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

ELECTRICAL CHARACTERISTICS

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

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP490 DRIVER					
DC Characteristics Differential Output Voltage Differential Output Voltage	GND 2		V _{cc}	Volts Volts	Unloaded; R = ∞ ; see figure 1 With Load; R = 50Ω; (RS422);
Differential Output Voltage	1.5		V _{cc}	Volts	see figure 1 With Load; R = 27Ω ; (RS485); see figure 1
Change in Magnitude of Driver Differential Output Voltage for Complimentary States Driver Common-Mode			0.2	Volts	R = 27Ω or R = 50Ω; see figure 1
Output Voltage Input High Voltage Input Low Voltage Input Current	2.0		3 0.8 ±10	Volts Volts Volts	R = 27Ω or R = 50Ω ; see figure 1 Applies to D Applies to D Applies to D
Driver Short-Circuit Current V _{OUT} = HIGH V _{OUT} = LOW	35 35		250 250	μA mA mA	-7V ≤ V _o ≤ +12V -7V ≤ V _o ≤ +12V
SP490 DRIVER					
AC Characteristics Maximum Data Rate Driver Input to Output	5	30	60	Mbps ns	t_{pLH} ; R_{DIFF} = 54 Ω , C_{L1} = C_{L2} = 100pF; see figures 3 and 6
Driver Input to Output		30	60	ns	see figures 3 and 6 t_{PHL} ; $R_{DIFF} = 54\Omega$, $C_{L_1} = C_{L_2} = 100pF$; see figures 3 and 6
Driver Skew		5		ns	see figures 3 and 6,
Driver Rise or Fall Time		15	40	ns	$\begin{array}{l} t_{\rm SKEW} = \ t_{\rm DPLH} - t_{\rm DPHL} \\ {\rm From}\ 10\%\ to\ 90\%;\ R_{\rm DIFF} = 54\Omega, \\ C_{\rm L1} = C_{\rm L2} = 100 {\rm pF};\ see\ figures\ 3\ and\ 6 \end{array}$
SP490 RECEIVER					
DC Characteristics Differential Input Threshold Input Hysteresis Output Voltage High Output Voltage Low Input Resistance Input Current (A, B); V _{IN} = 12V Input Current (A, B); V _{IN} = -7V Short-Circuit Current	0.2 3.5 12	70 15	+0.2 0.4 ±1.0 -0.8 85	Volts mV Volts Volts kΩ mA mA	$\begin{array}{l} -7 \text{V} \leq \text{V}_{\text{CM}} \leq 12 \text{V} \\ \text{V}_{\text{CM}} = 0 \text{V} \\ \text{I}_{\text{O}} = -4 \text{mA}, \text{V}_{\text{ID}} = +200 \text{mV} \\ \text{I}_{\text{O}} = +4 \text{mA}, \text{V}_{\text{ID}} = -200 \text{mV} \\ -7 \text{V} \leq \text{V}_{\text{CM}} \leq 12 \text{V} \\ \text{V}_{\text{IN}} = 12 \text{V} \\ \text{V}_{\text{IN}} = -7 \text{V} \\ 0 \text{V} \leq \text{V}_{\text{O}} \leq \text{V}_{\text{CC}} \end{array}$

 $\rm T_{MIN}$ to $\rm T_{MAX}$ and $\rm V_{cc}$ = 5V \pm 5% unless otherwise noted.

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP490 RECEIVER					
AC Characteristics					
Maximum Data Rate	5			Mbps	
Receiver Input to Output		90	150	ns ·	t_{out} ; $R_{\text{out}} = 54\Omega$,
·					t_{PLH} ; $R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100 pF$; Figures 3 & 8
Receiver Input to Output		90	150	ns	$t_{\text{BH}}^{\text{LI}}; R_{\text{DIFF}}^{\text{LZ}} = 54\Omega,$
					$C_{11}^{11} = C_{12}^{11} = 100 \text{pF}$; Figures 3 & 8
Diff. Receiver Skew It _{PLH} -t _{PHI} I		13		ns	$ \begin{array}{l} t_{\rm DHL}^{\rm LI}; R_{\rm DIFF}^{\rm LI} = 54\Omega, \\ C_{\rm L1} = C_{\rm L2}^{\rm L2} = 100 {\rm pF}; \ \emph{Figures 3 \& 8} \\ R_{\rm DIFF} = 54\Omega; \ C_{\rm L1} = C_{\rm L2} = 100 {\rm pF}; \end{array} $
					Figures 3 & 8
POWER REQUIREMENTS					
Supply Voltage	+4.75		+5.25	Volts	
Supply Current		900		μΑ	
ENVIRONMENTAL AND					
MECHANICAL					
Operating Temperature					
Commercial (C_)	0		+70	°C	
Industrial (E_)	-40		+85	°C	
Storage Temperature	-65		+150	°C	
Package					
Plastic DIP (_S)					
NSOIC (_N)					

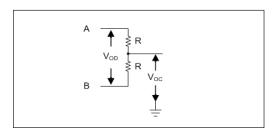


Figure 1. Driver DC Test Load Circuit

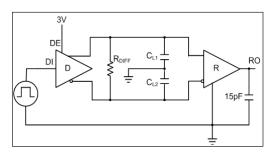


Figure 3. Driver/Receiver Timing Test Circuit

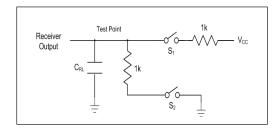


Figure 2. Receiver Timing Test Load Circuit

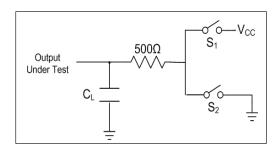


Figure 4. Driver Timing Test Load #2 Circuit

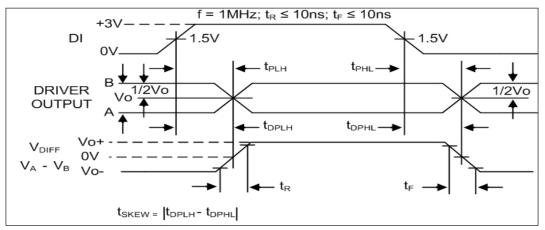


Figure 6. Driver Propagation Delays

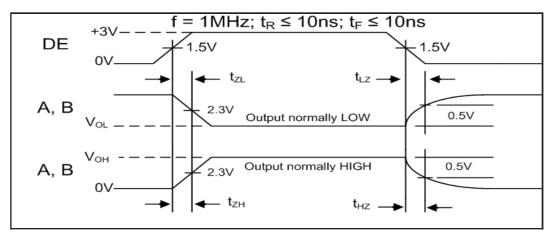


Figure 7. Driver Enable and Disable Times

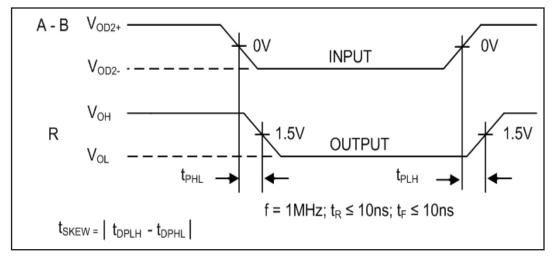


Figure 8. Receiver Propagation Delays

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}	+7V
Input Voltages	
Logic	0.5V to (V _{cc} +0.5V)
Drivers	0.5V to (V = +0.5V)
Receivers	±14V
Output Voltages	
Logic	0.5V to (V _{cc} +0.5V)
	±14V
Receivers	0.5V to (V _{cc} +0.5V)
Storage Temperature	
Power Dissipation	

ELECTRICAL CHARACTERISTICS

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

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP491 DRIVER					
DC Characteristics					
Differential Output Voltage	GND		V _{cc}	Volts	Unloaded; R = ∞ ; see figure 1
Differential Output Voltage	2		V _{cc}	Volts	With Load; $R = 50\Omega$; (RS422);
Differential Output Voltage	1.5		\ \/	Volto	see figure 1 With Load; $R = 27\Omega$; (RS485); see
figure 1	1.5		V _{cc}	Volts	Willi Load, R = 2712, (R5465), See
Change in Magnitude of Driver					
Differential Output Voltage for					
Complimentary States			0.2	Volts	$R = 27\Omega$ or $R = 50\Omega$; see figure 1
Driver Common-Mode					, ,
Output Voltage			3	Volts	$R = 27\Omega$ or $R = 50\Omega$; see figure 1
Input High Voltage	2.0			Volts	Applies to D, REB, DE
Input Low Voltage			0.8	Volts	Applies to D, REB, DE
Input Current			±10	μA	Applies to D, REB, DE
Driver Short-Circuit Current	35		250	m 1	7\/ < \/ < 10\/
V _{OUT} = HIGH V _{OUT} = LOW	35		250 250	mA mA	-7V ≤ V _o ≤ 12V -7V ≤ V _o ≤ 12V
V _{OUT} - LOVV	33		250		-7 V = V ₀ = 12 V
SP491 DRIVER					
AC Characteristics					
Maximum Data Rate	5			Mbps	REB = 5V, DE = 5V
Driver Input to Output	20	30	60	ns	t_{PLH} ; $R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pF$; see figures 3 and 6
					see figures 3 and 6
Driver Input to Output	20	30	60	ns	t_{PHL} ; $R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pF$; see figures 3 and 6
D: 01		_	40		see figures 3 and 6
Driver Skew		5	10	ns	see figures 3 and 6,
Driver Rise or Fall Time	3	15	40	ns	$t_{SKEW} = t_{DPLH} - t_{DPHL} $ From 10% to 90%; $R_{DIFF} = 54\Omega$,
Division to the time		'	10		$C_{} = C_{} = 100 \text{pF}$: see figures 3 and
Driver Enable to Output High		40	70	ns	$C_{L1} = C_{L2} = 100 pF$; see figures 3 and $C_{L1} = C_{L2} = 100 pF$; see figures
. 0					4 and 7: S _a closed
Driver Enable to Output Low		40	70	ns	$C_{L1} = C_{L2} = 100 \text{pF}$; see figures 4 and 7; S_1 closed
Duiver Disable Time from Law		40	70		4 and 7; S ₁ closed
Driver Disable Time from Low		40	70	ns	$C_{L1} = C_{L2} = 100 \text{pF}$; see figures 4 and 7; S_1 closed
Driver Disable Time from High		40	70	ns	$C_{11} = C_{12} = 100 \text{pF}$; see figures
ze. ziodolo riilo irolli riigii		'	'		4 and 7; S ₂ closed
					, 2

 T_{min} to T_{max} and V_{cc} = 5V ± 5% unless otherwise noted.

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP491 RECEIVER					
DC Characteristics					
Differential Input Threshold	-0.2		+0.2	Volts	-7V ≤ V _{CM} ≤ 12V
Input Hysteresis		70		mV	$V_{cM} = 0V$
Output Voltage High	3.5			Volts	$I_0 = -4 \text{mA}, V_{1D} = +200 \text{mV}$
Output Voltage Low			0.4	Volts	$I_{o}^{\text{CM}} = -4\text{mA}, V_{ID} = +200\text{mV}$ $I_{o} = +4\text{mA}, V_{ID} = -200\text{mV}$
Three State (high impedance)					
Output Current	40	4=	±1	μA	$0.4V \le V_0 \le 2.4V$; $\overline{REB} = 5V$
Input Resistance	12	15	.40	kΩ	$-7V \le V_{CM} \le 12V$
Input Current (A, B); V _{IN} = 12V			±1.0 -0.8	mA	DE = 0 V , $V_{\text{cc}} = 0 \text{ V or } 5.25 \text{ V}$, $V_{\text{in}} = 12 \text{ V}$
Input Current (A, B); $V_{IN} = -7V$ Short-Circuit Current	7		-0.6 85	mA mA	DE = 0V, V_{CC}^{CC} = 0V or 5.25V, V_{IN}^{IN} = -7V
Short-Circuit Guitent	'		05	IIIA	$0V \le V_0 \le V_{CC}$
SP491 RECEIVER					
AC Characteristics					
Maximum Data Rate	5			Mbps	REB = 0V
Receiver Input to Output	60	90	150	ns	t_{PLH} ; $R_{DIFF} = 54\Omega$,
					$C_{L1}^{FLR} = C_{L2}^{FR} = 100 \text{pF}$; Figures 3 & 8 t_{PHL} ; $R_{DIFF} = 54\Omega$,
Receiver Input to Output	60	90	150	ns	t_{PHL} ; $R_{DIFF} = 54\Omega$,
Diff Deseiver Skew It t I		13			C _{L1} = C _{L2} = 100pF; Figures 3 & 8
Diff. Receiver Skew It _{PLH} -t _{PHL} I		13		ns	$R_{DIFF}^{C} = 54\Omega; C_{L1} = C_{L2} = 100pF;$ Figures 3 & 8
Receiver Enable to Output Low		20	50	ns	C _{RI} = 15pF; Figures 2 and 9; S ₁ closed
Receiver Enable to Output High		20	50	ns	C_{RI} = 15pF; Figures 2 and 9; S ₂ closed
Receiver Disable from Low		20	50	ns	$C_{RI} = 15pF$; Figures 2 and 9; S_1 closed
Receiver Disable from High		20	50	ns	C _{BI} = 15pF; Figures 2 and 9; S ₂ closed
Š					RL 1 7 G 7 2
POWER REQUIREMENTS					
Supply Voltage	+4.75		+5.25	Volts	
Supply Current		600		μA	$\overline{\text{REB}}$, D = 0V or V_{cc} ; DE = V_{cc}
SP491 ENVIRONMENTAL					
AND MECHANICAL					
Operating Temperature					
Commercial (C_)	0		+70	°C	
Industrial (E_)	-40		+85	°C	
Storage Temperature	-65		+150	°C	
Package Plastic DIP (S)					
NSOIC (N)					
113313 (_11)					

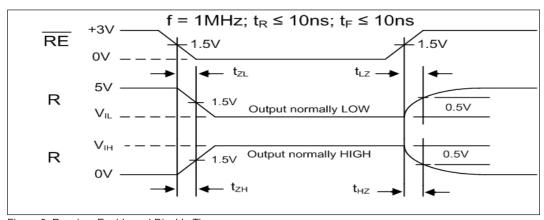


Figure 9. Receiver Enable and Disable Times

Exar Corporation 48720 Kato Road, Fremont CA, 94538 • (510)668-7017 • www.exar.com

DESCRIPTION

The **SP490** and **SP491** are full-duplex differential transceivers that meet the requirements of RS-485 and RS-422. Fabricated with a **Sipex** 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...

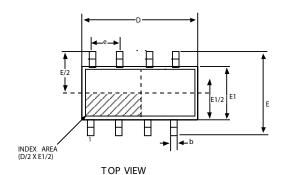
The drivers for both the **SP490** and **SP491** have differential outputs. The typical voltage output swing with no load will be 0 volts to +5 volts. With worst case loading of 54Ω across the differential outputs, the driver can maintain greater than 1.5V voltage levels.

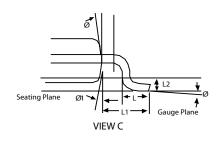
The driver of the **SP491** has a driver enable control line which is active high. A logic high on DE (pin 4) of the **SP491** will enable the differential driver outputs. A logic low on DE (pin 4) of the **SP491** will tri-state the driver outputs. The **SP490** does not have a driver enable.

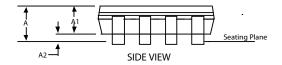
Receiver...

The receivers for both the **SP490** and **SP491** 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 **SP490** and **SP491** 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.

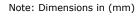
The receiver of the **SP491** has a receiver enable control line which is active low. A logic low on REB (pin 3) of the **SP491** will enable the differential receiver. A logic high on REB (pin 3) of the **SP491** will tri-state the receiver.

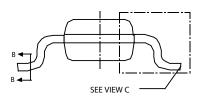


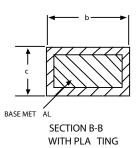


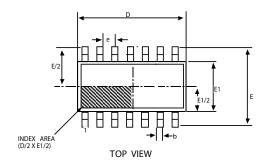


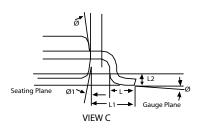
8 Pin NSOIC JEDEC MO-012 (AA) Variation						
SYMBOL	MIN	NOM	MAX			
Α	1.35	-	1.75			
A1	0.1	-	0.25			
A2	1.25	-	1.65			
b	0.31	-	0.51			
С	0.17	-	0.24			
D	4.90 BSC					
E	6.00 BSC					
E1	3.90 BSC					
е	1.27 BSC					
L	0.4	-	1.27			
L1	1.04 REF					
L2	0.25 BSC					
Ø	00 - 80					
α1	50	_	150			

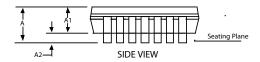






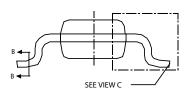


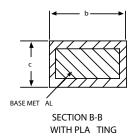


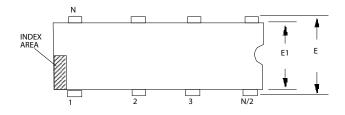


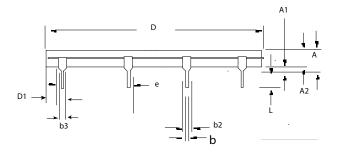
14 Pin NSOIC JEDEC MO-012 (AB) Variation					
SYMBOL	MIN	NOM	MAX		
Α	1.35	-	1.75		
A1	0.1	-	0.25		
A2	1.25	-	1.65		
b	0.31	-	0.51		
С	0.17	-	0.25		
D	8.65 BSC				
E	6.00 BSC				
E1	3.90 BSC				
е		1.27 BSC			
L	0.4	-	1.27		
L1	1.04 REF				
L2	0.25 BSC				
Ø	00	-	80		
ø1	50	-	15°		

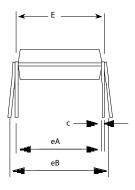


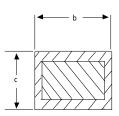






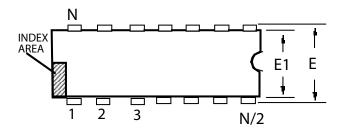


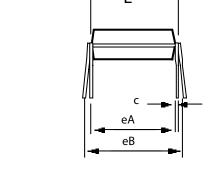




8 PIN PDIP JEDEC MS-001 (BA) Variation					
SYMBOL	MIN	NOM	MAX		
Α	-	-	0.21		
A1	0.15	-	-		
A2	0.115	0.13	0.195		
b	0.014	0.018	0.022		
b2	0.045	0.06	0.07		
b3	0.3	0.039	0.045		
С	0.008	0.01	0.014		
D	0.355	0.365	0.4		
D1	0.005	-	-		
E	0.3	0.31	0.325		
E1	0.24	0.25	0.28		
е	.100 BSC				
eA	.300 BSC				
eВ	_	-	0.43		
L	0.115	0.13	0.15		

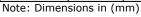
Note: Dimensions in (mm)

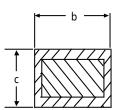




		A1
	D	-
D1	- b2	A A A2

14 PIN PDIP JEDEC MS-001 (AA) Variation					
SYMBOL	MIN	NOM	MAX		
Α	1	-	0.21		
A1	0.15	-	-		
A2	0.115	0.13	0.195		
b	0.014	0.018	0.022		
b2	0.045	0.06	0.07		
b3	0.3	0.039	0.045		
С	0.008	0.01	0.014		
D	0.735	0.75	0.755		
D1	0.005	-	-		
E	0.3	0.31	0.325		
E1	0.24	0.25	0.28		
е	.100 BSC				
eA	.300 BSC				
eB	-	-	0.43		
L	0.115	0.13	0.15		





ORDERING INFORMATION

Model	Temperature Range	Package
SP490CN	0°C to +70°C	8-Pin NSOIC
SP490CN/TR	0°C to +70°C	8-Pin NSOIC
SP490CS	0°C to +70°C	8-Pin PDIP
SP490EN	40°C to +85°C	8-Pin NSOIC
	40°C to +85°C	
SP490ES	40°C to +85°C	8-Pin PDIP
SP491CN	0°C to +70°C	14-Pin NSOIC
SP491CN/TR	0°C to +70°C	14-Pin NSOIC
	0°C to +70°C	
SP491EN	40°C to +85°C	14-Pin NSOIC
SP491EN/TR	-40°C to +85°C	14-Pin NSOIC
SP491ES	-40°C to +85°C	14-Pin PDIP

Available in lead free packaging. To order add "-L" suffix to part number.

Example: SP491CN/TR = standard; SP491CN-L/TR = lead free

/TR = Tape and Reel

Pack quantity is 2500 for NSOIC.

REVISION HISTORY

Date	Revision	Description
02/24/05	-	Sipex Legacy Data Sheet
07/14/08	1.0.0	Convert to Exar format.

Notice

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Datasheet June 2008

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