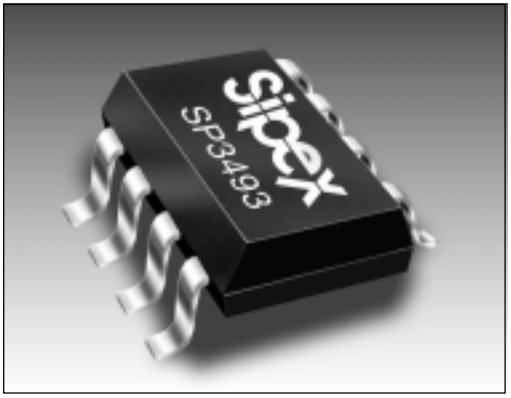
SP3493/SP3494

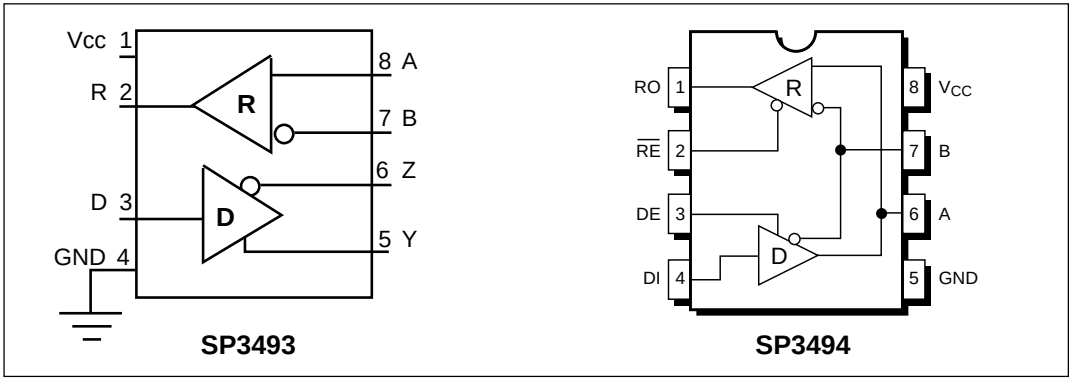
+3.3V Low Power RS-485/RS-422 Transceivers

- Operates From A Single +3.3V Supply
- Interoperable With +5V Logic
- ±200mV Receiver Input Sensitivity
- -7V to +12V Common-Mode Input Voltage Range
- Devices Allow Up To 32 Transceivers On The Serial Bus
- Driver/Receiver Enable Lines (**SP3494**)
- 2nA Low-Power Shutdown Mode (**SP3494**)
- Compatible With The MAX3488, LTC490 and 75179 Industry Standard Pinouts (**SP3493**)
- Compatible With The MAX3486 and 75176 Industry Standard Pinouts (**SP3494**)



DESCRIPTION

The **SP3493** and the **3494** devices are +3.3V, low power transceivers that meet the specifications of the RS-485 and RS-422 serial protocols. The **SP3493** and the **3494** devices are pin-to-pin compatible with the **Sipex SP3490** and the **SP3481** devices, respectively, as well as other popular industry standards. The devices feature **Sipex's** 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 **SP3493** is a full-duplex low power transceiver that will deliver a data transmission rate up to 250kbps. 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.



SP3493 **SP3494**

 © Copyright 2002 Sipex Corporation

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˚
Power Dissipation per Package
8-pin PDIP (derate11.8mW/ºC above +70ºC) 1000mW
8-pin NSOIC (derate 6.90mW/ºC above +70ºC) 600mW

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.

SPECIFICATIONS

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

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP3493 DRIVER					
DC Characteristics					
Differential Output Voltage	GND		V_{CC}	Volts	Unloaded; R = ∞ Ω; *Figure 1*
Differential Output Voltage	2		V_{CC}	Volts	With Load; R = 50Ω; (RS-422); *Figure 1*
Differential Output Voltage	1.5		V_{CC}	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	
Input Low Voltage			0.8	Volts	
Input Current			±10	µA	
Driver Short-Circuit Current					
V_{OUT} = HIGH			±250	mA	$-7V \le V_O \le +12V$
V_{OUT} = LOW			±250	mA	$-7V \le V_O \le +12V$
SP3493 DRIVER					
AC Characteristics					
Maximum Data Rate	250			kbps	
Driver Input to Output, t_{PLH}	400	900	1500	ns	*Figures 2 and 8*
Driver Input to Output, t_{PHL}	400	900	1500	ns	*Figures 2 and 8*
Differential Driver Skew		10		ns	$\lvert t_{PHL}(Y) - t_{PLH}(Y) \rvert, \lvert t_{PHL}(Z) - t_{PLH}(Z) \rvert$, *Figures 2 and 8*
Driver Rise or Fall Time		10	30	ns	From 10% to 90%; *Figures 2 and 8* *Figures 3 and 9*
SP3493 RECEIVER					
DC Characteristics					
Differential Input Threshold	0.2		+0.2	Volts	$-7V \le V_{CM} \le 12V$
Input Hysteresis		25		mV	V_{CM} = 0V
Output Voltage High	V_{CC}-0.4			Volts	I_O = -1.5mA, V_{ID} = +200mV
Output Voltage Low			0.4	Volts	I_O = +2.5mA, V_{ID} = -200mV
Input Resistance	12	15		kΩ	$-7V \le V_{CM} \le 12V$
Input Current (A, B); V_{IN} = 12V			1.0	mA	V_{IN} = 12V
Input Current (A, B); V_{IN} = -7V			-0.8	mA	V_{IN} = -7V
Short-Circuit Current			60	mA	$0V \le V_O \le V_{CC}$

 © Copyright 2002 Sipex Corporation

SPECIFICATIONS (continued)

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

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP3493 RECEIVER					
AC Characteristics					
Maximum Data Rate	250			kbps	
Receiver Input to Output, t_{PLH}	35	70	120	ns	*Figures 6 and 11*
Receiver Input to Output, t_{PHL}	35	70	120	ns	*Figures 6 and 11*
Differential Receiver Skew		10		ns	*Figures 6 and 11*
SP3493 POWER REQUIREMENTS					
Supply Current		1000	2000	µA	D = Ø or V_{CC}
SP3494 DRIVER					
DC Characteristics					
Differential Output Voltage	GND		V_{CC}	Volts	Unloaded; R = ∞; *Figure 1*
Differential Output Voltage	2		V_{CC}	Volts	with load; R = 50Ω; (RS-422); *Figure 1*
Differential Output Voltage	1.5		V_{CC}	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	$-7V \le V_O \le +12V$
V_{OUT} = LOW			±250	mA	$-7V \le V_O \le +12V$
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 and 8*
Driver Input to Output, t_{PHL}	20	45	75	ns	*Figures 2 and 8*
Differential Driver Skew		10		ns	$\lvert t_{DO1} - t_{DO2} \rvert$, *Figures 2 and 9*
Driver Rise or Fall Time		30	70	ns	From 10% to 90%, *Figures 3 and 9*
Driver Enable to Output High		52	120	ns	*Figures 4 and 10*
Driver Enable to Output Low		60	120	ns	*Figures 5 and 10*
Driver Disable Time from Low		40	120	ns	*Figures 5 and 10*
Driver Disable Time from High		60	120	ns	*Figures 4 and 10*
SP3494 RECEIVER					
DC Characteristics					
Differential Input Threshold	-0.2		+0.2	Volts	$-7V \le V_{CM} \le +12V$
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	µA	$0V \le V_O \le V_{CC}$; $\overline{RE} = V_{CC}$
Input Resistance	12	15		kΩ	$-7V \le V_{CM} \le +12V$
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	$0V \le V_{CM} \le V_{CC}$

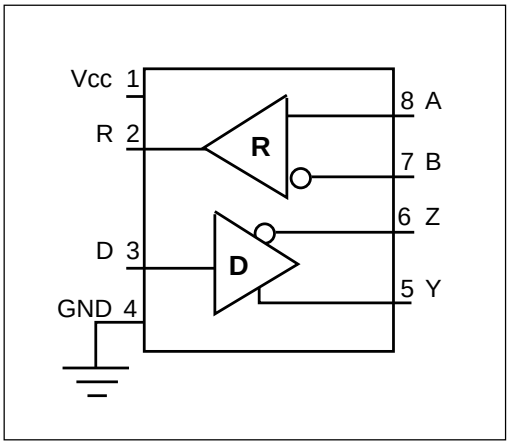
 © Copyright 2002 Sipex Corporation

SPECIFICATIONS (continued)

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

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP3494 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 11*
Receiver Input to Output, t_{PHL}	40	70	100	ns	*Figures 6 and 11*
Differential Receiver Skew		10		ns	$t_{RSKEW} = \lvert t_{RPHL} - t_{RPLH} \rvert$, *Figures 6 and 11*
Receiver Enable to Output Low		35	60	ns	*Figures 7 and 12*; S_1 closed, S_2 open
Receiver Enable to Output High		35	60	ns	*Figures 7 and 12*; S_2 closed, S_1 open
Receiver Disable from Low		35	60	ns	*Figures 7 and 12*; S_1 closed, S_2 open
Receiver Disable from High		35	60	ns	*Figures 7 and 12*; S_2 closed, S_1 open
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 10*
Driver Enable from Shutdown to Output Low		65	150	ns	*Figures 5 and 10*
Receiver Enable from Shutdown to Output High		50	200	ns	*Figures 7 and 12;* S_2 closed, S_1 open
Receiver Enable from Shutdown to Output Low		50	200	ns	*Figures 7 and 12;* S_1 closed, S_2 open
SP3494 POWER REQUIREMENTS					
Supply Current					
No Load		1000	2000	µA	$\overline{RE}$, DI = 0V or V_{CC}; DE = V_{CC}
		800	1500	µA	$\overline{RE}$ = 0V, DI = 0V or V_{CC}; DE = 0V
Shutdown Mode			10	µA	DE = 0V, $\overline{RE}$=V_{CC}

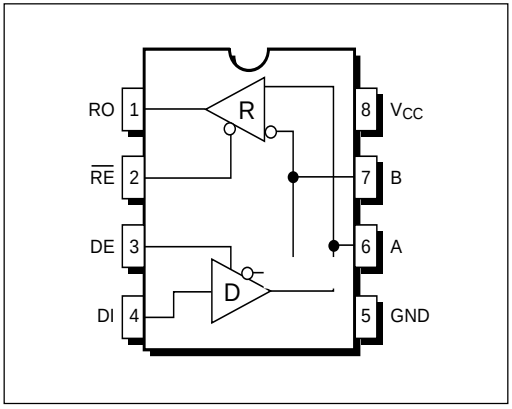
 © Copyright 2002 Sipex Corporation



SP3493
Pinout

PIN FUNCTION - SP3493

Pin 1 - V_{CC} - Positive supply +3.00 < V_{CC} < +3.60
Pin 2 - R - Receiver output.
Pin 3 - D - Driver input.
Pin 4 - GND - Ground connection.
Pin 5 - Y - Non-inverting driver output.
Pin 6 - Z - Inverting driver output.
Pin 7 - B - Inverting receiver input.
Pin 8 - A - Non-inverting receiver input.



SP3494
Pinout

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 – Driver Output/Receiver Input Non-inverting.

Pin 7 – B – Driver Output/Receiver Input Inverting.

Pin 8 – Vcc – Positive Supply +3.00V < V_{CC} < +3.60V

 © Copyright 2002 Sipex Corporation

DESCRIPTION

The **SP3493/3494** are +3.3V transceivers that meet the electrical specifications of the RS-485 and RS-422 serial protocols. The **SP3493/3494** feature Sipex's BiCMOS process allowing low power operation without sacrificing performance.

The **SP3493** device is a +3.3V full-duplex transceiver that is pin-to-pin compatible with the **Sipex SP3490** and **SP490** devices as well as popular industry standards such as the MAX3488, the LTC490, and the 75179. The **SP3493** has a driver with a data transmission rate of 250kbps.

The **SP3494** device is a +3.3V half-duplex transceiver that is pin-to-pin compatible with the **Sipex SP3481** and **SP481** devices as well as popular industry standards such as the MAX3486 and the 75176. The **SP3494** has a partially slew-rate limited driver with a data transmission rate of 2.5Mbps.

Drivers

The **SP3493/3494**devices both have differential outputs. The typical voltage output swing with no load will bo 0V 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** device 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 DE (pin 3) will force the driver outputs at high impedance (high-Z). The **SP3493** device does not have a driver enable.

The **SP3493/SP3494** drivers will operate up to 250kbps and 2.5Mbps, respectively. In addition to adhering to the 250mA I_{SC} maximum limit on the driver output, the driver output short-circuit protection will allow the devices to withstand an infinite short circuit over the -7.0V to +12V common mode range without damage.

Receivers

The receivers have differential inputs with an input sensitivity as low ±200mV. Input impedance of the receivers is typically 15kΩ (12kΩ minimum). A wide common mode range of -7V to +12V allows for large ground potential differences between systems.

Both the **SP3493/SP3494** receivers are equipped with fail-safe which guarantees that the receiver outputs will be in a high state when the input is left unconnected.

The **SP3494** receiver has a high impedance (high-Z) enable control pin. A logic LOW on $\overline{RE}$ (pin 2) will enable the 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 2nA typical, 1μA maximum.

 © Copyright 2002 Sipex Corporation

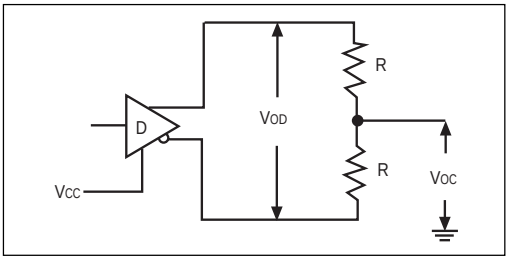


Figure 1. Driver DC Test Load Circuit

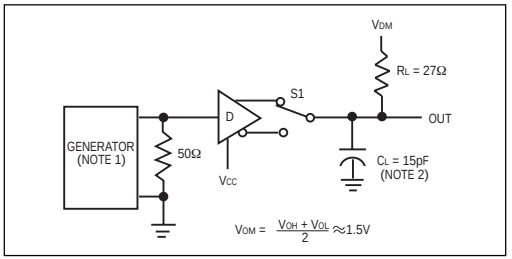


Figure 2. Driver Propagation Delay Test Circuit

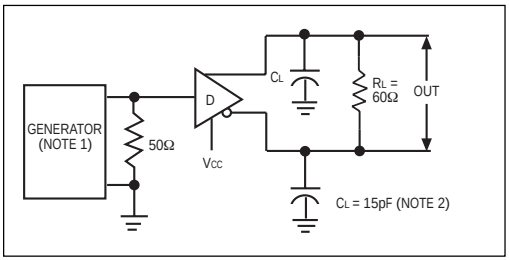


Figure 3. Driver Differential Output Delay and Transition Time Circuit

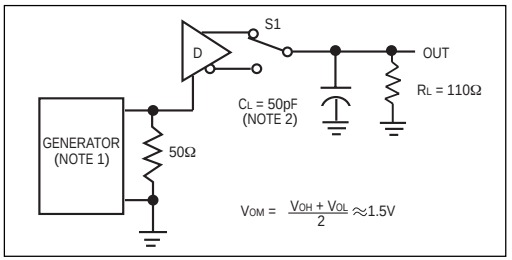


Figure 4. Driver Enable and Disable Timing Circuit, output HiGH

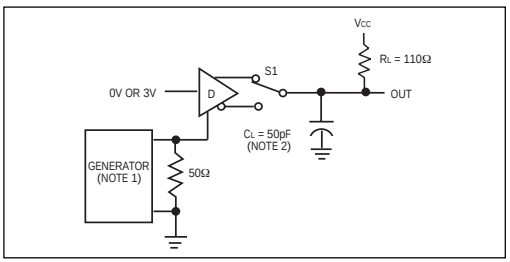


Figure 5. Driver Enable and Disable Timing Circuit, Output LOW

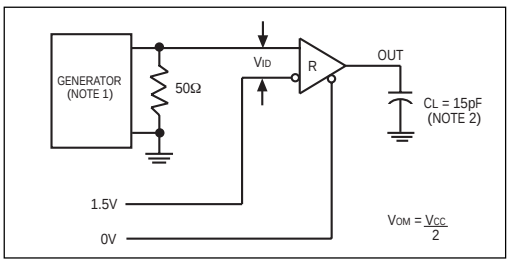


Figure 6. Receiver Propagation Delay Test Circuit

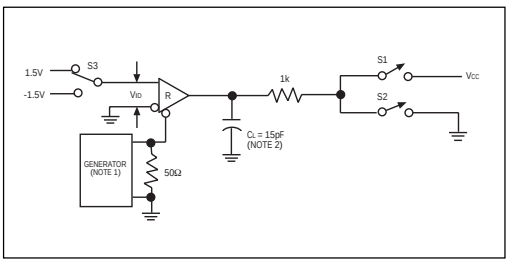


Figure 7. Receiver Enable and Disable Timing Circuit

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

 © Copyright 2002 Sipex Corporation

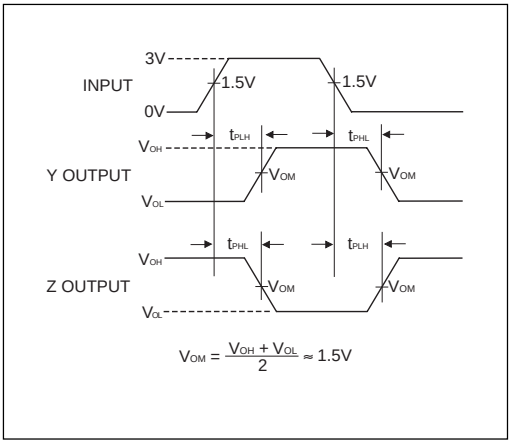


Figure 8. Driver Propagation Delay Waveforms

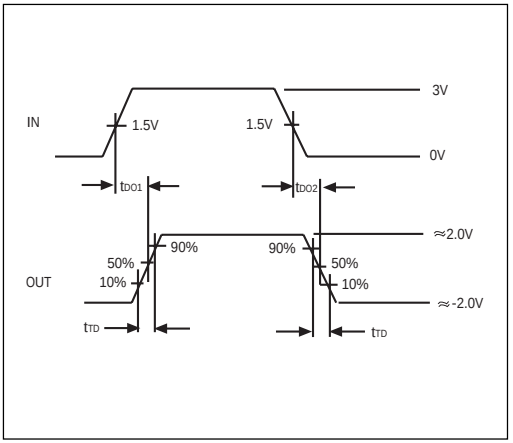


Figure 9. Driver Differential Output Delay and Transition Time Waveforms

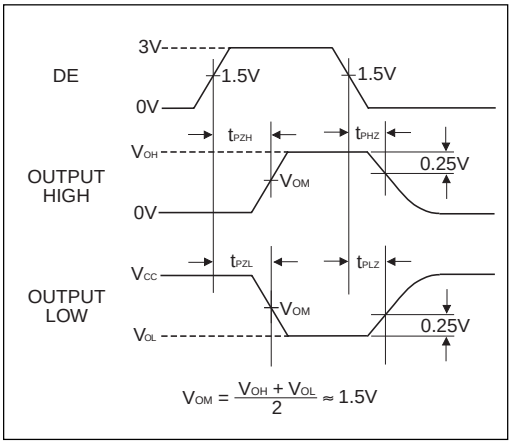


Figure 10. Driver Enable and Disable Timing Waveforms

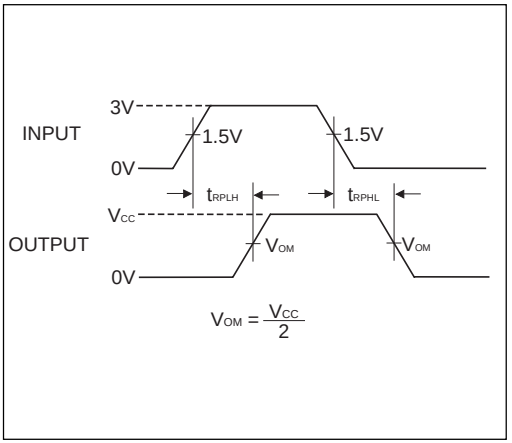


Figure 11. Receiver Propagation Delay Waveforms

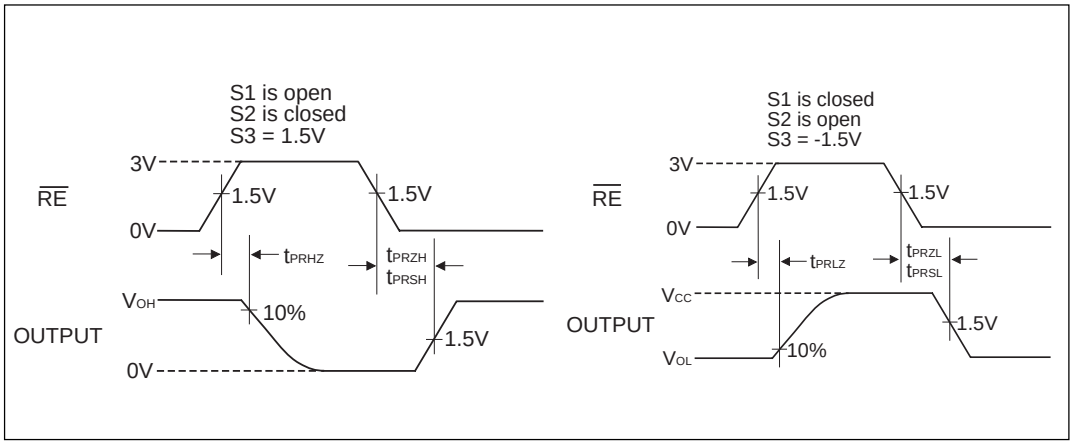
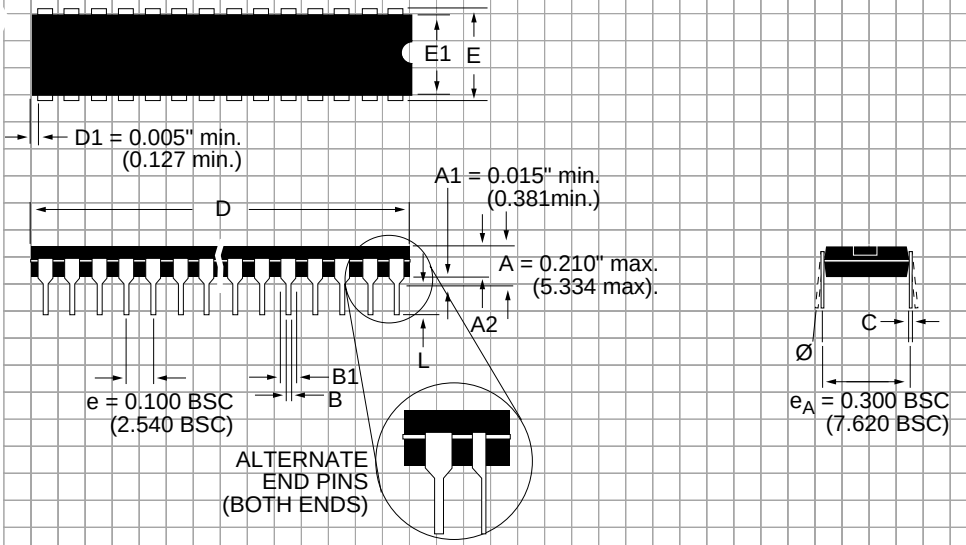


Figure 12. Receiver Enable and Disable Waveforms

NOTE 1: The input pulse is supplied by a generator with the following characteristics: PRR=250KHz, 50% duty cycle, t_r < 6.0ns, Z_0=50Ω.
NOTE 2: C_L includes probe and stray capacitance.

 © Copyright 2002 Sipex Corporation

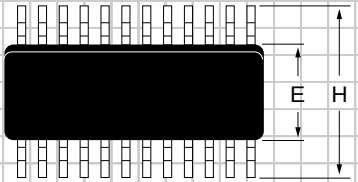
PACKAGE: PLASTIC DUAL–IN–LINE (NARROW)

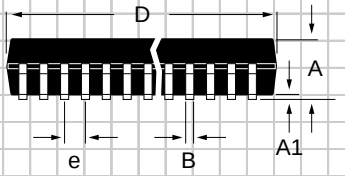


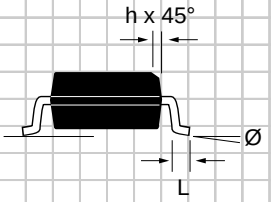
DIMENSIONS (Inches) Minimum/Maximum (mm)	8–PIN
A2	0.115/0.195 (2.921/4.953)
B	0.014/0.022 (0.356/0.559)
B1	0.045/0.070 (1.143/1.778)
C	0.008/0.014 (0.203/0.356)
D	0.355/0.400 (9.017/10.160)
E	0.300/0.325 (7.620/8.255)
E1	0.240/0.280 (6.096/7.112)
L	0.115/0.150 (2.921/3.810)
Ø	0°/ 15° (0°/15°)

 © Copyright 2002 Sipex Corporation

PACKAGE: PLASTIC SMALL OUTLINE (SOIC) (NARROW)







DIMENSIONS (Inches) Minimum/Maximum (mm)	8–PIN
A	0.053/0.069 (1.346/1.748)
A1	0.004/0.010 (0.102/0.249
B	0.014/0.019 (0.35/0.49)
D	0.189/0.197 (4.80/5.00)
E	0.150/0.157 (3.802/3.988)
e	0.050 BSC (1.270 BSC)
H	0.228/0.244 (5.801/6.198)
h	0.010/0.020 (0.254/0.498)
L	0.016/0.050 (0.406/1.270)
Ø	0°/8° (0°/8°)

 © Copyright 2002 Sipex Corporation

ORDERING INFORMATION

Model	Temperature Range	Package
SP3493CN	0˚C to +70˚C	8-pin Narrow SOIC
SP3493CP	0˚C to +70˚C	8-pin Plastic DIP
SP3493EN	-40˚C to +85˚C	8-pin Narrow SOIC
SP3493EP	-40˚C to +85˚C	8-pin Plastic DIP
SP3494CN	0˚C to +70˚C	8-pin Narrow SOIC
SP3494CP	0˚C to +70˚C	8-pin Plastic DIP
SP3494EN	-40˚C to +85˚C	8-pin Narrow SOIC
SP3494EP	-40˚C to +85˚C	8-pin Plastic DIP

Please consult the factory for pricing and availability on a Tape-On-Reel option.

SIGNAL PROCESSING EXCELLENCE

Sipex Corporation

Headquarters and Sales Office
233 South Hillview Drive
Milpitas, CA 95035
TEL: (408) 934-7500
FAX: (408) 935-7600

Sales Office
22 Linnell Circle
Billerica, MA 01821
TEL: (978) 667-8700
FAX: (978) 670-9001
e-mail: sales@sipex.com

Sipex Corporation reserves the right to make changes to any products described herein. Sipex does not assume any liability arising out of the application or use of any product or circuit described hereing; neither does it convey any license under its patent rights nor the rights of others.