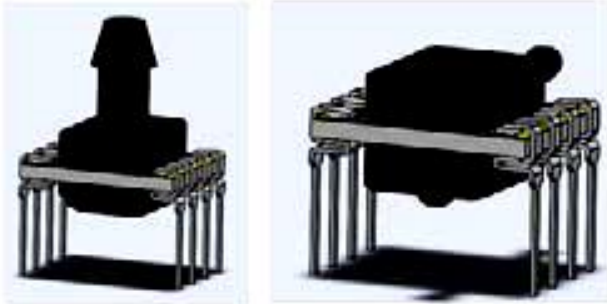




### Digital Board Level Pressure Sensor



- Absolute/Gauge Pressure Sensor
- Temperature Measurement
- -20°C - 85°C Operating Temperature
- Compact Size – 8 Pin DIP
- $\pm 0.25\%$  Linearity FS
- 14 Bit Digital Output – SPI/I2C
- Pressure Range: 3-300 PSI
- Resolution: .01 %
- Accuracy:  $\pm .5\%$   
(includes-Hysteresis, NL, TC)

#### DESCRIPTION

The PPS40 is an amplified digitally compensated pressure sensor in a compact 8-pin package. This silicon pressure sensor was designed for accurate pressure applications.

The PPS40 series utilizes MEMS piezo-resistive sensors pressurized on the passive backside of the pressure die and is isolated from the substrate with an RTV for long term stability and accuracy.

Please contact the factory for Custom design availability.

#### APPLICATIONS

- Flow Meters
- Gas chromatography
- HVAC
- Pneumatic Controls
- Aviation
- Medical Equipment

### Maximum Environmental Ratings

Operating Temperature ..... -25°C to 85°C  
Storage Temperature Range .....-40°C to 100°C

Proof pressure ..... 2.5x full scale pressure  
Burst pressure ..... 4x full scale pressure

### Package

The PPS40 is housed in an 8 PIN ceramic package with DIP or SMT leads. The covers are ABS plastic. There are several port options.

### Stability

The silicon MEMS pressure sensor has a SiO<sub>2</sub> base and is mounted to a ceramic base with RTV and is sealed with a ceramic cover. The special die attach material helps reduce the mechanical stress which results in greater stability over time and temperature.

Additional stability is gained from factory stabilization of all sensors.

### Pressure port

The PPS40-1 has a strong ceramic barbed port to protect against undue stress during manufacturing.

### Media

The pressure port is tolerant to most media including but not limited to air, gas, and most non-corrosive media.

### Wetted parts

The wetted surfaces are silicon, RTV, epoxy, ceramic (Alumina) and high temperature polyimide.



**Automated Oil/Gas Valves**



**Medical Equipment**

## PPS40-1 Digital Output Operational Characteristics

$V_+ = 5V$ ,  $V_- = 0V$ , Temperature = 25°C

PARAMETER	SYMBOL	Min	Typ	Max	UNITS
Supply Voltage	$V_{DD}$	4.8	5	5.2	V
Operating Temperature	$T_s$	-10		60	°C
Supply Current (Note 1)	$I_{DD}$	70	120	2500	μA
Sleep Mode Supply Current	$I_{stdby}$		0.5	32	μA
<b>Accuracy</b>					
Total Error Band		-0.5		0.5	%Full Scan
Non-Linearity (Note 2)		-0.1		0.1	%Full Scan
Temperature Error		-1		1	°C
Response Time	$t_R$	1	2	20	ms
<b>Analog-to-Digital</b>					
Resolution			14 Bit		Full Scale
Temperature Resolution			0.1		°C
<b>I2C &amp; SPI Interface</b>					
Input Low Level	$V_{in\_low}$	0		.2	Vdd%
Input High Level	$V_{in\_high}$	.8		1	Vdd%
Output Low Level	$V_{o\_low}$			.1	Vdd%
Load Capacitance @SDA	$C_{sda}$ @400khz			200	pF
Pull-Up Resistor	$R_{I2C\_PU}$	500			Ω
Input Capacitance (each pin)	$C_{I2C\_In}$			10	pF

Notes: 1) Measured at zero pressure. 2) Defined as best straight line

## Electrical Pin Configuration (Digital [SPI, I2C])

Output	Pin1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
I2C	GND	$V_{supply}$	SDA	SCL	NC	NC	NC	NC
SPI	GND	$V_{supply}$	MISO	SCLK	SS	NC	NC	NC

### Digital Interface – SPI

SPI is available only as half duplex (read-only from the PPS40-1). The factory default is negative edge detect with a clock frequency of 4 MHz.

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
SCLK clock frequency (4MHz clock)	$f_{SCLK}$	50		800	kHz
SCLK clock frequency (1MHz clock)	$f_{SCLK}$	50		200	kHz
SS drop to first clock edge	$t_{HDSS}$	2.5			$\mu s$
Minimum SCLK clock low width	$t_{LOW}$	0.6			$\mu s^1$
Minimum SCLK clock high width	$t_{HIGH}$	0.6			$\mu s^1$
Clock edge to data transition	$t_{CLKD}$	0		0.1	$\mu s$
Rise of SS relative to last clock edge	$t_{SUSS}$	0.1			$\mu s$
Bus free time between rise and fall of SS	$t_{BUS}$	2			$\mu s$

<sup>1</sup> Combined low and high widths must equal or exceed minimum SCLK period.

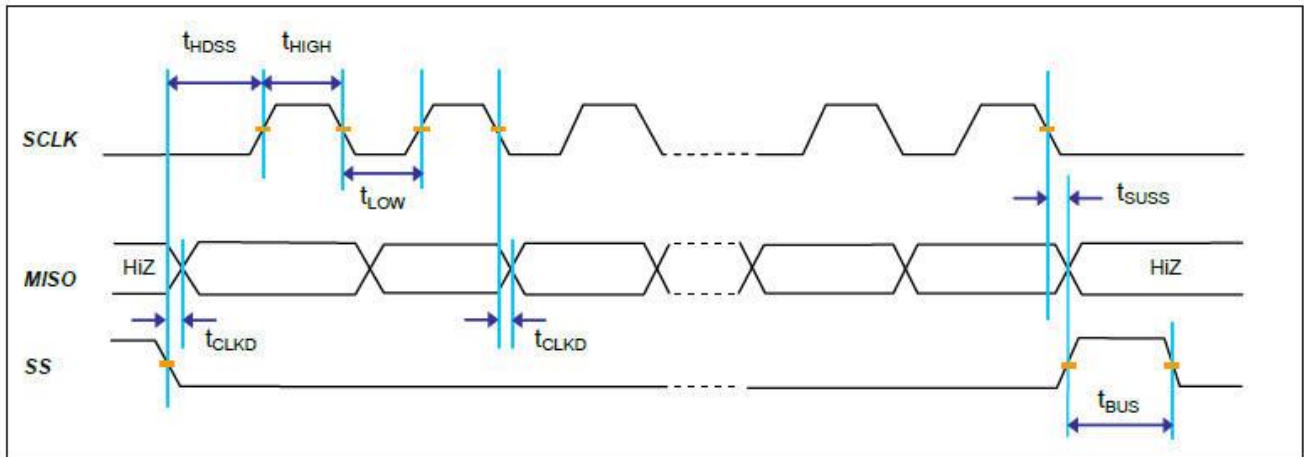


Figure 2

## SPI Read Operations

For simplifying explanations and illustrations, only falling edge SPI polarity will be discussed in the following sections. The SPI interface will have data change after the falling edge of SCLK. The master should sample MISO on the rise of SCLK. The entire output packet is 4 bytes (32 bits). The high bridge data byte comes first, followed by the low bridge data byte. Then 11 bits of corrected temperature (T[10:0]) are sent: first the T[10:3] byte and then the {T[2:0],xxxx} byte. The last 5 bits of the final byte are undetermined and should be masked off in the application. If the user only requires the corrected bridge value, the read can be terminated after the 2nd byte. If the corrected temperature is also required but only at an 8-bit resolution, the read can be terminated after the 3rd byte is read.

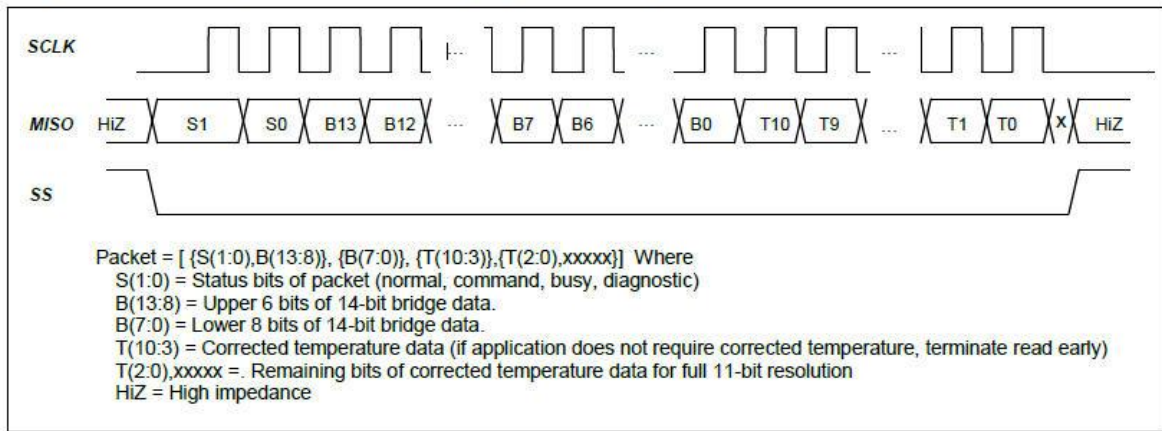
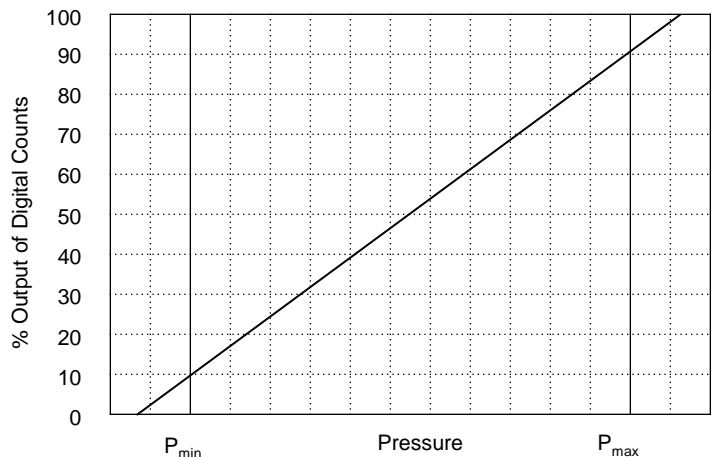


Figure 3

## Digital Output - Transfer Function

Sensor Output		
% Output	Decimal	Hex
0	0	0X0000
10	1638	0X0666
50	8192	0X2000
90	14746	0X399A
100	16383	0X3FFF



$$\text{Output} = (16,383 \cdot 80) / (P_{\max} - P_{\min}) \times (P_{\text{actual}} - P_{\min}) + 10\%$$

In Sleep Mode, after the command window, the PPS40-1 will power down until the master sends a Read\_MR (either I2C or SPI) or a Write\_MR (I2C only). A Read\_MR or Write\_MR wakes the PPS40-1 and starts a measurement cycle. If the command is Read\_MR, the part performs temperature, auto-zero (AZ), and a bridge measurement followed by the DSP correction calculations. If the command is Write\_MR, the part measures only the bridge and performs the correction calculations using previously measured temperature and auto-zero data. Valid values are then written to the digital output register, and the PPS40-1 powers down again.

Following a measurement sequence and before the next measurement can be performed, the master must send a Read\_DF command, which will fetch the data as 2, 3 or 4 bytes without waking the PPS40-1. When a Read\_DF is performed, the data packet returned will be the last measurement made with the status bits set to “valid.” After the Read\_DF is completed, the status bits will be set to “stale.” The next Read\_MR or Write\_MR will wake the part again and start a new measurement cycle. If a Read\_DF is sent while the measurement cycle is still in progress, then the status bits of the packet will read as “stale.” The chip should be polled at a frequency slower than 20% more than the Sleep Mode response times listed in Table 3.2

Table 3.2 Sleep Mode Response Times

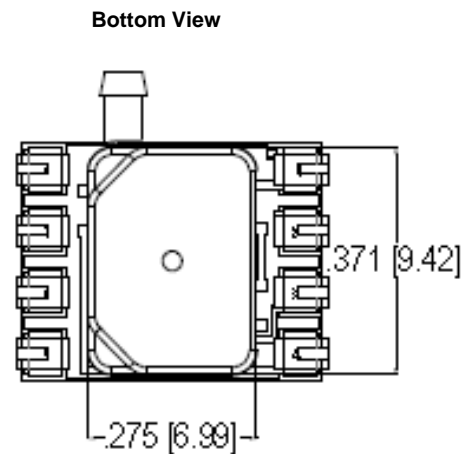
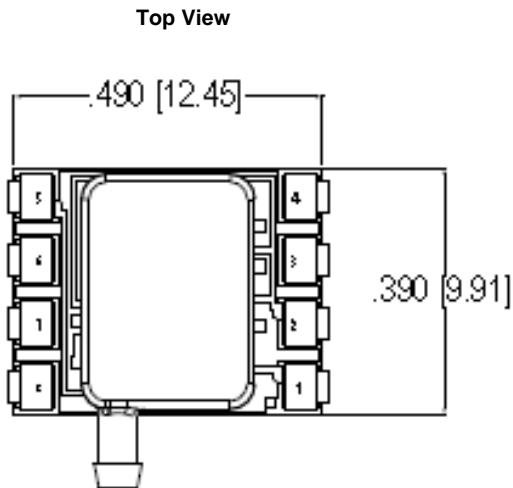
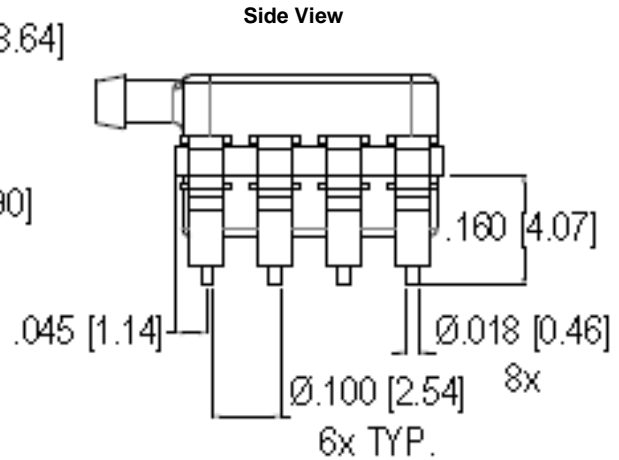
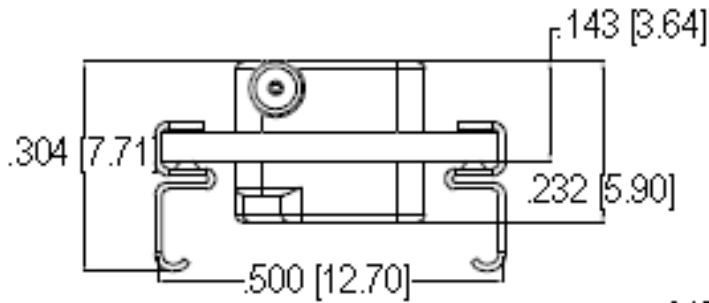
Measurement Request	Response/4MHz Clock
Read MR	1.5ms
Write MR	0.5ms

<sup>1</sup>All time values shown are typical; for worst case values, multiply by 1.15 (nominal frequency  $\pm 15\%$ ).

**Note:** Data is considered invalid from system power-on reset (POR) until the first measured data is written to the digital register. Sending an I2C Write\_MR as the first command after power-on delivers invalid data; even though the status bits report it as “valid”. This is due to the correction calculations being performed with an uninitialized temperature and Auto-Zero value.

In I2C Mode only, the INT/SS pin will assume the INT (interrupt) function. Instead of polling until a “valid” response is received, the application can look for a rise on the INT pin. This will indicate that the measurement and calculations are complete, and new valid data is ready to be read on the I2C interface.

**Surface Mount J-Clips**

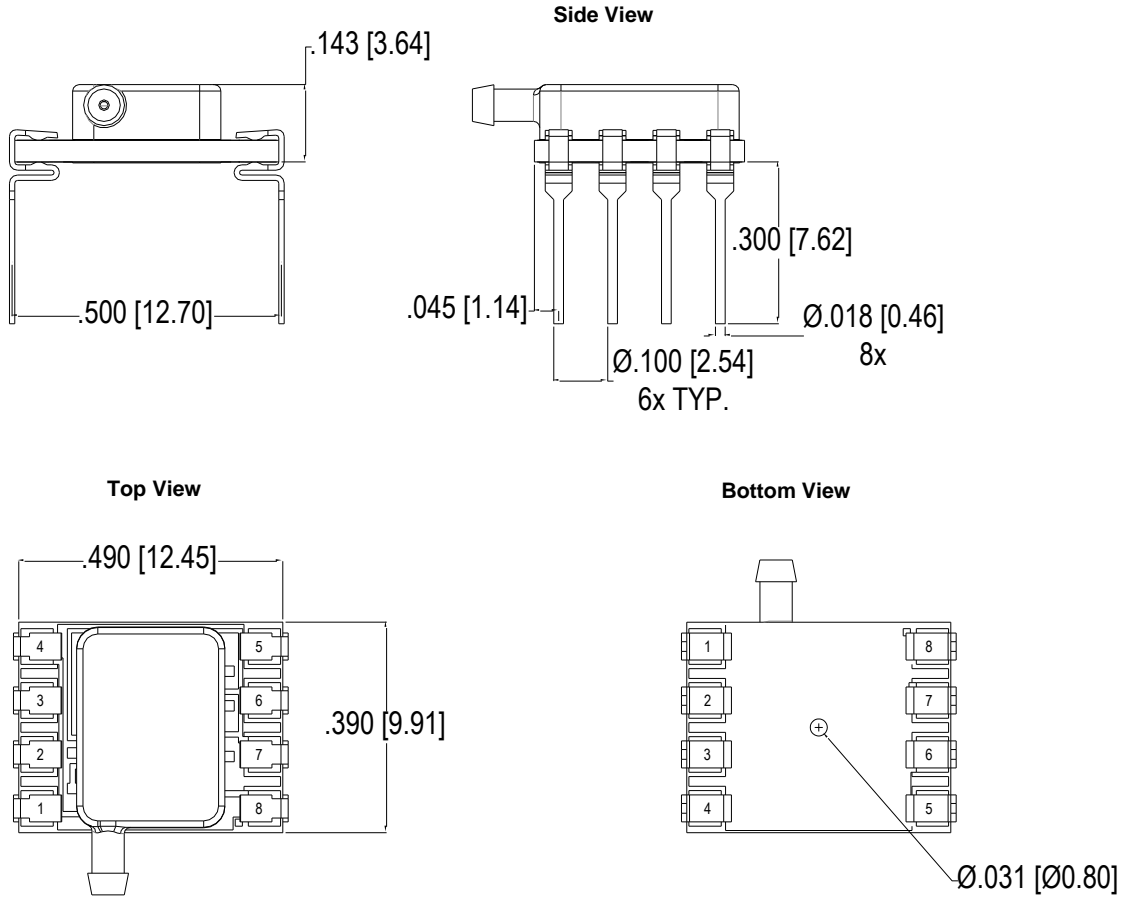


**Notice:**

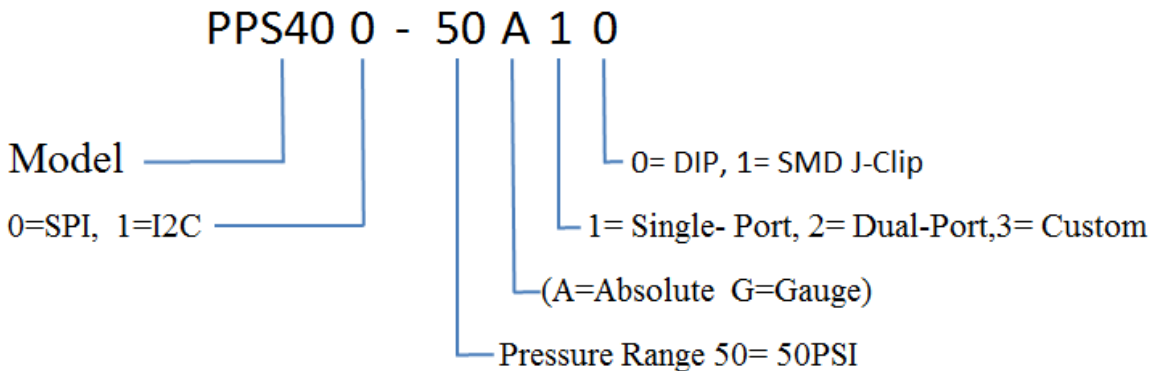
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**Surface Mount DIP Package**



**Part Number Configuration**



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