

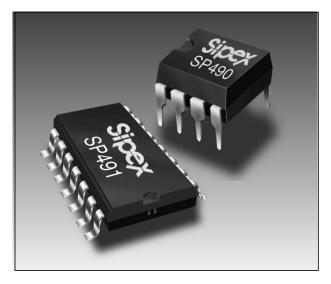
SP490 and SP491

Full Duplex RS-485 Transceivers

FEATURES

- +5V Only
- Low Power BiCMOS
- Driver/Receiver Enable (SP491)
- RS-485 and RS-422 Drivers/Receivers
- Pin Compatible with LTC490 and SN75179 (SP490)
- Pin Compatible with LTC491 and SN75180 (SP491)

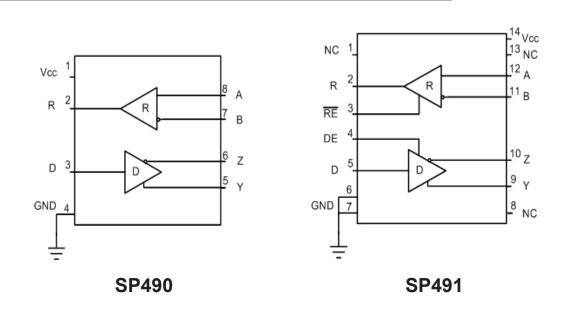
Now Available in Lead Free Packaging



DESCRIPTION

The **SP490** is a low power differential line driver/receiver meeting RS-485 and RS-422 standards up to 5Mbps. The **SP491** is identical to the **SP490** with the addition of driver and receiver tri-state enable lines. Both products feature ±200mV receiver input sensitivity, over wide common mode range. The **SP490** is available in 8-pin plastic DIP and 8-pin NSOIC packages for operation over the commercial and industrial temperature ranges. The **SP491** is available in 14-pin DIP and 14-pin NSOIC packages for operation over the commercial and industrial temperature ranges.





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

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

PARAMETERS MIN. TYP. MAX. UNITS CONDITIONS **SP490 DRIVER DC Characteristics** GND $V_{cc} V_{cc}$ **Differential Output Voltage** Volts Unloaded; $R = \infty$; see figure 1 **Differential Output Voltage** 2 Volts With Load; $R = 50\Omega$; (RS422); see figure 1 $\rm V_{\rm cc}$ **Differential Output Voltage** 1.5 Volts With Load; $R = 27\Omega$; (RS485); see fiaure 1 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 2.0 Input High Voltage Volts Applies to D Applies to D Input Low Voltage 0.8 Volts Applies to D Input Current ±10 μA **Driver Short-Circuit Current** $V_{OUT} = HIGH$ $V_{OUT} = LOW$ $\begin{array}{l} -7V \leq V_{_{\mathrm{O}}} \leq +12V \\ -7V \leq V_{_{\mathrm{O}}} \leq +12V \end{array}$ 35 250 mΑ 35 250 mΑ SP490 DRIVER **AC Characteristics** Maximum Data Rate 5 Mbps $t_{_{\rm PLH};}$ R $_{_{\rm DIFF}}$ = 54 $\Omega,$ C $_{_{\rm L1}}$ = C $_{_{\rm L2}}$ = 100 pF; see figures 3 and 6 Driver Input to Output 30 60 ns $t_{_{PHL}}$; $\vec{R}_{_{DIFF}} = 54\Omega$, $C_{_{L1}} = C_{_{L2}} = 100 \text{pF}$; see figures 3 and 6 Driver Input to Output 30 60 ns Driver Skew see figures 3 and 6. 5 ns Driver Rise or Fall Time 15 40 ns **SP490 RECEIVER DC Characteristics** $-7V \le V_{CM} \le 12V$ $V_{CM} = 0V$ **Differential Input Threshold** 0.2 +0.2 Volts Input Hysteresis 70 mV $\begin{array}{l} V_{CM} = 0V \\ I_{O} = -4mA, V_{ID} = +200mV \\ I_{O} = +4mA, V_{ID} = -200mV \\ -7V \leq V_{CM} \leq 12V \\ V_{IN} = 12V \\ V_{IN} = -7V \\ 0V \leq V_{O} \leq V_{CC} \end{array}$ Output Voltage High 3.5 Volts Output Voltage Low 0.4 Volts Input Resistance 12 15 kΩ Input Current (A, B); $V_{IN} = 12V$ Input Current (A, B); $V_{IN} = -7V$ mΑ ±1.0 -0.8 mΑ Short-Circuit Current 85 mΑ

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ELECTRICAL CHARACTERISTICS

ELECTRICAL CHARACTERISTICS

No T_{MAX} and $V_{cc} = 5V \pm 5\%$ unless other PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP490 RECEIVER	IVIIIN.				CONDITIONS
AC Characteristics					
Maximum Data Rate	5		1	Mbps	
Receiver Input to Output		90	150	ns	$t_{\text{PLH}}; R_{\text{DIFF}} = 54\Omega,$
Receiver Input to Output		90	150	ns	$\begin{array}{l} C_{L1} = C_{L2} = 100 \text{pF}; \ \textit{Figures 3 \& 8} \\ t_{\text{PHL}}; \ R_{\text{DIFF}} = 54\Omega, \\ C_{L1} = C_{L2} = 100 \text{pF}; \ \textit{Figures 3 \& 8} \\ R_{\text{DIFF}} = 54\Omega; \ C_{L1} = C_{L2} = 100 \text{pF}; \\ \textit{Figures 3 \& 8} \end{array}$
Diff. Receiver Skew $It_{_{PLH}}-t_{_{PHL}}I$		13		ns	
POWER REQUIREMENTS					
Supply Voltage	+4.75	000	+5.25	Volts	
Supply Current		900		μA	
ENVIRONMENTAL AND MECHANICAL Operating Temperature Commercial (C_) Industrial (E_) Storage Temperature Package Plastic DIP (_S) NSOIC (_N)	0 -40 -65		+70 +85 +150	သံသံ	

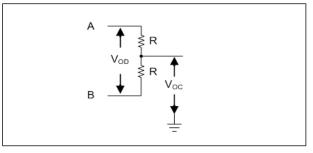


Figure 1. Driver DC Test Load Circuit

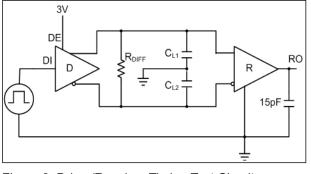


Figure 3. Driver/Receiver Timing Test Circuit

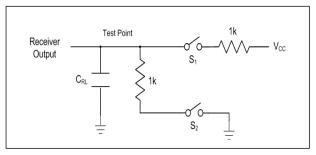


Figure 2. Receiver Timing Test Load Circuit

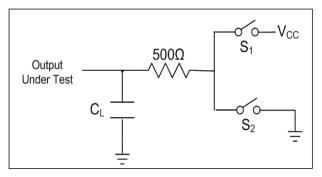


Figure 4. Driver Timing Test Load #2 Circuit

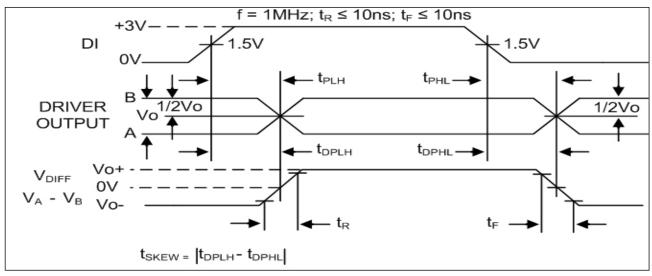


Figure 6. Driver Propagation Delays

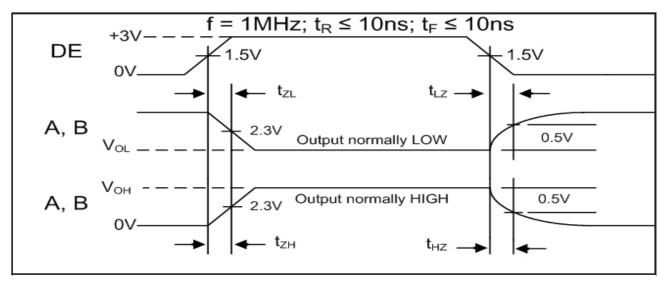


Figure 7. Driver Enable and Disable Times

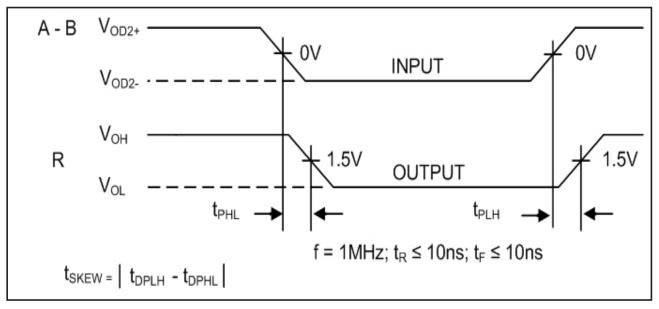


Figure 8. Receiver Propagation Delays

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

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

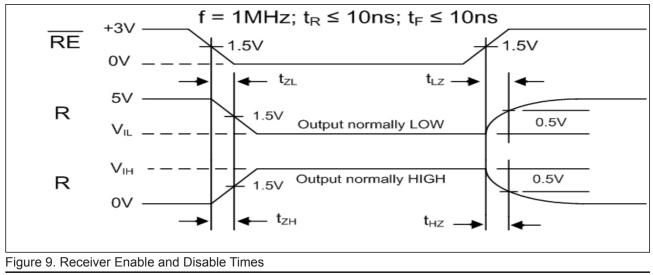
PARAMETERS MIN. TYP. MAX. UNITS CONDITIONS SP491 DRIVER **DC Characteristics** V_{cc} V_{cc} GND Volts **Differential Output Voltage** Unloaded; $R = \infty$; see figure 1 **Differential Output Voltage** Volts With Load; $R = 50\Omega$; (RS422); 2 see figure 1 $\rm V_{cc}$ **Differential Output Voltage** 1.5 Volts With Load; $R = 27\Omega$; (RS485); see figure 1 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 Applies to D, REB, DE Input High Voltage 2.0 Volts Input Low Voltage 0.8 Volts Applies to D, REB, DE Input Current Applies to D, REB, DE ±10 μΑ **Driver Short-Circuit Current** $V_{OUT} = HIGH$ $V_{OUT} = LOW$ 35 250 $\begin{array}{l} -7 \mathsf{V} \leq \mathsf{V}_{_{\mathrm{O}}} \leq 12 \mathsf{V} \\ -7 \mathsf{V} \leq \mathsf{V}_{_{\mathrm{O}}} \leq 12 \mathsf{V} \end{array}$ mΑ 35 250 mΑ SP491 DRIVER **AC Characteristics** REB = 5V, DE = 5VMaximum Data Rate 5 Mbps $t_{_{PLH};}$ R $_{_{DIFF}}$ = 54 $\Omega,$ C $_{_{L1}}$ = C $_{_{L2}}$ = 100 pF; see figures 3 and 6 20 Driver Input to Output 30 60 ns t_{PHL} ; $R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100 pF$; see figures 3 and 6 Driver Input to Output 20 30 60 ns Driver Skew 5 10 ns see figures 3 and 6, see ligures 3 and 6, $t_{SKEW} = |t_{DPLH} - t_{DPHL}|$ From 10% to 90%; $R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100$ pF; see figures 3 and 6 $C_{L1} = C_{L2} = 100$ pF; see figures 4 and 7; S_2 closed $C_{L1} = C_{L2} = 100$ pF; see figures 4 and 7; S_1 closed $C_{L1} = C_{L2} = 100$ pF; see figures Driver Rise or Fall Time 3 15 40 ns Driver Enable to Output High 70 40 ns Driver Enable to Output Low 40 70 ns $C_{L1} = C_{L2} = 100 \text{pF}$; see figures 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_2 closed Driver Disable Time from High 40 70 ns

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ELECTRICAL CHARACTERISTICS

- ELECTRICAL CHARACTERISTICS

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	$V_{\rm CM} = 0V$
Output Voltage High	3.5			Volts	I _o = -4mA, V _{ID} = +200mV
Output Voltage Low			0.4	Volts	I _o = +4mA, V _{ID} = -200mV
Three State (high impedance)					
Output Current			±1	μA	$0.4V \le V_0 \le 2.4V; \overline{\text{REB}} = 5V$
Input Resistance	12	15		kΩ	-7V ≤ V _{CM} ≤ 12V
Input Current (A, B); $V_{IN} = 12V$			±1.0	mA	$\begin{array}{l} DE = 0V, V_{\rm cc} = 0V \text{ or } 5.25V, V_{\rm IN} = 12V \\ DE = 0V, V_{\rm cc} = 0V \text{ or } 5.25V, V_{\rm IN} = -7V \\ 0V \le V_{\rm o} \le V_{\rm cc} \end{array}$
Input Current (A, B); $V_{IN} = -7V$	_		-0.8	mA	DE = 0V, V_{cc} = 0V or 5.25V, V_{IN} = -7V
Short-Circuit Current	7		85	mA	$0V \le V_0 \le V_{cc}$
SP491 RECEIVER					
AC Characteristics					
Maximum Data Rate	5			Mbps	$\overline{REB} = 0V$
Receiver Input to Output	60	90	150	ns	
	00	30	150	115	$t_{PLH}; R_{DIFF} = 54\Omega, C_{L1} = C_{L2} = 100 pF; Figures 3 & 8$
Receiver Input to Output	60	90	150	ns	t = R = 540
		00	100	110	$t_{PHL}^{L1}; R_{DIFF}^{L2} = 54\Omega, C_{L1} = C_{L2}^{-1} = 100 \text{pF}; \text{ Figures 3 \& 8}$
Diff. Receiver Skew It _{PIH} -t _{PHI} I		13		ns	$R_{\text{DIFF}} = 54\Omega; C_{L1} = C_{L2} = 100\text{pF};$
DIM: NOCONVOL OKOW NPLH (PHL)		10			Figures 3 & 8
Receiver Enable to Output Low		20	50	ns	$C_{RI} = 15 pF$; Figures 2 and 9; S ₁ close
Receiver Enable to Output High		20	50	ns	C_{RL}^{RL} = 15pF; Figures 2 and 9; S ₂ close
Receiver Disable from Low		20	50	ns	C_{RL}^{RL} = 15pF; Figures 2 and 9; S ₁ ² close
Receiver Disable from High		20	50	ns	C_{RI}^{RL} = 15pF; Figures 2 and 9; S ₂ close
6					KL I V G V Z
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				P	,
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)					



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...

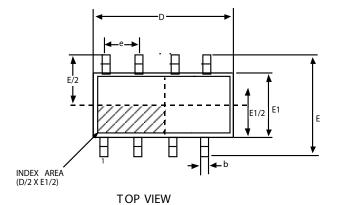
The drivers for both the **SP490** and **SP491** have differential outputs. The typical voltage output swing with no load will be 0 volts to +5 volts. With worst case loading of 54Ω across the differential outputs, the driver can maintain greater than 1.5V voltage levels.

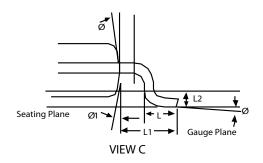
The driver of the **SP491** has a driver enable control line which is active high. A logic high on DE (pin 4) of the **SP491** will enable the differential driver outputs. A logic low on DE (pin 4) of the **SP491** will tri-state the driver outputs. The **SP490** does not have a driver enable.

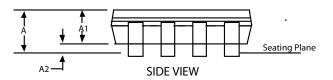
Receiver...

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.

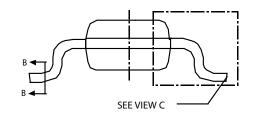


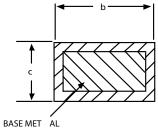




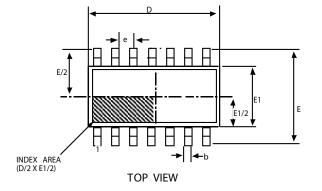
8 Pin NSOIC JEDEC MO-012 (AA) Variation				
SYMBOL	MIN	NOM	MAX	
A	1.35	-	1.75	
A1	0.1	-	0.25	
A2	1.25	-	1.65	
b	0.31	-	0.51	
С	0.17	-	0.24	
D	4.90 BSC			
E	6.00 BSC			
E1	3.90 BSC			
е	1.27 BSC			
L	0.4	-	1.27	
L1	1.04 REF			
L2	0.25 BSC			
Ø	00	-	8º	
ø1	5٥	-	15°	

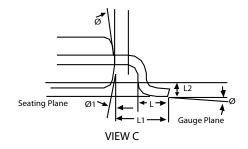
Note: Dimensions in (mm)

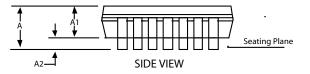




SECTION B-B WITH PLA TING

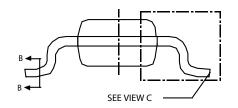


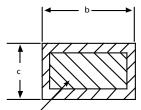




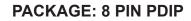
14 Pin NSOIC JEDEC MO-012 (AB) Variation				
SYMBOL	MIN NOM MAX			
		NOM		
A	1.35	-	1.75	
A1	0.1	-	0.25	
A2	1.25	-	1.65	
b	0.31	-	0.51	
с	0.17	-	0.25	
D	8.65 BSC			
E	6.00 BSC			
E1	3.90 BSC			
e	1.27 BSC			
L	0.4	-	1.27	
L1	1.04 REF			
L2	0.25 BSC			
Ø	00	-	8º	
ø1	50	-	15°	

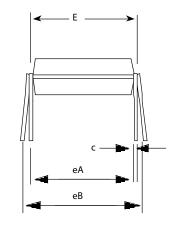
Note: Dimensions in (mm)

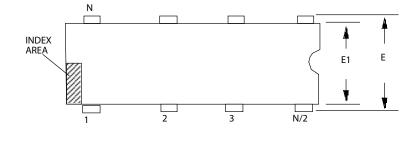


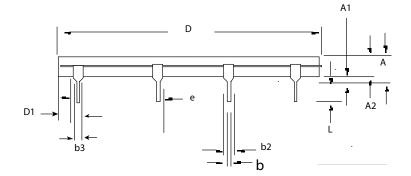


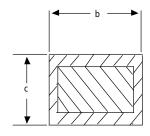
BASE MET ÁL SECTION B-B WITH PLA TING





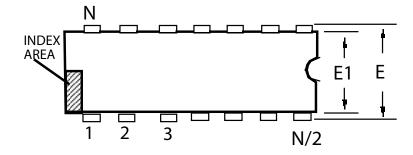


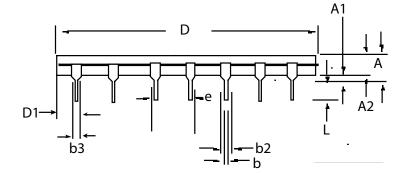


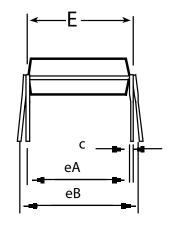


8 PIN PDIP JEDEC MS-001 (BA) Variation					
SYMBOL	MIN	NOM	MAX		
A	-	-	0.21		
A1	0.15	-	-		
A2	0.115	0.13	0.195		
b	0.014	0.018	0.022		
b2	0.045	0.06	0.07		
b3	0.3	0.039	0.045		
с	0.008	0.01	0.014		
D	0.355	0.365	0.4		
D1	0.005	-	-		
E	0.3	0.31	0.325		
E1	0.24	0.25	0.28		
e		.100 BSC			
eA	.300 BSC				
eB	-	-	0.43		
L	0.115	0.13	0.15		
Note: Dimensions in (mm)					

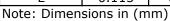
Note: Dimensions in (mm)

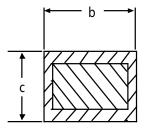






14 PIN PDIP JEDEC MS-001 (AA) Variation				
SYMBOL	MIN	NOM	MAX	
А	-	-	0.21	
A1	0.15	-	-	
A2	0.115	0.13	0.195	
b	0.014	0.018	0.022	
b2	0.045	0.06	0.07	
b3	0.3	0.039	0.045	
с	0.008	0.01	0.014	
D	0.735	0.75	0.755	
D1	0.005	-	-	
E	0.3	0.31	0.325	
E1	0.24	0.25	0.28	
е	.100 BSC			
eA		.300 BSC		
eB	-	-	0.43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





ORDERING INFORMATION

Model	Temperature Range	Package
SP490CN	0°C to +70°C	
SP490CN/TR	0°C to +70°C	
SP490CS	0°C to +70°C	8-Pin PDIP
SP490EN	40°C to +85°C	
	40°C to +85°C	
SP490ES	-40°C to +85°C	
SP491CN	0°C to +70°C	
SP491CN/TR	0°C to +70°C	
SP491CS	0°C to +70°C	
SP491EN	-40°C to +85°C	
SP491EN/TR	40°C to +85°C	
SP491ES	-40°C to +85°C	

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

EXAR Corporation reserves the right to make changes to any products contained in this publication in order to improve design, performance or reliability. EXAR Corporation assumes no representation that the circuits are free of patent infringement. Charts and schedules contained herein are only for illustration purposes and may vary depending upon a user's specific application. While the information in this publication has been carefully checked; no responsibility, however, is assumed for inaccuracies.

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Datasheet June 2008

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