ARM® ARM926EL-S Based
32-bit Microprocessor

N9H30K41I
NuDesign-HMI-N9H30
User Manual

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www.nuvoton.com

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1 OVERVIEW

Nuvoton's NuDesign-HMI-N9H30 development board is a specific development tool based on Nuvoton's N9H30K41I to provide customers with a low cost and ease of development. It can be easily customized for customers to provide their own HMI (**H**uman **M**achine **I**nterface) device server products.

Figure 1-1 NuDesign-HMI-N9H30 Development Board

2 INTRODUCTION TO NUDESIGN-HMI-N9H30 BOARD

The NuDesign-HMI-N9H30 solution uses an outstanding CPU core ARM926EJ-S, N9H30K41I which runs up to 300 MHz and features the embedded 16MB DDR 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 or booting from NAND Flash.

The NuDesign-HMI-N9H30 solution integrates touchscreen display, voice input/output, rich serial port service and I/O interface, providing multiple external storage methods. It contains two kinds of board, including the NuDesign-HMI-N9H30 board and NuDesign-TFT-LCD5 board.

2.1 NuDesign-HMI-N9H30 Board Features

- N9H30K41I: LQFP128 pin MCP package with DDR (16 MB).
- SPI Flash (16 MB) booting with quad mode or storage memory.
- NAND Flash (128 MB) booting or storage memory.
- One STD SD slot served either as a SD memory card for data storage or SDIO (Wi-Fi) device.
- Provides 4 sets of COM ports.
  - UART0 can be served for function debug and system development.
  - UART3/UART10 2 sets of UARTs with RS232/RS485 transceiver alternatively.
  - UART9 1 set of UARTs with RS232 transceiver alternatively.
- JTAG interface provided for software development.
- Microphone input and Speaker output with 24-bit stereo audio codec (NAU8822L) for I2S interfaces.
- 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 supports pen drives, keyboards, mouse and printers.
- 16 GPIO expansion ports, including 3sets UART port.
- 5” resolution 800x480 4W resistive touch panel for 16bits RGB565 interface.
- Provides over-voltage and over current protection.
- Retain RTC battery socket is for CR2032 type.
- 3.3V I/O power, 1.8V Memory power and 1.2V core power.

2.2 NuDesign-HMI-N9H30 Board – Front View

Figure 2-1 shows the main components and connectors from the front view of NuDesign-HMI-N9H30 board.

- NuDesign-HMI-N9H30 and NuDesign-TFT-LCD5 combination connector (CON12).

Option	State	Function
R87 / R86	Short / Open	Support 5-wire touch screen detection and connected to CON12.
R87 / R86	Open / Short	RTC battery (BT1) voltage detection and connected to ADC3.

- SPI Flash (16 MB) with Winbond 25Q128JVFQ (U7), only one (U7 or U8) SPI Flash can be used.
- Power supply switch (SW_POWER1): System will be power on if the SW1_POWER1 button is pressed.
- 2sets indication LEDs:

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 1A.
LED2	Green	Power normal state.

- 6sets user SWs, Key Matrix for user definition.

Key	Function	GPIO pin of N9H30
K1	Row0	GPJ0
	Col0	GPJ3
K2	Row0	GPJ0
	Col1	GPJ4
K3	Row1	GPJ1
	Col0	GPJ3
K4	Row1	GPJ1
	Col1	GPJ4
K5	Row2	GPJ2
	Col0	GPJ3
K6	Row2	GPJ2
	Col1	GPJ4

- Microphone (M1): Through the NAU8822L chip sound input.
- Audio CODEC chip (U10): nuvoTon NAU8822L connects to N9H30 using I2S interface.

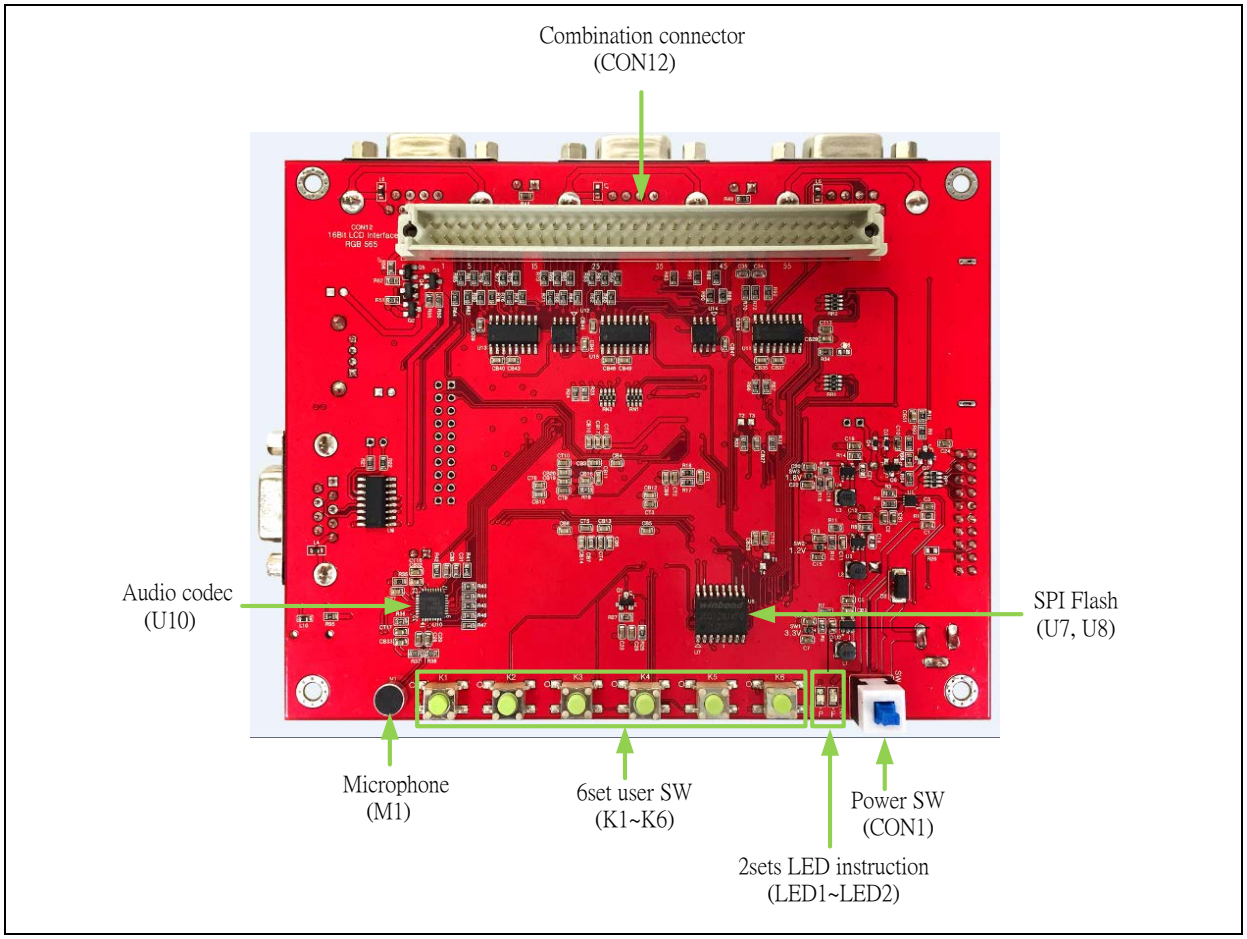


Figure 2-1 NuDesign-HMI-N9H30 Board (Front View)

2.3 NuDesign-HMI-N9H30 Board – Rear View

Figure 2-2 shows the main components and connectors from the rear view of NuDesign-HMI-N9H30 board.

- +5V in (CON1): Power adaptor 5V input.
- JTAG ICE interface (CON4).
- Standard SD connector (CON5).
- UART9 selection:

Function	GPIO pin of N9H30
RS232_TXD	GPH2
RS232_RXD	GPH3

- SW12 / SW13: 1-2 short for I2C1 function and connected to LCD connector (CON12).
- SW12 / SW13: 2-3 short for RS232 function and connected to DB9 female (CON7).

- UART10 selection:

Function	GPIO pin of N9H30
RS232_TXD / RS485_D	GPB12
RS232_RXD / RS485_R	GPB13
UART10_RTS / RS485_Control	GPB14
UART10_CTS	GPB15

  - SW15: 1-2 short for RS232 function and connected to DB9 female (CON9)
  - SW15: 2-3 short for RS485 function and connected to 2P terminal (J4).

- UART3 selection:

Function	GPIO pin of N9H30
RS232_TXD / RS485_D	GPE12
RS232_RXD / RS485_R	GPE13
RS485_Control	GPD7

  - SW14: 1-2 short for RS232 function and connected to DB9 female (CON8)
  - SW14: 2-3 short for RS485 function and connected to 2P terminal (J3).

- USB0 Device/HOST Micro-AB connector (CON10), By CON10 pin4 ID=1 is device, ID=0 is HOST
- USB1 for USB HOST with type-A connector (CON11).
- UART0 selection:

Function	Descriptions
RS232_TXD	GPE0
RS232_RXD	GPE1

  - RS232 function and connected to DB9 female (CON2) for debug message output.
  - GPE0 / GPE1 connected to 2P terminal (J2).

- Speaker output (CON6): Through the NAU8822L chip sound output.

- Expand port for user use (CON3).

Connector	GPIO pin of N9H30	Function
CON3.1	VD33	Power 3.3V
CON3.2	VD33	Power 3.3V
CON3.3	GPI5	UART1_TXD
CON3.4	GPI6	UART1_RXD
CON3.5	GPF0	
CON3.6	GPF1	
CON3.7	GPF2	
CON3.8	GPF3	
CON3.9	GPF4	
CON3.10	GPF5	
CON3.11	GPF6	
CON3.12	GPF7	
CON3.13	GPF8	
CON3.14	GPF9	
CON3.15	GPI9	UART4_TXD
CON3.16	GPI10	UART4_RXD
CON3.17	GPI12	UART8_TXD
CON3.18	GPI13	UART8_RXD
CON3.19	-	VSS
CON3.20	-	VSS

  - SW6 / SW9: 1-2 short for UART1 function and connected to expand port(CON3).
  - SW6 / SW9: 2-3 short for NAND function and connected to NAND Flash (U9).
  - SW7 / SW10: 1-2 short for UART4 function and connected to expand port(CON3).
  - SW7 / SW10: 2-3 short for NAND function and connected to NAND Flash (U9).
  - SW8 / SW11: 1-2 short for UART8 function and connected to expand port(CON3).
  - SW8 / SW11: 2-3 short for NAND function and connected to NAND Flash (U9).

- SOC CPU: nuvoTon N9H30K41I (U5).
- System Reset (SW5): system will be reset if the SW1 button is pressed.

- Power on setting (SW4, S2~9).

SW	State	Function
SW4.2 / SW4.1	ON / ON	Boot from USB
SW4.2 / SW4.1	ON / OFF	Boot from eMMC
SW4.2 / SW4.1	OFF / ON	Boot from NAND Flash
SW4.2 / SW4.1	OFF / OFF	Boot from SPI Flash

SW	State	Function
S2	Short	System clock from 12MHz crystal
S2	Open	System clock from UPLL output

SW	State	Function
S3	Short	Watchdog Timer OFF
S3	Open	Watchdog Timer ON

SW	State	Function
S4	Short	GPJ[4:0] used as GPIO pin
S4	Open	GPJ[4:0] used as JTAG ICE interface

SW	State	Function
S5	Short	UART0 debug message ON
S5	Open	UART0 debug message OFF

SW	State	Function
S7 / S6	Short / Short	NAND Flash page size 2KB
S7 / S6	Short / Open	NAND Flash page size 4KB
S7 / S6	Open / Short	NAND Flash page size 8KB
S7 / S6	Open / Open	Ignore

SW	State	Function
S9 / S8	Short / Short	NAND Flash ECC type BCH T12
S9 / S8	Short / Open	NAND Flash ECC type BCH T15
S9 / S8	Open / Short	NAND Flash ECC type BCH T24
S9 / S8	Open / Open	Ignore

- NAND Flash (128 MB) with Winbond W29N01HVS1NA (U9).
- Power supply for RTC 3.3V powered (BT1, J1).

  RTC power has 3 sources:

  - Share with 3.3V I/O power.
  - Battery socket for CR2032 (BT1).
  - External connector (J1).

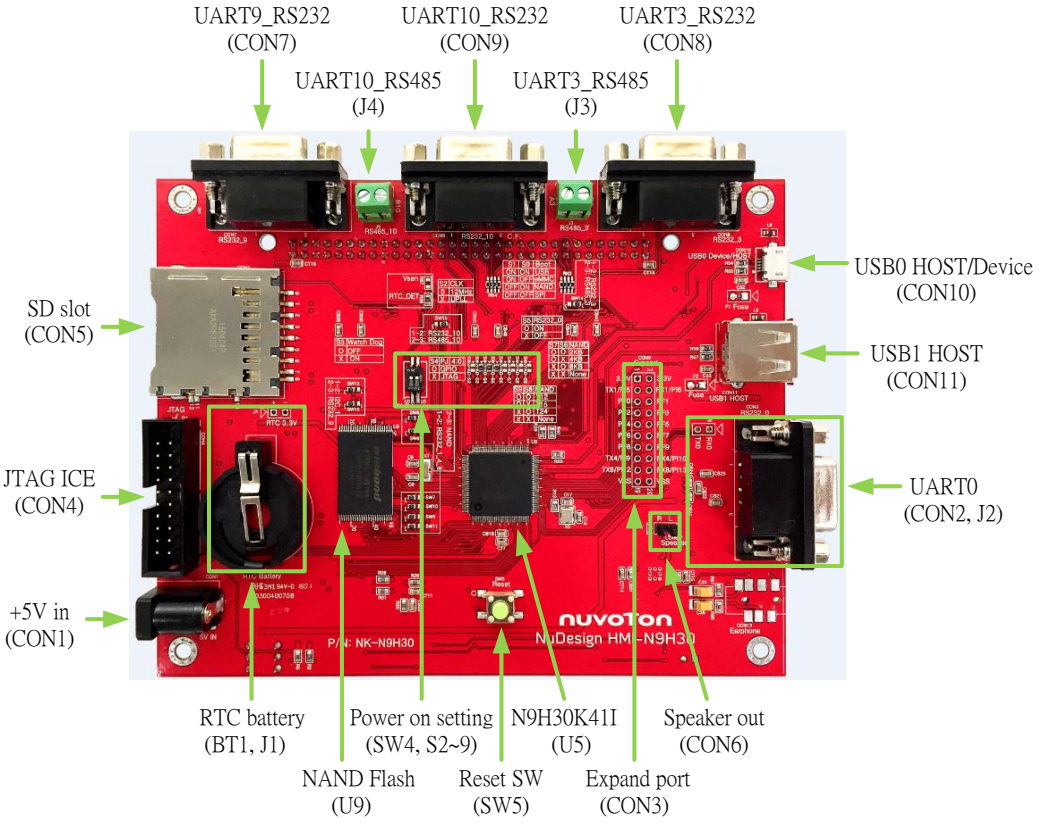


Figure 2-2 NuDesign-HMI-N9H30 Board (Rear View)

2.4 NuDesign-TFT-LCD5 – Front View

Figure 2-3 shows the main components and connectors from the Front view of NuDesign-TFT-LCD5 board.

- 5” resolution 800x480 4W resistive touch panel.

Figure 2-3 NuDesign-TFT-LCD5 Board (Front View)

2.5 NuDesign-TFT-LCD5 – Rear View

Figure 2-4 shows the main components and connectors from the rear view of NuDesign-TFT-LCD5 board.

- NuDesign-HMI-N9H30 and NuDesign-TFT-LCD5 combination connector (CON1).

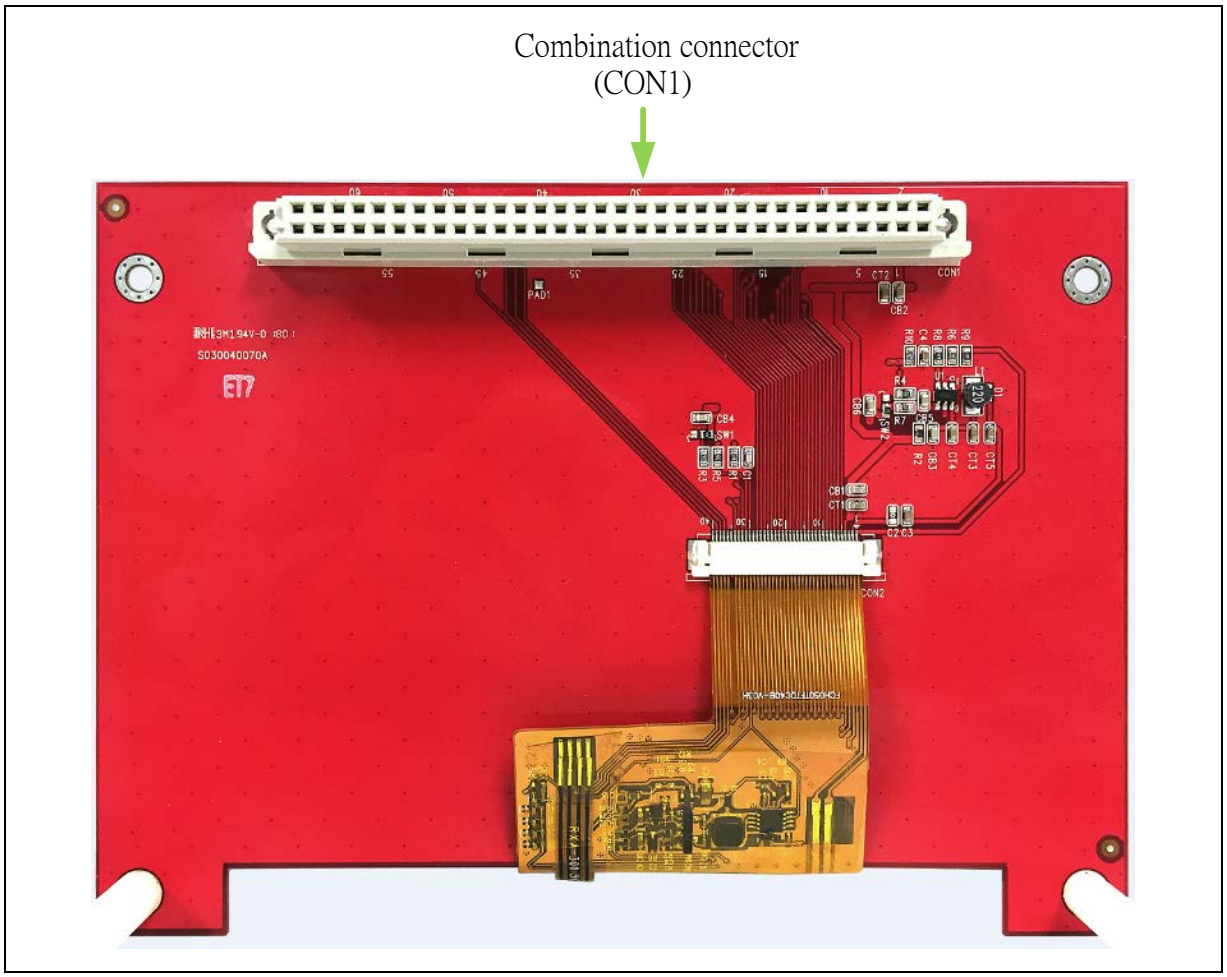


Figure 2-4 NuDesign-TFT-LCD5 Board (Rear View)

2.6 NuDesign-HMI-N9H30 and NuDesign-TFT-LCD5 PCB Placement

The following figure shows NuDesign-HMI-N9H30 and NuDesign-TFT-LCD5 PCB placement.

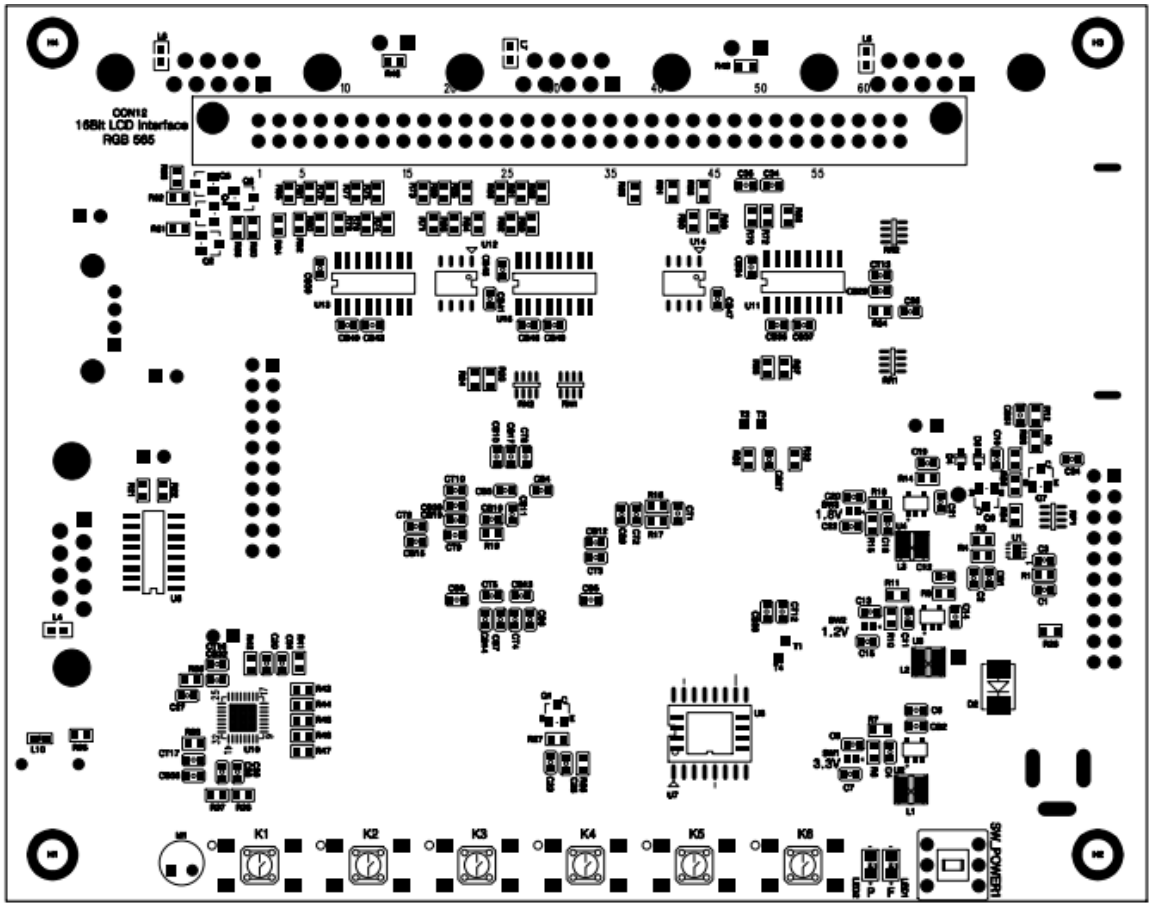


Figure 2-6 NuDesign-HMI-N9H30 Front PCB Placement

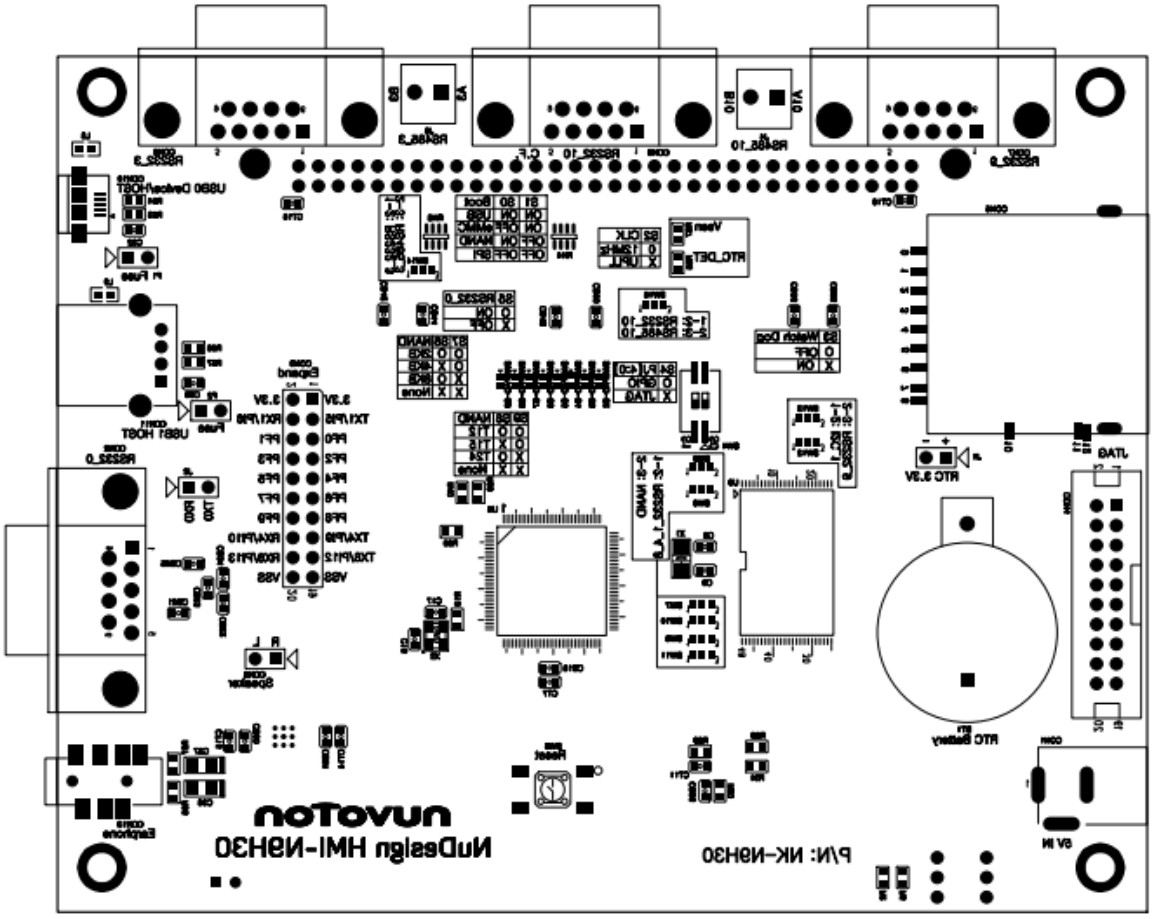


Figure 2-7 NuDesign-HMI-N9H30 Back PCB Placement

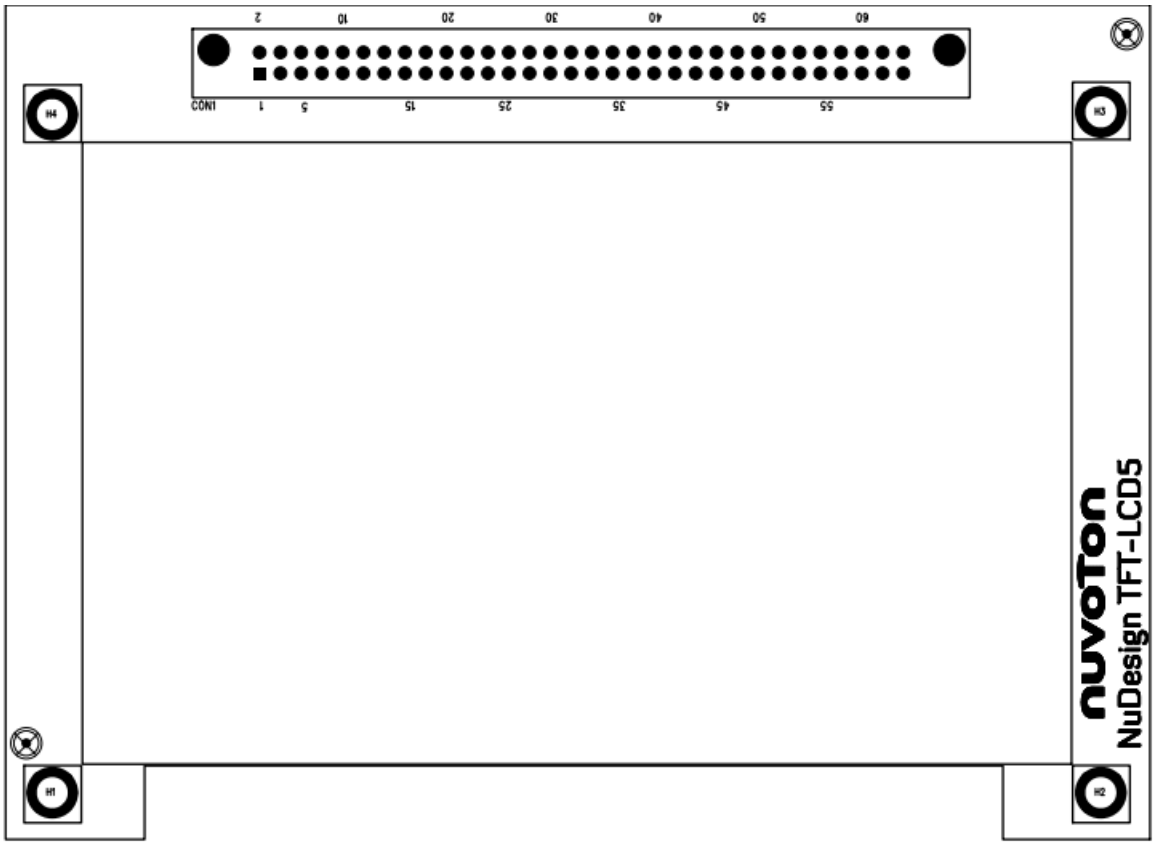


Figure 2-8 NuDesign-TFT-LCD5 Front PCB Placement

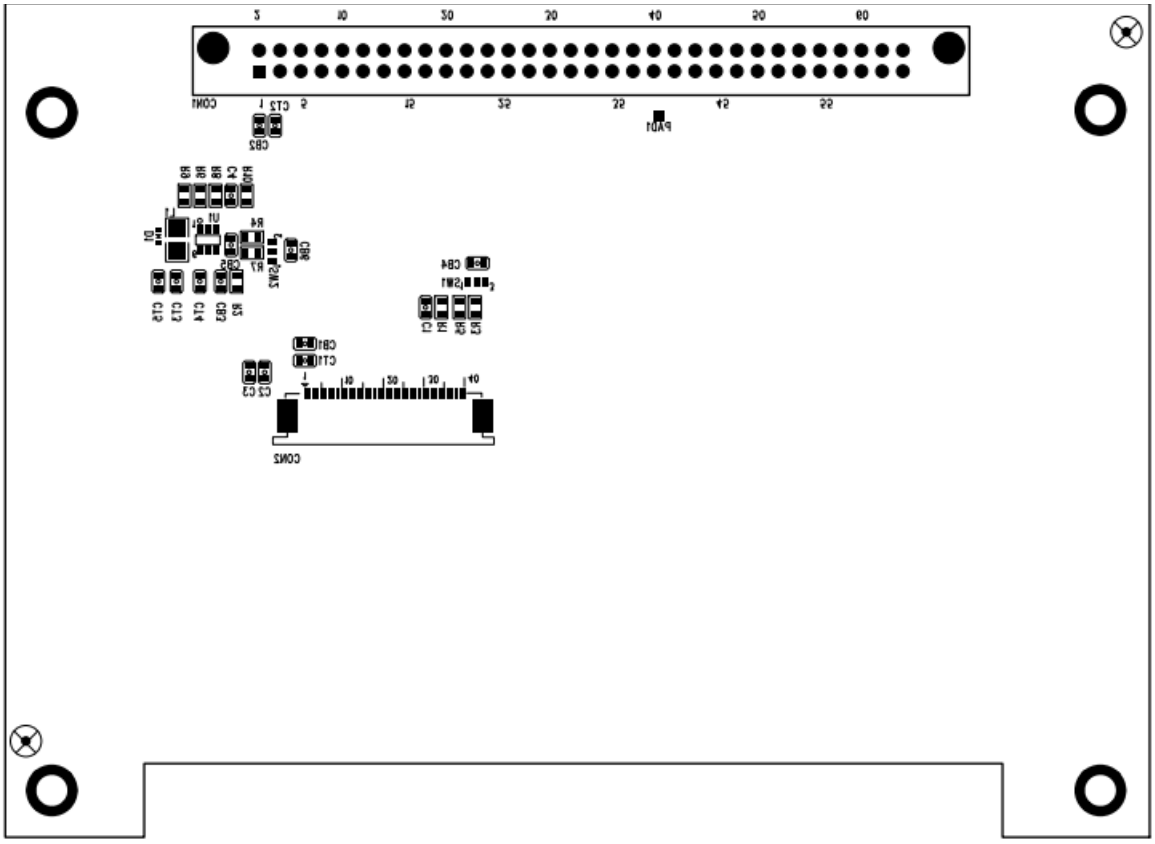
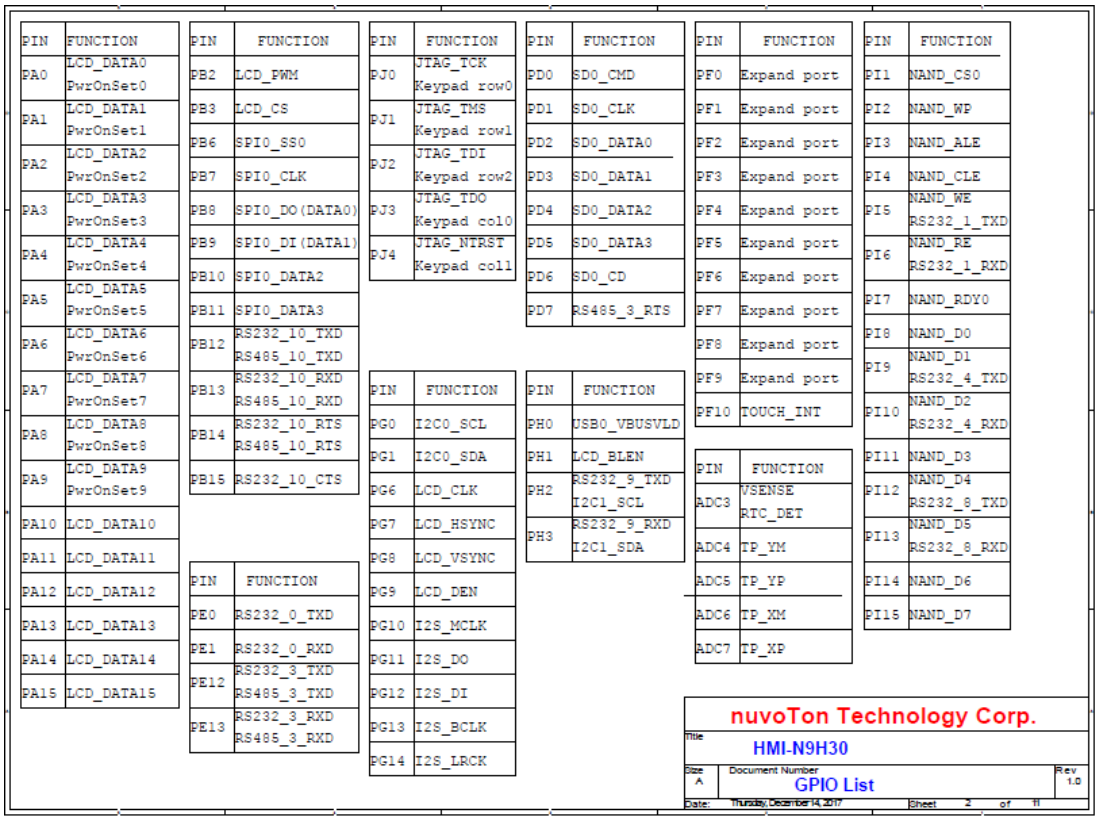


Figure 2-9 NuDesign-TFT-LCD5 Back PCB Placement

3 NUDESIGN-HMI-N9H30 AND NUDESIGN-TFT-LCD5 SCHEMATICS

3.1 NuDesign-HMI-N9H30 – GPIO List Schematic



PIN	FUNCTION
PA0	LCD_DATA0 PwrOnSet0
PA1	LCD_DATA1 PwrOnSet1
PA2	LCD_DATA2 PwrOnSet2
PA3	LCD_DATA3 PwrOnSet3
PA4	LCD_DATA4 PwrOnSet4
PA5	LCD_DATA5 PwrOnSet5
PA6	LCD_DATA6 PwrOnSet6
PA7	LCD_DATA7 PwrOnSet7
PA8	LCD_DATA8 PwrOnSet8
PA9	LCD_DATA9 PwrOnSet9
PA10	LCD_DATA10
PA11	LCD_DATA11
PA12	LCD_DATA12
PA13	LCD_DATA13
PA14	LCD_DATA14
PA15	LCD_DATA15

PIN	FUNCTION
PB2	LCD_PWM
PB3	LCD_CS
PB6	SPI0_SS0
PB7	SPI0_CLK
PB8	SPI0_DO(DATA0)
PB9	SPI0_DI(DATA1)
PB10	SPI0_DATA2
PB11	SPI0_DATA3
PB12	RS232_10_TXD RS485_10_TXD
PB13	RS232_10_RXD RS485_10_RXD
PB14	RS232_10_RTS RS485_10_RTS
PB15	RS232_10_CTS

PIN	FUNCTION
PE0	RS232_0_TXD
PE1	RS232_0_RXD
PE12	RS232_3_TXD RS485_3_TXD
PE13	RS232_3_RXD RS485_3_RXD

PIN	FUNCTION
PJ0	JTAG_TCK Keypad row0
PJ1	JTAG_TMS Keypad row1
PJ2	JTAG_TDI Keypad row2
PJ3	JTAG_TDO Keypad col0
PJ4	JTAG_NTRST Keypad col1

PIN	FUNCTION
PG0	I2C0_SCL
PG1	I2C0_SDA
PG6	LCD_CLK
PG7	LCD_HSYNC
PG8	LCD_VSYNC
PG9	LCD_DEN
PG10	I2S_MCLK
PG11	I2S_DO
PG12	I2S_DI
PG13	I2S_BCLK
PG14	I2S_LRCK

PIN	FUNCTION
PD0	SD0_CMD
PD1	SD0_CLK
PD2	SD0_DATA0
PD3	SD0_DATA1
PD4	SD0_DATA2
PD5	SD0_DATA3
PD6	SD0_CD
PD7	RS485_3_RTS

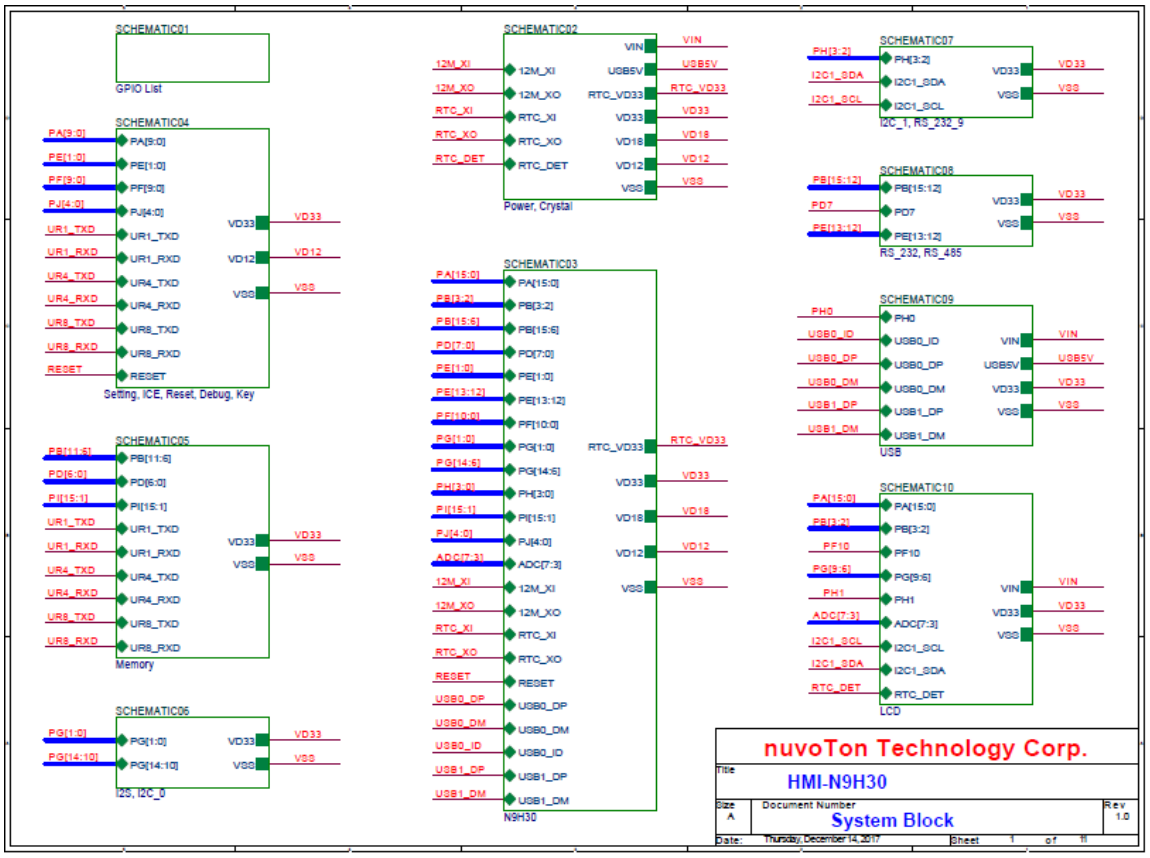
PIN	FUNCTION
PH0	USB0_VBUSVLD
PH1	LCD_BLEN
PH2	RS232_9_TXD I2C1_SCL
PH3	RS232_9_RXD I2C1_SDA

PIN	FUNCTION
PF0	Expand port
PF1	Expand port
PF2	Expand port
PF3	Expand port
PF4	Expand port
PF5	Expand port
PF6	Expand port
PF7	Expand port
PF8	Expand port
PF9	Expand port
PF10	TOUCH_INT

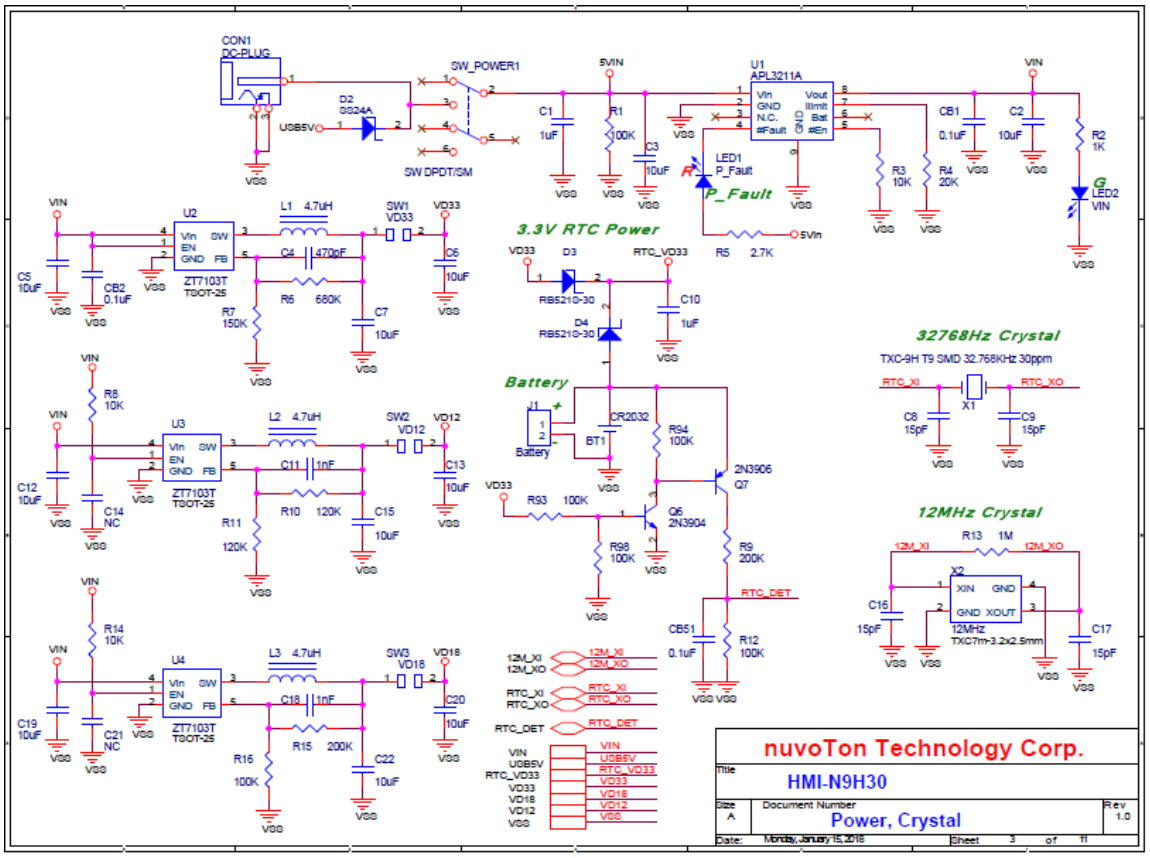
PIN	FUNCTION
ADC3	VSENSE RTC_DET
ADC4	TP_YM
ADC5	TP_YP
ADC6	TP_XM
ADC7	TP_XP

PIN	FUNCTION
PI1	NAND_CS0
PI2	NAND_WP
PI3	NAND_ALE
PI4	NAND_CLE
PI5	NAND_WE RS232_1_TXD
PI6	NAND_RE RS232_1_RXD
PI7	NAND_RDY0
PI8	NAND_D0
PI9	NAND_D1 RS232_4_TXD
PI10	NAND_D2 RS232_4_RXD
PI11	NAND_D3
PI12	NAND_D4 RS232_8_TXD
PI13	NAND_D5 RS232_8_RXD
PI14	NAND_D6
PI15	NAND_D7

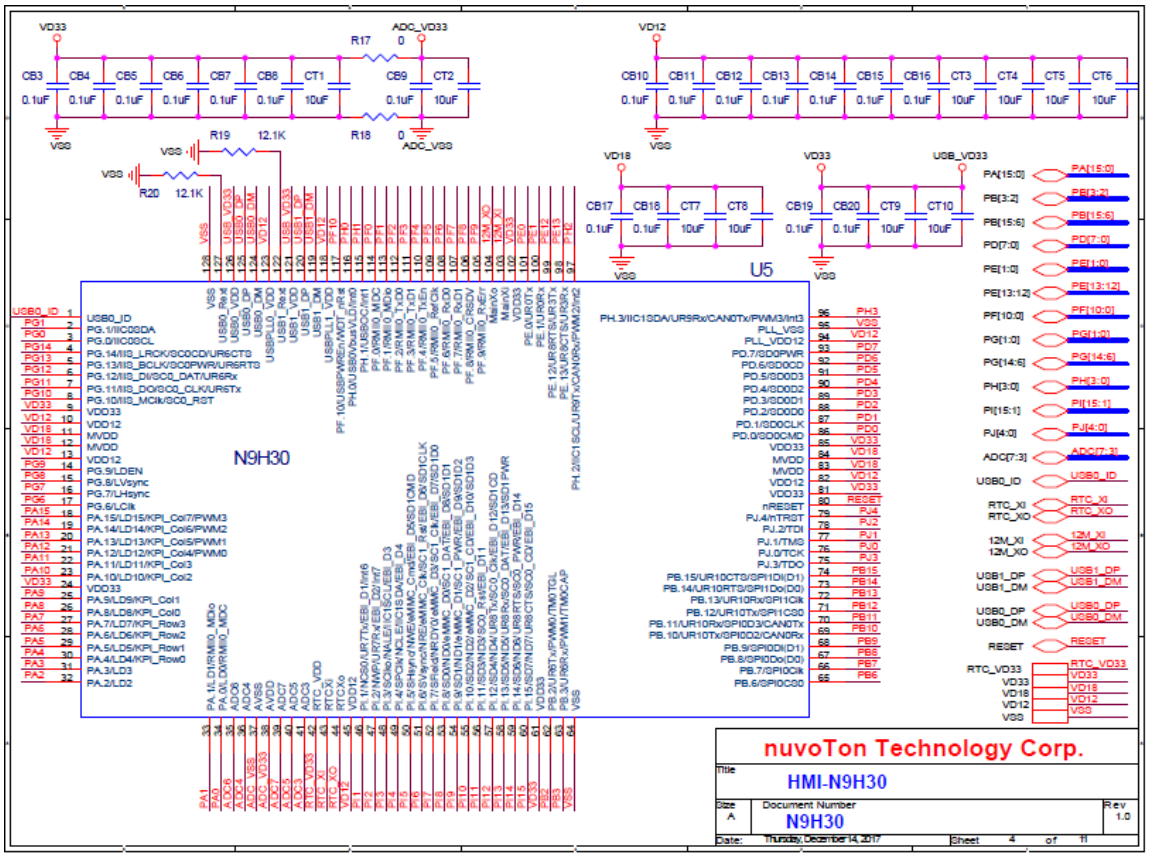
3.2 NuDesign-HMI-N9H30 – System Block Schematic



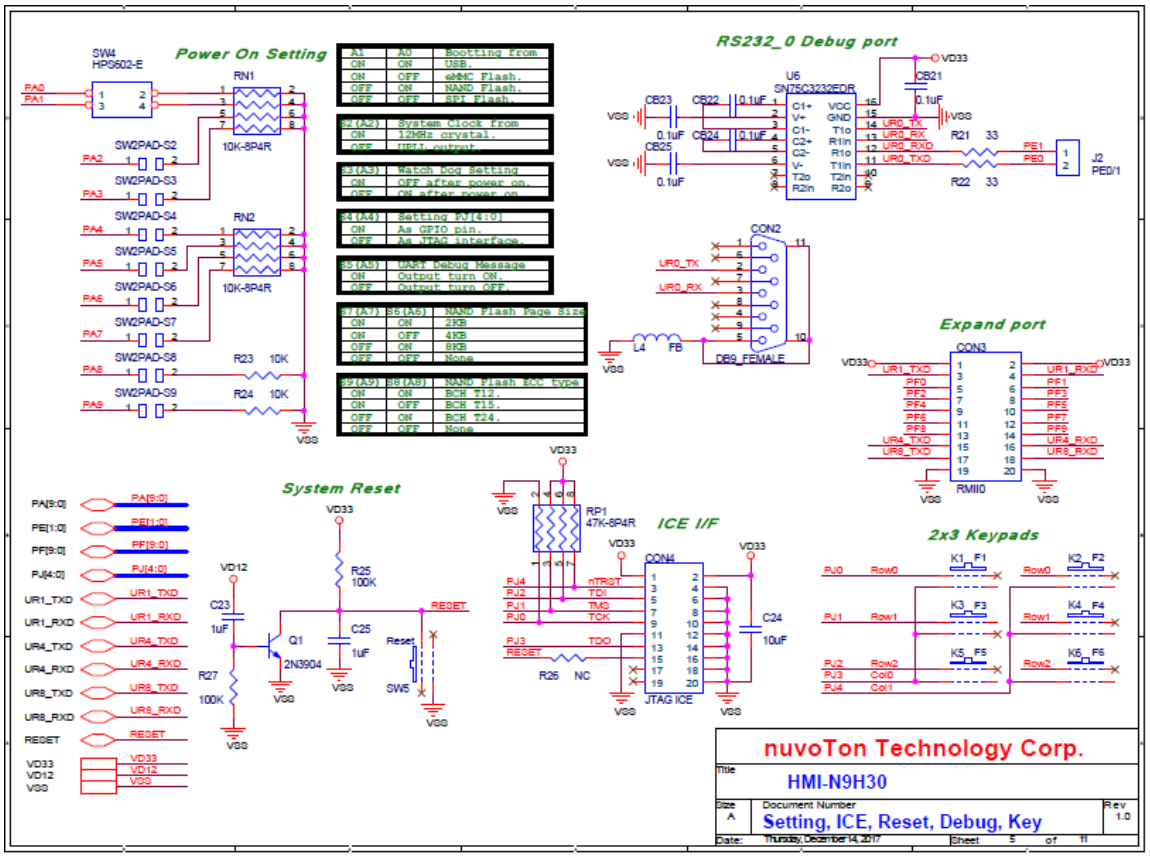
3.3 NuDesign-HMI-N9H30 – Power, Crystal Schematic



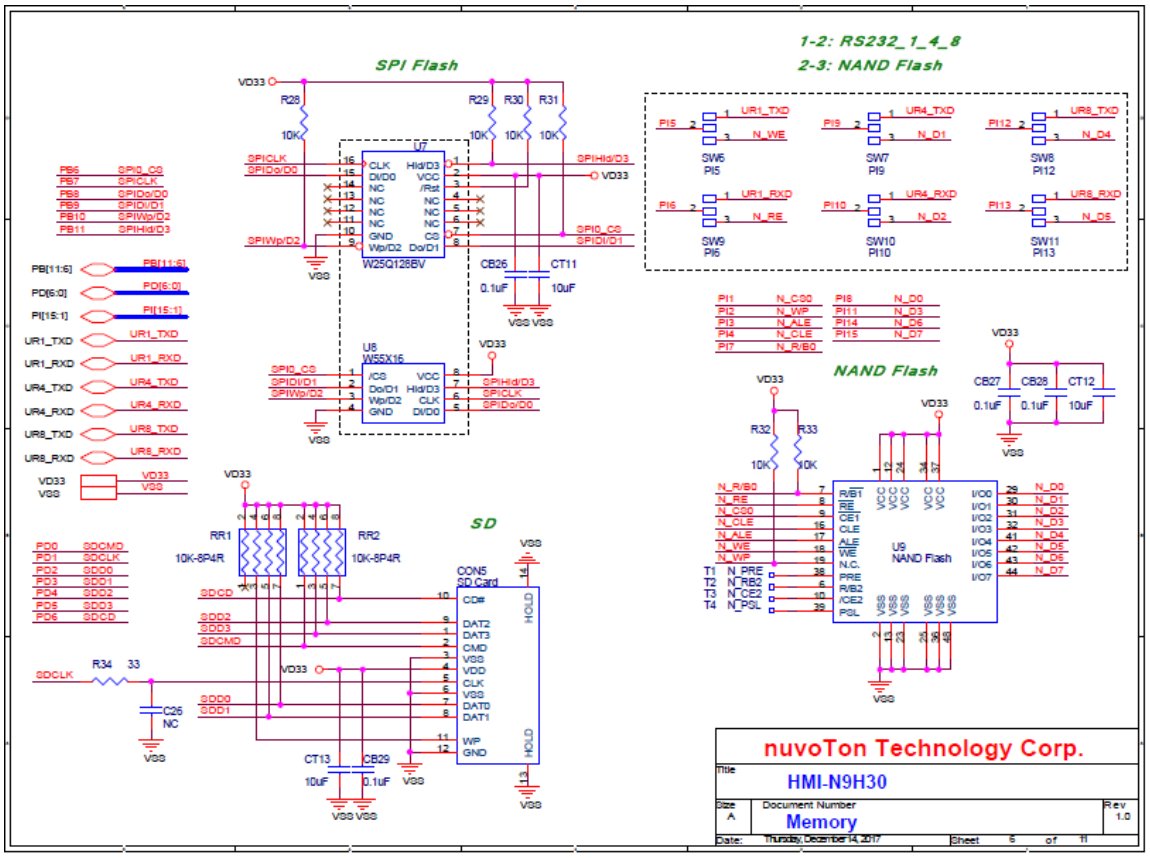
3.4 NuDesign-HMI-N9H30 – N9H30 Schematic



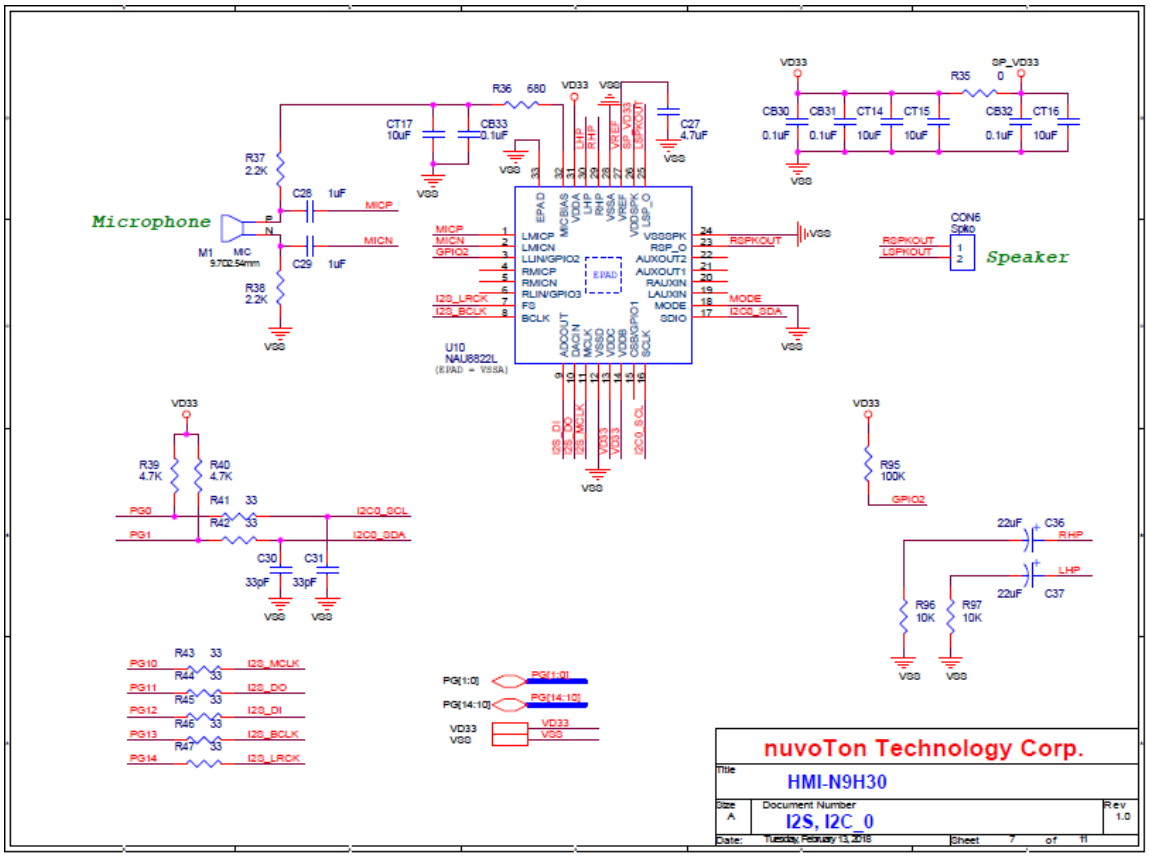
3.5 NuDesign-HMI-N9H30 – Setting, ICE, Reset, Debug, Key Schematic



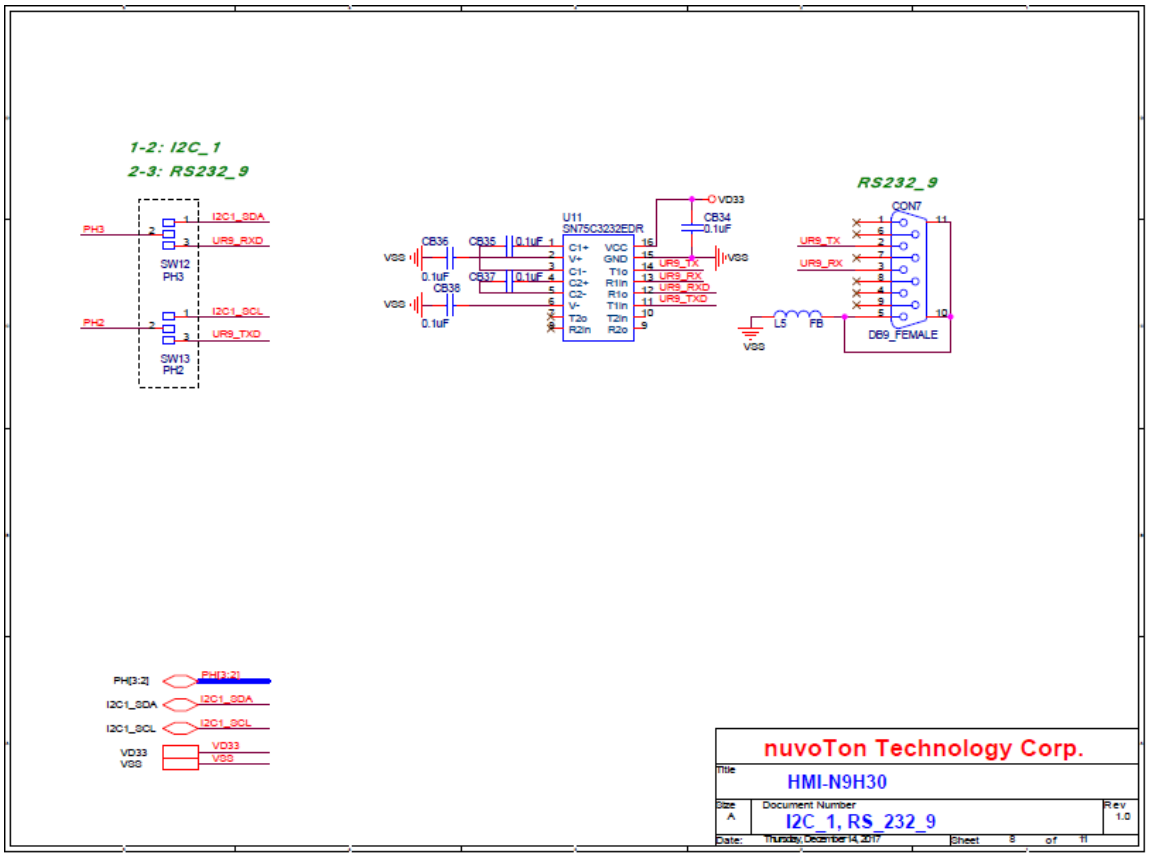
3.6 NuDesign-HMI-N9H30 – Memory Schematic



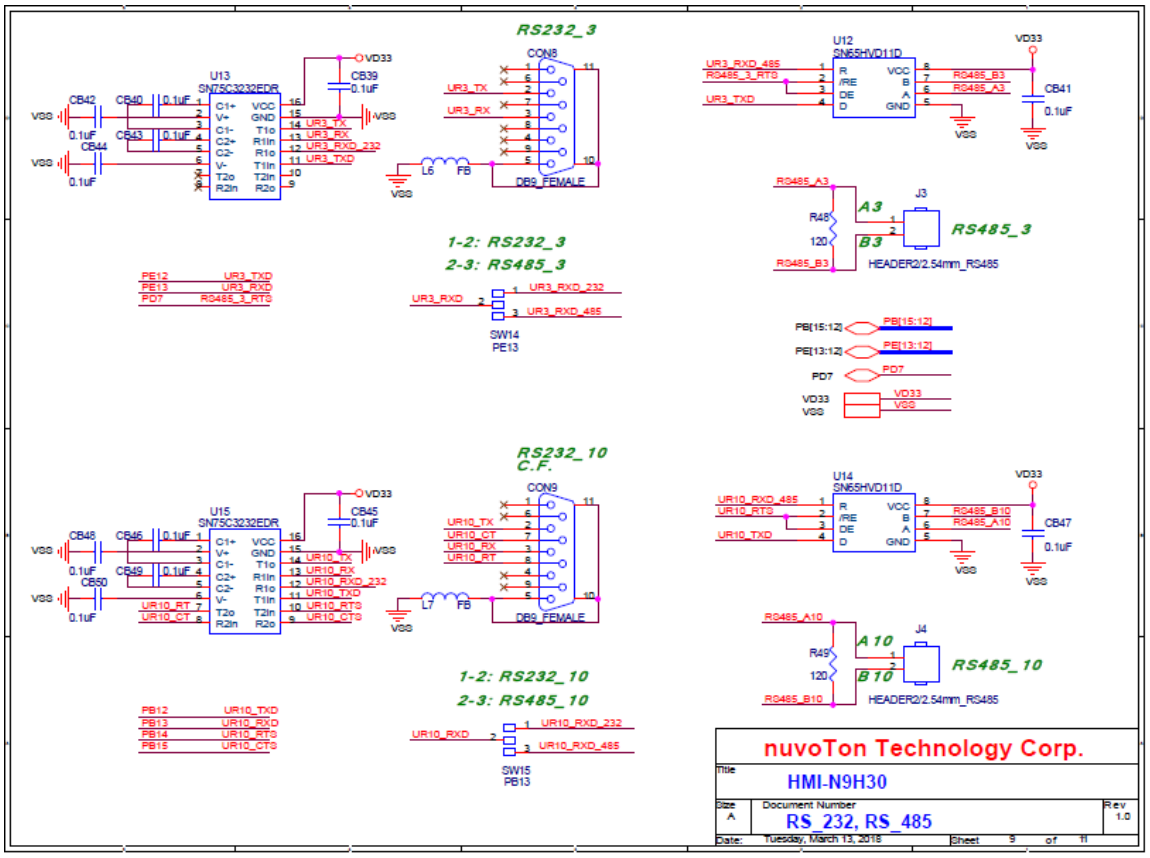
3.7 NuDesign-HMI-N9H30 – I2S, I2C_0 Schematic



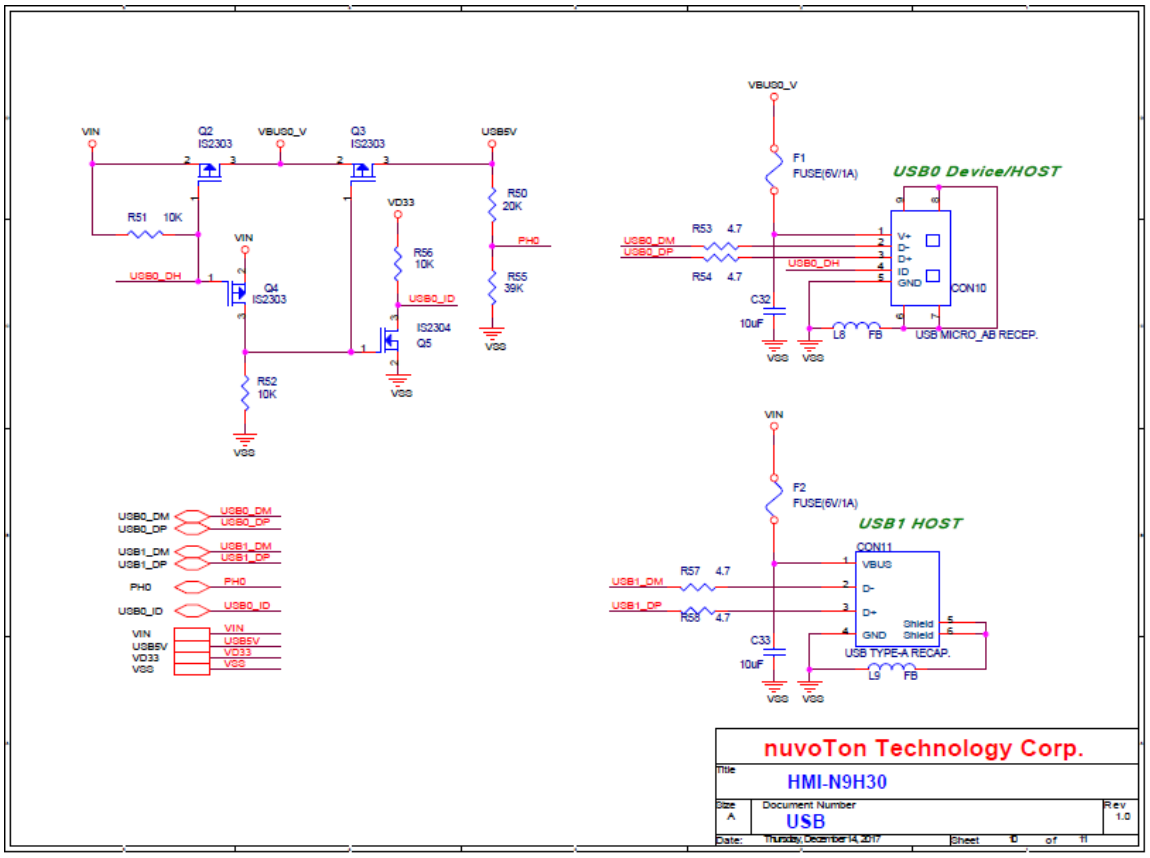
3.8 NuDesign-HMI-N9H30 – I2C_1, RS_232_9 Schematic



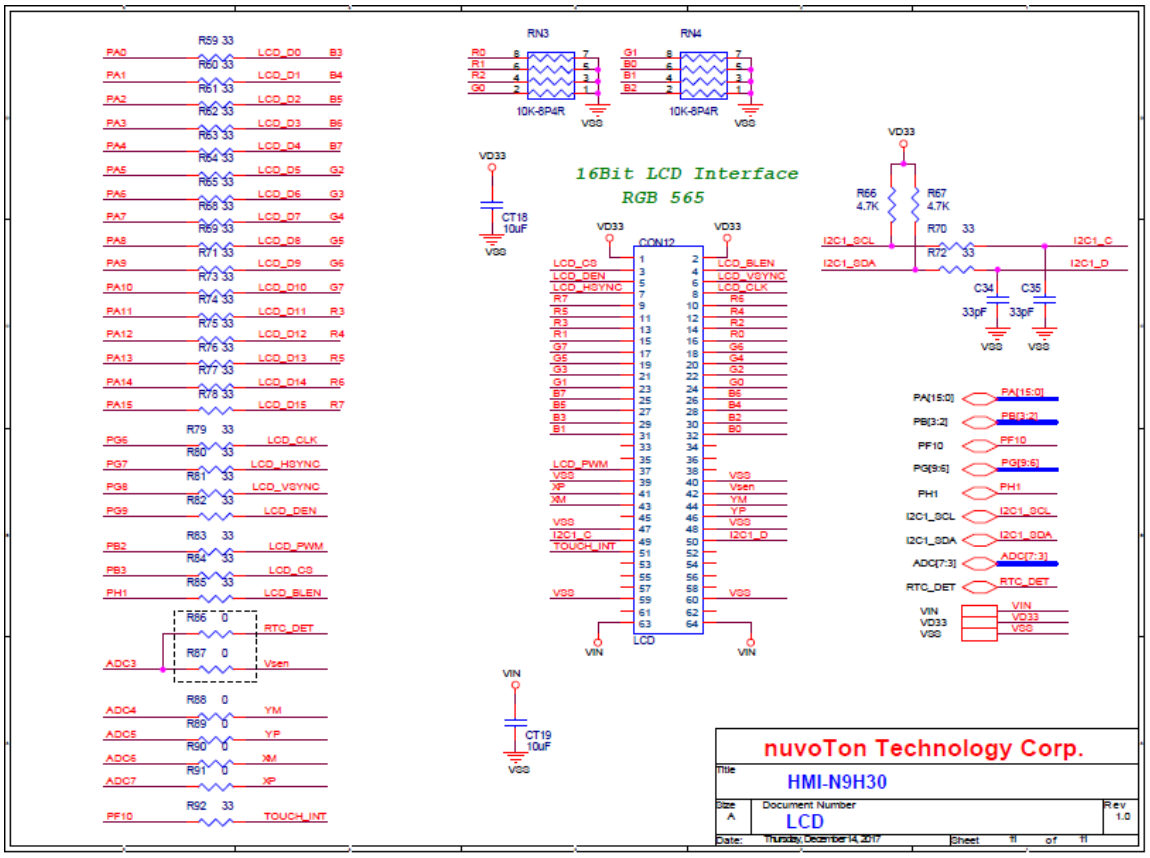
3.9 NuDesign-HMI-N9H30 – RS_232, RS485 Schematic



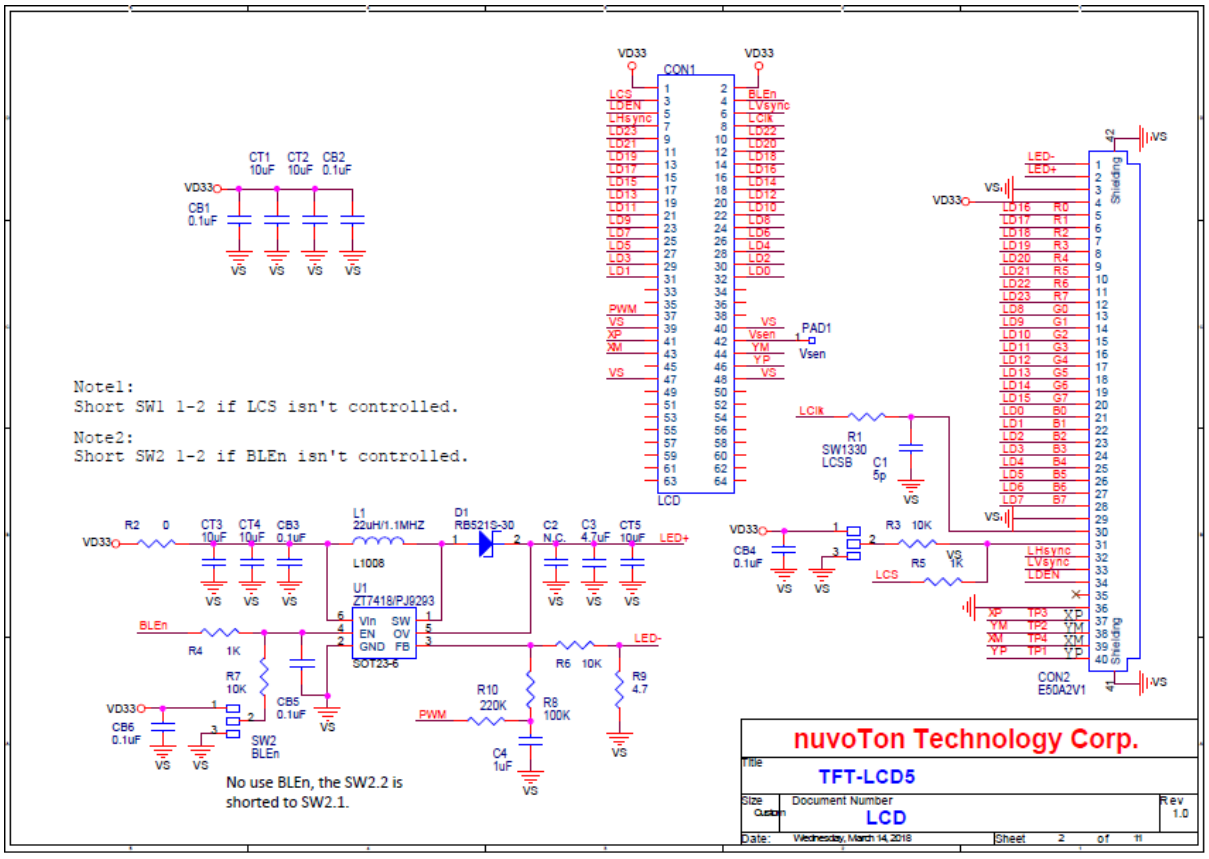
3.10 NuDesign-HMI-N9H30 – USB Schematic



3.11 NuDesign-HMI-N9H30 – LCD Schematic



3.12 NuDesign-TFT-LCD5 – LCD Schematic



4 REVISION HISTORY

Date	Revision	Description
2018.03.14	1.00	1. Initially issued.
2018.04.02	1.01	1. Remove RMII

Important Notice

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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.