# ±20-kV ESD Protected, 500-Kbps, Full Fail-safe, RS-485 Transceiver

## Features

- Exceeds Requirements of EIA-485 Standard
- Hot Plug Circuitry - Tx and Rx Outputs Remain Three-State During Power-up/Power-down
- Data Rates: 500 Kbps
- Full Fail-safe (Open, Short, Terminated) Receivers
- Up to 256 Nodes on a Bus (1/8 Unit Load)
- Wide Supply Voltage 3 V to 5.5 V
- Low Quiescent Supply Current: 750 µA
- Bus-Pin Protection:
  - ±20-kV HBM Protection
  - ±15-kV IEC-ESD
- Pb-Free

## Applications

- PROFIBUS® DP and FMS Networks
- SCSI “Fast 40” Drivers and Receivers
- Motor Controller/Position Encoder Systems
- Factory Automation
- Field Bus Networks
- Industrial/Process Control Networks

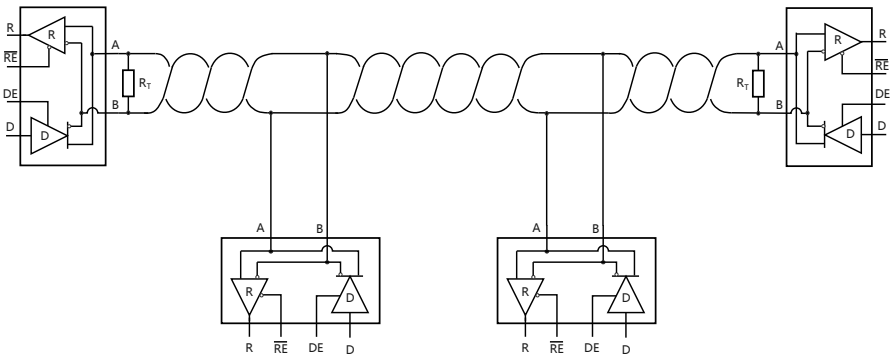
## Description

The TPT487A is the enhanced RS485 which exceeds the standard TIA/EIA-485-A. The TPT487A is a single transceiver for balanced communication with a ±15-kV IEC-ESD protection and a 3-V to 5.5-V power. It also features the larger output voltage and higher data rate (up to 500 Kbps) required by high-speed PROFIBUS applications.

Transmitters in this family deliver exceptional differential output voltages into the RS-485 required 54-Ω load. These 500-Kbps devices have very low bus currents, so they present a true “1/8 unit load” to the RS-485 bus. This allows up to 256 transceivers on the network without using repeaters.

This transceiver requires a 3-V to 5.5-V tolerance supply and delivers at least a 2.1-V differential output voltage on the 5-V supply condition. Receiver (Rx) inputs feature a “Full Fail-Safe” design, which ensures a logic-high Rx output if the Rx inputs are floating, shorted, or terminated but undriven. The Rx outputs feature high drive levels (typically > 25 mA @ $V_{OL}$ = 1 V) to ease the design of optically isolated interfaces. The TPT487A is available in the SOP8, MSOP8, and DFN3×3-8 packages, and is characterized from –40°C to 125°C.

## Typical Application Circuit



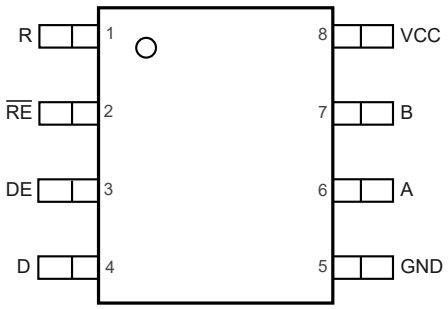
# Table of Contents

## Revision History

| Date | Revision | Notes |
|---|---|---|
| 2024-09-23 | Rev.A.0 | Initial released version. |

## Pin Configuration and Functions

TPT487A
SOP8/MSOP8
−SO1R, −VS1R
Top View




TPT487A
DFN3×3-8
−DF6R
Top View

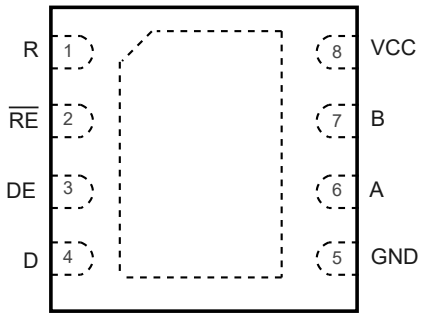



**Table 1. Pin Functions: TPT487A**

| Pin No. | Name | I/O | Description |
|---|---|---|---|
| 1 | R | Digital output | Receiver Output. |
| 2 | $\overline{RE}$ | Digital input | Receiver Output Enable. |
| 3 | DE | Digital input | Driver Output Enable. |
| 4 | D | Digital input | Driver Input. |
| 5 | GND | Ground | Ground. |
| 6 | A | Bus input/output | Noninverting Receiver Input A and Noninverting Driver Output A. |
| 7 | B | Bus input/output | Inverting Receiver Input B and Inverted Driver Output B. |
| 8 | $V_{CC}$ | Power | Power Supply. |

# Specifications

## Absolute Maximum Ratings

| Parameter | Min | Max | Unit |
|---|---|---|---|
| Supply Voltage: $V_{DD}$ to GND | −0.3 | +7 | V |
| Input Voltages: D, DE, RE | –0.3 | ($V_{CC}$) + 0.3 | V |
| Input/Output Voltages A, B | −25 | +25 | V |
| A, B (Transient Pulse Through 100 Ω) (1) | −100 | +100 | V |
| Output Voltage: R | –0.3 | ($V_{CC}$) + 0.3 | V |
| Receiver Output Current | −24 | 24 | mA |
| Short Circuit Duration A, B | | Continuous | |
| Maximum Junction Temperature | | 150 | °C |
| Storage Temperature Range | −65 | 150 | °C |

(1) The support is ±15 V in the receiver mode.
(2) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

## ESD, Electrostatic Discharge Protection

| Symbol | Parameter | Condition | Value | Unit |
|---|---|---|---|---|
| IEC | IEC Contact Discharge | IEC-61000-4-2, Bus Pin: A, B | ±15 | kV |
| | IEC Air-Gap Discharge | IEC-61000-4-2, Bus Pin: A, B | ±20 | kV |
| HBM | Human Body Model ESD (1) | ANSI/ESDA/JEDEC JS-001, Bus Pin: A, B | ±20 | kV |
| | | ANSI/ESDA/JEDEC JS-001, All Pin | ±7 | kV |
| CDM | Charged Device Model ESD (2) | ANSI/ESDA/JEDEC JS-002, All Pin | ±1.5 | kV |
| LU | Latch-up | LU, per JESD78, All Pin (3) | ±500 | mA |

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.
(3) Test at the temperature of 25℃.

## Recommended Operating Conditions

| Parameter | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | 3.0 | | 5.5 | V |
| $V_I$ | Input Voltage at any Bus Terminal | −15 | | 15 | V |
| $V_{IH}$ | High-Level Input Voltage (driver, driver enable, and receiver enable inputs) | 2 | | VCC | V |
| $V_{IL}$ | Low-Level Input Voltage (driver, driver enable, and receiver enable inputs) | 0 | | 0.8 | V |

| Parameter | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $V_{ID}$ | Differential Input Common-Mode Voltage | −15 | | 15 | V |
| $I_O$ | Output Current, Driver | −60 | | 60 | mA |
| $I_O$ | Output Current, Receiver | −8 | | 8 | mA |
| $R_L$ | Differential Load Resistance | 54 | | | Ω |
| $T_A$ | Operating Ambient Temperature | −40 | | +125 | °C |

(1) Tested according to TIA/EIA-485-A, Section 4.2.6 (±100 V for 15 μs at a 1% duty cycle).

## Thermal Information

| Package Type | $\theta_{JA}$ | $\theta_{JC}$ | Unit |
|---|---|---|---|
| SOP8 | 120 | 60 | °C/W |
| MSOP8 | 135 | 68 | °C/W |
| DFN3×3-8 | 70 | 25 | °C/W |

## Electrical Characteristics

All test conditions: $V_{CC}$ = 3.0 V to 5.5 V, $T_A$ = −45°C to +125°C, unless otherwise noted.

| Symbol | Parameter | Conditions | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| **Driver** | | | | | | | |
| $\|V_{OD}\|$ | Driver Differential-Output Voltage Magnitude | $R_L$ = 60 Ω with $V_A$ or $V_B$ from −7 to +12 V, $V_{CC}$ = 4.5 V~5.5 V | See Figure 1B | 2.0 | 3.5 | | V |
| | | $R_L$ = 60 Ω with $V_A$ or $V_B$ from −7 to +12 V, $V_{CC}$ = 3.0 V~3.6 V | | 1.5 | 2.3 | | V |
| | | $R_L$ = 54 Ω, $V_{CC}$ = 5 V | See Figure 1B | 2.0 | 3.4 | | V |
| | | $R_L$ = 54 Ω, $V_{CC}$ = 3 V | | 1.5 | 2.2 | | V |
| | | $R_L$ = 100 Ω, $V_{CC}$ = 5 V | | 2.7 | 3.9 | | V |
| | | $R_L$ = 100 Ω, $V_{CC}$ = 3 V | | 2.0 | 2.6 | | V |
| $\Delta\|V_{OD}\|$ | Change in Magnitude of Driver Differential-Output Voltage | $R_L$ = 100 Ω, $C_L$ = 50 pF | See Figure 1A | −50 | | 50 | mV |
| | | $R_L$ = 54 Ω, $C_L$ = 50 pF | See Figure 1A | −50 | | 50 | mV |
| $V_{OC(SS)}$ | Steady-Stage Common-Mode Output Voltage | Center of Two 27-Ω Load Resistors | See Figure 1A | 1 | $V_{CC}$ / 2 | 3 | V |
| $\Delta V_{OC}$ | Change in Differential Driver Common-Mode Output Voltage (1) | | | −65 | | 65 | mV |
| $V_{OC(PP)}$ | Peak-to-Peak Driver Common-Mode Output Voltage (1) | | | | 600 | | |
| $\|I_{OS}\|$ | Driver Short-circuit Output Current | \|IOS\| with A shorted to B | | | 120 | 180 | mA |
| | | \|IOS\| with −7 V to +12 V | | −250 | | 250 | |
| **Receiver** | | | | | | | |
| $V_{IT+}$ | Positive-Going Receiver Differential-Input Voltage Threshold | $V_A$ or $V_B$ from −7 to +12 V | | | | −10 | mV |
| $V_{IT-}$ | Negative-Going Receiver Differential-Input Voltage Threshold | $V_A$ or $V_B$ from −7 to +12 V | | −200 | | | mV |
| $V_{HYS}$ | Receiver Differential-Input Voltage Threshold Hysteresis ($V_{IT+}$ – $V_{IT-}$ ) (1) | | | | 70 | | mV |
| $V_{IH}$ | Logic Input High Voltage | D, DE, $\overline{RE}$ | | 2 | | | V |
| $V_{IL}$ | Logic Input Low Voltage | D, DE, $\overline{RE}$ | | | | 0.8 | V |

| Symbol | Parameter | Conditions | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| $V_{OH}$ | Receiver High-Level Output Voltage | $I_{OH}$ = −8 mA, $V_{CC}$ = 4.5 V to 5.5 V | | 3 | 4.5 | | V |
| | | $I_{OH}$ = −8 mA, $V_{CC}$ = 3.0 V to 3.6 V | | 2.45 | 2.65 | | V |
| $V_{OL}$ | Receiver Low-Level Output Voltage | $I_{OL}$= 8 mA, $V_{CC}$ = 4.5 V to 5.5 V | | | | 0.4 | V |
| | | $I_{OL}$ = 8 mA, $V_{CC}$ = 3.0 V to 3.6 V | | | | 0.5 | V |
| $I_{IN}$ | DE = 0, $V_{CC}$ = 0 or $V_{CC}$ =5.5 V (A, B) | $V_I$ = 12 V | | | 30 | 140 | μA |
| | | $V_I$ = −7 V | | −100 | −50 | | μA |
| $R_A$, $R_B$ | Bus Input Impedance | $V_A$ = −7 V, $V_B$ = 12 V; or $V_A$ = 12 V, $V_B$ = −7 V | | 96 | | | KΩ |
| $I_{OZ}$ | Receiver High-Z Output Current | $V_O$ = 0 V or $V_{CC}$, $\overline{RE}$ at $V_{CC}$ | | −1 | | 1 | μA |
| $I_{OSR}$ | Receiver Output Short to Ground | $\overline{RE}$ = 0 V, DE = $V_{CC}$ | | | 100 | 150 | mA |
| **Logic** | | | | | | | |
| $I_I$ | Driver Enable | DE | | -30 | | 30 | μA |
| | Driver Input, and Receiver Enable Input Current | D, $\overline{RE}$ | | -5 | | 5 | μA |
| **Supply** | | | | | | | |
| $I_{CC}$ | Supply Current (Quiescent) | Driver and Receiver Enabled | DE = $V_{CC}$, $\overline{RE}$ = GND, No LOAD | | 650 | 750 | μA |
| | | Driver Enabled, Receiver Disabled | DE = $V_{CC}$, $\overline{RE}$ = $V_{CC}$, No LOAD | | 450 | 600 | |
| | | Driver Disabled, Receiver Enabled | DE = GND, $\overline{RE}$ = GND, No LOAD | | 450 | 600 | |
| | | Driver and Receiver Disabled | DE = GND, $\overline{RE}$ = $V_{CC}$, D = $V_{CC}$ No LOAD | | 0.5 | 3 | |

(1) The parameter is provided by the lab bench test and design simulation. NOT tested in production.

## Switching Characteristics

| Symbol | Parameter | Conditions | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| **Driver** | | | | | | | |
| $f_{MAX}$ | Maximum Data Rate (1) | $V_{OD}$ ≥ ±1.5 V, $R_L$ = 54 Ω, $C_L$ = 100 pF (Figure 4) | | | 500 | | Kbps |
| $t_r$, $t_f$ | Driver Differential-Output Rise and Fall Times (1) | $R_L$ = 54 Ω, $C_L$ = 50 pF | See Figure 2 | | 300 | | ns |
| $t_{PHL}$, $t_{PLH}$ | Driver Propagation Delay | | | 220 | 330 | 450 | ns |
| $t_{SK(P)}$ | Driver Pulse Skew, $\|t_{PHL} - t_{PLH}\|$ (1) | | | | 10 | 30 | ns |
| $t_{PHZ}$, $t_{PLZ}$ | Driver Disable Time | | See Figure 3 | | 50 | 100 | ns |
| $t_{PZH}$, $t_{PZL}$ | Driver Enable Time | Receiver Enabled | | | 200 | 600 | ns |
| | Driver Enable Time | Receiver Disabled | | | 2800 | 4000 | ns |
| **Receiver** | | | | | | | |
| $t_r$, $t_f$ | Receiver output rise and fall times (1) | $C_L$ = 15 pF | See Figure 5 | | 30 | | ns |
| $t_{PHL}$, $t_{PLH}$ | Receiver Propagation Delay Time | | | | 100 | 210 | ns |
| $t_{SK(P)}$ | Receiver Pulse Skew, $\|t_{PHL} - t_{PLH}\|$ (1) | | | | 20 | 50 | ns |
| $t_{PHZ}$, $t_{PLZ}$ | Receiver Disable Time | | | | 30 | 80 | ns |
| $t_{PZH}$, $t_{PZL}$ | Receiver Enable Time | Driver Enabled | | | 130 | 200 | ns |
| | Receiver Enable Time | Driver Disabled | | | 3000 | 4500 | ns |

(1) The parameter is provided by the lab bench test and design simulation. NOT tested in production.

## Test Circuits and Waveforms

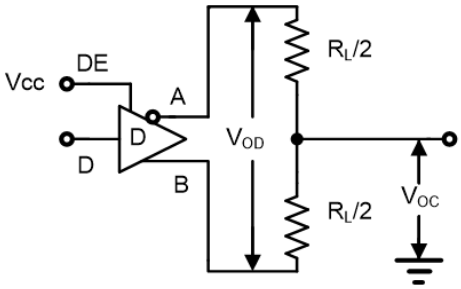



Figure 1A. VOD and VOC

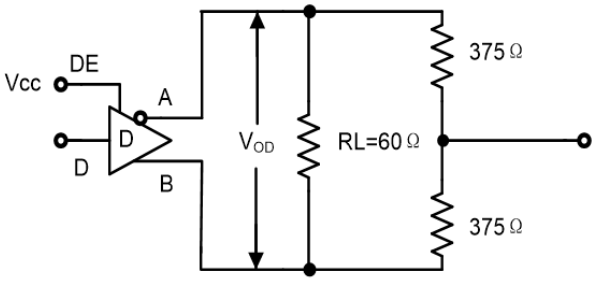



Figure 1B. VOD with Common Mode Load

Figure 1. DC Driver Test Circuits

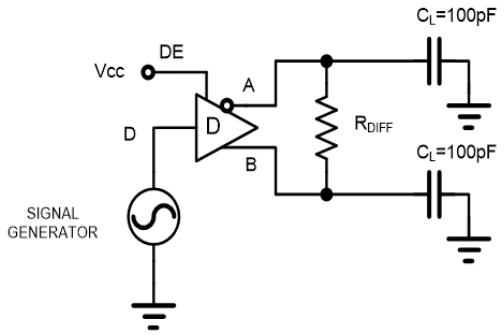



Figure 2A. Test Circuit

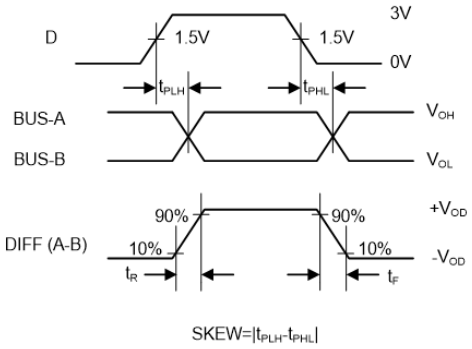
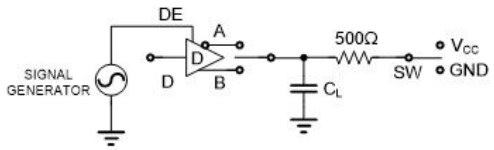



Figure 2B. Measurement Points

Figure 2. Driver Propagation Delay and Differential Transition Times




| PARAMETER | OUTPUT | RE | DI | SW | CL (pF) |
|---|---|---|---|---|---|
| tPHZ | A/B | X | 1/0 | GND | 15 |
| tPLZ | A/B | X | 0/1 | VCC | 15 |
| tPZH | A/B | 0 | 1/0 | GND | 100 |
| tPZL | A/B | 0 | 0/1 | VCC | 100 |
| tPZH(SHDN) | A/B | 1 | 1/0 | GND | 100 |
| tPZL(SHDN) | A/B | 1 | 0/1 | VCC | 100 |

Figure 3A. Test Circuit

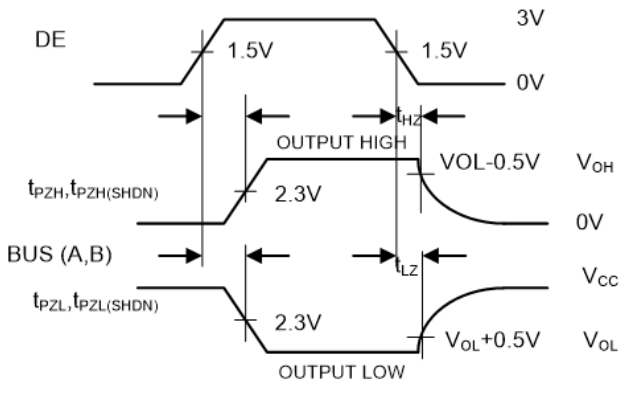



Figure 3B. Measurement Points

Figure 3. Driver Enable and Disable Times

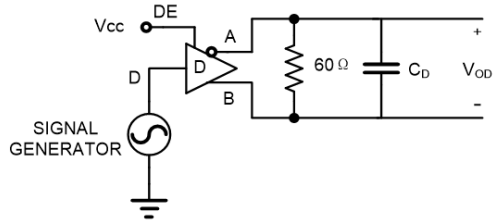



Figure 4A. Test Circuit

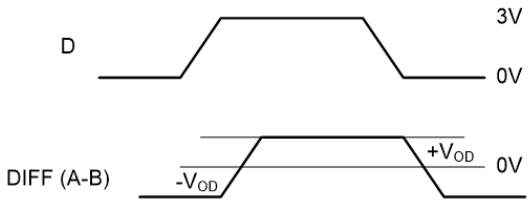



Figure 4B. Measurement Points

Figure 4. Driver Data rate

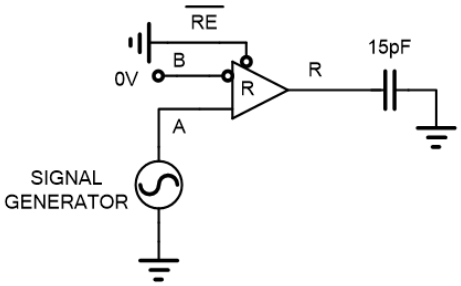



Figure 5A. Test Circuit

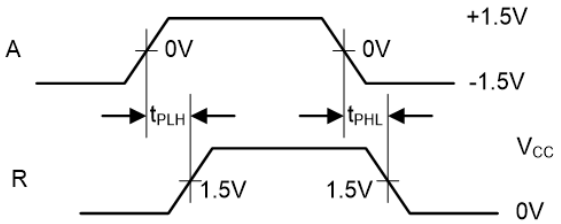
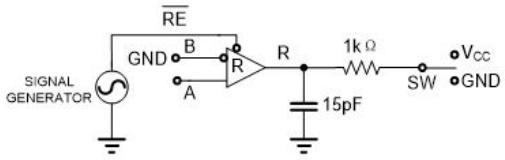



Figure 5B. Measurement Points

Figure 5. Receiver Propagation Delay and Data rate




| PARAMETER | DE | A | SW |
|---|---|---|---|
| tPHZ | 1 | +1.5V | GND |
| tPLZ | 1 | -1.5V | VCC |
| tPZH | 1 | +1.5V | GND |
| tPZL | 1 | -1.5V | VCC |
| tPZH(SHDN) | 0 | +1.5V | GND |
| tPZL(SHDN) | 0 | -1.5V | VCC |

Figure 6A. Test Circuit

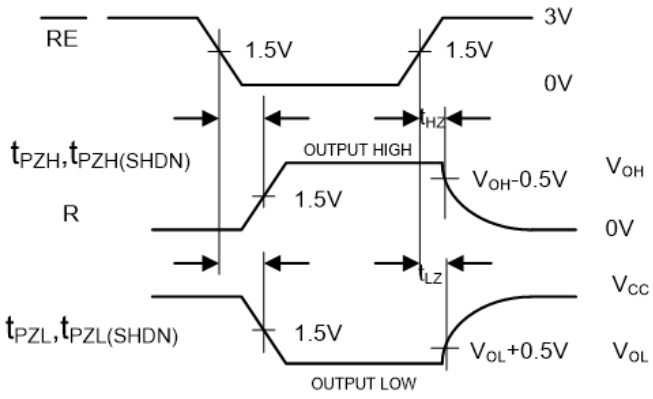



Figure 6B. Measurement Points

Figure 6. Receiver Enable and Disable Times

## Functional Table

**Table 2. Driver Pin Functions**

| Input | Enable | Outputs | | Description |
|---|---|---|---|---|
| **D** | **DE** | **A** | **B** | |
| **Normal Mode** | | | | |
| H | H | H | L | Actively drives bus High |
| L | H | L | H | Actively drives bus Low |
| X | L | Z | Z | Driver disabled |
| X | OPEN | Z | Z | Driver disabled by default |
| OPEN | H | H | L | Actively drives bus High |

**Table 3. Receiver Pin Functions**

| Differential Input | Enable | Output | Description |
|---|---|---|---|
| **$V_{ID} = V_A - V_B$** | **/RE** | **R** | |
| **Normal Mode** | | | |
| $V_{IT+} < V_{ID}$ | L | H | Receive valid bus High |
| $V_{IT-} < V_{ID} < V_{IT+}$ | L | ? | Indeterminate bus state |
| $V_{ID} < V_{IT-}$ | L | L | Receive valid bus Low |
| X | H | Z | Receiver disabled |
| X | OPEN | Z | Receiver disabled |
| Open, Short, Idle Bus | L | H | Indeterminate bus state |

# Detailed Description

## Featured Description

### High Data Rate

The RS-485/RS-422 is intended for network lengths up to 4000', but the maximum system data rate decreases as the transmission length increases. Devices operating at 10 Mbps are limited to lengths less than 100'.

The twisted pair is the cable of choice for the networks of the RS-485/RS-422. Twisted pair cables tend to pick up noise and other electromagnetically induced voltages as common-mode signals, which are effectively rejected by the differential receiver in this IC.

The proper termination is imperative to minimize reflections. In point-to-point, or point-to-multipoint (single driver on bus) networks, the main cable should be terminated in its characteristic impedance (typically 120 Ω) at the end farthest from the driver. In multi-receiver applications, stubs connecting receivers to the main cable should be kept as short as possible. Multipoint (multi-driver) systems require that the main cable be terminated in its characteristic impedance at both ends. Stubs connecting a transceiver to the main cable should be kept as short as possible.

The TPT487A may also be used at slower data rates over longer cables, but there are some limitations. The Rx is optimized for high-speed operation, so its output may glitch if the Rx input differential transition times are too slow. Keeping the transition times below 500 ns, which equates to the Tx driving a 1000' (305 m) CAT 5 cable, yields excellent performance over the full operating temperature range. For the below test waveform, the transmitter is driven at 10 Mps and with 100' (31 m) CAT 5 cable, and they are loaded with an RS-485 receiver in parallel with 54 Ω.

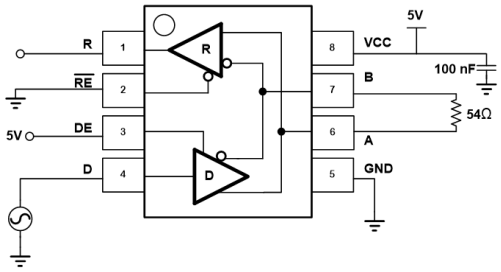



**Figure 7. Loopback Test Circuit**

### Full Fail-Safe

All the receivers include a "full fail-safe" function that guarantees a high-level receiver output if the receiver inputs are unconnected (floating), shorted together, or connected to a terminated bus with all the transmitters disabled. Receivers easily meet the data rates supported by the corresponding driver, and all receiver outputs are three-stable via the active low RE input.

### Hot Plug Function

When a piece of equipment powers up, there is a period where the processor or ASIC driving the control lines (DE, RE) of the RS-485 is unable to ensure that the Tx and Rx outputs of the RS-485 are kept disabled. If the equipment is connected to the bus, a driver activating prematurely during power-up may crash the bus. To avoid this scenario, the TPT487A incorporates a "Hot Plug" function. The circuitry monitoring $V_{CC}$ ensures that, during power-up and power-down, the Tx and Rx outputs remain disabled, regardless of the state of DE and RE, if $V_{CC}$ is less than ~2.5 V. This gives the processor/ASIC a chance to stabilize and drive the control lines of the RS-485 to the proper states.

**Transient Protection**

The bus terminals of the TPT487A transceiver family possess on-chip ESD protection against ±20-kV HBM. The International Electrotechnical Commission (IEC) ESD test is far more severe than the HBM ESD test. The IEC model, featuring a 50% higher charge capacitance ($C_S$) and a 78% lower discharge resistance ($R_D$), produces significantly higher discharge currents than the HBM model. The TPT487A can support ±20-kV IEC 61000-4-2 contact ESD.

As stated in the IEC 61000-4-2 standard, contact discharge is the preferred transient protection test method. Although the IEC air-gap testing is less repeatable than the contact testing, air discharge protection levels are inferred from the contact discharge test results.

## Application and Implementation

Note

Information in the following application sections is not part of the 3PEAK's component specification and 3PEAK does not warrant its accuracy or completeness. 3PEAK's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

### Typical Application

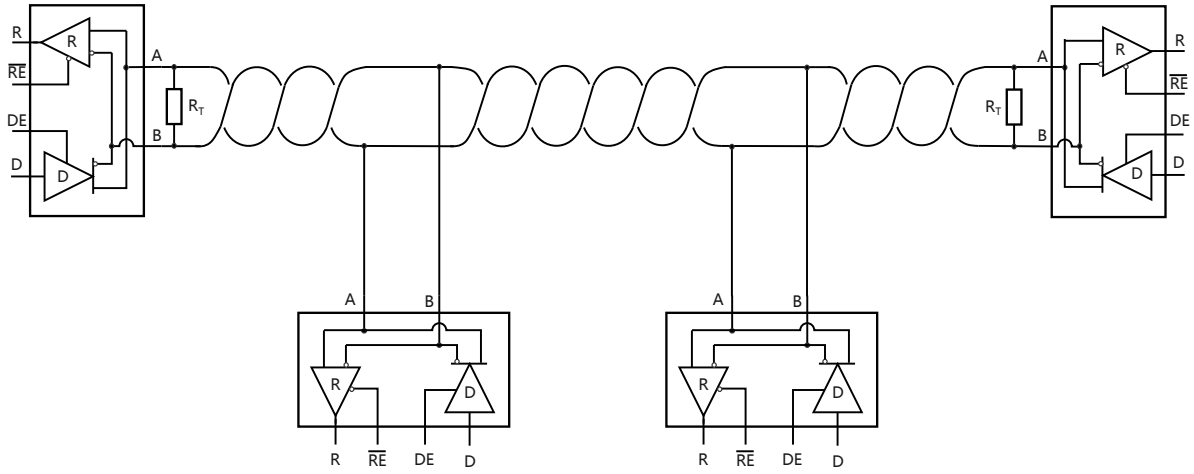
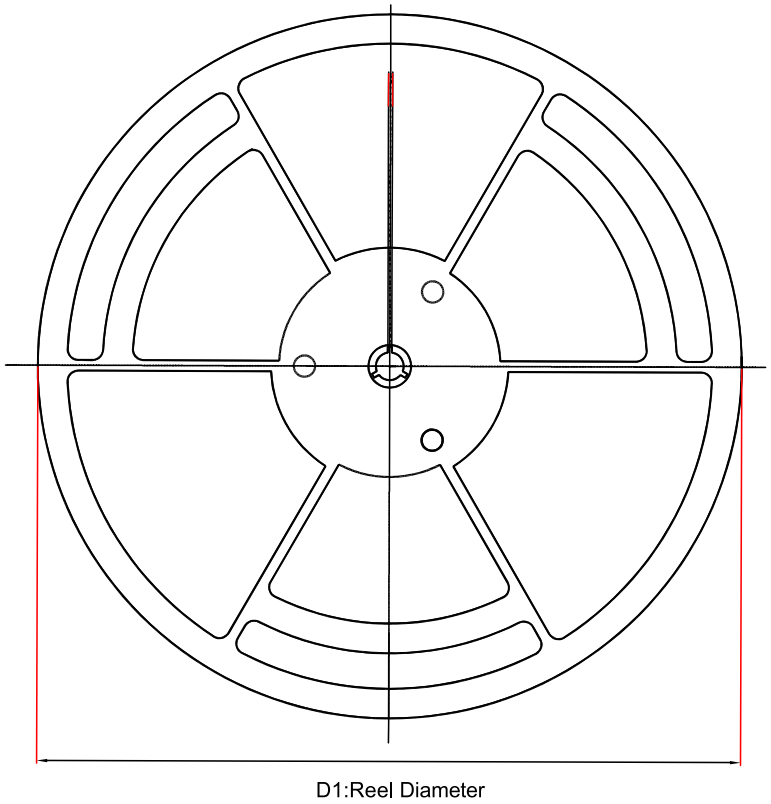
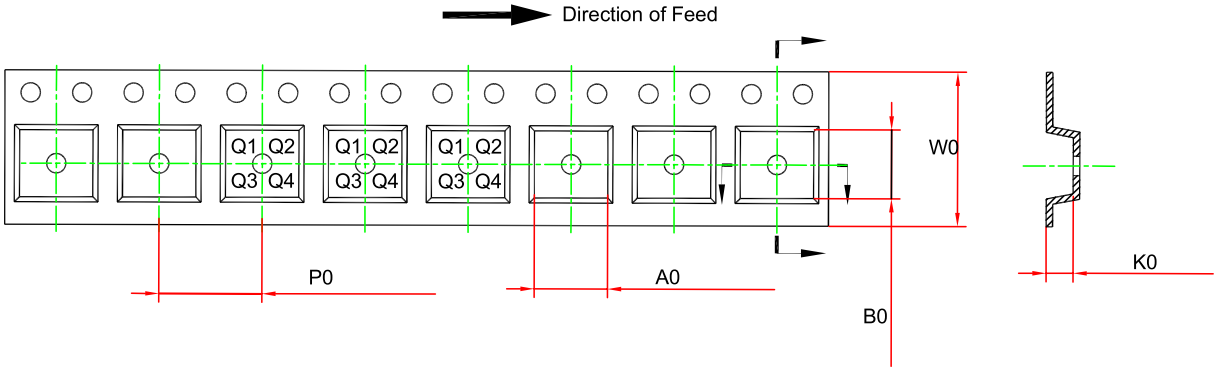



**Figure 8. Typical RS485 Network**

## Tape and Reel Information



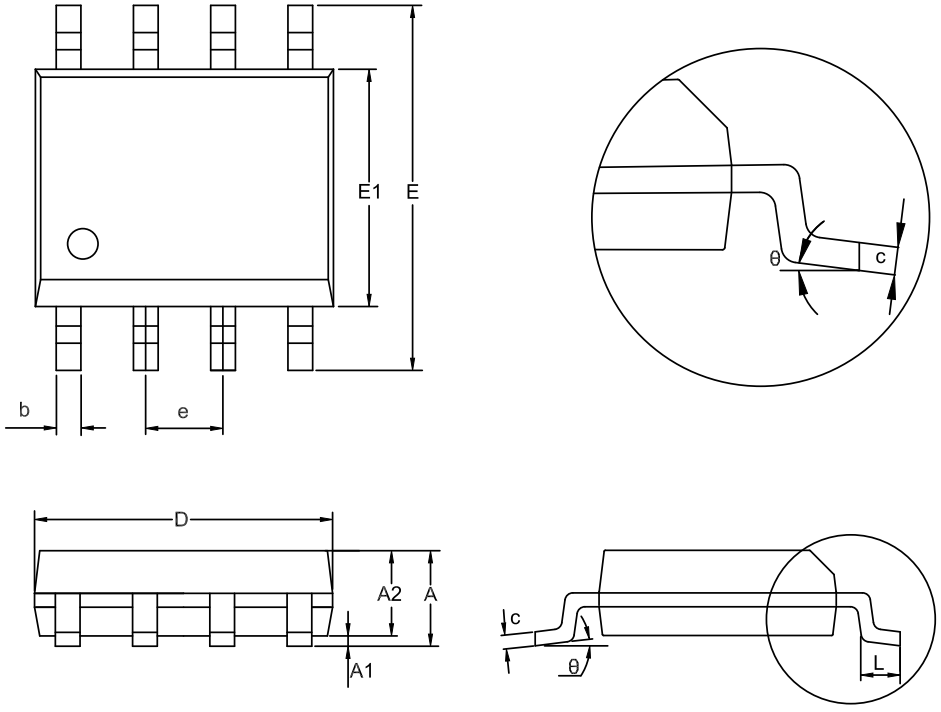




| Order Number | Package | D1 (mm) | A0 (mm) | K0 (mm) | W0 (mm) | W1 (mm) | B0 (mm) | P0 (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|
| TPT487A-SO1R | SOP8 | 330.0 | 6.5 | 2.0 | 12.0 | 17.6 | 5.4 | 8.0 | Q1 |
| TPT487A-VS1R | MSOP8 | 330.0 | 5.3 | 1.3 | 12.0 | 17.6 | 3.4 | 8.0 | Q1 |
| TPT487A-DF6R | DFN3×3-8 | 330.0 | 3.3 | 1.1 | 12.0 | 17.6 | 3.3 | 8.0 | Q1 |

## Package Outline Dimensions

### SOP8

Package Outline Dimensions SO1(SOP-8-A)



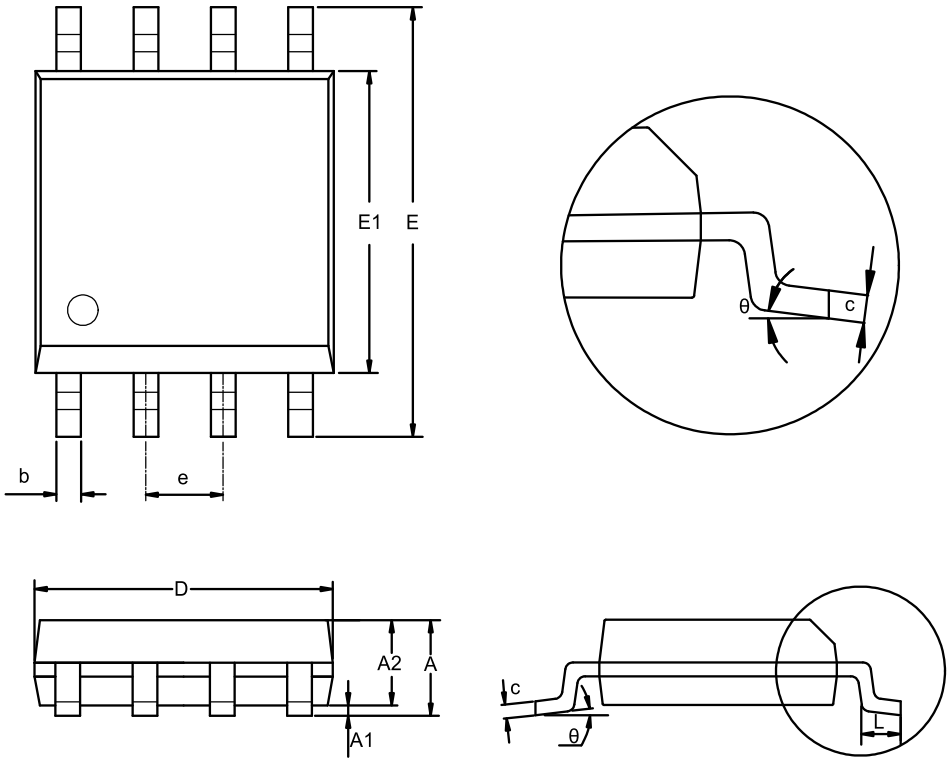

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.050 | 0.250 | 0.002 | 0.010 |
| A2 | 1.250 | 1.550 | 0.049 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.007 | 0.010 |
| D | 4.700 | 5.100 | 0.185 | 0.201 |
| E | 5.800 | 6.200 | 0.228 | 0.244 |
| E1 | 3.800 | 4.000 | 0.150 | 0.157 |
| e | 1.270 BSC | | 0.050 BSC | |
| L | 0.400 | 1.000 | 0.016 | 0.039 |
| θ | 0 | 8° | 0 | 8° |

NOTES

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

**MSOP8**

## Package Outline Dimensions VS1(MSOP-8-A)



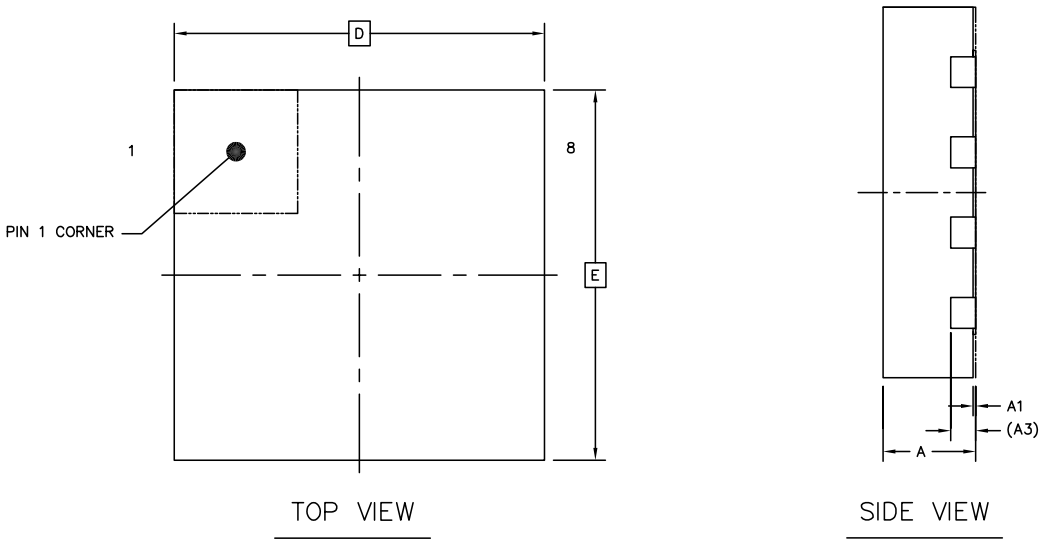

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.800 | 1.100 | 0.031 | 0.043 |
| A1 | 0.020 | 0.150 | 0.001 | 0.006 |
| A2 | 0.750 | 0.950 | 0.030 | 0.037 |
| b | 0.250 | 0.380 | 0.010 | 0.015 |
| c | 0.090 | 0.230 | 0.004 | 0.009 |
| D | 2.900 | 3.100 | 0.114 | 0.122 |
| E | 4.700 | 5.100 | 0.185 | 0.201 |
| E1 | 2.900 | 3.100 | 0.114 | 0.122 |
| e | 0.650 BSC | | 0.026 BSC | |
| L | 0.400 | 0.800 | 0.016 | 0.031 |
| θ | 0 | 8° | 0 | 8° |

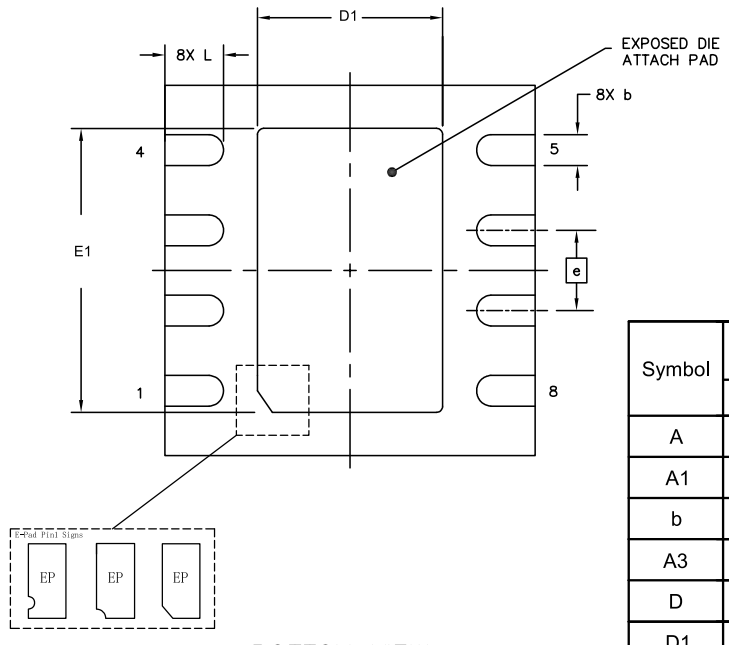
NOTES

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

**DFN3×3-8**

## Package Outline Dimensions DF6(DFN3X3-8-B)




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.700 | 0.800 | 0.028 | 0.031 |
| A1 | 0.000 | 0.050 | 0.000 | 0.002 |
| b | 0.250 | 0.350 | 0.010 | 0.014 |
| A3 | 0.150 | 0.250 | 0.006 | 0.010 |
| D | 2.900 | 3.100 | 0.114 | 0.122 |
| D1 | 1.100 | 1.300 | 0.043 | 0.051 |
| E | 2.900 | 3.100 | 0.114 | 0.122 |
| E1 | 2.050 | 2.250 | 0.081 | 0.089 |
| e | 0.650 BSC | | 0.026 BSC | |
| L | 0.350 | 0.450 | 0.014 | 0.018 |

NOTES

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.
3. The many types of E-pad Pin1 signs may appear in the product.

## Order Information

| Order Number | Operating Temperature Range | Package | Marking Information | MSL | Transport Media, Quantity | Eco Plan |
|---|---|---|---|---|---|---|
| TPT487A-SO1R | −40 to 125°C | SOP8 | T487A | MSL1 | Tape and Reel, 4,000 | Green |
| TPT487A-VS1R (1) | −40 to 125°C | MSOP8 | T487A | MSL1 | Tape and Reel, 3,000 | Green |
| TPT487A-DF6R (1) | −40 to 125°C | DFN3×3-8 | T487A | MSL1 | Tape and Reel, 4,000 | Green |

**Green**: 3PEAK defines "Green" to mean RoHS compatible and free of halogen substances.

(1) For future products, contact the 3PEAK factory for more information and samples.

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