

**FEATURES**

- Supply voltages from 3.0V to 5.5V
- Dual-channel
- 96kbps data rates
- 15kV HBM ESD-Protected
- 8kV IEC-4100-4-2 Contact Discharge

**PRODUCT APPEARANCE**


Provide green and environmentally friendly lead-free package

**DESCRIPTION**

SIT3232E is a 3.0V to 5.5V power-supply, dual-channel, high ESD-protected, low-power RS-232 transceiver that fully meets the requirements of the TIA/EIA-232 standard.

SIT3232E includes two drives and two receivers, with enhanced ESD protection function, reaching the protection capacity of HBM above 15kV and 8kV IEC-4100-4-2 contact discharge.

When powered, the charge pump only needs four 0.1 $\mu$ F external capacitors to achieve a rate of 96kbps error-free data transmission. Each driver and receiver can be used independently.

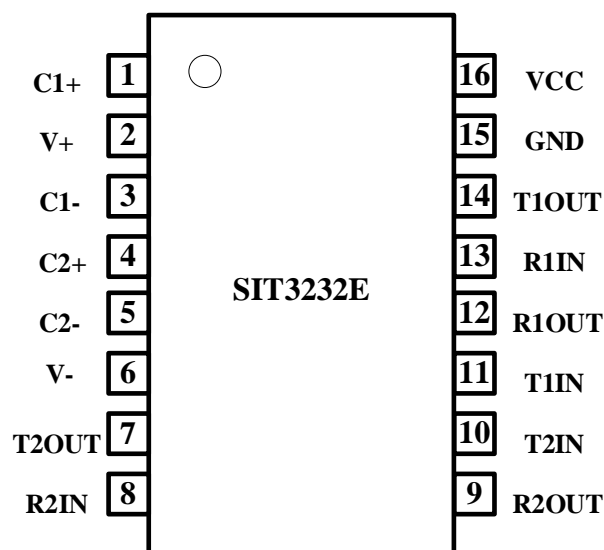
**PIN CONFIGURATION**


Fig 1 pin configuration

**PIN DESCRIPTION**

| PIN | SYMBOL | DESCRIPTION  |
|-----|--------|--|
| 1   | C1+    | Positive Terminal for the first Charge Pump Capacitor  |
| 2   | V+     | Doubled Voltage Terminal                               |
| 3   | C1-    | Negative Terminal for the first Charge Pump Capacitor  |
| 4   | C2+    | Positive Terminal for the second Charge Pump Capacitor |
| 5   | C2-    | Negative Terminal for the second Charge Pump Capacitor |
| 6   | V-     | Inverted Voltage Terminal                              |
| 7   | T2OUT  | Second Transmitter Output Voltage                      |
| 8   | R2IN   | Second Receiver Input Voltage                          |
| 9   | R2OUT  | Second Receiver Output Voltage                         |
| 10  | T2IN   | Second Transmitter Input Voltage                       |
| 11  | T1IN   | First Transmitter Input Voltage                        |
| 12  | R1OUT  | First Receiver Output Voltage                          |
| 13  | R1IN   | First Receiver Input Voltage                           |
| 14  | T1OUT  | First Transmitter Output Voltage                       |
| 15  | GND    | Ground   |
| 16  | VCC    | Supply Voltage   |

**LIMITING VALUES**

| PARAMETER                        | SYMBOL       | VALUE        | UNIT |
|----------------------------------|--------------|--------------|------|
| Supply voltage                   | VCC          | -0.3~+6      | V    |
| Doubled Voltage Terminal         | V+           | VCC-0.3~+7   | V    |
| Inverted Voltage Terminal        | V-           | +0.3~-7      | V    |
| $V+ +  V- $                      |              | +13          | V    |
| Transmitter Input Voltage Range  | T1IN, T2IN   | -0.3~+6      | V    |
| Receiver Input Voltage Range     | R1IN, R2IN   | ±25          | V    |
| Transmitter Output Voltage Range | T1OUT, T2OUT | ±13.2        | V    |
| Receiver Output Voltage Range    | R1OUT, R2OUT | -0.3~VCC+0.3 | V    |

| PARAMETER             | SYMBOL    | VALUE   | UNIT |
|-----------------------|-----------|---------|------|
| Operating Temperature | $T_A$     | -40~85  | °C   |
| Storage Temperature   | $T_{stg}$ | -60~150 | °C   |
| Soldering Temperature |           | 300     | °C   |
| Continuous Power      | SOP16     | 760     | mW   |
|                       | DIP16     | 840     | mW   |

The maximum limit parameters mean 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.

**SUPPLY CURRENT**

| PARAMETER                   | SYMBOL    | CONDITION | MIN. | TYP. | MAX. | UNIT |
|-----------------------------|-----------|-----------|------|------|------|------|
| Supply Current with no load | $I_{sup}$ |           |      | 2    |      | mA   |

(Unless specified otherwise,  $V_{CC}=3.0V\sim 5.5V$ ,  $T_A=-40^{\circ}C\sim 85^{\circ}C$ , typical value is tested when  $V_{CC}=+3.3V$ ,  $T_A=25^{\circ}C$ ,  $C1-C4=1\mu F$ ).

**LOGIC INPUT ELECTRICAL CHARACTERISTICS**

| PARAMETER                | SYMBOL       | CONDITION  | MIN. | TYP. | MAX.    | UNIT    |
|--------------------------|--------------|------------|------|------|---------|---------|
| Logic Control Low Level  | $V_{TIN\_L}$ | T1IN, T2IN |      |      | 0.8     | V       |
| Logic Control High Level | $V_{TIN\_H}$ | T1IN, T2IN | 2    |      |         | V       |
| Logic Control Hysteresis |              | T1IN, T2IN |      | 0.3  |         | V       |
| Input Logic Current      | $I_{TIN}$    | T1IN, T2IN |      |      | $\pm 1$ | $\mu A$ |

(Unless specified otherwise,  $V_{CC}=3.0V\sim 5.5V$ ,  $T_A=-40^{\circ}C\sim 85^{\circ}C$ , typical value is tested when  $V_{CC}=+3.3V$ ,  $T_A=25^{\circ}C$ ,  $C1-C4=1\mu F$ ).

**RECEIVER OUTPUT ELECTRICAL CHARACTERISTICS**

| PARAMETER                          | SYMBOL    | CONDITION                                   | MIN.         | TYP.         | MAX. | UNIT |
|------------------------------------|-----------|---|--------------|--------------|------|------|
| Receiver Output Logic-Low Voltage  | $V_{ROL}$ | $I_{OUT}=1.6mA$ ,<br>$V_{CC}=5V$ or $3.3V$  |              |              | 0.4  | V    |
| Receiver Output Logic-High Voltage | $V_{ROH}$ | $I_{OUT}=-0.5mA$ ,<br>$V_{CC}=5V$ or $3.3V$ | $V_{CC}-0.6$ | $V_{CC}-0.1$ |      | V    |

(Unless specified otherwise,  $V_{CC}=3.0V\sim 5.5V$ ,  $T_A=-40^{\circ}C\sim 85^{\circ}C$ , typical value is tested when  $V_{CC}=+3.3V$ ,  $T_A=25^{\circ}C$ ,  $C1-C4=1\mu F$ ).

**RECEIVER INPUT ELECTRICAL CHARACTERISTICS**

| PARAMETER                    | SYMBOL    | CONDITION     | MIN. | TYP. | MAX. | UNIT |
|------------------------------|-----------|---------------|------|------|------|------|
| Receiver Input Range         | $V_{RIN}$ |               | -25  |      | +25  | V    |
| Receiver Input Low Threshold | $V_{RIL}$ | $V_{CC}=3.3V$ | 0.6  | 1.1  |      | V    |
|                              |           | $V_{CC}=5V$   | 0.8  | 1.5  |      | V    |

| PARAMETER                     | SYMBOL    | CONDITION | MIN. | TYP. | MAX. | UNIT       |
|-------------------------------|-----------|-----------|------|------|------|------------|
| Receiver Input High Threshold | $V_{RIH}$ | VCC=3.3V  |      | 1.5  | 2.4  | V          |
|                               |           | VCC=5V    |      | 1.9  | 2.4  | V          |
| Receiver Input Hysteresis     |           |           |      | 0.4  |      | V          |
| Receiver Input Impedance      | $R_{RIN}$ |           | 3    | 5    | 7    | k $\Omega$ |

(Unless specified otherwise, VCC=3.0V~5.5V, T<sub>A</sub>=-40°C~85°C, typical value is tested when VCC=+3.3V, T<sub>A</sub>=25°C, C1-C4=1 $\mu$ F).

## TRANSMITTER OUTPUT ELECTRICAL CHARACTERISTICS

| PARAMETER                         | SYMBOL     | CONDITION  | MIN.    | TYP.    | MAX. | UNIT     |
|-----------------------------------|------------|--|---------|---------|------|----------|
| Transmitter Output Swing          | $V_{TOUT}$ | All output ports of transmitter connect 3k $\Omega$ load to ground | $\pm 4$ | $\pm 5$ |      | V        |
| Transmitter Output Impedance      | $R_{TOUT}$ | VCC=0V, Transmitter Input= $\pm 2$ V                               | 300     |         |      | $\Omega$ |
| Transmitter Short-Circuit Current | $I_{tsc}$  |  |         |         | 60   | mA       |

(Unless specified otherwise, VCC=3.0V~5.5V, T<sub>A</sub>=-40°C~85°C, typical value is tested when VCC=+3.3V, T<sub>A</sub>=25°C, C1-C4=1 $\mu$ F).

## ESD PROTECTION

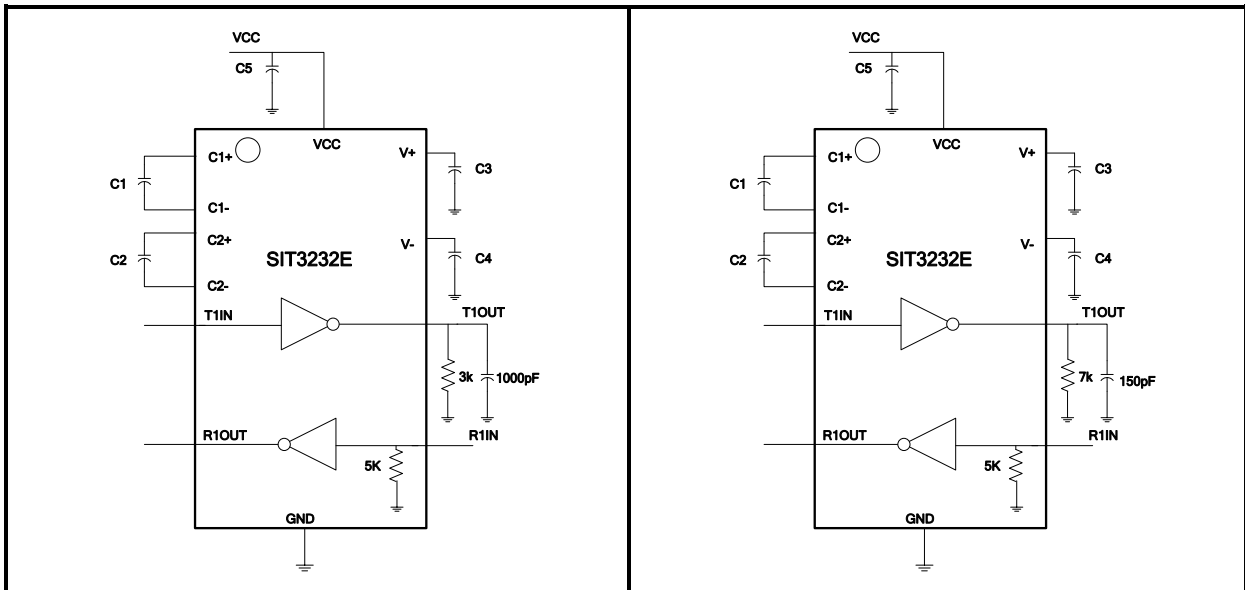
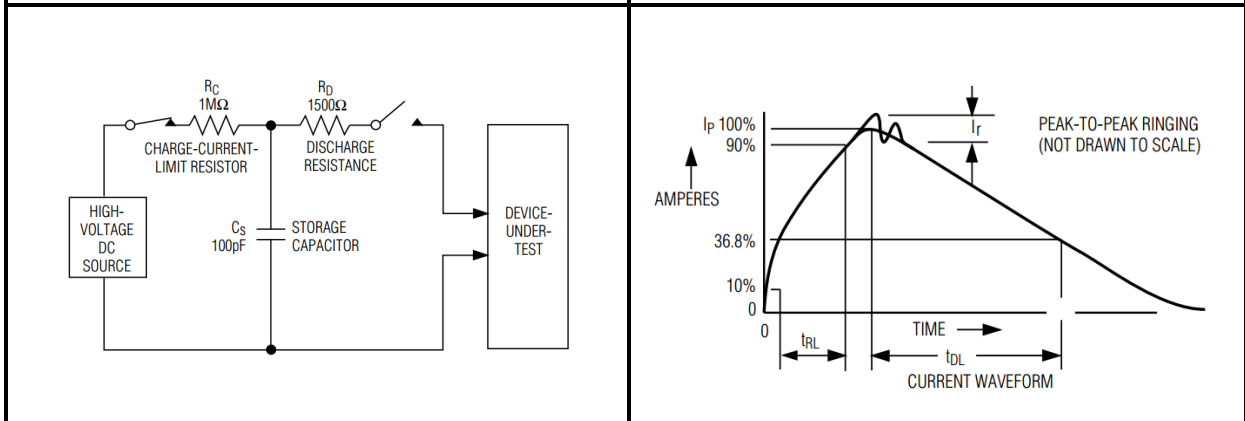
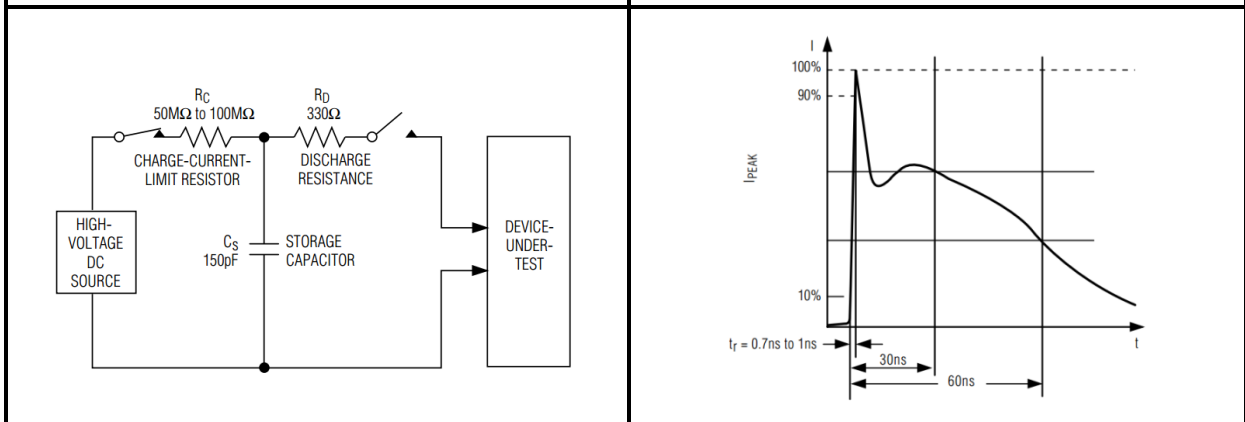
| PARAMETER                | SYMBOL | CONDITION         | MIN. | TYP.     | MAX. | UNIT |
|--------------------------|--------|-------------------|------|----------|------|------|
| R1IN、R2IN<br>T1OUT、T2OUT |        | HBM               |      | $\pm 15$ |      | kV   |
|                          |        | Air Discharge     |      | $\pm 15$ |      | kV   |
|                          |        | Contact Discharge |      | $\pm 8$  |      | kV   |

## SWITCHING CHARACTERISTICS PARAMETER

| PARAMETER                  | SYMBOL     | CONDITION                  | MIN. | TYP. | MAX. | UNIT |
|----------------------------|------------|----------------------------|------|------|------|------|
| Rate                       | Speed      | RL=3k $\Omega$ , CL=1000pF |      | 96   |      | kbps |
| Receiver Propagation delay | $t_{RPHL}$ | CL=150pF                   |      | 300  |      | ns   |
|                            | $t_{RPLH}$ |                            |      | 300  |      | ns   |

| PARAMETER               | SYMBOL | CONDITION   | MIN. | TYP. | MAX. | UNIT       |
|-------------------------|--------|---|------|------|------|------------|
| $ t_{RPHL} - t_{RPLH} $ |        |   |      | 150  |      | ns         |
| $ t_{TPHL} - t_{TPLH} $ |        |   |      | 150  |      | ns         |
| Transmitter Slew Rate   | SR     | $RL=3k\Omega\sim 7k\Omega$ ,<br>$CL=150pF\sim 1000pF$<br>from -3.0V~3.0V<br>or from 3.0V~-3.0V<br>See <a href="#">Fig 2</a> and <a href="#">Fig 3</a> | 4    |      | 30   | V/ $\mu$ s |

(Unless specified otherwise, VCC=3.0V~5.5V, T<sub>A</sub>=-40°C~85°C, typical value is tested when VCC=+3.3V, T<sub>A</sub>=25°C, C1-C4=1 $\mu$ F).

**TEST CIRCUIT**

**Fig 2 minimum swing rate test circuit**
**Fig 3 maximum swing rate test circuit**

**Fig 4 ESD test model of human body mode**
**Fig 5 human body mode current waveform**

**Fig 6 ESD test model of IEC 1000-4-2**
**Fig 7 current waveform of IEC 1000-4-2 ESD**

## ADDITIONAL DESCRIPTION

### 1 Dual Charge-Pump Operation

SIT3232E has a two-way charge pump inside to support the chip's voltage conversion work. Dual-electric pump provides +5.5V and -5.5V output voltage in the range of 3.0 ~ 5.5V, each charge pump requires a capacitor (C1, C2) and an energy storage capacitor (C3, C4) to generate V+ and V-power supplies, as shown in [Fig 8](#).

### 2 RS232 Transmitter

Convert the TTL/CMOS logic voltage to a voltage compatible with the EIA/TIA-232 standard. SIT3232E transmitter can guarantee 96kbps data rate under the worst operating conditions (Parallel load of 3kΩ resistor and 1000pF capacitor). Transmitter can drive multiple receivers in parallel. There is no pull-up resistance inside the input terminals T1IN and T2IN of SIT3232E transmitter. If the transmitter is not used, the unused input terminals T1IN and T2IN can be connected to GND or VCC.

### 3 RS232 Receiver

The SIT3232E has two separate receivers that convert the RS-232 signal to the CMOS logic output level.

### 4 ESD Protection

All pins of SIT3232E adopt ESD protection structure, and all driver outputs and receiver inputs have additional electrostatic protection capability. It can withstand ±15kV ESD (HBM) discharge, contact discharge above ±8KV and air gap discharge above ±15kV. The ESD protection structure can withstand the impact of high voltage ESD under all conditions, including standard working mode and power-off mode.

### 5 Typical Application

Typical dual-Path application scenarios are shown in [Fig 8](#), where the C1-C5 typical capacitance value is 0.1μF.

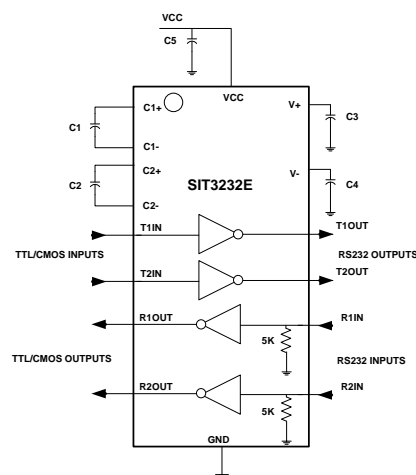
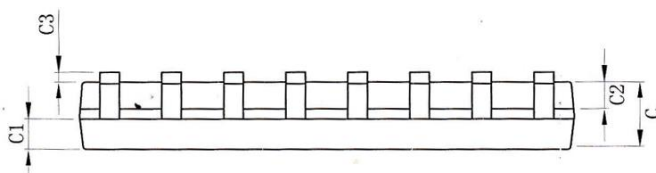
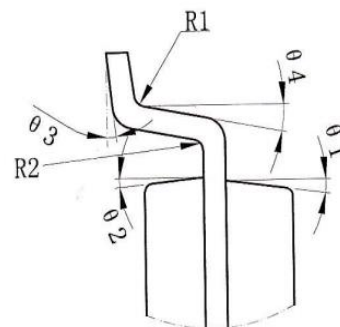
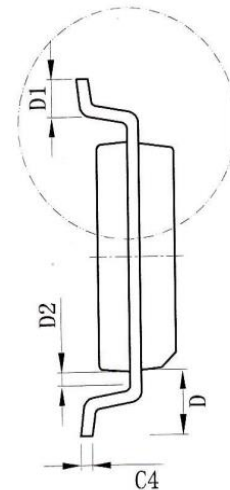
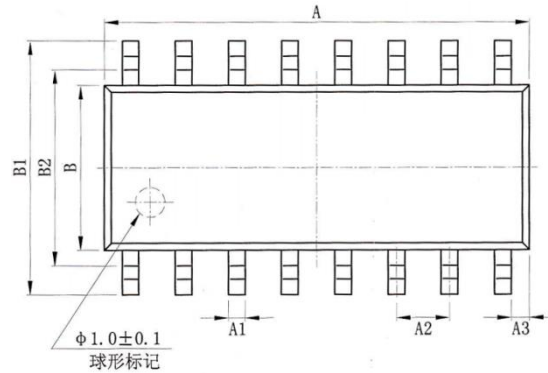


Fig 8 Typical dual-Path application scenarios



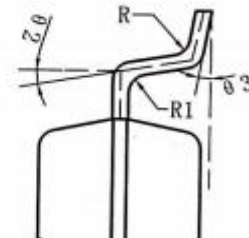
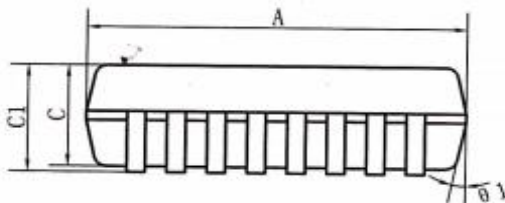
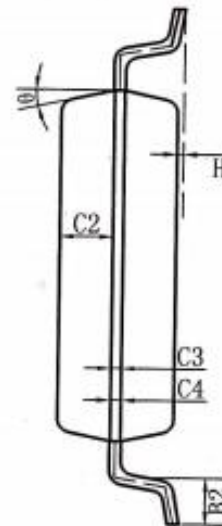
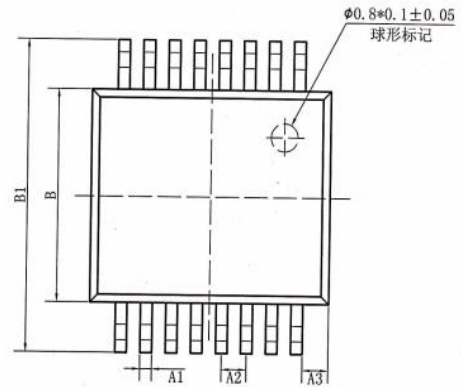
**SOP16 DIMENSIONS**
**PACKAGE SIZE**

| SIZE<br>SYMBOL | MIN./mm    | MAX./mm |
|----------------|------------|---------|
| A              | 9.80       | 10.00   |
| A1             | 0.356      | 0.456   |
| A2             | 1.27TYP    |         |
| A3             | 0.302TYP   |         |
| B              | 3.85       | 3.95    |
| B1             | 5.84       | 6.24    |
| B2             | 5.00 TYP   |         |
| C              | 1.40       | 1.60    |
| C1             | 0.61       | 0.71    |
| C2             | 0.54       | 0.64    |
| C3             | 0.05       | 0.25    |
| C4             | 0.203      | 0.233   |
| D              | 1.05 TYP   |         |
| D1             | 0.40       | 0.70    |
| D2             | 0.15       | 0.25    |
| R1             | 0.20TYP    |         |
| R2             | 0.20TYP    |         |
| θ1             | 8°~12°TYP4 |         |
| θ2             | 8°~12°TYP4 |         |
| θ3             | 0°~8°      |         |
| θ4             | 4°~12°     |         |



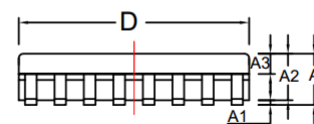
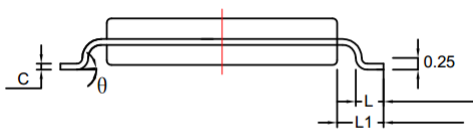
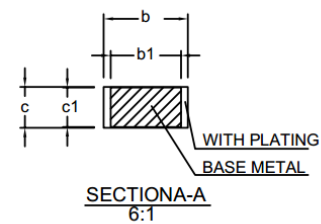
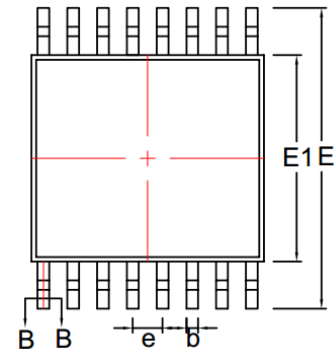
**SSOP16(0.65) DIMENSIONS**
**PACKAGE SIZE**

| SIZE<br>SYMBOL | MIN/mm   | MAX/mm |
|----------------|----------|--------|
| A              | 6.15     | 6.25   |
| A1             | 0.30TYP  |        |
| A2             | 0.65TYP  |        |
| A3             | 0.675TYP |        |
| B              | 5.25     | 5.35   |
| B1             | 7.65     | 7.95   |
| B2             | 0.60     | 0.80   |
| C              | 1.70     | 1.80   |
| C1             | 1.75     | 1.95   |
| C2             | 0.799    |        |
| C3             | 0.152    |        |
| C4             | 0.172    |        |
| H              | 0.05     | 0.15   |
| $\theta$       | 12°TYP4  |        |
| $\theta_1$     | 12°TYP4  |        |
| $\theta_2$     | 10°TYP   |        |
| $\theta_3$     | 0°~8°    |        |
| R              | 0.20°TYP |        |
| R              | 0.15°TYP |        |



**TSSOP16 DIMENSIONS**
**PACKAGE SIZE**

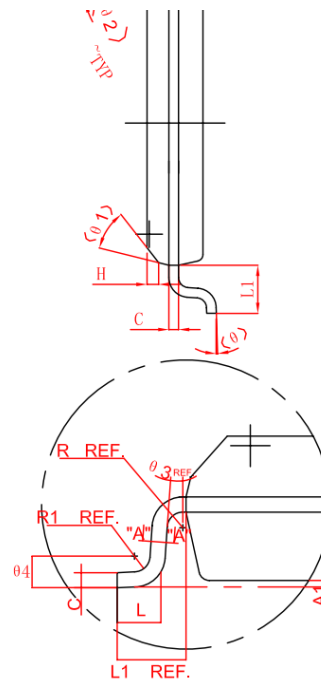
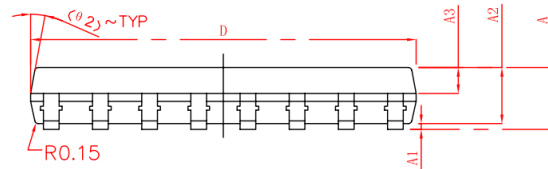
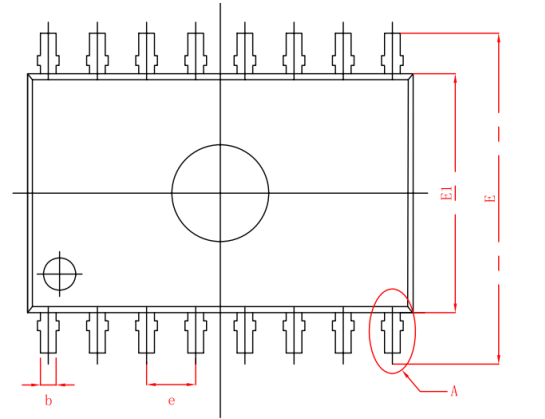
| SIZE<br>SYMBOL | MIN./mm | TYP./mm | MAX./mm |
|----------------|---------|---------|---------|
| A              | --      | --      | 1.20    |
| A1             | 0.05    |         | 0.15    |
| A2             | 0.90    | 1.00    | 1.05    |
| b              | 0.20    | --      | 0.30    |
| b1             | 0.19    | 0.22    | 0.25    |
| c              | 0.110   | 0.127   | 0.145   |
| c1             | 0.12    | 0.13    | 0.14    |
| D              | 4.86    | 4.96    | 5.06    |
| E              | 6.20    | 6.40    | 6.60    |
| E1             | 4.30    | 4.40    | 4.50    |
| e              | 0.65BSC |         |         |
| L              | 0.45    | 0.60    | 0.75    |
| L1             | 1.00BSC |         |         |
|                | 0°      | --      | 8°      |

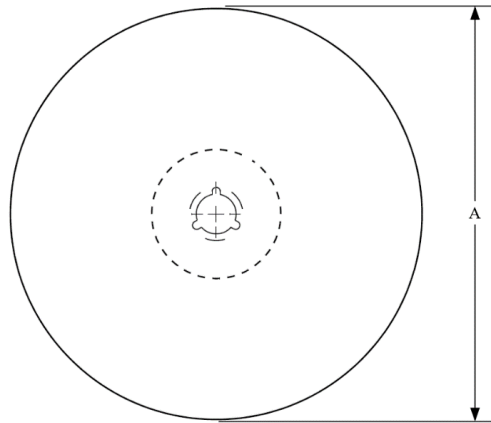


**SOPW16 DIMENSIONS**

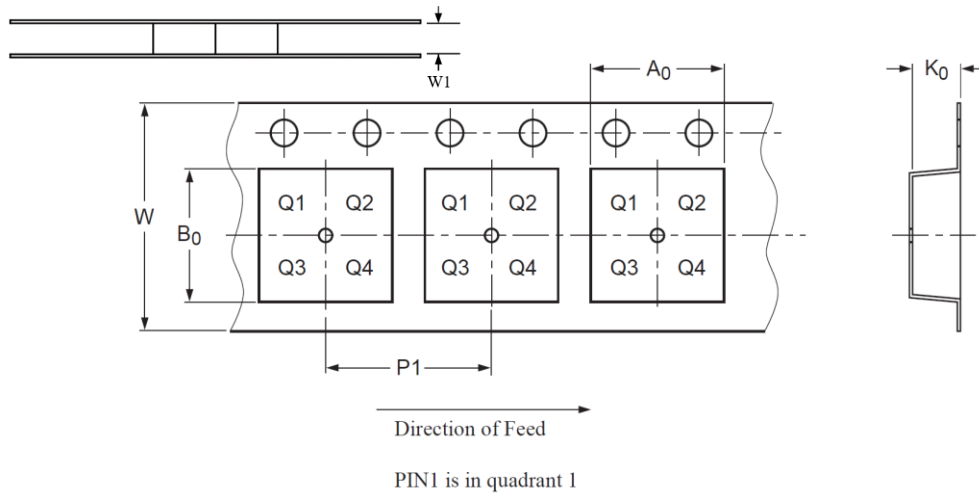
封装尺寸

| 标注         | 尺寸      | 最小值/mm | 最大值/mm |
|------------|---------|--------|--------|
| A          |         | -      | 2.65   |
| A1         |         | 0.10   | 0.30   |
| A2         |         | 2.25   | 2.35   |
| A3         |         | 0.97   | 1.07   |
| D          |         | 10.10  | 10.50  |
| E          |         | 10.26  | 10.60  |
| E1         |         | 7.30   | 7.70   |
| e          | 1.27BSC |        |        |
| L          |         | 0.55   | 0.85   |
| L1         | 1.4BSC  |        |        |
| H          |         | 0.345  | 0.365  |
| R          | 0.20TYP |        |        |
| R1         | 0.30TYP |        |        |
| $\theta$   |         | 0°     | 8°     |
| $\theta_1$ | 45°TYP  |        |        |
| $\theta_2$ | 12°TYP  |        |        |
| $\theta_3$ |         | 0°     | 8°     |
| $\theta_4$ |         | 0°     | 10°    |



**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                   |

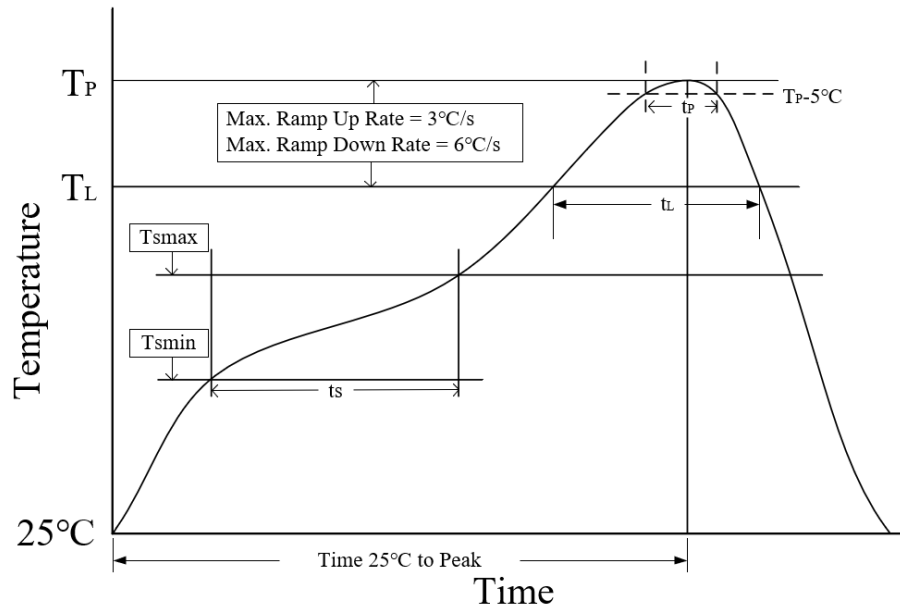


| Package Type | Reel Diameter A (mm) | Tape width W1 (mm) | A0 (mm)                                | B0 (mm)                                | K0 (mm)                                | P1 (mm)  | W (mm)                                  |
|--------------|----------------------|--------------------|--|--|--|----------|---|
| SOP16        | 330                  | 16                 | 6.43±0.10                              | 10.40±0.1                              | 1.85±0.10                              | 8.00±0.1 | 16.00 <sup>+0.30</sup> <sub>-0.10</sub> |
| SSOP16       | 330                  | 16                 | 8.30 <sup>+0.10</sup> <sub>-0.10</sub> | 6.60 <sup>+0.10</sup> <sub>-0.10</sub> | 2.40 <sup>+0.10</sup> <sub>-0.10</sub> | 8.00±0.1 | 16.00 <sup>+0.30</sup> <sub>-0.30</sub> |
| TSSOP16      | 330                  | 12                 | 6.80±0.1                               | 5.50±0.1                               | 1.30±0.1                               | 8.00±0.1 | 12.00±0.30                              |

**ORDERING INFORMATION**

| TYPE NUMBER | PACKAGE          | PACKING            |
|-------------|------------------|--------------------|
| SIT3232EESE | SOP16            | Tape and reel/Tube |
| SIT3232EEAE | SSOP16           | Tape and reel/Tube |
| SIT3232EEUE | TSSOP16          | Tape and reel/Tube |
| SIT3232EEWE | SOPW16 Wide body | Tube               |

SOP16 is packed with 2500 pieces/disc in braided packaging and 50 pieces/tube in tubed packaging.  
SSOP16 is packed with 2000 pieces/disc in braided packaging and 80 pieces/tube in tubed packaging.  
TSSOP16 is packed with 2500 pieces/disc in braided packaging and 100 pieces/tube in tubed packaging.  
SOPW16 is packed with 44 pieces/tube in tubed packaging.

**REFLOW SOLDERING**


| Parameter  | Lead-free soldering conditions |
|--|--------------------------------|
| Ave ramp up rate ( $T_L$ to $T_P$ )  | 3 °C/second max                |
| Preheat time $t_s$<br>( $T_{smin}=150\text{ °C}$ to $T_{smax}=200\text{ °C}$ ) | 60-120 seconds                 |
| Melting time $t_L$ ( $T_L=217\text{ °C}$ )                                     | 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.  | September 2017                   |
| V1.1~V1.10     | Adjusted format.  | September 2017<br>to August 2019 |
| V1.11          | Updated the parameters of “transmitter output electrical characteristics”;<br>Added the dimensions of SSOP16, TSSOP16 packages.   | August 2019                      |
| V1.12          | Added test conditions description of “supply current” typical value.  | February 2020                    |
| V1.13          | Adjusted format.  | March 2020                       |
| V1.14          | Added the dimensions of SOPW16 wide body package;<br>Update ordering information.   | August 2020                      |
| V1.15          | Updates the receiver propagation delay parameter information.   | January 2021                     |
| V1.16          | Updated the communication rate;<br>Updated the “Transmitter Output Swing” parameter;<br>Added tape and reel information;<br>Updated ordering information;<br>Added reflow soldering information;<br>Added revision history. | February 2023                    |
| V1.17          | Adjusted the communication rate to be consistent throughout the text.<br>Adjusted format.   | August 2023                      |
| V1.18          | Updated ordering information.   | January 2024                     |