

UM11184

QN9080-001-M17 DK User's Guide

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UM11184

Document information

Info	Content
Keywords	QN9080-001-M17 DK, QN9080-001-M17, BLE.
Abstract	This document is an introduction to the QN9080-001-M17 DK board.



1. Introduction

The QN9080-001-M17 DK board is designed to ease the evaluation of the chip's functions and performance on customer side to make it easy to control, connect, and debug the extension hardware and make it easy for the customer to develop and debug firmware.

1.1 Purpose

This document introduces all functions of the QN9080-001-M17 DK board and describes all its parts in detail.

1.2 Kit contents

QN9080-001-M17 DK includes the following:

- ◆ QN9080-001-M17 DK board.
- ◆ QN9080 USB dongle.
- ◆ NFC antenna.
- ◆ USB cable.

2. Hardware description

The QN9080-001-M17 DK board provides easy access to peripherals, such as buttons and LEDs. The board also provides useful interfaces, such as the USB port for UART communication, the CMSIS-DAP debugger, and the standard Arduino and Pmod connector. The USB dongle is a Bluetooth® device powered by QN9080. It acts as a master/slave when communicating with QN9080-001-M17 devices.

2.1 Hardware overview

The QN9080-001-M17 DK board is shown in [Fig 1](#). The detailed information is listed in [Table 1](#).

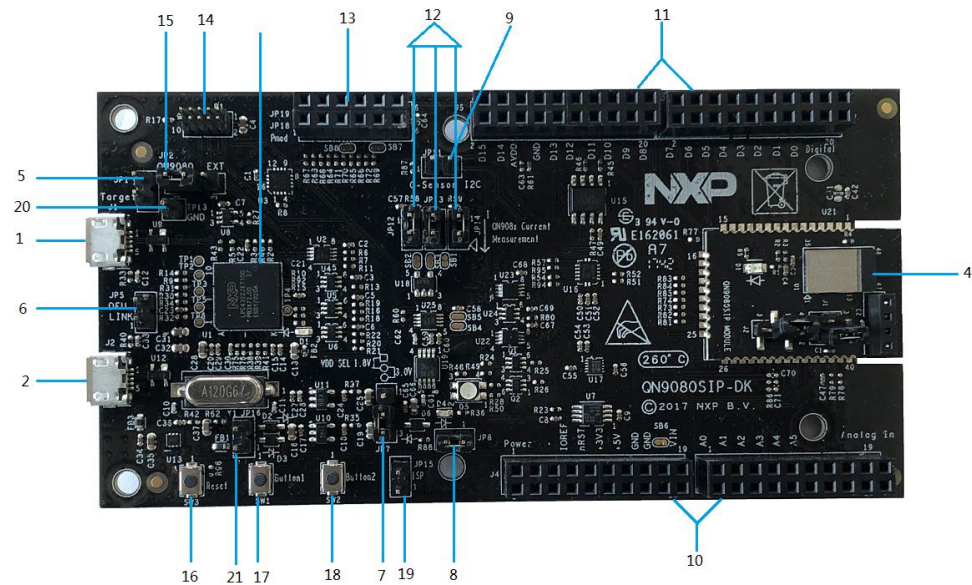


Fig 1. Board overview

Table 1. QN9080-001-M17 DK board's mark information list

Number	Name	Description
1	QN9080-001-M17 USB port	The QN9080-001-M17 USB port provides power supply to the whole board and the USB interface of the QN9080-001-M17 chip.
2	LPC4322 USB port	The LPC4322 USB port provides power supply to the whole board and the USB interface is connected to LPC4322.
3	LPC4322	LPC4322 works as a JTAG/SWD debugger.
4	QN9080-001-M17 module	The QN9080-001-M17 module board.
5	Jumper JP1	This jumper selects the JTAG/SWD debugging target: <ul style="list-style-type: none"> • Open: on-board target (default). • Short: off-board target.
6	Jumper JP5	This jumper selects the LPC4322 working mode: <ul style="list-style-type: none"> • Short: DFU mode enabled. • Open: normal mode (default).

Table 1. QN9080-001-M17 DK board's mark information list

Number	Name	Description
7	Jumper JP7	This jumper selects the QN9080-001-M17 module power supply voltage: <ul style="list-style-type: none"> • 1-2: 1.8 V power supply. • 2-3: 3.0 V power supply (default).
8	Jumper JP8	This jumper selects the transceiver mode to QN9080-001-M17 UART: <ul style="list-style-type: none"> • Short: UART interface enabled (default). • Open: UART interface disabled.
9	Jumper JP11	This jumper selects the transceiver mode to the QN9080-001-M17 I ² C interface: <ul style="list-style-type: none"> • Short: I²C interface enabled (default). • Open: I²C interface disabled.
10	Header J5 and J7	QN9080-001-M17 GPIO for testing and compatible with the Arduino interface.
11	Header J4 and J6	QN9080-001-M17 GPIO for testing and compatible with the Arduino interface.
12	Jumper JP12, JP13, JP14	These jumpers are used for the power consumption test.
13	Header J8	PMod interface connector, compatible with PMod.
14	Debugger connector	Used to offer the JTAG/SWD interfaces to the off-board target.
15	Jumper JP2	This jumper selects the QN9080-001-M17 power supply source: on-board power or EXT power.
16	Button3 SW3	Button3 resets the QN9080-001-M17 chip.
17	Button1 SW1	Button1 is used for user-defined function.
18	Button2 SW2	Button2 is used for user-defined function.
19	Jumper JP15	Jumper used to enable the QN9080-001-M17 ISP function.
20	GND Pin	GND pin used as the test point of ground.
21	Jumper JP16	Jumper used to eliminate the leakage from the USB interface when the DK board is powered by a battery.

2.2 Default jumper settings on the DK board

As shown in [Fig 2](#), the power, JTAG/SWD, UART, and I²C enable jumpers are connected by default. [Table 2](#) and [Table 5](#) show the jumpers' functions and correct connection.

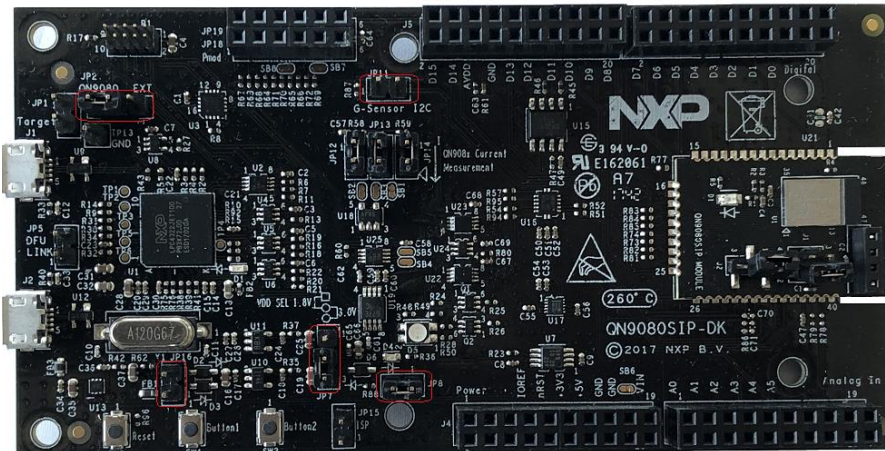


Fig 2. Board jumper default settings

Table 2. QN9080-001-M17 DK board's default jumper settings

Jumper	Jumper setting	Function
JP2	Pin 1, 2 shorted	QN9080-001-M17's on-board target.
JP7	Pin 2, 3 shorted	QN9080-001-M17's power (3 V).
JP8	Pin 1, 2 shorted	UART path enabled.
JP11	Pin 1, 2 shorted	I ² C path enabled.
JP16	Pin 1, 2 shorted	When the DK board is powered by a battery, leave it open.
J1 (on-module board)	Pin 1, 2 shorted	Internal NTAG powered on.
J2 (on-module board)	Pin 1, 2 shorted	When the module board is powered from the main board.

2.3 LPC4322 debugger

The LPC4322 debugger supports both the CMSIS-DAP (default) and the J-Link interface. It provides both the SWD/JTAG and UART interfaces. See section 4.4 in document [UM11097](#) on how to change the debug interface to J-Link and the other way round. You may download or update the firmware to the QN9080-001-M17 device using UART or JTAG/SWD interfaces. There is a debugger connector to program and debug an off-board target (shown in [Fig 3](#)).

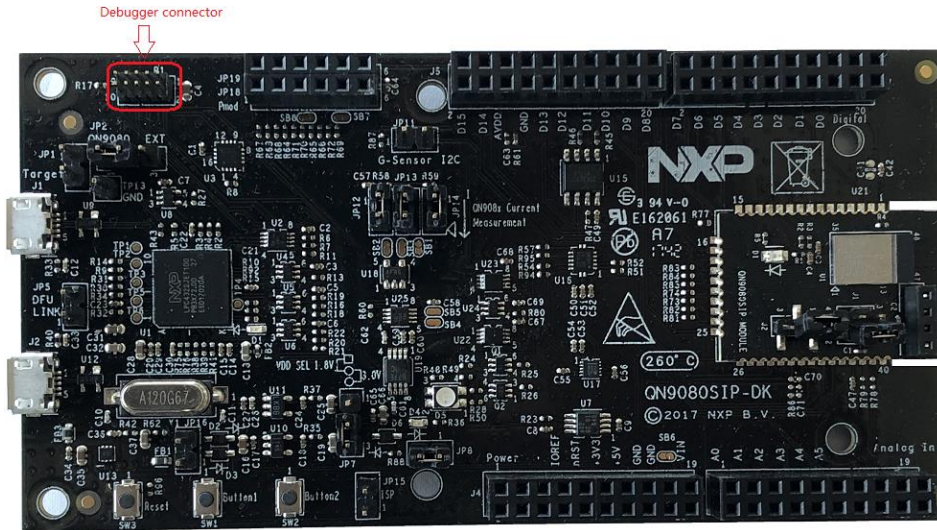


Fig 3. Debugger connector

2.4 QN9080-001-M17 module

The QN9080-001-M17 module integrates the BLE radio, controller, protocol stack, BLE antenna, NTAG, clocks, and profile software on a single chip, which provides a flexible and easy usage of the BLE SoC solution. It includes a high-performance MCU (32-bit Arm® Cortex®-M4F), on-chip memory, and peripherals for users to develop a truly single-chip wireless MCU solution.

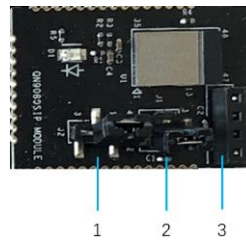


Fig 4. Module board details

Table 3. QN9080-001-M17 module board's mark information list

Number	Name	Description
1	Jumper J2	Jumper used to select the power NTAG inside.
2	Jumper J1	Jumper used to select the power for QN9080-001-M17.
3	Connector J4	Connector used to connect the NTAG antenna.

Table 4. QN9080-001-M17 DK module's default jumper settings

Jumper	Jumper setting	Function
J1	Pin 1, 2 shorted	The NTAG inside shares the same power supply with the QN9080 inside.
J2	Pin 1, 2 shorted	QN9080-001-M17 is powered by an on-board power supply.

The QN9080-001-M17 module is shown in Fig 5.

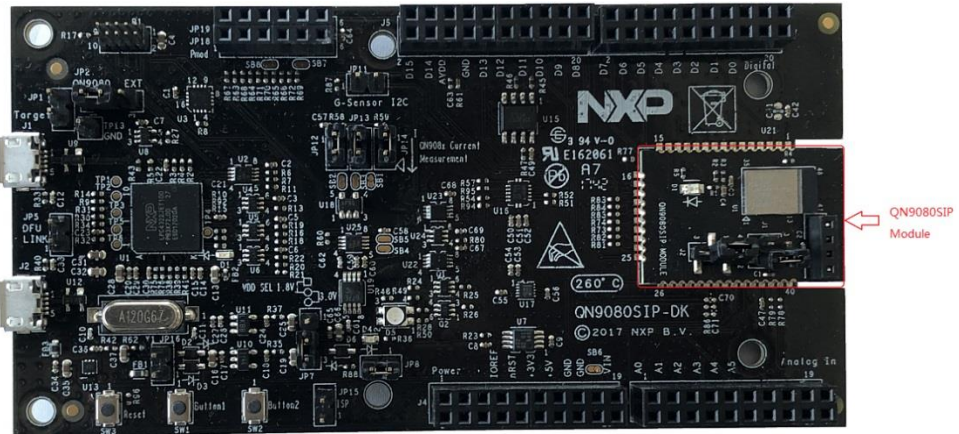


Fig 5. QN9080-001-M17 module board

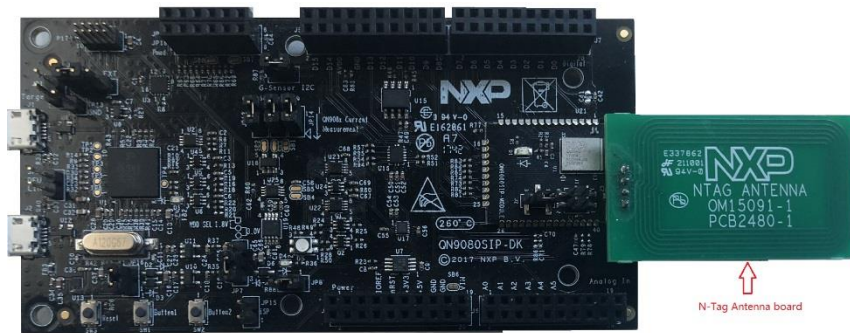


Fig 6. N-Tag antenna board

2.5 GPIO and Arduino interfaces

On the QN9080-001-M17 DK board, the J4, J5, J6, and J7 connectors all provide GPIO connection outputs. The board is also compatible with the Arduino board interface. The interface schematic is shown in Fig 7.

Arduino Shield receptacles R4

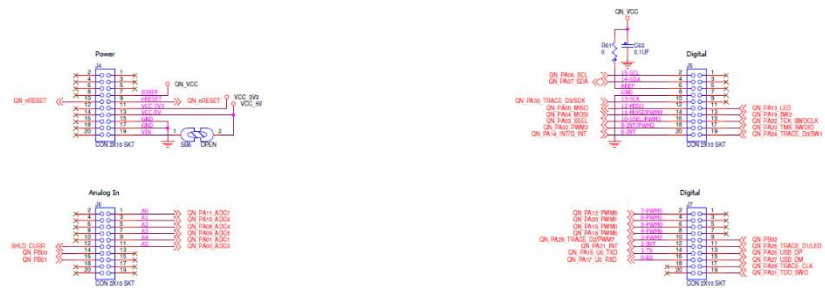


Fig 7. QN9080-001-M17 DK board GPIO and Arduino interface

2.6 QN9080-001-M17 reset button

The reset button provides a hardware reset to the QN9080-001-M17 device, as shown in [Fig 8](#).

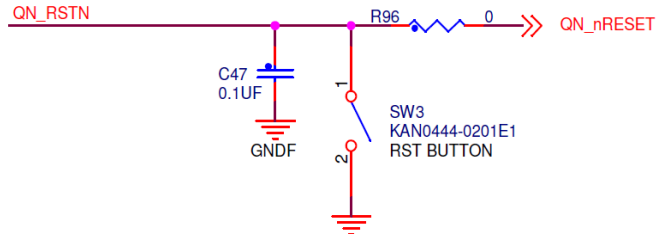


Fig 8. Reset button

2.7 ISP mode jumper

JP15 is the ISP mode jumper used to set the QN9080-001-M17 mode. When the jumper is shorted, the PB02 chip mode pin is connected to the GND and this function is enabled. When the jumper is open, the ISP mode function is disabled, as shown in [Fig 9](#).

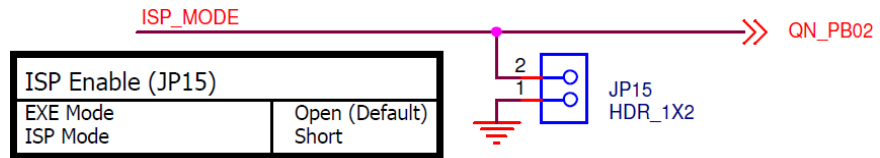


Fig 9. Chip mode jumper

2.8 SWD/JTAG interface

The board provides a SWD/JTAG interface to be used by an external debugger, as shown in [Fig 10](#).

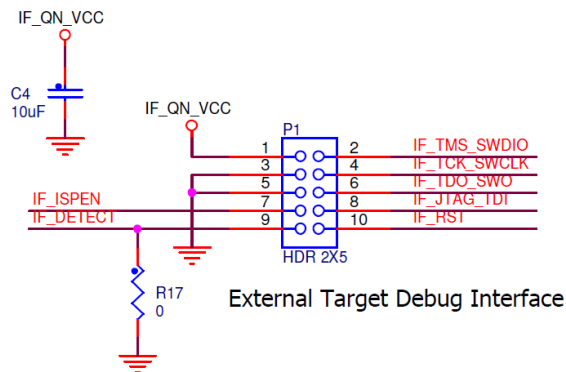


Fig 10. Debugger interface

2.9 Buttons

As shown in [Fig 11](#), the DK board offers three buttons. When using the SW1 and SW2 buttons, the GPIO must be configured as the input. The logic LOW input is applied to the GPIO when a button is pressed.

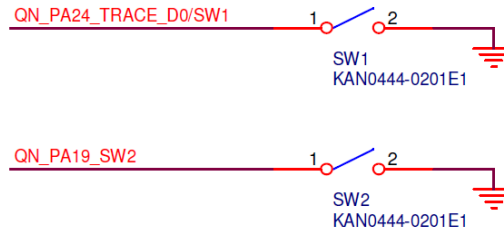


Fig 11. Buttons

The SW3 button is used to reset the QN9080-001-M17 chip. Press the button to reset the QN9080-001-M17.

2.10 LED

The board offers a 3-color RGB LED. The connections are shown in [Fig 12](#). The LED lights up when the corresponding GPIO outputs switch to the logic high level. The GPIO control pins are QN_PA13, QN_PA25, and QN_PA31. The GPIO QN_PA13 can work in the PWM out mode. Therefore, the brightness of the LED can change with the PWM pulse width.

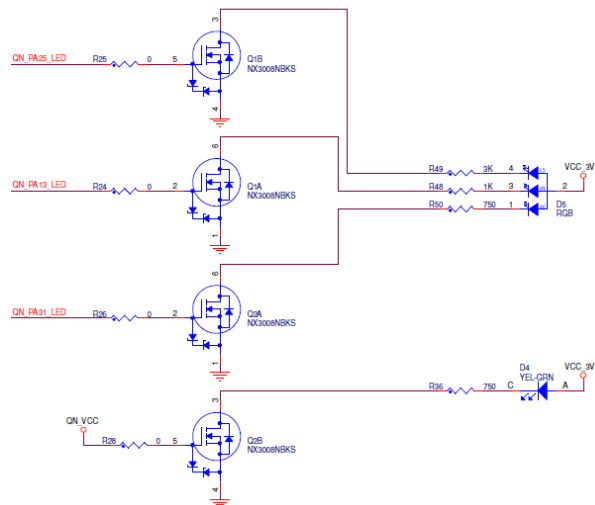


Fig 12. LED

3. DK board application function

3.1 CMSIS-DAP interface

The QN9080-001-M17 DK board offers the JTAG/SWD interface either to on-board or off-board QN9080-001-M17 targets. It also provides the USB-to-UART interface for QN9080-001-M17.

To change to the CMSIS-DAP interface, see Chapter 4.4 in document [UM11097](#).

3.1.1 CMSIS-DAP to on-board QN9080-001-M17

When programming or debugging a QN9080-001-M17 device using the CMSIS-DAP interface, JP1 and JP2 must be configured according to [Table 5](#).

Table 5. On-board debugger jumper setting

JP1	Open, CMSIS-DAP target is on the QN9080-001-M17 board.
JP2	Short pin 1, 2, QN9080-001-M17 power enable.

When downloading firmware to QN9080-001-M17 with the ISP mode, enable the UART path and set the chip mode pin to ground. The jumper setting is shown in [Table 6](#).

Table 6. ISP mode jumper setting

JP8	Short, UART path enable.
JP15	Short, ISP mode enable.

The ISP download operation flow is shown in [Fig 13](#).



Fig 13. ISP download operation flow

After the ISP download operation, remove the jumper cap on jumper JP15 and leave the JP15 open. Then, the QN9080-001-M17 can go into the normal mode normally.

3.1.2 CMSIS-DAP to off-board target

When using the QN9080-001-M17 DK board to program or debug off-board targets using the JTAG/SWD interface, JP1 and JP2 must be configured according to [Table 7](#).

Table 7. Off-board jumper setting

JP1	Short, CMSIS-DAP target is off-board target.
JP2	Short pin 2,3, 3 V power disable on JTAG/SWD connector.

3.2 Current consumption test

The QN9080-001-M17 DK board provides two ways to measure the QN9080-001-M17 chip current consumption. One way is to measure the current by the on-board precise resistor used for the I-to-V conversion. The small voltage signal is amplified by the operation amplifier and fed to the ADC. Then, it can be calculated by LPC4322 and shown in the MCUXpresso IDE. Another way is to measure the current by an external ammeter on jumper JP14.

On the QN9080SIP module board, remove the jumper on J1 and short Pin1 and Pin2 of the J2 to measure the QN9080 current draw only.

3.2.1 Current test using LPC4322

The QN9080-001-M17 DK board has an on-board current measurement circuit consisting of the MAX9634T (U18) current monitor chip and the 12-bit ADC (ADC122S021, U19) with 12-bit sampling from 50 ksps to 200 ksps. The on-board MAX9634T current monitor measures the voltage across the QN9080-001-M17 VCC V-sense resistors; either 8.24 Ω or 4.12 Ω if JP13 is installed. MAX9634 multiplies the sense voltage 25 times to provide a voltage range suitable for the ADC to measure.

A 2-input analog mux is used to select the channel to be measured; either the QN9080-001-M17 or the devices from the expansion board on the DK extension connectors. The current measurement circuit is controlled by the Link2 processor and is not user-programmable. The power-measurement utilities with this feature are available only after installing the MCUXpresso IDE.

Due to the input offset voltage variations in MAX9634, the current-measurement circuit is not recommended for measuring currents below 150 μA.

The QN9080-001-M17 current can be measured by the voltage across a sense resistor in series with the supply. The voltage across a series 4.12-Ω resistor with the target QN9080-001-M17 VCC can be manually measured at JP12 on the PCB. Use the Ohm's law to calculate the current (QN9080-001-M17 current = measured voltage / 4.12 Ω). For example, if the measured voltage is 10 mV, then $10e-3 / 4.12 \Omega = 2.44 \text{ mA}$. Note that the current consumed by MAX9634 used in the on-board current measurement is included in the voltage measured on this resistor. The detailed schematic is shown in [Fig 14](#).

QN908x Consumption|Current Test

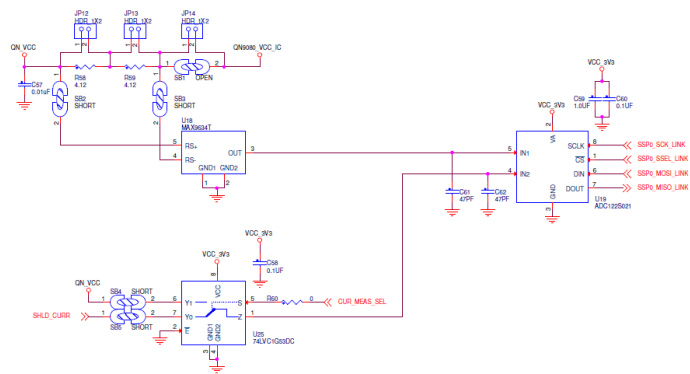


Fig 14. Current test using the LPC processor

When performing the current test using the Link2 processor, jumpers JP12, JP13, and JP14 must be set according to [Table 8](#).

Table 8. Current test jumper setting

JP12	Open when used for the Link2 processor current test.
JP13	Open when used for the Link2 processor current test.
JP14	Short when no digital ammeter in series.

3.2.2 Current test using a digital ammeter

When performing the current test using an external digital ammeter, jumpers JP12, JP13, and JP14 must be set according to [Table 9](#). Use a jumper cap to short the pins. The schematic is shown in [Fig 15](#).

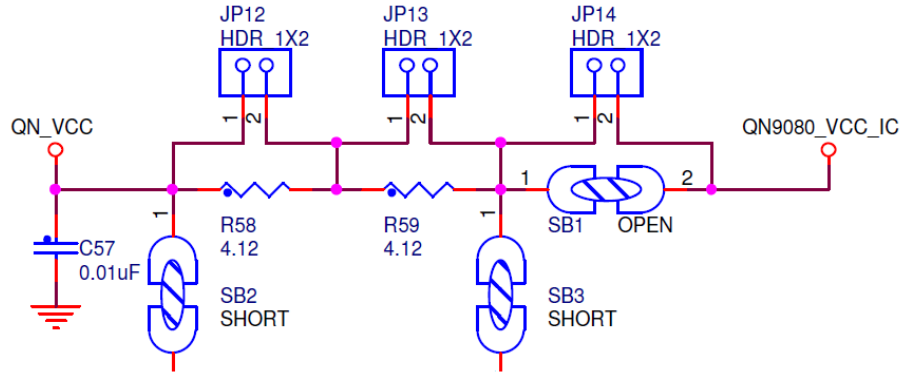


Fig 15. Current test using an ammeter

When performing the current test using an ammeter, jumpers JP12, JP13, and JP14 must be set according to [Table 9](#).

Table 9. Current test jumper setting

JP12	Short when used for Ammeter current test.
JP13	Short when used for Ammeter current test.
JP14	Need an ammeter in series.

3.2.3 Current test using a DC power analyzer

Measure the current using a DC power analyzer in these two ways: one way is to use the DC power analyzer as an ammeter that shares the same settings as the ammeter test, and the other way is to use the DC power analyzer as the power supply for the DUT.

In this case, the QN9080-001-M17 module is powered by the DC power analyzer. The QN_VCC power pin is on jumper JP14, where a triangle symbol indicates the pin. The GND pin near jumper TP13 can be also used as the power ground.

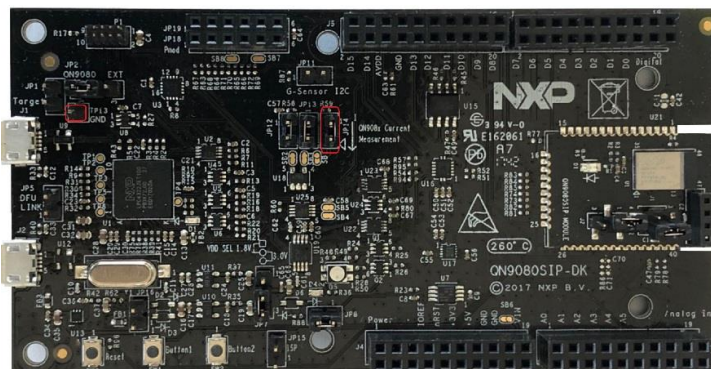


Fig 16. QN_VCC power pin

4. QN9080 USB dongle

4.1 Dongle hardware



Fig 17. Dongle hardware

The QN9080 USB dongle works together with the Connectivity QTool and behaves either as a master or a slave when talking to the QN9080-001-M17 DK (or other devices). As shown in Fig 18, the USB dongle receives commands from the Connectivity QTool via a virtual COM port, which initializes the QN9080 dongle either as a master device or a slave device. All tests can be performed by the Connectivity QTool after the initialization.

To update the firmware of the QN9080 USB dongle, see Chapter 4.3 in document [UM11097](#).

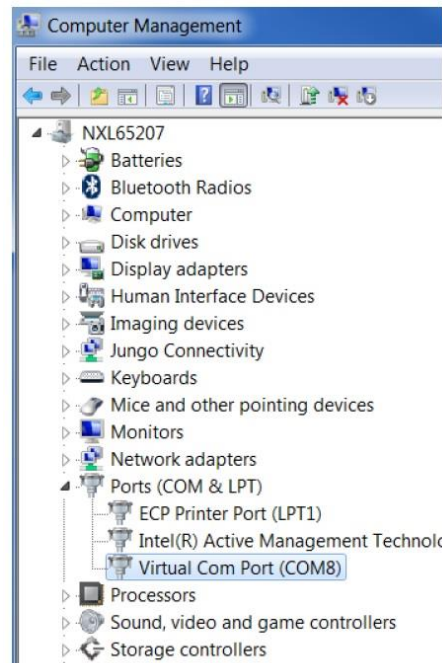


Fig 18. Connection as virtual COM port

4.2 Dongle connection

The QN9080 USB dongle is a USB-interfaced device with the QN9080 built in. With the driver and SDK installed on your computer (See Chapter 4.2 in document [UM11097](#)), use the Connectivity QTool in the SDK to control the QN9080 in the dongle to work as a central/peripheral device. The DK board is supplied from the USB port and works as a peripheral/central device. The dongle connection is illustrated in Fig 18. See the Connectivity QTool user manual for information about the Connectivity QTool usage.

5. Appendix

5.1 Schematics

5.1.1 QN9080-001-M17 DK main board

The QN9080-001-M17 DK board schematic has five parts: power, LPC processor, QN9080-001-M17-BLE, QN9080-001-M17-function, and Arduino interface.

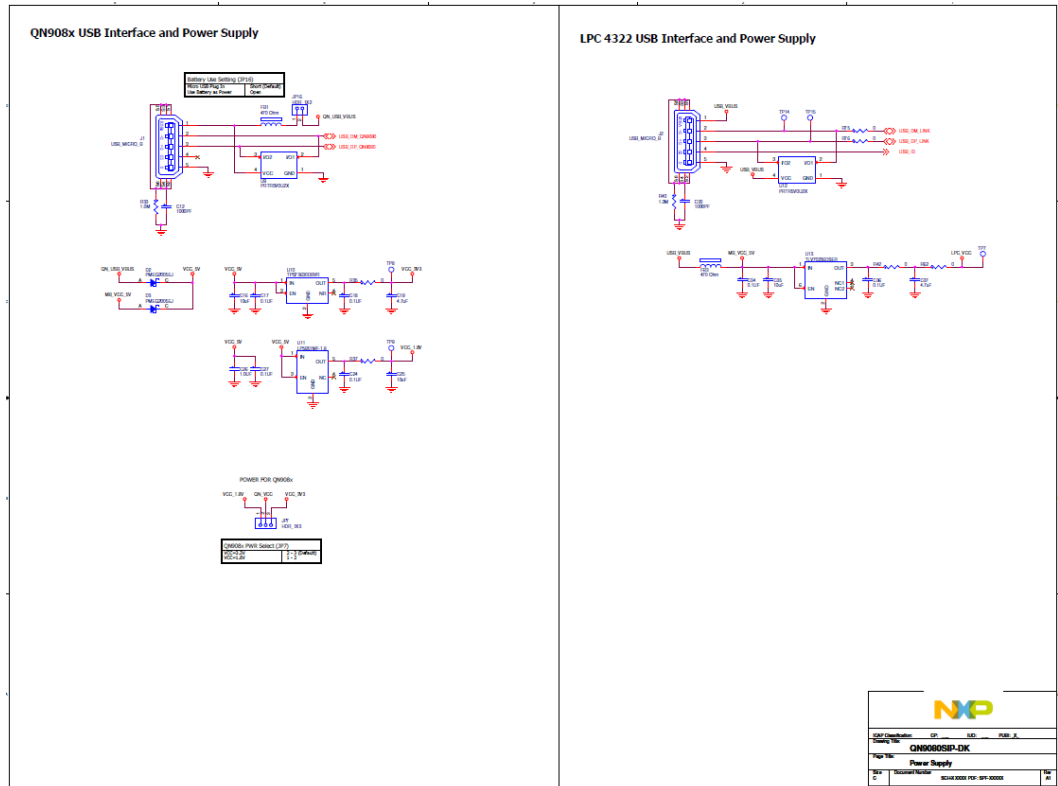


Fig 19. Power schematic of the QN9080-001-M17 DK board

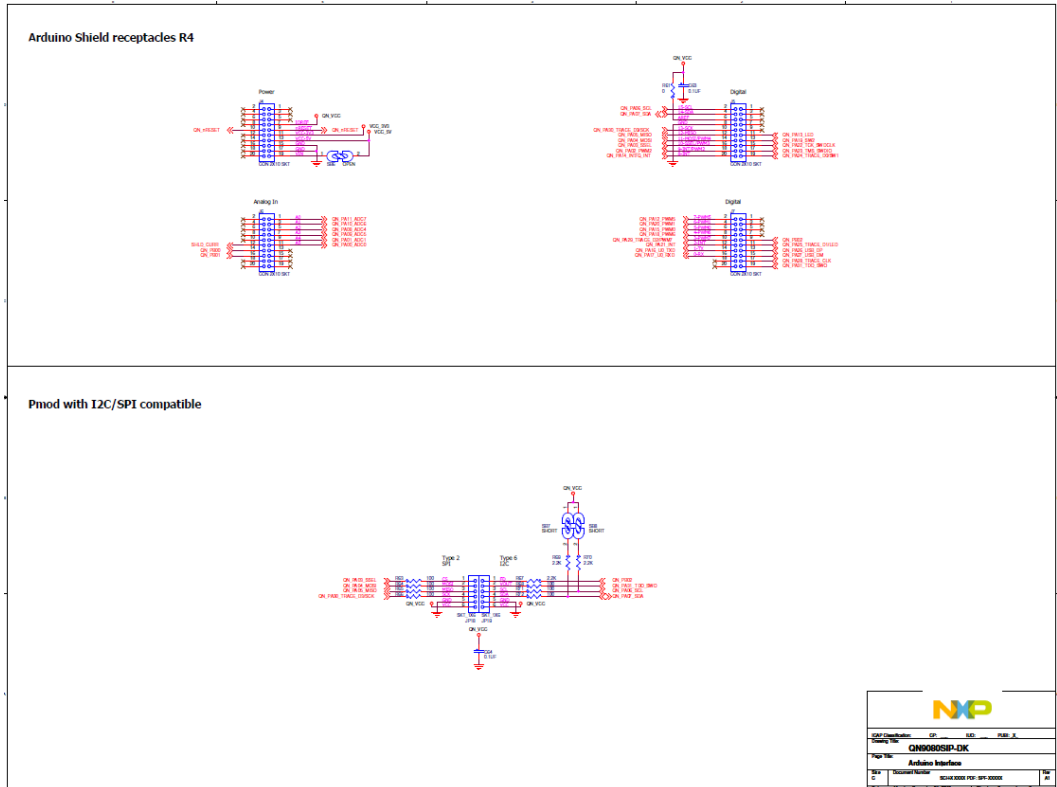


Fig 23. Arduino interface schematic of the QN9080-001-M17 DK board

5.1.2 QN9080-001-M17 module board

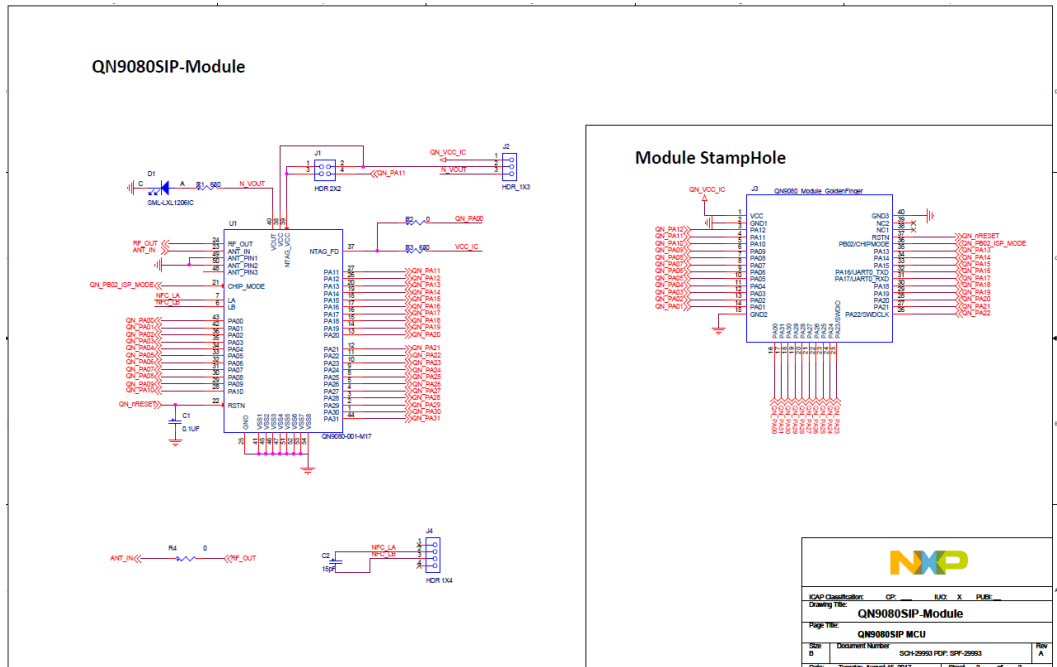


Fig 24. QN9080-001-M17 module board

5.2 PCB layout

5.2.1 QN9080-001-M17 DK main board

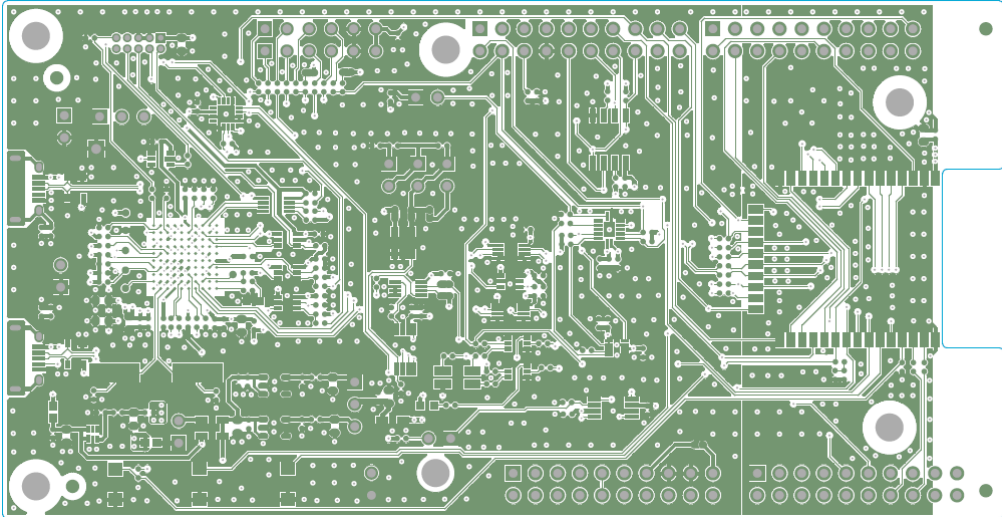


Fig 25. Top etch

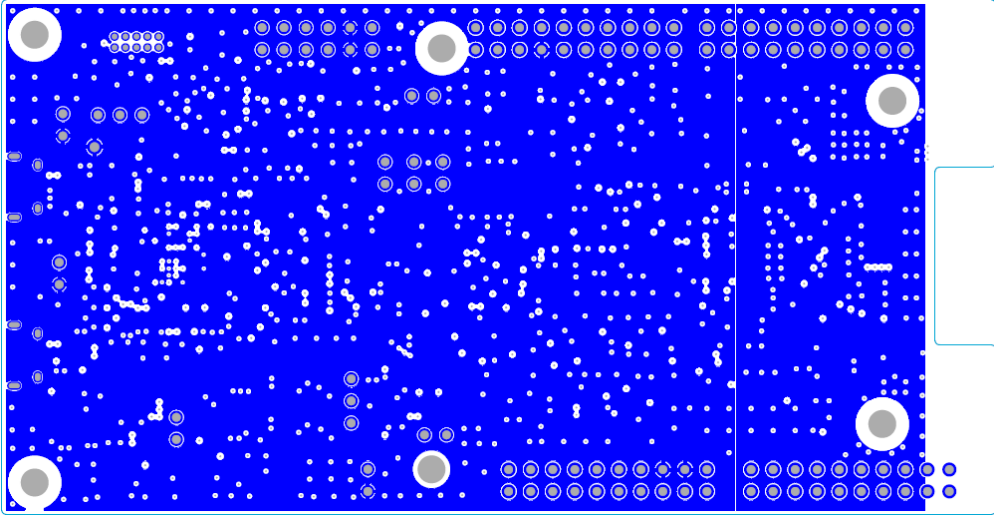


Fig 26. GND plane

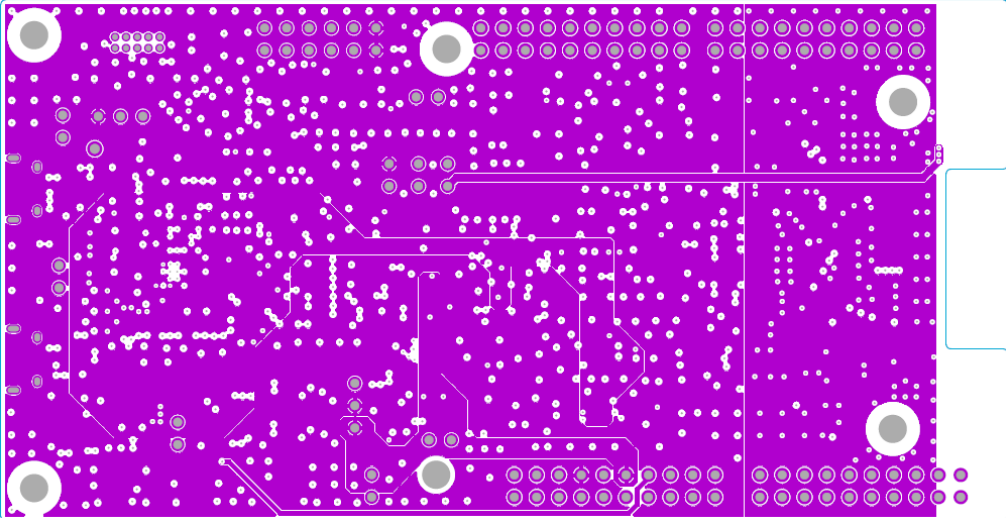


Fig 27. PWR plane

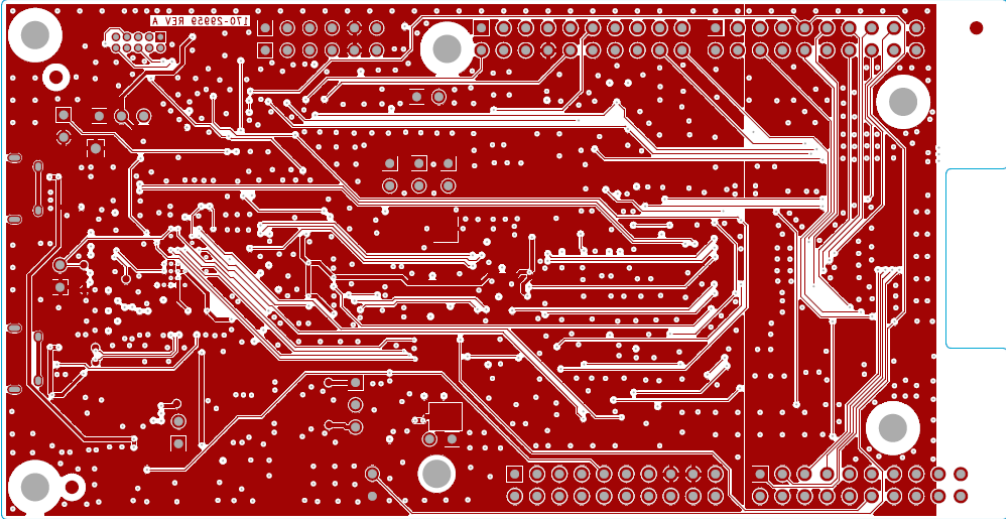


Fig 28. Bottom etch

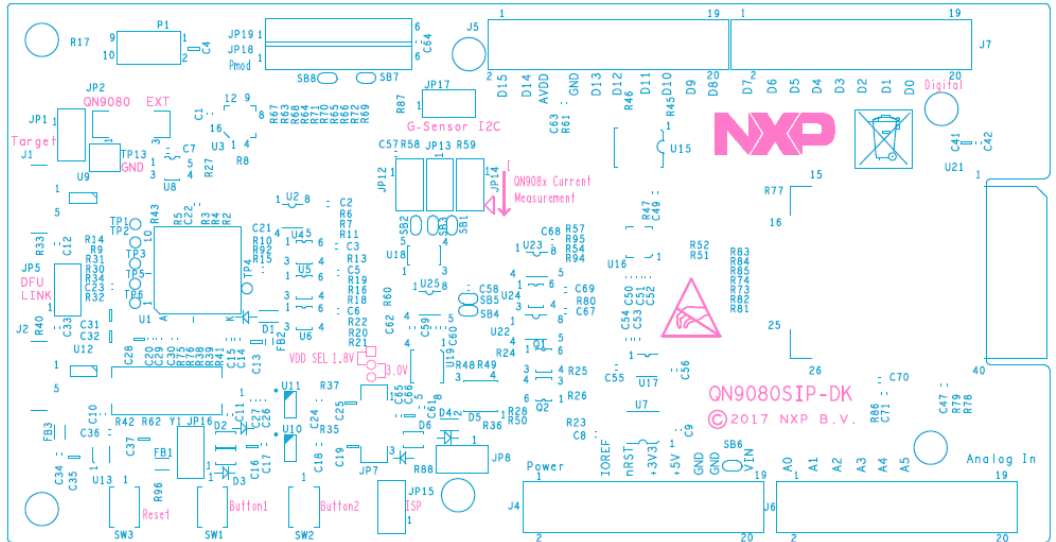


Fig 29. Top silkscreen

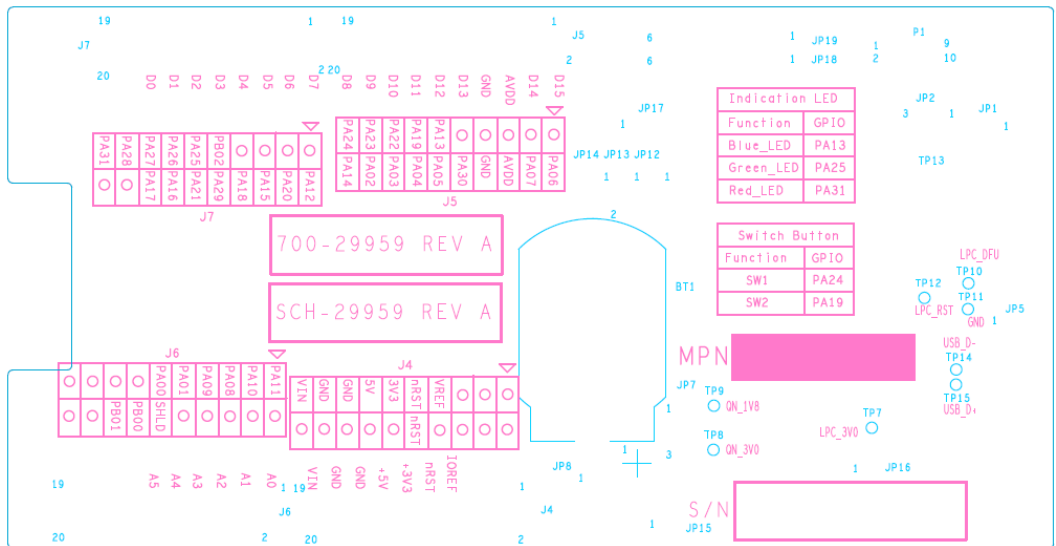


Fig 30. Bottom silkscreen

5.2.2 QN9080-001-M17 board

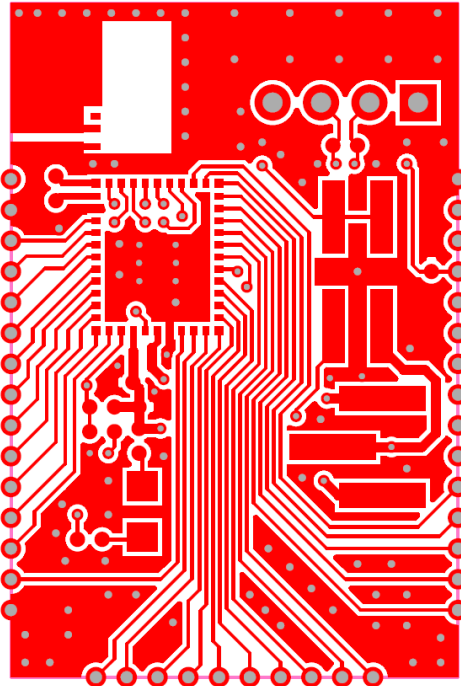


Fig 31. Top etch

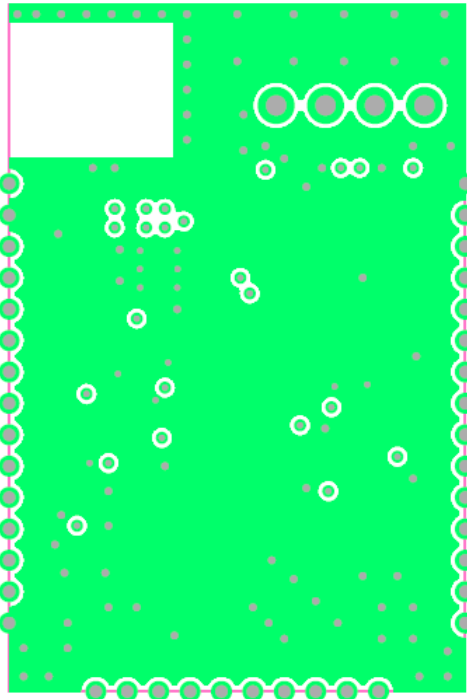


Fig 32. GND plane

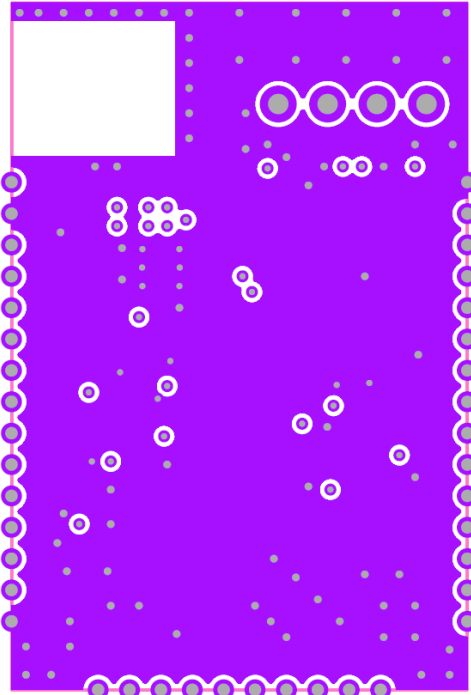


Fig 33. PWR plane

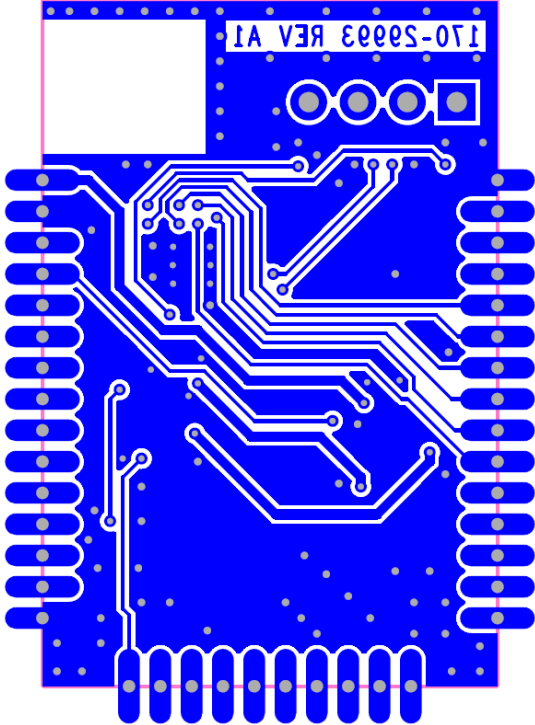


Fig 34. Bottom etch

5.3.2 QN9080-001-M17 module

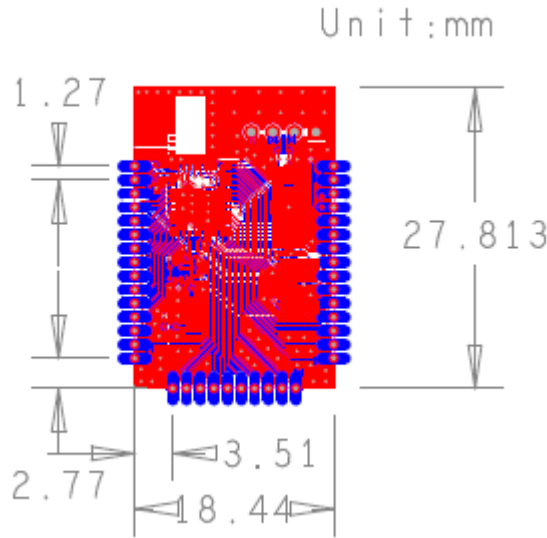


Fig 37. Dimensions of the QN9080-001-M17 module board

5.4 Notes for using a lithium battery

When using a lithium battery as the power supply for the QN9080-001-M17 module, pay attention to the following:

- ◆ To avoid current leakage from the QN9080-001-M17 USB data line, leave JP16 open.
- ◆ To avoid current leakage from the 3-color LED, remove resistors R48, R49, and R50.

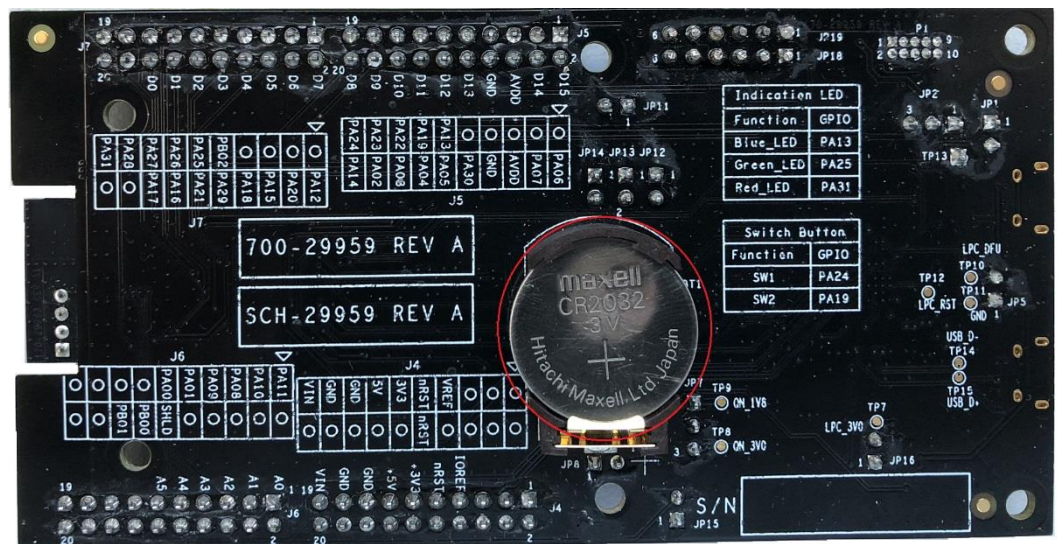


Fig 38. Lithium battery on the QN9080-001-M17 DK board

5.5 Statements

5.5.1 FCC compliance statement

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.

IC Compliance Statement

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

6. Legal information

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