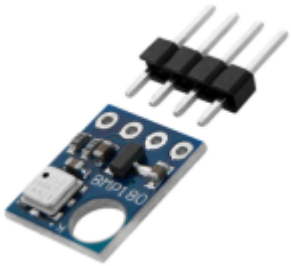
LamaPLC: BMP/BME Bosch Temperature/Humidity/Pressure sensors with I²C communication

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.

BMP180 (GY-68) Temperature/Barometric Pressure Module
BME280 (GY-BME280) Temperature/Humidity/Barometric Pressure module
BMP280 (HW-611) Temperature/Barometric Pressure module
BME680 Temperature/Humidity/Barometric Pressure/Gas (VOC) Module
BME688 Temperature/Humidity/Barometric Pressure/Gas (VOC) with AI Module

BMP180 Temperature/Barometric Pressure Module

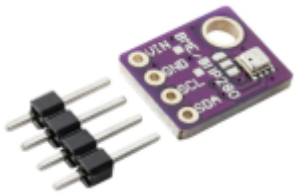


Another name for the **GY-68** module is a breakout board that integrates the Bosch BMP180 sensor to measure atmospheric pressure, temperature, and altitude. The two terms refer to different components of the same product for hobbyist use: the BMP180 is the sensing chip on the GY-68 printed-circuit board.

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	Bosch BMP180
Operating Voltage	**3.3V–5.5V** (module input voltage, includes voltage regulator); the chip itself runs on 1.8V–3.6V
Power Consumption	Ultra-low power, typically 0.5 µA in standard mode (at 1 Hz sampling)
Interface	I²C (Serial Data Line/SDA and Serial Clock Line/SCL)
Multiple modules on the I²C	No. Default address **0x77** is fixed, making it impossible to add multiple sensors to the same I²C bus
Pressure Range	300 to 1100 hPa (+9000m to -500m relative to sea level)
Pressure Accuracy	Up to ±0.03 hPa (~0.25m resolution) in high resolution mode
Temperature Range	-40°C to +85°C
Temperature Accuracy	±0.5°C
Calibration	Fully calibrated at the factory, and data is stored in internal E2PROM

BME280 Temperature/Humidity/Barometric Pressure module



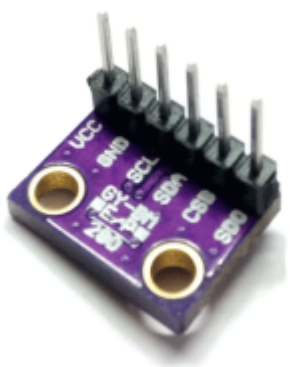
Another name, **GY-BME280**, is a sensor module that integrates the Bosch BME280 environmental sensor chip and measures temperature, humidity, and atmospheric pressure. It is an upgrade to the BMP280 and is widely used in hobbyist electronics and IoT projects for comprehensive environmental monitoring.

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	Bosch BME280
Measurements	Temperature, Humidity, and Pressure
Operating Voltage	**3.3V–5V** (via onboard regulator on some modules; chip runs on 1.71V–3.6V)
Interface	I²C (default) and SPI (optional)
Multiple modules on the I²C	Max. 2 modules. The module's default I²C address is **0x76**, 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 (±3% accuracy)
Pressure Range	300 to 1100 hPa (±1.0 hPa accuracy)
Power Consumption	As low as 0.1 µA in sleep mode, or 3.6 µA at 1 Hz for all three measurements

*: *To change the I²C 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**
Chipset	Bosch BMP280
Measurements	Pressure and Temperature (Does not measure humidity)
Operating Voltage	3.3V DC (module input voltage; chip runs on 1.71V–3.6V)
Power Consumption	Ultra-low power, typically 2.7 µA at 1 Hz sampling rate
Interface	I²C (up to 3.4 MHz) and SPI (up to 10 MHz)
Multiple modules on the I²C	Max. 2 modules. Default I²C is: **0x76** (SDO pin low). 2nd I²C address is: **0x77** *
Pressure Range	300 to 1100 hPa (+9000m to -500m relative to sea level)
Pressure Accuracy	Up to ±1 hPa absolute accuracy, allowing for ~±1m altitude resolution
Temperature Range	-40°C to +85°C
Temperature Accuracy	±1.0°C
Calibration	Factory-calibrated, with data stored in internal E2PROM

*: *To set the I²C 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 I²C interface.*

GY-BMP280-3.3 Pinout

Pin	**Name**	**I²C Function**	**SPI Function (4-wire)**	**Description**	
1	VCC	Power (**3.3V**)	Power (**3.3V**)	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	
5	CSB	High (I²C)	CS	Chip select. Pull High for I²C (default via onboard resistor) or Low for SPI	
6	SDO	ADR	SDO (MISO)	Sets I²C address: High for 0x77, Low for 0x76 (default). *Never leave the SDO pin floating. If it is not tied to GND or VCC, the I²C address may fluctuate randomly between the two values, causing communication errors.*	

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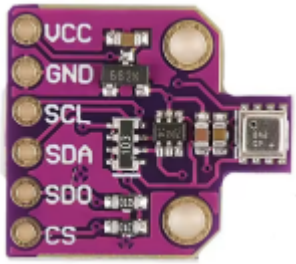
BME680 Temperature/Humidity/Barometric Pressure/Gas (VOC) Module



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	I²C or SPI	I²C (up to 3.4 MHz), SPI (up to 10 MHz)
Multiple modules on the I²C	Max. 2 modules. Default I²C is: **0x76** (SDO pin low). 2nd I²C address is: **0x77** *	
Current (Sleep)	0.15 µA	Extremely low standby power
Current (Active)	2.1 µA – 12 mA	Varies by mode; gas sensor heater uses most power
Dimensions	~30 x 14 x 10 mm	Compact breakout board size

Sensor Performance

Parameter	Measurement Range	Accuracy / Tolerance
Temperature	-40°C to +85°C	±1.0°C
Humidity	0% to 100% RH	±3% RH
Pressure	300 to 1100 hPa	±1 hPa (absolute) / ±0.12 hPa (relative)
Gas (VOC)	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 (τ33-63%)
- **Humidity Sensor:** ~8 seconds (τ0-63%)

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

CJMCU-680 Pinout

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

Pin	Name	Function
1	VCC	Power Supply (1.7V to 3.6V; commonly used with 3.3V)
2	GND	Ground
3	SCL	I²C Clock (SCL) or SPI Clock (SCK)
4	SDA	I²C Data (SDA) or SPI Data In (SDI/MOSI)
5	SDO	SPI Data Out (MISO). Also sets the I²C Address: connect to GND for 0x76 (default) or VCC for 0x77. *Never leave the SDO pin floating. If it is not tied to GND or VCC, the I²C address may fluctuate randomly between the two values, causing communication errors.*
6	CS	Chip Select for SPI. Pulling this high or leaving it disconnected defaults the module to I²C 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 680/688 sensor data
RP2040_ETH_Modul: Read BME 680/688 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_2	AI-trained classification

Hardware & Communication

- **Operating Voltage:** 1.71V to 3.6V (**typically 3.3V**).
- **Interface:** Supports both I²C (up to 3.4 MHz) and SPI (up to 10 MHz).
- **I²C 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)
Gas Detection	Broad VOCs (Volatile Organic Compounds)	VOCs + VSCs (Volatile Sulfur Compounds)
Gas resistance range	Standard	Extended (for better discrimination)
Humidity Stability	Moderate cross-sensitivity (~15-25% error)	High stability (<5% error in high humidity)
Software Support	Basic BSEC library	BSEC + BME AI-Studio

Feature	BME680	BME688
Replacement Type	N/A	Backward compatible “*Drop-in*” replacement

Since the BME688 and BME680 provide gas data as resistance in ohms (Ω), the value decreases as the air becomes more polluted. Here is how to interpret those ohm values for a typical indoor environment:

Gas Resistance (Ω)	Air Quality	Interpretation
> 1,000,000 (1M+)	♦ Excellent	Very clean air. Typical for outdoors or well-ventilated rooms.
500k – 1,000k	♦ Very Good	Fresh indoor air.
100k – 500k	♦ Good	Normal indoor environment.
50k – 100k	♦ Fair	Noticeable odors or VOCs (e.g., *cooking, cleaning products*).
10k – 50k	♦ Poor	Significant pollution. Time to open a window.
< 10k	♦ Very Poor	High concentration of VOCs or gases (e.g., *heavy smoke or alcohol*).

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Source codes

RP2040_ETH_Modul: Read BME 680/688 sensor data
RP2040_ETH_Modul: Read BME 680/688 sensor data and store in Modbus input registers

I²C topics on lamaPLC

Page	Date	Tags
• lamaPLC Communication: 1-Wire	2026/04/23 21:51	1-wire, communication, bus, microlan, i2c, uart, usart, ds18b20
• lamaPLC Communication: I²C	2025/09/23 21:25	i2c, i c, smbus, philips, bus, communication, arduino
• lamaPLC project: Sension SCD CO² measurement module	2026/04/15 19:34	scd30, scd40, scd41, iaq, ndir, sensor, i2c, arduino code
• LamaPLC: AHT10 Modul	2026/03/22 03:14	communication, i2c, temperature, humidity, sensor, aht, aht 10, modul
• LamaPLC: AHT20 / BMP280 Modul	2026/04/23 21:52	bmp280, aht20, adafruit, temperature, humidity, pressure, sensor, arduino, code, i2c
• LamaPLC: APDS - Avago ALS and proximity detection sensors with I²C communication	2026/04/23 21:52	avago, apds-9900, apds-9930, apds-9960, als, proximity, detection, gesture recognition, gesture, i2c, communication, sensor, arduino, code
• lamaPLC: Arduino Modul: BME680	2026/05/12 18:40	code, c, 2026, arduino, bme680, sensor, i2c, comunication
• lamaPLC: AS5600 Magnetic Induction Angle Measurement Sensor Module	2026/04/23 21:52	communication, i2c, as5600, as-5600, magnetic, induction, angle, sensor
• lamaPLC: Bi-Directional Logic Level Converter 3.3V ↔ 5V	2026/04/12 00:34	bi-directional, logic level converter, i2c, uart, spi

• LamaPLC: BMP/BME Bosch Temperature/Humidity/Pressure sensors with I²C communication	2026/04/23 21:52	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
• LamaPLC: CJMCU-219/INA-219 breakout board/IC with I²C communication	2026/04/23 21:52	cjmcu-219, ina-219, ina219, breakout board, i2c, communication, sensor, voltage, current, arduino, code, cjmcu
• LamaPLC: CJMCU-3216 / AP-3216 integrated digital ambient light and proximity sensor module/IC with I²C communication	2026/04/23 21:52	cjmcu-3216, cjmcu, ap-3216, ap3216, ambient light, proximity, sensor, arduino, code, i2c, communication
• lamaPLC: CJMCU-811 CCS811 Gas Sensor (VOCs TVOC CO2)	2026/04/23 21:52	cjmcu-811, ccs811, gas, sensor, vocs, tvoc, eco2, co2, arduino, air quality metal oxide, mox, i2c, micropython, rp2040-eth
• LamaPLC: D6T Omron Non-Contact Thermal Sensors with I²C communication	2026/04/23 21:52	d6t, d6t-32l, d6t-44l, d6t-8l, d6t-1a, omron, non-contact, thermal, sensor, i2c, arduino, code
• LamaPLC: DPS Infineon Temperature/Pressure sensors with I2C communication	2026/04/23 21:52	dps310, infineon, temperature, pressure, sensor, arduino, i2c, communication, code
• lamaPLC: Energy, power, current, and voltage	2025/05/31 23:32	i2c, i c, communication, arduino, energy, power, current, sensor, ina226
• LamaPLC: ENS ScioSense Multi-gas sensors with I²C communication	2026/04/23 21:52	ens160, sciosense, gas-quality, i2c, communication, sensor, arduino, code, eco_2, tvoc, aqi, indoor air quality, iaq, co_2, voc
• lamaPLC: ESP32 / ESP8266	2025/11/22 00:07	esp8266, esp32, esp32-c2, esp32-c3, esp32-c5, esp32-c6, esp32-c61, esp32-h2, esp32-s2, esp32-s3, esp32-p4, espressif systems, communication, ethernet, ip, wi-fi, thread, zigbee, matter, homekit, bluetooth, mqtt, adc, spi, uart, i2c, i2s, rmt, pwm, usb, usb otg, twai
• 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
• lamaPLC: GY-511 6DOF sensor module	2026/03/22 01:44	stmicroelectronics, lsm303dlhc, i2c, lsm303, sensor, gy-511, 6dof, pololu, module, arduino
• LamaPLC: GY-9250 MPU-9250/6500 9-axis Attitude Sensor Board	2026/04/23 21:52	ak8963, gy-9250, mpu-9250, 9-axis, motion detection, magnetometer, communication, i c, i2c, spi

• LamaPLC: HDC Texas Instruments Temperature/humidity sensors with I²C communication	2026/04/23 21:52	sht21, htu21, si7021, gy-21, gy-213v, hdc1080, gy-213v-hdc1080, cjmcu, cjmcu-1080, texas instruments, temperature, humidity, sensor, i2c, communication, arduino, code
• lamaPLC: HT16K33 display controller	2026/04/23 21:51	i2c, 7-segment display, display, ht16k33, arduino
• LamaPLC: HTU TE Connectivity temperature/humidity sensors with I²C 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	2026/04/11 19:54	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 I²C communication	2026/04/23 21:52	i2c, i c, communication, arduino, energy, power, current, monitor, sensor, ina226, ina219, ina
• lamaPLC: LCD 1602/2004 with I²C 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 I²C / 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 I²C communication	2026/05/14 15:21	communication, i2c, pcf857x, pcf8574, pcf8574a, pcf8575, i o expander, i o extension, nxp, texas instruments
• LamaPLC: Pixart PAJ7620U2 Gesture recognition sensors/module with I²C communication	2026/04/23 21:52	paj7620u2, gy-paj7620, pixart, gesture recognition, i2c, communication, sensor, arduino, code
• lamaPLC: RP2040_ETH_Modul: I²C 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 18:58	code, micropython, 2026, rp2040 eth, bme680, i2c, sensor, communication
• LamaPLC: SC16IS750 / SC16IS752: One or two serial (UART) ports from microcontroller via I²C 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 I²C communication	2026/04/15 19:41	sgp30, sgp40, sgp41, sensirion, gas-sensor, i2c, communication, sensor, arduino, code, eco₂, voc, tvoc, indoor air quality, iaq, nox, hydrogen
• LamaPLC: SHT Sensirion Temperature/humidity sensor with I²C 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: TCA9548A (HW617); Low-Voltage 8-Channel I²C 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 I²C 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 I²C 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 I²C 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	2026/03/05 21:19	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 I²C 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