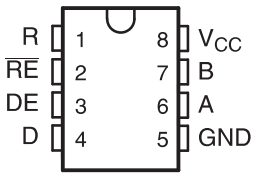
DESCRIPTION

The MAX3483ESA is ±15kV ESD-protected, +3.3V, low-power transceivers for RS-485 and RS-422 communications.
Each device con-tains one driver and one receiver.
The MAX3483ESA feature slew-rate-limited drivers that minimize EMI and reduce reflections caused by improperly termi-nated cables, allowing error-free data transmission at data rates up to 250kbps.
Devices feature enhanced electrostatic discharge (ESD)protection. All transmitter outputs and receiver inputs are protected to ±15kV using IEC 1000-4-2Air-Gap Discharge ±8kV using IEC 1000-4-2 Contact Discharge, and ±15kV using the Human Body Model.
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 guar-antees a logic-high output if both inputs are open circuit.
The MAX3483ESA is designed for half-duplex communication.

PIN CONFIGURATION



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FEATURES

- Interoperable with +5V Logic
- 2nA Low-Current Shutdown Mode
- Operate from a Single +3.3V Supply-No Charge Pump Required
- Slew-Rate Limited for Errorless Data Transmission
- Provide enhanced ESD protection for RS-485/ RS-422 A/B pins
- ESD Protection for RS-485 I/O Pins
  HBM human mode ±15kV
  IEC 1000-4-2: Contact discharge +8kV
  IEC 1000-4-2: Air discharge ± 15kV

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) 7V
Control Input Voltage -0.3V to 7V
Driver Input Voltage (DI) -0.3V to 7V

Driver Output Voltage (A, B) -7.5V to +12.5V
Receiver Input Voltage (A, B) -7.5V to +12.5V
Receiver Output Voltage (RO) -0.3V to (VCC + 0.3V)

Continuous Power Dissipation (T_A= +70°C)
8-Pin SO (derate 5.88mW/°C above +70°C) 471mW
Operating Temperature Ranges 0°C to +70°C
Storage Temperature Range -65°C to +150°C
Lead Temperature (soldering, 10sec) +300°C

APPLICATIONS

- Packet Switching
- Telecommunications
- Integrated Services Digital Networks
- Industrial-Control Local Area Networks
- Transceivers for EMI-Sensitive Applications

DC ELECTRICAL CHARACTERISTICS

(V_{CC} = 3.3V ±0.3, T_A = T_{MIN} to T_{MAX}, unless otherwise noted,T_A = 25°C)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Differential Driver Output (no load)	V_{OD1}			2.0			V
Differential Driver Output (with load)	V_{OD2}	R = 54Ω (RS-422)		2			V
		R = 60Ω (RS-485)		1.5			
Change in Magnitude of Driver Differential Output Voltage for Complementary Output States	ΔV_{OD}	R = 54Ω or 100Ω				0.2	V
Driver Common-Mode Output Voltage	V_{OC}	R = 54Ω or 100Ω				3	V
Change in Magnitude of Driver Common-Mode Output Voltage for Complementary Output States	ΔV_{OD}	R = 54Ω or 100Ω				0.2	V
Input High Voltage	V_{IH}	DE, DI, $\overline{RE}$		2.0			V
Input Low Voltage	V_{IL}	DE, DI, $\overline{RE}$				0.8	V
Input Current	I_{IN1}	DE, DI, $\overline{RE}$				±2	μA
Input Current (A, B)	I_{IN2}	DE = 0V;	V_{IN} = 12V			1.0	mA
		V_{CC} = 0V or 5.25V,	V_{IN} = -7V			-0.8	
Receiver Differential Threshold Voltage	V_{TH}	-7V ≤ V_{CM} ≤12V		-0.2		0.2	V
Receiver Input Hysteresis	ΔV_{TH}	V_{CM} = 0V			50		mV
Receiver Output High Voltage	V_{OH}	I_O = -1.5mA, VID = 200mV		2.9			V
Receiver Output Low Voltage	V_{OL}	I_O = 2.5mA, VID = -200mV				0.4	V
Three-State (high impedance) Output Current at Receiver	I_{OZR}	V_{CC}= 3.6V, 0.4V ≤ V_O ≤ 2.4V				±1	μA
Receiver Input Resistance	R_{IN}	-7V ≤ V_{CM} ≤ 12V		12			kΩ

DC ELECTRICAL CHARACTERISTICS (continued)

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

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
No-Load Supply Current	I_{CC}	DE = V_{CC} ,$\overline{RE}$= 0V or V_{CC}		1.1	2.2	mA
		DE = 0V,$\overline{RE}$= 0V		0.95	1.9	
		DE = 0V,$\overline{RE}$= V_{CC},DE = V_{CC} or 0		0.95	1.9	
Driver Short-Circuit Current,	I_{OSD}	V_{O} = -7V			-250	mA
		V_{O} = -12V			250	mA
Receiver Short-Circuit Current	I_{OSR}	0V ≤ V_O ≤ V_{CC}	±8		±60	mA

SWITCHING CHARACTERISTICS

(V_{CC} = 3.3V ±5% , T_A = 25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Maximum Data Rate	t_{DD}	R_L= 60Ω	600	900	1400	ns
Driver Diferential Output Delay	t_{TD}	R_L= 60Ω	400	740	1200	ns
Driver Diferential Output Transition Time	t_{PLH}	R_L= 27Ω	700	930	1500	ns
Driver Propagation Delay, Low-to-High Level	t_{PHL}	R_L= 27Ω	700	930	1500	ns
$\|t_{PLH}-t_{PLH}\|$ Driver Propagation Delay Skew	t_{PDS}	R_L= 27Ω		±50		ns
Driver-Output Enable Time to Low Level	t_{PZL}	R_L= 100Ω		900	1300	ns
Driver-Output Enable Time to High Level	t_{PZH}	R_L= 100Ω		600	800	ns
Driver-Output Disable Time from High Level	t_{PHZ}	R_L= 100Ω		50	80	ns
Driver-Output Disable Time from Low Level	t_{PLZ}	R_L= 100Ω		50	80	ns
Driver-Output Enable Time from Shutdown to Low Level	t_{PSL}	R_L= 100Ω		1.9	2.7	ns
Driver-Output Enable Time from Shutdown to High Level	t_{PSH}	R_L= 100Ω		2.2	3.0	ns
Maximum Data Rate	f_{MAX}		250			kbps

RECEIVER SWITCHING CHARACTERISTICS

(V_{CC} = 3.3V ±5% , T_A = 25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Time to Shutdown	t_{SHDN}		80	190	300	ns
Receiver Propagation Delay, Low-to-High Level	t_{RPLH}	V_{ID} = 0 to 3.0, C_L = 15pF	25	75	120	ns
Receiver Propagation Delay, High-to-Low Level	t_{RPHL}	V_{ID} = 0 to 3.0, C_L = 15pF	25	75	120	ns
$\|t_{PLH} - t_{PHL}\|$ Receiver Propagation Delay Skew	t_{RPDS}	V_{ID} = 0 to 3.0, C_L = 15pF		12	±20	ns
Receiver Output Enable Time to Low Level	t_{PRZL}	C_L = 15pF		25	50	ns
Receiver Output Enable Time to High Level	t_{PRZH}	C_L = 15pF		25	50	ns
Receiver Output Disable Time from High Level	t_{PRHZ}	C_L = 15pF		25	45	ns
Receiver Output Disable Time from Low Level	t_{PRLZ}	C_L = 15pF		25	45	ns
Receiver Output Enable Time from Shutdown to Low Level	t_{PRSL}	C_L = 15pF		720	1400	ns
Receiver Output Enable Time from Shutdown to High Level	t_{PRSH}	C_L = 15pF		720	1400	ns

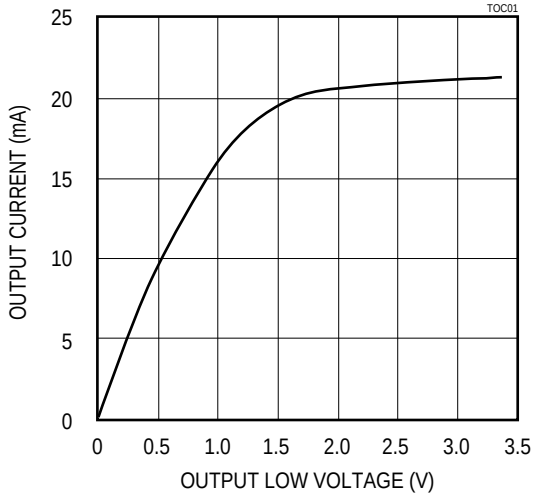
TABLEOF OPERATION

Transmission					Receipt			
Inputs			Outputs X		Inputs			Outputs
RE	DE	DI	A	B	RE	DE	A-B	RO
X	1	1	1	0	0	X	≥+0.2V	1
X	1	0	0	1	0	X	≤-0.2V	0
0	0	X	Z	Z	0	X	Inputs open	1
1	0	X	Z	Z	1	0	X	Z

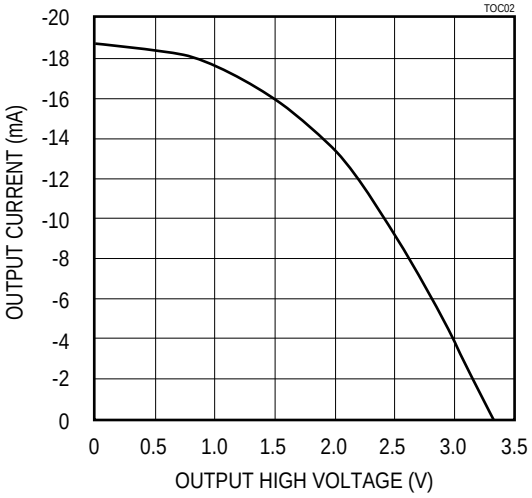
X-Any level
Z-High resistance

TYPICAL CHARACTERISTICS

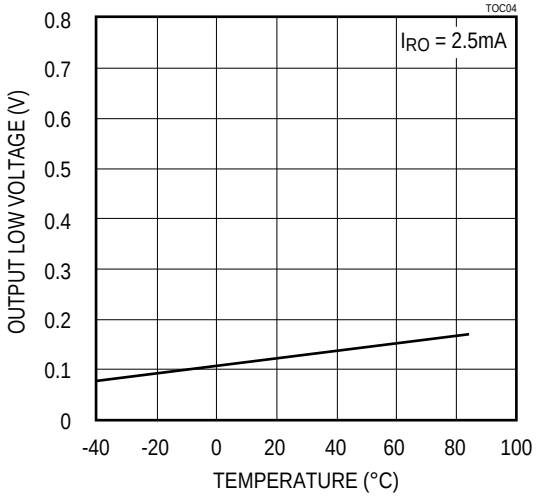
OUTPUT CURRENT vs.
RECEIVER OUTPUT LOW VOLTAGE



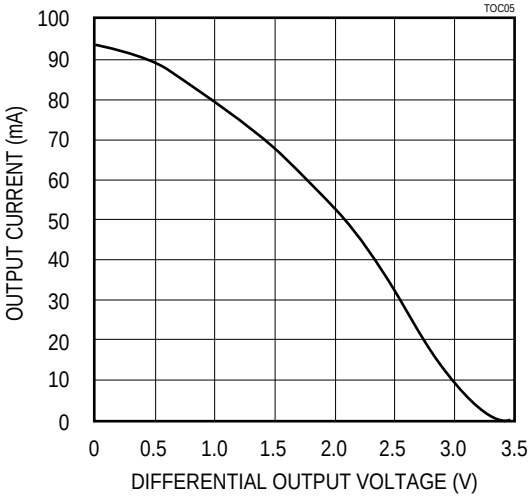
OUTPUT CURRENT vs.
RECEIVER OUTPUT HIGH VOLTAGE



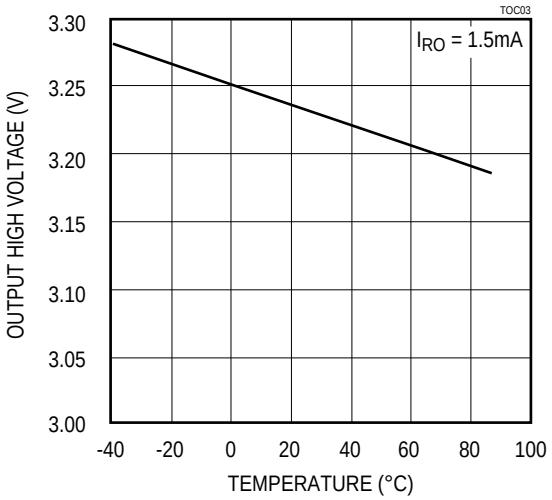
RECEIVER OUTPUT LOW VOLTAGE
vs. TEMPERATURE



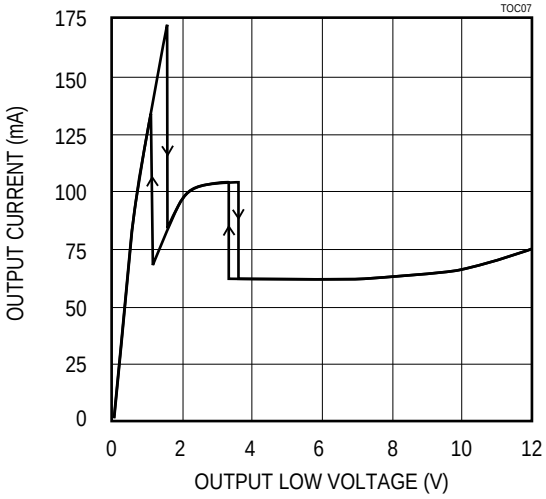
DRIVER OUTPUT CURRENT vs.
DIFFERENTIAL OUTPUT VOLTAGE



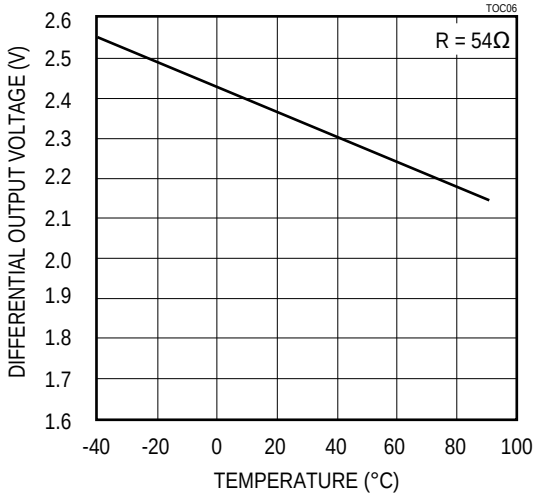
RECEIVER OUTPUT HIGH VOLTAGE
vs. TEMPERATURE



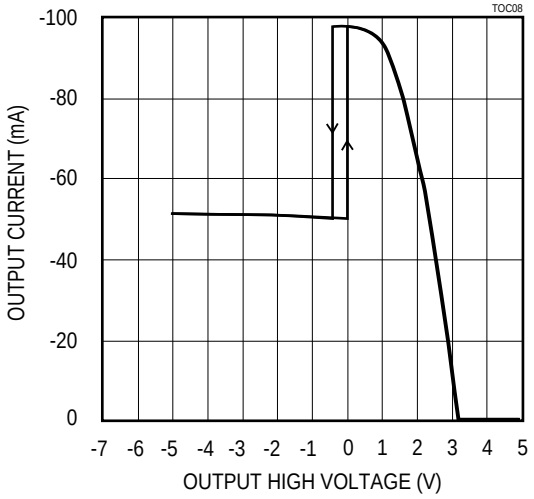
OUTPUT CURRENT vs.
DRIVER OUTPUT LOW VOLTAGE



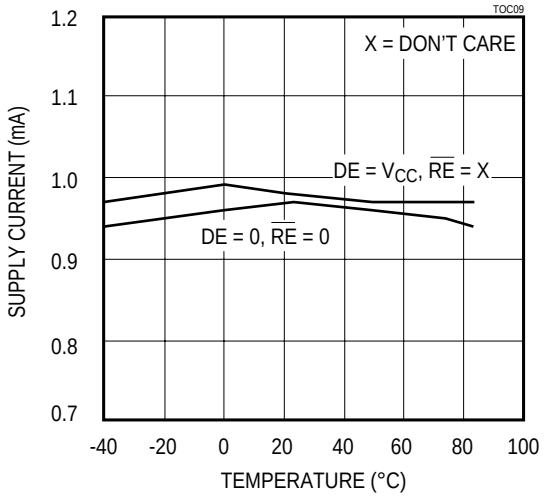
DRIVER DIFFERENTIAL OUTPUT
VOLTAGE vs.TEMPERATURE



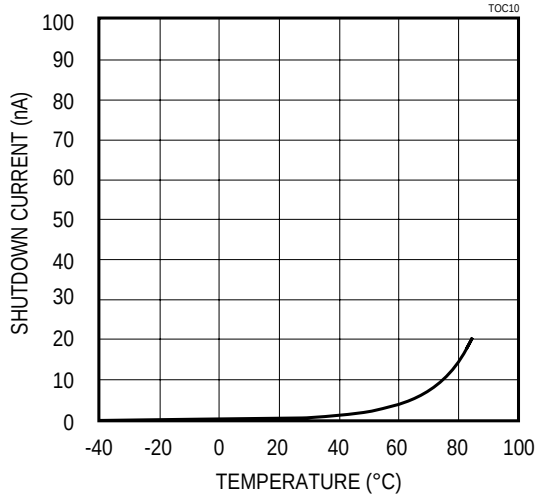
OUTPUT CURRENT vs.
DRIVER OUTPUT HIGH VOLTAGE



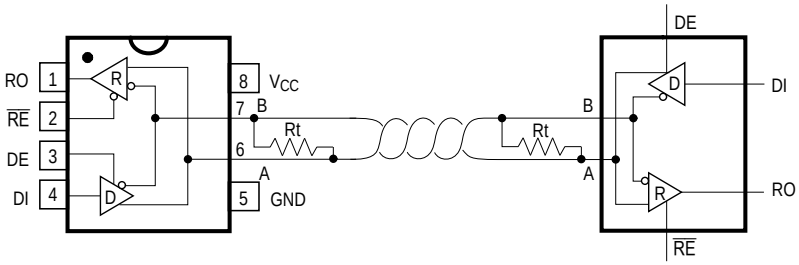
SUPPLY CURRENT
vs. TEMPERATURE



SHUTDOWN CURRENT
vs. TEMPERATURE



Typical Operating Circuit



Low-Power Shutdown Mode

A low-power shutdown mode is initiated by bringing both $\overline{RE}$ high and DE low.
The devices will not shut down unless both the driver and receiver are disabled (high impedance).
In shutdown, the devices typically draw only 2nA of supply current.
For these devices, the t_{PSH} and t_{PSL} enable times assume the part was in the low-power shutdown mode; the t_{PZH} and t_{PZL} enable times assume the receiver or driver was disabled, but the part was not shut down.

Applications Information

The MAX3485E is low-power transceivers for RS-485 and RS-422 communications. The MAX3483ESA can transmit and receive at data rates up to 250kbps. The MAX3483ESA is half-duplex. Driver Enable (DE) and Receiver Enable ($\overline{RE}$) pins is included on the MAX3483ESA.
When disabled, the driver and receiver outputs are high impedance.

Reduced EMI and Relections

The MAX3483ESA is slew-rate limited, mini-mizing EMI and reducing reflections caused by improp-erly terminated cables.

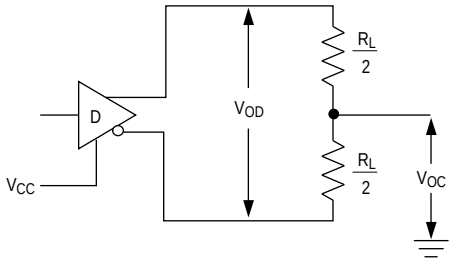
Driver Output Protection

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 (see *Typical Operating Characteristics*). In addition, a thermal shut-down circuit forces the driver outputs into a high-imped-ance state if the die temperature rises excessively.

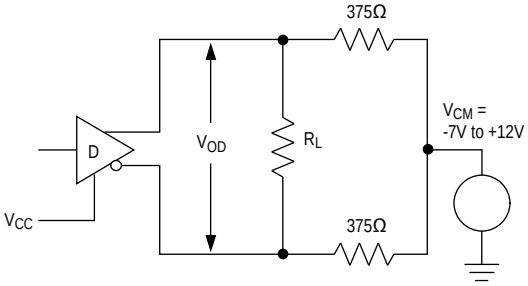
Propagation Delay

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, $|t_{PRLH} - t_{PRHL}|$, is under 10ns 20ns for the MAX3483ESA).
The driver skew times is 50ns.

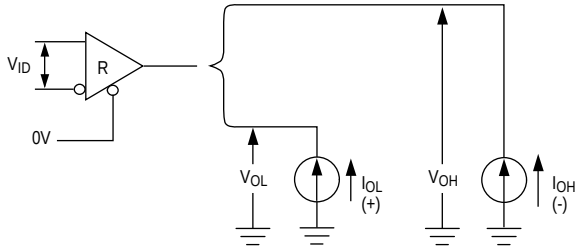
Driver DC Test Load



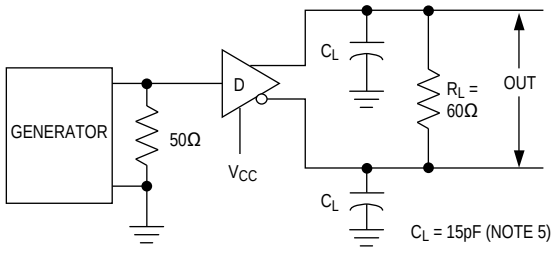
Driver VOD with Varying Common-Mode Voltage

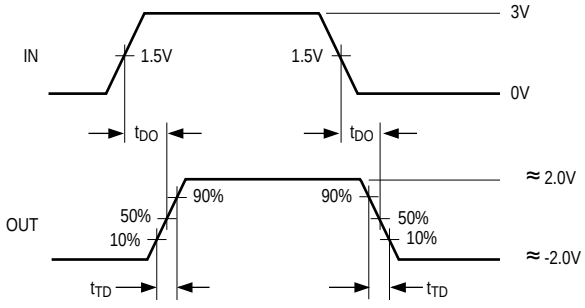


Receiver VOH and VOL

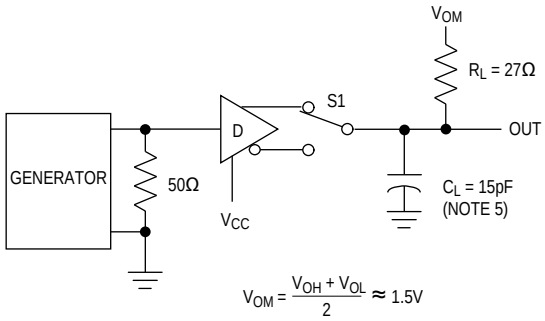


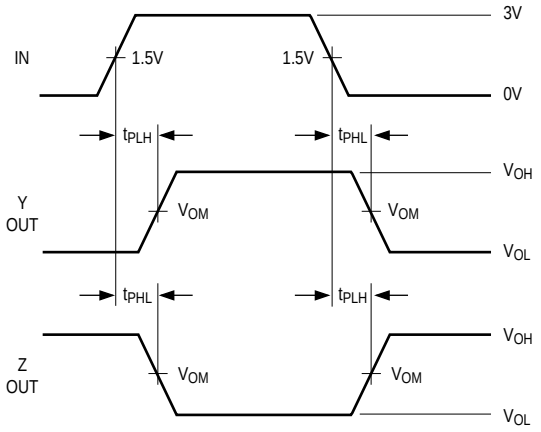
Driver Differential Output Delay and Transition Times



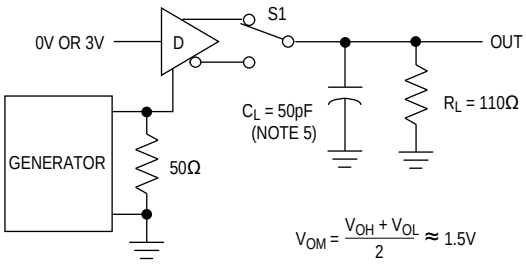


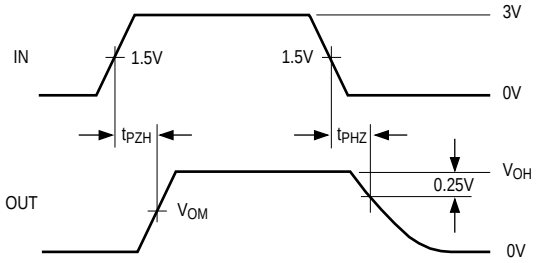
Driver Propagation Times



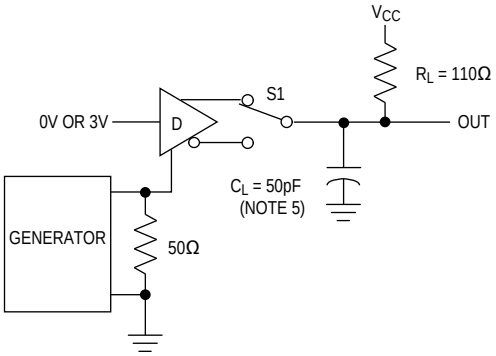


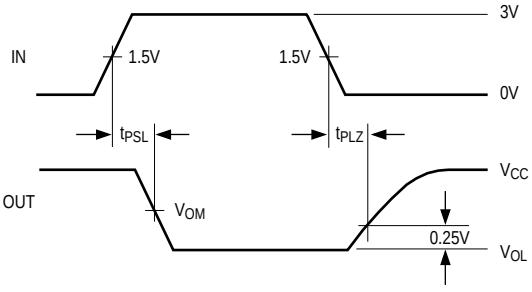
Driver Enable and Disable Times (tPZH, tPSH, tPHZ)



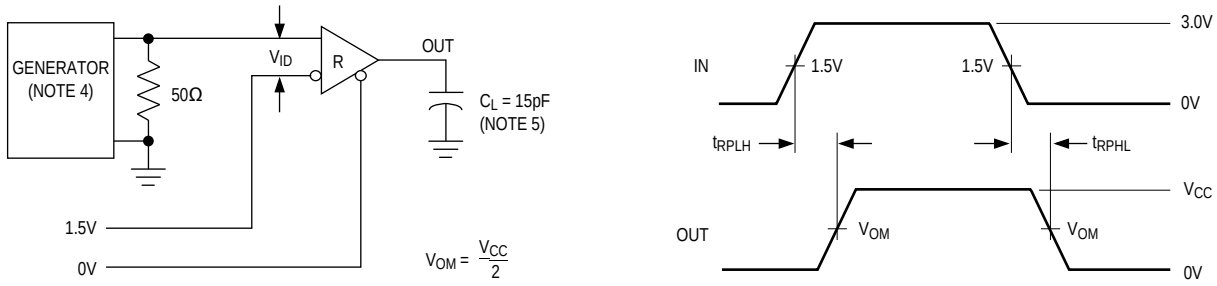


Driver Enable and Disable Times (tPZH, tPSH, tPHZ)





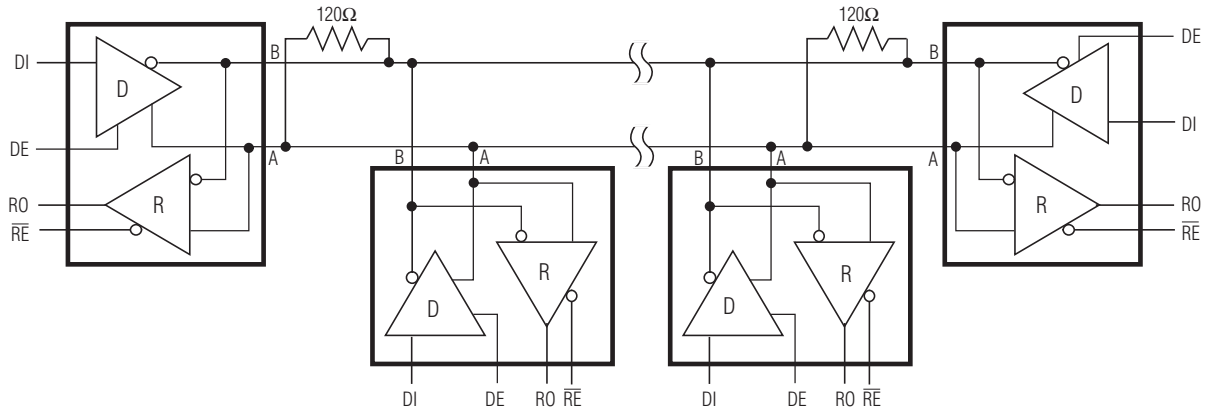
Receiver Propagation Delay



Typical Applications

The MAX3483E transceivers are designed for bidirectional data communications on multipoint bus transmission lines. The following figure show typical net-work applications circuits.
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.

Typical Half-Duplex RS-485 Network



PACKAGE OUTLINE DIMENSIONS

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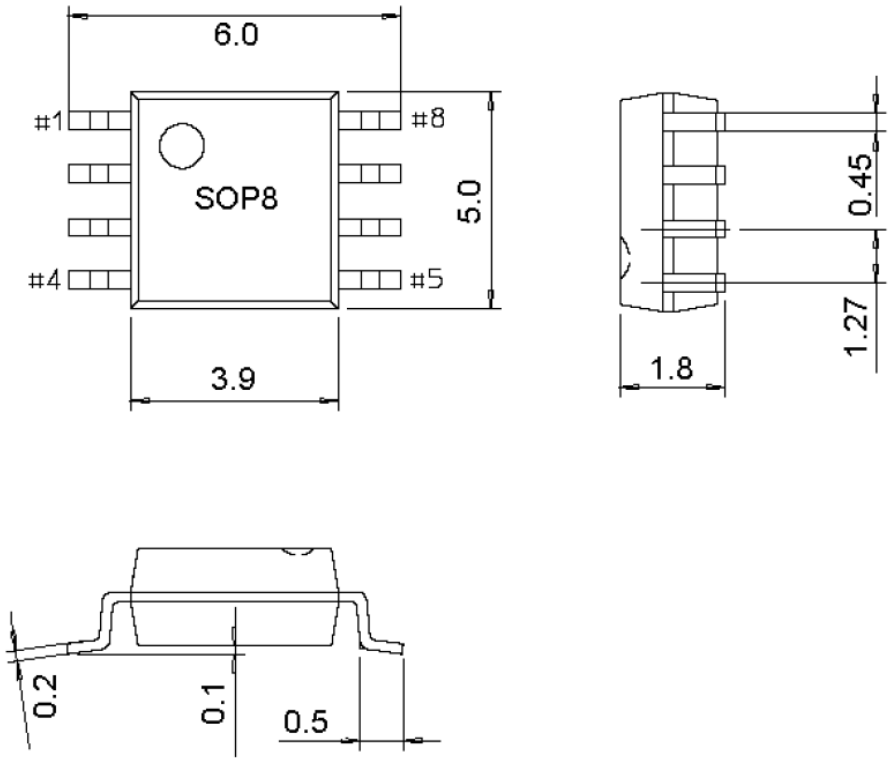

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