



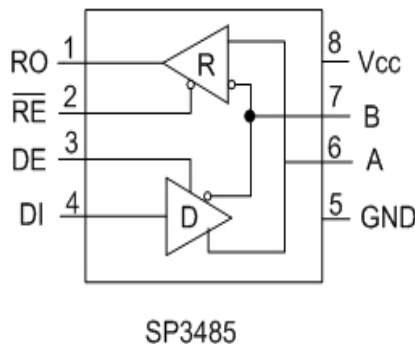
SP3485

+3.3V Low Power Half-Duplex RS-485 Transceiver with 10Mbps Data Rate

- RS-485 and RS-422 Transceiver
- Operates from a single +3.3V Supply
- Interoperable with +5.0V logic
- Driver/Receiver Enable
- -7V to +12V Common-Mode Input Voltage Range
- Allows up to 32 transceivers on the serial bus
- Compatibility with industry standard 75176 pinout
- Driver Output Short-Circuit Protection

DESCRIPTION

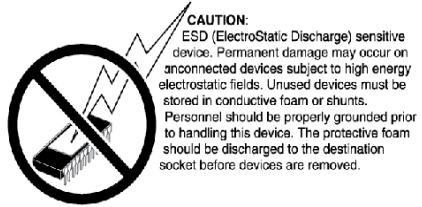
The **SP3485** device is a +3.3V low power half-duplex transceiver that meets the specifications of the RS-485 and RS-422 serial protocols. This device is pin-to-pin compatible with the **Exar** SP481, SP483 and SP485 devices as well as popular industry standards. The **SP3485** can meet the electrical specifications of the RS-485 and RS-422 serial protocols up to 10Mbps under load.



ABSOLUTE MAXIMUM RATINGS

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

V_{CC}	+6.0V
Input Voltages	
Logic.....	-0.3V to +6.0V
Drivers.....	-0.3V to +6.0V
Receivers.....	+/-15V
Output Voltages	
Drivers.....	+/-15V
Receivers.....	-0.3V to +6.0V
Storage Temperature.....	-65°C to +150°C
Power Dissipation	
8-pin NSOIC.....	600mW
(derate 6.90mW/°C above +70°C)	



ELECTRICAL CHARACTERISTICS

$T_{AMB} = T_{MIN}$ to T_{MAX} and $V_{CC} = +3.3V \pm 5\%$ unless otherwise noted.

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP3485 DRIVER					
DC Characteristics					
Differential Output Voltage	GND		V_{CC}	Volts	Unloaded; $R = \infty\Omega$; Figure 1
Differential Output Voltage	2		V_{CC}	Volts	With Load; $R = 50\Omega$ (RS-422); Figure 1
Differential Output Voltage	1.5		V_{CC}	Volts	With Load; $R = 27\Omega$ (RS-485); Figure 1
Change in Magnitude of Driver Differential Output Voltage for Complimentary states			0.2	Volts	$R = 27\Omega$ or $R = 50\Omega$; Figure 1
Driver Common Mode Output Voltage			3	Volts	$R = 27\Omega$ or $R = 50\Omega$; Figure 1
Input High Voltage	2.0			Volts	Applies to DE, DI, $\overline{RE}$
Input Low Voltage			0.8	Volts	Applies to DE, DI, $\overline{RE}$
Input Current			+/-10	μA	Applies to DE, DI, $\overline{RE}$
Driver Short Circuit Current $V_{OUT} = \text{HIGH}$			+/-250	mA	$-7V \leq V_O \leq +12V$; Figure 8
Driver Short Circuit Current $V_{OUT} = \text{LOW}$			+/-250	mA	$-7V \leq V_O \leq +12V$; Figure 8
SP3485 DRIVER					
AC Characteristics					
Maximum Data Rate	10			Mbps	$\overline{RE} = V_{CC}$, $DE = V_{CC}$
Driver Input to Output, t_{PLH}		17	60	ns	Figures 2 & 9
Driver Input to Output, t_{PHL}		17	60	ns	Figures 2 & 9
Differential Driver Skew		2	10	ns	$ t_{D01} - t_{D02} $, Figures 2 and 10
Driver Rise or Fall Time		5	20	ns	From 10%-90%; Figures 3 and 10

ELECTRICAL CHARACTERISTICS

$T_{AMB} = T_{MIN}$ to T_{MAX} and $V_{CC} = +3.3V \pm 5\%$ unless otherwise noted.

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP3485 DRIVER AC Characteristics continued					
Driver Enable to Output High		35	120	ns	Figures 4 and 11
Driver Enable to Output Low		30	120	ns	Figures 5 and 11
Driver Disable Time from Low		20	120	ns	Figures 5 and 11
Driver Disable Time from High		20	120	ns	Figures 4 and 11
Driver Enable from Shutdown to Output High, t_{PSH}			250	ns	$C_L = 50pF$, $R_L = 500\Omega$. Figures 4, 5, and 11
Driver Enable from Shutdown to Output Low, t_{PSL}			250	ns	
Time to Shutdown, t_{SHDN}	50	200	600	ns	Notes 1 and 2
SP3485 RECEIVER					
DC Characteristics					
Differential Input Threshold	-0.2		+0.2	Volts	$-7V \leq V_{CM} \leq +12V$
Input Hysteresis		20		mV	$V_{CM} = 0V$
Output Voltage HIGH	$V_{CC}-0.4$			Volts	$V_{ID} = +200mV$, $-1.5mA$
Output Voltage LOW			0.4	Volts	$V_{ID} = -200mV$, $2.5mA$
Three-State (High Impedance) Output Current			+/-1	μA	$0V \leq V_O \leq V_{CC}$; $\overline{RE} = V_{CC}$
Input Resistance	12			k Ω	$-7V \leq V_{CM} \leq +12V$
Input Current (A, B); $V_{IN} = 12V$			+1.0	mA	$DE = 0V$, $V_{CC} = 0V$ or $3.6V$, $V_{IN} = 12V$
Input Current (A, B); $V_{IN} = -7V$			-0.8	mA	$DE = 0V$, $V_{CC} = 0V$ or $3.6V$, $V_{IN} = -7V$
Short Circuit Current	7		60	mA	$0V \leq V_{CM} \leq V_{CC}$
SP3485 RECEIVER					
AC Characteristics					
Maximum Data Rate	10			Mbps	$\overline{RE} = 0V$, $DE = 0V$
Receiver Input to Output, t_{PLH}		40	100	ns	Figures 6 and 12
Receiver Input to Output, t_{PLH}			70	ns	$T_{AMB} = +25^\circ C$, $V_{CC} = 3.3V$, Figures 6 and 12
Receiver Input to Output, t_{PHL}		35	100	ns	Figures 6 and 12
Receiver Input to Output, t_{PHL}			70	ns	$T_{AMB} = +25^\circ C$, $V_{CC} = 3.3V$, Figures 6 and 12
Differential Receiver Skew		4		ns	$t_{RSKEW} = t_{RPHL} - t_{RPLH} $, Figures 6 and 12
Receiver Enable to Output Low		10	60	ns	Figures 7 and 13, S_1 closed, S_2 open
Receiver Enable to Output High		10	60	ns	Figures 7 and 13, S_2 closed, S_1 open
Receiver Disable from Low		10	60	ns	Figures 7 and 13, S_1 closed, S_2 open
Receiver Disable from High		10	60	ns	Figures 7 and 13, S_2 closed, S_1 open

ELECTRICAL CHARACTERISTICS

$T_{AMB} = T_{MIN}$ to T_{MAX} and $V_{CC} = +3.3V \pm 5\%$ unless otherwise noted.

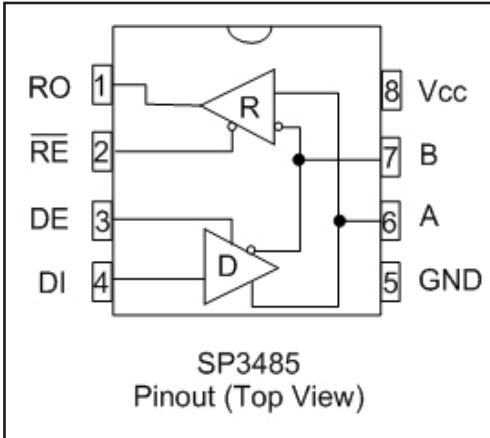
PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
Receiver Enable from Shutdown to Output High, t_{PRSH}			1800	ns	$C_L = 15pF$, $R_L = 1k\Omega$. Figures 7 and 13
Receiver Enable from Shutdown to Output Low, t_{PRSL}			1800	ns	
Time to Shutdown, t_{SHDN}	50	200	600	ns	Notes 1 and 2
POWER REQUIREMENTS					
Supply Current , No Load		425	2000	μA	$\overline{RE}$, DI = 0V or V_{CC} ; DE = V_{CC}
Supply Current , No Load		300	1500	μA	$\overline{RE} = 0V$, DI = 0V or V_{CC} , DE = 0V

Notes:

- The transceivers are put into shutdown by bringing $\overline{RE}$ High and DE Low simultaneously for at least 600ns. If the control inputs are in this state for less than 50ns, the device is guaranteed to not enter shutdown. If the enable inputs are held in this state for at least 600ns the device is assured to be in shutdown. Note that the receiver and driver enable times increase significantly when coming out of shutdown.
- This spec is guaranteed by design and bench characterization.

PIN FUNCTION

Pin Function SP3485



Pin 1 - RO - Receiver output

Pin 2 - $\overline{RE}$ - Receiver Output Enable Active LOW

Pin 3 - DE - Driver Output Enable Active HIGH

Pin 4 - DI - Driver Input

Pin 5 - GND - Ground Connection

Pin 6 - A - Non-Inverting Driver Output/Receiver Input

Pin 7 - B - Inverting Driver Output/Receiver Input

Pin 8 - Vcc - Positive Supply

TEST CIRCUITS

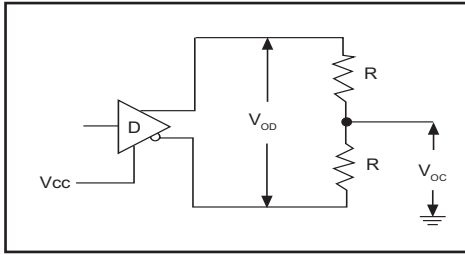


Figure 1. Driver DC Test Load Circuit

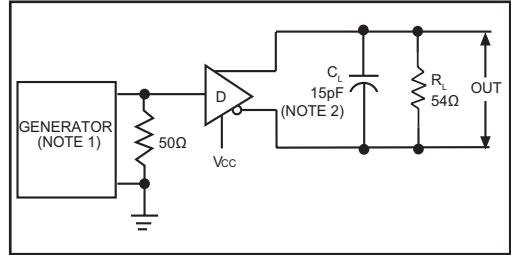


Figure 2. Driver Propagation Delay Test Circuit

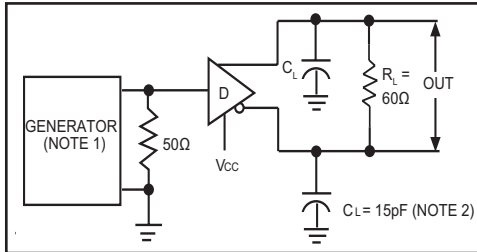


Figure 3. Driver Differential Output Delay and Transition Time Circuit.

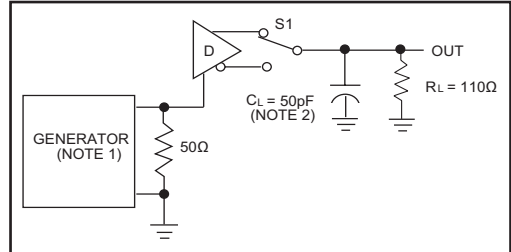


Figure 4. Driver Enable and Disable Timing Circuit, Output High

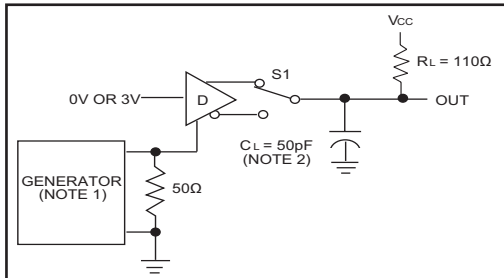


Figure 5. Driver Enable and Disable Timing Circuit, Output Low

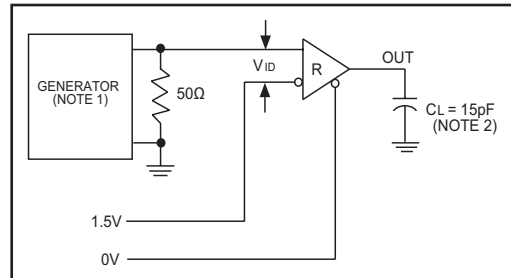


Figure 6. Receiver Propagation Delay Test Circuit

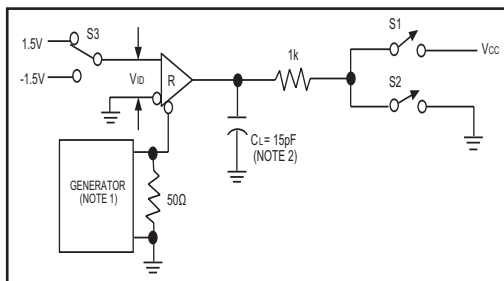


Figure 7. Receiver Enable and Disable Timing Circuit

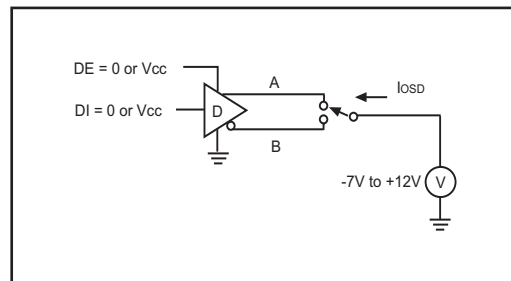


Figure 8. Driver Short Circuit Current Limit Test

NOTE 1: The input pulse is supplied by a generator with the following characteristics:
 PRR = 250kHz, 50% duty cycle, $t_R < 6.0\text{ns}$, $Z_o = 50\Omega$.
 NOTE 2: C_L includes probe and stray capacitance.

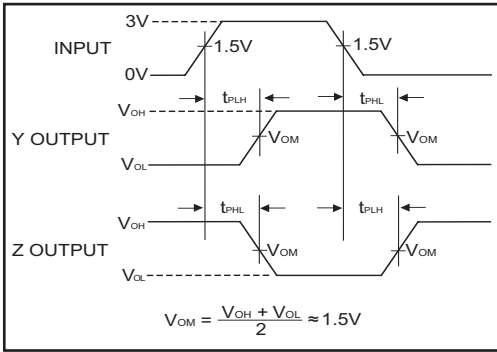


Figure 9. Driver Propagation Delay Waveforms

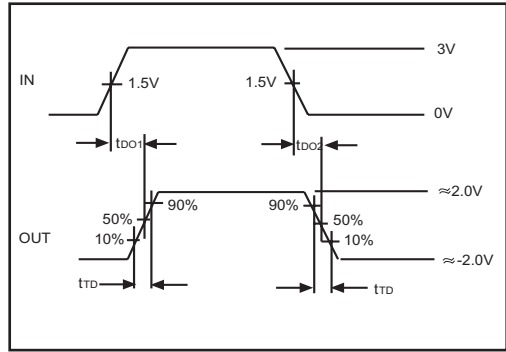


Figure 10. Driver Differential Output Delay and Transition Time Waveforms

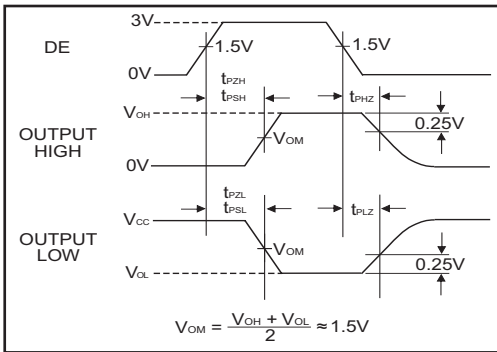


Figure 11. Driver Enable and Disable Timing Waveforms

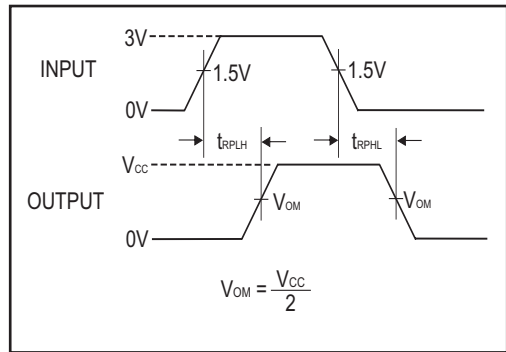


Figure 12. Receiver Propagation Delay Waveforms

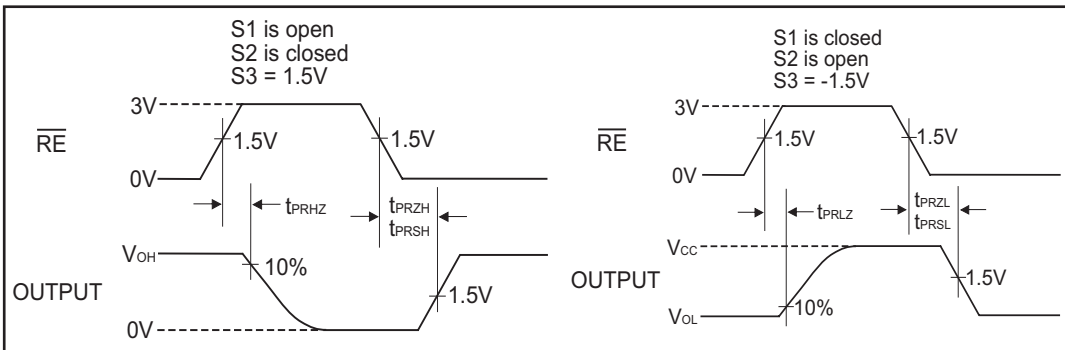


Figure 13. Receiver Enable and Disable Waveforms

The **SP3485** is a member in the family of +3.3V low power half-duplex transceivers that meet the electrical specifications of the RS-485 and RS-422 serial protocols. This device is pin-to-pin compatible with the **Exar** SP481, SP483 and SP485 devices as well as popular industry standards. The **SP3485** feature **Exar's** BiCMOS process allowing low power operation without sacrificing performance.

Driver

The driver outputs of the **SP3485** are differential outputs meeting the RS-485 and RS-422 standards. The typical voltage output swing with no load will be 0 volts to +3.3 Volts. With a load of 54Ω across the differential outputs, the drivers can maintain greater than 1.5V voltage levels.

The driver of the **SP3485** has a driver enable control line which is active HIGH. A logic HIGH on DE (pin 3) will enable the differential driver outputs. A logic LOW on the DE (pin 3) will tri-state the driver outputs.

The driver of the SP3485 operates up to 10Mbps. The 250mA I_{SC} maximum limit on the driver output allows the SP3485 to withstand an infinite short circuit over the -7.0V to +12V common mode range without catastrophic damage to the IC.

Receiver

The **SP3485** receiver has differential inputs with an input sensitivity of $\pm 200\text{mV}$. Input impedance of the receiver is 12kΩ minimum. A wide common mode range of -7V to +12V allows for large ground potential differences between systems. The receiver is equipped with a fail-safe feature that guarantees the receiver output will be in a HIGH state when the input is left unconnected. The receiver of the **SP3485** operates up to 10Mbps.

The receiver of the **SP3485** has an enable control line which is active LOW. A logic LOW on $\overline{\text{RE}}$ (pin 2) will enable the differential receiver. A logic HIGH on $\overline{\text{RE}}$ (pin 2) of the **SP3485** will disable the receiver.

Low Power Shutdown Mode

Low-power shutdown mode is initiated by bringing both $\overline{\text{RE}}$ high and DE low. In shutdown, the devices typically draw only 50nA of supply current. $\overline{\text{RE}}$ and DE can be driven simultaneously; the part is guaranteed not to enter shutdown if $\overline{\text{RE}}$ is high and DE is low for less than 50ns. If the inputs are in this state for at least 600ns, the parts are guaranteed to enter shutdown.

Enable times t_{PRZH} , t_{PZH} , t_{PRZL} and t_{PZL} assume the part was not in a low-power shutdown state. Enable times t_{PRSH} , t_{PSH} , t_{PRSL} and t_{PSL} assume the parts were shut down. It takes drivers and receivers longer to become enabled from low-power shutdown mode (t_{PRSH} , t_{PSH} , t_{PRSL} , t_{PSL}) than from driver/receiver-disable mode (t_{PRZH} , t_{PZH} , t_{PRZL} , t_{PZL}).

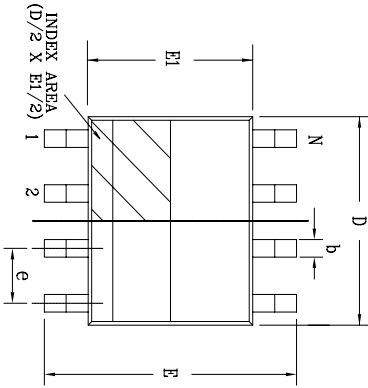
INPUTS			OUTPUTS	
$\overline{\text{RE}}$	DE	DI	B	A
X	1	1	0	1
X	1	0	1	0
0	0	X	High-Z	
1	0	X	Shutdown	

Table 1. Transmit Function Truth Table

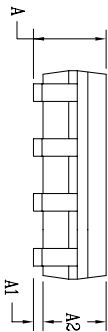
INPUTS			OUTPUTS
$\overline{\text{RE}}$	DE	$V_A - V_B$	RO
0	X	-50mV	1
0	X	-200mV	0
X	X	Open/Shorted	1
1	1	X	High-Z
1	0	X	Shutdown

Table 2. Receive Function Truth Table

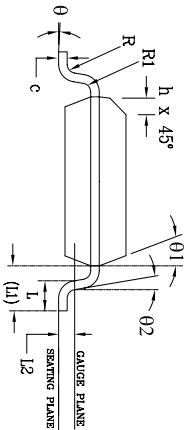
REVISION HISTORY				
REV.	DESCRIPTION	DATE	APP'D	
A	DRAWING ORIGINATOR	08/16/05	JL	
B	DRAWING FORMAT MODIFICATION	07/19/06	JL	
C	CHANGE DRAWING LOGO AND COMPANY NAME	11/16/07	JL	



Top View



Side View



Front View

8 Pin SOICN		JEDEC MS-012		Variation AA		
SYMBOLS		DIMENSIONS IN MM (Control Unit)		DIMENSIONS IN INCH (Reference Unit)		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.35	—	1.75	0.053	—	0.069
A1	0.10	—	0.25	0.004	—	0.010
A2	1.25	—	1.65	0.049	—	0.065
b	0.31	—	0.51	0.012	—	0.020
c	0.17	—	0.25	0.007	—	0.010
E	6.00 BSC			0.236 BSC		
E1	3.90 BSC			0.154 BSC		
e	1.27 BSC			0.050 BSC		
h	0.25	—	0.50	0.010	—	0.020
L	0.40	—	1.27	0.016	—	0.050
L1	1.04 REF			0.041 REF		
L2	0.25 BSC			0.010 BSC		
R	0.07	—	—	0.003	—	—
R1	0.07	—	—	0.003	—	—
11	0°	—	8°	0°	—	8°
12	5°	—	15°	5°	—	15°
13	0°	—	—	0°	—	—
D	4.90 BSC			0.193 BSC		
N	8			8		

		EXAR CORPORATION	
Packaging Approval:		8 PIN SOICN PACKAGE OUTLINE	
By: JL	Date: 11/16/07	Drawing No: 8-PIN SOICN	Revision: C
		Sheet: 1 OF 1	

ORDERING INFORMATION		
Model	Temperature Range	Package Types
SP3485CN-L	0°C to +70°C	8-pin NSOIC
SP3485CN-L/TR	0°C to +70°C	8-pin NSOIC
SP3485EN-L	-40°C to +85°C	8-pin NSOIC
SP3485EN-L/TR	-40°C to +85°C	8-pin NSOIC

Note: /TR = Tape and Reel

REVISION HISTORY

DATE	REVISION	DESCRIPTION
10/15/02	--	Legacy Sipex Datasheet
06/19/12	1.0.0	Convert to Exar Format. Update ordering information and add new Figure 8 - Driver Short Circuit Current Limit Test Circuit. Remove EOL device SP3481.
06/27/16	2.0.0	Update logo. Update description paragraph on page 1. Update timing specifications in electrical characteristics table on pages 2 and 3. Add Driver and Receiver Enable from Shutdown timing information on pages 3 and 4. Update typical supply current information on page 4. Update Figures 2, 4, 6, and 8. Update Figures 11 and 13 to add shutdown timing labels. Add low power shutdown section to page 7. Update transmit and receive truth tables on page 7. Update Receiver section on page 7.

Notice

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