SMARC2.0

RP-103-SMC

Carrier Board for RM-N8/RM-N8M/RM-N8MMI CPU Module

User's Manual

September 2020 V.0.6

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- Lead (Pb)
- Mercury (Hg)
- Cadmium (Cd)
- Hexavalent chromium (Cr6+)
- Polybrominated biphenyls (PBB)
- Polybrominated diphenyl ether (PBDE)

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- **IBASE standard products:**

  24-month (2-year) warranty from the date of shipment. If the date of shipment cannot be ascertained, the product serial numbers can be used to determine the approximate shipping date.

- **3rd-party parts:**

  12-month (1-year) warranty from delivery for the 3rd-party parts that are not manufactured by IBASE, such as CPU, memory, HDD, power adapter, panel and touchscreen.

* PRODUCTS, HOWEVER, THAT FAILS DUE TO MISUSE, ACCIDENT, IMPROPER INSTALLATION OR UNAUTHORIZED REPAIR SHALL BE TREATED AS OUT OF WARRANTY AND CUSTOMERS SHALL BE BILLED FOR REPAIR AND SHIPPING CHARGES.

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1. Visit the IBASE website at www.ibase.com.tw to find the latest information about the product.
2. If you need any further assistance from your distributor or sales representative, prepare the following information of your product and elaborate upon the problem.

   - Product model name
   - Product serial number
   - Detailed description of the problem
   - The error messages in text or in screenshots if there is any
   - The arrangement of the peripherals
   - Software in use (such as OS and application software, including the version numbers)

3. If repair service is required, you can download the RMA form at http://www.ibase.com.tw/english/Supports/RMAService/. Fill out the form and contact your distributor or sales representative.

Quick Start Guide

Here is a step by step guide to boot up your SMARC system:

a. By default, the (Android) or (Linux OS) has been preloaded in the eMMC, (or SD card) of the SMARC demo kit. All you have to do is
   - Connect your SMARC with TV/LCD by using an HDMI cable,
   - Or connect your LVDS panel by using LVDS cable if you have them
   - Connect the device with 19~24V power input directly.

b. To make a recovery SD card, please refer to Chapter 3.

c. To use the root/ serial port debug function, please check the section on COM1 debug cable setup information.

d. To boot up with an installed LVDS panel, please refer to Chapter 3.
   Note: Different LVDS panel needs different customization; please check with your sales contact.

e. For advanced users building their own products, please refer to Chapter 4~5.

f. For special requests or assistance, please contact the IBASE sales department.

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Introduction

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- IBASE i.MX 8 Series SMARC Solution
- SMARC Modules and RP-103-SMC Carrier Board
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- I/O View
- Installation

1. Introduction

1.1. IBASE i.MX 8 Series SMARC Solution

SMARC ('Smart Mobility ARChitecture') is a specification published by the Standardization Group for Embedded Technologies e.V. (SGET) for Computer-on-Modules (COMs). SMARC Computer-on-Modules are specifically designed for the development of compact low-power systems. Generally, SMARC modules are based on ARM processors and other low-power SoC architectures.
Measuring 82mm x 50mm, the RM-N8/RM-N8M/RM-N8MMI SMARC module integrates the i.MX 8/i.MX 8M/i.MX 8M Mini processor.

Measuring 170mm x 170mm, the RP-103-SMC (VDDIO=3.3V) carrier board is compatible with 82mm x 50mm standard SMARC form factors. Engineers can choose the required embedded IOs to verify developed software application under specified operation systems, aside from setting the default HDMI output with preloaded O.S.

1.2. SMARC Modules and RP-103-SMC Carrier Board

Features of RM-N8-QM408A:

- SMARC Small Form Factor (82mm x 50mm) SoM
- i.MX 8 Quad Max 4× Cortex-A53 @1.2 GHz, 2× Cortex-A72 @1.6 GHz, 2× Cortex-M4F @266 MHz
- 4Kp60 HEVC/H.265/VP9 and 4Kp30 AVC/H.264 decoder
- OpenGL ES 1.1, 2.0, 3.0, 3.1, Open CL 1.2, and Vulkan
- 4GB LPDDR4, 8GB eMMC on board
- Supports 4K HDMI or 1080P 4-lane MIPI-DSI
- Supports Yocto-Linux v2.5, Android 9

Specifications of RM-N8-QM408A:

Form Factor	SMARC™ (82mm x 50mm)
CPU	NXP Automotive grade i.MX8QuadMax Processor Up to 1.6GHz
Memory	4GB LPDDR4 on board 8GB eMMC on board
Display	2x MIPI-DSI 4-Lane 1x HDMI-TX/eDP 2x LVDS Tx with 2 channels of 4 lanes each
Audio Interface	2x I2S, 1x SPDIF
LAN	2x RGMII
USB	1x USB3.0+2.0 with PHY 1x USB2.0 with PHY
Camera I/F and Video	2x MIPI CSI-2 4-Lane 1x HDMI-RX
Serial	7x UART, 3x SPI, 1x QSPI
Media Interface	2x High-speed MMC/SDIO (MMC 8-bit, SDIO 4-bit)
PCIe	1x PCIe Gen.3 x 2 Lane, 1x PCIe Gen.3 x 1 Lane
GPIO	12x GPIO
I²C	4x I²C
CAN Bus	2x CAN
Operating Temperature	-25°C ~ 85°C
Board Connector	MXM3.0 / 314 pins
Operating System	Supports Yocto v2.5, Android 9

This specification is subject to change without prior notice.

Features of RM-N8M-Q316I:

- SMARC Small Form Factor (82mm x 50mm) SoM
- i.MX 8M Quad Processor Industrial Grade, up to 1.3GHz
- 4Kp60 HEVC/H.265/VP9 and 4Kp30 AVC/H.264 decoder
- OpenGL ES 1.1, 2.0, 3.0, 3.1, Open CL 1.2, and Vulkan
- 3GB LPDDR4, 16GB eMMC on board
- Supports 4K HDMI or 1080P 4-lane MIPI-DSI
- Supports Yocto v2.5, Android 9

Specifications of RM-N8M:

Form Factor	SMARC™ (82mm x 50mm)
CPU	NXP Industrial Grade i.MX 8M Quad Cortex-A53 Processor Up to 1.3GHz
Memory	3GB LPDDR4 on board 16GB eMMC on board
Display	1x MIPI-DSI 4-lane up to 1920 x 1080 at 60Hz 1x HDMI V2.0a, up to 4K
Video Codec	• 4Kp60 HEVC/H.265 main, and main 10 decoder • 4Kp60 VP9 decoder • 4Kp30 AVC/H.264 decoder • 1080p60 MPEG-2, MPEG-4p2, VC-1, VP8, RV9,AVS, MJPEG, H.263 decoder
Audio Interface	2x I2S, 1x SPDIF
LAN	1x RGMII
USB	2x USB3.0/USB2.0 with OTG interface
Image Capture	2x MIPI-CSI2 4-lane each
Serial	4x UART, 2x SPI
Media Interface	2x High-speed MMC/SDIO (MMC 8-bit, SDIO 4-bit)
PCIe	2x PCI-E (x1) Gen2
GPIO	12x GPIO
I^2C	4x I^2C
CAN Bus	N/A
Operating Temperature	-25°C ~ 85°C
Board Connector	MXM3.0 / 314 pins
Operating System	Supports Yocto v2.5, Android 9

This specification is subject to change without prior notice.

Features of RM-N8MMI-Q208I:

- SMARC Small Form Factor (82mm x 50mm) SoM
- i.MX 8M Mini Quad Processor Industrial Grade, up to 1.6GHz
- 1080p60 HEVC/H.265/1080p60 VP8 and 1080p60 AVC/H.264 decoder
- OpenGL ES 1.1, 2.0 / Open VG 1.1
- 2GB LPDDR4, 8GB eMMC on board
- Supports 1080p60 4-lane MIPI-DSI
- Supports Yocto v2.5, Android 9

Specifications of RM-N8MMI-Q208I:

Form Factor	SMARC™ (82mm x 50mm)
CPU	NXP Industrial Grade i.MX 8M Mini Quad Cortex-A53 Up to 1.6GHz
Memory	2GB LPDDR4 on board 8GB eMMC on board
Display	1x MIPI-DSI 4-lane up to 1920 x 1080 at 60Hz
Video Codec	• 1080p60 VP9 • 1080p60 HEVC/H.265 Decoder • 1080p60 AVC/H.264 Baseline, Main, High decoder • 1080p60 VP8 • 1080p60 AVC/H.264 Encoder
Audio Interface	2x I2S, 1x SPDIF
LAN	1x RGMII
USB	2x USB2.0 with OTG interface
Image Capture	1x MIPI-CSI2 4-lane
Serial	4x UART, 2x SPI
Media Interface	2x High-speed MMC/SDIO (MMC 8-bit, SDIO 4-bit)
PCIe	1x PCI-E (x1) Gen2
GPIO	12x GPIO
I^2C	4x I^2C
CAN Bus	N/A
Operating Temperature	-40°C ~ 85°C
Board Connector	MXM3.0 / 314 pins
Operating System	Supports Yocto v2.5, Android 9

Features of RP-103-SMC :

- Designed for SMARC2.0 form factor modules
- 19V~24V DC-in
- Carrier Board for RM-N8M, RM-N8MMI and RM-N8QM series SMARC 2.0 CPU Module
- Validated with Yocto v2.5 and Android 9

Specifications of RP-103-SMC:

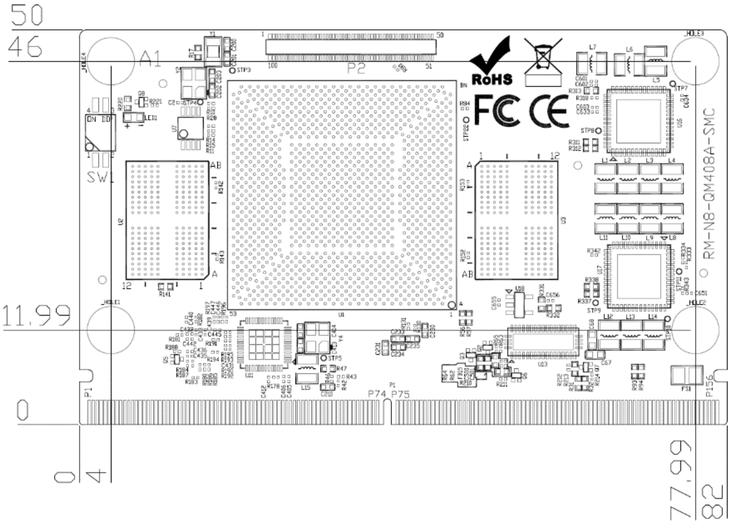
Form Factor	Standard (170mm x 170mm)
Edge IO	1x 19~24V DC-in Jack 2x RJ45 Gigabit LAN (one for RM-N8 only) 2x USB3.0 1x OTG Micro USB2.0 2x HDMI Tx (one for RM-N8 only) 1x HDMI Rx (for RM-N8 only) 1x Headphone & Mic 1x COM (RS232/422/485 by switch) 2x SD Slot (one for RM-N8 only)
Internal Headers / Connectors	1x 19~24V DC-in header 1x 12V Fan header 4x CAN bus 2.0b (three for RM-N8 only) 3x 18/24-bit Dual Channel LVDS (two for RM-N8 only) 4x LCD backlight 2x MIPI-CSI2 (one for RM-N8/RM-N8M only) 2x MIPI-DSI (one for RM-N8 only) 2x USB3.0 1x 12 GPIOs 2x RS232 (RX/TX only) 2x I2C 2x SATA II and power (one for RM-N8 only) 1x I2S 2x SPI (for RM-N8 only) 1x QSPI 1x Full size Mini PCI-E 1x SIM socket 1x M.2 Key-E (2230) 1x Speaker R and L 1 x RTC battery 2x UART (for RM-N8 only) 1x 4-Wire UART
Jumpers, Switch & Buttons	1x Boot select switch 1x I/O and Display select switch 1x Power button 1x Reset button 1x LID button 1x Sleep button 4x Backlight power (3V3/5V/12V) Jumper 3x LCD power 3V3/5V Jumper

This specification is subject to change without prior notice.

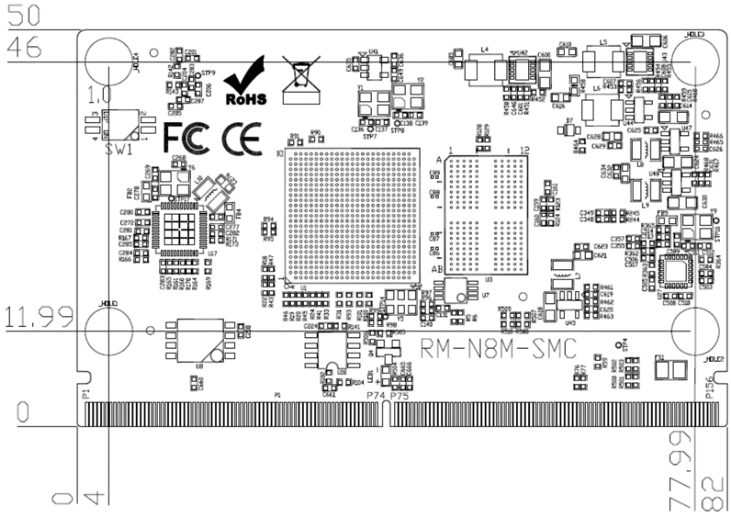
1 Introduction

1.3. Board Dimensions

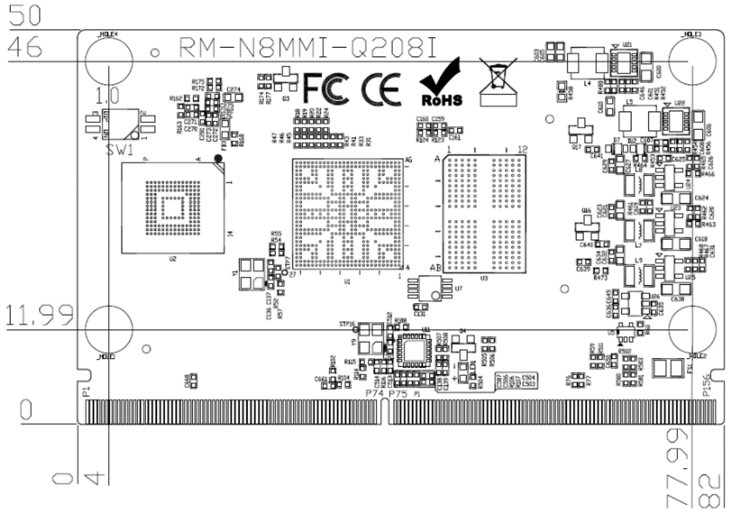
RM-N8-QM408A Dimensions



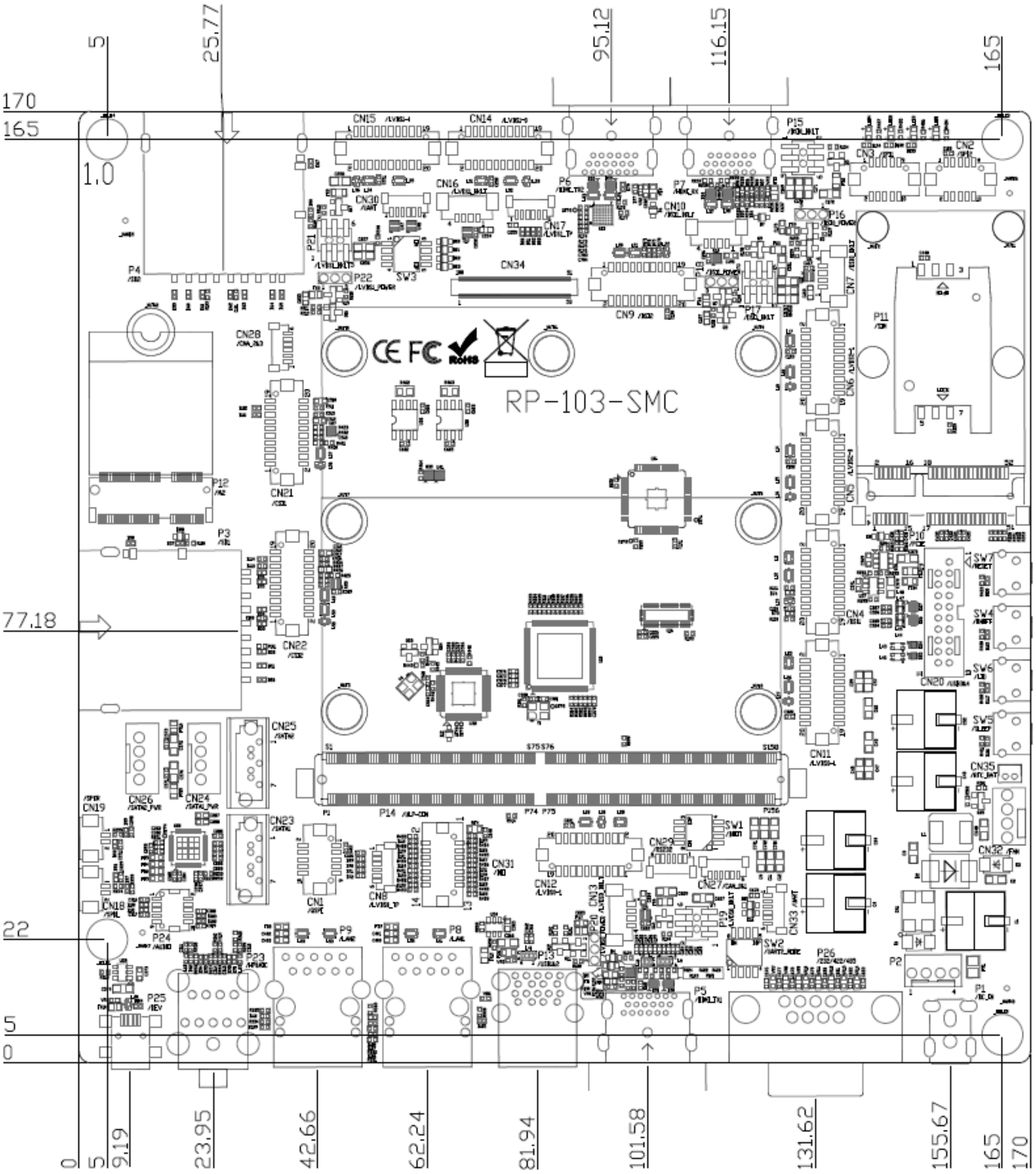
RM-N8M-Q316I Dimensions



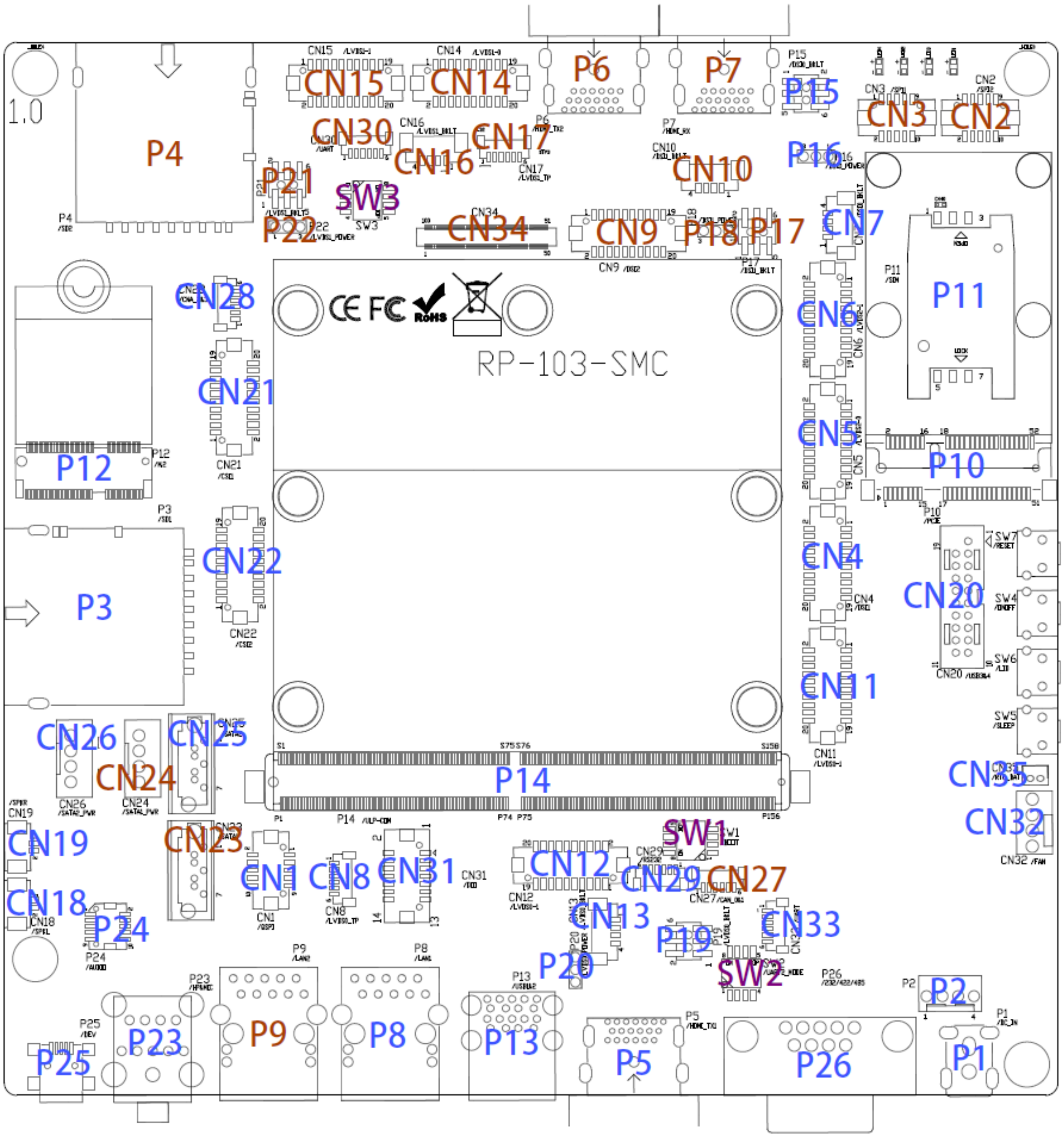
RM-N8MMI-Q208I Dimensions



RP-103-SMC Dimensions



1.4. I/O View


1.0
CN15
CN14
P6
P7
P15
CN3
CN2
P4
CN30
CN16
CN17
CN10
P16
P21
SW3
P22
CN34
CN9
P18
P17
CN7
CN28
P11
RP-103-SMC
CN6
CN21
CN5
P12
P10
CN22
CN4
P3
CN20
CN11
CN26
CN25
CN24
P14
CN35
CN32
SW1
CN19
CN23
CN1
CN8
CN31
CN12
CN29
CN27
CN18
P24
CN13
P19
CN33
P20
SW2
P2
P23
P9
P8
P13
P25
P5
P26
P1

1.5. Installing the SMARC

The MXM3.0 connector on RP-103-SMC supports the SMARC form factor (82mm x 50mm).

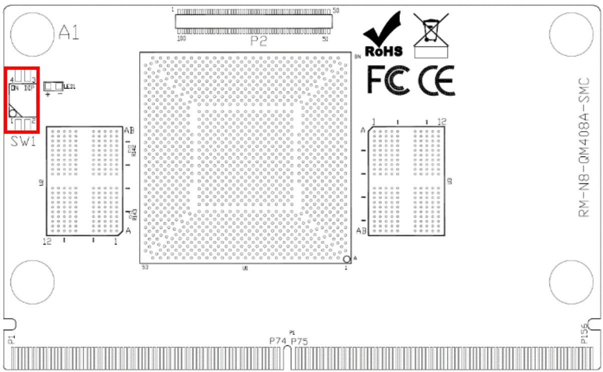
To install SMARC modules to the MXM slot on the board, please perform the following steps:

- Hold the SMARC module so that the edge fingers of the SMARC module aligns with the MXM connector.
- Gently push the SMARC module to the MXM connector until the edge fingers of SMARC completely touch the bottom of the slot.
- Gently press the SMARC module down and fix it with four screws.

Chapter 2
Jumpers and Connectors on the Carrier Board

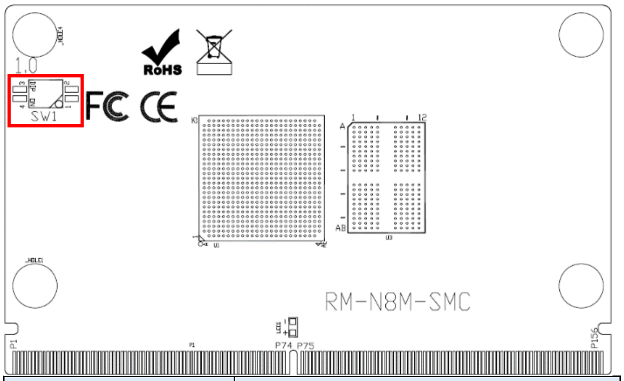
[Important] Please check the jumpers, DIP, buttons and switches on RP-103-SMC before doing the panel connection and boot up.

2.1. Switch on RM-N8-QM408A



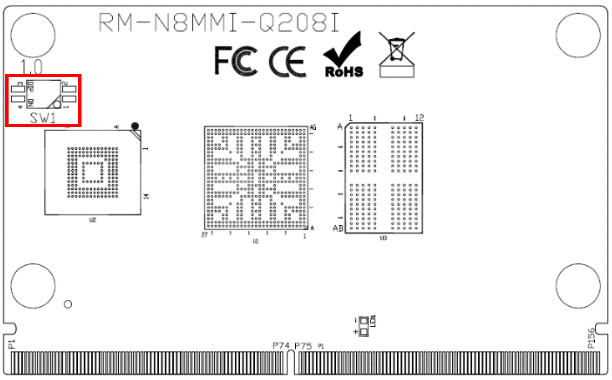
Mode	Signal Name	
	SW1_1-4	SW1_2-3
Normal Boot	OFF	OFF
Auto Test	OFF	ON
USB Download	ON	x

2.2. Switch on RM-N8M-Q316I



Mode	Signal Name	
	SW1_1-4	SW1_2-3
Normal Boot	OFF	OFF
Auto Test	OFF	ON
USB Download	ON	x

2.3. Switch on RM-N8MMI-Q208I



Mode	Signal Name	
	SW1_1-4	SW1_2-3
Normal Boot	OFF	OFF
Auto Test	OFF	ON
USB Download	ON	x

2.4. Connectors on RP-103-SMC

P1	DC-in	CN1	QSPI
P2	Internal DC-in	CN2	SPI(2.2.1)
P3	SD/MMC slot	CN3	SPI(2.2.1)
P4	SD/MMC slot(2.2.1)	CN4	MIPI DSI0
P5	HDMI TX1/EDP TX	CN5	LVDS2 ch0
P6	HDMI TX2(2.2.1)	CN6	LVDS2 ch1
P7	HDMI RX(2.2.1)	CN7	DSI0/LVDS2 Backlight
P8	LAN0	CN8	DSI0/LVDS2 TP (i2c for touch)
P9	LAN1(2.2.1)	CN9	MIPI DSI1(2.2.1)
P10	mPCIe slot	CN10	DSI1 Backlight(2.2.1)
P11	SIM slot	CN11	LVDS0 ch0
P12	M.2 E-Key 2230 slot	CN12	LVDS0 ch1
P13	USB1/2	CN13	LVDS0 Backlight
P14	MXM3 slot	CN14	LVDS1 ch0(2.2.1)
P15	DSI0/LVDS2 Backlight power select	CN15	LVDS1 ch1(2.2.1)
P16	DSI0/LVDS2 LCD power select	CN16	LVDS1 Backlight(2.2.1)
P17	DSI1 Backlight power select(2.2.1)	CN17	LVDS1 TP (i2c for touch) (2.2.1)
P18	DSI1 LCD power select(2.2.1)	CN18	Speaker L
P19	LVDS0 Backlight power select	CN19	Speaker R
P20	LVDS0 LCD power select	CN20	USB3/4
P21	LVDS1 Backlight power select(2.2.1)	CN21	MIPI CSI1(2.2.1)
P22	LVDS1 LCD power select(2.2.1)	CN22	MIPI CSI2
P23	Headphone & Mic.	CN23	SATA0(2.2.1)
P24	Line In/Out	CN24	SATA power(2.2.1)
P25	OTG USB	CN25	SATA1
P26	RS232/422/485	CN26	SATA power
SW1	Boot Mode Select	CN27	CAN0/1(2.2.1)
SW2	UART Mode Select	CN28	CAN2/3
SW3	I/O & Display Select	CN29	COM1/3
SW4	Power ON/OFF button	CN30	UART0/4(2.2.1)
SW5	Sleep button	CN31	DIO
SW6	LID button	CN32	FAN
SW7	Reset button	CN33	UART(4-wire)
		CN34	BTB Conn(2.2.1)
		CN35	RTC BAT

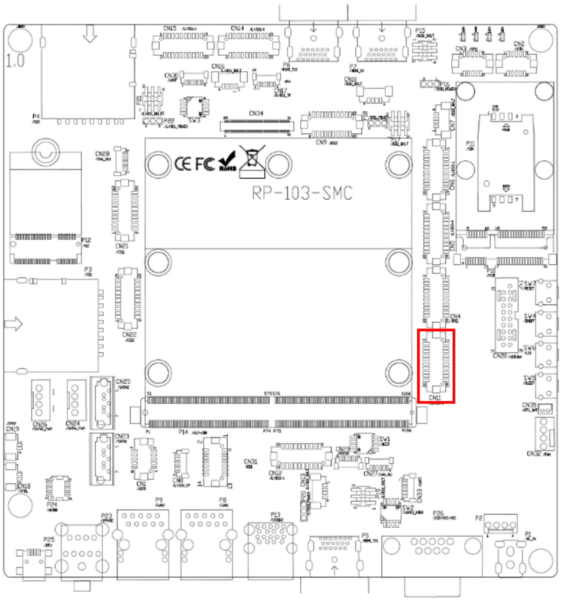
Note:
(2.2.1): RM-N8 module use only

2.5. Connector Functions on difference SMARC module

CONN	Function	RM-N8-QMxxx	RM-N8Mxxx	RM-N8MMIxxx
P1	DC-in	YES	YES	YES
P2	Internal DC-in	YES	YES	YES
P3	SD/MMC slot	YES	YES	YES
P4	SD/MMC slot	YES	NO	NO
P5	HDMI TX1/EDP TX	YES	YES	NO
P6	HDMI TX2	YES	NO	NO
P7	HDMI RX	YES	NO	NO
P8	LAN0	YES	YES	YES
P9	LAN1	YES	NO	NO
P10	mPCIe slot	YES	YES	YES
P11	SIM slot	YES	YES	YES
P12	M.2 E-Key 2230 slot	YES	YES	YES
P13	USB1/2	YES	YES	YES
P14	MXM3 slot	YES	YES	YES
P15	DSI0/LVDS2 Backlight power select	YES	YES	YES
P16	DSI0/LVDS2 LCD power select	YES	YES	YES
P17	DSI1 Backlight power select	YES	NO	NO
P18	DSI1 LCD power select	YES	NO	NO
P19	LVDS0 Backlight power select	YES	YES	YES
P20	LVDS0 LCD power select	YES	YES	YES
P21	LVDS1 Backlight power select	YES	NO	NO
P22	LVDS1 LCD power select	YES	NO	NO
P23	Headphone & Mic	YES	YES	YES
P24	Line In/Out	YES	YES	YES
P25	OTG USB	YES	YES	YES
P26	RS232/422/485	YES	YES	YES
CN1	QSPI	YES	YES	YES
CN2	SPI	YES	NO	NO
CN3	SPI	YES	NO	NO
CN4	MIPI DSI0	YES	YES	YES
CN5	LVDS2 ch0	YES	YES	YES
CN6	LVDS2 ch1	YES	YES	YES
CN7	DSI0/LVDS2 Backlight	YES	YES	YES
CN8	DSI0/LVDS2 TP (i2c for touch)	YES	YES	YES
CN9	MIPI DSI1	YES	NO	NO
CN10	DSI1 Backlight	YES	NO	NO
CN11	LVDS0 ch0	YES	NO	NO
CN12	LVDS0 ch1	YES	NO	NO
CN13	LVDS0 Backlight	YES	YES	YES

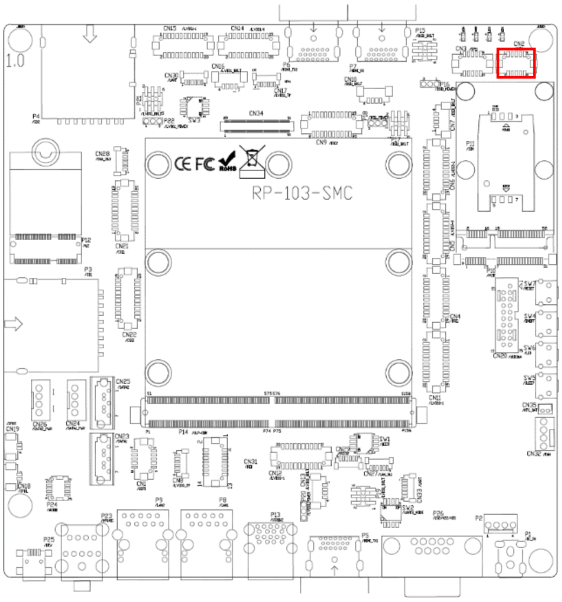
CONN	Function	RM-N8-QMxxx	RM-N8Mxxx	RM-N8MMIxxx
CN14	LVDS1 ch0	YES	NO	NO
CN15	LVDS1 ch1	YES	NO	NO
CN16	LVDS1 Backlight	YES	NO	NO
CN17	LVDS1 TP (i2c for touch)	YES	NO	NO
CN18	Speaker L	YES	YES	YES
CN19	Speaker R	YES	YES	YES
CN20	USB3/4	YES	YES	YES
CN21	MIPI CSI1	YES	YES	NO
CN22	MIPI CSI2	YES	YES	YES
CN23	SATA0	YES	NO	NO
CN24	SATA power	YES	NO	NO
CN25	SATA1	YES	YES	YES
CN26	SATA power	YES	YES	YES
CN27	CAN0/1	YES	NO	NO
CN28	CAN2/3	YES	CAN2	CAN2
CN29	COM1/3	YES	YES	YES
CN30	UART0/4	YES	NO	NO
CN31	DIO	YES	YES	YES
CN32	FAN	YES	YES	YES
CN33	UART(4-wire)	YES	YES	YES
CN34	BTB Conn	YES	NO	NO
CN35	RTC BAT	YES	YES	YES
SW1	Boot Mode Select	YES	YES	YES
SW2	UART Mode Select	YES	YES	YES
SW3	I/O & Display Select	YES	YES	YES
SW4	Power ON/OFF button	YES	YES	YES
SW5	Sleep button	YES	YES	YES
SW6	LID button	YES	YES	YES
SW7	Reset button	YES	YES	YES

CN1: QSPI (DF13E-10DP-1.25V)



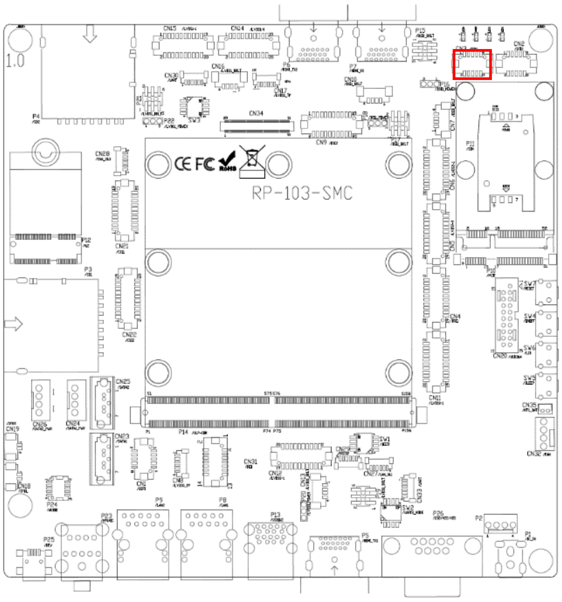
Pin #	Signal Name	Pin #	Signal Name
1	1V8	2	QSPI_IO_3
3	QSPI_CS0_B	4	QSPI_SCLK
5	QSPI_CS1_B	6	QSPI_IO_0
7	QSPI_RST_B	8	QSPI_IO_1
9	QSPI_IO_2	10	GND

CN2: SPI3 (DF13E-10DP-1.25V, RM-N8QM only)



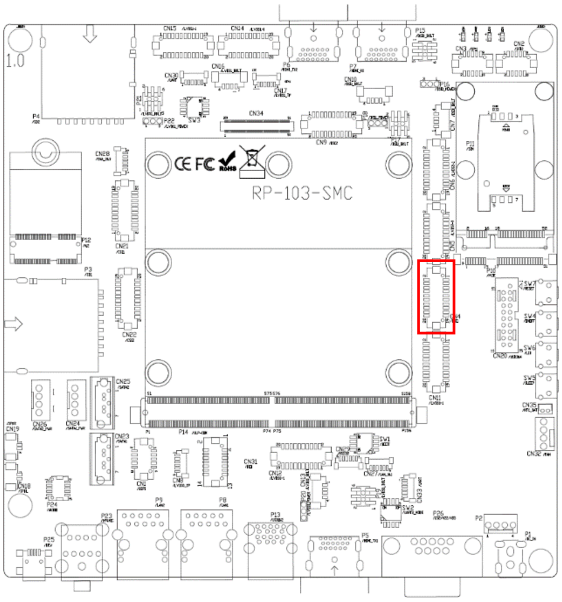
Pin #	Signal Name	Signal Name	Pin #
1	1V8	N.C.	2
3	SPI3_CS0_B	SPI3_SCLK	4
5	SPI3_CS1_B	SPI3_MOSI	6
7	N.C.	SPI3_MISO	8
9	N.C.	GND	10

CN3: SPI0 (DF13E-10DP-1.25V, RM-N8QM only)



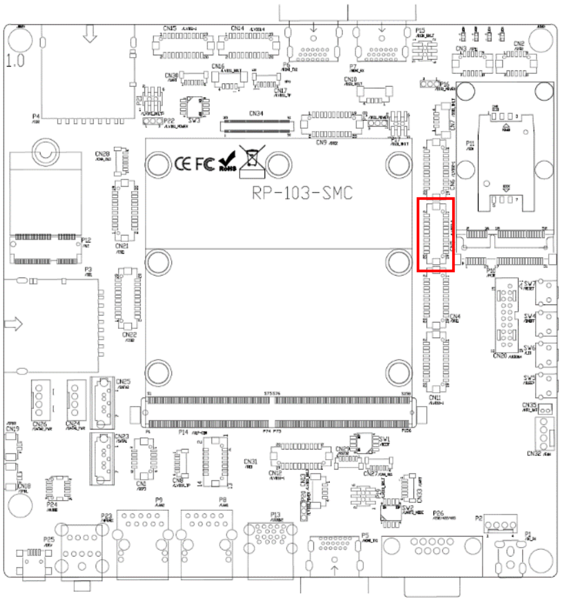
Pin #	Signal Name	Pin #	Signal Name
1	1V8	2	N.C.
3	SPI0_CS0_B	4	SPI0_SCLK
5	SPI0_CS1_B	6	SPI0_MOSI
7	N.C.	8	SPI0_MISO
9	N.C.	10	GND

CN4: MIPI-DSI0



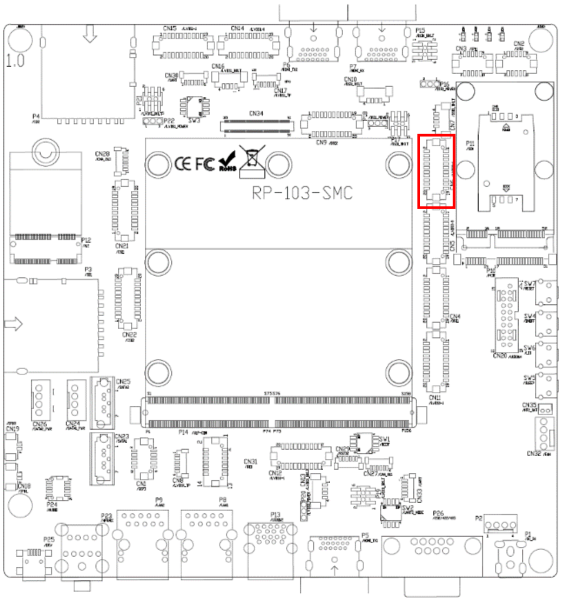
Pin #	Signal Name	Signal Name	Pin #
2	MIPI_DSI0_CKN	MIPI_DSI0_CKP	1
4	GND	GND	3
6	MIPI_DSI0_DNO	MIPI_DSI0_DP0	5
8	DSI0_VLCD	GND	7
10	MIPI_DSI0_DN1	MIPI_DSI0_DP1	9
12	MIPI_DSI0_DN2	MIPI_DSI0_DP2	11
14	SPDIF_TX0	HDMI_INT	13
16	MIPI_DSI0_DN3	MIPI_DSI0_DP3	15
18	DSI0_VLCD	LVDS0_TS_SCL	17
20	DSI0_BKLT	LVDS0_TS_SDA	19

CN5: Dual-channel LVDS2 ch0



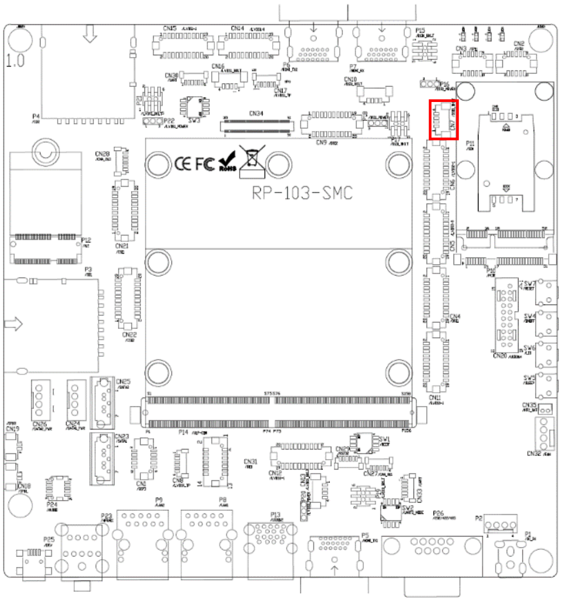
Pin #	Signal Name	Pin #	Signal Name
2	LVDS2_0_TX0_N	1	LVDS2_0_TX0_P
4	GND	3	GND
6	LVDS2_0_TX1_N	5	LVDS2_0_TX1_P
8	DSI0_VLCD	7	GND
10	LVDS2_0_TX3_N	9	LVDS2_0_TX3_P
12	LVDS2_0_TX2_N	11	LVDS2_0_TX2_P
14	GND	13	GND
16	LVDS2_0_CLK_N	15	LVDS2_0_CLK_P
18	DSI0_VLCD	17	DSI0_BL_PWM
20	DSI0_BKLT	19	DSI0_BKLT

CN6: Dual-channel LVDS2 ch1



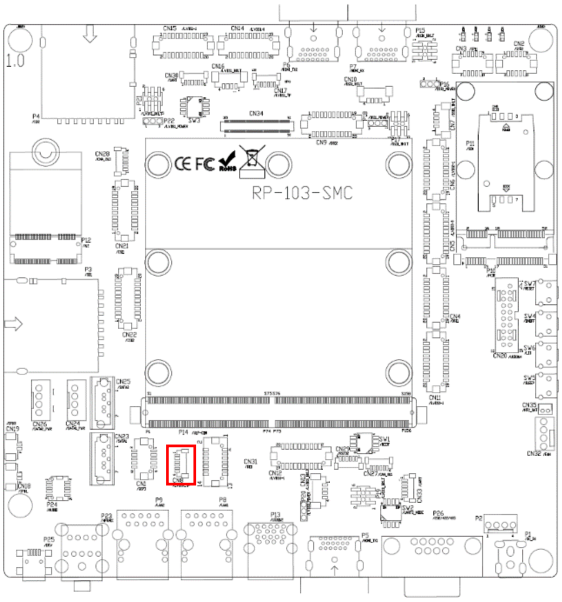
Pin #	Signal Name	Pin #	Signal Name
2	LVDS2_1_TX0_N	1	LVDS2_1_TX0_P
4	GND	3	GND
6	LVDS2_1_TX1_N	5	LVDS2_1_TX1_P
8	DSI0_VLCD	7	GND
10	LVDS2_1_TX3_N	9	LVDS2_1_TX3_P
12	LVDS2_1_TX2_N	11	LVDS2_1_TX2_P
14	GND	13	GND
16	LVDS2_1_CLK_N	15	LVDS2_1_CLK_P
18	DSI0_VLCD	17	DSI0_BL_PWM
20	DSI0_BKLT	19	DSI0_BKLT

CN7: DSI0/LVDS2 Backlight



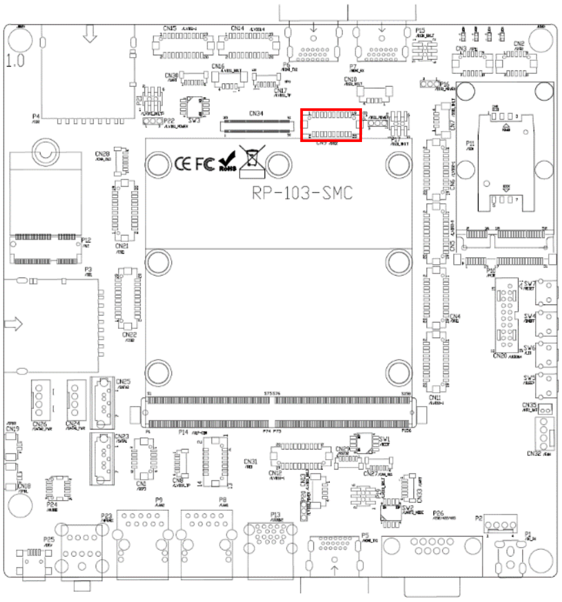
Pin #	Signal Name
1	DSI0_BKLT
2	DSI0_BKLT_EN
3	DSI0_BKLT_PWM
4	GND

CN8: DSI0/LVDS2 TP (i2c for touch)



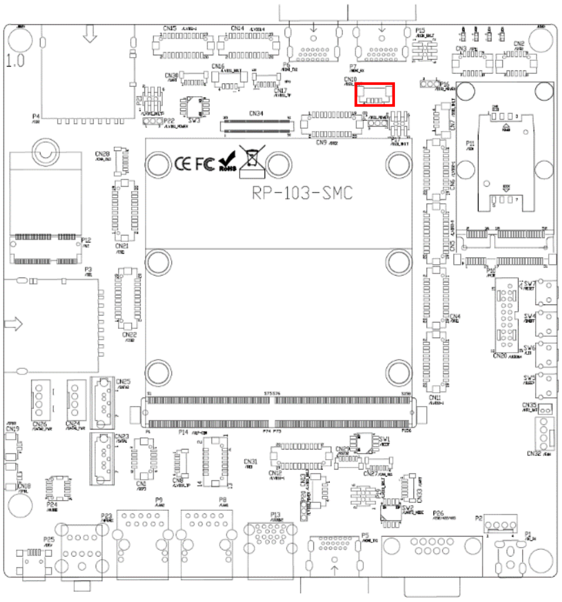
Pin #	Signal Name
1	1V8
2	TP_INT_B
3	TP_RST_B
4	LVDS0_TS_SCL
5	LVDS0_TS_SDA
6	GND

CN9: MIPI-DSI1 (RM-N8QM only)



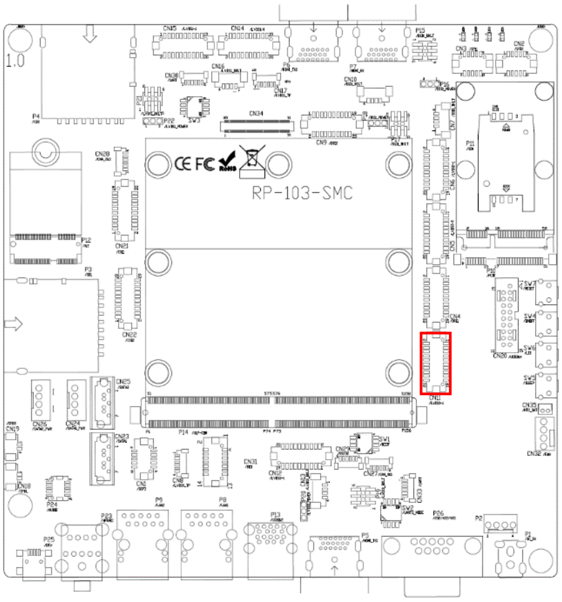
Pin #	Signal Name	Pin #	Signal Name
2	MIPI_DSI1_CKN	1	MIPI_DSI1_CKP
4	GND	3	GND
6	MIPI_DSI1_DNO	5	MIPI_DSI1_DP0
8	DSI0_VLCD	7	GND
10	MIPI_DSI0_DN1	9	MIPI_DSI1_DP1
12	MIPI_DSI0_DN2	11	MIPI_DSI1_DP2
14	SPDIF0_TX1	13	DSI1_INT_B
16	MIPI_DSI1_DN3	15	MIPI_DSI1_DP3
18	DSI1_VLCD	17	DSI1_TS_SCL
20	DSI1_BKLT	19	DSI1_TS_SDA

CN10: DSI1 Backlight (RM-N8QM only)



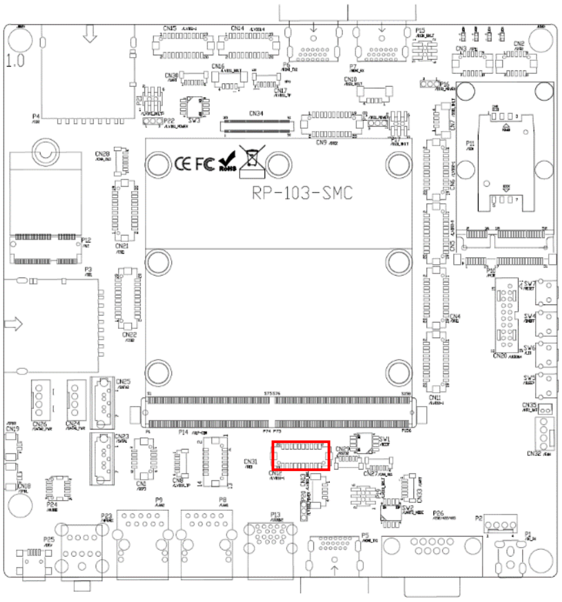
Pin #	Signal Name
1	DSI0_BKLT
2	DSI0_BKLT_EN
3	DSI0_BKLT_PWM
4	GND

CN11: Dual-channel LVDS0 ch0



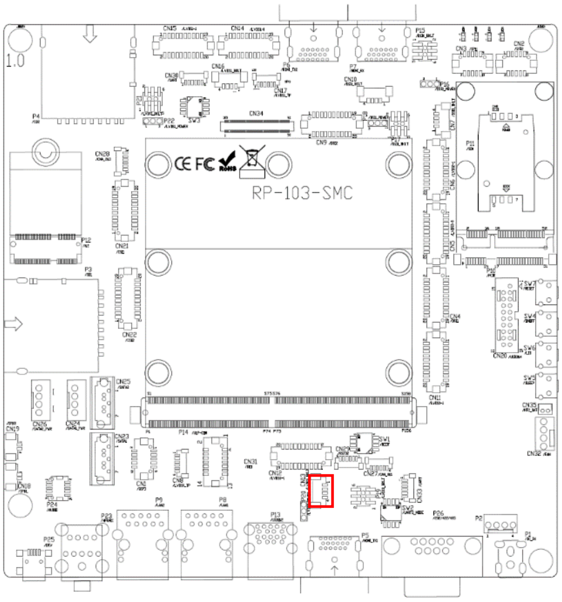
Pin #	Signal Name	Pin #	Signal Name
2	LVDS0_0_TX0_N	1	LVDS0_0_TX0_P
4	GND	3	GND
6	LVDS0_0_TX1_N	5	LVDS0_0_TX1_P
8	LVDS0_VLCD	7	GND
10	LVDS0_0_TX3_N	9	LVDS0_0_TX3_P
12	LVDS0_0_TX2_N	11	LVDS0_0_TX2_P
14	GND	13	GND
16	LVDS0_0_CLK_N	15	LVDS0_0_CLK_P
18	LVDS0_VLCD	17	LVDS0_BL_PWM
20	LVDS0_BKLT	19	LVDS0_BKLT

CN12: Dual-channel LVDS0 ch1



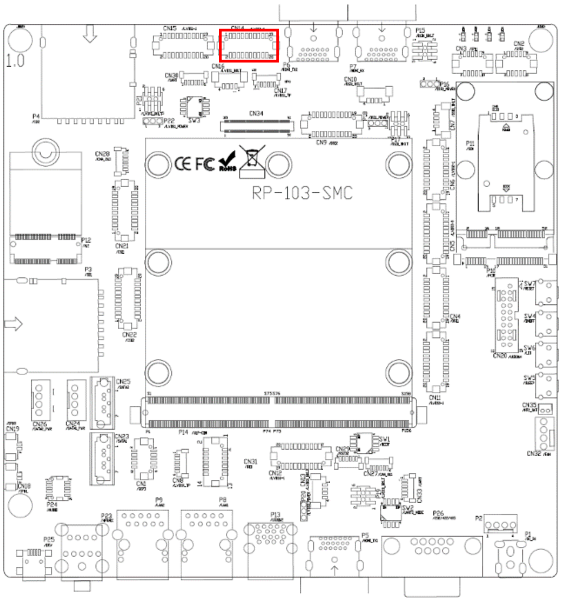
Pin #	Signal Name	Pin #	Signal Name
2	LVDS0_1_TX0_N	1	LVDS0_1_TX0_P
4	GND	3	GND
6	LVDS0_1_TX1_N	5	LVDS0_1_TX1_P
8	LVDS0_VLCD	7	GND
10	LVDS0_1_TX3_N	9	LVDS0_1_TX3_P
12	LVDS0_1_TX2_N	11	LVDS0_1_TX2_P
14	GND	13	GND
16	LVDS0_1_CLK_N	15	LVDS0_1_CLK_P
18	LVDS0_VLCD	17	LVDS0_BL_PWM
20	LVDS0_BKLT	19	LVDS0_BKLT

CN13: LVDS0 Backlight



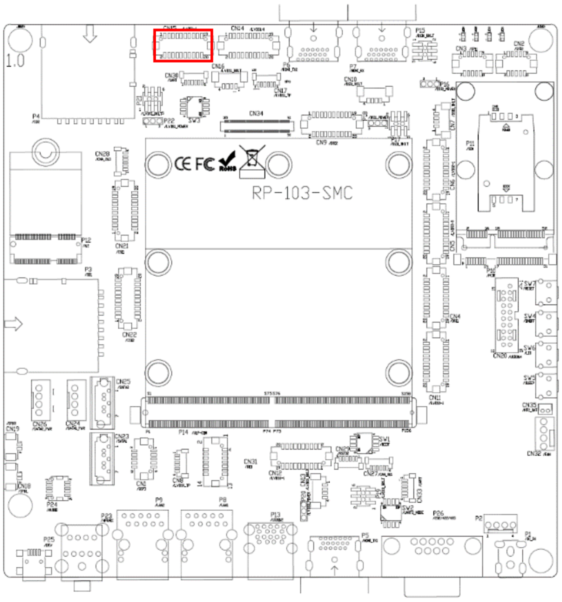
Pin #	Signal Name
1	LVDS0_BKLT
2	LVDS0_BKLT_EN
3	LVDS0_BKLT_PWM
4	GND

CN14: Dual-channel LVDS1 ch0 (RM-N8QM only)



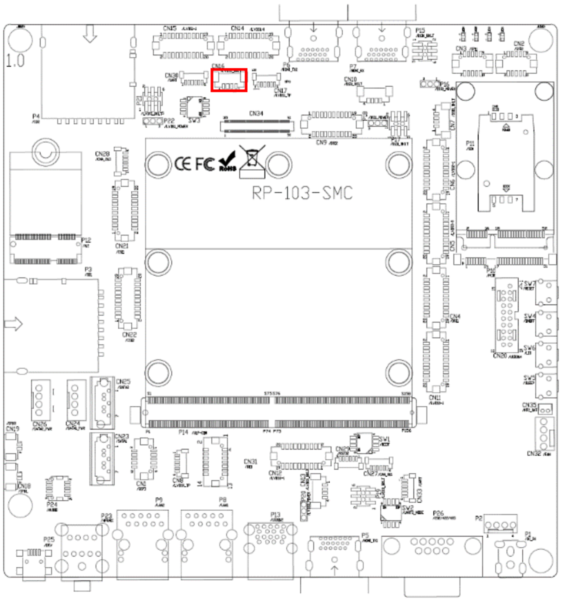
Pin #	Signal Name	Pin #	Signal Name
2	LVDS1_0_TX0_N	1	LVDS1_0_TX0_P
4	GND	3	GND
6	LVDS1_0_TX1_N	5	LVDS1_0_TX1_P
8	LVDS1_VLCD	7	GND
10	LVDS1_0_TX3_N	9	LVDS1_0_TX3_P
12	LVDS1_0_TX2_N	11	LVDS1_0_TX2_P
14	GND	13	GND
16	LVDS1_0_CLK_N	15	LVDS1_0_CLK_P
18	LVDS1_VLCD	17	LVDS1_BL_PWM
20	LVDS1_BKLT	19	LVDS1_BKLT

CN15: Dual-channel LVDS1 ch1 (RM-N8QM only)



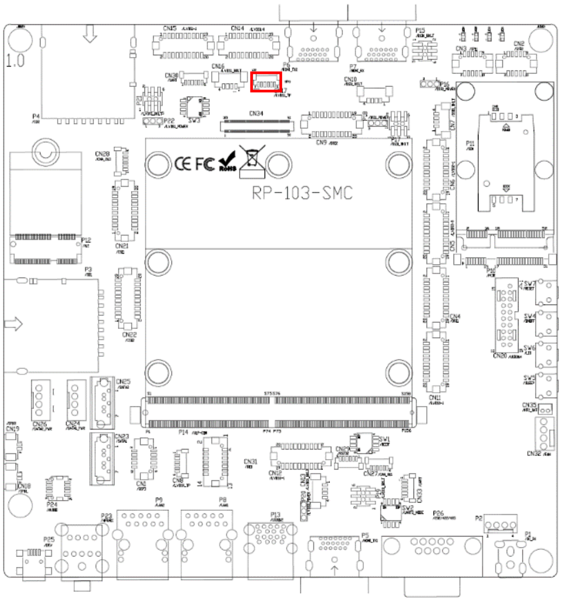
Pin #	Signal Name	Pin #	Signal Name
2	LVDS1_1_TX0_N	1	LVDS1_1_TX0_P
4	GND	3	GND
6	LVDS1_1_TX1_N	5	LVDS1_1_TX1_P
8	LVDS1_VLCD	7	GND
10	LVDS1_1_TX3_N	9	LVDS1_1_TX3_P
12	LVDS1_1_TX2_N	11	LVDS1_1_TX2_P
14	GND	13	GND
16	LVDS1_1_CLK_N	15	LVDS1_1_CLK_P
18	LVDS1_VLCD	17	LVDS1_BL_PWM
20	LVDS1_BKLT	19	LVDS1_BKLT

CN16: LVDS1 Backlight (RM-N8QM only)



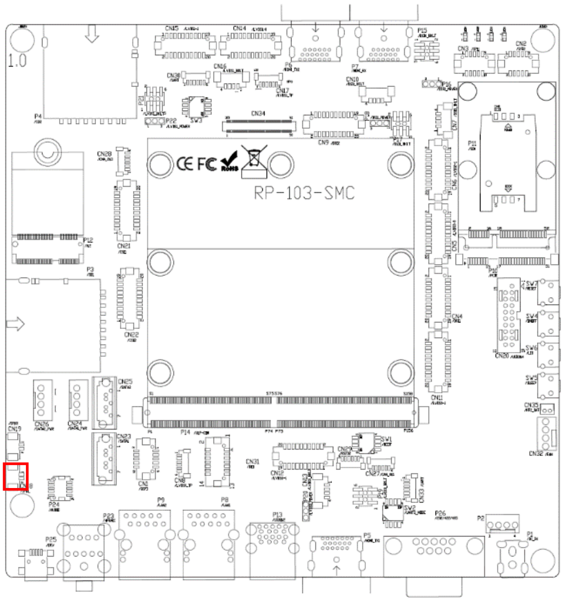
Pin #	Signal Name
1	LVDS1_BKLT
2	LVDS1_BKLT_EN
3	LVDS1_BKLT_PWM
4	GND

CN17: LVDS1 TP (i2c for touch) (RM-N8QM only)



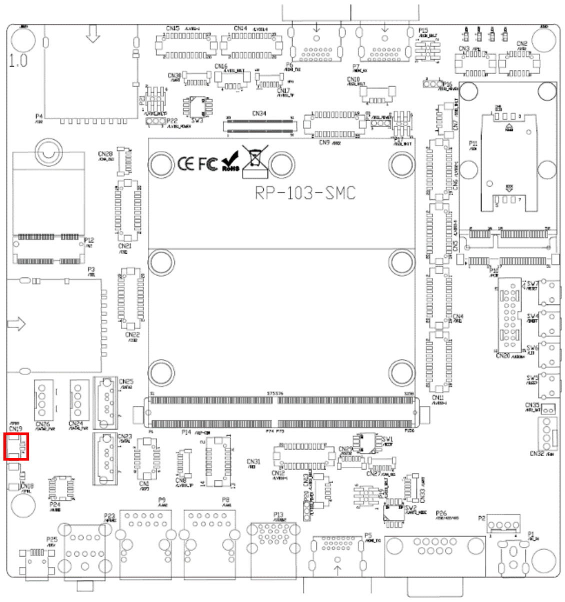
Pin #	Signal Name
1	1V8
2	LVDS1_TP_INT
3	LVDS1_TP_RST_B
4	LVDS1_TS_SCL
5	LVDS1_TS_SDA
6	GND

CN18: Speaker L



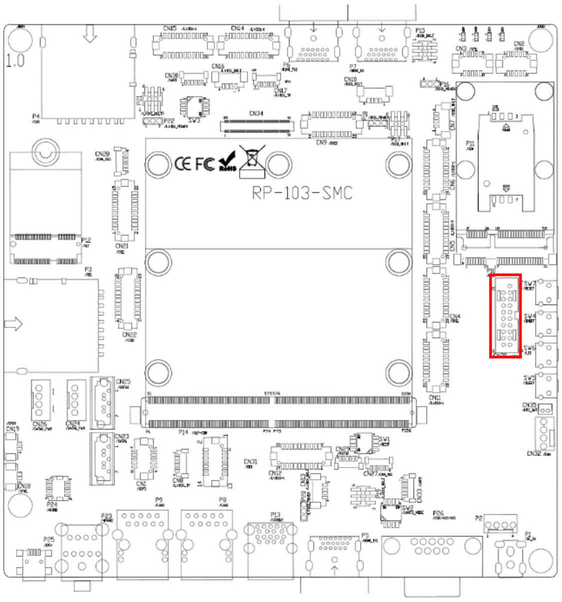
Pin #	Signal Name
1	SPK_LP
2	SPK_LN

CN19: Speaker R



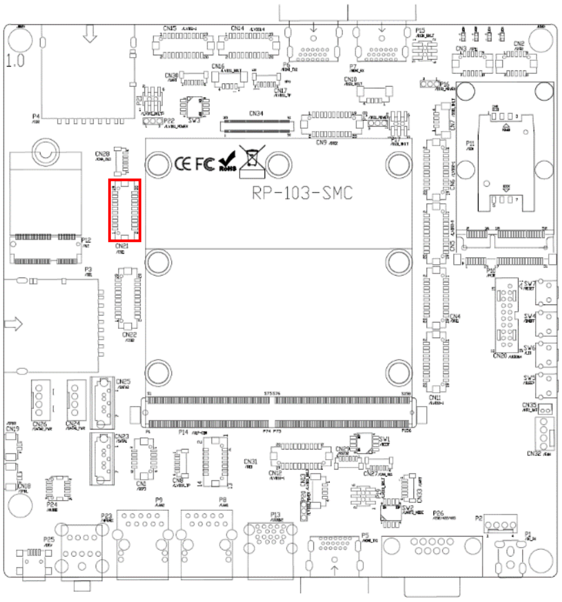
Pin #	Signal Name
1	SPK_RP
2	SPK_RN

CN20: USB3/4



Pin #	Signal Name	Pin #	Signal Name
1	USB_PWR_OUT3	-	-
2	RXDM3	19	USB_PWR_OUT4
3	RXDP3	18	RXDM4
4	GND	17	RXDP4
5	TXDM3	16	GND
6	TXDP3	15	TXDM4
7	GND	14	TXDP4
8	DM3	13	GND
9	DP3	12	DM4
10	N.C.	11	DP4

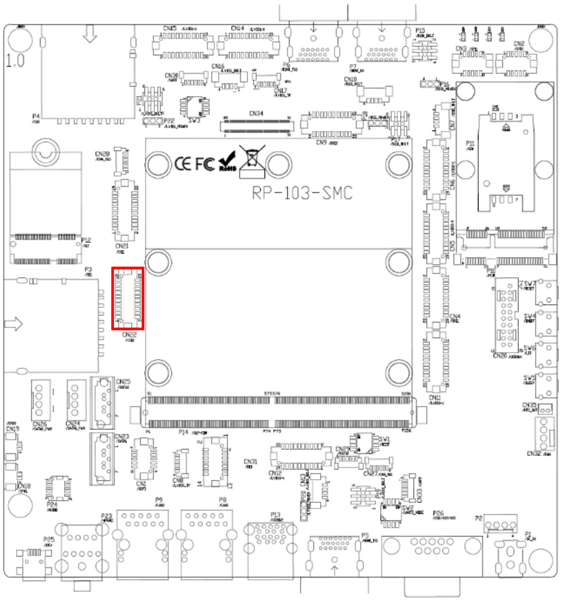
CN21: MIPI CSI1 (RM-N8QM only)



Pin #	Signal Name	Pin #	Signal Name
2	MIPI_CSI1_CKN	1	MIPI_CSI1_CKP
4	MIPI_CSI1_DNO	3	MIPI_CSI1_DP0
6	MIPI_CSI1_DN1	5	MIPI_CSI1_DP1
8	N.C.	7	N.C.
10	N.C.	9	N.C.
12	GND	11	GND
14	CSI1_SDA	13	CSI1_SCL
16	2V8	15	CSI1_RST_B
18	1V8	17	CSI1_PWEN_B
20	GND	19	CSI_MCLK

*Multi-Pin are used with others.

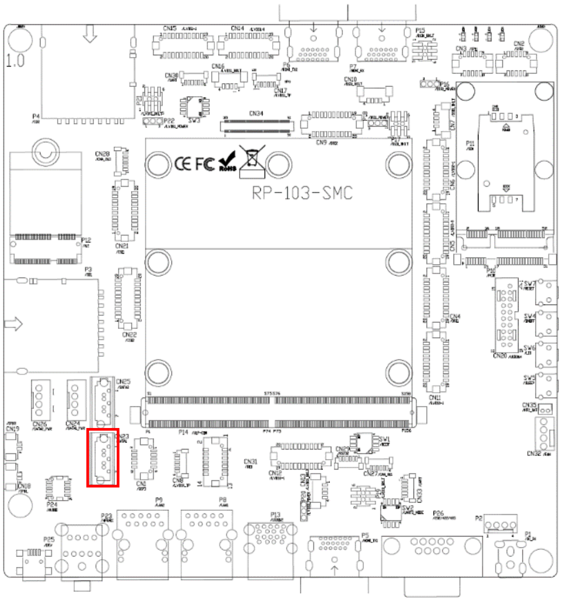
CN22: MIPI CSI1



Pin #	Signal Name	Pin #	Signal Name
2	MIPI_CSI2_CKN	1	MIPI_CSI2_CKP
4	MIPI_CSI2_DNO	3	MIPI_CSI2_DP0
6	MIPI_CSI2_DN1	5	MIPI_CSI2_DP1
8	MIPI_CSI2_DN2	7	MIPI_CSI2_DP2
10	MIPI_CSI2_DN3	9	MIPI_CSI2_DP3
12	GND	11	GND
14	CSI2_SDA	13	CSI2_SCL
16	2V8	15	CSI2_RST_B
18	1V8	17	CSI2_PWEN_B
20	GND	19	CSI_MCLK

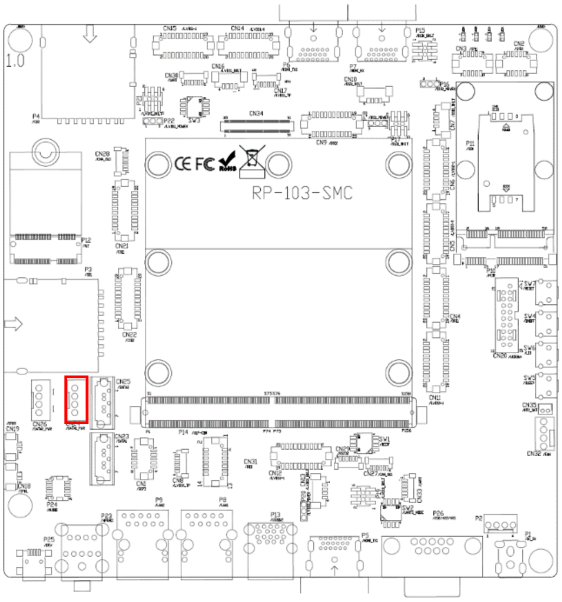
*Multi-Pin are used with others.

CN23: SATA0 (RM-N8QM only)



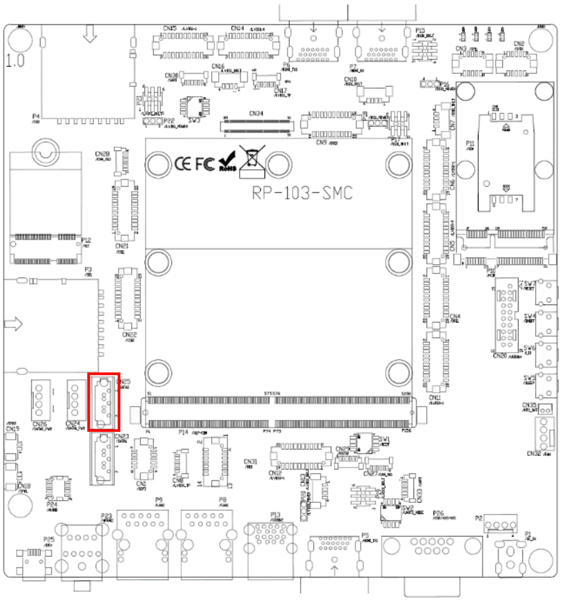
Pin #	Signal Name
1	GND
2	SATA0_TXP
3	SATA0_TXN
4	GND
5	SATA0_RXN
6	SATA0_RXP
7	GND

CN24: SATA power (RM-N8QM only)



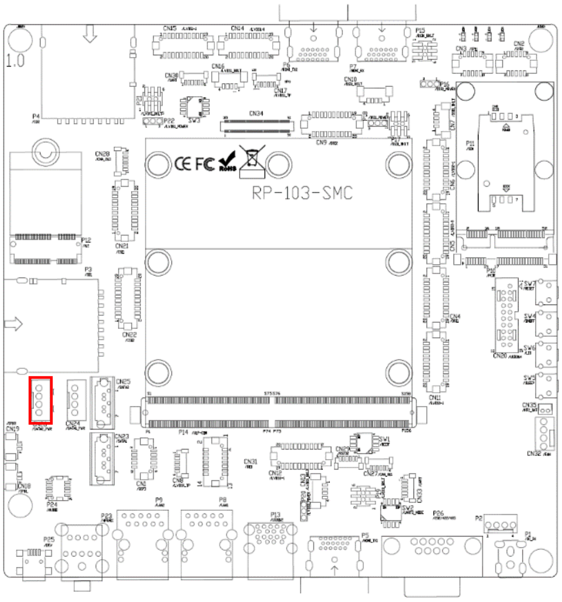
Pin #	Signal Name
1	5V
2	GND
3	GND
4	12V

CN25: SATA1



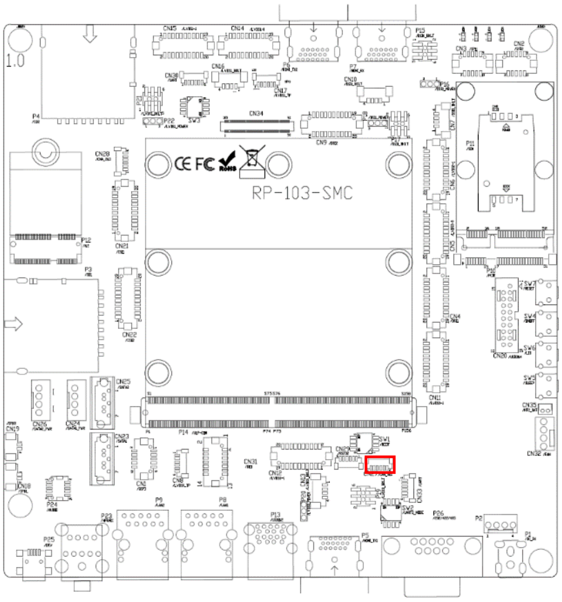
Pin #	Signal Name
1	GND
2	SATA_TXP
3	SATA_TXN
4	GND
5	SATA_RXN
6	SATA_RXP
7	GND

CN26: SATA power



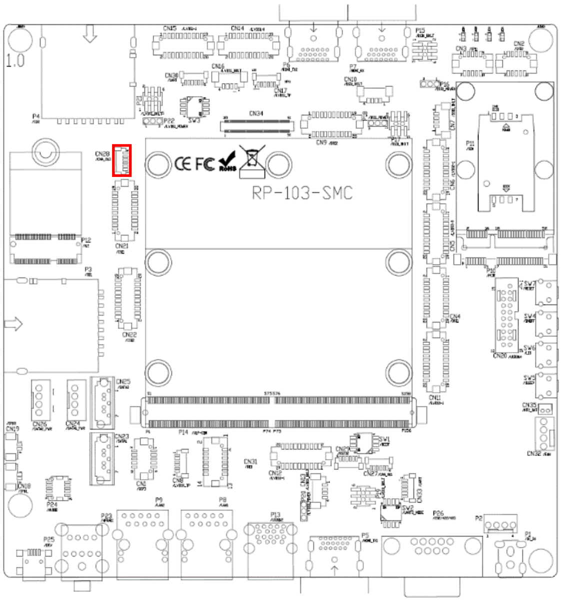
Pin #	Signal Name
1	5V
2	GND
3	GND
4	12V

CN27: CAN0/1 (RM-N8QM only)



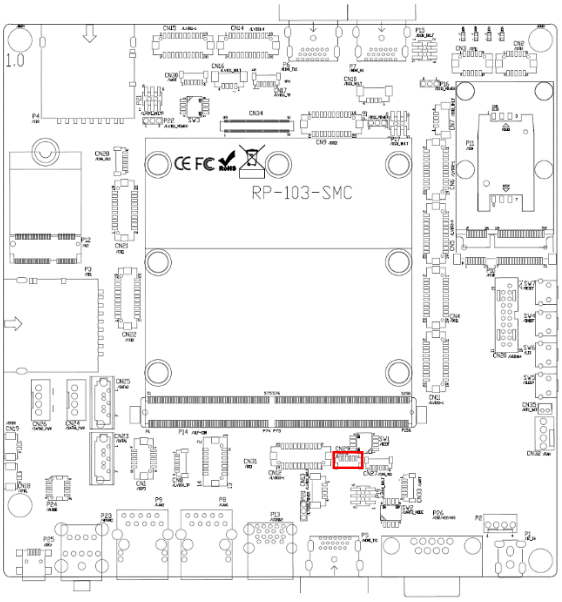
Pin #	Signal Name
1	CAN0_H
2	CAN0_L
3	GND
4	CAN1_H
5	CAN1_L
6	GND

CN28: CAN2/3



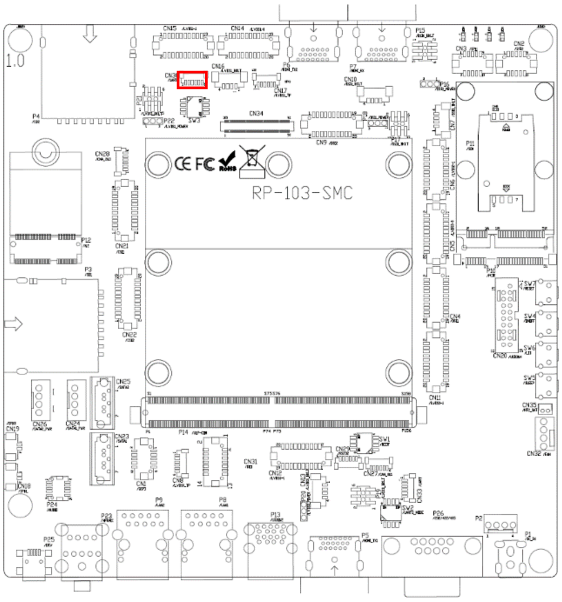
Pin #	Signal Name
1	CAN2_H
2	CAN2_L
3	GND
4	CAN3_H
5	CAN3_L
6	GND

CN29: COM1/3



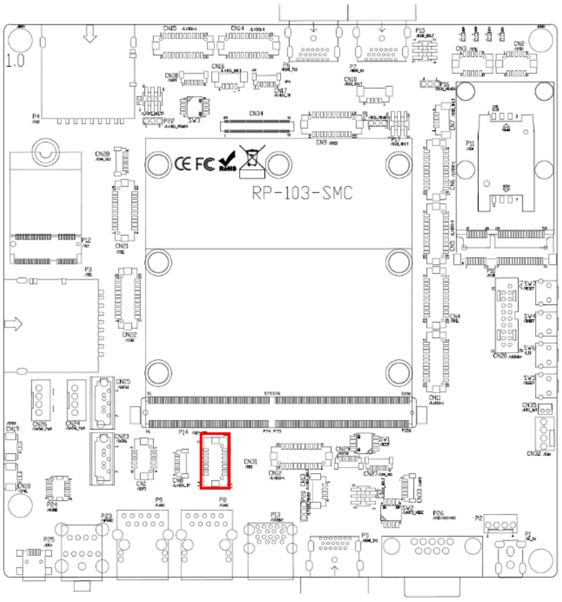
Pin #	Signal Name
1	RS232_1_TX
2	RS232_1_RX
3	GND
4	RS232_3_TX
5	RS232_3_RX
6	GND

CN30: UART0/UART4 (RM-N8QM only)



Pin #	Signal Name
1	UART4_TX
2	UART4_RX
3	GND
4	UART0_TX
5	UART0_RX
6	GND

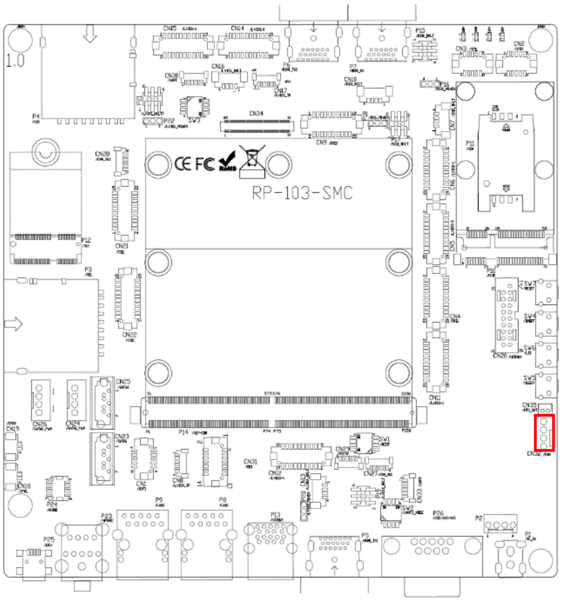
CN31: DIO



Pin #	Signal Name	Pin #	Signal Name
2	GPIO6/M2_I2C_IRQ_B	1	1V8
4	GPIO7/HP_DET_B	3	GPIO0/CSI1_PWEN_B
6	GPIO8/MIC_DET_B	5	GPIO1/CSI2_PWEN_B
8	GPIO9/TP_INT_B	7	GPIO2/CSI1_RST_B
10	GPIO10/TP_RST_B	9	GPIO3/CSI2_RST_B
12	GPIO11/M2_BT_DIS_B	11	GPIO4/HDA_RST_B
14	GND	13	GPIO5/M2_WIFI_DIS_B

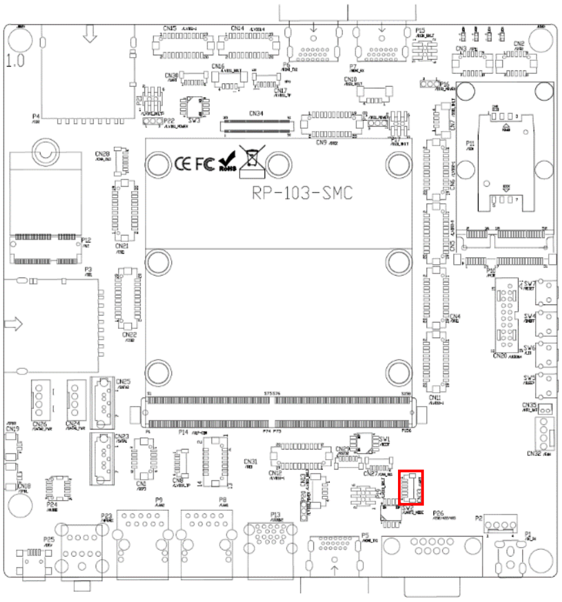
*Multi-Pin are used with others.

CN32: FAN



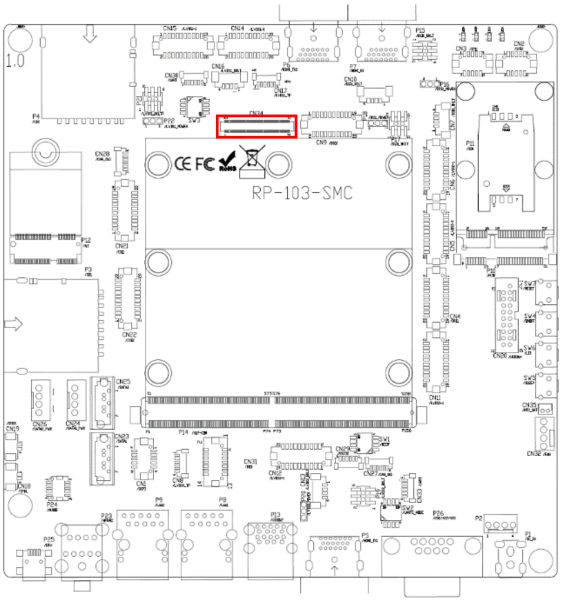
Pin #	Signal Name
1	GND
2	12V
3	N.C.
4	N.C

CN33: UART



Pin #	Signal Name
1	1V8
2	UART_TXD
3	UART_RXD
4	UART_RTS
5	UART_CTS
6	GND

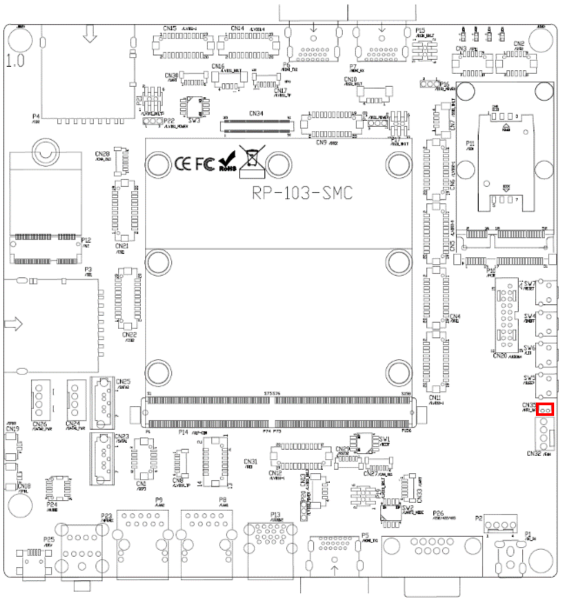
CN34: BTB Conn (RM-N8QM only)



Pin #	Signal Name	Pin #	Signal Name
1	GND	51	GND
2	DSI1_CLK+	52	HDMI_RX_CLK+
3	DSI1_CLK-	53	HDMI_RX_CLK-
4	GND	54	GND
5	DSI1_DAT0+	55	HDMI_RX_DAT0+
6	DSI1_DAT0-	56	HDMI_RX_DAT0-
7	DSI1_DAT1+	57	HDMI_RX_DAT1+
8	DSI1_DAT1-	58	HDMI_RX_DAT1-
9	DSI1_DAT2+	59	HDMI_RX_DAT2+
10	DSI1_DAT2-	60	HDMI_RX_DAT2-
11	DSI1_DAT3+	61	HDMI_RX_ARC+
12	DSI1_DAT3-	62	HDMI_RX_ARC-
13	DSI1_BL_PWM	63	HDMI_RX_CEC
14	DSI1_TS_INT_B	64	HDMI_RX_SCL
15	DSI1_TS_SCL	65	HDMI_RX_SDA
16	DSI1_TS_SDA	66	HDMI_RX_MON
17	GND	67	HDMI_RX_HDP
18	LVDS1_CH0_CLK+	68	M40_UART0_RX
19	LVDS1_CH0_CLK-	69	M40_UART0_TX
20	GND	70	M41_UART4_RX
21	LVDS1_CH0_TX0+	71	M41_UART4_TX
22	LVDS1_CH0_TX0-	72	RSVD
23	LVDS1_CH0_TX1+	73	RSVD
24	LVDS1_CH0_TX1-	74	RSVD
25	LVDS1_CH0_TX2+	75	RSVD

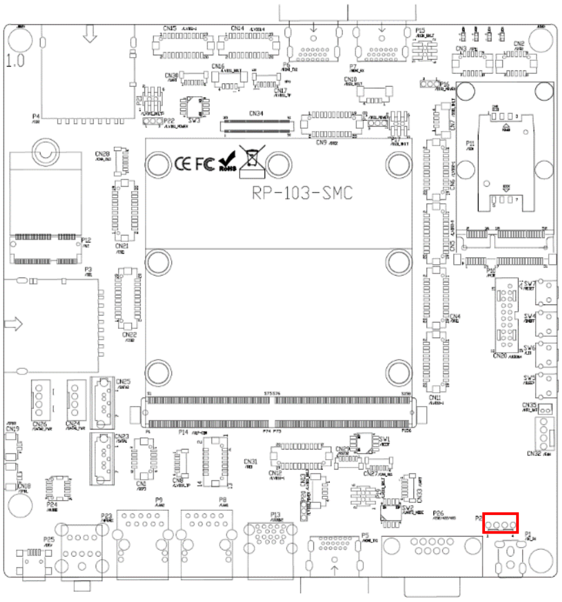
Pin #	Signal Name	Pin #	Signal Name
26	LVDS1_CH0_TX2-	76	GND
27	LVDS1_CH0_TX3+	77	SPI0_SCK
28	LVDS1_CH0_TX3-	78	SPI0_SDO
29	GND	79	SPI0_SDI
30	LVDS1_CH1_CLK+	80	SPI0_CS0
31	LVDS1_CH1_CLK-	81	SPI0_CS1
32	GND	82	SPI3_SCK
33	LVDS1_CH1_TX0+	83	SPI3_SDO
34	LVDS1_CH1_TX0-	84	SPI3_SDI
35	LVDS1_CH1_TX1+	85	SPI3_CS0
36	LVDS1_CH1_TX1-	86	SPI3_CS1
37	LVDS1_CH1_TX2+	87	GND
38	LVDS1_CH1_TX2-	88	SDHC1_CLK
39	LVDS1_CH1_TX3+	89	SDHC1_CMD
40	LVDS1_CH1_TX3-	90	SDHC1_DATA0
41	LVDS1_BL_PWM	91	SDHC1_DATA1
42	LVDS1_TS_INT	92	SDHC1_DATA2
43	LVDS1_I2C_SCL	93	SDHC1_DATA3
44	LVDS1_I2C_SDA	94	SDHC1_DATA4
45	LVDS1_TS_SCL	95	SDHC1_DATA5
46	LVDS1_TS_SDA	96	SDHC1_DATA6
47	GPT0_I2C_CLK	97	SDHC1_DATA7
48	GPT0_I2C_SDA	98	SDHC1_STROBE
49	M41_I2C_SCL	99	SDHC1_RESET_B
50	M41_I2C_SDA	100	SDHC1_VSELECT

CN35: RTC BAT



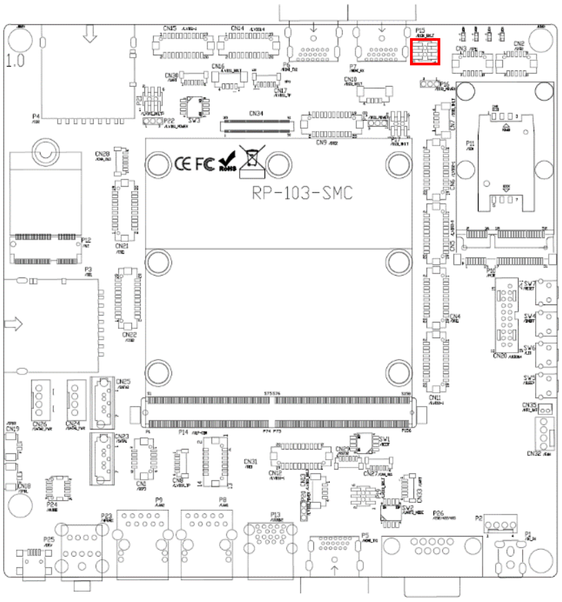
Pin #	Signal Name
1	LI_CELL
2	GND

P2: Internal DC-in



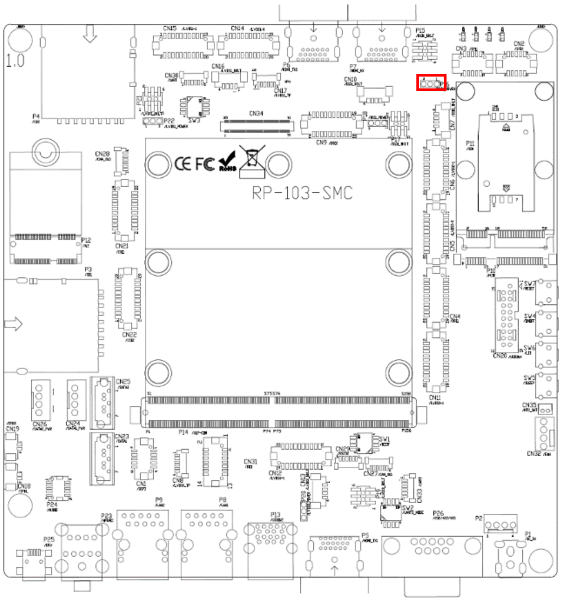
Pin #	Signal Name
1	GND
2	GND
3	DC-IN
4	DC-IN

P15: DSI0/LVDS2 Backlight Power Select



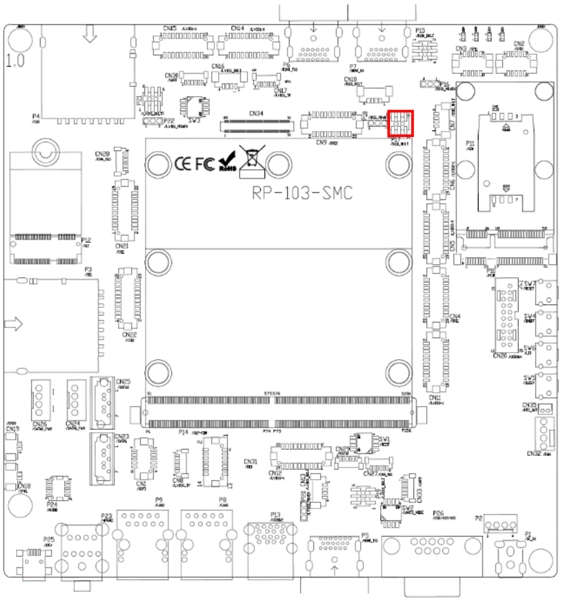
Mode	Setting
3V3	1-2:ON, 3-4:OFF, 5-6:OFF
5V	1-2:OFF, 3-4:ON, 5-6:OFF
12V	1-2:OFF, 3-4:OFF, 5-6:ON

P16: DSI0/LVDS2 LCD Power Select



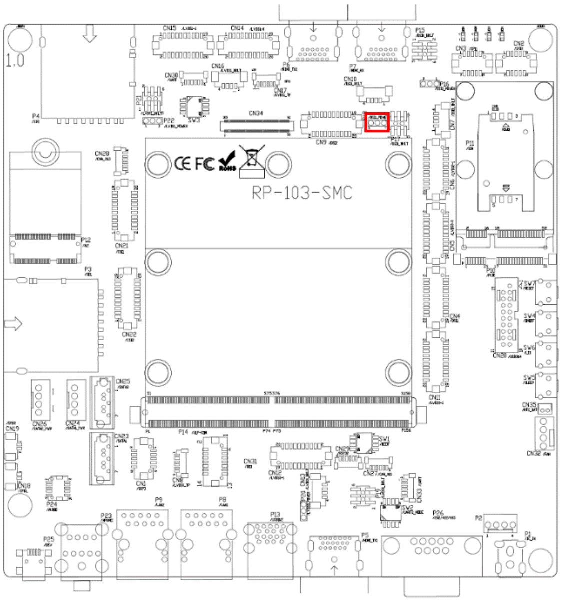
Mode	Setting
3V3	1-2:ON
5V	2-3:ON

P17: DSI1 Backlight Power Select



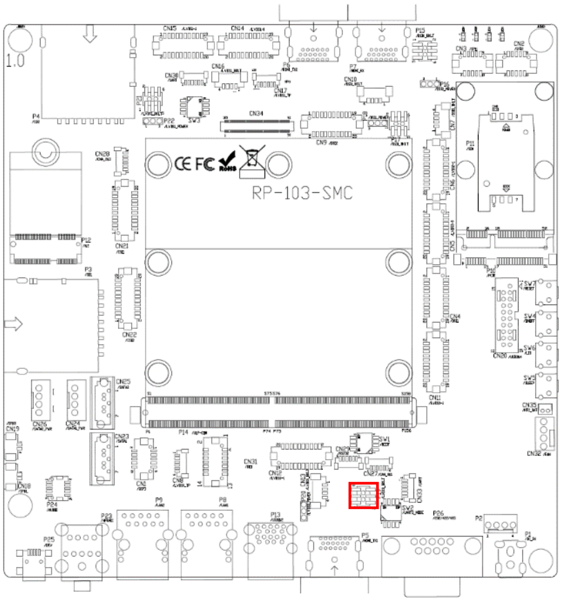
Mode	Setting
3V3	1-2:ON, 3-4:OFF, 5-6:OFF
5V	1-2:OFF, 3-4:ON, 5-6:OFF
12V	1-2:OFF, 3-4:OFF, 5-6:ON

P18: DSI1 LCD Power Select



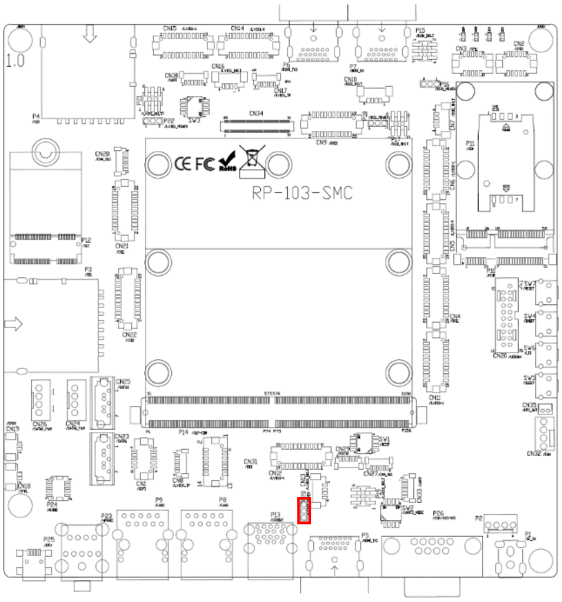
Mode	Setting
3V3	1-2:ON
5V	2-3:ON

P19: LVDS0 Backlight Power Select



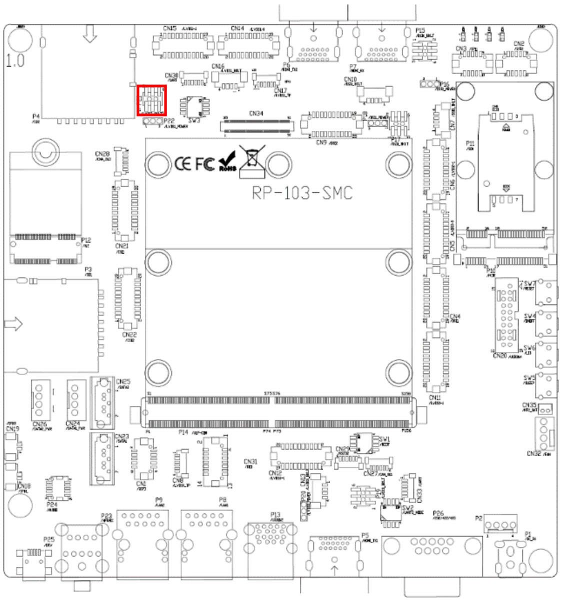
Mode	Setting
3V3	1-2:ON, 3-4:OFF, 5-6:OFF
5V	1-2:OFF, 3-4:ON, 5-6:OFF
12V	1-2:OFF, 3-4:OFF, 5-6:ON

P20: LVDS0 LCD Power Select



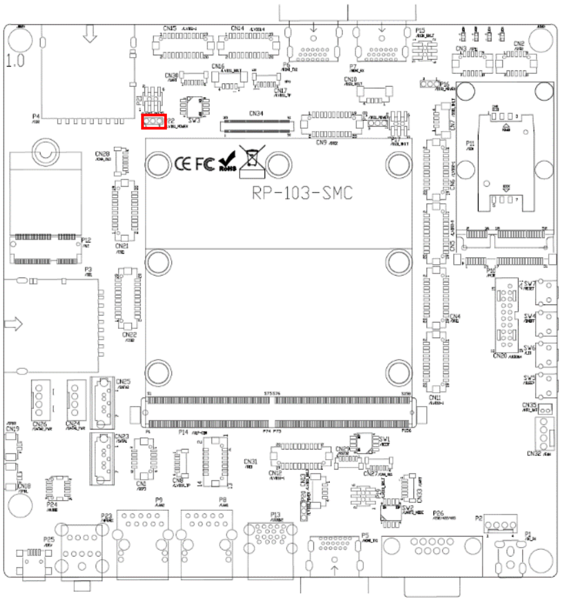
Mode	Setting
3V3	1-2:ON
5V	2-3:ON

P21: LVDS1 Backlight Power Select



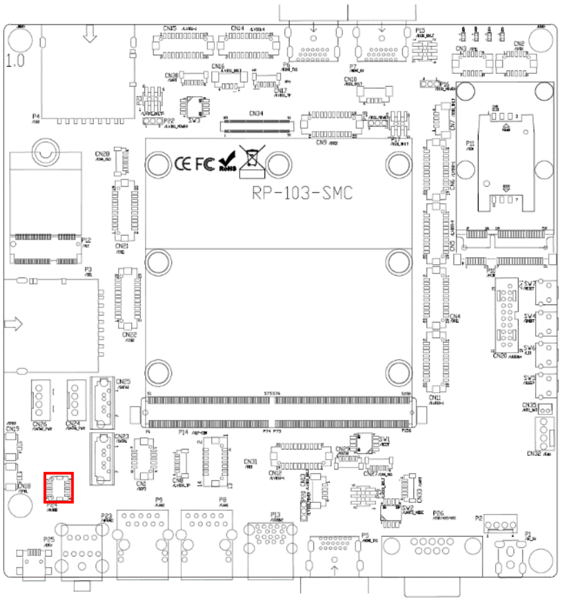
Mode	Setting
3V3	1-2:ON, 3-4:OFF, 5-6:OFF
5V	1-2:OFF, 3-4:ON, 5-6:OFF
12V	1-2:OFF, 3-4:OFF, 5-6:ON

P22: LVDS1 LCD Power Select



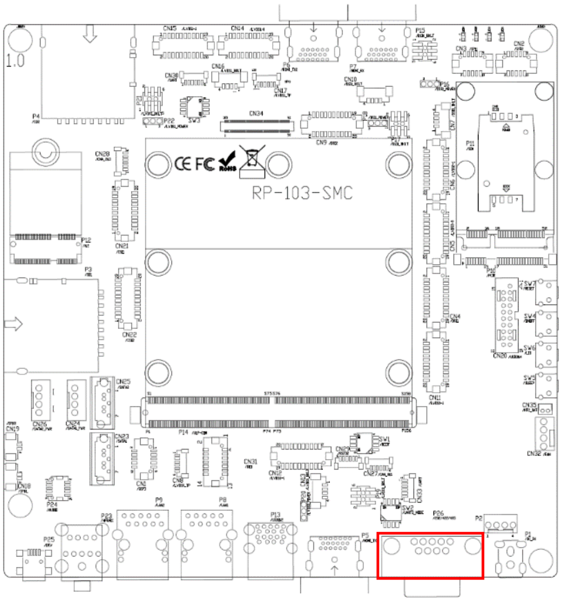
Pin #	Setting
3V3	1-2:ON
5V	2-3:ON

P24: Line In/Out



Pin #	Signal Name	Pin #	Signal Name
1	N.C.	2	Analog_GND
3	LINE_IN_R	4	Analog_GND
5	LINE_IN_L	6	Analog_GND
7	Analog_GND	8	LINE_OUT_L
9	Analog_GND	10	LINE_OUT_R

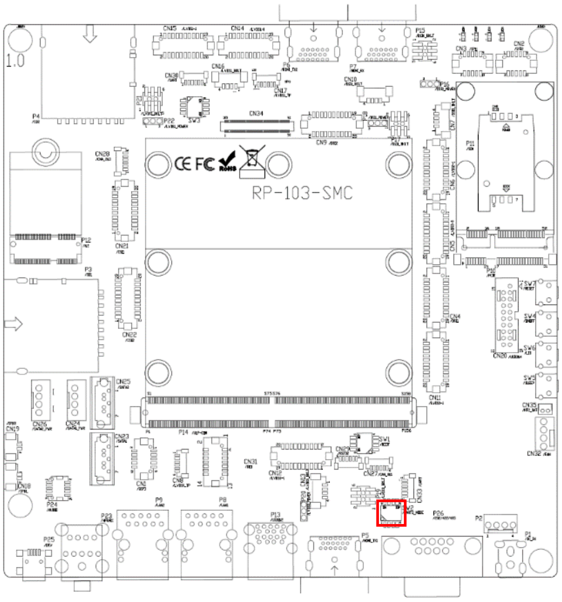
P26: RS232/422/485



Pin #	Signal Name	Pin #	Signal Name
1	DCD, Data carrier detect	6	DSR, Data set ready
2	RXD, Receive data	7	RTS, Request to send
3	TXD, Transmit data	8	CTS, Clear to send
4	DTR, Data terminal ready	9	N.C.
5	GND		

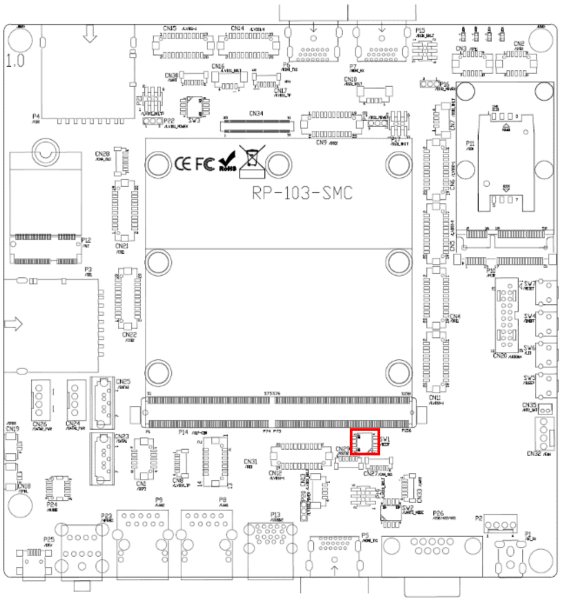
Pin #	RS-232	RS-422	RS-485
1	DCD	TX-	DATA-
2	RX	TX+	DATA+
3	TX	RX+	NC
4	DTR	RX-	NC
5	GND	GND	GND
6	DSR	NC	NC
7	TRT	NC	NC
8	CTS	NC	NC
9	NC	NC	NC

SW2: UART Mode Select (Enable P26 COM port)



SW2				Function	Status
1-8	2-7	3-6	4-5		
OFF	ON	ON	ON	RS-422 Full Duplex	1T/1R RS-422
OFF	OFF	ON	ON	Pure RS-232	3T/5R RS-232
OFF	ON	OFF	ON	RS-485 Half Duplex	1T/1R RS-485,TX Enable Low Active
OFF	OFF	OFF	ON	RS-485 Half Duplex	1T/1R RS-485,TX Enable High Active
OFF	ON	ON	OFF	RS-422 Full Duplex	1T/1R RS-422 with termination resistor
OFF	OFF	ON	OFF	Pure RS-232	1T/1R RS-232 co-exists with RS485
OFF	ON	OFF	OFF	RS-485 Half Duplex	1T/1R RS-485 with termination resistor
OFF	OFF	OFF	OFF	Low Power Shutdown	All I/O pins are High Impedance
ON	x	x	x	x	No output

SW1: Boot Mode Select (for RM-N8QM)

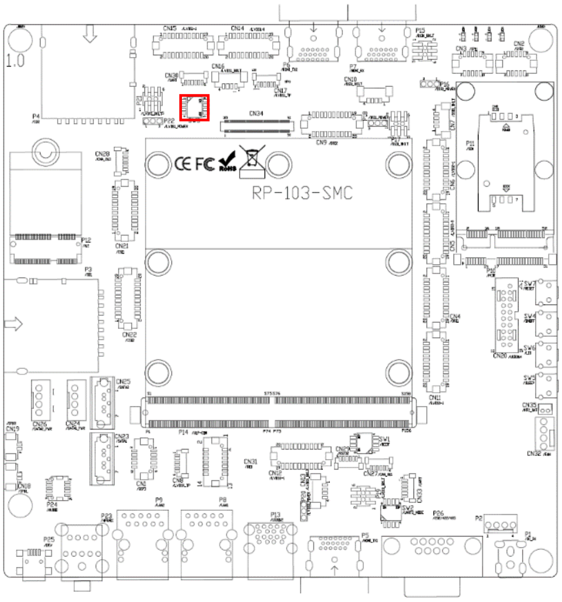


SW1				Function
1-8	2-7	3-6	4-5	
OFF	OFF	ON	OFF	reserve
OFF	ON	OFF	OFF	reserve
ON	OFF	OFF	OFF	reserve
OFF	OFF	OFF	OFF	Module eMMC Flash (Default)
x	x	x	ON	Force Recovery

SW1: Boot Mode Select (for RM-N8M/RM-N8MMI)

SW1				Function
1-8	2-7	3-6	4-5	
ON	ON	OFF	OFF	reserve
OFF	ON	OFF	OFF	reserve
ON	OFF	OFF	OFF	reserve
OFF	OFF	OFF	OFF	Module eMMC Flash (Default)
x	x	x	ON	Force Recovery

SW3: I/O & Display Select



I/O Output Select

SW3_1-8	Function
ON	CN31 I/O Free Definition
OFF	CN31 I/O Normal Function (Default)

DSI0 Output Select

SW3		Function
2-7	3-6	
ON	ON	DSI0 Output
ON	OFF	LVDS2 Output
OFF	x	LVDS0 CH0 Output

DSI1 Output Select

SW3_4-5	Function
ON	HDMI TX2 Output
OFF	DSI1 Output

Chapter 3
Software Setup

- Make a Recovery SD card (for advanced users only)
- Display Parameter Setting in Kernel

3.1 Make a Recovery SD Card and Recovery from SD Card

Note: This is for advanced users with IBASE standard image file only.

3.1.1 Make a Recovery SD Card

1. Set the board to download mode (sw1-A on)
2. Download recovery image
3. Push in an SD Card (4G or more)
4. Power on
5. Run “FW Download SDcard.bat” on recovery image
6. Wait to finish

3.1.2 Upgrade Firmware through the Recovery SD Card

1. Create direction “hmsupdate” to SD card p1 root.
2. Copy release files to “hmsupdate”

```
imx-boot-imx8mqevk-sd.bin-flash_evk
fsl-imx8mq-evk.dtb
Image
rootfs.tar.bz2
recovery.tar.bz2
```

3. Insert SD card in th board
4. Power up the board and the recovery program will start.
5. When recovery is done, power down the board, and pull out the recovery SD card.

3.2 Display Parameter Setting in Kernel

*SMARC2.0 supports HDMI output by default.

1. If you use HDMI to display, run the command below.

```
/home/root/display_config/config_displag_mode.sh 1
```

2. If you use LVDS 21.5” to display, run the command below.

```
/home/root/display_config/config_displag_mode.sh 5
```

Chapter 4
BSP Source Guide

This chapter is dedicated for advanced software engineers to build BSP source. The topics covered in this chapter are as follows:

- Preparation
- Installing Toolchain
- Building release
- Installing release to board

4.1 Building BSP Source

4.1.1 Preparation

The suggested host platform is Ubuntu 12.04 and 14.04 in 32-bit and 64-bit versions.

1. Install necessary packages before building:

```
$ sudo apt-get install gawk wget git-core diffstat unzip texinfo gcc-multilib \
build-essential chrpath socat libsdl1.2-dev
i.MX layers host packages for a Ubuntu 12.04 or 14.04 host setup are:
$ sudo apt-get install libsdl1.2-dev xterm sed cvs subversion coreutils texi2html \
docbook-utils python-pysqlite2 help2man make gcc g++ desktop-file-utils \
libgl1-mesa-dev libglu1-mesa-dev mercurial autoconf automake groff curl lzop asciidoc
i.MX layers host packages for a Ubuntu 12.04 host setup only are:
$ sudo apt-get install uboot-mkimage
i.MX layers host packages for a Ubuntu 14.04 host setup only are:
$ sudo apt-get install u-boot-tools
```

2. Decompress the BSP source file (e.g. RM-N8M-bsp-20200901.tar) into "/home/" folder.

4.1.2 Installing Toolchain

```
Run ./fsl-imx-wayland-glibc-x86_64-meta-toolchain-aarch64-toolchain-4.14-sumo.sh
```

4.1.3 Building release

For Yocto/uBuntu/Debian

```
cd /home/bsp-folder
./build-bsp-4.14.sh
```

For Android

```
cd /home/bsp-folder
source build/envsetup.sh
lunch evk_8mq-userdebug
make   ANDROID_COMPILE_WITH_JACK=false
```

4.1.4 Installing release to board

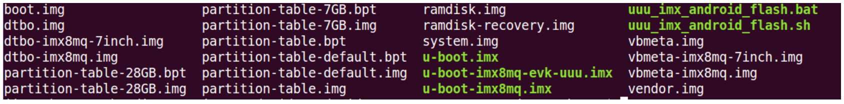
cd /home/bsp-folder

For Yocto/Ubuntu/Debian

1. cp file in release/ to windows
2. Set board to download mode, and connect OTG to USB
3. Run uuu.exe uuu.auto or “FW Download EMMC.bat”

For Android 9

1. Copy the following file in out/target/product/imx8mq/



```
boot.img                  partition-table-7GB.bpt      ramdisk.img                uuu_imx_android_flash.bat
dtbo.img                  partition-table-7GB.img      ramdisk-recovery.img       uuu_imx_android_flash.sh
dtbo-imx8mq-7inch.img     partition-table.bpt          system.img                 vbmeta.img
dtbo-imx8mq.img           partition-table-default.bpt  u-boot.imx                 vbmeta-imx8mq-7inch.img
partition-table-28GB.bpt  partition-table-default.img  u-boot-imx8mq-evk-uuu.imx  vbmeta-imx8mq.img
partition-table-28GB.img  partition-table.img          u-boot-imx8mq.imx          vendor.img
```

2. Set board to download mode, and connect OTG to USB
3. run :

For 7GByte emmc

    uuu_imx_android_flash.bat -f imx8mq   -tos -c 7 –e
    or FW Download emmc 7GB .bat

For 16GByte emmc

    uuu_imx_android_flash.bat -f imx8mq   -tos   –e
    or FW Download emmc 16GB .bat

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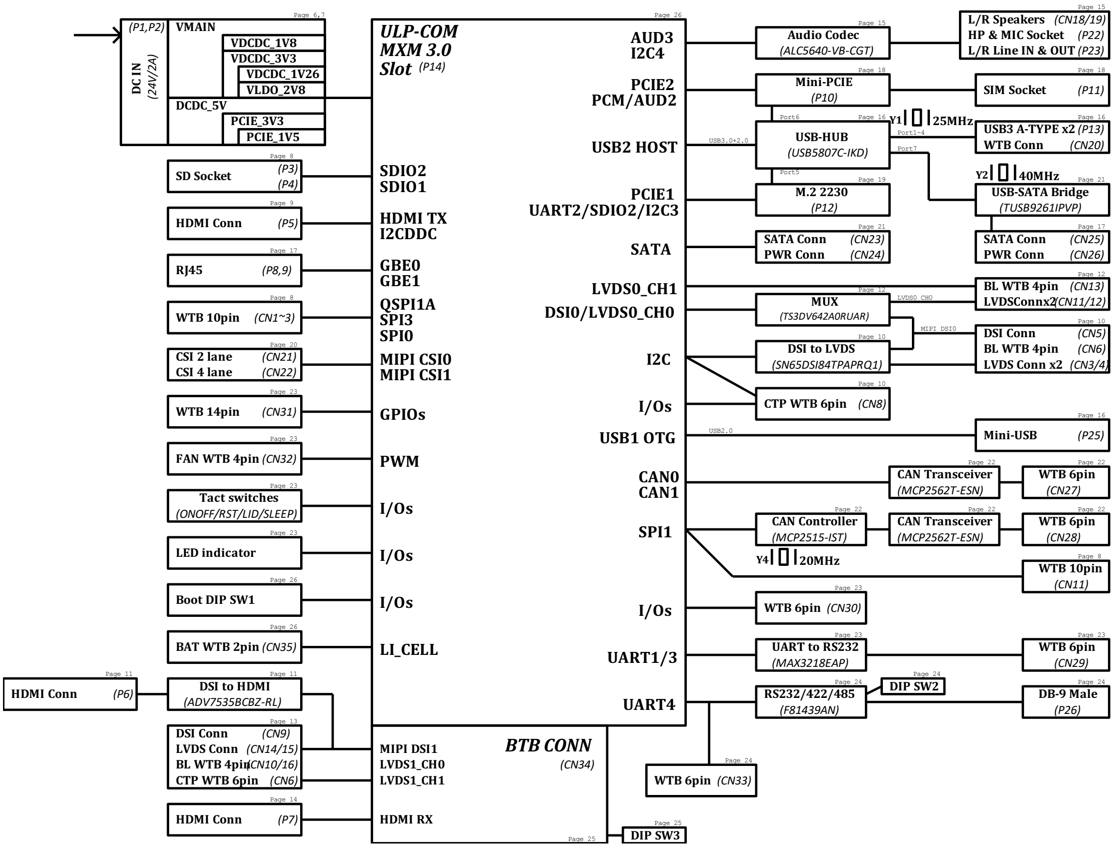
Chapter 5
Carrier Board Design Guide

This Chapter is for advanced EE to create carrier boards (or products). Layout suggestions can also be found for RP-103-SMC carrier board design schematic file. Please contact your sales representative in advance.

- Block Diagram
- SMARC Module Interfaces
- Layout recommendations

5.1 Block Diagram



5.25. 2 SMARC Module Interfaces

Pin No.	Signal Name	Default Function	Input/Output	Default Level	I/O power	Remarks
P1	SMB_ALT_B/GPIO3_15	I/O: I2C IRQ, Active Low	Input	High	1.8V	Can be used as GPIO for other Carrier board
P2	GND	Ground	-	-	-	
P3	CSI_P2_CKP	MIPI CSI2 I/F	Input	-	-	
P4	CSI_P2_CKN	MIPI CSI2 I/F	Input	-	-	
P5	NC	-	-	-	-	
P6	NC	-	-	-	-	
P7	CSI_P2_DP0	MIPI CSI2 I/F	Input	-	-	
P8	CSI_P2_DN0	MIPI CSI2 I/F	Input	-	-	
P9	GND	Ground	-	-	-	
P10	CSI_P2_DP1	MIPI CSI2 I/F	Input	-	-	
P11	CSI_P2_DN1	MIPI CSI2 I/F	Input	-	-	
P12	GND	Ground	-	-	-	
P13	CSI_P2_DP2	MIPI CSI2 I/F	Input	-	-	
P14	CSI_P2_DN2	MIPI CSI2 I/F	Input	-	-	
P15	GND	Ground	-	-	-	
P16	CSI_P2_DP3	MIPI CSI2 I/F	Input	-	-	
P17	CSI_P2_DN3	MIPI CSI2 I/F	Input	-	-	
P18	GND	Ground	-	-	-	
P19	RGMII_TRXN3	Gbit Ethernet I/F	Bidirectional	-	-	
P20	RGMII_TRXP3	Gbit Ethernet I/F	Bidirectional	-	-	
P21	RGMII_LED_10_100	Gbit Ethernet I/F	Output	-	2.5V	
P22	RGMII_LED_1000	Gbit Ethernet I/F	Output	Low	2.5V	
P23	RGMII_TRXN2	Gbit Ethernet I/F	Bidirectional	-	-	
P24	RGMII_TRXP2	Gbit Ethernet I/F	Bidirectional	-	-	
P25	RGMII_LED_ACT	Gbit Ethernet I/F	Output	Low	2.5V	

P26	RGMII_TRXN1	Gbit Ethernet I/F	Bidirectional	-	-	
P27	RGMII_TRXP1	Gbit Ethernet I/F	Bidirectional	-	-	
P28	ETH_AVDDL	Gbit Ethernet I/F	CTREF Power	High	2.5V	
P29	RGMII_TRXN0	Gbit Ethernet I/F	Bidirectional	-	-	
P30	RGMII_TRXP0	Gbit Ethernet I/F	Bidirectional	-	-	
P31	NC	-	-	-	-	
P32	GND	Ground	-	-	-	
P33	SD2_WP_B	SD I/F: I/O-WP detect, Active Low	Input	High	3.3V	Can be used as GPIO for other Carrier board
P34	SD2_CMD	SD I/F	Output	High	3.3V	Can be used as GPIO for other Carrier board
P35	SD2_DET_B	SD I/F: I/O-card detect, Active Low	Input	High	3.3V	Can be used as GPIO for other Carrier board
P36	SD2_CLK	SD I/F	Output	-	3.3V	Can be used as GPIO for other Carrier board
P37	SD2_PWR/GPIO2_19	SD I/F: I/O-Power control, Active High	Output	Low	3.3V	Can be used as GPIO for other Carrier board
P38	GND	Ground	-	-	-	
P39	SD2_DATA0	SD I/F	Bidirectional	-	3.3V	Can be used as GPIO for other Carrier board
P40	SD2_DATA1	SD I/F	Bidirectional	-	3.3V	Can be used as GPIO for other Carrier board
P41	SD2_DATA2	SD I/F	Bidirectional	-	3.3V	Can be used as GPIO for other Carrier board
P42	SD2_DATA3	SD I/F	Bidirectional	-	3.3V	Can be used as GPIO for other Carrier board
P43	CSPI1_SS0	SPI I/F: Chip select, Active Low	Output	High	1.8V	Can be used as GPIO for other Carrier board
P44	CSPI1_SCLK	SPI I/F	Output	-	1.8V	Can be used as GPIO for other Carrier board
P45	CSPI1_MISO	SPI I/F	Output	-	1.8V	Can be used as GPIO for other Carrier board
P46	CSPI1_MOSI	SPI I/F	Input	-	1.8V	Can be used as GPIO for other Carrier board
P47	GND	Ground	-	-	-	
P48	NC	-	-	-	-	
P49	NC	-	-	-	-	
P50	GND	Ground	-	-	-	
P51	NC	-	-	-	-	
P52	NC	-	-	-	-	
P53	GND	Ground	-	-	-	
P54	ESPI_CS0_B	QSPI A I/F Chip select, Active Low	Output	High	1.8V	Can be used as GPIO for other Carrier board
P55	ESPI_CS1_B	QSPI A I/F Chip select, Active Low	Output	High	1.8V	Can be used as GPIO for other Carrier board
P56	ESPI_SCLK	QSPI A I/F	Output	-	1.8V	Can be used as GPIO for other Carrier board
P57	ESPI_IO_0	QSPI A I/F	Bidirectional	-	1.8V	Can be used as GPIO for other Carrier board
P58	ESPI_IO_1	QSPI A I/F	Bidirectional	-	1.8V	Can be used as GPIO for other Carrier board
P59	GND	Ground	-	-	-	
P60	USB1_DP	USB1 I/F	-	-	-	
P61	USB1_DN	USB1 I/F	-	-	-	

P62	USBOTG1_OC_B/GPIO1_13	USB1 I/F: I/O-OverCurrent Detect, Active Low	Input	High	1.8V	Can be used as GPIO for other Carrier board
P63	USBOTG_5V	USB1 I/F Power	-	-	5V	
P64	USB1_ID	USB1 I/F	Input	High	1.8V	
P65	NC	-	-	-	-	
P66	NC	-	-	-	-	
P67	NC	-	-	-	-	
P68	GND	Ground	-	-	-	
P69	NC	-	-	-	-	
P70	NC	-	-	-	-	
P71	USBOTG1_PWR/GPIO1_12	USB1 I/F: I/O-Power control, Active High	Output	Low	1.8V	Can be used as GPIO for other Carrier board
P72	NC	-	-	-	-	
P73	NC	-	-	-	-	
P74	USBOTG2_OC_B/GPIO1_15	USB2 I/F: I/O-OverCurrent Detect, Active Low	Input	High	1.8V	Can be used as GPIO for other Carrier board
P75	M2_RST_B/GPIO3_05	PCIe1 I/F: I/O-Module reset, Active Low	Output	High	1.8V	Can be used as GPIO for other Carrier board
P76	NC	-	-	-	-	
P77	HDMI_AUXP	HDMI I/F	-	-	-	
P78	HDMI_AUXN	HDMI I/F	-	-	-	
P79	GND	Ground	-	-	-	
P80	NC	-	-	-	-	
P81	NC	-	-	-	-	
P82	GND	Ground	-	-	-	
P83	PCIe1_REFCKP	PCIe1 I/F	-	-	-	
P84	PCIe1_REFCKN	PCIe1 I/F	-	-	-	
P85	GND	Ground	-	-	-	
P86	PCIe1_RX_P	PCIe1 I/F	-	-	-	
P87	PCIe1_RX_N	PCIe1 I/F	-	-	-	
P88	GND	Ground	-	-	-	
P89	PCIe1_TX_P	PCIe1 I/F	-	-	-	
P90	PCIe1_TX_N	PCIe1 I/F	-	-	-	
P91	GND	Ground	-	-	-	
P92	HDMI_TX2_P	HDMI I/F	-	-	-	
P93	HDMI_TX2_N	HDMI I/F	-	-	-	
P94	GND	Ground	-	-	-	
P95	HDMI_TX1_P	HDMI I/F	-	-	-	
P96	HDMI_TX1_N	HDMI I/F	-	-	-	
P97	GND	Ground	-	-	-	
P98	HDMI_TX0_P	HDMI I/F	-	-	-	
P99	HDMI_TX0_N	HDMI I/F	-	-	-	
P100	GND	Ground	-	-	-	
P101	HDMI_TXC_P	HDMI I/F	-	-	-	
P102	HDMI_TXC_N	HDMI I/F	-	-	-	
P103	GND	Ground	-	-	-	
P104	HDMI_HPD	HDMI I/F	-	-	-	
P105	HDMI_DDC_SCL	HDMI I/F	-	-	-	

P106	HDMI_DDC_SDA	HDMI I/F	-	-	-	
P107	HDMI_DDCCEC	HDMI I/F	-	-	-	
P108	CSI1_PWEN_B/GPIO3_25	I/O: Camera Module Power control, Active Low	Output	High	1.8V	Can be used as GPIO for other Carrier board
P109	CSI2_PWEN_B/GPIO3_20	I/O: Camera Module Power control, Active Low	Output	High	1.8V	Can be used as GPIO for other Carrier board
P110	CSI1_RST_B/GPIO3_19	I/O: Camera Module Reset control, Active Low	Output	High	1.8V	Can be used as GPIO for other Carrier board
P111	CSI2_RST_B/GPIO3_21	I/O: Camera Module Reset control, Active Low	Output	High	1.8V	Can be used as GPIO for other Carrier board
P112	HDA_RST_B/GPIO1_09	I/O: HAD I2S Reset, Active Low	Output	High	1.8V	Can be used as GPIO for other Carrier board
P113	PWM3_OUT/GPIO5_03	I/O: PWM Output	Output	Low	1.8V	Can be used as GPIO for other Carrier board
P114	TACHIN/GPIO5_05	I/O: Tachometer input detect	Input	-	1.8V	Can be used as GPIO for other Carrier board
P115	CODEC_INT_B/GPIO4_29	I/O: Codec I2C IRQ detect, Active Low	Output	High	1.8V	Can be used as GPIO for other Carrier board
P116	VDCDC_5V_EN/GPIO1_03	I/O: 5V power control, Active High	Output	Low	1.8V	Can be used as GPIO for other Carrier board
P117	TP_INT_B/GPIO4_10	I/O: CapTouch panel IRQ detect, Active Low	Input	Low	1.8V	Can be used as GPIO for other Carrier board
P118	TP_RST_B/GPIO4_27	I/O: CapTouch panel Reset conrol, Active Low	Output	Low	1.8V	Can be used as GPIO for other Carrier board
P119	TP_EN_B/GPIO4_21	I/O: CapTouch panel control, Active Low	Output	Low	1.8V	Can be used as GPIO for other Carrier board
P120	GND	Ground	-	-	-	
P121	I2C4_SCL	I2C I/F	Output	-	1.8V	
P122	I2C4_SDA	I2C I/F	Bidirectional	-	1.8V	
P123	BOOT_SEL0/GPIO1_05	I/O: Bootup mode detect, Active Low	Input	Low	1.8V	Can be used as GPIO for other Carrier board
P124	BOOT_SEL1/GPIO1_06	I/O: Bootup mode detect, Active Low	Input	Low	1.8V	Can be used as GPIO for other Carrier board
P125	NC	-	-	-	-	
P126	RESET_OUT_B	System Reset output, Active Low	Output	Low		
P127	RESET_IN_B	System Reset Input, Active Low	Input	Low		
P128	ONOFF_B	System Power ON/OFF control, Active Low	Input	Low		
P129	UART2_TXD	UART2 I/F	Output	-	1.8V	Can be used as GPIO for other Carrier board
P130	UART2_RXD	UART2 I/F	Input	-	1.8V	Can be used as GPIO for other Carrier board
P131	UART2_RTS	UART2 I/F	Input	-	1.8V	Can be used as GPIO for other Carrier board
P132	UART2_CTS	UART2 I/F	Output	-	1.8V	Can be used as GPIO for other Carrier board
P133	GND	Ground	-	-	-	
P134	UART3_TXD	UART3 I/F	Output	-	1.8V	Can be used as GPIO for other Carrier board
P135	UART3_RXD	UART3 I/F	Input	-	1.8V	Can be used as GPIO for other Carrier board
P136	UART4_TXD	UART4 I/F	Output	-	1.8V	Can be used as GPIO for other Carrier board
P137	UART4_RXD	UART4 I/F	Input	-	1.8V	Can be used as GPIO for other Carrier board

P138	UART4_RTS	UART4 I/F	Input	-	1.8V	Can be used as GPIO for other Carrier board
P139	UART4_CTS	UART4 I/F	Output	-	1.8V	Can be used as GPIO for other Carrier board
P140	UART1_TXD	UART1 I/F, Debug only	Output	-	1.8V	
P141	UART1_RXD	UART1 I/F, Debug only	Input	-	1.8V	
P142	GND	Ground	-	-	-	
P143	NC	-	-	-	-	
P144	NC	-	-	-	-	
P145	NC	-	-	-	-	
P146	NC	-	-	-	-	
P147	VMAIN	System power	-	-	5V	
P148	VMAIN	System power	-	-	5V	
P149	VMAIN	System power	-	-	5V	
P150	VMAIN	System power	-	-	5V	
P151	VMAIN	System power	-	-	5V	
P152	VMAIN	System power	-	-	5V	
P153	VMAIN	System power	-	-	5V	
P154	VMAIN	System power	-	-	5V	
P155	VMAIN	System power	-	-	5V	
P156	VMAIN	System power	-	-	5V	
S1	I2C2_SCL	I2C I/F	-	-	1.8V	
S2	I2C2_SDA	I2C I/F	-	-	1.8V	
S3	GND	Ground	-	-	-	
S4	NC	-	-	-	-	
S5	I2C1_SCL	I2C I/F	-	-	1.8V	
S6	CLKO1_CSI_MCLK	MIPI CSI I/F: CSI MCLK	Output	-	1.8V	Can be used as GPIO for other Carrier board
S7	I2C1_SDA	I2C I/F	-	-	1.8V	
S8	CSI_P1_CKP	MIPI CSI1 I/F	Output	-	-	
S9	CSI_P1_CKN	MIPI CSI1 I/F	Output	-	-	
S10	GND	Ground	-	-	-	
S11	CSI_P1_DP0	MIPI CSI1 I/F	Input	-	-	
S12	CSI_P1_DN0	MIPI CSI1 I/F	Input	-	-	
S13	GND	Ground	-	-	-	
S14	CSI_P1_DP1	MIPI CSI1 I/F	Input	-	-	
S15	CSI_P1_DN1	MIPI CSI1 I/F	Input	-	-	
S16	GND	Ground	-	-	-	
S17	NC	-	-	-	-	
S18	NC	-	-	-	-	
S19	NC	-	-	-	-	
S20	NC	-	-	-	-	
S21	NC	-	-	-	-	
S22	NC	-	-	-	-	
S23	NC	-	-	-	-	
S24	NC	-	-	-	-	
S25	GND	Ground	-	-	-	
S26	NC	-	-	-	-	

S27	NC	-	-	-	-	
S28	NC	-	-	-	-	
S29	NC	-	-	-	-	
S30	NC	-	-	-	-	
S31	NC	-	-	-	-	
S32	NC	-	-	-	-	
S33	NC	-	-	-	-	
S34	GND	Ground	-	-	-	
S35	NC	-	-	-	-	
S36	NC	-	-	-	-	
S37	USB2_VBUS	USB2 Power	-	-	5V	
S38	AP_CODEC_MCLK	I2S I/F: CODEC	Output	-	1.8V	Can be used as GPIO for other Carrier board
S39	AP_AUD3_TXFS	I2S I/F: CODEC	Output	-	1.8V	Can be used as GPIO for other Carrier board
S40	AP_AUD3_TXD	I2S I/F: CODEC	Output	-	1.8V	Can be used as GPIO for other Carrier board
S41	AP_AUD3_RXD	I2S I/F: CODEC	Input	-	1.8V	Can be used as GPIO for other Carrier board
S42	AP_AUD3_TXC	I2S I/F: CODEC	Output	-	1.8V	Can be used as GPIO for other Carrier board
S43	ESPI_DQS_B	QSPI A I/F	Input	-	1.8V	Can be used as GPIO for other Carrier board
S44	NC	-	-	-	-	
S45	NC	-	-	-	-	
S46	NC	-	-	-	-	
S47	GND	Ground	-	-	-	
S48	I2C3_SCL	I2C I/F	Output	-	1.8V	
S49	I2C3_SDA	I2C I/F	Bidirectional	-	1.8V	
S50	HDA_AUD2_TXFS	I2S I/F: HAD	Output	-	1.8V	Can be used as GPIO for other Carrier board
S51	HDA_AUD2_TXD	I2S I/F: HAD	Output	-	1.8V	Can be used as GPIO for other Carrier board
S52	HDA_AUD2_RXD	I2S I/F: HAD	Input	-	1.8V	Can be used as GPIO for other Carrier board
S53	HDA_AUD2_TXC	I2S I/F: HAD	Output	-	1.8V	Can be used as GPIO for other Carrier board
S54	SATA_ACT_B/GPIO3_17	I/O: SATA State detect, Active Low	Input	High	1.8V	Can be used as GPIO for other Carrier board
S55	NC	-	-	-	-	
S56	ESPI_IO_2	QSPI A I/F	-	-	1.8V	Can be used as GPIO for other Carrier board
S57	ESPI_IO_3	QSPI A I/F	-	-	1.8V	Can be used as GPIO for other Carrier board
S58	ECSPI2_RST_B/GPIO3_04	QSPI A I/F: I/O-Reset control, Active Low	Output	High	1.8V	Can be used as GPIO for other Carrier board
S59	NC	-	-	-	-	
S60	NC	-	-	-	-	
S61	GND	Ground	-	-	-	
S62	USB2_TXP	USB2 I/F	-	-	-	
S63	USB2_TXN	USB2 I/F	-	-	-	
S64	GND	Ground	-	-	-	
S65	USB2_RXP	USB2 I/F	-	-	-	

S66	USB2_RXN	USB2 I/F	-	-	-	
S67	GND	Ground	-	-	-	
S68	USB2_DP	USB2 I/F	-	-	-	
S69	USB2_DN	USB2 I/F	-	-	-	
S70	GND	Ground	-	-	-	
S71	USB1_TXP	USB1 I/F	-	-	-	
S72	USB1_TXN	USB1 I/F	-	-	-	
S73	GND	Ground	-	-	-	
S74	USB1_RXP	USB1 I/F	-	-	-	
S75	USB1_RXN	USB1 I/F	-	-	-	
S76	PCIe2_RST_B/GPIO3_03	PCIe2 I/F: IO-Module reset control, Active Low	Output	High	1.8V	Can be used as GPIO for other Carrier board
S77	NC	-	-	-	-	
S78	NC	-	-	-	-	
S79	NC	-	-	-	-	
S80	GND	Ground	-	-	-	
S81	NC	-	-	-	-	
S82	NC	-	-	-	-	
S83	GND	Ground	-	-	-	
S84	PCIe2_REFCKP	PCIe2 I/F	-	-	-	
S85	PCIe2_REFCKN	PCIe2 I/F	-	-	-	
S86	GND	Ground	-	-	-	
S87	PCIe2_RX_P	PCIe2 I/F	-	-	-	
S88	PCIe2_RX_N	PCIe2 I/F	-	-	-	
S89	GND	Ground	-	-	-	
S90	PCIe2_TX_P	PCIe2 I/F	-	-	-	
S91	PCIe2_TX_N	PCIe2 I/F	-	-	-	
S92	GND	Ground	-	-	-	
S93	NC	-	-	-	-	
S94	NC	-	-	-	-	
S95	NC	-	-	-	-	
S96	NC	-	-	-	-	
S97	NC	-	-	-	-	
S98	NC	-	-	-	-	
S99	NC	-	-	-	-	
S100	NC	-	-	-	-	
S101	GND	Ground	-	-	-	
S102	NC	-	-	-	-	
S103	NC	-	-	-	-	
S104	USB2_ID	USB2 USB/F	Input	High	1.8V	
S105	NC	-	-	-	-	
S106	NC	-	-	-	-	
S107	LVDS_BL_PWEN/GPIO4_11	I/O: LVDS LCD Backlight power control, Active High	Output	Low	1.8V	Can be used as GPIO for other Carrier board
S108	NC	-	-	-	-	
S109	NC	-	-	-	-	
S110	GND	Ground	-	-	-	
S111	NC	-	-	-	-	

S112	NC	-	-	-	-	
S113	NC	-	-	-	-	
S114	NC	-	-	-	-	
S115	NC	-	-	-	-	
S116	LVDS_EN/GPIO4_22	I/O: LVDS LCD power control, Active High	Output	Low	1.8V	Can be used as GPIO for other Carrier board
S117	NC	-	-	-	-	
S118	NC	-	-	-	-	
S119	GND	Ground	-	-	-	
S120	NC	-	-	-	-	
S121	NC	-	-	-	-	
S122	LVDS_BL_PWM/PWMO2	LVDS LCD Backlight PWM Clock	Output	Low	1.8V	Can be used as GPIO for other Carrier board
S123	NC	-	-	-	-	
S124	GND	Ground	-	-	-	
S125	DSI_DP0	LVDS0 LVDS/F	-	-	-	
S126	DSI_DN0	LVDS0 LVDS/F	-	-	-	
S127	LCD_BL_PWEN/GPIO4_28	I/O: LCD Backlight power control, Active High	Output	Low	1.8V	Can be used as GPIO for other Carrier board
S128	DSI_DP1	LVDS0 LVDS/F	-	-	-	
S129	DSI_DN1	LVDS0 LVDS/F	-	-	-	
S130	GND	Ground	-	-	-	
S131	DSI_DP2	LVDS0 LVDS/F	-	-	-	
S132	DSI_DN2	LVDS0 LVDS/F	-	-	-	
S133	LCD_EN/GPIO4_01	I/O: LCD power control, Active High	Output	Low	1.8V	Can be used as GPIO for other Carrier board
S134	DSI_CKP	LVDS0 LVDS/F	-	-	-	
S135	DSI_CKN	LVDS0 LVDS/F	-	-	-	
S136	GND	Ground	-	-	-	
S137	DSI_DP3	LVDS0 LVDS/F	-	-	-	
S138	DSI_DN3	LVDS0 LVDS/F	-	-	-	
S139	I2C1_SCL	I2C I/F	Output	-	1.8V	
S140	I2C1_SDA	I2C I/F	Bidirectional	-	1.8V	
S141	LCD_BL_PWM/PWMO1	LCD Backlight PWM Clock	Output	Low	1.8V	Can be used as GPIO for other Carrier board
S142	NC	-	-	-	-	
S143	GND	Ground	-	-	-	
S144	NC	-	-	-	-	
S145	WDOG1_OUTPUT_B	System watch-dog reset output, Active Low	Output	High	1.8V	
S146	PCIe_WAKE_B/GPIO3_10	PCIe I/F: I/O-Wakeup detect, Active Low	Input	High	1.8V	Can be used as GPIO for other Carrier board
S147	LI_CELL	RTC Backup battery power	-	-	2~3.3V	
S148	LID_B/GPIO3_18	I/O: LID Off detect, Active Low	Input	High	1.8V	Can be used as GPIO for other Carrier board
S149	SLEEP_B/GPIO3_16	I/O: System Sleep select detect, Active Low	Input	High	1.8V	Can be used as GPIO for other Carrier board
S150	VIN_PWR_BAD_B	Input Power bad state output, Active Low	Output	Open Drive	-	
S151	CHARGING_B/GPIO3_11	I/O: Battery charging state detect, Active Low	Input	High	1.8V	Can be used as GPIO for other Carrier board

S152	CHARGER_PRSNT_B/GPIO3_12	I/O: DC input detect, Active Low	Input	High	1.8V	Can be used as GPIO for other Carrier board
S153	SYSTEM_STBY_B	System standby state output, Active Low	Output	High	3.3V	
S154	PMIC_ON_REQ	System power on control, Active High	Output	Low	3.3V	
S155	F_RECOV_B/GPIO3_13	I/O: F/W rewritten/restored detect, Active Low	Input	High	1.8V	Can be used as GPIO for other Carrier board
S156	BATTERY_LOW_B/GPIO1_00	I/O: Battery low power state detect, Active Low	Input	High	1.8V	Can be used as GPIO for other Carrier board
S157	AT_DET_B/GPIO4_20	I/O: PCBA autotest detect, active Low	Input	High	1.8V	Can be used as GPIO for other Carrier board
S158	GND	Ground	-	-	-	

5.35.3 Layout Recommendations

Signal impedance recommendation

Signal Group	**Impedance**	**Layout Tolerance (±)**
All signals, unless specified	50 Ω Single End	10%
PCIE_TX/RX Diff signals	85 Ω Differential	10%
USB Diff signals	90 Ω Differential	10%
Diff signals: LVDS, SATA, HDMI, DDR, PCIE_CLK,MIPI	100 Ω Differential	10%
(CSI & DSI), MLB, PHY IC to Ethernet Connector		

PCB stack up and trace width/space recommendation (based on RP-103-SMC reference board)

L1. Top signals
L2. GND
L3. Int1 signals
L4. Int2 signals
L5. Power
L6. Bottom signals

Micro strip			
Layer	Trace width/space	Single-End	Differential
1,6	5.5	50 +/- 10 %	
1,6	4.5/4/4.5		85 +/- 10 %
1,6	4/4.5/4		90 +/- 10 %
1,6	4/7/4		100 +/- 10 %

Strip line			
Layer	Trace width/space	Single-End	Differential
3,4	5.5	50 +/- 10 %	
3,4	4.5/4/4.5		85 +/- 10 %
3,4	4/4.5/4		90 +/- 10 %
3,4	4/7/4		100 +/- 10 %

Layer	Glass Style & Cu Wt.	Thickness
L1	0.5OZ plating to 1OZ	1.4
P.P	3313	3.6
L2	0.5OZ	0.65
CORE	0.102 FR-4	4
L3	0.5OZ	0.65
P.P	7628	7.1
CORE	0.71 FR-4	28
P.P	7628	7.1
L4	0.5OZ	0.65
CORE	0.102 FR-4	4
L5	0.5OZ	0.65
P.P	3313	3.6
L6	0.5OZ plating to 1OZ	1.4

Total thickness 62.8mil 1.595mm

Appendix

1. How to Use GPIO in Linux Dsdsd
2. How to Use Watchdog in LinuxSdsd
3. eMMC Test
4. USB (flash disk) Test
5. SD Card Test
6. RS-232 Test
7. RS-485 Test
8. Audio Test
9. Ethernet Test
10. LVDS Test
11. HDMI Test
12. SATA (hard disk) Test
13. CAN Test

1. How to Use GPIO in Linux Dsdsd

```
# Take gpio1_0    as example, export value:1*32+0=32

# GPIO example 1: Output
echo 32 > /sys/class/gpio/export
echo out > /sys/class/gpio/gpio40/direction
echo 0 > /sys/class/gpio/gpio40/value
echo 1 > /sys/class/gpio/gpio40/value

# GPIO example 2: Input
echo 32 > /sys/class/gpio/export
echo in > /sys/class/gpio/gpio40/direction
cat /sys/class/gpio/gpio40/value
```

2. How to Use Watchdog in LinuxSdsd

```
// create fd
int fd;
//open watchdog device
fd = open("/dev/watchdog", O_WRONLY);
//get watchdog support
ioctl(fd, WDIOC_GETSUPPORT, &ident);
//get watchdog status
ioctl(fd, WDIOC_GETSTATUS, &status);
//get watchdog timeout
ioctl(fd, WDIOC_GETTIMEOUT, &timeout_val);
//set watchdog timeout
ioctl(fd, WDIOC_SETTIMEOUT, &timeout_val);
//feed dog
ioctl(fd, WDIOC_KEEPALIVE, &dummy);
```

3. eMMC Test

Note: This operation may damage the data stored in eMMC flash. Before starting the test, make sure there is no critical data in the eMMC flash being used.

- **Read, write, and check**

```
MOUNT_POINT_STR="/var"

#create data file
dd if=/dev/urandom of=/tmp/data1 bs=1024k count=10
#write data to emmc
dd if=/tmp/data1 of=$MOUNT_POINT_STR/data2
bs=1024k count=10
#read data2, and compare    with data1
cmp $MOUNT_POINT_STR/data2 /tmp/data1
```

- **eMMC speed test**

```
MOUNT_POINT_STR="/var"

#get    emmc write speed"
time dd if=/dev/urandom of=$MOUNT_POINT_STR/test
bs=1024k count=10
# clean caches
echo 3 > /proc/sys/vm/drop_caches
#get    emmc read speed"
time dd if=$MOUNT_POINT_STR/test of=/dev/null
bs=1024k count=10
```

4. USB (flash disk) Test

Insert the USB flash disk. Ensure that it is in the SMARC device list.

Note: This operation may damage the data stored in the USB flash disk. Before starting the test, make sure there is no critical data in the eMMC flash being used.

- **Read, write, and check**

```
USB_DIR="/run/media/mmcblk1p1"
#create data file
dd if=/dev/urandom of=/var/data1 bs=1024k count=100
#write data to usb flash disk
dd if=/var/data1 of=$USB_DIR/data2 bs=1024k
count=100
#read data2, and compare    with data1
cmp $USB_DIR/data2 /var/data1
```

- **USB speed test**

```
USB_DIR="/run/media/mmcblk1p1"
# usb write speed
dd if=/dev/zero of=$BASIC_DIR/$i/test bs=1M
count=1000 oflag=nocache

# usb read speed
dd if=$BASIC_DIR/$i/test of=/dev/null bs=1M
oflag=nocache
```

5. SD Card Test

When SMARC is booted from eMMC, SD card is “/dev/mmcblk1” and able to see by “ls /dev/mmcblk1*” command:

```
/dev/mmcblk1    /dev/mmcblk1p2 /dev/mmcblk1p4
/dev/mmcblk1p5 /dev/mmcblk1p6
```

When SMARC is booted from SD card, replace test pattern “/dev/mmcblk1” to “/dev/mmcblk0”.

Note: This operation may damage the data stored the SD card. Before starting the test, make sure there is no critical data in the eMMC flash being used.

- **Read, write, and check**

```
SD_DIR="/run/media/mmcblk1"
#create data file
dd if=/dev/urandom of=/var/data1 bs=1024k count=100
#write data to SD card
dd if=/var/data1 of=$ SD_DIR/data2 bs=1024k count=100
#read data2, and compare    with data1
cmp $SD_DIR/data2 /var/data1
```

- **SD card speed test**

```
SD_DIR="/run/media/mmcblk1"

# SD write speed
dd if=/dev/zero of=$SD_DIR/test bs=1M count=1000
oflag=nocache

# SD read speed
dd if=$SD_DIR/test of=/dev/null bs=1M oflag=nocache
```

6. RS-232 Test

```
//open ttymxc1
fd    = open(/dev/ttymxc1,O_RDWR );

//set speed
tcgetattr(fd, &opt);
cfsetispeed(&opt, speed);
cfsetospeed(&opt, speed);
tcsetattr(fd, TCSANOW, &opt)

//get_speed
tcgetattr(fd, &opt);
speed = cfgetispeed(&opt);

//set_parity
// options.c_cflag
options.c_cflag &= ~CSIZE;
options.c_cflag &= ~CSIZE;
options.c_lflag    &= ~(ICANON | ECHO | ECHOE | ISIG);
/*Input*/
options.c_oflag    &= ~OPOST;      /*Output*/
//options.c_cc
options.c_cc[VTIME] = 150;
options.c_cc[VMIN] = 0;
#set parity
tcsetattr(fd, TCSANOW, &options)

//write ttymxc1
write(fd, write_buf, sizeof(write_buf));

//read ttymxc1
read(fd, read_buf, sizeof(read_buf)))
```

7. RS-485 Test

```
//open ttymxc1
fd    = open(/dev/ttymxc1,O_RDWR );

//set speed
tcgetattr(fd, &opt);
cfsetispeed(&opt, speed);
cfsetospeed(&opt, speed);
tcsetattr(fd, TCSANOW, &opt

//get_speed
tcgetattr(fd, &opt);
speed = cfgetispeed(&opt);

//set_parity
// options.c_cflag
options.c_cflag &= ~CSIZE;
options.c_cflag &= ~CSIZE;
options.c_lflag    &= ~(ICANON | ECHO | ECHOE | ISIG);  /*Input*/
options.c_oflag    &= ~OPOST;      /*Output*/
//options.c_cc
options.c_cc[VTIME] = 150;
options.c_cc[VMIN] = 0;
#set parity
tcsetattr(fd, TCSANOW, &options)

//write ttymxc1
write(fd, write_buf, sizeof(write_buf));

//read ttymxc1
read(fd, read_buf, sizeof(read_buf)))
```

8. Audio Test

```
// play mp3 by audio (ALC5640)
gplay-1.0 /home/root/ testscript/audio/a.mp3
// record mp3 by audio (ALC5640)
arecord -f cd $basepath/b.mp3 -D plughw:1,0
```

9. Ethernet Test

- **Ethernet FTP test**

```
#intall ftp
chmod 777
/home/root/testscript/ethernet/lftp_library/lftp
cp /home/root/testscript/ethernet/lftp_library/lftp
/usr/bin/
cp /home/root/testscript/ethernet/lftp_library/*.so
/usr/lib/ -rf
cp /home/root/testscript/ethernet/lftp_library/* /lib/

#lftp server 192.168.1.123
lftp 192.168.1.123 <<EOF
#upload data to server   192.168.1.123
put data1
#download data from server   192.168.1.123
get data1
#exit lftp
bye
```

- **Ethernet Ping test**

```
#ping server 192.168.1.123
ping -c 20 192.168.1.123 >/tmp/ethernet_ping.txt
```

- **Ethernet TCP test**

```
#server 192.168.1.123 run command   “iperf3 -s”
#communicate with server 192.168.1.123 in tcp mode by
iperf3
iperf3 -c 192.168.1.123 -i 1 -t 20 -w 32M -P 4
```

- **Ethernet UDP test**

```
#server 192.168.1.123 run command   “iperf3 -s”
#communicate with server 192.168.1.123 in udp mode by
iperf3
iperf3 -c $SERVER_IP -u -i 1 -b 200M
```

10. LVDS Test

```
//Open the file for reading and writing
framebuffer_fd = open("/dev/fb0", O_RDWR);

// Get fixed screen information
ioctl(framebuffer_fd, FBIOGET_FSCREENINFO, &finfo)

// Get variable screen information
ioctl(framebuffer_fd, FBIOGET_VSCREENINFO, &vinfo)

// Figure out the size of the screen in bytes
screensize = vinfo.xres * vinfo.yres * vinfo.bits_per_pixel / 8;

// Map the device to memory
fbp = (char *)mmap(0, screensize, PROT_READ | PROT_WRITE,
MAP_SHARED, framebuffer_fd, 0);

// Figure out where in memory to put the pixel
memset(fbp, 0x00,screensize);

//draw point by fbp
long int location = 0;
location = (x+g_xoffset) * (g_bits_per_pixel/8) +
  (y+g_yoffset) * g_line_length;
*(fbp + location + 0) = color_b;
*(fbp + location + 1) = color_g;
*(fbp + location + 2) = color_r;

//close framebuffer fd
close(framebuffer_fd);
```

11. HDMI Test

- **HDMI display test**

```
//Open the file for reading and writing
framebuffer_fd = open("/dev/fb2", O_RDWR);

// Get fixed screen information
ioctl(framebuffer_fd, FBIOGET_FSCREENINFO, &finfo)

// Get variable screen information
ioctl(framebuffer_fd, FBIOGET_VSCREENINFO, &vinfo)

// Figure out the size of the screen in bytes
screensize = vinfo.xres * vinfo.yres * vinfo.bits_per_pixel
/ 8;

// Map the device to memory
fbp = (char *)mmap(0, screensize, PROT_READ |
PROT_WRITE, MAP_SHARED, framebuffer_fd, 0);

// Figure out where in memory to put the pixel
memset(fbp, 0x00,screensize);

//draw point by fbp
long int location = 0;
location = (x+g_xoffset) * (g_bits_per_pixel/8) +
  (y+g_yoffset) * g_line_length;
*(fbp + location + 0) = color_b;
*(fbp + location + 1) = color_g;
*(fbp + location + 2) = color_r;

//close framebuffer fd
close(framebuffer_fd);
```

- **HDMI audio test**

```
#enable hdmi audio
echo 0 > /sys/class/graphics/fb2/blank
#play wav file by    hdmi audio
aplay /home/root/testscript/hdmi/1K.wav -D plughw:0,0
```

12. SATA (hard disk) Test

Insert the hard disk. Ensure it is in the SMARC device list.

Note: This operation may damage the data stored in the hard disk. Before starting the test, make sure there is no critical data in the hard disk being used.

- **Reading & writing test**

```
HD_DIR="/run/media/mmcblk1p1"
#create data file
dd if=/dev/urandom of=/var/data1 bs=1024k count=100
#write data to hard disk
dd if=/var/data1 of=$ HD_DIR/data2 bs=1024k
count=100
#read data2, and compare   with data1
cmp $HD_DIR/data2 /var/data1
```

- **Hard disk speed test**

```
HD_DIR="/run/media/mmcblk1p1"
# hard disk write speed
dd if=/dev/zero of=$HD_DIR/$i/test bs=1M count=1000
oflag=nocache

# hard disk read speed
dd if=$HD_DIR/$i/test of=/dev/null bs=1M oflag=nocache
```

13. CAN Test

- **Checking CAN GPIO**

```
#config can pin to gpio
/home/root/testscript/can/memtool -32    0x20e0208 = 5
echo "106"    > /sys/class/gpio/export
#config gpio to out mode
echo "out" > /sys/class/gpio/gpio106/direction
#set gpio to 1
echo    1       > /sys/class/gpio/gpio106/value
#set gpio to 1
echo    0       > /sys/class/gpio/gpio106/value
#config gpio to in mode
echo "in" > /sys/class/gpio/gpio106/direction
#get gpio value
ret0_0=`cat /sys/class/gpio/gpio106/value`
```

- **Testing CAN**

```
#config can parrameter
ip link set can0 type can bitrate 125000 triple-sampling on
#enable can
ifconfig can0 up
#disable
ifconfig can0 down
#send data
cangen can0 &
#receive data
candump -n 10 can1 -T 5000
```