Genio 720 and Genio 520 Evaluation Kit User Guide

Version: **1.0**
Release date: **2025-07-22**

Version History

Version	Date	Description
0.1	2025-06-03	Initial draft.
1.0	2025-07-22	Official release. • Updated Chapter 1.1: Added note description. • Updated Chapter 1.3: Changed UFS to Western Digital SDINFD04-128, and updated DC jack and USB Type-C power input to support 20V. • Updated Table 2-1: Revised content. • Updated Table 2-2: Updated UFS to Western Digital SDINFD04-128. • Updated Chapter 2.1: Revised key features and descriptions for LPDDR5 and LPDDR4X. • Updated Figure 2-3: Title changed to "Genio 720 EVK Bottom View". • Updated Figure 2-4: Redefined as Table 2-5. • Added Figure 2-4: Genio 520 EVK Bottom View. • Updated Chapter2.4: Updated UFS storage to Western Digital SDINFD04-128. • Updated Chapter 2.8: Updated DC power adapter from 12V to 20V, and revised descriptions for Step 1 and Step 3. • Updated Chapter 2.9: Revised Debug Port setup steps, and updated download link on the Genio Developer Center. • Updated Chapter 2.10: Updated reference from Section 6.1.3 to 6.1.4. • Updated Table 2-5: Redefined as Table 2-6. • Updated Table 2-6: Renumbered as Table 2-7 and adjusted table label position. • Updated Table 3-1: Revised content. • Updated Chapter 3.2.2: Revised content. • Updated Table 3-6: Revised notes for I2C7 and I2C8 to "Camera Sensor". • Updated Chapter 3.3: Revised content related to PWM. • Updated Chapter 3.5: Updated power supplies from 12V to 20V. • Updated Chapter 3.18: Reworded "BSDL" to "Boundary Scan". • Updated Table 3-19: Reworded "BSDL" to "Boundary Scan". • Added Figure 4-5: Camera Board Installation. • Updated Chapter 6: Revised content. • Updated Chapter 6.1.4: added description of Note. • Added Chapter 7 "Errata".

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1 Overview

1.1 General Information

Genio 720 EVK is an evaluation kit of MediaTek MT8391 platform and Genio 520 EVK is an evaluation kit of MediaTek MT8371 platform, integrated with Wi-Fi/Bluetooth (M.2 Module), which is a high performance IoT platform with rich features.

Note: Genio 720 EVK or Genio 520 EVK is only for development and evaluation; please follow the **MT8391 MT8371 Application Processor Schematic and PCB Design Notice** document for hardware design rules.

1.2 Architecture and Block Diagram

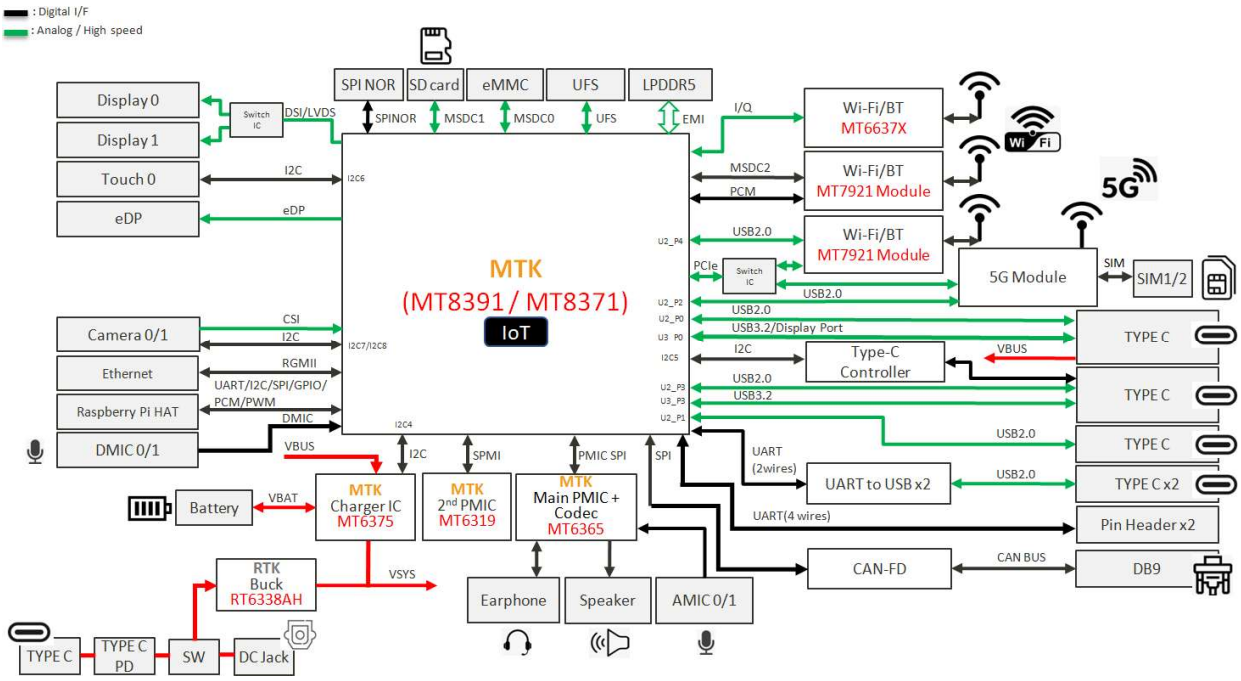


Figure 1-1 Genio 720 EVK or Genio 520 EVK System Block Diagram

1.3 Feature Summary

- MediaTek CPU (MT8391AV/AZA or MT8371AV/AZA)
- MediaTek PMIC (MT6365ICW/B)
- MediaTek Charger (MT6375P/A)
- 8GB LPDDR5 RAM (Micron MT62F2G32D4DS-023 IT:C)
- 64GB eMMC x 1 (Micron MTFC64GBCAQTC-IT)
- 128GB UFS x 1 (Western Digital SDINFD04-128)
- Φ2.0 DC Jack x 1 (Supports 20V DC Input)
- USB Type-C Power Adapter (20V PD Adapter)
- Micro SD Card Connector x 1
- Push Button x 4 (Power, Reset, Home and Download)
- LED x 3 (System Power, Reset, DC-IN Power)
- 4-lane MIPI DSI x 1 (MUX)
- 4-lane MIPI CSI x 2
- DP x 1 (Mode over USB Type-C)
- LVDS x 1 (MUX)
- eDP x 1
- 10/100/1000M Ethernet x 1 (Airoha AN8801RIN/A)
- USB Type-C Connector (UART) x 2
  - UART Port for Trace Log with USB to UART Bridge IC
- USB Type-C Connector (USB 3.2) x 2
- USB Type-C Connector (USB 2.0) x 1
- 3.5mm Earphone Jack x 1 (with Microphone Input)
- 3.5mm Line Out Audio Jack x 1
- Analog Microphone x 2 (Merry MMA102-006)
- Digital Microphone x 2 (Merry MMD300-007)
- UART Port x 4 (USB Port x 2, Pin Header x 2)
- M.2 Slot Key E x 2
  - For AzureWave AW-XB468NF Wi-Fi 6 & BT 5.2 Module
  - For Sona MT320 2230 Wi-Fi 6 & BT 5.4 Module
  - The M.2 slot designed on the EVK complies with the M.2 standard pin definition. Please ask the customer to confirm whether their M.2 module meets the M.2 standard pin definition
- M.2 Slot Key B x 1
  - The M.2 slot designed on the EVK complies with the M.2 standard pin definition. Please ask the customer to confirm whether their M.2 module meets the M.2 standard pin definition
- 40-Pin 2.54mm Pin Header x 1 (for Raspberry Pi Like I/O Interface)
- Micro SIM x 1
- Nano SIM x 1
- CAN Bus x 1 (RS232 Connector)

1.4 MediaTek Module Design (MMD) Layout Dimension

- MT8391 or MT8371 + LPDDR5: 30 x 36 = 1080mm²
- PMIC MT6365ICW/B: 16.5 x 19.5 = 321.75mm²
- Buck MT6319ABP/A: 7 x 10.2 = 71.4mm²
- Buck RT5762EHGH6F: 7.2x 4.3 = 30.96mm²

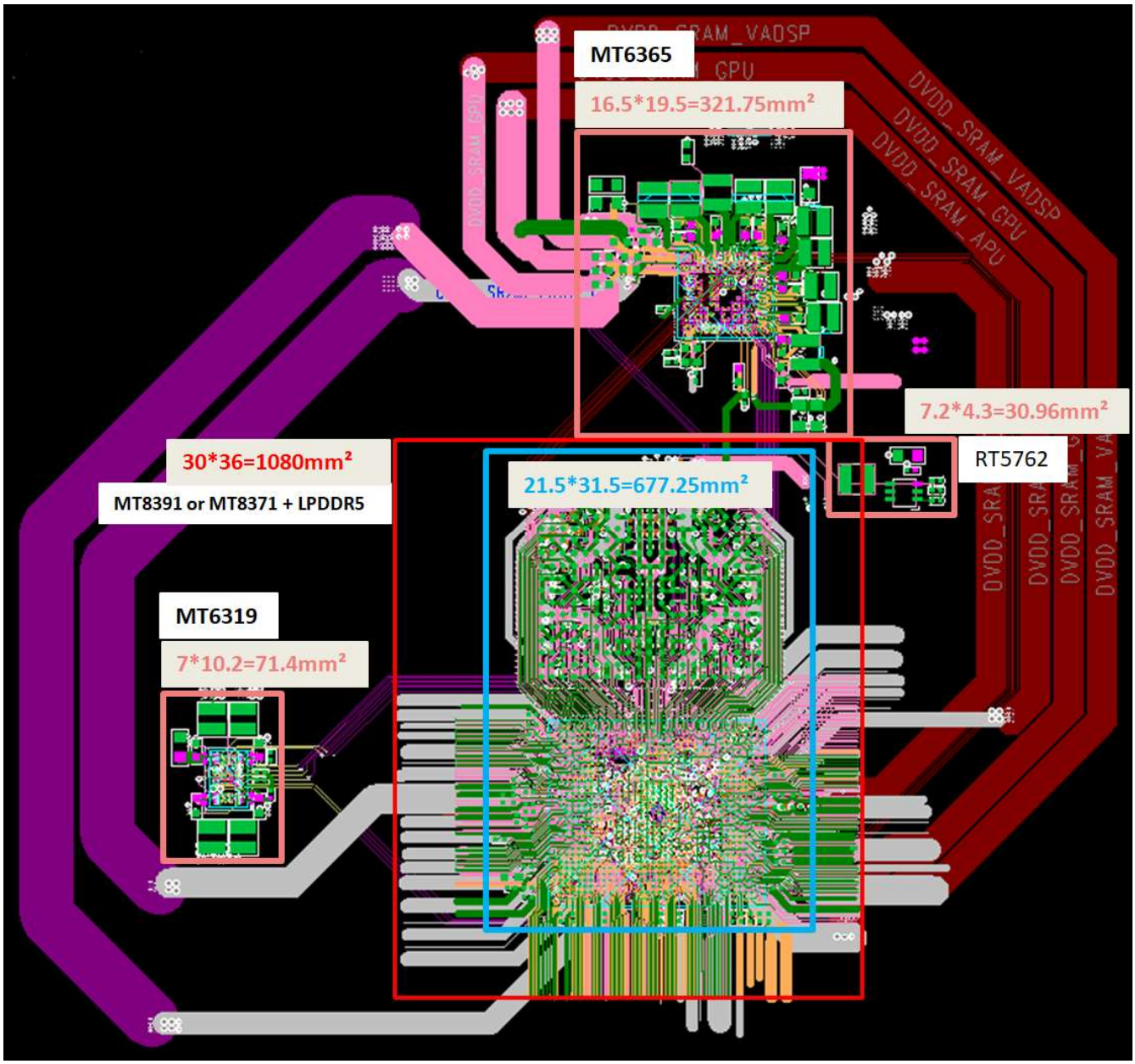


Figure 1-2 MMD Layout Dimension

2 Introduction

Genio 720 EVK board integrates MediaTek MT8391 processor and Genio 520 EVK board integrates MediaTek MT8371 processor, 64bit LPDDR5 memory, eMMC, UFS, Power Management IC (MT6365ICW/B) and Wi-Fi/BT M.2 Module.

The box contents a Genio 720 EVK main board or Genio 520 EVK main board, MIPI DSI 7” LCD panel, one Wi-Fi 6 module and two camera boards.

Figure 2-1 Genio 720 EVK or Genio 520 EVK System Setup

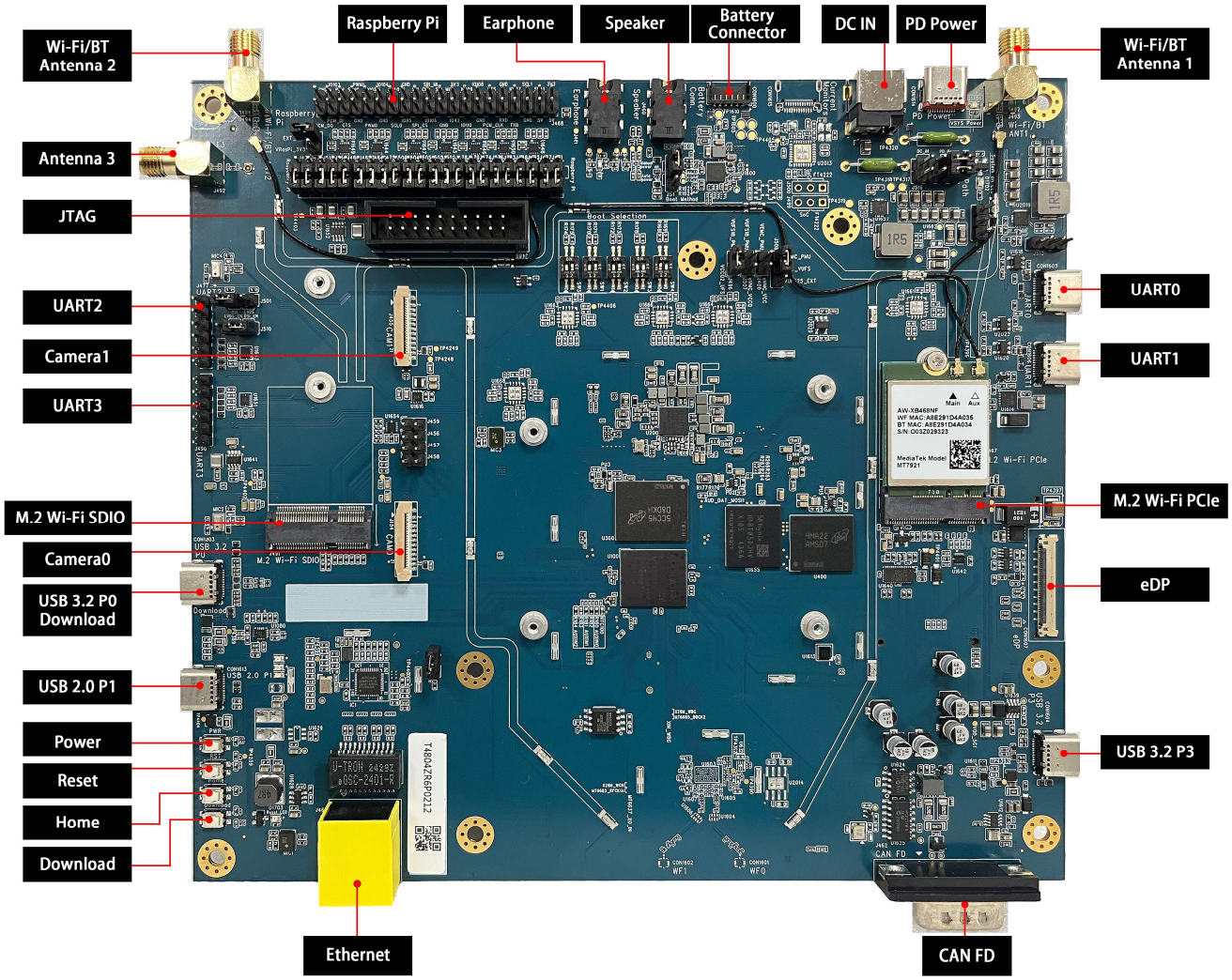


Figure 2-2 Genio 720 EVK or Genio 520 EVK Top View

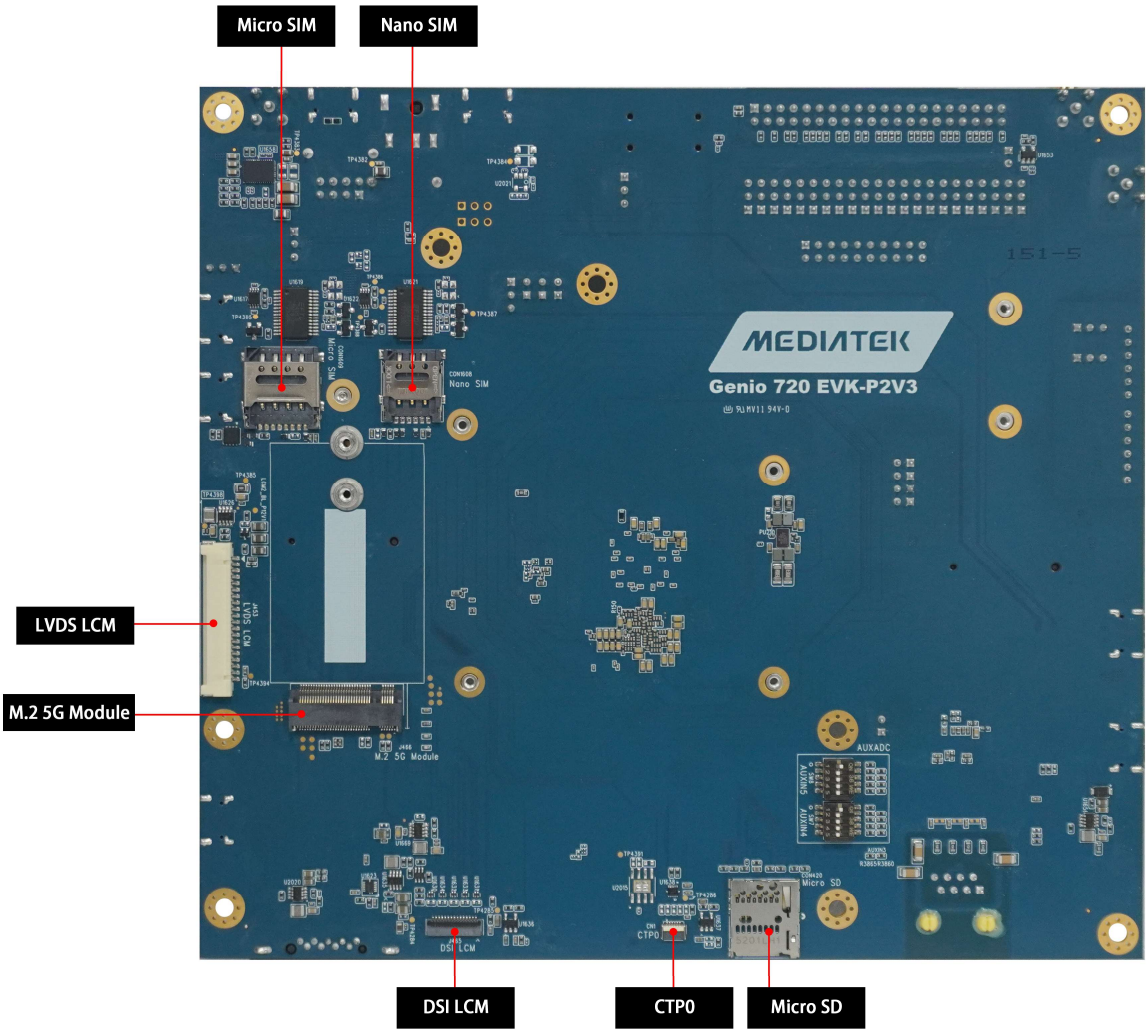


Figure 2-3 Genio 720 EVK Bottom View

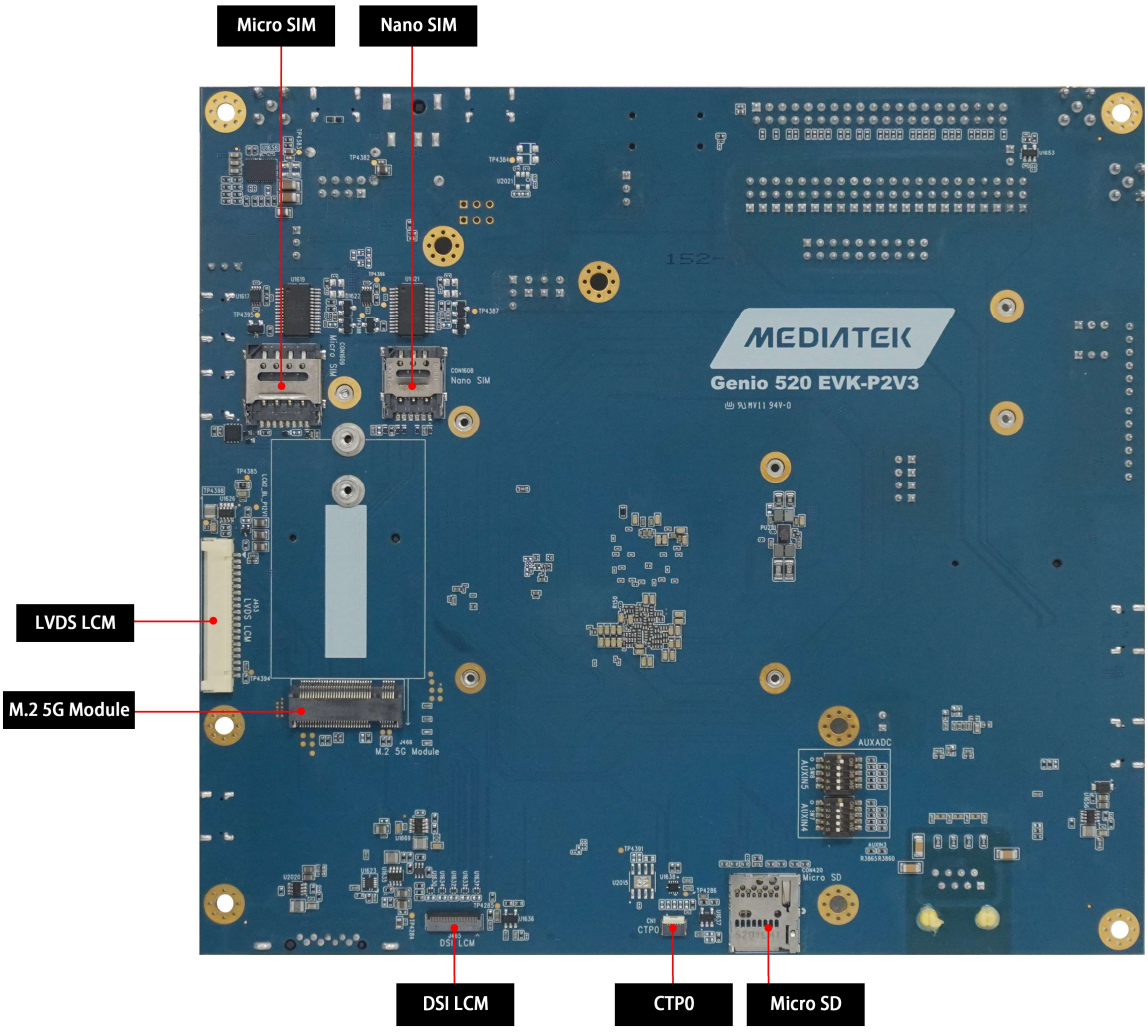


Figure 2-4 Genio 520 EVK Bottom View

Table 2-1 Box Contents

No.	Part Number or Marketing	Item Name	Description	Quantity
1	Genio 720 EVK-P2V3 or Genio 520 EVK-P2V3	Genio 720 EVK Main Board or Genio 520 EVK Main Board		1
2	IoT-CAM-DTB-D8V2	Camera Board (D8 Version)		1
3		Camera Module for D8	IMX258 Camera Module	1
4	IoT-CAM-DTB-D9V2	Camera Board (D9 Version)		1
5		Camera Module for D9	OV5640 Camera Module	1
6	CAM-DTB-FPC-V2	FPC for Camera Board	FPC is Suitable for Both D8 and D9 Camera Boards	2
7		7” LCD Panel	With Touch Panel and FPC Cable	1
8	AW-XB468NF	Wi-Fi Module	M.2 Wi-Fi 6 Module (IC: MT7921L)	1
9		Wi-Fi Antenna	SMA Antenna	2
10	EA1062SBR	USB Type-C Power Adapter		1

Table 2-2 Key Component List

Function	Manufacturer	PN
Baseband Processor	MediaTek	MT8391AV/AZA or MT8371AV/AZA
Main PMIC	MediaTek	MT6365ICW/B
Sub PMIC	MediaTek	MT6375P
Buck	MediaTek	MT6319ABP/A
LDO	MediaTek	MT6680P/A
Memory	Micron	MT62F2G32D4DS-023 IT:C
eMMC	Micron	MTFC64GBCAQTC-IT
UFS	Western Digital	SDINFD04-128
Camera Module	MediaTek	IOT-CAM-DTB-D8V2, IOT-CAM-DTB-D9V2
Connectivity	AzureWave	AW-XB468NF (MT7921L Module)
Ethernet PHY	Airoha	AN8801RIN/A

Table 2-3 Power Rails

Function	Regulator	Default Voltage (V)
GPU	MT6365ICW/B	0.75
APU		0.75
CPU_L		0.75
SRAM_CORE		0.75
CORE		0.75
eMMC VCC		3.3
eMMC VCCQ		1.86
UFS VCC		3.3
UFS VCCQ2		1.86
LPDDR5 VDD1		1.8
LPDDR5 VDD2H	MT6319ABP/A	1.125
LPDDR5 VDDQ		0.6
CPU_B		0.75
Buck for LPDDR5 VDD2L	RT5762EHGH6F	0.9
Buck for UFS VCCQ	RT5762EHGH6F	1.2
Buck for UFS VCC	RT5762EHGH6F (RESERVED)	2.5
Buck for LPDDR5 VDD1	MT6680P/A (RESERVED)	1.8
LDO for MT6637	RT9081AGQZA	1.3
LDO for MT6637	RT9048GSP	3.3
Boost for USBP3 VBUS	RT4812GJ8F	5.0
Boost for MIPI LCM	RT4812GJ8F	5.0
Boost for Raspberry Pi	RT4812GJ8F	5.0
Boost for USBP1 VBUS	RT4812GJ8F	5.0
Boost for CAN BUS	RT4812GJ8F	5.0
Boost for LVDS Backlight	RT8509GQW	12.0
Buck for Camera Board	RT5795AGQW	3.3

LDO for UART0 and UART1	FP6186S5	3.3
Buck for eDP	RT5788AGJ8F	3.3
Buck for 5G Module	RT5788AGJ8F	3.3
Buck for Wi-Fi Module	RT5788AGJ8F	3.3
Buck for LVDS	RT5788AGJ8F	3.3
Buck for Ethernet PHY	RT6252AHGJ6F	3.3
Buck for Ethernet PHY	RT6252AHGJ6F	1.8
LDO for Raspberry Pi and SBU MUX	RT9078N-08GJ5	3.3
Buck for System	RT6338AHGQUF	4.2
Buck for System	RT6338AHGQUF	4.2
USB PD for System	TPS25730DREFR	20.0

2.1 CPU (MT8391AV/AZA or MT8371AV/AZA)

MediaTek MT8391 and MT8371 processor is a highly integrated platform incorporating the following key features:

- Dual-Core ARM® Cortex-A78 processor
- Hexa-Core ARM® Cortex-A55 processor
- Arm Mali-G57 MC2 3D Graphics Accelerator (GPU) with Vulkan 1.0 and 1.1, OpenGL ES 1.1, 2.0 and 3.2 and OpenCL up to 2.2
- Al Processor Unit System (APUSYS)
- Deep Learning Accelerator (MDLA for AIA)
- Audio supports 8~192 kHz sampling rates; 16/24/32-bit mono/stereo formats; I2S, PCM, and PDM interfaces; Asynchronous Sample Rate Converter (ASRC)
- LPDDR5: Up to 16GB, with memory data rate up to 6400
- LPDDR4X: Up to 8GB, with memory data rate up to 4266
- Two display video processing pipes support up to 3840 x 2160 60fps per pipe
- ISP supports up to a single camera at 32MP@30fps or dual cameras at 16MP + 16MP@30fps, with 2× MIPI CSI-2 interfaces supporting 4-lane D-PHY at 2.5 Gbps or 3-trios C-PHY at 2.5 Gsps
- Video encoding: 4K30 fps HEVC/H.264 video encoder
- Video decoding: 4K60 fps HEVC/H.264/VP9 video decoder

Table 2-4 Genio 720 and 520 EVK Board Feature Summary

Feature	Genio 720 EVK	Genio 520 EVK
SoC	MT8391AV/AZA	MT8371AV/AZA
ARM® Cortex-A78	2x 2.6GHz	2x 2.2 GHz
ARM® Cortex-A55	6x 2.0GHz	6x 2.0GHz
ARM® Mali-G57 MC2	2x 1.1GHz	2x 880MHz
NPU	9 TOPS	9 TOPS
ISP	2x ISP	1x ISP

2.2 Power Management IC (MT6365ICW/B)

MediaTek MT6365ICW/B power management IC is a programmable power management IC that integrates 9 buck converters and 33 LDOs to provide all power rails required by SoC and peripherals.

MT6365ICW/B adopts the SPI interface and two SRCLKEN control pins to control buck converters, LDOs, and various drivers; it provides enhanced safety control and protocol for handshaking with the processor MT8391 or MT8371.

For system management, it provides the following features.

- 9 buck converters and 33 LDOs
- Precision voltage, temperature, and current measurement fuel gauge
- 26MHz external crystal for system clock
- 32.768KHz RTC oscillator for system timing
- Watchdog reset
- Over-current and thermal overload protection
- OVP, UVLO function
- WFBGA-203 package

Note: For the PMIC MT6365ICW/B software naming conventions, please refer to FAQ30421 on MediaTek On-Line.

2.3 DRAM (Micron MT62F2G32D4DS-023 IT:C)

Genio 720 EVK or Genio 520 EVK has one 8GB LPDDR5 memory with the following features.

- Selectable CKR (WCK:CK = 2:1 or 4:1)
- Bank architecture: bank group (BG) mode, and 16-bank (16B) mode supported
- Single x16 channel/die, double-data-rate command/address entry
- 2 Gig x 32 configuration

2.4 UFS Storage (Western Digital SDINFD04-128)

A 128GB UFS SDINFD04-128 of Western Digital is used for code and data storage.

2.5 eMMC Storage (Micron MTFC64GBCAQTC-IT)

A 64GB eMMC 5.1 Micron MTFC64GBCAQTC-IT is used for code and data storage, via MSDC0 interface of the baseband processor MT8391 or MT8371 with an 8-bit width data bus, which can be switched by the switch SW2 and SW4 on the EVK. Please refer to chapter 2.10.

2.6 M.2 Wi-Fi/Bluetooth Module (AzureWave AW-XB468NF)

MediaTek MT7921 is designed inside AzureWave AW-XB468NF M.2 Module. It supports the following features.

- M.2 2230 Wi-Fi Module with Key A-E
- MediaTek MT7921L Wi-Fi Chip
- PCIe/USB Interface
- Wi-Fi 802.11 a/b/g/n/ac/ax
- Dual Band 2T/2R MIMO
- Bluetooth 5.2
- Security WFA WPA/WPA2/WPA3 Personal, WPS 2.0, WAPI
- Integrated LNA, PA and T/R Switch

2.7 Ethernet PHY Transceiver (Airoha AN8801RIN/A)

The AN8801RIN/A is suitable for various applications requiring Ethernet connectivity, including:

- IoT devices
- Ethernet Switches
- Routers, Gateways
- DSLAM, PON Equipment
- Set-Top Boxes
- Smart TVs
- Gaming Consoles

In summary, the AN8801RIN/A is a feature-rich, low-power, and highly integrated Ethernet PHY transceiver suitable for a wide range of networking applications. For more detailed information, it is recommended to refer to the AN8801R's product datasheet. You can search for and download it from the Airoha Technology official website.

- Ethernet Standard Compliance: Supports 10Base-T (IEEE 802.3), 100Base-TX (IEEE 802.3u), and 1000Base-T (IEEE 802.3ab) standards
- Low Power Consumption: Designed for energy efficiency
- High Integration: Integrates multiple functionalities into a single chip, reducing the need for external components
- Robust Data Transmission and Reception: Provides reliable data transfer and reception capabilities
- Energy-Efficient Ethernet (EEE) Support: Compliant with IEEE 802.3az standard, further reducing power consumption
- Full-Duplex Flow Control Support: Compliant with IEEE 802.3x standard
- Auto-Negotiation: Automatically detects and configures the optimal connection speed and duplex mode
- Auto MDI/MDIX Support: Automatically detects and adjusts the wiring, eliminating the need for crossover cables
- Jumbo Frame Support: Supports jumbo frames up to 9KB
- Interfaces:
  - Single-Port Serdes Interface: Supports 1000Base-X/RGMII
  - MDC/MDIO Interface: For management and control of the PHY
  - SPI Interface: Can be used through shared GPIO pins
  - LED Control: Can control LED status through shared GPIO pins

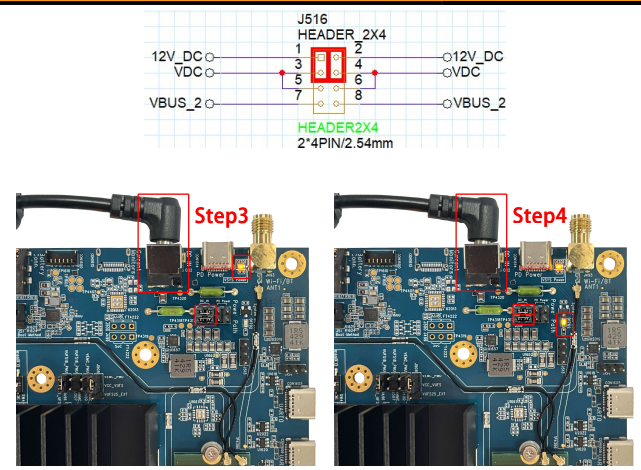
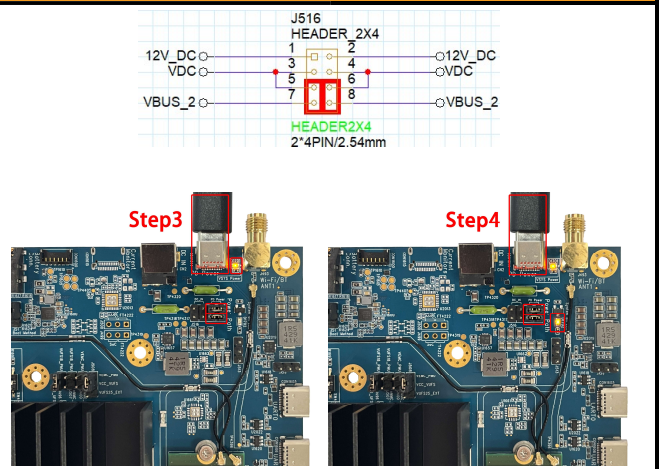
2.8 How to Boot the Genio 720 EVK or the Genio 520 EVK

Power on the Genio 720 EVK board or the Genio 520 EVK board using the following steps.

- Step1: Must install camera board on CAM0 or CAM1 connector.
- Step2: Connect UART0 to the computer via a USB Type-C cable (If you want to see the logs).
- Step3: First, set the jumper on J516, then insert the DC 20V power adapter or USB Type-C PD adapter.
- Step4: Long press PWR button for more than 3 seconds.

You will see the screen is shown on MIPI DSI display and some trace logs coming out from UART0.

Table 2-5 Power Up the System

DC Jack Power Adapter	USB Type-C Power Adapter
	
J516 1-3, 2-4 short	J516 5-7, 6-8 short

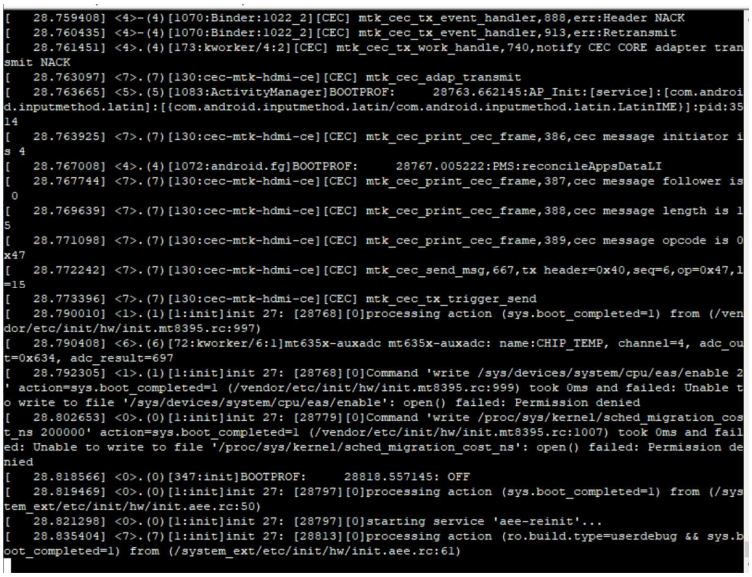


Figure 2-5 Console Screen

Note: If you want to use the camera app, please make sure to plug in the D8/D9 camera board before powering up the EVK.

2.9 EVK Debug

The SoC core processor log is output through USB Type-C (CON1605).

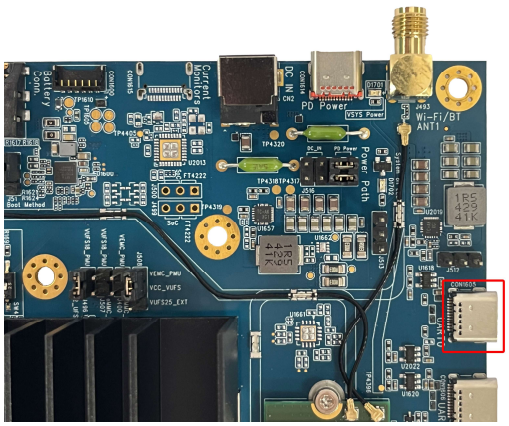


Figure 2-6 Debug Port

- Step1: Check whether the PC's USB port can recognize the UART device. If it cannot be recognized, please install the FT232RNL driver.
- Step2: Setting "Serial line" (ex. COM57), "Speed" to 921600, choose "Connection type" to serial and press "Open" on PuTTY for log (Example on PuTTY).

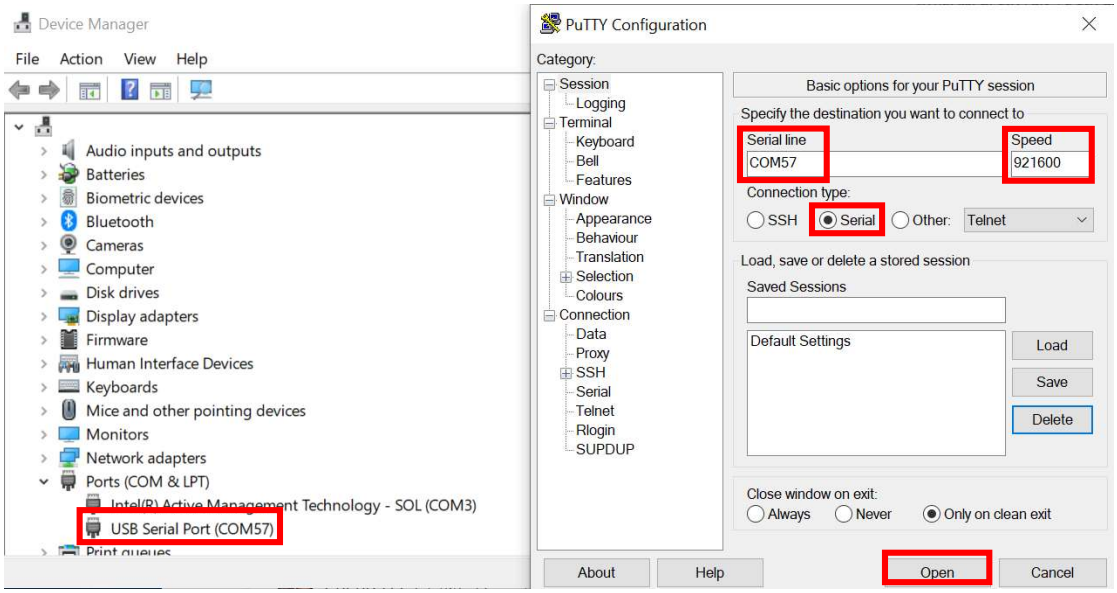


Figure 2-7 Putty Example

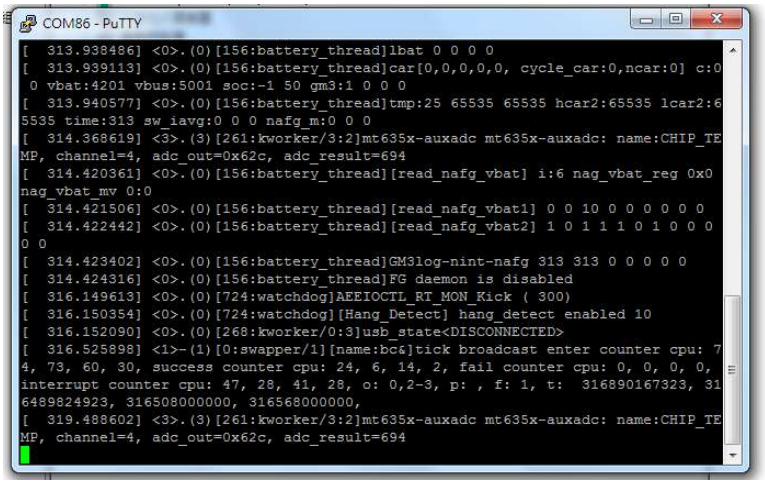


Figure 2-8 Log Screen

- Download "MTK USB cable driver (Driver_Auto_Installer_EXE.zip)" from MediaTek Genio Developer Center website (https://genio.mediatek.com/download/f6935c8f-bfaa-4b2a-9acc-d61b0616f1cb) and download "Universal ADB driver" from the Internet. Install these two programs into your Windows OS host machine.

2.10 Boot Mode Selections

You can choose to boot from eMMC or boot from UFS by switching the state of SW2 and SW4. This instruction is for Android image. In later section (6.1.4) we describe flashing Android image.

Table 2-6 Boot Initiation (SW1, SW2, SW4, J496, J508, J507 and J400)

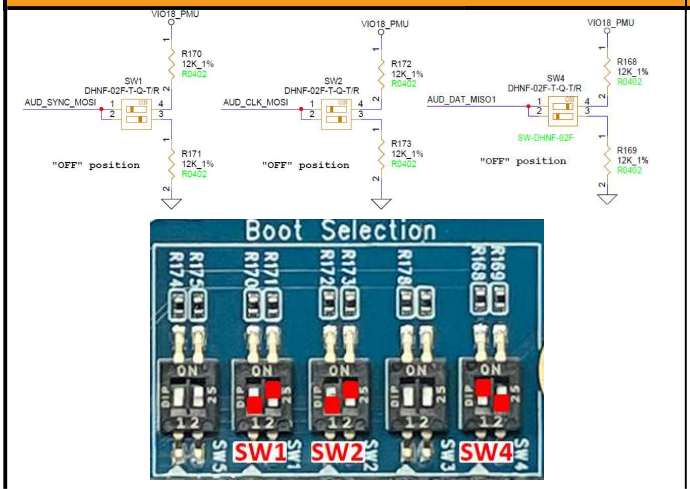
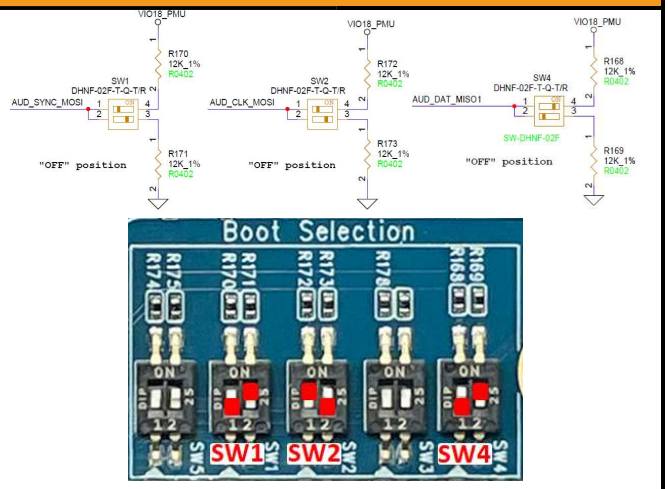
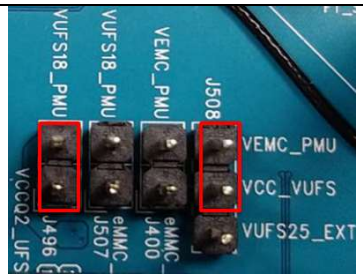
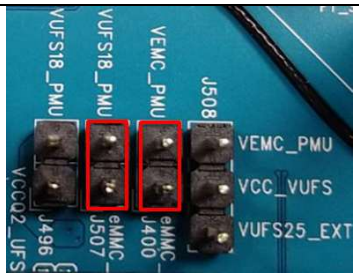
UFS	eMMC
	
SW2 1: OFF, 2: ON / SW4 1: ON, 2: OFF SW1 1: OFF, 2: ON(Default)	SW2 1: ON, 2: OFF / SW4 1: OFF, 2: ON SW1 1: OFF, 2: ON(Default)
	
J496 short, J508 1-2 short	J507 short, J400 short

Table 2-7 Switch Status (SW1, SW2 and SW4)

AUD_SYNC_MOSI	AUD_CLK_MOSI	AUD_DAT_MISO1	Storage Booting	Switch Status
L	H	L	eMMC boot	SW1 1: OFF, 2: ON SW2 1: ON, 2: OFF SW4 1: OFF, 2: ON
L	L	H	UFS boot	SW1 1: OFF, 2: ON SW2 1: OFF, 2: ON SW4 1: ON, 2: OFF

3 Interface and Connectors

3.1 Genio 720 EVK or Genio 520 EVK I/O Connectors

Table 3-1 Main Board Connectors

Description	Location	Note
Battery Connector	CON1600	
Charger Power Input Connector	CON1603	USB Type-C (USB Port 0)
DC Jack	CN2	DC IN (the silkscreen marking)
Adapter Selection	J516	DC jack power adapter or USB Type-C power adapter
Auto Power-on Jumper	J51	
DC-IN Power-on Indicator	D1701	Orange LED
System Power-on Indicator	D1702	Orange LED
Reset Indicator	D1703	Green LED
Power On Button	PWRKEY1	PWR (the silkscreen marking)
Reset Button	VOLD2	RST (the silkscreen marking)
Home Button	VOLD1	Home (the silkscreen marking)
Download Button	VOLU1	Download (the silkscreen marking)
Boot Switch	SW1, SW2, SW4	Switch between eMMC and UFS
eMMC VCC Supply Voltage	J400	
eMMC VCCQ Supply Voltage	J507	
UFS VCC Supply Voltage	J508	
UFS VCCQ2 Supply Voltage	J496	
Boundary Scan Testing	SW3, J200	Trapping pin for Boundary Scan testing
USB Download Port Selection	SW5	Trapping pin to select USB download port
Board ID for Bluetooth/Wi-Fi	SW7, SW8	AUXIN4, AUXIN5 (the silkscreen marking)
USB 3.2 Type-C Connector	CON1603, CON1604	Include USB 2.0 functionality
USB 2.0 Type-C Connector	CON1613	Only USB 2.0 functionality
UART0 Type-C Connector	CON1605	Debug (Core Processor Log)
UART1 Type-C Connector	CON1606	
UART2 Pin Header	J477	
UART3 Pin Header	J490	
Micro SD Card Connector	CON420	
DSI LCM Connector	J465	7” MIPI DSI Panel (DSI 0)
CTP0 Connector	CN1	7” Touch
eDP Connector	CON1607	
DisplayPort over USB Type-C Connector	CON1603	
LVDS Connector	J453	
MIPI LCM/LVDS Backlight Jumper	J510	
MIPI LCM/LVDS Switch Jumper	J501	
CAM0 Connector	J454	MIPI CSI0 Interface

CAM1 Connector	J455	MIPI CSI1 Interface
Nano SIM Card Connector	CON1608	
Micro SIM Card Connector	CON1609	
M.2 3052 Key B Slot	J466	
Wi-Fi Antenna (Wi-Fi/BT)	J493, CON1611	
Wi-Fi Antenna (Wi-Fi/BT)	J494, CON1612	
Wi-Fi Antenna (Spare)	J492, CON1610	
IPEX Antenna Connector	CON1601, CON1602	For MT6637X Wi-Fi Chip
M.2 2230 Key E Slot	J467	Compliant with the PCIe slot as defined by the M.2 Association
M.2 2230 Key E Slot	J491	Compliant with the SDIO slot as defined by the M.2 Association
Ethernet RJ45 Connector	J463	
Raspberry Pi Like I/O Pin Header	J468	
Raspberry Pi I/O Switch Jumper	J470, J471, J474, J475, J476, J478, J479, J480, J481, J482, J483, J484, J485, J487, J488, J502, J503, J504, J505, J506, J514, J515	
Raspberry Pi 3.3V Power Jumper	J469	
JTAG	J489	
CAN FD Connector	J462	
Earphone Jack	J461	
Speaker Line Out Jack	J460	

3.2 System Power Paths

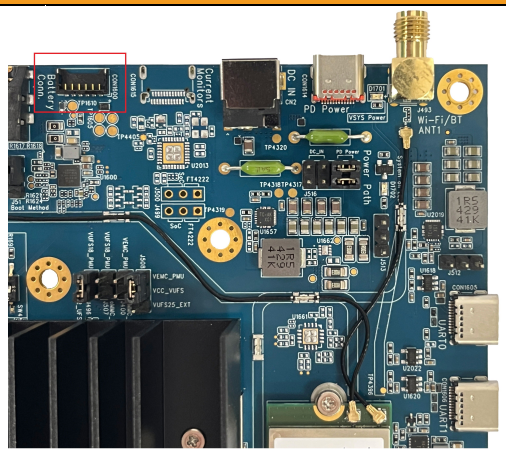
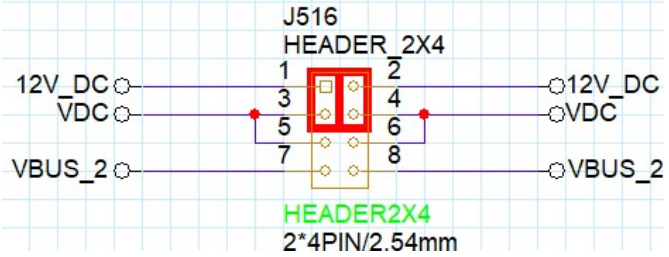
3.2.1 System Power

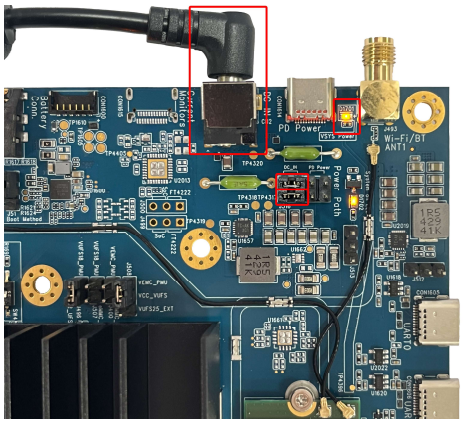
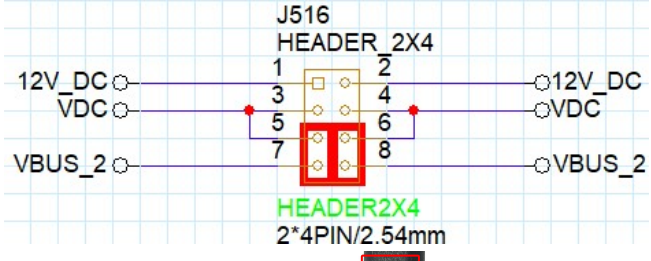
There are three power supply paths for the system. Two paths are selected as inputs using jumper J516: USB PD adapters or DC adapters.

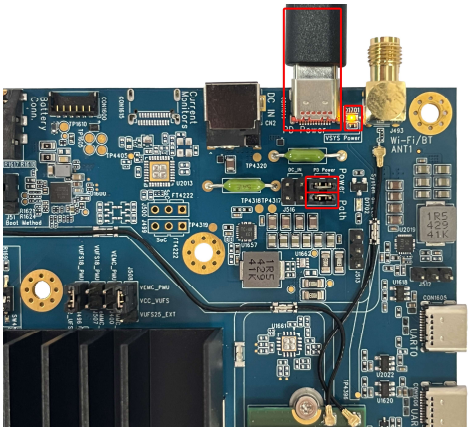
Note: DO NOT connect the battery when selecting USB PD adapters or DC adapters, as this will cause charging the battery unmanaged.

The third path is powered by Li-polymer battery. The battery power is connected to the charger IC (MediaTek MT6375), and then connected to VSYS through the charger IC. This path supports those applications using Li-polymer batteries. In this configuration, USB Port 0 is used as the power source for charging the battery. The power supplied from USB Port 0 is first processed by the charger IC to regulate the voltage and current before being delivered to the battery.

Table 3-2 Power Paths

<table>
<tr><th colspan="2">Battery Connector</th></tr>
<tr><td colspan="2">  </td></tr>
<tr><th>DC Jack Power Adapter</th><th>USB Type-C PD Adapter</th></tr>
<tr><td> 

 </td><td> 

 </td></tr>
<tr><td>J516 1-3, 2-4 short</td><td>J516 5-7, 6-8 short</td></tr>
</table>

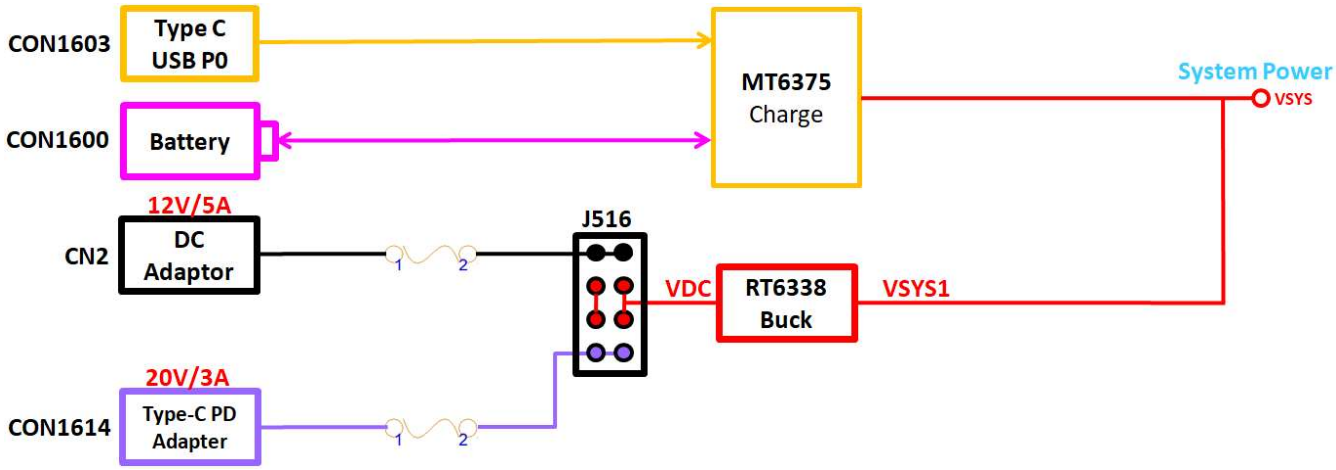


Figure 3-1 System Power Path

3.2.2 Auto Power On

The Genio 720 EVK or Genio 520 EVK supports system power on when the adapter is plugged in. You need to change the J51 jumper to switch the power on mode.

Table 3-3 Auto Power On (J51)

Manual Power On	Auto Power On
	
J51 short 1-2（default）	J51 short 2-3

3.3 I/O Interface

LED Indicators
There are three LED indicators.

Table 3-4 LED Indicators

LED Indicators	Location	Color	Note
DC-IN Power Indicator	D1701	Orange	The LED is on if adaptor is on
Reset Indicator	D1703	Green	The LED is off if the reset signal is low
System Power Indicator	D1702	Orange	The LED is on while VDC to VSYS complete

UART

On the Genio 720 EVK or the Genio 520 EVK, there are two UART interfaces (UART0 and UART1) equipped with USB to UART bridge ICs, and two 4-wire UART interfaces (UART2 and UART3) that are directly connected to the SoC.

- Supports word lengths from 5 to 8 bits with an optional parity bit and 1 or 2 stop bits
- Supports baud rates from 110 bps up to 921600 bps

Table 3-5 UART Ports (CON1605 and CON1606)

UART	Location	Note
UART0	CON1605 (Type-C)	Core Processor Log
UART1	CON1606 (Type-C)	
UART2	J477 (6 pin header)	
UART3	J490 (6 pin header)	

I2C

- Seven I2C buses (I2C0, I2C1, I2C4, I2C5, I2C6, I2C7 and I2C8)
- Supports master mode only
- Adjustable clock speed for LS/FS/FS+ mode operation
- Supports 7-bit address

Table 3-6 I2C Bus

I2C Bus	Purpose	Note
I2C0	Raspberry Pi Like I/O	
I2C1	Raspberry Pi Like I/O	
I2C4	Battery Charger	MT6375
I2C5	USB CC DET	RT1715
I2C6	MIPI LCM Touch Controller USB Type-C SBU MUX USB PD Controller (NM)	GT9271 TS3USBCA410IRSVT TPS25730DREFR (NM)
I2C7	CAM MIPI CSI0	Camera Sensor
I2C8	CAM MIPI CSI1	Camera Sensor

SPI

- Supports master mode

Table 3-7 SPI Bus

SPI Bus	Purpose	Note
SPIM0	CAN Bus	MCP2518FDT-E/SL
SPIM1	Raspberry Pi Like I/O	
SPINOR	SPI NOR Flash	MX25U12832FZNI02

PWM

- PWM supports old mode and FIFO mode
- The frequency can be set up to 13 MHz in the production version image (the maximum PWM frequency supported by the SoC is 39 MHz)

Table 3-8 PWM

PWM	Purpose	Note
PWM1	Raspberry Pi Like I/O	
PWM2	Raspberry Pi Like I/O	

Raspberry Pi Like I/O Interface

Table 3-9 Pin Assignments of the Raspberry Pi Like I/O Pin Header

Pin #	Description	Note	Pin #	Description	Note
1	3.3V		2	5V	
3	SDA1	GPIO54	4	5V	
5	SCL1	GPIO53	6	GND	
7	GPIO-107		8	UATXD2	GPIO35
9	GND		10	UARXD2	GPIO36
11	URTS2	GPIO17	12	PCM_CLK	GPIO115
13	GPIO-108		14	GND	
15	GPIO-109		16	GPIO-110	
17	3V3		18	GPIO-42	
19	SPI1_MO	GPIO75	20	GND	
21	SPI1_MI	GPIO76	22	GPIO-106	
23	SPI1_CLK	GPIO74	24	SPI1_CS	GPIO73
25	GND		26	GPIO-85	
27	SDA0	GPIO52	28	SCL0	GPIO51
29	GPIO-104		30	GND	
31	GPIO-105		32	PWM0	GPIO137
33	PWM1	GPIO138	34	GND	
35	PCM_SYNC	GPIO116	36	UCTS2	GPIO16
37	GPIO-103		38	PCM_DI	GPIO117
39	GND		40	PCM_DO	GPIO118

Note:

1. VRasPi_5V power can provide 5V/2A maximum
2. EXT_3V3 power can deliver 3.3V/300mA
3. Black text indicates a ground pin
4. Red text indicates a power pin
5. Green text indicates a special function pin
6. Blue text indicates a GPIO
7. Pink text indicates a pin, which multiplex with other function. Please check section 3.17 pin mux and Raspberry Pi

3.4 Micro SD Card Connector

Genio 720 EVK or Genio 520 EVK has one MicroSD connector. It uses MT8391 or MT8371 MSDC1 interface and supports following features.

- Default Speed Mode
- High Speed Mode
- SDR12 Mode
- SDR25 Mode
- SDR50 Mode
- SDR104 Mode
- DDR50 Mode
- Support 1bit/4bit SD Bus Width

3.5 Power and Function Key Interface

20V power supplies to the system from a 2.0 mm DC Jack (CN2) or 20V power supplies to the system from a USB Type-C connector (CON1614). Power-on button and Reset button on the evaluation-board to turn on and reboot the system, and Home and Download buttons are also retained.

3.6 USB Device

Genio 720 EVK or Genio 520 EVK has three USB device ports, among which the USB Type-C port 0 can be used for ADB debugging port.

3.7 USB Host

Genio 720 EVK or Genio 520 EVK has three USB Type-C host ports for USB device connections.

Table 3-10 USB Feature in Genio 720 EVK or Genio 520 EVK

USB Port 0 on SoC	SW Support Mode		Function
	Host Mode	Device Mode	
USB3.2 Gen1	Support	Support	USB Type-C
USB2.0	Support	Support	USB Type-C

USB Port 1 on SoC	SW Support Mode		Function
	Host Mode	Device Mode	
USB2.0	Support	Not Support	USB Type-C

USB Port 2 on SoC	SW Support Mode		Function
	Host Mode	Device Mode	
USB2.0	Support	Not Support	5G Module

USB Port 3 on SoC	SW Support Mode		Function
	Host Mode	Device Mode	
USB3.2 Gen1	Support	Not Support	USB Type-C
USB2.0	Support	Not Support	USB Type-C

USB Port 4 on SoC	SW Support Mode		Function
	Host Mode	Device Mode	
USB2.0	Support	Not Support	Wi-Fi Module

3.8 Audio Interface

Genio 720 EVK or Genio 520 EVK provides a 3.5mm earphone jack (with a microphone input) and another 3.5mm audio jack for line out (no audio amplifier is build-in).

3.9 Microphones

Genio 720 EVK or Genio 520 EVK provides two analog microphones (Merry MMA102-006) and two digital microphones (Merry MMD300-007).

Table 3-11 Microphones Location

Location	Type	Note
MIC1	Digital Microphone	To Processor MT8391 or MT8371
MIC2	Analog Microphone	To PMIC MT6365
MIC3	Digital Microphone	To Processor MT8391or MT8371
MIC4	Analog Microphone	To PMIC MT6365

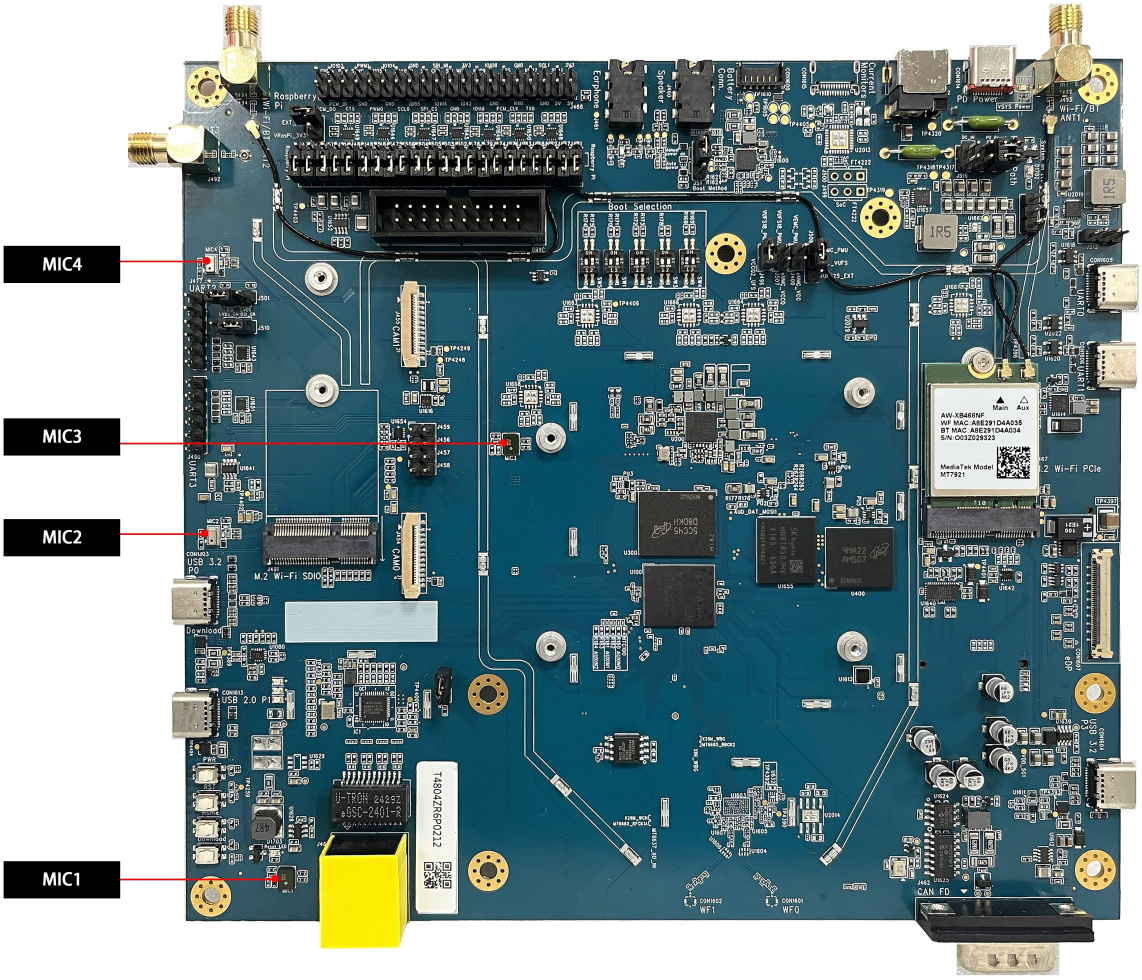


Figure 3-2 Microphone Placement

3.10 MIPI DSI Interface

Genio 720 EVK or Genio 520 EVK provides two 4-lane MIPI DSI interfaces. A Startek LCM (KD070FHFID078-01-C021A) with touch pad is provided in the box. The I2C capacitive touch controller is Goodix GT9271.

- Up to 1.2Gbps for 1-Data Lane
- Pixel format of RGB565/RGB666 or Loosely RGB666/RGB888
- Support peripheral TE and external TE signal detection

3.11 MIPI CSI Interface

Genio 720 EVK or Genio 520 EVK provides three 4-lane CSI interfaces, the CSI interface operates up to a maximum bit rate of 2.5Gbps per lane. Camera boards are connected through PCIe x1 slot.
Default: CAM0 and CAM1 enable.

3.12 Ethernet Interface

- Operate with an external Ethernet PHY (Airoha AN8801RIN/A)
- Dynamically configurable to support 10/100/1000M with RGMII
- CRC-32 checking with optional forwarding of the FCS field to the user application
- Optional magic packet detection
- EEE (Energy Efficient Ethernet) MII signaling according to the IEEE 802.3az specification
- RJ-45 Ethernet connector with transformer and LEDs in it
- Default does not support Wake-on-Lan

Table 3-12 Ethernet LED Indicator

	10M (LED_D7)	100M (LED_D6)	1G (LED_D5)
Non-Link	OFF	OFF	OFF
Link	ON	ON	ON
Active	Flash	Flash	Flash

3.13 DP Port

Genio 720 EVK or Genio 520 EVK provides one DP TX port, supporting DP1.4.

DP TX features

- Support DP1.4/eDP1.3 combo interface, 4-lane up to 5.4Gbps per lane and combo with USB3.2 Gen1
- Support DP TX HBR2 (eDP1.3 PSR is not supported)
- DP 1.4-TX and eDP 1.3-TX cannot operate simultaneously on the same interface
- Support Single Stream Transport (SST)
- Support DSC v1.1/1.2
- Support DP Alt Mode over USB Type-C
- Support HDCP 2.2 and HDCP 2.3
- Support up to 4-lane 3840x2160 60fps or 5120x2160 60fps 8-bit (without DSC), or 2-lane 3840x2160 60fps (with DSC)

3.14 Antenna Connector

Genio 720 EVK or Genio 520 EVK has three Wi-Fi antenna connectors; users can connect them via coaxial cables. These antennas are designed for Wi-Fi module.

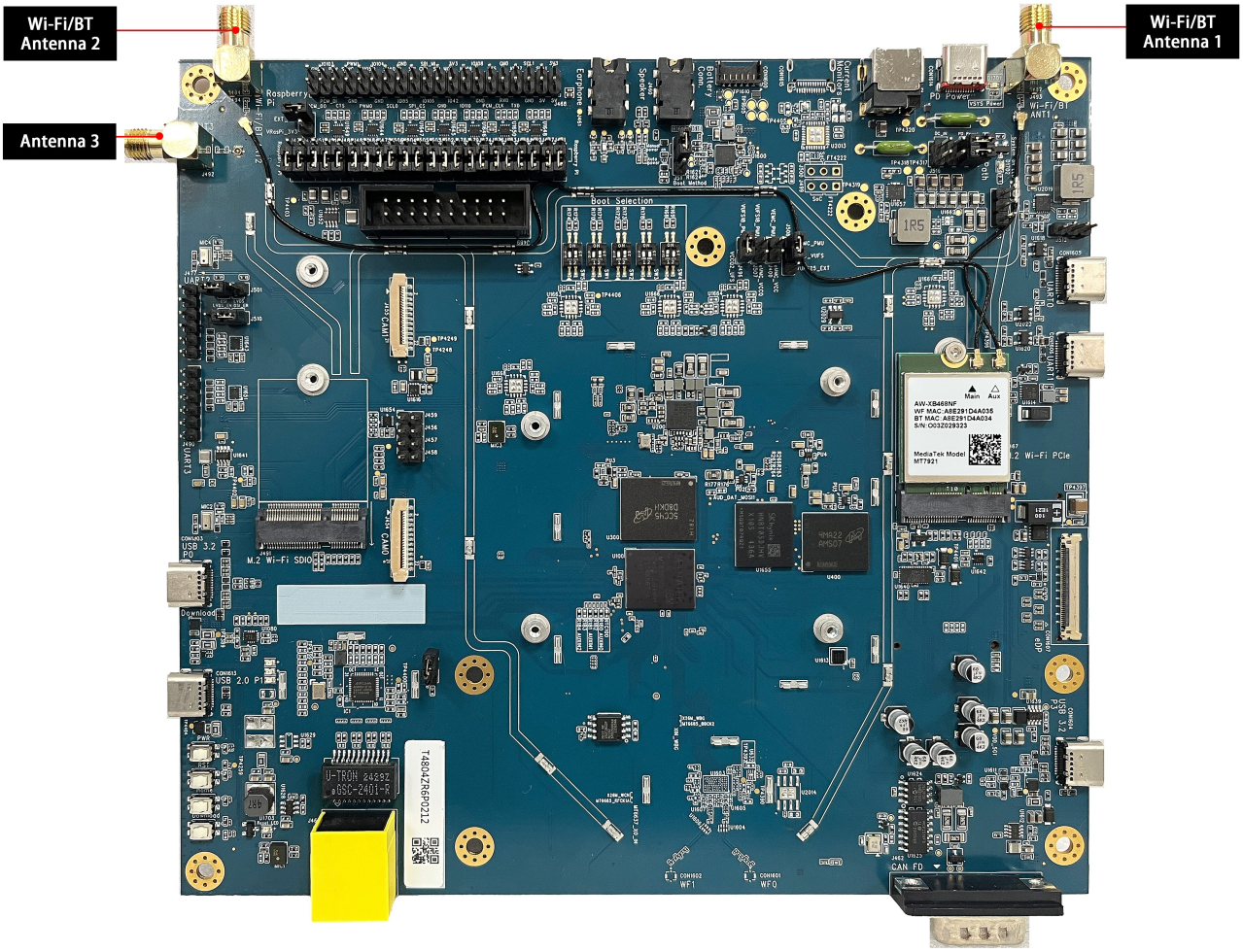


Figure 3-3 Antenna Connectors

Table 3-13 On-Board Antenna

Location	Band	Note
J493	Antenna 1	Wi-Fi/BT
J494	Antenna 2	Wi-Fi/BT
J492	Antenna 3	Spare

3.15 How to Select the Display Panel

The default setting is J501 2-3, J510 1-2 jumper shorted, the EVK supports MIPI LCM panel output, while setting J501 1-2, J510 2-3 jumper shorted, the EVK supports LVDS panel output.
The pre-installed software in the EVK MIPI LCM displays by default. Customers can further request MediaTek to provide eDP patch and/or DP patch by platform for their software development.

Table 3-14 Panel Switch (J501 and J510)

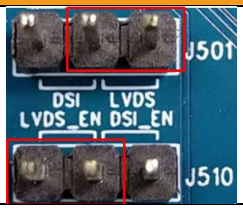
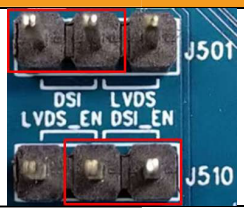
LVDS Panel	MIPI Panel (Default)
	
J501 short 1-2 pin, J510 short 2-3 pin	J501 short 2-3 pin, J510short 1-2 pin

Table 3-15 Pin Mux for LCM Interface

MT8391or MT8371 Pad Name	MIPI DPHY Mode	LVDS Mode
DSI_D0P_T0C	LCM1_D0P_T0C	LCM2_D0P_T0C_CONN
DSI_D0N_T1A	LCM1_D0N_T1A	LCM2_D0N_T1A_CONN
DSI_D1P_T2A	LCM1_D1P_T2A	LCM2_D1P_T2A_CONN
DSI_D1N_T2B	LCM1_D1N_T2B	LCM2_D1N_T2B_CONN
DSI_D2P_T0A	LCM1_D2P_T0A	LCM2_D2P_T0A_CONN
DSI_D2N_T0B	LCM1_D2N_T0B	LCM2_D2N_T0B_CONN
DSI_D3P_T2C	LCM1_D3P_T2C	LCM2_D3P_T2C_CONN
DSI_D3N	LCM1_D3N	LCM2_D3N
DSI_CKP_T1B	LCM1_CKP_T1B	LCM2_CKP_T1B_CONN
DSI_CKN_T1C	LCM1_CKN_T1B	LCM2_CKN_T1C_CONN

3.16 Pin Mux for Other Interface

Jumper default set to not support Raspberry Pi configuration. Use the jumper to switch the GPIO shared by the M.2 slot (for MT7921), eDP, UART, CSI and Raspberry Pi Like I/O.

Table 3-16 Pin Header Mux Configuration System and Raspberry Pi

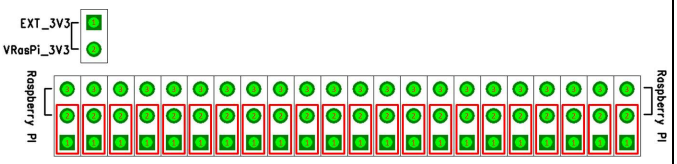
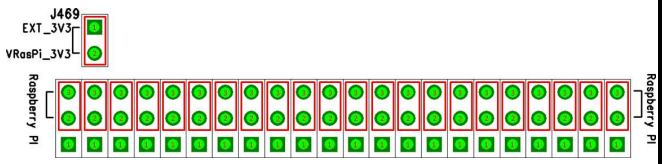
System Jumper Configuration	Raspberry Pi Configuration
	
Short 1-2 pin（ default ）	Raspberry Pi short 2-3 pin, J469 short 1-2 pin

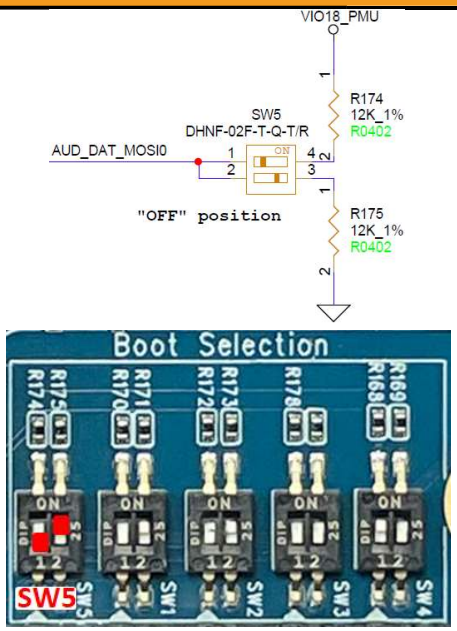
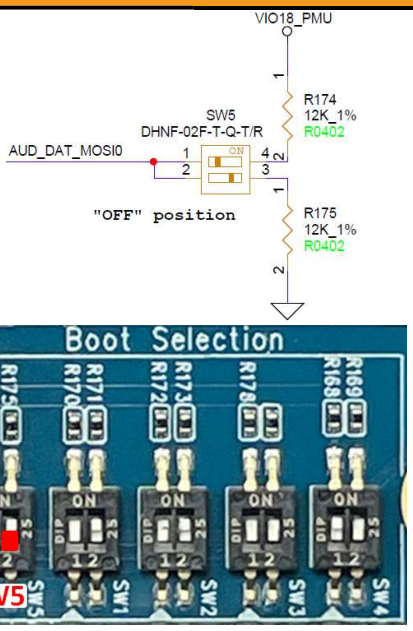
Table 3-17 Pin Mux and Raspberry Pi

MT8391 or MT8371 GPIO	Pin Header	Pin Header Pin 1 (Default Short Pin 2)	Pin Header Pin 2	Pin Header Pin 3 (Default Open) for Raspberry Pi Function
GPIO16	J514	UART2_CTS_H	UART2_CTS	RasPi_UCTS2
GPIO17	J515	UART2_RTS_H	UART2_RTS	RasPi_URTS2
GPIO35	J471	UART2_TX_H	UART2_TXD	RasPi_UTXD2
GPIO36	J470	UART2_RX_H	UART2_RXD	RasPi_URXD2
GPIO42	J484	DBG1_TDO	JTDO	RasPi_GPIO42
GPIO73	J505	CMMPDN1	SPIM1_CSB	RasPi_SPI_CS
GPIO74	J504	CMMPDN0	SPIM1_CLK	RasPi_SPI_CK
GPIO75	J502	WCN_3V3_EN	SPIM1_MOSI	RasPi_SPI_MO
GPIO76	J503	CAN_INT_GPIO	SPIM1_MISO	RasPi_SPI_MI
GPIO85	J474	WIFI_BT_RST_R	BT_RST	RasPi_GPIO85
GPIO103	J478	I2SIN0_MCK_T	I2SIN0_MCK	RasPi_GPIO103
GPIO104	J479	I2SIN0_BCK_T	I2SIN0_BCK	RasPi_GPIO104
GPIO105	J480	I2SIN0_LRCK_T	I2SIN0_LRCK	RasPi_GPIO105
GPIO106	J485	I2SIN0_DI_T	I2SIN0_DI	RasPi_GPIO106
GPIO107	J506	CSR_EN_GPIO107	I2SOUT0_MCK	RasPi_GPIO107
GPIO108	J475	EDP_BL_EN_1V8	I2SOUT0_BCK	RasPi_GPIO108
GPIO109	J476	EDP_3V3_EN	I2SOUT0_LRCK	RasPi_GPIO109
GPIO110	J483	EDP_12V_EN	I2SOUT0_DO	RasPi_GPIO110
GPIO115	J482	MT7921_PCM_CLK	PCM_CLK	RasPi_PCM_CLK
GPIO116	J481	MT7921_PCM_SYNC	PCM_SYNC	RasPi_PCM_SYNC
GPIO117	J487	MT7921_PCM_DI	PCM_DI	RasPi_PCM_DI
GPIO118	J488	MT7921_PCM_DO	PCM_DO	RasPi_PCM_DO

3.17 How to Select the USB Download Port

The default setting is SW5 1: OFF, 2: ON, the EVK supports USB port 0 download. While setting SW5 1: ON, 2: OFF, the EVK supports USB port 1 download.

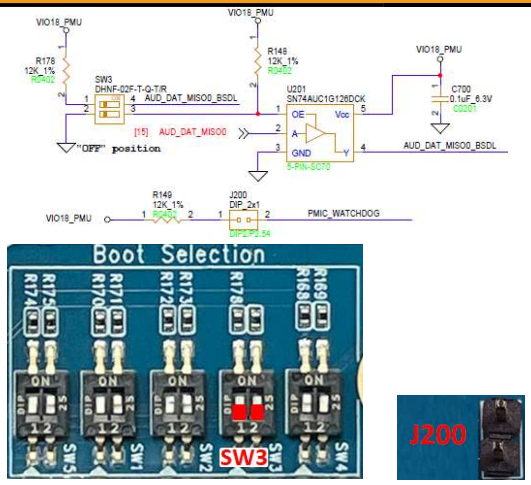
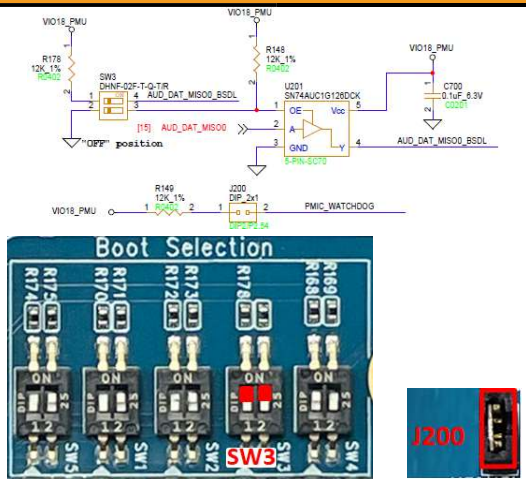
Table 3-18 USB Download Port Selection

USB Port 0	USB Port 1
	
SW5 1: OFF, 2: ON(Default)	SW5 1: ON, 2: OFF

3.18 How to Enable Boundary Scan Testing

The default configuration is SW3: 1 = OFF, 2 = OFF and J200 = OPEN, setting the EVK to normal mode. When SW3: 1 = ON, 2 = ON and J200 = SHORT, the EVK supports boundary scan testing.

Table 3-19 Configuration for Boundary Scan Mode

Normal Mode	Boundary Scan Mode
	
SW3: 1 = OFF, 2 = OFF; J200: OPEN (Default)	SW3: 1 = ON, 2 = ON; J200: SHORT

4 Camera Board

There are two camera boards incorporated with Genio 720 EVK or Genio 520 EVK: D8 and D9 camera boards.
Genio 720 EVK or Genio 520 EVK is built in with two CAM connectors.

Table 4-1 Camera Configuration (CAM Connector)

Camera Configuration	Front Camera	Rear Camera
No. 1	CAM 1	CAM 0

Table 4-2 Camera Board Differences

	D8 Camera Board	D9 Camera Board
Image Sensor	IMX258-0ATH5-C	OV5640
Output Format	RAW	RAW or RGB

Table 4-3 Collocation of Camera Board and CAM Connector

	D8 Camera Board	D9 Camera Board
CAM 0	O	O
CAM 1	O	O

Note: "O" means the camera board can be used in this CAM connector, "X" means it cannot.

4.1 D8 Camera Board

The D8 camera board is integrated with a SONY IMX258 image sensor chip, which is a high-performance camera image processor with rich features.

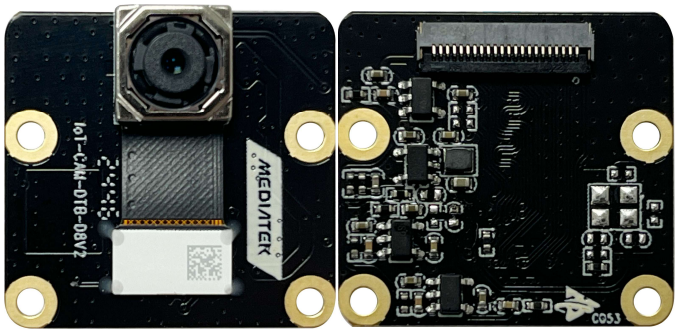


Figure 4-1 D8 Camera Board

4.2 D9 Camera Board

The D9 camera board is integrated with an OmniVision OV5640 image sensor chip, which is a high-performance camera image processor with rich features.

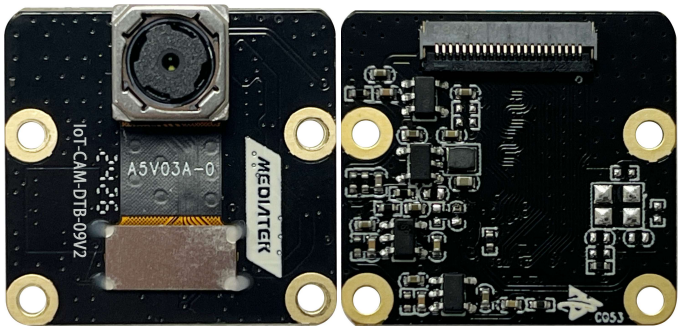


Figure 4-2 D9 Camera Board

4.3 Camera Board Installation

Installation procedure:

- Step 1

Loosen the camera board connector, insert the FPC into the camera board connector, and then lock it.

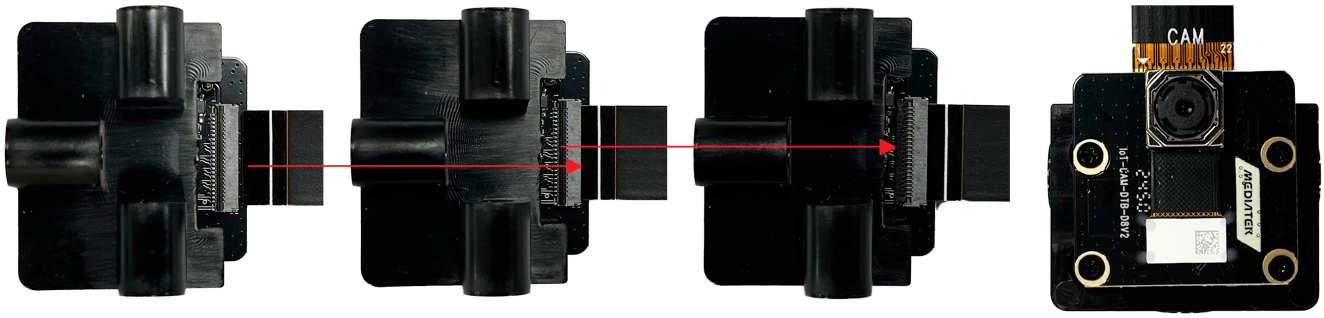


Figure 4-3 Camera Board FPC Installation

- Step 2

Loosen the connector on the Genio 720 EVK or Genio 520 EVK, insert the camera FPC into the connector, and then lock it.

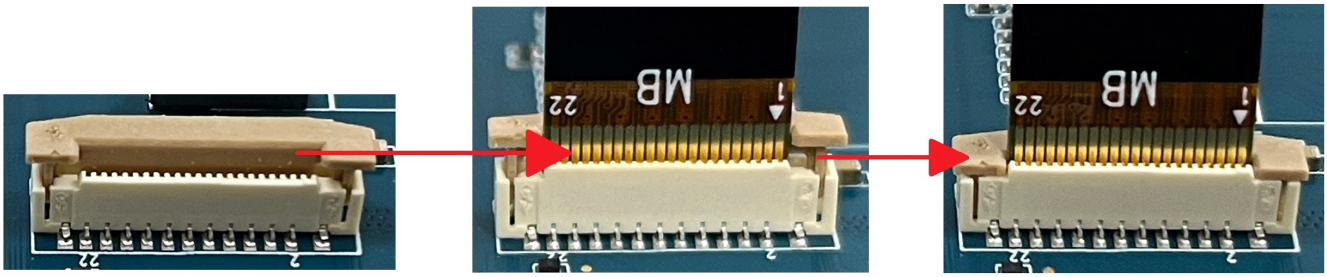


Figure 4-4 Genio 720 EVK or Genio 520 EVK Camera FPC Installation

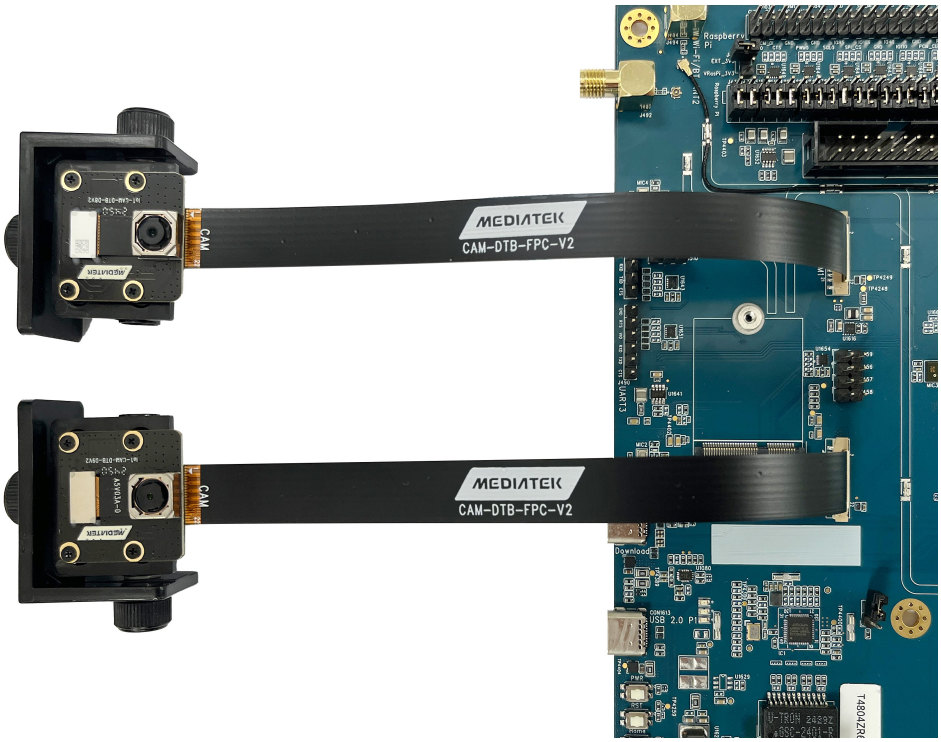


Figure 4-5 Camera Board Installation

5 Power Distribution

5.1 Power Distribution

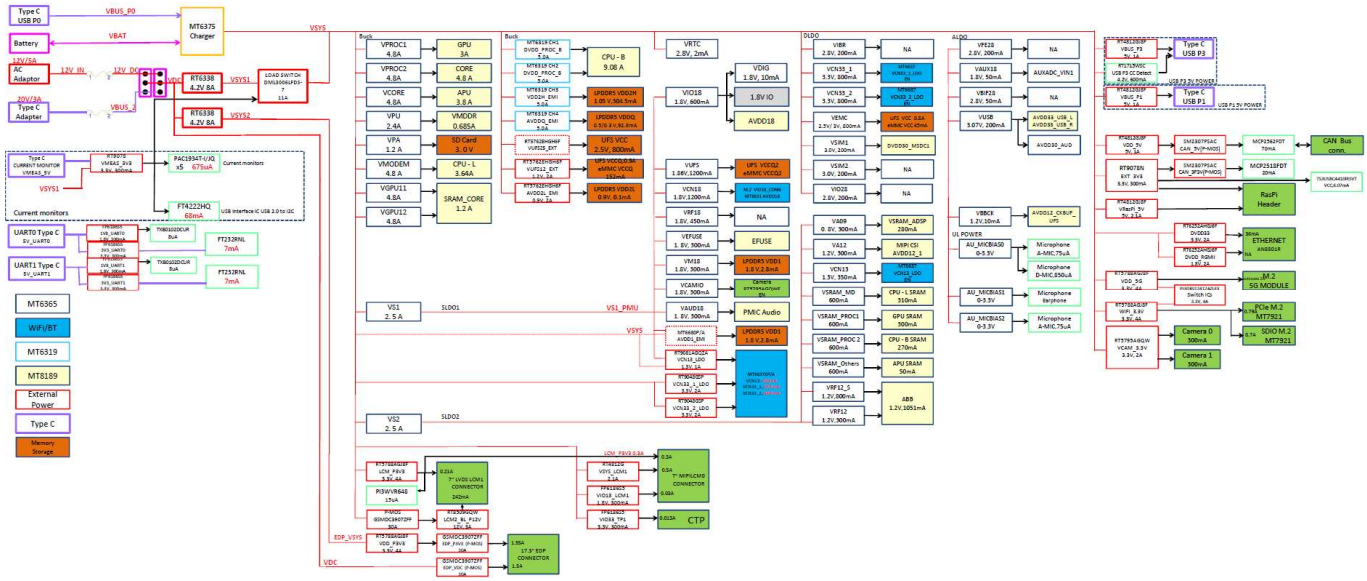


Figure 5-1 Power Distribution

6 Software

- Genio 720 EVK and Genio 520 EVK use the same software, and any differences are automatically recognized by the software without the need for any configuration.
- The pre-installed software for Genio 720/520 EVK is Android. The following sections will guide you through the process of building, obtaining, and flashing images for the Android system.

6.1 Android

6.1.1 Android Software Project and Configuration

Table 6-1 Android Project Name and Configuration

Project Name	Configuration
AIOT8391P2_64_BSP	IoT EVK+UFS+MT7921/MT7663

6.1.2 How to Get Android Software Image

Please contact with your VAR, Distributor, MediaTek FAE.

6.1.3 Setup Tool Environment

Download the latest USB driver (Driver_Auto_Installer) from Mediatek Online.
https://online.mediatek.com/apps/tool?id=83013128040570&action=download
And install Fastboot and ADB Device USB Driver on your Windows environment.

6.1.4 Android Software Image Flash Method

Following steps can format the UFS system code of the Genio 720/520 EVK board and flash the system code to UFS.

1. Power off the EVK, then switch to UFS boot: Run "SP Flash Tool V6", on <Format> tab, press <Start> button to format UFS. Then plug the USB Type-C cable to EVK. It will format UFS partition automatically.
   "SP Flash Tool" can be downloaded from the following link: https://online.mediatek.com/English/Tool

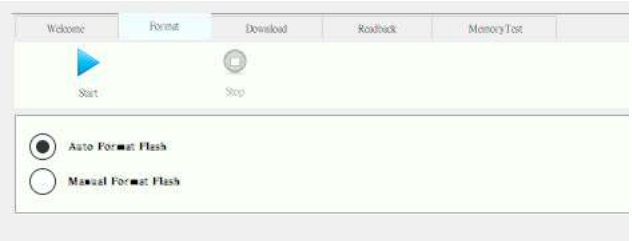


Figure 6-1 Flash Tool Format Screen

2. Power off the EVK and then switch to UFS boot. Run "SP Flash Tool V6", choose <Format All + Download> in combo box on <Download> tab and then press <Download> icon. Power on the EVK for flashing images into UFS storage device.

Figure 6-2 Flash Tool Download Screen

3. After flashing finished, remove the USB Type-C cable and reboot system.

Note: Choose “Format All + Download”, if Ethernet MAC address were set previously, after this action Ethernet MAC address will be format. If you need to write the MAC address back, please refer to "AP_META_Tool_User_Manual_V1.0.docx" and use the AP Meta tool to set the Ethernet MAC address.

Following steps can reflash the system codes of Genio720/520 EVK board.

1. Connect ADB port (USB port0) to PC via USB Type-C connector.
2. Execute MediaTek flash tool.
3. Select the proper “Download-XML” file. Choose the “flash.xml” file located in the “download_agent” directory.
4. Select the download mode (“Firmware Upgrade” is preferred).
5. Start download by pressing the button of “Download”.
6. Plug in the DC power cord, the downloader will start.

Note: If the flash tool does not start, please press the physical download and reset buttons simultaneously on the EVK and then re-plug the DC power cord. Once the progress bar starts to run shown in the flash tool, please release the reset button and then the download button on the EVK in sequence.

Figure 6-3 Flash Tool Window

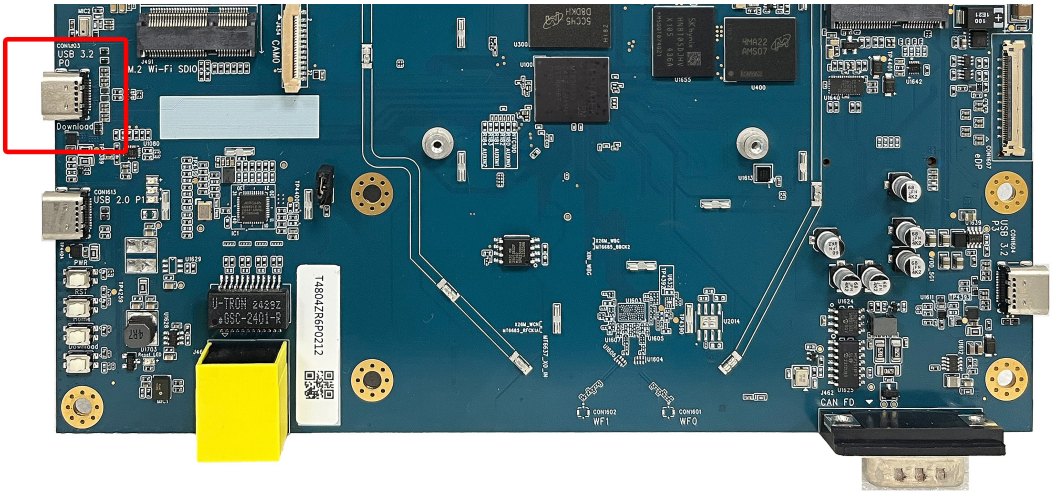


Figure 6-4 Download Port

6.1.5 Wi-Fi Chip Configuration

The aiot8391p2_64_bsp integrates three Wi-Fi chips into a single image: the MT7921 with a PCIe interface, the MT7921 with an SDIO interface, and the MT7663 with an SDIO interface. The configuration of these chips is specified through the board id (auxin4 and auxin5), which determines the loading of different Device Tree Blob Overlays (DTBOs). By adjusting the board id on the board side, you can select which Wi-Fi chip to use without needing to flash new images. The following sections will explain how to make the adjustments:

For the MT7921 with a PCIe interface (Default settings):

1. Disconnect USB cable and power supply.
2. Set the board id by adjusting auxin4 to 1 and auxin5 to 1.
3. Connect the MT7921 module and antenna.
4. Power on the system.

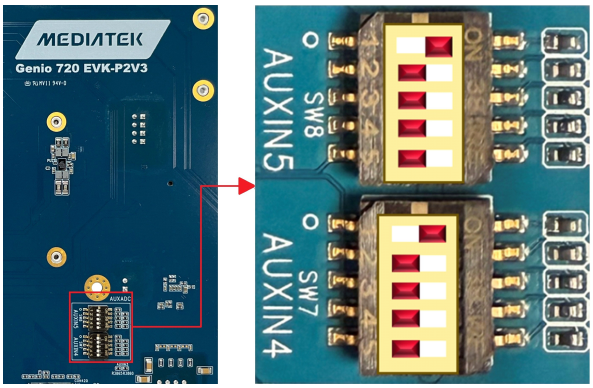


Figure 6-5 Board ID Configuration for MT7921 with PCIe Interface

For the MT7663 with a SDIO interface:

1. Disconnect USB cable and power supply.
2. Set the board id by adjusting auxin4 to 3 and auxin5 to 1.
3. Connect the MT7663 module and antenna.
4. Power on the system.

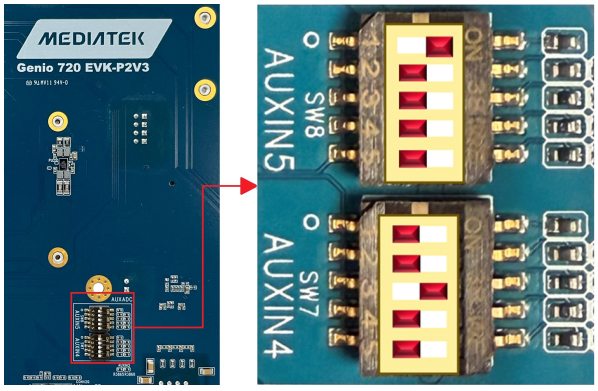


Figure 6-6 Board ID Configuration for MT7663 with SDIO Interface

For the MT7921 with a SDIO interface:

1. Disconnect USB cable and power supply.
2. Set the board id by adjusting auxin4 to 3 and auxin5 to 2.
3. Connect the MT7921 module and antenna.
4. Power on the system.

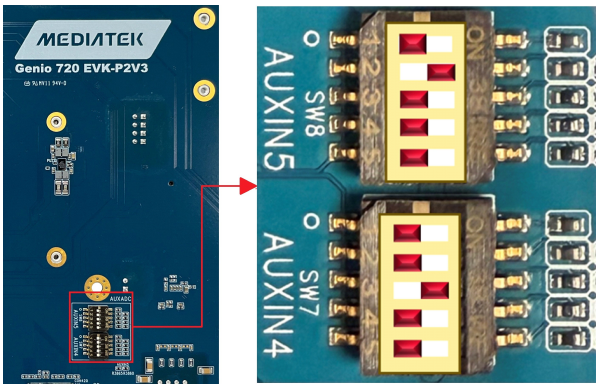


Figure 6-7 Board ID Configuration for MT7921 with SDIO Interface

7 Errata

7.1 Design for supplying system power (VSYS)

- Description

  On the EVK, the outputs of the charger IC MT6375 (U1600) and the buck converter RT6338 (U1657) are connected together on the VSYS power path.

- Affect

  When both the adapter and the battery are supplying power to the EVK at the same time, the output voltage of the RT6338 (U1657) will affect the accuracy of the MT6375 (U1600) in measuring the battery voltage. If only the battery is used to power the EVK, and the input voltage of the RT6338 is 0 volt while the output voltage equals VSYS, the internal LDO of the RT6338 will be activated, turning on the discharge resistor and causing a leakage current through a 100-ohm resistor to ground. Alternatively, this may cause the internal switch of the RT6338 to repeatedly turn on and off.

- Workaround

  If your project requires using a battery to power the system, please remove R1206 and R2046 from the VSYS power path in the EVK. Conversely, if your project does not require a charger IC MT6375, please remove R3810 and R3811 from the VSYS power path. There must not be two sets of power sources on the same power path at the same time.

- Original Schematic

  Users can separate the two power sources by removing either “R3810 and R3811” or “R1206 and R2046”.

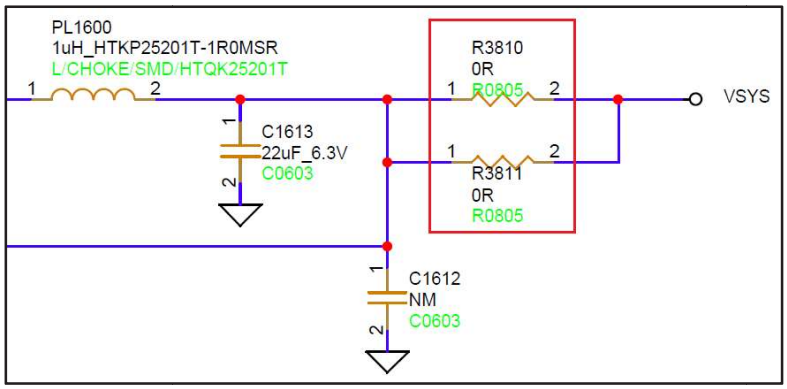


Figure 7-1 Resistors R3810 and R3811 on the MT6375 power output path

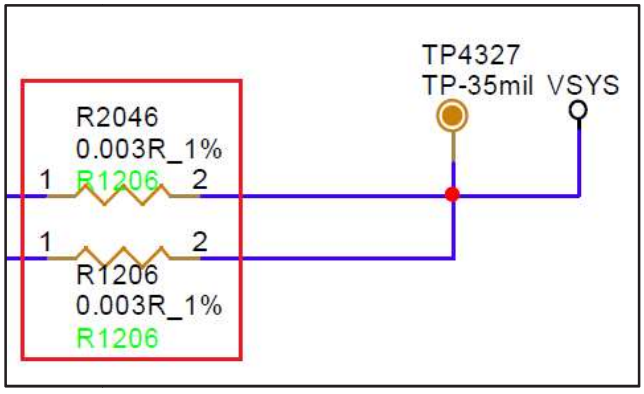


Figure 7-2 Resistors R1206 and R2046 on the RT6338 power output path

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