

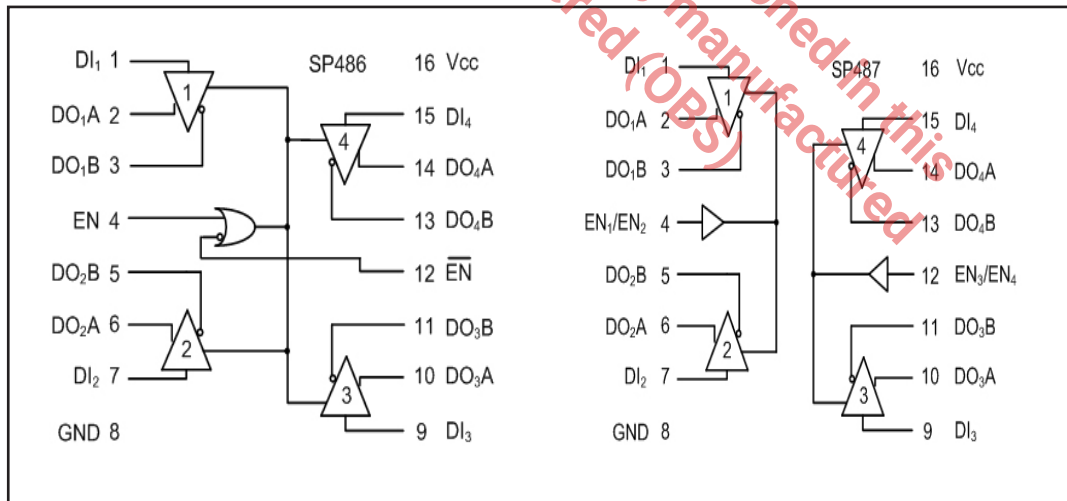
## Quad RS-485/RS-422 Line Drivers

- 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
- 100µA 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**SP487 is available, SP486 is obsolete**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.

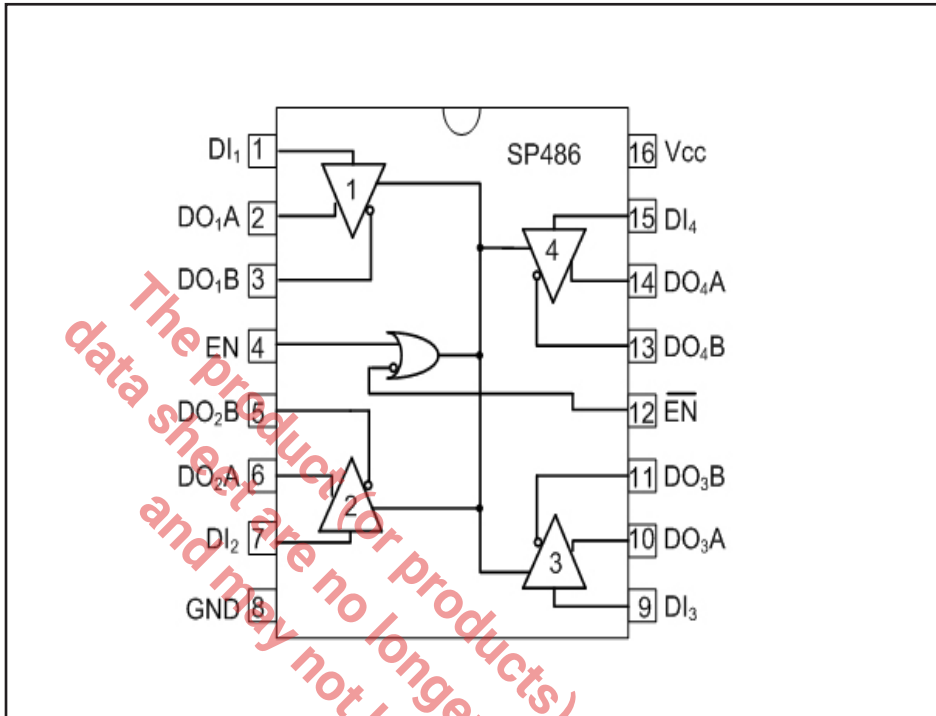
| PARAMETERS                                                            | MIN. | TYP. | MAX.   | UNITS | CONDITIONS                                                                                    |
|-----------------------------------------------------------------------|------|------|--------|-------|-----------------------------------------------------------------------------------------------|
| <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).

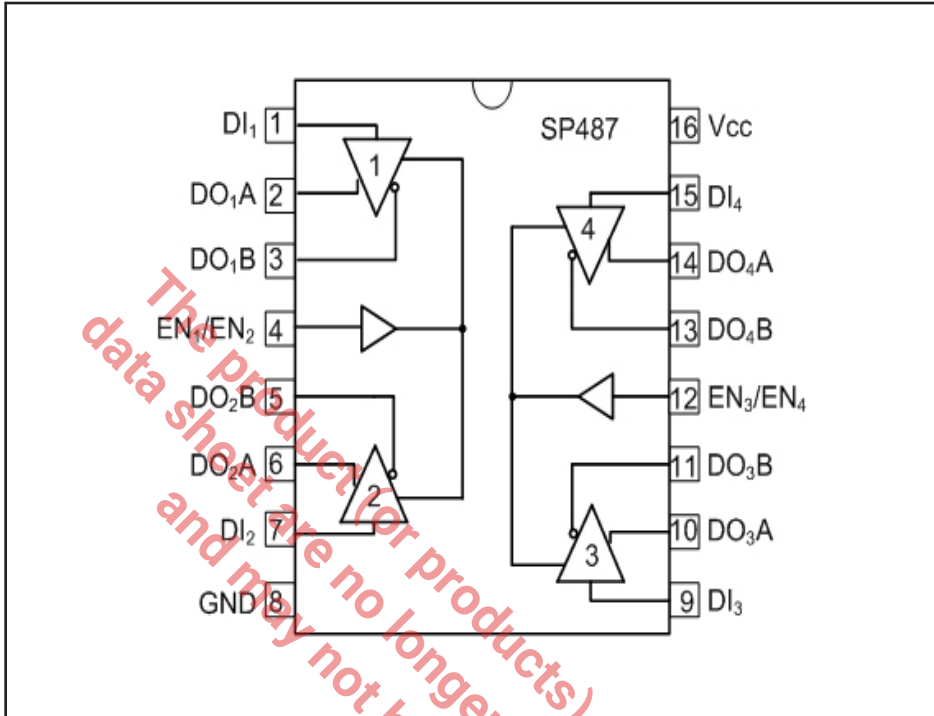
Pin 13 - DO<sub>4</sub>B - Driver 4 output B.

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 -  $+4.75\text{V} \leq V_{cc} \leq +5.25\text{V}$ .

## 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 -  $+4.75V \leq V_{cc} \leq +5.25V$ .

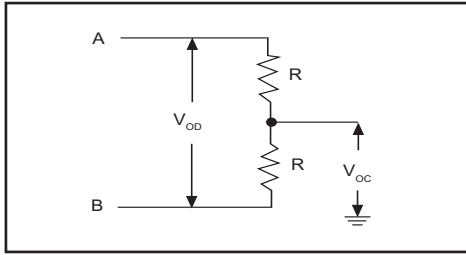


Figure 1. Driver DC Test Load

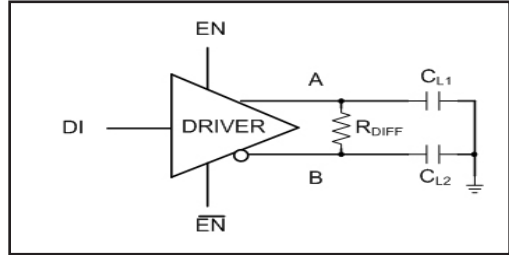


Figure 2. Driver Timing Test

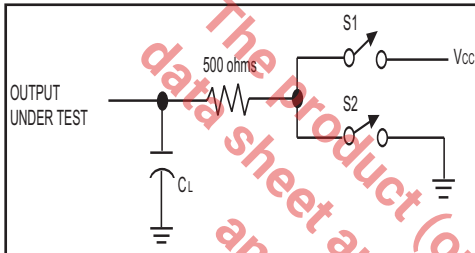


Figure 3. Driver Timing Test Load

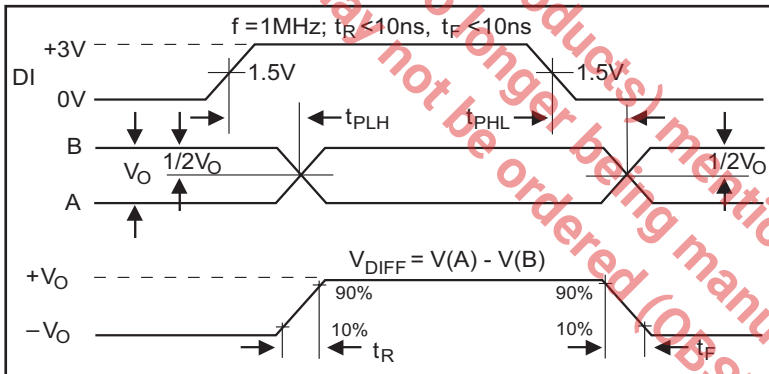


Figure 4. Driver Propagation Delays

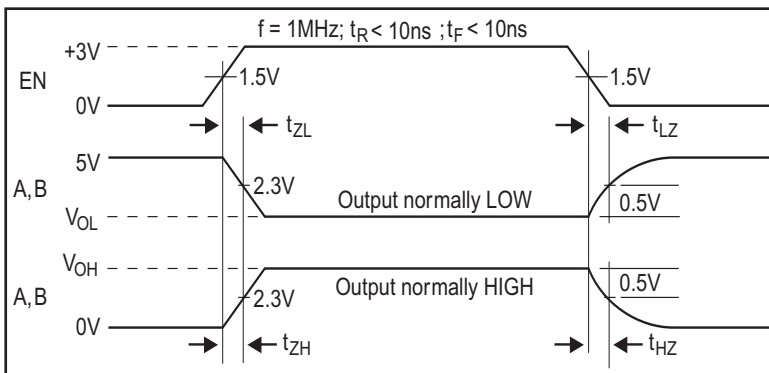


Figure 5. Driver Enable/Disable Timing

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.

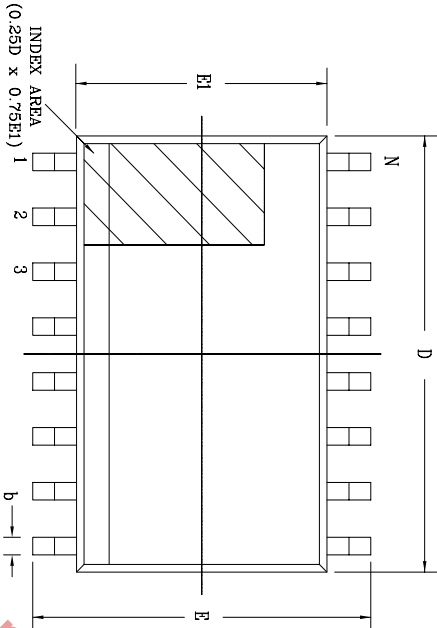
| INPUT | ENABLES |                        | OUTPUTS |      |
|-------|---------|------------------------|---------|------|
|       | EN      | $\overline{\text{EN}}$ | OUTA    | OUTB |
| H     | H       | X                      | H       | L    |
| L     | H       | X                      | L      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

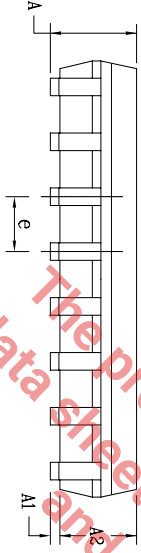
Table 2. SP487 Truth Table

| 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    |

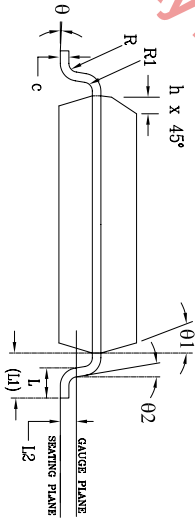


Top View

Side View



Front View



| 16 Pin SOICW JEDEC MS-013 Variation AA |       |                                     |       |
|----------------------------------------|-------|-------------------------------------|-------|
| DIMENSIONS IN MM (Control Unit)        |       | DIMENSIONS IN INCH (Reference Unit) |       |
| SYMBOLS                                | MIN.  | NOM.                                | MAX.  |
| A                                      | 2.35  | 2.65                                | 0.093 |
| A1                                     | 0.10  | 0.30                                | 0.004 |
| A2                                     | 2.05  | 2.55                                | 0.081 |
| b                                      | 0.31  | 0.51                                | 0.012 |
| c                                      | 0.20  | 0.33                                | 0.008 |
| E                                      | 10.30 | BSC                                 | 0.406 |
| E1                                     | 7.50  | BSC                                 | 0.295 |
| h                                      | 0.25  | 0.75                                | 0.010 |
| l                                      | 0.40  | 1.27                                | 0.016 |
| l1                                     | 1.40  | REF                                 | 0.055 |
| l2                                     | 0.25  | BSC                                 | 0.010 |
| R                                      | 0.07  | 0.003                               | 0.003 |
| R1                                     | 0.07  | 0.003                               | 0.003 |
| θ                                      | 0°    | 8°                                  | 0°    |
| θ1                                     | 5°    | 15°                                 | 5°    |
| θ2                                     | 0°    | 0°                                  | 0°    |
| D                                      | 10.30 | BSC                                 | 0.405 |
| N                                      | 16    | 16                                  | 16    |

|                                                                                     |                |                              |               |
|-------------------------------------------------------------------------------------|----------------|------------------------------|---------------|
|  |                | EXAR CORPORATION             |               |
| Packaging Approval:                                                                 |                | 16 PIN SOICW PACKAGE OUTLINE |               |
| By: JL                                                                              | Date: 11/21/07 | Drawing No: 16-PIN SOICW     | 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)

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