Silicon Pressure Sensor Signal Conditioned, Temperature Compensated and Calibrated

The MCP3V5004 series piezoresistive transducers are designe dfor a wide range of applications, but particularly those employing a microcontroller or microprocessor with A/D inputs. This transducer uses advanced micromachining techniques to Provide an accurate, high level analog output signal that is Proportional to the applied pressure.

MCP3V5004 Series

0 to 3.92 kPa (0 to 400 mm H_2O)
0.6 to 3.0 V Output

Features

- Durable Thermoplastic (PPS) Package
- Temperature Compensated from 10°C to 60°C
- Available in Gauge Surface Mount (SMT) Configuration

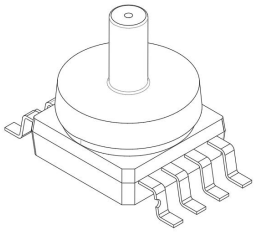
Application Examples

- Washing Machine Water Level
- Ideally Suited for Microprocessor or Microcontroller-Based Systems

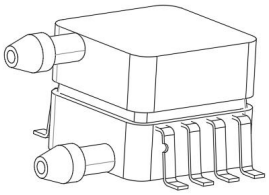
ORDERING INFORMATION

Device Name	# of Ports			Pressure Type			Device Marking
	None	Single	Dual	Gauge	Differential	Absolute	
Small Outline Package (MCP3V5004 Series)							
MCP3V5004GC6U		•		•			MCP3V5004G
MCP3V5004DP			•		•		MCP3V5004DP
MCP3V5004GVP		•		•			MCP3V5004GV
MCP3V5004GP		•		•			MCP3V5004GP

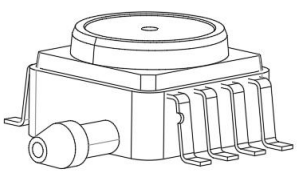
SMALL OUTLINE PACKAGES



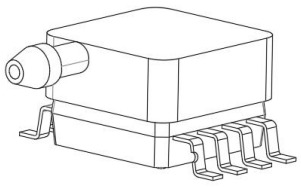
MCP3V5004GC6U



MCP3V5004DP



MCP3V5004GVP



MCP3V5004GP

Operating Characteristics

Table 1. Operating Characteristics (VS = 3.0 Vdc, TA = 25°C unless otherwise noted, P1 > P2)

Characteristics	Symbol	Min	Typ	Max	Unit
Pressure Range	P_{OP}	0	—	3.92 400	kPa mm H_2O
Supply Voltage(1)	V_S	2.7	3.0	3.3	Vdc
Supply Current	I_o	—	—	10	mAdc
Span at 306 mm H_2O (3 kPa)(2)	V_{FSS}	—	1.8	—	Vdc
Offset(3)	V_{off}	0.45	0.6	0.75	Vdc
Accuracy(4) 0 to 100 mm H_2O (10 to 60°C) 100 to 400 mm H_2O (10 to 60°C)	—	—	—	±1.5 ±2.5	$\%V_{FSS}$ $\%V_{FSS}$
Sensitivity	V/P	—	0.6 5.9	—	mV/kPa mV/mm H_2O

1. Device is ratiometric within this specified excitation range.
2. Span is defined as the algebraic difference between the output voltage at specified pressure and the output voltage at the minimum rated pressure.
3. Offset (V_{off}) is defined as the output voltage at the minimum rated pressure.
4. Accuracy (error budget) consists of the following:

   Linearity: Output deviation from a straight line relationship with pressure over the specified pressure range.

   Temperature Hysteresis: Output deviation at any temperature within the operating temperature range, after the temperature is cycled to and from the minimum or maximum operating temperature points, with zero differential pressure applied.

   Pressure Hysteresis: Output deviation at any pressure within the specified range, when this pressure is cycled to and from the minimum or maximum rated pressure, at 25°C.

   TcSpan: Output deviation over the temperature range of 0° to 85°C, relative to 25°C.

   TcOffset: Output deviation with minimum rated pressure applied, over the temperature range of 0° to 85°C, relative to 25°C.

   Variation from Nominal: The variation from nominal values, for Offset or Full Scale Span, as a percent of V_{FSS}, at 25°C.

Note: Plugged or unplugged with power may cause permanent damage.

Maximum Ratings

Table 2. Maximum Ratings(1)

Rating	Symbol	Value	Unit
Maximum Pressure (P1 > P2)	P_{max}	16	kPa
Storage Temperature	T_{stg}	–30 to +100	°C
Operating Temperature	T_A	0 to +85	°C

1. Exposure beyond the specified limits may cause permanent damage or degradation to the device.

Figure 1 shows a block diagram of the internal circuitry.

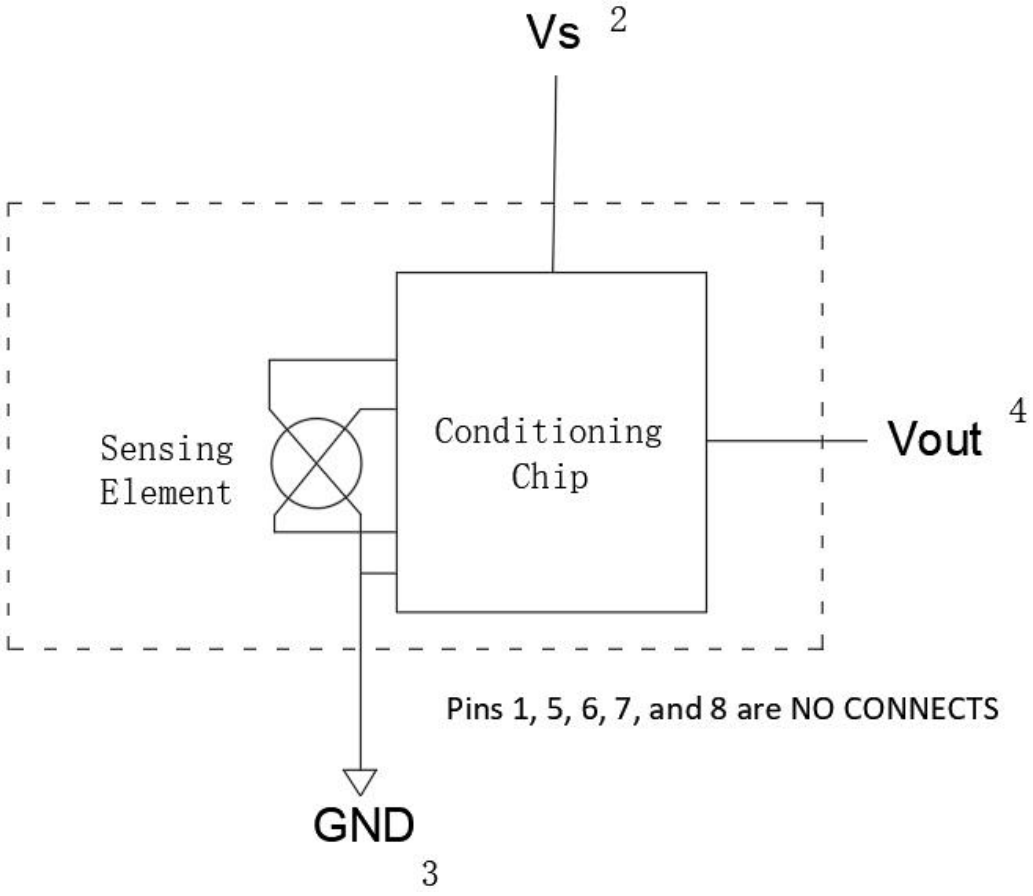


Figure 1. Pressure Sensor Schematic

TEMPERATURE COMPENSATION AND CALIBRATION

The performance over temperature is achieved by temperature compensation, calibration and signal conditioning circuitry.
A silicone gel isolates the die surface and wire bonds from the environment, while allowing the pressure signal to be transmitted to the sensor diaphragm.
The MCP3V5004 series pressure sensor operating characteristics,
and internal reliability and qualificationtests are based on use of dry air as the pressure media. Media, other than dry air, may have adverseeffects on sensor performance and long-term reliability. Contact the factory for information regardingmedia compatibility in your application.
Figure 2 shows the recommended decoupling circuit for interfacing the integrated sensor to the A/D input of a microprocessor or microcontroller. Proper decoupling of the power supply is recommended.
Figure 3 shows the sensor output signal relative to pressure input. Typical, minimum, and maximum output curves are shown for operation over a temperature range of 10° to 60°C using the decoupling circuit shown in Figure 2.

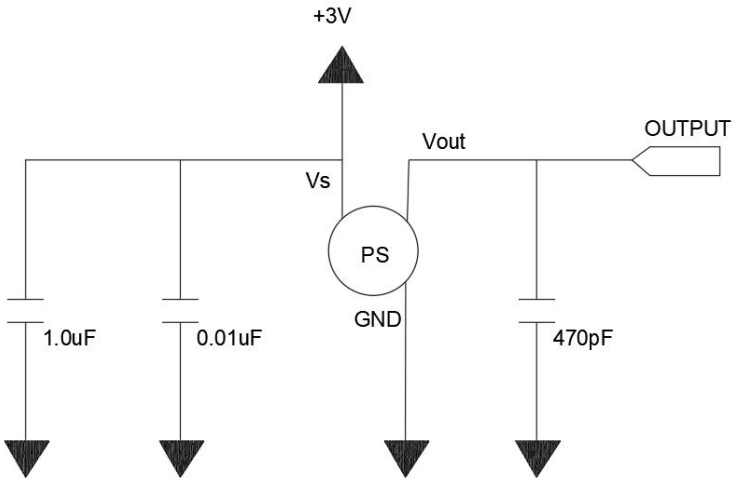


Figure 2. Recommended Power Supply Decoupling and Output Filtering

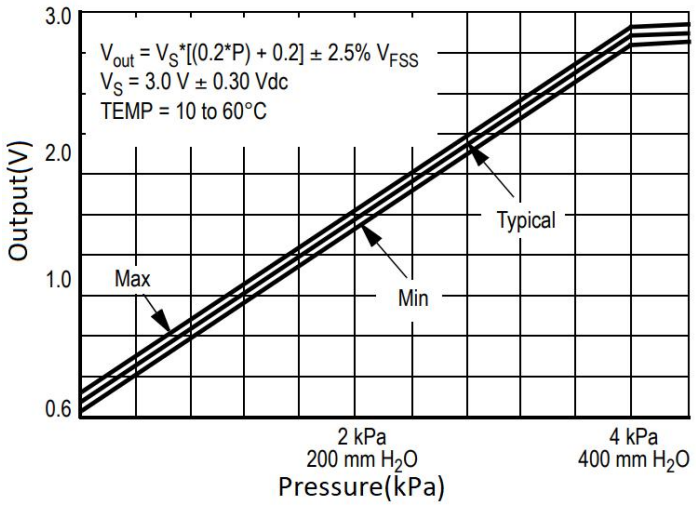


Figure 3. Output vs. Pressure Differential

PRESSURE (P1)/VACUUM (P2) SIDE IDENTIFICATION TABLE

The two sides of the pressure sensor are designated as the Pressure (P1) side and the Vacuum (P2) side. The Pressure (P1) side is the side containing silicone gel which protects the die from harsh media. The MCP pressure sensor is designed to operate with positive differential pressure applied, P1 > P2.
The Pressure (P1) side may be identified by using the table below:

Part Number	Pressure (P1) Side Identifier
MCP3V5004GC6U	Side with Port Attached
MCP3V5004DP	Side with Part Marking
MCP3V5004GVP	Stainless steel cap
MCP3V5004GP	Side with Port Attached

MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE MOUNTED APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the surface mount packages must be the correct size to ensure proper solder connection interface between the board and the package. With the correct footprint, the packages will self align when subjected to a solder reflow process. It is always recommended to design boards with a solder mask layer to avoid bridging and shorting between solder pads.

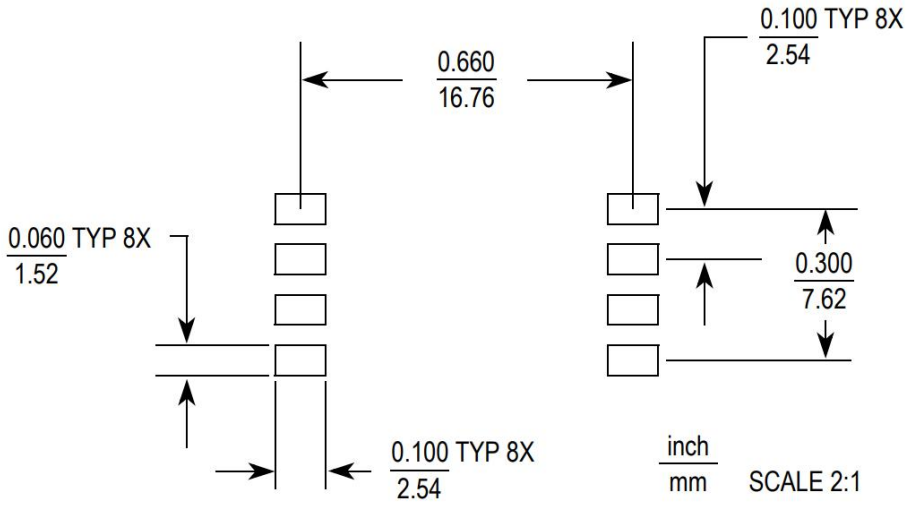
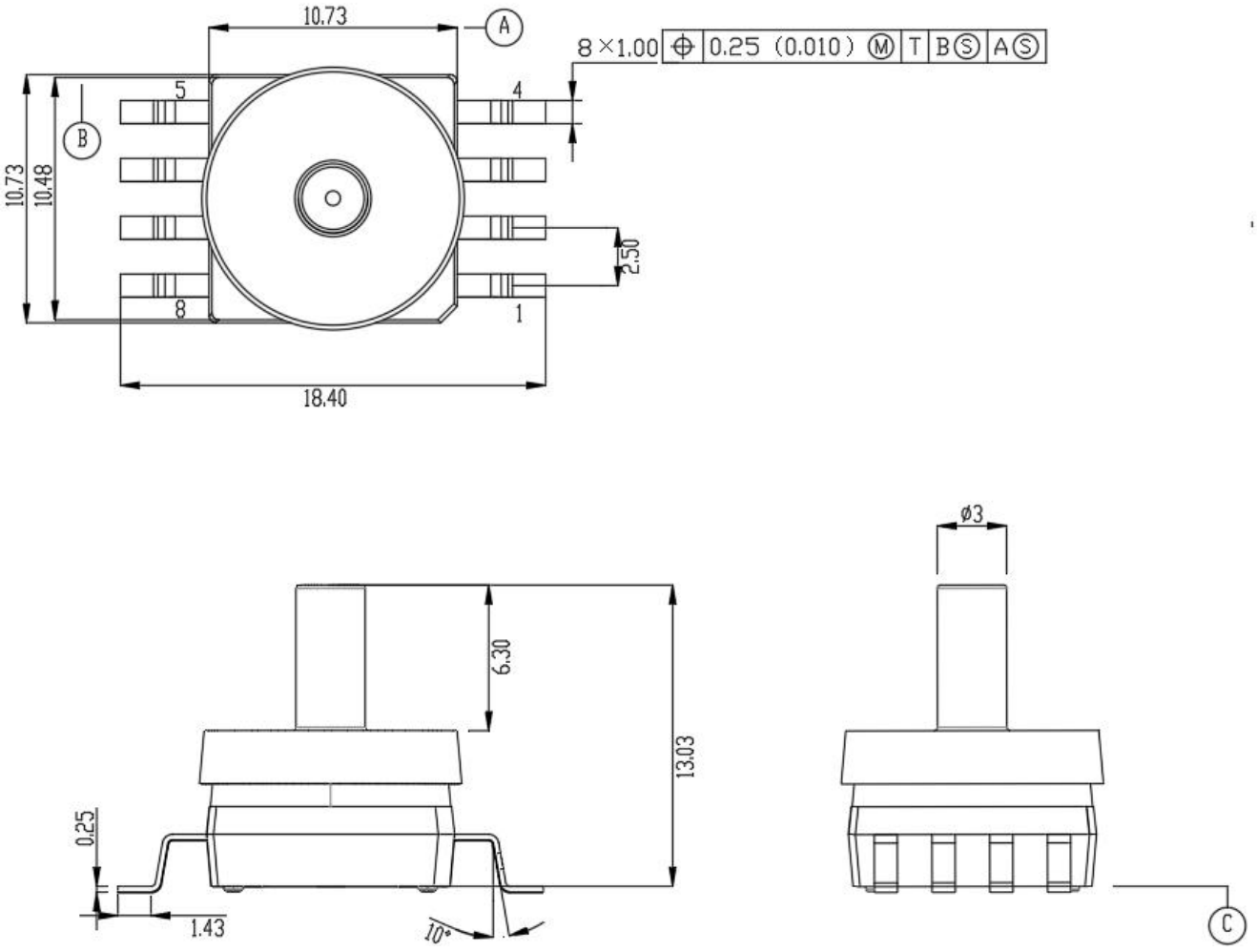
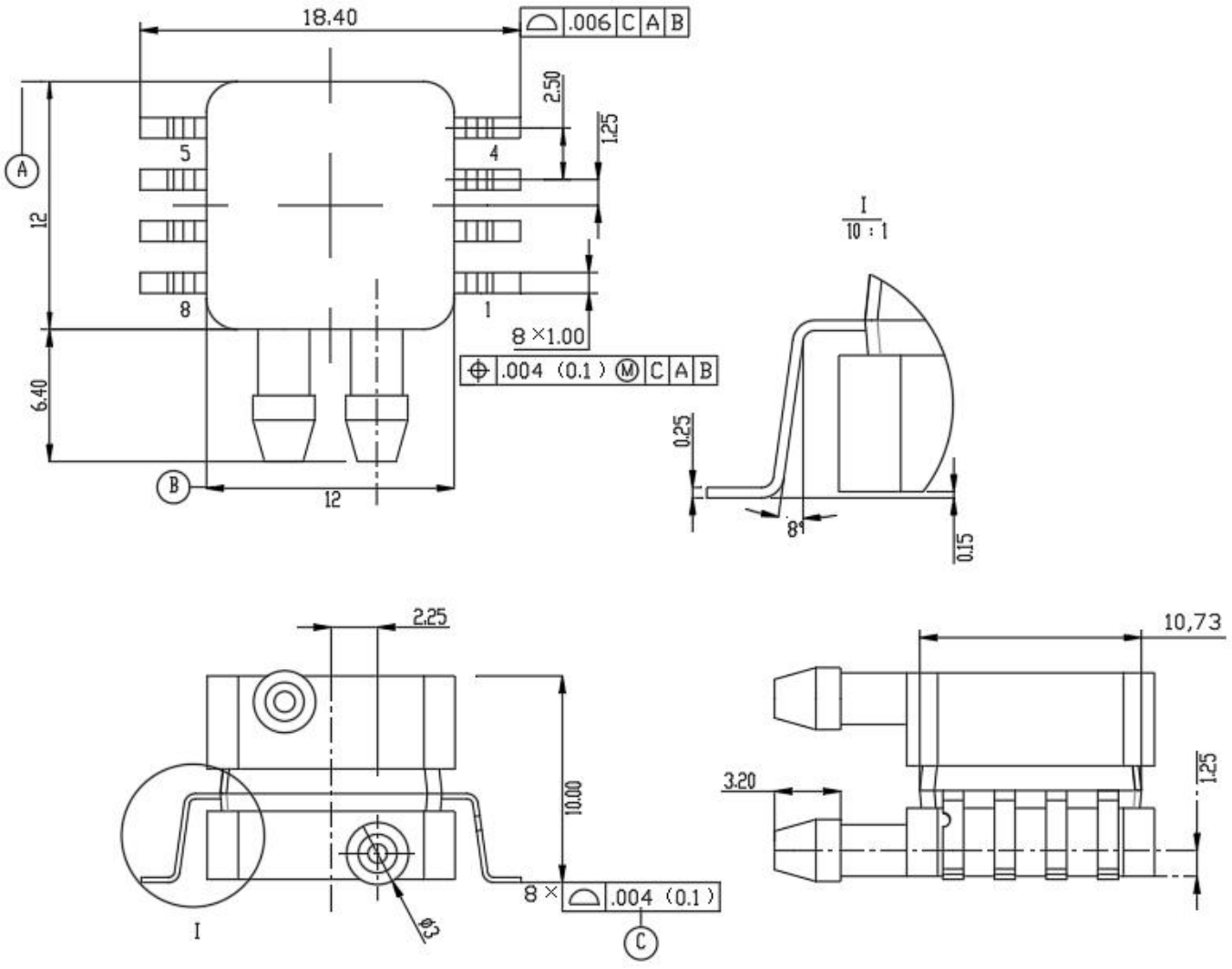


Figure 4. SOP Footprint

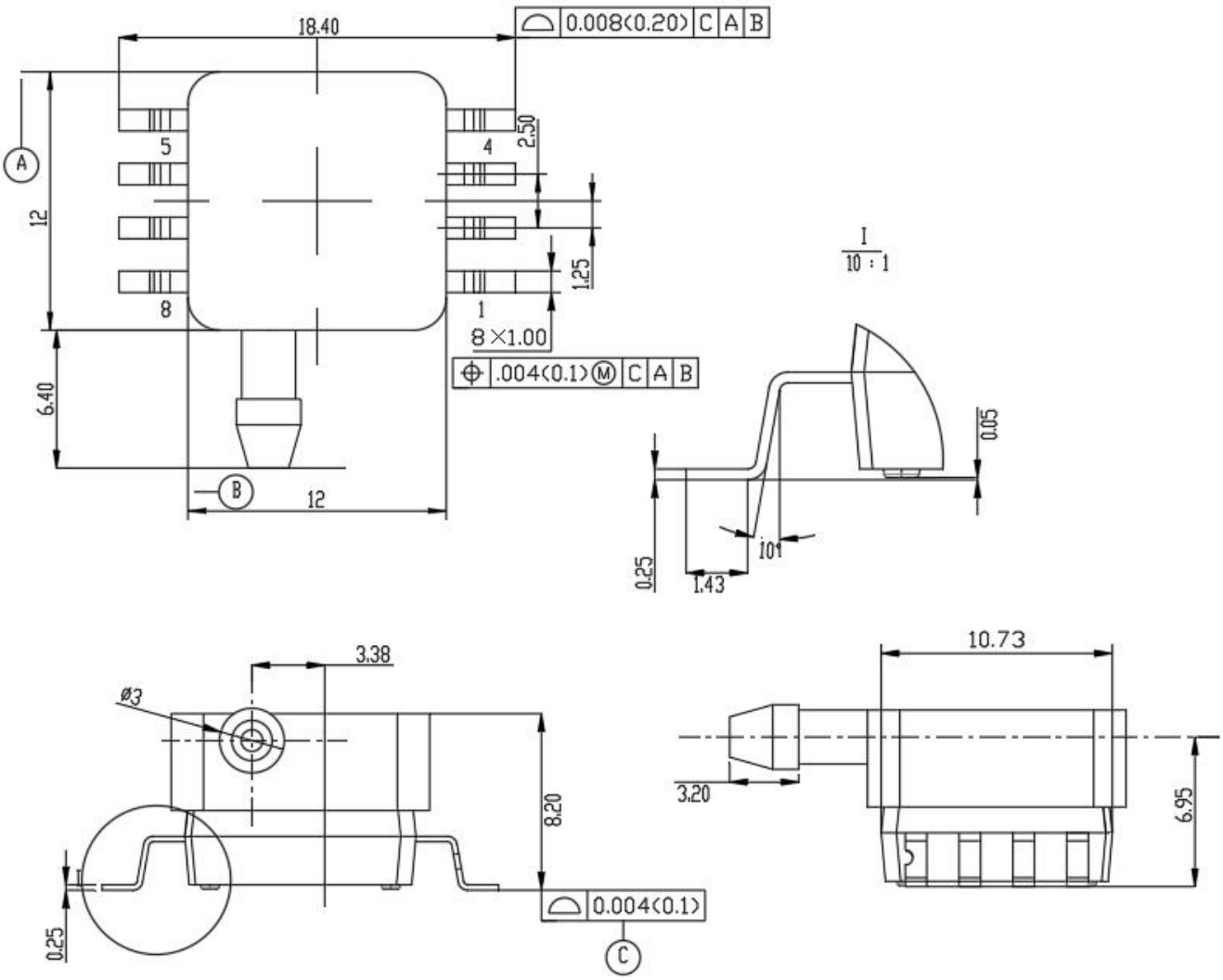
PACKAGE DIMENSIONS



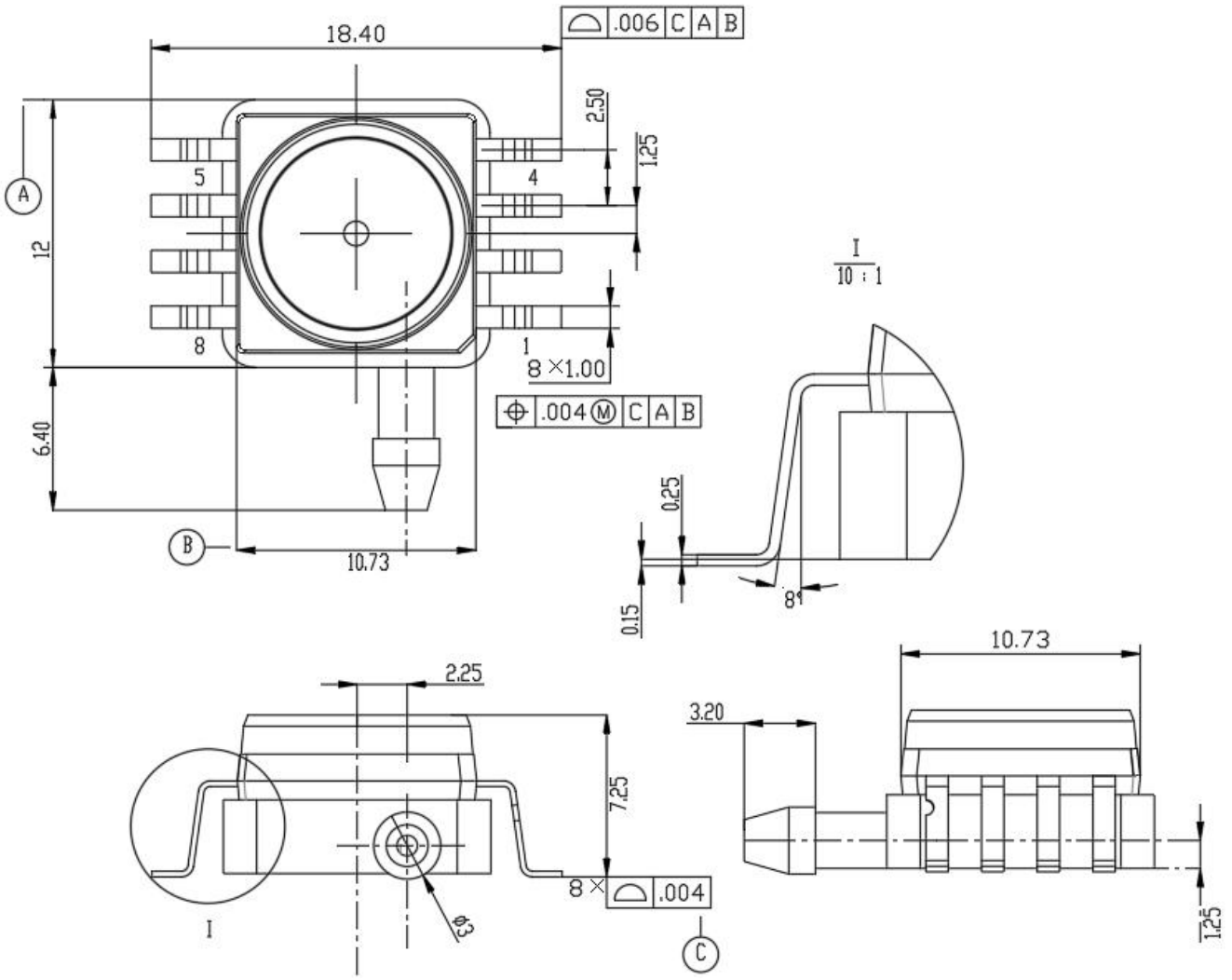
MCP3V5004GC6U



MCP3V5004DP



MCP3V5004GP



MCP3V5004GVP