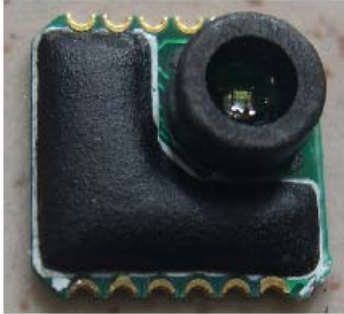




MBAW-1000

BAROMETER MODULE FOR WEATHER STATION



- Pressure range: 400 – 1100 mbar
- Temperature range: -10°C – +60°C
- Integrated pressure and temperature sensor
- Temperature compensation
- Integrated low power 8-bits MCU
- Integrated ADC and amplifier
- 3-wire synchronous serial interface
- Integrated software for pressure and temperature calculation
- Low power, low voltage
- Small dimension: 10 x 10 x 3.5mm

Description

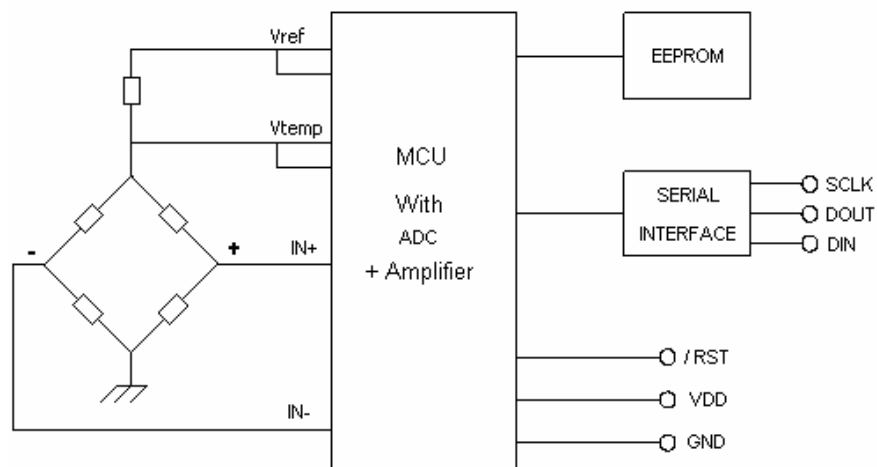
The MBAW-1000 is an SMD module including a piezoresistive pressure sensor, an EEPROM and 8-bit MCUs with integrated ADC and front end amplifier. This module supplies to designers all processed information such as temperature, temperature compensated pressure data. This high integration level allows an easy access to sensor technology without any background in it.

The MBAW-1000, low power and voltage device, could communicate with a low cost 4-bits MCU on three wires synchronous interface.

Application

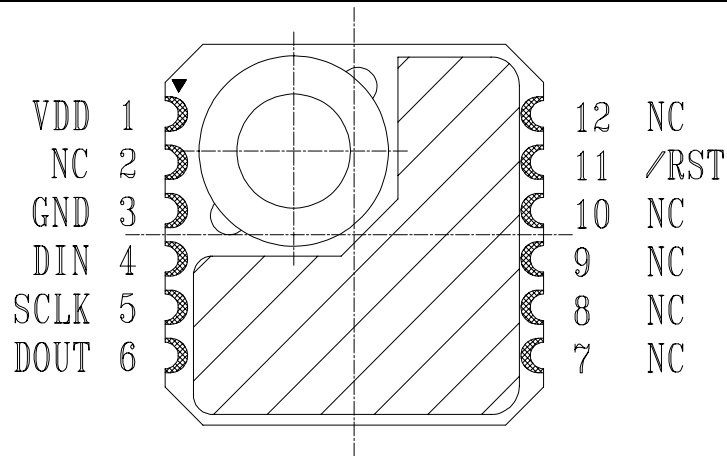
- Weather station

Block Diagram





Pin Configuration



Pin Descriptions

Name	In/Out	Pin No	Description
VDD	I	1	Positive Power Supply
NC		2	No connect
GND	I	3	Negative Power Supply (Ground)
DIN	I	4	Synchronous Serial Interface Data Input
SCLK	I	5	Synchronous Serial Interface Clock Input
DOUT	O	6	Synchronous Serial Interface Data Output
NC		7	No connect
NC		8	No connect
NC		9	No connect
NC		10	No connect
/RST	I	11	Reset low
NC		12	No connect

Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage to Ground Potential	-0.3 to 3.6	V
Maximum I/O Voltage	-0.3 to VDD+0.3	V
Operating Temperature	-10 to +60	°C
Storage Temperature	-20 to +100	°C
Maximum overpressure	5	Bar

**DC Characteristic (Unless otherwise specified VDD=3V, Ta=25°C)**

Parameter	Symbol	Conditions	Min	Typical	Max	Unit
Recommend Operation Power Voltage	VDD		2.5	3.0	3.3	V
Supply Current		V _{DD} = 3V				
Temperature Mode Average ⁽¹⁾	I _{avgT}			45	50	μA
Pressure Mode Average ⁽¹⁾	I _{avgP}			60	70	μA
Sleep Mode	I _{slp}			3	5	μA
Peak Current						
Read Temperature	I _{pT}			1100		μA
Read Pressure	I _{pP}			1300		μA
Conversion Time		VDD=3V				
Temperature mode	T _{cvT}			35	45	ms
Pressure mode	T _{cvP}			40	55	ms
Operating pressure range	P		400		1100	mbar
Operating temperature range	T _a		-10°C		+60	°C
Synchronous serial clock	Sclk				40	KHz

Notes:

1. Average current consumption for one reading per second.

Pressure and Temperature Output Characteristics

Parameter	Test conditions	Min	Typ.	Max	Unit	Notes
Pressure resolution			0.1		mbar	1
Absolute pressure accuracy	P = 750 ... 1000 mbar T=25°C	-3		+3	mbar	2
Relative pressure accuracy	P = 750 ... 1000 mbar	-1		+1	mbar	
Maximum pressure error over temperature	Ta = 0 ... +50°C	-2		+2	mbar	
Maximum error over supply voltage	VDD = 2.6V ... 3.3V	-1		+1	mbar	
Temperature accuracy	T= 0°C ... + 50°C	-2		+2	°C	
Temperature resolution	T= 0°C ... + 50°C		0.1		°C	

Notes :

1. Obtained by software filter.
2. Maximum error of pressure reading over the pressure range after offset adjustment at one pressure point.



Serial Communication Commands

- For each byte, MSB is sent first and LSB at the end. Data is in hexadecimal format, negative number is in 2's complement.
- The module will enter sleep mode after executing a command or time out expiring in communication.
- In Sleep Mode, the oscillator stops, all internal registers and RAM keep values before Sleep Mode.
- To wake up the module from sleep mode, the host MCU just writes the first clock to the SCLK pin. The module will wake up automatically and DOUT will go high after maximum 2 ms. The host MCU can then send out the new command.
- Data returned from MBAW-1000 are into 2 bytes, the host MCU have to send 17 pulse clk (16 pulse clk to read 2 bytes data, the last pulse is dummy clk) to read 2 bytes data.

The information supplied by MBAW-1000 module could be sent to the host MCU on request. Hereunder, the list of commands issued by the host MCU to the barometer module.

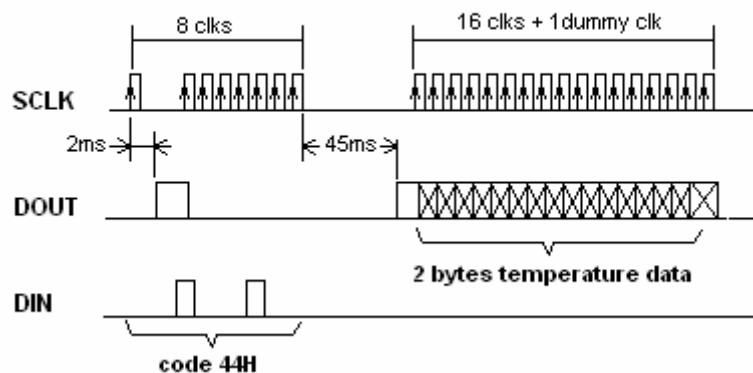
Commands name	Code	Host MCU	MBAW-1000	Notes
TEMP in C degree	44h	Send 1 byte code	Send 2 bytes temperature data	
PRESSURE in mbar	45h	Send 1 byte code	Send 4 bytes pressure data	
Check Low BATTERY	4Bh	Send 1 byte code	Send 2 bytes data	1

Notes:

1. If the battery level is lower than 2.6 ± 0.1 V, MBAW-1000 sends 2 bytes data equal 1111h. Otherwise the data will be 0000h

Temperature reading in C degree

READ TEMPERATURE

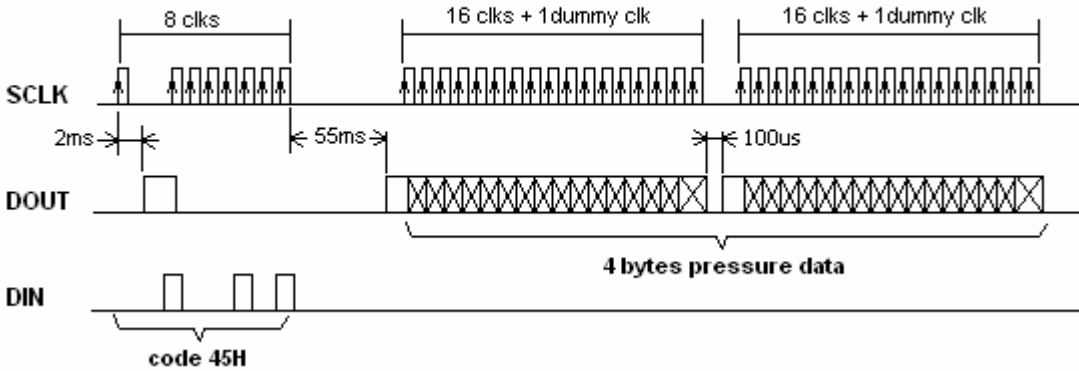


- To read temperature from MBAW-1000, the host MCU send code 44H and wait for DOUT turn high (Max 45ms) to read 2 bytes data return from MBAW-1000. Data must be divided by 10 to get the real temperature. (i.e. $0C8H = 200 = 20.0\text{ }^{\circ}\text{C}$)
- Temperature range is from -10°C to 60°C and resolution is 0.1°C .



Pressure reading in mbar

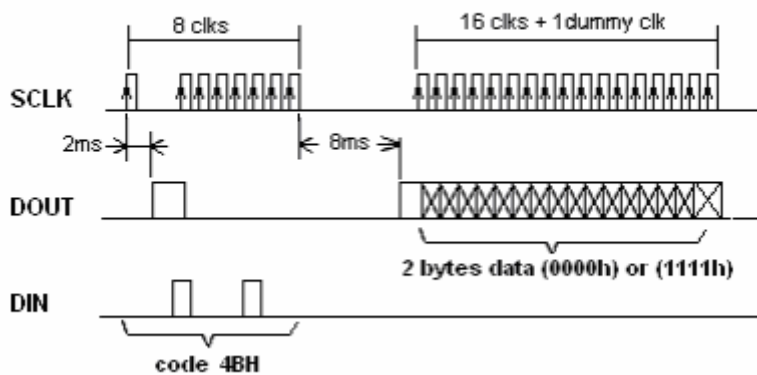
READ PRESSURE



- To read pressure from MBAW-1000, the host MCU sends code 45H and waits for DOUT turn high (Max 55ms) to read 4 bytes data return from MBAW-1000. Data must be divided by 100 to get the real pressure. (i.e. $186A0H = 100000 = 1000.00$ mbar)
- Pressure range is from 400mbar to 1100mbar and resolution is 0.1mbar.
- The pressure calculation uses the last read temperature for temperature compensation. In normal use with slow temperature change in house, the temperature could be updated every 5s to 10s to save power.

Check Low Battery

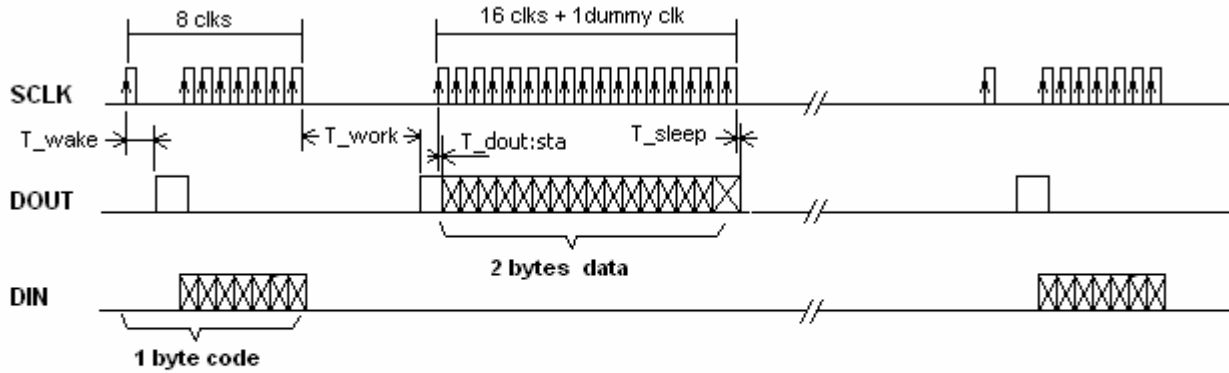
READ DATA



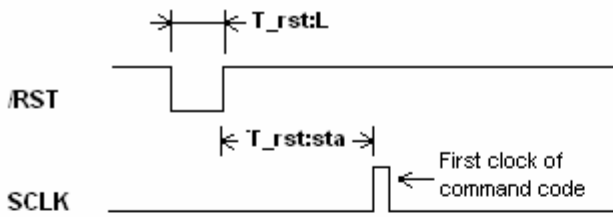
- To check the voltage level of MBAW-1000, the host MCU send code 4BH and wait for DOUT turn high (Max 8ms) to read 2 bytes data return from MBAW-1000. If supplied voltage is lower than 2.6 ± 0.1 V, MBAW-1000 sends 2 bytes data equal 1111h. Otherwise the data will be 0000h.



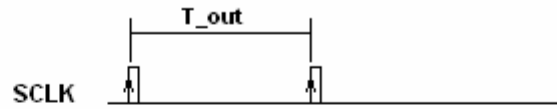
Timing diagram



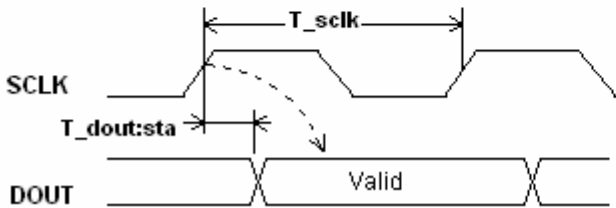
RESET TIMING



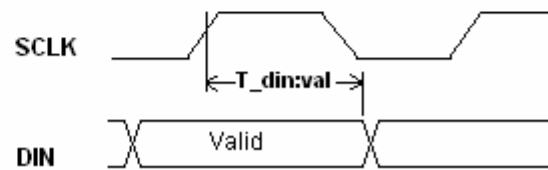
TIME OUT



DATA OUT TIMING



DATA IN TIMING





Symbol	Descriptions	Notes	Min	Typical	Max	Units
T_rst:L	Active low reset time		25			ms
T_rst:sta	Stable time after reset				35	ms
T_sclk	Clock cycle	1	0.025		1100	ms
T_out	Communication time out	1	800	1100	1400	ms
T_din:val	Hold time for valid input data from rising edge of clk	2	10			μs
T_dout:sta	Output valid from rising edge of clk	3			10	μs
T_wake	Wake up time from sleep mode	4			2	ms
T_work	Delay time for executing a command	5				
	Temperature reading			35	45	ms
	Pressure reading			40	55	ms
	Check Low Battery			5	8	ms
T_sleep	Hold time for the module return to sleep mode	6			30	μs

Notes:

1. The maximum clock cycle is 1.1s; it is the Time-out of clock. If the interval between 2 clocks is more than 1.1s, the module will return to sleep mode and reset its entire serial interface, the host MCU has to restart the communication.
2. DIN should be set before rising edge of clock and hold at least 10 μs since this rising edge.
3. DOUT have to be read at least 10 μs after the rising edge of clock. For safety, the host MCU could read it at the falling edge of clock.
4. After sending the first clock of code, the host MCU waits T_wake for the module waking up from sleep mode and check DOUT high before sending the next clocks.
5. The host MCU waits for DOUT high before processing the next step of communication test command. Dout will go high within T_work after the last clock of code.
6. After finishing a command, the module needs 30 μs to return to sleep mode. The host MCU has to delay T_sleep since the last clock of the previous command before sending new code.

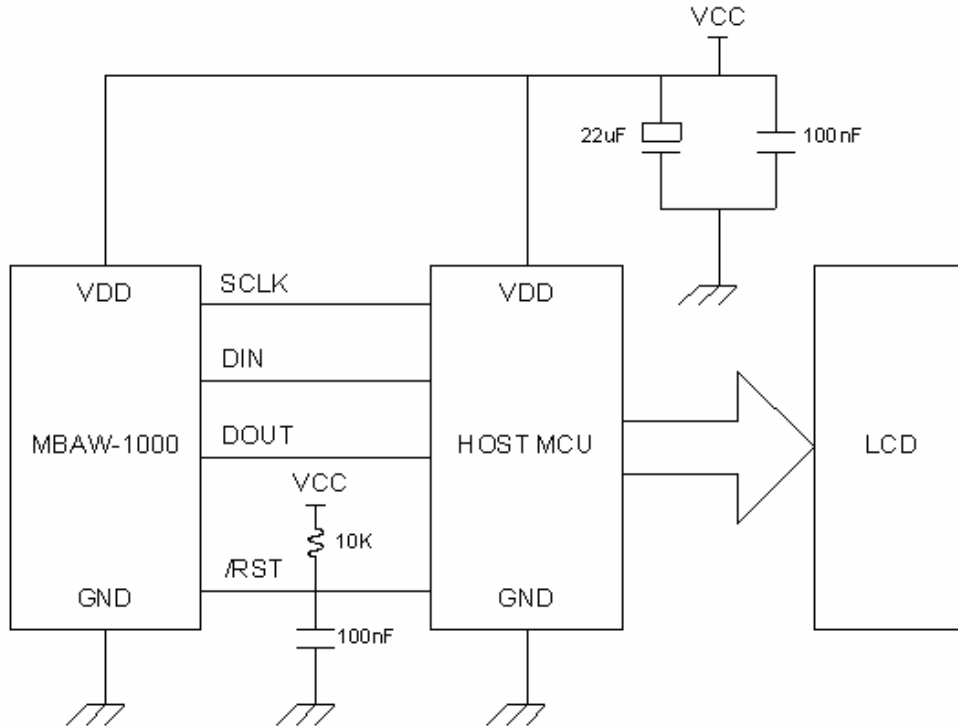
Sleep mode settings

- After executing a command, the module goes to sleep mode automatically. In order to save the power, the host MCU ports have to be set compatible with the settings of the module's ports.

Name of port	Module MBAW-1000	Recommended settings for host MCU
DIN	Input HiZ	Output low
DOUT	Output low	Output low or input HiZ
SCLK	Input HiZ	Output low
/RST	Input HiZ	Output high



Application Schematic

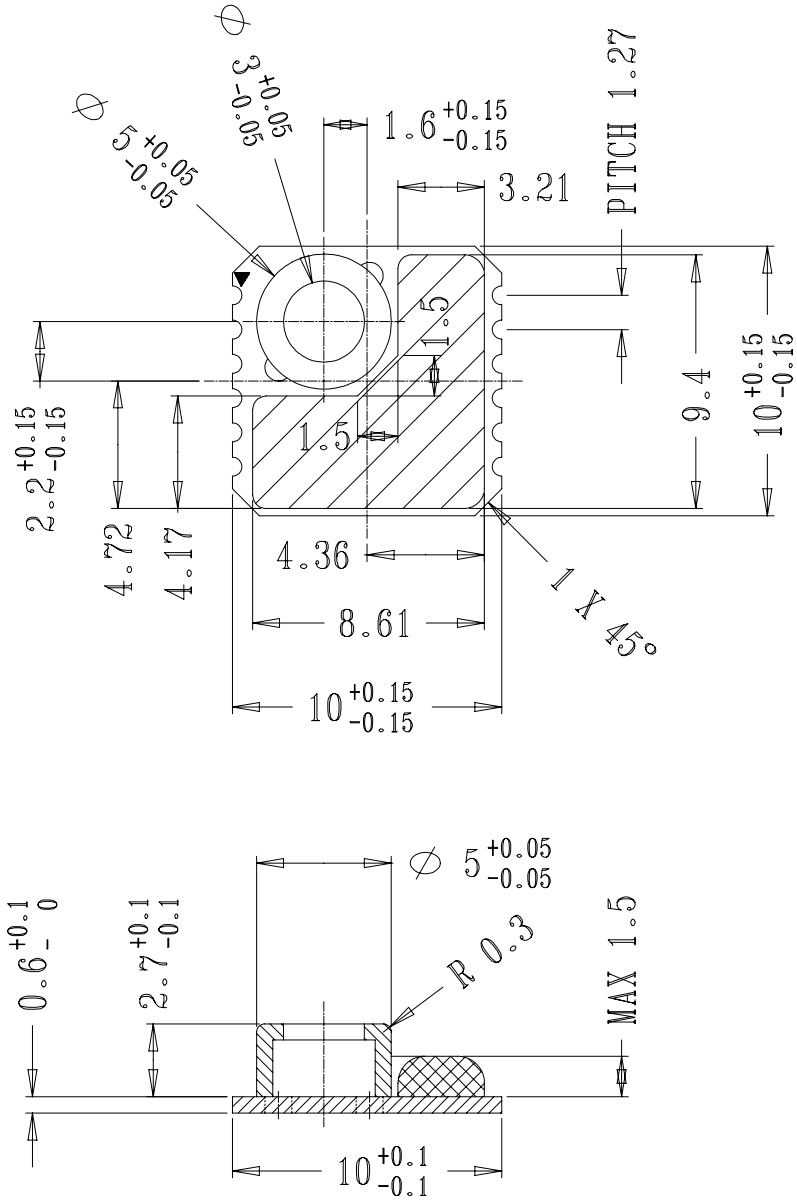


Recommendations

- **The module MBAW-1000 could not be soldered by reflow.** Hand soldering is recommended. The temperature of the solder tip must be lower than 300 °C.
- The pressure sensor used is very light sensitive. For a correct pressure reading, it must be well protected from light.
- Take all necessary ESD protection when handling this device.



Package Dimensions





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History of Document

1. **Rev00: First version.**
2. **Rev01: Picture**
3. **Rev02: Supply Current**
4. **Rev03: Company's address**