MERIT SENSOR™

DATA SHEET

LP Series – Digital

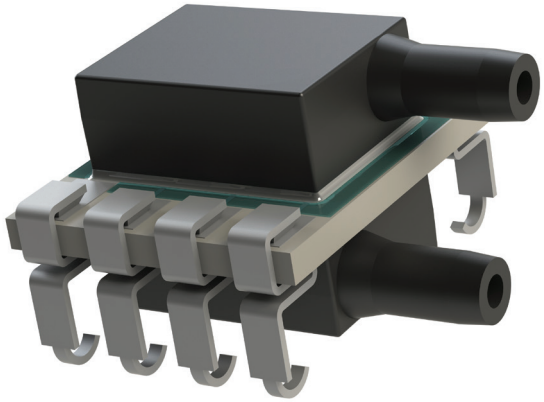
LP Series - Digital is a surface mountable pressure sensor package with a compensated digital output suitable for **ultra-low pressure sensing applications.**

COMPANY: Merit Sensor is a leader in piezoresistive pressure sensing and partners with clients to create high performing solutions for a variety of applications and industries.

SENTIUM: Merit Sensor products incorporate a proprietary Sentium® technology developed to provide superior stability.

TECHNOLOGY: Merit Sensor utilizes a piezoresistive Wheatstone bridge in a design that anodically bonds glass to a chemically etched silicon diaphragm. All products are RoHS compliant.

CAPABILITIES: Merit Sensor designs, engineers, fabricates, dices, assembles, tests, and sells die and packaged products from a state-of-the-art facility near Salt Lake City, Utah.



RoHS Compliant

FEATURES

Pressure Range	0.04 to 15 psi (2.5 mbar to 1 bar; 250 Pa to 100 kPa KPa; 1 in H_2O to 415 in H_2O)
Output	Digital I^2C
Type	Gage, Differential and Absolute
Media	Clean, Dry Air and Non-corrosive Gases
Packaging	Tape and Reel
Customization	Supply Voltage, Temperature Calibration Range, Output Range, Accuracy Specification, Update Rate, etc

BENEFITS

Performance	Enjoy best-in-class performance due to Merit's proprietary Sentium technology
Cost	Save money over time with high-performing die
Security	Feel confident doing business with an experienced company backed by a solid parent company (NASDAQ: MMSI)
Speed	Get to market quickly with creative and flexible solutions
Service	Experience prompt, personal and professional support

1420 Family Part Number Configurator

1420-XXXX-XX1X-XX1

Pressure
P04 = 250 Pa
P07 = 500 Pa
P15 = .15psi
P30 = .30psi
1P0 = 1.0psi
15P = 15psi

Reference
D = Differential
G = Gage
A = Absolute

Clock Speed
1 = 1MHz

I^2C Address
0 = 0x28
1 = 0x38
2 = 0x48
3 = 0x58
4 = 0x68
5 = 0x78
6 = Open*

Pin Type
1 = J-lead

Port
1 = Dual horizontal, facing same direction
2 = Single Horizontal

Calibrated Supply Voltage
1 = 5.0V
2 = 3.3V

Update Rate
1 = 25ms
2 = 5msec

Operation Mode
1 = Update mode constant

*Device will respond to any address.

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SPECIFICATIONS

Parameter	Minimum	Typical	Maximum	Units	Notes
Electrical					
Supply Voltage (Vs)	4.5	5	5.5	V	Depending on calibrated supply voltage
Supply Voltage (Vs)	3.0	3.3	3.6	V	Depending on calibrated supply voltage
Supply Current	1.2	2	3.5	mA	(1)
Operating Temperature	-40		85	°C	
Storage Temperature	-55		100	°C	
Performance					
Effective ADC Resolution		13		Bits	
Pressure Accuracy	-1.5		1.5	%FS	(2) (3)
Long-Term Stability	-0.5		0.5	%FS	
Startup Time		10		ms	Depending on the part configuration
Digital Update Time		25 5		ms ms	Faster or slower available depending on the part configuration. For faster update mode, there could be more variation in the output, and some increase in power consumption. The significance will be determined in the customer application.
Proof Pressure	5X				(4)
Burst Pressure	10X				

Notes:
(1) @5V input voltage,
(2) Over 0°C to 60°C
(3) Applicable if Vs = ±5% of the calibrated Vs
(4) Full scale pressure

Transfer Function Formula

$$P_{psi} = (P_{max} - P_{min}) \cdot \left(\frac{P_{counts} - 0.1 \cdot Max}{0.8 \cdot Max} \right) + P_{min}$$

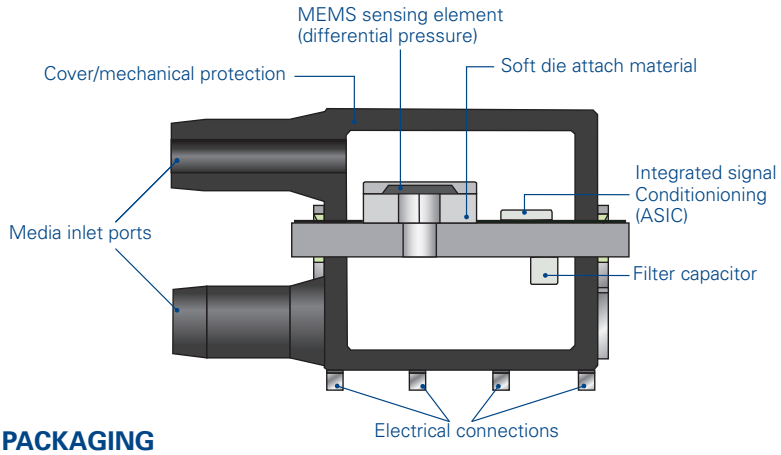
Where

P_{psi}	= Measured Pressure in PSI
P_{counts}	= Pressure Counts from Merit Sensor Part
P_{Min}	= Minimum Pressure
P_{Max}	= Maximum Pressure
Max	= 16384 = 14 Bits

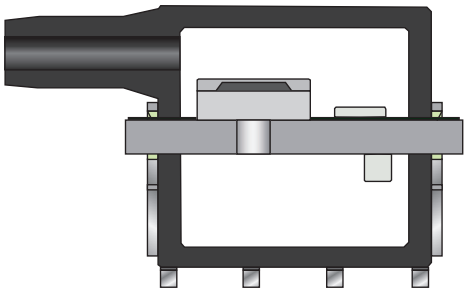
Media Compatibility

For Use With Non-corrosive Dry Gasses
Solder temperature: max 250 °C, 5 seconds max

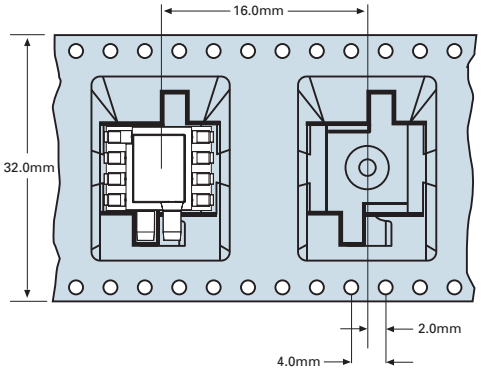
CROSS SECTION FOR DIFFERENTIAL AND GAGE



CROSS SECTION FOR ABSOLUTE

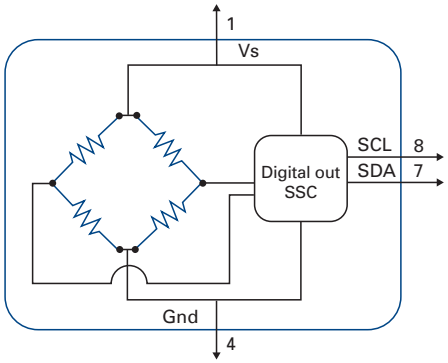


PACKAGING



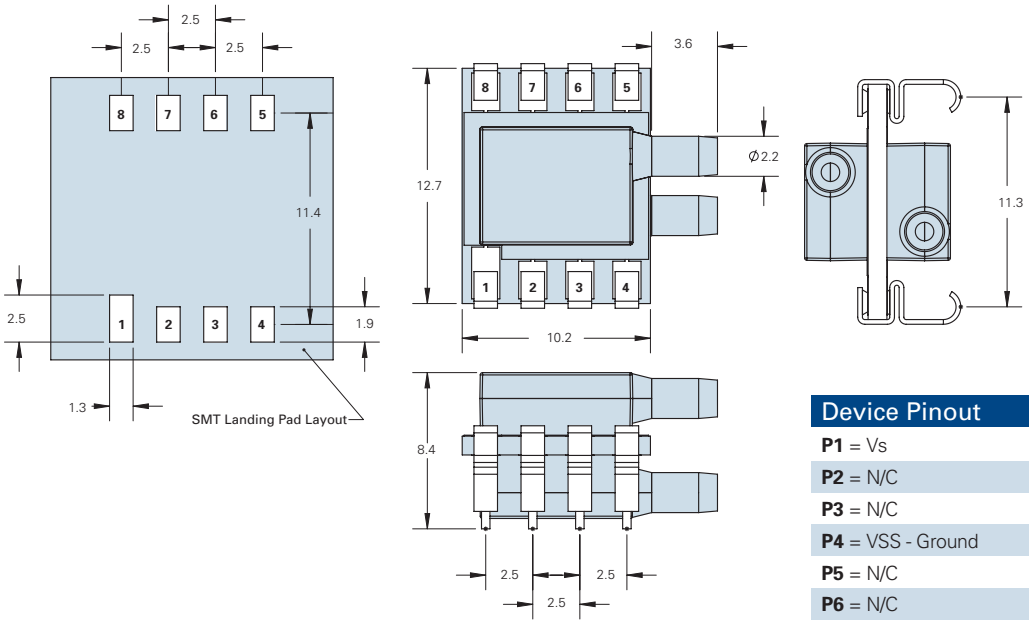
ELECTRICAL

Note: Power supply decoupling included



DIMENSIONS FOR STANDARD OPTIONS (in millimeters)

Dimensions for reference only. Engineering drawings (with tolerance) available upon order.



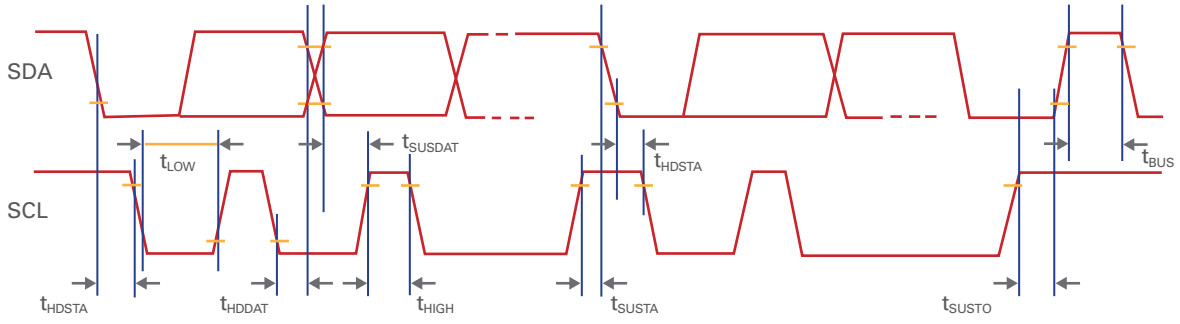
Device Pinout
P1 = Vs
P2 = N/C
P3 = N/C
P4 = VSS - Ground
P5 = N/C
P6 = N/C
P7 = SDA - I²C data
P8 = SCL - I²C clock

I²C PARAMETERS *

Parameter	Symbol	Min	Typ	Max	Units
SCL clock frequency	f_{SCL}	-		100	kHz
Start condition hold time relative to SCL edge	t_{HDSTA}	0.1			µs
Minimum SCL clock low width[1]	t_{LOW}	0.6			µs
Minimum SCL clock high width[1]	t_{HIGH}	0.6			µs
Start condition setup time relative to SCL edge	t_{SUSTA}	0.1			µs
Data hold time on SDA relative to SCL edge	t_{HDDAT}	0.0			µs
Data setup time on SDA relative to SCL edge	t_{SUDAT}	0.1			µs
Stop condition setup time on SCL	t_{SUSTO}	0.1			µs
Bus free time between stop condition and start condition	t_{BUS}	2			µs

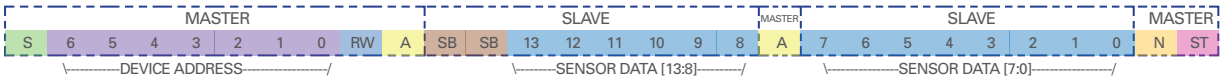
1Combined low and high widths must equal or exceed minimum SCLK period.

I²C TIMING DIAGRAM*



MERIT SENSOR 1420 I²C COMMUNICATION

Communications to the 1420 is read only. To read the pressure counts, the master performs a read request by asserting a start condition, sending the 7 bit address of the part (If the part has an open address, 7 bits of anything is acceptable), and sets the read/write bit. The master then waits for an acknowledgment. The acknowledgment is sent by the pressure sensor along with 2 bits of status and bits 13:8 of the pressure counts, the master acknowledges the first 8 bits, and the pressure sensor sends the remaining 8 bits of data. The Master then does not acknowledge and sends a stop condition signaling the end of the transaction.



S	Start Conditioning	#	Device Slave Address	#	Data Bit
RW	Read/Write Bit	A	Acknowledge Bit	N	No Acknowledge Bit
ST	Stop Condition	SB	Status Bits		

Status Bits

0	0	Normal Operation, Good Packet
0	1	Device in Command Mode
1	0	Stale Data
1	1	Diagnostic Condition Exsists

*Used by permission, IDT

TRANSFER FUNCTION EXAMPLES

Example 1: 0.15 PSI Gage

Part: 1420-P15G-xx11-111

P_{min} =0.0 *PSI*

P_{max} =0.15 *PSI*

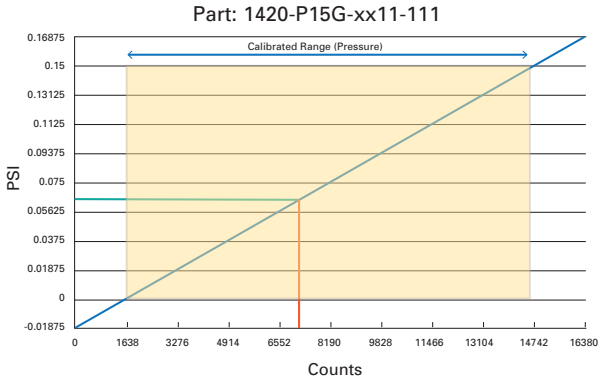
P_{counts} =7215

Max =16384

$$P_{psi} = (P_{max} - P_{min}) \cdot \left(\frac{P_{counts} - 0.1 \cdot Max}{0.8 \cdot Max} \right) + P_{min}$$

$$P_{Psi} = (0.15 - 0.0) \cdot \left(\frac{7215 - 0.1 \cdot 16384}{0.8 \cdot 16384} \right) + 0$$

P_{Psi} = .0638 *Psi*



Example 2: -.5 to .5 PSI Differential

Part: 1420-P50D-xx11-111

P_{min} = -0.5 *PSI*

P_{max} = 0.5 *PSI*

P_{counts} =8192

Max =16384

$$P_{psi} = (P_{max} - P_{min}) \cdot \left(\frac{P_{counts} - 0.1 \cdot Max}{0.8 \cdot Max} \right) + P_{min}$$

$$P_{Psi} = (0.5 - (-0.5)) \cdot \left(\frac{8192 - 0.1 \cdot 16384}{0.8 \cdot 16384} \right) + (-0.5)$$

P_{Psi} = 0.0 *Psi*