



钜地半导体
Tudi Semiconductor

Product Specification

TUDI-MAX3078

+3.3V, $\pm 15\text{kV}$ ESD-Protected, Fail-Safe, Hot-Swap,
RS-485/RS-422 Transceivers

网址 www.sztdbdt.com 🔍

用芯智造 · 卓越品质

**semiconductor device
manufacturer**

- Design
- research and development
- production
- and sales



FEATURES

- Robust performance protection
 - $\pm 15\text{kV}$ human model ESD on I/O pins
 - True fail-safe receiver maintains EIA/TIA485 compatibility
- Enhanced rate limiting for error-free data transmission
- DE and RE hot-pluggable input structure
- Flexible design characteristics
- Up to 256 transceivers allowed on the bus
- Industry-standard SO and DIP packages available as options
- Shutdown low current mode, energy saving

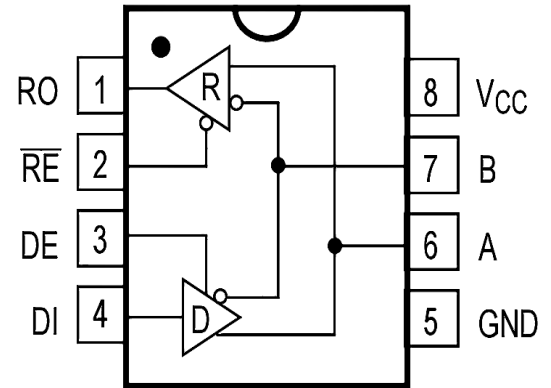


Figure 1. Pin Diagram

Description

The MAX3078E is an RS-485/RS-422 transceiver with one driver and one receiver. These incorporate protection circuitry to guarantee a logic high receiver output when the receiver input is open circuit or shorted. If all drivers on the terminated bus are disabled (high impedance), receiver output is logic high. These devices incorporate plug-and-play functionality to eliminate spurious transitions on the bus during power up or warm insertion.

The MAX3078E driver's unrestricted rise time allows for data rates up to 15Mbps.

The MAX3078E is suitable for half-duplex communication

The device features a $1/8$ unit load receiver input impedance allowing for up to 256 drivers on the bus.

Applications

- Lighting Systems
- Industrial Control
- Telecom
- Security Systems
- Instrumentation



Pin description

Pin Number	Pin Name	FUNCTION
1	RO	Receiver Output.When enabled,ifA-B $\geq$ -10mV,then RO=high.IfA-B $\leq$ -200 mV,then RO=low
2	/RE	Receiver Output Enable.Alow level enables the RO;a high level places it in a high impedance state.
3	DE	Driver Output Enable.A high level enables the driver differential outputs,Pin A and Pin B;a low level places the driver in a high impedance state.
4	DI	Driver Input.When the driver is enabled,a logic low on DI forces Pin A low and Pin B high;a logic high on DI forces PinA high and Pin B low.
5	GND	Ground Connection (0V).
6	A	No inverting Receiver Input A/Driver Output A
7	B	Inverting Receiver Input B/Driver Output B.
8	VCC	Power Supply

Parameter limit

PARAMETER	Symbol	Value	Unit
CTR Port	/RE,DE,DI	-0.3~VCC+0.3	V
Driver Output Voltage	A、B	-7~13	V
Receiver Output Voltage	RO	-0.3~VCC+0.3	V
Supply Voltage	VCC	+7	V
Continuous Power Dissipation	MSOP8.SOP8.DIP8	830	mW
Soldering Temperature (reflow)		300	°C
Storage Temperature Range		-60~150	°C
Temperature Range		- 40 ~ 125	°C

Stresses beyond those listed under “Parameter limit” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability



Receiver Switching Characteristics

Parameter	symbol	Test condition	Minimum	Typical case	Maximum	Unit
Propagation delay from receiver input to output, from low to high	tRPLH	CL=15pF See Figures 7 and 8		80	150	ns
The propagation delay from receiver input to output is from high to low	tRPHL			80	150	ns
tRPLH-tRPHL	tRPDS			7	10	ns
Enable low time out	tRPZL	CL=15pF See Figures 7 and 8		20	50	ns
Enable to output high time	tRPZH	CL=15pF See Figures 7 and 8		20	50	ns
Time from output low to disable	tpRLZ	CL=15pF See Figures 7 and 8		20	45	ns
Time from out-put high to disable	tpRHZ	CL=15pF See Figures 7 and 8		20	45	ns
Off stateEnable to output high time	tRPSH	CL=15pF See Figures 7 and 8		200	1400	ns
Off stateEnable low time out	tRPSL	CL=15pF See Figures 7 and 8		200	1400	ns
Time to turn off	tsHDN	NOTE	80		300	ns

NOTE: When /RE=1 and DE=0, the device will not enter shutdown mode if the duration is less than 80ns;however, it will definitely enter shutdown mode if the duration exceeds 300ns



supply current						
Parameter	symbol	Test condition	Minimum	Typical canse	Maximum	Unit
Supply current	I _{CC1}	/RE=0V,DE=0V		520	800	uA
	I _{CC2}	/RE=VCC,DE=VCC		540	700	uA
Turn-off current	I _{sHDN}	/RE=VCC,DE=0V		0.5	10	uA
Drive Switch Characterist-ics						
Parameter	symbol	Test condition	Minimum	Typical case	Maximum	Unit
Driver differen-tial output delay	t _{DD}	R _{DIFF} =60 Ω,CL ₁ =CL ₂ =100pF(see Fi-gure 3 and Figure 4)		10	35	ns
Drive differentialoutput transition time	t _{TD}			12	25	ns
Drive propagation delay from low to high	t _{PLH}	R _{DIFE} =27Ω(see Figure 3 and Figure 4)		8	35	ns
Drive propagationdelay from high to low	t _{PHL}			8	35	ns
t _{PLH} -t _{PHL}	t _{PDS}			1	8	ns
Enable to output high	t _{pZH}	R _L =110Ω(see Figure 5 and 6)		20	90	ns
Enable to output low	t _{pZL}			20	90	ns
Input low to disable	t _{PLZ}	R _L =110Ω(see Figure 5 and 6)		20	80	ns
Enable high input	t _{PHZ}			20	80	ns
Enable high outputunder off condition	t _{DSH}	R=110Ω(see Figure 5 and 6)		500	900	ns
Enable low output under shutdown conditions	t _{DSL}	R _L =110Ω(see Figure 5 and 6)		500	900	ns

DC electrical characteristics of the driver

Parameter	symbol	Test condition	Minimum	Typical case	Maximum	Unit
Driver differential output (non-loaded)	VoD ₁			3.3		V
Drive differential output	VoD ₂	graph 2, RL=54Ω	1.5		VCC	V
		graph 2, RL=100Ω	2		VCC	
Variation in the amplitude of the output voltage (NOTE1)	VoD	graph 2, RL=54Ω			0.2	V
Output common mode voltage	Voc	graph 2, RL=54Ω			3	V
Amplitude Variation of Common Mode Output Voltage (NOTE1)	Voc	graph 2, RL=54Ω			0.2	V
High-level input	VH	DE, DI, /RE	2.0			V
Low level input	V _π	DE, DI, /RE			0.8	V
Logic input current	IN1	DE, DI, /RE	-2		2	uA
Output the current during a short circuit, with high short-circuit	IosD ₁	Short circuit to 0V~12V			250	mA
Output the current during a short circuit, down to low	IosD ₂	Short circuit to -7V~0V	-250			mA
Overtemperature shutdown threshold temperature				140		
Overtemperature turn-off hysteresis temperature				20		



DC Electrical Characteristics of the Receiver

Parameter	symbol	Test condition	Minimum	Typical case	Maximum	Unit
Input current(A,B)	IN2	DE=0V,VCC=0 or 3.3V VIn=12V			125	uA
		DE=0V,VCC=0 or 3.3V VIn=-7V	-100			uA
Forward input threshold voltage	VIT+	$-7V \leq V_{cm} \leq 12V$			+200	mV
Reverse input threshold voltage	VIT-	$-7V \leq V_{cm} \leq 12V$	-200			mV
Input hysteresis voltage	Vhys	$-7V \leq V_{cm} \leq 12V$	10	30		mV
High level output voltage	VoH	IoUT=-2.5mA,VID=+200 mV	VCC-1.5			V
Low level output voltage	VoL	IoUT=+2.5mA,VD=-200 mV			0.4	V
Three-state input leakage cur-rent	IozR	$0.4V < V_o < 2.4V$			±1	uA
Input resistance of receiver	RIn	$-7V \leq V_{cm} \leq 12V$	96			kΩ
Receiver short circuit curr-ent	IosR	$0V \leq V_o \leq VCC$	±8		±60	mA



FUNCTION TABLES

TRANSMITTING						RECEIVING			
CTR	/RE	X	X	0	1	0	0	0	1
	DE	1	1	0	0	X	X	X	X
INPUTS	DI	1	0	X	X				
	A-B					$\geq -10\text{mV}$	$\leq -200\text{mV}$	Open/shorted	X
OUTPUTS	A	H	L	Z					
	B	L	H	Z					
	RO					H	L	H	Z

X:Don't care;Z:high impedance.

TEST CIRCUIT

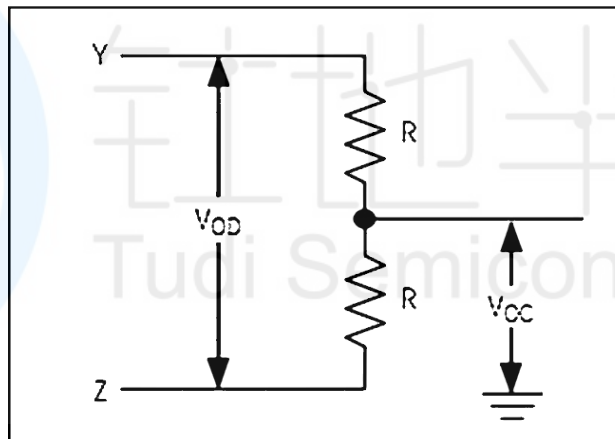


Figure 2 DC test load of the driver

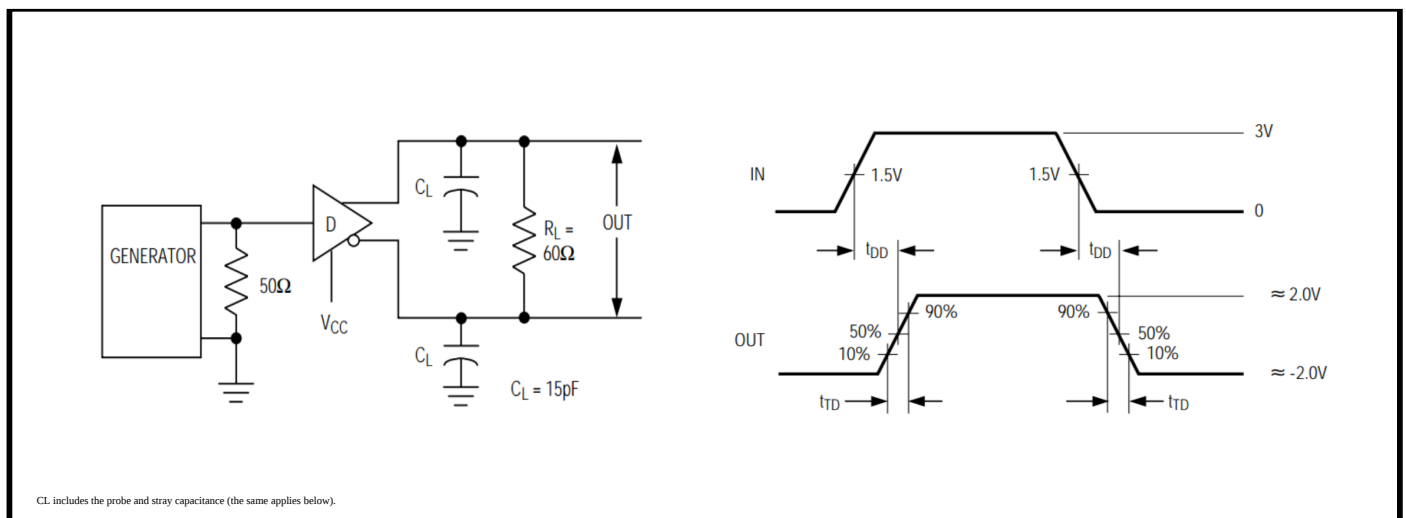


Figure 3 Differential delay and transit time of driver

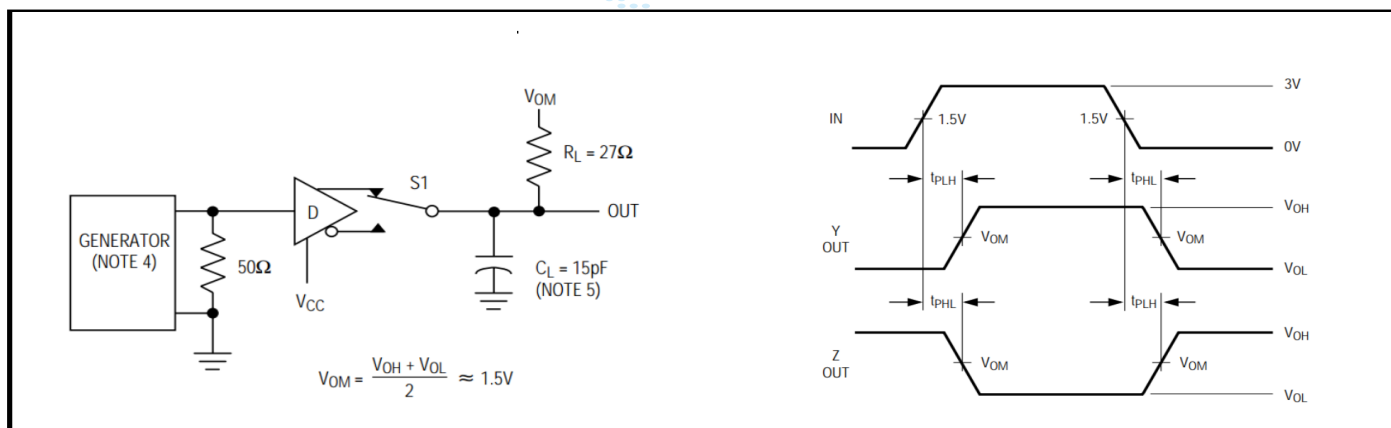


Figure 4 Propagation Delay of Driver

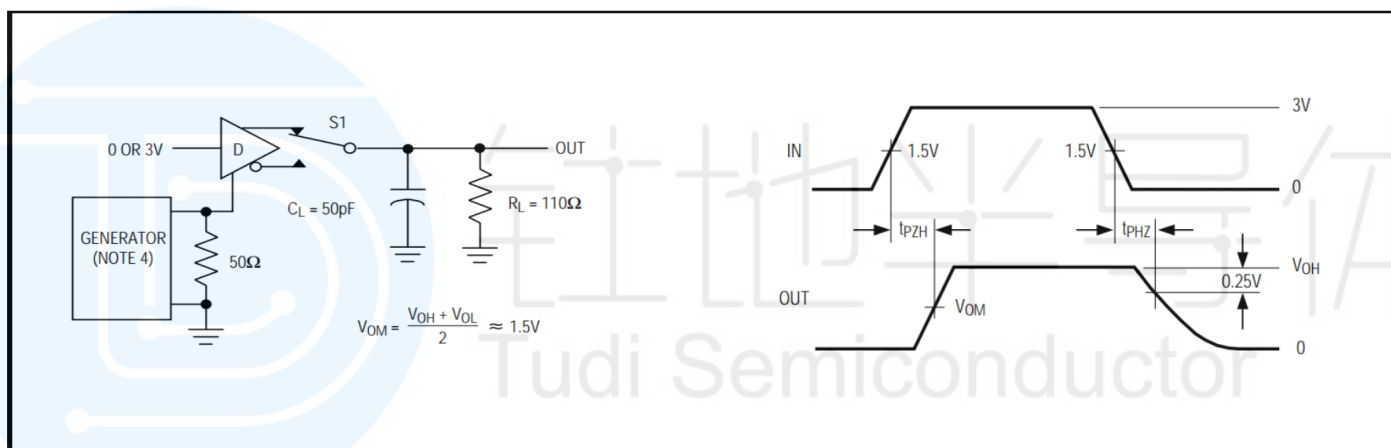


Figure 5 Driver enable and disable time

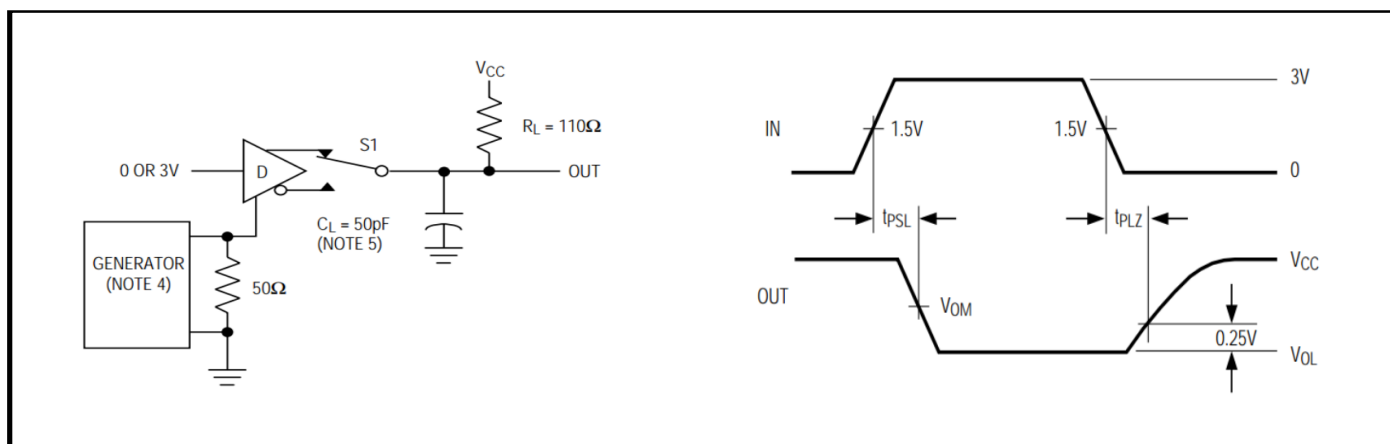


Figure 6 Driver enable and disable time

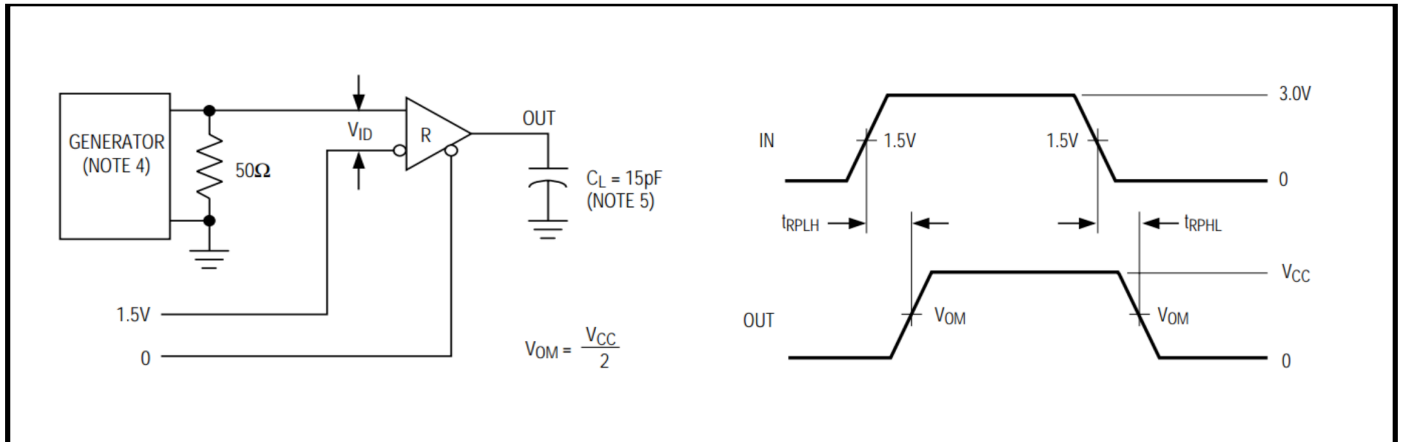


Figure 7 Receiver propagation delay test circuit

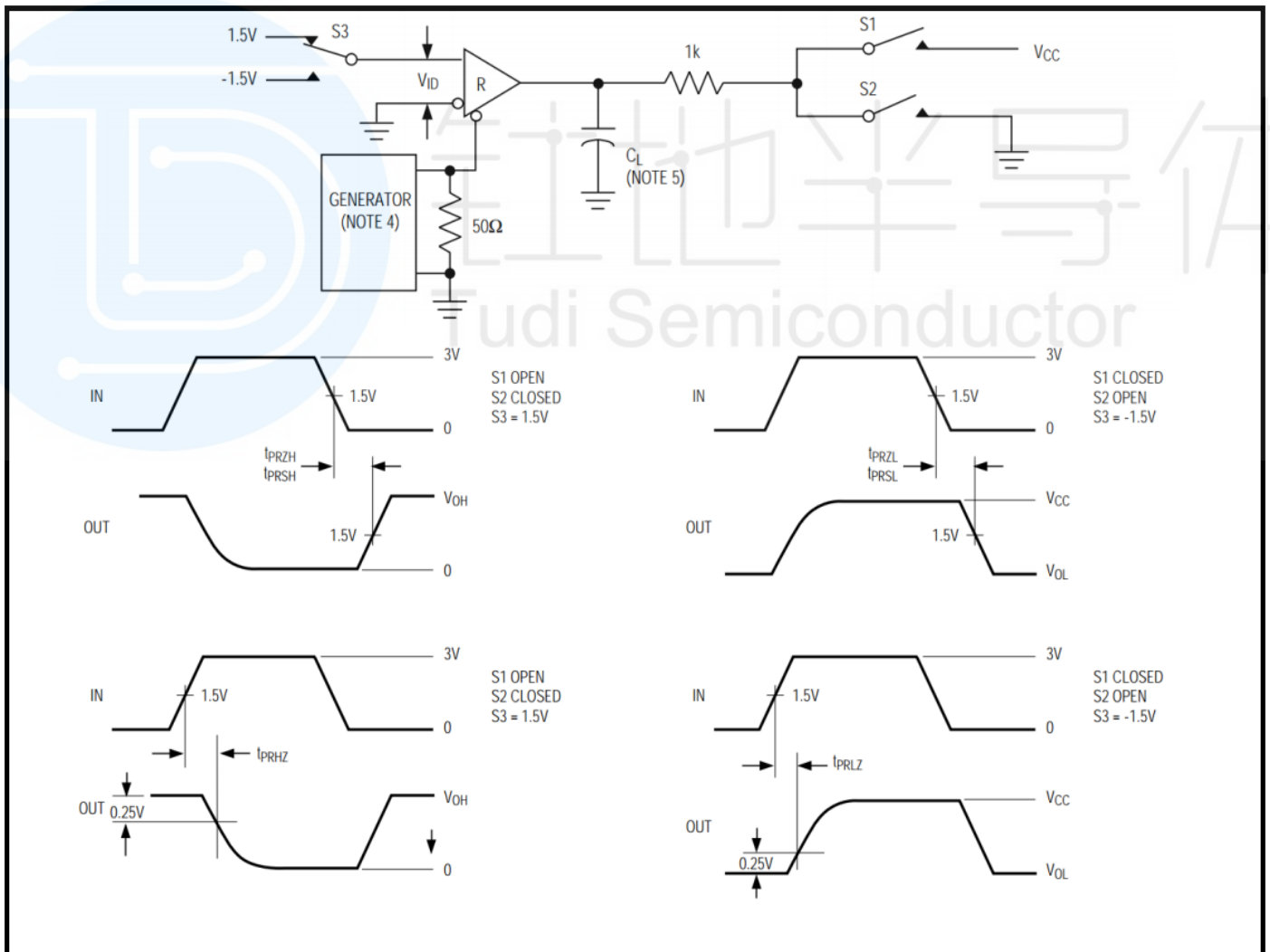


Figure 8 Receiver Enable and Disable Time

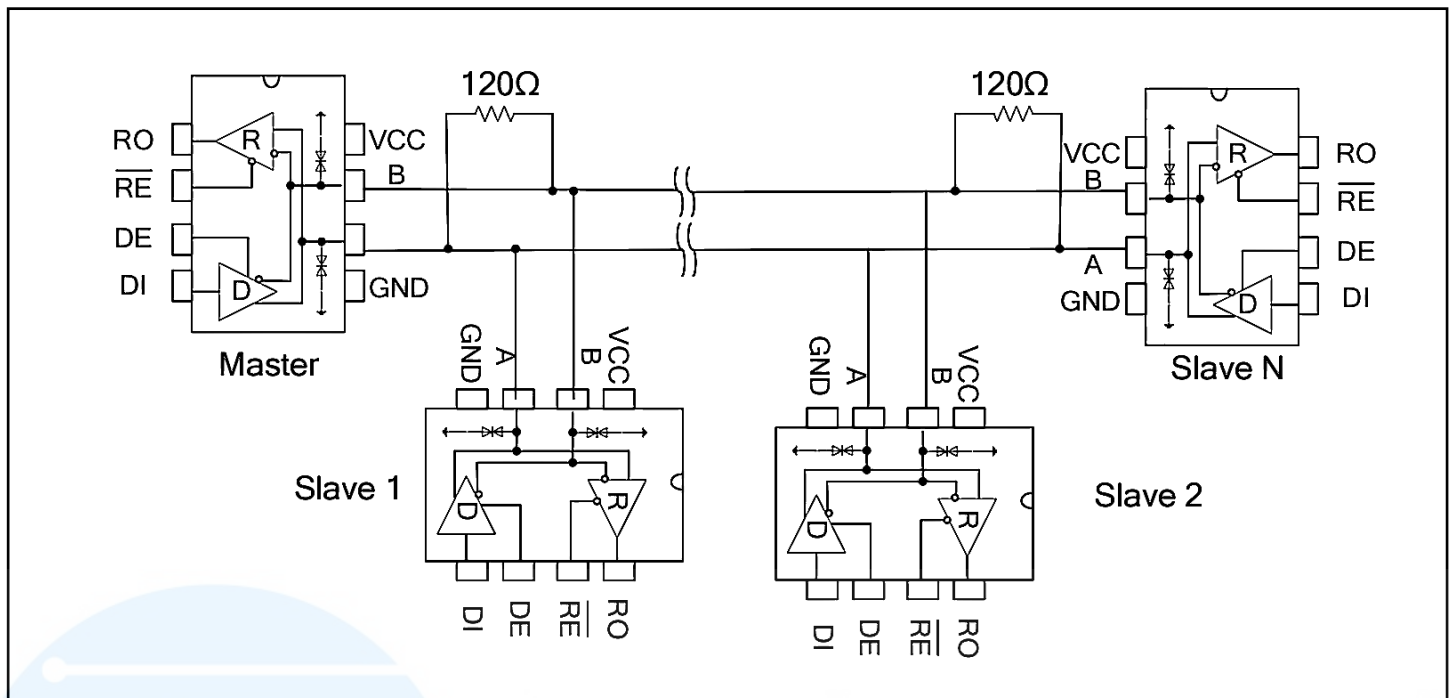


Fig11 Backbone cable type RS485 communications network

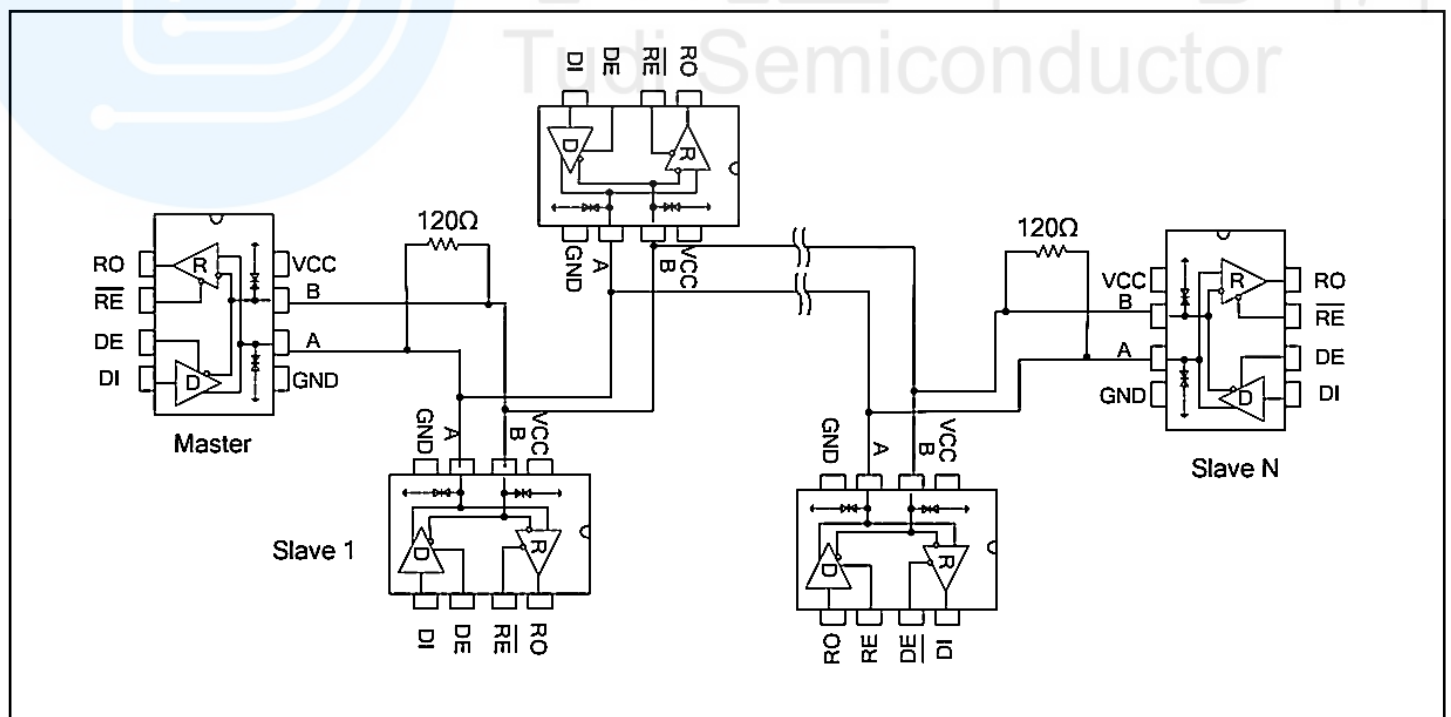


Fig12 Daisy chain topology type RS485 communications network

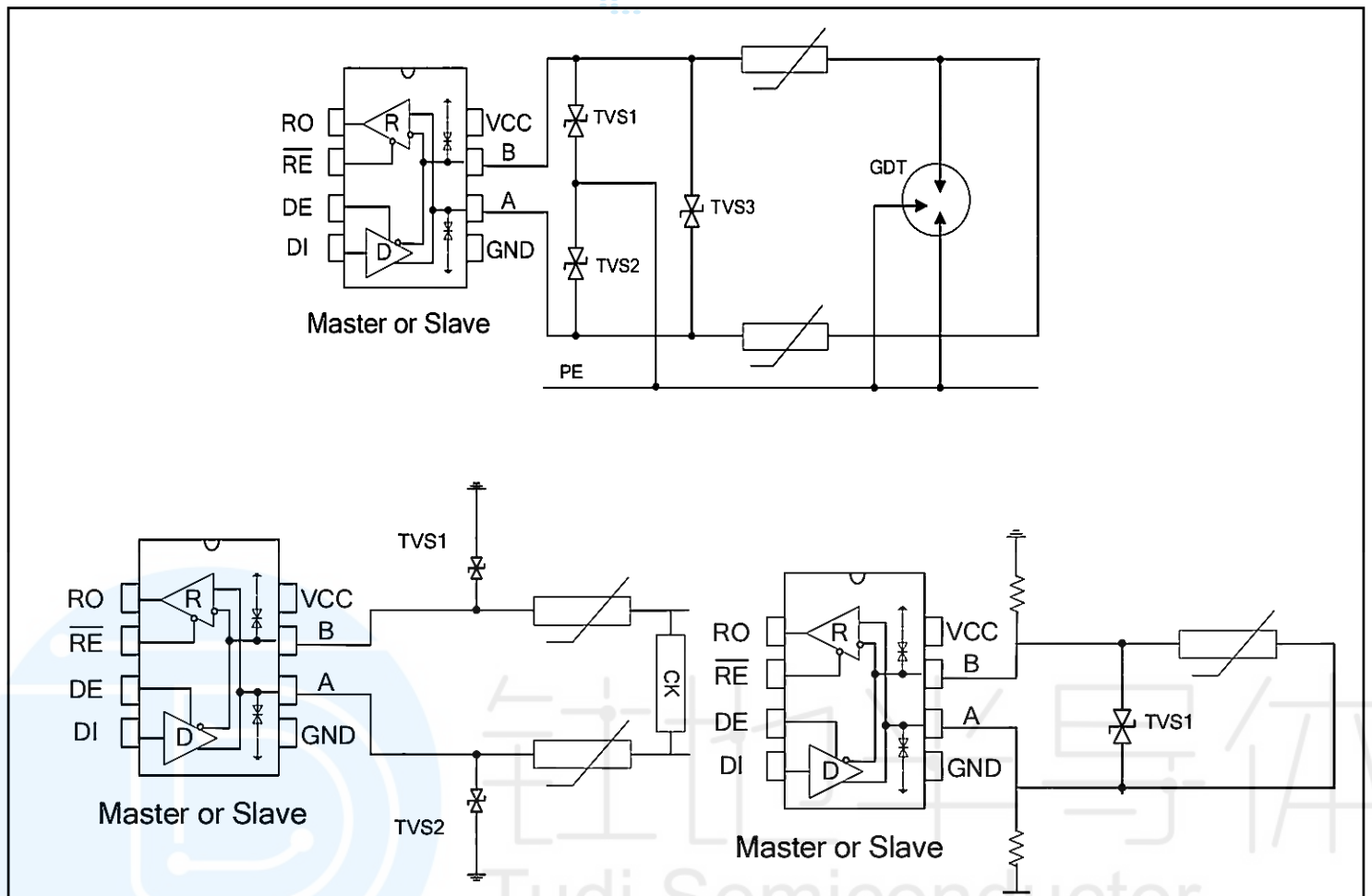
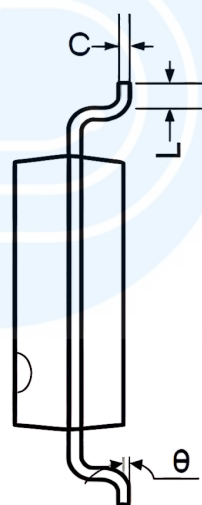
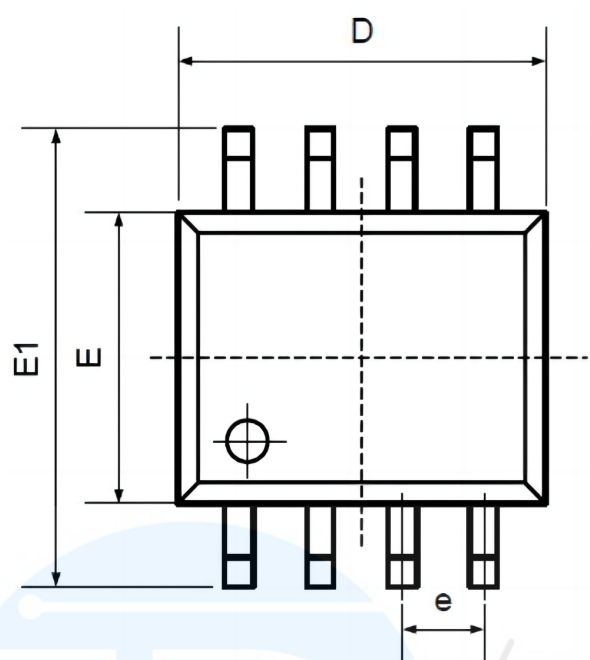


Fig13 RS485 bus ports Protection configuration

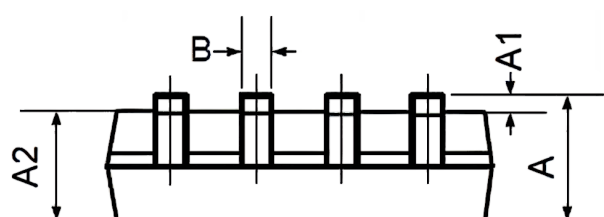
Order information

Order Number	Package	Package Quantity	Marking On The park	Temperature
MAX3078EEPA-TUDI	DIP8	Tube,50A box of 2000	MAX3078EEPA	- 40°C to 85°C
MAX3078EESA-TUDI	SOP8	Tape,Reel,2500	MAX3078EESA	
MAX3078EAPA-TUDI	DIP8	Tube,50A box of 2000	MAX3078EAPA	- 40°C to 125°C
MAX3078EASA-TUDI	SOP8	Tape,Reel,2500	MAX3078EASA	

Package SOP8

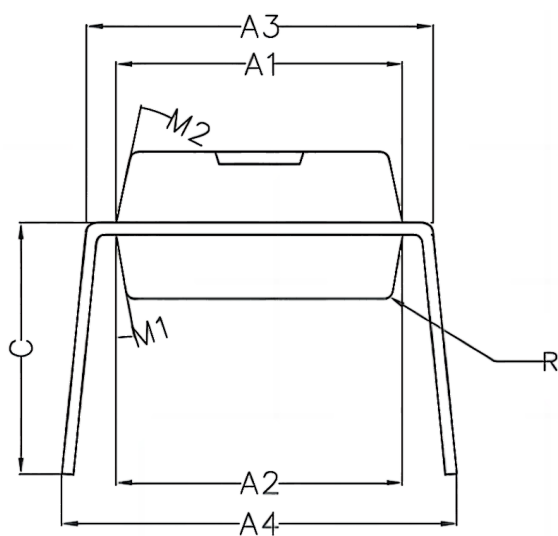
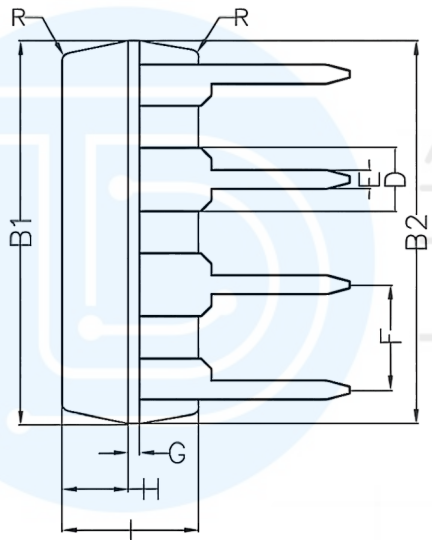
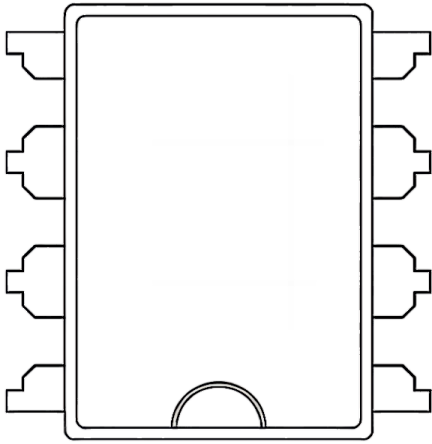


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°





Package DIP8



Symbol	Min	Non	Max
A1	6.28	6.33	6.38
A2	6.33	6.38	6.43
A3	7.52	7.62	7.72
A4	7.80	8.40	9.00
B1	9.15	9.20	9.25
B2	9.20	9.25	9.30
C		5.57	
D		1.52	
E	0.43	0.45	0.47
F		2.54	
G		0.25	
H	1.54	1.59	1.64
I	3.22	3.27	3.32
R		0.20	
M1	9°	10°	11°
M2	11°	12°	13°



Important statement:

- TUDI Semiconductor reserves the right to modify the product manual without prior notice! Before placing an order, customers need to confirm whether the obtained information is the latest version and verify the completeness of the relevant information.
- Any semi-guide product is subject to failure or malfunction under specified conditions. It is the buyer's responsibility to comply with safety standards when using TUDI Semiconductor products for system design and whole machine manufacturing. And take the appropriate safety measures to avoid the potential in the risk of loss of personal injury or loss of property situation!
- TUDI Semiconductor products have not been licensed for life support, military, and aerospace applications, and therefore TUDI Semiconductor is not responsible for any consequences arising from the use of this product in these areas.
- If any or all TUDI Semiconductor products (including technical data, services) described or contained in this document are subject to any applicable local export control laws and regulations, they may not be exported without an export license from the relevant authorities in accordance with such laws.
- The specifications of any and all TUDI Semiconductor products described or contained in this document specify the performance, characteristics, and functionality of said products in their standalone state, but do not guarantee the performance, characteristics, and functionality of said products installed in Customer's products or equipment. In order to verify symptoms and conditions that cannot be evaluated in a standalone device, the Customer should ultimately evaluate and test the device installed in the Customer's product device.
- TUDI Semiconductor documentation is only allowed to be copied without any alteration of the content and with the relevant authorization. TUDI Semiconductor assumes no responsibility or liability for altered documents.
- TUDI Semiconductor is committed to becoming the preferred semiconductor brand for customers, and TUDI Semiconductor will strive to provide customers with better performance and better quality products.