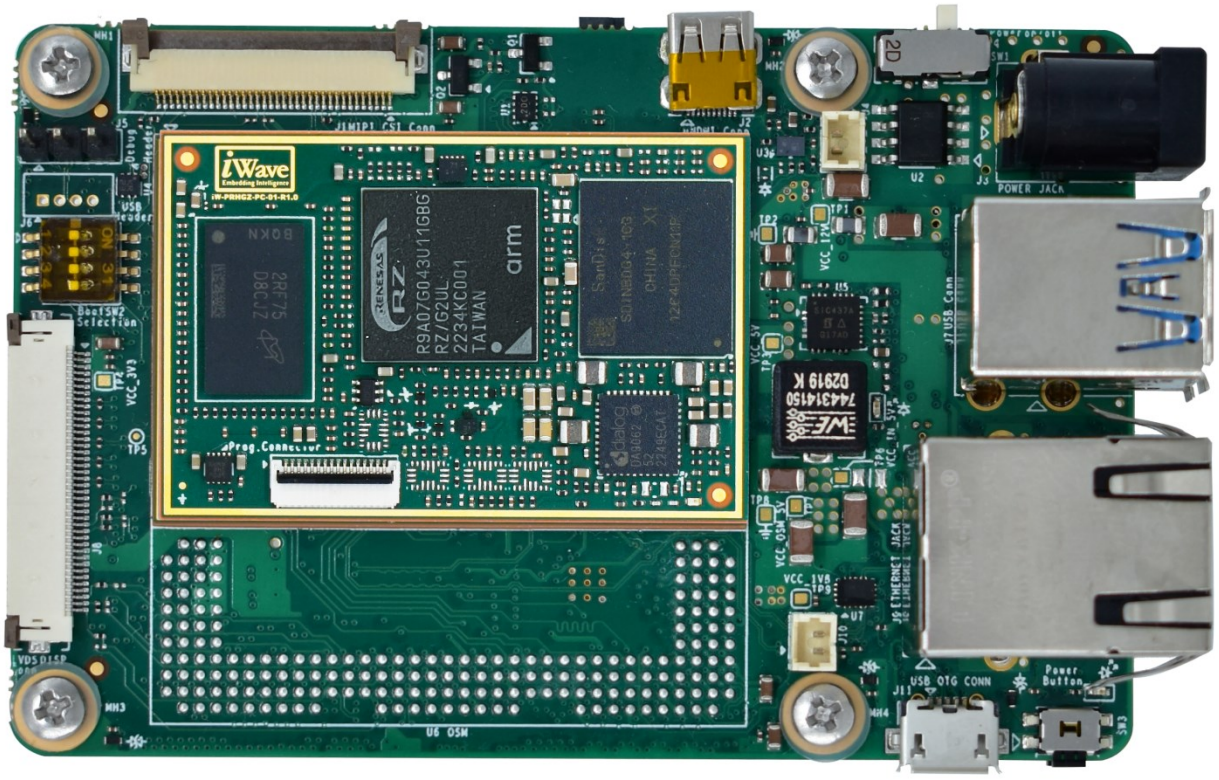
iW-RainboW-G53S
RZ/G2UL or RZ/A3UL or RZ/FIVE
SBC Datasheet



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Document Revision History

Document Number		iW-PRGJJ-UM-01-R1.0-REL0.1-Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE SBC Datasheet
Revision	**Date**	**Description**
0.1	20th July 2023	Draft Release Version
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Table of Contents

List of Figures

List of Tables

1. INTRODUCTION

1.1 Purpose

This document is the datasheet for the Single Board Computer based on the Renesas RZ/G2UL or RZ/ A3UL or RZ/FIVE MPU. This board is fully supported by iWave Systems Technologies Pvt. Ltd. This document provides detailed information on the overall design and usage of the Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC from a Hardware Systems perspective.

1.2 Renesas RZ/G2UL or RZ/A3UL or RZ/ FIVE based SBC Overview

The Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based is a versatile small form factor SBC (Single Board Computer) definition targeting application that require low power, low costs, and high performance. The SBCs are used as building blocks for portable and stationary embedded systems. The core CPU and support circuits, including DRAM, boot flash, power sequencing, CPU power supplies and GbE are concentrated on the SBC.

Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE MPU based Single Board computer is rich with Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE MPU features along with eMMC, Gigabit Ethernet PHY, MIPI Camera, RGB Display and comes in compact 85mm x 56mm form factor.

1.3 List of Acronyms

The following acronyms will be used throughout this document.

Table 1: Acronyms & Abbreviations

Acronyms	Abbreviations
ARM	Advanced RISC Machine
CAN	Controller Area Network
CMOS	Complementary Metal-Oxide Semiconductor
CODEC	Coder-Decoder
CPU	Central Processing Unit
CSI	Camera Serial Interface
CTS	Clear to Send
DC	Direct current
DRAM	Dynamic Random Access Memory
DSI	Display Serial Interface
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
eMMC	Enhanced Multi Media Card
EMS	Electronics manufacturing services
FLEXCAN	Flexible Control Area Network
GB	Giga Byte

Acronyms	Abbreviations
Gbps	Gigabits per second
GPIO	General Purpose Input Output
GPU	Graphics Processing Unit
I2C	Inter-Integrated Circuit
IC	Integrated Circuit
JTAG	Joint Test Action Group
LPDDR4	Low Power Double Data Rate4
MB	Mega Byte
Mbps	Mega Bits Per Second
MHz	Mega Hertz
MIPI	Mobile Industry Processor Interface
mm	millimetre
MMC	Multi Media Card Interface
NA	Not Applicable
OSM	Open Standard Module
OTG	On-The-Go
PCB	Printed Circuit Board
PCIe	Peripheral Component Interconnect express
PMIC	Power Management Integrated Circuits
PWM	Pulse Width Modulation
RAM	Random Access Memory
REACH	Regulation Evaluation Authorization of Chemical Substances
RGMII	Reduced Gigabit Media-Independent Interface
RIIC	Rx family Inter Integrated Circuit
RoHS	Restriction of Hazardous Substances
RSPI	Rx Family Serial Peripheral Interface
RTC	Real Time Clock
RTS	Request to Send
SAI	Serial Audio Interface
SBC	Single Board Computer
SCIF	Serial Communication Interface with FIFO
SD	Secure Digital
SDHC	Secure Digital High Capacity
SoC	System on Chip
SOM	System on Module
SPI	Serial Peripheral Interface
TBD	To Be Defined
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
USB OTG	USB On The Go
V	Voltage

1.4 Terminology Description

In this document, wherever Signal Type is mentioned, below terminology is used.

Table 2: Terminology

Terminology	Description
I	Input Signal
O	Output Signal
IO	Bidirectional Input/output Signal
CMOS	Complementary Metal Oxide Semiconductor Signal
GBE	Gigabit Ethernet Signal
OD	Open Drain Signal
OC	Open Collector Signal
PCIe	Peripheral Component Interconnect Express Signal
USB	Universal Serial Bus Signal
Power	Power Pin
PU	Pull Up
PD	Pull Down
NA	Not Applicable
NC	Not Connected

Note: Signal Type does not include internal pull-ups or pull-downs implemented by the chip vendors and only includes the pull-ups or pull-downs implemented on SBC.

1.5 References

- RZ/G2UL Hardware User Manual
- RZ/A3UL Hardware User Manual
- RZ/FIVE Hardware User Manual

1.6 Important Note

In this document, wherever Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE MPU signal name is mentioned, it is followed as per below format for easy understanding.

- If MPU pin doesn't have multiplexing option or used for dedicated functionality then the signal name is mentioned as functionality name.

  "*Functionality Name*"

  Example: ENET_TXC

  In this signal, ***ENET_TXC*** pad is used for same functionality.

- If CPU pin selected as GPIO function, then the signal name is mentioned as

  "Functionality Description (GPIO Number)"

  Example: BCONFIG_0(GPIO1_9)

  In this signal, ***BCONFIG_0*** is the GPIO functionality which we are using and ***GPIO1_9*** is the GPIO number.

Note: The above naming is not applicable for other signals which are not connected to CPU.

2 ARCHITECTURE AND DESIGN

This section provides detailed information about Renesas RZ/G2UL or RZ/A3UL or RZ/ FIVE based SBC features and Hardware architecture with high level block diagram.

2.1 Renesas RZ/G2UL or RZ/A3UL or RZ/Five based SBC Block Diagram

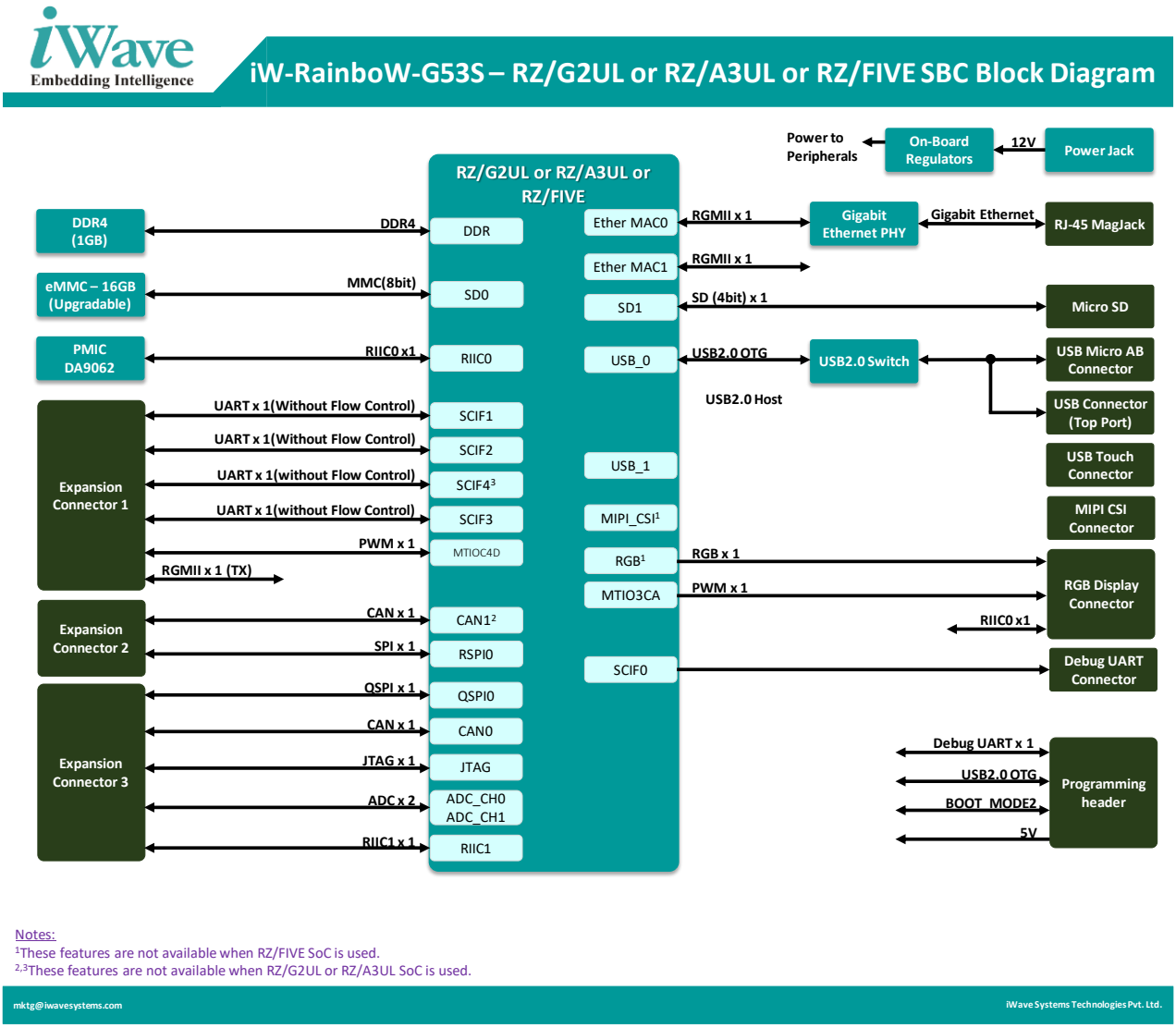

Figure 1: Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC Block Diagram

2.2 Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC Features

iW-G53s-Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC supports the following features.

SoC

- RZ/G2UL: 1 x Cortex-A55 @1.0GHz, 1 x M33 core@200MHz
- RZ/ A3UL: 1 x Cortex-A55@1.0GHz
- RZ/FIVE: 1 x RISC-V (AX45MP Single) @1.0GHz

Power

- DA9062-52AM1 PMIC

Memory

- 1GB DDR4 (Expandable)[1]
- 16GB eMMC Flash (Expandable)[1]

Network & Communication

- Gigabit Ethernet PHY Transceiver with RJ45 Magjack Connector x 1
- USB 2.0 OTG port through – Micro-AB Receptacle Connector x 1
- USB Host x 1

Audio/Video Features

- MIPI CSI x 1 (4Lane)[3]
- RGB Display x 1 (18 bit) [3]

Expansion Connector Interfaces

- CAN x 2 Ports[3,4]
- UART x 4 Ports (without flow control) [3,4]
- SPI x 1 Port
- QSPI x 1 Port
- PWM x 2 Port[4]
- ADC x 2 Ports
- JTAG x 1 Port
- I2C x 1 Port

Miscellaneous Interfaces

- Debug UART Header

General Specification

- Power Supply : 12V, 2A[5]
- Form Factor : 85mm x 56mm

1. *DDR4 and eMMC Memory Size will differ based on iWave's SBC Product Part Number.*
2. *Support only in RZ/G2UL and RZ/A3UL.*
3. *In RZ/Five, the 2nd CAN and 4th UART are multiplexed and only one interface can support at a time.*
4. *Some of these features are available only in RZ/FIVE.*
5. *The Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE SBC can optionally support wide range input power from 7V to 24V. By default, it supports 12V DC input.*

2.3 RZ/G2UL or RZ/FIVE or RZ/A3UL MPU

The iW-RainboW-G53S SBCe can support RZ/G2UL, RZ/FIVE or the RZ/A3UL MPUs from Renesas. The RZ/G2UL MPU features are given below:

- RZ/G2UL : 1 x Cortex-A55 @1.0GHz
  : 1 x M33 core@200MHz

The RZ/G2UL microprocessor includes a Cortex®-A55 (1.0 GHz) CPU, 16-bit DDR3L/DDR4 interface, and simple LCD controller. It also has many interfaces such as camera input, display output, USB 2.0, and Gbit-Ether, making it ideal for applications such as entry-class industrial gateway control and embedded devices with Simple GUI capabilities.

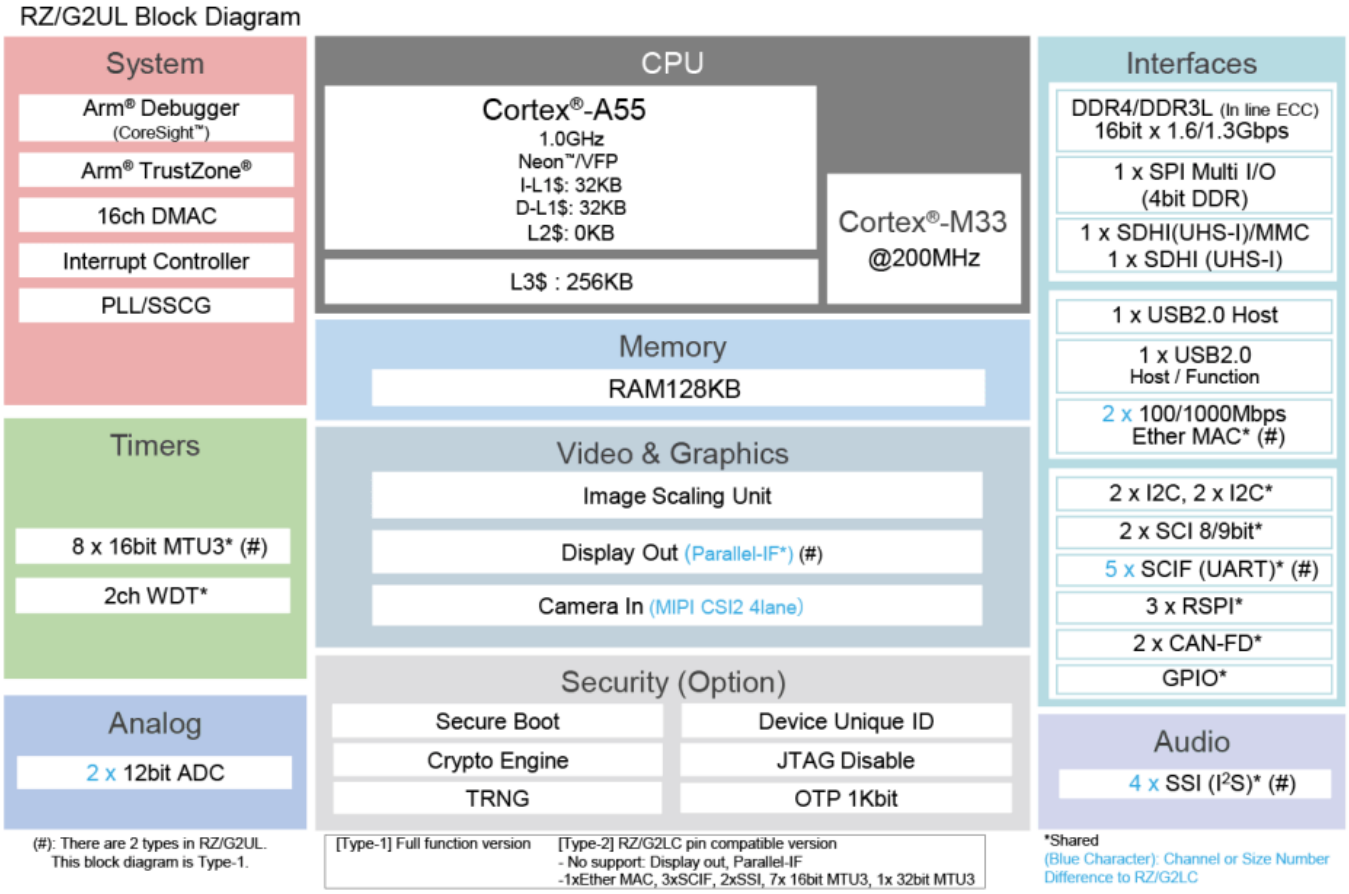

Figure 2: RZ/G2UL MPU Block Diagram

Note: The RZ/G2UL Microprocessor offers numerous advanced features, please refer the latest Datasheet of RZ/G2UL for Electrical characteristics and other information, which may be revised from time to time.

Similarly, the features of the RZ/FIVE MPU with RISC-V CPU core that can be supported in the iW-RainboW-G53M OSM is given below:

- RZ/FIVE : 1 x RISC-V (AX45MP Single) @1.0GHz

The RZ/Five microprocessor includes a RISC-V CPU Core (AX45MP Single) 1.0 GHz, 16-bit DDR3L/DDR4 interface. And it also has many interfaces such as Gbit-Ether, CAN, and USB 2.0, making it ideal for applications such as entry-class social infrastructure gateway control and industrial gateway control.

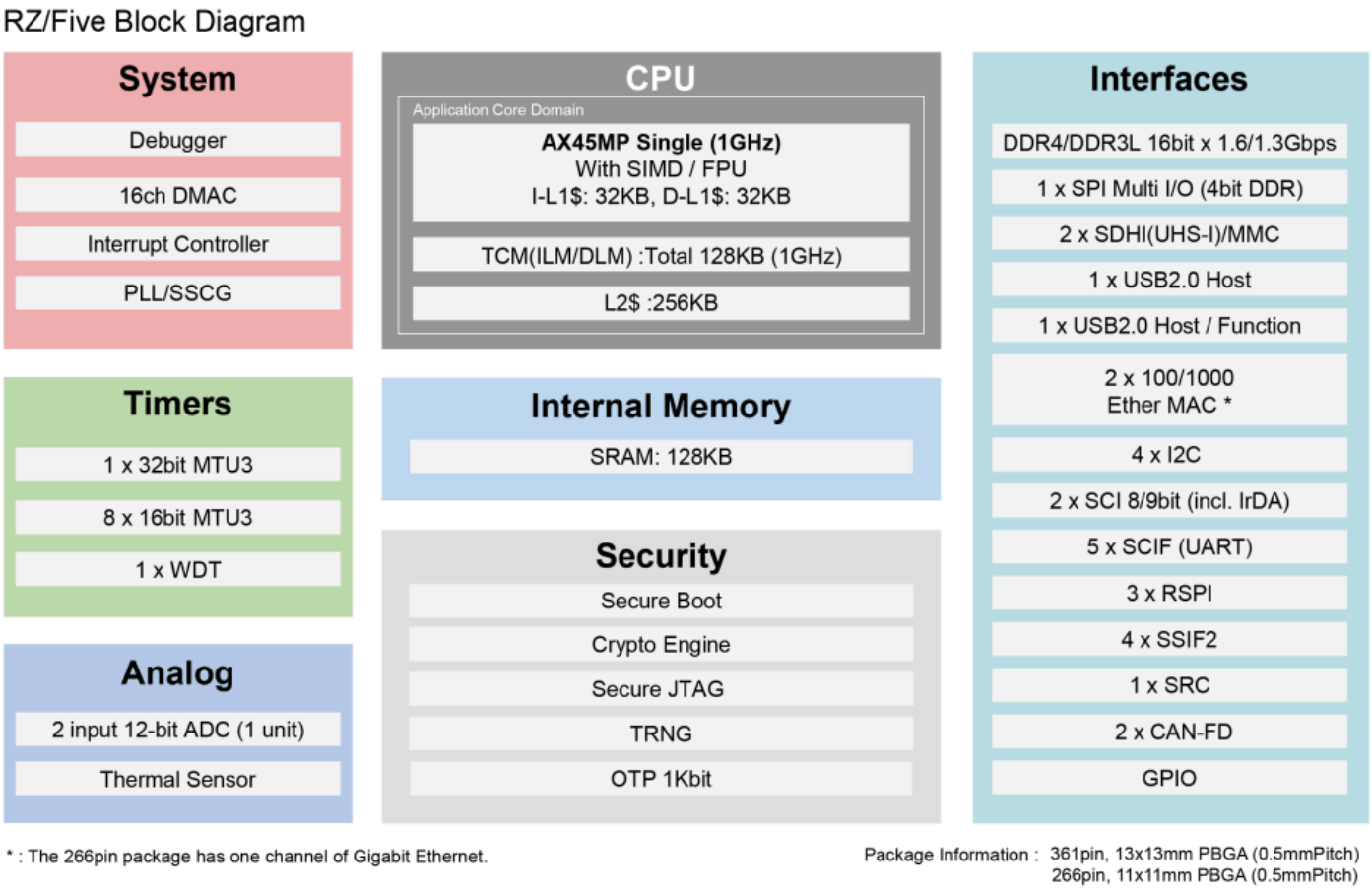

Figure 3: RZ/FIVE MPU Block Diagram

Note: The RZ/FIVE Microprocessor offers numerous advanced features, please refer the latest Datasheet of RZ/FIVE for Electrical characteristics and other information, which may be revised from time to time.

Similarly, the features of the RZ/A3UL MPU with RTOS support that can be supported in the iW-RainboW-G53M OSM is given below:

- RZ/A3UL : 1 x Cortex-A55@1.0GHz

The RZ/A3UL allows customers to achieve the full potential of a real-time operating system (RTOS) while leveraging the performance boost provided by the 64-bit Arm® Cortex®-A55 CPU core with a maximum operating frequency of 1 GHz. Using an RTOS allows systems to start up instantly, in less than a second after boot-up. This feature is ideal for systems that require a fast response time such as industrial equipment, home appliances and office automation equipment with liquid crystal displays or control panels, as well as POS terminals.

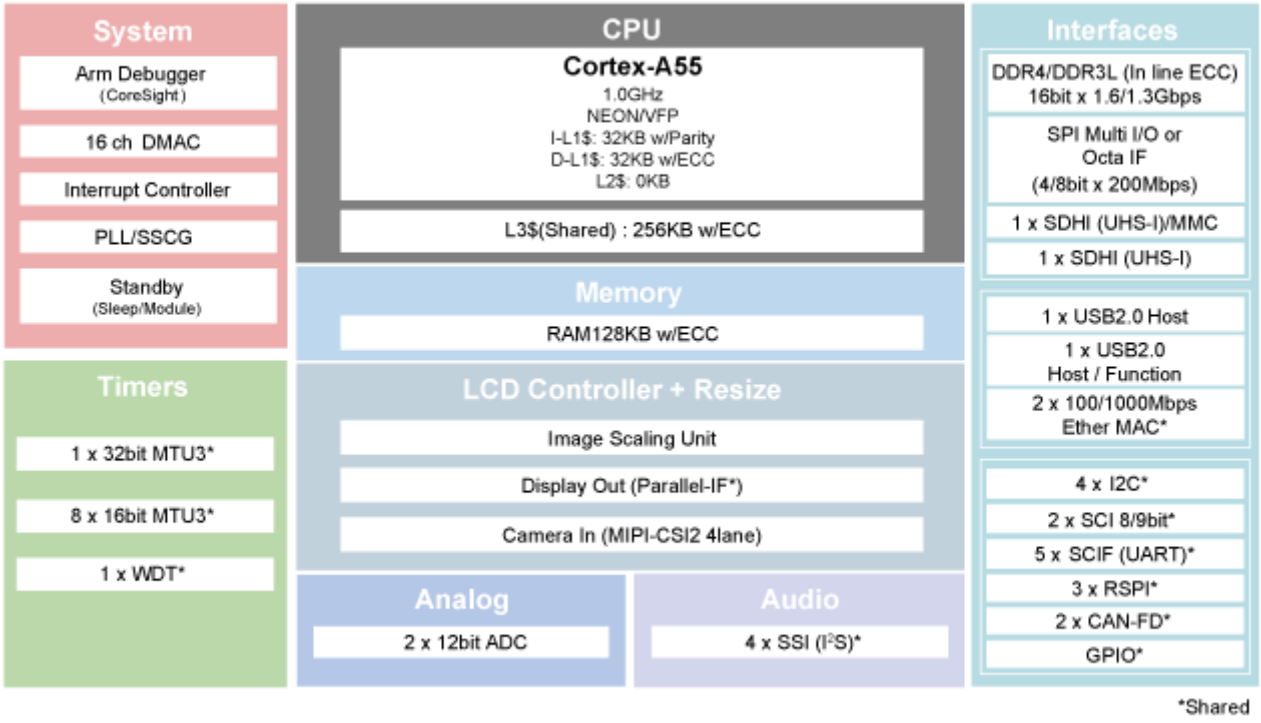

Figure 4: RZ/A3UL MPU Block Diagram

Note: The RZ/A3UL Microprocessor offers numerous advanced features, please refer the latest Datasheet of RZ/A3UL for Electrical characteristics and other information, which may be revised from time to time.

2.4 PMIC with RTC

The Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC uses one DA9062-52AM1 PMIC (U8) for module power management. The DA9062-52AM1 features four LDOs & four buck regulators. It is a high-performance Power Management Integrated Circuit (PMIC) that provides a highly programmable/configurable architecture with fully integrated power devices and built-in one-time programmable memory stores key start up configurations, drastically reducing external components typically used to set output voltage and sequence of external regulators. Regulator parameters are adjustable through high-speed I2C after start up offering flexibility for different system states.

The DA9062-52AM1 PMIC is pre-programmed as per the voltage, power sequence and other requirements of RZ/G2UL, RZ/FIVE or RZ/A3UL MPUs. The RIIC0 I2C from the RZ/G2UL, RZ/FIVE or RZ/A3UL MPU is used connected to the PMIC. The I2C slave address of the PMIC is 0x58.

The DA9062-52AM1 comes in 40 pin QFN (6mm x 6mm) Package and is placed on the Top side of the SBC.

Note: RTC wake up feature is not available in the preproduction boards.

2.5 Memory

2.5.1 DDR4 RAM

The Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC supports 1GB DDR4 SDRAM memory by default using 16-bit DDR_CH0 channel of Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE SoC. DDR4 part (U4) is placed on Top side of the SBC. To customize the DDR4 memory size, contact iWave.

The RZ/G2UL, RZ/FIVE or RZ/A3UL SBC can support up to 4GB DDR4 memory (subject to chip availability) using the 16bit DDR_CH0 channel of the MPU. The DDR4 part U4 is placed at the top of the board can operate at speed of up to 1.2GHz.

By default, in RZ/G2UL and RZ/A3UL, the default DDR density supported is 2GB and in RZ/FIVE, the density is 1GB. To customize the DDR4 memory size, contact iWave.

2.5.2 eMMC Flash Memory

The Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC supports 16GB eMMC Flash Memory which can be used as a default boot and storage device. This is directly connected to eMMC controller of the Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE SoC and operates at 1.8V (I/O supply) and 3.3V (NAND core supply) voltage levels.

The eMMC flash memory (U2) is physically located on Top side of the SBC. The memory size of the eMMC flash can be customised based on the requirement by contacting iWave Support Team.

2.6 Boot Media Setting

Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE MPU boot process begins at Power on Reset (POR) where the hardware reset logic forces the ARM core to begin execution starting from the on-chip boot ROM. Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE MPU Boot ROM code uses the state of the internal register BOOT_MODE [2:0] to determine the boot flow behaviour of the device.

The Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC can boot from the eMMC or serial flash memory. Also, for programming, we can make use of the Debug UART connector. For details on setting the required Boot media, refer table below:

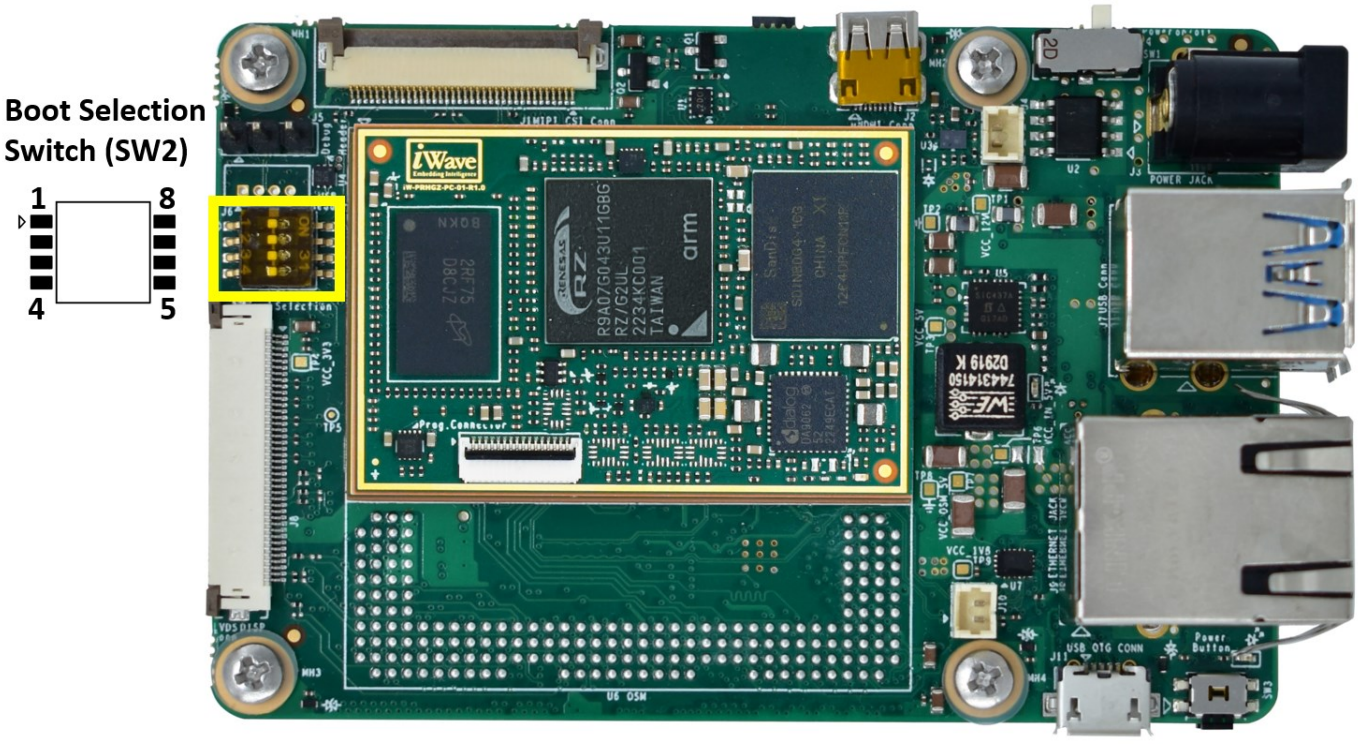

Figure 5: Boot Media Switch

Table 3: Boot Media Settings

Boot Media	Interface Module	SW1		
		POS1	POS2	POS3
1.8V eMMC	SDHI0	ON	X	OFF
1.8V Single or Quad serial flash memory	SPIBSC	OFF	X	OFF
Downloading through SCIF	SCIF	X	X	ON

2.7 Network & Communication

2.7.1 Gigabit Ethernet Interface

The Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC supports Single Ethernet interface through external Ethernet PHY from Analog Devices, which supports 10/100/1000Mbps Ethernet.

The ADIN1300BCPZ is a low power, single port, Gigabit Ethernet transceiver with low latency and Time sensitive networking support. The power consumption specifications primarily designed for industrial Ethernet applications. This integrates an energy efficient Ethernet (EEE) physical layer device (PHY) core with all associated common circuitry, input and output clock buffering, management interface and subsystem registers, and MAC interface and control logic to manage the reset and clock control and pin configuration.

The Ethernet PHY's output signals MDI are directly connected to RJ45 Magjack (J9). Also, it supports Speed (Yellow) and Link/Activity (Green) LED indications on RJ45 Magjack. The RJ45 Magjack combo connector is physically located at the top of the board as shown below.

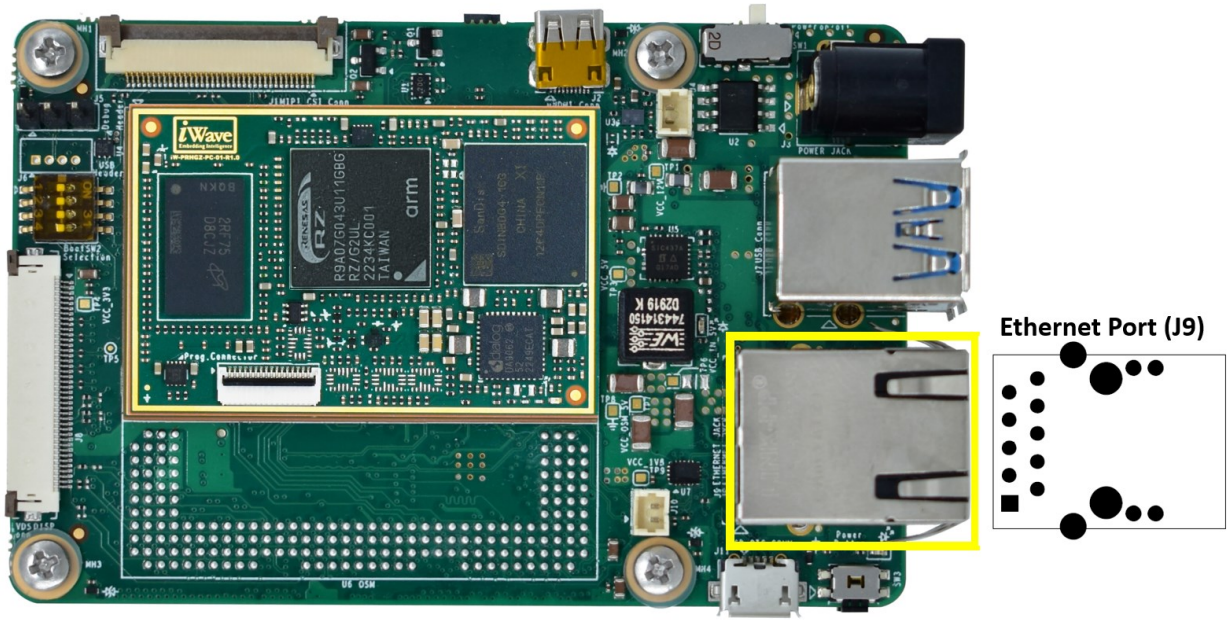

Figure 6: RJ45 Magjack

2.7.2 USB2.0 OTG Interface

Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC supports USB2.0 OTG interface. The USB0 signals are connected through the USB switch to the USB2.0 Micro-AB connector (J11). For the USB2.0 OTG interface to be enable, the 4th pin of the boot select switch (SW2) should be ON.

This port can be used as USB OTG functionality which supports USB host and USB device based on USB ID pin status. This USB2.0 OTG connector is physically located at the top of the board as shown below.

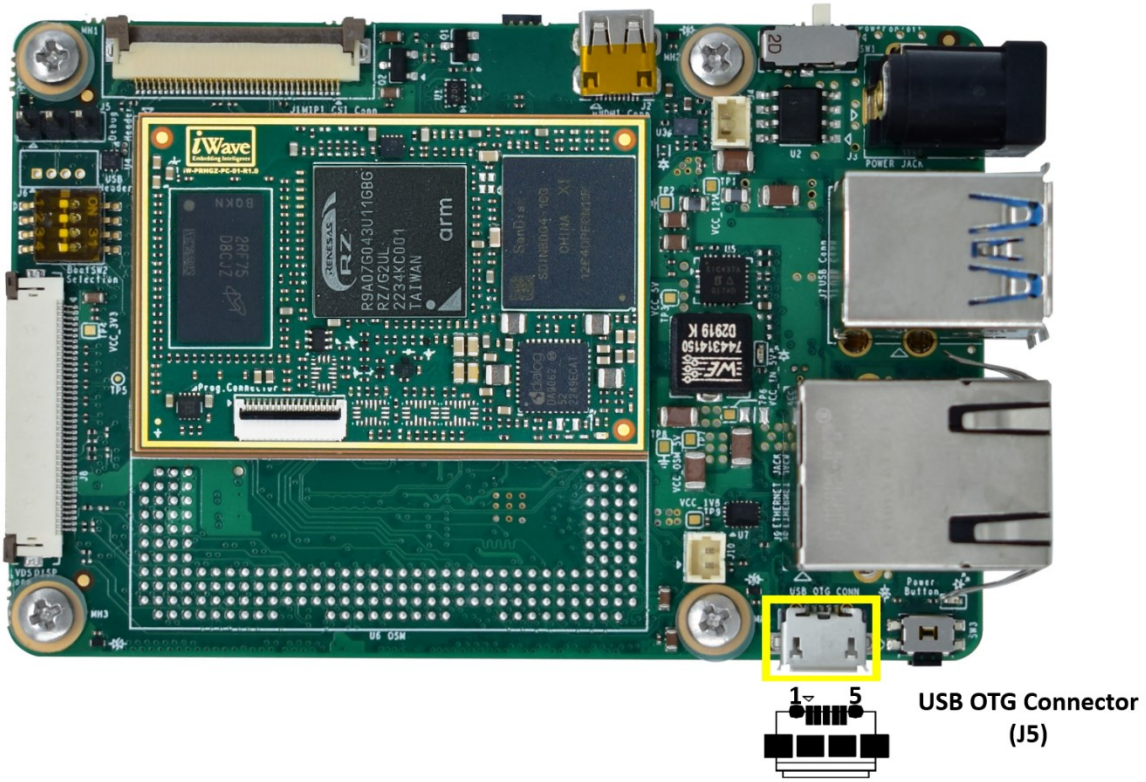

Figure 7: USB2.0 OTG Connector

2.7.3 USB Host

The Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC supports USB Host interface through the USB1 interface of the SoC which is connected through a 4pin Header. The VBUS power of this USB2.0 host connector is connected through a power switch and this USB2.0 4-pin USB header is physically located at the Top side of the board as shown below.

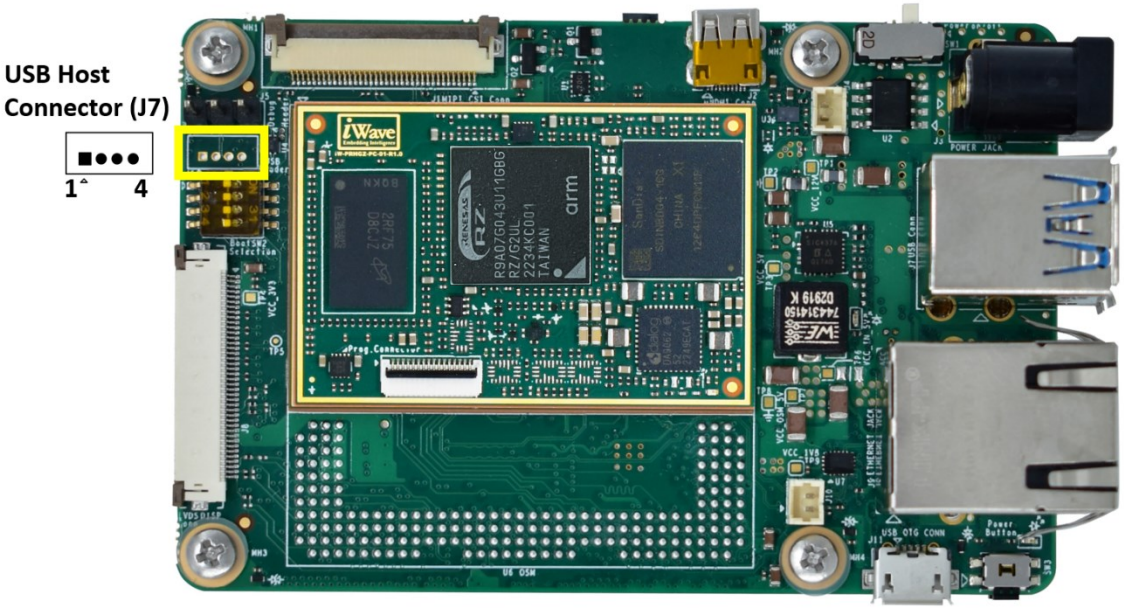

Figure 8: USB Host Connector

2.8 Serial Interface Features

2.8.1 Debug UART Interface

The Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC supports debug interface through Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE SoC's SCIF0 interface. This SCIF0 signals from the SoC is connected to Debug UART header(J5) through a 1.8V to 3.3V level Translator. This Debug UART header can be used for debug and programming purpose and is located at the top of the board as shown below.

Number of Pins : 3

Connector Part number : M20-9990345 from Harwin

USB to UART Cable : TTL-232R-RPI from FTDI

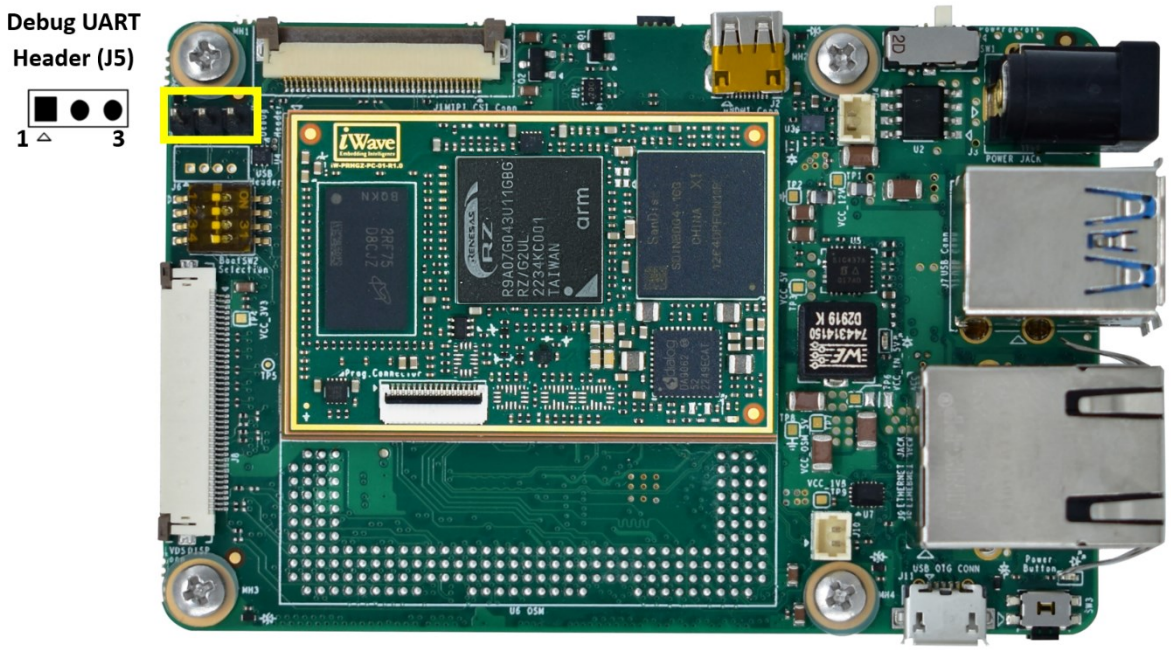

Figure 9: Debug UART

Table 4: Debug UART Header (J5) Pinout

Pin No	Pin Name	Signal Name	Signal Type/ Termination	Description
1	TX	SCIF0_RXD_1V8	O, 3.3V CMOS	Connect Transmit signal from the UART Cable to this pin.
2	RX	SCIF0_TXD_1V8	I, 3.3V CMOS	Connect Receive signal from the UART Cable to this pin.
3	GND	GND	Power	Ground.

2.9 Audio/Video Features

2.9.1 MIPI CSI Interface

The Renesas RZ/G2UL or RZ/A3UL based SBC supports MIPI CSI interface through SoC's CSI interface. This four lane CSI signals from the SoC is connected to the MIPI CSI Connector (J1) which is a 36-pin connector. The Renesas RZ/G2UL or RZ/A3UL based SBC support one camera interface. This connector(J1) is physically located at the top of the SBC.

Number of Pins : 36

Connector Part : FH12A-36S-0.5SH(55) from Hirose Electric

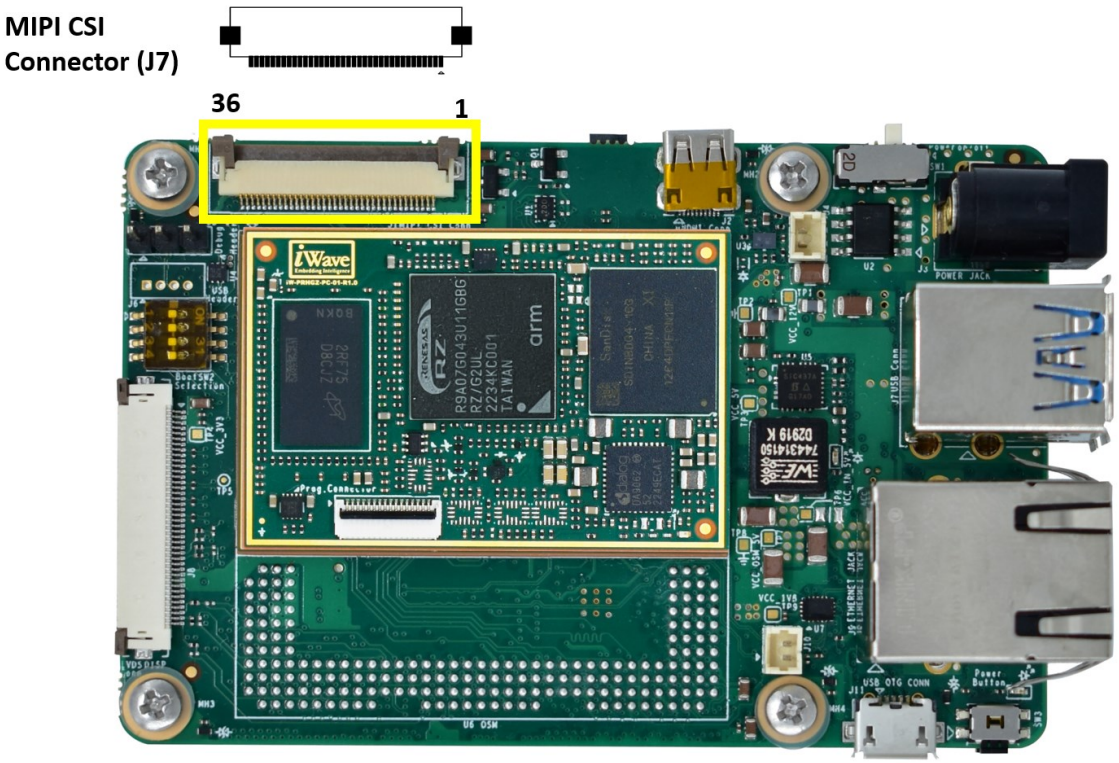

Figure 10: MIPI CSI Connector

Table 5: MIPI CSI Connector(J7) Pinout

Pin No	Pin Name	Signal Name	Signal Type/ Termination	Description
1	CAM_PWR	VCC_3V3	Power	Camera power input
2	CAM_PWR	VCC_3V3	Power	Camera power input
3	CAM0_CSI_D0+	CSI_DATA0_P	I LVDS D-PHY / I LVDS M-PHY	MIPI-CSI differential input
4	CAM0_CSI_D0-	CSI_DATA0_N	I LVDS D-PHY / I LVDS M-PHY	MIPI-CSI differential input
5	GND	GND	Power	Ground.

Pin No	Pin Name	Signal Name	Signal Type/ Termination	Description
6	CAM0_CSI_D1+	CSI_DATA1_P	I LVDS D-PHY / I LVDS M-PHY	MIPI-CSI differential input
7	CAM0_CSI_D1-	CSI_DATA1_N	I LVDS D-PHY / I LVDS M-PHY	MIPI-CSI differential input
8	GND	GND	Power	Ground.
9	CAM0_CSI_D2+	CSI_DATA2_P	I LVDS D-PHY / I LVDS M-PHY	MIPI-CSI differential input
10	CAM0_CSI_D2-	CSI_DATA2_N	I LVDS D-PHY / I LVDS M-PHY	MIPI-CSI differential input
11	CAM0_RST#	GPIO6	O CMOS	Camera 0 reset, active low output.
12	CAM0_CSI_D3+	CSI_DATA3_P	I LVDS D-PHY / I LVDS M-PHY	MIPI-CSI differential input
13	CAM0_CSI_D3-	CSI_DATA3_N	I LVDS D-PHY / I LVDS M-PHY	MIPI-CSI differential input
14	GND	GND	Power	Ground.
15	CAM0_CSI_CLK+	CSI_CLOCK_P	I LVDS D-PHY	MIPI-CSI differential clock input
16	CAM0_CSI_CLK-	CSI_CLOCK_N	I LVDS D-PHY	MIPI-CSI differential clock input
17	GND	GND	Power	Ground.
18	CAM0_I2C_CLK	I2C_CAM_SCL	I/O OD CMOS / O LVDS M-PHY	I2C clock for serial camera data support link
19	CAM0_I2C_DAT	I2C_CAM_SDA	I/O OD CMOS / O LVDS MPHY	I2C data for serial camera data support link
20	CAM0_ENA#	GPIO5	O CMOS	Camera 0 Power Enable, active high output.
21	MCLK	NC	NA	NC. *Optionally connected to CAM_MCK.*
22	CAM1_ENA#	NC	NA	NC.
23	CAM1_I2C_CLK	NC	NA	NC.
24	CAM1_I2C_DAT	NC	NA	NC.
25	GND	GND	Power	Ground.
26	CAM1_CSI_CLK+	NC	NA	NC.
27	CAM1_CSI_CLK-	NC	NA	NC.
28	GND	GND	Power	Ground.
29	CAM1_CSI_D0+	NC	NA	NC.
30	CAM1_CSI_D0-	NC	NA	NC.
31	CAM1_RST#	NC	NA	NC.
32	CAM1_CSI_D1+	NC	NA	NC.
33	CAM1_CSI_D1-	NC	NA	NC.
34	GND	GND	Power	Ground.
35	CAM0_GPIO	CAM0_(GPIO_B_0)	I/O CMOS	Camera 0 GPIO.
36	CAM1_GPIO	CAM1_(GPIO_B_1)	I/O CMOS	Camera 1 GPIO.

Note: The MIPI CSI support is not available in RZ/FIVE SBC.

2.9.2 RGB Display Connector

The Renesas RZ/G2UL or RZ/A3UL based SBC supports 18bit RGB Display interface through SoC's RGB interface. This 18-bit RGB signals from the SoC is connected to the RGB display Connector (J14) which is a 50-pin connector. This connector is physically placed on the bottom of the board as shown below.

Number of Pins : 50

Connector Part :541045033 from Molex

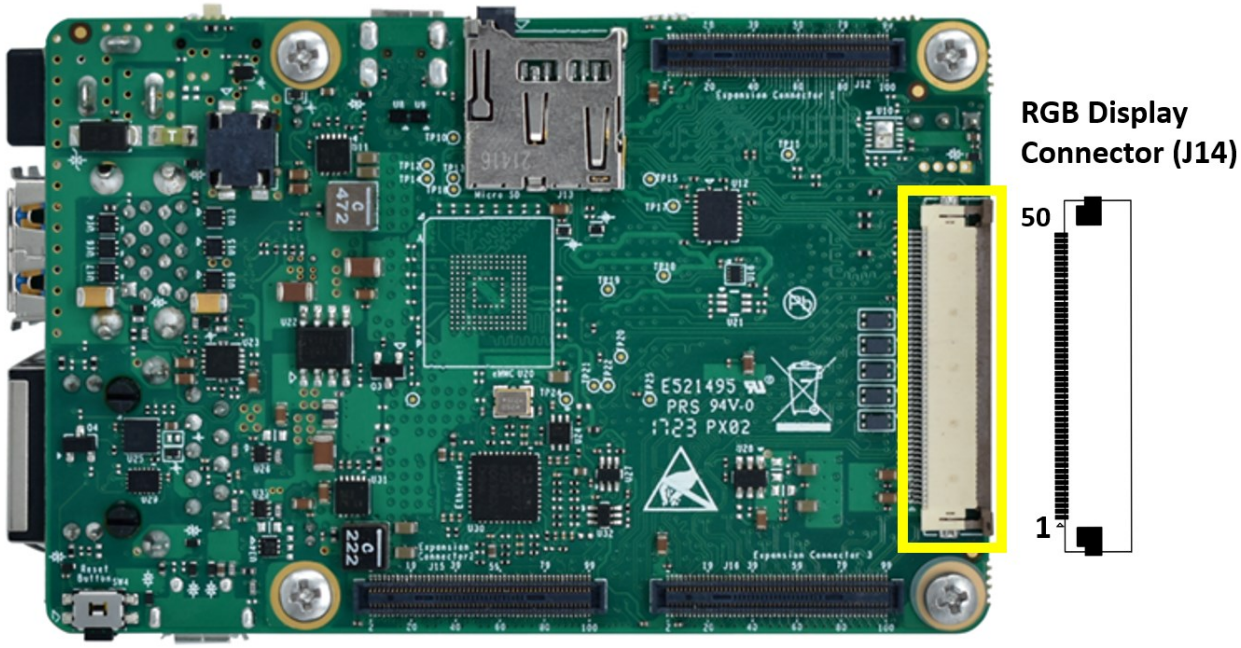

Figure 11: RGB Display Connector

Table 6: RGB Connector(J14) Pinout

Pin No	Pin Name	Signal Name	Signal Type/ Termination	Description
1	VDD1	VCC_3V3	Power	IO Power Input.
2	VDD2	VCC_3V3	Power	IO power Input.
3	VDD3	VCC_3V3	Power	IO Power Input.
4	VCC1	VCC_5V	Power	LED back light power Input.
5	VCC2	VCC_5V	Power	LED Back light Power Input.
6	VCC3	VCC_5V	Power	LED Back light Power Input.
7	GND1	GND	Power	Ground.
8	R0	NC	NC	NC.
9	R1	NC	NC	NC.
10	R2	RGB_R0	O CMOS	Red data bit 0.
11	R3	RGB_R1	O CMOS	Red data bit 1.
12	GND2	GND	Power	Ground.
13	R4	RGB_R2	O CMOS	Red data bit 2.
14	R5	RGB_R3	O CMOS	Red data bit 3.

Pin No	Pin Name	Signal Name	Signal Type/ Termination	Description
15	R6	RGB_R4	O CMOS	Red data bit 4.
16	R7	RGB_R5	O CMOS	Red data bit 5.
17	GND3	GND	Power	Ground.
18	G0	NC	NC	NC.
19	G1	NC	NC	NC.
20	G2	RGB_G0	O CMOS	Green data bit 0.
21	G3	RGB_G1	O CMOS	Green data bit 1.
22	GND4	GND	Power	Ground.
23	G4	RGB_G2	O CMOS	Green data bit 2.
24	G5	RGB_G3	O CMOS	Green data bit 3.
25	G6	RGB_G4	O CMOS	Green data bit 4.
26	G7	RGB_G5	O CMOS	Green data bit 5.
27	GND5	GND	Power	Ground.
28	B0	DISP_VDD_EN_3V3	O CMOS	Primary Display power enable, active high.
29	B1	DISP_BL_EN_3V3	O CMOS	Primary Display backlight enable, active high.
30	B2	RGB_B0	O CMOS	Blue data bit 0.
31	B3	RGB_B1	O CMOS	Blue data bit 1.
32	GND6	GND	Power	Ground.
33	B4	RGB_B2	O CMOS	Blue data bit 2.
34	B5	RGB_B3	O CMOS	Blue data bit 3.
35	B6	RGB_B4	O CMOS	Blue data bit 4.
36	B7	RGB_B5	O CMOS	Blue data bit 5.
37	GPIO	NC	NC	NC
38	DE	RGB_DE	O CMOS	Data Enable.
39	HS	RGB_HSYNC	O CMOS	Horizontal synch.
40	VS	RGB_VSYNC	O CMOS	Vertical synch.
41	DCLK	RGB_(PIXEL)CLK	O CMOS	Pixel Clock Signal.
42	GND7	GND	Power	Ground.
43	RGB Chipselect	RGB_CS#	O CMOS	Chip Select.
44	RGD Disp EN	RGB_DISP	O CMOS	Display ON/OFF.
45	GND8	GND	Power	Ground.
46	PWM	PWM_0_RGB	O CMOS	PWM signal.
47	RESET	RGB_RESET#	O CMOS	Global Reset signal.
48	I2C3_SCL	I2C_B_SCL_3V3	O CMOS	I2C Clock signal.
49	I2C3_SDA	I2C_B_SDA_3V3	O CMOS	I2C Data signal.
50	INT	NC	NC	NC

Note: RGB Display support is not available when using RZ/FIVE SBC. Also, Touch support is not available in the Pre-Production boards.

2.10 Expansion Connectors

The MPU interfaces which are not supported directly on the SBC are made available at the Expansion connectors so that they can be utilized making use of daughter cards. The interfaces which are available at 100 Pin Expansion connectors are explained in the following section. The stack height for this expansion connector is 4mm.These Expansion Connector (J12, J15 & J16) are physically located at the bottom of the SBC as shown below.

Number of Pins : 100

Connector Part : 10164227-1004A1RLF

Mating Connector : 10164228-1001A1RLF

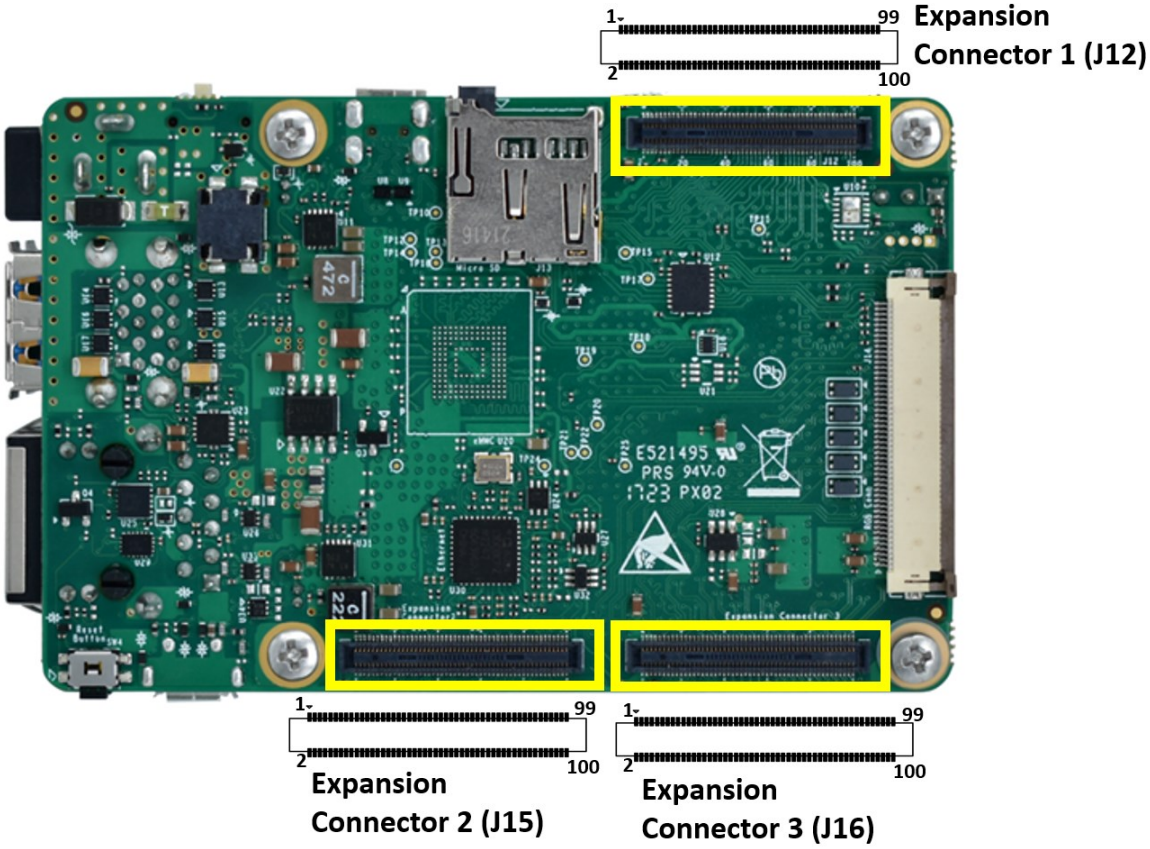

Figure 12: Expansion Connectors

Table 7: Expansion Connector 1 Pinouts

Exp. Pin No	Signal Name	CPU Ball Name/ Pin Number	Signal Type/ Termination	Description
1	VCC_5V	-	Power	5V Supply Voltage.
2	VCC_5V	-	Power	5V Supply Voltage.
3	VCC_5V	-	Power	5V Supply Voltage.
4	VCC_5V	-	Power	5V Supply Voltage.
5	VCC_5V	-	Power	5V Supply Voltage.

Exp. Pin No	Signal Name	CPU Ball Name/ Pin Number	Signal Type/ Termination	Description
6	VCC_5V	-	Power	5V Supply Voltage.
7	GND	-	Power	Ground.
8	VCC_5V	-	Power	5V Supply Voltage.
9	CAN1_TX(SCIF3_TXD)	OM_SIO4/NC/B4	Output	** Available only in RZ/Five.* ** Either CAN1 or SCIF3 is available at a time.*
10	GND	-	Power	Ground.
11	SCIF3_RXD	OM_DQS/NC/A4	Input	** Available only in RZ/Five.* ** Either CAN1 or SCIF3 is available at a time.*
12	VCC_1V8	-	Power	1.8V Supply Voltage.
13	NC	-	NC	NC.
14	VCC_1V8		Power	1.8V Supply Voltage.
15	NC	-	NC	NC.
16	nRESETREQ	-	Input	PMIC Reset Request.
17	NC	-	NC	NC.
18	SCIF4_TXD	OM_SIO7/NC/A2	Output	SCIF4 Transmit Signal.
19	NC	-	NC	NC.
20	SCIF4_RXD	OM_SIO6/NC/ B3	Input	SCIF4 Receive Signal.
21	NC	-	NC	NC.
22	NC	-	NC	NC.
23	NC	-	NC	NC.
24	NC	-	NC	NC.
25	NC	-	NC	NC.
26	NC	-	NC	NC.
27	NC	-	NC	NC.
28	NC	-	NC	NC.
29	NC	-	NC	NC.
30	NC	-	NC	NC.
31	NC	-	NC	NC.
32	NC	-	NC	NC.
33	NC	-	NC	NC.
34	MTIOC4D	OM_CS1#/NC/A2	I/O	Pulse Width Modulation.
35	NC	-	NC	NC.
36	AUDIO_CLK1	AUDIO_CLK1/A9	Input	External Audio Clock1.
37	GND	-	Power	Ground.
38	NC	-	NC	NC.
39	NC	-	NC	NC.
40	NC	-	NC	NC.
41	NC	-	NC	NC
42	GND	-	Power	Ground.
43	NC	-	NC	NC.
44	SCIF2_TXD_1V8	P6_0/AD1	Output	SCIF2 Transmit Signal.

Exp. Pin No	Signal Name	CPU Ball Name/ Pin Number	Signal Type/ Termination	Description
45	NC	-	NC	NC
46	SCIF2_RXD_1V8	P5_1/AC3	Input	SCIF2 Receive signal.
47	NC	-	NC	NC.
48	NC	-	NC	NC.
49	P4_2_1V8	P4_2/N2	I/O	General GPIO.
50	NC	-	NC	NC.
51	NC	-	NC	NC.
52	SCIF1_RXD_1V8	P13_1/A11	Input	SCIF1 Receive Signal.
53	P15_2_1V8	P15_2/ B15	I/O	General GPIO.
54	SCIF1_TXD_1V8	P11_2/B10	Output	SCIF1 Transmit Signal.
55	NC	-	NC	NC.
56	NC	-	NC	NC.
57	NC	-	NC	NC.
58	AUDIO_CLK2	AUDIO_CLK2/ B8	Input	External Audio Clock.
59	GND	-	Power	Ground.
60	NC	-	NC	NC.
61	NC	-	NC	NC.
62	ET1_MDIO	P10_3/AE21	I/O	ET1 Management information transmit/receive data.
63	NC	-	NC	NC.
64	ET1_MDC	P10_2/AC20	Output	ET1 Management information transfer clock.
65	GND	-	Power	Ground.
66	GND	-	Power	Ground.
67	NC	-	NC	NC.
68	P14_2_1V8	P14_2/A13	I/O	General GPIO.
69	NC	-	NC	NC.
70	NC	-	NC	NC.
71	GND	-	Power	Ground.
72	NC	-	NC	NC.
73	NC	-	NC	NC.
74	NC	-	NC	NC.
75	NC	-	NC	NC.
76	NC	-	NC	NC.
77	GND	-	Power	Ground.
78	NC	-	NC	NC.
79	NC	-	NC	NC.
80	NC	-	NC	NC.
81	NC	-	NC	NC.
82	NC	-	NC	NC.
83	GND	-	Power	Ground.
84	NC	-	NC	NC.

Exp. Pin No	Signal Name	CPU Ball Name/ Pin Number	Signal Type/ Termination	Description
85	NC	-	NC	NC.
86	GND	-	Power	Ground.
87	NC	-	NC	NC.
88	ET1_TXD3	P8_0/AE15	Output	ET1 Transmit data signal.
89	GND	-	Power	Ground.
90	ET1_TXD1	P7_3/AE16	Output	ET1 Transmit data signal.
91	NC	-	NC	NC.
92	ET1_TXD2	P7_4/AD15	Output	ET1 Transmit data signal.
93	NC	-	NC	NC.
94	ET1_TXD0	P7_2/AD16	Output	ET1 Transmit data signal.
95	GND	-	Power	Ground.
96	ET1_TX_CTL/TX_EN	P7_1/AD17/	Output	ET1 Transmit control/enable signal.
97	NC	-	NC	NC.
98	ET1_TXC/TX_CLK	P7_0/ AE18	Input	ET1 Transmit Clock signal.
99	NC	-	NC	NC.
100	GND	-	Power	Ground.

Table 8: Expansion Connector 2 Pinouts

Exp. Pin No	Signal Name	CPU Ball Name/ Pin Number	Signal Type/ Termination	Description
1	VCC_12V	-	Power	12V Power Supply.
2	VCC_12V	-	Power	12V Power Supply.
3	VCC_12V	-	Power	12V Power Supply.
4	VCC_12V	-	Power	12V Power Supply.
5	VCC_12V	-	Power	12V Power Supply.
6	VCC_12V	-	Power	12V Power Supply.
7	GND	-	Power	Ground.
8	GND	-	Power	Ground.
9	NC	-	NC	NC.
10	NC	-	NC	NC.
11	NC	-	NC	NC.
12	NC	-	NC	NC.
13	GND	-	Power	Ground.
14	GND	-	Power	Ground.
15	NC	-	NC	NC.
16	NC	-	NC	NC.
17	NC	-	NC	NC.
18	NC	-	NC	NC.
19	GND	-	Power	Ground.
20	GND	-	Power	Ground.
21	NC	-	NC	NC.
22	NC	-	NC	NC.
23	NC	-	NC	NC.
24	NC	-	NC	NC.
25	GND	-	Power	Ground.
26	GND	-	Power	Ground.
27	NC	-	NC	NC.
28	NC	-	NC	NC.
29	NC	-	NC	NC.
30	NC	-	NC	NC.
31	NC	-	NC	NC.
32	GND	-	Power	Ground.
33	NC	-	NC	NC.
34	NC	-	NC	NC.
35	NC	-	NC	NC.
36	NC	-	NC	NC.
37	NC	-	NC	NC.
38	GND	-	Power	Ground.
39	NC	-	NC	NC.
40	NC	-	NC	NC.
41	NC	-	NC	NC.

Exp. Pin No	Signal Name	CPU Ball Name/ Pin Number	Signal Type/ Termination	Description
42	NC	-	NC	NC.
43	NC	-	NC	NC.
44	GND	-	Power	Ground.
45	NC	-	NC	NC.
46	NC	-	NC	NC.
47	NC	-	NC	NC.
48	NC	-	NC	NC.
49	NC	-	NC	NC.
50	GND	-	Power	Ground.
51	NC	-	NC	NC.
52	NC	-	NC	NC.
53	NC	-	NC	NC.
54	NC	-	NC	NC.
55	GND	-	Power	Ground.
56	GND	-	Power	Ground.
57	NC	-	NC	NC.
58	NC	-	NC	NC.
59	NC	-	NC	NC.
60	NC	-	NC	NC.
61	NC	-	NC	NC.
62	GND	-	Power	Ground.
63	NC	-	NC	NC.
64	NC	-	NC	NC.
65	NC	-	NC	NC.
66	NC	-	NC	NC.
67	NC	-	NC	NC.
68	GND	-	Power	Ground.
69	NC	-	NC	NC.
70	NC	-	NC	NC.
71	NC	-	NC	NC.
72	NC	-	NC	NC.
73	NC	-	NC	NC.
74	NC	-	NC	NC.
75	NC	-	NC	NC.
76	NC	-	NC	NC.
77	NC	-	NC	NC.
78	NC	-	NC	NC.
79	NC	-	NC	NC.
80	NC	-	NC	NC.
81	NC	-	NC	NC.
82	NC	-	NC	NC.
83	NMI	NMI/AA2	Input	Non-Maskable Interrupt.

Exp. Pin No	Signal Name	CPU Ball Name/ Pin Number	Signal Type/ Termination	Description
84	NC	-	NC	NC.
85	BSCANP	BSCANP/AE22	Input	Boundary Scan Operation
86	RSPI0_SSL_1V8	P18_5/ A21	Input/Output	RSPI0 Slave Select.
87	NC	-	NC	NC.
88	NC	-	NC	NC.
89	NC	-	NC	NC.
90	RSPI0_MOSI	P2_2/ M3	Input/Output	RSPI0 Master Out Slave In.
91	NC	-	NC	NC.
92	RSPI0_MISO	P2_3/M6	Input/Output	RSPI0 Master In Slave Out.
93	NC	-	NC	NC.
94	RSPI0_CK_1V8	P2_1/ K6	Input/Output	RSPI0 Clock.
95	NC	-	NC	NC.
96	DEBUGEN_1V8	DEBUGEN/ Y19	Output	Debug Enable.
97	NC	-	NC	NC.
98	CAN1_TX(SCIF3 _TXD)	OM_SIO4/NC/ B4	Input	Available only in RZ/Five, either CAN1 or SCIF3 can use at a time.
99	NC	-	NC	NC.
100	CAN1_RX	OM_SIO5/NC/ A3	Output	Available only in RZ/Five, either CAN1 or SCIF3 can use at a time.

Table 9: Expansion Connector 3 Pinouts

Exp. Pin No	Signal Name	CPU Ball Name/ Pin Number	Signal Type/ Termination	Description
1	VCC_3V3	-	Power	3.3V Supply Voltage.
2	VCC_1V8	-	Power	1.8V Supply Voltage.
3	VCC_3V3	-	Power	3.3V Supply Voltage.
4	VCC_1V8	-	Power	1.8V Supply Voltage.
5	VCC_3V3	-	Power	3.3V Supply Voltage.
6	GND	-	Power	Ground.
7	VCC_3V3	-	Power	3.3V Supply Voltage.
8	NC	-	NC	NC.
9	GND	-	Power	Ground.
10	QSPI0_CS0	QSPI0_SSL/ B5	Input	QSPI0 Slave Select.
11	CAN0_RX_1V8	P6_2/ AB2	Input	CAN0 Receive Signal.
12	NC	-	NC	NC.
13	CAN0_TX_1V8	P6_1/ AE2	Output	CAN0 Transmit Signal.
14	RIIC1_SDA_1V8	RIIC1_SDA/ A20	Input/Output	RIIC1 Data Line.
15	NC	-	NC	NC.
16	RIIC1_SCL_1V8	RIIC1_SCL/ A19	Input/Output	RIIC1 Clock Line.
17	NC	-	NC	NC.
18	NC	-	NC	NC.
19	NC	-	NC	NC.
20	NC	-	NC	NC.
21	NC	-	NC	NC.
22	NC	-	NC	NC.
23	GND	-	Power	Ground.
24	NC	-	NC	NC.
25	NC	-	NC	NC.
26	NC	-	NC	NC.
27	NC	-	NC	NC.
28	GND	-	Power	Ground.
29	GND	-	Power	Ground.
30	QSPI0_IO3	QSPI0_IO3/ C6	Input/Output	QSPI0 Data3.
31	NC	-	NC	NC.
32	QSPI0_IO2	QSPI0_IO2/ B7	Input/Output	QSPI0 Data2.
33	NC	-	NC	NC.
34	NC	-	NC	NC.
35	GND	-	Power	Ground.
36	NC	-	NC	NC.
37	NC	-	NC	NC.
38	QSPI0_IO1	QSPI0_IO1/ A5	Input/Output	QSPI0 Data1.
39	NC	-	NC	NC.
40	NC	-	NC	NC.

Exp. Pin No	Signal Name	CPU Ball Name/ Pin Number	Signal Type/ Termination	Description
41	GND	-	Power	Ground.
42	NC	-	NC	NC.
43	NC	-	NC	NC.
44	QSPI0_IO0	QSPI0_IO0/ C7	Input/Output	QSPI0 Data0.
45	NC	-	NC	NC.
46	QSPI0_SCLK	QSPI0_SPCLK/B6	Input/Output	QSPI0 Clock.
47	GND	-	Power	Ground.
48	NC	-	NC	NC.
49	NC	-	NC	NC.
50	NC	-	NC	NC.
51	NC	-	NC	NC.
52	JTAG_TDO	TDO/ V2	Output	JTAG Test Data Output.
53	GND	-	Power	Ground.
54	JTAG_TRST#	TRST#/ V1	Input	Test Reset.
55	NC	-	NC	NC.
56	NC	-	NC	NC.
57	NC	-	NC	NC.
58	AUDIO_CLK2	AUDIO_CLK2/ B8	Input/Output	External Audio Clock2.
59	GND	-	Power	Ground.
60	JTAG_TDI	TDI/ W1	Input	JTAG Test Data Input.
61	NC	-	NC	NC.
62	JTAG_TCK	TCK/SWDCLK/ U2	Input	JTAG Test Clock.
63	NC	-	NC	NC.
64	JTAG_TMS	TMS/SWDIO/ U1	Input	JTAG Test Mode Select.
65	GND	-	Power	Ground.
66	ADC_CH1	ADC_CH1/NC/ A18	Input	Analog Input Pin.
67	NC	-	NC	NC.
68	NC	-	NC	NC.
69	NC	-	NC	NC.
70	ADC_CH0	ADC_CH0/NC/ B18	Input	Analog Input Pin.
71	GND	-	Power	Ground.
72	NC	-	NC	NC.
73	NC	-	NC	NC.
74	NC	-	NC	NC.
75	NC	-	NC	NC.
76	NC	-	NC	NC.
77	GND	-	Power	Ground.
78	NC	-	NC	NC.
79	NC	-	NC	NC.
80	NC	-	NC	NC.
81	NC	-	NC	NC.
82	NC	-	NC	NC.

Exp. Pin No	Signal Name	CPU Ball Name/ Pin Number	Signal Type/ Termination	Description
83	GND	-	Power	Ground.
84	NC	-	NC	NC.
85	NC	-	NC	NC.
86	NC	-	NC	NC.
87	NC	-	NC	NC.
88	NC	-	NC	NC.
89	GND	-	Power	Ground.
90	NC	-	NC	NC.
91	NC	-	NC	NC.
92	ET1_RXD3	P10_0/ AD20		ET1 Receive Data signal.
93	NC	-	NC	NC.
94	ET1_RXD2	P9_3/ AE20		ET1 Receive Data signal.
95	GND	-	Power	Ground.
96	ET1_RX_CTL/RX_DV	P9_0/AC18		ET1 Receive Control signal.
97	NC	-	NC	NC.
98	ET1_RXD1	P9_2/ AD19		ET1 Receive Data signal.
99	NC	-	NC	NC.
100	ET1_RXD0	P9_1/ AE19		ET1 Receive Data signal.

*Note: Refer GPIO Column under **"Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE Pin Multiplexing on Expansion Connector** for details on GPIO options available from Expansion connector.*

2.11 Other Features

2.11.1 Power ON/OFF Switch

The Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC has push button support for power ON/OFF switch (SW1) to control the Main power Input ON/OFF functionality. After the board is powered on, the Power ON/OFF switch needs to pressed for a few seconds to power ON the board. Similarly, we can power off the board by pressing and holding the button. The Power ON/OFF switch is physically located at the top of the board as shown below.

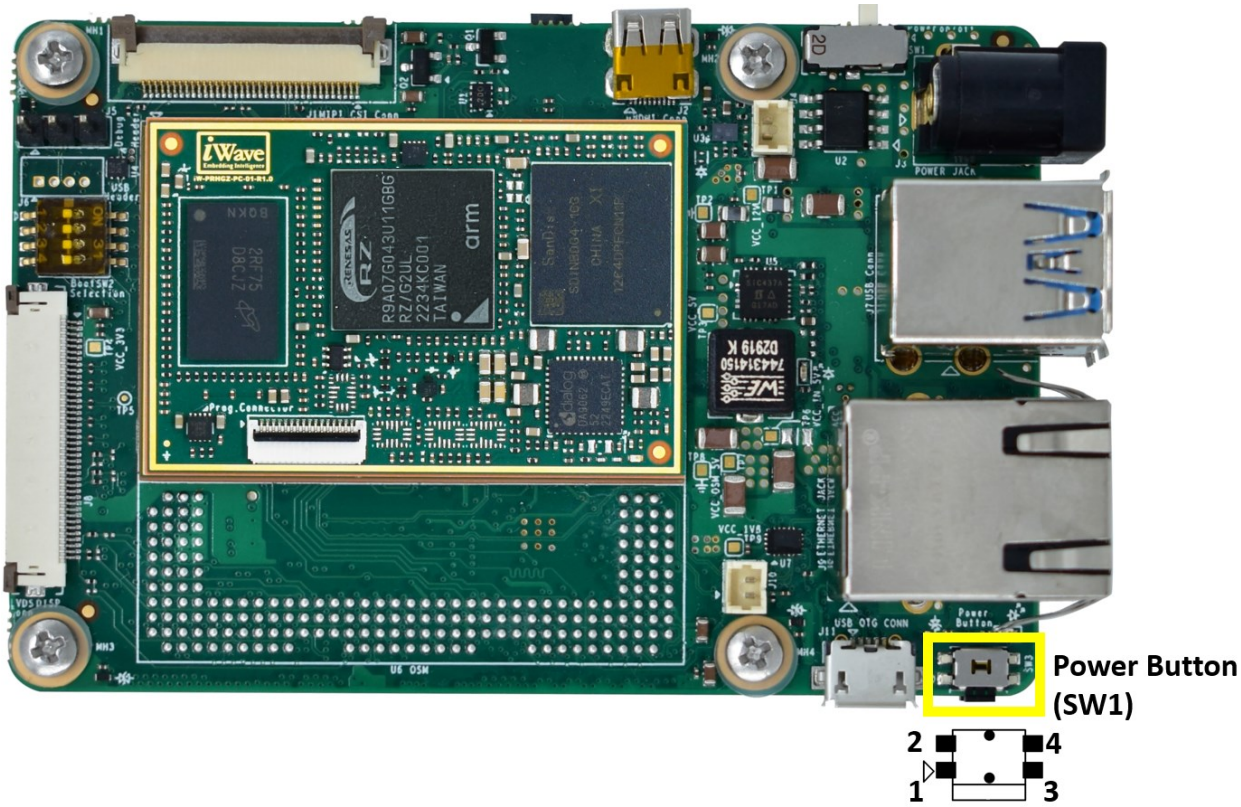

Figure 13: Power ON/OFF Switch

2.11.2 Reset Switch

The Renesas RZ/G2UL, RZ/FIVE or RZ/A3UL SBC supports Push button switch (SW4) to reset the Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE CPU. Reset signal is directly connected from Reset Push button switch. This Reset Push button switch is physically located at the bottom of the board as shown below.

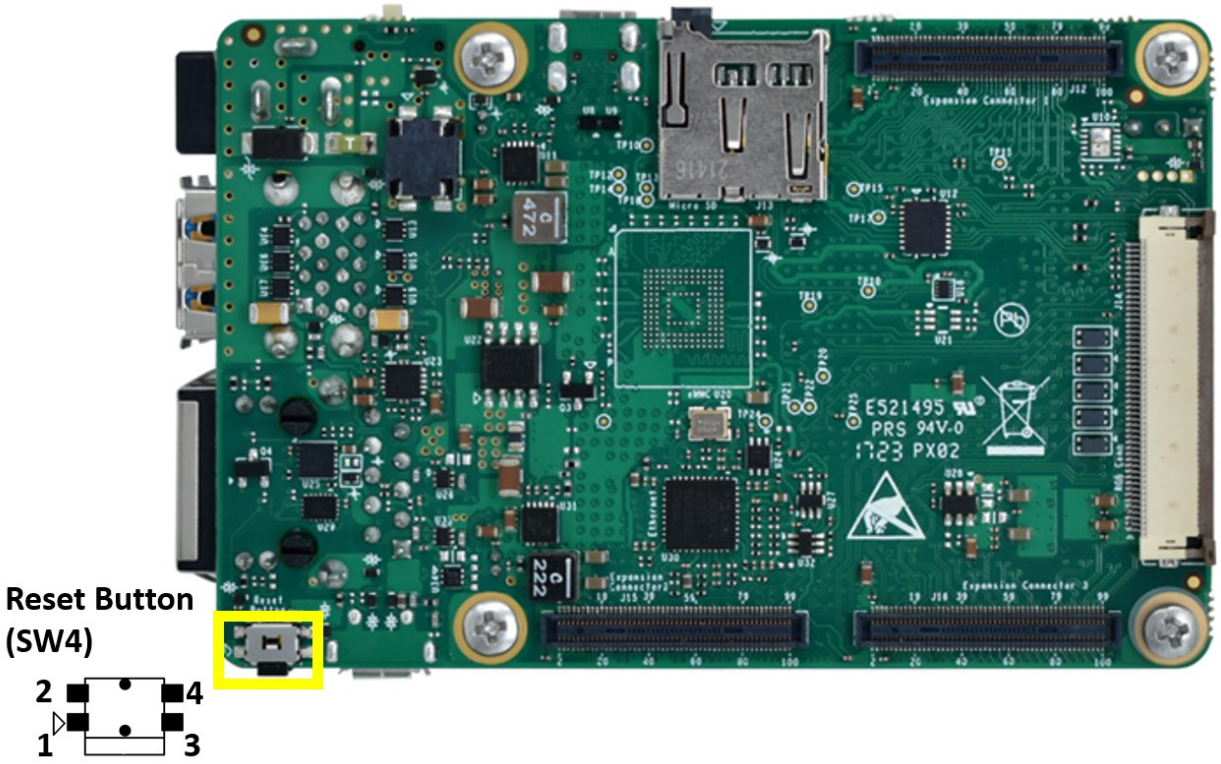

Figure 14: Reset Switch

2.12 Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE Pin Multiplexing on Expansion Connector

The Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE SoC IO pins have many alternate functions and can be configured to any one of the alternate functions based on the requirement, also most of the Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE SoC's IO pins can be configured as GPIO if required. The below table provides the details of Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE SoC pin connections to the expansion connector and with selected pin function highlighted and available alternate functions. This table has been prepared by referring Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE Hardware User's Manual.

Important Note:

1. It is strongly recommended to use the pin function same as selected in the SBC for iWave's BSP reusability and to have compatible SBCs in future for upgradability.
2. Signals in blue are available in Five

3. Signals in red are available in A3UL and Five

4. Signals in green are available in A3UL & G2UL

Table 10: Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE SoC IOMUX for Expansion Connector Interfaces

Interface	OSM Pin Number	RZ/G2UL or RZ/A3UL or RZ/FIVE SoC Pin Number	Function 0	Function 1	Function 2	Function 3	Function 4	Function 5	Function 6	Function7	Default
ET1	G1	AD16	P7_2	ET1_TXD0	SCI1_TXD	RSPI2_MISO	CAN0_RX	MTIOC0C	SCIF2_SCK		ET1_TXD0
	F1	AE16	P7_3	ET1_TXD1	SCI1_RXD	RSPI2_SSL	CAN0_TX_DATARATE_EN	MTIOC0D	SCIF2_CTS#		ET1_TXD1
	G2	AD15	P7_4	ET1_TXD2	SCI1_CTS#/RTS#	IRQ2	CAN0_RX_DATARATE_EN		SCIF2_RTS#		ET1_TXD2
	F2	AE15	P8_0	ET1_TXD3	SCIF0_SCK	SCIF1_RXD	SSI1_BCK	SCI0_SCK	MTIOC7A	IRQ1	ET1_TXD3
	J2	AD17	P7_1	ET1_TX_CTL/TX_EN	SCI1_SCK	RSPI2_MOSI	CAN0_TX	MTIOC0B	SCIF2_RXD		ET1_TX_CTL/TX_EN
	H1	AE18	P7_0	ET1_TXC/TX_CLK	ADC_TRG	RSPI2_CK	CAN_CLK	MTIOC0A	SCIF2_TXD	IRQ5	ET1_TXC/TX_CLK
	J1	AE19	P9_1	ET1_RXD0	RSPI0_MOSI		SSI2_RCK	MTIOC4B	SCIF4_RXD		ET1_RXD0
	K1	AD19	P9_2	ET1_RXD1	RSPI0_MISO		SSI2_DATA	MTIOC4C	SCIF4_TXD		ET1_RXD1
	M1	AE20	P9_3	ET1_RXD2	RSPI0_SSL	IRQ3		MTIOC4D	IRQ1		ET1_RXD2
	N1	AD20	P10_0	ET1_RXD3	SSI0_BCK	IRQ4		MTIOC6A	IRQ2		ET1_RXD3

Interface	OSM Pin Number	RZ/G2UL or RZ/A3UL or RZ/FIVE SoC Pin Number	Function 0	Function 1	Function 2	Function 3	Function 4	Function 5	Function 6	Function7	Default
	L1	AC18	P9_0	ET1_RX_CTL/RX_DV	RSPI0_CK		SSI2_BCK	MTIOC4A	SCIF4_SCK		ET1_RX_CTL/RX_DV
	P1	AC17	P8_4	ET1_RXC/RX_CLK	SCIF0_RTS#				ADC_TRG	RSPI2_SSL	ET1_RXC/RX_CLK
SCIF1	D13	B10	P11_2	SSI0_TXD	POE8#	SCI1_SCK	RSPI2_MISO		DISP_DATA0	SCIF1_TXD	SCIF1_TXD
	D14	A10	P13_1	SCIF0_RXD		CAN0_TX	MTIOC4B	USB1_OVRCUR	DISP_DATA1	SCIF1_RXD	SCIF1_RXD
SCIF2	A14	AC3	P5_1		SCIF2_RXD	MTIOC7B	ADC_TRG	SCI0_CTS#/RTS#	RSPI0_SSL	IRQ2	SCIF2_RXD
	B13	AD1	P6_0	USB1_VBUSEN	RSPI2_CK	CAN_CLK	SCIF2_TXD	MTIOC7A			SCIF2_TXD
SCIF3	C22	A4	OM_DQS	CAN0_RX_DATARATE_EN	SCIF0_RXD			SCIF3_RXD			SCIF3_RXD
	C23	B4	OM_SIO4	CAN1_TX	SCIF0_SCK	MTIC5U	SCI0_RXD	SCIF3_TXD			SCIF3_TXD
SCIF4	A22	B3	OM_SIO6	CAN1_TX_DATARATE_EN	SCIF0_RTS#	MTIC5W	SCI0_SCK	SCIF4_RXD			SCIF4_RXD
	B23	A2	OM_SIO7	CAN1_RX_DATARATE_EN	IRQ0	WDTOVF_PERROUT#	SCI0_CTS#/RTS#	SCIF4_TXD			SCIF4_TXD
MTIOC4D	F18	B2	OM_CS1#	CAN0_TX_DATARATE_EN	SCIF0_TXD	MTIOC4D		SCIF3_SCK			MTIOC4D
CAN1	AC19	B4	OM_SIO4	CAN1_TX	SCIF0_SCK	MTIC5U	SCI0_RXD	SCIF3_TXD			CAN1_TX
	AB19	A3	OM_SIO5	CAN1_RX	SCIF0_CTS#	MTIC5V	SCI0_TXD	SCIF4_SCK			CAN1_RX
RSPI0	Y21	K6	P2_1	ET0_TX_ERR	SSI0_RCK	CAN1_RX	MTCLKB	SCI0_SCK	RSPI0_CK		RSPI0_CK
	Y23	M3	P2_2	ET0_TX_COL	SSI0_TXD	CAN1_TX_DATARATE_EN	MTCLKC	SCI0_TXD	RSPI0_MOSI		RSPI0_MOSI
	Y22	M6	P2_3	ET0_TX_CRS	SSI0_RXD	CAN1_RX_DATARATE_EN	MTCLKD	SCI0_RXD	RSPI0_MISO		RSPI0_MISO

Interface	OSM Pin Number	RZ/G2UL or RZ/A3UL or RZ/FIVE SoC Pin Number	Function 0	Function 1	Function 2	Function 3	Function 4	Function 5	Function 6	Function7	Default
	AA23	A21	P18_5	IRQ7	RSPI0_SSL	SCI0_CTS#/RTS#	USB1_OVRCUR		SCI1_RXD	SCIF4_TXD	RSPI0_SSL
QSPI0	U16	B6	QSPI0_SPCLK								QSPI0_SPCLK
	U15	C7	QSPI0_IO0	SCIF3_TXD	SCIF1_TXD	MTIOC0A	SCI0_RXD				QSPI0_IO0
	V15	A5	QSPI0_IO1	SCIF3_RXD	SCIF1_RXD	MTIOC0B	SCI0_TXD				QSPI0_IO1
	W16	B7	QSPI0_IO2	CAN_CLK	SCIF1_SCK	MTIOC4A	USB1_VBUSEN				QSPI0_IO2
	W15	C6	QSPI0_IO3	CAN0_TX	SCIF1_CTS#	MTIOC4B	USB1_OVRCUR				QSPI0_IO3
	Y15	B5	QSPI0_SSL	CAN0_RX	SCIF1_RTS#	MTIOC4C					QSPI0_SSL
CAN0	AC17	AE2	P6_1	USB1_OVRCUR	RSPI2_MOSI	CAN0_TX	SCIF2_RXD	MTIOC7B			CAN0_TX
	AB17	AB2	P6_2	ADC_TRG	RSPI2_MISO	CAN0_RX	SCIF2_SCK	MTIOC7C		IRQ2	CAN0_RX
JTAG	N17	U2	TCK/SWDCLK								TCK/SWDCLK
	N19	U1	TMS/SWDIO								TMS/SWDIO
	P17	W1	TDI								TDI
	R17	V2	TDO								TDO
	R19	V1	TRST#								TRST#
ADC	M18	B18	ADC_CH0/NC								ADC_CH0/NC
	N18	A18	ADC_CH1/NC								ADC_CH1/NC
RIIC1	AA16	A20	RIIC1_SDA								RIIC1_SDA
	AA15	A19	RIIC1_SCL								RIIC1_SCL

3 TECHNICAL SPECIFICATION

This section provides detailed information about the Renesas RZ/G2UL, RZ/A3UL or RZ/FIVE SBC technical specification with respect to Electrical, Environmental and Mechanical characteristics.

3.1 Electrical Characteristics

3.1.1 Power Input Requirement

The Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC supports 7V to 24V external power and uses on board voltage regulators for internal power management. By default, it supports to work with 12V power input. 12V power input from an external power supply is connected to the Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC (J3). This 2.5mm x 6.5mm barrel connector Jack should fit standard DC Plugs with an inner dimension of 2.5mm and an outer dimension of 5.5mm. The Power Jack is physically placed at the top of the board as shown below.

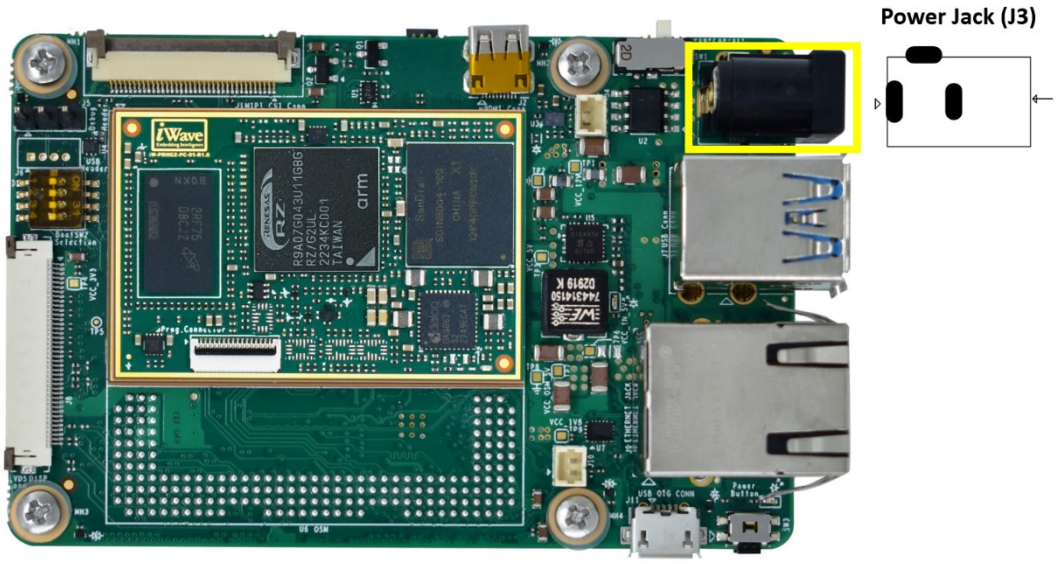

Figure 15: Power Input Jack

Table 11: Power Input Requirement

Sl. No.	Power Rail	Min (V)	Typical (V)	Max(V)	Max Input Ripple
1	VCC_12V	11.75V	12V	12.25V	

3.2 Power Consumption

The table below shows the Power Consumption for the RZ/G2UL SBC.

Task/Status	Power Rail	Current Drawn (A)/ Power Consumption (W)
Run Mode Power Consumption[1]		
Play Video run in RGB display (Gstreamer) resolution is 800x480p	VCC_12V	0.434/5.208
Camera Streaming in RGB Display - Camera resolution is 1920x1080p	VCC_12V	0.466/5.592
Ping Ethernet at 1000Mbps	VCC_12V	0.154/1.848
eMMC to Micro SD file transfer	VCC_12V	0.144/1.728
eMMC to USB2.0 file transfer	VCC_12V	0.187/2.244
Ethernet Streaming (Video Play)	VCC_12V	0.492/5.904
File Transfer - Transfer the 1GB files in storage devices	VCC_12V	0.176/2.112
Dhrystone	VCC_12V	0.137/1.644
Maximum Power Test: Run the below during Maximum Power Test, • Run video on RGB display using Gstreamer • Run the Camera Streaming • Ethernet – Ping (65500 packet size) test on background • FileTransfer - Transfer the 1GB files in storage devices • Run the dhrystone application on background	VCC_12V	0.58/6.96
Low Power Mode Power Consumption		
System Idle Mode.	VCC_12V	0.108/1.296
Deep Sleep Mode.	VCC_12V	0.107/1.284
RTC power when no VCC_12V supply is provided	VRTC_3V0	0.000000443 / 0.000001329

[1] Power consumption measurements have been done in iWave's RZ/G2UL based SBC with iWave's iW-PRHGZ-SC-01-R1.0-REL0.1-Linux5.10.158 BSP.

3.3 Environmental Characteristics

3.3.1 Environmental Specification

The below table provides the Environment specification of Renesas RZ/G2UL, RZ/A3UL or RZ/FIVE based SBC.

Table 12: Environmental Specification

Parameters	Min	Max
Operating temperature range[1]	-40°C	85°C

[1] *iWave guarantees the component selection for the given operating temperature. The operating temperature at the system level will be affected by the various system components like carrier board and its components, system enclosure, air circulation in the system, system power supply etc. based on the system design, specific heat dissipating approach might be required from system to system. It is recommended to do the necessary system level thermal simulation and find necessary thermal solution in the system before using this board in the end application.*

For more information on Thermal solution & Heat sink refer the following section.

3.3.2 Heat Sink

For any highly integrated SBC, thermal design is a very important factor. As IC's size is decreasing and performance of module is increasing by rising processor frequencies, it generates high amount of heat which should be dissipated for the system to work as expected without fault.

To dissipate the heat, appropriate thermal management techniques like Heat spreader, Heat sink or Fan Sink must be used. Always need to remember that more effective thermal solution will give more performance out of the CPU.

Note: iWave supports Heat Sink Solution for RZ/G2UL or RZ/A3UL or RZ/FIVE SBC. For more information on Heat Sink& Fan Sink contact iWave support team. Do not Power On the RZ/G2UL or RZ/A3UL or RZ/FIVE SBC without a proper thermal solution.

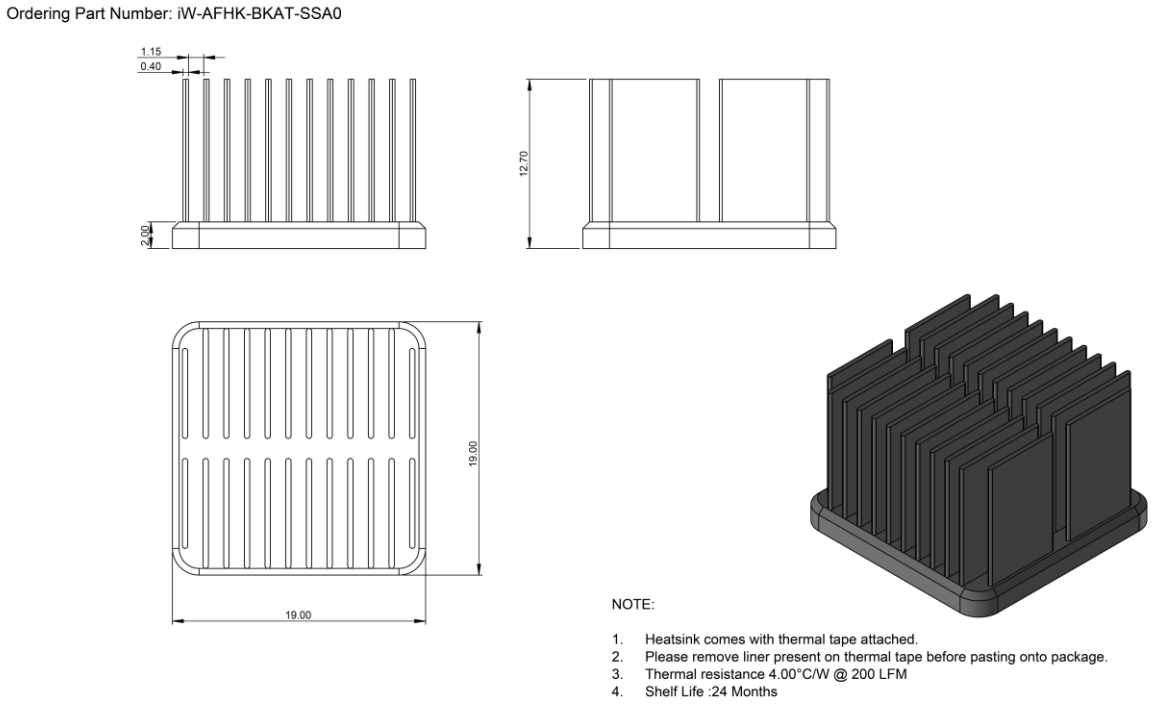

Figure 16: Mechanical dimension of Heat Sink

3.3.3 RoHS Compliance

iWave's Renesas RZ/G2UL, RZ/A3UL or RZ/FIVE based SBC is designed by using RoHS compliant components and manufactured on lead free production process.

3.3.4 Electrostatic Discharge

iWave's Renesas RZ/G2UL, RZ/A3UL or RZ/FIVE based SBC is sensitive to electro static discharge and so high voltages caused by static electricity could damage some of the devices on board. It is packed with necessary protection while shipping. Do not open or use the SBC except at an electrostatic free workstation.

3.4 Mechanical Characteristics

3.4.1 Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC Mechanical Dimensions

Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC PCB size is 85mm x 56mm. Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC mechanical dimension is shown below. (All dimensions are shown in mm)

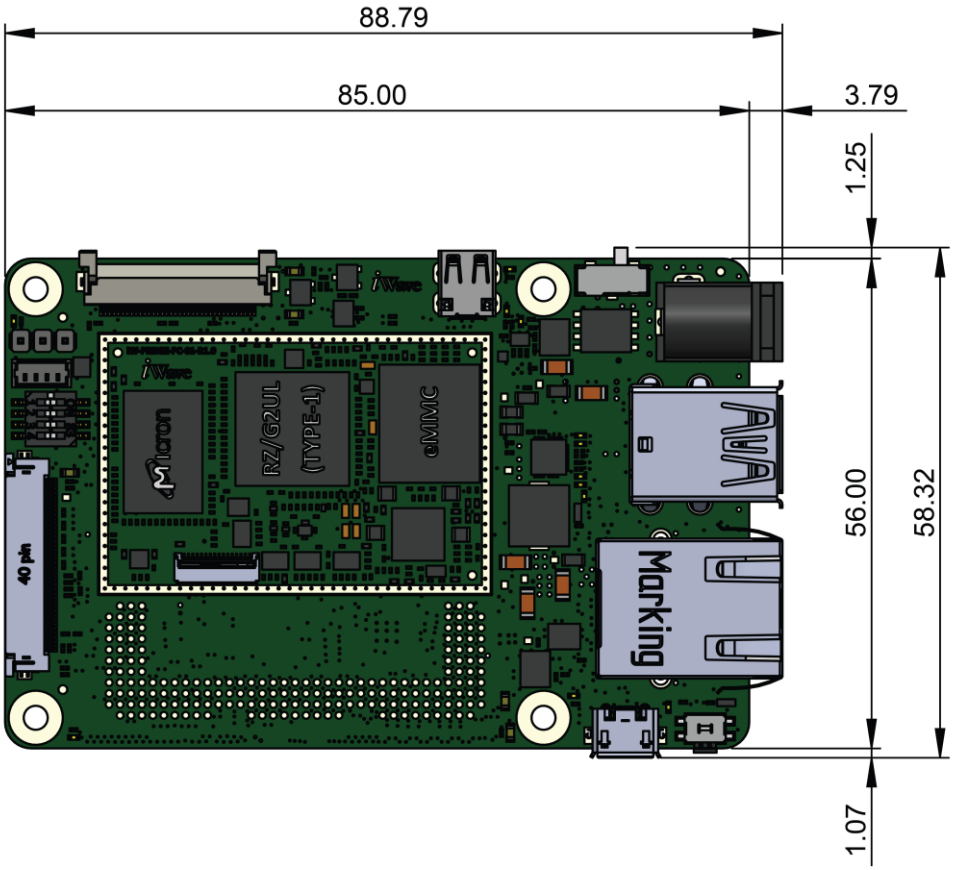

Figure 17: Mechanical Dimensions of Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC Top View

The Renesas RZ/G2UL or RZ/FIVE or RZ/A3ULbased SBC PCB thickness is 1.2mm±0.15mm, top side maximum height component is 16.40mm (HDMI Connector), followed by Dual Ethernet Connector (16.40mm). In bottom side maximum height component is JTAG connector (5.91mm) followed by M.2 SMT spacer (3.99mm).

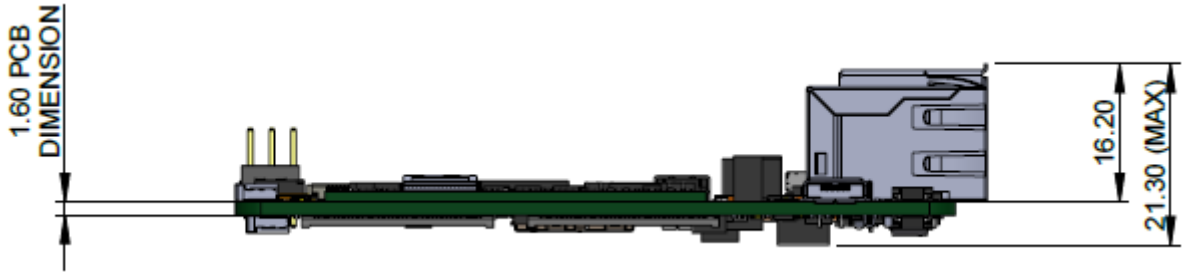

Figure 18: Mechanical Dimensions of Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC Side View-1

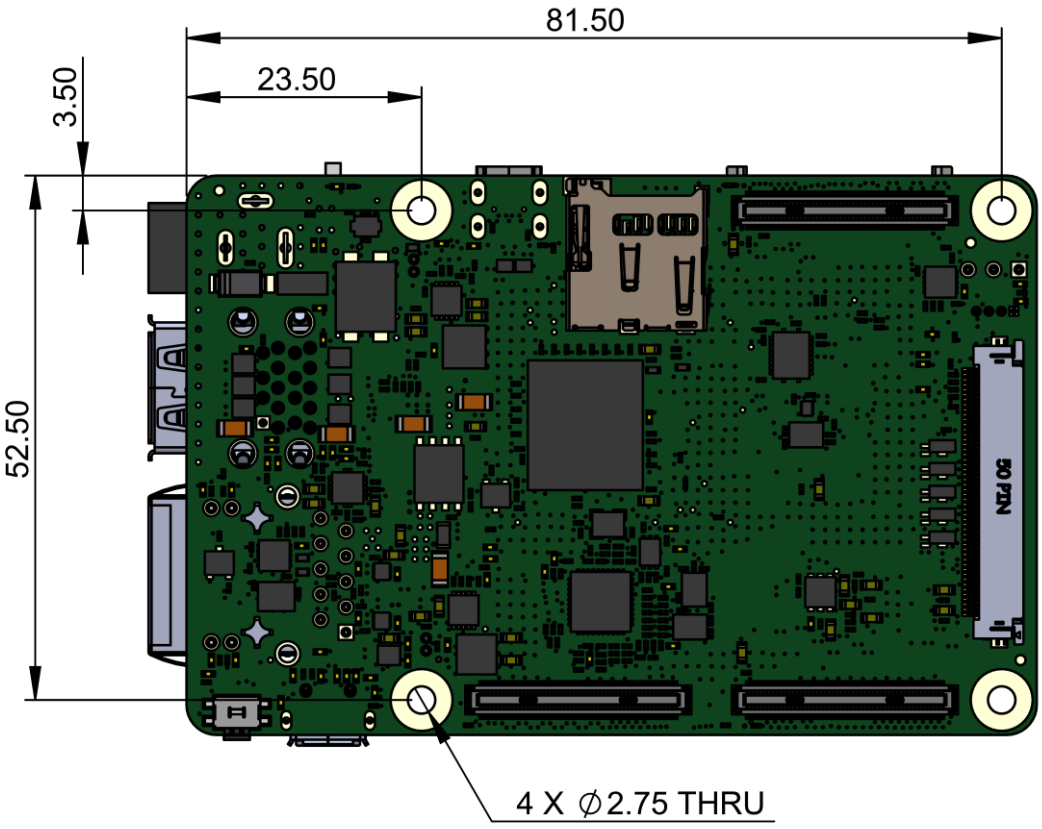

Figure 19: Mechanical Dimensions of Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC Bottom View

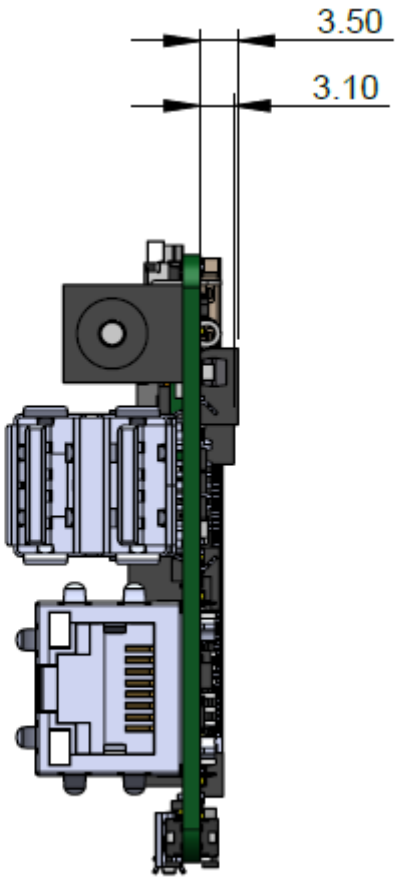

Figure 20: Mechanical Dimensions of Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC Side View-2

4 ORDERING INFORMATION

The below table provides the standard orderable part numbers for different Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC variations. Please contact iWave for orderable part number of higher RAM memory size or Flash memory size SBC configurations. Also, if the desired part number is not listed in below table or if any custom configuration part number is required, please contact iWave.

Table 13: Orderable Product Part Numbers

Product Part Number	Description	Temperature
iW-Rainbow G54S – Renesas RZ/G2UL or RZ/A3UL or RZ/FIVE based SBC		
iW-G53M-OM2U-4L002G-E016G-BIA	RZ/G2UL CPU, 2GB LPDDR4, 16GB eMMC based OSM	-40°C to 85°C
iW-G53M-OM3U-4L002G-E016G-BIA	RZ/A3UL CPU, 2GB LPDDR4, 16GB eMMC based OSM	-40°C to 85°C
iW-G53M-OMFV-4L001G-E016G-BIA	RZ/FIVE CPU, 1GB LPDDR4, 16GB eMMC based OSM	-40°C to 85°C

Important Note: Some of the above-mentioned Part Numbers are subject to MOQ purchase. Please contact iWave for further details.

For SBC identification purpose, Product Part Number and SBC Unique Serial Number are pasted as Label with Barcode readable format on SBC.