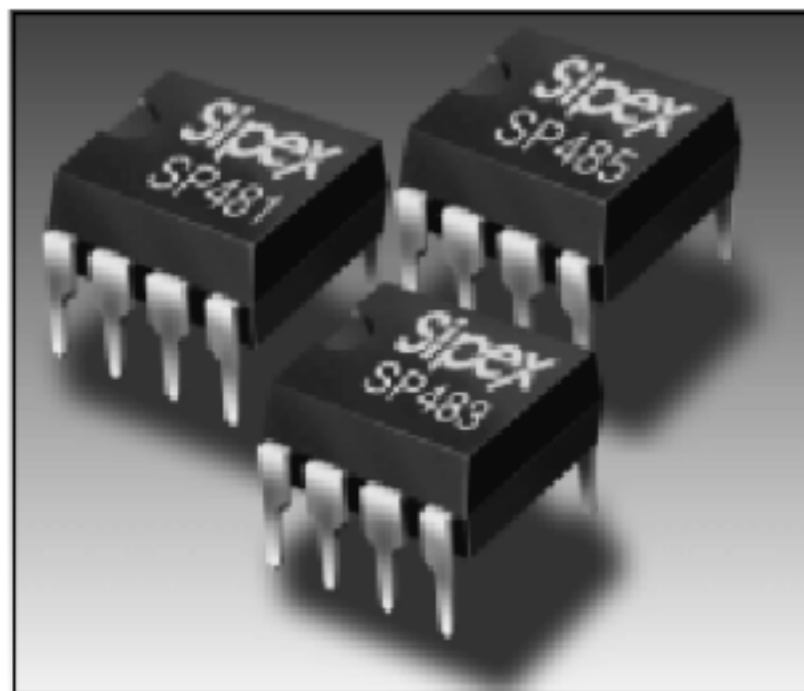




SP481/SP483/SP485

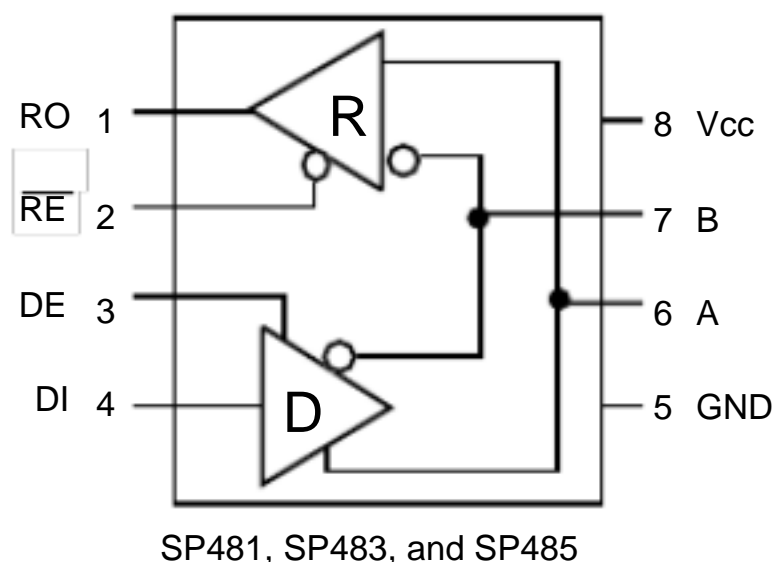
Low Power Half-Duplex RS-485 Transceivers

+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.



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 ±5% unless otherwise noted.

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP481/SP483/SP485 DRIVER					
DC Characteristics					
Differential Output Voltage	GND		V _{CC}	Volts	Unloaded; R = ; see figure 1
Differential Output Voltage	2		V _{CC}	Volts	with load; R = 50 ? ; (RS422); see figure 1
Differential Output Voltage	1.5		V _{CC}	Volts	with load; R = 27? ; (RS485); see figure 1
Change in Magnitude of Driver Differential Output Voltage for Complimentary States			0.2	Volts	R = 27 ? or R = 50 ? ; see figure 1
Driver Common-Mode Output Voltage			3	Volts	R = 27 ? or R = 50 ? ; see figure 1
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} = HIGH	35		250	mA	-7V V _O +12V
V _{OUT} = LOW	35		250	mA	-7V V _O +12V
SP481/SP485 DRIVER					
AC Characteristics					
Maximum Data Rate	5			Mbps	RE = 5V, DE = 5V
Driver Input to Output	20	30	60	ns	t _{PLH} ; R _{DIFF} = 54? , C _{L1} = C _{L2} = 100pF; see figures 3 and 6
Driver Input to Output	20	30	60	ns	t _{PHL} ; R _{DIFF} = 54? , C _{L1} = C _{L2} = 100pF; see figures 3 and 6
Driver Skew		5	10	ns	see figures 3 and 6, t _{SKEW} = t _{DPLH} - t _{DPHL}
Driver Rise or Fall Time	3	15	40	ns	From 10% to 90%; R _{DIFF} = 54 ? , C _{L1} = C _{L2} = 100pF; see figures 3 and 6
Driver Enable to Output High		40	70	ns	C _L = 100pF; see figures 4 & 7; S ₂ closed
Driver Enable to Output Low		40	70	ns	C _L = 100pF; see figures 4 & 7; S ₁ closed
Driver Disable Time from Low		40	70	ns	C _L = 15pF; see figures 2 & 9; S ₁ closed
Driver Disable Time from High		40	70	ns	C _L = 15pF; see figures 2 & 9; S ₂ closed
SP481/SP483/SP485 RECEIVER					
DC Characteristics					
Differential Input Threshold	-0.2		+0.2	Volts	-7V V _{CM} +12V
Input Hysteresis		10		mV	V _{CM} = 0V
Output Voltage High	3.5			Volts	I _O = -4mA, V _{ID} = +200mV
Output Voltage Low			0.4	Volts	I _O = +4mA, V _{ID} = -200mV
Three-State (High Impedance) Output Current			±1	μA	0.4V V _O 2.4V; RE = 5V
Input Resistance	12	15		k?	-7V V _{CM} +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 V _{CM} V _{CC}

SPECIFICATIONS (continued)

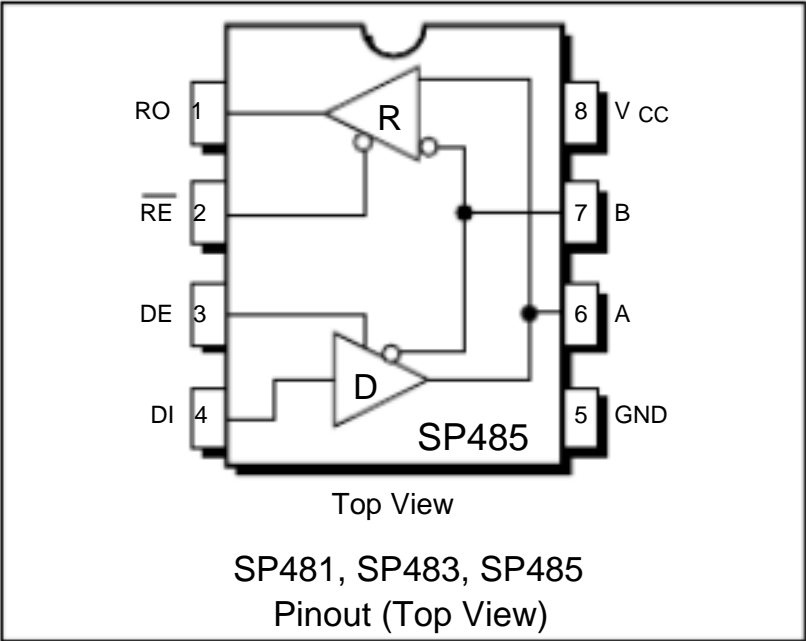
T_{MIN} to T_{MAX} and V_{CC} = 5V ±5% unless otherwise noted.

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP481/SP485 RECEIVER					
AC Characteristics					
Maximum Data Rate	5	90	200	Mbps	$\overline{RE} = 0V, DE = 0V$ $t_{PLH}; R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pF$; 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
Receiver Input to Output	60	90	200	ns	$R_{DIFF} = 54\Omega; C_{L1} = C_{L2} = 100pF$; Figures 3 & 8
Diff. Receiver Skew $t_{PLH} - t_{PHL}$		13		ns	
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	$\overline{RE} = 5V, DE = 0V$
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_2 closed
Receiver Enable from Shutdown to Output Low		300	1000	ns	$C_L = 15pF$; See figures 2 & 9; S_1 closed
POWER REQUIREMENTS					
Supply Voltage	+4.75		+5.25	Volts	
Supply Current					
SP481/485		900		μA	$\overline{RE}, DI = 0V$ or V_{CC} ; $DE = V_{CC}$
No Load				$A\mu$	$RE = 0V, DI = 0V$ or $5V$; $DE = 0V$
SP483		600		$A\mu$	$\overline{RE}, DI = 0V$ or V_{CC} ; $DE = V_{CC}$
No Load				$A\mu$	$RE = 0V, DI = 0V$ or $5V$; $DE = 0V$
SP481/SP483			10	$A\mu$	$DE = 0V, \overline{RE} = V_{CC}$
Shutdown Mode					
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 ±5% unless otherwise noted.

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP483 DRIVER					
AC Characteristics					
Maximum Data Rate	250			kbps	
Driver Input to Output	250	800	2000	ns	t _{PLH} ; R _{DIFF} = 54 ?, C _{L1} = C _{L2} = 100pF; see figures 3 & 6
Driver Skew	250	800	2000	ns	t _{PHL} ; R _{DIFF} = 54 ?, C _{L1} = C _{L2} = 100pF; see figures 3 & 6
Driver Rise and Fall Time		100	800	ns	see figures 3 & 6,
	250		2000	ns	t _{SKEW} = t _{DPLH} - t _{DPHL} From 10% to 90%; R _{DIFF} = 54 ?, 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					
Maximum Data Rate	250			kbps	
Receiver Input to Output	250		2000	ns	t _{PLH} ; R _{DIFF} = 54 ?, C _{L1} = C _{L2} = 100pF; Figures 3 & 8
Diff. Receiver Skew It _{PLH} - t _{PHL}		100		ns	R _{DIFF} = 54 ?, 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	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 ₂ closed
Receiver Enable from Shutdown to Output Low			2500	ns	C _L = 15pF; See figures 4 & 7; S ₁ closed



PIN FUNCTION

Pin#	Name	Description
1	RO	Receiver Output.
2	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 54 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 at least 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 15k Ω (12k Ω 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 $\overline{\text{RE}}$ (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 at least 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 μA .

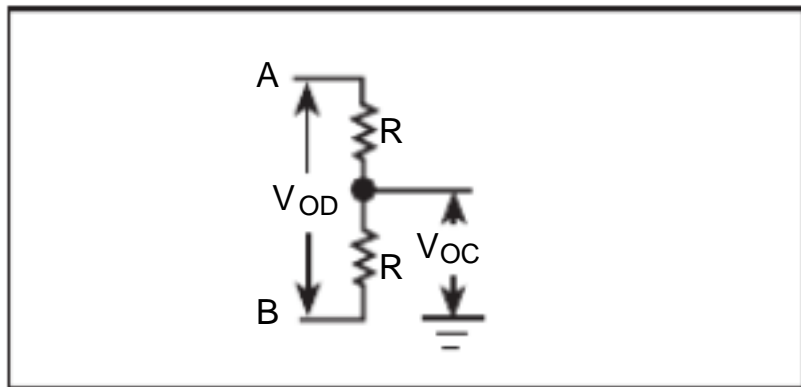


Figure 1. Driver DC Test Load Circuit

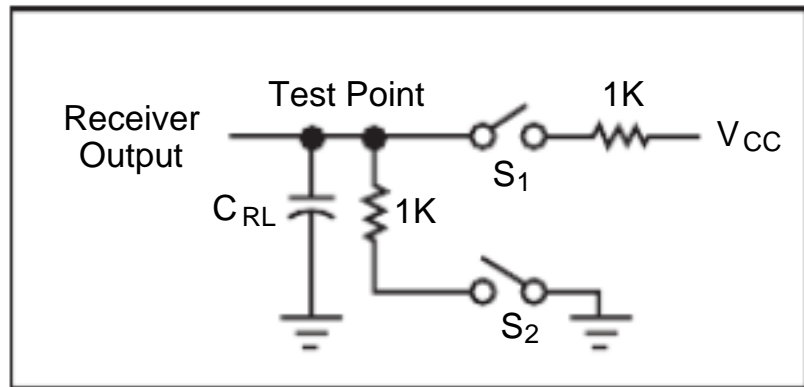


Figure 2. Receiver Timing Test Load Circuit

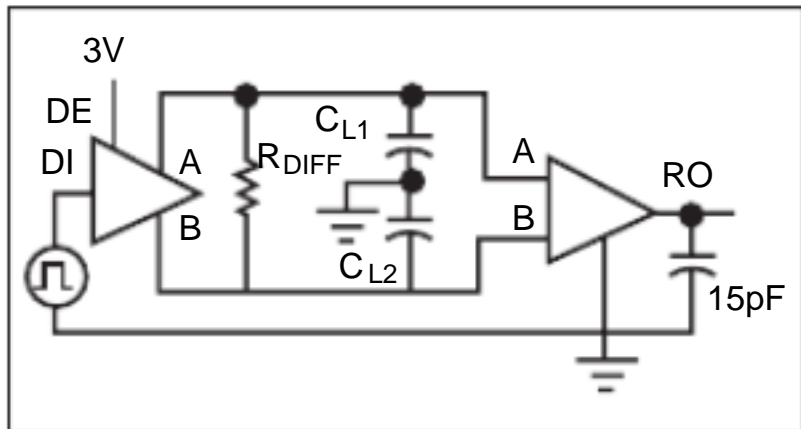


Figure 3. Driver/Receiver Timing Test Circuit

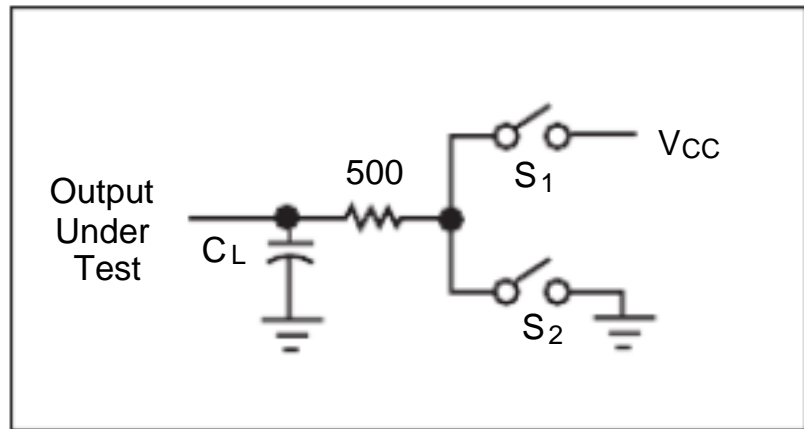


Figure 4. Driver Timing Test Load #2 Circuit

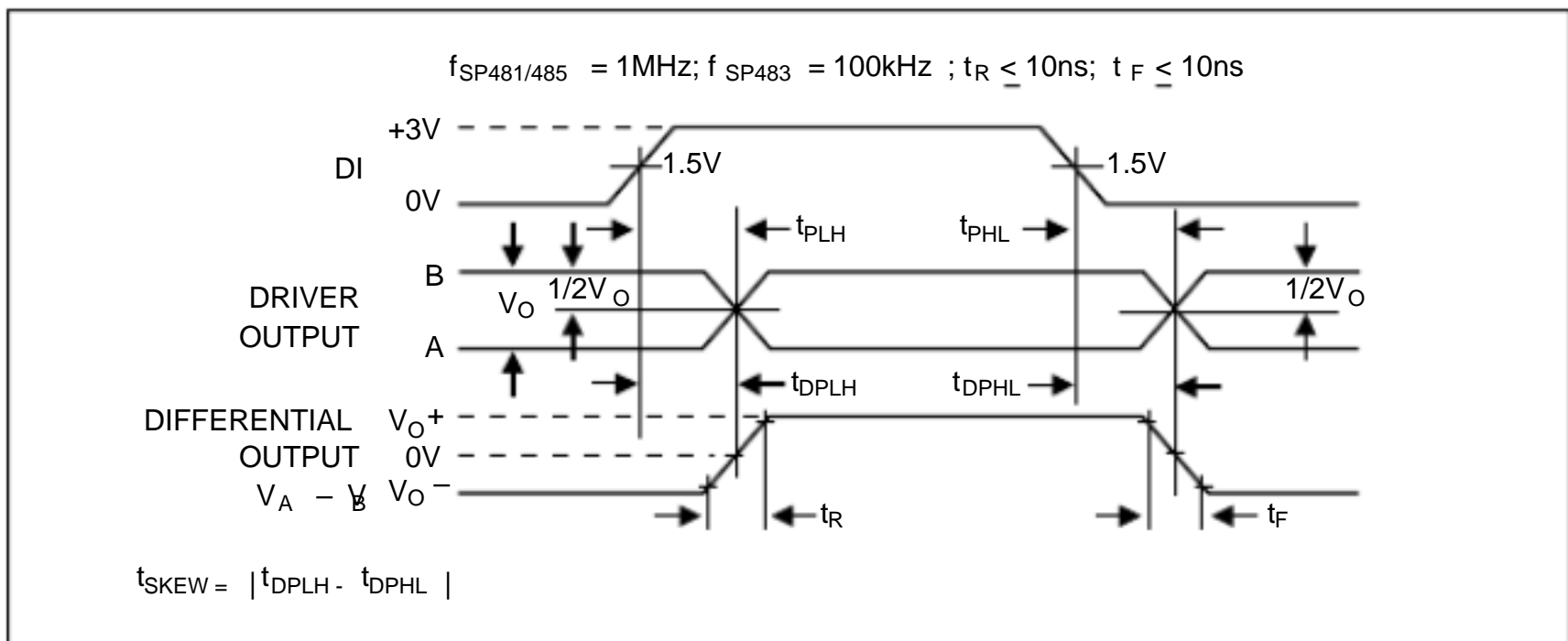


Figure 6. Driver Propagation Delays

INPUTS				OUTPUTS	
<u>RE</u>	DE	DI	LINE CONDITION	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			OUTPUTS
RE	DE	A - B	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

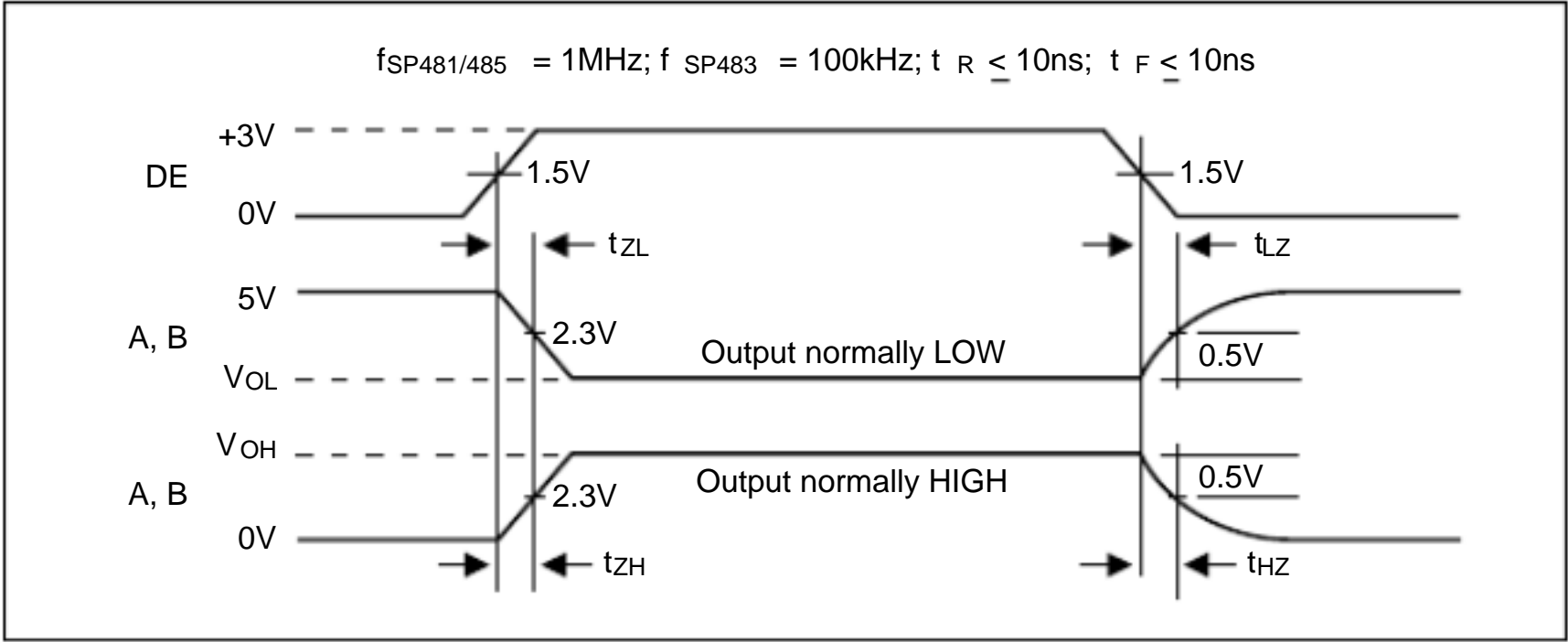


Figure 7. Driver Enable and Disable Times

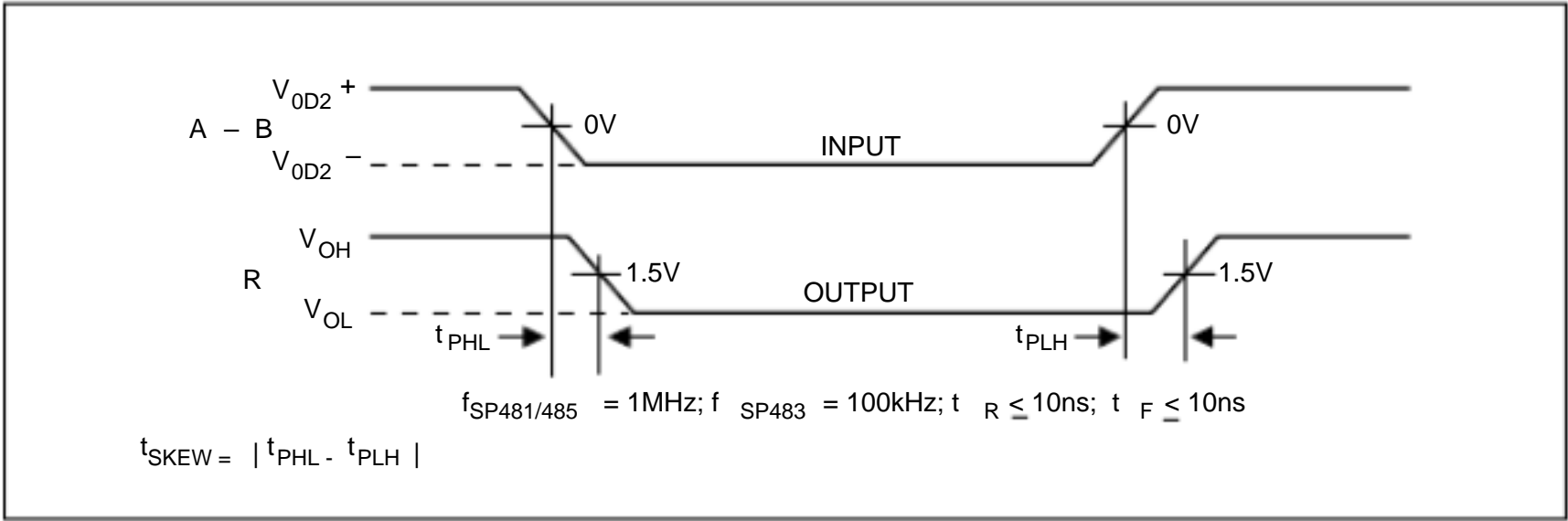


Figure 8. Receiver Propagation Delays

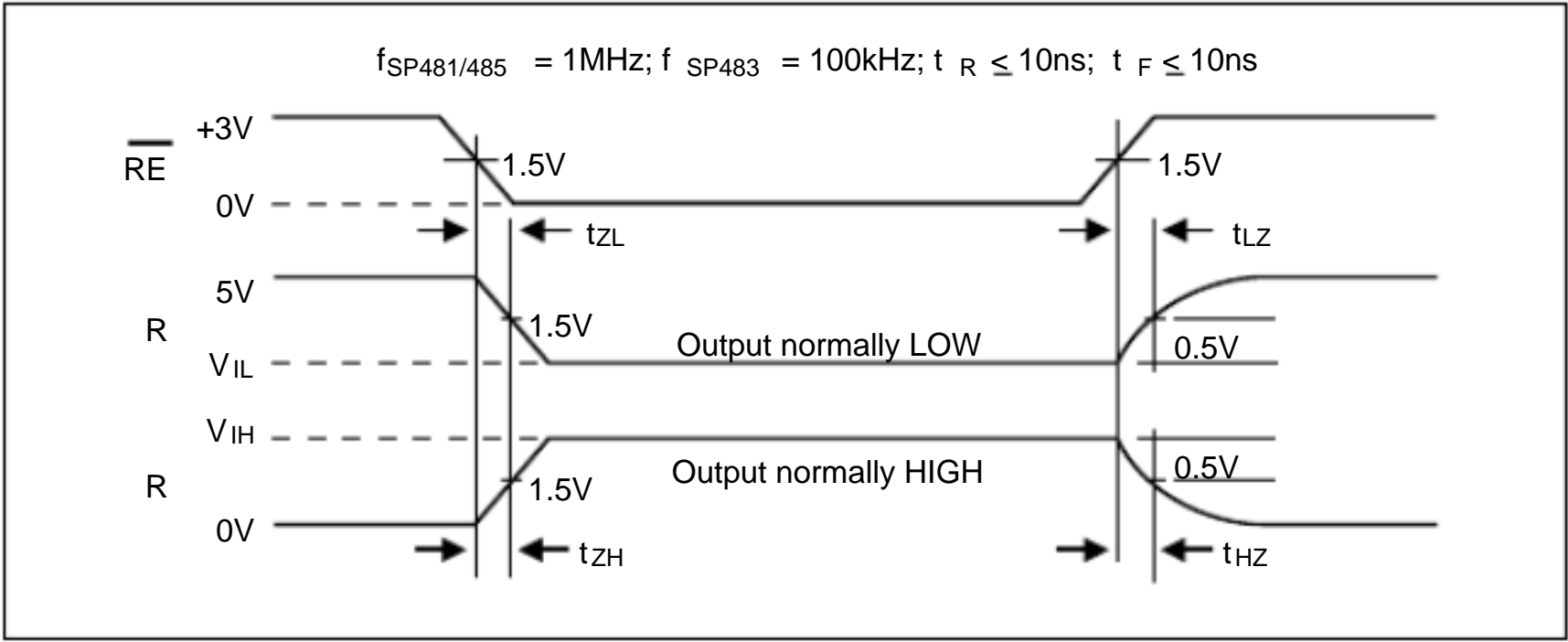
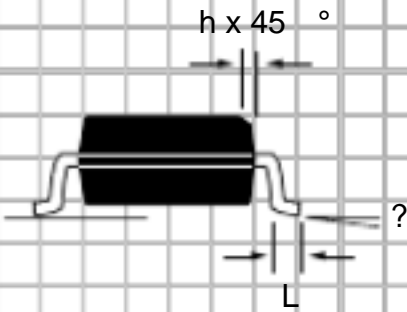
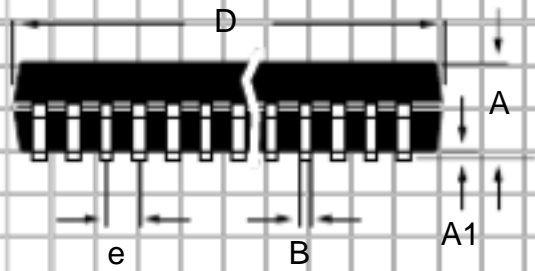
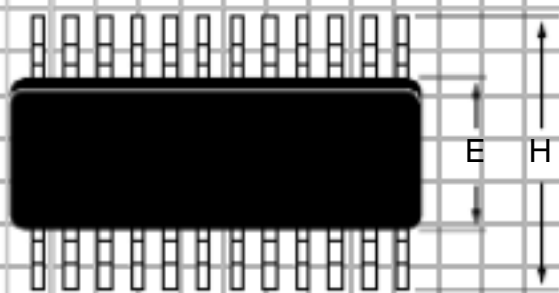


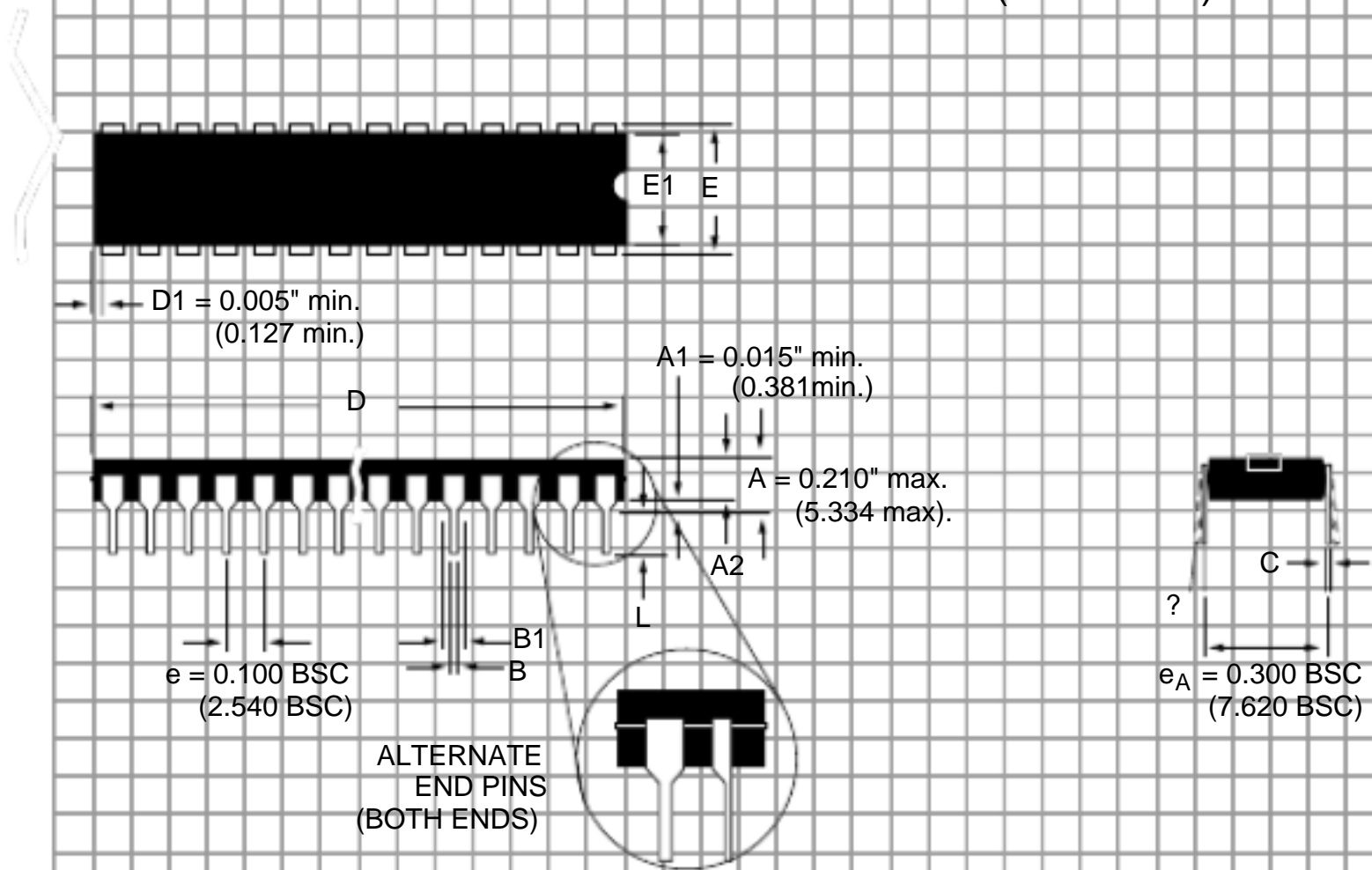
Figure 9. Receiver Enable and Disable Times

PACKAGE: 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)
?	0 ° /8 ° (0 ° /8 °)

PACKAGE: 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)
?	0 ° / 15 ° (0 ° / 15 °)

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

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



SIGNAL PROCESSING EXCELLENCE

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