

## Features

- Compensated analog output
- Ultra-low pressure sensing
- Gauge and differential types
- For use in clean, dry air and non-corrosive gas environments
- Tape and reel packaging
- RoHS compliant\*

## Applications

Industrial:

- HVAC systems
- Process monitoring
- Packaging automation

\*\*Medical Devices (low/medium risk):

- Diagnostic equipment
- Analysis equipment

# BPS110 Series - 12 mm Analog Low Pressure Sensor

### Electrical Characteristics

Supply Voltage (V <sub>s</sub> )	2.7 V minimum, 5 V typical, 5.5 V maximum
Supply Current @ 5 V	1.25 mA minimum, 2 mA typical, 2.4 mA maximum
Output Current	1.9 mA
Minimum Output Load Resistance	5 kΩ minimum

### Performance Characteristics

Operating Temperature	-40 °C to +85 °C (-40 °F to +185 °F)
Storage Temperature	-55 °C to +100 °C (-67 °C to +212 °F)
Pressure Range	0.15 to 1.0 psi (10.3 to 68.9 mbar; 1.03 to 6.89 KPa; 4.2 to 27.7 in H <sub>2</sub> O)
Output	Amplified analog
DAC Resolution	12 bit
Ratiometric Output Range (V <sub>out</sub> )***	10 % to 90 % V <sub>s</sub>
Accuracy @ 25 °C	±0.25 % FS
Total Error Band over 0 °C to 60 °C (+32 °F to +140 °F)	± 1.5 % FS
Lifetime Drift	± 0.5 % FS
Startup Time	8 ms maximum
Analog Update Time	25 ms typical
Sampling Range	200 Hz
Proof Pressure	5X full scale pressure
Burst Pressure	10 psi

### Product Characteristics

Media Compatibility	Non-corrosive dry gasses
Moisture Sensitivity Level	1
ESD Classification (HBM)	2 kV
Marking	Partial model number, media compatibility, pressure type, pressure rating, lot code
Standard Packaging	250 pcs./reel
Weight	1.307 grams (0.046 oz)

### Transfer Function Formula

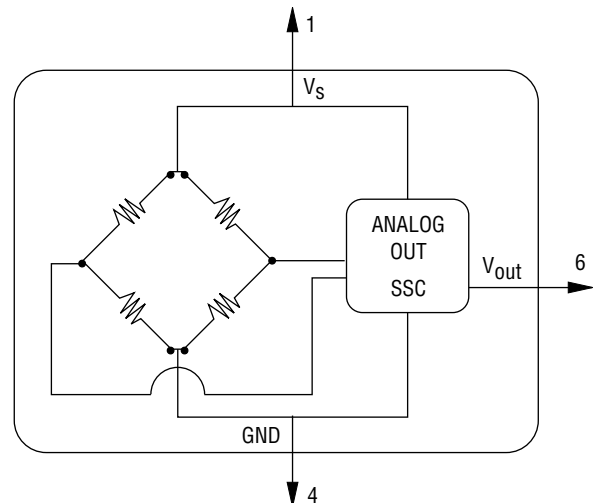
$$P_{\text{psi}} = (P_{\text{max}} - P_{\text{min}}) \cdot \left( \frac{V_{\text{out}} - V_{\text{minComp}}}{V_{\text{maxComp}} - V_{\text{minComp}}} \right) + P_{\text{min}}$$

#### Where

- P<sub>psi</sub> = Measured Pressure in PSI
- P<sub>max</sub> = Maximum Pressure
- P<sub>min</sub> = Minimum Pressure
- V<sub>minComp</sub> = Minimum Voltage (Usually 0.5 V)
- V<sub>maxComp</sub> = Maximum Voltage (Usually 4.5 V)
- V<sub>out</sub> = Output Voltage (Pin 6)

Consult factory for custom options such as supply voltage, temperature calibration range, output range accuracy specification, and update rate.

### Basic Circuit Schematic



Note: Power supply decoupling and output filtering included.

\* RoHS3 Directive 2015/863 Amendments of Annex II on March 31, 2015

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\*\*\* 5 V input voltage.

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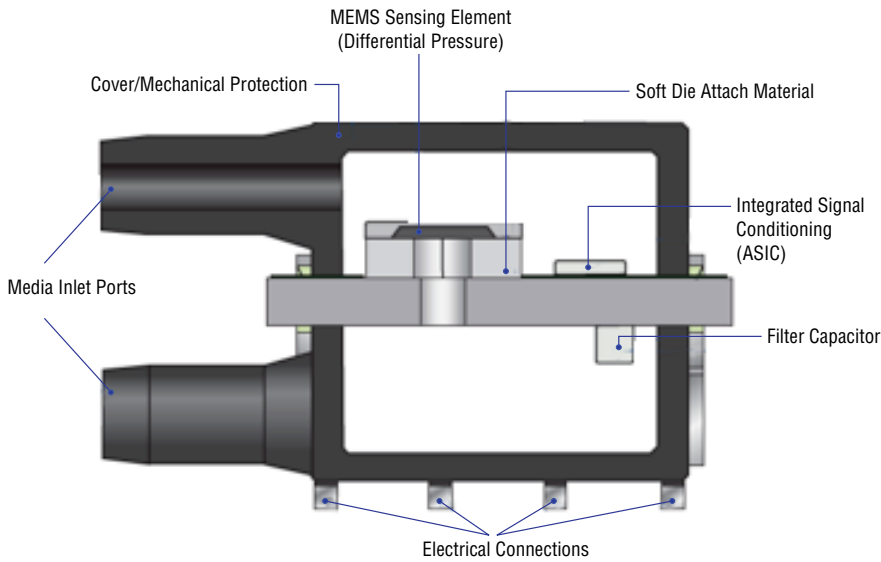
Users should verify actual device performance in their specific applications.

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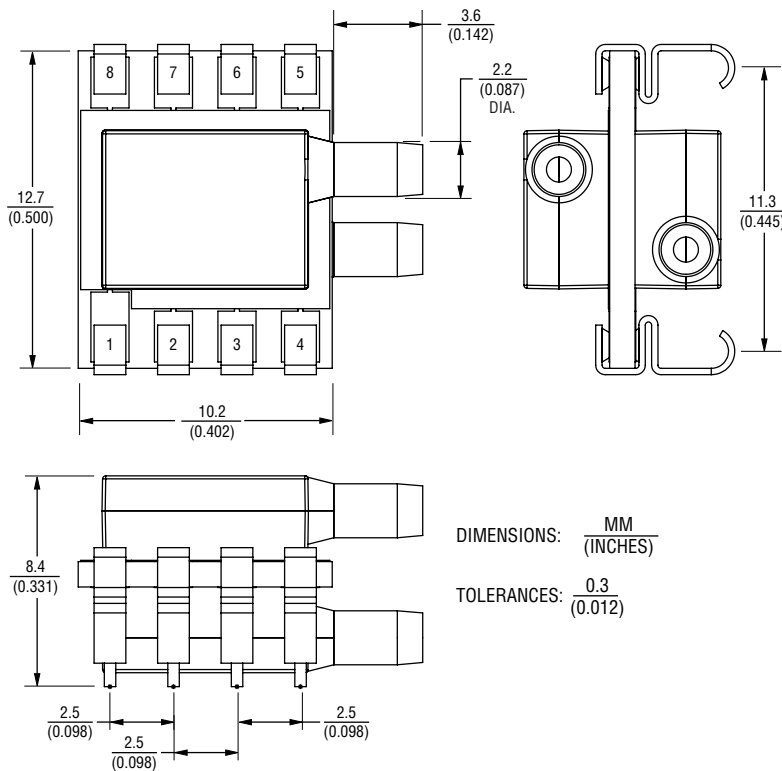
# BPS110 Series - 12 mm Analog Low Pressure Sensor

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## Cross Section



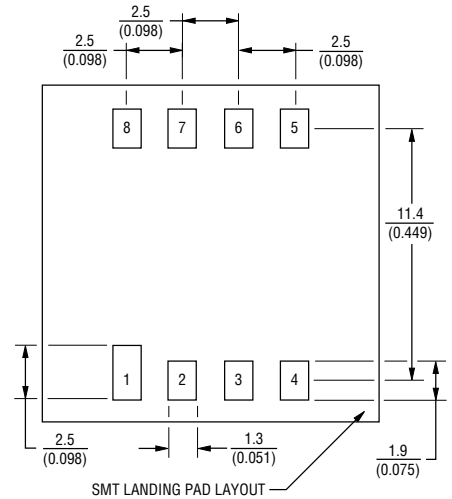
## Product Dimensions



## Terminal Assignment

DEVICE PINOUT	
P1	V <sub>S</sub>
P2	N/C
P3	N/C
P4	Ground
P5	N/C
P6	V <sub>out</sub>
P7	N/C
P8	N/C

## Recommended PCB Layout



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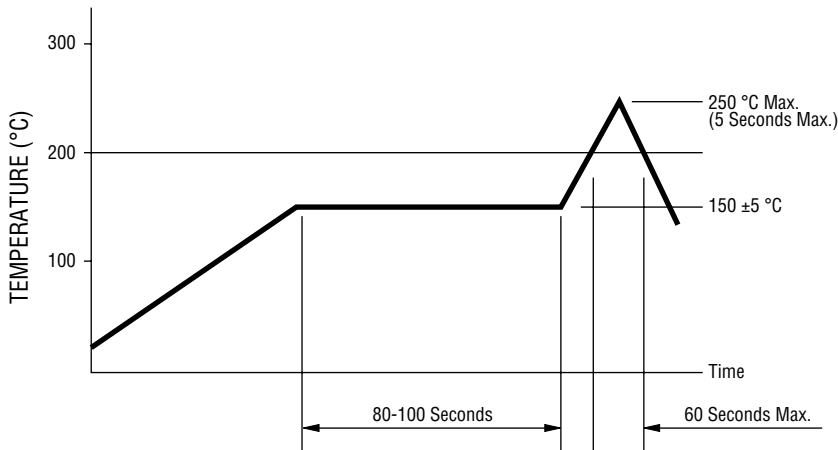
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## How To Order

**BPS110 - A G 0P15 - 2 D G**

Model Series \_\_\_\_\_  
 Analog Amplified \_\_\_\_\_  
 Media Compatibility \_\_\_\_\_  
 A = Air/Gas \_\_\_\_\_  
 Pressure Type \_\_\_\_\_  
 G = Gauge \_\_\_\_\_  
 D = Differential \_\_\_\_\_  
 Pressure (psi) \_\_\_\_\_  
 0P15 = 0.15 \_\_\_\_\_  
 0P30 = 0.30 \_\_\_\_\_  
 01P0 = 1.0 \_\_\_\_\_  
 Terminal Pins \_\_\_\_\_  
 2 = Surface Mount Terminals \_\_\_\_\_  
 Port Style \_\_\_\_\_  
 D = Dual Port, Horizontal \_\_\_\_\_  
 Packaging Designator \_\_\_\_\_  
 G = 250 pcs. per 13-inch Reel \_\_\_\_\_

## Solder Profile



### Notes:

1. No clean solder paste is recommended.
2. Aqueous wash is not recommended.
3. Use of water soluble soldering flux should be avoided due to possible corrosion.
4. Multiple passes through the soldering process is not recommended.
5. Other SMD processes and profiles should be verified by the customer.

Processing Method: Reflow soldering with infrared heat or forced air convection (only once).

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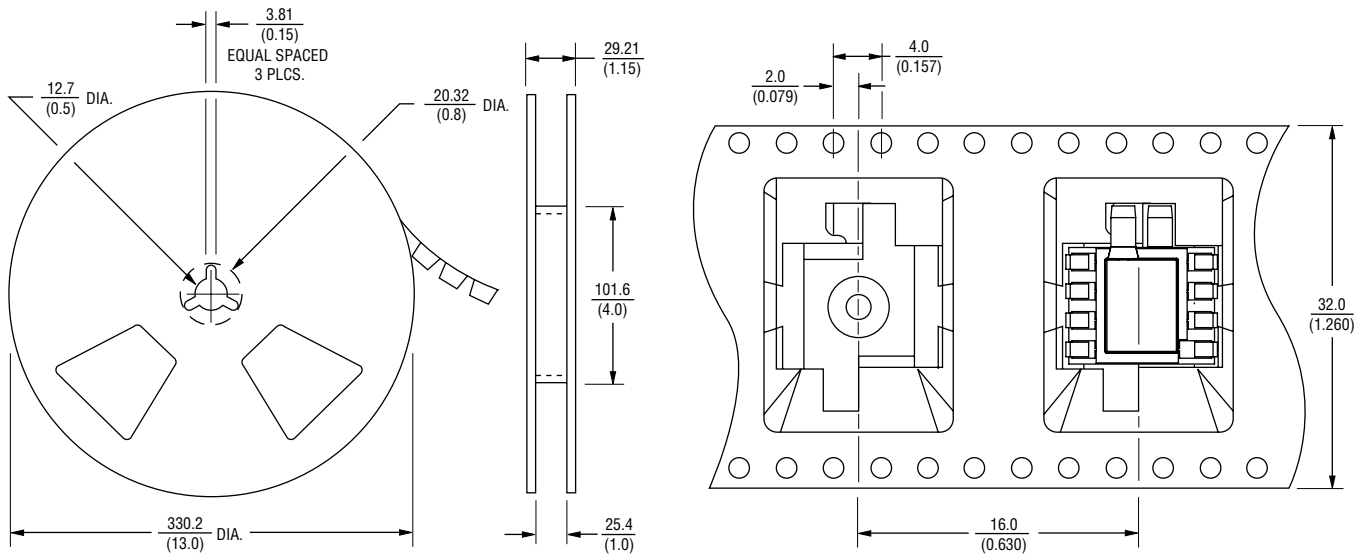
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# BPS110 Series - 12 mm Analog Low Pressure Sensor

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## Packaging Specification

250 pieces per 13-inch reel.  
Meets specifications of EIA-481-1 or EIA-481-2.



DIMENSIONS:  $\frac{\text{MM}}{\text{(INCHES)}}$

TOLERANCES:  $\frac{0.25}{(0.010)}$

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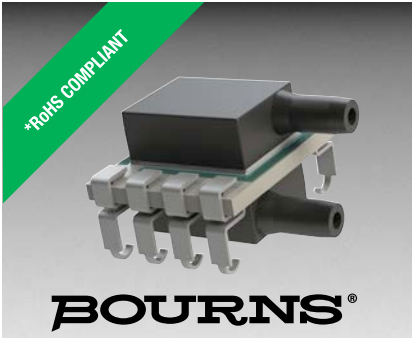
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### Features

- Compensated digital output
- Ultra-low pressure sensing
- Digital I<sup>2</sup>C output
- Gauge and differential types
- For use in clean, dry air and non-corrosive gas environments
- RoHS compliant\*

### Applications

- Industrial:
- HVAC systems
  - Process monitoring
  - Packaging automation
- \*\*Medical Devices (low/medium risk):
- Diagnostic equipment
  - Analysis equipment

## BPS120 Series - 12 mm Digital Low Pressure Sensor

#### Electrical Characteristics

Supply Voltage (V <sub>s</sub> ) .....	2.7 V minimum, 5 V typical, 5.5 V maximum
Supply Current @ 5 V .....	1.2 mA minimum, 2 mA typical, 3.5 mA maximum

#### Performance Characteristics

Operating Temperature .....	-40 °C to +85 °C (-40 °F to +185 °F)
Storage Temperature .....	-55 °C to +100 °C (-67 °C to +212 °F)
Pressure Range .....	0.15 to 1.0 psi (10.3 to 68.9 mbar; 1.03 to 6.89 KPa; 4.2 to 27.7 in H <sub>2</sub> O)
Output .....	Digital I <sup>2</sup> C (1)
Effective ADC Resolution .....	13 bit
Accuracy @ 25 °C .....	±0.25 % FS
Total Error Band over 0 °C to 60 °C (+32 °F to +140 °F) .....	± 1.5 % FS
Long Term Stability .....	± 0.5 % FS
Startup Time .....	15 ms maximum
Digital Update Time .....	8.5 ms typical
Proof Pressure .....	5X full scale pressure
Burst Pressure .....	10 psi

(1) I<sup>2</sup>C address is set to (0x28). Alternative addresses are available. Consult the factory for custom options.

#### Product Characteristics

Media Compatibility .....	Non-corrosive dry gasses
Moisture Sensitivity Level .....	1
ESD Classification (HBM) .....	2 kV
Marking .....	Partial model number, media compatibility, pressure type, pressure rating, lot code
Standard Packaging .....	250 pcs./13-inch reel
Weight .....	1.307 grams (0.046 oz)

#### Transfer Function Formula

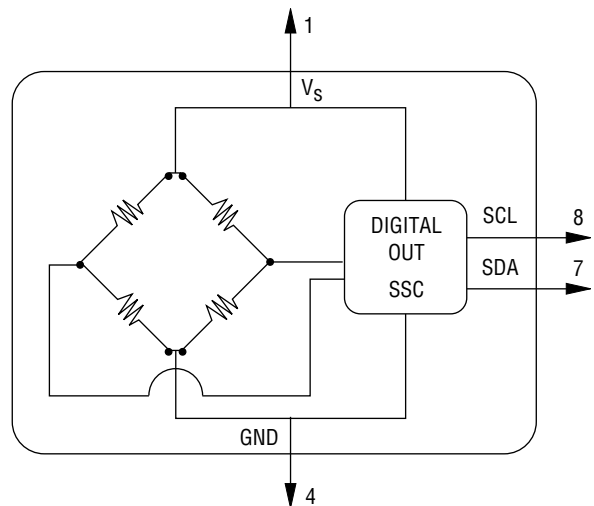
$$P_{psi} = (P_{max} - P_{min}) \cdot \left( \frac{P_{counts} - 0.1 \cdot Max}{0.8 \cdot Max} \right) + P_{min}$$

#### Where

- P<sub>psi</sub> = Measured Pressure in PSI
- P<sub>counts</sub> = Pressure Counts
- P<sub>min</sub> = Minimum Pressure
- P<sub>max</sub> = Maximum Pressure
- Max = 16384 = 14 Bits

Consult factory for custom options such as supply voltage, temperature calibration range, output range accuracy specification, and update rate.

#### Basic Circuit Schematic



Note: Power supply decoupling included.

\* RoHS3 Directive 2015/863 Amendments of Annex II on March 31, 2015

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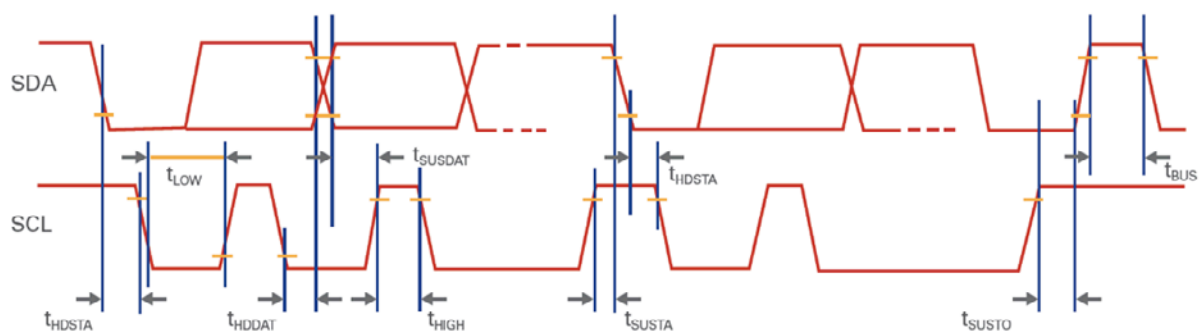
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## I<sup>2</sup>C Parameters

SCL Clock Frequency $f_{SCL}$ .....	100 to 400 kHz
Start Condition Hold Time Relative to SCL Edge $t_{HDSTA}$ .....	0.1 $\mu$ s
Minimum SCL Clock Low Width <sup>1</sup> $t_{LOW}$ .....	0.6 $\mu$ s
Minimum SCL Clock High Width <sup>1</sup> $t_{HIGH}$ .....	0.6 $\mu$ s
Start Condition Setup Time Relative to SCL Edge $t_{SUSTA}$ .....	0.1 $\mu$ s
Data Hold Time on SDA Relative to SCL Edge $t_{HDDAT}$ .....	0.0 $\mu$ s
Data Setup Time on SDA Relative to SCL Edge $t_{SUDAT}$ .....	0.1 $\mu$ s
Stop Condition Setup Time on SCL $t_{SUSTO}$ .....	0.1 $\mu$ s
Bus Free Time Between Stop Condition and Start Condition $t_{BUS}$ .....	2 $\mu$ s

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

## I<sup>2</sup>C Parameters



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## I<sup>2</sup>C Communication

Communication to the Model BPS120 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 (0x28), and sets the read/write bit. The master then waits for an acknowledgement. The acknowledgement 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.

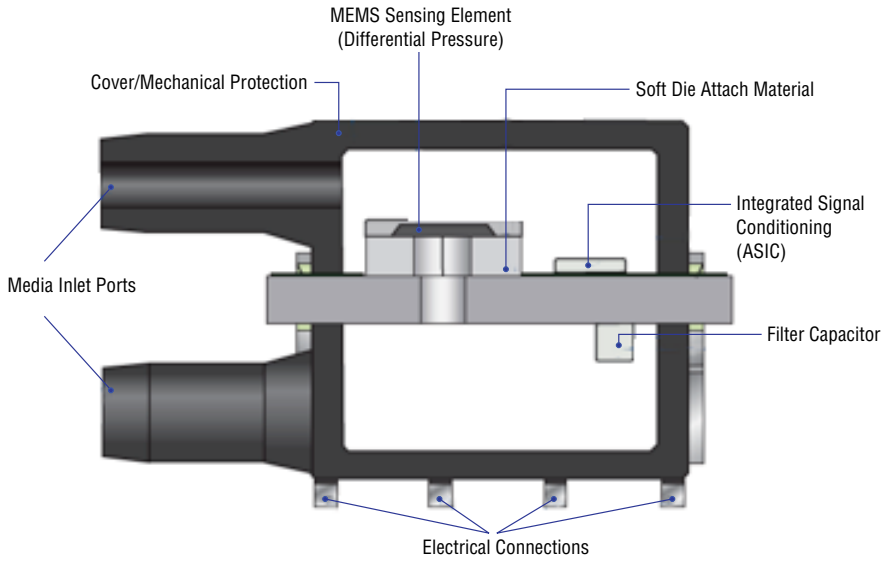


<b>S</b> Start Conditioning	<b>#</b> Device Slave Address	<b>#</b> Data Bit	<b>Status Bits</b>	
<b>RW</b> Read/Write Bit	<b>A</b> Acknowledge Bit	<b>N</b> No Acknowledge Bit	0 0	Normal Operation, Good Packet
<b>ST</b> Stop Condition	<b>SB</b> Status Bits		0 1	Device in Command Mode
			1 0	Stale Data
			1 1	Diagnostic Condition Exists

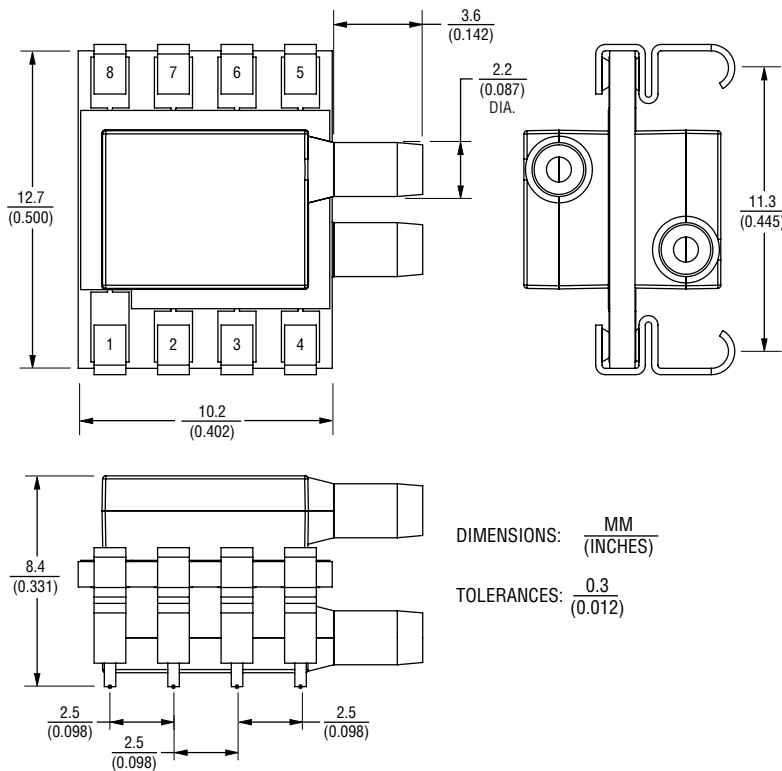
# BPS120 Series - 12 mm Digital Low Pressure Sensor

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## Cross Section



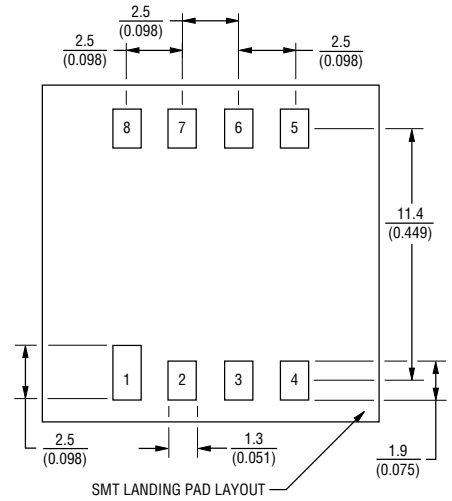
## Product Dimensions



## Terminal Assignment

DEVICE PINOUT	
P1	V <sub>s</sub>
P2	N/C
P3	N/C
P4	VSS - Ground
P5	N/C
P6	N/C
P7	SDA - I <sup>2</sup> C Data
P8	SCL - I <sup>2</sup> C Clock

## Recommended PCB Layout



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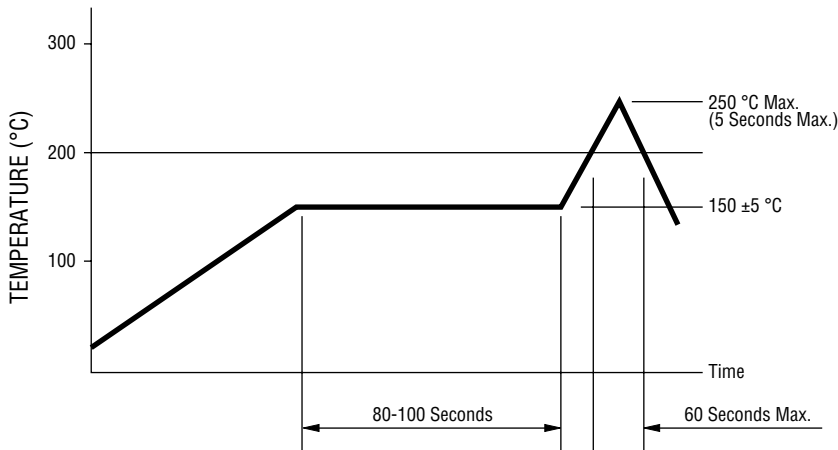
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## How To Order

BPS120 - A D 0P30 - 2 D G

Model Series _____	BPS120
Digital _____	A
Media Compatibility _____	D
A = Air/Gas _____	0P30
Pressure Type _____	- 2
G = Gauge _____	D
D = Differential _____	G
Pressure (psi) _____	
OP15 = 0.15 _____	
OP30 = 0.30 _____	
O1P0 = 1.0 _____	
Terminal Pins _____	
2 = Surface Mount Terminals _____	
Port Style _____	
D = Dual Port, Horizontal _____	
Packaging Designator _____	
G = 250 pcs. per 13-inch Reel _____	

## Solder Profile



Processing Method: Reflow soldering with infrared heat or forced air convection (only once).

### Notes:

1. No clean solder paste is recommended.
2. Aqueous wash is not recommended.
3. Use of water soluble soldering flux should be avoided due to possible corrosion.
4. Multiple passes through the soldering process is not recommended.
5. Other SMD processes and profiles should be verified by the customer.

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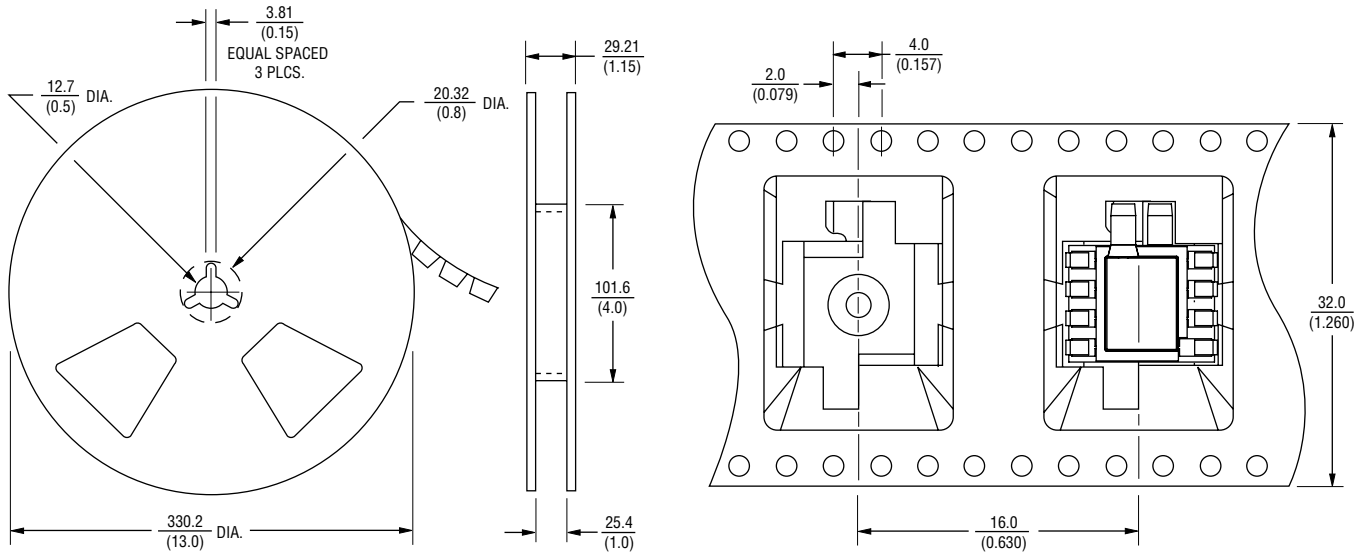
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# BPS120 Series - 12 mm Digital Low Pressure Sensor

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## Packaging Specification

250 pieces per 13-inch reel.  
Meets specifications of EIA-481-1 or EIA-481-2.



DIMENSIONS:  $\frac{\text{MM}}{\text{(INCHES)}}$

TOLERANCES:  $\frac{0.25}{(0.010)}$

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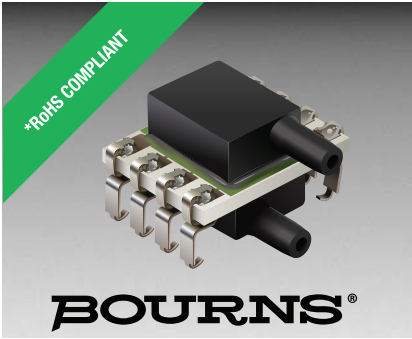
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**Features**

- 3.3 volt supply
- Compensated digital output (I<sup>2</sup>C)
- Ultra-low pressure sensing (250 Pa)
- Gauge and differential types
- For use in clean, dry air and non-corrosive gas environments
- RoHS compliant\*

**Applications**

- Industrial:
- HVAC systems
  - Process monitoring
  - Packaging automation
- \*\*Medical Devices (low/medium risk):
- Diagnostic equipment
  - Analysis equipment

**BPS125 Series - 12 mm Digital Low Pressure Sensor**

**Electrical Characteristics**

Supply Voltage (V <sub>s</sub> ) .....	3.0 V minimum, 3.3 V typical, 3.6 V maximum
Supply Current @ 5 V .....	1.2 mA minimum, 2 mA typical, 3.5 mA maximum

**Performance Characteristics**

Operating Temperature.....	-40 °C to +85 °C (-40 °F to +185 °F)
Storage Temperature.....	-55 °C to +100 °C (-67 °C to +212 °F)
Pressure Range.....	250 to 500 Pa, 0.15 to 1.0 PSI (1 " H <sub>2</sub> O to 2 " H <sub>2</sub> O, 1.03 to 6.89 kPa)
Output.....	Digital I <sup>2</sup> C (1)
Effective ADC Resolution .....	13 bit
Accuracy @ 25 °C.....	±0.25 % FS
Total Error Band over 0 °C to 60 °C (+32 °F to +140 °F).....	± 1.5 % FS
Long Term Stability.....	± 0.5 % FS
Startup Time .....	15 ms maximum
Digital Update Time .....	8.5 ms typical
Proof Pressure.....	5X full scale pressure
Burst Pressure.....	10 psi

(1) I<sup>2</sup>C address is set to (0x28). Alternative addresses are available. Consult the factory for custom options.

**Product Characteristics**

Media Compatibility .....	Non-corrosive dry gasses
Moisture Sensitivity Level.....	1
ESD Classification (HBM).....	2 kV
Marking.....	Partial model number, media compatibility, pressure type, pressure rating, lot code
Standard Packaging .....	250 pcs./13-inch reel
Weight .....	1.307 grams (0.046 oz)

**Transfer Function Formula**

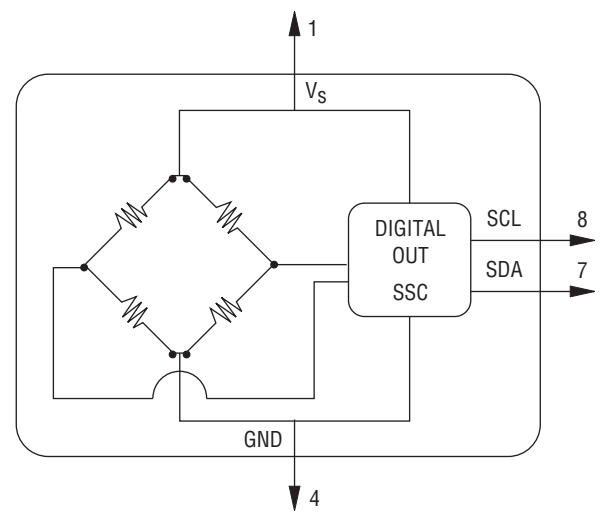
$$P_{psi} = (P_{max} - P_{min}) \cdot \left( \frac{P_{counts} - 0.1 \cdot Max}{0.8 \cdot Max} \right) + P_{min}$$

**Where**

- P<sub>psi</sub> = Measured Pressure in PSI
- P<sub>counts</sub> = Pressure Counts
- P<sub>min</sub> = Minimum Pressure
- P<sub>max</sub> = Maximum Pressure
- Max = 16384 = 14 Bits

Consult factory for custom options such as supply voltage, temperature calibration range, output range accuracy specification, and update rate.

**Basic Circuit Schematic**



Note: Power supply decoupling included.



**WARNING Cancer and Reproductive Harm - [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov)**

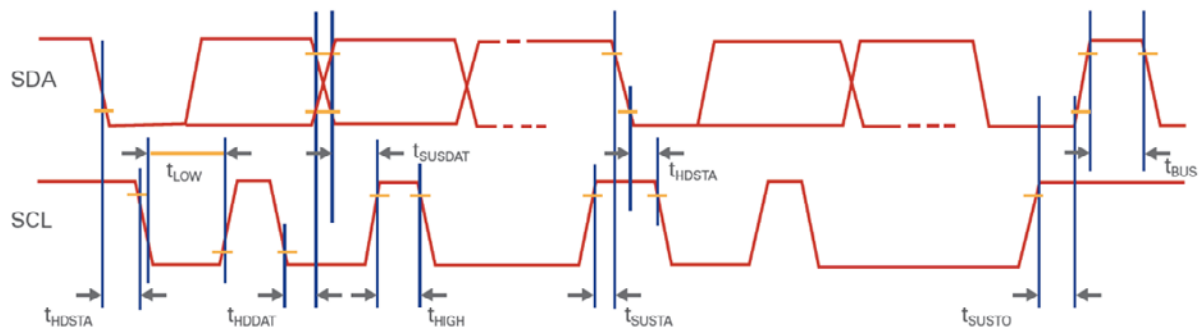
\* RoHS3 Directive 2015/863 Amendments of Annex II on March 31, 2015  
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## I<sup>2</sup>C Parameters

SCL Clock Frequency $f_{SCL}$ .....	100 to 400 kHz
Start Condition Hold Time Relative to SCL Edge $t_{HDSTA}$ .....	0.1 $\mu$ s
Minimum SCL Clock Low Width <sup>1</sup> $t_{LOW}$ .....	0.6 $\mu$ s
Minimum SCL Clock High Width <sup>1</sup> $t_{HIGH}$ .....	0.6 $\mu$ s
Start Condition Setup Time Relative to SCL Edge $t_{SUSTA}$ .....	0.1 $\mu$ s
Data Hold Time on SDA Relative to SCL Edge $t_{HDDAT}$ .....	0.0 $\mu$ s
Data Setup Time on SDA Relative to SCL Edge $t_{SUDAT}$ .....	0.1 $\mu$ s
Stop Condition Setup Time on SCL $t_{SUSTO}$ .....	0.1 $\mu$ s
Bus Free Time Between Stop Condition and Start Condition $t_{BUS}$ .....	2 $\mu$ s

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

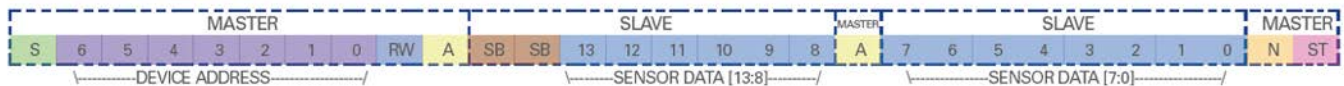
## I<sup>2</sup>C Parameters



Used by permission, ZMDI

## I<sup>2</sup>C Communication

Communication to the Model BPS125 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 (0x28), and sets the read/write bit. The master then waits for an acknowledgement. The acknowledgement 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.



<b>S</b> Start Conditioning	<b>#</b> Device Slave Address	<b>#</b> Data Bit	<b>Status Bits</b>	
<b>RW</b> Read/Write Bit	<b>A</b> Acknowledge Bit	<b>N</b> No Acknowledge Bit	0 0	Normal Operation, Good Packet
<b>ST</b> Stop Condition	<b>SB</b> Status Bits		0 1	Device in Command Mode
			1 0	Stale Data
			1 1	Diagnostic Condition Exists

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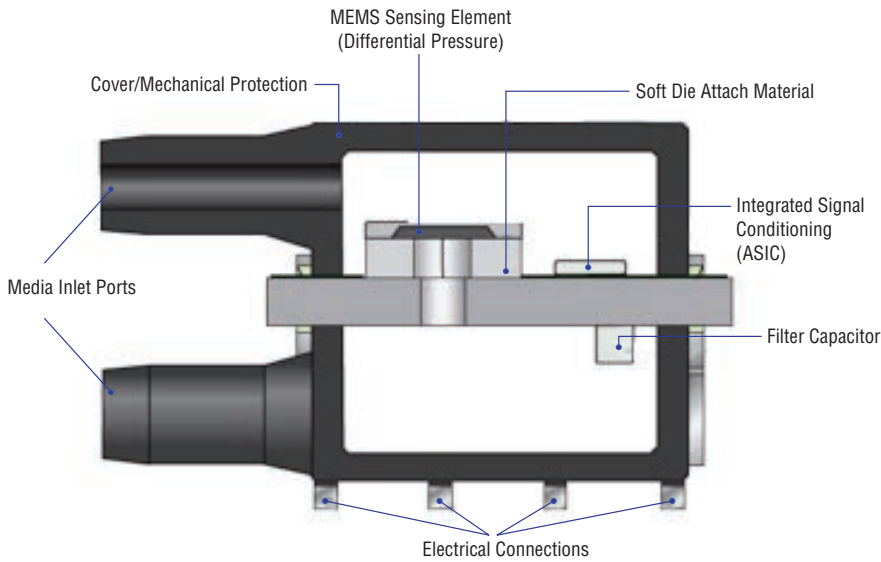
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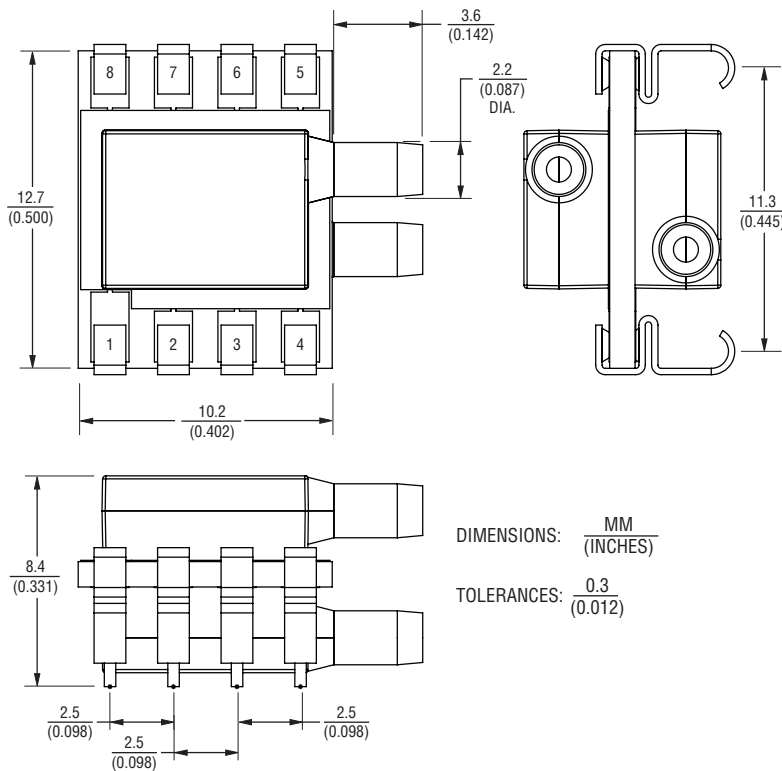
# BPS125 Series - 12 mm Digital Low Pressure Sensor

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## Cross Section



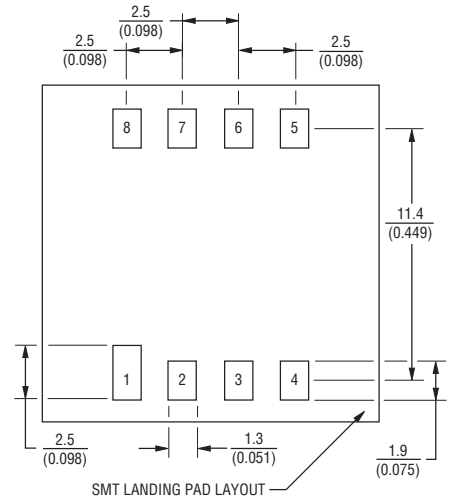
## Product Dimensions



## Terminal Assignment

DEVICE PINOUT	
P1	V <sub>s</sub>
P2	N/C
P3	N/C
P4	VSS - Ground
P5	N/C
P6	N/C
P7	SDA - I <sup>2</sup> C Data
P8	SCL - I <sup>2</sup> C Clock

## Recommended PCB Layout



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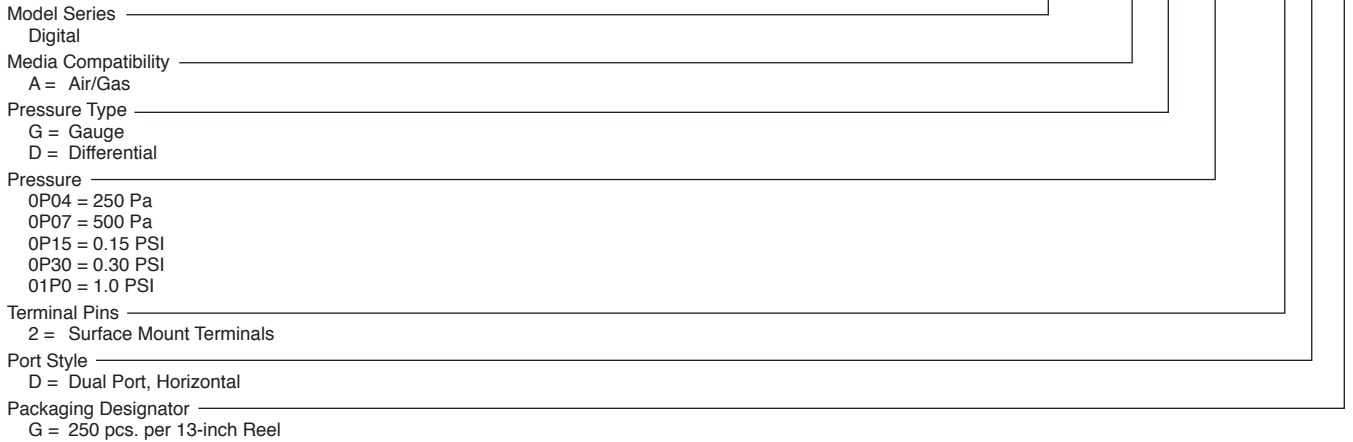
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# BPS125 Series - 12 mm Digital Low Pressure Sensor

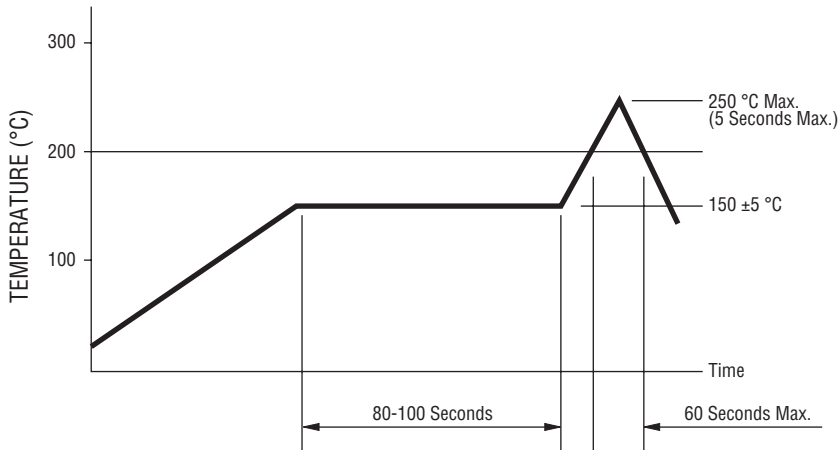
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## How To Order

**BPS125 - A D 0P07 - 2 D G**



## Solder Profile



Processing Method: Reflow soldering with infrared heat or forced air convection (only once).

### Notes:

1. No clean solder paste is recommended.
2. Aqueous wash is not recommended.
3. Use of water soluble soldering flux should be avoided due to possible corrosion.
4. Multiple passes through the soldering process is not recommended.
5. Other SMD processes and profiles should be verified by the customer.

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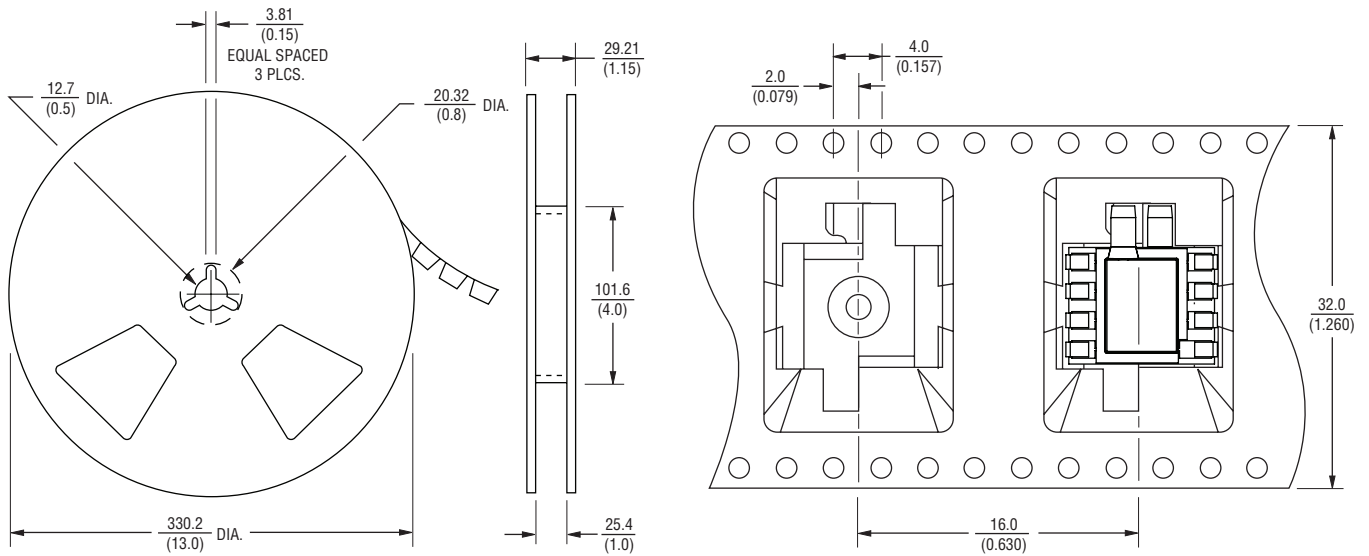
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# BPS125 Series - 12 mm Digital Low Pressure Sensor

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## Packaging Specification

250 pieces per 13-inch reel.  
Meets specifications of EIA-481-1 or EIA-481-2.



DIMENSIONS:  $\frac{\text{MM}}{\text{(INCHES)}}$

TOLERANCES:  $\frac{0.25}{(0.010)}$

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## Features

- Compensated output
- Direct-media monitoring
- Gauge and absolute types
- Isolated onboard electronics
- Gold-plated Kovar™ port option
- RoHS compliant\*

## Applications

- Industrial:
- Refrigerant systems
  - Water level & pressure monitoring
- \*\* Medical Devices (low/medium risk):
- Diagnostic/analysis equipment
- \*\*\* Heavy Equipment:
- Oil & fuel systems
  - Exhaust gas pressure sensing

# BPS130 Series - 10 mm Analog High Pressure Sensor

### Electrical Characteristics

Supply Voltage ( $V_S$ )	4.5 V minimum, 5 V typical, 5.5 V maximum
Supply Current	10 mA
Output Current	2.5 mA
Short Circuit Current	±25 mA
Reverse Polarity Protection	-33 V
Overshoot Protection	33 V

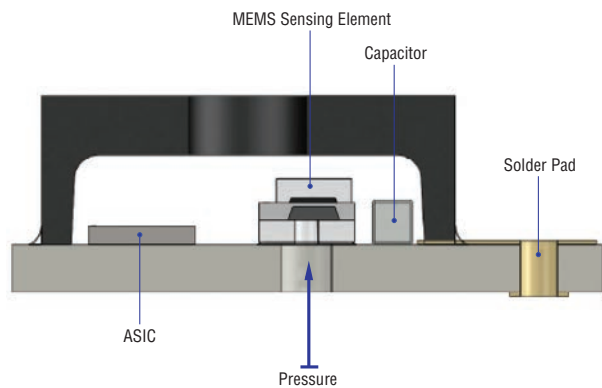
### Performance Characteristics

Operating Temperature	-40 °C to +150 °C (-40 °F to +302 °F)
Storage Temperature	-55 °C to +150 °C (-67 °C to +302 °F)
Output Range $V_{out}$ ****	10 % to 90 % $V_S$
Output Clamping Limit $V_{out}$ ****	5% to 95% $V_S$
Resolution (>12 bit DAC)	0.02 % FS
Accuracy @ 25 °C	±0.25 % FS
Total Error Band @ -40 °C to +150 °C (-40 °F to +302 °F)	±2.5 % FS
Static Proof Pressure	2X full scale PSIA
Burst Pressure	3X full scale PSIA
Lifetime Drift	±0.5 % FS

### Product Characteristics

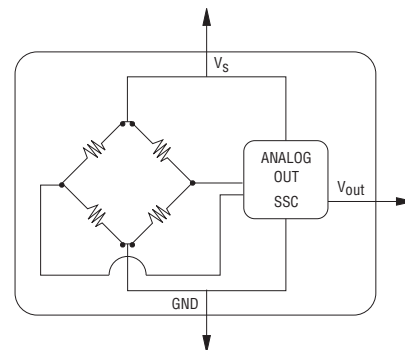
Media Compatibility	Harsh media (air, liquid and gas)
Moisture Sensitivity Level	1
ESD Classification (HBM)	>4 kV
Marking	Partial model number, media compatibility, pressure type, pressure rating, lot code
Standard Packaging	250 pcs./13-inch reel or 100 pcs./tray
Weight	1.080 grams (0.038 oz)

### Cross Section



“Wetted” Materials: Silicon, glass, Au/Sn, ceramic  
(Ported version also contains Au and solder)  
Any material in contact with the media is considered a “wetted” material.

### Basic Circuit Schematic



Note: Power supply decoupling and output filtering included.  
Consult factory for custom options such as supply voltage, temperature calibration range, output range accuracy specification, and update rate.

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\*\*\* Custom engineered solutions. Check with factory for availability.  
\*\*\*\* 5 V input voltage.

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# BPS130 Series - 10 mm Analog High Pressure Sensor

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## Transfer Function Formula

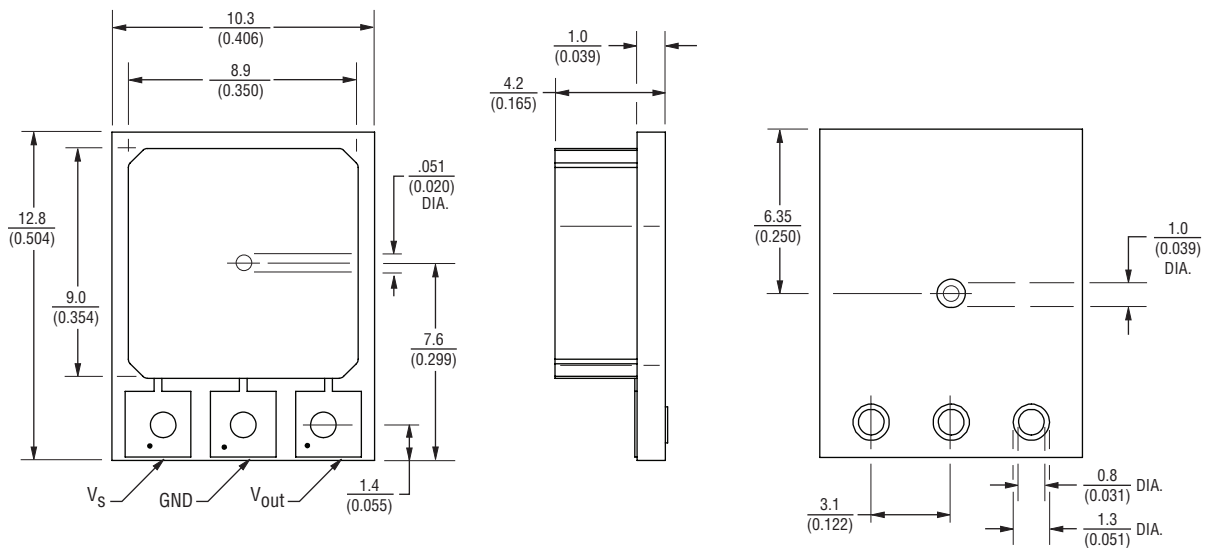
$$P_{\text{psi}} = (P_{\text{max}} - P_{\text{min}}) \cdot \left( \frac{V_{\text{out}} - V_{\text{minComp}}}{V_{\text{maxComp}} - V_{\text{minComp}}} \right) + P_{\text{min}}$$

### Where

- $P_{\text{psi}}$  = Measured Pressure in PSI
- $P_{\text{max}}$  = Maximum Pressure
- $P_{\text{min}}$  = Minimum Pressure
- $V_{\text{minComp}}$  = Minimum Voltage (Usually 0.5 V)
- $V_{\text{maxComp}}$  = Maximum Voltage (Usually 4.5 V)
- $V_{\text{out}}$  = Output Voltage

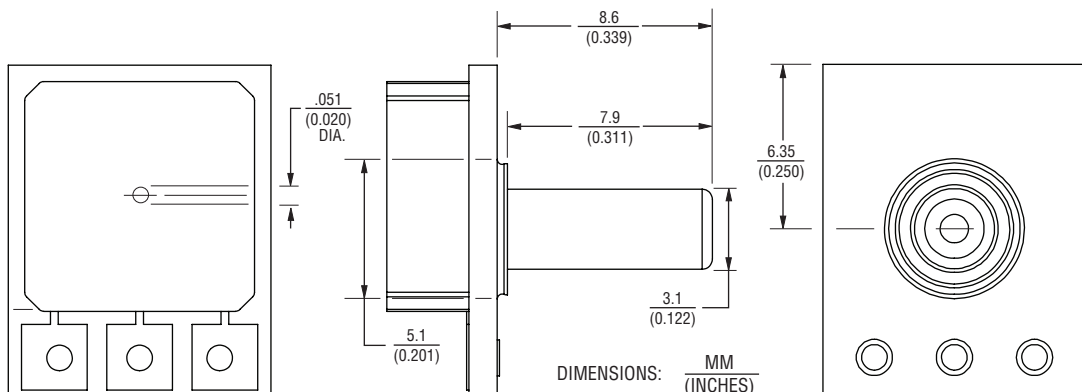
## Product Dimensions

### Manifold Mount



(Electrical pin-out for all configurations)

### Single Port



DIMENSIONS:  $\frac{\text{MM}}{\text{(INCHES)}}$

TOLERANCES:  $\frac{0.3}{(0.012)}$

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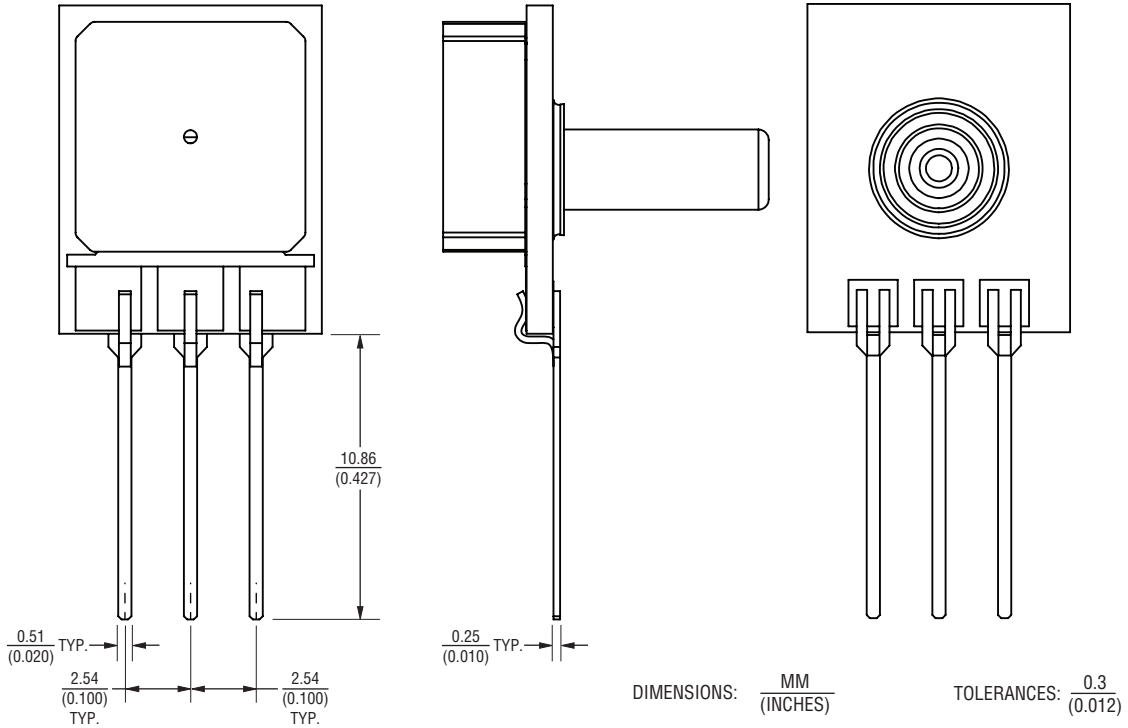
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# BPS130 Series - 10 mm Analog High Pressure Sensor

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## Product Dimensions (Continued)

### Single Port and Pins



## How To Order

**BPS130 - H G 015P - 1 M G**

Model Series \_\_\_\_\_

  Analog \_\_\_\_\_

Media Compatibility \_\_\_\_\_

  H = Certain Harsh Media \_\_\_\_\_

Pressure Type \_\_\_\_\_

  A = Absolute \_\_\_\_\_

  G = Gauge \_\_\_\_\_

Pressure (psi) \_\_\_\_\_

  015P = 15           300P = 300

  030P = 30           500P = 500

  100P = 100 \_\_\_\_\_

Terminal Pins \_\_\_\_\_

  1 = No Terminal Pins \_\_\_\_\_

  3 = Vertical Terminal Pins (Tray Packaging only) \_\_\_\_\_

Port Style \_\_\_\_\_

  M = Manifold Mount \_\_\_\_\_

  S = Single Port \_\_\_\_\_

Packaging Designator \_\_\_\_\_

  G = 250 pcs. per 13-inch Reel \_\_\_\_\_

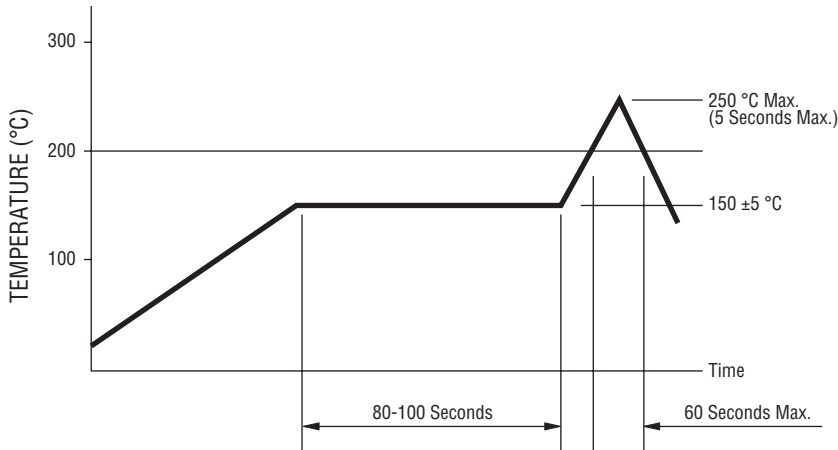
  Blank = 100 pcs. per Tray \_\_\_\_\_

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# BPS130 Series - 10 mm Analog High Pressure Sensor

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## Solder Profile



### Notes:

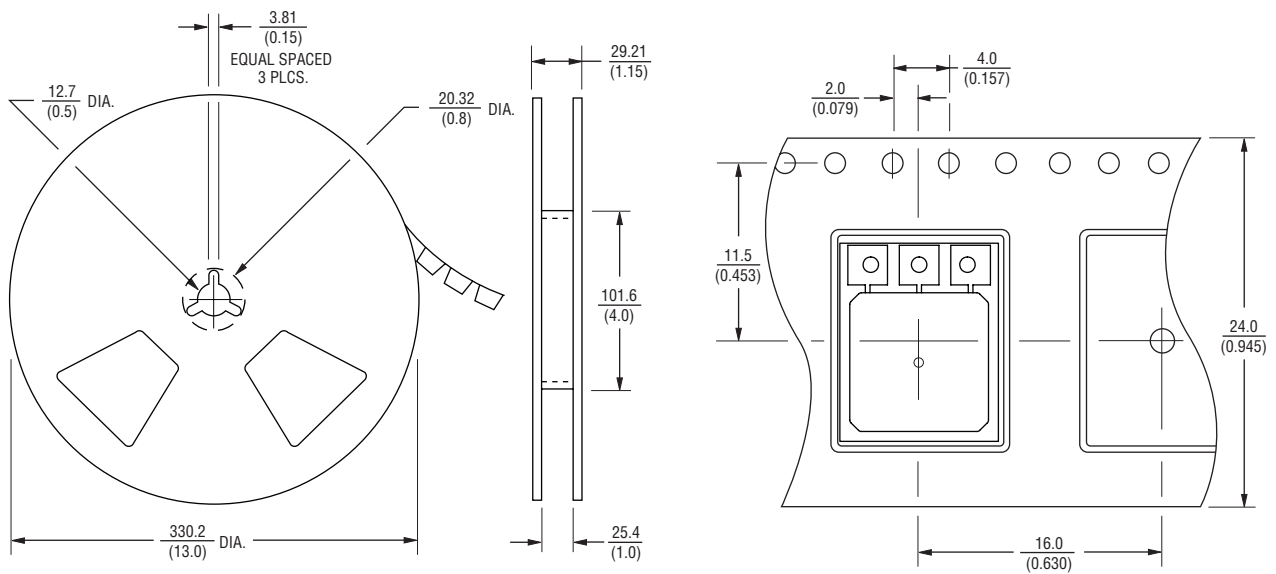
1. No clean solder paste is recommended.
2. Aqueous wash is not recommended.
3. Use of water soluble soldering flux should be avoided due to possible corrosion.
4. Multiple passes through the soldering process is not recommended.
5. Other SMD processes and profiles should be verified by the customer.

Processing Method: Reflow soldering with infrared heat or forced air convection (only once).

## Packaging Specification

250 pieces per 13-inch reel.

Meets specifications of EIA-481-1 or EIA-481-2.



DIMENSIONS:  $\frac{\text{MM}}{\text{(INCHES)}}$

TOLERANCES:  $\frac{0.25}{(0.010)}$

REV. 12/19

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## Features

- Compensated output
- Certain harsh media monitoring
- Absolute and gauge types
- Isolated onboard electronics
- Ceramic port
- RoHS compliant\*

## Applications

Industrial:

- Refrigerant systems
- Water level & pressure monitoring
- \*\* Medical Devices (low/medium risk):
- Diagnostic/analysis equipment
- \*\*\* Heavy Equipment:
- Oil & fuel systems
- Exhaust gas pressure sensing

## BPS140 Series - 10 mm Analog High Pressure Sensor for Certain Harsh Media

### Electrical Characteristics

Supply Voltage ( $V_S$ )	4.5 V minimum, 5 V typical, 5.5 V maximum
Supply Current	10 mA
Output Current	2.5 mA
Short Circuit Current	±25 mA
Reverse Polarity Protection	-33 V
Overshoot Protection	33 V

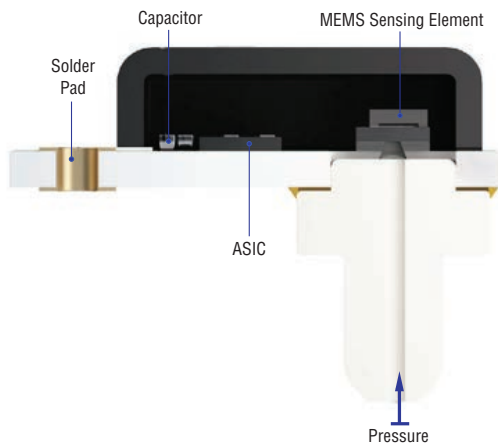
### Performance Characteristics

Operating Temperature	-40 °C to +150 °C (-40 °F to +302 °F)
Storage Temperature	-55 °C to +150 °C (-67 °C to +302 °F)
Output Range $V_{out}$ ****	10 % to 90 % $V_S$
Output Clamping Limit $V_{out}$ ****	5% to 95% $V_S$
Resolution (>12 bit DAC)	0.02 % FS
Accuracy @ 25 °C	±0.25 % FS
Total Error Band @ -40 °C to +150 °C (-40 °F to +302 °F)	±2.5 % FS
Static Proof Pressure	2X full scale PSIA
Burst Pressure	3X full scale PSIA
Lifetime Drift	±0.5 % FS

### Product Characteristics

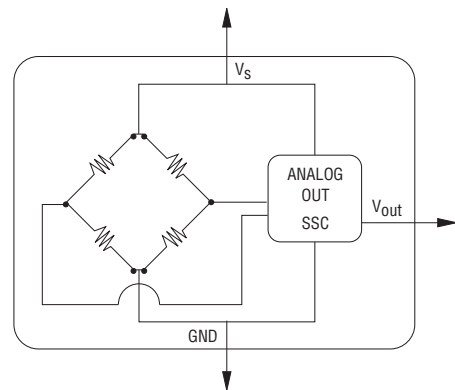
Media Compatibility	Harsh media (air, liquid and gas)
Moisture Sensitivity Level	1
ESD Classification (HBM)	>4 kV
Marking	Partial model number, media compatibility, pressure type, pressure rating, lot code
Standard Packaging	250 pcs./13-inch reel
Weight	1.042 grams (0.037 oz)

### Cross Section



“Wetted” Materials: Silicon, glass, ceramic  
Any material in contact with the media is considered a “wetted” material.

### Basic Circuit Schematic



Note: Power supply decoupling and output filtering included.

Consult factory for custom options such as supply voltage, temperature calibration range, and output range accuracy specification.

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\* RoHS3 Directive 2015/863 Amendments of Annex II on March 31, 2015

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\*\*\* Custom engineered solutions. Check with factory for availability. \*\*\*\* 5 V input voltage.

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## BPS140 Series - 10 mm Analog High Pressure Sensor for Certain Harsh Media

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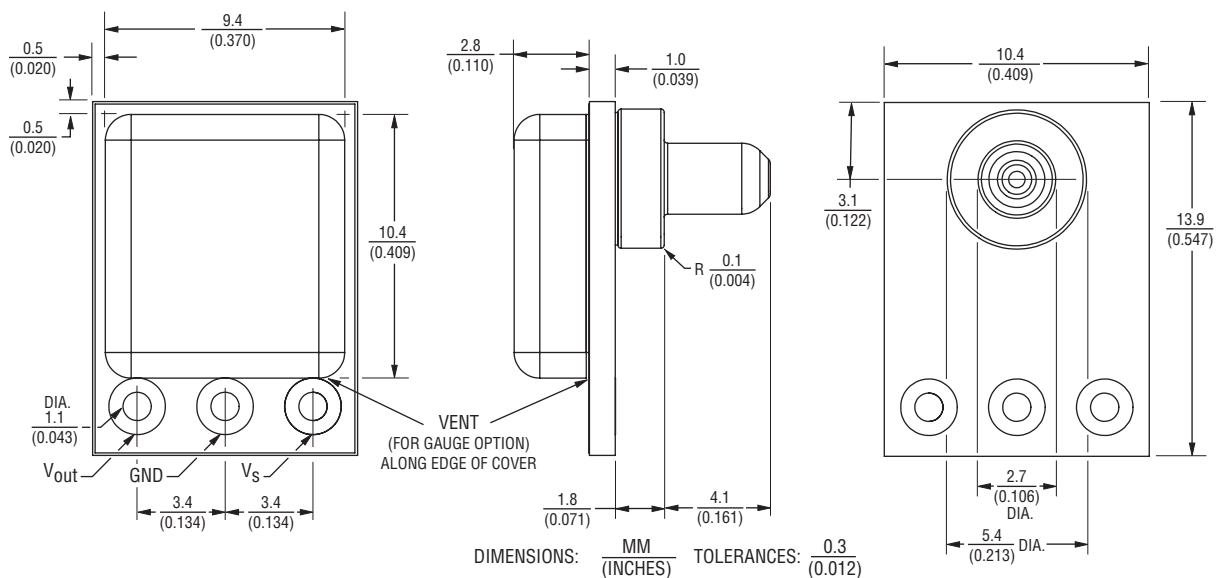
### Transfer Function Formula

$$P_{\text{psi}} = (P_{\text{max}} - P_{\text{min}}) \cdot \left( \frac{V_{\text{out}} - V_{\text{minComp}}}{V_{\text{maxComp}} - V_{\text{minComp}}} \right) + P_{\text{min}}$$

#### Where

- $P_{\text{psi}}$  = Measured Pressure in PSI
- $P_{\text{max}}$  = Maximum Pressure
- $P_{\text{min}}$  = Minimum Pressure
- $V_{\text{minComp}}$  = Minimum Voltage (Usually 0.5 V)
- $V_{\text{maxComp}}$  = Maximum Voltage (Usually 4.5 V)
- $V_{\text{out}}$  = Output Voltage

### Product Dimensions



### How To Order

**BPS140 - H A 015P - 1 S G**

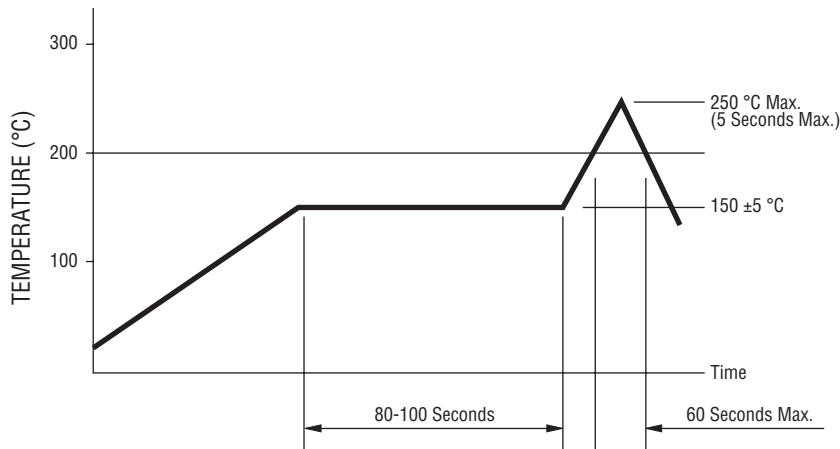
Model Series	_____	BPS140
Analog	_____	
Media Compatibility	_____	H
H = Certain Harsh Media		
Pressure Type	_____	A
A = Absolute		
G = Gauge		
Pressure (psi)	_____	015P
015P = 15	100P = 100	
030P = 30	300P = 300	
Terminal Pins	_____	1
1 = No Terminal Pins		
Port Style	_____	S
S = Single Port		
Packaging Designator	_____	G
G = 250 pcs. per 13-inch Reel		

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**Solder Profile**



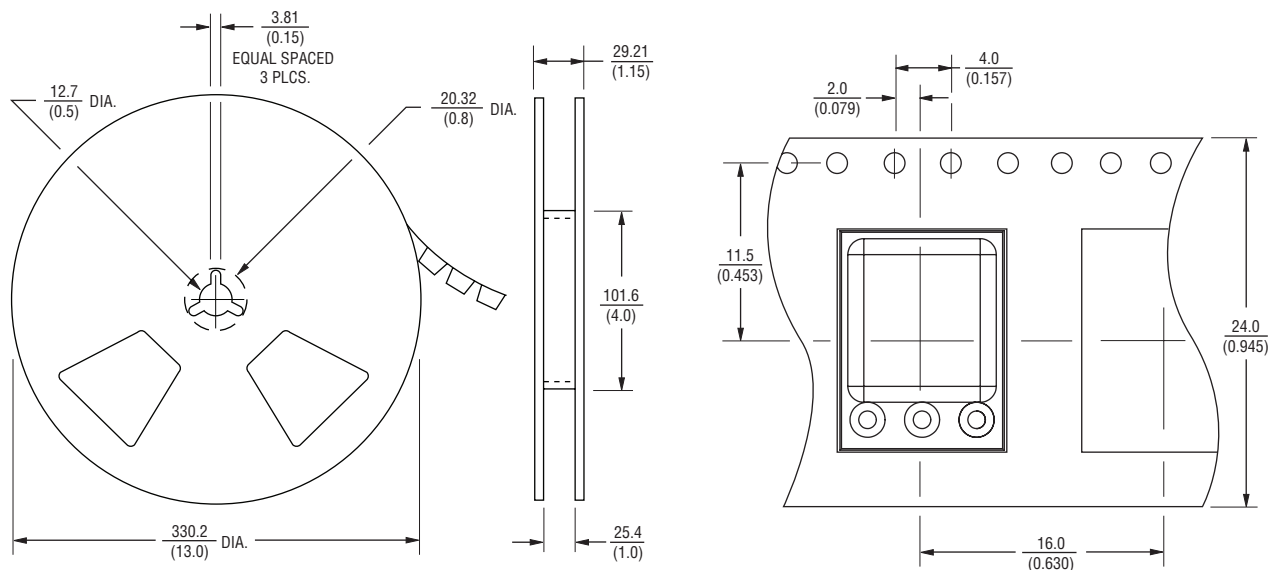
**Notes:**

1. No clean solder paste is recommended.
2. Aqueous wash is not recommended.
3. Use of water soluble soldering flux should be avoided due to possible corrosion.
4. Multiple passes through the soldering process is not recommended.
5. Other SMD processes and profiles should be verified by the customer.

Processing Method: Reflow soldering with infrared heat or forced air convection (only once).

**Packaging Specification**

250 pieces per 13-inch reel.  
Meets specifications of EIA-481-1 or EIA-481-2.



DIMENSIONS:  $\frac{\text{MM}}{\text{(INCHES)}}$

TOLERANCES:  $\frac{0.25}{(0.010)}$

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## Features

- Low voltage operation
- Low current consumption
- Miniature SMD package size
- I<sup>2</sup>C communication protocol
- Reliable capacitive technology
- Relative humidity accuracy of ±2 % (Typical)

## Applications

Industrial:

- HVAC systems
- Process monitoring
- Packaging automation

\*\*Medical Devices (low/medium risk):

- Diagnostic equipment
- Analysis equipment

## BPS230 Series - 2 mm Humidity Sensor

### Absolute Maximum Ratings

Supply Voltage ( $V_{CC}$ )	-0.3 to 7.0 V
Input Voltage ( $V_I$ )	
CE	-0.3 to $V_{CC} + 0.3$ V
SCL/SDA	-0.3 to 7.0 V
Output Voltage ( $V_O$ )	-0.3 to $V_{CC} + 0.3$ V
Hi-level Output Current (IOH)	
1 Terminal	-5 mA
All Terminals Total	-20 mA
Low-level Output Current (IOL)	
1 Terminal	5 mA
All Terminals Total	20 mA
Operating Temperature ( $T_a$ )	-40°C to +105°C (-40°F to +221°F)
Storage Temperature ( $T_{stg}$ )	-50°C to +125°C (-58°F to +257°F)

### Recommended Operating Conditions

Power Supply Voltage ( $V_{CC}$ )	1.62 to 5.5 VDC
Capacitance between $V_{CC}$ and $V_{SS}$ ( $C_P$ )	0.1 $\mu$ F typical
Pull Up Resistor Value on SDA <sup>1</sup> (R1)	5 k $\Omega$ typical
Pull Up Resistor Value on SCL <sup>1</sup> (R2)	5 k $\Omega$ typical

<sup>1</sup> Select the resistance value to meet AC characteristics.

### Electrical Characteristics

Humidity Detection	
Measurement Range	0 to 100 % RH
Resolution (10-bit)	0.1 % RH typical
Humidity Accuracy - Typical (see Humidity Sensor Accuracy Graph for Maximum Rating)	
@ 25 °C (20 to 80 % RH)	±2 % RH
@ 5 °C to 45 °C (0 to 100 % RH)	±4 % RH
Hysteresis @ 5 °C to 45 °C (0 to 100 % RH)	
Response Time	± 1 % RH typical
Reach ( $\tau$ 63 % @ 25 °C, wind velocity @ 1.0 m/s)	8 seconds

Unless otherwise specified:  $V_{CC} = 1.62$  to 5.5 V,  $V_{SS} = 0$  V,  $T_a = -20$  °C to 100 °C

Temperature Detection	
Measurement Range	-30 °C to +100 °C (-22 °F to +212 °F)
Resolution (11 bit)	
-10 °C to +70 °C	0.1 °C (0.18 °F)
All other temperatures	0.4 °C (0.72 °F)
Temperature Accuracy	
@ 5 °C to 60 °C	± 0.4 °C (±0.72 °F)
@ -20 °C to 85 °C	± 1.0 °C (±1.8 °F)
Reproducibility @ -30 °C to 100 °C	± 0.1 °C (±0.18 °F)
Response Time	
Reach ( $\tau$ 63 % (dependent on surrounding heat conduction NOTE 1))	30 seconds

Unless otherwise specified:  $V_{CC} = 1.62$  to 5.5 V,  $V_{SS} = 0$  V,  $T_a = -30$  °C to 100 °C

NOTE 1 Extended exposure to >90 % RH causes a shift of up to 3 % RH which is reversible after a period of 14 days.

### Current Consumption

Sleep Current (CE=0, Sleep Mode)	10 nA typical, 400 nA maximum
Average Operating Current	13 $\mu$ A typical, 35 $\mu$ A maximum

Unless otherwise specified:  $V_{CC} = 1.62$  to 5.5 V,  $V_{SS} = 0$  V,  $T_a = 0$  °C to 60 °C

\* RoHS3 Directive 2015/863 Amendments of Annex II on March 31, 2015

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# BPS230 Series - 2 mm Humidity Sensor



## Input/Output Terminal Characteristics

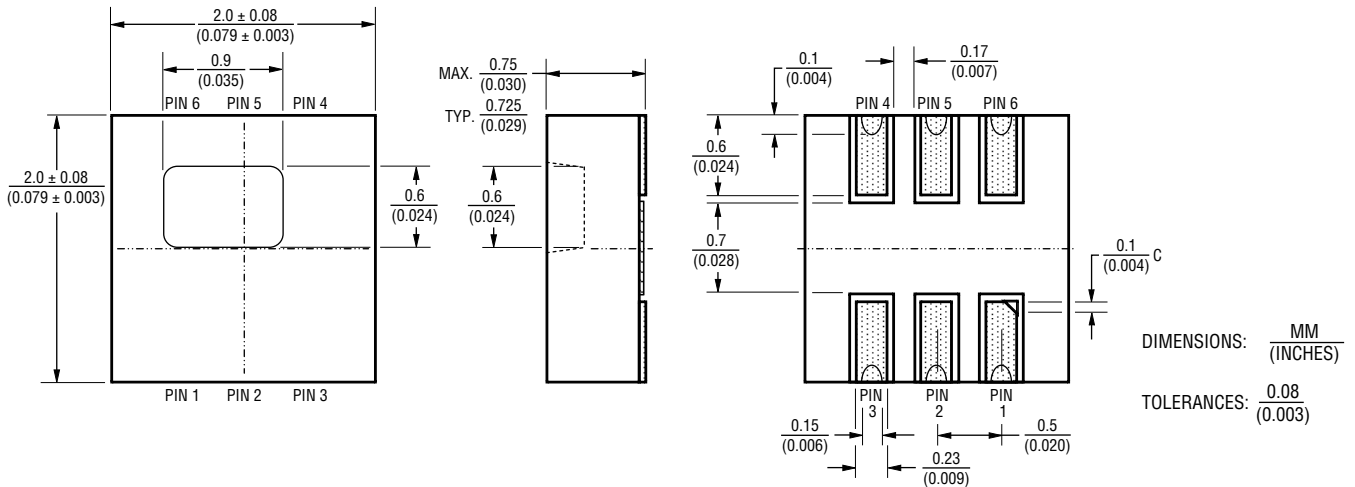
High Level Input Voltage 1 (VIH1) [Target Terminal: SCL, SDA]	0.7 V <sub>CC</sub> minimum, V <sub>CC</sub> maximum
High Level Input Voltage 2 (VIH2) [Target Terminal: CE]	0.8 V <sub>CC</sub> minimum, V <sub>CC</sub> maximum
Low Level Input Voltage 1 (VIL1) [Target Terminal: SCL, SDA]	V <sub>SS</sub> minimum, 0.3 V <sub>CC</sub> maximum
Low Level Input Voltage 2 (VIL2) [Target Terminal: CE]	V <sub>SS</sub> minimum, 0.2 V <sub>CC</sub> maximum
Low Level Output Current (IOL) [VOL = 0.1 V <sub>CC</sub> , Target Terminal: SCL, SDA]	0.5 mA minimum
Terminal Leak Current 1 (IL1) [Terminal voltage = V <sub>CC</sub> , Target Terminal: SCL, SDA]	± 1 μA
Terminal Leak Current 2 (IL2) [Terminal voltage = 0 V, Target Terminal: SCL, SDA, CE]	± 1 μA
Input Pull-Down Resistance (RPD) [Terminal voltage = V <sub>CC</sub> , Target Terminal: CE]	60 kΩ minimum, 150 kΩ typical, 450 kΩ maximum

Unless otherwise specified: V<sub>CC</sub> = 1.62 to 5.5 V, V<sub>SS</sub> = 0 V, T<sub>a</sub> = -30 °C to 100 °C

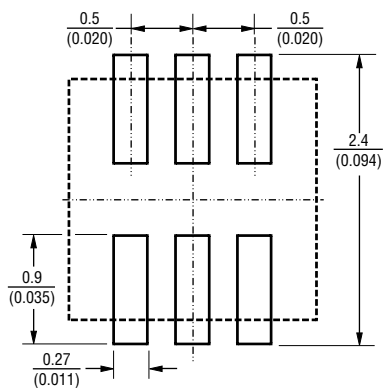
## Product Characteristics

Moisture Sensitivity Level	1
ESD Classification (HBM)	1 kV
Marking	<b>B</b> , Date Code
Standard Packaging	3,000 pcs. per 13-inch reel
Weight	0.059 grams (0.002 oz)

## Product Dimensions



## Recommended PCB Layout



## Terminal Assignment

No.	Terminal Name	Function
1	CE	Chip enable terminal
2	V <sub>SS</sub>	Power supply terminal (-)
3	V <sub>CC</sub>	Power supply terminal (+)
4	NC	No connection
5	SDA	I <sup>2</sup> C serial data
6	SCL	I <sup>2</sup> C serial clock

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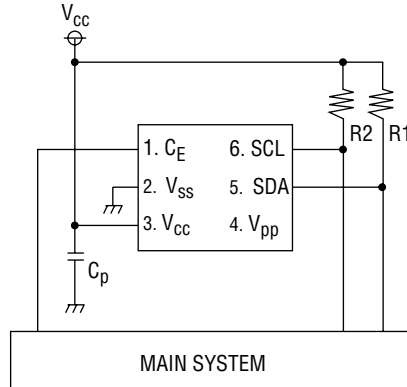
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# BPS230 Series - 2 mm Humidity Sensor

**BOURNS®**

## Basic Circuit Schematic



$C_p$  ..... 0.1  $\mu$ F  
 $R_1$  ..... 5k  $\Omega$   
 $R_2$  ..... 5k  $\Omega$

NOTE:  $R_1$  and  $R_2$  are reference values. Resistor values should be selected to meet the AC characteristics.

## Operation Mode

Operation Mode	Terminal Setup	Operation State of Each Functional Block						
	CE	$V_{pp}$	Power Supply	Oscillation	Temp. Detection	Capacitance Detection	OTP Memory	I <sup>2</sup> C-Bus
Sleep *1	0	NC	Stop	Stop	Stop	Stop	Stop	Stop
Standby	1	NC	Operation	Operation	Stop	Stop	Read-out Possible	Operation

\*1 In case of power control mode, there is no sleep operation.  
 I<sup>2</sup>C slave address (SADR) is defined as "111 1111" (7Fh).

## Control Register Map

Address	Bit	Bit Name	Function	Value	Read-Out	Write-In	R/W	Init.
00h	D7-1	-	Reserved	-			R	0
	D0	RESET	Reset	0	Normal Operation	None	R/W	0
1				-	Reset Action			
01h	D7-6	MANMODE	Manual Detection Mode	00	Normal Operation Mode		R/W	0
				D5-3	HAVE[2:0]	Humidity Detection Value Avg. Mode		
	001	2 Times Average Mode						
	01x	4 Times Average Mode						
	D2	TAVE	Temperature Detection Value Avg. Mode	0	8 Times Average Mode	R/W		
1				16 Times Average Mode				

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**Control Register Map (Continued)**

Address	Bit	Bit Name	Function	Value	Read-Out	Write-In	R/W	Init.
01h	D1	-	Reserved	-			R	0
	D0	MAN	Manual Detection Mode	0	Standby State	Detection Operation Stop	R/W	0
				1	Under Detection Operation	Detection Operation Start		
03h	D7-1	-	Reserved	-			R	0
	D0	ERR	Manual Detection Error Flag	0	No Error	Nothing is Done	R/W	0
1				Error Occurred	Error Flag Reset			
04h	D7-0	HC[7:0]	Humidity Detection Result <i>(After Correction Operation)</i>	000h-3FFh			R	X
05h	D7-2	-	Reserved	-			R	0
	D1-0	HC[9:8]	Humidity Detection Result <i>(After Correction Operation)</i>				R	X
06h	D7-0	TC[7:0]	Temperature Detection Result <i>(After Correction Operation)</i>	000h-7FFh			R	X
07h	D7-3	-	Reserved	-			R	0
	D2-0	TC[10:8]	Temperature Detection Result <i>(After Correction Operation)</i>				R	X
0Ah	D7-0	K[7:0]	Capacity Detection Result <i>(Before Correction Operation)</i>	000h-FFFFh			R	0

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**Control Register Map (Continued)**

Address	Bit	Bit Name	Function	Value	Read-Out	Write-In	R/W	Init.
0Bh	D7-0	K[15:8]	Capacity Detection Result <i>(Before Correction Operation)</i>				R	0
2Ch	D7-5	-	Reserved	-	-		R	0
	D4	SCR_ON_R	Standard Capacity Connection Control	0	Outside Capacity Cutting	R/W	0	
				1	Outside Capacity Connection			
D3-0	SCI_ON_R[3:0]	Internal Capacity Connection Control	0h~Fh x 0.6 pF Example: At the time of 8 hours, access to internal capacity of 4.8 pF		R/W	X		
03h	D7-1	-	Reserved	-			R	0
	D0	ERR	Manual Detection Error Flag	0	No Error	Nothing is Done	R/W	0
1				Error Occurred	Error Flag Reset			

**Transfer Function Formula**

**Humidity**

$$RH = \frac{100}{2^{10}} \times RH_{IC} \quad (0 \sim 100 \% RH)$$

RH<sub>IC</sub> : IC Humidity Output Data (10 bit)

Refer to Register Map:

RH<sub>IC</sub> = Data of the addresses 04H and 05H (000h ~ 3FFh)  
It changes into a decimal and is operation.

**Temperature**

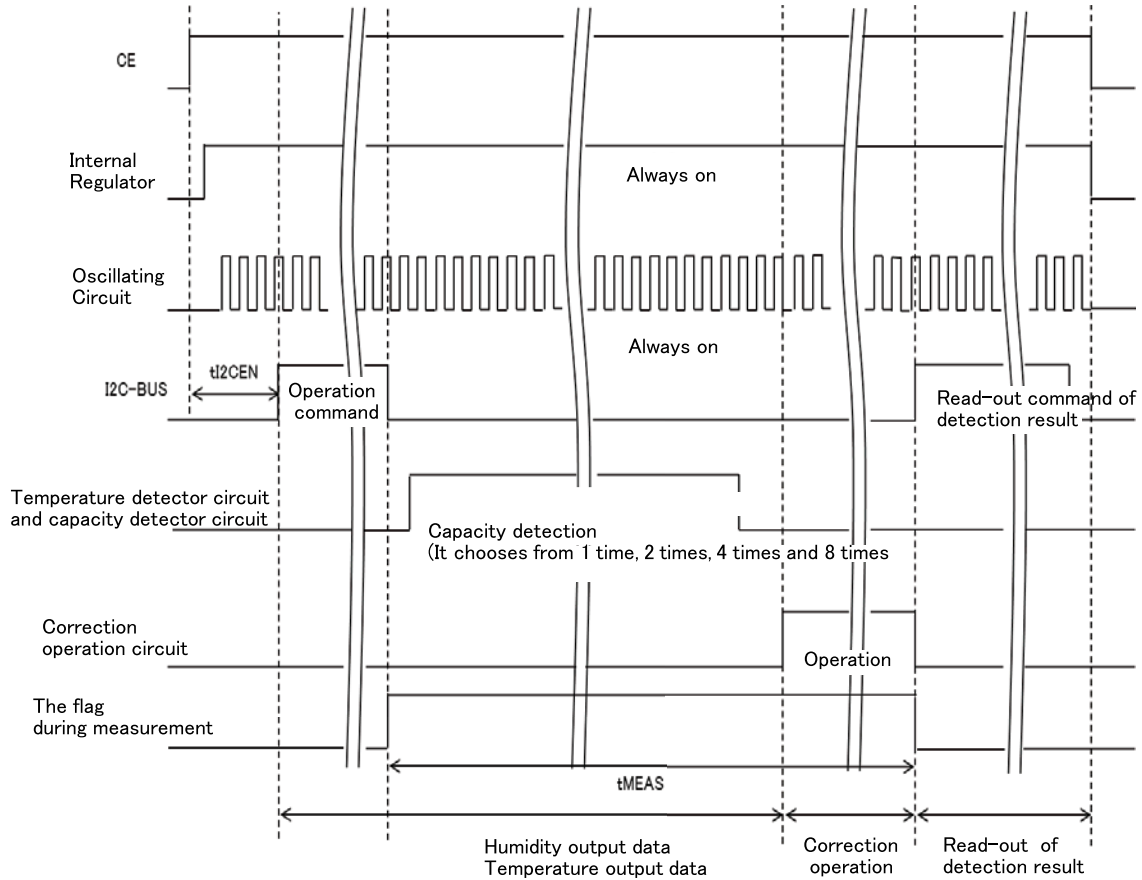
$$T = [T_{IC} - (2^{10} - \frac{25}{0.1})] \times 0.1 \quad (-30 \sim 100 \text{ } ^\circ\text{C})$$

T<sub>IC</sub> : IC Temperature Output Data (11 bit)

Refer to Register Map:

T<sub>IC</sub> = Data of the addresses 06H and 07H (000h ~ 7FFh)  
It changes into a decimal and is operation.

## Capacitance/Temperature Detection Sequence



## How To Order

**BPS230 - D 3P0 - S 10 E**

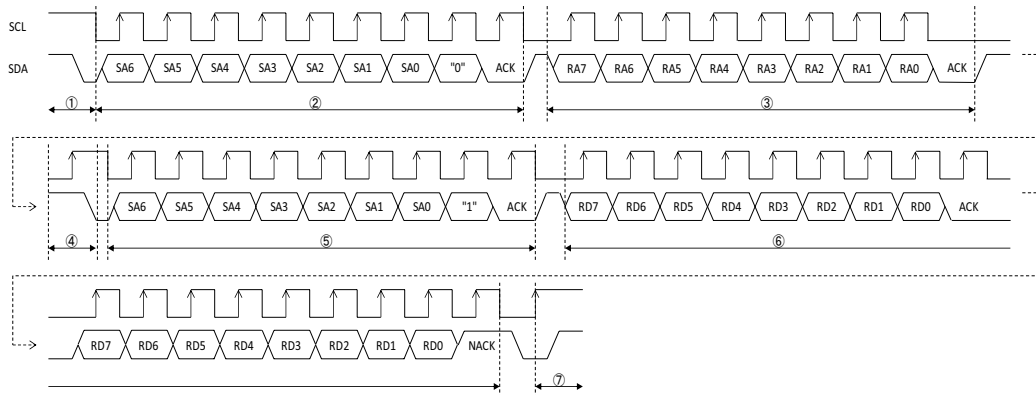
Model Series	Humidity-Temperature Sensor
Output Type	D = Digital
Accuracy (% RH)	3P0 = $\pm 3.0$
Moisture Sensitivity	S = Standard
Resolution	10 = 10-bit
Packaging Designator	E = 3000 pcs. per 7-inch Reel

Specifications are subject to change without notice.  
 Users should verify actual device performance in their specific applications.  
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## Output Type Waveform and Data Read/Write Procedure

### I<sup>2</sup>C-BUS Data Read-out Procedure

- ① I<sup>2</sup>C master device releases START condition.
- ② I<sup>2</sup>C master device transmits slave address and WRITE mode selection.
- ③ I<sup>2</sup>C master device transmits register address of this IC.
- ④ I<sup>2</sup>C master device releases repeated START condition. (Release method is same as START condition.)
- ⑤ I<sup>2</sup>C master device again transmits slave address and READ mode selection. (Read mode can be selected by transmitting "1" in 8th bit.)
- ⑥ I<sup>2</sup>C master device reads-out data from register address designated at ③.  
It is possible to read-out data while register address increments one, by reading-out multiple data continuously. However, during continuous read-out, please return ACK to this IC as a reply of master.
- ⑦ After the completion of all read-out, I<sup>2</sup>C master device releases STOP condition.



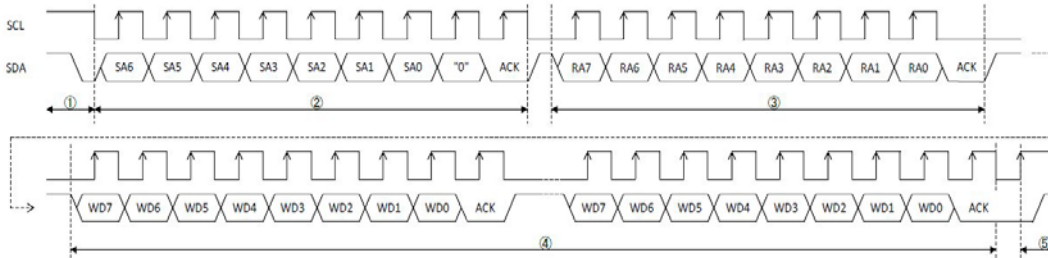
~ Continued ~

## Output Type Waveform and Data Read/Write Procedure (Continued)

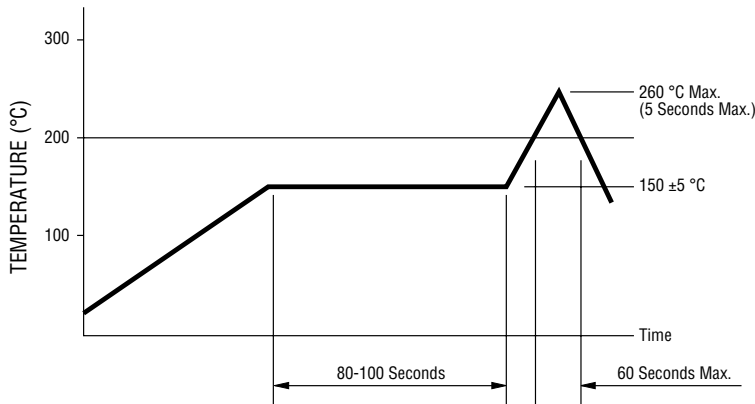
### I<sup>2</sup>C-BUS Data Write-in Procedure

- ① I<sup>2</sup>C master device releases START condition. (Start condition can be released by changing SDA from “H” to “L” while SCL is in “H” state.)
- ② I<sup>2</sup>C master device transmits slave address and WRITE mode selection. (Write mode can be selected by transmitting “0” in 8th bit while 1~7th bits are slave address.)
- ③ I<sup>2</sup>C master device transmits register address of this IC.
- ④ I<sup>2</sup>C master device transmits write-in data.
- ⑤ It is possible to write-in data while register address increments one, by transmitting multiple write-in data continuously.

After the completion of transmitting all write-in data, I<sup>2</sup>C master device releases stop condition. (Stop condition can be released by changing SDA from “L” to “H” while SCL is in “H” state.)



## Solder Profile



Processing Method: Reflow soldering with infrared heat or forced air convection (only once).

### Notes:

1. No clean solder paste is recommended.
2. Aqueous wash is not recommended.
3. Use of water soluble soldering flux should be avoided due to possible corrosion.
4. Multiple passes through the soldering process is not recommended.
5. Other SMD processes and profiles should be verified by the customer.

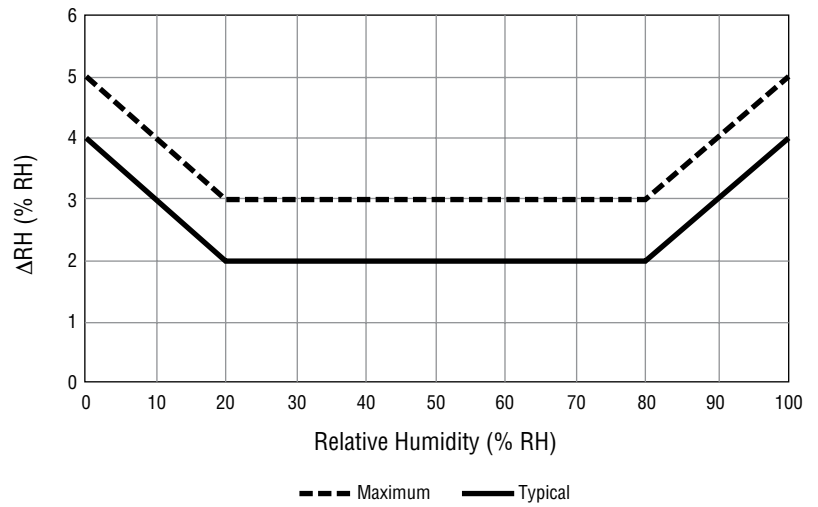
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**Humidity Sensor Accuracy**

Relative Humidity (% RH)	Maximum	Typical
0	5	4
10	4	3
20	3	2
30	3	2
40	3	2
50	3	2
60	3	2
70	3	2
80	3	2
90	4	3
100	5	4



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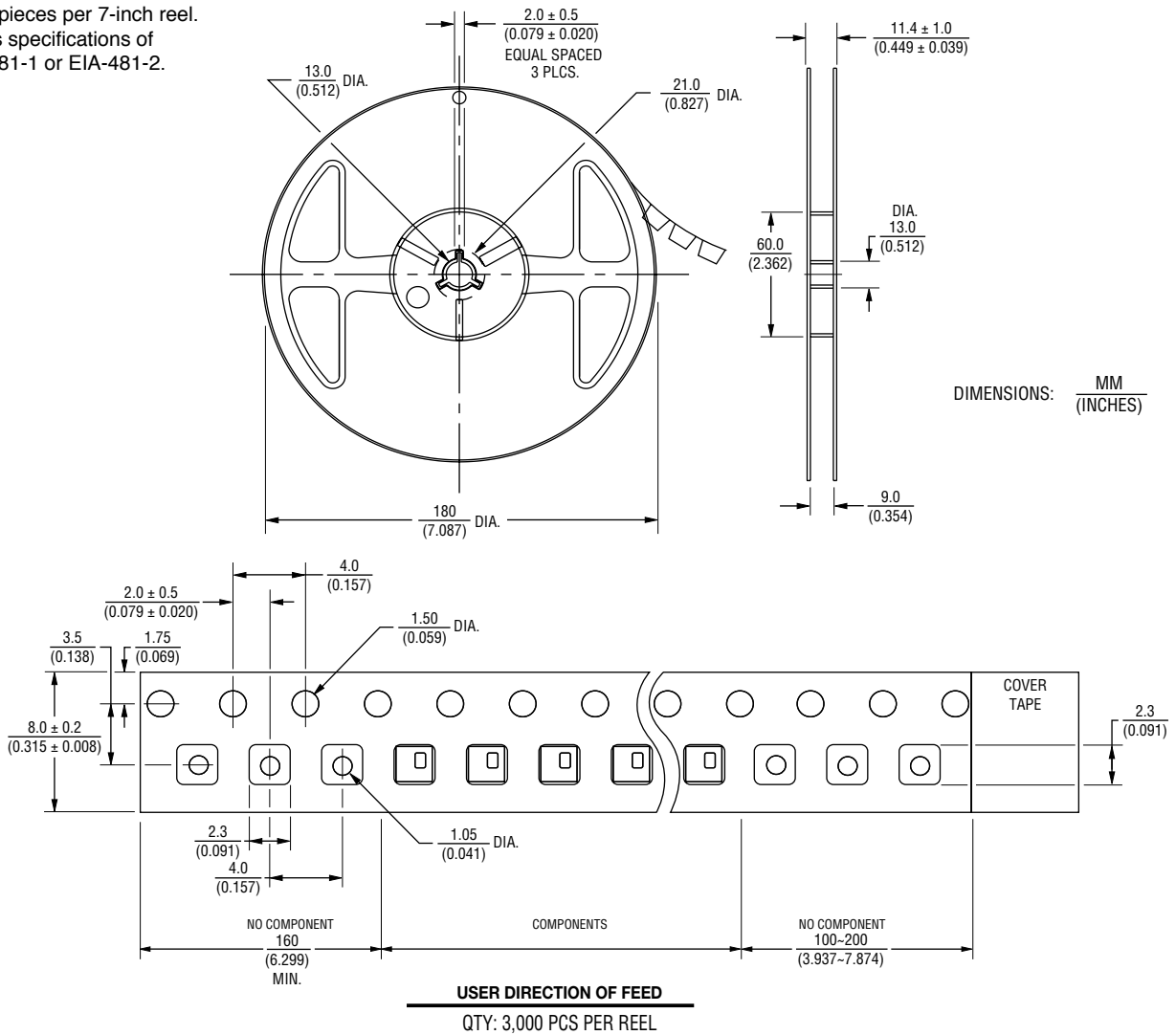
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# BPS230 Series - 2 mm Humidity Sensor

**BOURNS®**

## Packaging Specification

3000 pieces per 7-inch reel.  
Meets specifications of  
EIA-481-1 or EIA-481-2.



**BOURNS®**

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