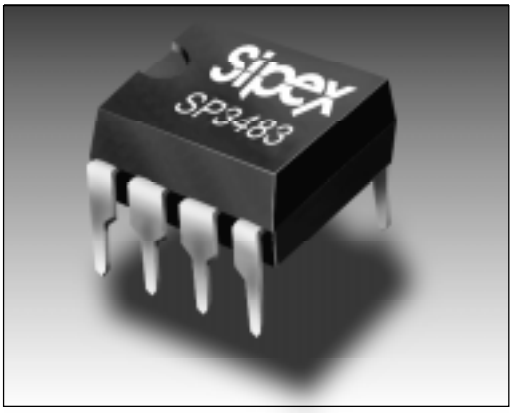
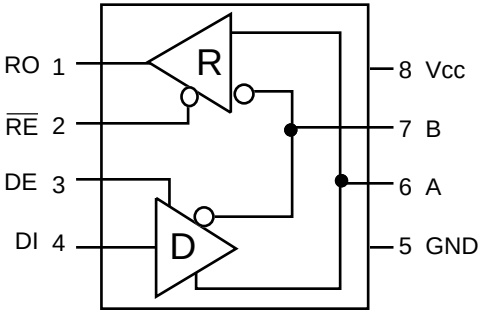
+3.3V Low Power Slew Rate Limited Half-Duplex RS-485 Transceiver

- 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**)



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.



SP3483

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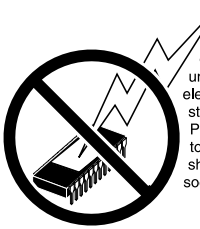
ABSOLUTE MAXIMUM RATINGS

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 6.14mW/˚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.

SPECIFICATIONS

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}

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SPECIFICATIONS (continued)

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}

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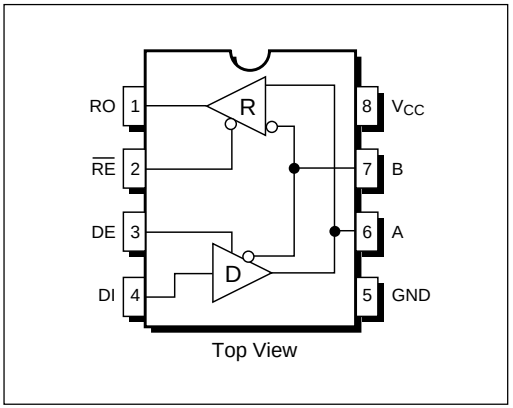

SP3483
Pinout (Top View)

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.

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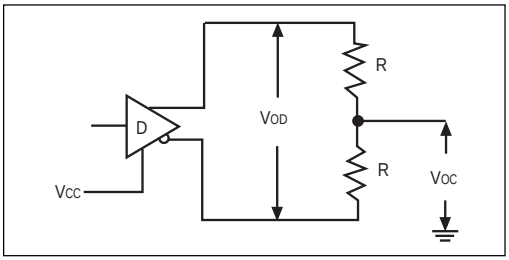

Figure 1. Driver DC Test Load Circuit

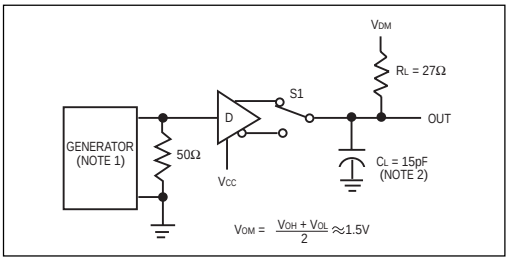

Figure 2. Driver Propagation Delay Test Circuit

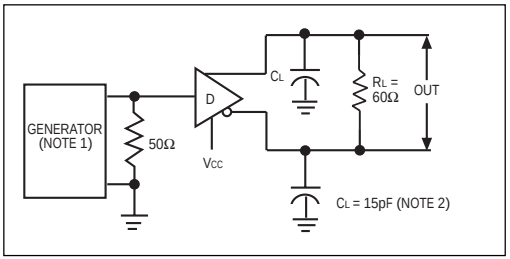

Figure 3. Driver Differential Output Delay and Transition Time Circuit

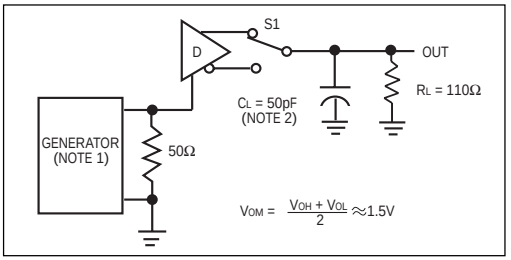

Figure 4. Driver Enable and Disable Timing Circuit, Output HIGH

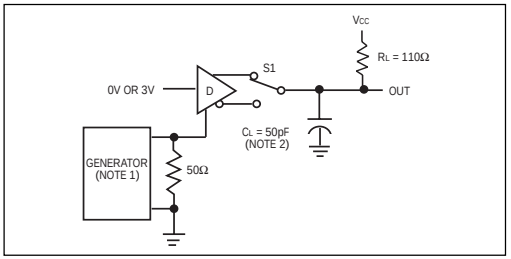

Figure 5. Driver Enable and Disable Timing Circuit, Output LOW

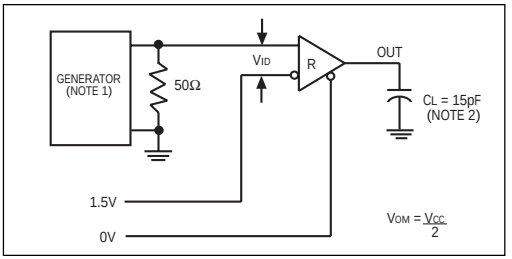

Figure 6. Receiver Propagation Delay Test Circuit

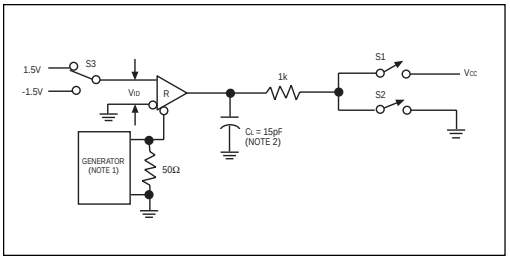

Figure 7. Receiver Enable and Disable Timing Circuit

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

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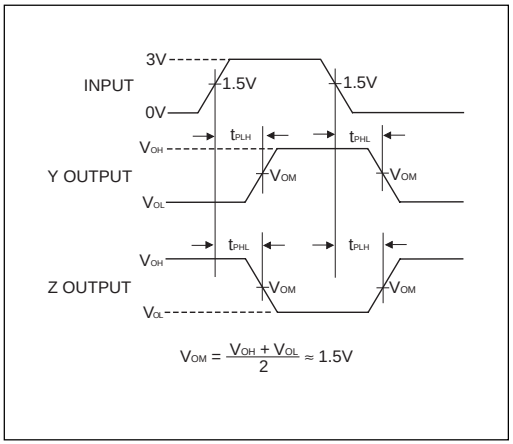

Figure 8. Driver Propagation Delay Waveforms

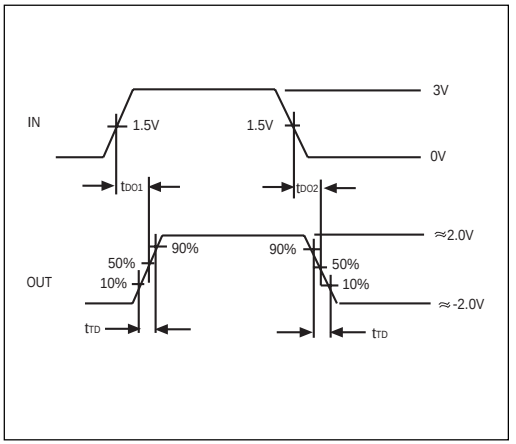

Figure 9. Driver Differential Output Delay and Transition Time Waveforms

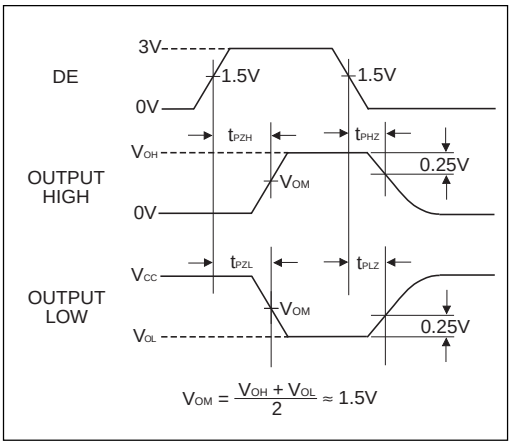

Figure 10. Driver Enable and Disable Timing Waveforms

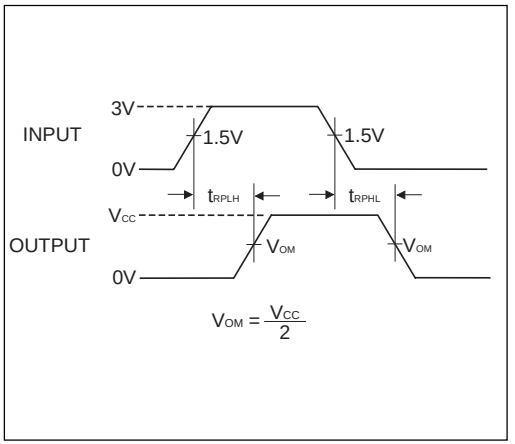

Figure 11. Receiver Propagation Delay Waveforms

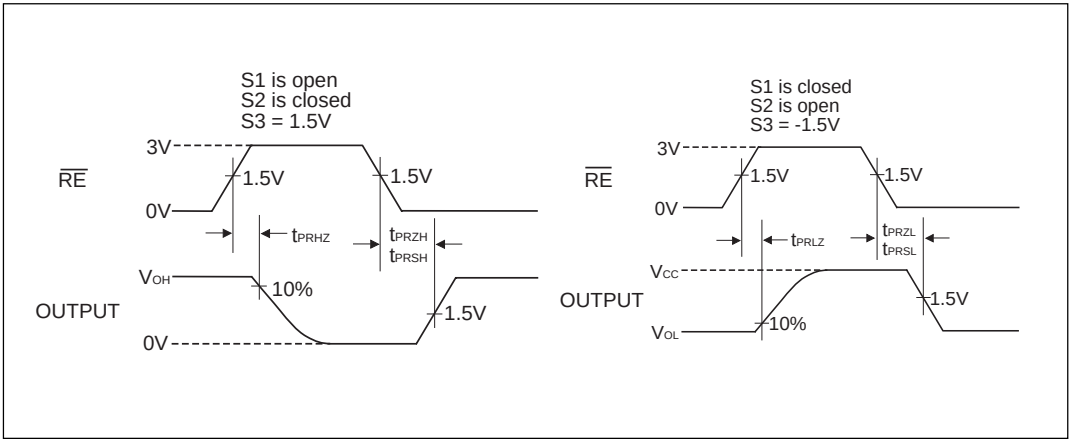

Figure 12. Receiver Enable and Disable Waveforms

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.

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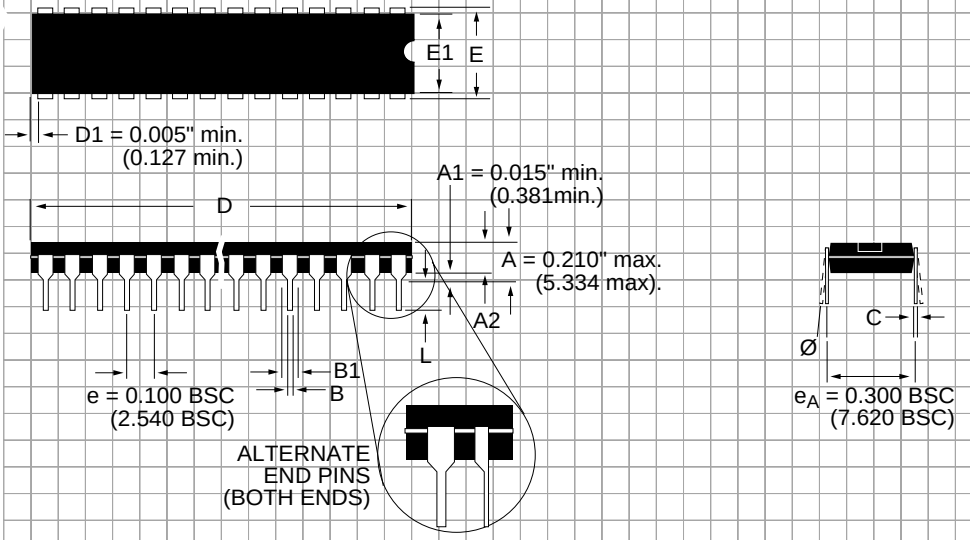
PACKAGE: PLASTIC DUAL–IN–LINE (NARROW)



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)
Ø	0°/ 15° (0°/15°)

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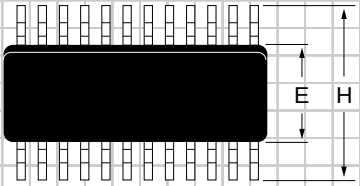
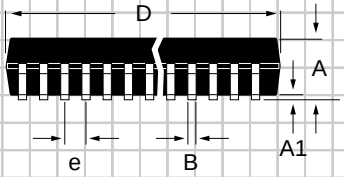
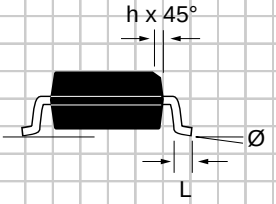
PACKAGE: PLASTIC SMALL OUTLINE (SOIC) (NARROW)







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°)

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ORDERING INFORMATION

Model	Temperature Range	Package
SP3483CN	0˚C to +70˚C	8-pin Narrow SOIC
SP3483CP	0˚C to +70˚C	8-pin Plastic DIP
SP3483EN	-40˚C to +85˚C	8-pin Narrow SOIC
SP3483EP	-40˚C to +85˚C	8-pin Plastic DIP

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

Sipex Corporation

SIGNAL PROCESSING EXCELLENCE

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