

TD041S232H

DFN package isolated RS232 Transceiver

Features

- Ultra-small, ultra-thin, chip scale DFN package
- Compliant with TIA/EIA-232 standard
- I/O power supply range supports 3.3V and 5V microprocessors
- High isolation to 3750VAC
- Bus-Pin ESD protection up to 15kV(HBM)
- Baud rate up to 120kbps
- >25kV/us CMTI
- Industrial operating ambient temperature range: -40℃ to +85℃
- Meet AEC-Q100 standards
- EN62368 approval
- Moisture Sensitivity Level (MSL) 3

Applications

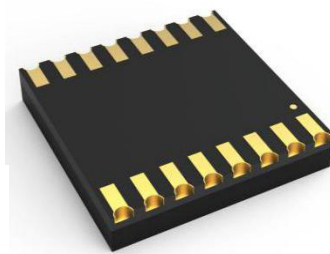
- Industrial Automation
- Building Automation
- Smart Electricity Meter

Functional Description

TD041S232H is a RS232 transceiver with low power consumption and high electrostatic protection and ESD protection, and it is fully compliant with TIA/EIA-232 standards. The main function of the product will be to convert the TTL level to the level of the RS232 protocol to achieve signal isolation. It can realize 3750VAC electrical isolation, and can also be easily embedded in user equipment, so that the equipment can easily realize the connection function of the RS232 protocol network.

TD041S232H focuses on strengthening the reliability design of TOUT and RIN pins and enhanced ESD design on the basis of traditional IC. Its TOUT and RIN port ESD tolerance is as high as 15kV (Human Body Model).

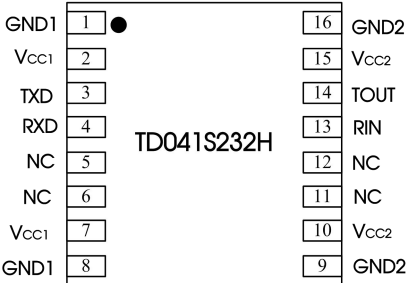
Package



Contents

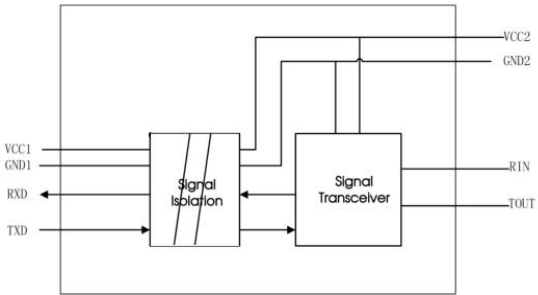
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Pin Connection



Note: All GND1 pins are internally connected; All GND2 pins are internally connected;
All VCC1 pins are internally connected; All VCC2 pins are internally connected;

Internal Block Diagram



Function Table

Letter	Description
H	High-Level
L	Low-Level

Table 1. Driver Function table

Transceiver function	Input	Output
Send function	TXD	T_OUT
	L	H
	H	L

Table 2. Receiver Function table

Transceiver function	Input	Output
Receive function①	R_IN	RXD
	≥2.4V	L
	≤0.6V	H
	0.6V<RXD<2.4V	Uncertainty

Note : ①The receiving threshold varies slightly with Vcc.

Pin Descriptions

Pin Number	Pin Name	Pin Functions
1	GND ₁	Ground(Logic side).
2	V _{CC1}	Power Supply(Logic side).
3	TXD	Driver Input.
4	RXD	Receiver Output Data.
5	NC	No Connect.
6	NC	No Connect.
7	V _{CC1}	Power Supply(Logic side).
8	GND ₁	Ground(Logic side).
9	GND ₂	Ground (Bus Side).
10	V _{CC2}	Power Supply (Bus Side).
11	NC	No Connect.
12	NC	No Connect.
13	RIN	Receiver input. This input accepts RS-232 signal level.
14	TOUT	Drive output. This pin outputs the RS-232 signal level.
15	V _{CC2}	Power Supply (Bus Side).
16	GND ₂	Ground (Bus Side).

Absolute Maximum Ratings

General test conditions: Free-air, normal operating temperature range (unless otherwise specified).

Parameters	Unit
V _{CC1}	-0.3 V to +6 V
V _{CC2}	-0.3 V to +6 V
Driver input pin, TXD	-0.3V to +6V
Driver output pin, TOUT	-13.2V to +13.2V
Receiver input pin, RIN	-25V to +25V
Receiver output pin, RXD	-0.3V to +6V
Operating Temperature Range	-40°C to +105°C
Storage Temperature Range	-50°C to +150°C
Reflow Soldering Temperature	Peak temp. ≤260°C, maximum duration ≤60s at 217°C. Please also refer to IPC/JEDEC J-STD-020D.3.

Important: Exposure to Absolute Maximum Rated conditions for an extended period may severely affect the device reliability, and stress levels exceeding the "Absolute Maximum Ratings" may result in permanent damage. All voltage values are based on the reference ground(GND).

Recommended Operating Conditions

Symbol	Recommended operating conditions		Min.	Typ.	Max.	Unit
V _{CC}	Supply voltage	Logic Side, V _{CC1}	2.375	3.3	5.5	V
		Bus Side, V _{CC2}	4.5	5	5.5	
V _{IH}	High-level input voltage(TXD)		2		V _{CC1}	
V _{IL}	Low-level input voltage(TXD)		0		0.8	
I _{OS}	Output current	Driver	2			mA
		Receiver			10	
R _L	Output load resistance			3		kΩ
T _A	Operating temperature range		-40		85	°C
-	Signaling rate				120	kbps

Electrical Characteristics

General test conditions and $V_{CC1}=V_{CC2}=5V$, $T_a = 25^{\circ}C$ (unless otherwise specified).

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Driver						
V_{TOUT}	Drive output high level	$R_L=3k\Omega$ to GND2	5	6.5		V
	Drive output low level	$R_L=3k\Omega$ to GND2		-6.5	-5	V
R_{TOUT}	Driver output impedance		300			Ω
I_{ISC}	Driver short circuit current				60	mA
R_{TXD}	Internal TXD Pull up Resistor			5.1		k Ω
Receiver						
V_{RIN}	Receiver input range		-25		25	V
V_{RIL}	Receiver input low threshold voltage		0.6	0.9		V
V_{RIH}	Receiver input high threshold voltage			1.5	2.4	V
	Receiver input hysteresis			0.4		V
R_{RIN}	Receiver input impedance		3	5	7	k Ω
V_{ROH}	RXD high level output voltage	$V_{CC} - 0.4$		$V_{CC} - 0.1$		V
V_{ROL}	RXD low level output voltage				0.4	V
Power supply and safeguard characteristic						
I_{CC1}	Logic side static input current	$2.375V \leq V_{CC1} \leq 5.5V$, No load		3	5	mA
I_{CC2}	Bus side static input current	$4.5V \leq V_{CC2} \leq 5.5V$, No load		15	30	mA
I_{CC}	Working current	No load		20	35	mA
		$R_L=3k\Omega$ to GND2		20	35	mA
ESD	HBM	TOUT、RIN to GND2			± 15	kV
		Other pin			± 2	kV
	Contact	TOUT、RIN to GND2			± 8	kV
EFT	IEC61000-4-4	TOUT、RIN to GND2			± 2	kV
SURGE	IEC61000-4-5	TOUT、RIN to GND2			± 2	kV
VI-O	Insulate voltage				3750	VAC
	Insulate impedance		1			G Ω
	Insulate capacitance			50		pF
CMTI	Common mode transient immunity	$TXD = V_{CC}$ or 0 V, $V_{CM} = 1$ kV, transient magnitude = 800 V	25			kV/us

Note : ESD indicators are non-charged test specifications, GND2 need to be connected to the earth during testing.

Transmission Characteristics

General test conditions and $V_{CC1}=V_{CC2}=5V$, $T_a = 25^{\circ}C$ (unless otherwise specified).

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
-	Maximum data rate	Duty 40% to 60%			120	kbps
T_{PHL}, T_{PLH}	Driver propagation delay	$R_L = 3k\Omega$ to 7k Ω , $C_L = 50pF$			2	us
T_{PHL}, T_{PLH}	Receiver propagation delay	$C_L = 15pF$			2	us

Physical Characteristics

Parameter	Value	Unit
Weight	0.4(Typ.)	g

Typical Performance Curves

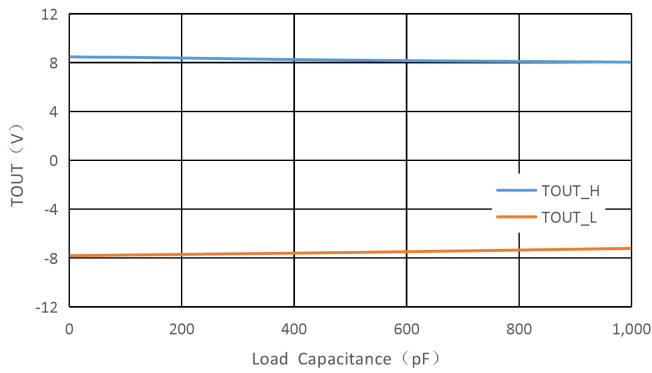


Figure 1. Transmitter Output Voltage High/Low VS Load Capacitance at 120 kbps

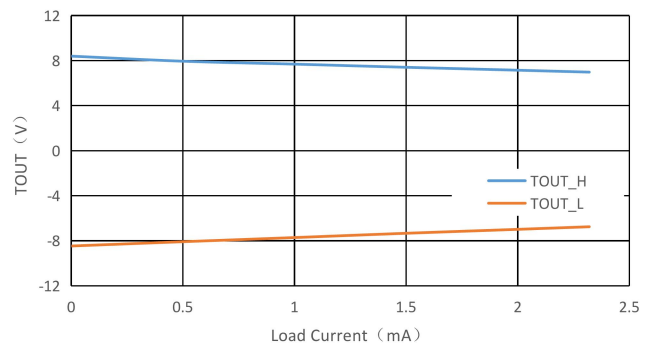


Figure 2. Transmitter Output Voltage High/Low VS Load Current

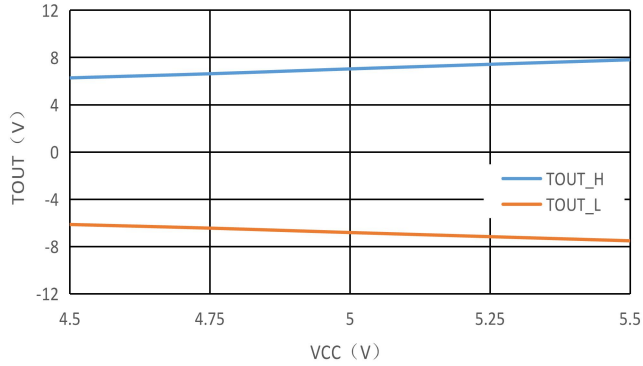


Figure 3. Transmitter Output Voltage High/Low VS VCC, $R_L=3\text{ k}\Omega$

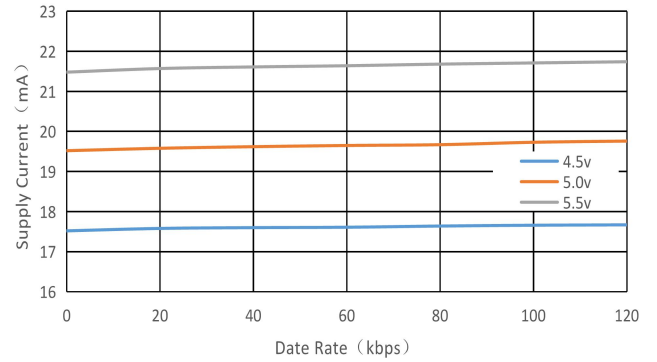


Figure 4. Supply current VS Data rate ($V_{CC1}=V_{CC2}=5\text{V}$, $R_L=3\text{ k}\Omega$)

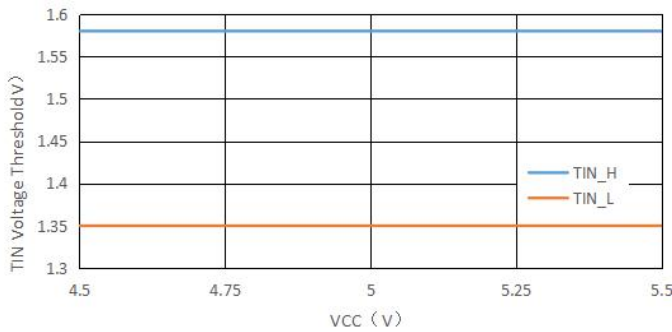


Figure 5. TIN Voltage Threshold VS VCC ($V_{CC1}=V_{CC2}=5\text{V}$)

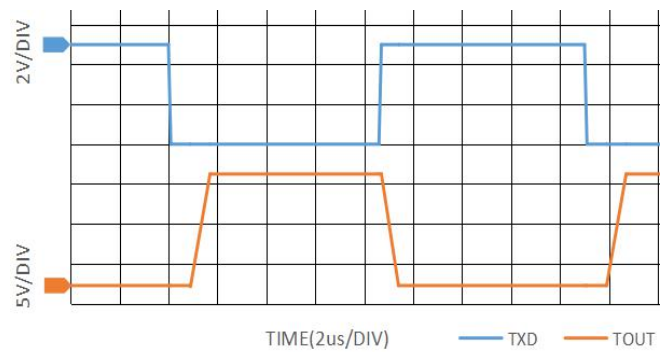


Figure 6. 120 kbps Data Transmission ($V_{CC1}=V_{CC2}=5\text{V}$, $R_L=3\text{ k}\Omega$)

Application circuit

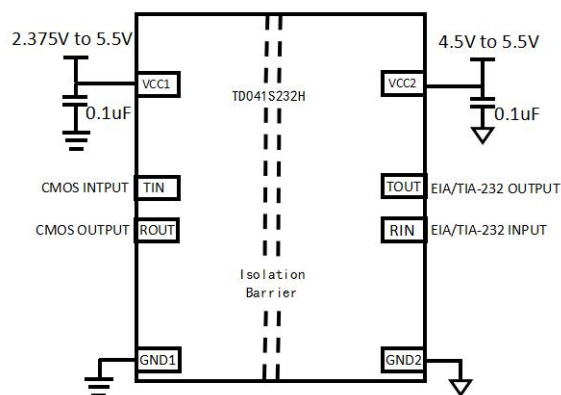


Figure 7. The typical application circuits

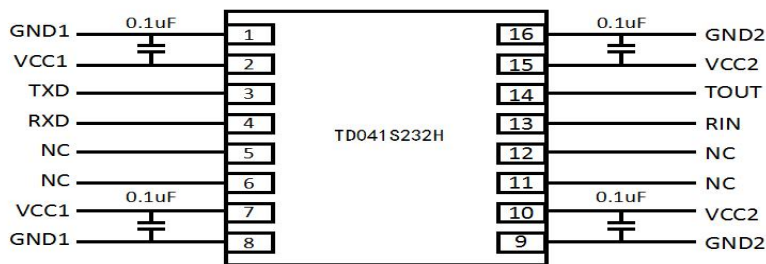


Figure8. The typical PCB layout

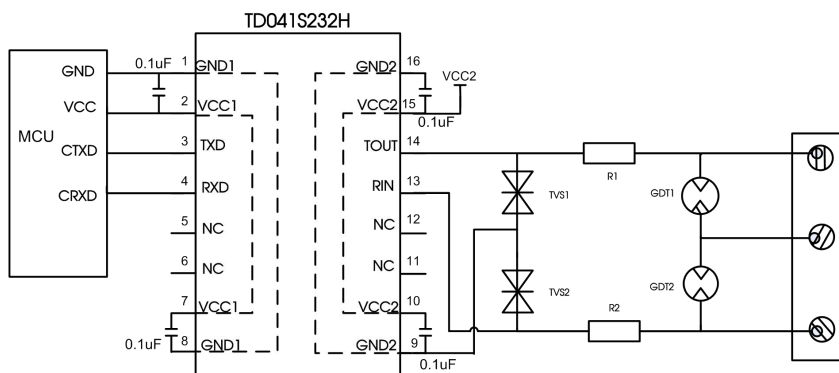


Figure9. Port protection circuit for harsh environments

Recommended components and values:

Components	TD041S232H
TVS1, TVS2	SMCJ15CA
R1, R2	12Ω/2W(Wire-wound resistor)
GDT1, GDT2	S30-A90X

When the module is used in applications with harsh environment, it can be susceptible to large energy like lightning strike, etc. in which case, it is essential to add an adequate protection circuit to the 232 signal ports to protect the system from failure and maintain a reliable bus communication. Figure 9 provides a recommended protection circuit design for high-energy lightning surges, with a degree of protection related to the selected protection device. Parameter description lists a set of recommended circuit parameters, which can be adjusted according to the actual application situation. Also, when using the shielded cable, the reliable single-point grounding of the shield must be achieved.

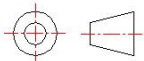
Note: The recommended components and values is a general guideline only and must be verified for the actual user's application.

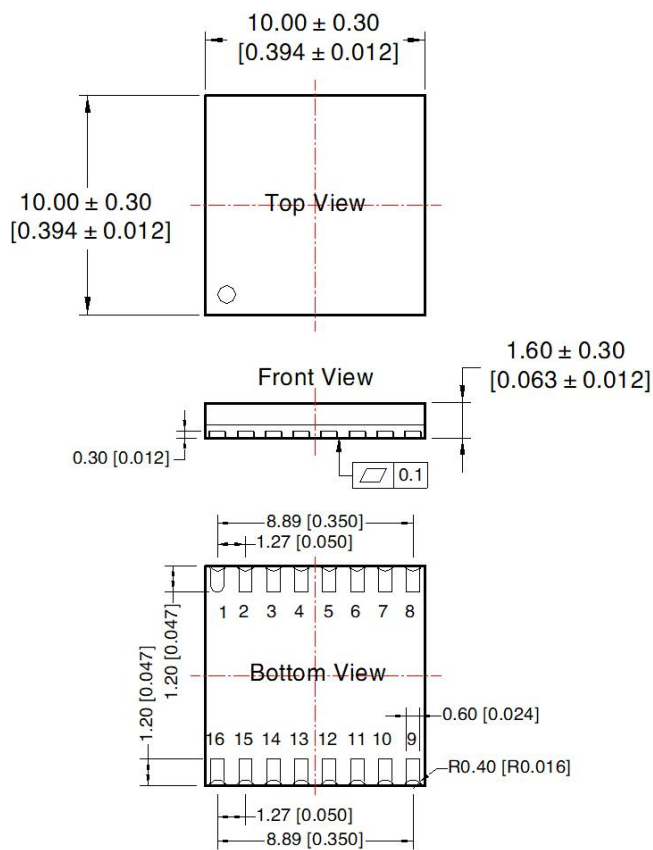
Recommendations

- ① Hot-swap is not supported.
- ② If the external input of TXD is insufficient, the pull-up resistor should be added according to the situation.
- ③ Refer to *IPC 7093* for the welding process design of this product. For detailed operation guidance, please refer to *Hot Air Gun Welding Operation Instruction for DFN Package Product* or *Welding Operation Instruction for DFN Package Product*.

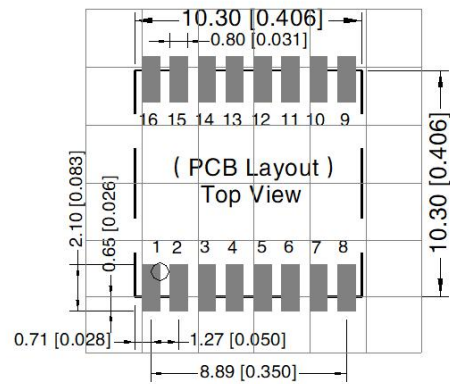
Ordering Information

Part number	Package	Number of pins	Product Marking	Tape & Reel
TD041S232H	DFN	16	TD041S232H	500/REEL

THIRD ANGLE PROJECTION 

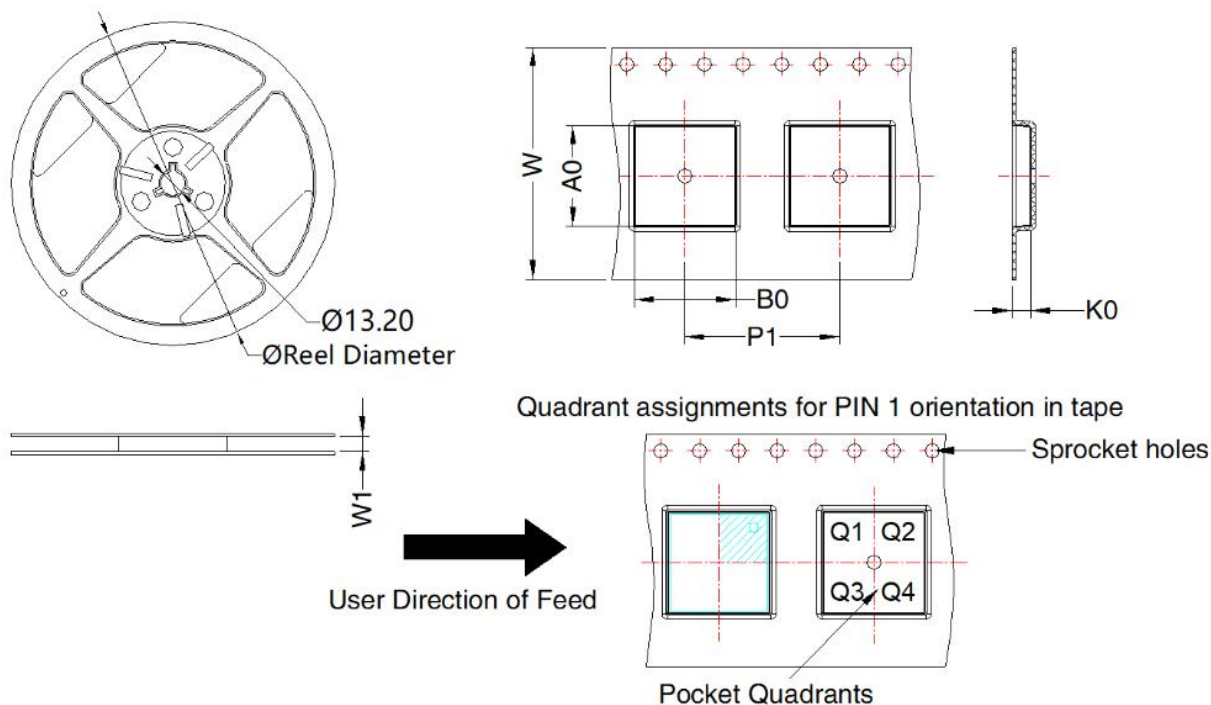


Note:
 Unit: mm[inch]
 General tolerances: ± 0.10 [± 0.004]



Note: Grid 2.54*2.54mm

Pin-Out			
Pin	Mark	Pin	Mark
1	GND1	9	GND2
2	VCC1	10	VCC2
3	TXD	11	NC
4	RXD	12	NC
5	NC	13	RIN
6	NC	14	TOUT
7	VCC1	15	VCC2
8	GND1	16	GND2



Device	Package Type	Pin	MPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TD041S232H	DFN 10x10	16	500	180.0	24.4	10.44	10.44	2.0	16.0	24.0	Q2

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