SIT65HVD08

**3V~5.5V Supply ±16kV ESD Protected, 10Mbps, Half-duplex RS485/RS422 Transceiver**

FEATURES

➢ 3V~5.5V power supply, half-duplex

➢ ESD protection for bus terminals:
  contact discharge ±16kV

➢ Bus fault tolerance and withstand voltage reach ±15V

➢ 1/8-unit-load, allows up to 256 transceivers on the bus

➢ Driver short-circuit out 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 10Mbps in an electric noise environment

PRODUCT APPEARANCE
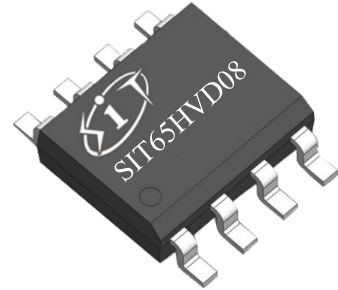
Provide Green and Environmentally Friendly Lead-free package

DESCRIPTION

SIT65HVD08 is a 3.0V~5.5V power supply, the contact discharge voltage of A/B is ±16kV, the fault protected voltage is ±15V, half-duplex, low power, RS485 Transceiver. SIT65HVD08 fully meets the TIA/EIA-485 standard.

SIT65HVD08 includes a driver and a receiver, both of which can be enabled and disabled independently. When both are disabled, the driver and receiver outputs are high resistance state. SIT65HVD08 has a 1/8-unit-load receiver input impedance, that allows up to 256 transceivers on the bus. The SIT65HVD08 allowing error-free data transmission up to 10Mbps.

SIT65HVD08 has a working voltage range of 3.0V to 5.5V and has the functions of fail-safe, overtemperature protection, current-limiting protection and overvoltage protection.
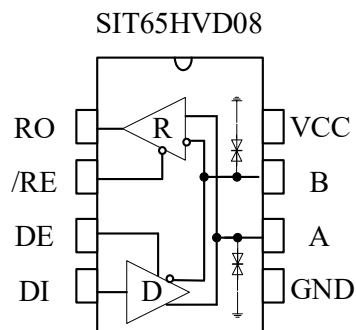
PIN CONFIGURATION

SIT65HVD08

Fig 1 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	Power supply.

LIMITING VALUES

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	VCC	+7	V
CTR Port	/RE, DE, DI	-0.3~VCC+0.5	V
Driver Output Voltage	A, B	-15~15	V
Receiver Output Voltage	RO	-0.3~VCC+0.5	V
Operating Temperature Range	T_A	-40~85	°C
Storage Temperature Range	T_{stg}	-60~150	°C
Lead Temperature		300	°C
Continuous Power Dissipation	SOP8	470	mW
	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	CONDITIONS	MIN	TYP	MAX	UNITS
Differential driver output (no load)	V_{OD1}		3.0		5.5	V
Differential driver output	V_{OD2}	Fig 2, RL=54Ω, VCC=3.3V		2	VCC	V
		Fig 2, RL=54Ω, VCC=5.0V		3.5	VCC	
Change in magnitude of differential output voltage (NOTE1)	ΔV_{OD}	Fig 2, RL=54Ω			0.2	V
Driver common-mode Output Voltage	V_{OC}	Fig 2, RL=54Ω			3	V
Change in magnitude of common-mode voltage (NOTE1)	ΔV_{OC}	Fig 2, RL=54Ω			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 current, short to LOW	I_{OSD2}	Short to-7V~0V	-250			mA
Thermal-shutdown threshold temperature				140		°C
Thermal-shutdown hysteresis temperature				20		°C

(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	CONDITIONS	MIN	TYP	MAX	UNITS
Input Current（A，B）	I_{IN2}	DE=0V, VCC=0 or 3.3/5V, V_{IN}=12V			125	μA
		DE=0V, VCC=0 or 3.3/5V, VIN=-7V	-100			μA
Positive-going input threshold voltage	V_{IT+}	-7V≤V_{CM}≤12V			+200	mV
Negative-going input threshold voltage	V_{IT-}	-7V≤V_{CM}≤12V	-200			mV
Receiver input hysteresis voltage	V_{hys}	-7V≤V_{CM}≤12V	10	30		mV
HIGH-level output voltage	V_{OH}	I_{OUT}=−4mA, V_{ID}=+200mV	VCC-1.5			V
LOW-level output voltage	V_{OL}	I_{OUT}=+4mA，V_{ID}=-200mV			0.4	V
Three-state input leakage current	I_{OZR}	0.4V<V_O<2.4V			±1	μA
Receiver input resistance	R_{IN}	-7V≤V_{CM}≤12V	96			kΩ
Receiver output short-circuit current	I_{OSR}	0 V≤V_O≤VCC	±8		±60	mA

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

SUPPLY CURRENT

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Current	I_{CC1}	/RE=DE=0V, VCC=3.3V		430	650	μA
		/RE=DE=0V, VCC=5V		470	750	μA
	I_{CC2}	/RE=DE=VCC, VCC=3.3V		450	650	μA
		/RE=DE=VCC, VCC=5V		510	750	μA

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Shutdown current	I_{SHDN}	/RE=VCC, DE=0V, VCC=3.3V		0.4	10	µA
		/RE=VCC, DE=0V, VCC=5V		0.1	10	µA

DRIVER SWITCHING CHARACTERISTICS

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Driver Differential Output Delay	t_{DD}	R_L=60Ω, C_L=100pF, Fig 3 & Fig 4		12	32	ns
Driver Differential Output Transition Time	t_{TD}			15	28	ns
Driver Propagation Delay, Low-to-High Level	t_{DZH}	R_L=27Ω Fig 3 & Fig 4	18		40	ns
Driver Propagation Delay, High-to-Low Level	t_{DZL}		18		40	ns
$\|t_{PLH} - t_{PHL}\|$ Driver Propagation-Delay Skew (Note 2)	t_{PDS}			2	2.5	ns
Driver-Output Enable Time to High Level	t_{PZH}	R_L=110Ω, Fig 5 & Fig 6			55	ns
Driver-Output Enable Time to Low Level	t_{PZL}				55	ns
Driver-Output Disable Time from Low Level	t_{PLZ}	R_L=110Ω, Fig 5 & Fig 6			85	ns
Driver-Output Disable Time from High Level	t_{PHZ}				85	ns
Driver-Output Enable Time from Shutdown to Low Level	t_{DSH}	R_L=110Ω, Fig 5 & Fig 6		400	1000	ns

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Driver-Output Enable Time from Shutdown to High Level	t_{DSL}	R_L=110Ω, Fig 5 & Fig 6		400	1000	ns

RECEIVER SWITCHING CHARACTERISTICS

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Receiver Propagation Delay (low to high)	t_{RPLH}	C_L=15pF Fig 7 & Fig 8		70		ns
Receiver Propagation Delay (high to low)	t_{RPHL}	C_L=15pF Fig 7 & Fig 8		70		ns
|t_{RPLH} − t_{RPHL}|	t_{RPDS}	C_L=15pF Fig 7 & Fig 8		5		ns
Receiver Enable to Output Low	t_{RPZL}	C_L=15pF Fig 7 & Fig 8		15		ns
Receiver Enable to Output High	t_{RPZH}	C_L=15pF Fig 7 & Fig 8		15		ns
Receiver Disable Time from Low	t_{RPLZ}	C_L=15pF Fig 7 & Fig 8		25	55	ns
Receiver Disable Time from High	t_{RPHZ}	C_L=15pF Fig 7 & Fig 8		25	55	ns
Receiver Enable from shutdown to Output High	t_{RPSH}	C_L=15pF Fig 7 & Fig 8		250	1500	ns
Receiver Enable from Shutdown to Output Low	t_{RPSL}	C_L=15pF Fig 7 & Fig 8		250	1500	ns
Time to Shutdown	t_{SHDN}	NOTE2	80		300	ns

NOTE2: The device is put into shutdown by bringing RE high and DE low. If the enable inputs are in this state for less than 50ns, the device is guaranteed not to enter shutdown. If the enable inputs are in this state for at least 600ns, the device is guaranteed to have entered shutdown.
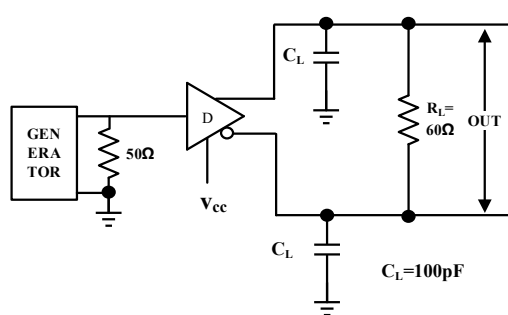
FUNCTION TABLES

TRANSMITTING

CTR		INPUTS	OUTPUTS	
/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: Don't care; Z: high impedance.				

RECEIVING

CTR		INPUTS	OUTPUTS
/RE	DE	A-B	RO
0	X	≥200mV	H
0	X	≤-200mV	L
0	X	Open/shorted	H
1	X	X	Z
X: Don't care; Z: high impedance.			

TEST CIRCUIT
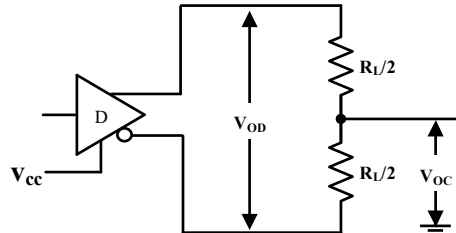
Fig 2 Driver DC Test Load

CL includes probe and stray capacitance, Same as below.
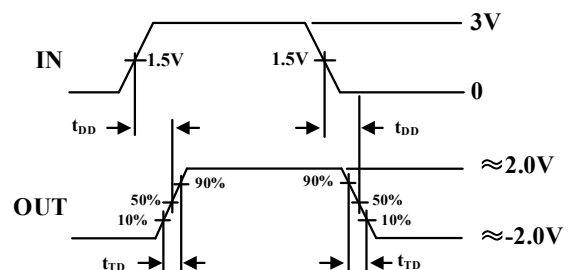
Fig 3 Driver Differential Output Delay and Transition Times
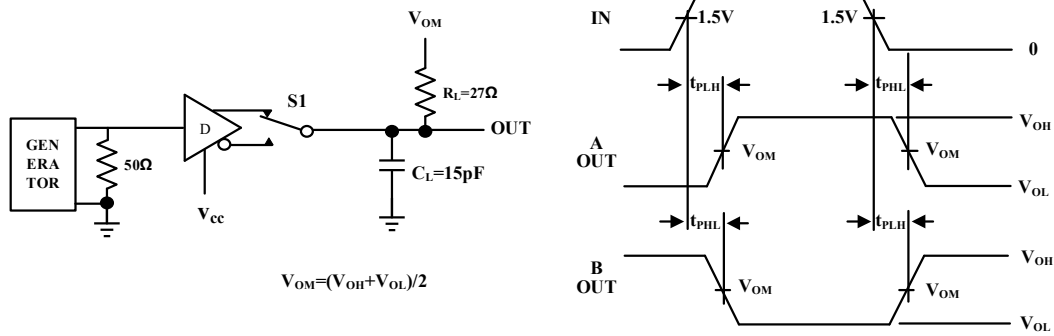
Fig 4 Driver Propagation Times
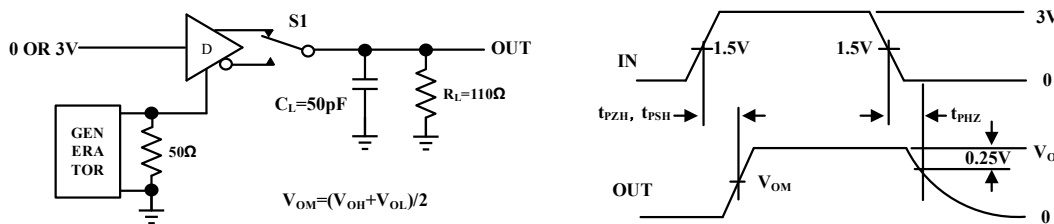
Fig 5 Driver Enable and Disable Times
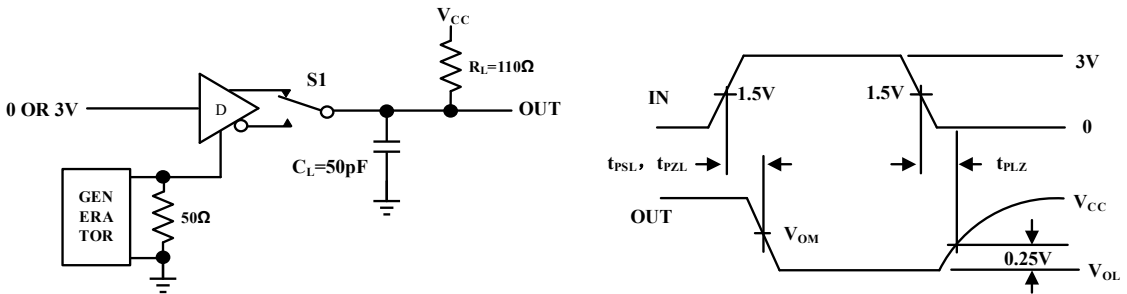
Fig 6 Driver Enable and Disable Times
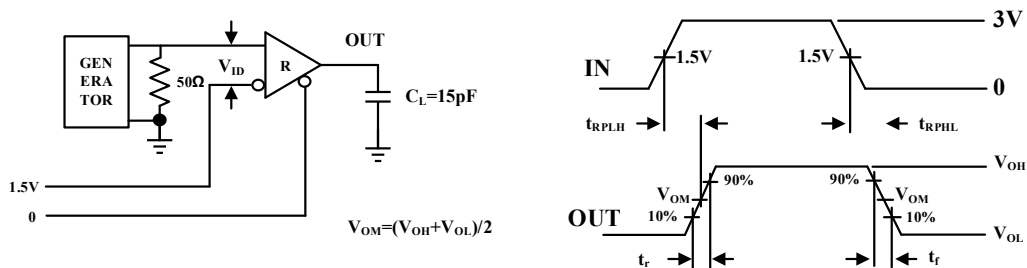
Fig 7 Receiver Propagation Delay
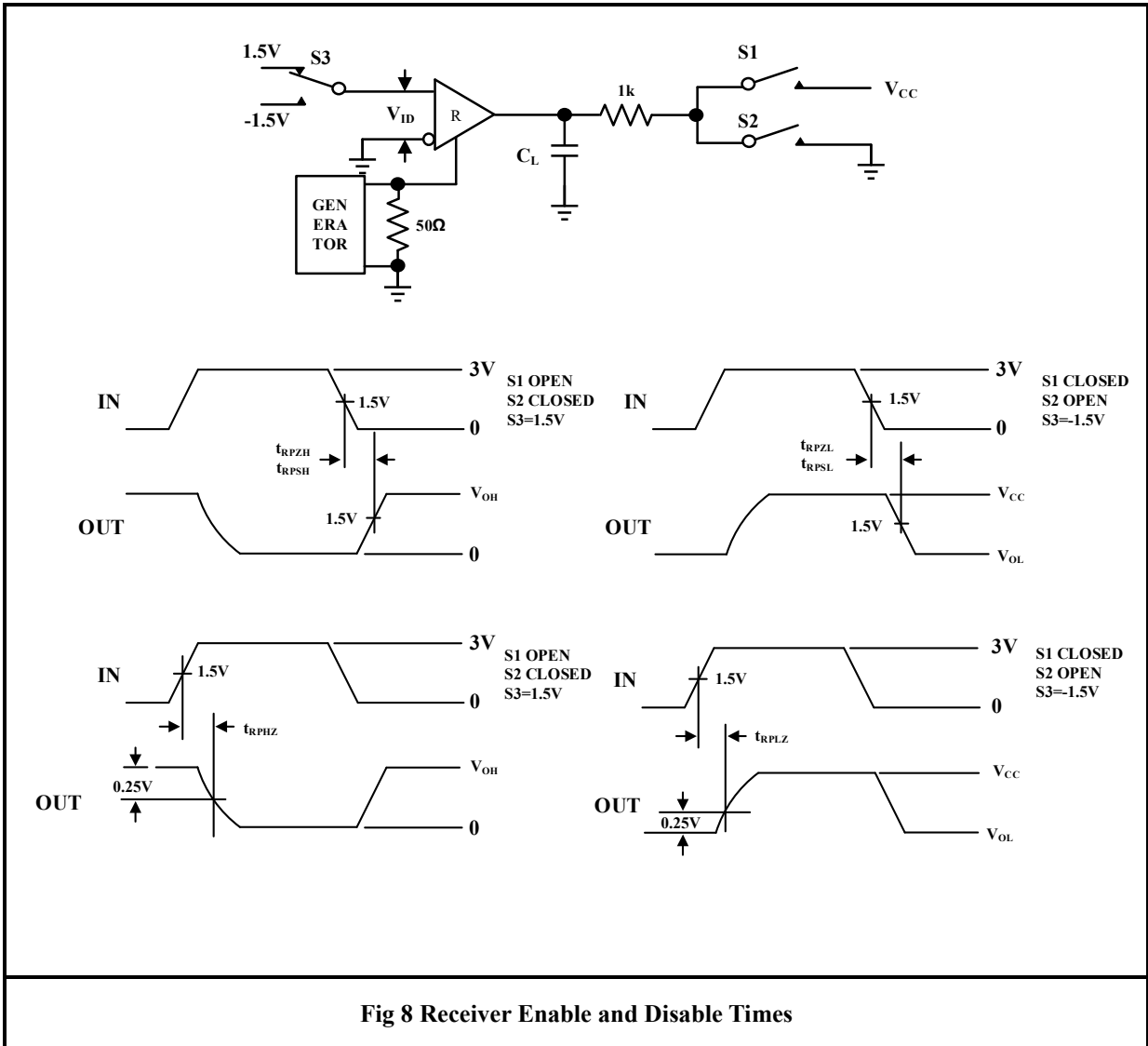
Fig 8 Receiver Enable and Disable Times

1 Sketch

SIT65HVD08 is a half-duplex high-speed transceiver with 3.0~5.5V wide power supply, ±16kV contact discharge capacity and bus DC withstand voltage of more than ±15V, used for RS-485/RS-422 communication, including a driver and a receiver. It has the function of fail-safe, overvoltage protection, over-current protection and over temperature protection. The SIT65HVD08 allows error-free data transmission up to 10Mbps.

2 Connecting 256 Transceivers on one Bus

The standard RS-485 receiver input impedance is 12kΩ (1 unit load), the standard driver can drive up to 32 unit loads. Receiver SIT65HVD08 transceiver has a 1/8 unit load receiver input impedance (96kΩ), allowing up to 256 transceivers to be connected in parallel on one bus. These devices can be any combination, or in combination with other RS-485 transceiver combination, as long as the total load does not load more than 32 units, can be connected on the same bus.

3 Drive Output Protection

Two 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℃, the output of the driver is forced into the high resistance state.

4 Typical Application

4.1 Bus Networking: SIT65HVD08 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 4,000 feet. In order to reduce the 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.
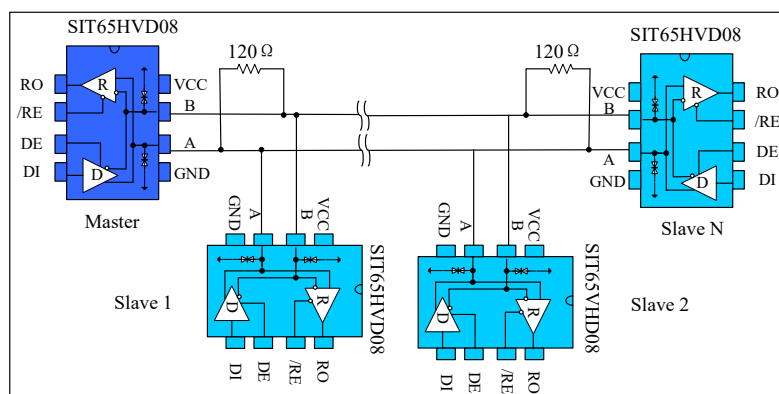

Fig 9 Bus type RS485 half-duplex communication network

4.2 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.
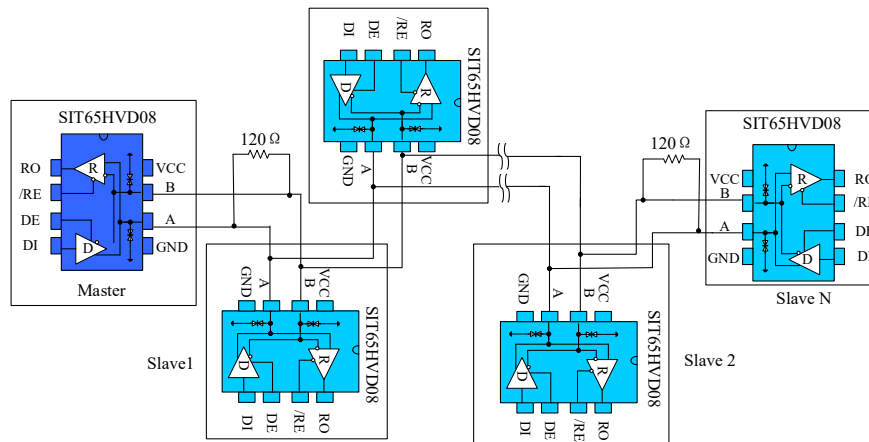

Fig 10 Hand in hand RS485 half-duplex communication network

4.3 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.
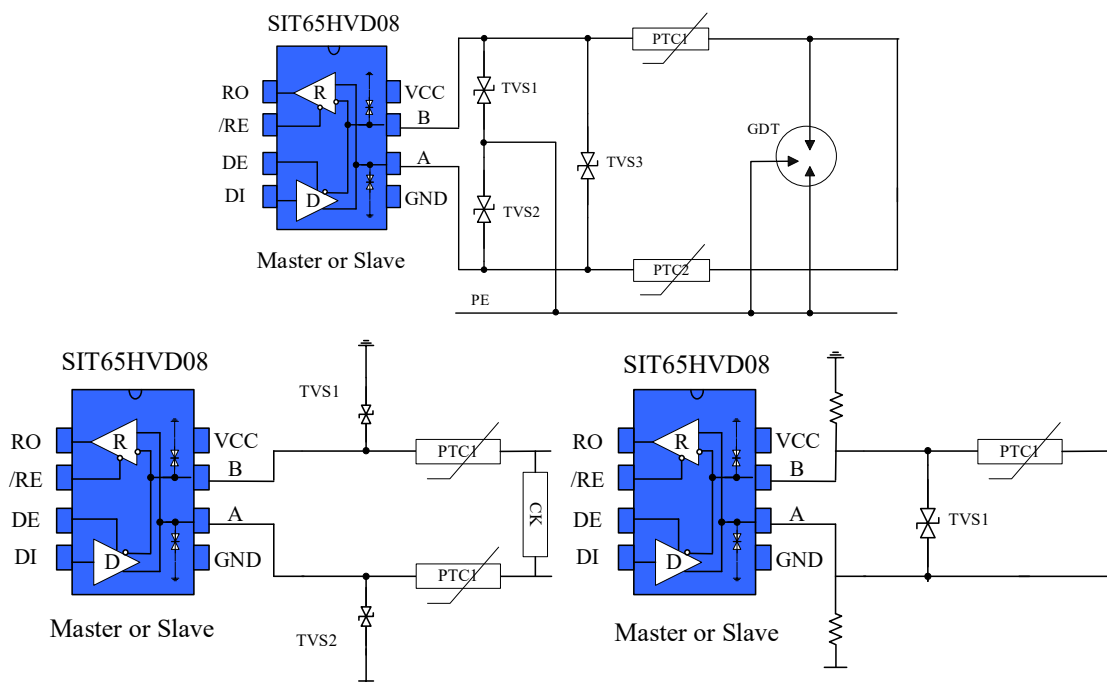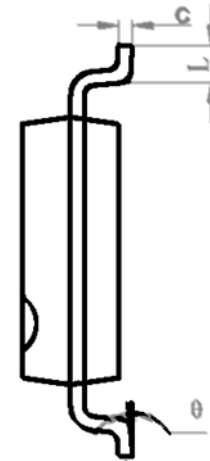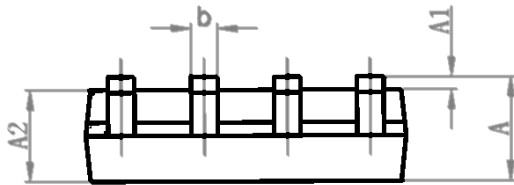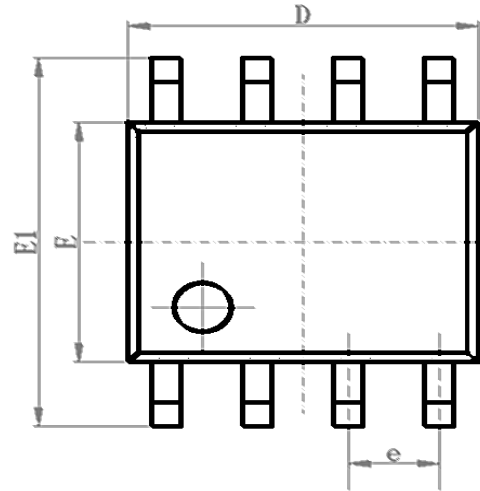

Fig 11 Port protection scheme

SOP8 DIMENSIONS

PACKAGE SIZE

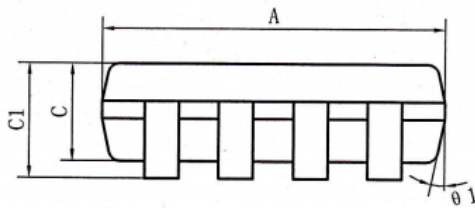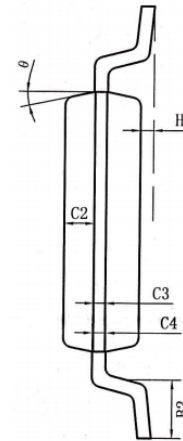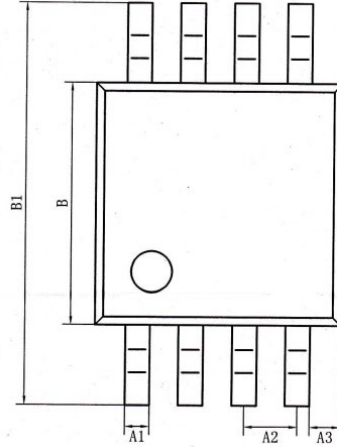| Symbol	Min./mm	Typ./mm	Max./mm
A	1.50	1.60	1.70
A1	0.1	0.15	0.2
A2	1.35	1.45	1.55
b	0.355	0.400	0.455
D	4.800	4.900	5.00
E	3.780	3.880	3.980
E1	5.800	6.000	6.200
e		1.270 BSC	
L	0.40	0.60	0.80
c	0.153	0.203	0.253
θ	-2°	-4°	-6°

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	0.65 TYP		
A3	0.375 TYP		
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
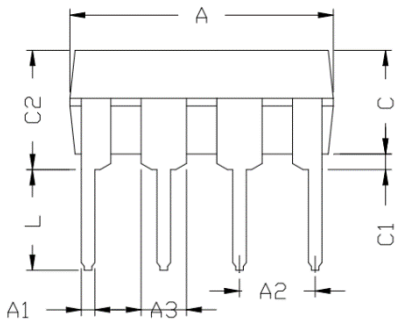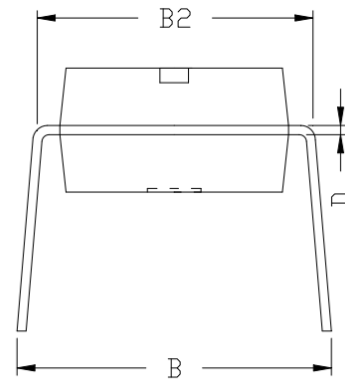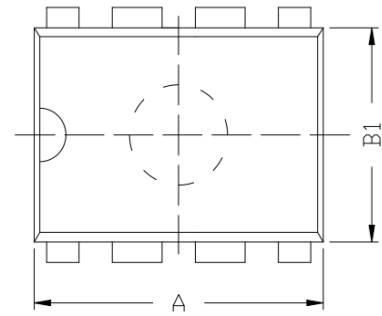
TAPE AND REEL INFORMATION
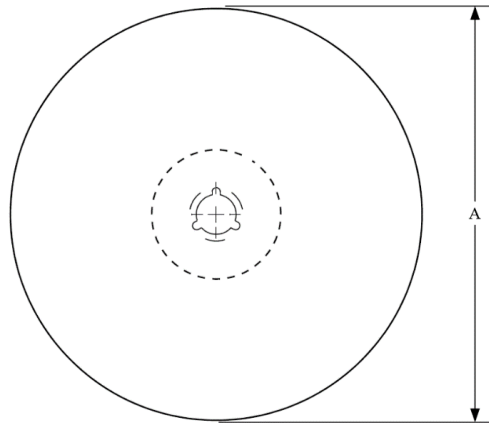
| A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

Direction of Feed
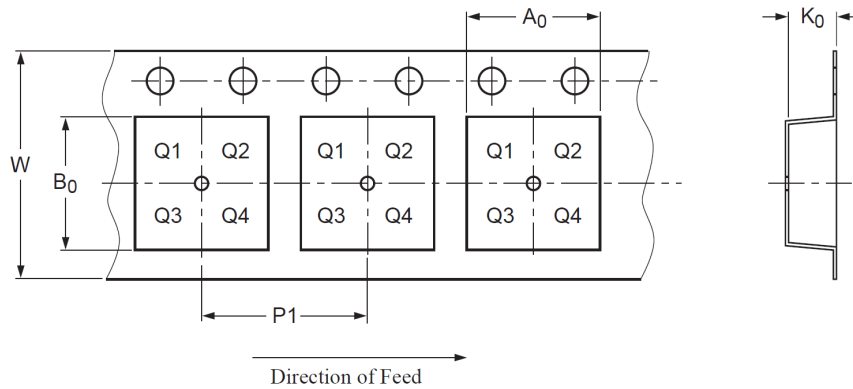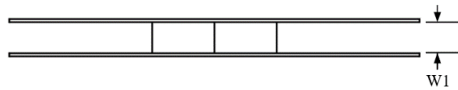
PIN1 is in quadrant 1

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
SIT65HVD08DR	SOP8	Tape and reel
SIT65HVD08DGK	MSOP8/VSSOP8/8μMAX	Tape and reel
SIT65HVD08P	DIP8	Tube

Tape and reel packing is 2500 pieces/disc, DIP8 is packed with 50 pieces/tube in tubed packaging.
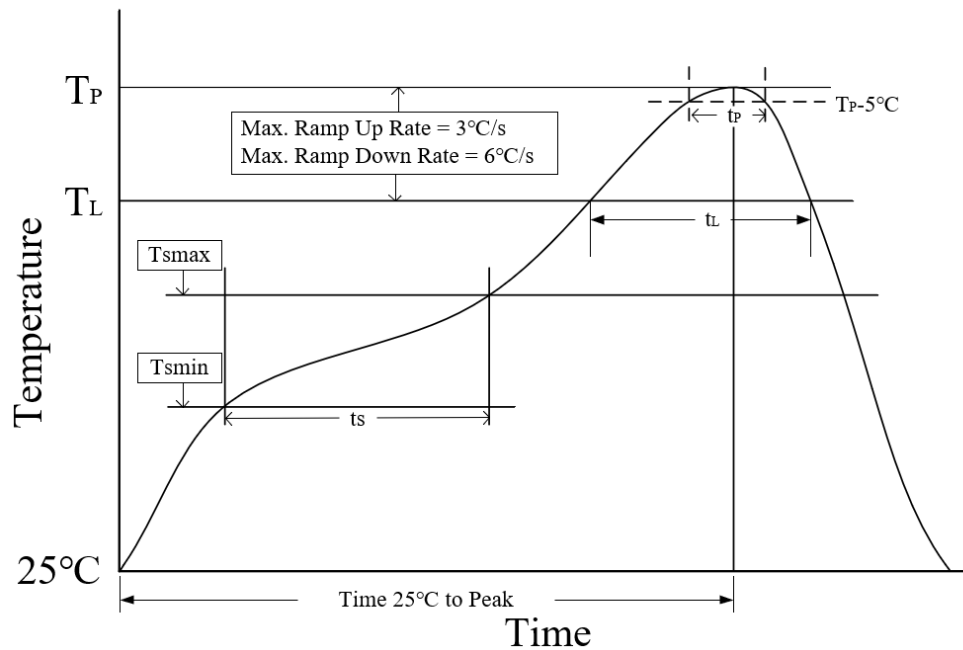
Parameter	Lead-free soldering conditions
Ave ramp up rate (T_L to T_P)	3°C/second max
Preheat time ts (T_{smin}=150°C to T_{smax}=200°C)	60-120 seconds
Melting time t_L (T_L=217°C)	60-150 seconds
Peak temp T_P	260-265°C
5°C below peak temperature t_P	30 seconds
Ave cooling rate (T_P to T_L)	6°C/second 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.	August 2018
V1.1~V1.4	Adjusted format.	February 2018 to May 2018
V1.5	Added ESD protection related content.	June 2018
V1.6	Adjusted format.	August 2018
V1.7	Updated test circuit; Added tape and reel information; Updated ordering information; Added reflow soldering; Added revision history.	February 2023