

Single high speed high isolation RS485 isolation transceiver module



RoHS

EN62368-1

## FEATURES

- Integrated high efficient isolated DC-DC converter
- High baud rate of up to 115200bps
- Two-port isolation test voltage(3.75kVAC)
- Operating ambient temperature range: -40℃ to +85℃
- The bus supports maximum 32 nodes
- Set isolation and ESD bus protection in one

The main function of the TDH301D485H/TDH501D485H 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 3750VAC. 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 Supply Input (VDC) | Baud Rate (bps) | Static Current (mA) | Maximum Operating Current(mA) | Number Of Nodes |
|---------------|-------------|--------------------------|-----------------|---------------------|-------------------------------|-----------------|
| EN            | TDH301D485H | 3.15-3.45                | 115200          | 50                  | 180                           | 32              |
|               | TDH501D485H | 4.75-5.25                | 115200          | 40                  | 130                           | 32              |

## 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    |      |
| Pin Soldering Temperature       | Soldering spot 1.5mm away from case, 10s max. | --   | --   | 300  | ℃    |

## 3.3V series Input Specifications

| Item                       |            | Symbol                                      | Min.                 | Typ. | Max.                 | Unit |
|----------------------------|------------|---|----------------------|------|----------------------|------|
| Power Supply Input Voltage |            | V <sub>CC</sub>                             | 3.15                 | 3.3  | 3.45                 | VDC  |
| TXD Logic Level            | High-level | V <sub>IH</sub>                             | 0.7V <sub>CC</sub>   | --   | V <sub>CC</sub> +0.5 |      |
|                            | Low-level  | V <sub>IL</sub>                             | 0                    | --   | 0.8                  |      |
| RXD Logic Level            | High-level | V <sub>OH</sub>                             | V <sub>CC</sub> -0.4 | --   | V <sub>CC</sub>      |      |
|                            | Low-level  | V <sub>OL</sub>                             | —                    | --   | 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 series Input Specifications

| Item                       |            | Symbol                                    | Min.                 | Typ. | Max.                 | Unit |
|----------------------------|------------|---|----------------------|------|----------------------|------|
| Power Supply Input Voltage |            | V <sub>CC</sub>                           | 4.75                 | 5    | 5.25                 | VDC  |
| TXD Logic Level            | High-level | V <sub>IH</sub>                           | 0.7V <sub>CC</sub>   | --   | V <sub>CC</sub> +0.5 |      |
|                            | Low-level  | V <sub>IL</sub>                           | 0                    | --   | 0.8                  |      |
| RXD Logic Level            | High-level | V <sub>OH</sub>                           | V <sub>CC</sub> -0.4 | --   | V <sub>CC</sub>      |      |
|                            | Low-level  | V <sub>OL</sub>                           | --                   | --   | 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                      | tr   | --   | 7    | us   |
|                                  | RXD Receiver Delay                         | tr   | --   | 7    |      |
| Transceiver switching delay time | Switch from receiving data to sending data | --   | 5    | 18   |      |
|                                  | Switch from sending data to receiving data | --   | 30   | 100  |      |

## Output Specifications

| Item                        | Symbol                        | Min.           | Typ. | Max. | Unit       |
|-----------------------------|-------------------------------|----------------|------|------|------------|
| Difference Level            | $V_{diff(d)}, R_L=54\ \Omega$ | 1.5            | 2    | —    | VDC        |
| Difference Input Impedance  | $-7V \leq V_{CM} \leq +12V$   | 96             | —    | —    | k $\Omega$ |
| Built-in Pull-down Resistor |                               | —              | 5.1  | —    |            |
| Bus Interface Protection    |                               | ESD protection |      |      |            |

## 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 <sup>①</sup> | CON   | $V_A-V_B$                  | RXD             |   |     |
|                             | 1     | $\geq -20mV$               | 1               |   |     |
|                             | 1     | $\leq -220mV$              | 0               |   |     |
|                             | 1     | $-220mV < V_A-V_B < -20mV$ | Undefined state |   |     |

Note: ① Receiving threshold varies with Vcc will produce subtle error.

## General Specifications

| Item                                   | Operating Conditions                                    | Value   |
|--|---|---|
| Isolation Test                         | Electric strength test for 1 min., leakage current <5mA | 3750VAC   |
| Insulation Resistance                  | At 500VDC   | 1000M $\Omega$  |
| Operating Temperature                  |   | -40℃ to +85℃  |
| Transportation and Storage Temperature |   | -55℃ to +105℃   |
| Operating Humidity                     | Non-condensing  | 10% - 90%   |
| Max. Case Temperature                  | Ta=25℃, Free air convection                             | 25℃   |
| Safety Standard                        |   | EN62368-1 (Report)  |
| Safety Class                           |   | CLASS III   |
| Application Environment                |   | The presence of dust, severe vibration, shock and corrosive gas may cause damage to the product |

## Mechanical Specifications

|                |   |
|----------------|---|
| Case Material  | Black flame-retardant heat-proof plastic (UL94 V-0) |
| Dimensions     | DIP10 (20 x 17 x 12.8mm)                            |
| Weight         | 4.0g(Typ.)  |
| Cooling Method | Free air convection                                 |

## Electromagnetic Compatibility (EMC)

|           |     |   |
|-----------|-----|---|
| Emissions | CE  | CISPR32/EN55032 CLASS A (see Fig.3)                 |
|           | RE  | CISPR32/EN55032 CLASS A (see Fig.3)                 |
| Immunity  | ESD | IEC/EN 61000-4-2 Contact $\pm 4kV$ Perf. Criteria B |

|       |   |                  |
|-------|---|------------------|
| EFT   | IEC/EN 61000-4-4 ±2kV (see Fig.2, Signal port)                                      | Perf. Criteria B |
| Surge | IEC/EN 61000-4-5 ±2kV (line to line)/±4kV (line to ground) (see Fig.2, Signal port) | Perf. Criteria B |

## 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 and 220V 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

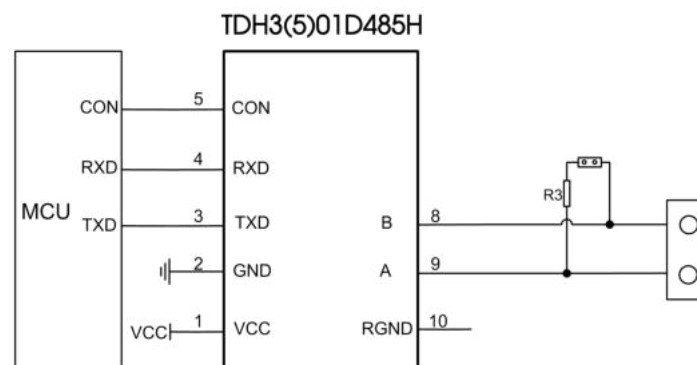


Fig.1

Figure 1 shows a typical connection circuit for the isolated transceiver module TDH301D485H and TDH501D485H. The TDH501D485H 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, TDH301D485H 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).

### 2. Recommended port protection circuit

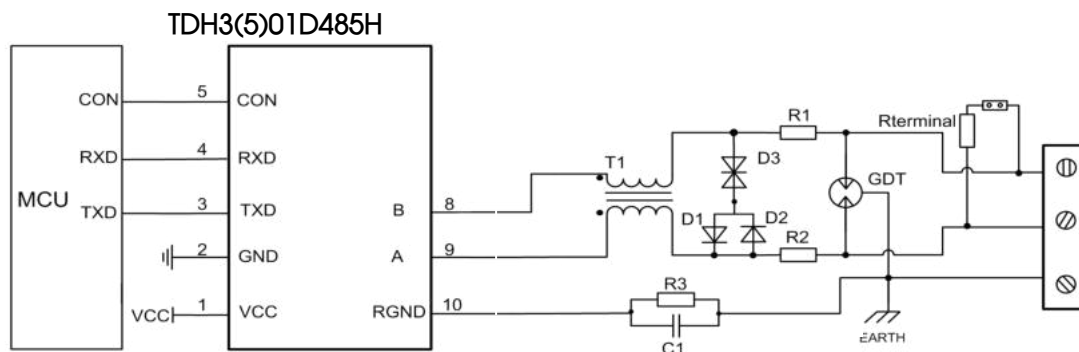


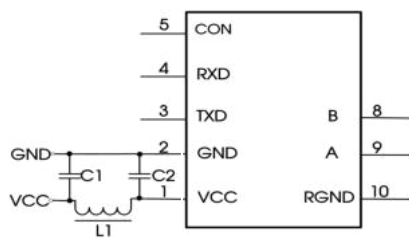
Fig.2

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     | 1N4007                  |
| T1        | ACM2520-301-2P          | D3        | SMBJ8.5CA               |
| GDT       | B3D090L                 | Rterminal | 120 $\Omega$            |

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, 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.



| Component | Recommended part, value |
|-----------|-------------------------|
| C1, C2    | 1uF/50V                 |
| L1        | 12uH                    |

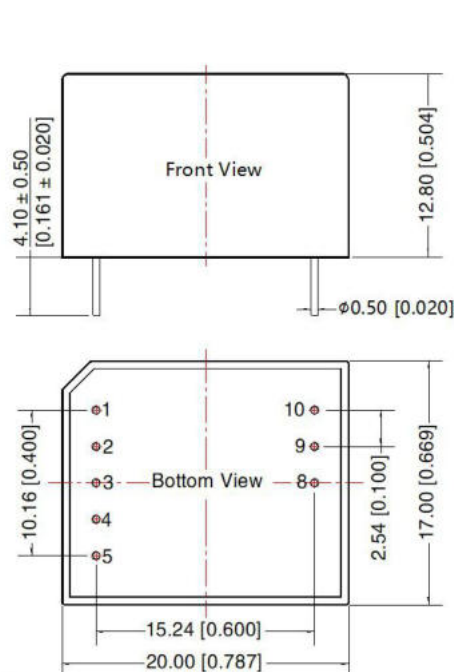
Fig.3

### 3. Precautions

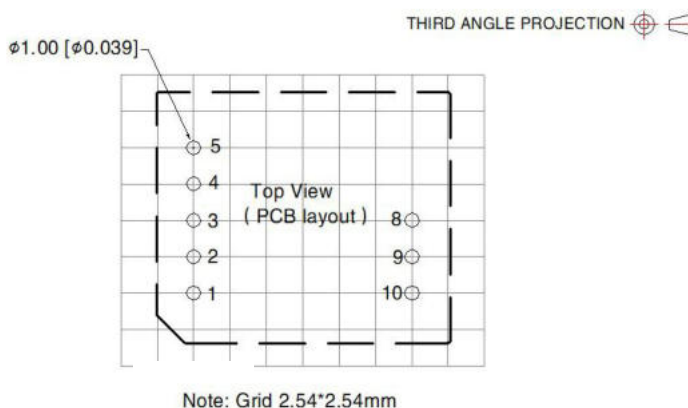
- 1) TDH501D485H is for 5V TTL level only (not compatible with 3.3V); TDH301D485H is for 3.3V TTL level only (not compatible with 5V).
- 2) Pin6 and Pin7 are not drawn. Please leave pin 10 open if unused.
- 3) We recommend using a shielded twisted pair of wires for the Data transmission line and using same single point earth connection for each of the networks.
- 4) 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.
- 5) 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 120 $\Omega$  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 Recommended Layout



Note:  
Unit: mm[inch]  
Pin diameter tolerances :  $\pm 0.10 [\pm 0.004]$   
General tolerances:  $\pm 0.50 [\pm 0.020]$   
The layout of the device is for reference only, please refer to the actual product



| Pin-Out |      |                             |
|---------|------|-----------------------------|
| Pin     | Mark | Function                    |
| 1       | VCC  | Input Power                 |
| 2       | GND  | GND                         |
| 3       | TXD  | TDH_D485H Send Pin          |
| 4       | RXD  | TDH_D485H Receiving Pin     |
| 5       | CON  | Send&Receiving Control Pin  |
| 8       | B    | TDH_D485H B Pin             |
| 9       | A    | TDH_D485H A Pin             |
| 10      | RGND | Isolation Power Output RGND |

### Notes:

- For additional information on Product Packaging please refer to [www.mornsun-power.com](http://www.mornsun-power.com). The Packaging bag number: 58220015;
- If wave soldering was being performed, it is recommended that the PCB cover on the bottom of the product should not be opened to avoid thermal deformation of the product base;
- 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;
- All index testing methods in this datasheet are based on company corporate standards;
- 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;
- We can provide product customization service, please contact our technical staff;
- Products are related to laws and regulations: see "Features" and "EMC";
- 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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