

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
- -7V to +12V common-mode input voltage range
- Allows up to 32 transceivers on the serial bus
- Driver / receiver enable lines
- 10 μA low-power shutdown mode
- Compatibility with the MAX3486 and 75176 industry standard pinout

Ordering Information - [page 8](#)

Block Diagram

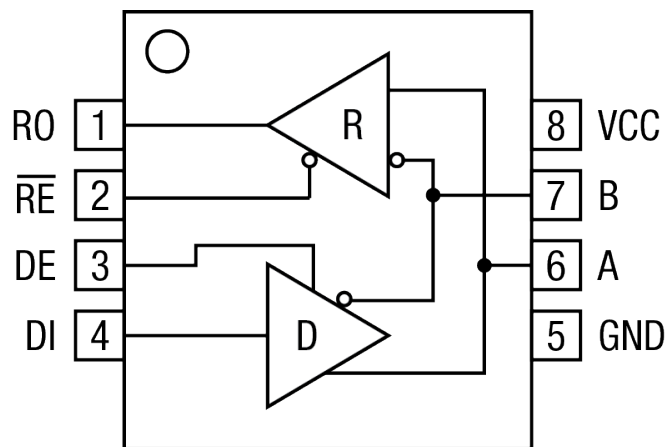


Figure 1: SP3494

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. |

Table of Contents

| | |
|------------------------------------|----------|
| General Description | i |
| Features | i |
| Block Diagram | i |
| Specifications | 1 |
| Absolute Maximum Ratings..... | 1 |
| ESD Ratings..... | 1 |
| Operating Conditions..... | 1 |
| Electrical Characteristics | 2 |
| Pin Information | 3 |
| Pin Configuration | 3 |
| Pin Descriptions | 3 |
| Test Circuits | 4 |
| Switching Waveforms | 5 |
| Description | 6 |
| Driver | 6 |
| Receiver | 6 |
| Mechanical Dimensions | 7 |
| Ordering Information | 8 |

List of Figures

| | |
|--|---|
| Figure 1: SP3494..... | i |
| Figure 2: SP3494 Pinout (Top View) | 3 |
| Figure 3: Driver DC Test Load Circuit..... | 4 |
| Figure 4: Driver Propagation Delay Test Circuit | 4 |
| Figure 5: Driver Differential Output Delay and Transition Time Circuit..... | 4 |
| Figure 6: Driver Enable and Disable Timing Circuit Output High..... | 4 |
| Figure 7: Driver Enable and Disable Timing Circuit Output Low | 4 |
| Figure 8: Receiver Propagation Delay Test Circuit..... | 4 |
| Figure 9: Receiver Enable and Disable Timing Circuit | 4 |
| Figure 10: Driver Short Circuit Current Limit Test..... | 4 |
| Figure 11: Driver Propagation Delay Waveforms | 5 |
| Figure 12: Driver Differential Output Delay and Transition Time Waveforms..... | 5 |
| Figure 13: Driver Enable and Disable Timing Waveforms..... | 5 |
| Figure 14: Receiver Propagation Delay Waveforms..... | 5 |
| Figure 15: Receiver Enable and Disable Waveforms | 5 |
| Figure 16: Mechanical Dimensions, NSOIC8 | 7 |

List of Tables

| | |
|---|---|
| Table 1: Absolute Maximum Ratings | 1 |
| Table 2: ESD Ratings | 1 |
| Table 3: Operating Conditions | 1 |
| Table 4: Electrical Characteristics | 2 |
| Table 5: Pin Descriptions..... | 3 |
| Table 6: Transmit Function Truth Table..... | 6 |
| Table 7: Receive Function Truth Table..... | 6 |
| Table 8: Ordering Information..... | 8 |

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.

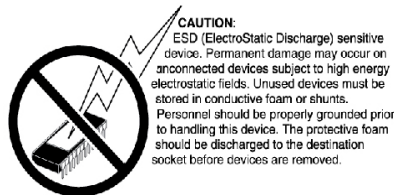
Table 1: Absolute Maximum Ratings

| 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 Θ_{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} | | | ± 10 | μA |
| Driver short circuit current $V_{OUT} = HIGH$ | $-7V \leq V_O \leq +12V$; Figure 8 | | | ± 250 | mA |
| Driver short circuit current $V_{OUT} = LOW$ | $-7V \leq V_O \leq +12V$; Figure 8 | | | ± 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 | $0V \leq V_O \leq V_{CC}$; $\overline{RE} = V_{CC}$ | | | ± 1 | μA |
| Input resistance | $-7V \leq V_{CM} \leq 12V$ | 12 | 15 | | k Ω |
| 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 | μA |
| Supply current, no load | $\overline{RE} = 0V, DI = 0V$ or $V_{CC}, DE = 0V$ | | 800 | 1500 | μA |
| Shutdown mode | $DE = 0V, \overline{RE} = V_{CC}$ | | | 10 | μA |

Pin Information

Pin Configuration

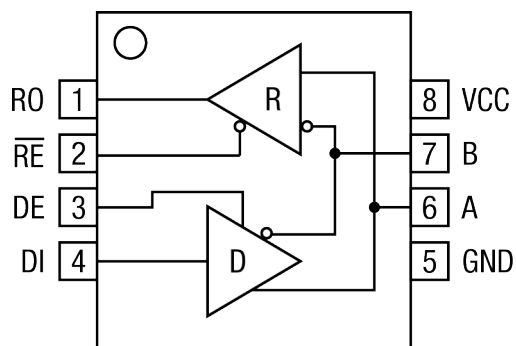


Figure 2: SP3494 Pinout (Top View)

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

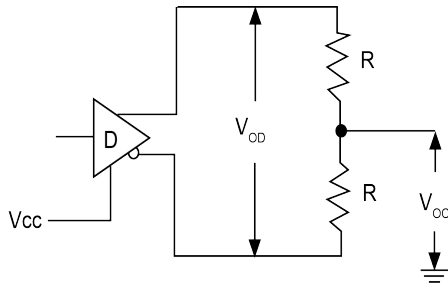


Figure 3: Driver DC Test Load Circuit

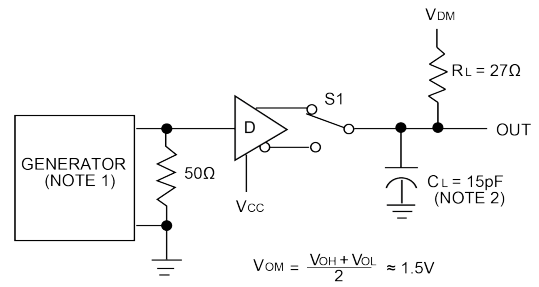


Figure 4: Driver Propagation Delay Test Circuit

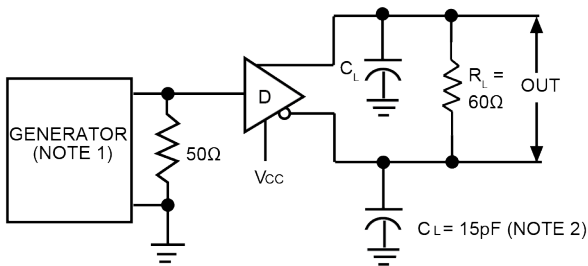


Figure 5: Driver Differential Output Delay and Transition Time Circuit

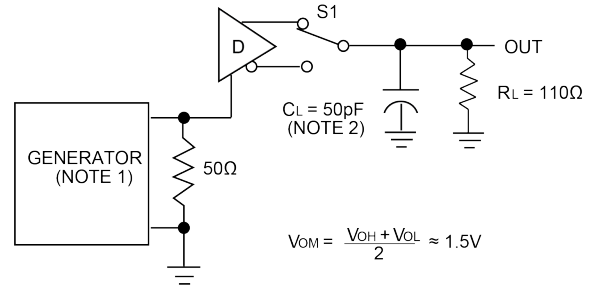


Figure 6: Driver Enable and Disable Timing Circuit, Output High

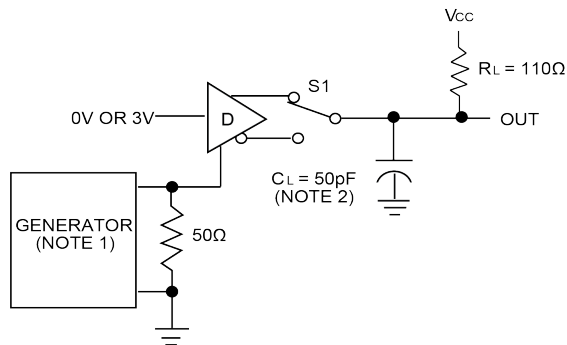


Figure 7: Driver Enable and Disable Timing Circuit, Output Low

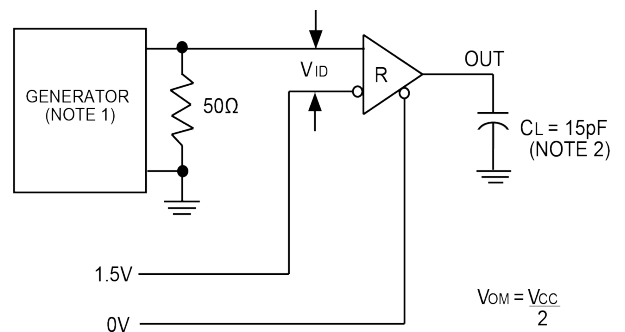


Figure 8: Receiver Propagation Delay Test Circuit

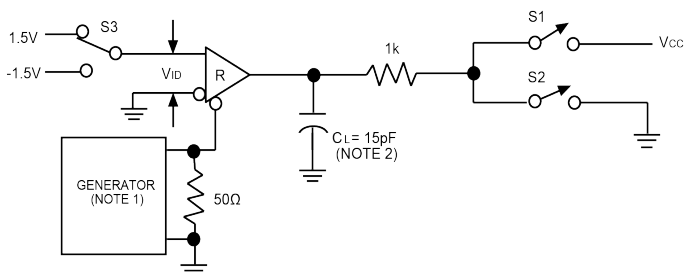


Figure 9: Receiver Enable and Disable Timing Circuit

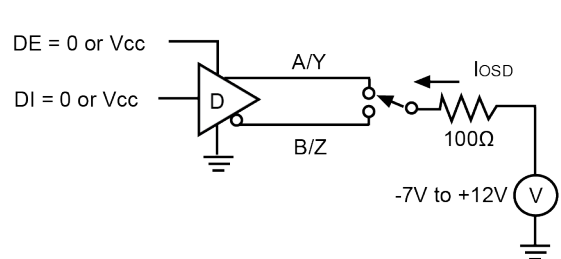


Figure 10: Driver Short Circuit Current Limit Test

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

Switching Waveforms

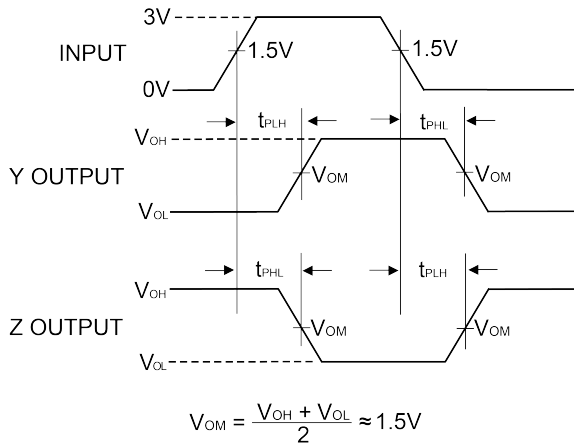


Figure 11: Driver Propagation Delay Waveforms

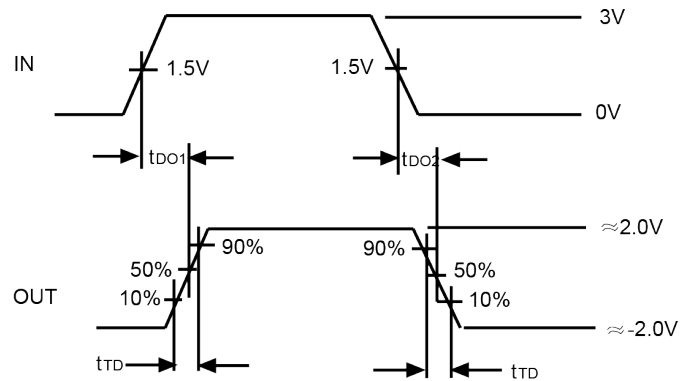


Figure 12: Driver Differential Output Delay and Transition Time Waveforms

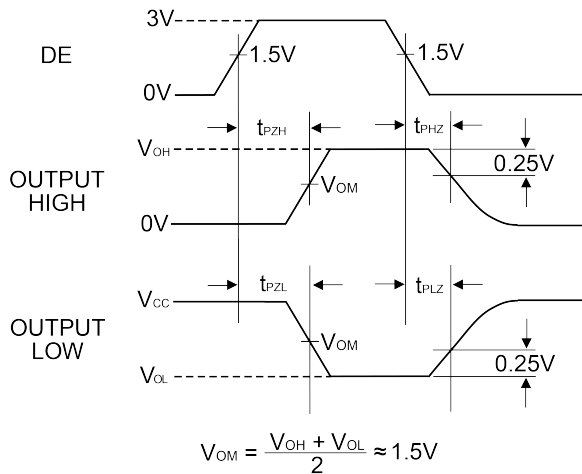


Figure 13: Driver Enable and Disable Timing Waveforms

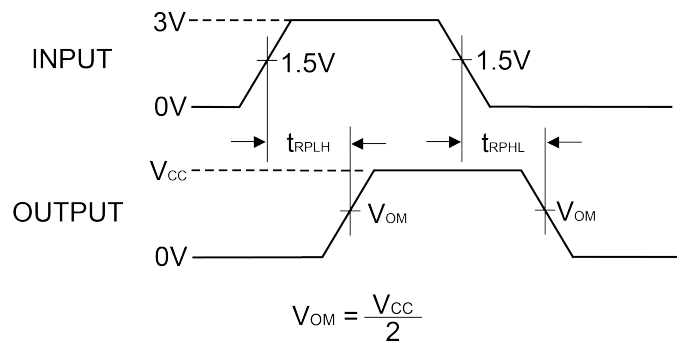


Figure 14: Receiver Propagation Delay Waveforms

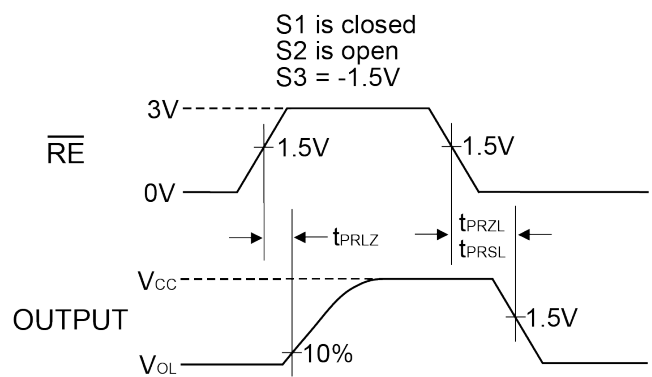
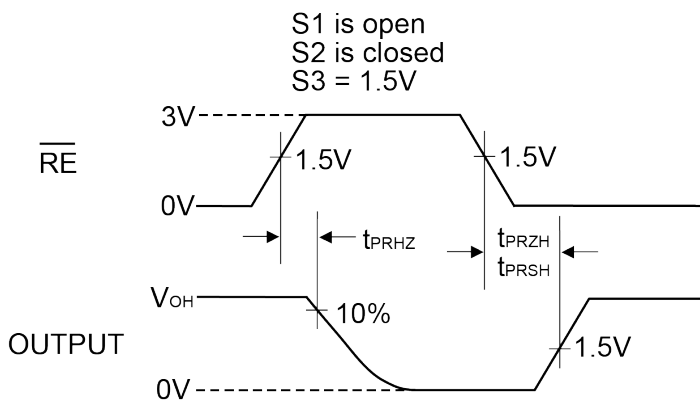


Figure 15: Receiver Enable and Disable Waveforms

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 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.

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 RE (pin 2) of the SP3494 will enable the differential receiver. A logic HIGH on 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 RE (pin 2) will put the SP3494 into shutdown. In shutdown, the supply current will drop to less than $10\mu A$.

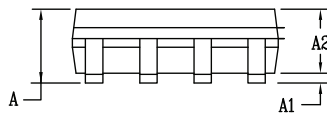
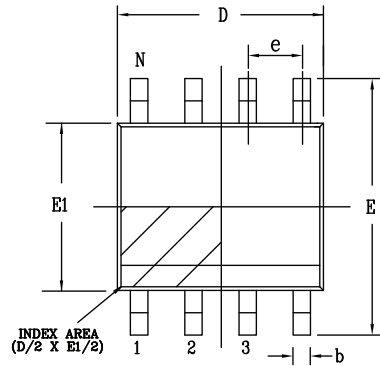
Table 7: Receive Function Truth Table

| 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 |

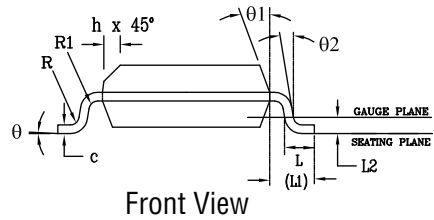
Mechanical Dimensions

NSOIC8

Top View



Side View



Front View

| PACKAGE OUTLINE NSOIC .150" BODY JEDEC MS-012 VARIATION AA | | | | | | |
|---|---|-----|------|---|-----|-------|
| SYMBOLS | COMMON DIMENSIONS IN MM (Control Unit) | | | COMMON 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 | — | — |
| 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⁽¹⁾

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

1. Refer to www.maxlinear.com/SP3494 for most up-to-date Ordering Information.

2. Visit www.maxlinear.com for additional information on Environmental Rating.



MaxLinear, Inc.
5966 La Place Court, Suite 100
Carlsbad, CA 92008
760.692.0711 p.
760.444.8598 f.
www.maxlinear.com

The content of this document is furnished for informational use only, is subject to change without notice, and should not be construed as a commitment by MaxLinear, Inc. MaxLinear, Inc. assumes no responsibility or liability for any errors or inaccuracies that may appear in the informational content contained in this guide. Complying with all applicable copyright laws is the responsibility of the user. Without limiting the rights under copyright, no part of this document may be reproduced into, stored in, or introduced into a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise), or for any purpose, without the express written permission of MaxLinear, Inc.

MaxLinear, Inc. does not recommend the use of any of its products in life support applications where the failure or malfunction of the product can reasonably be expected to cause failure of the life support system or to significantly affect its safety or effectiveness. Products are not authorized for use in such applications unless MaxLinear, Inc. receives, in writing, assurances to its satisfaction that: (a) the risk of injury or damage has been minimized; (b) the user assumes all such risks; (c) potential liability of MaxLinear, Inc. is adequately protected under the circumstances.

MaxLinear, Inc. may have patents, patent applications, trademarks, copyrights, or other intellectual property rights covering subject matter in this document. Except as expressly provided in any written license agreement from MaxLinear, Inc., the furnishing of this document does not give you any license to these patents, trademarks, copyrights, or other intellectual property.

MaxLinear, the MaxLinear logo, and any MaxLinear trademarks, MxL, Full-Spectrum Capture, FSC, G.now, AirPHY and the MaxLinear logo are all on the products sold, are all trademarks of MaxLinear, Inc. or one of MaxLinear's subsidiaries in the U.S.A. and other countries. All rights reserved. Other company trademarks and product names appearing herein are the property of their respective owners.

Данный компонент на территории Российской Федерации

Вы можете приобрести в компании MosChip.

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

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.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru

moschip.ru_4

moschip.ru_6

moschip.ru_9