LTE IoT 2 Click

PID: MIKROE-3144
Weight: 36 g

LTE IoT 2 click is a Click board™ that allows connection to the LTE networks, featuring Quectel BG96 LTE module, which offers two LTE technologies aimed at Machine to Machine communication (M2M) and Internet of Things (IoT). This module is an embedded IoT communication solution which supports the LTE Cat M1 and NB1 technologies, offering an alternative to similar Low Power Wide Area Network (LPWAN) solutions, such as the ones provided by Sigfox and LoRa. The LTE CAT1 and NB1 technologies are designed with specific requirements of the IoT network in mind. LTE IoT 2 click also offers various other features, allowing simple and reliable connection to these new 3GPP IoT technologies.

Two SMA connectors on board for the main and the secondary (GNSS) antennas, network and status indicators, familiar 3GPP standard AT commands set, as well as the Quectel enhanced AT commands over the UART interface, USB connector for interfacing it with the software application from Quectel, are just some of the features available on the LTE IoT 2 click. A rich set of Internet protocols, industry-standard interfaces (UART, USB, SPI…) and driver support for all the major operating systems allow the Click board™ to be used in a wide range of M2M applications, such as smart metering in various industries (agriculture, gas distribution, water distribution), product tracking, and more.

How does it work?

LTE IoT 2 click is equipped with the BG96 LTE module from Quectel Wireless Solutions, which supports LTE CAT M1 and NB1 technologies, developed with IoT applications in mind. In addition, it supports EGPRS at 850/900/1800/1900 MHz, meaning that it can be used globally; it is not restricted to any region. The support for the CAT M1 and NB1 technologies and the ultra-low power consumption makes this module a perfect choice for the forthcoming 3GPP IoT technology.
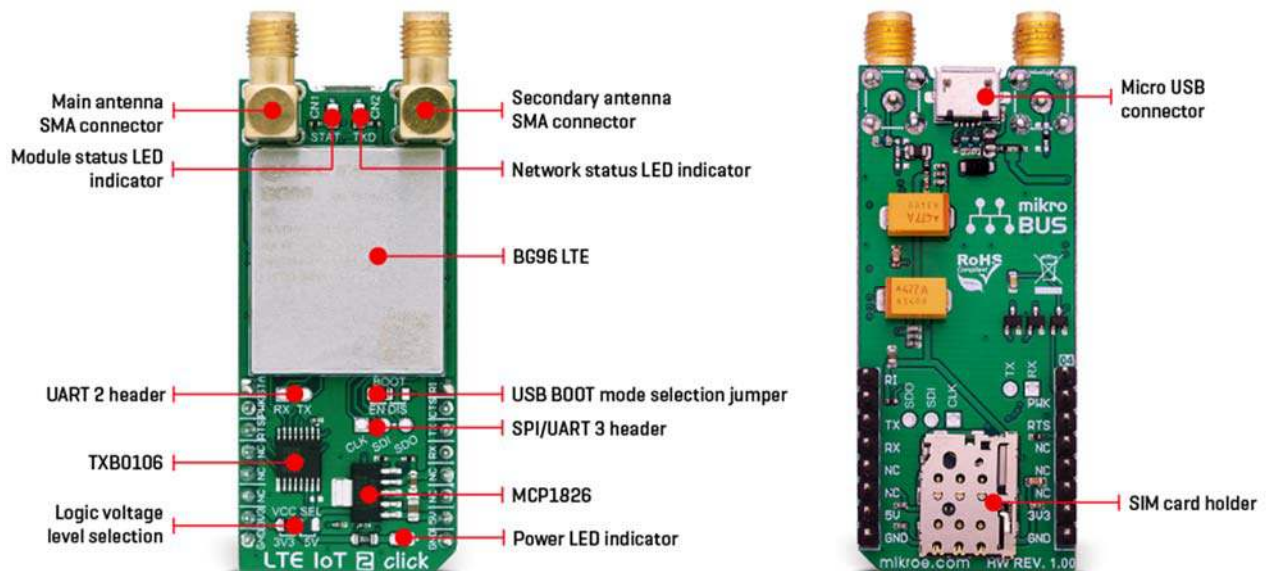
BG96 LTE module is the main component of the click board and it consists of a number of internal blocks or sections, such as the RF section, NAND flash and DDR RAM section, Power Management section, and the cellular baseband processor with the peripheral interfaces. BG96 module supports several peripheral interfaces, including USB, UART, SIM card, I2C, SPI, I2S, and GPIO interfaces. Besides the main UART interface used for exchanging AT commands with the host MCU (UART 1), there are two more auxiliary UART interfaces, one of which is shared with the SPI interface (UART 3/SPI), while the other is used for debugging purposes (UART 2). All the

additional UART/SPI interfaces are available on the Click board™ in a form of unpopulated headers, with the pads clearly labeled (RX, TX for the UART debug interface header, and CLK, SDI, SDO for the SPI interface header).

The main UART interface (UART 1) supports baud rates of 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600, and 3000000 bps, with the default setting to 115200bps. This interface is used for data transmission and exchanging AT communication commands with the host MCU.

The debug UART interface (UART 2) operates at 115200bps and it is used for firmware debugging and logging the output. The UART 3 interface is multiplexed with the SPI interface and it is used to output NEMA and GNSS data sentences. It defaults to UART 3 when the module is used as the modem, but it can be also used as the SPI for the data transfer. These interfaces are not normally used, so the headers come unpopulated. If required, two standard pitch (2.54) headers can be easily soldered.

The Quectel BG96 module has to be powered by a clean and stable power supply. The voltage needed for the module to work properly is about 4V and it is derived from the 5V mikroBUS™ rail, through the MCP1826, a 1A low drop output (LDO) regulator from Microchip. Although the Quectel BG96 module is an ultra-low power device, the cellular network modules in general are notorious for their high-power consumption while actively exchange data, so 1A LDO had to be used.

Digital sections of the Quectel BG96 are supplied by 1.8V, so it is necessary to condition the incoming communication bus lines which connect the host MCU with the module. By utilizing its internal LDO regulator, the BG96 module provides the needed reference voltage for one side of the TXB0106, a 6bit bidirectional level shifter and voltage translator. The reference voltage for the other side of the TXB0106 level shifter is taken from the onboard SMD jumper, labeled as VCC SEL. This jumper is used to select between 3.3V and 5V from the mikroBUS™, depending on the used MCU type and its logic voltage level requirements.

The main UART bus of the Quectel BG96 module is connected to one side of the TXB0106 level shifter, while the other side is connected to the respective mikroBUS™ UART pins. However, the Quectel BG96 module is designed as the traditional DCE device (Data Communication Equipment) offering the full serial interface pin count, including the hardware flow control pins (CTS, RTS). These pins are routed to the mikroBUS™ CS (RTS) and the INT pin (CTS) and can be used in the MCU software if hardware flow control is needed. The RI pin is the ringing indicator, and it is routed to the mikroBUS™ PWM pin.

The STAT pin is used to signalize the status of the device. This pin is routed both to the mikroBUS™ AN pin through the level shifter, and the yellow LED labeled STAT, which is used to visually indicate the device status. The network status is indicated by the red LED labeled as TXD, located next to the STAT LED. The network status is indicated by the TXD LED, using the following pattern:

- Cyclically high for 200ms, low for 1800ms: network searching

- Cyclically high for 1800ms, low for 200ms: idle

- Cyclically high for 125ms, low for 125ms: data transfer

- Always high: voice call

The PWRKEY pin is routed to the mikroBUS™ RST pin. A LOW pulse on this pin for at least 100ms will toggle the power status of the device. If powered down, and the valid power supply voltage is present, a pulse on this pin will power up the device. The successful action will be indicated by the STAT LED and the STAT (AN) pin. If the device is already powered up, a pulse on this pin will power the module down. It is also possible to power down the module by issuing the AT+QPOWD command. Both methods are considered as safe and will let the module log off from the network and allow the firmware to save important data, before completely disconnecting the power supply. An abrupt loss of power might lead to unwanted consequences.

LTE IoT 2 click has a SMD jumper labeled as the BOOT, which is used to force the device to boot from the USB, which can be used during the firmware development or for the firmware update. During the normal operation, the USB BOOT mode is disabled.

This Click board™ is equipped with the micro USB connector. It allows the module to be powered and configured by a personal computer. Quectel Wireless Solutions Company offers a software suite and drivers for all major OSes, offering connectivity for a wide range of different configurations.

The Micro SIM card holder on the back of the Click board™ is used to install a micro SIM card. This device cannot be used without a valid SIM card, which allows connection to the cellular network. Both 1.8V and 3V SIM card types are supported.

Two SMA antenna connectors are used for connecting the appropriate antennas: there is a main antenna SMA connector and the secondary (GNSS) antenna SMA connector. The main antenna is used to connect the module to the LTE base station. LTE IoT 2 click can be used with a GSM/GPRS antenna, such as the Rubber GSM/GPRS Antenna right angle, found in our shop. The secondary, global positioning (GNSS) antenna can be of both active or passive type, since the connector offers power supply from the internal LDO of the BG96 (1.8V). The module supports several global positioning technologies, including GPS, GLONASS, BeiDou/Compass, Galileo and QZSS. The Click board™ can use the Active GPS antenna for the global positioning purposes, which can be found at our shop. The GNSS interface is disabled by default and should be enabled by an AT command, if it is required.

Specifications

Type	GSM
Applications	Used for smart metering, IoT networking, remote monitoring automation and control (RMAC), and other IoT / M2M applications which rely on a cellular network connection
On-board modules	BGE96, a LTE CAT M1 / NB1 / EGPRS module, from Quectel; MCP1826, a 1A low drop output (LDO) regulator from Microchip; TXB0106, a 6bit bidirectional level shifter from Texas Instruments
Key Features	Embedded TCP/UDP/PPP stack, CAT NB and CAT M1 technologies support, enabled for all regions, aimed at M2M and IoT applications, dual SMA antenna connectors, USB connectivity, visual network and status indication, and more
Interface	USB,UART
Input Voltage	3.3V,5V
Compatibility	mikroBUS
Click board size	L (57.15 x 25.4 mm)

Pinout diagram

This table shows how the pinout on **LTE IoT 2 click** corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin	mikroBUS				Pin	Notes
Module status	**STA**	1	AN	PWM	16	**RI**	Ring indicator
Power-up module	**PWK**	2	RST	INT	15	**CTS**	UART Clear to Send

UART Ready to Send	**RTS**	3	CS	RX	14	**TX**	UART transmit
	NC	4	SCK	TX	13	**RX**	UART receive
	NC	5	MISO	SCL	12	NC	
	NC	6	MOSI	SDA	11	NC	
Power supply	**3.3V**	7	3.3V	5V	10	**5V**	Power supply
Ground	**GND**	8	GND	GND	9	**GND**	Ground

Onboard settings and indicators

Label	Name	Default	Description
PWR	PWR	-	Power LED indicator
LD2	TXD	-	Network status LED indicator
LD3	STAT	-	Module status LED indicator
JP1	BOOT	Left	Boot operation selection: left position - BOOT mode disabled, right position - BOOT mode enabled
JP2	VCC SEL	Left	Logic level voltage selection: left position 3V3, right position 5V

Onboard connectors

Label	Name	Description
CN1	CN1	Main antena SMA connector
CN2	CN2	Secondary antenna SMA connector
CN3	-	Micro USB connector
J1	-	SIM card holder

Software support

We provide a library for the LTE IoT2 Click on our LibStock page , as well as a demo application (example), developed using MikroElektronika compilers. The demo can run on all the main MikroElektronika development boards.

Library Description

The library carries generic command parser adopted for AT command based modules.

Generic parser

Key functions:

- lteiot2_cmdSingle - Sends provided command to the module
- lteiot2_setHandler - Handler assignation to the provied command
- lteiot2_modulePower - Turn on module

Example description

The application is composed of three sections:

- System Initialization - Initializes all necessary GPIO pins, UART used for the communication with LTE IOT 2 module and UART used for information logging
- Application Initialization - Initializes driver, power on the module and sends few commands for the default module configuration
- Application Task Sends a message to Quectel NB-IoT test server(bit.ly/quectel-udp-server) every 5 sec.

This code snippet shows how generic parser should be properly initialized. Before initialization module must be turned on and add to that hardware flow control should be also

Commands :
Command: ATI, product information
Command: AT+IPR=115200;&W, set baudrate
Command: AT+QCFG="nbsibscramble",0, Enable scrambling
Command: AT+QCFG="band",0,0,80,1, set baud
Command: AT+QCFG="nwscanmode",3,1, Set LTE mode
Command: AT+QCFG="nwscanseq",030201,1, set priority NB1 > M1 > 2G
Command: AT+QCFG="iotopmode",1,1, select CAT-NB1
Command: AT+QCFG="servicedomain",1,1, Set PS domain
Command: AT+CGDCONT=1,"IP","internet", set APN provided
Command: AT+CFUN=1, Full functionality
Command: AT+COPS=1,2,"22001",0, set MCC and MNC provided
Command: AT+QIACT=1, activate PDP context
Command: AT+QIOPEN=1,0,"UDP","79.114.83.116",16666, create an UDP socket
Command: AT+QISENDEX=0,"48656C6C6F", Send message - Hello

```
void applicationInit()
{
// MODULE POWER ON
 lteiot2_hfcEnable( true );
 lteiot2_modulePower( true );

// MODULE INIT
 lteiot2_cmdSingle( &ATI[0] );
 lteiot2_cmdSingle( &AT_IPR[0] );
 lteiot2_cmdSingle( &AT_QCFG_1[0] );
 lteiot2_cmdSingle( &AT_QCFG_2[0] );
 lteiot2_cmdSingle( &AT_QCFG_3[0] );
 lteiot2_cmdSingle( &AT_QCFG_4[0] );
 lteiot2_cmdSingle( &AT_QCFG_5[0] );
 lteiot2_cmdSingle( &AT_QCFG_6[0] );
 lteiot2_cmdSingle( &AT_CGDCONT[0] );
 lteiot2_cmdSingle( &AT_CFUN[0] );
 lteiot2_cmdSingle( &AT_COPS[0] );
 lteiot2_cmdSingle( &AT_CGATT[0] );
 lteiot2_cmdSingle( &AT_CEREG[0] );
 lteiot2_cmdSingle( &AT_QIACT[0] );
 lteiot2_cmdSingle( &AT_QIOPEN[0] );
 lteiot2_cmdSingle( &AT_QISENDEX[0] );
}
```

Alongside with the demo application timer initialization functions are provided. Note that timer is configured acording to default development system and MCUs, changing the system or MCU may require an update of timer init and timer ISR functions.

The full application code, and ready to use projects can be found on our Libstock page.

Other MikroElektronika libraries used in the example:

- String
- Conversion

Additional notes and information

Depending on the development board you are using, you may need USB UART click, USB UART 2 click or RS232 click to connect to your PC, for development systems with no UART to USB interface available on the board. The terminal available in all MikroElektronika compilers, or any other terminal application of your choice, can be used to read the message.

mikroSDK

This click board is supported with mikroSDK - MikroElektronika Software Development Kit. To ensure proper operation of mikroSDK compliant click board demo applications, mikroSDK should be downloaded from the LibStock and installed for the compiler you are using.

For more information about mikroSDK, visit the official page .

https://www.mikroe.com/lte-iot-2-click 9-20-18