# SP3483

# +3.3V Low Power Slew Rate Limited Half-Duplex RS-485 Transceiver

- RS-485 and RS-422 Transceiver
- Operates from a single +3.3V supply
- Interoperable with +5.0V logic
- Driver/Receiver Enable
- Low Power Shutdown Mode
- -7V to +12V Common-Mode Input Voltage Range
- Allows up to 32 transceivers on the serial bus
- Compatibility with the industry standard 75176 pinout
- Driver Output Short-Circuit Protection
- Slew Rate Limited Driver for Low EMI (**SP3483**)


*Now Available in Lead Free Packaging*

## DESCRIPTION

The **SP3483** device is part of a family of +3.3V low power half-duplex transceivers that meet the specifications of the RS-485 and RS-422 serial protocols. This device is pin-to-pin compatible with the **Sipex SP483** device as well as popular industry standards. The **SP3483** features **Sipex's** BiCMOS process, allowing low power operation without sacrificing performance. The **SP3483** is internally slew rate limited to reduce EMI and can meet the requirements of RS-485 and RS-422 up to 250kbps.

## TRUTH TABLES

| 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 |

*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 |

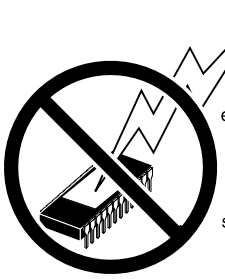
*Table 2. Receive Function Truth Table*

## 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.

$V_{CC}$ ..... +6.0V
Input Voltages
Logic ..... -0.3V to +6.0V
Drivers ..... -0.3V to +6.0V
Receivers ..... ±15V
Output Voltages
Drivers ..... ±15V
Receivers ..... -0.3V to +6.0V
Storage Temperature ..... -65°C to +150°C
Power Dissipation per package
8-pin NSOIC (derate 6.14mW/°C above +70°C) ..... 500mW
8-pin PDIP (derate 11.8mW/°C above +70°C) ..... 1000mW



**CAUTION**:
ESD (ElectroStatic Discharge) sensitive device. Permanent damage may occur on unconnected devices subject to high energy electrostatic fields. Unused devices must be stored in conductive foam or shunts. Personnel should be properly grounded prior to handling this device. The protective foam should be discharged to the destination socket before devices are removed.

## ELECTRICAL CHARACTERISTICS

$T_{MIN}$ to $T_{MAX}$ and $V_{CC}$ = +3.3V ± 5% unless otherwise noted.

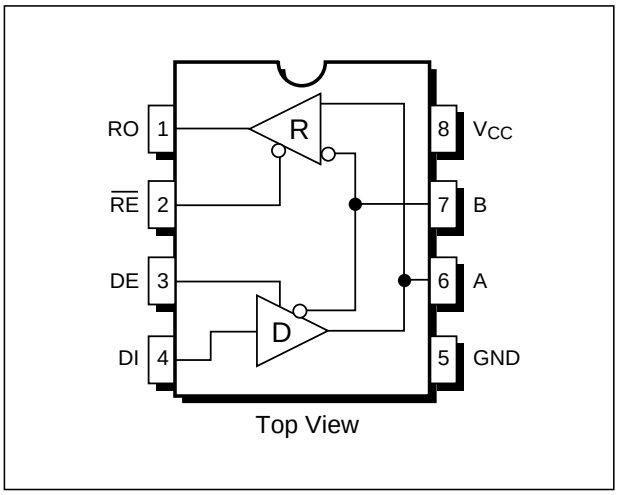
| PARAMETERS | MIN. | TYP. | MAX. | UNITS | CONDITIONS |
|---|---|---|---|---|---|
| **DRIVER** | | | | | |
| **DC Characteristics** | | | | | |
| Differential Output Voltage | GND | | $V_{CC}$ | Volts | Unloaded; R = ∞; *Figure 1* |
| Differential Output Voltage | 2 | | $V_{CC}$ | Volts | with load; R = 50Ω; (RS-422); *Figure 1* |
| Differential Output Voltage | 1.5 | | $V_{CC}$ | Volts | with load; R = 27Ω; (RS-485); *Figure 1* |
| Change in Magnitude of Driver Differential Output Voltage for Complimentary States | | | 0.2 | Volts | R = 27Ω or R = 50Ω; *Figure 1* |
| Driver Common-Mode Output Voltage | | | 3 | Volts | R = 27Ω or R = 50Ω; *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 |
| **DRIVER** | | | | | |
| **AC Characteristics** | | | | | |
| Maximum Data Rate | 250 | | | kbps | $\overline{RE}$ = $V_{CC}$, DE = $V_{CC}$ |
| Driver Input to Output, $t_{PLH}$ | 400 | 900 | 1500 | ns | *Figures 2 and 8* |
| Driver Input to Output, $t_{PHL}$ | 400 | 900 | 1500 | ns | *Figures 2 and 8* |
| Differential Driver Skew | | 10 | | ns | $\lvert t_{DO1} - t_{DO2} \rvert$ *Figures 2 and 9* |
| Driver Rise or Fall Time | | 700 | 1000 | ns | From 10% to 90% *Figures 3 and 9* |
| Driver Enable to Output High | | 700 | 1300 | ns | *Figures 4 and 10* |
| Driver Enable to Output Low | | 690 | 1300 | ns | *Figures 5 and 10* |
| Driver Disable Time from Low | | 80 | 120 | ns | *Figures 5 and 10* |
| Driver Disable Time from High | | 90 | 120 | ns | *Figures 4 and 10* |
| **RECEIVER** | | | | | |
| **DC Characteristics** | | | | | |
| Differential Input Threshold | -0.2 | | +0.2 | Volts | -7V ≤ $V_{CM}$ ≤ +12V |
| Input Hysteresis | | 20 | | mV | $V_{CM}$ = 0V |
| Output Voltage High | $V_{CC}$-0.4 | | | Volts | $V_{ID}$ = +200mV, -1.5mA |
| Output Voltage Low | | | 0.4 | Volts | $V_{ID}$ = -200mV, 2.5mA |
| Three-State (High Impedance) Output Current | | | ±1 | µA | 0V ≤ $V_O$ ≤ $V_{CC}$; RE = $V_{CC}$ |
| 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 3.6V, $V_{IN}$ = 12V |
| Input Current (A, B); $V_{IN}$ = -7V | | | -0.8 | mA | DE = 0V, $V_{CC}$ = 0V or 3.6V, $V_{IN}$ = -7V |
| Short-Circuit Current | 7 | | 60 | mA | 0V ≤ $V_{CM}$ ≤ $V_{CC}$ |

## ELECTRICAL CHARACTERISTICS

$T_{MIN}$ to $T_{MAX}$ and $V_{CC}$ = +3.3V ± 5% unless otherwise noted.

| PARAMETERS | MIN. | TYP. | MAX. | UNITS | CONDITIONS |
|---|---|---|---|---|---|
| **RECEIVER** | | | | | |
| **AC Characteristics** | | | | | |
| Maximum Data Rate | 250 | | | kbps | $\overline{RE}$ = 0V, DE = 0V |
| Receiver Input to Output, $t_{PLH}$ | 35 | 70 | 120 | ns | *Figures 6 and 11* |
| Receiver Input to Output, $t_{PHL}$ | 35 | 70 | 120 | ns | *Figures 6 and 11* |
| Differential Receiver Skew | | 50 | | ns | $t_{RSKEW} = \lvert t_{RPHL} - t_{RPLH} \rvert$ *Figures 6 and 11* |
| Receiver Enable to Output Low | | 45 | 70 | ns | *Figures 7 and 12*; $S_1$ closed, $S_2$ open |
| Receiver Enable to Output High | | 45 | 70 | ns | *Figures 7 and 12*; $S_2$ closed, $S_1$ open |
| Receiver Disable from Low | | 45 | 70 | ns | *Figures 7 and 12*; $S_1$ closed, $S_2$ open |
| Receiver Disable from High | | 45 | 70 | ns | *Figures 7 and 12*; $S_2$ closed, $S_1$ open |
| **Shutdown Timing** | | | | | |
| Time to Shutdown | 50 | 200 | 600 | ns | $\overline{RE}$ = 5V, DE = 0V |
| Driver Enable from Shutdown to Output High | | | 2000 | ns | *Figures 4 and 10* |
| Driver Enable from Shutdown to Output Low | | | 2000 | ns | *Figures 5 and 10* |
| Receiver Enable from Shutdown to Output High | | | 2500 | ns | *Figures 7 and 12;* $S_2$ closed, $S_1$ open |
| Receiver Enable from Shutdown to Output Low | | | 2500 | ns | *Figures 7 and 12;* $S_1$ closed, $S_2$ open |
| **POWER REQUIREMENTS** | | | | | |
| Supply Current | | | | | |
| No Load | | 350 | 650 | µA | $\overline{RE}$, DI = 0V or $V_{CC}$; DE = $V_{CC}$ |
| | | 250 | | µA | $\overline{RE}$ = 0V, DI = 0V or $V_{CC}$; DE = 0V |
| Shutdown Mode | | | 10 | µA | DE = 0V, $\overline{RE}$=$V_{CC}$ |




**SP3483**
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 +3.00V < $V_{CC}$ < +3.60V

## DESCRIPTION

The **SP3483** device is part of a family of +3.3V low power half-duplex transceivers that meet the specifications of the RS-485 and RS-422 serial protocols. The device is pin-to-pin compatible with the Sipex **SP483** device as well as popular industry standards. The **SP3483** features **Sipex's** BiCMOS process allowing low power operation without sacrificing performance.

### Drivers

The driver outputs of the **SP3483** are differential outputs meeting the RS-485 and RS-422 standards. The typical voltage output swing with no load will be 0 Volts to +3.3 Volts. With a loading of 54Ω across the differential outputs, the drivers maintain greater than 1.5V voltage levels. The drivers 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 force the driver outputs into high impedance (high-Z).

The **SP3483** has internally slew rate limited driver outputs to minimize EMI. The tranceivers will operate up to 250kbps. The 250mA $I_{SC}$ maximum limit on the driver output allows the **SP3483** to withstand an infinite short circuit over the -7.0V to +12.0V common mode range without catastrophic damage to the IC.

### Receivers

The **SP3483** receiver has 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 receiver of the **SP3483** has a high impedance (high-z) 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 of the **SP3483** will operate up to 250kbps. The receiver is equipped with a fail-safe feature that guarantees the receiver output will be in a HIGH state when the input is left unconnected.

### Shutdown Mode

The **SP3483** 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 **SP3483** into Shutdown mode. In Shutdown, supply current will drop to typical 1µA, 10µA maximum.

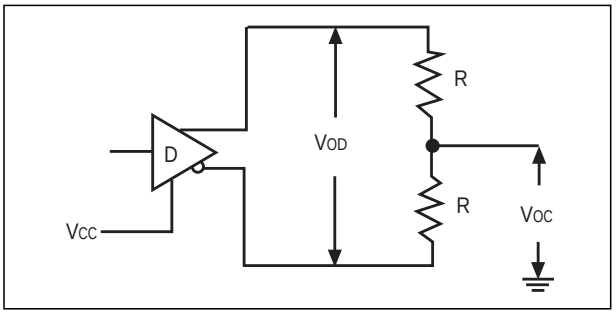



*Figure 1. Driver DC Test Load Circuit*

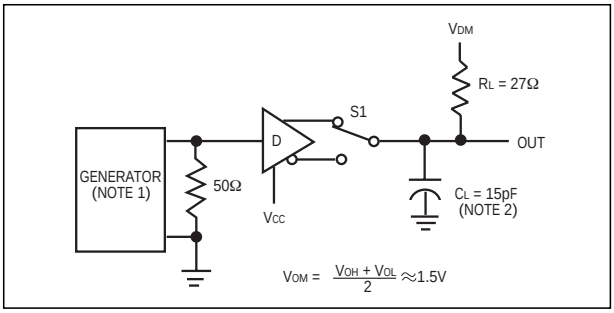



*Figure 2. Driver Propagation Delay Test Circuit*

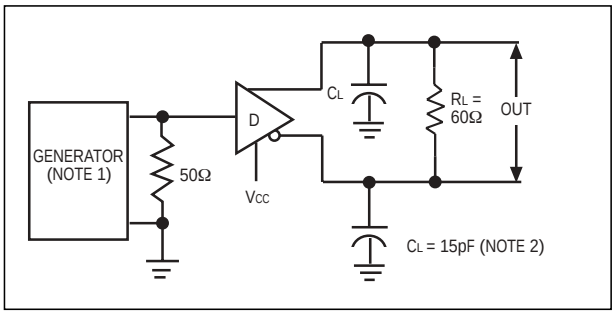



*Figure 3. Driver Differential Output Delay and Transition Time Circuit*

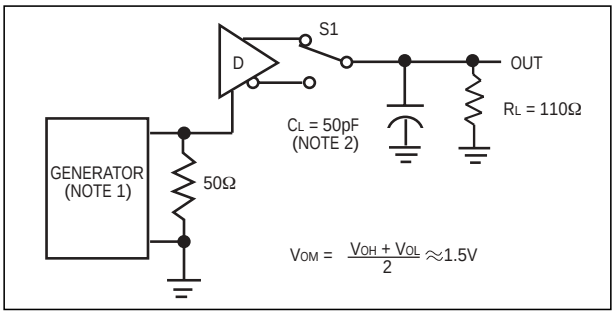



*Figure 4. Driver Enable and Disable Timing Circuit, Output HIGH*

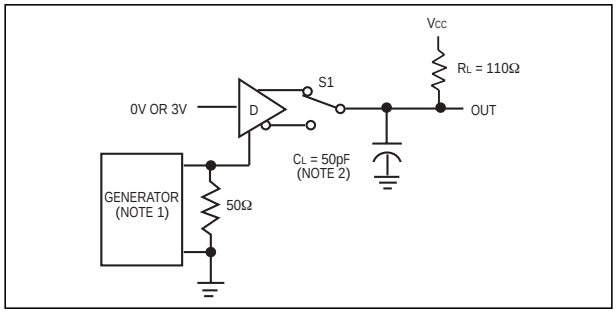



*Figure 5. Driver Enable and Disable Timing Circuit, Output LOW*

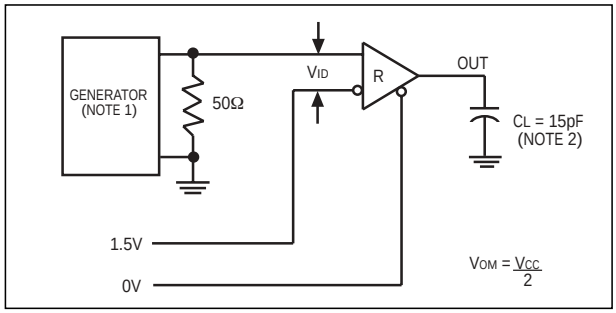



*Figure 6. Receiver Propagation Delay Test Circuit*

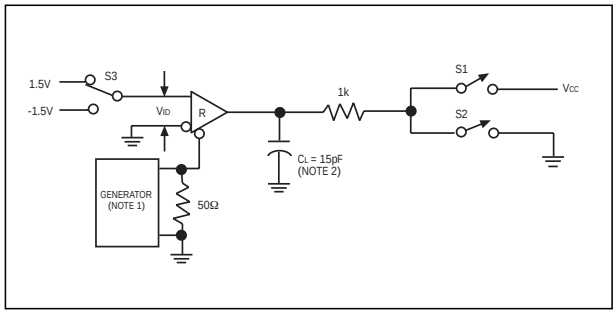



*Figure 7. Receiver Enable and Disable Timing Circuit*

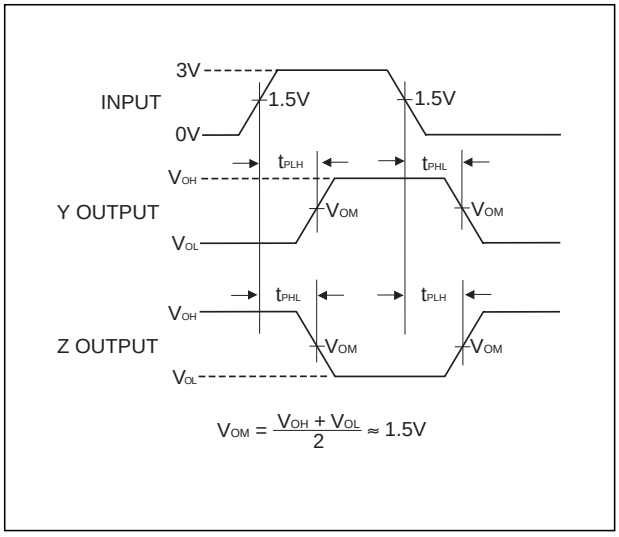



*Figure 8. Driver Propagation Delay Waveforms*

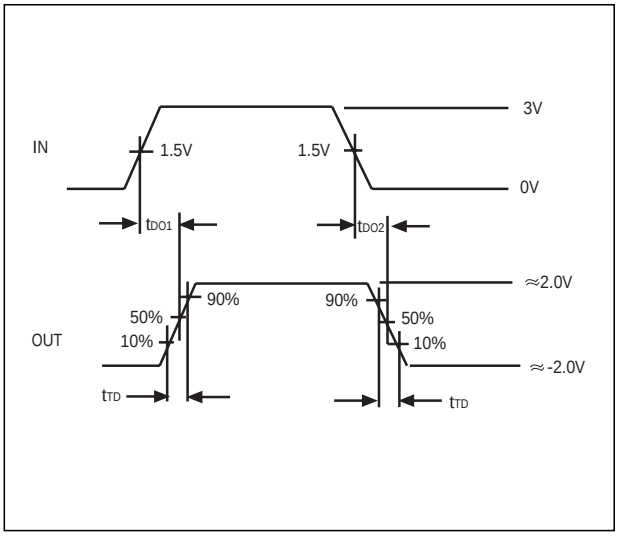



*Figure 9. Driver Differential Output Delay and Transition Time Waveforms*

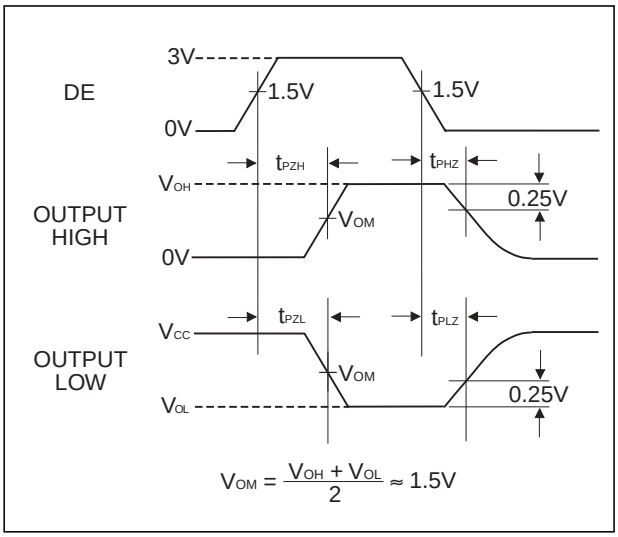



*Figure 10. Driver Enable and Disable Timing Waveforms*

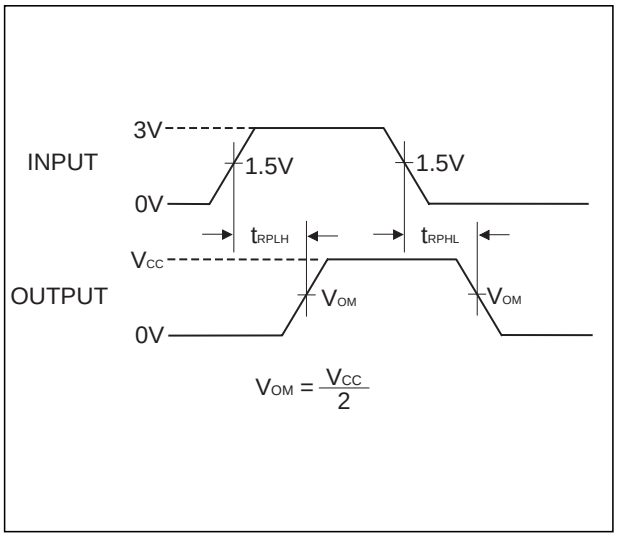



*Figure 11. Receiver Propagation Delay Waveforms*

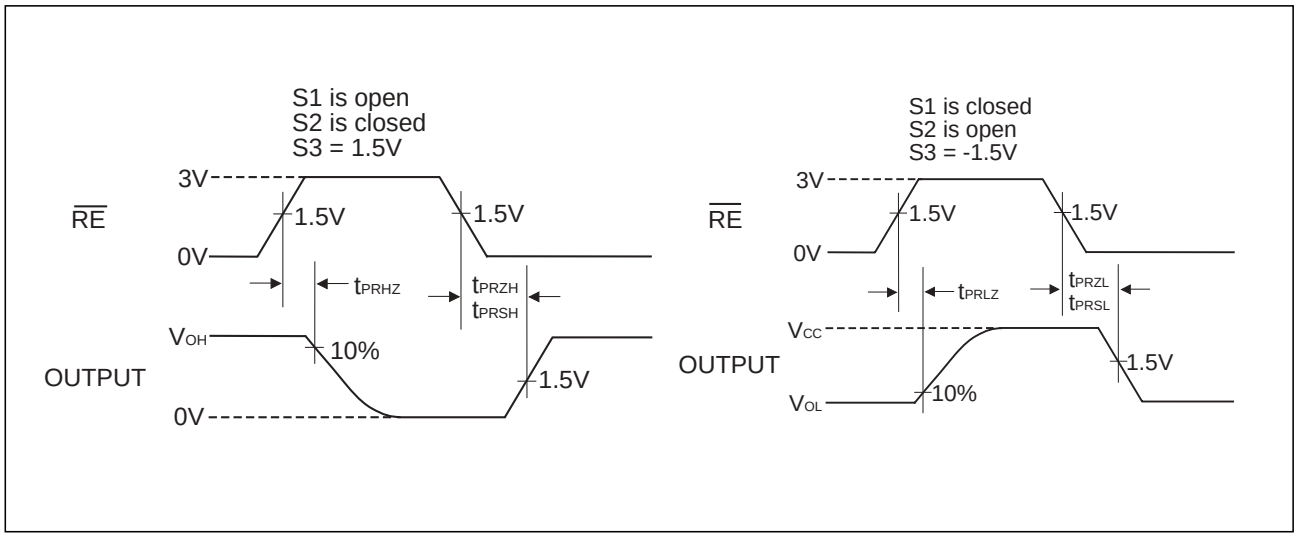
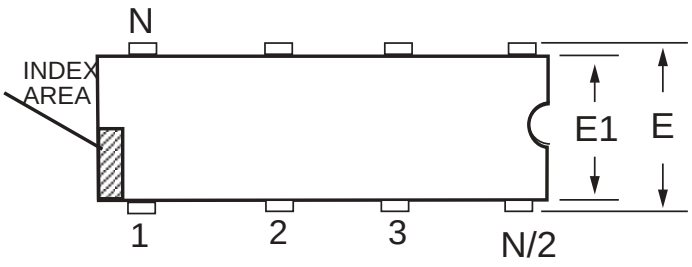


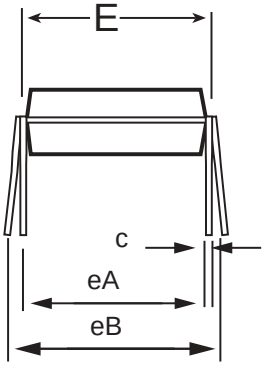

*Figure 12. Receiver Enable and Disable Waveforms*

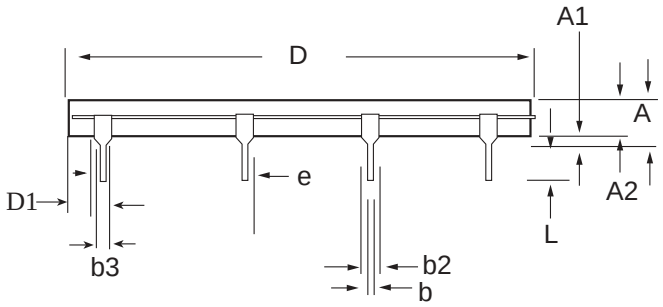
**NOTE 1:** The input pulse is supplied by a generator with the following characteristics: PRR=250KHz, 50% duty cycle, $t_r$ < 6.0ns, $Z_0$=50Ω.

**NOTE 2:** $C_L$ includes probe and stray capacitance.

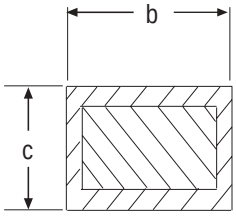
 



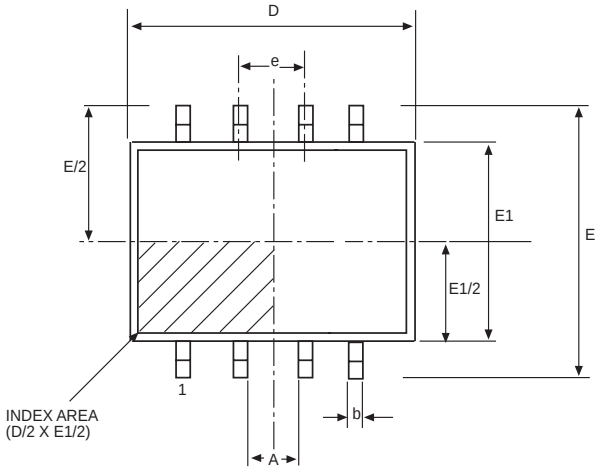




| 8 PIN PDIP JEDEC MS-001 (BA) Variation | Dimensions in inches | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | - | - | .210 |
| A1 | .015 | - | - |
| A2 | .115 | .130 | .195 |
| b | .014 | .018 | .022 |
| b2 | .045 | .060 | .070 |
| b3 | .030 | .039 | .045 |
| c | .008 | .010 | .014 |
| D | .355 | .365 | .400 |
| D1 | .005 | - | - |
| E | .300 | .310 | .325 |
| E1 | .240 | .250 | .280 |
| e | .100 BSC | | |
| eA | .300 BSC | | |
| eB | - | - | .430 |
| L | .115 | .130 | .150 |

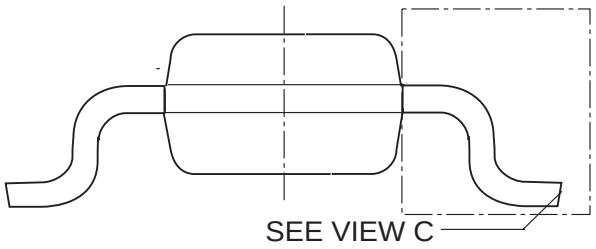


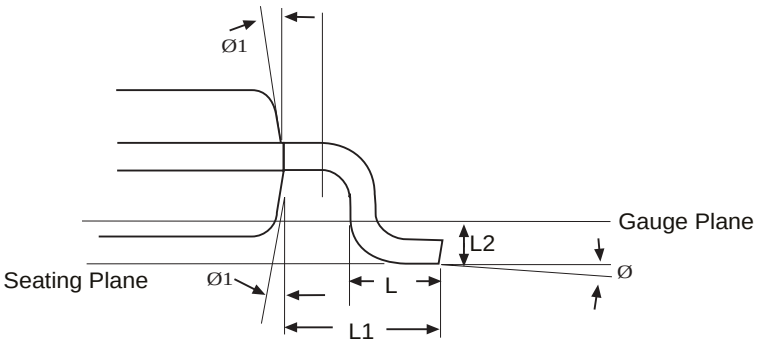

**8 PIN PDIP**

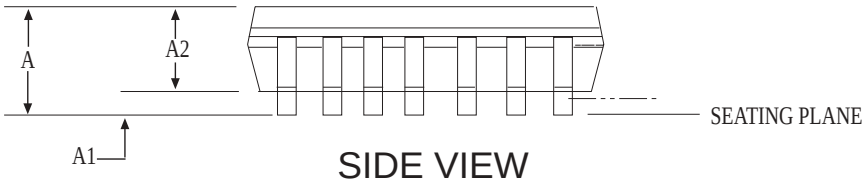



TOP VIEW



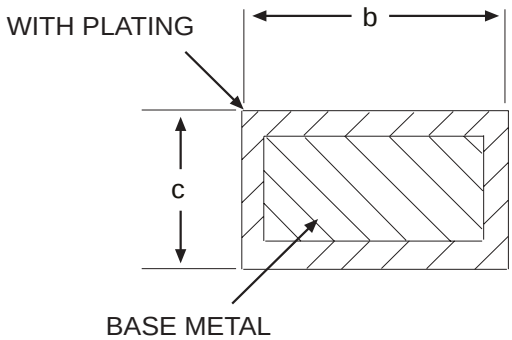




VIEW C




SIDE VIEW

| DIMENSIONS Minimum/Maximum (mm) | 8 Pin NSOIC (JEDEC MS-012, AA - VARIATION) | | |
|---|---|---|---|
| COMMON HEIGHT DIMENSION | | | |
| SYMBOL | MIN | NOM | MAX |
| A | 1.35 | - | 1.75 |
| A1 | 0.10 | - | 0.25 |
| A2 | 1.25 | - | 1.65 |
| b | 0.31 | - | 0.51 |
| c | 0.17 | - | 0.25 |
| D | 4.90 BSC | | |
| E | 6.00 BSC | | |
| E1 | 3.90 BSC | | |
| e | 1.27 BSC | | |
| L | 0.40 | - | 1.27 |
| L1 | 1.04 REF | | |
| L2 | 0.25 BSC | | |
| Ø | 0º | - | 8º |
| Ø1 | 5º | - | 15º |




CONTACT AREA

**PACKAGE: 8 PIN NSOIC**

## ORDERING INFORMATION

| Part Number | Temperature Range | Package |
|---|---|---|
| SP3483CN | 0˚C to +70˚C | 8-pin NSOIC |
| SP3483CN/TR | 0˚C to +70˚C | 8-pin NSOIC |
| SP3483CP | 0˚C to +70˚C | 8-pin PDIP |
| SP3483EN | -40˚C to +85˚C | 8-pin NSOIC |
| SP3483EN/TR | -40˚C to +85˚C | 8-pin NSOIC |
| SP3483EP | -40˚C to +85˚C | 8-pin PDIP |

Available in lead free packaging. To order add "-L" suffix to part number.

Example: SP3483EN/TR = standard; SP3483EN-L/TR = lead free

/TR = Tape and Reel

Pack quantity is 2,500 for NSOIC.


Sipex Corporation

ANALOG EXCELLENCE

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