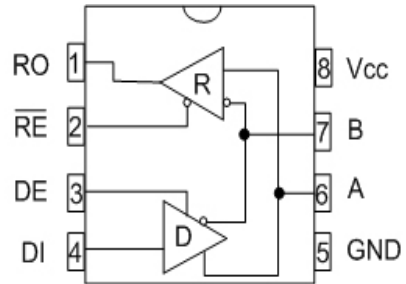


# 1/10th Unit Load RS-485 Transceiver

## FEATURES

- Allows Over 400 Transceivers On A Transmission Line (1/10th Unit Load)
- High Impedance on Receiver Inputs ( $R_{IN} = 150k\Omega$  typical)
- Half-Duplex Configuration Consistent With Industry Standard Pinout
- -7V to +12V Common Mode Input Voltage Range
- Low Power Consumption (250mW)
- Separate Driver and Receiver Enable



SP485R  
Pinout (Top View)

## DESCRIPTION

The **SP485R** is a pin-to-pin equivalent to our existing SP485 product and offers a high receiver input impedance. The higher receiver input impedance allows for connecting over 400 transceivers on a single transmission line without degrading the RS-485 driver signal. The device is packaged in a 8-pin plastic DIP or 8-pin narrow SOIC.

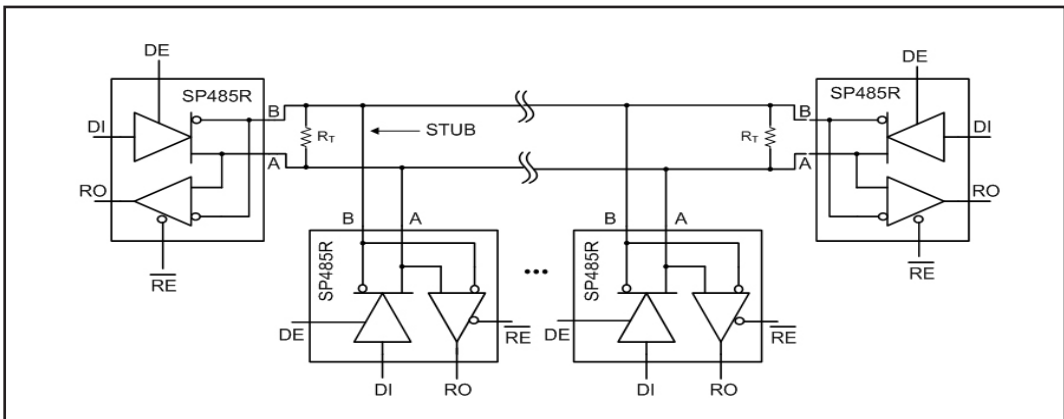


Figure 1. Typical Application Circuit

## 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  
Storage Temperature.....-65°C to +150°C

Power Dissipation  
8-pin NSOIC.....1000mW  
( $\theta_{JA} = 62^\circ\text{C/W}$ )  
8-pin PDIP.....1000mW  
( $\theta_{JA} = 62^\circ\text{C/W}$ )

## ELECTRICAL CHARACTERISTICS

Typically 25°C @  $V_{CC} = +5V$  unless otherwise noted.

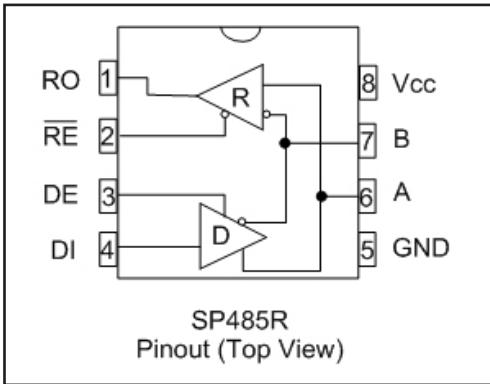
PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
<b>LOGIC INPUTS</b>					
$V_{IL}$			0.8	Volts	
$V_{IH}$	2.0			Volts	
<b>LOGIC OUTPUTS</b>					
$V_{OL}$			0.4	Volts	$I_{OUT} = -3.2\text{mA}$
$V_{OH}$	2.4			Volts	$I_{OUT} = 1.0\text{mA}$
<b>RS-485 DRIVER DC Characteristics</b>					
Open Circuit Voltage			6.0	Volts	
Differential Output Voltage	1.5		5.0	Volts	$R_L = 54\Omega, C_L = 50\text{pF}$
Balance			+/-0.2	Volts	$ V_T  -  \overline{V_T} $
Common-Mode Output			3.0	Volts	
Output Current	28.0			mA	$R_L = 54\Omega$
Short Circuit Current			+/-250	mA	Terminated in -7V to +12V
<b>RS-485 DRIVER AC Characteristics</b>					
Maximum Data Rate	5			Mbps	$R_L = 54\Omega,$
Output Transition Time		30		ns	Rise/fall time, 10% to 90%
Propagation Delay, $t_{PLH}$		60	100	ns	See Figures 4 & 6, $R_{DIFF} = 54\Omega,$ $C_{L1} = C_{L2} = 100\text{pF}$
Propagation Delay, $t_{PHL}$		60	100	ns	See Figures 4 & 6, $R_{DIFF} = 54\Omega,$ $C_{L1} = C_{L2} = 100\text{pF}$
Driver Output Skew		5	15	ns	see Figures 4 and 6, $t_{SKEW} =  t_{DPHL} - t_{DPLH} $
<b>RS-485 RECEIVER DC Characteristics</b>					
Output Voltage Low, $V_{OL}$			0.4	Volts	
Output Voltage High, $V_{OH}$	2.4			Volts	
Tri-State Output Current			+/-1	$\mu\text{A}$	$0.4V \leq V_{OUT} \leq 2.4V; \overline{RE} = V_{CC}$

## ELECTRICAL CHARACTERISTICS

Typically 25°C @ V<sub>CC</sub> = +5V unless otherwise noted.

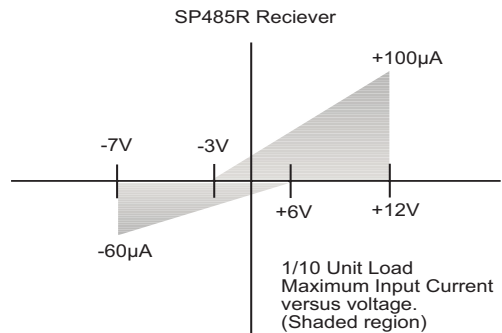
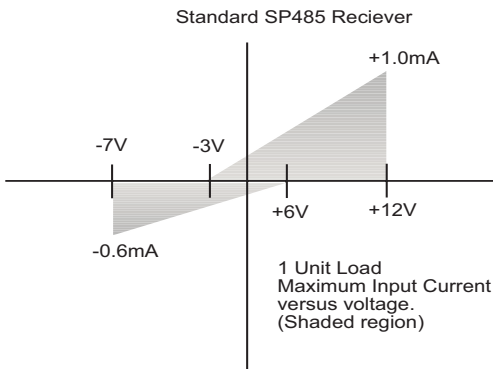
PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
<b>RS-485 RECEIVER DC Characteristics (continued)</b>					
Common Mode Range	-7.0		+12.0	Volts	
Receiver Sensitivity			+/-0.2	Volts	-7V ≤ V <sub>CM</sub> ≤ +12V
Input Impedance	120	150		kΩ	-7V ≤ V <sub>CM</sub> ≤ +12V
<b>RS-485 RECEIVER AC Characteristics</b>					
Maximum Data Rate	1			Mbps	
Propagation Delay; t <sub>PHL</sub>			1200	ns	See Figures 4 & 8, R <sub>DIFF</sub> = 54Ω, C <sub>L1</sub> = C <sub>L2</sub> = 100pF
Propagation Delay; t <sub>PLH</sub>			1200	ns	See Figures 4 & 8, R <sub>DIFF</sub> = 54Ω, C <sub>L1</sub> = C <sub>L2</sub> = 100pF
Differential Receiver Skew		60		ns	See Figures 4 & 8, R <sub>DIFF</sub> = 54Ω, C <sub>L1</sub> = C <sub>L2</sub> = 100pF, t <sub>SKEW</sub> =  t <sub>PHL</sub> - t <sub>PLH</sub>
<b>RS-485 DRIVER Enable / Disable Time</b>					
Driver Enable to Output Low		40	500	ns	C <sub>L</sub> = 15pF, see Figures 5 and 7, S <sub>1</sub> closed
Driver Enable to Output High		40	500	ns	C <sub>L</sub> = 15pF, see Figures 5 and 7, S <sub>2</sub> closed
Driver Disable Time from Low		40	500	ns	C <sub>L</sub> = 15pF, see Figures 5 and 7, S <sub>1</sub> closed
Driver Disable Time from High		40	500	ns	C <sub>L</sub> = 15pF, see Figures 5 and 7, S <sub>2</sub> closed
<b>RS-485 RECEIVER Enable / Disable Time</b>					
Receiver Enable to Output Low		40	500	ns	C <sub>L</sub> = 15pF, see Figures 3 and 9, S <sub>1</sub> closed
Receiver Enable to Output High		40	500	ns	C <sub>L</sub> = 15pF, see Figures 3 and 9, S <sub>2</sub> closed
Receiver Disable from Low		40	500	ns	C <sub>L</sub> = 15pF, see Figures 3 and 9, S <sub>1</sub> closed
Receiver Disable from High		40	500	ns	C <sub>L</sub> = 15pF, see Figures 3 and 9, S <sub>1</sub> closed
<b>POWER REQUIREMENTS</b>					
Supply Voltage V <sub>CC</sub>	+4.75		+5.25	Volts	
Supply Current I <sub>CC</sub> , No Load		300	500	μA	$\overline{RE} = V_{CC}$ or 0V, DE = 0V
Supply Current I <sub>CC</sub> , No Load		500	900	μA	$\overline{RE} = V_{CC}$ or 0V, DE = V <sub>CC</sub>
<b>ENVIRONMENTAL</b>					
Operating Temperature					
Commercial (..C..)	0		+70	°C	
Industrial (..E..)	-40		+85	°C	
Storage Temperature	-65		+150	°C	

## PIN FUNCTION



- 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  $4.75V \leq V_{CC} \leq 5.25V$

## RECEIVER INPUT GRAPH



## TEST CIRCUITS

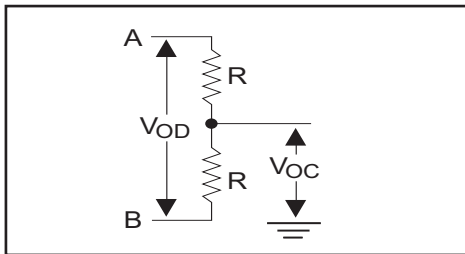


Figure 2. Driver DC Test Load Circuit

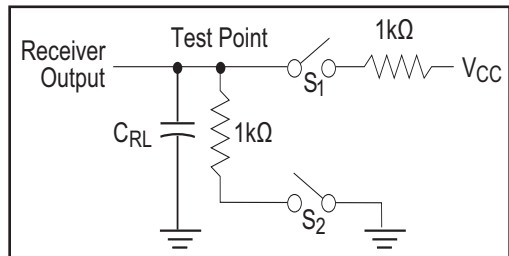


Figure 3. Receiver Timing Test Load Circuit

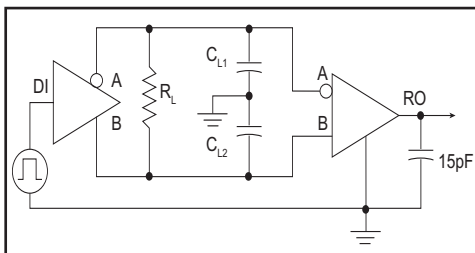


Figure 4. RS-485 Driver/Receiver Timing Test

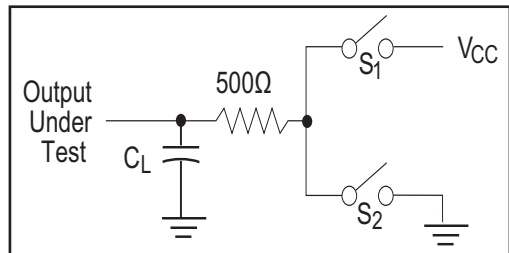


Figure 5. Driver Timing Test Load #2 Circuit

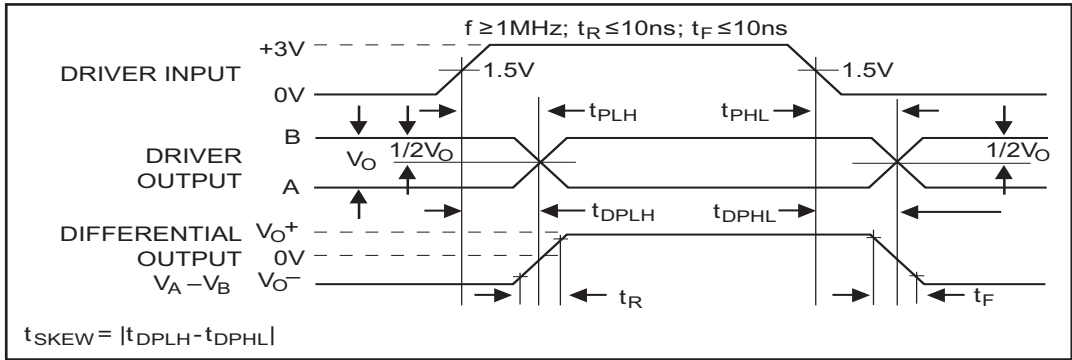


Figure 6. Driver Propagation Delays

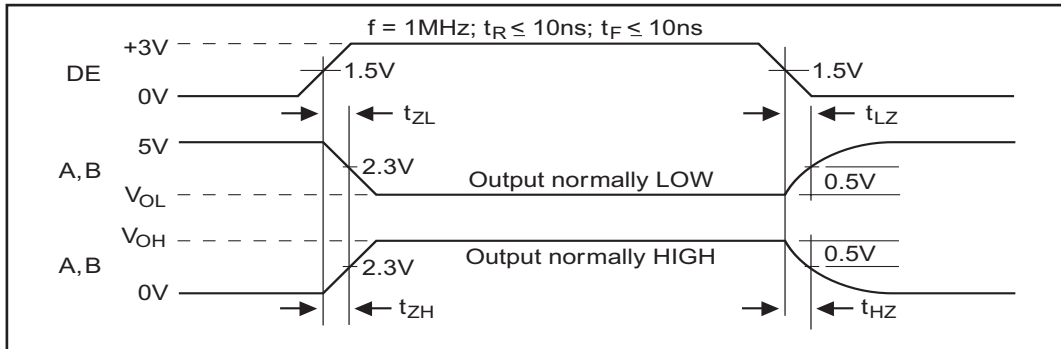


Figure 7. Driver Enable and Disable Times

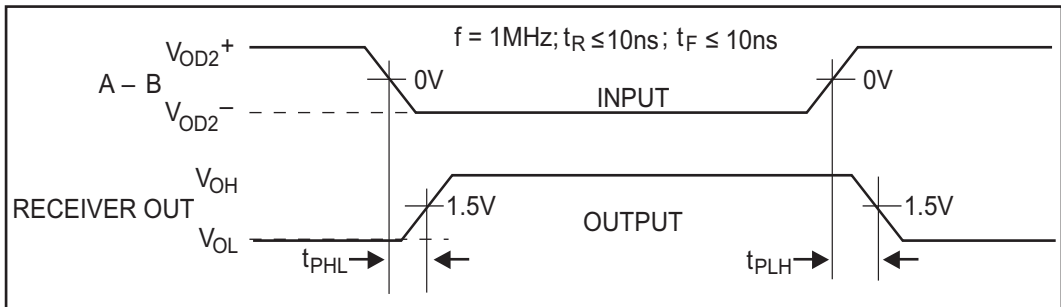


Figure 8. Receiver Propagation Delays

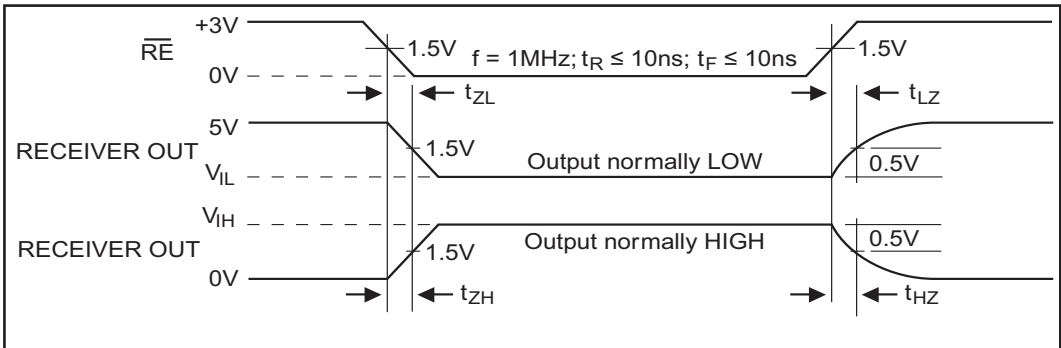


Figure 9. Receiver Enable and Disable Times

The **SP485R** is a low power RS-485 differential transceiver. Similar to the SP485, the **SP485R** contains a half-duplex driver and receiver with tri-state control. However, the **SP485R** is intended for increased connections on a single bus compared to the original RS-485 specification.

The RS-485 standard is ideal for multi-drop applications where one bus can contain many drivers and/or receivers. The RS-485 standard implementation allows up to 32 transceivers to be connected on to the data bus. RS-485 is also specified for driving higher speeds over long cable lengths of up to 4000 feet. The **SP485R** exceeds the standard by allowing up to 400 receivers to share the bus

## **DRIVERS**

The driver output complies with the RS-485 electrical characteristics as specified by the standard. The output swings from 0V to Vcc and maintains greater than +1.5V with a 54Ω load attached between the two outputs. In adhering to the RS-485 specification, the driver outputs inherently comply with the RS-422 standard. With a load of 100Ω between the two outputs, the driver can sustain at least +2.0V.

The driver contains an enable pin (DE) which tri-states the output when DE is logic LOW. The outputs during the tri-state condition are at high impedance (>100kΩ). A logic HIGH enables the driver for normal operation. The driver can operate to at least 5Mbps.

## **RECEIVERS**

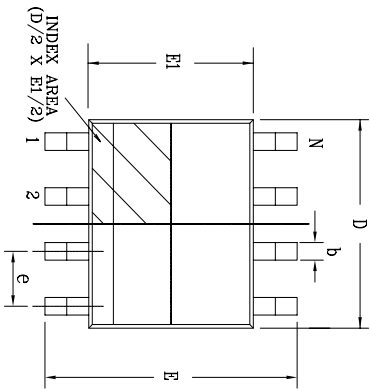
The **SP485R** receiver has differential inputs with an input sensitivity of lower than ±200mV. As mentioned above, the RS-485 specification allows up to 32 transceivers on the same bus. The **SP485R** allows over 400 transceivers on the same bus due to its high impedance of at least 120kΩ. This higher capacity allows more components to be attached to the same bus without degrading the signal quality. The drivers are still able to drive an equivalent 54Ω from the 320

transceivers with an input impedance of at least 120kΩ in parallel along with the two 125Ω cable termination resistors on each end.

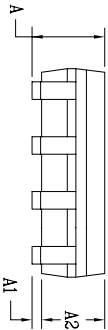
The receiver contains an enable pin ( $\overline{RE}$ ) which enables the receiver when a logic LOW is asserted. A logic HIGH will tri-state the receiver output and the inputs will maintain at least 120kΩ impedance. The receiver can operate to at least 1Mbps

The receiver also contains a fail-safe feature which outputs a logic HIGH when the inputs are open as in a disconnected cable.

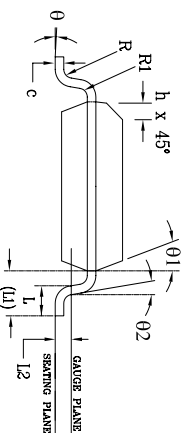
REVISION HISTORY			
REV	DESCRIPTION	DATE	APP'D
A	DRAWING ORIGINATION	08/16/05	JL
B	DRAWING FORMAT MODIFICATION	07/19/06	JL
C	CHANGE DRAWING LOGO AND COMPANY NAME	11/16/07	JL



Top View




Side View

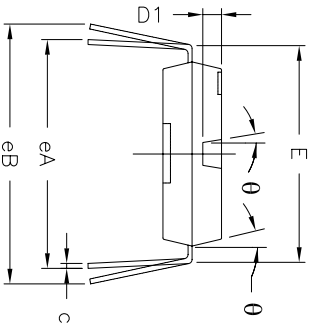
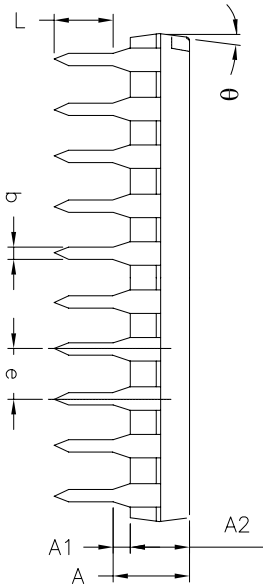
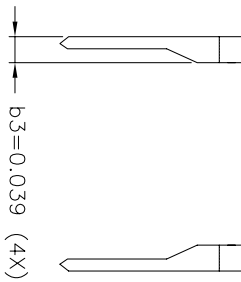
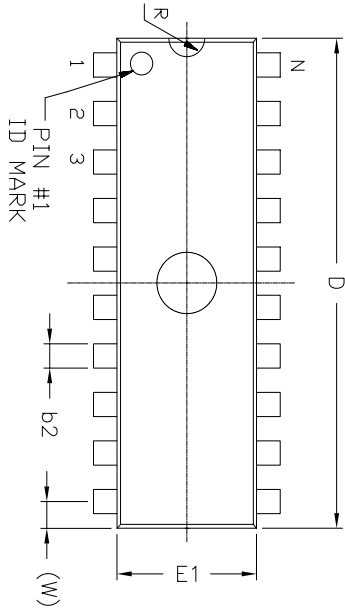


Front View

8 Pin SOICN JEDEC MS-012 Variation AA		DIMENSIONS IN MM (Control Unit)				DIMENSIONS IN INCH (Reference Unit)			
SYMBOLS		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	—	—	—		
theta	0°	—	—	8°	—	—	—		
theta1	5°	—	—	15°	—	—	—		
theta2	0°	—	—	0°	—	—	—		
D	4.90 BSC	—	—	0.193 BSC	—	—	—		
N	8	—	—	8	—	—	—		

		<b>EXAR CORPORATION</b> EXAR CORPORATION 8 PIN SOICN PACKAGE OUTLINE	
By: JL	Date: 11/16/07	Revision: C	Sheet: 1 OF 1

REMARKS:  
FOR 8LD AND 16LD  
ALL END LEADS (4X)  
ARE HALF LEAD TYPES



8 Pin PDIP JEDEC MS-001 Variation BA		DIMENSIONS IN INCH (Control Unit)				DIMENSIONS IN MM (Reference Unit)			
SYMBOLS	MIN	NOM	MAX	MIN	NOM	MAX			
A	—	—	0.210	—	—	5.33			
A1	0.015	—	—	0.38	—	—			
A2	0.115	0.130	0.195	2.92	3.30	4.95			
b	0.014	0.018	0.022	0.36	0.46	0.56			
b2	0.045	0.060	0.070	1.14	1.52	1.78			
c	0.008	0.010	0.014	0.20	0.25	0.36			
D1	0.030	—	0.060	0.76	—	1.52			
E	0.300	0.310	0.325	7.62	7.87	8.26			
E1	0.240	0.250	0.280	6.10	6.35	7.11			
e	—	—	—	—	—	2.54 BSC			
eA	—	—	—	—	—	7.62 BSC			
eB	—	—	0.430	—	—	10.92			
L	0.115	0.130	0.150	2.92	3.30	3.81			
W	—	—	—	0.075 REF	—	1.91 REF			
R	—	—	—	0.030 BSC	—	0.76 BSC			
theta	4°	7°	10°	—	—	—			
D	0.355	0.365	0.400	9.02	9.27	10.16			
N	8			8					

8-pin PDIP version is obsolete

REVISION HISTORY			
REV.	DESCRIPTION	DATE	APP'D
A	DRAWING ORIGINATION	04/26/06	JL
B	CHANGE DRAWING LOGO AND COMPANY NAME	11/28/07	JL

Side View

Front View

		<b>EXAR CORPORATION</b> Packaging Approval:	
By: JL	Date: 11/28/07	Revision: B	Sheet: 1 OF 1



## ORDERING INFORMATION<sup>(1), (3)</sup>

PART NUMBER	TEMPERATURE RANGE	PACKAGE	PACKAGING METHOD	LEAD-FREE <sup>(2)</sup>
SP485RCN-L/TR	0°C to 70°C	8-pin NSOIC	Tape and Reel	Yes
SP485REN-L/TR	-40°C to 85°C	8-pin NSOIC	Tape and Reel	Yes

### NOTES:

1. Refer to [www.maxlinear.com/SP485R](http://www.maxlinear.com/SP485R) for most up to date Ordering Information.
2. Visit [www.maxlinear.com](http://www.maxlinear.com) for additional information on Environmental Rating.
3. 8-pin PDIP version is obsolete.

## REVISION HISTORY

DATE	REVISION	DESCRIPTION
06/21/04	--	Legacy Sipex Datasheet
07/23/09	1.0.0	Convert to Exar Format. Update ordering information as a result of discontinued Lead type package options per PDN 081126-01. Remove all reference to the discontinued SP481R.
01/30/20	1.0.1	Update to MaxLinear logo. Update ordering information.



MaxLinear, Inc.  
5966 La Place Court, Suite 100  
Carlsbad, CA 92008  
760.692.0711 p.  
760.444.8598 f.  
[www.maxlinear.com](http://www.maxlinear.com)

The content of this document is furnished for informational use only, is subject to change without notice, and should not be construed as a commitment by MaxLinear, Inc. MaxLinear, Inc. assumes no responsibility or liability for any errors or inaccuracies that may appear in the informational content contained in this guide. Complying with all applicable copyright laws is the responsibility of the user. Without limiting the rights under copyright, no part of this document may be reproduced into, stored in, or introduced into a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise), or for any purpose, without the express written permission of MaxLinear, Inc.

MaxLinear, Inc. does not recommend the use of any of its products in life support applications where the failure or malfunction of the product can reasonably be expected to cause failure of the life support system or to significantly affect its safety or effectiveness. Products are not authorized for use in such applications unless MaxLinear, Inc. receives, in writing, assurances to its satisfaction that: (a) the risk of injury or damage has been minimized; (b) the user assumes all such risks; (c) potential liability of MaxLinear, Inc. is adequately protected under the circumstances.

MaxLinear, Inc. may have patents, patent applications, trademarks, copyrights, or other intellectual property rights covering subject matter in this document. Except as expressly provided in any written license agreement from MaxLinear, Inc., the furnishing of this document does not give you any license to these patents, trademarks, copyrights, or other intellectual property.

MaxLinear, the MaxLinear logo, and any MaxLinear trademarks, MxL, Full-Spectrum Capture, FSC, G.now, AirPHY and the MaxLinear logo are all on the products sold, are all trademarks of MaxLinear, Inc. or one of MaxLinear's subsidiaries in the U.S.A. and other countries. All rights reserved. Other company trademarks and product names appearing herein are the property of their respective owners.

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[MaxLinear:](#)

[SP485REN-L](#) [SP485RCN-L](#) [SP485REN-L/TR](#) [SP485RCN-L/TR](#)