Pressure Sensor series

Pressure Sensor IC

BM1383GLV

General Description

BM1383GLV is piezo-resistive pressure sensor.
BM1383GLV does temperature compensation for MEMS inside chip, so it's very easy to get pressure information.

Features

- Piezo-resistive pressure sensor.
- Pressure range is from 300hPa to 1100hPa.
- Built-in temperature compensation function.
- I^2C interface.
- Small package.

Applications

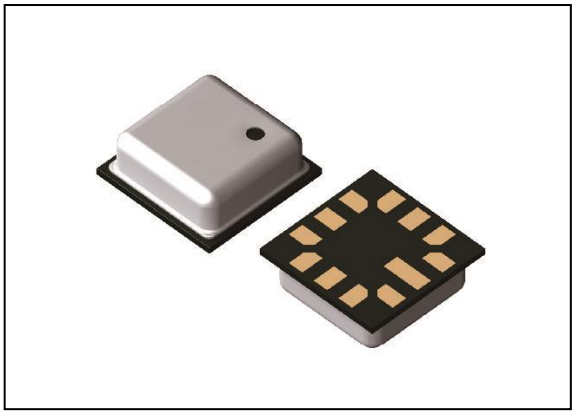
- Smartphone, Healthcare, mobile device (e.g. game).

Key Specifications

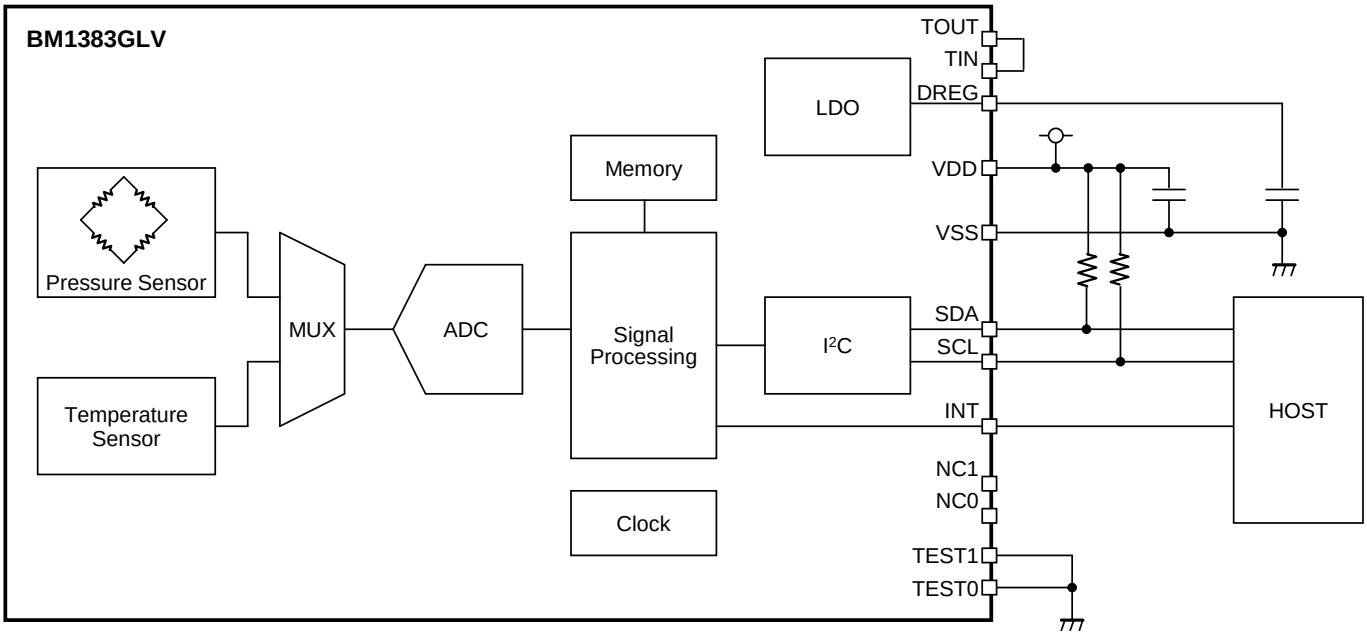
- Pressure Range: 300hPa to 1100hPa
- Relative Pressure Accuracy: ±0.12hPa(Typ)
- Absolute Pressure Accuracy: ±1hPa(Typ)
- Average Current Consumption: 5.0μA (Typ)
- Operating Temperature Range: -40°C to +85°C

Package

	W(Typ) x D(Typ) x H(Max)
CLGA12V025M	2.50mm x 2.50mm x 1.00mm



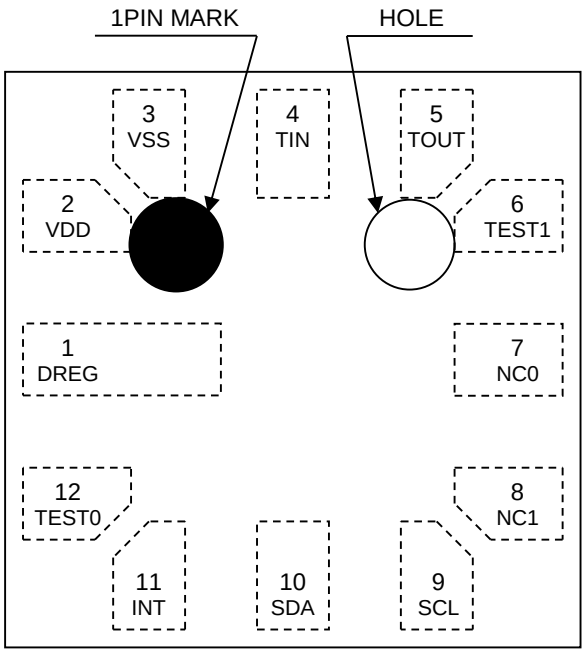
Typical Application Circuit



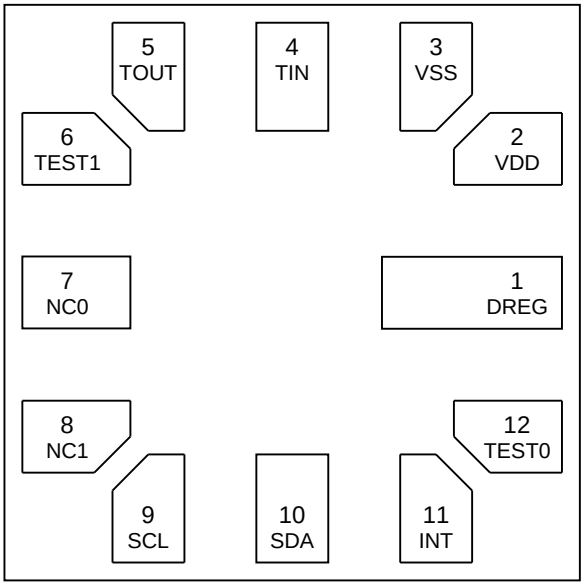
Contents

Pin Configuration

Top View
(pads not visible)



Bottom View
(pads visible)

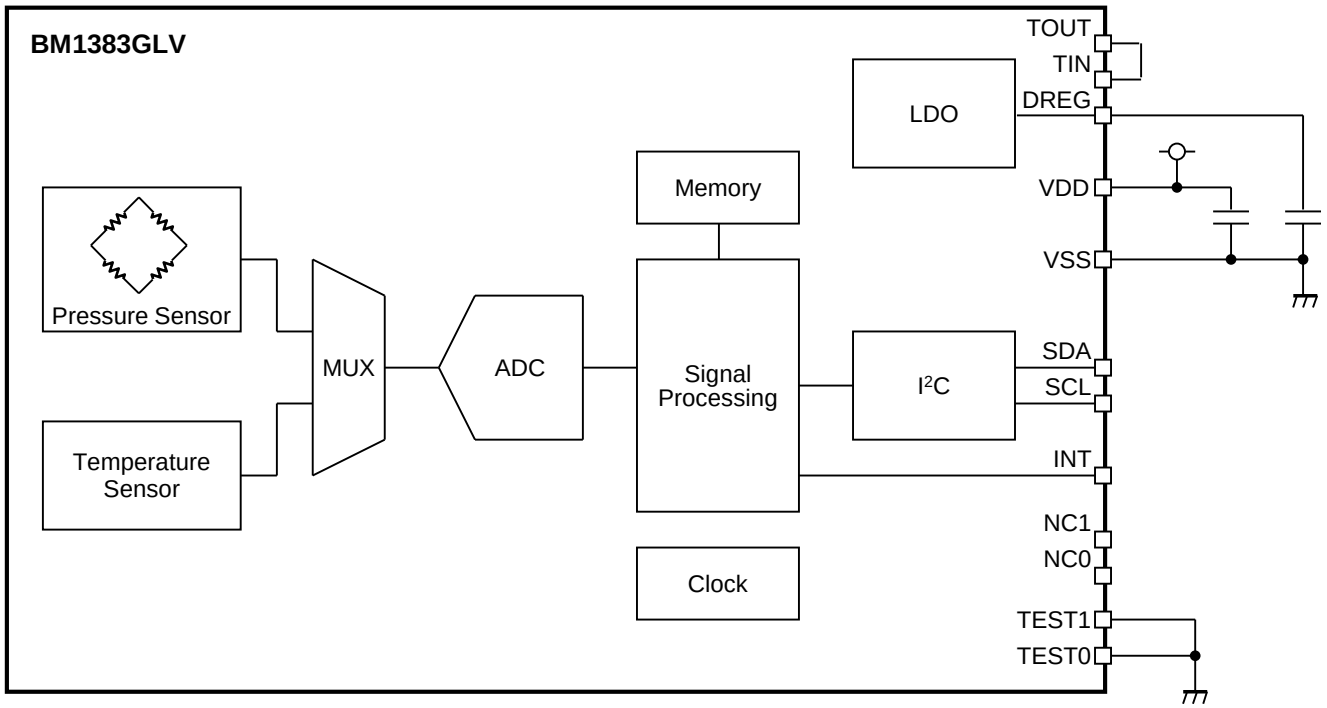


Pin Description

Pin No.	Pin Name	In/Out	Function
1	DREG	-	Logic voltage pin(Note 1)
2	VDD	-	power voltage pin(Note 2)
3	VSS	-	GND pin
4	TIN	In	Test pin (connect to TOUT)
5	TOUT	Out	Test pin (connect to TIN)
6	TEST1	In	Test pin (connect to GND)
7	NC0	-	Non connect pin
8	NC1	-	Non connect pin
9	SCL	In	I^2C serial bus clock pin
10	SDA	In/Out	I^2C serial bus data pin
11	INT	Out	INT pin
12	TEST0	In	Test pin (connect to GND)

(Note 1) Please place a bypass capacitor between DREG and VSS in the proximity of the terminals.
Please set a bypass capacitor of 1.0uF between DREG and VSS.
(Note 2) Please do not use DREG as power supply for other device because DREG should be only used to Logic.
(Note 3) Please place a bypass capacitor between VDD and VSS in the proximity of the terminals.

Block Diagram



Absolute Maximum Ratings (Ta = 25°C)

Parameter	Symbol	Rating	Unit
Power Supply	VDD	0 to +4.5	V
Input Voltage	V_{IN}	-0.3 to VDD+0.3	V
Operating Temperature	Topr	-40 to +85	°C
Storage Temperature	Tstg	-40 to +125	°C
Pressure	P_{ovr}	20000	hPa
Power Dissipation	P_d	0.43 (Note 1)	W

(Note 1) Derating in done 4.3 mW/°C for operating above Ta≧25°C (Mount on 4-layer 114.3×76.2×1.6mm board)
Caution: Operating the IC over the absolute maximum ratings may damage the IC. The damage can either be a short circuit between pins or an open circuit between pins and the internal circuitry. Therefore, it is important to consider circuit protection measures, such as adding a fuse, in case the IC is operated over the absolute maximum ratings.

Recommended Operating Conditions (Ta= -40°C to +85°C)

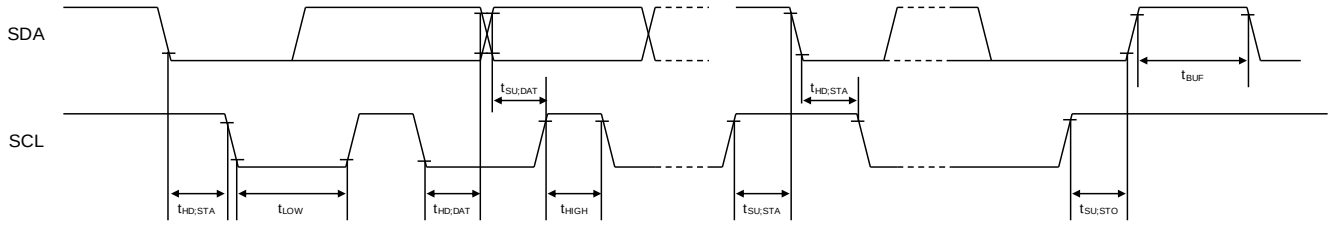
Parameter	Symbol	Rating	Unit
Power Supply	VDD	1.7 to 3.6	V
I^2C clock Input Frequency	f_{SCL}	MAX 400	kHz

Electrical Characteristics (Unless otherwise specified VDD=1.8V Ta=25°C)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Current Consumption						
Average Current Consumption (data rate 1Hz)	I_{dd}	-	5.0	-	µA	OneShotMode(Single Measurement)
Operating Mode Current Consumption	I_{ddp}	-	650	1000	µA	during Pressure measurement
	I_{ddt}	-	650	1000	µA	during Temperature measurement
Power Down Mode Current	I_{ss}	-	1	10	µA	PWR_DOWN=0 RSTB=0
Logic						
L Input Voltage	V_{IL}	GND	-	0.3 * VDD	V	SDA, SCL
H Input Voltage	V_{IH}	0.7 * VDD	-	VDD	V	SDA, SCL
L Input Current	I_{IL}	-10	-	0	µA	VIL= GND (SDA, SCL)
H Input Current	I_{IH}	0	-	10	µA	VIH= VDD (SDA, SCL)
L Output Voltage 1	V_{OL1}	GND	-	0.2 * VDD	V	IL= -0.3mA (INT)
L Output Voltage 2	V_{OL2}	GND	-	0.2 * VDD	V	IL= -3mA (SDA)
Pressure characteristics						
Pressure Detection Range	P_R	300	-	1100	hPa	
Relative Pressure Accuracy(Note 1)	P_{rel}	-	±0.12	-	hPa	950hPa to 1050hPa AVE_NUM=001
Absolute Pressure Accuracy	P_{abs}	-	±1	-	hPa	1000hPa
Temperature Accuracy	T_{abs}	-	±2	-	°C	25°C to 85°C
Measurement Time	T_{meas}	-	3	-	ms	OneShotMode(Single Measurement)

(Note 1) Target values

I²C bus Timing Chart (Unless Otherwise VDD=1.8V Ta=25°C)



Parameter	Symbol	Min	Typ	Max	Unit	Conditions
I²C SCL Frequency	f_{SCL}	0	-	400	kHz	
I²C 'L' Period of SCL	t_{LOW}	1.3	-	-	µs	
I²C 'H' Period of SCL	t_{HIGH}	0.6	-	-	µs	
I²C Setup Time for START Condition	$t_{SU;STA}$	0.6	-	-	µs	
I²C Hold Time for (Repeated) START Condition	$t_{HD;STA}$	0.6	-	-	µs	
I²C Data Setup Time	$t_{SU;DAT}$	100	-	-	ns	
I²C Data Hold Time	$t_{HD;DAT}$	0	-	-	µs	
I²C Setup Time For STOP Condition	$t_{SU;STO}$	0.6	-	-	µs	
I²C Bus Free Time Between STOP and START Condition	t_{BUF}	1.3	-	-	µs	

Register Map

Address	Register name	RW	D7	D6	D5	D4	D3	D2	D1	D0
10h	ID	R	0	0	1	1	0	0	0	1
11h	RESET_CONTROL	W	SW_ RESET	INT_ RESET	0	0	0	0	0	0
12h	POWER_DOWN	RW	0	0	0	0	0	0	0	PWR_ DOWN
13h	RESET	RW	0	0	0	0	0	0	0	RSTB
14h	MODE_CONTROL	RW	AVE_NUM			0	T_AVE	MODE		
15h	INT_H_TH_MSB (Upper 8bit)	RW	PDTH_H[15:8]							
16h	INT_H_TH_LSB (Lower 8bit)	RW	PDTH_H[7:0]							
17h	INT_L_TH_MSB (Upper 8bit)	RW	PDTH_L[15:8]							
18h	INT_L_TH_LSB (Lower 8bit)	RW	PDTH_L[7:0]							
19h	INT_CONTROL	RW	INT_H_ STATUS	INT_L_S TATUS	INT_H_ EN	INT_L_E N	INT_PU _EN	0	INT_ MODE	INT_EN
1Ah	Reserved	R	Reserved							
1Bh	Reserved	R	Reserved							
1Ch	PRESSURE_MSB (Upper 8bit)	R	PRESS_OUT[15:8]							
1Dh	PRESSURE_LSB (Lower 8bit)	R	PRESS_OUT[7:0]							
1Eh	PRESSURE_LSB (Least 6bit)	R	PRESS_OUT_XL[5:0]						0	0

○ID(10h)

Field	Bit	TYPE	Description
Manufacturer ID	7 : 4	R	0011
Part ID	3 : 0	R	0001

default value 31h

○RESET_CONTROL(11h)

This register can be accessed only in the case of PWR_DOWN=1 and RSTB=1.
(In other case Write: Ignored, Read:FFh)

Field	Bit	TYPE	Description
SW_RESET	7	W	When reading “0” is read. 0: Don’t execute software reset 1: execute software reset
INT_RESET	6	W	When reading “0” is read. 0: Keep INT terminal status. 1: INT terminal become inactive (high impedance)
Reserved	5 : 0	R	Write “000000”

default value 00h

○POWER_DOWN(12h)

Field	Bit	TYPE	Description
Reserved	7 : 1	R	Write “0”
PWR_DOWN	0	RW	0: power down 1: active

default value 00h

○RESET(13h)

Field	Bit	TYPE	Description
Reserved	7 : 1	R	Write “0”
RSTB	0	RW	0: Measurement control block is reset 1: Measurement control block is active.

default value 00h

○MODE_CONTROL(14h)

This register can be accessed only in the case of PWR_DOWN=1 and RSTB=1.
(In other case Write: Ignored, Read: FFh)

Field	Bit	TYPE	Description
AVE_NUM	7 : 5	RW	Set the average number of measurement data 000: single 001: average of 2 times 010: average of 4 times 011: average of 8 times 100: average of 16 times 101: average of 32 times 110: average of 64 times
Reserved	4	R	Write “0”
T_AVE	3	R/W	Set the measurement number of temperature data 0: Temperature measurement is performed same times as average number. 1: Temperature measurement is performed once per 4 times pressure measurements.
MODE	2 : 0	RW	Set measurement mode. Please refer to the table below for the measurement mode.

default value 00h

Measurement time and RMS noise against number of average (T_AVE=1)

AVE_NUM	Number of measurement		Measurement time Tm [ms]	RMS noise [hPa]
	Pressure	Temperature		
000	1	1	3	0.090
001	2	1	5	0.063
010	4	1	10	0.045
011	8	2	19	0.032
100	16	4	37	0.023
101	32	8	74	0.016
110	64	16	147	0.011

When measurement time is over a set Continuous rate, measurement has priority.
RMS noise is calculated as standard deviation of 32 data points (1σ).
RMS noise is a reference value and it’s not the value with guarantee.

Measurement mode

MODE	Measurement mode
000	Stand by
001	One shot
010	Continuous(50ms)
011	Continuous(100ms)
100	Continuous(200ms)
101	Prohibition
110	Prohibition
111	Prohibition

Pressure and Temperature are measured at one rate

Operation mode transition

Please refer to the below figure of operation mode transition.

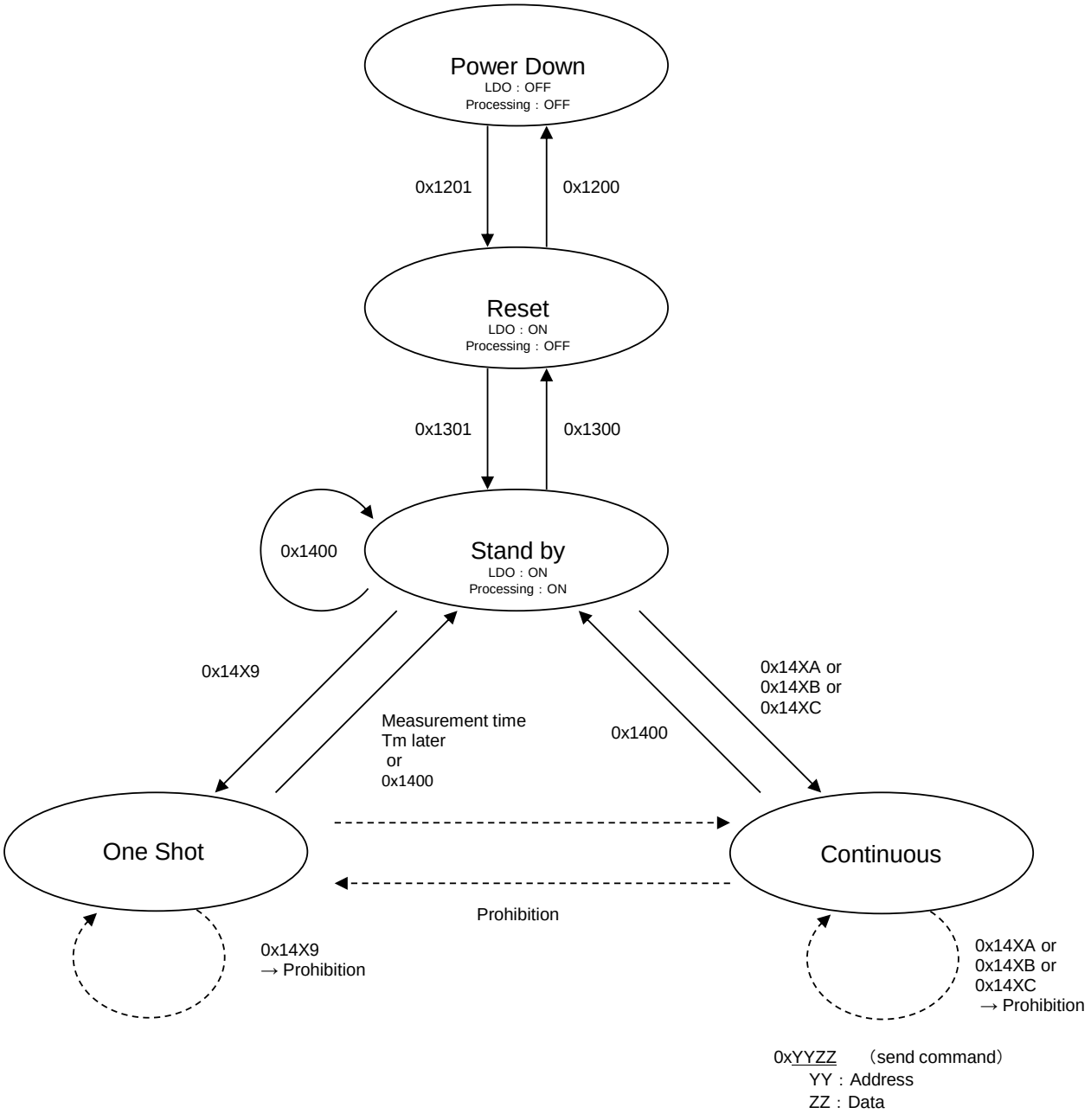
Power down mode is the smallest current consumption mode due to circuit is OFF. Please set this mode when reducing current consumption. Measurement is not available in this mode, so the measurement is performed after switching mode to standby mode.

In Reset mode, LDO is active and Measurement control block is reset. Register is initialized in Reset mode. Measurement command is acceptable when “1” is written in “RSTB”

There are 2 measurement modes. One shot mode and Continuous mode. They are switched from stand by mode. Then, please set AVE_NUM and T_AVE register.
Please write “0x1400” when setting to standby mode again.

In one shot mode, a single measurement is performed when “001” is written in “MODE”. After the measurement is performed, it is switched to standby mode automatically. When “0x1400” is written before end of measurement, mode is switched to standby immediately but pressure value is not updated.
Transition to the other measurement mode during measurement in one shot mode is forbidden.

In Continuous mode, when “MODE” is “010”, ”011” or ”100”, measurement starts and it continues until “0x1400” is written.Transition to the other measurement mode from Continuous mode is forbidden.



○INT_H_TH_MSB(15h)
This register can be accessed only in the case of PWR_DOWN=1 and RSTB=1.
(In other case Write: Ignored, Read: FFh)

Field	Bit	TYPE	Description
PDTH_H[15:8]	7 : 0	RW	The upper part of the high threshold value for pressure interrupt generation.

default value FFh

Threshold value of intrerrupt is pressure value. Integral part:11bit, Decimal part: 5bit
(Example) In case of setting 1000.5hPa.
Threshold value = $1000.5 \times 2^5 = 32016 = 0x7D10$

○INT_H_TH_LSB(16h)
This register can be accessed only in the case of PWR_DOWN=1 and RSTB=1.
(In other case Write: Ignored, Read: FFh)

Field	Bit	TYPE	Description
PDTH_H[7:0]	7 : 0	RW	The lower part of the high threshold value for pressure interrupt generation.

default value FFh

○INT_L_TH_MSB(17h)
This register can be accessed only in the case of PWR_DOWN=1 and RSTB=1.
(In other case Write: Ignored, Read: FFh)

Field	Bit	TYPE	Description
PDTH_L[15:8]	7 : 0	RW	The upper part of the low threshold value for pressure interrupt generation

default value 00h

○INT_L_TH_LSB(18h)
This register can be accessed only in the case of PWR_DOWN=1 and RSTB=1.
(In other case Write: Ignored, Read: FFh)

Field	Bit	TYPE	Description
PDTH_L[7:0]	7 : 0	RW	The lower part of the low threshold value for pressure interrupt generation

default value 00h

○INT_CONTROL(19h)
This register can be accessed only in the case of PWR_DOWN=1 and RSTB=1.
(In other case Write: Ignored, Read: FFh)

Field	Bit	TYPE	Description
INT_H_STATUS	7	R	Setting of INT_MODE is valid for status register. Even if INT_EN is “0”, setting of INT_MODE is asserted. 0: Measurement data is not over ‘H’ threshold. 1: Measurement data is over ‘H’ threshold.
INT_L_STATUS	6	R	Setting of INT_MODE is valid for status register. Even if INT_EN is “0”, setting of INT_MODE is asserted. 0: Measurement data is not below ‘L’ threshold. 1: Measurement data is below ‘L’ threshold.
INT_H_EN	5	RW	0: High threshold(PDTH_H[15:0]) inactive Disable 1: High threshold(PDTH_H[15:0]) inactive Enable
INT_L_EN	4	RW	0: Low threshold(PDTH_L[15:0]) inactive Disable 1: Low threshold(PDTH_L[15:0]) inactive Enable
INT_PU_EN	3	R/W	0: enable Pull-up resister of INT terminal 1: disable Pull-up resister of INT terminal
Reserved	2	R	Write 0
INT_MODE	1	RW	0: INT terminal is latched until interrupt is cleared (latch mode). 1: INT terminal is updated after each measurement (unlatch mode)
INT_EN	0	RW	0: disable interrupt 1: enable interrupt

default value 00h

○Reserved (1Ah)

This register can be accessed only in the case of PWR_DOWN=1 and RSTB=1. (In other case Read: FFh)

Field	Bit	TYPE	Description
Reserved	7 : 0	R	Reserved

default value 00h

○Reserved (1Bh)

This register can be accessed only in the case of PWR_DOWN=1 and RSTB=1.
(In other case Write: Ignored, Read: FFh)

Field	Bit	TYPE	Description
Reserved	7 : 0	R	Reserved

default value 00h

○PRESSURE_MSB(1Ch)

This register can be accessed only in the case of PWR_DOWN=1 and RSTB=1. (In other case Read: FFh)

Field	Bit	TYPE	Description
PRESS_OUT[15:8]	7 : 0	R	The upper part of pressure data By setting “1” to “SW_RESET” the register value is reset.

default value 00h

○PRESSURE_LSB(1Dh)

This register can be accessed only in the case of PWR_DOWN=1 and RSTB=1. (In other case Read: FFh)

Field	Bit	TYPE	Description
PRESS_OUT[7:0]	7 : 0	R	The lower part of pressure data By setting “1” to “SW_RESET” the register value is reset.

default value 00h

○PRESSURE_LSB(Least 6bit) (1Eh)

This register can be accessed only in the case of PWR_DOWN=1 and RSTB=1. (In other case Read: FFh)

Field	Bit	TYPE	Description
PRESS_OUT_XL [5:0]	7 : 2	R	Pressure data output (decimal extension 6bit) By setting “1” to “SW_RESET” the register value is reset.
Reserved	1 : 0	R	“00”

default value 00h

PRESS_OUT[15:5] : integer part of pressure value(11bit)
PRESS_OUT[4:0], PRESS_OUT_XL[5:0] : decimal part of pressure value(11bit)

Conversion to pressure value is like below.
Pressure value[hPa] = { PRESS_OUT[15:8], PRESS_OUT[7:0], PRESS_OUT_XL[5:0] } / 2048

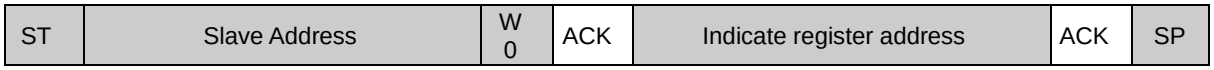
Reading data of one measurement should be done continuously (burst read).
If reading data of one measurement is done individualy, data is updated at the timming of measurement completion.
And data might be mixed up with the data of different measurement.

I²C bus communication

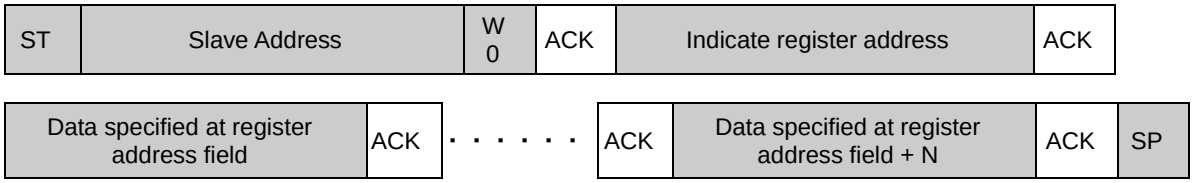
1. Slave address : “1011101”

2. Write format

(1) Case of indicating only register address

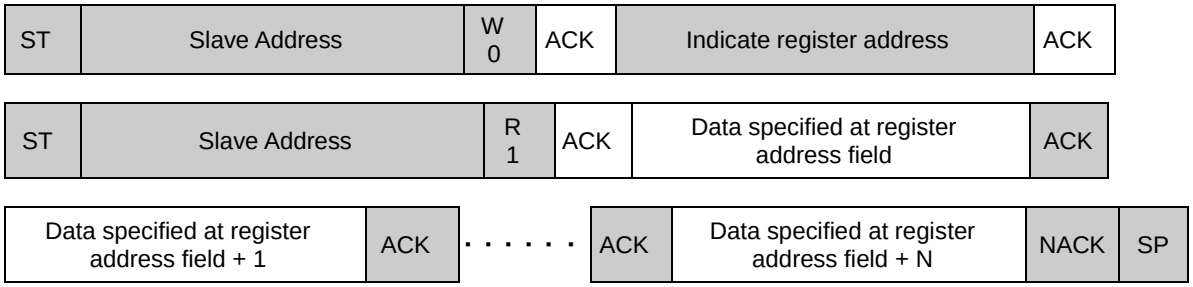


(2) Case of writing data register after indicating register address

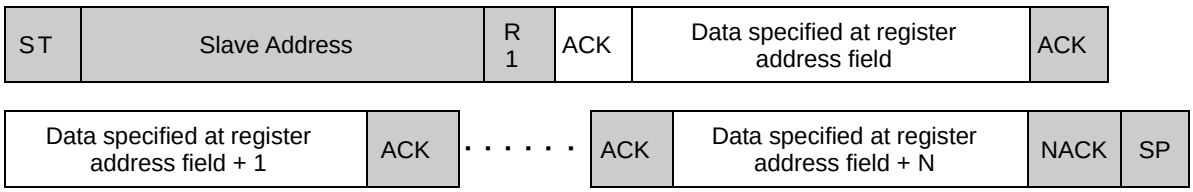


3. Read format

(1) Case of reading data after indicating register address (Master issues restart condition)



(2) Case of reading data



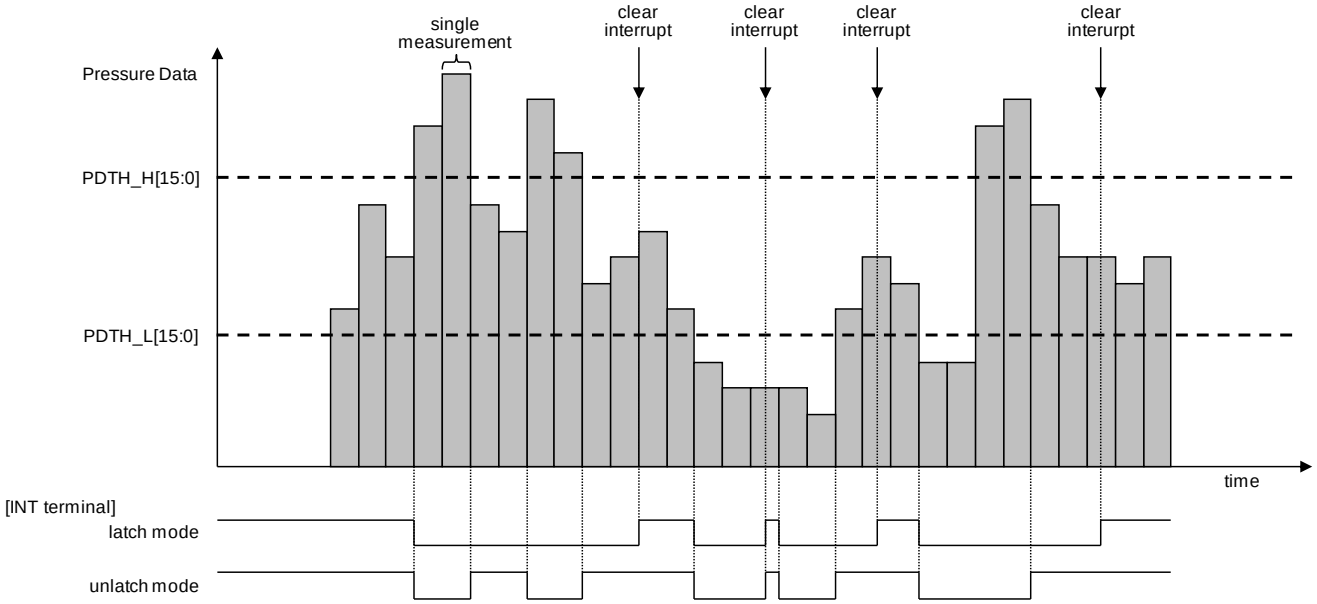

from master to slave


from slave to master

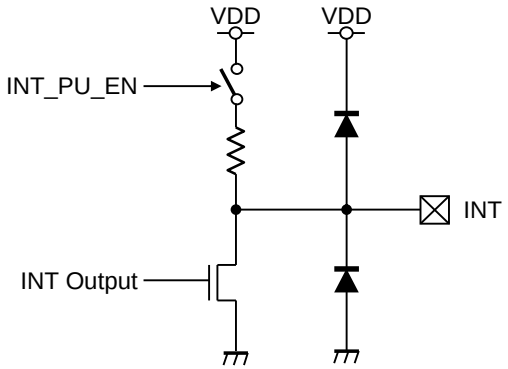
Interrupt function

Interrupt function compares measured pressure value and ‘H’ threshold register (PDTH_H[15:0]) and/or ‘L’ threshold register (PDTH_L[15:0]). If the measured pressure value exceeds 'H' threshold register value or the measured pressure value falls below 'L' threshold register value, interrupt occurs. The interrupt of 'H' threshold and 'L' threshold can be individually set enable. The below figure shows the case of 'H' and ‘L’ threshold enable.

There are two kinds of the interrupt function, one is a latch mode (INT_MODE=0), and another is unlatch mode (INT_MODE=1).
The latch mode keeps the state of INT terminal until interrupt is cleared, once interrupt occurs.
The unlatch mode judges the measured pressure data and the threshold register at each measurement.
When disabling interrupt function (DREN=0). Please do it after clearing interrupt.

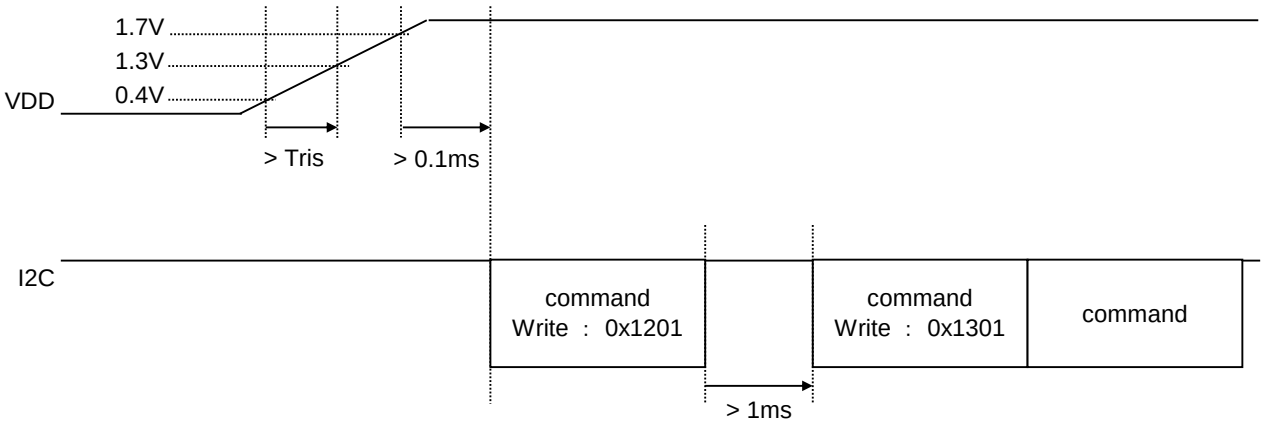


INT terminal is L at state of interrupt, and H by built-in pull-up resister at state of non-interrupt.
When INT terminal is not used, built-in pull-up resister should be ON (INT_PU_EN=0) and the terminal should be open.



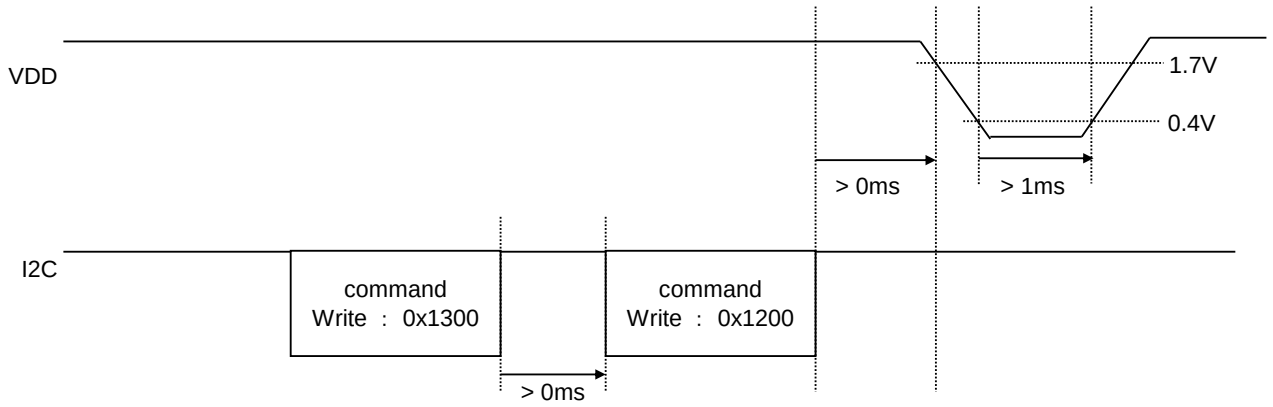
Control sequence

1. Power supply start-up sequence
   Please do the command control by I^2C after power is supplied.

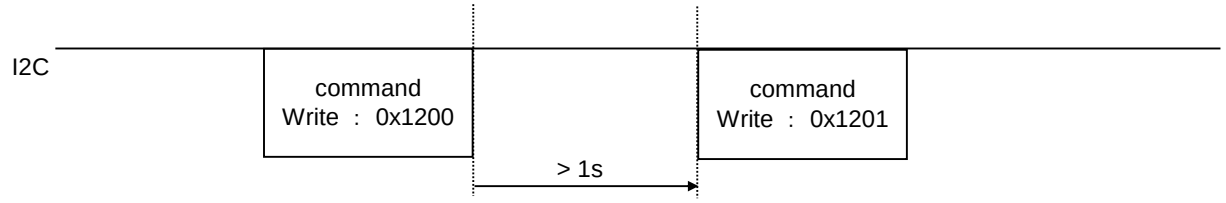


Tris [µs]	Conditions
40	-25 to 85℃
55	-35 to 85℃
65	-40 to 85℃

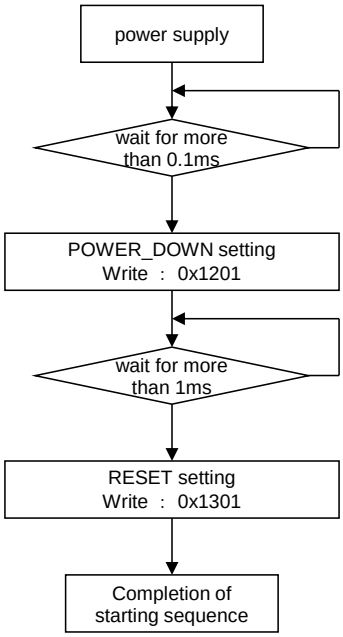
2. Power supply end sequence



3.PWR_DOWN control
When removing PowerDown mode(PWR_DOWN=1) after setting to PowerDown mode(PWR_DOWN=0), please keep PoweDown state more than 1S like below figure.



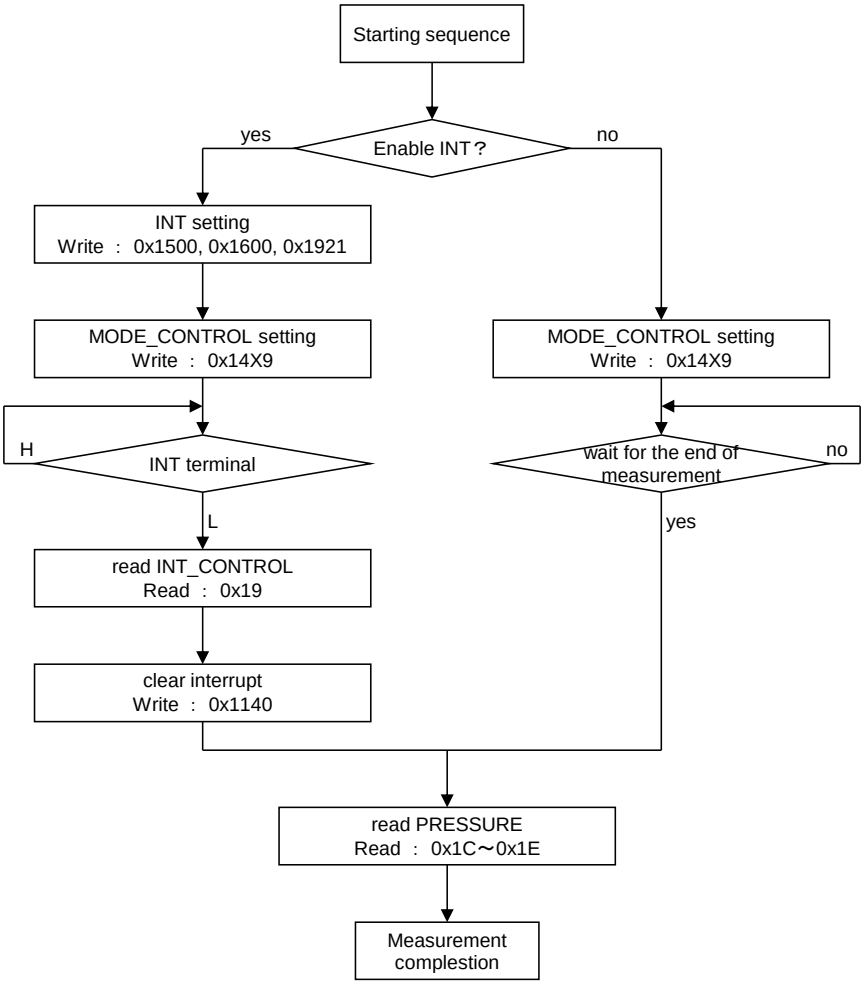
4. Starting sequence



: release Power down

: release Reset mode

5. Measurement sequence: One Shot Mode



: INT terminal is used as Information for end of measurement
to set INT H threshold registers and INT control register.

: measurement mode setting

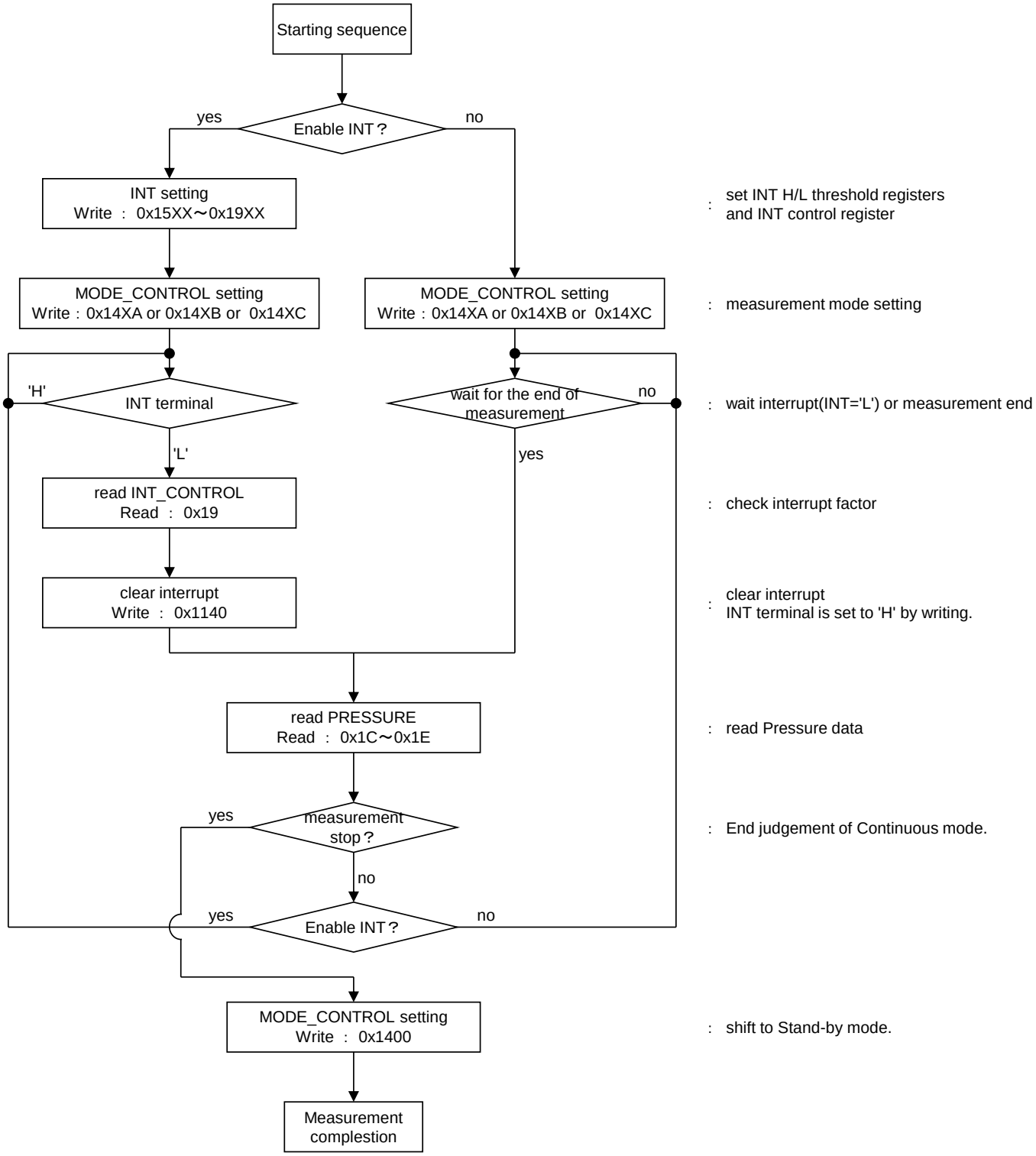
: wait interrupt(INT='L') or measurement end

: check interrupt factor

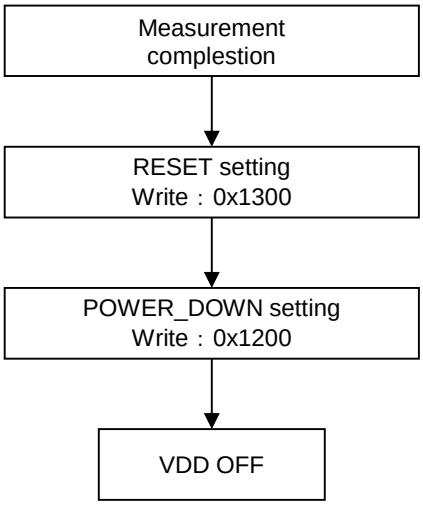
: clear interrupt
INT terminal is set to 'H' by writing.

: read Pressure data

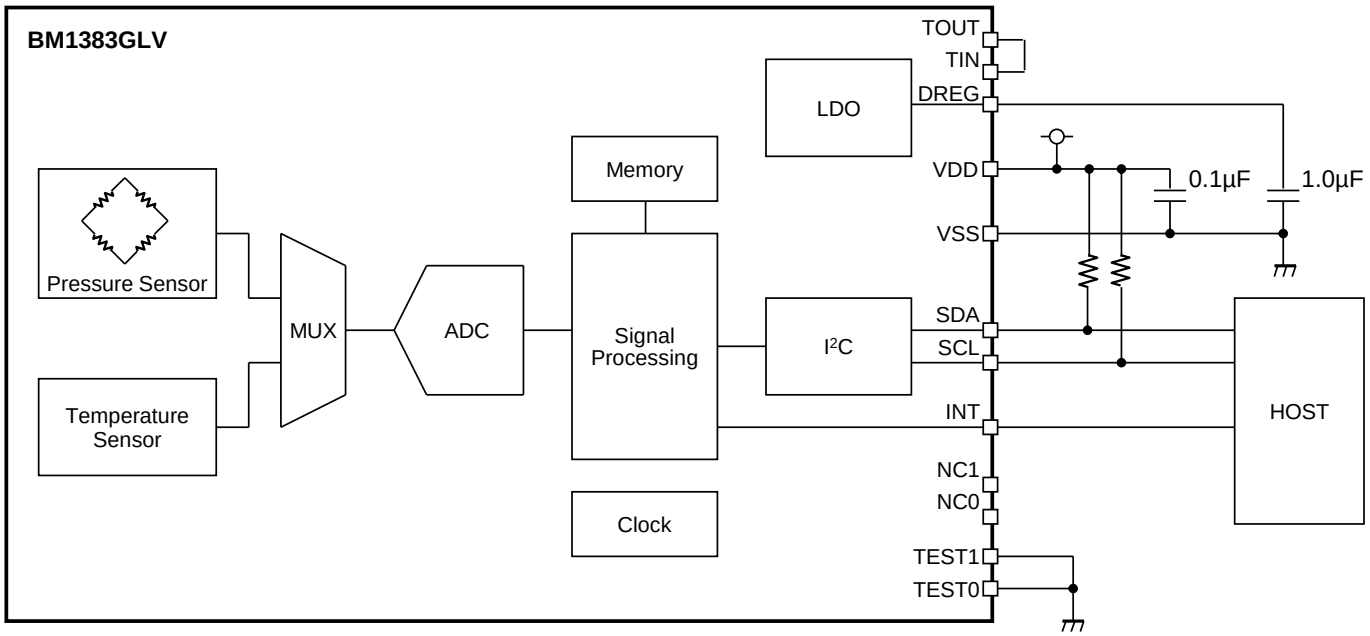
6. Measurement sequence: Continuous Mode (50ms/100ms/200ms)



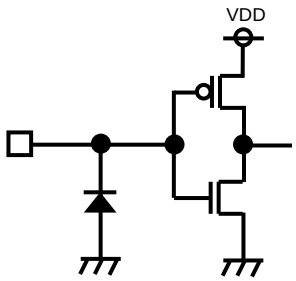
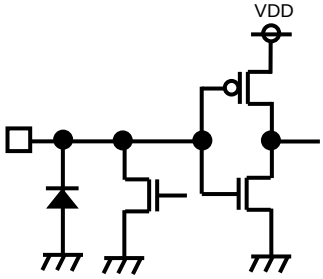
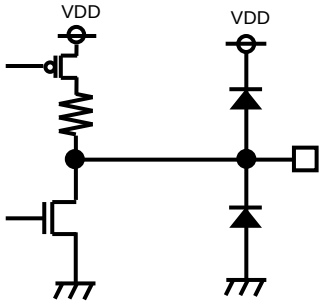
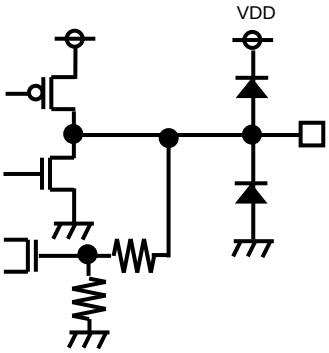
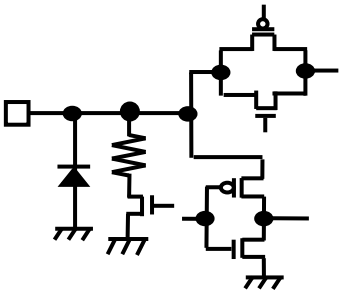
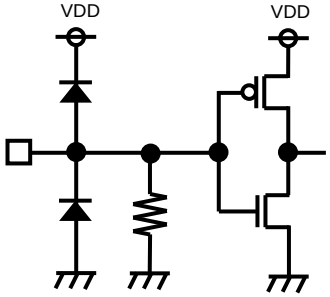
7. Ending sequence



Application Example



I/O equivalent circuit

Pin name	Equivalent Circuit Diagram	Pin name	Equivalent Circuit Diagram
SCL		SDA	
INT		DREG TOUT	
TIN		TEST0 TEST1	

Operational Notes

1. **Reverse Connection of Power Supply**
   Connecting the power supply in reverse polarity can damage the IC. Take precautions against reverse polarity when connecting the power supply, such as mounting an external diode between the power supply and the IC's power supply pins.

2. **Power Supply Lines**
   Design the PCB layout pattern to provide low impedance supply lines. Separate the ground and supply lines of the digital and analog blocks to prevent noise in the ground and supply lines of the digital block from affecting the analog block. Furthermore, connect a capacitor to ground at all power supply pins. Consider the effect of temperature and aging on the capacitance value when using electrolytic capacitors.

3. **Ground Voltage**
   Ensure that no pins are at a voltage below that of the ground pin at any time, even during transient condition.

4. **Ground Wiring Pattern**
   When using both small-signal and large-current ground traces, the two ground traces should be routed separately but connected to a single ground at the reference point of the application board to avoid fluctuations in the small-signal ground caused by large currents. Also ensure that the ground traces of external components do not cause variations on the ground voltage. The ground lines must be as short and thick as possible to reduce line impedance.

5. **Thermal Consideration**
   Should by any chance the power dissipation rating be exceeded the rise in temperature of the chip may result in deterioration of the properties of the chip. In case of exceeding this absolute maximum rating, increase the board size and copper area to prevent exceeding the Pd rating.

6. **Recommended Operating Conditions**
   These conditions represent a range within which the expected characteristics of the IC can be approximately obtained. The electrical characteristics are guaranteed under the conditions of each parameter.

7. **Inrush Current**
   When power is first supplied to the IC, it is possible that the internal logic may be unstable and inrush current may flow instantaneously due to the internal powering sequence and delays, especially if the IC has more than one power supply. Therefore, give special consideration to power coupling capacitance, power wiring, width of ground wiring, and routing of connections.

8. **Operation Under Strong Electromagnetic Field**
   Operating the IC in the presence of a strong electromagnetic field may cause the IC to malfunction.

9. **Testing on Application Boards**
   When testing the IC on an application board, connecting a capacitor directly to a low-impedance output pin may subject the IC to stress. Always discharge capacitors completely after each process or step. The IC's power supply should always be turned off completely before connecting or removing it from the test setup during the inspection process. To prevent damage from static discharge, ground the IC during assembly and use similar precautions during transport and storage.

10. **Inter-pin Short and Mounting Errors**
    Ensure that the direction and position are correct when mounting the IC on the PCB. Incorrect mounting may result in damaging the IC. Avoid nearby pins being shorted to each other especially to ground, power supply and output pin. Inter-pin shorts could be due to many reasons such as metal particles, water droplets (in very humid environment) and unintentional solder bridge deposited in between pins during assembly to name a few.

11. **Unused Input Pins**
    Input pins of an IC are often connected to the gate of a MOS transistor. The gate has extremely high impedance and extremely low capacitance. If left unconnected, the electric field from the outside can easily charge it. The small charge acquired in this way is enough to produce a significant effect on the conduction through the transistor and cause unexpected operation of the IC. So unless otherwise specified, unused input pins should be connected to the power supply or ground line.

Operational Notes – continued

12. Regarding the Input Pin of the IC

In the construction of this IC, P-N junctions are inevitably formed creating parasitic diodes or transistors. The operation of these parasitic elements can result in mutual interference among circuits, operational faults, or physical damage. Therefore, conditions which cause these parasitic elements to operate, such as applying a voltage to an input pin lower than the ground voltage should be avoided. Furthermore, do not apply a voltage to the input pins when no power supply voltage is applied to the IC. Even if the power supply voltage is applied, make sure that the input pins have voltages within the values specified in the electrical characteristics of this IC.

13. Ceramic Capacitor

When using a ceramic capacitor, determine the dielectric constant considering the change of capacitance with temperature and the decrease in nominal capacitance due to DC bias and others.

14. Absolute Maximum Ratings

Operate the IC such that the output voltage, output current, and power dissipation are all within the Absolute Maximum Ratings.

15. Disturbance light

In a device where a portion of silicon is exposed to light such as in a WL-CSP, IC characteristics may be affected due to photoelectric effect. For this reason, it is recommended to come up with countermeasures that will prevent the chip from being exposed to light.

Ordering Information

B M 1 3 8 3 G L V	-	Z E2

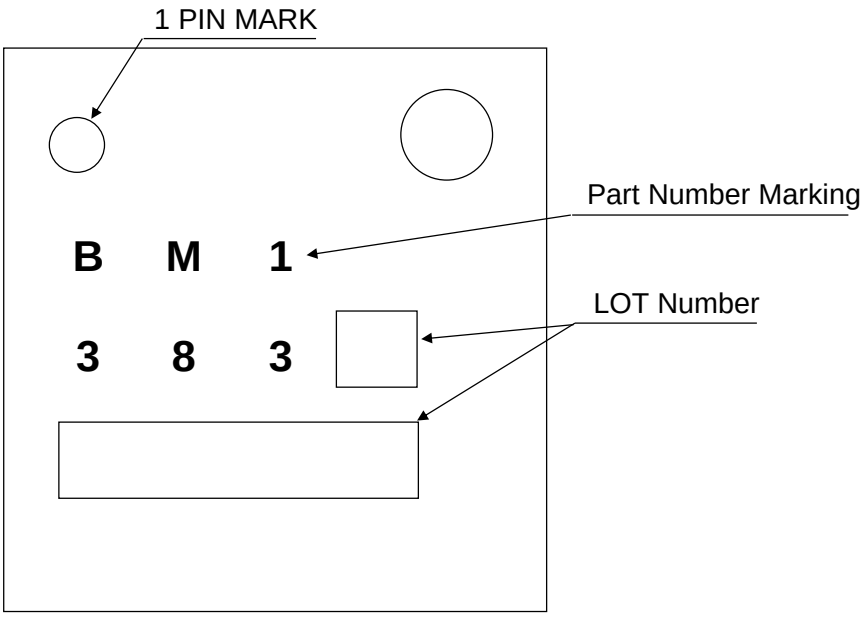
Part Number

Package
GLV: CLGA12V025M

Packaging and forming specification
E2: Embossed tape and reel

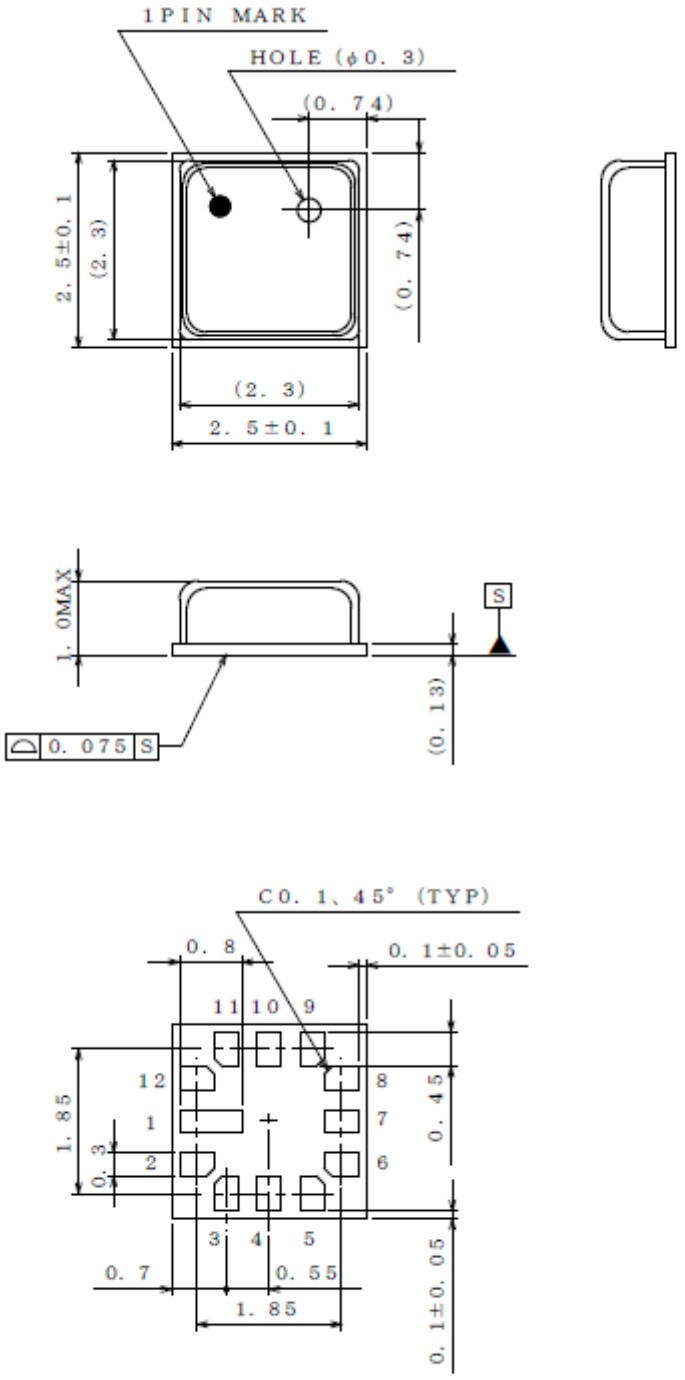
Marking Diagrams

CLGA12V025M
(TOP VIEW)



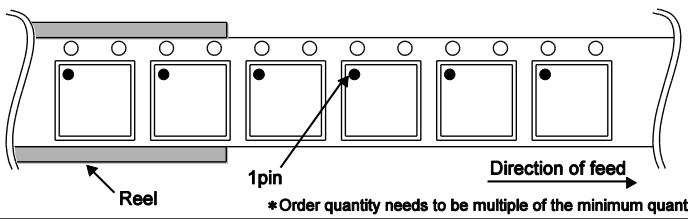
Physical Dimension, Tape and Reel Information

Package Name	CLGA12V025M



<Tape and Reel information>

Tape	Embossed carrier tape (with dry pack)
Quantity	3000pcs
Direction of feed	E2 (The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand)



*Order quantity needs to be multiple of the minimum quantity.

(UNIT : mm)

Revision History

Date	Revision	Changes
29.Jan.2015	001	New Release
3.Apr.2015	002	P9 Modify notice of RMS noise P10 Modify Operation mode transition
15.May.2015	003	P1 Modify Typical Application Circuit P4 Modify Block Diagram P5 Modify Electrical Characteristics P7 Modify Register Map P9 Modify MODE_CONTROL P10 Modify Operation mode transition P12 Modify Reading data Delete TEMPERATURE P14 Modify Interrupt function P15 Modify Control sequence P19 Modify Application Example
5.Jun.2015	004	P5 Modify Absolute Maximum Ratings P16,17 Measurement sequence

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(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

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   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

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   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   - [a] the Products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
   - [b] the temperature or humidity exceeds those recommended by ROHM
   - [c] the Products are exposed to direct sunshine or condensation
   - [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

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QR code printed on ROHM Products label is for ROHM's internal use only.

Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

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