









# LamaPLC: BMP/BME Bosch Temperature/Humidity/Pressure sensors with I<sup>2</sup>C communication

Bosch BMP sensors primarily measure barometric pressure and temperature, while Bosch BME sensors are more comprehensive, adding humidity and, in newer models, gas/air quality sensing.

Type of measurement	Model	Power voltage	Measurement, range, accuracy	Communication	Note
 Temperature Humidity Air pressure	Bosch <b>BME280</b> 	<b>3.3 V</b> (1.71 .. 3.6V)	Temperature measurement range: -40 .. +80 °C Temperature measurement accuracy: ±0.5°C (-40..85) Humidity measurement range: 0..100% RH Humidity measurement accuracy: ±3% Air pressure Range: 300 .. 1100 hPa Air pressure accuracy: ±0.25%	I <sup>2</sup> C default addr.: <b>0x76/77</b> SPI	-
 Temperature Humidity Air pressure	Bosch <b>BME680</b> 	<b>3.3 V</b> (1.71 .. 3.6V)	Temperature measurement range: -40 .. +80 °C Temperature measurement accuracy: ±1.5°C Humidity measurement range: 0..100% RH Humidity measurement accuracy: ±3% Air pressure Range: 300 .. 1100 hPa Air pressure accuracy: ±0.25%	I <sup>2</sup> C default addr.: <b>0x76/77</b> SPI	Direct output of IAQ: Index for Air Quality

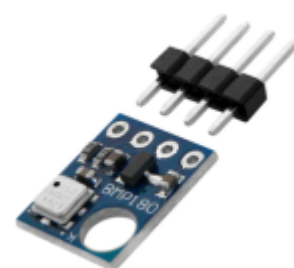
Type of measurement	Model	Power voltage	Measurement, range, accuracy	Communication	Note
 Temperature Air-pressure	Bosch <b>BMP180</b> 	<b>3.3 V</b> (1.62 .. 3.6V)	Temperature measurement range: -40 .. +85 °C Temperature measurement accuracy: ±1.5°C Air pressure Range: 4.35PSI .. 15.95PSI (30kPa .. 110kPa) Air pressure accuracy: ±2%	I <sup>2</sup> C default addr.: <b>0x77</b> (fix)	Maximum Pressure: 145.04PSI (1000kPa) Temperature resolution: 0.1 °C Pressure resolution: 1 Pa
 Temperature Air-pressure	Bosch <b>BMP280</b> 	<b>3.3 V</b> (1.71 .. 3.6V)	Temperature measurement range: -40 .. +85 °C Temperature measurement accuracy: ±1.5°C Air pressure Range: 4.35PSI .. 15.95PSI (30kPa .. 110kPa) Air pressure accuracy: ±2%	I <sup>2</sup> C SPI default addr.: <b>0x76</b>	Maximum Pressure: 290.08PSI (2000kPa) Temperature resolution: 0.01 °C Pressure resolution: 0.16 Pa

The BME/BMP sensors can be integrated with the [Tasmota](#) system. For more details, see here:

- BMP085, BMP180 and BMP280 sensors: <https://tasmota.github.io/docs/BME280/>
- BME280: <https://tasmota.github.io/docs/BME280/>
- BME680: <https://tasmota.github.io/docs/BME680/>

## BME/BMP Modules

### BMP180 Temperature/Barometric Pressure Module

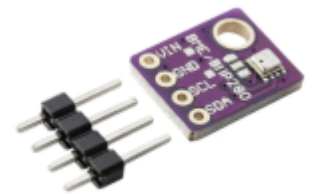


Another name for the **GY-68** module is a breakout board that integrates the [Bosch BMP180](#) sensor to measure atmospheric pressure, temperature, and altitude. The two terms refer to different components of the same product for hobbyist use: the BMP180 is the sensing chip on the GY-68 printed-circuit board.

The GY-68 BMP180 sensor module is known for its high precision, low power consumption, and ease of use via the I2C interface, making it popular for a wide range of DIY and IoT projects.

Feature	Specification
Chipset	<a href="#">Bosch BMP180</a>
Operating Voltage	<b>3.3V-5.5V</b> (module input voltage, includes voltage regulator); the chip itself runs on 1.8V-3.6V
Power Consumption	Ultra-low power, typically 0.5 $\mu$ A in standard mode (at 1 Hz sampling)
Interface	I <sup>2</sup> C (Serial Data Line/SDA and Serial Clock Line/SCL)
Multiple modules on the I <sup>2</sup> C	No. Default address <b>0x77</b> is fixed, making it impossible to add multiple sensors to the same I <sup>2</sup> C bus
Pressure Range	300 to 1100 hPa (+9000m to -500m relative to sea level)
Pressure Accuracy	Up to $\pm 0.03$ hPa ( $\sim 0.25$ m resolution) in high resolution mode
Temperature Range	-40°C to +85°C
Temperature Accuracy	$\pm 0.5$ °C
Calibration	Fully calibrated at the factory, and data is stored in internal E2PROM

## BME280 Temperature/Humidity/Barometric Pressure module



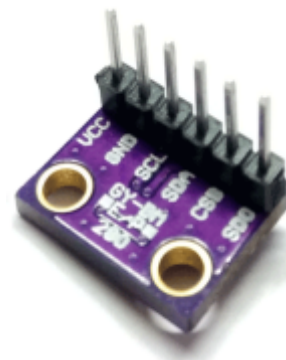
Another name, **GY-BME280**, is a sensor module that integrates the [Bosch BME280](#) environmental sensor chip and measures temperature, humidity, and atmospheric pressure. It is an upgrade to the BMP280 and is widely used in hobbyist electronics and IoT projects for comprehensive environmental monitoring.

The Bosch BME280 sensor features high precision and low power consumption, making it suitable for battery-powered systems. The GY-BME280 module often includes a voltage regulator and a logic-level converter, allowing it to operate with both 3.3V and 5V microcontrollers such as Arduino and Raspberry Pi.

Feature	Specification
Chipset	<a href="#">Bosch BME280</a>
Measurements	Temperature, Humidity, and Pressure
Operating Voltage	<b>3.3V-5V</b> (via onboard regulator on some modules; chip runs on 1.71V-3.6V)
Interface	I <sup>2</sup> C (default) and SPI (optional)
Multiple modules on the I <sup>2</sup> C	Max. 2 modules. The module's default I <sup>2</sup> C address is <b>0x76</b> , which can be easily changed to 0x77 using the provided solder jumper *
Temperature Range	-40°C to +85°C
Humidity Range	0% to 100% relative humidity ( $\pm 3\%$ accuracy)
Pressure Range	300 to 1100 hPa ( $\pm 1.0$ hPa accuracy)
Power Consumption	As low as 0.1 $\mu$ A in sleep mode, or 3.6 $\mu$ A at 1 Hz for all three measurements

\*: To change the I<sup>2</sup>C address to 0x77, cut the trace between the middle and left copper pads with a sharp knife. Then add a solder blob between the middle and right copper pads to short them.

## BMP280 (HW-611) Temperature/Barometric Pressure module



The GY-BMP280-3.3 is a sensor module featuring the [Bosch BMP280](#) environmental sensor chip, which precisely measures atmospheric pressure and temperature. This module operates from a 3.3V DC power supply, making it a low-power solution for applications such as weather monitoring, altimetry, and navigation systems.

The Bosch BMP280 improves on its predecessors (BMP085/BMP180) by delivering better performance and lower power consumption in a smaller form factor. The GY-BMP280-3.3 module features versatile interfacing and precise measurements.

Feature	Specification
<b>Chipset</b>	<a href="#">Bosch BMP280</a>
<b>Measurements</b>	Pressure and Temperature (Does not measure humidity)
<b>Operating Voltage</b>	3.3V DC (module input voltage; chip runs on 1.71V–3.6V)
<b>Power Consumption</b>	Ultra-low power, typically 2.7 $\mu$ A at 1 Hz sampling rate
<b>Interface</b>	I <sup>2</sup> C (up to 3.4 MHz) and SPI (up to 10 MHz)
<b>Multiple modules on the I<sup>2</sup>C</b>	Max. 2 modules. Default I <sup>2</sup> C is: <b>0x76</b> (SDO pin low). 2nd I <sup>2</sup> C address is: <b>0x77</b> *
<b>Pressure Range</b>	300 to 1100 hPa (+9000m to -500m relative to sea level)
<b>Pressure Accuracy</b>	Up to $\pm 1$ hPa absolute accuracy, allowing for $\sim \pm 1$ m altitude resolution
<b>Temperature Range</b>	-40°C to +85°C
<b>Temperature Accuracy</b>	$\pm 1.0^\circ$ C
<b>Calibration</b>	Factory-calibrated, with data stored in internal E2PROM

\*: To set the I<sup>2</sup>C address to **0x77**, connect pin 6 of the module (SDO) to Vcc, typically the 3.3V supply, and connect pin 5 of the module (CSB) to Vcc to select the I<sup>2</sup>C interface.

### GY-BMP280-3.3 Pinout

Pin	Name	I <sup>2</sup> C Function	SPI Function (4-wire)	Description
1	VCC	Power ( <b>3.3V</b> )	Power ( <b>3.3V</b> )	Supply voltage (1.71V to 3.6V)
2	GND	Ground	Ground	Common ground
3	SCL	SCL	SCK	Serial clock line
4	SDA	SDA	SDI (MOSI)	Serial data line

Pin	Name	I <sup>2</sup> C Function	SPI Function (4-wire)	Description
5	CSB	High (I <sup>2</sup> C)	CS	Chip select. Pull High for I <sup>2</sup> C (default via onboard resistor) or Low for SPI
6	SDO	ADR	SDO (MISO)	Sets I <sup>2</sup> C address: High for 0x77, Low for 0x76 (default). <i>Never leave the SDO pin floating. If it is not tied to GND or VCC, the I<sup>2</sup>C address may fluctuate randomly between the two values, causing communication errors.</i>



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### GY-BMP280/HW-611 Arduino code

```
// include
#include <Wire.h>
#include <Adafruit_Sensor.h>
#include <Adafruit_BMP280.h> // BMP280/HW-611

// variable
float bmp_280_temp;
float bmp_280_press;
bool bmp_280_ready;
String unitID = "abcd";

// init
Adafruit_BMP280 bmp_280; // BMP280/HW-611

// call block
void bmp_280_function () {
  bmp_280_temp = bmp_280.readTemperature();
  bmp_280_press = bmp_280.readPressure() / 100.0F;
  Serial.print("unitID: "); Serial.print(unitID); Serial.print(";
bmp_280_temp: "); Serial.print(bmp_280_temp); Serial.println(" ; unit: C");
  Serial.print("unitID: "); Serial.print(unitID); Serial.print(";
bmp_280_press: "); Serial.print(bmp_280_press); Serial.println(" ; unit:
hPa");
}

void setup() {
  Serial.begin(115200);
```

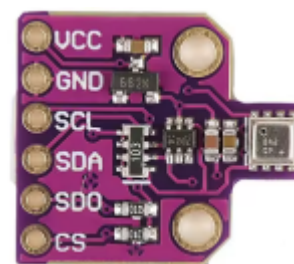
```

// unit works?
bmp_280_ready = bmp_280.begin(0x76);
if (!bmp_280_ready) {
Serial.println("BMP280/HW-611 Sensor not found");
} else {
Serial.println("BMP280/HW-611 Sensor works");
}
}

void loop() {
// call all units with 2 sec raster
static unsigned long lastTime = 0;
if (millis() - lastTime > 2000) {
lastTime = millis();
// units call, if works
if (bmp_280_ready) {bmp_280_function ();}
}
}

```

## BME680 Temperature/Humidity/Barometric Pressure/Gas (VOC) Module



The BME680 (CJMCU-680) is an environmental sensor breakout board based on the Bosch BME680 chip. It is a versatile “4-in-1” module designed for DIY electronics and IoT projects.

### Core Capabilities

The module measures four distinct environmental parameters:

- **Temperature:** Provides ambient temperature readings.
- **Humidity:** Measures relative humidity.
- **Barometric Pressure:** Can be used to calculate altitude or track weather changes.
- **Gas (VOC):** Features a heated metal-oxide sensor that detects Volatile Organic Compounds (VOCs) to estimate indoor air quality.

Feature	Specification	Details
Model	CJMCU-680 / BME680	4-in-1 Environmental Sensor
Operating Voltage	1.7V - 3.6V	Often compatible with 5V via onboard regulator
Communication	I <sup>2</sup> C or SPI	I <sup>2</sup> C (up to 3.4 MHz), SPI (up to 10 MHz)

Feature	Specification	Details
<b>Multiple modules on the I<sup>2</sup>C</b>	Max. 2 modules. Default I <sup>2</sup> C is: <b>0x76</b> (SDO pin low). 2nd I <sup>2</sup> C address is: <b>0x77</b> *	
<b>Current (Sleep)</b>	0.15 $\mu$ A	Extremely low standby power
<b>Current (Active)</b>	2.1 $\mu$ A - 12 mA	Varies by mode; gas sensor heater uses most power
<b>Dimensions</b>	~30 x 14 x 10 mm	Compact breakout board size

## Sensor Performance

Parameter	Measurement Range	Accuracy / Tolerance
<b>Temperature</b>	-40°C to +85°C	$\pm 1.0^\circ\text{C}$
<b>Humidity</b>	0% to 100% RH	$\pm 3\%$ RH
<b>Pressure</b>	300 to 1100 hPa	$\pm 1$ hPa (absolute) / $\pm 0.12$ hPa (relative)
<b>Gas (VOC)</b>	Qualitative IAQ Index	Detects ethanol, CO, and other VOCs

**Gas Sensor Note:** For accurate air quality readings, it is recommended to “burn-in” the sensor for 48 hours during the first use and allow 30 minutes of warm-up time for each subsequent session.

## Response Times:

- **Gas Sensor:** < 1 second ( $\tau_{33-63\%}$ )
- **Humidity Sensor:** ~8 seconds ( $\tau_{0-63\%}$ )

## CJMCU-680 Pinout

The standard CJMCU-680 module uses the following pin arrangement:

Pin	Name	Function
<b>1</b>	VCC	Power Supply (1.7V to 3.6V; commonly used with 3.3V)
<b>2</b>	GND	Ground
<b>3</b>	SCL	I <sup>2</sup> C Clock (SCL) or SPI Clock (SCK)
<b>4</b>	SDA	I <sup>2</sup> C Data (SDA) or SPI Data In (SDI/MOSI)
<b>5</b>	SDO	SPI Data Out (MISO). Also sets the I <sup>2</sup> C Address: connect to GND for 0x76 (default) or VCC for 0x77. <i>Never leave the SDO pin floating. If it is not tied to GND or VCC, the I<sup>2</sup>C address may fluctuate randomly between the two values, causing communication errors.</i>
<b>6</b>	CS	Chip Select for SPI. Pulling this high or leaving it disconnected defaults the module to I <sup>2</sup> C mode

## Controller wiring

- SCL: A5
- GND: GND
- SDA: A4
- Vdd: **3.3V** (or **5V** if your breakout board has a regulator).

## Source codes

Arduino C : [Read BME680 Temperature/Humidity/Barometric Pressure/Gas \(VOC\) Module](#)  
RP2040\_ETH\_Modul: [Read BME 680 sensor data and store in Modbus input registers](#)

## BME688 Temperature/Humidity/Barometric Pressure/Gas (VOC) Module



The Bosch **BME688** is an advanced 4-in-1 environmental sensor that integrates high-accuracy measurements for temperature, humidity, barometric pressure, and gas. It is the first sensor of its kind to include *Artificial Intelligence (AI)* features, enabling it to detect specific gas compositions, such as *Volatile Organic Compounds (VOCs)* and *Volatile Sulfur Compounds (VSCs)*.

Parameter	Measurement Range	Accuracy
Temperature	-40°C to +85°C	±0.5°C to ±1.0°C
Humidity	0 to 100%	RH±3% RH
Pressure	300 to 1100 hPa	±0.6 hPa (absolute)
Gas Sensor	VOC, VSC, CO, H <sub>2</sub>	AI-trained classification

### Hardware & Communication

- **Operating Voltage:** 1.71V to 3.6V (**typically 3.3V**).
- **Interface:** Supports both I<sup>2</sup>C (up to 3.4 MHz) and SPI (up to 10 MHz).
- **I<sup>2</sup>C Addresses:** The default is **0x76** or **0x77**, depending on the SDO pin connection.
- **Current Consumption:** Ranges from 0.15 µA in sleep mode to 3.9 mA during a standard gas scan.

### AI Features (The “Digital Nose”)

The BME688's standout feature is its ability to be trained using the BME AI-Studio software. This allows the sensor to:

- Recognize unique “fingerprints” of different gas mixtures.
- Detect bacteria growth or spoiled food by identifying volatile sulfur compounds.
- Provide an *Indoor Air Quality (IAQ)* index through the Bosch BSEC software library.

### Comparison Table: BME680 vs. BME688

Feature	BME680	BME688
Primary Focus	General Air Quality (IAQ)	Specific Gas Detection & AI
Gas Sensor Type	MOX (Metal Oxide)	
AI Integration	None (Software-based IAQ only)	Integrated AI support (BME AI-Studio)

Feature	BME680	BME688
<b>Gas Detection</b>	Broad VOCs (Volatile Organic Compounds)	VOCs + VSCs (Volatile Sulfur Compounds)
<b>Gas resistance range</b>	Standard	Extended (for better discrimination)
<b>Humidity Stability</b>	Moderate cross-sensitivity (~15-25% error)	High stability (<5% error in high humidity)
<b>Software Support</b>	Basic BSEC library	BSEC + BME AI-Studio
<b>Replacement Type</b>	N/A	Backward compatible "Drop-in" replacement

## I<sup>2</sup>C topics on lamaPLC

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- [LamaPLC: Gas sensors](#) 2023/07/01 17:29 [gas, sensor, i2c, onewire, communication, mq-3, mq-4, mq-5, mq-6, mq-7, mq-8, mq-9, mq-135, gm-102b, gm-302b, gm-502b, gm-702b, alcohol, ch4, natural gas, smoke, lng, co, co2, lpg, h2, iso-butane, nox, nh3, benzene, town gas, formaldehyde, propane, humidity, temperature, voc, grv gas sens v2](#)
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- [lamaPLC: HT16K33 display controller](#) 2026/04/23 21:51 [i2c, 7-segment display, display, ht16k33, arduino](#)
- [LamaPLC: HTU TE Connectivity temperature/humidity sensors with I<sup>2</sup>C communication](#) 2026/04/23 21:52 [htu, htu31d, htu21d, htu20d, sht20, htu20, sht21, htu21, si7021, gy-21, gy-213v, hdc1080, si702, gy-20, sht31, htu31, si7031, gy-31, te connectivity, temperature, humidity, i2c, communication, sensor, arduino, code](#)

• lamaPLC: INA modules with Arduino libraries	2026/04/23 21:52	i2c, i c, communication, arduino, energy, power, current, monitor, sensor, ina219, gy-219, ina226, gy-216, ina228, gy-228, ina237, ina238, ina260, ina3221, ina
• lamaPLC: INA226 - current/voltage/power monitor with I <sup>2</sup> C communication	2026/04/23 21:52	i2c, i c, communication, arduino, energy, power, current, monitor, sensor, ina226, ina219, ina
• lamaPLC: LCD 1602/2004 with I <sup>2</sup> C communication	2026/02/14 18:27	communication, i2c, display, lcd, 1602, 2004, hd44780, pcf8574, pcf8574t, pcf8574at, arduino
• LamaPLC: MAX30100/MAX30102 Heart Rate Click Sensor Module	2026/04/23 21:52	max30102, max30100, heart rate click, sensor, communication, i2c, arduino, code
• lamaPLC: MCP23017 / MCP23S17 16-Bit I/O Expander with Serial Interface I <sup>2</sup> C / SPI	2026/04/23 21:52	communication, i2c, mcp23017, mcp23s17, spi, i o expander, serial, cjmcu-2317, cjmcu
• lamaPLC: MLX90614 (GY-906) infrared non-contact thermometer	2026/05/08 00:03	communication, i2c, temperature, mlx90614, gy-906, modul, infrared, non-contact thermometer, dsp, pwm, smbus, hailege
• lamaPLC: PCF857x I/O Expander chip/modul with I <sup>2</sup> C communication	2026/05/15 01:03	communication, i2c, pcf857x, pcf8574, pcf8574a, pcf8575, i o expander, i o extension, nxp, texas instruments
• LamaPLC: Pixart PAJ7620U2 Gesture recognition sensors/module with I <sup>2</sup> C communication	2026/04/23 21:52	paj7620u2, gy-paj7620, pixart, gesture recognition, i2c, communication, sensor, arduino, code
• lamaPLC: RP2040_ETH_Modul: I <sup>2</sup> C scanner	2026/05/12 16:20	code, micropython, 2026, rp2040 eth, i2c, comunication
• lamaPLC: RP2040_ETH_Modul: MLX90614 simple	2026/05/12 17:06	code, micropython, 2026, rp2040 eth, i2c, communication, mlx90614
• lamaPLC: RP2040_ETH_Modul: Read BME 680/688 sensor data	2026/05/12 21:06	code, micropython, 2026, rp2040 eth, bme680, i2c, sensor, communication
• lamaPLC: RP2040_ETH_Modul: Read BME 680/688 sensor data and store in Modbus input registers	2026/05/12 21:04	code, micropython, 2026, rp2040 eth, bme680, i2c, sensor, communication
• LamaPLC: SC16IS750 / SC16IS752: One or two serial (UART) ports from microcontroller via I <sup>2</sup> C or SPI communication	2026/04/23 21:52	cjmcu-750, cjmcu-752, cjmcu, nxp, sc16is750, sc16is752, uart, serial, i2c, spi, modul, converter, arduino, code
• LamaPLC: SGP Sensirion TVOC/VOC sensors with I <sup>2</sup> C communication	2026/04/15 19:41	sgp30, sgp40, sgp41, sensirion, gas-sensor, i2c, communication, sensor, arduino, code, eco <sub>2</sub> , voc, tvoc, indoor air quality, iaq, nox, hydrogen
• LamaPLC: SHT Sensirion Temperature/humidity sensor with I <sup>2</sup> C communication	2026/04/23 21:52	sht20, sht21, sht25, sht30, sht31, sht35, sht40, gy21, temperature, humidity, i2c, communication, sensor, arduino, code
• lamaPLC: Signal level converters	2026/02/14 23:47	pca9306, i2c, voltage, level, converter

- [lamaPLC: st756x display drivers](#) 2026/05/20 16:17 [display, driver, i2c, spi, lcd, cog, oled, st7565, st7567, gm12864, gm12864-59n, gm12864-03a, gm12864-01a, gme12864-41](#)
- [lamaPLC: TCA9548A \(HW617\); Low-Voltage 8-Channel I<sup>2</sup>C Switch Module](#) 2026/02/14 23:51 [tca9548a, hw617, i2c, switch, communication, expansion board, arduino](#)
- [lamaPLC: TM1637 7-segment display](#) 2026/02/14 18:26 [i2c, 7-segment display, display, tm1637, arduino](#)
- [LamaPLC: TOFnnnC STMicroelectronics Time-of-Flight \(ToF\) sensors with I<sup>2</sup>C communication](#) 2026/04/23 21:52 [tof050c, vl6180, tof200c, vl53l0x, tof400c, vl53l1x, stmicroelectronics, time-of-flight, tof, i2c, communication, sensor, arduino, code](#)
- [LamaPLC: VL53Lnn STMicroelectronics time-of-flight \(ToF\) laser-ranging sensors with I<sup>2</sup>C communication](#) 2026/04/23 21:52 [vl53l0x, vl53l1x, vl53l0 1xv2, gy-530, time-of-flight, tof, laser-ranging, i2c, communication, sensor, arduino, code](#)
- [LamaPLC: VL6180X STMicroelectronics Time-of-Flight \(ToF\) sensor with I<sup>2</sup>C communication](#) 2026/04/23 21:52 [vl6180x, stmicroelectronics, time-of-flight, tof, i2c, communication, sensor, arduino, code](#)
- [lamaPLC: XGZP68xx: Silicon Pressure Sensors/Module](#) 2026/05/15 15:17 [communication, i2c, sensor, modul, pressure, cfsensor, xgzp68xx, xgzp6810d, xgzp6857d, xgzp6859d, xgzp6887d, xgzp6897d, xgzp6899a, piezoresistive, capacitive](#)
- [Magnetic angle sensors](#) 2026/04/23 21:52 [magnetic angle sensor, magnetic flux, sensor, spi, i2c, pwm, communication, modul, as5047p, as5600, mt6701, mt6816, mt6835, tle5012b, amr, gmr, tmr, anisotropic magnetoresistive](#)
- [SSH1106/SSD1306 OLED Display with I<sup>2</sup>C communication](#) 2026/02/14 18:27 [i2c, oled, display, ssd1306, sh1106, ssh1106, arduino, cmos](#)

[BME280](#), [BME680](#), [BME688](#), [BMP180](#), [BMP280](#), [HW-611](#), [HW611](#), [Bosch](#), [temperature](#), [humidity](#), [pressure](#), [sensor](#), [arduino](#), [i2c](#), [communication](#), [AI](#), [CJMCU](#), [Volatile Organic Compounds](#), [VOCs](#), [Volatile Sulfur Compounds](#), [VSCs](#), [IAQ](#)

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