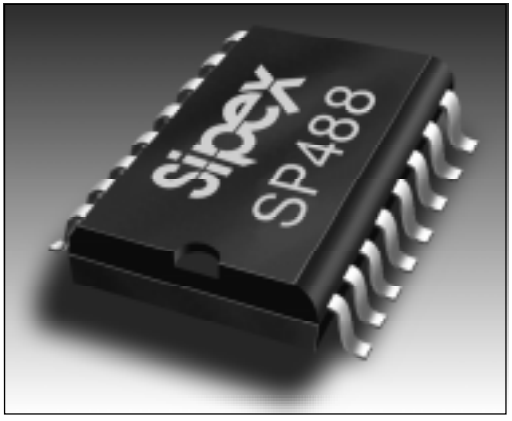
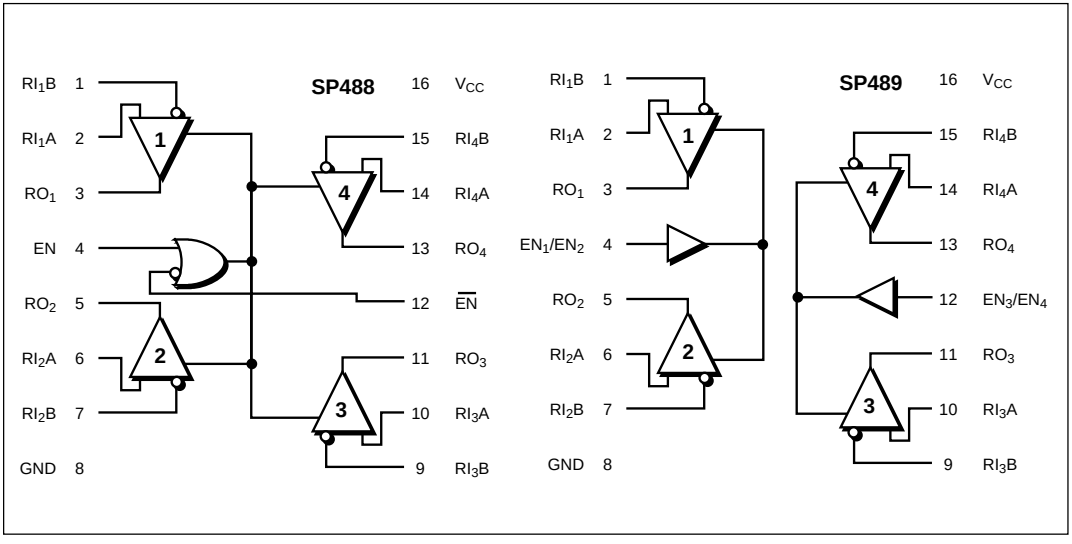
Quad RS-485/RS-422 Line Receivers

- RS-485 or RS-422 Applications
- Quad Differential Line Receivers
- Tri–state Output Control
- 120ns 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 **SP488** and **SP489** are low–power quad differential line receivers meeting RS-485 and RS-422 standards. The **SP488** features a common receiver enable control; the **SP489** 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.



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

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	10			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	V_{CC} = maximum; $0.4V \le V_O \le 2.4V$
POWER REQUIREMENTS					
Supply Voltage	4.75	5.00	5.25	Volts	
Supply Current		1	5	mA	No load
ENVIRONMENTAL AND MECHANICAL					
Operating Temperature					
–C	0		+70	°C	
–E	–40		+85	°C	
Storage Temperature	–65		+150	°C	
Package					
–_S	16–pin Plastic DIP				
–_T	16–pin SOIC				

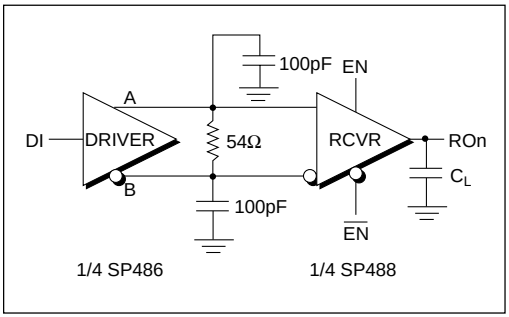


Figure 1. Timing Test Circuit

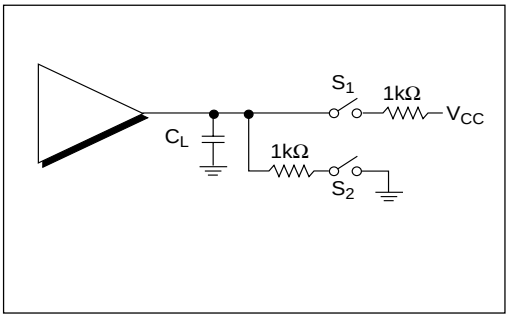


Figure 2. Enable/Disable Timing Test Circuit

SP488 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 SP488 *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.

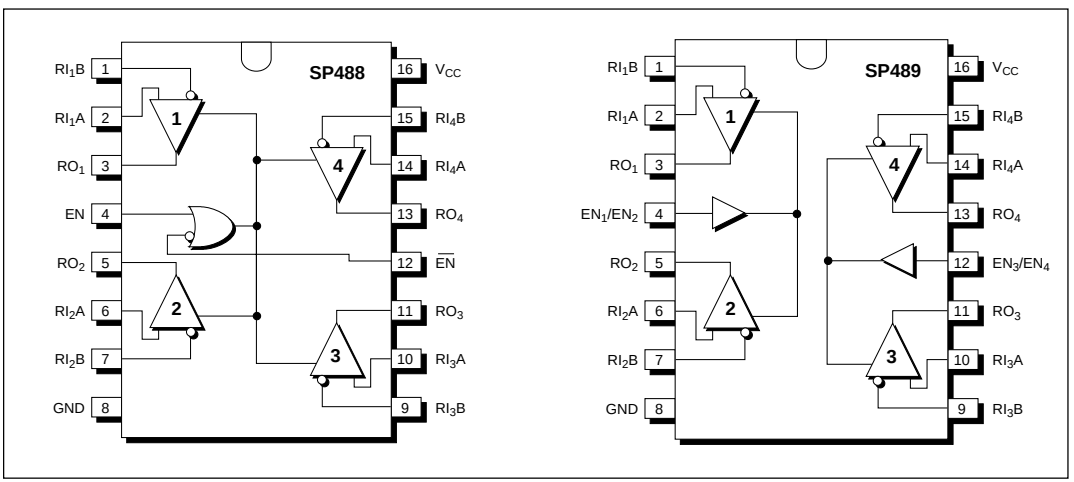
Pin 9 — RI_3B — Receiver 3 input B.

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 SP488 Truth Table (1).

PINOUT



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} — $4.75V \le V_{CC} \le 5.25V$.

SP489 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 SP489 *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.

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

Table 1. SP488 Truth Table

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 SP489 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} — $4.75V \le V_{CC} \le 5.25V$.

FEATURES...

The **SP488** and **SP489** are low–power quad differential line receivers meeting RS-485 and RS-422 standards. The **SP488** features active high and active low common receiver enable controls; the **SP489** 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 **SP488/489** are equipped with a fail–safe feature which forces a logic high at the receiver output when the input is left floating. Data rates up to 10Mbps are supported. Both are available in 16-pin plastic DIP and SOIC packages.

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

Table 2. SP489 Truth Table

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 (tPLH)		120	250	ns	
High to LOW (tPH$_L$)		120	250	ns	
Differential Receiver Skew (t_{SKD})		13		ns	
Receiver Rise Time (t_R)					10% to 90%
SP488		30	70	ns	
SP489		30	70	ns	
Receiver Fall Time (t_F)					90% to 10%
SP488		20	40	ns	
SP489		20	40	ns	
RECEIVER ENABLE					
To Output HIGH		70	150	ns	C_L = 15pF; *Figures 2 and 4* (S2 closed)
To Output LOW		80	200	ns	CL = 15pF; *Figures 2 and 4* (S1 closed)
RECEIVER DISABLE					
From Output LOW		70	150	ns	CL = 15pF; *Figures 2 and 4* (S1 closed)
From Output HIGH		70	150	ns	CL = 15pF; *Figures 2 and 4* (S2 closed)

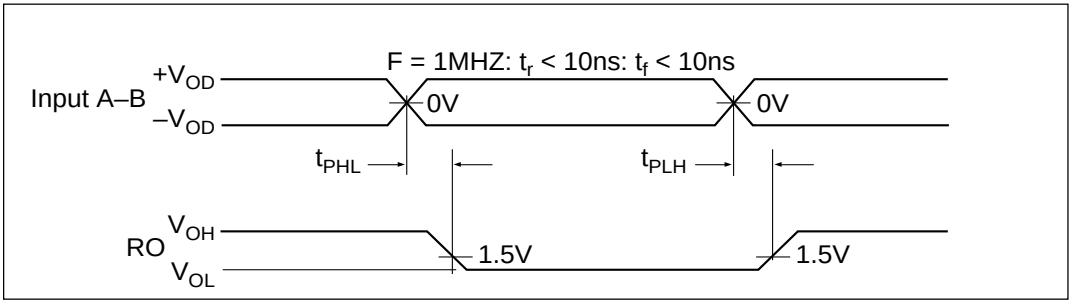


Figure 3. Receiver Propagation Delays

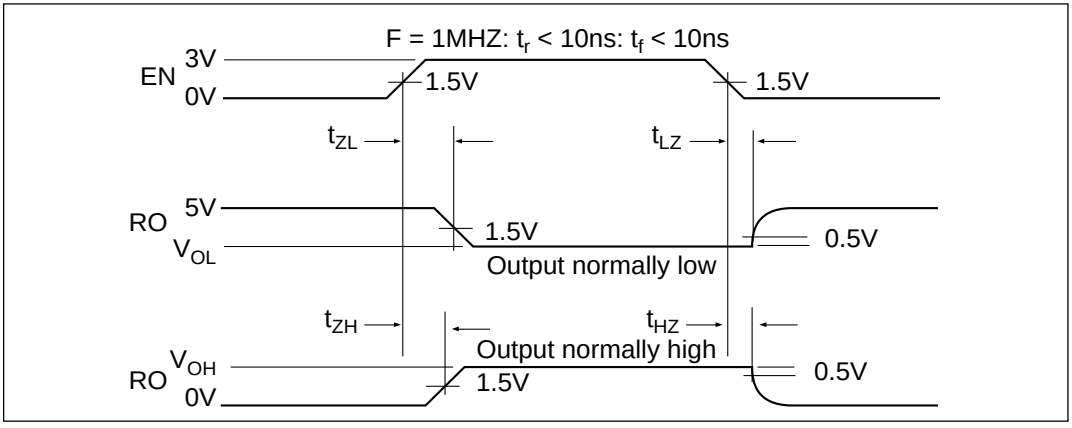


Figure 4. Receiver Enable/Disable Timing

ORDERING INFORMATION

Quad RS485 Receivers:

Model	Enable/Disable	Temperature Range	Package
SP488CS	Common; active Low and Active High	0°C to +70°C	16–pin Plastic DIP
SP488CT	Common; active Low and Active High	0°C to +70°C	16–pin SOIC
SP488ES	Common; active Low and Active High	–40°C to +85°C	16–pin Plastic DIP
SP488ET	Common; active Low and Active High	–40°C to +85°C	16–pin SOIC
SP489CS	One per driver pair; active High	0°C to +70°C	16–pin Plastic DIP
SP489CT	One per driver pair; active High	0°C to +70°C	16–pin SOIC
SP489ES	One per driver pair; active High	–40°C to +85°C	16–pin Plastic DIP
SP489ET	One per driver pair; active High	–40°C to +85°C	16–pin SOIC

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