## 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
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/ºC above +70ºC)

**CAUTION:**
ESD (ElectroStatic Discharge) sensitive device. Permanent damage may occur on unconnected devices subject to high energy electrostatic fields. Unused devices must be stored in conductive foam or shunts. Personnel should be properly grounded prior to handling this device. The protective foam should be discharged to the destination socket before devices are removed.

## ELECTRICAL CHARACTERISTICS

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

| PARAMETERS | MIN. | TYP. | MAX. | UNITS | CONDITIONS |
|---|---|---|---|---|---|
| **SP3494 DRIVER** | | | | | |
| **DC Characteristics** | | | | | |
| Differential Output Voltage | GND | | Vcc | Volts | Unloaded; R = ∞Ω ; Figure 1 |
| Differential Output Voltage | 2 | | Vcc | Volts | With Load; R = 50Ω (RS-422); Figure 1 |
| Differential Output Voltage | 1.5 | | Vcc | 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 $V_{OUT}$ = HIGH | | | +/-250 | mA | -7V ≤ $V_O$ ≤ +12V; Figure 8 |
| Driver Short Circuit Current $V_{OUT}$ = LOW | | | +/-250 | mA | -7V ≤ $V_O$ ≤ +12V; Figure 8 |
| **SP3494 DRIVER** | | | | | |
| **AC Characteristics** | | | | | |
| Maximum Data Rate | 2.5 | | | Mbps | $\overline{RE}$ = $V_{CC}$, DE = $V_{CC}$ |
| Driver Input to Output, $t_{PLH}$ | 20 | 45 | 75 | ns | Figures 2 & 9 |
| Driver Input to Output, $t_{PHL}$ | 20 | 45 | 75 | ns | Figures 2 & 9 |
| Differential Driver Skew | | 10 | | ns | $\lvert t_{DO1} - t_{DO2} \rvert$, Figures 2 and 10 |
| Driver Rise or Fall Time | | 30 | 70 | ns | From 10%-90%; Figures 3 and 10 |

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

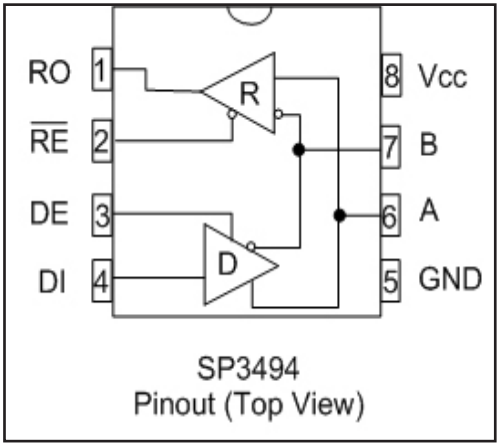
| PARAMETERS | MIN. | TYP. | MAX. | UNITS | CONDITIONS |
|---|---|---|---|---|---|
| **SP3494 DRIVER AC Characteristics continued** | | | | | |
| Driver Enable to Output High | | 52 | 120 | ns | Figures 4 and 11 |
| Driver Enable to Output Low | | 60 | 120 | ns | Figures 5 and 11 |
| Driver Disable Time from Low | | 40 | 120 | ns | Figures 5 and 11 |
| Driver Disable Time from High | | 60 | 120 | ns | Figures 4 and 11 |
| **SP3494 RECEIVER** | | | | | |
| **DC Characteristics** | | | | | |
| Differential Input Threshold | -0.2 | | +0.2 | Volts | -7V ≤ $V_{CM}$ ≤ +12V |
| Input Hysteresis | | 20 | | mV | $V_{CM}$ = 0V |
| Output Voltage HIGH | Vcc-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 ≤ $V_O$ ≤ $V_{CC}$; $\overline{RE}$ = $V_{CC}$ |
| Input Resistance | 12 | 15 | | kΩ | -7V ≤ $V_{CM}$ ≤ +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 ≤ $V_{CM}$ ≤ $V_{CC}$ |
| **SP3485 RECEIVER** | | | | | |
| **AC Characteristics** | | | | | |
| 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 | $t_{RSKEW}$ = $\lvert t_{RPHL} - t_{RPLH} \rvert$, 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 +/-5% unless otherwise noted.

| PARAMETERS | MIN. | TYP. | MAX. | UNITS | CONDITIONS |
|---|---|---|---|---|---|
| **SP3494 SHUTDOWN TIMING** | | | | | |
| 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 |
| **POWER REQUIREMENTS** | | | | | |
| Supply Current , No Load | | 1000 | 2000 | µA | $\overline{RE}$, DI = 0V or $V_{CC}$; DE = $V_{CC}$ |
| Supply Current , No Load | | 800 | 1500 | µA | $\overline{RE}$ = 0V, DI = 0V or $V_{CC}$, DE = 0V |
| Shutdown Mode | | | 10 | µA | DE = 0V, $\overline{RE}$ = $V_{CC}$ |

## PIN FUNCTION




SP3494
Pinout (Top View)

### 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%

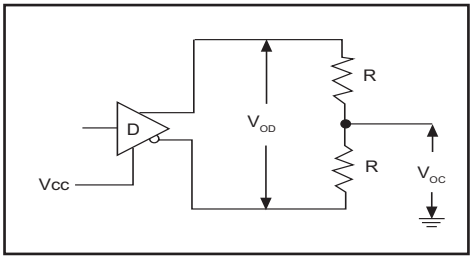



Figure 1. Driver DC Test Load Circuit

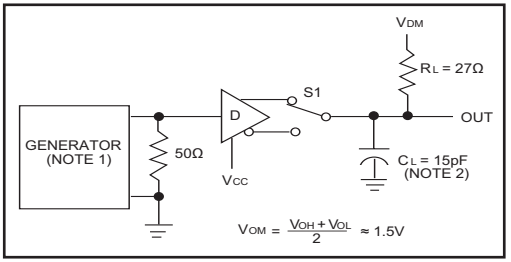



Figure 2. Driver Propagation Delay Test Circuit

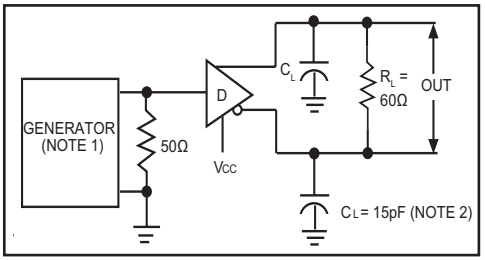



Figure 3. Driver Differential Output Delay and Transition Time Circuit.

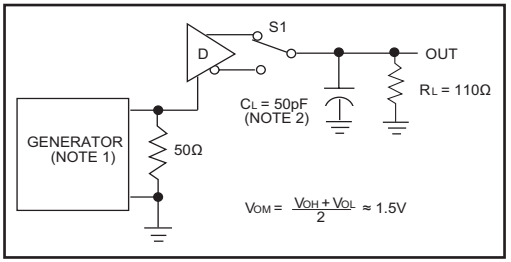



Figure 4. Driver Enable and Disable Timing Circuit, Output High

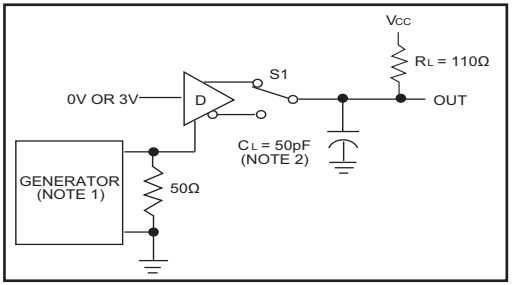



Figure 5. Driver Enable and Disable Timing Circuit, Output Low

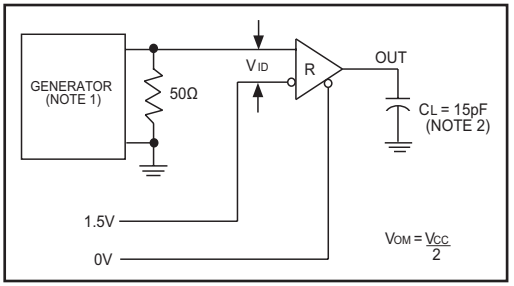



Figure 6. Receiver Propagation Delay Test Circuit

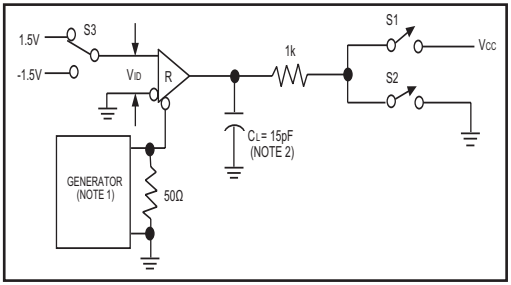



Figure 7. Receiver Enable and Disable Timing Circuit

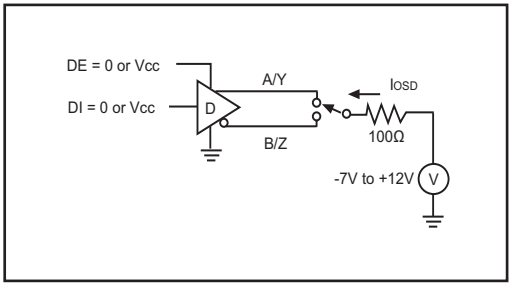



Figure 8. Driver Short Circuit Current Limit Test

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

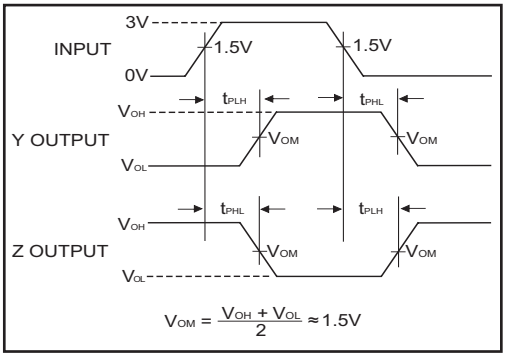



Figure 9. Driver Propagation Delay Waveforms

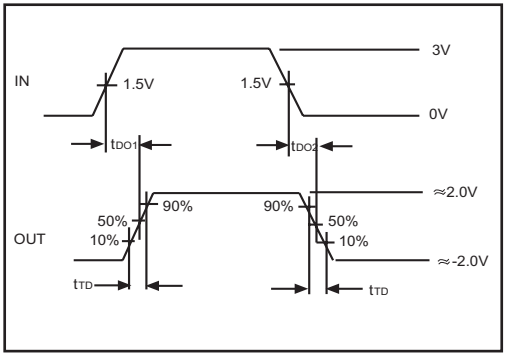



Figure 10. Driver Differential Output Delay and Transition Time Waveforms

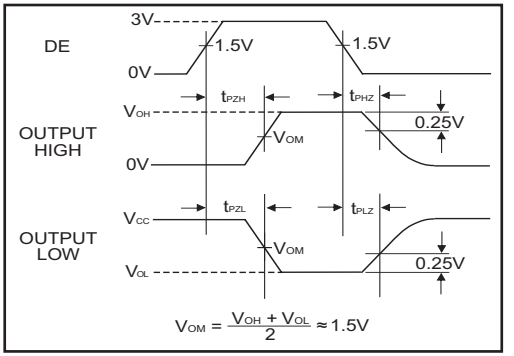



Figure 11. Driver Enable and Disable Timing Waveforms

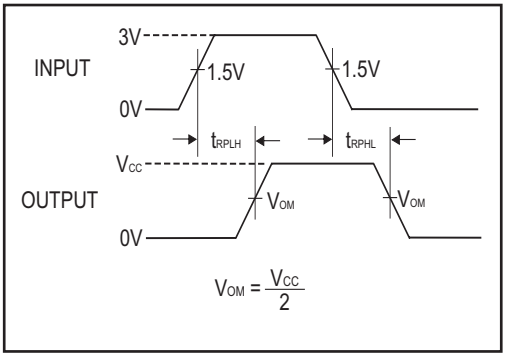



Figure 12. Receiver Propagation Delay Waveforms

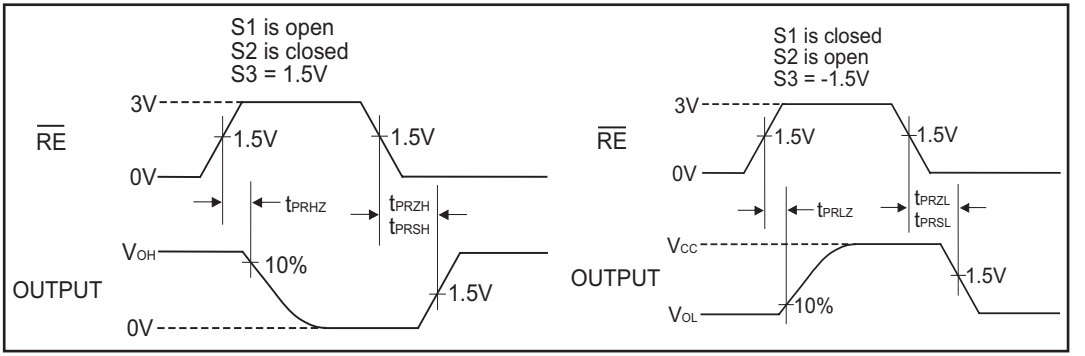



Figure 13. Receiver Enable and Disable Waveforms

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 54Ω 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 ±200mV. Input impedance of the receiver is typically 15kΩ (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 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 10µA.

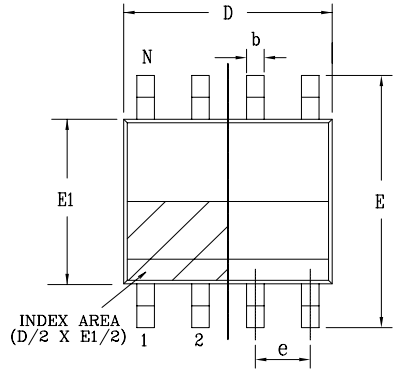
| INPUTS | | | | OUTPUTS | |
|---|---|---|---|---|---|
| $\overline{RE}$ | DE | DI | LINE CONDITION | B | A |
| X | 1 | 1 | No Fault | 0 | 1 |
| X | 1 | 0 | No Fault | 1 | 0 |
| X | 0 | X | X | Z | Z |

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 |

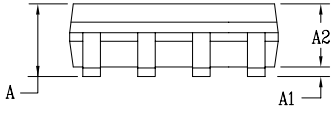
Table 2. Receive Function Truth Table

| REVISION HISTORY | | | |
|---|---|---|---|
| REV. | DISCRIPTION | DATE | APP'D |
| A | DRAWING ORIGINATION | 08/16/05 | JL |
| B | DRAWING FORMAT MODIFICATION | 07/19/06 | JL |
| C | CHANGE DRAWING LOGO ADN COMPANY NAME | 11/16/07 | JL |

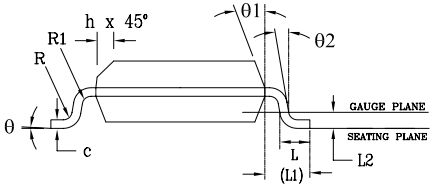



Top View

| 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 | — | — |
| 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

| | | | |
|---|---|---|---|
| EXAR Powering Connectivity | EXAR CORPORATION | | |
| | 8 PIN SOICN PACKAGE OUTLINE | | |
| 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 |
|---|---|---|
| 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. |



Datasheet July 2012

For technical support please email Exar's Serial Technical Support group at: serialtechsupport@exar.com