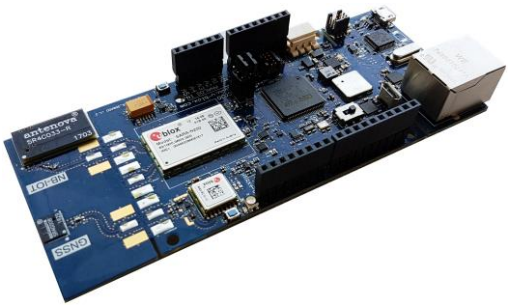
CELLULAR

C030

NB-IoT and 2G/3G Arm® Mbed Enabled™ IoT starter kit

User Guide



Abstract

This guide explains how to set up the C030 Arm® Mbed Enabled™ Internet of Things Starter Kit to begin evaluating u-blox 2G/3G/4G cellular and GNSS modules.

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Functional Sample	Draft	For functional testing. Revised and supplementary data will be published later.
In Development / Prototype	Objective Specification	Target values. Revised and supplementary data will be published later.
Engineering Sample	Advance Information	Data based on early testing. Revised and supplementary data will be published later.
Initial Production	Early Prod. Information	Data from product verification. Revised and supplementary data may be published later.
Mass Production / End of Life	Production Information	Final product specification.

This document applies to the following products:

Product name	Type number	Firmware version	PCN reference	Product Status
C030	C030-U201-0-00	G0.V.00.00.10R	UBX-18007786	Initial Production
	C030-N211-0-00	G0.V.00.00.10R	UBX-18007786	Initial Production

Preface

Using this guide

This guide assumes the user has basic computer skills and is familiar with the Windows Graphical User Interface (GUI) and cellular modem environments.

The following symbols are used to highlight important information in the document:

☞ An index finger points out key information pertaining to device operation and performance.

⚠ **A warning symbol indicates actions that could negatively impact or damage the device.**

Warnings and certifications

C030 is an Electrostatic Sensitive Device (ESD).

CAUTION! Risk of short circuit of the battery when touching it with conducting parts. In the unlikely event of a failure in the internal protection circuitry, there is a risk of an explosion when charging fully or partially discharged batteries. Replace the battery if it no longer has sufficient charge for unit operation. Control the battery before using it if the device has not been operated for an extended period of time.

Products marked with this lead-free symbol on the product label comply with the "Directive 2002/95/EC of the European Parliament and the Council on the Restriction of Use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS).

C030 evaluation kits are RoHS compliant and green (no halogens).

Technical Support

Worldwide Web

Our website (www.u-blox.com) is a rich pool of information. Product information and technical documents can be accessed 24 hours a day.

By E-mail

If you have technical problems or cannot find the required information in the provided documents, contact the closest Technical Support office. To ensure that we process your request as soon as possible, use our service pool email addresses rather than personal staff email addresses. Contact details are at the end of the document.

Helpful Information when Contacting Technical Support

When contacting Technical Support please have the following information ready:

- Application Board type (e.g. C030-U201-0-00) and firmware version (if applicable)
- Module configuration
- Clear description of your question or the problem
- A short description of the application
- Your complete contact details

Contents

1 Overview

The u-blox C030 NB-IoT and 2G/3G Arm® Mbed Enabled™ IoT starter kit is a versatile development platform that allows quick prototyping of a variety of applications for low-power Internet of Things (IoT) devices.

The u-blox C030 boards are delivered in several variants based on the type of u-blox cellular module employed, such as:

- SARA-U201 HSPA module with 2G fallback
- SARA-N211 NB-IoT (LTE Cat NB1) module

Additionally, the u-blox C030 application boards have a u-blox MAX-M8C module or a ZOE GNSS IC as a concurrent GNSS receiver, thereby enabling straight forward development of location-aware, globally communicating applications.

The u-blox C030 board provides access to a variety of hardware interfaces (10/100 Mb/s Ethernet, 22 GPIOs with SPI, I^2C, UART, PWM) through the Arduino™ Uno R3 compatible header connector.

An eUICC (embedded SIM) is integrated on the u-blox C030-U201 variant. The eUICC comes with International Data Roaming Cellular Connectivity Service by JT® JTGlobal (formerly Jersey Telecom) with 50 MB of data for the period of 90 days, which can be topped up and extended on demand.

The u-blox C030 board is powered by an Arm® Cortex-M4 based ST® STM32F437VGT Host microcontroller, which is fully supported by the Arm® Mbed™ platform. The microcontroller has 512 kB flash, 64 kB RAM, and runs an up-to-96 MHz system clock. The board provides simple USB drag-n-drop programming and ST-Link debug interface for the Host microcontroller. The Arm Mbed platform provides free software libraries and online tools for professional rapid prototyping. The programming is done using a standard-based C/C++ SDK. The Arm Mbed compiler also supports full export to various tool chains, for projects that demand it as they go into production.

The u-blox C030 also works with wide choice of Integrated Development Environments (IDEs) including but not limited to Arm® Keil®, GCC-based Eclipse IDEs.

This document only applies to C030-U201 2G/3G and C030-N211 4G NB-IoT variants with MAX-M8C GNSS modules.

2 Hardware description

The u-blox C030 has the following onboard hardware features:

- u-blox SARA-U201 HSPA/GSM module for global 2G/3G coverage (on C030-U201). Or u-blox SARA-N211 NB-IoT module with MicroSIM socket (on C030-N211)
- u-blox MAX-M8C concurrent GNSS receiver module for up to 3 GNSS (GPS, Galileo, GLONASS, and BeiDou)
- STM32F437VG Cortex-M4 Arm host MCU with 1024 kB Flash, 256 kB SRAM and SWD connector
  - 12 MHz crystal oscillator for system clock
  - 32.768 kHz crystal oscillator for real-time clock
  - 1.8 V operation
- On-board ST-Link/V2-1 debugger/programmer with SWD connector
  - ST-Link/V2-1 standalone development and debug capability
  - USB re-enumeration; Virtual COM port, mass storage device and debug port
  - 5V from ST-Link/V2-1 Debug USB VBUS, 3.3V operation
  - (CMSIS-DAP variant of the FW with extended features will be available in the future)
- On-board TI® bq24295 single cell LiPo battery charger and TI® bq27441-G1 battery fuel gauge
- Molex® SPOX™ 5268-03A LiPo battery connector
  - Supports battery types like BAK –LP-503759-IS-3 (battery is not included)
- On-board SiLabs® CP2105 USB to dual UART bridge as Serial USB Sniffer
  - Alternative to ST-Link/V2-1 virtual COM port when ST-LINK/V2-1 is not used/available
  - Alternative to main supply and Debug USB 5V VBUS inputs
  - Sniffing serial communication between the host MCU and the cellular module
- RGB User LED, and two push buttons: User and Reset
- On-board SiLabs® Si7034-A10 humidity and temperature sensor
  - Utilized temperature sensor only. Cannot be used for humidity measurements
- SD card socket for file storage
- Integrated NB-IoT and GNSS antennas by Antenova® on C030-N211's snap-off antenna section
- SMA RF connectors for 50 Ohm cellular and GNSS active antennas on C030-U201
- C030-U201 has an integrated eUICC including International Data Roaming Cellular Connectivity by JT® JTGlobal with 50 MB of data for the first 90 days
- C030-N211 has a MicroSIM card socket
- Extension:
  - Arduino™ Uno R3 compatible interface
  - 6 analog capable inputs
  - 8 PWM capable outputs
  - 22 GPIOs
  - 1 x SPI
  - 1 x I2C
  - 1 x UART with HW flow control option (RTS, CTS)
- Flexible board power supply:
  - 5 V main supply USB, Debug USB, and sniffer USB VBUS inputs
  - 2.5 V to 5.5 V Arduino UNO R3 VIN input
  - 2.8 V to 4.4 V LiPo battery input
- Support of a wide range of Integrated Development Environments (IDEs), including but not limited to GCC-based IDEs, Arm Mbed
- Arm Mbed Enabled (see http://mbed.org)

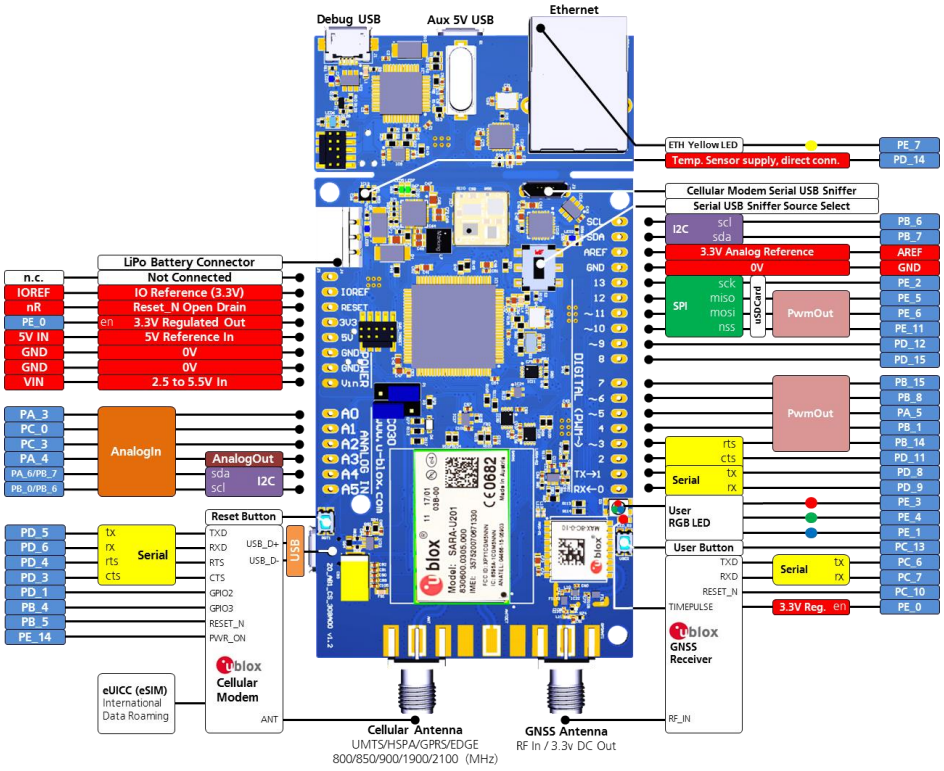

Figure 1: C030-U201 application board overview

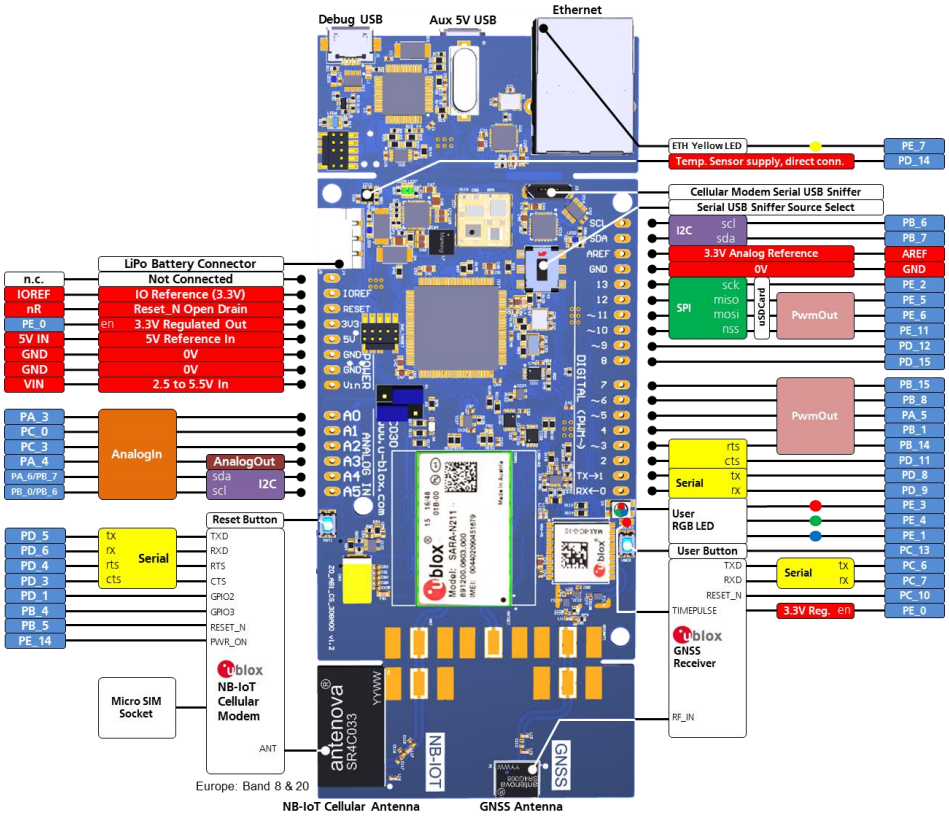

Figure 2: C030-N211 application board overview

2.1 C030 block diagram

The block diagram of the C030 is depicted in Figure 3.

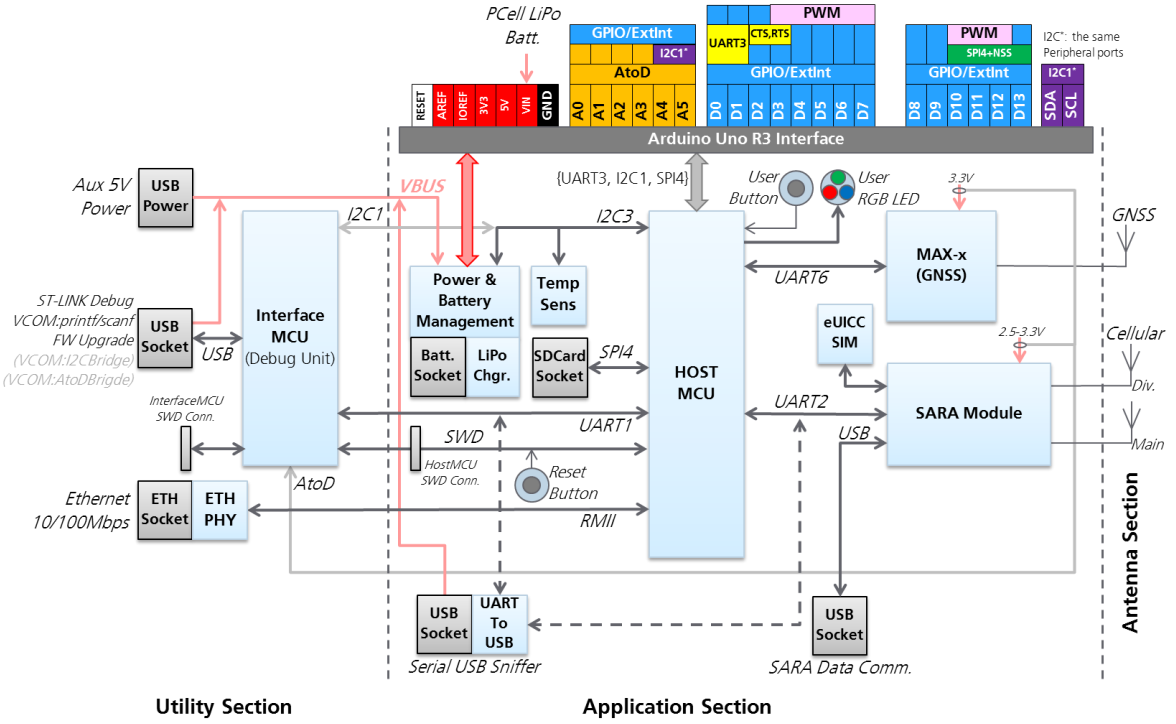

Figure 3: C030 block diagram

Figure 3 shows the major interfaces and internal connections of the C030. The C030 consists of three sections:

- **Utility section**

  Accommodates the components that provide SW debugging / virtual COM port (ST-Link/CMSIS-DAP) and Ethernet Interface functions. The SW debugging / virtual COM port functions are executed by the InterfaceMCU via the "Debug USB" interface.

  As this section is only needed during the application development and test activities, it could be physically snapped off from the Application section to decrease the size and power consumption.

  The Utility section is powered up from the "Debug USB" 5V VBus. When the "Debug USB" is not connected, SW debugging / virtual COM port and Ethernet Interface functions are turned off and isolated from the Application section.

  The "Auxiliary 5V USB" connector on the Utility section could be used to boost the power input to the Application section if the current input from the "Debug USB" 5V VBus is not sufficient.

- **Application section**

  Accommodates the GNSS and cellular modules, a eUICC (Embedded SIM) / MicroSIM socket, the HostMCU, the Battery Charging/Management and Power Supply circuitry, the SD card interface and socket, the Serial USB Sniffer for communication between the HostMCU to the cellular module and similarly to the InterfaceMCU. The application section also has a Temperature Sensor for measuring ambient temperature of the board. Reset and User buttons, configuration jumpers and User and system status indication LEDs are placed in the Application section.

  The Application section is designed for minimal power consumption. Unutilized circuitries and sections could be either turned off by software or inhibited electronically.

The Arduino Uno R3 interface on the Application section could be used to integrate sensors, actuators and power/battery supply circuitries as Arduino Shields/expansion daughter PCBs.

The Application section could run standalone when the Utility and Antenna sections are snapped off.

- **Antenna section**

  The C030 PCB has been designed to accommodate GNSS and Cellular antennas on-board depending on the build variant. The Antenna section could be snapped off if the orientation of the C030 is in an enclosure required by the application. Both Application and Antenna sections have SMA edge connector footprints. Therefore, by soldering the SMA Edge connectors, the antenna section can be connected to the Application section through adequate 50 Ohm RF cables.

- The C030-U201 and C030-N211 major component layouts are provided in Figure 4 and Figure 5.

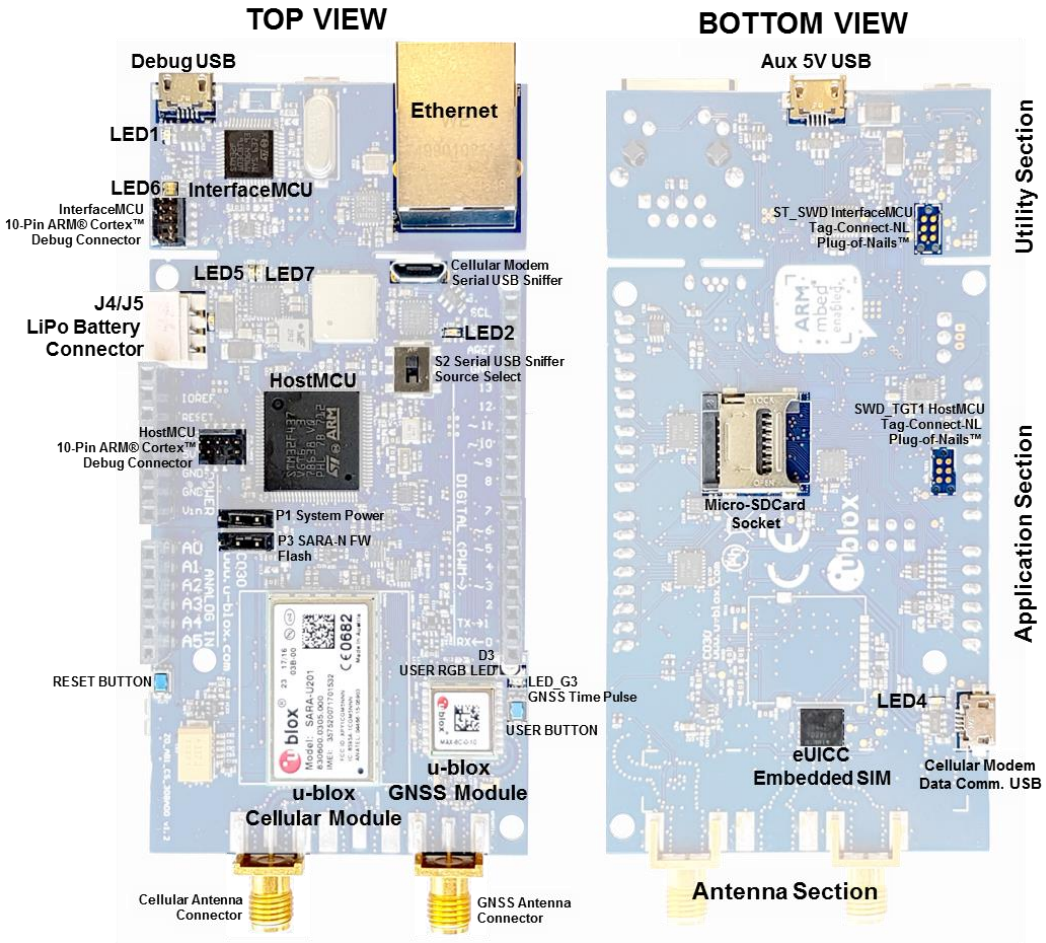

Figure 4: C030-U201 major component locations

The C030-N211 NB-IoT variant has a different component and PCB configuration.

- There is no international data roaming eUICC (embedded SIM) populated on the PCB. Instead, there is a MicroSIM card socket.
- There is no cellular modem data communication USB connector and relevant circuitry, as SARA-N2 series modules do not support USB device communication.
- In contrast to C030-U201, the C030-N211 has integrated NB-IoT and GNSS antennas by Antenova on the antenna section PCB.

The C030-N211 NB-IoT variant specific component locations are shown in Figure 5.

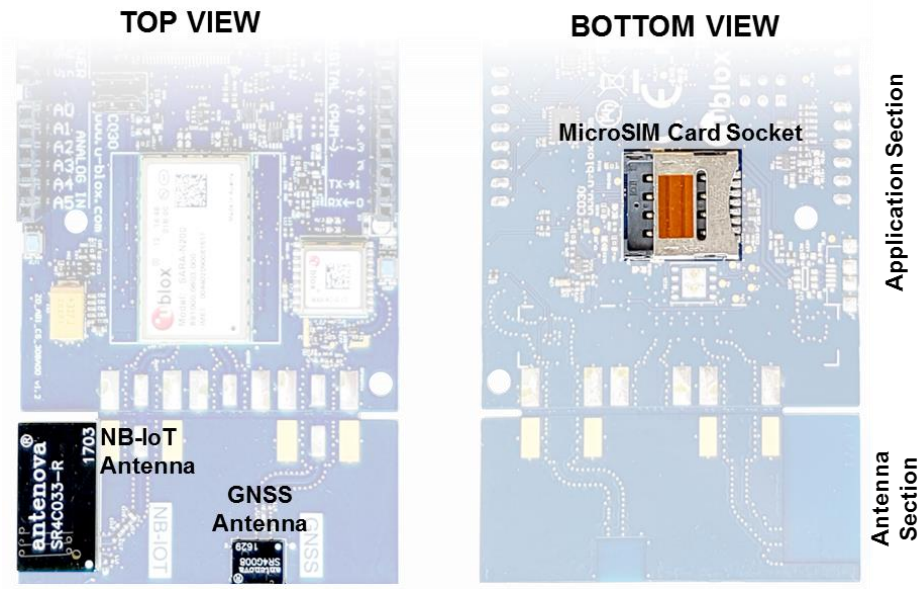

Figure 5: C030-N211 variant specific component locations

2.2 Buttons, jumpers and switches

The C030 is equipped with several buttons, jumpers and a switch that could be easily utilized by the user. The functions and locations of these components are provided in Table 1 and shown in Figure 4.

Annotation	Function	Description	Section
USER	User button	Push button for application use. Connected to HostMCU GPIO Port PC13	Application
RST1	Reset button	Push button to reset the HostMCU	Application
P1	System Power Jumper	System power input selection: • Pin 1-2: On board Power/Battery Management **(default configuration)** • Pin 2-3: VIN pin of Arduino Uno R3 Interface	Application
P3	SARA-N2 FW Flashing Jumper	Power supply jumper used for C030-N211 FW upgrade **only**. Non-functional on other variants. • Pin 1-2: disabled **(default configuration)** • Pin 2-3: flashing enabled	Application
S2	Serial USB Sniffer Source Select	Selection of cellular module communication UART channel to sniff: • Position 1: UART2 communication between HostMCU and cellular module **(default configuration)** • Position 2: C030–N211 **only** debug log output (921,600 b/s 8N1). Non-functional on other variants.	Application

Table 1: C030 buttons, jumpers, and switches

The C030 P1 and P3 jumpers and S2 switch positions are depicted in Figure 6.

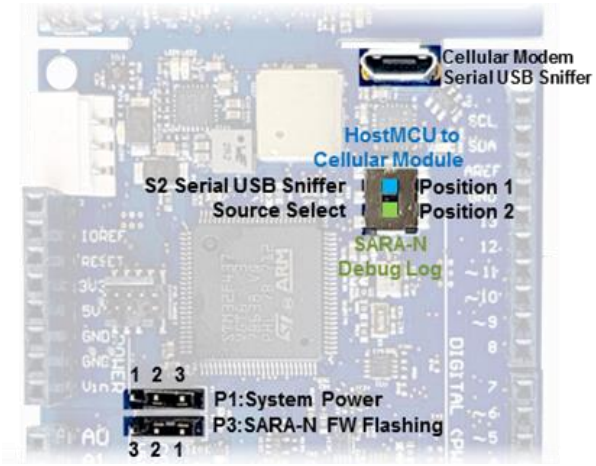

Figure 6: C030 jumper and switches

2.2.1 Utilization of cellular modem USB sniffer (and programmer)

The C030 cellular modem USB Sniffer provides two virtual UART COM channels to the connected USB master (development PC). The cellular module USB Sniffer USB VBUS 5VDC rail powers the Application section of the C030. The Virtual COM ports are utilized as follows;

- Standard COM port as on the development PC: HostMCU USART1 Tx "printf" channel sniffing.
  - HostMCU USART1 Tx is also connected to the InterfaceMCU on the Utility section
  - HostMCU USART1 Rx is connected to InterfaceMCU on the Utility section
  - Host HostMCU USART1 Rx can be connected to the Cellular Modem USB Sniffer Standard COM port Tx channel via R137 link (see Table 4). In this case, do **one** of the following:
    - The Utility section should be powered off (disconnect Debug USB)
    - Snap-off the Utility section
    - Remove R133 link (see Table 4)
- Enhanced COM Port as on the development PC. Two operation modes can be selected by using the S2 switch (see Figure 6):
  1. **S2 Position 1**: HostMCU USART2 to cellular module communication. Allows direct access to the cellular module. In this case, implement the following steps:
     - Connect the R151 link(see Table 4)
     - Remove the R105 link **or** set the HostMCU PD_5 port as GPIO input to avoid collision
       This mode is also used for **SARA-N2 FW Flashing/Programming** for C030-N211 variant **only**. The P3 Jumper should be configured accordingly to utilize this function (See section 2.2)
  2. **S2 Position 2**: SARA-N2 module Debug Log Output (GPIO1) with 921,600 b/s 8N1 configuration for the C030-N211 variant **only**.

☞ Enhanced COM Port Mode 1 direct access to the cellular module allows using development PC applications like u-blox m-center, to exercise the cellular module AT command interface bypassing the C030 HostMCU.

2.3 LED indicators

The C030 has a few LEDs as an indicator of the status of the board being ON for generic application use. Due to the low power design of C030, if the C030 is **not** connected to an external power source, or powered from battery only, all the LEDs except D3 User RGB LED and LED_G3 GNSS Time Pulse LED are off.

As the D3 User RGB LED and LED_G3 GNSS Time Pulse LED are controlled by the application, they could be turned off totally for power saving.

The C030 LED indicators are listed in Table 2 and their locations are depicted in Figure 4.

Annotation	Function	Description	Color
LED1	Debug USB VBUS	VBUS 5 V indicator for InterfaceMCU supply	
LED2	Serial USB Sniffer VBUS	VBUS 5 V indicator for serial USB sniffer supply	
LED3	Aux 5 V USB VBUS	VBUS 5 V indicator for 5 VDC supply input	
LED4	Cellular module USB VBUS	VBUS 5 V indicator for C030-U201 (not available for the C030-N211)	
LED5	Battery charging / man. input	Battery Charging/Management 5 VDC input supply indicator	
LED6	STLink/CMSIS-DAP status	InterfaceMCU Debugging/Flashing status RED/GREEN indicator	
LED7	Battery charging status	Battery Charging/Management battery charging status indicator	
D3	User RGB LED	HostMCU GPIO driven; PE_3: RED, PE_4: GREEN, PE_1: BLUE (all negative logic)	
LED_G3[1]	GNSS time pulse	GNSS status with 1 s blinks. Managed by HostMCU GPIO PA_15:0 Off, 1:On	
ETH Green[2]	ETH connection speed	10 or 100 Mb/s connection speed indication. On:100 Mb/s, Off:10 Mb/s	
ETH Yellow2	ETH transaction/traffic	Indicates Ethernet transaction. Controlled by HostMCU GPIO PE_7	

Table 2: C030 LED indicators

[1] GNSS Time Pulse LED indicator, LED_G3 is powered by the application section 3.3 VDC rail controlled by the HostMCU PE_0 port. If the Application Section 3.3 VDC supply rail is not turned on, the GNSS Time Pulse LED does not light up.

[2] Ethernet LED indicators are powered by 3.3 VDC generated from the Debug USB VBUS, which powers the whole Utility section. If the Debug USB is not connected to a USB Master (for example, a development PC), the Utility section is powered down, and therefore the Ethernet LED indicators do not light up.

2.4 Connectors

The C030 has various connectors as listed in Table 3. See Figure 4 and Figure 5 for connector locations.

Name	Function	Description	Section
ETH1	Ethernet receptacle	10/100 Mb/s Ethernet network connector	Utility
J6	Auxiliary 5V USB	Micro USB Device connector for auxiliary 5 VDC supply input to connect a high current 5 VDC PSU	Utility
J1	Debug USB	Micro USB Device connector for 5 VDC supply and ST-Link/CMSIS-DAP debug interface	Utility
J2	Micro SD Card Socket	Micro SD card holder for FAT file system	Application
J3	Serial USB Sniffer	Micro USB Device connector for 5 VDC supply and Serial USB Sniffer interface	Application
J4/J5	LiPo Battery Connector	LiPo Chargeable battery connector. J4:Not populated alternative connector, J5:Molex 22-05-7035	Application
J7	Cellular Module USB	Micro USB device connector for cellular module USB interface	Application
J8	SIM card holder	SIM card holder for C030-N211 only	Application
SWD	InterfaceMCU Debug	10-pin Arm Cortex Debug Connector for InterfaceMCU (may not be populated)	Utility
ST_SWD	InterfaceMCU Debug	Tag-Connect-NL Plug-of-Nails™ connector compatible PCB touch points footprint for InterfaceMCU	Utility
SWD_TARGET	HostMCU Debug	10-pin Arm Cortex Debug Connector for InterfaceMCU (may not be populated)	Application
SWD_TGT1	HostMCU Debug	Tag-Connect-NL Plug-of-Nails connector compatible PCB touch points footprint for HostMCU	Application
ANT	Cellular Main Antenna	SMA connector for the cellular module primary antenna (ANT1, Tx/Rx). N/A for C030-N211	Application
ANT2	Cellular Diversity Antenna	SMA connector for the cellular module secondary antenna (ANT2, Rx). N/A for C030-N211. Optional for other variants	Application
GPSANT	GNSS receiver antenna	SMA connector for the GNSS module (RF_IN, Rx). N/A for C030-N211	Application

Table 3: C030 connector description

The J2 Micro SD Card Socket shares the Arduino Interface D10 to D13 pins, which are used as an SPI bus to the HostMCU SPI4 peripheral. The D10 pin (NSS) is used as an SD Card SPI Slave Select signal. When the SPI bus on the Arduino Interface is utilized by other SPI slaves on daughter boards, free Arduino digital IO lines should be utilized for Slave Select signals.

As the SD card interface and its supply voltage are designed to work with 3.3 VDC, the SD card socket shall not be used when the Arduino interface IOREF voltage level is set to higher than 3.3 VDC. Such usage could cause a permanent damage and/or a failure to an SD card inserted in the J2 socket and the C030's Arduino™ interface level translators. (See R152 and R153 links in Table 4).

2.5 Configuration links/components

The C030 has multiple configurations links and components as SMT footprints, which require de-soldering/soldering these links or components on the PCB. The footprints of these configuration links, which are listed in Table 4 and depicted in Figure 7, are adequate to solder 0603 SMT components or short with solder.

Name	Function	Variant[3]		Description
		U201	N211	
R2	InterfaceMCU 1.8VDC supply sampling	●	●	Utilized for monitoring HostMCU 1.8 VDC supply level through a voltage divider
R3	InterfaceMCU PB_3 Port pull up link	●	●	Link to InterfaceMCU 3.3 VDC rail
R5	InterfaceMCU 3.3VDC Analog reference link	○	○	Reference voltage for InterfaceMCU AtoD conversion
R6	Cellular module current sense	○	○	(Provisional[4]) Connected to cellular module power supply current instrumentation amplifier output to measure the current level
R7	GNSS module current sense	○	○	(Provisional4) Connected to GNSS module power supply current instrumentation amplifier output to measure the current level
R14	InterfaceMCU 32 kHz Clock input	○	○	Ground connection
R15	InterfaceMCU BOOT0 pull up	○	○	Link to InterfaceMCU 3.3 VDC PSU
R20	InterfaceMCU USART2 Virtual COM Tx link	●	●	Link to HostMCU USART1 Tx signal through 3.3 V to 1.8 V level translator
R21	InterfaceMCU USART2 Virtual COM Rx link	●	●	Link to HostMCU USART1 Rx signal through 3.3 V to 1.8 V level translator
R22	InterfaceMCU Virtual COM Loop back	○	○	For testing InterfaceMCU Virtual COM port
R23	InterfaceMCU I2C1 SDA link	○	○	(Provisional[5]) Link to HostMCU I2C3 SDA bus through 3.3 V to 1.8 V level translator
R25	InterfaceMCU I2C1 SCL link	○	○	(Provisional5) Link to HostMCU I2C3 SCL bus through 3.3 V to 1.8 V level translator
R31	Arduino Interface IOREF to 3.3V	●	●	33 Ω link to 3.3 VDC
R33	Arduino Interface 3.3V supply	●	●	Link to 3.3 VDC rail
R38	Arduino Interface A4 pin voltage divisor	●	●	1 kΩ voltage divisor resistor for analog input. It could be removed for I2C SDA alternative usage
R39	Arduino Interface A5 pin voltage divisor	●	●	1 kΩ voltage divisor resistor for analog input. It could be removed for I2C SCL alternative usage
R47	HostMCU BOOT1 Pull down	○	○	HostMCU BOOT1 input setting to '0'
R48	HostMCU Temp Sensor power link	●	●	Si7034-A10 Temperature sensor power supply link[6]. Supply feeding to the temperature sensor from the HostMCU PD14 when it is set to '1'. PD14 Push-Pull output circuitry limits the current to the sensor.
R53	HostMCU 32 kHz RTC link	●	●	Links RTC crystal to the HostMCU
R56	Application Section 3.3VDC PSU control	●	●	Links the HostMCU PE_0 port to control 3.3VDC PSU. '0':disable, '1':enable
R59	HostMCU Reset Pull up	○	○	The application section reset circuitry pull up resistor
R60	HostMCU 32KHz RTC link	●	●	Links RTC crystal to the HostMCU
R61	Host MCU 12MHz XTAL link	●	●	The HostMCU 12 MHz crystal link
R68	HostMCU BOOT0 Pull down	●	●	HostMCU BOOT0 10 kΩ Pull down to ground for input setting to '0'

[3] ●: Connected/populated, ○:Not connected/open
[4] Provisional feature (Module current consumption): instrumenting the current consumption of the Cellular and GNSS Modules from the InterfaceMCU to characterize and instrument the application behavior during development.
[5] Provisional feature (I2C Bus Access): accessing Application section sensors and devices on the HostMCU I2C3 Bus from InterfaceMCU to characterize and instrument the application behavior during development.
[6] The Si7034-A10 is a Temperature and Relative Humidity Sensor. The HostMCU PD_4 port cannot provide enough current to the sensor to run the humidity sensor's heating element. So the humidity feature of the sensor shall not be used.

Name	Function	Variant[3]		Description
		U201	N211	
R77	Cellular Module voltage translator supply	●	○	Voltage translator supply level for the cellular module side for the HostMCU USART2 communication. Link the translator supply input to Cellular Module's V_INT internal supply output
R78	Cellular Module voltage translator supply	○	●	Voltage translator supply level for the cellular module side for the HostMCU USART2 communication. Link the translator supply input to the application section supply rail VSYS
R95	Cellular Module UB_M_PWRON to M_VBCKUP link	●	○	100 kΩ connection between M_VBCKUP and UB_M_PWRON nets
R96	Cellular Module V_BCKP link	●	●	Link to M_VBCKUP net
R97	Cellular Module PWR_ON link	●	○	The HostMCU PD2 port UB_M_PWRON signal to Cellular Module PWR_ON pin
R99	The HostMCU PC11port to Cellular Module GPIO1 link	○	○	The HostMCU UART4 Rx to Cellular Module GPIO1 link
R100	Serial USB Sniffer to Cellular Module GPIO1 link	○	●	Link to SARA-N2 Debug Log output GPIO1
R101	Cellular Module USB VBUS link	●	○	Cellular Module VUSB_DET
R102	Cellular Module GPIO2 link	●	●	Link to the HostMCU PD1 port
R103	Cellular Module to GNSS Module link	●	●	Cellular Module GPIO4 to GNSS Module GPS_EXTINT link
R104	Cellular Module USB Data_N signal link	●	○	Cellular Module USB signal to J7 Cellular Module USB connector
R105	HostMCU USART2 Tx link	●	●	When removed, isolates the HostMCU USART2 Tx pin PD_5 from the cellular module. Could be used in a configuration to drive the cellular module from the Serial USB Sniffer directly.
R107	Cellular Module USB Data_P signal link	●	○	Cellular Module USB signal to the J7 Cellular Module USB connector
R111	HostMCU USART2 Rx link	●	●	When removed isolates HostMCU USART2 Rx pin PD_6 from the Cellular Module Could be used in a configuration to drive the Cellular Module from the Serial USB Sniffer directly
R112	Cellular Module Flash provision	○	○	SARA-N2 Flash provision
R113	Cellular and GNSS Module I2C Bus link	●	●	Link for I2C SCL signal
R114	Cellular and GNSS Module I2C Bus link	●	●	Link for I2C SDA signal
R115	Cellular Module GPIO2 option	○	○	Cellular Module GPIO2 to Ground
R116	Cellular Module Pin 21 option	●	●	Cellular Module Pin 21 to Ground
R117	Cellular Module RSVD pin option	●	●	Cellular Module RSVD pin to ground
R118	GNSS current sense amplifier supply link	●	●	Link to 3.3 VDC
R119	Arduino™ Uno R3 interface A5 pin I2C provision	○	○	Link to Arduino™ Uno R3 interface SCL pin
R120	Arduino™ Uno R3 interface A4 pin I2C provision	○	○	Link to Arduino™ Uno R3 interface SDA pin
R121	GNSS Module Time Pulse indicator LED link	●	●	Link to LED_G3 for GNSS Time Pulse indication
R124	HostMCU 1.8V Backup Battery link	●	●	Links the 1.8 V battery backed supply rail to the HostMCU 4 kB of battery backed SRAM
R133	HostMCU USART1 Virtual COM Rx link	●	●	Link to InterfaceMCU USART2 Rx signal through 1.8 V to 3.3 V level translator
R134	HostMCU USART1 Virtual COM Tx link	●	●	Link to InterfaceMCU USART2 Tx signal through 1.8 V to 3.3 V level translator
R135	HostMCU External System Clock (Osc.) link	○	○	Link to 8 MHz clock generated from InterfaceMCU to drive the HostMCU
R136	HostMCU USART1 USB Sniffer Tx link	●	●	Link to Serial USB Sniffer Rx input

Name	Function	Variant[3]		Description
		U201	N211	
R137	HostMCU USART1 USB Sniffer Rx link	○	○	Link to Serial USB Sniffer Tx output
R142	InterfaceMCU 3.3 VDC supply sampling	○	○	Utilized for monitoring the InterfaceMCU 3.3VDC supply level
R144	HostMCU PA0 pull up	○	○	HostMCU PA_0-WKUP pin setting
R145	HostMCU BOOT1 Pull up	●	●	HostMCU BOOT1 input setting to '1'
R146	HostMCU BOOT0 Pull up	○	○	HostMCU BOOT0 input setting to '1'
R147	Serial USB Sniffer Reset link	○	○	Link between Serial USB Sniffer's reset input to the Application section reset signal
R150	The Si7034-A10 is a Temperature and Relative Humidity Sensor power link	○	○	Link to 1.8VDC supply rail. See R48 link for utilization.
R151	Serial USB Sniffer Tx link to Cellular Module	○	○	When connected links the Cellular Module to the Serial USB Sniffer directly. To use isolate HostMCU USART2 Tx pin on port PD_5 by removing R105, or set port PD_5 as input
R152	Arduino™ interface IOREF voltage level selection for 3.3 VDC	●	●	Link to Arduino™ interface 3.3 V pin
R153	Arduino™ interface IOREF voltage level selection for 5 VDC	○	○	Link to Arduino™ interface 5 V pin

Table 4: C030 HW configuration links and components

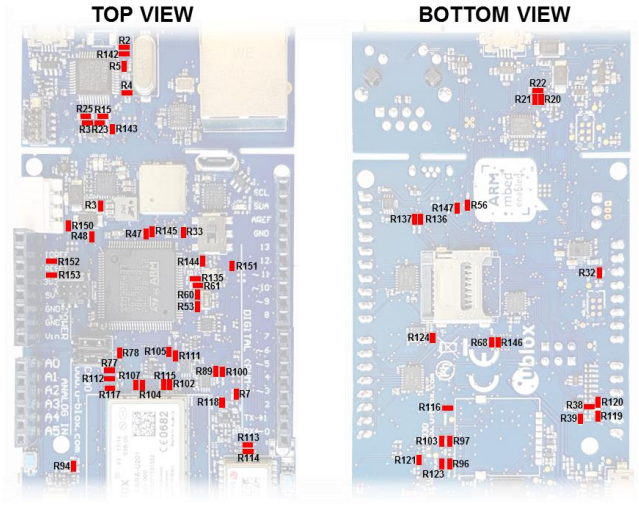

Figure 7: C030 configuration links and components

2.6 Test, break out points, and debug interfaces

The C030 has test and break out points to access key signals of the circuitry as well as Interface and Host MCU Debug interfaces placed on the bottom side of the PCB for easy access. These are listed in Table 5 and depicted in Figure 8.

Name	Signal
01	Cellular module Supply Voltage
02	GNSS module Supply Voltage
03	InterfaceMCU SWDCLK
04	InterfaceMCU SWDIO
05	InterfaceMCU Reset
06	3.3 VDC Supply for InterfaceMCU
07	OE Signal for IC4 Level Translator between Utility and Application Sections
08 to 19	N/A
20	1.8VDC Supply for HostMCU
21	HostMCU SWDIO
22	HostMCU Reset
23	HostMCU SWDCLK
24	HostMCU BOOT0
44	Cellular module pin 44 break-out (SPK_P). Unused
45	Cellular module pin 45 break-out (SPK_N). Unused
46	Cellular module pin 46 break-out (MIC_BIAS). Unused
47	Cellular module pin 47 break-out (MIC_GND). Unused
48	Cellular module pin 48 break-out (MIC_N). Unused
49	Cellular module pin 49 break-out (MIC_P). Unused
RSVDS1	Cellular module pin 19 break-out (RSVD, Reserved). Unused
ST-SWD1	Tag-Connect-NL Plug-of-Nails™ connector compatible PCB touch points footprint for InterfaceMCU
SWD_TGT1	Tag-Connect-NL Plug-of-Nails™ connector compatible PCB touch points footprint for HostMCU

Table 5: C030 test and break out points and debug interfaces

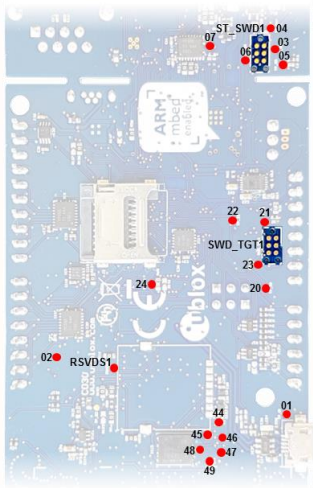

Figure 8: C030 Test and break out points and debug interfaces (bottom view)

2.7 Arduino™ UNO R3 compatible interface pin out

The C030 Arduino™ UNO R3 Compatible Interface details are given in Table 6 and depicted in Figure 9.

Conn.	Pin N°	Arduino naming	Description	HostMCU port assignment	Alternate functions and notes
Ard1A	1	n.c.	Not connected		
	2	IOREF	IO reference voltage level. Connected to 3.3 VDC		Could be used as input for external IO level setting.
	3	nR	Reset signal input. Negative logic		
	4	3.3V	3.3 VDC supply output		Controlled by HostMCU Port PE_0 0: Disable, 1:Enable
	5	5V	5 VDC Reference input		Could be used as IO Reference input
	6	GND	Ground level		
	7	GND	Ground level		
	8	VIN	External DC supply input	In the range of 2.5 VDC to 5.5 VDC	See Jumper J1 in section 2.4
Ard1B	9	A0	Analog input	PA_3 Analog input[7]	GPIO, Ext. interrupt
	10	A1	Analog input	PC_0 Analog input7	GPIO, Ext. interrupt
	11	A2	Analog input	PC_3 Analog input7	GPIO, Ext. interrupt
	12	A3	Analog input	PA_4 Analog input7	GPIO, Ext. interrupt
	13	A4	Analog input	PA_6 Analog input7, PB_7 I2C1 SDA[8]	GPIO, Ext. interrupt
	14	A5	Analog input	PB_0 Analog input7, PB_6 I2C1 SCL[9]	GPIO, Ext. interrupt
Ard1C	15	D0	Digital I/O, UART RX	PD_9, USART3_TX	GPIO, Ext. interrupt
	16	D1	Digital I/O, UART TX	PD_8, USART3_RX	GPIO, Ext. interrupt
	17	D2	Digital I/O	PD_11	USART3_CTS, GPIO, External interrupt
	18	D3	Digital I/O	PB_14	USART3_RTS, GPIO, PWM, Ext. interrupt
	19	D4	Digital I/O	PB_1	GPIO, PWM, Ext. interrupt
	20	D5	Digital I/O	PA_5	GPIO, PWM, Ext. interrupt
	21	D6	Digital I/O	PB_8	GPIO, PWM, Ext. interrupt
	22	D7	Digital I/O	PB_15	GPIO, PWM, Ext. interrupt
Ard1D	23	D8	Digital I/O	PD_15	GPIO, Ext. interrupt
	24	D9	Digital I/O	PD_12	GPIO, Ext. interrupt
	25	D10[10]	Digital I/O	PE_11, SPI4 NSS, shared with SD Card	GPIO, PWM, Ext. interrupt
	26	D11	Digital I/O	PE_6, SPI4 MOSI, shared with SD Card	GPIO, PWM, Ext. interrupt
	27	D12	Digital I/O	PE_5, SPI4 MISO, shared with SD Card	GPIO, PWM, Ext. interrupt
	28	D13	Digital I/O	PE_2, SPI4 SCK, shared with SD Card	GPIO, Ext. interrupt
	29	GND	Ground level		
	30	AREF	3.3 VDC Reference		
	31	SDA	I2C SDA I/O	PB_6 I2C1 SCL	GPIO, Ext. interrupt
	32	SCL	I2C SCL Output	PB_7 I2C1 SDA	GPIO, Ext. interrupt

Table 6: C030 Arduino UNO R3 compatible interface

[7] Pin is connected to the port via 1 kΩ/1 kΩ resistive voltage divider.
[8] PB_7 could be connected to the (A4) Ard1B Pin 13 to provide I2C1 SDA signal.
[9] PB_6 could be connected to the (A5) Ard1B Pin 14 to provide I2C1 SCL signal.
[10] Arduino interface D10 to D13 pins are used as an SPI Bus to HostMCU SPI4 peripheral. The D10 to D13 pins are shared with the SD card socket.

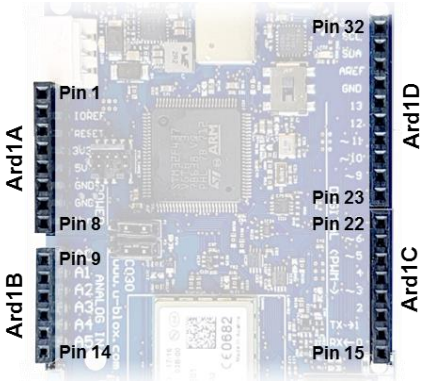

Figure 9: C030 Arduino™ UNO R3 connectors

2.8 Power supply options and LiPo battery usage

The C030 could be powered up from several resources, individually or all together. The power supply usage configurations are provided in Table 7.

#	Connector	Description
1	Debug USB	Uses development PC's USB 5 VDC VBUS to power up the Utility and Application sections of the C030. Charges up the LiPo battery if it is connected
2	Aux 5V USB	Auxiliary USB power input. A USB Power supply could be connected to power up only the Application section of the C030. Charges up the LiPo battery if it is connected. There is no communication functionality.
3	Serial USB sniffer	Uses Development PC's USB 5 VDC VBUS to power up only the Application section of the C030. Charges up the LiPo battery if it is connected. Note that Serial USB Sniffer circuitry could only be powered from its dedicated USB connector.
4	LiPo battery	The C030 Application section could run only from a LiPo Battery connected. If one or many of the #1, #2, #3 USB connections are available. The LiPo Battery is charged up as well.
5	Arduino™ UNO R3 VIN Pin 8	Arduino™ UNO R3 VIN pin 8 could be used to power up entire the C030 Application Section except Serial USB Sniffer circuitry. STLink (or CMSIS-DAP when available) feature could be used through the Debug USB. However, the C030 Application Section including LiPo Battery management circuitry is disconnected. The VIN input voltage should be in the range of 2.5 VDC to 5.5 VDC.

Table 7: C030 Power Supply options and LiPo Battery usage

☞ The C030 could run on a single supply input from #1 Debug USB or #3 Serial USB Sniffer. However, the Cellular module transmission power demand might not be satisfied from these connections. In such a use case, the C030 might be suffering brownout dues to USB VBUS supply rail cuts due to USB current limitations. Therefore, either a 5 VDC USB Power Supply with ~3 ADC capacity should be connected to the Aux 5V USB connector and/or an adequate LiPo Battery, such as a BAK LP-503759-IS-3, should be connected to the LiPo Battery Connector. The locations of the power supply connections are shown in Figure 10.

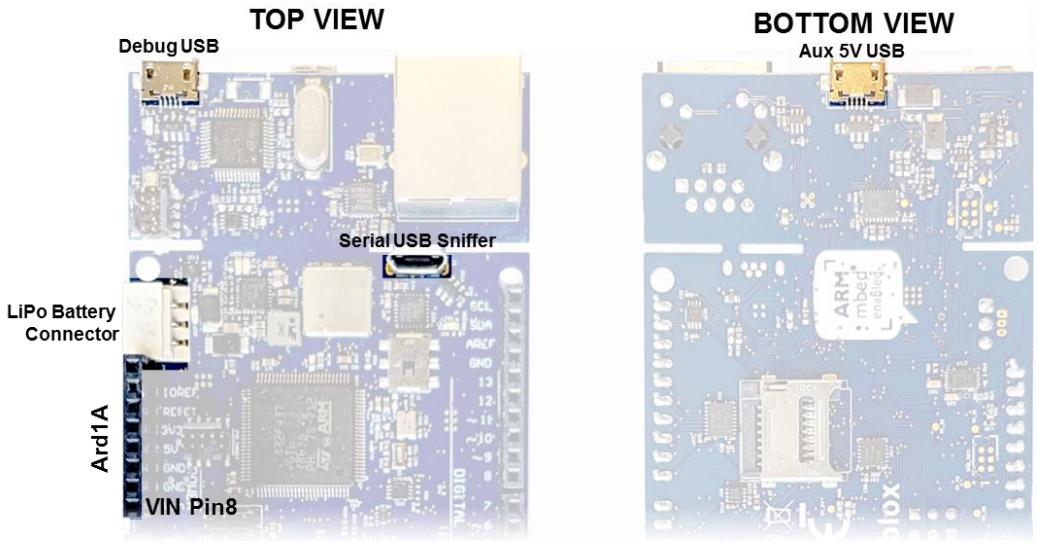

Figure 10: C030 power supply connection options

2.9 C030-N211 variant cellular module firmware upgrade

When new firmware is available for the SARA-N211 cellular module, it is possible to upgrade the firmware on the SARA-N211 that is on the C030-N211 board. For firmware upgrades, contact your local u-blox representative.

3 Getting started

3.1 C030-U201 variant eUICC (embedded SIM) activation

☞ This section applies to C030-U201 only.

The C030-U201 variant has an integrated eUICC (embedded SIM) for International Data Roaming Cellular Connectivity Service. The 50 MB of data or the period of 90 days Cellular Connectivity Service, whichever comes first, are covered in the C030-U201 package to provide a seamless out-of-the-box experience.

The International Data Roaming Connectivity Service is provided by JT® JTGlobal. The service must be activated through the Internet. The JT® International Data Roaming Cellular Connectivity Service activation procedure is provided below:

Visit http://www.jtiotsims.com/ubxC030 (the link is forwarded automatically to https://jtiotsims.com/ubxC030/)

1. Register (or Login) to your account
2. Enter the C030-U201 IMSI code given on the C030-U201 board
3. Customize the PIN code or leave as default
4. Optionally name your IMSI for easier top up in the future
5. Accept the Terms and Conditions
6. Click "Activate" to start your connectivity service.

3.2 C030 board setup

1. (Omit for C030-U201) Insert the SIM card into the SIM connector/card holder.
2. (Omit for C030-N211) Connect the cellular antenna to the cellular main antenna SMA female connector.
3. (Omit for C030-N211) Connect the GNSS antenna to the GNSS antenna SMA female.
4. Configure the C030 as described in section 2.2.
5. Power up the C030 board as described in section 2.8.

3.3 Development PC USB driver configuration

Although the USB drivers can be loaded by the development PC operating system automatically, it is recommended to follow the guidelines mentioned below:.

The Debug USB port STLink/V2-1 interface needs a driver. These drivers are available at: http://www.st.com/content/st_com/en/products/embedded-software/development-tool-software/stsw-link009.html.

Similarly, the Cellular Modem USB Sniffer USB port interface needs a driver, which is available at: http://www.silabs.com/products/interface/usb-bridges/classic-usb-bridges/device.cp2105

3.4 Getting started with Mbed

Up-to-date information on how to operate the C030 starter kit within the Mbed development environment is available at:

- For the C030-U201 variant: https://developer.mbed.org/platforms/ublox-C030-U201/
  (the link is forwarded automatically to the site https://os.mbed.com/platforms/ublox-C030-U201/)
- For the C030-N211 variant: https://developer.mbed.org/platforms/ublox-C030-N211/
  (the link is forwarded automatically to the site https://os.mbed.com/platforms/ublox-C030-N211/)

4 Approvals

4.1 C030-U201 European conformance CE mark

The C030-U201 application board has been evaluated against the essential requirements of the 2014/53/EU Radio Equipment Directive.

In order to satisfy the essential requirements of the 2014/53/EU Radio Equipment Directive, the device is compliant with the following standards:

- Radio Frequency spectrum use (Article 3.2):
  - EN 301 511
  - EN 301 908-1
  - EN 301 908-2
  - EN 303 413
- Electromagnetic Compatibility (Article 3.1b):
  - EN 301 489-1
  - EN 301 489-19
  - EN 301 489-52
- Health and Safety (Article 3.1a)
  - EN 62368-1
  - EN 62311 and EN 62479

The conformity assessment procedure for C030-U201 application boards, referred to in Article 17 and detailed in Annex III of Directive 2014/53/EU, has been followed.

Thus, the following marking is included in the product:

CE

There are no restrictions for the commercialization of the C030-U201 application boards in all the countries of the European Union.

Radiofrequency radiation exposure Information: this equipment complies with radiation exposure limits prescribed for an uncontrolled environment for fixed and mobile use conditions. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and the body of the user or nearby persons. This transmitter must not be collocated or operating in conjunction with any other antenna or transmitter except as authorized in the certification of the product.

The gain of the system antenna(s) used for C030-U201 application boards (i.e. the combined transmission line, connector, cable losses and radiating element gain) must not exceed 2.96 dBi (in the 900 MHz band, i.e. GSM 900 or UMTS FDD-8 band), 7.85 dBi (in the 1800 MHz band, i.e. GSM 1800 band), 11.84 dBi (in the 2100 MHz band, i.e. UMTS FDD-1 band) for mobile and fixed or mobile operating configurations.

4.2 C030-N211 European conformance CE mark

The C030-N211 application board has been evaluated against the essential requirements of the 2014/53/EU Radio Equipment Directive.

In order to satisfy the essential requirements of the 2014/53/EU Radio Equipment Directive, the device is compliant with the following standards:

- Radio Frequency spectrum use (Article 3.2):
  - EN 301 908-1
  - EN 301 908-13
  - EN 303 413
- Electromagnetic Compatibility (Article 3.1b):
  - EN 301 489-1
  - EN 301 489-19
  - EN 301 489-52
- Health and Safety (Article 3.1a)
  - EN 62368-1
  - EN 62311 and EN 62479

The conformity assessment procedure for C030-N211 application boards, referred to in Article 17 and detailed in Annex III of Directive 2014/53/EU, has been followed.

Thus, the following marking is included in the product:

CE

There are no restrictions for the commercialization of the C030-N211 application boards in all the countries of the European Union.

Radiofrequency radiation exposure Information: this equipment complies with radiation exposure limits prescribed for an uncontrolled environment for fixed and mobile use conditions. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and the body of the user or nearby persons. This transmitter must not be collocated or operating in conjunction with any other antenna or transmitter except as authorized in the certification of the product.

The gain of the system antenna(s) used for C030-N211 application boards (i.e. the combined transmission line, connector, cable losses and radiating element gain) must not exceed 9.2 dBi (in the 800 MHz band, i.e. LTE Band 20) and 9.4 dBi (in the 900 MHz band, i.e. LTE Band 8) for mobile and fixed or mobile operating configurations.

Related documents

[1] u-blox SARA-U2 series Data Sheet, Docu No UBX-13005287
[2] u-blox SARA-N2 series Data Sheet, Docu No UBX-15025564
[3] u-blox Nested Design Application Note, Docu No UBX-16007243

All these documents are available on our homepage (http://www.u-blox.com).

☞ For regular updates to u-blox documentation and to receive product change notifications, register on our homepage.

Revision history

Revision	Date	Name	Comments
R01	13-Jul-2017	euyg	Initial release.
R02	29-Nov-2017	euyg	Updated C030-N211 and C030-U201 product status
R03	07-Mar-2018	euyg	Updated C030-U201 product status. Added Approvals section
R04	23-Mar-2018	lpah	Updated C030-N211 product status.

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