1 Description

The RS485 is a +5V, half-duplex, ±15KV ESD protected RS485/RS422 transceiver circuit. The circuit contains single channel driver and single channel receiver internally.

The RS485 is a half-duplex type with drive enable (DE) and receive enable (RE) pins. When in the off state, the drive and receive outputs are high resistance.

The RS485 has a fail-safe circuit to ensure correct receiver output when the receiver input is open or shorted.

The RS485 receiver input impedance is 1/8 unit load, allowing up to 256 transceivers to be hooked up to the bus.

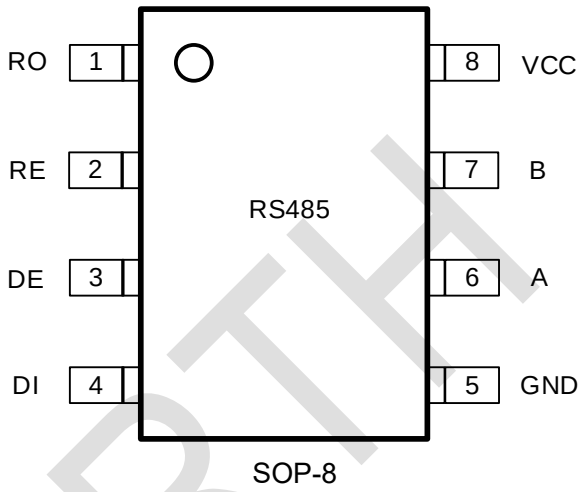
2 Features

- Electrostatic Protection (ESD): A/B ± 15KV - Human Body Mode (HBM)
- Bus allows up to 256 transceivers to be hooked up
- Strong swing rate limiting facilitates error-free data transfer
- Tristate output
- SOP8 package
- Comply with Q/GDW 11179.11-2015 Technical Specification for Energy Meter Components

3 Applications

- Industrial Control
- Power Meter
- Industrial Motor Drives
- Automatic HVAC System
- RS485/RS422 Interface

4 Pinout



SOP-8

5 Ordering information

Product Number	Package	Quantity/Tape
RS485	SOP-8	4000/Tape

6 Marking

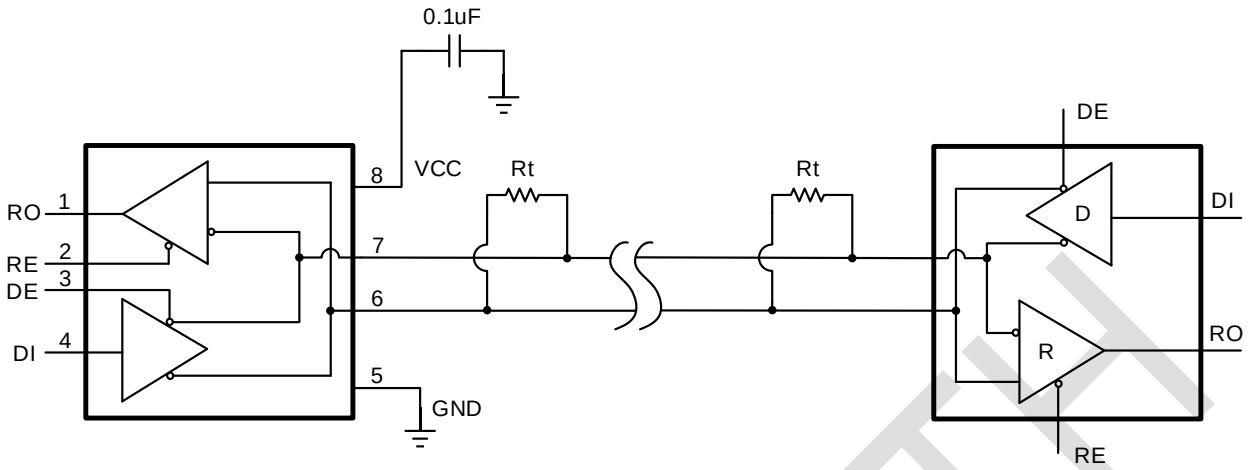
Product Number	Marking
RS485	RS485 YYWWX

Note: YY=Year WW=Week, X is a fixed letter.

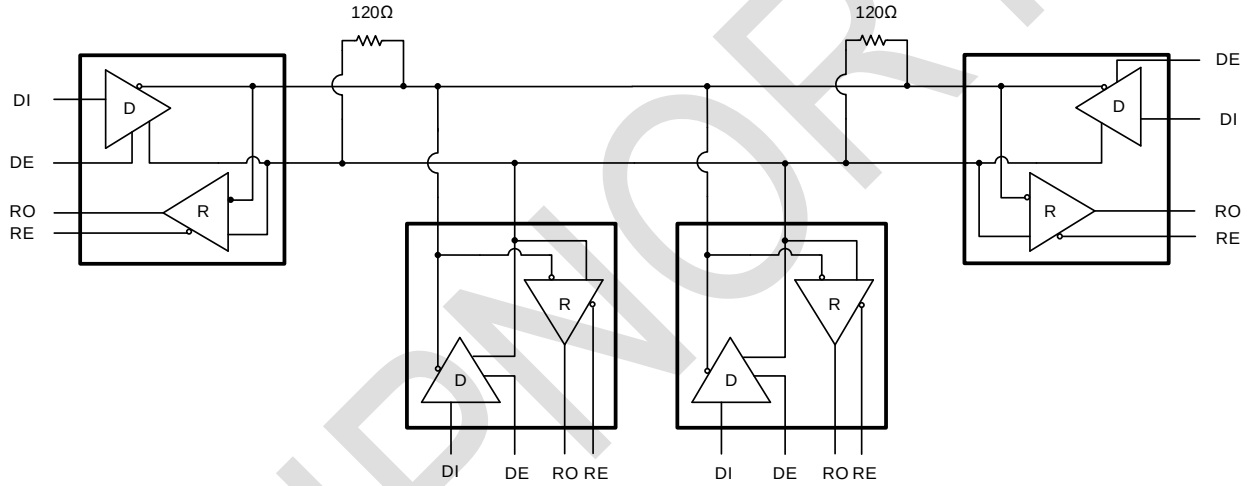
Green (RoHS & HF): CHIPNORTH defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your CHIPNORTH representative directly.

Moisture sensitivity level(MSL):3

7 Typical Application



RS485 Typical Half-Duplex Operating Circuitry



Typical half-duplex RS485 operating network

8 Pin Descriptions

Pin No.	Pin Name	Descriptions
1	RO	Receive output
2	RE	Receive Enable: active low, when high, the receive output is high resistance.
3	DE	Transmit Enable: active high, when DE is low, the transmit output is high resistance. when DE is high, the chip works in transmit state, when DE is low and low, the chip works in receive state.
4	DI	Transmit data input
5	GND	Ground
6	A	Receiver in-phase input and driver in-phase output
7	B	Receiver inverted input and driver inverted output
8	Vcc	Power supply

9 Absolute Ratings

Parameter	Symbol	Min.	Max.	Unit
V_{CC}	Supply Voltage		+6.0	V
DE，RE	Control input voltage (DE, RE)	-0.5	+6.0	V
DI	Drive Input Voltage (DI)	-0.5	+6.0	V
A，B	Driver Output Voltage	-7.0	+12.0	V
A，B	Receiver Input Voltage	-7.0	+12.0	V
RO	Receive Output Voltage (RO)	-0.3	V_{CC}+0.3	V
T_{STG}	Storage temperature range	-55	+150	°C
T_{OP}	Operating Temperature Range	-40	+85	°C
T_{MOP}	Maximum operating temperature range	-55	+125	°C
Continuous power consumption	8-pin molded SOP (above +70°C)		470	mW
T_{LEAD}	Solder temperature (10 seconds)		+300	°C

10 Thermal Information

Parameter	Symbol	Value	Unit
Junction-to-ambient thermal resistance	$R\theta_{JA}$	100	°C/W

11 logical relation

1. RS485 Chip Driver Truth Table

Input	Enable	Output	
DI	DE	A	B
H	H	H	L
L	H	L	H
X	L	Z	Z

2. RS485 Chip Receiver Truth Table

Input			Output
RE	**DE**	**A-B**	**RO**
L	X	>-50mV	H
L	X	<-200mV	L
L	X	Open Circuit	H
L	X	Short Circuit	H
H	H	X	Z
H	L	X	Z

12 Electrical Characteristics

12.1 DC Characteristics

Test conditions: if not specified V_{CC}=5V±10%, TA=25°C±10% (Note 1)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Operating Voltage Range	V_{CC}			4.5		5.5	V
Driver differential output (no load)	V_{OD1}					5	V
Driver differential output (with load)	V_{OD2}	Figure 1, R=54Ω or R=27Ω		1.5			V
Amplitude of change in driver differential output voltage (Note 2)	ΔV_{OD}					0.2	V
Driver Common Mode Output Voltage	V_{OC}			1		3	V
Amplitude of change in common mode output voltage of the driver (Note 2)	ΔV_{OC}					0.2	V
Input High Voltage	V_{IH}	DE, RE, DI		2			V
Input Low Voltage	V_{IL}	DE, RE, DI				0.8	V
Input Current	I_{IN1}	DE, RE, DI				±2	uA
Input current (A, B)	I_{IN2}	DE=0V, V_{CC}=5V	V_{IN}=5V		40	90	uA
			V_{IN}=0V		60	100	
Receiver differential input threshold voltage	V_{TH}	-7V ≤ V_{CM} ≤ +12V		-200		-50	mV
Receiver input hysteresis	ΔV_{TH}				25		mV
Receiver output high	V_{OH}	I_O=-8mA		4			V
Receiver output low	V_{OL}	I_O=8mA				0.4	V
Receiver-side tri-state (high-resistance) output current	I_{OZR}	0.4V ≤ V_O ≤ 2.4V				1	uA
Receiver Input Impedance	R_{IN}	-7V ≤ V_{CM} ≤ +12V		96			kΩ
No load supply current	I_{CC}	No Load，RE=DI=GND or V_{CC}	DE = Vcc		480	600	uA
			DE = GND		450	600	uA
Receiver output short-circuit current	I_{OSR}	0V ≤ V_{RO} ≤ V_{CC}				95	mA
ESD protection		Pins A, B, Human Body Mode		±8	±15		kV

Note 1: All currents flowing into the device are positive and currents flowing out of the device are negative; all voltages are referenced to ground if not otherwise noted.

Note 2: ΔVOD and ΔVOC are the respective changes in VOD and VOC when the DI input state is changed.

12.2 Switching Characteristics

Test conditions: if not specified V_{CC}=5V±10%, TA=25°C±10%

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drive Input to Output	t_{DPLH}	Figure 3 and 5 R_{DIFF}=50Ω C_{L1}=C_{L2}=100pF	250		1000	nS
	t_{DPHL}		250		1000	nS
Driver Output Offset | t_{DPLH} – t_{DPHL} |	t_{DSKEW}			-3	±100	nS
Drive Rise and Fall Time	t_{DR}		200		750	nS
	t_{DF}		200		750	nS
Driver enable to output high	t_{DZH}	Figures 4 and 6, C_L=100pF S2 closed			2500	nS
Driver enable to output low	t_{DZL}	Figures 4 and 6, C_L=100pF S1 closed			2500	nS
Drive from low to off	t_{DLZ}	Figures 4 and 6, C_L=15pF S1 closed			100	nS
Drive from high to off	t_{DHZ}	Figures 4 and 6, C_L=15pF S2 closed			100	nS
Receiver Input to Output	t_{RPLH}	Figures 7 and 9, | V_{ID} | ≥ 2.0V; V_{ID} rise-fall time ≤ 15nS			200	nS
	t_{RPHL}				200	nS
Differential Receiver Offset | t_{RPLH} - t_{RPHL} |	t_{RSKEW}			3	±30	nS
Receiver enable to output low	t_{RZL}	Figures 2 and 8 C_L=100pF S1 closed		20	50	nS
Receiver enable to output high	t_{RZH}	Figures 2 and 8 C_L=100pF S2 closed		20	50	nS
Receiver from low to off	t_{RLZ}	Figures 2 and 8 C_L=100pF S1 closed		20	50	nS
Receiver from high to off	t_{RHZ}	Figures 2 and 8 C_L=100pF S2 closed		20	50	nS
Driver output short-circuit current	I_{OD}	Short circuit current between A and B			150	mA
Maximum data speed	f_{MAX}		250	500		Kbps
Communications Bit Error Rate (BER)		Communication rate 250kbps			10^{-7}	

12.3 Test line and switch waveforms

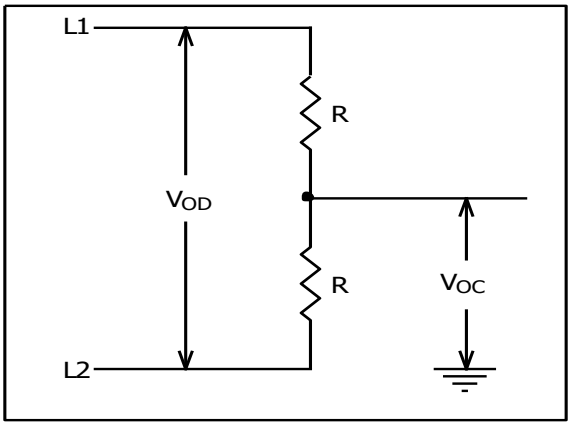


Figure 1: Driver DC Characterization Test Load

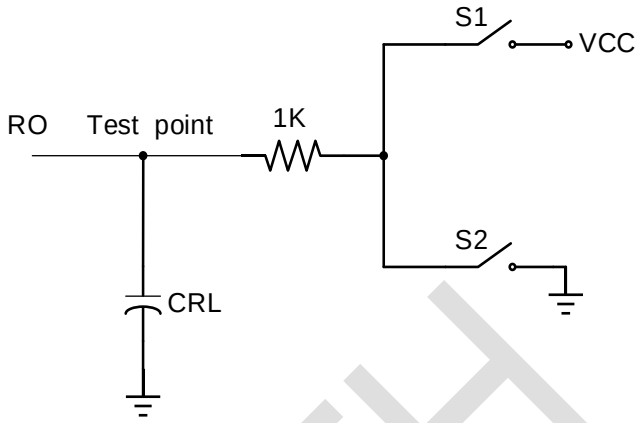


Figure 2: Receiver Enable/Off Switch Characterization Test Load

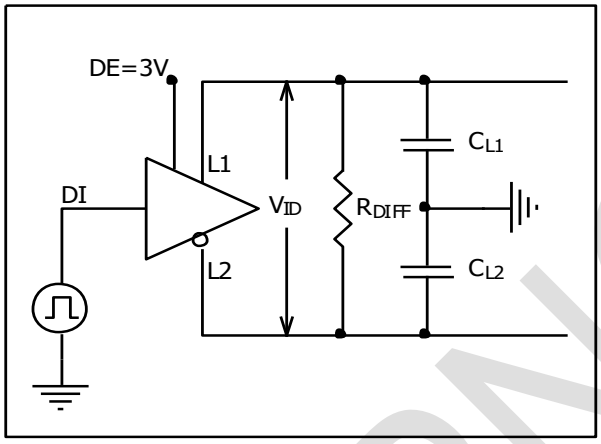


Figure 3: Driver Switching Characteristics Test Load

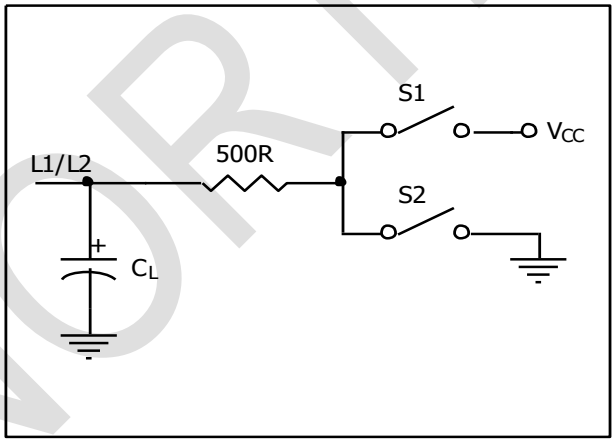


Figure 4: Driver Enable/Off Switching Characteristics Test Load

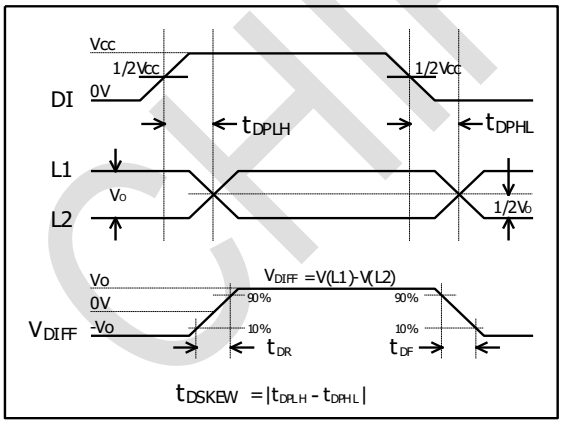


Figure 5: Driver Transmission Delay

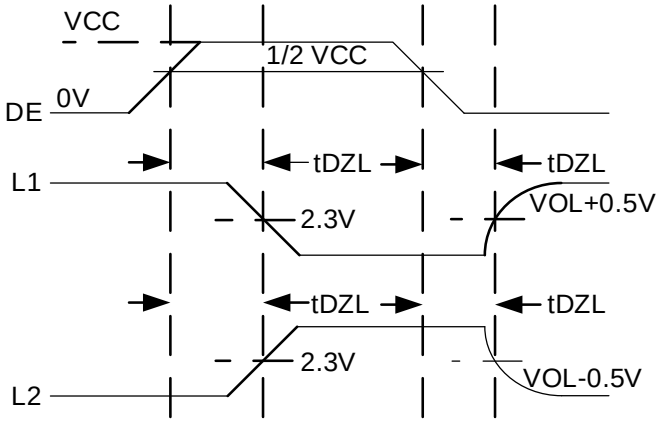


Figure 6: Driver Enable/Off Timing

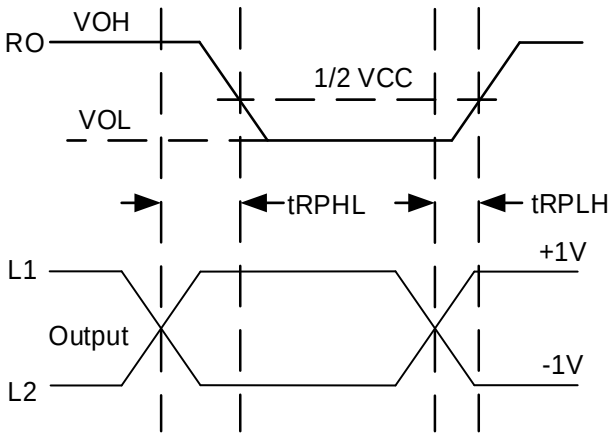


Figure 7: Receiver transmission delay

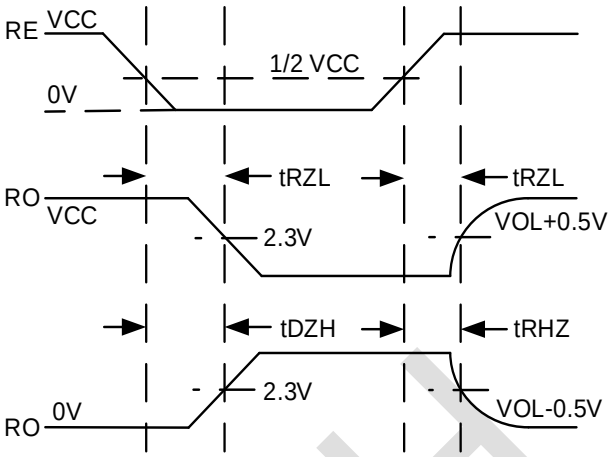


Figure 8: Receiver enable/shutdown timing

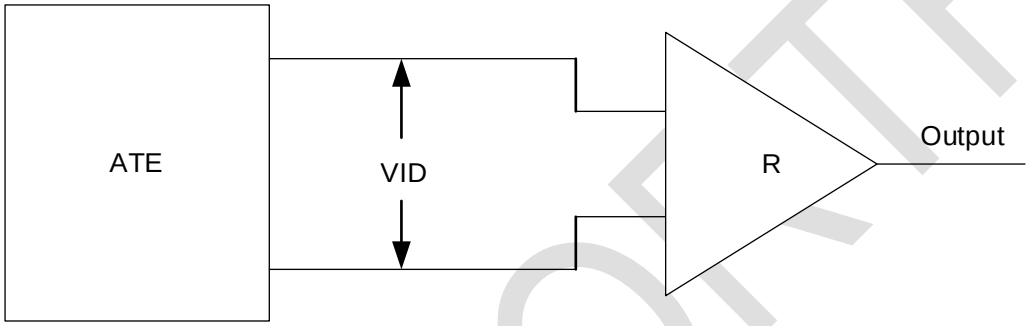


Figure 9: Receiver transmission delay test circuit

Note 1: L1 and L2 in each of the above diagrams refer to the output port when the polarity is not initialized.

13 Application Information

13.1 Detailed Description

The RS485 high speed transceiver for RS-485/RS-422 communication contains one way driver and one way receiver. Fail-safe circuitry is provided to ensure that the receiver output goes logic high when the receiver input is open or shorted. If all transmitters hooked up to the termination match bus are disabled (high resistance), the receiver will output a logic high. the RS485 has a low-swing driver that reduces EMI and reflections due to improper cable termination, enabling error-free data transmission up to 500 kbps. the RS485 is a half-duplex transceiver.

13.2 Receiver Input Filtering

When operating the RS485 in 500kbps mode, its receiver includes an input filter function in addition to input hysteresis. This filtering function improves noise rejection of differential signals that rise and fall slowly.

13.3 Reduces EMI And Reflections

The RS485's low-swing drivers minimize EMI and reduce reflections caused by improperly terminated matching cables.

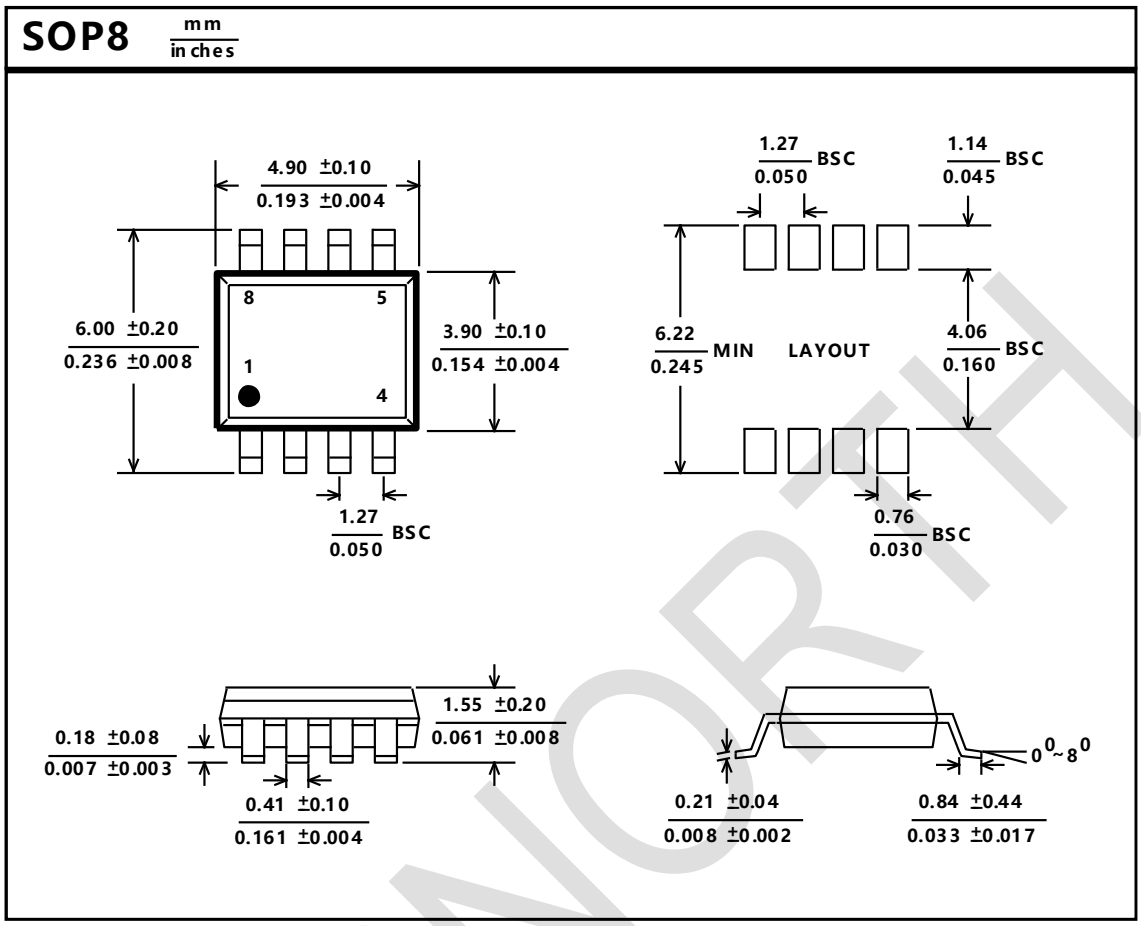
13.4 256 Loads On The Bus

RS485 load input impedance is greater than 96KΩ, allowing up to 256 transceivers to be hooked up to the same communication bus. The communication error rate is less than 10-5 under 2.4kbps and 9.6kbps networking communication rate.

13.5 Electrostatic protection

All pins of the RS485 have electrostatic discharge protection circuitry to prevent damage to the chip from human touch or ESD events during assembly. The driver output and receiver input pins utilize additional enhanced ESD protection circuits that allow these pins to withstand ESD shocks of ±15kV without damage.ESD protection can be tested in a variety of ways. The outputs of the driver and the inputs of the receiver are measured for ESD performance using the following ESD test methods: ±15kV Human Body Modeling.

14 Package Information



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