

## General Description

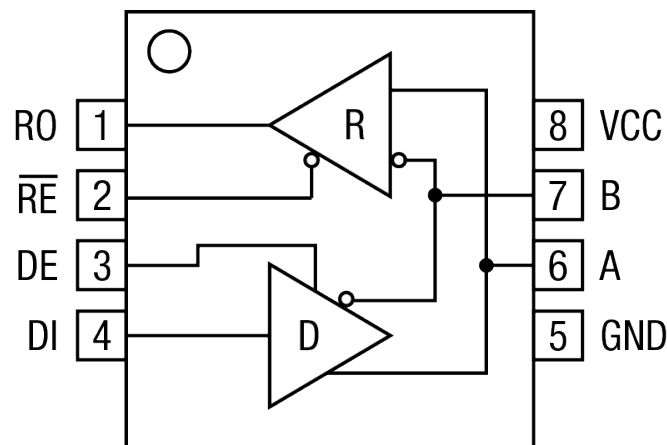
The SP3494 device is a 3.3V low power half-duplex transceiver that meets the specifications of the RS-485 and RS-422 serial protocols. This device is pin-to-pin compatible with the MaxLinear SP481E device and other popular industry standard devices. The SP3494 features the MaxLinear BiCMOS process, allowing 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.

## Features

- Operates from a single 3.3V supply
- Interoperable with 5.0V logic
- $\pm 200\text{mV}$  receiver input sensitivity
- $-7\text{V}$  to  $+12\text{V}$  common-mode input voltage range
- Allows up to 32 transceivers on the serial bus
- Driver / receiver enable lines
- $10\mu\text{A}$  low-power shutdown mode
- Compatibility with the MAX3486 and 75176 industry standard pinout

Ordering Information - [page 8](#)

## Block Diagram



**Figure 1:** SP3494

## Revision History

| Revision | Release Date | Change Description   |
|----------|--------------|--|
| --       | 10/15/02     | Legacy Sipex Datasheet   |
| 1.0.0    | 7/10/12      | Convert to Exar Format. Update ordering information and add new Figure 8 - Driver Short Circuit Current Limit Test Circuit. Remove EOL device SP3493.  |
| 1.0.1    | 9/7/17       | Update to MaxLinear logo. Remove GND from Differential Output Voltage min (page 2), correct part number (SP3485 Receiver, page 3). Added maximum junction temperature, package power dissipation and ESD rating. Update format and ordering information table. |
| 1.0.2    | 3/4/19       | Update to MaxLinear format. Update pin compatibility references.   |

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## Specifications

### Absolute Maximum Ratings

**Important:** 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 ratings conditions for extended periods of time may affect reliability.

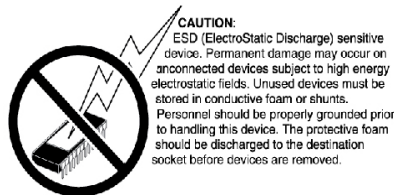
**Table 1: Absolute Maximum Ratings**

| Parameter                           | Minimum | Maximum | Units |
|-------------------------------------|---------|---------|-------|
| $V_{CC}$                            |         | 6.0     | V     |
| Input Voltages                      |         |         |       |
| Drivers                             | -0.3    | 6       | V     |
| Receivers                           | -14     | 14      | V     |
| Output Voltages                     |         |         |       |
| Drivers                             | -14     | 14      | V     |
| Receivers                           | -0.3    | 6       | V     |
| Temperature                         |         |         |       |
| Storage temperature                 | -65     | 150     | °C    |
| Maximum junction temperature, $T_J$ |         | 125     | °C    |
| Power Dissipation                   |         |         |       |
| 8-pin NSOIC $\Theta_{JA}$           |         | 600     | mW    |

### ESD Ratings

**Table 2: ESD Ratings**

| Parameter              | Value | Units |
|------------------------|-------|-------|
| HBM (Human Body Model) | ±2    | kV    |



### Operating Conditions

**Table 3: Operating Conditions**

| Parameter                 | Value | Units |
|---------------------------|-------|-------|
| Package Power Dissipation |       |       |
| 8-pin NSOIC               | 128.4 | °C/W  |

## Electrical Characteristics

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

**Table 4: Electrical Characteristics**

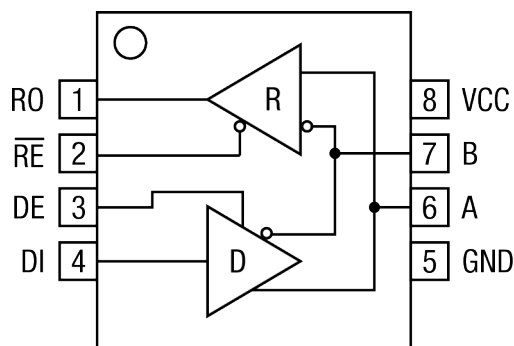
| Parameter  | Test Condition                                       | Minimum        | Typical | Maximum   | Units      |
|--|--|----------------|---------|-----------|------------|
| SP3494 Driver DC Characteristics   |  |                |         |           |            |
| Differential output voltage  | Unloaded; $R = \infty\Omega$ , Figure 1              |                |         | $V_{CC}$  | V          |
| Differential output voltage  | With load; $R = 50\Omega$ (RS-422); Figure 1         | 2              |         | $V_{CC}$  | V          |
| Differential output voltage  | With load; $R = 27\Omega$ (RS-485); Figure 1         | 1.5            |         | $V_{CC}$  | V          |
| Change in magnitude of driver differential output voltage for complimentary states | $R = 27\Omega$ or $R = 50\Omega$ ; Figure 1          |                |         | 0.2       | V          |
| Driver common-mode output voltage  | $R = 27\Omega$ or $R = 50\Omega$ ; Figure 1          |                |         | 3         | V          |
| Input high voltage   | Applies to DE, DI, $\overline{RE}$                   | 2.0            |         |           | V          |
| Input low voltage  | Applies to DE, DI, $\overline{RE}$                   |                |         | 0.8       | V          |
| Input current  | Applies to DE, DI, $\overline{RE}$                   |                |         | $\pm 10$  | $\mu A$    |
| Driver short circuit current<br>$V_{OUT} = HIGH$                                   | $-7V \leq V_O \leq +12V$ ; Figure 8                  |                |         | $\pm 250$ | mA         |
| Driver short circuit current<br>$V_{OUT} = LOW$                                    | $-7V \leq V_O \leq +12V$ ; Figure 8                  |                |         | $\pm 250$ | mA         |
| SP3494 Driver AC Characteristics   |  |                |         |           |            |
| Maximum data rate  | $\overline{RE} = V_{CC}$ , $DE = V_{CC}$             | 2.5            |         |           | Mbps       |
| Driver input to output, $t_{PLH}$  | Figures 2 & 9  | 20             | 45      | 75        | ns         |
| Driver input to output, $t_{PHL}$  | Figures 2 & 9  | 20             | 45      | 75        | ns         |
| Differential driver skew   | $ t_{D01} - t_{D02} $ , Figures 2 and 10             |                | 10      |           | ns         |
| Driver rise or fall time   | From 10% - 90%; Figures 3 and 10                     |                | 30      | 70        | ns         |
| Driver enable to output high   | Figures 4 and 11                                     |                | 52      | 120       | ns         |
| Driver enable to output low  | Figures 5 and 11                                     |                | 60      | 120       | ns         |
| Driver disable time from low   | Figures 5 and 11                                     |                | 40      | 120       | ns         |
| Driver disable time from high  | Figures 4 and 11                                     |                | 60      | 120       | ns         |
| SP3494 Receiver DC Characteristics   |  |                |         |           |            |
| Differential input threshold   | $-7V \leq V_{CM} \leq 12V$                           | -0.2           |         | 0.2       | V          |
| Input hysteresis   | $V_{CM} = 0V$  |                | 20      |           | mV         |
| Output voltage HIGH  | $V_{ID} = +200mV$ , $-1.5mA$                         | $V_{CC} - 0.4$ |         |           | V          |
| Output voltage LOW   | $V_{ID} = -200mV$ , $2.5mA$                          |                |         | 0.4       | V          |
| Three-state (high impedance) output current  | $0V \leq V_O \leq V_{CC}$ ; $\overline{RE} = V_{CC}$ |                |         | $\pm 1$   | $\mu A$    |
| Input resistance   | $-7V \leq V_{CM} \leq 12V$                           | 12             | 15      |           | k $\Omega$ |
| Input current (A, B); $V_{IN} = 12V$   | $DE = 0V$ , $V_{CC} = 0V$ or $3.6V$ , $V_{IN} = 12V$ |                |         | 1.0       | mA         |
| Input current (A, B); $V_{IN} = -7V$   | $DE = 0V$ , $V_{CC} = 0V$ or $3.6V$ , $V_{IN} = -7V$ |                |         | -0.8      | mA         |
| Short circuit current  | $0V \leq V_{CM} \leq V_{CC}$                         | 7              |         | 60        | mA         |

**Table 4: (Continued) Electrical Characteristics**

| Parameter                                      | Test Condition   | Minimum | Typical | Maximum | Units   |
|--|--|---------|---------|---------|---------|
| SP3494 Receiver AC Characteristics             |  |         |         |         |         |
| Maximum data rate                              | $\overline{RE} = 0V, DE = 0V$                          | 2.5     |         |         | Mbps    |
| Receiver input to output, $t_{PLH}$            | Figures 6 and 12                                       | 40      | 70      | 100     | ns      |
| Receiver input to output, $t_{PHL}$            | Figures 6 and 12                                       | 40      | 70      | 100     | ns      |
| Differential receiver skew                     | $t_{RSKEW} =  t_{RPHL} - t_{RPLH} $ , Figures 6 and 12 |         | 10      |         | ns      |
| Receiver enable to output low                  | Figures 7 and 13, $S_1$ closed, $S_2$ open             |         | 35      | 60      | ns      |
| Receiver enable to output high                 | Figures 7 and 13, $S_2$ closed, $S_1$ open             |         | 35      | 60      | ns      |
| Receiver disable from low                      | Figures 7 and 13, $S_1$ closed, $S_2$ open             |         | 35      | 60      | ns      |
| Receiver disable from high                     | Figures 7 and 13, $S_2$ closed, $S_1$ open             |         | 35      | 60      | ns      |
| SP3494 Shutdown Timing                         |  |         |         |         |         |
| Time to shutdown                               | $RE = 3.3V, DE = 0V$                                   | 50      | 75      | 200     | ns      |
| Driver enable from shutdown to output high     | Figures 4 and 11                                       |         | 65      | 150     | ns      |
| Driver enable from shutdown to output low      | Figures 5 and 11                                       |         | 65      | 150     | ns      |
| Receivers enabled from shutdown to output high | Figures 7 and 13, $S_2$ closed, $S_1$ open             |         | 50      | 200     | ns      |
| Receivers enabled from shutdown to output low  | Figures 7 and 13, $S_1$ closed, $S_2$ open             |         | 50      | 200     | ns      |
| Power Requirements                             |  |         |         |         |         |
| Supply current, no load                        | $\overline{RE}, DI = 0V$ or $V_{CC}$ ; $DE = V_{CC}$   |         | 1000    | 2000    | $\mu A$ |
| Supply current, no load                        | $\overline{RE} = 0V, DI = 0V$ or $V_{CC}, DE = 0V$     |         | 800     | 1500    | $\mu A$ |
| Shutdown mode                                  | $DE = 0V, \overline{RE} = V_{CC}$                      |         |         | 10      | $\mu A$ |

## Pin Information

### Pin Configuration



**Figure 2: SP3494 Pinout (Top View)**

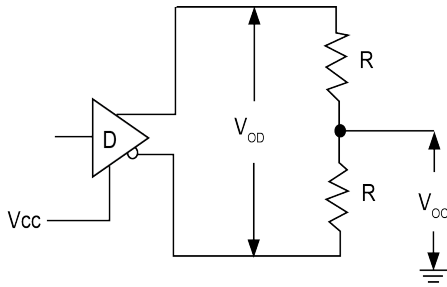
### Pin Descriptions

**Table 5: Pin Descriptions**

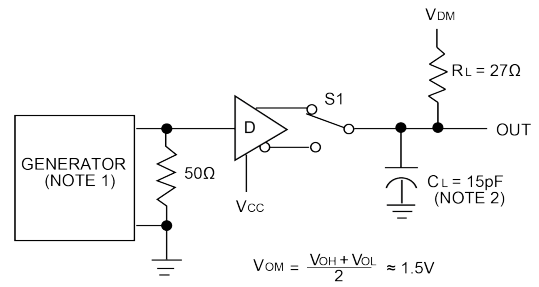
| Pin Number | Pin Name        | Description                                  |
|------------|-----------------|--|
| 1          | RO              | Receiver output                              |
| 2          | $\overline{RE}$ | Receiver Output Enable Active LOW            |
| 3          | DE              | Driver Output Enable Active HIGH             |
| 4          | DI              | Driver Input                                 |
| 5          | GND             | Ground Connection                            |
| 6          | A               | Non-Inverting Driver Output / Receiver Input |
| 7          | B               | Inverting Driver Output / Receiver Input     |
| 8          | VCC             | Positive Supply 3.3V $\pm 5\%$               |



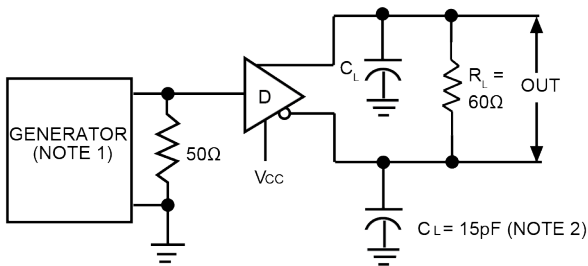
# Test Circuits



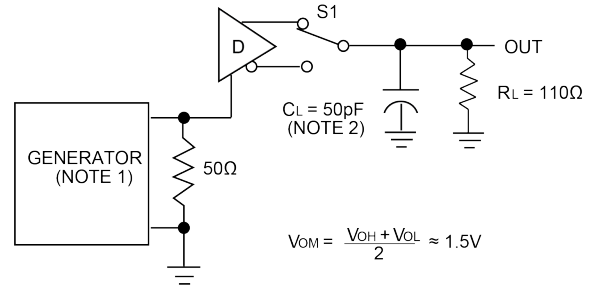
**Figure 3: Driver DC Test Load Circuit**



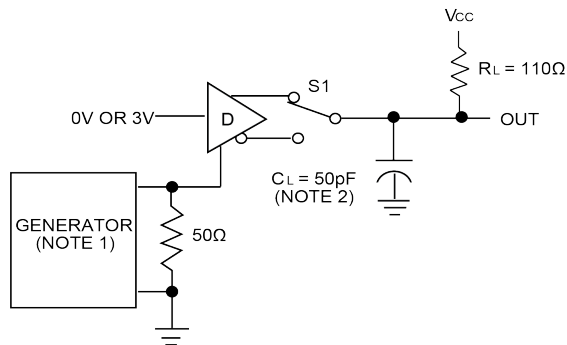
**Figure 4: Driver Propagation Delay Test Circuit**



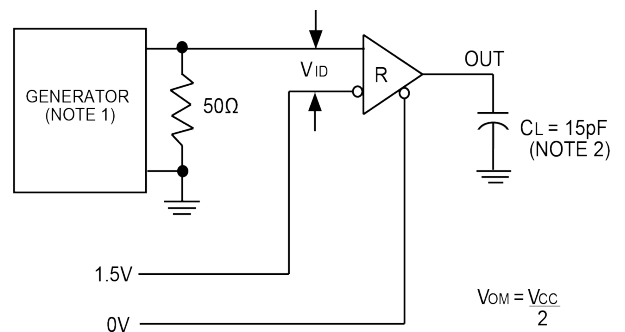
**Figure 5: Driver Differential Output Delay and Transition Time Circuit**



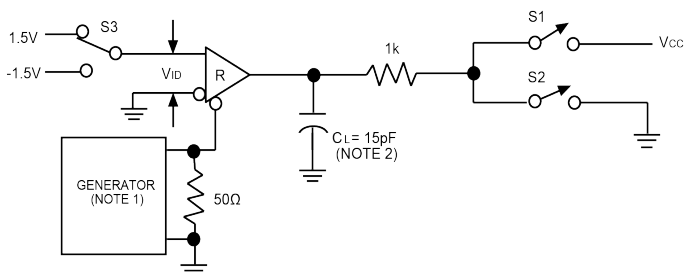
**Figure 6: Driver Enable and Disable Timing Circuit, Output High**



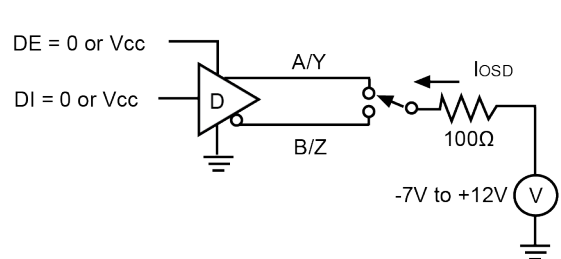
**Figure 7: Driver Enable and Disable Timing Circuit, Output Low**



**Figure 8: Receiver Propagation Delay Test Circuit**



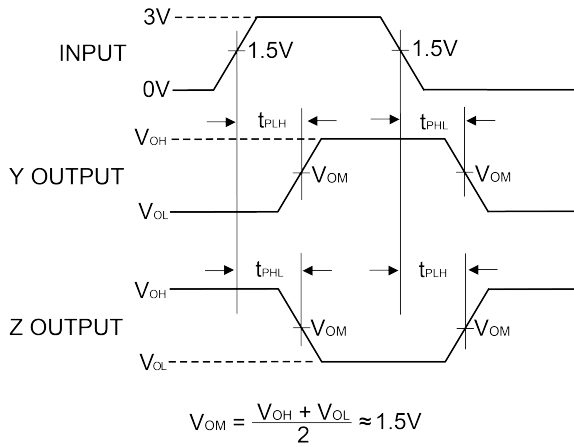
**Figure 9: Receiver Enable and Disable Timing Circuit**



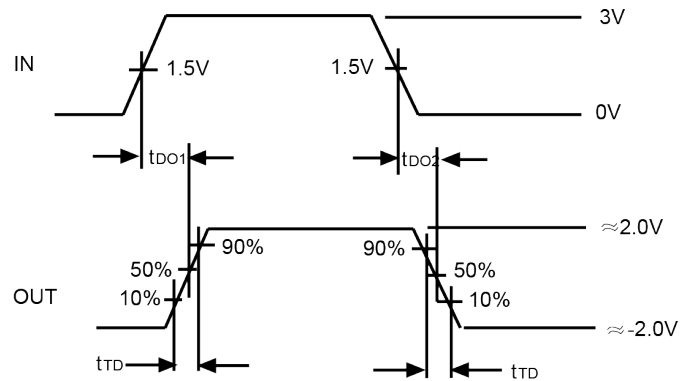
**Figure 10: Driver Short Circuit Current Limit Test**

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

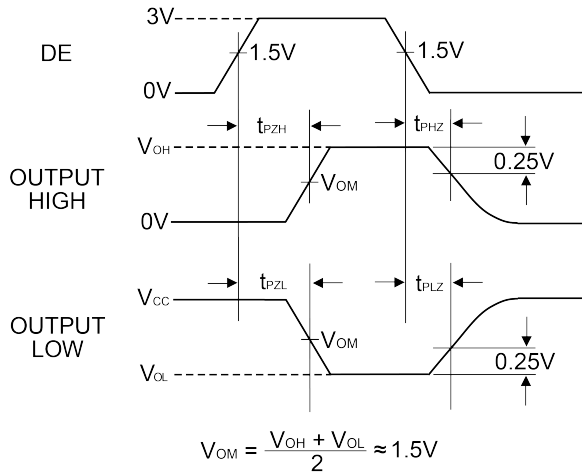
# Switching Waveforms



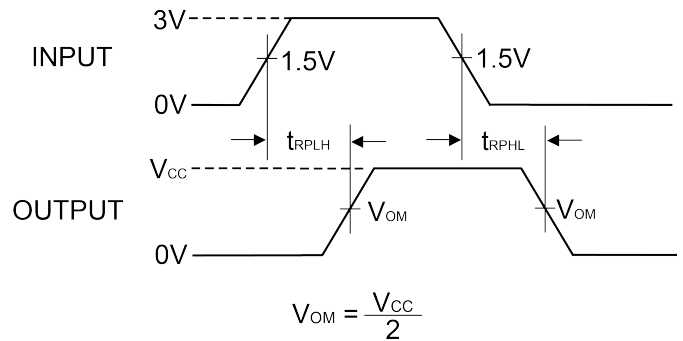
**Figure 11: Driver Propagation Delay Waveforms**



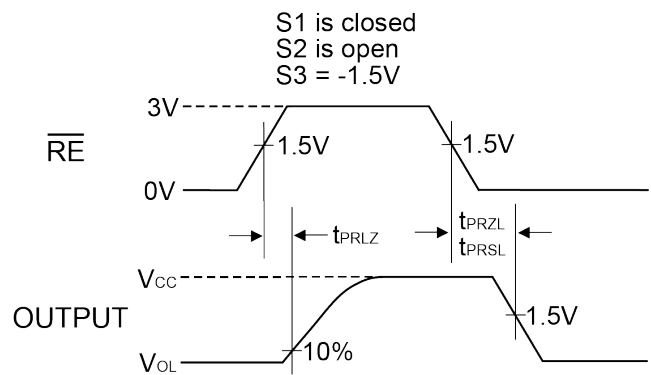
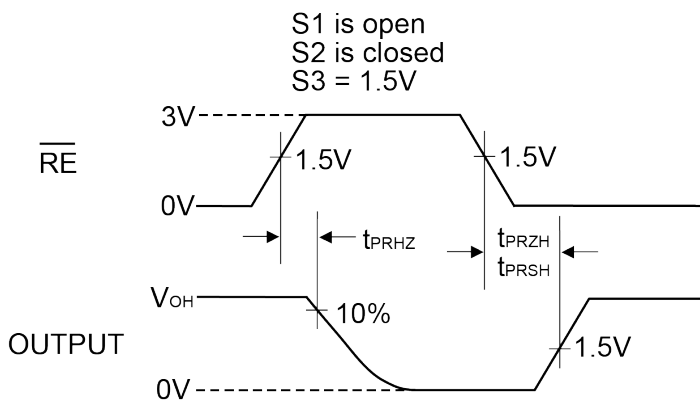
**Figure 12: Driver Differential Output Delay and Transition Time Waveforms**



**Figure 13: Driver Enable and Disable Timing Waveforms**



**Figure 14: Receiver Propagation Delay Waveforms**



**Figure 15: Receiver Enable and Disable Waveforms**

## Description

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 MaxLinear SP481E devices as well as other popular industry standard devices. The SP3494 feature Maxlinear'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.

**Table 6: Transmit Function Truth Table**

| Inputs          |    |    | Line Condition | Outputs |   |
|-----------------|----|----|----------------|---------|---|
| $\overline{RE}$ | DE | DI |                | B       | A |
| X               | 1  | 1  | No Fault       | 0       | 1 |
| X               | 1  | 0  | No Fault       | 1       | 0 |
| X               | 0  | X  | X              | Z       | Z |

## 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 operates 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 disabled 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  $10\mu A$ .

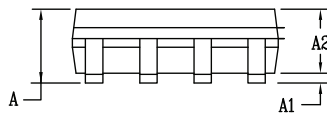
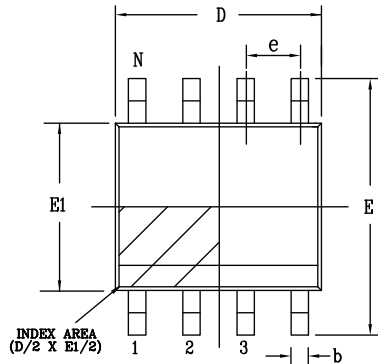
**Table 7: Receive Function Truth Table**

| Inputs          |    | A - B       | Output |
|-----------------|----|-------------|--------|
| $\overline{RE}$ | DE |             | R      |
| 0               | 0  | 0.2V        | 1      |
| 0               | 0  | -0.2V       | 0      |
| 0               | 0  | Inputs Open | 1      |
| 1               | 0  | X           | Z      |

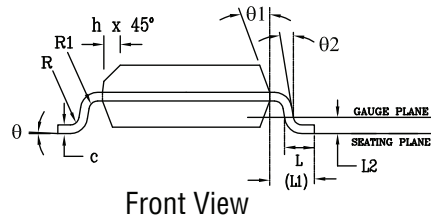
# Mechanical Dimensions

## NSOIC8

Top View



Side View



Front View

| PACKAGE OUTLINE NSOIC .150" BODY<br>JEDEC MS-012 VARIATION AA |   |     |      |   |     |       |
|---|---|-----|------|---|-----|-------|
| SYMBOLS   | COMMON DIMENSIONS IN MM<br>(Control Unit) |     |      | COMMON DIMENSIONS IN INCH<br>(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   | —   | —     |
| q   | 0°  | —   | 8°   | 0°  | —   | 8°    |
| qd1   | 5°  | —   | 15°  | 5°  | —   | 15°   |
| qd2   | 0°  | —   | —    | 0°  | —   | —     |
| D   | 4.90 BSC                                  |     |      | 0.193 BSC                                     |     |       |
| N   | 8   |     |      | 8   |     |       |

Drawing No: POD-0000108  
Revision: A

**Figure 16: Mechanical Dimensions, NSOIC8**

## Ordering Information

**Table 8: Ordering Information<sup>(1)</sup>**

| Ordering Part Number | Operating Temperature Range | Lead-Free          | Package     | Packaging Method |
|----------------------|-----------------------------|--------------------|-------------|------------------|
| SP3494CN-L/TR        | 0°C to 70°C                 | Yes <sup>(2)</sup> | 8-pin NSOIC | Reel             |
| SP3494EN-L           | -40°C to 85°C               |                    |             | Tube             |
| SP3494EN-L/TR        |                             |                    |             | Reel             |

1. Refer to [www.maxlinear.com/SP3494](http://www.maxlinear.com/SP3494) for most up-to-date Ordering Information.

2. Visit [www.maxlinear.com](http://www.maxlinear.com) for additional information on Environmental Rating.



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## Данный компонент на территории Российской Федерации

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Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

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