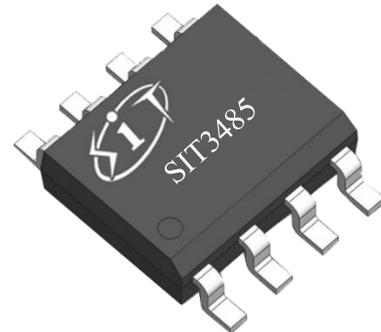




## FEATURES

- 3.3V 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;
- True Fail-Safe Receiver;
- Excellent noise immunity;
- Integrated transient voltage suppression;
- 12Mbps in Electrically Noisy Environments;

## PRODUCT APPEARANCE



Provide green and environmentally friendly lead-free package

## GENERAL DESCRIPTION

SIT3485 is a 3.3V power supply, half-duplex, low power, RS485 Transceiver. SIT3485 fully meets the TIA/EIA-485 standard.

SIT3485 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. SIT3485 has a 1/8-unit-load receiver input impedance, that allows up to 256 transceivers on the bus. The SIT3485 allowing error-free data transmission up to 12Mbps.

SIT3485 operates under the supply voltage of 3.0~3.6V. SIT3485 is a true fail-safe transceiver. SIT3485 also has the function of thermal shutdown protection, current limiting protection, overvoltage protection.

## FUNCTIONAL BLOCK

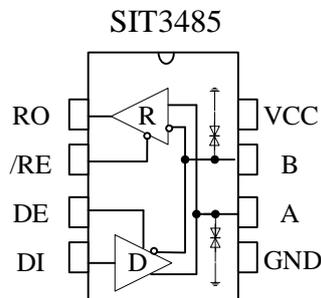


Figure 1 Functional Block

**ABSOLUTE MAXIMUM RATINGS**

PARAMETER	Symbol	Value	Unit
Supply Voltage	VCC	+7	V
CTR Port	/RE, DE, DI	-0.3~+7	V
Driver Output Voltage	A, B	-7~13	V
Receiver Output Voltage	RO	-0.3~+7	V
Temperature Range	T <sub>A</sub>	-40~85	°C
Storage Temperature Range	T <sub>stg</sub>	-60~150	°C
Soldering Temperature (reflow)		300	°C
Continuous Power Dissipation	SOP8	470	mW
	MSOP8/8μMAX/VSSOP8	830	mW
	DIP8	700	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 $A - B \geq 200\text{mV}$ , then RO = high. If $A - B \leq -200\text{mV}$ , 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	UNIT
Differential Driver Output (no load)	$V_{OD1}$			3.3		V
Differential Driver Output	$V_{OD2}$	Figure 2, $R_L=54\ \Omega$	1.5		VCC	V
		Figure 2, $R_L=100\ \Omega$	1.5		VCC	
Change in Magnitude of Differential Output Voltage (NOTE1)	$\Delta V_{OD}$	Figure 2, $R_L=54\ \Omega$			0.2	V
Driver Common-Mode Output Voltage	$V_{OC}$	Figure 2, $R_L=54\ \Omega$			3	V
Change In Magnitude of Common-Mode Voltage (NOTE1)	$\Delta V_{OC}$	Figure 2, $R_L=54\ \Omega$			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			250	mA
Driver Short-Circuit Output Current (short to low)	$I_{OSD2}$	Short to -7V~0V	-250			mA
Thermal-Shutdown Threshold				140		$^{\circ}C$
Thermal-Shutdown Hysteresis				20		$^{\circ}C$

(Unless otherwise noted,  $V_{CC}=3.3V\pm 10\%$ ,  $T_A=-40^{\circ}C\sim 85^{\circ}C$ , typically  $V_{CC}=3.3V$ ,  $T_A=25^{\circ}C$ )

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

**DC ELECTRICAL CHARACTERISTICS OF RECEIVER**

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Input Current (A, B)	$I_{IN2}$	DE = 0 V, VCC=0 or 3.3V, V <sub>IN</sub> = 12 V			125	μA
		DE = 0 V, VCC=0 or 3.3v, V <sub>IN</sub> = -7 V	-100			μA
Positive-going input threshold voltage	V <sub>IT+</sub>	-7V ≤ V <sub>CM</sub> ≤ 12V			+200	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	10	30		mV
RO Output-High Voltage	V <sub>OH</sub>	I <sub>OUT</sub> = -4mA, V <sub>ID</sub> = +200 mV	VCC-1.5			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	μA
Receiver Input Resistance	R <sub>IN</sub>	-7V ≤ V <sub>CM</sub> ≤ 12V	96			kΩ
Receiver Output Short-Circuit	I <sub>OSR</sub>	0 V ≤ V <sub>O</sub> ≤ VCC	±8		±60	mA

(Unless otherwise noted, V<sub>CC</sub>=3.3V±10%, T<sub>A</sub>=-40°C~85°C, typically V<sub>CC</sub>=3.3V, T<sub>A</sub>=25°C)

**SUPPLY CURRENT**

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Current	I <sub>CC1</sub>	/RE=0V, DE = 0 V		520	800	μA
	I <sub>CC2</sub>	/RE=VCC, DE=VCC		540	700	μA
Supply Current in Shutdown Mode	I <sub>SHDN</sub>	/RE=VCC, DE=0V		0.5	10	μA

(Unless otherwise noted, V<sub>CC</sub>=3.3V±10%, T<sub>A</sub>=-40°C~85°C, typically V<sub>CC</sub>=3.3V, T<sub>A</sub>=25°C)



### SWITCHING CHARACTERISTICS OF DRIVER

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Driver Differential Output Delay	$t_{DD}$	$R_L = 60 \Omega$ , $C_L = 100\text{pF}$ (Figure 3 & Figure 4)		10	35	ns
Driver Differential Output Transition Time	$t_{TD}$			12	25	ns
Driver Propagation Delay, Low-to-High Level	$t_{DZH}$	$R_L = 27 \Omega$ (Figure 3 & Figure 4)		8	35	ns
Driver Propagation Delay, High-to-Low Level	$t_{DZL}$			8	35	ns
tPLH - tPHL  Driver Propagation-Delay Skew (Note 2)	$t_{PDS}$			1	8	ns
Driver-Output Enable Time to High Level	$t_{PZH}$	$R_L = 110\Omega$ , (Figure 5 & Figure 6)		20	90	ns
Driver-Output Enable Time to Low Level	$t_{PZL}$			20	90	ns
Driver-Output Disable Time from Low Level	$t_{PLZ}$	$R_L = 110\Omega$ , (Figure 5 & Figure 6)		20	80	ns
Driver-Output Disable Time from High Level	$t_{PHZ}$			20	80	ns
Driver-Output Enable Time from Shutdown to Low Level	$t_{DSH}$	$R_L = 110\Omega$ , (Figure 5 & Figure 6)		500	900	ns
Driver-Output Enable Time from Shutdown to High Level	$t_{DSL}$	$R_L = 110\Omega$ , (Figure 5 & Figure 6)		500	900	ns



## SWITCHING CHARACTERISTICS OF RECEIVER

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Receiver Propagation Delay (low to high)	$t_{RPLH}$	$C_L=15pF$ (Figure 7 & Figure 8)		80	150	ns
Receiver Propagation Delay (high to low)	$t_{RPHL}$	$C_L=15pF$ (Figure 7 & Figure 8)		80	150	ns
$ t_{RPLH} - t_{RPHL} $	$t_{RPDS}$	$C_L=15pF$ (Figure 7 & Figure 8)		7	10	ns
Receiver Enable to Output Low	$t_{RPZL}$	$C_L=15pF$ (Figure 7 & Figure 8)		20	50	ns
Receiver Enable to Output High	$t_{RPZH}$	$C_L=15pF$ (Figure 7 & Figure 8)		20	50	ns
Receiver Disable Time from Low	$t_{PRLZ}$	$C_L=15pF$ (Figure 7 & Figure 8)		20	45	ns
Receiver Disable Time from High	$t_{PRHZ}$	$C_L=15pF$ (Figure 7 & Figure 8)		20	45	ns
Receiver Enable from shutdown to Output High	$t_{RPSH}$	$C_L=15pF$ (Figure 7 & Figure 8)		200	1400	ns
Receiver Enable from Shutdown to Output Low	$t_{RPSL}$	$C_L=15pF$ (Figure 7 & Figure 8)		200	1400	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 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.



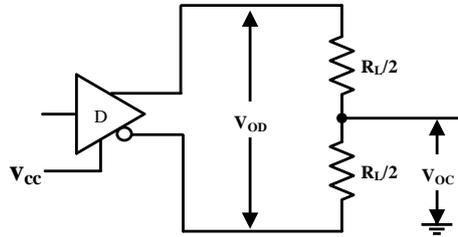
**FUNCTION TABLES**

**TRANSMITTING**

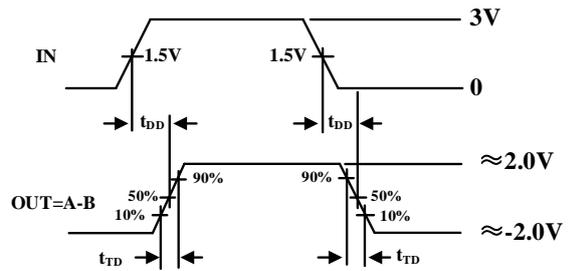
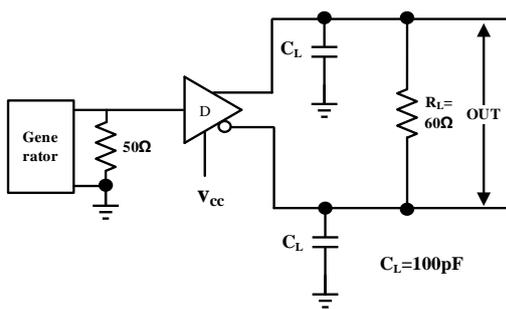
**RECEIVING**

TRANSMITTING					RECEIVING			
CTR		INPUTS	OUTPUTS		CTR		INPUTS	OUTPUTS
/RE	DE	DI	A	B	/RE	DE	A-B	RO
X	1	1	H	L	0	X	$\geq 200\text{mV}$	H
X	1	0	L	H	0	X	$\leq -200\text{mV}$	L
0	0	X	Z	Z	0	X	Open/shorted	H
1	0	X	Z (shutdown)		1	X	X	Z
X: Don't care; Z: high impedance.					X: Don't care; Z: high impedance.			

**TEST CIRCUIT**

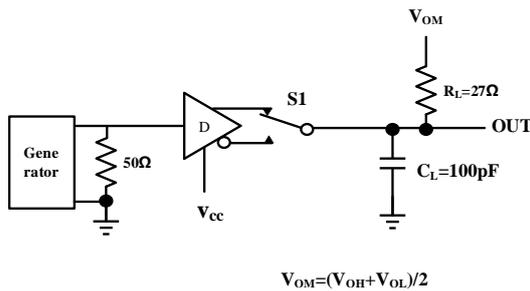


**Figure 2 Driver DC Test Load**

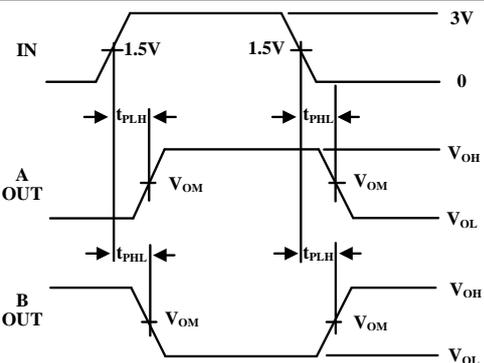


CL=100pF (CL includes probe and stray capacitance, Same as below)

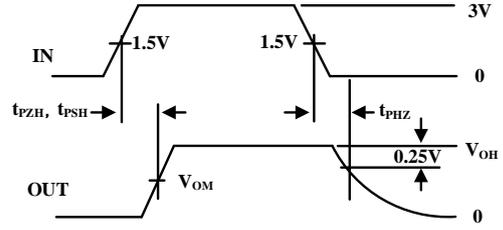
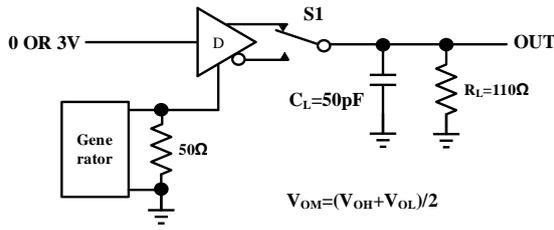
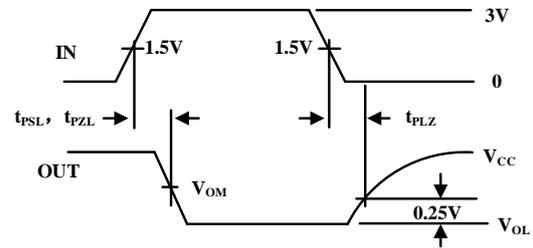
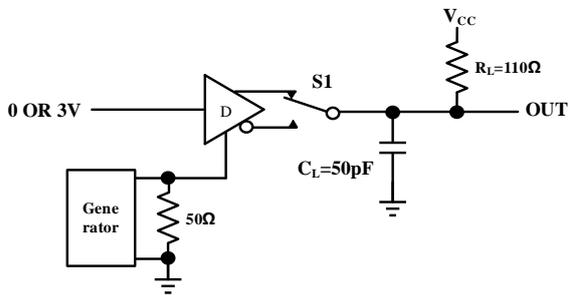
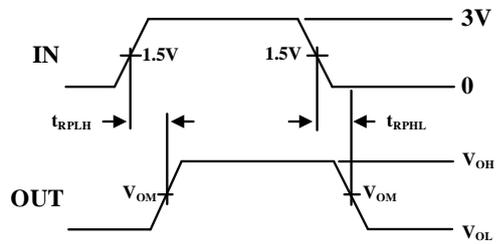
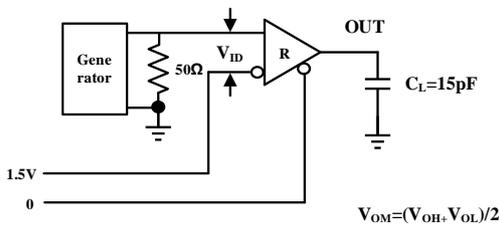
**Figure 3 Driver Differential Output Delay and Transition Times**

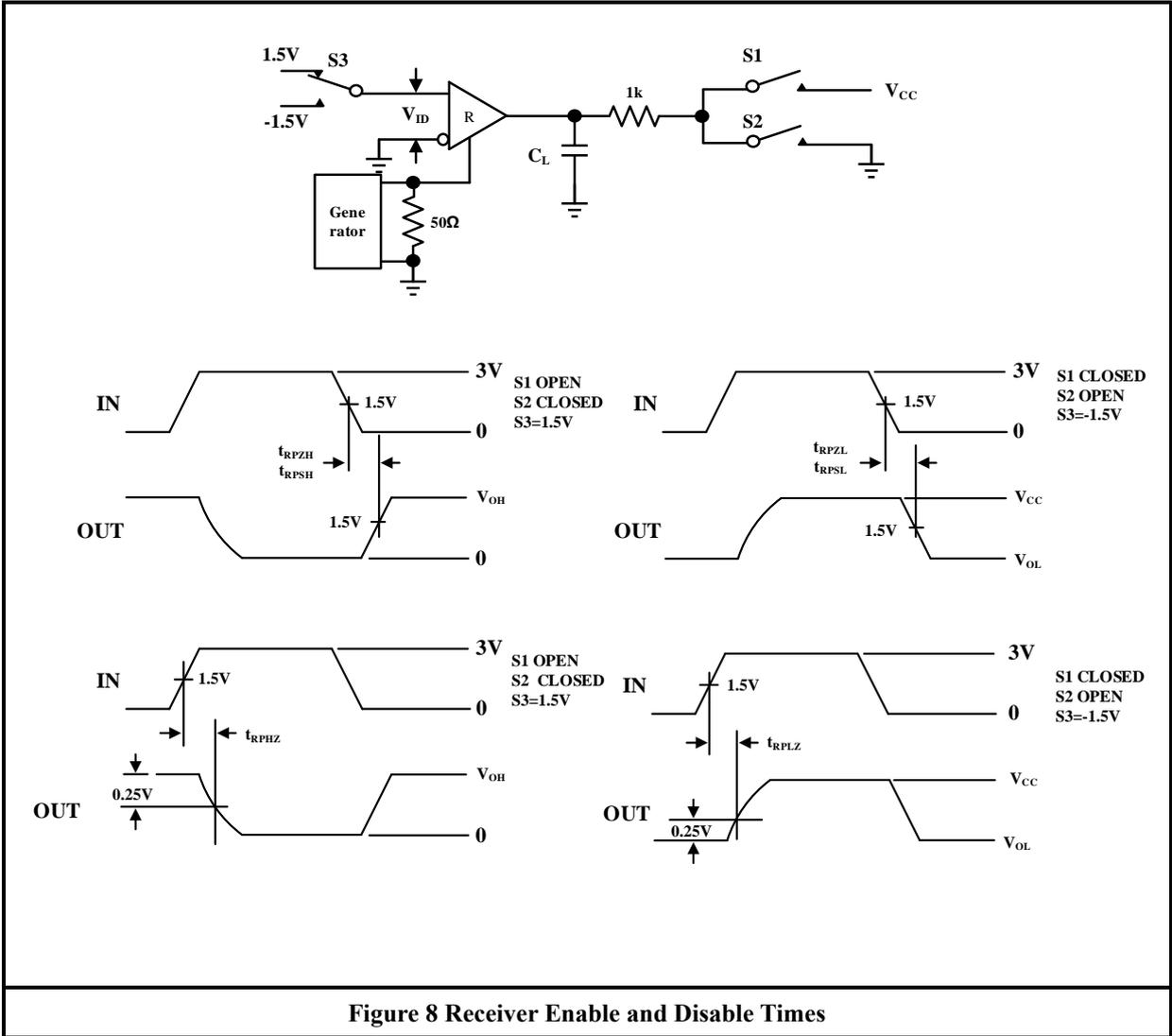


$$V_{OM} = (V_{OH} + V_{OL}) / 2$$



**Figure 4 Driver Propagation Times**


**Figure 5 Driver Enable and Disable Times**

**Figure 6 Driver Enable and Disable Times**

**Figure 7 Receiver Propagation Delay**


**Figure 8 Receiver Enable and Disable Times**

**ADDITIONAL DESCRIPTION**

**1 Description**

SIT3485 including a driver and a receiver, half-duplex high-speed transceivers for RS-485/RS-422 communications. SIT3485 features fail-safe, overvoltage protection, overcurrent protection, thermal protection. The SIT3485 allows error-free data transmission up to 12Mbps.

**2 Connecting 256 Transceivers on one Bus**

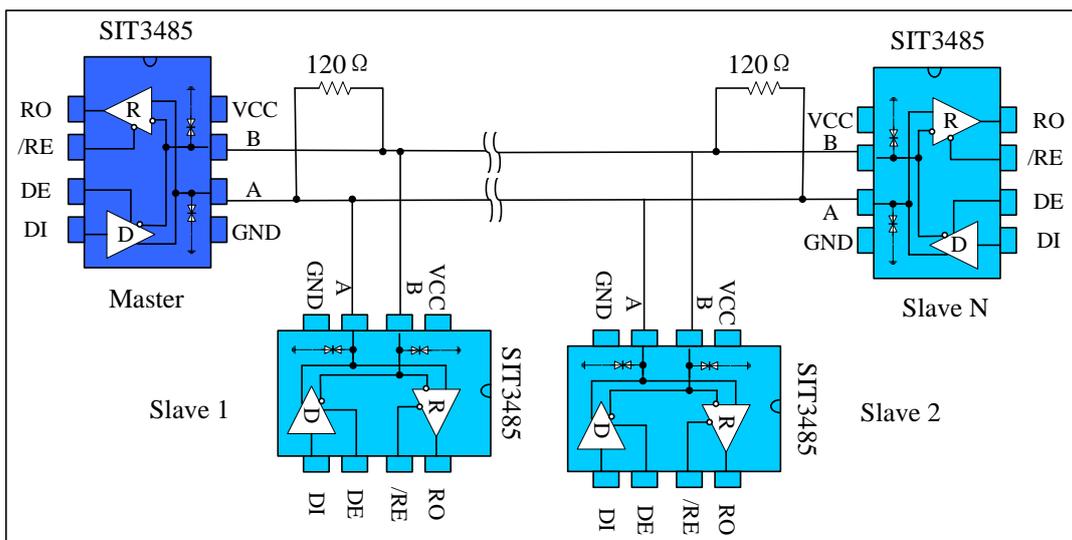
The standard RS-485 receiver input impedance is 12kΩ (1 unit load), the standard driver can drive up to 32 unit loads. Receiver SIT3485 transceiver has a 1/8 unit load receiver input impedance (96kΩ), allowing up to 256 transceivers to be connected in parallel on one bus. These devices can be any combination, 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**

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 140°C, driver output is forced into a high impedance state by the thermal shutdown circuit.

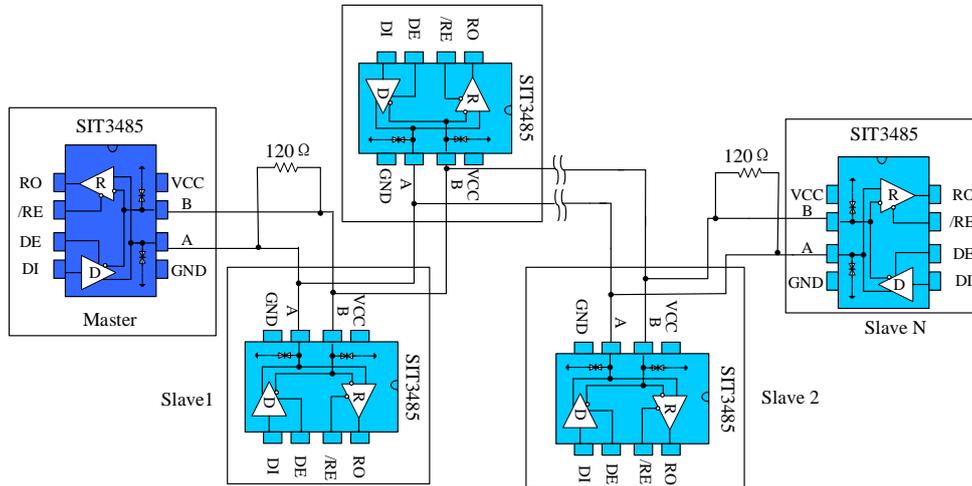
**4 Typical Application**

**4.1 Backbone cable type:** SIT3485 transceiver is designed for multi-point bi-directional data communication bus transmission lines. Figure 9 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.



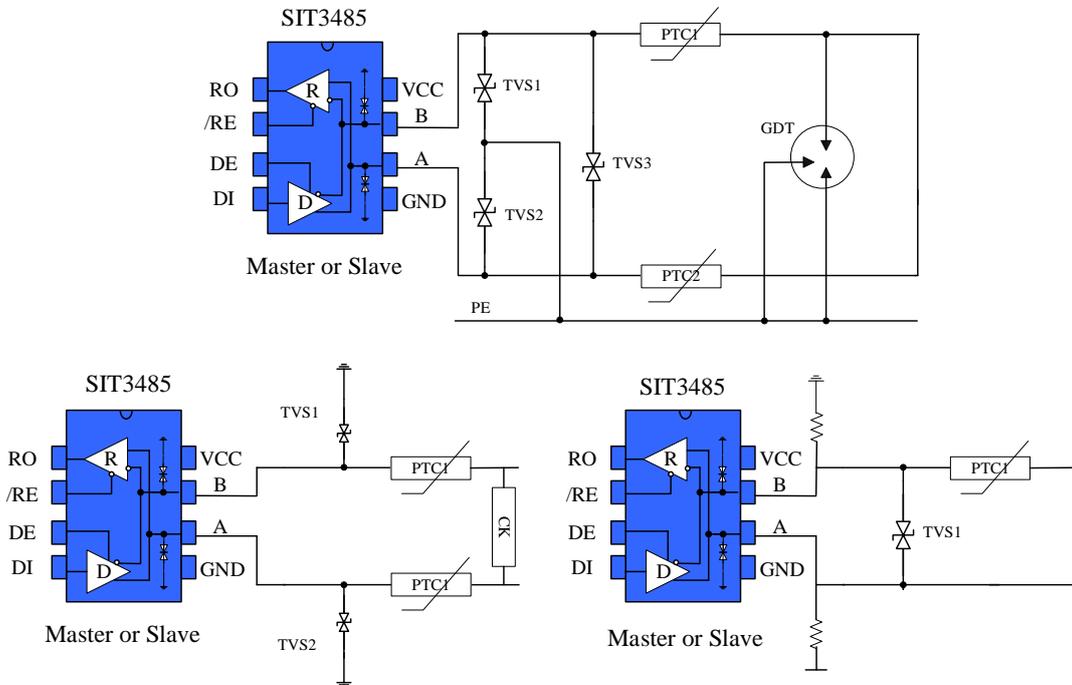
**Figure 9 Backbone cable type RS485 communications network**

**4.2 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 10. 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.



**Figure 10 Daisy chain topology type RS485 communications network**

**4.3 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 11 demonstrates three general kinds of RS485 bus port protection configuration.



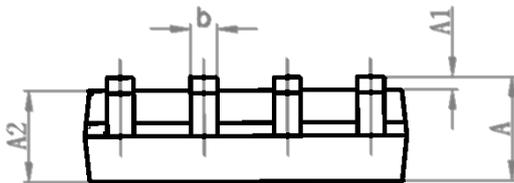
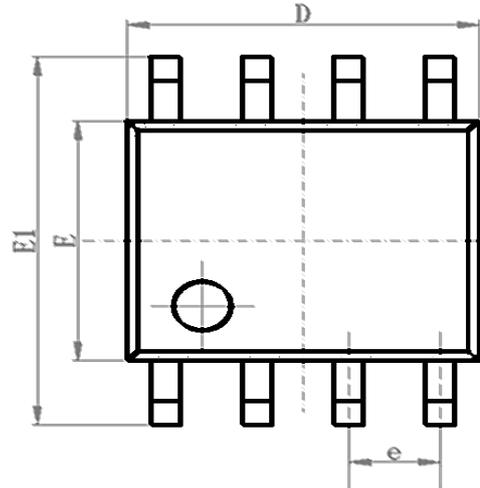
**Figure 11 RS485 bus ports Protection configuration**



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

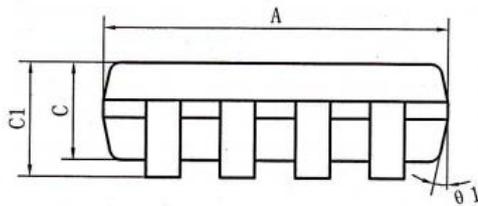
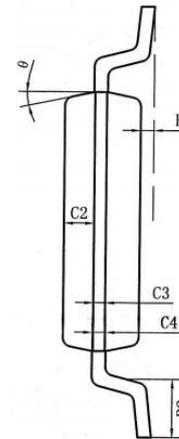
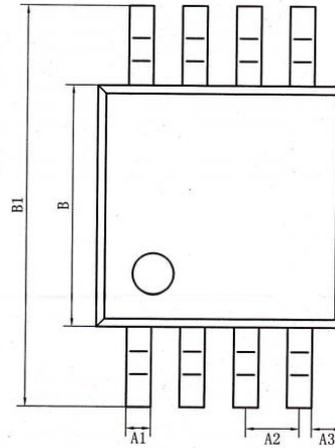




**MSOP8/8 $\mu$ MAX/VSSOP8 DIMENSIONS**

**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
$\theta$	12°TYP		

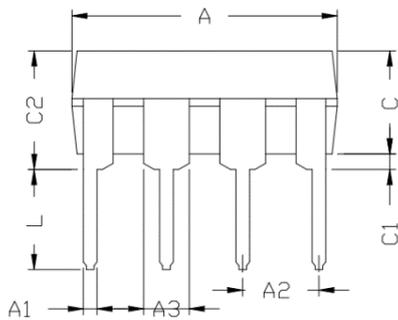
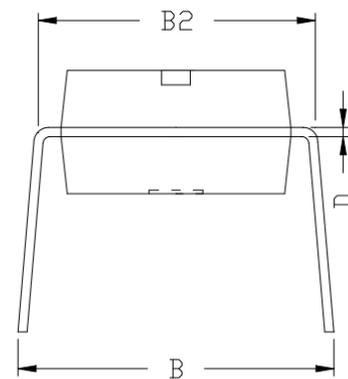
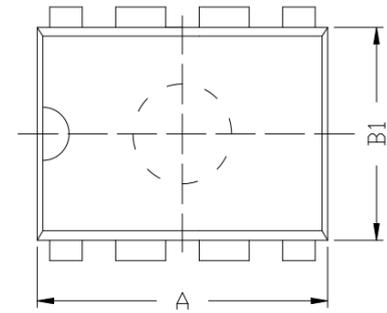




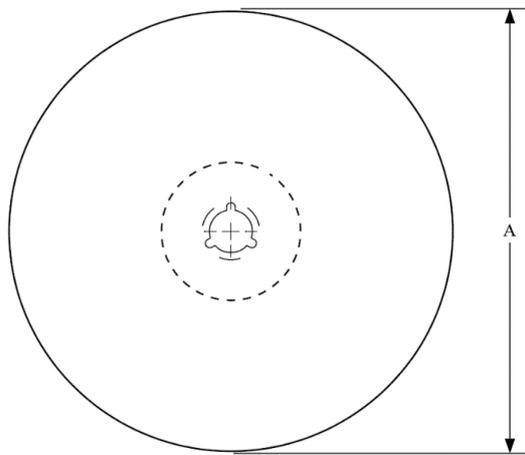
### DIP8 DIMENSIONS

PACKAGE SIZE

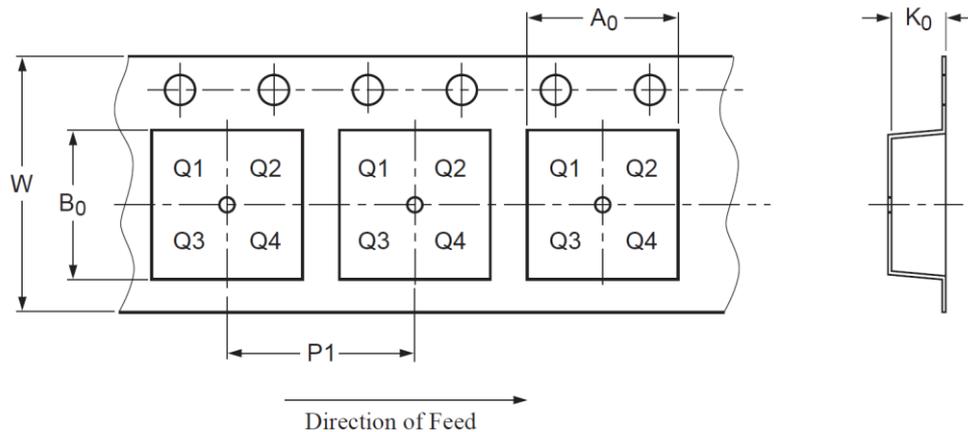
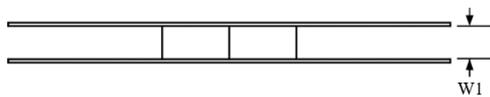
SYMBOL	MIN./mm	TYP./mm	MAX./mm
A	9.00	9.20	9.40
A1	0.33	0.45	0.51
A2	2.54TYP		
A3	1.525TYP		
B	8.40	8.70	9.10
B1	6.20	6.40	6.60
B2	7.32	7.62	7.92
C	3.20	3.40	3.60
C1	0.50	0.60	0.80
C2	3.71	4.00	4.31
D	0.20	0.28	0.36
L	3.00	3.30	3.60



## 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



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 <sup>+0.30</sup> <sub>-0.10</sub>



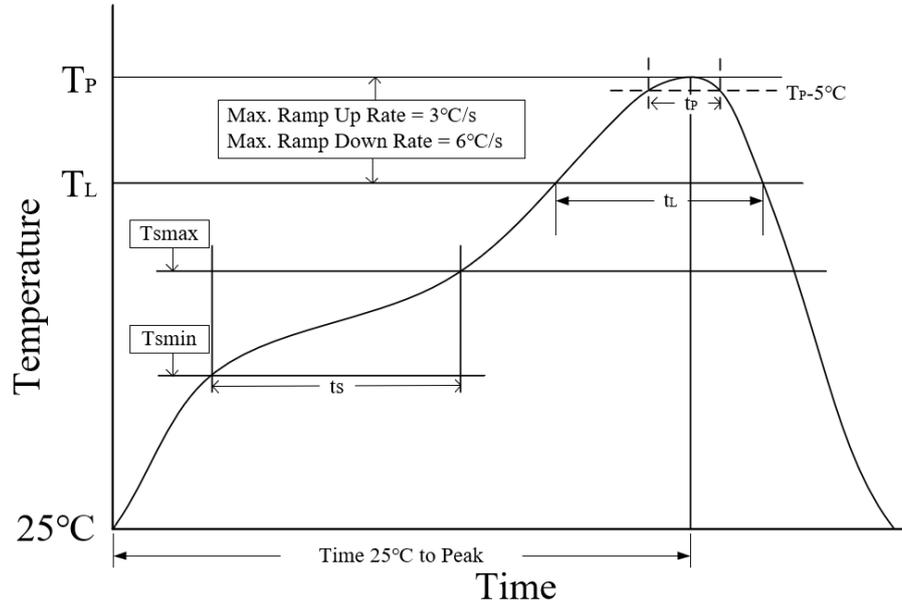
## ORDERING INFORMATION

TYPE NUMBER	PACKAGE	PACKING
SIT3485ESA	SOP8	Tape and reel
SIT3485EPA	DIP8	Tube/Box-packed
SIT3485EUA	MSOP8/VSSOP8/8 $\mu$ MAX	Tape and reel

SOP8 and MSOP8 packages are 2500 pieces/disc in braided packaging. DIP8 is 50 pieces/tube in tubed packaging and 2000 pieces/box in box-packed packaging.



**REFLOW SOLDERING**



Parameter	Lead-free soldering conditions
Ave ramp up rate ( $T_L$ to $T_P$ )	3 °C/second max
Preheat time $t_s$ ( $T_{smin}=150^\circ C$ to $T_{smax}=200^\circ C$ )	60-120 seconds
Melting time $t_L$ ( $T_L=217^\circ C$ )	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	Datasheet status	Revision date
V1.0~V1.5	Product datasheet.	April 2021
V1.6	Updated SOP8 dimensions; Added “important statement”	January 2022
V1.7	Updated V <sub>OD2</sub> ; Added tape and reel information; Updated ordering information; Added reflow soldering; Added revision history; Adjusted format.	May 2024