



钰地半导体
Tudi Semiconductor

Product Specification

TUDI-SN65HVD1785/1786/1787

Fault-protected RS-485 transceivers with extended common mode range

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**semiconductor device
manufacturer**

- Design
- research and development
- production
- and sales



FEATURES

- Bus pin fault protection
- Bus I/O protection
 - 16kV JEDEC Human Body Model (HBM) protection
- Reduced load unit for up to 256 nodes
- Fault-tolerant receiver open, shorted, and idle bus conditions
- Low power consumption
- No glitchy pulse operation on power up or power down

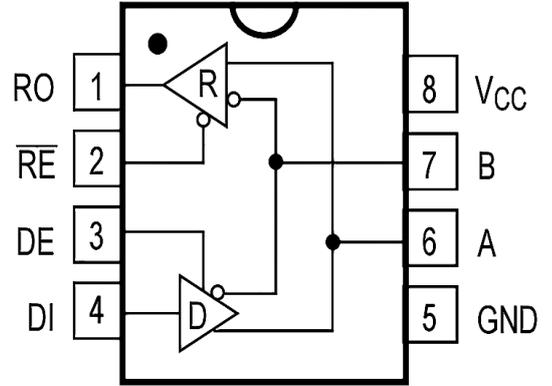


Figure 1. Pin Diagram

Description

These devices can withstand damage in the event of overvoltage faults (e.g., direct short of the power supply, miswiring faults, faults, cable crush, and misuse of tools). They also feature advanced ESD model protection specifications that remain stable in the event of a static discharge (ESD) event

These devices combine a differential driver and a differential receiver, both powered by a single supply. The driver's differential output and the receiver's differential input are internally connected to a bus port suitable for half-duplex (two-wire bus) communication. These ports all have a wide common mode voltage range, making the devices applicable for multi-point over long cables. The rated operating temperature range of these devices is from -40°C to 105°C.

Application

- Designed for RS-485 and RS-422 networks



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		-40~85	°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



PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
SWITCHING CHARACTERISTICS OF RECEIVER						
Receiver Enable to Output Low	tRZL	CL=100 pF, S1 closed		20	50	ns
Receiver Enable to Output High	tRZH	CL=100 pF, S2 closed		20	50	ns
Receiver Disable Time from Low	tRLZ	CL=100 pF,		20	50	ns
Receiver Disable Time from High	tRHZ	CL=100pF, S2 closed		20	50	ns
Receiver Propagation Delay (low to high)	tRPLH	Fig 7 and 8 VD≥2.0V; Rise and fall time VID≤15ns		50	200	ns
Receiver Propagation Delay (high to low)	tRPHL			50	200	ns
tRPLH-tRPHL	tsKEW2			13	15	ns
SWITCHING CHARACTERISTICS OF DRIVER						
Driver Enable to Output High	tDzH	CL=100 pF, S1 closed (Fig 5,6)			70	ns
Driver Enable to Output Low	tDzL				70	ns
Driver Disable Time from Low	tDLz	CL=15 pF, S2 closed (Fig 5,6)			70	ns
Driver Disable Time from High	tDHZ				70	ns
Driver Propagation Delay(low to high)	tDPLH	RDIFF=54Ω, CLi=CL ₂ =100pF (Fig 3,4)		60		ns
Driver Propagation Delay (high to low)	tDPHL			60		ns
tDPLH-tDPHL	tsKEW1			5	±10	ns
Driver Differential Output Rise or Fall Time	tDR,tDF				40	



PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
SUPPLY CURRENT						
Supply Current	I _{cc1}	/RE=0V or VCC, DE=0V		200	500	uA
	I _{cc2}	/RE=VCC, DE=VCC		300	600	uA
	I _{cc3}	/RE=0, DE=VCC		0.5	10	uA
DC ELECTRICAL CHARACTERISTICS OF RECEIVER						
Receiver Input Resistance	R _N	-7V ≤ V _{cM} ≤ 12V	12			kΩ
Receiver Output Short-Circuit	I _{osR}	0V ≤ V _o ≤ VCC	±7		±95	mA
RO Output-Low Voltage	V _{oL}	I _{oUT} = +4mA, V _{ID} = -200 mV			0.4	V
Three-State Output Current at Receiver	I _{ozR}	0.4V < V _o < 2.4V			±1	uA
Receiver Input Hysteresis	V _{hys}	-7V ≤ V _{cM} ≤ 12V		30		mV
RO Output-High Voltage	V _{oH}	I _{oUT} = -4mA, V _{ID} = +200 mV	3.5			V
Positive-going input threshold voltage	V _{IT+}	-7V ≤ V _{cM} ≤ 12V			-10	mV
Negative-going input threshold voltage	V _{IT-}	-7V ≤ V _{cM} ≤ 12V	-200			mV
Input Current(A,B)	I _{N2}	DE=0V, VCC=0 or 5V			1.0	mA
		DE=0V, VCC=0 or 5V	0.8			mA

NOTE

If no special situation occurs , VCC=5V±5% ,Temp=T^{MIN}~T^{MAX} , typically VCC=+5V , Temp = 25



PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC ELECTRICAL CHARACTERISTICS OF DRIVER						
Input High Voltage	VH	DE,DI,/RE	2.0			V
Input Low Voltage	Vn	DE,DI,/RE			0.8	V
Input Current (RE,DI,/RE)	IN1	DE,DI,/RE	-2		2	uA
Thermal-Shutdown Threshold				150		°C
Thermal-Shutdown Hysteresis				20		°C
Differential Driver Output(no load)	VoD1			5		V
Differential Driver Output	VoD2	Fig 2,RL=27Ω	1.5		VCC	V
		Fig 2,RL=50	2		VCC	
Change in Magnitude of Differential Output Voltage (NOTE1)	ΔVoD	Fig 2,RL=27Ω			0.2	V
Driver Common-Mode Output Voltage	Voc	Fig 2,RL=27Ω			3	V
Change In Magnitude of Common- Mode Voltage (NOTE1)	ΔVoc	Fig 2,RL=27Ω			0.2	V
Driver Short-Circuit Output Current (short to high)	IosD ₁	Short to 0V~12V	35		250	mA
Driver Short-Circuit Output Current (short to low)	IosD ₂	Short to -7V~0V	-250		-35	mA

TEST CIRCUIT

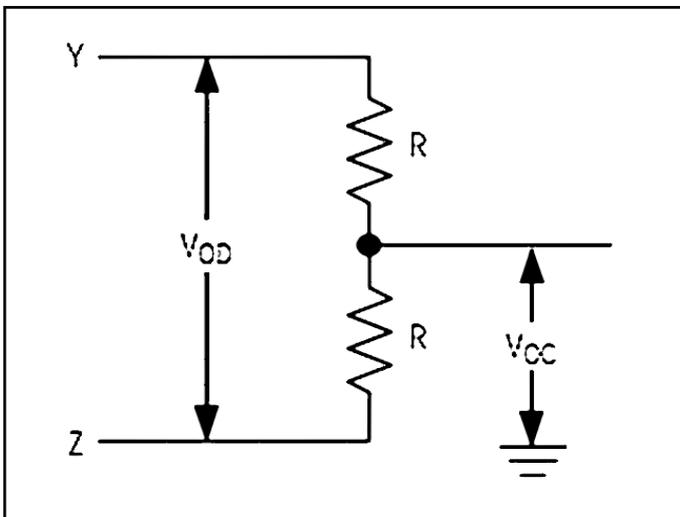


Fig 2 Driver DC Test Load

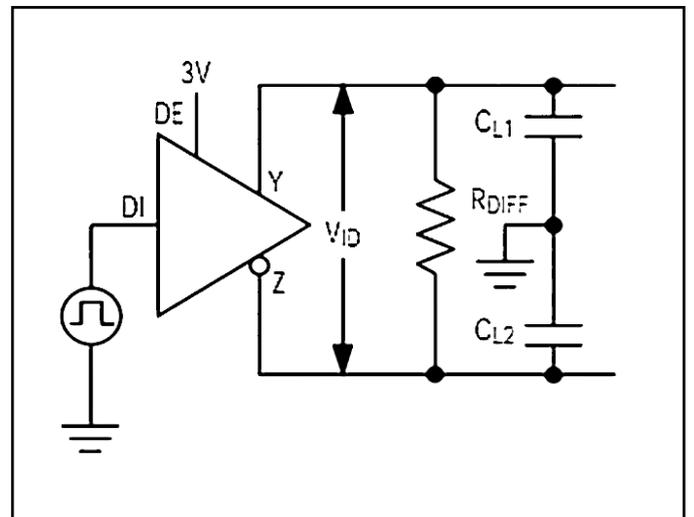


Fig 3 Driver Timing Test Circuit

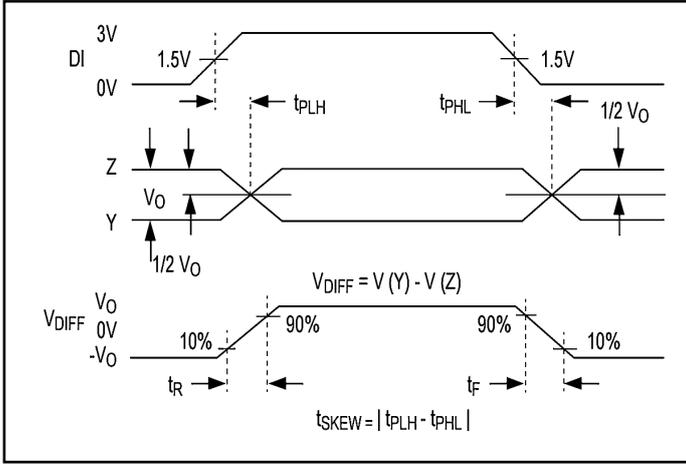


Fig 4 Driver Propagation Delays

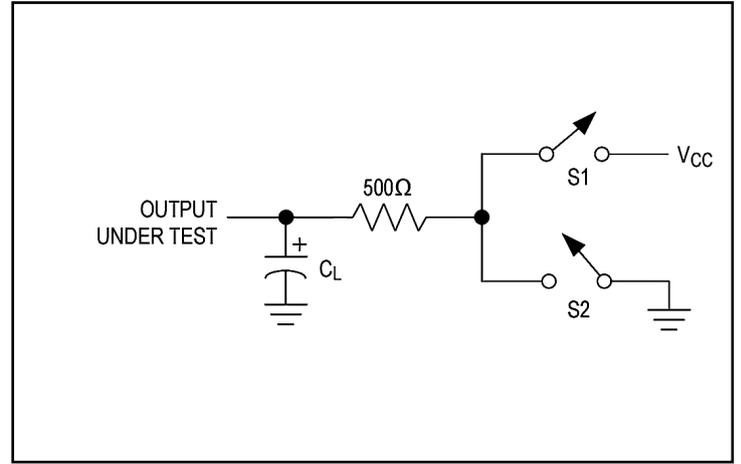


Fig 5 Driver Enable/Disable Timing Test Load

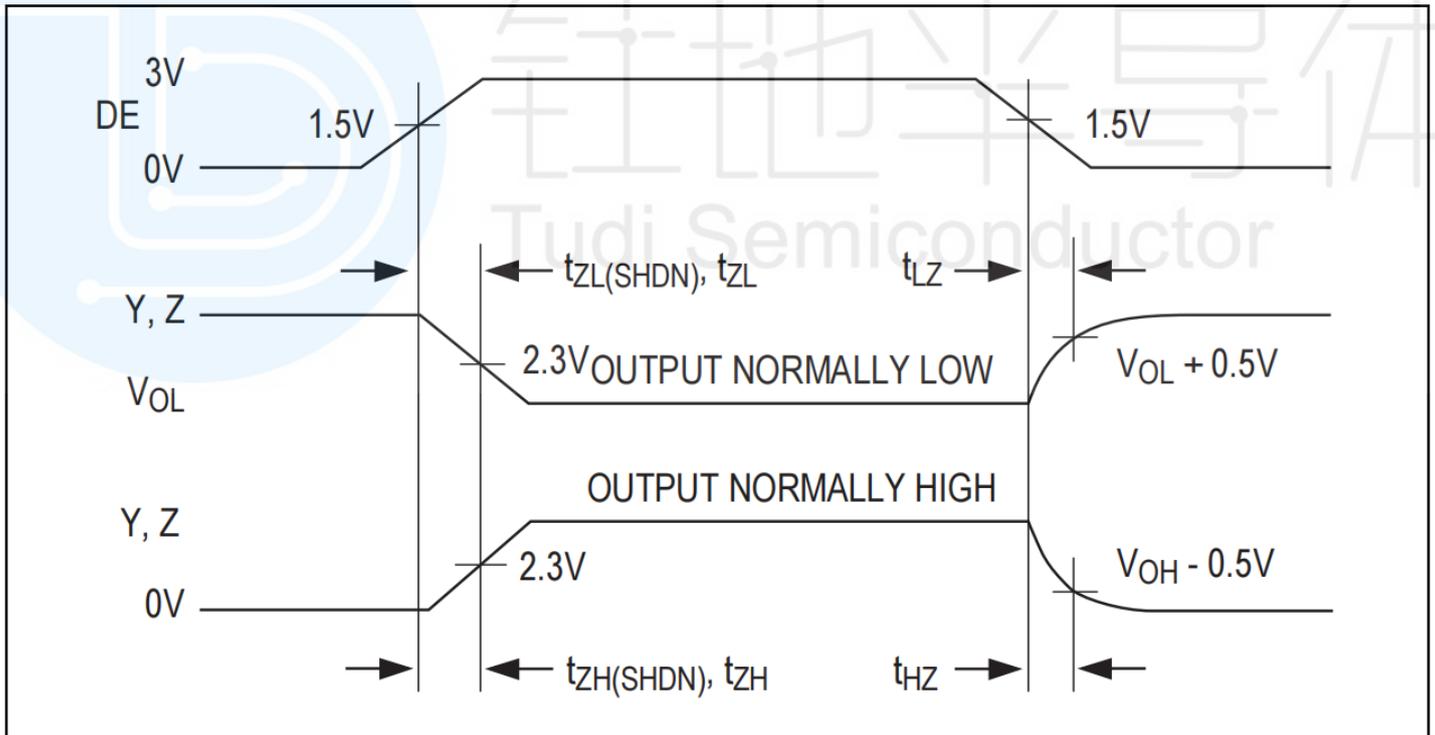


Fig 6 Driver Enable and Disable Times

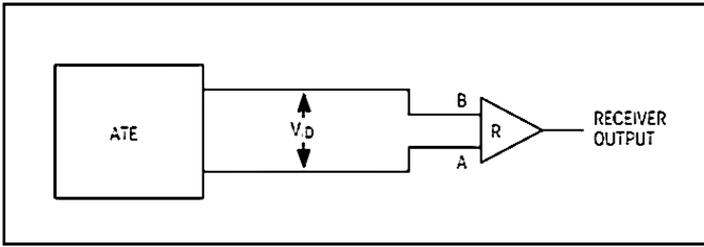


Fig 7 Receiver Propagation Delay Test Circuit

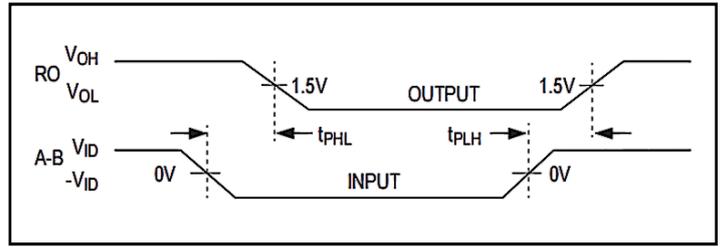


Fig 8 Receiver Propagation Delays

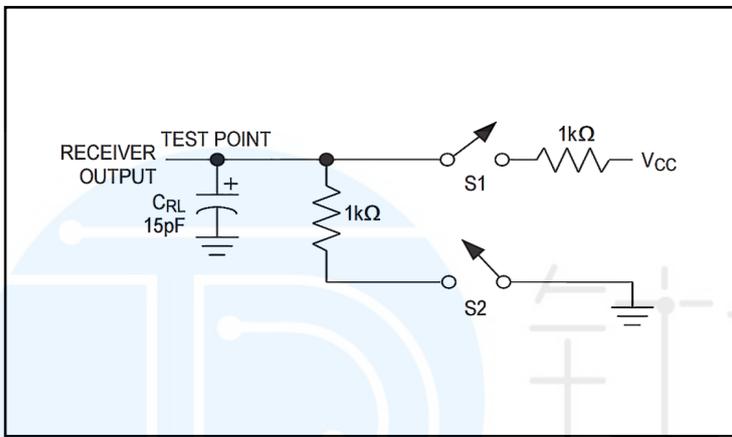


Fig 9 Receiver Enable/Disable Timing Test Load

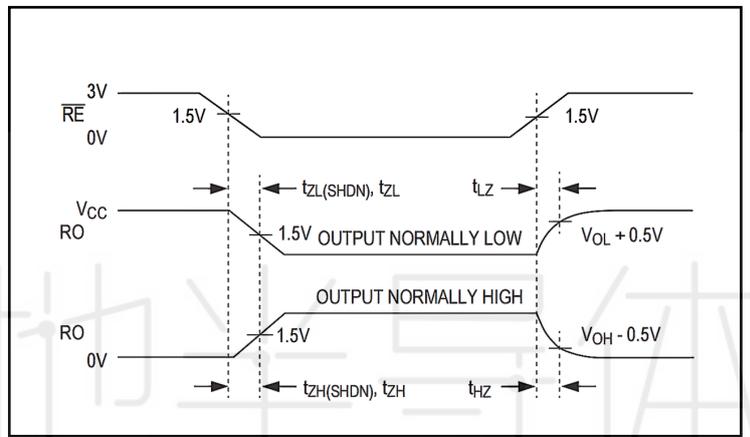


Fig 10 Receiver Enable and Disable Times

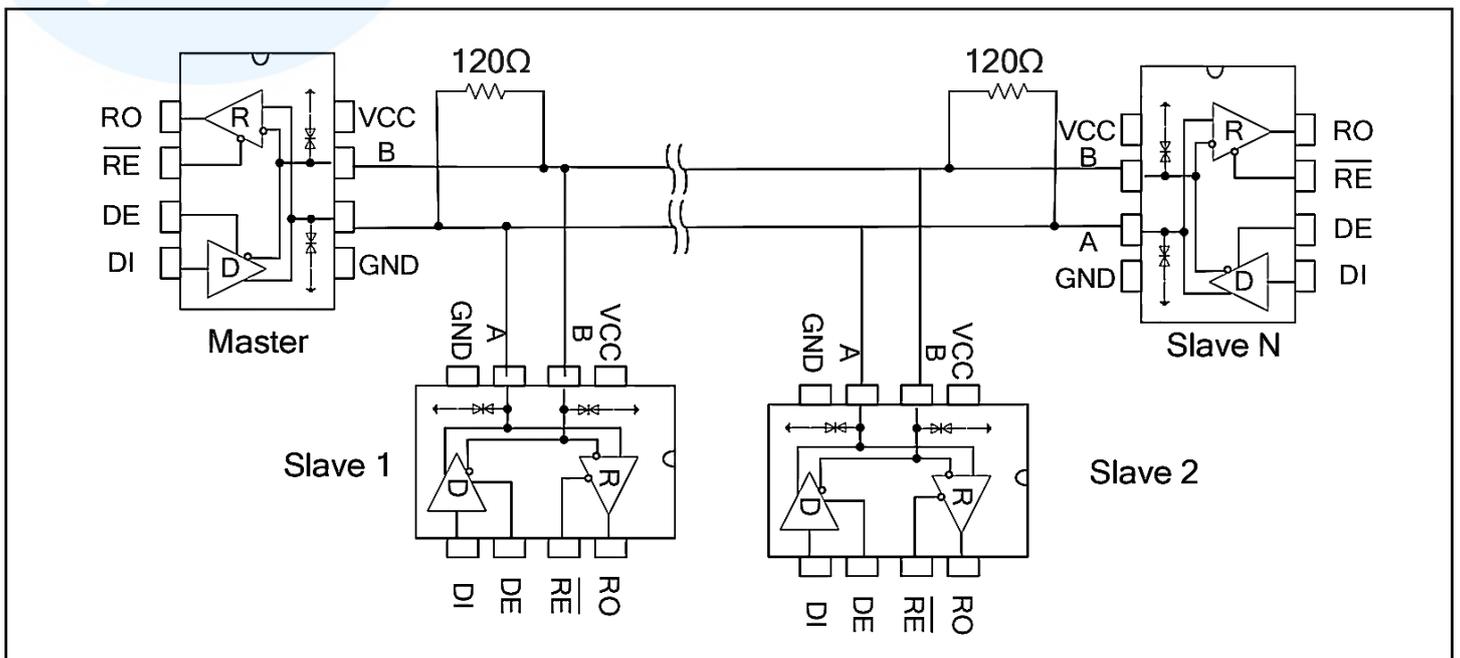


Fig11 Backbone cable type RS485 communications network

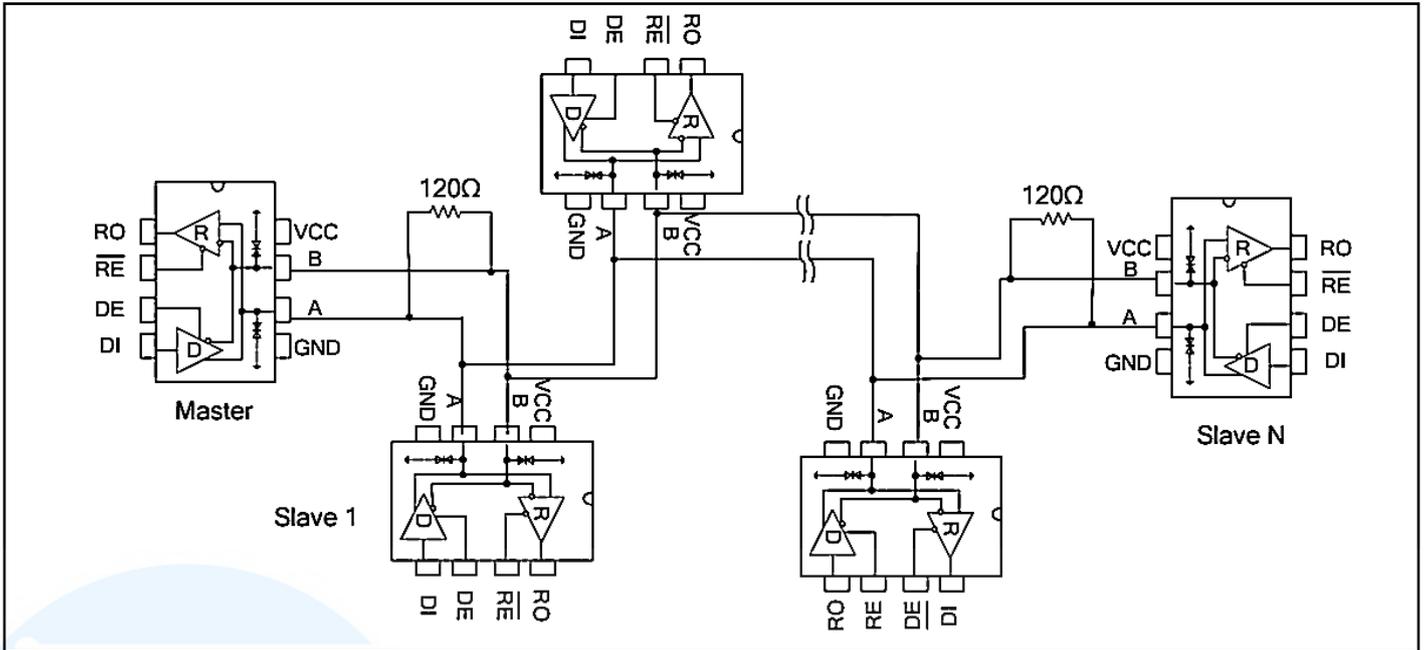


Fig12 Daisy chain topology type RS485 communications network

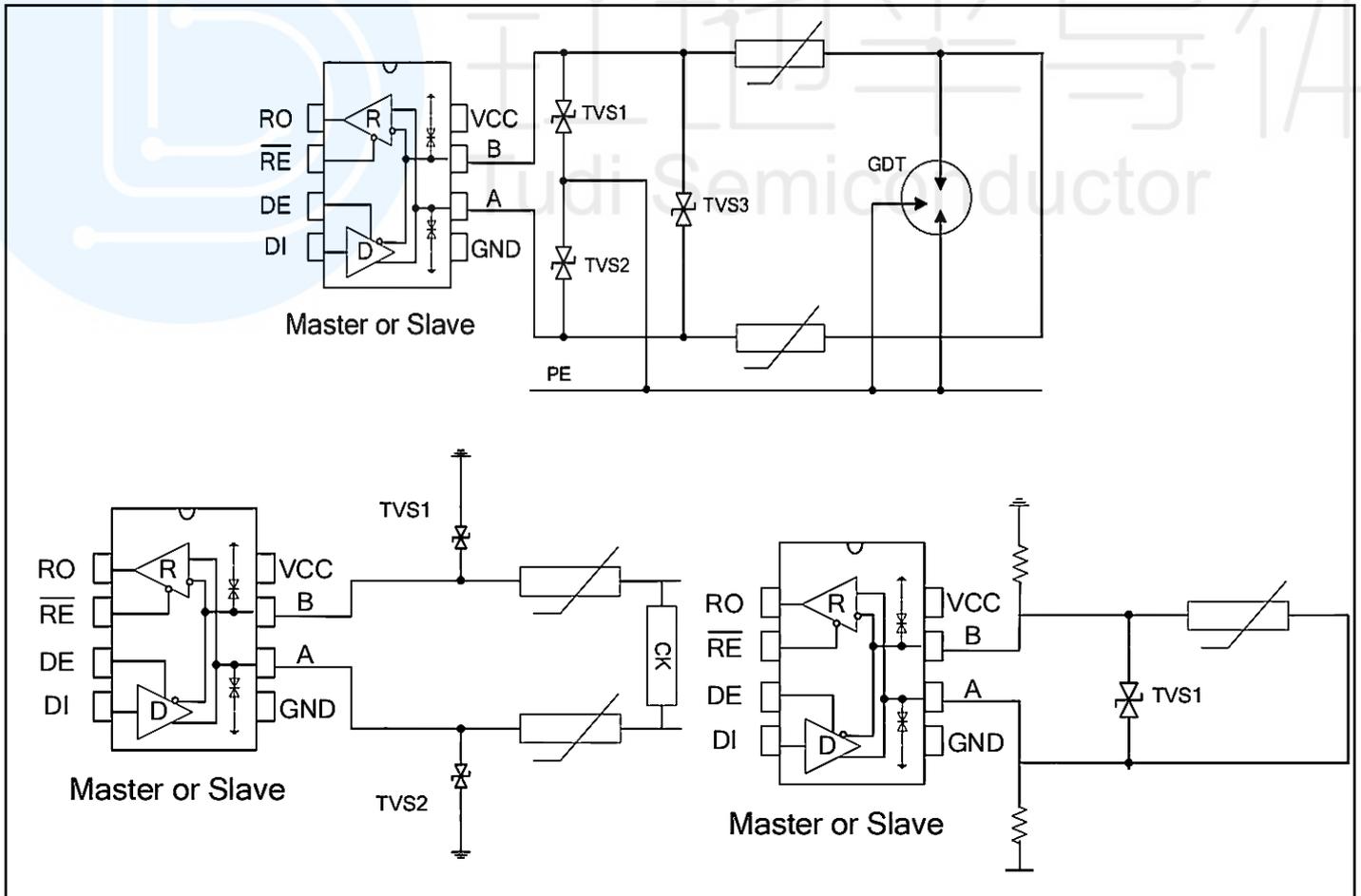
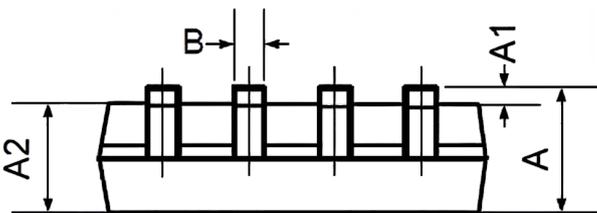
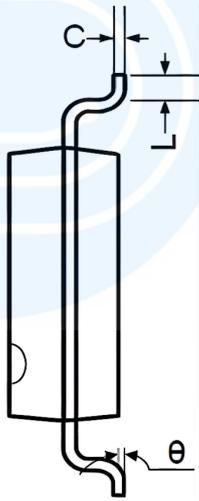
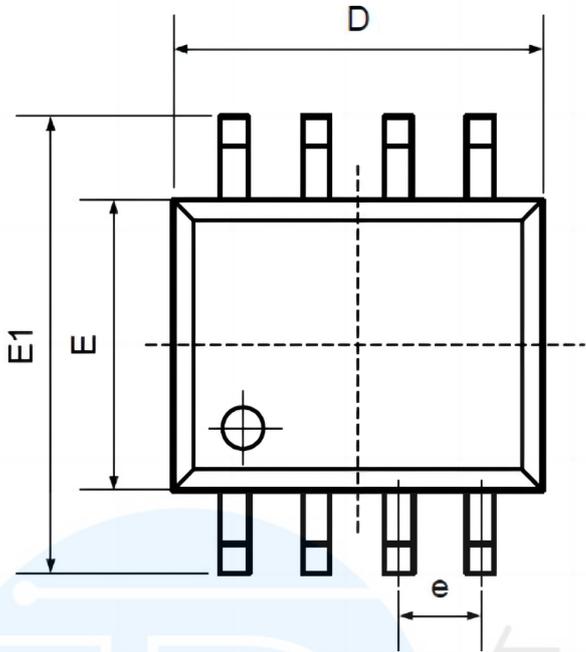


Fig13 RS485 bus ports Protection configuration



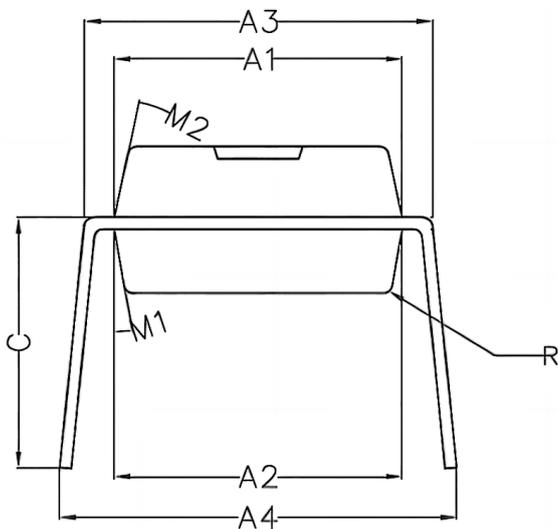
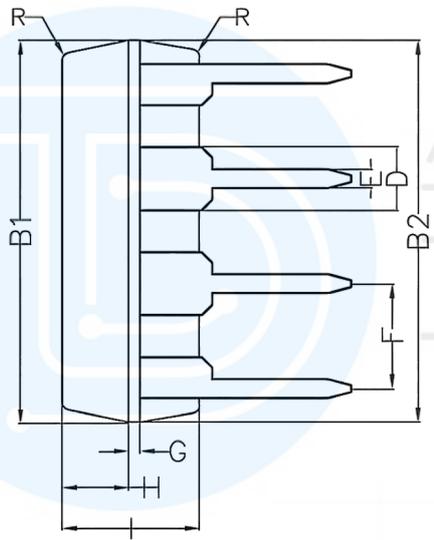
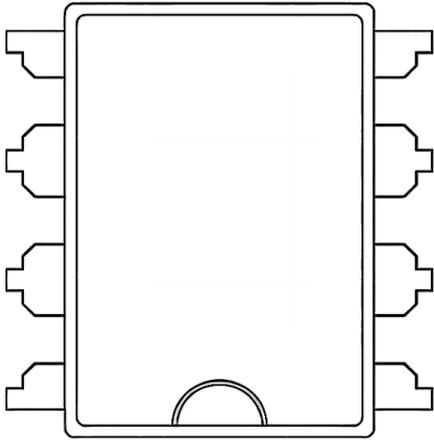
Package SOP8



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°



Order information

Order Number	Package	Package Quantity	Marking On The park	Temperature
SN65HVD1785DR-TUDI	SOP8	Tape,Reel,2500	VP1785	- 40°C to 105°C
SN65HVD1785P-TUDI	DIP8	Tube,50A box of 2000	65HVD1785	
SN65HVD1786DR-TUDI	SOP8	Tape,Reel,2500	VP1786	
SN65HVD1786P-TUDI	DIP8	Tube,50A box of 2000	65HVD1786	
SN65HVD1787DR-TUDI	SOP8	Tape,Reel,2500	VP1787	
SN65HVD1787P-TUDI	DIP8	Tube,50A box of 2000	65HVD1787	



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