

SP485

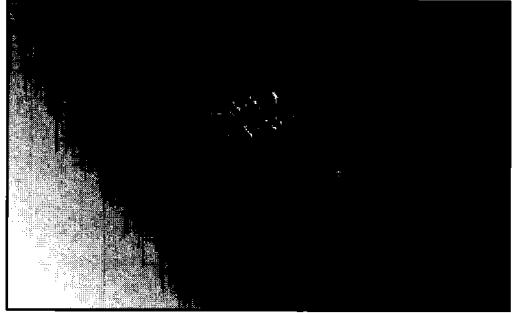
Low-Power RS485 Interface Transceiver

FEATURES

- Low Power: $I_{CC} = 300\mu\text{A}$ Typical
- Designed for RS485 Interface Applications
- Single +5V Supply
- -7V to +12V Bus Common Mode Range Permits $\pm 7\text{V}$ Ground Difference Between Devices on the Bus
- Power Up/Down Glitch-Free Driver Outputs – Permit Live Insertion or Removal of Transceiver
- Driver Maintains High Impedance in Three-State or With the Power Off
- Combined Impedance of a Driver Output and Receiver Allows Up to 32 Transceivers on the Bus
- 70mV Typical Input Hysteresis
- 30nS Typical Driver Propagation Delays with 5nS Skew
- Pin Compatible with the SN75176A, $\mu\text{A}96176$ and LTC485

APPLICATIONS

- Low Power RS485/RS422 Transceiver
- Level Translator



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DESCRIPTION

The **Sipex SP485** is a low power differential bus/line transceiver designed for multipoint data transmission standard RS485 applications with extended common mode range (+12V to -7V). It also meets the requirements of RS422.

The CMOS design offers significant power savings over its bipolar counterpart without sacrificing ruggedness against overload of ESD damage.

The driver and receiver feature three-state outputs, with the driver outputs maintaining high impedance over the entire common mode range. Excessive power dissipation caused by bus contention or faults is prevented by a current limiting circuit at the driver outputs.

The receiver has a fail safe feature which guarantees a high output state when the inputs are left open.

The **SP485** is fully specified over the commercial and extended industrial temperature range.

ABSOLUTE MAXIMUM RATINGS*

Supply Voltage (V_{CC})	+6.5 V
Control Input Voltages	-0.5V to $V_{CC} + 0.5V$
Driver Input Voltage	-0.5V to $V_{CC} + 0.5V$
Driver Output Voltage	$\pm 14V$
Receiver Input Voltages	$\pm 14V$

Receiver Output Voltage	-0.5V to $V_{CC} + 0.5V$
Operating Temperature Range	
SP485I	-40°C $\leq T_A \leq 85^\circ C$
SP485C	0°C $\leq T_A \leq 70^\circ C$

* This is a stress rating only and functional operation of the device at these or any other above those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

SPECIFICATIONS

$V_{CC} = 5V \pm 5\%$, $0^\circ C < T_A < 70^\circ C$ unless otherwise noted.

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
DIFFERENTIAL DRIVER					
Output Voltage	2 1.5		5	Volts Volts	$I_O = 0$; Unloaded with load; $R = 50\Omega$; (RS422) with load; $R = 27\Omega$; (RS485); Fig. 1
Magnitude Change of Output Voltage for Complementary Output States			0.2	Volts	$R = 27\Omega$ or $R = 50\Omega$; Fig. 1
Common Mode Output Change in Magnitude of Driver Common Mode Output Voltage for Complementary Output States			3 0.2	Volts Volts	$R = 27\Omega$ or $R = 50\Omega$; Fig. 1
Input High Voltage	2.0			Volts	DE, DI, \overline{RE}
Input Low Voltage			0.8	Volts	DE, DI, \overline{RE}
Input Current			± 2	μA	DE, DI, \overline{RE}
Input Current (A, B)			+1.0 -0.8	mA mA	DE = 0, $V_{CC} = 0V$ or 5.25V $V_{IN} = 12V$ $V_{IN} = -7V$ $-7V \leq V_O \leq +12V$
Driver Short-Circuit Current					
$V_{OUT} = HIGH$	35		250	mA	
$V_{OUT} = LOW$	35		250	mA	
Driver Input to Output	20	30	60	nS	$R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pf$; Figures 3 and 5
Driver Input to Output	20	30	60	nS	
Driver Output to Output		5	10	nS	
Driver Rise or Fall Time	3	15	40	nS	
Driver Enable to Output High		40	70	nS	$C_L = 100pF$; Fig. 4 & 6; S_2 closed
Driver Enable to Output Low		40	70	nS	$C_L = 100pF$; Fig. 4 & 6; S_1 closed
Driver Disable Time from Low		40	70	nS	$C_L = 15pF$; Fig. 4 & 6; S_1 closed
Driver Disable Time from High		40	70	nS	$C_L = 15pF$; Fig. 4 & 6; S_2 closed
RECEIVER					
Diff. Input Threshold Voltage	-0.2		+0.2	Volts	$-7V \leq V_{CM} \leq +12V$
Input Hysteresis		70		mV	$V_{CM} = 0V$
Output High Voltage	3.5			Volts	$I_O = -4mA$, $V_{ID} = +200mV$
Output Low Voltage			0.4	Volts	$I_O = +4mA$, $V_{ID} = -200mV$
Three-State (High Impedance) Output Current			± 1	μA	$V_{CC} = Max$; $0.4V \leq V_O \leq 2.4V$
Input Resistance	12			k Ω	$-7V \leq V_{CM} \leq +12V$
Supply Current		500 300		μA μA	No Load Outputs Enabled Outputs Disabled
Short-circuit Current	7		85	mA	$0V \leq V_O \leq V_{CC}$
Receiver Input to Output	60	90	200	nS	$R_{DIFF} = 54\Omega$, $C_{L1} = C_{L2} = 100pf$; Figures 3 & 7
Receiver Input to Output	60	90	200	nS	
Diff. Rcvr Skew $t_{PLH} - t_{PHL}$		13		nS	
Receiver Enable to Output Low		20	50	nS	$C_{RL} = 15pF$; Fig. 2 & 8; S_1 closed
Receiver Enable to Output High		20	50	nS	$C_{RL} = 15pF$; Fig. 2 & 8; S_2 closed
Receiver Disable from Low		20	50	nS	$C_{RL} = 15pF$; Fig. 2 & 8; S_1 closed
Receiver Disable from High		20	50	nS	$C_{RL} = 15pF$; Fig. 2 & 8; S_2 closed

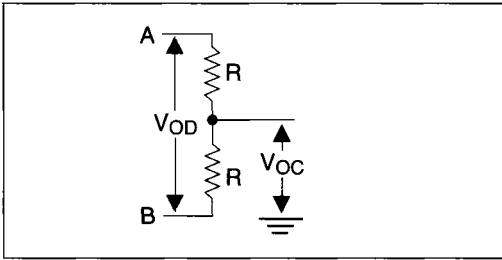


Figure 1. Driver DC Test Load

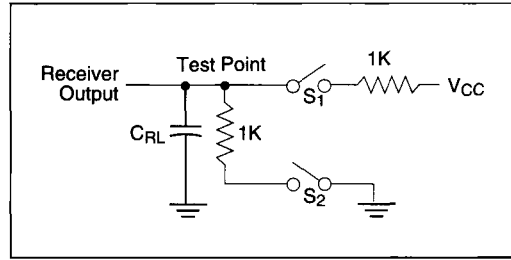


Figure 2. Receiver Timing Test Load

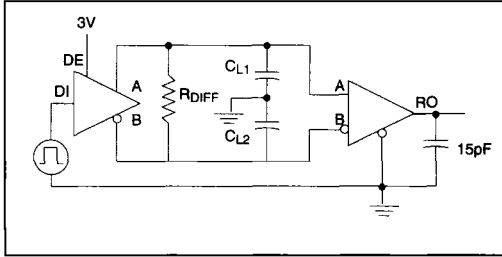


Figure 3. Driver/Receiver Timing Test Circuit

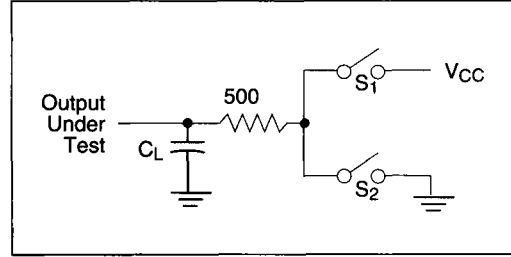


Figure 4. Driver Timing Test Load #2

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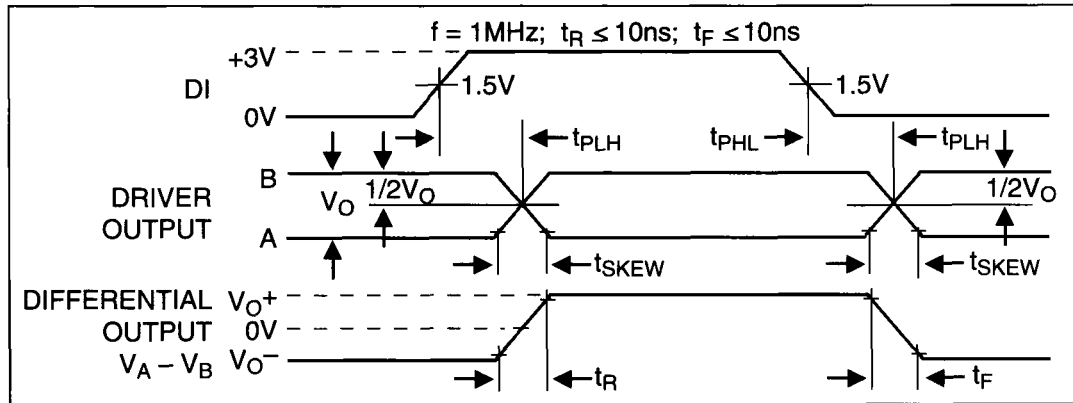


Figure 5. Driver Propagation Delays

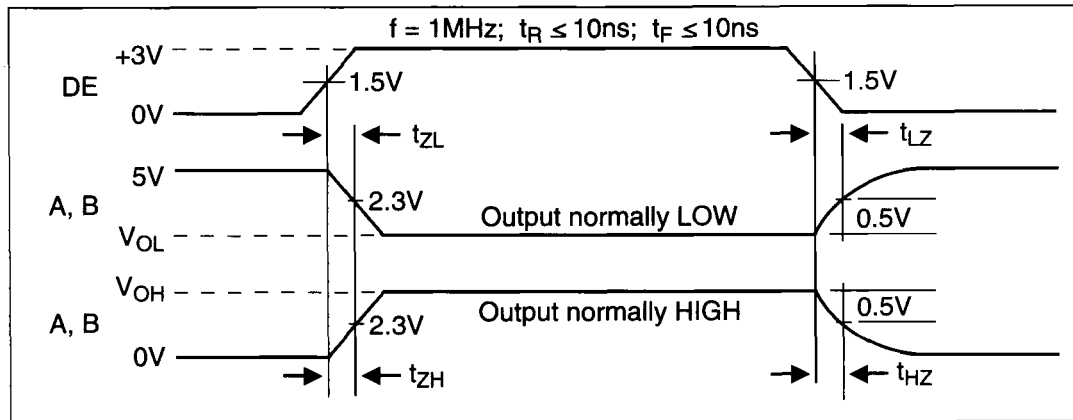


Figure 6. Driver Enable and Disable Times

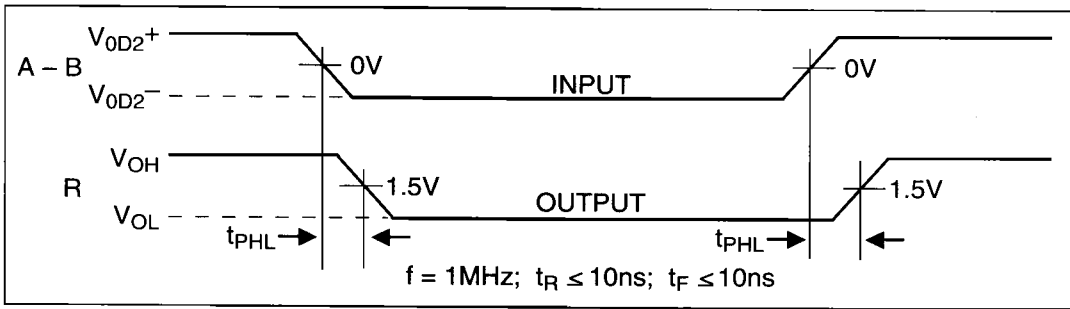


Figure 7. Receiver Propagation Delays

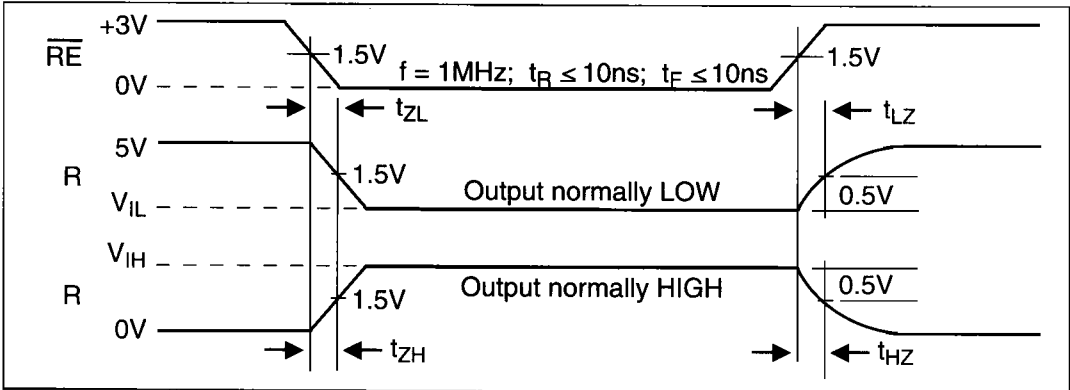


Figure 8. Receiver Enable and Disable Times

INPUTS			LINE CONDITION	OUTPUTS	
RE-bar	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 Table

INPUTS			A - B	OUTPUTS
RE-bar	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 Table

PIN FUNCTION

PIN #	NAME	DESCRIPTION
1	RO	Receiver Output. If the receiver output is enabled (RE low), then if A>B by 200mV, RO will be high. If A<B by 200mV, then RO will be low.
2	$\overline{\text{RE}}$	Receiver Output Enable. A low enables the receiver output, RO. A high input forces the receiver output into a high impedance state.
3	DE	Driver Outputs Enable. A high on DE enables the driver output. A and B, and the chip will function as a line driver. A low input will force the driver outputs into a high impedance state and the chip will function as a line receiver.
4	DI	Driver Input. If the driver outputs are enabled (DE high), then a low on DI forces the outputs A low and B high. A high on DI with the driver outputs enabled will force A high and B low.

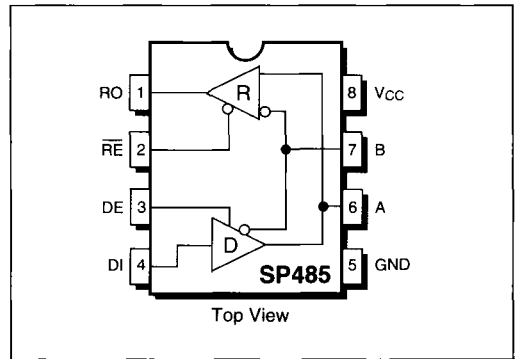


Figure 9. SP485 Pinout

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PIN #	NAME	DESCRIPTION
5	GND	Ground Connection.
6	A	Driver Output/Receiver Input.
7	B	Driver Output/Receiver Input.
8	V_{CC}	Positive Supply; $4.75V < V_{CC} < 5.25V$

ORDERING INFORMATION

0°C to +70°C:

SP485CN 8-pin N-SOIC
SP485CS 8-pin Plastic DIP
SP485CT 8-pin SOIC

-40°C to +85°C

SP485EN 8-pin N-SOIC
SP485ER 8-pin Cerdip
SP485ES 8-pin Plastic DIP
SP485ET 8-pin SOIC

CT and ET packages available Tape-on-Reel; please consult the factory

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