

## xyz-mIoT w. BG96 by itbrainpower.net

**low power IoT node w. LTE CATM1/NB IoT/EGPRS modem, Global version + GNSS (Galileo, GPS, GLONASS, BeiDou/Compass and QZSS)**

Built around **Microchip / ATMEL ATSAM21G** ARM0 microcontroller and having integrated Lithium battery (LiPo / LiION) charger, the **xyz-mIoT shield equipped with Quetel BG96 modem**, member of the **xyz-mIoT IoT node family**, supports endless devices / sensors / actuators interfacing via abundant 3.3V compliant interfaces (1 \* I2C, 1 \* SPI, 1 \* UART, 13 \* digital I/O - 1WIRE and PWM capable, 5 analog inputs and more) and providing support for solar powered applications and for **Lithium primer battery powered low power applications** (down to 35-37uA total shield sleep current and even further for particular configurations).

**xyz-mIoT IoT node family** is the worldwide first and most compact (35x45mm/~7g) IoT board in this class, class that combines the functionality of the low power Arm® Cortex®-M0 32-bit SAMD21G microcontroller (in Arduino Zero / MKR compatible design) with THS + tVOC + HALL + IR + tilt / vibration sensors bundled and global low power LTE (CATM1 or NB-IoT) / LTE / 3G / GSM connectivity.

**xyz-mIoT BG96 by itbrainpower.net** shields are *Arduino programmable* and are supported by RTCC, WDT, low power and other Arduino libraries.

GETTING STARTED posts containing powering, low power / solar powering tips and tricks and interfacing guidelines for GSM / low power modems, ethernet, WIFI, LORA, SD card reader, TFT displays, sensors, relays and other modules, together with CLOUD integration examples can be found in <https://itbrainpower.net/projects> section.

**xyz-mIoT BG96 by itbrainpower.net** commercial versions:

- PN: XYZMIOT209#BG96-UFL-0000000 SKU: ITBP-4003 - no embedded sensors
- PN: XYZMIOT209#BG96-SMA-0000000 SKU: ITBP-4003S - no embedded sensors
- embedded sensor versions are available as special order

### Equipped with Quetel BG96

Radio protocols supported: **low power LTE CAT M1 (eMTC), CAT NB1 (NB IOT) and EGPRS fallback**

Coverage: **Global (all over the world)**

GNSS support: **YES** - high performance multi constellation engine – Galileo, GPS, GLONASS, BeiDou/Compass and QZSS

SIM support: 1 x (nano)SIM/USIM socket

**xyz-mIoT IoT nodes** are designed and manufactured in EU by R&D Software Solutions.

## xyz-mIoT equipped with BG96 :: brief overview

### Modem side - BG96

**Radio protocols:** LTE CATM1 (eMTC), LTE CAT NB1 (NB IOT) and EGPRS (2G)  
**Radio coverage:** Global (all over the world)  
**Bands:** LTE - B1/B3/B8/B5/B20/B28;  
**Speeds:** NB IoT Single Tone / Multi Tone - Max. 25.2Kbps (DL), Max. 15.625 / 54 Kbps (UL);  
**GNSS support:** YES - multi constellation - GPS, GLONASS, BeiDou/Compass, Galileo and QZSS

**More specifications:** [https://itbrainpower.net/downloadables/Quectel\\_BG96\\_LTE\\_Specification\\_V1.3.pdf](https://itbrainpower.net/downloadables/Quectel_BG96_LTE_Specification_V1.3.pdf)

**AT commands:** [https://itbrainpower.net/downloadables/Quectel\\_BG96\\_AT\\_Commands\\_Manual\\_V2.0.pdf](https://itbrainpower.net/downloadables/Quectel_BG96_AT_Commands_Manual_V2.0.pdf)

**SIM support:** 1 x NANO SIM/USIM socket.

**External SIM:** supported as default - 5 pin 1.27mm interface.

**Embedded SIM:** option (feature available for high volume batches and for selected partners only)

**Modem power management** – power isolation controlled by MCU  
**GNSS active/passive antenna:** –yes, having active antenna power management supported by MCU  
**Radio connectors** – u.FL (SMA connector version available) for GSM + u.FL for GNSS  
**USB soldering pads for modem** – yes

### MCU side - ATMEL SAMD21G - Arm® Cortex®-M0 32-bit

**Clock Speed:** 32.768 kHz (RTCC) - crystal controlled, 48 MHz

**Flash Memory / SRAM:** 256 KB / 32KB

**WDT:** yes, having crystal time accuracy support

**Interfacing Voltage:** 3.3V

**Digital I/O Pins:** 13 + (analog, I2C, SPI, other) pins via alternate function + 2 reserved for shield power management DC current per I/O Pin: 7 mA

**PWM pins:** 12

**UART (hardware):** 1 + 1 reserved for modem communication

**SPI(hardware)** 1

**I2C (hardware)** 1

**Analog Input Pins** 5 (ADC 8/10/12 bit)

**External Interrupts** 8

**More specifications:** <https://itbrainpower.net/downloadables/40001882A.pdf>

### Embedded SENSORS - by PN suffix coding (xxxxxxx)

**voltage samplers (standard):** 2 dedicated ADCs for V<sub>raw</sub> (power in line) and V<sub>bat</sub> (battery voltage)

**optional sensors:** up to six sensors

THS sensor (optional): HDC2010 - <https://itbrainpower.net/downloadables/hdc2010.pdf>

CO2 + TVOC sensor (optional): CCS811 - [https://itbrainpower.net/downloadables/CCS811\\_DS000459\\_5-00.pdf](https://itbrainpower.net/downloadables/CCS811_DS000459_5-00.pdf)

HALL sensor (optional): DRV5032 - <https://itbrainpower.net/downloadables/drv5032.pdf>

IR sensor (optional): KP-2012P3C - <https://itbrainpower.net/downloadables/KP-2012P3C.pdf>

vibration / tilt sensor (optional): <https://itbrainpower.net/downloadables/SW-200d.pdf>

Shields without optional sensors embedded are available as standard commercial products. Versions having embedded sensors (THS / TVOC / HALL / TILT / IR / REED) are available as special order – [https://itbrainpower.net/downloadables/xyz-mIoT\\_shields\\_features\\_and\\_capabilities.pdf](https://itbrainpower.net/downloadables/xyz-mIoT_shields_features_and_capabilities.pdf) and “part number / SKU” chapter below.

## xyz-mIoT equipped with BG96 :: brief overview (continuation)

### Powering side and power management

**low power design:** yes – down to 35-40uA\* (and below\*\*) total shield sleep current support

**direct powering (no battery):** yes - 3.80-4.20 V supply (min. 200mA sustained and 500mA pulse capable) connected to VBAT and GND pins;

**Lithium primer battery support:** yes, default - via VBAT and GND pins\*\*;

**Integrated battery charger:** yes, having 6V solar cell support;

**Battery charger input voltages:** USB (5V) / V<sub>raw</sub> (4.8-7V);

**Supported rechargeable batteries:**

single cell Lithium Polymer min. 75mAh,

single cell Lithium ION min. 250mAh,

super-capacitor >1F / >5V w. ESR less than 150mOhm

**3.3V for MCU, sensors and external devices:** via embedded LDO;

**max. current on 3.3V PAD:** 75mA minus the total current sink by output ports;

**max. DC current per MCU I/O pin:** 7 mA;

**Additional modem power management:** yes (modem power isolation controlled by MCU)

\* measured at 25 C, RTCC and GPIO interrupt wake routines, crystal controlled WDT and RTCC, two UART and I2C (no embedded sensors)

\*\*&\*\* special Lithium primer battery only versions is capable of down to typical 5-7uA deep sleep current (contact us).

### Mechanical info

**Dimensions:** 1.4"x1.8" (35.56 x 45.72mm)

**Weight:** ~7g

**Mechanical drawing:** [https://itbrainpower.net/downloadables/xyz-mIoT\\_mechanical\\_drawing.png](https://itbrainpower.net/downloadables/xyz-mIoT_mechanical_drawing.png)

## xyz-mIoT equipped with BG96 :: INTERFACES, PADS / PORTS and CONNECTORS

### PADS / PORTS

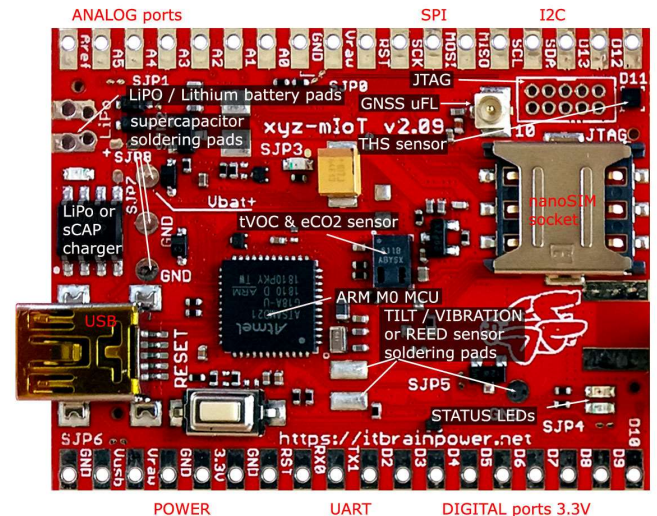
**Right image:** bottom PCB with component identification\*.

\* GNSS – default, but SENSORS are NOT available for this variant!

PADS & PORTS information and more:

[https://itbrainpower.net/xyz-mIoT/xyz-mIoT\\_Arduino\\_ports\\_mapping](https://itbrainpower.net/xyz-mIoT/xyz-mIoT_Arduino_ports_mapping)

[https://itbrainpower.net/downloadables/xyz-mIoT\\_2\\_09\\_block\\_schema\\_rev1.pdf](https://itbrainpower.net/downloadables/xyz-mIoT_2_09_block_schema_rev1.pdf).



Hints:

- full resolution picture [https://itbrainpower.net/images/xyz-mIoT-bottom-209\\_components\\_and\\_features\\_identification.jpg](https://itbrainpower.net/images/xyz-mIoT-bottom-209_components_and_features_identification.jpg)

- components / features are PN dependent [https://itbrainpower.net/xyz-mIoT/xyz-mIoT\\_shields\\_features\\_and\\_capabilities](https://itbrainpower.net/xyz-mIoT/xyz-mIoT_shields_features_and_capabilities)

## xyz-mIoT equipped with BG96 :: INTERFACES, PADS / PORTS and CONNECTORS (continuation)

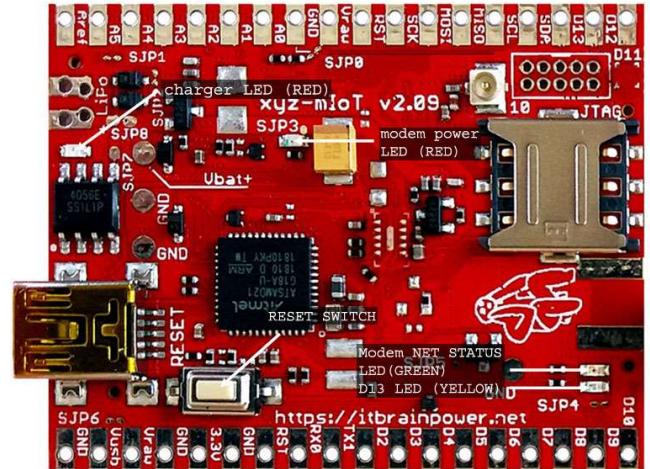
### LEDs, RESET SWITCH and additional info

1. RESET SWITCH - RESET/PROGRAMMING functions\*
2. GREEN LED - network status LED
3. YELLOW LED - D13 - ARDUINO system LED
4. RED LED (left) - battery charger LED
5. RED LED (center) - modem power LED

\* enable programming mode - push RESET twice (fast)

\* reset shield - push RESET button only once

- on right side - nano SIM socket connector
- on left side - LiPO battery PADS (LiPO+/Vbat and GND)
- on left side - USB mini B connector



Hints:

- full resolution picture [https://itbrainpower.net/images/xyz-mIoT-BG96\\_LEDs\\_RESET.jpg](https://itbrainpower.net/images/xyz-mIoT-BG96_LEDs_RESET.jpg)

### External SIM CARD port, antenna connector

External SIM card interface\*

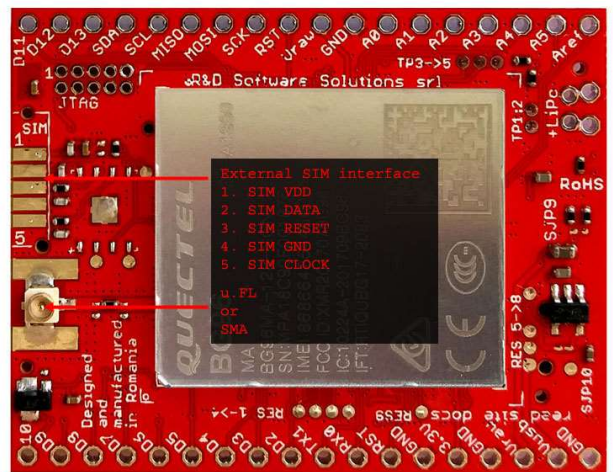
1. SIM VDD
2. SIM DATA
3. SIM RESET
4. SIM GND
5. SIM CLOCK

\* if not used, do not connect them

\* if used, in order to avoid interferences, keep the wires as short as possible and take in to account the wires routing.

GSM side antenna connector

xyz-mIoT shield may be ordered with *u.FL* connector or equipped with *SMA-F* connector.



Hints:

- full resolution picture <https://itbrainpower.net/images/xyz-mIoT-BG96-externalSIM-interface.jpg>

- uFL/SMA options, read [https://itbrainpower.net/downloadables/xyz-mIoT\\_shields\\_features\\_and\\_capabilities.pdf](https://itbrainpower.net/downloadables/xyz-mIoT_shields_features_and_capabilities.pdf)

## xyz-mIoT equipped with BG96 :: ARDUINO libraries, EXAMPLES and UTILITIES

xyz-mIoT shield Arduino board definition library, RTCC, WDT and low power Arduino support libraries, embedded sensors Arduino libraries and code examples for Arduino can be downloaded from <https://itbrainpower.net/downloads.php#xyz-mIoT> page.

Hint: Resources marked with "#", requires for download the following information: your name, email address and the modem IMEI. The modem IMEI can be found printed on the Quectel GSM module, or run AT+GMGS command.

## xyz-mIoT equipped with BG96 :: DOCUMENTATION DOWNLOAD/ONLINE

The xyz-mIoT shield documentation can be downloaded from [https://itbrainpower.net/downloads#xyz-mIoT\\_documentation](https://itbrainpower.net/downloads#xyz-mIoT_documentation) page.

## xyz-mIoT equipped with BG96 :: projects and how to

GETTING STARTED posts containing xyz-mIoT by itbrainpower.net powering, low power / solar cell powering tips and tricks and interfacing guidelines for GSM / low power modems, ethernet, WIFI, LORA, SD card reader, TFT displays, sensors, relays and other modules, together with CLOUD integration examples can be found at <https://itbrainpower.net/projects>.

## xyz-mIoT equipped with BG96 :: part number / SKU

### **a. commercial versions:**

xyz-mIoT BG96, uFL, no embedded sensors

- PN: XYZMIOT209#BG96-UFL-0000000 / SKU: ITBP-4003

xyz-mIoT BG96, SMA, no embedded sensors

- PN: XYZMIOT209#BG96-SMA-0000000 / SKU: ITBP-4003S

### **b. special order versions (most common):**

xyz-mIoT BG96, uFL, *CCS811, HDC2010 and DRV5032*

- PN: XYZMIOT209#BG96-UFL-1100100 / SKU: ITBP-4001

xyz-mIoT BG96, uFL, *HDC2010 and DRV5032*

- PN: XYZMIOT209#BG96-UFL-1100000 / SKU: ITBP-4002

xyz-mIoT BG96, SMA, *CCS811, HDC2010 and DRV5032*

- PN: XYZMIOT209#BG96-SMA-1100100 / SKU: ITBP-4001S

xyz-mIoT BG96, SMA, *HDC2010 and DRV5032*

- PN: XYZMIOT209#BG96-SMA-1100000 / SKU: ITBP-4002S