

User Guide

N32H787XKB7_EVB Full-Featured Development Board Hardware User Guide

Introduction

The purpose of this document is to enable users to quickly familiarize themselves with the N32H787XKB7_EVB full-featured development board, understand its functions, usage instructions, and precautions, so as to carry out MCU debugging and development based on the development board.

Table of contents

1 HARDWARE DEVELOPMENT NOTES	3
1.1 Brief.....	3
1.2 Development board functions.....	3
1.3 Development board layout.....	4
1.4 Development Board Jumper Usage Instructions.....	7
1.5 Development board schematic.....	8
2 HISTORICAL VERSIONS	21
3 NOTICE.....	22

1 Hardware Development Notes

1.1 Brief

The N32H787XKB7_EVB full-featured development board is used for sample development of the 32-bit N32H787XKB7 chip from National Technology Corporation. This document details the functions, usage instructions, and precautions of the N32H787XKB7_EVB full-featured development board.

1.2 Development board functions

On the development board is model N32H787XKB7, with a TFBGA256 package. The development board has the following functions:

- One 100 Mbps Ethernet port and one 1 Gigabit Ethernet port (due to the shared pins with other functions, the resistors need to be manually adjusted).
- Storage supports SRAM , NAND FLASH , SDRAM , XSPI FLASH , and TF cards .
- One DVP , one MIPI DSI
- Two USB 2.0 OTG communication interfaces
- Two MIC inputs , one I2S audio output
- Two RS485 communication interfaces, one of which is an isolated RS485 interface.
- Two FDCAN communication interfaces, one of which is an isolated FDCAN .
- One ADC input and two DAC outputs
- Integrated NSLINK online debugging
- Four buttons, three LED indicators

1.3 Development board layout

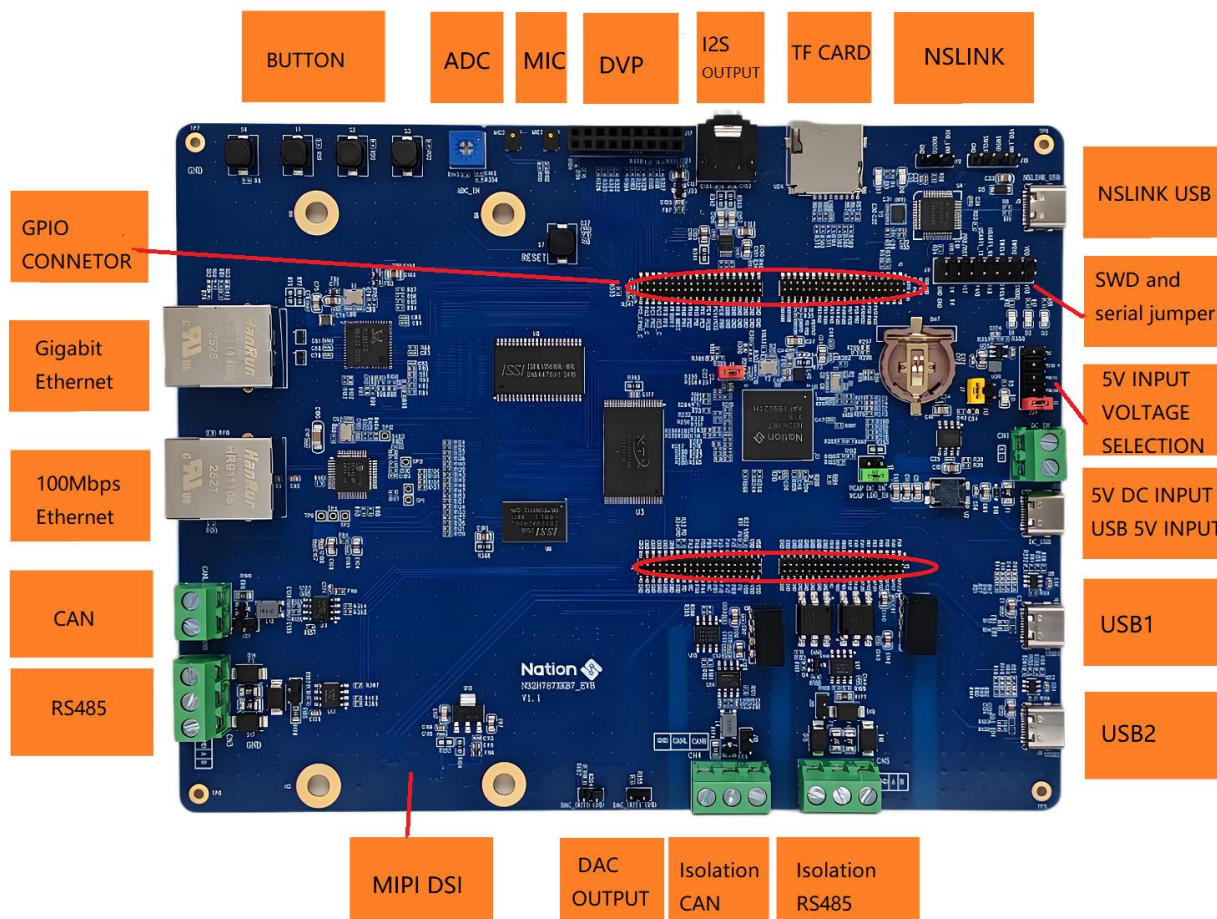


Figure 1-1 layout

1) Power supply for the development board

The development board offers power options including 5VDC / USB input, NSLINK USB, USB1 and USB2. The external 5V power supply is selected via J34. The 5V is converted to 3.3V via DC /DC converter. The 3.3V is supplied to the MCU and other peripherals via J7, and to the NSLINK via J13. For VCAP 0.9V, the power supply can be selected via J15 to connect to the integrated DC / DC converter in the MCU, or via an external LDO power supply.

2) USB Communication interface

Both USB1 and USB2 use Type - C USB interfaces (J6 and J8) to connect to the DP and DM signals of the main MCU (U1) for USB interface communication with the main MCU.

3) NSLINK USB (J9)

The DEBUG USB interface of the NS-LINK chip (U4) can provide the function of downloading and debugging the main MCU program, and can also be connected to the MCU's serial port to provide USB to serial port function.

4) SWD interface and serial port (J11)

SWD interface: SWDIO and SWDCK, used for downloading and debugging the main MCU program. ULINK2 or JLINK can be used to download and debug the MCU, or jumper caps can be used to short the SWDIO and SWDCK signal pins to download and debug the MCU via DEBUG USB.

Serial ports: MCU_TX and MCU_RX are used as external serial signals. PA9 (TX) and PA10 (RX) of the MCU are used as serial ports. They can be used to connect serial devices independently, or the MCU_TX signal pin and MCU_RX signal pin can be shorted with jumpers to convert the USB port to a serial port through NS-LINK on the development board for the convenience of customers.

5) Reset and wake-up buttons (S7, S6)

S7 and S6 are the reset button and wake-up button, respectively, connected to the NRST pin and PA0 pin of the chip, and are used for chip reset and wake-up functions.

6) General buttons (S1, S2, S3)

S1, S2, and S3 are general-purpose buttons, which are connected to the PI15, PI14, and PI13 pins of the chip, respectively.

7) LED lights

D1, D2, and D3 are LEDs, connected to the pins of chips PJ14, PJ15, and PK4 respectively.

8) BOOT (J1 PIN7)

The J1 PIN7 is the BOOT0 connector, which can be shorted to power or ground as needed using a jumper cap.

9) GPIO port(J1,J2,J3,J5)

The GPIO part of the chip does not involve high-speed communication interfaces that are led out to the connectors. 3.3V and GND pins are provided on the connectors for easy testing. See the schematic diagram for the

specific interface definitions.

10) ADC and DAC

Adjusting the voltage of the adjustable potentiometer allows the AC input voltage to vary between 0 and 3.3 V, and the voltage value can be obtained through AC sampling.

H1 and H2 are the interfaces for the outputs of DAC0 and DAC1. DAC1 is disconnected from MCU by default (the pin function is FEMC function by default). If needed, 0 ohms to R255 can be soldered, and R256 can be removed.

11) Data storage

Currently supports NAND FLASH, SRAM, SDRAM, XSPI FLASH and TF card storage.

12) Audio

It supports two MIC audio inputs and one I2S audio output.

13) DVP

The DVP camera interface supports the ALIENTEK OV5640 camera module.

14) MIPI

The MIPI DSI interface supports the Wildfire 10.1- inch 800*1280 MIPI capacitive touchscreen. The MIPI interface is located on the back of the development board.

15) CAN communication

It includes two FDCAN communication channels, where CN4 is an isolated FDCAN communication interface and CN2 is a normal FDCAN communication interface.

16) RS485 communication

It includes two RS485 communication channels, where CN5 is an isolated RS485 communication interface and CN3 is a normal RS485 communication interface.

17) Ethernet communication

The development board supports a 100-Mbps Ethernet and a Gigabit Ethernet. The default setting is 100 Mbps Ethernet ETH1 RMII . 100 Mbps Ethernet can also be set to ETH2 by selecting resistors .

Gigabit Ethernet is currently not used by default because it reuses pins for other functions. If you need to use it, you need to solder the selection resistor of the reused pin to the Gigabit Ethernet function. Please refer to the schematic diagram for details.

1.4 Development Board Jumper Usage Instructions

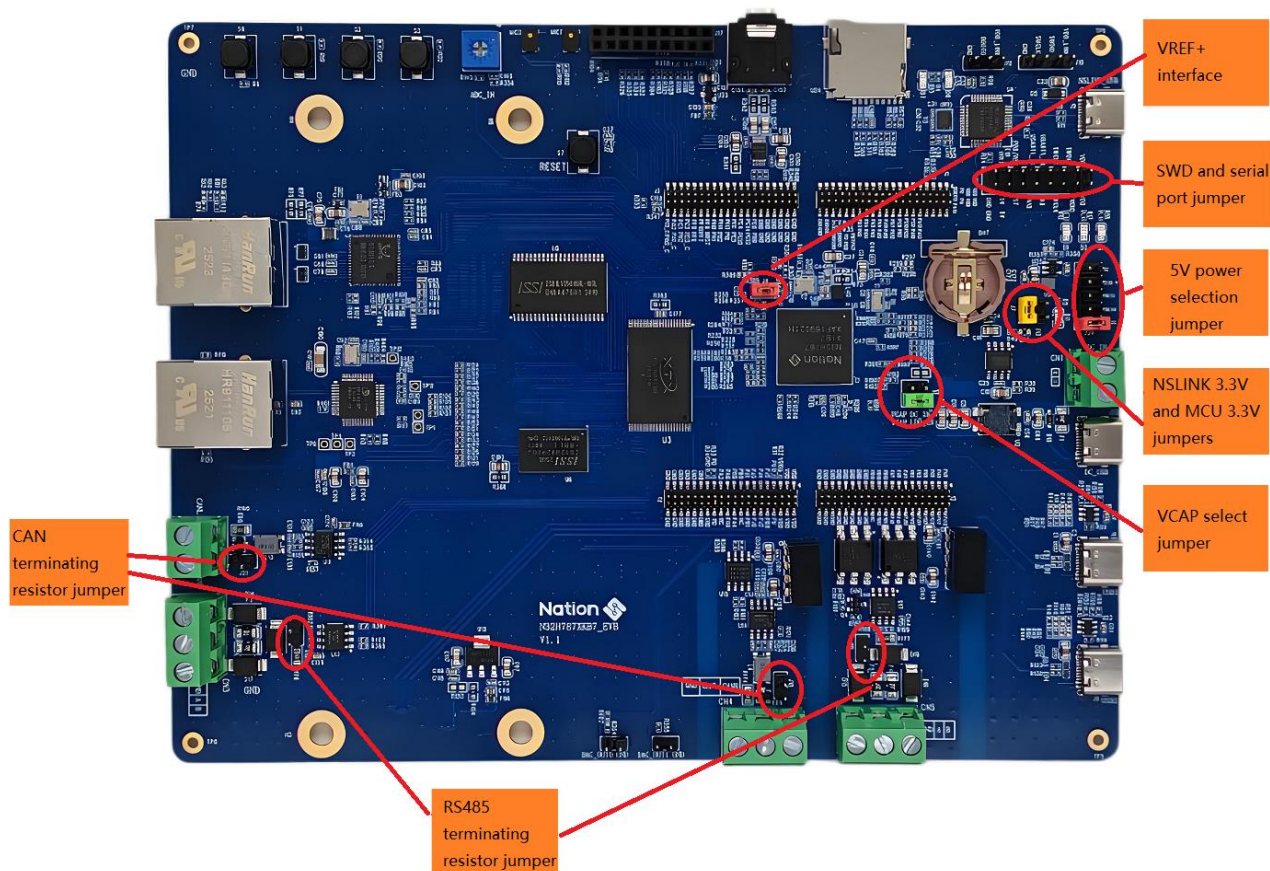


Figure 1-2Jumper Instructions

Table 1-1 Development Board Jumper Description List

No.	Jumper position	Jumper function	Instructions for use
1	J34	5V input voltage jumper	The J34 jumper is used to select either the J6 or J8 USB interface, or the J22 / CN1 DC power interface, or the J9 NSLINK USB power supply to the DC/DC input port.

2	J7、J13	3.3V power supply jumper	J13: Provides 3.3V power to the NS-LINK MCU chip. J7: Provides 3.3V power to the main MCU chip.
3	J11	SWD jumper	To download a program to the MCU via the USB DEBUG port using NS-LINK, you need to short the SWDIO and SWDCK signal pins.
	J11	Serial port jumper	When using NS-LINK as a serial port via the USB DEBUG port, it is necessary to short the MCU_TX signal pin and the MCU_RX signal pin.
4	J1 PIN7	BOOT jumper	J1 PIN7: BOOT0.
5	J4	VREF+ jumper	J4:Shorting this jumper will cause VREF to use an external VDD as the reference source.
6	J19、J20	RS485 terminating resistor connection jumper	J19, J20: Shorting this jumper sets the terminating resistor to 120 ohms.
7	J18、J21	CAN terminating resistor connection jumper	J18, J21: Shorting this jumper sets the terminating resistor to 120 ohms.
8	J15	VCAP power selection jumper	LDO power supply selection, short LDO_IN and VCAP. DCDC power supply selection: D C_IN and V CAP shorted.

1.5 Development board schematic

The schematic diagram of the N32H787XKB7_EVB development board is described below (see N32H787XKB7_EVB_V1.1 for details):

1) MCU connection

Referring to Figure 1-3, which shows the MCU connection schematic, each VDD pin of the MCU is connected to a capacitor. The internal DC- DC converter of the MCU also has reserved functions. Some GPIO pins are led out and connected to the J1, J2, J3 and J5 pins for easy debugging.

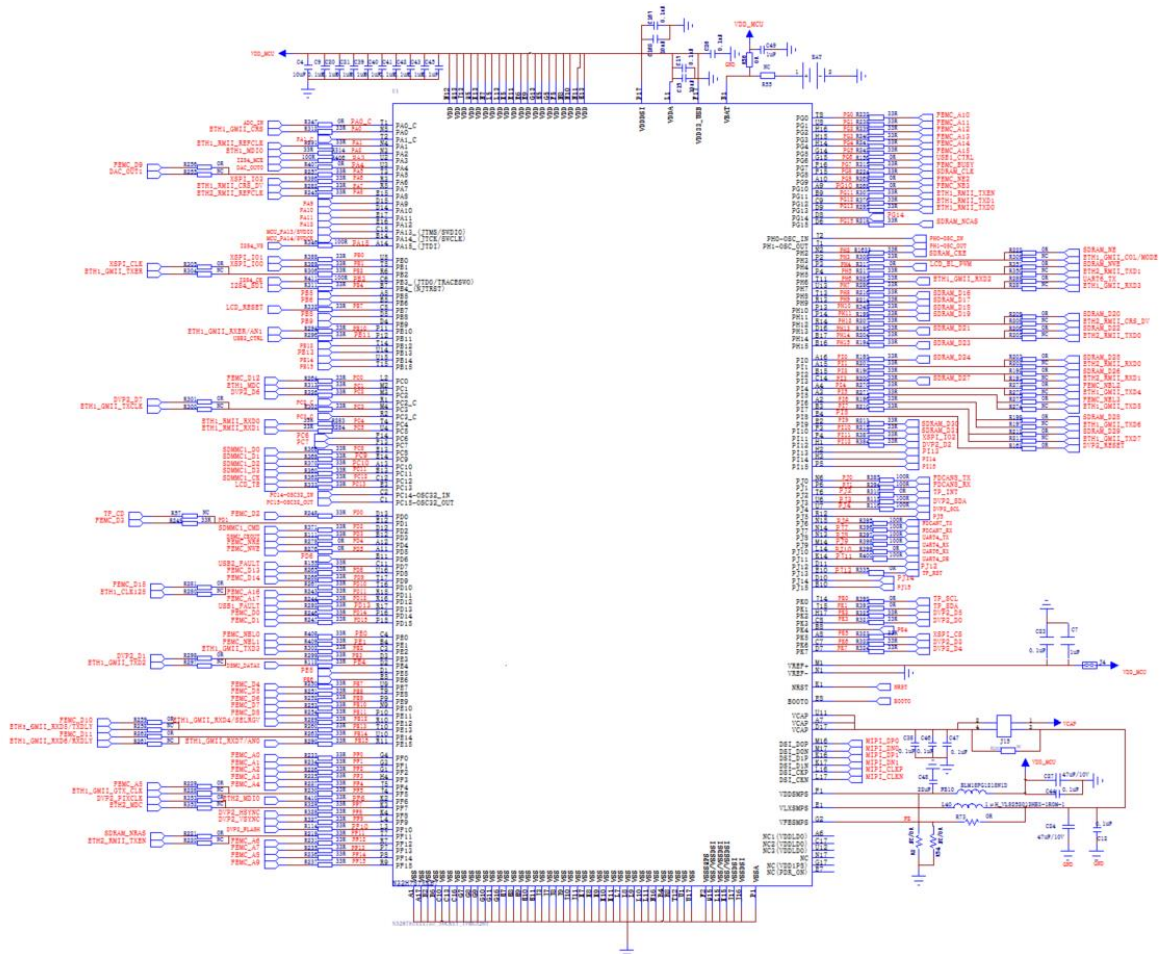
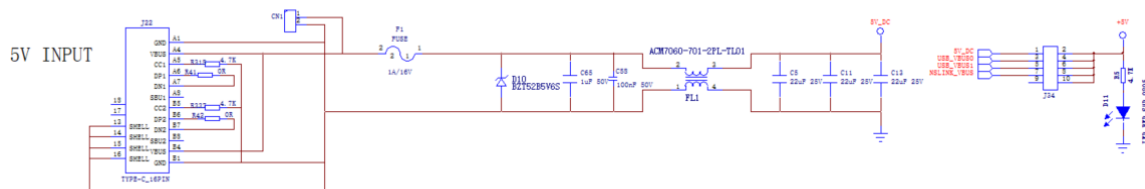


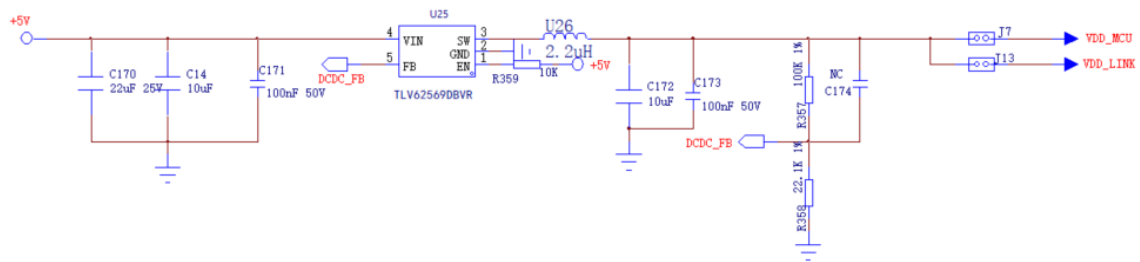
Figure 1-3 MCU connection diagram

2) Power supply design

Referring to Figure 1-4 for the power supply design schematic, the PCB is powered by an external 5V source. After selecting the external 5V source, a 3.3V voltage is output through DCDC to supply power to the entire PCB board. The VCAP 0.9V source allows for the selection of either internal DCDC power supply from the MCU or external LDO power supply.



DCDC 5V TO 3.3V 2A



LDO 0.9V

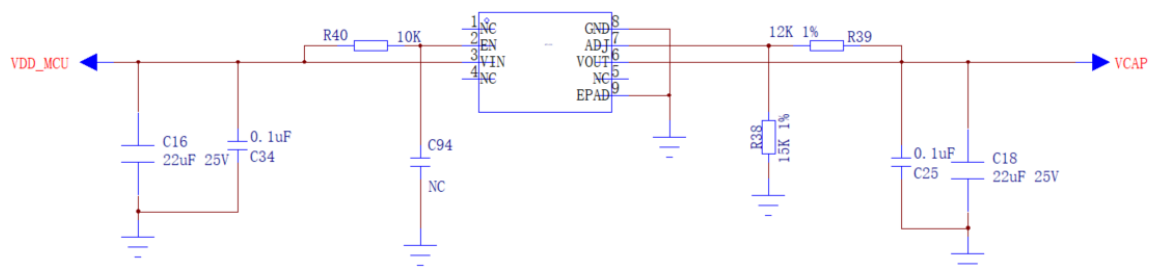


Figure 1-4 Power supply design

3) Button Design

Referring to Figure 1-5, which shows the button design schematic, there are a total of 5 buttons: 3 general buttons, an MCU wake-up button, and a reset button.

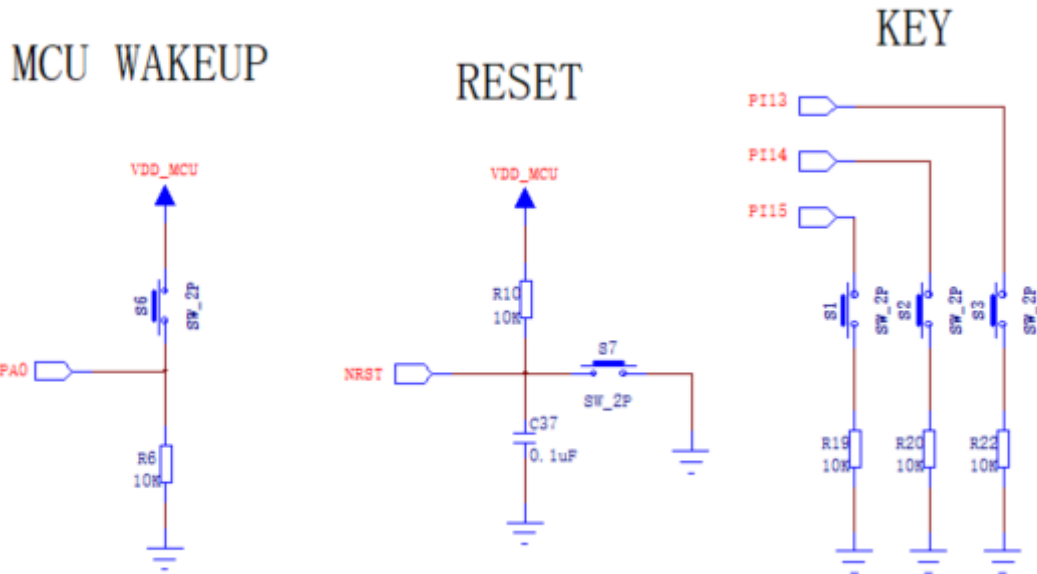


Figure 1-5 Button Design

4) LED lighting design

Referring to Figure 1-6, which shows the LED light design schematic, there are a total of 5 LEDs. D1, D2, and D3 are connected to PJ14, PJ15, and PK4 of the main MCU, respectively, and can be used for debugging. D6 and D7 are used for NS-LINK MCU control to monitor the NS-LINK's operating status.

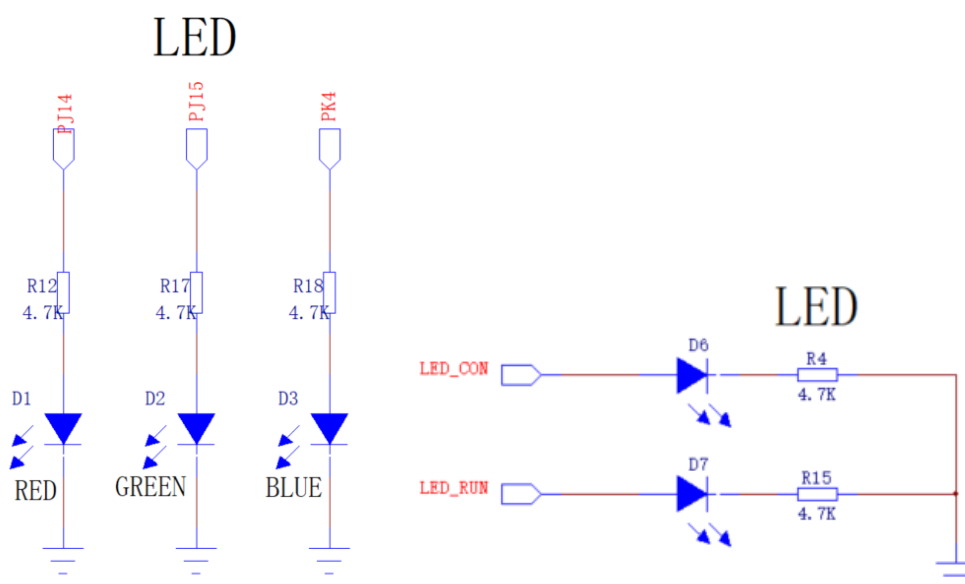


Figure 1-6 LED lighting design

5) Crystal

Referring to Figure 1-7, which shows the crystal connection diagram, the chip has two external crystals, one at 32.768 kHz and the other at 25 MHz.

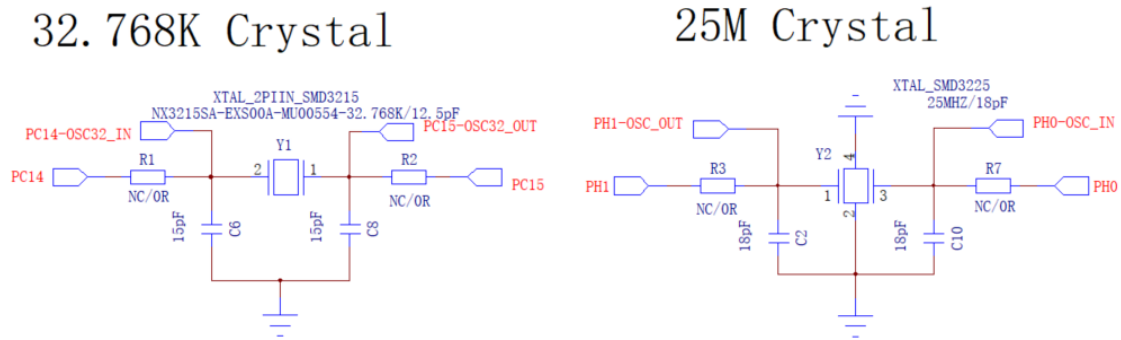


Figure 1-7 Crystal Design

6) ADC and DAC

Refer to Figure 1-8 for the external connection schematic of ADC and DAC.

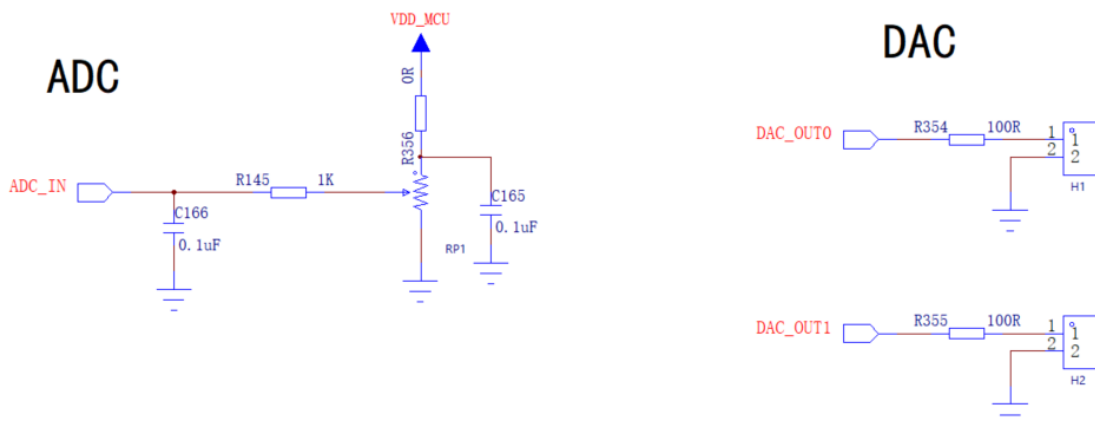


Figure 1-8 ADC and DAC

7) NS-LINK

Referring to Figure 1-9, which shows the NS-LINK schematic, users can directly connect a USB cable via the DEBUG USB port to download programs, eliminating the need for a ULINK or JLINK programmer. Debugging can also be performed via the DEBUG USB port, which simulates a serial port.

NS-LINK

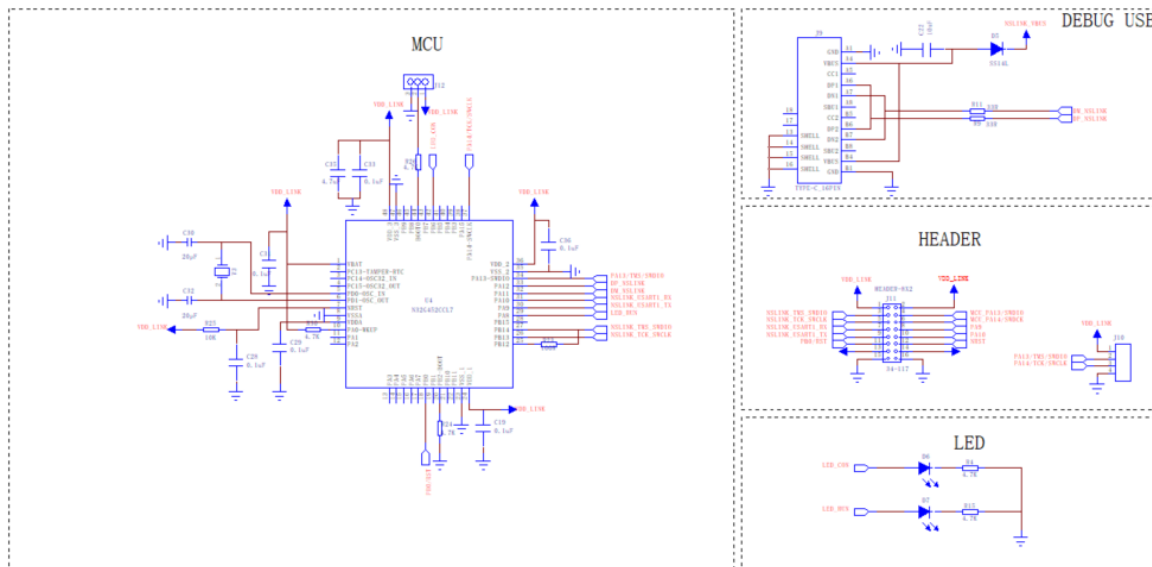


Figure 1-9 NS-LINK

8) USB communication interface

Referring to Figure 1-10, there are two USB-OTG ports, which users can use to connect to a host computer or other USB devices.

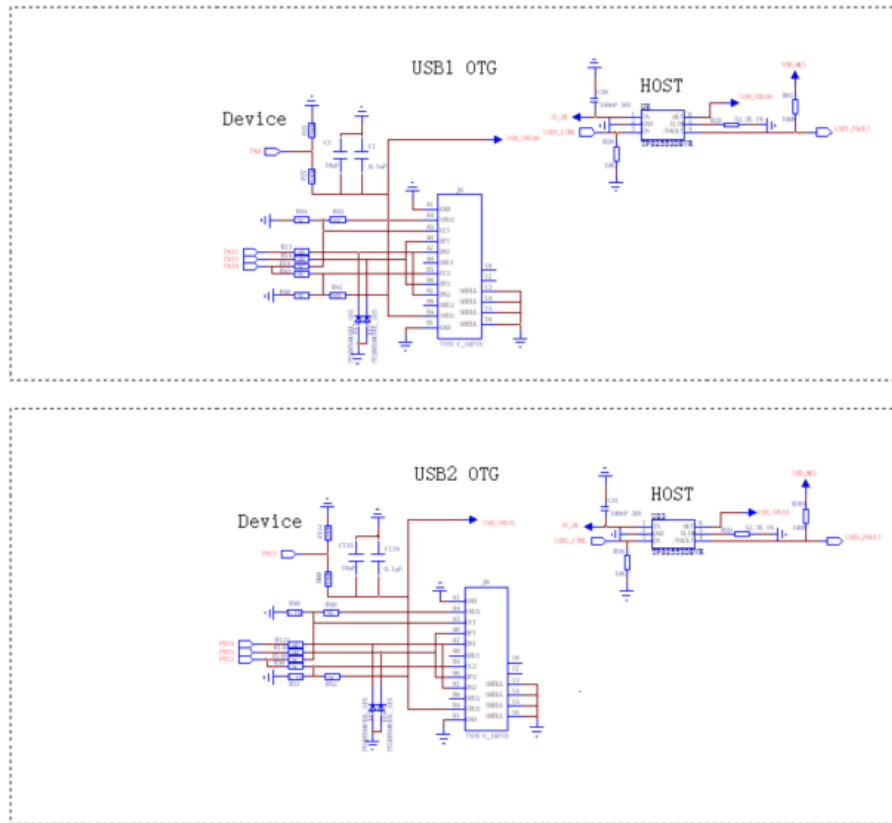
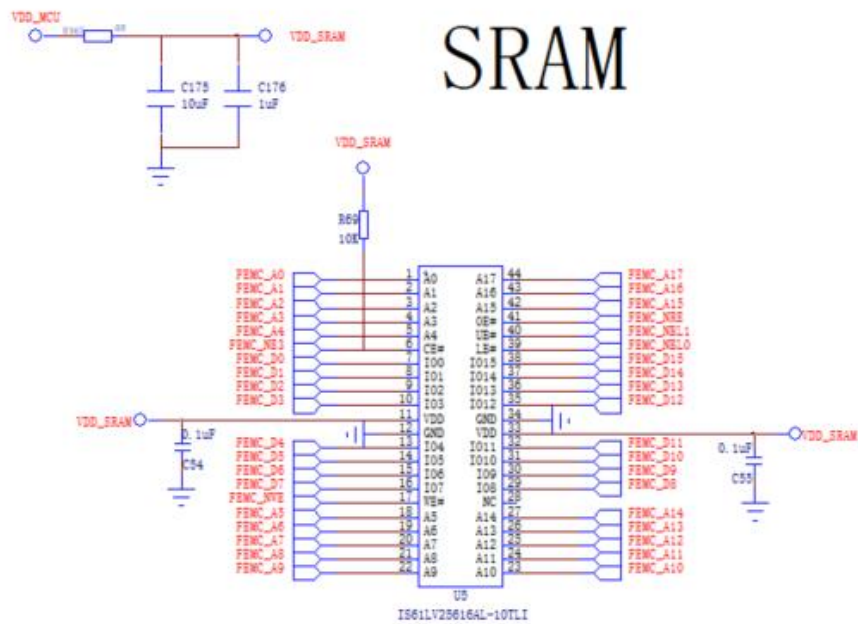
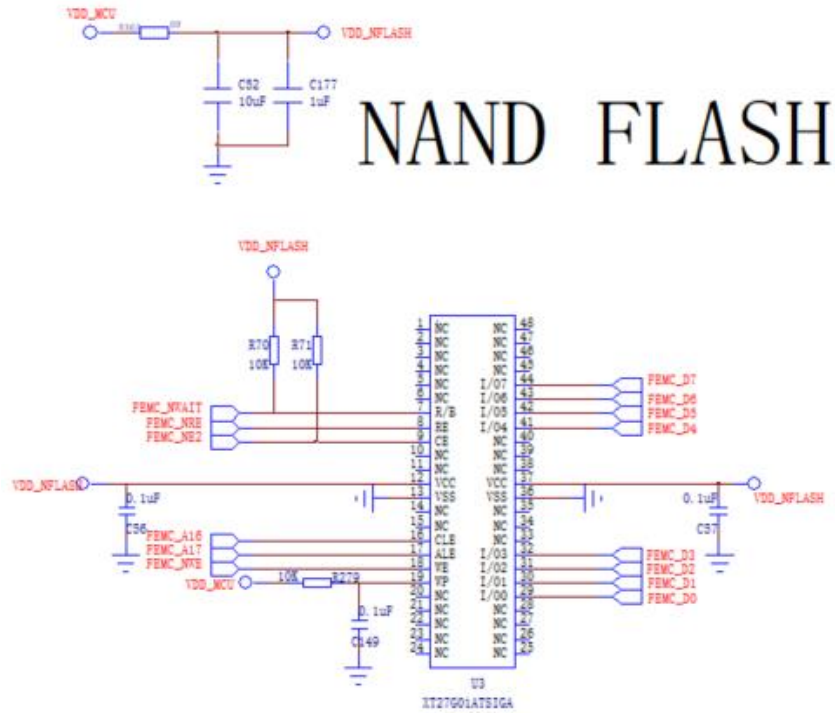
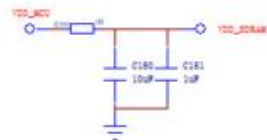


Figure 1-10 NS-LINK

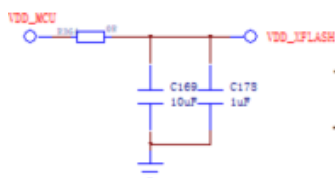
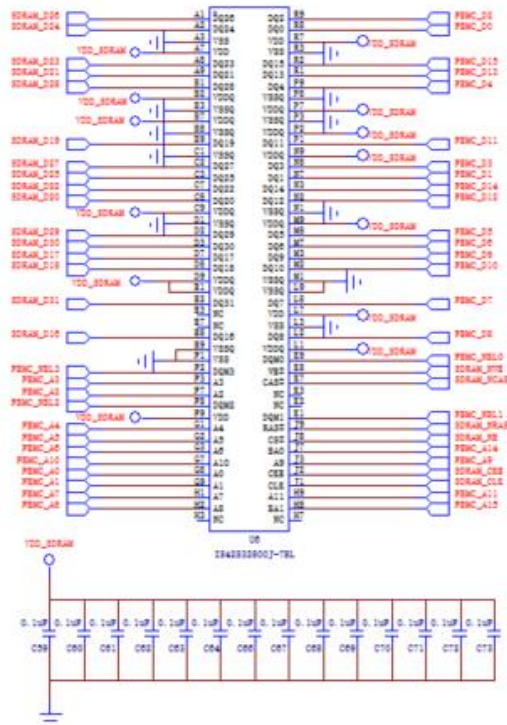
9) Data storage

Refer to Figures 1-10 for schematic diagrams of NAND FLASH, SRAM, SDRAM, XSPI FLASH, and TF card, respectively.

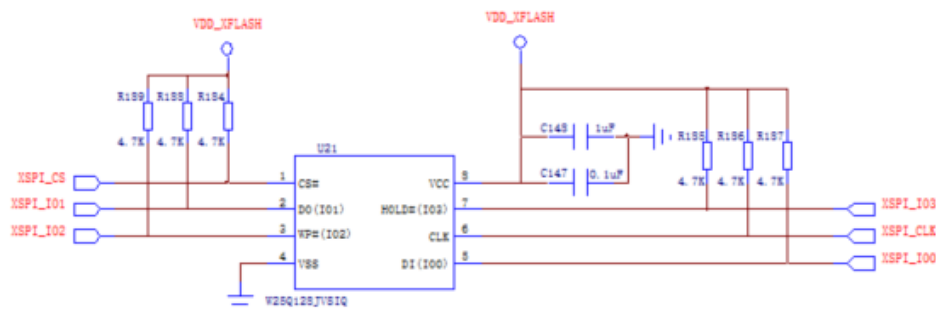




SDRAM



XSPI FLASH



TF CARD

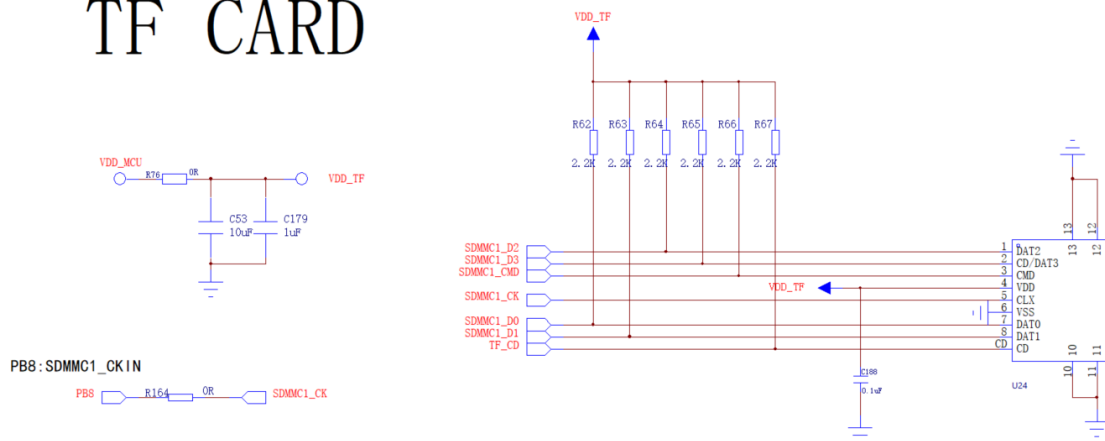


Figure 1-11 Data storage

10) 100Mbps Ethernet

Refer to Figure 1-12 for the reference schematic of 100 Mbps Ethernet. The default mode is ETH1 100 Mbps RMII. If you want to switch to ETH2, you need to change the RMII and GMIII selection resistors. See the schematic for details.

RMII

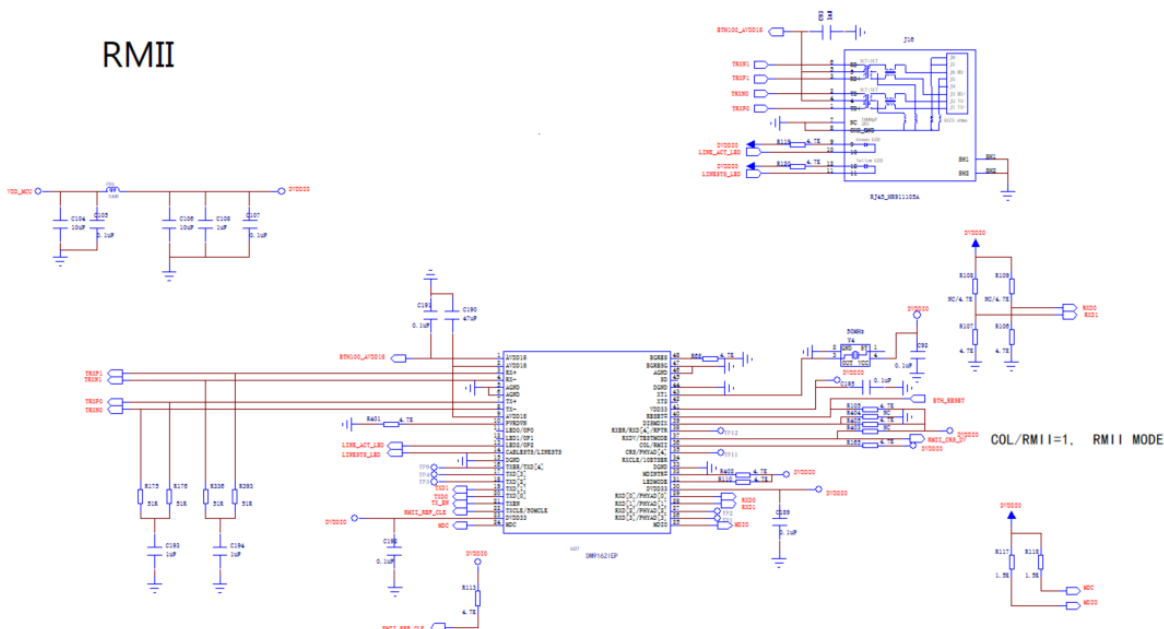


Figure 1-12 100Mbps Ethernet

11) Gigabit Ethernet

Refer to Figure 1-13 for the Gigabit Ethernet reference schematic. Due to pin multiplexing, Gigabit Ethernet is not working by default. If you want to debug Gigabit Ethernet, you need to change the RMII and GMII selection resistors, as well as the function selection resistors of other multiplexed pins. See the schematic for details.

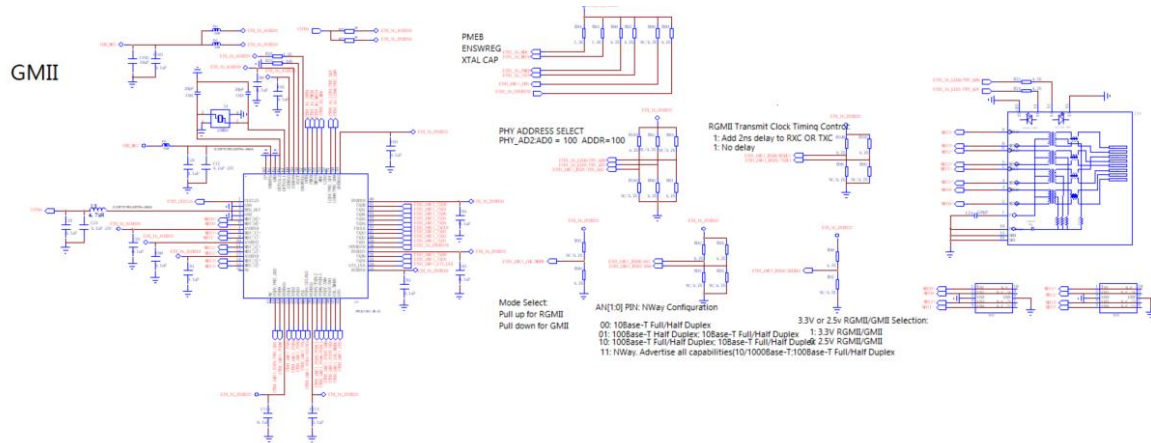
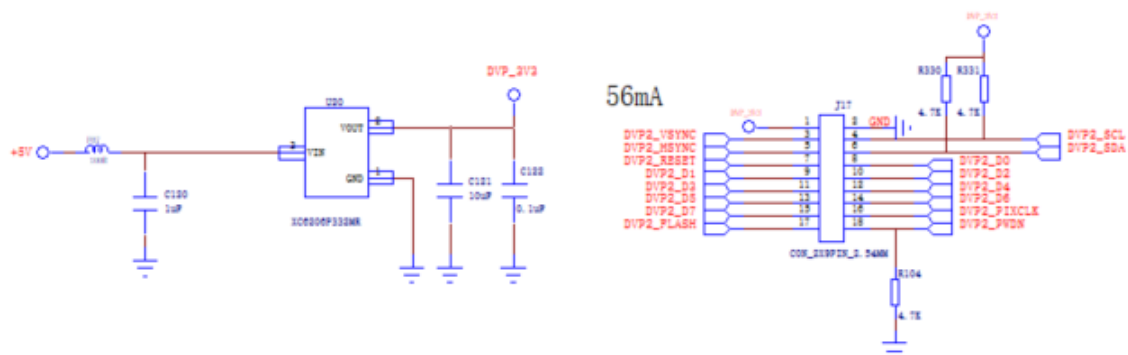


Figure 1-13 Gigabit Ethernet

12) DVP and MIPI LCD

Referring to Figure 1-14, which shows the reference schematics for the DVP and MIPI interfaces, they respectively support the ALIENTEK VO5640 camera module and the Wildfire 10.1-inch 4-lane touch MIPI display.

DVP CAMERA



MIPI LCD

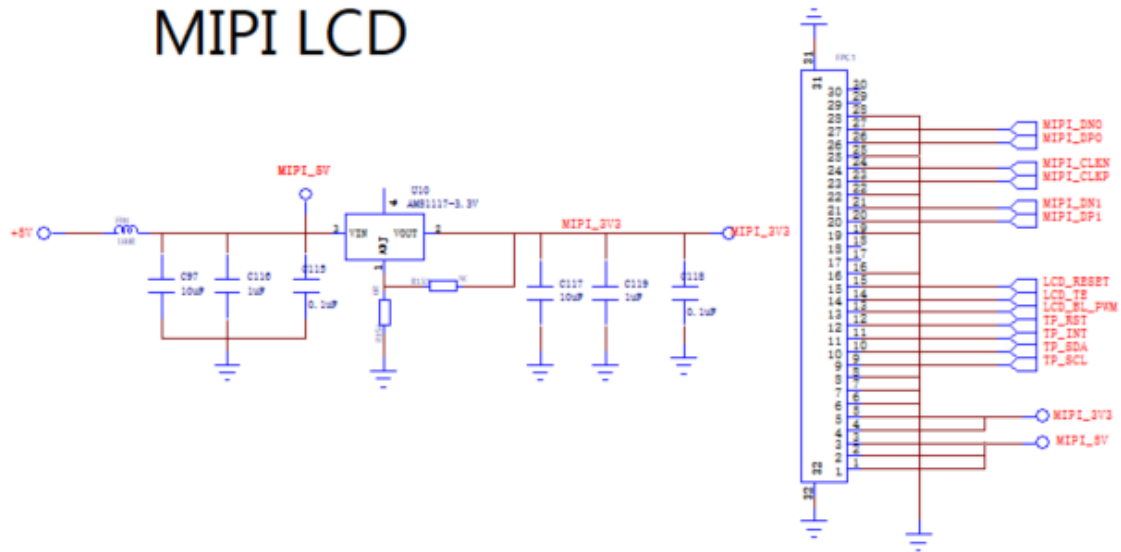


Figure 1-14 DVP and MIPI LCD

13) MIC and I2S

Refer to Figure 1-15 for the MIC audio input and I2S audio output reference schematic.

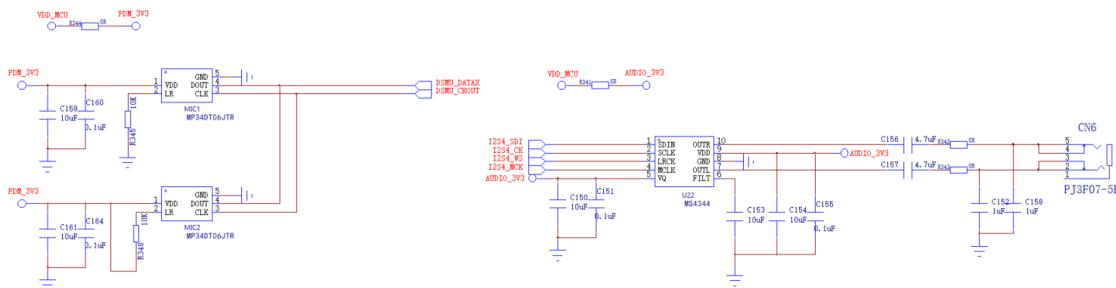


Figure 1-15 MIC audio input and I2S audio output

14) CAN and RS485 communication

Refer to Figure 1-16 for the FDCAN and RS485 reference schematics.

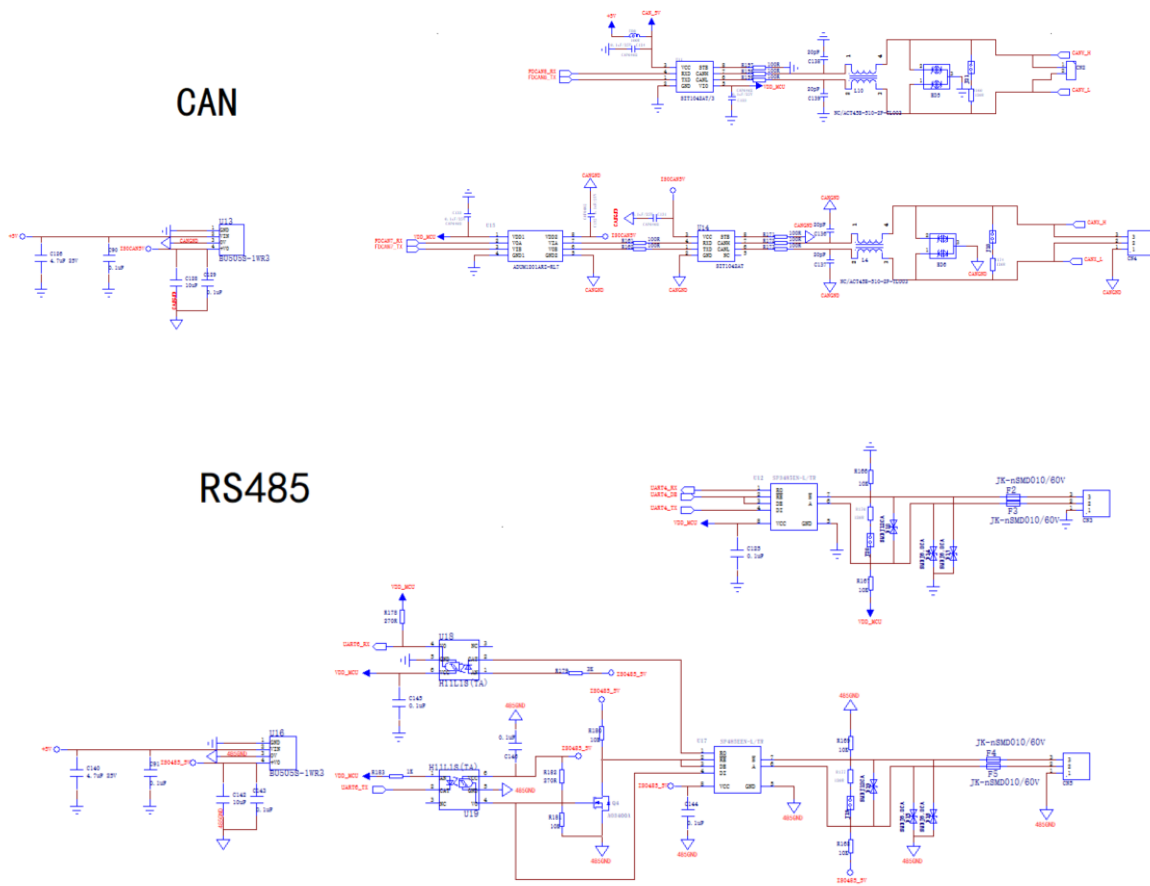


图 1-16 CAN 和 RS485 通信

● MCU peripheral device description:

- 1) When designing the PCB layout, place two capacitors near the MCU, one 10uF and the other 0.1uF, and place a 0.1uF capacitor near the remaining VDD pins.
- 2) The VDD33_USB has a voltage range of 1.8-3.6 V and is specifically designed to power the USB PHY.
- 3) VCAP is the core power supply for the chip, with a voltage of 0.9 V.
- 4) VDDA is an analog power supply. It is recommended to place a 0.1uF and a 10uF capacitor on the input pin.
- 5) VREF + is the reference voltage, providing a reference level for both ADC and DAC. When VREF + uses the built-in reference source VREFBUF, it is recommended to place a 0.1uF and a 1uF capacitor nearby on the VREF+ pin. When VREF + is externally powered, it is recommended to place a 0.1uF and a 10uF capacitor nearby on the VREF + pin.

2 Historical versions

Version	Date	Remark
V1.0.0	2025-04-25	Create document
V1.1.0	2025-08-20	1. Modify the logo in the header .
V1.2.0	2025-11-19	Full-featured board upgrade, image changes

3 Notice

This document is the exclusive property of NSING TECHNOLOGIES PTE. LTD. (Hereinafter referred to as NSING). This document, and the product of NSING described herein (Hereinafter referred to as the Product) are owned by NSING under the laws and treaties of Republic of Singapore and other applicable jurisdictions worldwide. The intellectual properties of the product belong to NSING Technologies Inc. and NSING Technologies Inc. does not grant any third party any license under its patents, copyrights, trademarks, or other intellectual property rights. Names and brands of third party may be mentioned or referred thereto (if any) for identification purposes only. NSING reserves the right to make changes, corrections, enhancements, modifications, and improvements to this document at any time without notice. Please contact NSING and obtain the latest version of this document before placing orders. Although NSING has attempted to provide accurate and reliable information, NSING assumes no responsibility for the accuracy and reliability of this document. It is the responsibility of the user of this document to properly design, program, and test the functionality and safety of any application made of this information and any resulting product. In no event shall NSING be liable for any direct, indirect, incidental, special, exemplary, or consequential damages arising in any way out of the use of this document or the Product. NSING 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, all types of safety devices, and other applications intended to supporter sustain life. All Insecure Usage shall be made at user's risk. User shall indemnify NSING and hold NSING harmless from and against all claims, costs, damages, and other liabilities, arising from or related to any customer's Insecure Usage Any express or implied warranty with regard to this document or the Product, including, but not limited to. The warranties of merchantability, fitness for a particular purpose and non-infringement are disclaimed to the fullest extent permitted by law. Unless otherwise explicitly permitted by NSING, anyone may not use, duplicate, modify, transcribe or otherwise distribute this document for any purposes, in whole or in part.