

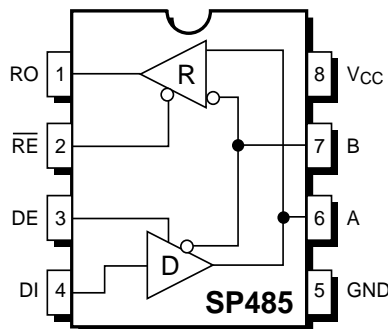
## High-Fanout RS-485 Transceiver

- Allows Over 400 Transceivers On A Transmission Line
- High Impedance on Receiver Inputs ( $R_{IN} = 150k\Omega$  typical)
- Half-Duplex Configuration Consistant With Industry Standard Pinout
- -7V to +12V Common Mode Input Voltage Range
- Includes Shutdown Mode ( $I_{CC} < 10\mu A$ ) (For SP481R Only)
- Low Power Consumption (250mW)
- Separate Driver and Receiver Enable



### DESCRIPTION...

The **SP481R** and **SP485R** are our newest members of **Sipex's** RS-485 family. The **SP481R** and **SP485R** are pin-to-pin equivalent with our existing SP485 product and contain enhancements such as higher ESD tolerance and 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. Each device is packaged in an 8-pin plastic DIP or 8-pin narrow SOIC package. The **SP481R** offers a shutdown feature via the enable pins which will reduce the supply current ( $I_{CC}$ ) below  $1\mu A$  typical.



Top View

## 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 Plastic DIP.....1000mW  
     8-pin Plastic N-SOIC.....1000mW

Package Derating:

8-pin Plastic DIP

$\theta_{JA}$ .....62°C/W

8-pin Plastic N-SOIC

$\theta_{JA}$ .....62°C/W

## SPECIFICATIONS

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

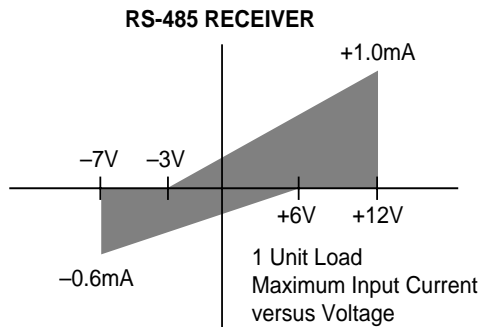
	MIN.	TYP.	MAX.	UNITS	CONDITIONS
<b>LOGIC INPUTS</b>					
$V_{IL}$			0.8	Volts	
$V_{IH}$	2.0			Volts	
<b>LOGIC OUTPUTS</b>					
$V_{OL}$			0.4	Volts	$I_{OUT} = -3.2mA$
$V_{OH}$	2.4			Volts	$I_{OUT} = 1.0mA$
<b>RS-485 DRIVER</b>					
<b>DC Characteristics</b>					
TTL Input Levels					
$V_{IL}$			0.8	Volts	
$V_{IH}$	2.0			Volts	
Outputs					
Open Circuit Voltage			6.0	Volts	
Differential Output	1.5		5.0	Volts	$R_L = 54\Omega, C_L = 50pF$
Balance			$\pm 0.2$	Volts	$ V_+  -  V_- $
Common-Mode Output			3.0	Volts	
Output Current	28.0			mA	$R_L = 54\Omega$
Short Circuit Current			$\pm 250$	mA	Terminated in -7V to +12V
<b>AC Characteristics</b>					
Maximum Data Rate	5			Mbps	$R_L = 54\Omega$
Output Transition Time		30		ns	Rise/fall time, 10%–90%
Propagation Delay					See Figures 3 and 5
$t_{PHL}$		60	100	ns	$R_{DIFF} = 54\Omega, C_{L1} = C_{L2} = 100pF$
$t_{PLH}$		60	100	ns	$R_{DIFF} = 54\Omega, C_{L1} = C_{L2} = 100pF$
Driver Output Skew		5	15	ns	see Figure 3 and 5, $t_{SKEW} =  t_{DPLH} - t_{DPLH} $
<b>RS-485 RECEIVER</b>					
<b>DC Characteristics</b>					
TTL Output Levels					
$V_{OL}$			0.4	Volts	
$V_{OH}$	2.4			Volts	
Tri-State Output Current			$\pm 1$	$\mu A$	$0.4V \leq V_{OUT} \leq 2.4V; \overline{RE} = V_{CC}$
Inputs					
Common Mode Range	-7.0		+12.0	Volts	
Receiver Sensitivity			$\pm 0.2$	Volts	$-7V \leq V_{CM} \leq +12V$
Input Impedance	120	150		k $\Omega$	$-7V \leq V_{CM} \leq +12V$

# SPECIFICATIONS

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

	MIN.	TYP.	MAX.	UNITS	CONDITIONS
<b>AC Characteristics</b> Maximum Data Rate Propagation Delay $t_{PHL}$ $t_{PLH}$ Differential Receiver Skew	1		1200 1200	Mbps ns ns	See Figures 3 and 7 $R_{DIFF}=54\Omega$ , $C_{L1}=C_{L2}=100pF$ $R_{DIFF}=54\Omega$ , $C_{L1}=C_{L2}=100pF$ $ t_{PLH} - t_{PHL} $ ; $R_{DIFF}=54\Omega$ , $C_{L1}=C_{L2}=100pF$ , see Figures 3 and 7
<b>SHUTDOWN TIMING (SP481R)</b> Time to Shutdown <b>RS-485 Driver</b> Enable Time Enable to Low Enable to High Disable Time Disable From Low Disable From High <b>RS-485 Receiver</b> Enable Time Enable to Low Enable to High Disable Time Disable From Low Disable From High	50		600	ns	$\overline{RE} = V_{CC}$ , $DE = 0V$  See Figures 4 and 6 $C_L=15pF$ , $S_1$ Closed $C_L=15pF$ , $S_2$ Closed See Figures 4 and 6 $C_L=15pF$ , $S_1$ Closed $C_L=15pF$ , $S_2$ Closed  See Figures 2 and 8 $C_L=15pF$ , $S_1$ Closed $C_L=15pF$ , $S_2$ Closed See Figures 2 and 8 $C_L=15pF$ , $S_1$ Closed $C_L=15pF$ , $S_2$ Closed
<b>POWER REQUIREMENTS</b> Supply Voltage V <sub>CC</sub> Supply Current I <sub>CC</sub> No Load No Load Supply Current in Shutdown	+4.75		+5.25	Volts	$\overline{RE} = V_{CC}$ or $0V$ , $DE = 0V$ $\overline{RE} = V_{CC}$ or $0V$ , $DE = V_{CC}$ $\overline{RE} = V_{CC}$ , $DE = 0V$
<b>ENVIRONMENTAL</b> Operating Temperature Commercial (..C..) Industrial (..E..) Storage Temperature	0 -40 -65		+70 +85 +150	°C °C °C	

## RECEIVER INPUT GRAPH



## TEST CIRCUITS

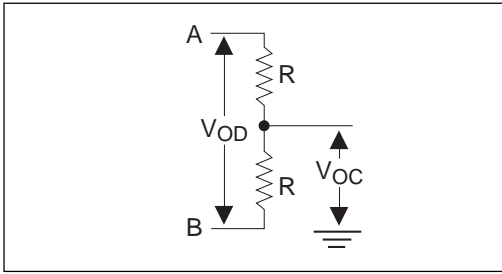


Figure 1. Driver DC Test Load Circuit

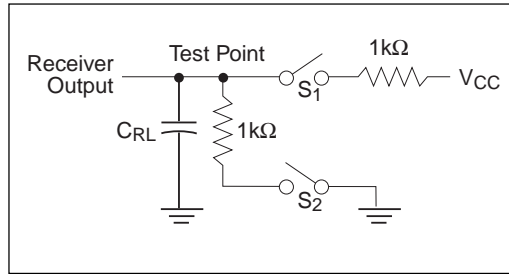


Figure 2. Receiver Timing Test Load Circuit

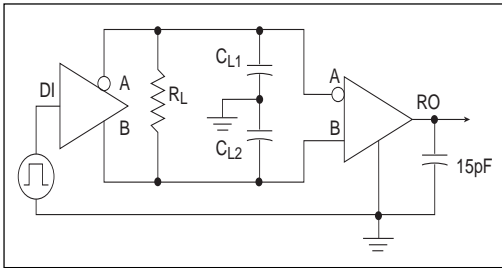


Figure 3. Driver/Receiver Timing Test Circuit

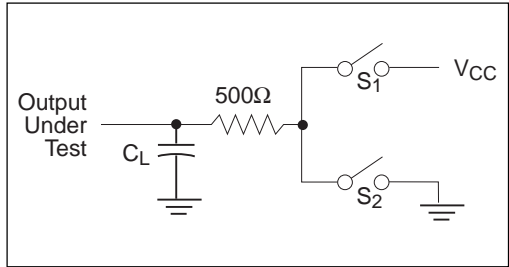


Figure 4. Driver Timing Test Load #2 Circuit

## SWITCHING WAVEFORMS

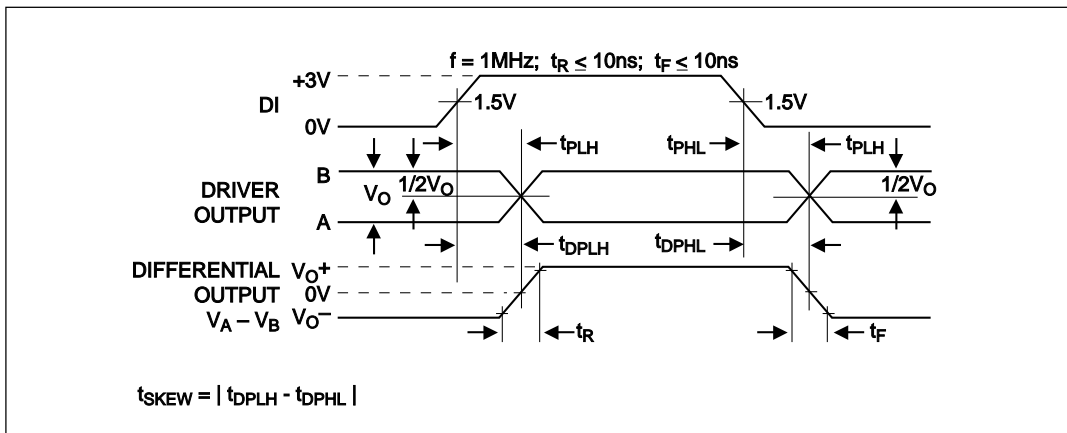


Figure 5. Driver Propagation Delays

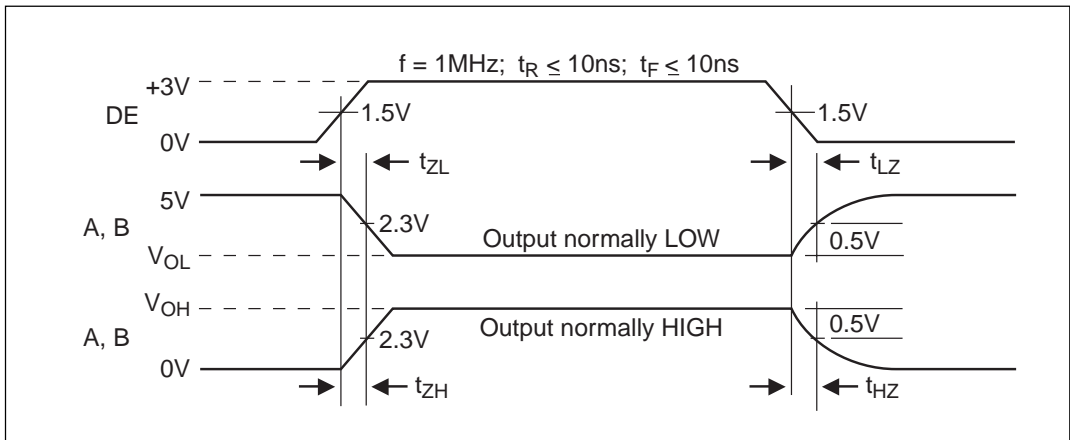


Figure 6. Driver Enable and Disable Times

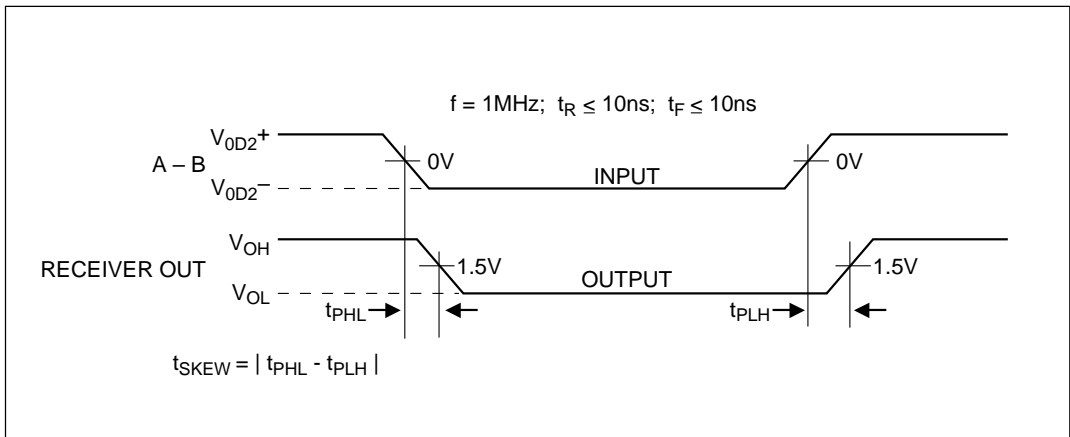


Figure 7. Receiver Propagation Delays

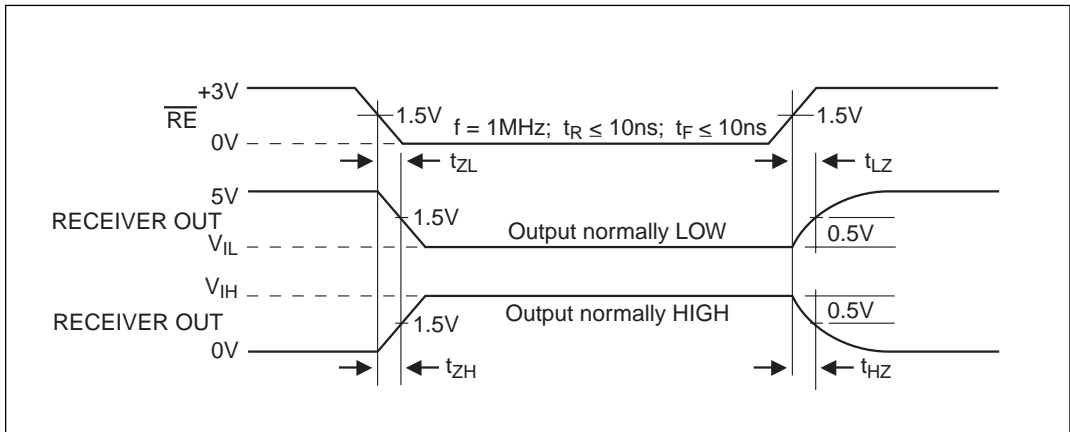


Figure 8. Receiver Enable and Disable Times

## GENERAL DESCRIPTION

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 specification 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 4,000 feet.

## DRIVERS

The driver output complies with the RS-485 electrical characteristics as specified by the standard. The output swings from 0V to  $V_{CC}$  and decreases to greater than +1.5V with a  $54\Omega$  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  $100\Omega$  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 a logic LOW. The outputs during the tri-stated condition are at a high impedance ( $>100k\Omega$ ). 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  $\pm 200mV$ . As mentioned above, the RS-485 specification allows up to 32 transceivers on a the same bus. The **SP485R** allows over 400 transceivers on the same bus due to the high input impedance of at least  $98k\Omega$ . 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  $54\Omega$  from the 320 transceivers with an input impedance of at least  $120k\Omega$  in parallel along with the two  $125\Omega$  cable termination resistors on each end.

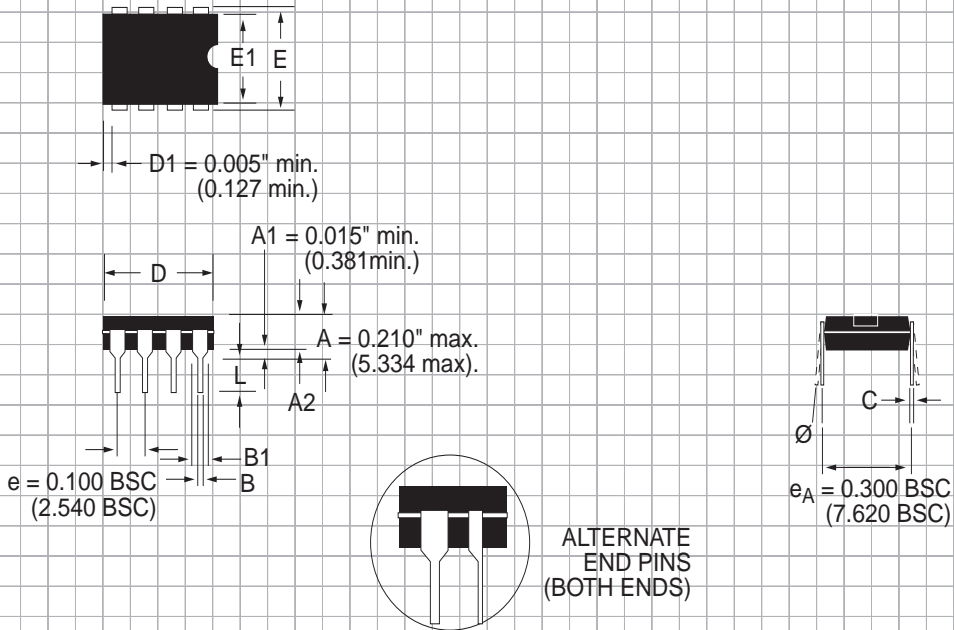
The receiver contains a enable pin ( $\overline{RE}$ ) which enables the receiver when a logic LOW is asserted. A logic HIGH will tri-state the receiver output and the inputs will maintain at least  $120k\Omega$  impedance. The receiver can operate to at least 1Mbps.

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

## SHUTDOWN MODE

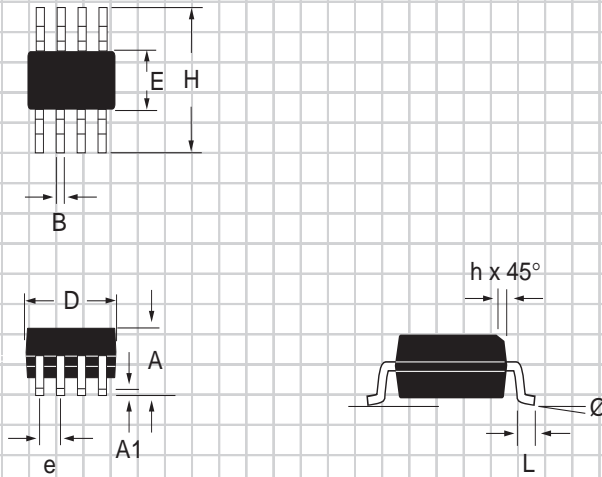
The **SP481R** includes a shutdown function to reduce power consumption. The shutdown is activated by simultaneously applying a logic LOW to DE and a logic HIGH to  $\overline{RE}$ . While in the shutdown mode, the power supply current is typically less than  $1\mu A$ . The driver outputs are disabled and are at a high impedance state determined by the receiver input impedance which should be at least  $120k\Omega$ . The receiver output is at also at high impedance during shutdown. Output leakage current when the receiver is disabled is under  $1\mu A$ .

# PACKAGE: 8-PIN 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)
$\emptyset$	0°/ 15° (0°/15°)

**PACKAGE: 8-PIN 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°)



## ORDERING INFORMATION

Model	Temperature Range	Package Types
SP481RCP .....	0°C to +70°C .....	8-pin Plastic DIP
SP481RCN .....	0°C to +70°C .....	8-pin Plastic Narrow SOIC
SP485RCP .....	0°C to +70°C .....	8-pin Plastic DIP
SP485RCN .....	0°C to +70°C .....	8-pin Plastic Narrow SOIC

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



SIGNAL PROCESSING EXCELLENCE

### Sipex Corporation

#### Headquarters and Sales Office

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

#### Sales Office

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

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