

NuMicro[®] Family**Arm[®] Cortex-A35-based Microprocessor**

NuMaker-HMI-MA35D1-S1

User Manual

Evaluation Board for NuMicro[®] MA35D1 Series

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 and microprocessor 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	9
1.1 NuMaker-SOM-MA35D16A81 Board	11
1.2 NuMaker-BASE-MA35D1B1 Board	12
1.3 7" TFT LCD Daughter Board	13
1.4 Board Part Number and Information	14
2 FEATURES	15
2.1 NuMaker-SOM-MA35D16A81 Features	15
2.2 NuMaker-BASE-MA35D1B1 Features	15
2.3 7" TFT LCD Daughter Board Features	16
3 HARDWARE CONFIGURATION	17
3.1 NuMaker-SOM-MA35D16A81 Board	17
3.1.1 Front View.....	17
3.1.2 Rear View	17
3.1.3 Power Input	17
3.1.4 RTC Wake-up Control.....	17
3.1.5 PMIC.....	18
3.1.6 eMMC NAND Flash.....	19
3.1.7 RGMII Gigabit PHY	20
3.1.8 High Speed Connectors	21
3.2 NuMaker-BASE-MA35D1B1 Board	26
3.2.1 Front View.....	26
3.2.2 Rear View	26
3.2.3 Power and Ground	27
3.2.4 High Speed Connectors	27
3.2.5 QSPI Flash	31
3.2.6 NAND Flash	32
3.2.7 SD Card Slot	33
3.2.8 HS USB2.0 Connectors.....	33
3.2.9 Power-on Setting	33
3.2.10Gigabit Ethernet Transformers and RJ45 Ports	36
3.2.11CMOS Sensor Capture Connectors	36
3.2.12External Bus Interface (EBI) Connector	38
3.2.13EADC Header	41
3.2.14UART	41
3.2.15RS485	42
3.2.16CAN FD.....	43
3.2.17SWJ, SWD and ETM	44
3.2.18USB Virtual COM (VCOM) Port.....	46

3.2.19	Reset and RTC Wake-up Key Buttons	47
3.2.20	TFT LCD Connector	47
3.2.21	Audio Codec	49
3.2.22	SIM Card Slot	50
3.2.23	Key Buttons, LEDs, Buzzer and Fan Control	50
3.2.24	MEMS Digital Microphone	51
3.2.25	MEMS G-Sensor	52
3.3	7" TFT LCD Daughter Board	53
3.3.1	Front View	53
3.3.2	Rear View	53
3.3.3	Connectors	54
4	QUICK START	55
4.1	Hardware Setup and Power On	55
4.1.1	Configure Power-on Setting	55
4.1.2	Power On the NuMaker-BASE-MA35D1B1 Board	56
4.1.3	VCOM Port (Optional)	57
4.2	Embedder Demos	58
4.2.1	H.264 Video Playback	58
4.2.2	ML People Counting	58
4.2.3	2D Accelerator	59
4.2.4	VoIP Demonstration	59
4.2.5	Data Security	60
4.2.6	Keyword Spotting by RTP M4	60
5	SUPPORTING RESOURCES	62
5.1	Documents	62
5.2	Software	62
6	HARDWARE SCHEMATICS	64
6.1	NuMaker-SOM-MA35D16A81 Schematics	64
6.1.1	System Block	64
6.1.2	PMIC, Crystal and Power Filter Schematic	65
6.1.3	Power Group 0, 2, 4 and 5 Schematic	66
6.1.4	Power Group 1 Schematic	67
6.1.5	Power Group 3 (eMMC1_PJ) Schematic	68
6.1.6	Power Group 6, 7, ADC and USB Schematic	69
6.1.7	Power Group 8 (RGMII0_PE) Schematic	70
6.1.8	Power Group 9 (RGMII1_PF) Schematic	71
6.1.9	DDR PHY Schematic	72
6.1.10	PCB Placement	73
6.2	NuMaker-BASE-MA35D1B1 Schematics	75
6.2.1	Power Schematic	75

6.2.2 SOM Connectors Schematic 76

6.2.3 Power-on Setting and NAND Flash Schematic 77

6.2.4 SD0 Schematic 78

6.2.5 QSPI0 Schematic 79

6.2.6 EADC0 Schematic..... 80

6.2.7 RGMII0_PE Schematic..... 81

6.2.8 RGMII1_PF Schematic..... 82

6.2.9 HSUSB 0/1 Schematic..... 83

6.2.10CCAP 0/1 Connector Schematic..... 84

6.2.11 LCM Connector Schematic 85

6.2.12EBI Connector Schematic 86

6.2.13NAU88C22 Audio Codec Schematic 87

6.2.14SIM Card Schematic 88

6.2.15RS232 Schematic..... 89

6.2.16RS485 Schematic..... 90

6.2.17CAN FD Schematic 91

6.2.18Key Buttons, LEDs, Buzzer and Fan Control Schematic 92

6.2.19SWJ, SWD and ETM Connectors Schematic 93

6.2.20NUC123 VCOM Schematic..... 94

6.2.21MEMS Digital Microphone Schematic 95

6.2.22MEMS G-Sensor Schematic..... 96

6.2.23PCB Placement 97

6.3 7" TFT LCD Daughter Board Schematic..... 99

7 REVISION HISTORY 100

List of Figures

Figure 1-1 NuMaker-HMI-MA35D1-S1 Board from SOM Side	10
Figure 1-2 NuMaker-HMI-MA35D1-S1 Board from TFT LCD Side	10
Figure 1-3 NuMaker-SOM-MA35D16A81 Board	11
Figure 1-4 NuMaker-BASE-MA35D1B1 Board	12
Figure 1-5 7" TFT LCD Daughter Board	13
Figure 3-1 Front View of NuMaker-SOM-MA35D16A81	17
Figure 3-2 Rear View of NuMaker-SOM-MA35D16A81	17
Figure 3-3 Front View of NuMaker-BASE-MA35D1B1	26
Figure 3-4 Rear View of NuMaker-BASE-MA35D1B1	27
Figure 3-5 Front View of 7" TFT LCD Daughter Board	53
Figure 3-6 Rear View of 7" TFT LCD Daughter Board	54
Figure 4-1 Power-on Setting DIP Switch (SW4)	55
Figure 4-2 Power Jack (CON1) and Slide Switch (SW1)	57
Figure 4-3 USB VCOM Port (CON21)	57
Figure 4-4 Main Screen of Demonstration	58
Figure 4-5 H.264 Video Playback Demonstration	58
Figure 4-6 ML People Counting Demonstration	59
Figure 4-7 2D Accelerator Demonstration	59
Figure 4-8 VoIP Demonstration	60
Figure 4-9 Data Security Demonstration	60
Figure 4-10 Keyword Spotting by RTP M4 Demonstration	61
Figure 5-1 Nuvoton Website	62
Figure 5-2 MA35D1 GitHub Resources	63
Figure 6-1 System Block	64
Figure 6-2 PMIC, Crystal and Power Filter Schematic	65
Figure 6-3 Power Group 0, 2, 4 and 5 Schematic	66
Figure 6-4 Power Group 1 Schematic	67
Figure 6-5 Power Group 3 (eMMC1_PJ) Schematic	68
Figure 6-6 Power Group 6, 7, ADC and USB Schematic	69
Figure 6-7 Power Group 8 (RGMII0_PE) Schematic	70
Figure 6-8 Power Group 9 (RGMII1_PF) Schematic	71
Figure 6-9 DDR PHY Schematic	72
Figure 6-10 Front PCB Placement of NuMaker-SOM-MA35D16A81 Board	73
Figure 6-11 Rear PCB Placement of NuMaker-SOM-MA35D16A81 Board	74
Figure 6-12 Power Schematic	75
Figure 6-13 SOM Connectors Schematic	76

Figure 6-14 Power-on Setting and NAND Flash Schematic	77
Figure 6-15 SD0 Schematic	78
Figure 6-16 QSPI0 Schematic	79
Figure 6-17 EADC0 Schematic	80
Figure 6-18 RGMII0_PE Schematic	81
Figure 6-19 RGMII1_PF Schematic	82
Figure 6-20 HSUSB 0/1 Schematic	83
Figure 6-21 CCAP 0/1 Connectors Schematic	84
Figure 6-22 LCM Connector Schematic	85
Figure 6-23 EBI Connector Schematic	86
Figure 6-24 NAU88C22 Audio Codec Schematic	87
Figure 6-25 SIM Card Schematic	88
Figure 6-26 RS232 Schematic	89
Figure 6-27 RS485 Schematic	90
Figure 6-28 CAN FD Schematic	91
Figure 6-29 Key Buttons, LEDs, Buzzer and Fan Control Schematic	92
Figure 6-30 SWJ, SWD and ETM Connectors Schematic	93
Figure 6-31 NUC123 VCOM Schematic	94
Figure 6-32 MEMS Digital Microphone Schematic	95
Figure 6-33 MEMS G-Sensor Schematic	96
Figure 6-34 Front PCB Placement of NuMaker-BASE-MA35D1B1 Board	97
Figure 6-35 Rear PCB Placement of NuMaker-BASE-MA35D1B1 Board	98
Figure 6-36 7" TFT LCD Daughter Board Schematic	99

List of Tables

Table 1-1 Board Part Number and Information.....	14
Table 3-1 RTC Power Control Pins of MA35D1.....	18
Table 3-2 PMIC (U2) Output Voltage.....	19
Table 3-3 PMIC (U2) Control Pins	19
Table 3-4 eMMC1 NAND Flash Device (U3) Pin Function	20
Table 3-5 RGMII0 PHY (U4) Pin Function	21
Table 3-6 RGMII1 PHY (U5) Pin Function	21
Table 3-7 SOM Connector 1 (P1) Pin Function	23
Table 3-8 SOM Connector 2 (P2) Pin Function	25
Table 3-9 SOM Connector 1 (CON2) Pin Function.....	29
Table 3-10 SOM Connector 2 (CON3) Pin Function.....	31
Table 3-11 QSPI0 Flash (U8) Pin Function	32
Table 3-12 NAND Flash (U4) Pin Function.....	32
Table 3-13 SD0 Standard-SD Card Slot (CON4) Pin Function	33
Table 3-14 Secure Boot Options.....	34
Table 3-15 Booting Source QSPI0 and SD/eMMC IO Voltage Options	34
Table 3-16 Booting Source Options.....	34
Table 3-17 Page Size Options for NAND Flash Booting Source	34
Table 3-18 ECC Options for NAND Flash Booting Source.....	35
Table 3-19 Options for SD Card 0/1 or eMMC 0/1 NAND Flash Device Booting Source.....	35
Table 3-20 4/8-bit Options for eMMC NAND Flash Device Booting Source.....	35
Table 3-21 1-bit Options for QSPI0 NAND/NOR Flash Booting Source.....	35
Table 3-22 Options for USB0 or USBH Booting Source	36
Table 3-23 USBH Port 0/1 Options for USBH Booting Source.....	36
Table 3-24 Over-current High/Low-active Detect Options for USBH Booting Source.....	36
Table 3-25 CCA0 Connector (CON7) Pin Function.....	37
Table 3-26 CCA1 Connector (CON8) Pin Function.....	38
Table 3-27 EBI Connector (CON10) Pin Function	40
Table 3-28 EADC0 Header (J6) Pin Function.....	41
Table 3-29 UART0, Ground VSS and Tamper Pin Header (J1) Pin Function (V2.0)	41
Table 3-30 UART0, Tamper Pin, CAN1_H/L and CAN3_H/L Header (J1) Pin Function (V2.1)....	42
Table 3-31 UART11 (U21, CON13) Pin Function	42
Table 3-32 UART16 (U22, CON14) Pin Function	42
Table 3-33 UART12 (U23, CON15) Pin Function	43
Table 3-34 UART14 (U24, CON16) Pin Function	43
Table 3-35 RS485 Transceiver A/B I/O and Ground VSS Header (J12) Pin Function (V2.1)	43

Table 3-36 CAN1 (U25, CON17) Pin Function	43
Table 3-37 CAN3 (U26, CON18) Pin Function	44
Table 3-38 SWJ Interface (CON19) Pin Function	45
Table 3-39 SWD Interface (J8) Pin Function	45
Table 3-40 ETM Interface (CON20) Pin Function	46
Table 3-41 NUC123 ICE Interface (J9) Pin Function	46
Table 3-42 LCM Connector (CON9) Pin Function	49
Table 3-43 I2S0 (U18) Pin Function	49
Table 3-44 I2C2 (U18) Pin Function	50
Table 3-45 Audio Codec (U18) Control Pin Function	50
Table 3-46 SC0 SIM Card Connector (CON12) Pin Function	50
Table 3-47 Key Buttons (KEY_1, KEY_2 and KEY_3) Pin Function	50
Table 3-48 LEDs (LED_0 and LED_1) Pin Function	51
Table 3-49 Fan Control (FAN_EN, FAN_PWM and FAN_SP) Pin Function (V2.1)	51
Table 3-50 2-pin Fan Connector (J10) Pin Function (V2.1)	51
Table 3-51 4-pin Fan Connector (J11) Pin Function (V2.1)	51
Table 3-52 MEMS Digital Microphone (U31) Pin Function	52
Table 3-53 MEMS G-Sensor (U32) Pin Function	52
Table 4-1 Secure Boot Disable Configuration	55
Table 4-2 eMMC1 Boot Source IO Voltage Configuration	56
Table 4-3 SD/eMMC Boot Source Configuration	56
Table 4-4 eMMC1 Boot Source Configuration	56
Table 4-5 eMMC1 NAND Flash Device Boot Source eMMC 8-bit Configuration	56

1 OVERVIEW

The NuMaker-HMI-MA35D1-S1 is an evaluation board for Nuvoton NuMicro MA35D1 series microprocessors, and consists of three parts: a NuMaker-SOM-MA35D16A81 SOM board, a NuMaker-BASE-MA35D1B1 base board and a 7" TFT-LCD daughter board. The SOM board integrates core components to simplify the system design, based on MA35D16A887C (BGA312 package, and stacking a 256 MB DDR), PMIC power solution, a 16 GB eMMC Flash, and two Gigabit Ethernet PHY. The NuMaker-HMI-MA35D1-S1 has rich peripherals such as 2 sets of Gigabit Ethernet, USB2.0 high-speed host and device, 2 sets of CAN FD, and SPI, I2C, UART, RS-485 serial communication ports for users to facilitate the evaluation in HMI and industrial control, home appliances, 2-wheel cluster, medical device, new energy applications, ML (Machine Learning) 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.

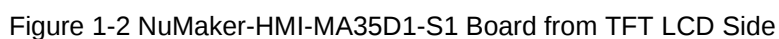
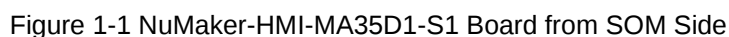
The NuMicro MA35D1 series is a heterogeneous multi-core microprocessor targeted to high-end edge IIoT gateway. It is based on dual 64-bit Arm Cortex-A35 cores with speed up to 800 MHz, and one 180 MHz Arm Cortex-M4 core. Based on the high-performance cores, the MA35D1 series facilitates the tiny AI/ML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

The MA35D1 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.



1.1 NuMaker-SOM-MA35D16A81 Board

The NuMaker-SOM-MA35D16A81 board contains an on-board target chip MA35D16A887C packaged in a MCP type with internal DDR3L 256 MB SDRAM, a PMIC device DA9062-3A to supply the powers to the target chip MA35D16A887C and dedicated peripherals on this SOM board, an eMMC NAND Flash memory device, two Gigabit Ethernet (RGMII) PHY devices, a battery input header and a PMIC reset key button.

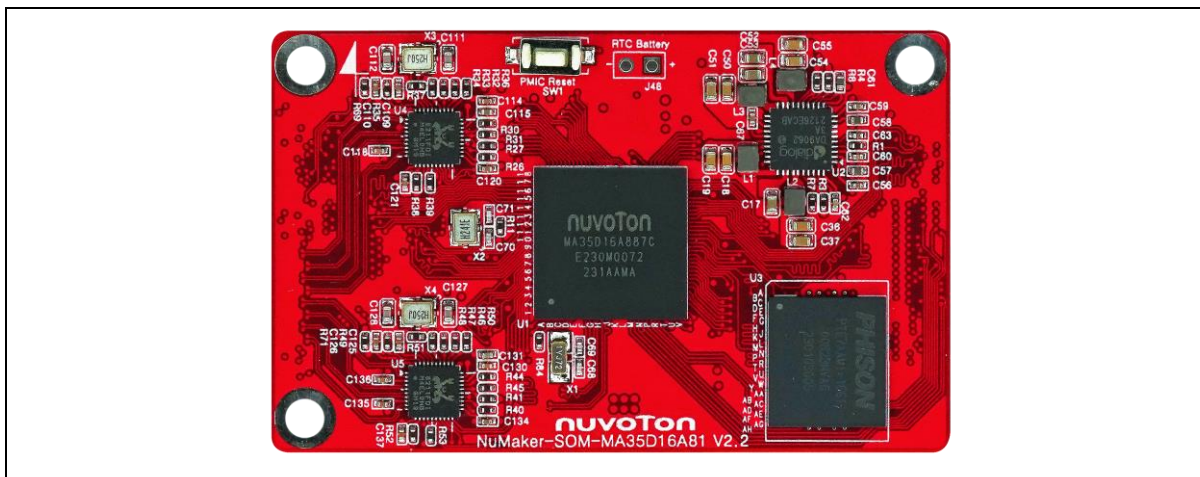


Figure 1-3 NuMaker-SOM-MA35D16A81 Board

1.2 NuMaker-BASE-MA35D1B1 Board

The NuMaker-BASE-MA35D1B1 board contains rich peripherals, including two high speed connectors to connect the NuMaker-SOM-MA35D16A81 board, serial SPI NAND and parallel NAND Flash memory devices, a Standard-SD memory card slot, two Gigabit Ethernet transformers and RJ45 ports, two High Speed USB ports (Host/Device and Host), an audio codec with microphone and headset jack, a 24-bit RGB LCD with touch connector, an External Bus Interface (EBI) connector, two CMOS sensor input connectors, eight channels of ADC input, two RS232 COM ports, two RS485 connectors, two CAN FD connectors, three user key buttons and two user LEDs.

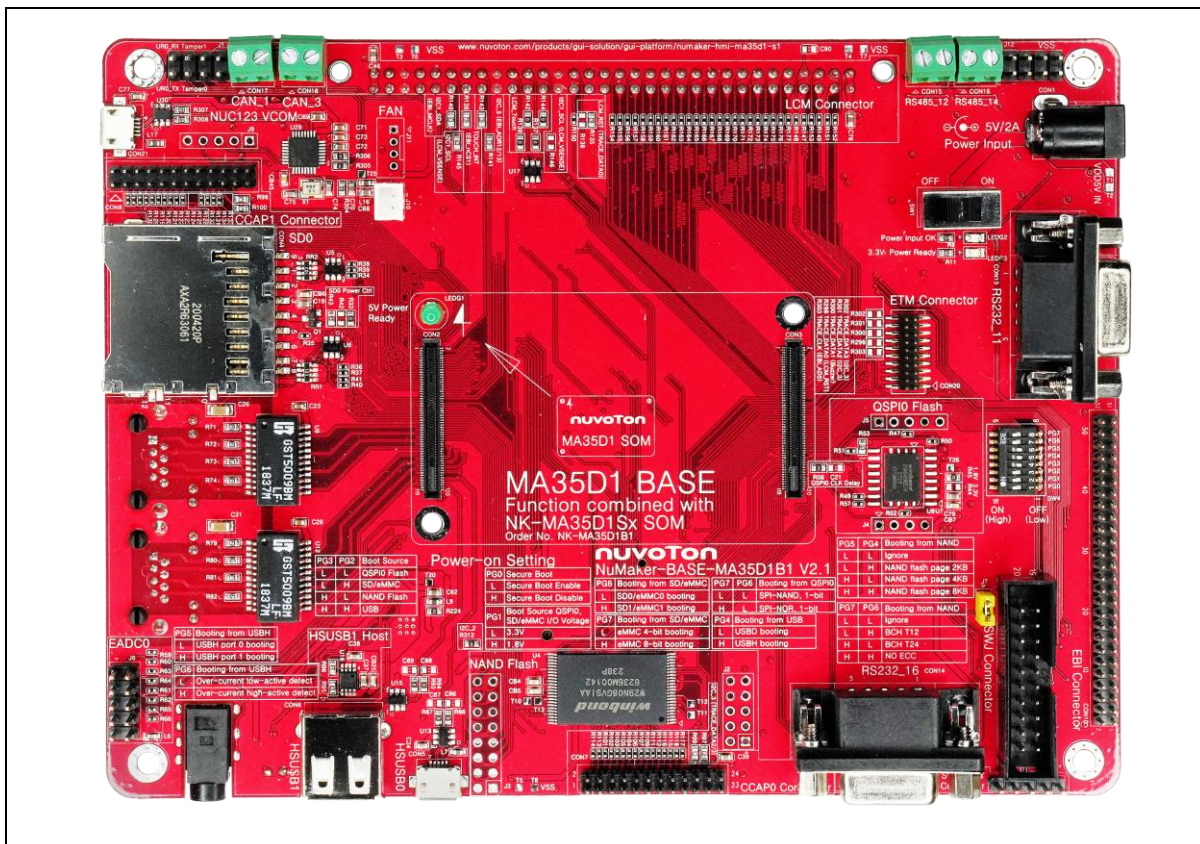


Figure 1-4 NuMaker-BASE-MA35D1B1 Board

1.3 7" TFT LCD Daughter Board

This daughter board contains a 7" 4-wire resistive touch TFT LCD panel with pixel resolution of 1024x600. (TH0701024600NYR50L1 + AN-3748A)

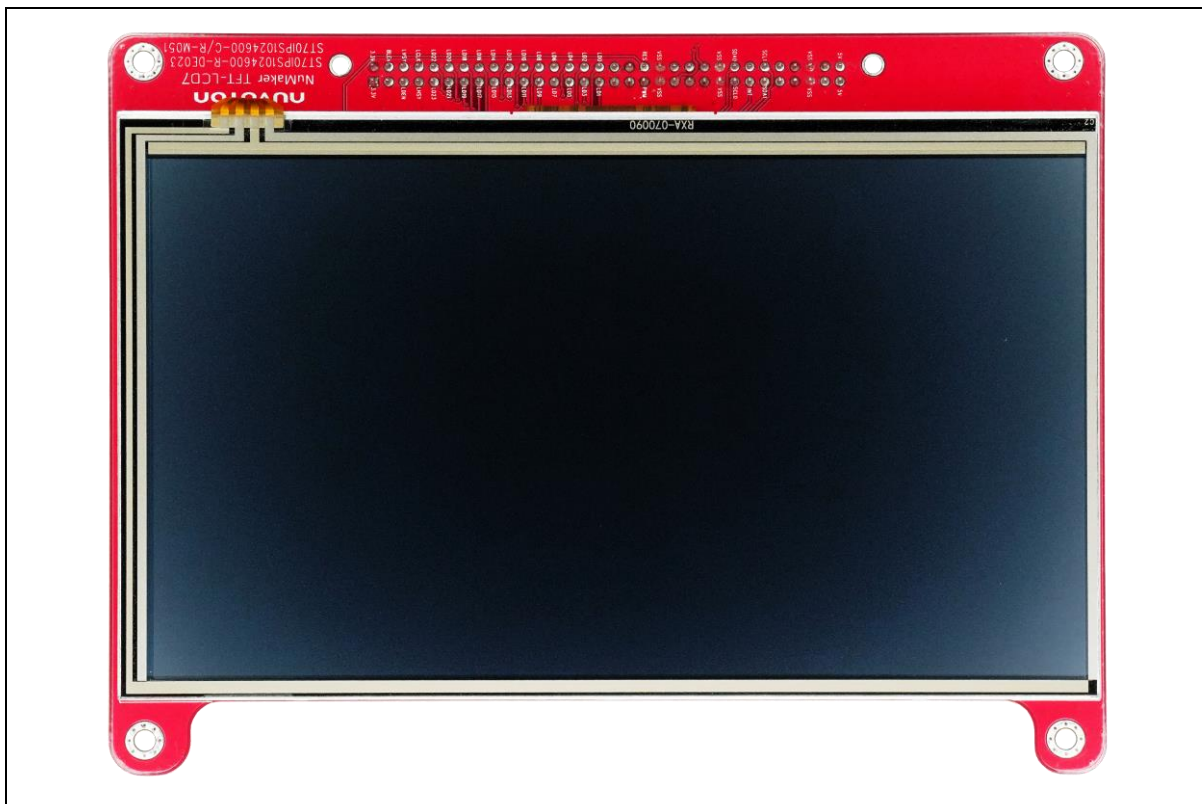


Figure 1-5 7" TFT LCD Daughter Board

1.4 Board Part Number and Information

The following table lists the part number of this evaluation board (EVB) based on the MA35D16A887C microprocessors, and the PCB names of three parts: NuMaker-SOM-MA35D16A81 SOM board, NuMaker-BASE-MA35D1B1 base board and 7" TFT-LCD daughter board.

Part Number of EVB	SOM Board	BASE Board	7" TFT LCD Daughter Board
NuMaker-HMI-MA35D1-S1	NuMaker-SOM-MA35D16A81 V2.x	NuMaker-BASE-MA35D1B1 V2.x	NuMaker TFT-LCD7

Table 1-1 Board Part Number and Information

2 FEATURES

2.1 NuMaker-SOM-MA35D16A81 Features

- Target Chip: MA35D16A887C (BGA 312-Ball) MCP package with DDR3L (256 MB), which can run up to 800 MHz
- Power
 - DC 5V input from the NuMaker-BASE-MA35D1B1 board through the SOM high speed connector
 - PMIC DA9062-3A:
 - ◆ Four DC/DC: To supply 1.2V Core power, 1.2V CPU power, 1.35V DDR3L Memory power and 3.3V I/O power
 - ◆ Four LDO: To supply 3.0V RTC power, 1.8V I/O power, 2.5V PLL power and 3.3V/1.8V eMMC NAND Flash power
 - Battery input header (J48): Independent DC 3.3V input to V_{BAT} for RTC power (Optional)
- Memory Devices
 - An on-board eMMC NAND Flash memory device (16 GB)
- Two Gigabit Ethernet (RGMII) PHY devices
- Two 120-pin high speed connectors to connect with NuMaker-BASE-MA35D1B1 board
- One PMIC reset key button

2.2 NuMaker-BASE-MA35D1B1 Features

- Power:
 - 5V/2A Power Jack and Slide Switch
- Debug/Trace:
 - UART0 debug port: USB Virtual COM (VCOM) port
 - Debug/Trace ports: SWJ (JTAG+SWD), ETM and SWD connectors
- Memory Devices
 - An on-board Quad SPI NAND Flash device (512 MB)
 - An on-board NAND Flash device (1 GB)
 - Standard-SD (SD2.0) memory card slot
- One power-on setting DIP-Switch for evaluation booting source selection
- Two 120-pin high speed connectors to connect with NuMaker-SOM-MA35D16A81 board
- Two sets of Gigabit Ethernet ports: Two Gigabit Ethernet transformer devices and two RJ45 port connectors
- Two sets of high speed USB ports: One Host/Device port and one Host port
- Two camera capture (CMOS sensor) header connectors
- One LCM connector to connect with 7" 1024x600 LCD daughter board
- One audio codec with microphone input and speaker output
- One SIM card slot
- One External Bus Interface (EBI) header connector

- Two sets of UART transceivers and DB9 connectors
- Two sets of RS485 transceivers and header connectors
- Two sets of CAN FD transceivers and header connectors
- One 8-channel ADC header connector
- MEMS Microphone
- MEMS G-Sensor
- Three user key buttons
- Two user LEDs
- One set of buzzer pads
- One fan connector (Only supported in V2.1)

2.3 7" TFT LCD Daughter Board Features

- One LCD FPC connector to connect with 7" 1024x600 TFT LCD panel
- One 4-wire resistive touch FPC connector
- One connector to connect with NuMaker-BASE-MA35D1B1 board

3 HARDWARE CONFIGURATION

3.1 NuMaker-SOM-MA35D16A81 Board

3.1.1 Front View

Figure 3-1 shows the main components and connectors from the front side of NuMaker-SOM-MA35D16A81 board.

- Target Chip (U1): MA35D16A887C (BGA312) MCP package with DDR3L (256MB).

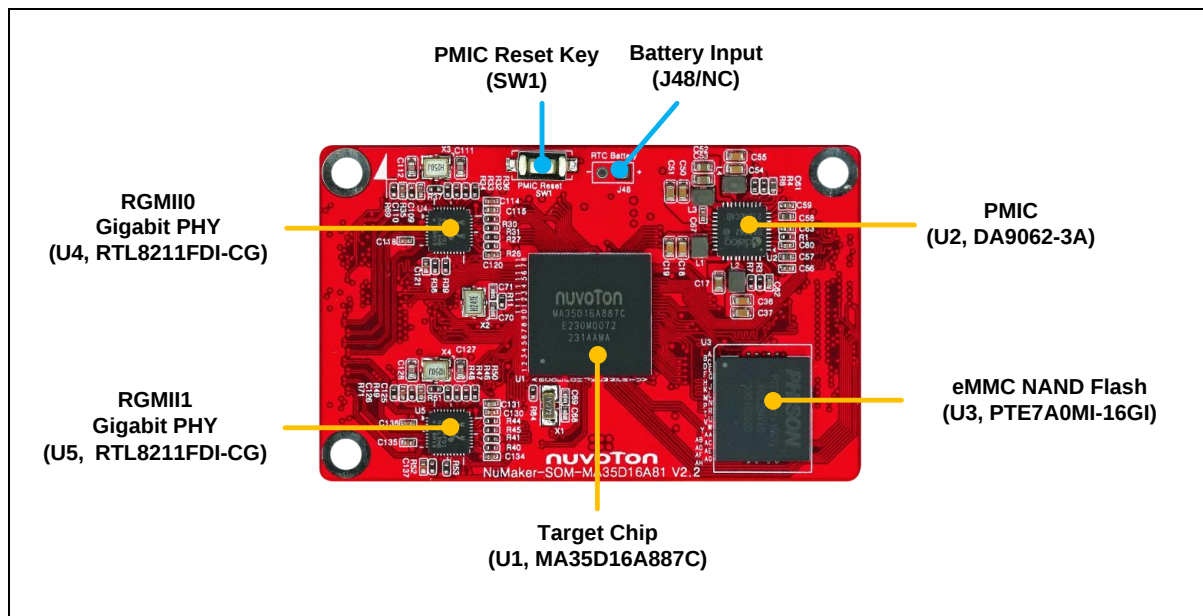


Figure 3-1 Front View of NuMaker-SOM-MA35D16A81

3.1.2 Rear View

Figure 3-2 shows the main components and connectors from the rear side of NuMaker-SOM-MA35D16A81 board.

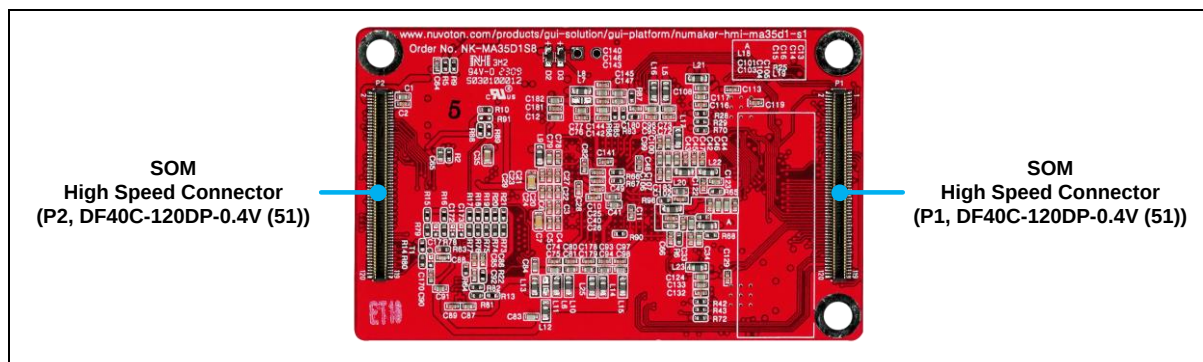


Figure 3-2 Rear View of NuMaker-SOM-MA35D16A81

3.1.3 Power Input

- 5V Input (P2.1~6): DC 5V power input for the NuMaker-SOM-MA35D16A81 board that supplied from the base board through the pin 1 to pin 6 of SOM high speed connector P2.

3.1.4 RTC Wake-up Control

- Battery Input Connector (J48): DC 3V battery input connector to provide an additional optional power to keep the RTC power from the V_{BAT} pin of MA35D1 when the system is power off.
- 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. (This funtion is reserved due to both R88 and R90 resistors are mounted on board by default)

Pin No.	Pin Name of MA35D1	Function Description
U1.E7	RTC_RPWR*1	RTC wake-up output pin for external DC/DC (for example, the PMIC device DA9062-3A (U2) on this NuMaker-SOM-MA35D16A81 board) enable pin control.
U1.G5	RTC_nRWAKE*2*3	RTC wake-up interrupt input with internal pull-high

Note *1: This RTC_RPWR output pin of MA35D1 is not wired directly to the SYS_EN input pin (pin 30) of PMIC device DA9062-3A (U2) on this NuMaker-SOM-MA35D16A81 board by default. (The R88 resistor is mounted on board but R89 resistor is NC by default)

Note *2: This RTC_nRWAKE input pin is wired directly to the RTC Wakeup key button (SW3, SW3 is not mounted on board in V2.1) on NuMaker-BASE-MA35D1B1 board and the R90 resistor is mounted on 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 (the R90 is mounted on board by default). 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 3-1 RTC Power Control Pins of MA35D1

3.1.5 PMIC

- PMIC Reset Key Button (SW1): Press this key to pull the nRESETREQ (pin 16) of PMIC device DA9062-3A (U2) low to reset this PMIC device to supply the output voltages and control the nRESET signal following the default power-on sequence stored in the internal configured initialization.
- PMIC (U2): After system power-on and pull the SYS_EN (pin 30) of the PMIC device DA9062-3A (U2) to high, the PMIC will follows the configured power-on sequence to supply all necessary and different voltages to the target chip MA35D16A887C and dedicated peripherals on this NuMaker-SOM-MA35D16A81 board, and release the nRESET signal from low to high at the last one sequence step.

U2.#	Pin Name	Output Voltage / MAX. Current
U2.26	VBUCK1	DC 1.2V ~ 1.34V / 2.5A
U2.27	VBUCK2	DC 1.2V / 2.5A
U2.25	VBUCK3	DC 3.3V / 2A
U2.24	VBUCK4*1	DC 1.35V or 1.8V / 2A
U2.1	VLDO1	DC 3V / 100mA
U2.2	VLDO2	DC 1.8V / 300mA
U2.9	VLDO3	DC 2.5V / 300mA

U2.11	VLDO4*2	DC 3.3V or 1.8V / 300mA
Note *1: The output voltage of VBUCK4 depends on the status of U2.28 pin and to supply the voltage to the internal DDR memory and DDR PHY of the target chip MA35D16A887C (MCP package with DDR3L SDRAM memory). By default, the U2.28 pin is pull-down to force VBUCK4 pin of PMIC to output 1.35V on this NuMaker-SOM-MA35D16A81 board. Note *2: No connection (NC) by default. For more detailed information about how to change the output voltage on VLDO4, please refer to the PMIC DA9062-3A Application Note on Nuvoton website.		

Table 3-2 PMIC (U2) Output Voltage

U2.#	Pin Name	GPIO Function / Pin Name of MA35D1
U2.13	SDA	PMIC_I2C0_SDA / PD6*1
U2.14	SCL	PMIC_I2C0_SCL / PD7*2
U2.37	nIRQ	PMIC_nIRQ / PA15*3
U2.30	SYS_EN*4	RTC_RPWR*5*6
Note *1: This PD6 pin is dedicated as PMIC_I2C0_SDA function for controlling external PMIC by default. Note *2: This PD7 pin is dedicated as PMIC_I2C0_SCL function for controlling external PMIC by default. Note *3: This PA15 pin is dedicated as PMIC_nIRQ input function from external PMIC by default. Note *4: This SYS_EN input pin of PMIC device DA9062-3A (U2) can be controlled by RTC_RPWR output of MA35D1, but this SYS_EN pin is pulled-up on this NuMaker-SOM-MA35D16A81 board by default and it is not controllable by MA35D1 chip. (The R88 resistor is mounted on board but R89 resistor is NC by default) Note *5: This RTC_RPWR output pin state of MA35D1 is controlled by RTC internal logic and the RTC_nRWAKE input pin state of the target chip MA35D16A887C. The RTC_nRWAKE input pin is pulled-down directly on this NuMaker-SOM-MA35D16A81 board. (The R90 resistor is mounted on board by default) Note *6: Although the RTC_nRWAKE input pin is wired directly to the RTC Wake-up key (SW3) on NuMaker-BASE-MA35D1B1 board, but it does not need to press the SW3 key button to pull RTC_nRWAKE pin to low after supplied power to this NuMaker-BASE-MA35D1B1 board. (SW3 is NC in V2.1)		

Table 3-3 PMIC (U2) Control Pins

3.1.6 eMMC NAND Flash

- eMMC1 NAND Flash Memory Device (U3): An on-board eMMC NAND Flash memory device (PTE7A0MI-16GI, 16 GB) for optional booting source. The booting source depends on the Power-on Setting by the status of DIP Switch (SW4) on the NuMaker-BASE-MA35D1B1 board.

Function Name	GPIO pin of MA35D1
eMMC1_DAT4	PJ0
eMMC1_DAT5	PJ1

eMMC1_DAT6	PJ2
eMMC1_DAT7	PJ3
-	PJ4*1
-	PJ5*1*2
eMMC1_CMD	PJ6
eMMC1_CLK	PJ7
eMMC1_DAT0	PJ8
eMMC1_DAT1	PJ9
eMMC1_DAT2	PJ10
eMMC1_DAT3	PJ11
Note *1: No connection (NC) by default. Note *2: It is necessary to pull the PJ5 pin (SD1_nCD) to low when these PJ0~PJ3 and PJ6~PJ11 pins (eMMC1_xxx) are used to connect with eMMC device and act as the booting source.	

Table 3-4 eMMC1 NAND Flash Device (U3) Pin Function

3.1.7 RGMII Gigabit PHY

- RGMII0 Gigabit PHY (U4): The RGMII0 MAC of MA35D1 needs an external Gigabit PHY (RTL8211FDI) to transform signal and pass these 4-pair differential signals to the Ethernet transformer on NuMaker-BASE-MA35D1B1 board through the SOM high speed connector P1.

Function Name	GPIO pin of MA35D1
RGMII0_MDC	PE0
RGMII0_MDIO	PE1
RGMII0_TXCTL	PE2
RGMII0_TXD0	PE3
RGMII0_TXD1	PE4
RGMII0_RXCLK	PE5
RGMII0_RXCTL	PE6
RGMII0_RXD0	PE7
RGMII0_RXD1	PE8
RGMII0_RXD2	PE9
RGMII0_RXD3	PE10
RGMII0_TXCLK	PE11
RGMII0_TXD2	PE12

RGMIIO_TXD3	PE13
-------------	------

Table 3-5 RGMII0 PHY (U4) Pin Function

- RGMII1 Gigabit PHY (U5): The RGMII1 MAC of MA35D1 needs an external Gigabit PHY (RTL8211FDI) to transform signal and pass these 4-pair differential signals to the Ethernet transformer on NuMaker-BASE-MA35D1B1 board through the SOM high speed connector P1.

Function Name	GPIO pin of MA35D1
RGMII1_MDC	PF0
RGMII1_MDIO	PF1
RGMII1_TXCTL	PF2
RGMII1_TXD0	PF3
RGMII1_TXD1	PF4
RGMII1_RXCLK	PF5
RGMII1_RXCTL	PF6
RGMII1_RXD0	PF7
RGMII1_RXD1	PF8
RGMII1_RXD2	PF9
RGMII1_RXD3	PF10
RGMII1_TXCLK	PF11
RGMII1_TXD2	PF12
RGMII1_TXD3	PF13

Table 3-6 RGMII1 PHY (U5) Pin Function

3.1.8 High Speed Connectors

- SOM High Speed Connectors (P1 and P2): Two 120-pin high speed connectors (DF40C-120DP-0.4V (51)) to connect with the NuMaker-BASE-MA35D1B1 board.

Pin No.	GPIO of MA35D1 or Function pin	Pin No.	GPIO of MA35D1 or Function pin
1	PL4	2	nRESET
3	PL5	4	RTC_nRWAKE
5	PN14	6	VSS
7	PD15	8	PN15
9	PN12	10	PK15
11	PN13	12	PK14
13	PN7	14	PK13

15	PN6	16	PK12
17	PN5	18	PL3
19	PN4	20	PL2
21	PN3	22	PL1
23	PN2	24	PL0
25	PN1	26	PJ15
27	PN0	28	PJ14
29	VSS	30	PJ13
31	PN10	32	PJ12
33	VSS	34	PL15
35	PN11	36	PL14
37	VSS	38	PL13
39	PD9	40	PL12
41	PD8	42	PL11
43	PC4	44	PL10
45	PC5	46	PD14
47	PC0	48	PA14
49	VSS	50	PA13
51	PC1	52	PA12
53	VSS	54	PA11
55	PC2	56	PA10
57	PC3	58	PA9
59	PC7	60	PA8
61	PC6	62	PA7
63	VSS	64	PA6
65	E_MDIP0	66	PA5
67	E_MDIN0	68	PA4
69	VSS	70	PA3
71	E_MDIP1	72	PA2
73	E_MDIN1	74	PA1
75	VSS	76	PA0

77	E_MDIP2	78	PF14
79	E_MDIN2	80	E_LED0
81	VSS	82	E_LED1
83	E_MDIP3	84	E_LED2
85	E_MDIN3	86	F_LED0
87	VSS	88	F_LED1
89	F_MDIP0	90	F_LED2
91	F_MDIN0	92	EADC0_CH7
93	VSS	94	EADC0_CH3
95	F_MDIP1	96	EADC0_CH6
97	F_MDIN1	98	EADC0_CH2
99	VSS	100	EADC0_CH5
101	F_MDIP2	102	EADC0_CH1
103	F_MDIN2	104	EADC0_CH4
105	VSS	106	EADC0_CH0
107	F_MDIP3	108	VSS
109	F_MDIN3	110	HSUSB0_D+
111	VSS	112	HSUSB0_D-
113	PE15	114	VSS
115	PE14	116	HSUSB1_D+
117	HSUSB0_ID	118	HSUSB1_D-
119	PF15	120	VSS

Table 3-7 SOM Connector 1 (P1) Pin Function

Pin No.	GPIO of MA35D1 or Function pin	Pin No.	GPIO of MA35D1 or Function pin
1	VDD5V	2	VDD5V
3	VDD5V	4	VDD5V
5	VDD5V	6	VDD5V
7	VSS	8	VSS
9	PH3	10	PH4
11	PH2	12	PH5

13	PH1	14	PH6
15	PH0	16	PH7
17	PI15	18	PC12
19	PI14	20	PC13
21	PI13	22	PC14
23	PI12	24	PC15
25	PI11	26	PH12
27	PI10	28	PH13
29	PI9	30	PH14
31	PI8	32	PH15
33	PB15	34	VSS
35	PB14	36	PG10
37	PB13	38	VSS
39	PB12	40	PG9
41	PB11	42	PG8
43	PB10	44	PK4
45	PB9	46	PK5
47	PB8	48	PK6
49	PK3	50	PK7
51	PK2	52	PM15
53	PK1	54	PM14
55	PK0	56	PM13
57	PI7	58	PM12
59	PI6	60	VSS
61	PI5	62	PL6
63	PI4	64	VSS
65	PI3	66	PG15
67	PI2	68	PG14
69	PI1	70	PG13
71	PI0	72	PG12
73	PD13	74	PG11

75	PD12	76	PG7
77	PD11	78	PG6
79	PD10	80	PG5
81	PL9	82	PG4
83	PL8	84	PG3
85	PL7	86	PG2
87	PH9	88	PG1
89	PH8	90	PG0
91	VSS	92	VSS
93	PK10	94	PD0
95	VSS	96	PD3
97	PK9	98	PD4
99	VSS	100	PD2
101	PM2	102	VSS
103	PM3	104	PD1
105	PM4	106	VSS
107	PM5	108	PD5
109	PM6	110	VSS
111	PM7	112	PM1
113	PM8	114	PK8
115	PM9	116	PK11
117	PM10	118	PM0
119	PM11	120	PH4

Table 3-8 SOM Connector 2 (P2) Pin Function

3.2 NuMaker-BASE-MA35D1B1 Board

3.2.1 Front View

Figure 3-3 shows the main components and connectors from the front side of NuMaker-BASE-MA35D1B1 board.

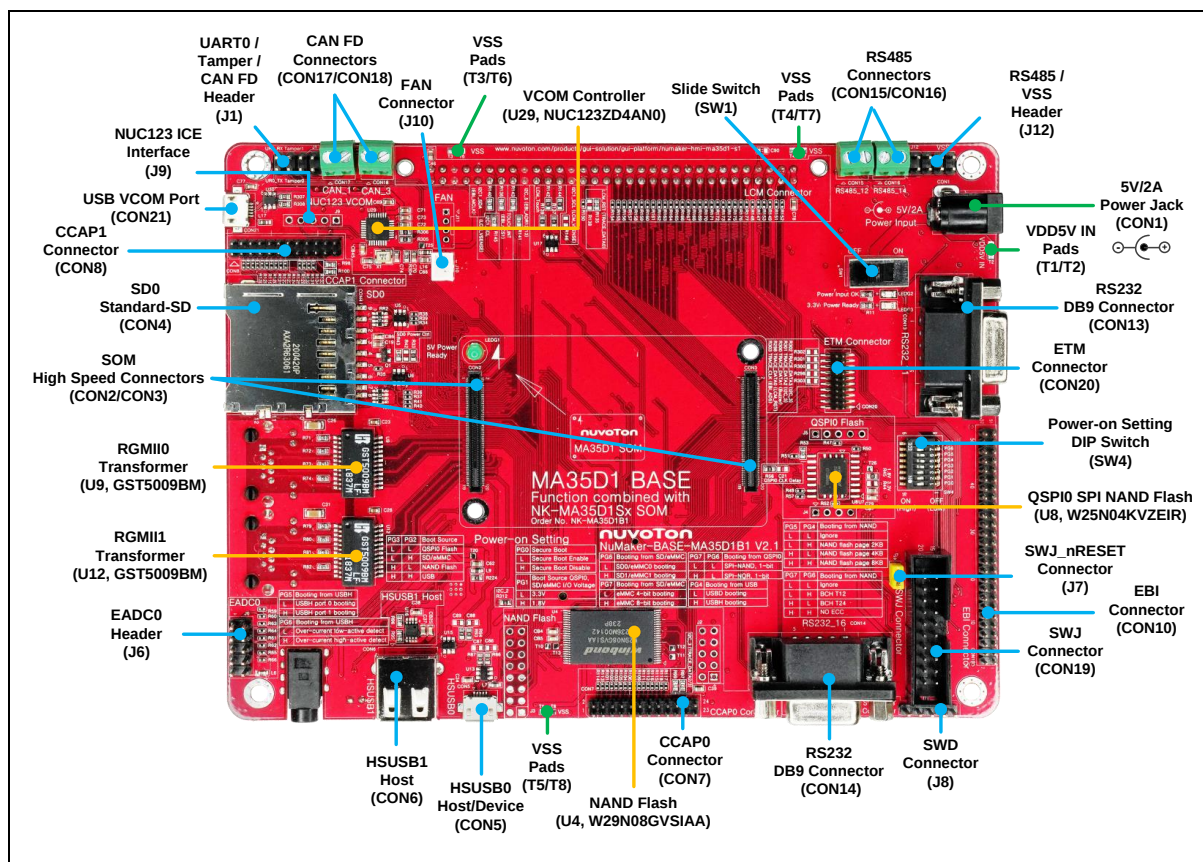


Figure 3-3 Front View of NuMaker-BASE-MA35D1B1

3.2.2 Rear View

Figure 3-4 shows the main components and connectors from the rear side of NuMaker-BASE-MA35D1B1 board.

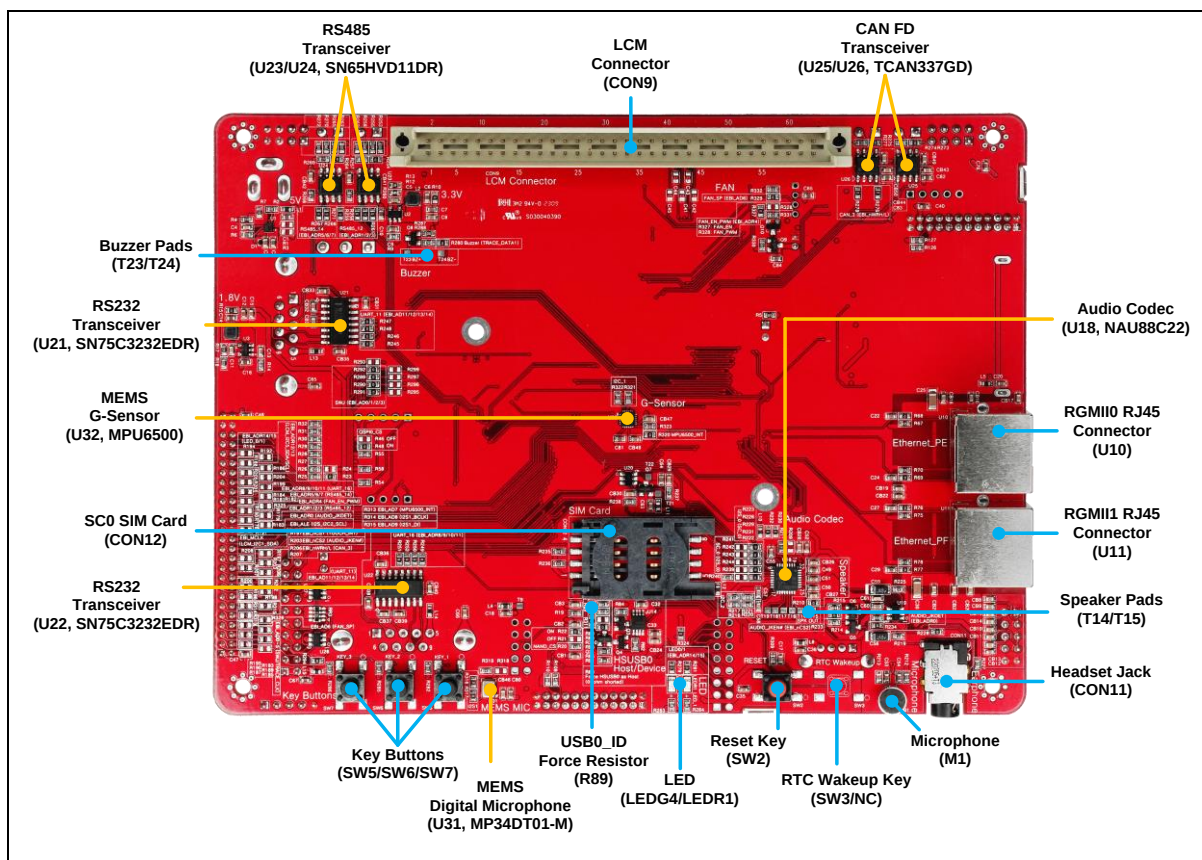


Figure 3-4 Rear View of NuMaker-BASE-MA35D1B1

3.2.3 Power and Ground

- 5V Power Jack (CON1): This power jack needs to connect an extra adapter to supply DC 5V/2A power input for this NuMaker-BASE-MA35D1B1 board.
- VDD5V_IN Pads (T1 and T2): Optional to supply 5V power input for this NuMaker-BASE-MA35D1B1 board.
- GND Pads (T3~T8): The ground pads of this NuMaker-BASE-MA35D1B1 board.
- Slide Switch (SW1): To switch the input 5V voltage to supply power to this NuMaker-BASE-MA35D1B1 board.

3.2.4 High Speed Connectors

- SOM High Speed Connectors (CON2 and CON3): Two 120-pin high speed connectors (DF40C-120DS-0.4V (51)) to connect with the NuMaker-SOM-MA35D16A81 board.

Pin No.	GPIO of MA35D1 or Function pin	Pin No.	GPIO of MA35D1 or Function pin
1	PL4	2	nRESET
3	PL5	4	RTC_nRWAKE
5	PN14	6	VSS
7	PD15	8	PN15
9	PN12	10	PK15

11	PN13	12	PK14
13	PN7	14	PK13
15	PN6	16	PK12
17	PN5	18	PL3
19	PN4	20	PL2
21	PN3	22	PL1
23	PN2	24	PL0
25	PN1	26	PJ15
27	PN0	28	PJ14
29	VSS	30	PJ13
31	PN10	32	PJ12
33	VSS	34	PL15
35	PN11	36	PL14
37	VSS	38	PL13
39	PD9	40	PL12
41	PD8	42	PL11
43	PC4	44	PL10
45	PC5	46	PD14
47	PC0	48	PA14
49	VSS	50	PA13
51	PC1	52	PA12
53	VSS	54	PA11
55	PC2	56	PA10
57	PC3	58	PA9
59	PC7	60	PA8
61	PC6	62	PA7
63	VSS	64	PA6
65	E_MDIP0	66	PA5
67	E_MDIN0	68	PA4
69	VSS	70	PA3
71	E_MDIP1	72	PA2

73	E_MDIN1	74	PA1
75	VSS	76	PA0
77	E_MDIP2	78	PF14
79	E_MDIN2	80	E_LED0*
81	VSS	82	E_LED1
83	E_MDIP3	84	E_LED2
85	E_MDIN3	86	F_LED0*
87	VSS	88	F_LED1
89	F_MDIP0	90	F_LED2
91	F_MDIN0	92	EADC0_CH7
93	VSS	94	EADC0_CH3
95	F_MDIP1	96	EADC0_CH6
97	F_MDIN1	98	EADC0_CH2
99	VSS	100	EADC0_CH5
101	F_MDIP2	102	EADC0_CH1
103	F_MDIN2	104	EADC0_CH4
105	VSS	106	EADC0_CH0
107	F_MDIP3	108	VSS
109	F_MDIN3	110	HSUSB0_D+
111	VSS	112	HSUSB0_D-
113	PE15	114	VSS
115	PE14	116	HSUSB1_D+
117	HSUSB0_ID	118	HSUSB1_D-
119	PF15	120	VSS
Note *: No connection (NC) by default.			

Table 3-9 SOM Connector 1 (CON2) Pin Function

Pin No.	GPIO of MA35D1 or Function pin	Pin No.	GPIO of MA35D1 or Function pin
1	VDD5V	2	VDD5V
3	VDD5V	4	VDD5V
5	VDD5V	6	VDD5V

7	VSS	8	VSS
9	PH3	10	PH4
11	PH2	12	PH5
13	PH1	14	PH6
15	PH0	16	PH7
17	PI15	18	PC12
19	PI14	20	PC13
21	PI13	22	PC14
23	PI12	24	PC15
25	PI11	26	PH12
27	PI10	28	PH13
29	PI9	30	PH14
31	PI8	32	PH15
33	PB15	34	VSS
35	PB14	36	PG10
37	PB13	38	VSS
39	PB12	40	PG9
41	PB11	42	PG8
43	PB10	44	PK4
45	PB9	46	PK5
47	PB8	48	PK6
49	PK3	50	PK7
51	PK2	52	PM15
53	PK1	54	PM14
55	PK0	56	PM13
57	PI7	58	PM12
59	PI6	60	VSS
61	PI5	62	PL6
63	PI4	64	VSS
65	PI3	66	PG15
67	PI2	68	PG14

69	PI1	70	PG13
71	PI0	72	PG12
73	PD13	74	PG11
75	PD12	76	PG7
77	PD11	78	PG6
79	PD10	80	PG5
81	PL9	82	PG4
83	PL8	84	PG3
85	PL7	86	PG2
87	PH9	88	PG1
89	PH8	90	PG0
91	VSS	92	VSS
93	PK10	94	PD0
95	VSS	96	PD3
97	PK9	98	PD4
99	VSS	100	PD2
101	PM2	102	VSS
103	PM3	104	PD1
105	PM4	106	VSS
107	PM5	108	PD5
109	PM6	110	VSS
111	PM7	112	PM1
113	PM8	114	PK8
115	PM9	116	PK11
117	PM10	118	PM0
119	PM11	120	PH4

Table 3-10 SOM Connector 2 (CON3) Pin Function

3.2.5 QSPI Flash

- QSPI0 Flash (U8): Winbond SPI NAND Flash (W25N04KWZEIR, 512 MB) for optional booting source, supporting dual / quad mode.

Pin No.	Pin Name	GPIO pin of MA35D1	Default Connected R#
---------	----------	--------------------	----------------------

1	QSPI0_SS0	PD0	R47
2	QSPI0_MISO0	PD3	R50
3	QSPI0_MOSI1	PD4	R51
4	VSS	-	-
5	QSPI0_MOSI0	PD2	R49
6	QSPI0_CLK	PD1	R57
7	QSPI0_MISO1	PD5	R52
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 the NuMaker-SOM-MA35D16A81 board. Please make sure the power group voltage of these GPIO PD0~PD5 pins is set at the equal voltage 1.8V on both NuMaker-SOM-MA35D16A81 board and NuMaker-BASE-MA35D1B1 board.

Table 3-11 QSPI0 Flash (U8) Pin Function

3.2.6 NAND Flash

- NAND Flash (U4): Winbond NAND Flash (W29N08GVSIAA, 1 GB) 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 3-12 NAND Flash (U4) Pin Function

3.2.7 SD Card Slot

- SD0 Standard-SD Card Slot (CON4): Support SD0 (SD2.0) for optional booting source.

Pin No.	Pin Name	GPIO pin of MA35D1	Default Connected R#
1	SD0_DTA3	PC5	R39
2	SD0_CMD	PC0	R34
3	VSS	-	-
4	VDD3V3	-	-
5	SD0_CLK	PC1	R35
6	VSS	-	-
7	SD0_DAT0	PC2	R36
8	SD0_DAT1	PC3	R37
9	SD0_DTA2	PC4	R38
10	SD0_nCD	PC6*3	R40
11	SD0_WP	PC7	R41
12	VSS	-	-
13	HOLD	-	-
14	HOLD	-	-
15*1	SD0_PWR_CTRL#	PD14	R42*2

Note *1: This pin does not belong to the SD0 Standard-SD card slot.

Note *2: Optional GPIO PD14 can control the power of SD0 Standard-SD card slot, but this function is disabled (R42 is NC, No Connection) by default, the power of SD0 Standard-SD card slot is always ON.

Note *3: It is necessary to pull the PC6 pin (SD0_nCD) to low when these PC0~PC5 pins (eMMC0_xxx) are used to connect with eMMC device and act as the booting source.

Table 3-13 SD0 Standard-SD Card Slot (CON4) Pin Function

3.2.8 HS USB2.0 Connectors

- HSUSB0 Host/Device (CON5, 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 shorting with a 0-ohm resistor on the R89 (NC by default) to force the ID pin of HSUSB0 at low state.
- HSUSB1 Host (CON6, USB Type-A Receptacle): HSUSB1 for USB Host with type-A connector.
- USB0_ID Resistor (R89): Optional to pull-down the ID pin of HSUSB0 by mounting a resistor (R89) to force HSUSB0 to always act as an USB Host.

3.2.9 Power-on Setting

- Power-on Setting DIP Switch (SW4): The GPIO PG0, PG1, PG2, PG3, PG4, PG5, PG6 and PG7 determine how to boot the evaluation environment on the NuMaker-BASE-MA35D1B1 board. These GPIO pins are internal weakly pull-down.

- Options for enabling or disabling secure booting:

SW4.1 / PG0*	Secure Booting
Low	Enable
High	Disable
Note *: The GPIO PG0 is internal weakly pull-down.	

Table 3-14 Secure Boot Options

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

SW4.2 / PG1*	Booting Source QSPI0 and SD/eMMC IO Voltage
Low	3.3 V
High	1.8 V
Note *: The GPIO PG1 is internal weakly pull-down.	

Table 3-15 Booting Source QSPI0 and SD/eMMC IO Voltage Options

- Options for booting source selection:

SW4.4 / PG3* ¹	SW4.3 / 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 : The eMMC1 NAND Flash memory device is on the NuMaker-SOM-MA35D16A81 board.		

Table 3-16 Booting Source Options

- Options for booting from NAND Flash device:

SW4.6 / PG5*	SW4.5 / 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 3-17 Page Size Options for NAND Flash Booting Source

SW4.8 / PG7*	SW4.7 / 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 3-18 ECC Options for NAND Flash Booting Source

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

SW4.7 / 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 : The eMMC1 NAND Flash memory device is on the NuMaker-SOM-MA35D16A81 board.	

Table 3-19 Options for SD Card 0/1 or eMMC 0/1 NAND Flash Device Booting Source

SW4.8 / 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 : The eMMC1 NAND Flash memory device is on the NuMaker-SOM-MA35D16A81 board.	

Table 3-20 4/8-bit Options for eMMC NAND Flash Device Booting Source

- Options for booting from QSPI0 Flash device:

SW4.8 / PG7* ¹	SW4.7 / PG6* ¹	Boot from QSPI0 Flash
Low	Low	SPI NAND 1-bit* ²
High	Low	SPI NOR 1-bit* ²
Note * ¹ : These GPIO PG6 and PG7 are internal weakly pull-down.		
Note * ² : Only SPI NAND Flash memory device (U8 only by default) is on this NuMaker-BASE-MA35D1B1 board.		

Table 3-21 1-bit Options for QSPI0 NAND/NOR Flash Booting Source

- Options for booting from USB0 or USBH:

SW4.5 / 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 the USB Host booting source on this NuMaker-HMI-MA35D1-S1 board.	

Table 3-22 Options for USB D or USB H Booting Source

SW4.6 / PG5*1	Boot from USBH*2
Low	USBH Port 0 Booting
High	USBH Port 1 Booting
Note *1: The GPIO PG5 is internal weakly pull-down.	
Note *2: It does not support the USB Host booting source on this NuMaker-HMI-MA35D1-S1 board.	

Table 3-23 USBH Port 0/1 Options for USBH Booting Source

SW4.7 / 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 the USB Host booting source on this NuMaker-HMI-MA35D1-S1 board.	

Table 3-24 Over-current High/Low-active Detect Options for USBH Booting Source

3.2.10 Gigabit Ethernet Transformers and RJ45 Ports

- RGMII0 Gigabit Ethernet Transformer (U9): Gigabit Ethernet transformer (GST5009BM) to isolate the differential signals from the Gigabit PHY device on the NuMaker-SOM-MA35D16A81 board through the SOM connector CON2 and pass these signals to the Ethernet network through the RJ45 connector (U10).
- RGMII1 Gigabit Ethernet Transformer (U12): Gigabit Ethernet transformer (GST5009BM) to isolate the differential signals from the Gigabit PHY device on the NuMaker-SOM-MA35D16A81 board through the SOM connector CON2 and pass these signals to the Ethernet network through the RJ45 connector (U11).
- RGMII0 RJ45 Connector (U10): The Gigabit Ethernet RGMII0 RJ45 connector.
- RGMII1 RJ45 Connector (U11): The Gigabit Ethernet RGMII1 RJ45 connector.

3.2.11 CMOS Sensor Capture Connectors

- CCAP0 Connector (CON7): This connector is used to connect CMOS sensor for image capture application through the CCAP0 (Camera Capture 0) interface.

Pin No.	Pin Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
1	VSS	-	-	-
2	VSS	-	-	-

3	CCAP0_PIXCLK	PK10	R113	-
4	CCAP0_SCLK	PK9	R114	-
5	CCAP0_DATA0	PM2	R101	-
6	CCAP0_DATA1	PM3	R102	-
7	CCAP0_DATA2	PM4	R103	-
8	CCAP0_DATA3	PM5	R105	-
9	CCAP0_DATA4	PM6	R104	-
10	CCAP0_DATA5	PM7	R106	-
11	CCAP0_DATA6	PM8	R107	-
12	CCAP0_DATA7	PM9	R109	-
13	CCAP0_DATA8	PM10	R111	-
14	CCAP0_DATA9	PM11	R112	-
15	CCAP0_VSYNC	PM0	R116	-
16	CCAP0_HSYNC	PK11	R115	-
17	CCAP0_PWDN	PK8	R118	-
18	CCAP0_nRST	PM1	R117	-
19	CCAP0_I2C3_SCL	PM15	R99	TRACE_DATA3 / R302*
20	CCAP0_I2C3_SDA	PM14	R97	TRACE_DATA2 / R301*
21	VDD3V3	-	-	-
22	VDD3V3	-	-	-
23	VSS	-	-	-
24	VSS	-	-	-
Note *: No connection (NC) by default.				

Table 3-25 CCAP0 Connector (CON7) Pin Function

- CCAP1 Connector (CON8): This connector is used to connect CMOS sensor for image capture application through the CCAP1 (Camera Capture 1) interface.

Pin No.	Pin Name	GPIO pin of MA35D1	Default Connected R#
1	VSS	-	-
2	VSS	-	-
3	CCAP1_PIXCLK	PN11	R130

4	CCAP1_SCLK	PN10	R129
5	CCAP1_DATA0	PN0	R119
6	CCAP1_DATA1	PN1	R120
7	CCAP1_DATA2	PN2	R121
8	CCAP1_DATA3	PN3	R122
9	CCAP1_DATA4	PN4	R123
10	CCAP1_DATA5	PN5	R124
11	CCAP1_DATA6	PN6	R125
12	CCAP1_DATA7	PN7	R128
13	-	-	-
14	-	-	-
15	CCAP1_VSYNC	PN13	R132
16	CCAP1_HSYNC	PN12	R131
17	CCAP1_PWDN	PD15	R134
18	CCAP1_nRST	PN14	R133
19	CCAP1_I2C4_SCL	PL5	R100
20	CCAP1_I2C4_SDA	PL4	R98
21	VDD3V3	-	-
22	VDD3V3	-	-
23	VSS	-	-
24	VSS	-	-

Table 3-26 CCAP1 Connector (CON8) Pin Function

3.2.12 External Bus Interface (EBI) Connector

- EBI Connector (CON10): This connector is used to extend the memory (ex. SRAM) through the EBI (External Bus Interface) interface.

Pin No.	Pin Name	GPIO Pin of MA35D1	Default Connected R#	Conflict Function / R#
1	VDD3V3	-	-	-
2	VDD3V3	-	-	-
3	EBI_AD0	PG11	R185*	JTAG_TDO / R289
4	EBI_AD1	PG12	R187*	JTAG_TCK / R290
5	EBI_AD2	PG13	R189*	JTAG_TMS / R291

6	EBI_AD3	PG15	R190*	JTAG_TDI / R292
7	EBI_AD4	PG15	R193*	JTAG_nTRST / R294
8	EBI_AD5	PL6	R195*	TRACE_CLK / R303
9	EBI_AD6	PL7	R326*	FAN_SP / R329 Note: Only supported in V2.1.
10	EBI_AD7	PL8	R313*	MPU6500_INT / R320
11	EBI_AD8	PL9	R314*	I2S1_BCLK / R316
12	EBI_AD9	PD10	R315*	I2S1_DI / R317
13	EBI_AD10	PD11	-	-
14	EBI_AD11	PL0	R196*	UR11_nCTS / R245
15	EBI_AD12	PL1	R198*	UR11_nRTS / R246
16	EBI_AD13	PL2	R200*	UR11_RXD / R247
17	EBI_AD14	PL3	R202*	UR11_TXD / R248
18	EBI_AD15	PG0	-	-
19	EBI_nWRH	PL10	R206*	CAN3_RXD / R276
20	EBI_nWRL	PL11	R207*	CAN3_TXD / R278
21	EBI_nCS2	PD13	R203*	AUDIO_JKEN# / R233
22	EBI_MCLK	PB10	R208*	LCM_I2C1_SDA / R140
23	EBI_nCS1	PD12	R197*	TOUCH_INT / R136
24	EBI_nWR	PG7	-	-
25	EBI_nRD	PG6	-	-
26	EBI_nCS0	PG1	-	-
27	EBI_ALE	PB9	R191*	I2S_I2C2_SCL / R312
28	VSS	-	-	-
29	EBI_ADR0	PI0	R183*	AUDIO_JKDET / R234

30	EBI_ADR1	PI1	R178*	UR12_nRTS / R256
31	EBI_ADR2	PI2	R179*	UR12_RXD / R259
32	EBI_ADR3	PI3	R180*	UR12_TXD / R261
33	EBI_ADR4	PI4	R325*	FAN_EN / R327 FAN_PWM / R328* Note: Only Supported in V2.1.
34	EBI_ADR5	PI5	R181*	UR14_nRTS / R266
35	EBI_ADR6	PI6	R182*	UR14_RXD / R267
36	EBI_ADR7	PI7	R184*	UR14_TXD / R271
37	EBI_ADR8	PK0	R199*	UR16_nCTS / R249
38	EBI_ADR9	PK1	R201*	UR16_nRTS / R250
39	EBI_ADR10	PK2	R204*	UR16_RXD / R251
40	EBI_ADR11	PK3	R205*	UR16_TXD / R252
41	EBI_ADR12	PJ12	R186*	LCM_I2C5_SDA / R141
42	EBI_ADR13	PJ13	R188*	LCM_I2C5_SCL / R143
43	EBI_ADR14	PJ14	R192*	LED_0 / R349
44	EBI_ADR15	PJ15	R194*	LED_1 / R351
45	EBI_ADR16	PG2	-	-
46	EBI_ADR17	PG3	-	-
47	EBI_ADR18	PG4	-	-
48	EBI_ADR19	PG5	-	-
49	VSS	-	-	-
50	VSS	-	-	-
51	VDD5V	-	-	-
52	VDD5V	-	-	-
Note *: No connection (NC) by default.				

Table 3-27 EBI Connector (CON10) Pin Function

3.2.13 EADC Header

- EADC0 Header (J6): The EADC0 analog channel input header.

Pin No.	Pin Name	Pin Name of MA35D1	Default Connected R#
1	EADC_CH0	EADC_CH0	R59
2	EADC_CH2	EADC_CH2	R63
3	EADC_CH4	EADC_CH4	R60
4	EADC_CH6	EADC_CH6	R64
5	EADC_CH1	EADC_CH1	R61
6	EADC_CH3	EADC_CH3	R65
7	EADC_CH5	EADC_CH5	R62
8	EADC_CH7	EADC_CH7	R66
9	AVSS_E*	-	-
10	AVSS_E*	-	-
Note *: AVSS_E is the EADC0 analog ground.			

Table 3-28 EADC0 Header (J6) Pin Function

3.2.14 UART

- UART0 Port, Ground VSS and Tamper Pin Header (J1, supported in V2.0): This header includes the TXD/RXD pins of UART0, the ground VSS pins, and the tamper pins (TAMPER0, TAMPER1).

Pin No.	Pin Name	GPIO pin of MA35D1
1	UR0_TX	PE14
2	UR0_RX	PE15*
3	VSS	-
4	VSS	-
5	TAMPER0	PH8
6	TAMPER1	PH9
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).		

Table 3-29 UART0, Ground VSS and Tamper Pin Header (J1) Pin Function (V2.0)

- UART0 Port, Tamper Pin, CAN1_H/L and CAN3_H/L Header (J1, supported in V2.1): This header includes the TXD/RXD pins of UART0, the tamper pins (TAMPER0, TAMPER1), CAN1_H/L pins and CAN3_H/L pins.

Pin No.	Pin Name	GPIO pin of MA35D1
---------	----------	--------------------

1	UR0_TX	PE14
2	UR0_RX	PE15*
3	TAMPER0	PH8
4	TAMPER1	PH9
5	CAN1_H	-
6	CAN3_H	-
7	CAN1_L	-
8	CAN3_L	-

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).

Table 3-30 UART0, Tamper Pin, CAN1_H/L and CAN3_H/L Header (J1) Pin Function (V2.1)

- RS232 Transceiver (U21) and DB9 Connector (CON13): The UART11 transceiver (SN75C3232EDR) and DB9 connector.

Function Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
UR11_nCTS	PL0	R245	EBI_AD11 / R196*
UR11_nRTS	PL1	R246	EBI_AD12 / R198*
UR11_RXD	PL2	R247	EBI_AD13 / R200*
UR11_TXD	PL3	R248	EBI_AD14 / R202*

Note *: No connection (NC) by default.

Table 3-31 UART11 (U21, CON13) Pin Function

- RS232 Transceiver (U22) and DB9 Connector (CON14): The UART16 transceiver (SN75C3232EDR) and DB9 connector.

Function Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
UR16_nCTS	PK0	R249	EBI_ADR8 / R199*
UR16_nRTS	PK1	R250	EBI_ADR9 / R201*
UR16_RXD	PK2	R251	EBI_ADR10 / R204*
UR16_TXD	PK3	R252	EBI_ADR11 / R205*

Note *: No connection (NC) by default.

Table 3-32 UART16 (U22, CON14) Pin Function

3.2.15 RS485

- RS485 Transceiver (U23) and Connector (CON15): The UART12 transceiver (SN65HVD11DR)

and connector.

Function Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
UR12_nRTS	PI1	R256	EBI_ADR1 / R178*
UR12_RXD	PI2	R259	EBI_ADR2 / R179*
UR12_TXD	PI3	R261	EBI_ADR3 / R180*
Note *: No connection (NC) by default.			

Table 3-33 UART12 (U23, CON15) Pin Function

- RS485 Transceiver (U24) and Connector (CON16): The UART14 transceiver (SN65HVD11DR) and connector.

Function Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
UR14_nRTS	PI5	R266	EBI_ADR5 / R181*
UR14_RXD	PI6	R267	EBI_ADR6 / R182*
UR14_TXD	PI7	R271	EBI_ADR7 / R184*
Note *: No connection (NC) by default.			

Table 3-34 UART14 (U24, CON16) Pin Function

- RS485 Transceiver A/B I/O and Ground VSS Header (J12, only supported in V2.1): This header includes the RS485 transceiver I/O pins A3_1, B3_1, A3_2, B3_2, and Ground VSS pins.

Pin No.	Pin Name	Pin No.	Pin Name
1	B3_1	2	B3_2
3	A3_1	4	A3_2
5	VSS	6	VSS
7	VSS	8	VSS

Table 3-35 RS485 Transceiver A/B I/O and Ground VSS Header (J12) Pin Function (V2.1)

3.2.16 CAN FD

- CAN Transceiver (U25) and Connector (CON17): The CAN1 transceiver (TCAN337GDR) and connector.

Function Name	GPIO Pin of MA35D1
CAN1_RXD	PL14
CAN1_TXD	PL15

Table 3-36 CAN1 (U25, CON17) Pin Function

- CAN Transceiver (U26) and Connector (CON18): The CAN3 transceiver (TCAN337GDR) and

connector.

Function Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
CAN3_RXD	PL10	R276	EBI_nWRH / R206*
CAN3_TXD	PL11	R278	EBI_nWRL / R207*
Note *: No connection (NC) by default.			

Table 3-37 CAN3 (U26, CON18) Pin Function

3.2.17 SWJ, SWD and ETM

- SWJ_nRESET Connector (J7): A jumper is needed if SWJ_nRESET should be connected with nRESET signal.
- SWJ Interface (CON19): Arm JTAG and SWD interface for tracing or debugging code.

Pin No.	Pin Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
	VDD3V3	-	-	-
2	VDD3V3	-	-	-
3	JTAG_nTRST	PG15*2	R294	EBI_AD4 / R193*1
4	VSS	-	-	-
5	JTAG_TDI	PG14*2	R292	EBI_AD3 / R190*1
6	VSS	-	-	-
7	JTAG_TMS / SW_DIO	PG13*2	R291	EBI_AD2 / R189*1
8	VSS	-	-	-
9	JTAG_TCK / SW_CLK	PG12*2	R290	EBI_AD1 / R187*1
10	VSS	-	-	-
11	VSS	-	-	-
12	VSS	-	-	-
13	JTAG_TDO	PG11*2	R289	EBI_AD0 / R185*1
14	VSS	-	-	-
15	SWJ_nRESET	nRESET	J7	-
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 3-38 SWJ Interface (CON19) Pin Function

- SWD Interface (J8): Arm SWD (Serial Wire Debug) interface for tracing or debugging code.

Pin No.	Pin Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
1	VDD3V3	-	-	-
2	SW_DIO	PG13*2	R291	EBI_AD2 / R189*1
3	SW_CLK	PG12*2	R290	EBI_AD1 / R187*1
4	SWJ_nRESET	nRESET	J7	-
5	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 3-39 SWD Interface (J8) Pin Function

- ETM Interface (CON20): Arm ETM (Embedded Trace Macrocell) interface is an optional debug component that enables reconstruction of program execution.

Pin No.	Pin Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
1	VDD3V3	-	-	-
2	ETM_SW_DIO	PG13*2	R295*1	SW_DIO / R291
3	VSS	-	-	-
4	ETM_SW_CLK	PG12*2	R296*1	SW_CLK / R290
5	VSS	-	-	-
6	ETM_JTAG_TDO	PG11*2	R297*1	JTAG_TDO / R289
7	-	-	-	-
8	ETM_JTAG_TDI	PG14*2	R299*1	JTAG_TDI / R292
9	-	-	-	-
10	ETM_nRESET	nRESET	R293*1	SWJ_nRESET / J7

11	-	-	-	-
12	TRACE_CLK	PL6	R303* ¹	EBI_AD5 / R195* ¹
13	-	-	-	-
14	TRACE_DATA0	PM12	R298* ¹	LCM_RST / R135
15	VSS	-	-	-
16	TRACE_DATA1	PM13	R300* ¹	BUZZER / R280
17	VSS	-	-	-
18	TRACE_DATA2	PM14	R301* ¹	CCAP0_I2C3_SDA / R97
19	VSS	-	-	-
20	TRACE_DATA3	PM15	R302* ¹	CCAP0_I2C3_SCL / R99

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 3-40 ETM Interface (CON20) Pin Function

3.2.18 USB Virtual COM (VCOM) Port

- USB VCOM Port (CON21, USB Micro-AB Receptacle): The microcontroller NUC123ZD4AN0 (U29) 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-B connector (CON21) 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 (U29): The microcontroller NUC123ZD4AN0 (U29) acts as an USB VCOM device to communicate data between the UART0 port of MA35D1 chip and USB host of PC.
- NUC123 ICE Interface (J9): The ICE interface of NUC123ZD4AN0 microcontroller (U29) for programming the internal Flash of NUC123 MCU. The internal Flash of NUC123 MCU had been programmed and acts as an USB VCOM device before this NuMaker-BASE-MA35D1B1 board be delivered by Nuvoton.

Pin No.	Pin Name	Functions
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 3-41 NUC123 ICE Interface (J9) Pin Function

3.2.19 Reset and RTC Wake-up Key Buttons

- Reset Key Button (SW2): Press this key to reset the MA35D1 target chip on the NuMaker-SOM-MA35D16A81 board.
- RTC Wake-up Key Button (SW3): Press this key to wake up the MA35D1 target chip on the NuMaker-SOM-MA35D16A81 board from standby state. (This function is reserved in V2.0 and the SW3 key button is not mounted on board in V2.1)

3.2.20 TFT LCD Connector

- LCM Connector (CON9):

Pin No.	Pin Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
1	VDD3V3	-	-	-
2	VDD3V3	-	-	-
3	LCM_CS	PK6	R151	-
4	LCM_BLEn	PK7	R152	-
5	LCM_DEN	PK4	R149	-
6	LCM_VSYSNC	PG8	R153	-
7	LCM_HSYNC	PG9	R147	-
8	LCM_CLK	PG10	R148	-
9	LCM_DATA23	PH15	R177	-
10	LCM_DATA22	PH14	R176	-
11	LCM_DATA21	PH13	R175	-
12	LCM_DATA20	PH12	R174	-
13	LCM_DATA19	PC15	R173	-
14	LCM_DATA18	PC14	R172	-
15	LCM_DATA17	PC13	R171	-
16	LCM_DATA16	PC12	R170	-
17	LCM_DATA15	PH7	R169	-
18	LCM_DATA14	PH6	R168	-
19	LCM_DATA13	PH5	R167	-
20	LCM_DATA12	PH4	R166	-
21	LCM_DATA11	PH3	R165	-
22	LCM_DATA10	PH2	R164	-
23	LCM_DATA9	PH1	R163	-

24	LCM_DATA8	PH0	R162	-
25	LCM_DATA7	PI15	R161	-
26	LCM_DATA6	PI14	R160	-
27	LCM_DATA5	PI13	R159	-
28	LCM_DATA4	PI12	R158	-
29	LCM_DATA3	PI11	R157	-
30	LCM_DATA2	PI10	R156	-
31	LCM_DATA1	PI9	R155	-
32	LCM_DATA0	PI8	R154	-
33	-	-	-	-
34	-	-	-	-
35	-	-	-	-
36	-	-	-	-
37	LCM_PWM	PK5	R150	
38	LCM_RST	PM12	R135	nRESET / R138*
39	VSS	-	-	-
40	VSS	-	-	-
41	LCM_XP	PB15	R144	-
42	LCM_VSENSE	PB11	R146*	LCM_I2C1_SCL / R145
43	LCM_XM	PB14	R142	-
44	LCM_YM	PB12	R137	-
45	-	-	-	-
46	LCM_YP	PB13	R139	-
47	VSS	-	-	-
48	VSS	-	-	-
49	LCM_I2C5_SCL	PJ13	R143	EBI_ADR13 / R188*
50	LCM_I2C5_SDA	PJ12	R141	EBI_ADR12 / R186*
51	TOUCH_INT	PD12	R136	EBI_nCS1 / R197*
52	-	-	-	-

53	LCM_I2C1_SDA	PB10	R140	EBI_MCLK / R208*
54	LCM_I2C1_SCL	PB11	R145	LCM_VSENSE / R146*
55	-	-	-	-
56	-	-	-	-
57	-	-	-	-
58	-	-	-	-
59	VSS	-	-	-
60	VSS	-	-	-
61	-	-	-	-
62	-	-	-	-
63	VDD5V	-	-	-
64	VDD5V	-	-	-
Note *: No connection (NC) by default.				

Table 3-42 LCM Connector (CON9) Pin Function

3.2.21 Audio Codec

- Speaker Pads (T14 and T15): To connect a speaker to output audio sound.
- Microphone (M1): An on-board microphone for audio sound input.
- Headset Jack (CON11): A headset input jack that follows CTIA definition.
- Audio Codec Device (U18): Nuvoton NAU88C22YG is audio codec device that integrates microphone input, speaker output and headphone output for audio application on this NuMaker-BASE-MA35D1B1 board.

Function Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
I2S0_MCLK	PN15	R222	SC0_nCD / R239*
I2S0_LRCK	PK12	R223	SC0_CLK / R241*
I2S0_BCLK	PK13	R226	SC0_DAT / R242*
I2S0_DI	PK14	R229	SC0_RST / R243*
I2S0_DO	PK15	R231	SC0_PWR / R244*
Note *: No connection (NC) by default.			

Table 3-43 I2S0 (U18) Pin Function

Function Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
---------------	--------------------	----------------------	------------------------

I2S_I2C2_SDA	PB8	R220	-
I2S_I2C2_SCL	PB9	R312/R221	EBI_ALE / R191*
Note *: No connection (NC) by default.			

Table 3-44 I2C2 (U18) Pin Function

Function Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
AUDIO_JKEN#	PD13	R233	EBI_nCS2 / R203*
AUDIO_JKDET	PI0	R234	EBI_ADR0 / R183*
Note *: No connection (NC) by default.			

Table 3-45 Audio Codec (U18) Control Pin Function

3.2.22 SIM Card Slot

- SC0 SIM Card (CON12): SIM card slot for SC0.

Function Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
SC0_nCD	PN15	R239*	I2S0_MCLK / R222
SC0_CLK	PK12	R241*	I2S0_LRCK / R223
SC0_DAT	PK13	R242*	I2S0_BCLK / R226
SC0_RST	PK14	R243*	I2S0_DI / R229
SC0_PWR	PK15	R244*	I2S0_DO / R231
Note *: No connection (NC) by default.			

Table 3-46 SC0 SIM Card Connector (CON12) Pin Function

3.2.23 Key Buttons, LEDs, Buzzer and Fan Control

- User-defined Key Buttons (KEY_1, KEY_2 and KEY_3):

KEY_#	SW#	GPIO pin of MA35D1	Pull-up Power
KEY_1	SW5	PD8	DC 3.3V
KEY_2	SW6	PD9	DC 3.3V
KEY_3	SW7	PF14	DC 1.8V*
Note *: The power group of this GPIO PF14 pin belongs to the VDDIO9 power domain of MA35D1 series, the default voltage of VDDIO9 (power input F_VDDIO) is VDD1V8 (DC 1.8V) on the NuMaker-SOM-MA35D16A81 board. Please make sure the power group voltage of this GPIO PF14 pin is set at the equal voltage 1.8V on both NuMaker-SOM-MA35D16A81 board and NuMaker-BASE-MA35D1B1 board.			

Table 3-47 Key Buttons (KEY_1, KEY_2 and KEY_3) Pin Function

- User Indication LEDs (LED_0 and LED_1):

LED_#	Function / Color	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
LED_0	LEDG4 / Green	PJ14	R279	EBI_ADR14 / R192*
LED_1	LEDR1 / Red	PJ15	R281	EBI_ADR15 / R194*
Note *: No connection (NC) by default.				

Table 3-48 LEDs (LED_0 and LED_1) Pin Function

- Buzzer Pads (T23 and T24): To connect a buzzer to output sound.
- Fan Control (FAN_EN, FAN_PWM and FAN_SP): To turn on or turn off the fan by FAN_EN (PI4) pin high or low state. (only supported in V2.1)

Function Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
FAN_EN	PI4	R327	EBI_ADR4 / R325*
FAN_PWM	PI4	R328*	EBI_ADR4 / R325*
FAN_SP	PL7	R329	EBI_AD6 / R326*
Note *: No connection (NC) by default.			

Table 3-49 Fan Control (FAN_EN, FAN_PWM and FAN_SP) Pin Function (V2.1)

- 2-pin Fan Connector (J10, only supported in V2.1):

Pin No.	Pin Name	Function	GPIO pin of MA35D1	Type
1	VSS	GND	-	Power
2	VDD5V	Controlled DC 5V by FAN_EN	PI4	Output

Table 3-50 2-pin Fan Connector (J10) Pin Function (V2.1)

- 4-pin Fan Connector (J11, only supported in V2.1): This connector is NC by default.

Pin No.	Pin Name	Function	GPIO pin of MA35D1	Type
1	VSS	GND	-	Power
2	VDD5V	Fixed DC 5V	-	Power
3	FAN_SP	Fan speed signal	PL7	Input
4	FAN_PWM	Fan PWM signal	PI4	Output

Table 3-51 4-pin Fan Connector (J11) Pin Function (V2.1)

3.2.24 MEMS Digital Microphone

- MEMS Digital Microphone (U31): The MP34DT01-M is a digital MEMS microphone.

Function Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
I2S1_BCLK	PL9	R316	EBI_AD8 / R314*
I2S1_DI	PD10	R317	EBI_AD9 / R315*
Note *: No connection (NC) by default.			

Table 3-52 MEMS Digital Microphone (U31) Pin Function

3.2.25 MEMS G-Sensor

- MEMS G-Sensor (U32): The MPU6500 is a 6-axis motion tracking device that combines a 3-axis gyroscope, 3-axis accelerometer.

Function Name	GPIO pin of MA35D1	Default Connected R#	Conflict Function / R#
I2C1_SDA	PB10	R140	-
I2C1_SCL	PB11	R145	LCM_VSENSE / R146*
MPU6500_INT	PL8	R320	EBI_AD7 / R313*
Note *: No connection (NC) by default.			

Table 3-53 MEMS G-Sensor (U32) Pin Function

3.3 7" TFT LCD Daughter Board

3.3.1 Front View

Figure 3-5 shows the main components from the front view of 7" TFT LCD daughter board and an on-board 7" 4-wire resistive touch TFT LCD panel.

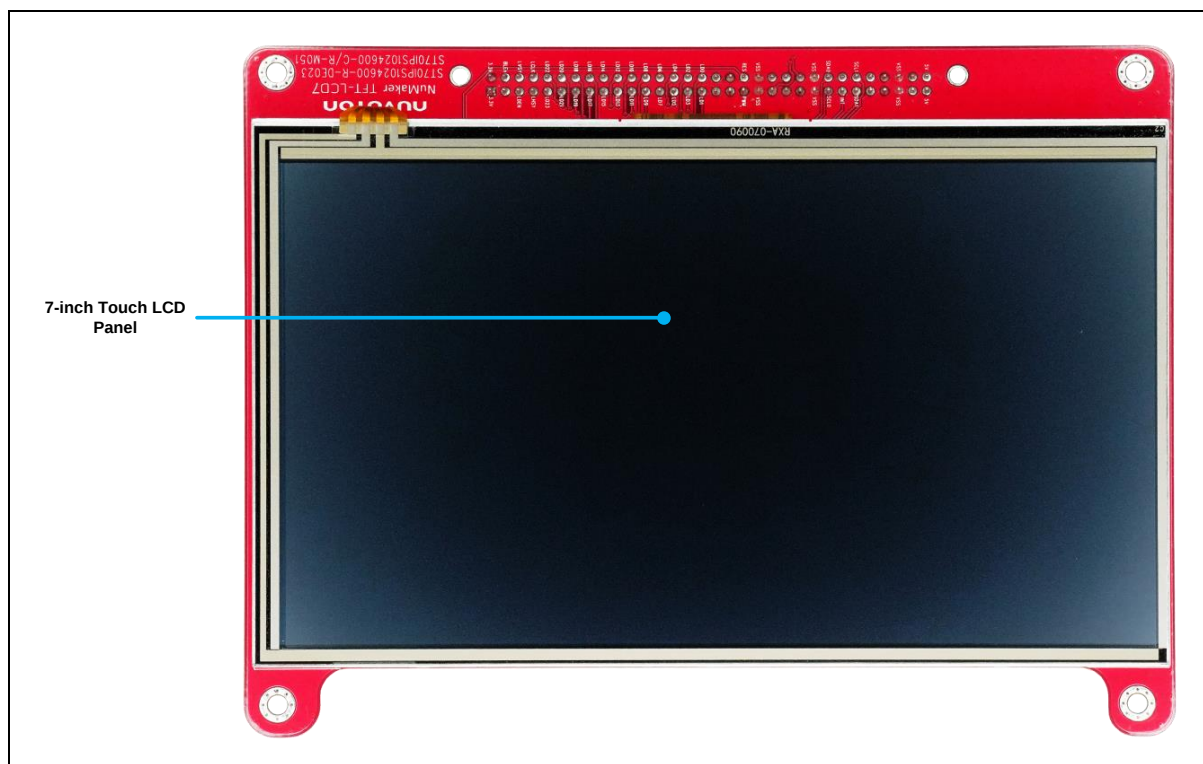


Figure 3-5 Front View of 7" TFT LCD Daughter Board

3.3.2 Rear View

Figure 3-6 shows the main components from the rear view of 7" TFT LCD daughter board.

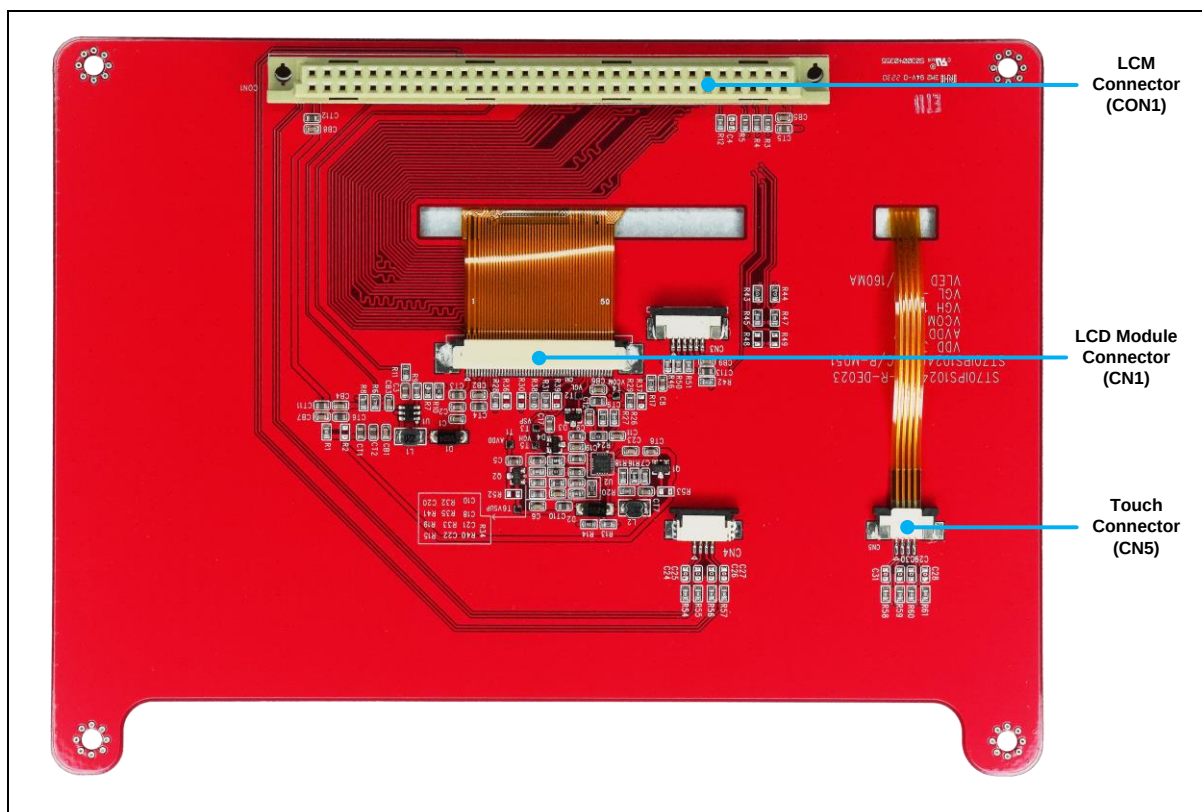


Figure 3-6 Rear View of 7" TFT LCD Daughter Board

3.3.3 Connectors

- LCD Module Connector (CN1): FPC (pitch-0.5mm x 50) connector of TFT LCD module.
- LCM Connector (CON1): To connect with the LCM connector (CON9) of the NuMaker-BASE-MA35D1B1 board.
- Touch Connector (CN5): 4-wire resistive-touch connector of TFT LCD touch screen.

4 QUICK START

This chapter guides users step by step to start the NuMicro NuMaker-HMI-MA35D1-S1 evaluation environment based on the assembled boards: NuMaker-SOM-MA35D16A81 board, NuMaker-BASE-MA35D1B1 board and TFT LCD daughter board. After the steps are completed successfully, users can see the demonstration on the LCD screen and try to operate the demonstration on the LCD screen by finger touch. For more detailed information and description about the board hardware setting and configuration of NuMaker-SOM-MA35D16A81 board and NuMaker-BASE-MA35D1B1 board, please see the Hardware Configuration chapter.

4.1 Hardware Setup and Power On

4.1.1 Configure Power-on Setting

The second step is to make sure the power-on setting for the booting source selection on the DIP Switch (SW4) that followed the correct ON/OFF states shown the following Table 4-3 and 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 eMMC1 NAND Flash memory device mounted on the NuMaker-SOM-MA35D16A81 board when power is supplied to the NuMaker-BASE-MA35D1B1 board.

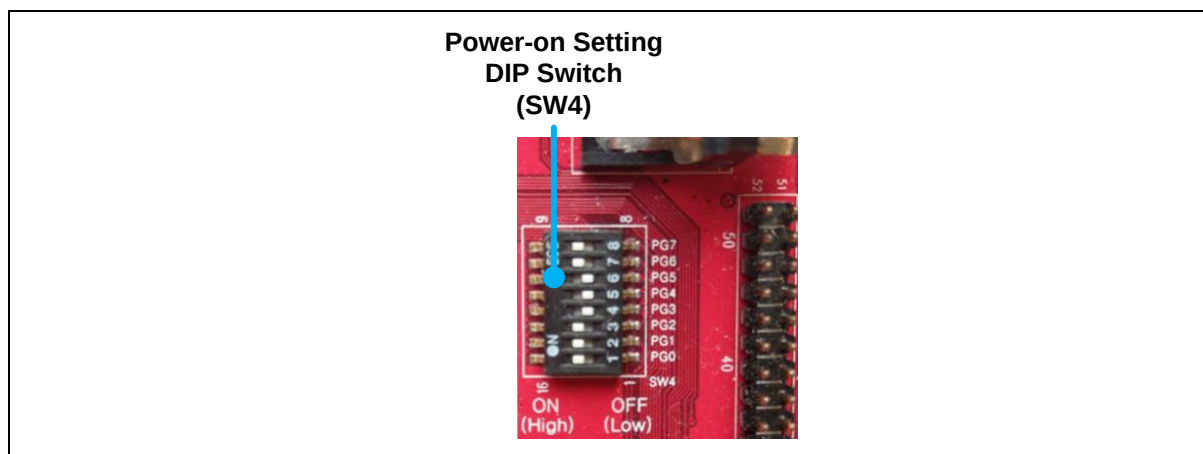


Figure 4-1 Power-on Setting DIP Switch (SW4)

- Options for secure boot enable or disable:

SW4.1 / 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:

SW4.2 / 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 eMMC1 Boot Source IO Voltage Configuration

- Options for booting source selection:

SW4.4 / PG3*	SW4.3 / PG2*	Boot Source
Low	Low	QSPI0 Flash
Low (OFF)	High (ON)	SD/eMMC
High	Low	NAND Flash
High	High	USB
Note *: These GPIO PG2 and PG3 are internal weakly pull-down.		

Table 4-3 SD/eMMC Boot Source Configuration

- Options for booting from eMMC1 NAND Flash memory device:

SW4.7 / PG6* ¹	Boot from SD/eMMC
Low (OFF)	SD0/eMMC0 Boot
High (ON)	SD1/eMMC1 Boot*²
Note * ¹ : The GPIO PG6 is internal weakly pull-down.	
Note * ² : The eMMC1 NAND Flash memory device is on the NuMaker-SOM-MA35D16A81 board.	

Table 4-4 eMMC1 Boot Source Configuration

SW4.8 / 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 : The eMMC1 NAND Flash memory device is on the NuMaker-SOM-MA35D16A81 board.	

Table 4-5 eMMC1 NAND Flash Device Boot Source eMMC 8-bit Configuration

4.1.2 Power On the NuMaker-BASE-MA35D1B1 Board

The third step is to plug the head of an adapter that can supply 5V/2A power into the power jack (CON1) on the NuMaker-BASE-MA35D1B1 board. Then, switch on the Slide Switch (SW1) to the ON side to supply power on the NuMaker-BASE-MA35D1B1 board.

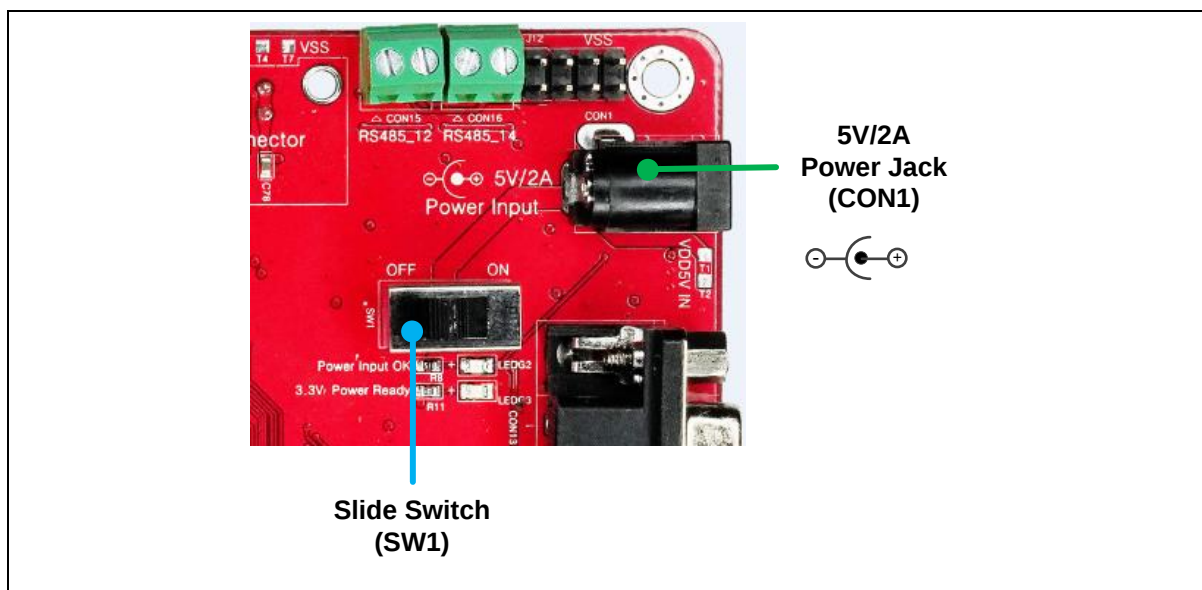


Figure 4-2 Power Jack (CON1) and Slide Switch (SW1)

4.1.3 VCOM Port (Optional)

User can connect the USB micro-B connector (CON21) 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. User also needs to select the right serial COM port on the PC and setup the serial port at 115200 Baud rate, 8-bit Data, none Parity bit, 1-bit Stop bit and none Flow Control.

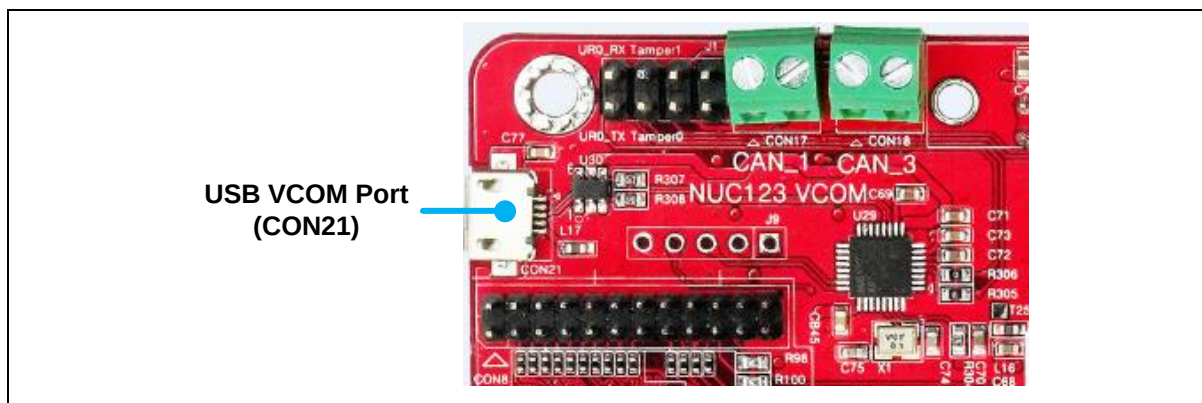


Figure 4-3 USB VCOM Port (CON21)

4.2 Embedder Demos

After the NuMaker-HMI-MA35D1-S1 board is successfully powered on, the MA35D1 target chip will enter the Linux OS and the TFT LCD screen will show the main screen as Figure 4-4. User can see six kinds of demonstration blocks on the TFT LCD screen and can try to operate each demonstration on the TFT LCD screen by finger touch. For more detailed information about these demonstrations, please visit and browse [Nuvoton website](http://www.nuvoton.com) and search the related description or documents on the website.



Figure 4-4 Main Screen of Demonstration

4.2.1 H.264 Video Playback

This demonstration displays MP4 videos via VC8000 h.264 decoder embedded in the target chip MA35D1 microprocessor. The display result on the TFT LCD screen is shown as Figure 4-5.



Figure 4-5 H.264 Video Playback Demonstration

4.2.2 ML People Counting

This machine learning (ML) demonstration counts the people captured from the USB CMOS camera and shows the people counting result on the TFT LCD screen as Figure 4-6.



Figure 4-6 ML People Counting Demonstration

4.2.3 2D Accelerator

The MA35D1 series supports the 2D hardware acceleration engine, Figure 4-7 shows the QT demonstration result that the MA35D1 uses the 2D engine through DirectFB to show the mice Blit pictures on the TFT LCD screen.



Figure 4-7 2D Accelerator Demonstration

4.2.4 VoIP Demonstration

This demonstration supports a portable and modular SIP User-Agent with audio and video through wire connection between the NuMaker-HMI-MA35D1-S1 board and PC/NB/smart-phone. The result is shown in Figure 4-8.



Figure 4-8 VoIP Demonstration

4.2.5 Data Security

This demonstration shows how to use a Secure Key (SW key) to restore the protected data, the Secure Key is encrypted by the key stored in OTP (One-Time Program) in the OP-TEE OS. Figure 4-9 shows the data flow and structure about this demonstration.

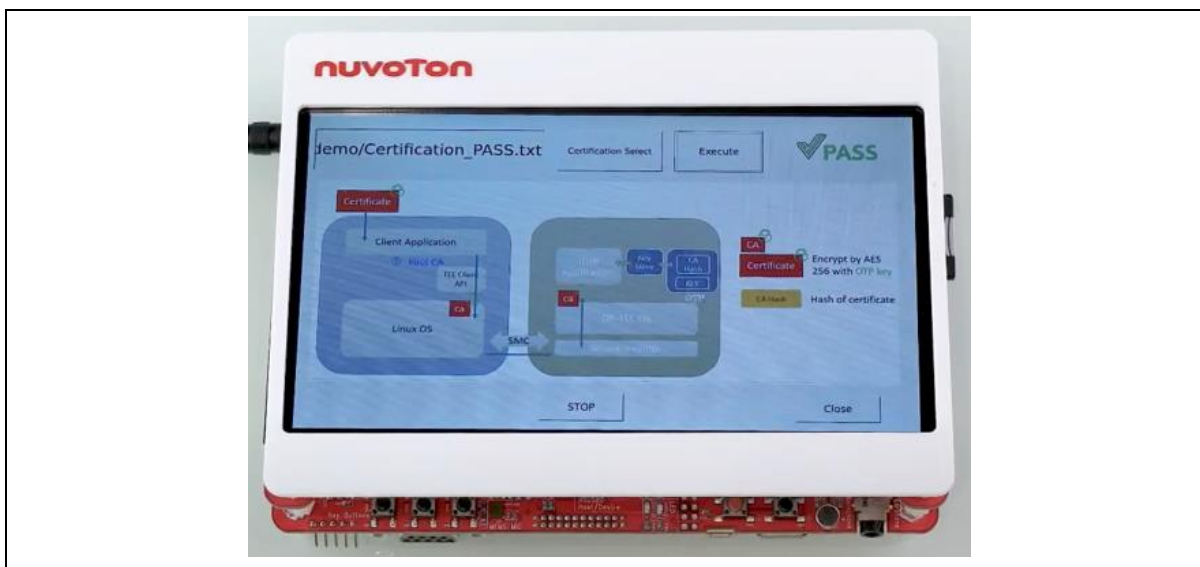


Figure 4-9 Data Security Demonstration

4.2.6 Keyword Spotting by RTP M4

This demonstration describes an example about how to use real-time processor (RTP) Arm Cortex-M4 embedded in the MA35D1 series to wake up the Arm Cortex A35 core in Deep Power-down (DPD) mode. When A35 core enters DPD mode, the RTP M4 runs the Keyword Spotting code and identifies the keyword voice input from the microphone on the NuMaker-HMI-MA35D1-S1 board. After the keyword voice is matched, the RTP M4 will generate an interrupt to wake up the A35 core. Figure 4-10 shows the data flow and structure about the demonstration.



Figure 4-10 Keyword Spotting by RTP M4 Demonstration

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](https://www.nuvoton.com) and search for the Arm Cortex-A35 MPUs product line for the MA35D1 series products from the “Products” menu on the [Nuvoton website](https://www.nuvoton.com) homepage.

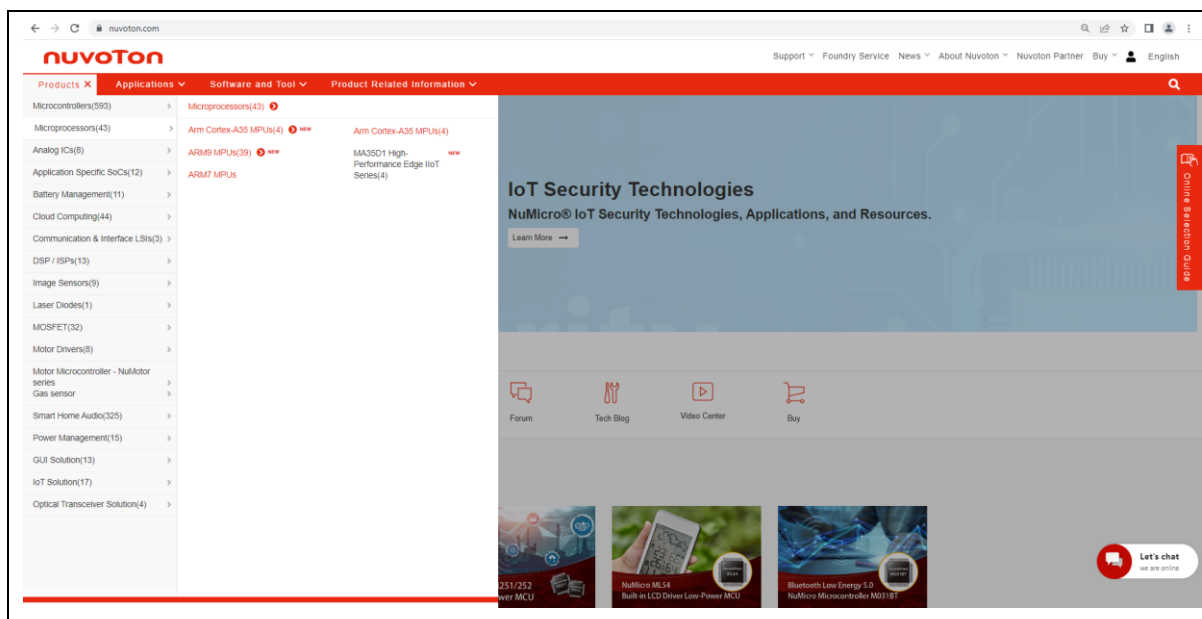


Figure 5-1 Nuvoton Website

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](https://github.com). The related Github resources are listed and shown as Figure 5-2.

9. MA35D1

- [Yocto](#)
- [Buildroot](#)
- [TF-A](#)
- [OP-TEE](#)
- [U-Boot](#)
- [Linux-5.4.y](#)
- [Linux-5.10.y](#)
- [Linux Applications](#)
- [RTP](#)
- [OpenWrt](#)
- [NuWriter](#)
- [Docker](#)
- [VMWare Linux develop environment](#)
 - username: user
 - password: user

Figure 5-2 MA35D1 GitHub Resources

6 HARDWARE SCHEMATICS

6.1 NuMaker-SOM-MA35D16A81 Schematics

6.1.1 System Block

Figure 6-1 shows the system block of the NuMaker-SOM-MA35D16A81 board.

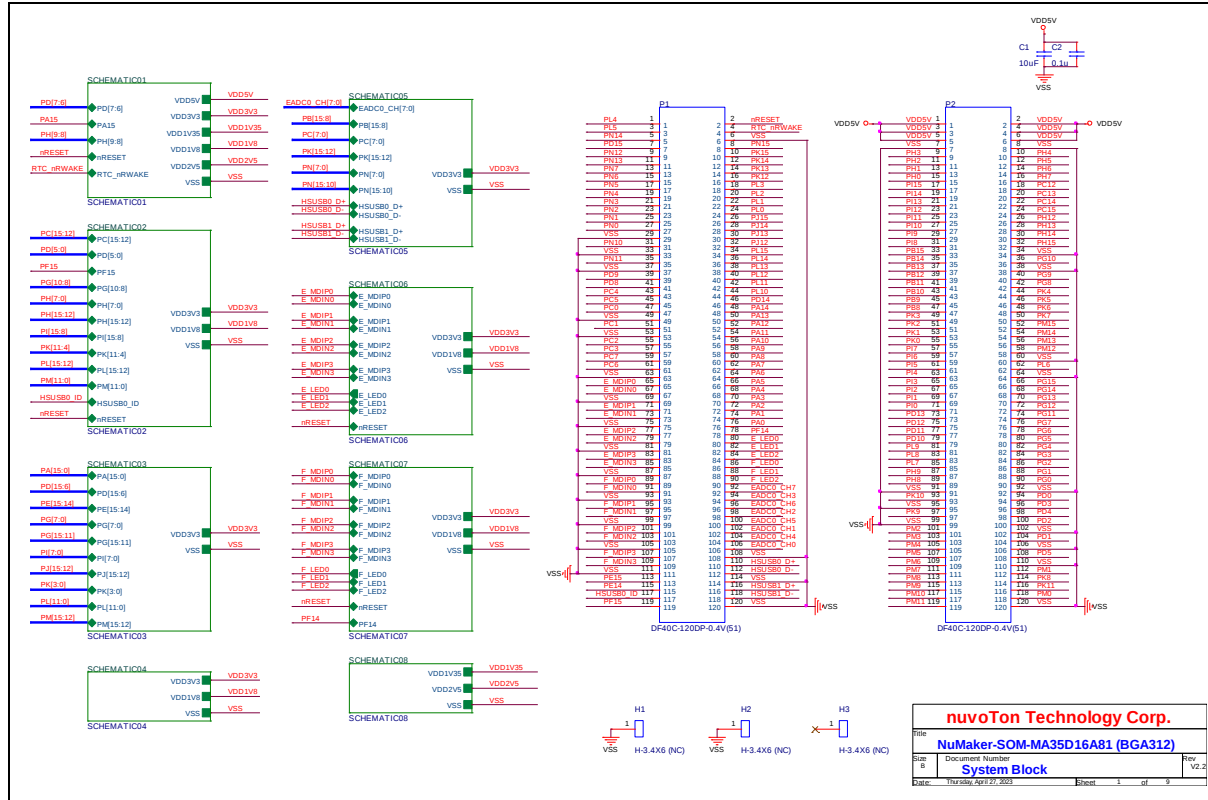


Figure 6-1 System Block

6.1.2 PMIC, Crystal and Power Filter Schematic

Figure 6-2 shows the PMIC, crystal and power filter circuit of the NuMaker-SOM-MA35D16A81 board.

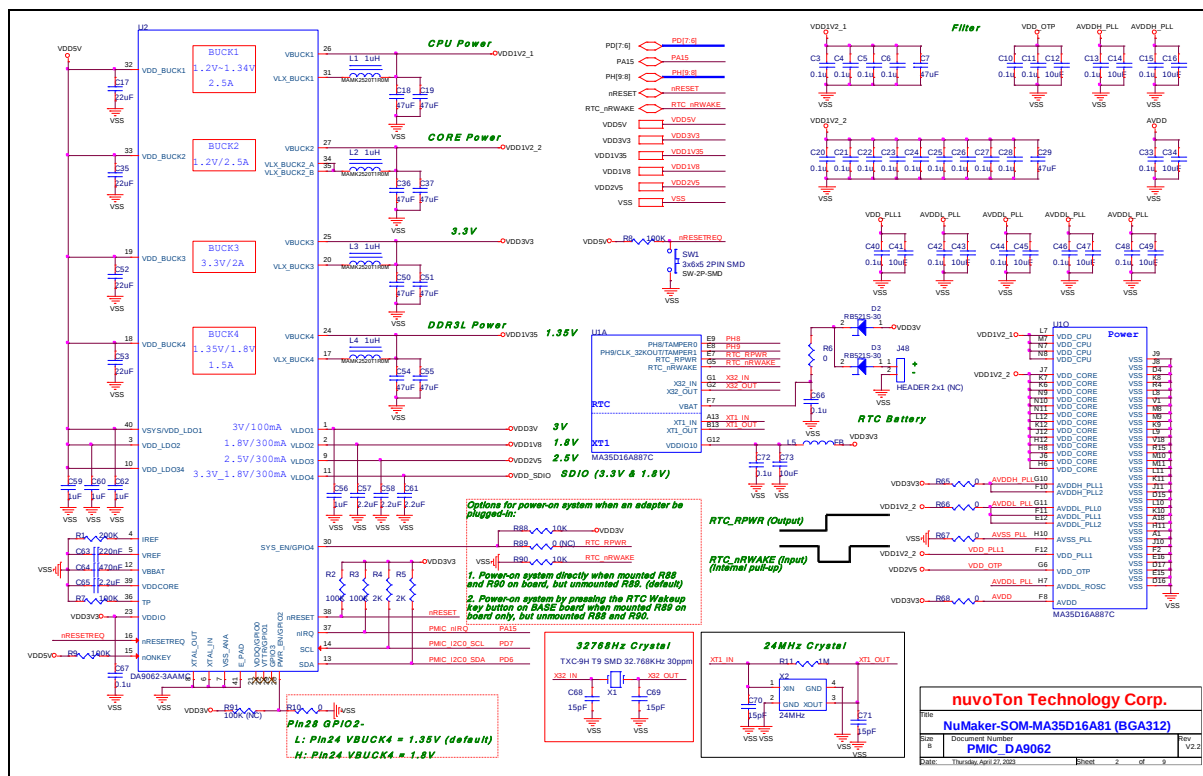


Figure 6-2 PMIC, Crystal and Power Filter Schematic

6.1.3 Power Group 0, 2, 4 and 5 Schematic

Figure 6-3 shows the power group 0, 2, 4 and 5 circuit of the NuMaker-SOM-MA35D16A81 board.

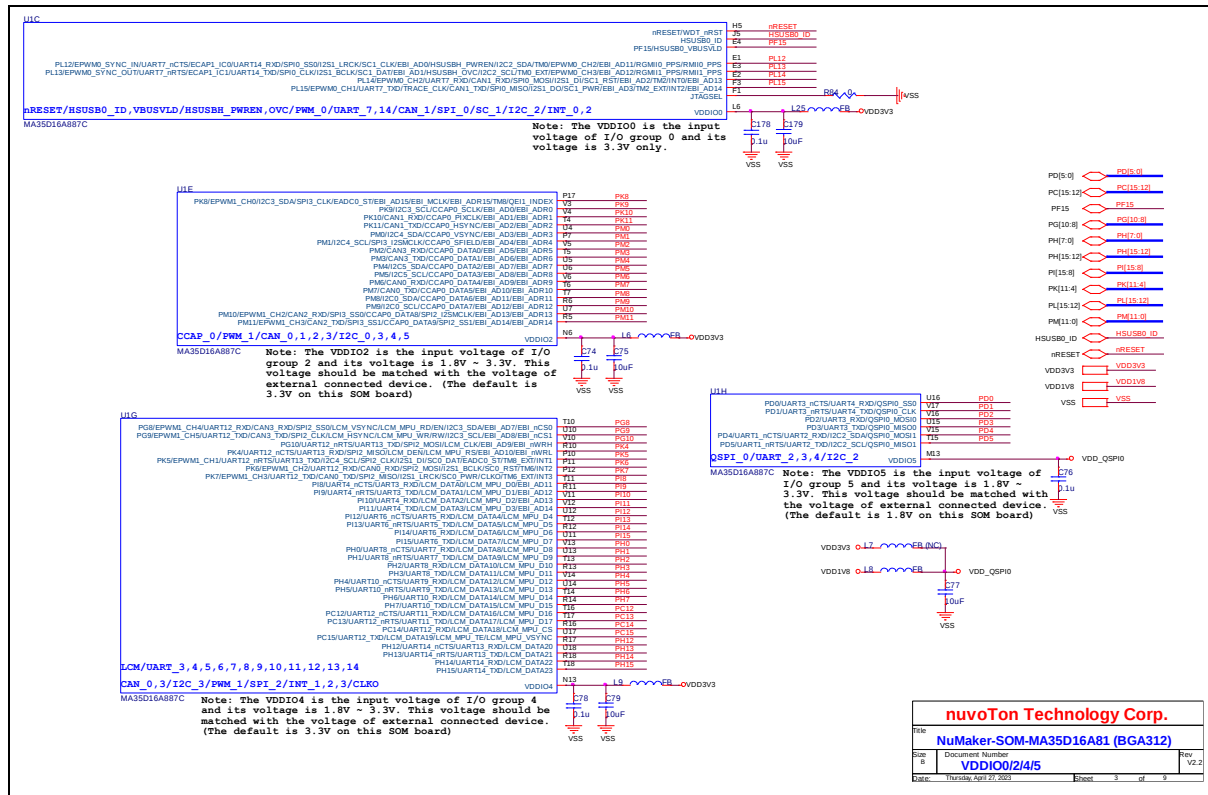
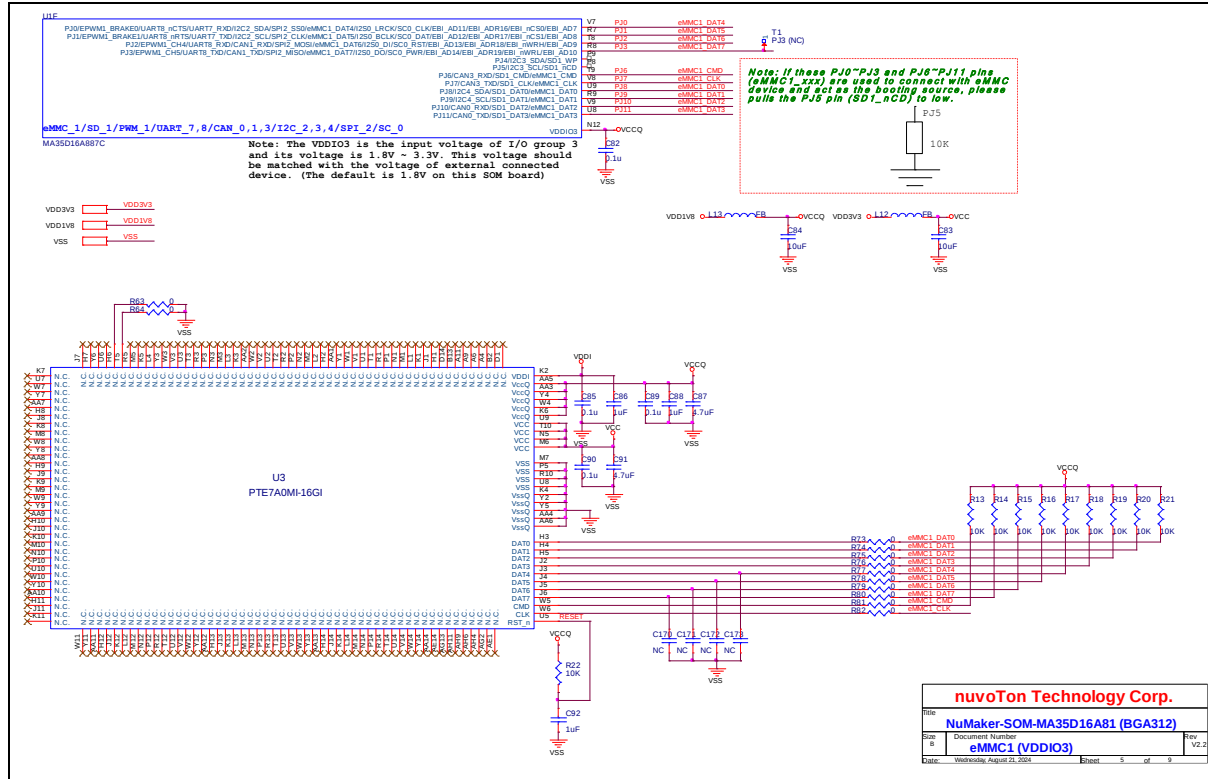


Figure 6-3 Power Group 0, 2, 4 and 5 Schematic

6.1.5 Power Group 3 (eMMC1_PJ) Schematic

Figure 6-5 shows the power group 3 (SD1/eMMC1 on PJ port) dedicated for the on-board eMMC NAND Flash memory device circuit of the NuMaker-SOM-MA35D16A81 board.



6.1.7 Power Group 8 (RGMII0 PE) Schematic

Figure 6-7 shows the power group 8 dedicated for the RGMII0 (PE port) PHY circuit of the NuMaker-SOM-MA35D16A81 board.

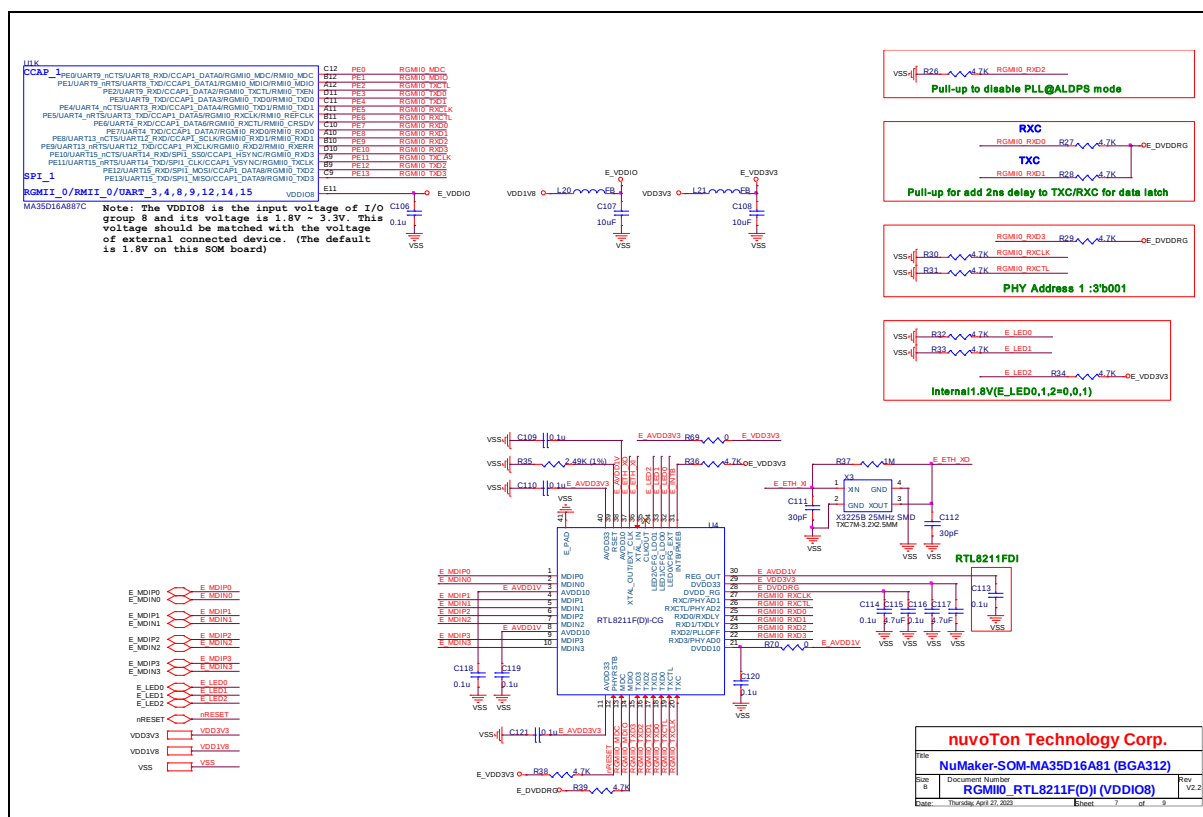


Figure 6-7 Power Group 8 (RGMII0_PE) Schematic

6.1.8 Power Group 9 (RGMII1_PF) Schematic

Figure 6-8 shows the power group 9 dedicated for the RGMII1 (PF port) PHY circuit of the NuMaker-SOM-MA35D16A81 board.

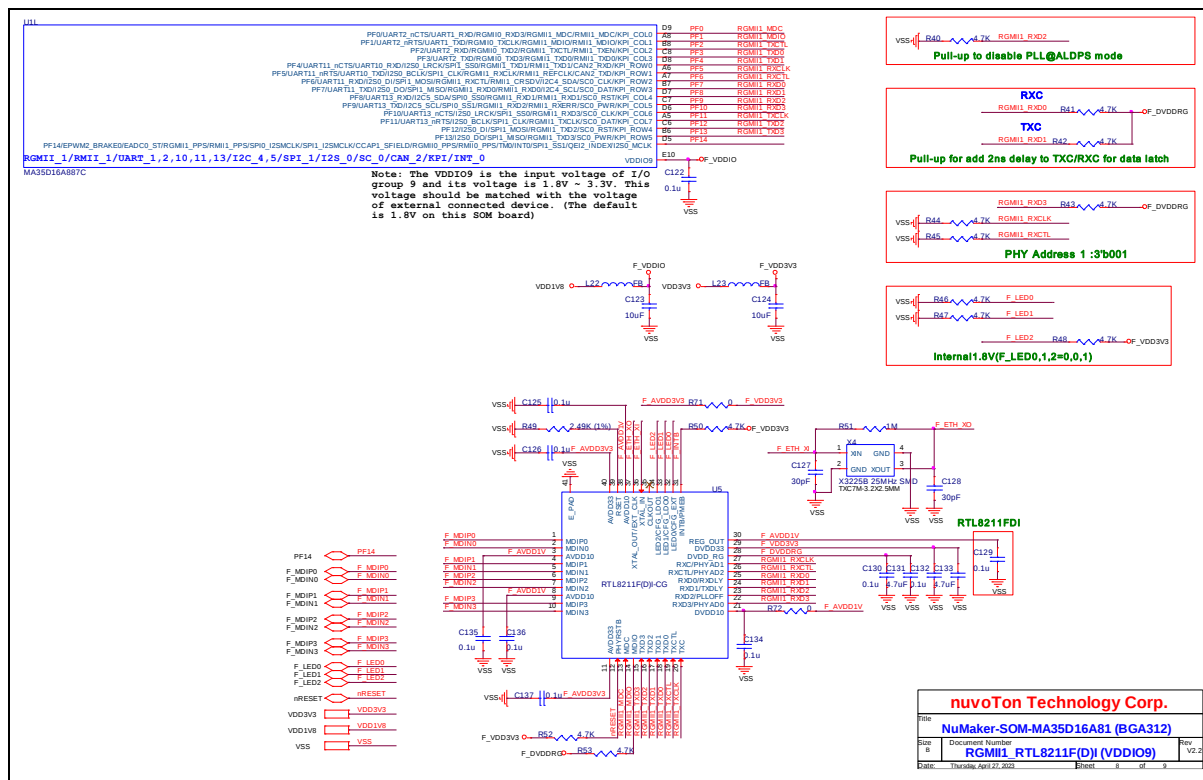


Figure 6-8 Power Group 9 (RGMII1_PF) Schematic

6.1.9 DDR PHY Schematic

Figure 6-9 shows the DDR PHY circuit of the NuMaker-SOM-MA35D16A81 board.

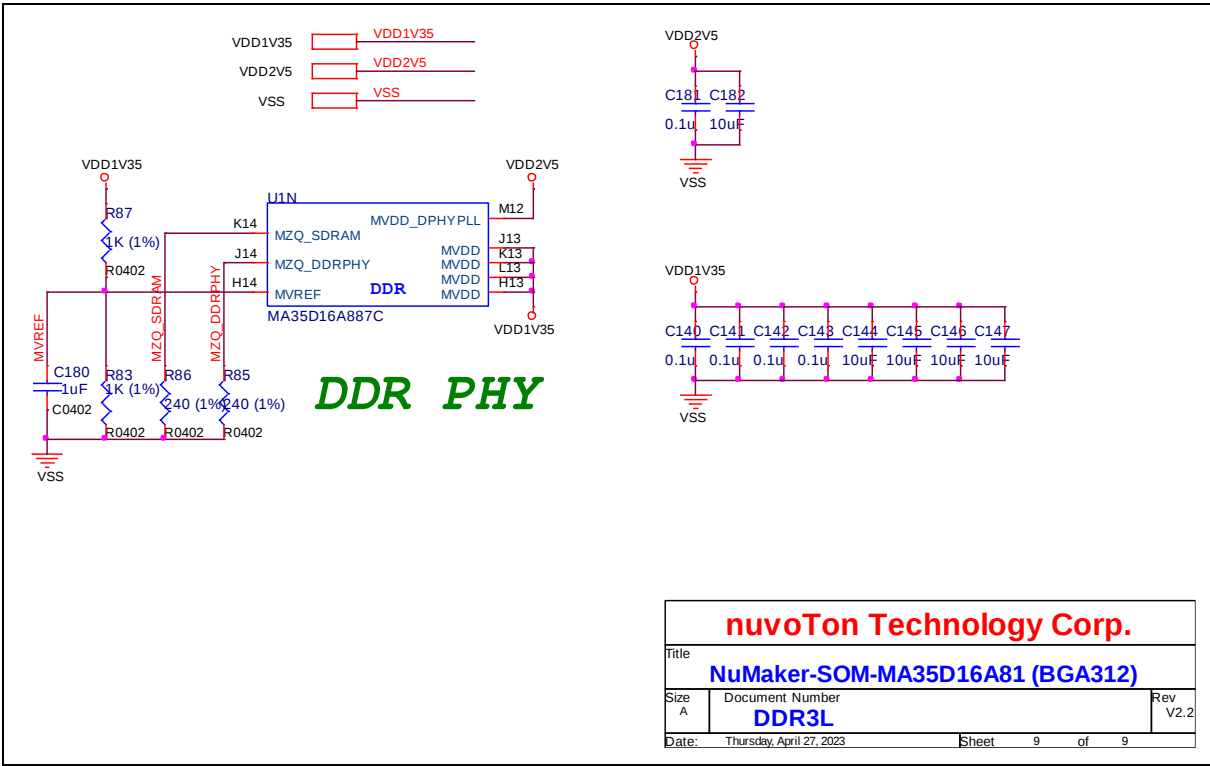


Figure 6-9 DDR PHY Schematic

6.1.10 PCB Placement

Figure 6-10 and Figure 6-11 show the front and rear PCB component placement of the NuMaker-SOM-MA35D16A81 board.

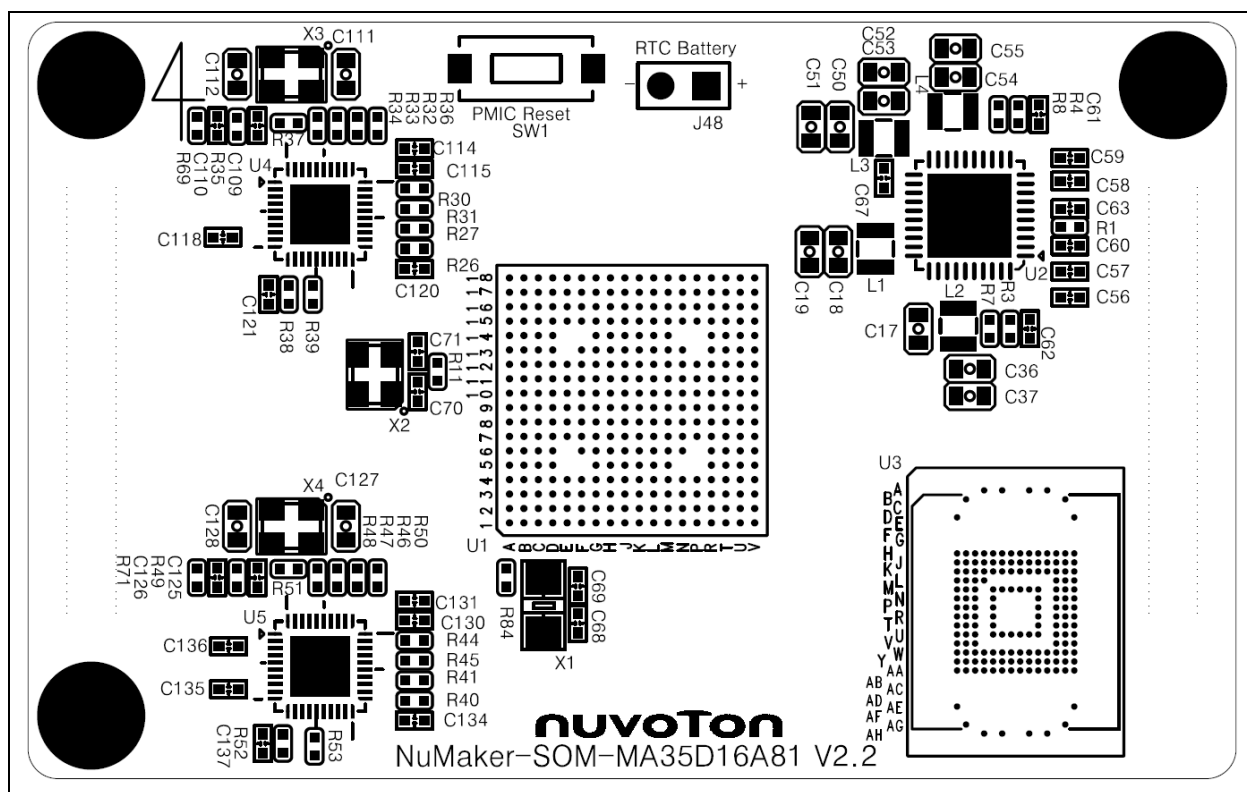


Figure 6-10 Front PCB Placement of NuMaker-SOM-MA35D16A81 Board

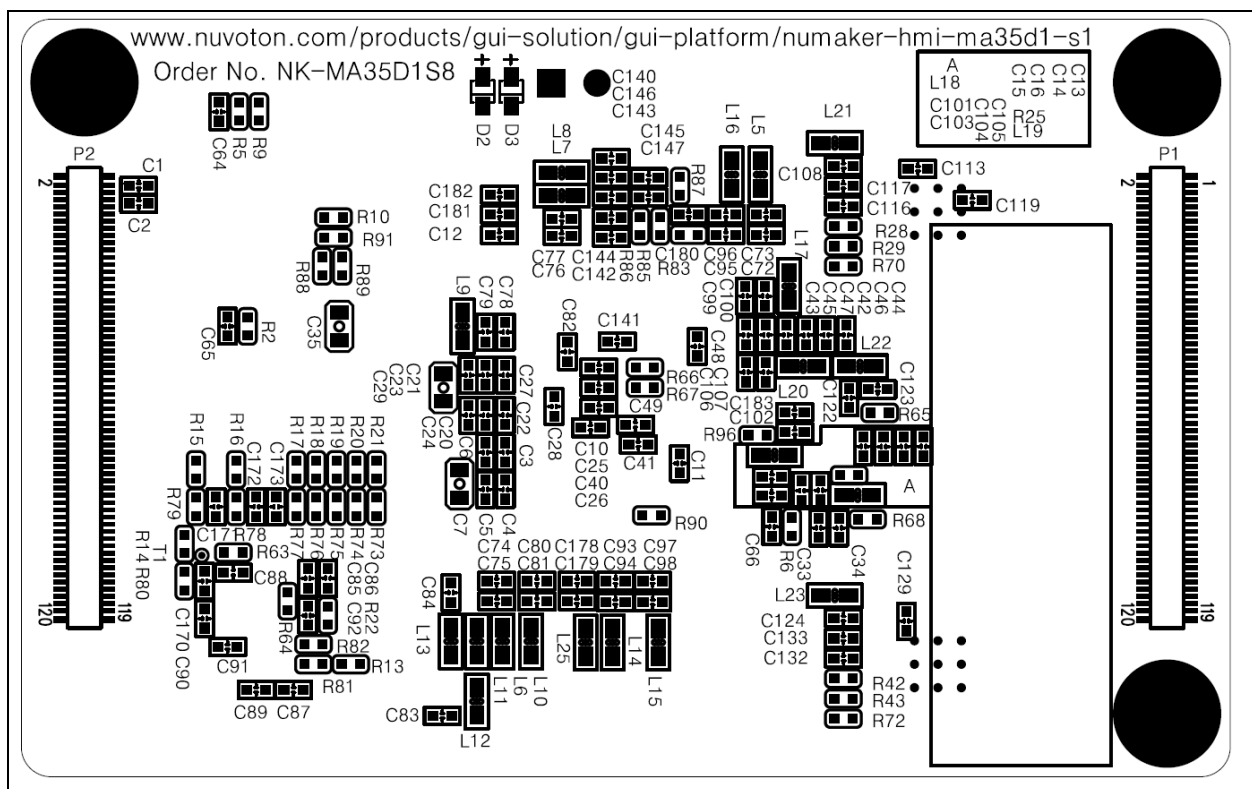


Figure 6-11 Rear PCB Placement of NuMaker-SOM-MA35D16A81 Board

6.2.2 SOM Connectors Schematic

Figure 6-13 shows the SOM Connectors circuit of the NuMaker-BASE-MA35D1B1 board.

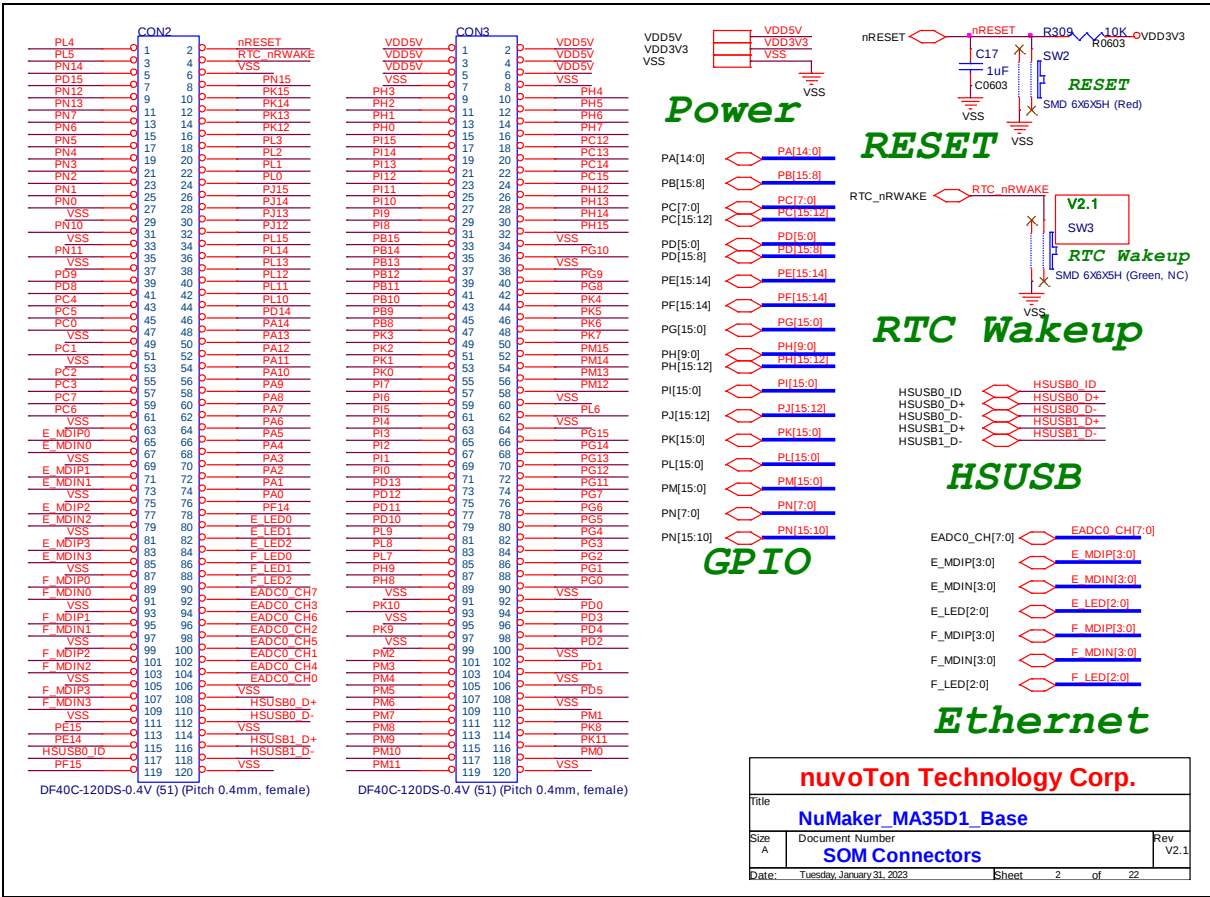


Figure 6-13 SOM Connectors Schematic

6.2.3 Power-on Setting and NAND Flash Schematic

Figure 6-14 shows the power-on setting and NAND Flash device circuit of the NuMaker-BASE-MA35D1B1 board.

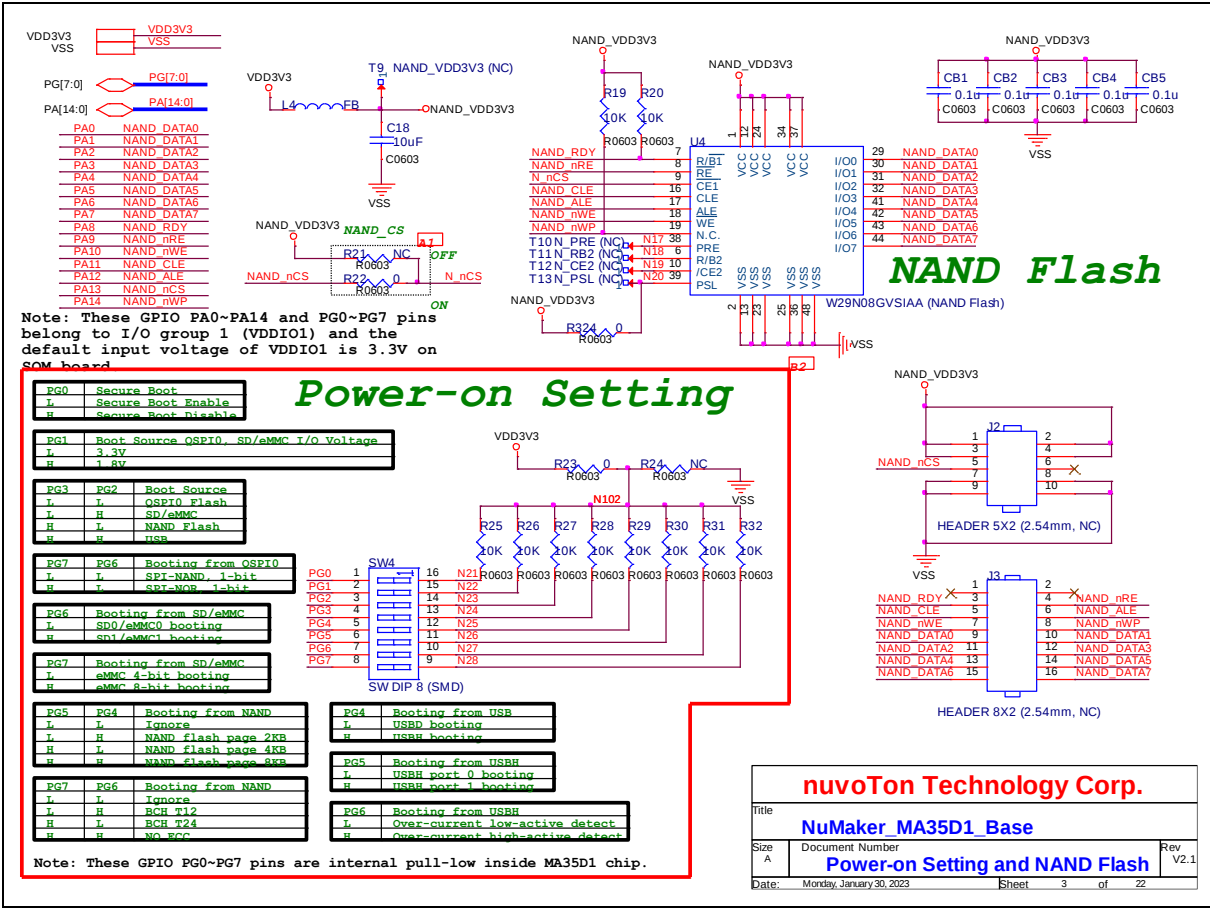


Figure 6-14 Power-on Setting and NAND Flash Schematic

6.2.4 SD0 Schematic

Figure 6-15 shows the SD0 card slot circuit of the NuMaker-BASE-MA35D1B1 board.

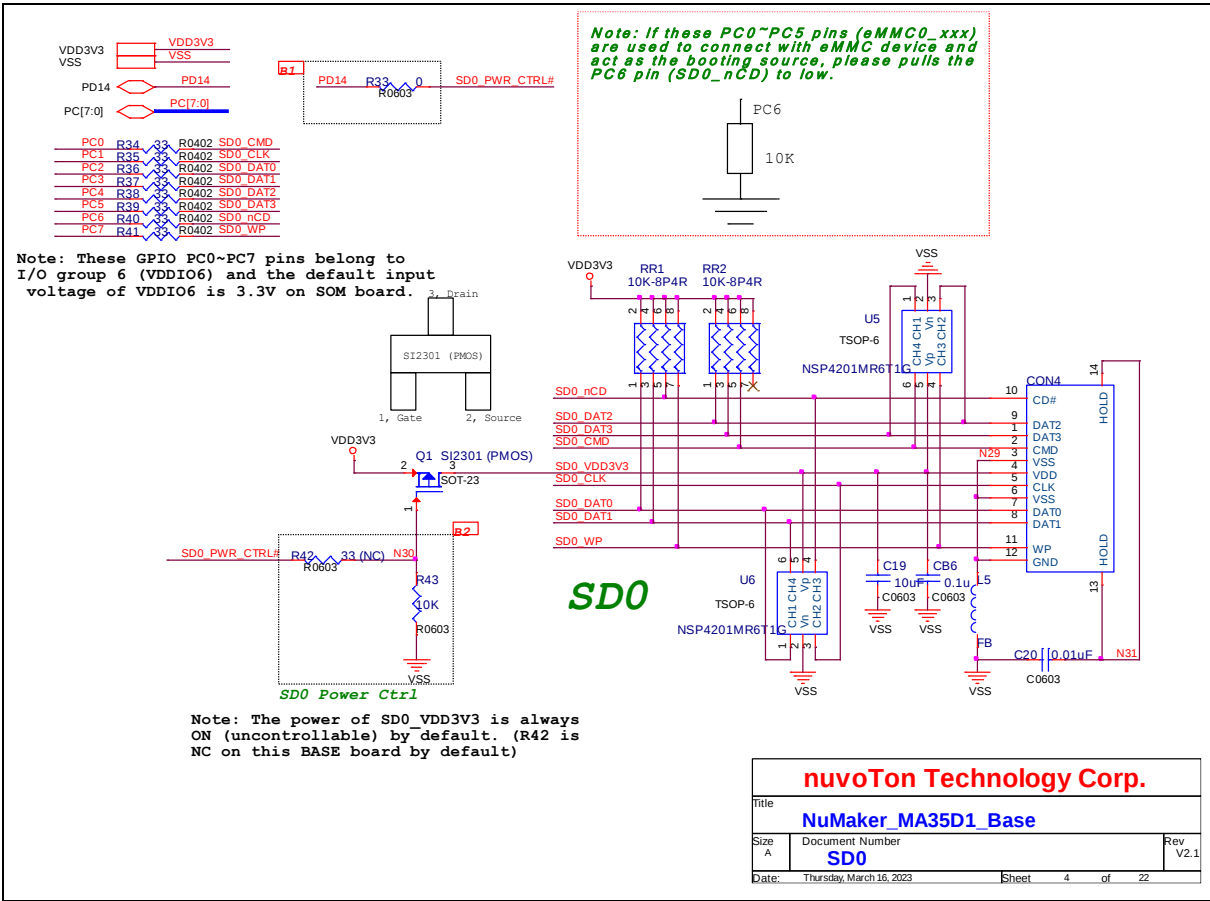


Figure 6-15 SD0 Schematic

6.2.5 QSPI0 Schematic

Figure 6-16 shows the QSPI0 NOR/NAND Flash device circuit of the NuMaker-BASE-MA35D1B1 board.

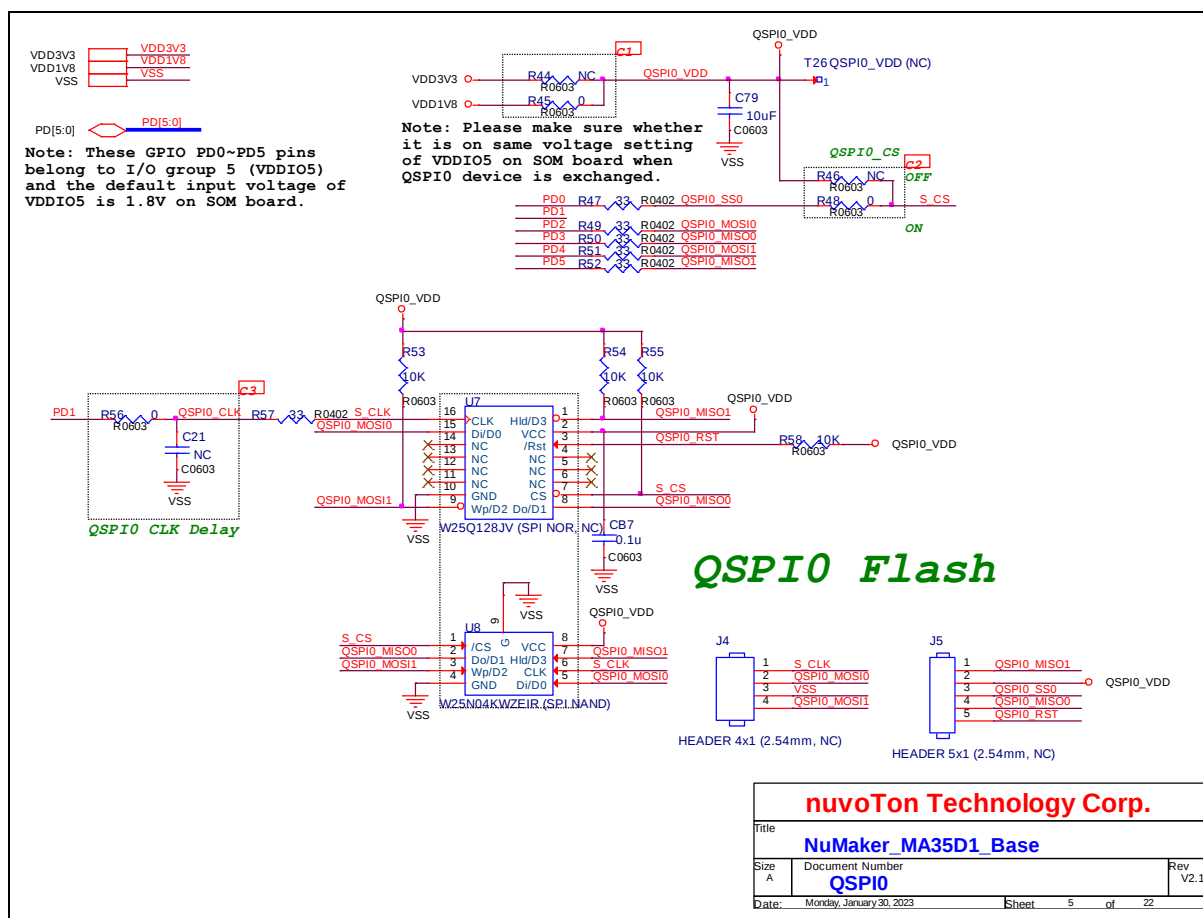


Figure 6-16 QSPI0 Schematic

6.2.6 EADC0 Schematic

Figure 6-17 shows the EADC0 circuit of the NuMaker-BASE-MA35D1B1 board.

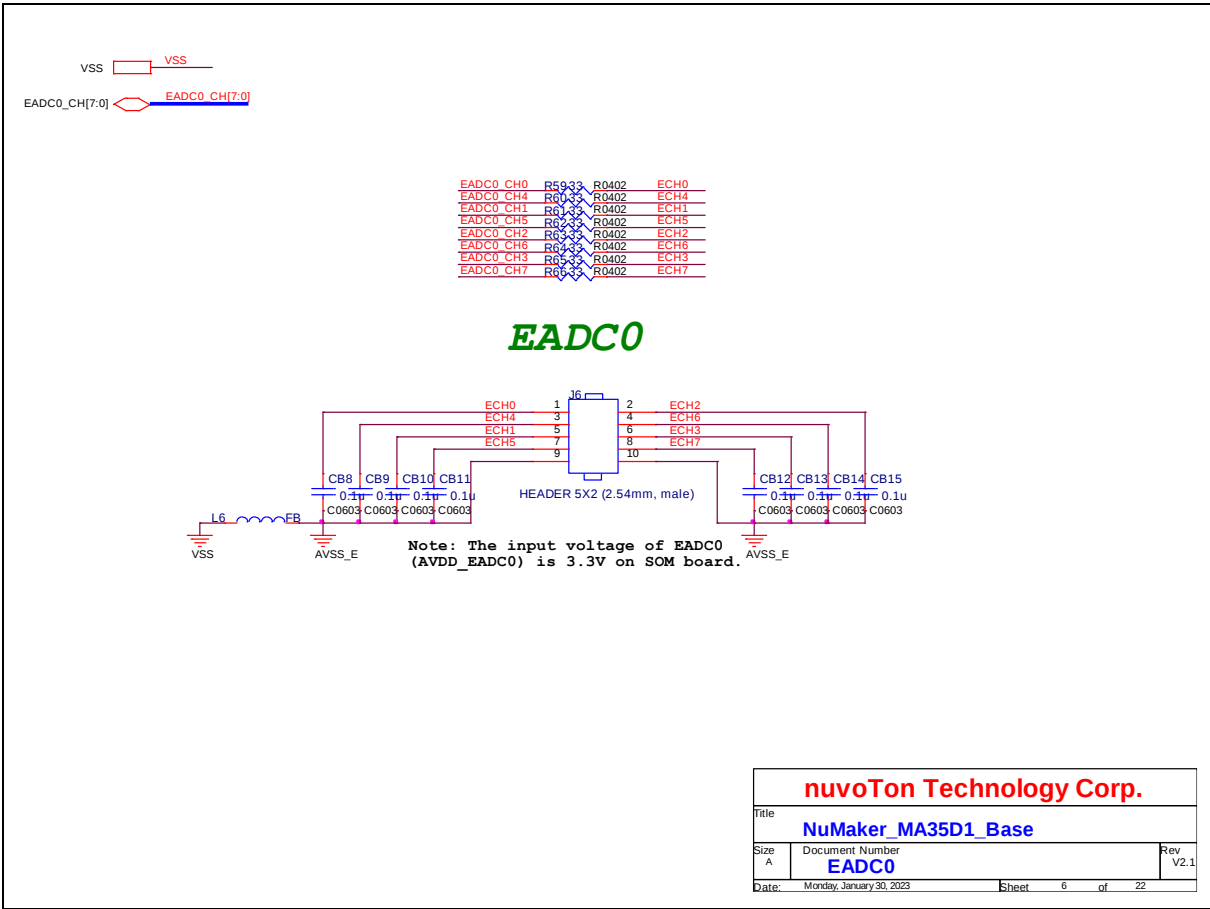


Figure 6-17 EADC0 Schematic

6.2.7 RGMII0_PE Schematic

Figure 6-18 shows the RGMII0 PE port circuit of the NuMaker-BASE-MA35D1B1 board.

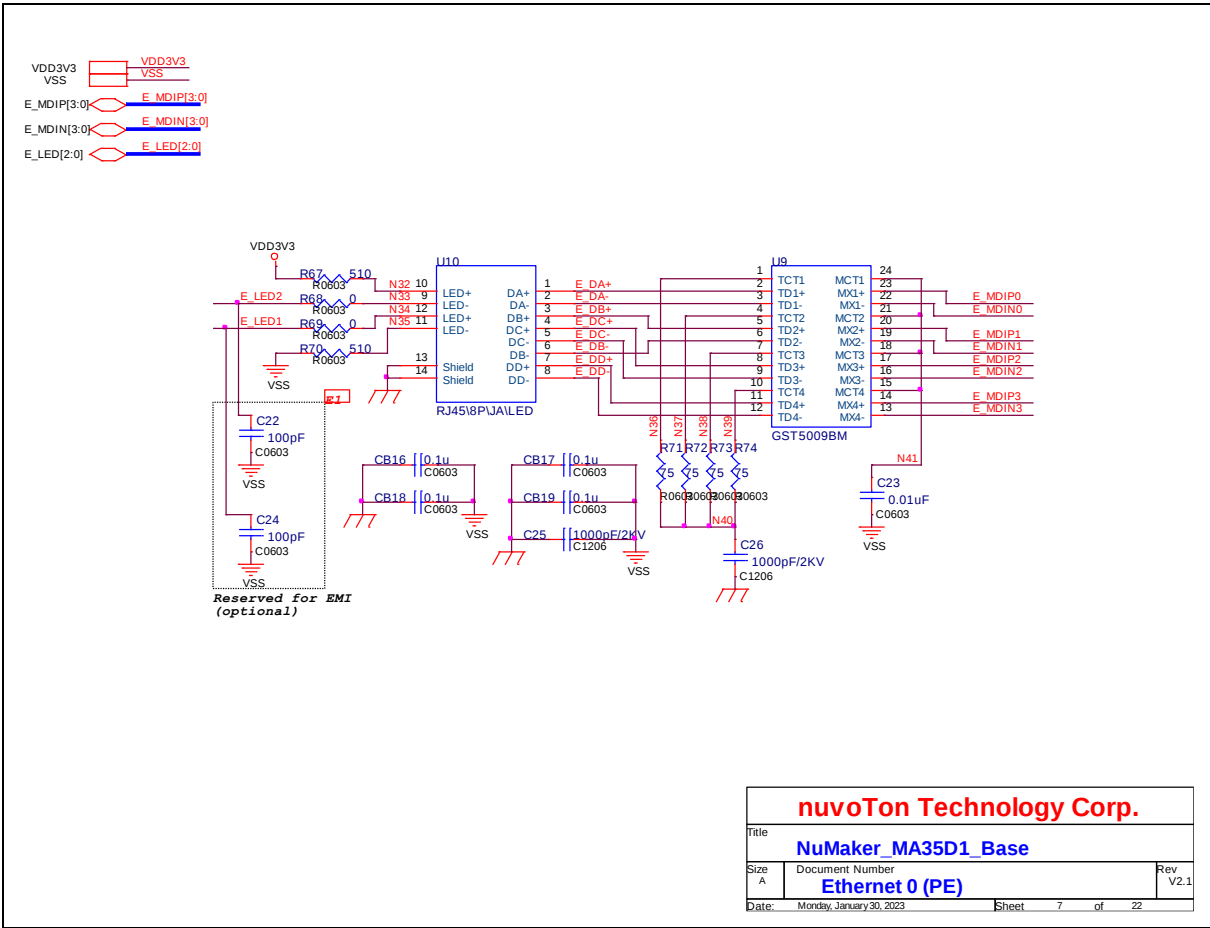


Figure 6-18 RGMII0_PE Schematic

6.2.8 RGMII1_PF Schematic

Figure 6-19 shows the RGMII1 PF port circuit of the NuMaker-BASE-MA35D1B1 board.

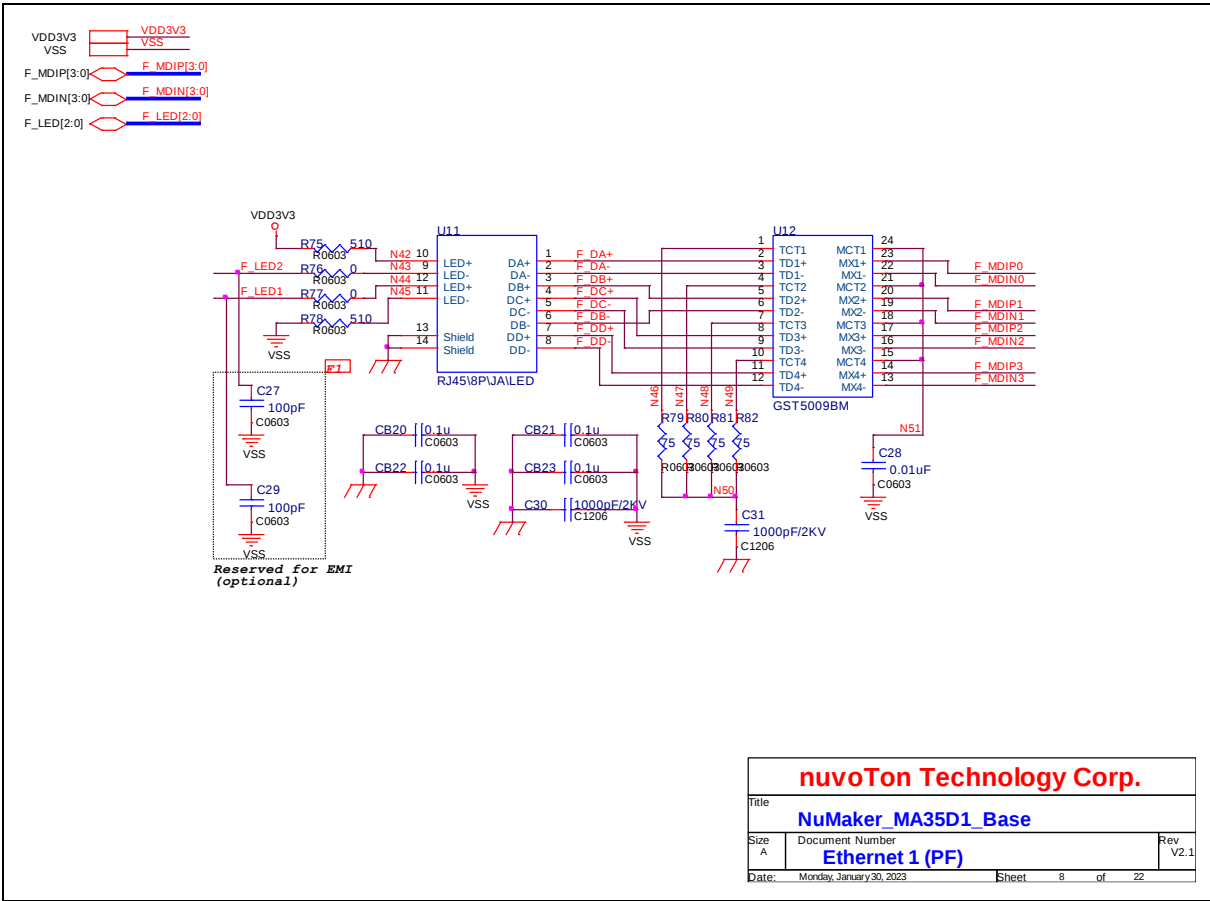


Figure 6-19 RGMII1_PF Schematic

6.2.9 HSUSB 0/1 Schematic

Figure 6-20 shows the HS (high speed) USB 0/1 circuit of the NuMaker-BASE-MA35D1B1 board.

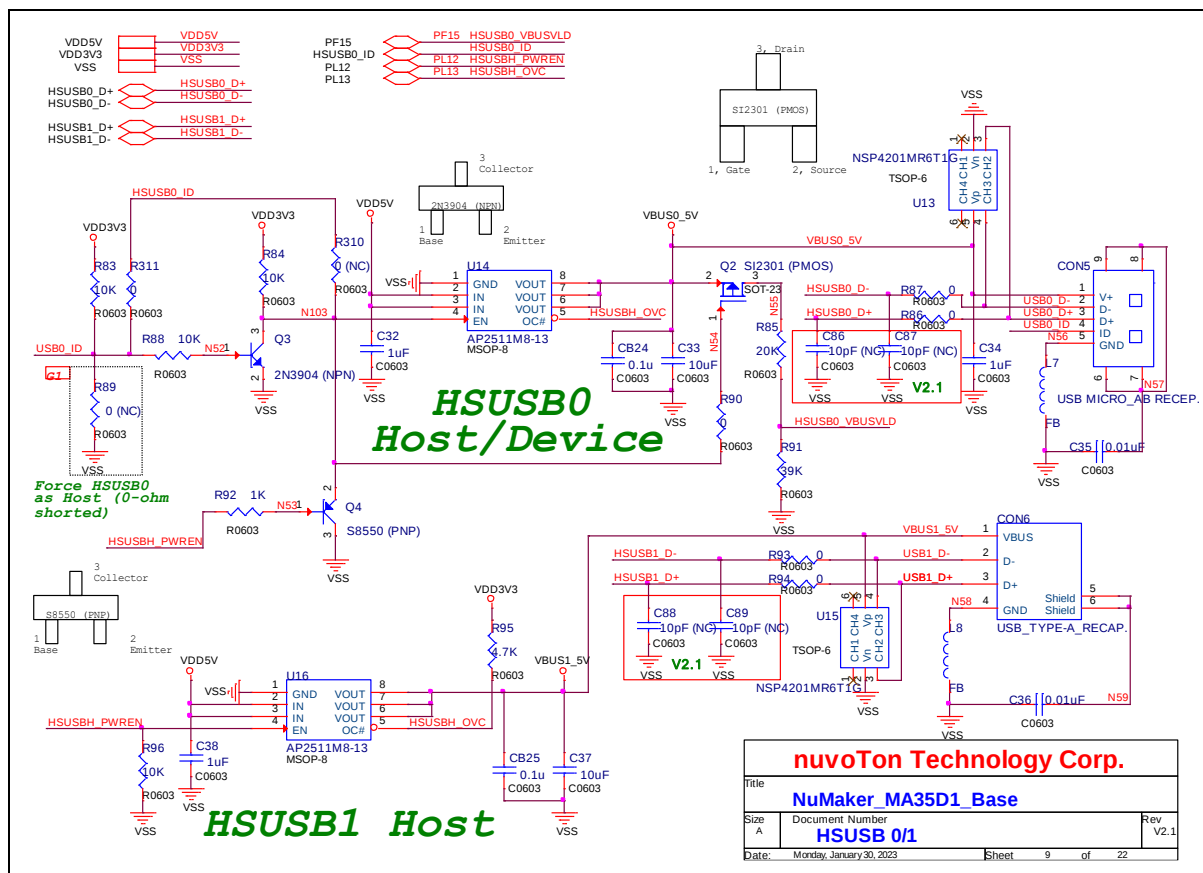


Figure 6-20 HSUSB 0/1 Schematic

6.2.10 CCAP 0/1 Connector Schematic

Figure 6-21 shows the CCAP 0/1 connectors circuit of the NuMaker-BASE-MA35D1B1 board.

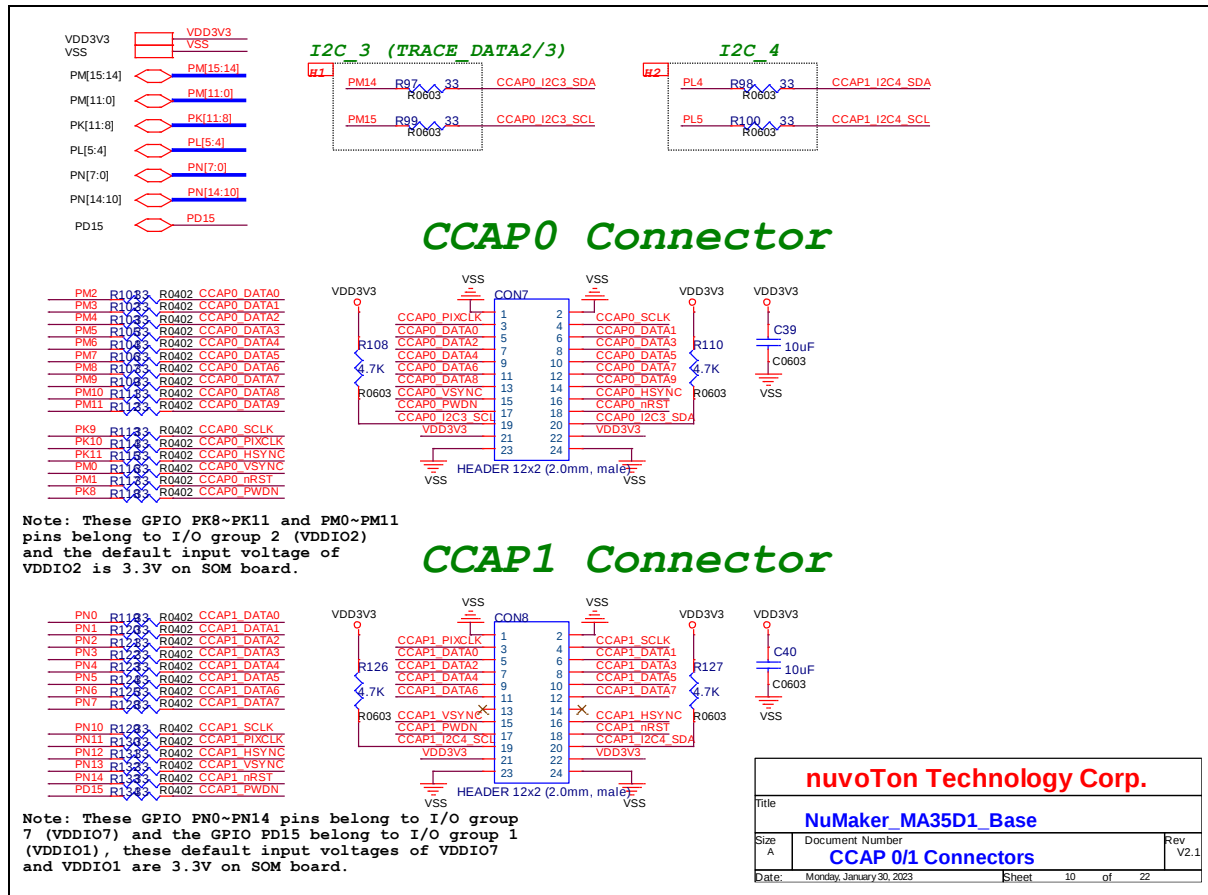


Figure 6-21 CCAP 0/1 Connectors Schematic

6.2.11 LCM Connector Schematic

Figure 6-22 shows the LCM connector circuit of the NuMaker-BASE-MA35D1B1 board.

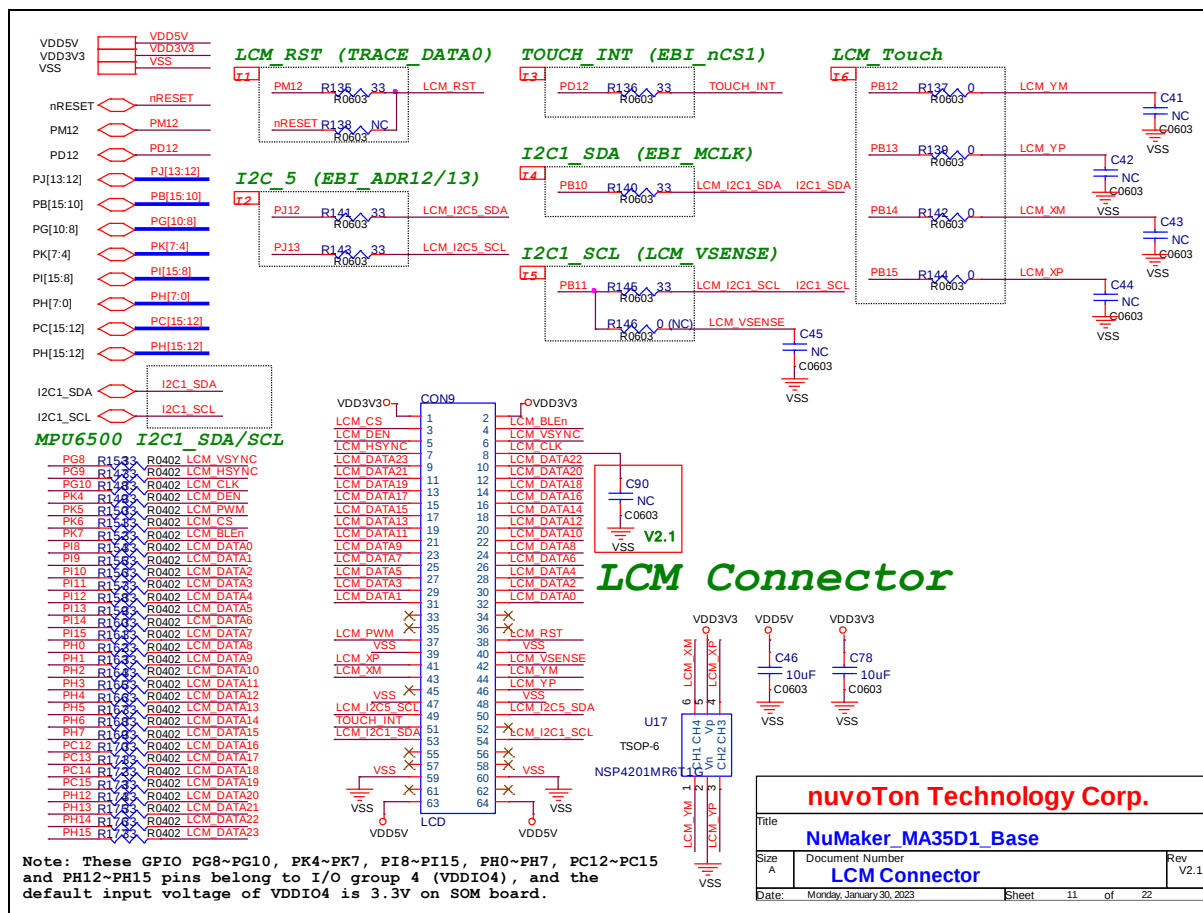


Figure 6-22 LCM Connector Schematic

Figure 6-23 shows the EBI connector circuit of the NuMaker-BASE-MA35D1B1 board.

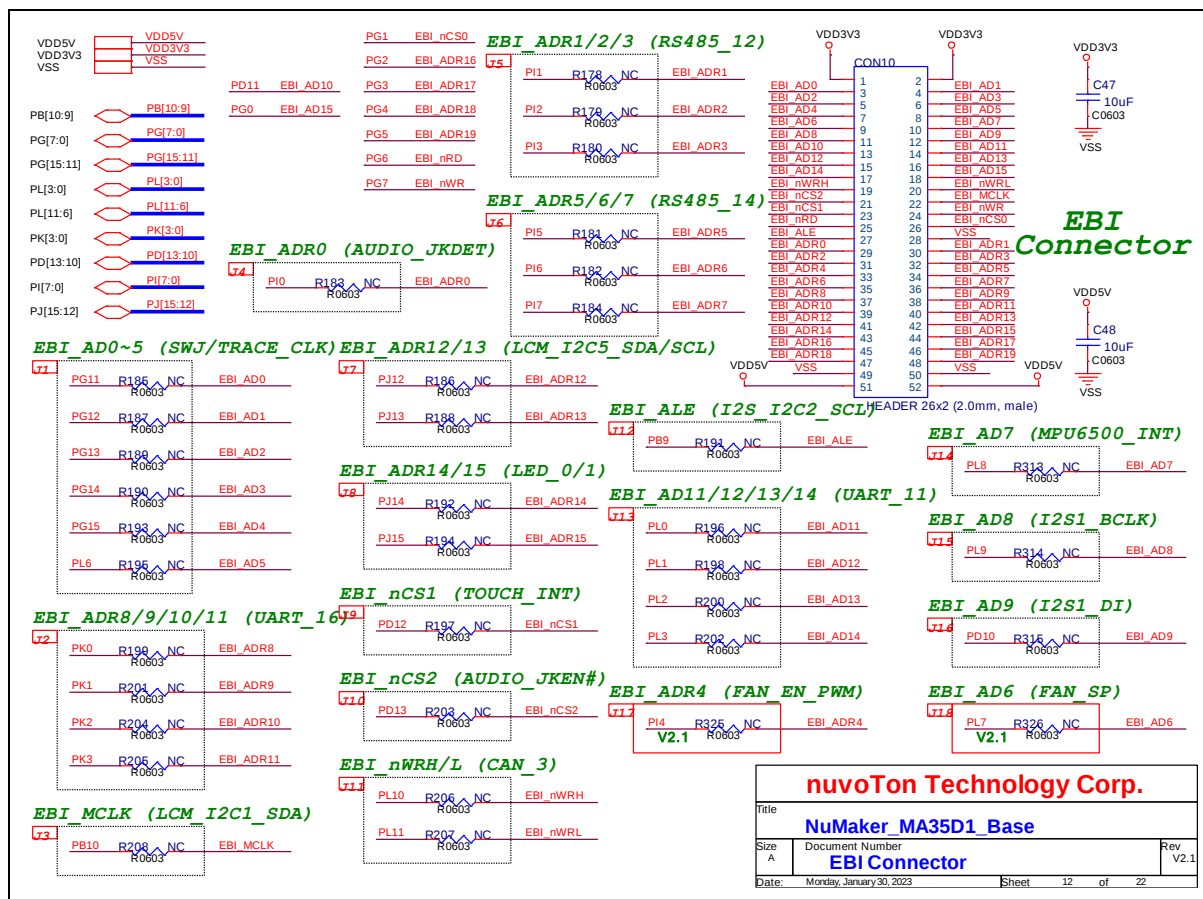


Figure 6-23 EBI Connector Schematic

6.2.13 NAU88C22 Audio Codec Schematic

Figure 6-24 shows the NAU88C22 audio codec circuit of the NuMaker-BASE-MA35D1B1 board.

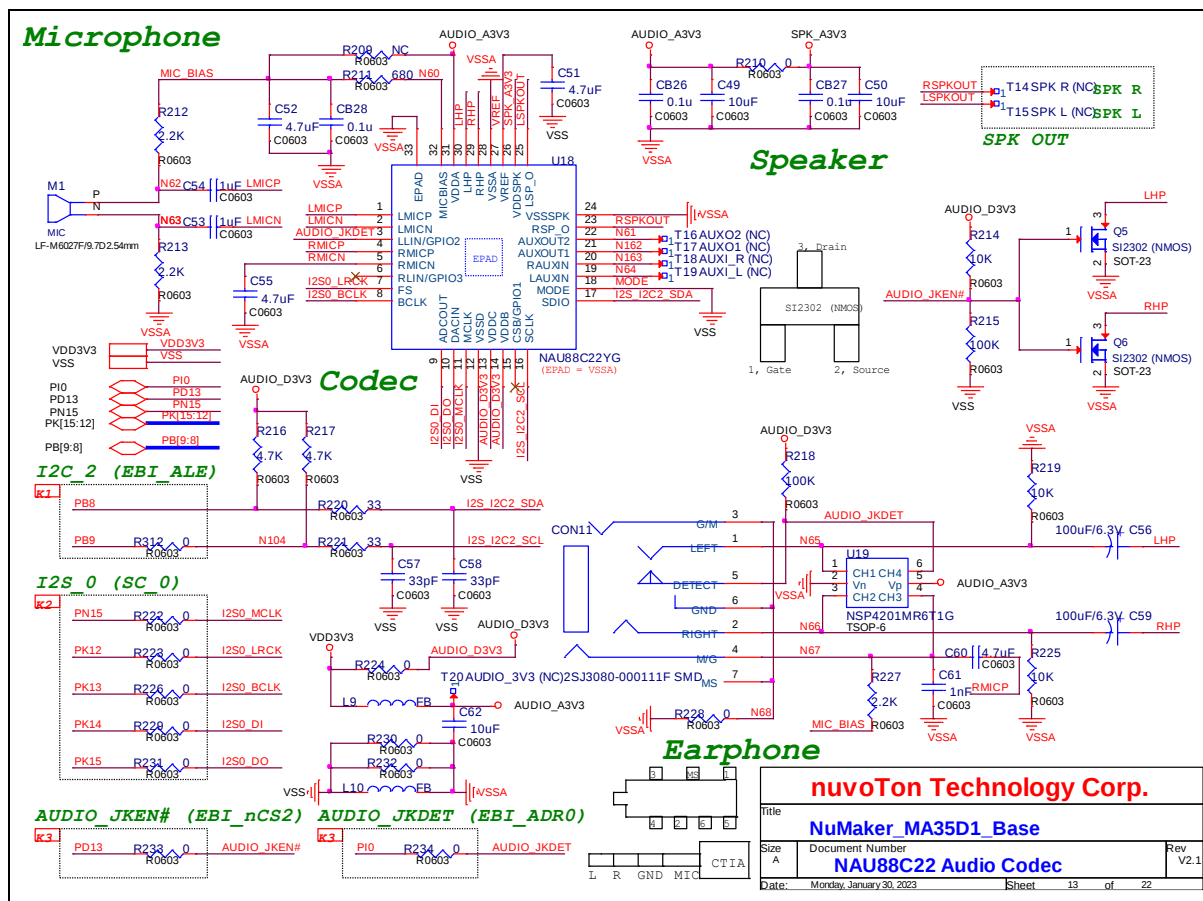


Figure 6-24 NAU88C22 Audio Codec Schematic

6.2.14 SIM Card Schematic

Figure 6-25 shows the SIM card circuit of the NuMaker-BASE-MA35D1B1 board.

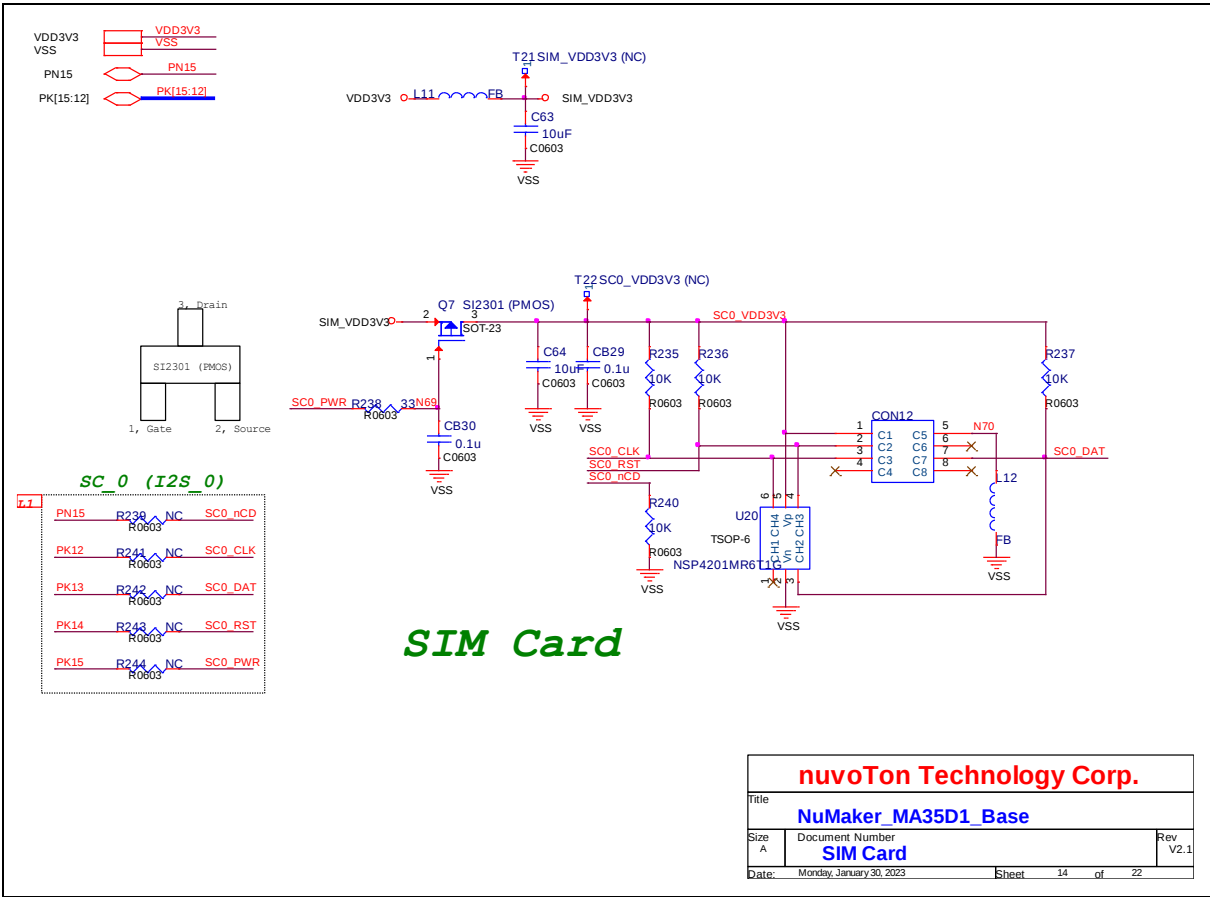


Figure 6-25 SIM Card Schematic

6.2.15 RS232 Schematic

Figure 6-26 shows the RS232 circuit of the NuMaker-BASE-MA35D1B1 board.

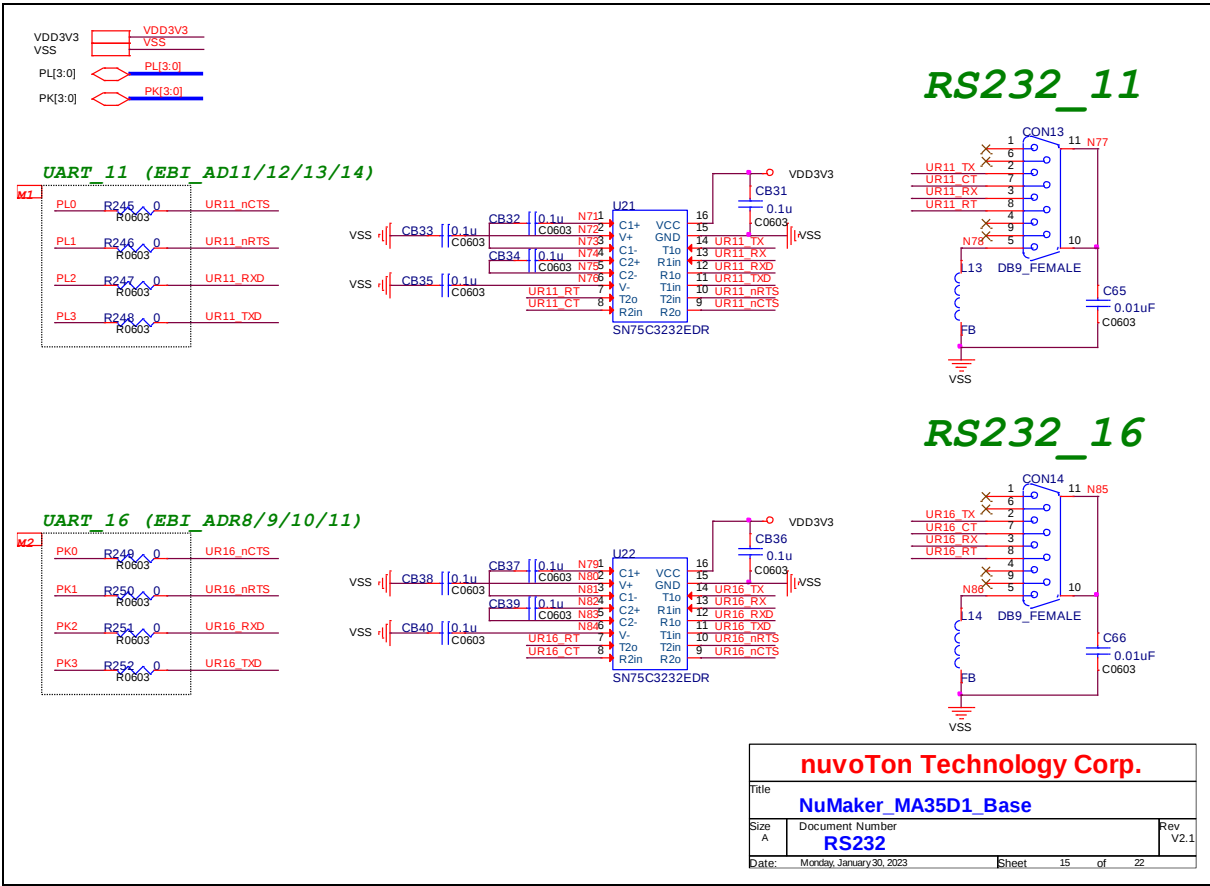


Figure 6-26 RS232 Schematic

6.2.16 RS485 Schematic

Figure 6-27 shows the RS485 circuit of the NuMaker-BASE-MA35D1B1 board.

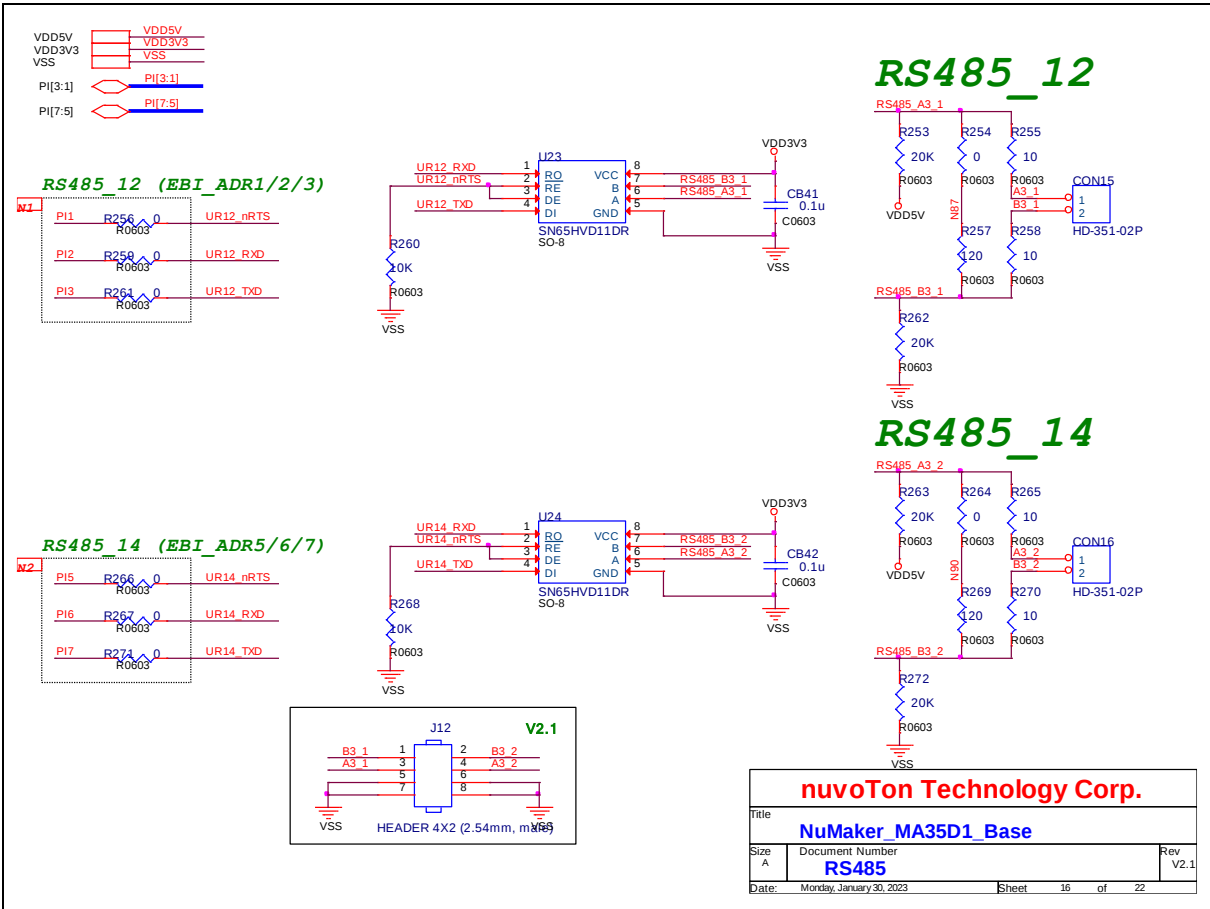


Figure 6-27 RS485 Schematic

6.2.17 CAN FD Schematic

Figure 6-28 shows the CAN FD circuit of the NuMaker-BASE-MA35D1B1 board.

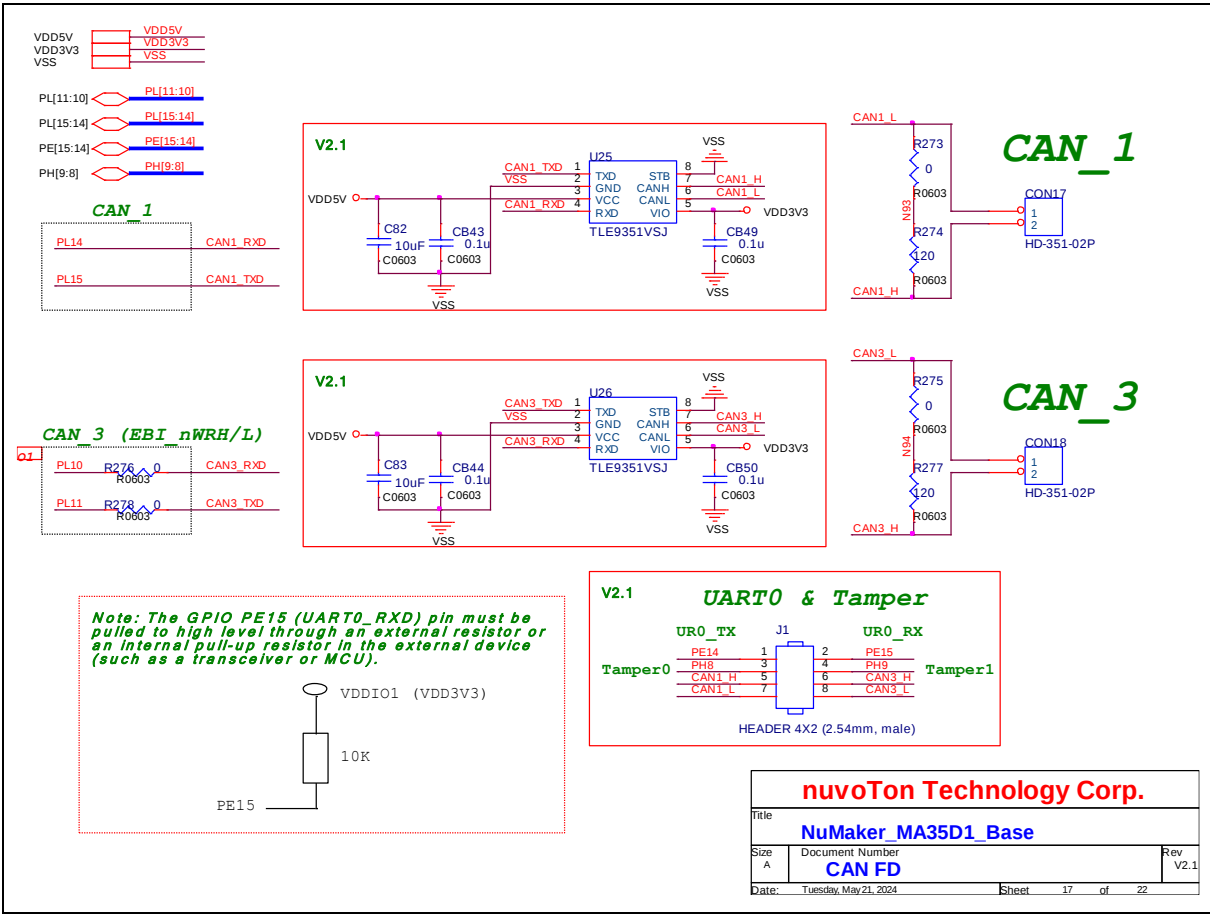


Figure 6-28 CAN FD Schematic

6.2.18 Key Buttons, LEDs, Buzzer and Fan Control Schematic

Figure 6-29 shows the key buttons, LEDs, buzzer and fan control (only supported in V2.1) circuit of the NuMaker-BASE-MA35D1B1 board.

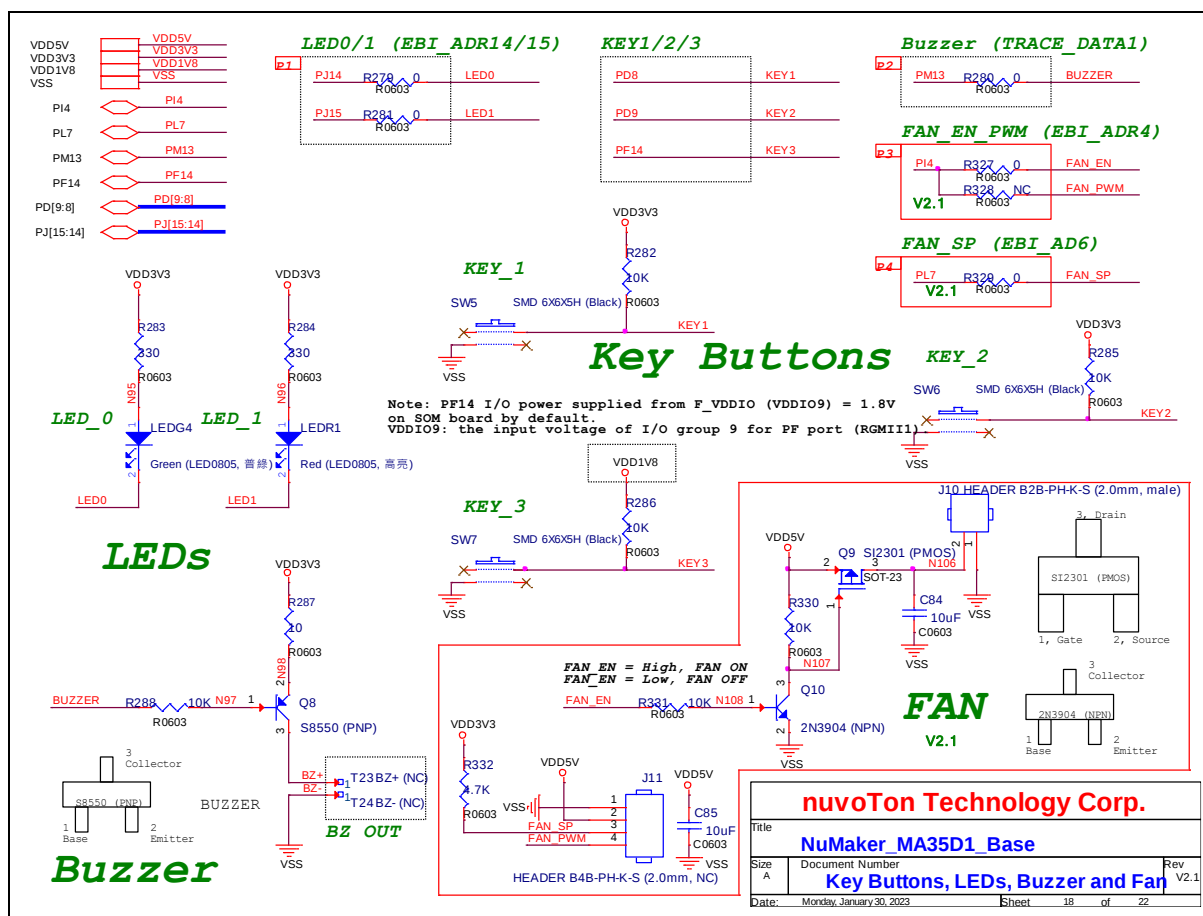


Figure 6-29 Key Buttons, LEDs, Buzzer and Fan Control Schematic

6.2.19 SWJ, SWD and ETM Connectors Schematic

Figure 6-30 shows the SWJ, SWD and ETM connectors circuit of the NuMaker-BASE-MA35D1B1 board.

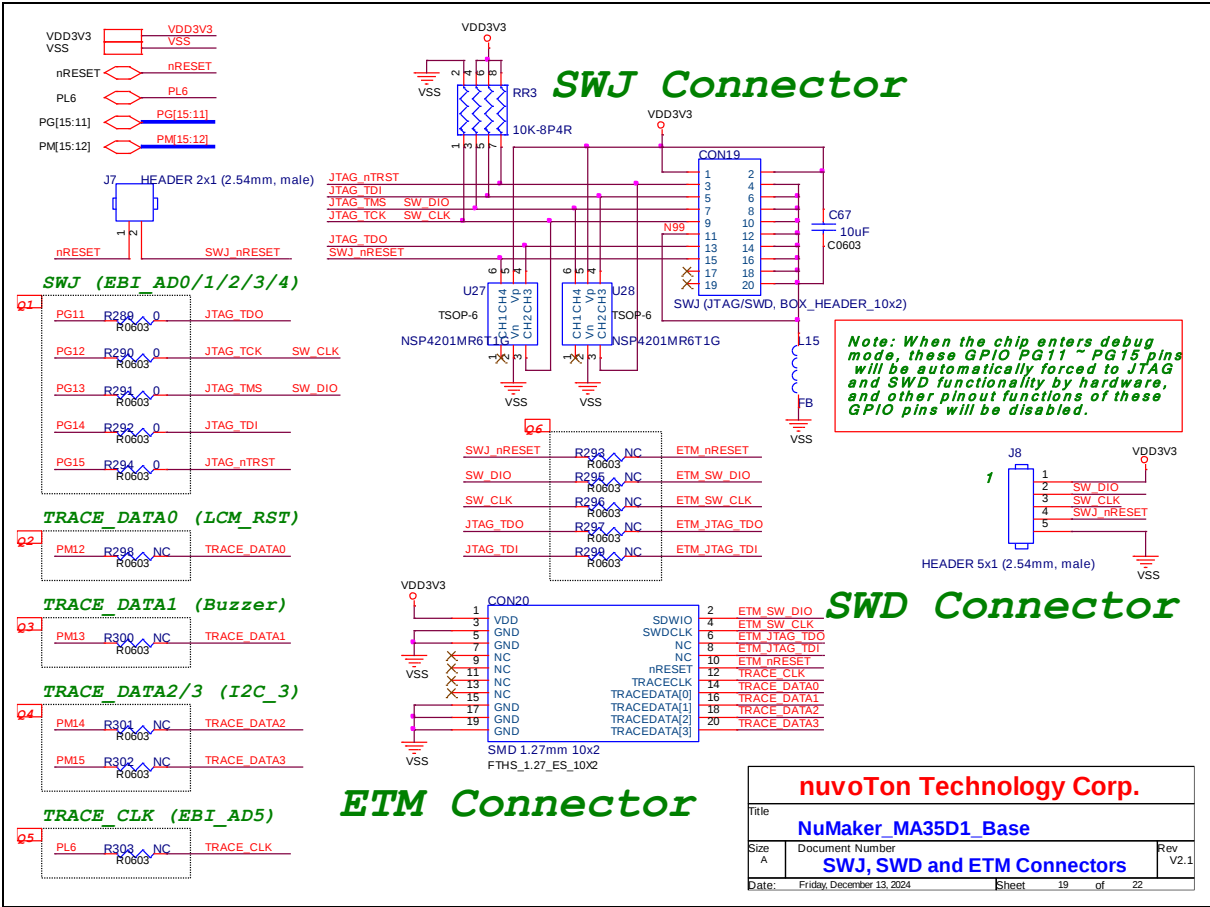


Figure 6-30 SWJ, SWD and ETM Connectors Schematic

6.2.20 NUC123 VCOM Schematic

Figure 6-31 shows the NUC123 VCOM circuit of the NuMaker-BASE-MA35D1B1 board.

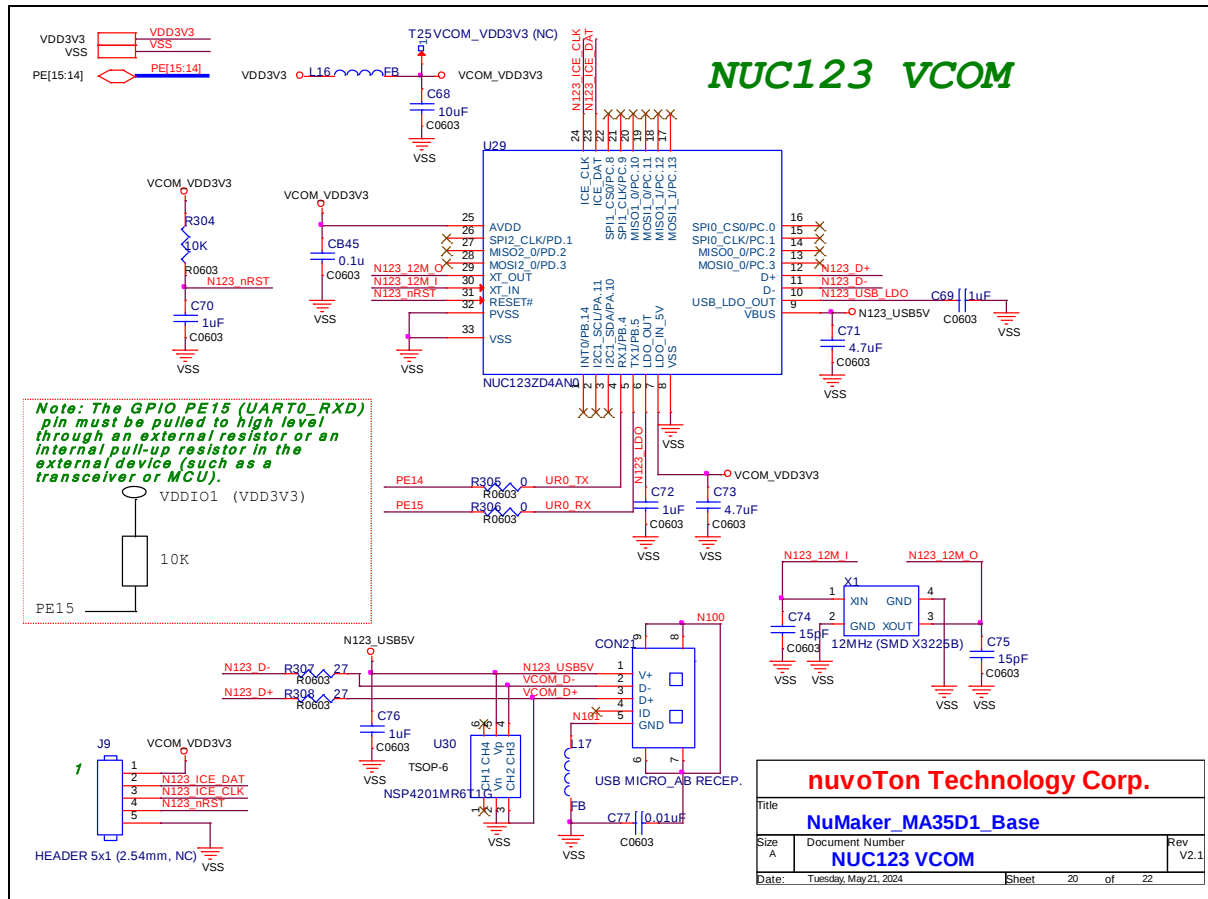


Figure 6-31 NUC123 VCOM Schematic

6.2.21 MEMS Digital Microphone Schematic

Figure 6-32 shows the MEMS digital microphone circuit of the NuMaker-BASE-MA35D1B1 board.

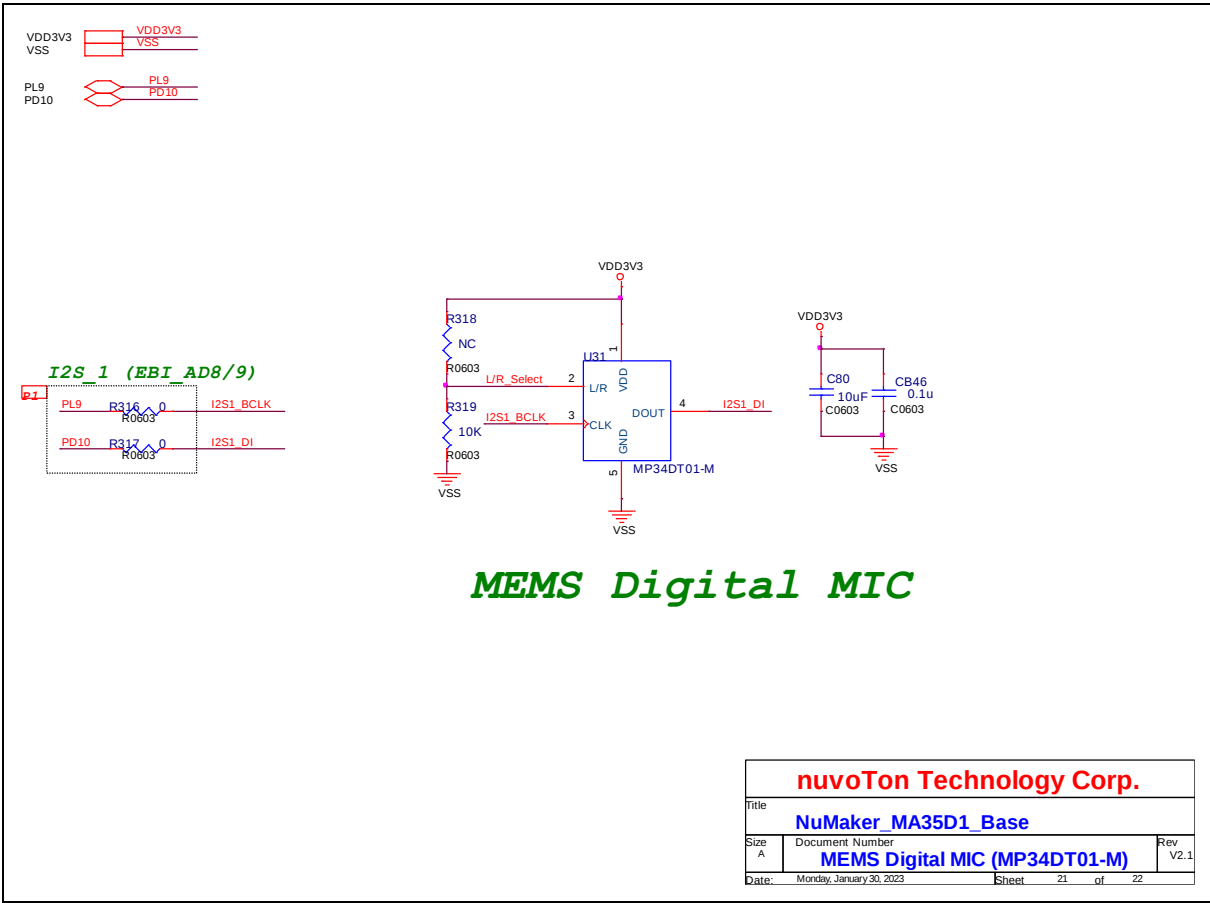


Figure 6-32 MEMS Digital Microphone Schematic

6.2.22 MEMS G-Sensor Schematic

Figure 6-33 shows the MEMS G-sensor circuit of the NuMaker-BASE-MA35D1B1 board.

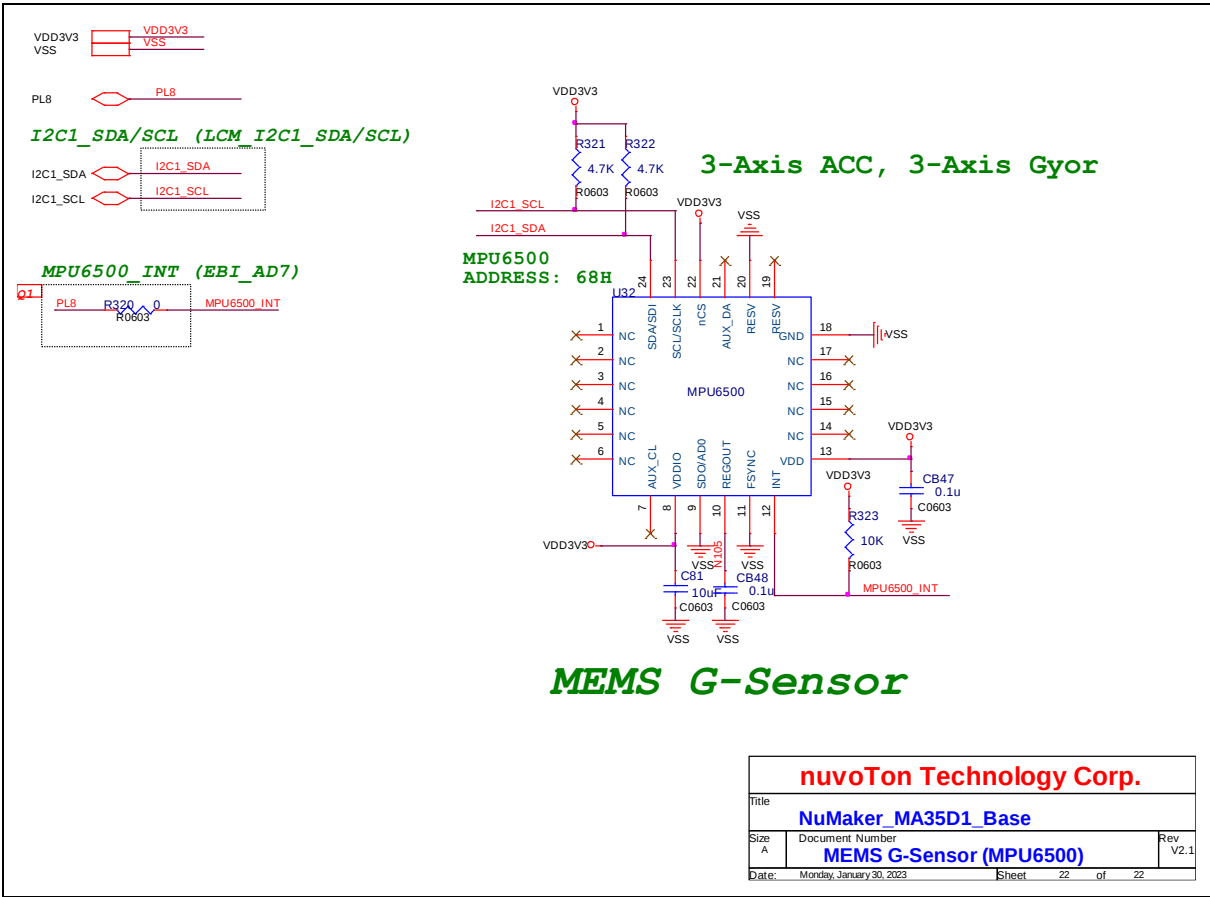


Figure 6-33 MEMS G-Sensor Schematic

6.2.23 PCB Placement

Figure 6-34 and Figure 6-35 show the front and rear PCB component placement of the NuMaker-BASE-MA35D1B1 board.

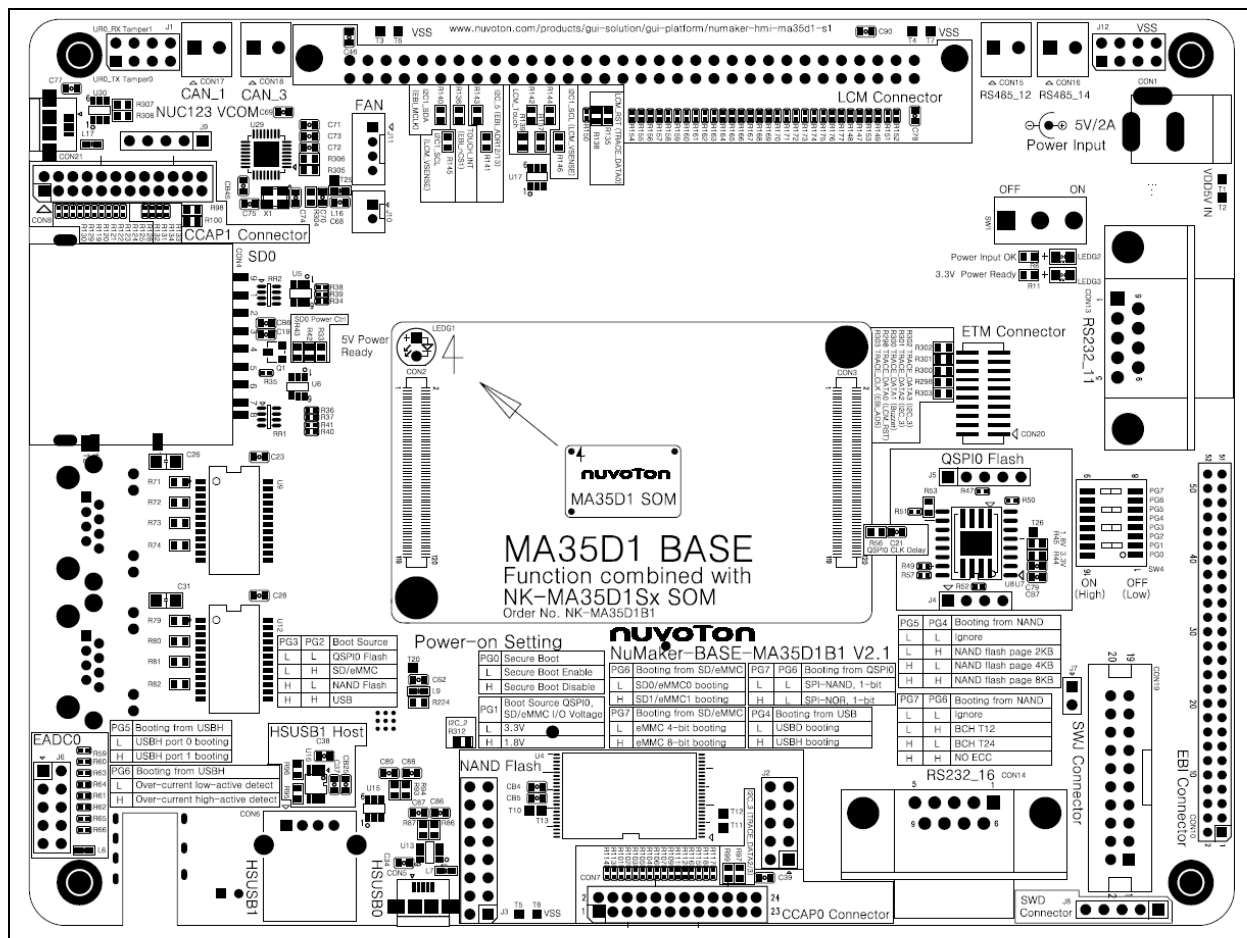


Figure 6-34 Front PCB Placement of NuMaker-BASE-MA35D1B1 Board

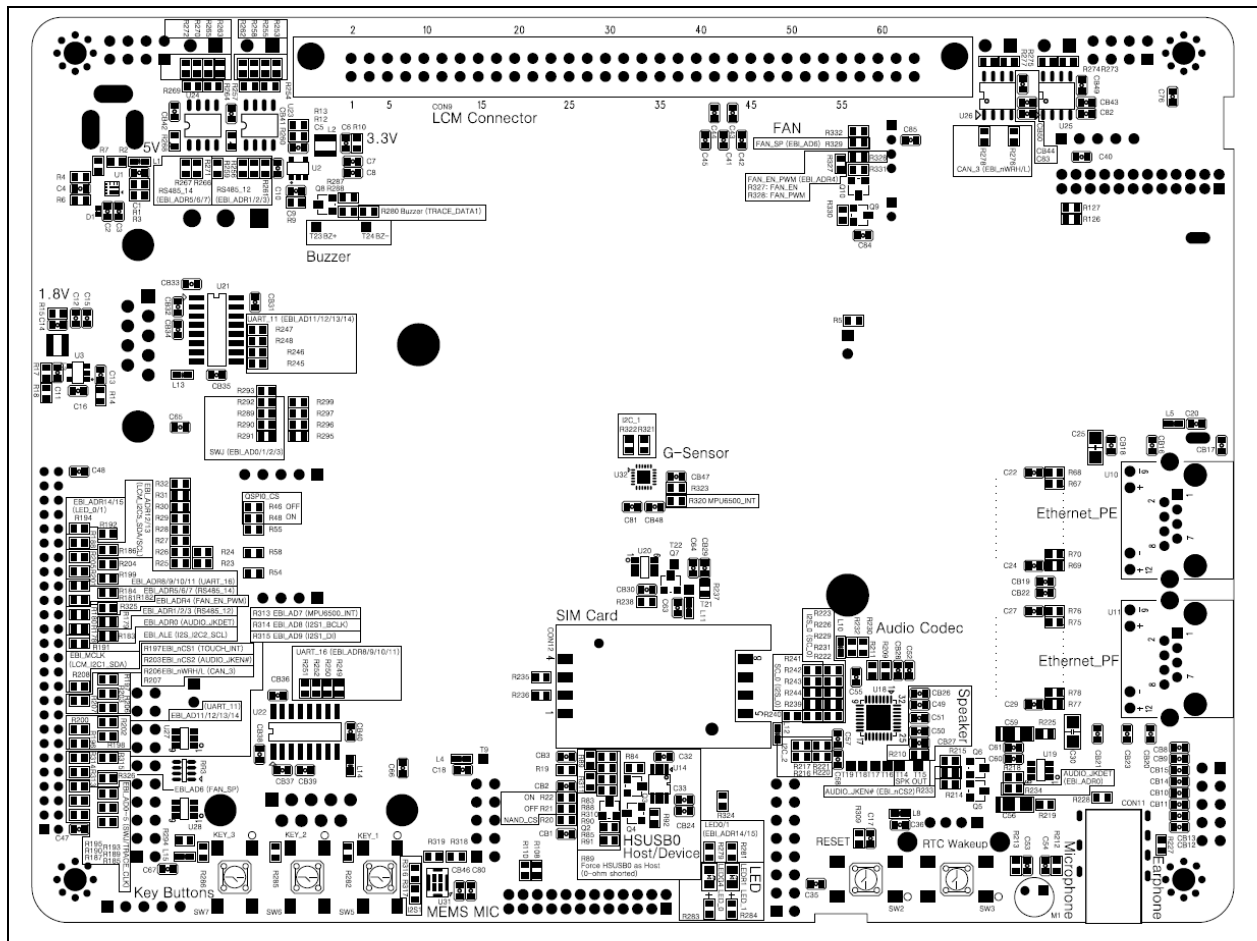


Figure 6-35 Rear PCB Placement of NuMaker-BASE-MA35D1B1 Board

6.3 7" TFT LCD Daughter Board Schematic

Figure 6-36 shows the circuit of the 7" TFT LCD daughter board.

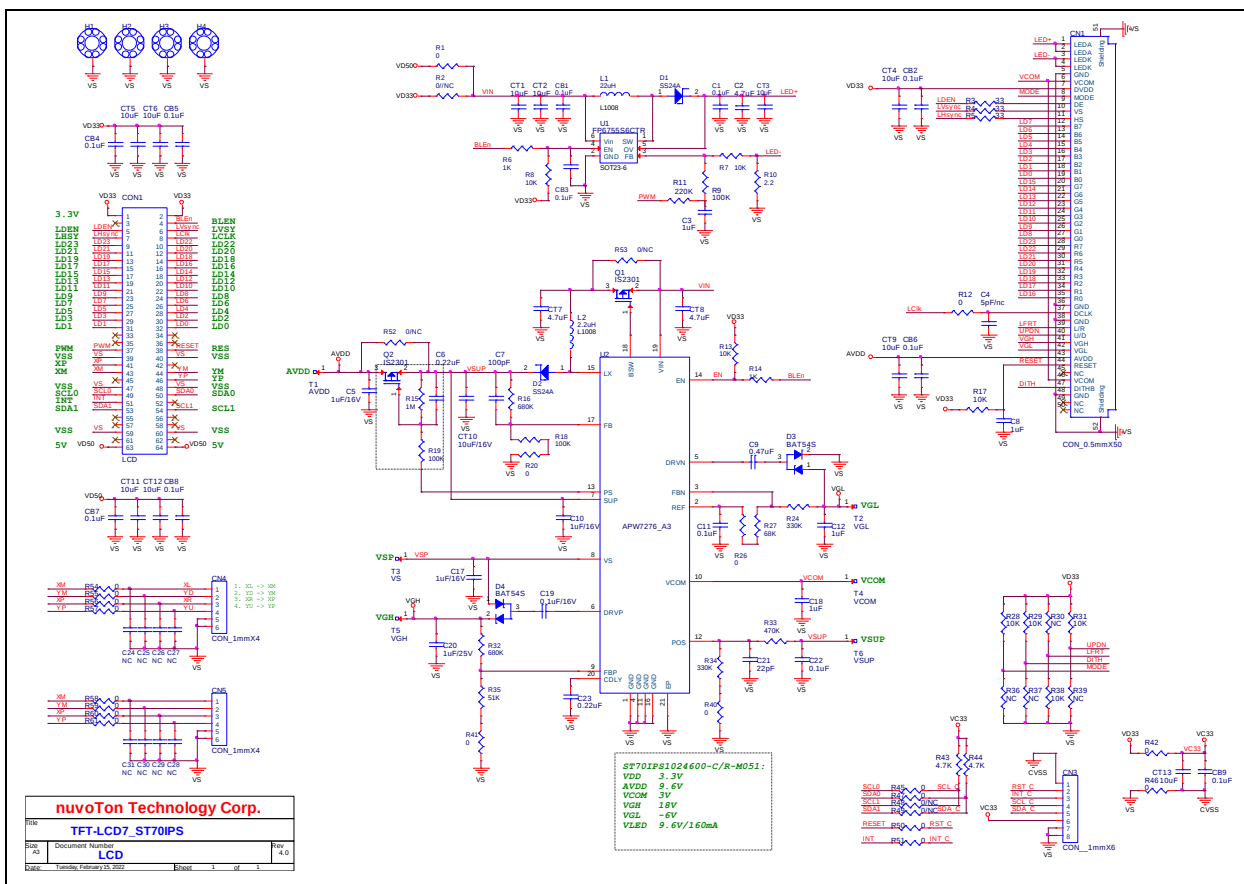


Figure 6-36 7" TFT LCD Daughter Board Schematic

7 REVISION HISTORY

Date	Revision	Description
2022.07.27	1.00	Initial version.
2022.11.02	1.01	- Updated Figure 1-1, Figure 1-2, Figure 1-3, Figure 5-2, Figure 6-2, and Table 3-1. - Updated the options about USB booting source in section 3.2.9. - Removed section 4.1.5.
2022.12.29	1.02	Updated Figure 6-3, Figure 6-4, Figure 6-5, Figure 6-6, Figure 6-7, Figure 6-8, Figure 6-14, Figure 6-15, Figure 6-16, Figure 6-17, Figure 6-21 and Figure 6-22.
2023.4.20	1.03	- Updated pictures in Figure 1-1, Figure 1-2, Figure 1-3, Figure 1-4, Figure 1-5, Figure 3-1, Figure 3-2, Figure 3-3, Figure 3-4, Figure 3-5, Figure 3-6, Figure 4-2, Figure 4-3, Figure 6-10, Figure 6-11, Figure 6-34 and Figure 6-35. - Added or updated notes in Table 3-1, Table 3-3, Table 3-4, Table 3-13, Table 3-27, Figure 6-2, Figure 6-5 and Figure 6-6. - Updated section 2.2, 3.1.4, 3.2.14, 3.2.15, 3.2.19, 3.2.23 and 3.3.3. - Updated Figure 6-12 ~ Figure 6-33 for NuMaker-BASE-MA35D1B1 base board V2.1 schematics.
2023.6.12	1.04	Updated the chapter 1.
2023.9.25	1.05	Updated the Figure 6-4.
2024.5.21	1.06	Added a note for GPIO PE15 (UART0_RXD) pin in section 3.2.18, Table 3-29, Table 3-30, Figure 6-4, Figure 6-28 and Figure 6-31.
2024.8.20	1.07	Updated the Figure 6-5.
2024.12.13	1.08	Added a note for GPIO PG11 ~ PG15 in Table 3-38, Table 3-39, Table 3-40 and Figure 6-30.
2025.3.12	1.09	Updated the sections 3.2.9 and 4.1.1.

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.