

**FEATURES**

- 3.0V~5.5V supply, full-duplex
- 1/8 unit load, allow up to 256 transceivers on the bus
- Driver short-circuit output protection
- Strong anti-noise ability
- Integrated transient voltage suppression function
- The data transmission rate up to 12Mbps in electric noise environment
- ESD protection for RS-485 I/O Pins  $\pm 15\text{kV}$ , HBM

**PRODUCT APPEARANCE**

Provide green and environmentally friendly lead-free package

**DESCRIPTION**

SIT3491E is a 3.0V~5.5V powered, full-duplex, low power dissipation RS-485 transceiver fully meeting the requirements of RS-485 & RS-422 standard.

SIT3491E contains one driver and one receiver, both can transmit signals independently. The SIT3491E has a 1/8-unit-load. It allows up to 256 transceivers on the bus and error-free data transmission up to 12Mbps.

SIT3491E has a working voltage range of 3.0V~5.5V, with the functions of fail-safe, current-limiting protection, over-voltage protection, etc.

SIT3491E has excellent ESD release capability, and HBM reaches  $\pm 15\text{kV}$ .

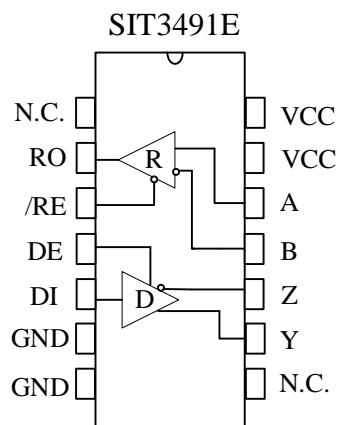
**PIN CONFIGURATION**

Fig1 SIT3491E Pin Configuration

**PIN DESCRIPTION**

PIN	SYMBOL	DESCRIPTION
1	NC	No Connection. Not internally connected.
2	RO	Receiver Output. When /RE is low, If $A-B \geq +200\text{mV}$ , RO will be high; If $A-B \leq -200\text{mV}$ , RO will be low
3	/RE	Receiver Output Enable. RO is enabled when /RE is low; RO is high impedance when /RE is high. If /RE is high and DE is low, the device will enter a low-power shutdown mode.
4	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.
5	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.
6	GND	Ground.
7	GND	Ground.
8	NC	No Connection. Not internally connected.
9	Y	Non-inverting Driver Output.
10	Z	Inverting Driver Output.
11	B	Inverting Receiver Input.
12	A	Non-inverting Receiver Input.
13	VCC	Positive Supply: $3.0\text{V} \leq \text{VCC} \leq 5.5\text{V}$ or No Connection.
14	VCC	Positive Supply: $3.0\text{V} \leq \text{VCC} \leq 5.5\text{V}$ .

**LIMITING VALUES**

PARAMETER	SYMBOL	VALUE	UNIT
Supply voltage	VCC	+7	V
Driver Input Voltage	DI	$-0.3 \sim \text{VCC} + 0.3$	V
Receiver Input Voltage	A, B	-8~13	V
Receiver Output Voltage	RO	$-0.3 \sim \text{VCC} + 0.3$	V



<b>PARAMETER</b>	<b>SYMBOL</b>	<b>VALUE</b>	<b>UNIT</b>
Operating Temperature Ranges	$T_A$	-40~125	°C
Storage Temperature Range	$T_{stg}$	-60~150	°C
Lead Temperature		300	°C
Continuous Power Dissipation	SOP14	600	mW
	DIP14	700	mW

The maximum limit parameters means 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 Driver Output (No load)	$V_{OD1}$		3		5.5	V
Differential Driver Output	$V_{OD2}$	Fig 2, $RL=27\Omega$	1.5		VCC	V
		Fig 2, $RL=50\Omega$	1.5		VCC	
Change in Magnitude of Driver Differential Output Voltage (NOTE1)	$\Delta V_{OD}$	Fig 2, $RL=27\Omega$			0.2	V
Driver Common-Mode Output Voltage	$V_{OC}$	Fig 2, $RL=27\Omega$			3	V
Change in Magnitude of Common-Mode Output Voltage (NOTE1)	$\Delta V_{OC}$	Fig 2, $RL=27\Omega$			0.2	V
Input High Voltage	$V_{IH}$	DI	2.0			V
Input Low Voltage	$V_{IL}$	DI			0.8	V
Logic Input Current	$I_{IN1}$	DI	-2		2	$\mu A$
Output short-circuit current, short-circuit to high	$I_{OSD1}$	short-circuit to 0V~12V	35		250	mA
Output short-circuit current, short-circuit to low	$I_{OSD2}$	short-circuit to -7V~0V	-250		-35	mA

(Unless otherwise noted,  $V_{CC}=3.0V\sim 5.5V$ ,  $Temp=T_{MIN}\sim T_{MAX}$ , Typical values are at  $Temp=25^{\circ}C$ ).

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

**RECEIVER DC ELECTRICAL CHARACTERISTICS**

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Input current (A, B)	$I_{IN2}$	$V_{CC}=0$ or 3.3V $V_{IN}=12$ V			125	$\mu A$
		$V_{CC}=0$ or 3.3V $V_{IN}=-7$ V	-100			$\mu A$



PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Positive input threshold voltage	$V_{IT+}$	$-7V \leq V_{CM} \leq 12V$			+200	mV
Reverse input threshold voltage	$V_{IT-}$	$-7V \leq V_{CM} \leq 12V$	-200			mV
Input hysteresis voltage	$V_{hys}$	$-7V \leq V_{CM} \leq 12V$	10	30		mV
Receiver Output High Voltage	$V_{OH}$	$I_{OUT} = -4mA$ , $V_{ID} = +200 mV$	$V_{CC} - 1.5$			V
Receiver Output Low Voltage	$V_{OL}$	$I_{OUT} = +4mA$ , $V_{ID} = -200 mV$			0.4	V
Three-State Output Current at Receiver	$I_{OZR}$	$0.4V < V_O < 2.4V$			$\pm 1$	$\mu A$
Receiver Input Resistance	$R_{IN}$	$-7V \leq V_{CM} \leq 12V$	96			k $\Omega$
Receiver Short-Circuit Output Current	$I_{OSR}$	$0 V \leq V_O \leq V_{CC}$	$\pm 7$		$\pm 95$	mA

(Unless otherwise noted,  $V_{CC} = 3.0V \sim 5.5V$ ,  $Temp = T_{MIN} \sim T_{MAX}$ , Typical values are at  $Temp = 25^{\circ}C$ ).

## SUPPLY CURRENT

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Supply Current	$I_{CC1}$	/RE=0V, DE=0V		220	400	$\mu A$
	$I_{CC2}$	/RE=VCC, DE=VCC		240	400	$\mu A$
Shutdown Current	$I_{SHDN}$	/RE=VCC, DE=0V		0.5	10	$\mu A$

## ESD PROTECTION

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
A, B, Y, Z		HBM		$\pm 15$		kV
Other ports		HBM		$\pm 6$		kV

**DRIVER SWITCHING CHARACTERISTICS**

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Driver Propagation Delay, Low-to-High Level	$t_{PLH}$	$R_L=54\Omega$ , $C_L=100pF$ <a href="#">Fig 3</a> & <a href="#">Fig 4</a>		15	35	ns
Driver Propagation Delay, High-to-Low Level	$t_{PHL}$			15	35	ns
$ t_{DPLH} - t_{DPHL} $	$t_{SKEW1}$			7	10	ns
Rising time /Falling time	$t_{DR}, t_{DF}$			10	25	ns
Driver Enable to Output High	$t_{PZH}$	$R_L=110\Omega$ , <a href="#">Fig 5</a> & <a href="#">Fig 6</a>		20	90	ns
Driver Enable to Output low	$t_{PZL}$			20	90	ns
Driver Disable Time from Low	$t_{PLZ}$			20	80	ns
Driver Disable Time from high	$t_{PHZ}$			20	80	ns
In Shutdown mode, Enable to Output High	$t_{PSH}$			500	900	ns
In Shutdown mode, Enable to Output low	$t_{PSL}$			500	900	ns

**RECEIVER SWITCHING CHARACTERISTICS**

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Receiver Propagation Delay, Low-to-High Level	$t_{RPLH}$	<a href="#">Fig 7</a> & <a href="#">Fig 8</a> , $V_{ID} \geq 2.0V$ , Rising and falling edge time $V_{ID} \leq 15ns$	20	60	90	ns
Receiver Propagation Delay, High-to-Low Level	$t_{RPHL}$		20	60	90	ns
$ t_{RPLH} - t_{RPHL} $	$t_{SKEW2}$		7	10	ns	
Receiver Enable to Output Low	$t_{RPZL}$	$C_L=15pF$ <a href="#">Fig 7</a> & <a href="#">Fig 8</a>		20	50	ns
Receiver Enable to Output high	$t_{RPZH}$	$C_L=15pF$ <a href="#">Fig 7</a> & <a href="#">Fig 8</a>		20	50	ns



PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Receiver Disable Time from Low	$t_{PRLZ}$	$C_L=15pF$ <a href="#">Fig 7</a> & <a href="#">Fig 8</a>		20	45	ns
Receiver Disable Time from high	$t_{PRHZ}$	$C_L=15pF$ <a href="#">Fig 7</a> & <a href="#">Fig 8</a>		20	45	ns
In Shutdown mode, Enable to Output High	$t_{RPSH}$	$C_L=15pF$ <a href="#">Fig 7</a> & <a href="#">Fig 8</a>		200	1400	ns
In Shutdown mode, Enable to Output low	$t_{RPSL}$	$C_L=15pF$ <a href="#">Fig 7</a> & <a href="#">Fig 8</a>		200	1400	ns
Time to Shutdown	$t_{SHDN}$	NOTE2	80		300	ns

NOTE2: If the enable inputs are RE=high and DE=low for less than 50ns, 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**

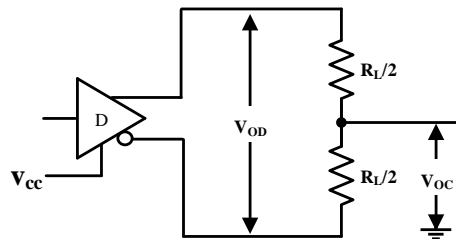
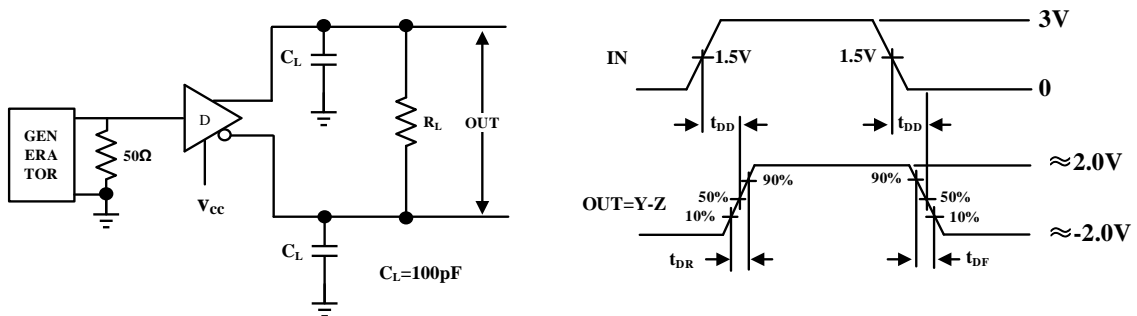
CONTROL		INPUT	OUTPUT	
/RE	DE	DI	Y	Z
X	1	1	H	L
X	1	0	L	H
0	0	X	Z	Z
1	0	X	Z(shutdown)	

X=irrelevant; Z=high impedance

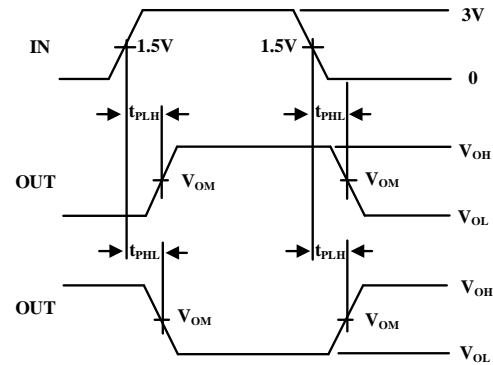
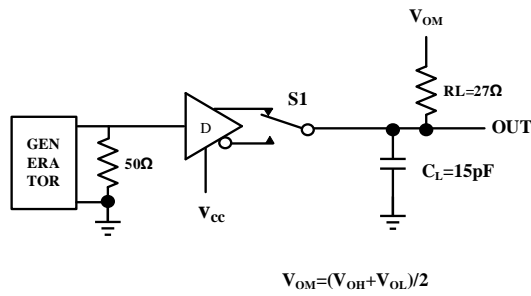
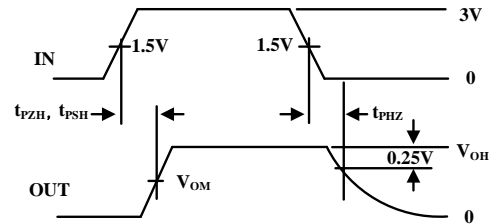
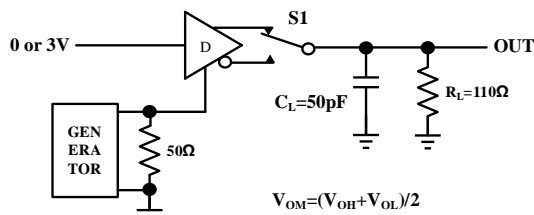
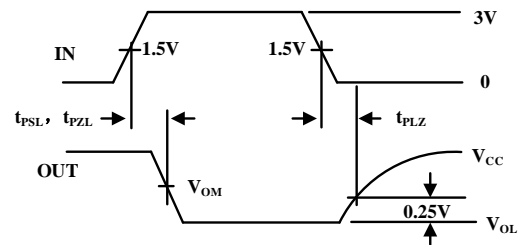
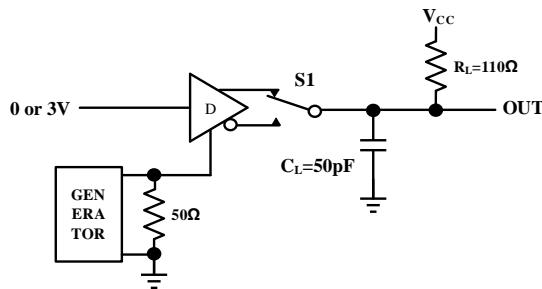
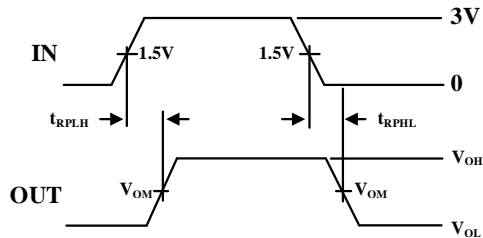
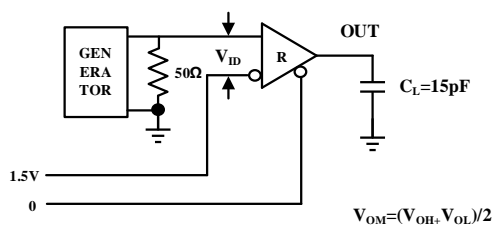
**Receiver Function**

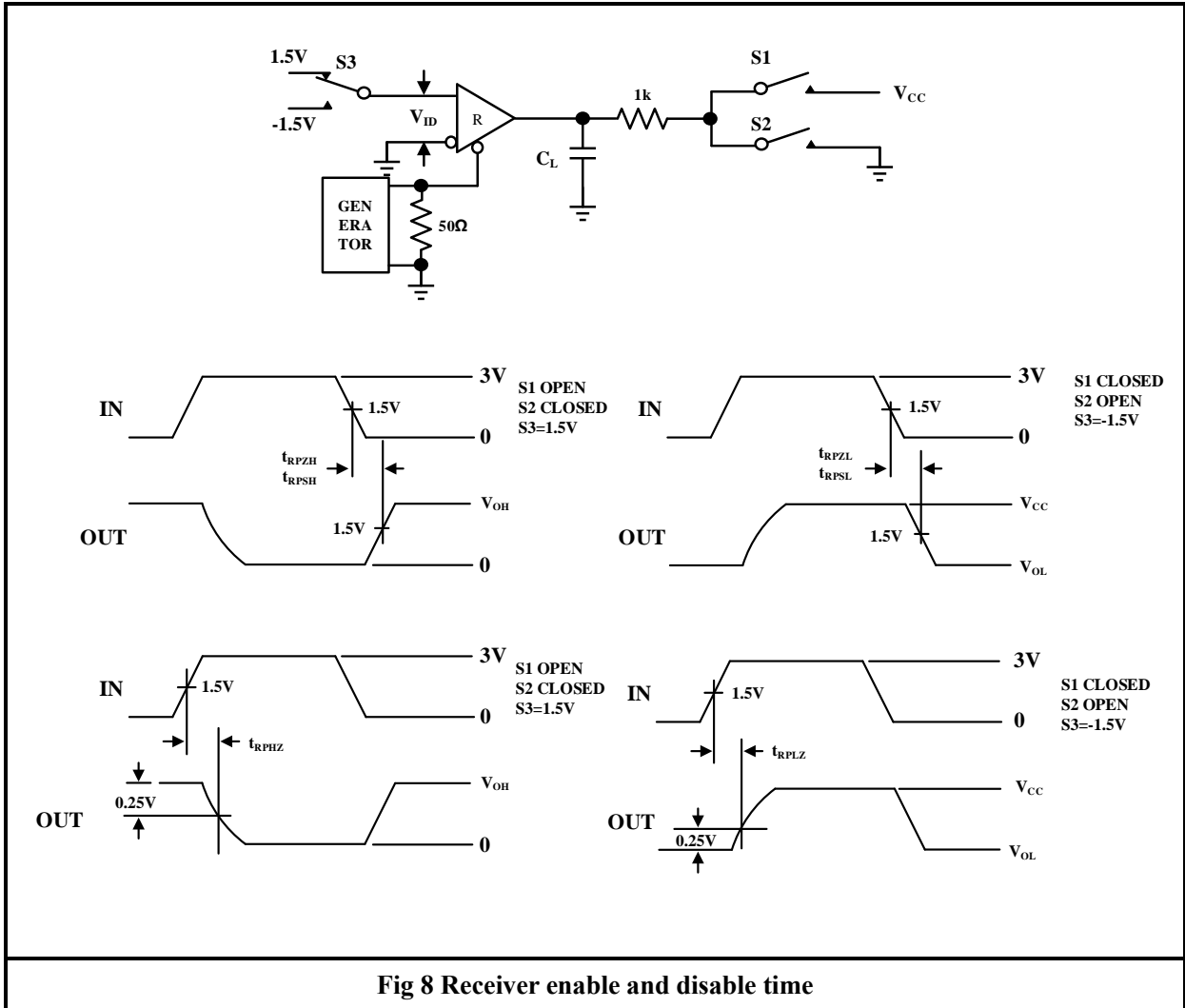
CONTROL		INPUT	OUTPUT
/RE	DE	A-B	RO
0	X	$\geq +200\text{mV}$	H
0	X	$\leq -200\text{mV}$	L
0	X	Open/Short Circuit	H
1	X	X	Z

X=irrelevant; Z=high impedance

**TEST CIRCUIT**

**Fig 2 Driver DC test load**

**Fig 3 Differential delay and transit time of driver**




**Fig 4 Drive propagation delay**

**Fig 5 Drive enable and disable time**

**Fig 6 Drive enable and disable time**

**Fig 7 Receiver propagation delay test circuit**


**Fig 8 Receiver enable and disable time**



## ADDITIONAL DESCRIPTION

### 1 Sketch

SIT3491E is a full-duplex high-speed transceiver for RS-485/RS-422 communication, which includes a driver and a receiver. It has fail-safe, over-voltage protection and over-current protection. SIT3491E realizes error-free data transmission up to 12Mbps.

### 2 Low-Power Shutdown Mode

A low-power shutdown mode is initiated by bringing both RE high and DE low. The devices will not shut down unless both the driver and receiver are disabled (high impedance). In shutdown, the devices typically draw only 0.5 $\mu$ A of supply current.

### 3 Allowing up to 256 transceivers on the bus

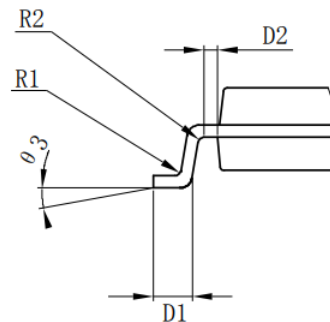
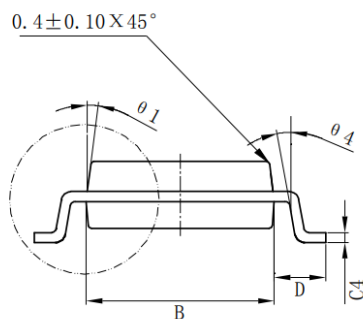
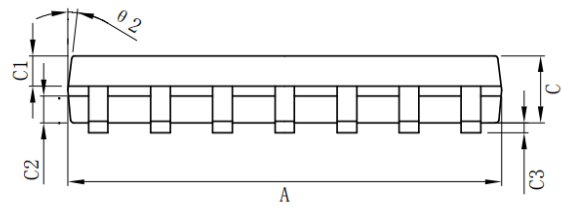
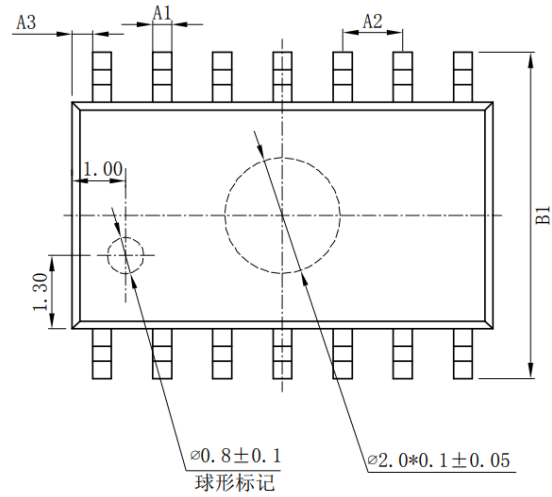
The input impedance of the standard RS485 receiver is 12k $\Omega$  (1 unit load), and the standard driver can drive up to 32 unit loads. The receiver of SIT3491E transceiver has 1/8 unit load input impedance (96k $\Omega$ ), which allows up to 256 transceivers to be connected on the same communication bus in parallel. These devices can be combined arbitrarily or with other RS485 transceivers. Any combination of these devices and/or other RS-485 transceivers with a total of 32 unit loads or less can be connected to the line.

### 4 Driver output protection

By means of over-current and over-voltage protection mechanism, it can prevent excessive output current and power dissipation caused by faults or by bus contention, and fast short-circuit protection can be provided in the whole common mode voltage range (refer to typical working characteristics).

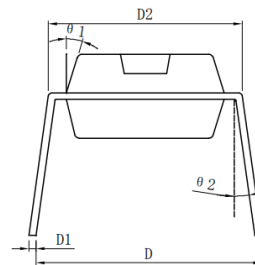
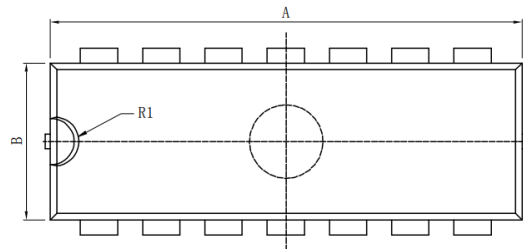
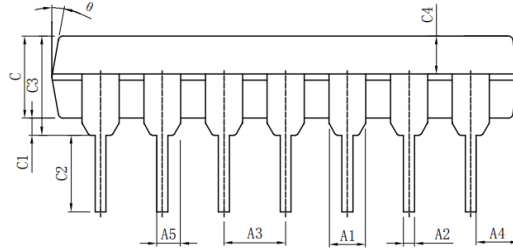
**SOP14 DIMENSIONS**
**PACKAGE SIZE**

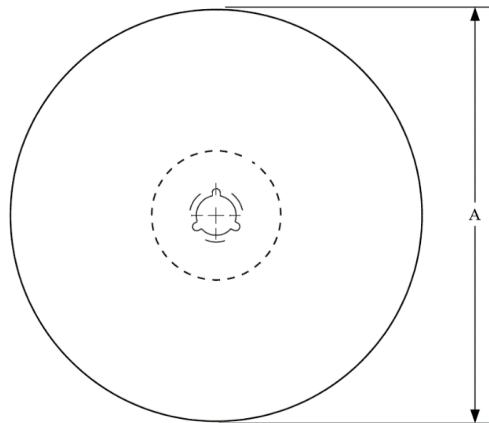
SYMBOL	MIN/mm	MAX/mm
A	8.55	8.75
A1	0.356	0.456
A2	1.27TYP	
A3	0.312TYP	
B	3.80	4.00
B1	5.80	6.20
C	1.40	1.60
C1	0.60	0.70
C2	0.55	0.65
C3	0.05	0.25
C4	0.193	0.213
D	0.95	1.15
D1	0.40	0.70
D2	0.20TYP	
R1	0.20TYP	
R2	0.20TYP	
θ1	8°~12°TYP4	
θ2	8°~12°TYP4	
θ3	0°~8°	
θ4	4°~12°	



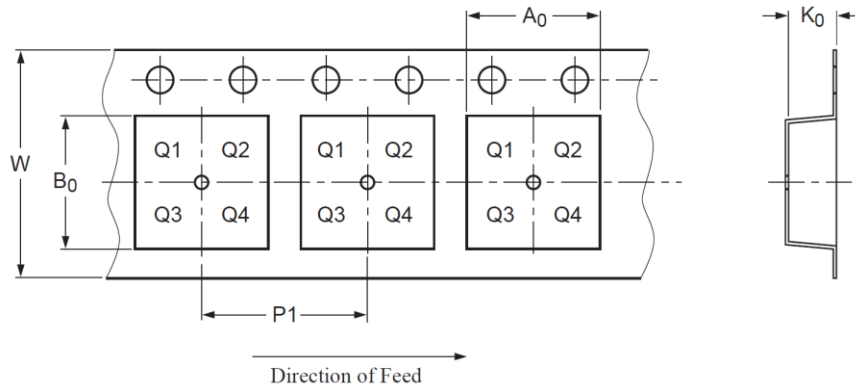
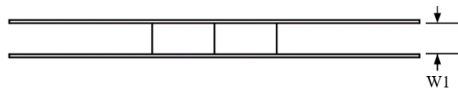
**DIP14 DIMENSIONS****PACKAGE SIZE**

SYMBOL	MIN/mm	MAX/mm
A	19.00	19.20
A1	1.524TYP	
A2	0.41	0.51
A3	2.54TYP	
A4	1.70TYP	
A5	0.99TYP	
B	6.30	6.50
C	3.00	3.20
C1	0.51TYP	
C2	3.00	3.60
C3	3.85	4.45
C4	1.40	1.50
D	8.20	8.80
D1	0.20	0.35
D2	7.74	8.00
$\theta$	10°TYP4	
$\theta 1$	17°TYP4	
$\theta 2$	6°TYP	
R1	1.27TYP	



**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



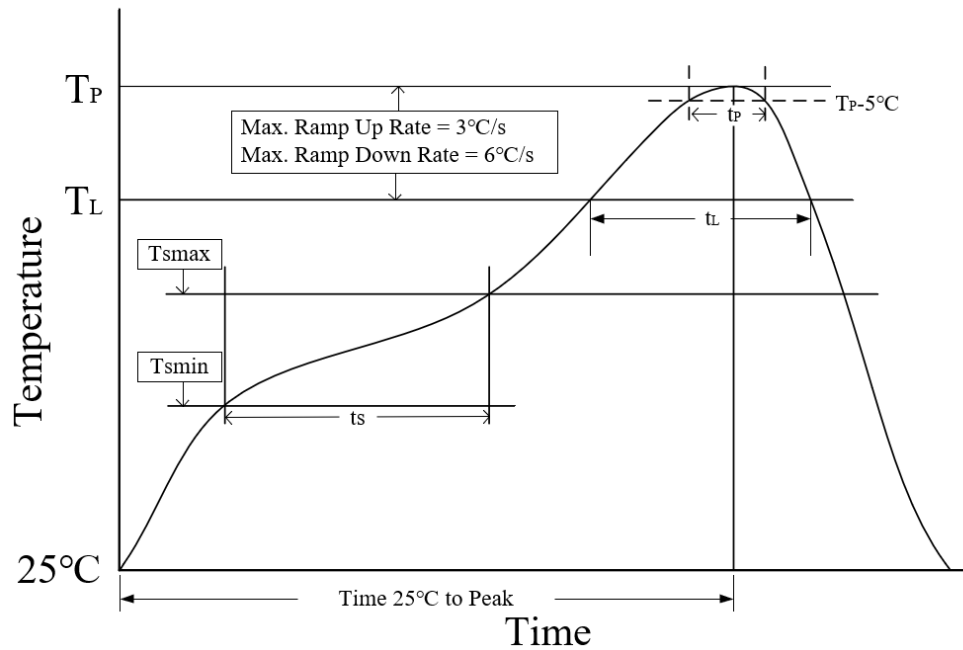
PIN1 is in quadrant 1

Package Type	Reel Diameter A (mm)	Tape width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)
SOP14	330	12.5±1	6.45±0.10	9.20±0.10	2.10±0.10	8.00±0.1	16.00 <sup>+0.30</sup> <sub>-0.10</sub>

**ORDERING INFORMATION**

TYPE NUMBER	PACKAGE	PACKING
SIT3491EESD	SOP14	Tape and reel
SIT3491EEPD	DIP14	Tube

Tapered package is 2500 pieces/disc.

**REFLOW SOLDERING**


Parameter	Lead-free soldering conditions
Ave ramp up rate ( $T_L$ to $T_P$ )	3°C/second max
Preheat time $t_s$ ( $T_{smin}=150^\circ\text{C}$ to $T_{smax}=200^\circ\text{C}$ )	60-120 seconds
Melting time $t_L$ ( $T_L=217^\circ\text{C}$ )	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 2019
V1.1	Adjusted format.	November 2019
V1.2	Deleted “fail-safe” related information; Updated VIT+ maximum; Updated the “Receive Function Table”; Added “Low power off mode” description.	April 2020
V1.3	Added “RS-422 transceiver” description.	July 2020
V1.4	Updated V <sub>OD2</sub> minimum under RL=50Ω test conditions; Updated test circuit; Added tape and reel information; Added reflow information; Added important statement; Added revision history.	February 2023