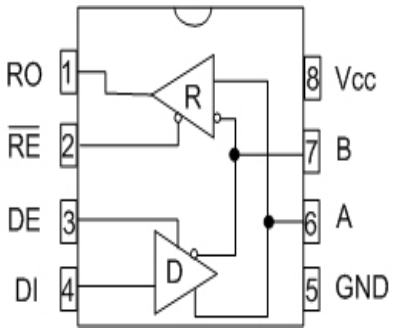
SP1481E/SP1485E

Enhanced Low Power Half-Duplex RS-485 Transceivers

- +5V Only
- Low Power BiCMOS
- Driver/Receiver Enable for Multi-Drop configurations
- Low Power Shutdown Mode (SP1481E)
- Enhanced ESD Specifications:
  ±15KV Human Body Model
  ±15KV IEC61000-4-2 Air Discharge



Now Available in Lead Free Packaging

DESCRIPTION

The SP1481E and the SP1485E are a family of half-duplex transceivers that meet the specifications of RS-485 and RS-422 serial protocols with enhanced ESD performance. The ESD tolerance has been improved on these devices to over ±15KV for both Human Body Model and IEC61000-4-2 Air Discharge Method. These devices are pin-to-pin compatible with Exar's SP481 and SP485 devices as well as popular industry standards. As with the original versions, the SP1481E and the SP1485E feature Exar's BiCMOS design allowing low power operation without sacrificing performance. The SP1481E and SP1485E meet the requirements of the RS-485 and RS-422 protocols up to 20Mbps under load. The SP1481E is 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}.....+7V

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 per Package

8-pin NSOIC (derate 6.60mW/ºC above +70ºC).....550mW

ELECTRICAL CHARACTERISTICS

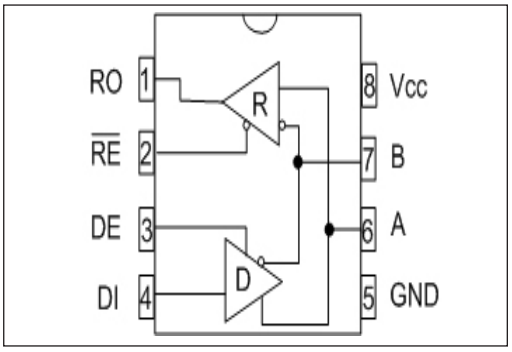
T_{MIN} to T_{MAX} and V_{CC} = 5V ± 5% unless otherwise noted.

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP1481E/SP1485E DRIVER DC Characteristics					
Differential Output Voltage	3.5		V_{CC}	Volts	Unloaded; R = ∞; see Figure 1
Differential Output Voltage	2		V_{CC}	Volts	with load; R = 50Ω; (RS-422); see Figure 1
Differential Output Voltage	1.5		V_{CC}	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
V_{OUT} = LOW			±250	mA	-7V ≤ V_O ≤ +12V
SP1481E/SP1485E DRIVER AC Characteristics					
Maximum Data Rate	20			Mbps	$\overline{RE}$ = 5V, DE = 5V; R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF
Driver Input to Output		20	30	ns	t_{PLH}; R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF; see Figures 3 and 5
Driver Input to Output (SP1485EMN ONLY)		20	40	ns	t_{PLH}; R_{DIFF} = 54Ω, C_{LI} = C_{L2} = 100pF; See Figures 3 and 5
Driver Input to Output		20	30	ns	t_{PHL}; R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF; see Figures 3 and 5
Driver Input to Output (SP1485EMN ONLY)		20	40	ns	t_{PHL}; R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF; see Figures 3 and 5
Driver Skew		3	5	ns	see Figures 3 and 5, t_{SKEW} = | t_{PLH} - t_{PHL} |
Driver Rise or Fall Time		8	20	ns	From 10% to 90%; R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF; see Figures 3 & 6
Driver Enable to Output High		40	70	ns	C_L = 100pF; see Figures 4 & 6; S_2 closed
Driver Enable to Output Low		40	70	ns	C_L = 100pF; see Figures 4 & 6; S_1 closed
Driver Disable Time from Low		40	70	ns	C_L = 100pF; see Figures 4 & 6; S_1 closed
Driver Disable Time from High		40	70	ns	C_L = 100pF; see Figures 4 & 6; S_2 closed

SPECIFICATIONS (continued)

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

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
SP1481E/SP1485E RECEIVER					
DC Characteristics					
Differential Input Threshold	-0.2		+0.2	Volts	-7V ≤ V_{CM} ≤ +12V
Differential Input Threshold	-0.4		+0.4	Volts	-7V ≤ V_{CM} ≤ +12V
(SP1485EMN ONLY)					
Input Hysteresis		20		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; $\overline{RE}$ = 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	7		95	mA	0V ≤ V_O ≤ V_{CC}
SP1481E/SP1485E RECEIVER					
AC Characteristics					
Maximum Data Rate	20			Mbps	$\overline{RE}$ = 0V, DE = 0V
Receiver Input to Output		25	70	ns	t_{PLH}; R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF; Figures 3 & 7
Receiver Input to Output		25	70	ns	t_{PHL}; R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF; Figures 3 & 7
Diff. Receiver Skew $\lvert t_{PLH}-t_{PHL} \rvert$		5	10	ns	R_{DIFF} = 54Ω; C_{L1} = C_{L2} = 100pF; Figures 3 & 7
Receiver Enable to Output Low		45	70	ns	C_{RL} = 15pF; Figures 2 & 8; S_1 closed
Receiver Enable to Output High		45	70	ns	C_{RL} = 15pF; Figures 2 & 8; S_2 closed
Receiver Disable from Low		45	70	ns	C_{RL} = 15pF; Figures 2 & 8; S_1 closed
Receiver Disable from High		45	70	ns	C_{RL} = 15pF; Figures 2 & 8; S_2 closed
SP1481E					
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 & 6; S_2 closed
Driver Enable from Shutdown to Output Low		40	100	ns	C_L = 100pF; See Figures 4 & 6; S_1 closed
Receiver Enable from Shutdown to Output High		300	1000	ns	C_L = 15pF; See Figures 2 & 8; S_2 closed
Receiver Enable from Shutdown to Output Low		300	1000	ns	C_L = 15pF; See Figures 2 & 8; S_1 closed
POWER REQUIREMENTS					
Supply Voltage	+4.75		+5.25	Volts	
Supply Current					
SP1481E/1485E					
No Load		900		µA	$\overline{RE}$, DI = 0V or V_{CC}; DE = V_{CC}
		600		µA	$\overline{RE}$ = 0V, DI = 0V or 5V; DE = 0V
SP1481E					
Shutdown Mode			10	µA	DE = 0V, $\overline{RE}$=V_{CC}
ENVIRONMENTAL AND MECHANICAL					
Operating Temperature					
Commercial (_C_)	0		+70	°C	
Industrial (_E_)	-40		+85	°C	
(_M_)	-40		+125	°C	
Storage Temperature	-65		+150	°C	
Package					
NSOIC (_N)					



SP1481E and SP1485E
Pinout (Top View)

PIN FUNCTION

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.

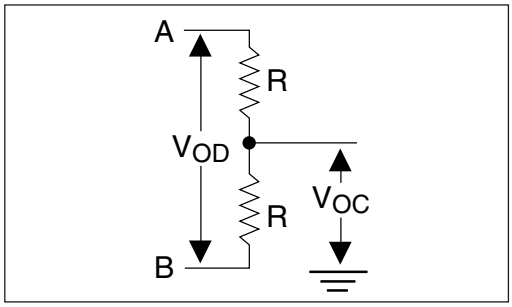


Figure 1. RS-485 Driver DC Test Load Circuit

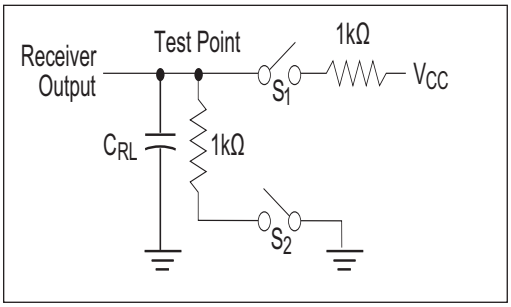


Figure 2. Receiver Timing Test Load Circuit

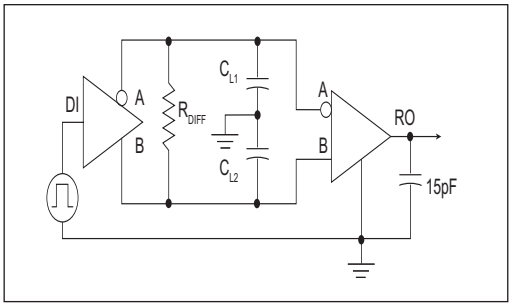


Figure 3. RS-485 Driver/Receiver Timing Test Circuit

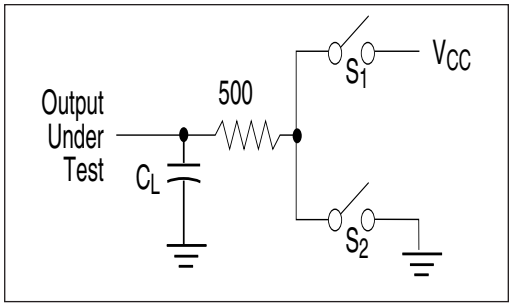


Figure 4. RS-485 Driver Timing Test Load #2 Circuit

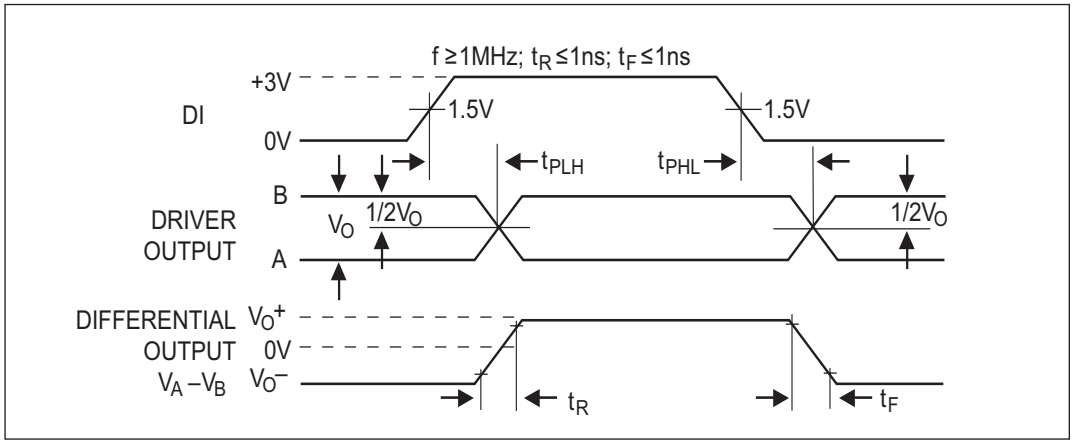


Figure 5. Driver Propagation Delays

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
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

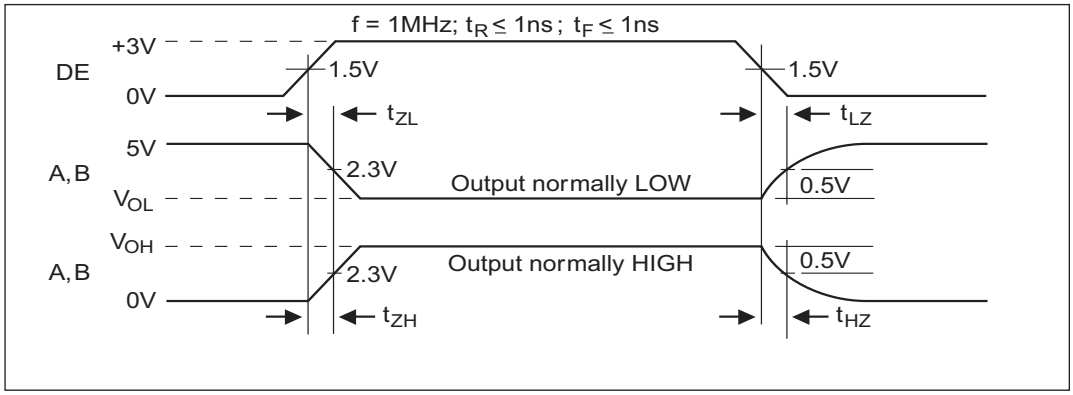


Figure 6. Driver Enable and Disable Times

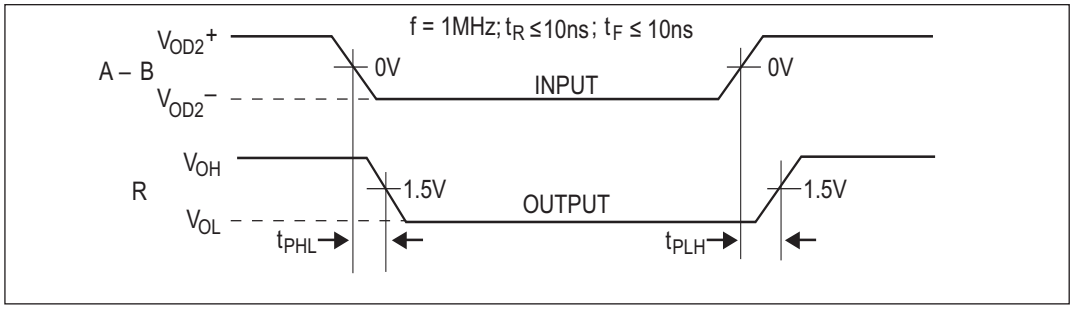


Figure 7. Receiver Propagation Delays

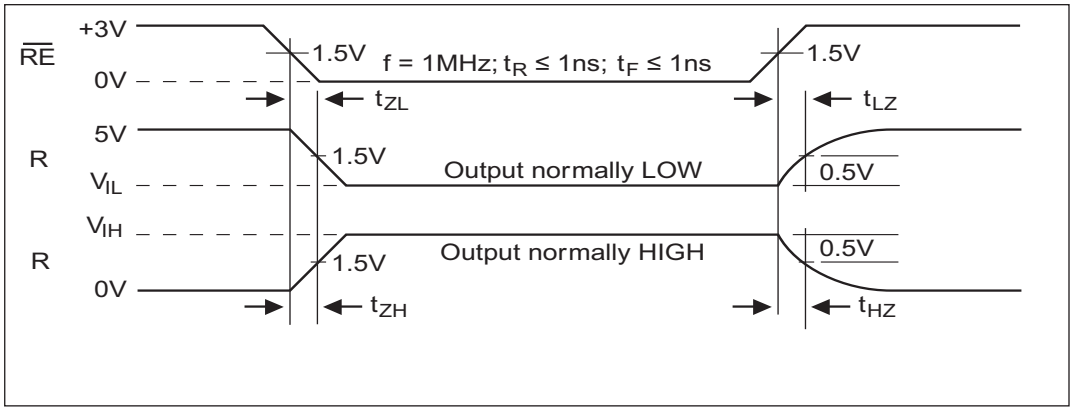


Figure 8. Receiver Enable and Disable Times

DESCRIPTION

The SP1481E and SP1485E are half-duplex differential transceivers that meet the requirements of RS-485 and RS-422. Fabricated with a Exar proprietary BiCMOS process, these 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

The driver outputs of the SP1481E and SP1485E 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 SP1481E, and SP1485E 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 DE (pin 3) will tri-state the driver outputs.

The transmitters of the SP1481E and SP1485E will operate up to at least 20Mbps.

Receivers

The SP1481E and SP1485E 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 SP1481E and SP1485E have a tri-state enable control pin.

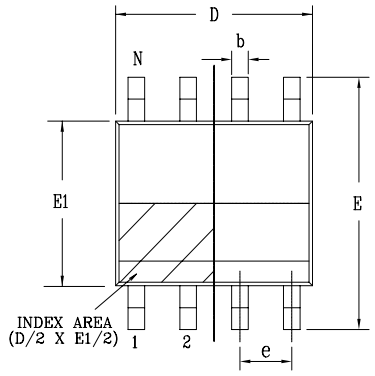
A logic LOW on $\overline{RE}$ (pin 2) will enable the receiver, a logic HIGH on $\overline{RE}$ (pin 2) will disable the receiver.

The receiver for the SP1481E and SP1485E will operate up to at least 20Mbps. The receiver for each of the two 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
SP1481E

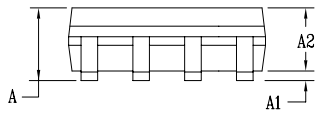
The SP1481E is equipped with a Shutdown mode. To enable the Shutdown state, both the driver and receiver must be disabled simultaneously.
A logic LOW on DE (pin 3) and a logic HIGH on $\overline{RE}$ (pin 2) will put the SP1481E into Shutdown mode. In Shutdown, supply current will drop to typically 1µA.

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

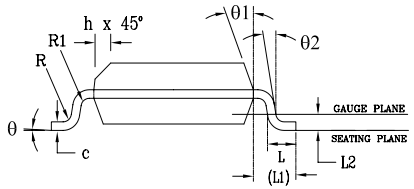


Top View

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 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	

ORDERING INFORMATION

Model	Temperature Range	Package
SP1481ECN-L	0˚C to +70˚C	8-pin Narrow SOIC
SP1481ECN-L/TR	0˚C to +70˚C	8-pin Narrow SOIC
SP1481EEN-L	-40˚C to +85˚C	8-pin Narrow SOIC
SP1481EEN-L/TR	-40˚C to +85˚C	8-pin Narrow SOIC
SP1485ECN-L	0˚C to +70˚C	8-pin Narrow SOIC
SP1485ECN-L/TR	0˚C to +70˚C	8-pin Narrow SOIC
SP1485EEN-L	-40˚C to +85˚C	8-pin Narrow SOIC
SP1485EEN-L/TR	-40˚C to +85˚C	8-pin Narrow SOIC
SP1485EMN-L	-40˚C to +125˚C	8-pin Narrow SOIC
SP1485EMN-L/TR	-40˚C to +125˚C	8-pin Narrow SOIC

DATE	REVISION	DESCRIPTION
03/08/07	J	Legacy Sipex Datasheet
06/16/09	1.0.0	Convert to Exar format, update ordering information and change revision to 1.0.0
08/03/10	1.0.1	Remove SP1485EMN option.
10/27/10	1.0.2	Reactiviate SP1485EMN option per PCN # 07-0502-01
05/24/13	1.0.3	Correct type errors per PCN 13-0503-01 ECN: 1322-01 5/29/13

Datasheet May 2013

For technical support please email Exar's Serial Technical Support group at: serialtechsupport@exar.com