MEMS Sensor series

Pressure Sensor IC

BM1383GLV

General Description

BM1383 is piezo-resistive pressure sensor.
BM1383 does temperature 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 and offset compensation function.
- I^2C interfaces.
- Small package.

Applications

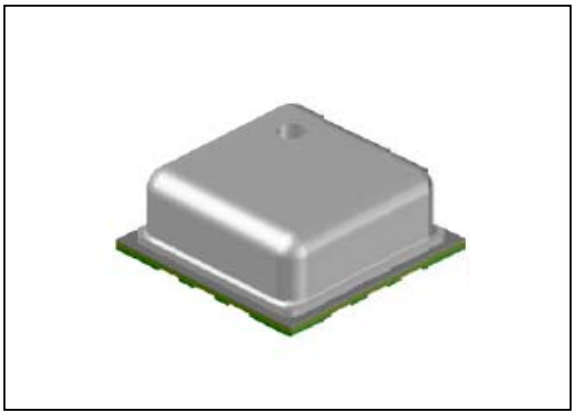
- Smartphone, Helthcare Game and mobile device.

Key Specifications

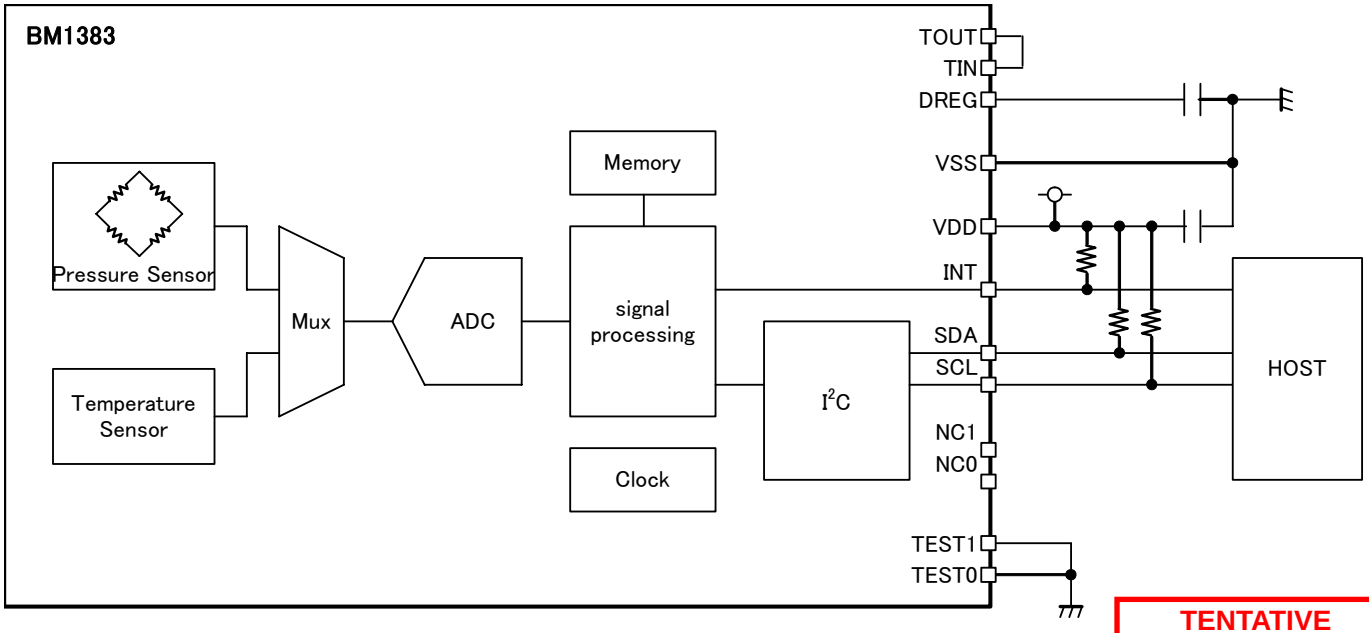
- Pressure Range: 300hPa to 1100hPa
- Relative Pressure Accuracy: ±0.12hPa (Typ)
- Absolute Pressure Accuracy: ±1hPa (Typ)
- Average Current Consumption: 3.7μA (Typ)

Package CLGA12V025M

W(Typ) x D(Typ) x H(Typ) 2.50mm x 2.50mm x 0.95mm



Typical Application Circuit



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○Product structure : Silicon monolithic integrated circuit ○This product has no designed protection against radioactive rays

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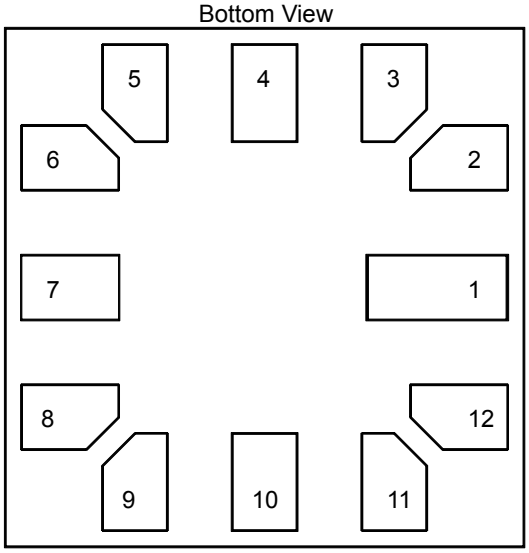
Pin Configuration

Bottom View



Pin Description

Pin No.	Pin Name	In/Out	Function
1	DREG	-	Logic voltage pin
2	VDD	-	power voltage pin
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	I2Cserial bus cock pin
10	SDA	In/Out	I2C serial bus data pin
11	INT	In/Out	INT output pin
12	TEST0	In	Test pin (connect to GND)

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 +100	°C
Power Dissipation	P_d	TBD	W

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.

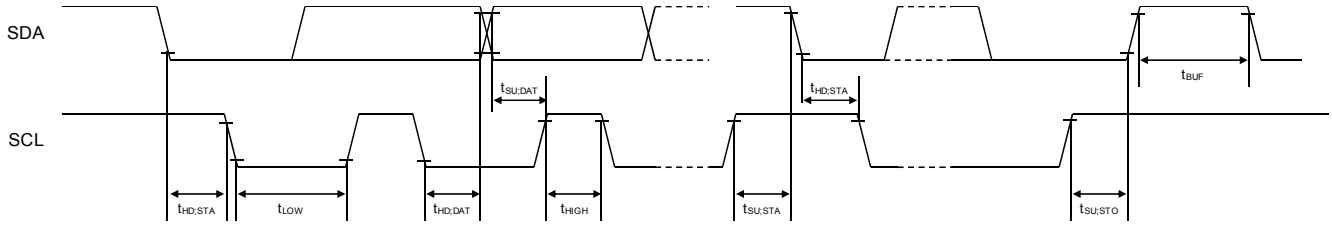
Recommended Operating Conditions (Ta= -40°C to +85°C)

Parameter	Symbol	Min	Typ	Max	Unit
Power Supply	VDD	1.71	1.8	3.6	V
Input Voltage	V_{IN}	0	-	VDD	V
I^2C Frequency	f_{SCL}	-	-	400	kHz

Electrical Characteristics (Unless otherwise specified V_{IN}=12V Ta=25°C)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Current Consumption						
Average Current Consumption (data rate 1Hz)	I_{cc}	-	3.7	-	μA	One Shot mode
Standby Mode Current	I_{dd}	-	1	-	μA	PWR_DOWN(Address:12h[0])=0 SLEEP(Address:13h[0])=0
Logic						
L Input Voltage	V_{IL}	GND	-	0.3 * VDD	V	
H Input Voltage	V_{IH}	0.7 * VDD	-	VDD	V	
L Input Current	I_{IL}	-10	-	0	μA	VIL= DVDD
H Input Current	I_{IH}	0	-	10	μA	VIH= GND
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						
Pressure Detection Range	P_R	300	-	1100	hPa	
Relative Pressure Accuracy	P_{rel}	-	±0.12	-	hPa	950hPa to 1050hPa AVE_NUM(Address:14h[7:5])=010
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	One Shot Mode (Single Measurement)

I2C Bus Timing Chart(Unless Otherwise AVDD=3.0V, VDDIO=1.8V, Ta=25°C)



Parameter	Symbol	Min	Typ	Max	Unit	Conditions
I^2C SCL Frequency	f_{SCL}	0	-	400	kHz	
I^2C 'L' Period of SCL	t_{LOW}	1.3	-	-	µs	
I^2C 'H' Period of SCL	t_{HIGH}	0.6	-	-	µs	
I^2C Setup Time for START Condition	$t_{SU;STA}$	0.6	-	-	µs	
I^2C Hold Time for (Repeated) START Condition	$t_{HD;STA}$	0.6	-	-	µs	
I^2C Data Setup Time	$t_{SU;DAT}$	100	-	-	µs	
I^2C Data Hold Time	$t_{HD;DAT}$	0	-	-	µs	
I^2C Setup Time For STOP Condition	$t_{SU;STO}$	0.6	-	-	µs	
I^2C Bus Free Time Between STOP and START Condition	t_{BUF}	1.3	-	-	µs	

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Register Map

Address	TYPE	Default	Register Name
10h	R	31h	ID
11h	RW	00h	RESET_CONTROL
12h	W	00h	POWER_DOWN
13h	R/W	00h	SLEEP
14h	RW	00h	MODE_CONTROL
15h	RW	FFh	INT_H_TH_MSB(Upper 8bit)
16h	RW	FFh	INT_H_TH_LSB(Lower 8bit)
17h	RW	00h	INT_L_TH_MSB(Upper 8bit)
18h	RW	00h	INT_L_TH_LSB(Lower 8bit)
19h	RW	00h	INT_CONTROL
1Ah	R	00h	TEMPERATURE_MSB(Upper 8bit)
1Bh	R	00h	TEMPERATURE_LSB(Lower 8bit)
1Ch	R	00h	PRESSURE_MSB(Upper 8bit)
1Dh	R	00h	PRESSURE_LSB(Lower 8bit)
1Eh	R	00h	PRESSURE_LSB(Least 6bit)

○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 SLEEP=1.
(In other case Write: Ignored, REED: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	W	When reading “0” is read. 0: power down 1: active

default value 00h

○SLEEP(13h)

Field	Bit	TYPE	Description
Reserved	7 : 1	R	Write “0”
SLEEP	0	W	When reading “0” is read. 0: Measurement control block is Sleep status 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 SLEEP=1.
(In other case Write: Ignored, REED: 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 : 3	R	Write “00”
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

AVE_NUM	Measurement time [ms]	RMS noise [hPa]
000	3	0.080
001	6	0.057
010	12	0.040
011	25	0.028
100	50	0.020
101	100	0.014
110	195	0.010

When measurement time is over a set sampling rate, measurement has priority.
RMS noise is calculated as standard deviation of 10 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	Sampling(50ms)
011	Sampling(100ms)
100	Sampling(200ms)
101	Prohibition
110	Prohibition
111	Prohibition

Pressure and Temperature are measured at one rate

○INT_H_TH_MSB(15h)

This register can be accessed only in the case of PWR_DOWN=1 and SLEEP=1.
(In other case Write: Ignored, REED: 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

○INT_H_TH_LSB(16h)

This register can be accessed only in the case of PWR_DOWN=1 and SLEEP=1.
(In other case Write: Ignored, REED: 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 SLEEP=1.
(In other case Write: Ignored, REED: 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 SLEEP=1.
(In other case Write: Ignored, REED: 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 SLEEP=1.
(In other case Write: Ignored, REED: 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 not 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

○TEMPERATURE_MSB(1Ah)

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

Field	Bit	TYPE	Description
TEMP_OUT[11:8]	7 : 0	R	The upper part of temperature data. By setting “1” to “SW_RESET” the register value is reset.

default value 00h

○TEMPERATURE_LSB(1Bh)

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

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

default value 00h

TEMP_OUT[15]: sign
TEMP_OUT[14:5]: integer (2’s complement numbers)
TEMP_OUT[4:0]: decimal (2’s complement numbers)

Conversion to temperature value is like below. But please note that TEMP_OUT is data with signe.
Temperature value [°C]= TEMP_OUT[15:0]/32

○PRESSURE_MSB(1Ch)

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

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

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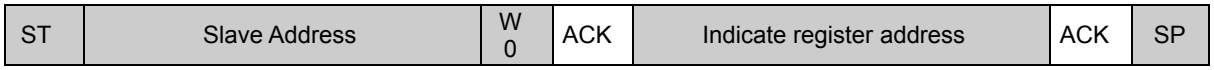
I²C bus communication

1. Slave address : “1011101”

2. Write format

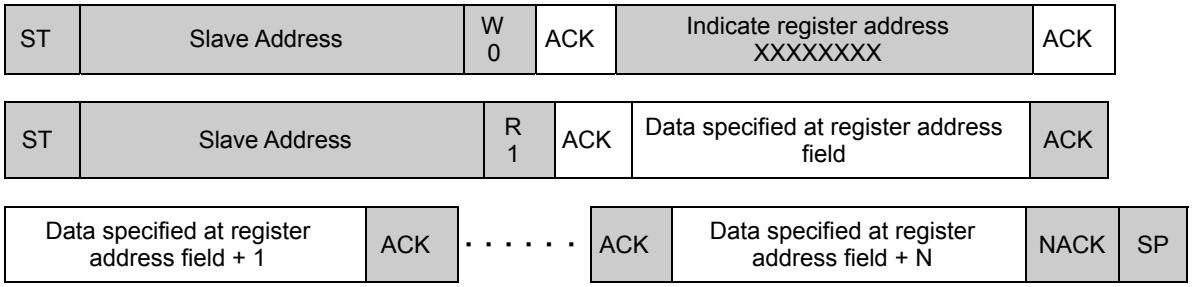
(1) Case of indicating only register address



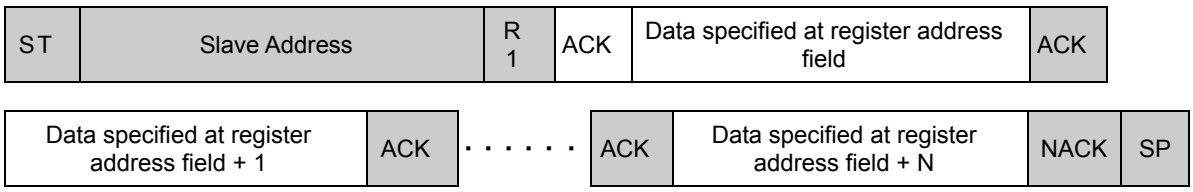
(2) Case of writing data register after indicating register address

3. Read format

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



(2) Case of reading data



Please refer formal I²C bus specification of NXP semiconductor.

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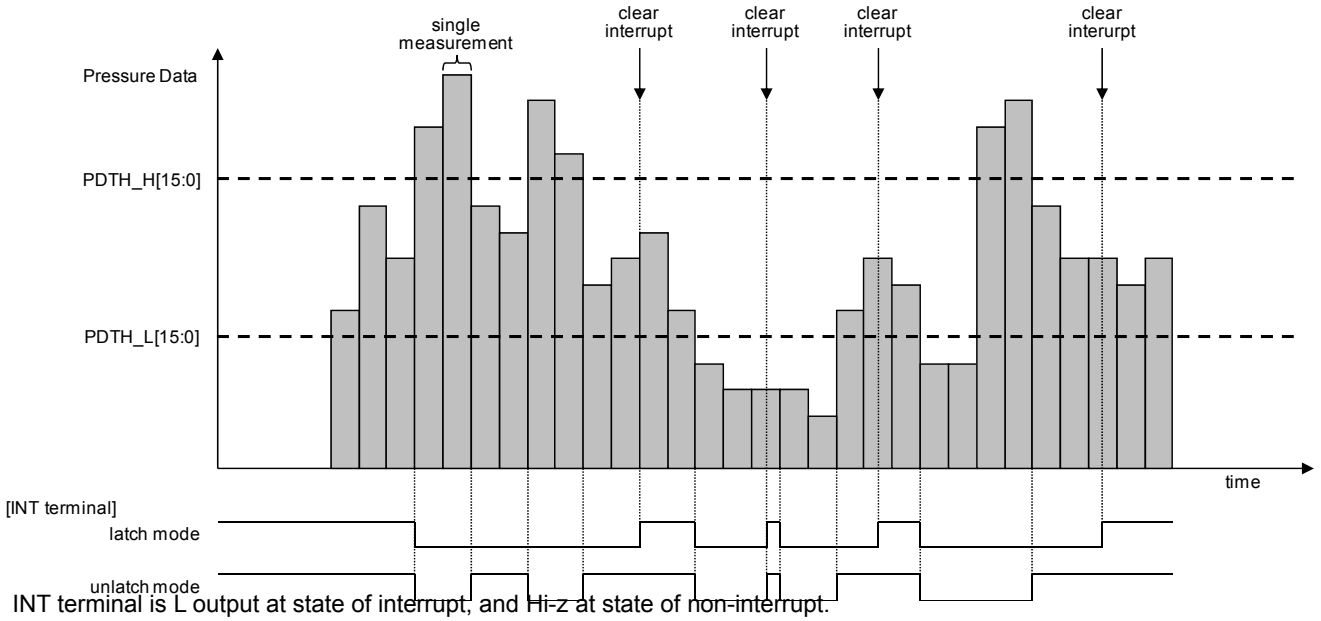
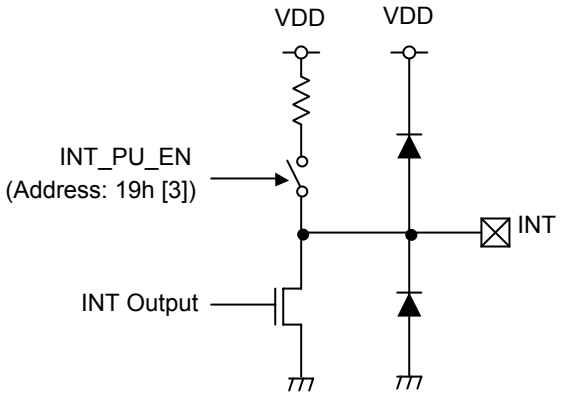
Interrupt function

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 (Address:19h INT_MODE=’L’), and another is unlatch mode (Address:19h INT_MODE=’H’).
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.

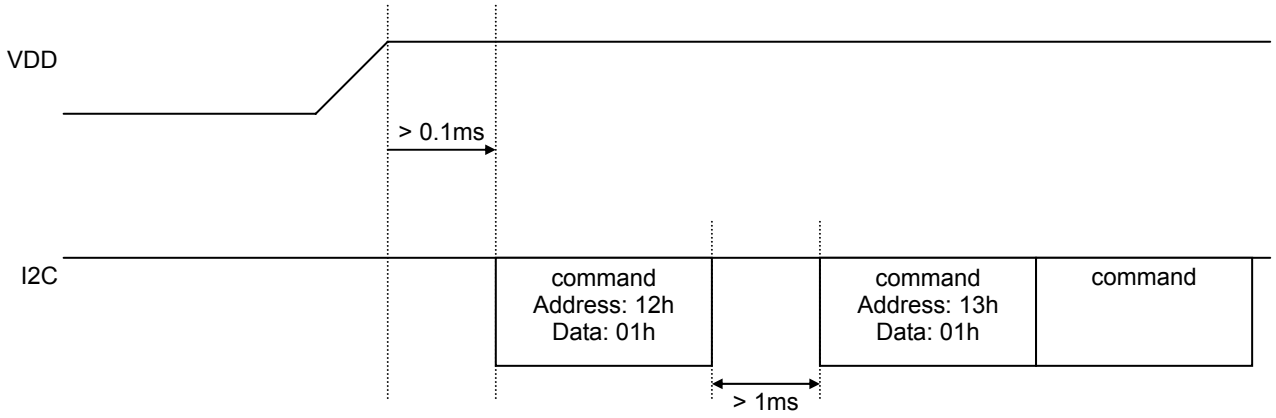


INT terminal is L output at state of interrupt, and Hi-z at state of non-interrupt.
So, INT terminal is attached Pull-up resister of built-in or outside.

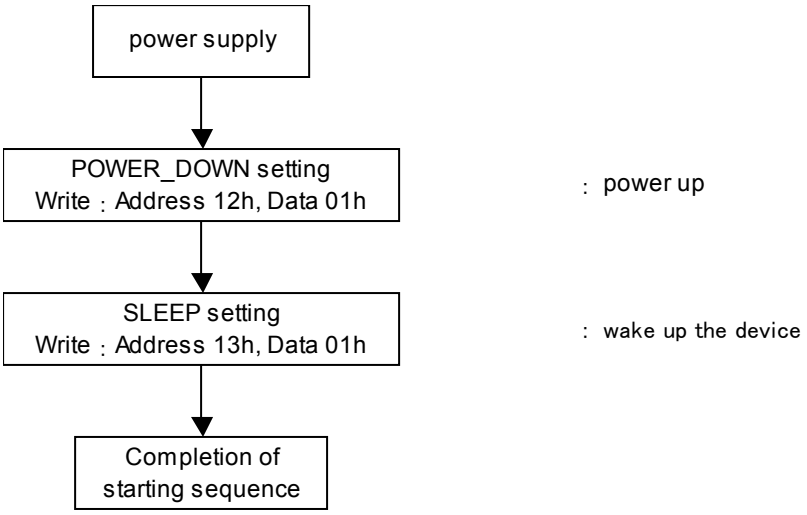


Control sequence

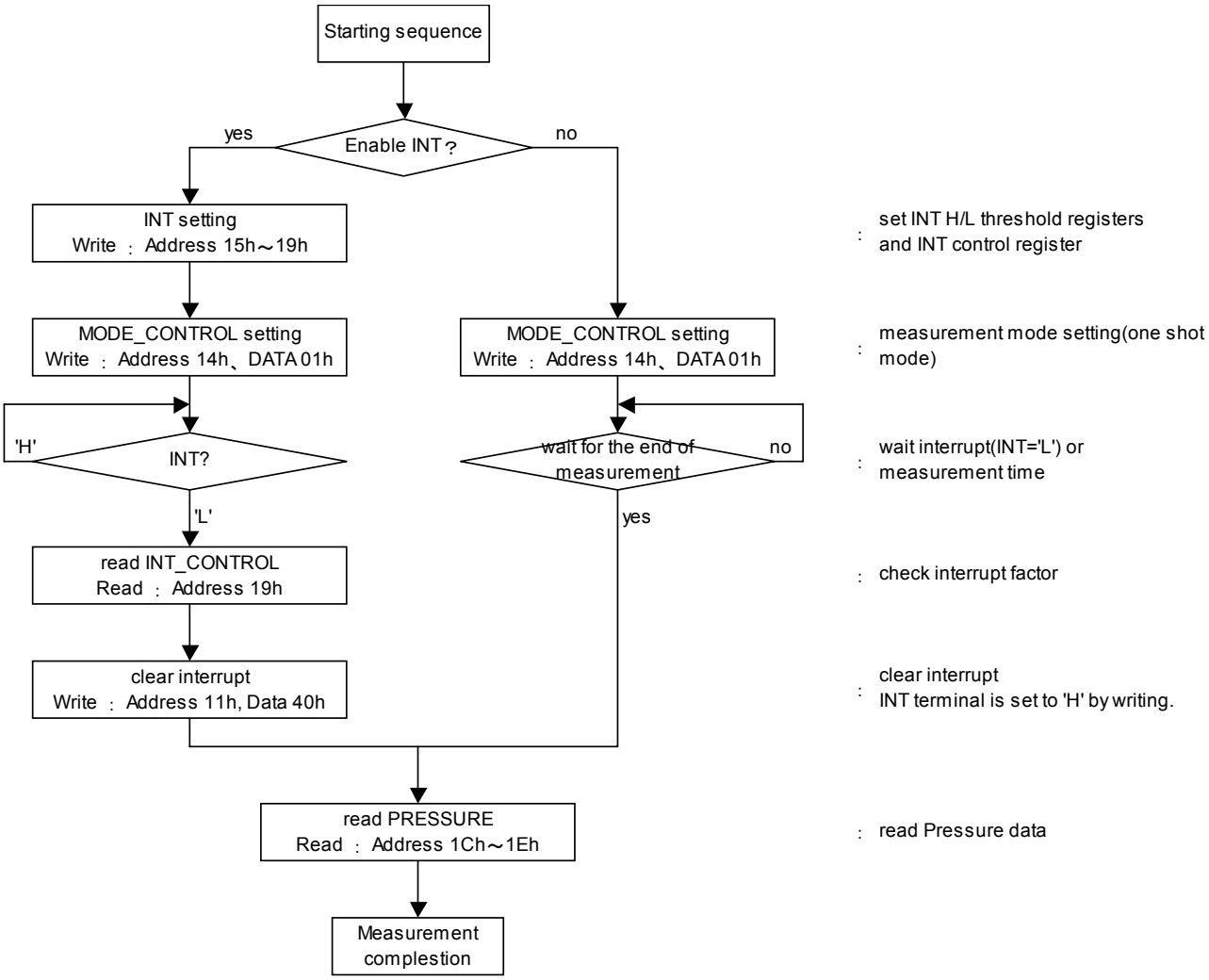
1. Power supply start-up sequence
   Please do the command control by I2C after power is supplied.



2. Starting sequence



3. Measurement sequence: One Shot Mode



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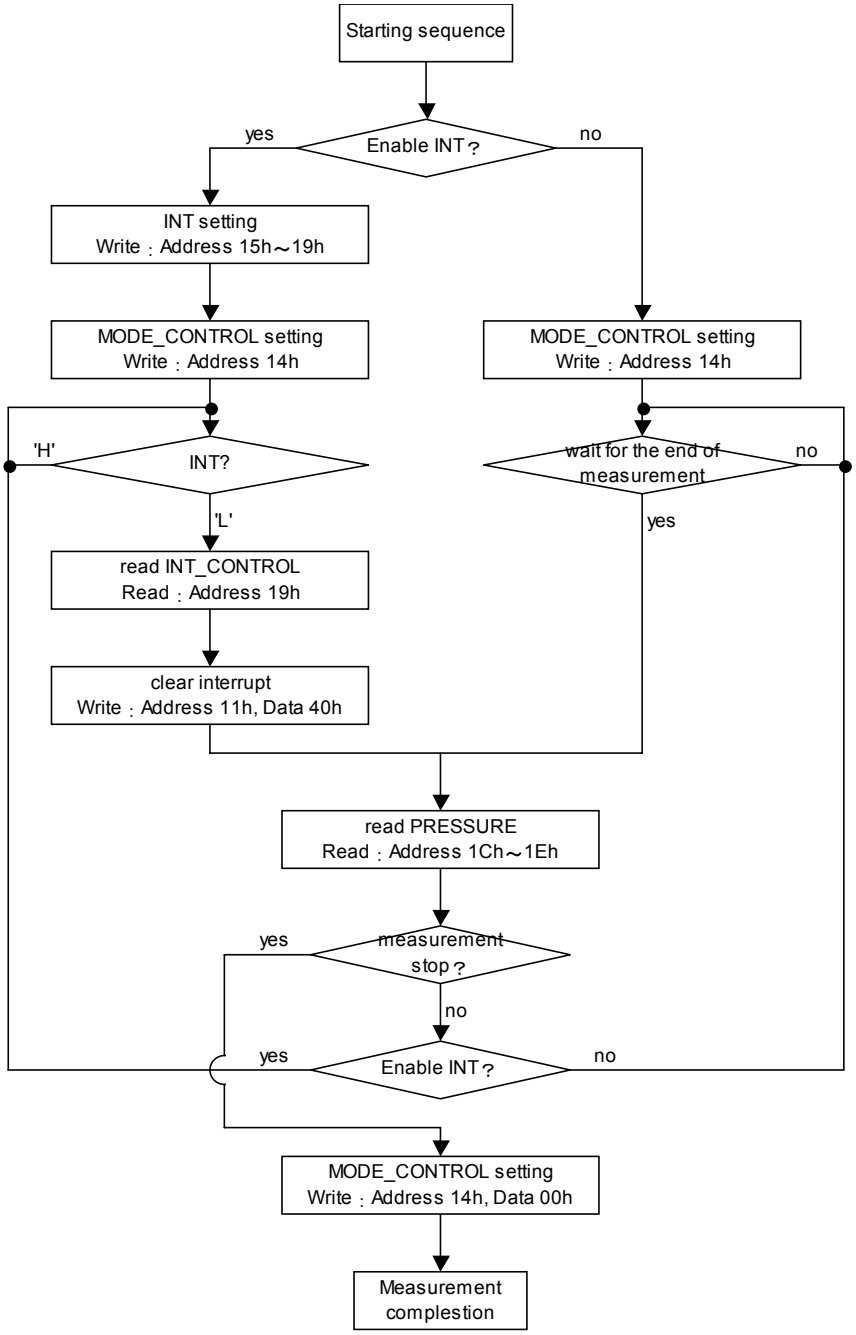
4. Measurement sequence: Free Run Mode (50ms/100ms/200ms)



: set INT H/L threshold registers and INT control register

: measurement mode setting(Free Run mode)

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

: check interrupt factor

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

: read Pressure data

: shift to Stand-by mode.

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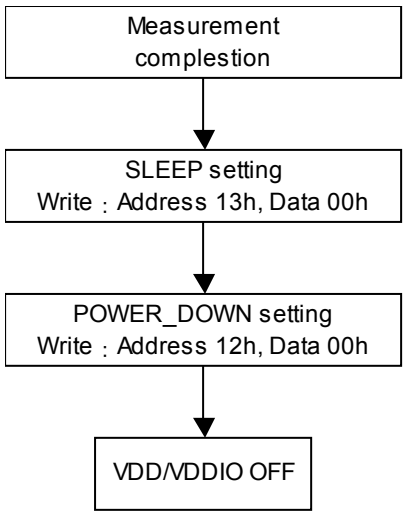
5. Ending sequence



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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. The absolute maximum rating of the Pd stated in this specification is when the IC is mounted on a 70mm x 70mm x 1.6mm glass epoxy board. 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

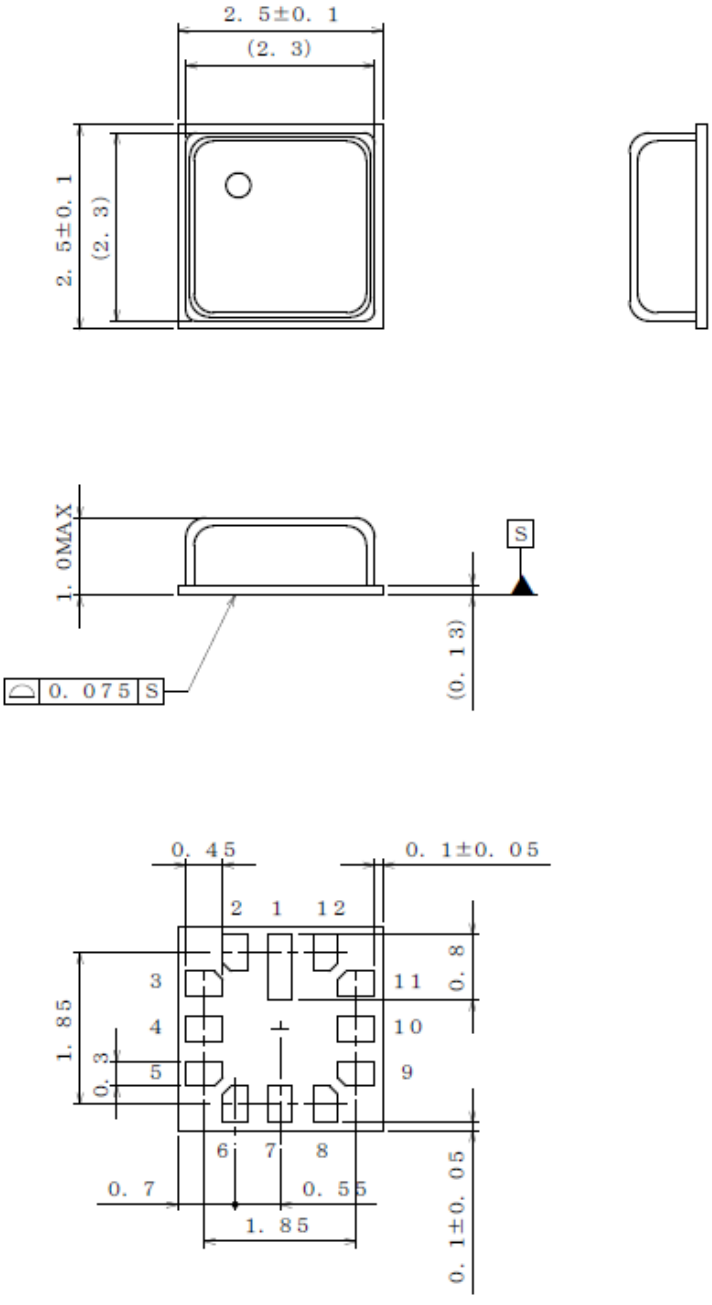
Operate the IC such that the output voltage, output current, and power dissipation are all within the Absolute Maximum Ratings.

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.

Physical Dimension

Package Name	CLGA12V025M



(UNIT : mm)

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Revision History

Date	Revision	Changes
2.Sep.2013	001	New Release
27.Sep.2013	002	Add I^2C bus timing characteristics Add Register map Add I^2C bus communication Add Control sequence
18.Dec.2013	003	Add Interrupt function
20.Jan.2014	004	Page1 modify Typical Application Circuit
6.Feb.2014	005	Page1 Add figure of Package Page3 condition of Relative pressure accuracy: AVE_NUM(Address:14h[7:6])=01
14.Feb.2014	006	Overall revision about New Style Page3 condition of Relative pressure accuracy: AVE_NUM(Address:14h[7:5])=010 Page3 modify Pin name Page5 modify Register map Page6 modify comment of ID register Page7 modify AVE_NUM
16.May.2014	007	All page modify IC name Page7 modify Measurement mode Page12 modify Power supply start-up sequence Page13 modify Flow chart Page14 modify Flow chart
29.May.2014	008	Overall revision about New Style
11.Jun.2014	009	Page9 modify Description of Address 1Eh Reserved register
19.Jun.2014	010	Page7 add RMS noise
9.July.2014	011	Page1 modify package name Page18 add Physical Dimension
16.Sep.2014	012	New Format Page4 modify Absolute Pressure Accuracy

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Notice

Precaution on using ROHM Products

1. Our Products are designed and manufactured for application in ordinary electronic equipments (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, 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 any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
   [a] Installation of protection circuits or other protective devices to improve system safety
   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

3. Our Products are designed and manufactured for use under standard conditions and not under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
   [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [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; if flow soldering method is preferred, 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.

Precaution for Product Label

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.

Precaution for Foreign Exchange and Foreign Trade act

Since our Products might fall under controlled goods prescribed by the applicable foreign exchange and foreign trade act, please consult with ROHM representative in case of export.

Precaution Regarding Intellectual Property Rights

1. All information and data including but not limited to application example contained in this document is for reference only. ROHM does not warrant that foregoing information or data will not infringe any intellectual property rights or any other rights of any third party regarding such information or data. ROHM shall not be in any way responsible or liable for infringement of any intellectual property rights or other damages arising from use of such information or data.:

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