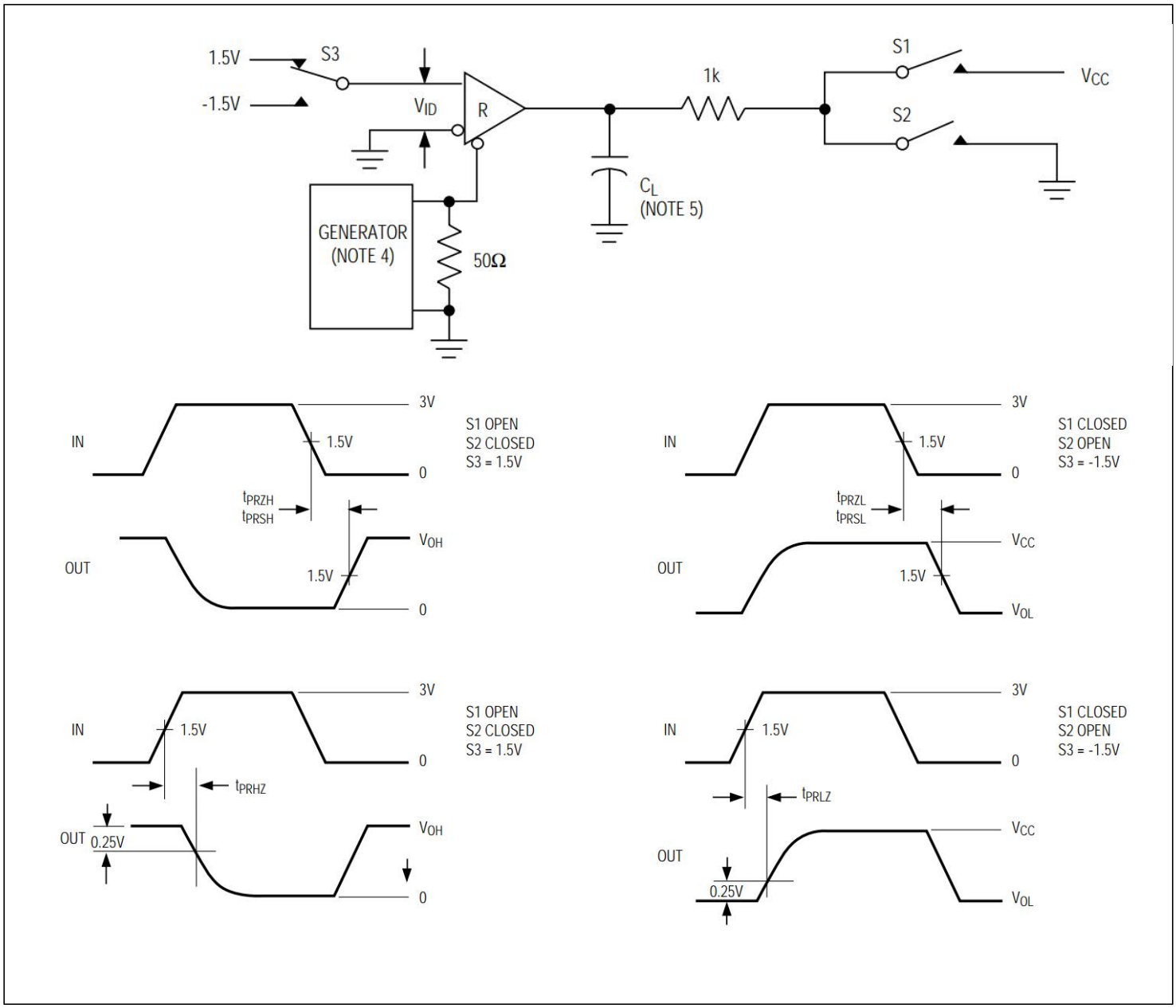


Figure 8 Receiver enable and disable time

ADDITIONAL DESCRIPTION

1 Sketch

SP3485EN-L/TR is a half-duplex high-speed transceiver with 3.0V~5.5V wide power supply, bus port ESD protect -ion capacity of more than 15kV HBM , bus DC withstand voltage of more than± 15V , used for RS-485/RS-422 communication, including a driver and receiver. It has the functions of fail-safe, over-voltage protection,over-current protection and over temperature protection. SP3485EN-L/TR realizes error-free data transmission up to 12Mbps.

2 Allowing up to 256 Transceivers on the Bus

The input impedance of the standard RS485 receiver is 12kΩ (1 unit load) , and the standard driver can drive up to 32 unit loads . The receiver of SP3485EN-L/T Rtransceiver has 1/8 unit load input impedance (96kΩ) , which allows up to256 transceivers to be connected on the same communication bus in parallel. These devices can be combined arbitrarily or with other RS485 transceivers. Any combination of these devices and/or other RS-485 transceivers with a total of 32 unit loads or less can be connected to the line.

3 Driver output protection

Tow mechanisms prevent excessive output current and power dissipation caused by faults or by bus contention. First, over-current protection, fast short circuit protection in the mode voltage range (refer to typical operating characteri stics) . Second , when the temperature of the tube core exceeds 140℃ , the output of the driver is forced into the high resistance state.

4 Typical Applications

4．1Bus Networking : SP3485EN-L/TR transceiver is designed for bidirectional data communication on multi-point bus transmission line. Figure 9 shows a typical network application circuit. These devices can also be used as linear repeaters with cables longer than 4000 feet. In order to reduce reflection , terminal matching should be carried out at both ends of the transmission line with its characteristic impedance, and the length of branch lines outside the main line should be as short as possible

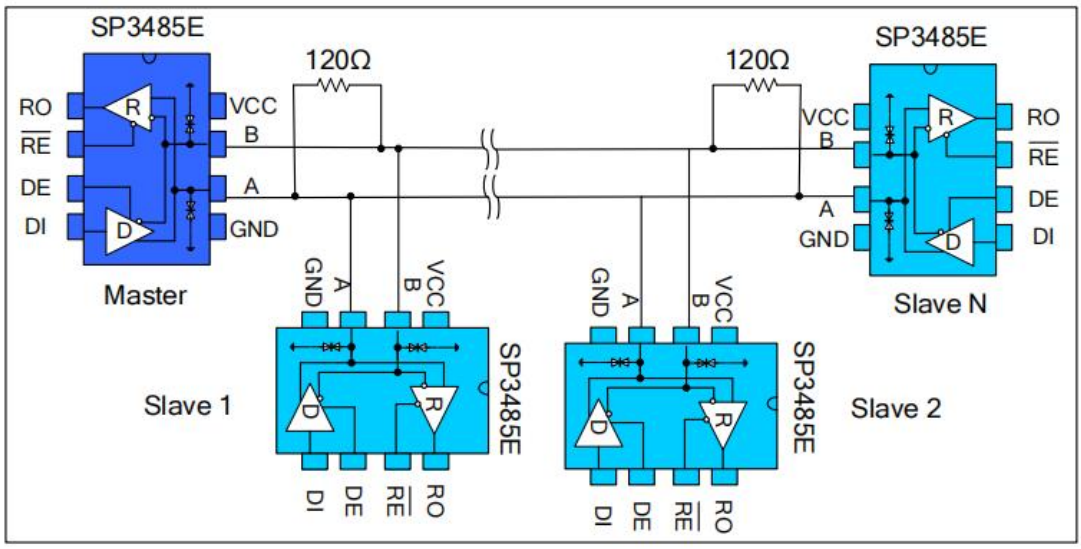


Figure 9 Bus type SP3485EN-L/TR half duplex communication network

4.2 Hand in hand Networking: also known as daisy chain topology, is the standard and specification of SP485EN-L /TR buswiring , and is the RS485 bus topology recommended by TIA and other organizations . The wiring mode is that the main control equipment and a plurality of slave control equipment form a hand-held connection mode, as show n in Figure 10, and the hand-held mode is no branches . This wiring mode has the advantages of small signal reflection and high communication success rate.

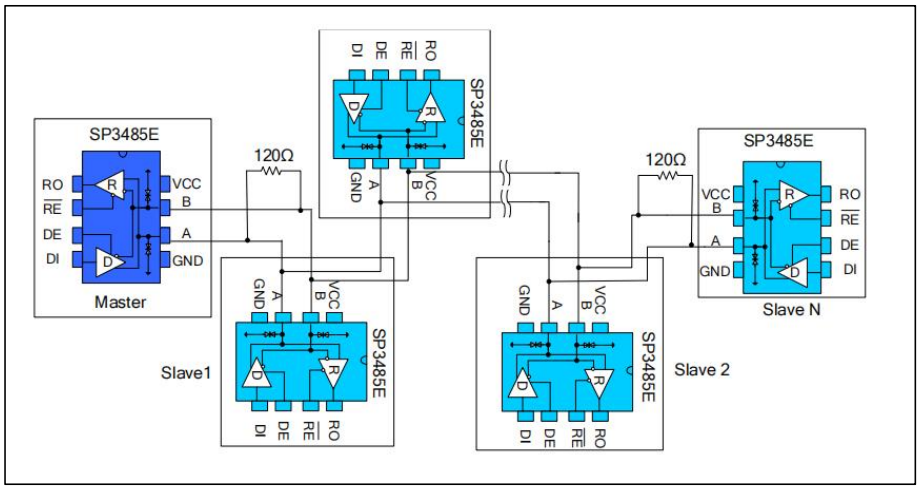
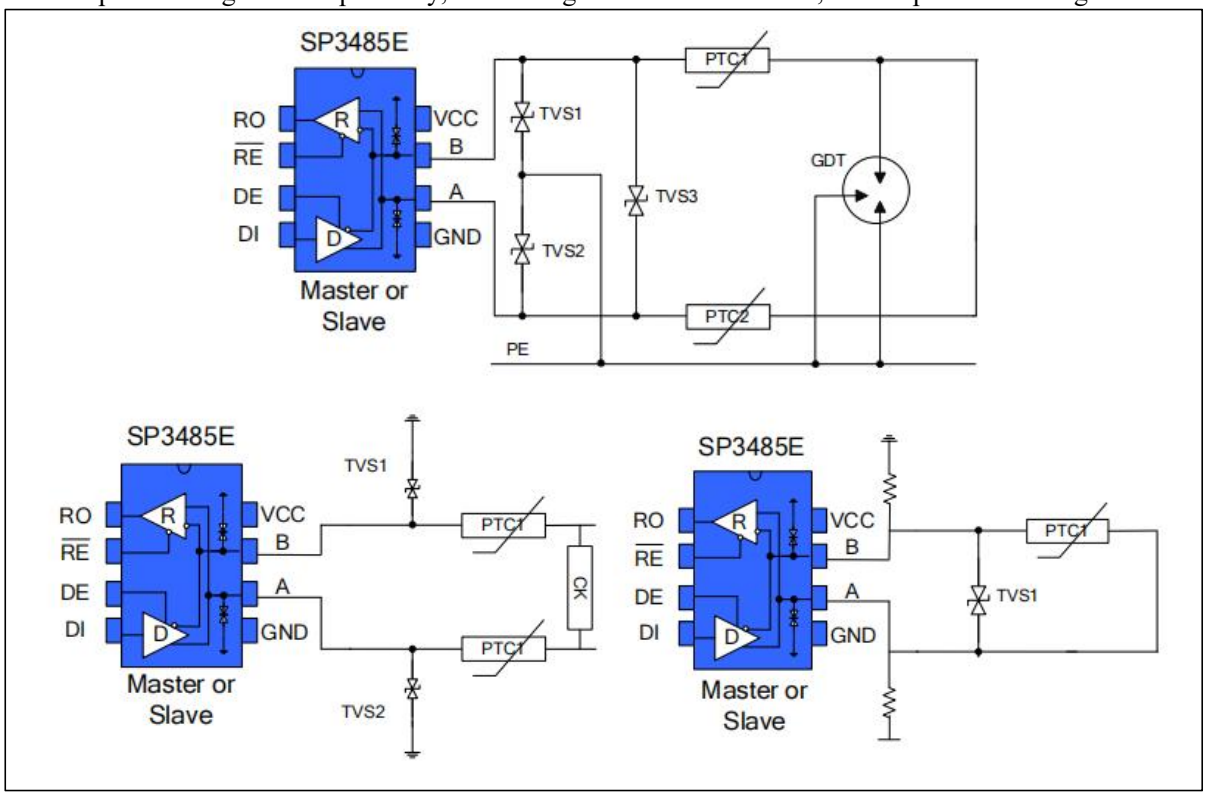


Figure10 Hand in hand SP3485EN-L/TR half duplex communication network

4.3 Bus port protection: in severe environment, SP3485EN-L/TR communication port is usually provided with electros tatic protection, lightning surge protection and other additional protection, and even the plan to prevent 380V marke t electricity access is needed to avoid the damage of intelligent instrument and industrial control host. Figure 11 shows three common SP3485EN-L/TR bus port protection schemes. The first is the scheme of three-level protection by conn ecting TVS devices in parallel with A,B port to the protective ground, TVS devices in parallel with A,B port, thermi stor inseries with A,B port, gas discharge tube in parallel to the protective ground; the second is the scheme of three-level protection by connecting TVS in parallel with A,B port to the ground, thermistor in series with A,B port, and va ristorin parallel with A,B port; the third is the scheme of three-level protection by connecting AB with pull-up or pull-downresistor to power and ground respectively, connecting TVS between A & B, A or B port connecting thermistor.



SOP8 DIMENSIONS

PACKAGE SIZE

SYMBOL	MIN./mm	TYP./mm	MAX./mm
A	1.40	-	1.80
A1	0.10	-	0.25
A2	1.30	1.40	1.50
b	0.38	-	0.51
D	4.80	4.90	5.00
E	3.80	3.90	4.00
E1	5.80	6.00	6.20
e		1.27BSC	
L	0.40	0.60	0.80
c	0.20	-	0.25
θ	0°	-	8°

