DSPC01
Digital Compass Pressure Sensor Module V1.20

Features:

- Calibrated digital sensor
- I2C data interface
- Pressure resolution: 0.01hpa
- Pressure accuracy: ±2hpa
- Pressure range: 300~1100hpa
- Altitude resolution: 1m
- Altitude range: -689~8948m
- Compass resolution: 1°
- Compass accuracy:±3°
- Compass range: 0°~359°
- Temperature resolution: 0.1°C
- Temperature accuracy: ±1°C
- Temperature range: -40°C ~+85°C
- Standby current ≤ 2uA
- Supply voltage: 2.4~3.6V

Applications

- GPS navigation
- Sports watch
- Digital Compass
- Sports vehicle
- Mobile altimeter
- Barometer systems
- Weather station

DESCRIPTION

DSPC01 is a type of digital sensor module which consists of a high resolution piezo-resistive pressure sensor, a compass sensor and a MCU. By one module DSPC01 can measure pressure, temperature and compass parameters. The output data are digitally calibrated and users can easily access related data through I2C interface, which shortens the development time and simplifies the work of designers greatly.

For pressure measurement DSPC01 module provides three modes: Altitude mode, Pressure mode and Pattern mode. The pattern mode is used for forecasting the variation of weather and users can know the weather conditions through the weather patterns (sunny, cloudy and rainy) displayed on the screen. This function is similar to what weather station offers but more convenient and concise.

DSPC01 modules work at 2.4~3.6V. It consumes about 2uA in standby mode and 1.5mA in normal work mode. Because of its compact size and extra low power consumption, it is very suitable for portable products.

PIN FUNCTIONS

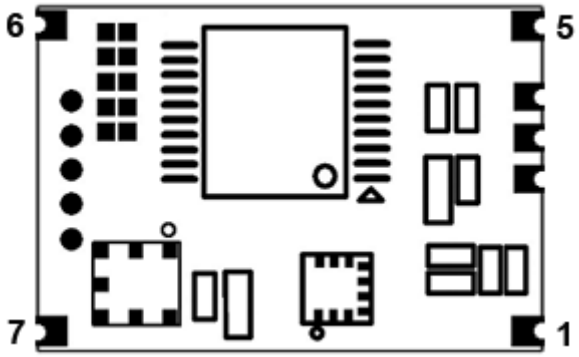

Figure 1: DSPC01 Pin Layout

PIN	DIP	Function	Description
1	GND	Ground	Ground (0V)
2	SDA	Input/output	I2C serial port, data pin
3	SCK	Input	I2C serial port, clock pin
4	VCC	Power	Power supply
5	GND	Ground	Ground (0V)
6	GND	Ground	Ground (0V)
7	GND	Ground	Ground (0V)

Table 1 DSPC01 Pin functions

ELECTRICAL SPECIFICATIONS

Symbol	Parameter (condition)	Min.	Typ.	Max.	Units
VCC	Supply Voltage	2.4	3	3.6	V
Temp	Operating temperature range	-40	25	85	℃
IDD	Sleep mode		2		uA
	Normal working mode		1.5		mA
Rp	Pressure range	300		1100	hpa
Pa	Absolute pressure accuracy		±1.5		hpa
Par	Absolute pressure resolution		0.01		hpa
Pr	Relative pressure accuracy		±0.12		hpa
Prr	Relative pressure resolution		0.01		hpa
Ra	Altitude range	-698		8943	m
Ha	Absolute altitude accuracy		±12		m
Har	Absolute altitude resolution		1		m
Hr	Relative altitude accuracy		±1		m

Hrr	Relative altitude resolution		1		m
Rc	Compass range	0		359	°
Ca	Compass accuracy		±3		°
Cr	Compass resolution		1		°
Rt	Temperature range	-40		85	℃
Tr	Temperature resolution		0.1		℃
Ta	Temperature accuracy @ 25℃		±0.5		℃
	@ 0…+65℃	-2	±1	2	℃

Table 2 DSPC01 Electrical Specifications

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Min.	Max.	Units
VCC	Supply Voltage	-0.3	4.0	V
V_I	Input voltage	-0.3	VCC+0.3	V
V_O	Output voltage	-0.3	VCC+0.3	V
T_{ST}	Storage temperature	-40	85	℃

Table 3 DSPC01 Maximum Ratings

WORK MODE

1. Initialization and Power-saving mode

Initialization: It starts as soon as being powered on. After 200ms delay, the module will enter into sleep mode.

Wake-up mode: The host sends command (0x70) to DSPC01 module. After 1s delay, the sensor module then can accept other commands.

Sleep mode: The DSPC01 module will enter into sleep mode after getting command (0x71) from the host.

2. Altitude Mode

The host sends command (0xA0) to DSPC01 and the module will return 3 bytes of Hex data representing altitude value. The MSB of first byte is symbol bit so the altitude might be a negative number. The remaining 23 bits will be divided by 10 and the result is the actual altitude in meters.

E.g. 0x80 00 10 = 1 00000000000000000010000B → -1.6m

0x00 07 D1 =0 00000000000011111010001B → 200.1m

Command	Function	Returned Value	Explanation
A0	Read altitude value	0x XX XX XX	Signed value; one decimal fraction

Table 4 DSPC01 Altitude Mode

3. Pressure Mode

The host sends command (0xB0) to DSPC01 and the module will return 3 bytes of Hex data representing pressure value (300hpa ~1100hpa) which should be transferred to decimal value.

Command	Function	Returned Value	Explanation
B0	Read pressure value	0x XX XX XX	No decimal fraction

Table 5 DSPC01 Pressure Mode

4. Patten Mode

The host sends command (0xB3) to DSPC01 and the module will return one bytes of data representing the weather trend.

Command	Function	Returned Value	Explanation
B3	Read pressure value	0x XX	1 → Sunny; 2 → Cloudy; 3 → Rainy

Table 6 DSPC01 Patten Mode

5. Compass Mode

The host sends command (0xC0) to DSPC01 and the module will return two bytes of unsigned data (0~359). In order to get the accurate direction, the compass should be calibrated for the first use. After sending command (0Xe0) users should rotate the DSPC01 module horizontally for at least 2 times and each circle should last at least 3 seconds. The DSPC01 module will quit the calibration mode after 10 seconds.

Command	Function	Returned Value	Explanation
C0	Read compass value	0x XX XX	Unsigned value, no fraction
E0	Calibration mode	---	Calibrating the compass

Table 7 DSPC01 Compass Mode

6. Temperature Mode

The host sends command (0x80) to DSPC01 and the module will return 2 bytes of Hex data.

The MSB of first byte is symbol bit so the temperature might be negative. The remaining 15 bits will be divided by 10 and the result is the actual temperature in Celsius degree.

E.g. 0x80 12 = 1 000000000010010B → -1.8 ℃
0x01 17 = 0 000000100010111B → 27.9 ℃

Command	Function	Returned Value	Explanation
80	Read temp value	0x XX XX	Signed value; one decimal fraction

Table 8 DSPC01 Temperature Mode

7. Communication

DSPC01 communicates with the host through I2C interface so three wires are needed for normal operation. The address for "write operation" is 0x20 and for "read operation" it is 0x21. Because the pull-up resisters are installed on the DSPC01 module, the host doesn't need any pull-up for I2C interface.

TECHNICAL NOTES

1. The timing for "Start", "Stop", "ACK", "NACK", "write" and "read" is same as I2C
2. The timing for write is : start + write 0x20 +ACK + write command + ACK + stop
3. The timing for read is : start + write 0x21 + ACK + read data1 + ACK + read data2+ ACK +…read datax+ NACK + stop
4. For compass calibration, it will last for around 9.5s, during this period, it won't respond for any command.
5. For any command, if you don't get the ACK from the module, you must add the timeout (0.1s) in your program. And resend this command again till you got the right ACK.
6. When switching the write command to read command you need to wait 150ms and 10ms for switching from read to write.
7. When you want the module to be in power save mode, you need to send the write command (0x71)
8. When wake up from sleep mode, you need to send write command (0x70), and also any commands except 0x71 will wake up the module.
9. For the frequency of I2C, it can't be higher than 10 KHz. For old version of sensor, the highest frequency can't exceed 5 KHz so users can try to start at 5 KHz or lower.
10. For the power supply it is limited to (2.4 – 3.6V)
11. For data reading, the highest byte is first and MSB in each byte. For example

    Start + 0x20 + ack + 0xa0 + ack + stop

    Delay 200ms

    Start + 0x21 + ack + 0x00 + ack + 0x03 + ack + 0x48+ NACK + stop

    The altitude got is 0x000348, and it is 84.0m

12. For temperature and altitude, the highest bit will show it is positive or negative. When the highest bit is 1, the value is negative. The other bit show the actual value. For example, for altitude, when the data got is 0x80111c, the actual altitude is : -438.0m.

Wake up command:

Start + 0x20 + ACK_from _module + 0x70 + ACK_from_module + stop

Delay 1s

Sleep command

Start + 0x20 + ACK_from _module + 0x71 + ACK_from_module + stop

Delay 100ms

Read altitude command

Start + 0x20 + ACK_from _module + 0xa0 + ACK_from_module + stop

Delay 200ms

Start + 0x21 + ACK_from _module + Data1 + ACK_from_master + Data2 + ACK_from_master + Data3 + NACK_from_master + Stop

Delay 10ms

Read pressure command

Start + 0x20 + ACK_from _module + 0xb0 + ACK_from_module + stop

Delay 200ms

Start + 0x21 + ACK_from _module + Data1 + ACK_from_master + Data2 + ACK_from_master + Data3 + NACK_from_master + Stop

Delay 10ms

Read weather forecast command

Start + 0x20 + ACK_from _module + 0xb3 + ACK_from_module + stop

Delay 200ms

Start + 0x21 + ACK_from _module + Data1 + NACK_from_master + Stop

Delay 10ms

Read Compass command

Start + 0x20 + ACK_from _module + 0xc0 + ACK_from_module + stop

Delay 200ms

Start + 0x21 + ACK_from _module + Data1 + ACK_from_master + Data2 + NACK_from_master + Stop

Delay 10ms

Read Temperature command

Start + 0x20 + ACK_from _module + 0x80 + ACK_from_module + stop

Delay 200ms

Start + 0x21 + ACK_from _module + Data1 + ACK_from_master + Data2 + NACK_from_master + Stop

Delay 10ms

Start Compass calibration command

Start + 0x20 + ACK_from _module + 0xE0 + ACK_from_module + stop

MECHANICAL DATA

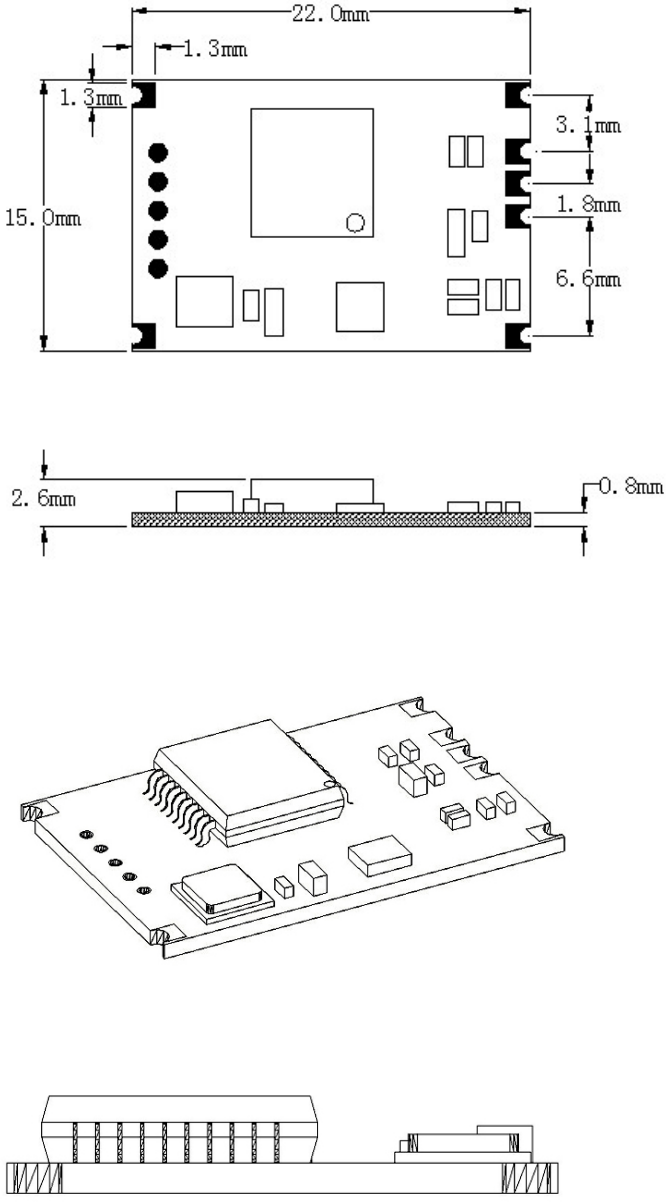

Figure 2: DSPC01 Dimensions

APPLIATION NOTES

1. The heat from mother board might affect the accuracy of temperature when measuring environment temperature so DSPC01 module should be kept away from power or PA (Specially in mobile phone) which dissipate heat greatly.
2. DSPC01 module should be kept away from the outlet of wind in measuring pressure value. Dust or other foreign substance should not block or cover the measuring hole of pressure sensor or else the pressure value will be inaccurate or be postponed in reading.
3. In measuring direction the module should be kept in horizontal level in order to get the correct value and should avoid to be used in strong magnetic environment such as large electromechanical equipment, iron mine, magnet, etc. If the product is equipped with speaker, the speaker should be turned off in case the magnetic field will interfere the compass.
4. If the sensor module is put or pass in strong magnetic environment, the compass should be calibrated after leaving such environment. The users also need to calibrate the compass for the first use when the finished products are sold on market

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