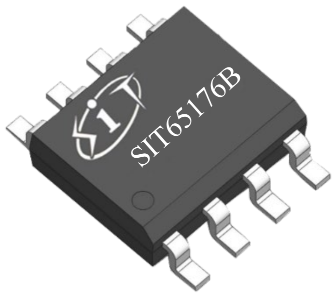
FEATURES

- 3.0~5.5V voltage ranges, half-duplex
- ESD protection for RS-485 I/O pins ±15kV, Human Body Model
- Bus fault tolerance and withstand voltage reach ±15V
- Driver short-circuit output protection
- Overtemperature protection function
- Low power shutdown function
- Receiver open-circuit failure protection
- Strong anti-noise ability
- Integrated transient voltage suppression function
- Data transmission up to 16Mbps in an electric noise environment

PRODUCT APPEARANCE



Provide Green and Environmentally Friendly Lead-free package

DESCRIPTION

SIT65176B 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.

SIT65176B 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. It can realize error-free data transmission up to 14Mbps.

SIT65176B has a working voltage range of 3.0~5.5V, and has the functions of fail-safe, overtemperature protection, current-limiting protection, over-voltage protection, etc.

PIN CONFIGURATION

SIT65176B

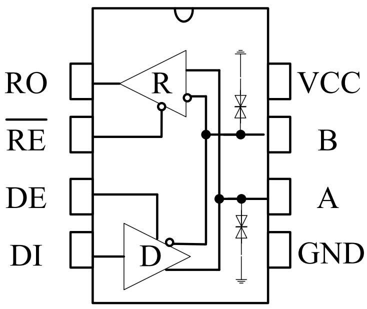


Fig 1 SIT65176B pin configuration

PIN DESCRIPTION

PIN	SYMBOL	DESCRIPTION
1	RO	Receiver output. When /RE is low, if A-B≥200 mV, then RO=high. If A-B≤-200 mV, then RO=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
Input Voltage on the Bus side	A, B	-15~+15	V
Receiver Output voltage	RO	-0.3~VCC+0.5	V
Operating Temperature Range	T_A	-40~85	℃
Storage Temperature Range	T_{stg}	-55~150	℃
Continuous Power	SOP8	470	mW

PARAMETER	SYMBOL	VALUE	UNIT
Dissipation	MSOP8	830	mW
	DIP8	700	mW

The maximum limit parameters mean that exceeding these values may cause irreversible damage to the device. Under these conditions, it is not conducive to the normal operation 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 output voltage (no load)	V_{OD1}		2.5		5.5	V
Differential output voltage	V_{OD2}	Fig 2, RL = 54 Ω, VCC=3.3V	1.5	1.8	VCC	V
		Fig 2, RL = 54 Ω, VCC=5V	1.5	3	VCC	
Change in magnitude of differential output voltage (NOTE1)	ΔV_{OD}	Fig 2, RL = 54 Ω			0.2	V
Common-mode output voltage	V_{OC}	Fig 2, RL = 54 Ω			3	V
Change in magnitude of common-mode output voltage (NOTE1)	ΔV_{OC}	Fig 2, RL = 54 Ω			0.2	V
High-level input voltage	V_{IH}	DE, DI, /RE	2.0			V
Low-level input voltage	V_{IL}	DE, DI, /RE			0.8	V
Logic input current	I_{IN1}	DE, DI, /RE	-2		2	μA
Short-circuit output current, short to HIGH	I_{OSD1}	short to 0V~12V			250	mA
Short-circuit output	I_{OSD2}	short to -7V~0V	-250			mA

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
current, short to LOW						
Thermal-shutdown threshold temperature				140		℃
Thermal-shutdown hysteresis temperature				20		℃

(Unless otherwise stated, Temp=T_{MIN}~T_{MAX}, Temp=25°C, VCC=5V).

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 or 5V, V_{IN} = 12 V			125	μA
		DE = 0 V, VCC=0 or 5V, V_{IN} = -7 V	-100			μA
Positive-going input threshold voltage	V_{IT+}	$-7V \le V_{CM} \le 12V$			-10	mV
Negative-going input threshold voltage	V_{IT-}	$-7V \le V_{CM} \le 12V$	-200			mV
Input hysteresis voltage	V_{hys}	$-7V \le V_{CM} \le 12V$	10	30		mV
HIGH-level output voltage	V_{OH}	I_{OUT} = −2.5mA, V_{ID} = +200 mV	VCC-1.5			V
LOW-level output voltage	V_{OL}	I_{OUT} = +2.5mA, V_{ID} = -200 mV			0.4	V
Three-state input leakage current	I_{OZR}	0.4 V < V_O < 2.4 V			±1	μA
Receiver input resistance	R_{IN}	$-7V \le V_{CM} \le 12V$	96			kΩ
Receiver output short-circuit current	I_{OSR}	$0 V \le V_O \le VCC$	±8		±90	mA

(Unless otherwise stated, Temp=T_{MIN}~T_{MAX}, Temp=25°C).

SUPPLY CURRENT

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

DRIVER SWITCHING CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Differential-output delay time	t_{DD}	R_{DIFF} = 60 Ω, C_{L1}=C_{L2}=100pF (Fig 3& Fig 4)		15	32	ns
Differential-output transition time	t_{TD}			8	20	ns
Drive propagation delay from low to high	t_{PLH}	R_{DIFF} = 27 Ω, (Fig 3& Fig 4)		18	40	ns
Drive propagation delay from low to high	t_{PHL}			18	40	ns
$\|t_{PLH}-t_{PHL}\|$	t_{PDS}			2	6	ns
Output enable time to high level	t_{PZH}	R_L = 110Ω, (Fig 5& Fig 6)			55	ns
Output enable time to low level	t_{PZL}				55	ns
Input disable time from low level	t_{PLZ}	R_L = 110Ω, (Fig 5& Fig 6)			85	ns
Input disable time from high level	t_{PHZ}				85	ns

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Output enable time to high level (shutdown)	t_{DSH}	$R_L = 110\Omega$, (Fig 5& Fig 6)		20	100	ns
Output enable time to low level (shutdown)	t_{DSL}	$R_L = 110\Omega$, (Fig 5& Fig 6)		20	100	ns

RECEIVER SWITCHING CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Propagation delay time, low- to high-level output	t_{RPLH}	C_L=15pF (Fig 7& Fig 8)		40	70	ns
Propagation delay time, high- to low-level output	t_{RPHL}			40	70	ns
$\lvert t_{RPLH} - t_{RPHL} \rvert$	t_{RPDS}			3	8	ns
Output enable time to low level	t_{RPZL}	C_L=15pF (Fig 7& Fig 8)		15	40	ns
Output enable time to high level	t_{RPZH}	C_L=15pF (Fig 7& Fig 8)		15	40	ns
Output disable time from low level	t_{PRLZ}	C_L=15pF (Fig 7& Fig 8)		25	55	ns
Output disable time from high level	t_{PRHZ}	C_L=15pF (Fig 7& Fig 8)		25	55	ns
Output enable time to high level (shutdown)	t_{RPSH}	C_L=15pF (Fig 7& Fig 8)		150	500	ns
Output enable time to low level (shutdown)	t_{RPSL}	C_L=15pF (Fig 7& Fig 8)		150	500	ns
Time to shutdown	t_{SHDN}	NOTE2	50		300	ns

NOTE2: If the enable inputs are /RE=1 and DE=0 for less than 80ns, 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

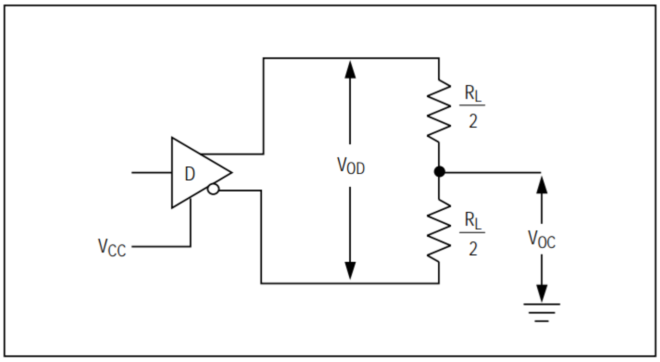
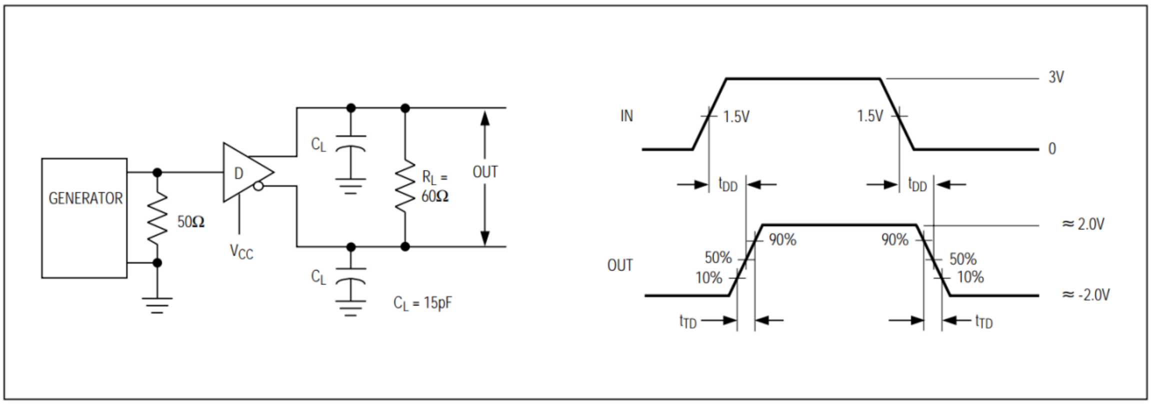


Fig 2 Driver DC test load



CL includes probe and stray capacitance (the same below).

Fig 3 Differential delay and transition time of driver

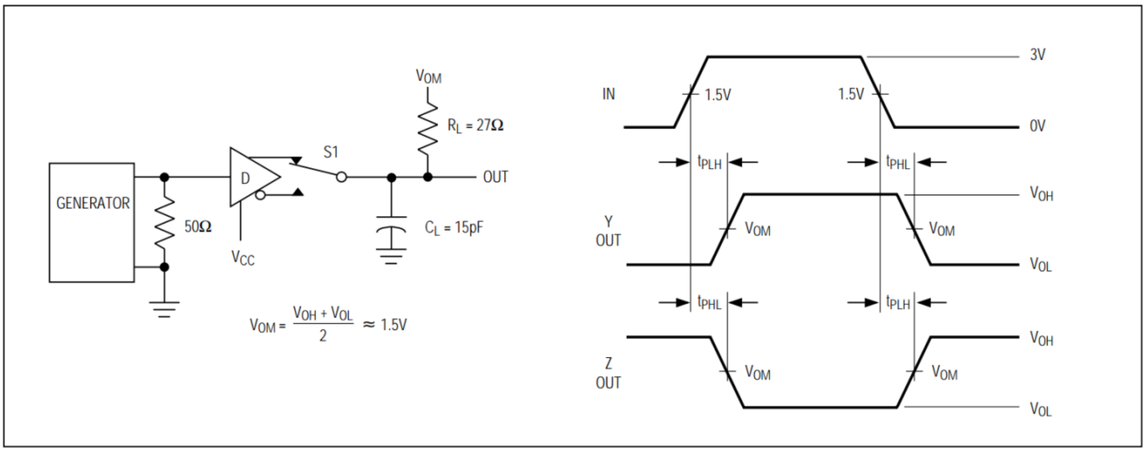


Fig 4 Driver propagation delay

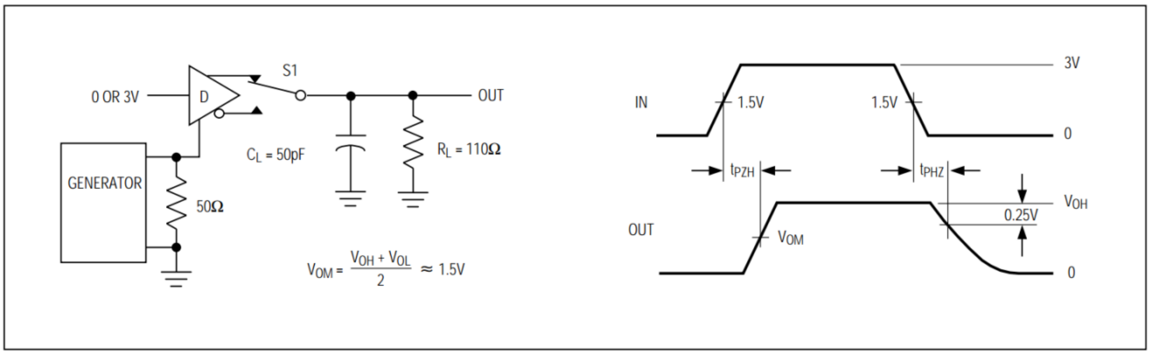


Fig 5 Driver enable and disable time

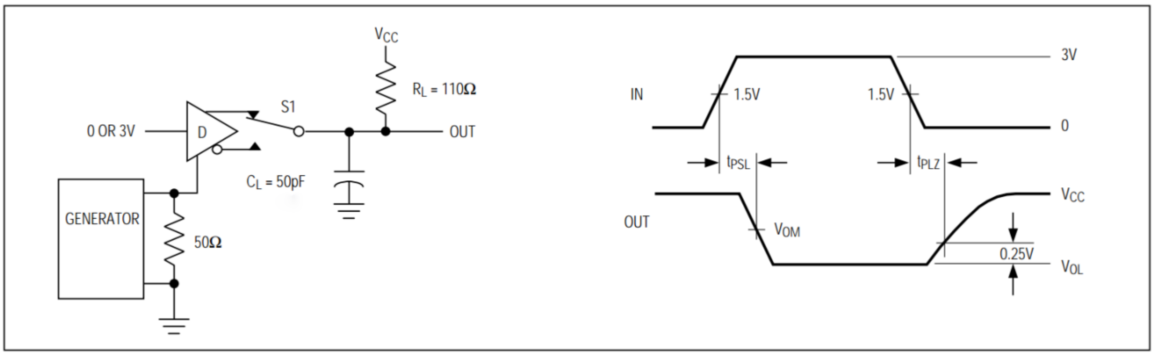


Fig 6 Driver enable and disable time

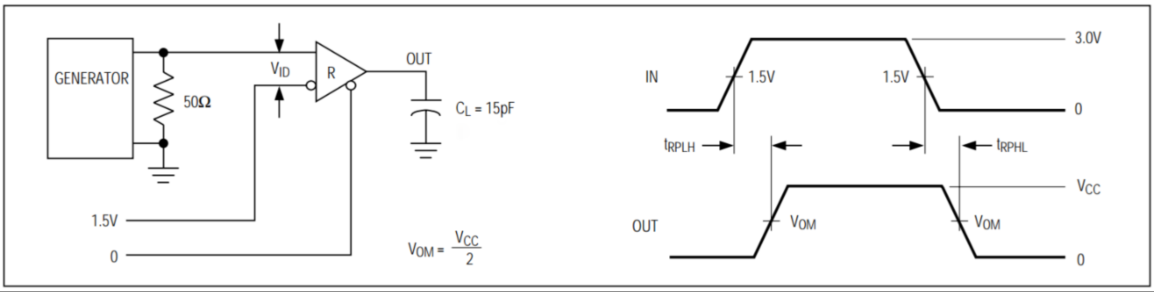


Fig 7 Receiver propagation delay test circuit

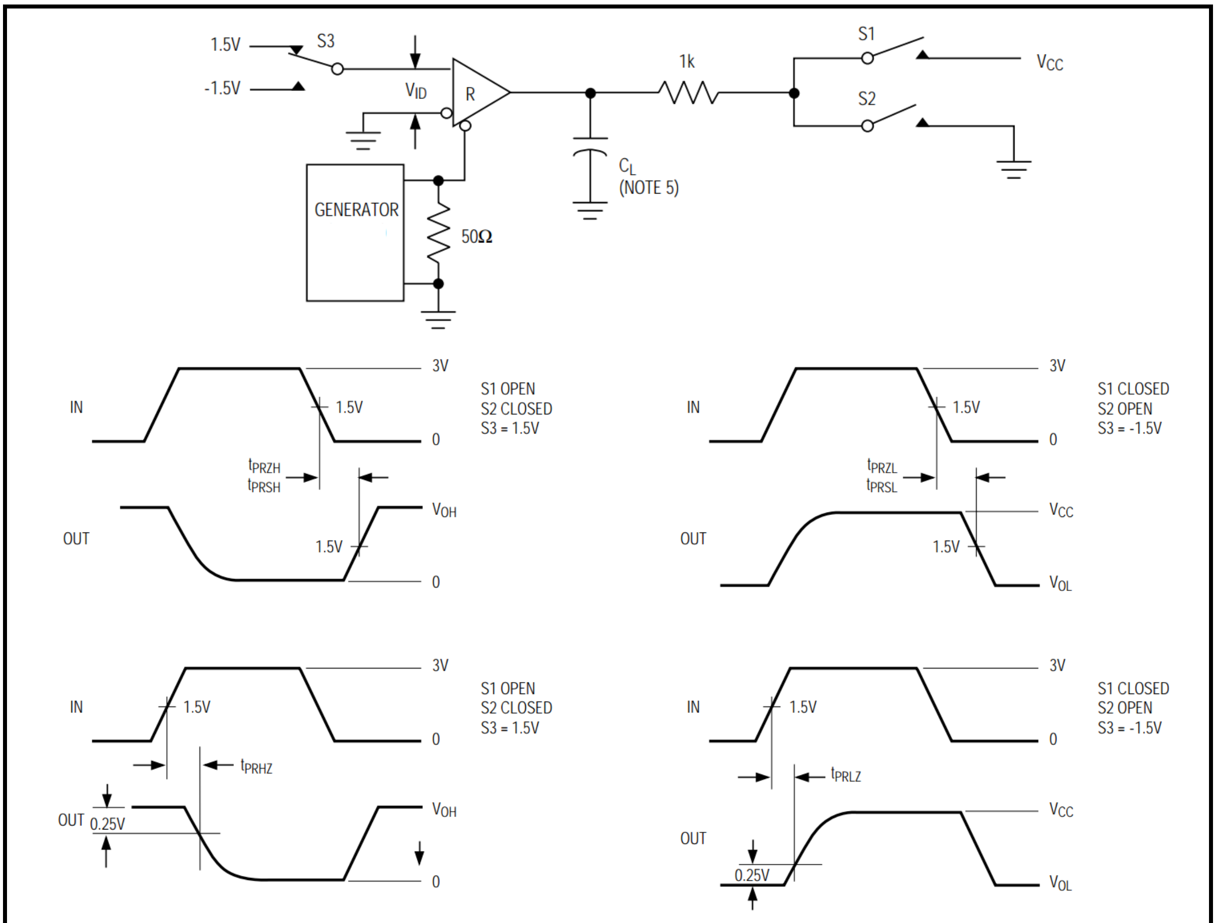


Fig 8 Receiver enable and disable time

ADDITIONAL DESCRIPTION

1 Sketch

SIT65176B is a half-duplex high-speed transceiver with 3.0V~5.5V wide power supply, bus port ESD protection 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. SIT65176B realizes error-free data transmission up to 16Mbps.

2 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 characteristics). Second, when the temperature of the tube core exceeds 140°C, the output of the driver is forced into the high resistance state.

3 Typical applications

3.1 Bus Networking: SIT65176B RS485 transceiver is designed for bidirectional data communication on multi-point bus transmission line. Fig 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.

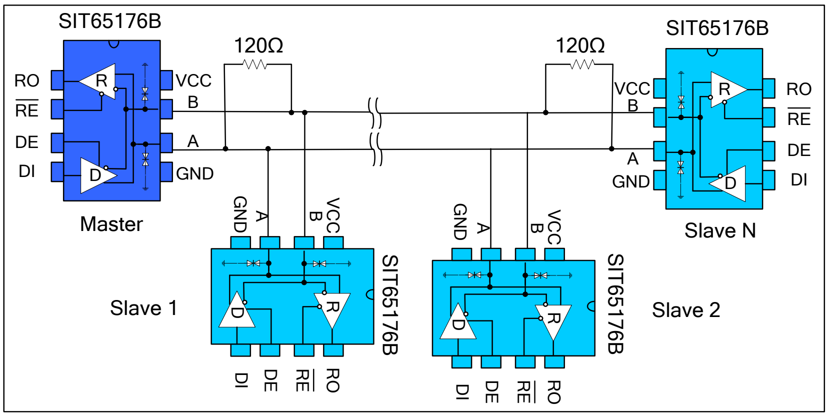


Fig 9 Bus type RS485 half-duplex communication network

3.2 Hand in hand Networking: also known as daisy chain topology, is the standard and specification of RS485 bus wiring, 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 shown in Fig 10, and the hand-held mode is no branches. This wiring mode has the advantages of small signal reflection and high communication success rate.

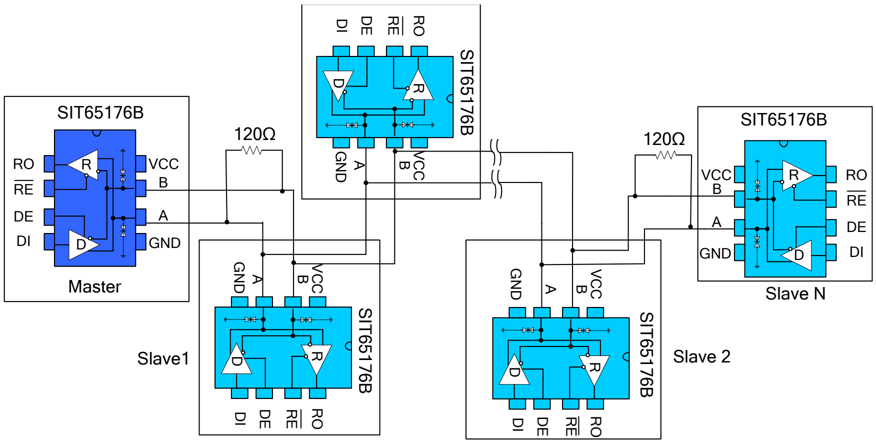


Fig 10 Hand in hand RS485 half-duplex communication network

3.3 Bus port protection: in severe environment, RS485 communication port is usually provided with electrostatic protection, lightning surge protection and other additional protection, and even the plan to prevent 380V market electricity access is needed to avoid the damage of intelligent instrument and industrial control host. Fig 11 shows three common RS485 bus port protection schemes. The first is the scheme of three-level protection by connecting TVS devices in parallel with A, B port to the protective ground, TVS devices in parallel with A, B port, thermistor in series 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 varistor in parallel with A, B port; the third is the scheme of three-level protection by connecting AB with pull-up or pull-down resistor to power and ground respectively, connecting TVS between A & B, A or B port connecting thermistor.

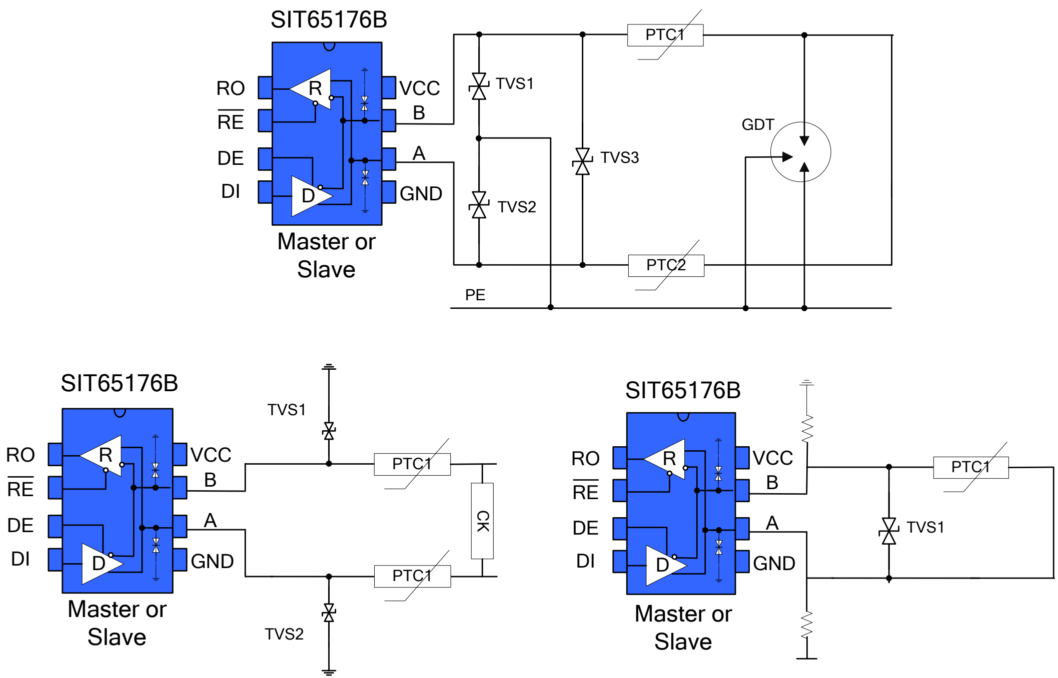
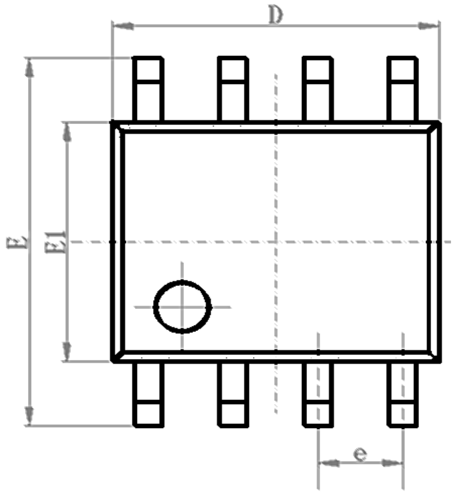


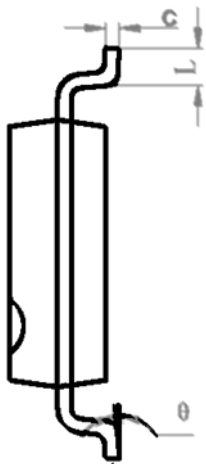
Fig 11 Port protection scheme

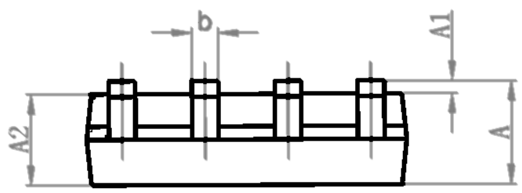
SOP8 DIMENSIONS

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	5.80	6.00	6.20
E1	3.80	3.90	4.00
e		1.27BSC	
L	0.40	0.60	0.80
c	0.20	-	0.25
θ	0°	-	8°



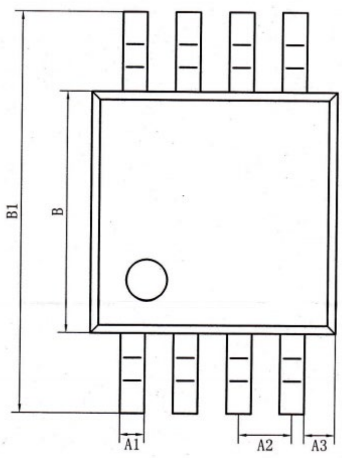


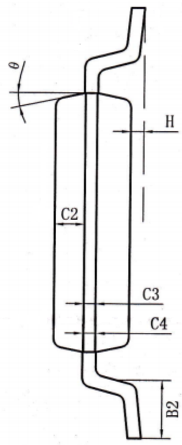


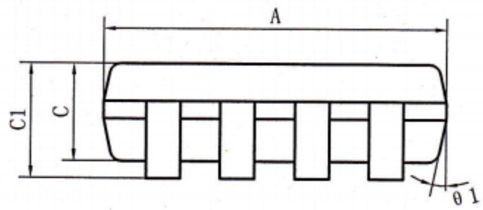
MSOP8/8μMAX/VSSOP8 DIMENSIONS

PACKAGE SIZE

SYMBOL	MIN./mm	TYP./mm	MAX./mm
A	2.90	3.0	3.10
A1	0.28		0.35
A2		0.65TYP	
A3		0.375TYP	
B	2.90	3.0	3.10
B1	4.70		5.10
B2	0.45		0.75
C	0.75		0.95
C1			1.10
C2		0.328 TYP	
C3		0.152	
C4	0.15		0.23
H	0.00		0.09
θ		12°TYP	



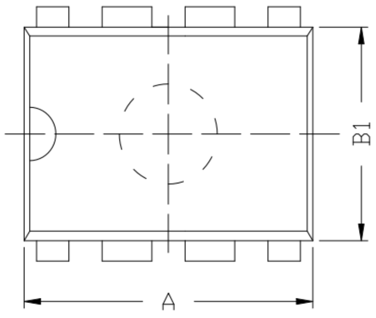


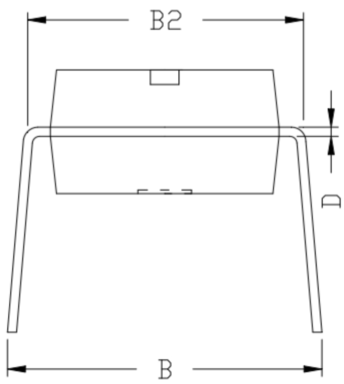


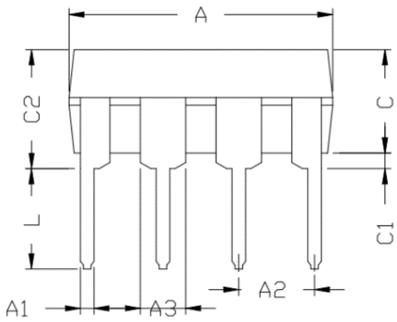
DIP8 DIMENSIONS

PACKAGE SIZE

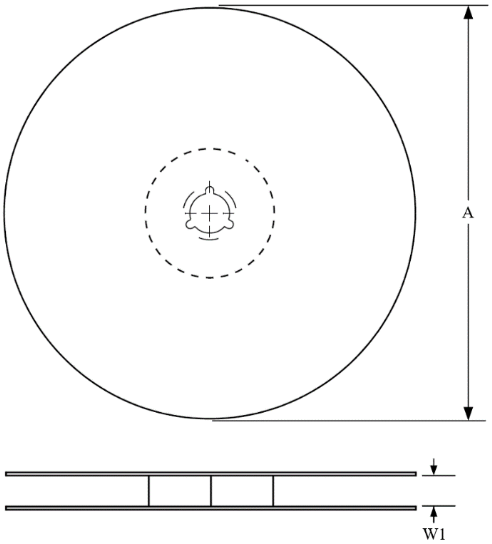
SYMBOL	MIN./mm	TYP./mm	MAX./mm
A	9.00	9.20	9.40
A1	0.33	0.45	0.51
A2	2.54TYP		
A3	1.525TYP		
B	8.40	8.70	9.10
B1	6.20	6.40	6.60
B2	7.32	7.62	7.92
C	3.20	3.40	3.60
C1	0.50	0.60	0.80
C2	3.71	4.00	4.31
D	0.20	0.28	0.36
L	3.00	3.30	3.60



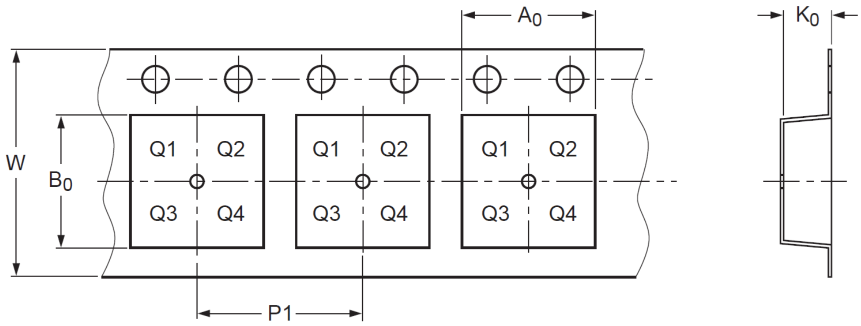




TAPE AND REEL INFORMATION



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers



Direction of Feed

PIN1 is in quadrant 1

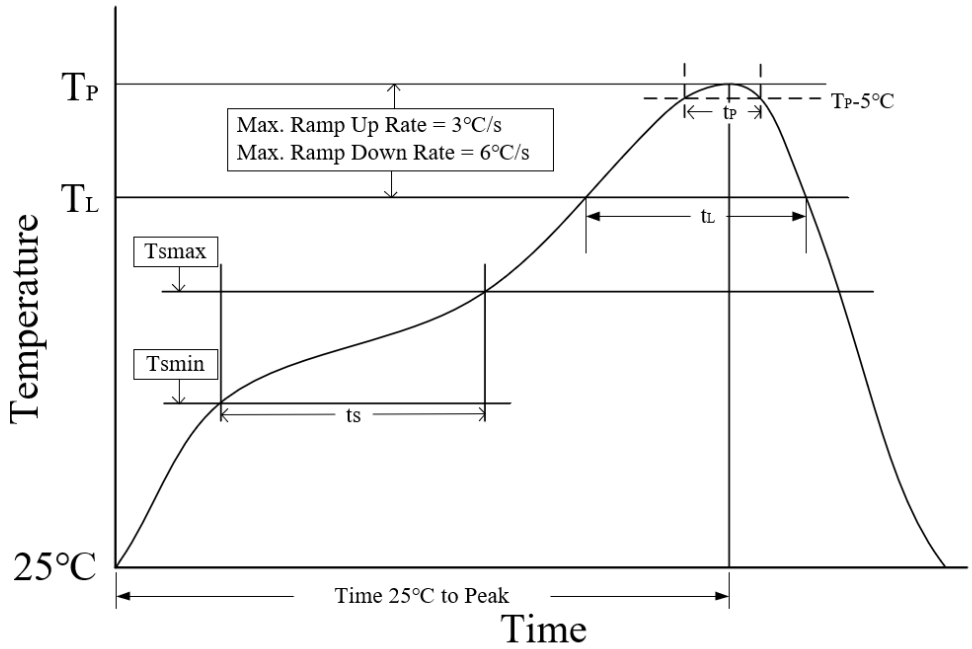
Package Type	Reel Diameter A (mm)	Tape width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)
SOP8	330	12.5±0.20	6.50±0.1	5.30±0.10	2.05±0.1	8.00±0.1	12.00±0.1
MSOP8	330	12.5±0.20	5.33±0.10	3.40±0.10	1.53±0.10	8.00±0.10	$12.00^{+0.30}_{-0.10}$

ORDERING INFORMATION

TYPE NUMBER	PACKAGE	PACKING
SIT65176BDR	SOP8	Tape and reel
SIT65176BDGK	MSOP8/VSSOP8/8μMAX	Tape and reel
SIT65176BP	DIP8	Tube

Tapered package is 2500 pcs/reel. DIP8 is packed with 50 pieces/tube in tubed packaging.

REFLOW SOLDERING



Parameter	Lead-free soldering conditions
Ave ramp up rate (T_L to T_P)	3°C/second max
Preheat time ts (T_{smin}=150°C to T_{smax}=200°C)	60-120 seconds
Melting time t_L (T_L=217°C)	60-150 seconds
Peak temp T_P	260-265°C
5°C below peak temperature t_P	30 seconds
Ave cooling rate (T_P to T_L)	6°C/second max
Normal temperature 25°C to peak temperature T_P time	8 minutes max

Important statement

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

REVISION HISTORY

Version number	Data sheet status	Revision date
V1.0	Initial version.	November 2022