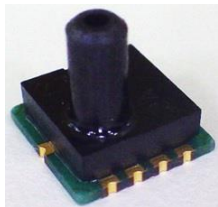


# Digital Output Gage Pressure Sensor

# MMR902 Datasheet

## DESCRIPTION



This product is digitally outputs a pressure value which was corrected in the module. Customers need no correction because it corrects and outputs the differences of sensors and temperature characteristics. It does not require complicated sensor drive or control circuit, and devices with high performance can be made only with this module and an external microcontroller which will be the host.

## FEATURES

- Small package: 7.0(W) × 7.0(D) × 7.2(H)mm  
Operating pressure range: -30~360mmHg (-4~47.99kPa)  
Pressure resolution: 0.001mmHg (0.13Pa)  
effective resolution: 0.020mmHgRMS (2.7PaRMS) (at MODE1)  
Pressure measurement error: ±2mmHg (±266Pa)
- It corrects the differences of sensors and temperature characteristics when shipped from our factory.
- It digitally outputs pressure value corrected in the module. (SPI/I2C)  
I2C slave address (7 bits) is 0x65.
- RoHS compliant
- Halogen-free

## INDEX

|                                                             |    |
|-------------------------------------------------------------|----|
| DESCRIPTION .....                                           | 1  |
| FEATURES .....                                              | 1  |
| BLOCK DIAGRAM.....                                          | 3  |
| PIN CONFIGURATION .....                                     | 4  |
| TERMINAL EXPLANATIONS .....                                 | 5  |
| ABSOLUTE MAXIMUM RATINGS .....                              | 6  |
| RECOMMENDED OPERATING CONDITIONS .....                      | 6  |
| ELECTRICAL CHARACTERISTICS .....                            | 7  |
| Analog characteristics.....                                 | 7  |
| Digital I/O.....                                            | 7  |
| Pressure sensor characteristics.....                        | 8  |
| Temperature sensor characteristics .....                    | 8  |
| Definition of characteristics .....                         | 9  |
| FUNCTION EXPLANATION.....                                   | 11 |
| Function Outline.....                                       | 11 |
| Flow chart of pressure/temperature measurement .....        | 12 |
| SERIAL COMMUNICATION INTERFACE .....                        | 13 |
| Baud rate .....                                             | 13 |
| SPI format .....                                            | 14 |
| SPI AC Characteristics .....                                | 15 |
| I2C format .....                                            | 16 |
| I2C AC Characteristics .....                                | 18 |
| Command code.....                                           | 19 |
| State transition table .....                                | 21 |
| Timing Chart.....                                           | 22 |
| TYPICAL APPLICATION CIRCUIT .....                           | 23 |
| TYPICAL PERFORMANCE CHARACTERISTICS .....                   | 24 |
| DIMENSIONS .....                                            | 29 |
| PRODUCT NAME.....                                           | 30 |
| PRODUCT LINEUP .....                                        | 30 |
| PRESSURE SENSOR LINEUP .....                                | 31 |
| NOTES.....                                                  | 32 |
| ATTENTION .....                                             | 33 |
| ADDDITIONAL NOTES.....                                      | 33 |
| MARKING CONTENTS .....                                      | 34 |
| PACKING SPECIFICATIONS (TRAY).....                          | 35 |
| PACKING SPECIFICATIONS (TAPING, B HOUSING, R HOUSING) ..... | 40 |
| RECOMMENDED LAND PATTERN .....                              | 48 |
| CONDITION FOR PACKAGE MOUNTING .....                        | 49 |
| Pb-Free recommended profile condition.....                  | 49 |
| Storage method .....                                        | 50 |

BLOCK DIAGRAM

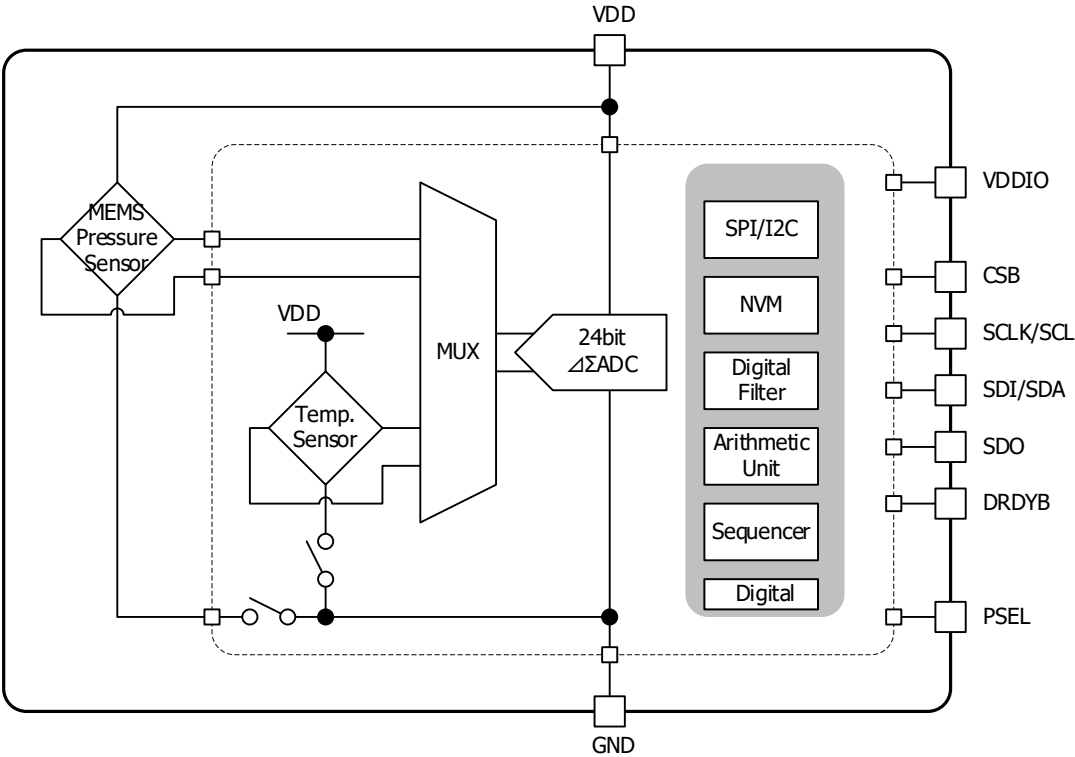


Fig. 1 Block diagram

PIN CONFIGURATION

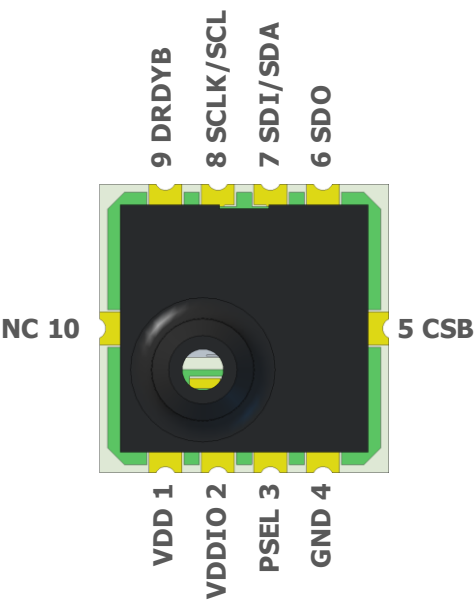


Fig. 2 Pin configuration (Top view)

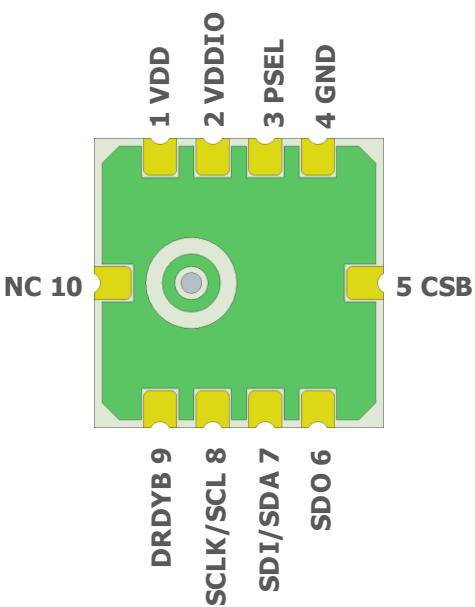


Fig. 3 Pin configuration (Bottom view)

## TERMINAL EXPLANATIONS

Table 1 Pin table

| No. | Pin Name    | Type     | Function                                                                                                                                                   |
|-----|-------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | VDD         | I        | Power-supply for analog circuit                                                                                                                            |
| 2   | VDDIO       | I        | Power-supply for digital I/O                                                                                                                               |
| 3   | PSEL        | I        | Protocol select terminal (High:SPI/Low:I2C)<br>* PSEL is not pull-up / pull-down in the internal circuit. Please use it must be connected to VDDIO or GND. |
| 4   | GND         | -        | GND                                                                                                                                                        |
| 5   | CSB         | I        | Chip select for SPI communication<br>*Please set to open circuit when I2C is used                                                                          |
| 6   | SDO         | O        | Serial Data Output for SPI communication (SDO=MISO)<br>*Please set to open circuit when I2C is used                                                        |
| 7   | SDI<br>SDA  | I<br>I/O | Serial Data Input for SPI communication (SDI=MOSI)<br>Serial Data (Input and output) for I2C communication (SDA)                                           |
| 8   | SCLK<br>SCL | I<br>I/O | Serial clock for SPI communication (SCLK)<br>Serial clock for I2C communication (SCL)                                                                      |
| 9   | DRDYB       | O        | Output terminal which notifies the completion of pressure measurement and calculation correction (negative logic)                                          |
| 10  | NC          | -        | No connect                                                                                                                                                 |

## ABSOLUTE MAXIMUM RATINGS

(unless otherwise specified, Ta=25°C)

| Item                                 | Symbol               | Min.                | Max.        | Unit          |
|--------------------------------------|----------------------|---------------------|-------------|---------------|
| Storage temperature range            | T <sub>STG</sub>     | -20                 | 70          | °C            |
| Analog supply voltage                | VDD <sub>MAX</sub>   | -0.3                | 4.0         | V             |
| Digital I/O voltage                  | VDDIO <sub>MAX</sub> | -0.3                | 4.0         | V             |
| Overpressure                         | P <sub>MAX</sub>     | -100<br>(-13.33)    | 600<br>(80) | mmHg<br>(kPa) |
| Pressure medium (note <sup>1</sup> ) | -                    | AIR (don't dewfall) |             | -             |

note<sup>1</sup>: Storage and operation in an environment of dry and non-corrosive gases.

## RECOMMENDED OPERATING CONDITIONS

(unless otherwise specified, Ta=25°C)

| Item                        | Symbol               | Min.        | Typ. | Max.           | Unit          |
|-----------------------------|----------------------|-------------|------|----------------|---------------|
| Operating temperature range | T <sub>OPR</sub>     | 0           | -    | 60             | °C            |
| Analog supply voltage       | VDD <sub>OPR</sub>   | 1.7         | 3.4  | 3.6            | V             |
| Digital I/O voltage         | VDDIO <sub>OPR</sub> | 1.14        | -    | 3.6            | V             |
| Operating pressure range    | P <sub>OPR</sub>     | -30<br>(-4) | -    | 360<br>(47.99) | mmHg<br>(kPa) |

## ELECTRICAL CHARACTERISTICS

## Analog characteristics

(unless Ta=25°C, VDD=VDDIO=3.4V)

| Item                      | Symbol                | Condition                     | Min.   | Typ.   | Max.   | Unit. |
|---------------------------|-----------------------|-------------------------------|--------|--------|--------|-------|
| VDD Current consumption   | I <sub>VDDact</sub>   | Pressure measure active       | 520    | 650    | 780    | μA    |
|                           | I <sub>VDDsd</sub>    | Shutdown                      | -      | 0.01   | 0.1    |       |
| VDDIO Current consumption | I <sub>VDDIOact</sub> | Pressure measure active       | 1.5    | 2.0    | 2.6    | μA    |
|                           | I <sub>VDDIOsd</sub>  | Shutdown                      | -      | 0.1    | 1.0    |       |
| Conversion time           | t <sub>con1</sub>     | MODE1                         | 15.250 | 15.625 | 16.000 | msec  |
|                           | t <sub>con2</sub>     | MODE2                         | 7.62   | 7.81   | 8.00   |       |
|                           | t <sub>con3</sub>     | MODE3                         | 3.81   | 3.91   | 4.00   |       |
|                           | t <sub>con4</sub>     | MODE4<br>High Resolution Mode | 244    | 250    | 256    |       |

## Digital I/O

(unless otherwise specified, Ta=25°C, VDD=VDDIO=3.4V)

| Item                         | Symbol           | Conditions   | Min.        | Typ. | Max.        | Unit |
|------------------------------|------------------|--------------|-------------|------|-------------|------|
| High level input voltage     | V <sub>IH</sub>  | -            | 0.8 × VDDIO | -    | VDDIO +0.3  | V    |
| Low level input voltage      | V <sub>IL</sub>  | -            | -0.3        | -    | 0.2 × VDDIO | V    |
| Output voltage<br>High level | V <sub>OH1</sub> | VDDIO ≥ 2.0V | VDDIO - 0.4 | -    | -           | V    |
|                              | V <sub>OH2</sub> | VDDIO < 2.0V | 0.8 × VDDIO | -    | -           | V    |
| Output voltage<br>Low level  | V <sub>OL1</sub> | VDDIO ≥ 2.0V | -           | -    | 0.4         | V    |
|                              | V <sub>OL2</sub> | VDDIO < 2.0V | -           | -    | 0.2 × VDDIO | V    |

## Pressure sensor characteristics

(unless otherwise specified, Ta=25°C, VDD=VDDIO=3.4V)

| Item                                                                    | Symbol                              | Condition                                              | Min.  | Typ.  | Max.  | Unit        |
|-------------------------------------------------------------------------|-------------------------------------|--------------------------------------------------------|-------|-------|-------|-------------|
| Pressure resolution                                                     | P <sub>Res</sub>                    | -                                                      | -     | 0.001 | -     | mmHg        |
| Pressure effective resolution                                           | P <sub>Eres1</sub>                  | MODE1<br>(tcon1 = Typ. 15.625msec)                     | -     | 0.020 | 0.040 | mmHg<br>RMS |
|                                                                         | P <sub>Eres2</sub>                  | MODE2<br>(tcon2 = Typ. 7.81msec)                       | -     | 0.028 | 0.056 |             |
|                                                                         | P <sub>Eres3</sub>                  | MODE3<br>(tcon3 = Typ. 3.91msec)                       | -     | 0.040 | 0.080 |             |
|                                                                         | P <sub>Eres4</sub>                  | MODE4<br>(tcon4 = Typ. 250msec)                        | -     | 0.005 | 0.010 |             |
| Pressure offset                                                         | P <sub>Off</sub>                    | No air pressure<br>Ta = 5°C~45°C                       | -5    | 0     | 5     | mmHg        |
| Pressure span                                                           | P <sub>S</sub>                      | 0 ~ 300mmHg<br>Ta = 5°C~45°C                           | 298.1 | 300   | 301.9 | mmHg        |
| Pressure linearity                                                      | P <sub>L</sub>                      | 0 ~ 300mmHg<br>Ta = 5°C~45°C                           | -0.6  | 0     | 0.6   | mmHg        |
| Pressure measurement error                                              | P <sub>Err</sub>                    | 0 ~ 300mmHg<br>Ta = 5°C~45°C                           | -7    | -     | 7     | mmHg        |
| Pressure measurement error<br>- Pressure offset<br>(note <sup>2</sup> ) | P <sub>Err</sub> - P <sub>Err</sub> | 0 ~ 300mmHg<br>Ta = 5°C~45°C                           | -2    | -     | 2     | mmHg        |
|                                                                         |                                     | -10 ~ 330mmHg<br>Ta = 5°C~45°C<br>(note <sup>3</sup> ) |       |       |       |             |

note<sup>2</sup>: It can take advantage of the performance to the fullest by canceling the pressure offset.note<sup>3</sup>: This item is not inspected at the time of shipment.

## Temperature sensor characteristics

(unless otherwise specified, Ta=25°C, VDD=VDDIO=3.4V)

| Item                          | Symbol           | Conditions | Min. | Typ. | Max. | Unit |
|-------------------------------|------------------|------------|------|------|------|------|
| Temperature measurement error | T <sub>Err</sub> | 5°C ~ 45°C | -2.0 | -    | 2.0  | °C   |

## Definition of characteristics

### Pressure resolution $P_{Res}$

This Value is equivalent to 1LSB of output digital value.

### Pressure effective resolution $P_{Eres}$

Measure 16 points after the pressure output is stable, and it is the standard deviation of the 16 points.

### Pressure offset $P_{Off}$

It is the output under no air pressure.

### Pressure span $P_s$

The difference between the pressure measurement value of 300mmHg and no air pressure.

### Pressure linearity $P_L$

It is the amount of deviation from the Ref. line that linked measurement value 0mmHg-300mmHg.

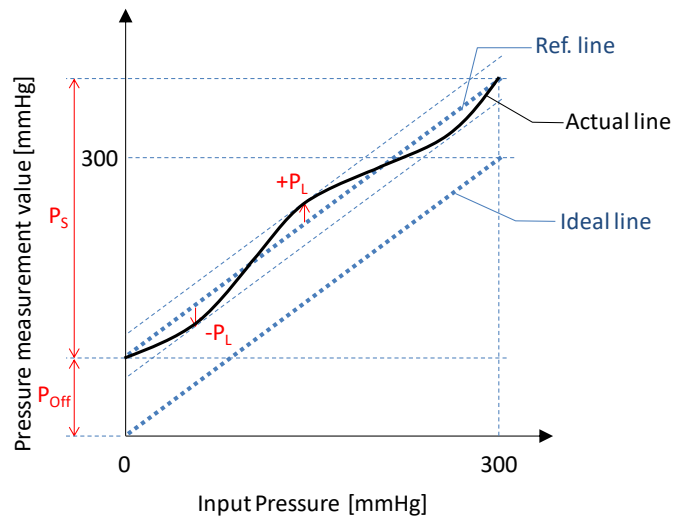


Fig. 4 Pressure offset, Pressure span, Pressure linearity

**Pressure measurement error  $P_{Err}$** 

Pressure measurement error  $P_{Err}$  is the amount of deviation from the ideal line. It is the error integrated Pressure offset  $P_{Off}$ , Pressure span  $P_s$  error and Pressure linearity  $P_L$  error by the formula(1).

$$P_{Err} = P_{Off} + \sqrt{(P_{Serr}^2 + P_L^2)} \quad [mmHg] \quad (1)$$

$P_{Serr}$ : Error of  $P_s$

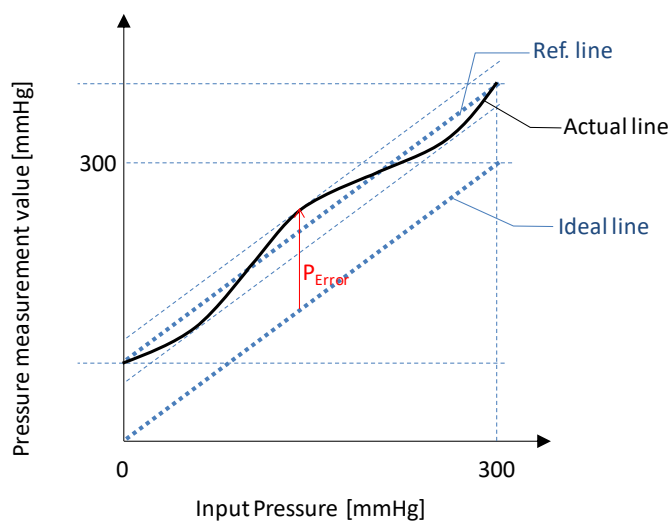


Fig. 5 Pressure measurement error

## FUNCTION EXPLANATION

### Function Outline

The MMR902 consists of piezoresistive pressure sensor and an analog front end IC.

It converts analog output voltage from piezoresistive pressure sensor to digital value of 24 bits, and corrects and outputs variations of sensor characteristics due to variations of temperature and process.

## Flow chart of pressure/temperature measurement

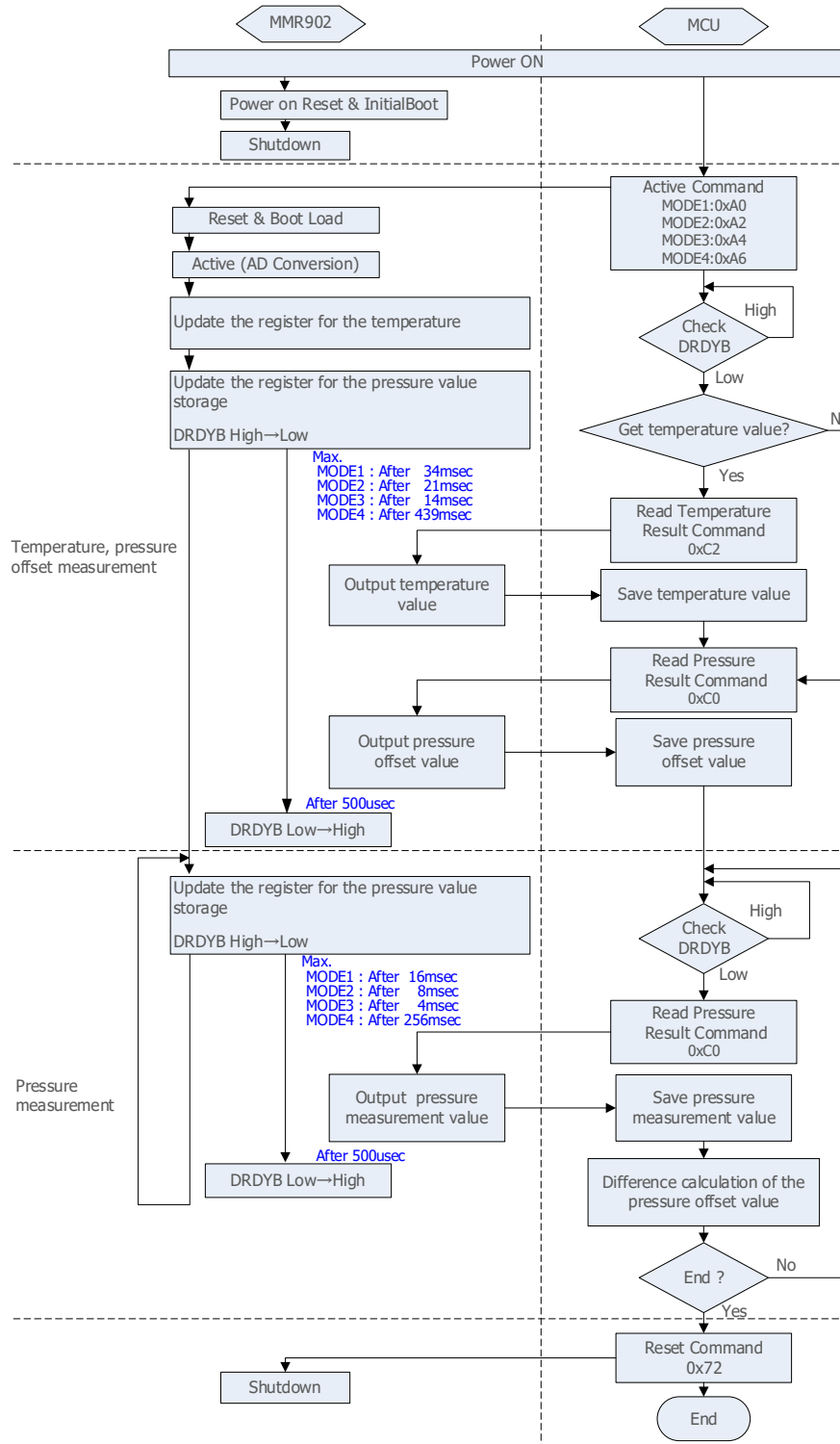


Fig. 6 Flow chart of pressure/temperature measurement

## SERIAL COMMUNICATION INTERFACE

It supports SPI and I2C as an interface for serial communication. SPI (max. 5Mbps) or I2C (max.3.4Mbps) can be selected by PSEL terminal. When PSEL terminal is set to High, SPI will be selected. When it is set to Low, I2C will be selected. Please set High voltage of PSEL terminal the same potential as VDDIO terminal.

## Baud rate

※ This item is not inspected at the time of shipment.  
(unless otherwise specified, Ta=25°C, VDD=3.4V)

| Item                    | Symbol             | Conditions                 | Min. | Typ. | Max. | Unit |
|-------------------------|--------------------|----------------------------|------|------|------|------|
| I2C communication speed | BR <sub>I2C1</sub> | VDDIO ≥ 2.0V<br>Cb ≤ 100pF | -    | -    | 3.4  | Mbps |
|                         | BR <sub>I2C2</sub> | VDDIO < 2.0V<br>Cb < 100pF | -    | -    | 0.4  |      |
|                         | BR <sub>I2C3</sub> | VDDIO ≥ 2.0V<br>Cb ≤ 400pF | -    | -    | 1.7  |      |
|                         | BR <sub>I2C4</sub> | VDDIO < 2.0V<br>Cb < 400pF | -    | -    | 0.4  |      |
| SPI communication speed | BR <sub>SPI1</sub> | VDDIO ≥ 2.0V<br>Cb ≤ 100pF | -    | -    | 5.0  |      |
|                         | BR <sub>SPI2</sub> | VDDIO < 2.0V<br>Cb < 100pF | -    | -    | 1.0  |      |
|                         | BR <sub>SPI3</sub> | VDDIO ≥ 2.0V<br>Cb ≤ 400pF | -    | -    | 2.5  |      |
|                         | BR <sub>SPI4</sub> | VDDIO < 2.0V<br>Cb < 400pF | -    | -    | 0.5  |      |

SPI format

SPI command format is shown below. Data send/receive is started when CSB becomes low level from the status when SCLK is high level. Input data is sampled on rising edges of the SCLK. (SPI MODE 3) For the detailed timing, please refer to the each command format.

SPI Operation Command format

- Corresponding Command
- Reset Command (0x72)
  - Active Command (0xA0, 0xA2, 0xA4, 0xA6)

Please send command code of 8 bits. When their commands are received, it turns over ACK to 8 bits and it performs operation corresponding to each command.

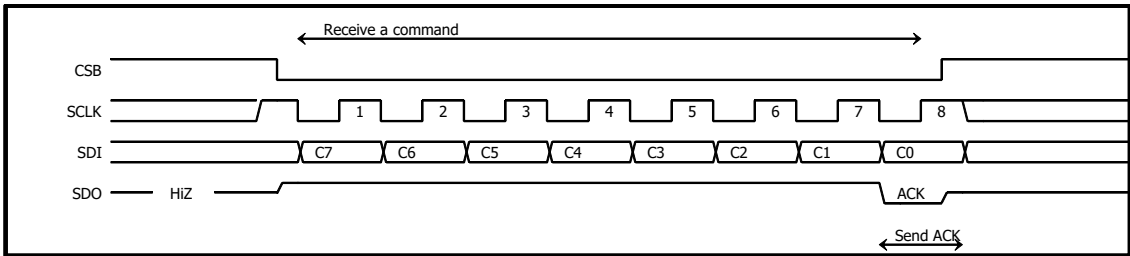


Fig. 7 SPI Operation command format

SPI Result command format

- Corresponding Command
- Result command (0xC0, 0xC2)
  - Status command (0x80)

Please send reset command or active command of 8 bits. When the command is received, it turns over ACK to 8 bits and it outputs the data at 24 bits, MSB first. At the Status command, it is immediately output from D7 to D0 after ACK transmission.

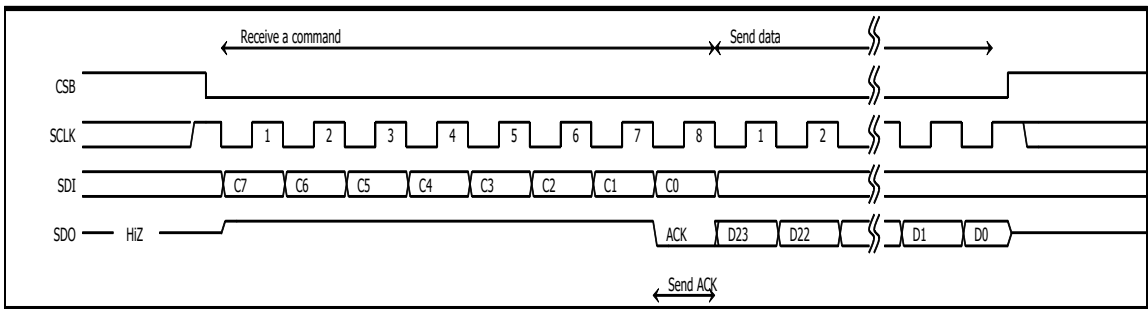


Fig. 8 SPI Result command format (during 24-bit data output.)

## SPI AC Characteristics

※ This item is not inspected at the time of shipment.

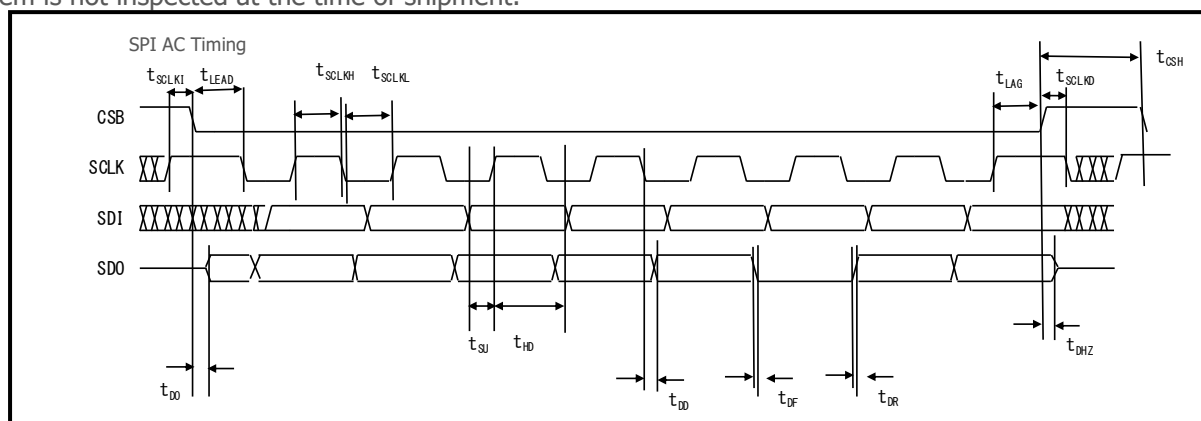


Fig. 9 SPI AC timing chart

Table 2 SPI AC Characteristics

| Items                                                       | Symbol      | VDDIO<2V |      | VDDIO≥2V |      | Unit |
|-------------------------------------------------------------|-------------|----------|------|----------|------|------|
|                                                             |             | min.     | max. | min.     | max. |      |
| SCLK frequency (Duty 50±10%)                                | $f_{SCLK}$  | -        | 1    | -        | 5    | MHz  |
| SCLK High period (90%~90%)                                  | $t_{SCLKH}$ | 400      | -    | 80       | -    | ns   |
| SCLK Low period (10%~10%)                                   | $t_{SCLKL}$ | 400      | -    | 80       | -    | ns   |
| SCLK standby time                                           | $t_{SCLKI}$ | 500      | -    | 100      | -    | ns   |
| SCLK delay time                                             | $t_{SCLKD}$ | 0        | -    | 0        | -    | ns   |
| CSB High period (90%~90%)                                   | $t_{CSH}$   | 1000     | -    | 200      | -    | ns   |
| Time from CSB falling edge to SCLK falling edge             | $t_{LEAD}$  | 0        | -    | 0        | -    | ns   |
| Time from SCLK rising edge to CSB rising edge               | $t_{LAG}$   | 500      | -    | 100      | -    | ns   |
| SDI setup time                                              | $t_{SU}$    | 100      | -    | 10       | -    | ns   |
| SDI hold time                                               | $t_{HD}$    | 10       | -    | 10       | -    | ns   |
| SDO rise time (Load: 100pF) (10%~90%)                       | $t_{DR}$    | -        | 50   | -        | 50   | ns   |
| SDO fall time (Load: 100pF) (10%~90%)                       | $t_{DF}$    | -        | 50   | -        | 50   | ns   |
| SDO output delay time (Load: 100pF)                         | $t_{DDY}$   | -        | 120  | -        | 60   | ns   |
| SDO output delay time (Load 100pF) from CSB became Low      | $t_{ACC}$   | -        | 120  | -        | 60   | ns   |
| Time from CSB reaches High to SDO reaches HiZ (Load: 100pF) | $t_{DHZ}$   | -        | 170  | -        | 170  | ns   |

I2C format

I2C address is the total of 8 bits ; The first 7 bits are slave address and the rest of 1 bit is R/W bit. Slave address for MMR902 (7 bits) is 0x65. I2C address (8 bits) will be 0xCA(Write) and 0xCB(Read) by combining with R/W bit.

Table 3 I2C address

| HEX. | I2C Address (8 bit)   |    |    |    |    |    |    |         |
|------|-----------------------|----|----|----|----|----|----|---------|
|      | Slave address (7 bit) |    |    |    |    |    |    | R/W bit |
|      | A6                    | A5 | A4 | A3 | A2 | A1 | A0 |         |
| 0xCA | 1                     | 1  | 0  | 0  | 1  | 0  | 1  | 0       |
| 0xCB | 1                     | 1  | 0  | 0  | 1  | 0  | 1  | 1       |

I2C Operation command format

- Corresponding Command
- Reset Command (0x72)
  - Active Command (0xA0, 0xA2, 0xA4, 0xA6)

Please send I2C address of 8 bits (0xCA) by Write Mode. When the command is received, it turns over ACK to 9 bits. Then please send command code of 8bits. When the command is received, it turns over ACK to 9 bits and it performs operation corresponding to each command.

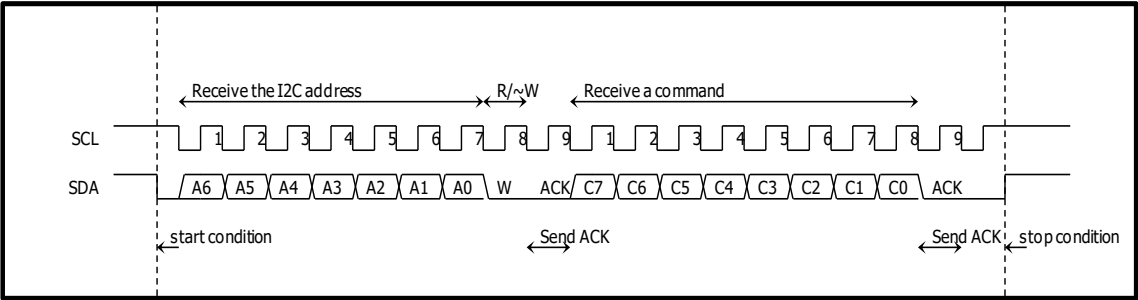


Fig. 10 I2C Operation command format

**I2C Result command format**

Corresponding Command

- Result command (0xC0, 0xC2)
- Status command (0x80)

Please send I2C address of 8 bits (0xCA) and the command by Write Mode. When the address and the command is received, it turns over ACK to 9 bits. Then please send I2C address of 8 bits (0xCB) by Read Mode. When the address is received, it turns over ACK to 9 bits and it outputs the data at 24 bits in steps of 8 bits, MSB first. Please send ACK every 8 bits. At the status command, only 8-bit data from D7 to D0 is output.

MMR902 quits immediately communication when receiving NACK.

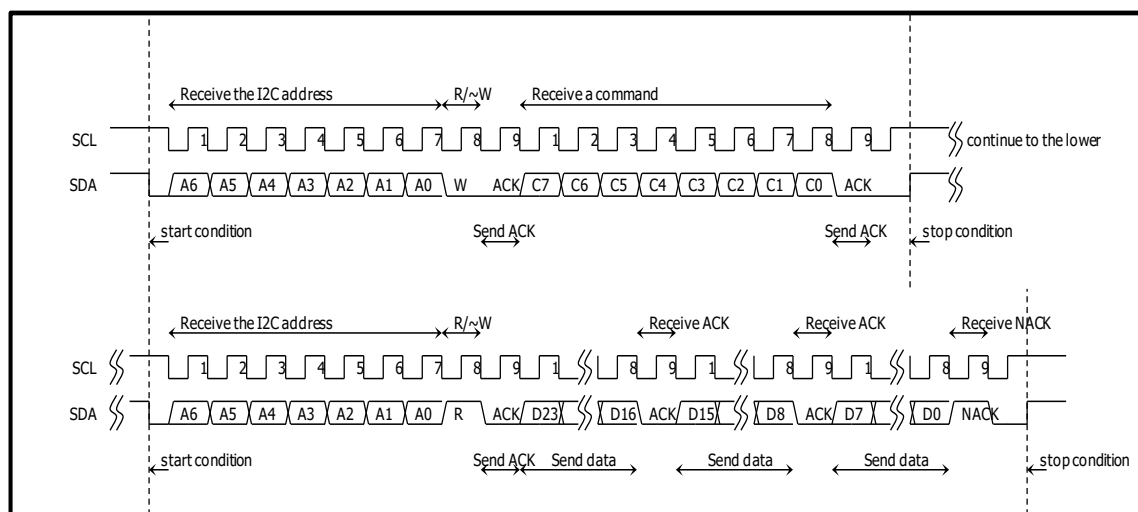


Fig. 11 I2C Result command format

## I2C AC Characteristics

※ This item is not inspected at the time of shipment

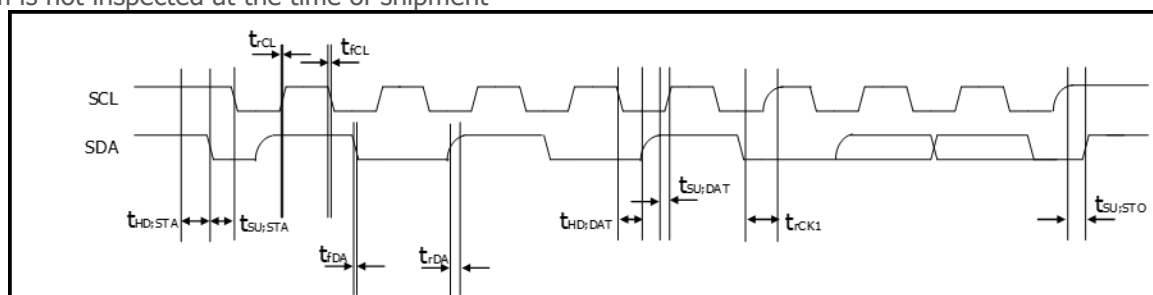


Fig. 12 I2C AC timing chart

Table 4 I2C AC Characteristics

| Items                                                           | Symbol              | VDDIO < 2.0V |        | VDDIO ≥ 2.0V |      |          |     | Unit |
|-----------------------------------------------------------------|---------------------|--------------|--------|--------------|------|----------|-----|------|
|                                                                 |                     | Fast mode    |        | Hsmode       |      |          |     |      |
|                                                                 |                     |              |        | Cb=100pF     |      | Cb=400pF |     |      |
|                                                                 |                     |              |        |              |      |          |     |      |
| min.                                                            | max.                | min.         | max.   | min.         | max. |          |     |      |
| SCL frequency                                                   | f <sub>SCL</sub>    | 0            | 400kHz | 0            | 3.4  | 0        | 1.7 | MHz  |
| Start condition setup time                                      | t <sub>SU;STA</sub> | 600          | -      | 160          | -    | 160      | -   | ns   |
| Start condition hold time                                       | t <sub>HD;STA</sub> | 600          | -      | 160          | -    | 160      | -   | ns   |
| Stop condition setup time                                       | t <sub>SU;STO</sub> | 600          | -      | 160          | -    | 160      | -   | ns   |
| Data setup time                                                 | t <sub>SU;DAT</sub> | 100          | -      | 20           | -    | 20       | -   | ns   |
| Data hold time (note <sup>4</sup> )                             | t <sub>HD;DAT</sub> | 20           | -      | 20           | 70   | 20       | 150 | ns   |
| SCL rise time                                                   | t <sub>rCL</sub>    | -            | 300    | 10           | 40   | 20       | 80  | ns   |
| Rise time of SCL after ACK<br>(When clock stretch is released.) | t <sub>rCL1</sub>   | -            | 300    | 10           | 80   | 20       | 160 | ns   |
| SCL fall time                                                   | t <sub>fCL</sub>    | 10           | 300    | 10           | -    | 20       | 80  | ns   |
| SDA rise time                                                   | t <sub>rDA</sub>    | -            | 300    | 10           | 80   | 20       | 160 | ns   |
| SDA fall time                                                   | t <sub>fDA</sub>    | 10           | 300    | 10           | 80   | 20       | 160 | ns   |

note<sup>4</sup>: This product does not have the function to retain data in SDA.

Please ensure the hold of SDA with 20nsec for the area where SCL falling edge is not defined.

Command code

Table 5 Operation command list

| Command Name |                   | Command Code |      |    |    |    |    |    |    |    | Action                             |
|--------------|-------------------|--------------|------|----|----|----|----|----|----|----|------------------------------------|
|              |                   | HEX.         | BIN. |    |    |    |    |    |    |    |                                    |
|              |                   |              | C7   | C6 | C5 | C4 | C3 | C2 | C1 | C0 |                                    |
| Reset        |                   | 0x72         | 0    | 1  | 1  | 1  | 0  | 0  | 1  | 0  | Reset and Return to Shutdown state |
| Active       | Measure at MODE 1 | 0xA0         | 1    | 0  | 1  | 0  | 0  | 0  | 0  | 0  | Start measure at MODE1             |
|              | Measure at MODE 2 | 0xA2         | 1    | 0  | 1  | 0  | 0  | 0  | 1  | 0  | Start measure at MODE2             |
|              | Measure at MODE 3 | 0xA4         | 1    | 0  | 1  | 0  | 0  | 1  | 0  | 0  | Start measure at MODE3             |
|              | Measure at MODE 4 | 0xA6         | 1    | 0  | 1  | 0  | 0  | 1  | 1  | 0  | Start measure at MODE4             |

Table 6 Result command list

| Command Name            | Command Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      |    |    |          |    |         |    |             | Action                                                |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----|----|----------|----|---------|----|-------------|-------------------------------------------------------|
|                         | HEX.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | BIN. |    |    |          |    |         |    |             |                                                       |
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | C7   | C6 | C5 | C4       | C3 | C2      | C1 | C0          |                                                       |
| Read Temperature Result | 0xC0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1    | 1  | 0  | 0        | 0  | 0       | 0  | 0           | Read pressure result                                  |
|                         | Read compensated pressure result.<br>It outputs the result of pressure measurement at 24bits, MSB first.<br>A negative number is expressed by 2's complement.<br>About output range, in case of positive output : 000000 h ~ 7FFFFFFF h (in decimal number : 0 ~ 8388607), in case of negative output : FFFFFFFF h ~ 800000 h (in decimal number : -1 ~ -8388608)<br>However, the result of measurement when being used beyond a recommended operating condition can't be guaranteed.<br><br>Pressure value = DEC. / 1000<br><br>Output example:       |      |    |    |          |    |         |    |             |                                                       |
|                         | BIN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |    |    | HEX.     |    | DEC.    |    | Pressure    |                                                       |
|                         | 11111111110100010010000 b                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |    |    | FFE890 h |    | -6000   |    | -6.000mmHg  |                                                       |
|                         | 00000000000000000000000 b                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |    |    | 000000 h |    | 0       |    | 0.000mmHg   |                                                       |
|                         | 000001001001001111100000 b                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |    |    | 0493E0 h |    | 300000  |    | 300.000mmHg |                                                       |
| Read Temperature Result | 0xC2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1    | 1  | 0  | 0        | 0  | 0       | 1  | 0           | Read temperature result                               |
|                         | Read compensated temperature result.<br>It outputs the result of pressure measurement at 24bits, MSB first.<br>A negative number is expressed by 2's complement.<br>About output range, in case of positive output : 000000 h ~ 7FFFFFFF h (in decimal number : 0 ~ 8388607), in case of negative output : FFFFFFFF h ~ 800000 h (in decimal number : -1 ~ -8388608)<br>However, the result of measurement when being used beyond a recommended operating condition can't be guaranteed.<br><br>Temperature value = DEC. / 2^16<br><br>Output example: |      |    |    |          |    |         |    |             |                                                       |
|                         | BIN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |    |    | HEX.     |    | DEC.    |    | Temperature |                                                       |
|                         | 0000010100000000000000000 b                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |    |    | 050000 h |    | 327680  |    | 5.000 °C    |                                                       |
|                         | 0001100100000000000000000 b                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |    |    | 190000 h |    | 1638400 |    | 25.000 °C   |                                                       |
|                         | 0010110100000000000000000 b                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |    |    | 2D0000 h |    | 2949120 |    | 45.000 °C   |                                                       |
| Status                  | 0x80                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1    | 0  | 0  | 0        | 0  | 0       | 0  | 0           | Output status signals that can indicate the IC status |
|                         | Output 8bits data depending on the IC conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |    |    |          |    |         |    |             |                                                       |
|                         | D7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | D6   | D5 | D4 | D3       | D2 | D1      | D0 | State       |                                                       |
|                         | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0    | 0  | 0  | 0        | 0  | 0       | 0  | Shutdown    |                                                       |
|                         | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1    | 1  | 0  | 1        | 1  | 0       | 1  | Active      |                                                       |

State transition table

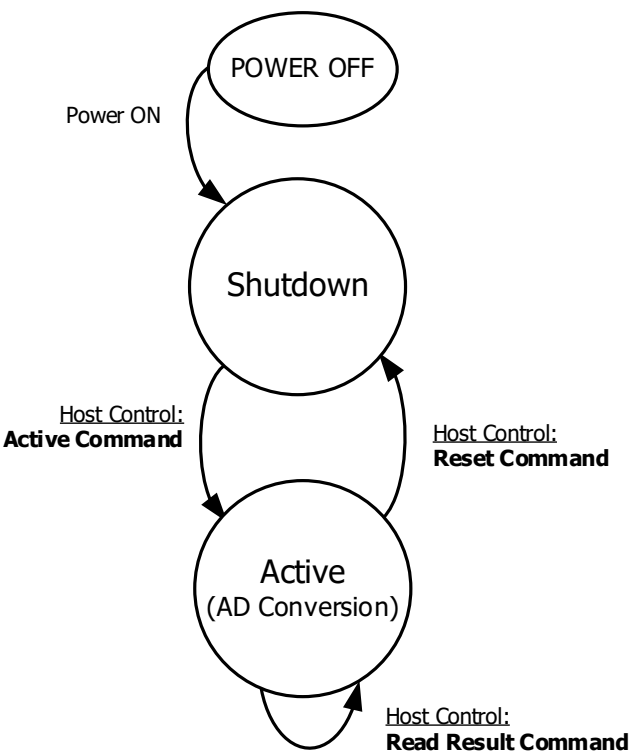


Fig. 13 State transition diagram

| State \ Command | Shutdown                                         | Active                                  |
|-----------------|--------------------------------------------------|-----------------------------------------|
| Reset           | Power on Reset & InitialBoot =>Shutdown          | Power on Reset & InitialBoot =>Shutdown |
| Active          | Reset & Boot Load =>Active state (AD conversion) | Ignore(note <sup>5</sup> ) =>Keep state |
| Result          | Ignore(note <sup>5</sup> ) =>Keep state          | Output result =>Keep state              |
| Status          | Output code =>Keep state                         | Output code =>Keep state                |

Table 7 State transition table

note<sup>5</sup>: NACK is returned to the command.

Timing Chart

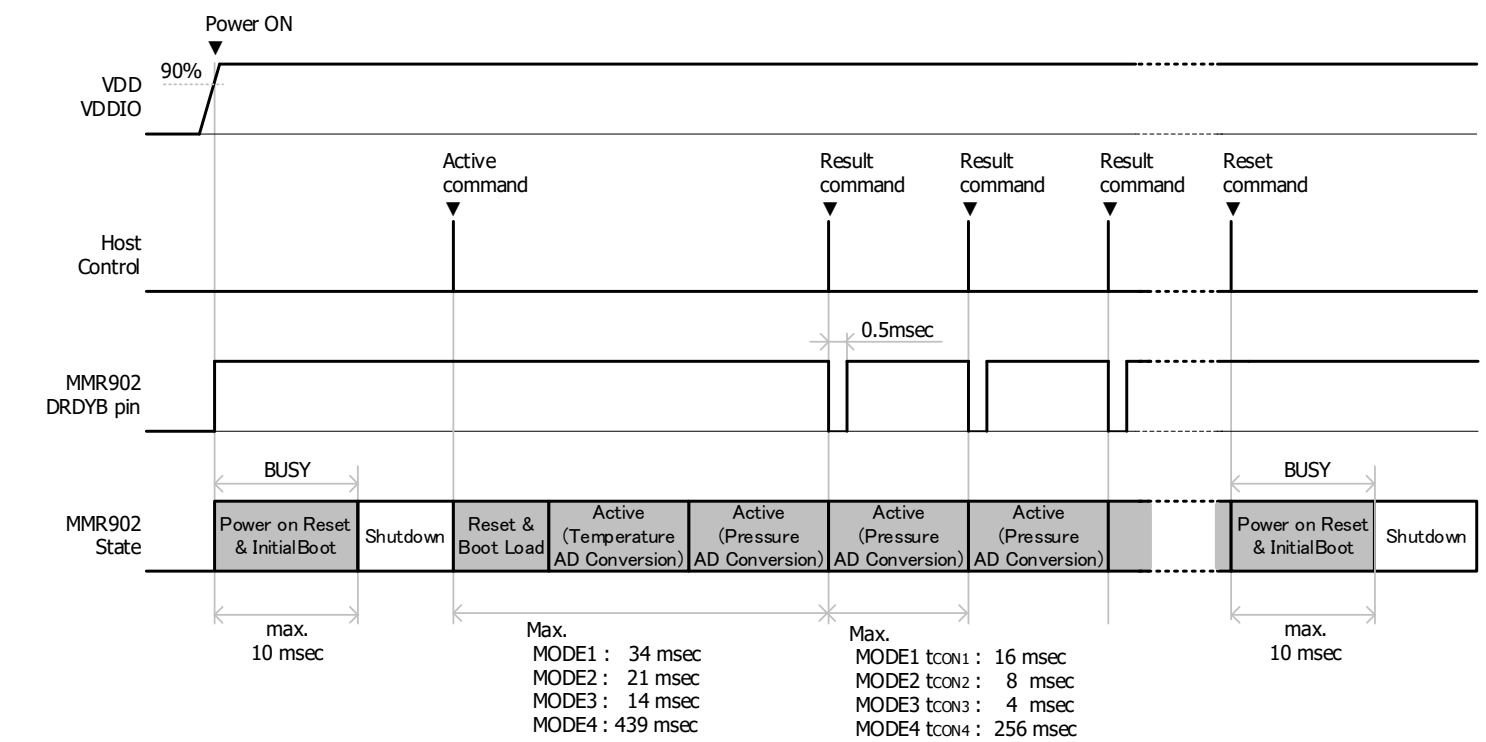


Fig. 14 Timing Chart

note<sup>6</sup>: Power on reset voltage is set to 1.62V in case of VDD<1.8V, and set to 1.08V in case of VDDIO<1.2V.

## TYPICAL APPLICATION CIRCUIT

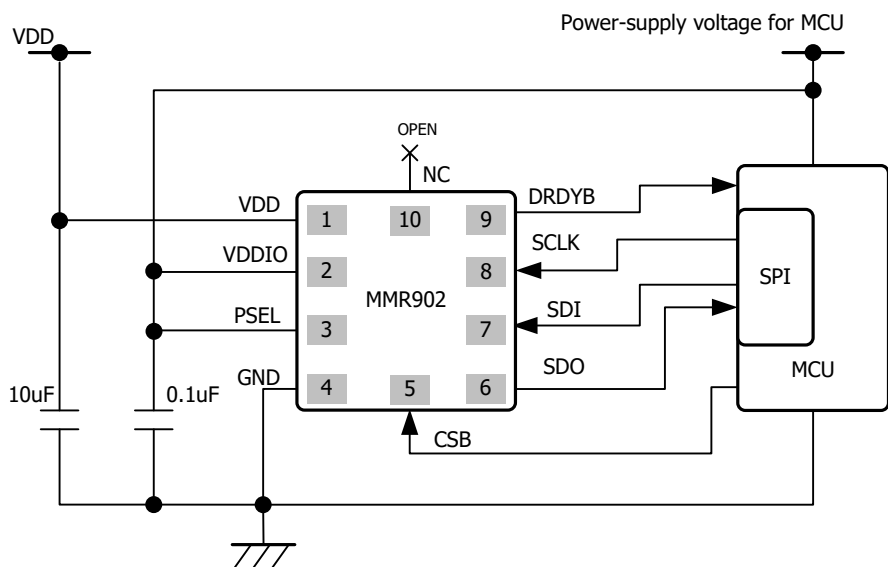


Fig. 15 Typical Electrical Connection (SPI)

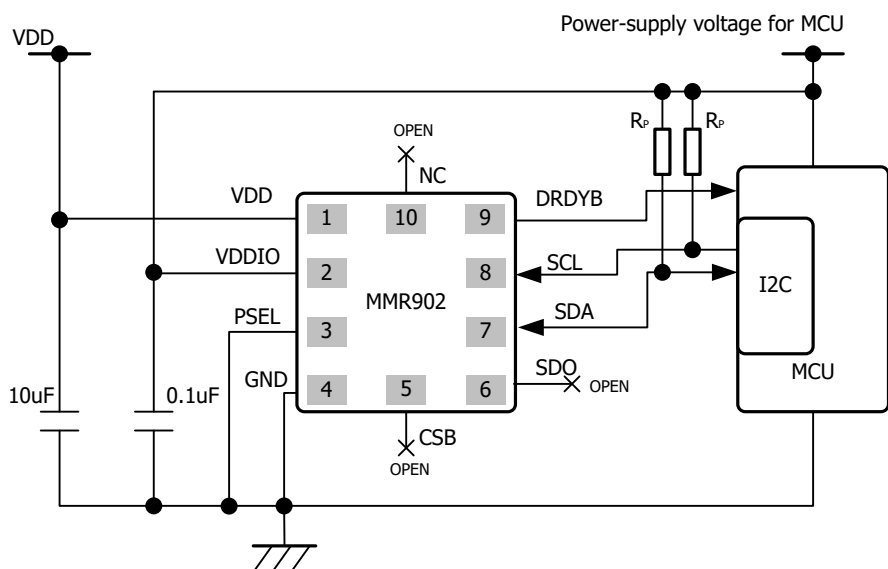


Fig. 16 Typical Electrical Connection (I2C)

TYPICAL PERFORMANCE CHARACTERISTICS

(unless otherwise specified, Ta=25°C,VDD=VDDIO=3.4V)

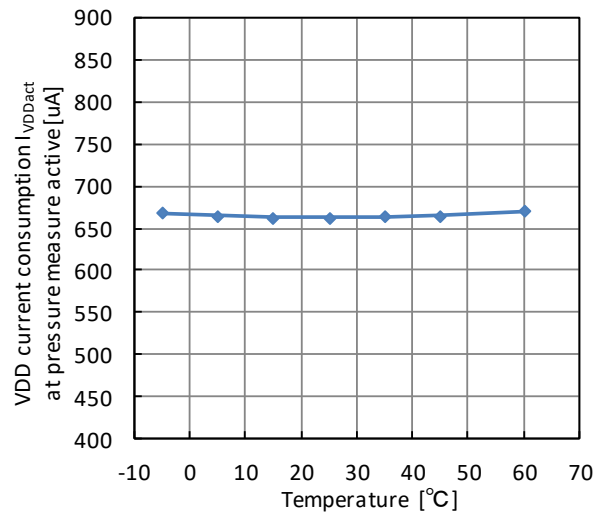


Fig. 17.1 VDD current consumption  $I_{VDDact}$  at pressure measure active temperature characteristic

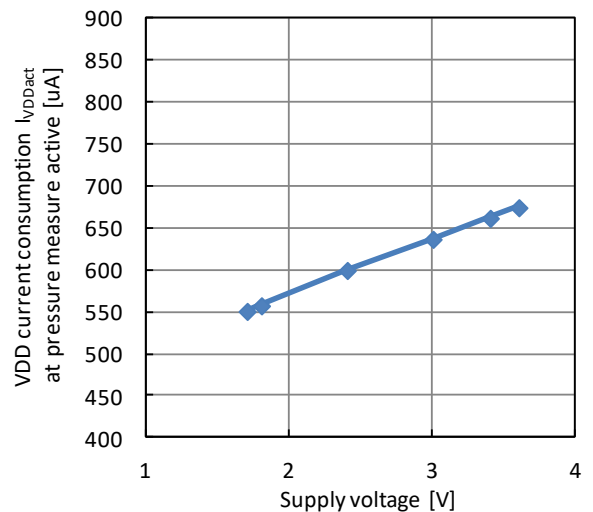


Fig. 17.2 VDD current consumption  $I_{VDDact}$  at pressure measure active supply voltage characteristic

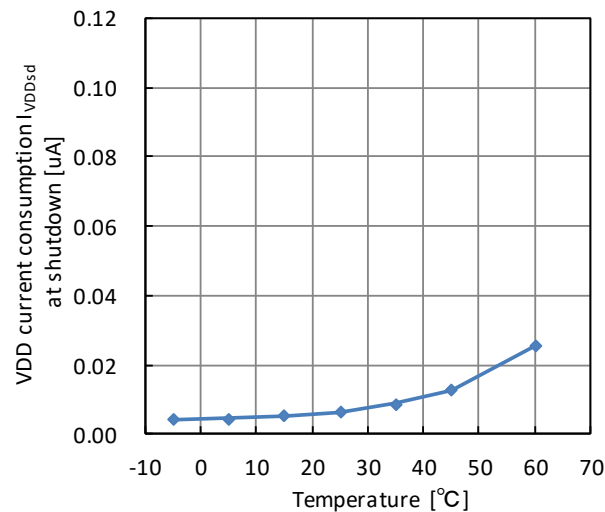


Fig. 17.3 VDD current consumption  $I_{VDDsd}$  at shutdown temperature characteristic

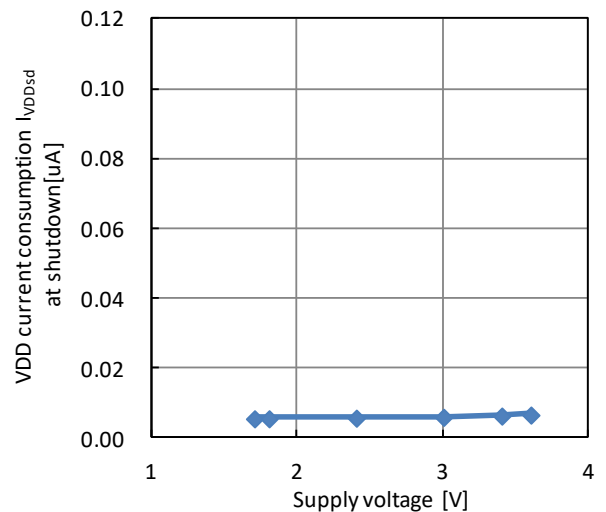


Fig. 17.4 VDD current consumption  $I_{VDDsd}$  at shutdown supply voltage characteristic

(unless otherwise specified, Ta=25°C,VDD=VDDIO=3.4V)

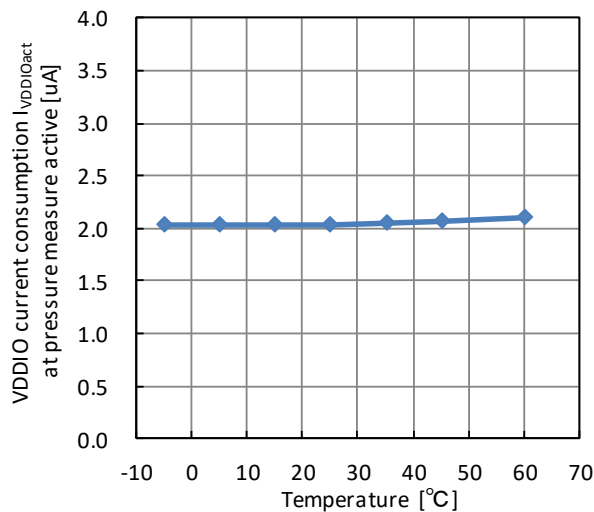


Fig. 17.5 VDDIO current consumption  $I_{VDDIOact}$  at pressure measure active temperature characteristic

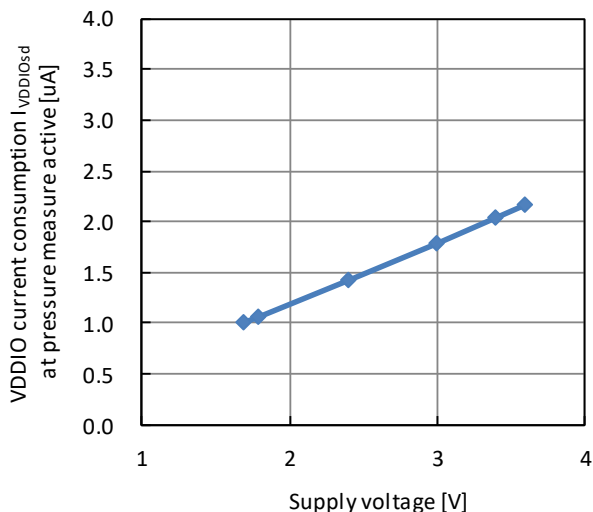


Fig. 17.6 VDDIO current consumption  $I_{VDDIOact}$  at pressure measure active supply voltage characteristic

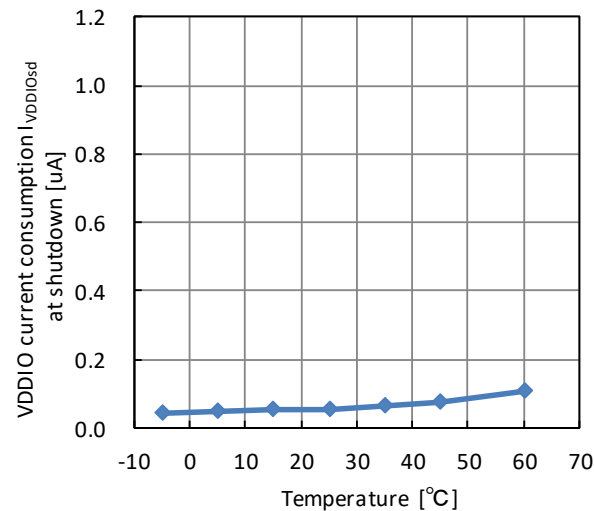


Fig. 17.7 VDDIO current consumption  $I_{VDDIOsd}$  at shutdown temperature characteristic

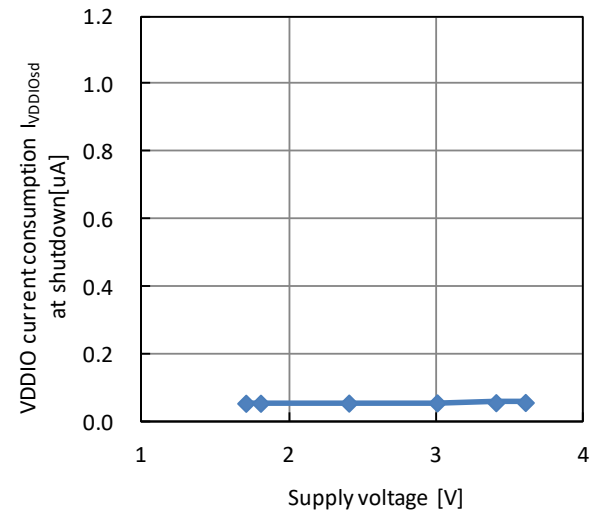


Fig. 17.8 VDDIO current consumption  $I_{VDDIOsd}$  at shutdown supply voltage characteristic

(unless otherwise specified, Ta=25°C,VDD=VDDIO=3.4V)

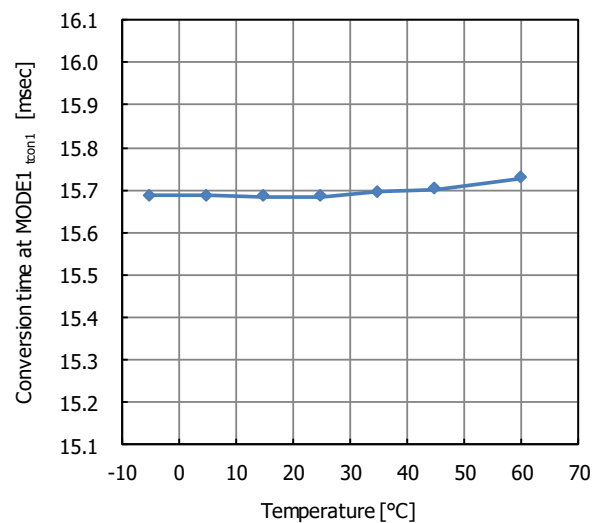


Fig. 17.9 Conversion time at MODE 1 temperature characteristic

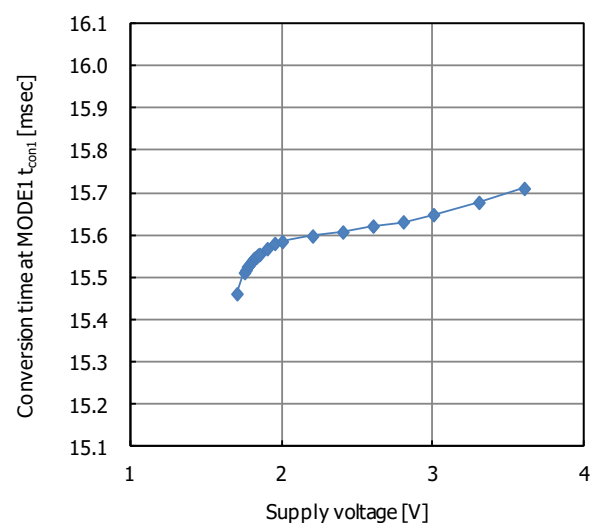


Fig. 17.10 Conversion time at MODE 1 supply voltage characteristic

(unless otherwise specified, Ta=25°C,VDD=VDDIO=3.4V)

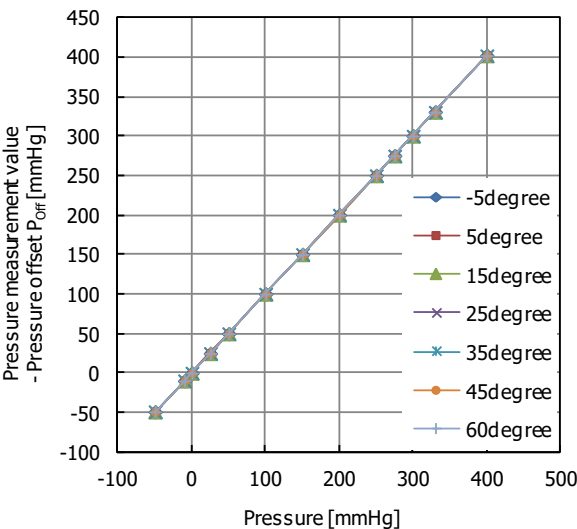


Fig. 17.11 Pressure measurement value - Pressure offset P<sub>Off</sub> temperature characteristic (note<sup>7</sup>)

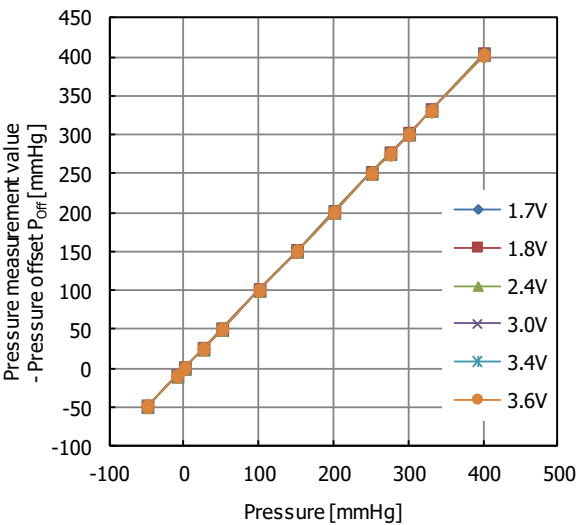


Fig. 17.12 Pressure measurement value - Pressure offset P<sub>Off</sub> supply voltage characteristic (note<sup>7</sup>)

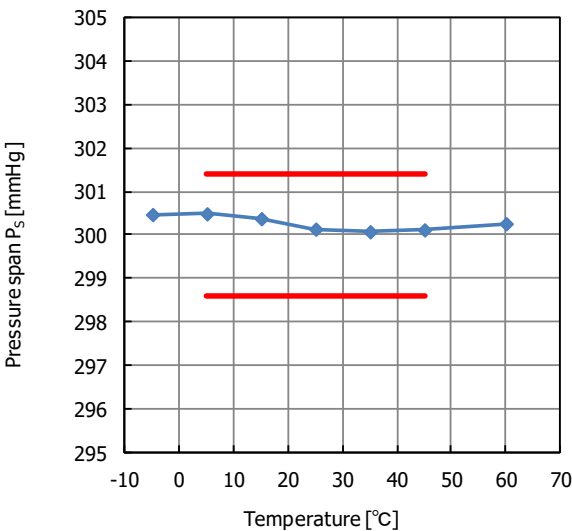


Fig. 17.13 Pressure span P<sub>s</sub> temperature characteristic (note<sup>7</sup>)

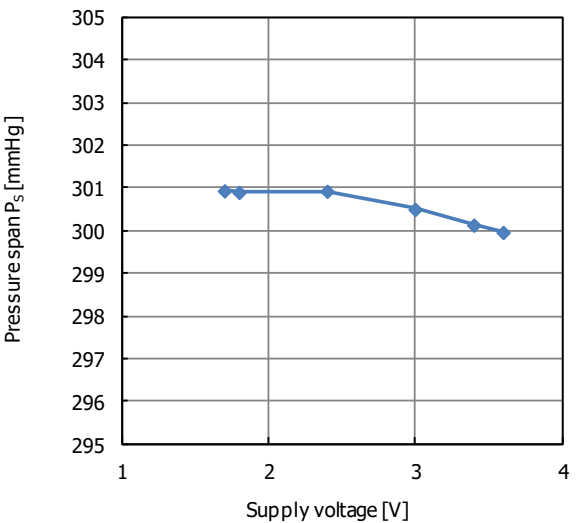


Fig. 17.14 Pressure span P<sub>s</sub> supply voltage characteristic (note<sup>7</sup>)

note<sup>1</sup>: Corrected at 3.4V.

(unless otherwise specified, Ta=25°C,VDD=VDDIO=3.4V)

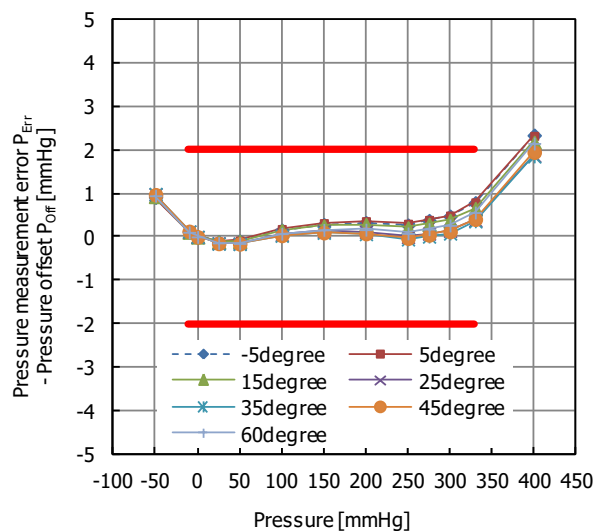


Fig. 17.15 Pressure measurement error P<sub>Err</sub>  
- Pressure offset P<sub>Off</sub>  
temperature characteristic (note<sup>7</sup>)

note<sup>1</sup>: Corrected at 3.4V.

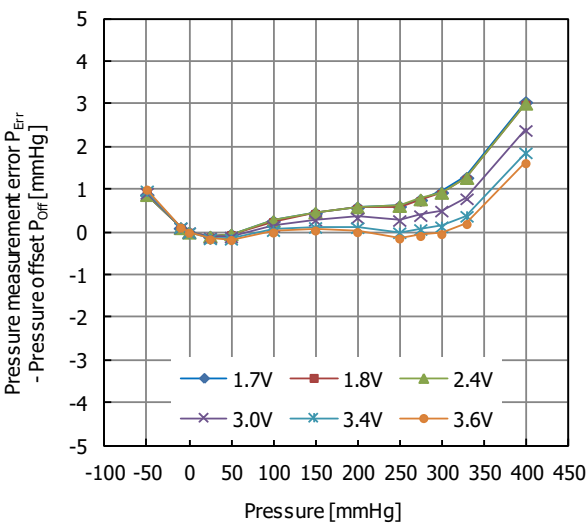
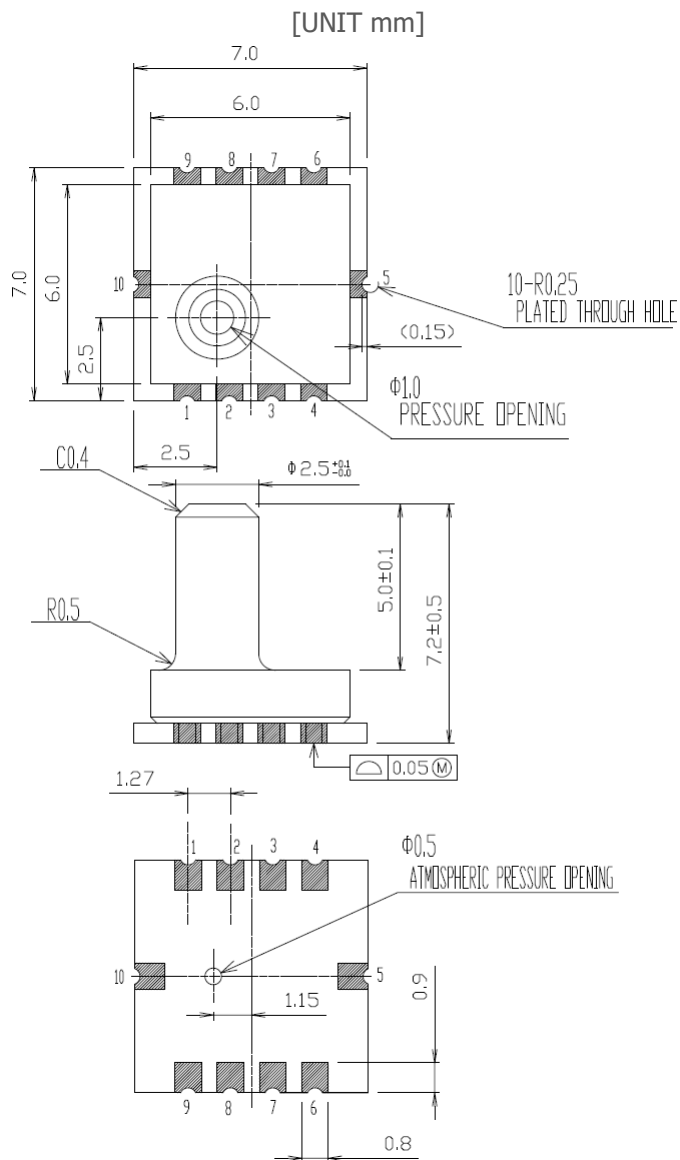


Fig. 17.16 Pressure measurement error P<sub>Err</sub>  
- Pressure offset P<sub>Off</sub>  
supply voltage characteristic (note<sup>7</sup>)

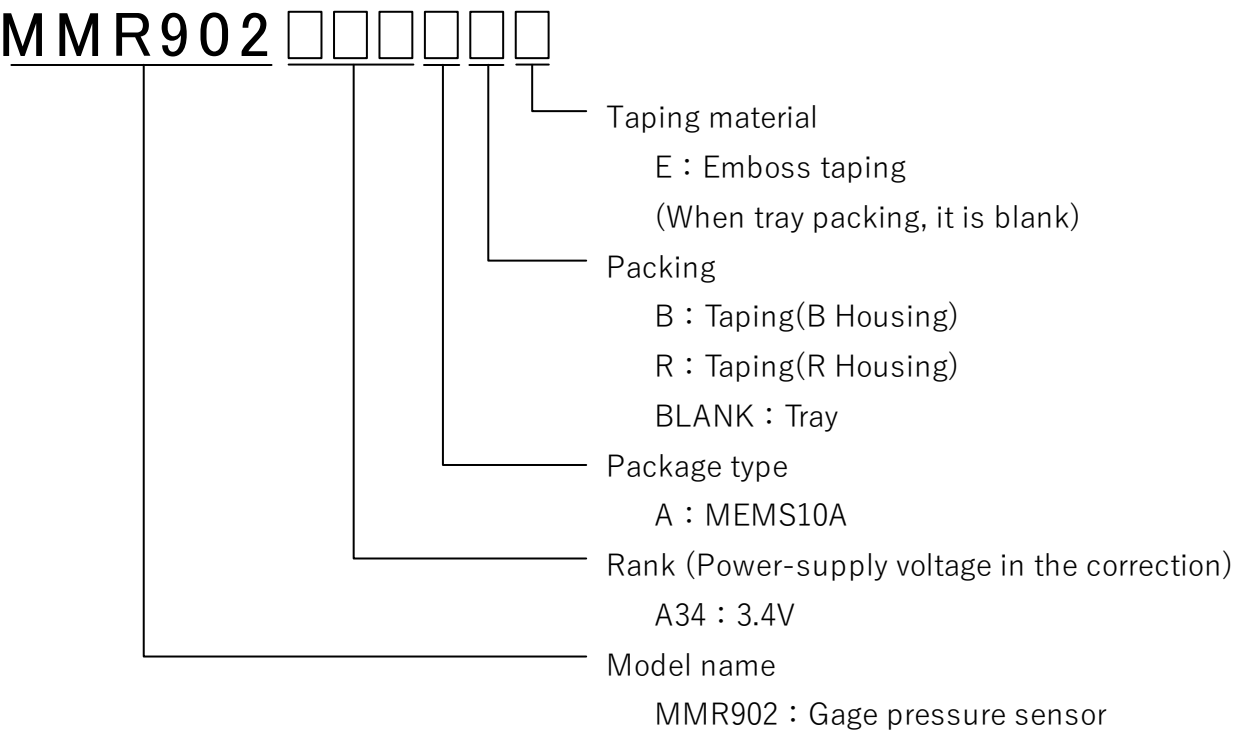
**Package Name: MEMS10A**



| Pin No. | Name     |
|---------|----------|
| 1       | VDD      |
| 2       | VDDIO    |
| 3       | PSEL     |
| 4       | GND      |
| 5       | CSB      |
| 6       | SDO      |
| 7       | SDI/SDA  |
| 8       | SCLK/SCL |
| 9       | DRDYB    |
| 10      | NC       |

|                |                                |
|----------------|--------------------------------|
| Grade          | FR-4                           |
| UL             | 94V-0                          |
| Thickness      | 0.6±0.1                        |
| Structure      | 2Layers PCB with through holes |
| Parts assemble | One side                       |
| Solder resist  | Both side                      |

PRODUCT NAME



PRODUCT LINEUP

| Product Name | Packing   | Status |
|--------------|-----------|--------|
| MMR902A34A   | Tray      | MP     |
| MMR902A34ABE | Taping(B) | MP     |
| MMR902A34ARE | Taping(R) | MP     |

## PRESSURE SENSOR LINEUP

| Function                           | Product Name | Size<br>[mm]<br>(L x W x H) | Pressure<br>Range<br>[Pa] | Full<br>Scale<br>[Pa] | Pressure<br>Measurement<br>error<br>[%FS] | Span<br>Accuracy<br>[%FS] | Effective<br>Resolution<br>[PaRMS] | Packing       | Halogen | Status     |
|------------------------------------|--------------|-----------------------------|---------------------------|-----------------------|-------------------------------------------|---------------------------|------------------------------------|---------------|---------|------------|
| Gage<br>Pressure<br>Sensor         | MMR920C02A   | 7 x 7 x<br>7.2              | -1,961<br>~ 1,961         | 1,961                 | 2.0                                       | 1.30                      | 0.2                                | Tray          | Contain | Developing |
|                                    | MMR920C02ARE | 7 x 7 x<br>7.2              | -1,961<br>~ 1,961         | 1,961                 | 2.0                                       | 1.30                      | 0.2                                | Taping<br>(R) | Contain | Developing |
|                                    | MMR920C04A   | 7 x 7 x<br>7.2              | -3,922<br>~ 3,922         | 3,922                 | 1.0                                       | 0.65                      | 0.2                                | Tray          | Contain | MP         |
|                                    | MMR920C04ARE | 7 x 7 x<br>7.2              | -3,922<br>~ 3,922         | 3,922                 | 1.0                                       | 0.65                      | 0.2                                | Taping<br>(R) | Contain | MP         |
|                                    | MMR920C07A   | 7 x 7 x<br>7.2              | -6,865<br>~ 6,865         | 6,865                 | 1.0                                       | 0.65                      | 0.2                                | Tray          | Contain | Developing |
|                                    | MMR920C07ARE | 7 x 7 x<br>7.2              | -6,865<br>~ 6,865         | 6,865                 | 1.0                                       | 0.65                      | 0.2                                | Taping<br>(R) | Contain | Developing |
|                                    | MMR920C10A   | 7 x 7 x<br>7.2              | -9,807<br>~ 9,807         | 9,807                 | 1.0                                       | 0.65                      | 0.2                                | Tray          | Contain | MP         |
|                                    | MMR920C10ARE | 7 x 7 x<br>7.2              | -9,807<br>~ 9,807         | 9,807                 | 1.0                                       | 0.65                      | 0.2                                | Taping<br>(R) | Contain | MP         |
|                                    | MMR906XAN    | 6 x 5 x<br>7.2              | -1,000<br>~ 40,000        | 40,000                | -                                         | 0.66                      | 1.0                                | Tray          | Free    | MP         |
|                                    | MMR906XARE   | 6 x 5 x<br>7.2              | -1,000<br>~ 40,000        | 40,000                | -                                         | 0.66                      | 1.0                                | Taping<br>(R) | Free    | MP         |
|                                    | MMR902A34A   | 7 x 7 x<br>7.2              | -1,000<br>~ 40,000        | 40,000                | 2.3                                       | 0.66                      | 0.7                                | Tray          | Free    | MP         |
|                                    | MMR902A34ABE | 7 x 7 x<br>7.2              | -1,000<br>~ 40,000        | 40,000                | 2.3                                       | 0.66                      | 0.7                                | Taping<br>(B) | Free    | MP         |
|                                    | MMR902A34ARE | 7 x 7 x<br>7.2              | -1,000<br>~ 40,000        | 40,000                | 2.3                                       | 0.66                      | 0.7                                | Taping<br>(R) | Free    | MP         |
| Differential<br>Pressure<br>Sensor | MMR940C02A   | 29 x 18 x<br>14.25          | -1,961<br>~ 1,961         | 1,961                 | (2.0)                                     | 1.30                      | 0.2                                | Tray          | Contain | Planning   |
|                                    | MMR940C04A   | 29 x 18 x<br>14.25          | -3,922<br>~ 3,922         | 3,922                 | (1.0)                                     | 0.65                      | 0.2                                | Tray          | Contain | Developing |
|                                    | MMR940C07A   | 29 x 18 x<br>14.25          | -6,865<br>~ 6,865         | 6,865                 | (1.0)                                     | 0.65                      | 0.2                                | Tray          | Contain | Planning   |
|                                    | MMR940C10A   | 29 x 18 x<br>14.25          | -9,807<br>~ 9,807         | 9,807                 | (1.0)                                     | 0.65                      | 0.2                                | Tray          | Contain | Planning   |

## NOTES

**Safety Precautions**

- Though Mitsumi Electric Co., Ltd. (hereinafter referred to as "Mitsumi") works continually to improve our product's quality and reliability, semiconductor products may generally malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of this product could cause loss of human life, bodily injury, or damage to property, including data loss or corruption. Before customers use this product, create designs including this product, or incorporate this product into their own applications, customers must also refer to and comply with (a) the latest versions or all of our relevant information, including without limitation, product specifications, data sheets and application notes for this product and (b) the user's manual, handling instructions or all relevant information for any products which is to be used, or combined with this products. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. Mitsumi assumes no liability for customers' product design or applications.
- This product is intended for applying to computers, OA units, communication units, instrumentation units, machine tools, industrial robots, AV units, household electrical appliances, and other general electronic units.
- If you have any intentions to apply this product to the units related to the control and safety of transportation units (vehicles, trains, etc.), traffic signaling units, disaster-preventive & burglar-proof units, or the like, contact our sales representatives in advance.
- Don't apply this product to any aeronautical & space systems, submarine repeaters, nuclear power controllers, medical units involving the human life, or the like.
- Before using this product, even when it is not used for the usage written above, notify and present us beforehand if special care and attention are needed for its application, intended purpose, environment of usage, risk, and the design or inspection specification corresponding to them.
- If any damage to our customer is objectively identified to be caused by the defect of this product, Mitsumi is responsible for it. In this case, Mitsumi is liable for the cost limited to the delivery price of this product.

**Application considerations during actual circuit design**

- The outline of parameters described herein has been chosen as an explanation of the standard parameters and performance of the product. When you actually plan to use the product, please ensure that the outside conditions are reflected in the actual circuit and assembling designs.
- Before using this product, please evaluate and confirm the actual application with this product mounted and embedded.
- To investigate the influence by applied transient load or external noise, It is necessary to evaluate and confirm them with mounting this product to the actual application.
- Any usage above the maximum rating may destroy this product or shorten the lifetime. Be sure to use this product under the maximum rating.
- If you continue to use this product highly-loaded (applying high temperature, large current or high voltage; or variation of temperature) even under the absolute maximum rating and even in the operating range, the reliability of this product may decrease significantly. Please design appropriate reliability in consideration of power dissipation and voltage corresponding to the temperature and designed lifetime after confirming our individual reliability documents (such as reliability test report or estimated failure rate). It is recommended that, before using this product, you appropriately derate the maximum power dissipation (typically, 80% or less of the maximum value) considering parameters including ambient temperature, input voltage, and output current.

**Precautions for Foreign Exchange and Foreign Trade Control Act**

- If you export or take products and technologies in this document which are subject to security trade control based on the Foreign Exchange and Foreign Trade Act to overseas from Japan, permission of the Japanese government is required.

**Prohibitions for Industrial Property Rights**

- Since this document contains the contents related to our copyright and know-how, you are requested not to use this document for any purpose other than the application of this product.
- If a use of this product causes a dispute related to the industrial property rights of a third party, Mitsumi has no liability for any disputes except those which arise directly from the manufacturing and manufacturing method of our products.

**Precautions for Product Liability Act**

- No responsibility is assumed by us for any consequence resulting from any wrong or improper use or operation, etc. of this product.

**Others**

- Any part of the contents contained herein must not be reprinted or reproduced without our prior permission.
- In case of any question arises out of the description in this specification, it shall be settled by the consultation between both parties promptly.

**ATTENTION**

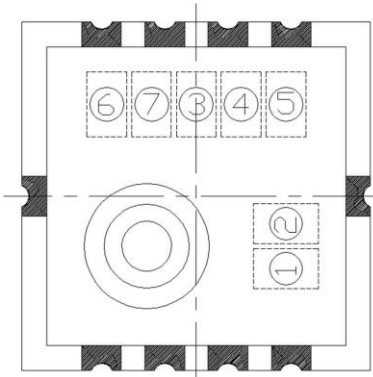
- This product is designed and manufactured with the intention of normal use in general electronics. No special circumstance as described below is considered for the use of it when it is designed. With this reason, any use and storage under the circumstances below may affect the performance of this product. Prior confirmation of performance and reliability is requested to customers.
  - Environment with strong static electricity or electromagnetic wave
  - Environment with high temperature or high humidity where dew condensation may occur
- This product is not designed to withstand radioactivity, and must avoid using in a radioactive environment.

**ADDDITIONAL NOTES**

- The pressure medium which can use directly is only air. Please do not use other media, especially corrosive gases (organic solvent gas, sulfurous acid gas, hydrogen sulfide gas, etc.) and media which include moisture and foreign substance, since they could cause damages or malfunctions.
- Please handle it noting the foreign body mixing with the pressure opening and atmospheric pressure opening after opening packing.
- When cut folding the PCB after mounting this product, take measures to prevent stress to the package. Also, when you insert the tube in this product, please note that plugging it vertically. Load in the lateral direction of the cover of the nozzle is up to 1kg or less. (Load condition: position of height 4mm from the marking surface.) Excessive load could cause damages of cover, or air leak by peeling from the interface of the cover and the substrate, or malfunctions.
- The light that enters from the pressure entrance reaches the semiconductor chip. Please avoid use in the environment that light enters into the pressure entrance directly, because the semiconductor chip might malfunction because of light.

MARKING CONTENTS

|     |                     |         |           |         |
|-----|---------------------|---------|-----------|---------|
| ①~② | Model name          |         |           |         |
|     | 2A                  |         |           |         |
| ③   | Production year     |         |           |         |
| ④   | Production month    |         |           |         |
|     | month               | marking | month     | marking |
|     | January             | 1       | July      | 7       |
|     | February            | 2       | August    | 8       |
|     | March               | 3       | September | 9       |
|     | April               | 4       | October   | J       |
|     | May                 | 5       | November  | K       |
|     | June                | 6       | December  | L       |
| ⑤   | Production day      |         |           |         |
|     | day                 | marking | day       | marking |
|     | 1                   | 1       | 16        | G       |
|     | 2                   | 2       | 17        | H       |
|     | 3                   | 3       | 18        | J       |
|     | 4                   | 4       | 19        | K       |
|     | 5                   | 5       | 20        | L       |
|     | 6                   | 6       | 21        | M       |
|     | 7                   | 7       | 22        | N       |
|     | 8                   | 8       | 23        | P       |
|     | 9                   | 9       | 24        | R       |
|     | 10                  | A       | 25        | S       |
|     | 11                  | B       | 26        | T       |
|     | 12                  | C       | 27        | U       |
|     | 13                  | D       | 28        | V       |
|     | 14                  | E       | 29        | W       |
|     | 15                  | F       | 30        | X       |
|     |                     |         | 31        | Y       |
| ⑥~⑦ | Rank                |         |           |         |
|     | Typ. Supply voltage |         | marking   |         |
|     | 3.4V                |         | 34        |         |



## PACKING SPECIFICATIONS (TRAY)

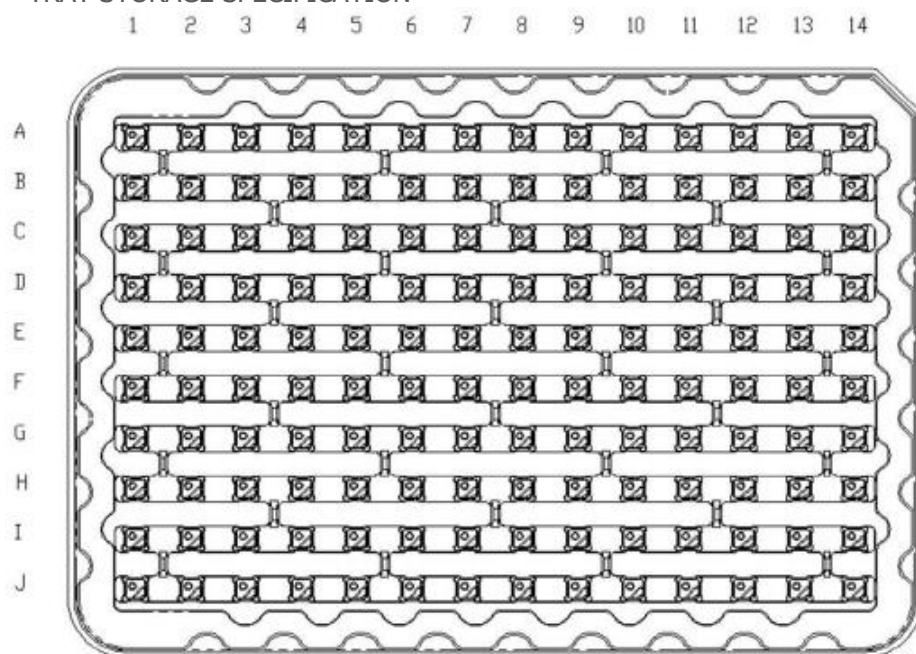
**QUANTITY**

- VACUUM PACKING 700 pcs/SHIELD BAG
- BOX PACKING MAX 5,600 pcs BOX (8BAGS)

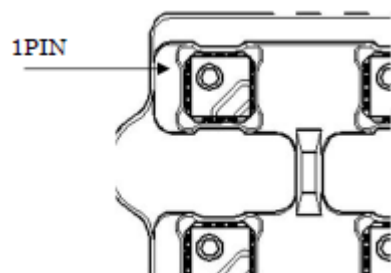
THE QUANTITY IS FILLED IN THE PACKING SLIP

**PACKING SPECIFICATIONS**

- TRAY STORAGE SPECIFICATION



## 1. PRODUCTION STORAGE DIRECTION



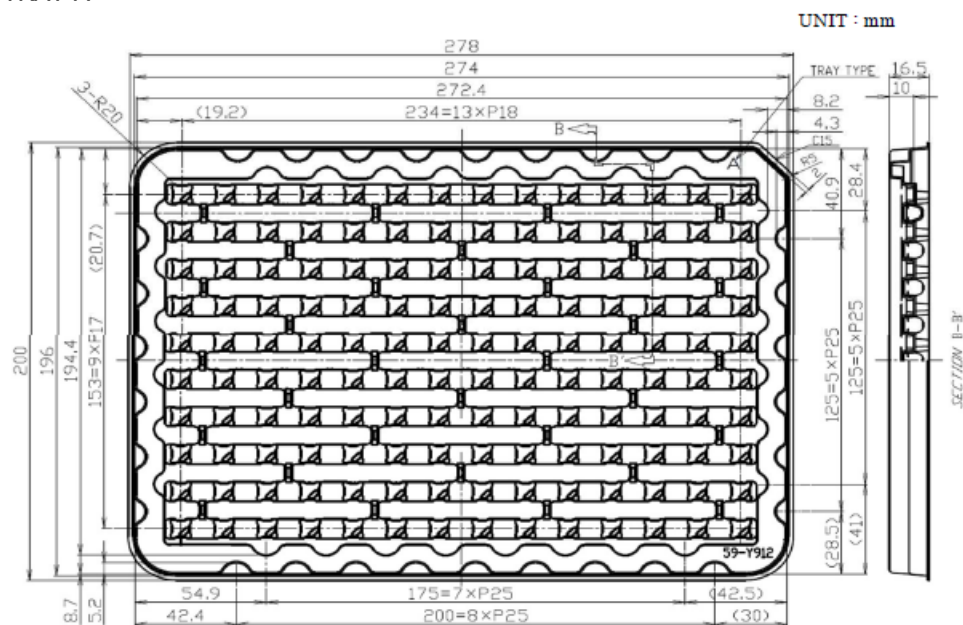
## 2. BROKEN NUMBER PRODUCTION STORAGE

REGARDING BROKEN NUMBER PRODUCTION STORAGE ,  
IT IS HOUSED IN FOLLOWING-ORDER.  
(A1,B1,...,I1,J1),(A2,B2,...,I2,J2),...,(A14,B14,...,I14,J14).

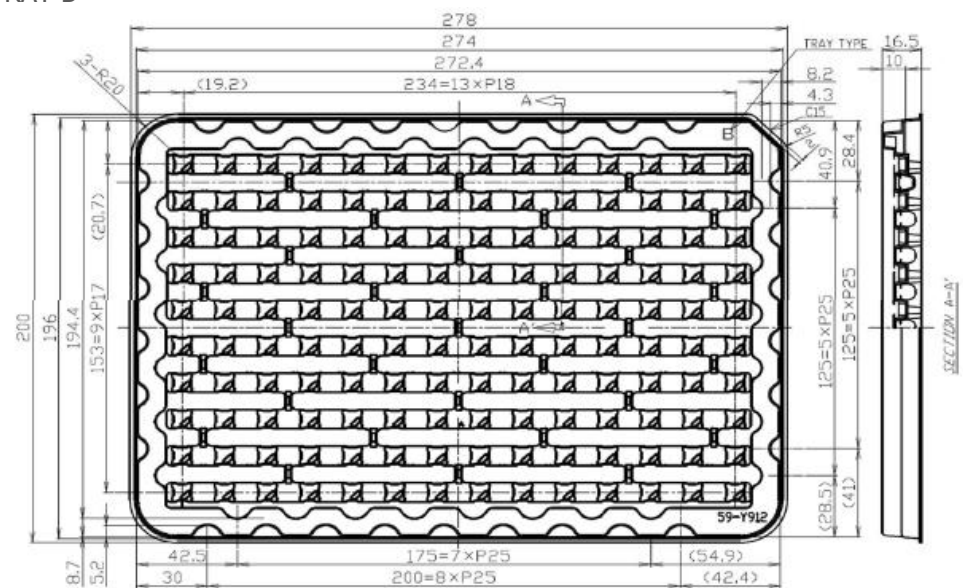
## 3. TRAY MATERIAL, DISPOSED ELECTRICATION PREVENTION.

· TRAY DIMENSION

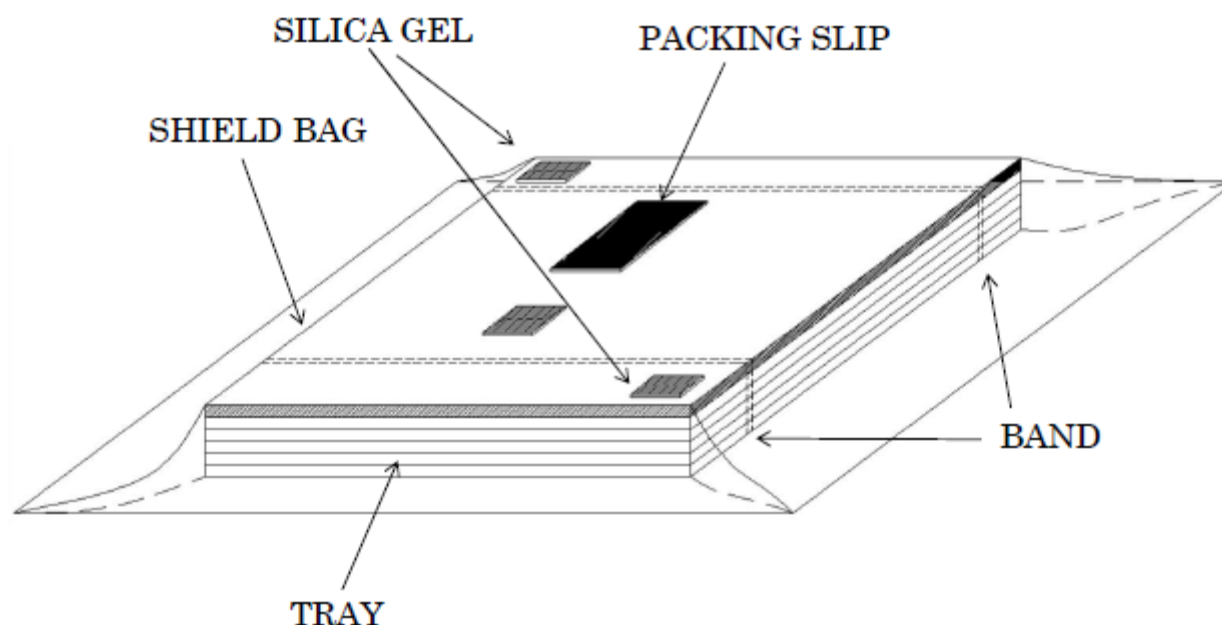
TRAY A



TRAY B



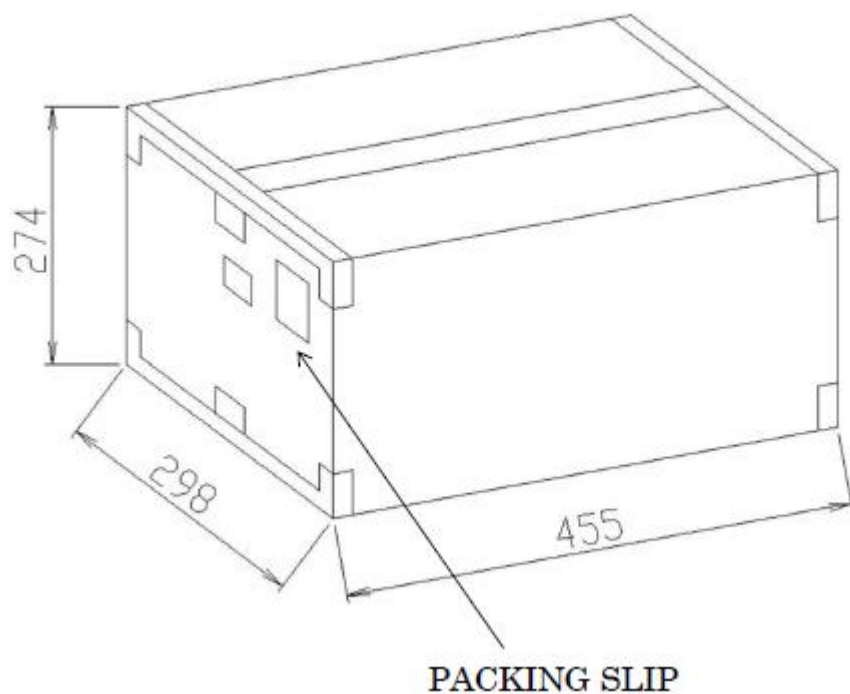
## · PACKING SPECIFICATION



THESE 6 TRAYS WHICH ARE 5 TRAYS WITH PRODUCTS AND EMPTY TRAY AS LID ARE PILED UP. ALSO, THESE TRAYS ARE FIXED BY BAND. THESE ARE VACUUM-HEAT-SEALED TOGETHER WITH THE SILICA GEL.  
※THIS TRAY HAS TYPE A AND TYPE B. THEY ARE PILED UP ALTERNATELY.  
(IT IS POSSIBLE TO USE BOTH TYPE TRAYS AS EMPTY ONE.)

## · BOX DIMENSION

UNIT : mm



PUT MAX 8 BAGS IN THE CARTON BOX.  
AFTER PACKING BY TAPE (5,600 PCS MAX)  
PUT THE PACKING SLIP ON THE SIDE OF THE CARTON BOX.

· PACKING SLIP SPECIFICATION

MITSUMI ELECTRIC CO., LTD.

 現 品 票 PACKING SLIP

納入先 MESSRD.

品番 PART NO.

品名 DESCRIPTION  
MMR901XA

注番 P/O NO.

特記 NOTE  
MMR901XA PBF

TOTAL Q'TY/BOXES    Q'TY/BOX

DATE  
15/07/30

LOT NO.

R 901

R 59

1

2

3

4

5

6

7

- ① CUSTOMER NAME

② CUSTOMER'S MODEL NAME

③ MITSUMI MODEL NAME

④ "G mark" meaning is RoHS-compliant.

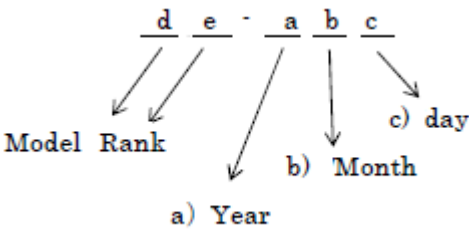
⑤ PACKING Q'TY (PACK/CARTON)

⑥ QC STAMP(SHIPMENT DATE)

※ This is pass-stamp about shipment inspection.

⑦ MITSUMI DRAWING NUMBER

MARK LOT NUMBER



|    |                  |         |       |         |
|----|------------------|---------|-------|---------|
| a) | Production year  |         |       |         |
| b) | Production month |         |       |         |
|    | month            | marking | month | marking |
|    | JAN              | 1       | JUL   | 7       |
|    | FEB              | 2       | AUG   | 8       |
|    | MAR              | 3       | SEP   | 9       |
|    | APR              | 4       | OCT   | J       |
|    | MAY              | 5       | NOV   | K       |
| c) | JUN              | 6       | DEC   | L       |
|    | Production day   |         |       |         |
|    | day              | marking | day   | marking |
|    | 1                | 1       | 16    | G       |
|    | 2                | 2       | 17    | H       |
|    | 3                | 3       | 18    | J       |
|    | 4                | 4       | 19    | K       |
|    | 5                | 5       | 20    | L       |
|    | 6                | 6       | 21    | M       |
|    | 7                | 7       | 22    | N       |
|    | 8                | 8       | 23    | P       |
|    | 9                | 9       | 24    | R       |
|    | 10               | A       | 25    | S       |
|    | 11               | B       | 26    | T       |
|    | 12               | C       | 27    | U       |
|    | 13               | D       | 28    | V       |
|    | 14               | E       | 29    | W       |
|    | 15               | F       | 30    | X       |
|    |                  |         | 31    | Y       |

PACKING SPECIFICATIONS (TAPING, B HOUSING, R HOUSING)

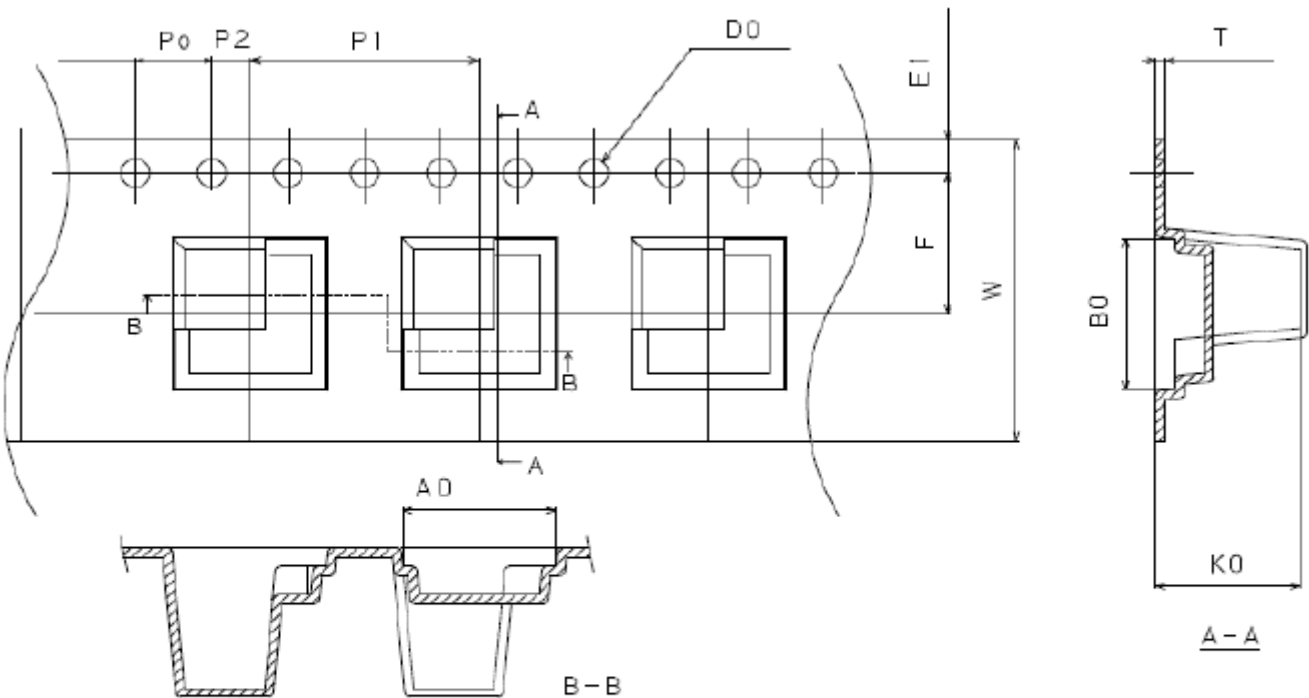
QUANTITY

- REEK PACKING      700 pcs/REEL
- BOX PACKING      MAX 700 pcs /BOX (1REEL)

THE QUANTITY IS FILLED IN THE PACKING SLIP

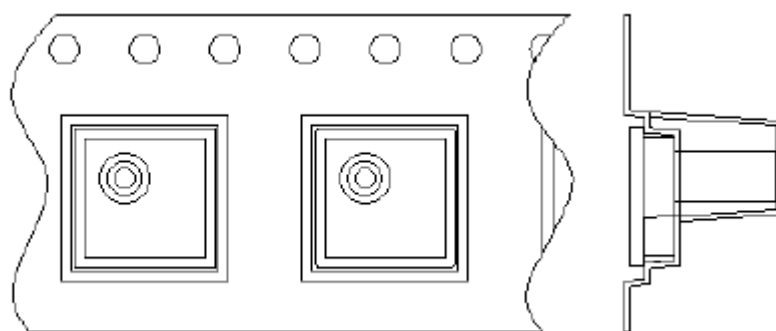
PACKING SPECIFICATIONS

- B HOUSING SPECIFICATION



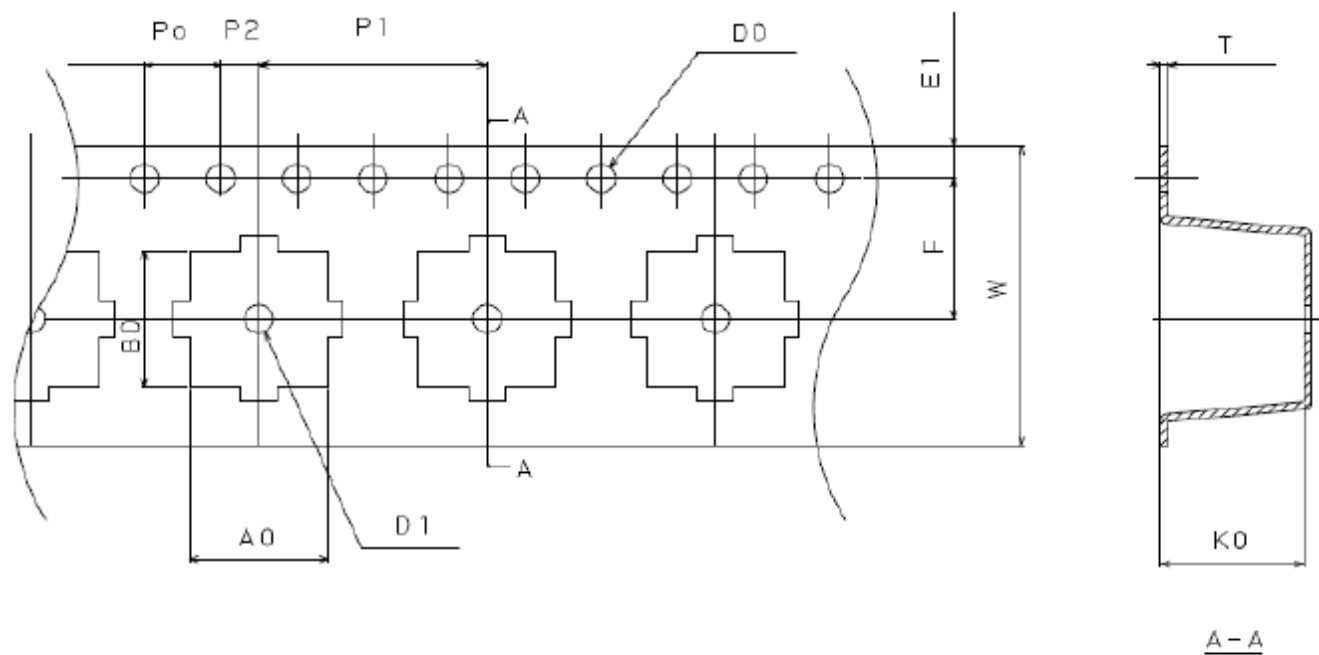
| SYM. | A0   | B0   | W            | F    | E1   | P1   | P2   | P0   | φD0          | T     | K0   |
|------|------|------|--------------|------|------|------|------|------|--------------|-------|------|
| UNIT | 8.0  | 8.0  | 16.0         | 7.5  | 1.75 | 12.0 | 2.0  | 4.0  | 1.5          | 0.5   | 7.5  |
| mm   | ±0.1 | ±0.1 | +0.3<br>-0.1 | ±0.1 | ±0.1 | ±0.1 | ±0.1 | ±0.1 | +0.1<br>-0.0 | ±0.05 | ±0.1 |

## 1. PRODUCTION STORAGE DIRECTION

**B HOUSING**

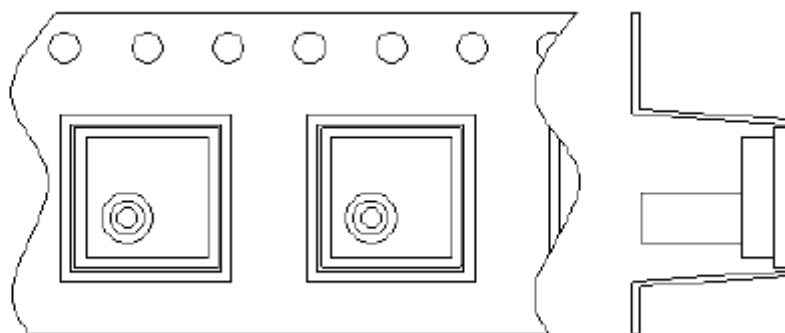
2. CARRIER TAPE MATERIAL : DISPOSED ELECTRICATION PREVENTION.
3. THE LENGTH OF LEADER TAPE : MORE THAN 100 mm INCLUDING 9 OR MORE EMBOSES IN WHICH NO COMPONENT IS PLACED.
4. THE LENGTH OF TRAILER TAPE : MORE THAN 160 mm INCLUDING EMBOSES IN WHICH NO COMPONENT IS PLACED.

· R HOUSING SPECIFICATION



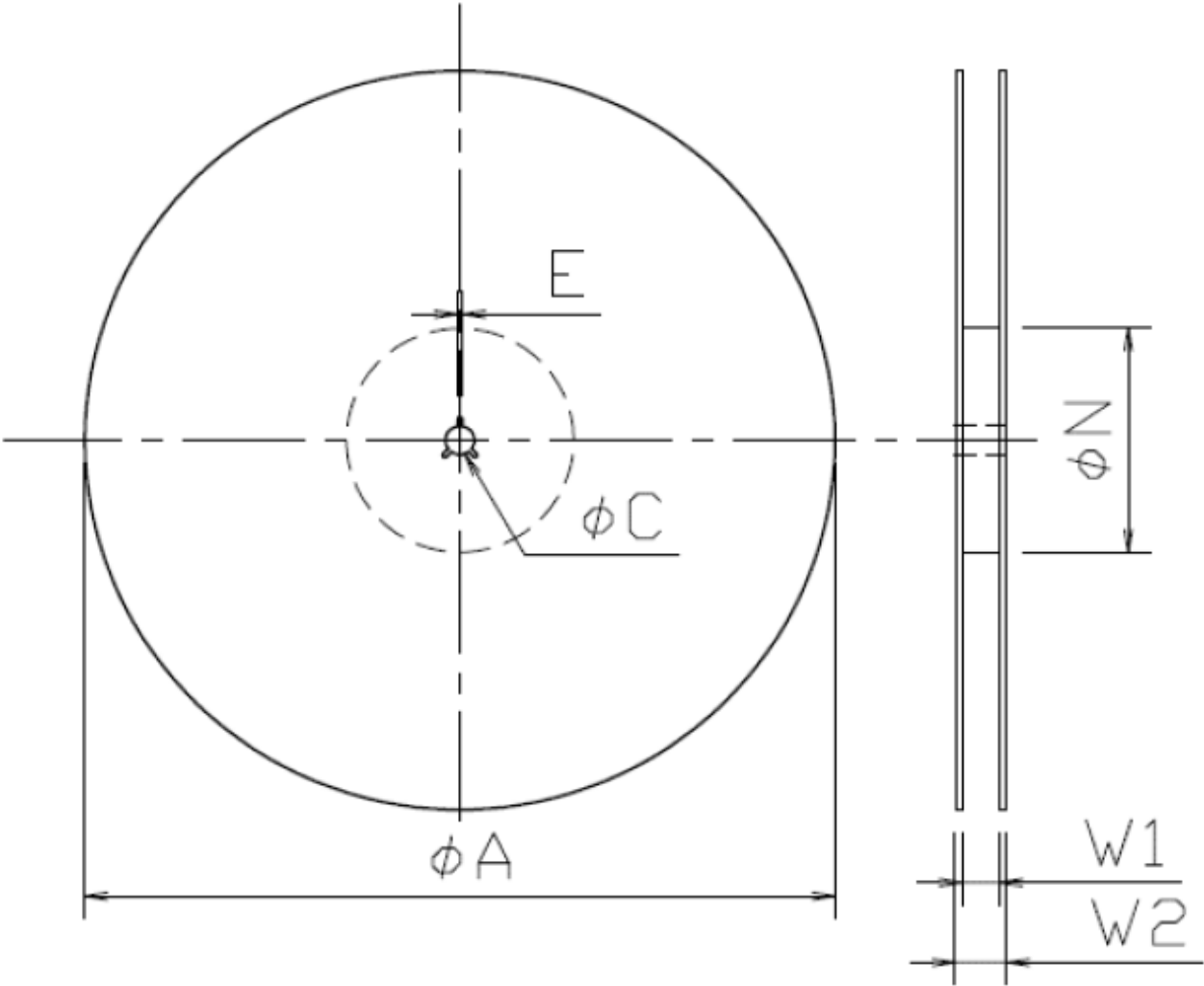
| SYM. | A0   | B0   | W            | F    | E1   | P1   | P2   | P0   | φ D0         | T     | K0   | φ D1 |
|------|------|------|--------------|------|------|------|------|------|--------------|-------|------|------|
| UNIT | 7.3  | 7.3  | 16.0         | 7.5  | 1.75 | 12.0 | 2.0  | 4.0  | 1.5          | 0.4   | 7.5  | 1.5  |
| mm   | ±0.1 | ±0.1 | +0.3<br>-0.1 | ±0.1 | ±0.1 | ±0.1 | ±0.1 | ±0.1 | +0.1<br>-0.0 | ±0.05 | ±0.1 | ±0.1 |

## 1. PRODUCTION STORAGE DIRECTION

**R HOUSING**

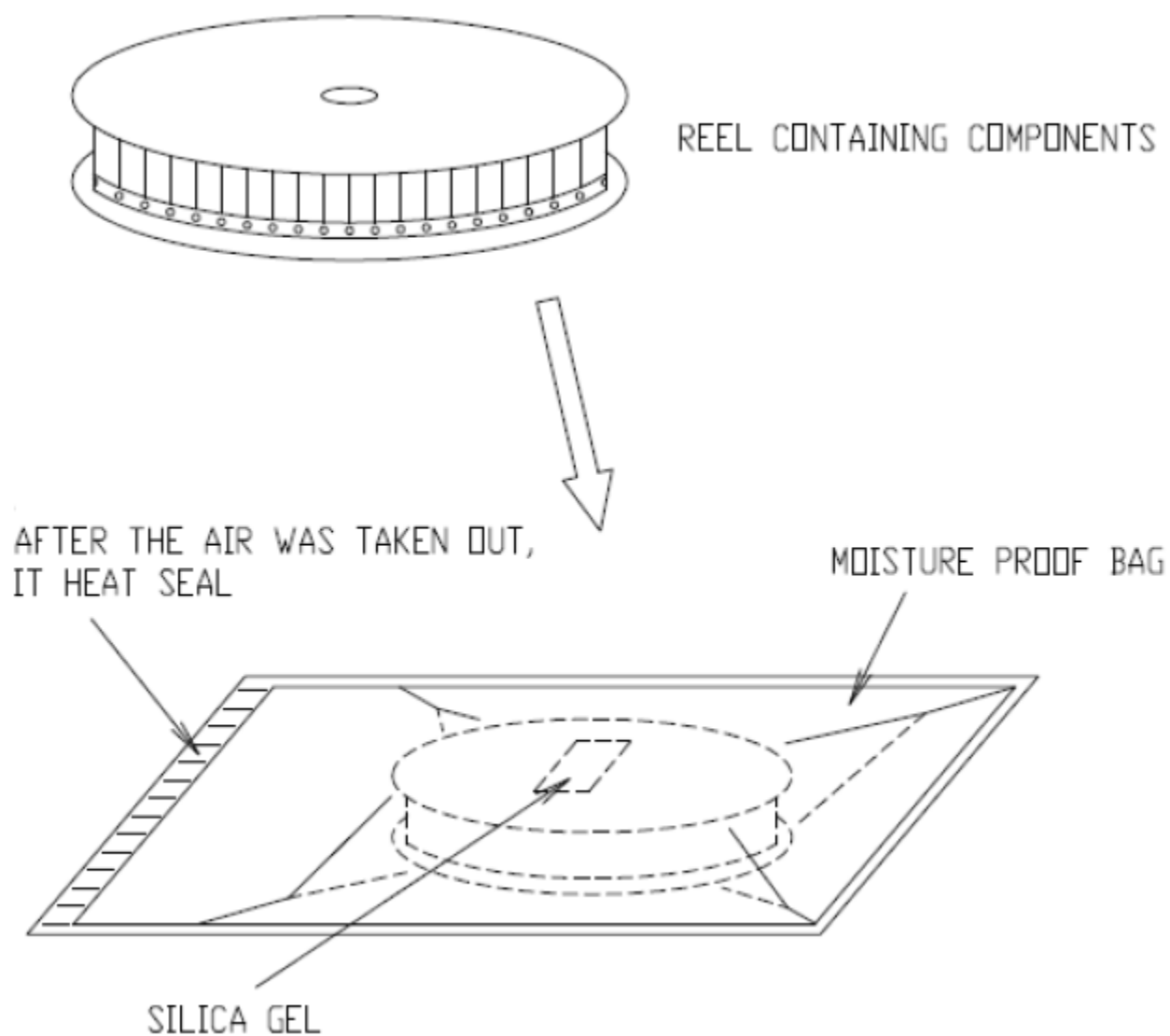
2. CARRIER TAPE MATERIAL : DISPOSED ELECTRICATION PREVENTION.
3. THE LENGTH OF LEADER TAPE : MORE THAN 100 mm INCLUDING 9 OR MORE EMBOSES IN WHICH NO COMPONENT IS PLACED.
4. THE LENGTH OF TRAILER TAPE : MORE THAN 160 mm INCLUDING EMBOSES IN WHICH NO COMPONENT IS PLACED.

・ REEL DIMENSION

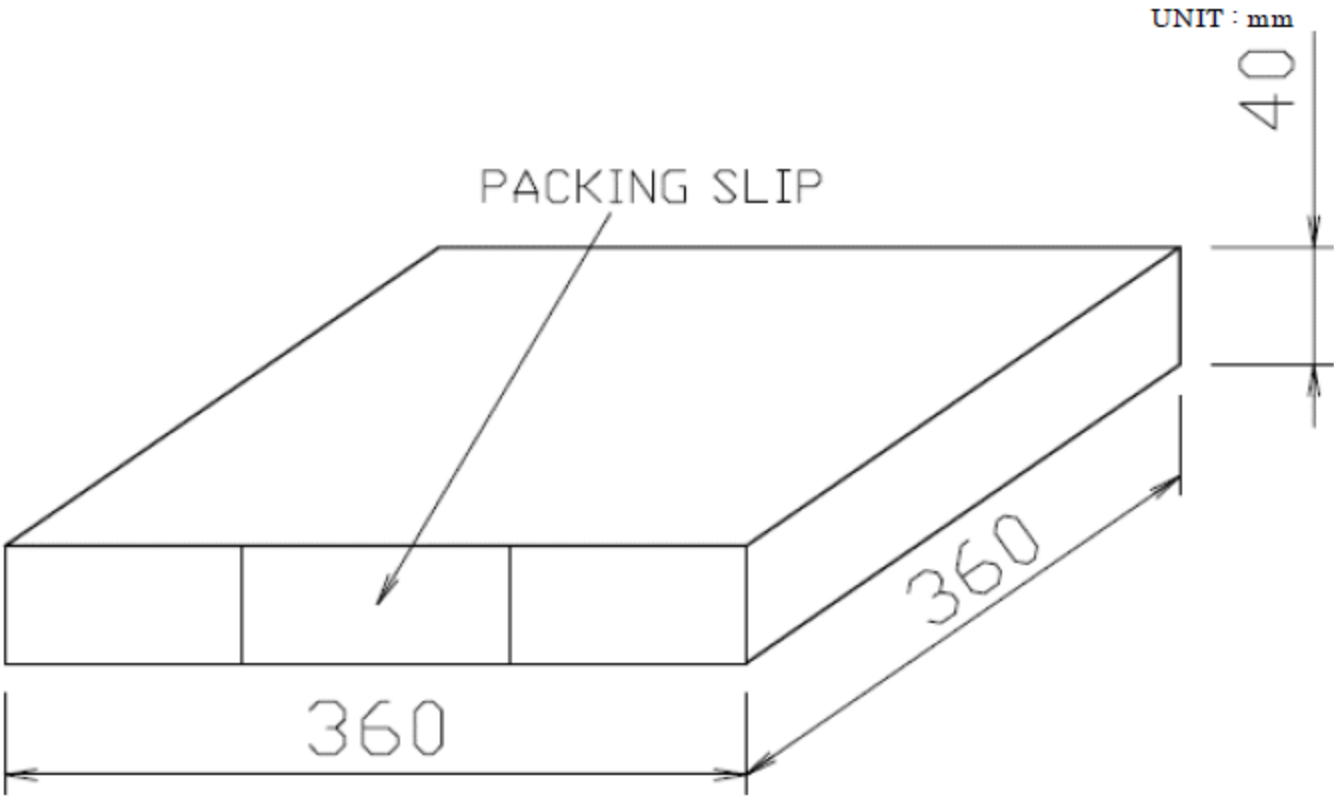


| 記号<br>SYM. | $\phi A$  | $\phi C$  | $\phi N$  | $E$       | $W1$      | $W2$      |
|------------|-----------|-----------|-----------|-----------|-----------|-----------|
| UNIT<br>mm | 330       | 13.0      | 100       | 2.0       | 17.4      | 21.4      |
|            | $\pm 2.0$ | $\pm 0.2$ | $\pm 1.0$ | $\pm 0.5$ | $\pm 1.0$ | $\pm 1.0$ |

## · MOISTURE PROOF PACKING



· BOX DIMENSION



· PACKING SLIP SPECIFICATION

MITSUMI ELECTRIC CO., LTD.

 現 品 票 PACKING SLIP

輸入先 MESSRS.

品番 PART NO.

品名 DESCRIPTION  
MMR901XA

仕番 P/O NO.

特記 NOTE  
<G>  
MMR901XA PBF

TOTAL Q'TY/BOXES    Q'TY/BOX

数量    単位

DATE  
15/07/30

LOT NO.

R SPEC. R.  
R901

R 59

1

2

3

4

5

6

- ① CUSTOMER NAME

② CUSTOMER'S MODEL NAME

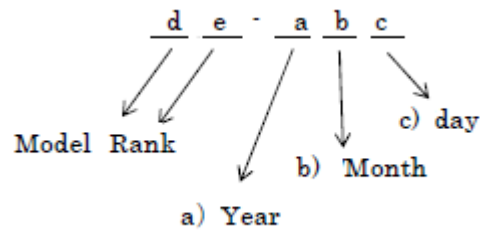
③ MITSUMI MODEL NAME

④ "G mark" meaning is RoHS-compliant.

⑤ PACKING Q'TY (PACK/CARTON)

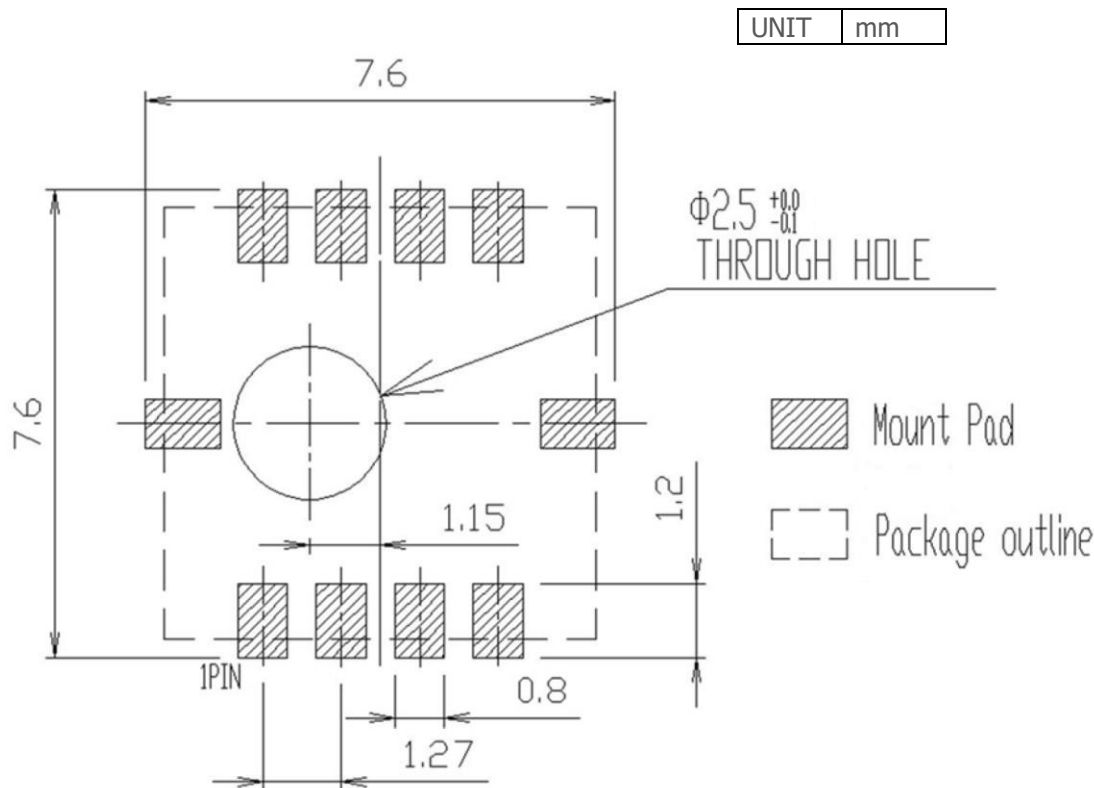
⑥ MITSUMI DRAWING NUMBER

MARK LOT NUMBER



|    |                  |         |       |         |
|----|------------------|---------|-------|---------|
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|    | APR              | 4       | OCT   | J       |
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|    | 3                | 3       | 18    | J       |
|    | 4                | 4       | 19    | K       |
|    | 5                | 5       | 20    | L       |
|    | 6                | 6       | 21    | M       |
|    | 7                | 7       | 22    | N       |
|    | 8                | 8       | 23    | P       |
|    | 9                | 9       | 24    | R       |
|    | 10               | A       | 25    | S       |
|    | 11               | B       | 26    | T       |
|    | 12               | C       | 27    | U       |
|    | 13               | D       | 28    | V       |
|    | 14               | E       | 29    | W       |
|    | 15               | F       | 30    | X       |
|    |                  |         | 31    | Y       |

RECOMMENDED LAND PATTERN

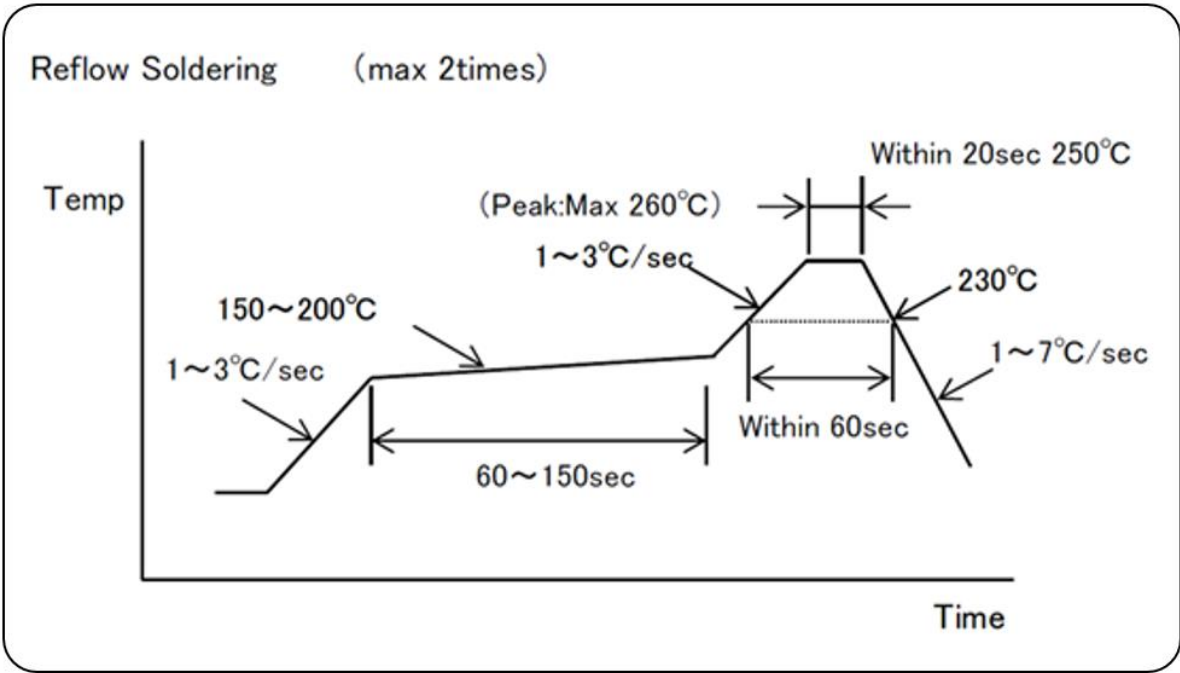


The dimension are for reference only and not guaranteed by design.

To design practically, correction should be made for optimized dimensions considering the effects of the board type to be mounted, mount (soldering) method, type and coating thickness of cream solder.

CONDITION FOR PACKAGE MOUNTING

Pb-Free recommended profile condition



This profile gives recommended values, which are not guaranteed.  
For mounting the package, evaluate the profile with the equipment, conditions, and materials to be used.

Mounting by flow soldering

Flow soldering cannot be used for mounting of this package.

Mounting by manual soldering

Manual soldering cannot be used for mounting of this package.

In the case of cleaning, please use cotton swab, and also please keep soldering-solution from entering into the pressure and atmospheric pressure opening. Please do not use ultrasonic cleaning (dipping).

Cleaning method

|                     |                   |
|---------------------|-------------------|
| Cleaning solution   | Isopropyl alcohol |
| Solvent temperature | Max 45°C          |
| Cleaning time       | Within 3 min      |

Note

When insert a tube to this package, please keep direction of a tube at right angle with this package.  
Also, after mounting by reflow, please make sure not to insert a tube to package before finish cooling.  
If place an extra strain on cover nozzle, it is possible that occur cover nozzle broken, interface delamination between cover nozzle and printed wiring board. It has the potential to become air-leak problem.

## Storage method

### Storage condition

Store the device under the following conditions.

Temperature: 5~30°C

Humidity: 40~70%RH

Storage life: 1year

For the product in the moisture-proof packaging, follow these conditions after unpacking.

Temperature: 5~30°C

Humidity: 40~70%RH

Storage life: 168hours

Do not store this device where a large amount of dust or harmful volatile gas exists, electrostatic is easily charged, condensation is generated, or changes in temperature and humidity are wide, or under the direct sunlight.

### Baking

If the storage time specified above has passed, mounting by soldering may cause cracks on the moisture absorbed package. Before mounting, the package should be baked under the following conditions.

Temperature: 125°C

Treating time: 16 to 24 hours

Trays, embossing tapes and reels are not heat-resistant type.

Before baking, the device should be placed in a heat-resistant container.

In consideration of the time-consuming baking process and the possibility of deformed terminal, the device should be mounted promptly within the time observing the storage conditions.

If a long-term storage is needed, a desiccator or a dry box should be used.

### Handling instructions

Shipping boxes must be handled with care because any drop or shock may damage the device.

Additionally, the device must be handled in the place with the protection against electrostatic charge and without extreme changes of temperature/humidity.

## MITSUMI ELECTRIC CO., LTD.

Strategy Engineering Department Semiconductor Business Division

Tel: +81-46-230-3470 / <https://product.minebeamitsumi.com/en/contact/>

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