# MORNSUN®

# TD551SCANH3
## SOIC 16 package isolated CAN Transceiver

## Features

- Ultra-small, ultra-thin, chip scale SOIC package
- Compliant with ISO11898-2 standard
- Integrated efficient isolation power supply
- I/O power supply range supports 4.5V and 5.5V
- High isolation to 5000VAC
- Bus-Pin ESD protection up to 8kV(HBM)
- Baud rate up to 5Mbps
- -40V to 40V bus fault protection
- High CMTI: ±180 kV/µs (typical)
- TXD dominant time-out function
- Nanosecond level communication delay
- The bus supports maximum 110 nodes
- Industrial operating ambient temperature range: -40℃ to +125℃
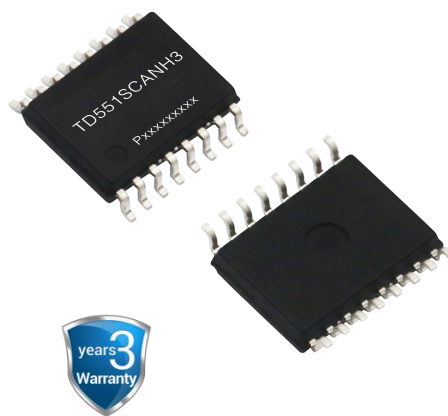
## Package



## Applications

- Industrial automation, control, sensors and drive systems
- Building and greenhouse environmental control(HVAC) automation
- Security system
- Transport
- Medical treatment
- Telecommunication
- CAN Bus standard such as CAN open, Device Net, NMEA2000, ARNIC825, ISO11783, CAN Kingdom, CAN aerospace

## Functional Description

TD551SCANH3 is a isolated CAN Bus transceiver, which is compliant with ISO11898-2 standard. TD551SCANH3 integrate 5V quarantine power. The TD551SCANH3 provide differential transmitting and receiving capability between the CAN protocol controller and the physical layer bus. It is capable of running at data of rates up to 5Mbps. The device has over-voltage(-40V to 40V) and thermal shutdown so that it is especially suitable for working in harsh environment.
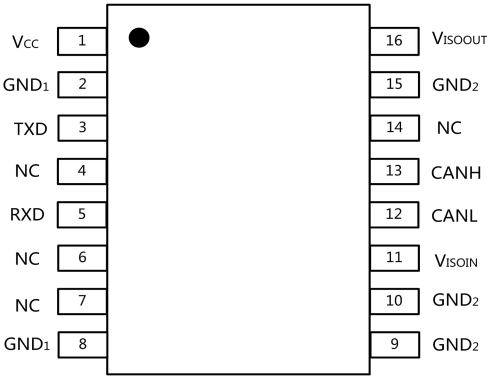
# Contents

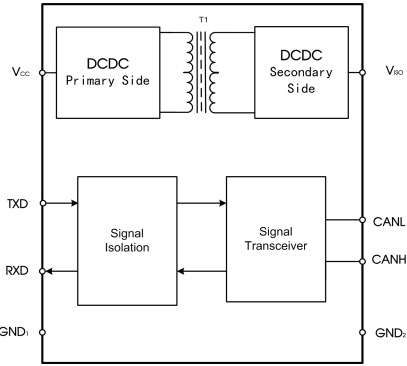## Pin Connection

| | Pin | | | Pin | |
|---|---|---|---|---|---|
| $V_{CC}$ | 1 | | | 16 | $V_{ISOOUT}$ |
| $GND_1$ | 2 | | | 15 | $GND_2$ |
| TXD | 3 | | | 14 | NC |
| NC | 4 | | | 13 | CANH |
| RXD | 5 | | | 12 | CANL |
| NC | 6 | | | 11 | $V_{ISOIN}$ |
| NC | 7 | | | 10 | $GND_2$ |
| $GND_1$ | 8 | | | 9 | $GND_2$ |

Note：Pin2 and Pin8 GND1 are not internally connected;
Pin15 and Pin9&10 GND2 are not internally connected；

## Internal Block Diagram



## Function Table

| Letter | Description |
|---|---|
| H | High-Level |
| L | Low-Level |
| X | Unrelated |
| Z | High Impedance |

Table 1. Driver Function table

| Input | Output | | Bus State |
|---|---|---|---|
| TXD | CANH | CANL | |
| L | H | L | Dominant |
| H ( Or No Connection ) | Z | Z | Recessive |

Table 2. Receiver Function table

| $V_{ID}$=CANH-CANL | RXD | Bus State |
|---|---|---|
| $V_{ID}$≥0.9V | L | Dominant |
| 0.5< $V_{ID}$<0.9V | Uncertainty | Uncertainty |
| $V_{ID}$≤0.5V | H | Recessive |
| Open | H | Recessive |

## Pin Descriptions

| Pin Number | Pin Name | Pin Functions |
|---|---|---|
| 1 | $V_{CC}$ | Power supply pin. By using 0.1uF and 10uF ceramic capacitance ground $GND_1$. |
| 2 | $GND_1$ | Ground(Logic side) |
| 3 | TXD | Driver input pin |
| 4 | NC | No connect |
| 5 | RXD | Receiver output pin. |
| 6 | NC | No connect |
| 7 | NC | No connect |
| 8 | $GND_1$ | Ground(Logic side). The pin needs to be connected to pin2 in application. |
| 9 | $GND_2$ | Ground (Bus side). The pin needs to be connected to pin15 in application. |
| 10 | $GND_2$ | Ground (Bus side). The pin needs to be connected to pin15 in application. |
| 11 | $V_{ISOIN}$ | Insulation power input.By using 0.1uF and 10uF ceramic capacitance ground $GND_2$. The pin needs to be connected to pin16 in application. |
| 12 | CANL | CANL pin |
| 13 | CANH | CANH pin |
| 14 | NC | No connect |
| 15 | $GND_2$ | Ground (Bus side) |
| 16 | $V_{ISOOUT}$ | Insulation power output. The pin needs to be connected to pin11 in application. |

## Absolute Maximum Ratings

General test conditions: Free-air, normal operating temperature range (unless otherwise specified).

| Parameters | Unit |
|---|---|
| Supply voltage, (Vcc) | -0.5V to +6V |
| Logic-side input voltage Vin | -0.5V to $V_{CC}$+0.5V |
| Bus-side voltage (CANH, CANL) | -40 to 40V |
| Output current $I_O$ | -10mA to +10mA |
| Junction temperature $T_J$ | < 150℃ |
| Operating temperature range | -40°C to +125°C |
| Storage temperature range | -65°C to +150°C |

Important: Exposure to absolute maximum rated conditions for an extended period may severely affect the device reliability, and stress levels exceeding the "Absolute Maximum Ratings" may result in permanent damage. All voltage values are based on the reference ground(GND) maximum voltage not exceeding 6V.

## Recommended Operating Conditions

| Parameters | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | Power supply | 4.5 | 5 | 5.5 | V |
| $V_I$ or $V_{IC}$ | Bus input pin withstand voltage (differential mode) | -40 | | 40 | V |
| $V_{IH}$ | TXD High level output voltage | 2 | | 5.5 | V |
| $V_{IL}$ | TXD low level output voltage | 0 | | 0.8 | V |
| $T_A$ | Operating temperature range | -40 | | 125 | °C |
| $T_J$ | Junction temperature $T_J$ | -40 | | 150 | °C |
| $T_{J(shutdown)}$ | Thermal shutdown temperature | | 165 | | °C |
| | Signaling rate | | | 5000 | kbps |

## Electrical Characteristics

General test conditions and $V_{CC}=V_{ISO}= 5V$, Ta = 25℃ (unless otherwise specified).

| Parameters | | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Driver** | | | | | | |
| $|V_{O(D)}|$ | Dominant CANH output voltage | Figure 18, $V_{TXD}$ = 0 V, $R_L$ = 60 Ω | 2.75 | 3.5 | 4.5 | V |
| | Dominant CANL output voltage | | 0.5 | 1.5 | 2 | |
| $V_{O(R)}$ | Recessive bus voltage | $V_{TXD}$ = 2 V, No load | 2 | 2.5 | 3 | V |
| $V_{OD(D)}$ | Differential output voltage | Figure 18, $V_{TXD}$ = 0 V, $R_L$ = 60 Ω | 1.5 | 2 | 3 | V |
| $V_{OD(R)}$ | Recessive differential output voltage | $R_L$=60 Ω | -0.05 | | 0.05 | V |
| $I_{IH}$ | TXD High-level input current | $V_{TXD}$ =2 V | | | 20 | uA |
| $I_{IL}$ | TXD Low-level input current | $V_{TXD}$ =0.8 V | -20 | | | uA |
| CMTI | Common Mode Transient Immunity | $V_I$ = 0 or $V_I$ =$V_{CC}$ | | 180 | | kV/us |
| **Receiver** | | | | | | |
| $V_{IT+}$ | Positive-going input threshold voltage | | | | 900 | mV |
| $V_{IT-}$ | Negative-going input threshold voltage | | 500 | | | mV |
| $V_{hys}$ | Hysteresis voltage ($V_{IT+}$ - $V_{IT-}$) | | | 120 | | mV |
| $V_{OH}$ | High-level output voltage | Figure 19; $I_{OH}$ = –4 mA | $V_{CC}$ – 0.4 | 4.8 | | V |
| $V_{OL}$ | Low-level output voltage | Figure 19; $I_{OL}$ = 4 mA | 0 | 0.2 | 0.4 | V |
| $R_{IN}$ | Input resistance (CANH or CANL) | $V_{TXD}$ = 3 V | 10 | | 100 | kΩ |
| $R_{I(m)}$ | Input resistance matching: $[1 - R_{IN(CANH)} / R_{IN(CANL)}] \times 100\%$ | $V_{CANH}$ = $V_{CANL}$ | -5% | 0% | 5% | -- |
| **Supply and Protection** | | | | | | |
| $V_{ISO}$ | Isolated power output voltage | No load, $I_{ISO}$=0mA | 4.75 | 5.06 | 5.3 | V |
| $I_{VCC}$ | Supply Current(Logic side) | $V_I$ = 0 V, $R_L$ = 60 Ω, Access to the main dynamic protection | | 75 | 120 | mA |
| | | $V_I$ = $V_{CC}$, hostage-taking | | 23 | 30 | |
| ESD | HBM Mode | CANH, CANL inter-pin to GND | | | ±8 | kV |
| | Contact discharge Mode | CANH, CANL | | | ±2 | kV |
| Insulation characteristics | Isolation voltage | Input-Output, Leakage current<1mA Rise time 3s, Fall time 1s | | | 5000 | VAC |
| | Insulation resistance | | 1 | | | GΩ |

## Transmission Characteristics

General test conditions and $V_{CC}=V_{ISO}= 5V$, Ta = 25℃ (unless otherwise specified).

| Parameters | | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{onTxD}$ | Propagation delay TXD On to bus active | Figure 20 $R_L$ = 60 Ω, $C_L$ = 100 pF | | 75 | 110 | ns |
| $t_{offTxD}$ | Propagation delay TXD Off to bus inactive | | | 85 | 120 | ns |
| $t_r$ | Differential output signal rise time | | | 30 | 60 | ns |
| $t_f$ | Differential output signal fall time | | | 30 | 60 | ns |
| $t_{onRxD}$ | Propagation delay RXD On to receiver active | | | 85 | 130 | ns |
| $t_{offRxD}$ | Propagation delay RXD Off to receiver inactive | | | 85 | 130 | ns |
| $t_r$ | Output Signal Rise | | | 3 | 6 | ns |
| $t_f$ | Output Fall Time | | | 3 | 6 | ns |
| $T_{loop}$ | $T_{loop}$ delay | | | 160 | 210 | ns |
| $t_{TXD\_DTO}$ | Dominant time-out time | $C_L$=100 pF | 0.3 | | 5 | ms |

## Physical Specifications

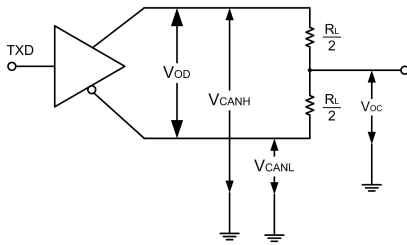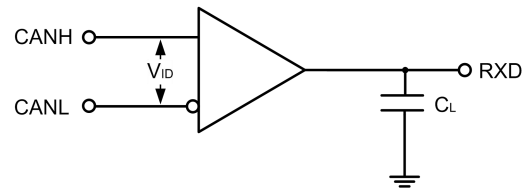| Parameters | Value | Unit |
|---|---|---|
| Weight | 0.4(Typ.) | g |

Figure 18. Driver test circuit
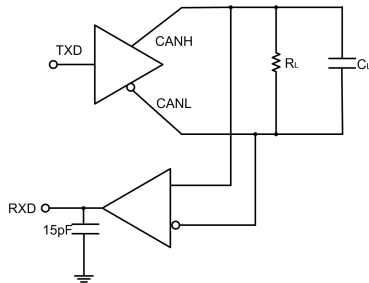


Figure 19. Receiver test circuit



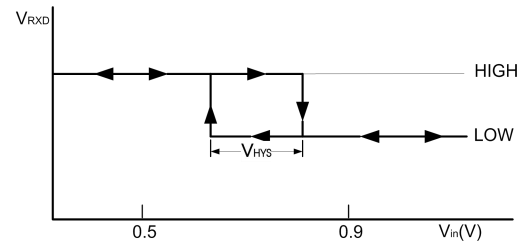Figure 20. Switching characteristics test circuit
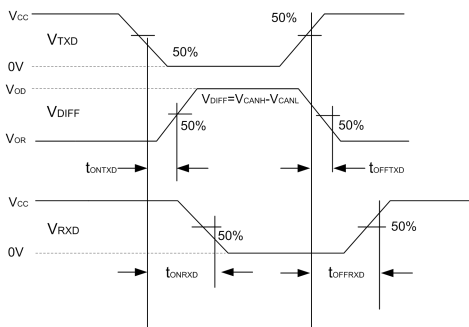


Figure 21. Receiver input hysteresis



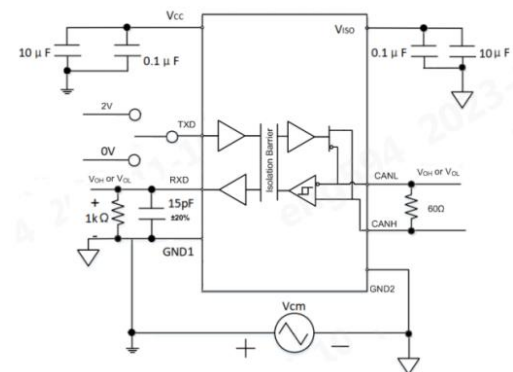Figure 22. Drive and receiver propagation delay



Figure 23.CMTI Test Circuit

## Detailed Description

TD551SCANH3 is a CAN of a style of separation transceiver with the ability of differential signal transmission between the bus and CAN protocol controller, it the inner integration insulate DC/DC power supply.which is compliant with ISO11898-2 standard.

Short-circuit protection: TD551SCANH3 has current-limiting protection to prevent the drive circuit from short-circuiting to positive and negative supply voltages. The power dissipation increases when a short circuit occurs. The short-circuit protection function protects the driver stage from damage.

Over-temperature protection: TD551SCANH3 has over-temperature protection. When the junction temperature exceeds 150°C, the current in the driver stage will decrease. Because the drive tube is the primary energy consuming component, current reduction can reduce power consumption and reduce chip temperature. At the same time, the rest of the chip remains functional.

Dominant time-out function: TD551SCANH3 has dominant time-out function to prevent if the pin TXD is forced to a permanent low level due to a hardware or software application failure, the built-in TXD dominant timeout timer circuit prevents the bus line from being driven to a permanent dominant state (blocking all network traffic). The timer is triggered by the negative edge on pin TXD.

If the low level on pin TXD lasts longer than the internal timer value ($t_{TXD\_OTD}$), the transmitter will be disabled and the drive bus will enter a recessive state. The timer is reset by the positive edge on pin TXD.
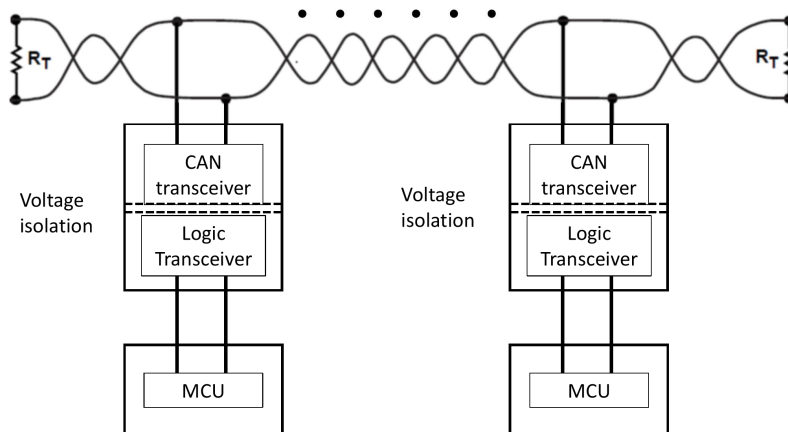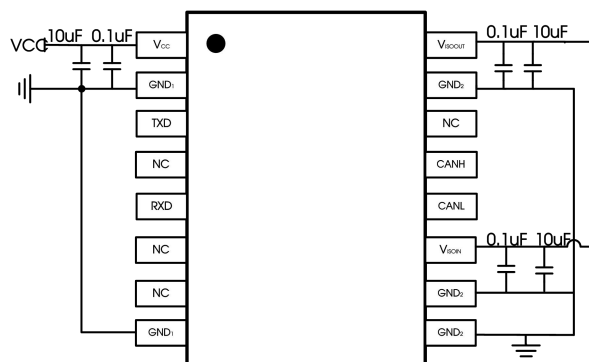
*Figure24. Typical application circuit*



*Figure25. Typical Application of PCB layout*

PCB Design Instructions

1. The decoupling capacitors (0.1uF)and energy storage capacitor(10uF) of VCC and GND1, $V_{ISO}$ and GND2 should be placed as close the chip pins as possible to the chip pins to reduce loop area and parasitic inductance of PCB traces. General control should be 2mm. The decoupling capacitor is placed close the chip, and the energy storage capacitor is placed outside. As shown in Figure 25-1.
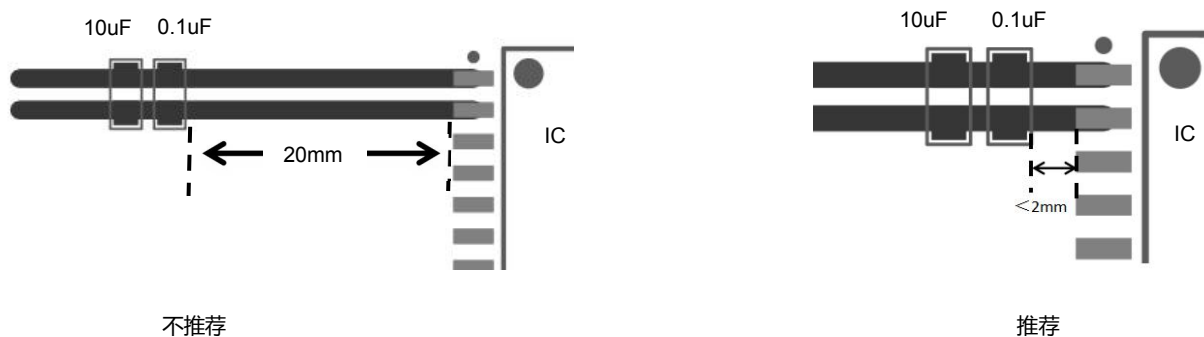


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Figure 25-1

2. The power line width should be designed at least 0.5mm when wiring.

3. When it is necessary to place vias in the power supply line and the ground wire, the position of the vias should be placed on the outside of the capacitor relative to the chip pins, ather than between the capacitor and the chip, as shown in the figure25-2 below to reduce the number of vias effect of parasitic inductance.
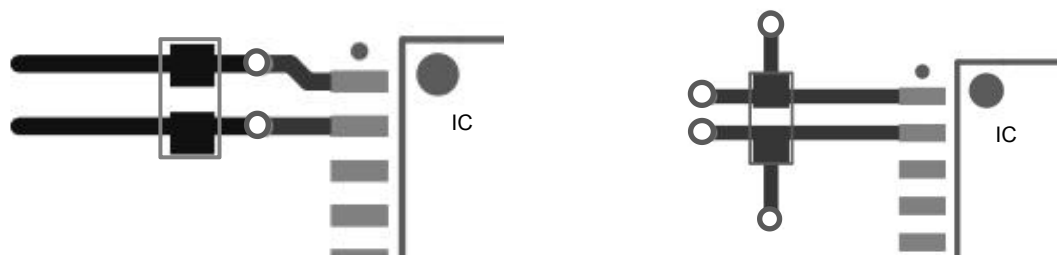
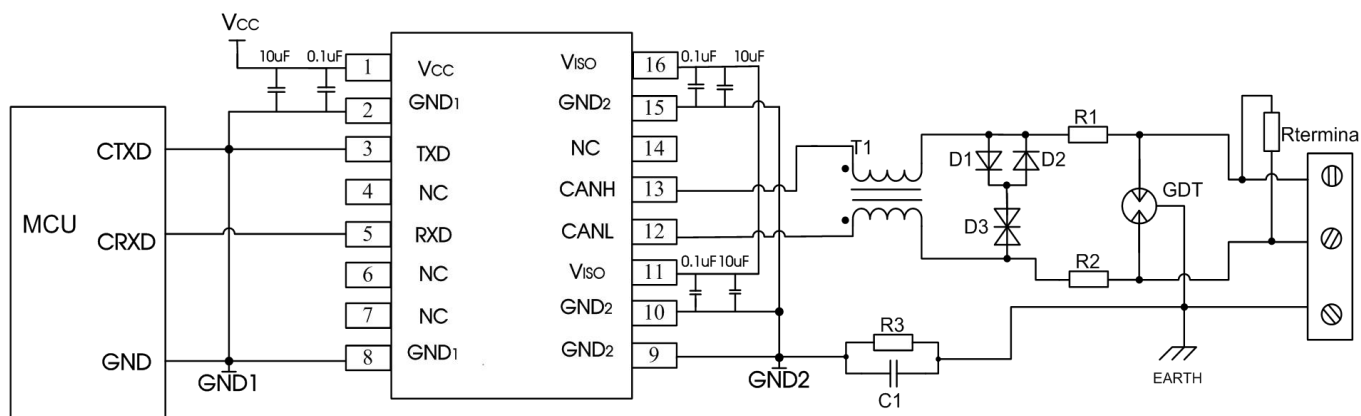Not Recommended                                           Recommended

Figure 25-2



*Figure26. Port protection circuit for harsh environments*

Recommend components and values:

| Component | Recommend part, value | Component | Recommend part, value |
|---|---|---|---|
| R3 | 1MΩ | D1、D2 | 1N4007 |
| C1 | 1nF, 2kV | D3 | SMBJ30CA |
| T1 | ACM2520-301-2P | Rterminal | 120Ω |
| GDT | B3D090L | R1、R2 | 2.7Ω/2W |

When the module is used in applications with harsh environment, it can be susceptible to large energy like lightning strike, etc. in which case, it is essential to add an adequate protection circuit to the CAN signal ports to protect the system from failure and maintain a reliable bus communication. Figure 26 provides a Recommend protection circuit design for high-energy lightning surges, with a degree of protection related to the selected protection device. Parameter description lists a set of Recommend circuit parameters, which can be adjusted according to the actual application situation. Also, when using the shielded cable, the reliable single-point grounding of the shield must be achieved.

Note: The Recommend components and values is a general guideline only and must be verified for the actual user's application. We Recommend using PTC's for R1 and R2 and to use fast recovery diodes for D1 and D2.
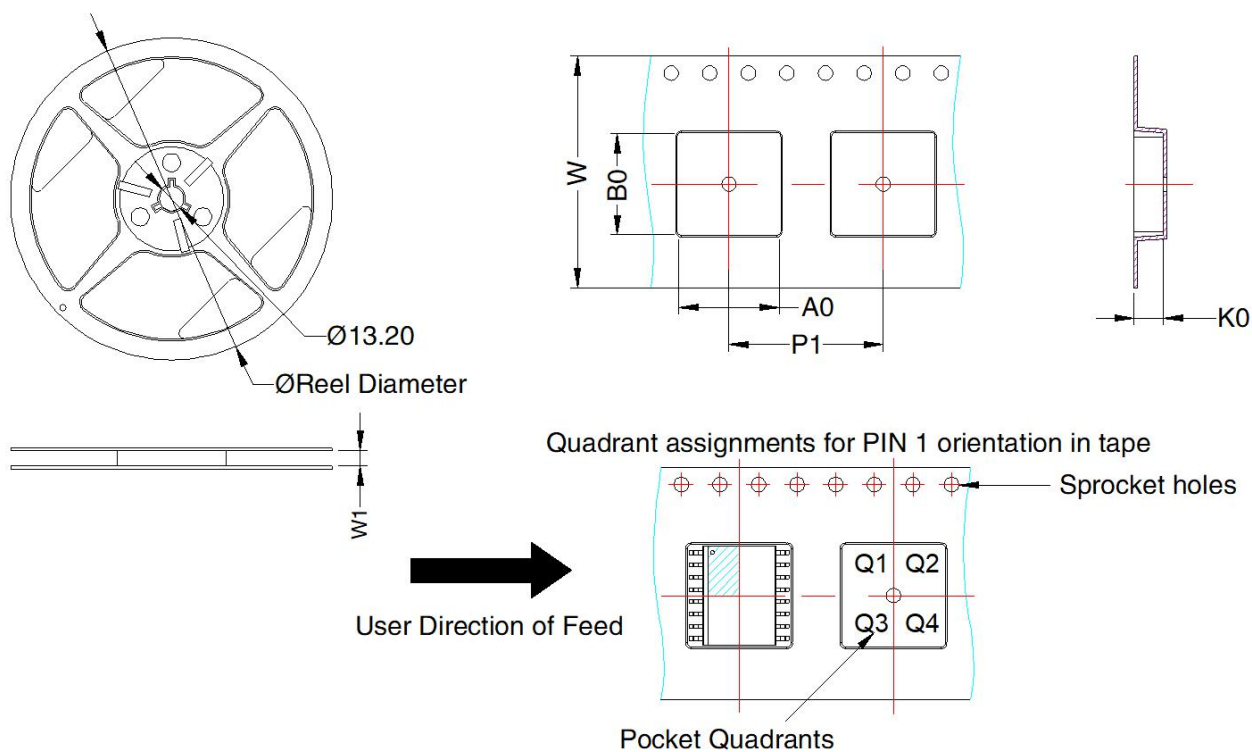
## Ordering Information

| Part number | Package | Number of pins | Product marking | Tape & Reel |
|---|---|---|---|---|
| TD551SCANH3 | SOIC | 16 | TD551SCANH3 | 340/REEL |

THIRD ANGLE PROJECTION
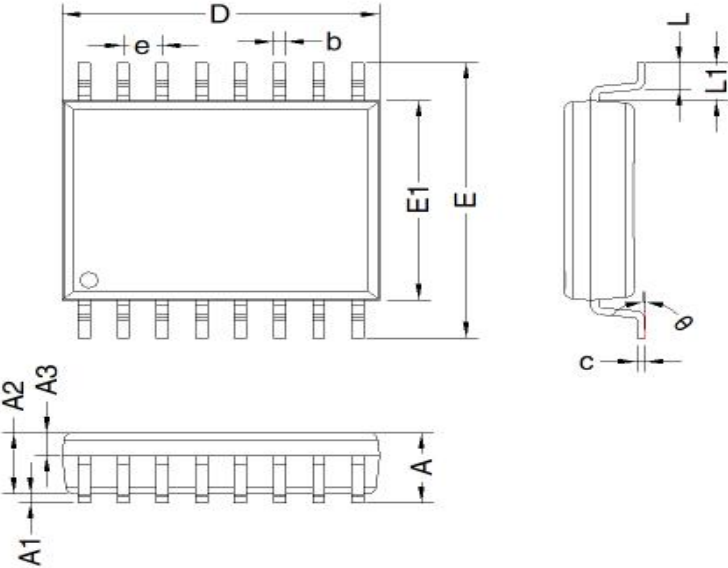
| Max | Unit (mm) | |
|---|---|---|
| | Min | Max |
| A | – | 2.65 |
| A1 | 0.10 | 0.30 |
| A2 | 2.25 | 2.35 |
| A3 | 0.97 | 1.07 |
| b | 0.35 | 0.43 |
| c | 0.24 | 0.29 |
| D | 10.20 | 10.40 |
| e | 1.27 BSC | |
| E | 10.10 | 10.50 |
| E1 | 7.40 | 7.60 |
| L | 0.55 | 0.85 |
| L1 | 1.40 BSC | |
| θ | 0° | 8° |

Ø13.20

ØReel Diameter

W1

W

B0

A0

P1

K0

Quadrant assignments for PIN 1 orientation in tape

Sprocket holes

User Direction of Feed

Q1 Q2
Q3 Q4

Pocket Quadrants

| Package Type | Pin | MPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|
| SOIC−16 | 16 | 340 | 180.0 | 16.4 | 10.74 | 10.65 | 3.05 | 16.0 | 16.0 | Q1 |

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