



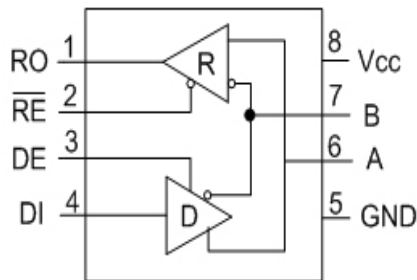
**SP3485**

## **+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** features the **Exar** BiCMOS process, allowing low power operation without sacrificing performance. The **SP3485** can meet the electrical specifications of the RS-485 and RS-422 serial protocols up to 10Mbps under load.

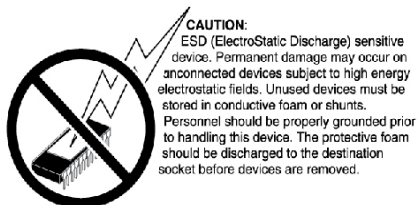


**SP3485**

## 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 <sub>CC</sub> .....	+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<sub>AMB</sub> = T<sub>MIN</sub> to T<sub>MAX</sub> and V<sub>CC</sub> = +3.3V +/-5% unless otherwise noted.

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
<b>SP3485 DRIVER</b>					
<b>DC Characteristics</b>					
Differential Output Voltage	GND		V <sub>CC</sub>	Volts	Unloaded; R = ∞Ω ; Figure 1
Differential Output Voltage	2		V <sub>CC</sub>	Volts	With Load; R = 50Ω (RS-422); Figure 1
Differential Output Voltage	1.5		V <sub>CC</sub>	Volts	With Load; R = 27Ω (RS-485); Figure 1
Change in Magnitude of Driver Differential Output Voltage for Complimentary states			0.2	Volts	R = 27Ω or R = 50Ω; Figure 1
Driver Common Mode Output Voltage			3	Volts	R = 27Ω or R = 50Ω; 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 <sub>OUT</sub> = HIGH			+/-250	mA	-7V ≤ V <sub>O</sub> ≤ +12V; Figure 8
Driver Short Circuit Current V <sub>OUT</sub> = LOW			+/-250	mA	-7V ≤ V <sub>O</sub> ≤ +12V; Figure 8
<b>SP3485 DRIVER</b>					
<b>AC Characteristics</b>					
Maximum Data Rate	10			Mbps	$\overline{RE} = V_{CC}$ , DE = V <sub>CC</sub>
Driver Input to Output, t <sub>PLH</sub>	20	40	60	ns	Figures 2 & 9
Driver Input to Output, t <sub>PHL</sub>	20	40	60	ns	Figures 2 & 9
Differential Driver Skew		2	10	ns	[t <sub>DO1</sub> - t <sub>DO2</sub> ], Figures 2 and 10
Driver Rise or Fall Time		5	20	ns	From 10%-90%; Figures 3 and 10

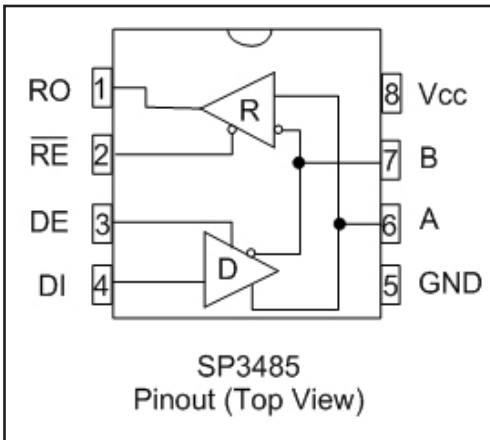
## ELECTRICAL CHARACTERISTICS

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

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
<b>SP3485 DRIVER AC Characteristics continued</b>					
Driver Enable to Output High		52	120	ns	Figures 4 and 11
Driver Enable to Output Low		60	120	ns	Figures 5 and 11
Driver Disable Time from Low		40	120	ns	Figures 5 and 11
Driver Disable Time from High		60	120	ns	Figures 4 and 11
<b>SP3485 RECEIVER</b>					
<b>DC Characteristics</b>					
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	$\mu A$	$0V \leq V_O \leq V_{CC}; \overline{RE} = V_{CC}$
Input Resistance	12	15		k $\Omega$	$-7V \leq V_{CM} \leq +12V$
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	$0V \leq V_{CM} \leq V_{CC}$
<b>SP3485 RECEIVER</b>					
<b>AC Characteristics</b>					
Maximum Data Rate	10			Mbps	$\overline{RE} = 0V, DE = 0V$
Receiver Input to Output, $t_{PLH}$	40	70	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, $t_{PHL}$	40	70	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		35	60	ns	Figures 7 and 13, $S_1$ closed, $S_2$ open
Receiver Enable to Output High		35	60	ns	Figures 7 and 13, $S_2$ closed, $S_1$ open
Receiver Disable from Low		35	60	ns	Figures 7 and 13, $S_1$ closed, $S_2$ open
Receiver Disable from High		35	60	ns	Figures 7 and 13, $S_2$ closed, $S_1$ open
<b>POWER REQUIREMENTS</b>					
Supply Current , No Load		1000	2000	$\mu A$	$\overline{RE}, DI = 0V$ or $V_{CC}; DE = V_{CC}$
Supply Current , No Load		800	1500	$\mu A$	$\overline{RE} = 0V, DI = 0V$ or $V_{CC}, DE = 0V$

## 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

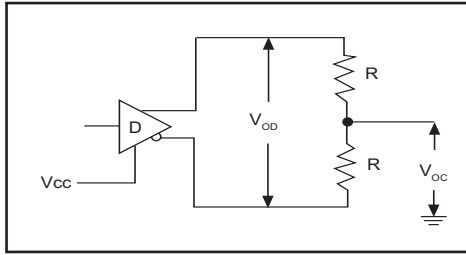


Figure 1. Driver DC Test Load Circuit

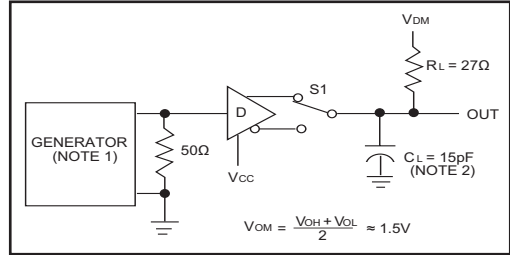


Figure 2. Driver Propagation Delay Test Circuit

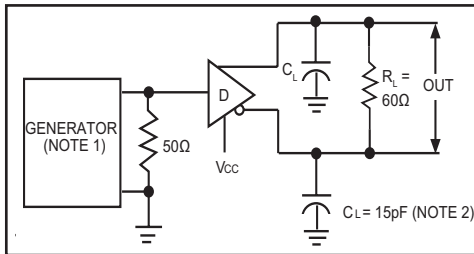


Figure 3. Driver Differential Output Delay and Transition Time Circuit.

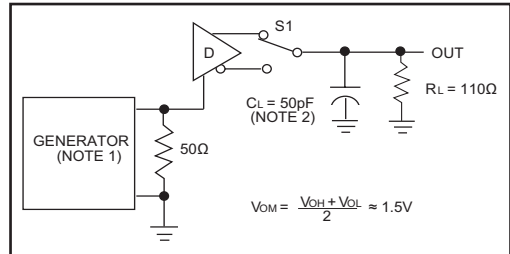


Figure 4. Driver Enable and Disable Timing Circuit, Output High

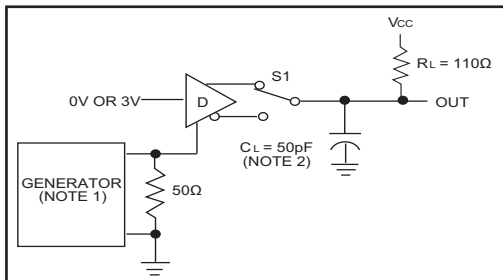


Figure 5. Driver Enable and Disable Timing Circuit, Output Low

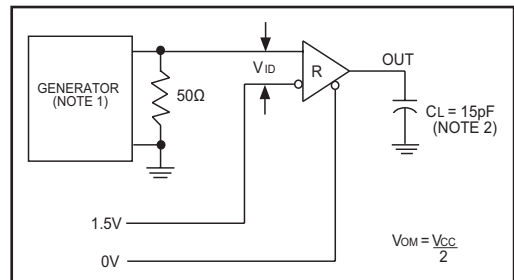


Figure 6. Receiver Propagation Delay Test Circuit

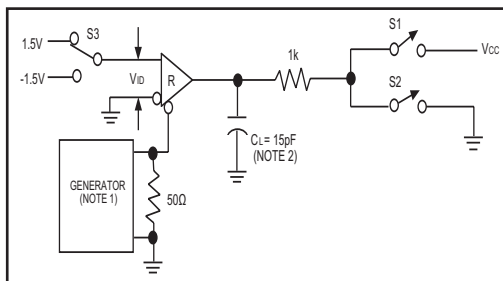


Figure 7. Receiver Enable and Disable Timing Circuit

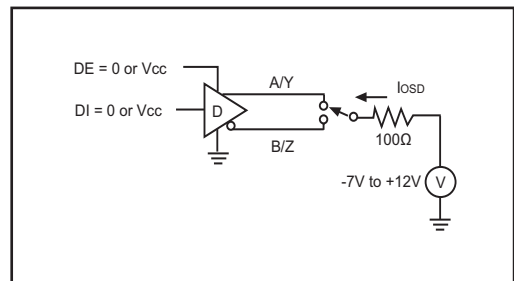


Figure 8. Driver Short Circuit Current Limit Test

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.

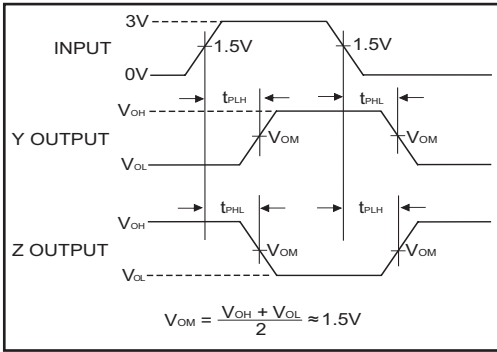


Figure 9. Driver Propagation Delay Waveforms

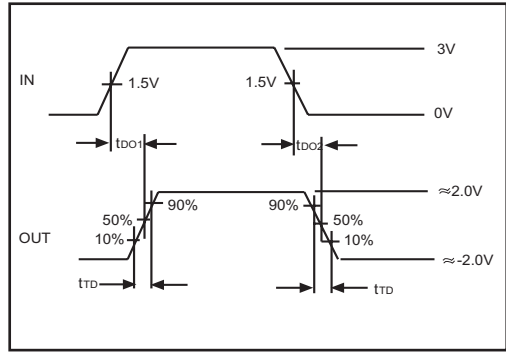


Figure 10. Driver Differential Output Delay and Transition Time Waveforms

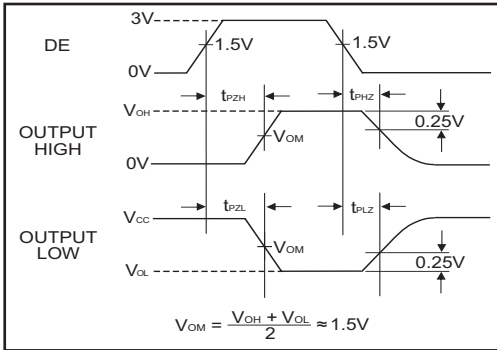


Figure 11. Driver Enable and Disable Timing Waveforms

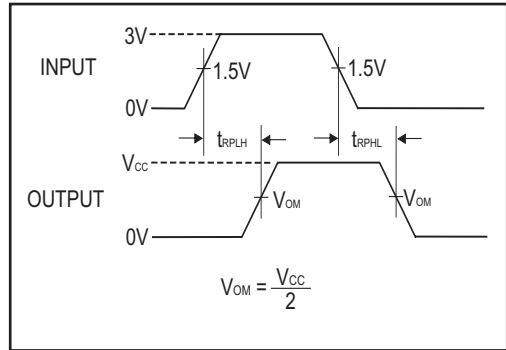


Figure 12. Receiver Propagation Delay Waveforms

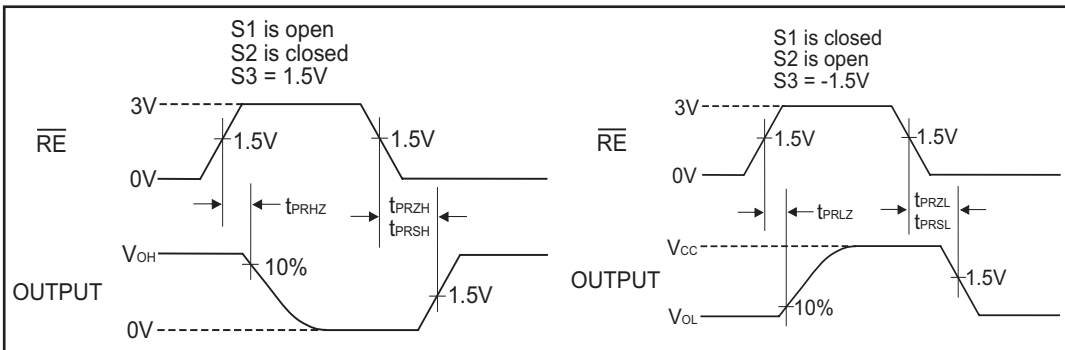


Figure 13. Receiver Enable and Disable Waveforms

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 54 $\Omega$  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 typically 15k $\Omega$  (12k $\Omega$  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 RE (pin 2) of the **SP3485** will disable the receiver.

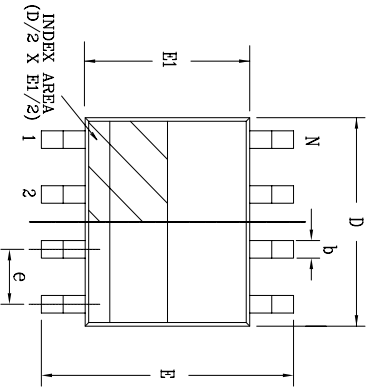
INPUTS				OUTPUTS	
$\overline{\text{RE}}$	DE	DI	LINE CONDITION	B	A
X	1	1	No Fault	0	1
X	1	0	No Fault	1	0
X	0	X	X	Z	Z

Table 1. Transmit Function Truth Table

INPUTS				OUTPUTS
$\overline{\text{RE}}$	DE	A - B		R
0	0	+0.2V		1
0	0	-0.2V		0
0	0	Inputs Open		1
1	0	X		Z

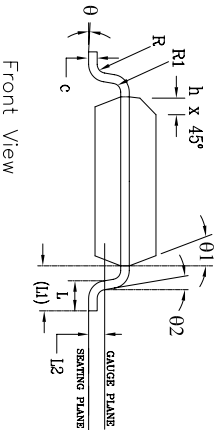
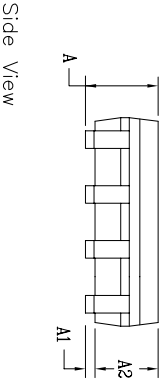
Table 2. Receive Function Truth Table

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

SYMBOLS	8 Pin SOICN			JEDEC MS-012			Variation AA		
	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	—	—			
θ	0°	—	8°	0°	—	8°			
θ1	5°	—	15°	5°	—	15°			
θ2	0°	—	—	0°	—	—			
D	4.90 BSC			0.193 BSC					
N	8			8					



Side View

Front View

		<b>EXAR CORPORATION</b>	
Packaging Approval:		Drawing No:	8-PIN SOICN
By: JL	Date: 11/16/07	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.

### Notice

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