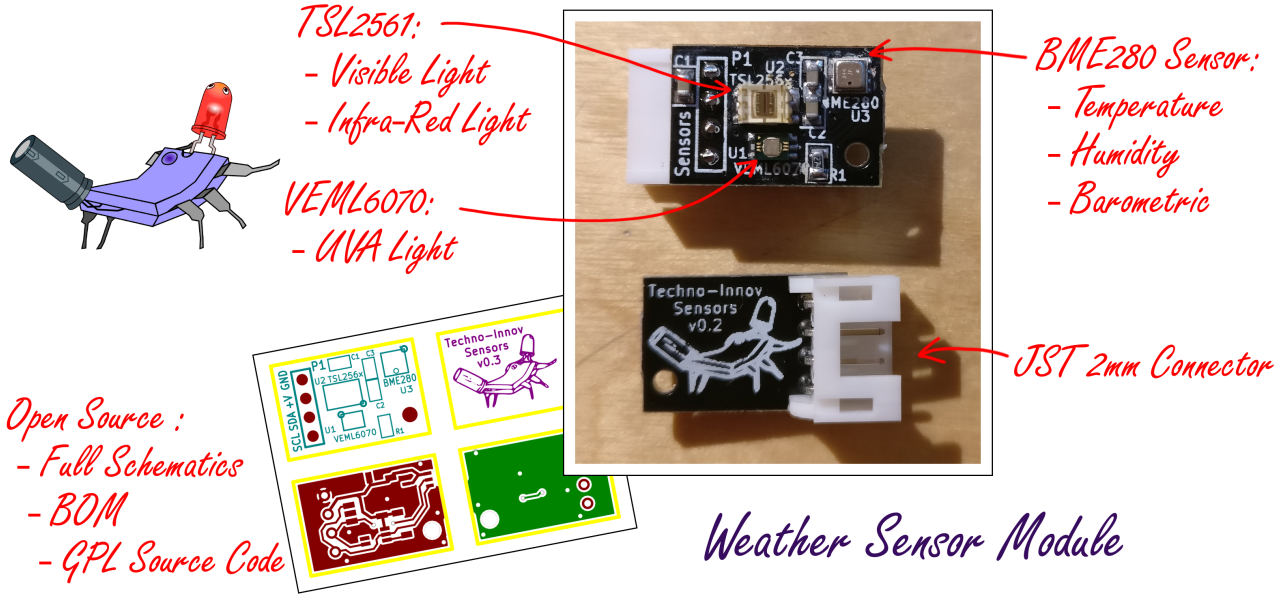


Weather Sensors System Reference Manual

Weather Sensors SRM for Module v0.3
December 9, 2017 - Doc rev 0.3a
Author: Nathaël Pajani

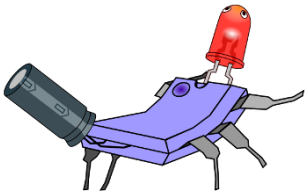


Table des matières

1 Introduction

You are reading the **System Reference Manual** for the Weather sensors module. This manual covers the module use and design.

The Weather sensors module is a small board which agregates three sensors to provide six different information about the environment : Temperature, Pressure, Humidity, Visible light, UV Light and IR light.
This is done using the BME280 sensor from Bosh sensortec [1], the TSL2561T from AMS [2], and the VEML6070 from Vishay [3].

The four pins connector provides power supply and I²C interface pins, and is compatible with Grove interface.

Every information about the design is available and all documentations are freely accessible. You can download the source files for the Weather sensors module and modify them using KiCad EDA (GPL) according to the license terms found in the license section. You can create your own Weather sensors module or a modified version.

In this document the Weather sensors module will be referred to as **the module**.

2 Licenses

2.1 Documentation

It is written in LaTeX and the PDF version is generated using pdflatex.

2.2 Hardware

2.3 Software

1. https://www.bosch-sensortec.com/bst/products/all_products/bme280
2. http://ams.com/eng/Products/Light-Sensors/Ambient-Light-Sensors/TSL2561
3. http://www.vishay.com/ppg?84277

3 Hardware

3.1 Dimensions

The following figures 1 and 2 give the different dimensions and the position of the main elements (connector, sensors, mounting hole) of the module.

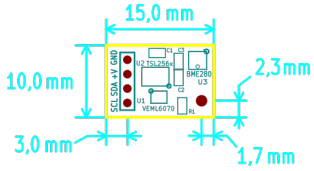


Fig 1 – Mechnanical dimensions

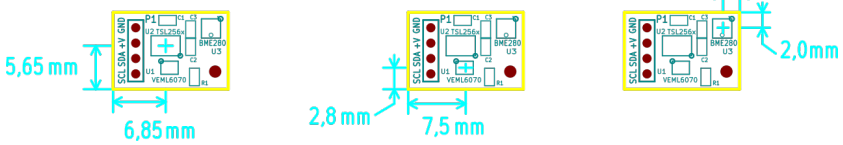


Fig 2 – Sensors position

3.2 Connectors

The module has one 2mm pitch connector numbered P1. Refer to figure 3 for connector position and to table 1 for a short description. Detailed description of the signals found on each connector pin follow.

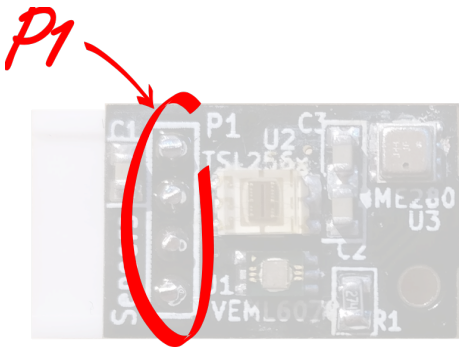


Fig 3 – Module Connectors

Name	Description
P1	1x4 pins, 2mm pitch S4B-PH JST [a] connector (Grove compatible).

TABLE 1 – Module Connectors Description

a. http://www.jst-mfg.com/product/detail_e.php?series=199

3.2.1 P1 Connector

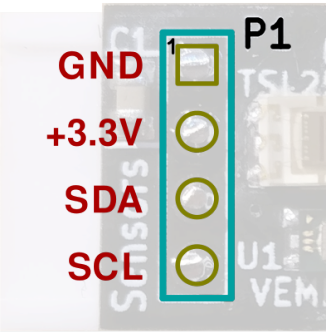


Fig 4 – P1 Connector

Pin #	Description
1	GND : Ground
2	+3.3V : +3.3 Volt
3	SDA : Bidirectional Serial Data for I²C bus.
4	SCL : Clock for I²C bus.

Table 2 – P1 Connector Pinout

P1 connector is a S4B-PH JST [4] connector, with a pinout and pitch compatible with the I²C Grove connector from Seeedstudio [5]. It provides both power supply and communication interface to the module.

4 Electronics

The Weather sensors module has been created using KiCad [6] EDA software suite for the creation of the schematics and printed circuit boards.

See page 10 in the annexes for the full schematics. The sources for the schematics are available for download from the module page [7] on Techno-Innov.fr.

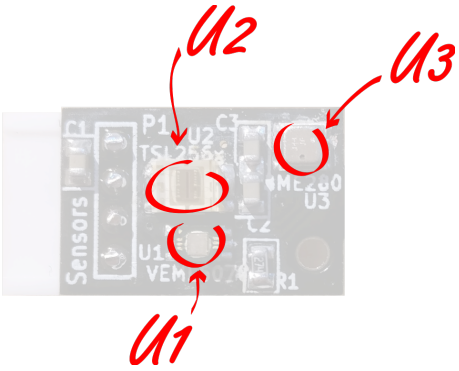


Fig 5 – Module Main Components

Name	Description
U1	VEML6070 UVA sensor from Vishay.
U2	TSL2561 Ambiant light and IR sensor from AMS.
U3	BME280 Temperature, Barometric and Humidity sensor from Bosh Sensortec.

Table 3 – Module Main Components Description

4. http://www.jst-mfg.com/product/detail_e.php?series=199
5. http://wiki.seeed.cc/Grove_System/
6. http://www.kicad-pcb.org/display/KICAD/
7. http://www.techno-innov.fr/technique-module-weather/

4.1 VEML6070

The VEML6070 [8] is an advanced ultraviolet (UV) light sensor with linear sensitivity to solar UV light.

It's peak sensitivity is at 355nm, which makes it an UVA (315 to 400nm) sensor (not UVB or UVC).

4.2 TSL2561

The TSL2561 [9] is a light-to-digital converter that transforms light intensity to a digital signal.
Each device combines one broadband photodiode (visible plus infrared) and one infrared-responding photodiode on a single integrated circuit capable of providing a near-photopic response. Two integrating ADCs convert the photodiode currents to a digital output that represents the irradiance measured on each channel. This digital output can be input to a microprocessor where illuminance (ambient light level) in lux is derived using an empirical formula to approximate the human eye response.

The user can read both of the integrated value, and the real ambiant light value should be computed according to the information provided in the technical document "Using the Lux Equation [10]" from AMS.

4.3 BME280

The BME280 [11] is an integrated environmental sensor combining individual high linearity, high accuracy sensors for pressure, humidity and temperature.

The humidity sensor features a fast response time and high accuracy over a wide temperature range.
The pressure sensor is an absolute barometric pressure sensor with features high accuracy and resolution at very low noise.
The integrated temperature sensor has been optimized for very low noise and high resolution. It is primarily used for temperature compensation of the pressure and humidity sensors, and can also be used for estimating ambient temperature.

Refer to the BME280 datasheet [12] or BME280 driver [13] from Bosh Sensortec for complete information about the sensor.

8. http://www.vishay.com/ppg?84277
9. http://ams.com/eng/Products/Light-Sensors/Ambient-Light-Sensors/TSL2561
10. http://ams.com/eng/content/view/download/145438
11. https://www.bosch-sensortec.com/bst/products/all_products/bme280
12. https://ae-bst.resource.bosch.com/media/_tech/media/datasheets/BST-BME280_DS001-11.pdf
13. https://github.com/BoschSensortec/BME280_driver

4.4 I²C

The module has three components on the I²C bus.

4.4.1 I²C Addresses

I²C Component	I²C Address W / R
VEML6070	0x70 / 0x71 and 0x73 (LSB and MSB are read on two different addresses
TSL2561	0x52 / 0x53 (Pin Addr Sel (pin2 of tsl256x) connected to GND)
BME280	0xEC / 0xED

TABLE 4 – I²C Addresses

Table 4 shows all the possible I²C Addresses for the components used on the module.

5 Software

We provide example code for reading the values from the three sensors using our GPIO Demo module, published under GPLv3 licence.

Th module can of course be used on other systems, and use of the sensor values depend on your application, and code depends on your choice of system and programming language.

5.1 Sample Source Code

5.1.1 Grab the sources

An example application code can be downloaded from our git repository [14] using the following clone command :

```
user@host:~/sw$ git clone http://gitclone.techno-innov.fr/modules
```

5.1.2 Sample code content

We wrote drivers for each of the three sensors found on the module.
The drivers are available in the `extdrv/` directory as `bme280_humidity_sensor.c` for the BME280 sensor, `tsl256x_light_sensor.c` for the TSL2561 sensor, and `veml6070_uv_sensor.c` for the VEML6070 sensor. The directory `apps/base/test_sensor_env` provides an example application for our GPIO Demo module which sends all sensor values on the UART interface.

14. http://git.techno-innov.fr/?p=modules;a=summary

5.1.3 Sample code usage

Refer to the software related chapter in the documentation of our GPIO Demo module [15] for information on how to modify, compile, and upload code on the GPIO Demo module.

6 Board revisions history

6.1 v01

This board revision has not been sold.
It was a first test with different sensors.

6.2 v02

First sold version. (20 boards produced)
No errors known, but assembly made difficult by footprints design and connector hiding pin names on silk screen.

6.3 v03

Actual version sold as of writting of this documentation.
Footprints re-worked and silkscreen modified.

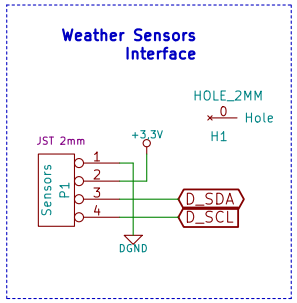
7 Annexes

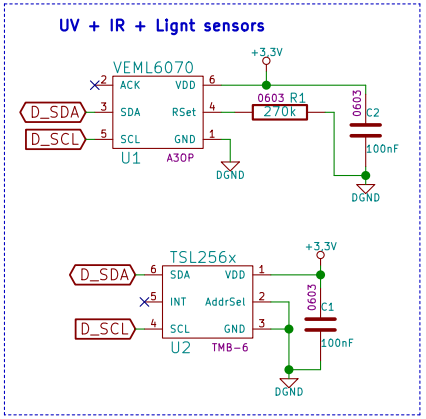
7.1 Schematics

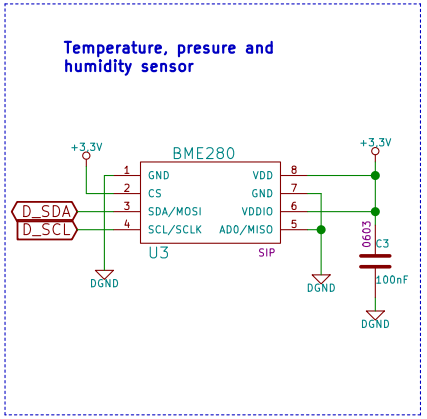
The board schematics and PCB layout have been created using KiCad [16] EDA software suite. You can download the sources on the module page [17] on Techno-Innov.fr.

(See on next pages)

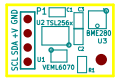
15. http://www.techno-innov.fr/technique-module-gpio-demo/
16. http://www.kicad-pcb.org/display/KICAD/
17. http://www.techno-innov.fr/technique-module-weather/

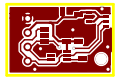


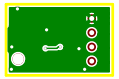


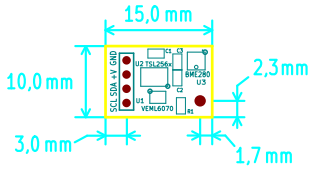


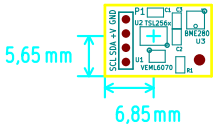
Author : Nathael Pajani – nathael.pajani@techno-innov.fr Licence : Creative Commons – CC – By – SA – NC	
Title: E-Xanh Gardener – Weather board	**Rev: 0.3**
Sheet: /	Id: 1/1
Techno-Innov	Date: 2017-12-08

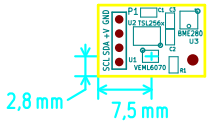


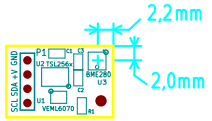












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Techno-Innov

Sheet:
File: ExanhWeather.kicad_pcb

Title: E-Xanh Gardener – Weather board

Size: A4	Date: 2017-12-08	**Rev: 0.3**
KiCad E.D.A. kicad 4.0.7+dfsg1-1		Id: 1/1

7.2 BOM

7.2.1 Block version

Part Description	Ref	Module	Nb	Vendor	Vendor ref	Farnell ref
VEML6070 sensor	U1	-	1	Vishay	VEML6070	2504137
TSL2561 sensor	U2	-	1	AMS	TSL2561T	1226888
BME280 sensor	U3	-	1	Bosh Sensortec	BME280	262-BME280 (Mouser)
Decoupling capacitors 100nF	C1, C2, C3	0603	3	Multicomp	MC0603B104K500CT	1759122
Config resistor 270kOhms	R1	0603	1	Multicomp	MCWR06X2703FTL	2447313
JST PH 4pins	P1	2mm	1	JST	S4B-PH-K-S (LF)(SN)	9492488

TABLE 5 – BOM by functional block

Note : Components used on Board may change for functionnally equivalent references without prior notice

7.3 Document revision History

Version	Date	Author	Information
0.3a	December 9, 2017	Nathaël Pajani	Initial revision

7.4 Disclaimer

The Weather sensors module is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The entire risk as to the quality and performance of the Weather sensors module is with you. Should the Weather sensors module prove defective, you assume the cost of all necessary servicing, repair or correction.