

NuMicro® Family

Arm® Cortex®-A35-based Microprocessor

NuMaker-HMI-MA35H0-A1/A2 User Manual

Evaluation Board for NuMicro® MA35H0 Series

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1 OVERVIEW

The NuMaker-HMI-MA35H0-A1 is an evaluation board for Nuvoton NuMicro MA35H0 series microprocessors, and consists of two parts: a NuMaker- HMI-MA35H04F70 board and a NuMaker-TFT-LCD7 board. The NuMaker-HMI-MA35H0-A1 board integrates core components to simplify the system design, based on MA35H04F764C (LQFP216 package, and stacking a 128 MB DDR), discrete power supply power solution, and one megabit Ethernet PHY. The NuMaker-HMI-MA35H0-A1 has rich peripherals such as 1 set of megabit Ethernet, USB2.0 high-speed host and device, 1 set of SD2.0 in Micro SD slot, 1 set of SD3.0 in SD slot, 1 set of CAN FD, SPI, I²C, UART, and 2 sets of RS-485/RS-232 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.

The NuMicro MA35H0 series is a multi-core microprocessor targeted to various HMI applications in the medium resolution. It is based on dual 64/32-bit Arm Cortex-A35 cores, the high-performance cores run up to 650 MHz and include 32/32 KB I/D L1 cache for each core, and a 512 KB shared L2 cache.

The MA35H0 series has a built-in 128 KB IBR (Internal Boot ROM) and supports secure booting from four modes, USB, SD/eMMC, NAND, and SPI Flash (SPI NOR/SPI NAND). In order to provide easy system design and manufacture, the MA35H0 series also offers LQFP package stacked with a DDR SDRAM and the size up to 128 MB.

The MA35H0 series is a trusted system for IoT products' security requirement. It includes several advanced security mechanisms such as Arm TrustZone technology and secure boot, built-in cryptographic accelerators with AES, SHA, ECC, RSA, SM2/3/4, and a TRNG, also Key Store and OTP memory to protect sensitive and high-value data.

To obtain better graphical HMI effects, the MA35H0 series provides an LCD Display controller with the resolution up to 1280x800 at 60 fps, a 2D graphic engine, a JPEG and a H.264 decoder for video decoding. Furthermore, the MA35H0 series also provides high-speed connectivity and advanced control interfaces for high-performance HMI applications, such as Megabit Ethernet, high-speed USB host and device, SD3.0/eMMC, and CAN FD.

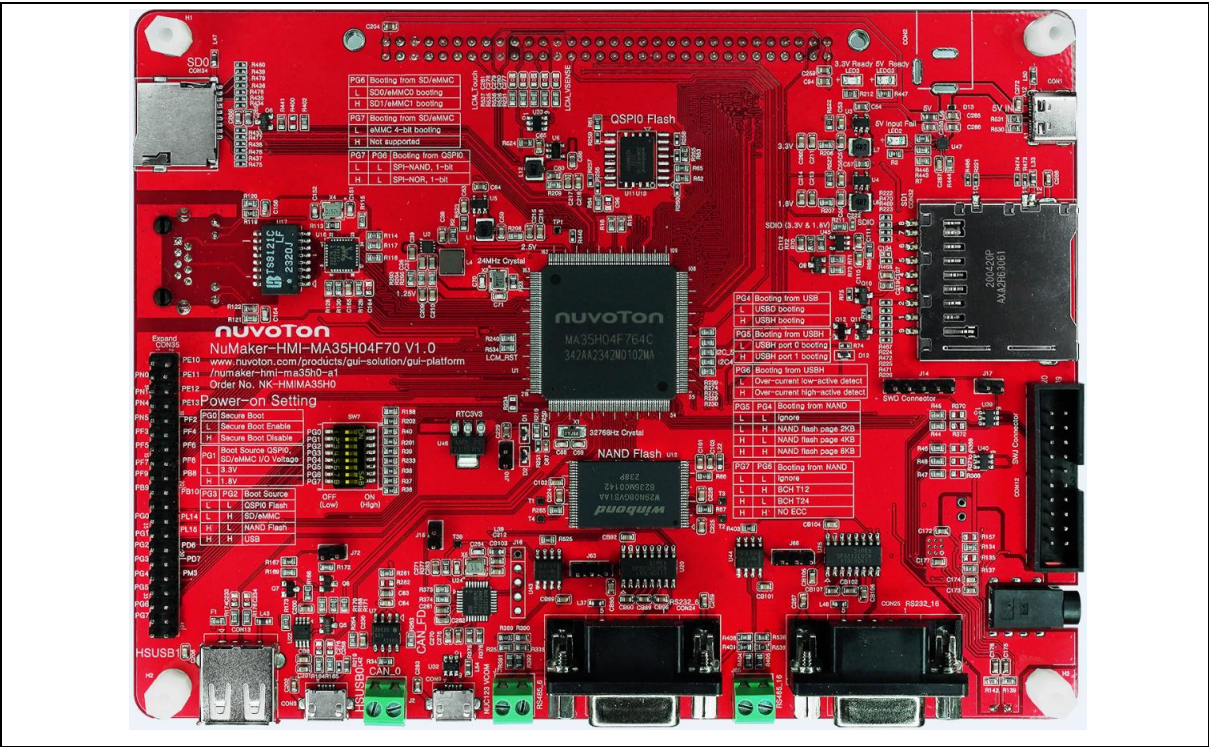


Figure 1-1 NuMaker-HMI-MA35H0-A1/A2 Board from Target Chip Side

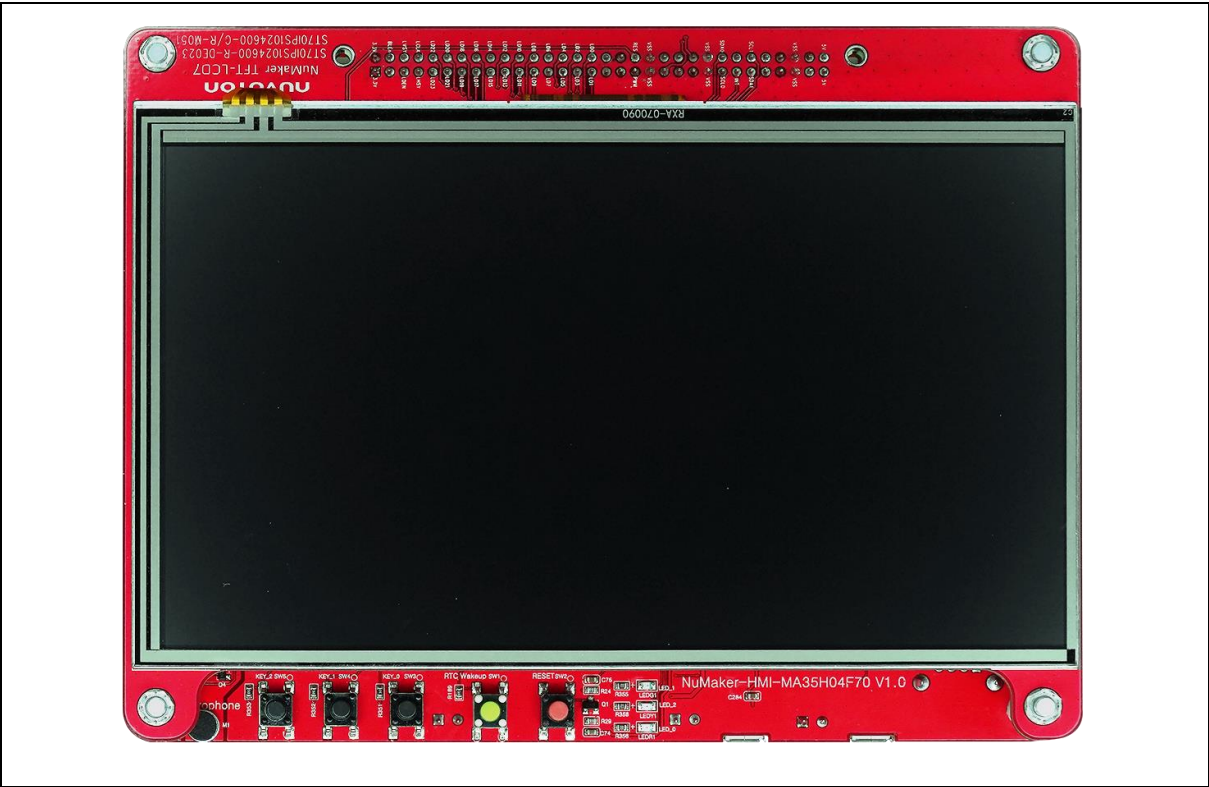


Figure 1-2 NuMaker-HMI-MA35H0-A1 from TFT LCD Side (With RTP)

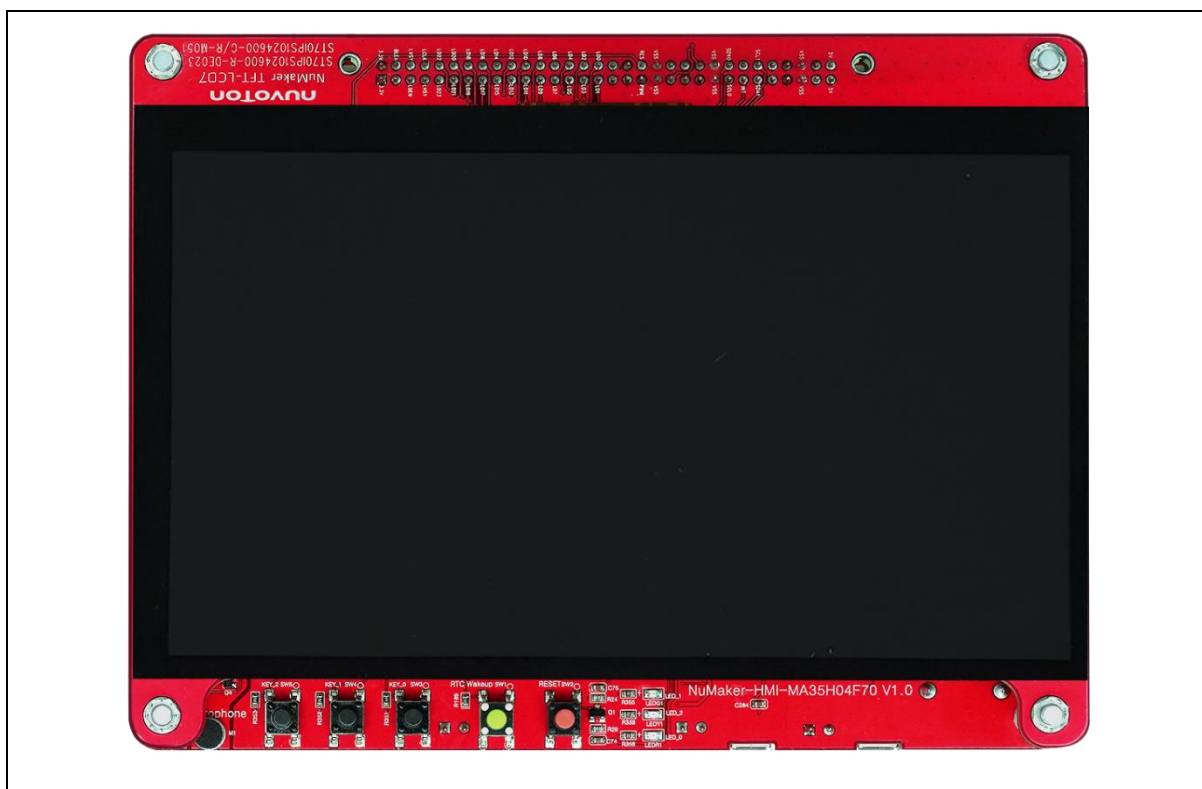


Figure 1-3 NuMaker-HMI-MA35H0-A2 from TFT LCD Side (With CTP)

1.1 NuMaker-HMI-MA35H04F70 Board

The NuMaker-HMI-MA35H04F70 has rich peripherals such as 1 set of megabit Ethernet, USB2.0 high-speed host and device, 1 set of SD2.0 in Micro SD slot, 1 set of SD3.0 in SD slot, 1 set of CAN FD, SPI, I²C, UART, and 2 sets of RS-485/RS-232 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.

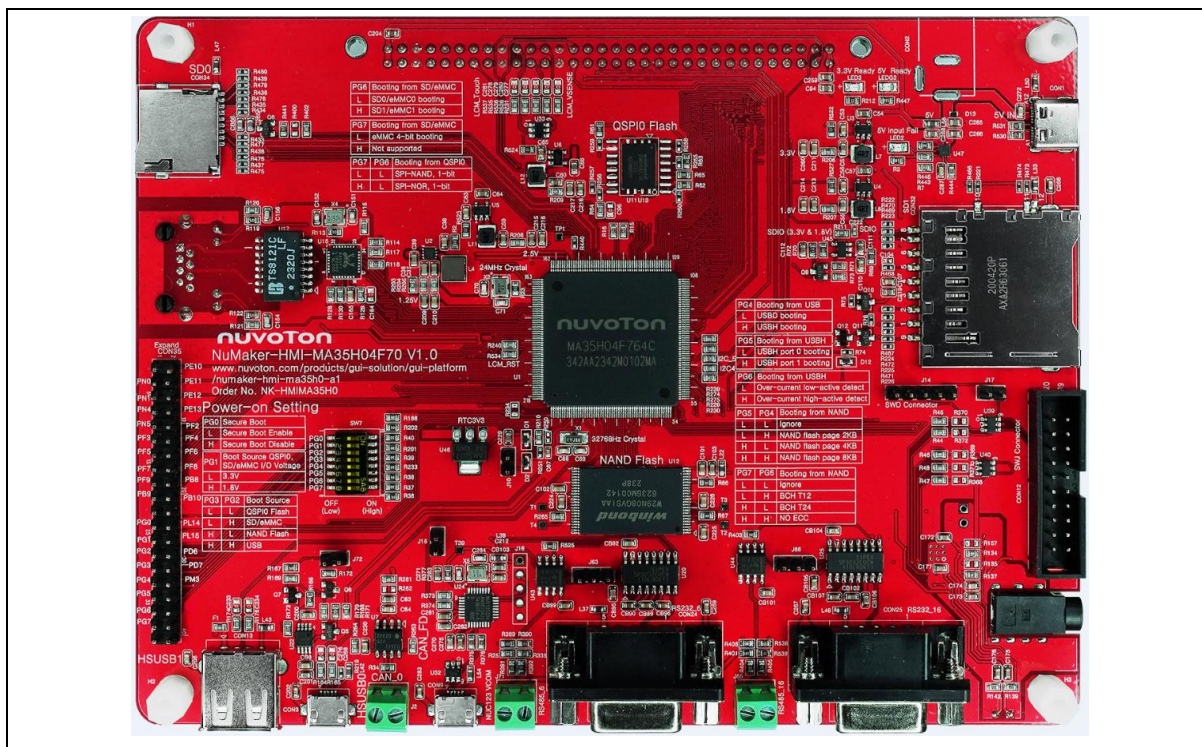


Figure 1-4 NuMaker-HMI-MA35H04F70 Board

1.2 NuMaker TFT-LCD7 Board

This daughter board contains a 7" 4-wire resistive or Capacitive touch panel with pixel resolution of 1024x600.

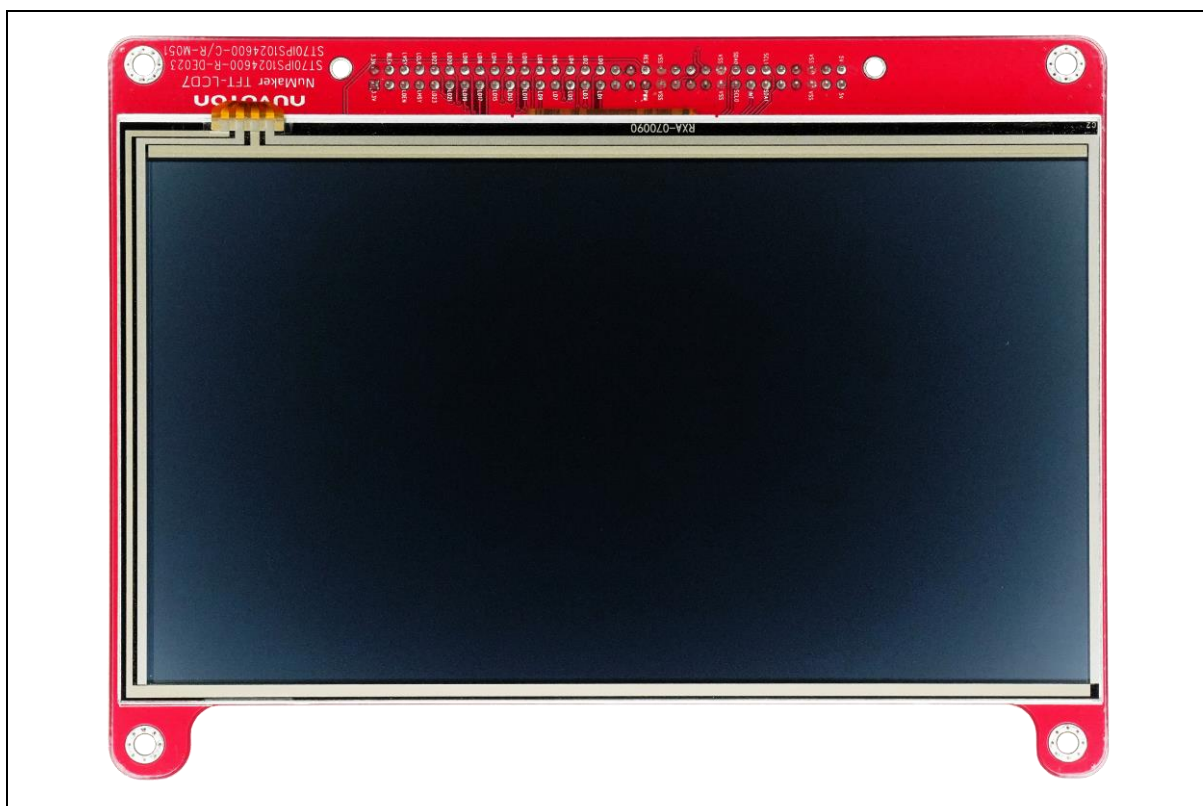


Figure 1-5 NuMaker-TFT-LCD7 (RTP) Board



Figure 1-6 NuMaker-TFT-LCD7 (CTP) Board

1.3 Order Number and Part Number of EVB

The following table lists the part number of this evaluation board (EVB) based on the MA35H04F764C microprocessors, and the PCB names of two parts: NuMaker-HMI-MA35H04F70 board and NuMaker-TFT-LCD7 board.

Order Number	Part Number of EVB	HMI Base Board	7" TFT LCD Daughter Board
NK-HMA35H0A1	NuMaker-HMI-MA35H0-A1	NuMaker-HMI-MA35H04F70	NuMaker TFT-LCD7 (RTP ^{*1})
NK-HMA35H0A2	NuMaker-HMI-MA35H0-A2	NuMaker-HMI-MA35H04F70	NuMaker TFT-LCD7 (CTP ^{*2})
Note ^{*1} : RTP (Resistive Touch Panel)			
Note ^{*2} : CTP (Capacitive Touch Panel)			

Table 1-1 Board Part Number and Information

2 FEATURES

2.1 NuMaker-HMI-MA35H04F70 Board Features

- Target Chip: MA35H04F764C (LQFP216) MCP package with DDR2 (128 MB), which can run up to 650 MHz
- Power:
 - 5V Powered by USB Type-C
 - 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 (SD0, supports SD2.0)
 - Standard-SD memory card (SD1, supports SD3.0)
- One power-on setting DIP-Switch for evaluation booting source selection
- One set of 10/100 Megabit Ethernet port: One Megabit Ethernet (RMII) PHY device, one transformer and one RJ45 port connector
- Two sets of high speed USB ports: One Host/Device port and one Host port
- One audio codec with microphone input and speaker output
- Two set of RS232/RS485 transceiver and DB9/header connector
- One set of CAN FD transceiver and header connector
- Three user key buttons
- Three user LEDs
- One 3-channel ADC header connector
- One LCM connector to connect with 7" 1024x600 LCD daughter board

2.2 NuMaker TFT-LCD7 Board Features

- One LCD FPC connector to connect with 7" 1024x600 TFT LCD panel
- One 4-wire resistive or Capacitive touch FPC connector
- One connector to connect with NuMaker-HMI-MA35H04F70 board

3 HARDWARE CONFIGURATION

3.1 NuMaker-HMI-MA35H04F70 Board

3.1.1 Front View

Figure 3-1 shows the main components and connectors from the front side of NuMaker-HMI-MA35H04F70 board.

- Target Chip (U1): MA35H04F764C (LQFP216) MCP package with DDR2 (128 MB).

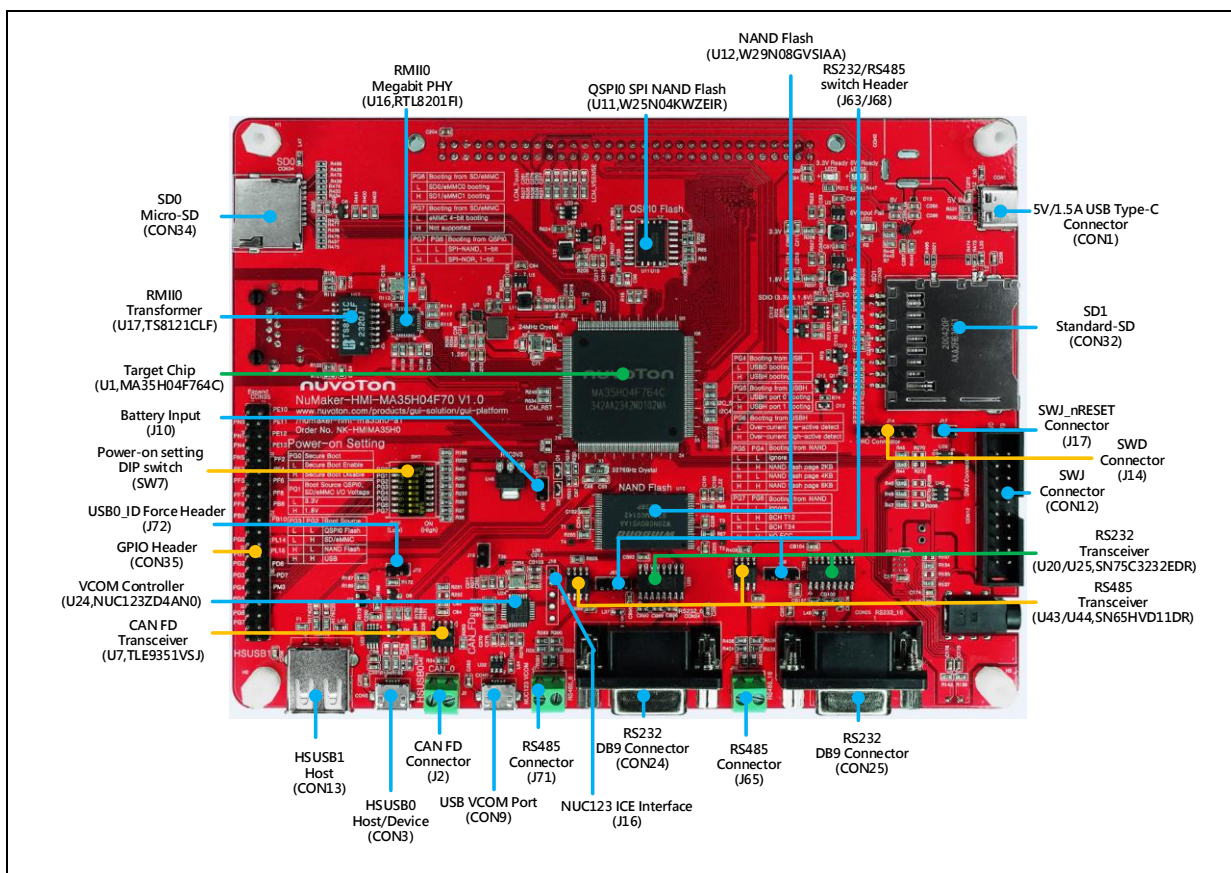


Figure 3-1 Front View of NuMaker-HMI-MA35H04F70

3.1.2 Rear View

Figure 3-2 shows the main components and connectors from the rear side of NuMaker-HMI-MA35H04F70 board.

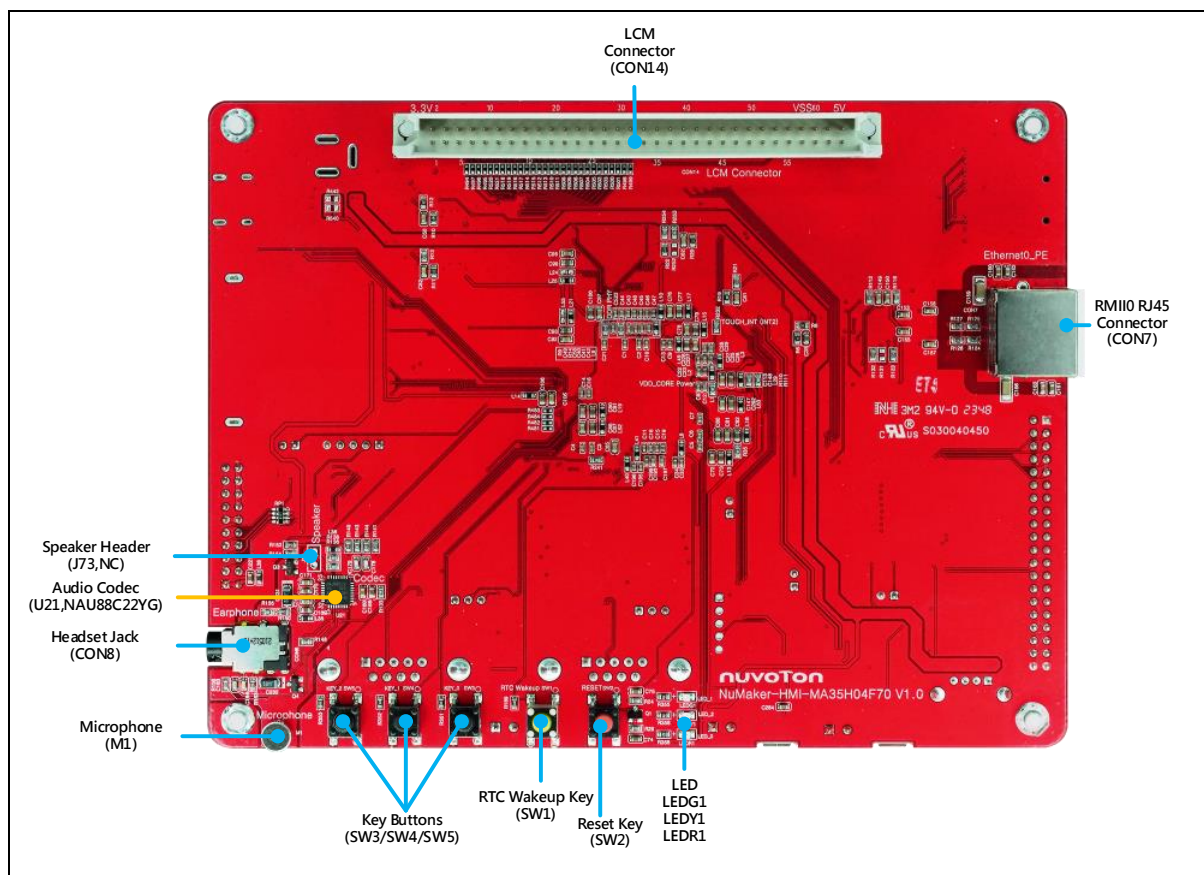


Figure 3-2 Rear View of NuMaker-HMI-MA35H04F70

3.1.3 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 MA35H04F764C target chip.

Mounted on PCB	DRAM_VDD Voltage	MA35H0 PN / MCP DRAM Type
R252*1	1.35V	-
R253*1	1.8V	MA35H04F764C / DDR2*2

Note *1: Only one resistor R252 or R253 can be mounted on the PCB and user should make sure which part number chip of MA35H0 series that be mounted on the NuMaker-HMI- MA35H04F70 board.

Note *2: By default, only R253 resistor and MA35H04F764C target chip are mounted on the NuMaker-HMI- MA35H04F70 board.

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

3.1.4 Audio Codec

- Audio Codec Device (U21): 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 (J73): To connect a speaker to output audio sound.

- Microphone (M1): An on-board microphone for audio sound input.

Function Name	GPIO Pin of MA35H0	Default Connected R#	Conflict Function / R#
I2S0_MCLK	PG11	R44	JTAG_TDO / R372*
I2S0_LRCK	PG12	R45	JTAG_TCK_SW_CLK / R370*
I2S0_BCLK	PG13	R46	JTAG_TMS_SW_DIO / R369*
I2S0_DI	PG14	R47	JTAG_TDI / R368*
I2S0_DO	PG15	R48	JTAG_nTRST / R371*
Note *: No connection (NC) by default.			

Table 3-2 I2S0 (U21) Pin Function

Function Name	GPIO Pin of MA35H0	Default Connected R#
I2C0_SDA	PM8	R143
I2C0_SCL	PM9	R144
Note *: No connection (NC) by default.		

Table 3-3 I2C0 (U21) Pin Function

Function Name	GPIO Pin of MA35H0
AUDIO_JKEN#	PM6
AUDIO_JKDET	PM7
Note *: No connection (NC) by default.	

Table 3-4 Audio Codec (U21) Control Pin Function

3.1.5 RMII Megabit Ethernet

- RMII0 Megabit PHY (U16) and Transformer (U17): The RMII0 MAC of MA35H0 series needs an external Megabit PHY (RTL8201FI) and a transformer (TS8121C) to connect with the Ethernet network.
- RMII0 RJ45 Connector (CON7): The Ethernet RMII0 RJ45 connector.

Pin No.	Pin Name	Pin of MA35H0
1	RMII0_MDC	PE0
2	RMII0_MDIO	PE1
3	RMII0_TXEN	PE2
4	RMII0_TXD0	PE3

5	RMII0_TXD1	PE4
6	RMII0_REFCLK	PE5
7	RMII0_CRSDV	PE6
8	RMII0_RXD0	PE7
9	RMII0_RXD1	PE8
10	RMII0_RXERR	PE9

Table 3-5 RMII0 Pin Function

Pin of Transformer (U17)	Pin Name	Note
1	MDI-[1]	To RTL8201FI (U16)
2	CT	
3	MDI+[1]	To RTL8201FI (U16)
4	-	NC
5	-	NC
6	MDI-[0]	To RTL8201FI (U16)
7	CT	
8	MDI+[0]	To RTL8201FI (U16)
9	TX+	To RJ45 (CON7)
10	CT	
11	TX-	To RJ45 (CON7)
12	-	NC
13	-	NC
14	RX+	To RJ45 (CON7)
15	CT	
16	RX-	To RJ45 (CON7)

Table 3-6 Transformer (U17) Pin Function

3.1.6 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 MA35H0
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 MA35H0 series, the default voltage of VDDIO5 (power input VDD_QSPI0) is VDD1V8 (DC 1.8V) on this NuMaker-HMI- MA35H04F70 board.

Table 3-7 QSPI0 Flash (U11) Pin Function

3.1.7 NAND Flash

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

Function Name	GPIO Pin of MA35H0
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 3-8 NAND Flash (U12) Pin Function

3.1.8 USB Virtual COM (VCOM) Port

- USB VCOM Port (CON9, USB Micro-AB Receptacle): The NUC123ZD4AN0 microcontroller

(MCU) (U24) acts as an USB VCOM device to communicate data between the UART0 port of MA35H0 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).

- VCOM Controller (U24): The NUC123ZD4AN0 microcontroller (U24) acts as an USB VCOM device to communicate data between the UART0 port of MA35H0 series and USB host of PC.
- NUC123 ICE Interface (J16): The ICE interface of NUC123ZD4AN0 microcontroller (U24) 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-HMI-MA35H04F70 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 3-9 NUC123 ICE Interface (J16) Pin Function

3.1.9 Powered by USB Type-C

- 5V Powered by USB Type-C (CON1): This USB Type-C needs to connect an external power (PC or adapter) to supply DC 5V/1.5A for this board.

3.1.10 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-HMI-MA35H04F70 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 3-10 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 3-11 Booting Source QSPI0 and SD/eMMC IO Voltage Options

- Options for booting source selection:

SW7.4 / PG3* ¹	SW7.3 / PG2* ¹	Bootng 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 SD0 micro card slot on this NuMaker-HMI-MA35H04F70 board.

Table 3-12 Bootng Source Options

- Options for bootng 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 3-13 Page Size Options for NAND Flash Bootng 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 3-14 ECC Options for NAND Flash Bootng Source

- Options for bootng 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

Note *¹: The GPIO PG6 is internal weakly pull-down.

Note *²: There's only SD0 micro card slot on this NuMaker-HMI-MA35H04F70 board.

Table 3-15 Options for SD Card 0/1 or eMMC 0/1 Device Booting Source

SW7.8 / PG7* ¹	Boot from SD/eMMC
Low	eMMC 4-bit Booting* ²
High	Not Supported* ²
Note * ¹ : The GPIO PG7 is internal weakly pull-down.	
Note * ² : There's no eMMC memory device on this NuMaker-HMI-MA35H04F70 board.	

Table 3-16 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 3-17 1-bit Options for QSPI0 NAND/NOR Flash Booting Source

- Options for booting from USB0 or USBH:

SW7.5 / PG4* ¹	Boot from USB
Low	USB Device Booting
High	USB Host Booting
Note * ¹ : The GPIO PG4 is internal weakly pull-down.	

Table 3-18 Options for USB0 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.	

Table 3-19 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.	

Table 3-20 Over-current High/Low-active Detect Options for USBH Booting Source

3.1.11 Reset and RTC Wake-up Control

- Reset Button (SW2): Press this key to reset the MA35H04F764C target chip on this NuMaker-HMI-MA35H04F70 board.
- RTC Battery Connector (J10): 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 MA35H04F764C target chip on this NuMaker-HMI-MA35H04F70 board from standby state.
- RTC Wake-up Control Pins: The RTC_RPWR and RTC_nRWAKE pins of MA35H0 are the RTC wake-up control pins to control the related DC/DC power whether output voltages or not.

Pin No.	Pin Name of MA35H0	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-HMI-MA35H0-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 MA35H0 is wired directly to these EN input pins of the discrete power IC devices (U2~U6) on this NuMaker-HMI-MA35H04F70 board by default. (Only the R250 resistor is unmounted on board, but both R189 and R210 are mounted)

Note *²: This RTC_nRWAKE input pin is wired directly to the RTC Wakeup key button (SW1) on NuMaker-HMI-MA35H04F70 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 3-21 RTC Power Control Pins of MA35H0

3.1.12 TFT LCD Connector

- LCM Connector (CON14):

● Pin No.	Pin Name	GPIO pin of MA35H0	Default Connected R#	Conflict Function / R#
1	VDD3V3	-	-	-
2	VDD3V3	-	-	-
3	LCM_CS	PF0	R240	-
4	LCM_BLEn	PA15	R241	-
5	LCM_DEN	PK4	R497	-
6	LCM_VSYSNC	PG8	R494	-
7	LCM_HSYNC	PG9	R495	-
8	LCM_CLK	PG10	R496	-
9	LCM_DATA23	PH15	R521	-
10	LCM_DATA22	PH14	R520	-

11	LCM_DATA21	PH13	R519	-
12	LCM_DATA20	PH12	R518	-
13	LCM_DATA19	PC15	R517	-
14	LCM_DATA18	PC14	R516	-
15	LCM_DATA17	PC13	R515	-
16	LCM_DATA16	PC12	R514	-
17	LCM_DATA15	PH7	R513	-
18	LCM_DATA14	PH6	R512	-
19	LCM_DATA13	PH5	R511	-
20	LCM_DATA12	PH4	R510	-
21	LCM_DATA11	PH3	R509	-
22	LCM_DATA10	PH2	R508	-
23	LCM_DATA9	PH1	R507	-
24	LCM_DATA8	PH0	R506	-
25	LCM_DATA7	PI15	R505	-
26	LCM_DATA6	PI14	R504	-
27	LCM_DATA5	PI13	R503	-
28	LCM_DATA4	PI12	R502	-
29	LCM_DATA3	PI11	R501	-
30	LCM_DATA2	PI10	R500	-
31	LCM_DATA1	PI9	R499	-
32	LCM_DATA0	PI8	R498	-
33	-	-	-	-
34	-	-	-	-
35	-	-	-	-
36	-	-	-	-
37	LCM_PWM	PM11	R239	
38	LCM_RST	PF1	R534	nRESET / R234*
39	VSS	-	-	-
40	VSS	-	-	-
41	LCM_XP	PB15	R526	-

42	LCM_VSENSE	PB11	R231	
43	LCM_XM	PB14	R536	-
44	LCM_YM	PB12	R535	-
45	-	-	-	-
46	LCM_YP	PB13	R537	-
47	VSS	-	-	-
48	VSS	-	-	-
49	LCM_I2C5_SCL	PM5	R274	
50	LCM_I2C5_SDA	PM4	R275	
51	TOUCH_INT	PK12	R232	
52	-	-	-	-
53	LCM_I2C4_SDA	PM0	R230	
54	LCM_I2C4_SCL	PM1	R229	
55	-	-	-	-
56	-	-	-	-
57	-	-	-	-
58	-	-	-	-
59	VSS	-	-	-
60	VSS	-	-	-
61	-	-	-	-
62	-	-	-	-
63	VDD5V	-	-	-
64	VDD5V	-	-	-
Note *: No connection (NC) by default.				

Table 3-22 LCM Connector (CON14) Pin Function

3.1.13 SWJ

- SWJ_nRESET Header (J17): 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 MA35H0	Default Connected R#	Conflict Function / R#
1	VDD3V3	-	-	-
2	VDD3V3	-	-	-
3	JTAG_nTRST	PG15	R371*	I2S0_DO / R48
4	VSS	-	-	-
5	JTAG_TDI	PG14	R368*	I2S0_DI / R47
6	VSS	-	-	-
7	JTAG_TMS / SW_DIO	PG13	R369*	I2S0_BCLK / R46
8	VSS	-	-	-
9	JTAG_TCK_ SW_CLK	PG12	R370*	I2S0_LRCK / R45
10	VSS	-	-	-
11	VSS	-	-	-
12	VSS	-	-	-
13	JTAG_TDO	PG11	R372*	I2S0_MCLK / R44
14	VSS	-	-	-
15	SWJ_nRESET	nRESET	J3	-
16	VSS	-	-	-
17	-	-	-	-
18	VSS	-	-	-
19	-	-	-	-
20	VSS	-	-	-
Note *: No connection (NC) by default.				

Table 3-23 SWJ Interface (CON12) Pin Function

3.1.14 HS USB2.0 Connectors

- USB0_ID Header (J72): 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 (CON3, 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 J72 connector to force the ID pin of HSUSB0 at low state.
- HSUSB1 Host (CON13, USB Type-A Receptacle): HSUSB1 for USB Host with Type-A connector.

3.1.15 RS232 or RS485

- RS232_6: The UART6 to RS232 transceiver (U20, SN75C3232EDR) and Connector (CON24).

Pin No.	Function Name
1	
2	UR6_TX
3	UR6_RX
4	
5	VSS
6	
7	UR6_CT
8	UR6_RT
9	
10	
11	

Table 3-24 RS232_6 Connector (CON24) Pin Function

- RS485_6: The UART6 to RS485 transceiver (U43, SN65HVD11DR) and Connector (J71).

Pin No.	Function Name
1	RS485_A1
2	RS485_B1

Table 3-25 RS485_6 Connector (J71) Pin Function

Note: UART6 can use J63 to switch functions (RS232 or RS485)

- RS232_16: The UART6 to RS232 transceiver (U25, SN75C3232EDR) and Connector (CON25).

Pin No.	Function Name
1	
2	UR16_TX
3	UR16_RX
4	
5	VSS
6	
7	UR16_CT
8	UR16_RT
9	

10	
11	

Table 3-26 RS232_16 Connector (CON25) Pin Function

- RS485_16: The UART6 to RS485 transceiver (U44, SN65HVD11DR) and Connector (J65).

Pin No.	Function Name
1	RS485_A2
2	RS485_B2

Table 3-27 RS485_16 Connector (J65) Pin Function

Note: UART16 can use J68 to switch functions (RS232 or RS485)

3.1.16 CAN FD

- CAN_0 :The CAN_0 transceiver (U7, TLE9351VSJ) and connector (J2).

Pin No.	Function Name
1	CAN0_H
2	CAN0_L

Table 3-28 CAN_0 Header (J2) Pin Function

3.1.17 Key Buttons and LEDs

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

KEY_#	SW#	GPIO pin of MA35H0	Pull-up Power
KEY_0	SW3	PK10	VDD3V3
KEY_1	SW4	PK11	VDD3V3
KEY_2	SW5	PM2	VDD3V3

Table 3-29 Key Buttons (KEY_0, KEY_1, KEY_2) Pin Function

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

LED_#	Function / Color	GPIO pin of MA35H0
LED_0	LEDR1 / Red	PN6
LED_1	LEDG1 / Green	PN7
LED_2	LEDY1 / Yellow	PN10

Table 3-30 LEDs (LED_0, LED_1, LED_2) Pin Function

3.1.18 SD Card and MicroSD Card Slot

- SD0 MicroSD Card Slot (CON34): Support SD0 (SD2.0) for optional booting source.

Pin No.	Pin Name	GPIO pin of MA35H0	Default Connected R#
1	SD0_DTA2	PC4	R437
2	SD0_DTA3	PC5	R438
3	SD0_CMD	PC0	R433
4	VDD3V3	-	-
5	SD0_CLK	PC1	R434
6	VSS	-	-
7	SD0_DAT0	PC2	R435
8	SD0_DAT1	PC3	R436
9	SD0_nCD	PC6*3	R439
10	VSS	-	-
11	VSS	-	-
12	VSS	-	-
13	VSS	-	-
14*1:	SD0_PWR_CTRL#	PM10	R400*2

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

Note *2: Optional GPIO PM10 can control the power of SD0 Micro-SD card slot, but this function is disabled (R400 is NC, No Connection) by default, the power of SD0 Micro-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 3-31 SD0 MicroSD Card Slot (CON34) Pin Function

- SD1 Standard SD Card Slot (CON32): Supports SD1 (SD3.0) for optional system booting.

Pin No.	Pin Name	GPIO pin of MA35H0	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 PK9 pin or nRESET signal controls the ON/OFF of VDD_SD power that feeds the fixed 3.3V to the Standard SD card slot or not.

Table 3-32 SD1 Standard SD Card Slot (CON32) 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 3-33 PN11 Pin State Control for SD1 VDD_SDIO 3.3V or 1.8V Power Voltage

- SD1 Standard Card Power (VDD_SD) ON/OFF Control: The GPIO PK9 pin or nRESET signal controls the ON/OFF of VDD_SD power that feeds to the Standard SD card slot.

PK9 or nRESET State	SD1 VDD_SD Power ON/OFF
Low	OFF
High	ON

Table 3-34 PK9 or nRESET Pin State Control for SD1 Standard SD Card Power ON or OFF

3.2 NuMaker TFT-LCD7 Board

3.2.1 Front View

Figure 3-3 shows the main components from the front view of NuMaker TFT-LCD7 board and an on-board 7" 4-wire touch TFT LCD panel.

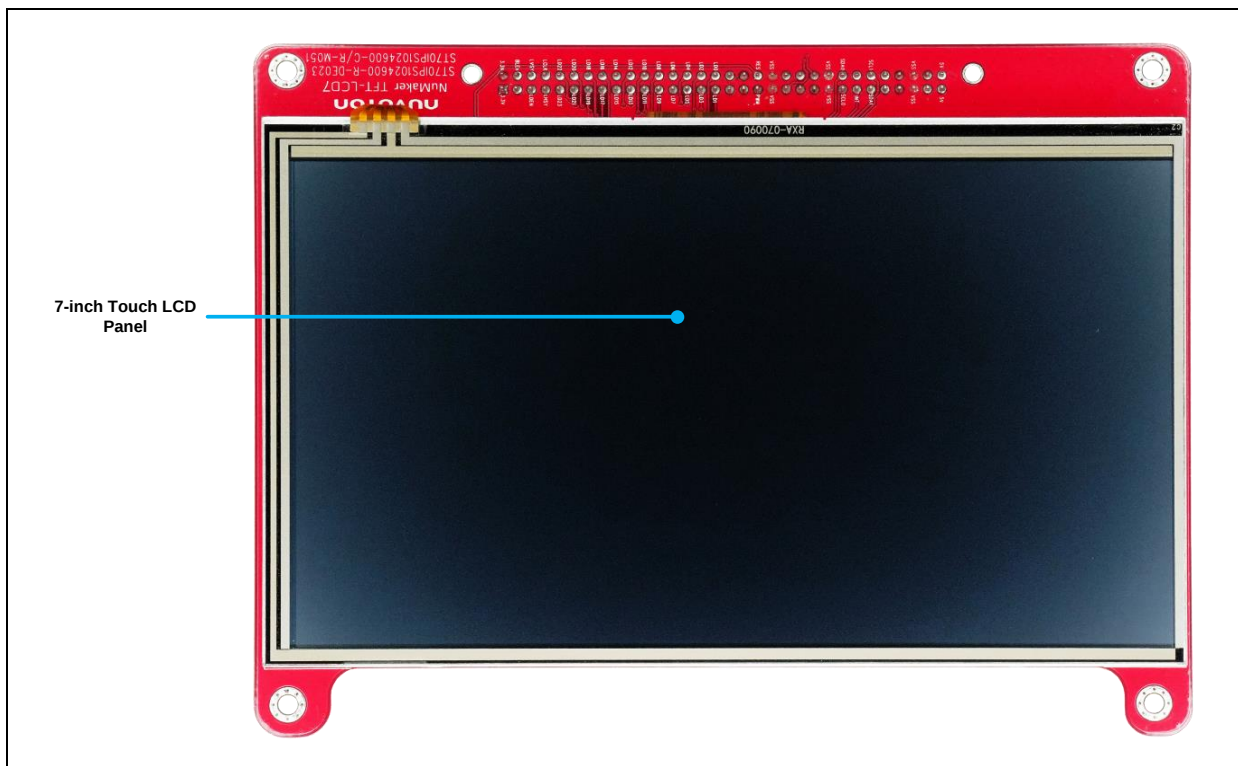


Figure 3-3 Front View of NuMaker TFT-LCD7 Board

3.2.2 Rear View

Figure 3-4 shows the main components from the rear view of NuMaker TFT-LCD7 board.

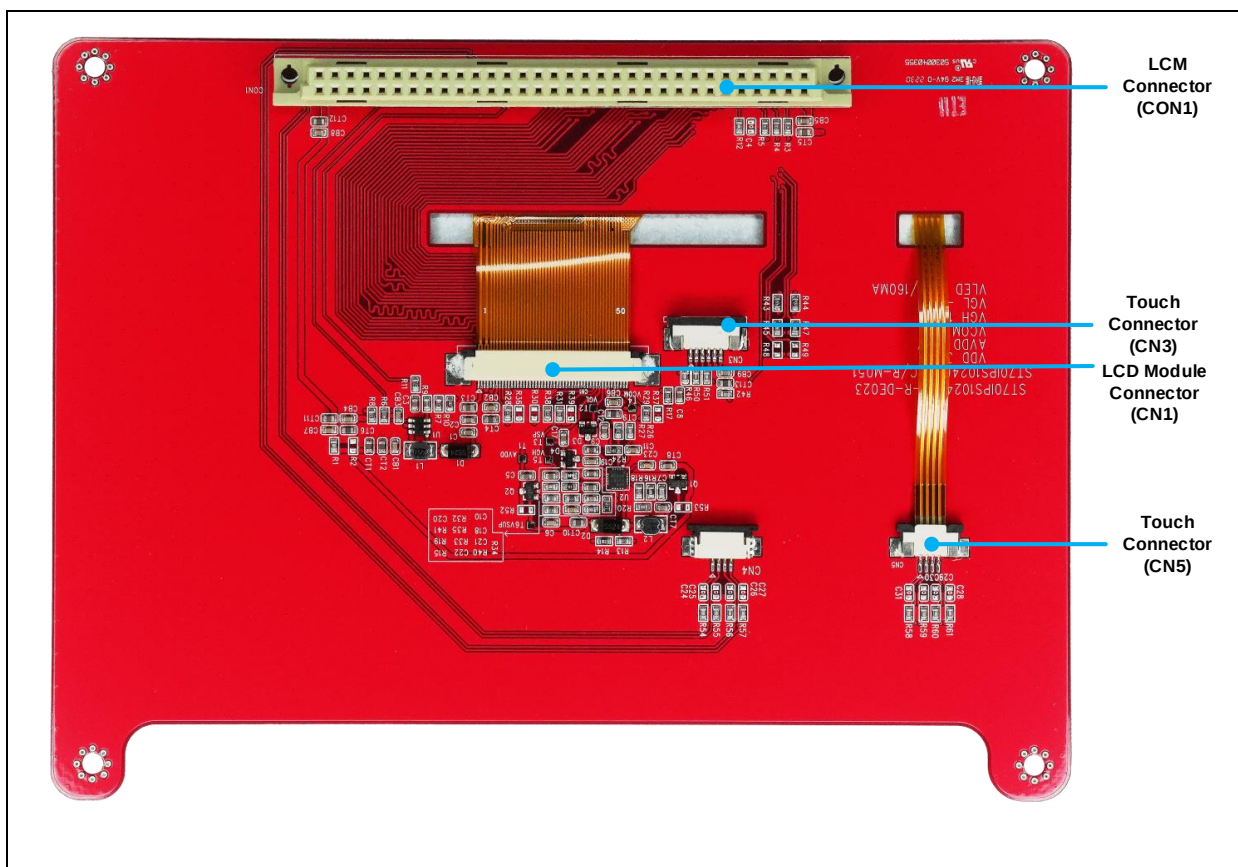


Figure 3-4 Rear View of NuMaker TFT-LCD7 Board

3.2.3 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 (CON14) of the NuMaker-HMI-MA35H04F70 board.
- Touch Connector (CN5): 4-wire resistive-touch connector of TFT LCD touch screen.
- Touch Connector (CN3): 4-wire capacitive-touch connector of TFT LCD touch screen.

4 QUICK START

This chapter guides users step by step to start the NuMicro MA35H0 evaluation system based on the NuMaker-HMI-MA35H0F70 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 SD memory card device (SD0) when power is supplied to the NuMaker-HMI-MA35H0-A1 board.

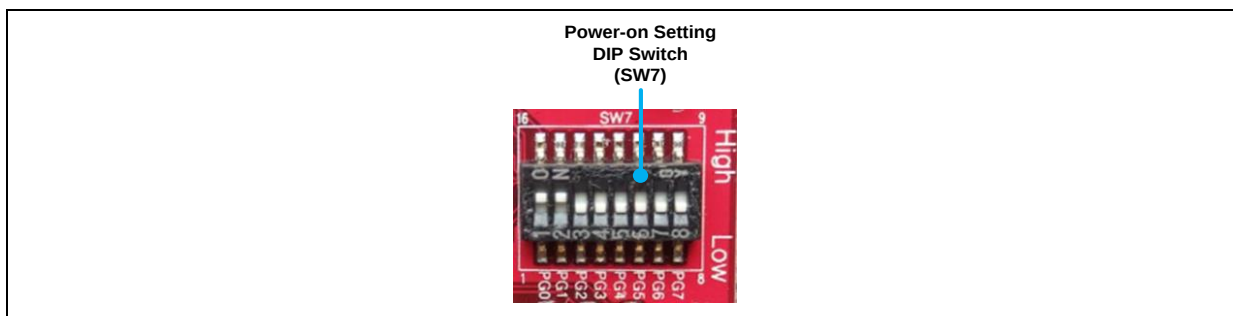


Figure 4-1 Power-on Setting DIP Switch (SW7)

- 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 (OFF)	3.3V
High	1.8V

Note *: The GPIO PG1 is internal weakly pull-down.

Table 4-2 SD Boot Source IO Voltage Configuration

- Options for booting source selection:

SW7.4 / PG3*	SW7.3 / 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 Boot Source SD/eMMC Configuration

- Options for booting from SD/eMMC device:

SW7.7 / PG6*	Boot from SD/eMMC
Low (OFF)	SD0/eMMC0 booting
High	SD1/eMMC1 booting
Note *: These GPIO PG6 and PG7 are internal weakly pull-down.	

Table 4-4 SD Boot Source SD0/eMMC0 Configuration

4.2 Power On the System

User can use USB Type-C (CON1) to provide the power to this NuMaker-HMI-MA35H0-A1 board:

- 5V Powered by USB Type-C (CON1): This USB Type-C needs to connect an external power (PC or adapter) to supply DC 5V/1.5A for this board.

4.3 VCOM Port (Optional)

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

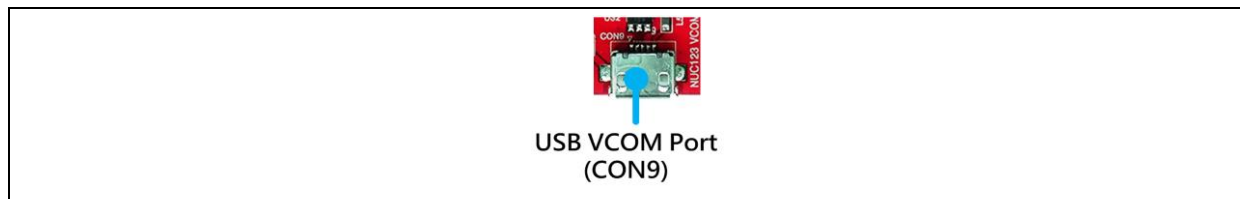


Figure 4-2 USB VCOM Port (CON9)

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)

4.5 CTP Settings

The default code setting is RTP. User can change RTP to CTP by modifying the MA35H0 device tree. Please refer to modification steps below.

Path: MA35D1_linux-5.10.y/arch/arm64/boot/dts/nuvoton/ma35h0-hmi-128m.dts

Modify adc0 status from “okay” to “disabled”

```
&adc0 {
    status = "disabled";
    pinctrl-names = "default";
    pinctrl-0 = <&pinctrl_adc0>;
};
```

Modify i2c5 and goodix touch driver status from “disabled” to “okay”

```
&i2c5 {
    pinctrl-names = "default";
    pinctrl-0 = <&pinctrl_i2c5>;
    status = "okay";

    goodix_ts@5d {
        compatible = "goodix,gt911";
        status = "okay";
        reg = <0x5d>;
        interrupt-parent = <&gpio0>;
        interrupts = <12 2>;
        reset-gpios = <&gpio0 1 0x00>;
        irq-gpios = <&gpio0 12 0x00>;
        touchscreen-size-x = <1024>;
        touchscreen-size-y = <600>;
        touchscreen-inverted-x = <1>;
        touchscreen-inverted-y = <1>;
    };
};
```

After modifying, remember to rebuild the Linux kernel.

Buildroot: make linux-rebuild && make

Yocto: bitbake linux-ma35d1 -C compile && bitbake nvt-image-qt5

5 SUPPORTING RESOURCES

5.1 Documents

For more details about MA35H0 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 MA35H0 series products from the “Products” menu on the [Nuvoton website](https://www.nuvoton.com) homepage.

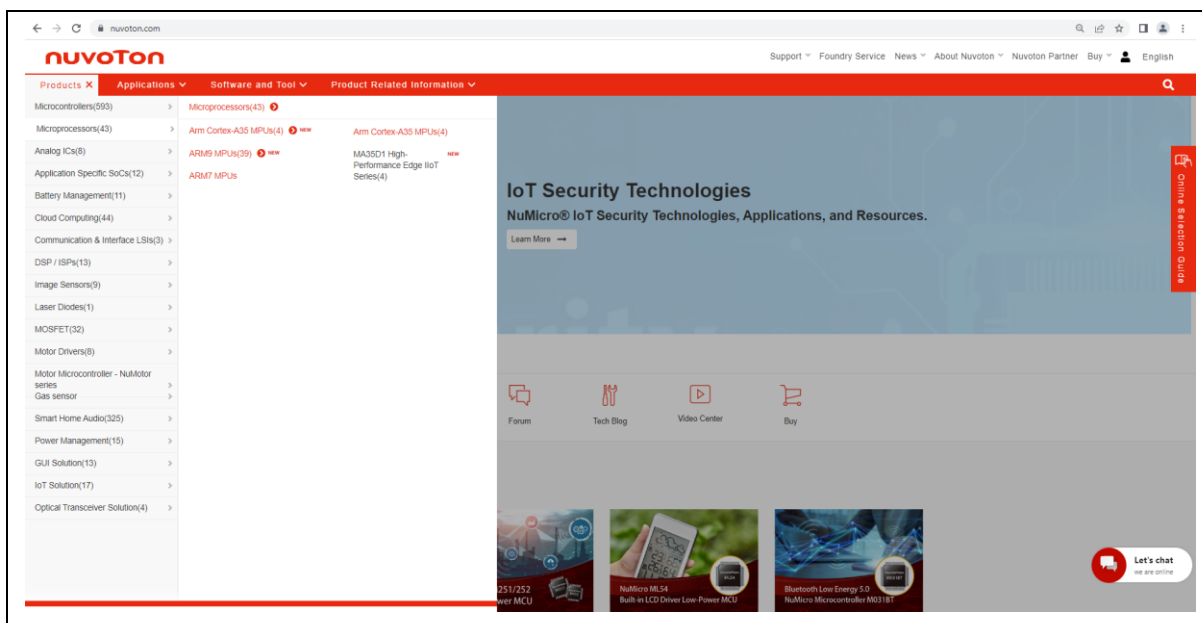


Figure 5-1 Nuvoton Website

5.2 Software

For more details about MA35H0 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.

- [Buildroot](#)
 - [TF-A](#)
 - [OP-TEE](#)
 - [U-Boot](#)
 - [Linux-5.10.y](#)
 - [Linux Applications](#)
 - [NuWriter](#)
 - [Docker](#)
- username: user
password: user

Figure 5-2 MA35H0 GitHub Resources

6 NUMAKER-HMI-MA35H0-A1/A2 SCHEMATICS

6.1 NuMaker-HMI-MA35H04F70 Schematic

6.1.1 Power Input Schematic

Figure 6-1 shows the power circuit of the NuMaker-HMI-MA35H04F70 board.

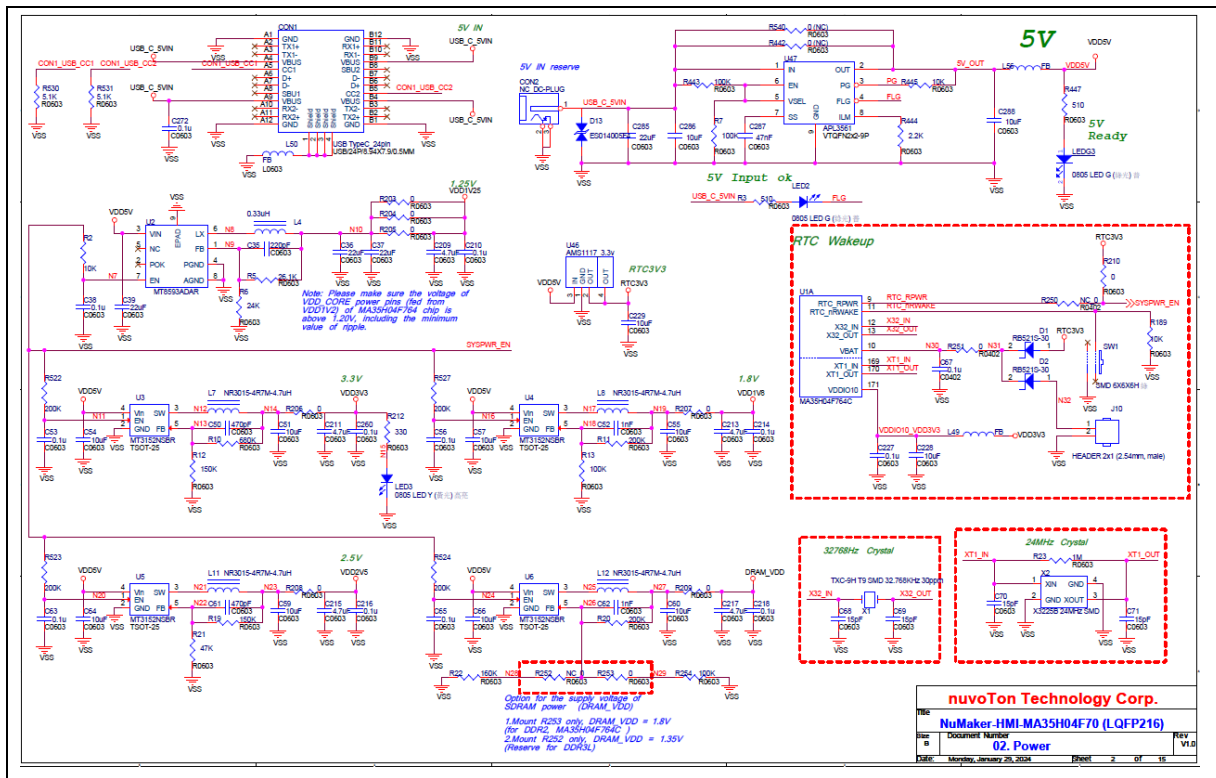


Figure 6-1 Power Input Schematic

6.1.2 ADC and Reset Buttons Schematic

Figure 6-2 shows the Reset buttons circuit of the NuMaker-HMI-MA35H04F70 board.

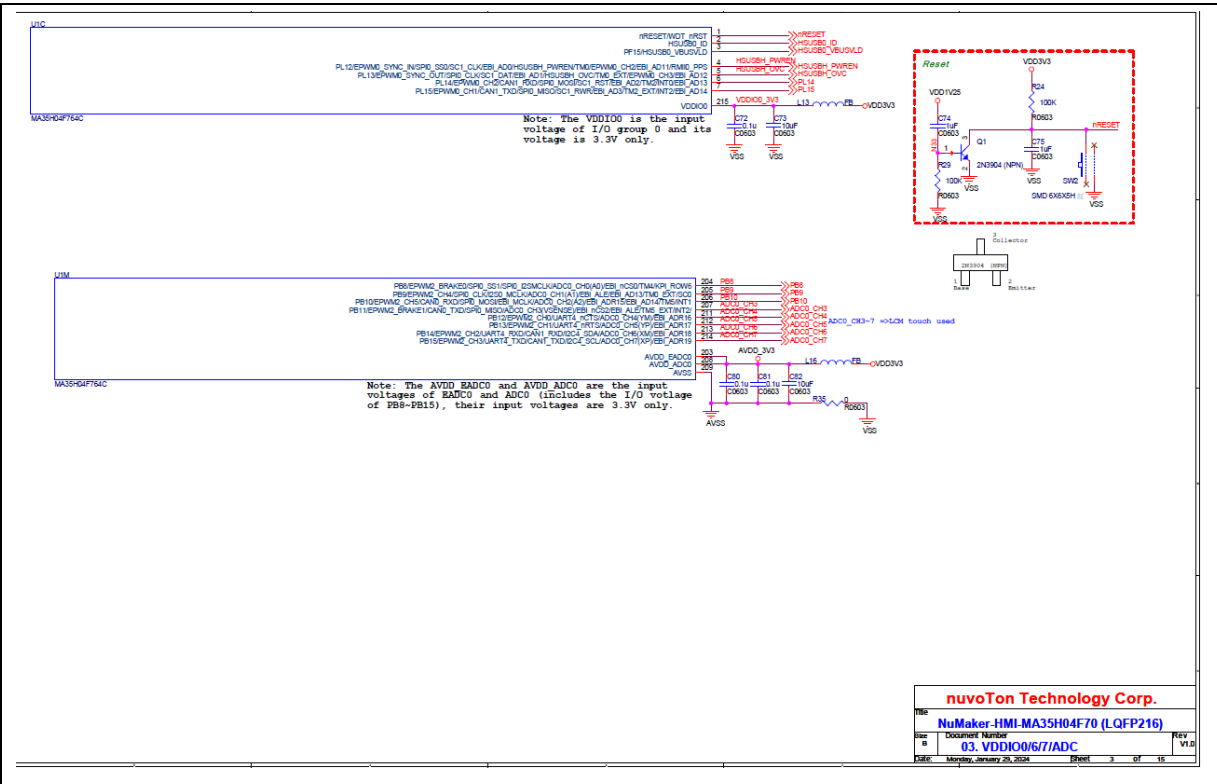


Figure 6-2 ADC and Reset Buttons Schematic

6.1.3 Power-on Setting and SWJ Schematic

Figure 6-3 shows the power-on setting and SWJ circuit of the NuMaker-HMI-MA35H04F70 board.

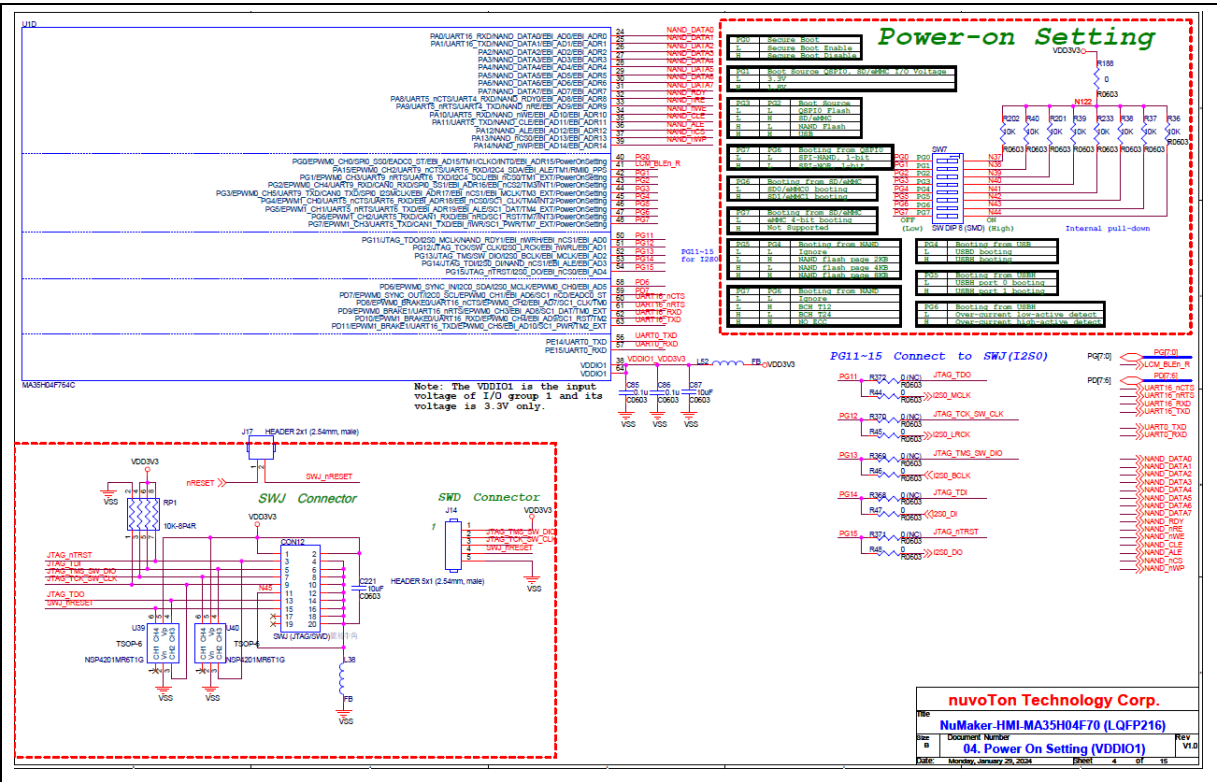


Figure 6-3 Power-on Setting and SWJ Schematic

6.1.4 Key buttons Schematic

Figure 6-4 shows the key buttons circuit of the NuMaker-HMI-MA35H04F70 board.

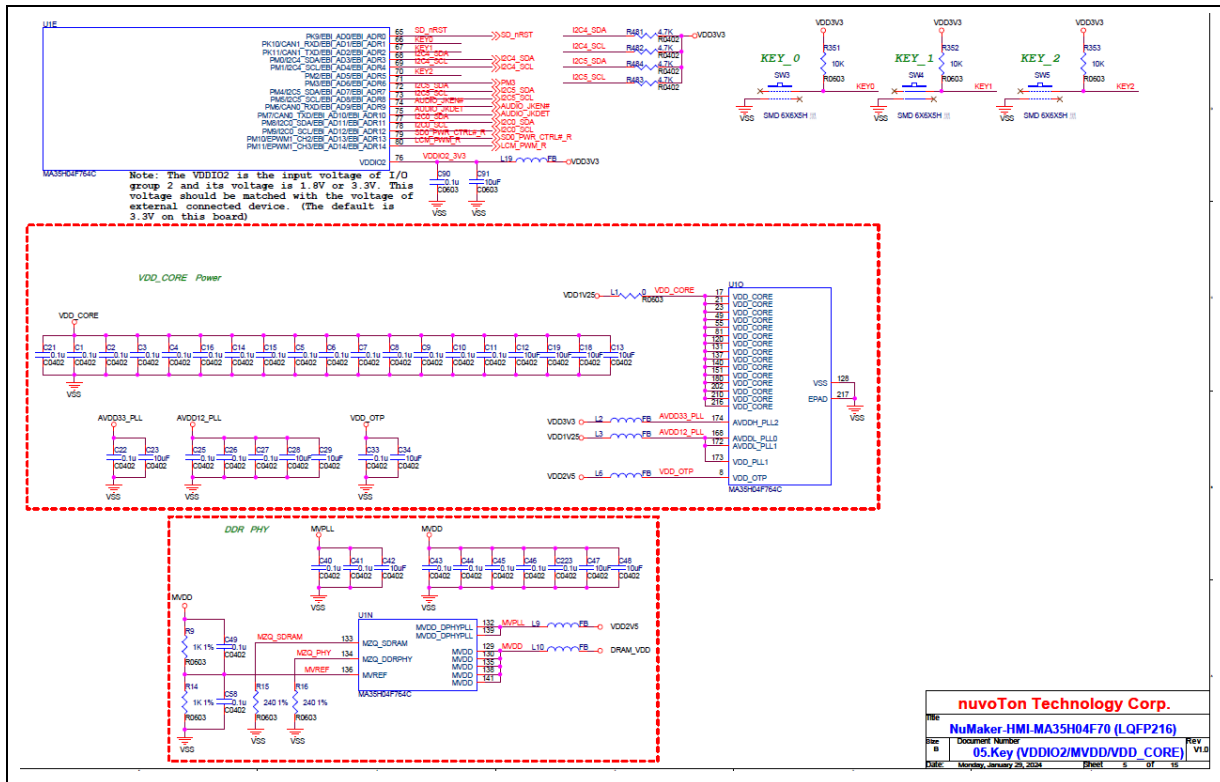


Figure 6-4 Key Buttons Schematic

6.1.5 LCM Schematic

Figure 6-5 shows the LCM circuit of the NuMaker-HMI-MA35H04F70 board.

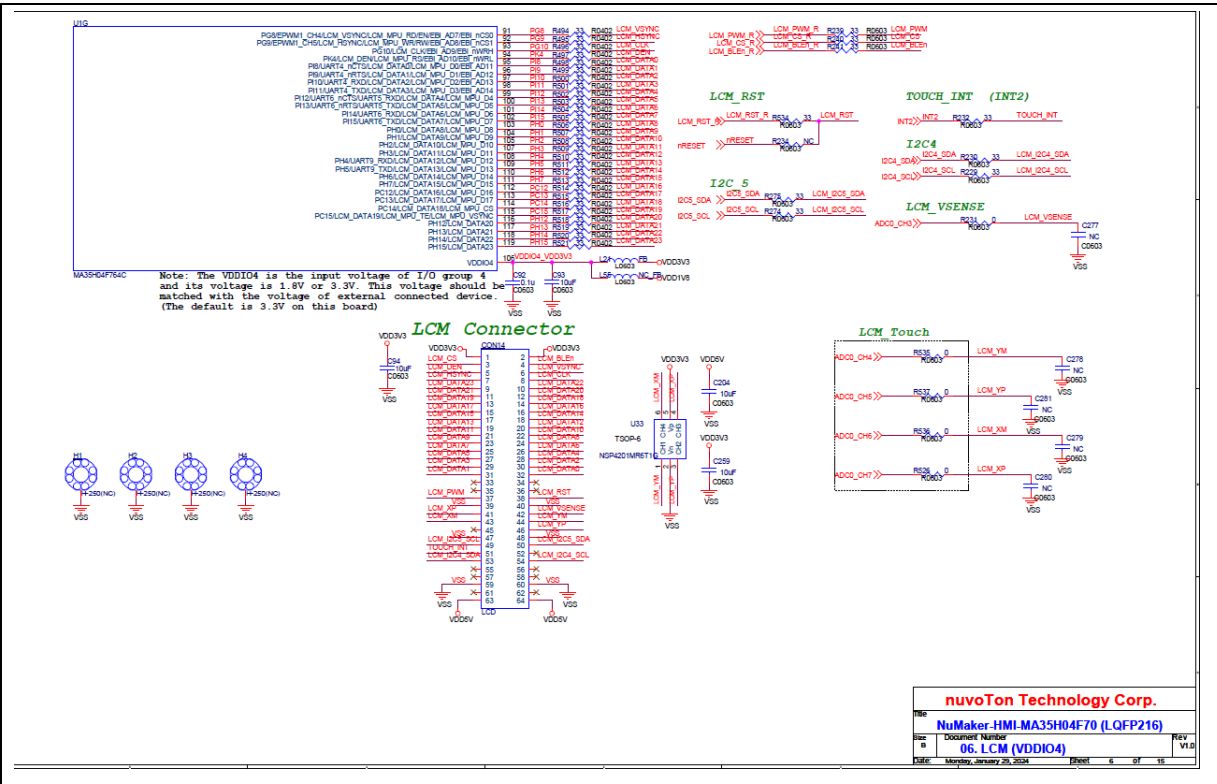


Figure 6-5 LCM Schematic

Figure 6-6 shows the QSPI0 (only SPI NAND Flash device mounted) and NAND flash device circuit of the NuMaker-HMI-MA35H04F70 board.



Figure 6-6 QSPI0 and NAND Flash Schematic

6.1.7 SD0 Schematic

Figure 6-7 shows the SD0 card slot circuit of the NuMaker-HMI-MA35H04F70 board.

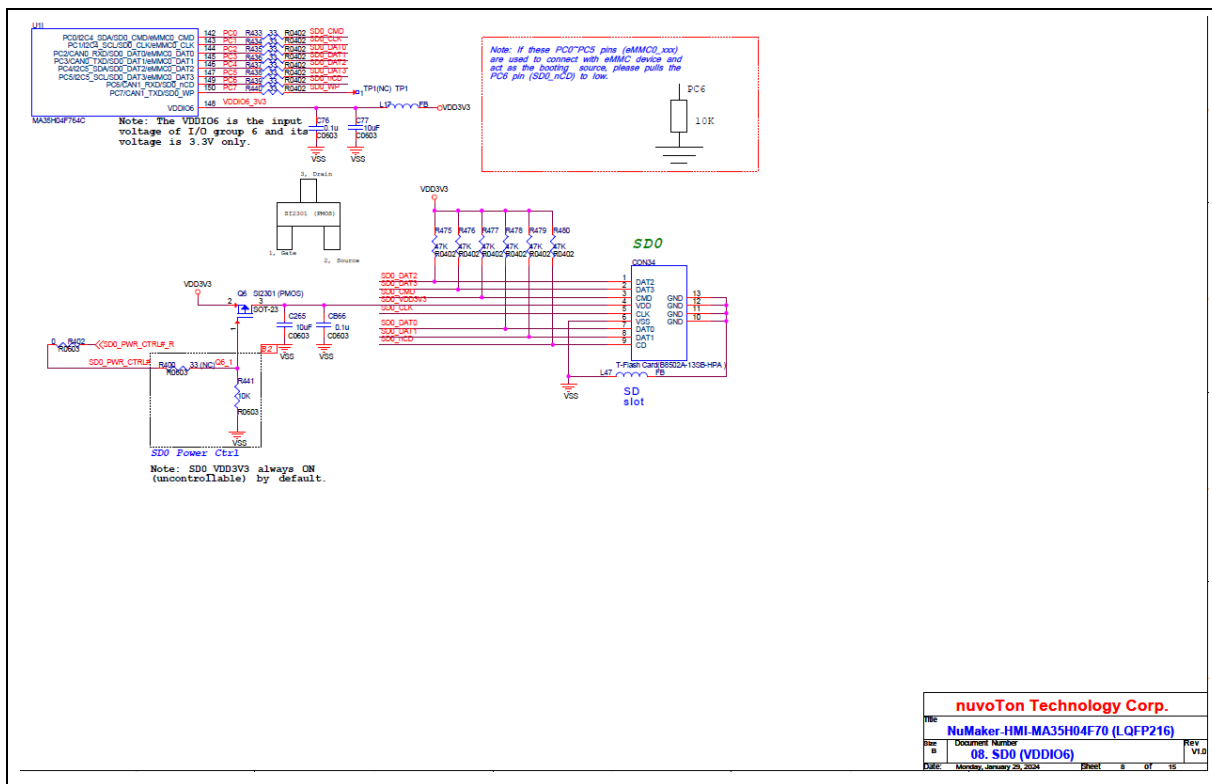


Figure 6-7 SD0 Schematic

6.1.8 SD1 Schematic

Figure 6-8 shows the SD1 card slot circuit of the NuMaker-HMI-MA35H04F70 board.

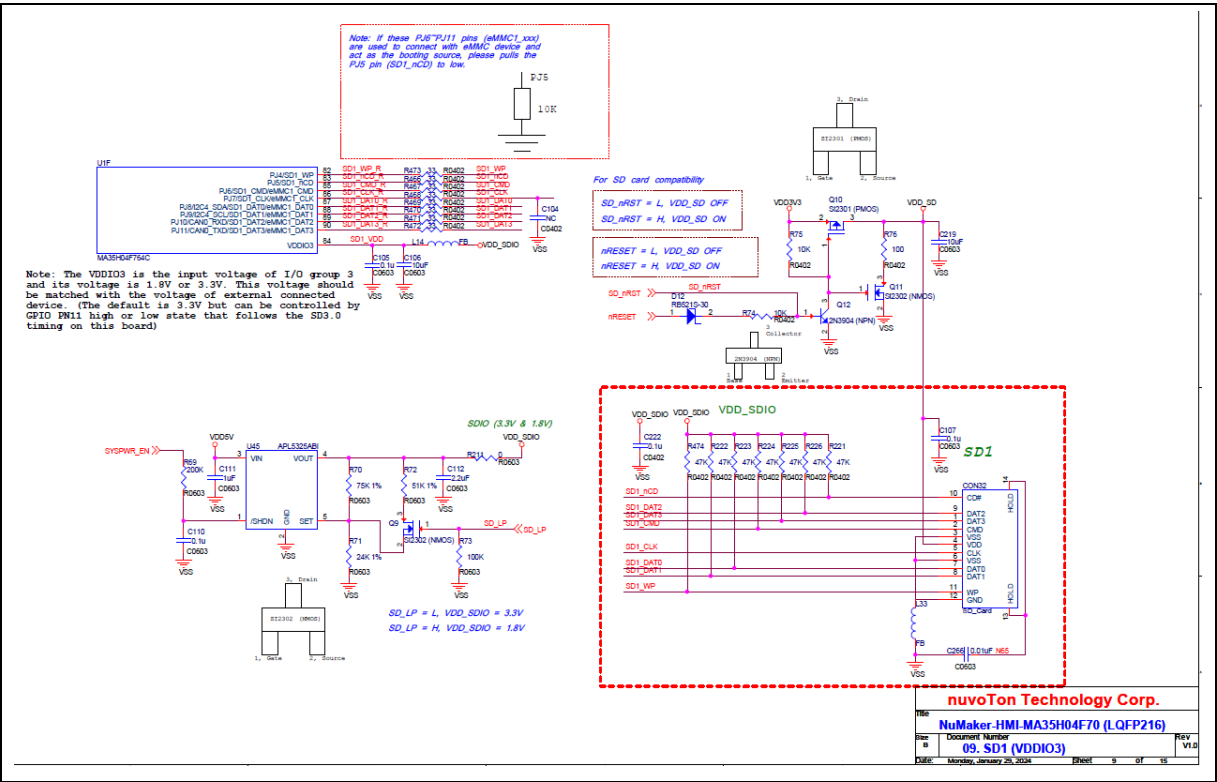


Figure 6-8 SD1 Schematic

Figure 6-10 shows the GPIO circuit of the NuMaker-HMI-MA35H04F70 board



6.1.11 NAU88C22 Audio Codec Schematic

Figure 6-11 shows the NAU88C22 audio codec circuit of the NuMaker-HMI-MA35H04F70 board.

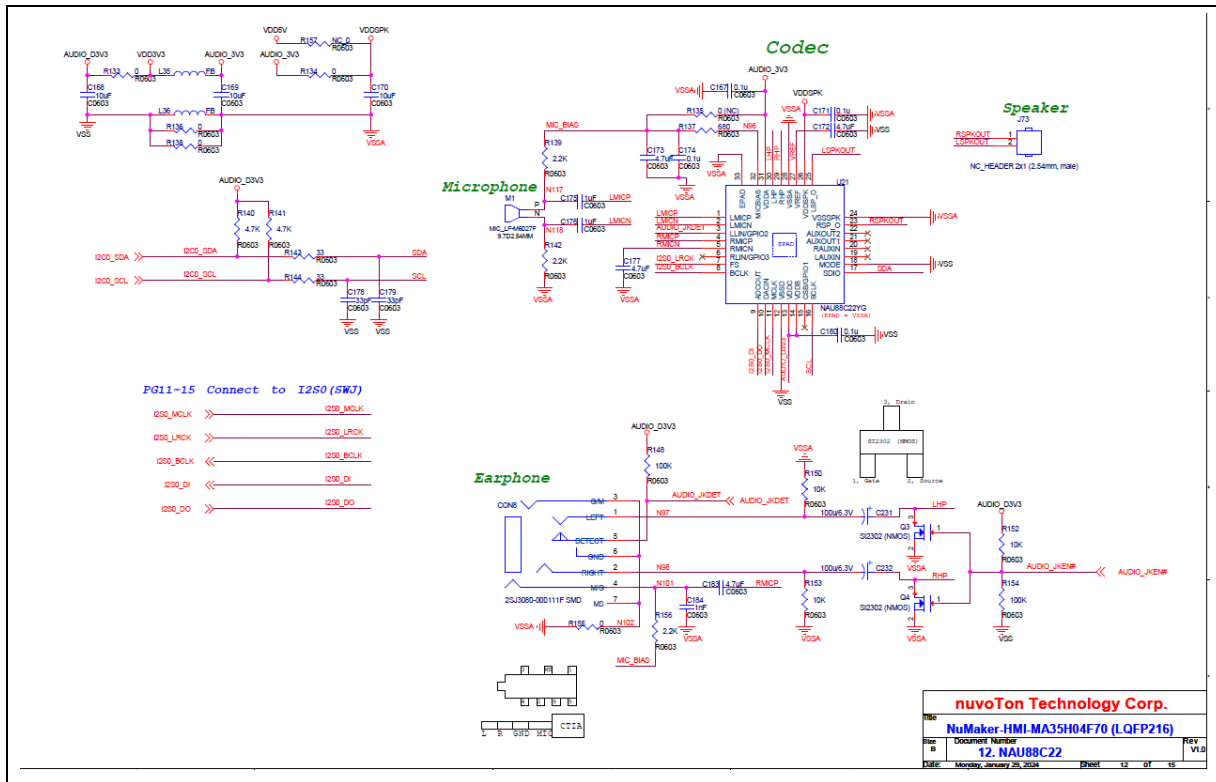


Figure 6-11 NAU88C22 Audio Codec Schematic

6.1.12 NUC123 VCOM Schematic

Figure 6-12 shows the NUC123 VCOM circuit of the NuMaker-HMI-MA35H04F70 board.

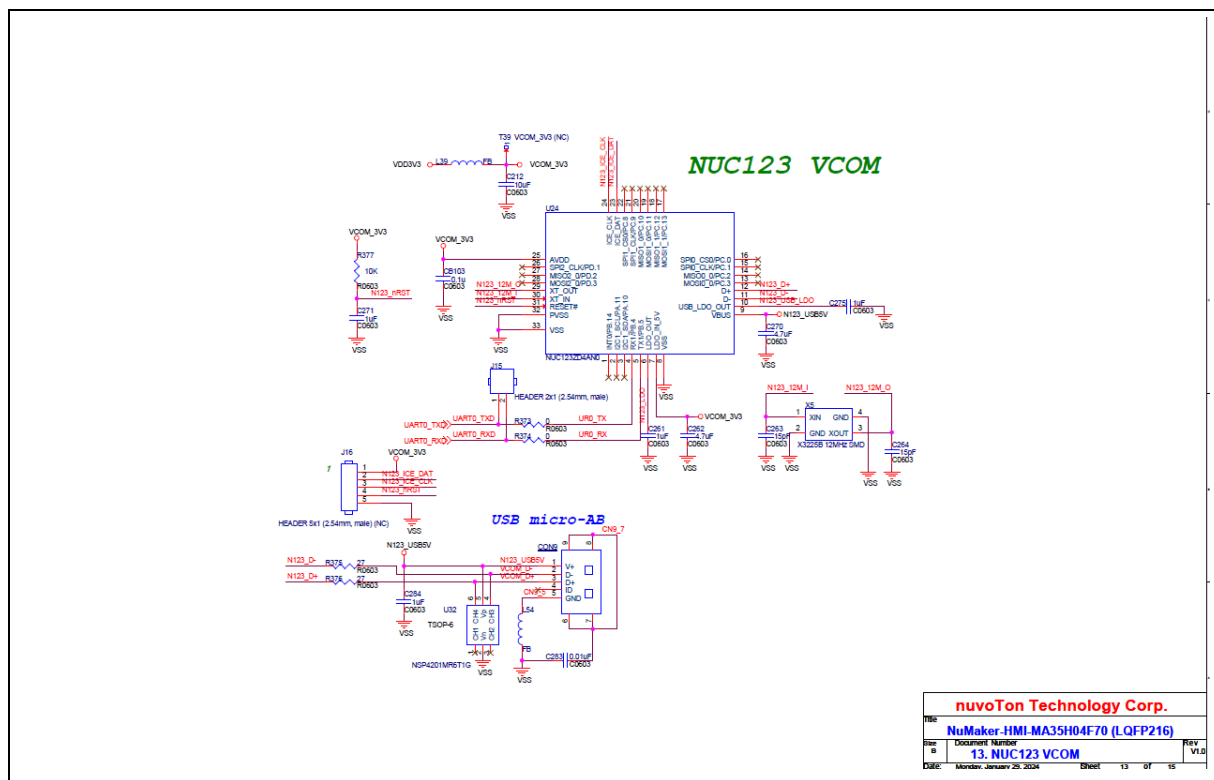


Figure 6-12 NUC123 VCOM Schematic

6.1.13 HSUSB 0/1 Schematic

Figure 6-13 shows the HS (high speed) USB 0/1 circuit of the NuMaker-HMI-MA35H04F70 board.

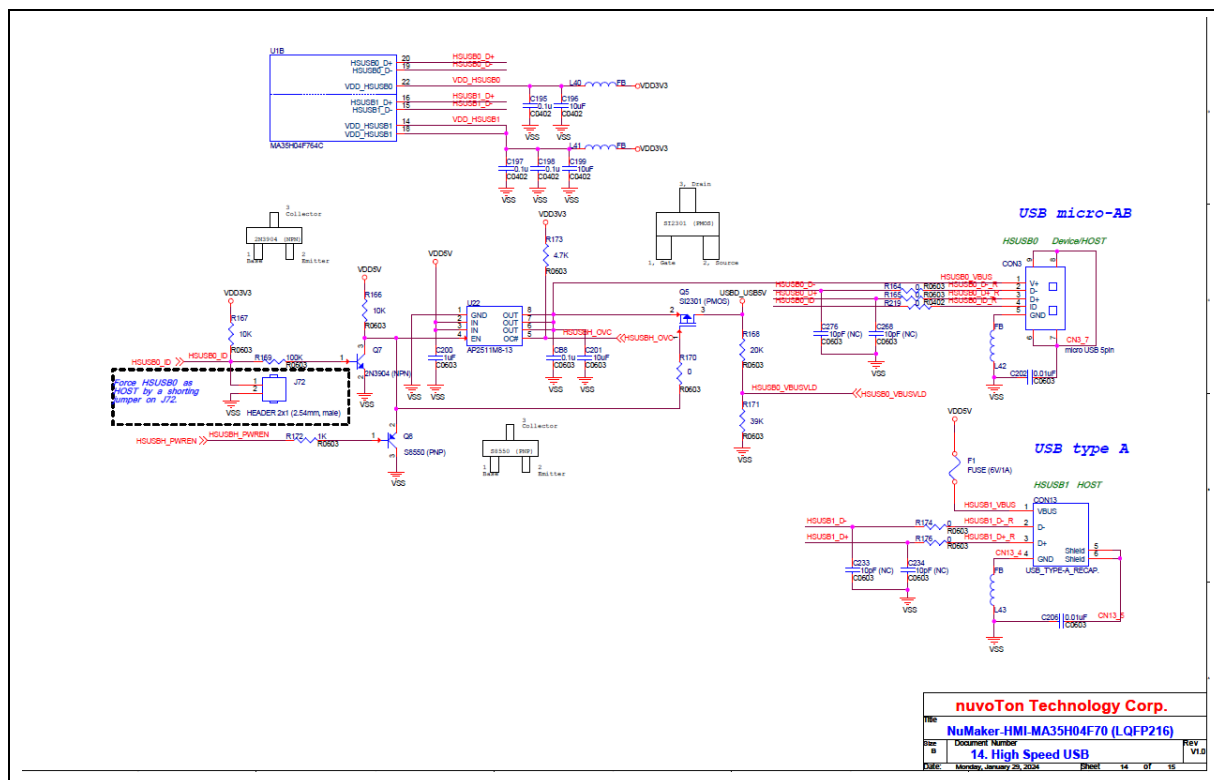


Figure 6-13 HSUSB 0/1 Schematic

6.1.14 LED, CAN FD, RS232 and RS485 Schematic

Figure 6-14 shows the LED, CAN FD, RS232 and RS485 circuit of the NuMaker-HMI-MA35H04F70 board.

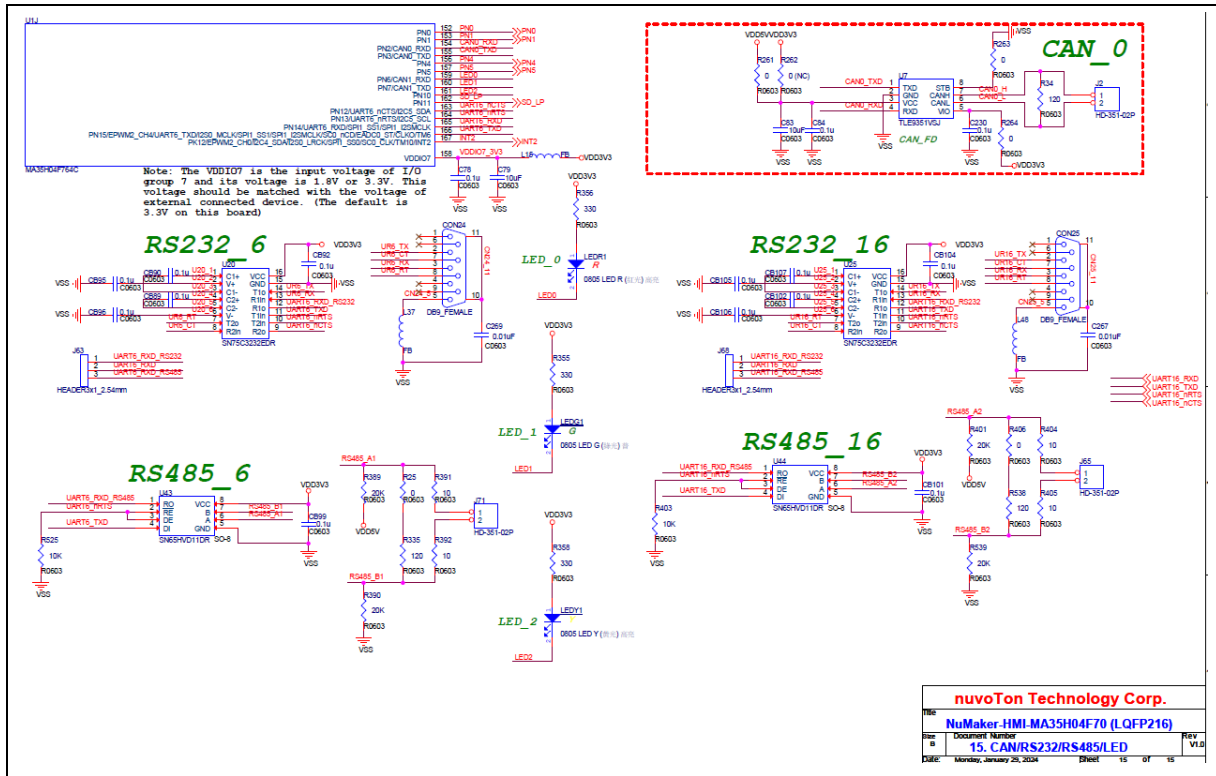


Figure 6-14 LED, CAN FD, RS232 and RS485 Schematic

6.1.15 PCB Placement

Figure 6-15 and Figure 6-16 show the front and rear PCB component placement of the NuMaker-HMI-MA35H04F70 board.

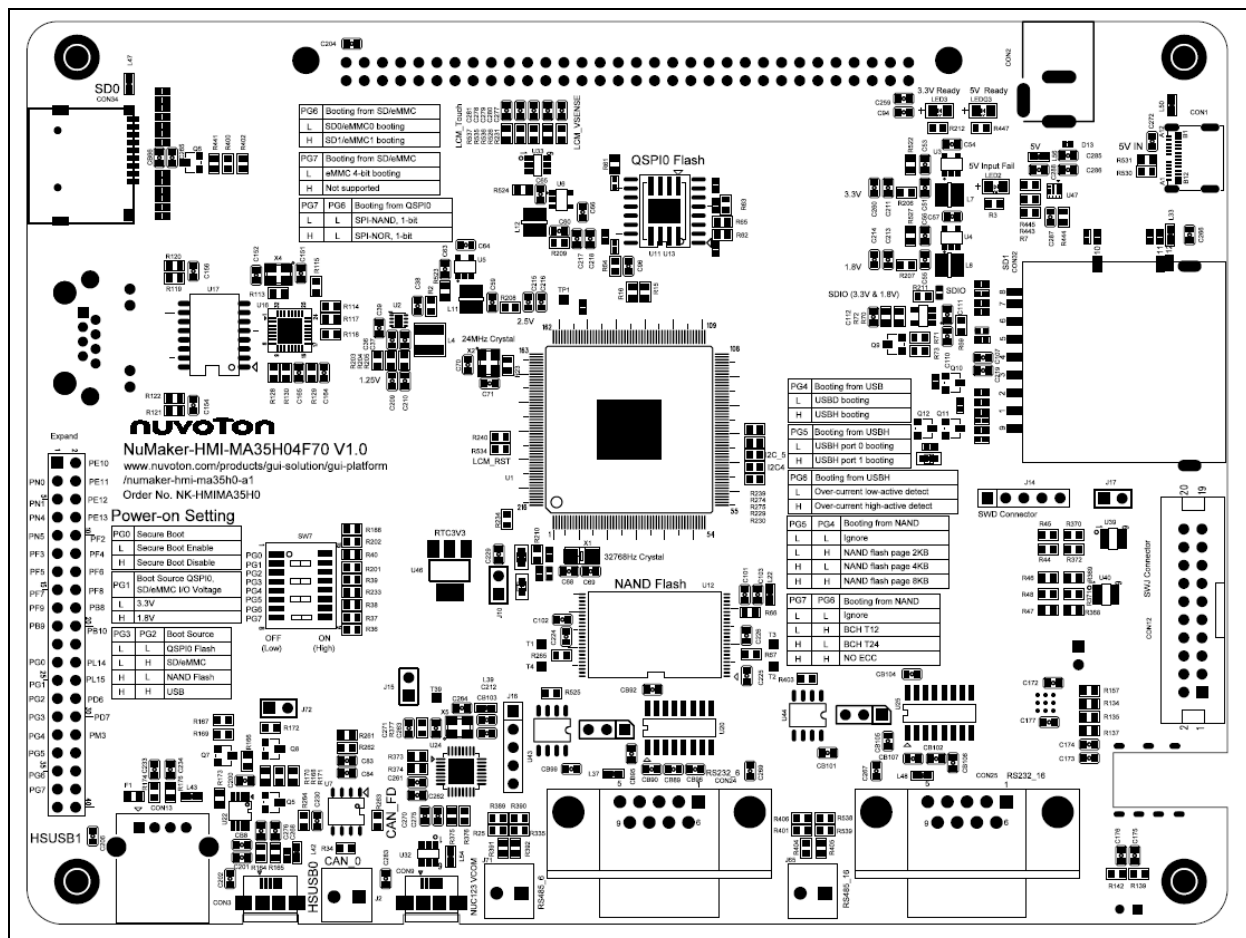


Figure 6-15 Front PCB Placement of NuMaker-HMI-MA35H070 Board



Figure 6-16 Rear PCB Placement of NuMaker-HMI-MA35H070 Board

6.2 NuMaker TFT-LCD7 Board Schematic

Figure 6-17 shows the circuit of the NuMaker TFT-LCD7 board.

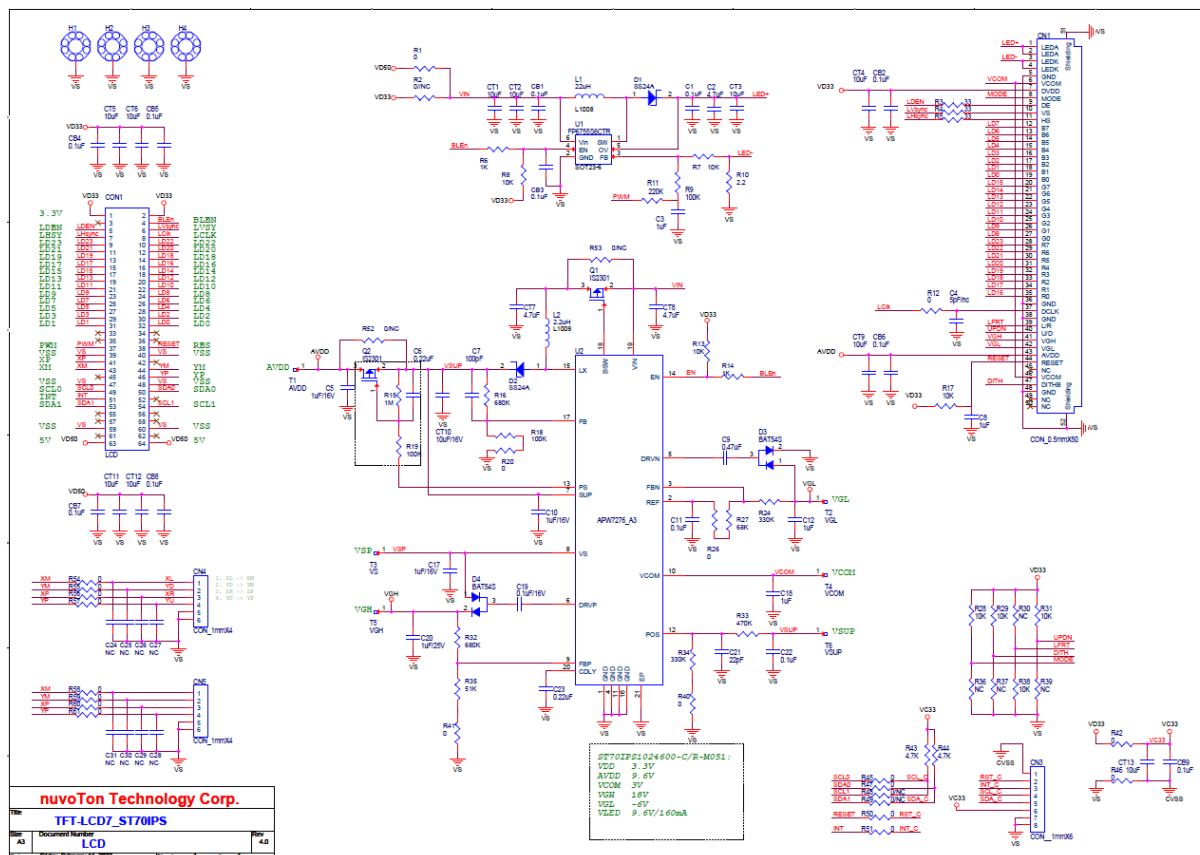


Figure 6-17 NuMaker TFT-LCD7 Board Schematic

7 REVISION HISTORY

Date	Revision	Description
2023.12.12	1.00	Initial version.
2024.01.11	1.01	Changed MA35H0 Display Resolution from 1366x768 to 1280x800.
2024.01.29	1.02	Changed Part Number from MA35H04F767C to MA35H04F764C.
2024.03.21	1.03	- Updated the section:1.2, 2.2, 3.2.3, 4.5. - Updated Figure 1-3 and Figure 1-6. - Updated Table 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.

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