

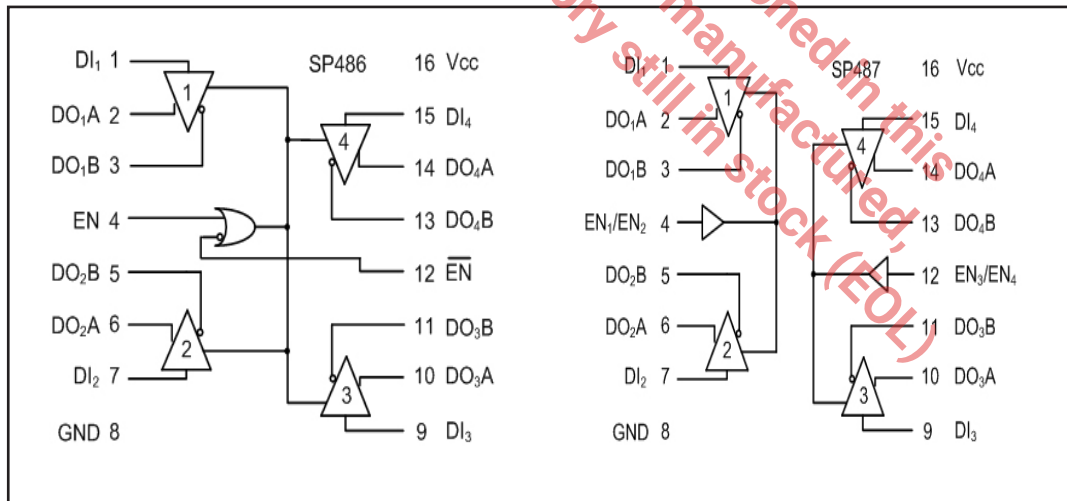
## Quad RS-485/RS-422 Line Drivers

- RS-485 or RS-422 Applications
- Quad Differential Line Drivers
- Tri-state Output Control
- 40ns Typical Driver Propagation Delays
- 5ns Skew
- -7V to +12V Common Mode Output Range
- 100 $\mu$ A Supply Current
- Single +5V Supply Operation
- Pin Compatible with SN75172, SN75174, LTC486 and LTC487

### DESCRIPTION

The **SP486** and **SP487** are low-power quad differential line drivers meeting RS-485 and RS-422 standards. The SP486 features a common driver enable control; the SP487 provides independent driver enable controls for each pair of drivers. Both feature tri-state outputs and a wide common-mode output range. SP486 and SP487 are available in a 16-pin SOIC package.

**SP487 is available; SP486 is obsolete**



## 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.....	-0.5V to ( $V_{CC} + 0.5V$ )
Drivers.....	-0.5V to ( $V_{CC} + 0.5V$ )
Driver Output Voltage.....	+/-14V
Input Currents	
Logic.....	+/-25mA
Driver.....	+/-25mA
Storage Temperature.....	-65°C to +150°C
Power Dissipation	
Plastic DIP.....	375mW
(derate 7mW/°C above +70°C)	
Small Outline.....	375mW
(derate 7mW/°C above +70°C)	

## ELECTRICAL CHARACTERISTICS

$V_{CC} = +5.0V \pm 5\%$ ; typicals at 25°C;  $T_{MIN} \leq T_{AMB} \leq T_{MAX}$  unless otherwise noted.

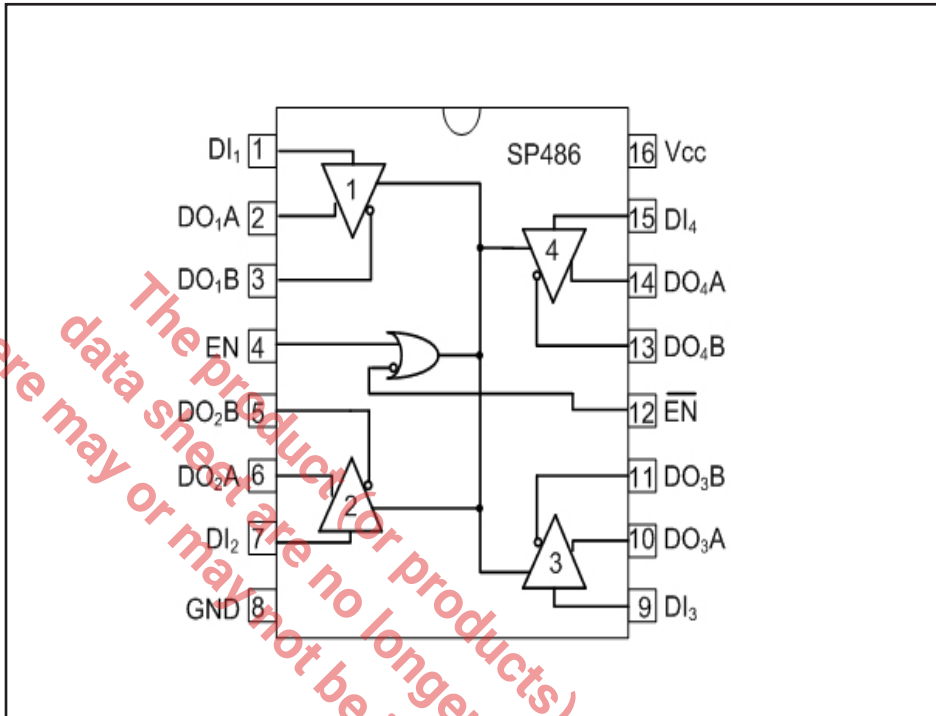
PARAMETERS	MIN	TYP	MAX	UNITS	CONDITIONS
<b>DC CHARACTERISTICS</b>					
<b>DIGITAL INPUTS</b>					DI, EN, $\overline{EN}$ , EN <sub>1</sub> /EN <sub>2</sub> , EN <sub>3</sub> /EN <sub>4</sub>
Voltage $V_{IL}$			0.8	Volts	
Voltage $V_{IH}$	2.0			Volts	
Input Current			+/-2	μA	$V_{IN} = 0V$ to $V_{CC}$
<b>DRIVER OUTPUTS</b>					
Differential Voltage			5	Volts	$I_O = 0$ ; unloaded
Differential Voltage	2			Volts	$R_L = 50\Omega$ (RS-422); Figure 1
Differential Voltage	1.5	2	5	Volts	$R_L = 27\Omega$ (RS-485); Figure 1
Change in Output Magnitude for Complementary Output state			0.2	Volts	$R_L = 27\Omega$ or $50\Omega$ ; Figure 1
Common Mode Output Voltage		2.3	3	Volts	$R_L = 27\Omega$ or $50\Omega$ ; Figure 1
Change in Common Mode Output Magnitude for Complementary Output state			0.2	Volts	$R_L = 27\Omega$ or $50\Omega$ ; Figure 1
Driver Short Circuit Current $V_{OH}$			+/-250	mA	$-7V \leq V_O \leq +10V$
Driver Short Circuit Current $V_{OL}$			+/-250	mA	$-7V \leq V_O \leq +10V$
High Impedance Output Current		+/-2	+/-200	μA	$V_O = -7V$ to $+10V$
<b>POWER REQUIREMENTS</b>					
Supply Voltage	4.75		5.25	Volts	
Supply Current		0.5	10	μA	No load, output enabled
Supply Current		0.1	10	μA	No load, output disabled

## ELECTRICAL CHARACTERISTICS

$V_{CC} = +5.0V \pm 5\%$ ; typicals at  $25^{\circ}C$ ;  $T_{MIN} \leq T_{AMB} \leq T_{MAX}$  unless otherwise noted.

PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
ENVIRONMENTAL AND MECHANICAL					
Operating Temperature, _C	0		+70	°C	
Operating Temperature, _E	-40		+85	°C	
Storage Temperature	-65		+150	°C	
Package - _T	16-pin SOIC				
AC CHARACTERISTICS					
Maximum Data Rate	10			Mbps	
Propagation Delay, t <sub>PLH</sub>	20	40	60	ns	R <sub>DIFF</sub> = 54 ohms, C <sub>L1</sub> = C <sub>L2</sub> = 100pF; Figure 2
Propagation Delay, t <sub>PHL</sub>	20	40	60	ns	R <sub>DIFF</sub> = 54 ohms, C <sub>L1</sub> = C <sub>L2</sub> = 100pF; Figure 2
Differential Driver Skew		5	15	ns	R <sub>DIFF</sub> = 54 ohms, C <sub>L1</sub> = C <sub>L2</sub> = 100pF; Figure 2
Driver Rise Time (t <sub>R</sub> )		20		ns	10% to 90%
Driver Fall Time (t <sub>F</sub> )		20		ns	90% to 10%
Driver Enable to output High		60	110	ns	C <sub>L</sub> = 100pF, Figures 3 and 5 (S2 closed)
Driver Enable to output Low		60	115	ns	C <sub>L</sub> = 100pF, Figures 3 and 5 (S1 closed)
Driver Disable from output High		60	130	ns	C <sub>L</sub> = 15pF, Figures 3 and 5 (S2 closed)
Driver Disable from output Low		60	130	ns	C <sub>L</sub> = 15pF, Figures 3 and 5 (S1 closed)

## SP486



## Pin Function SP486

Pin 1 - DI<sub>1</sub> - Driver 1 Input - If driver 1 output is enabled, a logic 0 on DI<sub>1</sub> forces driver output DO<sub>1</sub>A low and DO<sub>1</sub>B high. A logic 1 on DI<sub>1</sub> with driver 1 output enabled forces driver DO<sub>1</sub>A high and DO<sub>1</sub>B low.

Pin 2 - DO<sub>1</sub>A - Driver 1 output A.

Pin 3 - DO<sub>1</sub>B - Driver 1 output B.

Pin 4 - EN - Driver Output Enable; Please refer to SP486 truth table (1).

Pin 5 - DO<sub>2</sub>B - Driver 2 output B.

Pin 6 - DO<sub>2</sub>A - Driver 2 output A.

Pin 7 - DI<sub>2</sub> - Driver 2 Input - If driver 2 output is enabled, a logic 0 on DI<sub>2</sub> forces driver output DO<sub>2</sub>A low and DO<sub>2</sub>B high. A logic 1 on DI<sub>2</sub> with driver 2 output enabled forces driver DO<sub>2</sub>A high and DO<sub>2</sub>B low.

Pin 8 - GND - Ground.

Pin 9 - DI<sub>3</sub> - Driver 3 Input - If driver 3 output is enabled, a logic 0 on DI<sub>3</sub> forces driver output DO<sub>3</sub>A low and DO<sub>3</sub>B high. A logic 1 on DI<sub>3</sub> with driver 3 output enabled forces driver DO<sub>3</sub>A high and DO<sub>3</sub>B low.

Pin 10 - DO<sub>3</sub>A - Driver 3 output A.

Pin 11 - DO<sub>3</sub>B - Driver 3 output B.

Pin 12 -  $\overline{\text{EN}}$  - Driver Output Disable; Please refer to SP486 truth table (1).

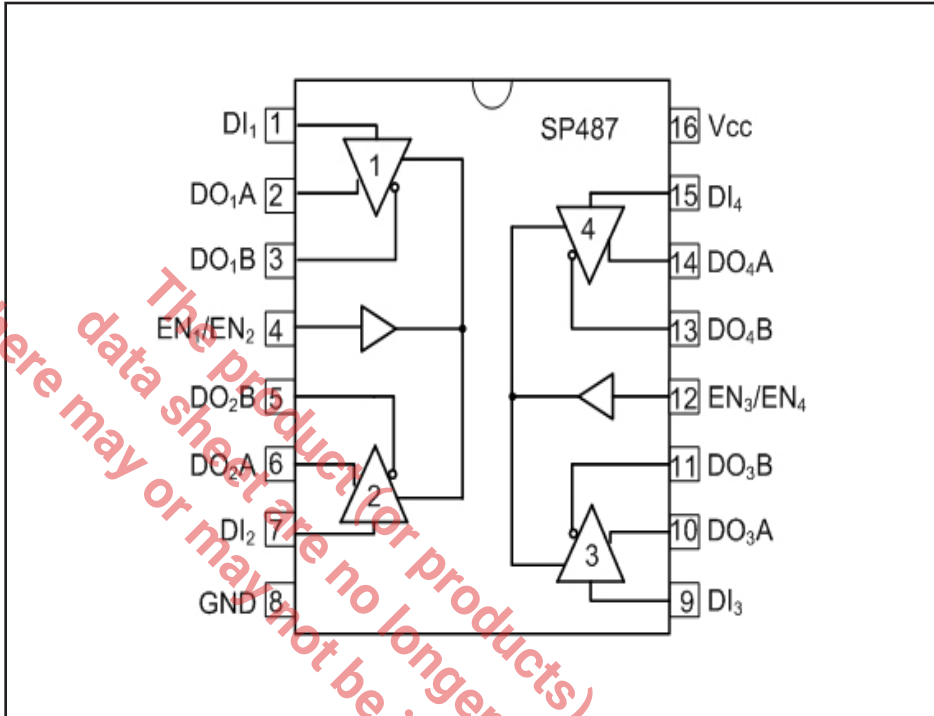
Pin 13 - DO<sub>4</sub>B - Driver 4 output B.

Pin 14 - DO<sub>4</sub>A - Driver 4 output A.

Pin 15 - DI<sub>4</sub> - Driver 4 Input - If driver 4 output is enabled, a logic 0 on DI<sub>4</sub> forces driver output DO<sub>4</sub>A low and DO<sub>4</sub>B high. A logic 1 on DI<sub>4</sub> with driver 4 output enabled forces driver DO<sub>4</sub>A high and DO<sub>4</sub>B low.

Pin 16 - Supply Voltage -  $+4.75\text{V} \leq V_{\text{CC}} \leq +5.25\text{V}$ .

## SP487



## Pin Function SP487

Pin 1 - DI<sub>1</sub> - Driver 1 Input - If driver 1 output is enabled, a logic 0 on DI<sub>1</sub> forces driver output DO<sub>1</sub>A low and DO<sub>1</sub>B high. A logic 1 on DI<sub>1</sub> with driver 1 output enabled forces driver DO<sub>1</sub>A high and DO<sub>1</sub>B low.

Pin 2 - DO<sub>1</sub>A - Driver 1 output A.

Pin 3 - DO<sub>1</sub>B - Driver 1 output B.

Pin 4 - EN<sub>1</sub>/EN<sub>2</sub> - Driver 1 and 2 Output Enable; Please refer to SP487 truth table (2).

Pin 5 - DO<sub>2</sub>B - Driver 2 output B.

Pin 6 - DO<sub>2</sub>A - Driver 2 output A.

Pin 7 - DI<sub>2</sub> - Driver 2 Input - If driver 2 output is enabled, a logic 0 on DI<sub>2</sub> forces driver output DO<sub>2</sub>A low and DO<sub>2</sub>B high. A logic 1 on DI<sub>2</sub> with driver 2 output enabled forces driver DO<sub>2</sub>A high and DO<sub>2</sub>B low.

Pin 8 - GND - Ground.

Pin 9 - DI<sub>3</sub> - Driver 3 Input - If driver 3 output is enabled, a logic 0 on DI<sub>3</sub> forces driver output DO<sub>3</sub>A low and DO<sub>3</sub>B high. A logic 1 on DI<sub>3</sub> with driver 3 output enabled forces driver DO<sub>3</sub>A high and DO<sub>3</sub>B low.

Pin 10 - DO<sub>3</sub>A - Driver 3 output A.

Pin 11 - DO<sub>3</sub>B - Driver 3 output B.

Pin 12 - EN<sub>3</sub>/EN<sub>4</sub> - Driver 3 and 4 Output Enable; Please refer to SP487 truth table (2)..

Pin 13 - DO<sub>4</sub>B - Driver 4 output B.

Pin 14 - DO<sub>4</sub>A - Driver 4 output A.

Pin 15 - DI<sub>4</sub> - Driver 4 Input - If driver 4 output is enabled, a logic 0 on DI<sub>4</sub> forces driver output DO<sub>4</sub>A low and DO<sub>4</sub>B high. A logic 1 on DI<sub>4</sub> with driver 4 output enabled forces driver DO<sub>4</sub>A high and DO<sub>4</sub>B low.

Pin 16 - Supply Voltage -  $+4.75V \leq V_{cc} \leq +5.25V$ .

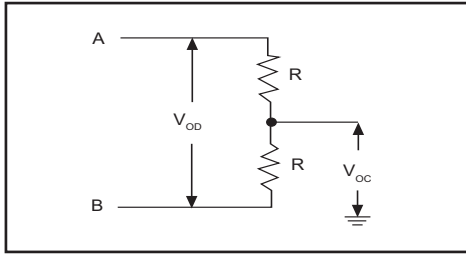


Figure 1. Driver DC Test Load

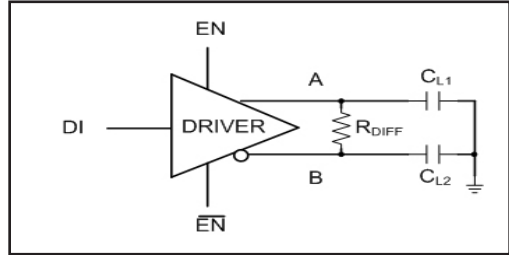


Figure 2. Driver Timing Test

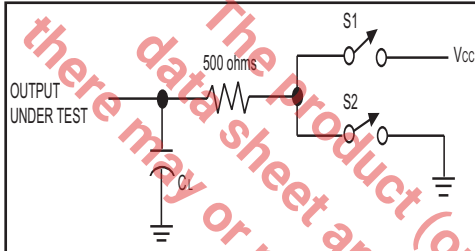


Figure 3. Driver Timing Test Load

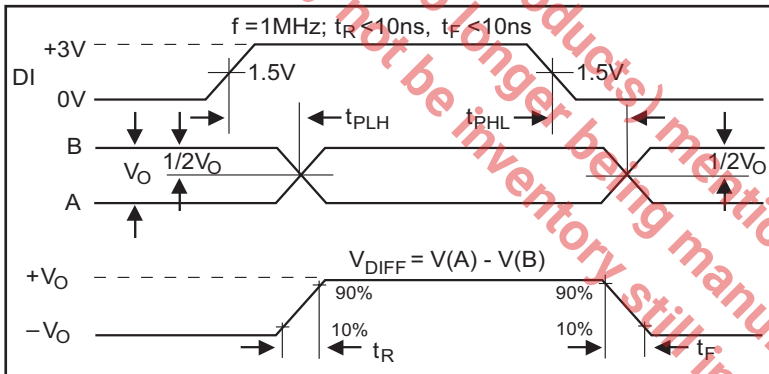


Figure 4. Driver Propagation Delays

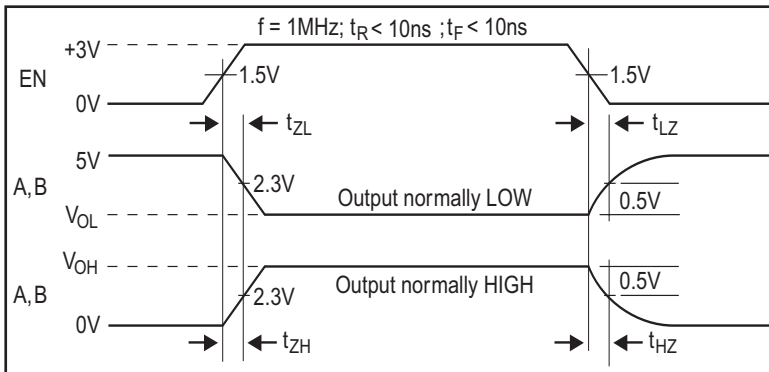


Figure 5. Driver Enable/Disable Timing

The **SP486** and **SP487** are low power quad differential line drivers meeting RS-485 and RS-422 standards. The SP486 features active high and active low common driver enable controls; the SP487 provides independent, active high driver enable controls for each pair of drivers. The driver outputs are short-circuit limited to 200mA. Data rates up to 10Mbps are supported. The SP486 and SP487 are available in a 16-pin SOIC package.

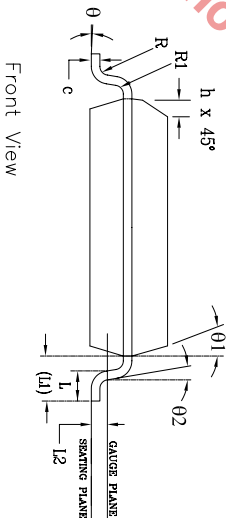
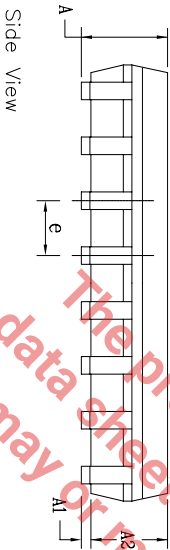
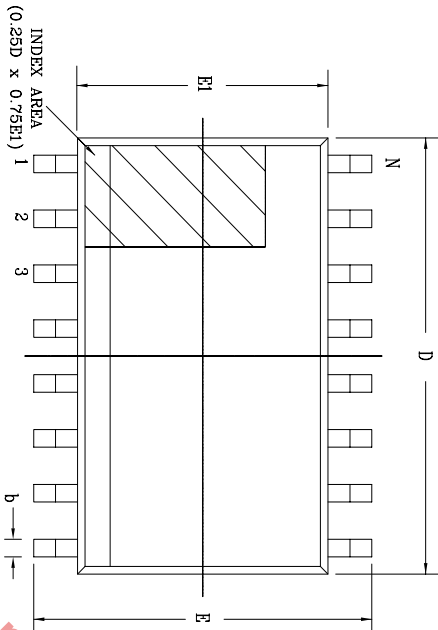
INPUT	ENABLES		OUTPUTS	
	EN	$\overline{\text{EN}}$	OUTA	OUTB
H	H	X	H	L
L	H	X	L	H
H	X	L	H	L
L	X	L	L	H
X	L	H	Hi-Z	Hi-Z

Table 1. SP486 Truth Table


INPUT	ENABLES		OUTPUTS	
	$\text{EN}_1/\text{EN}_2$ or $\text{EN}_3/\text{EN}_4$		OUTA	OUTB
H	H		H	L
L	H		L	H
X	L		Hi-Z	Hi-Z

Table 2. SP487 Truth Table

REVISION HISTORY				
REV.	DESCRIPTION	DATE	APP'D	
A	DRAWING ORIGINATOR	11/05/05	JL	
B	DRAWING FORMAT MODIFICATION	09/13/06	JL	
C	CHANGE DRAWING LOGO AND COMPANY NAME	11/21/07	JL	



16 Pin SOICW			JEDEC MS-013			Variation AA		
SYMBOLS			DIMENSIONS IN MM (Control Unit)			DIMENSIONS IN INCH (Reference Unit)		
	MIN	NOM	MAX	MIN	NOM	MAX		
A	2.35	—	2.65	0.093	—	0.104		
A1	0.10	—	0.30	0.004	—	0.012		
A2	2.05	—	2.55	0.081	—	0.100		
b	0.31	—	0.51	0.012	—	0.020		
c	0.20	—	0.33	0.008	—	0.013		
E	10.30 BSC			0.406 BSC				
E1	7.50 BSC			0.295 BSC				
h	1.27 BSC			0.050 BSC				
L	0.25	—	0.75	0.010	—	0.030		
L1	0.40	—	1.27	0.016	—	0.050		
L2	1.40 REF			0.055 REF				
R	0.07 BSC			0.010 BSC				
R1	0.07	—	—	0.003	—	—		
θ	0°	—	8°	0°	—	8°		
θ1	5°	—	15°	5°	—	15°		
θ2	0°	—	—	0°	—	—		
D	10.30 BSC			0.405 BSC				
N	16			16				

EXAR CORPORATION	
	
Packaging Approval:	16 PIN SOICW PACKAGE OUTLINE
By: JL	Date: 11/21/07
Drawing No:	16-PIN SOICW
Revision:	C
Sheet:	1 OF 1



## ORDERING INFORMATION<sup>(1), (3)</sup>

PART NUMBER	TEMPERATURE RANGE	PACKAGE	PACKAGING METHOD	LEAD-FREE <sup>(2)</sup>
SP487CT-L	0°C to 70°C	16-pin WSOIC	Tube	Yes
SP487CT-L/TR	0°C to 70°C	16-pin WSOIC	Tape and Reel	Yes

### NOTES:

1. Refer to [www.maxlinear.com/SP487](http://www.maxlinear.com/SP487) for most up to date Ordering Information.
2. Visit [www.maxlinear.com](http://www.maxlinear.com) for additional information on Environmental Rating.
3. SP486 is obsolete.

## REVISION HISTORY

DATE	REVISION	DESCRIPTION
June 2005	--	Legacy Sipex Datasheet
June 2011	1.0.0	Update ordering information per PDN 110510-01 and convert to Exar Format
January 2020	1.0.1	Update to MaxLinear logo. Update ordering information.



MaxLinear, Inc.  
 5966 La Place Court, Suite 100  
 Carlsbad, CA 92008  
 760.692.0711 p.  
 760.444.8598 f.  
[www.maxlinear.com](http://www.maxlinear.com)

The content of this document is furnished for informational use only, is subject to change without notice, and should not be construed as a commitment by MaxLinear, Inc. MaxLinear, Inc. assumes no responsibility or liability for any errors or inaccuracies that may appear in the informational content contained in this guide. Complying with all applicable copyright laws is the responsibility of the user. Without limiting the rights under copyright, no part of this document may be reproduced into, stored in, or introduced into a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise), or for any purpose, without the express written permission of MaxLinear, Inc.

Maxlinear, Inc. does not recommend the use of any of its products in life support applications where the failure or malfunction of the product can reasonably be expected to cause failure of the life support system or to significantly affect its safety or effectiveness. Products are not authorized for use in such applications unless MaxLinear, Inc. receives, in writing, assurances to its satisfaction that: (a) the risk of injury or damage has been minimized; (b) the user assumes all such risks; (c) potential liability of MaxLinear, Inc. is adequately protected under the circumstances.

MaxLinear, Inc. may have patents, patent applications, trademarks, copyrights, or other intellectual property rights covering subject matter in this document. Except as expressly provided in any written license agreement from MaxLinear, Inc., the furnishing of this document does not give you any license to these patents, trademarks, copyrights, or other intellectual property.

MaxLinear, the MaxLinear logo, and any MaxLinear trademarks, MxL, Full-Spectrum Capture, FSC, G.now, AirPHY and the MaxLinear logo are all on the products sold, are all trademarks of MaxLinear, Inc. or one of MaxLinear's subsidiaries in the U.S.A. and other countries. All rights reserved. Other company trademarks and product names appearing herein are the property of their respective owners.