



RoHS



MSOP8 Package SIT485CUA  
2.5Mbps, Half-duplex RS485/RS422 Transceiver

### FEATURES:

- 5V Power Supply, Half-duplex;
- allows up to 32 transceivers on the bus;
- Short-circuit protection;
- Thermal shutdown protection;
- Low-Current Shutdown Mode;
- True Fail-Safe Receiver;
- Excellent noise immunity;
- 2.5Mbps in Electrically Noisy Environments;
- Hot-Swap Input Structures on DE and /RE;

### Configuration:



PB Free Package (RoHS)

### General Description

SIT485CUA is a 5V power supply, half-duplex, low power, high speed RS485/RS422 Transceiver. SIT485CUA Fully meets the TIA/EIA-485 standard.

SIT485CUA 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. SIT485CUA allows up to 32 transceivers on the bus. The SIT485CUA features reduced slew-rate drivers that minimize EMI and reduce reflections caused by improperly terminated cables, allowing error-free data transmission up to 2.5Mbps.

SIT485CUA operates under the supply voltage of 4.75V to 5.25V. SIT485CUA is a true fail-safe transceiver. SIT485CUA also has the function of thermal shutdown protection, current limiting protection, overvoltage protection. DE and /RE control port input features such as hot-swappable.

### Functional Block

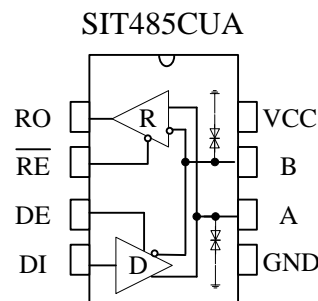


Fig1.Functional Block

**RoHS****MSOP8 Package SIT485CUA**  
**2.5Mbps, Half-duplex RS485/RS422 Transceiver****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	°C
Storage Temperature Range		-60~150	°C
Soldering Temperature (reflow)		300	°C
Continuous Power Dissipation	MSOP8	830	mW

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 $A-B \geq -10$ mV, then RO = high. If $A-B \leq -200$ 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

**RoHS****MSOP8 Package SIT485CUA**  
**2.5Mbps, Half-duplex RS485/RS422 Transceiver****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, $R_L = 27 \Omega$	1.5		VCC	V
		Fig 2, $R_L = 50 \Omega$	2		VCC	
Change in Magnitude of Differential Output Voltage (NOTE1)	$\Delta V_{OD}$	Fig 2, $R_L = 27 \Omega$			0.2	V
Driver Common-Mode Output Voltage	$V_{OC}$	Fig 2, $R_L = 27 \Omega$			3	V
Change In Magnitude of Common-Mode Voltage (NOTE1)	$\Delta V_{OC}$	Fig 2, $R_L = 27 \Omega$			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	$\mu A$
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		$^{\circ}C$
Thermal-Shutdown Hysteresis				20		$^{\circ}C$

(If no special situation occurs,  $V_{CC}=5V \pm 5\%$ ,  $Temp=T_{MIN} \sim T_{MAX}$ , typically  $V_{CC}=+5V$ ,  $Temp=25^{\circ}C$ )

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

**RoHS****MSOP8 Package SIT485CUA**  
2.5Mbps, Half-duplex RS485/RS422 Transceiver**DC ELECTRICAL CHARACTERISTICS OF RECEIVER**

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Input Current (A, B)	I <sub>IN2</sub>	DE = 0 V, VCC=0 or 5V V <sub>IN</sub> = 12 V			1.0	mA
		DE = 0 V, VCC=0 or 5V V <sub>IN</sub> = -7 V	0.8			mA
Positive-going input threshold voltage	V <sub>IT+</sub>	-7V ≦ V <sub>CM</sub> ≦ 12V			-10	mV
Negative-going input threshold voltage	V <sub>IT-</sub>	-7V ≦ V <sub>CM</sub> ≦ 12V	-200			mV
Receiver Input Hysteresis	V <sub>hys</sub>	-7V ≦ V <sub>CM</sub> ≦ 12V		30		mV
RO Output-High Voltage	V <sub>OH</sub>	I <sub>OUT</sub> = -4mA, V <sub>ID</sub> = +200 mV	3.5			V
RO Output-Low Voltage	V <sub>OL</sub>	I <sub>OUT</sub> = +4mA, V <sub>ID</sub> = -200 mV			0.4	V
Three-State Output Current at Receiver	I <sub>OZR</sub>	0.4 V < V <sub>O</sub> < 2.4 V			±1	uA
Receiver Input Resistance	R <sub>IN</sub>	-7V ≦ V <sub>CM</sub> ≦ 12V	12			kΩ
Receiver Output Short-Circuit	I <sub>OSR</sub>	0 V ≤ V <sub>O</sub> ≤ VCC	±7		±95	mA

(If no special situation occurs, VCC=5V ±5% ,Temp=T<sub>MIN</sub>~T<sub>MAX</sub>, typically VCC=+5V, Temp=25°C)**SUPPLY CURRENT**

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Current	I <sub>CC1</sub>	/RE=0V or VCC, DE = 0 V		200	500	uA
	I <sub>CC2</sub>	/RE= VCC, DE =VCC		300	600	uA
	I <sub>CC3</sub>	/RE=0, DE=VCC		0.5	10	uA

**RoHS****SWITCHING CHARACTERISTICS OF DRIVER**

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	
Driver Propagation Delay (low to high)	$t_{DPLH}$	$R_{DIFF} = 54 \Omega$ , $C_{L1} = C_{L2} = 100pF$ (Fig 3,4)		60		ns	
Driver Propagation Delay (high to low)	$t_{DPHL}$			60		ns	
$ t_{DPLH} - t_{DPHL} $	$t_{SKEW1}$				5	$\pm 10$	ns
Driver Differential Output Rise or Fall Time	$t_{DR}, t_{DF}$				40		ns
Driver Enable to Output High	$t_{DZH}$	$C_L = 100 pF$ , S1 closed (Fig 5,6)			70	ns	
Driver Enable to Output Low	$t_{DZL}$				70	ns	
Driver Disable Time from Low	$t_{DLZ}$	$C_L = 15 pF$ , S2 closed (Fig 5,6)			70	ns	
Driver Disable Time from High	$t_{DHZ}$				70	ns	

**SWITCHING CHARACTERISTICS OF RECEIVER**

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	
Receiver Propagation Delay (low to high)	$t_{RPLH}$	Fig 7 and 8 $V_{ID} \geq 2.0V$ ; Rise and fall time $V_{ID} \leq 15ns$		50	200	ns	
Receiver Propagation Delay (high to low)	$t_{RPHL}$				50	200	ns
$ t_{RPLH} - t_{RPHL} $	$t_{SKEW2}$				13	15	ns
Receiver Enable to Output Low	$t_{RZL}$	$C_L = 100 pF$ , S1 closed (Fig 9,10)		20	50	ns	
Receiver Enable to Output High	$t_{RZH}$	$C_L = 100 pF$ , S2 closed (Fig 9,10)		20	50	ns	



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Receiver Disable Time from Low	$t_{RLZ}$	$C_L = 100\text{ pF}$ , S1 closed (Fig 9,10)		20	50	ns
Receiver Disable Time from High	$t_{RHZ}$	$C_L = 100\text{ pF}$ , S2 closed (Fig 9,10)		20	50	ns

**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	$\geq -10\text{mV}$	H
0	X	$\leq -200\text{mV}$	L
0	X	Open/shorted	H
1	X	X	Z

X: Don't care; Z: high impedance.

TEST CIRCUIT

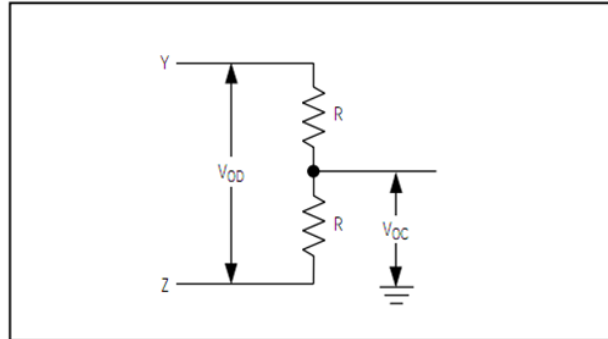


Fig 2 Driver DC Test Load

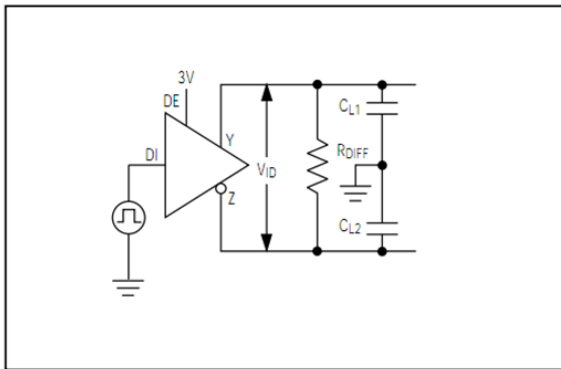


Fig 3 Driver Timing Test Circuit

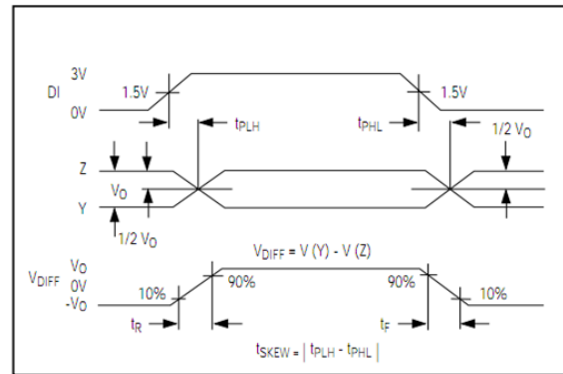


Fig 4 Driver Propagation Delays

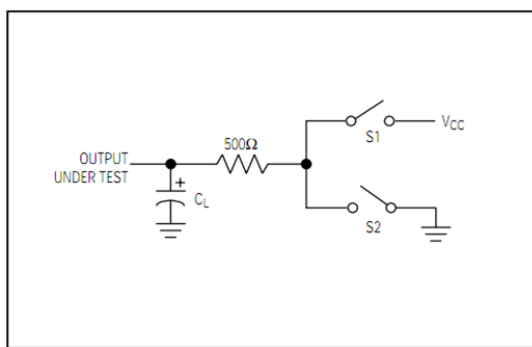


Fig 5 Driver Enable/Disable Timing Test Load

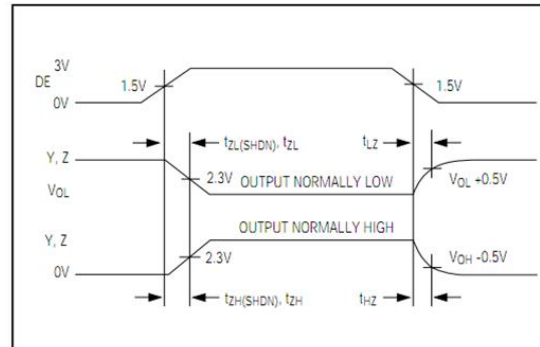
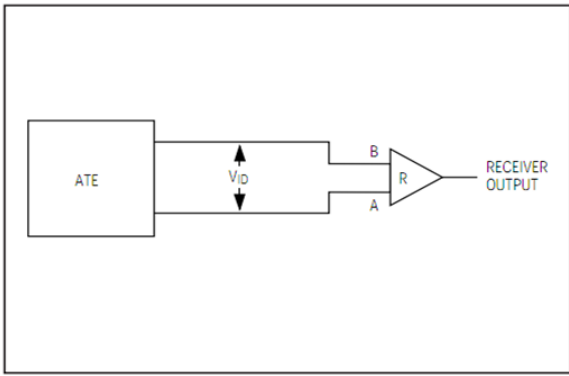
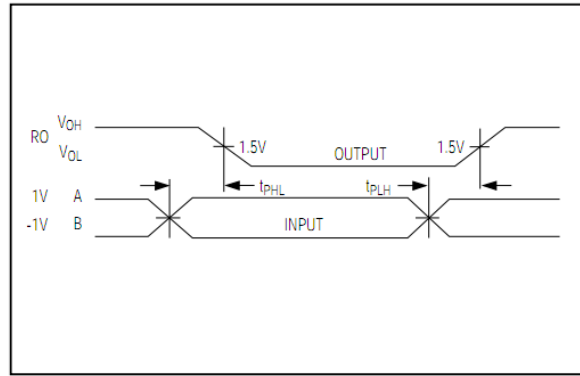


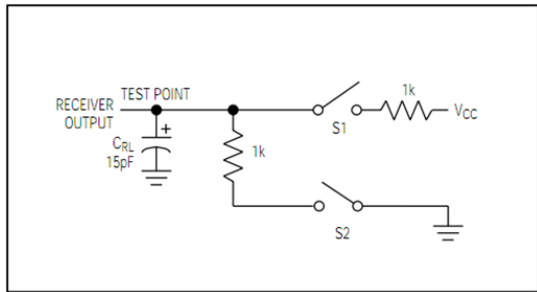
Fig 6 Driver Enable and Disable Times



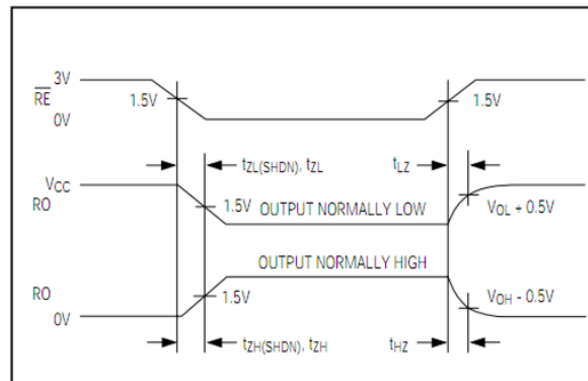
**Fig 7 Receiver Propagation Delay Test Circuit**



**Fig 8 Receiver Propagation Delays**



**Fig 9 Receiver Enable/Disable Timing Test Load**



**Fig 10 Receiver Enable and Disable Times**



**SUMMARY**

**1 Description**

SIT485CUA, including a driver and a receiver, is a half-duplex high-speed transceivers for RS-485 / RS-422 communications. SIT485CUA features fail-safe, overvoltage protection, overcurrent protection, thermal protection, and allows / RE, DE hot-swappable.

The SIT485CUA allows an error-free data transmission up to 2.5Mbps.

**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, SIT485CUA guarantees a logic-high receiver output. This is done by the receiver input thresholds are set between -10mV and -200mV. If the differential receiver input voltage (A-B)  $\geq$ -10mV, RO is logic high; if the voltage (A-B)  $\leq$ -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 SIT485CUA, this results in a logic-high with a 10mV minimum noise margin. The -10mV to -200mV threshold complies with the  $\pm$ 200mV EIA/TIA-485 standard.

**3 Connecting 32 Transceivers on one Bus**

The standard SIT485 receiver input impedance is guaranteed  $>12k\Omega$ , the standard driver can drive up to 32 unit loads. 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°C, driver output is forced into a high impedance state by the thermal shutdown circuit.

**5 Typical Application**

5.1 **Backbone cable type:** SIT485CUA 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.

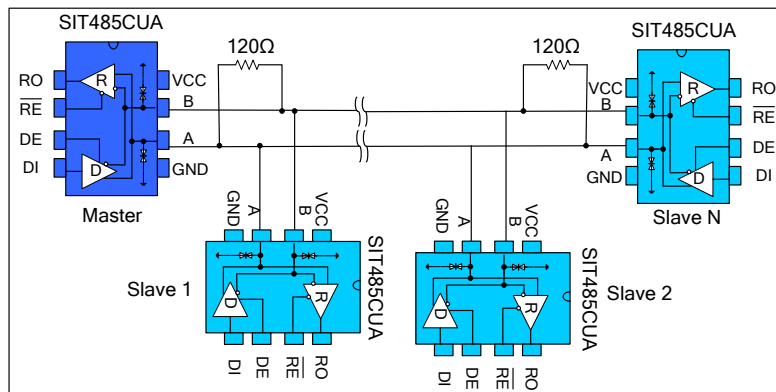


Fig11 Backbone cable type RS485 communications network

**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 that hand in hand means no branch line. This kind of topology has the advantages of small reflection and high rate of success communication.

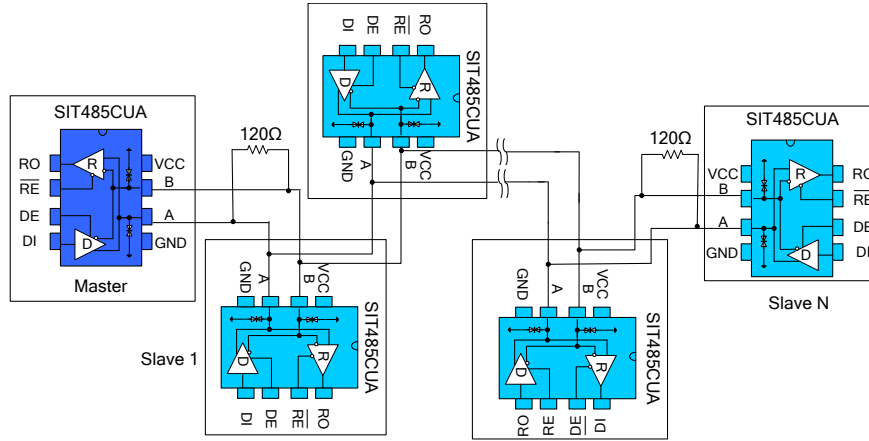


Fig12 Daisy chain topology type RS485 communications network

**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.

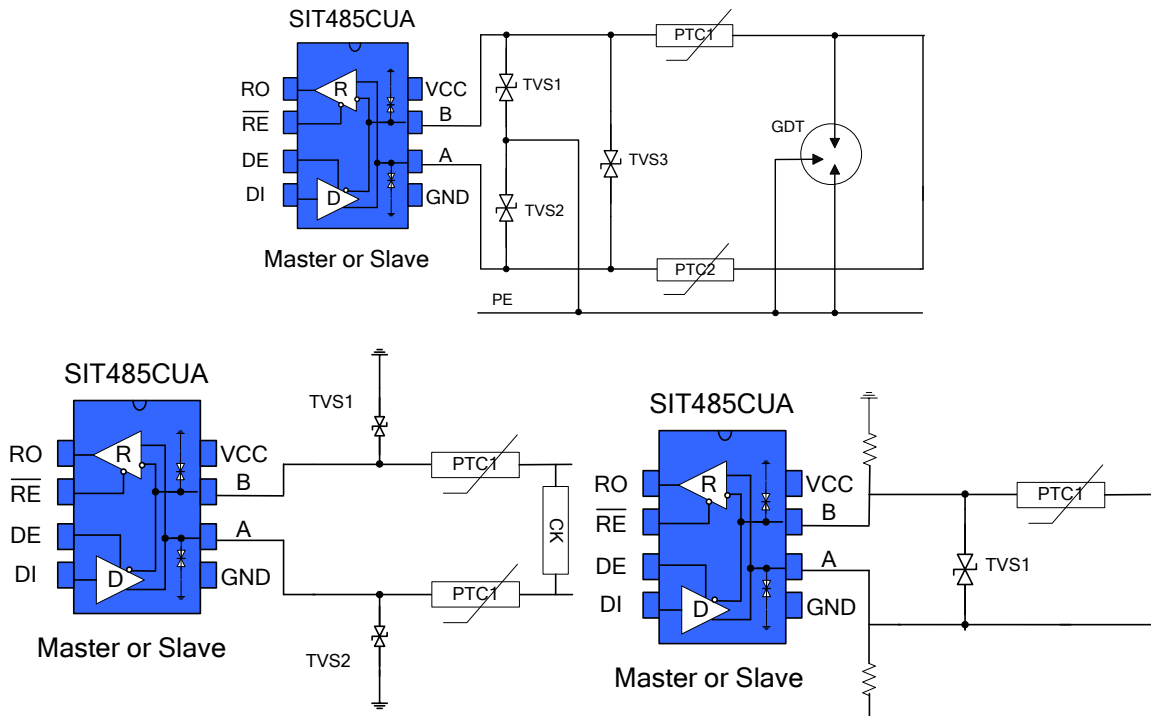


Fig13 RS485 bus ports Protection configuration



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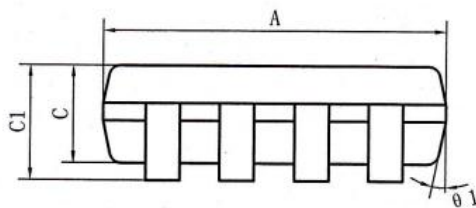
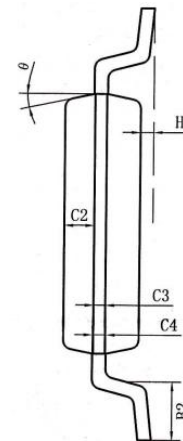
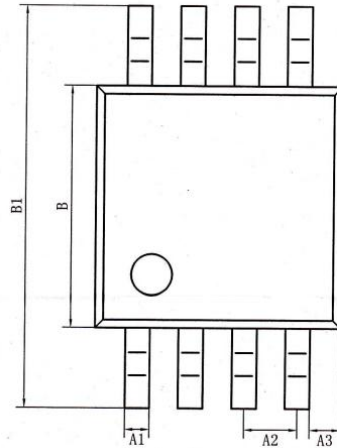


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PACKAGE OUTLINE

Package DEMINSIONS

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	0.328typ		
C3	0.152		
C4	0.15		0.23
H	0.00		0.09
$\theta$	12 typ		



Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
SIT485CUA	-40°C~85°C	MSOP8

Tape and Reel: Pack quantity is 2,500.