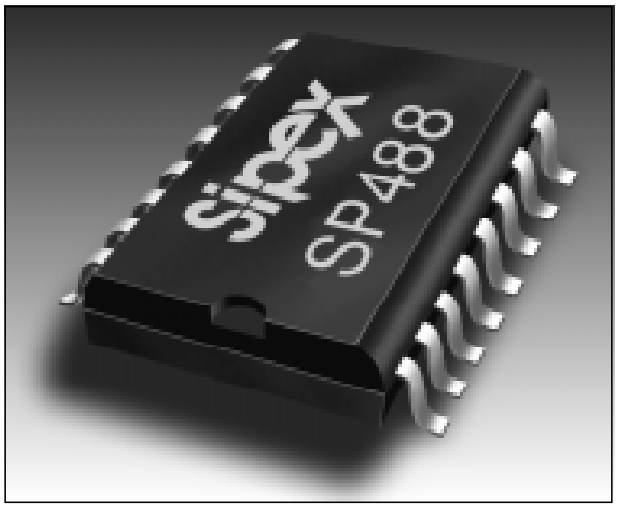
PRELIMINARY INFORMATION

SP488A and SP489A

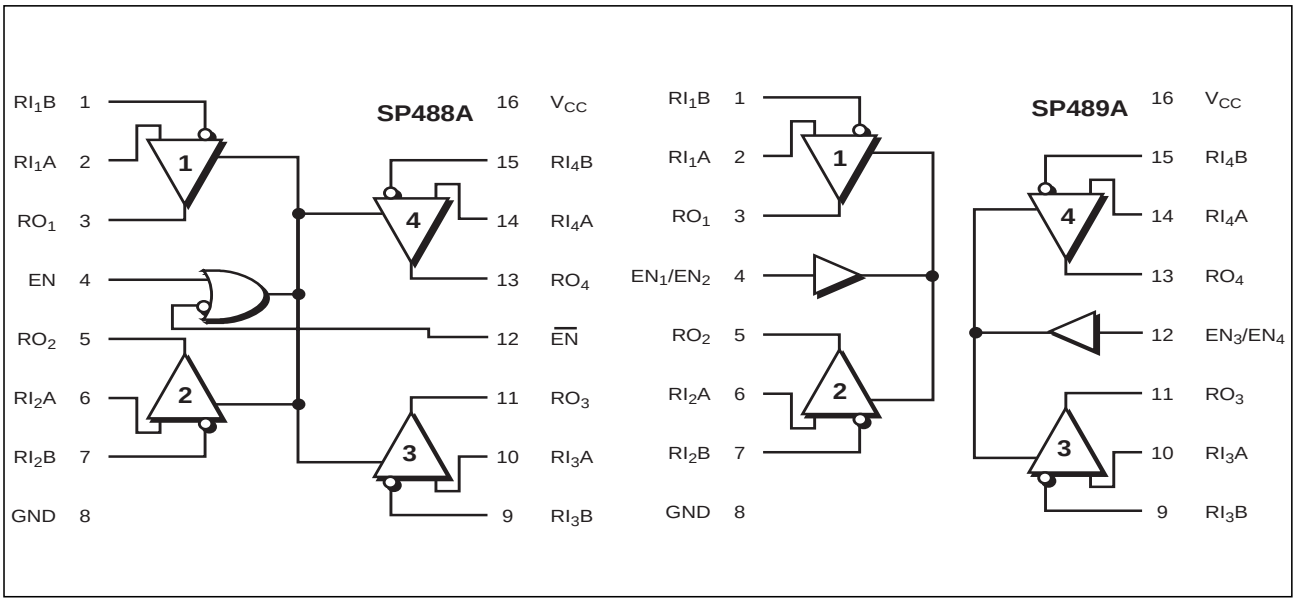
High Speed Quad RS-485/RS-422 Line Receivers

- High Speed Versions of **Sipex's** SP488 & SP489
- 30Mbps Transmission Rates
- Quad Differential Line Receivers
- RS-485 or RS-422 Applications
- Tri–state Output Control
- 30ns Typical Receiver Propagation Delays
- –7V to +12V Common Mode Input Range
- 1mA Supply Current
- Single +5V Supply Operation
- Pin Compatible with SN75173, SN75175, LTC488 and LTC489



DESCRIPTION…

The **SP488A** and **SP489A** are high speed quad differential line receivers capable of meeting the RS-485 and RS-422 protocols while running at five times the normal transmission rates. The **SP488A** and **SP489A** are enhanced versions of **Sipex's** SP488 and SP489 quad RS-485/RS-422 line receivers. The **SP488A** features a common receiver enable control; the **SP489A** provides independent receiver enable controls for each pair of receivers. Both feature tri–state outputs and wide common–mode input range. The receivers have a fail–safe feature which forces a logic “1” output when receiver inputs are left floating. Both are available in 16–pin plastic DIP and SOIC packages.

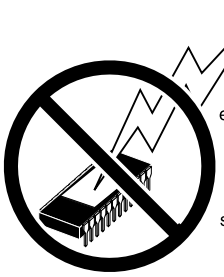


PRELIMINARY INFORMATION

ABSOLUTE MAXIMUM RATINGS

These are stress ratings only and functional operation of the device at these 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)
  Receiver ..... ±14V
Receiver Output Voltage ..... –0.5V to (V_{CC} +0.5V)
Input Currents
  Logic ..... ±25mA
Storage Temperature ..... –65°C to +150°C
Power Dissipation
  Plastic DIP 375mW
  (derate 7mW/°C above +70°C)
  Small Outline 375mW
  (derate 7mW/°C above +70°C)
Lead Temperature (soldering, 10 sec) ..... 300°C



CAUTION:
ESD (ElectroStatic Discharge) sensitive device. Permanent damage may occur on unconnected devices subject to high energy electrostatic fields. Unused devices must be stored in conductive foam or shunts. Personnel should be properly grounded prior to handling this device. The protective foam should be discharged to the destination socket before devices are removed.

SPECIFICATIONS

V_{CC} = 5V±5%; typicals at 25°C; $T_{MIN} \le T_A \le T_{MAX}$ unless otherwise noted.

PARAMETER	MIN.	TYP.	MAX.	UNIT	CONDITIONS
DC CHARACTERISTICS					
Digital Inputs					EN, $\overline{EN}$, EN_1/EN_2, EN_3/EN_4
Voltage					
V_{IL}			0.8	Volts	
V_{IH}	2.0			Volts	
Input Current			±2	µA	$0V \le V_{IN} \le V_{CC}$
RECEIVER INPUTS					
Input Resistance	12			kOhm	$-7V \le V_{CM} \le 12V$
Differential Input Threshold	-0.2		+0.2	Volts	$-7V \le V_{CM} \le 12V$
Input Current (A, B)					V_{CC} = 0V or 5.25V; I_{IN2}
			+1.0	mA	V_{IN} = +12V
			-0.8	mA	V_{IN} = –7V
Maximum Data Rate	30			Mbps	
RECEIVER OUTPUTS					
Output Voltage					
V_{OH}	3.5			V	I_O = –4mA; V_{ID} = +0.2V
V_{OL}			0.4	V	I_O = +4mA; V_{ID} = –0.2V
High Impedance Output Current			±1	µA	EN = Ø, $\overline{EN}$ = V_{CC}, EN_1/EN_2 = Ø, EN_3/EN_4 = Ø, $0.4V \le V_O \le 2.4V$
POWER REQUIREMENTS					
Supply Voltage	4.75		5.25	Volts	
Supply Current		TBD		mA	No load
ENVIRONMENTAL AND MECHANICAL					
Operating Temperature					
–C	0		+70	°C	
–E	-40		+85	°C	
Storage Temperature	-65		+150	°C	
Package					
–_P	16–pin Plastic DIP				
–_T	16–pin SOIC				

AC PARAMETERS

V_{CC} = 5V±5%; typicals at 25°C; 0°C ≤ T_A ≤ +70°C unless otherwise noted.

PARAMETER	MIN.	TYP.	MAX.	UNIT	CONDITIONS
PROPAGATION DELAY					
Receiver Input to Output					C_L = 15pF; *Figure 1, 3*
Low to HIGH (t_{PLH})		TBD		ns	
High to LOW (t_{PHL})		TBD		ns	
Differential Receiver Skew (t_{SKD})		TBD		ns	
Receiver Rise Time (t_R)					10% to 90%
SP488A		TBD		ns	
SP489A		TBD		ns	
Receiver Fall Time (t_F)					90% to 10%
SP488A		TBD		ns	
SP489A		TBD		ns	
RECEIVER ENABLE					
To Output HIGH		TBD		ns	C_L = 15pF; *Figures 2 and 4* (S2 closed)
To Output LOW		TBD		ns	CL = 15pF; *Figures 2 and 4* (S1 closed)
RECEIVER DISABLE					
From Output LOW		TBD		ns	CL = 15pF; *Figures 2 and 4* (S1 closed)
From Output HIGH		TBD		ns	CL = 15pF; *Figures 2 and 4* (S2 closed)

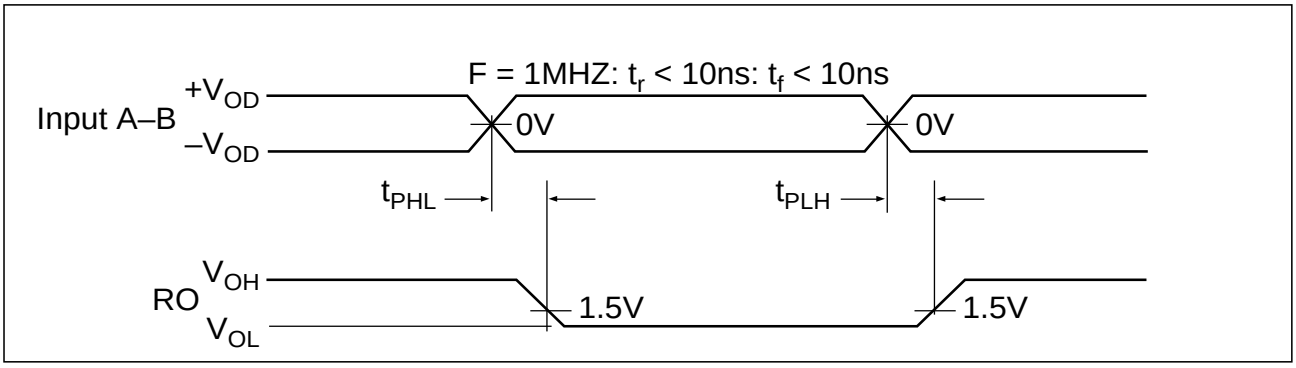


Figure 1. Receiver Propagation Delays

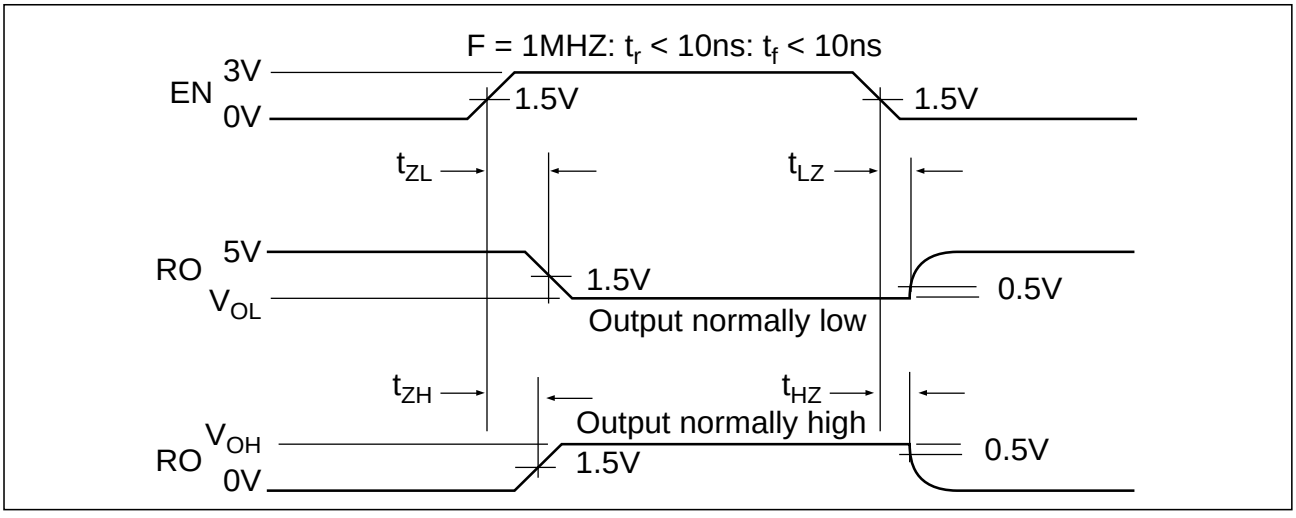
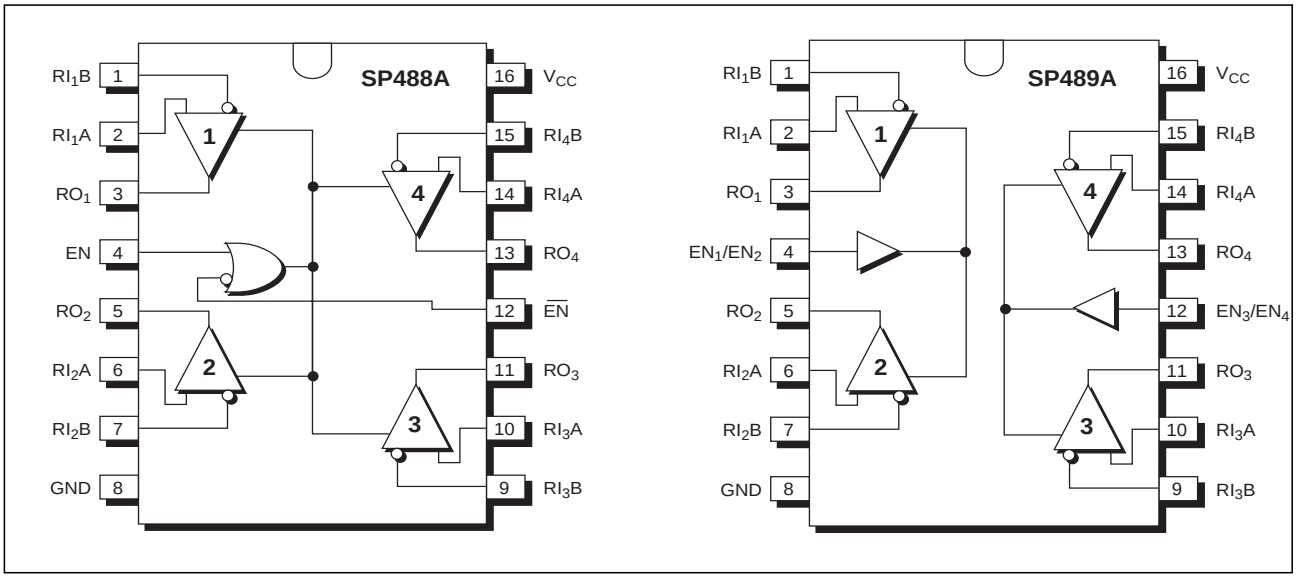


Figure 2. Receiver Enable/Disable Timing

PINOUT



SP488A PINOUT

Pin 1 — RI_1B — Receiver 1 input B.

Pin 2 — RI_1A _ Receiver 1 input A.

Pin 3 — RO_1 — Receiver 1 Output — If Receiver 1 output is enabled, if $RI_1A > RI_1B$ by 200mV, Receiver output is high. If Receiver 1 output is enabled, and if $RI_1A < RI_1B$ by 200mV, Receiver 1 output is low.

Pin 4 — EN — Receiver Output Enable. Please refer to **SP488A** *Truth Table (1)*.

Pin 5 — RO_2 — Receiver 2 Output — If Receiver 2 output is enabled, if $RI_2A > RI_2B$ by 200mV, Receiver 2 output is high. If Receiver 2 output is enabled, and if $RI_2A < RI_2B$ by 200mV, Receiver 2 output is low.

Pin 6 — RI_2A — Receiver 2 input A.

Pin 7 — RI_2B — Receiver 2 input B.

Pin 8 — GND — Digital Ground.

Pin 9 — RI_3B — Receiver 3 input B.

Pin 10 — RI_3A — Receiver 3 input A.

Pin 11 — RO_3 — Receiver 3 Output — If Receiver 3 output is enabled, if $RI_3A > RI_3B$ by 200mV, Receiver 3 output is high. If Receiver 3 output is enabled, and if $RI_3A < RI_3B$ by 200mV, Receiver 3 output is low.

Pin 12 — $\overline{EN}$ — Receiver Output Enable. Please refer to **SP488A** Truth Table (1).

Pin 13 — RO_4 — Receiver 4 Output — If Receiver 4 output is enabled, if $RI_4A > RI_4B$ by 200mV, Receiver 4 output is high. If Receiver 4 output is enabled, and if $RI_4A < RI_4B$ by 200mV, Receiver 4 output is low.

Pin 14 — RI_4A — Receiver 4 input A.

Pin 15 — RI_4B — Receiver 4 input B.

Pin 16 — Supply Voltage V_{CC} — $4.75V \le V_{CC} \le 5.25V$.

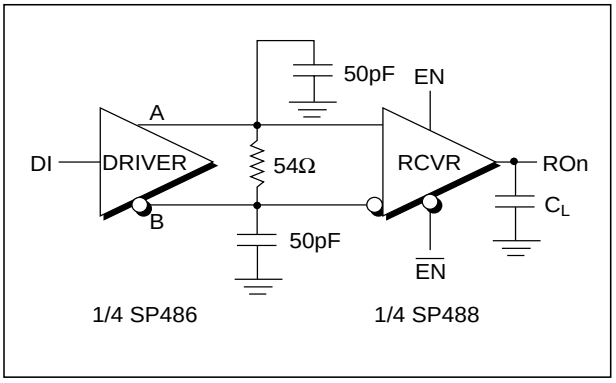


Figure 3. Timing Test Circuit

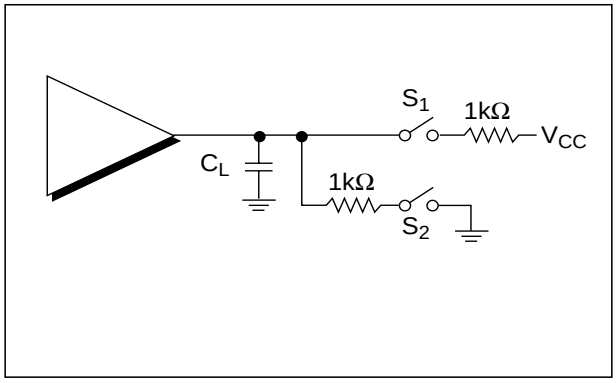


Figure 4. Enable/Disable Timing Test Circuit

SP489A PINOUT

Pin 1 — RI_1B — Receiver 1 input B.

Pin 2 — RI_1A — Receiver 1 input A.

Pin 3 — RO_1 — Receiver 1 Output — If Receiver 1 output is enabled, if $RI_{1A} > RI_1B$ by 200mV, Receiver output is high. If Receiver 1 output is enabled, and if $RI_1A < RI_1B$ by 200mV, Receiver 1 output is low.

Pin 4 — EN1/EN2 — Receiver 1 and 2 Output Enable. Please refer to **SP489A** *Truth Table (2)*.

Pin 5 — RO_2 — Receiver 2 Output — If Receiver 2 output is enabled, if $RI_2A > RI_2B$ by 200mV, Receiver 2 output is high. If Receiver 2 output is enabled, and if $RI_2A < RI_2B$ by 200mV, Receiver 2 output is low.

Pin 6 — RI_2A — Receiver 2 input A.

Pin 7 — RI_2B — Receiver 2 input B.

Pin 8 — GND — Digital Ground.

Pin 9 — RI_3B — Receiver 3 input B.

Pin 10 — RI_3A — Receiver 3 input A.

Pin 11 — RO_3 — Receiver 3 Output — If Receiver 3 output is enabled, if $RI_3A > RI_3B$ by 200mV, Receiver 3 output is high. If Receiver 3 output is enabled, and if $RI_3A < RI_3B$ by 200mV, Receiver 3 output is low.

Pin 12 — EN3/EN4 — Receiver 3 and 4 Output Enable. Please refer to **SP489A** Truth Table (2).

Pin 13 — RO_4 — Receiver 4 Output — If Receiver 4 output is enabled, if $RI_4A > RI_4B$ by 200mV, Receiver 4 output is high. If Receiver 4 output is enabled, and if $RI_4A < RI_4B$ by 200mV, Receiver 4 output is low.

Pin 14 — RI_4A — Receiver 4 input A.

Pin 15 — RI_4B — Receiver 4 input B.

Pin 16 — Supply Voltage V_{CC} — $4.75V \le V_{CC} \le 5.25V$.

DIFFERENTIAL	ENABLES		OUTPUT
A – B	EN	$\overline{EN}$	RO
$V_{ID} \geq 0.2V$	H X	X L	H H
$-0.2V < V_{ID} < +0.2V$	H X	X L	X X
$V_{ID} \leq 0.2V$	H X	X L	L L
X	L	H	Hi–Z

Table 1. SP488A Truth Table

DIFFERENTIAL	ENABLES	OUTPUT
A – B	EN_1/EN_2 or EN_3/EN_4	RO
$V_{ID} \geq 0.2V$	H	H
$-0.2V < V_{ID} < +0.2V$	H	X
$V_{ID} \leq 0.2V$	H	L
X	L	Hi–Z

Table 2. SP489A Truth Table

FEATURES...

The **SP488A** and **SP489A** are low–power quad differential line receivers meeting RS-485 and RS-422 serial protocol. The **SP488A** and **SP489A** feature **Sipex's** BiCMOS process allowing low power operational characteristics of CMOS technology while meeting all of the demands of the RS-485 and RS-422 serial protocols over 10Mbps under load in harsh environments. In fact, the **SP488A** and **SP489A** can transmit signals up to 30Mbps.

The RS-485 standard is ideal for multi-drop applications and for long-distance communication. 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.

Normally an RS-485 driver will produce no less than 1.5V before cable attenuation. After cable loss, the signal may degrade and have an amplitude of less than 1.0V. The receiver input sensitivity of the **SP488A** and **SP489A** allows the devices to receive signals as low as 200mV.

The **SP488A** features active high and active low common receiver enable controls; the **SP489A** provides independent, active high receiver enable controls for each pair of receivers. Both feature tri–state outputs and a -7V to +12V common–mode input range permitting a ±7V ground difference between devices on the communications bus. The **SP488A/489A** are equipped with a fail–safe feature which forces a logic high at the receiver output when the input is left floating. Both are available in 16-pin plastic DIP and SOIC packages.

PRELIMINARY INFORMATION

ORDERING INFORMATION

Quad RS485 Receivers:

Model	Enable/Disable	Temperature Range	Package
SP488ACP	Common; active Low and Active High	0°C to +70°C	16–pin Plastic DIP
SP488ACT	Common; active Low and Active High	0°C to +70°C	16–pin SOIC
SP488AEP	Common; active Low and Active High	–40°C to +85°C	16–pin Plastic DIP
SP488AET	Common; active Low and Active High	–40°C to +85°C	16–pin SOIC
SP489ACP	One per driver pair; active High	0°C to +70°C	16–pin Plastic DIP
SP489ACT	One per driver pair; active High	0°C to +70°C	16–pin SOIC
SP489AEP	One per driver pair; active High	–40°C to +85°C	16–pin Plastic DIP
SP489AET	One per driver pair; active High	–40°C to +85°C	16–pin SOIC

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

Sipex Corporation

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

