UM10895

QN9020 mini DK user guide

Rev. 2.1 — 14 June 2016 **User manual**

Document information

Info	Content
Keywords	mini DK, J-Link OB, UART, SWD, GPIO, LED, button, power supply, buzzer
Abstract	This user manual describes the features of the QN9020_MINIDK_Vx board.

Revision history

Rev	Date	Description
v.2.1	20150614	Add USB dongle part and some Notes
v.2	20160524	second release. Modifications: • Section 1.2 "Additional resource" updated. • Figure 5 updated. • Section 2.6 "GPIO interface" updated. • Section 5.1 "Schematics for QN9020 mini DK board" updated.
v.1	20150601	initial release

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1. Introduction

This user manual describes the hardware details of the QN9020 mini Development Kit (DK).

1.1 Kit contents

The QN9020 mini development kit includes the following:

- QN9020 mini development board
- QN9020 USB dongle
- USB cable

1.2 Additional resource

For additional resources, visit http://www.nxp.com/products/microcontrollers-and-processors/more-processors/application-specific-mcus-mpus/bluetooth-low-energy-ble:BLUETOOTH-LOW-ENERGY-BLE

2. Hardware description

The QN9020 mini development board provides easy access to peripherals such as buttons, piezo buzzer and LED. The board also provides useful interfaces such as a USB port for UART communication and J-Link debug, and a GPIO/optional sensor board connector.

A USB dongle is a Bluetooth device powered by the QN9020. It acts as a master when communicating with the QN9020.

2.1 Hardware overview

The hardware blocks in the QN9020 mini DK, and the functional relationship of each main component, are shown in Figure 1.

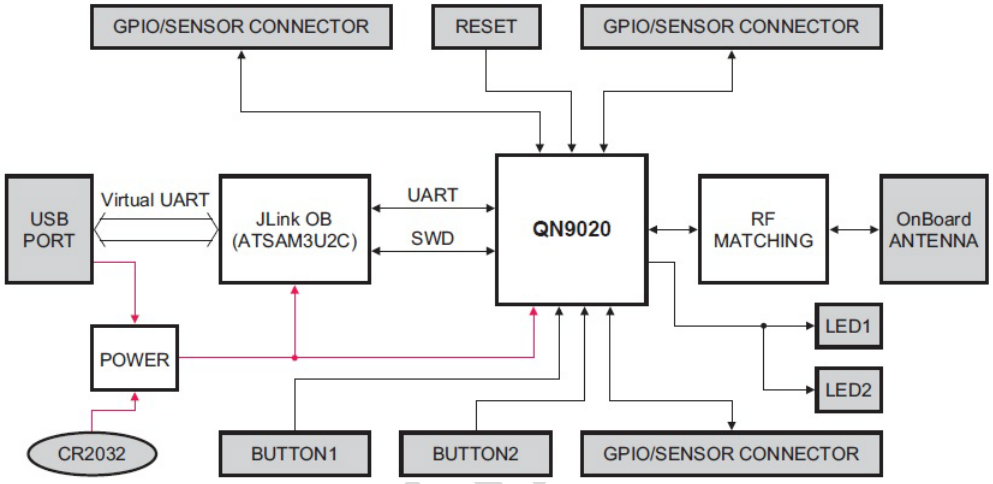


Fig 1. The QN9020 functional diagram

The component layout on both the sides of the board is shown in Figure 2 and Figure 3. The detailed information of each component is listed in Table 1.

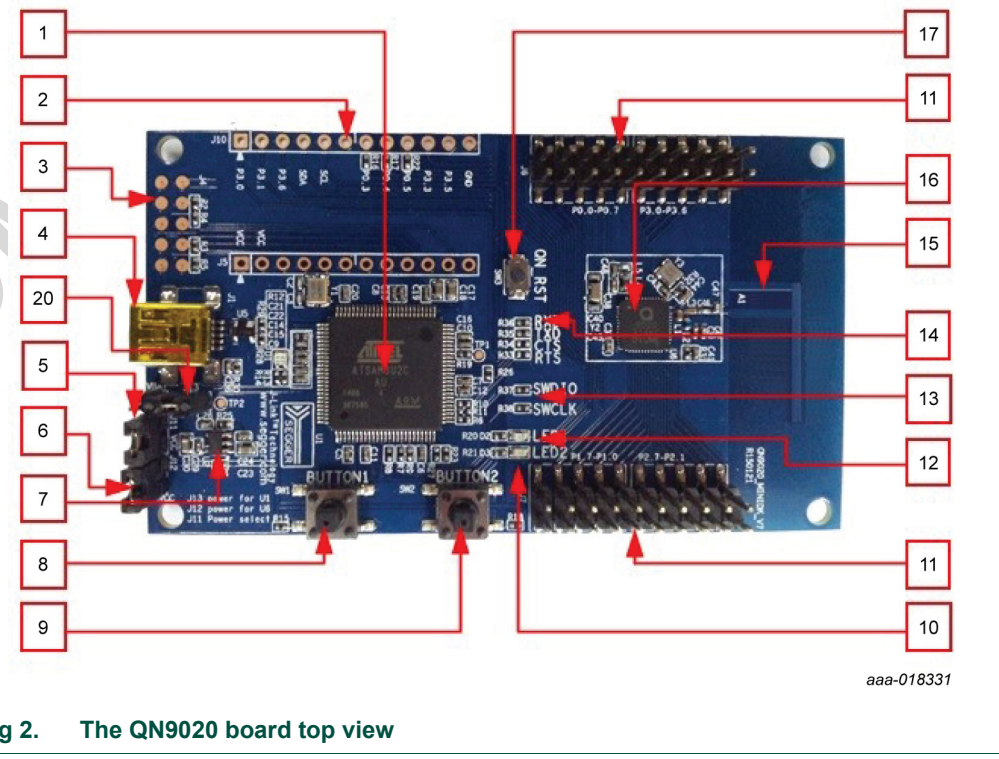


Fig 2. The QN9020 board top view

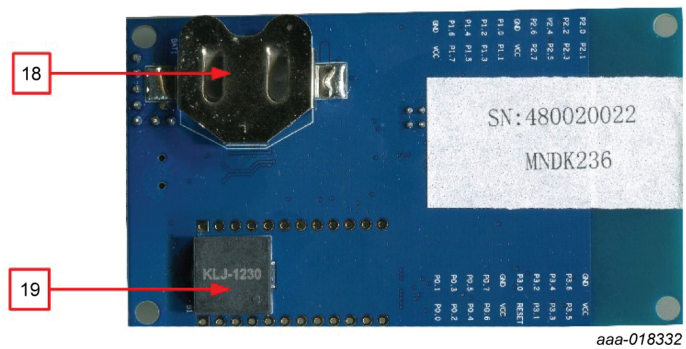


Fig 3. The QN9020 board bottom view

Table 1. QN9020 board components list

Number	Name	Description
1	J-Link OB	ATSAM3U2C; used to offer SWD and UART interfaces for QN9020 debug and communication
2	connector	optional; used for connecting sensor board
3	debug port	debug port for ATSAM3U2CA
4	mini USB port	power and communication port
5	power source select jumper	used for power source selection; see Section 2.3
6	current measurement jumper	used to measure the QN9020 device power consumption
7	LDO (TPS73630)	5 V to 3 V regulator
8	button1	used as input; see Section 2.9
9	button2	used as input; see Section 2.9
10	LED2	used as output; see Section 2.8
11	QN9020 GPIO port	used for interface extension
12	LED1	used as output; see Section 2.8
13	SWD resistors	zero ohm resistors; shorted for QN9020 device debug
14	UART interface	used as communication port for QN9020 device
15	PCB antenna	onboard Bluetooth antenna
16	QN9020 chip	QN9020 chip
17	QN9020 reset button	used for QN9020 hardware reset
18	CR2032 battery holder	CR2032 battery holder
19	piezo buzzer	buzzer: KLJ-1230
20	jumper	used for power cycle ATSAM3U2CA

2.2 Default jumper settings on mini DK board

The jumpers on QN9020 mini DK are factory set to power the board over the USB. The factory-set jumper and switch settings are shown in Table 2.

Table 2. QN9020 mini DK board components list

Jumper	Pins to be shorted using jumpers	Function
J11	2 and 3	USB powered
J12	1 and 2	VCC_QN9020 3.3 V
J13	1 and 2	VCC_MB 3.3 V

2.3 Power supply

The QN9020 board has two power supply modes:

1. Bus-power mode: The board can be powered using the USB cable. The onboard LDO is used to regulate output voltage to 3 V and supplies power to all parts on the board.
2. Battery-power mode: The CR2032 supplies power to QN9020 and optional sensor connector when it is in battery-power mode. The J-Link OB still uses the LDO as power supply via USB cable. When using USB interface as a power supply, connect the jumper J11 pin 2 and pin 3; see Figure 4.

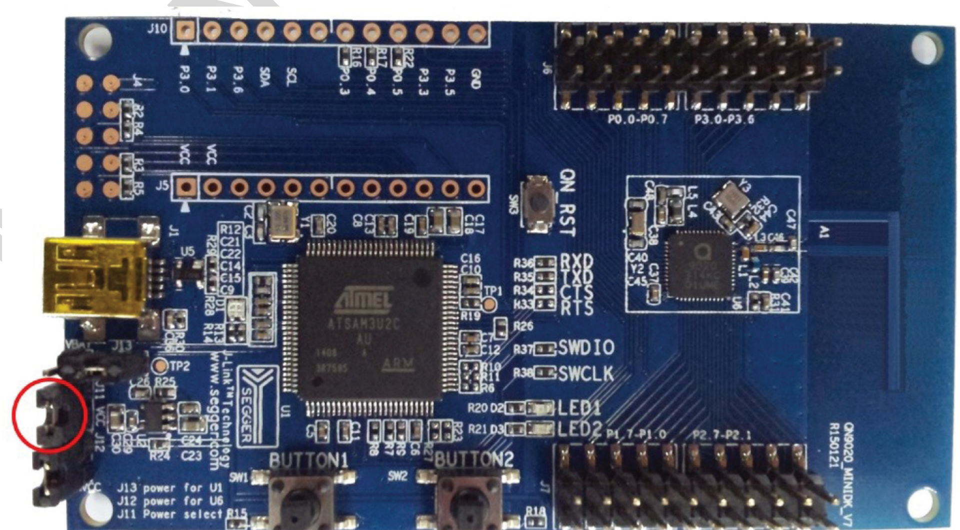


Fig 4. Connecting jumper J11 pin 2 and pin 3 to select USB as power supply

When using a CR2032 coin cell as a power supply, connect the jumper J11 pin 1 and pin 2; see Figure 5.

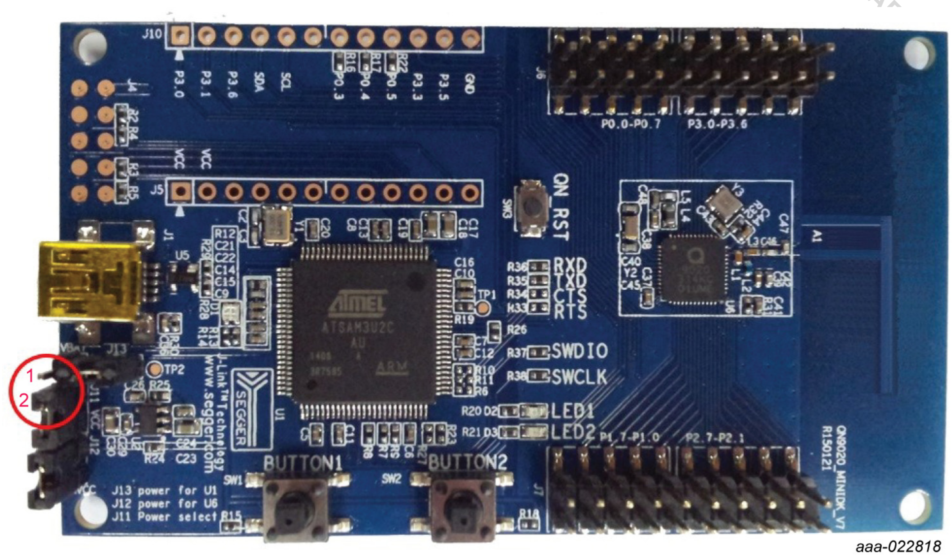


Fig 5. Connecting jumper J11 Pin1 and Pin 2 to select CR2032 coin cell as power supply

2.4 SEGGER J-Link OB part

The SEGGER J-Link OB offers the SWD and UART interface. Users can download or update firmware into a QN9020 device by using the UART or SWD interface. Furthermore, it is convenient to debug the program for a QN9020 device using SWD interface.

To program or debug the QN9020 device using the SEGGER J-Link OB, the 0 Ω resistors R37, R38 should be soldered; see Figure 6.

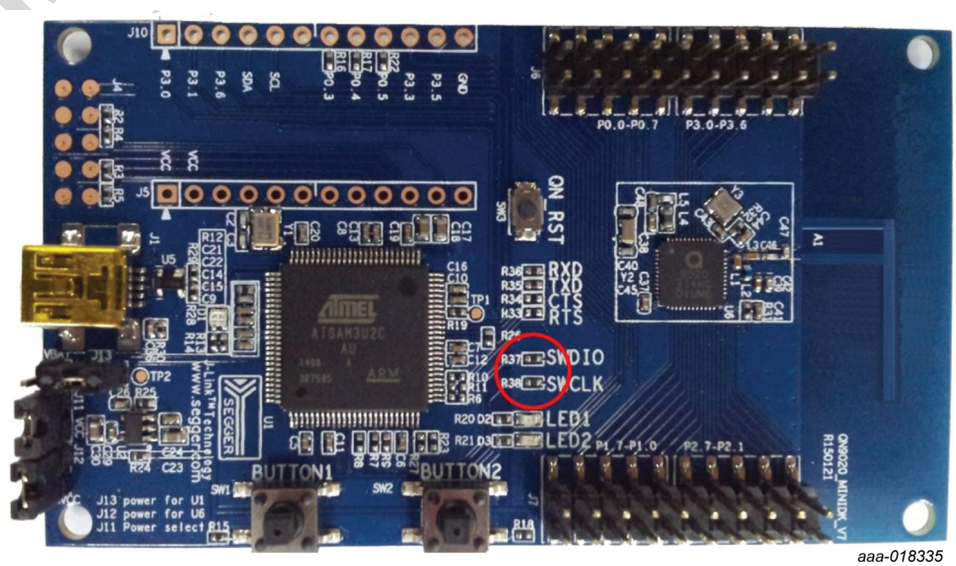


Fig 6. Connect R37, R38

In order to use a USB to UART bridge for the QN9020 download, the solder bridge SB3, SB4 should be shorted; see Figure 7.

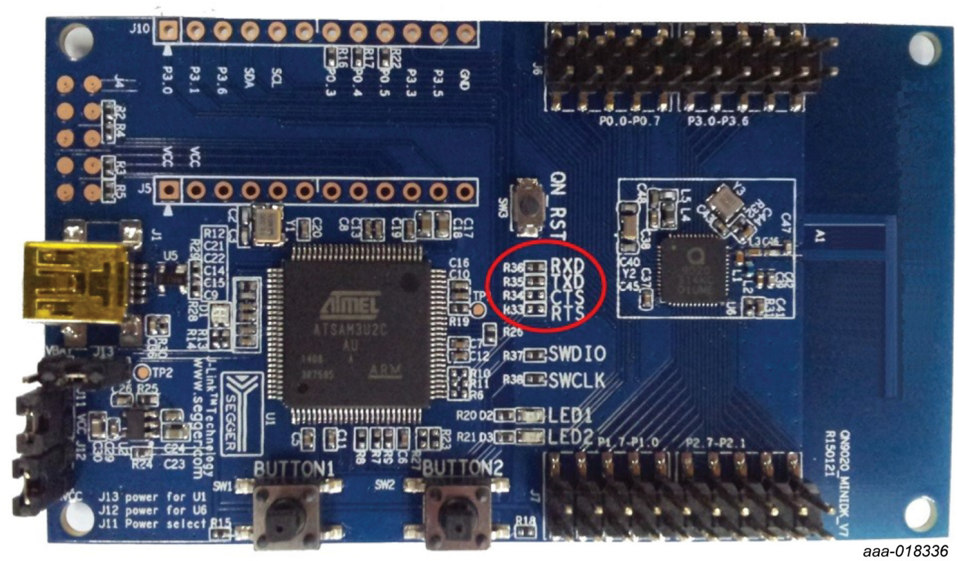


Fig 7. Short R35, R36

2.5 QN9020 device

The QN9020 device is integrated with a BLE radio, controller, protocol stack and profile software, and a high performance MCU on a single chip; see Figure 8.

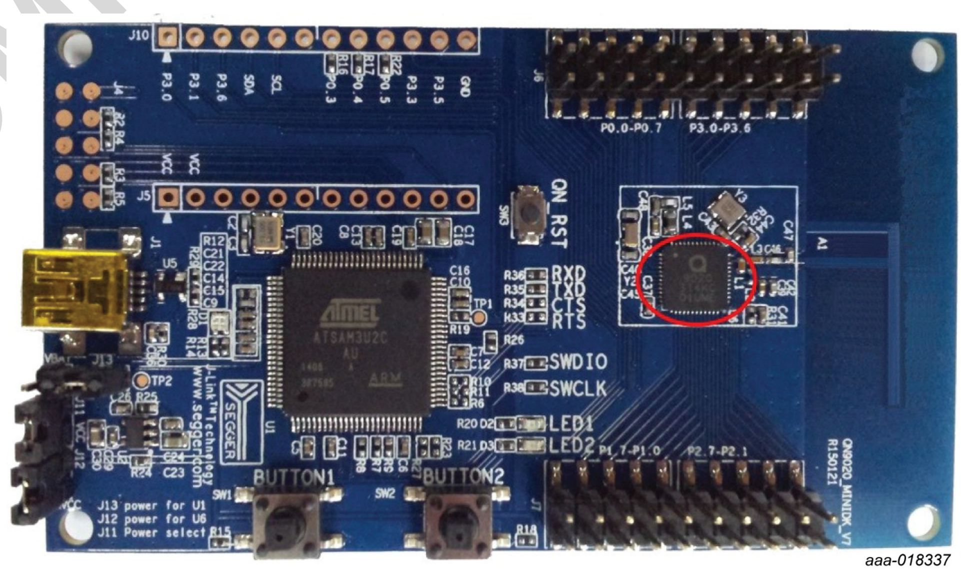


Fig 8. The QN9020 device

2.6 GPIO interface

In QN9020 mini development board version V7, the connectors J6, J7, J8 and J9 provide GPIO connection. The net name is shown in Figure 9.

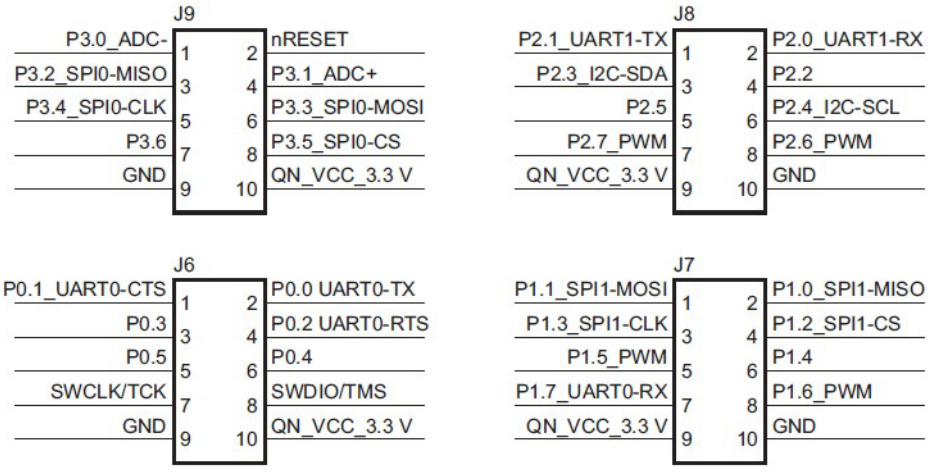


Fig 9. QN9020 MiniDK version V7 GPIO connections

In QN9020 mini development board version V8, connectors J6 and J7 provide GPIO connection, as shown in Figure 10.

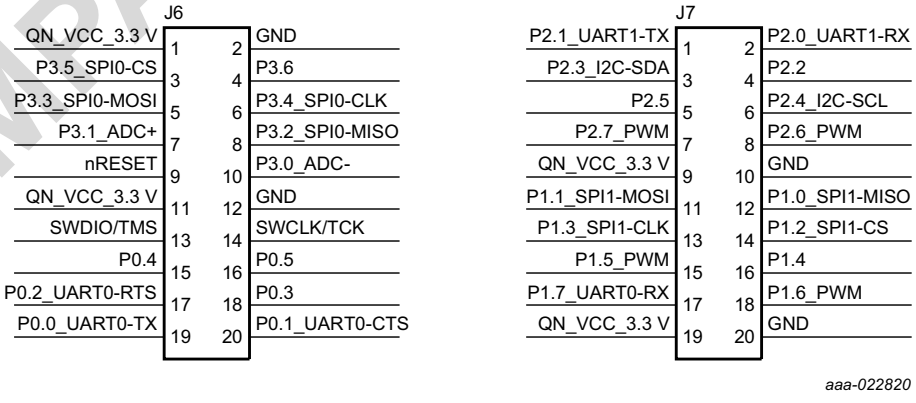


Fig 10. QN9020 version V8 GPIO connections

2.7 QN9020 reset button

The reset button is used to provide hardware reset to the QN9020 device. When programming the QN9020 using UART interface of SEGGER J-Link OB, the reset button should be pressed first to ensure that QN9020 is in boot mode. See Figure 11 for the detailed circuit.

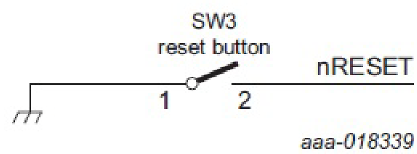


Fig 11. QN9020 reset

2.8 LED

The QN9020 board offers two programmable LEDs, which are connected to the QN9020 device GPIO.

LED1 and LED2 are connected to GPIO P0.4 and P0.5 respectively. The connections are shown in Figure 12. The LEDs are powered-up when the corresponding GPIO outputs switch to logic LOW level.

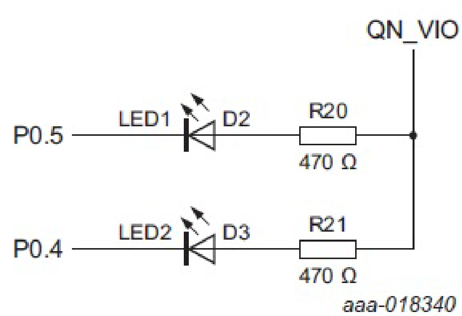


Fig 12. LED circuit

2.9 Button

The QN9020 board offers two buttons which are connected to QN9020 device GPIO. Button 1 and button 2 are connected to GPIO P1.4 and P1.5 respectively. See Figure 13 for detailed circuits.

When using the buttons, the GPIO P1.4 and P1.5 must be configured as inputs. Logic LOW input is applied to QN9020 when a button is pressed.

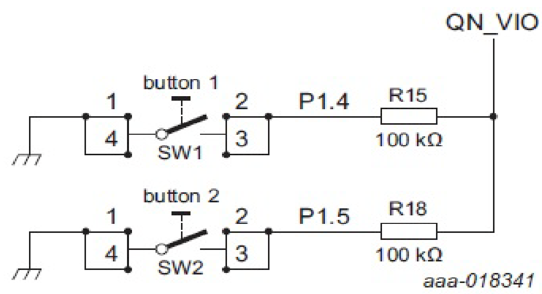


Fig 13. Button circuit

2.10 Piezo buzzer

The piezo buzzer receives input from GPIO P2.6; see Figure 14. Refer to *KLJ-1230 data sheet* for detailed information.

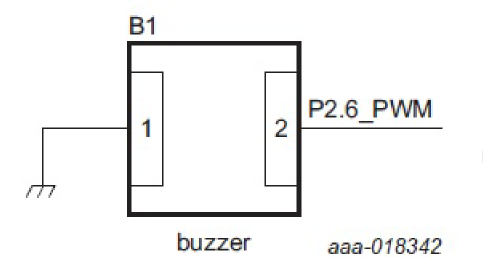


Fig 14. Piezo buzzer circuit

2.11 Optional sensor connector

These connectors are used as an interface to connect the sensor board. The pin name definitions are shown in Figure 15.

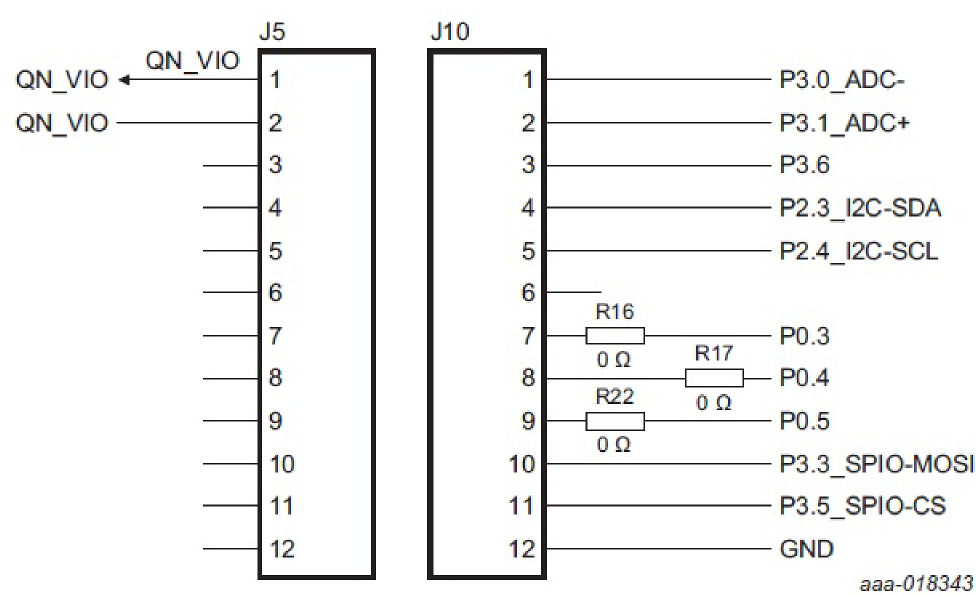


Fig 15. Connecting the sensor board

2.12 Current measurement

The jumper J12 is used to measure the QN9020 device current. In current test mode, the digital ammeter should be connected in series with J12. In the other modes, pin 1 and pin 2 of J12 are shorted. A jumper cap is used to short the pins.

3. QN902x USB Dongle

3.1 Dongle Block Diagram

USB Dongle works together with QTool and behaves as a master or slave when talking to MiniDK or other devices. Just as illustrated in diagram as below, USB Dongle receives commands from QTool via virtual COM port, by which QN902x would be initialized as a Master or Slave device. All tests can be performed by QTool after initialization.

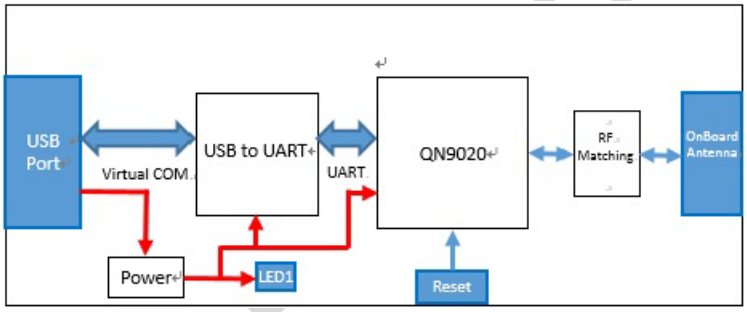


Fig 16. Dongle Block Diagram

3.2 Dongle Connection

QN902x USB dongle is a USB interfaced device with a QN9020 packed in. With driver and SDK installed in computer (refer to QN9020 quick start guide), user can use QTool in SDK to control the QN902x in dongle to work as a central device. The MiniDK board with USB power supply from computer works as a peripheral device. The connection of the dongle is illustrated as blow figure. For QTool usage, please refer to QTool User Manual v1.1 in SDK.

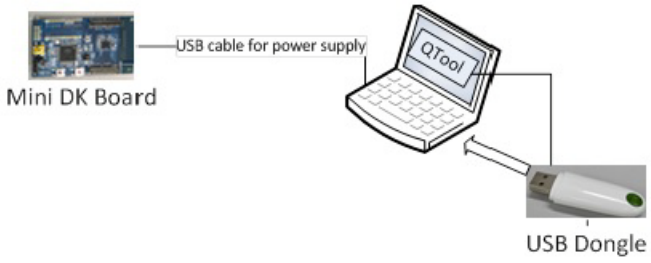


Fig 17. Dongle Connection

4. Notes

- Proper ESD precautions should be used when handling the board
- FCC related notes

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference,

and (2) this device must accept any interference received, including interference that may cause undesired operation.

changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.

-- Increase the separation between the equipment and receiver.

-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-- Consult the dealer or an experienced radio/TV technician for help.

5. Appendix - Schematics and PCB layout

5.1 Schematics for QN9020 mini DK board

QN9020 mini DK board schematics have three parts: J-Link, power and QN9020. Figure 18, Figure 19 and Figure 20 are the same for all versions. The QN9020 schematic in version V7 is shown in Figure 21. In version V8, it is shown in Figure 22.

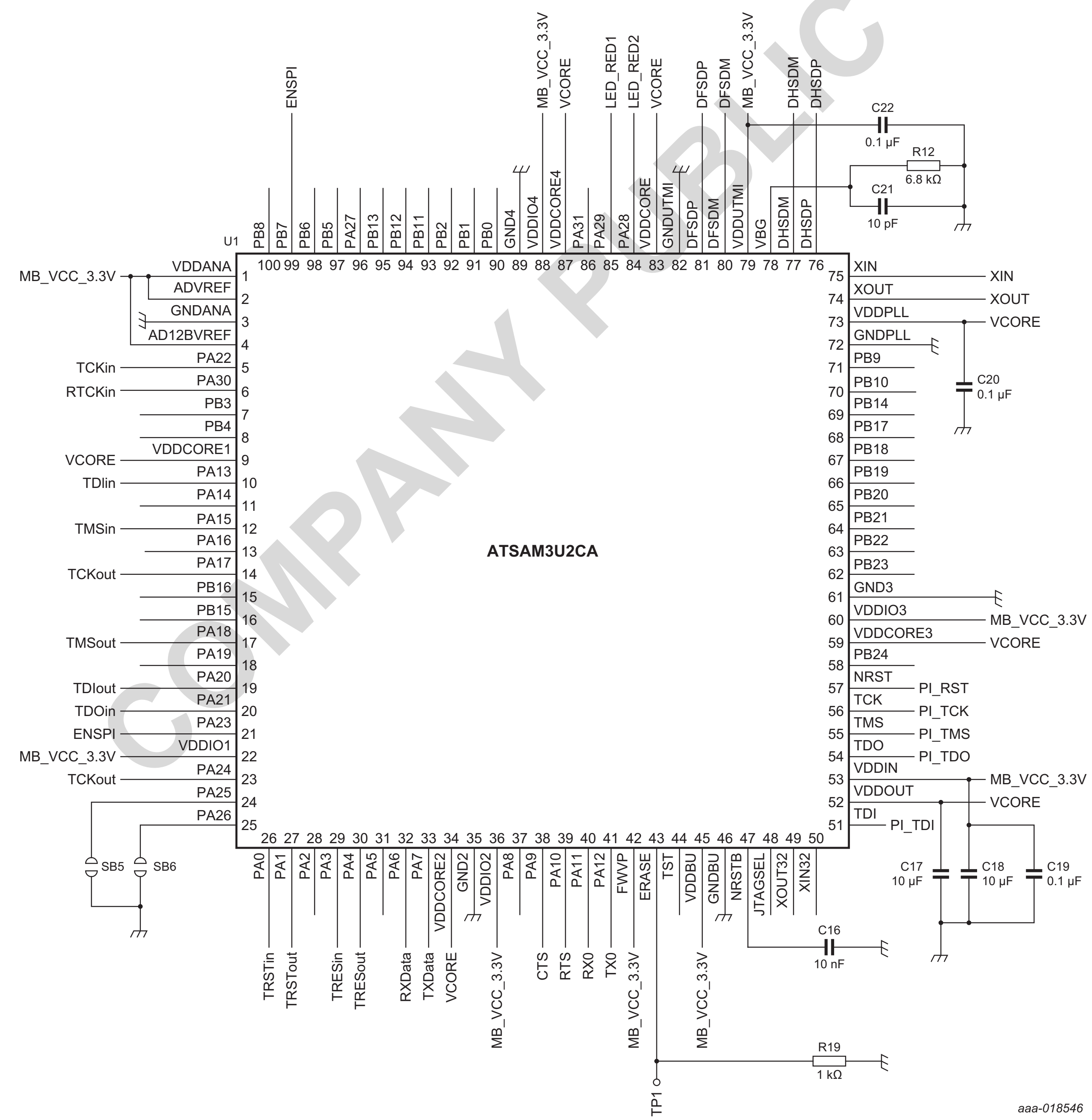


Fig 18. J-Link schematic for all QN9020 mini DK versions, part I

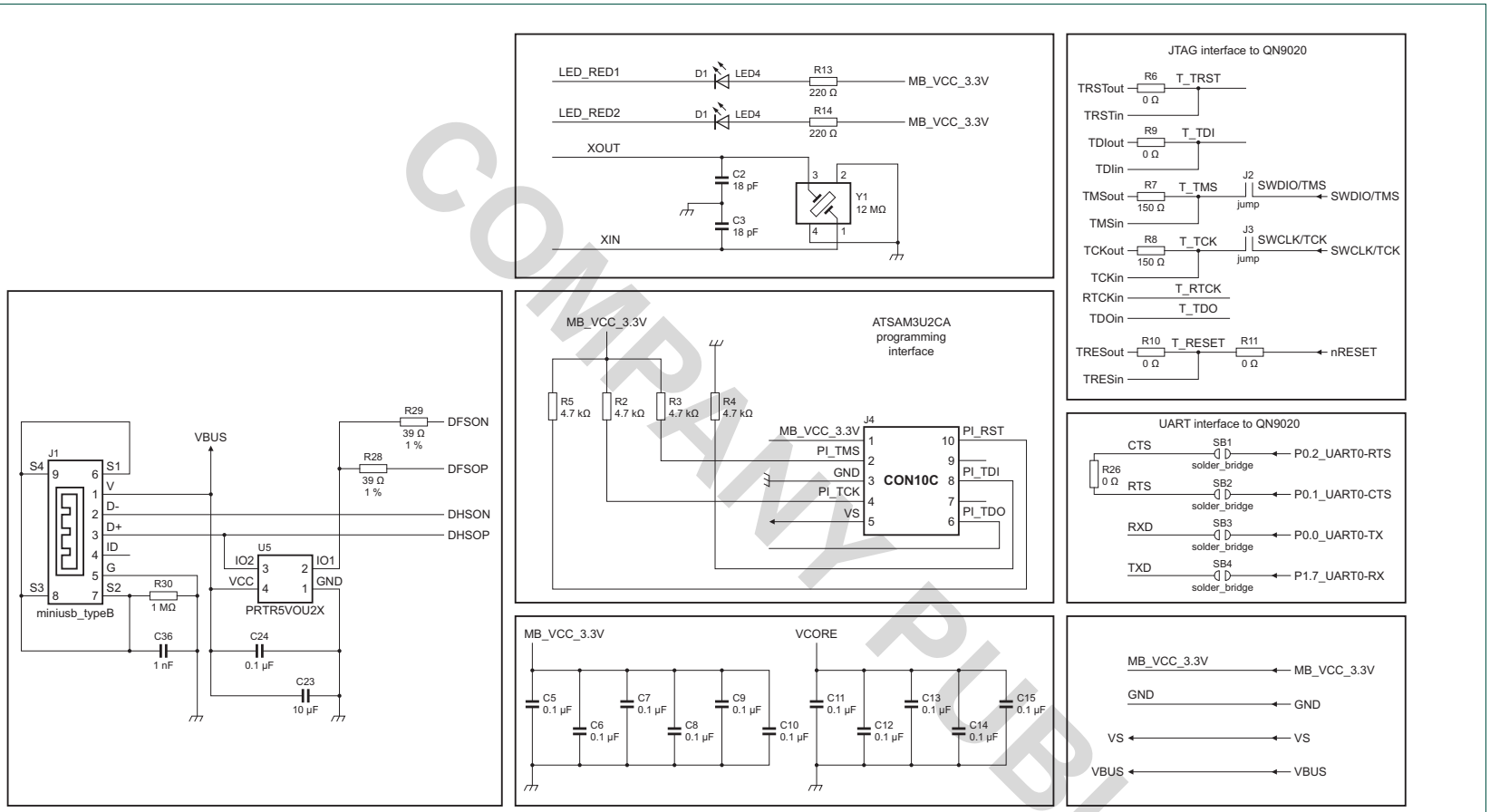


Fig 19. J-Link schematic for all QN9020 mini DK versions, part II

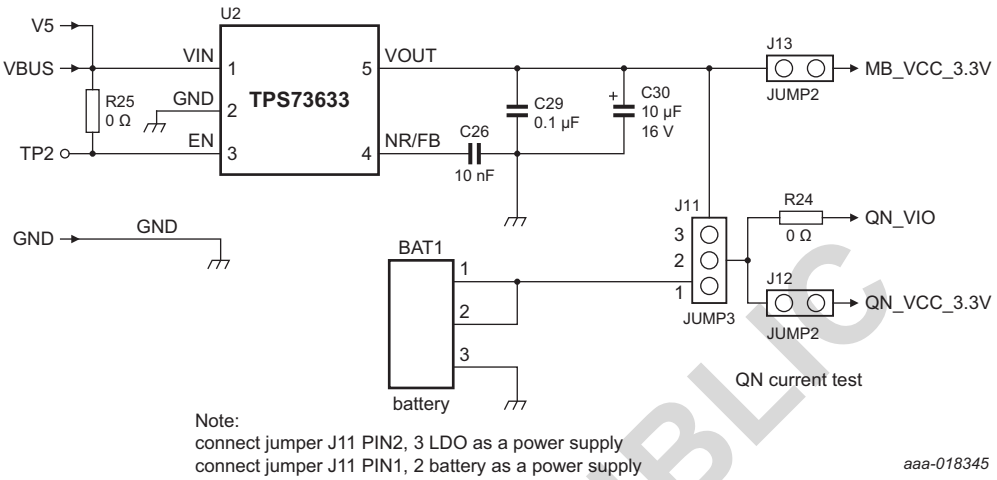


Fig 20. Power schematic for all mini DK versions

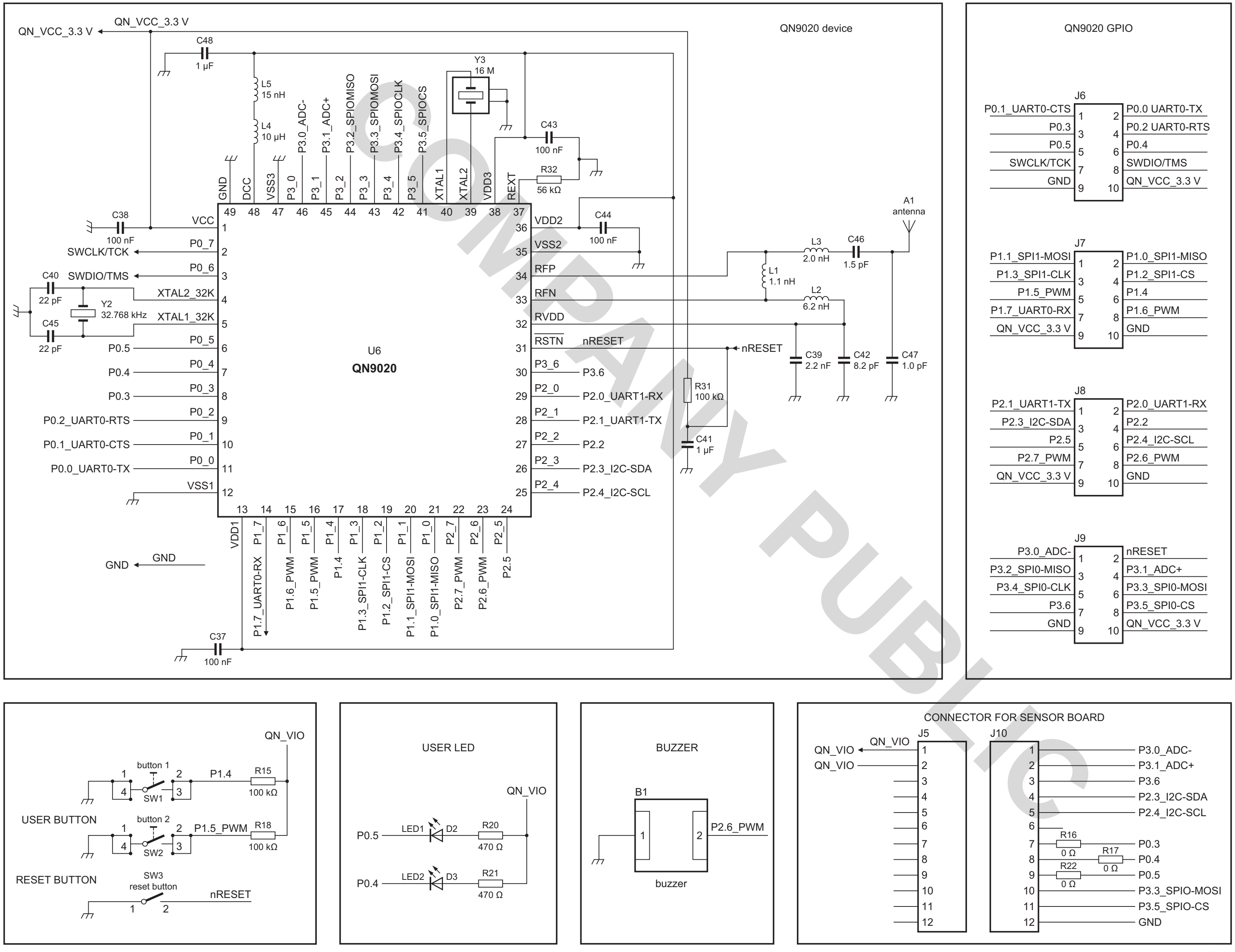


Fig 21. QN9020 schematic in QN9020 mini DK board V7 and below

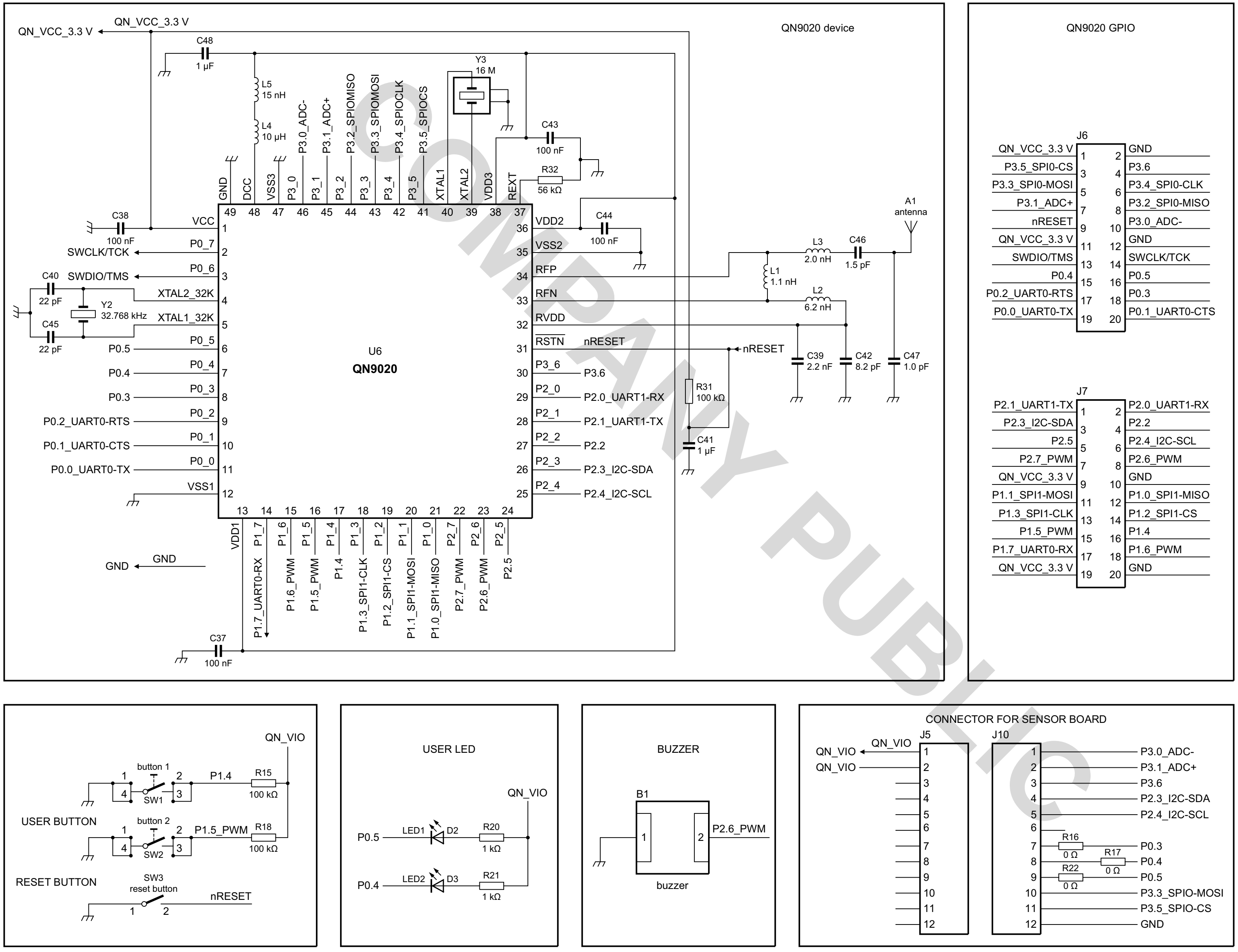


Fig 22. QN9020 schematic in QN9020 mini DK board V8

5.2 PCB layout

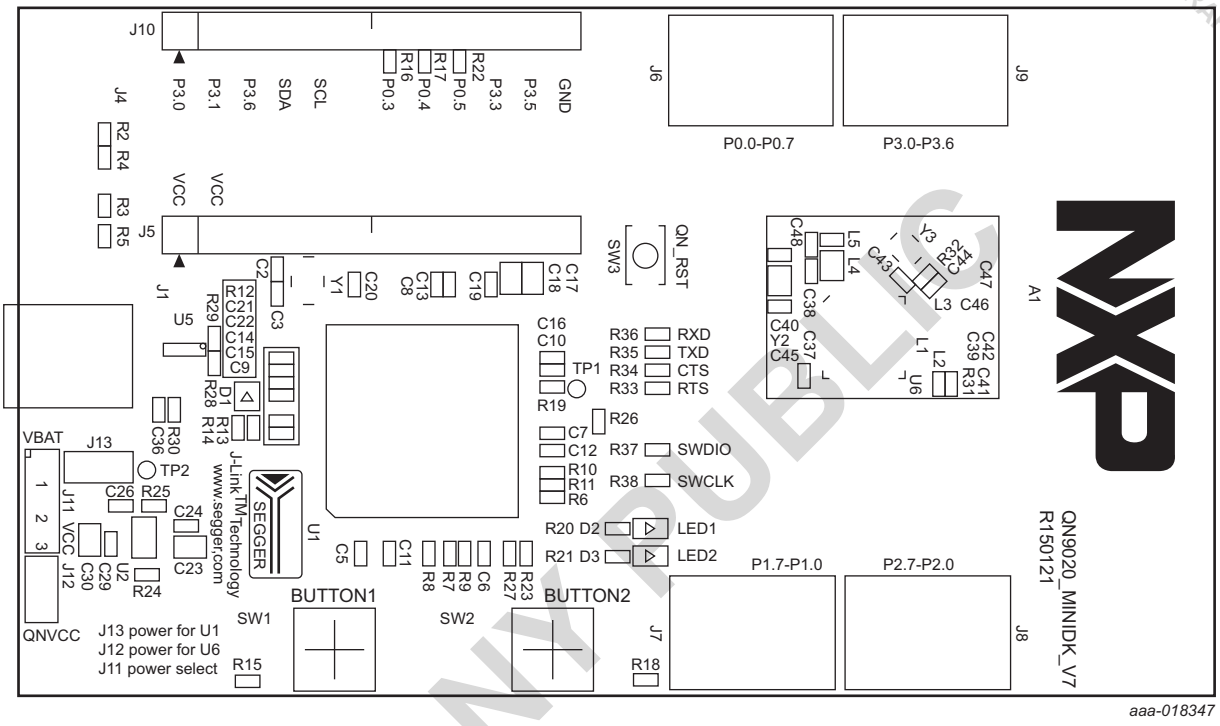
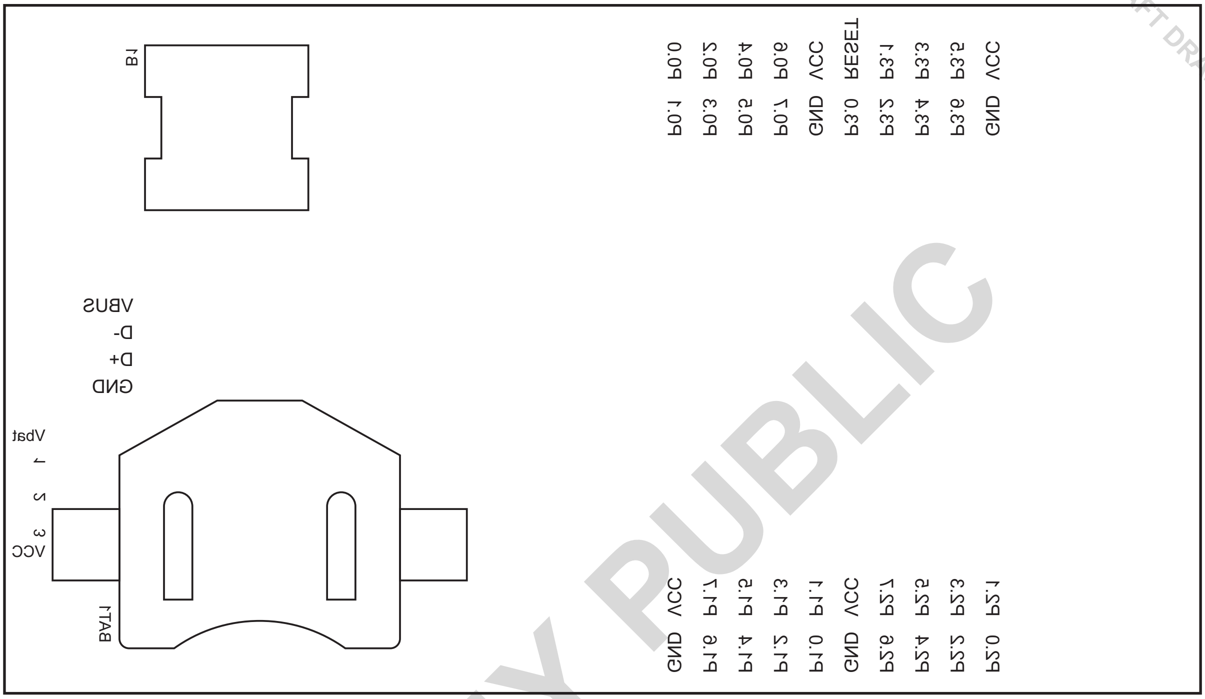


Fig 23. Silk screen top



aaa-018348

Fig 24. Silk screen bottom

6. Abbreviations

Table 3. Abbreviations

Acronym	Description
UART	Universal Asynchronous Receiver Transmitter
DK	Development Kit
LDO	Low DropOut
SWD	Serial Wire Debug
PCB	Printed-Circuit Board
BLE	Bluetooth Low Energy
MCU	MicroController Unit
GPIO	General Purpose Input Output
ISP	In System Programming
USB	Universal Serial Bus

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8. Tables

9. Figures

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