



Full Duplex RS-485 Transceivers

FEATURES

- +5V Only
- Low Power BiCMOS
- Driver/Receiver Enable (SP1491E)
- RS-485 and RS-422 Drivers/Receivers
- Pin Compatible with SN75179 (SP1490E)
- Pin Compatible with SN75180 (SP1491E)
- Improved ESD Specifications ±15kV Human Body Model ±15kV IEC61000-4-2 Air Discharge



APPLICATIONS

- Industial Networks
 Telecom
- Motor Control
- HVAC/ Building Control

DESCRIPTION

The SP1490E is a low power differential line driver/receiver meeting RS-485 and RS-422 standards up to 20Mbps. The SP1491E is identical to the SP1490E with the addition of driver and receiver tristate enable lines. Both products feature ±200mV receiver input sensitivity, over wide common mode range. The SP1490E is available in an 8-pin NSOIC packages for operation over the commercial and industrial temperature ranges. The SP1491E is available in a 14-pin NSOIC packages for operation over the commercial and industrial temperature ranges.



BLOCK DIAGRAM

ABSOLUTE MAXIMUM RATINGS These are stress ratings only and functional operation of the device at

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}	+7V
Input Voltages	
Drivers	0.5V to (V _{cc} +0.5V)
Receivers	±14V
Output Voltages	
Drivers	±14V
Receivers	0.5V to (V _{cc} +0.5V)
Storage Temperature	65°C to +150°
Power Dissipation	1000mW

ELECTRICAL CHARACTERISTICS

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP1490E/1491E DRIVER DC Characteristics Differential Output Voltage Differential Output Voltage	3.5 2		V _{cc} V _{cc}	Volts Volts	Unloaded; $R = \infty$; see figure 1 With Load; $R = 50\Omega$; (RS422);
Differential Output Voltage figure 1 Change in Magnitude of Driver Differential Output Voltage for Complimentary States Driver Common-Mode Output Voltage Input Voltage Input Low Voltage Input Low Voltage Input Current Driver Short-Circuit Current V_{OUT} = HIGH V_{OUT} = LOW	2.0		V _{cc} 0.2 3 0.8 ±10 ±250 ±250	Volts Volts Volts Volts Volts MA mA	see figure 1 With Load; R = 27Ω ; (RS485); see R = 27Ω or R = 50Ω ; see figure 1 R = 27Ω or R = 50Ω ; see figure 1 Applies to D Applies to D Applies to D $-7V \le V_o \le +12V$ $-7V \le V_o \le +12V$
SP1490E/1491E DRIVER AC Characteristics Maximum Data Rate Driver Input to Output Driver Input to Output Driver Skew Driver Rise or Fall Time SP1491E only Driver Enable to Output High Driver Enable to Output Low	20	30 30 8 20 40	40 40 5 20 70 70	Mbps ns ns ns ns ns	$\begin{split} t_{\rm R/F}; R_{\rm DIFF} &= 54\Omega, C_{\rm L1} = C_{\rm L2} = 100 {\rm pF};\\ \text{see figures 3 and 6}\\ t_{\rm R/F}; R_{\rm DIFF} &= 54\Omega, C_{\rm L1} = C_{\rm L2} = 100 {\rm pF};\\ \text{see figures 3 and 6}\\ \text{see figures 3 and 6},\\ t_{\rm R/F} &= t_{\rm PLH} - t_{\rm PHL} \\ \text{From 10\% to 90\%; } R_{\rm DIFF} &= 54\Omega,\\ C_{\rm L1} &= C_{\rm L2} = 100 {\rm pF};\\ \text{see figures 3 and 6}\\ t_{\rm R/F} &= t_{\rm L2} = 100 {\rm pF};\\ \text{see figures 3 and 6}\\ t_{\rm R/F} &= t_{\rm L2} = 100 {\rm pF};\\ \text{see figures 3 and 6}\\ t_{\rm R/F} &= t_{\rm L2} = 100 {\rm pF};\\ \text{see figures 4 and 7}; S_2 \text{closed}\\ C_{\rm L1} &= C_{\rm L2} = 100 {\rm pF};\\ \text{see figures 4 and 7}; S_1 \text{closed} \end{split}$
Driver Disable Time from Low Driver Disable Time from High		40 40	70 70	ns ns	$C_{L1} = C_{L2} = 100 \text{pF}$; see figures 4 and 7; S ₁ closed $C_{L1} = C_{L2} = 100 \text{pF}$; see figures 4 and 7; S ₂ closed

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

 $\rm T_{_{MIN}}$ to $\rm T_{_{MAX}}$ and $\rm V_{_{CC}}$ = 5V ± 5% unless otherwise noted.

SP1490E/1491E RECEIVER					
DC Characteristics					
Differential Input Threshold	0.2		+0.2	Volts	-7V ≤ V _{CM} ≤ 12V
Input Hysteresis		70		mV	$V_{\rm CM} = 0V$
Output Voltage High	3.5			Volts	$I_0 = -4mA, V_{ID} = +200mV$
Output Voltage Low			0.4	Volts	$I_0 = +4mA, V_{ID} = -200mV$
Input Resistance	12	15		kΩ	$-7V \le V_{CM} \le 12V$ (1 unit load)
Input Current (A, B); V _{IN} = 12V			±1.0	mA	$V_{IN} = 12V$
Input Current (A, B); $V_{IN} = -7V$			-0.8	mA	$V_{iN}^{in} = -7V$
Short-Circuit Current			85	mA	$0\ddot{V} \le V_{0} \le V_{cc}$
					0 00
PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP1490E/1491E RECEIVER					
AC Characteristics					
Maximum Data Rate	20			Mbps	
Receiver Input to Output	20	45	50	ns	t: R = 54Ω.
					$C_{1,1} = C_{1,2} = 100 \text{ pF}$: Figures 3 & 8
Receiver Input to Output	20	45	50	ns	t_{DM} ; $R_{\text{DEE}} = 54\Omega$,
					$C_{1,2}^{\text{PHL}} = C_{1,2}^{\text{PHL}} = 100 \text{pF};$ Figures 3 & 8
Diff. Receiver Skew It, -t, I		5	10	ns	$R_{\text{DFF}} = 54\Omega; C_{14} = C_{15} = 100 \text{pF};$
Receiver Tplh/Tphl		40	70	ns	
POWER REQUIREMENTS					
Supply Voltage	+4.75		+5.25	Volts	
Supply Current		900		μA	
ENVIRONMENTAL AND					
MECHANICAL					
Operating Temperature					
Commercial (C)	0		+70	°C	
Industrial (E)	-40		+85	°Č	
Storage Temperature	-65		+150	°C	
				-	



Figure 1. Driver DC Test Load Circuit



Figure 3. Driver/Receiver Timing Test Circuit



Figure 2. Receiver Timing Test Load Circuit



Figure 4. Driver Timing Test Load #2 Circuit



Figure 6. Driver Propagation Delays



Figure 7. Driver Enable and Disable Times SP1491E only



Figure 8. Receiver Propagation Delays

The SP1490E and SP1491E are full-duplex differential transceivers that meet the requirements of RS-485 and RS-422. Fabricated with a Exar proprietary BiCMOS process, both products require a fraction of the power of older bipolar designs.

The RS-485 standard is ideal for multi-drop applications or for long-distance interfaces. RS-485 allows up to 32 drivers and 32 receivers to be connected to a data bus, making it an ideal choice for multi-drop applications. Since the cabling can be as long as 4,000 feet, RS-485 transceivers are equipped with a wide (-7V to +12V) common mode range to accommodate ground potential differences. Because RS-485 is a differential interface, data is virtually immune to noise in the transmission line.

Driver...

The drivers for both the SP1490E and SP1491E have differential outputs. The typical voltage output swing with no load will be 0 volts to +5 volts. With worst case loading of 54Ω across the differential outputs, the driver can maintain greater than 1.5V voltage levels.

The driver of the SP1491E has a driver enable control line which is active high. A logic high on DE (pin 4) of the SP1491E will enable the differential driver outputs.

INPUTS		OUTPUTS	
DE SP1491E only	DI	Y	Z
1	1	1	0
0	v v	7	1
	A		

Transmit Function Truth Table

A logic low on DE (pin 4) of the SP1491E will tri-state the driver outputs. The SP1490E does not have a driver enable.

Receiver...

The receivers for both the SP1490E and SP1491E have differential inputs with an input sensitivity as low as ± 200 mV. Input impedance of the receivers 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 receivers for both the SP1490E and SP1491E are equipped with the fail-safe feature. Fail-safe guarantees that the receiver output will be in a high state when the input is left unconnected and floating.

The receiver of the SP1491E has a receiver enable control line which is active low. A logic low on REB (pin 3) of the SP1491E will enable the differential receiver. A logic high on REB (pin 3) of the SP1491E will tri-state the receiver.

INPUTS	OUTPUTS	
RE SP1491E only	A-B	R
0	+0.2V	1
0	-0.2V	0
0	open	1
1	х	Z

Recieve Function Truth Table





ORDERING INFORMATION

Part Number	TopMark	Temperature Range	Package
SP1490ECN-L		0°C to +70°C	8-Pin NSOIC
SP1490ECN-L/TR		0°C to +70°C	
SP1490EEN-L	SP1490EENYYWW	40°C to +85°C	
SP1490EEN-L/TR	SP1490EENYYWW	40°C to +85°C	
SP1491ECN-L	SP1491ECNYYWW	0°C to +70°C	
SP1491ECN-L/TR	SP1491ECNYYWW	0°C to +70°C	
SP1491EEN-L	SP1491EENYYWW	40°C to +85°C	
SP1491EEN-L/TR.	SP1491EENYYWW	40°C to +85°C	

/TR = Tape and Reel

Pack quantity is 2500 for Narrow SOIC.

DATE	REVISION	DESCRIPTION
03/08/07	J	Legacy Sipex Datasheet
06/12/09	1.0.0	Convert to Exar format, update ordering information and change revision to 1.0.0
05/24/13	1.0.1	Correct type error per PCN 13-0503-01 ECN: 1322-02 05/24/13

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