## FEATURES

1. Single input power supply
2. No isolated output power pin
3. Up to 256 nodes can be connected
4. Extremely low electromagnetic radiation (EMI)
5. Operating temperature range: -40°C ~ +85°C
6. Integrated isolation, signal isolation, and bus ESD protection




RoHS CE 3 years Warranty

## Product Description

The TD301D485H-E / TD501D485H-E modules primarily convert logic levels to RS-485 protocol differential levels while providing signal isolation. These are RS-485 protocol transceiver modules that integrate power isolation, signal isolation, RS-485 communication, and bus protection using IC integration technology. The product includes a built-in regulated isolated power supply, achieving 2500VDC electrical isolation. The module can be easily embedded into user equipment, enabling easy connection to an RS-485 protocol network.

## Selection Guide

| Part No. | Voltage Range (VDC) | Quiescent Current (mA, Typ) | Max Operating Current (mA) | Baud Rate (kbps) | Node Count (pcs) | Type |
|---|---|---|---|---|---|---|
| TD301D485H-E | 3.3 （3.15~3.45） | 36 | 130 | 500 | 256 | High-Speed |
| TD501D485H-E | 5 (4.75~5.25) | 32 | 100 | 500 | 256 | High-Speed |

## Absolute Maximum Ratings

| Items | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Input voltage range | TD301D485H-E | -0.7 | 3.3 | 5 | VDC |
| | TD501D485H-E | -0.7 | 5 | 7 | VDC |
| Pin soldering temperature | Hand soldering @3~5 sec | -- | 370 | -- | ℃ |
| | Wave soldering @5~10 sec | -- | 265 | -- | ℃ |
| Hot Plug | unavailable | | | | |
| Note：This series of modules does not have input reverse polarity protection. Reverse connection of input positive and negative is strictly prohibited, as it will cause irreversible damage to the module. | | | | | |

# Input Characteristics

| Item | | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| Input voltage | | $V_{CC}$ | TD301D485H-E | 3.15 | 3.3 | 3.45 | VDC |
| | | | TD501D485H-E | 4.75 | 5 | 5.25 | |
| TXD logic level | High level | $V_{IH}$ | | $0.7V_{CC}$ | -- | $V_{CC}$+0.5 | |
| | Low level | $V_{IL}$ | | 0 | -- | $0.3V_{CC}$ | |
| RXD logic level | High level | $V_{OH}$ | $I_{RXD}$=-2mA | 2.0 | -- | -- | |
| | Low level | $V_{OL}$ | $I_{RXD}$=2mA | -- | -- | 0.8 | |
| CON control level | High level | $V_{CON_H}$ | TD301D485H-E | 2.3 | -- | $V_{CC}$+0.5 | |
| | | | TD501D485H-E | 3.8 | -- | $V_{CC}$+0.5 | |
| | Low level | $V_{CON_L}$ | | 0 | -- | $0.3V_{CC}$ | |
| TXD drive current | | $I_{TXD}$ | | -- | -- | 2 | mA |
| CON drive current | | $I_{CON}$ | | -- | 5 | -- | |
| RXD output current | | $I_{RXD}$ | | -- | -- | 2 | |
| TXD pull-up resistor | | $R_{TXD}$ | | -- | 5.1 | -- | kΩ |
| Serial interface | | | TD301D485H-E | 3.3V standard UART interface | | | |
| | | | TD501D485H-E | 5V standard UART interface | | | |

# Output Characteristics

| Item | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Built-in isolated output supply voltage | $V_O$ | Nominal input voltage | -- | -- | -- | mA |
| Differential output voltage (A-B) | $V_{OD}$ | Nominal input voltage, differential load 54Ω | 1.5 | -- | VO | |
| Differential output current (A-B) | $I_{OD}$ | | 28 | -- | -- | |
| Bus interface protection | | | ESD protection | | | |

# Transmission Characteristics

| Item | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Built-in pull-up/pull-down resistor | | | -- | 120 | -- | kΩ |
| Transceiver input impedance | | -7V≤VCM≤+12V | 96 | -- | -- | |
| Data transmit delay | | | -- | 400 | -- | ns |
| Data receive delay | | | -- | 150 | -- | |
| Transceiver state delay | $T_{RTT}$, $T_{TTR}$ | -- | -- | 25 | | μs |

# Truth Table Characteristics

| Item | Input | | Output | |
|---|---|---|---|---|
| Transmit Function | CON | TXD | A | B |
| | 0 | 1 | 1 | 0 |
| | 0 | 0 | 0 | 1 |
| Receive Function | CON | $V_A$-$V_B$ | RXD | |
| | 1 | ≥-10mV | 1 | |
| | 1 | ≤-200mV | 0 | |
| | 1 | -200mV＜$V_A$-$V_B$＜-10mV | Indeterminate | |

# General Characteristics

| Item | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Electrical isolation | | Isolation between input and output | | | |
| Isolation voltage | Test time 1 minute, leakage <5mA, humidity <95% | -- | 2.5K | -- | VDC |
| Operating temperature range | Output at full load | -40 | -- | +85 | ℃ |
| Storage temperature | -- | -55 | -- | +105 | ℃ |
| Storage humidity | Non-condensing | -- | -- | 95 | % |
| Case temperature rise during operation | | -- | 20 | -- | ℃ |
| Operating environment | Dust, strong vibration, shock, and corrosive gases may damage the product | | | | |

# Mechanical Characteristics

| | |
|---|---|
| **Case Material** | Black flame-retardant heat-resistant plastic (UL94-V0) |
| **Dimensions** | 19.50 × 16.50 × 7.10 mm |
| **Weight** | 4.0g (Typ.) |
| **Cooling Method** | Free air convection |

# EMC Characteristics

| | | | |
|---|---|---|---|
| **EMS** | ESD | IEC/EN 61000-4-2 Contact ±4KV/Air ±8KV(bare module) | Perf.Criteria B |
| | | IEC/EN 61000-4-2 Contact ±8KV/Air ±15KV (with recommended circuit Figure 5) | Perf.Criteria B |
| | EFT | IEC/EN 61000-4-4 ±2KV | Perf.Criteria B |
| | Surge | IEC/EN 61000-4-5 Common mode ±2KV (bare module) | Perf.Criteria B |
| | | IEC/EN 61000-4-5 Differential ±2KV, Common mode ±4KV (with recommended circuit Figure 5) | Perf.Criteria B |
| | CS | IEC/EN61000-4-6 3Vr.m.s | Perf.Criteria A |

# Product Characteristic Curves

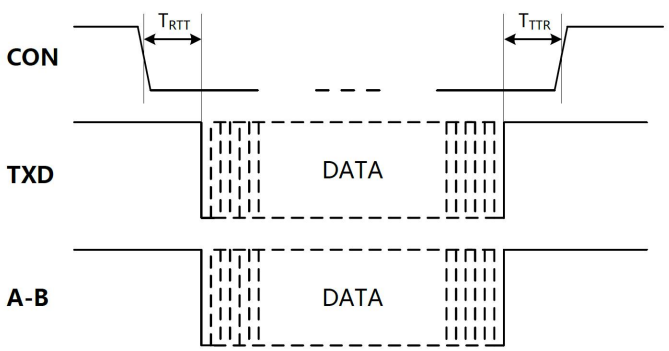



Figure 1. TDx01D485H-E Module Data Transmit Timing Diagram

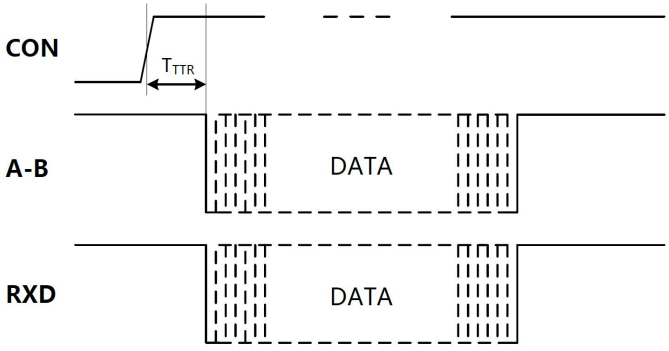



Figure 2. TDx01D485H-E Module Data Receive Timing Diagram

# Typical Application

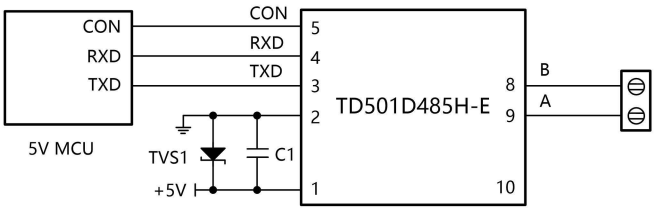



Figure 3. MCU 5V Power Supply Application Circuit

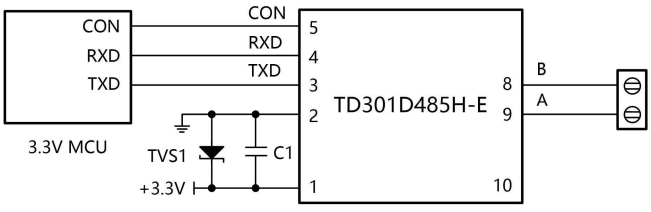



Figure 4. MCU 3.3V Power Supply Application Circuit

Figure 3 shows the connection diagram for a 5V MCU system UART interface with the TD501D485H-E isolated transceiver module. The module must be powered by a 5V supply. The TXD, RXD, and CON pin interface levels are 5V and do not support 3.3V system logic.

Figure 4 shows the connection diagram for a 3.3V MCU system UART interface with the TD301D485H-E isolated transceiver module. The module must be powered by a 3.3V supply. The TXD, RXD, and CON pin interface levels are 3.3V and do not support 5V system logic.

# EMC Typical Recommended Circuit

Since the module has built-in pull-up/pull-down resistors and ESD protection devices on the A/B lines, additional ESD protection devices are generally not required in benign environments, as shown in the typical connection circuit diagrams in Section 8.1. However, if the application environment is harsh (e.g., high voltage power, lightning, etc.), it is recommended to add external protection measures such as TVS tubes, common mode chokes, surge arresters, shielded twisted pair cables, or single-point earth grounding for the same network at the module's A/B line terminals.

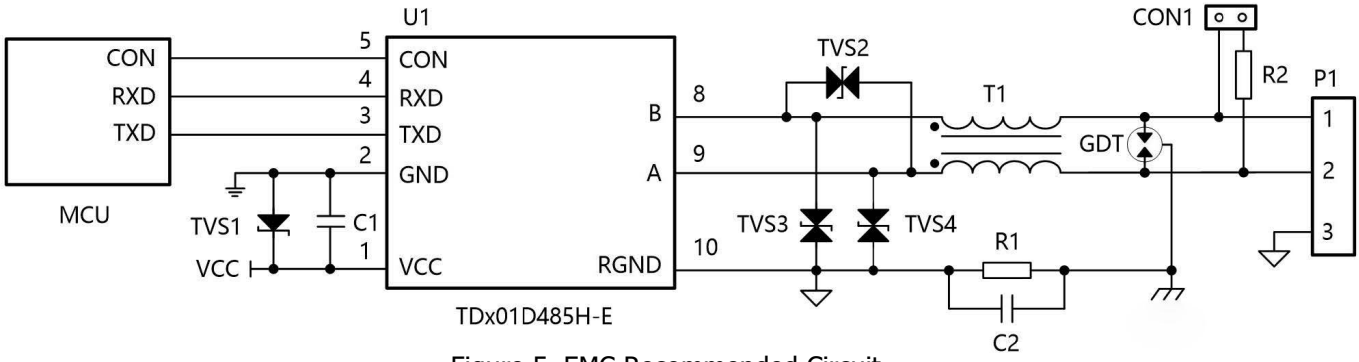


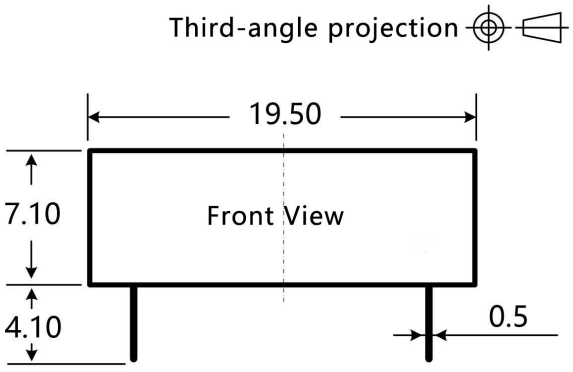

Figure 5. EMC Recommended Circuit

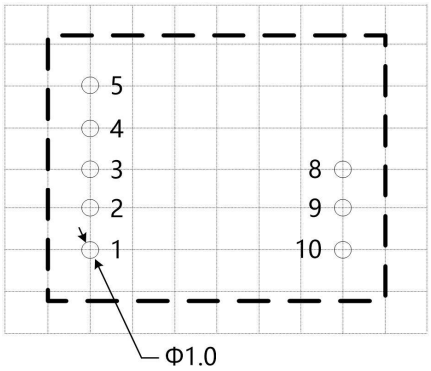
To meet specific surge immunity levels, the recommended protection circuit shown in Figure 5 is suggested. Table 1 provides a set of recommended component parameters. The recommended circuit and parameter values are for reference only; appropriate values should be determined based on actual conditions.

| Designator | Model/Value | Designator | Model/Value |
|---|---|---|---|
| C1 | 10μF, 25V | TVS1 | SMBJ5.0A |
| C2 | 102, 2KV, 1206 | TVS2 | SMBJ12CA |
| GDT | 3RL090M-5-S | TVS3, TVS4 | SMBJ6.5CA |
| R1 | 1MΩ, 1206 | T1 | B82793S0513N201 |
| R2 | 120Ω, 1206 | U1 | TDx01D485H-E Module |

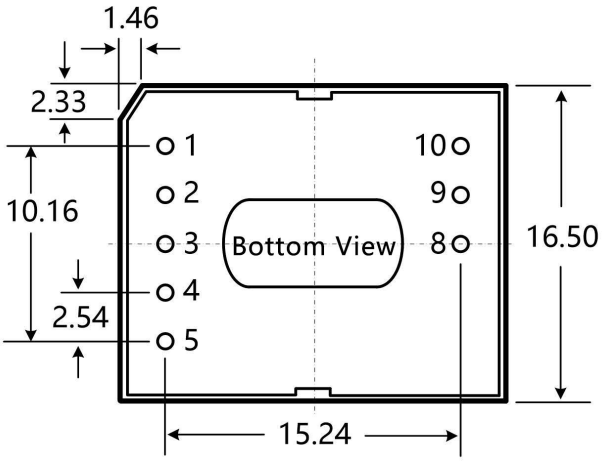
Table 1. EMC Recommended Parameters

# Product Dimensions & Recommended PCB Layout




Note: Grid 2.54 * 2.54mm




Note:
Unit: mm[inch]
Terminal diameter tolerance: ±0.10
Unspecified tolerance: ±0.25

| Pin | Name | Function |
|---|---|---|
| 1 | VCC | Power input positive |
| 2 | GND | Power input ground |
| 3 | TXD | Data transmit pin |
| 4 | RXD | Data receive pin |
| 5 | CON | Transceiver control pin |
| 8 | B | RS-485 B pin |
| 9 | A | RS-485 A pin |
| 10 | RGND | Isolated output power ground |

# Product Usage Precautions

## 1,MCU IO Level Matching

The TXD, RXD, and CON pin interface levels of the TD501D485H-E are 5V and do not support 3.3V system logic. The TXD, RXD, and CON pin interface levels of the TD301D485H-E are 3.3V and do not support 5V system logic.

## 2,RS485 A-B Bus Level Threshold Description

From the truth table characteristics, when the A/B line differential voltage is ≥ -10mV, the module receive level is high; when the A/B line differential voltage is ≤ -200mV, the module receive level is low; when the A/B line differential voltage is between -200mV and -10mV, the module receive level is indeterminate. Design must ensure the module does not operate in this indeterminate state. Therefore, when designing or applying an RS-485 network, users must decide whether to add a 120Ω termination resistor based on actual conditions. The principle is: regardless of whether the RS-485 network is static or dynamic, the A/B line differential voltage must not fall between -200mV and -10mV; otherwise, communication errors may occur.

## 3,Module RS485 Transmit/Receive Data Control Pin CON Level Description

From the truth table characteristics, this series of embedded isolated RS-485 transceiver modules transmits data when the CON pin is low and receives data when the CON pin is high, which is the opposite of standard RS-485 transceiver chip control logic. Therefore, if the user wishes to use the same control logic as standard RS-485 transceiver chips, it is recommended to add an inverting circuit between the MCU and the module's CON pin.

## 4,Module Pin Description

Pins 6 and 7 are not brought out. If pin 10 is not used, leave it floating.

## 5,Module Pin Description

For data transmission lines, use shielded twisted pair cables. The shield of the same network should be single-point grounded to earth. For better noise immunity of the RS-485 network, double-shielded twisted pair cable can be used. Connect the RGND of each node to the inner shield, and single-point ground the outer shield to earth.

## 6,Module Pin Description

For data transmission lines, use shielded twisted pair cables. The shield of the same network should be single-point grounded to earth. For better noise immunity of the RS-485 network, double-shielded twisted pair cable can be used. Connect the RGND of each node to the inner shield, and single-point ground the outer shield to earth.