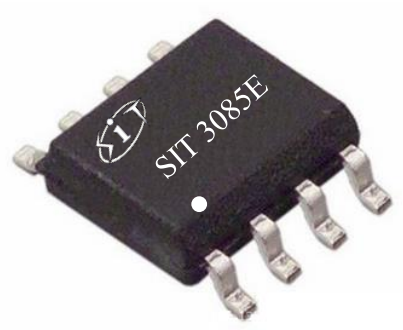
FEATURES：

- 5V Power Supply, Half-duplex；
- 1/8-unit-load, allows up to 256 transceivers on the bus；
- Short-circuit protection；
- Thermal shutdown protection；
- Low-Current Shutdown Mode；
- Hot-Swap Input Structures on DE and /RE；
- True Fail-Safe Receiver；
- Excellent noise immunity；
- Integrated transient voltage suppression；
- 1Mbps in Electrically Noisy Environments；
- ESD Protection for Bus Terminals：
  Contact Discharge±16KV； HBM±16KV；

Configuration：



PB Free Package (RoHS)

General Description

SIT3085E is a 5V power supply, half-duplex, low power, low slew rate RS485 Transceiver. SIT3085E Fully meets the TIA/EIA-485 standard.

SIT3085E includes a driver and a receiver, both of which can be independently enabled and disabled. When both are disabled, the driver and receiver outputs are high-impedance state. SIT3085E has a 1/8-unit-load receiver input impedance, that allows up to 256 transceivers on the bus. The SIT3085E features reduced slew-rate drivers that minimize EMI and reduce reflections caused by improperly terminated cables, allowing error-free data transmission up to 1Mbps.

SIT3085E operates under the supply voltage of 4.5V to 5.5V. SIT3085E is a true fail-safe transceiver. SIT3085E also has the function of thermal shutdown protection, current limiting protection, overvoltage protection. DE and /RE control port input features such as hot-swappable.

The transceiver is intergraded with TVS device, the contact discharge voltage is ±16KV, and HBM is ±16KV, air discharge is ±16KV

Functional Block

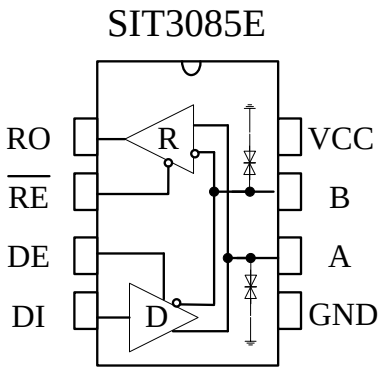


Fig1.Functional Block

ABSOLUTE MAXIMUM RATINGS

PARAMETER	Symbol	Value	Unit
Supply Voltage	VCC	+7	V
CTR Port	/RE，DE，DI	-0.3~VCC+0.3	V
Driver Output Voltage	A、B	-7~13	V
Receiver Output Voltage	RO	-0.3~VCC+0.3	V
Temperature Range		-40~85	℃
Storage Temperature Range		-60~150	℃
Soldering Temperature (reflow)		300	℃
Continuous Power Dissipation	SOP8	400	mW
	DIP8	700	

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Pin Description

Pin Number	Pin Name	FUNCTION
1	RO	Receiver Output. When enabled, if A –B ≥ -50 mV, then RO = high. If A -B ≤ -200 mV, then RO = low.
2	/RE	Receiver Output Enable. A low level enables the RO; a high level places it in a high impedance state.
3	DE	Driver Output Enable. A high level enables the driver differential outputs, Pin A and Pin B; a low level places the driver in a high impedance state.
4	DI	Driver Input. When the driver is enabled, a logic low on DI forces Pin A low and Pin B high; a logic high on DI forces Pin A high and Pin B low.
5	GND	Ground Connection (0 V).
6	A	No inverting Receiver Input A/Driver Output A.
7	B	Inverting Receiver Input B/Driver Output B.
8	VCC	Power Supply

DC ELECTRICAL CHARACTERISTICS OF DRIVER

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Differential Driver Output(no load)	V_{OD1}			5		V
Differential Driver Output	V_{OD2}	Fig 2，RL = 27 Ω	1.5		VCC	V
		Fig 2，RL = 50 Ω	2		VCC	
Change in Magnitude of Differential Output Voltage (NOTE1)	ΔV_{OD}	Fig 2，RL = 27 Ω			0.2	V
Driver Common-Mode Output Voltage	V_{OC}	Fig 2，RL = 27 Ω			3	V
Change In Magnitude of Common-Mode Voltage (NOTE1)	ΔV_{OC}	Fig 2，RL = 27 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
Input Current (RE,DI,/RE)	I_{IN1}	DE，DI，/RE	-2		2	uA
Driver Short-Circuit Output Current （short to high）	I_{OSD1}	Short to 0V~12V	35		250	mA
Driver Short-Circuit Output Current （short to low）	I_{OSD2}	Short to-7V~0V	-250		-35	mA
Thermal-Shutdown Threshold				150		℃
Thermal-Shutdown Hysteresis				20		℃

（If no special situation occurs，VCC=5V ±10% ,Temp=T_{MIN}~T_{MAX}，typically VCC=+5V，Temp＝25℃）

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

DC ELECTRICAL CHARACTERISTICS OF RECEIVER

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Input Current（A，B）	I_{IN2}	DE = 0 V，VCC=0 or 5V V_{IN} = 12 V			125	uA
		DE = 0 V，VCC=0 or 5V V_{IN} = -7 V	-100			uA
Positive-going input threshold voltage	V_{IT+}	-7V≦V_{CM}≦12V			-50	mV
Negative-going input threshold voltage	V_{IT-}	-7V≦V_{CM}≦12V	-200			mV
Receiver Input Hysteresis	V_{hys}	-7V≦V_{CM}≦12V	10	30		mV
RO Output-High Voltage	V_{OH}	I_{OUT} = −4mA，V_{ID} = +200 mV	VCC-1.5			V
RO Output-Low Voltage	V_{OL}	I_{OUT} = +4mA，V_{ID} = -200 mV			0.4	V
Three-State Output Current at Receiver	I_{OZR}	0.4 V < V_O < 2.4 V			±1	uA
Receiver Input Resistance	R_{IN}	-7V≦V_{CM}≦12V	96			kΩ
Receiver Output Short-Circuit	I_{OSR}	0 V≤V_O≤VCC	±7		±95	mA

（If no special situation occurs，VCC=5V±10% ,Temp=T_{MIN}~T_{MAX}，typically VCC=+5V，Temp＝25℃）

SUPPLY CURRENT

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Current	I_{CC1}	/RE=0V or VCC，DE = 0 V		180	300	uA
	I_{CC2}	/RE=VCC，DE=VCC		150	300	uA
Supply Current in Shutdown Mode	I_{SHDN}	/RE=VCC，DE=0V		0.5	10	uA

ESD PROTECTION

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
A、B		Human Body Model（HBM）		±16		KV
		Contact Discharge		±16		KV
OTHER PINS		Human Body Model（HBM）		±6		KV

SWITCHING CHARACTERISTICS OF DRIVER

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Driver Propagation Delay（low to high）	t_{DPLH}	R_{DIFF} = 54 Ω, C_{L1}=C_{L2}=100pF (Fig 3,4)		100	150	ns
Driver Propagation Delay（high to low）	t_{DPHL}			100	150	ns
$\lvert t_{DPLH} - t_{DPHL} \rvert$	t_{SKEW1}				±10	ns
Driver Differential Output Rise or Fall Time	t_{DR}, t_{DF}			190	250	ns
Driver Enable to Output High	t_{DZH}	C_L = 100 pF, S1 closed （Fig 5,6）		70	160	ns
Driver Enable to Output Low	t_{DZL}			70	160	ns
Driver Disable Time from Low	t_{DLZ}	C_L = 15 pF, S2 closed （Fig 5,6）		70	100	ns
Driver Disable Time from High	t_{DHZ}			70	100	ns
Driver Enable from Shutdown to Output High	$t_{DZH(SHDN)}$	C_L = 15 pF, S2 closed （Fig 5,6）		80	120	ns
Driver Enable from Shutdown to Output Low	$t_{DZL(SHDN)}$	C_L = 15 pF, S1 closed （Fig 5,6）		80	120	ns

SWITCHING CHARACTERISTICS OF RECEIVER

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Receiver Propagation Delay (low to high)	t_{RPLH}	Fig 7 and 8 V_{ID}≥2.0V; Rise and fall time V_{ID}≤15ns		50	80	ns
Receiver Propagation Delay (high to low)	t_{RPHL}			50	80	ns
$\|t_{RPLH} - t_{RPHL}\|$	t_{SKEW2}			5	15	ns
Receiver Enable to Output Low	t_{RZL}	C_L = 100 pF, S1closed (Fig 9,10)		25	40	ns
Receiver Enable to Output High	t_{RZH}	C_L = 100 pF, S2 closed (Fig 9,10)		25	40	ns
Receiver Disable Time from Low	t_{RLZ}	C_L = 100 pF, S1 closed (Fig 9,10)		25	50	ns
Receiver Disable Time from High	t_{RHZ}	C_L= 100pF, S2 closed (Fig 9,10)		25	50	ns
Receiver Enable from shutdown to Output High	$t_{RZH(SHDN)}$	C_L = 100 pF, S2 closed (Fig 9,10)			1000	ns
Receiver Enable from Shutdown to Output Low	$t_{RZL(SHDN)}$	C_L = 100 pF, S1 closed (Fig 9,10)			1000	ns
Time to Shutdown	t_{SHDN}	NOTE2	50	200	600	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	⩾-50mV	H
0	X	⩽-200mV	L
0	X	Open/shorted	H
1	X	X	Z

X：Don’t care；Z：high impedance。

TEST CIRCUIT

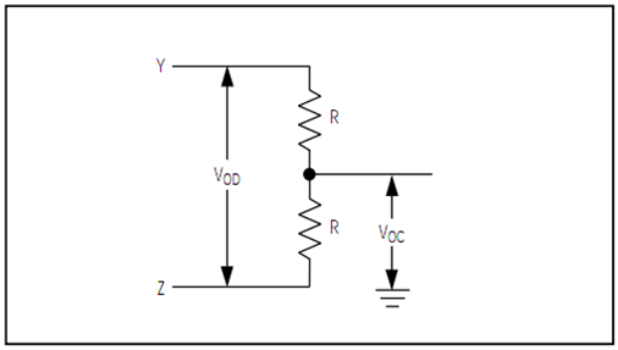


Fig 2 Driver DC Test Load

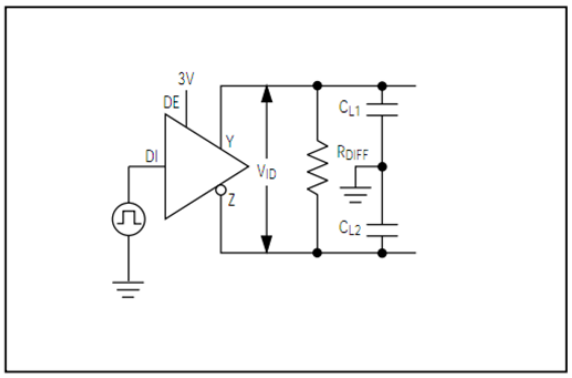


Fig 3 Driver Timing Test Circuit

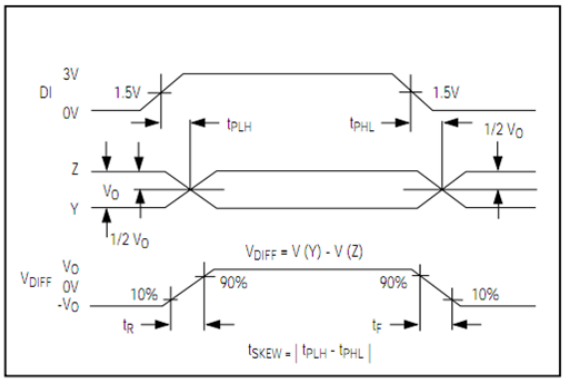


Fig 4 Driver Propagation Delays

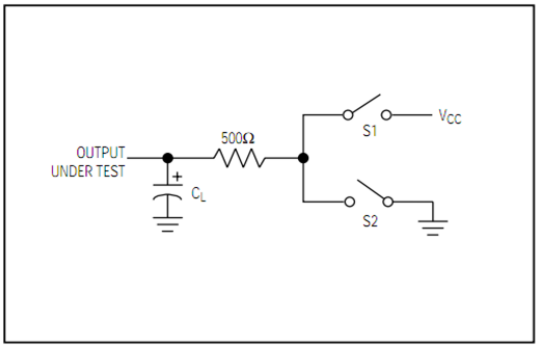


Fig 5 Driver Enable/Disable Timing Test Load

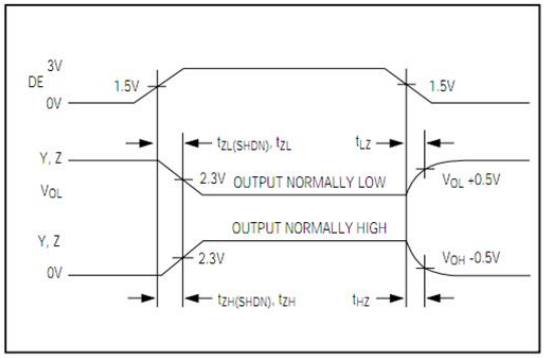


Fig 6 Driver Enable and Disable Times

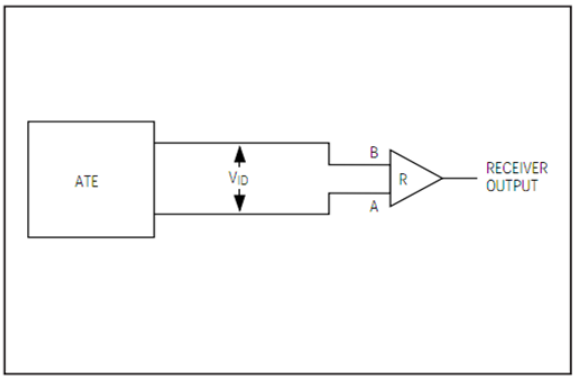


Fig 7 Receiver Propagation Delay Test Circuit

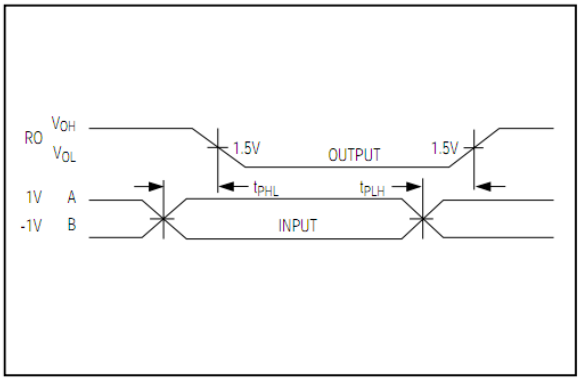


Fig 8 Receiver Propagation Delays

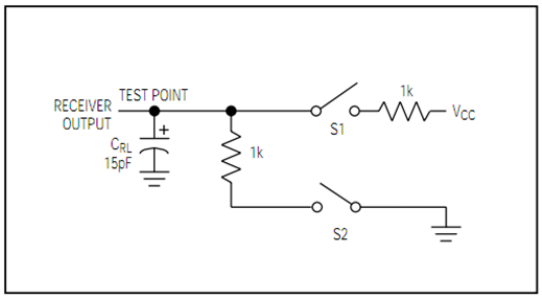


Fig 9 Receiver Enable/Disable Timing Test Load

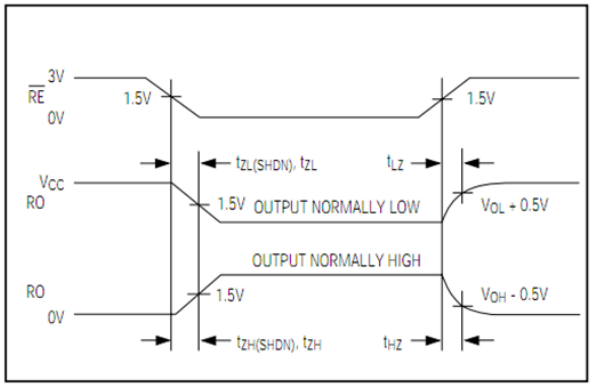


Fig 10 Receiver Enable and Disable Times

SUMMARY

1 Description

SIT3085E, including a driver and a receiver, is a half-duplex high-speed transceivers for RS-485 / RS-422 communications. SIT3085E features fail-safe, overvoltage protection, overcurrent protection, thermal protection, and allows / RE, DE hot-swappable.

The SIT3085E features reduced slew-rate drivers that minimize EMI and reduce reflections caused by improperly terminated cables, allowing error-free data transmission up to 1Mbps.

2 Fail Safe

When the receiver inputs are shorted or open, or when they are connected to a terminated transmission line with all drivers disabled, SIT3085E guarantees a logic-high receiver output. This is done by the receiver input thresholds are set between -50mV and -200mV. If the differential receiver input voltage (A-B) ≥-50mV, RO is logic high; if the voltage (A-B) ≤-200mV, RO is logic low. When attached to the terminal all transmitters on the bus are disabled, the receiver differential input voltage is pulled to 0V by the termination resistor. With the receiver threshold of the SIT3085E, this results in a logic-high with a 50mV minimum noise margin. The -50mV to -200mV threshold complies with the ±200mV EIA/TIA-485 standard.

3 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 SIT3085E 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.

4 Drive Output Protection

Through two mechanisms to avoid failure or a bus contention causes power consumption is too high. First, in the entire common Mode voltage range, overcurrent protection circuit provides a fast short protection. Second, when the die temperature exceeds 150℃, driver output is forced into a high impedance state by the thermal shutdown circuit.

5 Typical Application

5.1 **Backbone cable type:**SIT3085E transceiver is designed for multi-point bi-directional data communication bus transmission lines. Figure 11 shows a typical network application circuit. These devices can also be used as a cable longer than 4,000 feet of line repeater, to reduce the reflection, the transmission line should be in its ends terminated in its characteristic impedance, and stub lengths off the main line should be as short as possible.

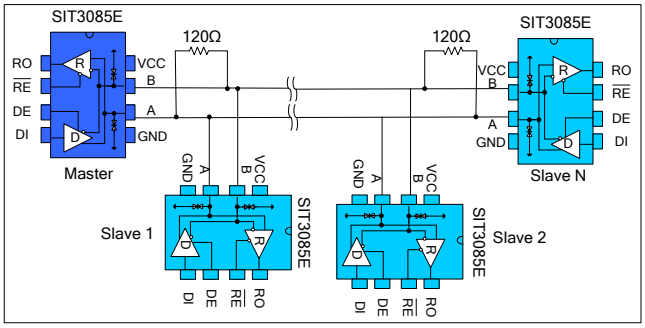


Fig11 Backbone cable type RS485 communications network

5.2 **Hand in hand type**: Also known as daisy chain topology, is the prior RS485 bus topology recommended by the TIA organization. The routing method is the master device and a number of slave devices connected in hand-handle configuration, as shown in Figure 12. It' should be noted at that hand in handle means no branch line. This kind of topology has the advantages of small reflection and high rate of success communication.

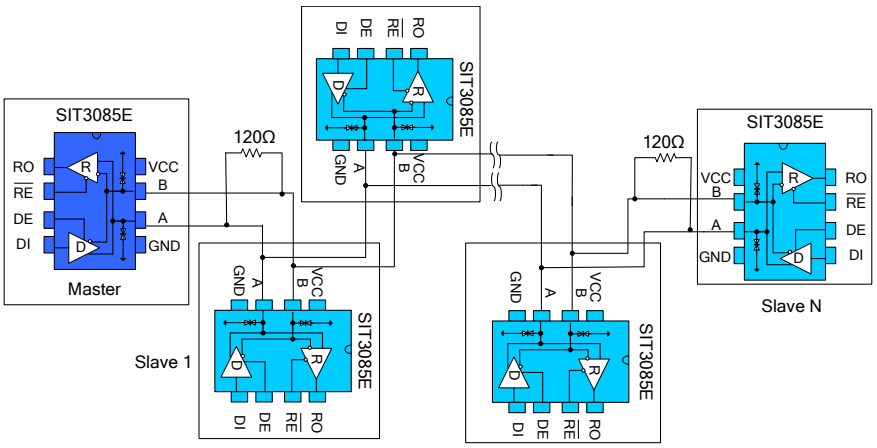


Fig12 Daisy chain topology type RS485 communications network

5.3 The bus port protection： In harsh environments，RS485 communication ports are usually done with static protection, lightning surge protection, and other additional protection，even prepared to prevent 380V electricity access by mistake. To avoid the destruction of intelligent instruments and industrial control host, figure 13 demonstrates three general kinds of RS485 bus port protection configuration.

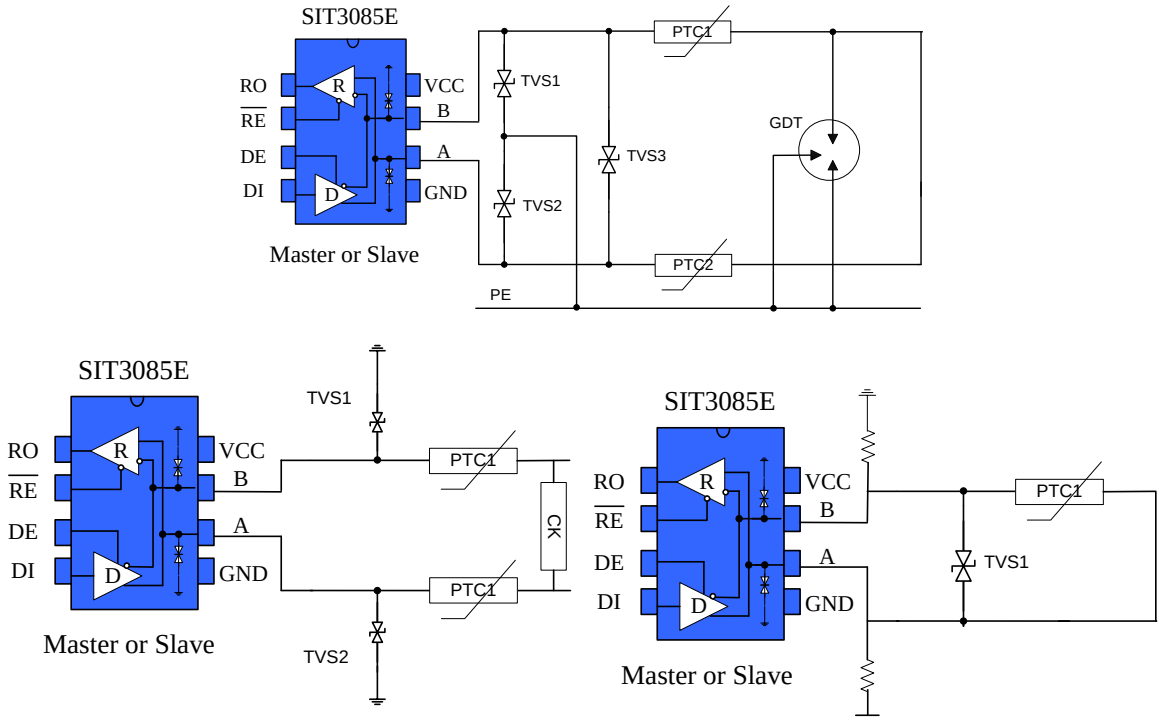
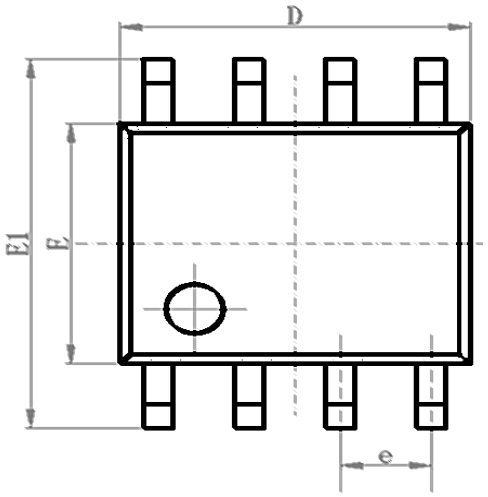


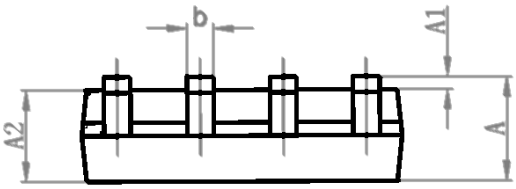
Fig13 RS485 bus ports Protection configuration

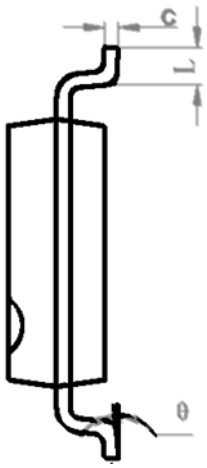
SOP8 PACKAGE OUTLINE

Package Dimensions

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		1.270BSC	
L	0.40	0.60	0.80
c	0.153	0.203	0.253
θ	-2 °	-4 °	-6 °



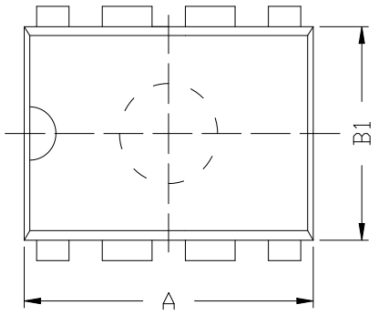


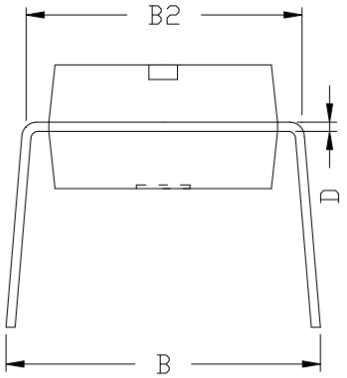


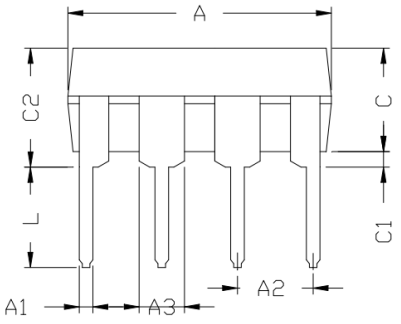
DIP8 PACKAGE OUTLINE

Package Dimensions

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







Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
SIT3085EESA	-40℃~85℃	8 SO
SIT3085EEPA	-40℃~85℃	DIP8
SIT3085EDGK	-40℃~85℃	MSOP8/VSSOP8/8μMAX

Tape and Reel: Pack quantity is 2,500.