



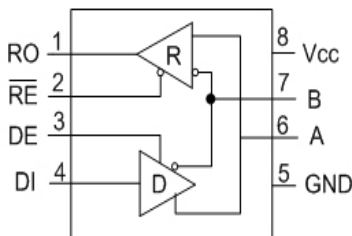
**SP3494**

## **+3.3V Low Power RS-485/RS-422 Transceiver**

- Operates From A Single +3.3V Supply
- Interoperable With +5.0V Logic
- +/-200mV Receiver Input Sensitivity
- -7V to +12V Common-Mode Input Voltage Range
- Allows Up To 32 transceivers On The Serial Bus
- Driver/Receiver Enable Lines
- 10 $\mu$ A Low-Power Shutdown Mode
- Compatibility with the MAX3486 and 75176 Industry Standard Pinout

### **DESCRIPTION**

The **SP3494** 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** SP3481 device as well as other popular industry standards. The **SP3494** features the **Exar** BiCMOS process, allowing low power operation without sacrificing performance. The partially slew-rate limited drivers minimize EMI and reduce reflections caused by improperly terminated cables allowing error-free data transmission. The **SP3494** is a half-duplex partially slew-rate limited transceiver that will deliver a data transmission rate up to 2.5Mbps. The **SP3494** is equipped with a low-power shutdown mode and driver/receiver high-Z enable lines.

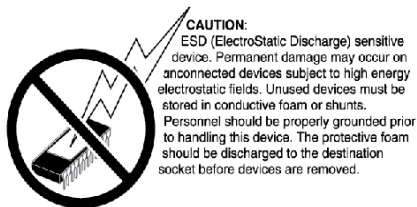


SP3494

## 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	
Drivers.....	-0.3V to +6.0V
Receivers.....	+/-14V
Output Voltages	
Drivers.....	+/-14V
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>SP3494 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>SP3494 DRIVER</b>					
<b>AC Characteristics</b>					
Maximum Data Rate	2.5			Mbps	$\overline{RE} = V_{CC}$ , DE = V <sub>CC</sub>
Driver Input to Output, t <sub>PLH</sub>	20	45	75	ns	Figures 2 & 9
Driver Input to Output, t <sub>PHL</sub>	20	45	75	ns	Figures 2 & 9
Differential Driver Skew		10		ns	[t <sub>DO1</sub> - t <sub>DO2</sub> ], Figures 2 and 10
Driver Rise or Fall Time		30	70	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>SP3494 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>SP3494 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	2.5			Mbps	$\overline{RE} = 0V, DE = 0V$
Receiver Input to Output, $t_{PLH}$	40	70	100	ns	Figures 6 and 12
Receiver Input to Output, $t_{PHL}$	40	70	100	ns	Figures 6 and 12
Differential Receiver Skew		10		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

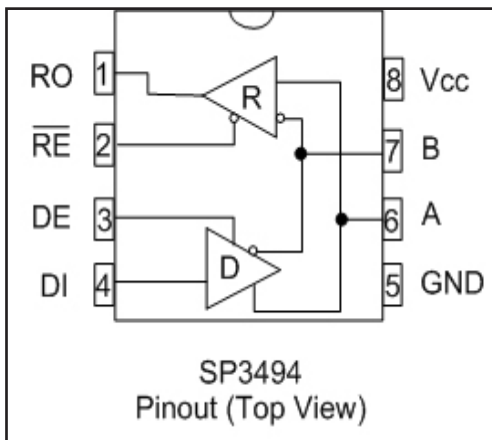
## ELECTRICAL CHARACTERISTICS

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

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
<b>SP3494 SHUTDOWN TIMING</b>					
Time to Shutdown	50	75	200	ns	$\overline{RE} = 3.3V, DE = 0V$
Driver Enable from Shutdown to Output High		65	150	ns	Figures 4 and 11
Driver Enable from Shutdown to Output Low		65	150	ns	Figures 5 and 11
Receivers Enabled from Shutdown to Output High		50	200	ns	Figures 7 and 13, $S_2$ closed, $S_1$ open
Receivers Enabled from Shutdown to Output Low		50	200	ns	Figures 7 and 13, $S_1$ closed, $S_2$ 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 $V_{CC}$ , $DE = 0V$
Shutdown Mode			10	$\mu A$	$DE = 0V, \overline{RE} = V_{CC}$

## PIN FUNCTION

### Pin Function SP3494



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 +3.3V +/-5%

## TEST CIRCUITS

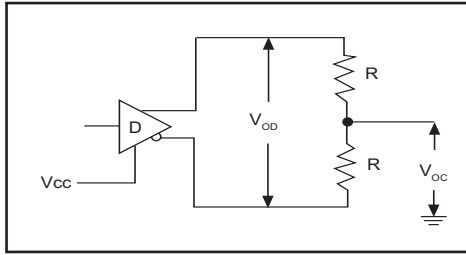


Figure 1. Driver DC Test Load Circuit

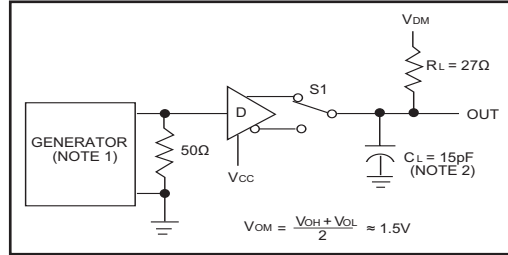


Figure 2. Driver Propagation Delay Test Circuit

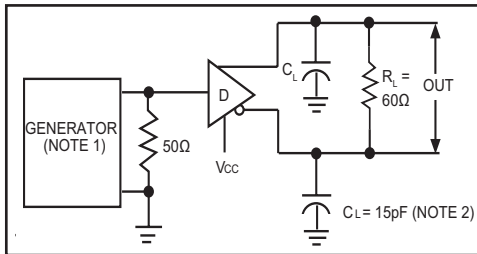


Figure 3. Driver Differential Output Delay and Transition Time Circuit.

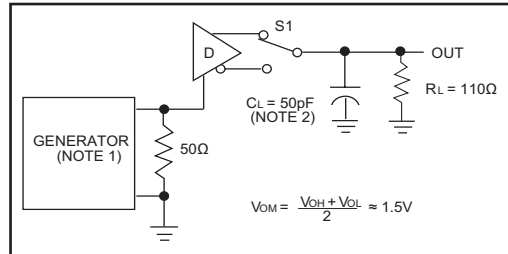


Figure 4. Driver Enable and Disable Timing Circuit, Output High

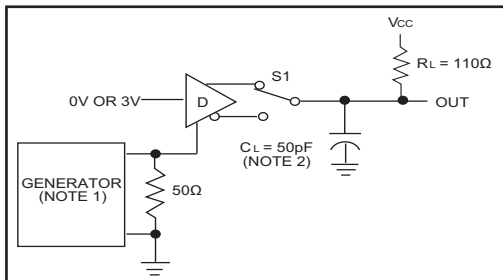


Figure 5. Driver Enable and Disable Timing Circuit, Output Low

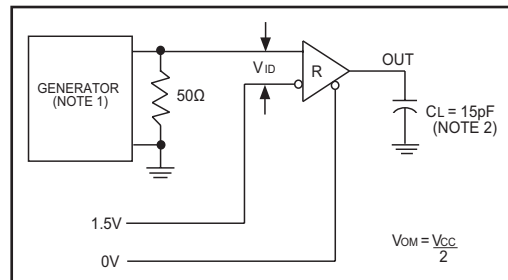


Figure 6. Receiver Propagation Delay Test Circuit

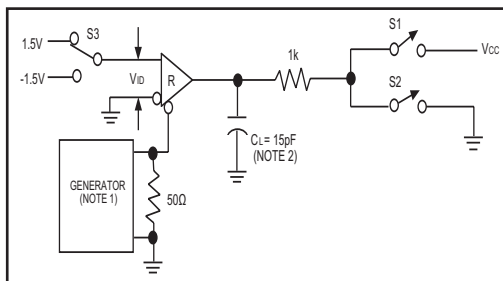


Figure 7. Receiver Enable and Disable Timing Circuit

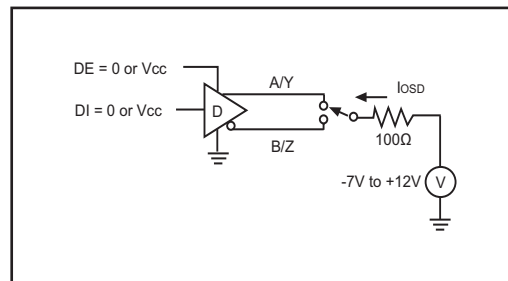


Figure 8. Driver Short Circuit Current Limit Test

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.

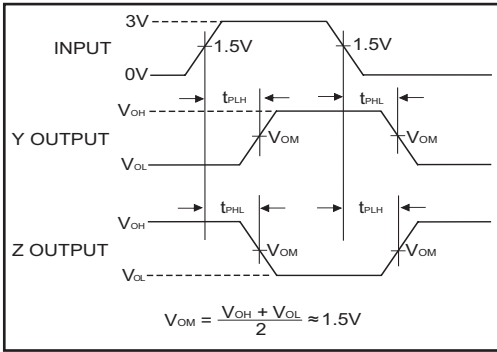


Figure 9. Driver Propagation Delay Waveforms

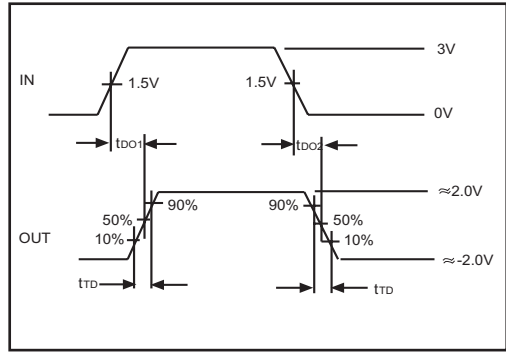


Figure 10. Driver Differential Output Delay and Transition Time Waveforms

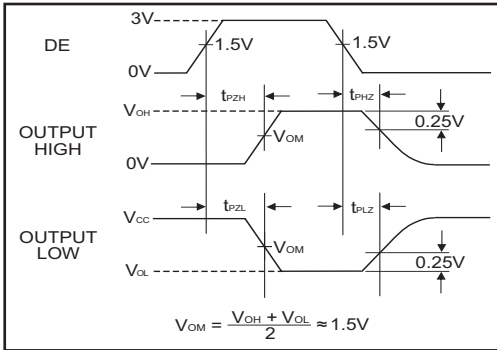


Figure 11. Driver Enable and Disable Timing Waveforms

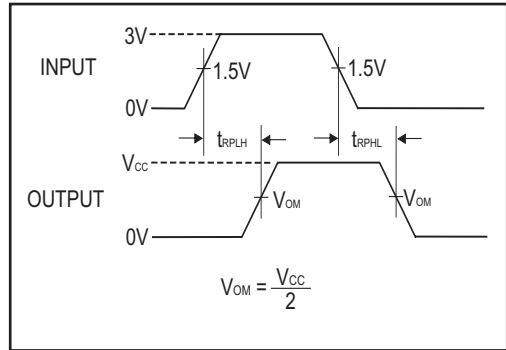


Figure 12. Receiver Propagation Delay Waveforms

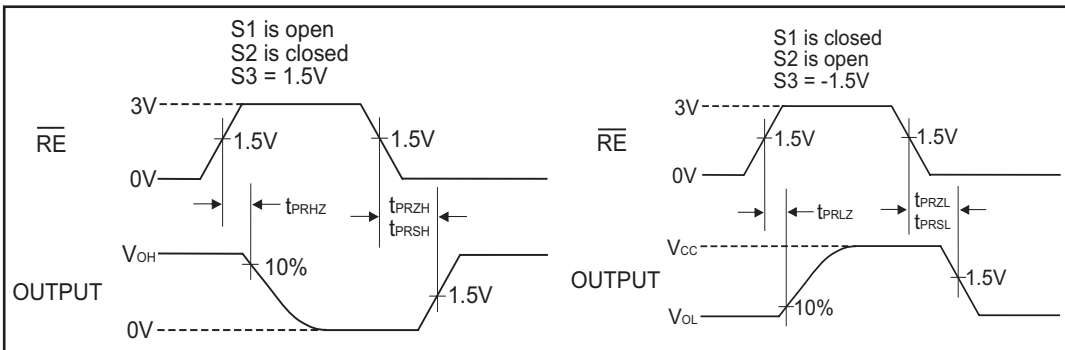


Figure 13. Receiver Enable and Disable Waveforms

The **SP3494** is a +3.3V low power half-duplex transceiver that meets the electrical specifications of the RS-485 and RS-422 serial protocols. This device is pin-to-pin compatible with the **Exar** SP3481 and SP481 devices as well as popular industry standards such as the MAX3486 and the 75176. The **SP3494** feature **Exar's** BiCMOS process allowing low power operation without sacrificing performance. The SP3494 has a partially slew rate limited driver with a data transmission rate of 2.5Mbps.

### Driver

The driver outputs of the **SP3494** are differential outputs. The typical voltage output swing with no load will be 0 volts to  $V_{CC}$ . With worst case loading of  $54\Omega$  across the differential outputs, the driver can maintain greater than 1.5V voltage levels.

The **SP3494** driver has an 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 force the driver outputs to high impedance (high-Z).

The **SP3494** driver will operate up to 2.5Mbps. In addition to adhering to the 250mA  $I_{sc}$  maximum limit on the driver output, the driver output short-circuit protection will allow the device to withstand an infinite short circuit over the -7.0V to +12V common mode range without damage.

### Receiver

The receiver has differential inputs with an input sensitivity of  $\pm 200mV$ . 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 which guarantees that the receiver output will be in a high state when the input is left unconnected. The receiver of the **SP3494** operate up to 2.5Mbps.

The receiver of the **SP3494** has an enable control line which is active LOW. A logic LOW on  $\overline{RE}$  (pin 2) of the **SP3494** will enable the differential receiver. A logic HIGH on  $\overline{RE}$  (pin 2) will disable the receiver.

The **SP3494** is equipped with a shutdown mode. To enable the shutdown state, both the driver and receiver must be disable simultaneously. A logic LOW on DE (pin 3) and a logic HIGH on  $\overline{RE}$  (pin 2) will put the **SP3494** into shutdown. In shutdown, the supply current will drop to less than  $10\mu A$ .

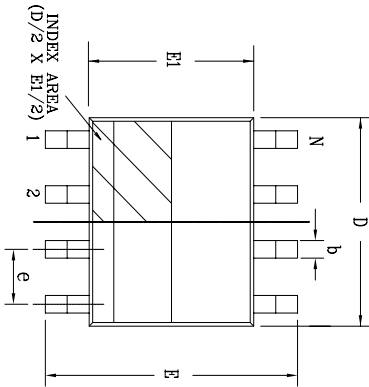
INPUTS				OUTPUTS	
$\overline{RE}$	DE	DI	LINE CONDITION	B	A
X	1	1	No Fault	0	1
X	1	0	No Fault	1	0
X	0	X	X	Z	Z

Table 1. Transmit Function Truth Table

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

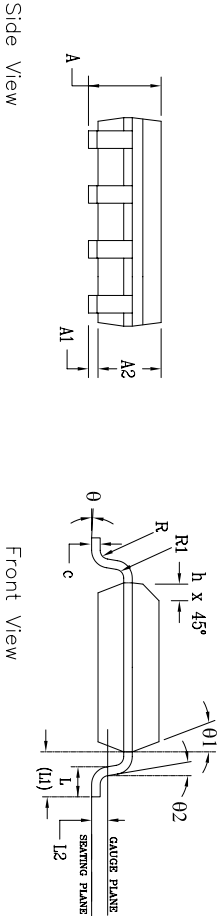
Table 2. Receive Function Truth Table

REVISION HISTORY			
REV.	DESCRIPTION	DATE	APPR'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> <i>Revolving Connectivity</i>	
Packaging Approval:		Drawing No:	
By: JL	Date: 11/16/07	Revision: C	
		Sheet: 1 OF 1	



## ORDERING INFORMATION

Model	Temperature Range	Package Types
SP3494CN-L .....	0°C to +70°C .....	.8-pin NSOIC
SP3494CN-L/TR .....	0°C to +70°C .....	.8-pin NSOIC
SP3494EN-L .....	-40°C to +85°C .....	.8-pin NSOIC
SP3494EN-L/TR .....	-40°C to +85°C .....	.8-pin NSOIC

Note: /TR = Tape and Reel, -L = RoHS Packaging

## REVISION HISTORY

DATE	REVISION	DESCRIPTION
10/15/02	--	Legacy Sipex Datasheet
07/10/12	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 SP3493.

### Notice

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