

Low power consumption single RS485 isolated transceiver module, SMD package



RoHS



FEATURES

- Ultra-low quiescent current, 8 mA
- Small size, SMD package
- Integrated high efficient isolated DC-DC converter
- High baud rate up to 19200bps
- Two-port isolation test voltage (2.5kVDC)
- Operating ambient temperature range: -40°C to +85°C
- The bus supports maximum 16 nodes
- Set isolation and ESD bus protection in one
- Used in coal mines, chemical industries request ultra-low power consumption

The main function of the TD331S485-L / TD531S485-L series is to convert a logic level signal into isolated RS485 differential level signals. The special integrated IC technology of the RS485 transceiver achieves isolation between the power supply and the signal lines isolation, does RS485 communication and protects the bus all in one and the same module. The product's isolated power supply withstands a test voltage of up to 2500VDC. The Products are using pick and place SMD technology, thus enabling the use of fully automated processing. Also, they can easily be embedded in the user's end equipment, to achieve fully functional RS485 network connections. The products feature ultra-low power consumption and are guaranteed in coal mines, chemical industry areas with continue operating at low energy consumption.

Selection Guide

| Certification | Part No. | Power Input (VDC) | Baud Rate (kbps) | Static Current (mA)(typ.) | Max.Operating Current (mA)(typ) | Isolated Power output (typ.) (VDC) | Number of Nodes |
|---------------|-------------|-------------------|------------------|---------------------------|---------------------------------|------------------------------------|-----------------|
| CE(May) | TD331S485-L | 3.15-3.45 | 19.2 | 8 | 90 | 5 | 16 |
| | TD531S485-L | 4.75-5.25 | 19.2 | 8 | 70 | 5 | 16 |

Absolute Limits

| Item | Operating Conditions | Min. | Typ. | Max. | Unit |
|---------------------------------|---|------|------|------|------|
| Input Surge Voltage (1sec.max.) | 3.3V series | -0.7 | -- | 5 | VDC |
| | 5.0V series | -0.7 | -- | 7 | |
| Reflow Soldering Temperature | Peak temp. ≤245°C, duration ≤60s max.at 217°C. For details, please refer to IPC/JEDEC J-STD-020D.1. | | | | |

3.3V Input Specifications

| Item | Symbol | Min. | Typ. | Max. | Unit |
|----------------------------|---|----------------|------|------|------|
| Power Supply Input Voltage | VCC | 3.15 | 3.3 | 3.45 | VDC |
| TXD Logic Level | High-level | $0.7 * V_{CC}$ | -- | 3.6 | |
| | Low-level | 0 | -- | 0.8 | |
| RXD Logic Level | High-level | $V_{CC} - 0.4$ | 3.1 | -- | |
| | Low-level | 0 | 0.2 | 0.4 | |
| TXD Drive Current | I _T | 2 | -- | -- | mA |
| CON Drive Current | I _{CON} | -- | -- | 5 | |
| RXD Output Current | I _R | -- | -- | 3.5 | |
| Serial Interface | Compatible with + 3.3 V UART interface only | | | | |

5.0V Input Specifications

| Item | Symbol | Min. | Typ. | Max. | Unit |
|----------------------------|------------------|----------------|------|------|------|
| Power Supply Input Voltage | VCC | 4.75 | 5 | 5.25 | VDC |
| TXD Logic Level | High-level | $0.7 * V_{CC}$ | -- | 5.5 | |
| | Low-level | 0 | -- | 0.8 | |
| RXD Logic Level | High-level | $V_{CC} - 0.4$ | 4.8 | -- | |
| | Low-level | 0 | 0.2 | 0.4 | |
| TXD Drive Current | I _T | 2 | -- | -- | mA |
| CON Drive Current | I _{CON} | -- | -- | 5 | |

| | | | | | |
|--------------------|---|---|----|-----|--|
| RXD Output Current | I_R | - | -- | 3.5 | |
| Serial Interface | Compatible with + 5 V UART interface only | | | | |

Transmission Specifications

| Item | Symbol | Min. | Typ. | Max. | Unit | |
|---------------|-----------------------|-------|------|------|------|----|
| Data Delay | TXD Transmitter Delay | t_r | 2 | 3 | 4 | us |
| | RXD Receiver Delay | t_R | 2 | 3 | 4 | |
| Handoff Delay | | -- | 5 | 18 | | |

Output Specifications

| Item | Symbol | Min. | Typ. | Max. | Unit |
|---------------------------------|---------------------------------------|----------------|------|------|-------------|
| Difference Level | $V_{diff(\alpha)}$, $R_L=90\ \Omega$ | 1.5 | 2 | -- | VDC |
| Difference Load Resistance | | 90 | -- | -- | Ω |
| Difference Input Impedance | $-7V \leq V_{CM} \leq +12V$ | 96 | -- | -- | $k\ \Omega$ |
| Built-in Pull-down Resistor | | -- | 2.7 | -- | |
| Isolation Power Output Voltage* | Nominal input voltage | 4.9 | 5 | 5.5 | VDC |
| Bus Interface Protection | | ESD protection | | | |

Note: *Isolated output power pins are for external pull-up, pull-down resistors only (recommended maximum current <25mA) and are not meant for any other purpose.

Truth Table Specifications

| Transceiver Control | Input | | Output | | |
|-----------------------------|-------|----------------------------|-----------------|---|-----|
| | CON | TXD | A | B | RXD |
| Send Status | 0 | 1 | 1 | 0 | 1 |
| | 0 | 0 | 0 | 1 | 1 |
| Receive Status ^① | CON | V_A-V_B | RXD | | |
| | 1 | $\geq -10mV$ | 1 | | |
| | 1 | $\leq -200mV$ | 0 | | |
| | 1 | $-200mV < V_A-V_B < -10mV$ | Undefined state | | |

Note: ①Receiving threshold varies with V_{CC} will produce subtle error.

General Specifications

| Item | Operating Conditions | Value |
|--|---|-------------------------------|
| Isolation Test | Electric strength test for 1 minute, leakage current <1mA | 2500VDC |
| Insulation Resistance | At 500VDC | 1000M Ω (input-output) |
| Operating Temperature | | -40°C to +85°C |
| Transportation And Storage Temperature | | -50°C to +105°C |
| Operating Humidity | Non-condensing | 10% - 90% |
| Safety Class | | CLASS III |

Mechanical Specifications

| | |
|----------------|---|
| Case Material | WH9100-F (UL94 V-0) |
| Dimensions | SMD12; Dimension 17.00 x 12.14 x 9.45mm |
| Weight | 2.8g (Typ.) |
| Cooling Method | Free air convection |

Electromagnetic Compatibility (EMC)

| Emissions | CE | CISPR32/EN55032 | CLASS B (see Fig. 4) | |
|-----------|-------|------------------|---|------------------|
| Immunity | ESD | IEC/EN 61000-4-2 | Contact $\pm 4kV$ / Air $\pm 8kV$ (A, Bport, without external components) | Perf. Criteria B |
| | RS | IEC/EN 61000-4-3 | 10V/m (without external components) | Perf. Criteria B |
| | EFT | IEC/EN 61000-4-4 | $\pm 2kV$ (without external components, signal port) | Perf. Criteria B |
| | | IEC/EN 61000-4-4 | $\pm 4kV$ (see Fig.2, A, B port) | Perf. Criteria B |
| | Surge | IEC/EN 61000-4-5 | $\pm 2kV$ (without external components, common mode, A, B port) | Perf. Criteria B |

| | | |
|----|--------------------------|------------------|
| CS | IEC/EN 61000-4-6 3Vr.m.s | Perf. Criteria A |
|----|--------------------------|------------------|

Application Precautions

1. Carefully read and follow the instructions before use; contact our technical support if you have any question;
2. Do not use the product in hazardous areas;
3. Use only DC power supply source for this product. 220V AC power supply is prohibited;
4. It is strictly forbidden to disassemble the product privately in order to avoid product failure or malfunction.

After-sales service

1. Factory inspection and quality control are strictly enforced before shipping any product; please contact your local representative or our technical support if you experience any abnormal operation or possible failure of the module;
2. The products have a 3-year warranty period, from the date of shipment. The product will be repaired or exchanged free of charge within the warranty period for any quality problem that occurs under normal use.

Applied circuit

Refer to the RS485 Isolated Industrial Bus Interface Module Application Manual.

Design Reference

1. Typical application circuit

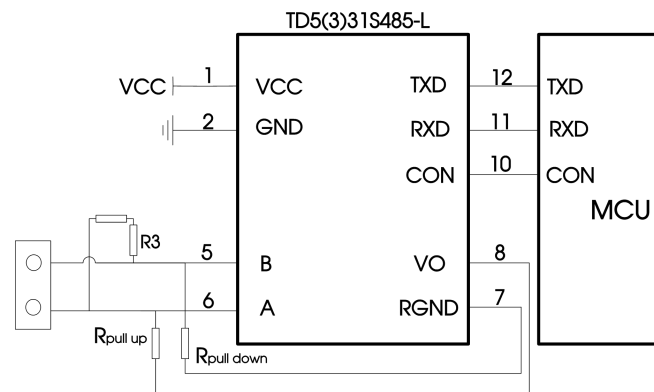


Fig. 1: Typical application

Figure 1 shows a typical connection circuit for the isolated transceiver module TD331S485-L and TD531S485-L. The TD531S485-L module's power supply must be 5V and match the module's TXD, RXD and CON pin interface level of 5V (not supporting any 3.3V system levels). Accordingly, TD331S485-L module's power supply must be 3.3V and match the module's TXD, RXD and CON pin interface level of 3.3V (not supporting any 5V system levels).

The module has a built-in 2.7kΩ pull-down resistor, which under normal circumstances meets the demand for the use of internal pull-up and pull-down resistors. Depending on the actual circuit, the use of additional external R pull-up and R pull-down resistor may be chosen.

2. Recommended port protection circuit

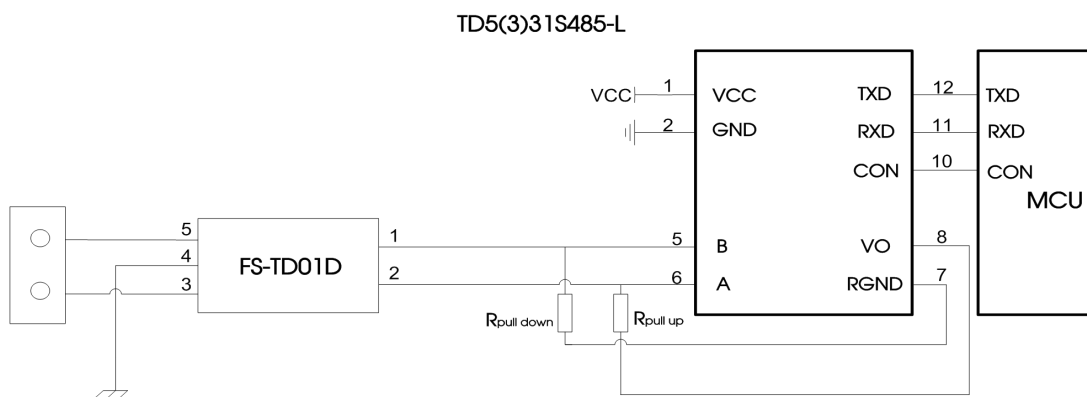


Fig. 2: Port protection circuit for harsh environments

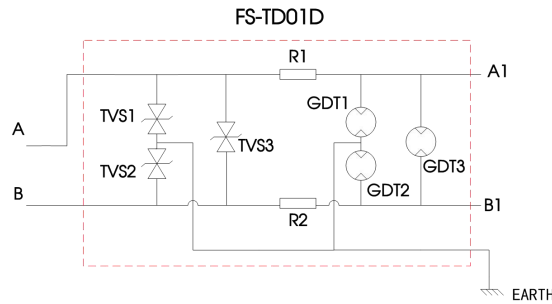
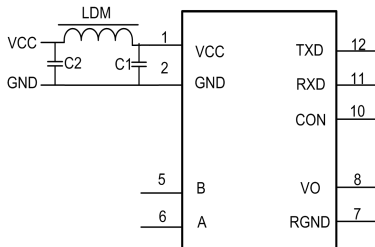


Fig. 3: Recommended protection circuit

Note: Ground shield of twisted wire pair reliably.
Recommended components and values:

| Component | Recommended part, value |
|------------------|-------------------------|
| GDT1, GDT2, GDT3 | S30-A90X |
| TVS1, TVS2, TVS3 | SMBJ15CA |
| R1, R2 | 12 Ω /2W |

As the modules internal A / B lines come with its own ESD protection, which generally satisfy most application environments without the need for additional ESD protection devices, as shown in the typical circuit in Figure 1. For harsh and noisy application environments such as motors, high voltage/current switches, lightning and similar however, we recommended that the user protects the module's A / B lines with additional measures and external components such as TVS tube, common mode inductors, Gas discharge tube, shielded twisted pair of wires with the same single network Earth point. To simplify application design, we recommend to use FS-TD01D which is surge protectegated module. Figure 2 shows our recommended circuit diagram for such type of applications with components and values given in the table above. This recommendation is for reference only and may have to be adapted accordingly with appropriate component values in order to match the actual situation and application.



| Component | Recommended part, value |
|-----------|-------------------------|
| C1, C2 | 1uF/16V |
| LDM | CD43-12uH |

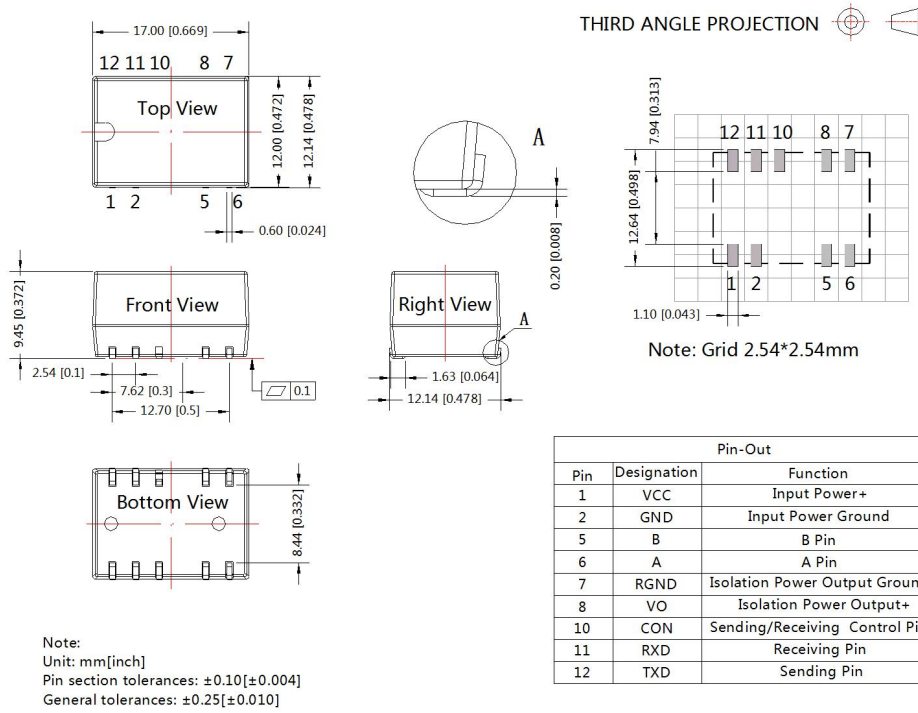
Fig.4

3. Precautions

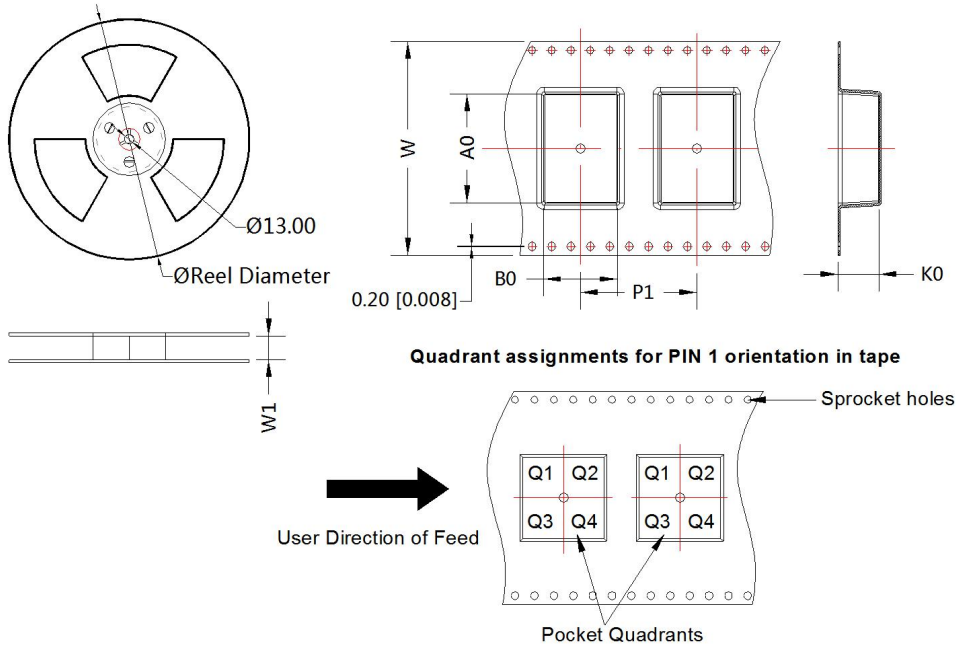
- Hot-swap is not supported.
- TD531S485-L is for 5V TTL level only (not compatible with 3.3V); TD331S485-L is for 3.3V TTL level only (not compatible with 5V).
- Pin3, Pin4 and Pin9 are not drawn. Please leave pin7 open if unused.
- We recommend using a shielded twisted pair of wires for the Data transmission line and using same single point earth connection for each of the networks.
- From the truth table characteristics, it can be derived that the isolated RS-485 transceiver module's CON pin is low to send data and high when receiving data. Note that the general 485 transceiver chip control level is exactly the opposite, therefore, if the customer desires to change the level to the ordinary 485 transceiver chip control level, we recommend using a transistor circuit between the MCU and the CON feed to reverse this signal.
- Reference the truth table characteristics: When the A / B line differential voltage of the series of embedded isolated RS-485 transceiver module is $\geq -10\text{mV}$, the modules receiving level is high and when the A / B line differential voltage is $\leq -200\text{mV}$ the modules receiving level is low; the modules receiving level is undefined when the A / B line differential voltage is greater than -200mV but less than -10mV , so the design is to ensure that the module will not be receiving this state. Depending on the actual situation, it is up to the user of the RS-485 network design or application to decide whether to add a 180Ω termination resistor. Avoiding data communication errors: Regardless if the RS-485 network is static or dynamic, it is essential to avoid that the differential voltage of A / B line ever comes between -200mV and -10mV . For long distance use, the terminal resistance value can be appropriately reduced to meet this principle.

4. For additional information, please refer to our application note on www.mornsun-power.com

Dimensions and Recommended Layout



Package diagram:



| Device | Package Type | Pin | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-------------|--------------|-----|-----|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TDx31S485-L | SMD | 9 | 300 | 330.0 | 32.5 | 17.72 | 12.92 | 10.5 | 20.0 | 32.0 | Q1 |

Notes:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. The Tube Packaging bag number: 58240014; The Roll Packaging bag number: 58240013;
2. Unless otherwise specified, parameters in this datasheet were measured under the conditions of $T_a=25^{\circ}\text{C}$, humidity<75%RH with nominal input voltage and rated output load;
3. All index testing methods in this datasheet are based on company corporate standards;
4. The above are the performance indicators of the product models listed in this datasheet. Some indicators of non-standard models will exceed the above requirements. For details, please contact our technical staff;
5. We can provide product customization service;
6. Products are related to laws and regulations: see "Features" and "EMC";
7. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

MORNSUN Guangzhou Science & Technology Co., Ltd.

Address: No. 5, Kehui St. 1, Kehui Development Center, Science Ave., Guangzhou Science City, Huangpu District, Guangzhou, P. R. China
Tel: 86-20-38601850 Fax: 86-20-38601272 E-mail: info@mornsun.cn www.mornsun-power.com