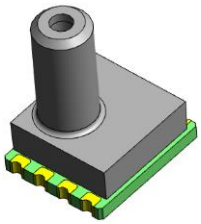
Low Supply Voltage, Digital Output Gage Pressure Sensor

MMR906XAN Data Sheet

DESCRIPTION



The MMR906XAN digitally outputs a pressure value which was corrected. 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: 5.0(W) × 6.0(D) × 7.2(H)mm
- It is able to output pressure value with high precision.
  Effective resolution: 0.025mmHgRMS (3.4PaRMS) (at MODE1)
  Pressure measurement error (With OffsetCancel):±2.0mmHg(±267Pa)
  Pressure measurement error (With UserCalibration):±1.0mmHg(±133pa)
- It corrects the differences of sensors and temperature characteristics when shipped from our factory.
- It digitally outputs pressure value by a built-in sequencer (SPI)
- Noise reduction is possible by a built-in second order LowPassFilter.

INDEX

BLOCK DIAGRAM

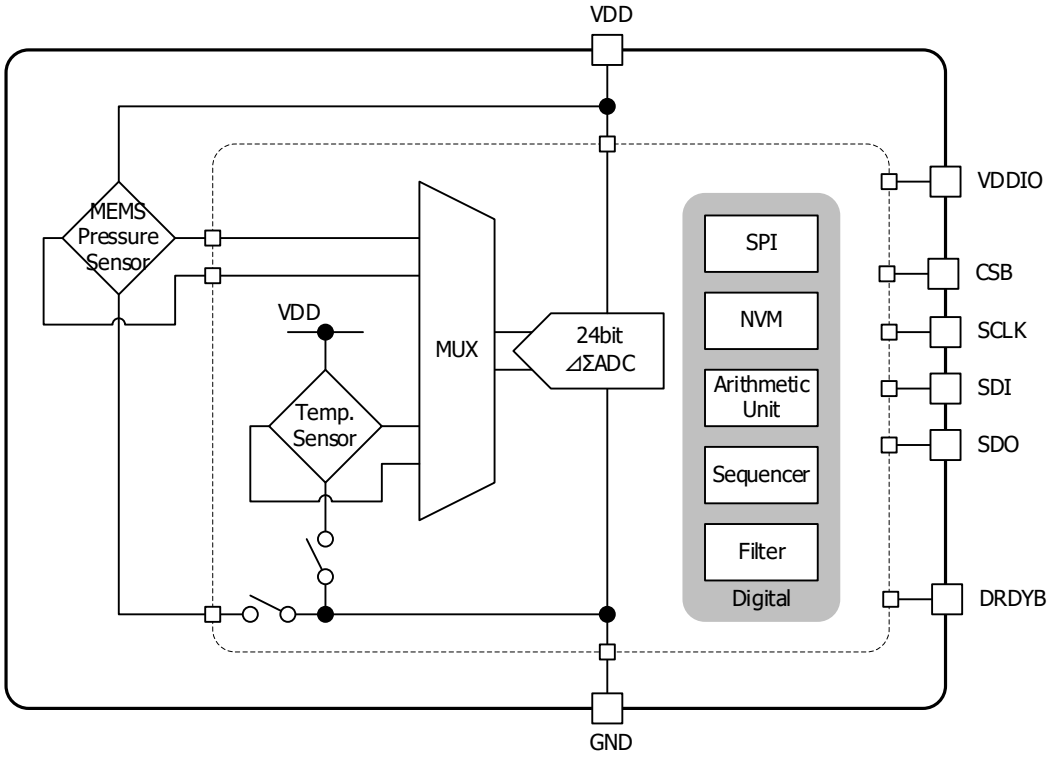


Fig. 1 Block diagram

PIN CONFIGURATION

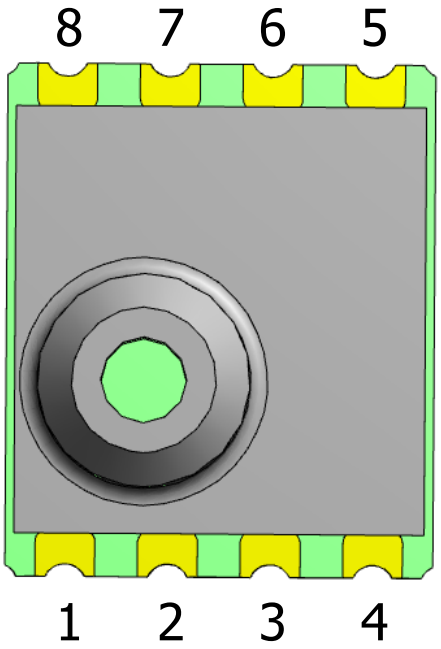


Fig. 2 Pin configuration (Top view)

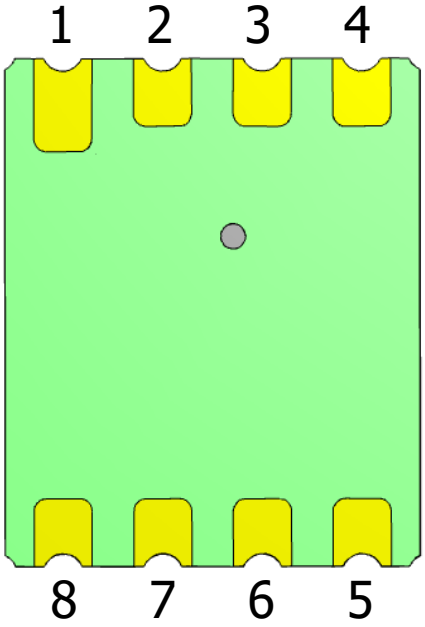


Fig. 3 Pin configuration (Bottom view)

TERMINAL EXPLANATIONS

Table 1 Pin table

No.	Pin Name	Type	Function
1	SCLK	I	Serial clock (SCLK)
2	DRDYB	O	Output terminal which notifies the completion of pressure measurement and calculation correction (negative logic)
3	VDD	I	Power-supply for analog circuit
4	VDDIO	I	Power-supply for digital I/O
5	GND	-	GND
6	CSB	I	Chip select
7	SDO	O	Serial Data Output(SDO=MISO)
8	SDI	I	Serial Data Input(SDI=MOSI)

ABSOLUTE MAXIMUM RATINGS

(unless otherwise specified, Ta=25°C)

Item	Symbol	Min.	Max.	Unit
Storage temperature range	T_{STG}	-20	70	°C
Analog supply voltage	VDD_{MAX}	-0.3	4.0	V
Digital I/O voltage	$VDDIO_{MAX}$	-0.3	4.0	V
Overpressure	P_{MAX}	-100 (-13.33)	+600 (+80)	mmHg (kPa)
Pressure medium (note[1])	-	AIR (non-condensing)		-

note[1]: 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_{OPR}	0	-	60	°C
Analog supply voltage	VDD_{OPR}	1.7	3.0	3.6	V
Digital input voltage	$VDDIO_{OPR}$	1.14	-	3.6	V
Operating pressure range	P_{OPR}	-30 (-4)	-	+360 (+47.99)	mmHg (kPa)

ELECTRICAL CHARACTERISTICS

Analog characteristics
(unless Ta=25°C, VDD=VDDIO=3.0V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit.
VDD Current consumption	I_{VDDact}	Pressure measure active	510	640	770	µA
	I_{VDDsd}	Shutdown	-	0.01	0.1	
VDDIO Current consumption	$I_{VDDIOact}$	Pressure measure active	1.2	1.8	2.4	µA
	$I_{VDDIOsd}$	Shutdown	-	0.1	1.0	
Conversion time	t_{con1}	MODE1	15.250	15.625	16.000	msec
	t_{con2}	MODE2	7.73	7.92	8.11	
	t_{con3}	MODE3	3.97	4.07	4.17	
	t_{con4}	MODE4	241	247	253	

I/O Digital I/O
(unless otherwise specified, Ta=25°C, VDD=1.7~3.6V, VDDIO=1.14~3.6V)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
High level input voltage	V_{IH}	-	0.8 × VDDIO	-	VDDIO + 0.3	V
Low level input voltage	V_{IL}	-	-0.3	-	0.2 × VDDIO	V
Output voltage High level	V_{OH1}	VDDIO ≧ 2.0V I_{OH}=-3mA	VDDIO - 0.4	-	-	V
	V_{OH2}	VDDIO < 2.0V I_{OH}=-1mA	0.8 × VDDIO		-	V
Output voltage Low level	V_{OL1}	VDDIO ≧ 2.0V I_{OL}=3mA	-	-	0.4	V
	V_{OL2}	VDDIO < 2.0V I_{OL}=1mA	-	-	0.2 × VDDIO	V

Pressure sensor characteristics
(unless otherwise specified, Ta=25°C, VDD=3.0V, VDDIO=1.14~3.6V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Pressure resolution	P_{Res}	-	-	0.001	-	mmHg
Pressure effective resolution	P_{Eres1}	MODE1	-	0.025	0.050	mmHg RMS
	P_{Eres2}	MODE2	-	0.035	0.070	
	P_{Eres3}	MODE3	-	0.050	0.100	
	P_{Eres4}	MODE4 High Resolution Mode	-	0.007	0.014	
Pressure effective resolution (with LowPassFilter)	$P_{Eres\ 1st}$	MODE1 LowPassFilter 1st	–	0.016	–	mmHg RMS
	$P_{Eres\ 1st + 2nd}$	MODE1 LowPassFilter 1st	–	0.011	–	
Pressure measurement error (With OffsetCancel) (note[2])	$P_{Err-off}$	-10 ~ 330mmHg Ta = 0°C～50°C	-2	–	2	mmHg
Pressure measurement error (With UserCalibration) (note[2])	$P_{Err-caliboff}$	-10 ~ 330mmHg Ta = 0°C～50°C	-1	–	1	mmHg

note[2]: It can take advantage of the performance to the fullest by OffsetCancel, and UserCalibration.

Temperature sensor characteristics
(unless otherwise specified, Ta=25°C, VDD=3.0V, VDDIO=1.14~3.6V)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Temperature measurement error	T_{acc}	0°C~ 50°C	-2.0	-	2.0	°C

Definition of characteristics

Pressure measurement value P_{result}
It is the device output value obtained by Read Pressure Result Command.

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 Pressure measurement value under no air pressure.

Pressure measurement value (With OffsetCancel) $P_{Result\text{-}off}$
It is the value that subtracted a Pressure offset from Pressure measurement value.

Equation

$$P_{Result\text{-}off} = P_{Result} - P_{Off} \quad \text{.....(Eq1)}$$

P_{Result} : Pressure measurement value
P_{Off} : Pressure measurement value under no air pressure.
For set operation, Assume that set will get it again each time under no air pressure.

Pressure measurement value (With UserCalibration) $P_{Result\text{-}calib}$
It is the Pressure measurement value with UserCalibration.

Equation

$$P_{Result\text{-}calib} = (P_{Result} - P_{Off}) \times Ratio \quad \text{.....(Eq2)}$$

$$Ratio = (P_{max} - P_{min}) / (P_{Result\text{-}max} - P_{Result\text{-}min}) \quad \text{.....(Eq3)}$$

P_{Result} : Pressure measurement value
P_{Off} : Pressure measurement value under no air pressure.
For set operation, Assume that set will get it again each time under no air pressure.
Ratio : Calibration ratio.
Please obtain and calculate it after device mounting, and store it in ROM of MCU
P_{max} : Max pressure
P_{min} : Min pressure
$P_{Result\text{-}max}$: Pressure measurement value at Max pressure
$P_{Result\text{-}min}$: Pressure measurement value at Min pressure

Pressure measurement error P_{Err}
It is the deviation amount of the Pressure measurement value from the ideal line.

Pressure measurement error (With OffsetCancel) $P_{Err\text{-}off}$
It is the deviation amount of the Pressure measurement value with OffsetCancel from the ideal line.

Pressure measurement error (With UserCalibration) $P_{Err\text{-}calib}$
It is the deviation amount of the measurement value with UserCalibration from the ideal line.

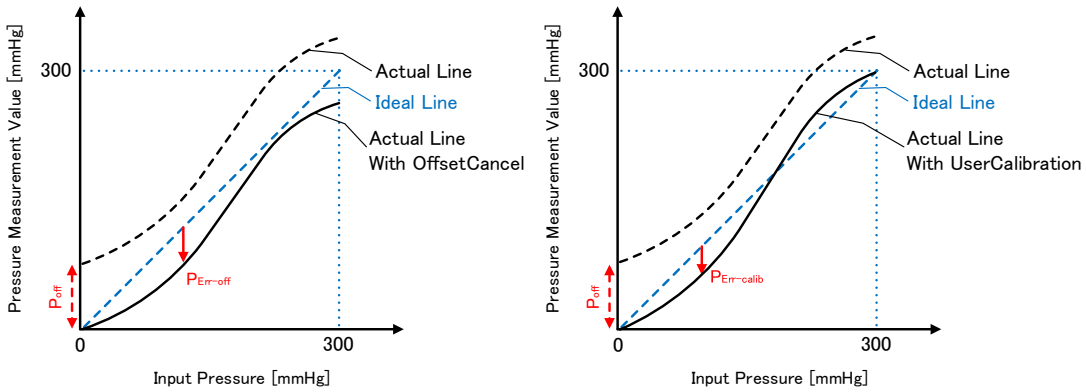


Fig. 4 Definition of Characteristics

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FUNCTION EXPLANATION

Function Outline

The MMR906XAN is 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.

Conversion time and Pressure effective resolution are selectable with the mode of different four. Conversion time and Pressure effective resolution are in the relationship of trade-off. When measuring during pressurization by a pump, MODE1 is recommended.

Noise reduction is possible by a built-in second order LowPassFilter. Cutoff frequency is shown in Table.11-1.1. It is applied first step filter by Result Command 0xC4. It is applied first step and second step filter by Result Command 0xC6.

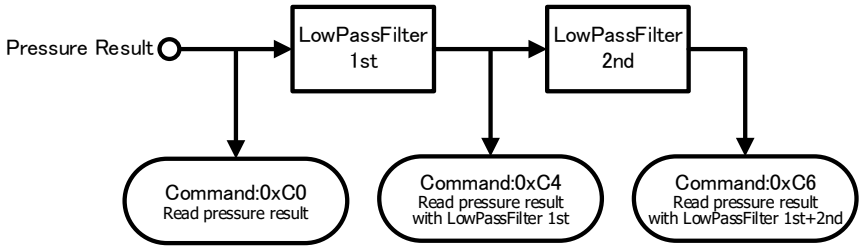

Fig. 5 LowPassFilter Configuration

Table 2 Cutoff Frequency

	1st fc[Hz]	2nd fc[Hz]
MODE1	10.14	5.07
MODE2	20.00	10.00
MODE3	38.92	19.47
MODE4	0.64	0.32

Table 3 example of Pressure effective resolution

	No filter [mmHgRMS]	1st [mmHgRMS]	1st+2nd [mmHgRMS]
MODE1	0.015	0.011	0.007
MODE2	0.021	0.015	0.009
MODE3	0.028	0.019	0.012
MODE4	0.008	0.007	0.007

Flow chart of pressure/temperature measurement

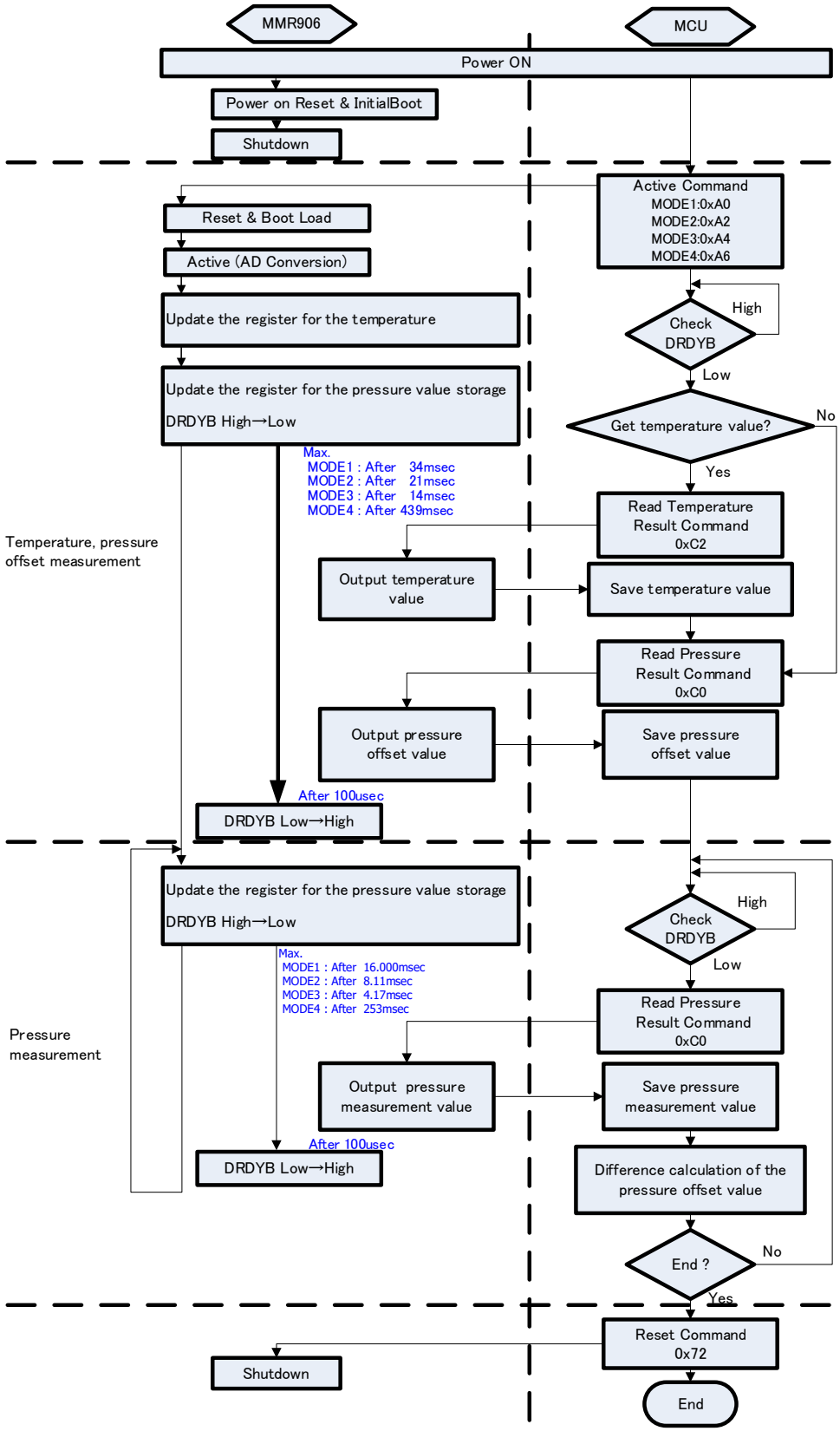

Fig. 6 Flow chart of pressure/temperature measurement

Product code

Product code has been recorded in internal memory (NVM(Non-volatile memory)) of theMMR906XAN. Product code can be obtained by the process of Fig. 7

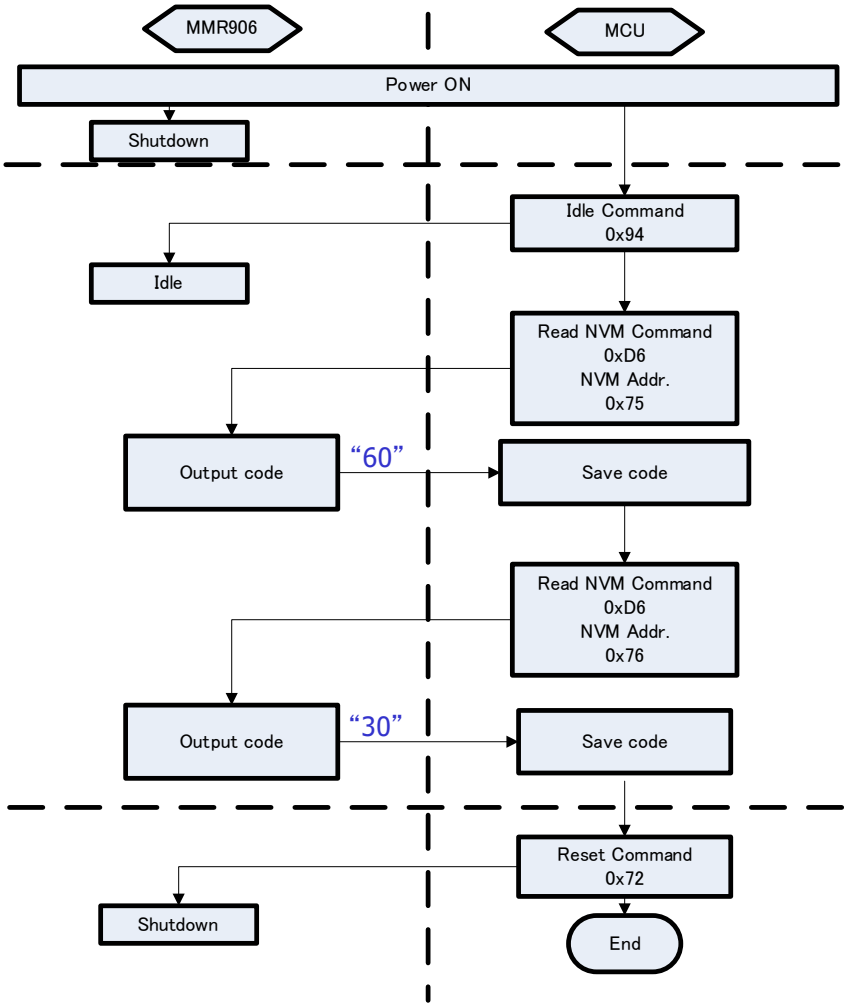

Fig. 7 Flow chart of product code gets

Table 4 Description of the product code

	NVM Addr.	Data	Description
(1)	0x75	60 h	Model name and Rank. 6:It shows the MMR906. 0:It shows the X rank.
(2)	0x76	30 h	Power-supply voltage in the correction. 30:It shows that it was corrected at 3.0V.

SEIAL INTERFACE

It supports SPI (max. 5Mbps) as an interface for serial communication.

Baud rate

※This item is not inspected at the time of shipment.
(unless otherwise specified, Ta=25°C, VDD=1.7~3.6V)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
SPI communication speed	BR_{SPI1}	VDDIO ≧ 2.0V Cb≦100pF	-	-	5.0	Mbps
	BR_{SPI2}	VDDIO < 2.0V Cb≦100pF	-	-	1.0	
	BR_{SPI3}	VDDIO ≧ 2.0V Cb≦400pF	-	-	2.5	
	BR_{SPI4}	VDDIO < 2.0V 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)
・Idle Command (0x94)

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.

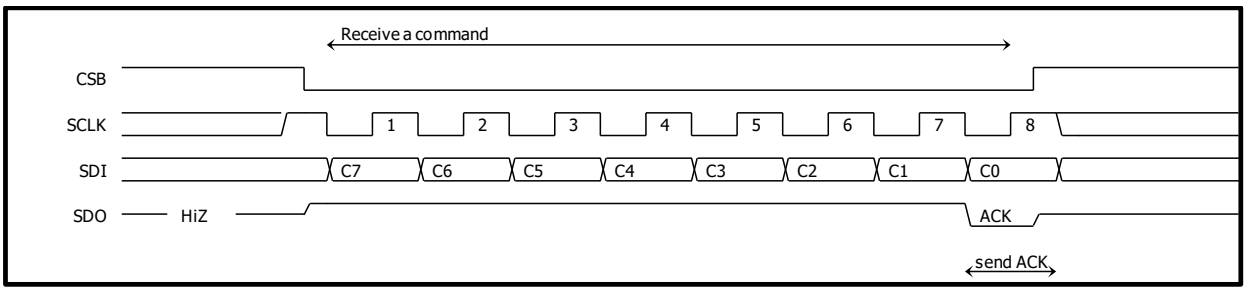

Fig. 8 SPI Operation Command format

SPI Result command format

Corresponding Command
・Result Command (0xC0, 0xC2, 0xC4, 0xC6)
・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.

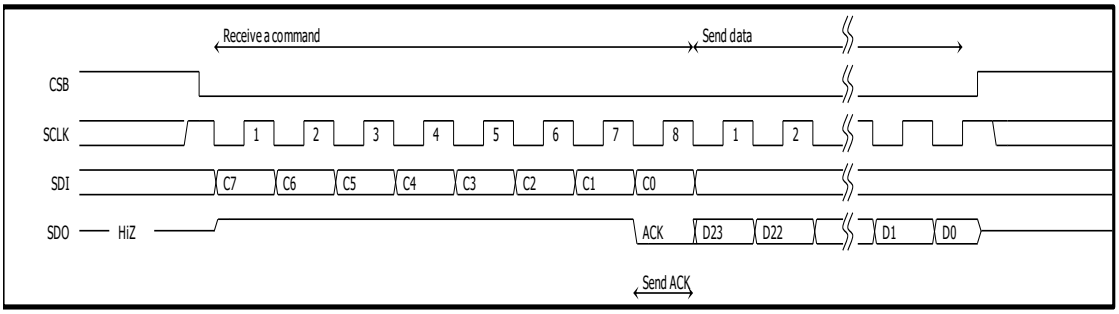

Fig. 9 SPI Result command format

SPI Read command format

Corresponding Command
・Read NVM command (0xD6)

Please send command code of 8 bits. When their commands are received, it turns over ACK to 8 bits. Then please send the memory address of 8bits (0x75 or 0x76). After receiving memory address, the internal area becomes busy for the maximum 25usec in order to prepare for data sending. During this time, 00h which indicates busy is output. When the preparation of data is completed, 01h is output, and continuously, 8bit data is output.

How to discern busy:
After sending writing data, continue to input clock with maintaining communicating mode. Then, 00h is output to indicate that it is busy. When the writing has been completed, 01h will be output. *The "00h" to indicate busy may sometimes be output or not depending on the clock frequency.

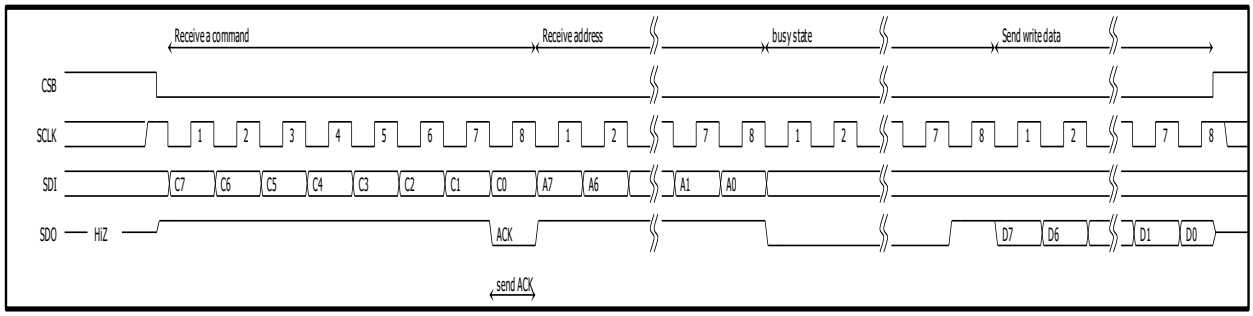

Fig. 10 Read command format

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Baud rate

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

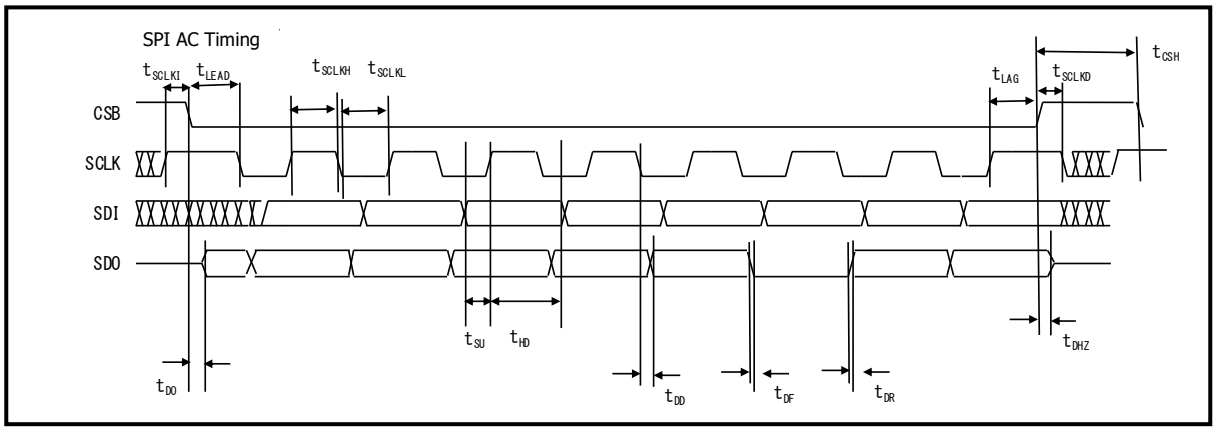


Fig. 11 SPI AC timing chart

Table 5 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 wait 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 to SCLK falling	t_{LEAD}	0	-	0	-	ns
Time from SCLK rising to CSB rising	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
Time from CSB falling to SDO output(Load 100pF) Time from CSB falling to SDO output	t_{ACC}	-	120	-	60	ns
Time from CSB rising to SDO output HiZ(Load 100pF)	t_{DHZ}	-	170	-	170	ns

Command

Table 6 Operation command list

Command Name		Command Code HEX.	BIN. C7	C6	C5	C4	C3	C2	C1	C0	Action
Reset		0x72	0	1	1	1	0	0	1	0	Reset and Return to Shutdown state
Idle		0x94	1	0	0	1	0	1	0	0	Shift to Idle 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 MODE 2
	Measure at MODE 3	0xA4	1	0	1	0	0	1	0	0	Start measure at MODE 3
	Measure at MODE 4	0xA6	1	0	1	0	0	1	1	0	Start measure at MODE 4

Table 7 Result command list (1/2)

<table>
<tr><th rowspan="2">Command Name</th><th rowspan="2">Command Code HEX.</th><th colspan="8">BIN.</th><th rowspan="2">Action</th></tr>
<tr><th>C7</th><th>C6</th><th>C5</th><th>C4</th><th>C3</th><th>C2</th><th>C1</th><th>C0</th></tr>
<tr><td rowspan="4">Read Pressure Result</td><td>0xC0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>Read pressure result</td></tr>
<tr><td>0xC4</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>Read pressure result with LowPassFilter 1st</td></tr>
<tr><td>0xC6</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>Read pressure result with LowPassFilter 1st+2nd</td></tr>
<tr><td colspan="10">Read compensated pressure result.
It outputs the result of pressure measurement at 24bits, MSB first.
A negative number is expressed by 2’s complement.
About output range, in case of positive output : 000000 h ~ 7FFFFF h (in decimal number : 0 ~ +8388607), in case of negative output : FFFFFF h ~ 800000 h (in decimal number : -1 ~ -8388608)
However, the result of measurement when being used beyond a recommended operating condition can't be guaranteed.

Pressure value = DEC. / 1000

Output example:
<table>
<tr><th>BIN.</th><th>HEX.</th><th>DEC.</th><th>Pressure</th></tr>
<tr><td>111111111111111110010000 b</td><td>FFE890 h</td><td>-6000</td><td>-6.000mmHg</td></tr>
<tr><td>000000000000000000000000 b</td><td>000000 h</td><td>0</td><td>0.000mmHg</td></tr>
<tr><td>000001001001001111100000 b</td><td>0493E0 h</td><td>300000</td><td>300.000mmHg</td></tr>
</table>
</td></tr>
</table>

Table 8 Result command list (2/2)

<table>
<tr><th rowspan="3">Command Name</th><th colspan="9">Command Code</th><th rowspan="3">Action</th></tr>
<tr><th rowspan="2">HEX.</th><th colspan="8">BIN.</th></tr>
<tr><th>C7</th><th>C6</th><th>C5</th><th>C4</th><th>C3</th><th>C2</th><th>C1</th><th>C0</th></tr>
<tr><td rowspan="2">Read Temperature Result</td><td>0xC2</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>Read Temperature result</td></tr>
<tr><td colspan="10">Read compensated temperature result.
It outputs the result of pressure measurement at 24bits, MSB first.
A negative number is expressed by 2’s complement.
About output range, in case of positive output : 000000 h ~ 7FFFFF h (in decimal number : 0 ~ +8388607), in case of negative output : FFFFFF h ~ 800000 h (in decimal number : -1 ~ -8388608)
However, the result of measurement when being used beyond a recommended operating condition can't be guaranteed.

Temperature value = DEC. / 2^16

Output example:
<table>
<tr><th>BIN.</th><th>HEX.</th><th>DEC.</th><th>Temperature</th></tr>
<tr><td>00000101000000000000000 b</td><td>050000 h</td><td>327680</td><td>5.000 ℃</td></tr>
<tr><td>00011001000000000000000 b</td><td>190000 h</td><td>1638400</td><td>25.000 ℃</td></tr>
<tr><td>00101101000000000000000 b</td><td>2D0000 h</td><td>2949120</td><td>45.000 ℃</td></tr>
</table></td></tr>
<tr><td rowspan="2">Status</td><td>0x80</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>Output status signals that can indicate the IC status</td></tr>
<tr><td colspan="10">Output 8bits data depending on the conditions
<table>
<tr><th>D7</th><th>D6</th><th>D5</th><th>D4</th><th>D3</th><th>D2</th><th>D1</th><th>D0</th><th>State</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>Shutdown</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>Idle</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>Active</td></tr>
</table></td></tr>
</table>

Table 9 Read command list

<table>
<tr><th rowspan="3">Command Name</th><th colspan="9">Command Code</th><th rowspan="3">Action</th></tr>
<tr><th rowspan="2">HEX.</th><th colspan="8">BIN.</th></tr>
<tr><th>C7</th><th>C6</th><th>C5</th><th>C4</th><th>C3</th><th>C2</th><th>C1</th><th>C0</th></tr>
<tr><td>Read NVM</td><td>0xD6</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>Read data from NVM</td></tr>
</table>

State transition table

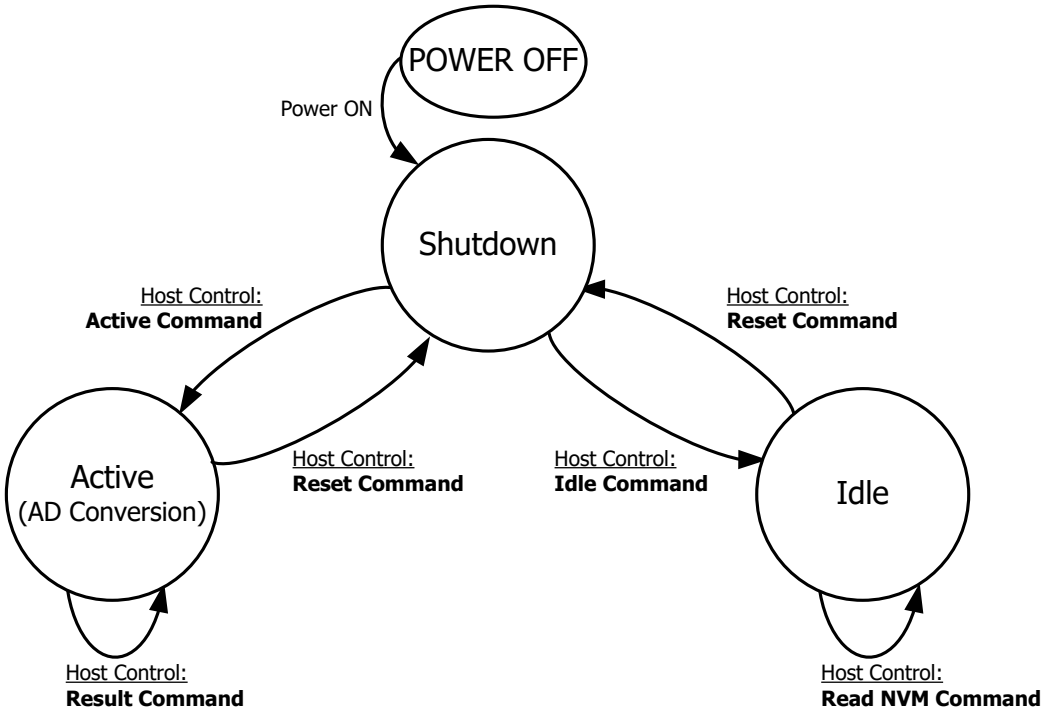


Fig. 12 State transition diagram

Table 10 State transition table

State / Command	Shutdown	Active	Idle
Reset	Power on Reset & Initial Boot =>Shutdown	Power on Reset & Initial Boot =>Shutdown	Power on Reset & Initial Boot =>Shutdown
Active	Reset & Boot Load =>Active state(AD conversion)	Ignore(note[3]) =>Keep state	=>Active state (AD conversion)
Result	Ignore(note[3]) =>Keep state	Output result =>Keep state	Do not issue(note[4]) =>Keep state
Idle	Reset & Boot Load =>Idle state	=>Idle state	=>Keep state
Read NVM	Ignore(note[3]) =>Keep state	Do not issue(note[5]) =>Keep state	Output code =>Keep state
Status	Output code =>Keep state	Output code =>Keep state	Output code =>Keep state

note[3]: NACK is returned to the command.
note[4]: The correct result isn't output. Additionally, ACK is returned to the command.
note[5]: Although command is acceptable, it goes unintended behavior since sequence is running.

Timing Chart

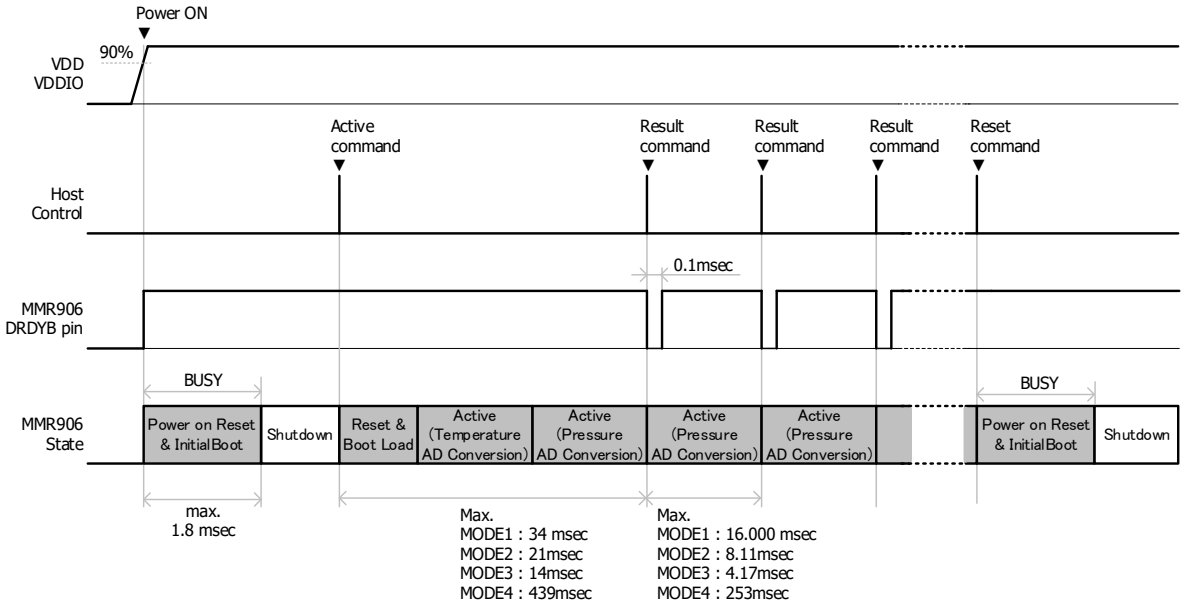


Fig. 13 Timing Chart

note[6]: 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

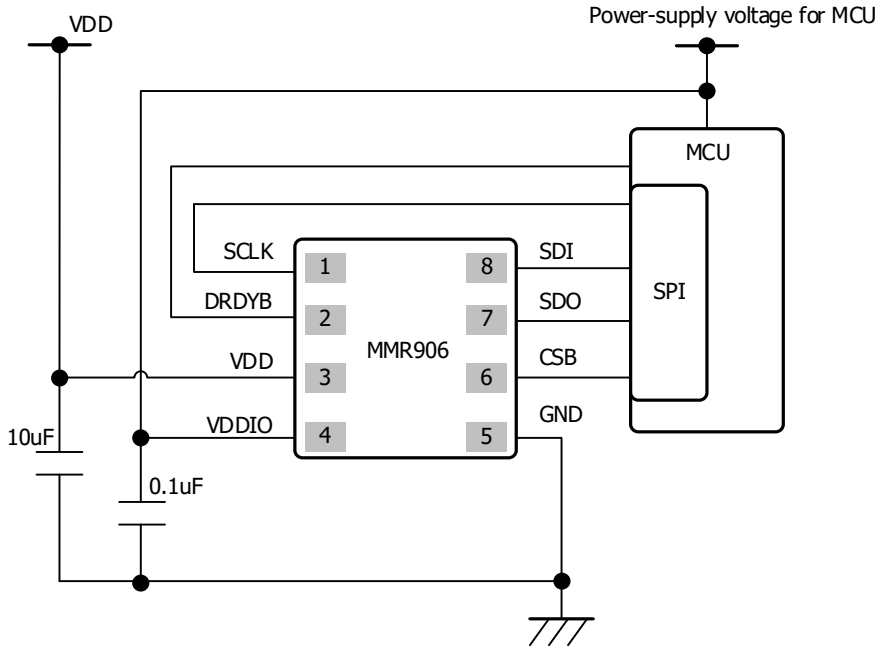


Fig. 14 Typical Electrical Connection

TYPICAL PERFORMANCE CHARACTERISTICS

（unless otherwise specified, Ta=25℃, VDD=VDDIO=3.0V）

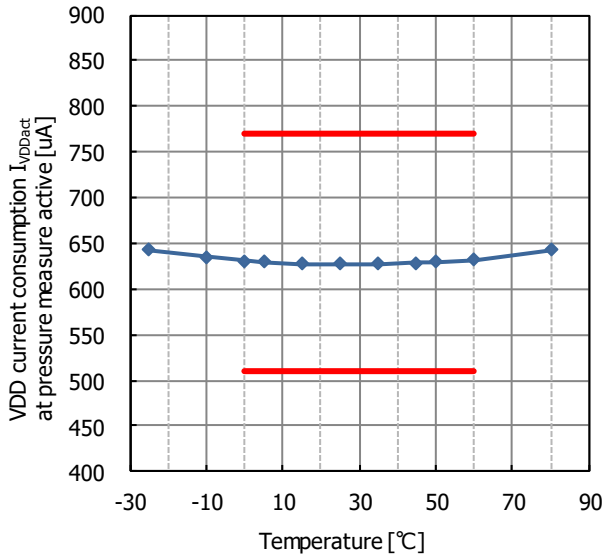


Fig.15.1 VDD current consumption I_{VDDact} at pressure measure active temperature characteristic

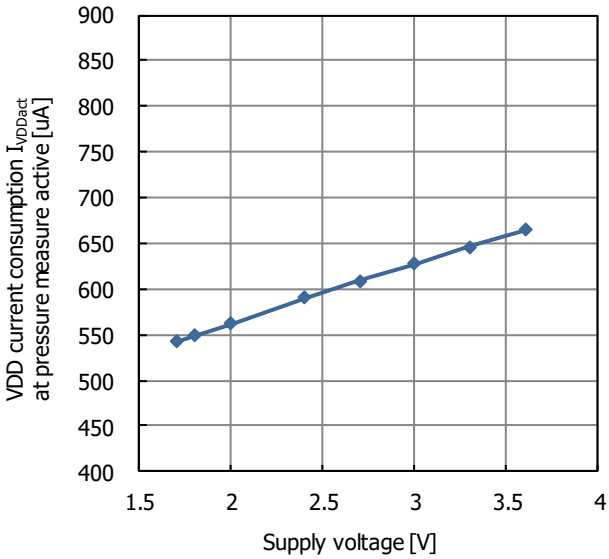


Fig.15.2 VDD current consumption I_{VDDact} at pressure measure active supply voltage characteristic

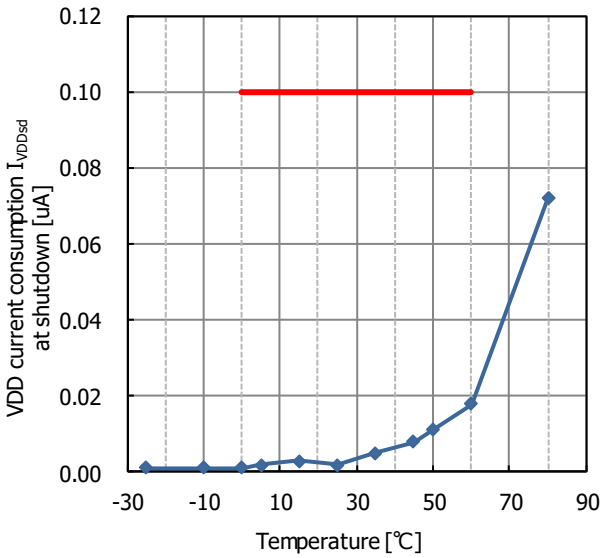


Fig.15.3 VDD current consumption I_{VDDsd} at shutdown temperature characteristic

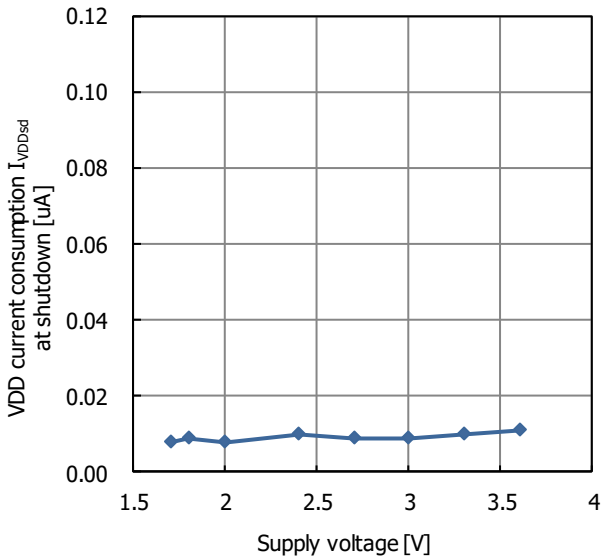


Fig.15.4 VDD current consumption I_{VDDsd} at shutdown supply voltage characteristic

（unless otherwise specified, Ta=25°C, VDD=VDDIO=3.0V）

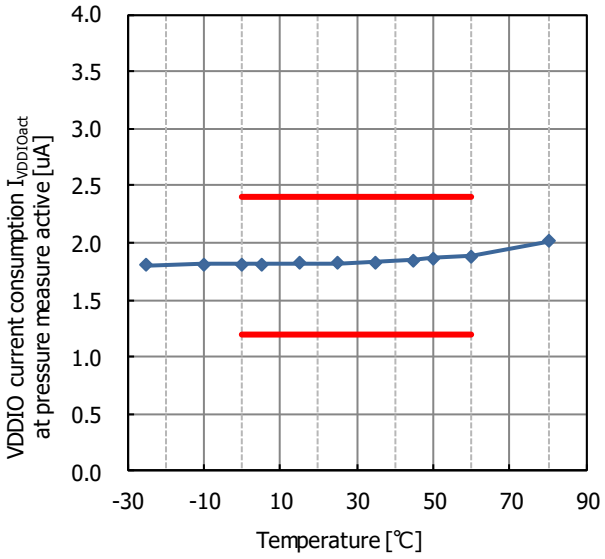


Fig.15.5 VDDIO current consumption $I_{VDDIOact}$ at pressure measure active temperature characteristic

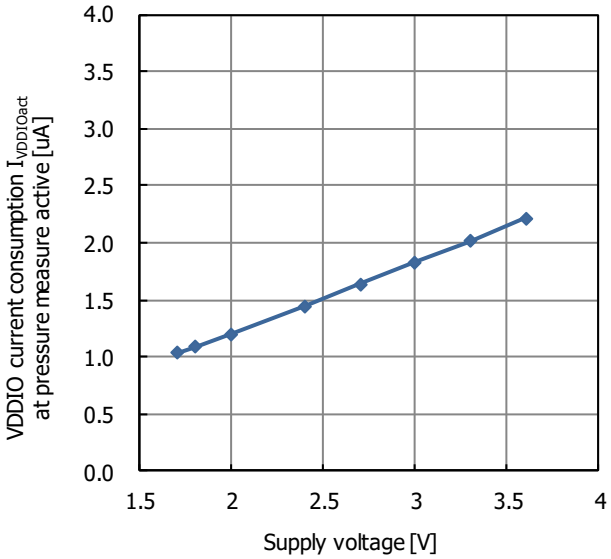


Fig.15.6 VDDIO current consumption $I_{VDDIOact}$ at pressure measure active supply voltage characteristic

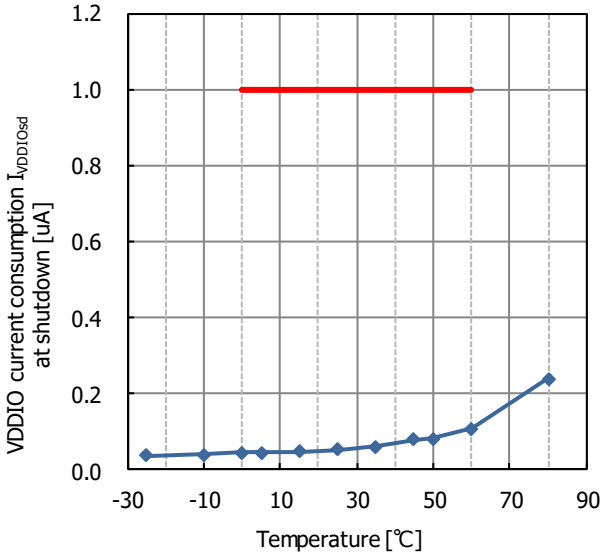


Fig.15.7 VDDIO current consumption $I_{VDDIOsd}$ at shutdown temperature characteristic

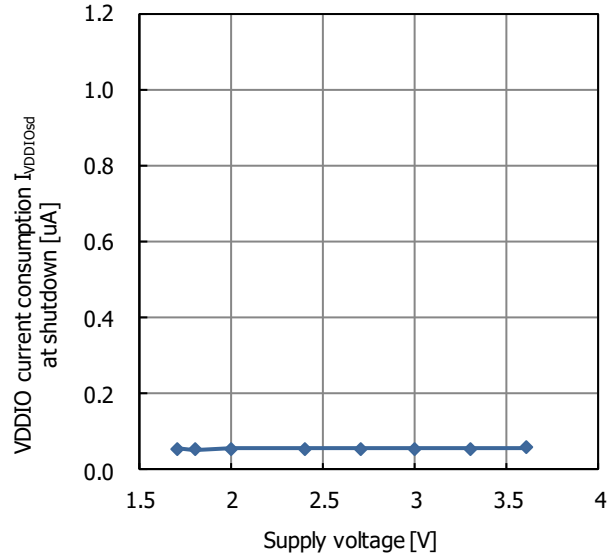


Fig.15.8 VDDIO current consumption $I_{VDDIOsd}$ at shutdown supply voltage characteristic

（unless otherwise specified, Ta=25°C, VDD=VDDIO=3.0V）

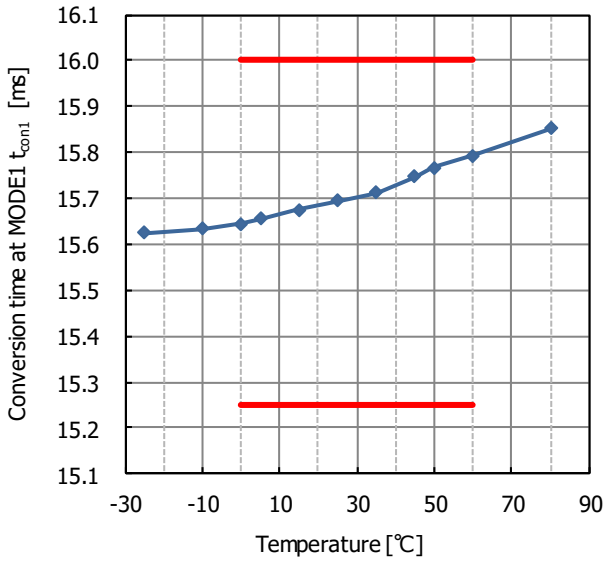


Fig.15.9 Conversion time at MODE 1 temperature characteristic

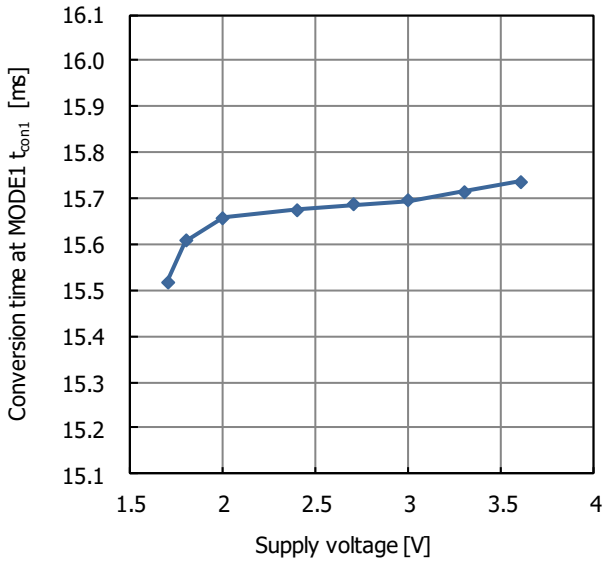


Fig.15.10 Conversion time at MODE 1 supply voltage characteristic

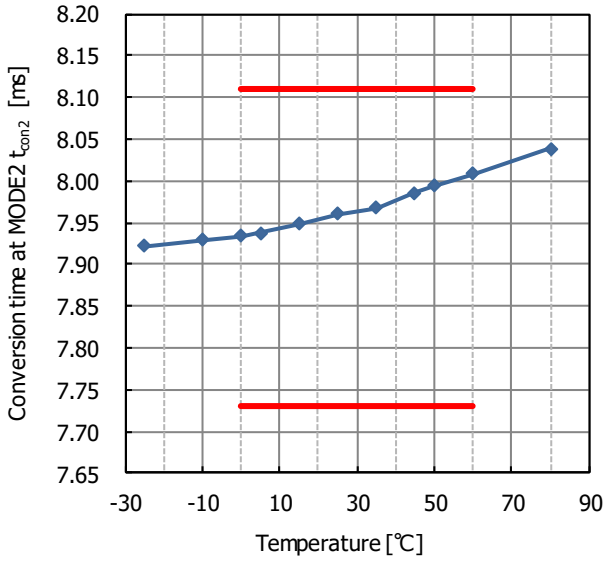


Fig.15.11 Conversion time at MODE 2 temperature characteristic

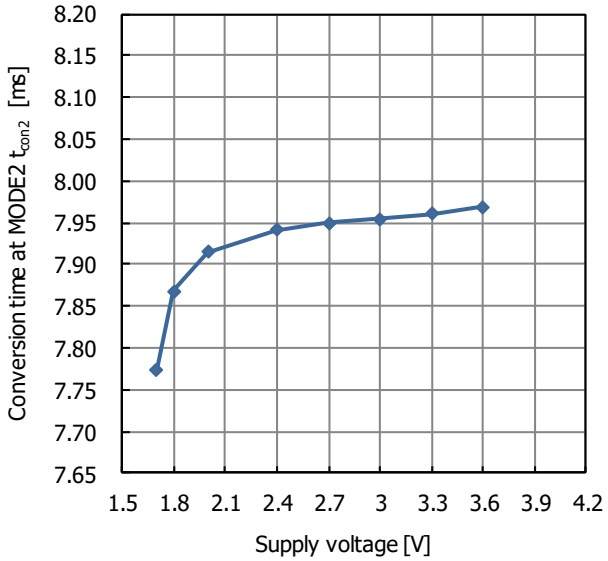


Fig.15.12 Conversion time at MODE 2 supply voltage characteristic

（unless otherwise specified, Ta=25℃, VDD=VDDIO=3.0V）

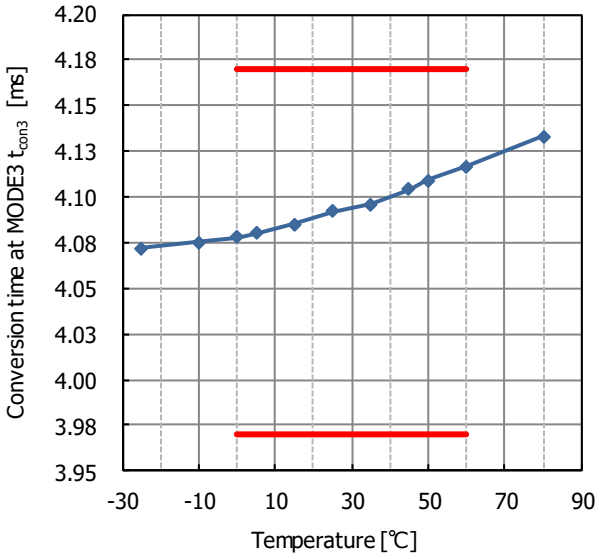


Fig.15.13 Conversion time at MODE 3 temperature characteristic

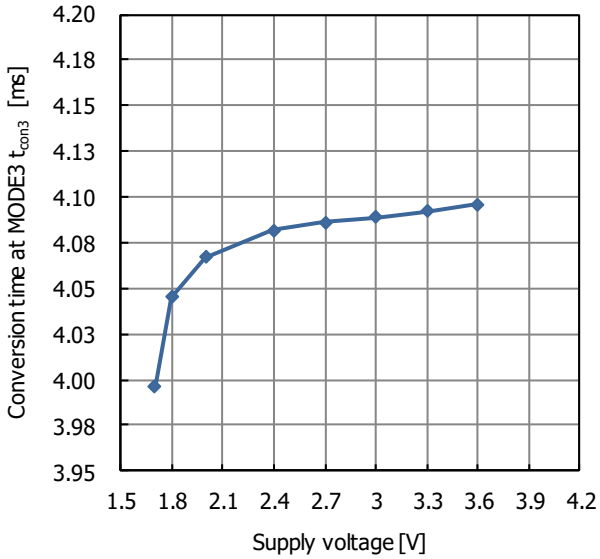


Fig.15.14 Conversion time at MODE 3 supply voltage characteristic

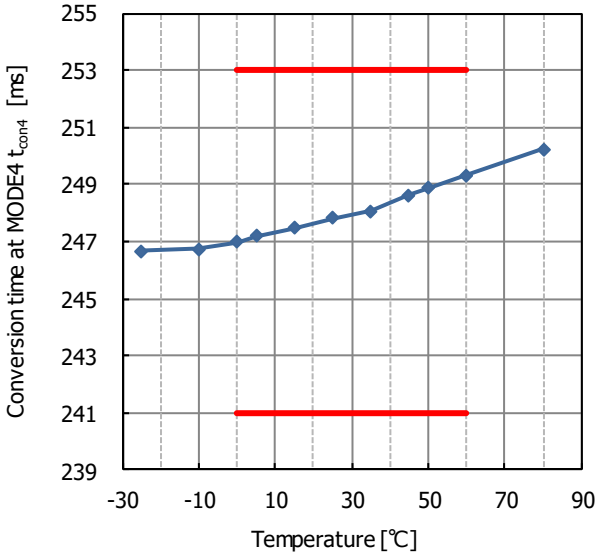


Fig.15.15 Conversion time at MODE 4 temperature characteristic

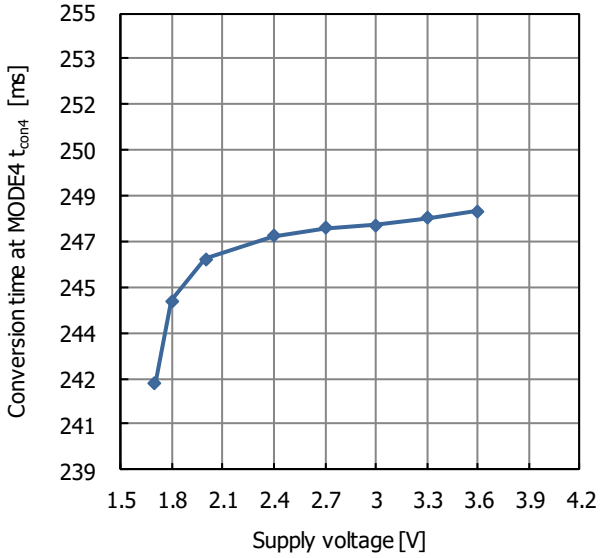


Fig.15.16 Conversion time at MODE 4 supply voltage characteristic

（unless otherwise specified, Ta=25°C, VDD=VDDIO=3.0V）

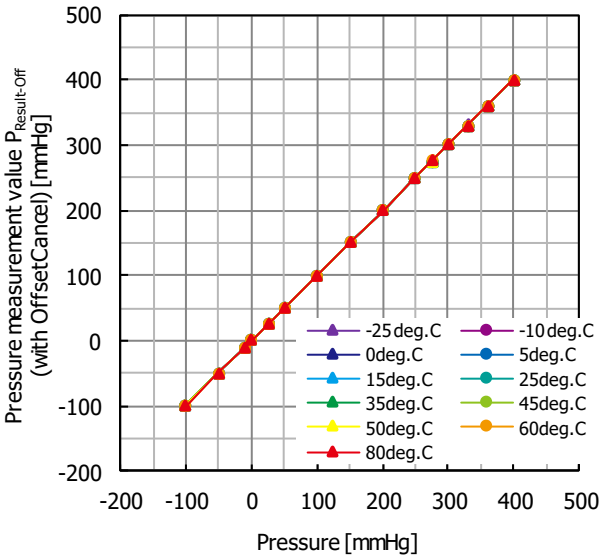


Fig.15.17 Pressure measurement value $P_{Result-Off}$ (with Offset Cancel) temperature characteristic

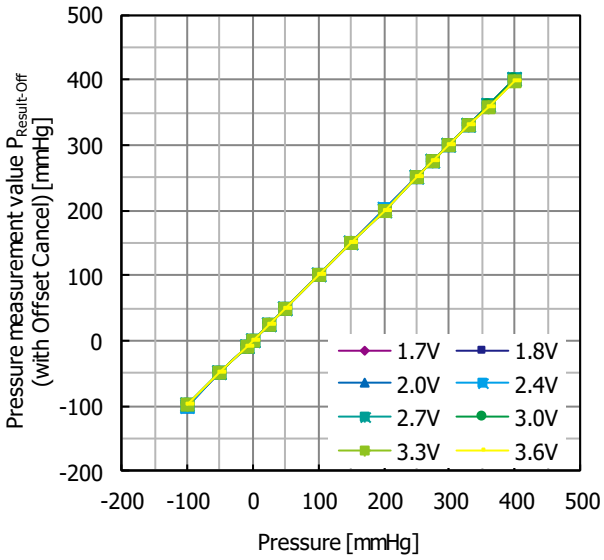


Fig.15.18 Pressure measurement value $P_{Result-Off}$ (with Offset Cancel) suplly voltage characteristic

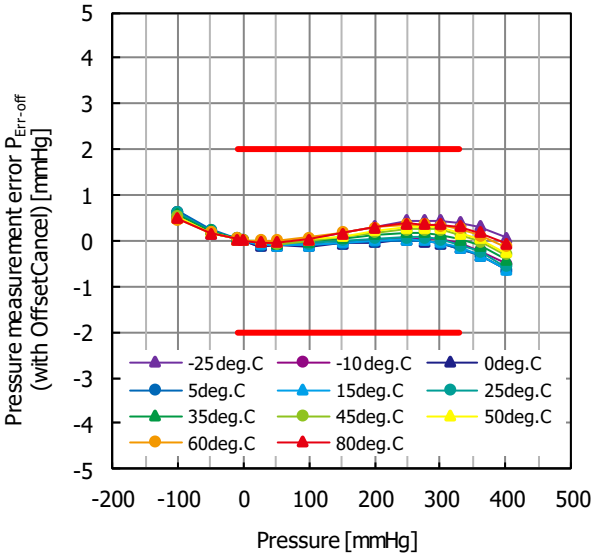


Fig.15.19 Pressure measurement error $P_{Err-Off}$ (with Offset Cancel) temperature characteristic

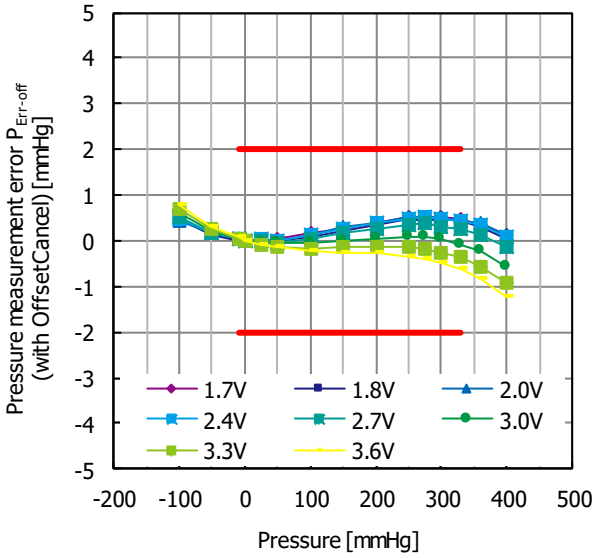
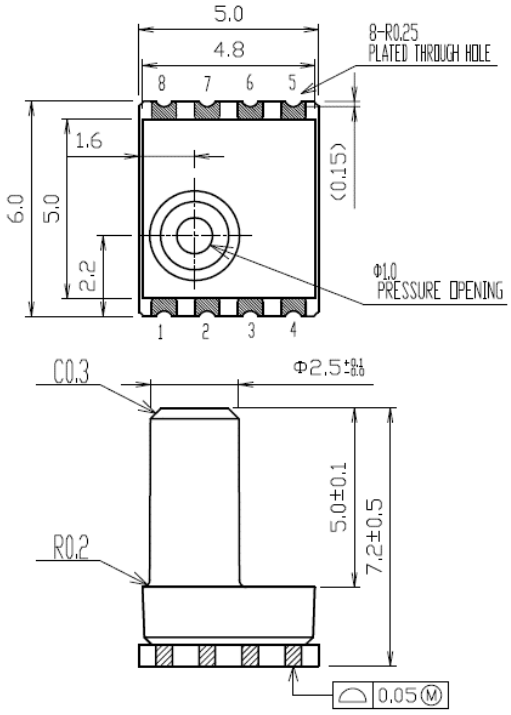


Fig.15.20 Pressure measurement error $P_{Err-Off}$ (with Offset Cancel) supply voltage characteristic

DIMENSIONS

PACKAGE : MEMS-8B

UNIT	mm



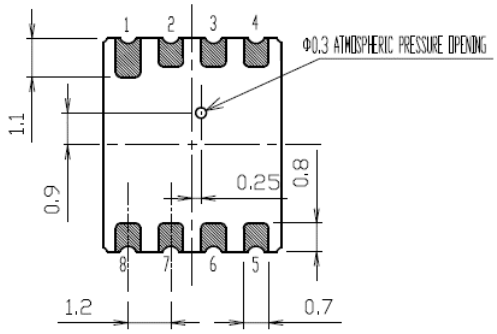


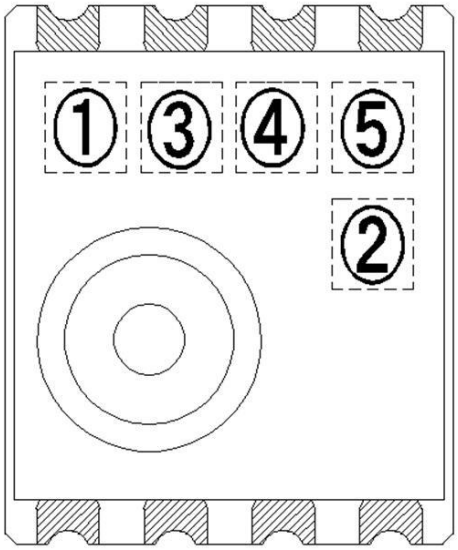
Table.11 Terminal list

PIN No.	Name
1	SCLK
2	DRDYB
3	VDD
4	VDDIO
5	GND
6	CSB
7	SDO
8	SDI

Print circuit board specifications

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

MARKING CONTENTS

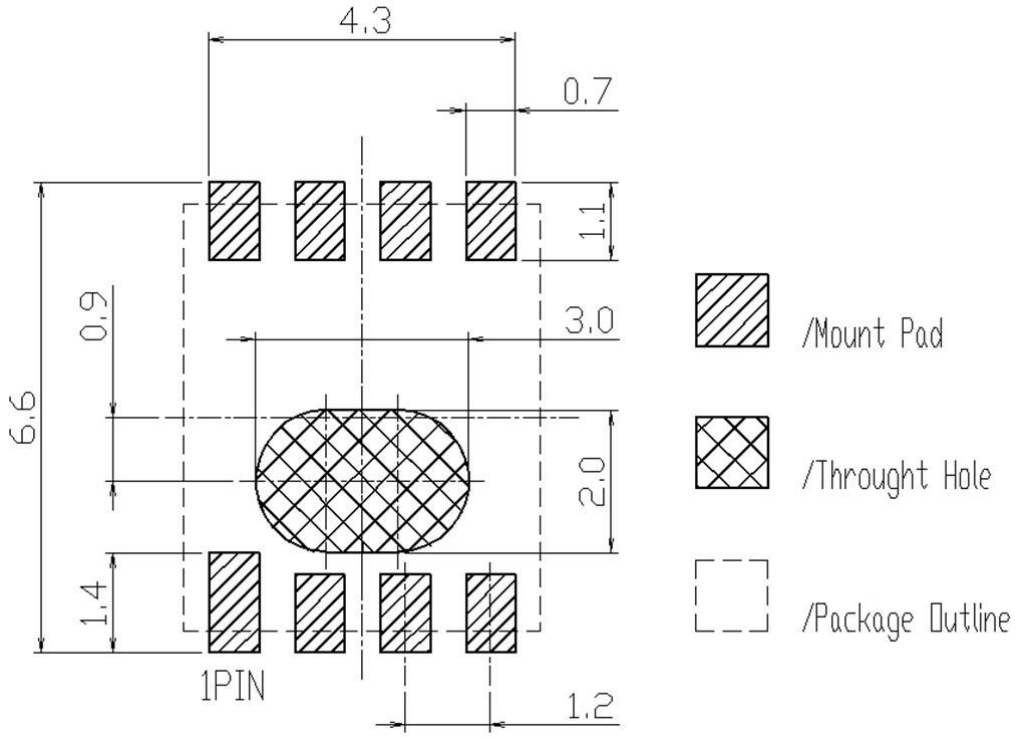


①～②	Model name	Rank
	MMR906XAN	6X

③	Production year			
④	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
	JUN	6	DEC	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

RECOMMENDED LAND PATTERN

UNIT	mm

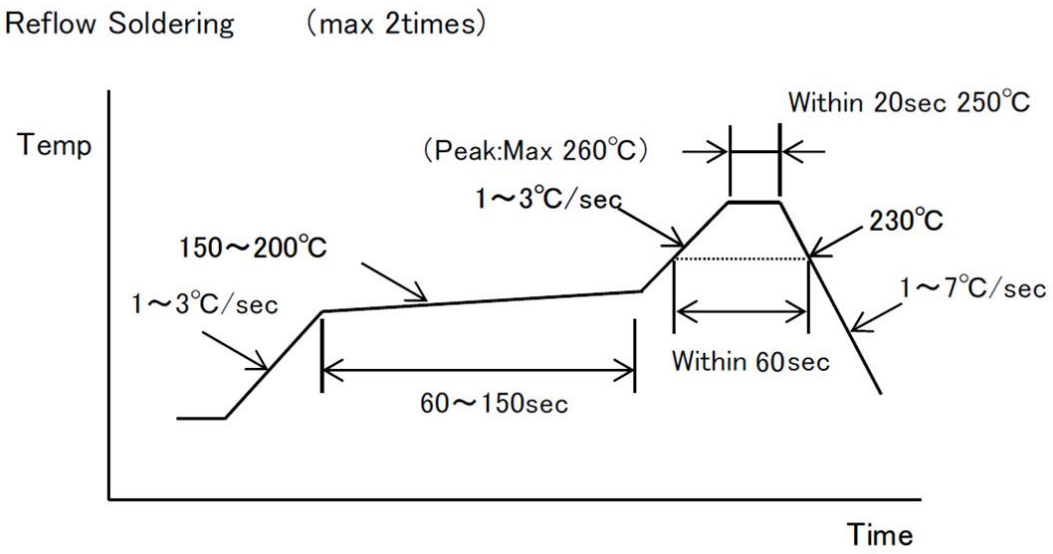


The dimension is for reference only and not guaranteed by design.

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℃
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℃
Humidity：40～70%RH
Storage life：1year

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

Temperature： 5～30℃
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 moistureabsorbed package. Before mounting, the package should be baked under the following conditions.

Temperature: 125°C
Treating time: 16～24 hours

Tray is 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 / http://www.mitsumi.co.jp

Notes:
Any products mentioned this datasheet are subject to any modification in their appearance and others for improvements without prior notification. The details listed here are not a guarantee of the individual products at the time of ordering. When using the products, you will be asked to check their specifications.

