SP3494

Data Sheet

3.3V Low Power RS-485 / RS-422 Transceiver

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
- ±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
- 10µA low-power shutdown mode
- Compatibility with the MAX3486 and 75176 industry standard pinout

Ordering Information - page 8

Block Diagram

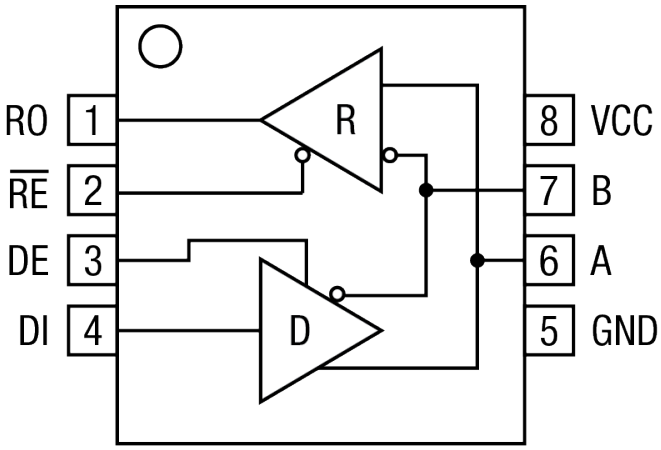

Figure 1: SP3494

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.

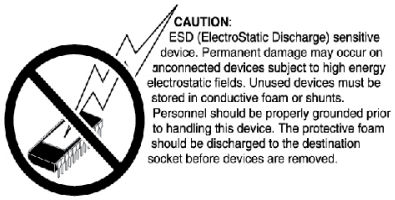
Table 1: Absolute Maximum Ratings

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 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 ±5% unless otherwise noted.

Table 4: Electrical Characteristics

Parameter	Test Condition	Minimum	Typical	Maximum	Units
SP3494 Driver DC Characteristics					
Differential output voltage	Unloaded; R = ∞Ω, Figure 1			V_{CC}	V
Differential output voltage	With load; R = 50Ω (RS-422); Figure 1	2		V_{CC}	V
Differential output voltage	With load; R = 27Ω (RS-485); Figure 1	1.5		V_{CC}	V
Change in magnitude of driver differential output voltage for complimentary states	R = 27Ω or R = 50Ω; Figure 1			0.2	V
Driver common-mode output voltage	R = 27Ω or R = 50Ω; 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	uA
Driver short circuit current V_{OUT} = HIGH	-7V ≤ V_O ≤ +12V; Figure 8			±250	mA
Driver short circuit current V_{OUT} = LOW	-7V ≤ V_O ≤ +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	$\|t_{DO1} - t_{DO2}\|$, 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 ≤ V_{CM} ≤ 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 ≤ V_O ≤ V_{CC}; $\overline{RE}$ = V_{CC}			±1	uA
Input resistance	-7V ≤ V_{CM} ≤ 12V	12	15		kΩ
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 ≤ V_{CM} ≤ 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	$t_{RSKEW} = \lvert t_{RPHL} - t_{RPLH} \rvert$, 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	$\overline{RE}$ = 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	uA
Supply current, no load	$\overline{RE}$ = 0V, DI = 0V or V_{CC}, DE = 0V		800	1500	uA
Shutdown mode	DE = 0V, $\overline{RE}$ = V_{CC}			10	uA

Pin Information

Pin Configuration

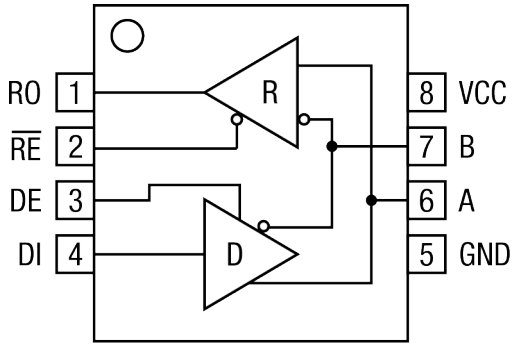


Figure 2: SP3494 Pinout (Top View)

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 ±5%

Test Circuits

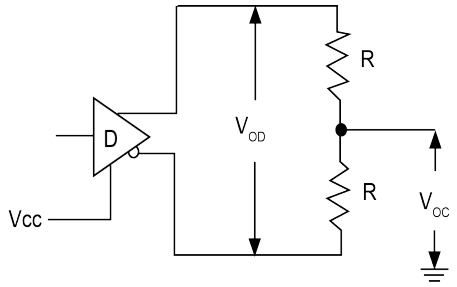


Figure 3: Driver DC Test Load Circuit

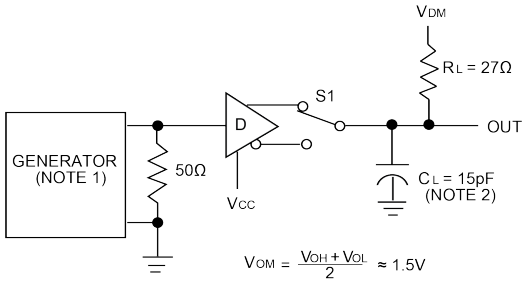


Figure 4: Driver Propagation Delay Test Circuit

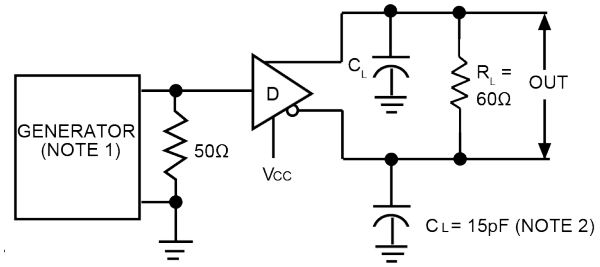


Figure 5: Driver Differential Output Delay and Transition Time Circuit

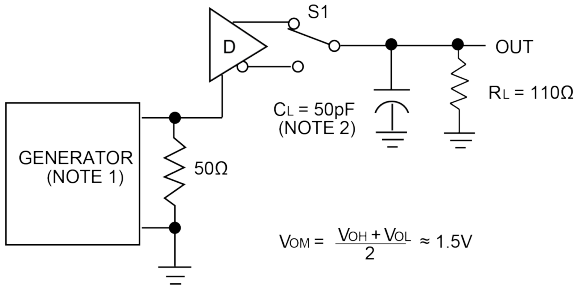


Figure 6: Driver Enable and Disable Timing Circuit, Output High

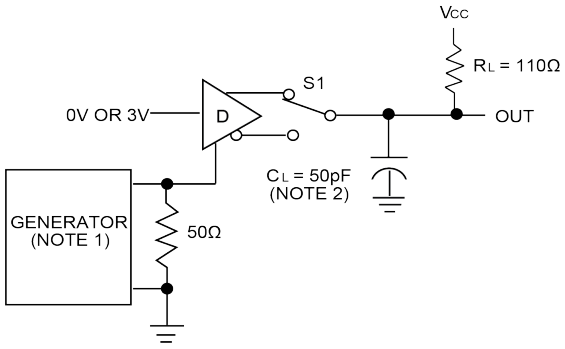


Figure 7: Driver Enable and Disable Timing Circuit, Output Low

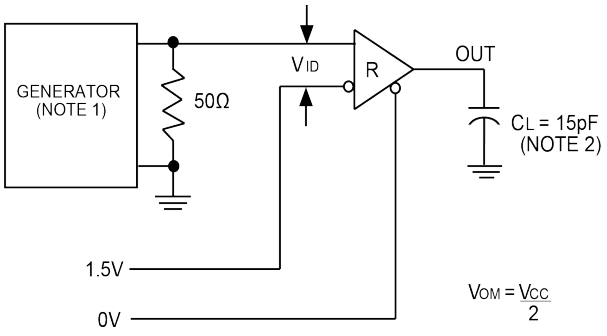


Figure 8: Receiver Propagation Delay Test Circuit

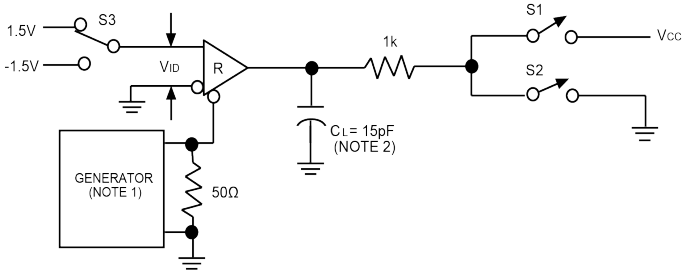


Figure 9: Receiver Enable and Disable Timing Circuit

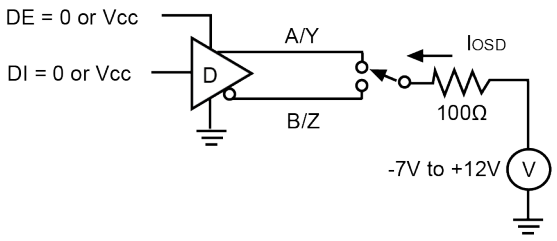


Figure 10: Driver Short Circuit Current Limit Test

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

Switching Waveforms

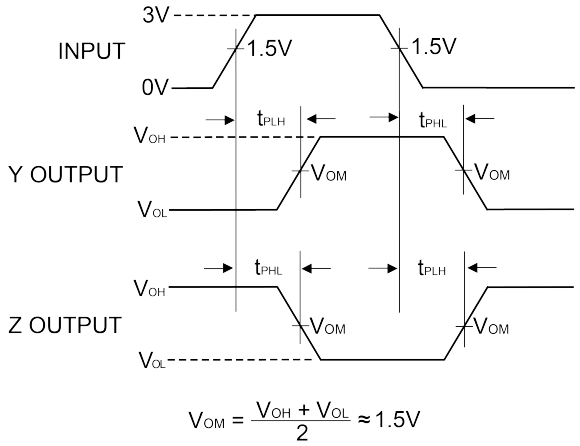


Figure 11: Driver Propagation Delay Waveforms

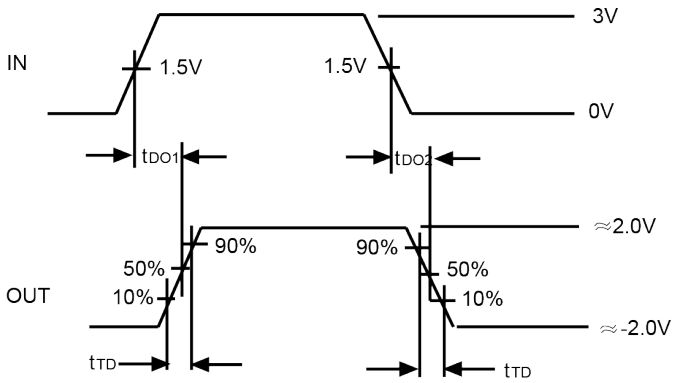


Figure 12: Driver Differential Output Delay and Transition Time Waveforms

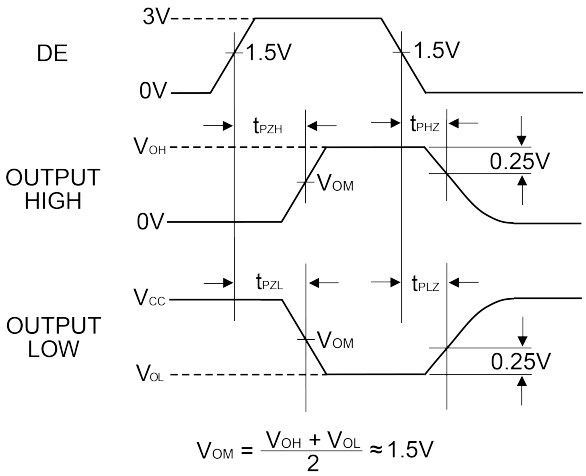


Figure 13: Driver Enable and Disable Timing Waveforms

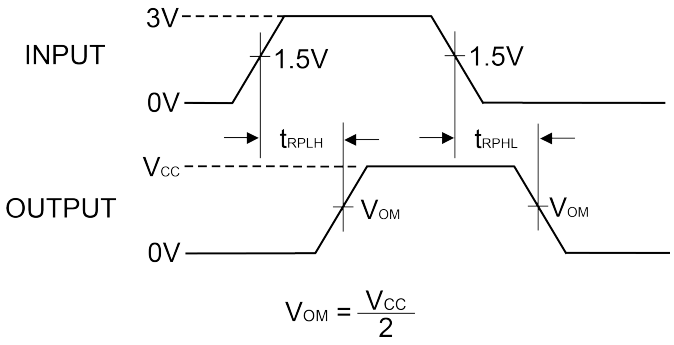
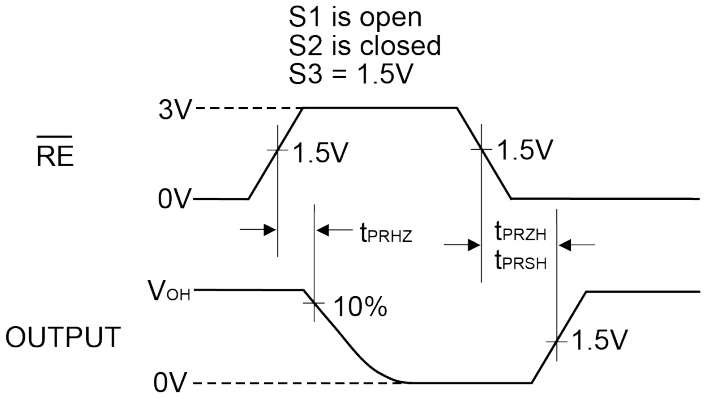


Figure 14: Receiver Propagation Delay Waveforms



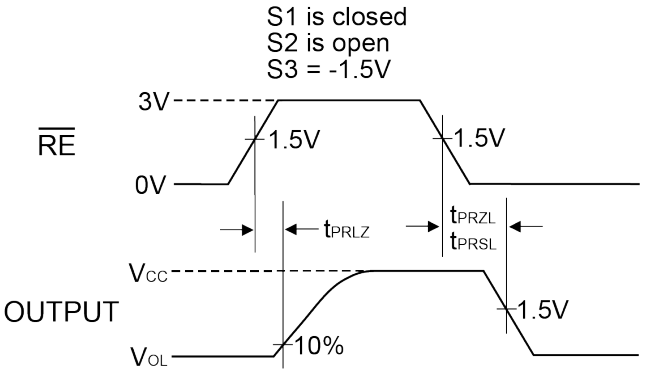


Figure 15: Receiver Enable and Disable Waveforms

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				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

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 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.

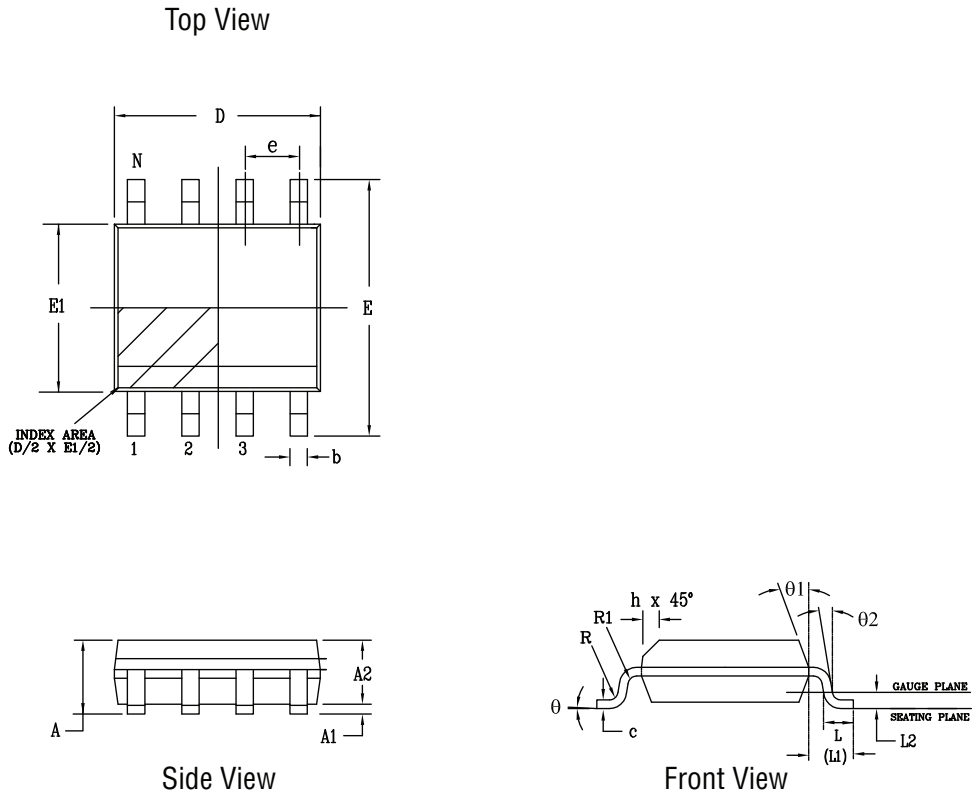
The SP3494 is equipped with a shutdown mode. To enable the shutdown state, both the driver and receiver must be disabled simultaneously. A logic LOW on DE (pin 3) and a logic HIGH on $\overline{RE}$ (pin 2) will put the SP3494 into shutdown. In shutdown, the supply current will drop to less than 10µA.

Table 7: Receive Function Truth Table

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

Mechanical Dimensions

NSOIC8



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°
q1	5°	—	15°	5°	—	15°
q2	0°	—	—	0°	—	—
D	4.90 BSC			0.193 BSC		
N	8					

Drawing No: POD-00000108
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.

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OCEAN CHIPS
Океан Электроники
Поставка электронных компонентов

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «**JONHON**», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «**FORSTAR**».

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