

ARM® Cortex®-M
32-bit Microcontroller

**4G/LTE/NB-IoT Module
with UNO to PCIe board
User Manual**

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1 OVERVIEW

This user manual is aimed to give users a fast introduction to the UNO to PCIe (Ver 1.2) board. This board is a daughter board for both NuMaker-IoT-M487 (Ver 1.2) board and NK-980IoT. It needs to be combined with the Quectel EC21 module board, Quectel BG96 module and ZTE ME3630 module board to connect to LTE. This board can work independently by USB2.0.

Figure 1-1 shows the combination picture of UNO to PCIe board (top) and NuMaker-IoT-M487 board (bottom). Figure 1-2 shows the combination picture of UNO to PCIe board (top) and NuMaker NUC980 IIoT Board (bottom).

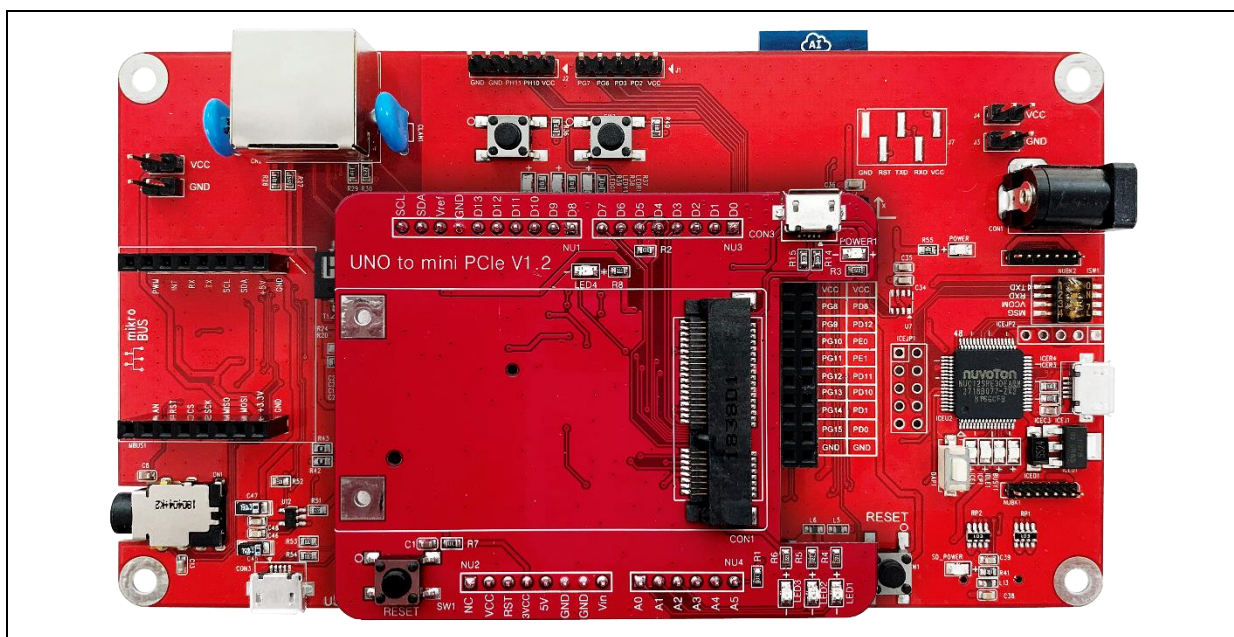


Figure 1-1 Combination of UNO to PCIe Board and NuMaker-IoT-M487 Board

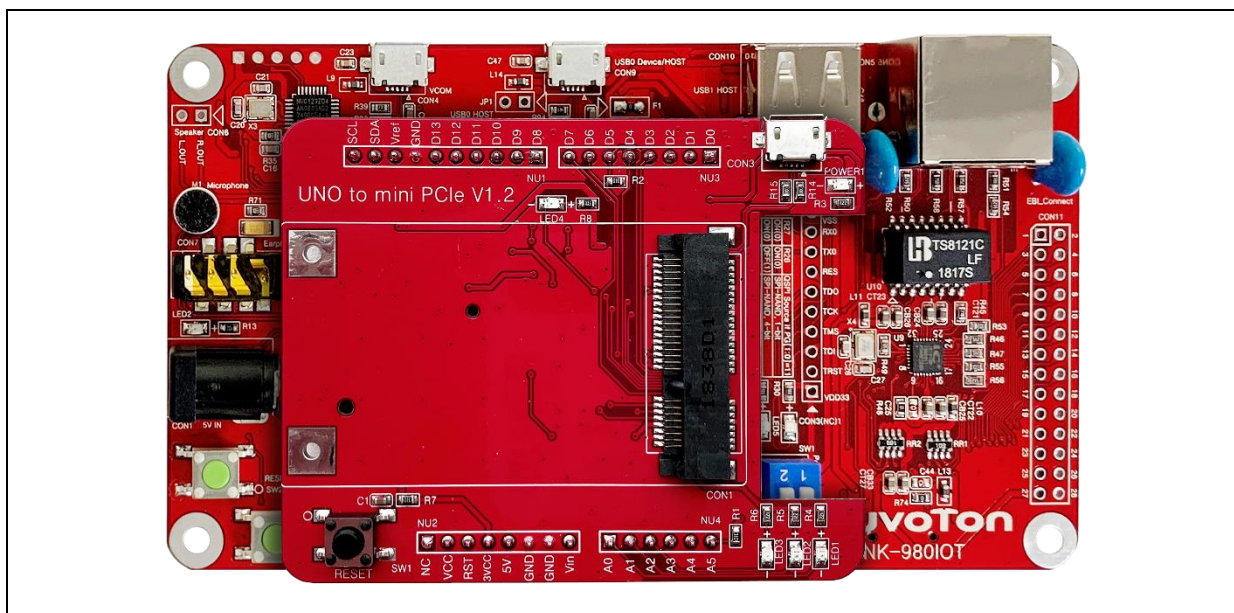


Figure 1-2 Combination of UNO to PCIe Board and NuMaker NUC980 IIoT Board

The UNO to PCIe (Ver 1.2) board is not necessary for NuMaker-IoT-M263A board (NK-IOT-M263A), just plug Quectel EC21 or BG96 module board into PCIe connector of NuMaker-IoT-M263A board directly. Please refer to user manual of NuMaker-IoT-M263A board. Figure 1-3 shows the combination picture of Quectel EC21/BG96 module board and NuMaker-IoT-M263A board.

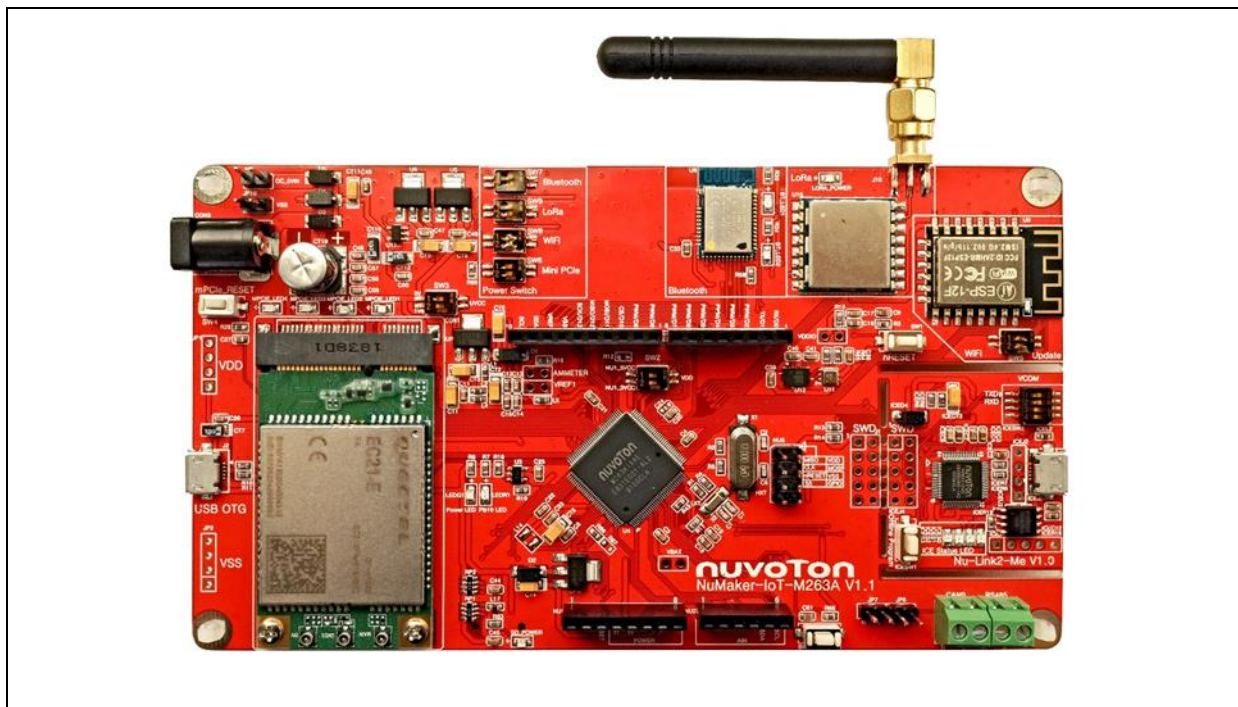


Figure 1-3 Combination of UNO to PCIe Board and NuMaker-IoT-M263A Board

1.1 Brief Introduction to NuMaker-IoT-M487 Board

The NuMaker-IoT-M487 is a development board using Nuvoton M487JIDAE MCU which includes Arm® Cortex®-M4 core and rich peripherals. It also has motion sensor and WiFi connectivity on board as well as plenty of reference materials to let user to quickly develop IoT device applications. Furthermore, the board provides several interface and connectors for expansion. There are Arduino Uno compatible interface, mikroBUS™ interface, NuMaker Brick I2C connector, and simulated CMOS sensor connector.

For more detailed information about the NuMaker-IoT-M487 board, please visit Nuvoton NuMicro Family ARM® Cortex®-M4 MCUs website to get the related User Manual document.

<https://www.nuvoton.com/hq/products/microcontrollers/arm-cortex-m4-mcus/m487-ethernet-series/User-Manual>

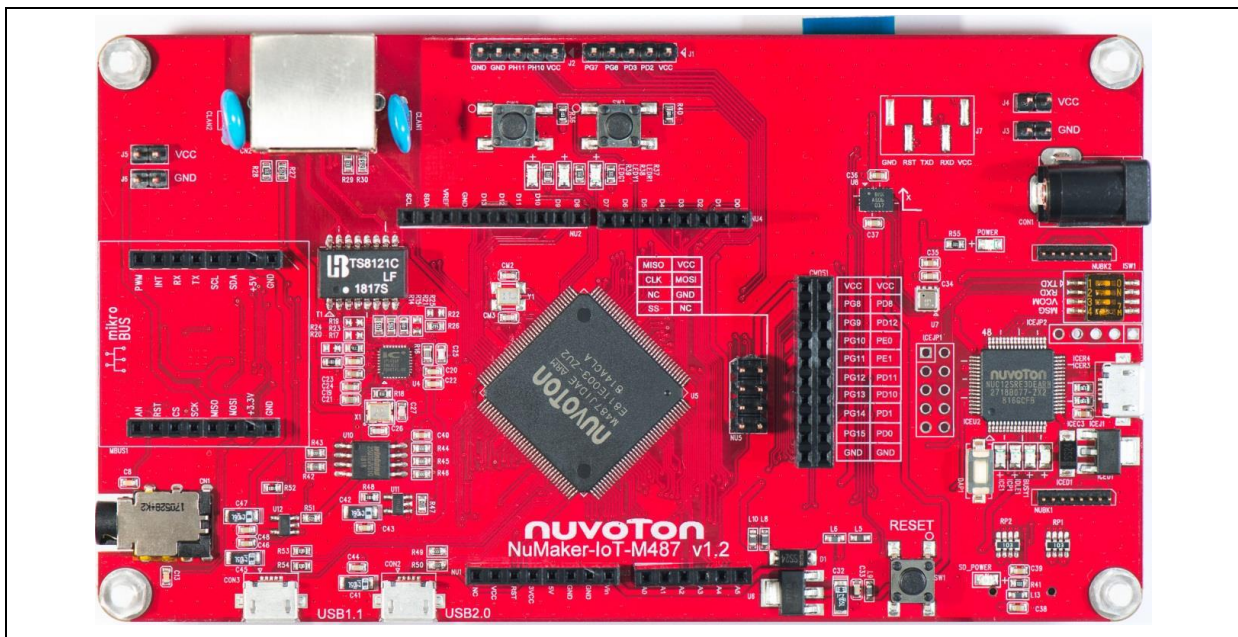


Figure 1-4 NuMaker-IoT-M487 Board

1.2 Brief Introduction to NuMaker NUC980 IIoT Board (NK-980IOT)

The NuMaker NUC980 IIoT board (NK-980IOT) is a development board based on an ARM® ARM926EJ-S microprocessor NUC980DK61Y which has very rich peripherals to help users easily to design-in their products or application systems. The NK-980IoT board uses NUC980DK61Y microprocessor run up to 300 MHz with built-in 64MB DDR2 memory, 16 KB I-cache, 16 KB D-cache and MMU, 16 KB embedded SRAM and 16.5 KB IBR (Internal Boot ROM) for system booting from USB, SPI NAND flash and SD/eMMC. All functions of the NUC980DK61Y are placed on the board, including peripheral interfaces such as memory (SPI NAND Flash, eMMC, SD), UART, Audio controller(NAU8822L), 10/100 Mb Ethernet MAC controller, high speed USB(device, HOST), JTAG and EBI, furthermore, the board provides Arduino Uno compatible interface for expansion. Users can use it to develop and verify applications to emulate the real behavior.

For more detailed information about the NuMaker NUC980 IIoT board (NK-980IOT), please visit Nuvoton ARM9 Family website to get the related User Manual document.

<https://www.nuvoton.com/hq/products/microprocessors/arm9-mpus/User-Manual>

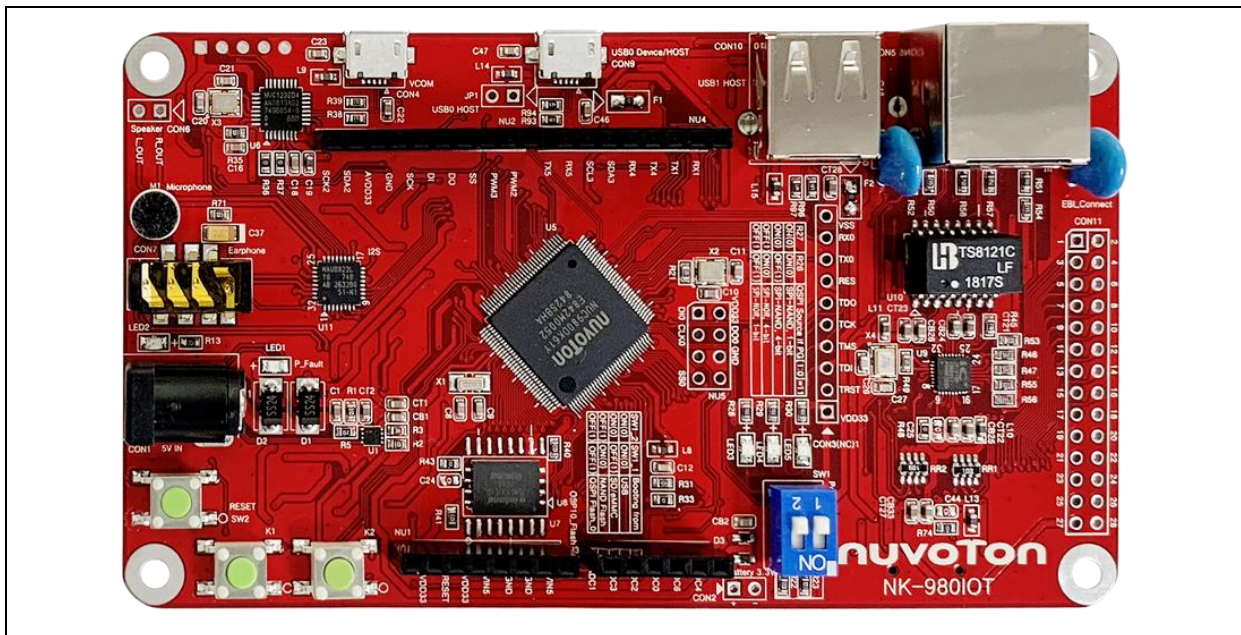


Figure 1-5 NuMaker NUC980 IIoT Board (NK-980IOT)

1.3 Brief Introduction to NuMaker-IoT-M263A Board (NK-IOT-M263A)

The NuMaker-IoT-M263A (NK-IOT-M263A) is a development board based on an ARM® Cortex-M23 microcontroller M263KIAAE which behaves both low power and robust security features that focusing on IoT applications. M263KIAAE is based on Arm® Cortex®-M23 secure core for Armv8-M architecture, running up to 64 MHz with 512 KB Flash in dual bank mode supporting Over-The-Air (OTA) Firmware update and 96 KB SRAM. M263KIAAE adopts advanced low power and security technology with high performance connectivity interface. The power consumption in the normal run is down to 45 μ A/MHz in DC-DC mode and it implements a secure boot function and hardware crypto acceleration to achieve the security of IoT device. M263KIAAE is equipped with plenty of peripherals such as Timers, Watchdog Timers, RTC, PDMA, External Bus Interface (EBI), LPUART, Universal Serial Control Interface (USCI), Qual SPI (QSPI), SPI/I²S, I2C, Smart Card Interface (ISO-7816-3), GPIOs, USB 2.0 FS OTG, CAN Bus 2.0B, SDHC 2.0 and up to 24 channels of PWM. Those peripherals make it highly suitable for connecting comprehensive external modules. For high performance analog front-end circuit blocks, it integrates up to a 16-channel 12-bit 3.76 MSPS SAR ADC, two 12-bit 1 MSPS voltage type DAC, two rail-to-rail analog comparator (ACMP), temperature sensor, low voltage reset (LVR), and brown-out detector (BOD) to enhance product performance and reduce both external components and form factor.

NuMaker-IoT-M263A board (NK-IOT-M263A) is a new platform focusing on IoT products design, it integrates 9-axis sensor, environmental sensor, and popular wireless communication modules including Bluetooth module, Wi-Fi module, and LoRa module. A 2G/3G/4G-LTE/NB-IoT module with GPS function is available for purchase. With the IoT software package provided by Nuvoton, connecting the cloud of Arm Pelion, Amazon AWS, and Ali-Cloud is hazard-free. And the development of IoT products can be completed quickly.

For more detailed information about the NuMaker-IoT-M263A board (NK-IOT-M263A), please visit Nuvoton ARM Cortex-M23 MCUs Family website to get the related User Manual document.

https://www.nuvoton.com/hq/board/numaker-iot-m263a/?_locale=en

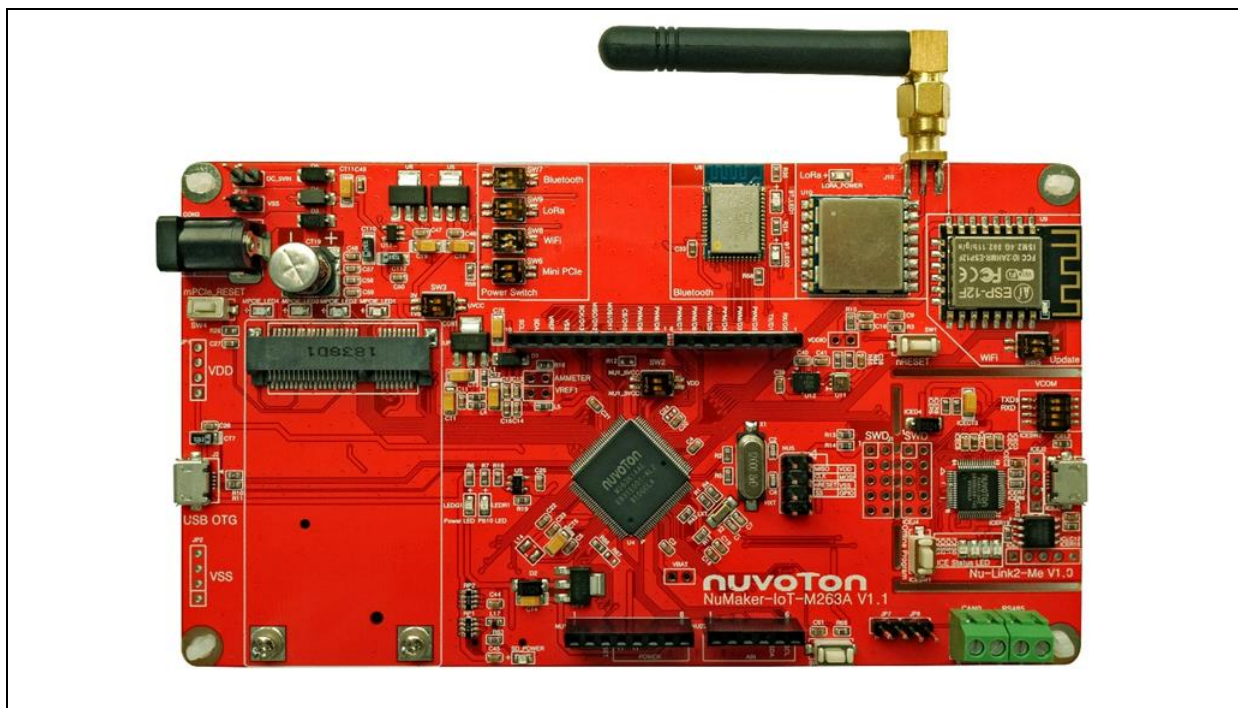


Figure 1-6 NuMaker-IoT-M263A Board (NK-IOT-M263A)

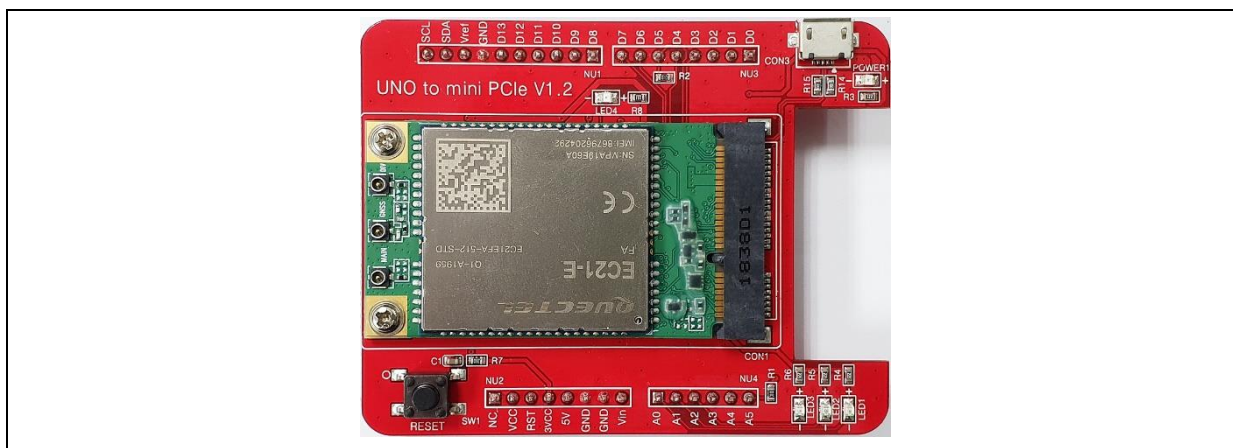
2 4G/LTE/NB-IOT MODULE WITH UNO TO PCIE BOARD

2.1 Quectel EC21 and BG96 module board with UNO to PCIe board

This UNO to PCIe board supports Quectel EC21 module board and Quectel BG96 module board. For more detailed information about Quectel EC21 and BG96 module board, please visit Quectel website to get the related User Manual document.

- Quectel EC21: <https://www.quectel.com/product/ec21.htm>
- Quectel BG96: <https://www.quectel.com/product/BG96.htm>

Figure 2-1 shows the front side of Quectel EC21 module board on UNO to PCIe board. Figure 2-2 shows the front side of Quectel BG96 module board on UNO to PCIe board. Figure 2-3 shows the switch setting of Quectel EC21 and BG96 module board with UNO to PCIe board. Table 2-1 shows the switch setting for Quectel EC21 and BG96 module board.



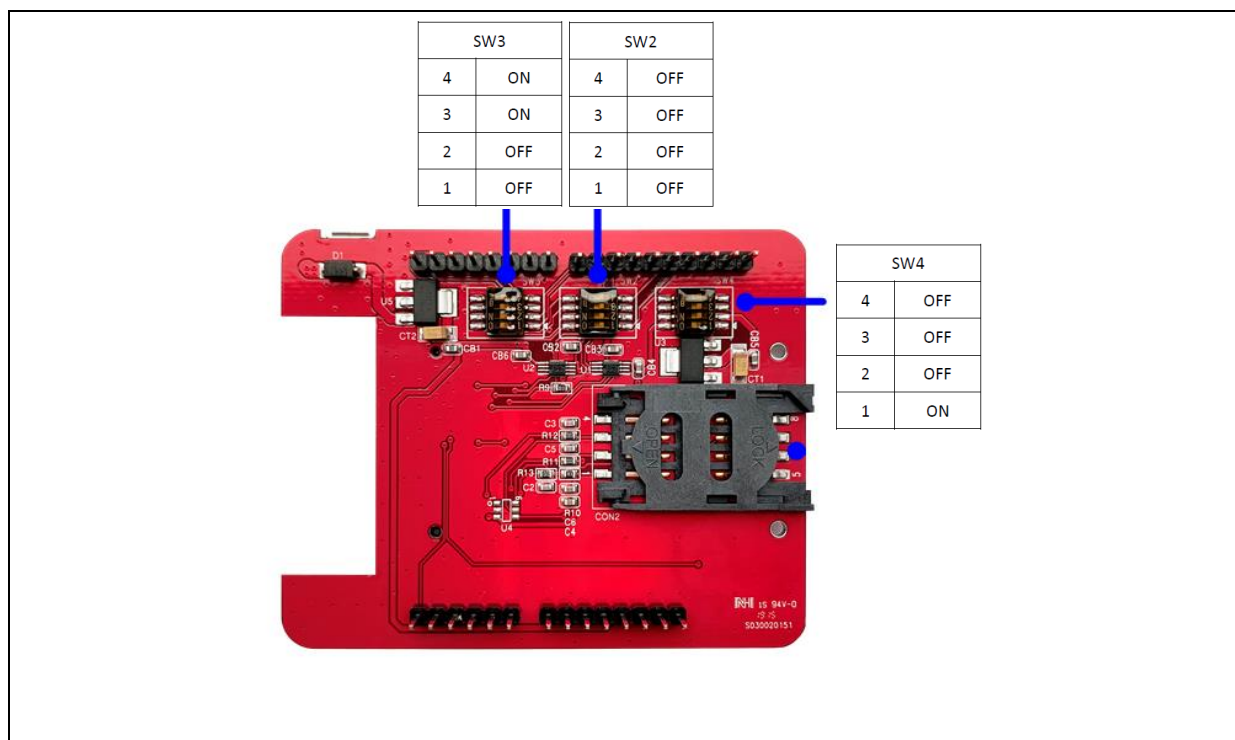


Figure 2-3 The switch setting view of Quectel EC21 and BG96 module board with UNO to PCIe board

Table 2-1 The switch setting for Quectel EC21 and BG96 module board.

SW	Status	Function	GPIO pin of UNO interface
SW2.1	OFF	UART_CTS	D12
SW2.2	OFF	UART_RTS	D11
SW2.3	OFF	UART_TXD	D10
SW2.4	OFF	UART_RXD	D13
SW3.1	OFF	UART_CTS	D9
SW3.2	OFF	UART_RTS	D8
SW3.3	ON	UART_TXD	D1
SW3.4	ON	UART_RXD	D0
SW4.1	ON	UART power supply	3.3V
SW4.2	OFF	UART power supply	3.3V
SW4.3	X	None	None
SW4.4	X	None	None

3 UNO TO PCIE BOARD OVERVIEW

3.1 Front View

Figure 3-1 shows the main components and connectors from the front side of UNO to PCIe board.

The following lists components and connectors from the front view:

- mini PCIe connector (CON1)
- USB0 Device (CON3)
- Push-buttons (SW1)
- LEDs (POWER, LED1, LED2, LED3, LED4)
- UNO interface connectors (NU1, MU2, NU3, NU4)

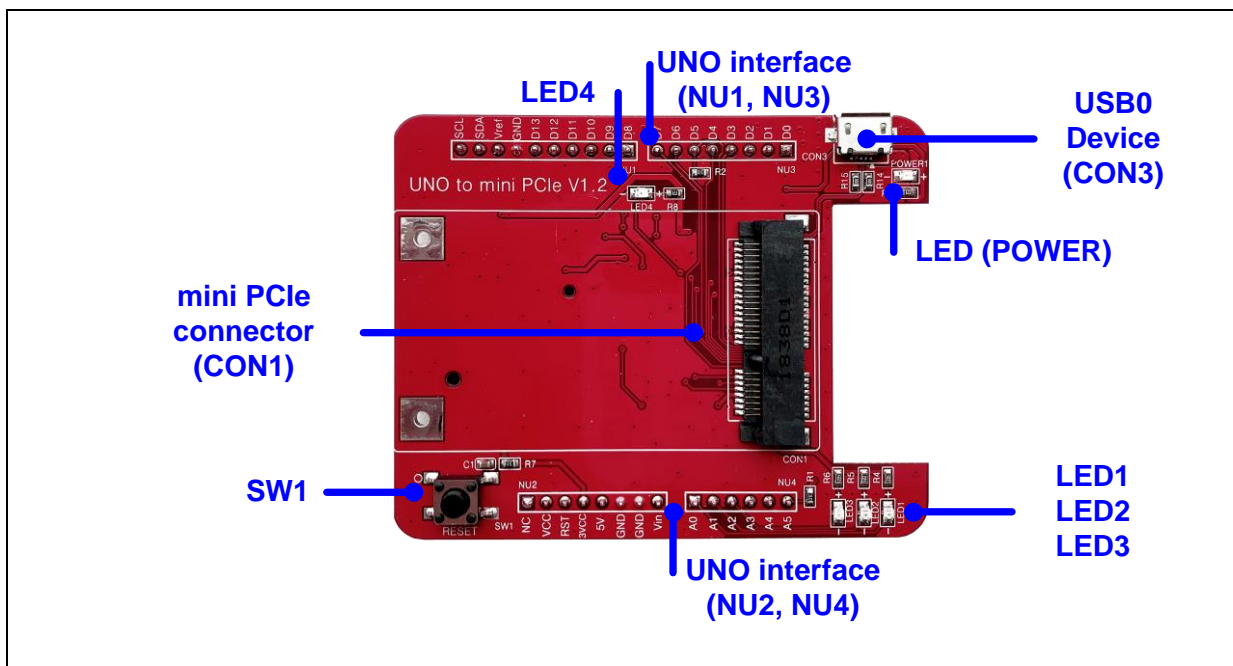


Figure 3-1 Front View of UNO to PCIe Board

3.2 Rear View

Figure 3-2 shows the main components and connectors from the rear side of UNO to PCIe board.

The following lists connectors from the rear view:

- Mini SIM card slot for SIM1 (CON2)
- Switch for UART pins of NuMaker-IoT-M487 board (SW2)

SW	Status	Function	GPIO pin of UNO interface
SW2.1	ON	UART_CTS	D12
SW2.2	ON	UART_RTS	D11
SW2.3	ON	UART_TXD	D10
SW2.4	ON	UART_RXD	D13

- Switch for UART pins of NuMaker NUC980 IIoT board (SW3)

SW	Status	Function	GPIO pin of UNO interface
SW3.1	ON	UART_CTS	D9
SW3.2	ON	UART_RTS	D8
SW3.3	ON	UART_TXD	D1
SW3.4	ON	UART_RXD	D0

Note: Only one switch of SW2 and SW3 can be used and cannot be used at the same time. If users only need to use UART_TXD and UART_RXD, users can turn on SW3.3 and SW3.4 regardless of NuMaker-IoT-M487 board and NuMaker NUC980 IIoT Board board.

- Switch for UART power supply (SW4)

SW	Status	Function	power
SW4.1/ SW4.2	ON/OFF	UART power supply	3.3V
SW4.1/ SW4.2	OFF/ON	UART power supply	1.8V

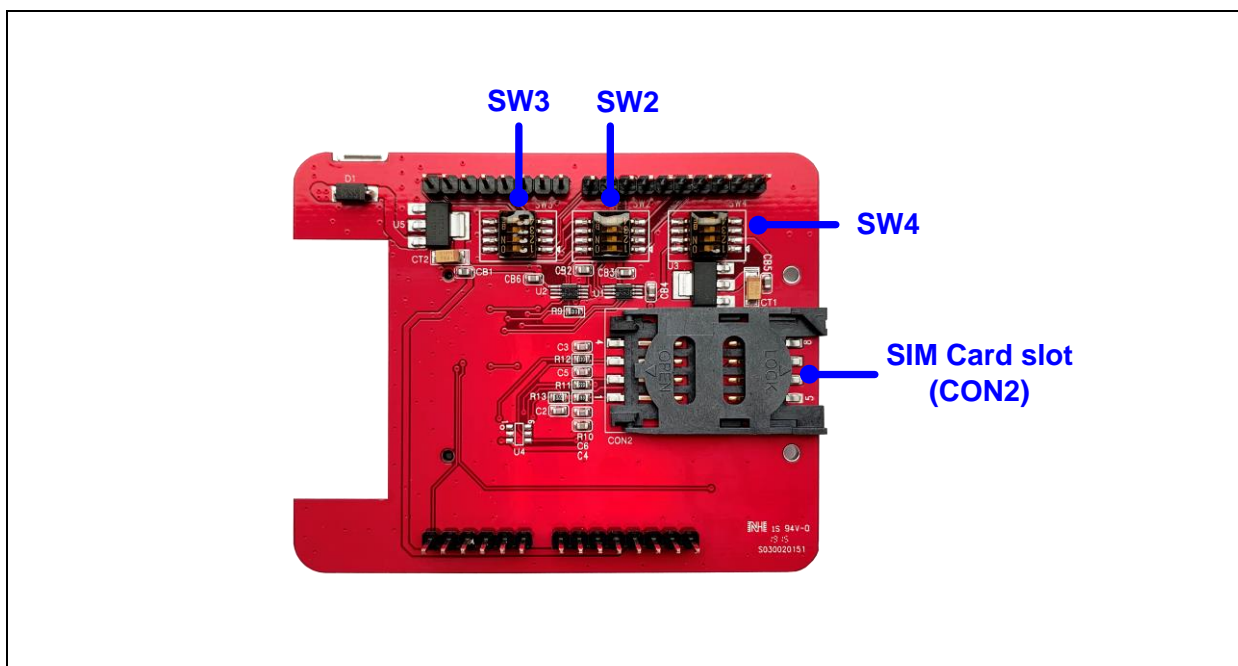


Figure 3-2 Rear View of UNO to PCIe Board

3.3 Pin Assignment for mini PCIe interface

The UNO to PCIe daughter board is equipped with mini PCIe connector, USB2.0, Sim Card and one push button for user developing and verifying some special feature. Besides, the pin arrangement of UNO to PCIe is compatible with Arduino UNO.

This UNO to PCIe board supports Quectel EC21 module board, Quectel BG96 module board and ZTE ME3630 module board. Table 3-1 shows the pin assignment for mini PCIe interface.

Table 3-1 Pin Assignment for mini PCIe interface

Pin No.	PCIe Pin Name	Pin No.	PCIe Pin Name
1	WAKE#	2	3VCC
3	-	4	GND
5	-	6	-
7	-	8	SC_PWR
9	GND	10	SC_DAT
11	UART_RXD	12	SC_CLK
13	UART_TXD	14	SC_RST
15	GND	16	-
17	UART_RI	18	GND
19	-	20	W_DISABLE
21	GND	22	PERST#
23	UART_CTS	24	-
25	UART_RTS	26	GND
27	GND	28	-
29	GND	30	-
31	UART_DTR	32	-
33	UART_DCD	34	GND
35	GND	36	PCIe_USB_DM
37	GND	38	PCIe_USB_DP
39	3VCC	40	GND
41	3VCC	42	LED_WWAN#
43	GND	44	-
45	-	46	-
47	-	48	-
49	-	50	GND
51	-	52	3VCC

3.4 Arduino UNO Compatible Interface

Figure 3-3 shows the Arduino UNO compatible interface.

The Table 3-2 shows the mapping tables on these connector headers of NuMaker-IoT-M487 board and NK-980IoT board.

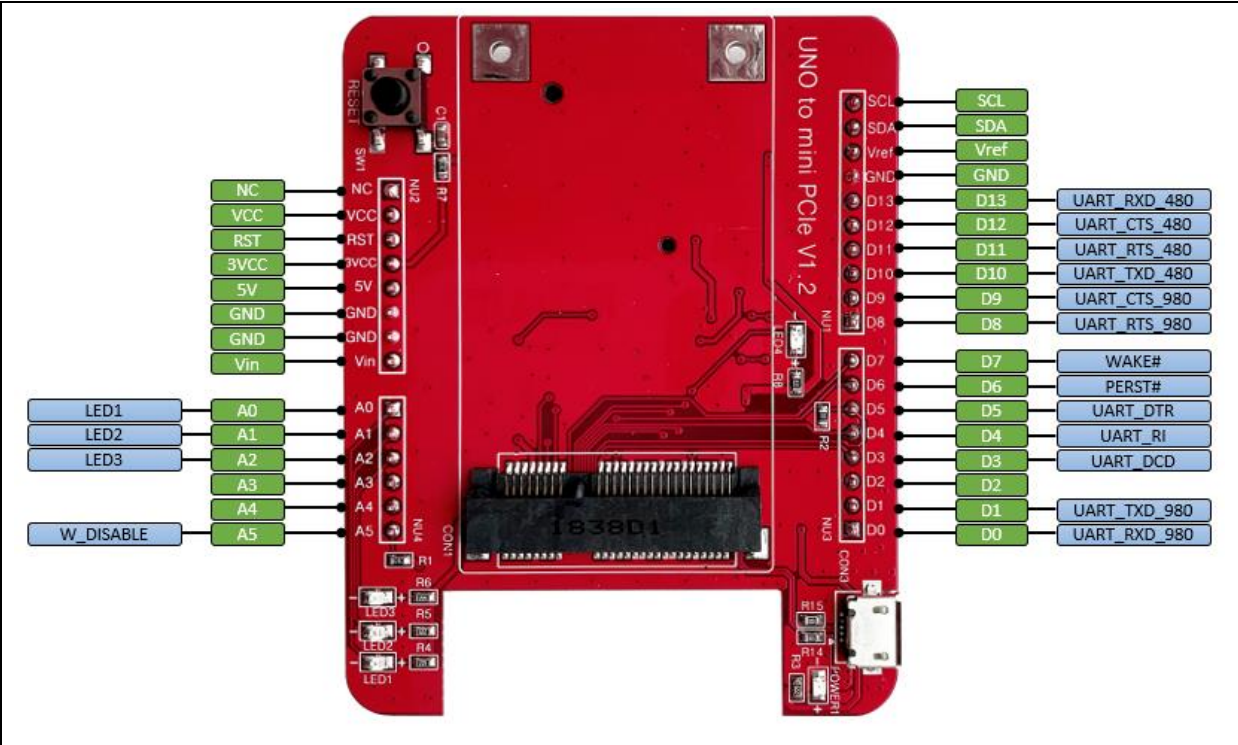


Figure 3-3 Arduino UNO Compatible Interface

Table 3-2 Arduino UNO Interface of NuMaker-IoT-M487 board and NK-980IoT board Mapping with UNO to PCIe Board

Header		UNO to PCIe Board		Header		UNO to PCIe Board	
		Compatible to Arduino UNO	UNO to PCIe Board			Compatible to Arduino UNO	UNO to PCIe Board
N U 2	NU2.1	NC	-	N U 1	NU1.10	I2C_SCL	-
	NU2.2	VDD			NU1.9	I2C_SDA	
	NU2.3	MCU_RESET			NU1.8	VREF	
	NU2.4	3VCC			NU1.7	GND	
	NU2.5	5VCC			NU1.6	D13	UART_RXD_480
	NU2.6	GND			NU1.5	D12	UART_CTS_480
	NU2.7	GND			NU1.4	D11	UART_RTS_480
	NU2.8	VIN			NU1.3	D10	UART_TXD_480
N U 4	NU4.1	A0	LED1	N U 3	NU1.2	D9	UART_CTS_980
	NU4.2	A1	LED2		NU1.1	D8	UART_RTS_980
	NU4.3	A2	LED3		NU3.8	D7	WAKE#
	NU4.4	A3	-		NU3.7	D6	PERST#
	NU4.5	A4	-		NU3.6	D5	UART_DTR
	NU4.6	A5	W_DISABLE		NU3.5	D4	UART_RI
					NU3.4	D3	UART_DCD
					NU5.3	D2	-
					NU5.2	D1	UART_TXD_980
					NU5.1	D0	UART_RXD_980

3.5 PCB Placement

Figure 3-4 and Figure 3-5 show the front and rear placement of UNO to PCIe board.

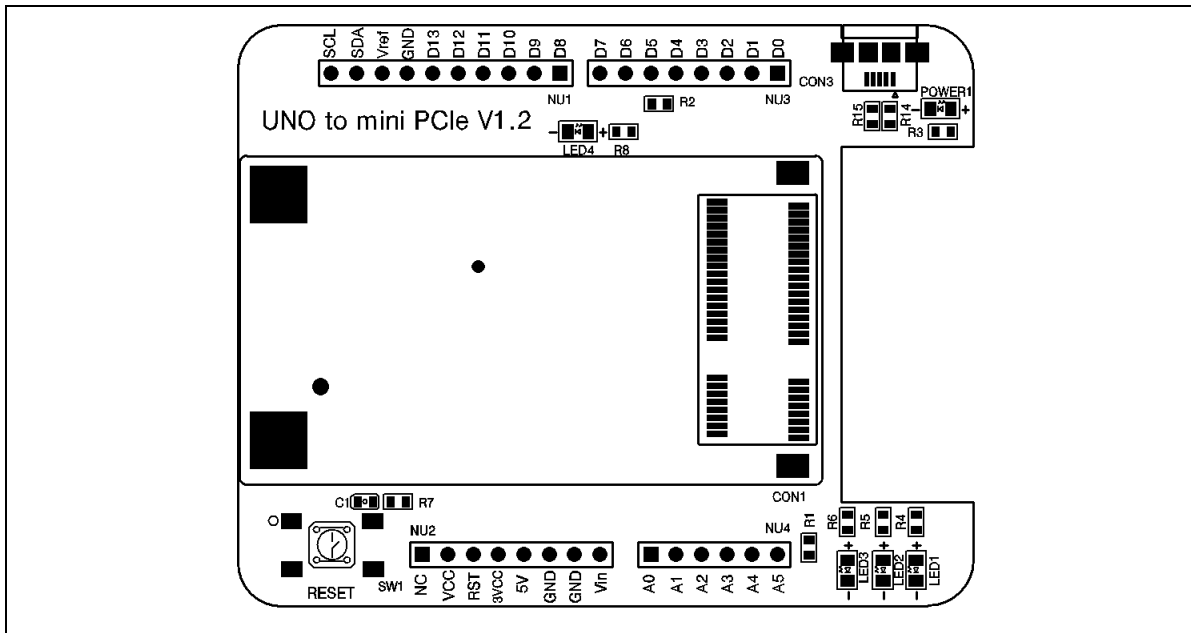


Figure 3-4 Front Placement

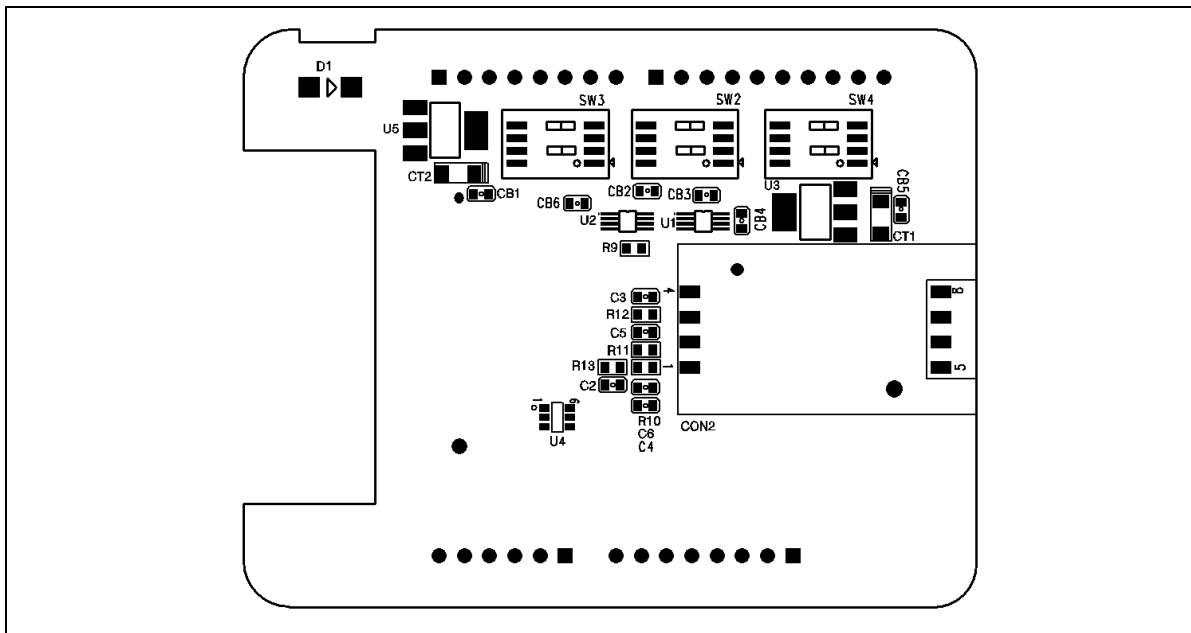


Figure 3-5 Rear Placement

4 UNO TO PCIE BOARD SCHEMATICS

4.1 Interface Connectors

Figure 4-1 shows the all the interface connectors NU1~NU4 that should be connected to the interface connectors NU1~NU4 of NuMaker-IoT-M487 board and NK-980IoT.

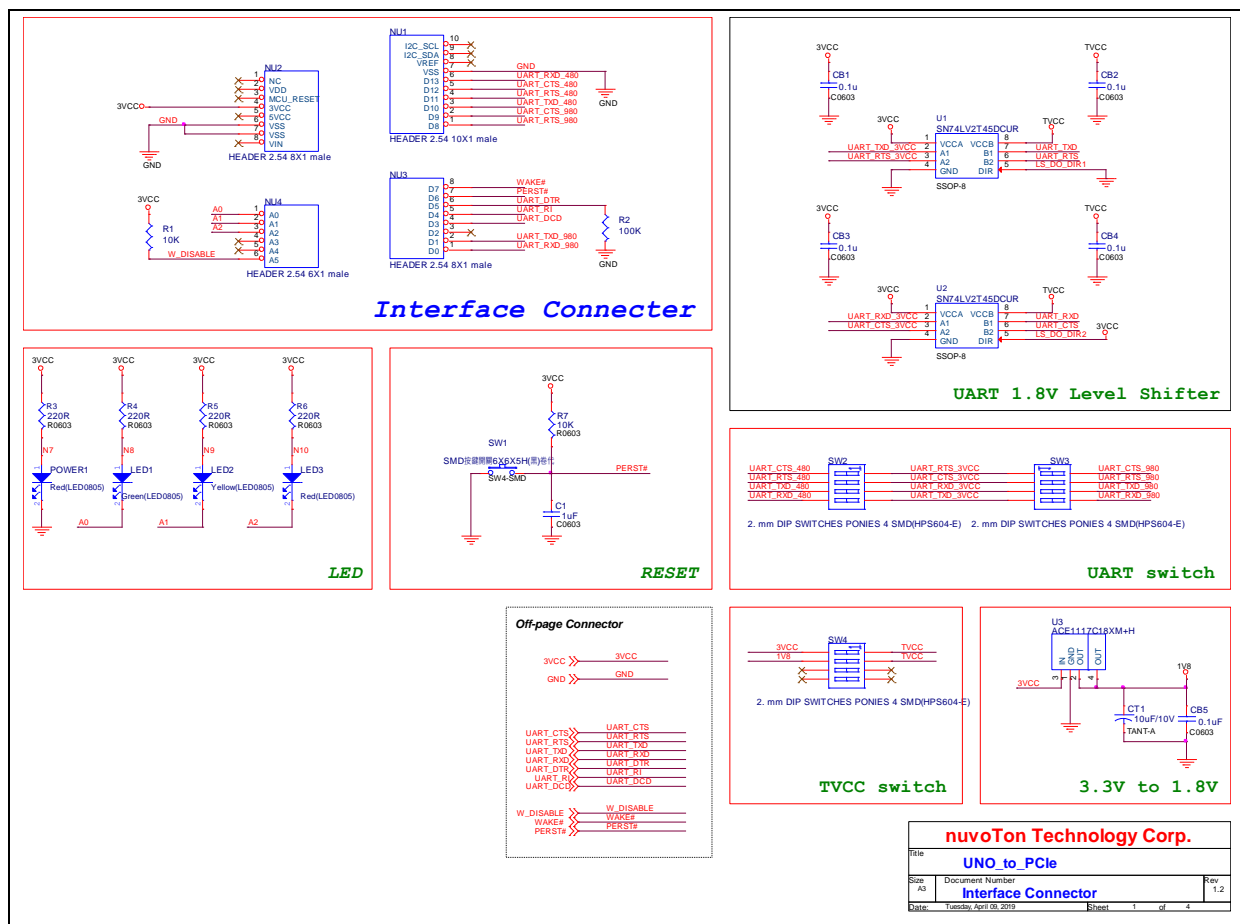


Figure 4-1 Interface Connectors

4.2 mini PCIe interface

Figure 4-2 shows the mini PCIe interface.

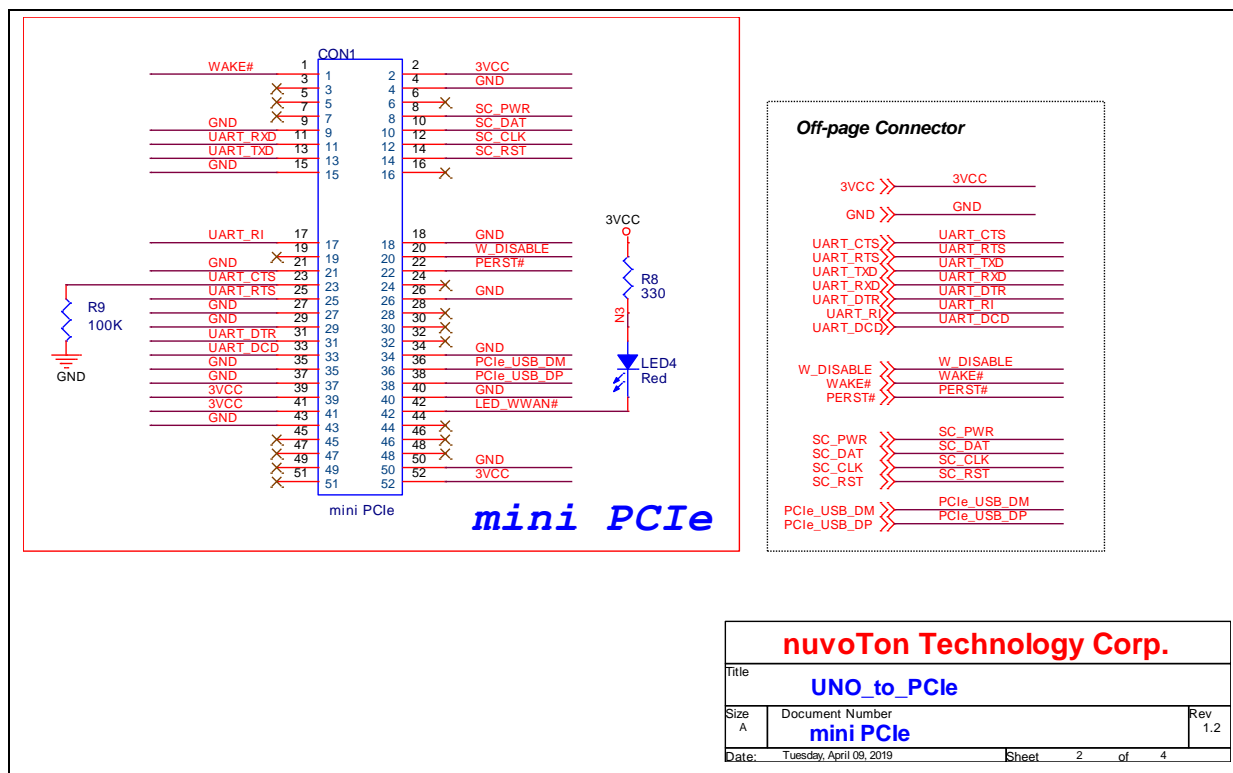


Figure 4-2 mini PCIe interface

4.3 SIM Card

Figure 4-3 shows the SIM Card circuit.

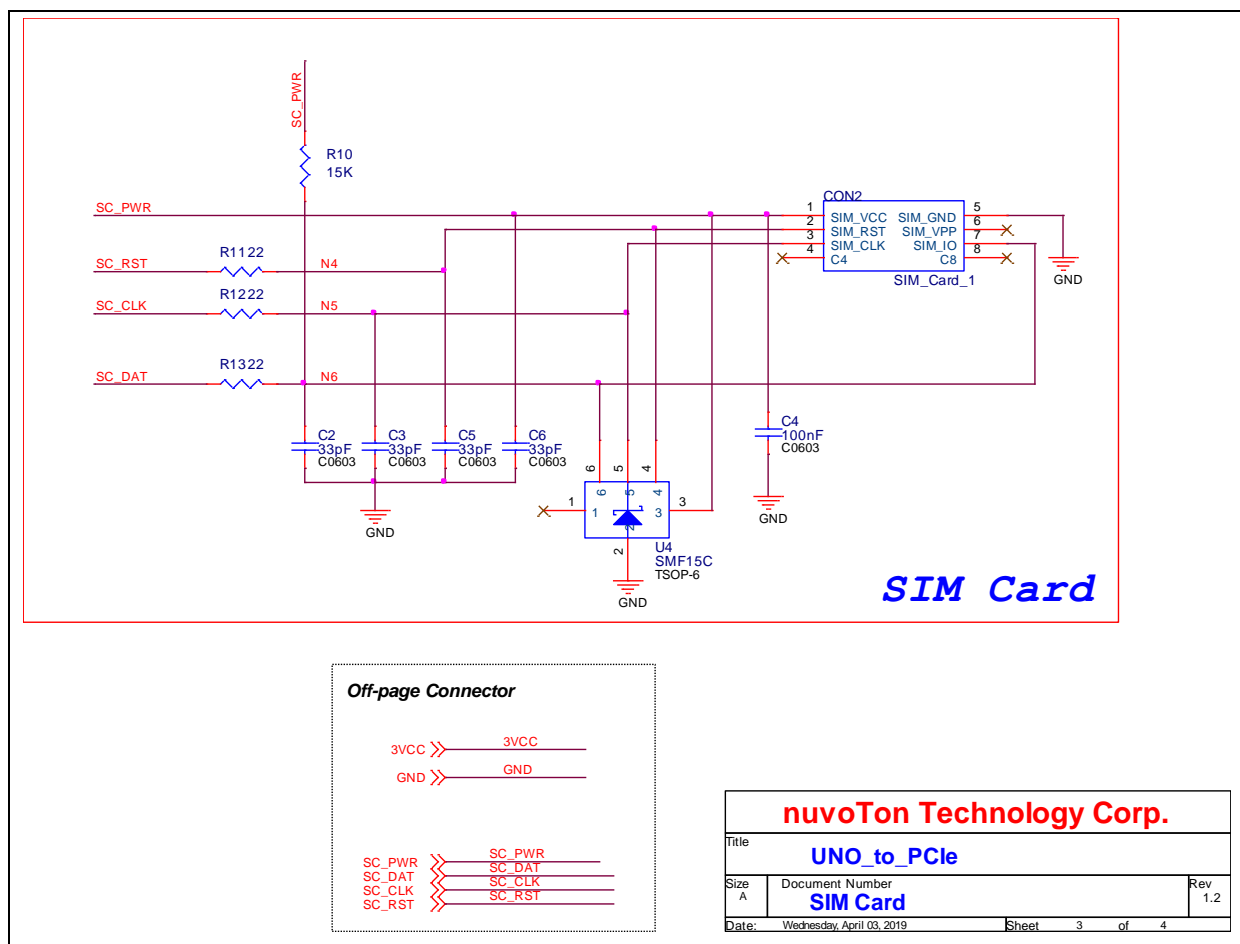


Figure 4-3 SIM Card Circuit

4.4 USB Device

Figure 4-4 shows the USB device circuit.

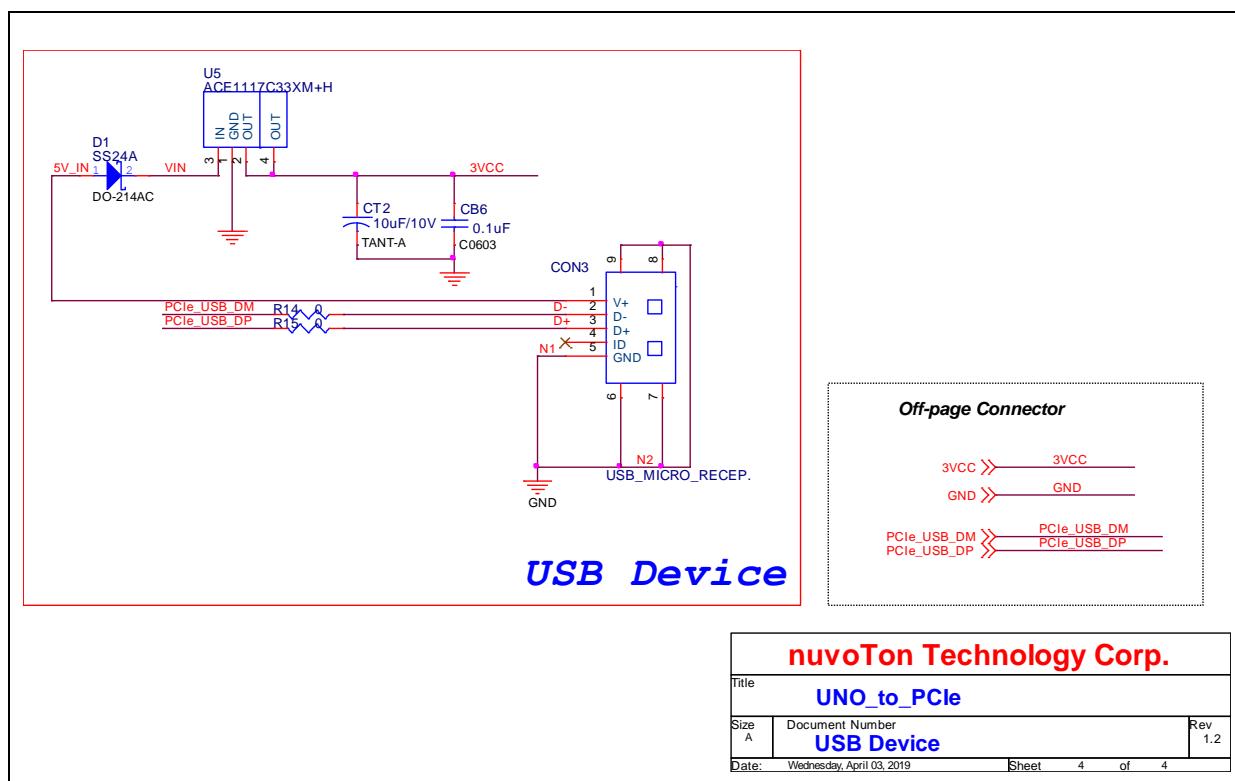


Figure 4-4 USB Device Circuit

5 REVISION HISTORY

Date	Revision	Description
2019.04.30	1.00	1. Initially issued.
2019.08.26	1.01	1. Add Quectel EC21 and BG96 description.

Important Notice

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