NuMicro® Family

Arm® Cortex®-A35-based Microprocessor

NuMaker-IoT-MA35D1-A1

User Manual

Evaluation Board for NuMicro® MA35D1 Series

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1 OVERVIEW

The NuMaker-IoT-MA35D1-A1 evaluation board provides the Ethernet and connectivity features of Nuvoton NuMicro MA35D1 series microprocessors (MPUs), based on MA35D16F987C (LQFP-EP 216-Pin package, and stacking a 512 MB DDR). The NuMaker-IoT-MA35D1-A1 includes rich peripherals such as one set of Gigabit Ethernet, one set of Megabit Ethernet, high-speed USB2.0 Host and device, one set of SD2.0 in Micro SD slot, one set of CAN FD, and RS-485 and RS232 serial communication ports. Furthermore, the NuMaker-IoT-MA35D1-A1 provides discrete power supply to be the reference design. It also provides compatible headers with Raspberry Pi and Arduino UNO for minimizing effort in connecting popular sensors and modules to the system. Based on these features, it helps user to facilitate the evaluation in IIoT Edge Gateway, Smart Building, Smart Agriculture, T-Box, 4G/5G Base Station, or your creative applications.

There are two evaluation boards for the MA35D1 series, NuMaker-HMI-MA35D1-S1 and NuMaker-IoT-MA35D1-A1, which are ideal for HMI and edge gateway applications, respectively. For more details on HMI applications, please refer to NuMaker-HMI-MA35D1-S1 User Manual. For more details on edge gateway applications, please refer to NuMaker-IoT-MA35D1-A1 User Manual.

The NuMicro MA35D1 series is a heterogeneous multi-core microprocessor targeted to high-end edge IIoT gateway. It is based on dual 64-bit Arm Cortex-A35 cores with speed up to 800 MHz, and one 180 MHz Arm Cortex-M4 core. Based on the high-performance cores, the MA35D1 series facilities the tiny AI/ML for edge computing.

The MA35D1 series supports 16-bit DDR2 and DDR3/DDR3L SDRAM. For an easy system design and manufacture, the MA35D1 series also offers LQFP and BGA packages stacked with the DDR2/DDR3L SDRAM and density up to 512 MB, which significantly reduces PCB layer, size and electromagnetic interference (EMI).

The MA35D1 series is a trusted system for IoT products' security requirements. It includes several advanced security mechanisms such as Nuvoton Trusted Secure Island (TSI) an isolated secure hardware unit, TrustZone, secure boot, tamper-detection, built-in cryptographic accelerators, and a TRNG, as well as Key Store and OTP memory. All the security operations are performed in the TSI to protect sensitive and high-value data. The features also satisfy customers in IEC 62443 certification requirements.

For high-end edge IIoT gateway requirements, the MA35D1 series provides multiple advanced and high-speed connection interfaces, such as Gigabit Ethernet, SDIO3.0, USB 2.0 HS, and CAN FD, for edge gateway and new energy applications.

For HMI applications, the MA35D1 series provides a LCD display controller with the resolution up to 1920x1080 at 60 FPS, a 2D graphic engine, a JPEG and a H.264 decoder integrated for better graphical HMI effects and video playback.

Figure 1-1 NuMaker-IoT-MA35D1-A1 Board

2 FEATURES

- Target Chip: MA35D16F987C (LQFP-EP 216-Pin) MCP package with DDR3L (512 MB), which can run up to 800 MHz
- Power:
  - 5V/2A Power Jack, USB VCOM Port or HSUSB0 Device
  - Battery header for RTC power
- Debug:
  - UART0 debug port: USB Virtual COM (VCOM) port
  - Debug port: SWJ (JTAG + SWD) connector
- Memory Devices
  - An on-board Quad SPI NAND Flash device (512 MB)
  - An on-board NAND Flash device (1 GB)
  - MicroSD memory card (SD1, supports SD3.0)
- One power-on setting DIP-Switch for evaluation booting source selection
- One set of Gigabit Ethernet port: One Gigabit Ethernet (RGMII) PHY device, transformer and RJ45 port connector
- One set of Megabit Ethernet port: One Megabit Ethernet (RMII) PHY device, transformer and RJ45 port connector
- Two sets of high speed USB ports: One Host/Device port and one Host port
- One Raspberry Pi 40-pin header connector
- Arduino UNO compatible extension connectors
- One camera capture (CMOS sensor) header connector
- One audio codec with microphone input and speaker output
- One UART header
- One set of RS485 transceiver and header connector
- One set of CAN FD transceiver and header connector
- Four user key buttons
- Three user LEDs

3 HARDWARE CONFIGURATION

3.1 Front View

Figure 3-1 shows the main components and connectors from the front side of NuMaker-IoT-MA35D1-A1 board.

- Target Chip (U1): MA35D16F987C (LQFP-EP*1 216-Pin) MCP package with DDR3L (512MB).

  Note *1: The LQFP-EP 216-Pin package has an exposed die pad (EPAD) on the bottom of IC. Please log in Nuvoton's website and download the "MA35 Series LQFP-EP 216-Pin Package Application Note" document from the following link for reference in PCB design and layout as well as PCBA assembly and soldering. MA35 Series LQFP-EP 216-Pin Package Application Note

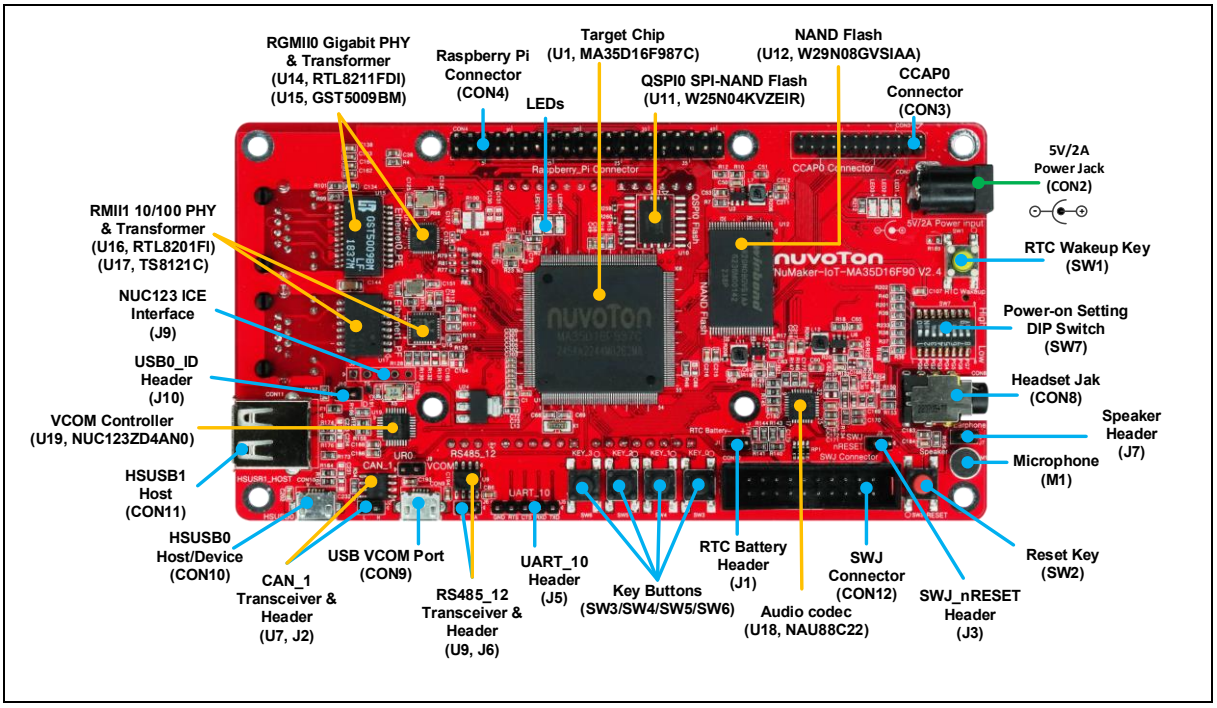

Figure 3-1 Front View of NuMaker-IoT-MA35D1-A1

3.2 Rear View

Figure 3-2 shows the main components and connectors from the rear side of NuMaker-IoT-MA35D1-A1 board.

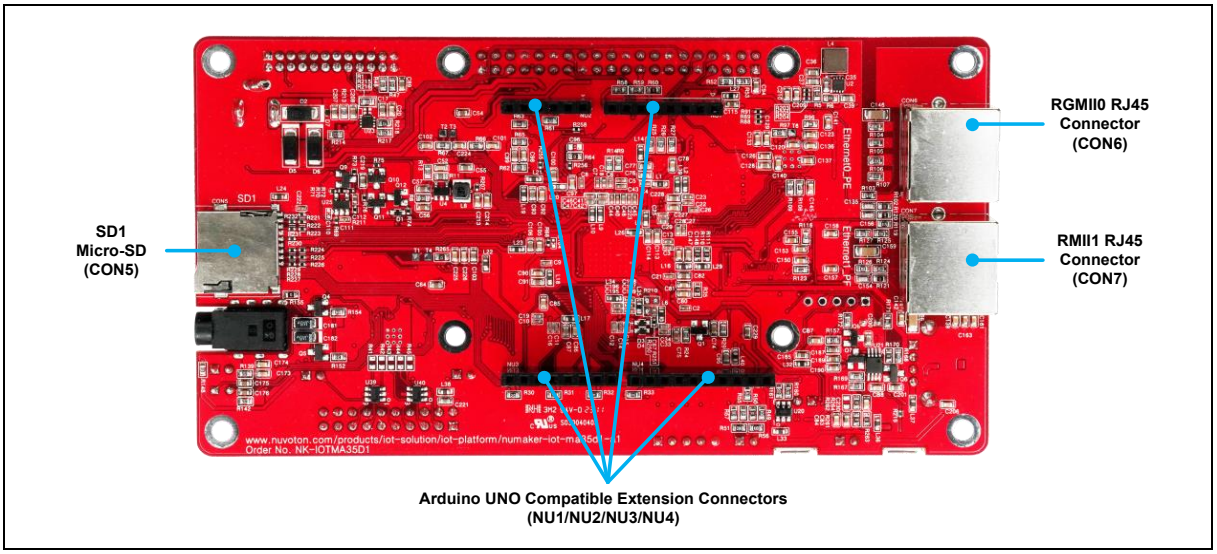

Figure 3-2 Rear View of NuMaker-IoT-MA35D1-A1

3.3 DDR PHY and MCP DRAM Power Voltage

- DDR PHY and MCP DRAM Power Selection Resistors (R252 and R253): These two resistors R252 and R253 can decide the power voltage (1.35V or 1.8V) of DRAM_VDD that feeds to the internal DDR PHY and MCP DARM of MA35D1 target chip.

Mounted on PCB	DRAM_VDD Voltage	MA35D1 PN / MCP DRAM Type
R252*1*2	1.35V	MA35D16F987C/MA35D16F887C / DDR3L*2
R253*1	1.8V	MA35D16F787C / DDR2
Note *1: Only one resistor R252 or R253 can be mounted on the PCB and user should make sure which part number chip of MA35D1 series that be mounted on this NuMaker-IoT-MA35D1-A1 board. **Note** *2: By default, only R252 resistor and MA35D16F987C target chip are mounted on the NuMaker-IoT-MA35D1-A1 board.		

Table 3-1 DDR PHY and MCP DRAM Power Voltage Selection

3.4 Audio Codec

- Audio Codec Device (U18): Nuvoton NAU88C22 is audio codec device that integrates microphone input, speaker output and headphone output for audio application on this board.
- Headset Jack (CON8): A headset input jack that follows CTIA definition.
- Speaker Connector (J7): To connect a speaker to output audio sound.
- Microphone (M1): An on-board microphone for audio sound input.

3.5 RGMII Gigabit Ethernet

- RGMII0 Gigabit PHY (U14) and Transformer (U15): The RGMII0 MAC of MA35D1 series needs an external Gigabit PHY (RTL8211FDI) and a transformer (GST5009BM) to connect with the Ethernet network.
- RGMII0 RJ45 Connector (CON6): The Ethernet RGMII0 RJ45 connector.

3.6 RMII Megabit Ethernet

- RMII1 Megabit PHY (U16) and Transformer (U17): The RMII1 MAC of MA35D1 series needs an external Megabit PHY (RTL8201FI) and a transformer (TS8121C) to connect with the Ethernet network.
- RMII1 RJ45 Connector (CON7): The Ethernet RMII1 RJ45 connector.

3.7 QSPI Flash

- QSPI0 Flash (U11): Winbond SPI NAND Flash (W25N04KWZEIR, 512MB) for optional booting source, supporting dual / quad mode.

Pin No.	Pin Name	GPIO pin of MA35D1
1	QSPI0_SS0	PD0
2	QSPI0_MISO0	PD3
3	QSPI0_MOSI1	PD4
4	VSS	-
5	QSPI0_MOSI0	PD2
6	QSPI0_CLK	PD1
7	QSPI0_MISO1	PD5
8	QSPI0_VDD*	
Note *: The power group of these GPIO PD0~PD5 belongs to the VDDIO5 power domain of MA35D1 series, the default voltage of VDDIO5 (power input VDD_QSPI0) is VDD1V8 (DC 1.8V) on this NuMaker-IoT-MA35D1-A1 board.		

Table 3-2 QSPI0 Flash (U11) Pin Function

3.8 NAND Flash

- NAND Flash (U12): Winbond NAND Flash (W29N08GVSIAA, 1GB) for optional booting source.

Function Name	GPIO pin of MA35D1
NAND_DATA0	PA0
NAND_DATA1	PA1
NAND_DATA2	PA2
NAND_DATA3	PA3
NAND_DATA4	PA4
NAND_DATA5	PA5
NAND_DATA6	PA6
NAND_DATA7	PA7
NAND_RDY	PA8

NAND_nRE	PA9
NAND_nWE	PA10
NAND_CLE	PA11
NAND_ALE	PA12
NAND_nCS	PA13
NAND_nWP	PA14

Table 3-3 NAND Flash (U12) Pin Function

3.9 USB Virtual COM (VCOM) Port

- USB VCOM Port (CON9, USB Micro-AB Receptacle): The NUC123ZD4AN0 microcontroller (MCU) (U19) acts as an USB VCOM device to communicate data between the UART0 port of MA35D1 series and USB host of PC. An USB cable should be connected with this micro-AB connector (CON9) and should be plugged-in the PC host to display the debug messages on PC (Optional).

  Note: The GPIO PE15 (UART0_RXD) pin must be pulled to high level through an external resistor or an internal pull-up resistor in the external device (such as a transceiver or MCU).

- VCOM Controller (U19): The NUC123ZD4AN0 microcontroller (U19) acts as an USB VCOM device to communicate data between the UART0 port of MA35D1 series and USB host of PC.

- NUC123 ICE Interface (J9): The ICE interface of NUC123ZD4AN0 microcontroller (U19) for programming the internal Flash of NUC123 series MCU. The internal Flash of NUC123 series MCU had been programmed and acts as an USB VCOM device before the NuMaker-IoT-MA35D1-A1 board is delivered by Nuvoton.

Pin No.	Pin Name	Function
1	VCOM_3.3V	DC 3.3V
2	N123_ICE_DAT	SWD data pin of NUC123
3	N123_ICE_CLK	SWD clock pin of NUC123
4	N123_nRST	Reset pin of NUC123
5	VSS	Ground

Table 3-4 NUC123 ICE Interface (J9) Pin Funciton

3.10 Power Jack

- 5V Power Jack (CON2): This power jack needs to connect an extra adapter to supply DC 5V/2A power input for this board.

3.11 Power-on Setting

- Power-on Setting DIP Switch (SW7): The GPIO PG0, PG1, PG2, PG3, PG4, PG5, PG6 and PG7 determine how to boot the evaluation environment on the NuMaker-IoT-MA35D1-A1 board. These GPIO pins are internal weakly pull-down.

- Options for secure boot enable or disable:

SW7.1 / PG0*	Secure Booting
Low	Enable
High	Disable
Note *: The GPIO PG0 is internal weakly pull-down.	

Table 3-5 Secure Boot Options

- Options for booting source QSPI0 and SD/eMMC IO voltage selection:

SW7.2 / PG1*	Boot Source QSPI0 and SD/eMMC I/O Voltage
Low	3.3V
High	1.8V
Note *: The GPIO PG1 is internal weakly pull-down.	

Table 3-6 Booting Source QSPI0 and SD/eMMC IO Voltage Options

- Options for booting source selection:

SW7.4 / PG3*[1]	SW7.3 / PG2*[1]	Booting Source
Low	Low	QSPI0 Flash
Low	High	SD/eMMC*[2]
High	Low	NAND Flash
High	High	USB
Note *[1]: These GPIO PG2 and PG3 are internal weakly pull-down. **Note** *[2]: There's only SD1 micro card slot on this NuMaker-IoT-MA35D1-A1 board.		

Table 3-7 Booting Source Options

- Options for booting from NAND Flash device:

SW7.6 / PG5*	SW7.5 / PG4*	Boot from NAND Flash
Low	Low	Ignore
Low	High	NAND Page = 2KB
High	Low	NAND Page = 4KB
High	High	NAND Page = 8KB
Note *: These GPIO PG4 and PG5 are internal weakly pull-down.		

Table 3-8 Page Size Options for NAND Flash Booting Source

SW7.8 / PG7*	SW7.7 / PG6*	Boot from NAND Flash
Low	Low	Ignore

Low	High	BCH T12
High	Low	BCH T24
High	High	NO ECC
Note *: These GPIO PG6 and PG7 are internal weakly pull-down.		

Table 3-9 ECC Options for NAND Flash Booting Source

- Options for booting from SD0/1 card or eMMC0/1 NAND Flash memory device:

SW7.7 / PG6*1	Boot from SD/eMMC
Low	SD0/eMMC0 Boot
High	SD1/eMMC1 Boot*2
Note *1: The GPIO PG6 is internal weakly pull-down. **Note** *2: There's only SD1 micro card slot on this NuMaker-IoT-MA35D1-A1 board.	

Table 3-10 Options for SD Card 0/1 or eMMC 0/1 NAND Flash Device Booting Source

SW7.8 / PG7*1	Boot from SD/eMMC
Low	eMMC 4-bit Booting*2
High	eMMC 8-bit Booting*2
Note *1: The GPIO PG7 is internal weakly pull-down. **Note** *2: There's no eMMC1 NAND Flash memory device on this NuMaker-IoT-MA35D1-A1 board.	

Table 3-11 4/8-bit Options for eMMC NAND Flash Device Booting Source

- Options for booting from QSPI0 Flash device:

SW7.8 / PG7*	SW7.7 / PG6*	Boot from QSPI0 Flash
Low	Low	SPI NAND 1-bit
High	Low	SPI NOR 1-bit
Note *: These GPIO PG6 and PG7 are internal weakly pull-down.		

Table 3-12 1-bit Options for QSPI0 NAND/NOR Flash Booting Source

- Options for booting from USBD or USBH:

SW7.5 / PG4*1	Boot from USB
Low	USB Device Booting
High	USB Host Booting*2
Note *1: The GPIO PG4 is internal weakly pull-down. **Note** *2: It does not support USB Host booting on V2.3 board but supports on V2.4 board.	

Table 3-13 Options for USBD or USBH Booting Source

SW7.6 / PG5*1	Boot from USBH*2
Low	USBH Port 0 Booting*3
High	USBH Port 1 Booting*3
Note *1: The GPIO PG5 is internal weakly pull-down. **Note** *2: It does not support USB Host booting on V2.3 board but supports on V2.4 board. **Note** *3: It only supports USB Host Port 1 booting on V2.4 board.	

Table 3-14 USBH Port 0/1 Options for USBH Booting Source

SW7.7 / PG6*1	Boot from USBH*2
Low	Over-current Low-active Detect
High	Over-current High-active Detect
Note *1: The GPIO PG6 is internal weakly pull-down. **Note** *2: It does not support USB Host booting on V2.3 board but supports on V2.4 board.	

Table 3-15 Over-current High/Low-active Detect Options for USBH Booting Source

3.12 Reset and RTC Wake-up Control

- Reset Button (SW2): Press this key to reset the MA35D1 target chip on this NuMaker-IoT-MA35D1-A1 board.
- RTC Battery Connector (J1): Optional to supply the RTC power from battery. (DC 3.3V from VDD3V3 on this board by default).
- RTC Wake-up Key Button (SW1): Press this key to wake up the MA35D1 target chip on this NuMaker-IoT-MA35D1-A1 board from standby state.
- RTC Wake-up Control Pins: The RTC_RPWR and RTC_nRWAKE pins of MA35D1 are the RTC wake-up control pins to control the related DC/DC power whether output voltages or not.

Pin No.	Pin Name of MA35D1	Function Description
Pin 9 of U1	RTC_RPWR*1	RTC wake-up output pin for external DC/DC (for example, the discrete power IC devices on this NuMaker-IoT-MA35D1-A1 board) enable pin control.
Pin 11 of U1	RTC_nRWAKE*2*3	RTC wake-up interrupt input with internal pull-high
Note *1: This RTC_RPWR output pin of MA35D1 is wired directly to these EN input pins of the discrete power IC devices (U2~U6) on this NuMaker-IoT-MA35D1-A1 board by default. (Only the R250 resistor is mounted on board, but both R189 and R210 are unmounted) **Note** *2: This RTC_nRWAKE input pin is wired directly to the RTC Wakeup key button (SW1) on NuMaker-IoT-MA35D1-A1 board by default. **Note** *3: This RTC_nRWAKE pin is internal pull-high. If user does not use the RTC wake-up interrupt function, please pull this pin to low. In this condition, user also needs to disable the PWRST bit (RTC_PWRCTL[6]) of the RTC Power Control Register by clearing it for saving the RTC power consumption.		

Table 3-16 RTC Power Control Pins of MA35D1

3.13 SWJ

- SWJ_nRESET Header (J3): A jumper is needed if SWJ_nRESET should be connected with nRESET signal.
- SWJ Interface (CON12): Arm JTAG and SWD interface for tracing or debugging code.

Pin No.	Pin Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
1	VDD3V3	-	-	-
2	VDD3V3	-	-	-
3	JTAG_nTRST	PG15*2	R151	I2S0_DO / R45*1
4	VSS	-	-	-
5	JTAG_TDI	PG14*2	R149	I2S0_DI / R44*1
6	VSS	-	-	-
7	JTAG_TMS / SW_DIO	PG13*2	R147	I2S0_BCLK / R43*1
8	VSS	-	-	-
9	JTAG_TCK / SW_CLK	PG12*2	R146	I2S0_LRCK / R42*1
10	VSS	-	-	-
11	VSS	-	-	-
12	VSS	-	-	-
13	JTAG_TDO	PG11*2	R145	I2S0_MCLK / R41*1
14	VSS	-	-	-
15	SWJ_nRESET	nRESET	J3	-
16	VSS	-	-	-
17	-	-	-	-
18	VSS	-	-	-
19	-	-	-	-
20	VSS	-	-	-

Note *1: No connection (NC) by default.

Note *2: When the chip enters debug mode, these GPIO PG11 ~ PG15 pins will be automatically forced to JTAG and SWD functionality by hardware, and other pinout functions of these GPIO pins will be disabled.

Table 3-17 SWJ Interface (CON12) Pin Funciton

3.14 HS USB2.0 Connectors

- USB0_ID Header (J10): Optional to pull-down the ID pin of HSUSB0 by a jumper to force HSUSB0 to always act as an USB Host.
- HSUSB0 Host/Device (CON10, USB Micro-AB Receptacle): HSUSB0 can act as an USB Host or Device that depends on the ID pin state of plugged-in USB cable or always acts as Host by connecting a jumper on the J10 connector to force the ID pin of HSUSB0 at low state.
- HSUSB1 Host (CON11, USB Type-A Receptacle): HSUSB1 for USB Host with type-A connector.

  Note: USB power switch device (U22) had removed on NuMaker-IoT-MA35D1-A1 board in V2.4.

3.15 RS232 or UART

- RS232_10 Transceiver (U8, only supported in V2.3) and Header (J5, old funtion definitions in V2.3): The UART10 transceiver (SN75C3232EDR) and header (J5).

Pin No.	Function Name
1	UR10_TX
2	UR10_RX
3	UR10_CT
4	UR10_RT
5	VSS

Table 3-18 RS232_10 Header (J5) Pin Funciton (V2.3)

- UART_10 Header (J5, new funtion definitions in V2.4): The UART10 header (J5).

  Note: RS232 transceiver (U8) had removed on NuMaker-IoT-MA35D1-A1 board in V2.4.

Pin No.	Function Name
1	UART10_TXD
2	UART10_RXD
3	UART10_nCTS
4	UART10_nRTS
5	VSS

Table 3-19 UART_10 Header (J5) Pin Funciton (V2.4)

3.16 RS485

RS485_12 Transceiver (U9) and Header (J6): The UART12 transceiver (SN65HVD11DR) and header (J6).

Pin No.	Function Name
1	RS485_A3_1
2	RS485_B3_1

Table 3-20 RS485_12 Header (J6) Pin Funciton

3.17 CAN FD

- CAN_1 Transceiver (U7) and Header (J2): The CAN_1 transceiver (TCAN332GD in V2.2, TLE9351VSJ in V2.3/V2.4) and header (J2).

  Note: For more accurate DC 5V power input to the CAN_1 Transceiver (TLE9351VSJ) and let it works normally under V2.3/V2.4, please make sure the 5V/2A adapter is plugged-in the Power Jack (CON2) to supply the power to this NuMaker-IoT-MA35D1-A1 board.

Pin No.	Function Name
1	CAN1_H
2	CAN1_L

Table 3-21 CAN_1 Header (J2) Pin Funciton

3.18 Raspberry Pi 40-pin Connector

- Raspberry Pi 40-pin Connector (CON4):

Pin No.	GPIO pin of MA35D1	Function
1	-	VDD3V3
2	-	VDD5V*
3	PC4	I2C5_SDA
4	-	VDD5V*
5	PC5	I2C5_SCL
6	-	VSS
7	PN15	-
8	PH15	UART14_TXD
9	-	VSS
10	PH14	UART14_RXD
11	PI13	-
12	PG6	-
13	PH3	-
14	-	VSS
15	PI14	-
16	PI15	-
17	-	VDD3V3
18	PH0	-
19	PL14	SPI0_MOSI

20	-	VSS
21	PL15	SPI0_MISO
22	PH1	-
23	PB9	SPI0_CLK
24	PG0	SPI0_SS0
25	-	VSS
26	PB8	SPI0_SS1
27	PC0	I2C4_SDA
28	PC1	I2C4_SCL
29	PI8	-
30	-	VSS
31	PI9	-
32	PI10	-
33	PI11	-
34	-	VSS
35	PG7	-
36	PI12	-
37	PH2	-
38	PG5	-
39	-	VSS
40	PG4	-
Note *: For more accurate DC 5V power, please make sure the 5V/2A adapter is plugged-in the Power Jack (CON2) to supply the power to this NuMaker-IoT-MA35D1-A1 board.		

Table 3-22 Raspberry Pi 40-pin Connector (CON4) Pin Funciton

Figure 3-3 shows the UART, RS485, CAN headers and Raspberry Pi connector.

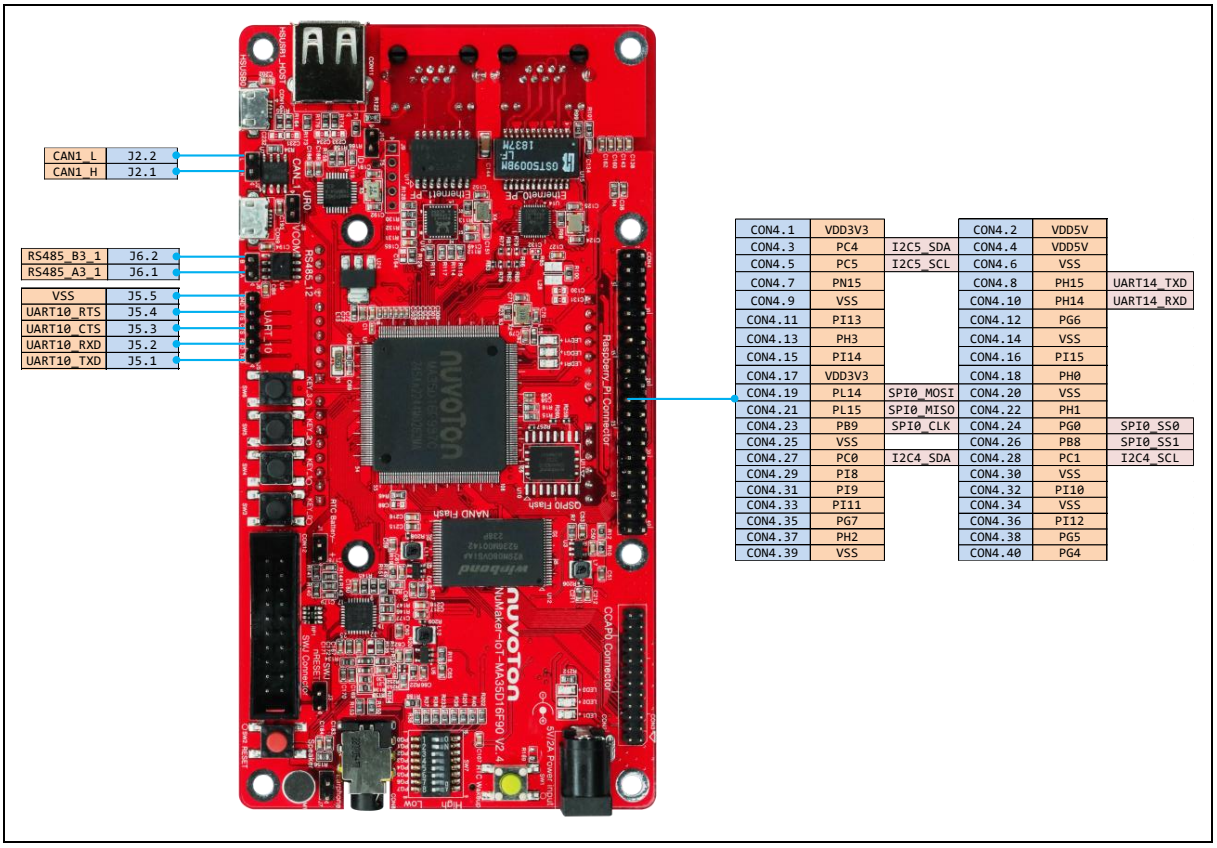

Figure 3-3 UART, RS485, CAN Headers and Raspberry Pi Connector

3.19 Key Buttons and LEDs

- User-define Key Buttons (KEY_0, KEY_1, KEY_2, KEY_3):

KEY_#	SW#	GPIO pin of MA35D1	Pull-up Power
KEY_0	SW3	PN2	VDD3V3
KEY_1	SW4	PN3	VDD3V3
KEY_2	SW5	PN12	VDD3V3
KEY_3	SW6	PN13	VDD3V3

Table 3-23 Key Buttons (KEY_0, KEY_1, KEY_2, KEY_3) Pin Function

- User Indication LEDs (LED_0, LED_1, LED_2):

LED_#	Function / Color	GPIO pin of MA35D1
LED_0	LEDR1 / Red	PN6
LED_1	LEDG1 / Green	PN7
LED_2	LEDY1 / Yellow	PN10

Table 3-24 LEDs (LED_0 , LED_1, LED_2) Pin Function

3.20 CMOS Sensor Capture Connector

- CCAP0 Connector (CON3): This connector is used to connect CMOS sensor for image capture application thru the CCAP0 (Camera Capture 0) interface.

Pin No.	Pin Name	GPIO pin of MA35D1
1	VSS	-
2	VSS	-
3	CCAP0_PIXCLK	PK10
4	CCAP0_SCLK	PK9
5	CCAP0_DATA0	PM2
6	CCAP0_DATA1	PM3
7	CCAP0_DATA2	PM4
8	CCAP0_DATA3	PM5
9	CCAP0_DATA4	PM6
10	CCAP0_DATA5	PM7
11	CCAP0_DATA6	PM8
12	CCAP0_DATA7	PM9
13	CCAP0_DATA8	PM10
14	CCAP0_DATA9	PM11
15	CCAP0_VSYNC	PM0
16	CCAP0_HSYNC	PK11
17	CCAP0_PWDN	PC12
18	CCAP0_nRST	PM1
19	CCAP0_I2C2_SCL	PN1
20	CCAP0_I2C2_SDA	PN0
21	VDD3V3	
22	VDD3V3	
23	VSS	
24	VSS	

Table 3-25 CCAP0 Connector (CON3) Pin Funciton

3.21 MicroSD Card Slot

- SD1 MicroSD Card Slot (CON5): Supports SD1 (SD3.0) for optional system booting.

Pin No.	Pin Name	GPIO pin of MA35D1	Default Connected R#
1	SD1_DTA2*1	PJ10	R227
2	SD1_DAT3*1	PJ11	R228
3	SD1_CMD*1	PJ6	R229
4	VDD (VDD_SD*2)	-	-
5	SD1_CLK*1	PJ7	R230
6	VSS	-	-
7	SD1_DAT0*1	PJ8	R231
8	SD1_DAT1*1	PJ9	R232
9	SD1_nCD*1	PJ5	-
10	VSS	-	-
11	VSS	-	-
12	VSS	-	-
13	VSS	-	-
Note *1: The GPIO PN11 pin controls the VDD_SDIO power, the I/O and pull-up voltage of these SD1 group signals, to output 3.3V or 1.8V voltage. **Note** *2: The GPIO PN14 pin or nRESET signal controls the ON/OFF of VDD_SD power that feeds the fixed 3.3V to the MicroSD card slot or not.			

Table 3-26 SD1 MicroSD Card Slot (CON5) Pin Function

- SD1 VDD_SDIO Power Voltage Control: The GPIO PN11 pin controls the output voltage 3.3V or 1.8V of VDD_SDIO power.

PN11 State	SD1 VDD_SDIO Power Voltage
Low	3.3V
High	1.8V

Table 3-27 PN11 Pin State Control for SD1 VDD_SDIO 3.3V or 1.8V Power Voltage

- SD1 MicroSD Card Power (VDD_SD) ON/OFF Control: The GPIO PN14 pin or nRESET signal controls the ON/OFF of VDD_SD power that feeds to the MicroSD card slot.

PN14 or nRESET State	SD1 VDD_SD Power ON/OFF
Low	OFF
High	ON

Table 3-28 PN14 or nRESET Pin State Control for SD1 MicroSD Card Power ON or OFF

3.22 Arduino UNO Compatible Extension Connectors

- Arduino UNO Compatible Extension Connectors (NU1, NU2, NU3, NU4)

Figure 3-4 shows the Arduino UNO compatible extension connectors.

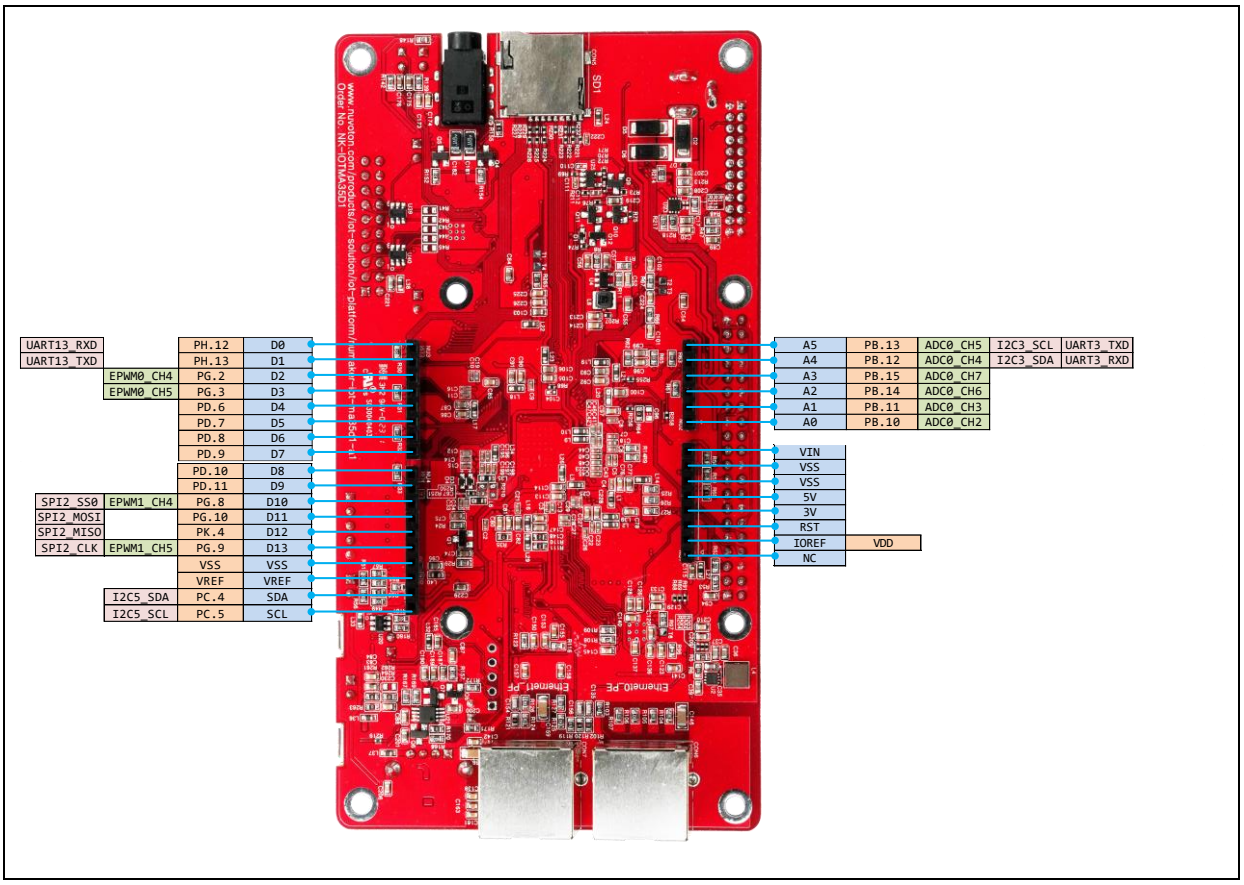

Figure 3-4 Arduino UNO Compatible Extension Connectors

- Arduino UNO Interface Connector 1 (NU1):

Pin No.	Pin Name	GPIO pin of MA35D1 or Power/GND
1	NC	-
2	VDD	VDD3V3
3	nRESET	nRESET
4	3VCC	VDD3V3
5	5VCC	VDD5V*
6	VSS	VSS
7	VSS	VSS
8	VIN	-
Note *: For more accurate DC 5V power, please make sure the 5V/2A adapter is plugged-in the Power Jack (CON2) to supply the power to this NuMaker-IoT-MA35D1-A1 board.		

Table 3-29 Arduino UNO Interface Connector 1 (NU1) Pin Funciton

- Arduino UNO Interface Connector 2 (NU2):

Pin No.	Pin Name	GPIO pin of MA35D1
1	A0	PB10
2	A1	PB11
3	A2	PB14
4	A3	PB15
5	A4/SDA	PB12
6	A5/SCL	PB13

Table 3-30 Arduino UNO Interface Connector 2 (NU2) Pin Funciton

- Arduino UNO Interface Connector 3 (NU3):

Pin No.	Pin Name	GPIO pin of MA35D1
1	D0	PH12
2	D1	PH13
3	D2	PG2
4	D3	PG3
5	D4	PD6*1
6	D5	PD7*1
7	D6	PD8
8	D7	PD9
Note *1: Both PD.6 and PD.7 pins are dedicated to I²C0 functions for controlling external PMIC.		

Table 3-31 Arduino UNO Interface Connector 3 (NU3) Pin Funciton

- Arduino UNO Interface Connector 4 (NU4):

Pin No.	Pin Name	GPIO pin of MA35D1 or Power/GND
1	D8	PD10
2	D9	PD11
3	D10	PG8
4	D11	PG10
5	D12	PK4
6	D13	PG9
7	VSS	VSS
8	VREF	VDD3V3
9	I2C_SDA	PC4

10	I2C_SCL	PC5

Table 3-32 Arduino UNO Interface Connector 4 (NU4) Pin Funciton

4 QUICK START

This chapter guides users step by step to start the NuMicro MA35D1 evaluation system based on the NuMaker-IoT-MA35D1-A1 board.

4.1 Configure Power-on Setting

Secondly, make sure the power-on setting for the booting source selection on the DIP Switch (SW7) followed the correct ON/OFF states shown in Table 4-1 ~ Table 4-4.

After choosing the correct power-on setting on these DIP switches, the evaluation environment will boot from the image stored in the SPI NAND flash device (QSPI0) when power is supplied to the NuMaker-IoT-MA35D1-A1 board.

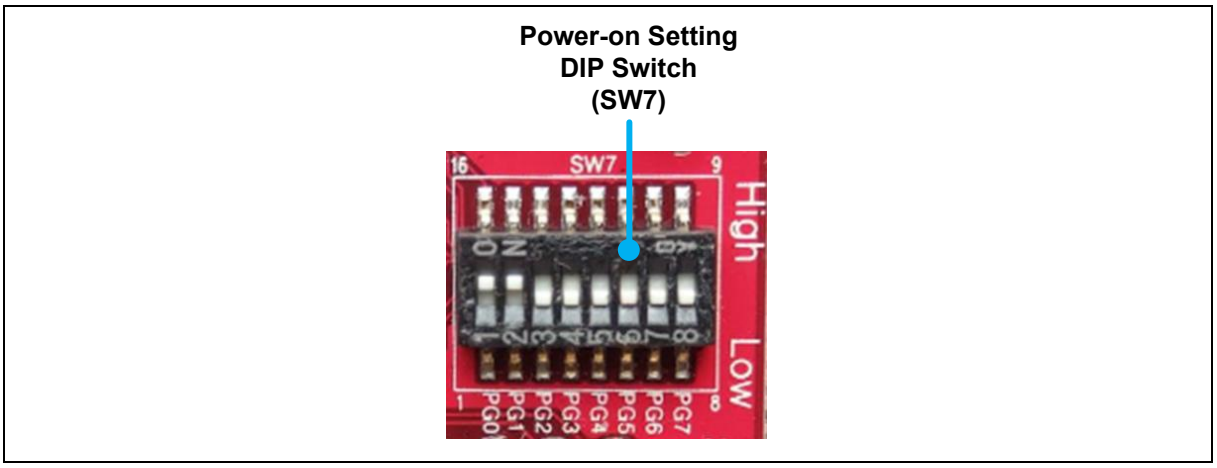

Figure 4-1 Power-on Setting DIP Switch (SW7)

- Options for secure boot enable or disable:

SW7.1 / PG0*	Secure Booting
Low	Enable
High (ON)	**Disable**
Note *: The GPIO PG0 is internal weakly pull-down.	

Table 4-1 Secure Boot Disable Configuration

- Options for booting source QSPI0 and SD/eMMC IO voltage selection:

SW7.2 / PG1*	Boot Source QSPI0 and SD/eMMC I/O Voltage
Low	3.3V
High (ON)	**1.8V**
Note *: The GPIO PG1 is internal weakly pull-down.	

Table 4-2 QSPI0 Boot Source IO Voltage Configuration

- Options for booting source selection:

SW7.4 / PG3*	SW7.3 / PG2*	Boot Source

Low (OFF)	Low (OFF)	QSPI0 Flash
Low	High	SD/eMMC
High	Low	NAND Flash
High	High	USB
Note *: These GPIO PG2 and PG3 are internal weakly pull-down.		

Table 4-3 QSPI0 Boot Source Configuration

- Options for booting from QSPI0 Flash device:

SW7.8 / PG7*	SW7.7 / PG6*	Boot from QSPI0 Flash
Low (OFF)	**Low (OFF)**	**SPI NAND 1-bit**
High	Low	SPI NOR 1-bit
Note *: These GPIO PG6 and PG7 are internal weakly pull-down.		

Table 4-4 QSPI0 Boot Source SPI NAND 1-bit Configuration

4.2 Power On the System

The third step is to power on the system. There are three ways to provide the power to this NuMaker-IoT-MA35D1-A1 board:

- To plug the head of an adapter that can supply 5V/2A power into the power jack (CON2). (highly recommended)
- To connect the USB VCOM Port (CON9) to PC USB Host with an USB cable.
- To connect the HSUSB0 Device connector (CON10) to PC USB Host with an USB cable.

4.3 VCOM Port (Optional)

User can connect the USB micro-B connector (CON9) and plug-in to the PC host with an USB cable to display the messages on PC when the evaluation environment is booting or CPU is running in the Linux kernel.

USB VCOM Port (CON9)

Figure 4-2 USB VCOM Port (CON9)

4.4 Press the RTC Wakeup Key Button

Finally, press RTC Wakeup Button (SW1) to enable the discrete power converters.

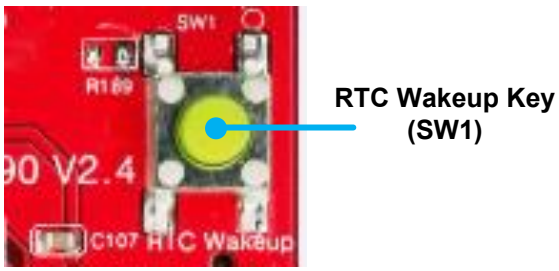

Figure 4-3 RTC Wakeup Key Button (SW1)

5 SUPPORTING RESOURCES

5.1 Documents

For more details about MA35D1 series documents, for example, Technical Reference Manual, Datasheet, Application Note and User Manual documents, please visit Nuvoton website and search for the Arm Cortex-A35 MPUs product line for the MA35D1 series products from the “Products” menu on the Nuvoton website homepage.

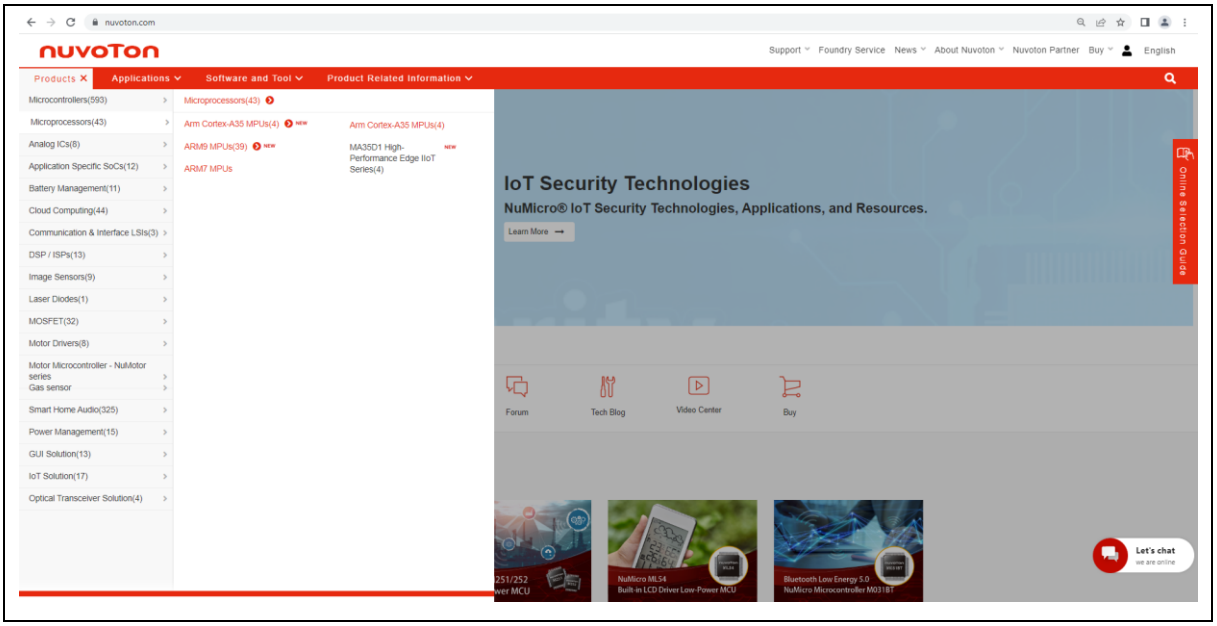

Figure 5-1 Nuvoton Website

5.2 Software

For more details about MA35D1 series software, for example, BSP (Board Support Package), Yocto, Buildroot, U-Boot, Linux, software NuWriter tool and example code, please visit GitHub’s website. The related Github resources are listed and shown as Figure 5-2.

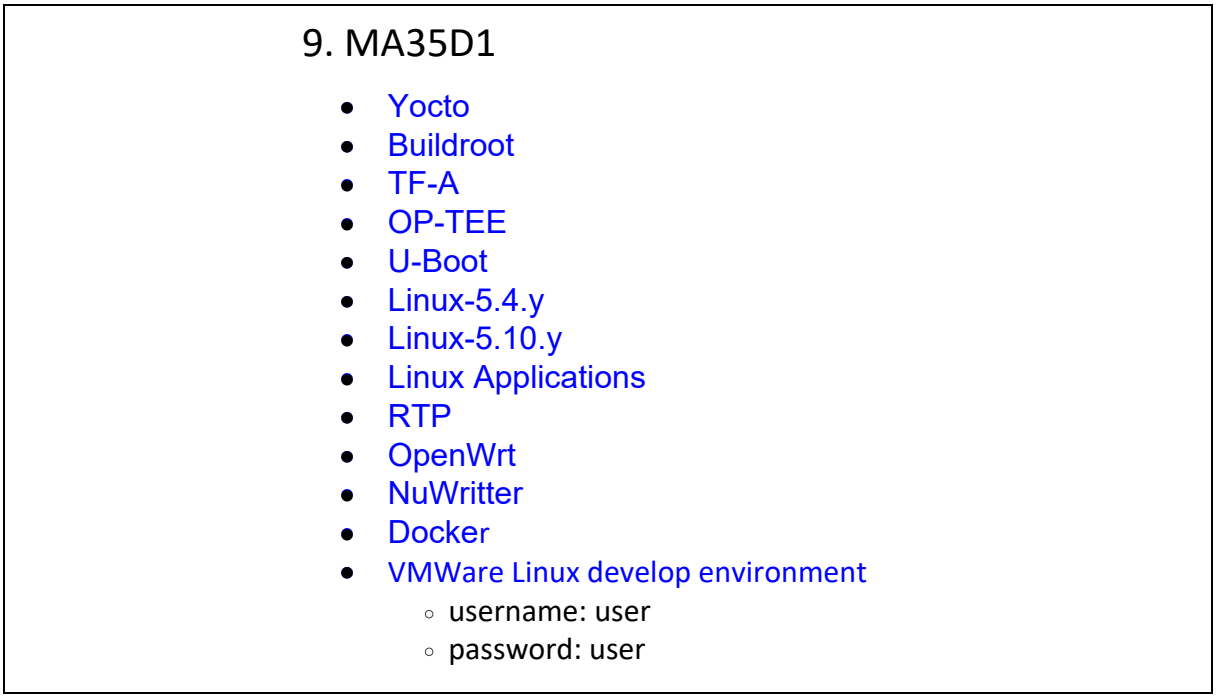

Figure 5-2 MA35D1 GitHub Resources

6 NUMAKER-IOT-MA35D1-A1 SCHEMATICS

6.1 Power Input Schematic

Figure 6-1 shows the power circuit of the NuMaker-IoT-MA35D1-A1 board.

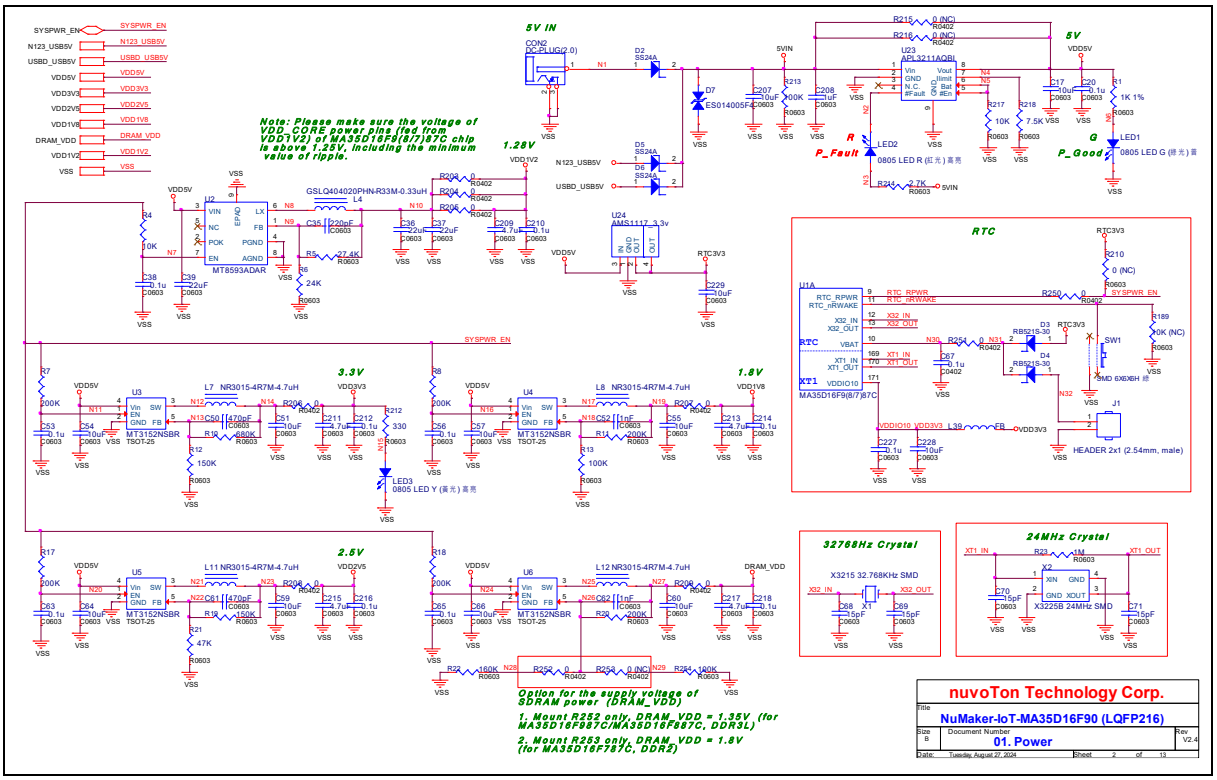

Figure 6-1 Power Input Schematic

6.2 Key Buttons and LEDs Schematic

Figure 6-2 shows the key buttons and LEDs circuit of the NuMaker-IoT-MA35D1-A1 board.

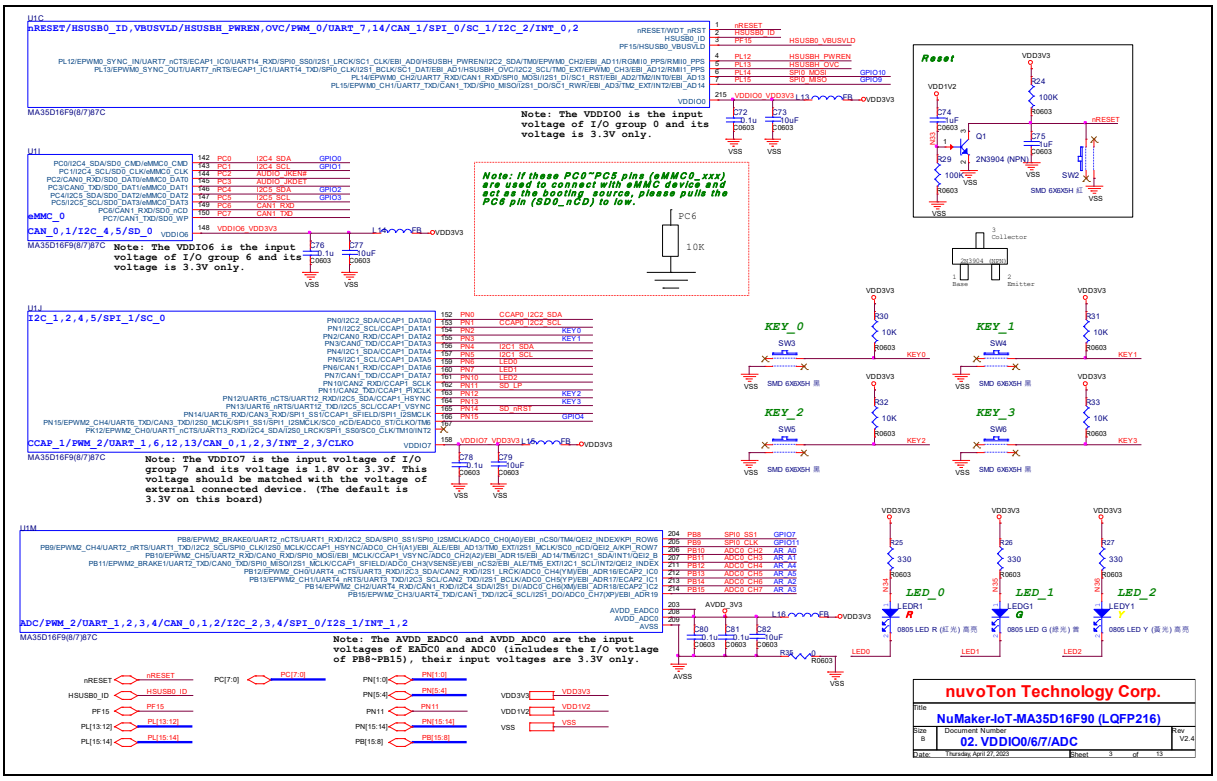

Figure 6-2 Key Buttons and LEDs Schematic

6.3 Power-on Setting and SWJ Schematic

Figure 6-3 shows the power-on setting and SWJ circuit of the NuMaker-IoT-MA35D1-A1 board.

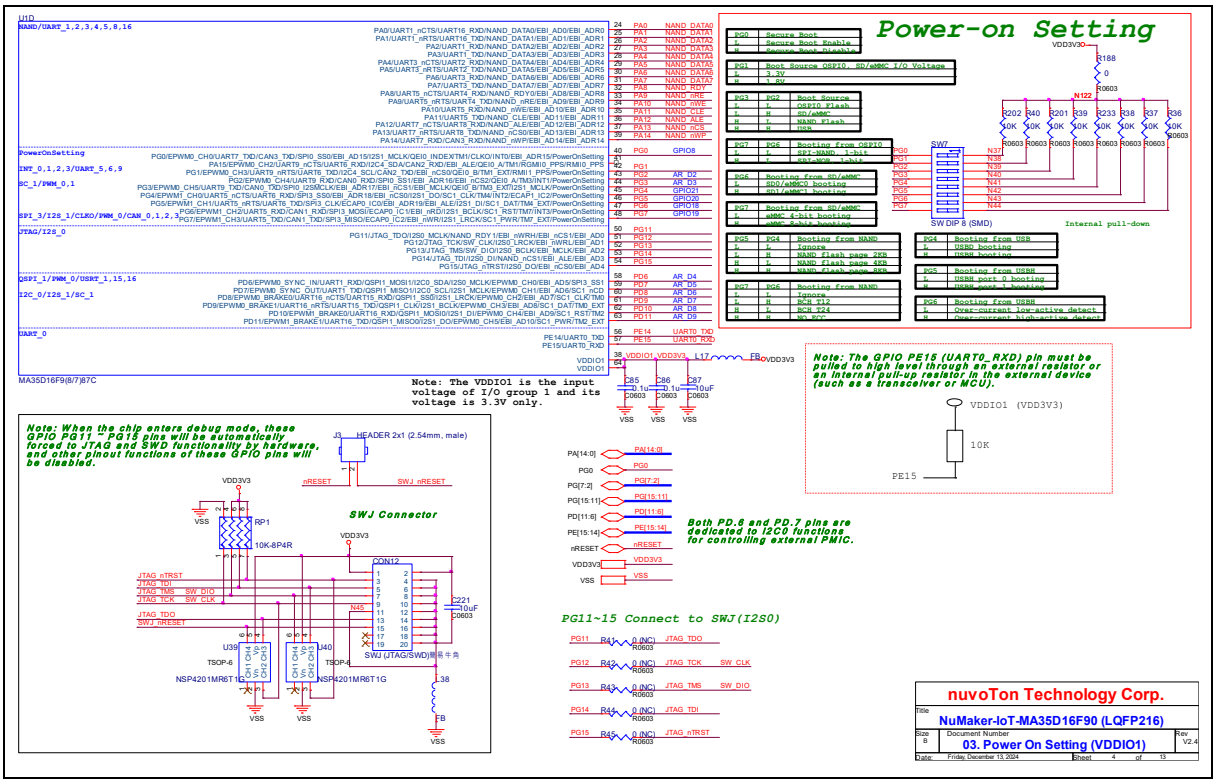

Figure 6-3 Power-on Setting and SWJ Schematic

6.4 CCAP0 Schematic

Figure 6-4 shows the CCAP0 connector circuit of the NuMaker-IoT-MA35D1-A1 board.

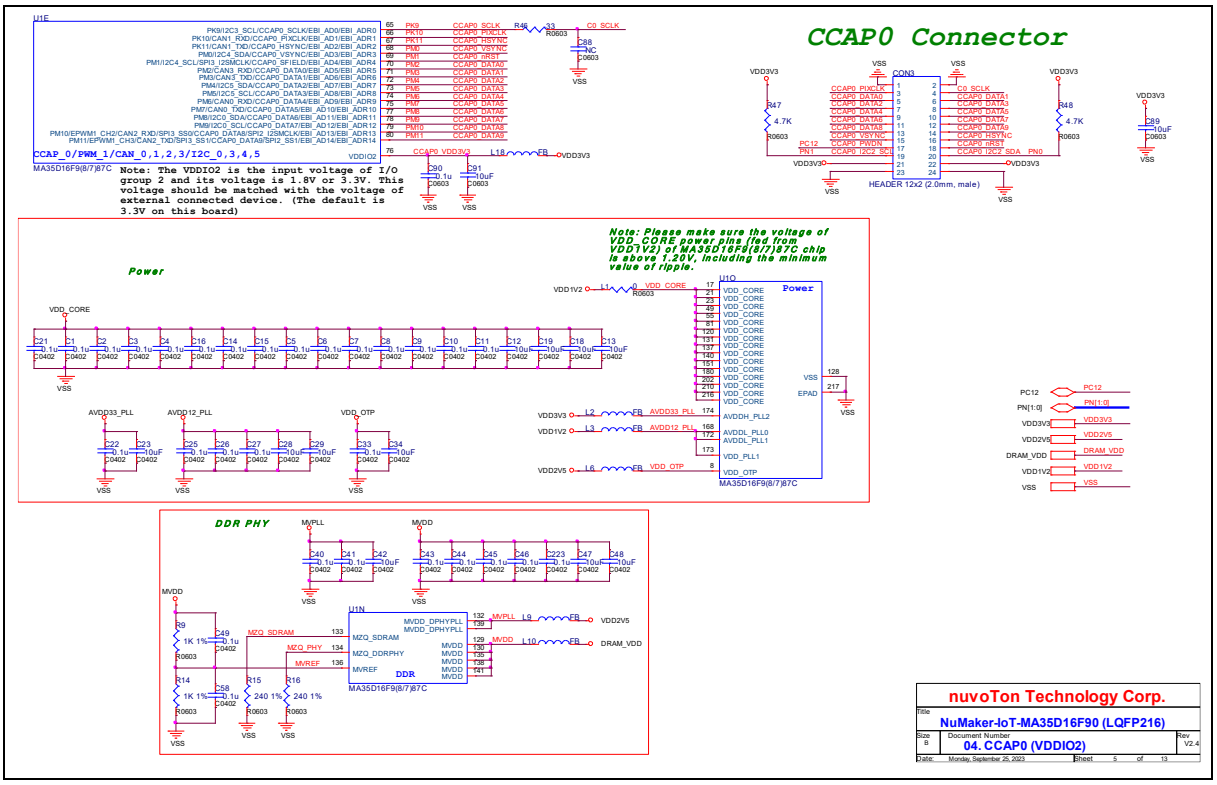

Figure 6-4 CCAP0 Schematic

6.5 CAN FD, UART and RS485 Schematic

Figure 6-5 shows the CAN FD, UART and RS485 circuit of the NuMaker-IoT-MA35D1-A1 board.

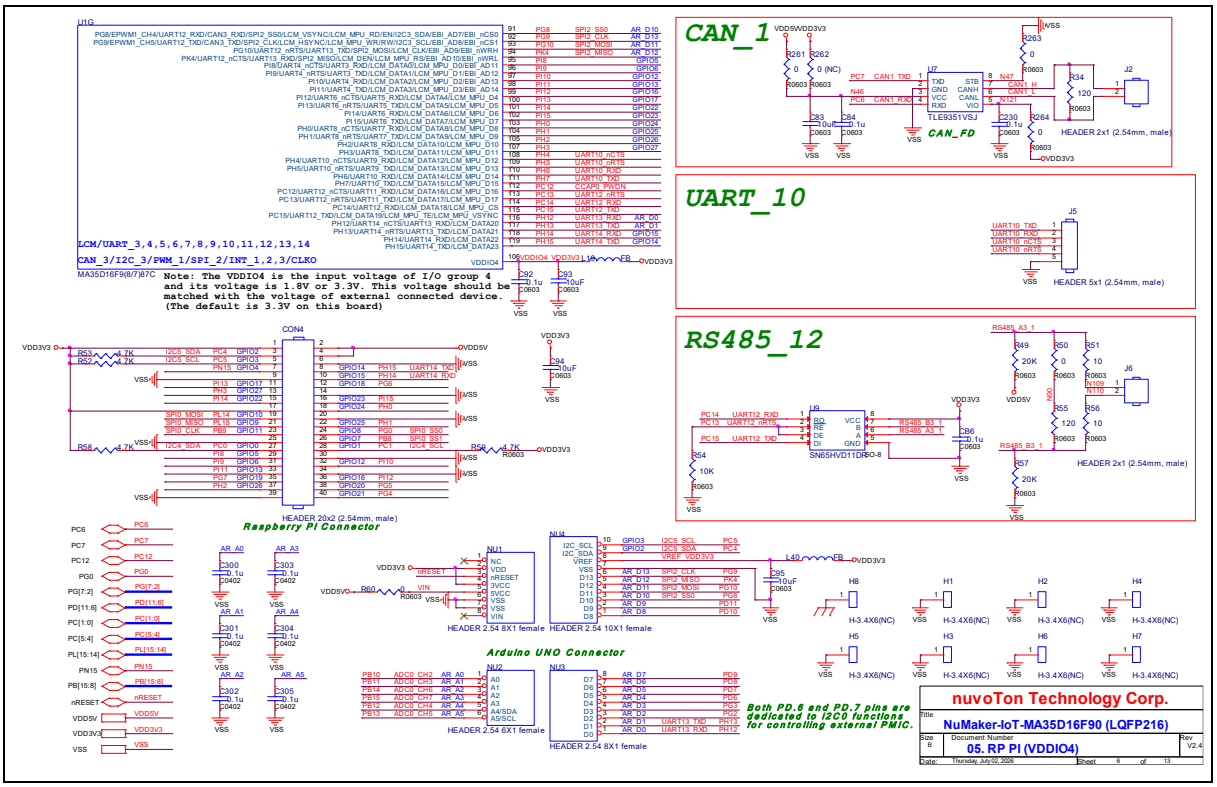

Figure 6-5 CAN FD, UART and RS485 Schematic

6.6 QSPI0 and NAND Flash Schematic

Figure 6-6 shows the QSPI0 (only SPI NAND flash device mounted) and NAND flash device circuit of the NuMaker-IoT-MA35D1-A1 board.

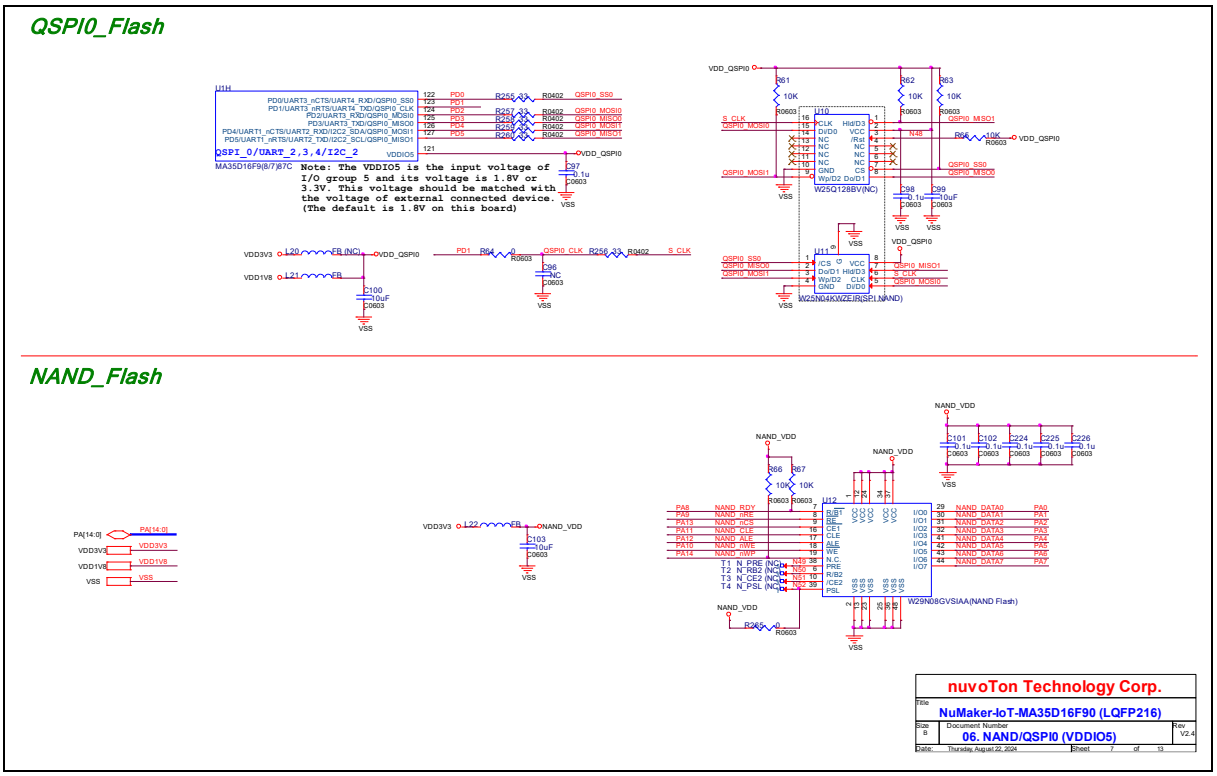

Figure 6-6 QSPI0 and NAND Flash Schematic

6.7 SD1 Schematic

Figure 6-7 shows the SD1 card slot circuit of the NuMaker-IoT-MA35D1-A1 board.

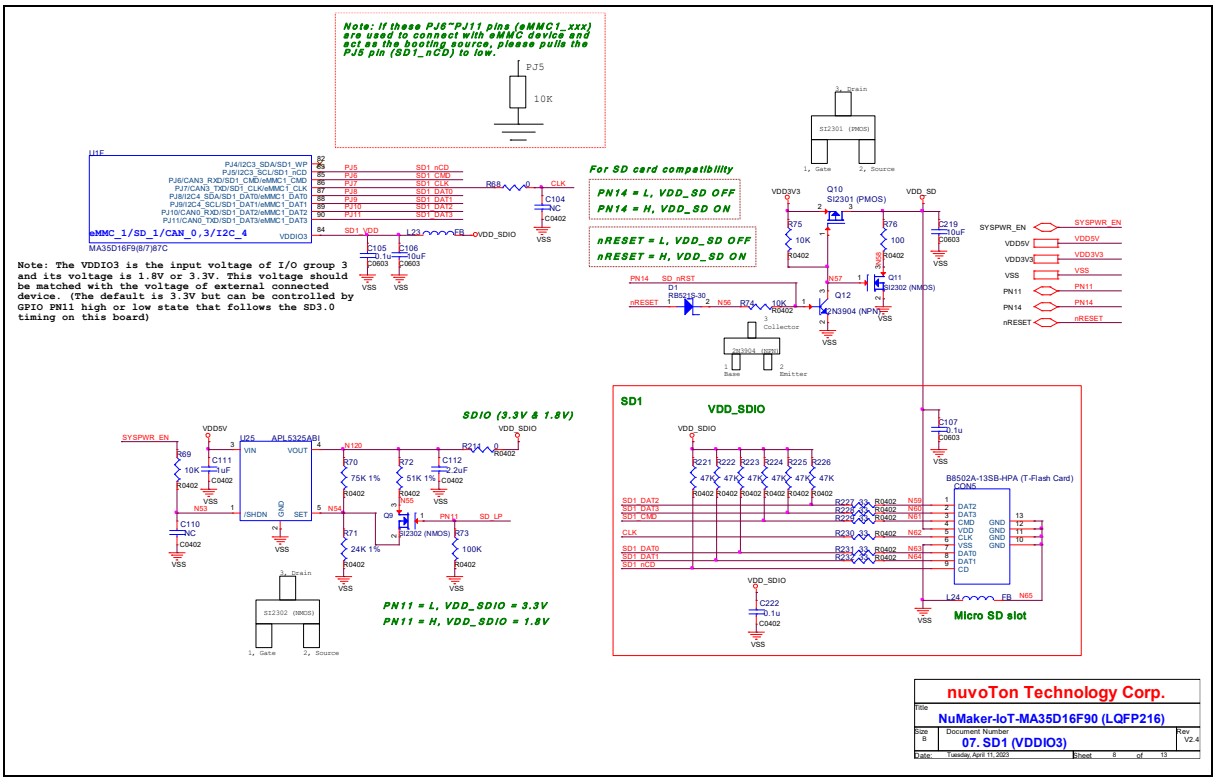

Figure 6-7 SD1 Schematic

6.8 RGMII0_PE Schematic

Figure 6-8 shows the RGMII0 PE port circuit of the NuMaker-IoT-MA35D1-A1 board.

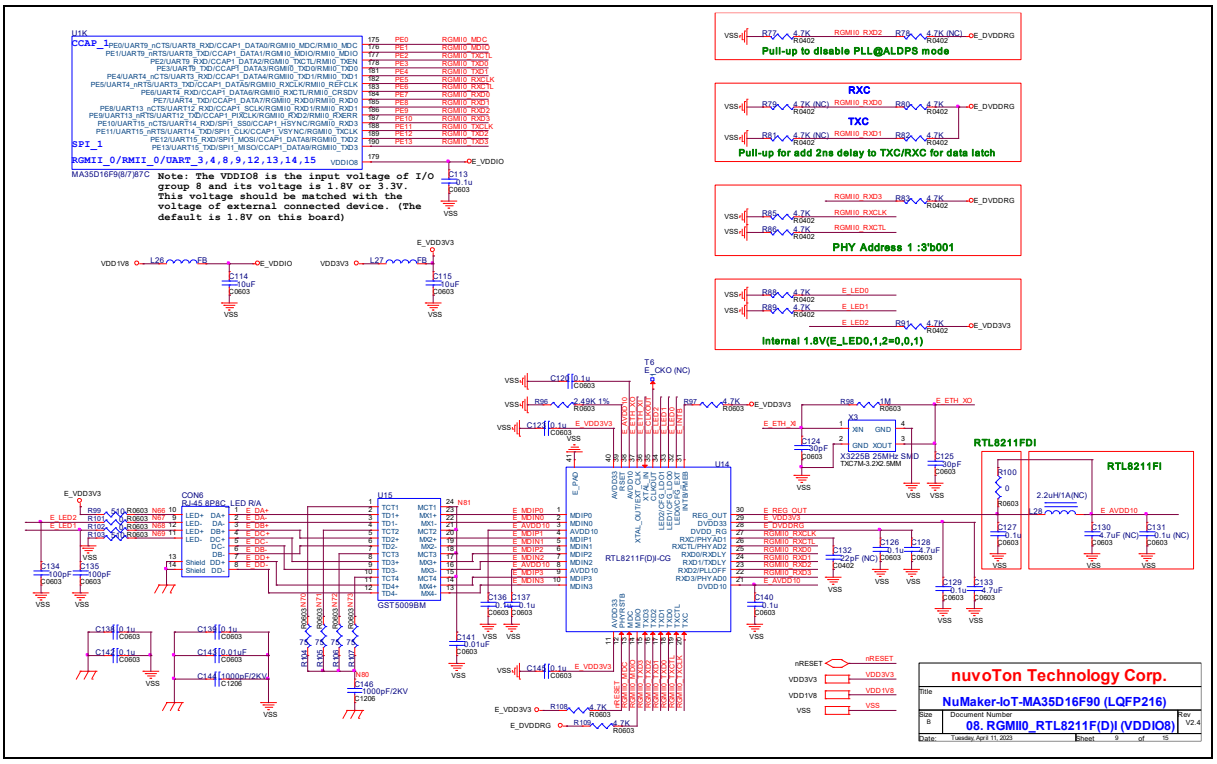

Figure 6-8 RGMII0_PE Schematic

6.9 RMII1_PF Schematic

Figure 6-9 shows the RMII1 PF port circuit of the NuMaker-IoT-MA35D1-A1 board.

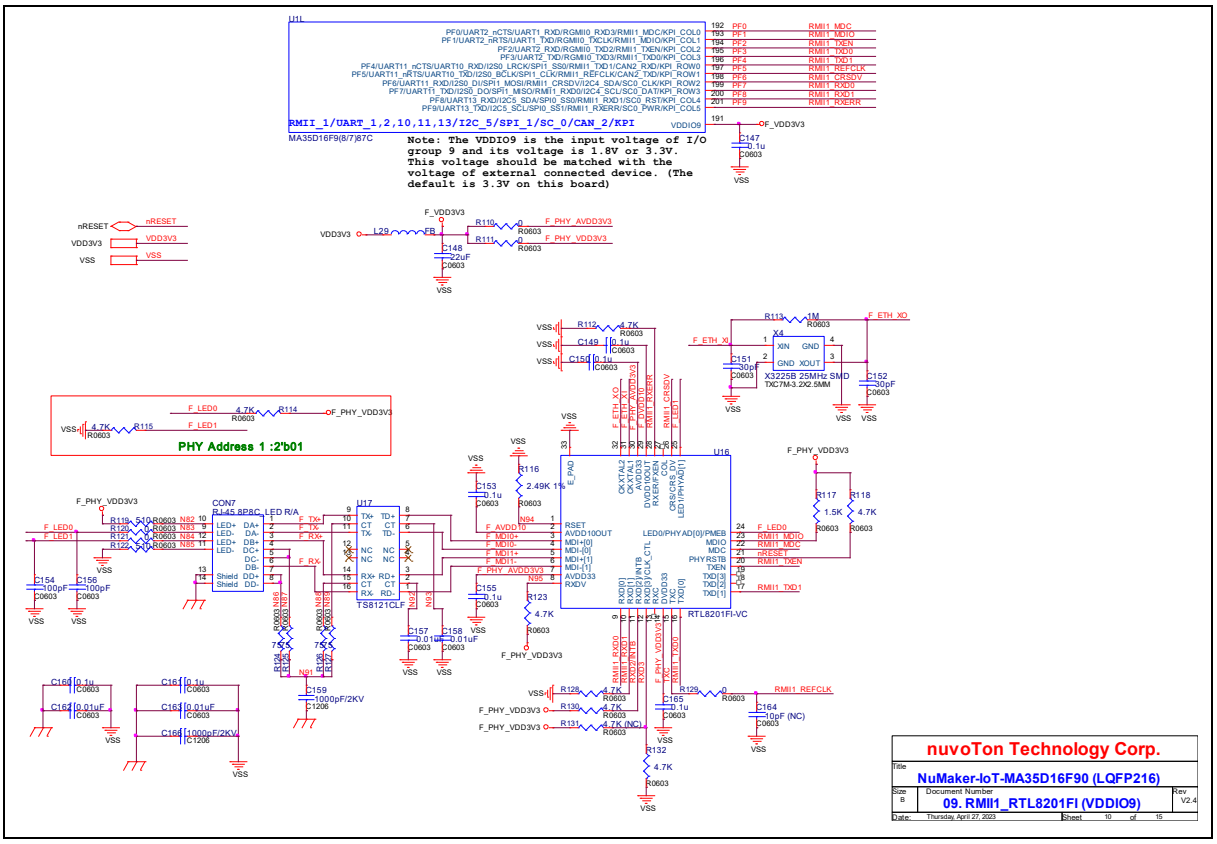

Figure 6-9 RMII1_PF Schematic

6.10 NAU88C22 Audio Codec Schematic

Figure 6-10 shows the NAU88C22 audio codec circuit of the NuMaker-IoT-MA35D1-A1 board.

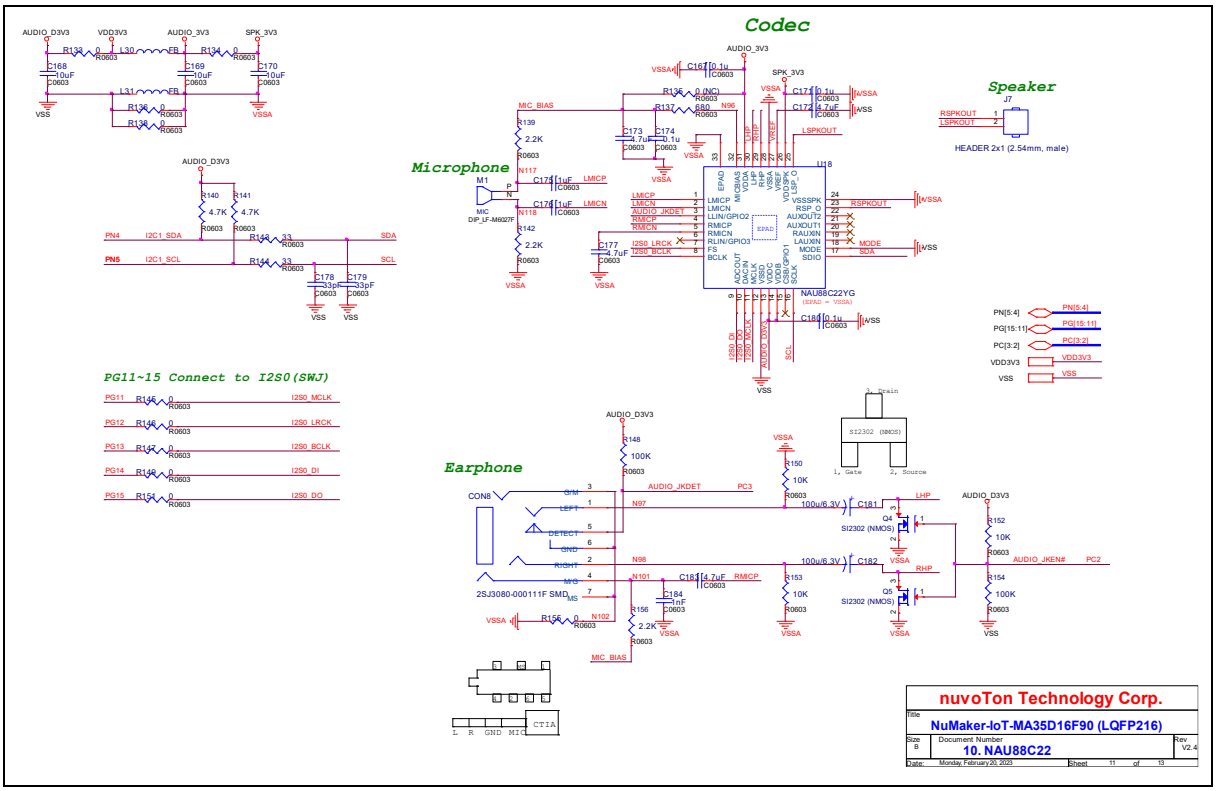

Figure 6-10 NAU88C22 Audio Codec Schematic

6.11 NUC123 VCOM Schematic

Figure 6-11 shows the NUC123 VCOM circuit of the NuMaker-IoT-MA35D1-A1 board.

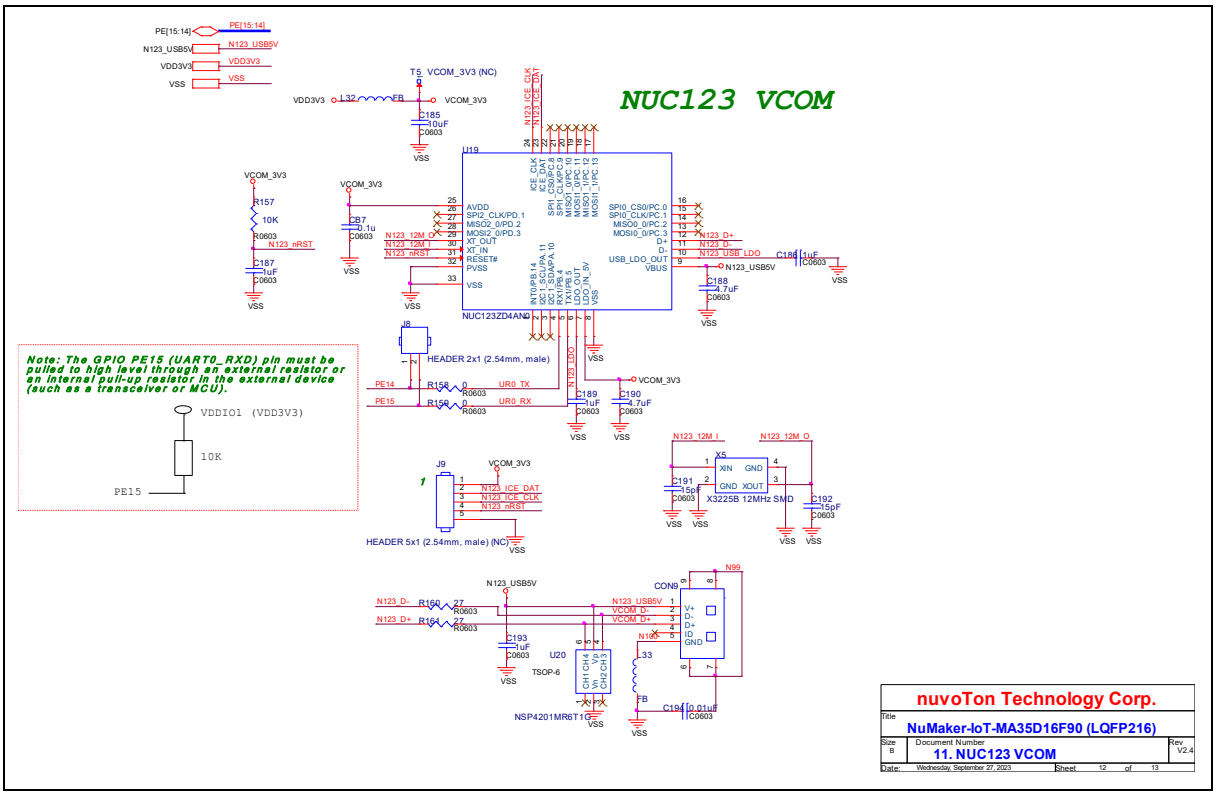

Figure 6-11 NUC123 VCOM Schematic

6.12 HSUSB 0/1 Schematic

Figure 6-12 shows the HS (high speed) USB 0/1 circuit of the NuMaker-IoT-MA35D1-A1 board.

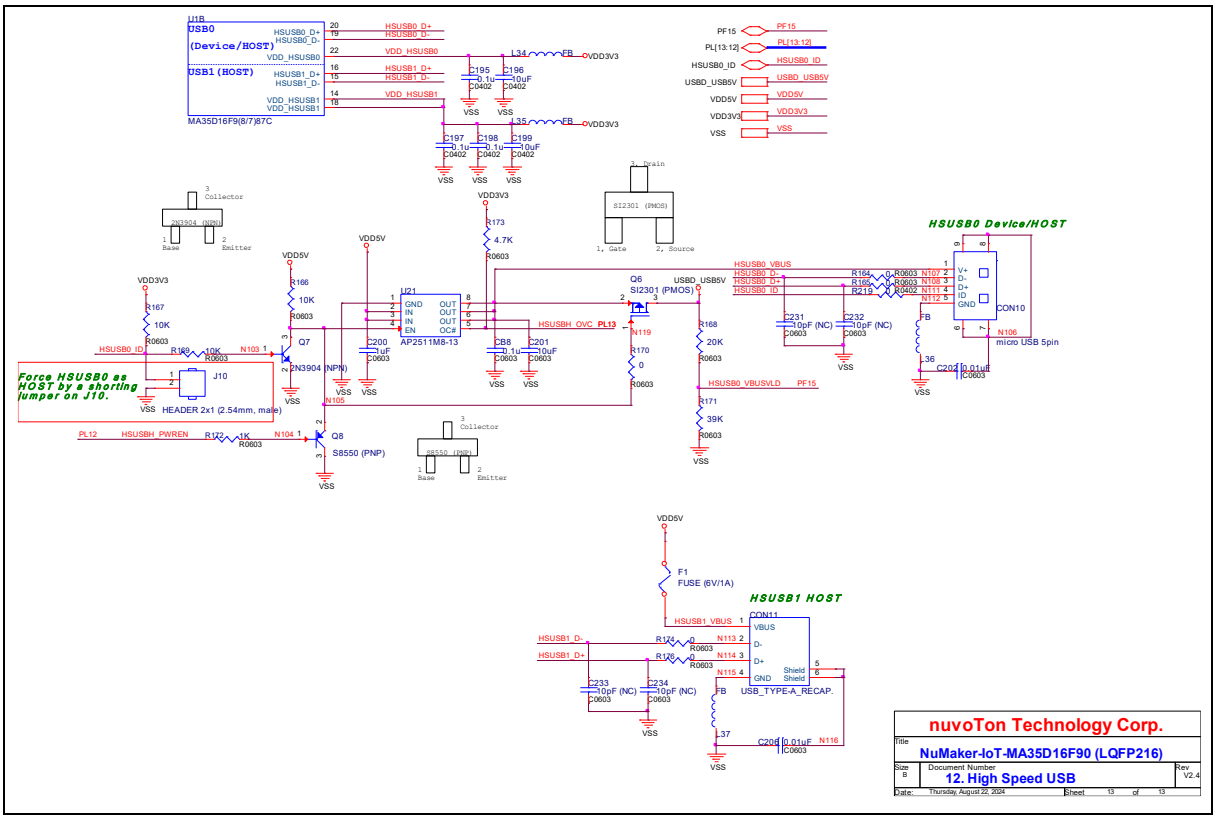

Figure 6-12 HSUSB 0/1 Schematic

6.13 PCB Placement

Figure 6-13 and Figure 6-14 show the front and rear PCB component placement of the NuMaker-IoT-MA35D1-A1 board.

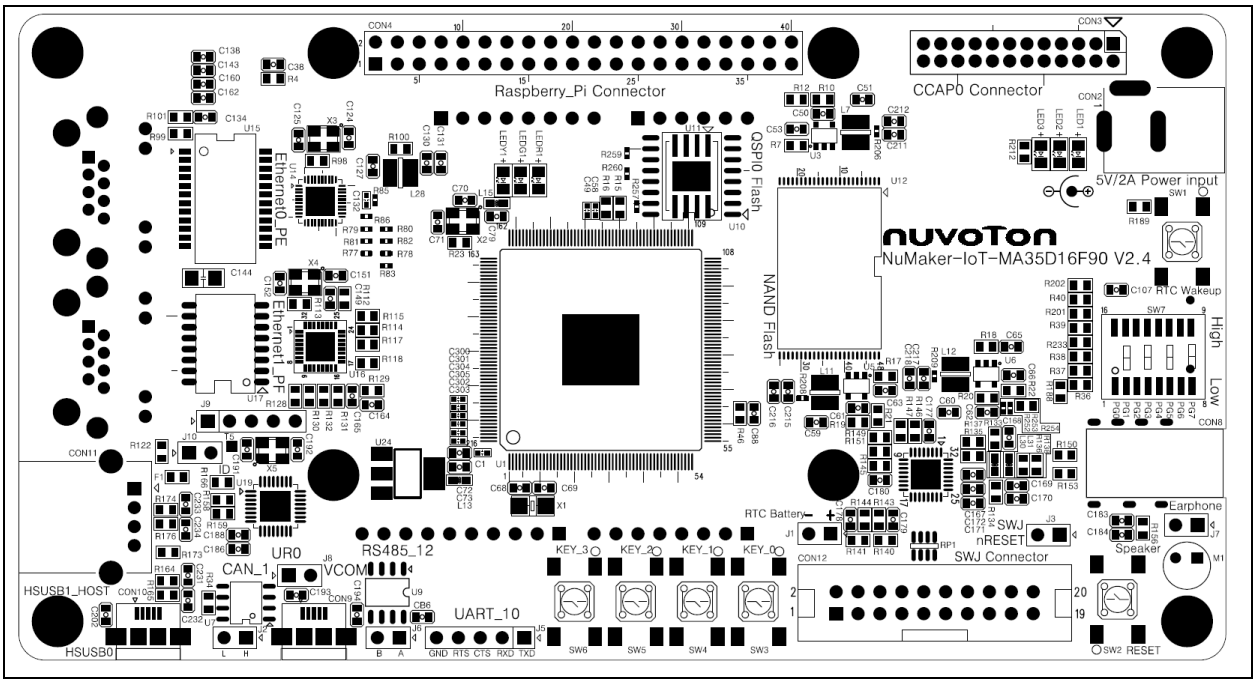

Figure 6-13 Front PCB Placement of NuMaker-IoT-MA35D1-A1 Board

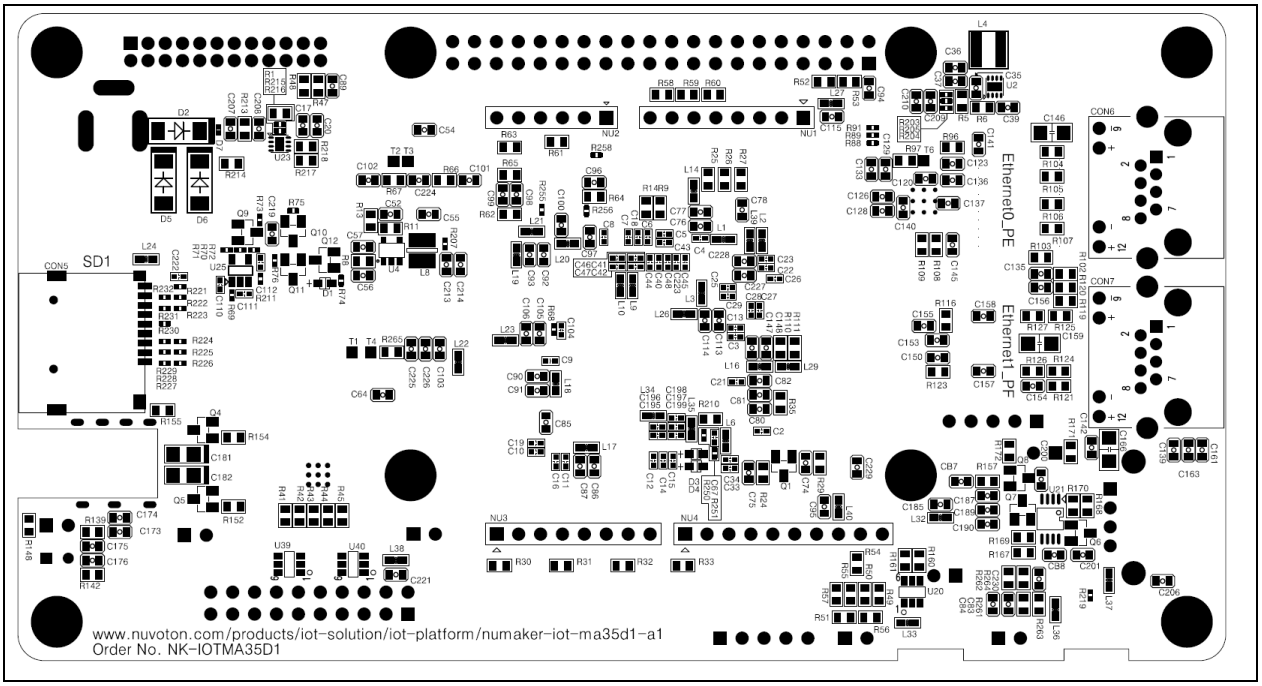

Figure 6-14 Rear PCB Placement of NuMaker-IoT-MA35D1-A1 Board

7 REVISION HISTORY

Date	Revision	Description
2022.10.6	1.00	• Initial version.
2022.10.31	1.01	• Updated Figure 1-1, Figure 3-1, Figure 3-2, Figure 5-2, and Figure 6-1. • Updated the options about USB booting source in section 3.11.
2022.12.13	1.02	• Updated the pictures in Figure 1-1, Figure 3-1, Figure 3-2, Figure 3-3, Figure 3-4, Figure 6-13 and Figure 6-14. • Updated the V2.3 schematic in Figure 6-1, Figure 6-6 and Figure 6-12.
2023.2.6	1.03	• Added notes in section 3.17, Table 3-22 and Table 3-29.
2023.4.10	1.04	• Updated Table 3-1 to add new part number MA35D16F887C. • Updated the notes in Table 3-16. • Updated the section 4.1 and 4.2. • Updated Figure 6-1 and Figure 6-9.
2023.5.20	1.05	• Updated Figure 6-1.
2023.6.30	1.06	• Updated the chapter 1. • Updated the pictures in Figure 1-1, Figure 3-1, Figure 3-2, Figure 3-3, Figure 3-4, Figure 4-2, Figure 4-3, Figure 6-13 and Figure 6-14. • Updated chapter 2 and section 3.14, 3.15, 3.21 and 6.5. • Updated notes in Table 3-13, Table 3-14 and Table 3-15. • Updated Figure 6-1 ~ Figure 6-12 for V2.4 schematics.
2023.9.25	1.07	• Added notes in Figure 6-1 and Figure 6-4. • Updated Figure 6-3.
2024.5.21	1.08	• Added a note for GPIO PE15 (UART0_RXD) pin in section 3.9, Figure 6-3 and Figure 6-11.
2024.8.27	1.09	• Updated Figure 6-1, Figure 6-3, Figure 6-5, Figure 6-6 and Figure 6-12.
2024.12.13	1.10	• Updated Figure 3-1 and Table 3-1. • Added a note for GPIO PG11 ~ PG15 in Table 3-17 and Figure 6-3.

2025.3.12	1.11	• Added a note in section 3.1. • Updated the sections 3.11 and 4.1.
2026.7.2	1.12	• Added a note in Table 3-31, Figure 6-3 and Figure 6-5.

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.

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