BME688

UNIT Electronics

BME688 Environmental Sensor 4-in-1

v1.0

2025-07-17
Rev. A

Professional electronic component

PRODUCT OVERVIEW

Professional electronic module designed for reliable performance and easy integration with modern development platforms.

PRODUCT VIEWS

TOP VIEW

Top View

Component placement and connectors

BOTTOM VIEW

Bottom View

Underside components and connections

TECHNICAL FEATURES

Accurately measures ambient moisture for precise environmental monitoring.

Delivers consistent temperature readings even under varying conditions.

Power supply: 1.71V to 3.6V Sensor Supply Voltage

Communication interfaces: I²C (Qwiic) and SPI

Humidity measurement: 0 to 100 % RH, ±3 % accuracy

VOC detection: Indoor Air Quality (IAQ) index

Compact form factor: Qwiic connector + standard through-hole pins

Detects atmospheric pressure changes to support dynamic weather tracking.

Monitors a range of gases to help identify potential environmental hazards.

Low power consumption: sleep < 0.1 µA, typical operation < 3 µA

Temperature measurement: –40 to +85 °C, ±0.5 °C accuracy

Barometric pressure: 300 to 1100 hPa, ±1 hPa accuracy

Dual interface: I²C (Qwiic) and SPI

TECHNICAL SPECIFICATIONS

📦 OVERVIEW

FEATURE	DESCRIPTION
Sensor	BME688 Environmental Sensor
Communication Protocol	I2C and SPI
Power Supply	1.71V to 3.6V

⚙️ TECHNICAL SPECIFICATIONS

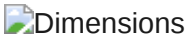
PARAMETER	TECHNICAL DATA
Package dimensions	8-Pin LGA with metal3.0 x 3.0 x 0.93 mm^3
Operation range (full accuracy)	Pressure: 300...1100 hPaHumidity: 0…100%Temperature: -40…85°C
Supply voltage VDDIO	1.2 ... 3.6 V
Supply voltage VDD	1.71 ... 3.6 V
Interface	I²C and SPI
Average current consumption	2.1 µA at 1 Hz humidity and temperature3.1 µA at 1 Hz pressure and temperature3.7 µA at 1 Hz humidity, pressure and temperature90 µA at ULP mode for p/h/T & air quality0.9 mA at LP mode for p/h/T & air quality3.9 mA in standard gas scan mode (gas scan mode & scan rate can be optimized on applications with BME AI studio)
Gas sensor - F1 score for H_2S scanning	0.94
Gas sensor - Standard scan speed	10.8 s / scan
Gas sensor - Electric charge for standard scan	0.18 mAh (5 scans ~ 1 min)
Gas sensor - Response time (τ 33-63%)	< 1 s (for new sensors)
Gas sensor - Sensor-to-sensor deviation	+/- 15%
Gas sensor - Power consumption	< 0.1 mA in ultra-low power mode
Gas sensor - Output data processing	Major direct outputs: Index for Air Quality (IAQ), bVOC-& CO_2-equivalents (ppm), Gas scan result (%) & many more (all listed in datasheet in Table 20: BSEC outputs)
Humidity sensor - Response time (τ0-63%)	8 s
Humidity sensor - Accuracy tolerance	± 3 % relative humidity
Humidity sensor - Hysteresis	≤ 1.5 % relative humidity
Pressure sensor - RMS Noise	0.12 Pa (equiv. to 1.7 cm)
Pressure sensor - Sensitivity Error	± 0.25 % (equiv. to 1 m at 400 m height change)
Pressure sensor - Temperature coefficient offset	±1.3 Pa/K (equiv. to ±10.9 cm at 1°C temperature change)

SUPPORTS

SYMBOL	I/O	DESCRIPTION
VCC	Input	3.3V or 5V
GND	GND	Common ground for all components

HARDWARE DOCUMENTATION

MECHANICAL DIMENSIONS



Physical dimensions and mounting specifications (measurements in millimeters)

SYSTEM TOPOLOGY

Connection topology and system integration diagram

Click image to open in full size

COMPONENT REFERENCE

FEATURE	ICON	DESCRIPTION
Relative Humidity		Accurately measures ambient moisture for precise environmental monitoring.
Barometric Pressure		Detects atmospheric pressure changes to support dynamic weather tracking.
Excellent Temperature Stability		Delivers consistent temperature readings even under varying conditions.
Gas Sensing		Monitors a range of gases to help identify potential environmental hazards.

REF.	DESCRIPTION
IC1	BME688 Environmental Sensor
L1	Power On LED
U1	AP2112K 3V3 Regulator
JP1	2.54 mm Castellated Holes
J1	QWIIC Connector (JST 1 mm pitch) for I2C

INTERFACE	SIGNALS / PINS	TYPICAL USE
UART	–	Unavailable
I²C	SDA, SCL (CSB held high)	Default interface (Qwiic connector)
SPI	CSB = GND, SDI (MOSI), SCK, SDO (MISO)	High-speed alternative
USB	–	Unavailable on this module

CIRCUIT SCHEMATIC

Circuit Schematic

Complete circuit schematic showing all component connections

View Complete Schematic PDF

PIN DESCRIPTION

Detailed pin assignment and electrical specifications

SIGNAL DESCRIPTION

FUNCTION	NOTES
Power Supply	3.3V or 5V
Ground	Common ground for all components

GROUP	AVAILABLE PINS	SUGGESTED USE
SPI	CSB, SDI (MOSI), SDO (MISO), SCK	High-speed SPI to read sensor data
I²C	SDA, SCL (via Qwiic connector)	Standard I²C for configuration & data acquisition

PIN CONFIGURATION LAYOUT

Physical connector layout and pin positioning

Pin Configuration Layout

Complete pin configuration diagram showing all connectors, pin assignments, and electrical connections for proper integration

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Professional Technical Datasheet

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