

**ARM® ARM926EL-S Based
32-bit Microprocessor**

**NUC972DF62Y
NuDesign UART to Ethernet
User Manual**

The information described in this document is the exclusive intellectual property of Nuvoton Technology Corporation and shall not be reproduced without permission from Nuvoton.

Nuvoton is providing this document only for reference purposes of NuMicro microcontroller based system design. Nuvoton assumes no responsibility for errors or omissions.

All data and specifications are subject to change without notice.

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

www.nuvoton.com

Table of Contents

1	Overview	4
2	Introduction to NuDesign UART to Ethernet Board	5
2.1	NuDesign-EtherU and NuDesign-EtherD Board Features	5
2.2	NuDesign-EtherU Board — Front View	5
2.3	NuDesign-EtherU Board — Rear View	7
2.4	NuDesign-EtherD — Front View	8
2.5	NuDesign-EtherD — Rear View	9
2.6	NuDesign-EtherU and NuDesign-EtherD — Front View	10
2.7	NuDesign-EtherU and NuDesign-EtherD Jumper Description	11
2.8	NuDesign-EtherU and NuDesign-EtherD PCB Placement	15
3	Starting to Use VCOM Function	17
3.1	Download and Install VCOM Driver	17
3.2	Connect to PC HOST	18
4	NuDesign UART To Ethernet Schematics	21
4.1	NuDesign-EtherU — Block Diagram Schematic	21
4.2	NuDesign-EtherU — Configure Schematic	22
4.3	NuDesign-EtherU — Connector Schematic	23
4.4	NuDesign-EtherU — Memory Schematic	24
4.5	NuDesign-EtherU — NUC123ZD4AN0 Schematic	25
4.6	NuDesign-EtherU — NUC972DF62Y Schematic	26
4.7	NuDesign-EtherU — Power Schematic	27
4.8	NuDesign-EtherU — Power Filter Schematic	28
4.9	NuDesign-EtherU — RMII_PE Schematic	29
4.10	NuDesign-EtherU — RMII_PF Schematic	30
4.11	NuDesign-EtherU — UART Schematic	31
4.12	NuDesign-EtherU — USB Schematic	32
4.13	NuDesign-EtherD — Block Diagram Schematic	33
4.14	NuDesign-EtherD — Connector Schematic	34
4.15	NuDesign-EtherD — UART 3/4/5/6 Schematic	35
4.16	NuDesign-EtherD — UART 7/8/9/10 Schematic	36

5 Revision History 37

1 OVERVIEW

Nuvoton's NuDesign-EtherU and NuDesign-EtherD development board is a specific development tool based on Nuvoton's NUC972DF62Y to provide customers with a low cost and ease of development. It can be easily customized for customers to provide their own UART-to-Ethernet device server products.

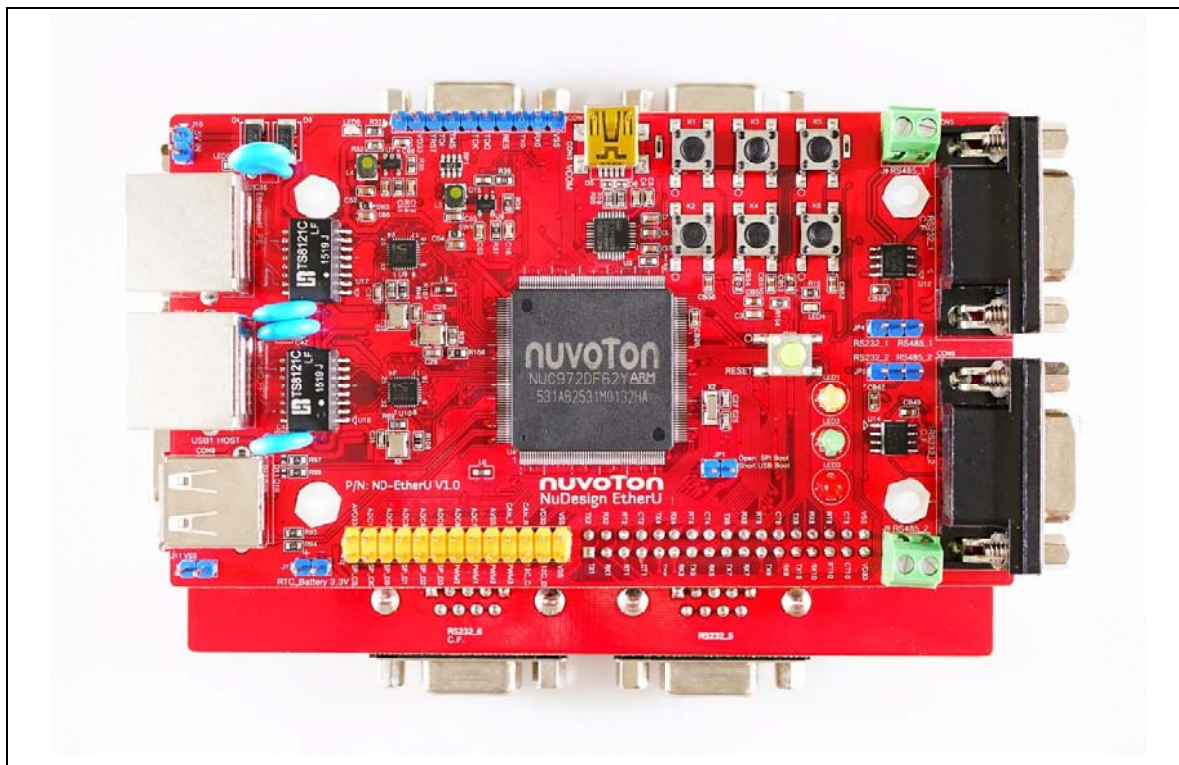


Figure 1-1 NuDesign-EtherU and EtherD Development Board

2 INTRODUCTION TO NUDESIGN UART TO ETHERNET BOARD

The NuDesign UART to Ethernet solution uses an outstanding CPU core ARM926EJ-S, NUC972DF62Y which runs up to 300 MHz and features the embedded 64MB DDR2 memory, with 16 KB I-cache, 16 KB D-cache and MMU, 56 KB embedded SRAM and 16 KB IBR (Internal Boot ROM) for booting from SPI Flash.

The NuDesign UART to Ethernet solution integrates 10 sets of full-duplex serial data converters for communications with two 10/100 Mb Ethernet ports communication. It contains two kinds of board, including the NuDesign-EtherU board and NuDesign-EtherD board.

The NuDesign-EtherU board supports two full-duplex RS232/RS485 UART ports for traditional UART devices connection and two Ethernet ports for network connection. If users want to use more serial devices, they must connect the NuDesign EtherD board to the NuDesign EtherU board such that system will be expanded to 10 UART ports.

2.1 NuDesign-EtherU and NuDesign-EtherD Board Features

- NUC972DF62Y: LQFP216 pin MCP package with DDR2 (64 MB).
- SPI Flash (32 MB) booting with quad mode.
- One STD SD slot served either as a SD memory card for data storage or SDIO (Wi-Fi) device.
- Provides 11 sets of COM ports.
 - UART0 can be served as Virtual COM port for system development .
 - NuDesign-EtherU main board, including 2 sets of UARTs with RS232/RS484 transceiver alternatively.
 - NuDesign-EtherD extended board, including 8 sets of UARTs with RS232 transceiver.
- JTAG interface provided for software development .
- Two Ethernet RJ45 ports with RMII PHY (IP101GR) and transformer.
- 3 sets of LED for status indication.
- 6 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.
- Provides over-voltage and over current protection .
- 3.3V I/O power, 1.8V Memory power and 1.2V core power.

2.2 NuDesign-EtherU Board — Front View

Figure 2-1 shows the main components and connectors from the front view of NuDesign-EtherU board.

- SOC CPU: NUC972DF62Y (U4).
- Virtual COM controller: NUC123ZD4AN0 (U3), USB mini-B connector (CON3) to PC HOST.
- Power-on Booting Selection Jumper (JP1)
 - JP1 open: booting from SPI Flash.
 - JP1 short: booting from USB.
- System Reset (SW1): system will be reset if the SW1 button is pressed.

- JTAG interface (CON1).
- Power supply connectors: +5V (J10) and GND (J11).
- External BAT supply for RTC 3.3V powered (J7) .
- RJ45-1 connector with LED Indicator (CON9), RMII PHY-1 with IP101GR (U9).
- RJ45-0 connector with LED Indicator (CON10), RMII PHY-0 with IP101GR (U10).
- USB port 1 for USB HOST with type-A connector (CON8).
- Expanded connectors (J2), including SPI, 4 sets of PWM, I²C, 7 sets of ADC and CAN bus functions.
- 6 push button keys (K1 ~ K6).
- Three indication LEDs:

LED	Color	GPIO pin of NUC972
LED1	Yellow	GPD12
LED2	Green	GPD13
LED3	Red	GPD14

- UART1 selection:
 - JP4: 1-2 short for RS232 function and RS232 connected to DB9 female (CON5).
 - JP4: 2-3 short for RS485 function with SN65HVD10D (U12) transceiver, and RS485 connected to 2P terminal (J8).
- UART2 selection:
 - JP5: 1-2 short for RS232 function and RS232 connected DB9 female (CON6)
 - JP5: 2-3 short for RS485 function with SN65HVD10D (U14) transceiver, and RS485 connected to 2P terminal (J9)

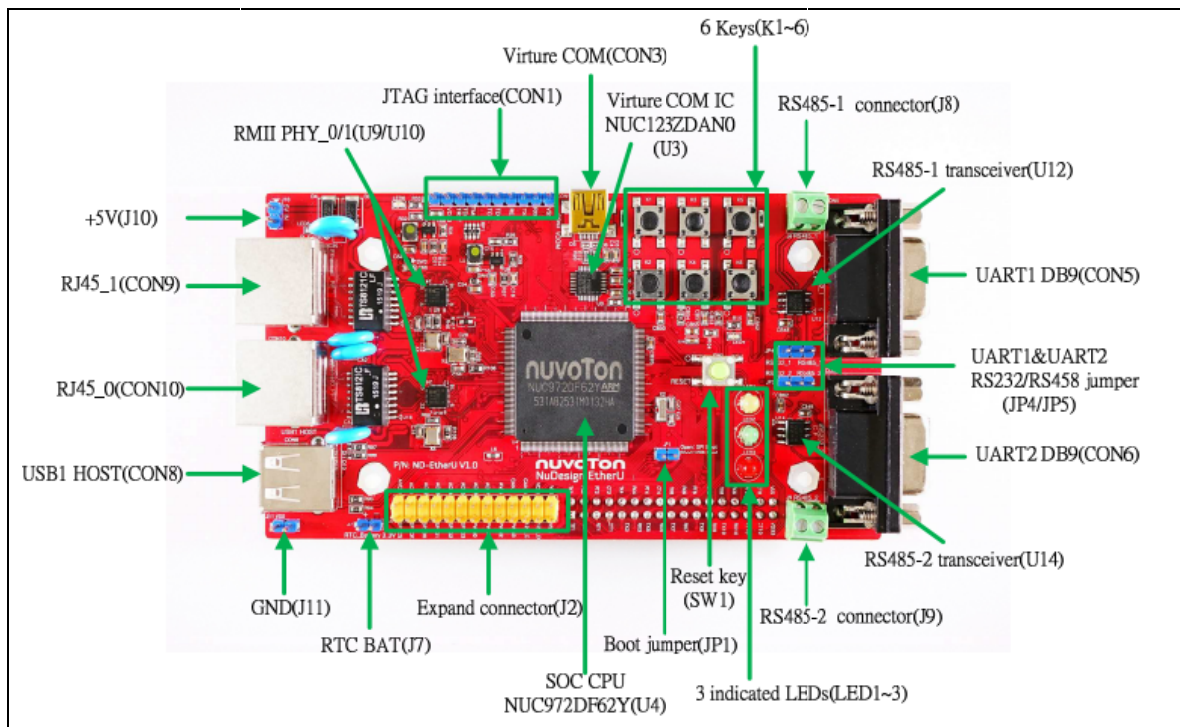


Figure 2-1 NuDesign-EtherU Board (Front View)

2.3 NuDesign-EtherU Board — Rear View

Figure 2-2 shows the main components and connectors from the rear view of NuDesign-EtherU board.

- Standard SD connector used as a SD memory card or SDIO (Wi-Fi) device (CON2)
- RS232-1/2 transceivers with 75C3232E (U11 and U13)
- SPI Flash (32 MB) with EN25QH256 (U2)
- Power protection IC with APL3211A (U5)
- USB0 Device/HOST mini-B connector (CON7)
- NuDesign-EtherU and NuDesign-EtherD combination connector (J1)

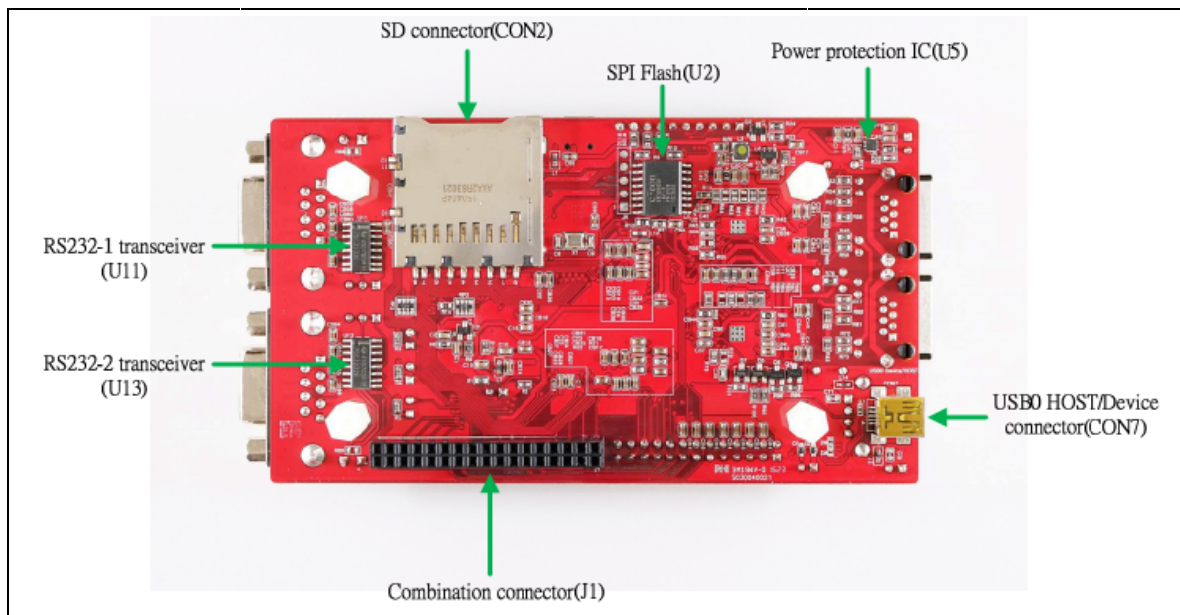


Figure 2-2 NuDesign-EtherU Board (Rear View)

2.4 NuDesign-EtherD — Front View

Figure 2-3 shows the main components and connectors from the Front view of NuDesign-EtherD board.

- **NuDesign-EtherU and NuDesign-EtherD combination connector (J1)**

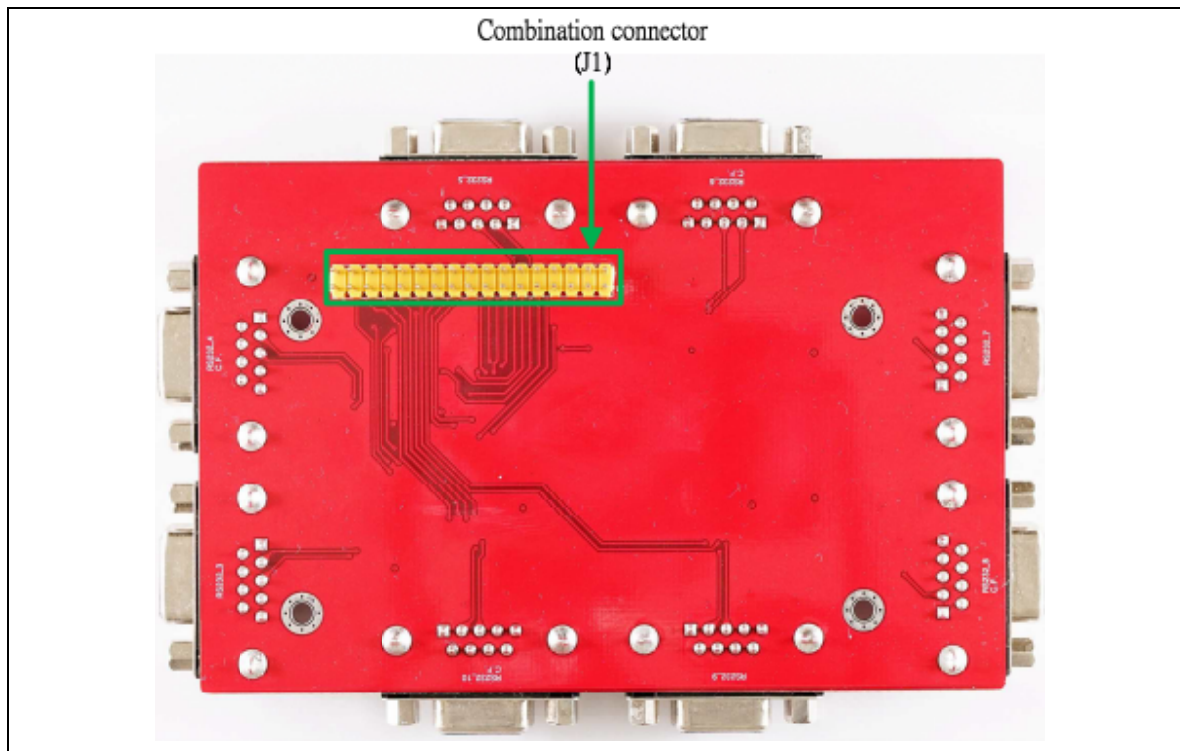


Figure 2-3 NuDesign-EtherD Board (Front View)

2.5 NuDesign-EtherD — Rear View

Figure 2-4 shows the main components and connectors from the rear view of NuDesign-EtherD board.

- RS232 transceivers with 75C3232E (U1, U2, U3, U4, U5, U6, U7 and U8)
- UART3: RS232 DB9 female (CON1)
- UART4: RS232 DB9 female (CON2)
- UART5: RS232 DB9 female (CON3)
- UART6: RS232 DB9 female (CON4)
- UART7: RS232 DB9 female (CON5)
- UART8: RS232 DB9 female (CON6)
- UART9: RS232 DB9 female (CON7)
- UART10: RS232 DB9 female (CON8)

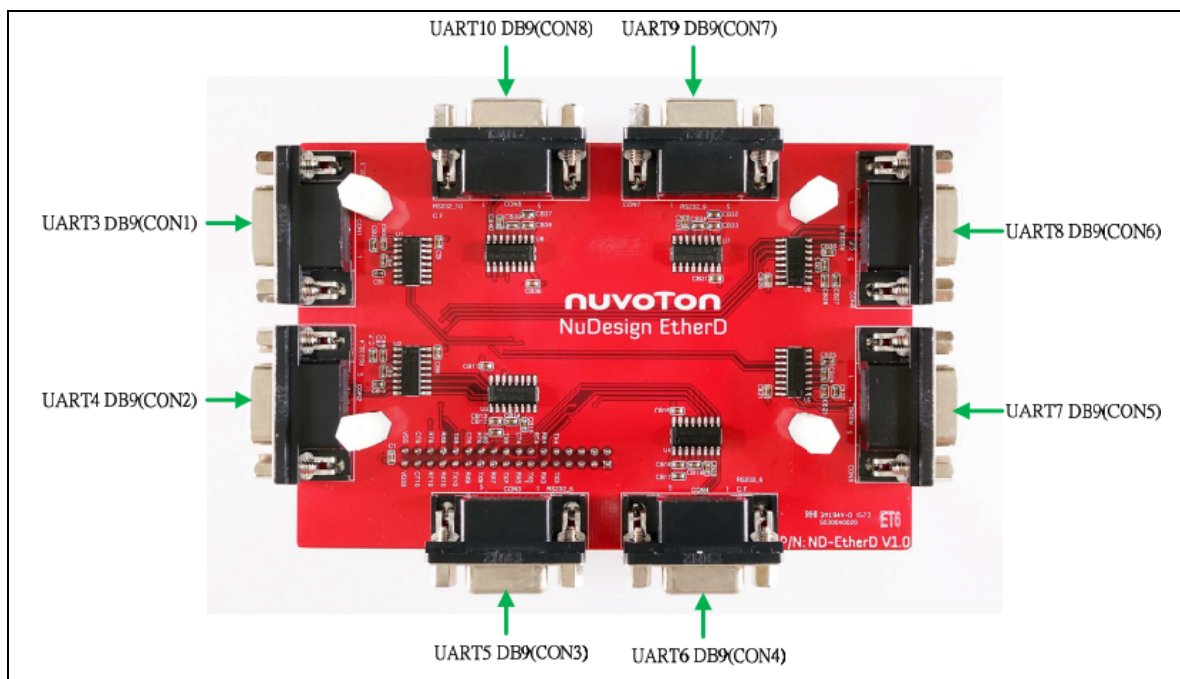


Figure 2-4 NuDesign-EtherD Board (Rear View)

2.6 NuDesign-EtherU and NuDesign-EtherD — Front View

Figure 2-5 shows the NuDesign-EtherU board and NuDesign-EtherD board connected through the connector (J1).

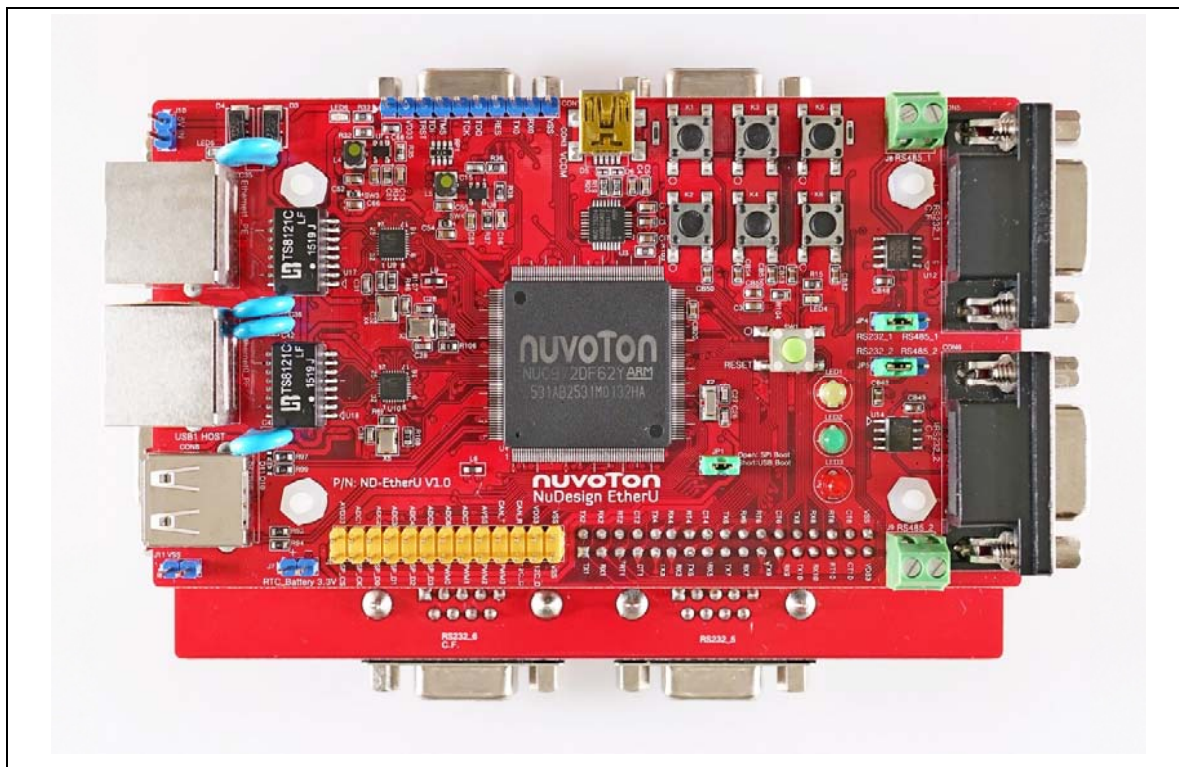


Figure 2-5 NuDesign-EtherU Board Connected with NuDesign-EtherD Board (Front View)

2.7 NuDesign-EtherU and NuDesign-EtherD Jumper Description

2.7.1 Power Supply Model Settings

- **CON3:** NUC123 with USB mini-B connector for Virtual COM function and 5V powered from PC HOST.
- **CON7:** NUC972 with USB mini-B connector, 5V powered from PC HOST when NUC972 USB_ID pin setting is low.
- **J10:** Power Supply with + 5V.
- **J11:** Power GND to V_{SS} .
- **LED6:** Green color, which is active by 3.3V.
- **LED5:** Red color, which is active if OVP (5.7V (MIN.)) or OCP (1.042mA (MIN.)) occurred.
- **J7:** Pin1 connected to battery "+" and Pin2 connect to battery "-" Used for RTC power (3.3V).

Power Model	CON3 USB Port (mini-B)	CON7 USB Port (mini-B)	J10 (VDD5V)/ J11(VSS)
Model 1	Connect to PC	-	-
Model 2	-	Connect to PC	-
Model 3	-	-	VDD5V Input

Table 2-1 Power Supply Model Settings.

2.7.2 Debug Connector

- **CON1:** JTAG interface and UART0

Connector	GPIO pin of NUC972	Function
CON1.1	-	VDD33
CON1.2	GPJ4	TRST
CON1.3	GPJ2	TDI
CON1.4	GPJ1	TMS
CON1.5	GPJ0	TCK
CON1.6	GPJ3	TDO
CON1.7	-	RESET
CON1.8	GPE0	UART0-TXD
CON1.9	GPE1	UART0-RXD
CON1.10	-	VSS

Table 2-2 JTAG Interface (CON1)

2.7.3 Booting Control Connector

- **JP1:** Power-on setting for booting
 - JP1 open for SPI Flash booting.
 - JP1 short for USB booting.

2.7.4 UART1 Control Connector

- UART1 port control
 - JP4.1 and JP4.2 short for RS232, RS232 connected to DB9 female (CON5).
 - JP4.2 and JP4.3 short for RS485, RS485 connected to 2P terminal (J8).

2.7.5 UART2 Control Connector

- UART2 port control:
 - JP5.1 and JP5.2 short for RS232, RS232 connected to DB9 female (CON6).
 - JP5.2 and JP5.3 short for RS485, RS485 connected to 2P terminal (J9).

2.7.6 Expand Connector

- J2: Expand connector

Connector	GPIO pin of NUC972	Function
J2.1	GPB12	SPI1-CS
J2.3	GPB13	SPI1-CK
J2.5	GPB14	SPI1-D0
J2.7	GPB15	SPI1-D1
J2.9	GPG4	SPI1-D2
J2.11	GPG5	SPI1-D3
J2.13	GPA12	PWM0
J2.15	GPA13	PWM1
J2.17	GPA14	PWM2
J2.19	GPA15	PWM3
J2.21	GPG0	I2C0-CK
J2.23	GPG1	I2C0-DA
J2.25	-	VSS
J2.2	-	AVD33
J2.4	-	ADC1
J2.6	-	ADC2
J2.8	-	ADC3
J2.10	-	ADC4
J2.12	-	ADC5
J2.14	-	ADC6
J2.16	-	ADC7
J2.18	-	AVSS
J2.20	GPI4	CAN0-TX
J2.22	GPI3	CAN0-RX
J2.24	-	VDD33
J2.26	-	VSS

Table 2-3 Expand Connector (J2)

2.7.7 Buttons

- **SW1**: Reset button, for system reset
- **K1~K6**: Key buttons, for user definition

Key	Function	GPIO pin of NUC972
K1	Row0	GPA4
	Col0	GPA8
K2	Row0	GPA4
	Col1	GPA9
K3	Row1	GPA5
	Col0	GPA8
K4	Row1	GPA5
	Col1	GPA9
K5	Row2	GPA6
	Col0	GPA8
K6	Row2	GPA6
	Col1	GPA9

Table 2-4 K1~K6 Key Matrix

2.8 NuDesign-EtherU and NuDesign-EtherD PCB Placement

The following figure shows NuDesign EtherU and NuDesign EtherD PCB placement.

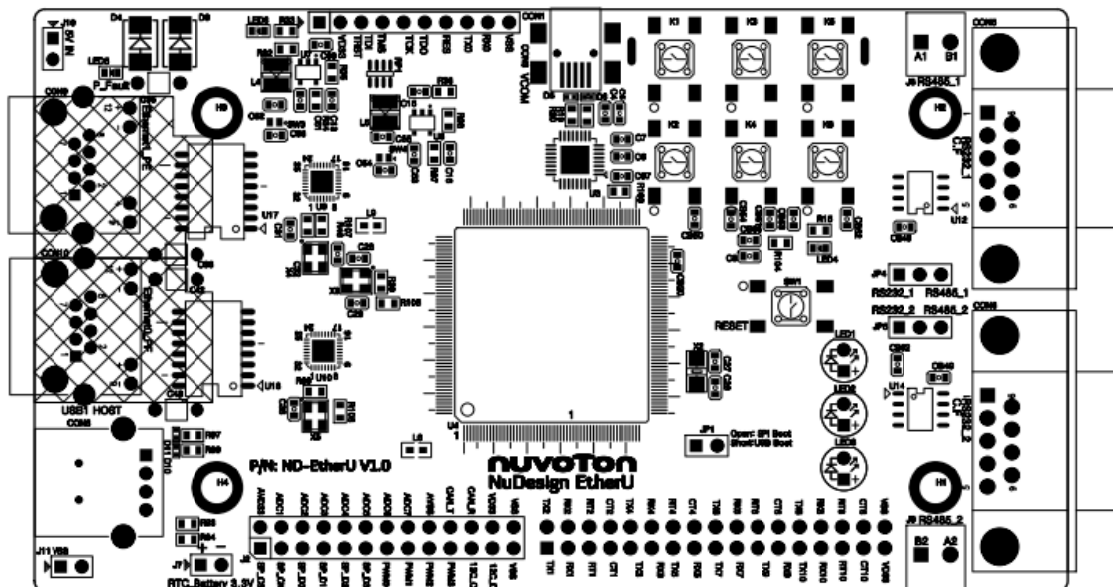


Figure 2-6 NuDesign-EtherU Front PCB Placement

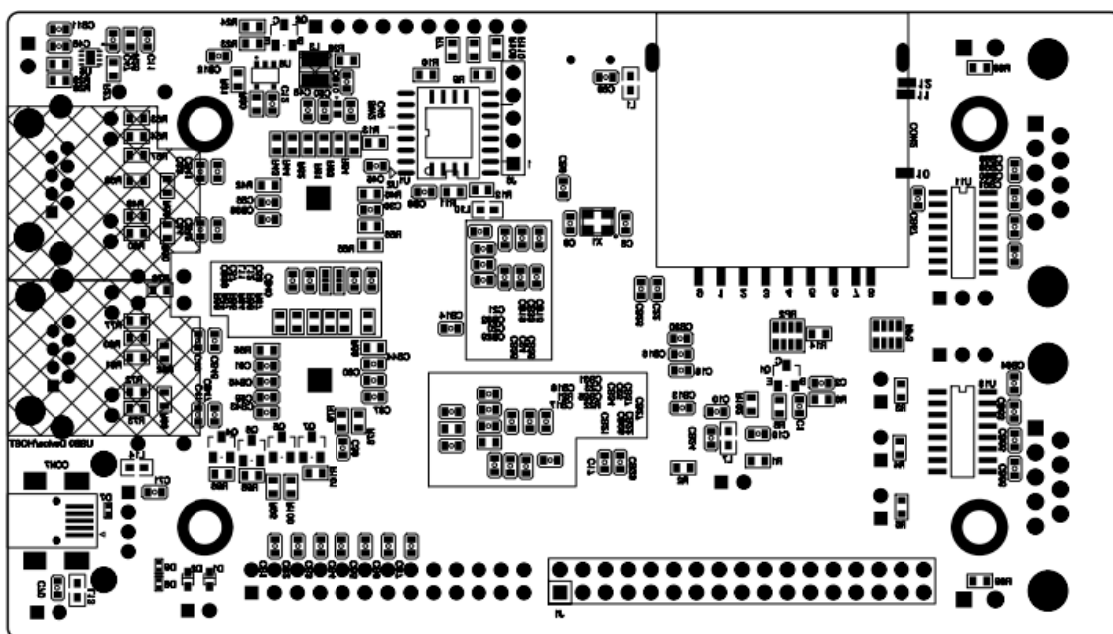


Figure 2-7 NuDesign-EtherU Back PCB Placement

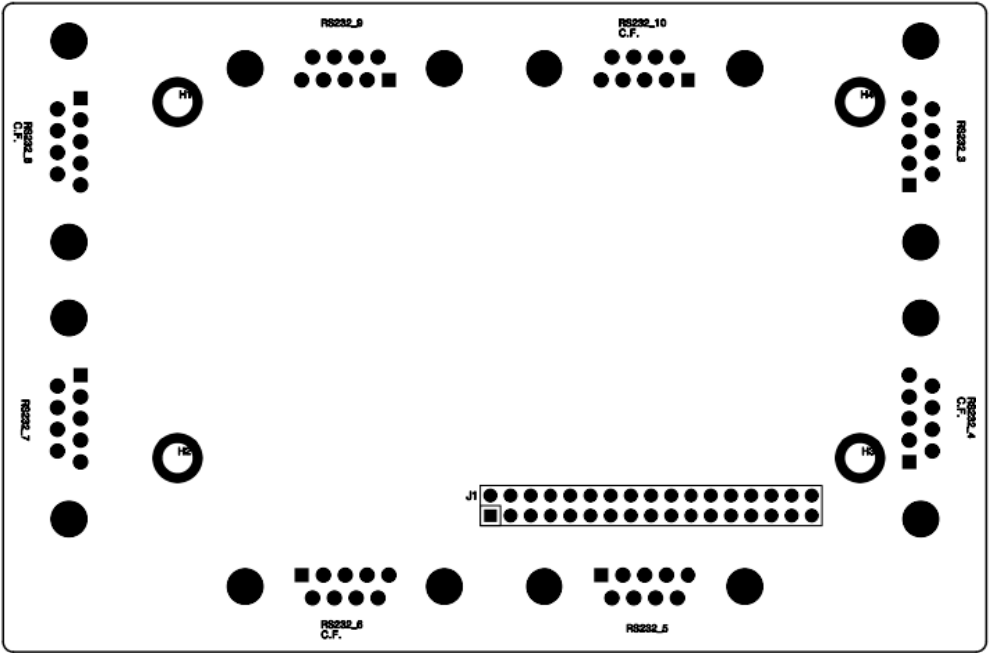


Figure 2-8 NuDesign-EtherD Front PCB Placement

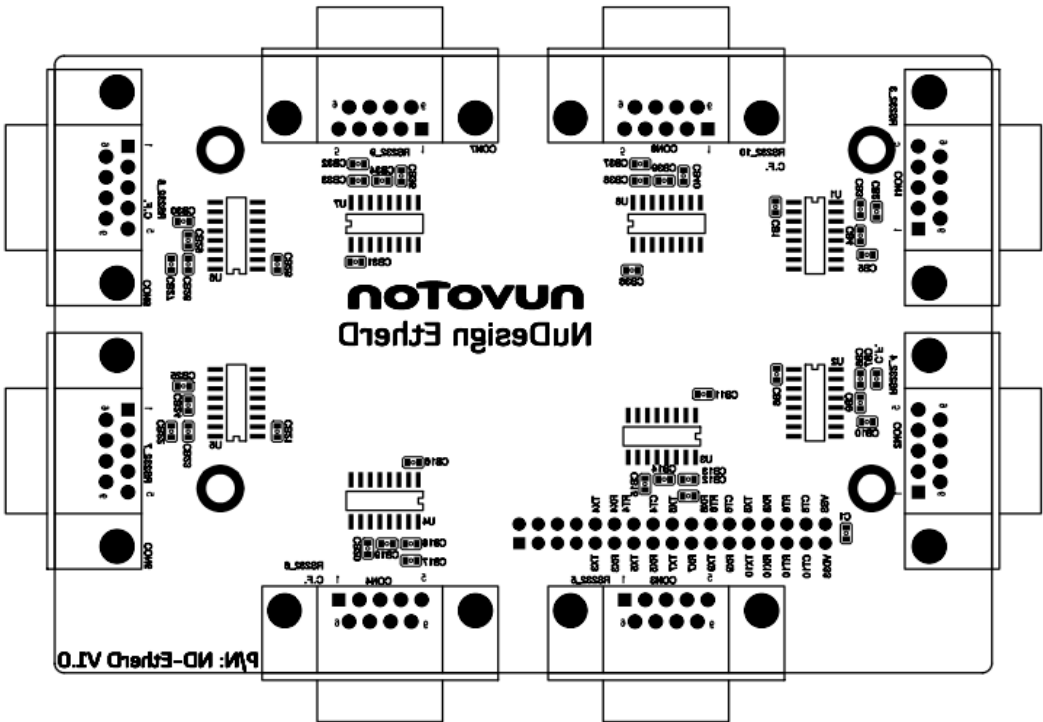


Figure 2-9 NuDesign-EtherD Back PCB Placement

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.

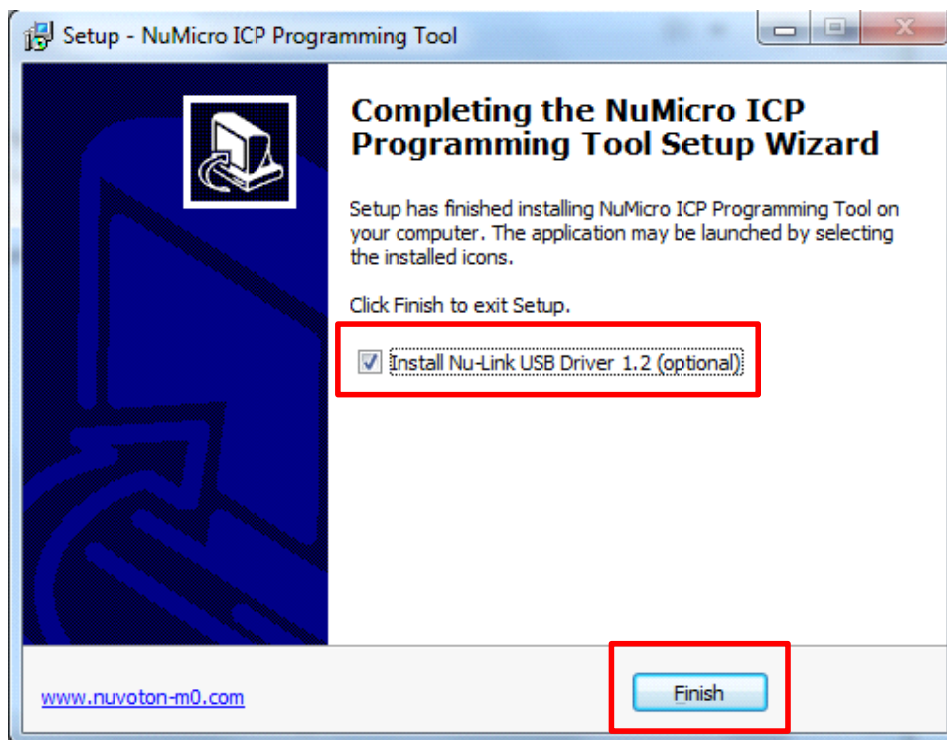


Figure 3-1 Optional Step after ICP Programming Tool Installation

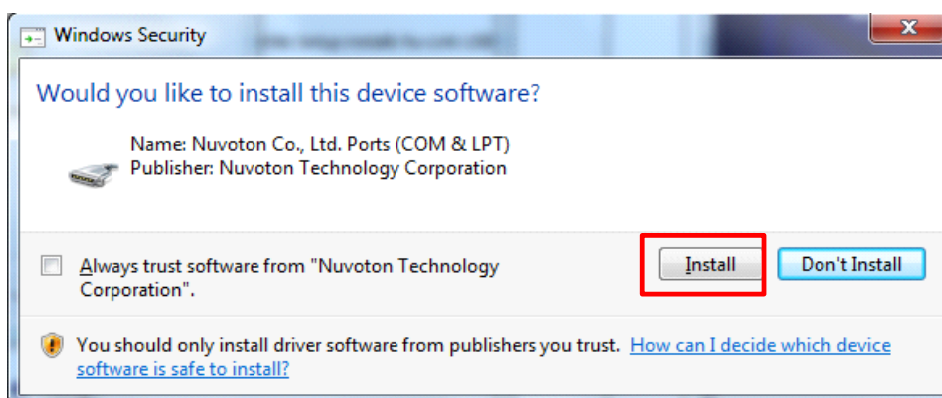


Figure 3-2 Install Nuvoton COM &LPT Driver

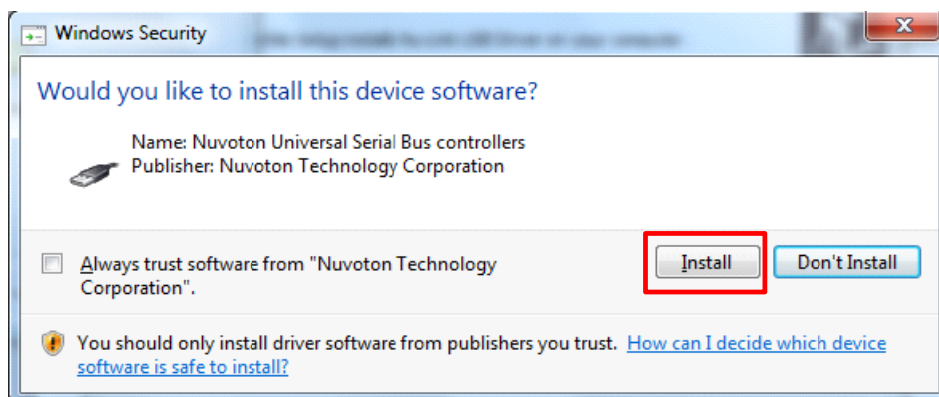


Figure 3-3 Install Nuvoton Universal Serial Bus Controllers

3.2 Connect to PC HOST

Connect the USB mini-B port (CON3) to the PC HOST.

The PC HOST will supply 5V power to the NuDesign-EtherU and NuDesign-EtherD 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.

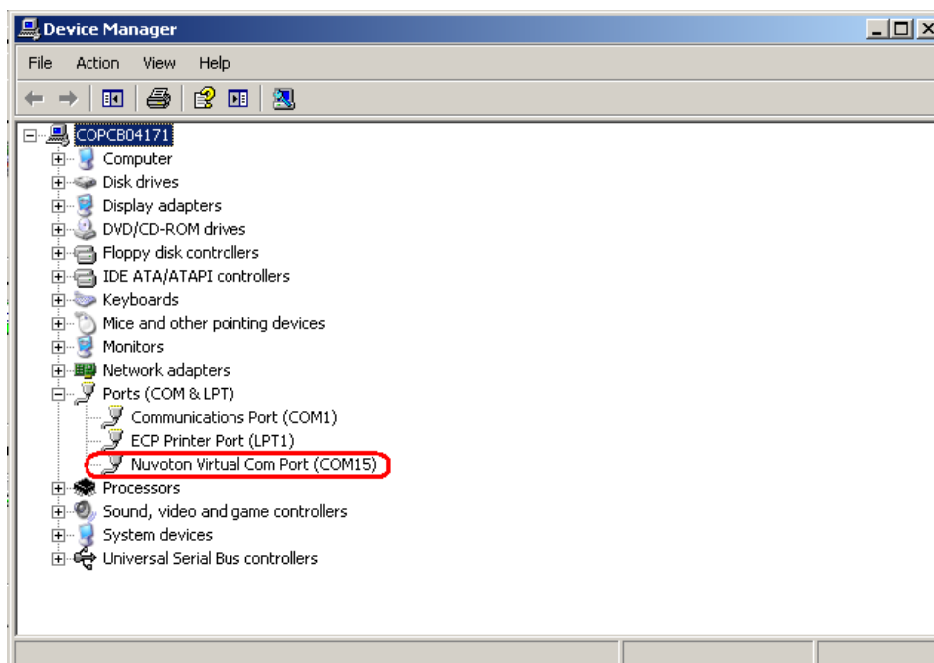


Figure 3-4 NuDesign-EtherU and NuDesign-EtherD in "Device Manager"

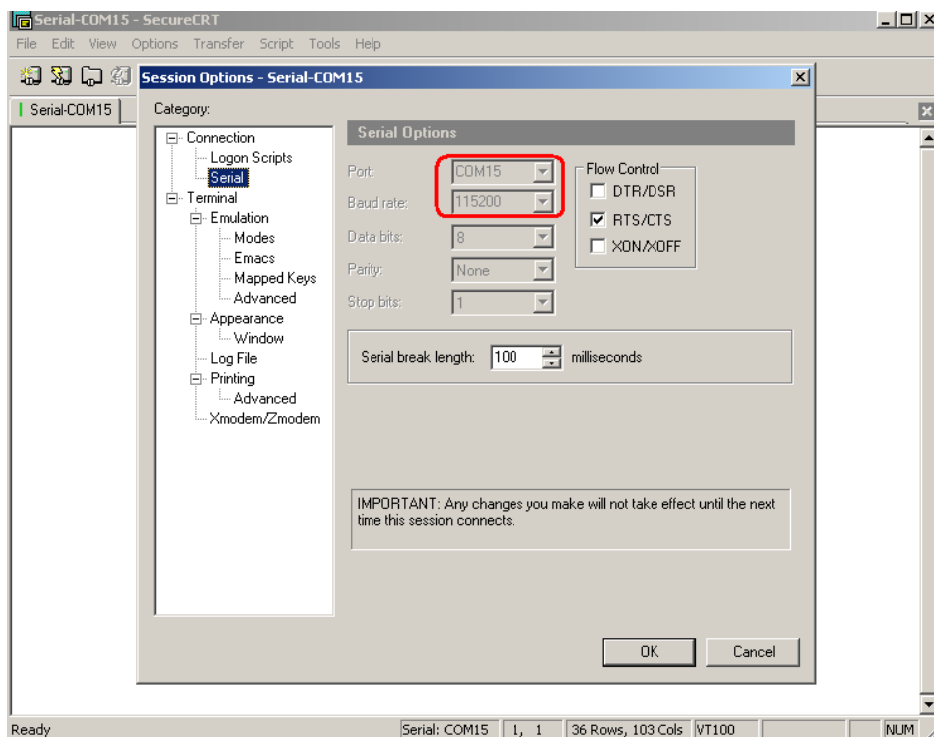


Figure 3-5 SecureCRT Baud Rate Setting

3.2.2 Reset Chip

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

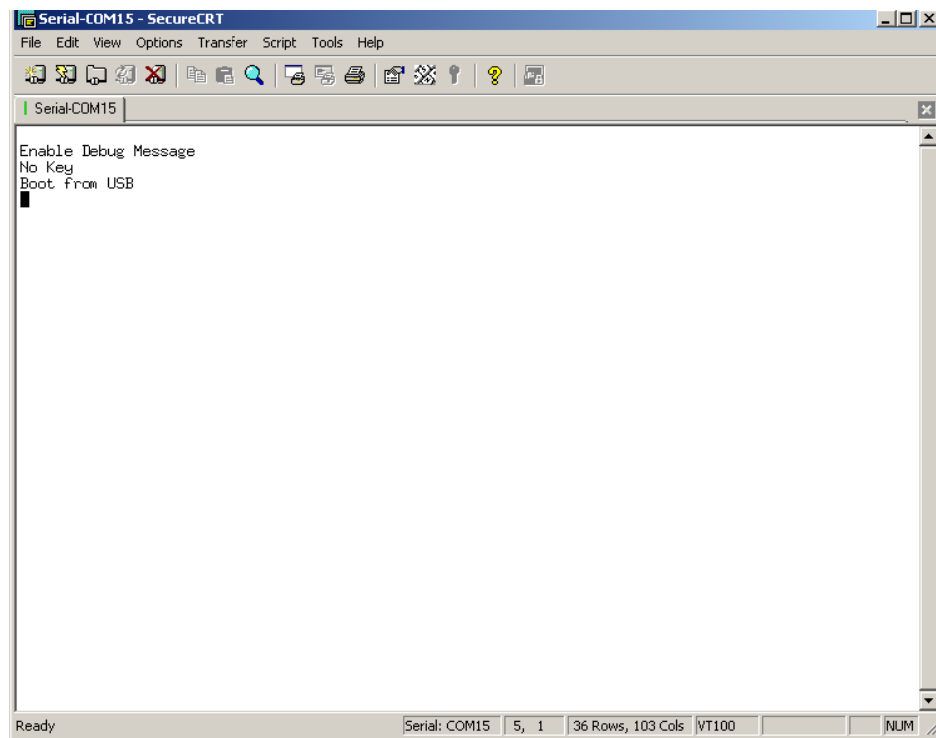
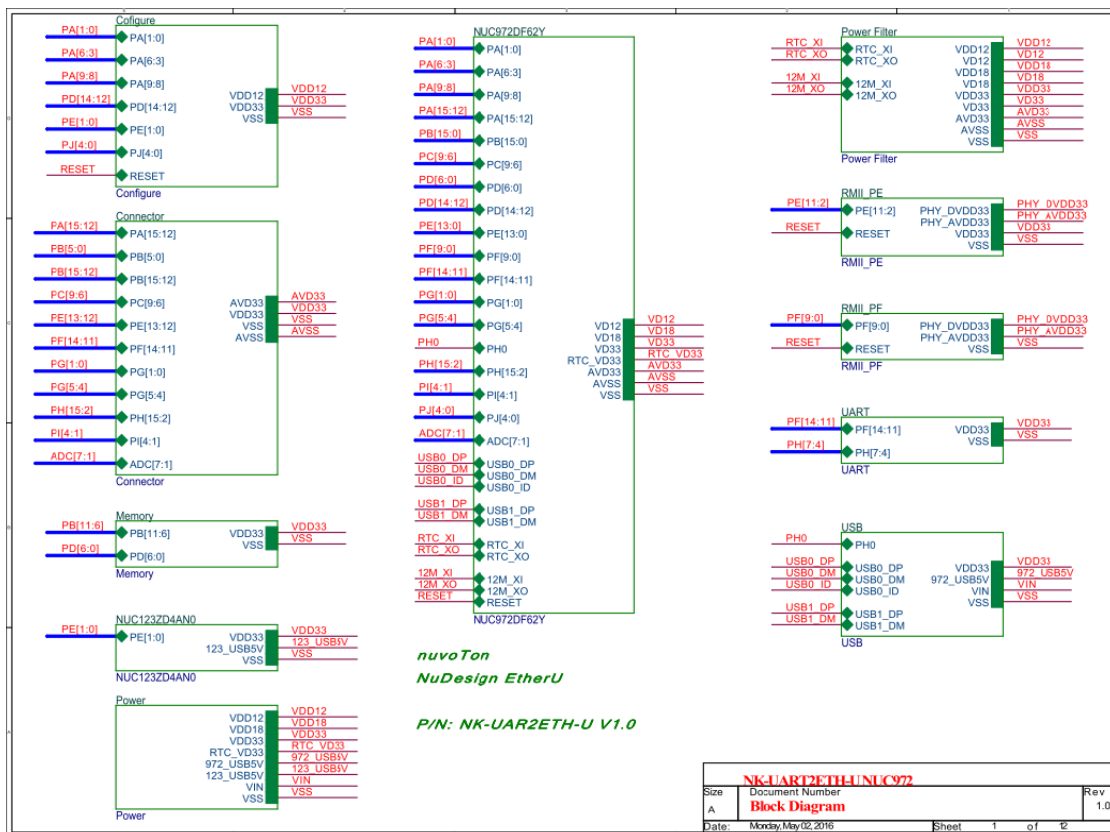
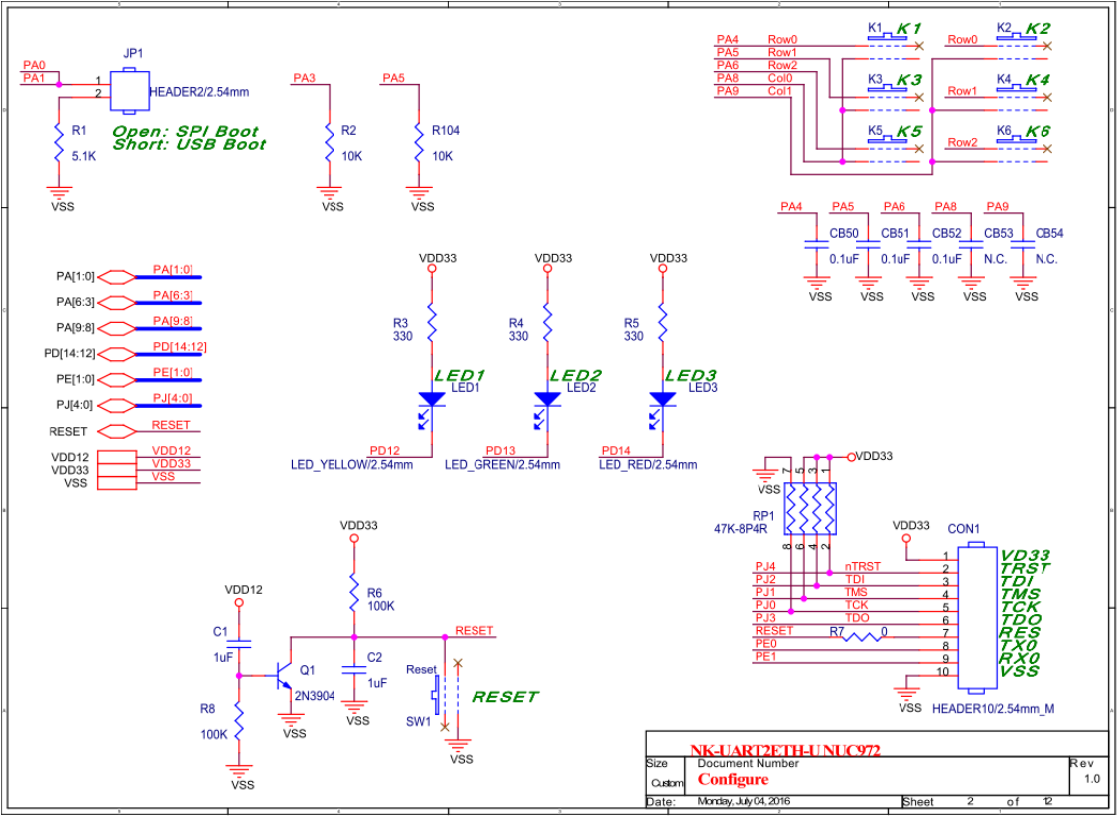


Figure 3-4 Serial Port Terminal Windows

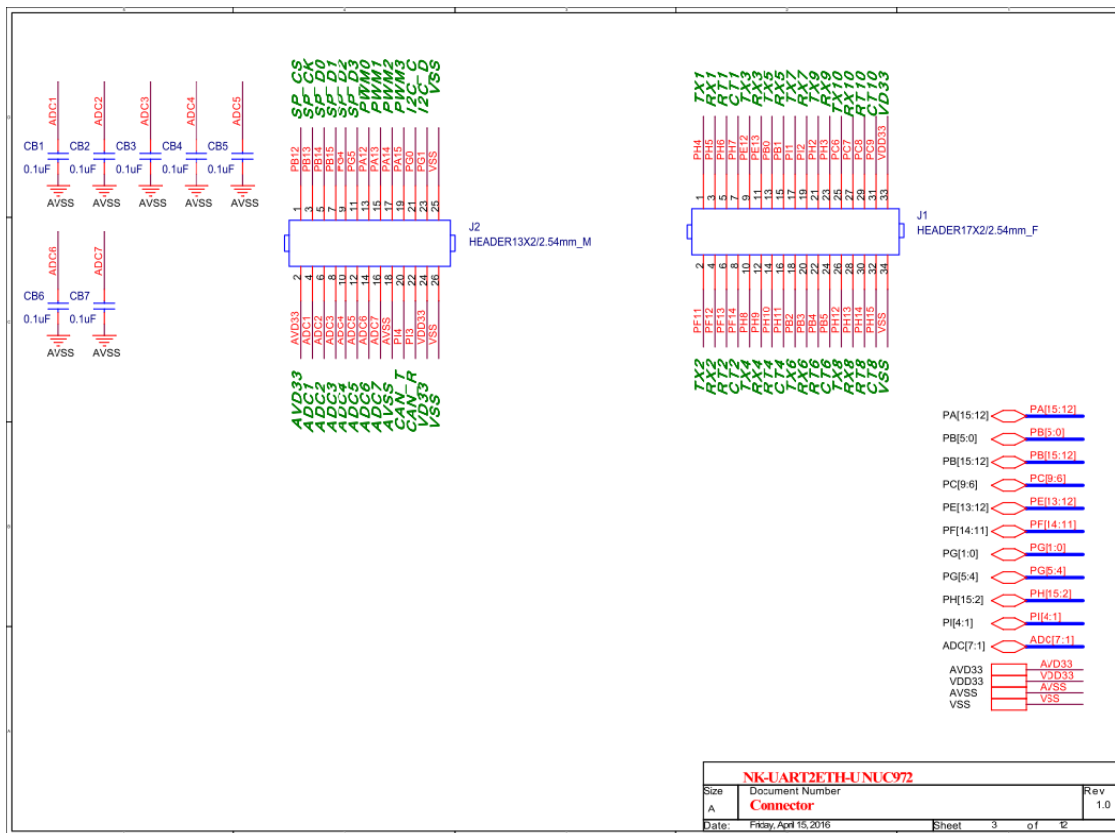
4.1 NuDesign-EtherU – Block Diagram Schematic



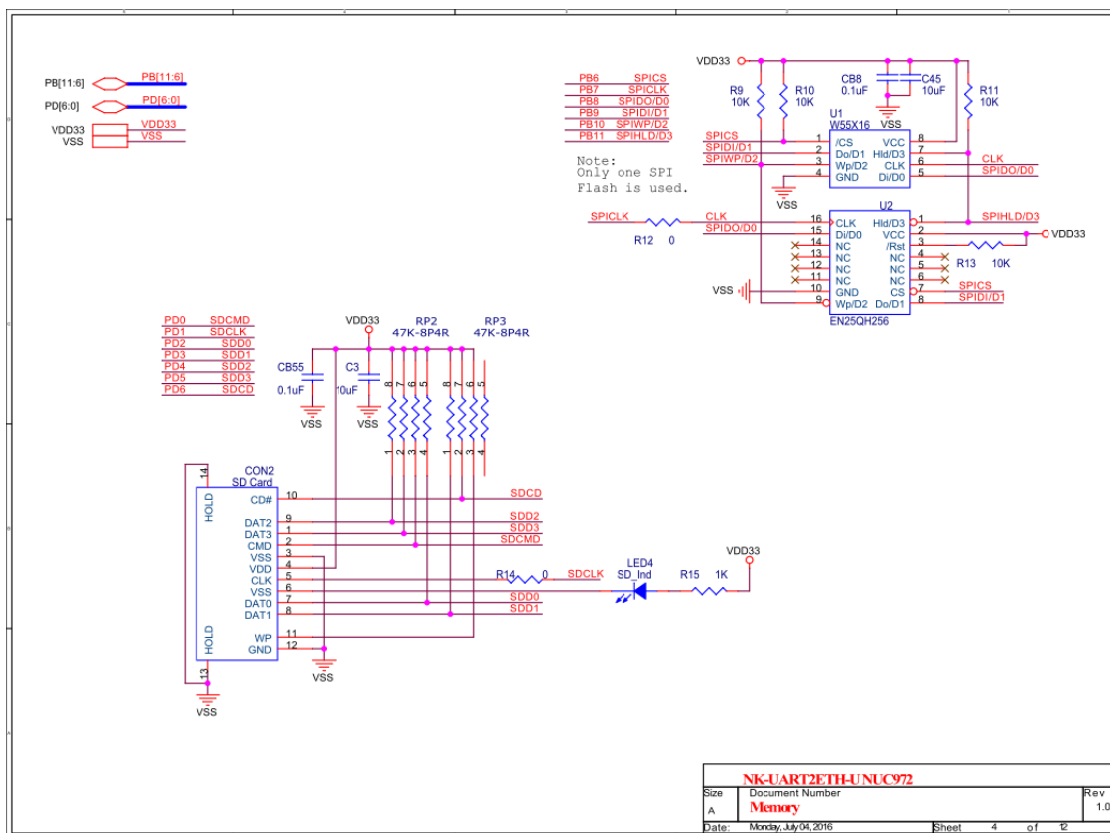
4.2 NuDesign-EtherU — Configure Schematic



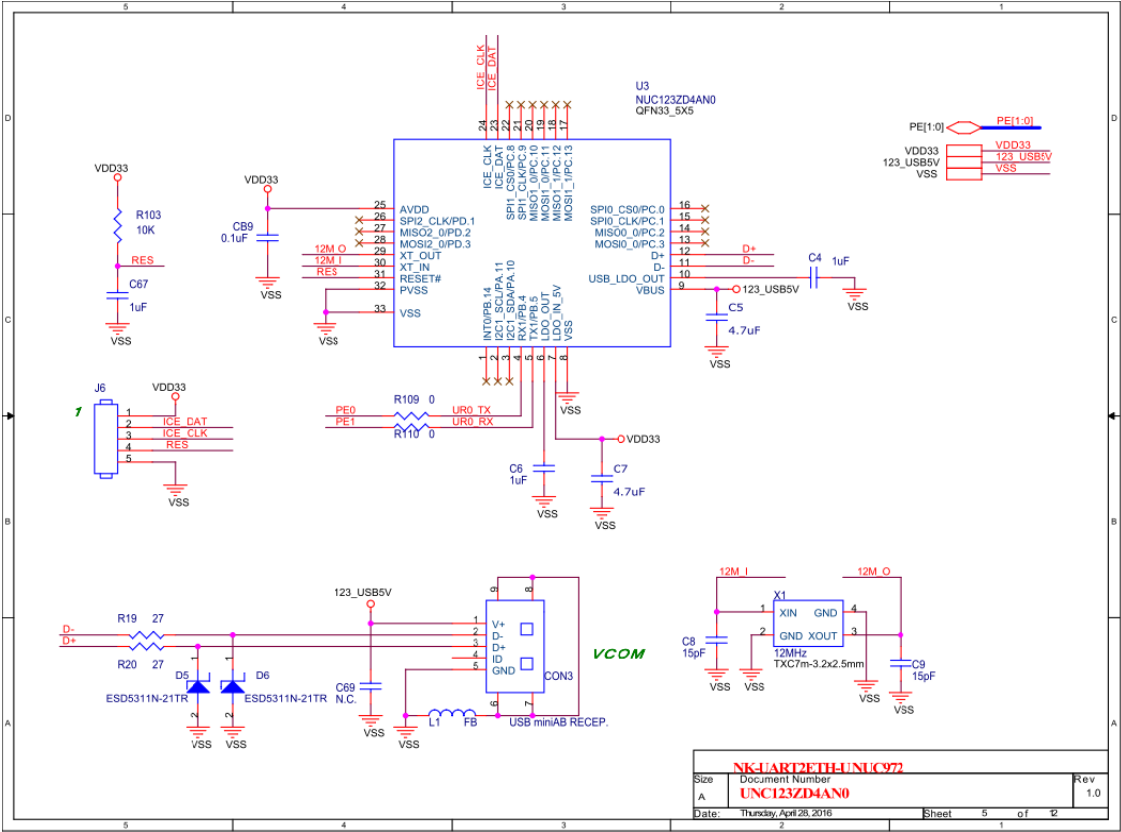
4.3 NuDesign-EtherU — Connector Schematic



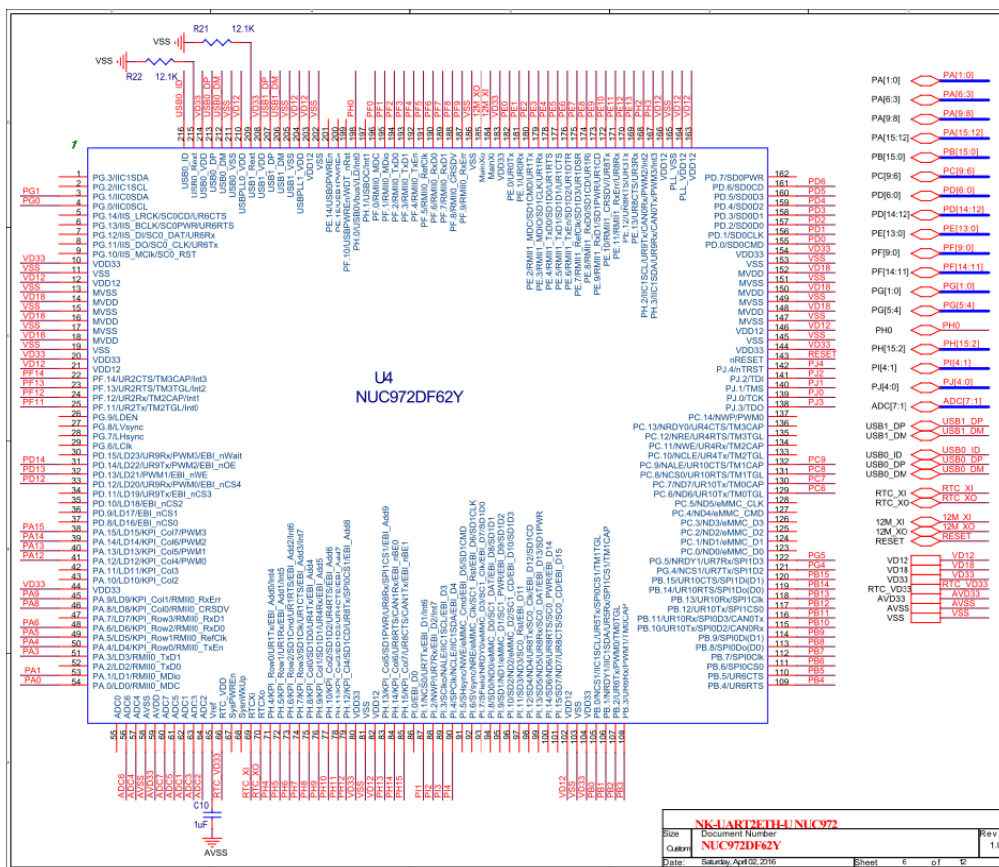
4.4 NuDesign-EtherU — Memory Schematic



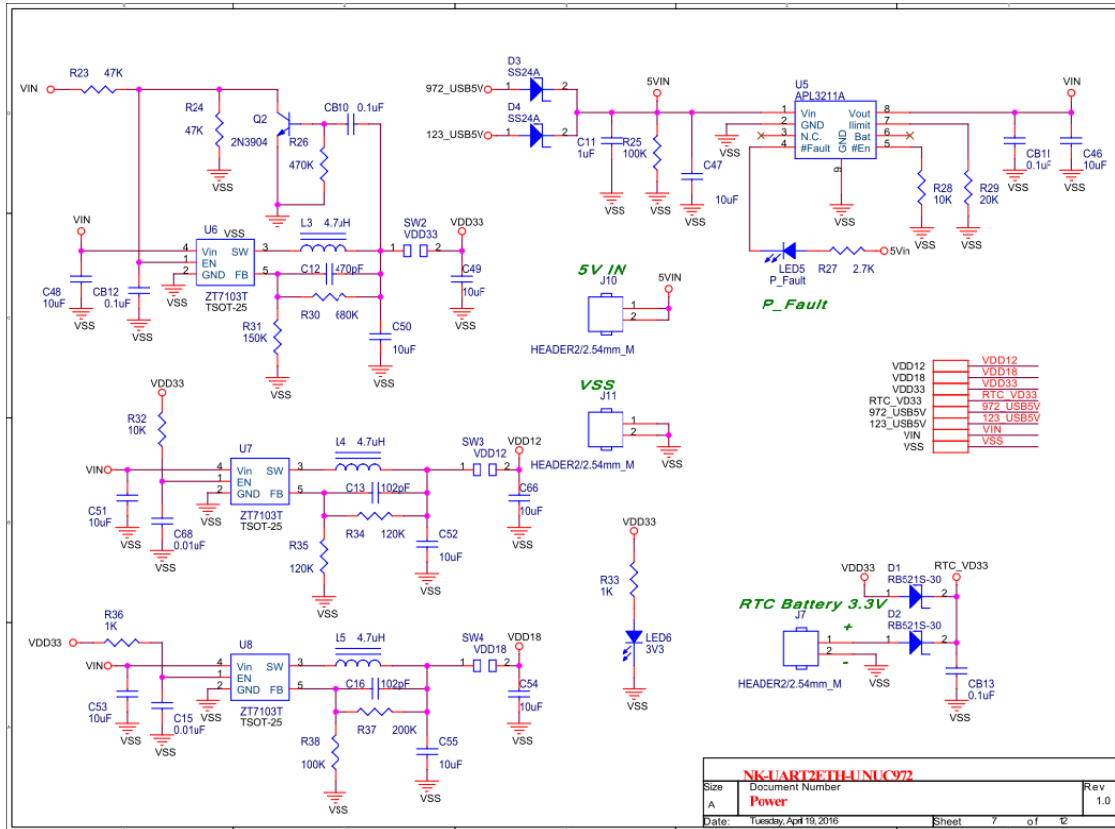
4.5 NuDesign-EtherU — NUC123ZD4AN0 Schematic



4.6 NuDesign-EtherU – NUC972DF62Y Schematic

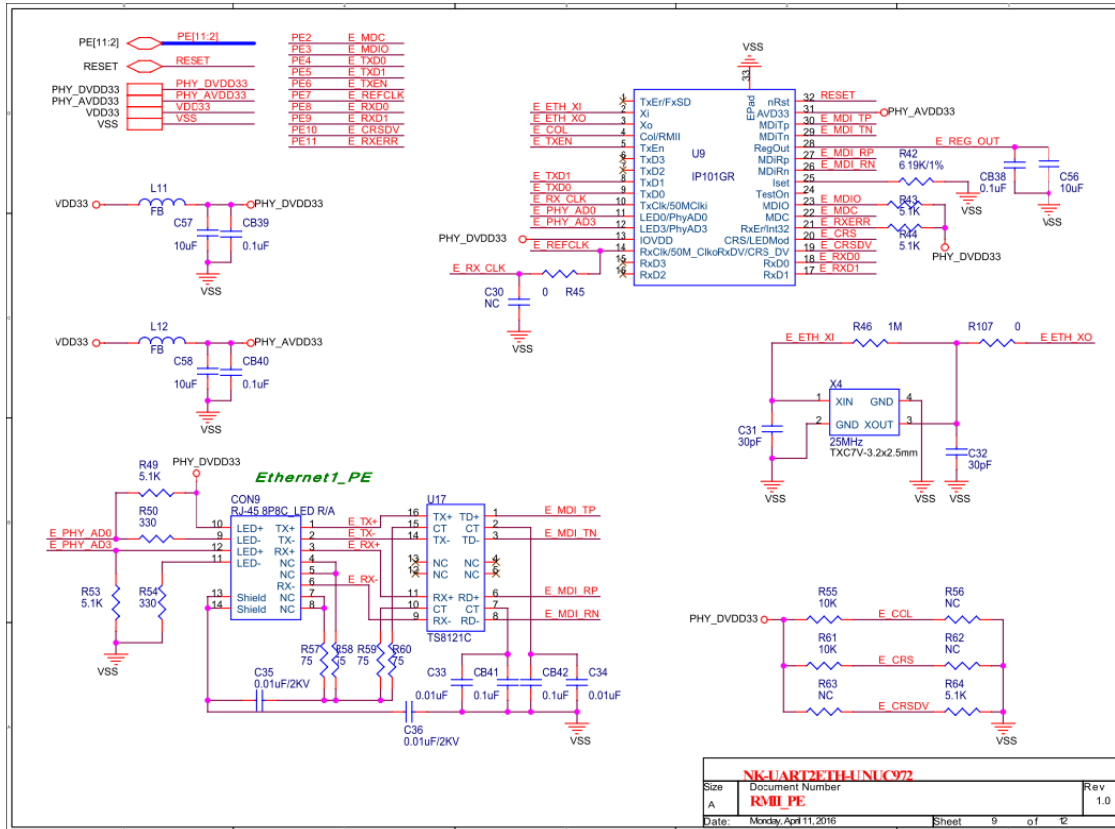


4.7 NuDesign-EtherU — Power Schematic



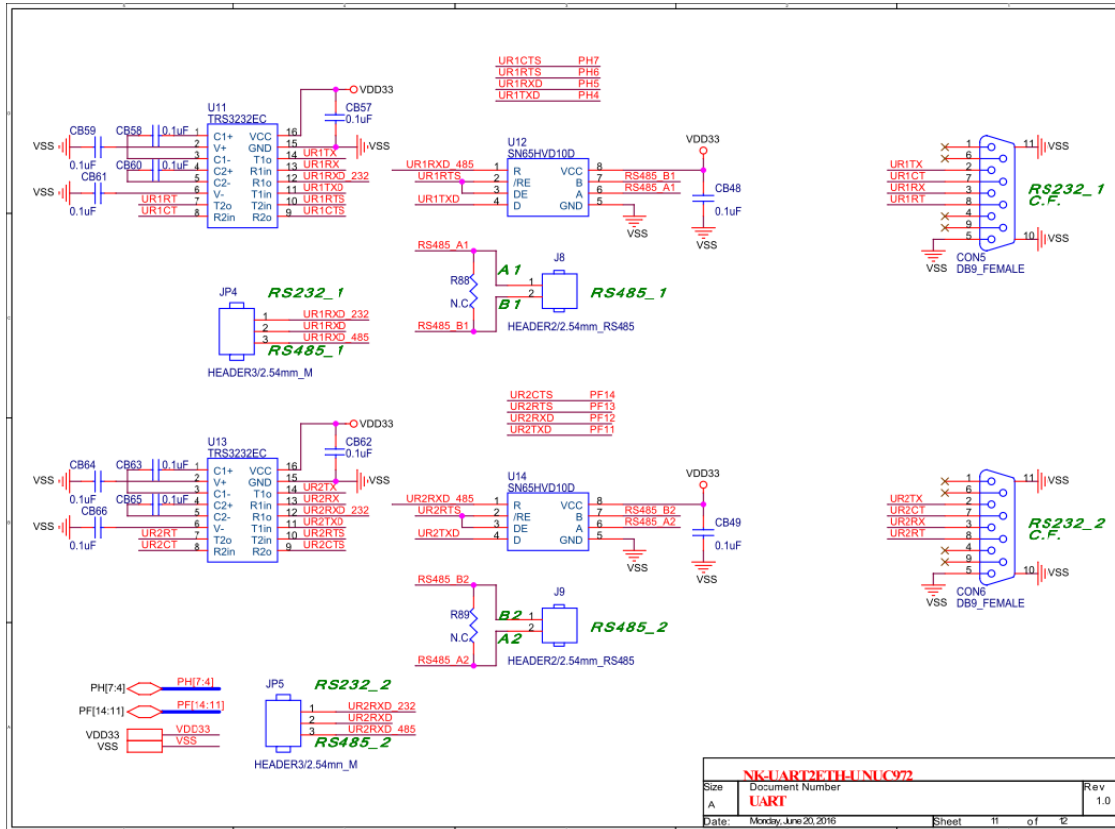


4.9 NuDesign-EtherU — RMII_PE Schematic

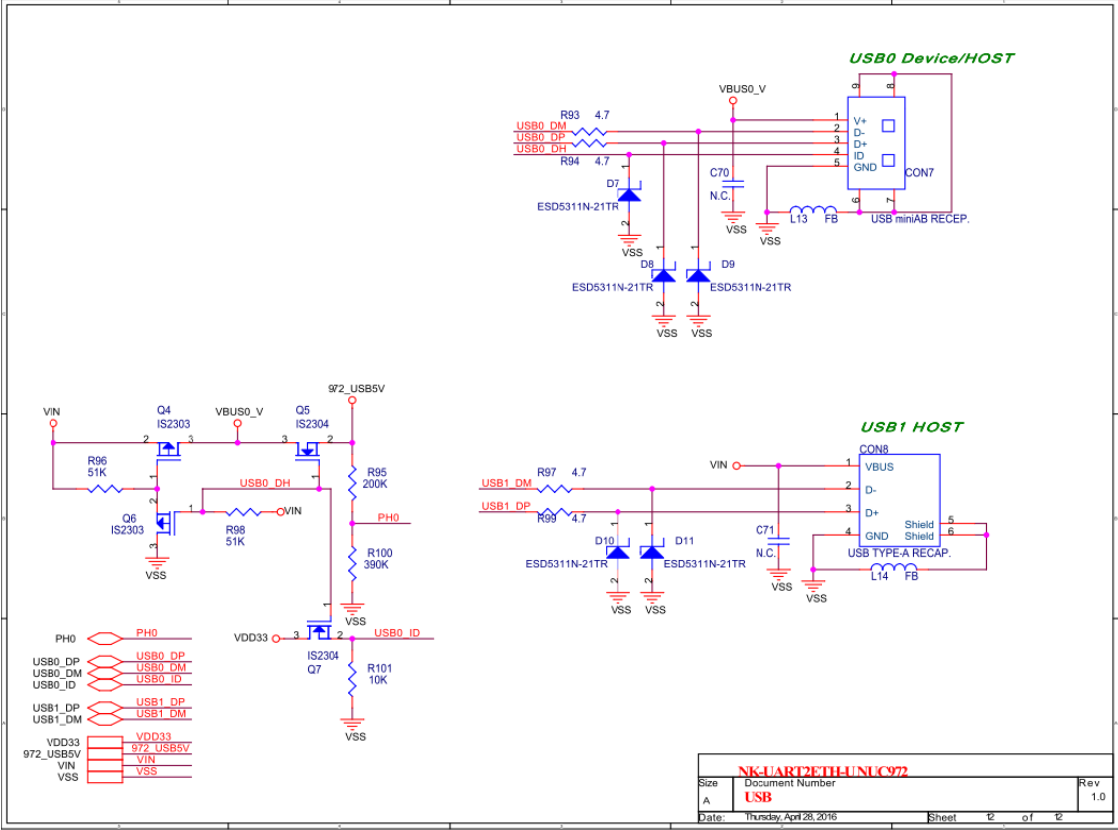




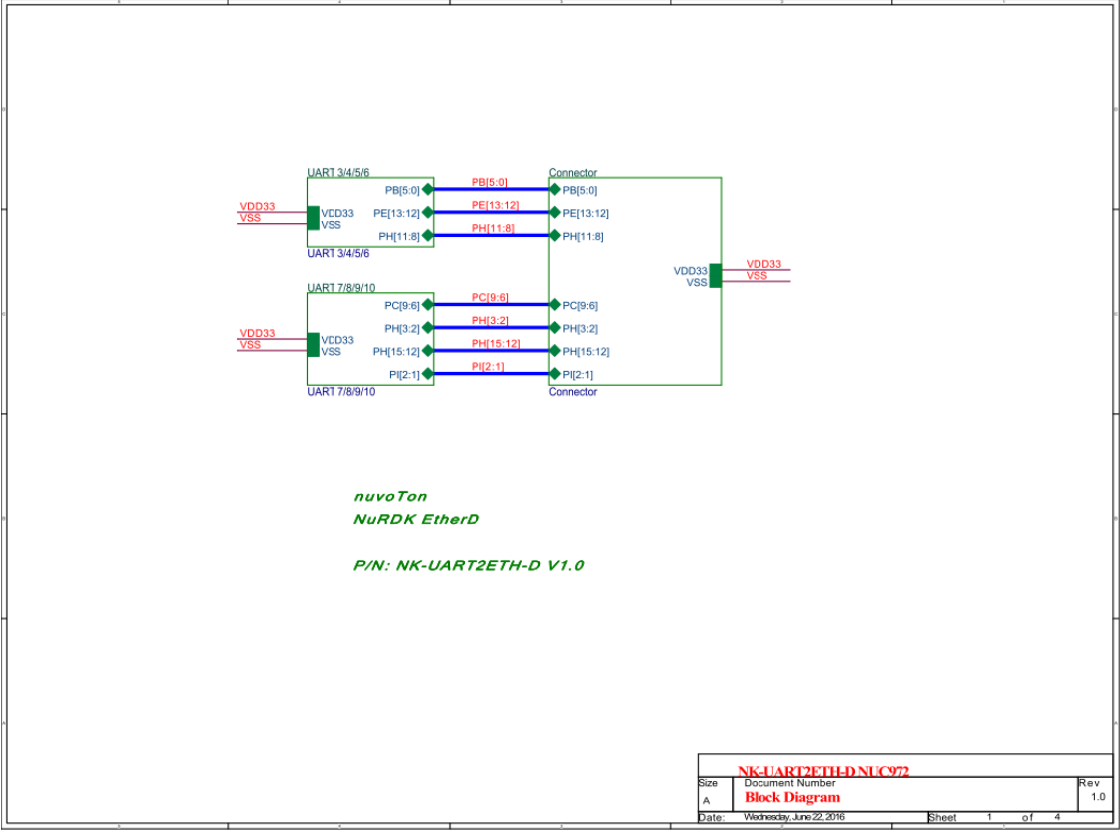
4.11 NuDesign-EtherU — UART Schematic



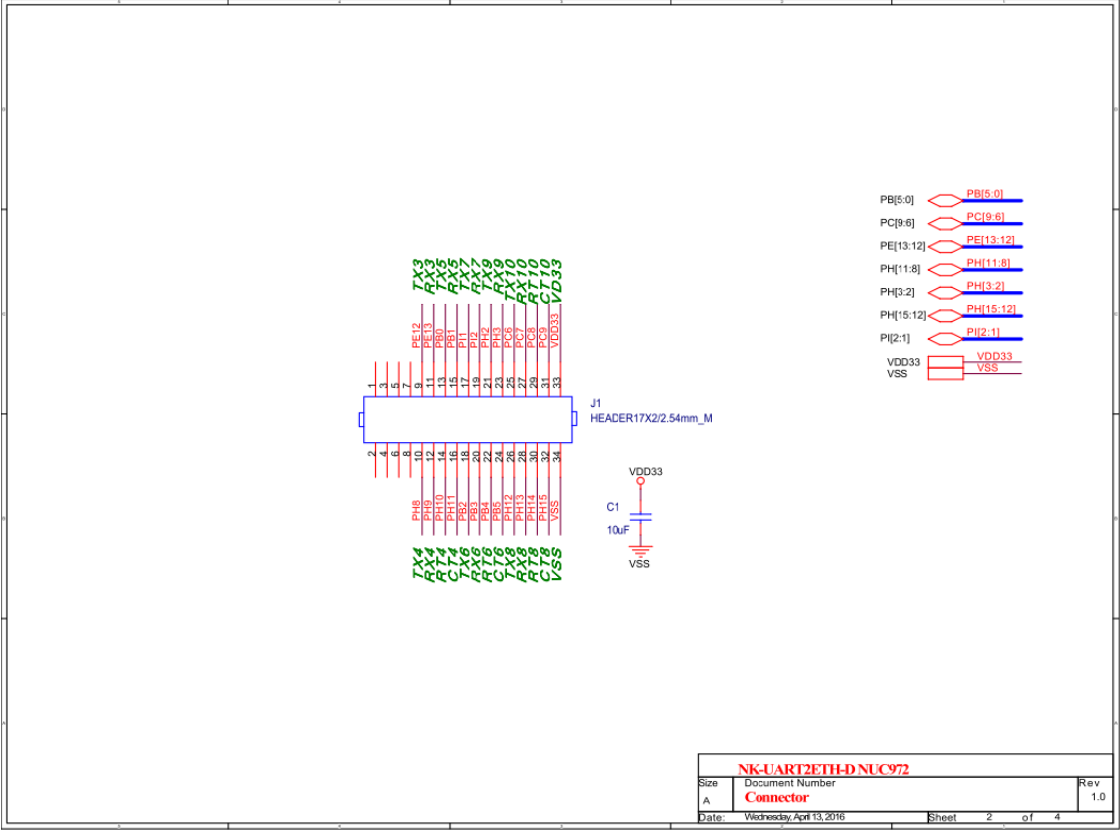
4.12 NuDesign-EtherU — USB Schematic



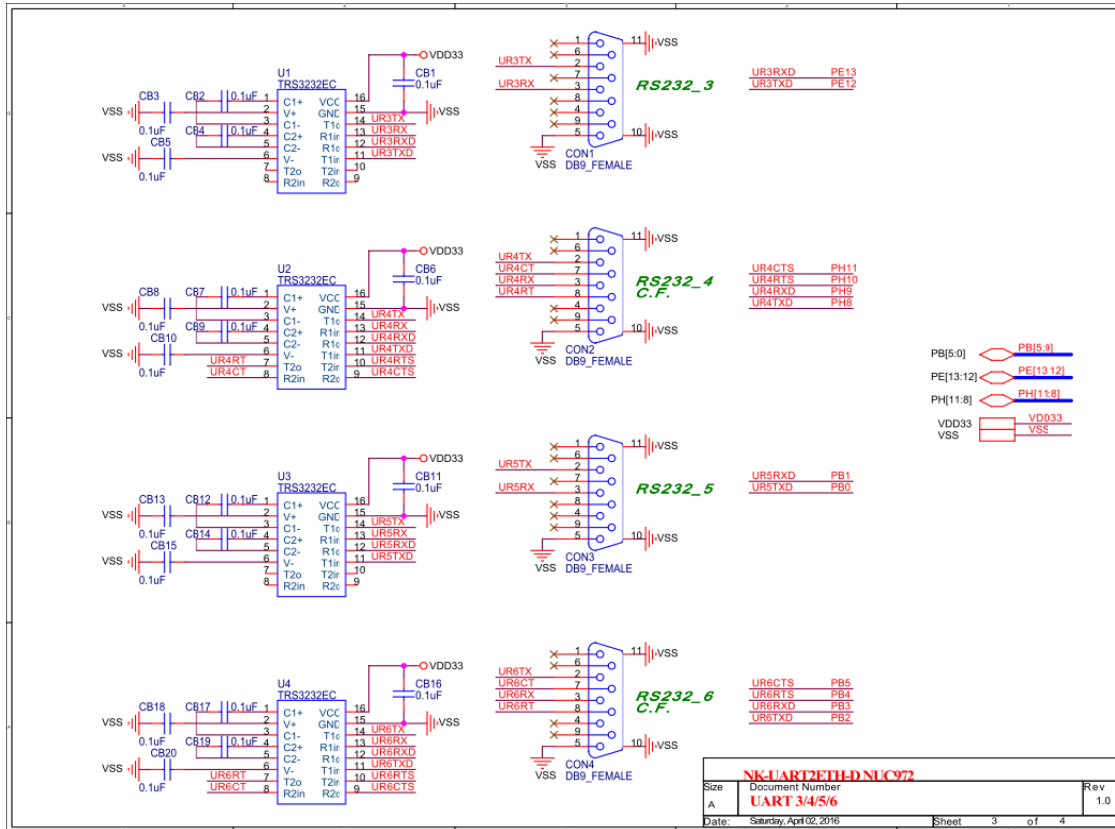
4.13 NuDesign-EtherD — Block Diagram Schematic



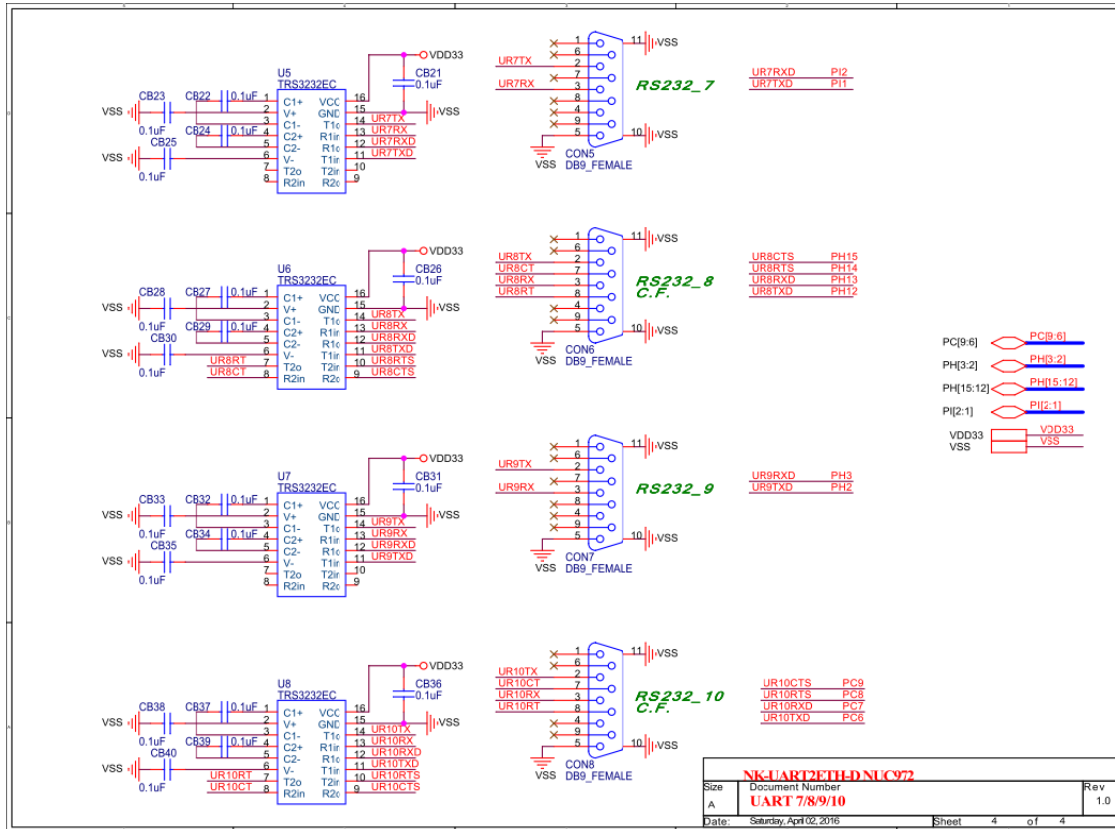
4.14 NuDesign-EtherD — Connector Schematic



4.15 NuDesign-EtherD — UART 3/4/5/6 Schematic



4.16 NuDesign-EtherD — UART 7/8/9/10 Schematic



5 REVISION HISTORY

Date	Revision	Description
2016.09.01	1.00	1. Initially issued.

Important Notice

Nuvoton Products are neither intended nor warranted for usage in systems or equipment, any malfunction or failure of which may cause loss of human life, bodily injury or severe property damage. Such applications are deemed, "Insecure Usage".

Insecure usage includes, but is not limited to: equipment for surgical implementation, atomic energy control instruments, airplane or spaceship instruments, the control or operation of dynamic, brake or safety systems designed for vehicular use, traffic signal instruments, all types of safety devices, and other applications intended to support or sustain life.

All Insecure Usage shall be made at customer's risk, and in the event that third parties lay claims to Nuvoton as a result of customer's Insecure Usage, customer shall indemnify the damages and liabilities thus incurred by Nuvoton.

Please note that all data and specifications are subject to change without notice.
All the trademarks of products and companies mentioned in this datasheet belong to their respective owners.