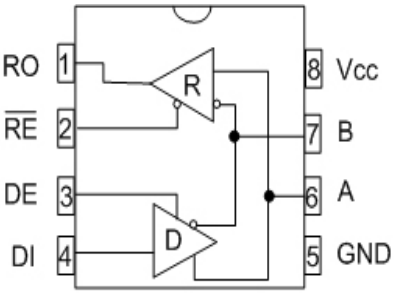
SP483 / SP485

Low Power Half-Duplex RS-485 Transceivers

FEATURES

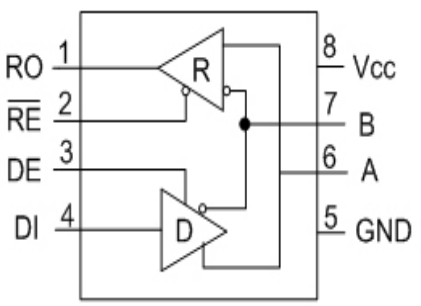
- +5V Only
- Low Power BiCMOS
- Driver / Receiver Enable
- Slew Rate Limited Driver for Low EMI (SP483)
- Low Power Shutdown mode (SP483)
- RS-485 and RS-422 Drivers/Receivers



SP483,SP485
Pinout (Top View)

DESCRIPTION

The **SP483** and **SP485** are a family of half-duplex transceivers that meet the specifications of RS-485 and RS-422. Their BiCMOS design allows low power operation without sacrificing performance. The **SP485** meets the requirements of RS-485 and RS-422 up to 5Mbps. Additionally, the **SP483** 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.



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}.....+7V
Input Voltages
Logic.....-0.3V to (Vcc + 0.5V)
Drivers.....-0.3V to (Vcc + 0.5V)
Receivers.....+/-15V
Output Voltages
Logic.....-0.3V to (Vcc + 0.5V)
Drivers.....+/-15V
Receivers.....-0.3V to (Vcc + 0.5V)
Storage Temperature.....-65˚C to +150˚C
Power Dissipation
8-pin NSOIC.....500mW

ELECTRICAL CHARACTERISTICS

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

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP483/SP485 DRIVER					
DC Characteristics					
Differential Output Voltage			Vcc	Volts	Unloaded; R = ∞ ; see figure 1
Differential Output Voltage	2		Vcc	Volts	With Load; R = 50Ω (RS-422); see figure 1
Differential Output Voltage	1.5		Vcc	Volts	With Load; R = 27Ω (RS-485); see figure 1
Change in Magnitude of Driver Differential Output Voltage for Complimentary states			0.2	Volts	R = 27Ω or R = 50Ω; see figure 1
Driver Common Mode Output Voltage			3	Volts	R = 27Ω or R = 50Ω; see 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
Driver Short Circuit Current, V_{OUT} = LOW			250	mA	-7V ≤ V_O ≤ +12V
SP485 DRIVER					
AC Characteristics					
Maximum Data Rate	5			Mbps	$\overline{RE}$ = 5V, DE = 5V
Driver Input to Output, t_{PLH}		30	60	ns	Figures 3 and 5, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF
Driver Input to Output, t_{PHL}		30	60	ns	Figures 3 and 5, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF
Driver Skew		5	10	ns	Figures 3 and 5, t_{SKEW} = $\lvert t_{DPHL} - t_{DPLH} \rvert$
Driver Rise or Fall Time		15	40	ns	From 10%-90%; R_{DIFF} = 54Ω C_{L1} = C_{L2} = 100pF; see figures 3 and 5

ELECTRICAL CHARACTERISTICS

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

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP485 DRIVER (continued)					
AC Characteristics					
Driver Enable to Output High		40	70	ns	C_L = 100pF, see figures 4 and 6, S_2 closed
Driver Enable to Output Low		40	70	ns	C_L = 100pF, see figures 4 and 6, S_1 closed
Driver Disable Time from High		40	70	ns	C_L = 15pF, see figures 2 and 8, S_2 closed
Driver Disable Time from Low		40	70	ns	C_L = 15pF, see figures 2 and 8, S_1 closed
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	2.4		5	Volts	I_O = -4mA, V_{ID} = +200mV
Output Voltage Low	0.0		0.4	Volts	I_O = +4mA, V_{ID} = -200mV
Three-State (High Impedance) Output Current			+/-1	µA	0.4V ≤ V_O ≤ 2.4V; $\overline{RE}$ = 5V
Input Resistance	12	15		kΩ	-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			95	mA	0V ≤ V_{CM} ≤ V_{CC}
SP485 RECEIVER					
AC Characteristics					
Maximum Data Rate	5			Mbps	$\overline{RE}$ = 0V, DE = 0V
Receiver Input to Output	20	45	200	ns	t_{PLH} ; Figures 3 and 7, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF
Receiver Input to Output	20	45	200	ns	t_{PHL} ; Figures 3 and 7, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF
Differential Receiver Skew $\lvert t_{PHL} - t_{PLH} \rvert$		13		ns	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF, Figures 3 and 7
Receiver Enable to Output Low		45	70	ns	C_{RL} = 15pF, Figures 2 and 8; S_1 Closed
Receiver Enable to Output High		45	70	ns	C_{RL} = 15pF, Figures 2 and 8; S_2 Closed
Receiver Disable from LOW		45	70	ns	C_{RL} = 15pF, Figures 2 and 8; S_1 Closed
Receiver Disable from High		45	70	ns	C_{RL} = 15pF, Figures 2 and 8; S_2 Closed

ELECTRICAL CHARACTERISTICS

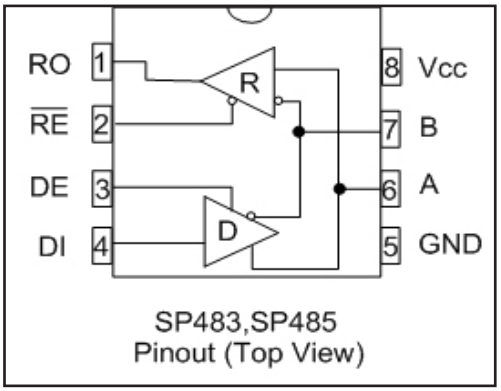
T_{MIN} to T_{MAX} and V_{CC} = 5V +/-5% unless otherwise noted.

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
POWER REQUIREMENTS					
Supply Voltage V_{CC}	+4.75		+5.25	Volts	
Supply Current					
SP485		900		µA	No Load; $\overline{RE}$, DI = 0V or V_{CC}; DE = V_{CC}
		900		µA	No Load; $\overline{RE}$ = 0V, DI = 0V or 5V; DE = 0V
SP483		600		µA	No Load; $\overline{RE}$, DI = 0V or V_{CC}; DE = V_{CC}
		600		µA	No Load; $\overline{RE}$ = 0V, DI = 0V or 5V; DE = 0V
SP483			10	µA	Shutdown Mode; $\overline{DE}$ = 0V, RE = V_{CC}
ENVIRONMENTAL AND MECHANICAL					
Operating Temperature					
Commercial (_C_)	0		70	ºC	
Industrial (_E_)	-40		+85	ºC	
Storage Temperature	-65		+150	ºC	
Package: Plastic DIP (_P), NSOIC (_N)					

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

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP483 DRIVER					
AC Characteristics					
Maximum Date Rate	250			kbps	
Driver Input to Output, t_{PLH}	250	800	2000	ns	t_{PLH}; R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF, see figures 3 and 5
Driver Input to Output, t_{PHL}	250	800	2000	ns	t_{PHL}; R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF, see figures 3 and 5
Driver Skew		100	800	ns	see figures 3 and 5, $t_{SKEW} = \lvert t_{DPHL} - t_{DPLH} \rvert$
Driver Rise or Fall Time	250		2000	ns	From 10%-90%; R_{DIFF} = 54Ω C_{L1} = C_{L2} = 100pF; see Figures 3 and 5
Driver Enable to Output High	250		2000	ns	C_L = 100pF, see figures 4 and 6, S_2 closed
Driver Enable to Output Low	250		2000	ns	C_L = 100pF, see figures 4 and 6, S_1 closed
Driver Disable Time from High	300		3000	ns	C_L = 15pF, see figures 4 and 6, S_2 closed
Driver Disable Time from Low	300		3000	ns	C_L = 15pF, see figures 4 and 6, S_1 closed
SP483 RECEIVER					
AC Characteristics					
Maximum Data Rate	250			kbps	
Receiver Input to Output	250		2000	ns	t_{PLH}, t_{PHL}; Figures 3 and 7: R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF
Differential Receiver Skew $\lvert t_{PHL} - t_{PLH} \rvert$		100		ns	R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF, see Figures 3 and 7
Receiver Enable to Output Low		20	50	ns	C_{RL} = 15pF, Figures 2 and 8; S_1 Closed
Receiver Enable to Output High		20	50	ns	C_{RL} = 15pF, Figures 2 and 8; S_2 Closed
Receiver Disable from LOW		20	50	ns	C_{RL} = 15pF, Figures 2 and 8; S_1 Closed
Receiver Disable from High		20	50	ns	C_{RL} = 15pF, Figures 2 and 8; 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 and 6; S_2 Closed
Driver Enable from Shutdown to Output Low			2000	ns	C_L = 100pF; See Figures 4 and 6; S_1 Closed
Receiver Enable from Shutdown to Output High			2500	ns	C_L = 15pF; See Figures 4 and 6; S_2 Closed
Receiver Enable from Shutdown to Output Low			2500	ns	C_L = 15pF; See Figures 4 and 6; S_1 Closed

PIN FUNCTION



SP483,SP485
Pinout (Top View)

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 - Driver Output / Receiver input
Non-Inverting

Pin 7 - B - Driver Output / Receiver Input Inverting

Pin 8 - Vcc - Positive Supply 4.75V ≤ Vcc ≤ 5.25V

TEST CIRCUITS

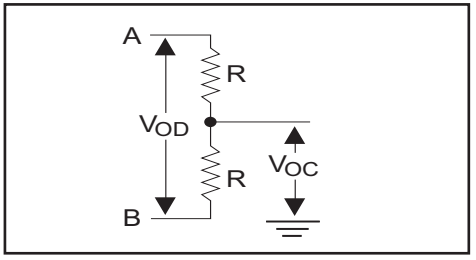


Figure 1. Driver DC Test Load Circuit

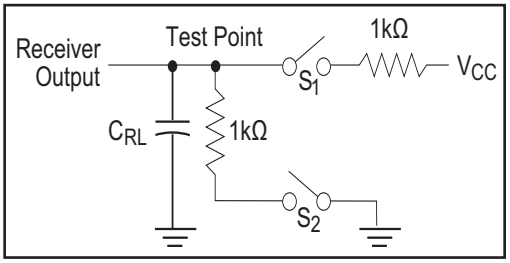


Figure 2. Receiver Timing Test Load Circuit

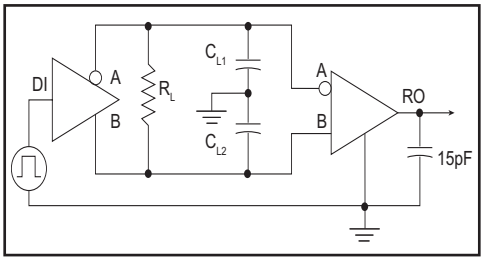


Figure 3. RS-485 Driver/Receiver Timing Test

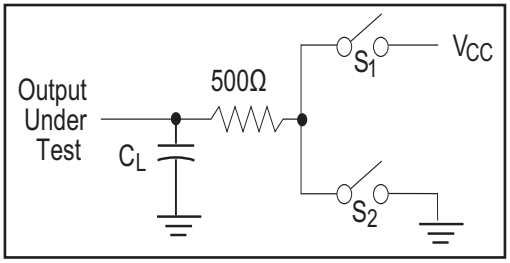


Figure 4. Driver Timing Test Load #2 Circuit

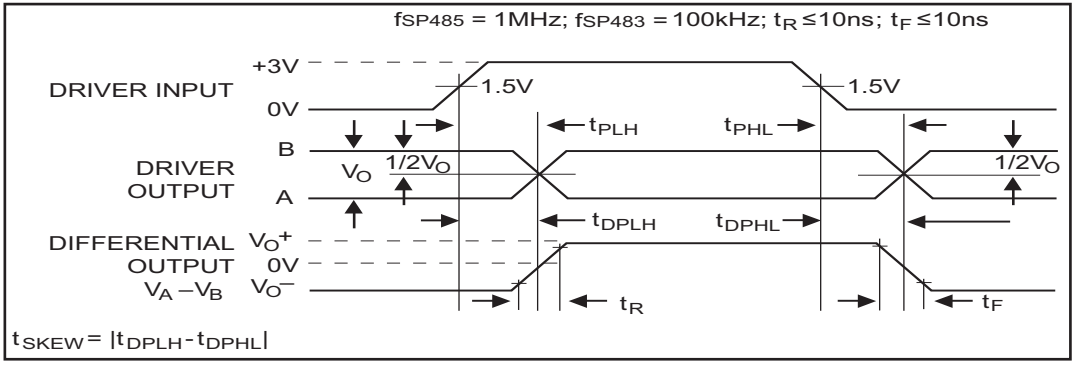


Figure 5. Driver Propagation Delays

FUNCTION TRUTH TABLES

INPUTS				OUTPUTS	
$\overline{RE}$	DE	DI	LINE CONDITION	A	B
X	1	1	No Fault	1	0
X	1	0	No Fault	0	1
X	0	X	X	Z	Z
X	1	X	Fault	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

SWITCHING WAVEFORMS

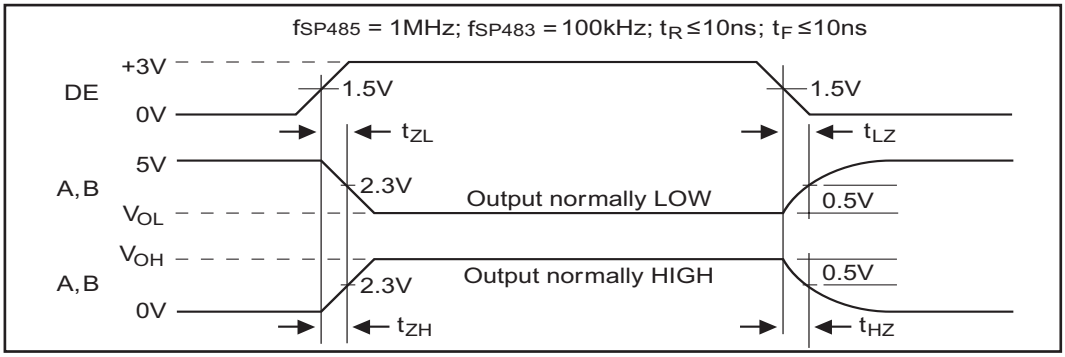


Figure 6. Driver Enable and Disable Times

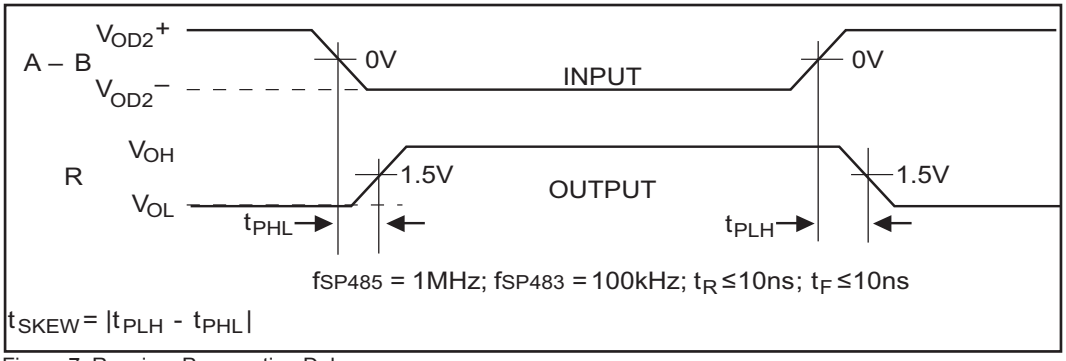


Figure 7. Receiver Propagation Delays

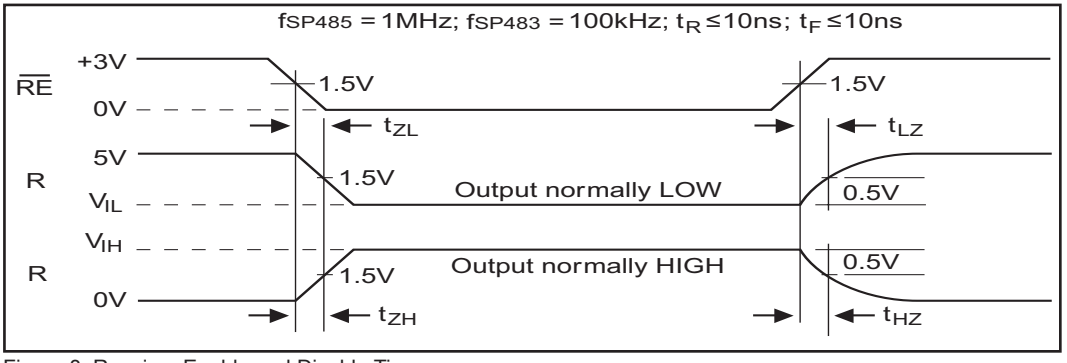


Figure 8. Receiver Enable and Disable Times

The **SP483** and **SP485** are half-duplex differential transceivers that meet the requirements of RS-485 and RS-422. Fabricated with an **Exar** proprietary BiCMOS process, this product requires 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
SP483 and SP485

The driver outputs of the **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 **SP483** and **SP485** have an 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 transmitters of the **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
SP483 and SP485

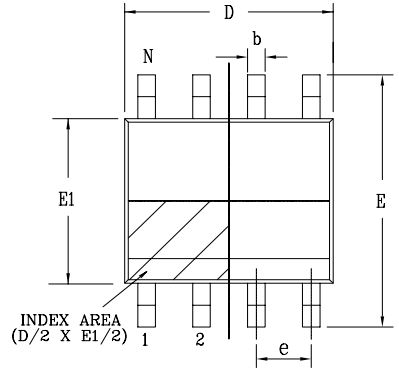
The **SP483** and **SP485** receivers have differential inputs with an input sensitivity as low as ±200mV. Input impedance of the receivers is typically 15kΩ (12kΩ minimum). A wide common mode range of -7V to +12V allows for large ground potential differences between systems. The receivers of the **SP483** and **SP485** have a tri-state enable control pin. A logic LOW on $\overline{RE}$ (pin 2) will enable the receiver, a logic HIGH on $\overline{RE}$ (pin 2) will disable the receiver.

The receiver for the **SP485** will operate up to at least 10Mbps. 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 and floating.

Shutdown Mode
SP483

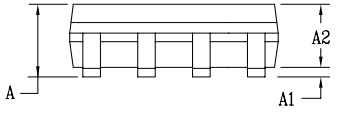
The **SP483** is equipped with a Shutdown mode. To enable the shutdown state, both driver and receiver must be disabled simultaneously. A logic LOW on DE (pin 3) and a Logic HIGH on $\overline{RE}$ (pin 2) will put the **SP483** into Shutdown mode. In Shutdown, supply current will drop to typically 1µA.

REVISION HISTORY			
REV.	DISCRIPTION	DATE	APP'D
A	DRAWING ORIGINATION	08/16/05	JL
B	DRAWING FORMAT MODIFICATION	07/19/06	JL
C	CHANGE DRAWING LOGO ADN COMPANY NAME	11/16/07	JL

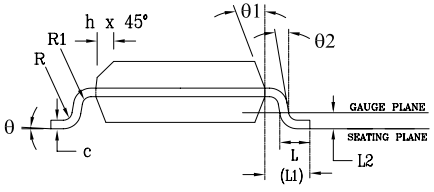


Top View

8 Pin SOICN JEDEC MS-012 Variation AA						
SYMBOLS	DIMENSIONS IN MM (Control Unit)			DIMENSIONS IN INCH (Reference Unit)		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.35	—	1.75	0.053	—	0.069
A1	0.10	—	0.25	0.004	—	0.010
A2	1.25	—	1.65	0.049	—	0.065
b	0.31	—	0.51	0.012	—	0.020
c	0.17	—	0.25	0.007	—	0.010
E	6.00 BSC			0.236 BSC		
E1	3.90 BSC			0.154 BSC		
e	1.27 BSC			0.050 BSC		
h	0.25	—	0.50	0.010	—	0.020
L	0.40	—	1.27	0.016	—	0.050
L1	1.04 REF			0.041 REF		
L2	0.25 BSC			0.010 BSC		
R	0.07	—	—	0.003	—	—
R1	0.07	—	—	0.003	—	—
θ	0°	—	8°	0°	—	8°
θ1	5°	—	15°	5°	—	15°
θ2	0°	—	—	0°	—	—
D	4.90 BSC			0.193 BSC		
N	8			8		



Side View

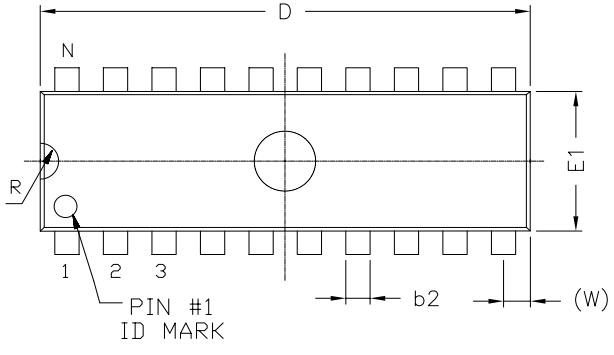


Front View

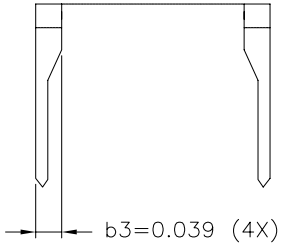
EXAR Powering Connectivity	EXAR CORPORATION		
	8 PIN SOICN PACKAGE OUTLINE		
Packaging Approval:		Drawing No:	8-PIN SOICN
By: JL	Date: 11/16/07	Revision: C	Sheet: 1 OF 1

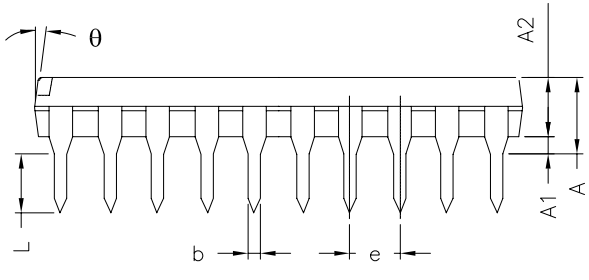
REVISION HISTORY			
REV.	DISCRIPTION	DATE	APP'D
A	DRAWING ORIGINATION	04/26/06	JL
B	CHNAGE DRAWING LOGO AND COMPANY NAME	11/28/07	JL

REMARKS:
FOR 8LD AND 16LD
ALL END LEADS (4X)
ARE HALF LEAD TYPES

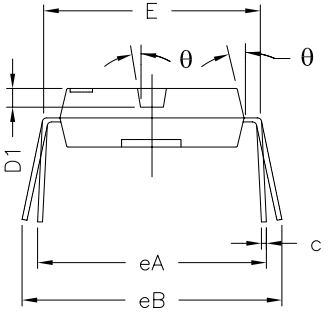


Top View





Side View



Front View

8 Pin PDIP JEDEC MS-001 Variation BA						
SYMBOLS	DIMENSIONS IN INCH (Control Unit)			DIMENSIONS IN MM (Reference Unit)		
	MIN	NOM	MAX	MIN	NOM	MAX
A	—	—	0.210	—	—	5.33
A1	0.015	—	—	0.38	—	—
A2	0.115	0.130	0.195	2.92	3.30	4.95
b	0.014	0.018	0.022	0.36	0.46	0.56
b2	0.045	0.060	0.070	1.14	1.52	1.78
c	0.008	0.010	0.014	0.20	0.25	0.36
D1	0.030	—	0.060	0.76	—	1.52
E	0.300	0.310	0.325	7.62	7.87	8.26
E1	0.240	0.250	0.280	6.10	6.35	7.11
e	0.100 BSC			2.54 BSC		
eA	0.300 BSC			7.62 BSC		
eB	—	—	0.430	—	—	10.92
L	0.115	0.130	0.150	2.92	3.30	3.81
W	0.075 REF			1.91 REF		
R	0.030 BSC			0.76 BSC		
θ	4°	7°	10°	4°	7°	10°
D	0.355	0.365	0.400	9.02	9.27	10.16
N	8			8		

EXAR Powering Connectivity	EXAR CORPORATION		
	8 PIN PDIP PACKAGE OUTLINE		
Packaging Approval:	Drawing No: 8-PIN PDIP		
By: JL / Date: 11/28/07	Revision: B	Sheet: 1 OF 1	

ORDERING INFORMATION

Model	Temperature Range	Package Types
SP483CN-L	0°C to +70°C	8-pin NSOIC
SP483CN-L/TR	0°C to +70°C	8-pin NSOIC
SP483EN-L	-40°C to +85°C	8-pin NSOIC
SP483EN-L/TR	-40°C to +85°C	8-pin NSOIC
SP485CN-L	0°C to +70°C	8-pin NSOIC
SP485CN-L/TR	0°C to +70°C	8-pin NSOIC
SP485CS-L	0°C to +70°C	8-pin PDIP
SP485EN-L	-40°C to +85°C	8-pin NSOIC
SP485EN-L/TR	-40°C to +85°C	8-pin NSOIC
SP485ES-L	-40°C to +85°C	8-pin PDIP

Note: /TR = Tape and Reel

REVISION HISTORY

DATE	REVISION	DESCRIPTION
07/28/04	--	Legacy Sipex Datasheet
07/14/10	1.0.0	Convert to Exar Format. Update ordering information as a result of discontinued Lead type package options per PDN 081126-01. Remove all options and reference to SP481; Part is EOL. Remove "GND" entry from Minimum column of SP483/485 driver DC Characteristic paramter "Differential output voltage - Unloaded".
June 2011	1.0.1	Remove Driver Short Circuit Current minimum. Change Vcc ABS MAX Rating from +12V to +7V. Add 12k ohm minimum value to receiver Input Resistance. Change SP485 receiver propagation delay MIN and TYP to 20 and 45ns respectively, receiver Enable and Disable TYP and MAX to 45 and 70ns respectively. Remove SP483CS-L and SP483ES-L ordering part number per PDN 110510-01.

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