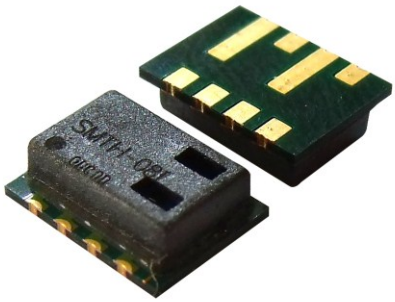
Preliminary

Features

- On-chip Humidity & Temperature sensor
- Fully calibrated
- Excellent long-term stability
- Low power consumption (<1 µA idle)
- I²C compatible output
- Available in 8-pins SOP



Applications

- HVAC
- Consumer
- Test & measurement
- Medical
- Battery operated equipment

1. Product summary

The SMTH08I is a combined Humidity and Temperature sensor with calibrated output. Both the temperature and the relative humidity sensor have a 14 bits resolution. The on-chip I^2C interface circuit make the device easy for interfacing with any kind of microcontroller.

Each SMTH08I is individually calibrated in a precision environment. The calibration coefficients are stored in an on-chip OTP memory and are used for internal correction and calibration.

Due to the very low idle state power (less than 1 µA), this device is of high interest for battery powered applications.

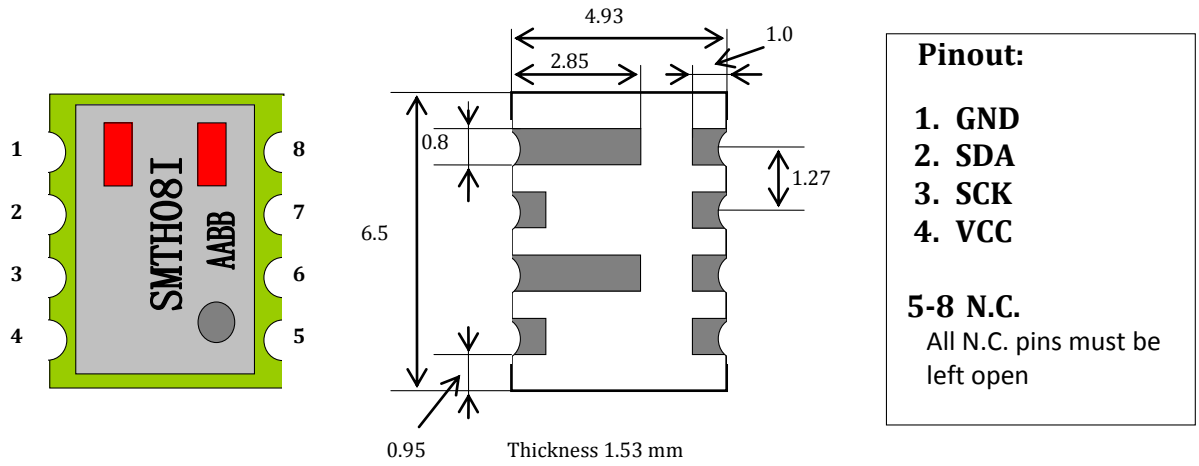
The completely automatic production method makes it possible to offer the temperature/humidity module with a very competitive price.

2. Specifications

Specifications @25 °C unless otherwise mentioned.

Parameter	Min	Typ	Max	Units.
General				
Supply voltage	2.4	3.3	5.5	**V**
Supply current (idle)		1		**µA**
Supply current (operation)		500	600	**µA**
Humidity				
Operating range	0		100	**% RH**
Accuracy (20 - 80%RH)		2		**% RH**
Response time		5		**s**
Output (resolution)		14		**bits**
Temperature				
Operating Range	-40		125	**°C**
Accuracy (-10 ~ 80 °C)		0.3		**°C**
Output (resolution)		14		**bits**
In/Outputs				
Level low/high input	<0.3		>0.7	**x V_{CC}**
Level low/high output	<0.2		>0.8	**x V_{CC}**
SCK frequency			1	**MHz(V_{CC}>3 V)**
SCK high/low time	200			**ns**
SCK rise/fall time		10		**ns**
SDA fall time	3	10	20	**ns**
SDA setup time	100			**ns**
SDA valid time		250		**ns**

3. Pin Configuration and Dimensions



- All sizes in mm (not to scale)

Figure 1. Pin configurations and dimensions

4. Block diagram

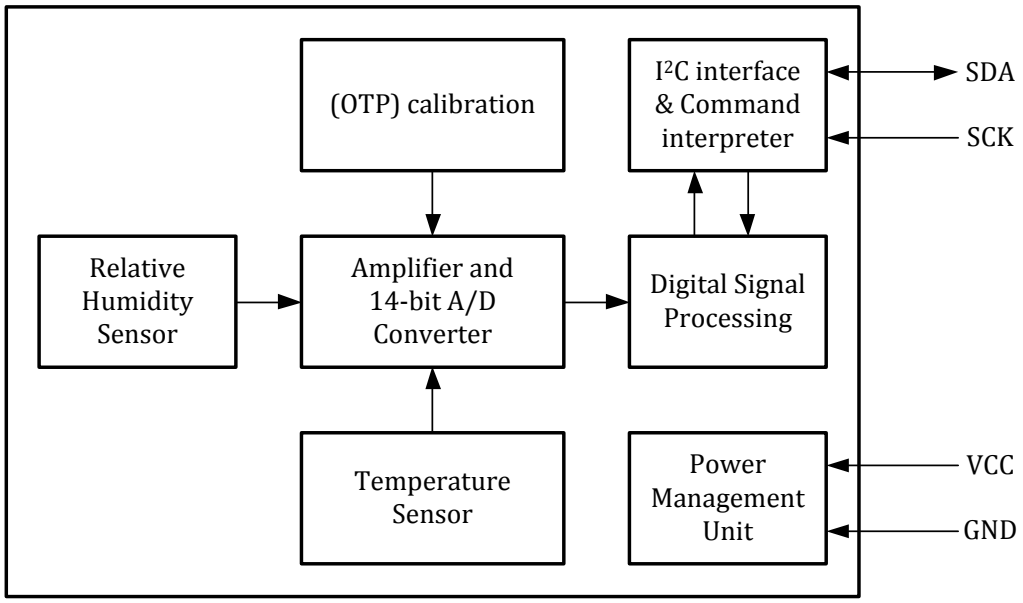


Figure 2. System block diagram

5. Hardware Interfacing

The SMTH08I employs a standard I^{2}C interface to the microcontrollers by means of a two-wire bus SDA/SCK, both with pull-up resistors (with a typical value of 2.2kΩ).

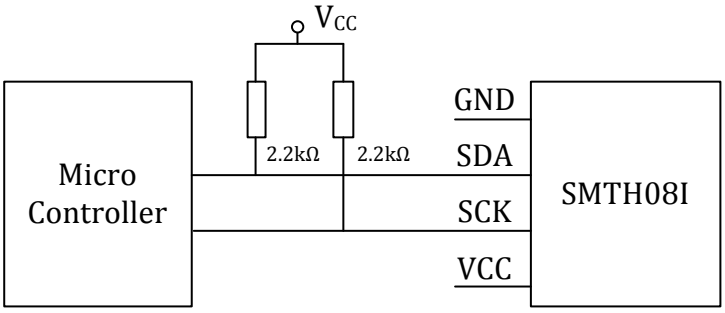


Figure 3. Hardware connection with microcontroller

6. Software Interfacing

Standard I^{2}C acknowledgement signals are used to ensure the correct reception of each byte of information. The built-in I^{2}C interface has a communication speed between 100kbit/s and 400kbit/s.

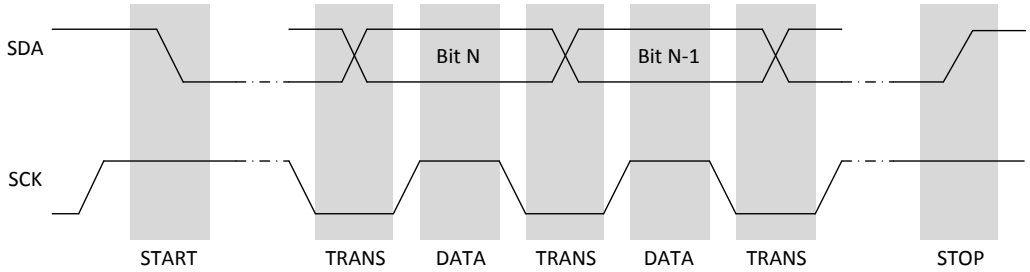


Figure 4. Electrical characteristics for I²C interface

Immediately after power-up, the sensor needs 10ms to enter the sleep mode. No commands are allowed to be sent to the sensor during this period.

The communication starts when a microcontroller initiates the interface, then sends either an “Update” command or a “Read” command. Depending on which command is being performed, the microcontroller will either read the data from the sensor or terminate the communication.

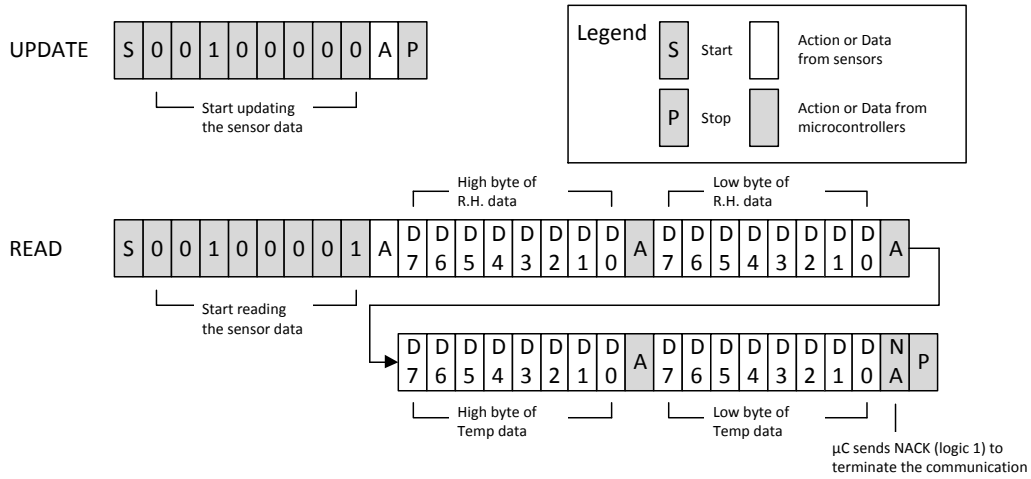


Figure 5. Communication protocols of the sensor

6.1 Update

The SMTH08I always stay in sleep mode until a valid “Update” command is received and executed. After this command is received and interpreted, the sensor will perform the RH and the temperature measurements as well as the associated processing and calculations. This procedure takes about 60ms to finish. Then the processed data will be stored into the output registers for microcontrollers to read out.

The “Update” command is sent by the master device (µCs) to the sensor. It consists of 7-bits device address, which is defaulted to 10H, and a one-bit logic “0” for the 8^{th} bit. After receiving the 8 bits command, the sensor will send an “Ack” (logic “0”) to the master device (µCs).

6.2 Read

When a complete measurement is finished, the output registers can be read by microcontrollers. A “Read” command is sent by the master device (µCs) to the sensor. It consists of 7-bits device address, which is defaulted to 10H, and a one-bit logic “1” for the 8^{th} bit. After receiving the 8 bits command, the sensor will send an “Ack” (logic “0”) back to the master device. Then the sensor will continue to send four bytes of measurement data, started with high byte RH value, low byte RH value and followed by high byte Temp value and low byte Temp value. The first two bits of the high byte RH value are status bits and the last two bits of the low Temp value are undefined, thus should be ignored. After receiving each byte of data, the master device must send an “Ack” back to the sensor, otherwise the data reading will be terminated.

7. Understanding the Output

The $Temp_{\_High}$ and the $Temp_{\_Low}$ bytes can be combined into a temperature reading in °C.

$$Temp[°C] = (Temp_{\_High}[7:0]*64 + Temp_{\_Low}[7:2]) / 16384 * 165 – 40$$

The lower two bits of Temp_Low should be ignored.

The RH_High and RH_Low bytes can be combined into a relative humidity reading by:

$$RH[\%] = (RH_{\_High}[5:0]*256+RH_{\_Low}[7:0]) / 16384 * 100$$

The higher two bits of RH_High are status bits. For normal operations, “00” is assigned to these two bits. If the data being sent from the sensor has been read out already, then a “01” is assigned. Any other value suggests wrong status of the chip and a power reset of the sensor should be performed.

8. Revision History

Revision	Date	Notes
2.0	4th Nov, 2011	A complete rewrite of the document.
2.1	10th Jan, 2012	Correcting the 8th bit of the command byte in Figure 5, according to the descriptions in section 6. Adding section numberings, figure numberings.
2.2	21st Feb, 2012	Improving the product photo quality and Figure 4.

9. Contact Info

Smartec B.V.
Delpratsingel 26
4811 AP Breda
The Netherlands
Tel.: +31 76 520 53 53
Fax: +31 76 520 53 54
E-mail: info@smartec-sensors.com