# UM10895

## QN9020 mini DK user guide

**Rev. 2 — 24 May 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 | 20160524 | second release. Modifications:<br>• Section 1.2 “Additional resource” updated.<br>• Figure 5 updated.<br>• Section 2.6 “GPIO interface” updated.<br>• Section 3.1 “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

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# 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.


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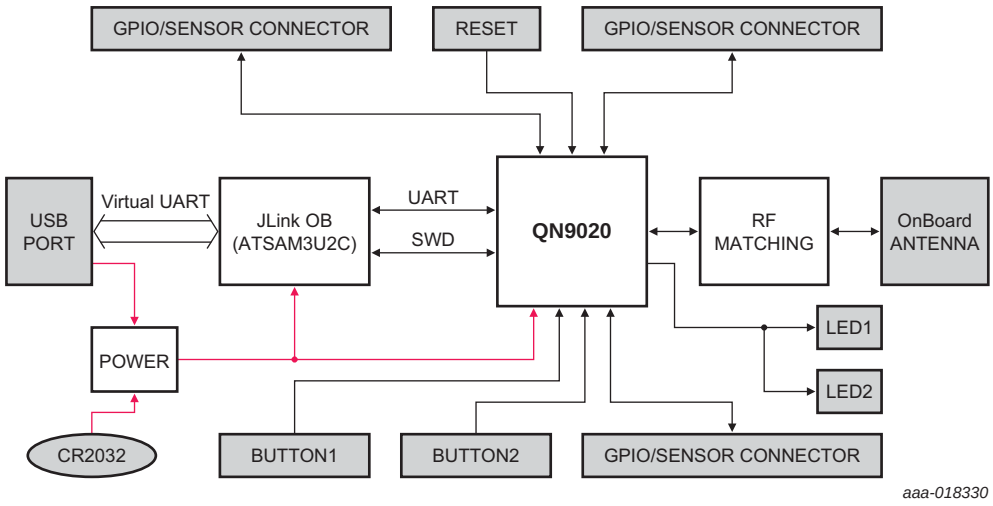


**Fig 1. The QN9020 functional diagram**

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.

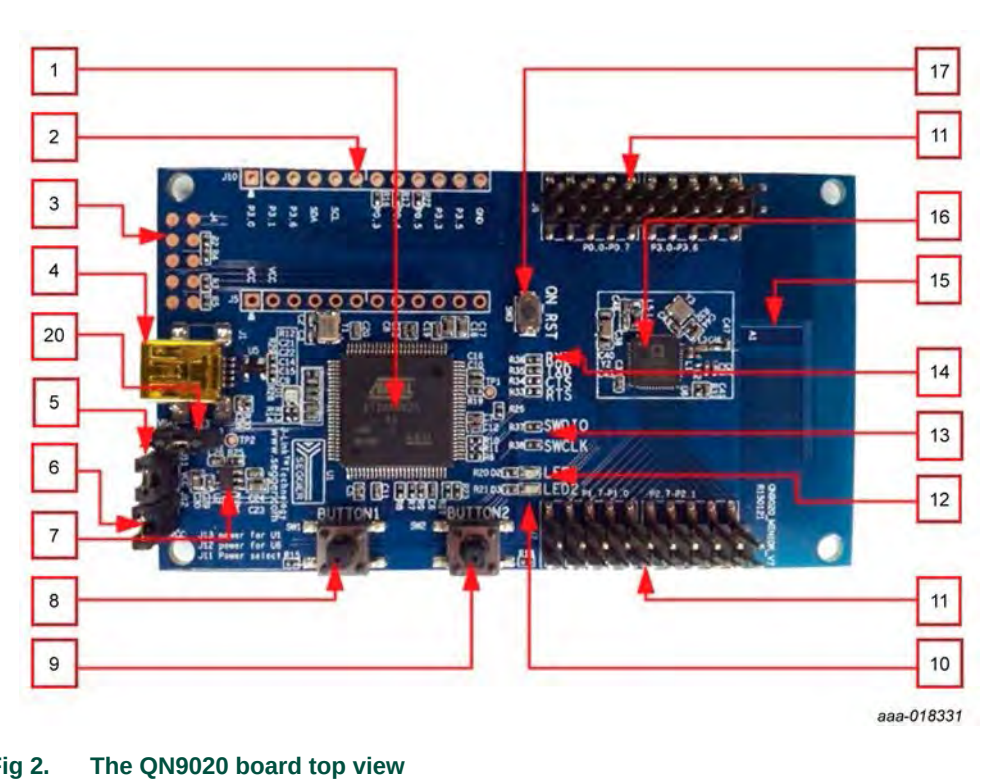


**Fig 2. The QN9020 board top view**


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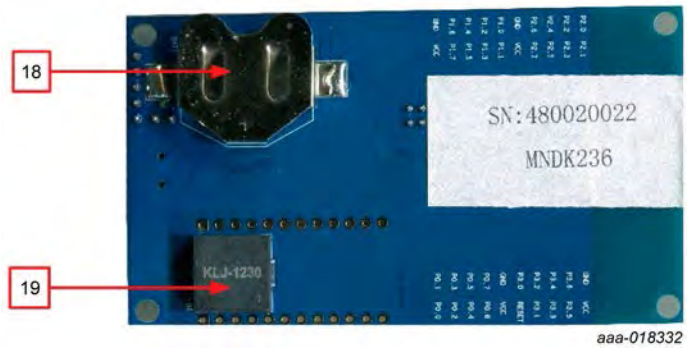


**Fig 3. The QN9020 board bottom view**

**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 |


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## 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.

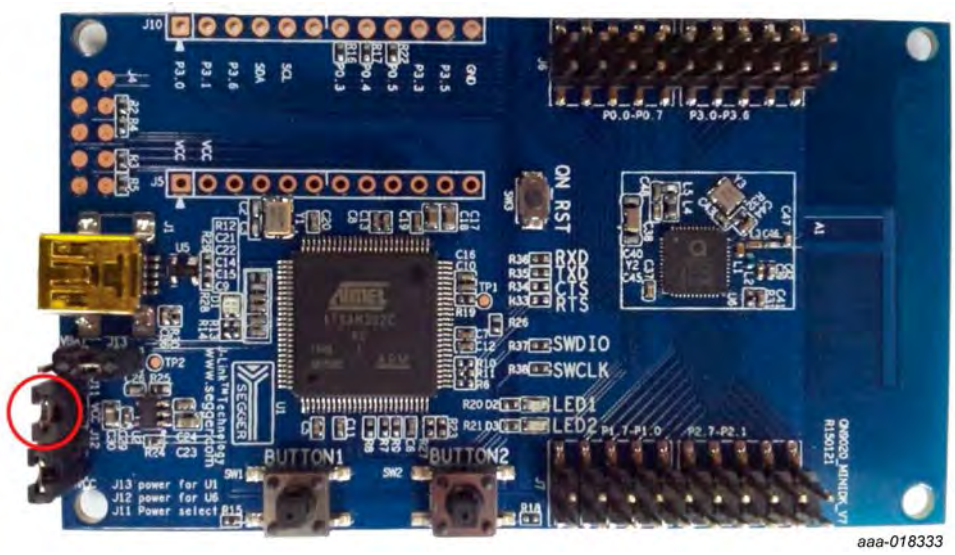


**Fig 4. Connecting jumper J11 pin 2 and pin 3 to select USB as power supply**

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


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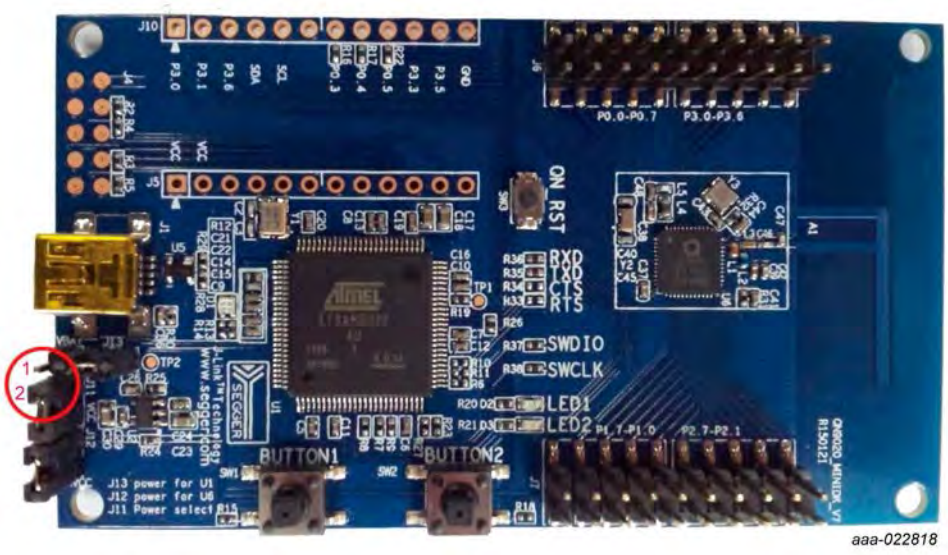


**Fig 5. Connecting jumper J11 Pin1 and Pin 2 to select CR2032 coin cell as power supply**

## 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.

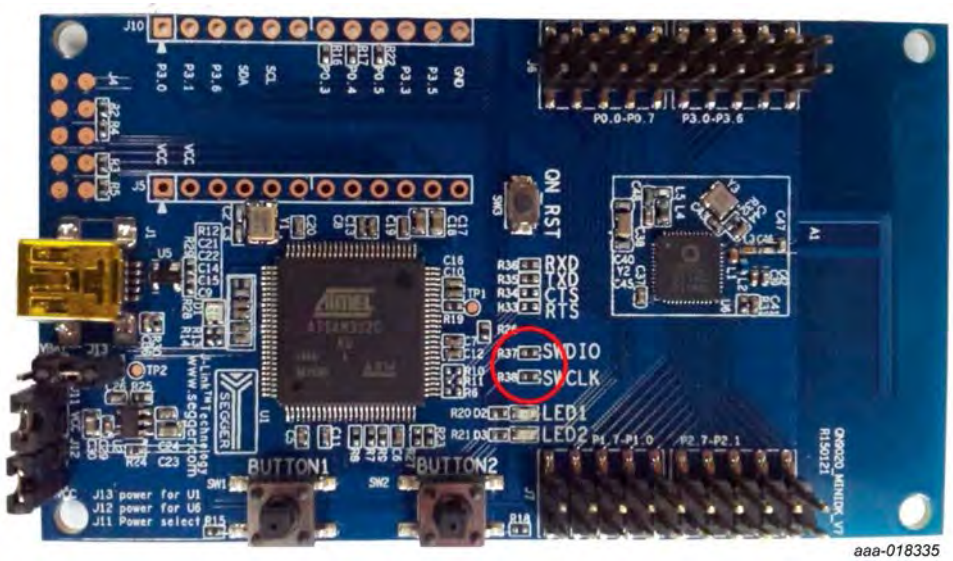


**Fig 6. Connect R37, R38**


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

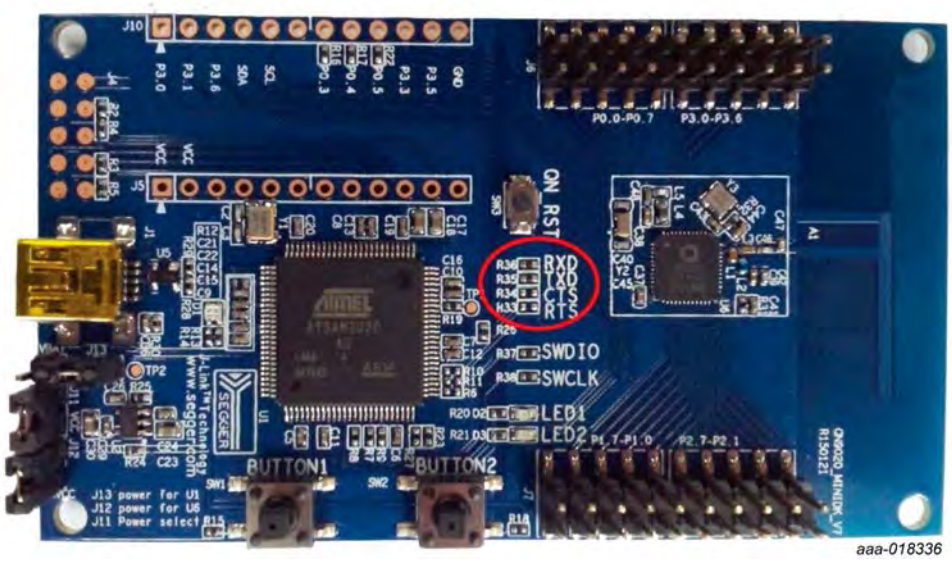


**Fig 7. Short R35, R36**

## 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.

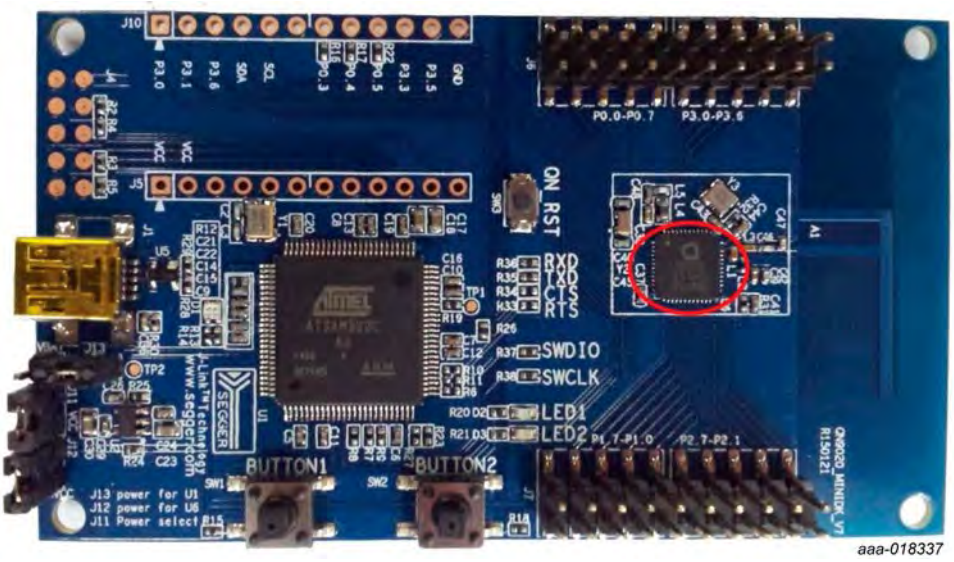


**Fig 8. The QN9020 device**


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## 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.

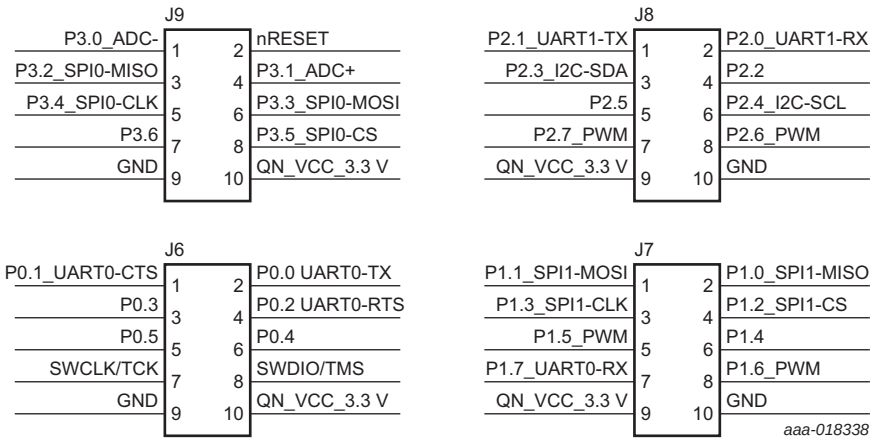


**Fig 9. QN9020 version V7 GPIO connections**

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

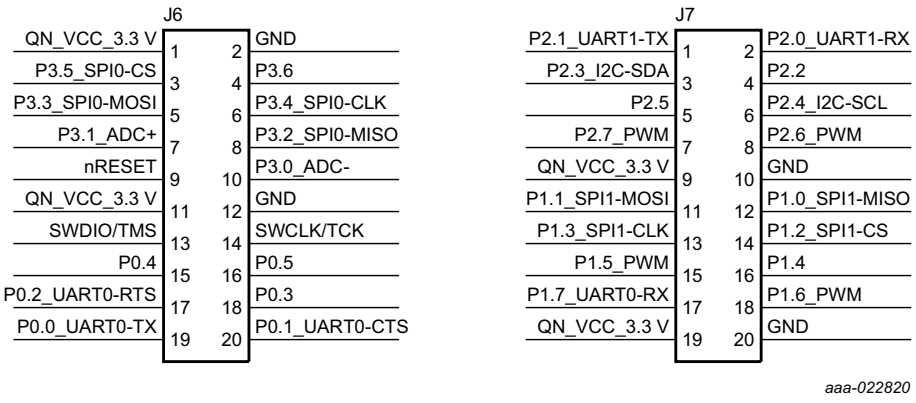


**Fig 10. QN9020 version V8 GPIO connections**

## 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.


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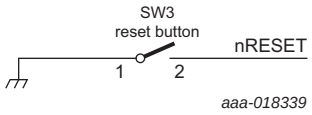


**Fig 11. QN9020 reset**

## 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.

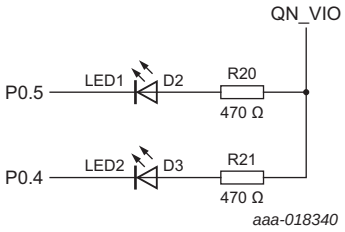


**Fig 12. LED circuit**

## 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.

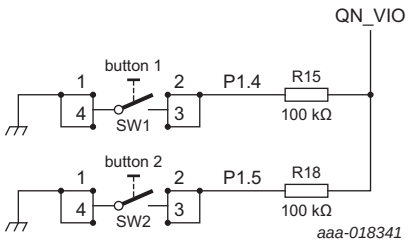


**Fig 13. Button circuit**


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## 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.

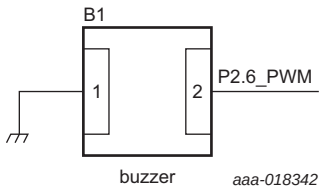


**Fig 14. Piezo buzzer circuit**

## 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.

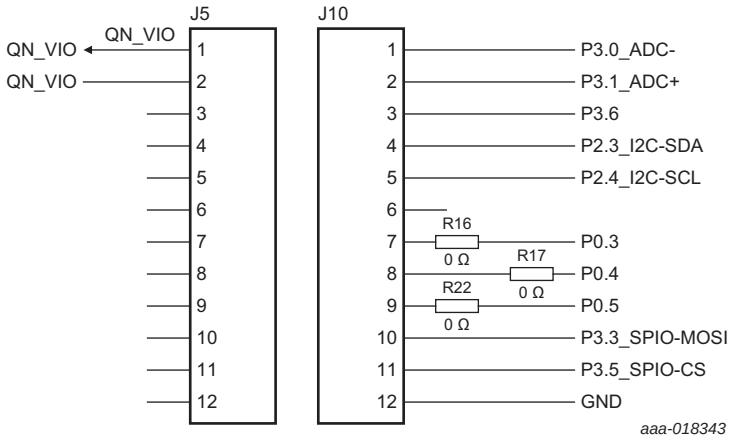


**Fig 15. Connecting the sensor board**

## 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.


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# 3. Appendix - Schematics and PCB layout

## 3.1 Schematics for QN9020 mini DK board

QN9020 mini DK board schematics have three parts: J-Link, power and QN9020. Figure 16, Figure 17 and Figure 18 are the same for all versions. The QN9020 schematic in version V7 is shown in Figure 19. In version V8, it is shown in Figure 20.

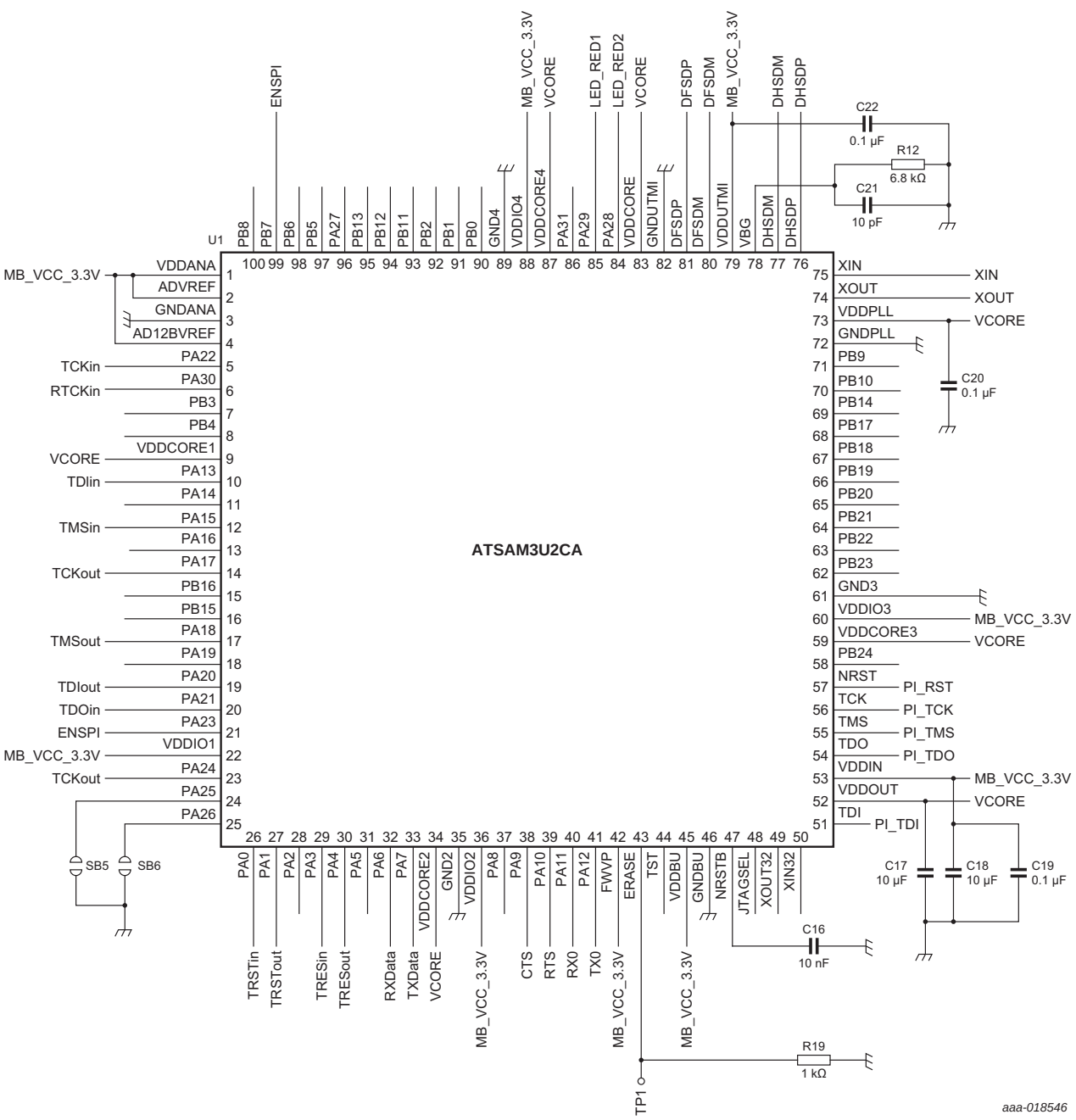


**Fig 16. J-Link schematic for all QN9020 mini DK versions, part I**


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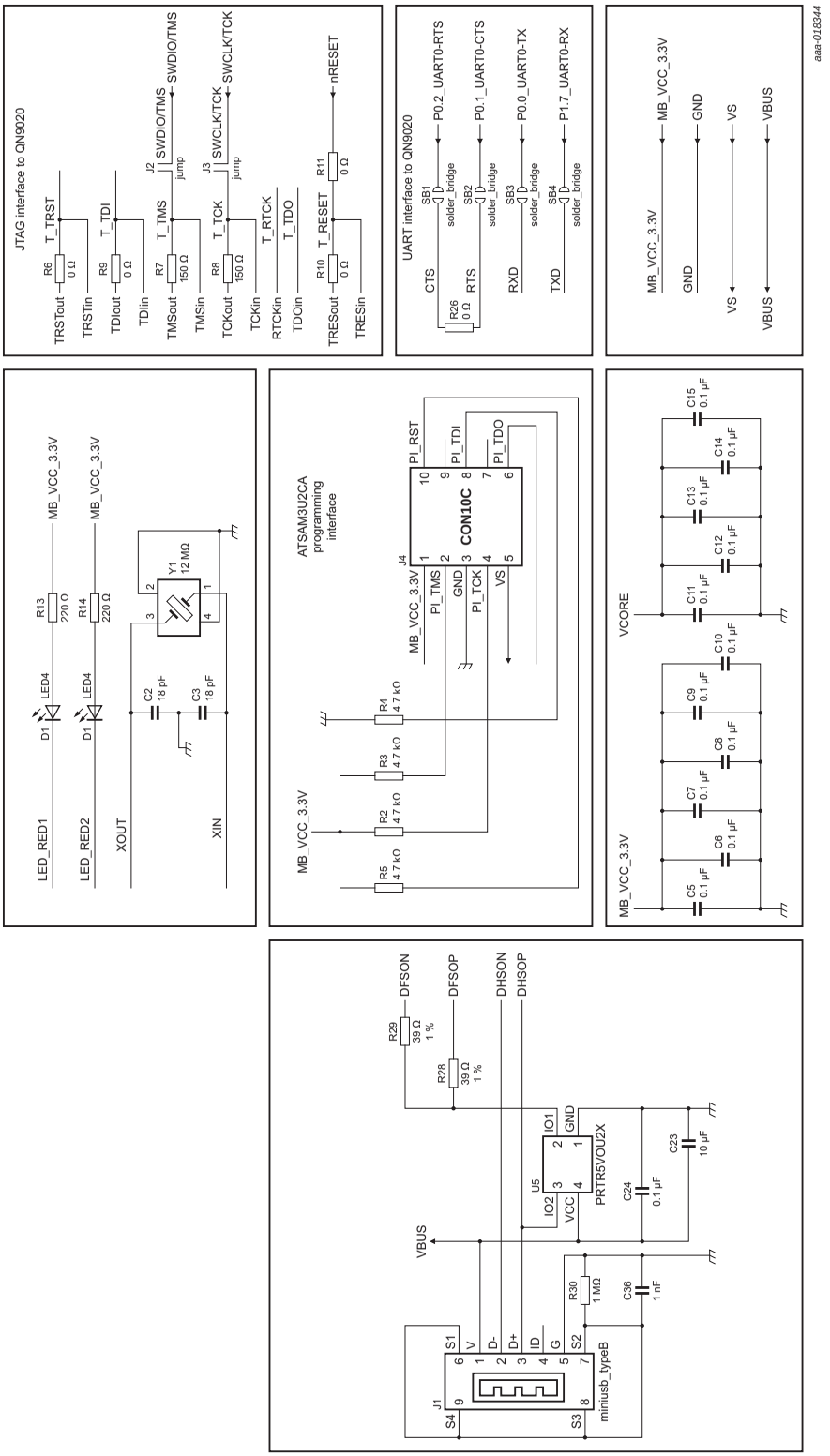


**Fig 17. J-Link schematic for all QN9020 mini DK versions, part II**



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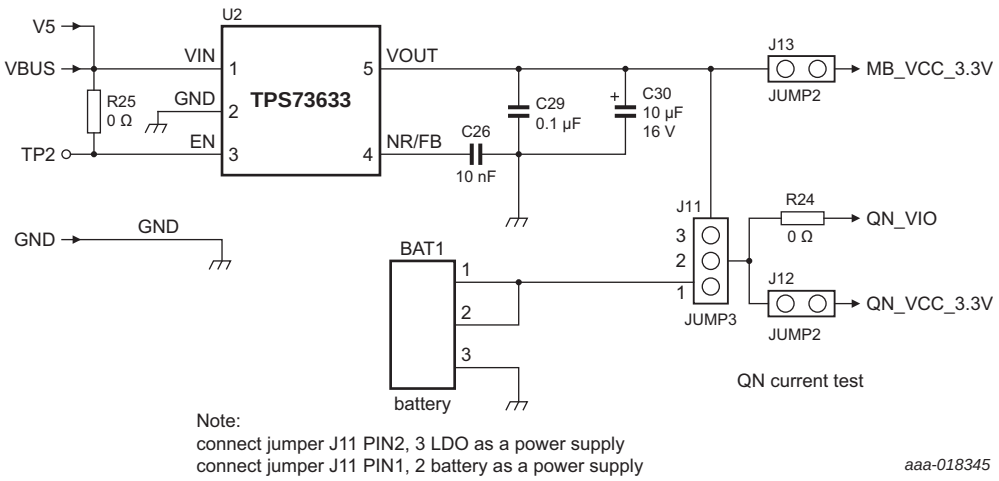


**Fig 18. Power schematic for all mini DK versions**


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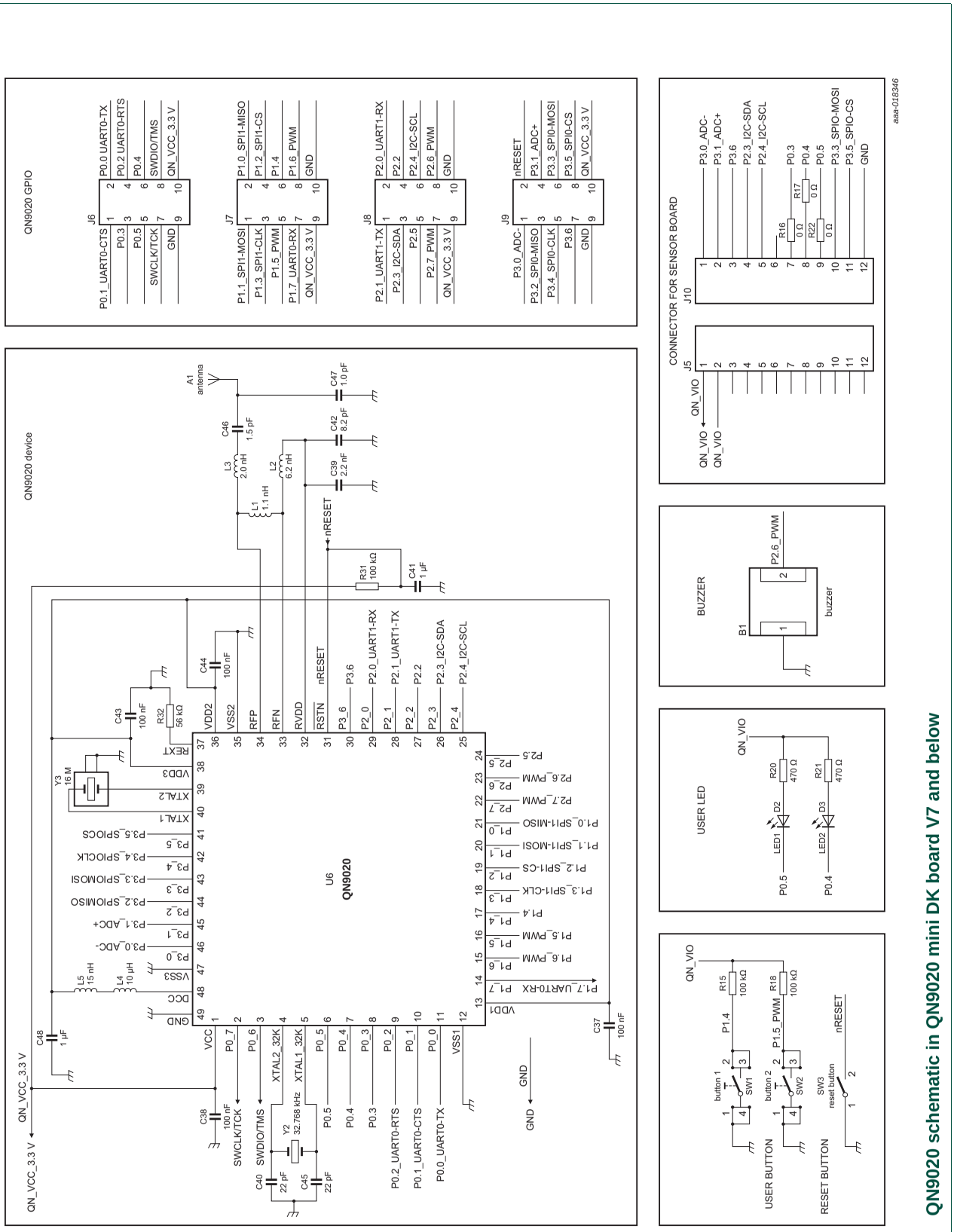


**Fig 19. QN9020 schematic in QN9020 mini DK board V7 and below**



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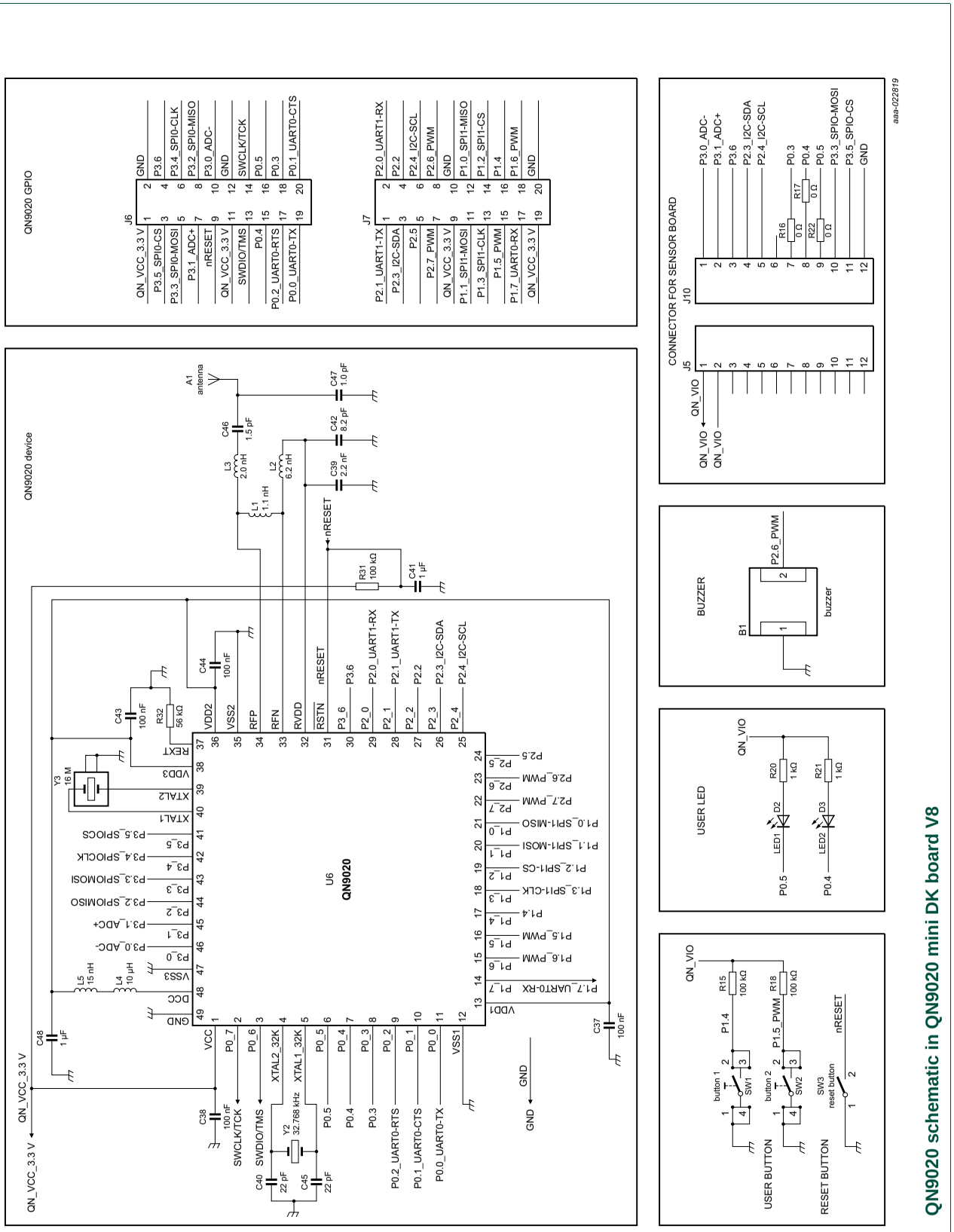


Fig 20. QN9020 schematic in QN9020 mini DK board V8



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## 3.2 PCB layout

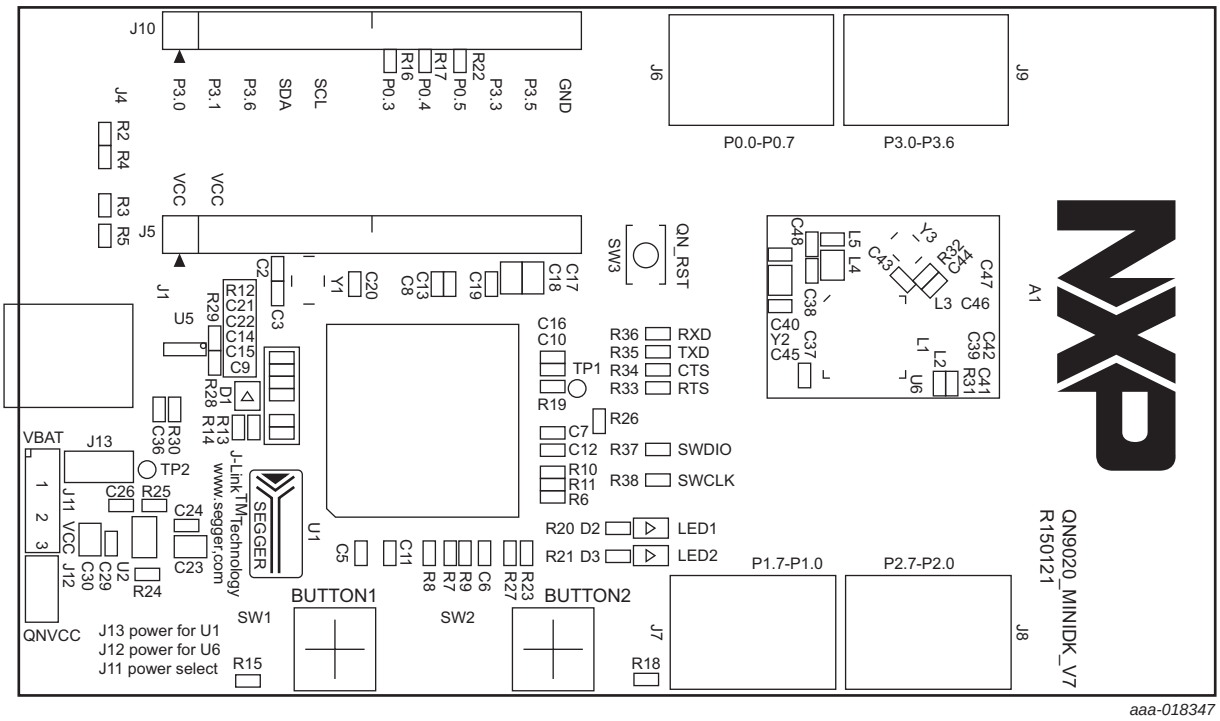


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**Fig 21. Silk screen top**


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**Fig 22. Silk screen bottom**

# 4. 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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