Genio 700 Evaluation Kit Hardware User Guide

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Version History

Version	Date	Author	Description
0.1	2023-03-08	MTK	Draft Release

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1 Overview

1.1 General Information

Genio 700 EVK board is an evaluation kit of MediaTek MT8390 platform, integrated with WiFi/Bluetooth (M.2 Module) and 5G/GPS (M.2 Module), which is a high performance IoT platform with rich features.

1.2 Architecture and Block Diagram
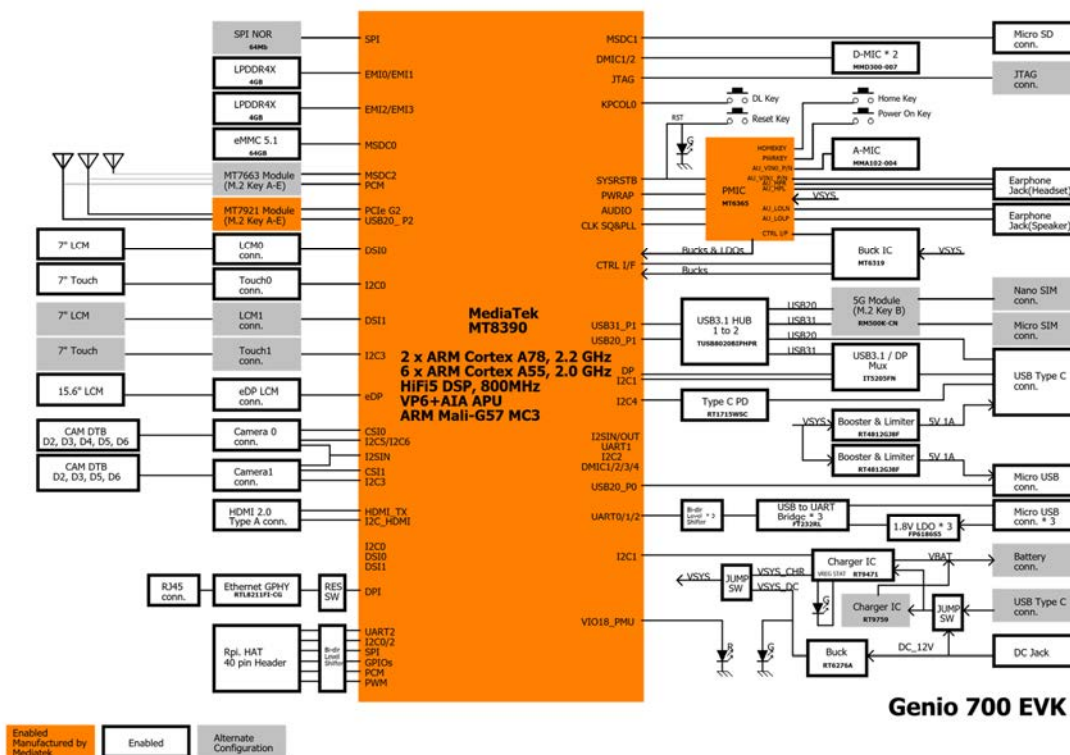
Figure 1-1. Genio 700 Evaluation Kit System Block Diagram

1.3   Feature Summary

- MediaTek CPU (MT8390)
- MediaTek PMIC (MT6365)
- 4GB + 4GB LPDDR4X RAM (Micron MT53E1G32D2FW-046 IT: B)
- 64GB eMMC5.1 x 1 (WD SDINBDG4-64G-XI2)
- 2.0mm DC Jack x 1 (for 12V DC Input)
- Micro SD Card Slot x 1
- Push Button x 4 (Power, Reset, Download and Home Key)
- LED x 4 (Power, Reset, System on and Charging Status)
- 4-Lane DSI x 2
- eDP x 1
- HDMI2.0 x 1
- 10/100/1000M Ethernet x 1 (Shared with DPI Signal)
- USB Device Port x 1 (Micro USB Connector)
- USB Host Port x 1 (Type-C USB Connector)
- 3.5mm Earphone Jack x 1 (with Microphone Input)
- 3.5mm Line Out Audio Jack x 1
- Analog Microphone x 1
- Digital Microphone x 2
- UART Port x 3 for Trace Log with USB to UART Bridge IC (Micro USB Connector x 3)
- I2C Capacitive Touch Pad
- 4-Data Lane CSI x 2
- M.2 Slot x 2 (for AzureWave AW-XB468NF WiFi Module、 AW-CB451NF WiFi Module)
- 40-Pin 2.54mm Pin Header x 1 (for Raspberry Pi like I/O Interface)

2   Introduction

Genio 700 EVK board integrates MediaTek MT8390 processor, 64bit LPDDR4X memory, eMMC, Power Management IC (MT6365) , WiFi/BT M.2 Module and 5G M.2 Module.

The package contains a Genio 700 EVK Main board, 7" LCD panel, and a stand set for 7" LCD panel.

Figure 2-1. Genio 700 EVK Board System Setup
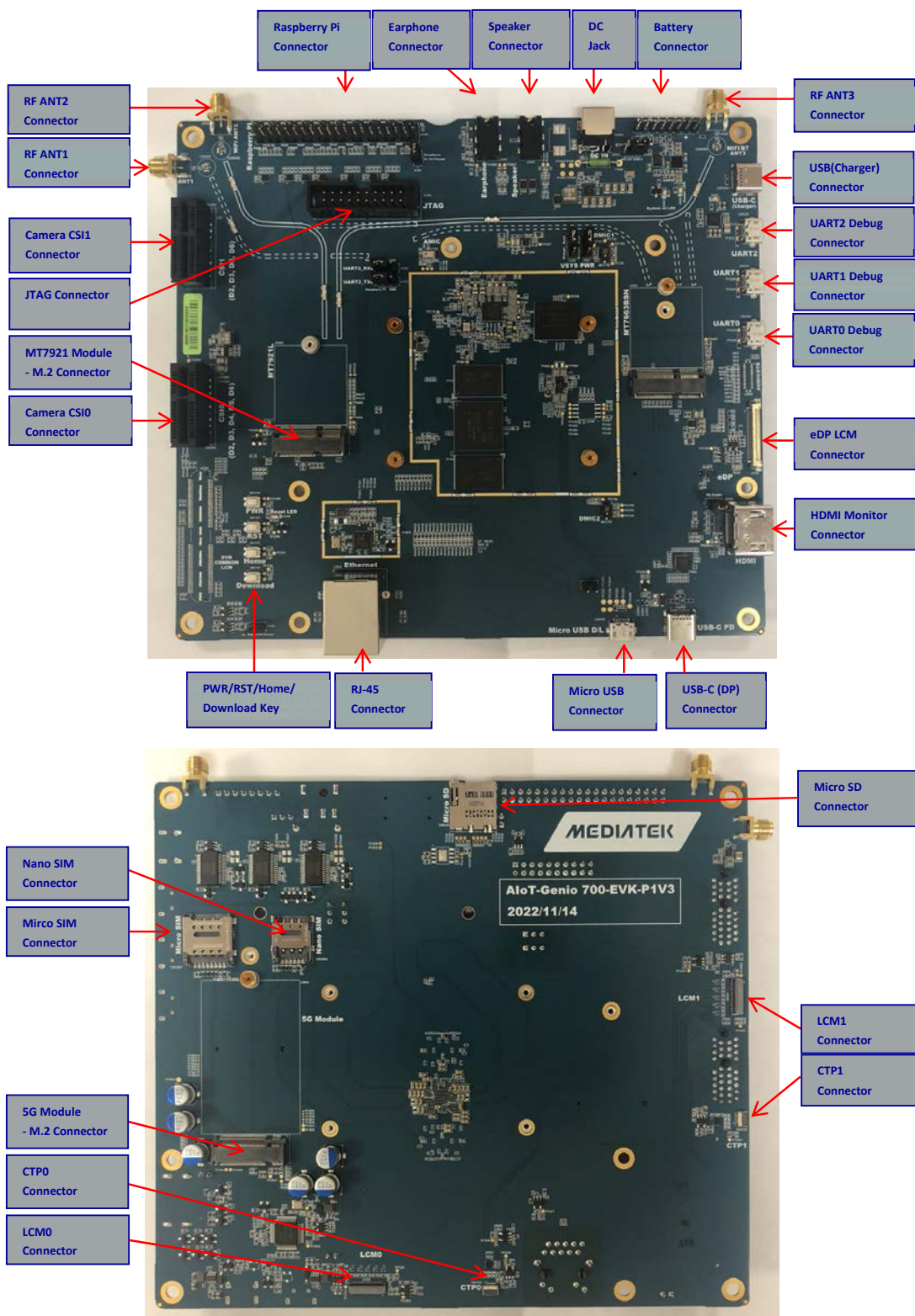
Figure 2-2. Genio 700 EVK Board I/O Overview

S.No	Part Number or Marking	Item Name	Description	Quantity
1	IoT-Genio 700 EVK-P1V3	Genio 700 Main Board		1
2	Camera Board (Genio 700- CAM DTB-D1V1-D2)	Camera Board (D2 Version)	Camera sub-board using onsemi AP1302 Image Sensor Processor	1
3	IMX214 Camera Module	Camera Module for D2	Camera Module using SONY IMX214 CMOS Digital Image Sensor, preconnected to AP1302 ISP Camera Board	1
4	With Touch Panel and FFC cable	7" LCD Panel	LCM Module	1
5	M.2 WIFI6 Module AW-XB468NF (IC: MT7921L)	WIFI Module		1
6		WIFI Antenna		2
7		WIFI Antenna Cable		2
8		12V AC adaptor		1
9		AC Power cord		1

Table 2-1. Contains in The Box

Function	Mfr.	PN
Baseband Processor	MediaTek	MT8390AV/AZA
PMIC	MediaTek	MT6365IBW/B
Buck IC	MediaTek	MT6319LP/A
Charger (Master)	Richtek	RT9471DGQW
Charger (Slave)	Richtek	RT9759WSC
Buck for SYS	Richtek	RT6276AHGQUF
Memory	Micron	MT53E1G32D2FW-046 IT: B
eMMC	WD(SANDISK)	SDINBDG4-64G-XI2
Connectivity	AzureWare	AW-XB468NF (MT7921L Module)
LCM	SHENZHEN STARTEK	KD070FHFID015-C021A V1.3 (7" LCD Panel)
Camera Module	御光視覺	WDN01A-100 with IMX214 image sensor
USB3.0 HUB IC	Texas Instruments	TUSB8020BIPHPR
Type C USB Mux IC	ITE	IT5205FN/BX
Ethernet PHY	Realtek	RTL8211FI-CG

Table 2-2. Key Component List

2.1　　CPU (MT8390)

MediaTek MT8390 processor integrates dual-core ARM® Cortex-A78, 2.2GHz processor and six-core ARM® Cortex-A55 2.0GHz MPCore processor equipped with the NEON engine offers processing power necessary to support the latest OpenOs along with its demanding applications such as web browsing, email, GPS navigation, and games.

The features of the MT8390 processor include the following:

- Octa -Core
- 2 x ARM® Cortex-A78 Operating at 2.2GHz with each core 64KB L1 I-Cache, 64KB L1 D-Cache and 256KB L2 Cache
- 6 x ARM® Cortex-A55 Operating at 2.0GHz with each core 32KB L1 I-Cache, 32KB L1 D-Cache and 128KB Cache.
- Shared 2MB L3 Cache
- NEON Processing Engine
- ARM TrustZone Security
- DVFS Technology with Adaptive Operating Voltage from 0.55V to 0.973V
- Tensilica VP6 processor with AI Accelerator (AIA or MDLA– MediaTek Deep Learning Accelerator)
- VFGBA-1204 Package

2.2　　Power Management IC (MT6365)

MediaTek MT6365 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.

MT6365 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 MT8390.

For system management, it provides the following features,

- 9 Buck Converters
- 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

2.3　　DRAM (Micron MT53E1G32D2FW-046 IT: B)

Genio 700 EVK is embedded a 4GB+4GB LPDDR4X memory with the following features,

- Dual Channels with 16-bit Data Bus Width
- Supports self-refresh/ partial self-refresh mode.
- Supports dual-rank memory device.

2.4　　　eMMC Storage (WD SDINBDG4-64G-XI2)

A 64GB eMMC 5.1 WD SDINBDG4-64G-XI2 is used for code and data storage, via MSDC0 interface of the baseband processor MT8390 with 8-bit width data bus.

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

MediaTek MT7921L is in AzureWave AW-XB468NF M.2 Module. It supports following features.

- M.2 2230 WiFi Module with Key A-E
- MediaTek MT7921L WiFi Chip
- PCIe/USB Interface
- WiFi 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

2.6　　　M.2 5G Module (Quectel_RM500K-CN)

MediaTek T700 is in Quectel RM500K-CN M.2 Module. It supports following features.

- M.2 Key-B WWAN
- USB 3.0/USB2.0
- Dual SIM Single Standby (Micro SIM x 1 + nano SIM x 1)
- 5G NR SA support n1/n28/n41/n78/n79
- 5G NR NSA support n41/n78/n79
- LTE-FDD support B1/B3/B5/B8/B28
- LTE-TDD support B34/B39/B40/B41
- WCDMA support B1/B8
- GNSS support GPS/GLONASS/BeiDou(COMPASS)/Galileo/QZSS

3 Interfaces and Connectors

3.1 Genio 700 EVK Board I/O Connectors

Interface	Location	Note
DC Jack	CN1000	12V DC Input
System Power Indicator	D1002	Green LED
Reset Indicator	D3200	Green LED
System On Indicator	D1003	Red LED
Charging Status Indicator	D1001	Green LED
Power On Button	SW3200	
Download Button	SW3201	
Home Key Button	SW3202	
Reset Button	SW3203	
USB Device	CON480	USB2.0 Port
USB3.1/DP MUX	CON490	USB3.1 Port/DP Display Port(MUX)
UART0	CN3200	Debug Port
UART1	CN3201	Debug Port
UART2	CN3202	Debug Port
Micro SD Card Slot	CON420	
DSI	J2300	7" LCM0
DSI	J2400	7" LCM1
Touch	CN2300	7" Touch0
Touch	CN2400	7" Touch1
eDP	J3700	15.6" LCM
CSI0	CN2900	Camera 0 Interface
CSI1	CN2901	Camera 1 Interface
HDMI	J2500	HDMI Type-A Connector
Ethernet	J3900	10/100/1000M Ethernet Transceiver
M.2 Slot Key E	J4000	AW-XB468NF(MT7921L) WiFi Module
M.2 Slot Key B	J3800	RM500K-CN 5G Module
Raspberry Pi like I/O	J4200	
JTAG	J3200	
Earphone Jack	J2601	
Line Out	J2600	
Battery Connector	J1002	
Analog Microphone	MIC2702	
Digital Microphone 0	MIC2700	
Digital Microphone 1	MIC2701	

Table 3-1. Main Board Connectors

3.2   System Power Paths

There are two power supply paths for the system. One is through a buck converter (Richtek RT6276A), which convert 12V (DC Jack) to 4.2V (VSYS). This path supports those applications without Li-Polymer batteries.
The other is through a battery charger IC (Richtek RT9471D). This path supports those applications with Li-Polymer batteries.
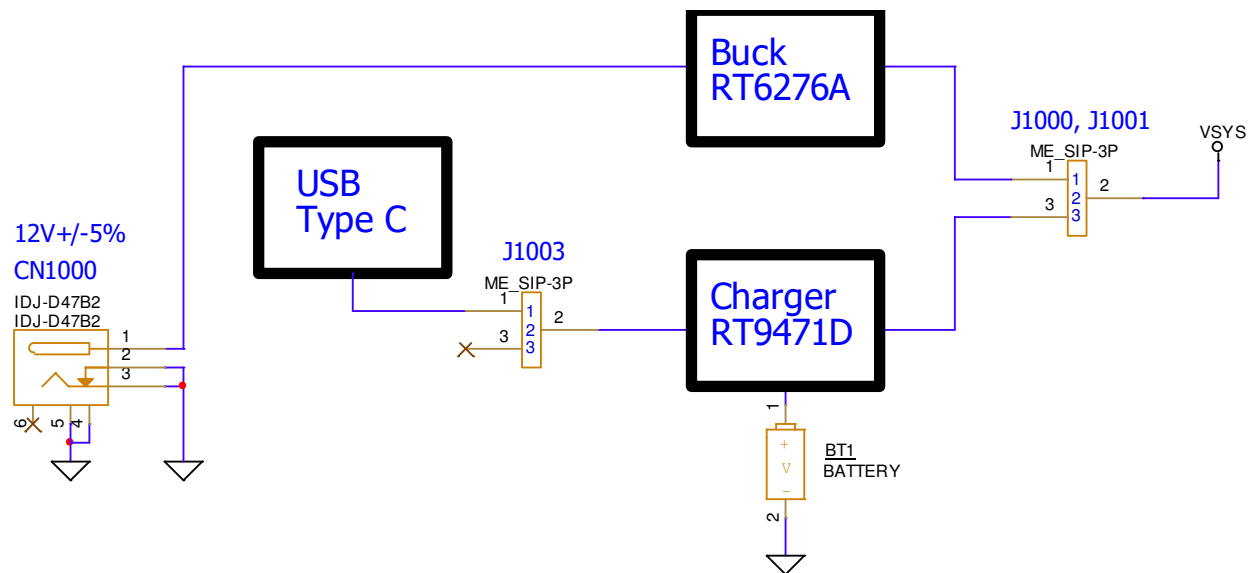
Figure 3-1. System Power Path

3.2.1   Charger Power Source

The user can choose USB type C or DC12V to power the charger ICs by J1003. Usually, any one of them can meet the requirement for most cases.

Current Rating	Charger Power Source
3 Ampere	

Figure 3-2. Jumper Selection for Charger Power Source Input Path

3.2.2　System Power

There are two power paths can be selected by J1000 and J1001 (at the same time) for system power VSYS.

Current Rating	System Power
6 Ampere	
6 Ampere	

Figure 3-3. Jumper Selection for System Power

3.2.3　5G Module Power

Before using the 5G Module, the J3801 need to plug a Jumper to get power.
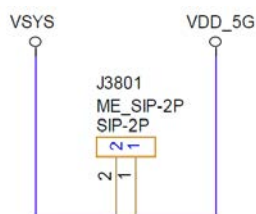
Current Rating	5G Module Power
3 Ampere	

Figure 3-4. Jumper Selection for 5G Module Power Input

3.2.4   Raspberry Pi Power 3V3

Before using the Raspberry Pi like connector, the J4201 need to plug a Jumper to get power.

Current Rating	Raspberry Pi Power 3V3
0.3 Ampere	

Figure 3-5. Jumper Selection for Raspberry Pi Power 3V3 Input

3.2.5   Auto Power On by plugin of AC Adaptor

Before using Auto Power On function by plugin of AC adaptor, the J3001 need to plug a Jumper.

Current Rating	Auto Power On by plugin of AC Adaptor
0.1 Ampere	

Figure 3-6. Jumper Selection for Auto Power on by plugin of Adapter

3.3   I/O Interface

LED Indicators

There are four LED indicators.

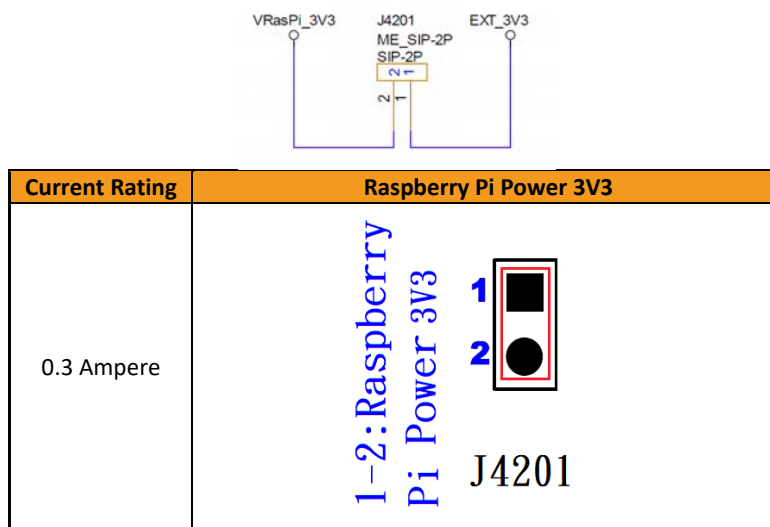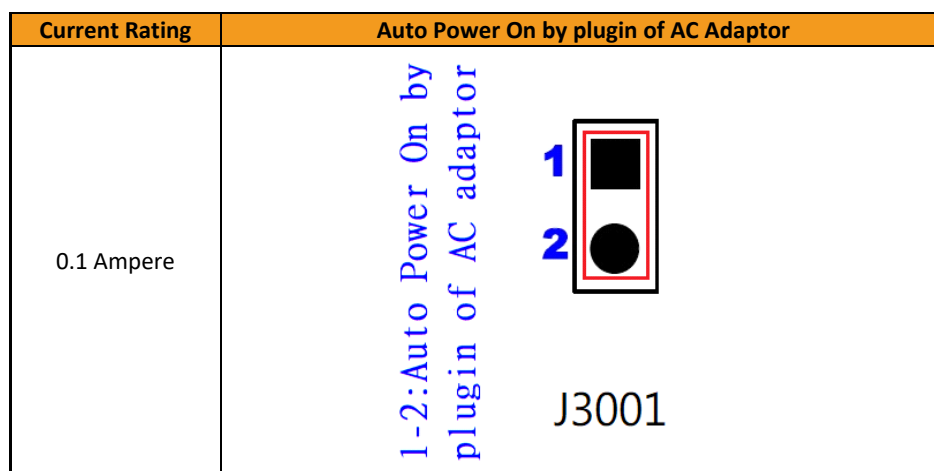| LED Indicators	Location	Color	Note
System Power Indicator	D1002	Green	LED is on when system power in.
Reset Indicator	D3200	Green	LED is on when reset key is pressed.
System On Indicator	D1003	Green	LED is on when system is on.
Charging Status Indicator	D1001	Red	LED is on while charging.

Table 3-2. LED Indicators

UART

There are three UART (UART0 、UART1 and UART2) consoles with USB to UART Bridge ICs (FT232RL) on Genio 700 EVK

board. Users can use these consoles for debug purpose. The connectors are Micro USB type.

• 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 961,200 bps.
• FTDI USB to UART Bridge FT232RL

UARR Port	I/O Connector	Purpose
UART0	CN3200 (Micro USB)	Debug
UART1	CN3201 (Micro USB)	Debug
UART2	CN3202 (Micro USB)	Debug

Table 3-3. UART Ports

Configure UART2 Port

Two Jumper (J4202 and J4203) to select UART2 connect to Micro USB2(CN3202) or Raspberry Pi Conn. (J4200).

Schematic	Description
	(1) Jumper @ 1-2, UART2 = USB
	(2) Jumper @ 2-3, UART2 = Raspberry Pi

Figure 3-7. Configure UART2 Ports

I2C

• Seven I2C buses (I2C0 to I2C6)
• Supports Master Mode Only
• Adjustable clock speed for LS/FS/FS+ mode operation
• Supports 7-bit address.

I2C Bus	Purpose	Note
I2C0	Capacitive Touch Controller	Goodix GS9271
	Raspberry Pi I/O	
I2C1	Battery Charger	RT9471D
	Battery Charger	RT9759
	Buck Convertor	MA5721
	USB Type C MUX	IT5205FN/BX
I2C2	Audio DTB Connector	
	Raspberry Pi I/O	
I2C3	Capacitive Touch Controller	Goodix GS9271
	Camera Module CSI1	
I2C4	USB PD Controller	RT1715
I2C5	Camera Module CSI0	
I2C6	Camera Module CSI0	

Table 3-4. I2C Bus

SPI
- Support Master/Slave mode
- One chip select output.

PWM
- PWM supports old mode and FIFO mode.
- The frequency can be set from 0Hz to 39MHz.

Raspberry Pi like I/O Interface
The pin definitions are as followings:

Pin #	Description	Note	Pin #	Description	Note
1	**3.3V**		2	**5V**	
3	SDA2	GPIO60	4	**5V**	
5	SCL2	GPIO59	6	**GND**	
7	IO39		8	TXD2	GPIO35
9	**GND**		10	RXD2	GPIO36
11	IO0		12	PCM_CLK	GPIO121
13	IO37		14	**GND**	
15	IO41		16	IO111	
17	**3V3**		18	IO40	
19	SPI_MO	GPIO81	20	**GND**	
21	SPI_MI	GPIO82	22	IO38	
23	SPI_CLK	GPIO80	24	SPI_CS	GPIO79
25	**GND**		26	IO90	
27	SDA0	GPIO56	28	SCL0	GPIO55
29	IO1		30	**GND**	
31	IO26		32	PWM0	GPIO29
33	PWM1	GPIO30	34	**GND**	
35	PCM_SYNC	GPIO122	36	IO76	
37	IO28		38	PCM_DI	GPIO124
39	GND		40	PCM_DO	GPIO123

Table 3-5. Pin Assignments of the Raspberry Pi like I/O Connector

Note:

1. VDD_5V power can provide 5V/2A maximum but share with Camera 、HDMI 5V output.

2. EXT_3V3 power can deliver 3.3V/300mA but share with Audio DTB 、DP MUX and HDMI CEC.

3. **Black** words are ground pins.

4. **Red** words are power pins**.**

5. **Green** words are special function pins**.**

6. **Blue** words are GPIOs.

7. **Pink** words are pins, which multiplex with other function.

3.4   MicroSD Slot

Genio 700 EVK board has one MicroSD slot. It uses MT8390 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

12V power supplies to the system from a 2.0mm DC Jack. Power-on button and Reset button on the evaluation-board to turn on and reboot the system. Home and Download buttons make the operation easier.

3.6   USB Device

Genio 700 EVK board has one USB Device port (CON480), which can be used for download and ADB debug, with Micro USB connector.

3.7   USB Host

Genio 700 EVK board has one USB Host port (CON490) for USB device connection, with Type-C USB connector.

3.8   Audio Interface (Earphone and Line Out)

Genio 700 EVK board provides a 3.5mm earphone jack (with a microphone input) and another 3.5mm audio jack for Line Out (no audio amplifier is built-in).

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3.9　　　　Microphones

Genio 700 EVK board was designed with one analog microphone (Merry MMA102-004) and two digital microphones (Merry MMD300-007).

Location	Type	Note
MIC2700	Digital Microphone 1	To Processor MT8390
MIC2701	Digital Microphone 2	To Processor MT8390
MIC2702	Analog Microphone	To PMIC MT6365

Table 3-6. Microphone Input

3.10　　　　MIPI DSI Interface

Genio 700 EVK board provides one 4-lane MIPI DSI interface. A StarTek LCM (KD070FHFID015-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

• 　　Support D-PHY version 1.1

3.11　　　　MIPI CSI Interface

Genio 700 EVK board provides two 4-lane CSI interfaces, the CSI interface operates up to a maximum bit rate of 1.5Gbps per lane. Camera sub-boards are connected through Molex 877159006 connector.

3.12　　　　Ethernet RGMII Interfaces

Ethernet RGMII interface shares some pins with DPI interface. Some configurations should be done before booting up.

• 　　Operate with an external Ethernet PHY (Realtek RTL8211FI-CG)

• 　　Dynamically configurable to support 10/100/1000M with RGMII.

• 　　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.

3.13　　　　How to Switch between DPI and Ethernet Interfaces

DPI and Ethernet RGMII Interfaces share some GPIO pins. These two functions cannot exist simultaneously. Reflash code and reboot system might be necessary when you switch between the interfaces. The zero resistors are used to switch these two interfaces.

MT8390 GPIO Table	Ethernet RGMII Net Name	0R Resistor	NM Resistor	DPI	NM Resistor	0R Resistor
GPIO147	GBE_COL	R4401	R4404	DPI_HSYNC_DTB	R4401	R4404
GPIO148	GBE_INTR	R4407	R4410	DPI_VSYNC_DTB	R4407	R4410
GPIO131	GBE_TXD3	R4417	R4418	DPI_D0_DTB	R4417	R4418
GPIO132	GBE_TXD2	R4421	R4423	DPI_D1_DTB	R4421	R4423
GPIO133	GBE_TXD1	R4427	R4428	DPI_D2_DTB	R4427	R4428
GPIO134	GBE_TXD0	R4431	R4432	DPI_D3_DTB	R4431	R4432
GPIO135	GBE_RXD3	R4435	R4436	DPI_D4_DTB	R4435	R4436
GPIO136	GBE_RXD2	R4402	R4405	DPI_D5_DTB	R4402	R4405
GPIO137	GBE_RXD1	R4408	R4411	DPI_D6_DTB	R4408	R4411
GPIO138	GBE_RXD0	R4413	R4415	DPI_D7_DTB	R4413	R4415
GPIO139	GBE_TXC	R4419	R4420	DPI_D8_DTB	R4419	R4420
GPIO140	GBE_RXC	R4425	R4426	DPI_D9_DTB	R4425	R4426
GPIO141	GBE_RXDV	R4429	R4430	DPI_D10_DTB	R4429	R4430
GPIO142	GBE_TXEN	R4433	R4434	DPI_D11_DTB	R4433	R4434
GPIO143	GBE_MDC	R4403	R4406	DPI_D12_DTB	R4403	R4406
GPIO144	GBE_MDIO	R4409	R4412	DPI_D13_DTB	R4409	R4412
GPIO145	GBE_TXER	R4414	R4416	DPI_D14_DTB	R4414	R4416
GPIO146	GBE_RXER	R4422	R4424	DPI_D15_DTB	R4422	R4424

Table 3-7. Pin Mux for DPI and Ethernet RGMII Interface

3.14   HDMI Port

Genio 700 EVK board provides an HDMI port, users can connect external displays. The HDMI encoder of the processors MT8390 generate HDMITX format data base on HDMI Specification 2.0b. which support max. frequency up to 594Mhz (4096x2160p@60Hz 8-bit mode)
The HDMI port also supports HPD, EDID, HDCP2.3 and 3D HDMI function.

3.15   Antenna

Genio 700 EVK board has three SMA connector. Users can connect them via SMA antenna. At First, three IPEX RF cables must be connected to WiFi module and IPEX Connector (CON4000, CON4001 and CON4002). These antennas are designed for AzueWave M.2 (MT7921L) WiFi module.

Location	Band	Note
J4002	2.4GHz / 5GHz	WiFi / BT
J4003	2.4GHz / 5GHz	WiFi / BT
J4004	2.4GHz / 5GHz	WiFi / BT

Table 3-8. SMA Antennas

3.16   How to Power Up the Genio 700 EVK

Power on Genio 700 EVK board by following steps.
1. **You must install the Camera DTB on the Genio 700 EVK board.**
   (If the camera app is not on the desktop , please refer to Appendix for fixing it)
2. Connect UART0 (CN3200) to the computer via an USB cable. (If you want to see the logs.)
3. Power on the system by long pressing Power Key for 4 seconds or Plug a Jumper at J3001 and Auto power on by plug in of AC adaptor.
4. You will see the boot-up picture on LCD display and some trace logs come out from UART0.

3.17   How to Reflash the Codes of Genio 700 EVK

Following steps can reflash the system codes of Genio 700 EVK board.
1. Connect ADB port to PC Via Micro USB (CON480)
2. Execute MediaTek Flash Tool
3. Select the proper Download-XML file.
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 downloader does not start.

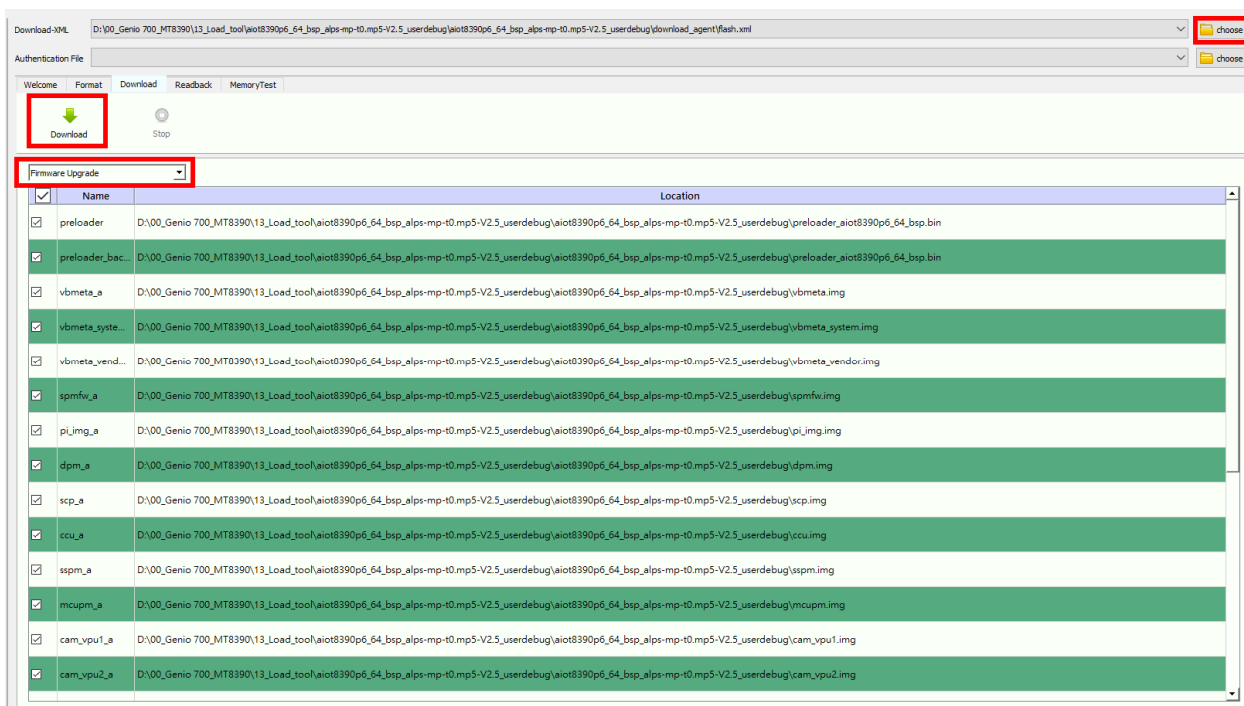Press Download button and plug in the DC power cord will execute a force download.
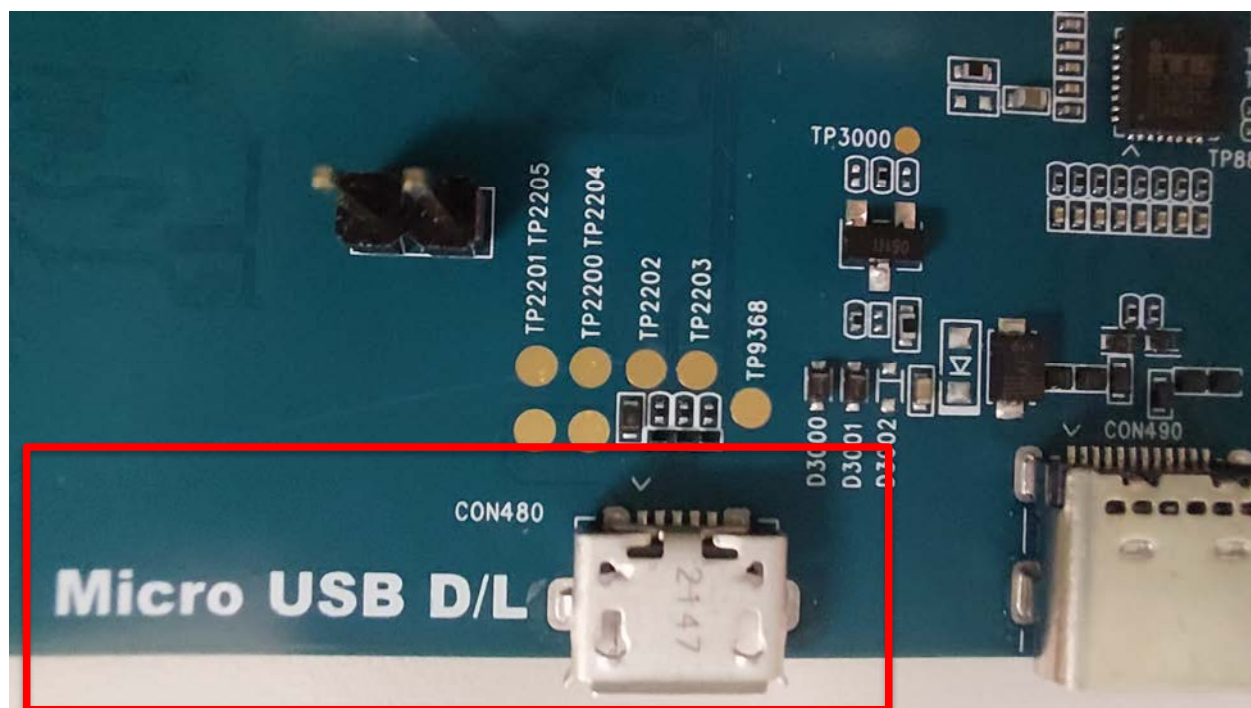
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Figure 3-8. Flash Tool Window

Figure 3-9. Download Port

3.18 Debug

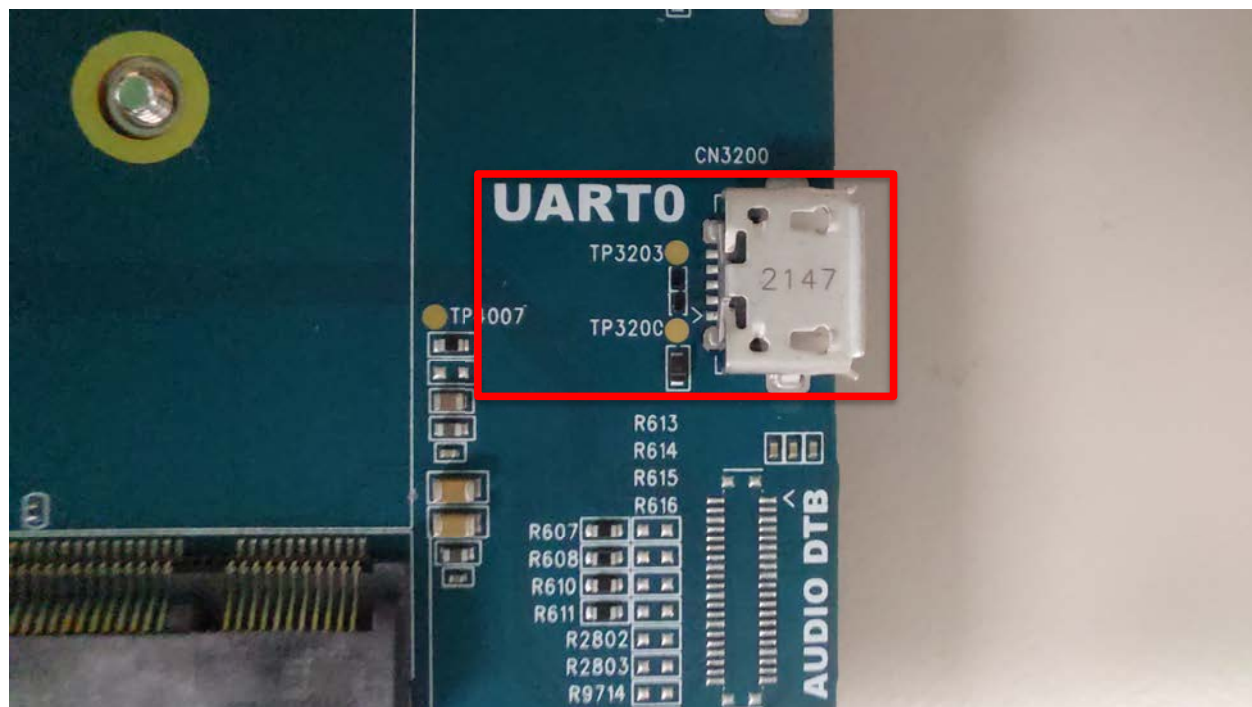- Micro USB (CN3200)output UART log
- Please install FT232RL driver.

Figure 3-10. Debug Port

- Check PC USB port could recognize the UART device.
- Setting serial line (ex. COM57) , serial speed to 921600, choose connection type to serial and press OPEN on putty for Log (Example on Putty)
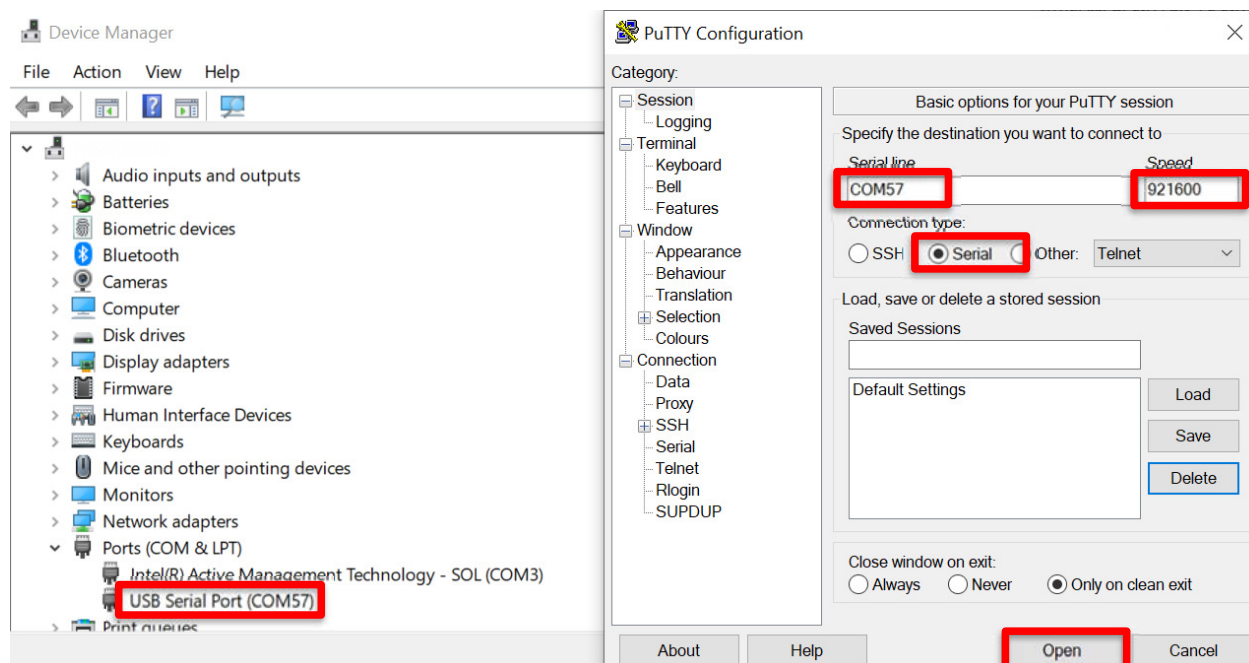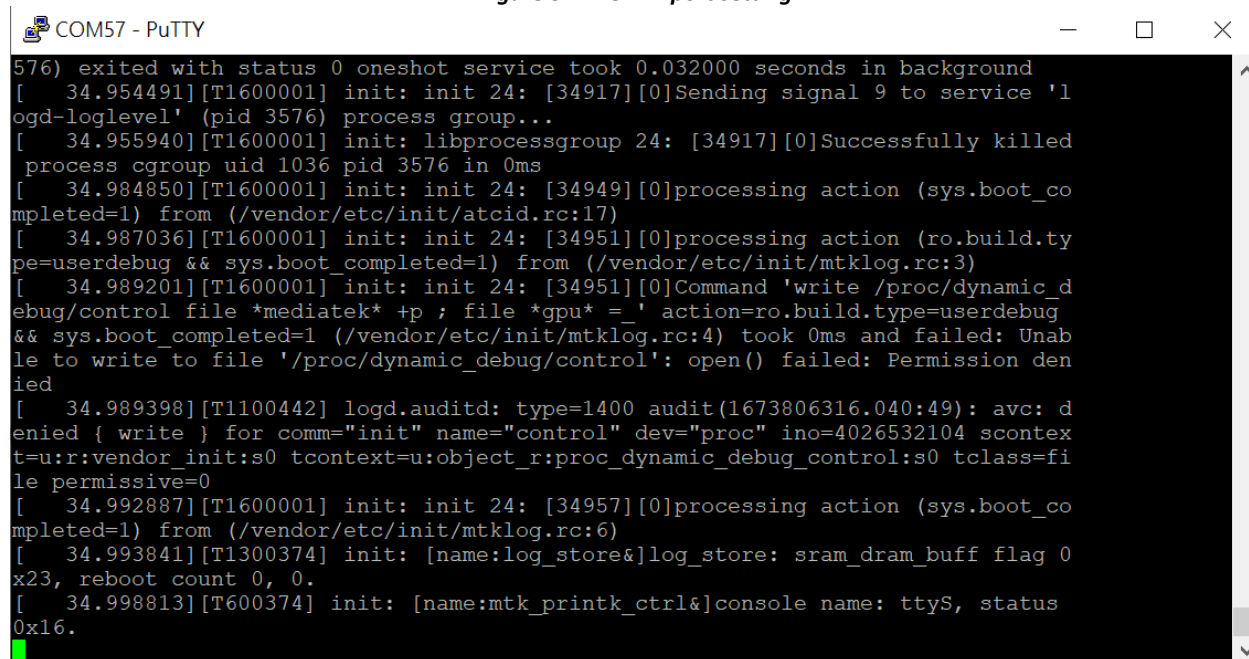

Figure 3-11. UART port setting

Figure 3-12. Log (For reference)

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4   Camera DTB Board

There is one camera board incorporated with Genio 700 main board : D2 Camera DTB board.

4.1   D2 Camera DTB Board

D2 camera DTB board is an evaluation kit for MediaTek Genio 700 platform, integrated with a SONY IMX214-0AQH5-C image sensor chip, which is a high-performance camera image processor with rich features.
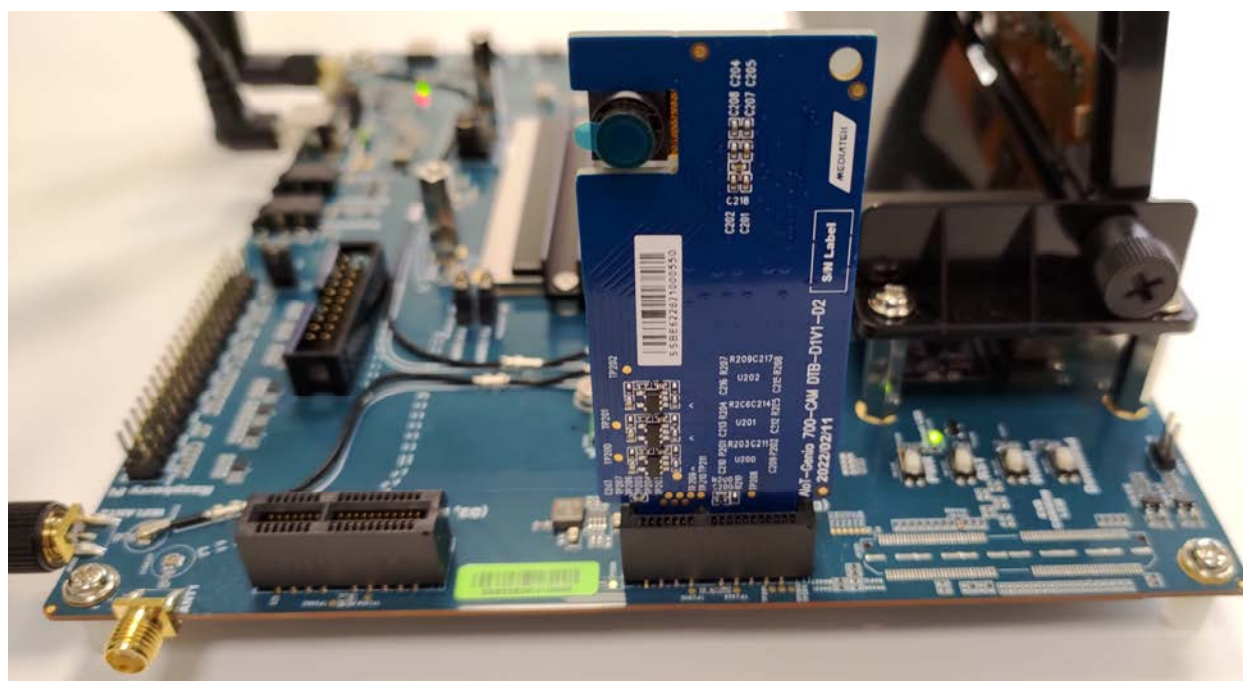

Figure 4-1. D2 Camera Sub-Board

Figure 4-2. D2 setup on Genio 700 EVK

4.1.1   Key Feature and Block Diagram

- Support 4-Lane MIPI CSI Interface and connect with main board through a 36 pin Gold-Finger.
- Integrate a 1.0V LDO circuit for camera digital power supply, a 2.8V LDO circuit for camera analog power supply and a 1.8V LDO circuit for camera I/O power supply.

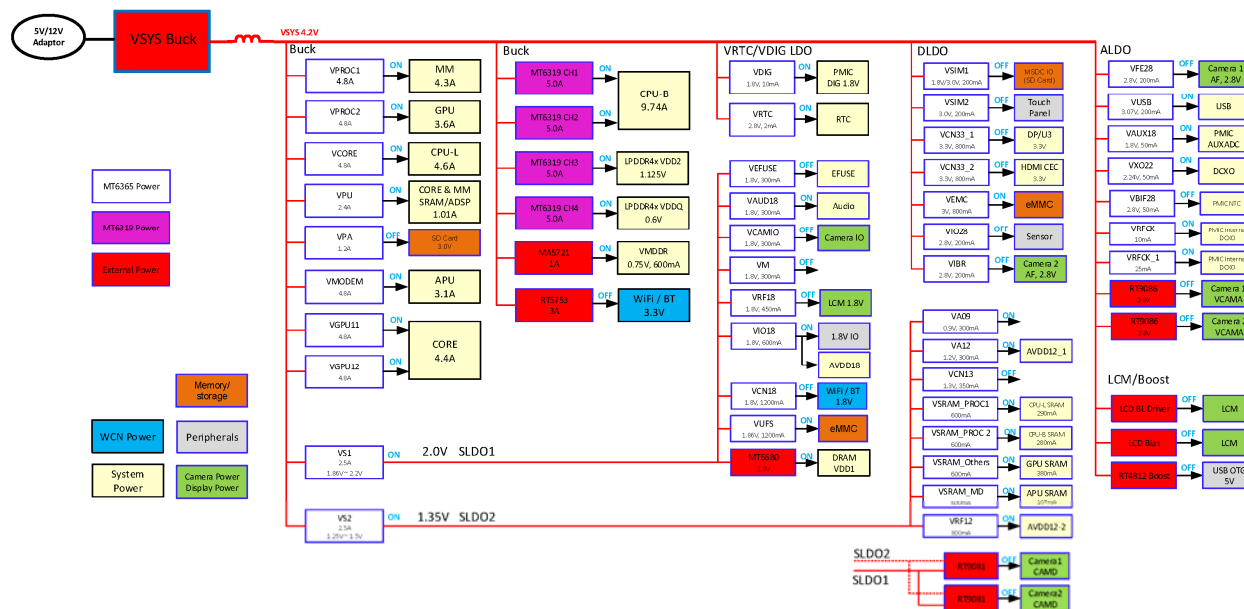*Figure 4-3. Block Diagram of D2 Camera DTB Board*
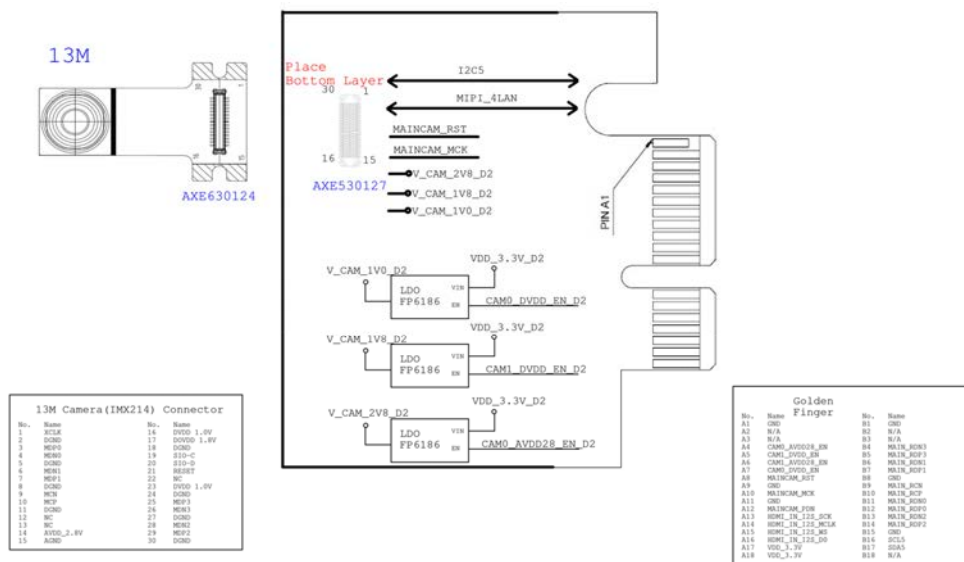
5 Power Distribution

Figure 5-1. Power Distribution

6   Appendix

6.1   The reason why camera icon disappears on home screen and how to resolve it.

This is because the camera app detects the existence of camera sensor from Android 4.1.

If there is no camera sensor, it hides the camera icon.

The camera sensor is detected the very first boot up time the device is flashed with a new software. If the camera sensor is not found , the icon is hidden permanently even if the camera sensor is plugged afterward.

Step:

1. Power off the Genio 700 EVK

2. Install camera DTB board in Camera CSI0 connector or Camera CSI1 connector then power on Genio 700 EVK.

3. Execute Factory reset :

    Settings -> System -> Reset options -> Erase all data (factory reset) -> ERASE ALL DATA -> ERASE ALL DATA.

4. Genio 700 EVK will automatically power on.

5. Check the camera function.

| Camera Icon Disappears | Setting | System | Reset Option |

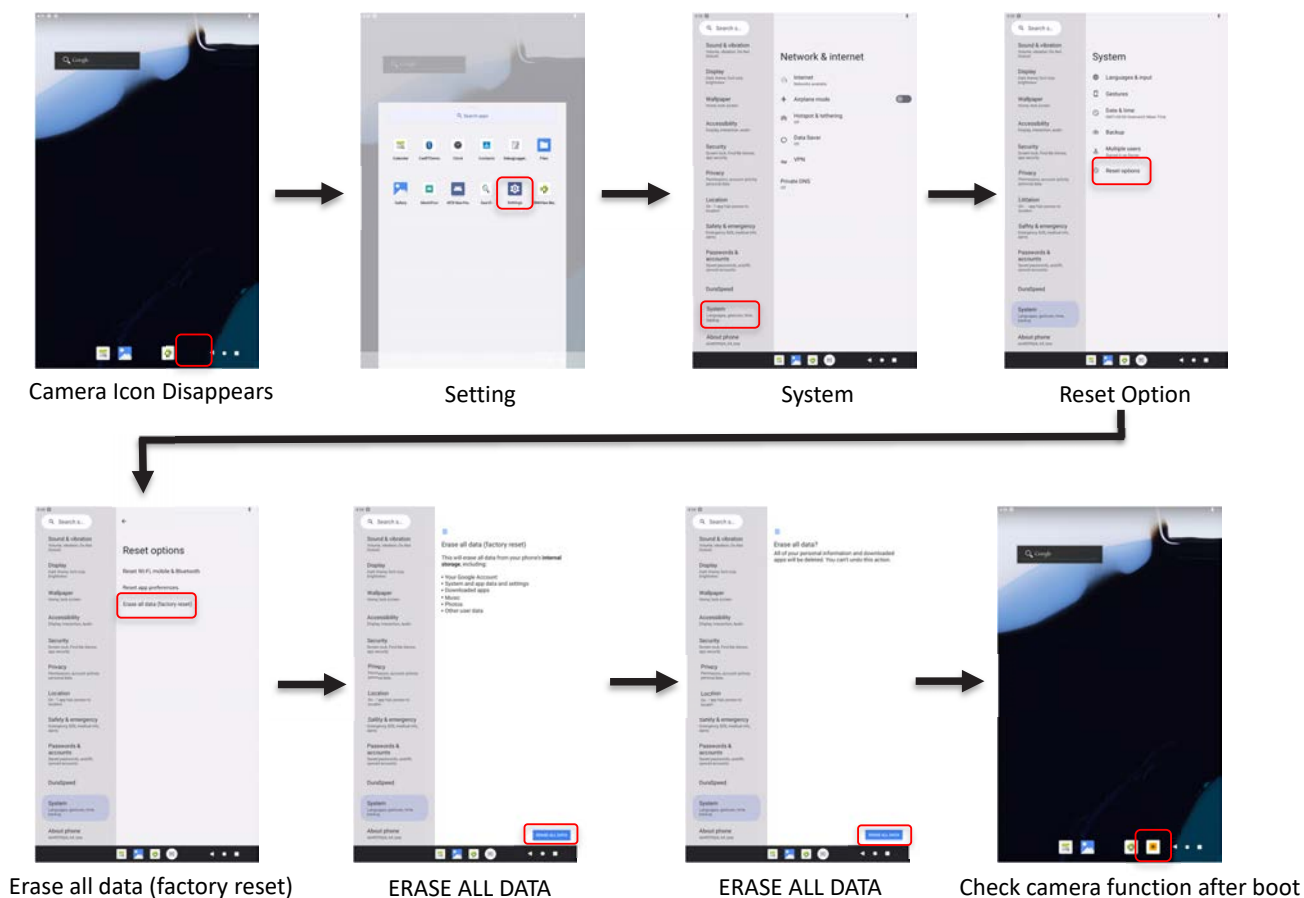| Erase all data (factory reset) | ERASE ALL DATA | ERASE ALL DATA | Check camera function after boot |

Figure 6-1. Factory reset.