

1. DESCRIPTION

The AKSD/AKSL3485 is a 3.3V powered, half-duplex, low-power RS-485 transceivers that fully meets the requirements of the TIA/EIA-485 standard.

The AKSD/AKSL3485 consists of a driver and a receiver, both of which can be independently enabled and disabled. When both are disabled, both the driver and receiver

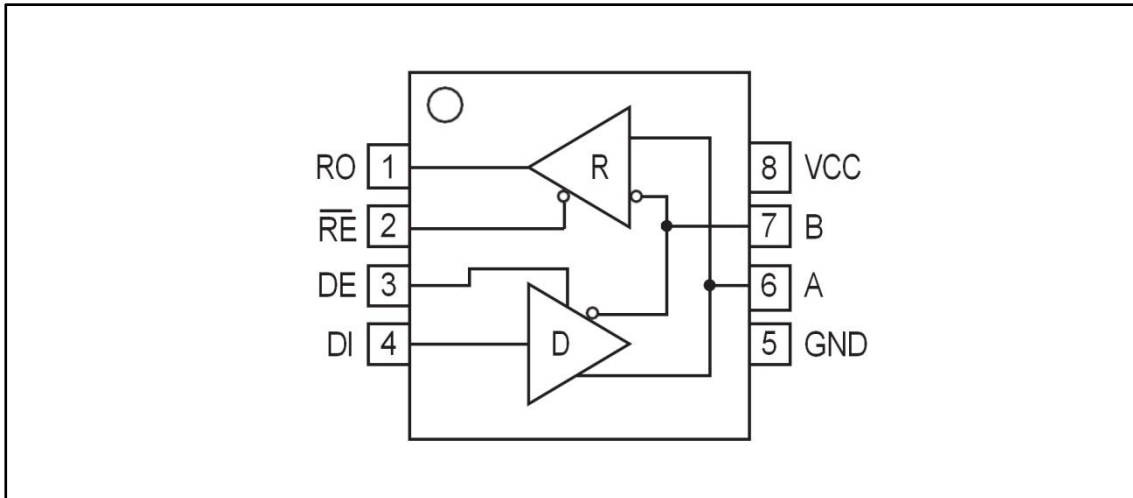
The AKSD/AKSL3485 has a 1/8 load, allowing 256 AKSD/AKSL3485 transceivers to be connected in parallel on the same communication bus. Error-free data transmission of up to 12 Mbps is possible.

The AKSD/AKSL3485 has an operating voltage range of 3.0~3.6 V. It is fail-safe, over-temperature protected, current-limited, and over-voltage protected.

2. FEATURES

- 3.3V supply powered, half-duplex;
- 1/8 unit load, allowing up to 256 devices to be connected to the bus;
- Driver short-circuit output protection;
- Over-temperature protection function;
- Low-power shutdown function;
- Receiver open-circuit failure protection;
- High noise immunity;
- Integrated transient voltage resist function;
- Data rates up to 12 Mbps in electrically noisy environments;
- SOP-8(AKSL3485), DIP-8(AKSD3485)

3. PIN CONFIGURATIONS AND FUNCTIONS



Pin Functions

Pin	Name	Description
1	RO	Receiver output. When \overline{RE} is low, if $A-B \cong 200mV$, RO output is high; if $A-B \cong -200mV$, RO output is low.
2	\overline{RE}	Receiver output enable control. When \overline{RE} is low, the receiver output is enabled and the RO output is active; when \overline{RE} is high, the receiver output is disabled and the RO is in high resistance state; When \overline{RE} is high and DE is low, the device enters the low power shutdown mode.
3	DE	Driver output enable control. The driver output is active when DE is high, and the output is highly resistive when DE is low; When \overline{RE} is high and DE is low, the device enters the low-power shutdown mode.
4	DI	DI driver input. When DE is high, a low level on DI will cause the driver in-phase terminal A output to be low and the driver inverting terminal B output to be high; a high level on DI will cause the in-phase terminal output to be high and the inverting terminal output to be low.
5	GND	Ground
6	A	Receiver In-Phase Inputs and Driver In-Phase outputs
7	B	Receiver Inverting Inputs and Driver Inverting outputs
8	Vcc	Power supply

4. SPECIFICATIONS

4.1. Absolute Maximum Ratings

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	VCC	+7	V
Control Port Voltage	\overline{RE} , DE, DI	-0.3~+7	V
Bus-side input voltage	A、B	-7~13	V
Receiver output voltage	RO	-0.3~+7	V
Operating Temperature Range		-40~85	°C
Storage operating temperature range		-55~150	°C
Welding temperature range		300	°C
Continuous power consumption	SOP-8	400	mW
	DIP-8	700	mW

- [1] Maximum Limit Parameter values are values above which irrecoverable damage to the device may occur. Under these conditions it is detrimental to the normal operation of the device, and continuous operation of the device at the maximum permissible ratings may affect the reliability of the device. the reference point for all voltages is ground.

4.2. Driver DC Electrical Characteristics

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Driver Differential Output (no load)	VOD1			3.3		V
Drive Differential Outputs	VOD2	Figure 2, $R_L = 54\Omega$	1.5		VCC	V
		Figure 2, $R_L = 100\Omega$	2		VCC	
Change in output voltage amplitude (NOTE1)	ΔVOD	Figure 2, $R_L = 54\Omega$			0.2	V
Output common mode voltage	VOC	Figure 2, $R_L = 54\Omega$			3	V
Change in common mode output voltage amplitude (NOTE1)	ΔVOC	Figure 2, $R_L = 54\Omega$			0.2	V
High Level Input	V _{IH}	DE, DI, \overline{RE}	2.0			V
Low Level Input	V _{IL}	DE, DI, \overline{RE}			0.8	V
Logic Input Current	I _{IN1}	DE, DI, \overline{RE}	-2		2	μA
Current at output short-circuit, short-circuit to high	I _{OSD1}	Short circuit to 0V~12V			250	mA
Current at output short-circuit, short-circuit to low	I _{OSD2}	Short circuit to -7V~0V	-250			mA
Over Temperature Shutdown Threshold Temperature				140		$^{\circ}C$
Over-temperature shutdown hysteresis temperature				20		$^{\circ}C$

(Unless otherwise specified, VCC=3.3V±10% ,Temp=TMIN~TMAX, typical value at VCC=+3.3V, Temp=25 $^{\circ}C$)

NOTE1: ΔVOD and ΔVOC are the changes in the amplitude values of VOD and VOC, respectively, caused by changes in the state of the DI of the input signals.

4.3. Receiver DC Electrical Characteristics

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input current (A, B)	I _{IN2}	DE = 0 V, VCC=0 or 3.3V VIN = 12 V			125	μA
		DE = 0 V, VCC=0 or 3.3V VIN = -7 V	-100			μA

Forward Input Threshold Voltage	VIT+	$-7V \leq V_{CM} \leq 12V$			+200	mV
Reverse Input Threshold Voltage	VIT-	$-7V \leq V_{CM} \leq 12V$	-200			mV
Input Hysteresis Voltage	V _{hys}	$-7V \leq V_{CM} \leq 12V$	10	30		mV
High Level Output Voltage	VOH	I _{OUT} = -2.5mA, V _{ID} = +200 mV	VCC-1.5			V
Low Level Output Voltage	VOL	I _{OUT} = +2.5mA, V _{ID} = -200 mV			0.4	V
Tri-state input leakage current	IOZR	0.4 V < V _O < 2.4 V			±1	µA
Receiver input resistance	RIN	$-7V \leq V_{CM} \leq 12V$	96			kΩ
Receiver short-circuit current	IOSR	0 V ≤ V _O ≤ VCC	±8		±60	mA

4.4. Supply Current

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Supply Current	I _{CC1}	$\overline{RE}=0V,$ DE = 0 V		520	800	µA
	I _{CC2}	$\overline{RE}=V_{CC},$ DE=VCC		540	700	µA
Shutdown current	I _{SHDN}	$\overline{RE}=V_{CC},$ DE=0V		0.5	10	µA

4.5. Driver Switching Characteristics

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Driver differential output delay	t _{DD}	R _{DIFF} = 60 Ω, CL1=CL2=100pF (See Figure 3 and 4)		10	35	ns
Driver Differential Output Transition Time	t _{TD}				12	25
Drive propagation delay from low to high	t _{PLH}	R _{DIFF} = 27 Ω, (See Figure 3 and 4)		8	35	ns
Drive propagation delay from high to low	t _{PHL}				8	35

tPLH-tPHL	tPDS			1	8	ns
Enable to Output High	tPZH	RL= 110Ω, (See Figure 5、 6)		20	90	ns
Enable to Output Low	tPZL			20	90	ns
Input low to forbidden energy	tPLZ	RL= 110Ω, (See Figure 5、 6)		20	80	ns
Input high to forbidden energy	tPHZ			20	80	ns
Off condition, Enable to output high	tDSH	RL= 110Ω, (See Figure 5、 6)		500	900	ns
Off condition, Enable to output low	tDSL	RL= 110Ω, (See Figure 5、 6)		500	900	ns

4.6. Receiver Switching Characteristics

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Receiver input to output propagation delay from low to high	tRPLH	CL=15pF See Figure 7 and Figure 8		80	150	ns
Receiver input to output propagation delay from high to low	tRPHL			80	150	ns
tRPLH - tRPHL	tRPDS				7	10
Enable to Output Low Time	tRPZL	CL=15pF See Figure 7 and Figure 8		20	50	ns
Enable to Output High Time	tRPZH	CL=15pF See Figure 7 and Figure 8		20	50	ns
From low output to disabled time	tPRLZ	CL=15pF See Figure 7 and Figure 8		20	45	ns
From high output to disablement time	tPRHZ	CL=15pF See Figure 7 and Figure 8		20	45	ns
Enable to Output High Time in Off State	tRPSH	CL=15pF See Figure 7 and Figure 8		200	1400	ns
Enable to Output Low Time in Off State	tRPSL	CL=15pF See Figure 7 and Figure 8		200	1400	ns
Time to shutdown	tSHDN	NOTE2	80		300	ns

NOTE2: When the duration of /RE=1, DE=0 is less than 80ns, the device must not enter the shutdown state, when it is more than 300ns, it must enter the shutdown state.

4.7. Function Table

Sending menu

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: arbitrary level; Z: high resistance

Receiving menu

control		input	output
/RE	DE	A-B	RO
0	X	$\geq 200\text{mV}$	H
0	X	$\leq -200\text{mV}$	L
0	X	Open/Short Circuit	H
1	X	X	Z

X: arbitrary level; Z: high resistance

4.8. Test Circuit

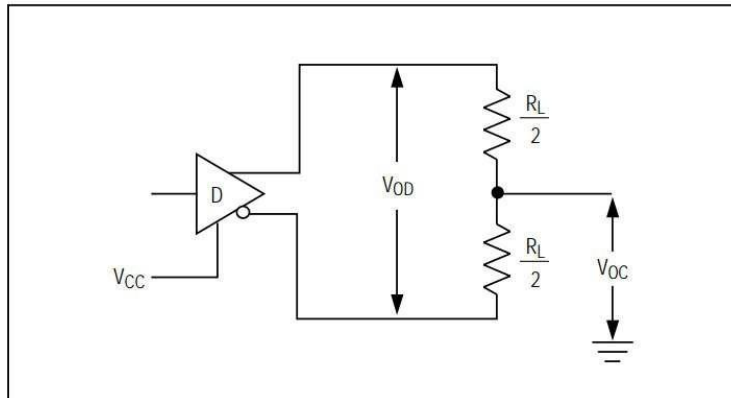
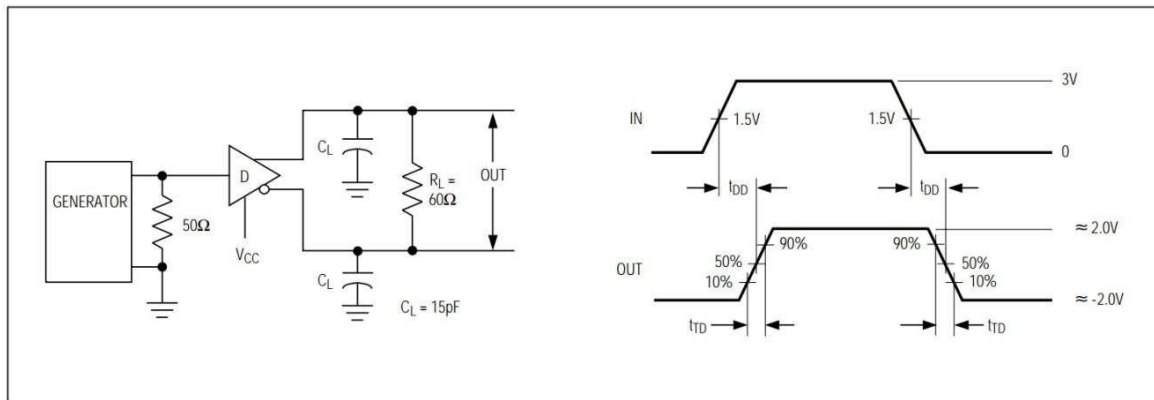


Figure 2 Driver DC Test Load



CL Contains probe and stray capacitance (below)

Figure 3 Driver Differential Delay and Transition Time

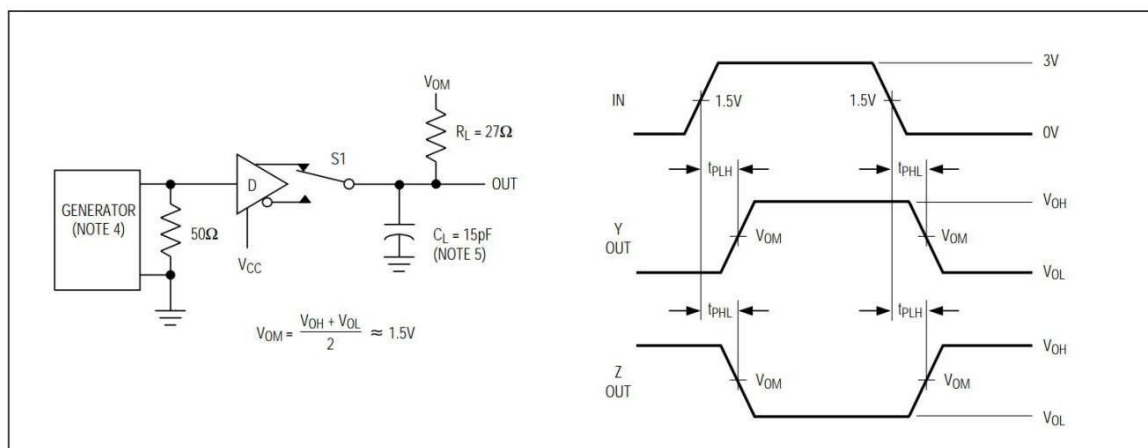


Figure 4 Driver propagation delay

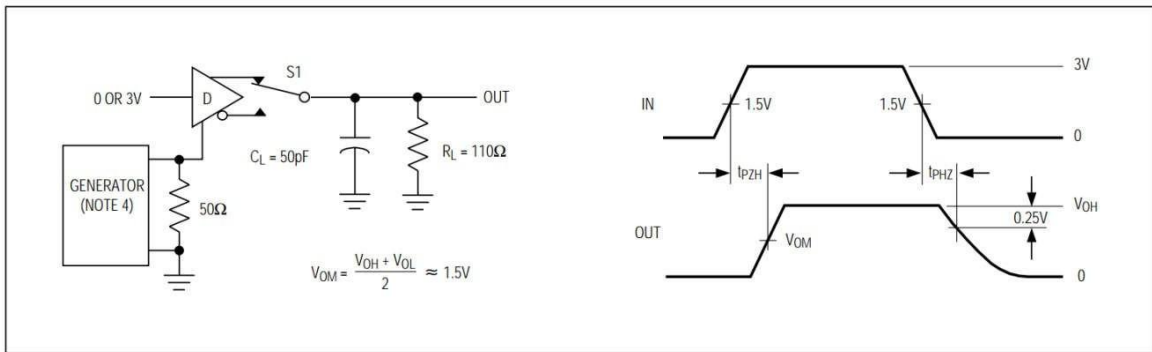


Figure 5 Driver Enable and Disable Times

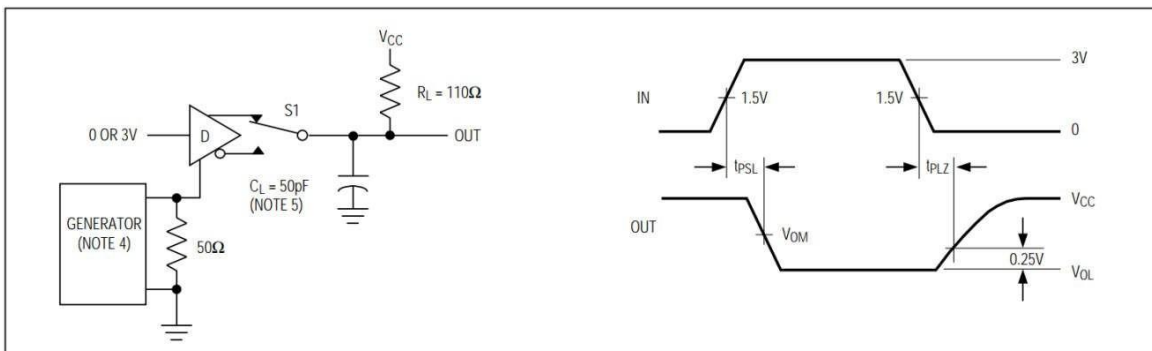


Figure 6 Driver Enable and Disable Times

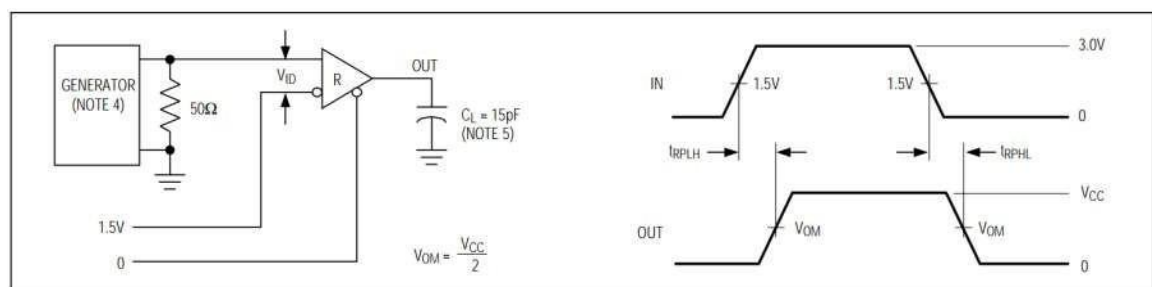


Figure 7 Receiver propagation delay test circuit

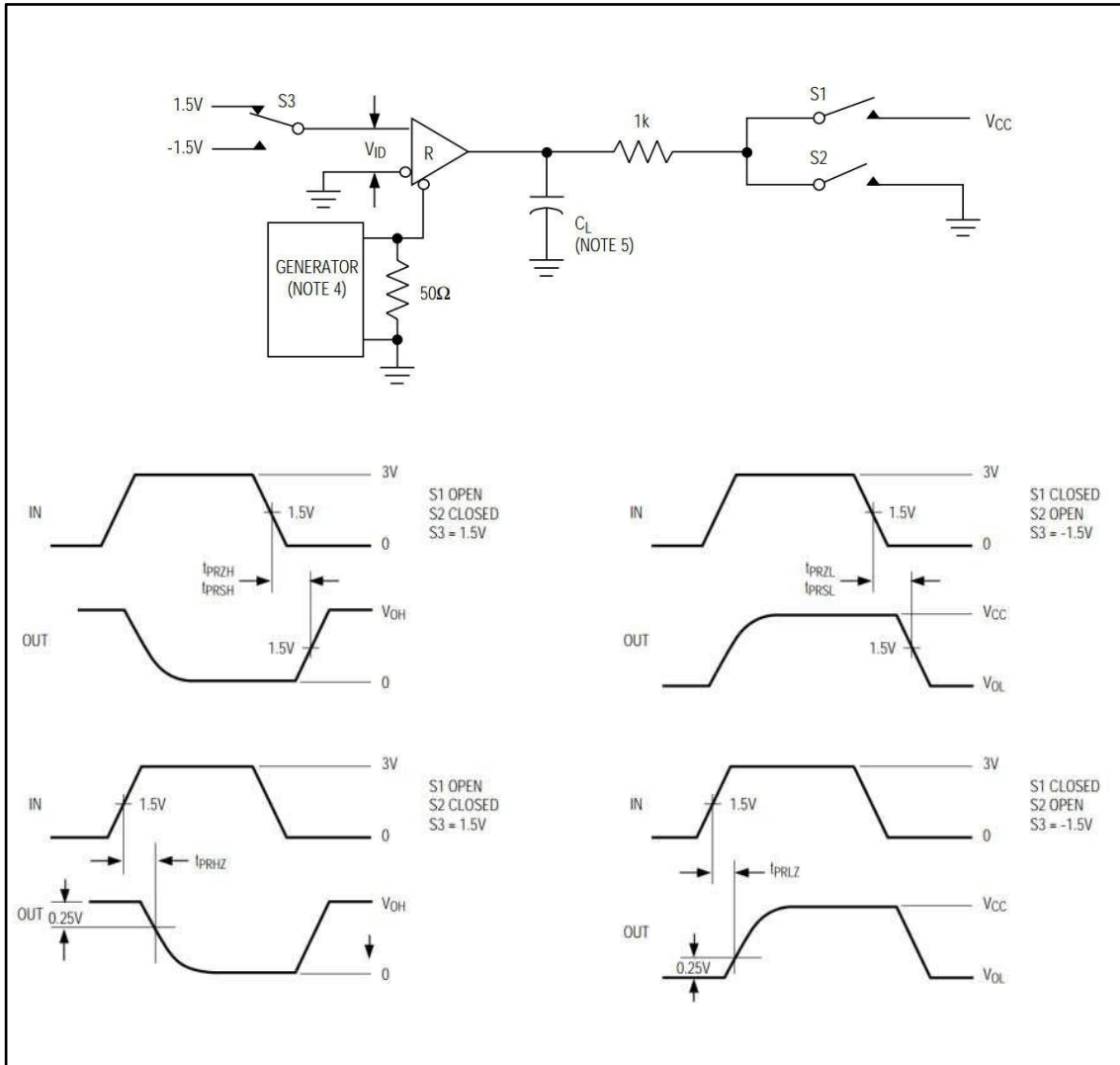


Figure 8 Receiver Enable and Disable Times

5. PRODUCT DESCRIPTION

5.1. Brief Description

The AKSD/AKSL3485 is a half-duplex, high-speed transceivers for RS-485 communications, consisting of a driver and receiver. With fail-safe, over-voltage, over-current, and over-temperature protection, the AKSD/AKSL3485 achieves error-free data transmission up to 12Mbps.

5.2. 256 transceivers hooked up to the bus

Standard RS485 receivers have an input impedance of 12k Ω (1 unit load) and standard drivers can drive up to 32 unit loads. The AKSD/AKSL3485 transceivers has a receiver with 1/8 unit load input impedance (96k Ω), allowing up to 256 transceivers to be hooked up in parallel on the same communications bus. These devices can be combined in any combination, or with other RS485 transceivers, on the same bus as long as the total load does not exceed 32 unit loads.

5.3. Driver output protection

Two mechanisms are used to avoid excessive output current and power consumption caused by faults or bus conflicts. First, overcurrent protection, which provides fast short-circuit protection over the entire common-mode voltage range (referenced to typical operating characteristics). Second, a thermal shutdown circuit that forces the driver outputs into a high resistance state when the core temperature exceeds 140°C.

5.4. Typical Applications

Bus-based networking: The AKSD/AKSL3485 RS485 transceivers is designed for bi-directional data communication over a multi-point bus transmission line. Figure 9 shows a typical networking application circuit. These devices can also be used as linear transponders for cable lengths longer than 4000 ft. To minimise reflections, the transmission line should be terminated with its characteristic impedance at both ends, and the lengths of branch connections off the trunk should be as short as possible.

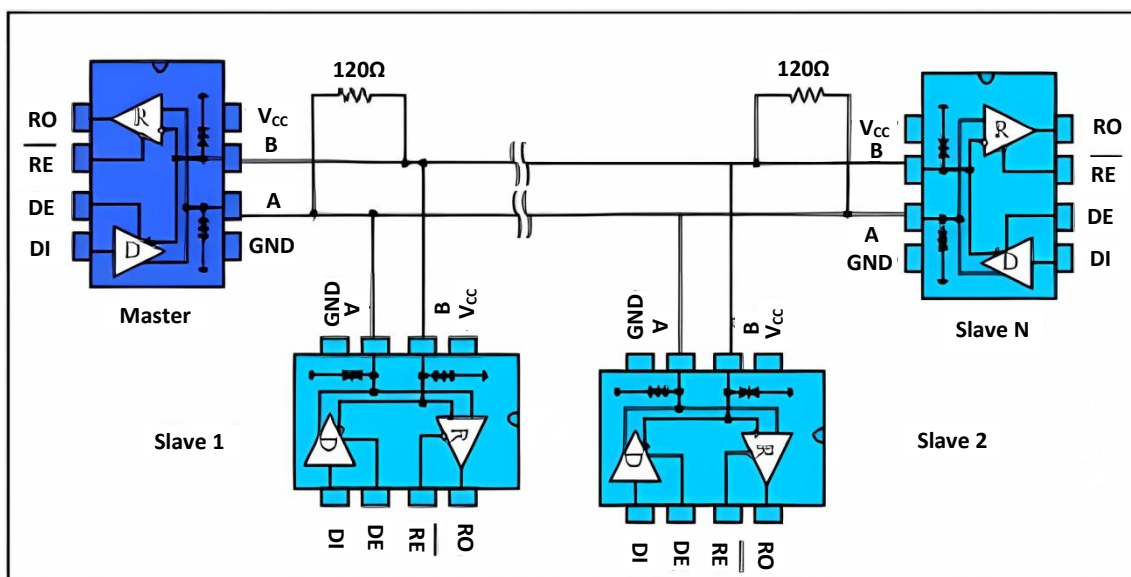


Figure 9 Bus RS485 half-duplex communication network

Hand-in-hand networking: also known as daisy-chain topology, is the standard and specification for RS485 bus cabling, and is the RS485 bus topology recommended by TIA and other organisations. Its wiring is the master control device and multiple slave control devices to form a hand in hand connection, as shown in Figure 10, do not leave a branch in the hand in hand way. This wiring method has the advantages of small signal reflection and high communication success rate.

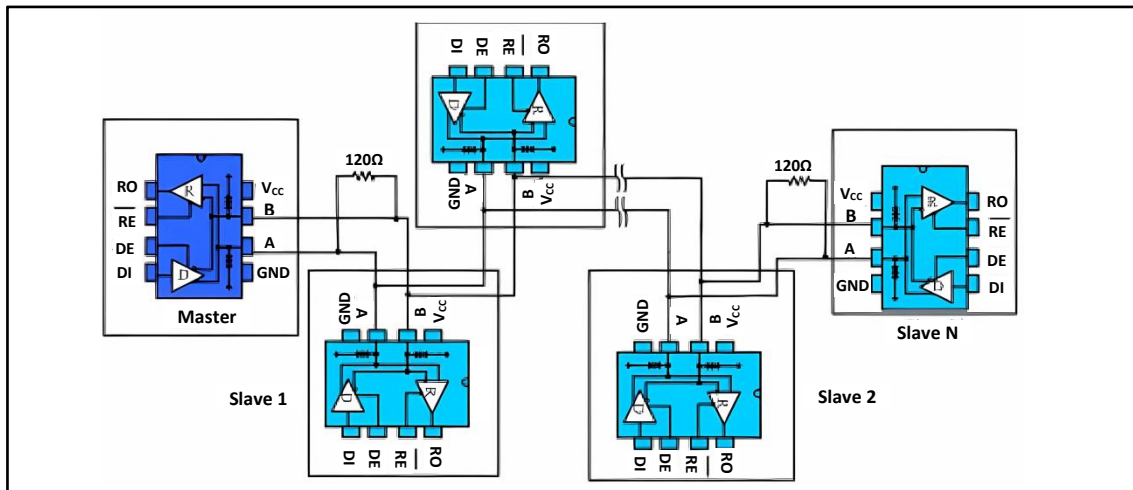


Figure 10 Handshake RS485 half-duplex communication network

Bus port protection: In harsh environments, RS485 communication ports are usually well protected against static electricity, lightning surge protection and other additional protection, and even need to prevent 380V mains access solutions to avoid damage to smart meters and industrial control hosts. Figure 11 shows three common RS485 bus port protection schemes. The first is a three-stage protection scheme in which the AB port is connected in parallel with a TVS device to the protection ground, a TVS device is connected in parallel between the AB ports, a thermistor is connected in series with the AB port, and a gas discharge tube is connected in parallel to the protection ground. The third one is the scheme of connecting upper and lower pull-down resistors to the power supply and ground respectively, connecting TVS between AB, and connecting thermistor to one of the ports of A or B.

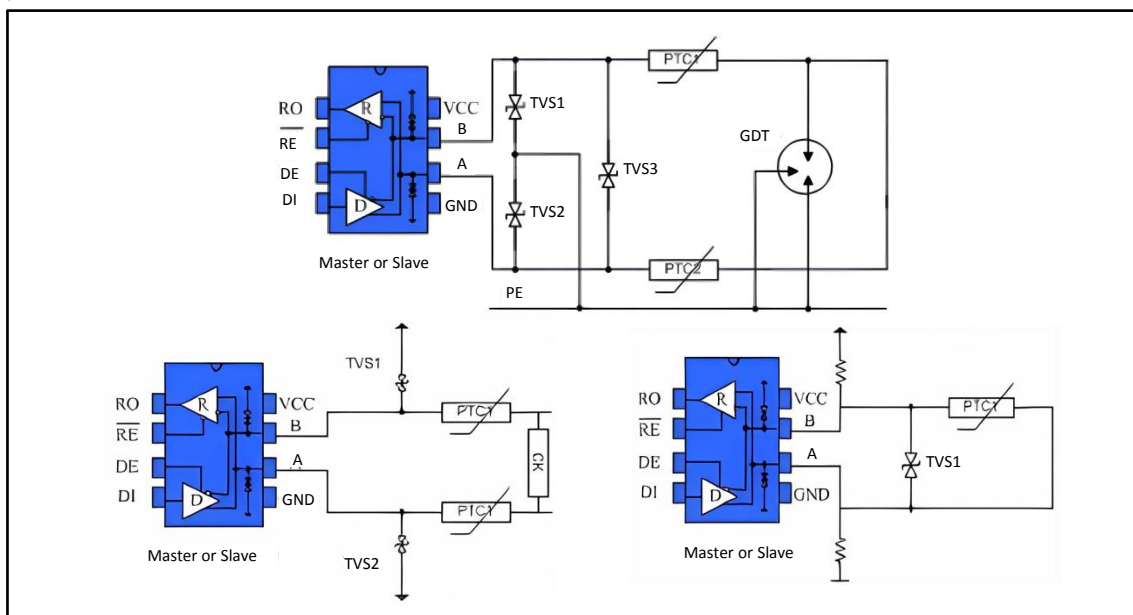


Figure 11 Port protection scheme

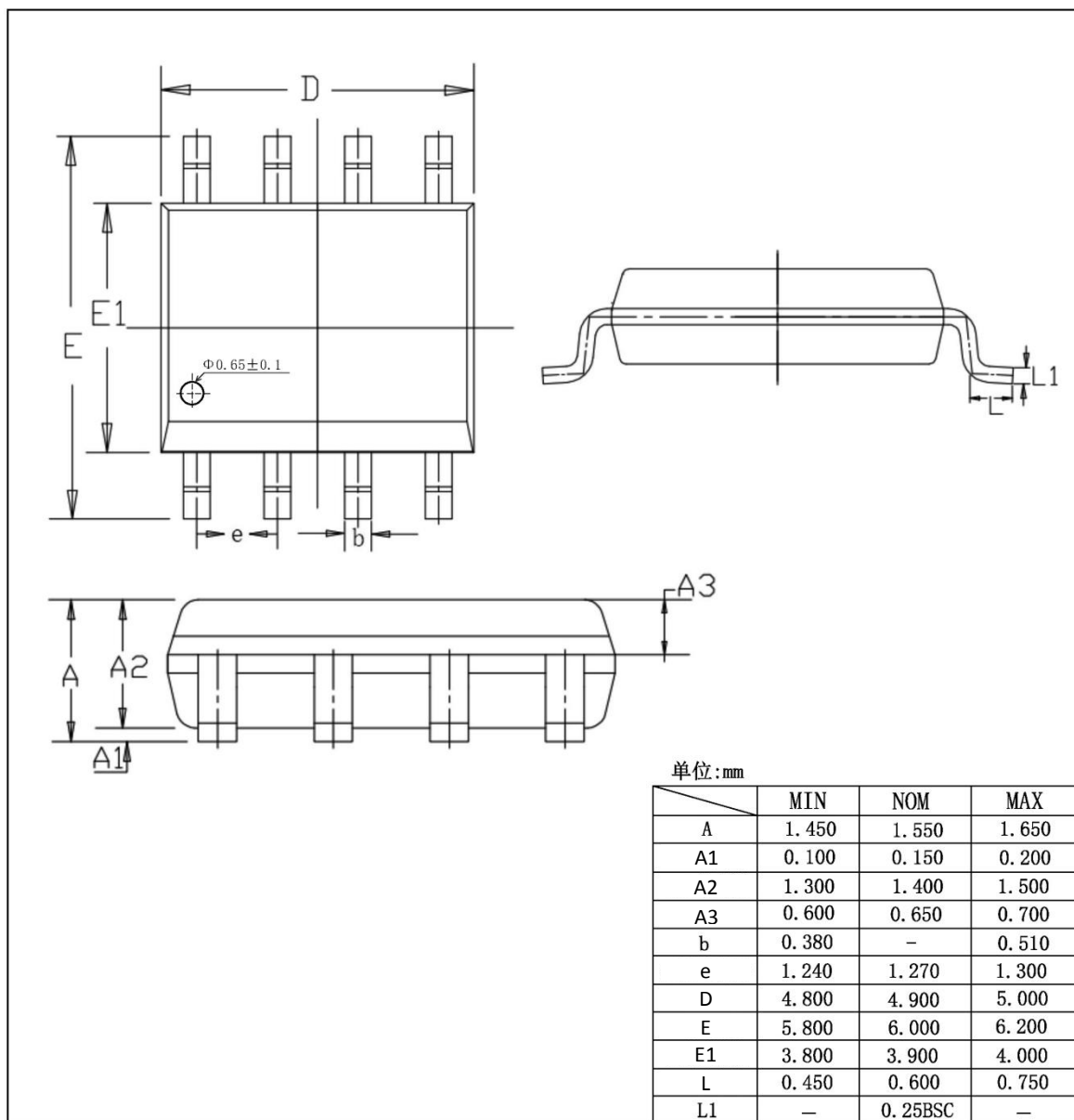
6. ORDERING INFORMATION

Ordering Information

Part Number	Device Marking	Package Type	Body size (mm)	Temperature (°C)	MSL	Transport Media	Package Quantity
AKSL3485	XL3485	SOP-8	4.90 * 3.90	-40 to +85	MSL3	T&R	2500
AKSD3485	XD3485	DIP-8	9.25 * 6.38	-40 to +85	MSL3	Tube 50	2000

7. DIMENSIONAL DRAWINGS

SOP-8



DIP-8

