


## Features

- Exceeds Requirements of EIA-485 Standard
- Data Rate: 500 kbps
- Support Failsafe function
- Low Power Consumption: < 1  $\mu$ A Standby Supply Current
- Large Receiver Hysteresis: 60mV
- Up to 256 Nodes on a Bus (1/8 unit load)
- Wide Supply Voltage 4.5V to 5.5V
- SOP8 Package for Backward Compatibility
- Bus-Pin Protection:
  - ±18 kV HBM protection
  - ±12 kV IEC61000-4-2 Contact Discharge

## Description

The TPT485E is 4.5V~5.5V powered transceivers that meet the RS-485 and RS-422 standards for balanced communication. Driver outputs and receiver inputs are protected against  $\pm 18$  kV ESD strikes without latch-up. Transmitters in this family deliver exceptional differential output voltages as 2.5V (min) in 5Vcc power supplier, into the RS-485 required 54 $\Omega$  load, for better noise immunity. These 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. Receiver (RX) inputs feature a “Full Fail-Safe” design, which ensures a logic high Rx output if Rx inputs are floating, shorted, or on a terminated but undriven bus. The TPT485E is available in an SOP8 package, and is characterized from  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ .

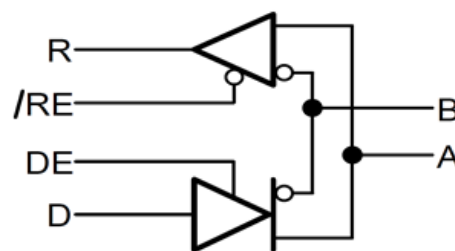
---

 3PEAK and the 3PEAK logo are registered trademarks of 3PEAK INCORPORATED. All other trademarks are the property of their respective owners.

## Applications

- E-Metering Networks
- HVAC Systems
- Video Surveillance Systems
- DMX512-Networks

## Simplified Schematic



# TPT485E

±18K ESD Protection, RS-485 Transceiver

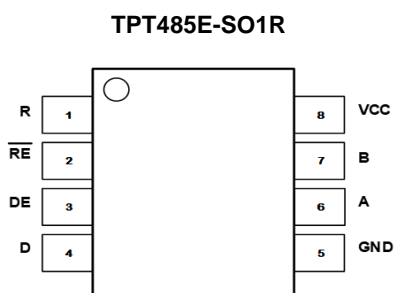
## Revision History

Date	Revision	Notes
2019/3/27	Rev. Pre 0.1	Definition Draft
2019/9/10	Rev. Pre 0.2	Update ESD data
2019/9/25	Rev. 0	Final version

## Order Information

Model Name	Order Number	Package	Transport Media, Quantity	Marking Information
TPT485E	TPT485E-SO1R	8-Pin SOP	Tape and Reel 4,000	T485E

## Pin Configuration and Functions



Pin No.	Pin Name	I/O	Description
1	RO	Digital output	Receiver Output.
2	/RE	Digital input	Receiver Output Enable.
3	DE	Digital input	Driver Output Enable.
4	DI	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 <sub>CC</sub>	Power	Power Supply.

## Functional Table

### DRIVER PIN FUNCTIONS

INPUT	ENABLE	OUTPUTS		DESCRIPTION
		A	B	
<b>NORMAL MODE</b>				
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

### RECEIVER PIN FUNCTIONS

DIFFERENTIAL INPUT	ENABLE	OUTPUT	DESCRIPTION
<b>NORMAL MODE</b>			
V <sub>IT+</sub> < V <sub>ID</sub>	L	H	Receive valid bus High
V <sub>IT-</sub> < V <sub>ID</sub> < V <sub>IT+</sub>	L	?	Indeterminate bus state
V <sub>ID</sub> < V <sub>IT-</sub>	L	L	Receive valid bus Low
X	H	Z	Receiver disabled
X	OPEN	Z	Receiver disabled
Open, short, idle Bus	L	H	Out of polarity correction time

### Absolute Maximum Ratings

V <sub>CC</sub> to GND.....	-0.3V to +7V
Input Voltages DI, DE, /RE.....	-0.3V to (VCC + 0.3V)
I/O Voltages A, B .....	-15V to +15V
A, B (Transient Pulse Through 100Ω).....	±100V
R.....	-0.3V to (VCC +0.3V)
Short Circuit Duration A, B .....	Continuous
ESD Rating.....	See Specification Table

**\* Note:** 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.

### Recommended Operating Conditions

Supply Voltage.....	4.5V to 5.5V
Temperature Range.....	-40°C to +125°C
Bus Pin Common Mode Voltage Range .....	-7V to +12V
Thermal Resistance, ΘJA (Typical)	
8-Pin SOP Package .....	136°C/W
Maximum Junction Temperature (Plastic Package) .....	+150°C
Maximum Storage Temperature Range .....	-65°C to +150°C

### ESD Rating

		Value	Unit
Contact Discharge, per IEC 61000-4-2	Bus Pin	12	kV
HBM, per ANSI/ESDA/JEDEC JS-001 / ANSI/ESD STM5.5.1	Bus Pin	18	kV
	All Pin Except Bus Pin	4	kV
CDM, per ANSI/ESDA/JEDEC JS-002		1500	V

## Electrical Characteristics

Test Conditions: VCC = 5V, Over operating free-air temperature range (unless otherwise noted)

Parameter		Conditions		Min	Typ	Max	Units
<b>Driver</b>							
V <sub>OD</sub>	Driver differential-output voltage magnitude	RL = 60 Ω, -7V≤V test ≤12V	See Figure 1B	2.0	3.5		V
		RL = 54 Ω (RS-485)	See Figure 1A	2.0	3.4		
		RL = 100 Ω (RS-485)		2.7	3.7		
Δ V <sub>OD</sub>	Change in magnitude of driver differential-output voltage	RL = 54 Ω, CL=50pF	See Figure 1A	-50		50	mV
V <sub>OC(SS)</sub>	Steady-state common-mode output voltage	Center of two 27-Ω load resistors	See Figure 1A	1	VCC/2	3	V
ΔV <sub>OC</sub>	Change in differential driver common-mode output voltage			-65		65	mV
V <sub>OC(PP)</sub>	Peak-to-peak driver common-mode output voltage				600		
I <sub>OS</sub>	Driver short-circuit output current	I <sub>OS</sub>   with A shorted to B			90	110	mA
<b>Receiver</b>							
V <sub>IT+</sub>	Positive-going receiver differential-input voltage threshold				-100	-15	mV
V <sub>IT-</sub>	Negative-going receiver differential-input voltage threshold			-240	-150		mV
V <sub>HYS</sub> <sup>(1)</sup>	Receiver differential-input voltage threshold hysteresis (V <sub>IT+</sub> - V <sub>IT-</sub> )				60		mV
V <sub>IH</sub>	Logic Input High Voltage	DI, DE, RE		2			V
V <sub>IL</sub>	Logic Input Low Voltage	DI, DE, RE				0.8	V
V <sub>OH</sub>	Receiver high-level output voltage	I <sub>OH</sub> = -8 mA		4.0	VCC-0.3		V
V <sub>OL</sub>	Receiver low-level output voltage	I <sub>OL</sub> = 8 mA			0.2	0.4	V
I <sub>i</sub>	DE=0, VCC=0 or VCC=5.5V	VI=12V			30	120	μA
		VI=-7V		-100	-50		μA
RA, RB	Bus input impedance	VA=-7V, VB=12V or VA=12V, VB=-7V		96			kΩ
I <sub>OZ</sub>	Receiver high-impedance output current	VO = 0 V or VCC, /RE at VCC		-1		1	μA
I <sub>OSR</sub>	Receiver output short to ground current	REN=0, DE=VCC			80	95	mA
<b>Logic</b>							
I <sub>IN</sub>	Input current (RE, DE, D)	4.5V<VCC<5.5V		-5		5	uA
<b>Supply</b>							
I <sub>CC</sub>	Supply current(quiescent)	Driver and receiver enabled	DE = VCC, /RE = GND, No LOAD		650	800	μA
		Driver enabled, receiver disabled	DE = /RE = VCC, No LOAD		450	600	
		Driver disabled, receiver enabled	DE = /RE = GND, No LOAD		450	600	
		Driver and receiver disabled	DE = GND, /RE = D= VCC, No LOAD		0.5	2	

## Switching CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units	
<b>DRIVER</b>						
$t_r, t_f$	Driver differential-output rise and fall times		300		ns	
$t_{PHL}, t_{PLH}$	Driver propagation delay	200	300	410		
$t_{SK(P)}$	Driver pulse skew, $ t_{PHL} - t_{PLH} $		50	90		
$t_{PHZ}, t_{PLZ}$	Driver disable time	RE = 0	50	100	ns	
		RE = VCC	50	100		
$t_{PZH}, t_{PZL}$	Driver enable time	RE = 0	200	450	ns	
		RE = VCC	2800	4000		
<b>RECEIVER</b>						
$t_r, t_f$	Receiver output rise and fall times		30		ns	
$t_{PHL}, t_{PLH}$	Receiver propagation delay time	CL=15 pF	100	150		
$t_{SK(P)}$	Receiver pulse skew, $ t_{PHL} - t_{PLH} $			25		
$t_{PHZ}, t_{PLZ}$	Receiver disable time		20	65	ns	
$t_{PZL}$	Receiver enable time	DE = VCC	See Figure 6	130	250	ns
$t_{PZH}$		DE = 0	See Figure 6	2800	4000	

## Test Circuits and Waveforms



Figure 1. DC Driver Test Circuits

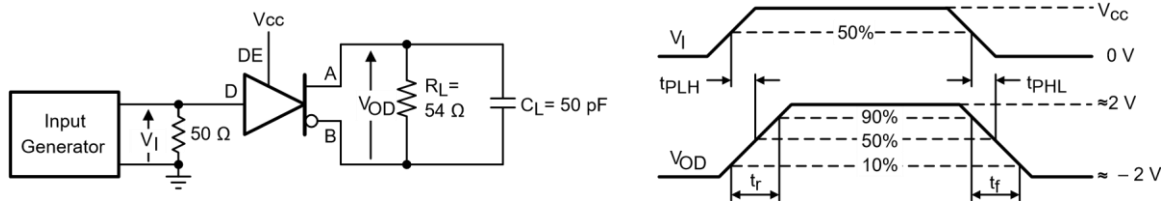


Figure 2. Driver Propagation Delay and Differential Transition Times

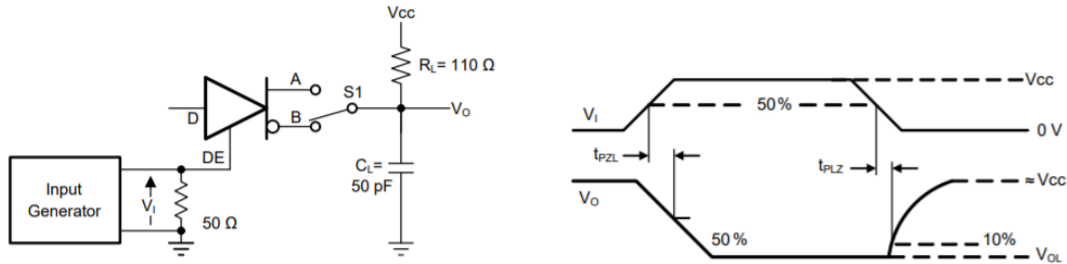


Figure 3. Driver Enable and Disable Times



Figure 4. Driver Propagation Delay and Rise/Fall Time Measurement

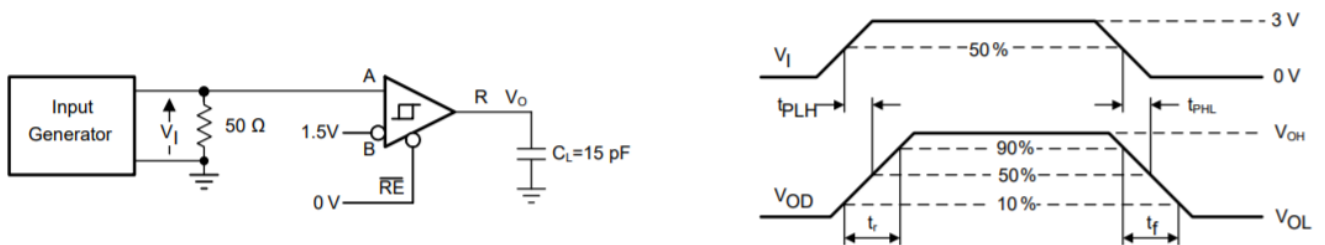


Figure 5. Receiver Propagation Delay and Data rate

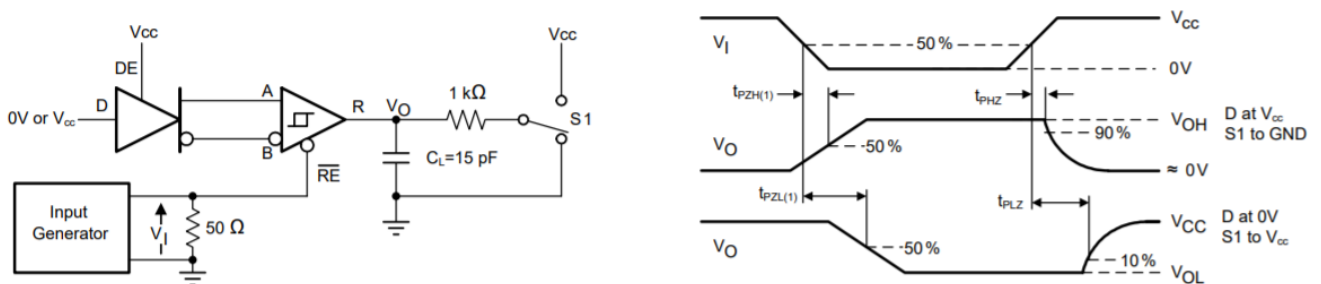
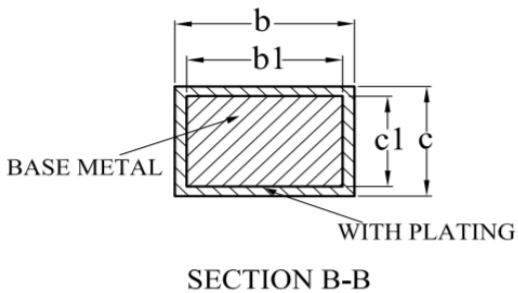
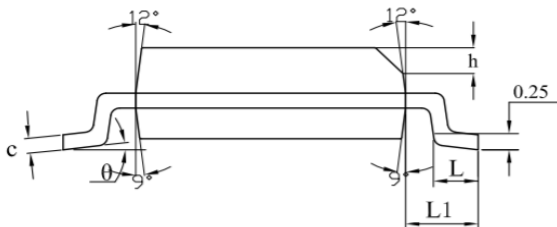
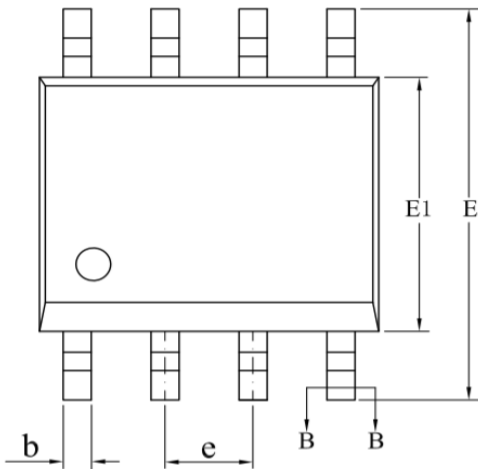
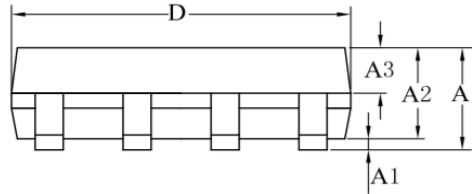


Figure 6. Receiver Enable and Disable Times

Package Outline Dimensions

SO1R (SOP8)



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.75
A1	0.10	—	0.225
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	—	0.47
b1	0.38	0.41	0.44
c	0.20	—	0.24
c1	0.19	0.20	0.21
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
h	0.25	—	0.50
L	0.50	—	0.80
L1	1.05REF		
θ	0	—	8°