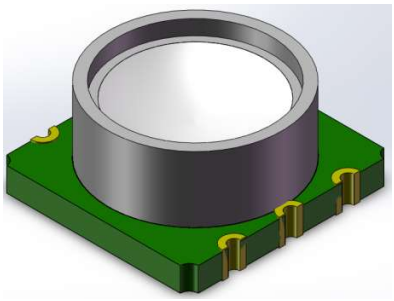


Features

- High resolution module, 3 Pa
- Supply voltage: 1.8V to 5.5V
- Operating range: 100 to 2000 mbar, -40 to +85℃
- Integrated digital pressure sensor (24 bit ADC)
- Excellent long term stability
- Standby current<0.1μA @ 25°C
- No external components (Internal oscillator)
- High-speed I²C digital output interface
- Size: 6.8 x 6.4 x 3.2 mm

Applications

- Water Proof Pressure Measurement
- Adventure and Sports Equipment

Descriptions

The DA17-02BA-W04 employs a MEMS pressure sensor with an I²C interface to provide accurate temperature, pressure data. The sensor pressure and temperature outputs are digitized by a high resolution 24-bit ADC. Data compensation is integrated internally to save the effort of the external host MCU system. Easy command-based data acquisition interface and programmable interrupt control is available. Pressure output can be resolved with output in fractions of Pascal. Package is surface mount with a stainless steel cap and is RoHS compliant

Sensor Performances (VDD = 3.0 V)				
Pressure	Min	Typ	Max	Unit
Range	100		2000	mbar
ADC		24		bit
Resolution		3		Pa
Accuracy@25°C (600 to 2000 mbar)	-0.2%		+0.2%	%F.S
Accuracy@ 0°C to 50°C (300 to 2000mbar)	-0.4%		+0.4%	%F.S
Response time@ OSR=1024		2.5		ms
Long term stability		±0.1%		%F.S/yr

1. Block Diagram

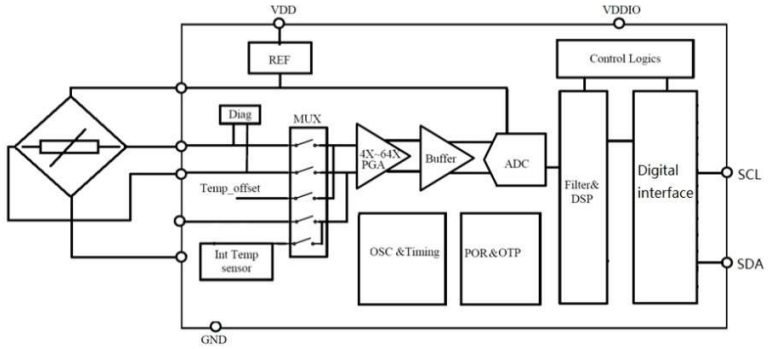


Figure 1: Functional Block Diagram

2. Electrical Specifications

2.1 Pressure and Temperature Characteristics

Table1: Pressure Output Characteristics @ VDD = 3.0V, T = 25°C unless otherwise noted

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating Pressure Range	P_{FS}	Full Accuracy	300		2000	mbar
Extended Pressure Range	P_{ext}	Linear Range of ADC	100		2000	mbar
Absolute Accuracy		at 25°C, 600 to 2000 mbar at 0..50°C, 300..2000 mbar	-0.2% -0.4%		+0.2% +0.4%	%F.S
Resolution RMS				3		Pa
Long Term Drift		After a period of 1 year		±0.1%		%F.S/yr

(1) The long-term stability is measured with non-soldered devices.

(2) Reflow soldering impact ±1.5 mbar.

(3) Recovering time after reflow (Time to recover at least 80% of the reflow impact) 5 days.

Table2: Temperature Output Characteristics @ VDD = 3.0V, T = 25℃ unless otherwise noted

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operation Temperature Range	T_{OP}		-40	25	85	℃
Temperature Absolute Accuracy		25℃	-0.8	0.5	+0.8	℃
Temperature Absolute Accuracy		0℃ to +50℃	-2	1	+2	℃
		-40℃ to + 85℃	-2.5	1	+2.5	℃
Temperature Resolution of Output Data				1/256		℃

2.2 Electrical Characteristics

Table3: DC Characteristics @VDD=3.0 V, T=25℃ unless otherwise noted

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operation Supply Voltage	V_{DD}		1.8	3.0	5.5	V
Operation Temperature	T_{OP}		-40		85	℃
Supply Current@25°C on during conversion	I_{BDD}_pgaoff	PGA off(Gain<=2)		0.9		mA
	I_{BDD}_pgaon	PGA on (Gain>=4)		1.5		mA
Conversion time	Tc	OSR 4096 2048 1024(1) 512 256		6.34 3.78 2.5 1.86 1.54		ms
Supply current (1 sample per sec.)	Idd	OSR 4096 2048 1024(1) 512 256		5.75 3.45 2.3 1.8 1.4		uA
Standby Supply Current	I_{DDSTB}	At 25℃			0.1	μA
Serial Data Clock Frequency	f_{SCLK}	I^2C protocol, pull-up resistor of 4k7~10k		100	400	kHz
Digital Input High Voltage	V_{IH}		0.8			V
Digital Input Low Voltage	V_{IL}				0.2	V
Digital Output High Voltage	V_{OH}	IO = 0.5 mA	0.9			V
Digital Output Low Voltage	V_{OL}	IO = 0.5 mA			0.1	V
Input Capacitance	C_{IN}			4.7		pF

(1) Standard Product. Could be customized.

2.3 Absolute Maximum Rating

Table4: Absolute Maximum Rating

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Overpressure	P_{MA}				10	bar
Supply Voltage	V_{DD}		-0.3		5.5	V
Interface Voltage	V_{IF}		-0.3		VDD+0.3	V
Storage Temperature Range	T_{STG}		-40		125	℃
Maximum Soldering Temperature	T_{MS}	40 second maximum			250	℃
ESD Rating		Human body model	-2		+2	kV
Latch-up Current		At 85℃	-100		100	mA

Stresses above those listed as "absolute maximum ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device under these conditions is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

3. Function Descriptions

3.1 General Description

The DA17-02BA-W04 is a highly integrated 24-bit sensor conditioner for applications of high precision low frequency measurement such as pressure transducer, weight scale. It can provide fully calibration for the sensor inherent temperature drift and non-linearity with multiple temperature sensing methods supported. The chip incorporates an in-amp, a buffer and a 24-bit sigma delta modulator followed by a calibration DSP. With wide gain and OSR range, the sensor could be suitable for variance sensors. One-time-programmable fuses are used to store the calibration coefficients for on-chip calibration calculations. IIC interfaces are supported for serial communication. The fully-compensated values can be read out via the I^2C interface by external MCU.

3.2 Factory Calibration

Every sensor is individually factory calibrated for sensitivity and offset for both of the temperature and pressure measurements, further calibrations are not necessary to be done by the user. The OTP registers are used to store the configurations and calibration coefficients for the sensor.

3.3 Sensor Output Conversion

For each pressure measurement, customer used to send a conversion command to the sensor, read back the conversion data from the normal register to be stored from 0x06 to 0x0a, the pressure data is stored from 0x06 to 0x08, the highest bit is sign bit, the low 5bits are decimal part, unit: Pa, the temperature data is stored from 0x09 to 0x0a, the highest bit is sign bit, the low 8bits are decimal part(1/256), unit: °C. All the data are sent starting from the MSB.

4. High-Speed I²C Digital Output Interface

The I²C interface is fully compatible to the official I²C protocol specification.

4.1 I²C Specification

Table5: I²C Slave Timing Values

Parameter	Symbol	Conditions	I²C			Unit
			Min	Typ	Max	
Clock frequency	f_{BsclB}				400	kHz
SCL low pulse	t_{BLOWB}		1.3			µs
SCL high pulse	t_{BHIGHB}		0.6			µs
SDA setup time	$t_{BSUDATB}$		0.1			µs
SDA hold time	$t_{BHDDATB}$		0.0			µs
Setup Time for a repeated start condition	$t_{BSUSTAB}$		0.6			µs
Hold time for a start condition	$t_{BHDSTAB}$		0.6			µs
Setup Time for a stop condition	$t_{BSUSTOB}$		0.6			µs
Time before a new transmission can start	t_{BBUFB}		1.3			µs

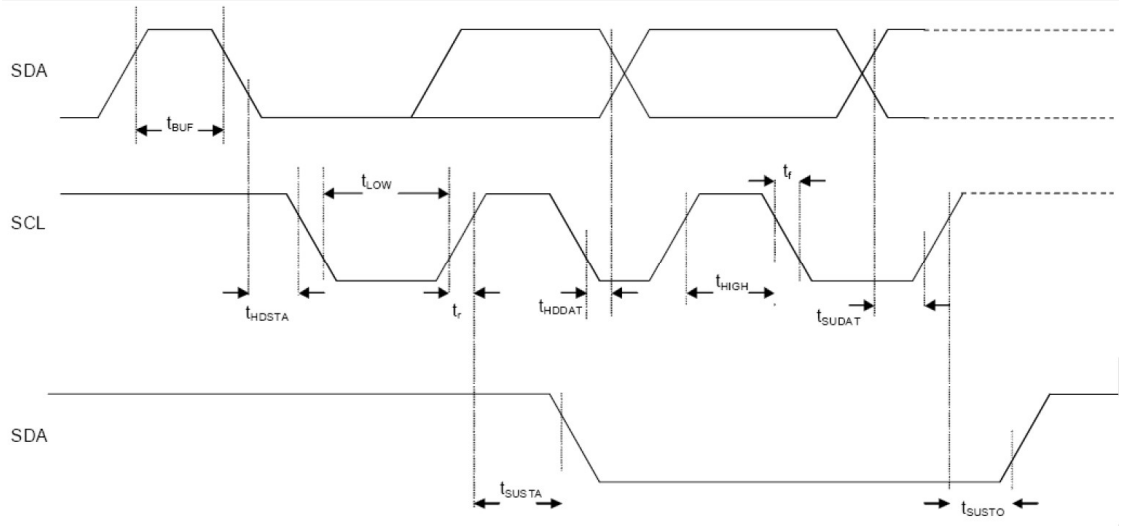
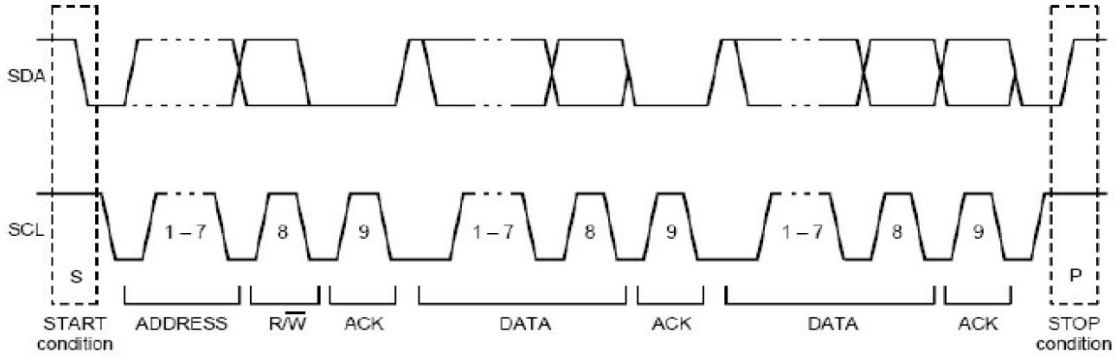


Figure 2: I²C Timing Diagram

The I²C interface protocol has special bus signal conditions. Start (S), stop (P) and binary data conditions are shown below. At start condition, SCL is high and SDA has a falling edge. Then the slave address is sent. After the 7 address bits, the direction control bit R/W selects the read or write operation. When a slave device recognizes that it is being addressed, it should acknowledge by pulling SDA low in the ninth SCL (ACK) cycle.

At stop condition, SCL is also high, but SDA has a rising edge. Data must be held stable at SDA when SCL is high. Data can change value at SDA only when SCL is low.

Figure 3: I²C Protocol



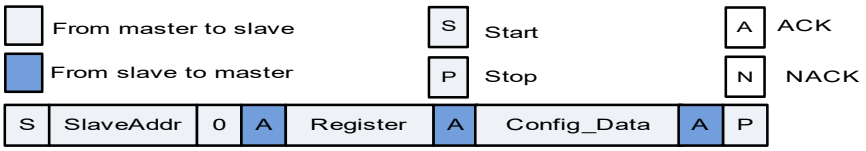
4.2 I²C Device Address

The I²C device address is shown below. The LSB of the device address is corresponding to address 0XDA (write) and 0XDB (read).

A7	A6	A5	A4	A3	A2	A1	W/R
1	1	0	1	1	0	SDO/ADDR	0/1

4.3 I²CProtocol

4.3.1 P_Config

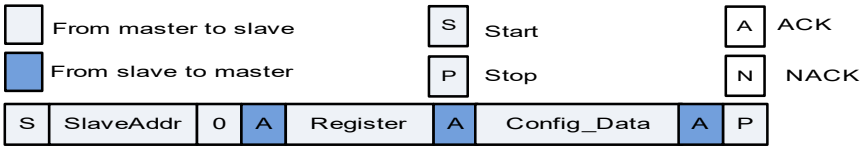


Register=0XA6
Config_Data:

Address	Description	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	default
0xA6	P_CONFIG	RW						OSR_P<2:0>			OTP

OSR_P: set the over sampling ratio of the sensor signal conversion channel. 000:1024X, 001:2048X, 010:4096X, 011:8192X, 100:256X, 101:512X, 110: 16384X, 111:32768X.

4.3.2 T_Config

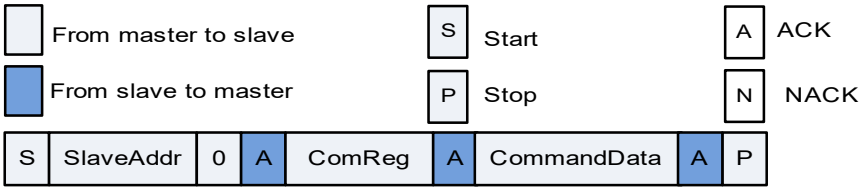


Register=0XA7
Config_Data:

Address	Description	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	default
0xA7	T_CONFIG	RW						OSR_T<2:0>			OTP

OSR_T: set the over sampling ratio of the sensor signal conversion channel. 000:1024X, 001:2048X, 010:4096X, 011:8192X, 100:256X, 101:512X, 110: 16384X, 111:32768X.

4.3.3 Send Command



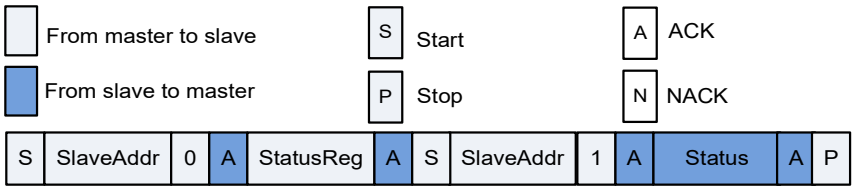
ComReg=0x30
CommandData:

Address	Description	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	default
0x30	CMD	RW	Sleep_time<3:0>				Sco	Measurement_ctrl<2:0>			OTP

Sleep_time<3:0>:0000:0ms, 0001:62.5ms,0010:125ms... 1111: 1s, only active during sleep mode conversion. **Measurement_control<1:0>:** 010b: indicate a combined conversion (once temperature conversion immediately followed by once sensor signal conversion).

Sco: 1, Start of conversion, automatically come back to 0 after conversion ends (except sleep mode conversion).

4.3.4 Read Status



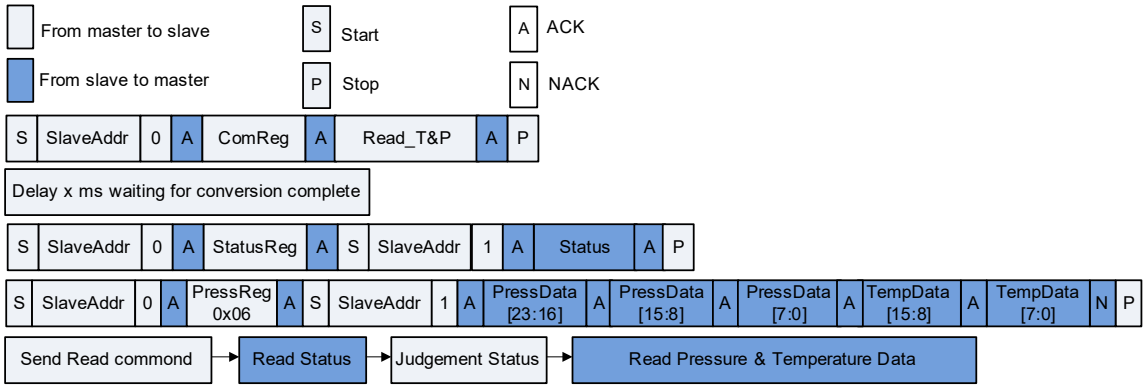
StatusReg=0x02

Status:

Address	Description	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0x02	Status	R					1'b0			DRDY

DRDY： 1, indicates once conversion complete, and the output data is ready for reading.

4.3.5 Read the Pressure & Temperature Values



Xms:
OSR_1024X_dl_ms 2*2.5 //1*2.5
OSR_2048X_dl_ms 2*3.78 //1*3.78
OSR_4096X_dl_ms 2*6.34 //1*6.34
OSR_8192X_dl_ms 2*11.46 //1*11.46
OSR_256X_dl_ms 2*1.54 //1*1.54
OSR_512X_dl_ms 2*1.86 //1*1.86
OSR_16384X_dl_ms 2*21.7 //1*21.7
OSR_32768X_dl_ms 2*42.18 //1*42.18

```
Pressure = PressData[23:0]/32;//Pa 2 bar product
If (TempData[15:0]&0x8000)//temperature<0
{
 Temperature1 = (0x8000 - TempData[15:0]&0x7fff)/256;// Integral part ℃
 Temperature2 =  ((0x8000 - TempData[15:0]&0x7fff)&0xff)*100/256;// decimal part ℃
}
Else //temperature>0
{
  Temperature1 = TempData[15:0]/256; // Integral part ℃
  Temperature2 = (TempData[15:0]&0xff)*100/256; // decimal part ℃
}
```

5. Application Circuit

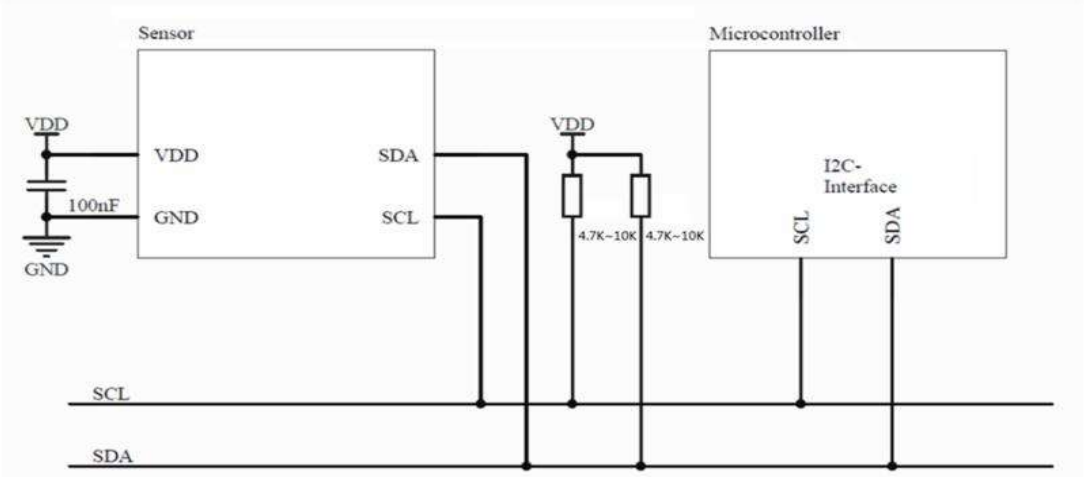


Figure4: Application Circuit

6. Package Outlines and Configuration

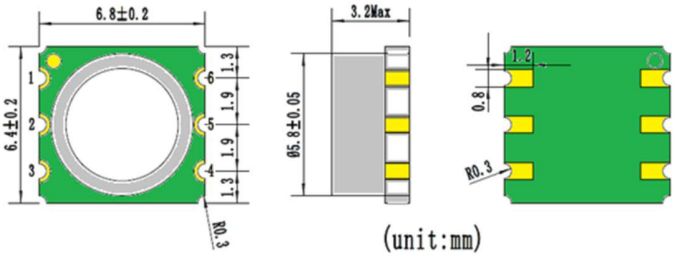
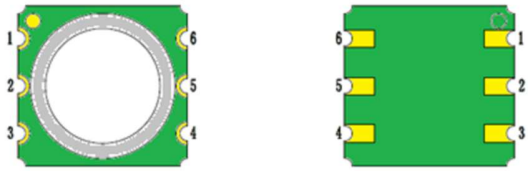


Figure 5: Package Outlines



Pin	Name	Type	Function
1	GND	G	Power Ground
2	VDD	P	Positive supply voltage
3	NC		Not connect
4	NC		Not connect
5	SDA	I/O	Serial data input/output
6	SCL	I	Serial data clock

Figure 6: Pin Configuration

7. Recommended Pad Layout

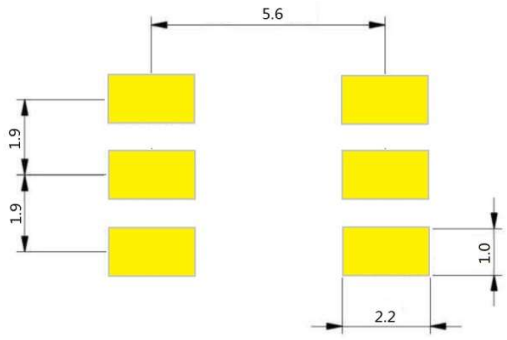
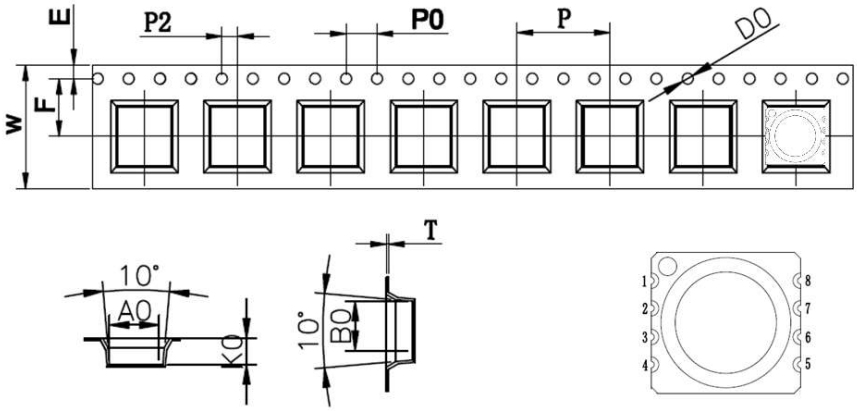


Figure 7: Pad layout

8. Shipping Package

a) Tube

b) Tape & Reel



ITEM	W	A0	B0	K0	K1	P	F	E	D0	D1	P0	P2	T
DIM	16.0	6.80	7.20	3.50	0.00	12.0	7.50	1.75	1.5	0	4.0	2.0	0.35
TOLE	±0.3	±0.1	±0.1	±0.1	±0.1	±0.1	±0.1	±0.1	+0.1 -0.0	min	±0.1	±0.1	±0.05