ARM® ARM926EL-S Based
32-bit Microprocessor

NK-980IoT
User Manual
NUC980DK61Y

For additional information or questions, please contact: nuvoTon Technology Corporation.

www.nuvoton.com

Table of Contents

1 OVERVIEW

This user manual is aimed to give users an introduction the specification, features, and uses of NK-980IoT board to develop network as well as Internet of Thing (IoT) applications.

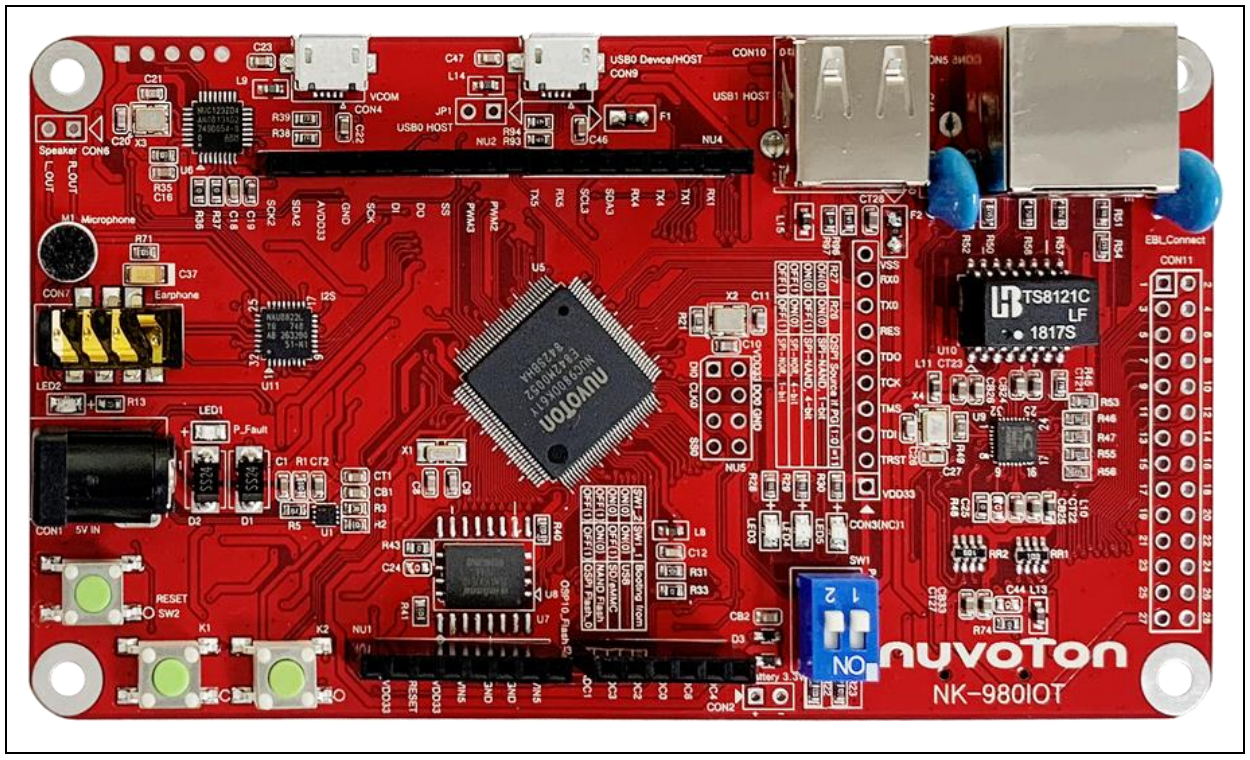


Figure 1-1 NK-980IoT Board

2 INTRODUCTION TO NK-980IOT BOARD

The 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.

2.1 NK-980IoT Board Features

- NUC980DK61Y: LQFP128 pin MCP package with DDR2 (64 MB), which can run up to 300MHz operating speed
- SPI Flash: Quad mode system booting or data storage, use W25N01GVZE1G SPI-NAND (128 MB)
- SD1/eMMC1: User SD/eMMC memory card for system booting, data storage or SDIO (Wi-Fi) device
- UART0: Connected to Virtual COM port for system development, debug message output
- Arduino Uno compatible interface connectors (NU1, NU2, NU3, NU4 and NU5)
- JTAG interface provided for software development
- RJ45 port with Ethernet 10/100Mbps MAC (Ethernet0)
- EBI interface with pin header
- Microphone input and Earphone/Speaker output with 24-bit stereo audio codec (NAU8822L) for I2S interfaces
- 3 sets of LED for status indication
- 2 sets of user-configurable push button keys
- USB port-0 that can be used as Device/HOST and USB port-1 that can be used as HOST

  Supports pen drives, keyboards, mouse and printers
- Provides over-voltage and over current protection
- 3.3V I/O power, 1.8V Memory power and 1.2V core power

2.2 NK-980IoT Board – Front View

Figure 2-1 shows the main components from the front view of NK-980IoT board

- +5V In (CON1): Power adaptor 5V input

Power Model	CON4 USB Port (Micro-B)	CON9 USB Port (Micro-B)	CON1
Model 1	Connect to PC	-	-
Model 2	-	Connect to PC	-
Model 3	-	-	VDD5V Input

- Power indication LEDs (LED1, LED2):

LED	Color	Descriptions
LED1	Red	The system power will be terminated and LED1 lighting when the input voltage is over 5.7V or the current is over 1.7A.
LED2	Green	Power normal state.

- RTC Battery (CON2): External Battery supply for RTC 3.3V powered
  - CON2.1: Positive (+)
  - CON2.2: Negative (-)
- System Reset (SW2): System will be reset if the SW2 button is pressed
- Virtual COM (CON4, U6): NUC123ZD4AN0 microcontroller (U6), USB micro-B connector (CON4) to PC, for debug message output
- User indication LEDs (LED3, LED4, LED5):

LED	Color	GPIO pin of NUC980
LED3	Yellow	PB8
LED4	Green	PG15
LED5	Red	PB13

- SPI NAND Flash (U7, U8): Use Winbond W25N01GVZE1G 128MB (U8) for system booting, only one (U7 or U8) SPI Flash can be used, support dual / quad mode
- JTAG interface and UART0 (CON3)

Connector	GPIO pin of NUC980	Function
CON3.1	-	VDD33
CON3.2	GPG15	nTRST
CON3.3	GPG14	TDI
CON3.4	GPG13	TMS
CON3.5	GPG12	TCK

CON3.6	GPG11	TDO
CON3.7	-	nRESET
CON3.8	GPF12	UART0_TXD
CON3.9	GPF11	UART0_RXD
CON3.10	-	VSS

- User Key SWs (K1 and K2)

Key	GPIO pin of NUC980
K1	GPE10
K2	GPE12

- Arduino UNO compatible interface (NU1, NU2, NU3, NU4 and NU5)

Connector	GPIO pin of NUN980	Function
NU1.1	-	-
NU1.2	-	VDD33
NU1.3	-	nRESET
NU1.4	-	VDD33
NU1.5	-	VIN
NU1.6	-	VSS
NU1.7	-	VSS
NU1.8	-	VIN

Connector	GPIO pin of NUN980	Function
NU2.1	GPF7	PWM2
NU2.2	GPF8	PWM3
NU2.3	GPG11	SPI1_SS
NU2.4	GPG14	SPI1_DO
NU2.5	GPG13	SPI1_DI
NU2.6	GPG12	SPI1_CLK
NU2.7	-	VSS
NU2.8	-	ADC VDD33
NU2.9	GPB7	I2C2_SDA
NU2.10	GPB5	I2C2_SCL

Connector	GPIO pin of NUN980	Function
NU3.1	GPB1	UART9_TXD
NU3.2	GPB3	UART9_RXD
NU3.3	GPB2	ADC_AIN[2]
NU3.4	GPB0	ADC_AIN[0]
NU3.5	GPB6	UART7_TXD
NU3.6	GPB4	UART7_RXD

Connector	GPIO pin of NUN980	Function
NU4.1	GPF9	UART1_RXD
NU4.2	GPF10	UART1_TXD
NU4.3	GPD12	UART4_TXD
NU4.4	GPD13	UART4_RXD
NU4.5	GPD15	I2C3_SDA
NU4.6	GPD14	I2C3_SCL
NU4.7	GPG6	UART5_RXD
NU4.8	GPG7	UART5_TXD

Connector	GPIO pin of NUN980	Function
NU5.1	GPD11	SPI0_DI
NU5.2	-	VDD33
NU5.3	GPD9	SPI0_CLK
NU5.4	GPD10	SPI0_DO
NU5.5	-	-
NU5.6	-	VSS
NU5.7	GPD8	SPI0_SS
NU5.8	-	-

- EBI port for user use (CON11)

Connector	GPIO pin of NUN980	Function
CON11.1	GPC0	EBI_DATA0
CON11.2	GPC1	EBI_DATA1
CON11.3	GPC2	EBI_DATA2
CON11.4	GPC3	EBI_DATA3
CON11.5	GPC4	EBI_DATA4
CON11.6	GPC5	EBI_DATA5
CON11.7	GPC6	EBI_DATA6
CON11.8	GPC7	EBI_DATA7
CON11.9	GPC8	EBI_DATA8
CON11.10	GPC9	EBI_DATA9
CON11.11	GPC10	EBI_DATA10
CON11.12	GPC11	EBI_DATA11
CON11.13	GPC12	EBI_DATA12
CON11.14	GPC13	EBI_DATA13
CON11.15	GPC14	EBI_DATA14
CON11.16	GPC15	EBI_DATA15
CON11.17	GPA7	EBI_nWE
CON11.18	GPA8	EBI_nRE
CON11.19	GPA9	EBI_nCS0
CON11.20	GPA12	EBI_ADDR8
CON11.21	GPA11	EBI_ADDR9
CON11.22	GPA10	EBI_ADDR10
CON11.23	GPB0	ADC_AIN[0]
CON11.24	GPB2	ADC_AIN[2]
CON11.25	GPB4	ADC_AIN[4]
CON11.26	GPB6	ADC_AIN[6]
CON11.27	-	VDD33
CON11.28	-	VSS

- SD1/eMMC1 (CON8): Use Micro SD/eMMC memory card for system booting, data storage or SDIO (Wi-Fi) device

- Power on setting (SW1, R24~R27)

Switch	Status	Function	GPIO pin of NUC980
SW1.2/SW1.1	ON/ON	Boot from USB	GPG1/GPG0
SW1.2/SW1.1	ON/OFF	Boot from SD/eMMC	GPG1/GPG0
SW1.2/SW1.1	OFF/ ON	Boot from NAND Flash	GPG1/GPG0
SW1.2/SW1.1	OFF/OFF	Boot from QSPI0 Flash	GPG1/GPG0

Resistance	Status	Function	GPIO pin of NUC980
R24	Solder R	Watchdog Timer OFF	GPG3
R24	Remove	Watchdog Timer ON	GPG3

Resistance	Status	Function	GPIO pin of NUC980
R25	Solder R	UART0 debug message ON	GPG5
R25	Remove	UART0 debug message OFF	GPG5

Resistance	Status	Function	GPIO pin of NUC980
R27/R26	Solder R/ Solder R	SPI-NAND Flash boot with 1-bit mode	GPG9/GPG8
R27/R26	Solder R/ Remove	SPI-NAND Flash boot with 4-bit mode	GPG9/GPG8
R27/R26	Remove/ Solder R	SPI-NOR Flash boot with 4-bit mode	GPG9/GPG8
R27/R26	Remove/ Remove	SPI-NOR Flash boot with 1-bit mode	GPG9/GPG8

- Audio CODEC (U11, M1, CON6, CON7, CN1): nuvoTon NAU8822L (U11) connects to NUC980 using I2S interface
  - Microphone (M1): Through the NAU8822L chip sound input
  - Speaker output (CON6): Through the NAU8822L chip sound output

Connector	Pin Name	Functions
CON6.1	SPKOUT_R	NAU8822L BTL Speaker Positive Output or Right high current output.
CON6.2	SPKOUT_L	NAU8822L BTL Speaker Negative Output or Left high current output.

  - Earphone output (CON7): Through the NAU8822L chip sound output

- USB0 Device/HOST (CON9, JP1): USB0 Device/HOST Micro-B connector, By JP1 status or defined by the ID pin of the USB cable
- USB1 HOST (CON10): USB1 for USB HOST with type-A connector
- Ethernet0_PE (CON5, U9): For Ethernet port, the NUC980 support RMII interface which add one Ethernet PHY IP101GR to RJ45 connector with LED indicator
- SOC CPU: NUC980DK61Y (U5)

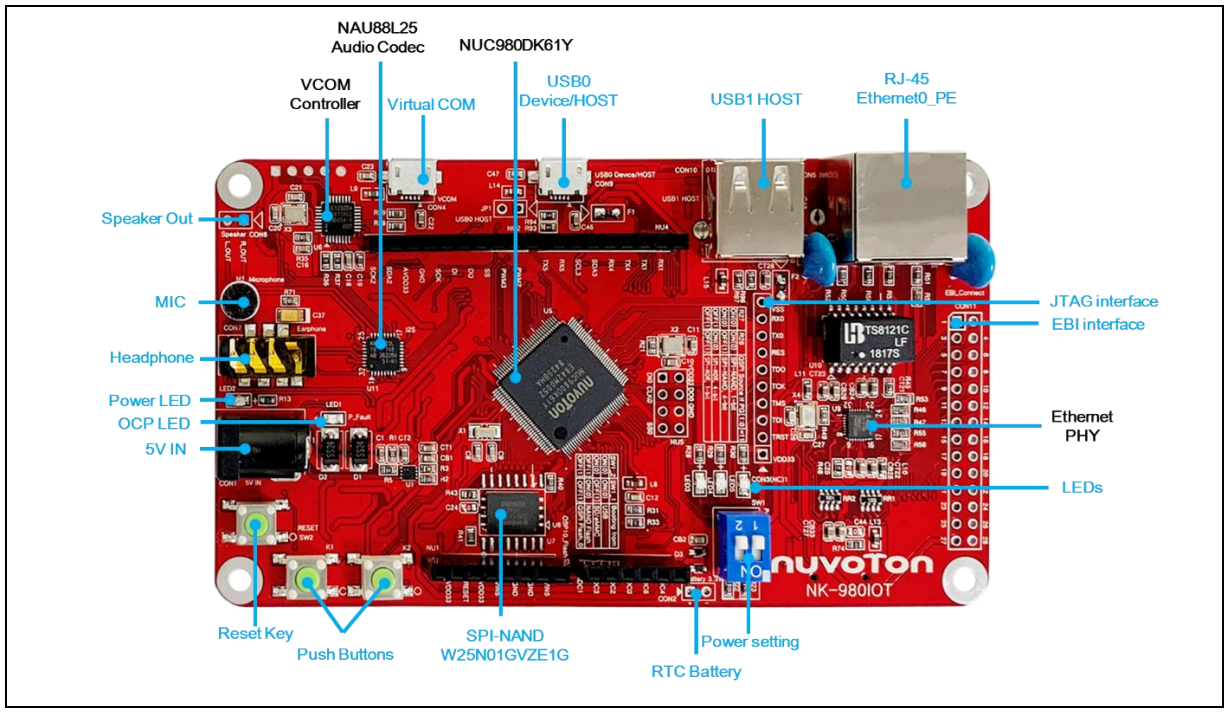


Figure 2-1 NK-980IoT Board (Front View)

2.3 NK-980IoT Board – Rear View

Figure 2-2 shows the main components from the rear view of NK-980IoT board

- VCOM ICE interface: ICE Controller NUC123ZD4AN0 (U6), USB connector (CON3) to PC Host

Connector	Pin Name	Functions
CON3.1	VDD33	DC 3.3V
CON3.2	ICE_DAT	Serial Wired Debugger Data
CON3.3	ICE_CLK	Serial Wired Debugger Clock
CON3.4	RST#	VCOM Chip Reset, Active Low.
CON3.5	VSS	Power Ground

- Audio CODEC (U11, M1, CON6, CON7, CN1): nuvoTon NAU8822L (U11) connects to NUC980 using I2S interface
  - Auxiliary Input and Output(CN1)

Connector	Pin Name	Functions
CN1.1	AUXOUT1	Mono Mixed Output / Line Output
CN1.2	AUXOUT2	Line Output
CN1.3	AUXINR	Right Auxiliary Input
CN1.4	AUXINL	Left Auxiliary Input

- MicroSD Card Slot: T-Flash slot (CON8)

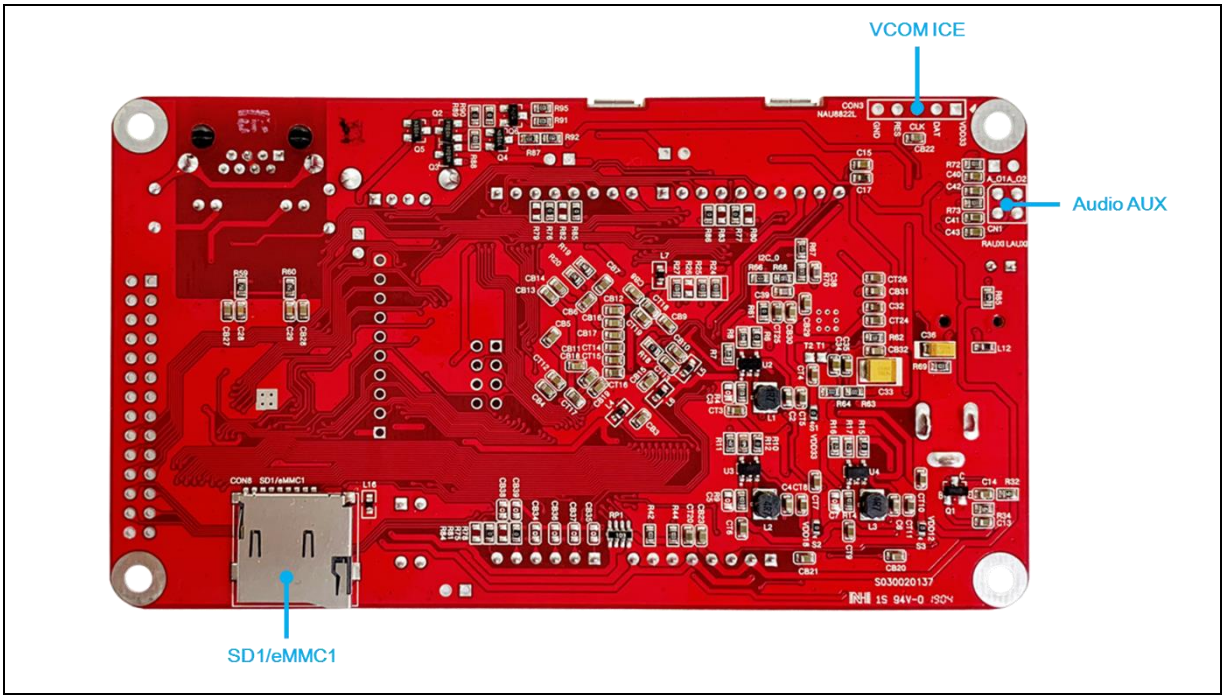


Figure 2-2 NK-980IoT Board (Rear View)

2.4 NK-980IoT Board PCB Placement

The following figure shows NK-980IoT board PCB placement.

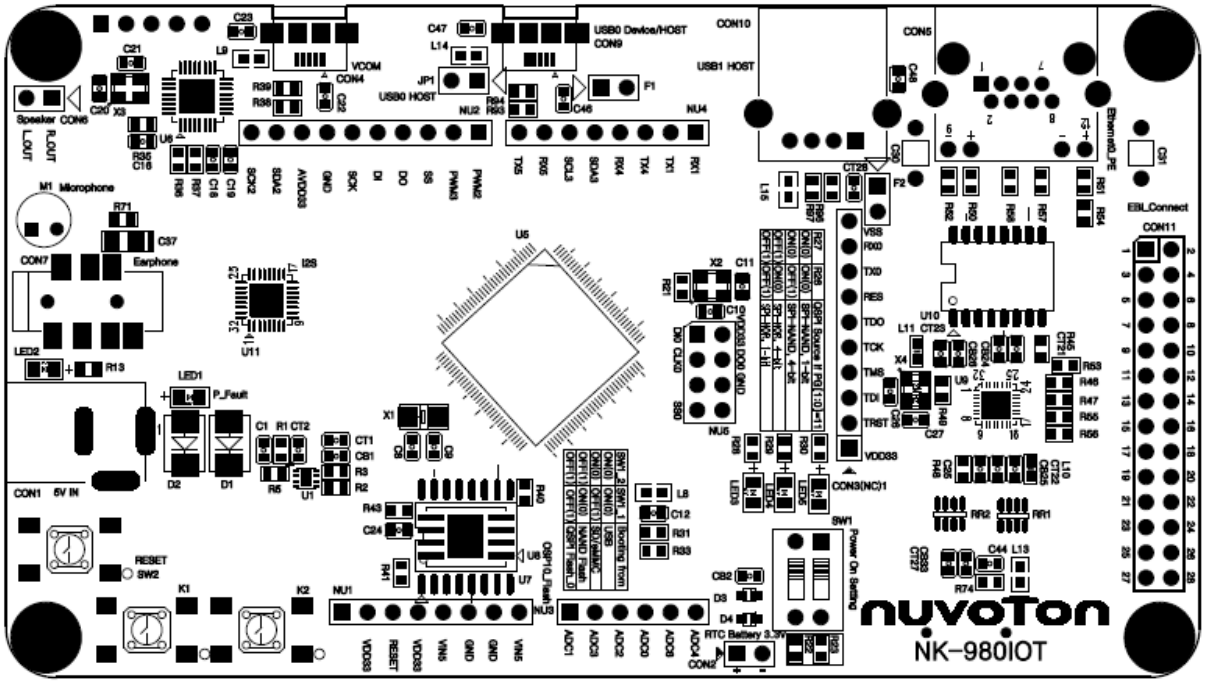


Figure 2-3 NK-980IoT Board Front PCB Placement

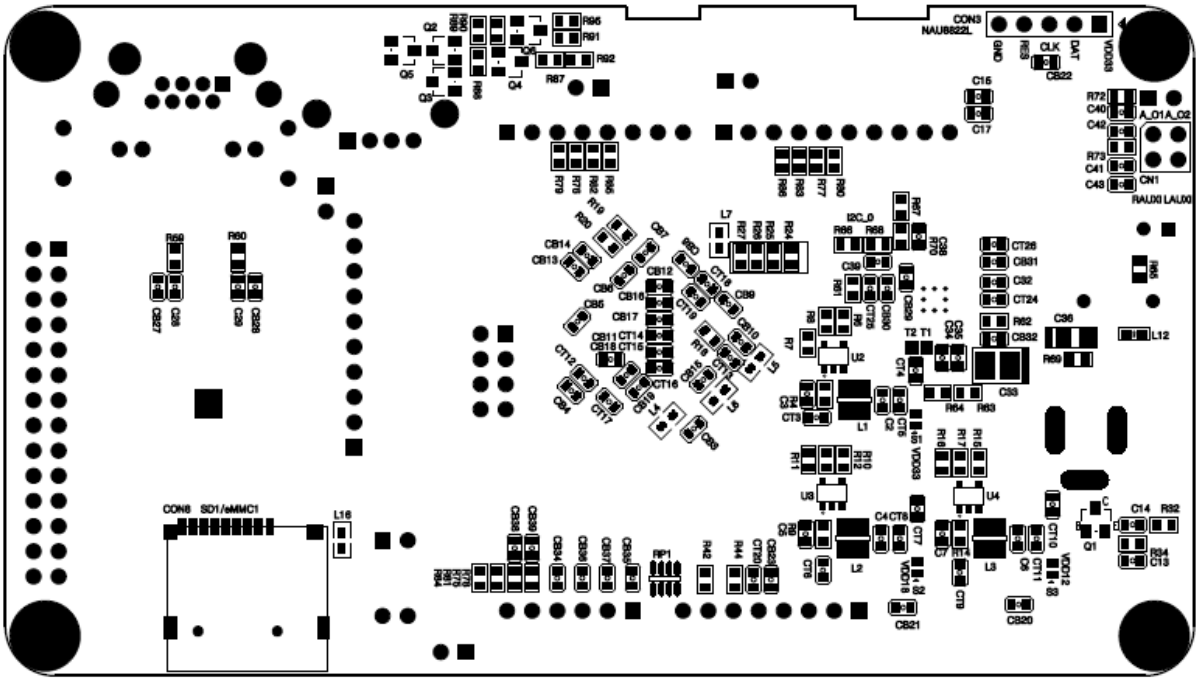


Figure 2-4 NK-980IoT Board Back PCB Placement

3 STARTING TO USE VCOM FUNCTION

3.1 Download and Install VCOM Driver

Please visit nuvoTon's NuMicro™ website (http://www.nuvoton.com/NuMicro) to download the "NuMicro™ ICP Programming Tool" file. After the ICP Programming Tool driver is downloaded, please unzip the file and execute the "ICP Programming Tool.exe". Simply follow the installation and optional steps to install ICP Programming Tool and Nu-Link USB Driver, which included VCOM driver.

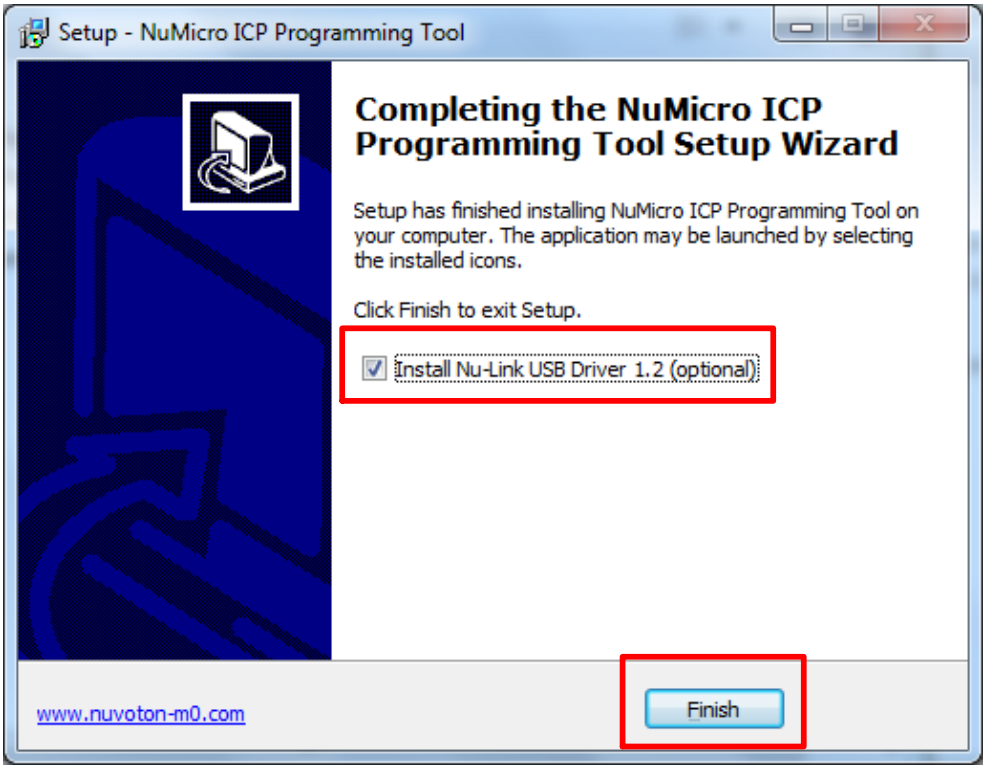


Figure 3-1 Optional Step after ICP Programming Tool Installation

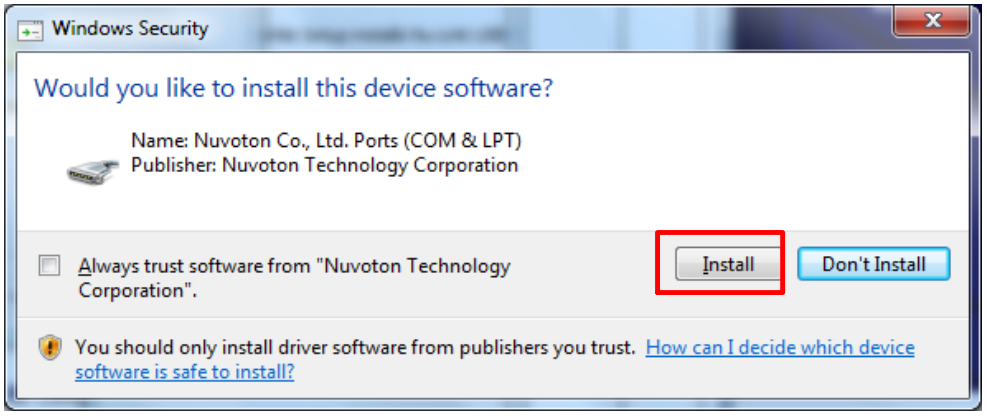


Figure 3-2 Install nuvoTon COM &LPT Driver

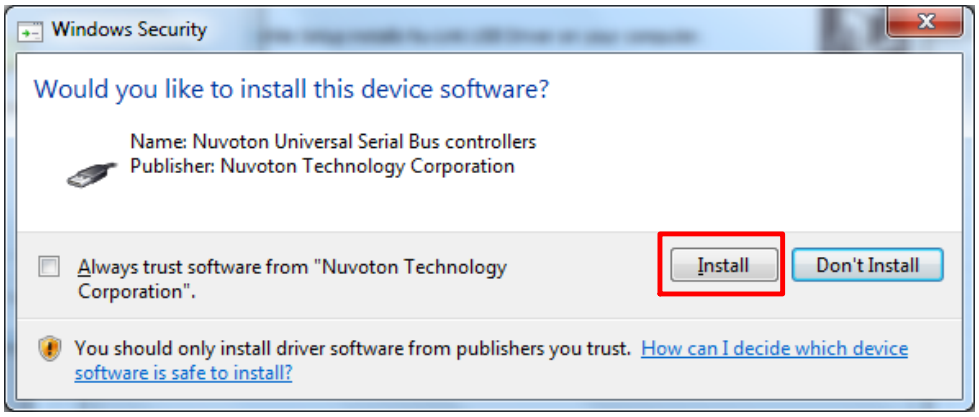


Figure 3-3 Install nuvoTon Universal Serial Bus Controllers

3.2 Connect to PC HOST

Connect the USB micro-B port (CON4) to the PC HOST.

The PC HOST will supply 5V power to the NK-980IoT board and will recognize the board as a USB composite device.

The VCOM port function is used to print some messages on PC API, such as Tera Term, through the standard UART protocol to help user to debug program.

3.2.1 Open the Serial Port Terminal

Use the serial port terminal, SecureCRT for example, to print out debug message.

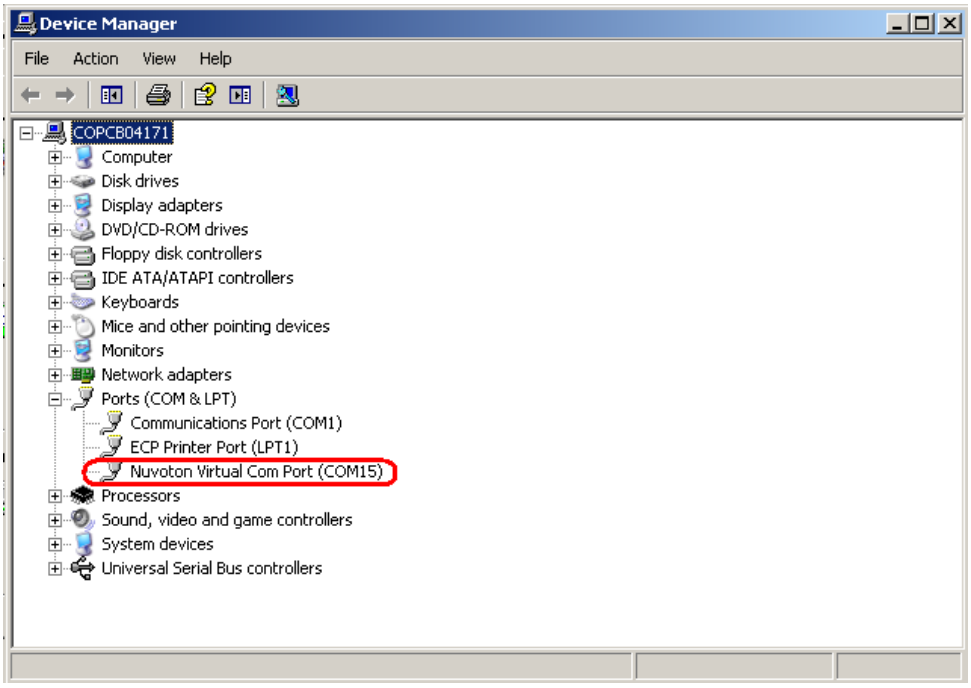


Figure 3-4 NK-980IoT board in “Device Manager”

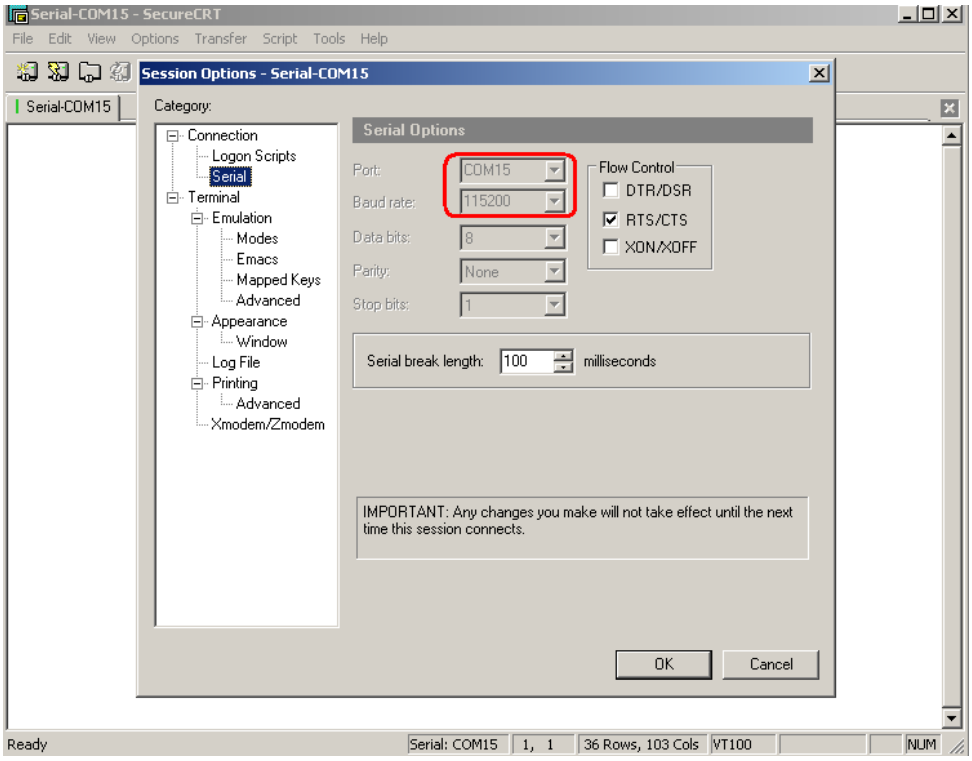


Figure 3-5 SecureCRT Baud Rate Setting

3.2.2 Reset Chip

After pressing the reset button, the chip will reprogram application and print out debug message.

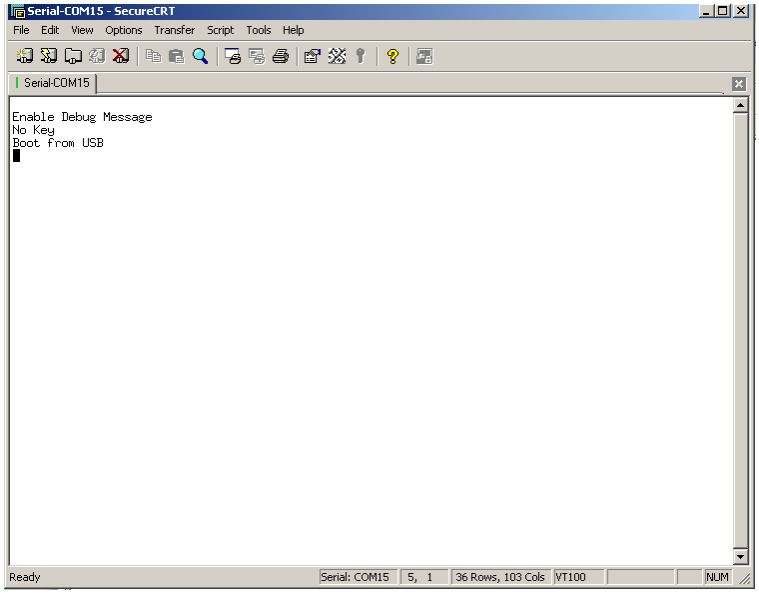
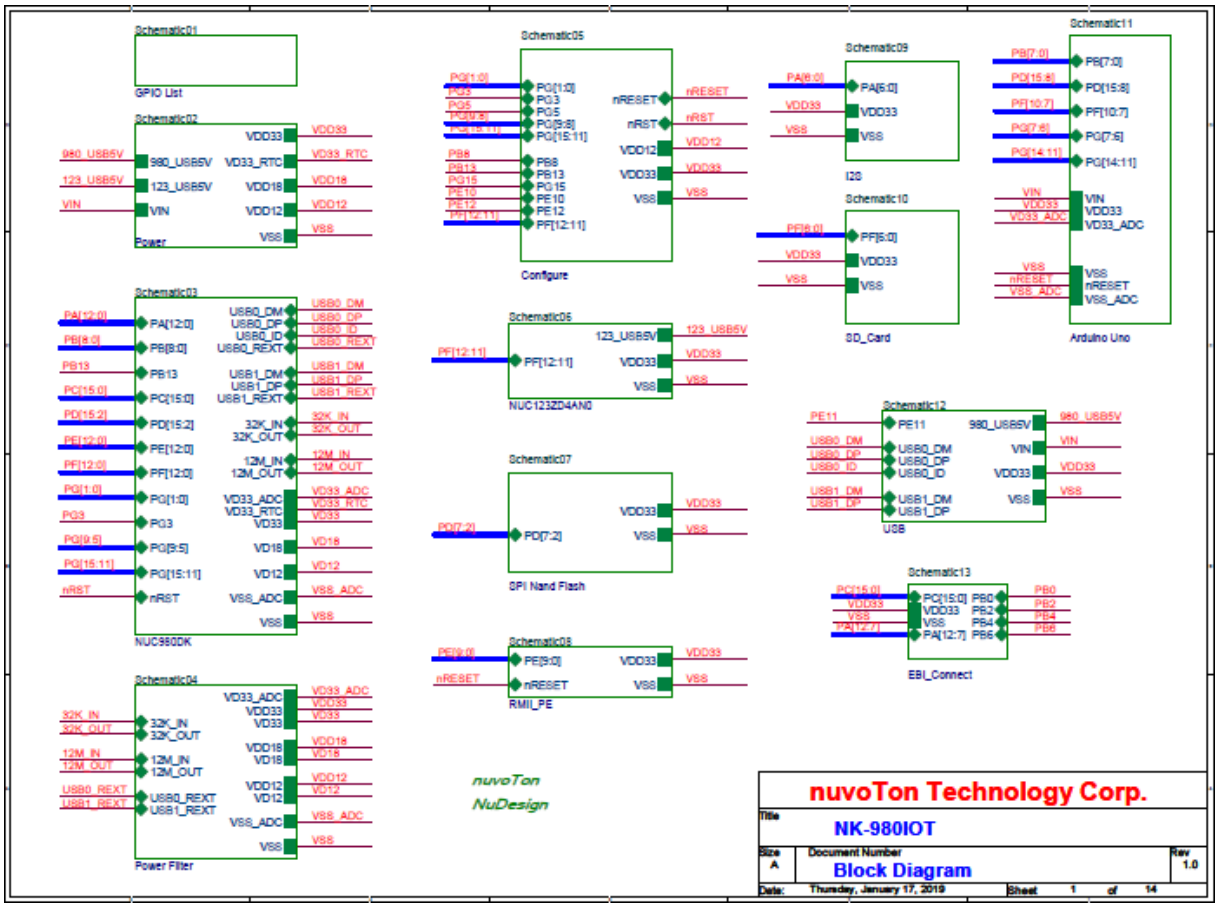


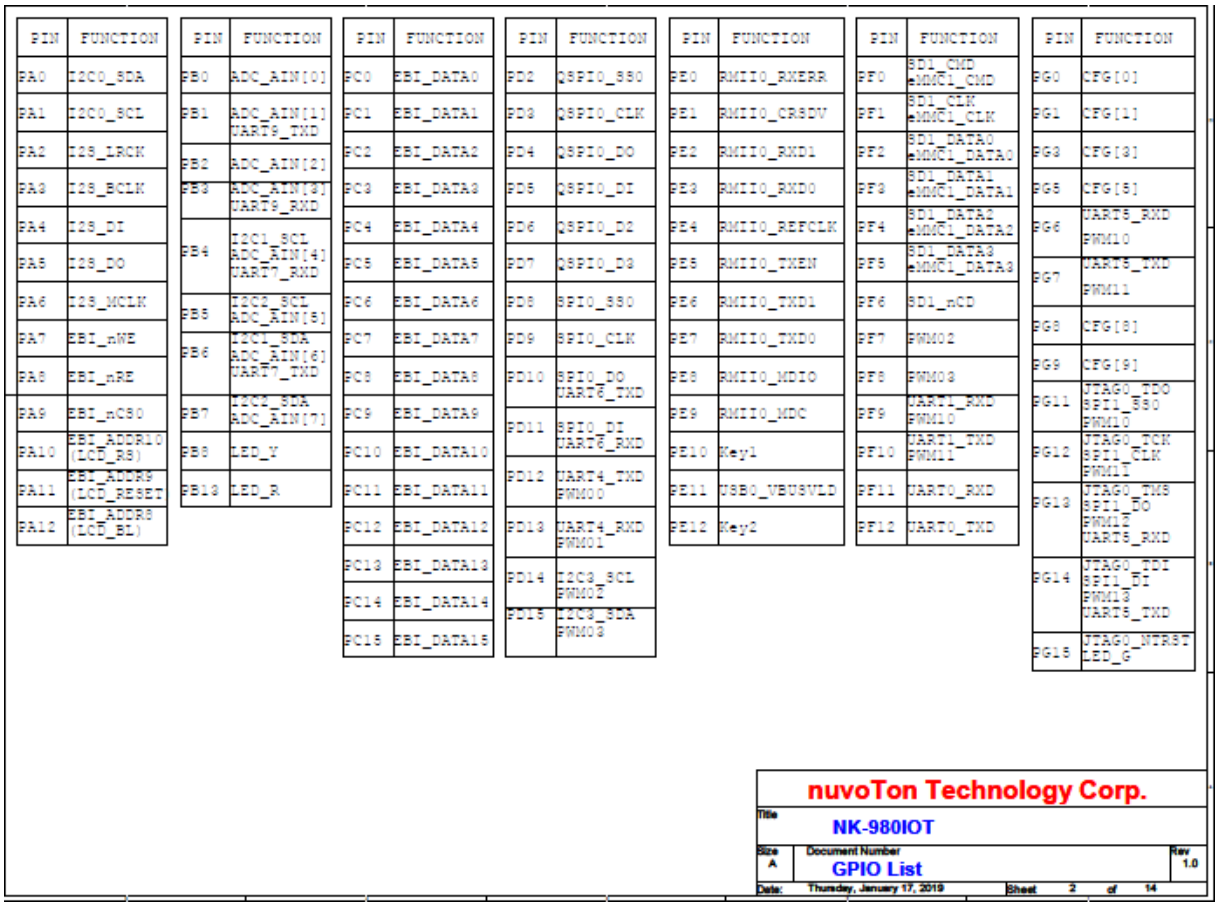
Figure 3-4 Serial Port Terminal Windows

4 NK-980IOT SCHEMATICS

4.1 NK-980IoT – Block Diagram Schematic



4.2 NK-980IoT – GPIO List Schematic



PIN	FUNCTION
PA0	I2C0_SDA
PA1	I2C0_SCL
PA2	I2S_LRCK
PA3	I2S_BCLK
PA4	I2S_DI
PA5	I2S_DO
PA6	I2S_MCLK
PA7	EBI_nWE
PA8	EBI_nRE
PA9	EBI_nCS0
PA10	EBI_ADDR10 (LCD_RS)
PA11	EBI_ADDR9 (LCD_RESET)
PA12	EBI_ADDR8 (LCD_BL)

PIN	FUNCTION
PB0	ADC_AIN[0]
PB1	ADC_AIN[1] UART9_TXD
PB2	ADC_AIN[2]
PB3	ADC_AIN[3] UART9_RXD
PB4	I2C1_SCL ADC_AIN[4] UART7_RXD
PB5	I2C2_SCL ADC_AIN[5]
PB6	I2C1_SDA ADC_AIN[6] UART7_TXD
PB7	I2C2_SDA ADC_AIN[7]
PB8	LED_Y
PB10	LED_R

PIN	FUNCTION
PC0	EBI_DATA0
PC1	EBI_DATA1
PC2	EBI_DATA2
PC3	EBI_DATA3
PC4	EBI_DATA4
PC5	EBI_DATA5
PC6	EBI_DATA6
PC7	EBI_DATA7
PC8	EBI_DATA8
PC9	EBI_DATA9
PC10	EBI_DATA10
PC11	EBI_DATA11
PC12	EBI_DATA12
PC13	EBI_DATA13
PC14	EBI_DATA14
PC15	EBI_DATA15

PIN	FUNCTION
PD2	QSPI0_SS0
PD3	QSPI0_CLK
PD4	QSPI0_D0
PD5	QSPI0_D1
PD6	QSPI0_D2
PD7	QSPI0_D3
PD8	SPI0_SS0
PD9	SPI0_CLK
PD10	SPI0_D0 UART6_TXD
PD11	SPI0_D1 UART6_RXD
PD12	UART4_TXD PWM00
PD13	UART4_RXD PWM01
PD14	I2C3_SCL PWM02
PD15	I2C3_SDA PWM03

PIN	FUNCTION
PE0	RMII0_RXERR
PE1	RMII0_CRSDV
PE2	RMII0_RXD1
PE3	RMII0_RXD0
PE4	RMII0_REFCLK
PE5	RMII0_TXEN
PE6	RMII0_TXD1
PE7	RMII0_TXD0
PE8	RMII0_MDIO
PE9	RMII0_MDC
PE10	Key1
PE11	USB0_VBUSVLD
PE12	Key2

PIN	FUNCTION
PF0	SD1_CMD eMMC1_CMD
PF1	SD1_CLK eMMC1_CLK
PF2	SD1_DATA0 eMMC1_DATA0
PF3	SD1_DATA1 eMMC1_DATA1
PF4	SD1_DATA2 eMMC1_DATA2
PF5	SD1_DATA3 eMMC1_DATA3
PF6	SD1_nCD
PF7	PWM02
PF8	PWM03
PF9	UART1_RXD PWM10
PF10	UART1_TXD PWM11
PF11	UART0_RXD
PF12	UART0_TXD

PIN	FUNCTION
PG0	CFG[0]
PG1	CFG[1]
PG3	CFG[3]
PG5	CFG[5]
PG6	UART5_RXD PWM10
PG7	UART5_TXD PWM11
PG8	CFG[8]
PG9	CFG[9]
PG11	JTAG0_TDO SPI1_SS0 PWM10
PG12	JTAG0_TCK SPI1_CLK PWM11
PG13	JTAG0_TMS SPI1_D0 PWM10 UART5_RXD
PG14	JTAG0_TDI SPI1_D1 PWM11 UART5_TXD
PG15	JTAG0_nTRST LED_G

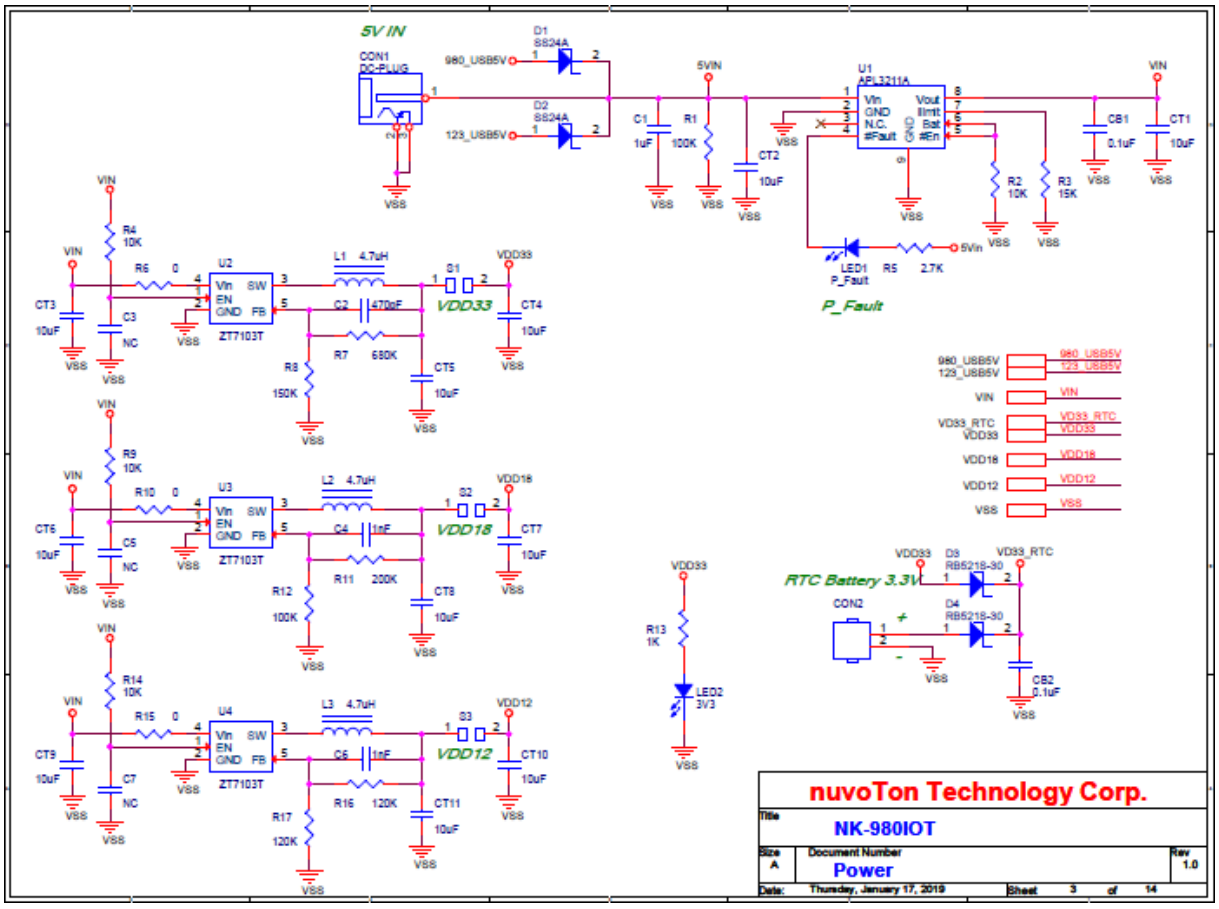
nuvoTon Technology Corp.

Title: NK-980IOT

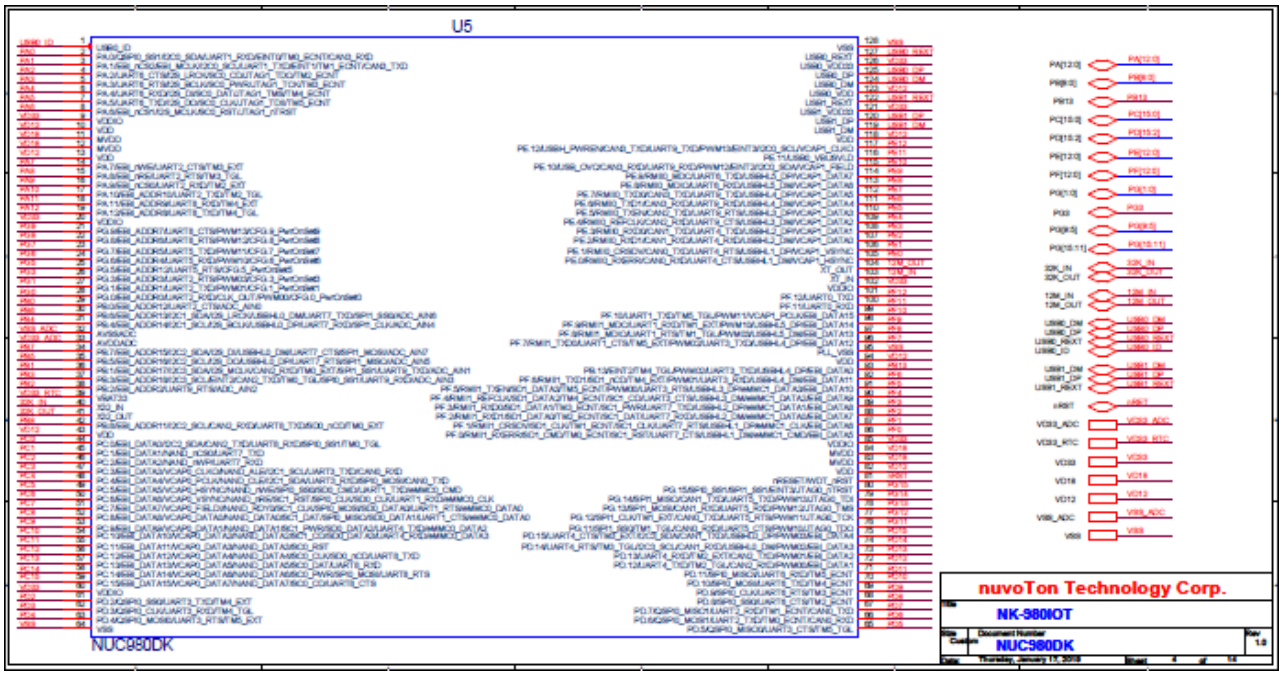
Size: A | Document Number: GPIO List | Rev: 1.0

Date: Thursday, January 17, 2019 | Sheet 2 of 14

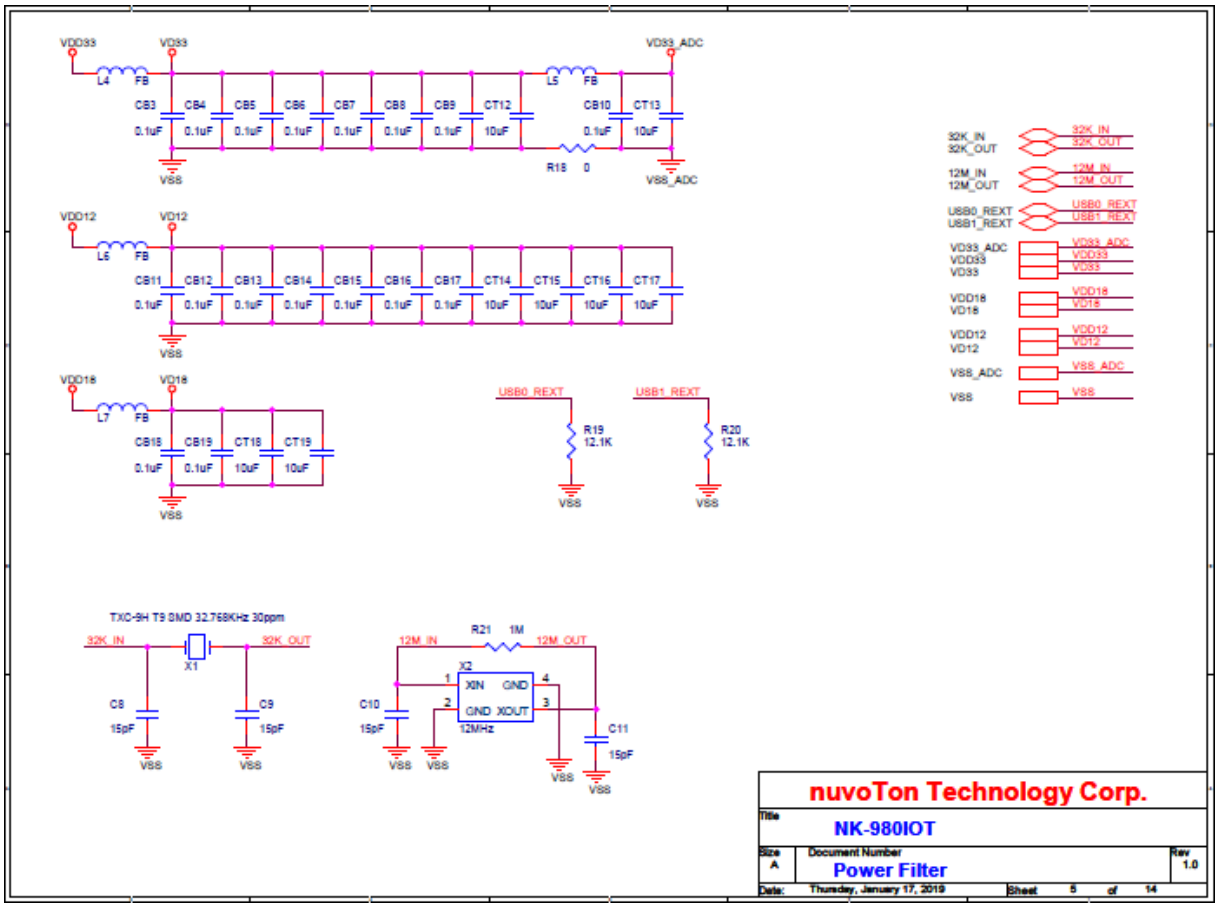
4.3 NK-980IoT – Power Schematic



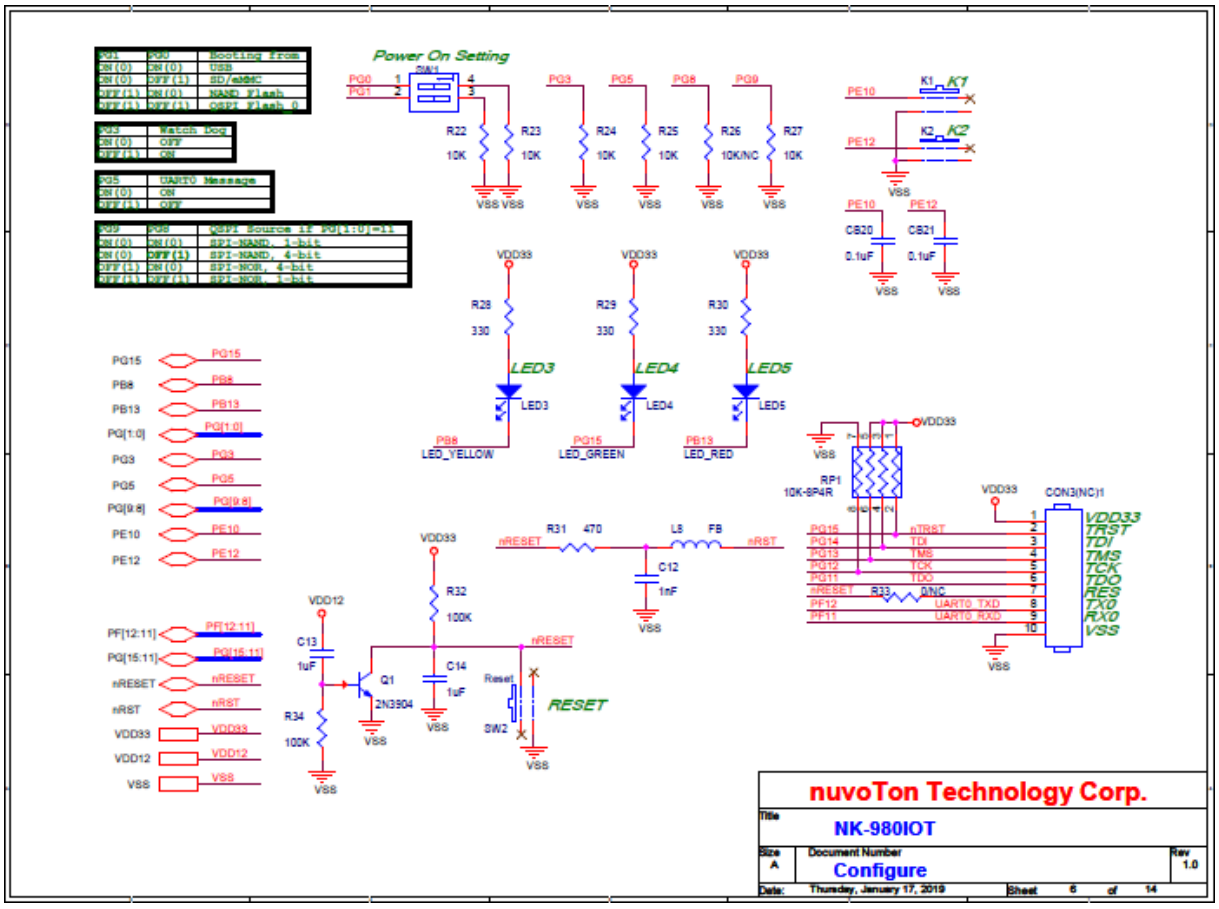
4.4 NK-980IoT – NUC980DK Schematic



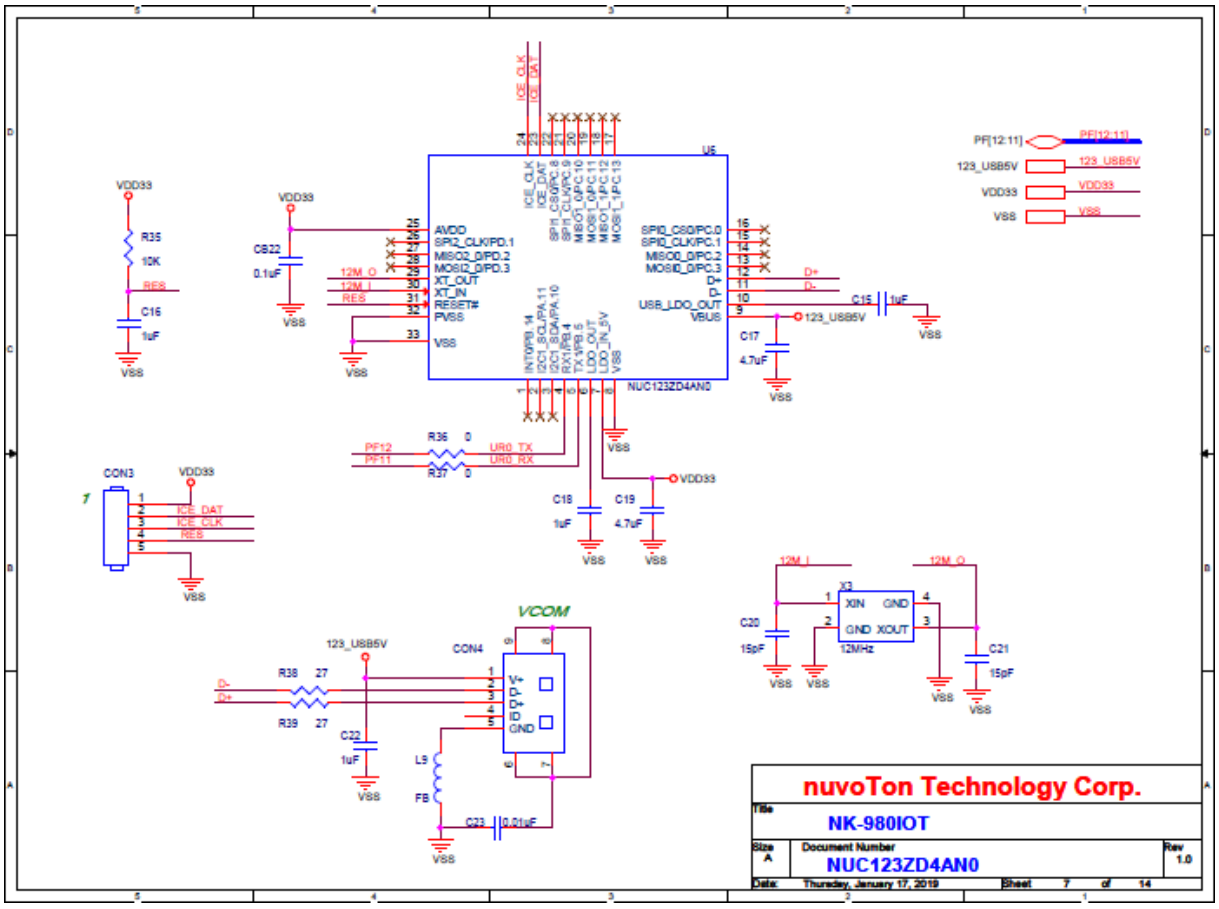
4.5 NK-980IoT – Power Filter Schematic



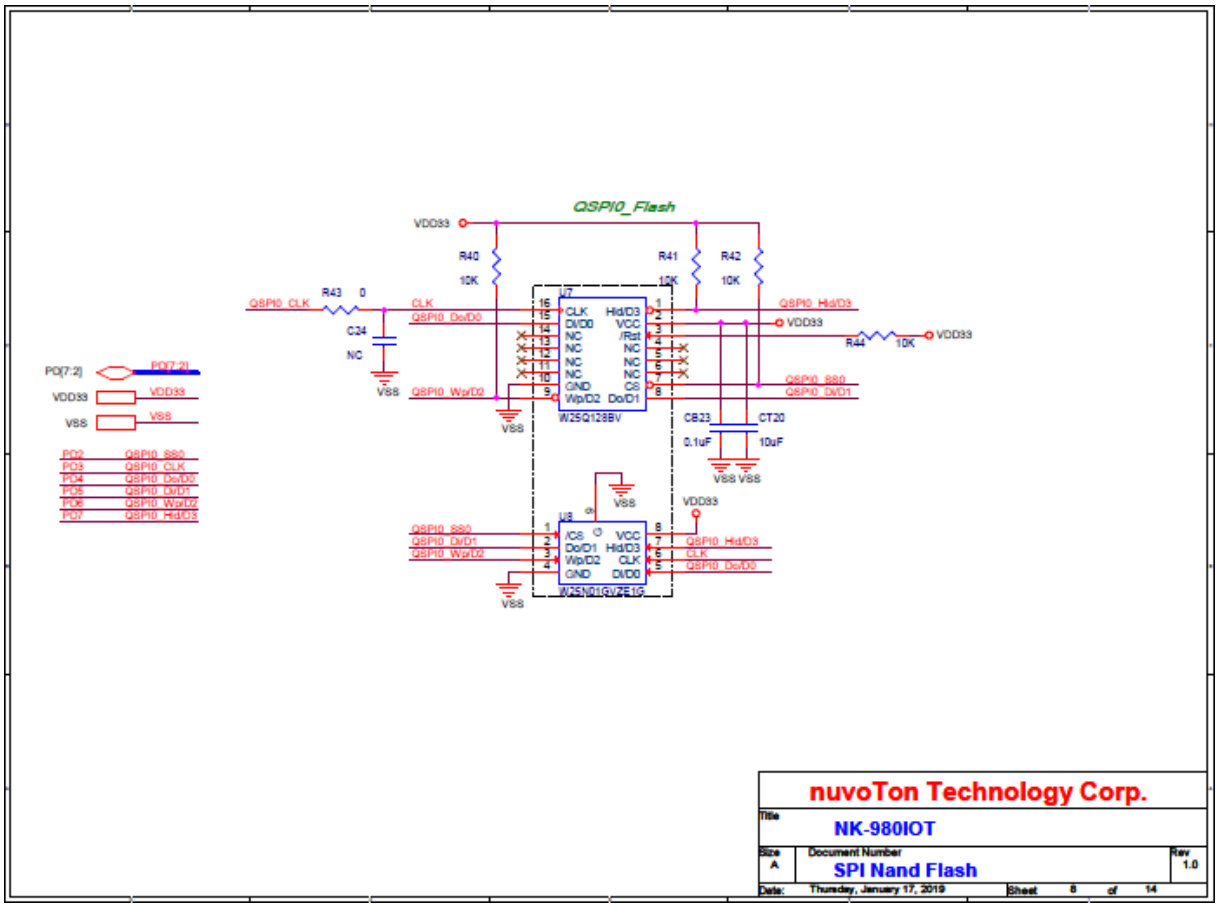
4.6 NK-980IoT – Configure Schematic



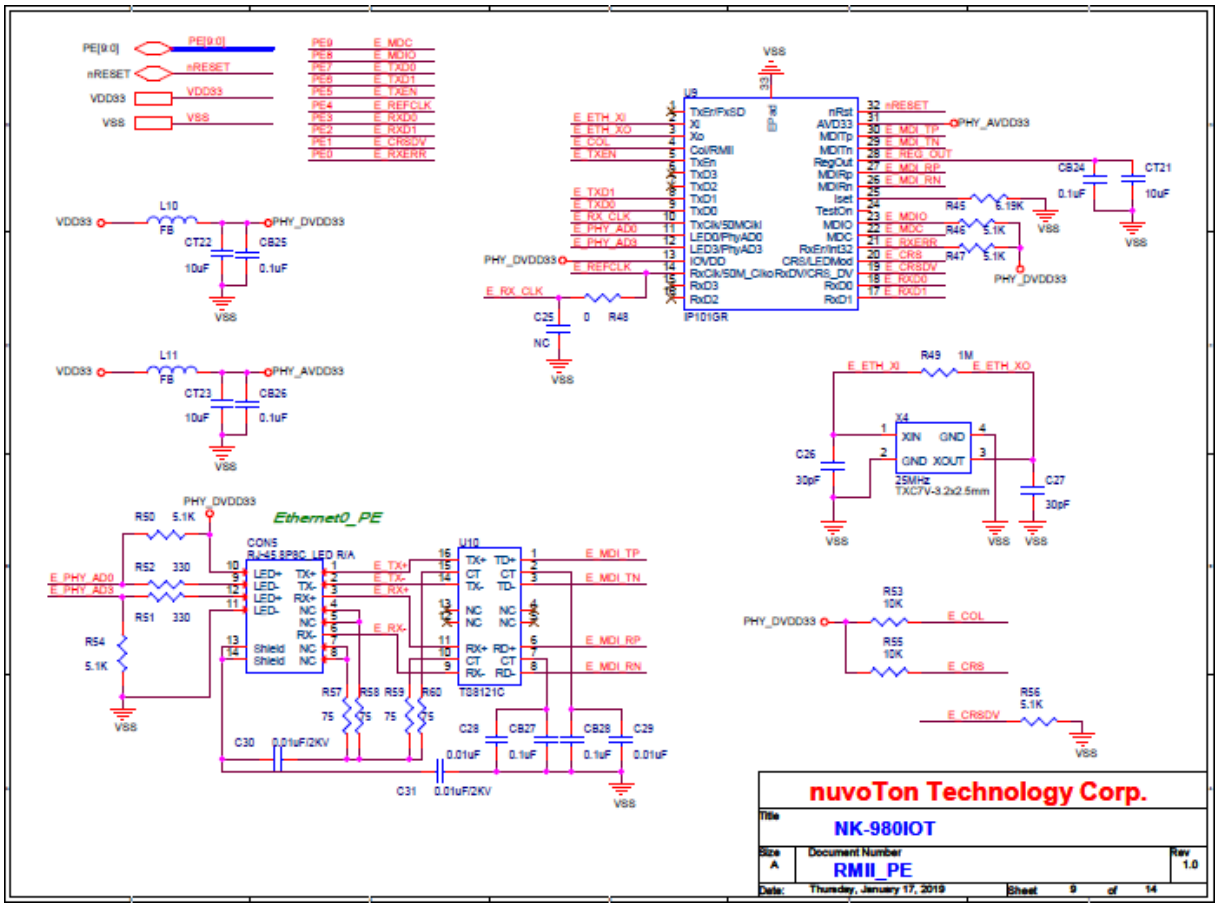
4.7 NK-980IoT – NUC123ZD4AN0 Schematic



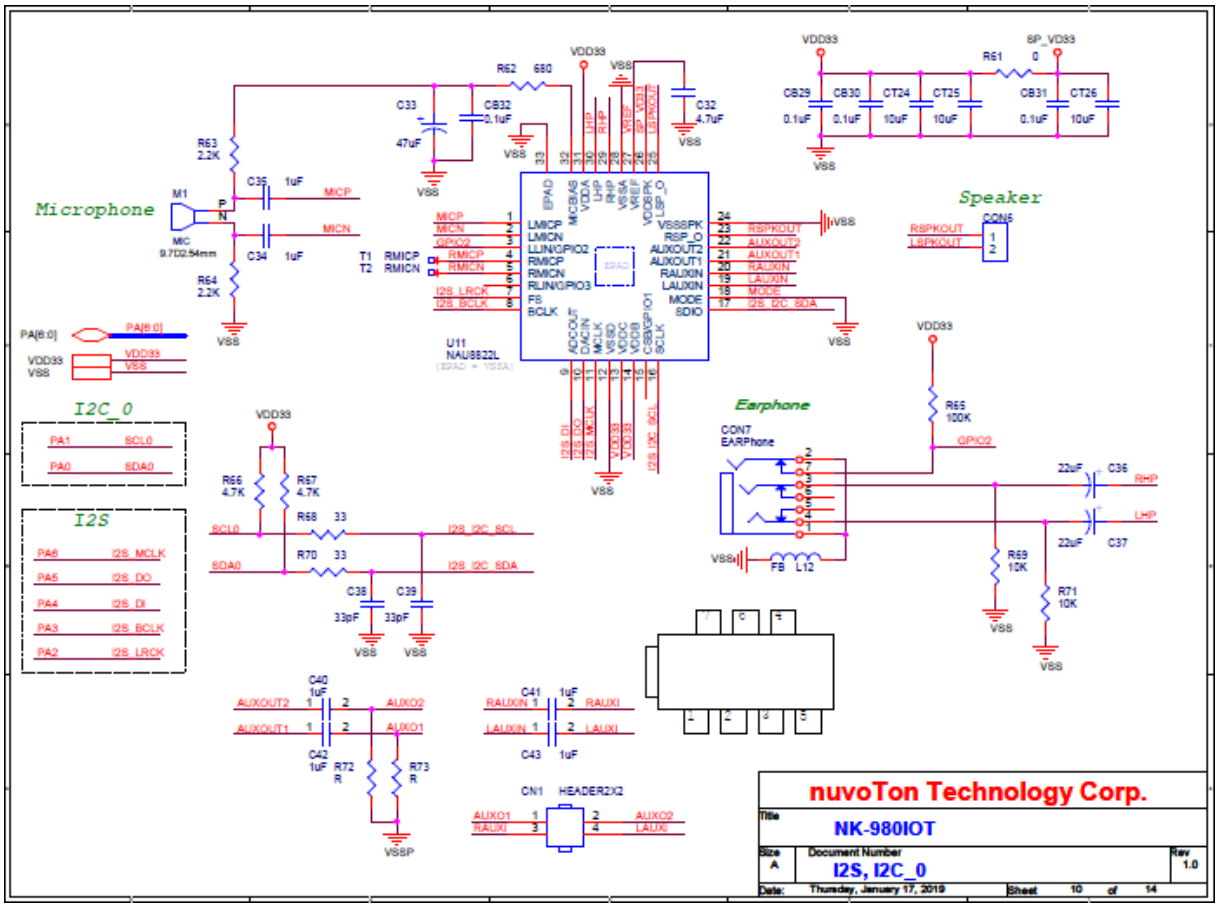
4.8 NK-980IoT – Memory Schematic



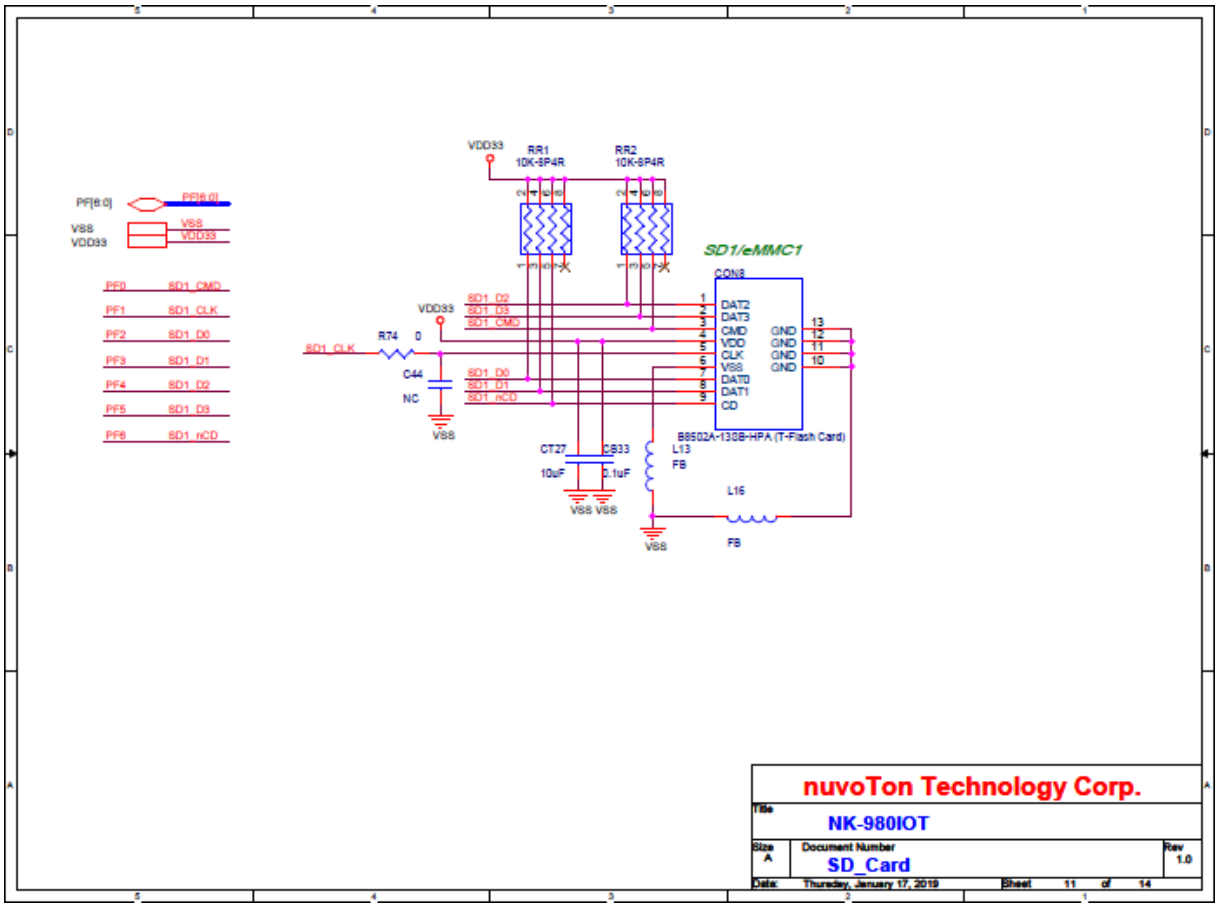
4.9 NK-980IoT – RMII_PE Schematic



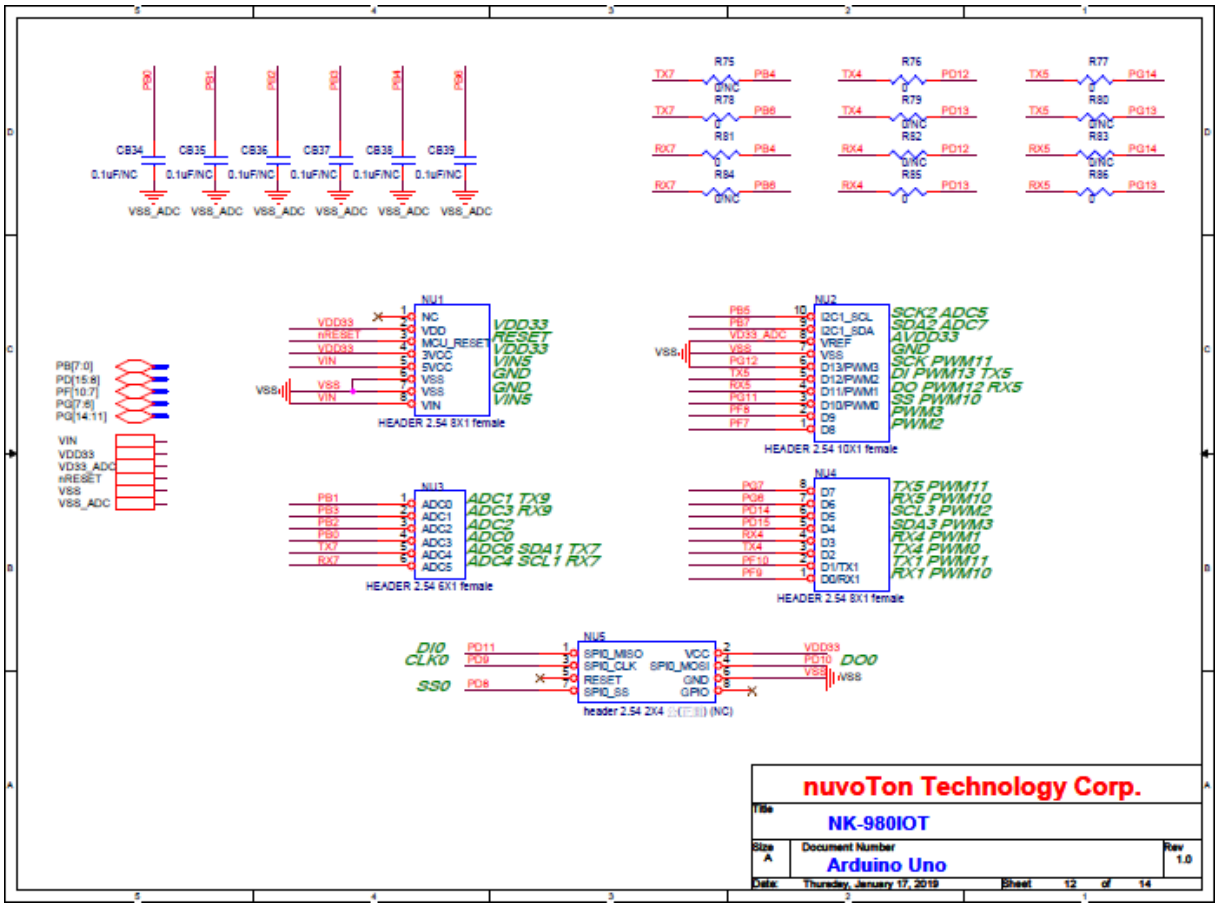
4.10 NK-980IoT – Audio Codec Schematic



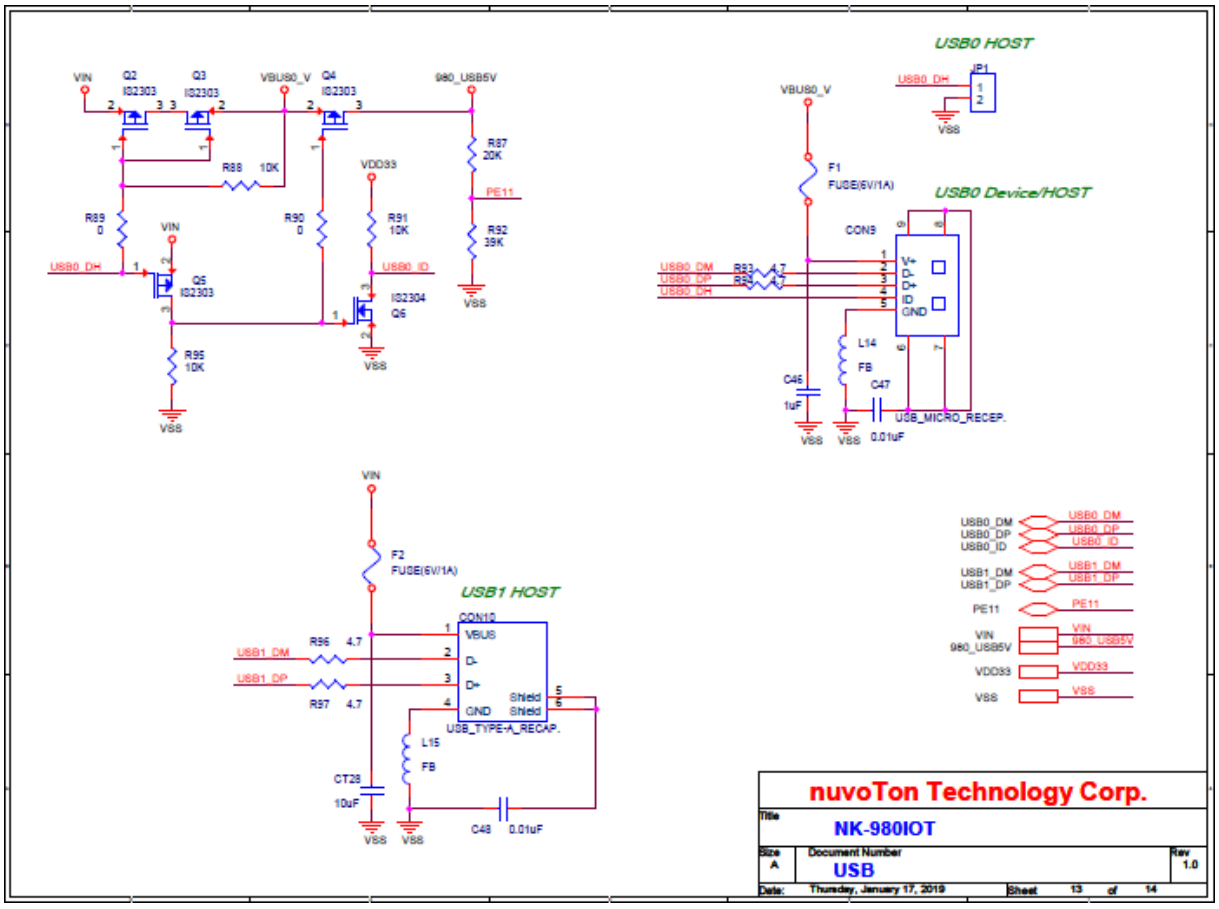
4.11 NK-980IoT – SD1/eMMC1 Schematic



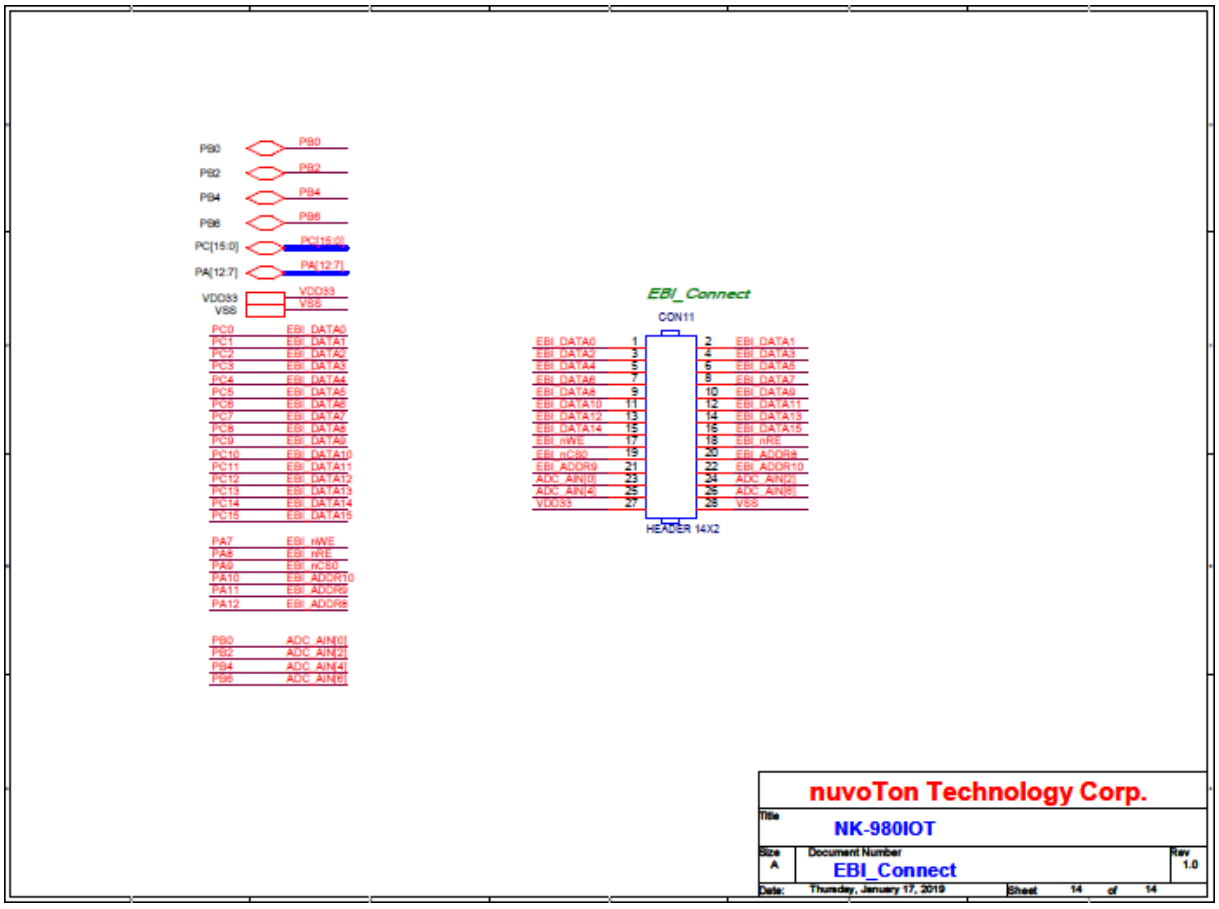
4.12 NK-980IoT – Arduino Uno Interface Schematic



4.13 NK-980IoT – USB Schematic



4.14 NK-980IoT – Expand EBI Interface Schematic



5 REVISION HISTORY

Date	Revision	Description
2019.02.25	1.00	1. Initially issued.

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