RoHS (HAL) (PB) Green

+3.3V Low Power Half-Duplex RS-485 Transceiver with 10Mbps Data Rate

The **SP3485** device is a +3.3V low power half-duplex transceiver that meets the specifications of the RS-485 and RS-422 serial protocols. This device is pin-to-pin compatible with the **HTC** SP481, SP483 and SP485 devices as well as popular industry standards. The **SP3485** features the **HTC** BiCMOS process, allowing low power operation without sacrificing performance. The **SP3485** can meet the electrical specifications of the RS-485 and RS-422 serial protocols up to 10Mbps under load.

- RS-485 and RS-422 Transceiver
- Operates from a single +3.3V Supply
- Interoperable with +5.0V logic
- Driver/Receiver Enable
- -7V to +12V Common-Mode Input Voltage Range
- Allows up to 32 transceivers on the serial bus
- Compatibility with industry standard 75176 pinout
- Driver Output Short-Circuit Protection
- Enhanced ESD Specifications:

+15KV Human Body Model

+15KV IEC1000-4-2 Air Discharge

+8KV IEC1000-4-2 Contact Discharge
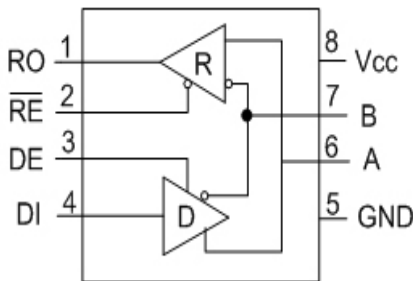
ORDERINGINFORMATION

SOP−8 R
SUFFIX
SP3485EARZ

&SP3485	= Specific Device Code
&EA	= Version
&R	= Reel
&Z	= Pb−Free Package
&#	=Date Code

T_A = -40° to 85° C for all packages

SP3485

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}...+6.0V
Input Voltages
     Logic....................................-0.3V to +6.0V
     Drivers.................................-0.3V to +6.0V
     Receivers..+/-15V
Output Voltages
     Drivers..+/-15V
     Receivers............................-0.3V to +6.0V
Storage Temperature.......................-65°C to +150°C
Power Dissipation
8-pin NSOIC...600mW
     (derate 6.90mW/ºC above +70ºC)

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.

ELECTRICAL CHARACTERISTICS

T_{AMB} = T_{MIN} to T_{MAX} and V_{CC} = +3.3V +/-5% unless otherwise noted.

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP3485 DRIVER					
DC Characteristics					
Differential Output Voltage	GND		Vcc	Volts	Unloaded; R = ∞Ω ; Figure 1
Differential Output Voltage	2		Vcc	Volts	With Load; R = 50Ω (RS-422); Figure 1
Differential Output Voltage	1.5		Vcc	Volts	With Load; R = 27Ω (RS-485); Figure 1
Change in Magnitude of Driver Differential Output Voltage for Complimentary states			0.2	Volts	R = 27Ω or R = 50Ω; Figure 1
Driver Common Mode Output Voltage			3	Volts	R = 27Ω or R = 50Ω; Figure 1
Input High Voltage	2.0			Volts	Applies to DE, DI, $\overline{RE}$
Input Low Voltage			0.8	Volts	Applies to DE, DI, $\overline{RE}$
Input Current			+/-10	µA	Applies to DE, DI, $\overline{RE}$
Driver Short Circuit Current V_{OUT} = HIGH			+/-250	mA	-7V ≤ V_O ≤ +12V; Figure 8
Driver Short Circuit Current V_{OUT} = LOW			+/-250	mA	-7V ≤ V_O ≤ +12V; Figure 8
SP3485 DRIVER					
AC Characteristics					
Maximum Data Rate	10			Mbps	$\overline{RE}$ = V_{CC}, DE = V_{CC}
Driver Input to Output, t_{PLH}	20	40	60	ns	Figures 2 & 9
Driver Input to Output, t_{PHL}	20	40	60	ns	Figures 2 & 9
Differential Driver Skew		2	10	ns	$|t_{DO1} - t_{DO2}|$, Figures 2 and 10
Driver Rise or Fall Time		5	20	ns	From 10%-90%; Figures 3 and 10

ELECTRICAL CHARACTERISTICS

$T_{AMB} = T_{MIN}$ to T_{MAX} and V_{CC} = +3.3V +/-5% unless otherwise noted.

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP3485 DRIVER AC Characteristics continued					
Driver Enable to Output High		52	120	ns	Figures 4 and 11
Driver Enable to Output Low		60	120	ns	Figures 5 and 11
Driver Disable Time from Low		40	120	ns	Figures 5 and 11
Driver Disable Time from High		60	120	ns	Figures 4 and 11
SP3485 RECEIVER					
DC Characteristics					
Differential Input Threshold	-0.2		+0.2	Volts	$-7V \le V_{CM} \le +12V$
Input Hysteresis		20		mV	$V_{CM} = 0V$
Output Voltage HIGH	Vcc-0.4			Volts	V_{ID} = +200mV, -1.5mA
Output Voltage LOW			0.4	Volts	V_{ID} = -200mV, 2.5mA
Three-State (High Impedance) Output Current			+/-1	µA	$0V \le V_O \le V_{CC}$; $\overline{RE} = V_{CC}$
Input Resistance	12	15		kΩ	$-7V \le V_{CM} \le +12V$
Input Current (A, B); V_{IN} = 12V			+1.0	mA	DE = 0V, V_{CC} = 0V or 3.6V, V_{IN} = 12V
Input Current (A, B); V_{IN} = -7V			-0.8	mA	DE = 0V, V_{CC} = 0V or 3.6V, V_{IN} = -7V
Short Circuit Current	7		60	mA	$0V \le V_{CM} \le V_{CC}$
SP3485 RECEIVER					
AC Characteristics					
Maximum Data Rate	10			Mbps	$\overline{RE}$ = 0V, DE = 0V
Receiver Input to Output, t_{PLH}	40	70	100	ns	Figures 6 and 12
Receiver Input to Output, t_{PLH}			70	ns	T_{AMB} = +25°C, Vcc = 3.3V, Figures 6 and 12
Receiver Input to Output, t_{PHL}	40	70	100	ns	Figures 6 and 12
Receiver Input to Output, t_{PHL}			70	ns	T_{AMB} = +25°C, Vcc = 3.3V, Figures 6 and 12
Differential Receiver Skew		4		ns	$t_{RSKEW} = |t_{RPHL} - t_{RPLH}|$, Figures 6 and 12
Receiver Enable to Output Low		35	60	ns	Figures 7 and 13, S_1 closed, S_2 open
Receiver Enable to Output High		35	60	ns	Figures 7 and 13, S_2 closed, S_1 open
Receiver Disable from Low		35	60	ns	Figures 7 and 13, S_1 closed, S_2 open
Receiver Disable from High		35	60	ns	Figures 7 and 13, S_2 closed, S_1 open
POWER REQUIREMENTS					
Supply Current , No Load		1000	2000	µA	$\overline{RE}$, DI = 0V or V_{CC} ; DE = V_{CC}
Supply Current , No Load		800	1500	µA	$\overline{RE}$ = 0V, DI = 0V or V_{CC}, DE = 0V

Pin Function SP3485
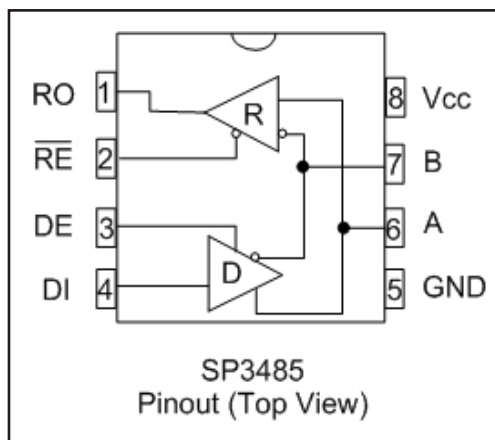
Pin 1 - RO - Receiver output

Pin 2 - $\overline{RE}$ - Receiver Output Enable Active LOW

Pin 3 - DE - Driver Output Enable Active HIGH

Pin 4 - DI - Driver Input

Pin 5 - GND - Ground Connection

Pin 6 - A - Non-Inverting Driver Output/Receiver Input

Pin 7 - B - Inverting Driver Output/Receiver Input
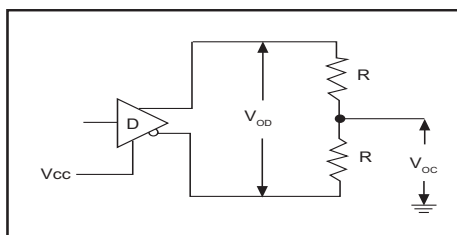
Pin 8 - Vcc - Positive Supply

TEST CIRCUITS
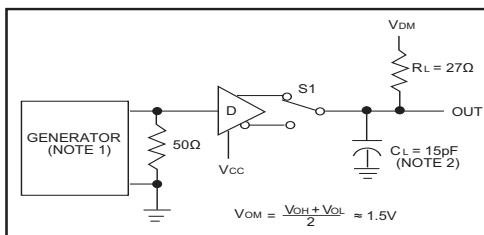

Figure 1. Driver DC Test Load Circuit
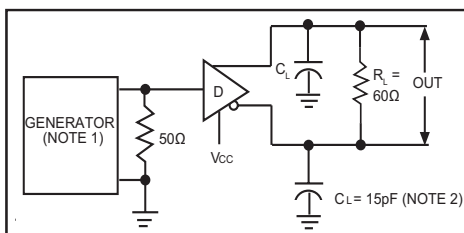

Figure 2. Driver Propagation Delay Test Circuit

$$V_{OM} = \frac{V_{OH} + V_{OL}}{2} \approx 1.5V$$

Figure 3. Driver Differential Output Delay and Transition Time Circuit.
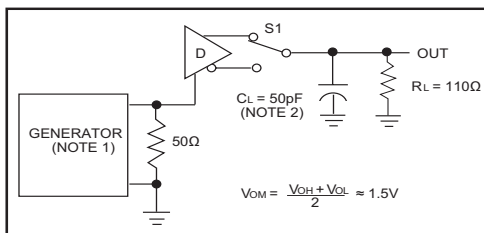
Figure 4. Driver Enable and Disable Timing Circuit, Output High

$$V_{OM} = \frac{V_{OH} + V_{OL}}{2} \approx 1.5V$$
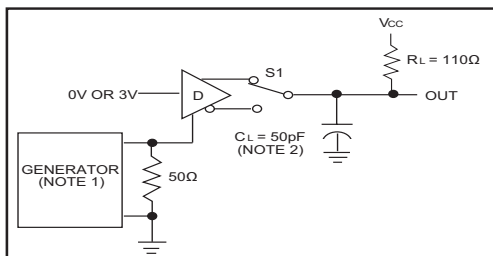
Figure 5. Driver Enable and Disable Timing Circuit, Output Low
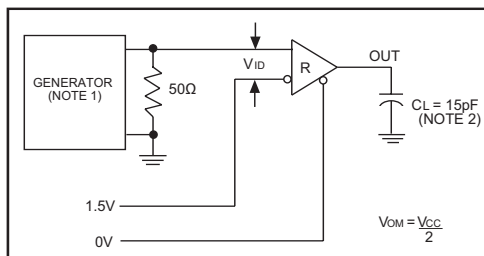
Figure 6. Receiver Propagation Delay Test Circuit

$$V_{OM} = \frac{V_{CC}}{2}$$
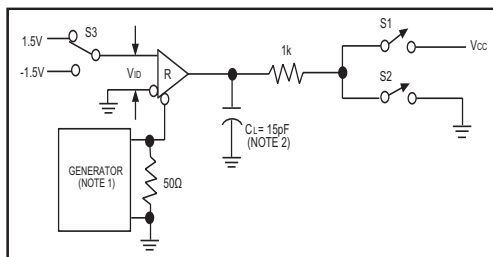
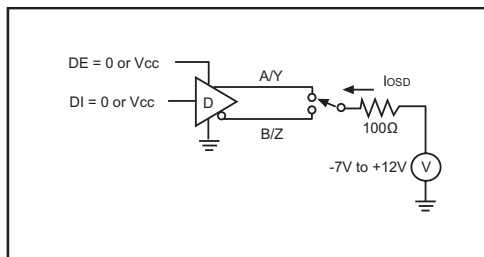Figure 7. Receiver Enable and Disable Timing Circuit

Figure 8. Driver Short Circuit Current Limit Test

NOTE 1: The input pulse is supplied by a generator with the following characteristics:
PRR = 250kHz, 50% duty cycle, t_R < 6.0ns, Z_O = 50Ω.
NOTE 2: C_L includes probe and stray capacitance.

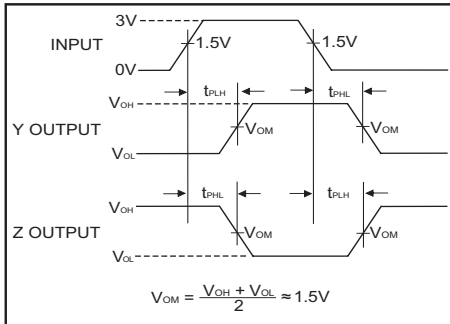Figure 9. Driver Propagation Delay Waveforms
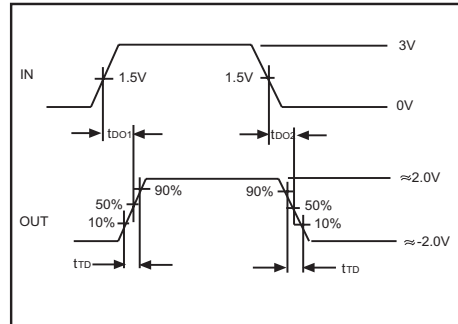
$$V_{OM} = \frac{V_{OH} + V_{OL}}{2} \approx 1.5V$$

Figure 10. Driver Differential Output Delay and Transition Time Waveforms
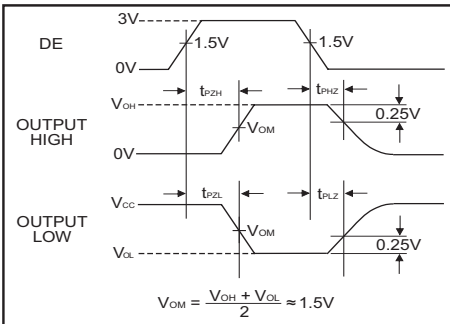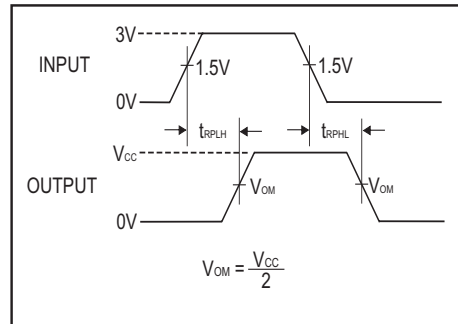
Figure 11. Driver Enable and Disable Timing Waveforms

$$V_{OM} = \frac{V_{OH} + V_{OL}}{2} \approx 1.5V$$

Figure 12. Receiver Propagation Delay Waveforms

$$V_{OM} = \frac{V_{CC}}{2}$$

S1 is open
S2 is closed
S3 = 1.5V

S1 is closed
S2 is open
S3 = -1.5V
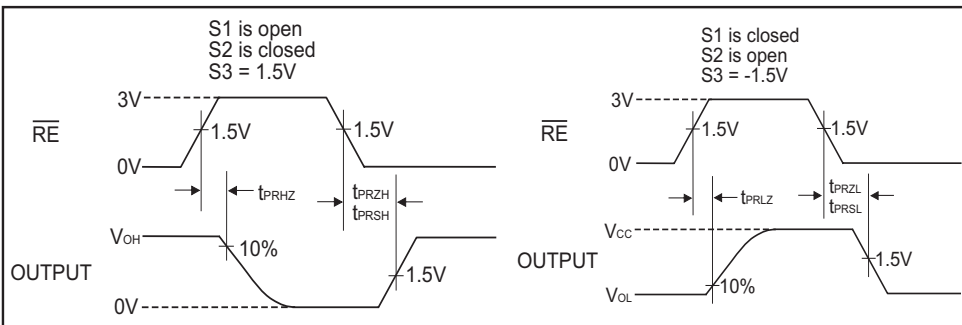
Figure 13. Receiver Enable and Disable Waveforms

The **SP3485** is a member in the family of +3.3V low power half-duplex transceivers that meet the electrical specifications of the RS-485 and RS-422 serial protocols. This device is pin-to-pin compatible with the **HTC** SP481, SP483 and SP485 devices as well as popular industry standards. The **SP3485** feature **HTC's** BiCMOS process allowing low power operation without sacrificing performance.

Driver

The driver outputs of the **SP3485** are differential outputs meeting the RS-485 and RS-422 standards. The typical voltage output swing with no load will be 0 volts to +3.3 Volts. With a load of 54Ω across the differential outputs, the drivers can maintain greater than 1.5V voltage levels.

The driver of the **SP3485** has a driver enable control line which is active HIGH. A logic HIGH on DE (pin 3) will enable the differential driver outputs. A logic LOW on the DE (pin 3) will tri-state the driver outputs.

The driver of the SP3485 operates up to 10Mbps. The 250mA I_{SC} maximum limit on the driver output allows the SP3485 to withstand an infinite short circuit over the -7.0V to +12V common mode range without catastrophic damage to the IC.

Receiver

The **SP3485** receiver has differential inputs with an input sensitivity of ±200mV. Input impedance of the receiver is typically 15kΩ (12kΩ minimum). A wide common mode range of -7V to +12V allows for large ground potential differences between systems. The receiver is equipped with a fail-safe feature that guarantees the receiver output will be in a HIGH state when the input is left unconnected. The receiver of the **SP3485** operates up to 10Mbps.

The receiver of the **SP3485** has an enable control line which is active LOW. A logic LOW on $\overline{RE}$ (pin 2) will enable the differential receiver. A logic HIGH on $\overline{RE}$ (pin 2) of the **SP3485** will disable the receiver.

INPUTS				OUTPUTS	
$\overline{RE}$	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

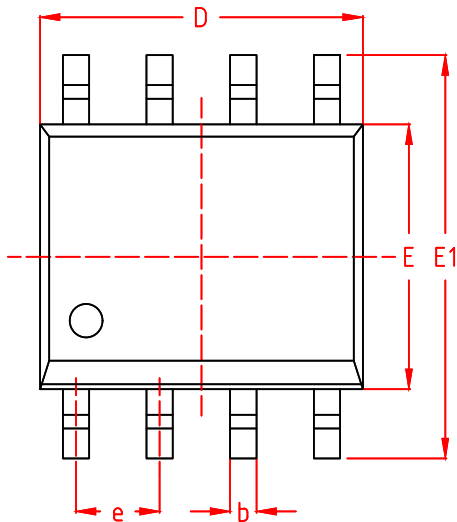Table 1. Transmit Function Truth Table

INPUTS			OUTPUTS
$\overline{RE}$	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
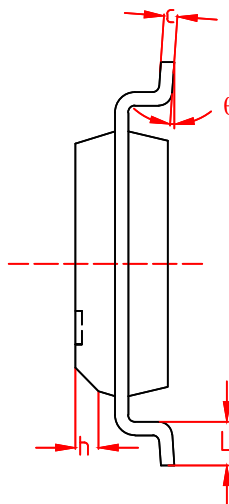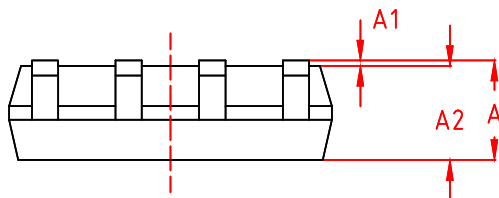
HTCSEMI 海天芯

SOP8 package information

SIDE VIEW
侧视图

SIDE VIEW
侧视图

	机械尺寸/mm Dimensions		
字符 SYMBOL	最小值 MIN	典型值 NOMINAL	最大值 MAX
A	–	–	1.75
A1	0.10	0.15	0.25
A2	1.30	1.40	1.50
b	0.35	–	0.50
c	0.19	–	0.25
D	4.80	4.90	5.00
E	3.80	3.90	4.00
E1	5.80	6.00	6.20
e	1.27 BSC		
h	0.25	–	0.45
L	0.50	–	0.80
θ	0°	–	8°