C027-C20/U20/G35
MBED enabled Internet of Things (IoT) starter kit
User Guide

Abstract
This user guide explains how to set up the C027 starter kit to begin
developing Internet of Things applications for the u-blox LISA-U200,
LISA-C200 or SARA-G350 cellular and MAX-M8 positioning
modules.
Contents

1 Starting up.................................................................4
   1.1 C027-C20/U20/G35 pin definition.................................................. 5
   1.2 C027-C20/U20/G35 block diagram .................................................. 6
   1.3 C027 starter kit BoM .......................................................... 6
   1.4 Features............................................................................... 6
       1.4.1 Cellular and GNSS modules ...................................................... 6
       1.4.2 Main CPU ........................................................................ 6
       1.4.3 Interfaces and electrical data ..................................................... 6
   1.5 C027-C20/U20/G35 connectors ...................................................... 7
   1.6 LEDs .................................................................................. 7

2 Getting started with mbed......................................................8
   2.1 Board setup and settings ............................................................ 8
   2.2 Board power supply ................................................................. 8
   2.3 Windows serial configuration ...................................................... 8
   2.4 Board interface settings ............................................................ 8
   2.5 Flashing the ARM-Cortex M0 LPC11U35 MCU ......................... 8
   2.6 Getting started with mbed .......................................................... 8

3 Cloud services and analytics.................................................9

Related documents ..................................................................10
Revision history .....................................................................10
Contact ..................................................................................11
1 Starting up

The C027 is a complete starter kit that allows quick prototyping of a variety of applications for the Internet of Things. The application board has a MAX-M8 GNSS receiver and a LISA-U200, LISA-C200 or SARA-G350 cellular module, enabling straightforward development of location-aware, global communicating applications. The application board provides access to Ethernet and CAN interfaces, and to a variety of hardware interfaces (22 GPIOs with SPI, I²C, UART, I’S) through a standard-based header connector.

The board is powered by a Cortex-M3 microprocessor, which is fully supported by the mbed platform. The CPU has 512 kB flash, 64 kB RAM, and runs at 96 MHz. The board provides simple USB drag-n-drop programming and a CMSIS-DAP debug interface for the target microcontroller. The 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 mbed compiler also supports full export to different tool chains, for projects that demand it as they go to production.

C027-C20/U20/G35 supports different cellular technologies via the u-blox nested design concept:

- CDMA 1xRTT: C027-C20 (LISA-C200-04S / LISA-C200-24S mounted)
- UMTS/HSPA/GSM/EGPRS: C027-U20 (LISA-U200-02S mounted)
- GSM/GPRS: C027-G35 (SARA-G350-01S mounted)

This document identifies all the variants as C027.
1.1 C027-C20/U20/G35 pin definition

Figure 1: C027-C20/U20/G35 pin definition
1.2 C027-C20/U20/G35 block diagram

Figure 2 shows the main interfaces and internal connections of the C027:

![C027 block diagram](image)

1.3 C027 starter kit BoM

The C027 IoT starter kit contains the following items:

- C027 PCB with cellular module, GNSS module, ARM CPU and all interfaces
- GNSS antenna (Taoglas AA.161 or AA.162)
- Quick start instruction card

1.4 Features

1.4.1 Cellular and GNSS modules

- LISA-C200 (C027-C20), LISA-U200 (C027-U20) or SARA-G350 (C027-G35)
- MAX-M8 GNSS receiver

1.4.2 Main CPU

- High-performance ARM(R) Cortex(TM)-M3 NXP LPC1768 MCU running at 96 MHz
- 512 kByte on-chip flash
- 64 kByte on-chip SRAM

1.4.3 Interfaces and electrical data

- A standard-based header connector with
  - 6 analog inputs
  - 9 PWM capable outputs
  - 22 GPIOs
  - 1 x SPI
  - 1 x I²C
  - 1 x UART
  - 1 x I²S
- GNSS antenna SMA connector for external GNSS antenna
- Cellular antenna SMA connector for external cellular antenna
- Ethernet RJ45 connector
- CAN screw terminal connector
- SIM / mini SIM card holder
- USB (connector type B)
- CMSIS-DAP
- Serial port
- Power supply 12V ± 10% @ 900 mA (power jack or header connector pins)
- IO voltage 3.3 V output, 5 V compatible input

### 1.5 C027-C20/U20/G35 connectors

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>12V ± 10% Power Input</td>
<td>+12 V / 2.5 A AC/DC power adapter input for the whole board supply</td>
</tr>
<tr>
<td>CAN connector</td>
<td>Controller Area Network controlled by Cortex-M3 processor</td>
</tr>
<tr>
<td>USB B-type connector</td>
<td>Functions: disk drive for drag and drop programming, CDC Serial Port, CMSIS-DAP debug interface, power input</td>
</tr>
<tr>
<td>Ethernet connector</td>
<td>Ethernet connector for Cortex-M3 processor</td>
</tr>
<tr>
<td>Cellular main antenna</td>
<td>SMA connector for the cellular module main antenna</td>
</tr>
<tr>
<td>SIM card holder</td>
<td>SIM card holder</td>
</tr>
<tr>
<td>GNSS antenna</td>
<td>SMA connector for the GNSS antenna</td>
</tr>
<tr>
<td>Arduino connectors</td>
<td>I/O connectors compatible with Arduino devices</td>
</tr>
</tbody>
</table>

Table 1: C027-C20/U20/G35 connectors description

### 1.6 LEDs

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPWR</td>
<td>USB cable plugged in <strong>USB B</strong> connector</td>
<td>Green</td>
</tr>
<tr>
<td>UART</td>
<td>CDC serial port activity</td>
<td>Yellow</td>
</tr>
<tr>
<td>MSD</td>
<td>Drag and drop programming activity</td>
<td>Red</td>
</tr>
<tr>
<td>HID</td>
<td>CMSIS-DAP debug interface activity</td>
<td>Green</td>
</tr>
<tr>
<td>NET_IND</td>
<td>Module network indicator</td>
<td>Green</td>
</tr>
<tr>
<td>RI</td>
<td>Module ring indicator</td>
<td>Red</td>
</tr>
<tr>
<td>TPLS</td>
<td>Indicates if the GNSS is synchronized with GNSS or UTC time grid</td>
<td>Green</td>
</tr>
<tr>
<td>LED1</td>
<td>User / error LED</td>
<td>Red</td>
</tr>
</tbody>
</table>

Table 2: C027-C20/U20/G35 LEDs description
2 Getting started with mbed

2.1 Board setup and settings
- Insert the SIM card into the SIM connector / card holder (not required for CDMA variants).
- Connect the cellular antenna to the cellular main antenna SMA female connector.
- Connect the GNSS antenna to GNSS antenna SMA female connector.

2.2 Board power supply

There are three mutually exclusive ways to supply the board:
- Connect a power supply to the 12 V DC In connector (power supply is not included in the kit).
- Provide power supply 12V to VIN pin of the row connector.
- Connect C027 to host PC using USB cable (USB cable is not included in the kit).

Due to the USB current limitation, optimal RF performance can be achieved only by supplying the board either through the 12 V DC In connector or the VIN pin of the row connector.

2.3 Windows serial configuration
The mbed serial port works by default on Mac and Linux, but Windows OS needs a driver. The driver is available in: https://mbed.org/handbook/Windows-serial-configuration.

2.4 Board interface settings
- Connect a USB cable to the USB B connector. Status light DPWR (green LED) will come on.
- Connect the other interfaces (CAN, Ethernet) as needed.
- The board is ready.

2.5 Flashing the ARM-Cortex M0 LPC11U35 MCU
There is a “USB_BOOT” switch located near the small microcontroller unit.
- If you want to re-flash the ARM-Cortex M0 LPC11U35 MCU, then press the “USB_BOOT” switch and then connect the C027 device to the host PC via a USB cable.
- C027 device will appear as CRP DISABLD removable disk. To re-flash the FW, simply delete the file “firmware.bin” and copy the new firmware binary to this disk.
- Reconnect the USB cable. Your device will now appear as “MBED” removable disk and is ready for use.

2.6 Getting started with mbed
Up-to-date information on how to operate the C027 starter kit within the mbed development environment is available in: www.mbed.org/users/ublox/notebook/ublox-C027-Getting-Started.
Other instructions and information:
- u-blox C027 downloading instructions: https://mbed.org/users/ublox/notebook/u-blox-C027-Downloading/
- Creating a program: https://mbed.org/handbook/Creating-a-program
- How to check the firmware version: https://mbed.org/users/ublox/notebook/ublox-C027-Update-CMSIS-DAP-Interface-Firmware/
3 Cloud services and analytics

u-blox C027 is pre-enabled to support the IBM Internet of Things Foundation through the IBM Bluemix Platform, a hub that provides access to more than 100 open-source tools and platform services, for data storage and analytics.

The C027 internet of things starter kit provides users with an immediate access to IBM services, such as device registration, rapid visualization of dashboards and storage of data. Users can collect and manage a time-series view of data from things, run advanced analytics or even compose new analytics applications for multiple market verticals. Some examples are:

- Predictive modeling and geospatial analytics
- Understanding vehicle performance by analyzing data from its On-Board Diagnostic system
- Linking real-time machine condition monitoring with IBM asset management to monitor everything from the health of household appliances to wheels on a railroad car
- Spotting trends and obtaining solutions to common problems through graphical representation of historical and real-time data from IoT devices

Tutorials on how to get cellular connectivity to the IBM Bluemix Platform with C027 boards are available through the IBM developerWorks Recipes web site.
Related documents
All LISA-U, LISA-C and SARA-G technical 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

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Name</th>
<th>Status / Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>R01</td>
<td>13-Dec-2013</td>
<td>jpod</td>
<td>Initial Release</td>
</tr>
<tr>
<td>R02</td>
<td>28-Jan-2015</td>
<td>jbev</td>
<td>New ordering codes: C027-U20-0-02, C027-G35-0-02, C027-C20-0-02, C027-C20-1-02</td>
</tr>
<tr>
<td>R03</td>
<td>18-Nov-2015</td>
<td>smoI</td>
<td>New section, Cloud services and analytics</td>
</tr>
</tbody>
</table>
Contact
For complete contact information visit us at www.u-blox.com

u-blox Offices
North, Central and South America
u-blox America, Inc.
Phone: +1 703 483 3180
E-mail: info_us@u-blox.com
Regional Office West Coast:
Phone: +1 408 573 3640
E-mail: info_us@u-blox.com
Technical Support:
Phone: +1 703 483 3185
E-mail: support_us@u-blox.com

u-blox AG
Phone: +41 44 722 74 44
E-mail: info@u-blox.com
Support: support@u-blox.com

Headquarters
Europe, Middle East, Africa

Asia, Australia, Pacific
u-blox Singapore Pte. Ltd.
Phone: +65 6734 3811
E-mail: info_ap@u-blox.com
Support: support_ap@u-blox.com
Regional Office Australia:
Phone: +61 2 8448 2016
E-mail: info_an@u-blox.com
Support: support_ap@u-blox.com
Regional Office China (Beijing):
Phone: +86 10 68 133 545
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com
Regional Office China (Chongqing):
Phone: +86 23 6815 1588
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com
Regional Office China (Shanghai):
Phone: +86 21 6090 4832
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com
Regional Office China (Shenzhen):
Phone: +86 755 8627 1083
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com
Regional Office India:
Phone: +91 959 1302 450
E-mail: info_in@u-blox.com
Support: support_in@u-blox.com
Regional Office Japan (Osaka):
Phone: +81 6 6941 3660
E-mail: info_jp@u-blox.com
Support: support_jp@u-blox.com
Regional Office Japan (Tokyo):
Phone: +81 3 5775 3850
E-mail: info_jp@u-blox.com
Support: support_jp@u-blox.com
Regional Office Korea:
Phone: +82 2 542 0861
E-mail: info_kr@u-blox.com
Support: support_kr@u-blox.com
Regional Office Taiwan:
Phone: +886 2 2657 1090
E-mail: info_tw@u-blox.com
Support: support_tw@u-blox.com