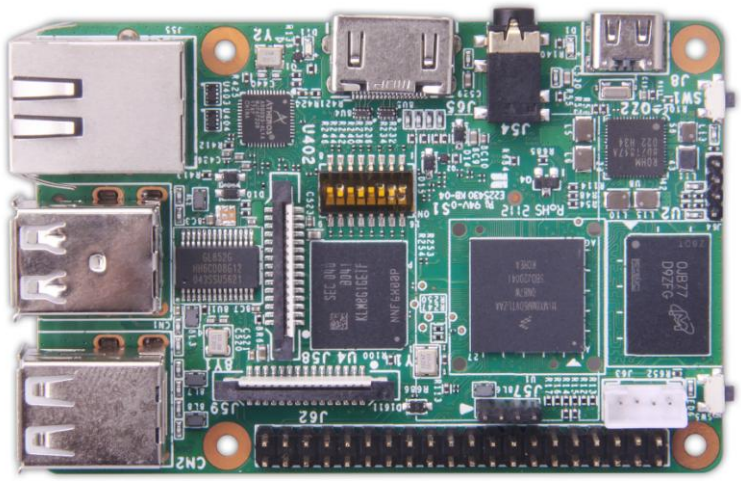
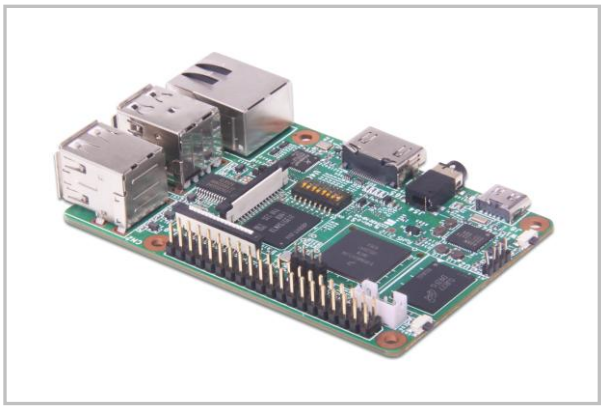
XPI-iMX8M Mini Hardware Usermanul

V1.0



----------Product modality----------



XPI-iMX8M Mini

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Revision History

Rivision	Date	Content	Author	Reviewers
1.0	2021-7-8	Initial	Wanghx	

Content

1 Introduction

The XPI-iMX8M Mini is a microcomputer product of Raspberry Pi 4 Module B developed by Geniatech based on the NXP I.Mx 8M Mini platform. Raspberry Pi 4 Model B is the latest product in the popular Raspberry Pi range of computers. It offers ground-breaking increases in processor speed, multimedia performance, memory, and connectivity compared to the prior-generation Raspberry Pi 3 Model B+, while retaining backwards compatibility and similar power consumption. This product's key features including a NXP high-performance 64-bit quad-core processor, HDMI display support at resolutions up to 1080P , hardware video decode at up to 1080P, up to 4GB of RAM, dual-band 2.4/5.0 GHz wireless LAN, Bluetooth 4.0, Gigabit Ethernet, USB 2.0.

1.1 Supporting Products

- XPI-iMX8M Mini

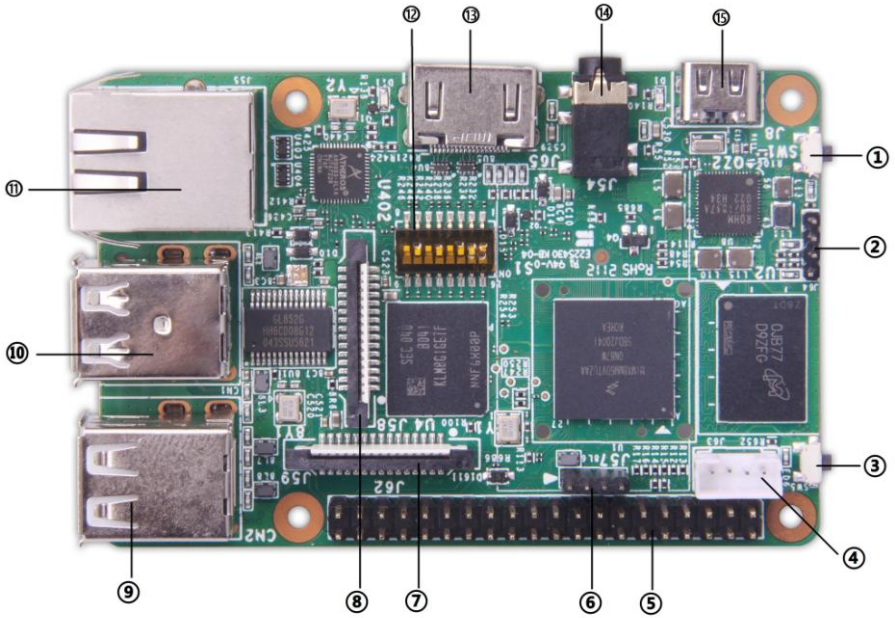
1.2 Key features

Type	Description	
Multicore Processing	4x Cortex-A53 core platforms up to 1.8GHz per core 32KB L1-I Cache/ 32 kB L1-D Cache 512 kB L2 Cache 1x Cortex-M4 core up to 400MHz 16 kB L1-I Cache/ 16 kB L2-D Cache	
Memory/Storage	1GB LPDDR4 (1GB~4GB LPDDR4 optional) 8GB eMMC5.1(8-128GB Optional) SD 3.0 (UHS-I)	
Video Playback	1080p60 VP9 Profile 0, 2 (10-bit) decoder, HEVC/H.265 decoder, AVC/H.264 Baseline, Main, High decoder, VP8 decoder 1080p60 AVC/H.264 encoder, VP8 encoder	
Audio	5x SAI (12Tx + 16Rx external I2S lanes), 8ch PDM input	
NETWORK	Ethernet	RJ45, 10/100/1000M
	WiFi	WIFI Module 2.4G/5.8G (optional)
	Bluetooth	BT4.0(integraded in the WiFi module)
Interface	HDMI Out	*1
	USB 2.0	*4,The upper USB2.0 interface of CN2 supports OTG function
	TF Card	*1
	Audio Out	*1（3.5mm Headphone Jack）
	DC IN	*1(USB Type-C)
Connectivity	**1x Standard 40-pin GPIO header** • Can be expanded to I2S,UART, SPI, I2C ,PWM and GPIO function **1x4 pin USB-Wifi connector** • Support USB-Wifi Module **1x MIPI DSI** • 2-lane MIPI DSI display port **1x MIPI cSI**	

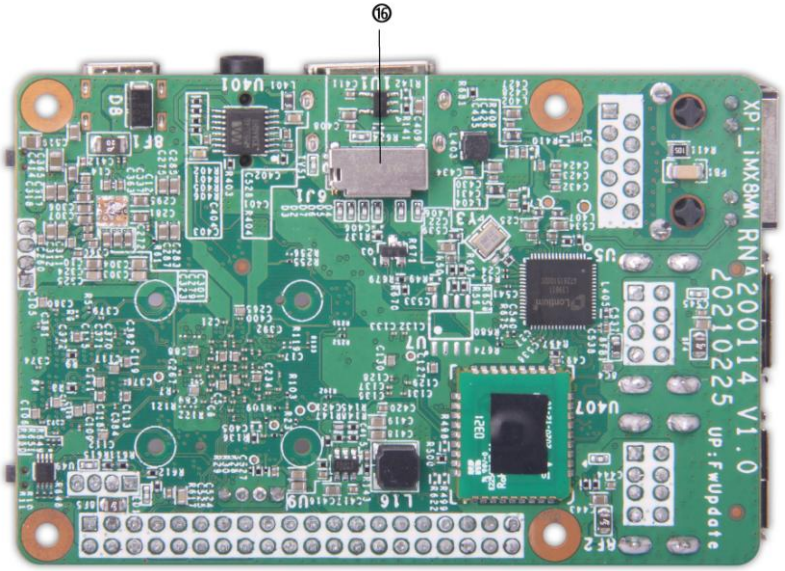
	• 2-lane MIPI CSI camera port
Indicator	• 1 Power indicator • 1 Status indicator
Button	Power/Reset
OS-support	Linux(Yocto)
Size (mm)	85*56mm
Operating Temperature	0°C to +70°C(Standard) -40°C to +85°C(optional)
Power	DC5V/3A

Table 1

2 Board overview



Top View



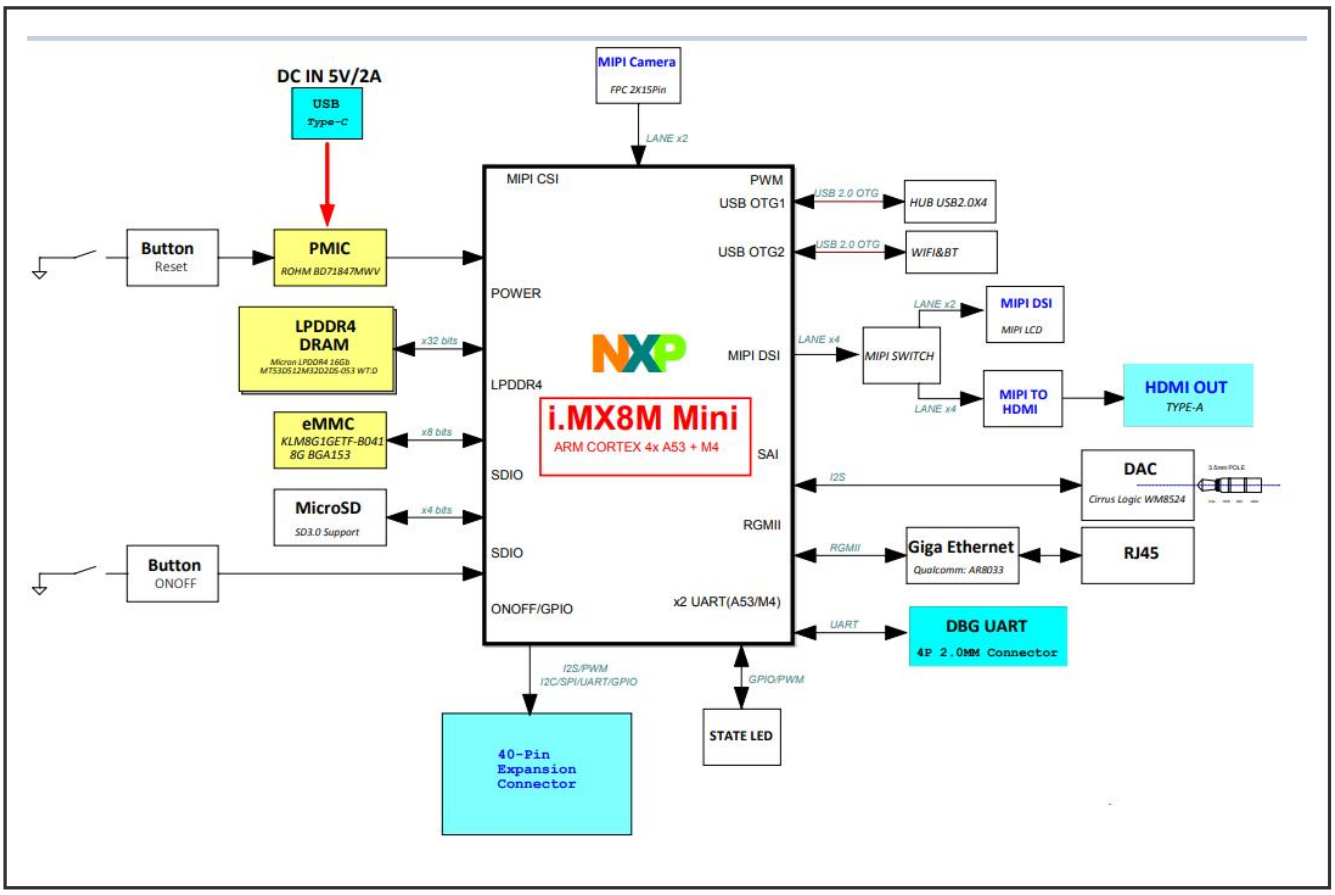
Bottom View

No.	Function	No.	Function	No.	Function	No.	Function
1(SW1)	RESET Key	5(J62)	40 Pin GPIO header	9(CN2)	USB2.0 double layer connector	13(J65)	HDMI Connector
2(J64)	M4 Core debug consloe	6(J57)	USB-WiFI/BT port	10(CN1)	USB2.0 double layer connector	14(J54)	LINE OUT and MIC IN
3(SW5)	POWER Key	7(J59)	MIPI CSI connector	11(J55)	RJ45 Gigabit Ethernet	15(J8)	DC IN
4(J63)	A53 Core debug consloe	8(J58)	MIPI DSI connector	12(S1)	BOOT DIP Switch	16(6J1)	Micro SD Socket

Table 2 An overview of the interface

3 Function Overview

3.1 System Block diagram



3.2 Processor

The i.MX8MMini applications processor represents NXP's latest video and audio experience combining state-of-the-art media-specific features with high-performance processing while optimized for lowest power consumption. The i.MX 8M Mini family of processors features advanced implementation of a quad Arm® Cortex®-A53 core, which operates at speeds of up to 1.8 GHz. A general purpose Cortex®-M4 400 MHz core processor is for low-power processing. The DRAM controller supports 32-bit/16-bit LPDDR4, DDR4, and DDR3L memory. A wide range of audio interfaces are available, including I2S, AC97, TDM, and S/PDIF. There are a number of other interfaces for connecting peripherals, such as USB, SPI,I2C and Ethernet.

Video Processing Unit:

- 1080p60 VP9 Profile 0, 2 (10-bit)
- 1080p60 HEVC/H.265 Decoder
- 1080p60 AVC/H.264 Baseline, Main, High decoder
- 1080p60 VP8
- 1080p60 AVC/H.264 Encoder
- 1080p60 VP8

- TrustZone support

3.3 RAM

This design USES SDRAM-mobile - LPDDR4-memory - IC-8GB (256m-x-32) - 2133MHZ-200-WFBGA (10x14.5), with 1GB memory, low power consumption characteristics.

Key Feature：

- Ultra-low-voltage core and I/O power supplies
  - VDD1 = 1.70 – 1.95V; 1.80V nominal
  - VDD2 = 1.06 – 1.17V; 1.10V nominal
  - VDDQ = 1.06 – 1.17V; 1.10V nominal or Low VDDQ = 0.57 – 0.65V; 0.60V nominal
- Frequency range
  - 2133 – 10 MHz (data rate range: 4266 – 20 Mb/s/ pin)
- 16n prefetch DDR architecture
- 8 internal banks per channel for concurrent operation
- Single-data-rate CMD/ADR entry
- Bidirectional/differential data strobe per byte lane
- Programmable READ and WRITE latencies (RL/WL)
- Programmable and on-the-fly burst lengths (BL = 16, 32)
- Directed per-bank refresh for concurrent bank operation and ease of command scheduling
- Up to 8.5 GB/s per die
- On-chip temperature sensor to control self refresh rate
- Partial-array self refresh (PASR)
- Selectable output drive strength (DS)
- Clock-stop capability
- RoHS-compliant, “green” packaging
- Programmable VSS (ODT) termination

3.4 Storage

The XPI-iMX8M Mini board uses SUMSUNG eMMC with 8 G capaticy , eMMC consists of NAND flash and a MMC controller. 3V supply voltage is required for the NAND area (VDDF or VCC) whereas 1.8V or 3V dual supply voltage (VDD or VCCQ) is supported for the MMC controller.

Key features:

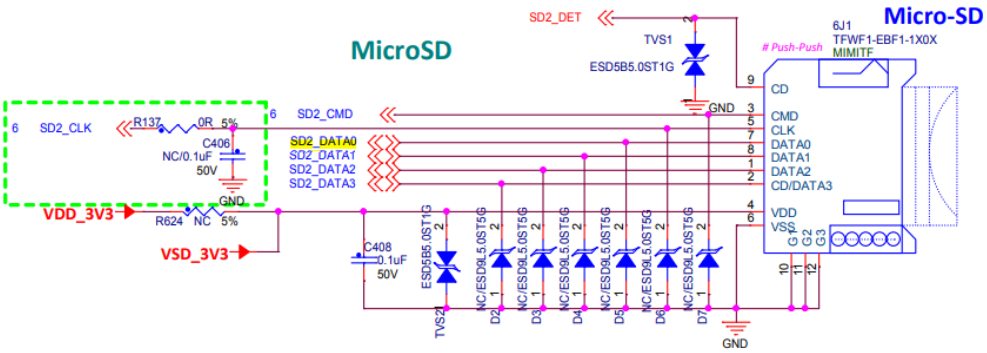
- embedded MultiMediaCard Ver. 5.1 compatible.
- SAMSUNG eMMC supports features of eMMC5.1 which are defined in JEDEC Standard
  - Supported Features : Packed command, Cache, Discard, Sanitize, Power Off ,Notification, Data Tag, Partition types, Context ID, Real Time Clock, Dynamic Device ,Capacity, Command Queuing, Enhanced Strobe Mode, Secure Write Protection, HS200, HS400, Field Firmware Update.
  - Non-supported Features : Large Sector Size (4KB)
- Full backward compatibility with previous MultiMediaCard system specification (1bit data bus, multi-eMMC systems)
- Data bus width : 1bit (Default), 4bit and 8bit
- MMC I/F Clock Frequency : 0 ~ 200MHz

MMC I/F Boot Frequency : 0 ~ 52MHz

- Temperature : Operation (-25 C ~ 85 C), Storage without operation (-40 C ~ 85 C)
- Power : Interface power → VDD(VCCQ) (1.70V ~ 1.95V or 2.7V ~ 3.6V) , Memory power → VDDF(VCC) (2.7V ~ 3.6V)

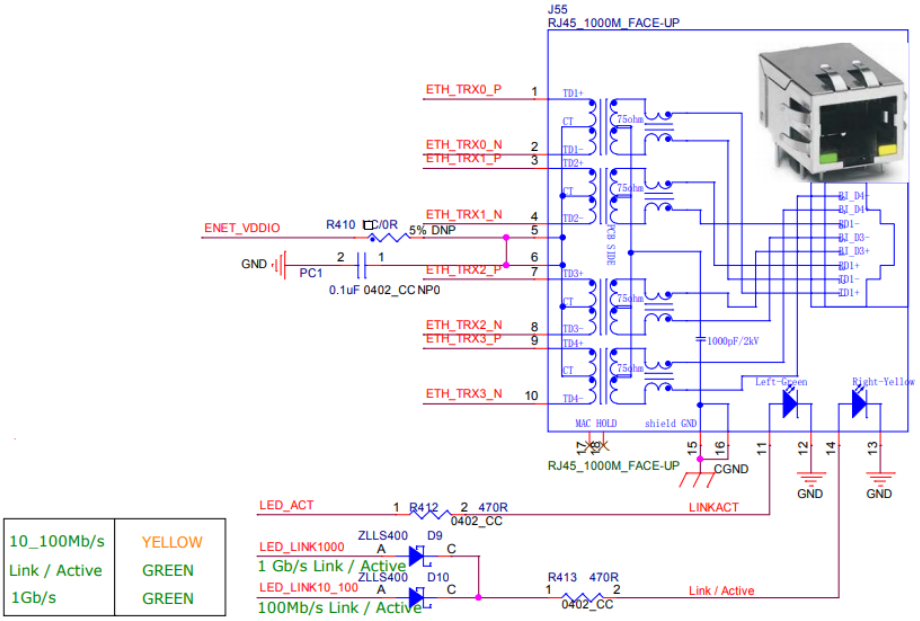
3.5 Micro-SD

The XPI-iMX8M Mini Micro-SD slot (6j1) signals are routed directly to the i.MX8M Mini SDHC interface. The slot is a push-push type with a dedicated support for card detect signal (many Micro-SD slots do not have a dedicated CD pins, they use DATA3 state as the card detected signal). The XPI board uses GPIO1_IO15 as the SD2_DET.



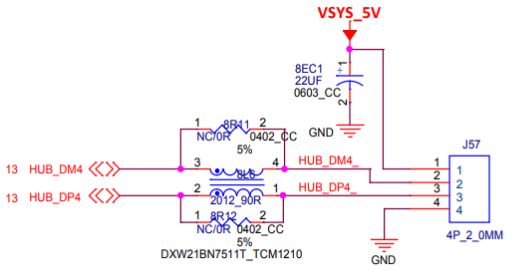
3.6 Ethernet

The AR8033 Ethernet transceiver is a single port, 10/100/1000 Mbps tri-speed Ethernet PHY. The AR8033 Ethernet transceiver supports both RGMII and SGMII to the MAC. The AR8033 Ethernet transceiver belongs to the Arctic™ PHY family which provides a low power, low BOM cost solution for comprehensive applications including enterprise, carrier and home networks such as CPE, home gateway, enterprise switch, carrier switch/router, mobile base station and base station controller, optical module and media converter, industrial automation and measurement.



3.7 WiFi/BT(BLE)

To realize WiFi function, you need to add a USB-WiFi module 88W8897. The connector J57 is reserved to the USB-Wifi module.



The Marvell® 88W8897 is a dual-band (2.4/5 GHz) IEEE 802.11ac 2x2 System-on-Chip (SoC), specifically designed to support the speed, reliability, and quality requirements of next generation, Very High Throughput (VHT) WLAN products.

The SoC is a single-chip WLAN/Bluetooth/NFC solution, providing both simultaneous and independent operation of the following: „

- ❖ IEEE 802.11ac (draft) compliant, 2x2 MIMO spatial stream multiplexing with data rates up to MCS9 (866.7 Mbps) „
- ❖ Bluetooth 4.0 + High Speed (HS) (supports Low Energy (LE)) „
- ❖ Near Field Communication (NFC) connectivity technology, per NFC Forum specification, for short-range, contactless communication

3.7 MIPI

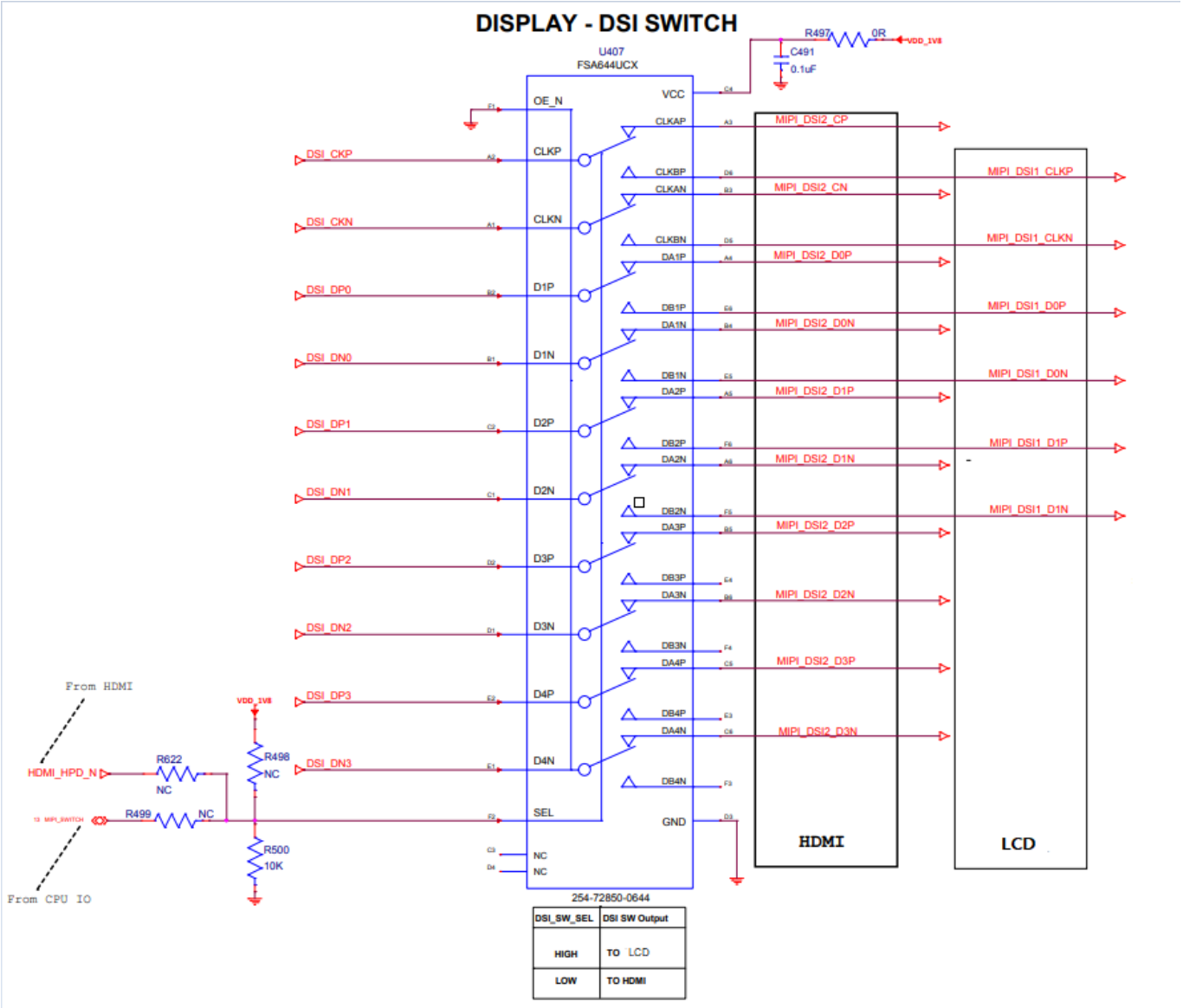
- 4-lane MIPI-DSI Interface
- 4-lane MIPI-CSI Interface

3.7.1 MIPI DSI

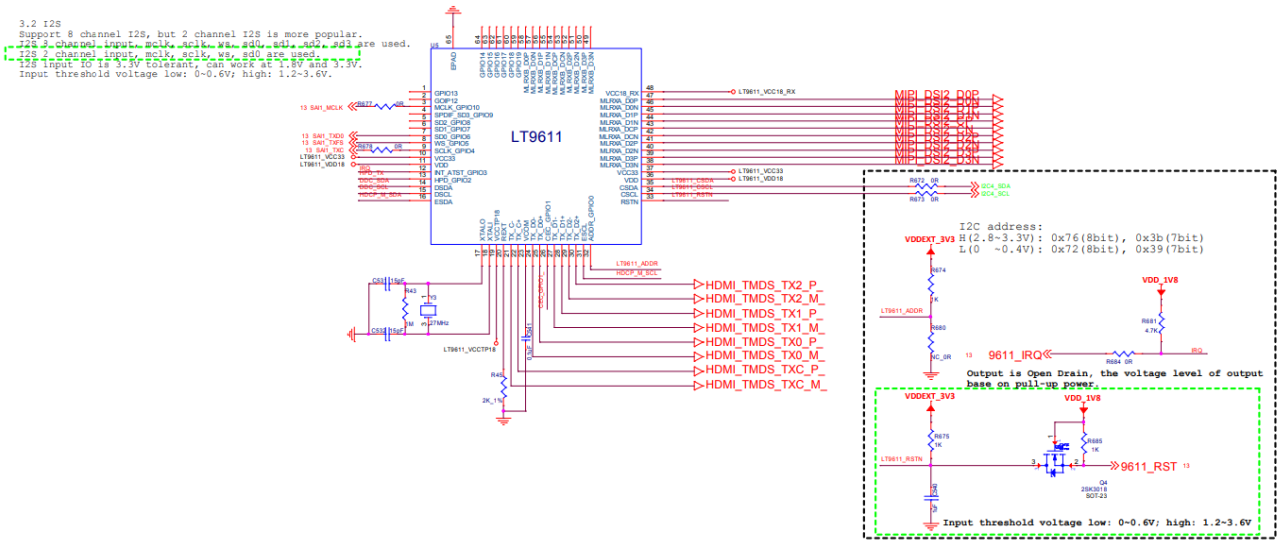
This module provides a four-lane MIPI display serial interface.Each lane supports a maximum of data rate per lane of 1Gbit/s

Through the MIPI DSI, we realize the MIPI LCD function and HDMI function.

MIPI DSI singal is switched to MIPI LCD and HDMI. When plug in HDMI monitor, the singal DSW_SW_SEL set low, the MIPI DSI is switched to HDMI. On the other case, it switched to LCD.

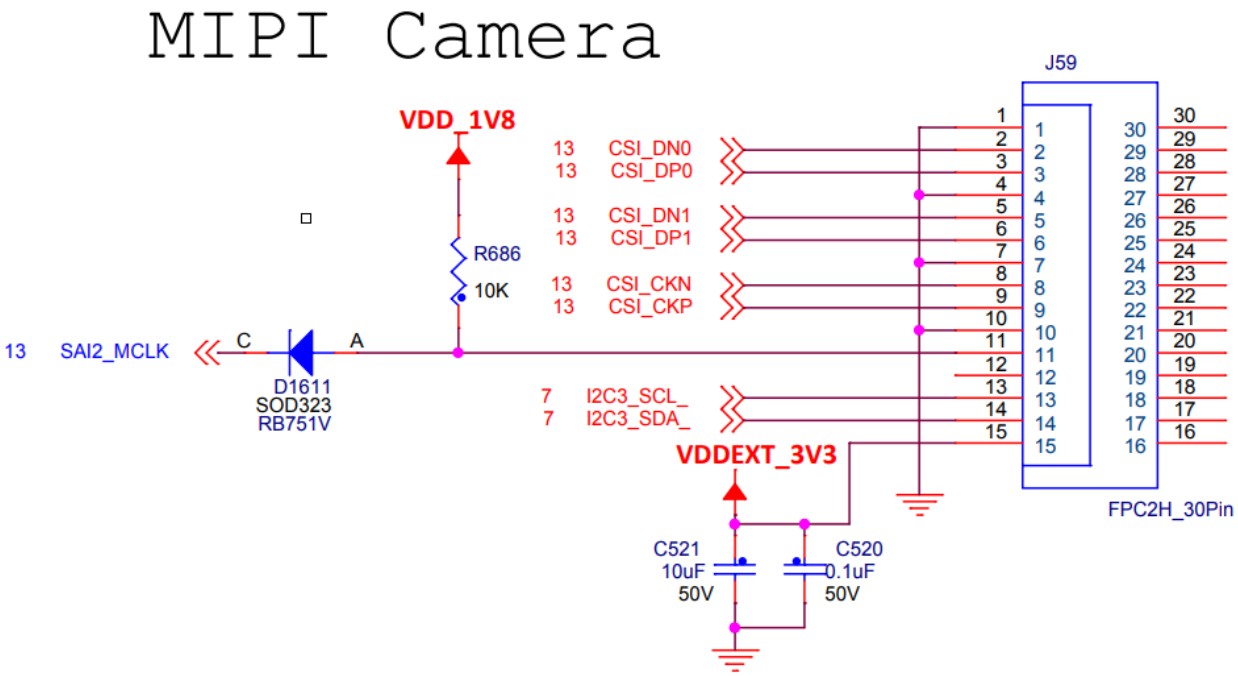


In order to realized the HDMI function, we used a DSI to HDMI Bright IC to realize the HDMI singal conversion.

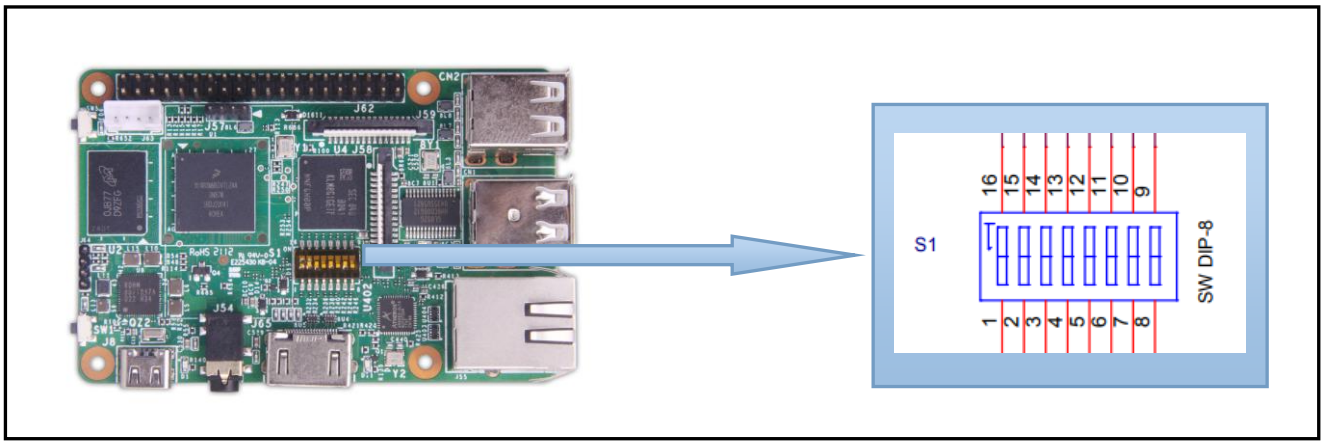


3.7.2 MIPI CSI

This module provides one four-lane MIPI camera serial interfaces,which operates up to a maximum bit rate of 1.5 Gbps



3.8 BOOT switch



3.8.1 BOOT Settings

Boot Device	Boot Mode		Internal Boot (SW1 [3-8])					
eMMC/SDHC3	BOOT_MODE 1	BOOT_MODE 0	1	0	1	0	1	0
MicroSD/SDHC2			0	1	0	1	0	1

Table 2

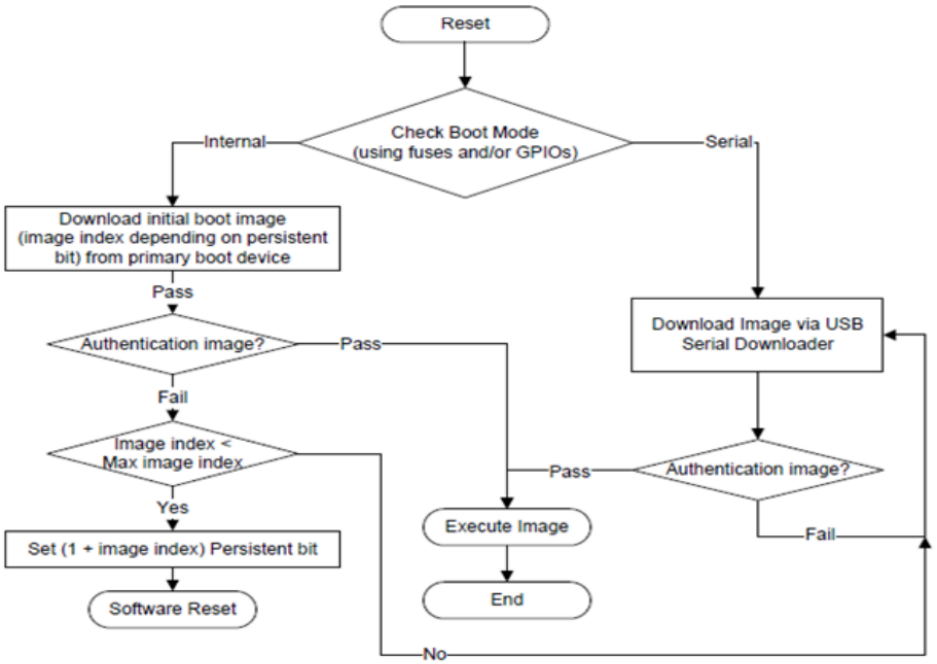
BOOT TYPE:

00 Boot From Fuses

01 Serial Downloader

10 Internal Boot (Development)

11 Reserved



BOOT FLOW

When the sw1[1-8] set to 01101010, the processor continues to execute the boot code from the internal boot ROM--eMMC.The boot code performs the hardware initialization, loads the program image from eMMC, performs the image validation using the HAB library , and then jumps to an address derived from the program image.

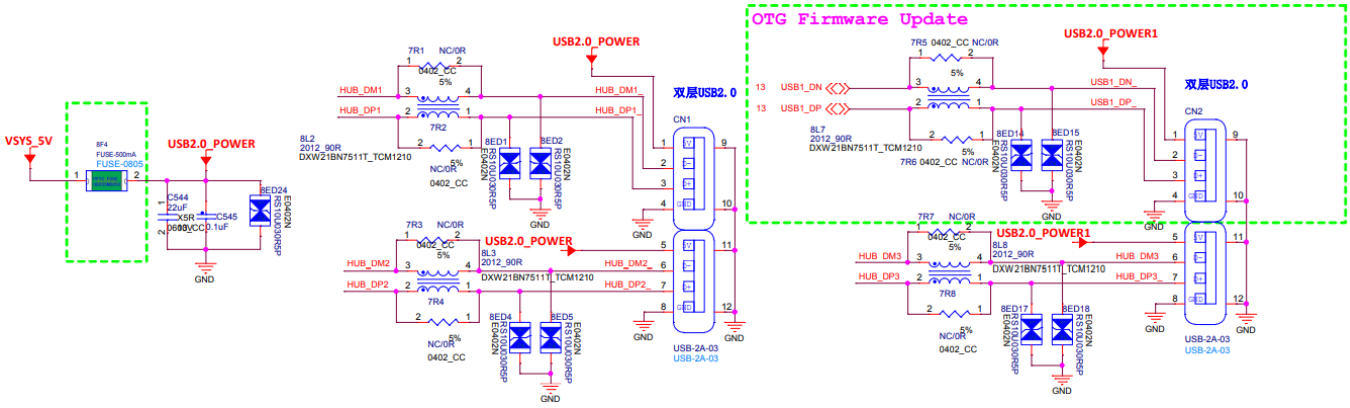
When the sw1[1-8] set to 10101010, The Serial Downloader provides a means to download a program image to the chip over the USB serial connection. In this mode, you can flash the image to the boot ROM--eMMC.

When the sw1[3-8] set to 010101, the internal boot ROM is selected to micro-SD/SDHC2.

3.9 USB

The XPI Board provides four USB ports for connectting USB devices. The processor iMX 8M Mini only provides two USB port. In

orde to expandd four USB ports, we use a USB to HUB ic to expand four USB singals. The upper USB port of CN2 is used to USB OTG funcition port. The rest three USB ports are normal USB ports using the expanded USB singals.

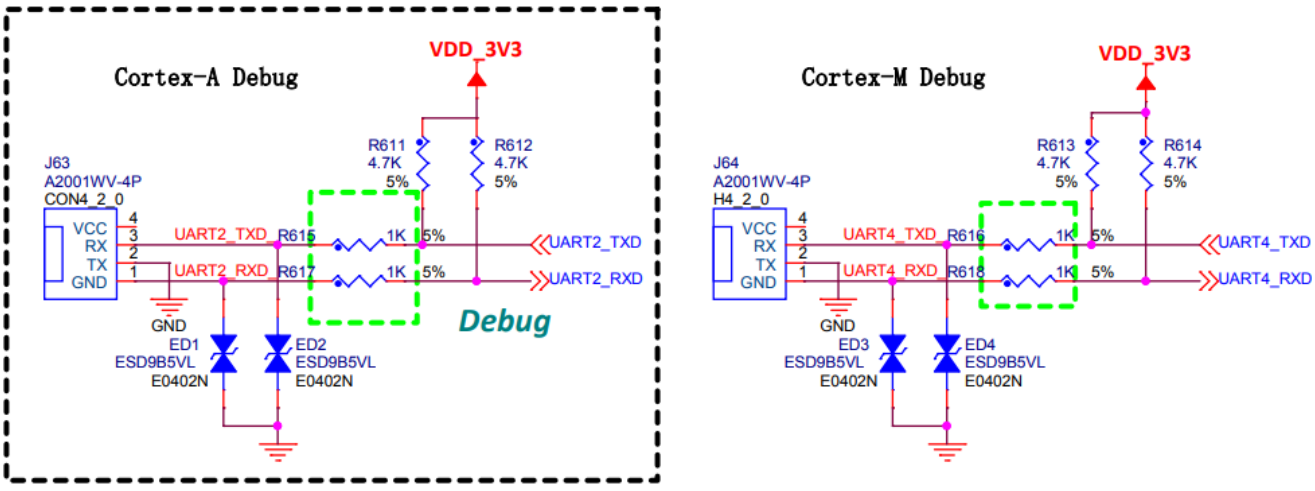


3.10 Audio

Five synchronous audio interface (SAI) modules supporting I2S, AC97, TDM, codec/DSP, and DSD interfaces, including one SAI with 8 Tx and 8 Rx lanes, one SAI with 4 Tx and 4 Rx lanes, two SAI with 2 Tx and 2 Rx lanes, and one SAI with 1 Tx and 1Rx lane. Support over 20 channels of audio subject to I/O limitations. The XPI board support 24-bit 192kHz Stereo DAC 2Vrms Line Out.

3.11 Cortex Debug Port

The XPI board provide two uart debug port for two cortex core. One is for Cortex-A53 core, the other is for Cortex-M4 core.



- UART For A53 Debug ((J63)
- UART For M4 Debug (J64)
- Baud rate:115200bps
- Stop bit::1
- Data bits:8
- Parity bit::none

3.12 GPIO

There are 28 pins available for general purpose I/O (GPIO), which correspond to the GPIO pins on the Raspberry Pi 4, Model B 40-pin header.

Any of the GPIO pins can be designated (in software) as an input or output pin and used for a wide range of purposes.

Voltages

Two 5V pins and two 3V3 pins are present on the board, as well as a number of ground pins (0V), which are unconfigurable. The remaining pins are all general purpose 3V3 pins, meaning outputs are set to 3V3 and inputs are 3V3-tolerant.

Outputs

A GPIO pin designated as an output pin can be set to high (3V3) or low (0V).

Inputs

A GPIO pin designated as an input pin can be read as high (3V3) or low (0V). This is made easier with the use of internal pull-up or pull-down resistors. Pins GPIO2 and GPIO3 have fixed pull-up resistors, but for other pins this can be configured in software.

More

As well as simple input and output devices, the GPIO pins can be used with a variety of alternative functions, some are available on all pins, others on specific pins.

-PWM (pulse-width modulation)

Software PWM available on all pins

Hardware PWM available on GPIO12, GPIO13, GPIO18, GPIO19

-SPI

SPI0: MOSI (GPIO10); MISO (GPIO9); SCLK (GPIO11); CE0 (GPIO8), CE1 (GPIO7)

SPI1: MOSI (GPIO20); MISO (GPIO19); SCLK (GPIO21); CE0 (GPIO18); CE1 (GPIO17); CE2 (GPIO16)

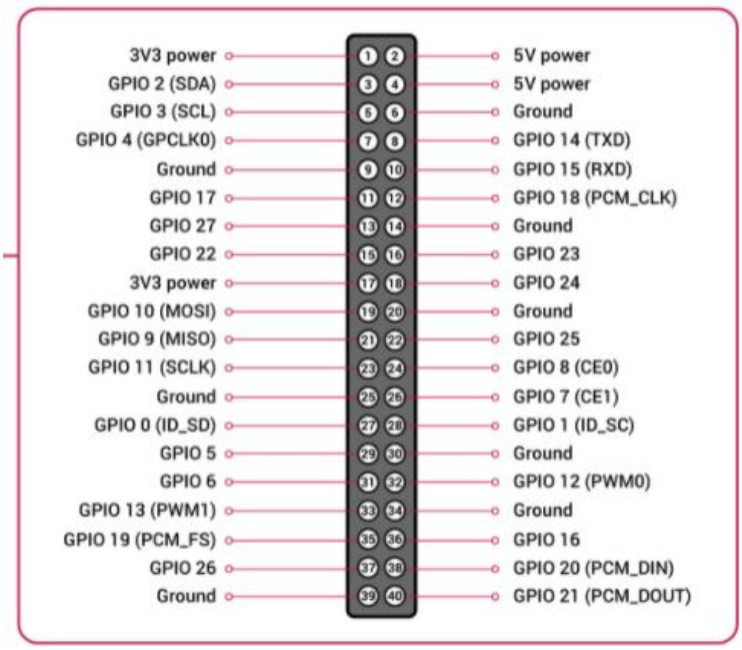
-I2C

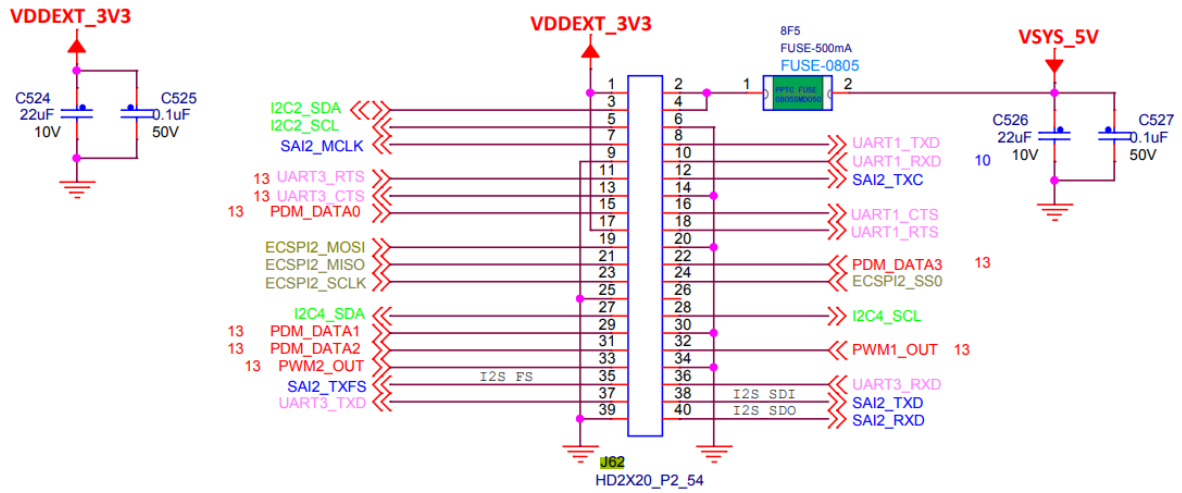
Data: (GPIO2); Clock (GPIO3)

EEPROM Data: (GPIO0); EEPROM Clock (GPIO1)

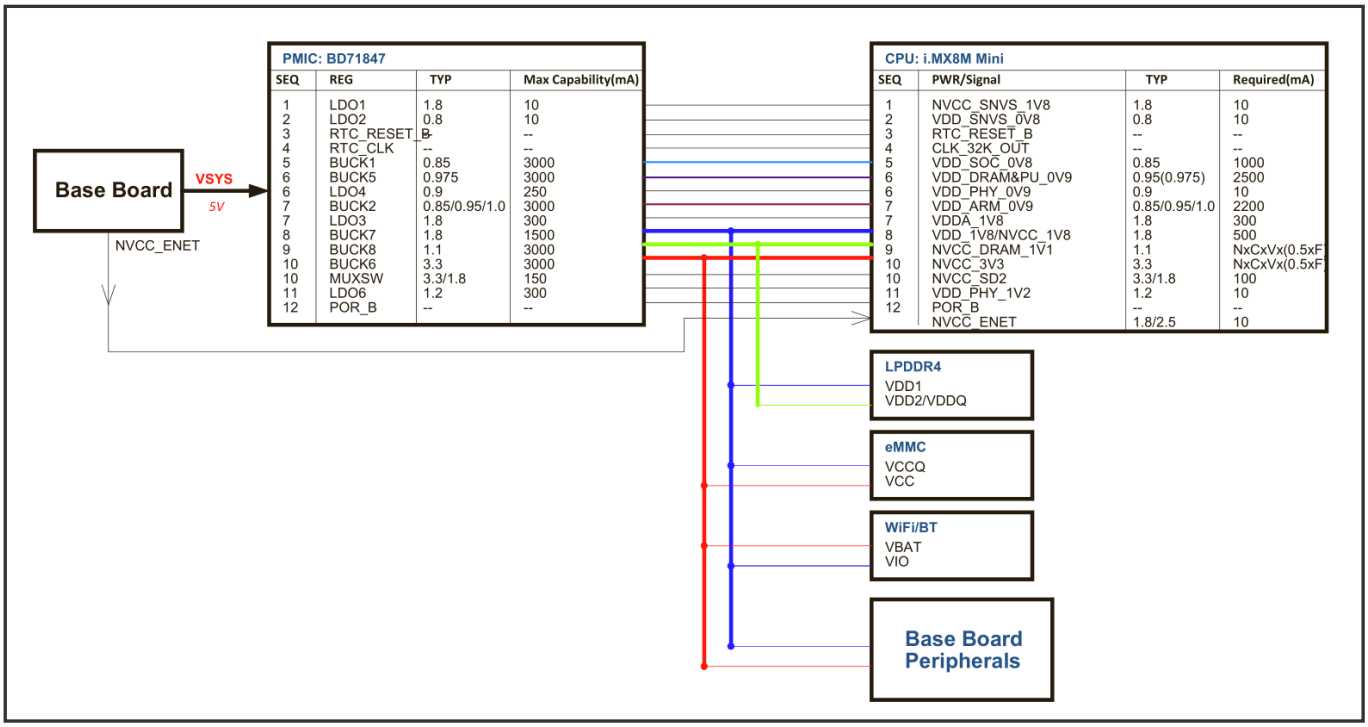
-Serial

TX (GPIO14); RX (GPIO15)





3.13 Power Block diagram



4 Mechanical specification

4.1 Board dimensions