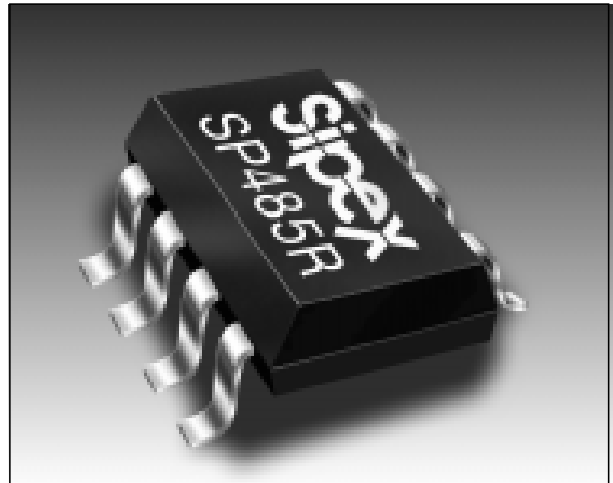


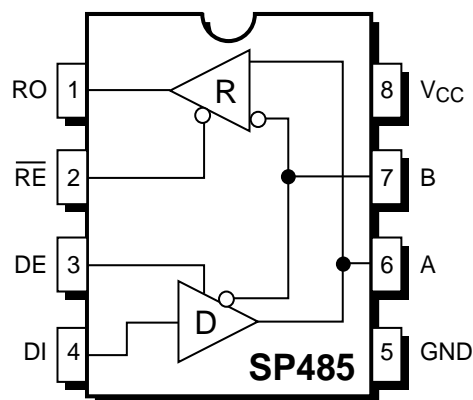
High-Fanout RS-485 Transceiver

- Allows Over 400 Transceivers On A Transmission Line
- High Impedance on Receiver Inputs ($R_{IN} = 150k\Omega$ typical)
- Half-Duplex Configuration Consistent With Industry Standard Pinout
- $-7V$ to $+12V$ Common Mode Input Voltage Range
- Includes Shutdown Mode ($I_{CC} < 10\mu A$) (For SP481R Only)
- Low Power Consumption (250mW)
- Separate Driver and Receiver Enable



DESCRIPTION...

The **SP481R** and **SP485R** are our newest members of **Sipex's** RS-485 family. The **SP481R** and **SP485R** are pin-to-pin equivalent with our existing SP485 product and contain enhancements such as higher ESD tolerance and high receiver input impedance. The higher receiver input impedance allows for connecting over 400 transceivers on a single transmission line without degrading the RS-485 driver signal. Each device is packaged in an 8-pin plastic DIP or 8-pin narrow SOIC package. The **SP481R** offers a shutdown feature via the enable pins which will reduce the supply current (I_{CC}) below $1\mu A$ typical.



Top View

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
 Storage Temperature.....-65°C to +150°C
 Power Dissipation
 8-pin Plastic DIP.....1000mW
 8-pin Plastic N-SOIC.....1000mW

Package Derating:
 8-pin Plastic DIP
 θ_{JA}62°C/W
 8-pin Plastic N-SOIC
 θ_{JA}62°C/W

SPECIFICATIONS

Typically 25°C @ $V_{CC} = +5V$ unless otherwise noted.

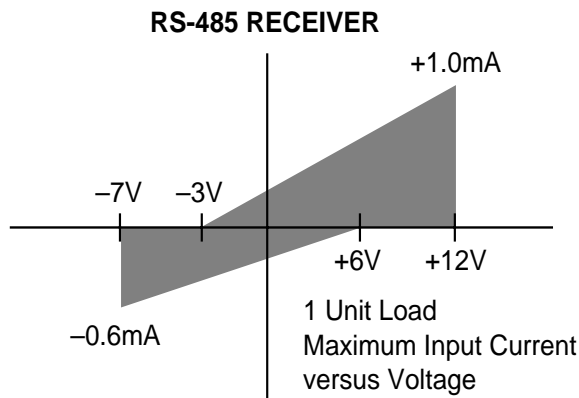
| | MIN. | TYP. | MAX. | UNITS | CONDITIONS |
|---------------------------|------|------|-----------|------------|---|
| LOGIC INPUTS | | | | | |
| V_{IL} | | | 0.8 | Volts | |
| V_{IH} | 2.0 | | | Volts | |
| LOGIC OUTPUTS | | | | | |
| V_{OL} | | | 0.4 | Volts | $I_{OUT} = -3.2mA$ |
| V_{OH} | 2.4 | | | Volts | $I_{OUT} = 1.0mA$ |
| RS-485 DRIVER | | | | | |
| DC Characteristics | | | | | |
| TTL Input Levels | | | | | |
| V_{IL} | | | 0.8 | Volts | |
| V_{IH} | 2.0 | | | Volts | |
| Outputs | | | | | |
| Open Circuit Voltage | | | 6.0 | Volts | |
| Differential Output | 1.5 | | 5.0 | Volts | $R_L = 54\Omega, C_L = 50pF$ |
| Balance | | | ± 0.2 | Volts | $ V_{T1} - V_{T1} $ |
| Common-Mode Output | | | 3.0 | Volts | |
| Output Current | 28.0 | | | mA | $R_L = 54\Omega$ |
| Short Circuit Current | | | ± 250 | mA | Terminated in -7V to +12V |
| AC Characteristics | | | | | |
| Maximum Data Rate | 5 | | | Mbps | $R_L = 54\Omega$ |
| Output Transition Time | | 30 | | ns | Rise/fall time, 10%–90% |
| Propagation Delay | | | | | See Figures 3 and 5 |
| t_{PHL} | | 60 | 100 | ns | $R_{DIFF} = 54\Omega, C_{L1} = C_{L2} = 100pF$ |
| t_{PLH} | | 60 | 100 | ns | $R_{DIFF} = 54\Omega, C_{L1} = C_{L2} = 100pF$ |
| Driver Output Skew | | 5 | 15 | ns | see Figure 3 and 5, $t_{SKEW} = t_{DPLH} - t_{DPHL} $ |
| RS-485 RECEIVER | | | | | |
| DC Characteristics | | | | | |
| TTL Output Levels | | | | | |
| V_{OL} | | | 0.4 | Volts | |
| V_{OH} | 2.4 | | | Volts | |
| Tri-State Output Current | | | ± 1 | μA | $0.4V \leq V_{OUT} \leq 2.4V; \overline{RE} = V_{CC}$ |
| Inputs | | | | | |
| Common Mode Range | -7.0 | | +12.0 | Volts | $-7V \leq V_{CM} \leq +12V$ |
| Receiver Sensitivity | | | ± 0.2 | Volts | $-7V \leq V_{CM} \leq +12V$ |
| Input Impedance | 120 | 150 | | k Ω | |

SPECIFICATIONS

Typically 25°C @ Vcc = +5V unless otherwise noted.

| | MIN. | TYP. | MAX. | UNITS | CONDITIONS |
|--|-------|------|-------|---------|---|
| AC Characteristics | | | | | |
| Maximum Data Rate | 1 | | | Mbps | See Figures 3 and 7 $R_{DIFF}=54\Omega$, $C_{L1}=C_{L2}=100pF$ $R_{DIFF}=54\Omega$, $C_{L1}=C_{L2}=100pF$ $ t_{PLH} - t_{PHL} $; $R_{DIFF}=54\Omega$, $C_{L1}=C_{L2}=100pF$, see Figures 3 and 7 |
| Propagation Delay | | | 1200 | ns | |
| t_{PHL} t_{PLH} Differential Receiver Skew | | 60 | 1200 | ns | |
| SHUTDOWN TIMING (SP481R) | | | | | |
| Time to Shutdown | 50 | | 600 | ns | $\overline{RE} = V_{CC}$, $DE = 0V$ |
| RS-485 Driver | | | | | |
| Enable Time | | | | | See Figures 4 and 6 $C_L=15pF$, S_1 Closed $C_L=15pF$, S_2 Closed |
| Enable to Low | | 40 | 500 | ns | |
| Enable to High | | 40 | 500 | ns | See Figures 4 and 6 $C_L=15pF$, S_1 Closed $C_L=15pF$, S_2 Closed |
| Disable Time | | | | | |
| Disable From Low | | 40 | 500 | ns | See Figures 2 and 8 $C_L=15pF$, S_1 Closed $C_L=15pF$, S_2 Closed |
| Disable From High | | 40 | 500 | ns | |
| RS-485 Receiver | | | | | |
| Enable Time | | | | | See Figures 2 and 8 $C_L=15pF$, S_1 Closed $C_L=15pF$, S_2 Closed |
| Enable to Low | | 40 | 500 | ns | |
| Enable to High | | 40 | 500 | ns | See Figures 2 and 8 $C_L=15pF$, S_1 Closed $C_L=15pF$, S_2 Closed |
| Disable Time | | | | | |
| Disable From Low | | 40 | 500 | ns | See Figures 2 and 8 $C_L=15pF$, S_1 Closed $C_L=15pF$, S_2 Closed |
| Disable From High | | 40 | 500 | ns | |
| POWER REQUIREMENTS | | | | | |
| Supply Voltage V_{CC} | +4.75 | | +5.25 | Volts | $\overline{RE} = V_{CC}$ or $0V$, $DE = 0V$ $\overline{RE} = V_{CC}$ or $0V$, $DE = V_{CC}$ $\overline{RE} = V_{CC}$, $DE = \emptyset V$ |
| Supply Current I_{CC} | | | | | |
| No Load | | 300 | 500 | μA | |
| No Load | | 500 | 900 | μA | |
| Supply Current in Shutdown | | 0.5 | 10 | μA | |
| ENVIRONMENTAL | | | | | |
| Operating Temperature | | | | | |
| Commercial (..C..) | 0 | | +70 | °C | |
| Industrial (..E..) | -40 | | +85 | °C | |
| Storage Temperature | -65 | | +150 | °C | |

RECEIVER INPUT GRAPH



TEST CIRCUITS

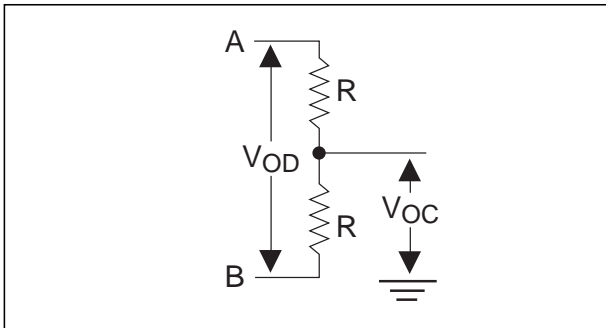


Figure 1. Driver DC Test Load Circuit

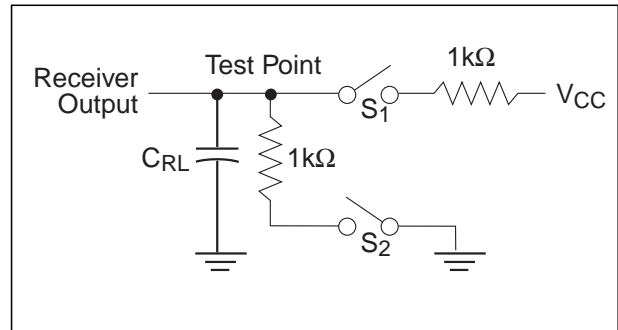


Figure 2. Receiver Timing Test Load Circuit

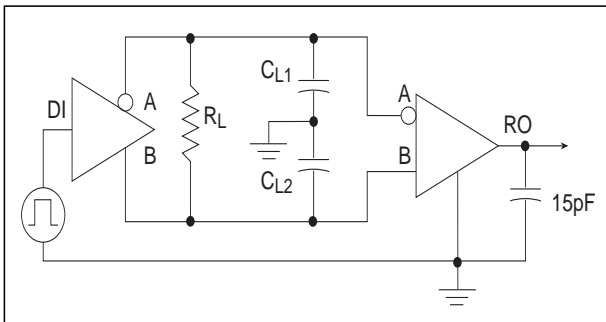


Figure 3. Driver/Receiver Timing Test Circuit

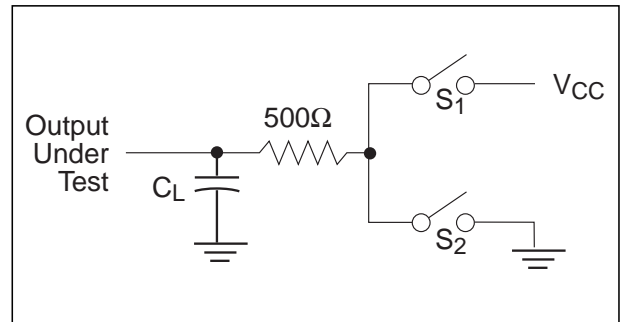


Figure 4. Driver Timing Test Load #2 Circuit

SWITCHING WAVEFORMS

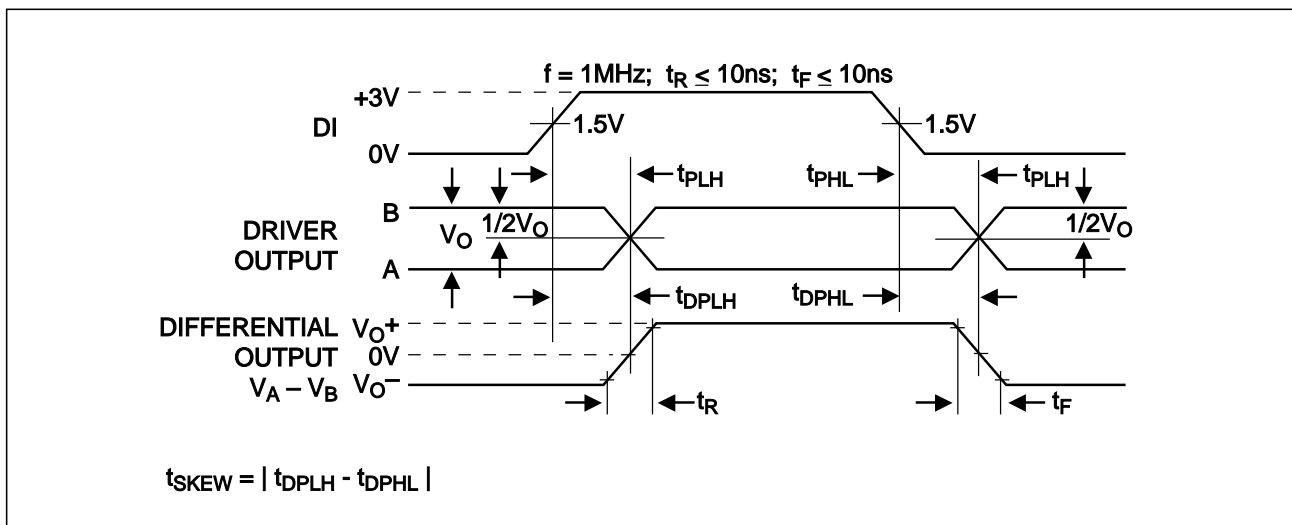


Figure 5. Driver Propagation Delays

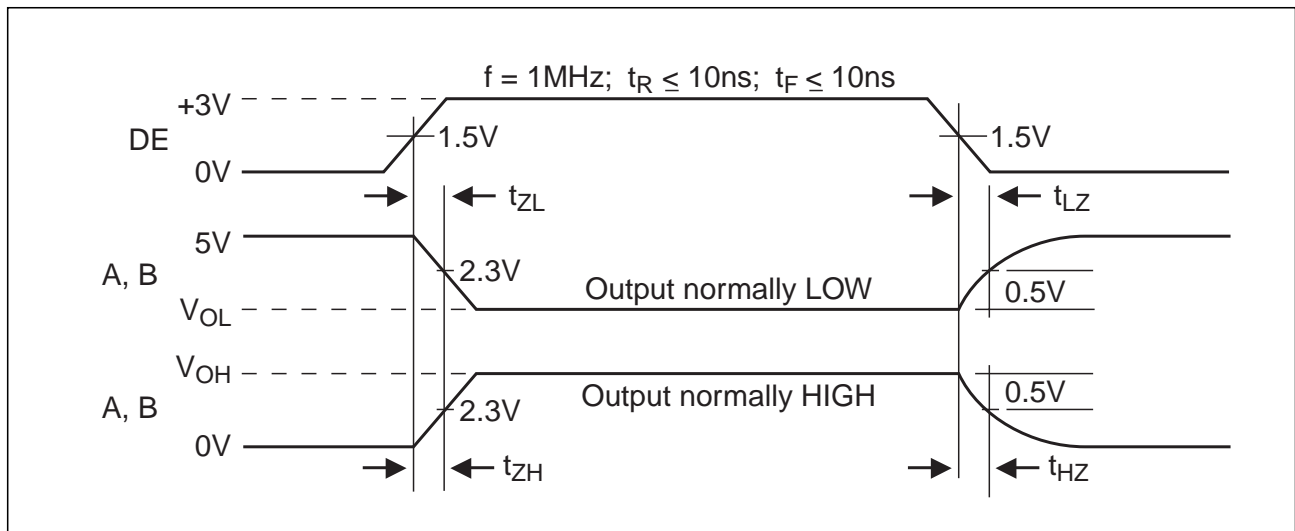


Figure 6. Driver Enable and Disable Times

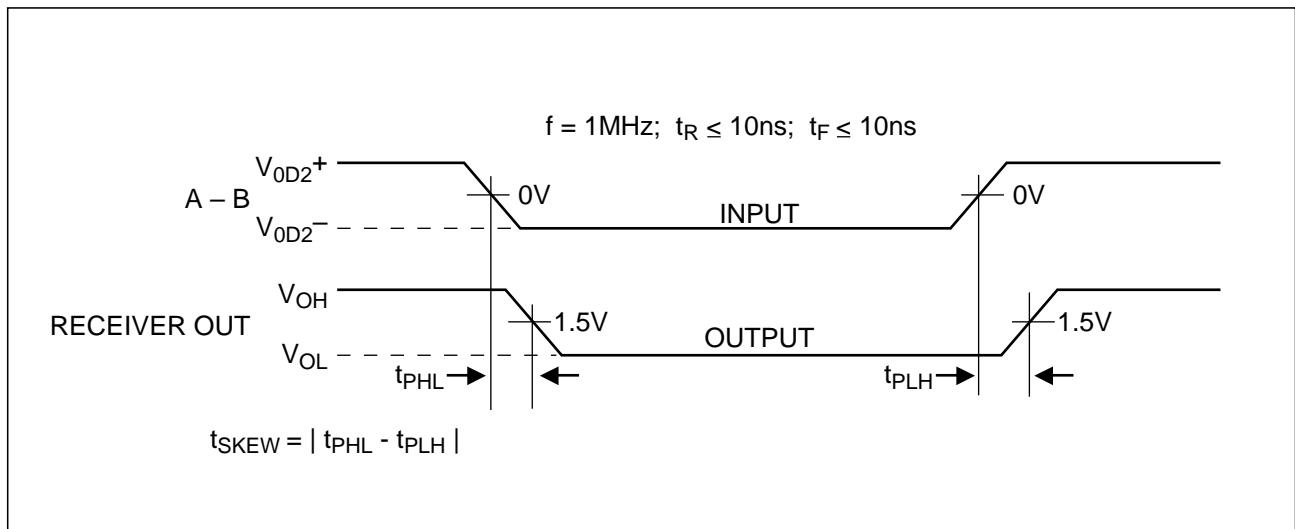


Figure 7. Receiver Propagation Delays

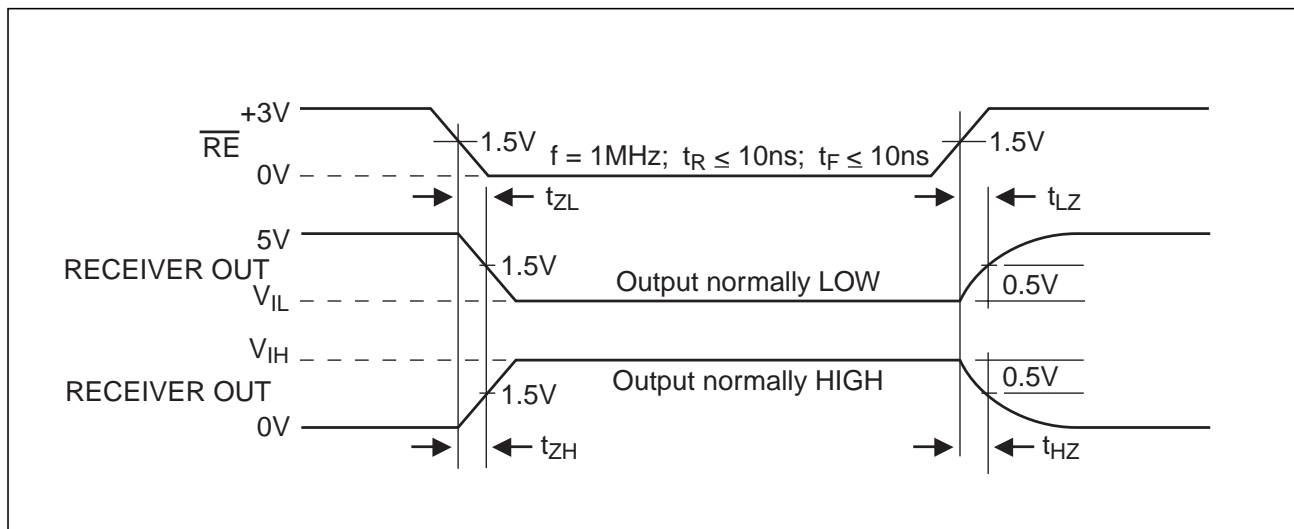


Figure 8. Receiver Enable and Disable Times

GENERAL DESCRIPTION

The **SP485R** is a low power RS-485 differential transceiver. Similar to the SP485, the **SP485R** contains a half-duplex driver and receiver with tri-state control. However, the SP485R is intended for increased connections on a single bus compared to the original RS-485 specification.

The RS-485 standard is ideal for multi-drop applications where one bus can contain many drivers and/or receivers. The RS-485 specification allows up to 32 transceivers to be connected on to the data bus. RS-485 is also specified for driving higher speeds over long cable lengths of up to 4,000 feet.

DRIVERS

The driver output complies with the RS-485 electrical characteristics as specified by the standard. The output swings from 0V to V_{CC} and decreases to greater than +1.5V with a 54 Ω load attached between the two outputs. In adhering to the RS-485 specification, the driver outputs inherently comply with the RS-422 standard. With a load of 100 Ω between the two outputs, the driver can sustain at least +2.0V.

The driver contains an enable pin (DE) which tri-states the output when DE is a logic LOW. The outputs during the tri-stated condition are at a high impedance (>100k Ω). A logic HIGH enables the driver for normal operation. The driver can operate to at least 5Mbps.

RECEIVERS

The **SP485R** receiver has differential inputs with an input sensitivity of lower than $\pm 200\text{mV}$. As mentioned above, the RS-485 specification allows up to 32 transceivers on a the same bus. The **SP485R** allows over 400 transceivers on the same bus due to the high input impedance of at least 98k Ω . This higher capacity allows more components to be attached to the same bus without degrading the signal quality. The drivers are still able to drive an equivalent 54 Ω from the 320 transceivers with an input impedance of at least 120k Ω in parallel along with the two 125 Ω cable termination resistors on each end.

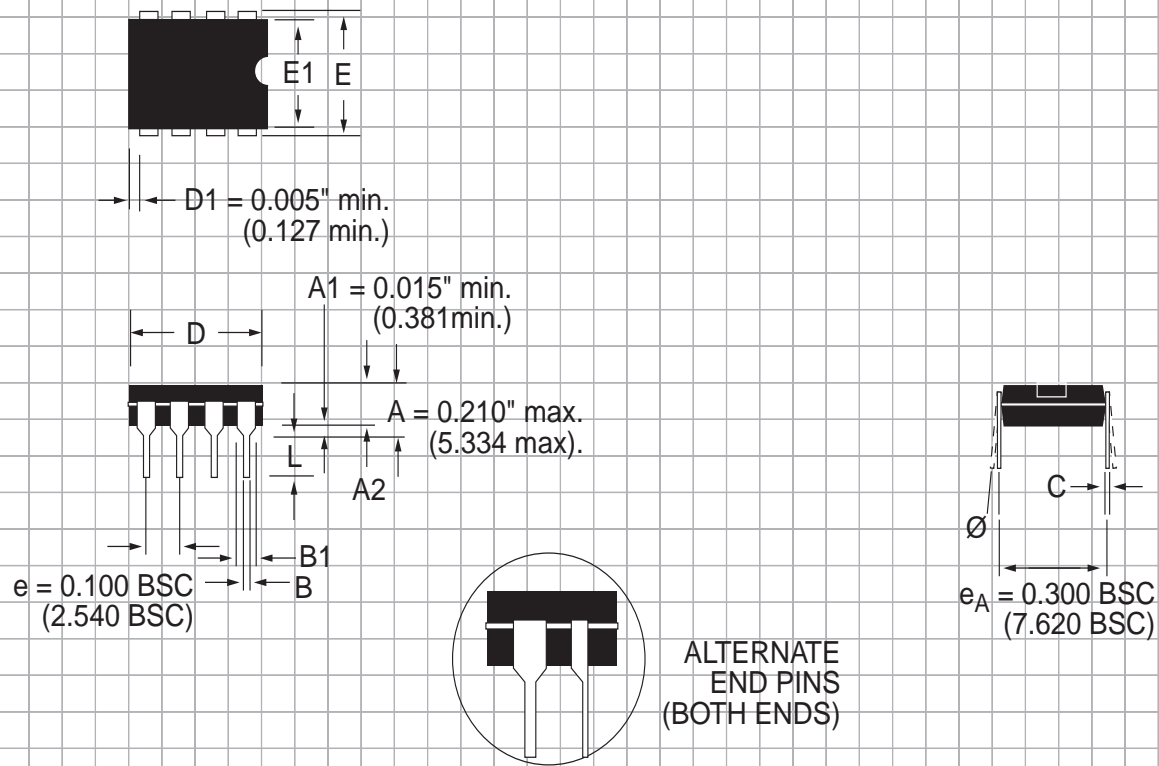
The receiver contains a enable pin ($\overline{\text{RE}}$) which enables the receiver when a logic LOW is asserted. A logic HIGH will tri-state the receiver output and the inputs will maintain at least 120k Ω impedance. The receiver can operate to at least 1Mbps.

The receiver also contains a fail-safe feature which outputs a logic HIGH when the inputs are open as in a disconnected cable.

SHUTDOWN MODE

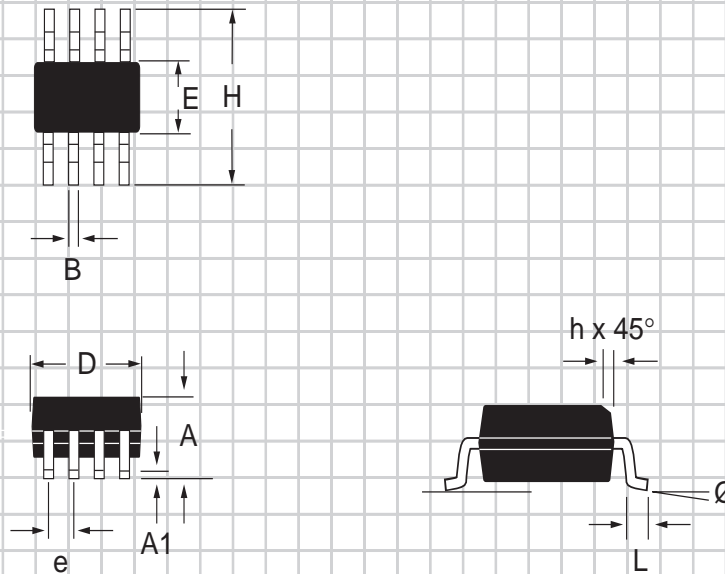
The **SP481R** includes a shutdown function to reduce power consumption. The shutdown is activated by simultaneously applying a logic LOW to DE and a logic HIGH to $\overline{\text{RE}}$. While in the shutdown mode, the power supply current is typically less than 1 μA . The driver outputs are disabled and are at a high impedance state determined by the receiver input impedance which should be at least 120k Ω . The receiver output is at also at high impedance during shutdown. Output leakage current when the receiver is disabled is under 1 μA .

PACKAGE: 8-PIN PLASTIC DUAL-IN-LINE (NARROW)



| DIMENSIONS (Inches) Minimum/Maximum (mm) | 8-PIN |
|--|-------------------------------|
| A2 | 0.115/0.195 (2.921/4.953) |
| B | 0.014/0.022 (0.356/0.559) |
| B1 | 0.045/0.070 (1.143/1.778) |
| C | 0.008/0.014 (0.203/0.356) |
| D | 0.355/0.400 (9.017/10.160) |
| E | 0.300/0.325 (7.620/8.255) |
| E1 | 0.240/0.280 (6.096/7.112) |
| L | 0.115/0.150 (2.921/3.810) |
| \emptyset | 0°/15° (0°/15°) |

**PACKAGE: 8-PIN PLASTIC
SMALL OUTLINE (SOIC)
(NARROW)**



| DIMENSIONS (Inches) Minimum/Maximum (mm) | 8-PIN |
|---|--------------------------------------|
| A | 0.053/0.069 (1.346/1.748) |
| A1 | 0.004/0.010 (0.102/0.249) |
| B | 0.014/0.019 (0.35/0.49) |
| D | 0.189/0.197 (4.80/5.00) |
| E | 0.150/0.157 (3.802/3.988) |
| e | 0.050 BSC (1.270 BSC) |
| H | 0.228/0.244 (5.801/6.198) |
| h | 0.010/0.020 (0.254/0.498) |
| L | 0.016/0.050 (0.406/1.270) |
| Ø | 0°/8° (0°/8°) |

ORDERING INFORMATION

| Model | Temperature Range | Package Types |
|----------------|--------------------|---------------------------|
| SP481RCP | 0°C to +70°C | 8-pin Plastic DIP |
| SP481RCN | 0°C to +70°C | 8-pin Plastic Narrow SOIC |
| SP485RCP | 0°C to +70°C | 8-pin Plastic DIP |
| SP485RCN | 0°C to +70°C | 8-pin Plastic Narrow SOIC |

Please consult the factory for pricing and availability on a Tape-On-Reel option.



SIGNAL PROCESSING EXCELLENCE

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