Features

- Low Quiescent Current: 300 µA

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- Three-State Outputs

- -7 V to +12 V Common-Mode Input Voltage Range

- 50 ns Propagation Delays, 5 ns Skew

- Half-Duplex Version Available

- Operate from a Single 5 V Supply

- Allows up to 32 Transceivers on the Bus

- Data rate: 5 Mbps

- Current-Limiting and Thermal Shutdown for Driver Overload Protection

- Enhanced ESD Specifications:

- ±15kV IEC61000-4-2 Air Discharge

- ±8kV IEC61000-4-2 Contact Discharge

Applications

- Low power RS-485 systems

- DTE/DCE interface

- Packet switching

- Local area networks (LNAs)

- Data multiplexers

- Data concentration

- Integrated services digital network (ISDN)

General Description

The TGS485 is low-power transceivers for RS-485 and RS-422 communication. IC contains one driver and one receiver.

The driver slew rates of the TGS485 is not limited, allowing them to transmit up to 10 Mbps. These transceivers draw between 120 µA and 500 µA of supply current when unloaded or fully loaded with disabled drivers. All parts operate from a single 5 V supply. Drivers are short-circuit current limited and are protected against excessive power dissipation by thermal shutdown circuitry that places the driver outputs into a high-impedance state.

The receiver input has a fail-safe feature that guarantees a logic-high output if the input is open circuit. The TGS485 is designed for half-duplex applications.
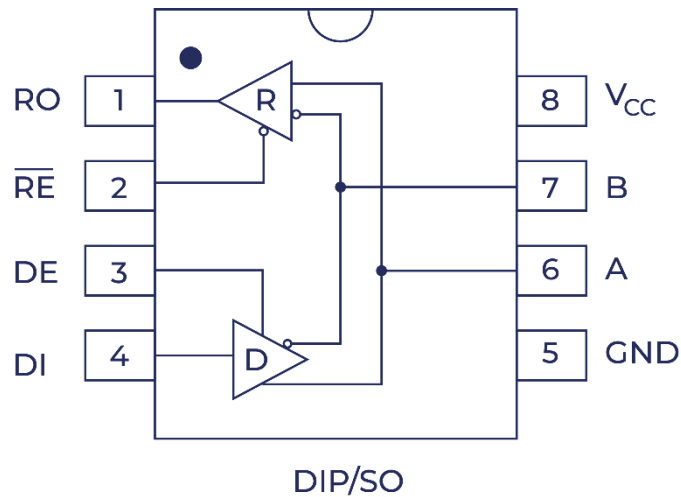
Figure 0.

Absolute Maximum Ratings

Supply Voltage (V_{CC}) 12 V	Continuous Power Dissipation (T_A= +70°C)
Control Input Voltage -0.5 V to (V_{CC}+ 0.5 V)	8-Pin Plastic DIP (derate 9.09mW/°C above +70°C) 727 mW
Driver Input Voltage (D_I)-0.5 V to (V_{CC}+0.5 V)	8-Pin SOP (derate 5.88 mW/°C above +70°C) 471 mW
Driver Output Voltage (A, B) -8 V to +12.5 V	Operating Temperature Ranges -40°C to +125°C
Receiver Input Voltage (A, B) -8 V to +12.5 V	Storage Temperature Range -65°C to +160°C

* Stresses beyond those listed under "absolute maximum ratings" 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 under "recommended operating conditions" is not implied.

Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

DC Electrical Characteristics

($V_{CC} = 5V \pm 5\%$, $T_A = T_{MIN}$ to T_{MAX}, unless otherwise noted.) (Notes 1, 2)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Differential Driver Output (no load)	V_{OD1}					5	V
Differential Driver Output (with load)	V_{OD2}	R = 50 Ω (RS-422)		2			V
		R = 274 Ω (RS-485), Figure 0		1.5			
Change in Magnitude of Driver Differential Output Voltage for Complementary Output States	ΔV_{OD}	R = 27 Ω or 50 Ω, Figure 0				0.2	V
Driver Common-Mode Output Voltage	V_{OC}	R = 27 Ω or 100 Ω, Figure 0				3	V
Change in Magnitude of Driver Common-Mode Output Voltage for Complementary Output States	ΔV_{OC}	R = 27 Ω or 100 Ω, Figure 0				0.2	V
Input High Voltage	V_{IH}	DE, DI, RE		2.0			V
Input Low Voltage	V_{IL}	DE, DI, RE				0.8	V
Input Current	I_{IN1}	DE, DI, RE				±2	μA
Input Current (A, B)	I_{IN2}	DE = 0 V; V_{CC} = 0 V or 5.25 V;	V_{IN} = 12 V			1.0	mA
			V_{IN} = -7 V			-0.8	
Receiver Differential Threshold Voltage	V_{TH}	-7 V ≤ V_{CM} ≤ 12 V		-0.2		0.2	V
Receiver Input Hysteresis	ΔV_{TH}	V_{CM} = 0 V			70		mV
Receiver Output High Voltage	V_{OH}	I_O = -4 mA, V_{ID} = 200 mV		3.5			V

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Parameter	Symbol	Conditions	Min	Typ	Max	Units
Receiver Output Low Voltage	V_{OL}	I_O = 4 mA, V_{ID} = -200 mV			0.4	V
Three-State (high impedance) Output Current at Receiver	I_{OZR}	0.4 V ≤ V_O ≤ 2.4 V			±1	μA
Receiver Input Resistance	R_{IN}	-7 V ≤ V_{CM} ≤ 12 V	12			kΩ
No-Load Supply Current (Note 3)	I_{CC}	DE = V_{CC}		500	900	μA
		RE = 0 V or V_{CC}		300	500	
		DE = 0 V				
Driver Short-Circuit Current	I_{OSD1}	-7 V ≤ V_O ≤ 12 V (Note 4)	35		250	mA
V_O = High Driver Short-Circuit Current	I_{OSD2}	-7 V ≤ V_O ≤ 12 V (Note 4)	35		250	mA
V_O = Low Receiver Short-Circuit Current	I_{OSR}	0 V ≤ V_O ≤ V_{CC}	7		95	mA
ESD Protection		A, B, Y and Z pins, tested using Human Body Model		15		kV

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Switching Characteristics

(V_{CC} = 5V ±5%, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.) (Notes 1, 2)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Driver Input to Output	T_{PLH}	R_{DIFF} = 54	10	55	60	ns
	T_{PHL}	C_{L1} = C_{L2} = 100 pF	10	55	60	
Driver Output Skew to Output	T_{SKEW}	R_{DIFF} = 54, C_{L1} = C_{L2} = 100 pF		5	10	ns
Driver Enable to Output High	T_{ZH}	C_L= 100 pF, S2 closed		40	70	ns
Driver Enable to Output Low	T_{ZL}	C_L = 100 pF, S1 closed		40	70	ns
Driver Disable Time from Low	T_{LZ}	C_L = 15 pF, S1 closed		40	70	ns
Driver Disable Time from High	T_{HZ}	C_L = 15 pF, S2 closed		40	70	ns
Receiver Input to Output	T_{PLH}	R_{DIFF} = 54 C_{L1} = C_{L2} = 100 pF	20	60	100	ns
	T_{PHL}		20	60	100	
| T_{PLH} - T_{PHL} | Differential Receiver Skew		R_{DIFF} = 54 C_{L1} = C_{L2} = 100 pF				
Receiver Enable to Output Low	T_{ZL}	C_{RL} = 15 pF, S1 closed	5			ns
Receiver Enable to Output High	T_{ZH}	C_{RL} = 15 pF, S2 closed	10			ns
Receiver Disable Time from Low	T_{LZ}	C_{RL} = 15 pF, S1 closed		30	50	ns
Receiver Disable Time from High	T_{HZ}	C_{RL} = 15 pF, S2 closed		30	50	ns
Maximum Data Rate	F_{MAX}			30	50	Mbps

Note 1: All currents into device pins are positive; all currents out of device pins are negative. All voltages are referenced to device ground unless otherwise specified.

Note 2: All typical specifications are given for V_{CC} = 5 V and T_A = +25°C.

Note 3: Supply current specification is valid for loaded transmitters when DE = 0 V.

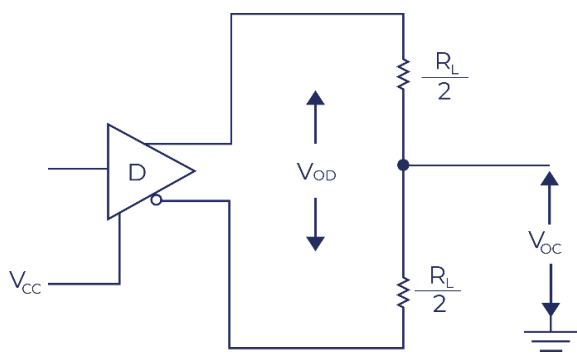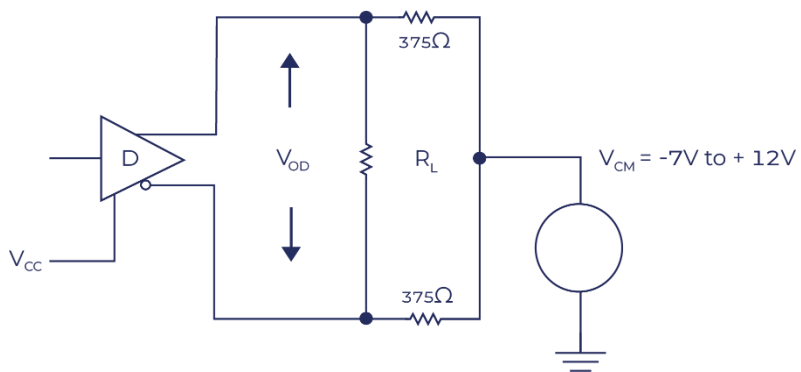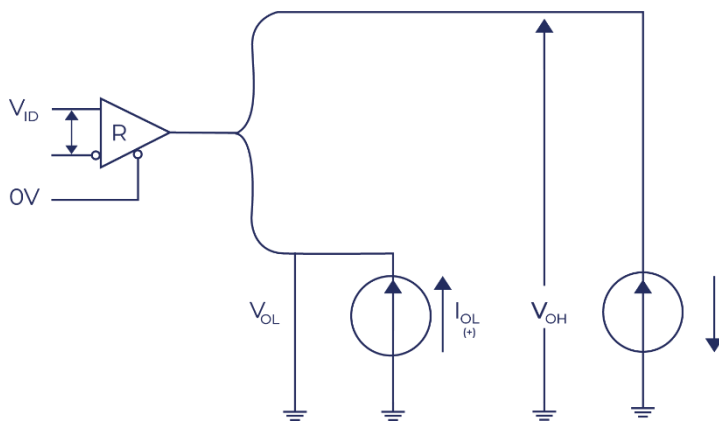Note 4: Applies to peak current.

Test Circuits

Figure 1. Driver V_{OD} and V_{OC}

Figure 2. Driver V_{OD} with Varying Common-Mode Voltage

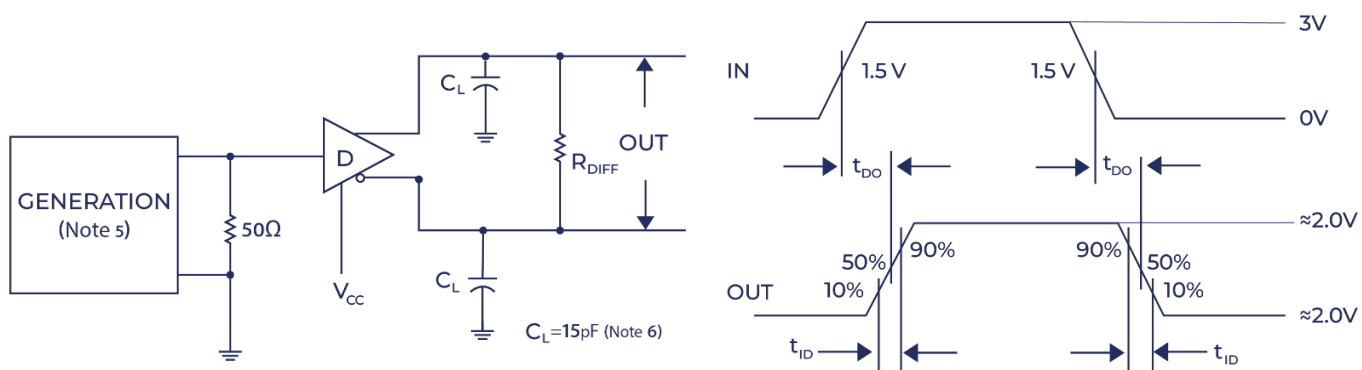Figure 3. Receiver V_{OH} and V_{OL}

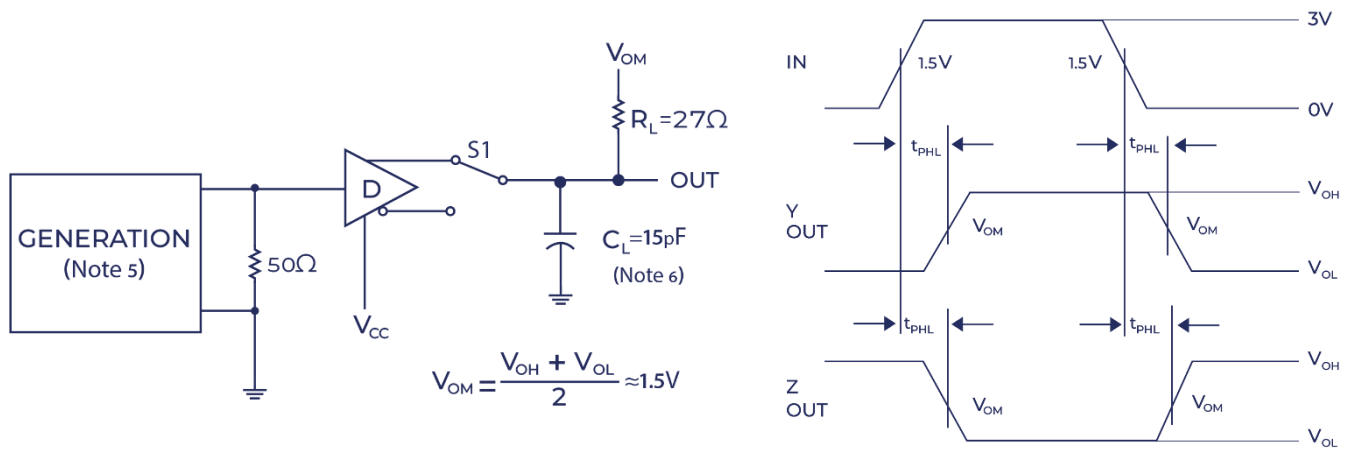Figure 4. Driver Differential Output Delay and Transition Times
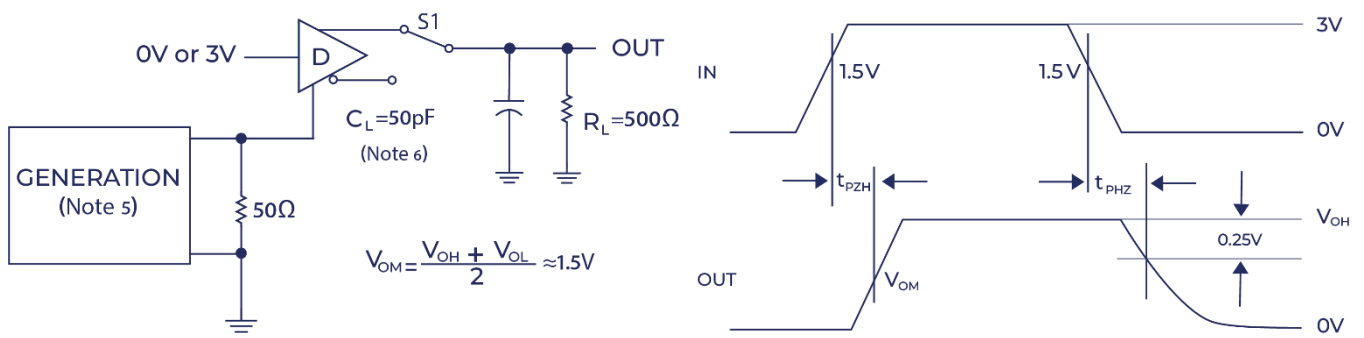
Figure 5. Driver Propagation Times

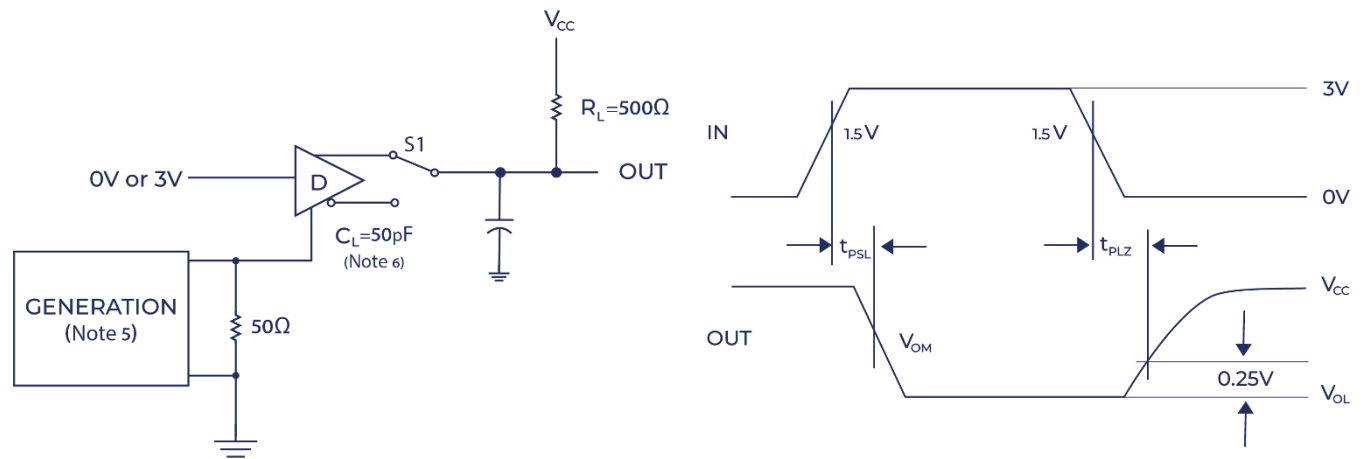Figure 6. Driver Enable and Disable Times (T_{PZH}, T_{PSH}, T_{PHZ})

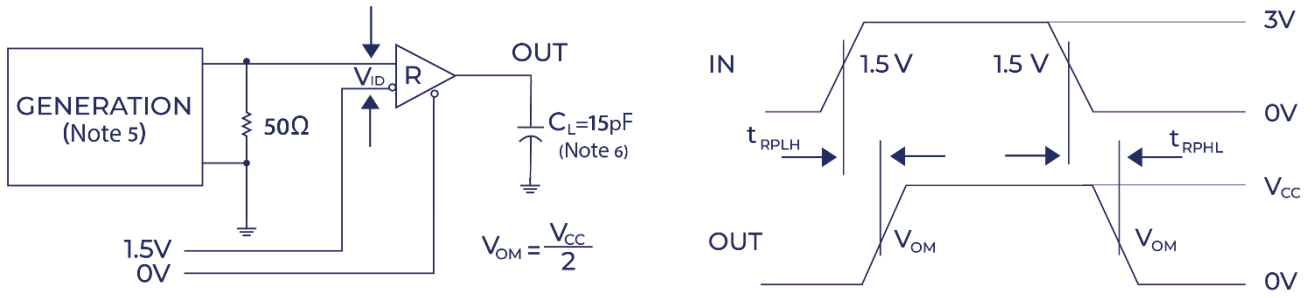Figure 7. Driver Enable and Disable Times (T_{PZH}, T_{PSH}, T_{PHZ})

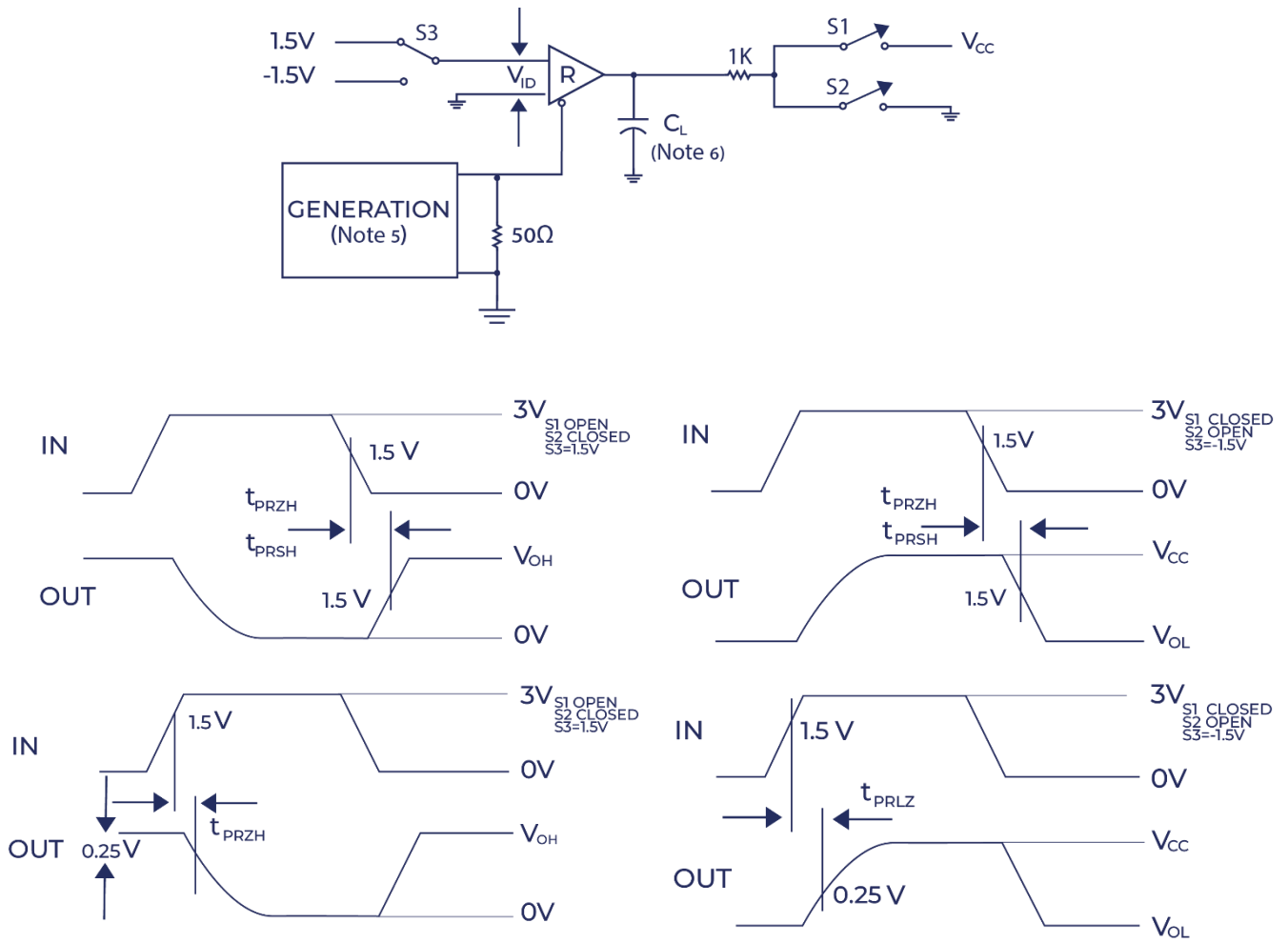Figure 8. Driver Enable and Disable Times (T_{PZH}, T_{PSH}, T_{PHZ})

Figure 9. Driver Enable and Disable Times (T_{PZH}, T_{PSH}, T_{PHZ})

Note 5: The input pulse is supplied by a generator with the following characteristics: PRR = 250 kHz, 50% duty cycle, $t_r \leq 6.0$ ns, $Z_O = 50\ \Omega$.

Note 6: C_L includes probe and stray capacitance.

Function Tables

Transmitting				
INPUTS			OUTPUTS X	
RE	DE	DI	Z	Y
X	1	1	0	1
X	1	0	1	0
0	0	X	Z	Z
1	0	X	Z	Z

Receiving			
INPUTS			OUTPUTS
RE	DE	A-B	RO
0	0	+0.2V	1
0	0	-0.2V	0
0	0	open	1
1	0	X	Z

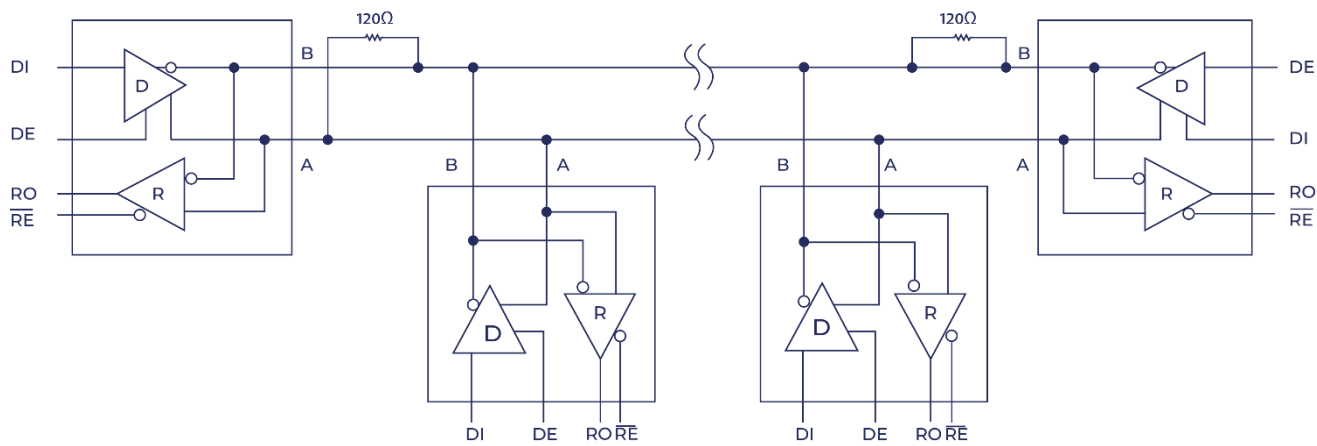X - don't care

Z - high impedance

Typical Information

Figure 10. TGS485 Typical RS-485 Network

Driver Output Protection

Excessive output current and power dissipation caused by faults or by bus contention are prevented by two mechanisms. A foldback current limit on the output stage provides immediate protection against short circuits over the whole common-mode voltage range. In addition, a thermal shutdown circuit forces the driver outputs into a high-impedance state if the die temperature rises excessively.

Propagation Delay

Skew time is simply the difference between the low-to-high and high-to-low propagation delay. Small driver/receiver skew times help maintain a symmetrical mark-space ratio (50% duty cycle). The receiver skew time, |TPRLH - TPRHL|, is under 10ns. The driver skew times are 5ns for the TGS485.

Typical Applications

TGS485 transceivers are designed for bidirectional data communications on multipoint bus transmission lines. Figure 10 shows typical network applications circuits. These parts can also be used as line repeaters, with cable lengths longer than 4000 feet.

To minimize reflections, the line should be terminated at both ends in its characteristic impedance, and stub lengths off the main line should be kept as short as possible.
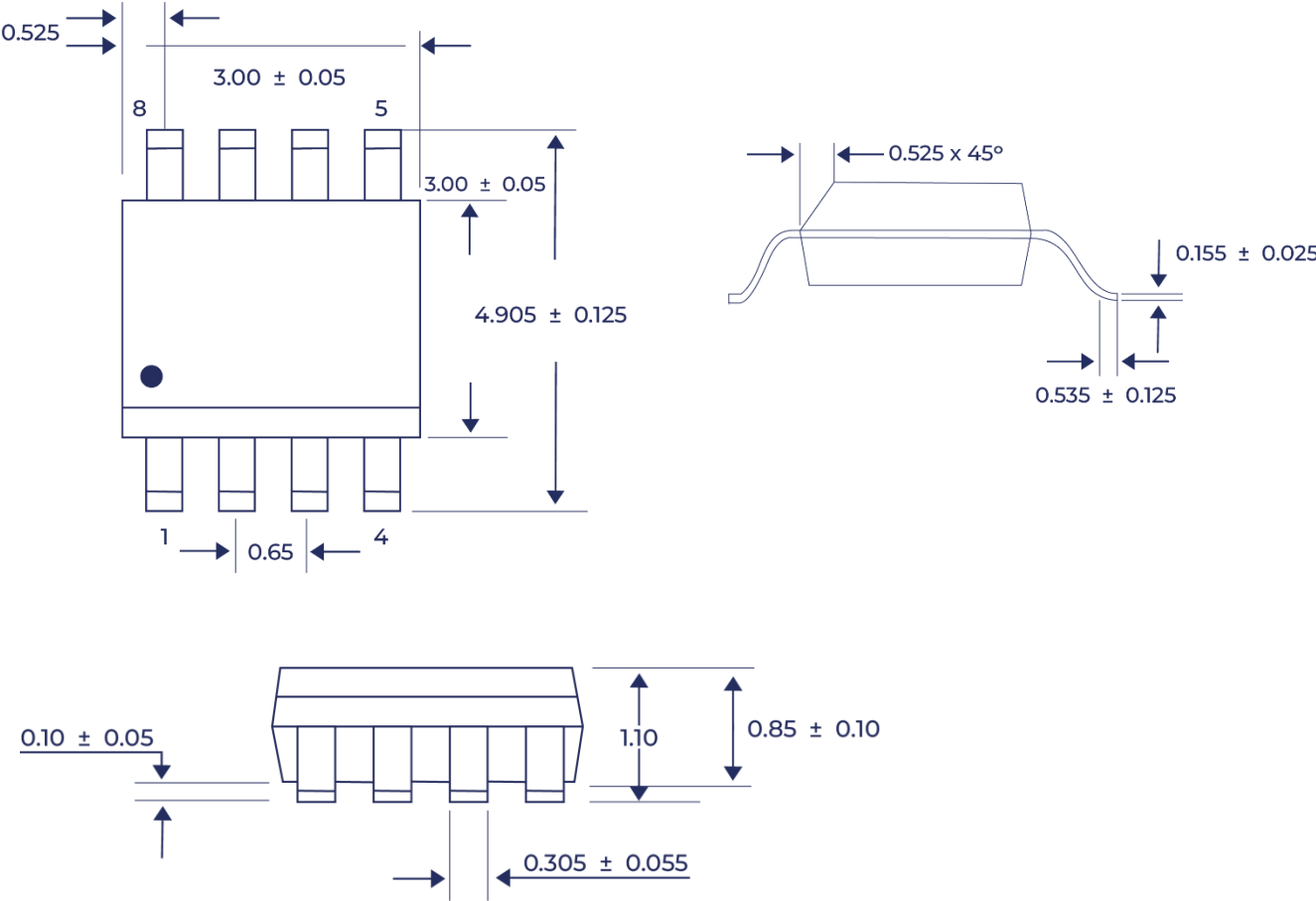
Package

SOP-8
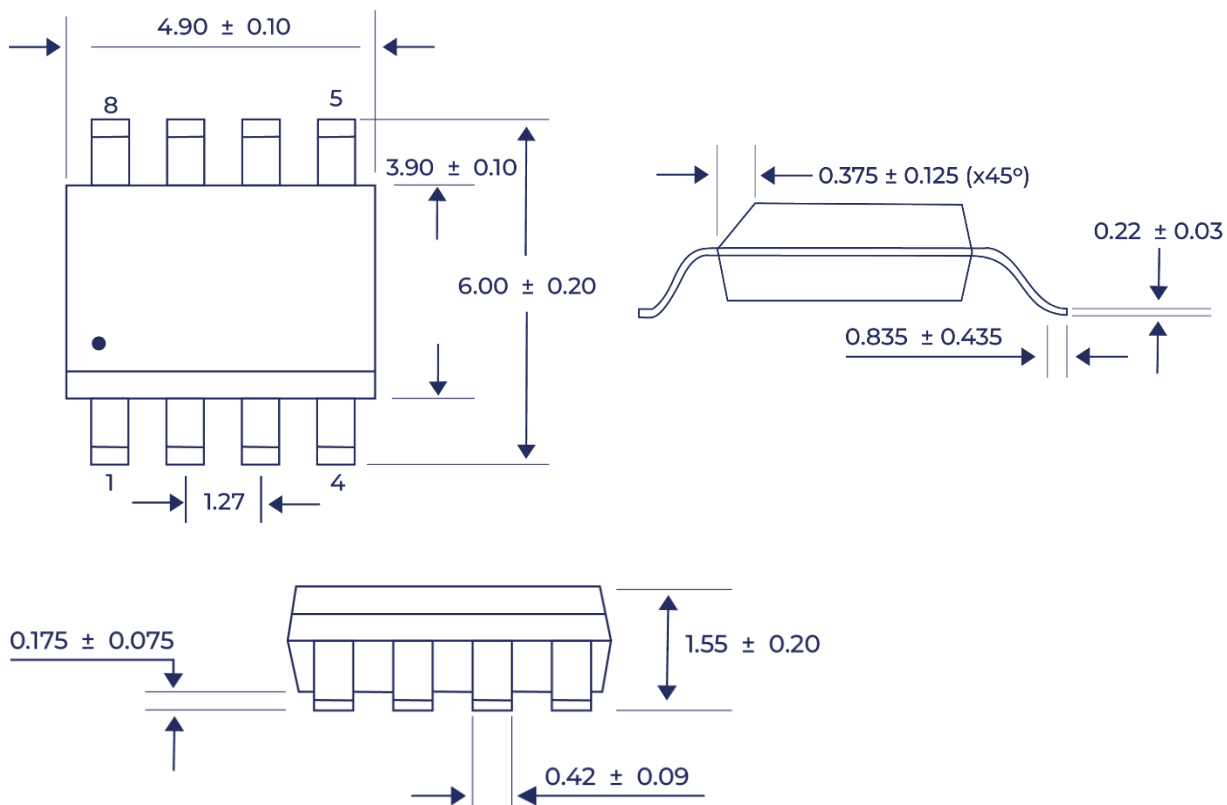
NOTES: 1. Dimensions A = 4.9 ± 0.1 mm and B = 3.9 ± 0.1 mm do not include mold flash or protrusion.

2. Maximum mold flash or protrusion 0.15 mm per side for A; for B - 0.25 mm per side.

MSOP-8

0.525

3.00 ± 0.05

8   5

3.00 ± 0.05

4.905 ± 0.125

1   4

0.65

0.525 x 45°

0.155 ± 0.025

0.535 ± 0.125

0.10 ± 0.05

1.10   0.85 ± 0.10

0.305 ± 0.055

Package/Ordering Information

Product	Ordering number	Tempe range	Package	Trans pot Media, Quantity
TGS485	TGS485AS8	-40℃ ~ 125℃	SOIC-8(SOP8)	Tape and Reel, 2500
	TGS485ACS8	-0℃ ~ 70℃	SOIC-8(SOP8)	Tape and Reel, 2500
	TGS485AMS8	-40℃ ~ 125℃	MSOP8	Tape and Reel, 3000