

Single high-speed RS485 isolated transceiver module (automatic switching), SMD package



RoHS



### FEATURES

- Small size, SMD package
- Integrated high efficient isolated DC-DC converter
- Automatic send and receive data function
- High baud rate of up to 150kbps
- Two-port isolation test voltage (2.5kVDC)
- Operating ambient temperature range: -40°C to +85°C
- The bus supports maximum 128 nodes
- Set isolation and ESD bus protection in one

The main function of the TD331S485H-A / TD531S485H-A 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. In addition, the product features an automatic switching function, that no longer requires the need to pass through the node to send and receive control signals, which to a certain extent, reduces the design complexity. 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.

### Selection Guide

| Certification | Part No.     | Power input (VDC) | Baud rate (kbps) | Static Current (mA) | Max. Operating Current (mA) | Isolated power output (typ.)(VDC) | Number of Nodes |
|---------------|--------------|-------------------|------------------|---------------------|-----------------------------|-----------------------------------|-----------------|
| EN            | TD331S485H-A | 3.15-3.45         | 150              | 37                  | 90                          | 5                                 | 128             |
|               | TD531S485H-A | 4.75-5.25         | 150              | 40                  | 90                          | 5                                 | 128             |

### 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                                  | 0.7V <sub>CC</sub>   | --   | 3.6  |      |
|                            | Low-level                                   | 0                    | --   | 0.8  |      |
| RXD Logic Level            | High-level                                  | V <sub>CC</sub> -0.4 | 3.1  | --   |      |
|                            | Low-level                                   | 0                    | 0.2  | 0.4  |      |
| TXD Drive Current          | I <sub>T</sub>                              | 2                    | --   | --   | mA   |
| RXD Output Current         | I <sub>R</sub>                              | --                   | --   | 10   |      |
| 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                                | 0.7V <sub>CC</sub>   | --   | 5.5  |      |
|                            | Low-level                                 | 0                    | --   | 0.8  |      |
| RXD Logic Level            | High-level                                | V <sub>CC</sub> -0.4 | 4.8  | --   |      |
|                            | Low-level                                 | 0                    | 0.2  | 0.4  |      |
| TXD Drive Current          | I <sub>T</sub>                            | 2                    | --   | --   | mA   |
| RXD Output Current         | I <sub>R</sub>                            | --                   | --   | 10   |      |
| Serial Interface           | Compatible with + 5 V UART interface only |                      |      |      |      |

Transmission Specifications

| Item       | Symbol                | Min.           | Typ. | Max. | Unit |
|------------|-----------------------|----------------|------|------|------|
| Data Delay | TXD Transmitter Delay | $t_{\text{r}}$ | --   | 5    | us   |
|            | RXD Receiver Delay    | $t_{\text{r}}$ | --   | 5    |      |

Output Specifications

| Item                            | Symbol                             | Min.           | Typ. | Max. | Unit      |
|---------------------------------|------------------------------------|----------------|------|------|-----------|
| Difference Level                | $V_{\text{diff(ol)}}$ , No load    | 1.5            | --   | --   | VDC       |
| Difference Input Impedance      | $-7V \leq V_{\text{CM}} \leq +12V$ | 96             | --   | --   | $k\Omega$ |
| Built-in Pull-down Resistor     |                                    | --             | 47   | --   |           |
| 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          |   |     |
|-----------------------------|--|-----------------|---|-----|
|                             | TXD  | A               | B | RXD |
| Send Status                 | 1  | 1               | 0 | 1   |
|                             | 0  | 0               | 1 | 1   |
| Receive Status <sup>①</sup> | $V_A - V_B$                                | RXD             |   |     |
|                             | $\geq -20\text{mV}$                        | 1               |   |     |
|                             | $\leq -220\text{mV}$                       | 0               |   |     |
|                             | $-220\text{mV} < V_A - V_B < -20\text{mV}$ | Undefined state |   |     |

Note: The receive threshold varies slightly with Vcc.

General Specifications

| Item                                   | Operating Conditions                                      | Value                         |
|--|---|-------------------------------|
| Isolation Test                         | Electric Strength Test for 1 minute, leakage current <1mA | 2500VDC                       |
| Insulation Resistance                  | At 500VDC   | 1000M $\Omega$ (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 Standard                        |   | EN62368-1 (Report)            |
| Safety Class                           |   | CLASS III                     |
| Moisture Sensitivity Level (MSL)       | IPC/JEDEC J-STD-020D.1                                    | Level 1                       |

Note: \* For actual application, please refer to IPC/JEDEC J-STD-020D.1.

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 A (see Fig. 3)   |                  |
|-----------|-------|------------------|--|------------------|
| Immunity  | ESD   | IEC/EN 61000-4-2 | Contact $\pm 4\text{kV}$ / Air $\pm 8\text{kV}$ (A, B port, without external components) | Perf. Criteria B |
|           | EFT   | IEC/EN 61000-4-4 | $\pm 2\text{kV}$ (A, B port)   | Perf. Criteria B |
|           | Surge | IEC/EN 61000-4-5 | $\pm 2\text{kV}$ (line to ground) (A, B port, common mode, without external components)  | Perf. Criteria B |
|           | CS    | IEC/EN 61000-4-6 | 3Vr.m.s (without external components)  | 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. AC power supply is prohibited;
4. It is strictly forbidden to disassemble the product privately in order to avoid product failure or malfunction.
5. Hot-swap is not supported;
6. If the external input of TXD is insufficient, the pull-up resistor should be added according to the situation.

### 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

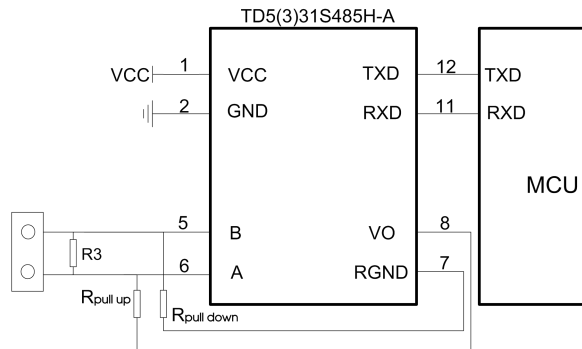


Fig. 1: Typical application

Figure 1 shows a typical connection circuit for the isolated transceiver module TD331S485H-A and TD531S485H-A. The TD531S485H-A module's power supply must be 5V and match the module's TXD and RXD pin interface level of 5V (not supporting any 3.3V system levels). Accordingly, TD331S485H-A module's power supply must be 3.3V and match the module's TXD and RXD pin interface level of 3.3V (not supporting any 5V system levels).

The module has a built-in 47kΩ 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

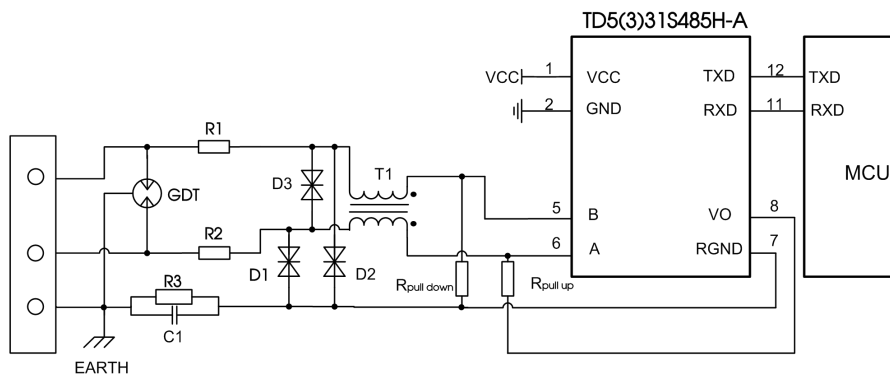


Fig. 2: Port protection circuit for harsh environments

Note: Ground shield of twisted wire pair reliably.

Recommended components and values:

| Component | Recommended part, value | Component | Recommended part, value |
|-----------|-------------------------|-----------|-------------------------|
| R3        | 1M $\Omega$             | R1、R2     | 2.7 $\Omega$ /2W        |
| C1        | 1nF, 2kV                | D1、D2     | SMBJ6.5CA               |
| T1        | ACM2520-301-2P          | D3        | SMBJ6.5CA               |
| GDT       | B3D090L                 |           |                         |

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, when used in low level EMS conditions (eg EFT at 2kV ), please refer to the typical circuit in Figure 1. For harsh and noisy application environments such as motors, high voltage/current switches, lightning, EFT at 4kV and similar however, we recommended that the user protects the module's A / B lines with additional measures and external components such as TVS, common mode inductors, gas discharge tube, shielded twisted pair of wires with the same single network Earth point. 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.



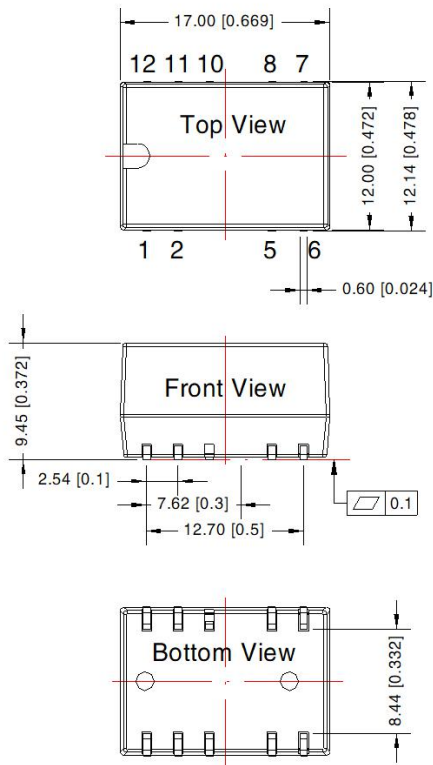
Fig. 3

### 3. Precautions

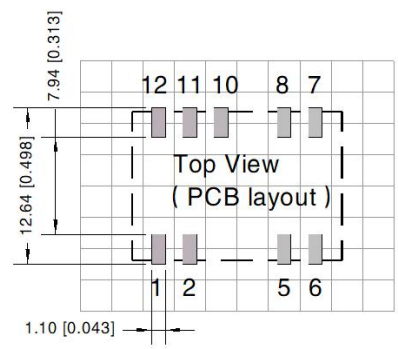
- 1) TD531S485H-A is for 5V TTL level only (not compatible with 3.3V TTL level); TD331S485H-A is for 3.3V TTL level only (not compatible with 5V).
- 2) Pin3, Pin4, Pin9 and Pin10 are not drawn. Please leave pin7 open if unused.
- 3) We recommend using a shielded twisted pair of wires for the Data transmission line and using same single point earth connection for each of the networks.
- 4) Reference the truth table characteristics: When the A / B line differential voltage of the series of embedded isolated RS-485 transceiver module is  $\geq -20\text{mV}$ , the modules receiving level is high and when the A / B line differential voltage is  $\leq -220\text{mV}$  the modules receiving level is low; the modules receiving level is undefined when the A / B line differential voltage is greater than  $-220\text{mV}$  but less than  $-20\text{mV}$ , 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 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  $-220\text{mV}$  and  $-20\text{mV}$ .

4. For additional information, please refer to our application note on [www.mornsun-power.com](http://www.mornsun-power.com)

Dimensions and Recommended Layout



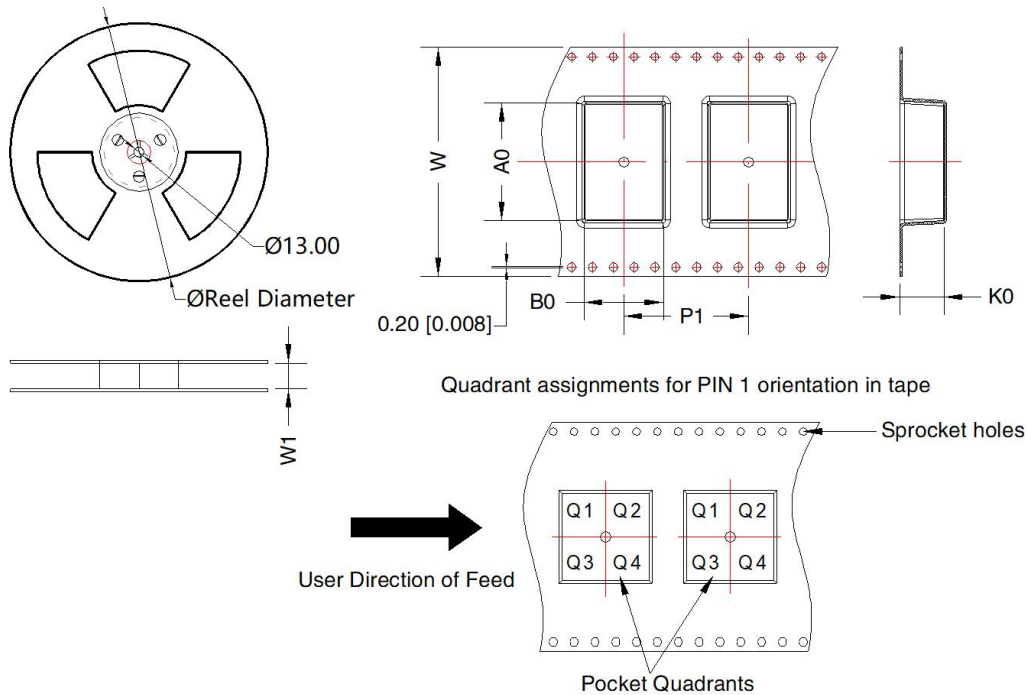
THIRD ANGLE PROJECTION



Note:  
 Unit: mm[inch]  
 Pin section tolerances:  $\pm 0.10[\pm 0.004]$   
 General tolerances:  $\pm 0.25[\pm 0.010]$

| Pin-Out |      |                               |
|---------|------|-------------------------------|
| Pin     | Mark | Function                      |
| 1       | VCC  | Input Power+                  |
| 2       | GND  | Input Power Ground            |
| 5       | B    | B Pin                         |
| 6       | A    | A Pin                         |
| 7       | RGND | Isolation Power Output Ground |
| 8       | VO   | Isolation Power Output+       |
| 10      | NC   | No Function Pin               |
| 11      | RXD  | Receiving Pin                 |
| 12      | TXD  | Sending Pin                   |

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    | SMD          | 9   | 300 | 330.0              | 32.5               | 17.72   | 12.92   | 10.5    | 20.0    | 32.0   | Q1            |
| TDx31S485H   | SMD          | 9   | 300 | 330.0              | 32.5               | 17.72   | 12.92   | 10.5    | 20.0    | 32.0   | Q1            |
| TDx31S485H-E | SMD          | 9   | 300 | 330.0              | 32.5               | 17.72   | 12.92   | 10.5    | 20.0    | 32.0   | Q1            |
| TDx31S485H-A | 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](http://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 performance indexes of the product models listed in this datasheet are as above, but some indexes of non-standard model products will exceed the above-mentioned requirements, and please directly contact our technician for specific information;
5. We can provide product customization service, please contact our technical staff;
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.

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