

Features

- Meets the Requirements of TIA/EIA- 232-F and ITU V.28 Standards
- Power Supply Range: Single power supplier from +3.0V to 5.5V
- 1.65V to 5.5V Logic Interface V_L pin
- Two Drivers and Two Receivers
- Operates up to 1Mbps
- Requires Only Four External 0.1 μ F Capacitors
- ESD Protection for RS-232 Bus Pins
 - ±15 kV (HBM)
 - ±12 kV (IEC61000-4-2, Contact Discharge)
 - ±15 kV (IEC61000-4-2, Air-Gap Discharge)

Description

The TPT3122EH is IEC61000-4-2 ESD protected, support 3.0V to 5.5V power with a 1.65V to 5.5V logic interface that meets the RS-232 standards. Each receiver converts TIA/RS-232 inputs to TTL/CMOS levels.

The chip operates at data signaling rates up to 1000 kbps. The TPT3122EH is available in 24-Pin QFN4X4 package, and is characterized from -40°C to 125°C.

The AUTO ON-LINE feature allows the chip to automatically "wake-up" during a shutdown state when an RS-232 cable is connected and the device is turned on.

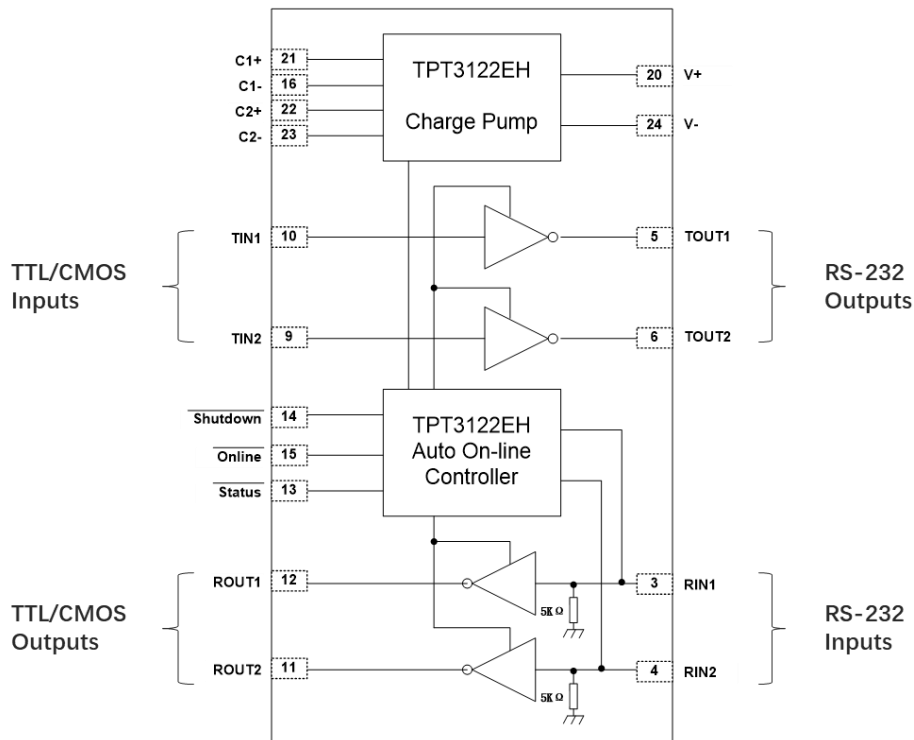
Applications

- Battery-Powered Equipment
- Industry Human Machine Interface
- Notebook, Computers
- Printers

Device Table

Device	Package	Body size
TPT3122EH	QFN24	4 mm x 4 mm

Function Block



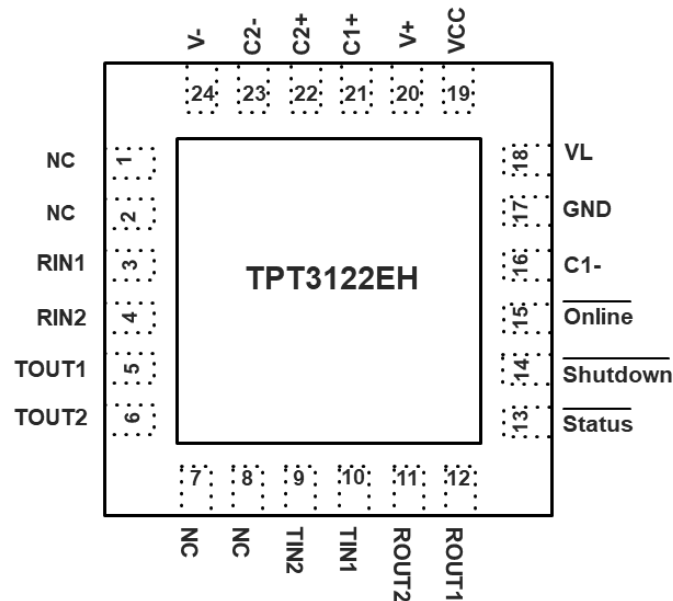
Revision History

Date	Revision	Notes
2018/10/11	Rev. Pre 0	Definition Draft
2019/04/18	Rev. Pre 0.1	Update package information
2019/05/06	Rev. Pre 0.2	Update pin 1,2 definition, and Temperature range
2019/06/05	Rev. Pre 0.3	Update Thermal Information
2019/12/10	Rev. Pre 0.4	Update electrical data
2020/02/24	Rev. 0	Fix the datasheet

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Pin Configuration and Functions



Pin No.	Symbol	I/O Type	Description
1, 2	NC	-	No Connect (not connect to the die). Can be left floating
3, 4	RIN1, RIN2	I	RS-232 receiver inputs
5, 6	TOUT1, TOUT2	O	RS-232 driver outputs
7, 8	NC	-	No Connect (not connect to the die). Can be left floating
9,10	TIN1, TIN2	I	TTL/CMOS Driver inputs
11,12	ROUT1, ROUT2	O	TTL/CMOS Receiver outputs
13	Status	O	TTL/CMOS level output indicating if no valid RS-232 levels are present at the RIN1 or RIN2 pins.
14	Shutdown	I	TTL/CMOS level input, when driven low puts the RS232 into shutdown mode (tri-stating driver outputs and disabling the charge-pump); normal operation when driven high. Internal weak pull down, if leave the pin floating, then Shutdown = LOW as default
15	Online	I	TTL/CMOS level input. A low input enables Auto On-Line mode, a high input disables Auto On-Line Mode. Internal weak pull down, if leave the pin floating, then Online = LOW as default
16	C1-	-	Negative terminals of voltage-double charge-pump capacitors (required)
17	GND	-	Ground
18	V _L	-	I/O Power supply. All CMOS inputs (TINx) and outputs (ROUTx) are referenced to this supply.
19	V _{CC}	-	3V to 5.5V supply voltage
20	V+	-	Positive charge pump storage capacitor (required), suggest 0.2uF cap to GND
21, 22	C1+, C2+	-	Positive terminals of voltage-double charge-pump capacitors (required), suggest 0.2uF cap connect to negative pin (C1-, C2-)
23	C2-	-	Negative terminals of voltage-double charge-pump capacitors (required)
24	V-	-	Negative charge pump storage capacitor (required), suggest 0.2uF cap to GND

Operation Truth Table

Valid RS-232 Level at Receiver Input	Shutdown	Online	Driver Outputs	Receiver Outputs	Status	Mode of Operation
Yes	L	X	High-Z	High-Z	H	Manually forced shutdown
No	L	X	High-Z	High-Z	L	Manually forced shutdown
Yes	H	L	Active	Active	H	Normal Operation (Auto On-Line enabled)
No	H	L	High-Z	Active	L	Standby Operation due to Auto On-Line circuitry
Yes	H	H	Active	Active	H	Normal Operation
No	H	H	Active	Active	L	Normal Operation

Driver and Receiver Truth Table

Shutdown	RINx	ROUTx	TINx	TOUTx
L	X	High-Z	X	High-Z
H	L	H	L	H
H	H	L	H	L

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity
TPT3122EH-QF8R	-40 to 125°C	QF8R QFN4X4-24L	3122EH	MSL3	Tape and Reel, 3000

Absolute Maximum Ratings

Symbol	Description	Min	Max	Units
V _{CC}	Supply voltage	-0.3	6	V
V+	Positive output supply voltage	-0.3	7	V
V-	Negative output supply voltage	-7	0.3	V
V+ – V-	Supply voltage difference		13	V
TIN1, TIN2	Input voltage of driver, TTL/CMOS level	-0.3	6	V
TOUT1, TOUT2	Output voltage of driver, RS232 level	-13.2	13.2	V
RIN1, RIN2	Input voltage of receiver, RS232 level	-15	15	V
ROUT1, ROUT2	Output voltage of receiver, TTL/CMOS level	-0.3	V _{CC} +0.3	V
T _J	Operating virtual junction temperature		150	°C

Thermal Resistance

Part Number	Package Type	θ_{JA}	θ_{JC}	UNIT
TPT3122EH	24-Pin QFN4X4	42.8	33.8	°C/W

ESD Rating

		Value	Units
RS232 Bus Pin: TOUT1, TOUT2, RIN1, RIN2	HBM, Human body model	±15	kV
All Pin except RS232 Bus Pin	HBM, Human body model	±4	kV
All Pin	CDM, Charge device model	±1.5	kV
RS232 Bus Pin: TOUT1, TOUT2, RIN1, RIN2	IEC-61000-4-2, Contact Discharge	±12	kV
RS232 Bus Pin: TOUT1, TOUT2, RIN1, RIN2	IEC-61000-4-2, Air-Gap Discharge	±15	kV

Electrical Characteristics

The following specifications apply for $V_{CC} = 3.0V$ to $5.5V$, $C1 - C4 = 0.2\mu F$, $T_A = 25^\circ C$

Symbol	Parameter	Conditions	Min	Typ	Max	Units
DC Characteristics						
ICC1	Supply Current, Auto On-Line enabled	All RINx open, $\overline{\text{Online}} = \text{GND}$, $\overline{\text{Shutdown}} = V_L$, $V_{CC} = V_L = 3.3V$, $TINx = V_L$ or GND		10	15	μA
ICC2	Supply Current, Shutdown	$\overline{\text{Shutdown}} = \text{GND}$, $V_{CC} = V_L = 3.3V$, $TINx = V_L$ or GND		8	12	μA
ICC3	Supply Current, Auto On-Line disabled	$\overline{\text{Online}} = \overline{\text{Shutdown}} = V_L$, no load, $V_{CC} = V_L = 3.3V$, $TINx = V_L$ or GND		1	2	mA
Logic Inputs and Receiver outputs						
VIL	Input Voltage of Logic Low	$TINx$, $\overline{\text{Online}}$, $\overline{\text{Shutdown}}$			$1/3 * V_L$	V
VIH	Input Voltage of Logic High		$2/3 * V_L$			V
IIL	Input Leakage Current	$TINx$, $\overline{\text{Online}}$, $\overline{\text{Shutdown}}$; $T_{AMB} = 25^\circ C$, $V_{IN} = x0V$ to V_L	-1	± 0.01	1	μA
IOL	Output Leakage Current	ROUTx (Receivers disabled); $V_{OUT} = 0V$ to V_L	-5	± 0.05	5	μA
VOL	Output Voltage Low	$\overline{\text{Status}}$, ROUTx; $I_{OUT} = 1.5mA$			0.4	V
VOH	Output Voltage High	$\overline{\text{Status}}$, ROUTx; $I_{OUT} = -1.5mA$	$V_L - 0.6$			V
Driver Outputs						
V _{SWING}	Output Voltage Swing	$R_L = 3k\Omega$, $TINx = V_{CC}$ or GND	± 5.0	± 5.3		V
O _R	Output Resistance	$V_{CC} = V_+ = V_- = 0V$, $TOUTx = +2V$	20K	2.3M		Ω
I _{osc}	Output Short-Circuit Current	$V_{OUT} = 0V$		31	60	mA
IOL	Output Leakage Current	$V_{CC} = 0V$ or $3.0V$ to $5.5V$, $V_{OUT} = \pm 12V$	-15	± 6	15	μA
Receiver Inputs						
I _{VR}	Input Voltage Range		-15		15	V
VIL	Input Threshold Low	$V_{CC} = 3.0V \sim 5.5V$	0.8	1.2		V
VIH	Input Threshold High	$V_{CC} = 3.0V \sim 5.5V$		1.6	2.1	V
RXHYS	Input Hysteresis ^{Note1}			0.3		V
RX _R	Input Resistance		3	5	7	k Ω
Auto On-line Circuitry Characteristics ($\overline{\text{Online}} = \text{GND}$, $\overline{\text{Shutdown}} = V_L$, $V_L = V_{CC}$)						
RX _{STSH}	Receiver Threshold to Status high level		-2.7		+2.7	V
RX _{STSL}	Receiver Threshold to Status low level		-0.3		+0.3	V
t _{STSH}	Receiver Threshold to Status high			0.36	1	μs
t _{STSL}	Receiver Threshold to Status low			16	60	μs
t _{ONLINE}	Receiver Threshold to Drivers Enabled			66	90	μs
t _{OFFLINE}	Receiver Threshold to Drivers Disabled			20	30	μs

1Mbps RS-232 Transceivers with 1.65-5.5V Interface

AC Timing Characteristics -- Receiver						
fMAX	Maximum Data Rate ^{Note1}	$R_L = 3k\Omega, C_L = 250pF$, one driver active	1000			kbps
tPHL	Receiver Propagation Delay, high to low output	Receiver input to receiver output, $C_L = 150pF$		200	350	ns
tPLH	Receiver Propagation Delay, low to high output	Receiver input to receiver output, $C_L = 150pF$		175	350	ns
tSKEW	Receiver Skew	$ t_{PHL} - t_{PLH} $ (Receiver propagation delays)		35	135	ns
tREN	Receiver Output Enable Time	Normal operation		260	400	ns
tRDIS	Receiver Output Disable Time	Normal operation		185	350	ns
AC Timing Characteristics -- Driver						
fMAX	Maximum Data Rate ^{Note1}	$R_L = 3k\Omega, C_L = 250pF$, one driver active	1000			kbps
tPHL	Driver Propagation Delay, high to low output	Driver input to receiver output, $C_L = 150pF$		130	250	ns
tPLH	Driver Propagation Delay, low to high output	Driver input to receiver output, $C_L = 150pF$		125	250	ns
tSKEW	Driver Skew	$ t_{PHL} - t_{PLH} $ (Driver propagation delays)		45	120	ns
TXSLEW	Transition-Region Slew Rate – slew rise ^{Note1}	$V_{CC} = 3.3V, R_L = 5K\Omega, C_L = 250pF$, Measured from -3.0V to +3.0V or +3.0V to -3.0V		45		V/ μ s
	Transition-Region Slew Rate – Slew fall ^{Note1}			60		V/ μ s

Note1: based on bench test and design simulation.

Parameter Measurement Information

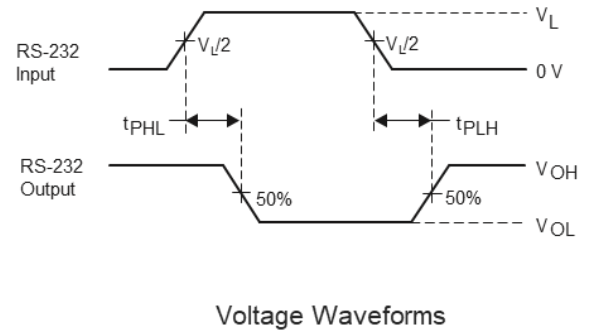
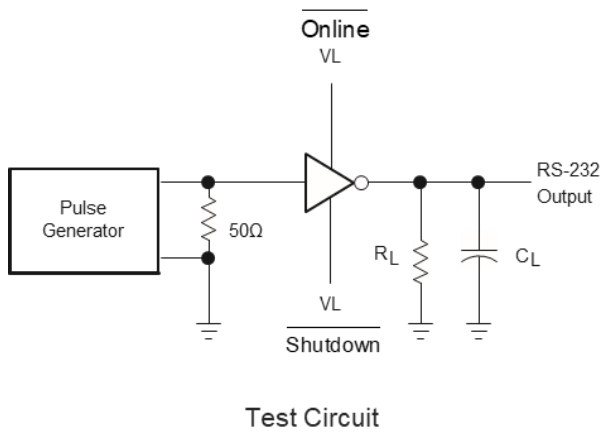


Figure 1 Driver Pulse Skew

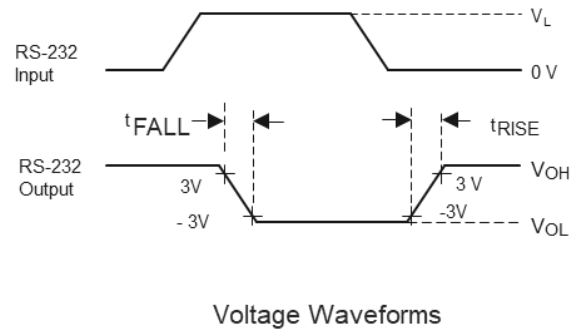
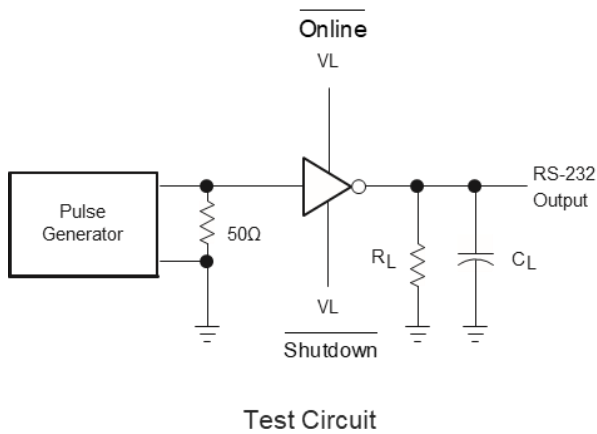


Figure 2. Driver Slew Rate

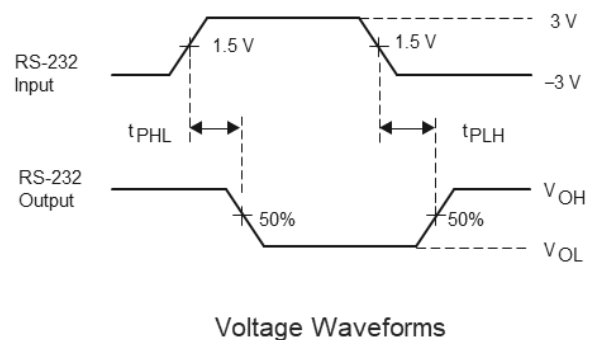
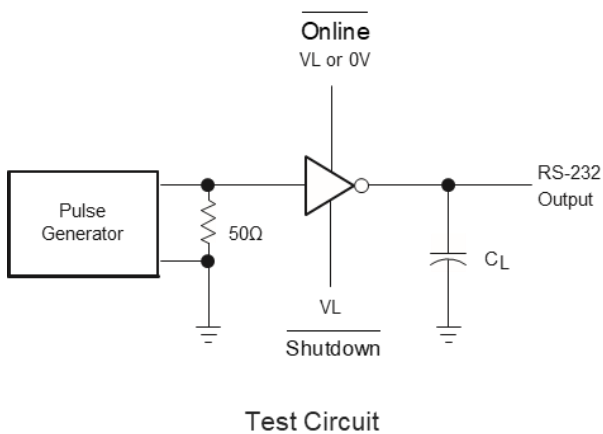


Figure 3. Receiver Propagation Delay Times

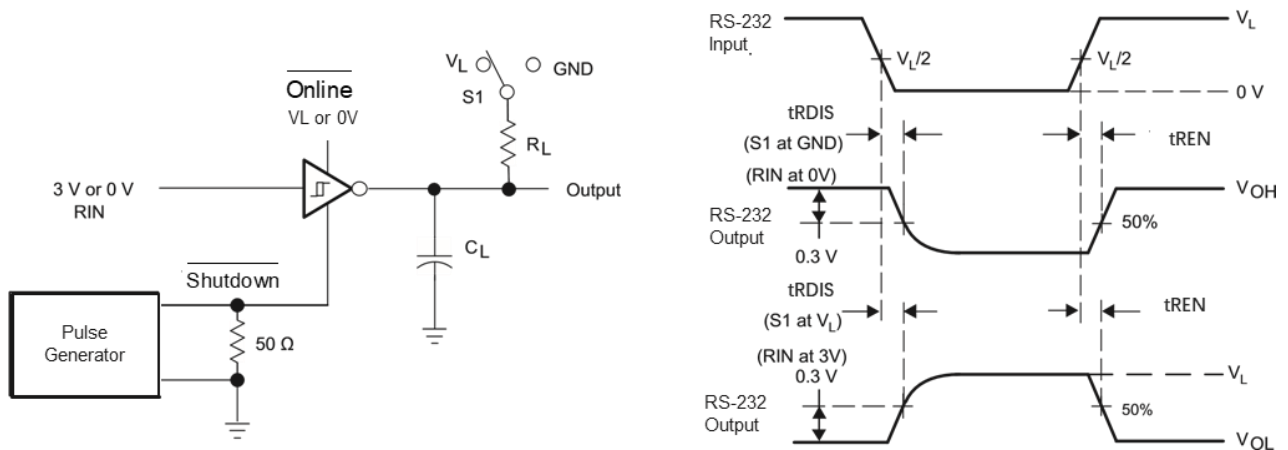


Figure 4. Receiver Enable and Disable Times

Typical Application

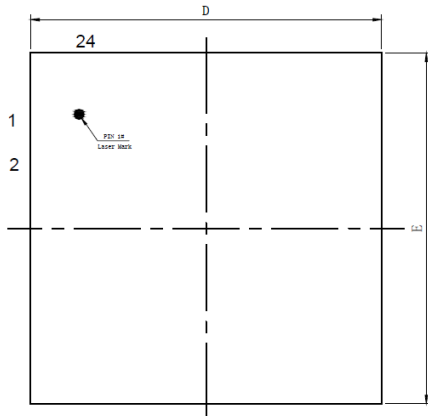
For the reference design, we suggest external capacitor C1 between pin21(C1+) and pin26(C1-), capacitor C2 between pin22(C2+) and pin23(C2-). There is C3 connect pin20(V+) to GND, and C4 connect pin24(V-) to GND. Non-polarized ceramic capacitors are acceptable. If polarized tantalum or electrolytic capacitors are used, they should be connected as shown in Table 1. The recommended capacitor value of C1 to C4 is in Table 1

V _{CC} (V)	C1(μF)	C2, C3, C4(μF)
3.0 to 3.6	0.2	0.1
4.5 to 5.5	0.1	0.1
3.0 to 5.5	0.2	0.2

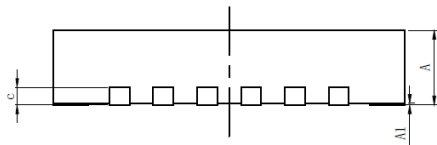
Table 1 Required Minimum Capacitor Values

Package Outline Dimensions

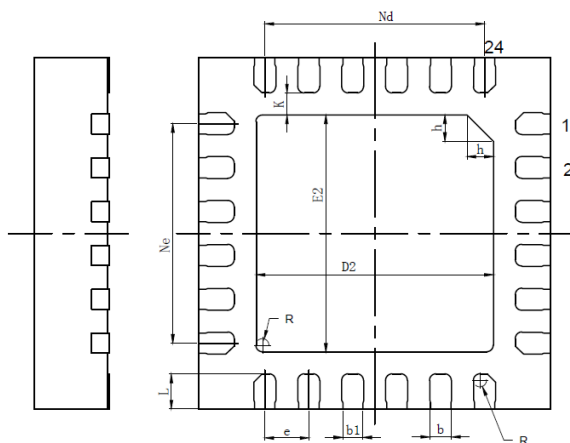
QF8R (QFN4X4-24L)



TOP VIEW



SIDE VIEW



BOTTOM VIEW

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.80	0.85	0.90
A1	0	0.02	0.05
b	0.20	0.25	0.30
b1	0.23REF		
c	0.203REF		
D	3.90	4.00	4.10
D2	2.65	2.70	2.75
e	0.50BSC		
Nd	2.50BSC		
Ne	2.50BSC		
E	3.90	4.00	4.10
E2	2.65	2.70	2.75
L	0.35	0.40	0.45
h	0.25	0.30	0.35
K	0.25REF		
R	0.075REF		