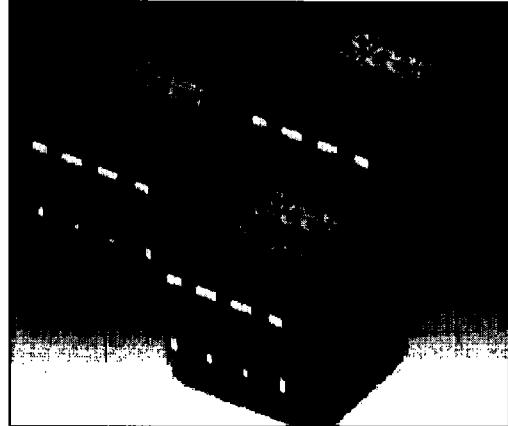


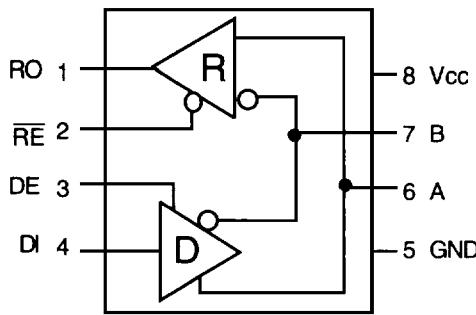
Low Power Half-Duplex RS-485 Transceivers

- +5V Only
- Low Power BiCMOS
- Driver/Receiver Enable
- Slew Rate Limited Driver for Low EMI (SP483)
- Low Power Shutdown Mode (SP481 and SP483)
- RS-485 and RS-422 Drivers/Receivers



DESCRIPTION...

The **SP481**, **SP483**, and the **SP485** are a family of half-duplex transceivers that meet the requirements of RS-485 and RS-422. Their BiCMOS design allows low power operation without sacrificing performance. The **SP481** and **SP485** meet the requirements of RS-485 and RS-422 up to 5Mbps. Additionally, the **SP481** is equipped with a low power Shutdown mode. The **SP483** is internally slew rate limited to reduce EMI and can meet the requirements of RS-485 and RS-422 up to 250kbps. The **SP483** is also equipped with a low power Shutdown mode.



SP481, SP483, and SP485

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}	.....	±12V
Input Voltages		
Logic	.....	-0.3V to (V_{CC} +0.5V)
Drivers	.....	-0.3V to (V_{CC} +0.5V)
Receivers	.....	±15V
Output Voltages		
Logic	.....	-0.3V to (V_{CC} +0.5V)
Drivers	.....	±15V
Receivers	.....	-0.3V to (V_{CC} +0.5V)
Storage Temperature	.....	-65°C to +150°C
Power Dissipation	.....	500mW

SPECIFICATIONS

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

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP481/SP483/SP485 DRIVER					
DC Characteristics					
Differential Output Voltage	GND			V_{CC}	Volts
Differential Output Voltage	2			V_{CC}	Volts
Differential Output Voltage	1.5			V_{CC}	Volts
Change in Magnitude of Driver					
Differential Output Voltage for					
Complimentary States			0.2	Volts	$R = 27\Omega$ or $R = 50\Omega$; <i>see figure 1</i>
Driver Common-Mode					
Output Voltage			3	Volts	$R = 27\Omega$ or $R = 50\Omega$; <i>see figure 1</i>
Input High Voltage	2.0			Volts	Applies to DE, DI, RE
Input Low Voltage			0.8	Volts	Applies to DE, DI, RE
Input Current			±10	µA	Applies to DE, DI, RE
Driver Short-Circuit Current					
$V_{OUT} = \text{HIGH}$	35		250	mA	$-7V \leq V_O \leq +12V$
$V_{OUT} = \text{LOW}$	35		250	mA	$-7V \leq V_O \leq +12V$
SP481/SP485 DRIVER					
AC Characteristics					
Driver Data Rate			5	Mbps	$\overline{RE} = 5V$, $DE = 5V$
Driver Input to Output	20	30	60	ns	$t_{PLH}, R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pF$; <i>see figures 3 and 6</i>
Driver Input to Output	20	30	60	ns	$t_{PHL}, R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pF$; <i>see figures 3 and 6</i>
Driver Skew		5	10	ns	From output to output; <i>see figures 3 and 6</i>
Driver Rise or Fall Time	3	15	40	ns	From 10% to 90%; $R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pF$; <i>see figures 3 and 6</i>
Driver Enable to Output High		40	70	ns	$C_L = 100pF$; <i>see figures 4 & 7</i> ; S_2 closed
Driver Enable to Output Low	40	70	ns		$C_L = 100pF$; <i>see figures 4 & 7</i> ; S_1 closed
Driver Disable Time from Low	40	70	ns		$C_L = 15pF$; <i>see figures 2 & 9</i> ; S_1 closed
Driver Disable Time from High	40	70	ns		$C_L = 15pF$; <i>see figures 2 & 9</i> , S_2 closed
SP481/SP483/SP485 RECEIVER					
DC Characteristics					
Differential Input Threshold	-0.2		+0.2	Volts	$-7V \leq V_{CM} \leq +12V$
Input Hysteresis		10		mV	$V_{CM} = 0V$
Output Voltage High	3.5		0.4	Volts	$I_O = -4mA$, $V_{ID} = +200mV$
Output Voltage Low				Volts	$I_O = +4mA$, $V_{ID} = -200mV$
Three-State (High Impedance)					
Output Current			±1	µA	$0.4V \leq V_O \leq 2.4V$; $\overline{RE} = 5V$
Input Resistance	12	15		kΩ	$-7V \leq V_{CM} \leq +12V$
Input Current (A, B); $V_{IN} = 12V$			+1.0	mA	$DE = 0V$, $V_{CC} = 0V$ or 5.25V, $V_{IN} = 12V$
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		95	mA	$0V \leq V_{CM} \leq V_{CC}$

SPECIFICATIONS (continued)

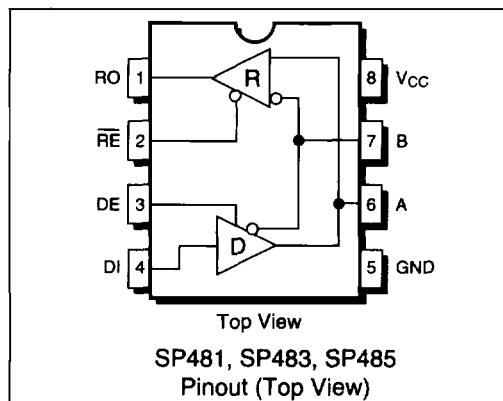
T_{MIN} to T_{MAX} and $V_{CC} = 5V \pm 5\%$ unless otherwise noted.

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP481/SP485 RECEIVER					
AC Characteristics					
Receiver Data Rate			5	Mbps	$\bar{RE} = 0V, DE = 0V$
Receiver Input to Output	60	90	200	ns	$t_{PLH}; R_{DIFF} = 54\Omega, C_{L1} = C_{L2} = 100pF$; Figures 3 & 8
Receiver Input to Output	60	90	200	ns	$t_{PHL}; R_{DIFF} = 54\Omega, C_{L1} = C_{L2} = 100pF$; Figures 3 & 8
Diff. Receiver Skew $t_{PLH} - t_{PHL}$		13		ns	$R_{DIFF} = 54\Omega; C_{L1} = C_{L2} = 100pF$; Figures 3 & 8
Receiver Enable to Output Low		20	50	ns	$C_{RL} = 15pF$; Figures 2 & 9, S_1 closed
Receiver Enable to Output High		20	50	ns	$C_{RL} = 15pF$; Figures 2 & 9, S_2 closed
Receiver Disable from Low		20	50	ns	$C_{RL} = 15pF$; Figures 2 & 9, S_1 closed
Receiver Disable from High		20	50	ns	$C_{RL} = 15pF$; Figures 2 & 9, S_2 closed
SP481					
Shutdown Timing					
Time to Shutdown	50	200	600	ns	$\bar{RE} = 5V, DE = 0V$
Driver Enable from Shutdown to Output High		40	100	ns	$C_L = 100pF$; See figures 4 & 7; S_2 closed
Driver Enable from Shutdown to Output Low		40	100	ns	$C_L = 100pF$; See figures 4 & 7; S_1 closed
Receiver Enable from Shutdown to Output High		300	1000	ns	$C_L = 15pF$; See figures 2 & 9; S_1 closed
Receiver Enable from Shutdown to Output Low		300	1000	ns	$C_L = 15pF$; See figures 2 & 9; S_2 closed
POWER REQUIREMENTS					
Supply Voltage	+4.75		+5.25	Volts	
Supply Current					
SP481/485					
No Load		500	900	μA	$\bar{RE}, DI = 0V$ or V_{CC} ; $DE = V_{CC}$
		300		μA	$\bar{RE} = 0V, DI = 0V$ or 5V; $DE = 0V$
SP483					
No Load		350	650	μA	$\bar{RE}, DI = 0V$ or V_{CC} ; $DE = V_{CC}$
		250		μA	$\bar{RE} = 0V, DI = 0V$ or 5V; $DE = 0V$
SP481/SP483					
Shutdown Mode			10	μA	$DE = 0V, \bar{RE} = V_{CC}$
ENVIRONMENTAL AND MECHANICAL					
Operating Temperature					
Commercial ($_C$)	0		+70	$^{\circ}C$	
Industrial ($_E$)	-40		+85	$^{\circ}C$	
Storage Temperature	-65		+150	$^{\circ}C$	
Package					
Plastic DIP ($_S$)					
NSOIC ($_N$)					

SP483 AC SPECIFICATIONS

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

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP483 DRIVER					
AC Characteristics					
Driver Data Rate	250	800	250	kbps	
Driver Input to Output			2000	ns	$t_{PLH}; R_{DIFF} = 54\Omega, C_{L1} = C_{L2} = 100pF$; see figures 3 & 6
Driver Skew	250	800	2000	ns	$t_{PHL}; R_{DIFF} = 54\Omega, C_{L1} = C_{L2} = 100pF$; see figures 3 & 6
Driver Rise and Fall Time	250	100	800	ns	From output to output; see figures 3 & 6
			2000	ns	From 10% to 90%; $R_{DIFF} = 54\Omega, C_{L1} = C_{L2} = 100pF$; see figures 3 & 6
Driver Enable to Output High	250		2000	ns	$C_L = 100pF$; See figures 4 & 7; S_2 closed
Driver Enable to Output Low	250		2000	ns	$C_L = 100pF$; See figures 4 & 7; S_1 closed
Driver Disable Time from Low	300		3000	ns	$C_L = 15pF$; See figures 4 & 7; S_1 closed
Driver Disable Time from High	300		3000	ns	$C_L = 15pF$; See figures 4 & 7; S_2 closed
SP483 RECEIVER					
AC Characteristics					
Receiver Data Rate	250		250	kbps	
Receiver Input to Output			2000	ns	$t_{PLH}; R_{DIFF} = 54\Omega, C_{L1} = C_{L2} = 100pF$; Figures 3 & 8
Diff. Receiver Skew $|t_{PLH} - t_{PHL}|$		100		ns	$R_{DIFF} = 54\Omega, C_{L1} = C_{L2} = 100pF$; Figures 3 & 8
Receiver Enable to Output Low		20	50	ns	$C_{RL} = 15pF$; Figures 2 & 9; S_1 closed
Receiver Enable to Output High		20	50	ns	$C_{RL} = 15pF$; Figures 2 & 9; S_2 closed
Receiver Disable from Low		20	50	ns	$C_{RL} = 15pF$; Figures 2 & 9; S_1 closed
Receiver Disable from High		20	50	ns	$C_{RL} = 15pF$; Figures 2 & 9; S_2 closed
SP483					
Shutdown Timing					
Time to Shutdown	50	200	600	ns	$\overline{RE} = 5V, DE = 0V$
Driver Enable from Shutdown to Output High			2000	ns	$C_L = 100pF$; See figures 4 & 7; S_2 closed
Driver Enable from Shutdown to Output Low			2000	ns	$C_L = 100pF$; See figures 4 & 7; S_1 closed
Receiver Enable from Shutdown to Output High			2500	ns	$C_L = 15pF$; See figures 4 & 7; S_1 closed
Receiver Enable from Shutdown to Output Low			2500	ns	$C_L = 15pF$; See figures 4 & 7; S_2 closed



PIN FUNCTION

Pin#	Name	Description
1	RO	Receiver Output.
2	\overline{RE}	Receiver Output Enable Active LOW.
3	DE	Driver Output Enable Active HIGH.
4	DI	Driver Input.
5	GND	Ground Connection.
6	A	Driver Output/Receiver Input Non-inverting.
7	B	Driver Output/Receiver Input Inverting.
8	Vcc	Positive Supply $4.75V < Vcc < 5.25V$.

DESCRIPTION... **SP481, SP483, SP485**

The **SP481**, **SP483**, and **SP485** are half-duplex differential transceivers that meet the requirements of RS-485 and RS-422. Fabricated with a Sipex proprietary BiCMOS process, all three products require a fraction of the power of older bipolar designs.

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

Drivers... **SP481, SP483, SP485**

The driver outputs of the **SP481**, **SP483**, and **SP485** are differential outputs meeting the RS-485 and RS-422 standards. 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 drivers can maintain greater than 1.5V voltage levels. The drivers of the **SP481**, **SP483** and **SP485** have an enable control line which is active HIGH. A logic HIGH on DE (pin 5) will enable the differential driver outputs. A logic LOW on DE (pin 5) will tri-state the driver outputs.

The transmitters of the **SP481** and **SP485** will operate up to 5Mbps. The **SP483** has internally slew rate limited driver outputs to minimize EMI. The maximum data rate for the **SP483** driver is 250kbps.

Receivers... **SP481, SP483, SP485**

The **SP481**, **SP483**, and **SP485** receivers have differential inputs with an input sensitivity as low as $\pm 200\text{mV}$. Input impedance of the receivers is typically $15\text{k}\Omega$ ($12\text{k}\Omega$ minimum). A wide common mode range of -7V to +12V allows for large ground potential differences between systems. The receivers of the **SP481**, **SP483** and **SP485** have a tri-state enable control pin. A logic LOW on RE (pin 4) will enable the receiver, a logic HIGH on $\overline{\text{RE}}$ (pin 4) will disable the receiver.

The receiver for the **SP481** and **SP485** will operate up to 5Mbps. The **SP483** receiver is rated for data rates up to 250kbps. The receiver for each of the three devices is 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.

Shutdown Mode... **SP481/SP483**

The **SP481** and **SP483** are equipped with a Shutdown mode. To enable the Shutdown state, both the driver and receiver must be disabled simultaneously. A logic LOW on DE (pin 5) and a logic HIGH on $\overline{\text{RE}}$ (pin 4) will put the **SP481** or **SP483** into Shutdown mode. In Shutdown, supply current will drop to typically $1\mu\text{A}$.

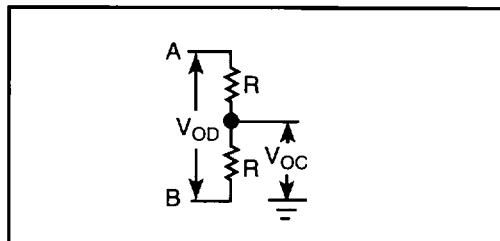


Figure 1. Driver DC Test Load Circuit

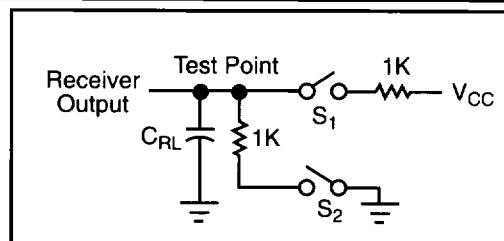


Figure 2. Receiver Timing Test Load Circuit

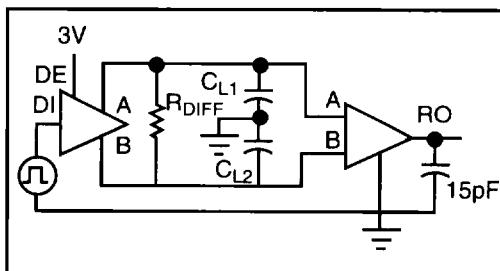


Figure 3. Driver/Receiver Timing Test Circuit

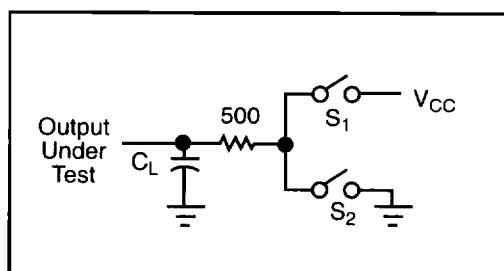


Figure 4. Driver Timing Test Load #2 Circuit

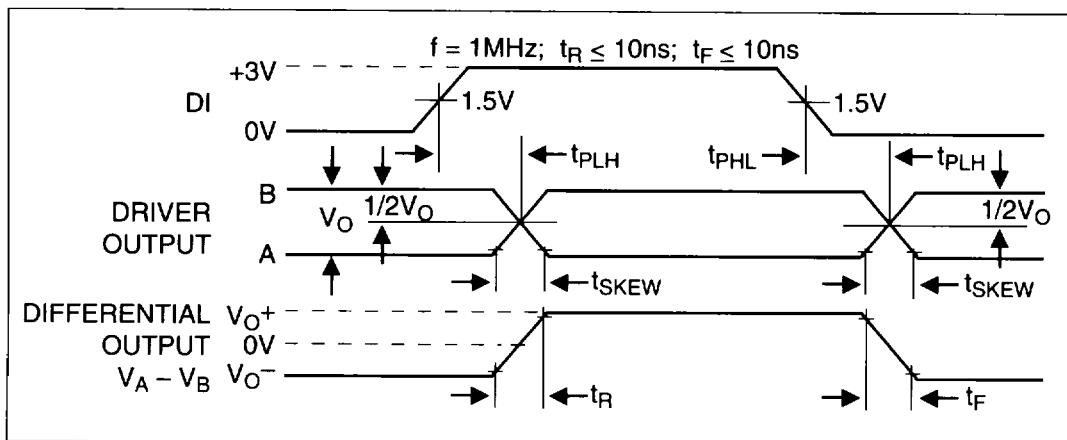


Figure 6. Driver Propagation Delays

INPUTS			LINE CONDITION	OUTPUTS	
RE	DE	DI		B	A
X	1	1	No Fault	0	1
X	1	0	No Fault	1	0
X	0	X	X	Z	Z
X	1	X	Fault	Z	Z

Table 1. Transmit Function Truth Table

INPUTS			A - B	OUTPUTS	
RE	DE			R	
0	0		+0.2V	1	
0	0		-0.2V	0	
0	0		Inputs Open	1	
1	0		X	Z	

Table 2. Receive Function Truth Table

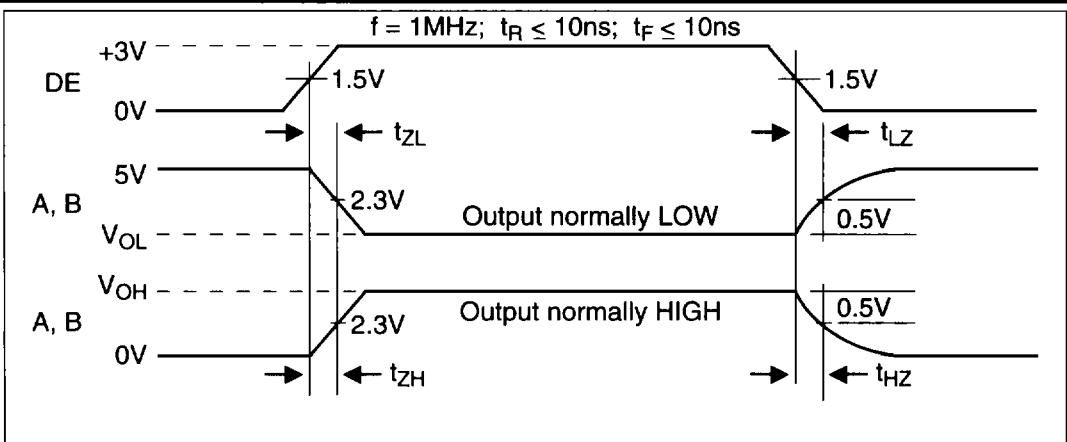


Figure 7. Driver Enable and Disable Times

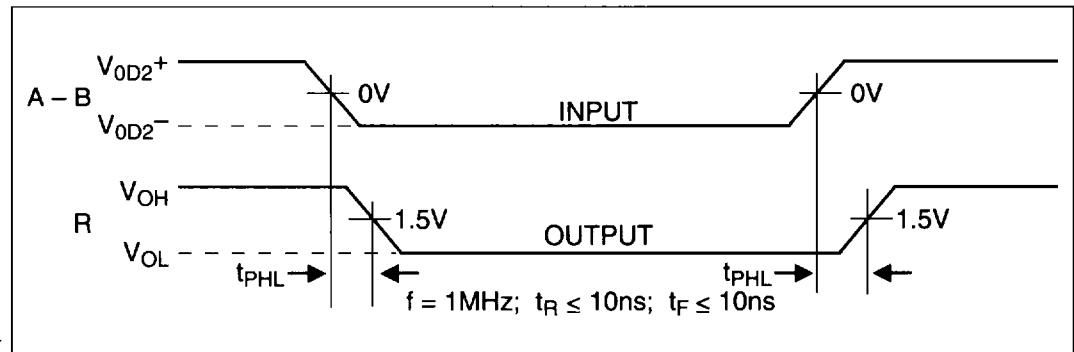


Figure 8. Receiver Propagation Delays

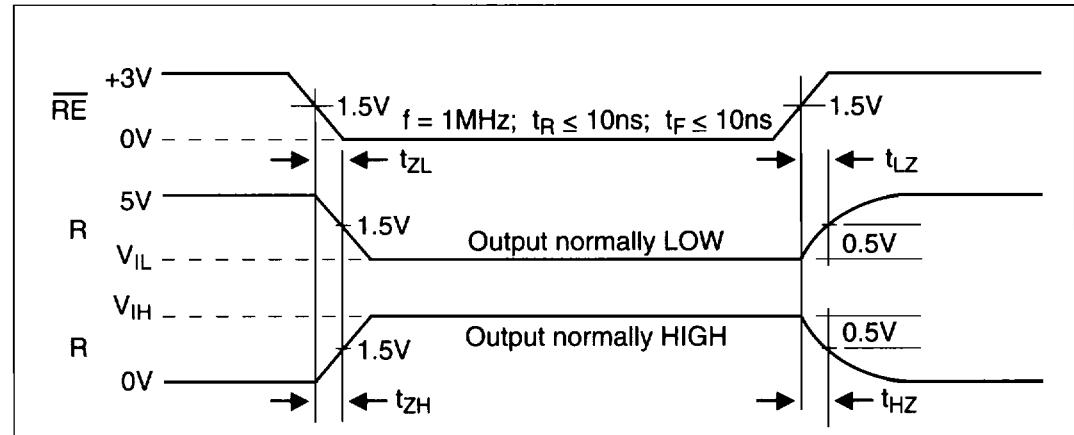


Figure 9. Receiver Enable and Disable Times

ORDERING INFORMATION

Model	Temperature Range	Package
SP481CN	0°C to +70°C	8-pin Narrow SOIC
SP481CS	0°C to +70°C	8-pin Plastic DIP
SP481EN	-40°C to +85°C	8-pin Narrow SOIC
SP481ES	-40°C to +85°C	8-pin Plastic DIP
SP483CN	0°C to +70°C	8-pin Narrow SOIC
SP483CS	0°C to +70°C	8-pin Plastic DIP
SP483EN	-40°C to +85°C	8-pin Narrow SOIC
SP483ES	-40°C to +85°C	8-pin Plastic DIP
SP485CN	0°C to +70°C	8-pin Narrow SOIC
SP485CS	0°C to +70°C	8-pin Plastic DIP
SP485EN	-40°C to +85°C	8-pin Narrow SOIC
SP485ES	-40°C to +85°C	8-pin Plastic DIP