



## DESCRIPTION

The SP3483EN is  $\pm 15\text{kV}$  ESD-protected, +3.3V, low-power transceivers for RS-485 and RS-422 communications.

Each device contains one driver and one receiver. The SP3483EN feature slew-rate-limited drivers that minimize EMI and reduce reflections caused by improperly terminated 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  $\pm 15\text{kV}$  using IEC 1000-4-2 Air-Gap Discharge  $\pm 8\text{kV}$  using IEC 1000-4-2 Contact Discharge, and  $\pm 15\text{kV}$  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 guarantees a logic-high output if both inputs are open circuit.

The SP3483EN is designed for half-duplex communication.

## 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 ( $V_{CC} + 0.3\text{V}$ )

Continuous Power Dissipation ( $T_A = +70^\circ\text{C}$ )

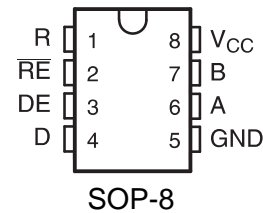
8-Pin SO (derate 5.88mW/ $^\circ\text{C}$  above  $+70^\circ\text{C}$ )  
471mW

Operating Temperature Ranges  $0^\circ\text{C}$  to  $+70^\circ\text{C}$

Storage Temperature Range  $-65^\circ\text{C}$  to  $+150^\circ\text{C}$

Lead Temperature (soldering, 10sec)  $+300^\circ\text{C}$

## PIN CONFIGURATION



## 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  $\pm 15\text{kV}$   
IEC 1000-4-2: Contact discharge  $+8\text{kV}$   
IEC 1000-4-2: Air discharge  $\pm 15\text{kV}$

## APPLICATIONS

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



### DC ELECTRICAL CHARACTERISTICS

( $V_{CC} = 3.3V \pm 0.3$ ,  $T_A = T_{MIN}$  to  $T_{MAX}$ , unless otherwise noted,  $T_A = 25^\circ C$ )

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

### DC ELECTRICAL CHARACTERISTICS (continued)

( $V_{CC} = 5V \pm 5\%$ ,  $T_A = T_{MIN}$  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,	$I_{OSD}$	$V_{OD} = -7V$			-250	mA
		$V_{OD} = -12V$			250	mA
Receiver Short-Circuit Current	$I_{OSR}$	$0V \leq V_O \leq V_{CC}$	$\pm 8$		$\pm 60$	mA



## SWITCHING CHARACTERISTICS

( $V_{CC} = 3.3V \pm 5\%$ ,  $T_A = 25^\circ C$ )

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

## RECEIVER SWITCHING CHARACTERISTICS

( $V_{CC} = 3.3V \pm 5\%$ ,  $T_A = 25^\circ C$ )

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_{RPLH} - t_{RPHL} $ Receiver Propagation Delay Skew	$t_{RPDS}$	$V_{ID} = 0$ to 3.0, $C_L = 15pF$		12	$\pm 20$	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

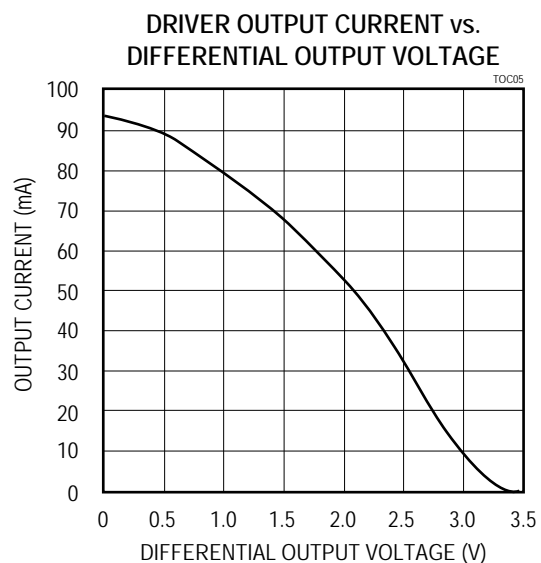
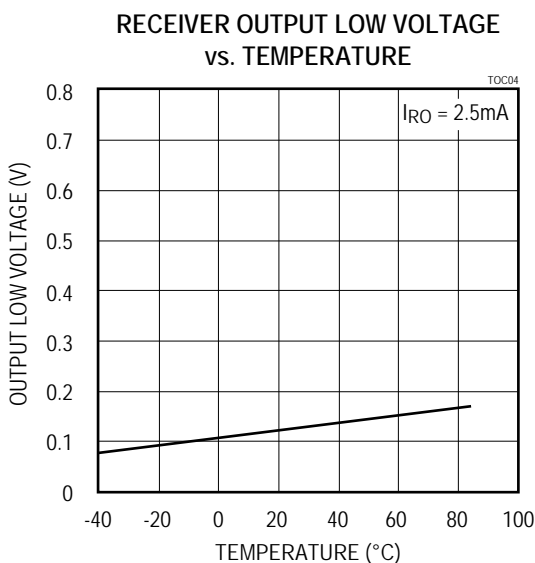
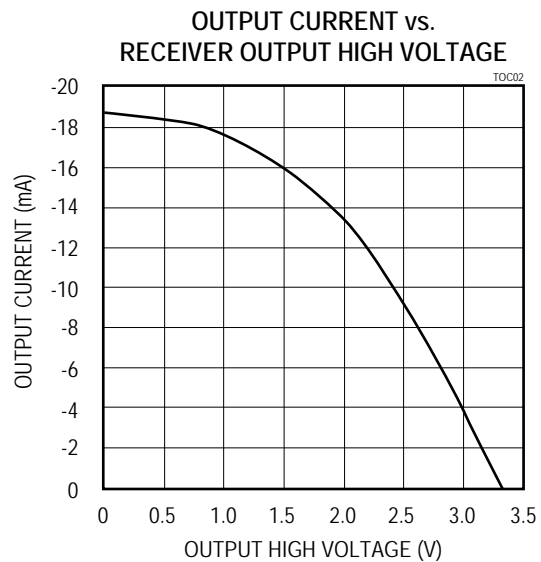
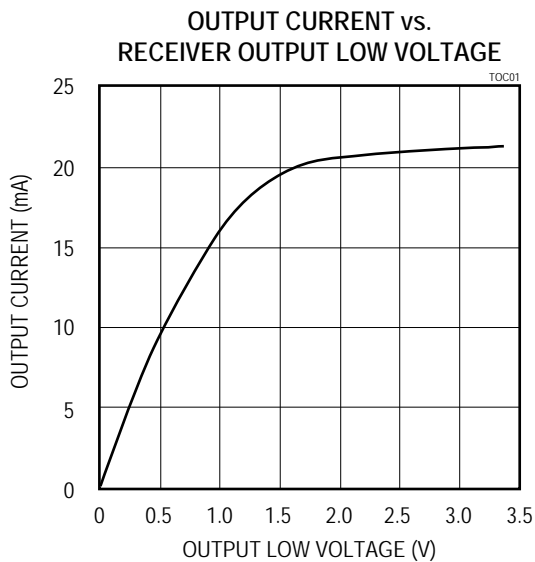


### TABLE OF OPERATION

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

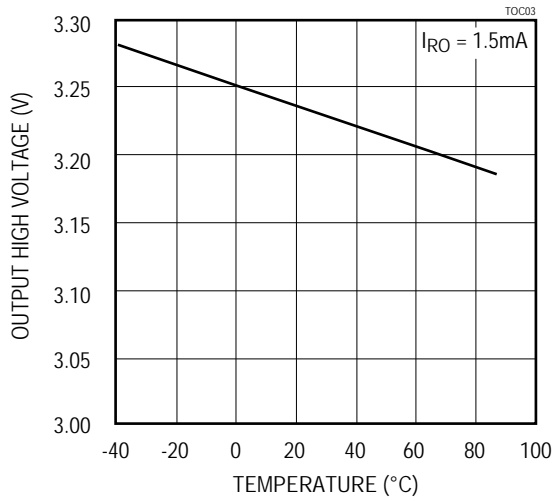
X-Any level  
Z-High resistance

### TYPICAL CHARACTERISTICS

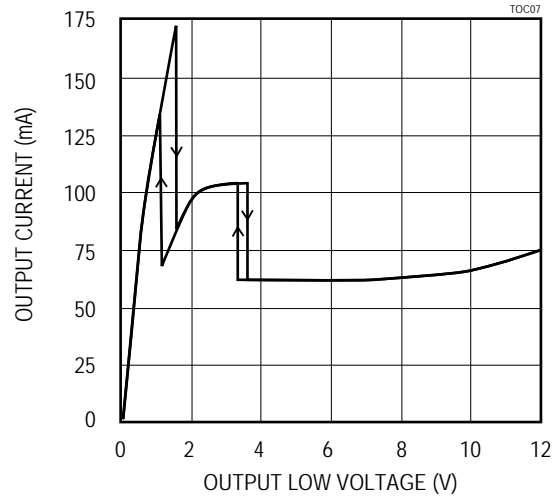




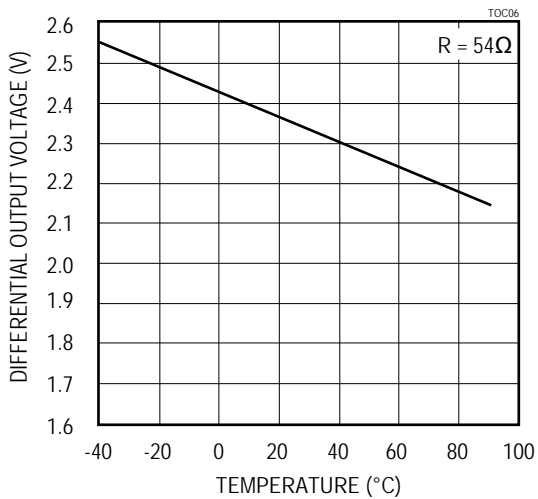
RECEIVER OUTPUT HIGH VOLTAGE  
vs. TEMPERATURE



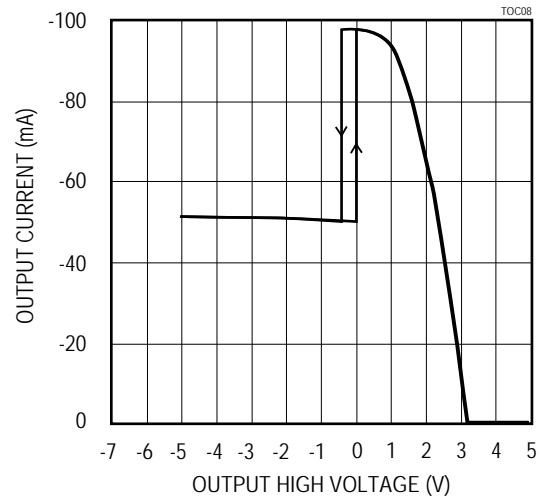
OUTPUT CURRENT vs.  
DRIVER OUTPUT LOW VOLTAGE



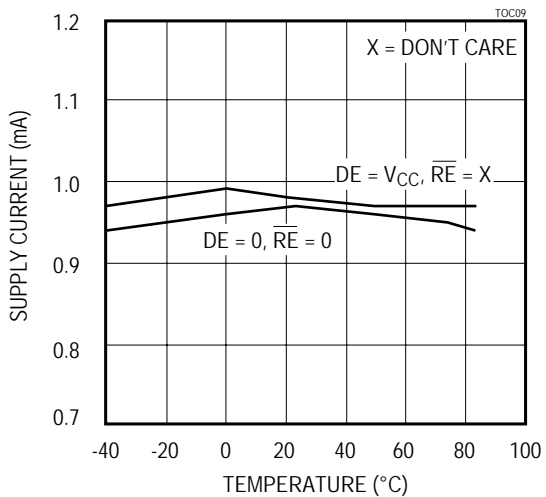
DRIVER DIFFERENTIAL OUTPUT  
VOLTAGE vs. TEMPERATURE



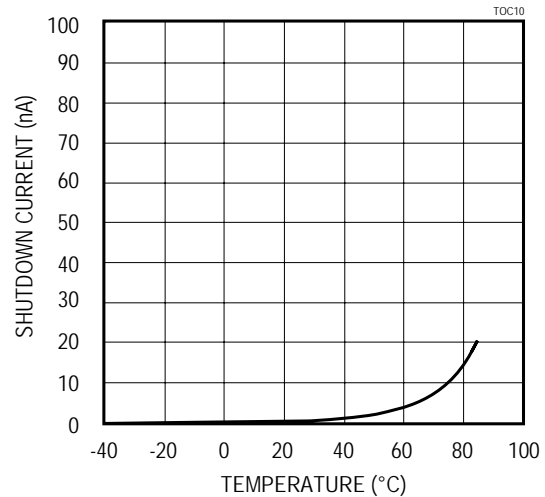
OUTPUT CURRENT vs.  
DRIVER OUTPUT HIGH VOLTAGE



SUPPLY CURRENT  
vs. TEMPERATURE

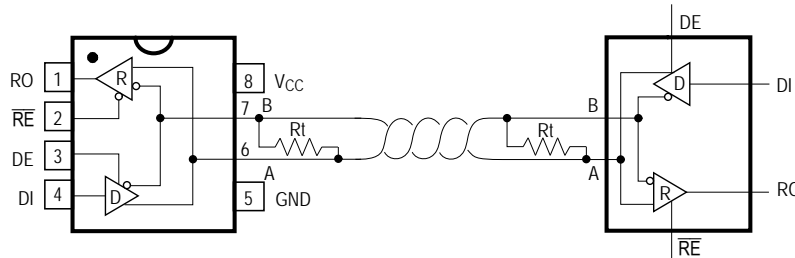


SHUTDOWN CURRENT  
vs. TEMPERATURE





## 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 tPSH and tPSL enable times assume the part was in the low-power shutdown mode; the tPZH and tPZL 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 SN3483EN can transmit and receive at data rates up to 250kbps. The SN3483EN is half-duplex. Driver Enable (DE) and Receiver Enable ( $\overline{RE}$ ) pins is included on the SN3483EN.

When disabled, the driver and receiver outputs are high impedance.

### Reduced EMI and Relections

The SN3483EN is slew-rate limited, minimizing EMI and reducing reflections caused by improperly 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 shutdown circuit forces the driver outputs into a high-impedance state if the die temperature rises excessively.

### Propagation Delay

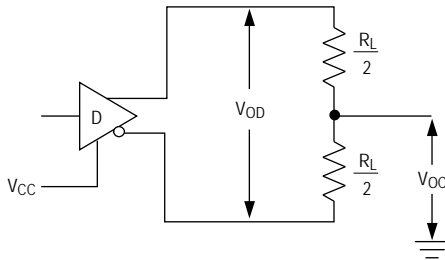
Skew time is simply the difference between the low-to-high and high-to-low propagation delay. Small driver/receiver skew times help maintain a symmetrical mark-space ratio (50% duty cycle).

The receiver skew time,  $|t_{PRLH} - t_{PRHL}|$ , is under 10ns 20ns for the SN3483EN).

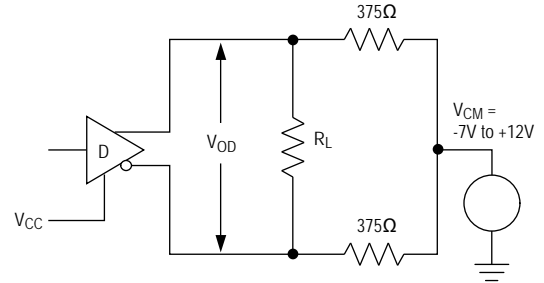
The driver skew times is 50ns.



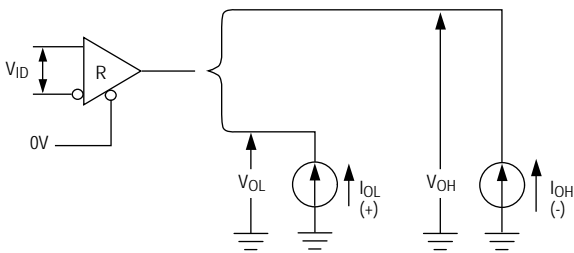
### Driver DC Test Load



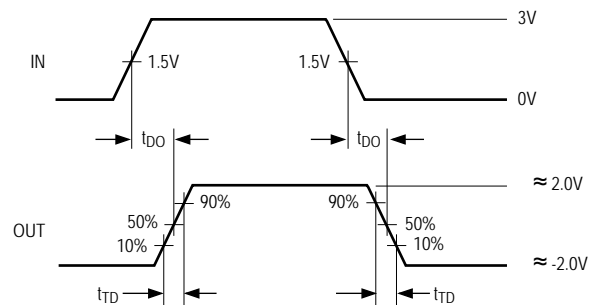
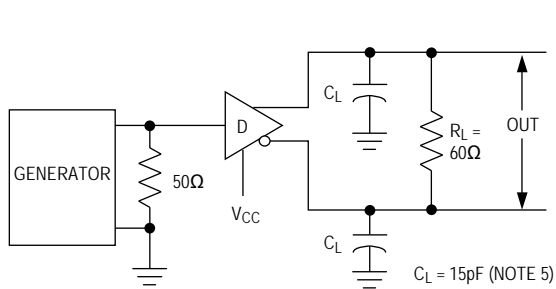
### Driver VOD with Varying Common-Mode Voltage



### Receiver VOH and VOL

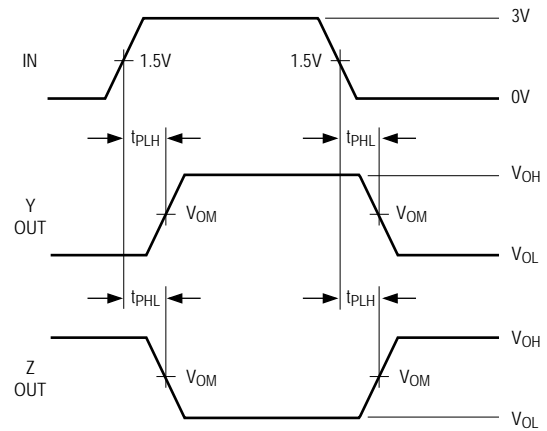
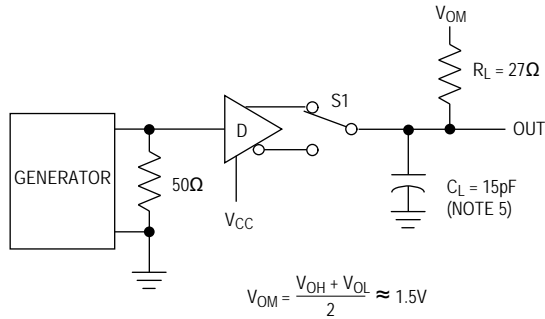


### Driver Differential Output Delay and Transition Times

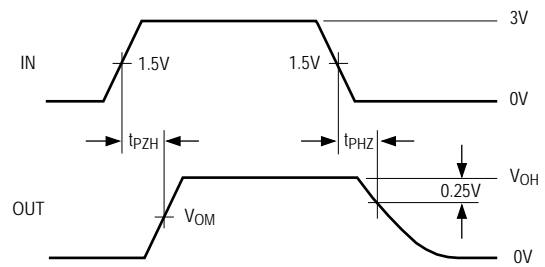
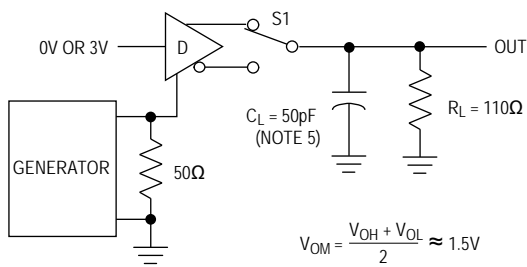




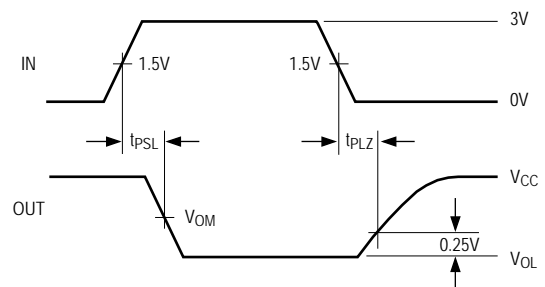
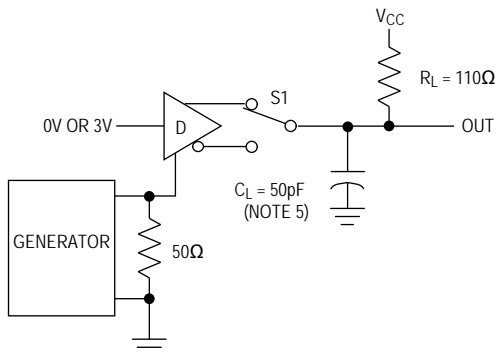
### Driver Propagation Times



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



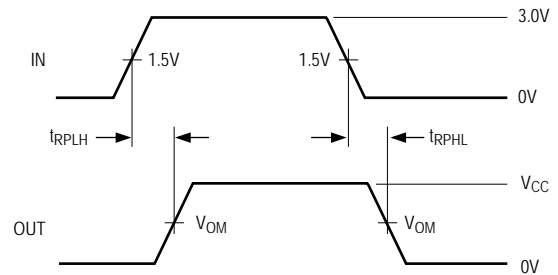
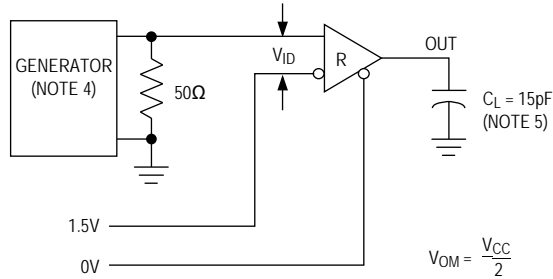
### Driver Enable and Disable Times (tPSL, tPLZ)







### Receiver Propagation Delay

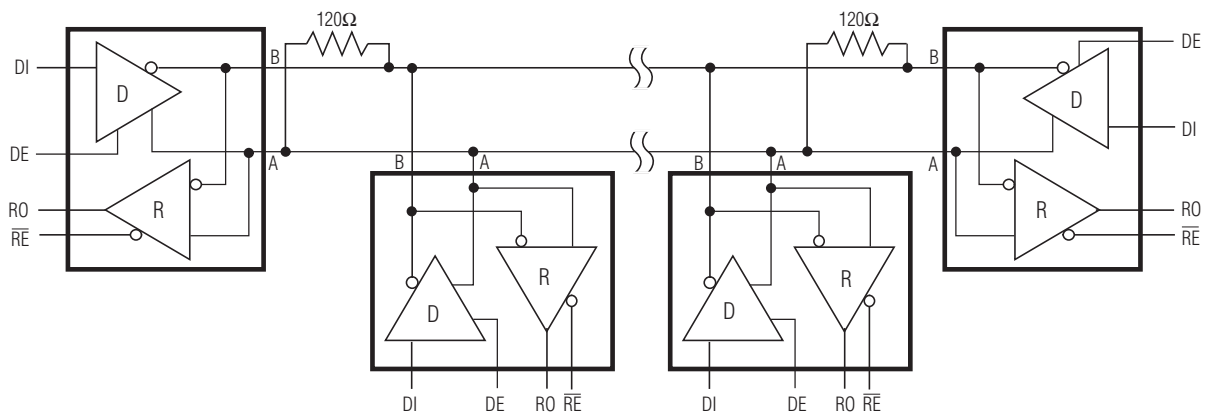


### Typical Applications

The SN3483EN 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.

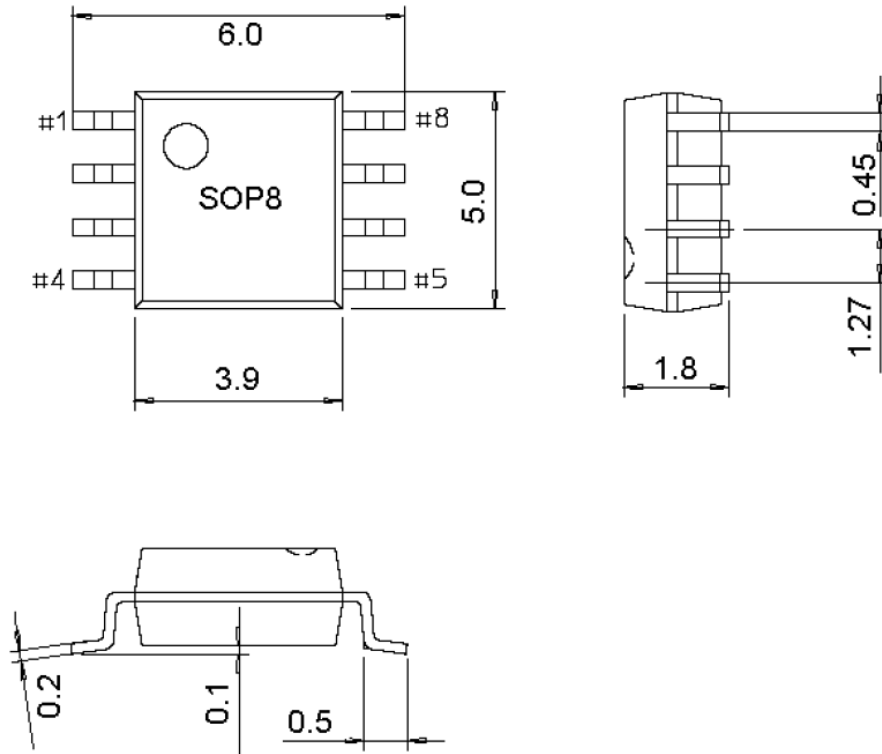
### Typical Half-Duplex RS-485 Network





## PACKAGE OUTLINE DIMENSIONS

SOP-8





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