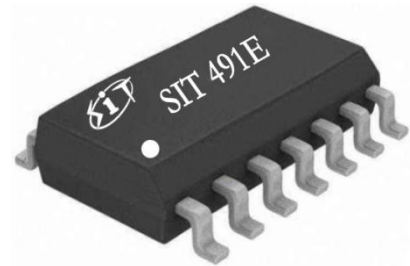


**FEATURES**

- 4.5V~5.5V Supply, Full-Duplex
- Fail-Safe
- 1/8 Unit Load, Allow Up to 256 Transceivers on the Bus
- Driver Short-Circuit Output Protection
- Receiver Open Circuit Failure 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 $\pm 15\text{kV}$, Human Body Model

OUTLINE

Provide green and environmentally friendly lead-free package

DESCRIPTION

SIT491E is a 4.5V~5.5V powered, full-duplex, low power dissipation RS-485 transceiver fully meeting the requirements of RS-485 & RS-422 standard.

SIT491E contains one driver and one receiver, both can transmit signals independently. The SIT491E has a 1/8-unit-load. It allows up to 256 transceivers on the bus and error-free data transmission up to 12Mbps.

SIT491E has a working voltage range of 4.5V~5.5V, with the functions of Current-Limiting Protection, Over-voltage Protection, Control Port Hot Plug Input, etc.

SIT491E has excellent ESD release capability, and HBM reaches $\pm 15\text{kV}$.

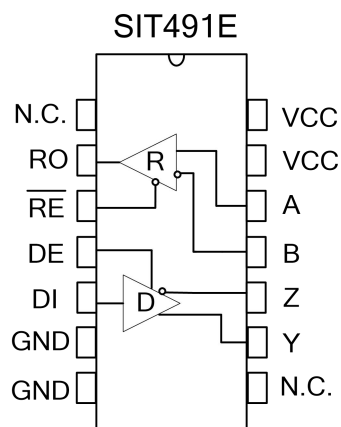
PIN CONFIGURATION

Figure.1 SIT491E Pin Configuration

**LIMITING VALUES**

| PARAMETER | SYMBOL | VALUE | UNIT |
|------------------------------|--------|--------------|------|
| Supply voltage | VCC | +7 | V |
| Driver Input Voltage | DI | -0.3~VCC+0.3 | V |
| Receiver Input Voltage | A、B | -8~13 | V |
| Receiver Output Voltage | RO | -0.3~VCC+0.3 | V |
| Operating Temperature Ranges | | -40~125 | °C |
| Storage Temperature Range | | -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

PINNING

| PIN | SYMBOL | DESCRIPTION |
|-----|--------|--|
| 1 | NC | No Connection. Not internally connected |
| 2 | RO | Receiver Output. When /RE is low, If A-B \geq -10mV, RO will be high; If A-B \leq -200mV, 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. The driver outputs are enabled by bringing DE high. They are high impedance when DE is low. If /RE is high and DE is low, the device will enter a low-power shutdown mode. |
| 5 | DI | Driver Input. When DE is high, a low on DI forces output A low and output B high. Similarly, a high on DI forces output A high and output B 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 or No Connection |
| 14 | VCC | Positive Supply. |

DRIVER DC ELECTRICAL CHARACTERISTICS

| PARAMETER | SYMBOL | CONDITION | MIN | TYP | MAX | UNIT |
|---|-----------------|------------------------------|-----|-----|-----|------|
| Differential Driver Output (No load) | V_{OD1} | | | 4.5 | VCC | V |
| Differential Driver Output | V_{OD2} | Figure 2, $RL = 27\Omega$ | 1.5 | 2.3 | VCC | V |
| | | Figure 2, $RL = 50\Omega$ | 2 | 2.8 | VCC | |
| Change in Magnitude of Driver Differential Output Voltage (NOTE1) | ΔV_{OD} | Figure 2, $RL = 27\Omega$ | | | 0.2 | V |
| Driver Common-Mode Output Voltage | V_{OC} | Figure 2, $RL = 27\Omega$ | | | 3 | V |
| Change in Magnitude of Common-Mode Output Voltage (NOTE1) | ΔV_{OC} | Figure 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 | μA |
| 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, VCC=4.5V~5.5V ,Temp=T_{MIN}~T_{MAX}, Typical values are at Temp=25°C)

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 | CONDITION | MIN | TYP | MAX | UNIT |
|--|------------------|---|---------|-----|-----|------|
| Input current (A, B) | I _{IN2} | VCC=0 or 3.3V V _{IN} = 12 V | | | 125 | μA |
| | | VCC=0 or 3.3V V _{IN} = -7 V | -100 | | | μA |
| Positive input threshold voltage | V _{IT+} | -7V ≦ V _{CM} ≦ 12V | | | -10 | mV |
| Reverse input threshold voltage | V _{IT-} | -7V ≦ V _{CM} ≦ 12V | -200 | | | mV |
| Input hysteresis voltage | V _{hys} | -7V ≦ V _{CM} ≦ 12V | 10 | 30 | | mV |
| Receiver Output High Voltage | V _{OH} | I _{OUT} = -4mA, V _{ID} = +200 mV | VCC-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} | 0.4 V < V _O < 2.4 V | | | ±1 | μA |
| Receiver Input Resistance | R _{IN} | -7V ≦ V _{CM} ≦ 12V | 96 | | | kΩ |
| Receiver Short-Circuit Output Current | I _{OSR} | 0 V ≦ V _O ≦ VCC | ±7 | | ±95 | mA |

(Unless otherwise noted, VCC=4.5V~5.5V ,Temp=T_{MIN}~T_{MAX}, Typical values are at Temp=25°C)

**SUPPLY CURRENT**

| PARAMETER | SYMBOL | CONDITION | MIN | TYP | MAX | UNIT |
|------------------|-------------------|---------------------|-----|-----|-----|------|
| Supply Current | I _{CC1} | /RE=0V, DE = 0 V | | 220 | 400 | μA |
| | I _{CC2} | /RE=VCC, DE=VCC | | 240 | 400 | μA |
| Shutdown Current | I _{SHDN} | /RE=VCC, DE=0V | | 0.5 | 10 | μA |

ESD PROTECTION

| PARAMETER | SYMBOL | CONDITION | MIN | TYP | MAX | UNIT |
|-------------|--------|-----------|-----|-----|-----|------|
| A, B, Y, Z | | HBM | | ±15 | | KV |
| Other ports | | HBM | | ±6 | | KV |

DRIVER SWITCHING CHARACTERISTICS

| PARAMETER | SYMBOL | CONDITION | MIN | TYP | MAX | UNIT | |
|---|-----------------------------------|--|-----|-----|-----|------|----|
| Driver Propagation Delay, Low-to-High Level | t _{DPLH} | R _{DIFF} = 54 Ω, C _{L1} =C _{L2} =100pF (Figure3、 4) | | 12 | 35 | ns | |
| Driver Propagation Delay, High-to-Low Level | t _{DPHL} | | | 12 | 35 | ns | |
| t _{DPLH} - t _{DPHL} | t _{SKEW1} | | | | 6 | 10 | ns |
| Rising time /Falling time | t _{DR} , t _{DF} | | | | 9 | 25 | ns |
| Driver Enable to Output High | t _{PZH} | R _L = 110Ω, (Figure5、 6) | | 20 | 90 | ns | |
| Driver Enable to Output low | t _{PZL} | | | 20 | 90 | ns | |



| | | | | | | |
|---|-----------|-------------------------------------|--|-----|-----|----|
| Driver Disable Time from Low | t_{PLZ} | $R_L = 110\Omega$, (Figure5、 6) | | 20 | 80 | ns |
| Driver Disable Time from high | t_{PHZ} | | | 20 | 80 | ns |
| In Shutdown mode, Enable to Output High | t_{DSH} | $R_L = 110\Omega$, (Figure5、 6) | | 500 | 900 | ns |
| In Shutdown mode, Enable to Output low | t_{DSL} | $R_L = 110\Omega$, (Figure5、 6) | | 500 | 900 | ns |

RECEIVER SWITCHING CHARACTERISTICS

| PARAMETER | SYMBOL | CONDITION | MIN | TYP | MAX | UNIT |
|--|-------------|---|-----|-----|------|------|
| Receiver Propagation Delay,Low-to-High Level | t_{RPLH} | Figure 5 & Figure 6 $V_{ID} \geq 2.0V$; 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} | $C_L = 15pF$ Figure7 & Figure8 | | 20 | 50 | ns |
| Receiver Enable to Output high | t_{RPZH} | $C_L = 15pF$ Figure7 & Figure8 | | 20 | 50 | ns |
| Receiver Disable Time from Low | t_{PRLZ} | $C_L = 15pF$ Figure7 & Figure8 | | 20 | 45 | ns |
| Receiver Disable Time from high | t_{PRHZ} | $C_L = 15pF$ Figure7 & Figure8 | | 20 | 45 | ns |
| In Shutdown mode, Enable to Output High | t_{RPSH} | $C_L = 15pF$ Figure7 & Figure8 | | 200 | 1400 | ns |
| In Shutdown mode, Enable to Output low | t_{RPSL} | $C_L = 15pF$ Figure7 & Figure8 | | 200 | 1400 | ns |
| Time to Shutdown | t_{SHDN} | NOTE2 | 80 | | 300 | ns |

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 | $\geq -10\text{mV}$ | H |
| 0 | X | $\leq -200\text{mV}$ | L |
| 0 | X | Open/Short Circuit | H |
| 1 | X | X | Z |

X=irrelevant; Z=high impedance

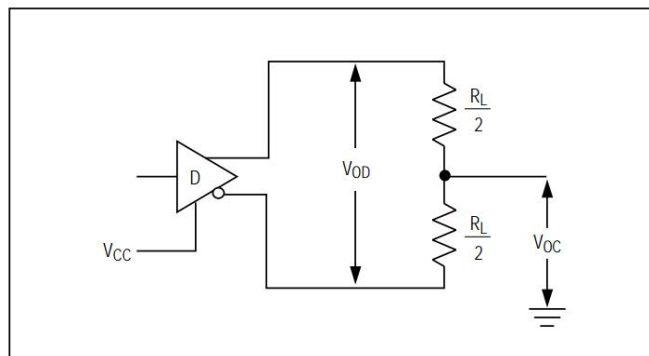
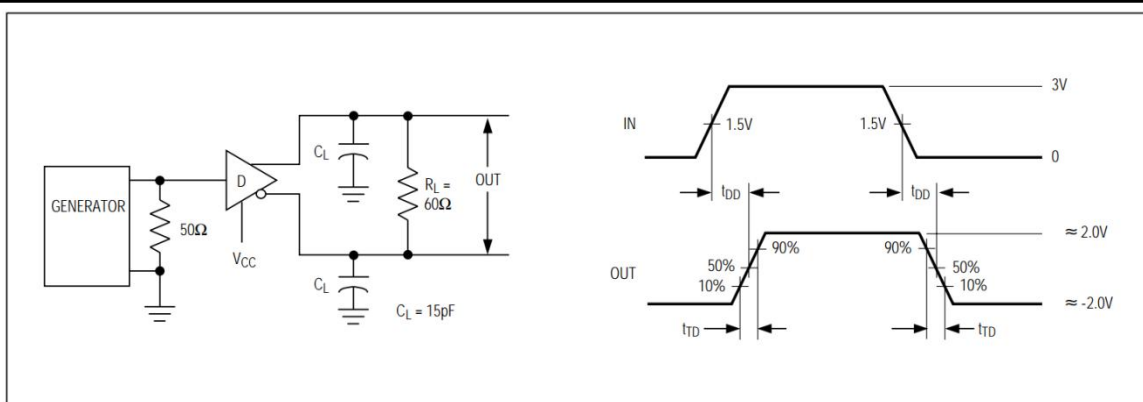
TEST CIRCUIT

Figure 2 Driver DC test load


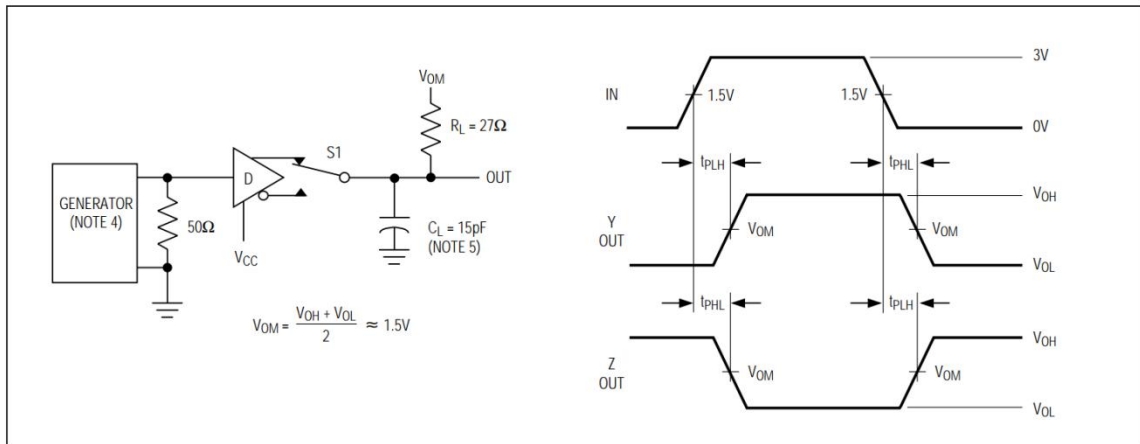
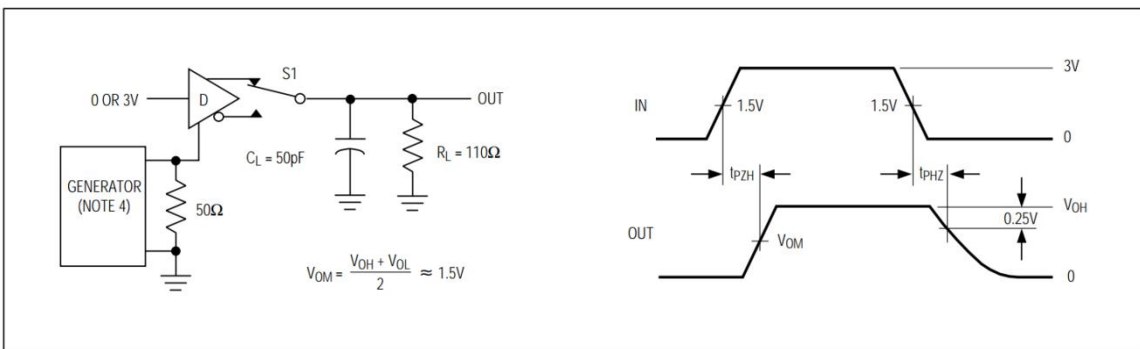
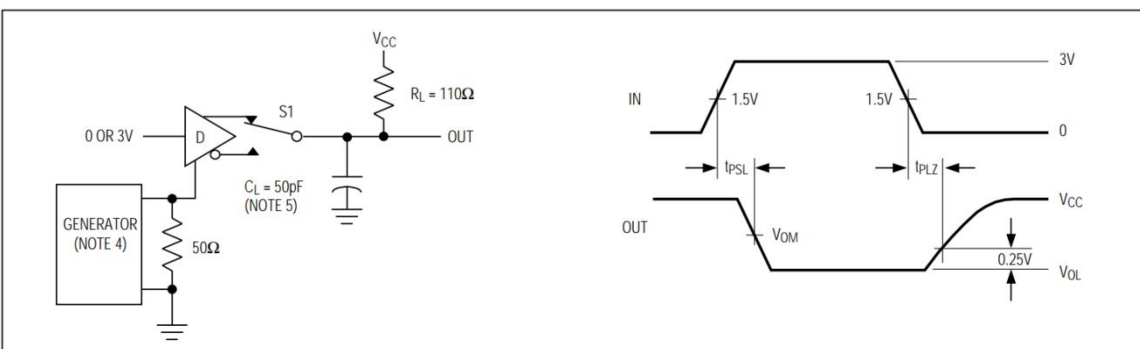
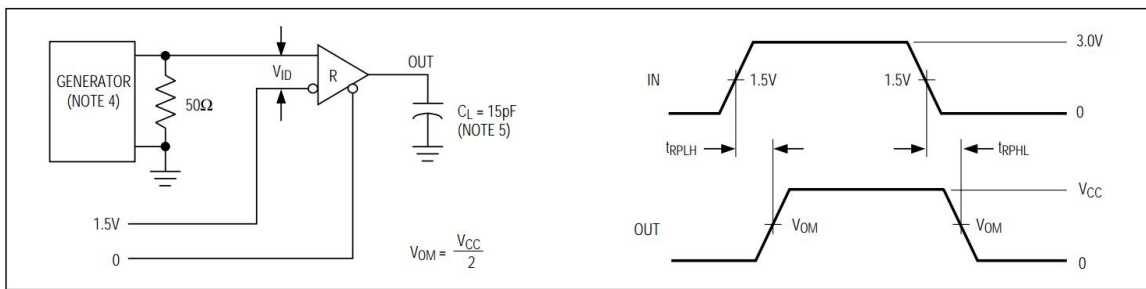
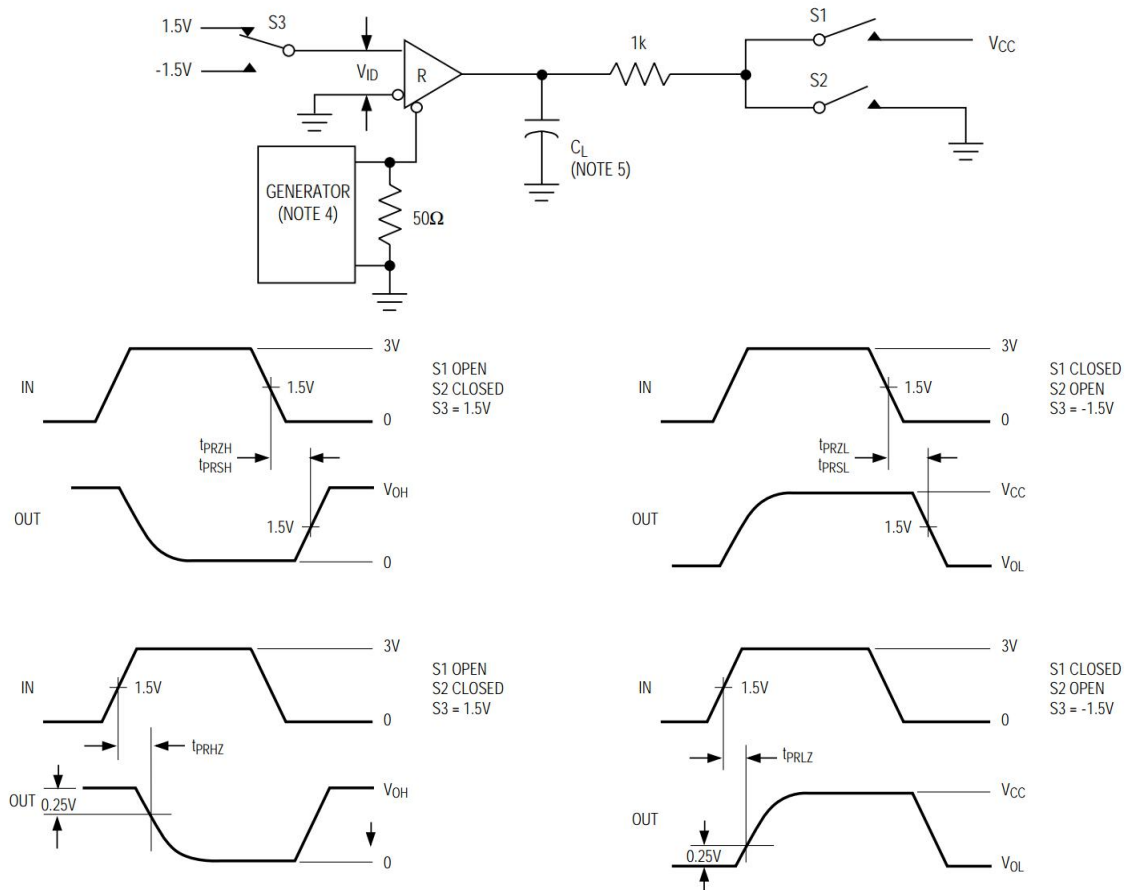
Figure 3 Differential delay and transit time of driver

Figure 4 Drive propagation delay

Figure 5 Drive enable and disable time


Figure 6 Drive enable and disable time

Figure 7 Receiver propagation delay test circuit

Figure 8 Receiver enable and disable time



ADDITIONAL DESCRIPTION

1 Sketch

SIT491E is a full-duplex high-speed transceiver for RS-485/RS-422 communication, which includes a driver and a receiver. It has failure safety, over-voltage protection and over-current protection. SIT491E realizes error-free data transmission up to 12Mbps.

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, SIT491E 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) $\geq -10\text{mV}$, RO is logic high; if the voltage (A-B) $\leq -200\text{mV}$, RO is logic low. With the receiver threshold of the SIT491E, this results in a logic-high with a 30mV minimum noise margin. The -10mV to -200mV threshold complies with the $\pm 200\text{mV}$ EIA/TIA-485 standard.

3 Allowing up to 256 transceivers on the bus

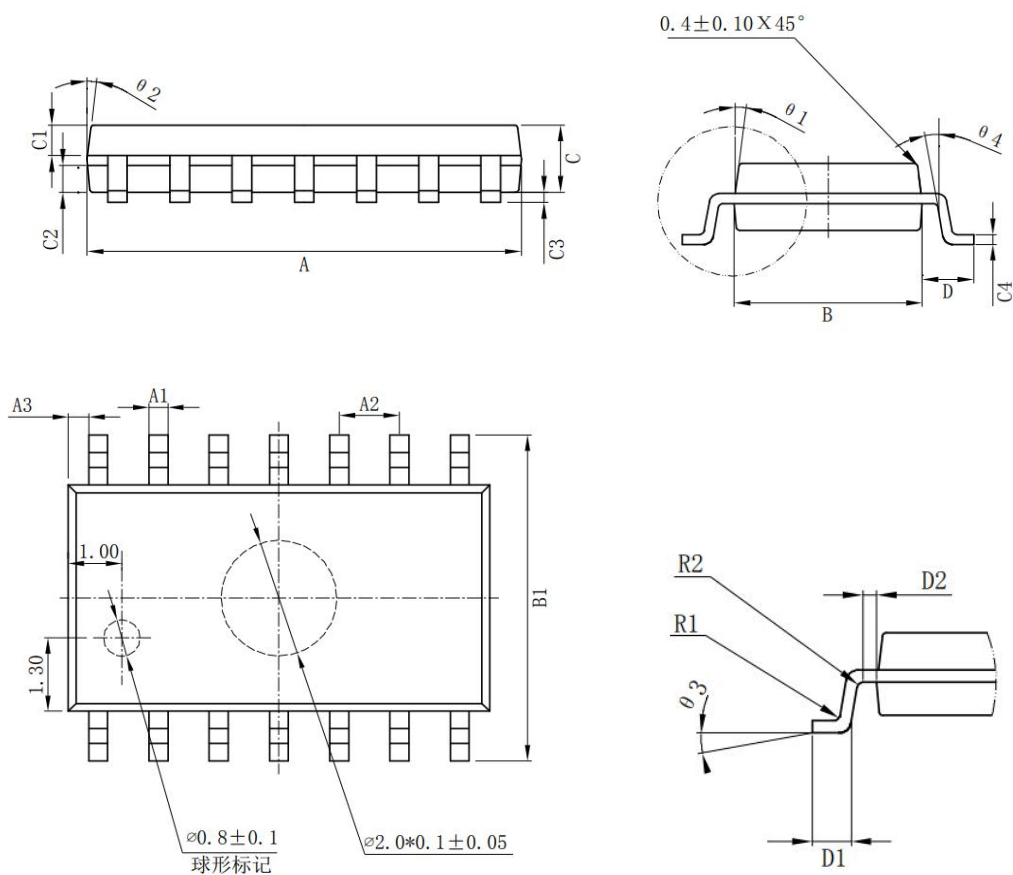
The input impedance of the standard RS485 receiver is $12\text{k}\Omega$ (1 unit load), and the standard driver can drive up to 32 unit loads. The receiver of SIT491E transceiver has $1/8$ unit load input impedance ($96\text{k}\Omega$), which allows up to 256 transceivers to be connected on the same 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).

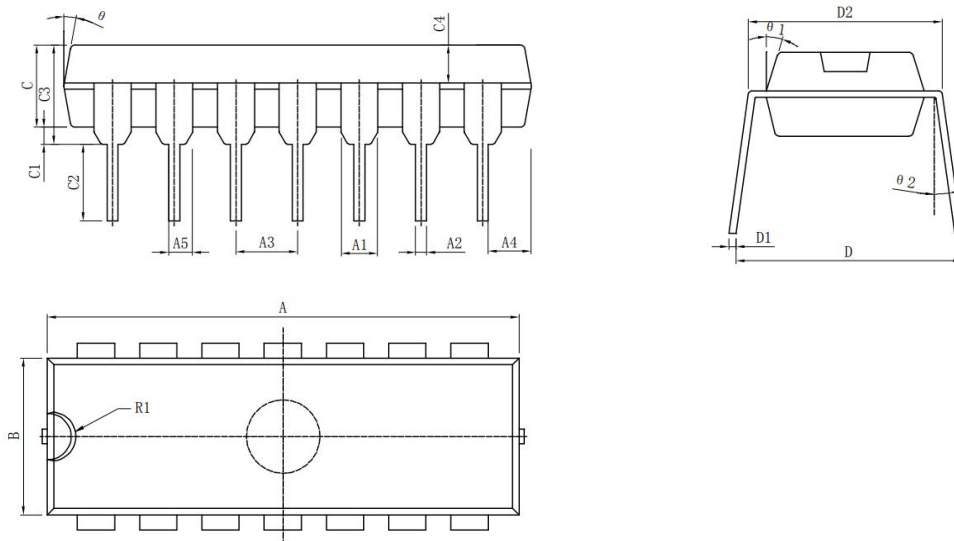
SOP14 DIMENSIONS
PACKAGE SIZE

| SYMBOL | MIN/mm | MAX/mm | SYMBOL | MIN/mm | MAX/mm |
|--------|----------|--------|------------|------------|--------|
| A | 8.55 | 8.75 | C4 | 0.193 | 0.213 |
| A1 | 0.356 | 0.456 | D | 0.95 | 1.15 |
| A2 | 1.27TYP | | D1 | 0.40 | 0.70 |
| A3 | 0.312TYP | | D2 | 0.20TYP | |
| B | 3.80 | 4.00 | R1 | 0.20TYP | |
| B1 | 5.80 | 6.20 | R2 | 0.20TYP | |
| C | 1.40 | 1.60 | $\theta 1$ | 8°~12°TYP4 | |
| C1 | 0.60 | 0.70 | $\theta 2$ | 8°~12°TYP4 | |
| C2 | 0.55 | 0.65 | $\theta 3$ | 0°~8° | |
| C3 | 0.05 | 0.25 | $\theta 4$ | 4°~12° | |



DIP14 DIMENSIONS
PACKAGE SIZE

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


ORDERING INFORMATION

| TYPE NUMBER | TEMPERATURE | PACKAGE |
|-------------|-------------|---------|
| SIT491EESD | -40°C~125°C | SOP14 |
| SIT491EEPD | -40°C~125°C | DIP14 |

Tapered package is 2500 pieces/disc.