

Messrs.

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# SPECIFICATION

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Semiconductor Pressure Sensor

Model: AT7 sensor series

Project: \_\_\_\_\_

Distributor: \_\_\_\_\_

Reference: \_\_\_\_\_

A handwritten signature in black ink that reads 'Osamu Kitamura'.

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Sensor Business Unit, Electronics Business Company  
Fujikura Ltd.

**Fujikura Ltd.**

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Table shown below is revision records of this specification

Est.	Mar. 28, 2022	O. Kitamura	Issued as a preliminary version	
	Date	Name	Comment	Mark

### 1. General

This document describes the specifications of Fujikura Pressure Sensors, AT7 series.

### 2. Principle

Fujikura Pressure Sensor is composed of a silicon piezoresistive pressure sensing chip and a signal conditioning integrated circuit. The low-level signal from the sensing chip is amplified, temperature compensated, calibrated, and finally converted to a high-level output signal that is proportional to the applied pressure.

### 3. Device Lineup

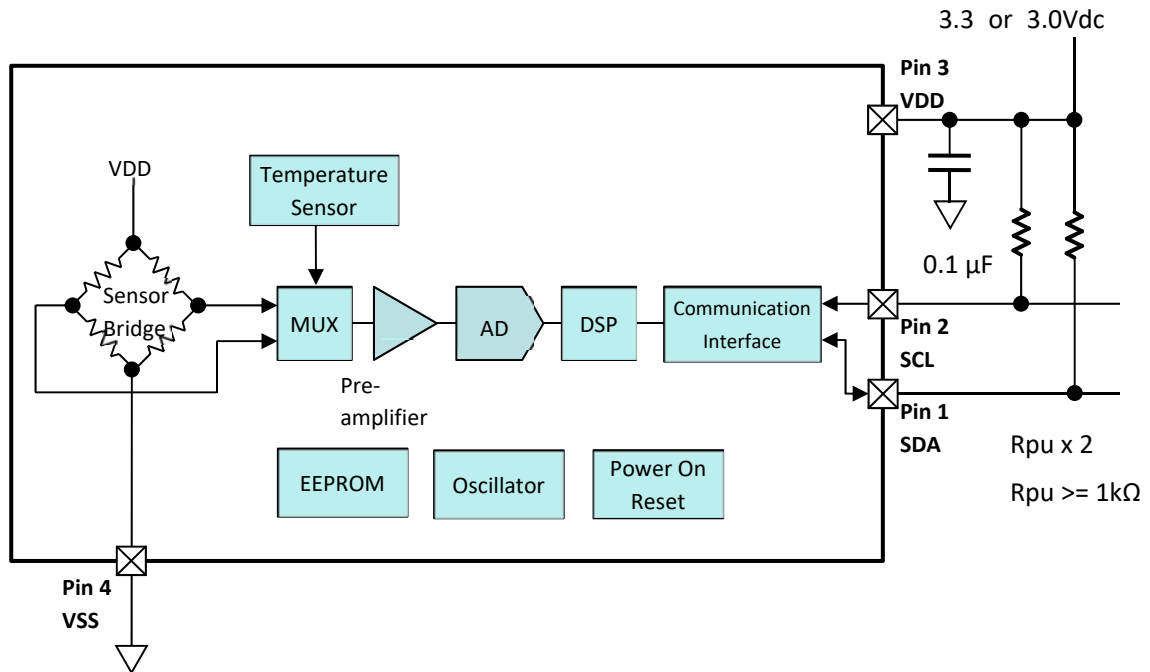
This device has the following lineup.

Model	Pressure Type	Supply Voltage	Accuracy	Pressure Range							
				-100	0	25	50	100	200	500	1000 kPa
AT71	Gauge	3.3 Vdc	±1.5 %FS		025KG	050KG	100KG	200KG	500KG		
AT72		3.0 Vdc		001MG	100KV	100KW					

### 4. RoHS

This device is compliant with the Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment (RoHS).

## 5. Block Diagram and Pin Connections



Pin Assignment		Pin No.	Pin Name	Note
		1	SDA	Serial bidirectional data
		2	SCL	Serial clock input
		3	VDD	Power supply connection
		4	VSS	Common voltage connection

Notes:

\*1) Put a 0.1 μF capacitor between Pin 3 (VDD) and VSS.

## 6. Device Name Code

The device name code is consisted of Sensor code, Pressure code, Slave address code and Packing style.

<b>Sensor Code</b>	<b>Pressure Code</b>		
<b>AT7 1</b>	<b>- 100K G -</b>	<b>2</b>	<b>- TP</b>
			Blank: Tray <b>TP:</b> Tape & Reel
		<b>Custom ID</b>	if applicable (3 characters)
			<b>2:</b> 0x28 ⋮ <b>7:</b> 0x78
		<b>Slave address code</b>	
		<b>Pressure type</b>	<b>G:</b> Gauge / Positive-pressure <b>V:</b> Gauge / Negative-pressure <b>W:</b> Gauge / Compound-pressure
		<b>Pressure value</b>	<b>025K:</b> 25 kPa <b>050K:</b> 50 kPa <b>100K:</b> 100 kPa <b>200K:</b> 200 kPa <b>500K:</b> 500 kPa <b>001M:</b> 1 MPa
		<b>Supply voltage</b>	<b>1:</b> 3.3 Vdc <b>2:</b> 3.0 Vdc
<b>Model</b>	<b>AT7:</b> Tiny SMD / Digital Output		

## 7. Absolute Maximum Ratings

Item		Symbol	Rating			Unit
			Min.	Typ.	Max.	
Load Pressure	Pressure Code	025KG	-	-	+50	kPa
		050KG	-	-	+100	kPa
		100KG	-	-	+200	kPa
		200KG	-	-	+400	kPa
		500KG	-	-	+1000	kPa
		001MG	-	-	+1500	kPa
		100KV	-	-	+200	kPa
		100KW	-	-	+200	kPa
Supply Voltage		VDDmax	-0.3	-	6	Vdc
Voltage at Digital I/O pins		Vdiomax	-0.3	-	VDD+0.3	Vdc
Operating Temperature		Topt	-40	-	+125	°C
Storage Temperature		Tstg	-40	-	+125	°C

Note: Absolute maximum ratings are the limits that the device will withstand without damage.

## 8. General Specifications

Item	Condition		Symbol	Rating			Unit
				Min.	Typ.	Max.	
Supply Voltage	Sensor Code	AT71		3.135	3.3	3.465	
		AT72		2.85	3.0	3.15	
Type of Pressure			-	Gauge pressure			*2
Pressure Media			-	Non-corrosive gases			*3
Pressure Range	Pressure Code	025KG	Popt	0	-	+25	kPa
		050KG		0	-	+50	kPa
		100KG		0	-	+100	kPa
		200KG		0	-	+200	kPa
		500KG		0	-	+500	kPa
		001MG		0	-	+1	MPa
		100KV		-100	-	0	kPa
		100KW		-100	-	+100	kPa
Compensated Temperature			-	0	-	+85	°C
Operating Humidity	Non-condensing		Hopt	30	-	85	%RH
Storage Humidity	Non-condensing		Hstg	30	-	85	%RH
Dielectric Strength				-	-	1	mA
Insulation Resistance				100	-	-	MΩ

Notes:

- \*1) Supply voltage (VDD) should be constant.
- \*2) Gauge pressure is defined as the difference between applied pressure to the pressure port and atmospheric pressure of the device.
- \*3) Ensure the pressure media contains no particulates. The device is not compatible with liquids.
- \*4) Pressure range is defined as the measurable pressure range of the device. Do not expose intentionally beyond minimum Popt and maximum Popt.
- \*5) Please also refer to Chapter 13 Transfer Function.
- \*6) Do not wet the device with dew.
- \*7) Dielectric strength is defined as the leakage current between all pins and the package with AC 500 V, 1 minute.
- \*8) Insulation resistance is defined as the resistance value between all pins and the package with DC 500 V.

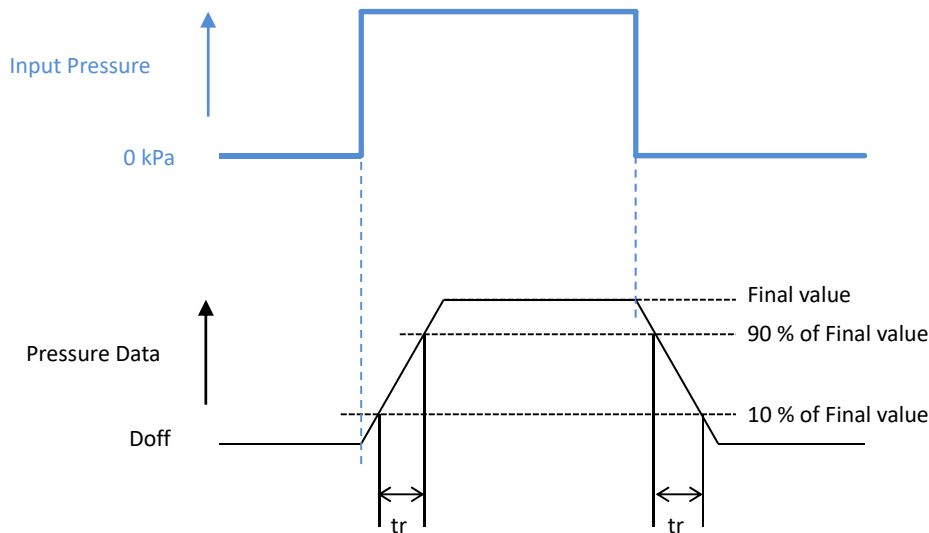
## 9. Electrical Characteristics

Ambient temperature  $T_a = 25^\circ\text{C}$

Item	Condition	Symbol	Rating			Unit
			Min.	Typ.	Max.	
Offset Pressure Data		Doff	2,392	3,277	4,162	Count
Full Scale Pressure Data		Dfs	61,374	62,259	63,144	Count
Span Pressure Data		SD	-	58,982	-	Count
Sampling rate				1.1		kHz
Accuracy	0 to 85°C	Error	-1.5	-	+1.5	%FS
Supply current	VDD = 3.3 Vdc, 3.0 Vdc		-	-	3.5	
Response Time	for reference	tr	-	1	-	msec.
Temperature Data	for reference		-40°C	0	-	
			+25°C	25817	-	
			+125°C	65535	-	

Notes:

- \*1) Offset pressure data (Doff) is defined as the pressure data at minimum Popt. In case of 100KV, Offset pressure data (Doff) is defined as the pressure data of maximum Popt.
- \*2) Offset error is calibration error of Offset pressure data (Doff) at production. It does not include Long term offset drift. It would be suggested that applications have Auto-zeroing function.
- \*3) Full scale pressure data (Dfs) is defined as the pressure data at maximum Popt. In case of 100KV, Full scale pressure data (Dfs) is defined as the pressure data of minimum Popt.
- \*4) Span pressure data (SD) is defined as the pressure data difference between Offset pressure data (Doff) and Full scale pressure data (Dfs).
- \*5) Accuracy consists of the following:
  - Non-linearity
  - Temperature errors over the temperature range 0 to 85°C
  - Pressure hysteresis
  - Calibration errors of sensitivity and offset
- \*6) The unit of Accuracy “%FS” is defined as a percent error by Span pressure data (SD).
- \*7) Response time (tr) is defined as the time for the change in the pressure data from 10 % to 90 % or from 90 % to 10 % of its final value when the input pressure makes a step change.



- \*8) Temperature Data (Dtmp) is for reference.

### 10. Communication Interface

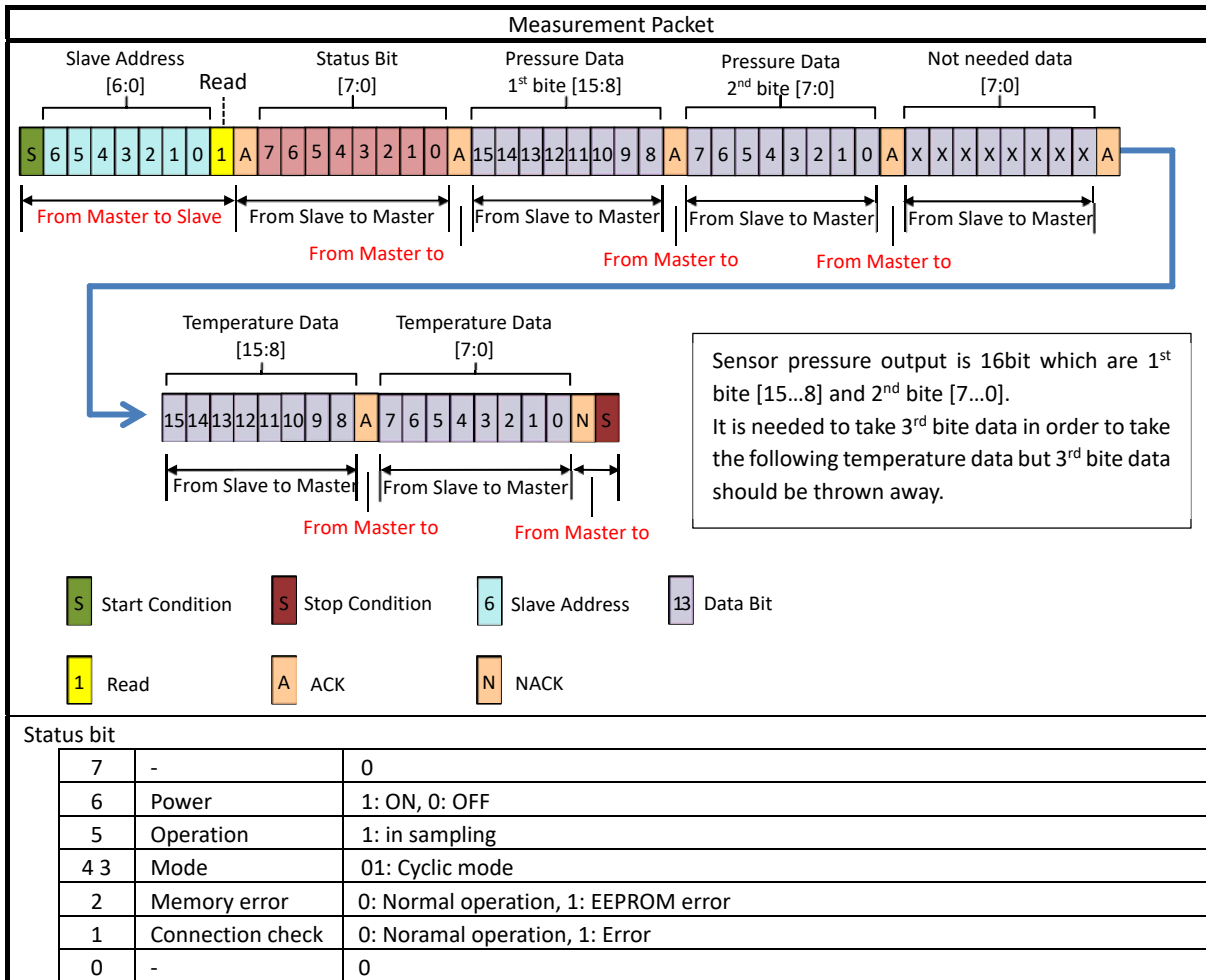
Ambient temperature Ta = 25°C

Item	Condition	Symbol	Rating			Unit
			Min.	Typ.	Max.	
Interface			I <sup>2</sup> C™			*1
Input Low Voltage	Sensor Code	AT71	0	-	0.99	V
		AT72	0	-	0.9	V
Input High Voltage	Sensor Code	AT71	2.31	-	3.3	V
		AT72	2.1	-	3	V
SCL clock frequency		f <sub>SCL</sub>	100	-	400	kHz
Load Capacitance	SDA, 400kHz				100	pF
Slave address	7 bit		0x28 to 0x78			*2

Notes:

- \*1) I<sup>2</sup>C™ is a trademark of NXP Semiconductors.
- \*2) Slave address is set by the factory. If you can accept any address, 0x28 is recommended.

### 11. Communication Protocol





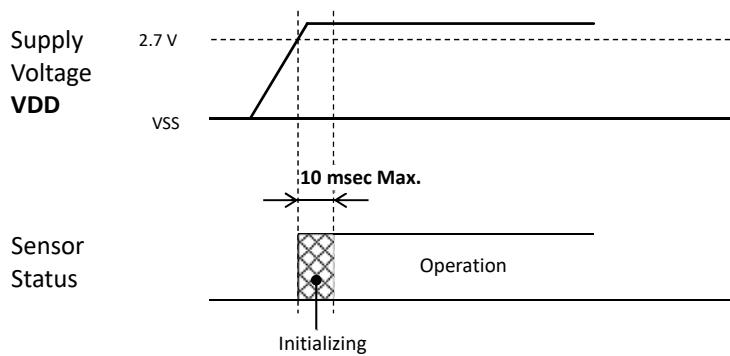
12. Output versus Input Pressure

Pressure Code	16 bit sensor
<p>025KG 050KG 100KG 200KG 001MG</p>	
<p>100KV</p>	
<p>100KW</p>	<p>Temp. = 0 to 85°C</p>

### 13. Transfer Function

Item	Transfer Function																																													
Pressure Data	$\text{Pressure Data (Count)} = P \times \alpha + \beta \pm (\text{Error} \times \text{Temperature Error Multiplier})$ $P \text{ (kPa)} = \frac{\text{Pressure Data} - \beta \pm (\text{Error} \times \text{Temperature Error Multiplier})}{\alpha}$																																													
	<table border="1"> <thead> <tr> <th>Pressure Code</th> <th>P (kPa)</th> <th><math>\alpha</math></th> <th><math>\beta</math></th> <th>Error</th> </tr> </thead> <tbody> <tr> <td colspan="5">16bit sensor</td> </tr> <tr> <td>025KG</td> <td>0 to +25</td> <td>58982/25</td> <td>3277</td> <td>885</td> </tr> <tr> <td>050KG</td> <td>0 to +50</td> <td>29491/25</td> <td>3277</td> <td>885</td> </tr> <tr> <td>100KG</td> <td>0 to +100</td> <td>29491/50</td> <td>3277</td> <td>885</td> </tr> <tr> <td>200KG</td> <td>0 to +200</td> <td>29491/100</td> <td>3277</td> <td>885</td> </tr> <tr> <td>001MG</td> <td>0 to +1000</td> <td>29491/500</td> <td>3277</td> <td>885</td> </tr> <tr> <td>100KV</td> <td>-100 to 0</td> <td>-29491/50</td> <td>3277</td> <td>885</td> </tr> <tr> <td>100KW</td> <td>-100 to +100</td> <td>29491/100</td> <td>32768</td> <td>885</td> </tr> </tbody> </table>	Pressure Code	P (kPa)	$\alpha$	$\beta$	Error	16bit sensor					025KG	0 to +25	58982/25	3277	885	050KG	0 to +50	29491/25	3277	885	100KG	0 to +100	29491/50	3277	885	200KG	0 to +200	29491/100	3277	885	001MG	0 to +1000	29491/500	3277	885	100KV	-100 to 0	-29491/50	3277	885	100KW	-100 to +100	29491/100	32768	885
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Temperature Data	$T \text{ (}^\circ\text{C)} = 165 \times \frac{\text{Dtemp}}{65535} - 40$ <p>0 LSB = -40°C 65535LSB = 125°C</p>																																													

### 14. Operating Sequence

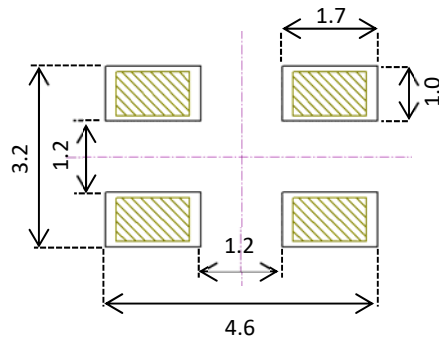


## 15. Dimensions and Weights

Refer to the following drawing as attached.

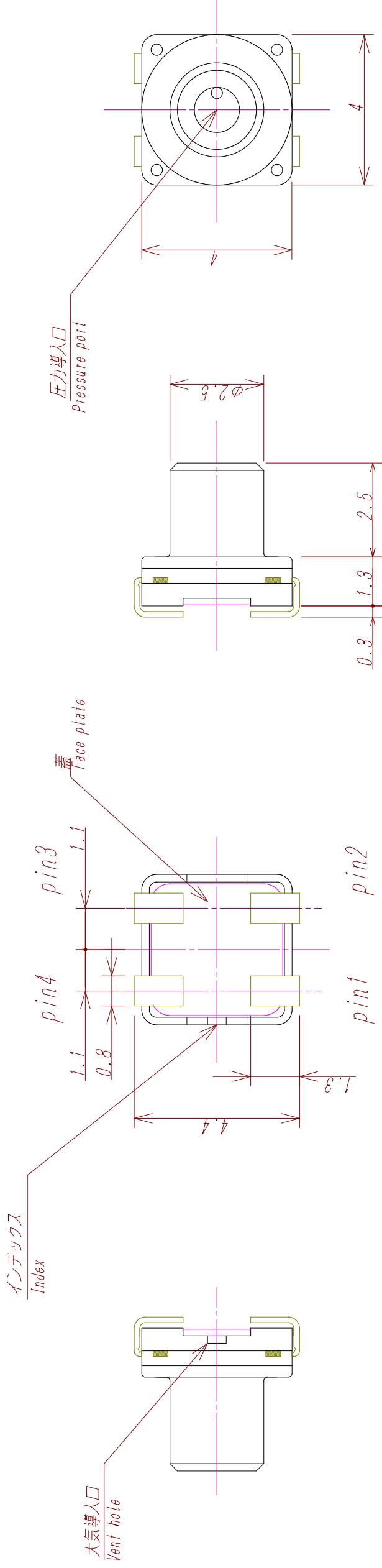
Sensor Code	Dimension Drawing	Weight
AT7x	TFP-L2004-01	approx. 0.07 grams

## 16. Footprint for PCB designing (Reference)



Notes:

\*1) These footprints are for reference. Please evaluate well these footprints, before your mass production.



Unless otherwise specified, tolerance: +/-0.1mm

PART NO.	部品名	材質	個数	摘要	
PROJECT NAME :		NAME OF PART	MAT'L	QTY. R E M A R K S	
名称TITLE		ATシリーズ 外形図			
第3角法 3RD ANGLE PROJECTION					
単位UNITS m.m					
尺度SCALE 8:1					
DATE OF ISSUE 09-07-2020	図面番号DRAWING NO.				REV. MARK
DATE OF DESIGN 09-07-2020	9-772-XXX				◇

①			
MARK	変更 REVISIONS	年月日 DATE	変更者 BY