User's Manual

RZ SMARC Series Carrier Board

User's Manual: Hardware

Renesas Microprocessor
RZ Family / RZ/G, RZ/V Series

RTK97X4XXXB00000BE

All information contained in these materials, including products and product specifications, represents information on the product at the time of publication and is subject to change by Renesas Electronics Corp. without notice. Please review the latest information published by Renesas Electronics Corp. through various means, including the Renesas Electronics Corp. website (http://www.renesas.com).

Renesas Electronics
www.renesas.com

Rev.1.01 Oct, 2021

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall be responsible for determining what licenses are required from any third parties, and obtaining such licenses for the lawful import, export, manufacture, sales, utilization, distribution or other disposal of any products incorporating Renesas Electronics products, if required.
5. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
6. Renesas Electronics products are classified according to the following two quality grades: “Standard” and “High Quality”. The intended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below.
   "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.
   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.
   Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user’s manual or other Renesas Electronics document.
7. No semiconductor product is absolutely secure. Notwithstanding any security measures or features that may be implemented in Renesas Electronics hardware or software products, Renesas Electronics shall have absolutely no liability arising out of any vulnerability or security breach, including but not limited to any unauthorized access to or use of a Renesas Electronics product or a system that uses a Renesas Electronics product. RENESAS ELECTRONICS DOES NOT WARRANT OR GUARANTEE THAT RENESAS ELECTRONICS PRODUCTS, OR ANY SYSTEMS CREATED USING RENESAS ELECTRONICS PRODUCTS WILL BE INVULNERABLE OR FREE FROM CORRUPTION, ATTACK, VIRUSES, INTERFERENCE, HACKING, DATA LOSS OR THEFT, OR OTHER SECURITY INTRUSION (“Vulnerability Issues”). RENESAS ELECTRONICS DISCLAIMS ANY AND ALL RESPONSIBILITY OR LIABILITY ARISING FROM OR RELATED TO ANY VULNERABILITY ISSUES. FURTHERMORE, TO THE EXTENT PERMITTED BY APPLICABLE LAW, RENESAS ELECTRONICS DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO THIS DOCUMENT AND ANY RELATED OR ACCOMPANYING SOFTWARE OR HARDWARE, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.
8. When using Renesas Electronics products, refer to the latest product information (data sheets, user’s manuals, application notes, “General Notes for Handling and Using Semiconductor Devices” in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
12. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
13. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
14. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.

(Note2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

(Rev.5.0-1 October 2020)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Contact information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:。

www.renesas.com/contact/

Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

© 2021 Renesas Electronics Corporation. All rights reserved.

Trademarks (continued)

For the “Cortex” notation, it is used as follows;
— Arm® Cortex®-A55
— Arm® Cortex®-M33
Note that after this page, they may be noted as Cortex-A55 and Cortex-M33 respectively.

Examples of trademark or registered trademark used in the RZ SMARC Series Carrier Board RTK97X4XXXB00000BE User’s Manual: Hardware;
CoreSight™: CoreSight is a trademark of Arm Limited.
MIPI®: MIPI is a registered trademark of MIPI Alliance, Inc.
eMMC™: eMMC is a trademark of MultiMediaCard Association.

Note that in each section of the Manual, trademark notation of ® and TM may be omitted.
All other trademarks and registered trademarks are the property of their respective owners.

© 2021 Renesas Electronics Corporation. All rights reserved.

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)
   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
2. Processing at power-on
   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.
3. Input of signal during power-off state
   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.
4. Handling of unused pins
   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.
5. Clock signals
   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.
6. Voltage application waveform at input pin
   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).
7. Prohibition of access to reserved addresses
   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.
8. Differences between products
   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

Table of Contents

1. Overview

1.1 Overview

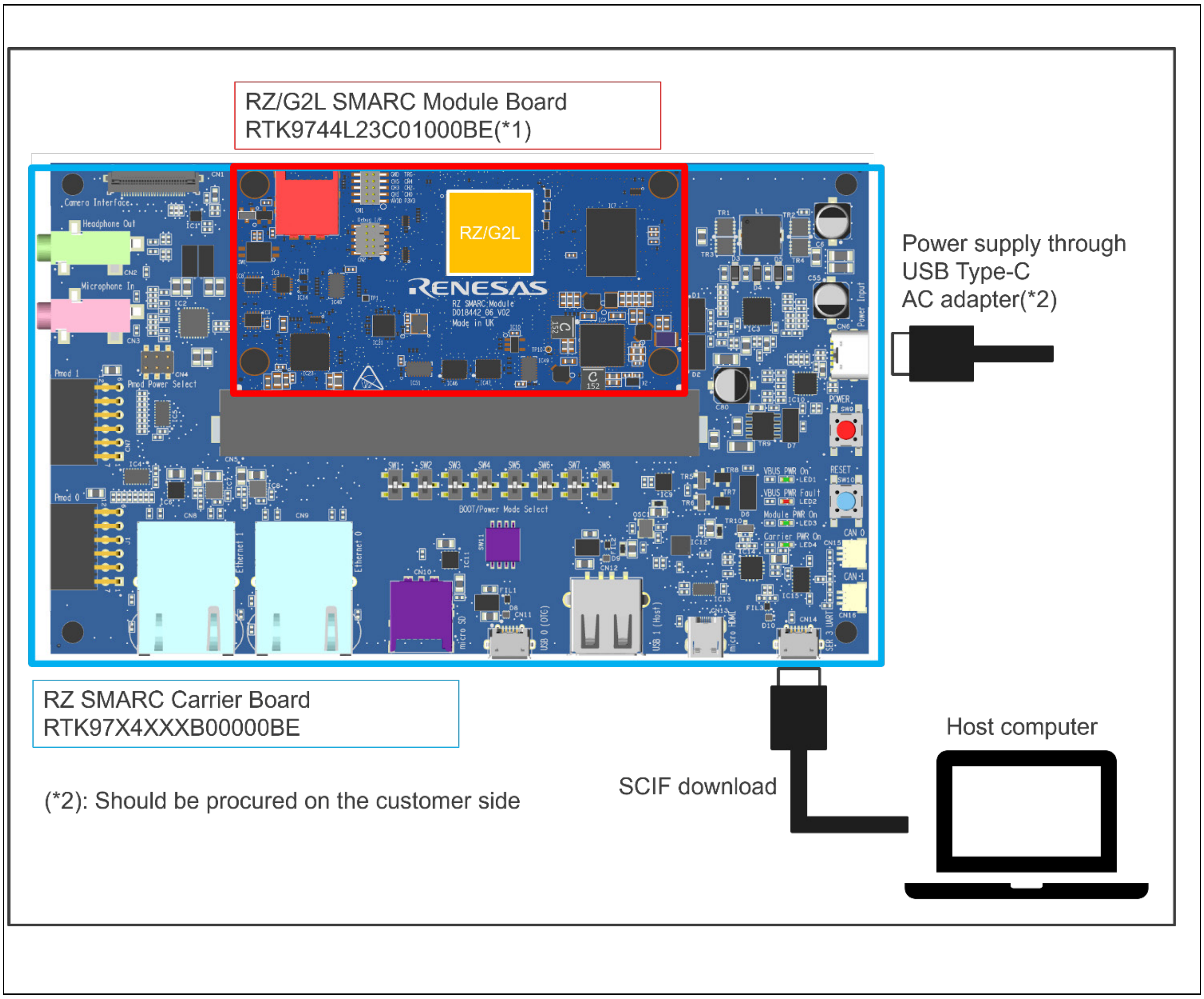
This document describes the specification of RTK97X4XXXB00000BE which is a Carrier board for use with to a Module board. In combination with the Module board, device functionality and performance can be evaluated, and application software can be developed and evaluated in advance.

The RTK97X4XXXB00000BE complies with the SMARC v2.1 and has following features.

- The FFC/FPC connector is mounted as standard for connection to high-speed serial interface for camera module.
- The microHDMI connector via MIPI-DSI to HDMI transceiver is mounted as standard for connection to high-speed serial interface for digital video module.
- The microUSB Type-AB receptacle (ch0: USB2.0 Host-Function) and USB Type-A receptacle (ch1: USB2.0 Host) are respectively mounted as standard for connection to USB interface.
- The RJ45 connector is mounted as standard for software development and evaluation using Ethernet.
- The audio codec is mounted as standard for advance development of audio system. The audio input/output jack is implemented for connection to audio interface.
- The CAN connector is implemented for connection to CAN-FD interface.
- The microUSB Type-AB receptacles is implemented for connection to asynchronous serial port interface.
- The microSD card slot and two sockets for PMOD are implemented as an interface for peripheral functions.
- For power supply, it is mounted a USB Type-C receptacle that supports the USB PD standard.

1.2 Configuration

Figure 1.1 shows an example of system configuration using RTK97X4XXXB00000BE. Here, it shows an example that RTK9744L23C01000BE is used as the Module Board(*1).



(*2): Should be procured on the customer side

Figure 1.1 Example of System Configuration Using RTK97X4XXXB00000BE

Note 1. The targeted Module Board is below:

- PMIC Edition
  - RTK9744C22C01000BE (RZ/G2LC SMARC Module Board)
  - RTK9754L23C01000BE (RZ/V2L SMARC Module Board)

1.3 Features

Table 1.1 shows the features of RTK97X4XXXB00000BE.

Table 1.1 Features of RTK97X4XXXB00000BE

Item	Details
Video IC	MIPI-DSI to HDMI transceiver: 1pc
CAN Interface IC	CAN transceiver: 1pc
Codec IC	Audio codec: 1pc
Connector	SMARC edge connector (314 pins): 1pc Audio input/output jack: 2pcs Serial port connector (microUSB Type-AB): 1pc LAN connector (RJ-45): 2pcs microSD card slot (4 bits): 1pc USB Type-A receptacle: 1pc microUSB Type-AB receptacle: 1pc MIPI CSI-2 camera connector: 1pc microHDMI connector: 1pc CAN connector: 2pcs PMOD connector: 2pcs USB Type-C receptacle: 1pc
Switch	Power switch: 1pc Reset switch: 1pc System setting DIP switch: 4 bits I/F setting DIP switch: 8pcs
Circuit board specifications	Dimensions: 160 mm * 100 mm Mount: Single-sided mounting (6 layers)

1.4 Outside View

Figure 1.2 and **Figure 1.3** show the outside view of RTK97X4XXXB00000BE.

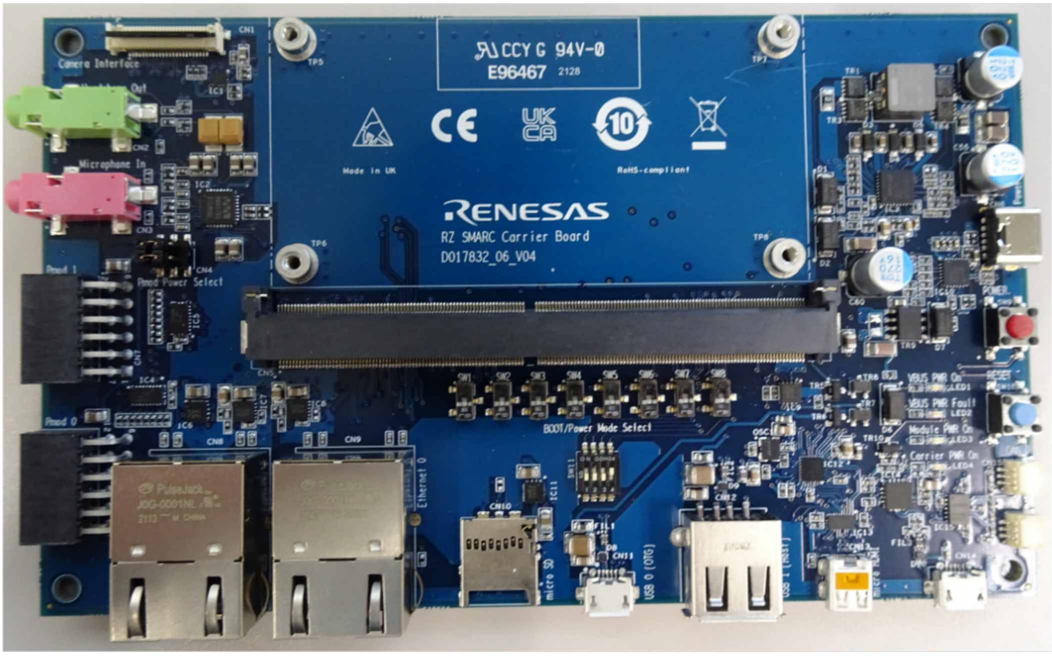


Figure 1.2 Outside View of RTK97X4XXXB00000BE (Top View)

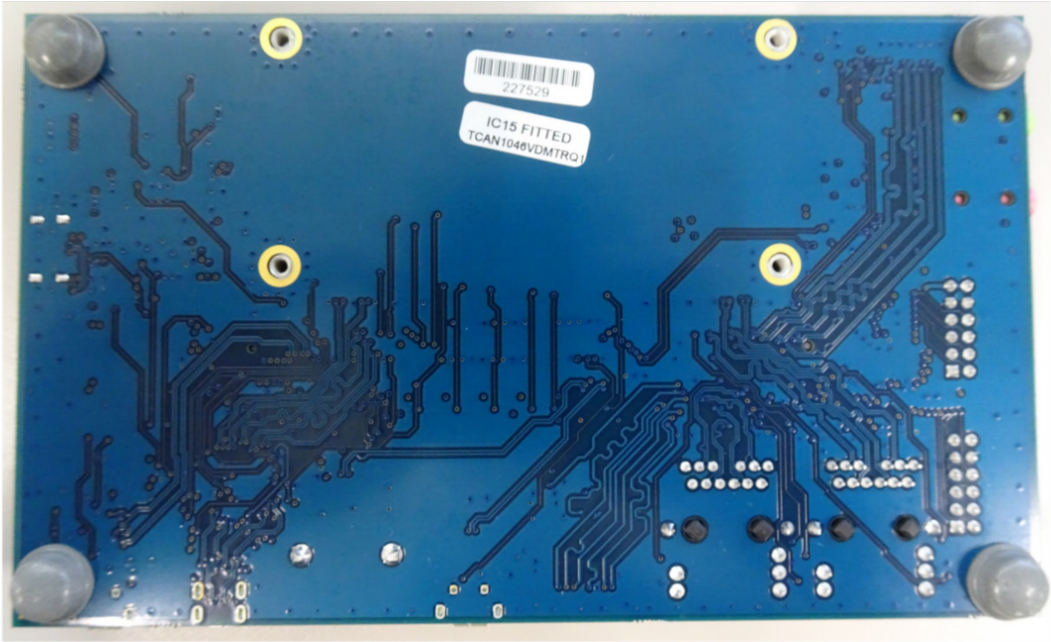


Figure 1.3 Outside View of RTK97X4XXXB00000BE (Bottom View)

1.5 Block Diagram

Figure 1.4 shows the block diagram of RTK97X4XXXB00000BE.

Here, it shows an example that RTK9744L23C0100BE is used as the Module Board.

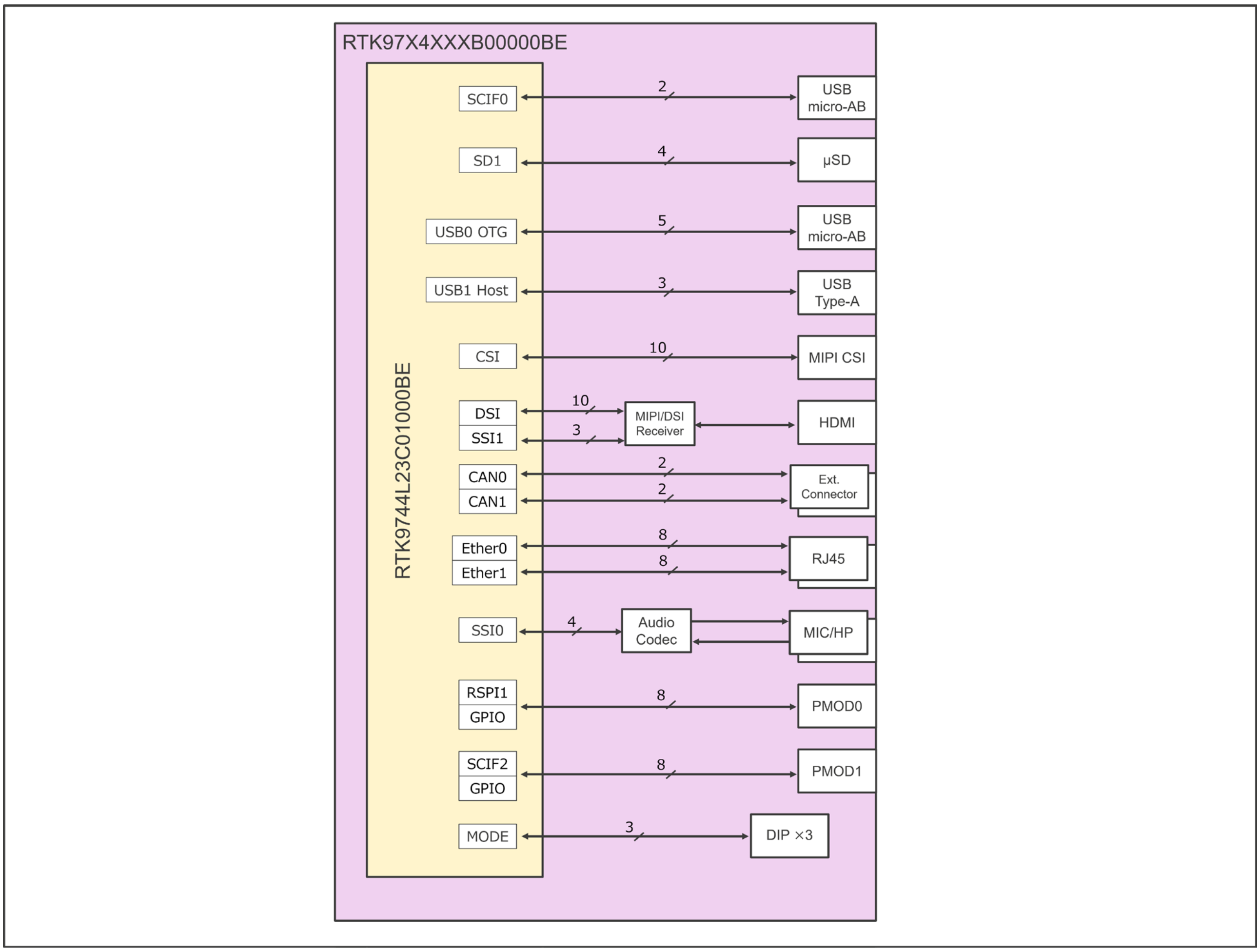


Figure 1.4 Block Diagram of RTK97X4XXXB00000BE

1.6 Layout Components

Figure 1.5 and **Figure 1.6** show the layout of main components of RTK97X4XXXB00000BE.

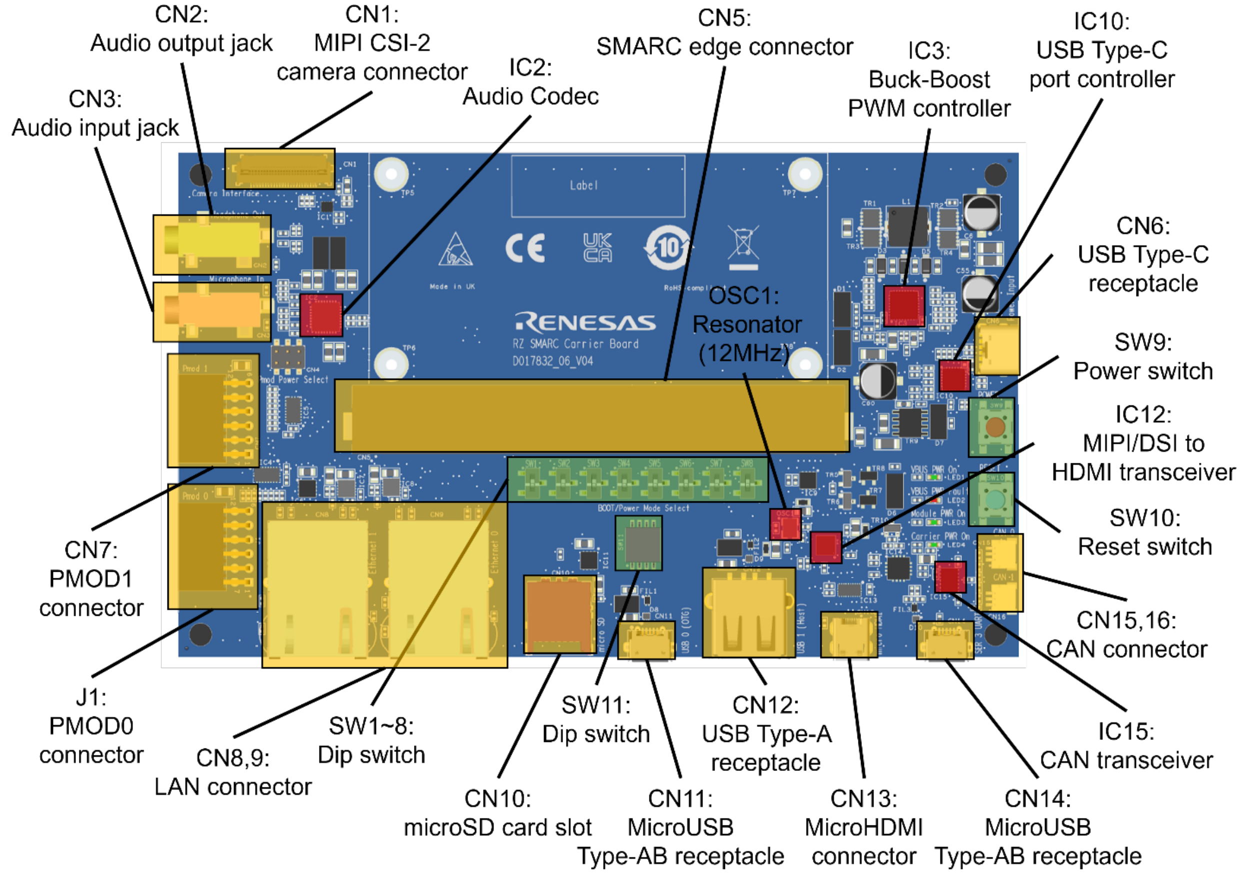


Figure 1.5 Layout of Components of RTK97X4XXXB00000BE (Top View)

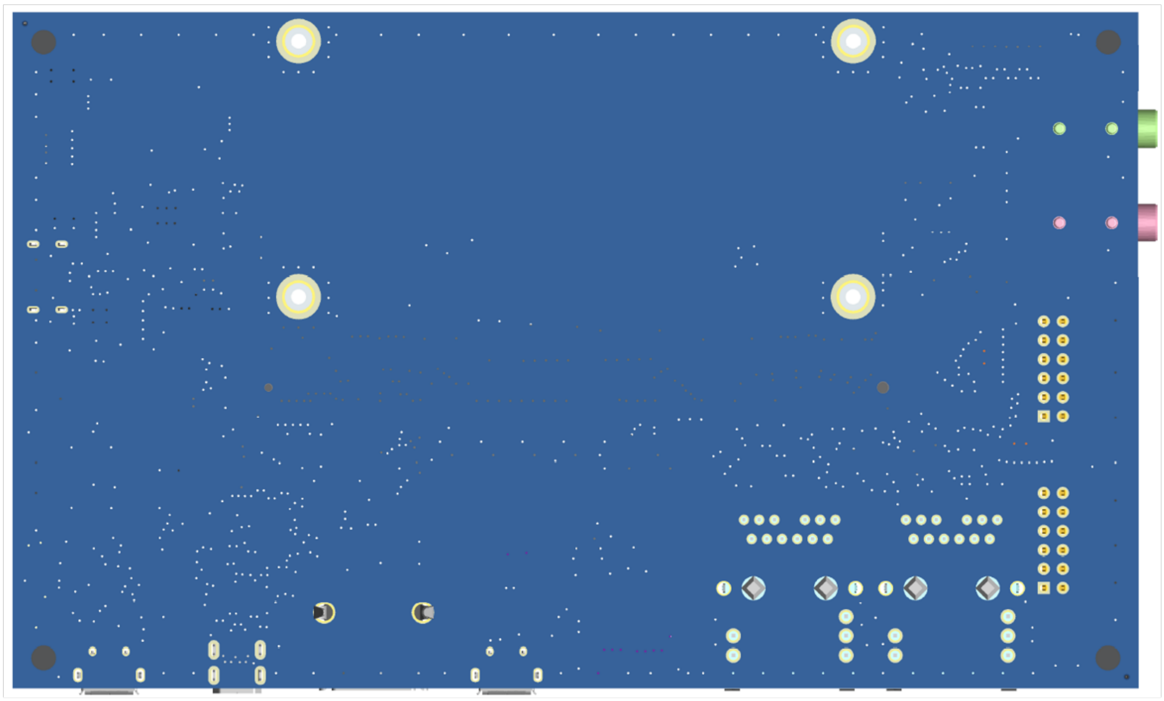


Figure 1.6 Layout of Components of RTK97X4XXXB00000BE (Bottom View)

Table 1.2 and **Table 1.3** list main components mounted on RTK97X4XXXB00000BE.

Table 1.2 Main Components on RTK97X4XXXB00000BE (1) IC

Component Number	Component Name	Type (Manufacturer)	Recommended Optional Components
IC2	Audio Codec	WM8978CGEFL/V (Wolfson Cirrus Logic)	
IC3	Buck-Boost PWM controller	ISL81401FRZ (Renesas Electronics)	
IC10	USB Type-C port controller	CYPD3177-24LQXQ (Cypress)	
IC12	MIPI-DSI to HDMI transceiver	ADV7535BCBZ-RL (Analog Devices)	
IC15	CAN transceiver	TCAN1046VDMTRQ1 (Texas Instruments)	
OSC1	Crystal resonator for HDMI transceiver	SIT1602AI-23-18E-12.000000D (SiTime)	12MHz

Table 1.3 Main Components on RTK97X4XXXB00000BE (2) Connector

Components Number	Component Name	Type (Manufacturer)	Recommend Optional Parts
CN1	MIPI CSI-2 camera connector	5051102491 (Molex)	
CN2	Audio output jack	SJ-3524-SMT-TR-GR (CUI Devices)	
CN3	Audio input jack	SJ-3524-SMT-TR-PI (CUI Devices)	
CN5	SMARC edge connector (314pin)	MM70-314B1-2-R300 (JAE)	
CN6	USB Type-C receptacle	UJC-HP-3-SMT-TR (CUI Devices)	
J1, CN7	PMOD0/1 connector	SSW-106-02-T-D-RA (Samtec)	
CN8, CN9	LAN connector	J0G-0001NL (Pulse Electronics)	
CN10	MicroSD card slot	504077-1891 (Molex)	
CN12	USB Type-A receptacle	KUSBX-SMT-AS1N-B (Kycon)	
CN11, CN14	MicroUSB Type-AB Receptacle	629105150921 (We-online)	
CN13	MicroHDMI connector	46765-1301 (Molex)	
CN15, CN16	CAN connector	SM03B-SRSS-TB(LF)(SN)(JST)	

1.7 Absolute Maximum Ratings

Table 1.4 lists absolute maximum ratings of RTK97X4XXXB00000BE.

Table 1.4 Absolute Maximum Ratings of RTK97X4XXXB00000BE

Symbol	Item	Rated Value	Note
USBC_VBUS_IN	Power voltage	30V	Reference: USB Type-C Port Controller (CYPD3177) Specification
—	Maximum power consumption	3A	Includes continuous RZ/G2L Module Board current consumptions
Topr	Operating ambient temperature*[1]	0°C to 50°C	Do not expose to condensation or corrosive gases
Tstg	Storage temperature*[1]	-10°C to 60°C	Do not expose to condensation or corrosive gases

Note 1. Ambient temperature is the air temperature at a position as close to the board as possible.

1.8 Operating Condition

Table 1.5 lists operating conditions of RTK97X4XXXB00000BE.

Table 1.5 Operating Conditions of RTK97X4XXXB00000BE

Symbol	Item	Rated Value	Note
USBC_VBUS_IN	Power voltage	4.5V to 12.5V	Reference: Vss
—	Maximum consumption current	2A	In the case of 5V input voltge Includes continuous RZ/G2L Module Board current consumptions
Topr	Operating ambient temperature*[1]	0°C to 40°C	Do not expose to condensation or corrosive gases

Note 1. Ambient temperature is the air temperature at a position as close to the board as possible.

2. Functional Specifications

2.1 Overview of Functions

Table 2.1 lists function modules of RTK97X4XXXB00000BE.

Table 2.1 Function Modules of RTK97X4XXXB00000BE

Section	Function	Description
2.2	**MPU**	Devices pin functions used in the RTK97X4XXXB00000BE
2.3	**USB Interface**	Connection between the USB2.0 host/function module and microUSB Type-AB, Type-A connector
2.4	**Gigabit Ethernet Interface**	Connection between the Ethernet controller (E-MAC) and LAN connector via Ethernet PHY
2.5	**Serial Interface**	Connection between the Serial Communications Interface with FIFO (SCIFA) and microUSB Type-AB connector
2.6	**Clock Configuration**	System clock configuration
2.7	**Reset Control**	Reset control for the Module board and devices installed on RTK97X4XXXB00000BE.
2.8	**Power Supply Configuration**	System power supply configuration of the Module board and RTK97X4XXXB00000BE
2.9	**SD1 Interface**	Connection between the SD/MMC Host Interface (SDHI) channel 1 and microSD card slot
2.10	**Audio Interface**	Connection for the Serial Sound Interface (SSIF-2) via Audio Codec (WM8978)
2.11	**Camera Interface**	Connection between the Camera Data Receiving Unit (CRU) and camera connector
2.12	**Display Interface**	Connection between devices and microHDMI connector via the MIPI/DSI to HDMI transceiver
2.13	**CAN-FD Interface**	Connection between the CAN-FD interface (RS-CANFD) and CAN connector
2.14	**PMOD Interface**	Connection between General Purpose Input Output interface (GPIO) and PMOD connector
—	Operating specification	Connectors, switches and LEDs Details are described in Chapter 3

2.2 MPU

Please refer to the function list (section 2.2.2) in the user's manual of each module board.

2.3 USB Interface

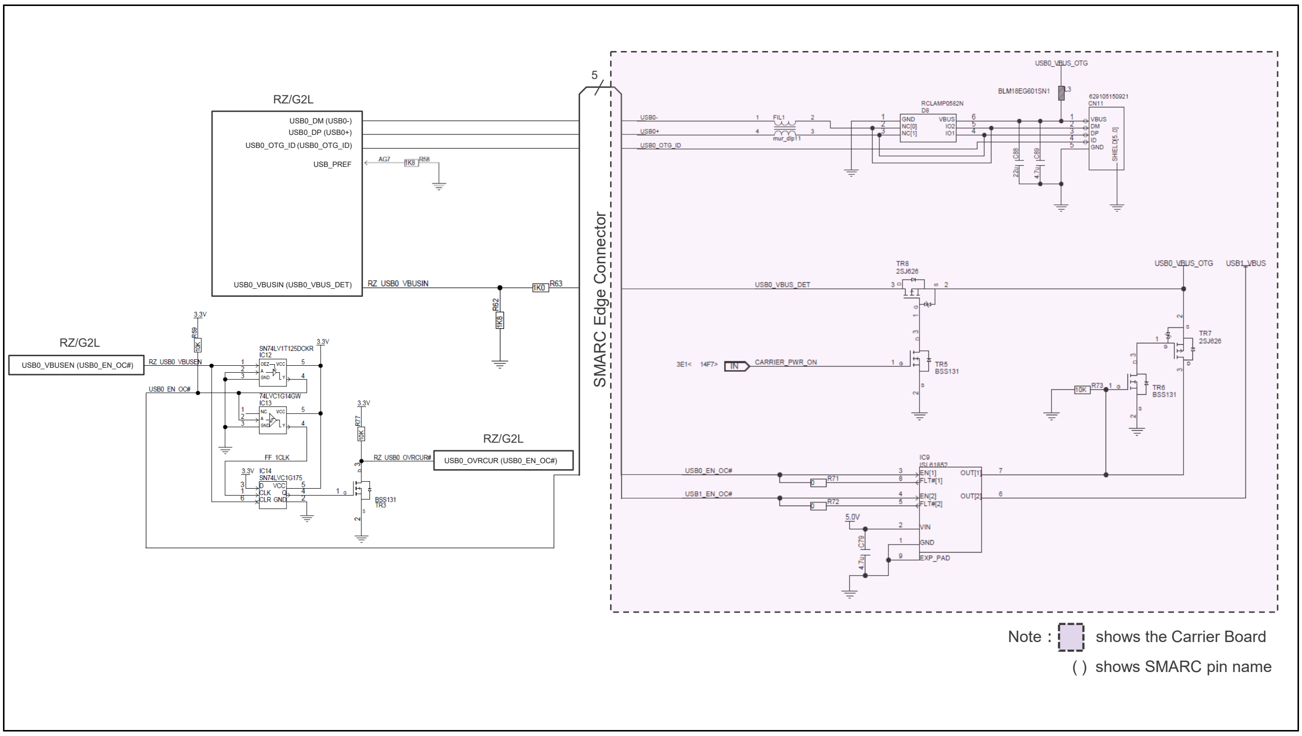
2.3.1 USB0 (Host-Function)

Figure 2.1 shows a block diagram of the USB0 (Host-Function) interface.

RTK97X4XXXB00000BE is implemented the VBUS supply circuit, a protection diode and the microUSB Type-AB receptacle.

This interface complies with the USB standard version 2.0 and supports the USB On-The-Go function.

Here, it shows an example that RTK9744L23C0100BE is used as the Module Board.



Note : ▨ shows the Carrier Board

( ) shows SMARC pin name

Figure 2.1 Block Diagram of USB0 (Host-Function) I/F

2.3.2 USB1 (Host)

Figure 2.2 shows a block diagram of the USB1 (Host) interface.

RTK97X4XXXB00000BE is implemented the VBUS supply circuit, a protection diode and the USB Type-A receptacle.

This interface complies with the USB standard version 2.0.

Here, it shows an example that RTK9744L23C0100BE is used as the Module Board.

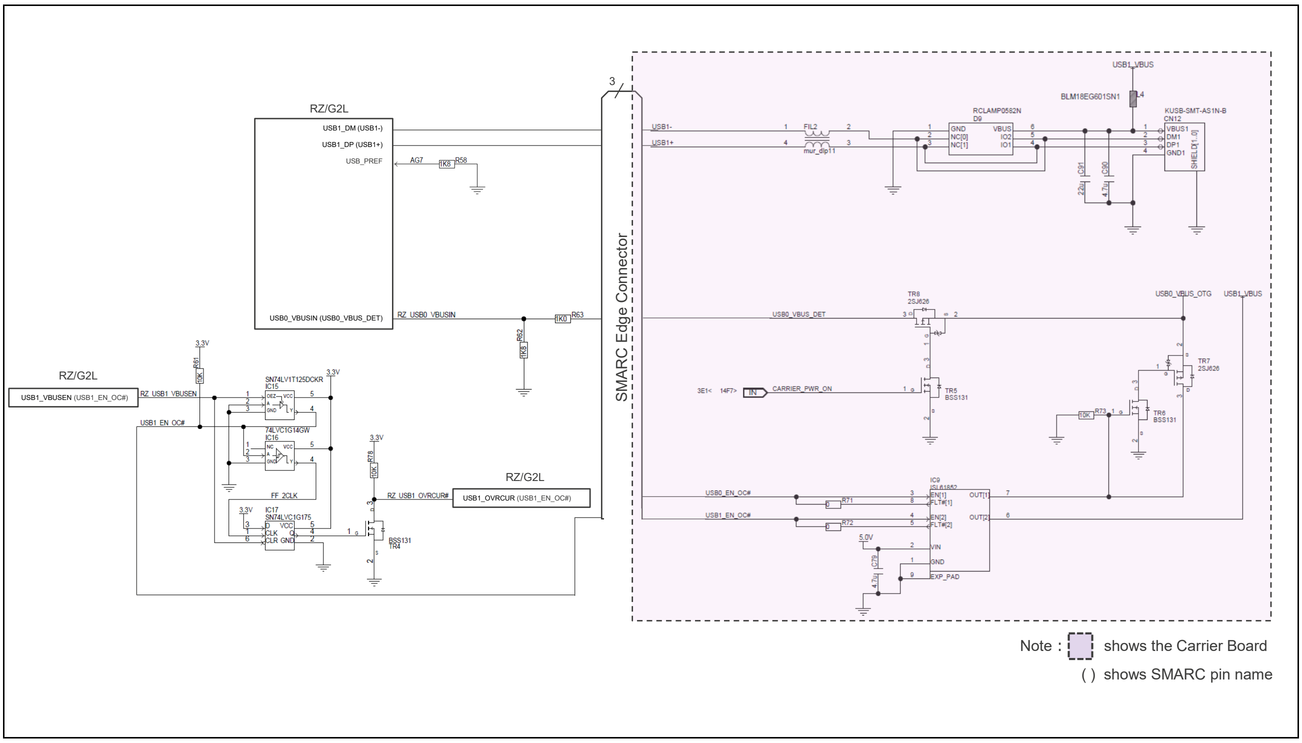


Figure 2.2 Block Diagram of USB1 (Host) I/F

2.4 Gigabit Ethernet Interface

Figure 2.3 and **Figure 2.4** show a block diagram of Ethernet0 and Ethernet1 interface.

RTK97X4XXXB00000BE is implemented the RJ45 connector for connection to the Ethernet interface.

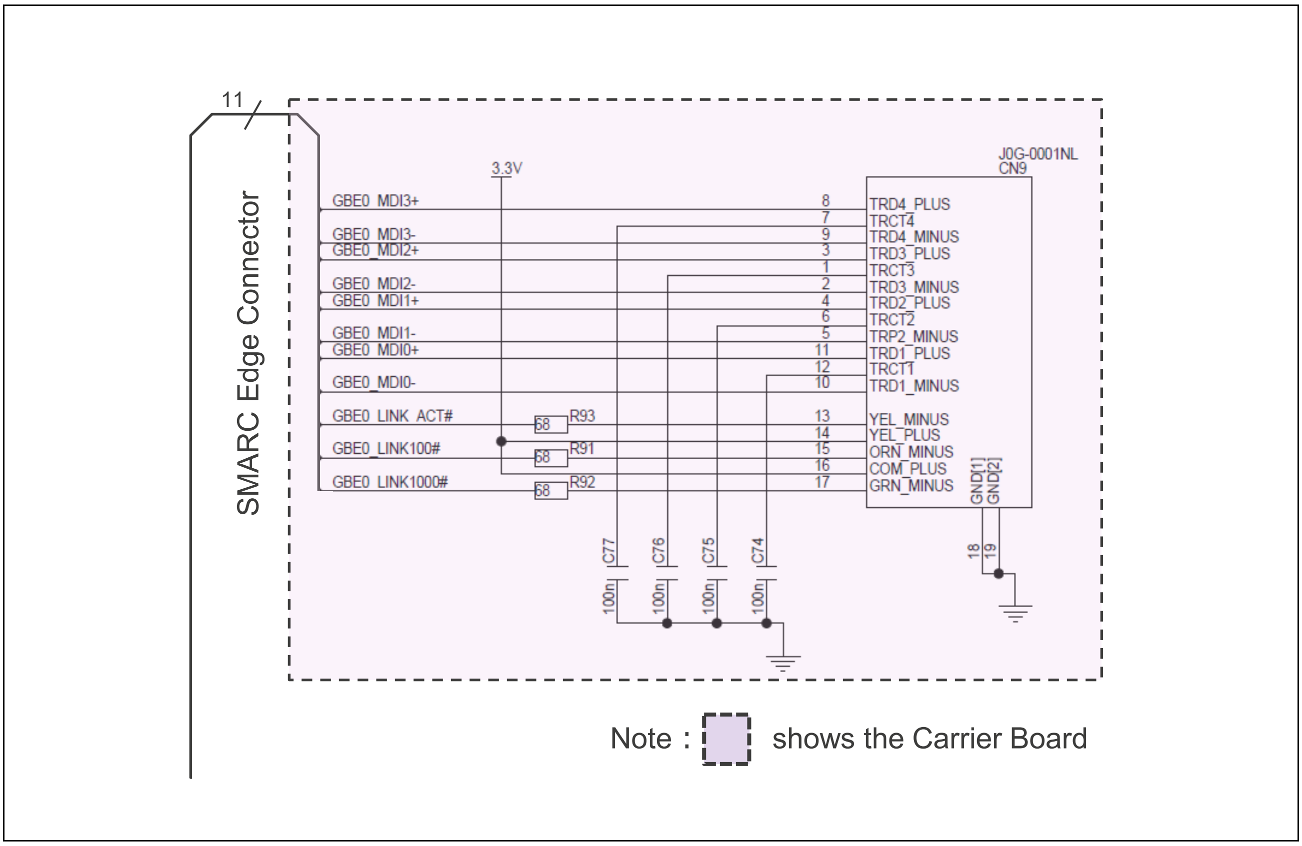
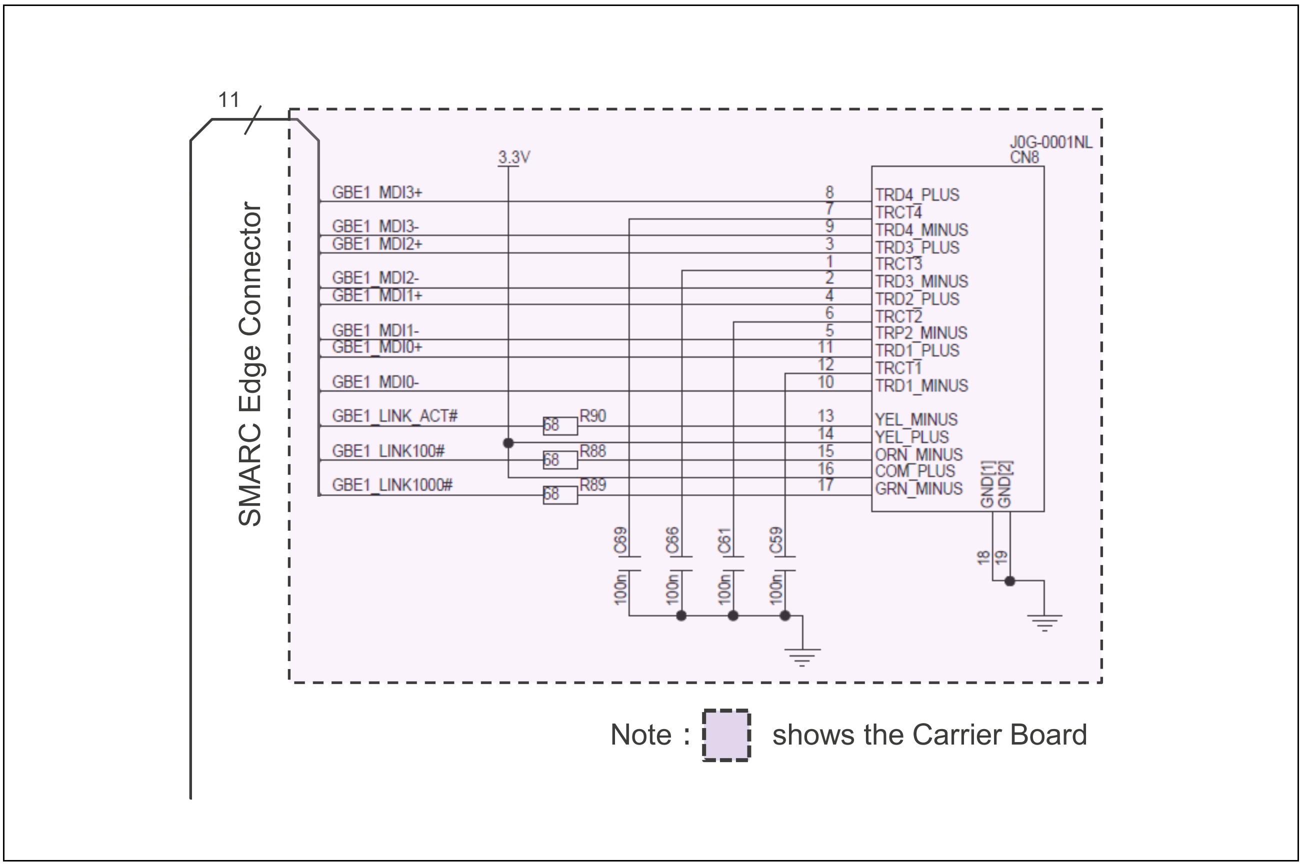


Figure 2.3 Block Diagram of Ethernet0 I/F



Note : ▨ shows the Carrier Board

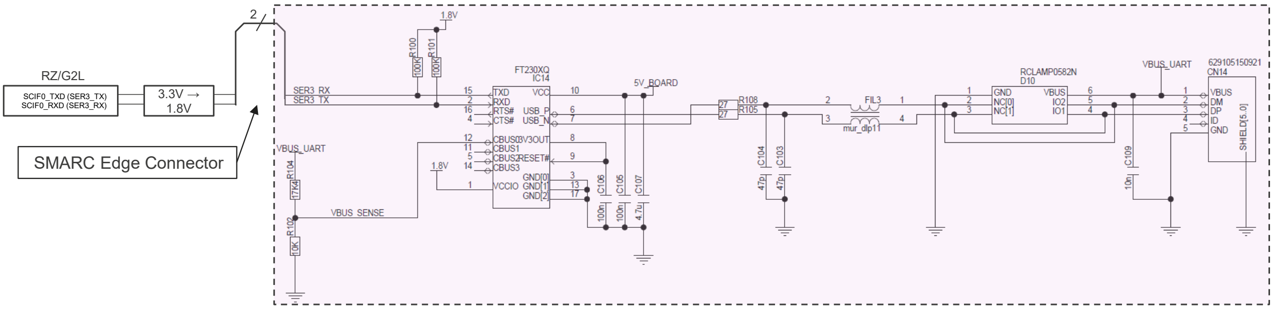
Figure 2.4 Block Diagram of Ethernet1 I/F

2.5 Serial Interface

Figure 2.5 shows a block diagram of Serial interface.

RTK97X4XXXB00000BE is connected the microUSB Type-AB receptacle through the USB serial conversion IC. The six input channels can be used.

Here, it shows an example that RTK9744L23C0100BE is used as the Module Board.



Note : 🟪 shows the Carrier Board

( ) shows SMARC pin name

Figure 2.5 Block Diagram of Serial I/F

2.6 Clock Configuration

Figure 2.6 shows a block diagram of the Clock configuration.

Here, it shows an example that RTK9744L23C0100BE is used as the Module Board.

NOTE

MIPI-DSI Interface supports operation up to Full HD, 60fps mode.

SD Interface supports UHS-I mode of 50MB/s (SDR50) and 104MB/s (SDR104).

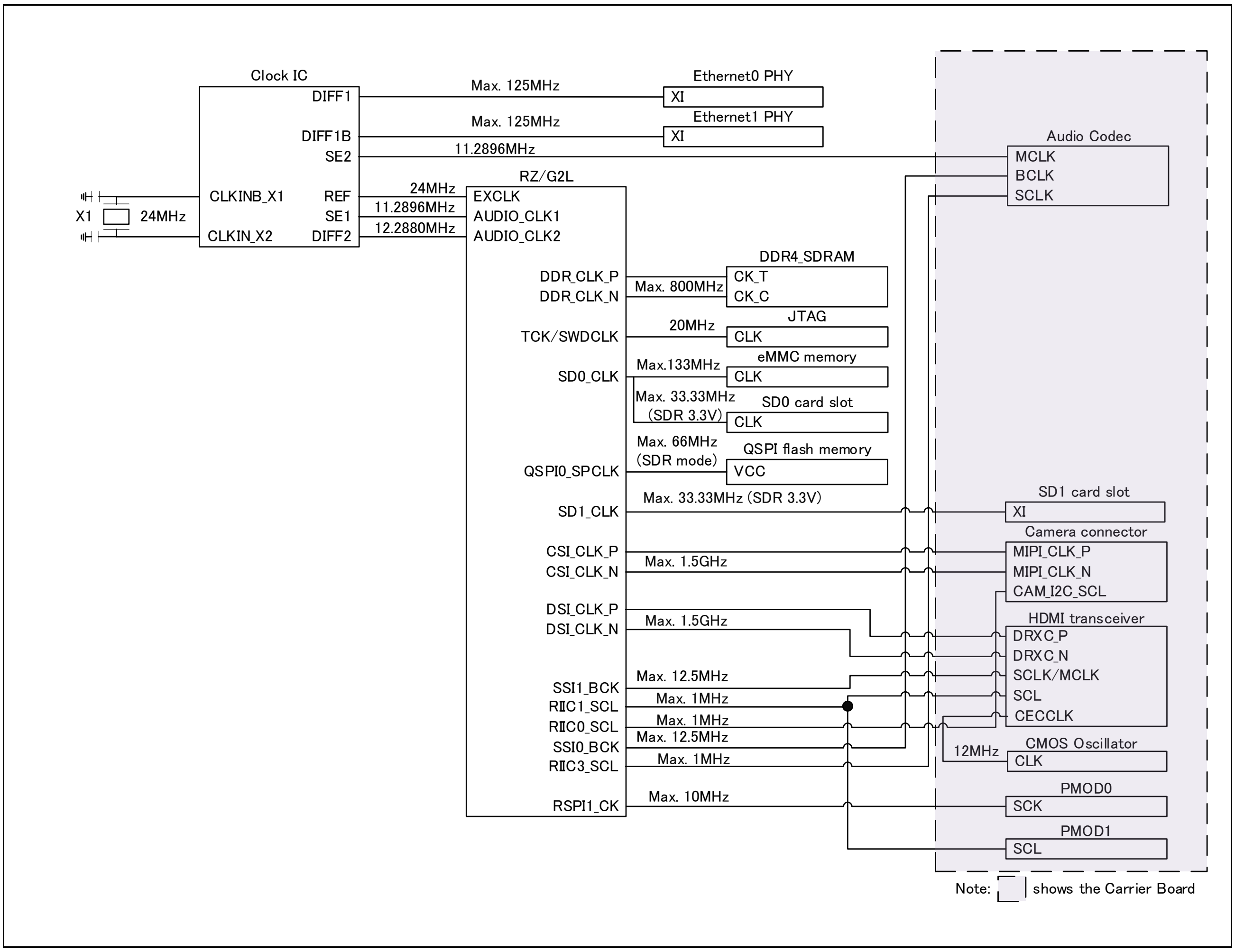


Figure 2.6 Block Diagram of Clock Configuration

2.7 Reset Control

Figure 2.7 shows block diagrams of a reset control for RTK9744L23S01000BE (RZ/G2L Evaluation Board Kit).

For the RTK97X4XXXXB00000BE, the interfaces of PMOD and Camera are controlled by reset signal from the PMIC.

There are two types of system resets: power-on reset and reset by the button switch.

Here, it shows an example that RTK9744L23C0100BE is used as the Module Board.

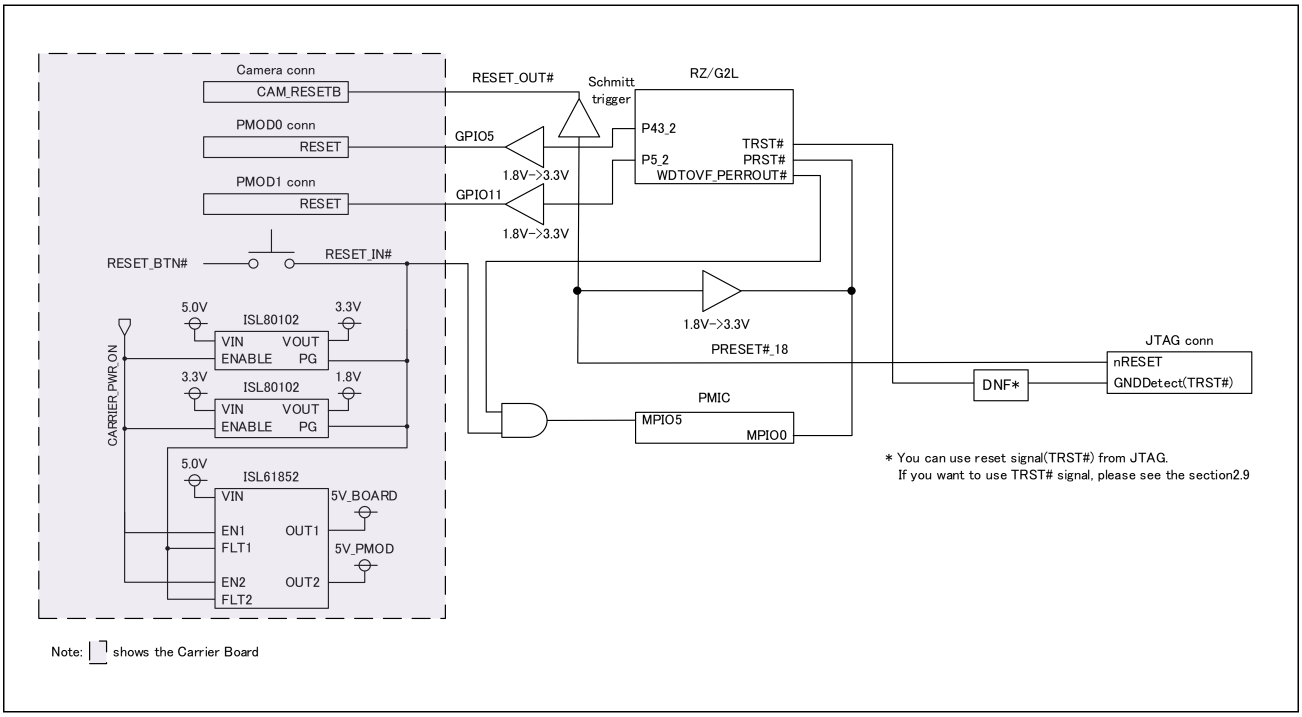


Figure 2.7 Block Diagram of Reset Control

2.8 Power Supply Configuration

Figure 2.8 shows a block diagram of power configuration for RTK9744L23S01000BE (RZ/G2L Evaluation Board Kit).

This board has a USB Type-C receptacle for power input with USB Power Delivery. The input voltage of VBUS can be selected between 5V and 9V.

The default setting for controlling the input voltage level is 5V (max 3A input) with SW11-4 is turned on. When the switch is turned off, the input voltage is 9V (max 3A input). Only when RTK9744L23S01000BE is connected to external devices that requires a lot of power and is expected to run out of power, the SW 11-4 is turned off.

The 5V power supply is supplied to the PMIC installed in RTK9744L23C01000BE, and the PMIC generates the power supply voltage for each interface.

Here, it shows an example that RTK9744L23C0100BE is used as the Module Board.

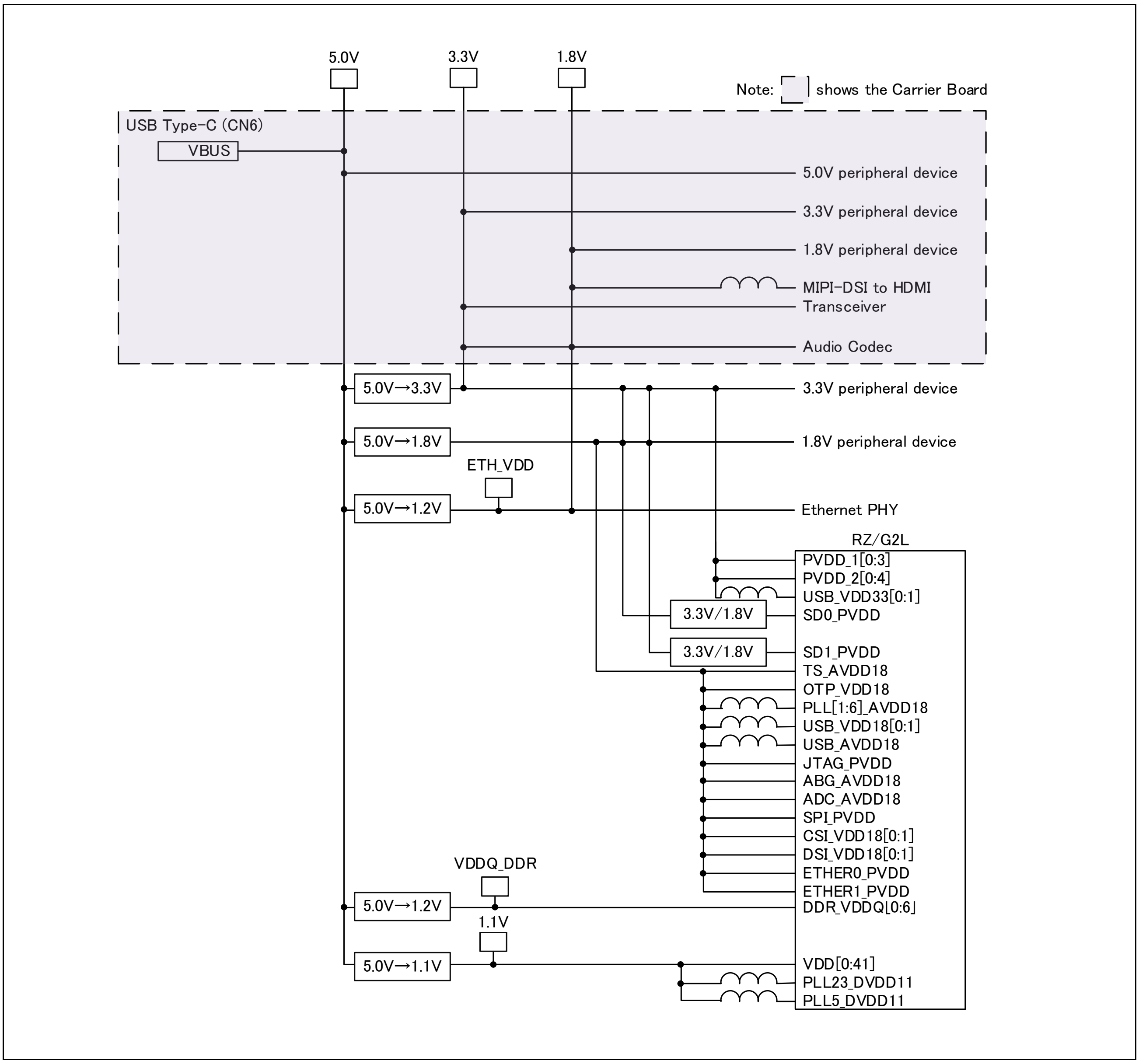
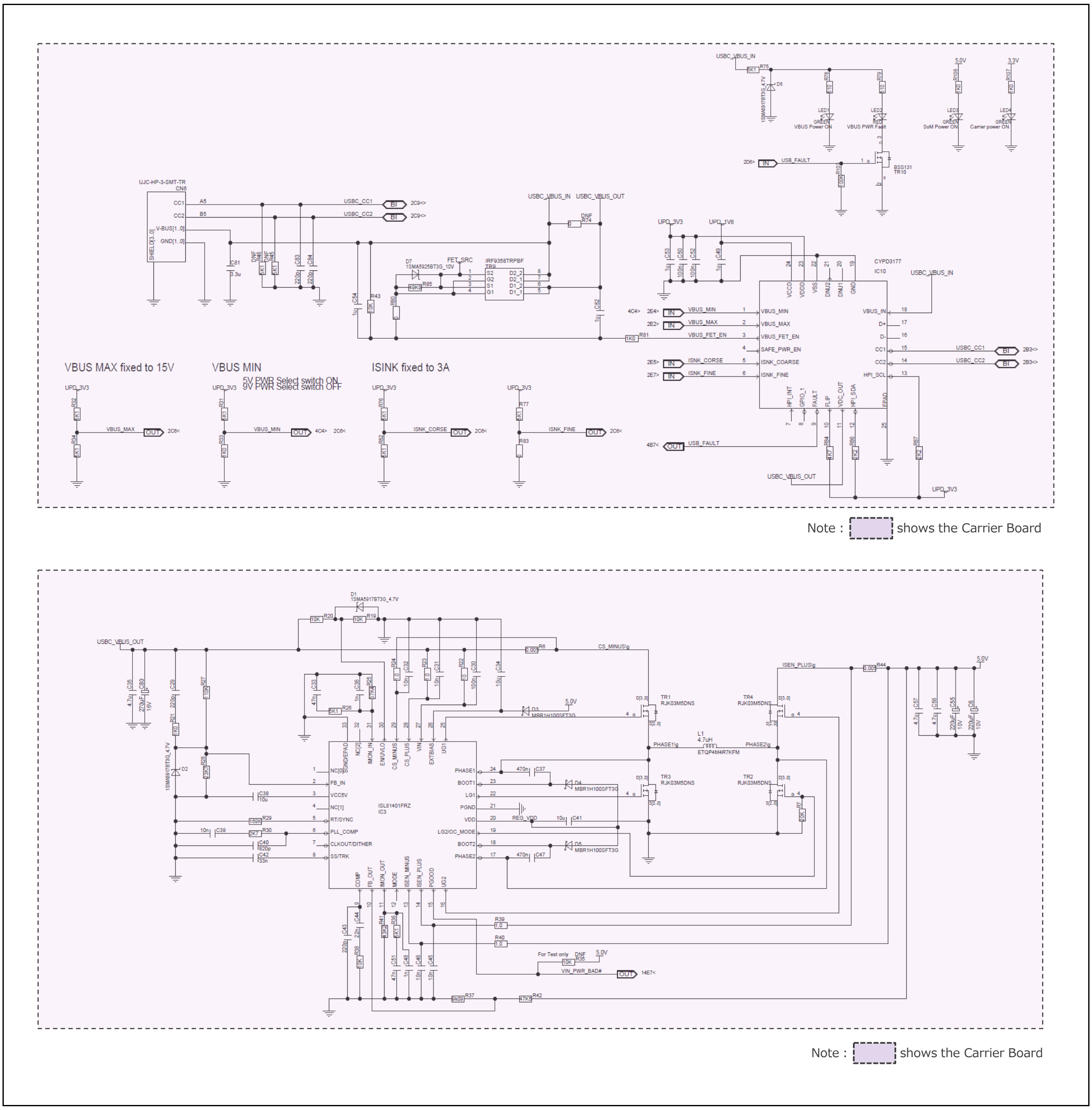


Figure 2.8 Block Diagram of Power Configuration

Figure 2.9 shows a block diagram of a power regulation for RTK97X4XXXB00000BE.



Note : shows the Carrier Board

Note : shows the Carrier Board

Figure 2.9 Block Diagram of Power Regulation

2.9 SD1 Interface

Figure 2.10 shows a block diagram of the SD1 interface.

RTK97X4XXXB00000BE is implemented a microSD card socket and connected to channel1 of SD interface with built-in RZ/G2L.

This interface complies with the memory card standard version 3.0 and supports the UHS-I mode of 50MB/s (SDR) and 104MB/s (SDR104).

Here, it shows an example that RTK9744L23C0100BE is used as the Module Board.

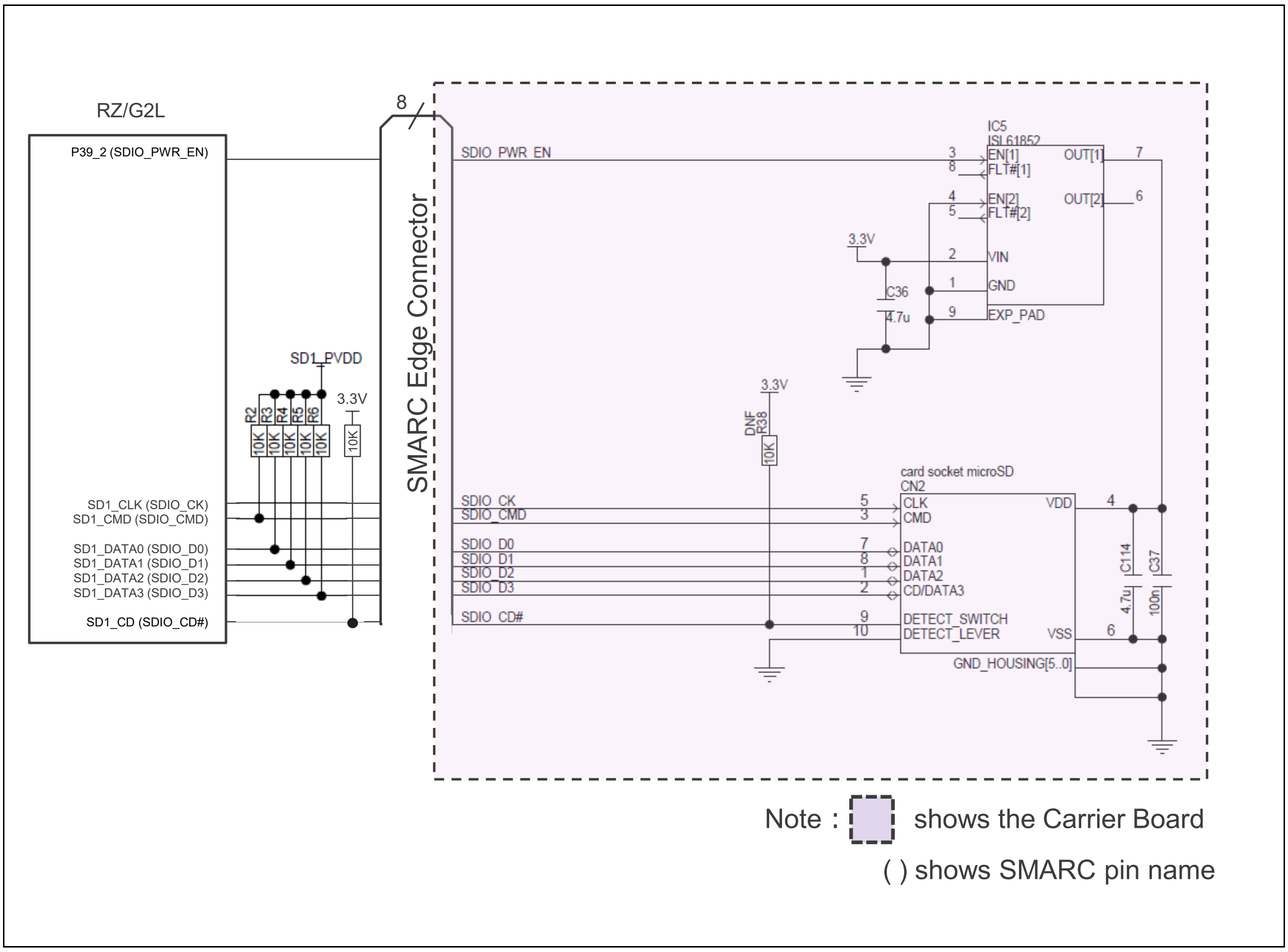


Figure 2.10 Block Diagram of SD1 I/F

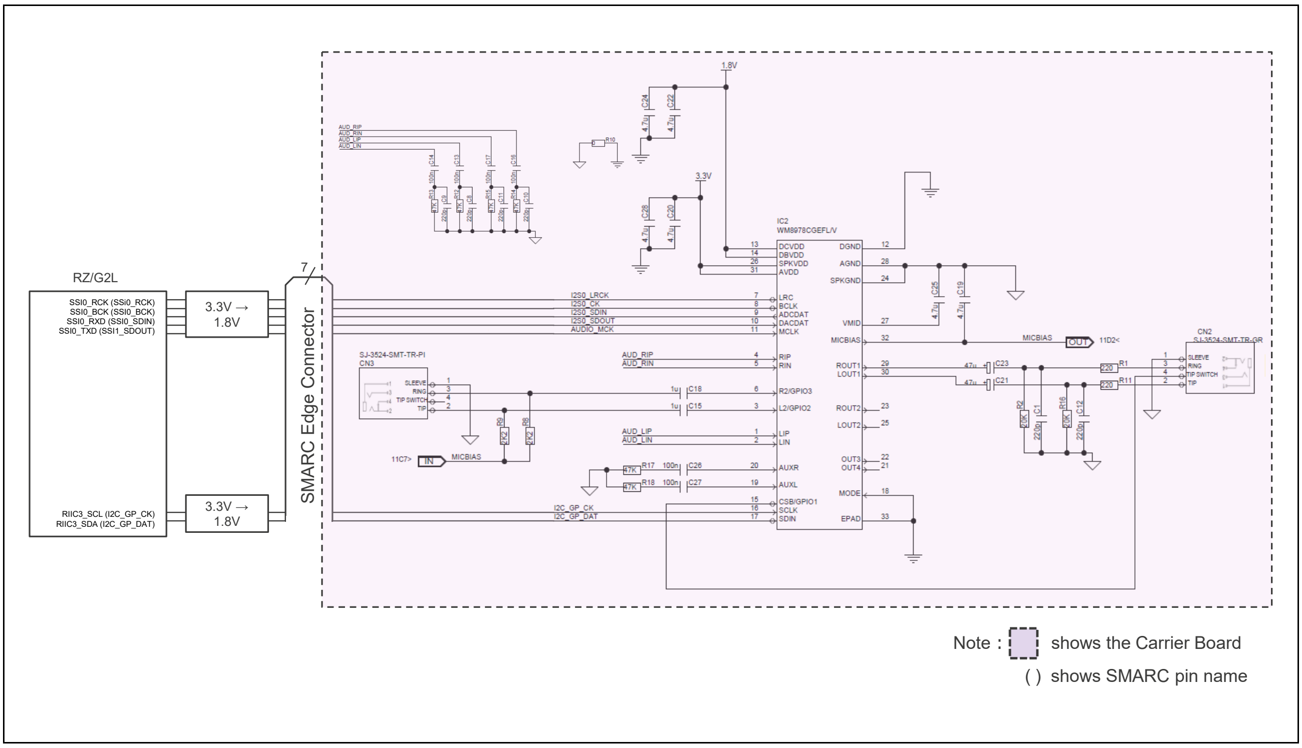
2.10 Audio Interface

Figure 2.11 shows a block diagram of the Audio interface.

RTK97X4XXXB00000BE is connected a connector through the Audio Codec. This interface supports I2S/monaural formats.

The Audio data input/output is controlled with the serial sound interface (SSIF-2) with built-in RZ/G2L.

Here, it shows an example that RTK9744L23C0100BE is used as the Module Board.



Note : ▢ shows the Carrier Board

( ) shows SMARC pin name

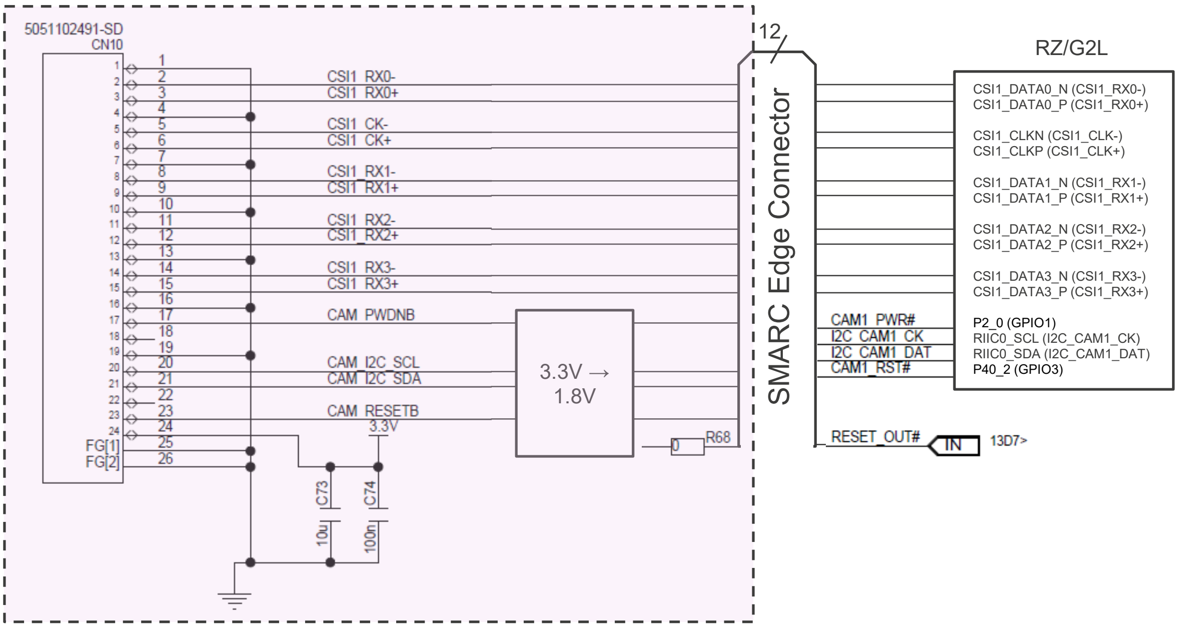
Figure 2.11 Bloc Diagram around Audio I/F

2.11 Camera Interface

Figure 2.12 shows a block diagram of Camera interface.

RTK97X4XXXB00000BE is implemented the FFC/FPC connector for connection to the MIPI CSI-2. This interface supports a maximum resolution5MP/30fps.

Here, it shows an example that RTK9744L23C0100BE is used as the Module Board.



Note : ▨ shows the Carrier Board

( ) shows SMARC pin name

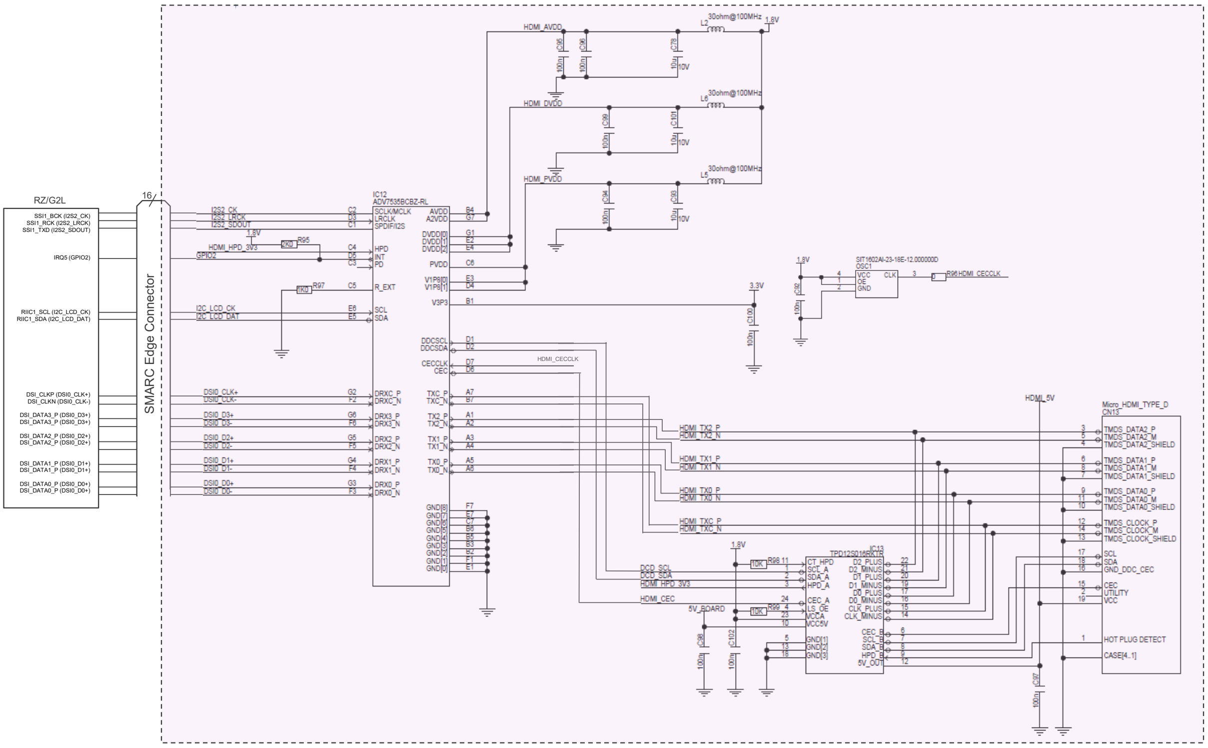
Figure 2.12 Block Diagram of Camera I/F

2.12 Display Interface

Figure 2.13 shows a block diagram of the Display (MIPI-DSI to HDMI) interface.

RTK97X4XXXB00000BE is connected a microHDMI connector through the MIPI-DSI to HDMI transceiver. This interface supports Full HD and 60fps.

Here, it shows an example that RTK9744L23C0100BE is used as the Module Board.



Note : ⬚ shows the Carrier Board
( ) shows SMARC pin name

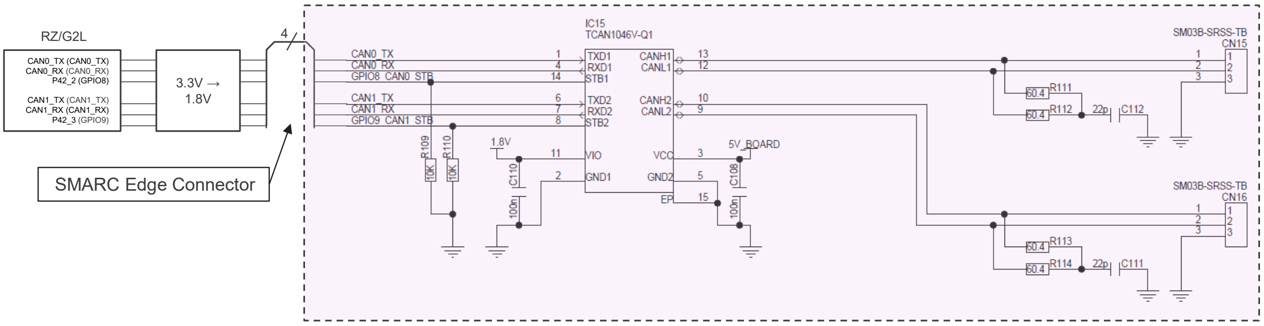
Figure 2.13 Block Diagram of Display I/F

2.13 CAN-FD Interface

Figure 2.14 shows a block diagram of the CAN-FD interface.

RTK97X4XXXB00000BE is connected the CAN0 and CAN1 connector through the CAN0 and CAN1 transceiver. This interface complies with ISO 11898-1 (2003) and CAN-FD interface complies with ISO 11898-1 (CD2014).

Here, it shows an example that RTK9744L23C0100BE is used as the Module Board.



Note : ▨ shows the Carrier Board

( ) shows SMARC pin name

Figure 2.14 Block Diagram of CAN-FD I/F

2.14 PMOD Interface

Figure 2.15 shows a block diagram of the PMOD interface.

RTK97X4XXXB00000BE is implemented a Type2A PMOD module. The Type2A interface provides a SPI interface plus additional control signals. There is also a 5V power source option.

Here, it shows an example that RTK9744L23C0100BE is used as the Module Board.

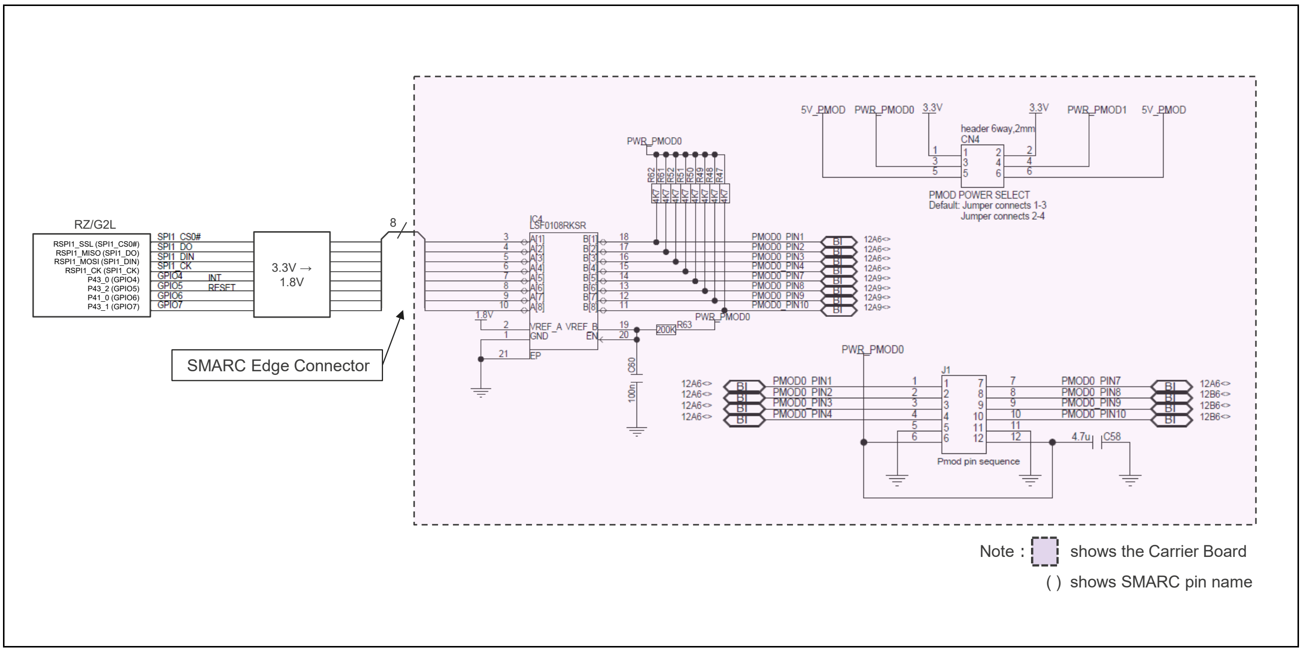


Figure 2.15 Block Diagram of PMOD0 I/F

Figure 2.16 shows a block diagram of the PMOD interface.

RTK97X4XXXB00000BE is implemented a Type3A&Type6A PMOD module. The Type3A interface provides a UART interface with optional hardware flow control plus additional control signals. The Type6A interface provides an I2C interface. There is also a 5V power source option.

Here, it shows an example that RTK9744L23C0100BE is used as the Module Board.

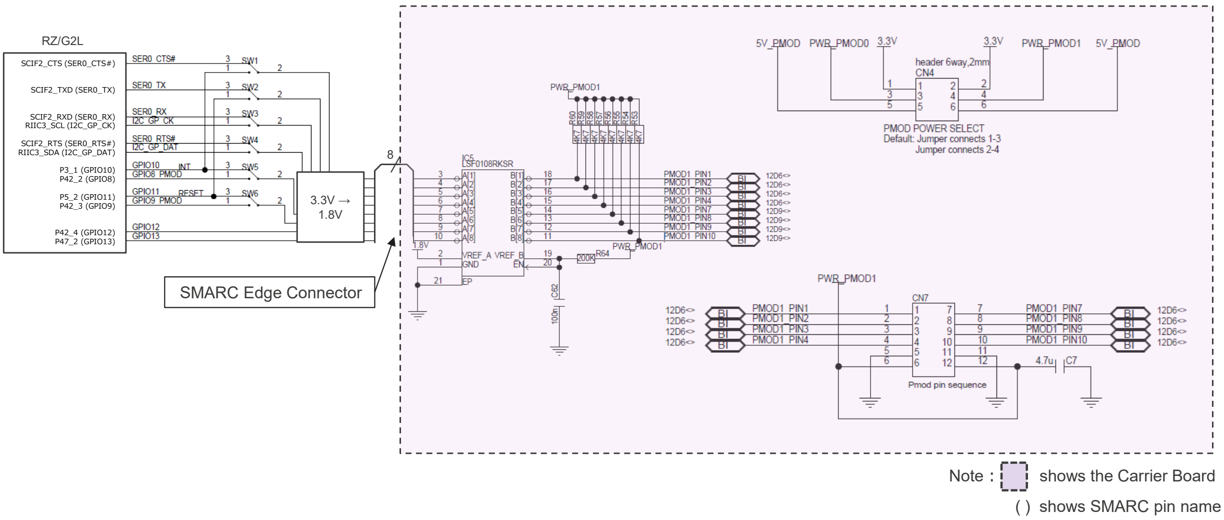


Figure 2.16 Block Diagram of PMOD1 I/F

3. Operation Specifications

3.1 Overview of Connectors

Figure 3.1 Illustrates the layout of connectors of RTK97X4XXXB00000BE.

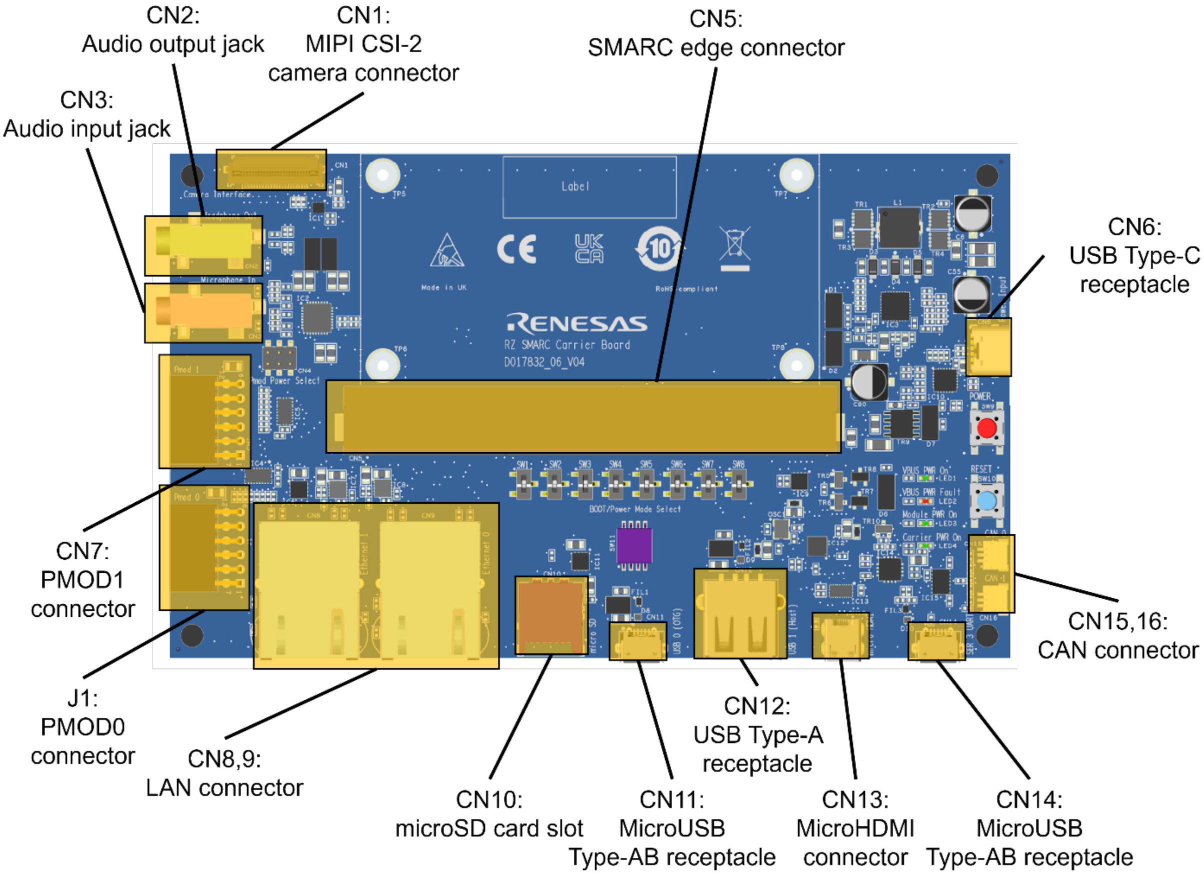


Figure 3.1 Layout of connectors of RTK97X4XXXB00000BE (Top side)

3.1.1 MIPI CSI-2 Camera Connector (CN1)

RTK97X4XXXB00000BE contains a Camera Connector (CN1).

Figure 3.2 illustrates the layout of Camera Connector pins. **Table 3.1** shows the assignment of Camera Connector pins.

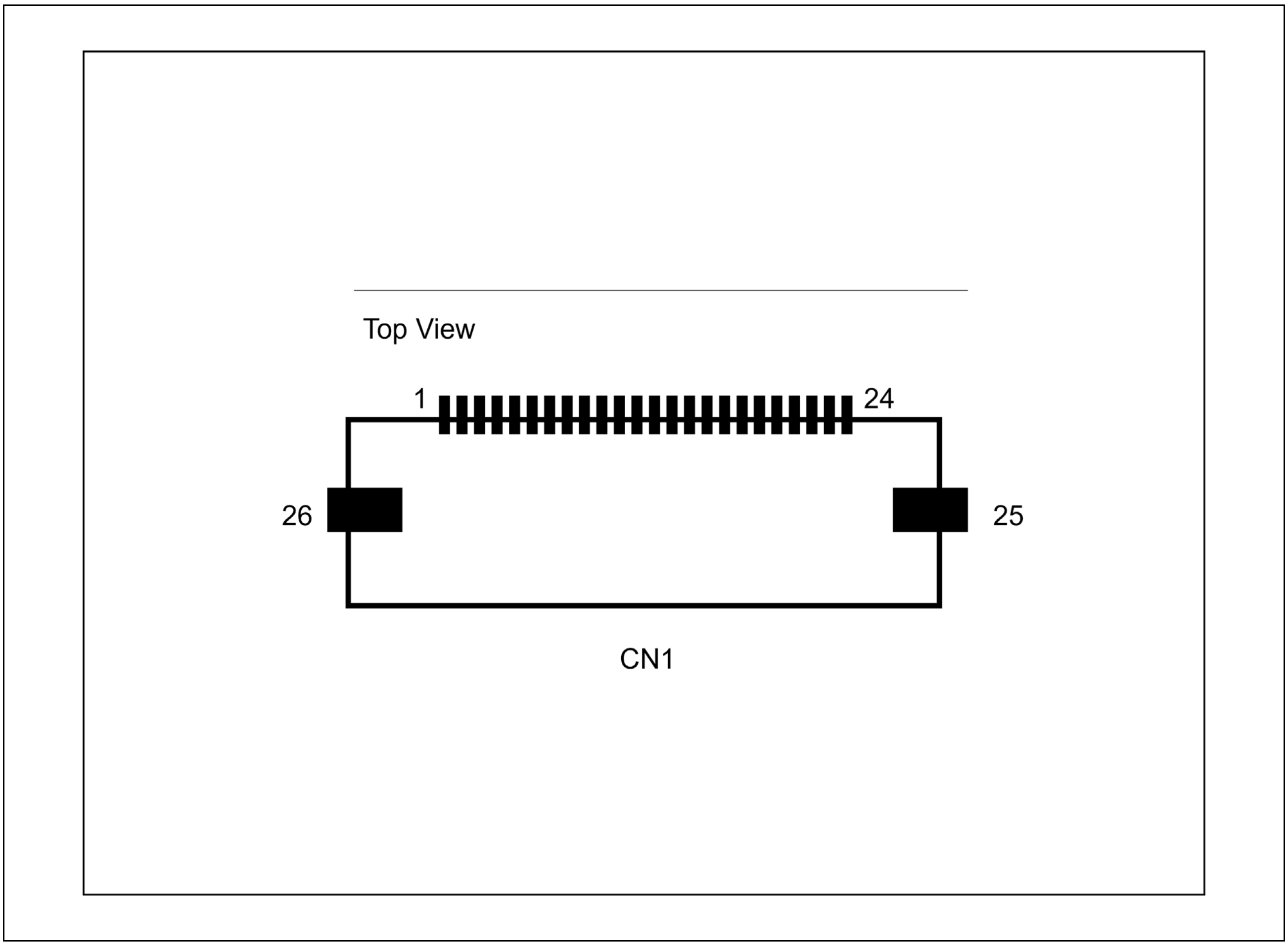


Figure 3.2 Camera Connector (CN1) Pin Layout Diagram

Table 3.1 Camera Connector (CN1) Pin Layout Table

Pin	Signal Name
1	GND
2	CSI1_RX0-
3	CSI1_RX0+
4	GND
5	CSI1_CK-
6	CSI1_CK+
7	GND
8	CSI1_RX1-
9	CSI1_RX1+
10	GND
11	CSI1_RX2-
12	CSI1_RX2+
13	GND
14	CSI1_RX3-
15	CSI1_RX3+
16	GND
17	CAM_PWDNB
18	—
19	GND
20	CAM_I2C_SCL
21	CAM_I2C_SDA
22	—
23	CAM_RESETB
24	3.3V
25	GND
26	GND

3.1.2 Audio Output Jack (CN2)

RTK97X4XXXB00000BE contains an Audio Output Jack (CN2).

Figure 3.3 illustrates the layout of Audio Output Jack pins. **Table 3.2** shows the assignment of Audio Output Jack pins.

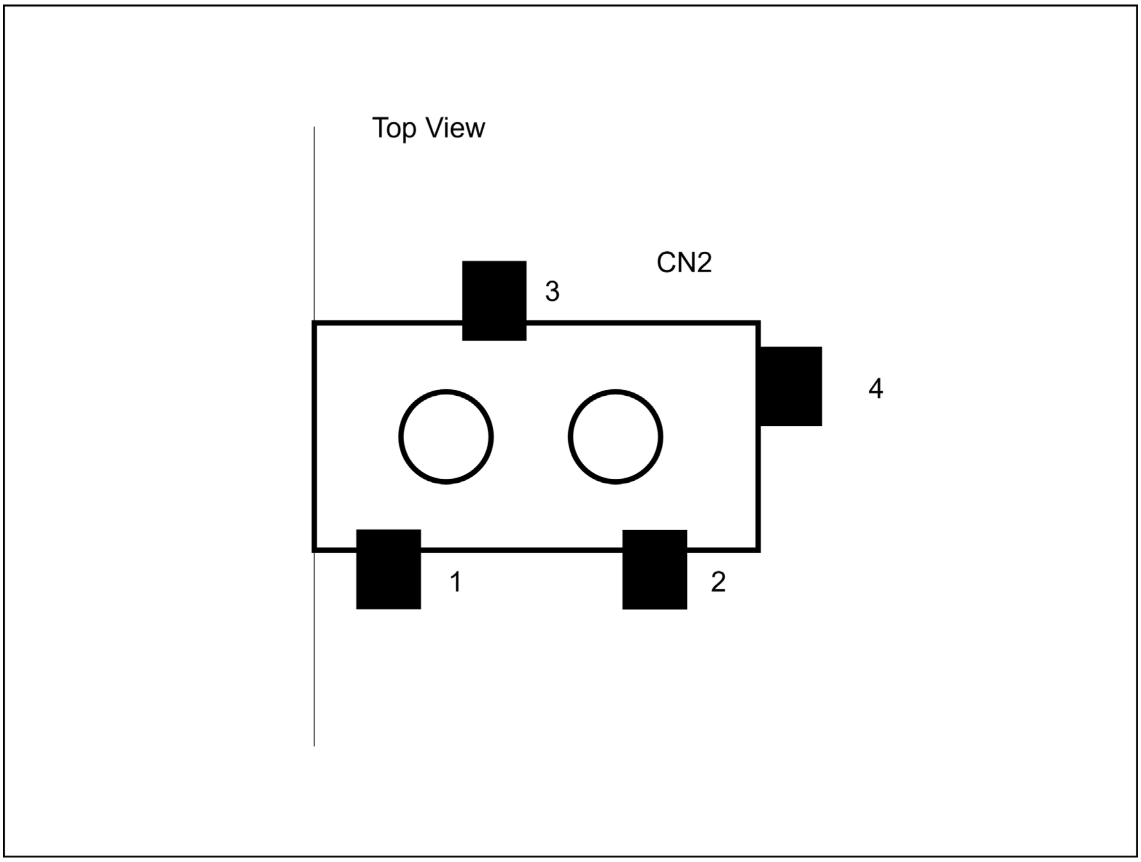


Figure 3.3 Audio Output Jack (CN2) Layout Diagram

Table 3.2 Audio Output Jack (CN2) Layout Table

Pin	Signal Name
1	GND
2	LOUT (Audio Codec Lch analog output pin)
3	ROUT (Audio Codec Rch analog output pin)
4	CSB/GPIO (3-Wire Control Interface Chip Select)

3.1.3 Audio Input Jack (CN3)

RTK97X4XXXB00000BE contains an Audio Input Jack (CN3).

Figure 3.4 illustrates the layout of Audio Input Jack pins. **Table 3.3** shows the assignment of Audio Input Jack pins. Pin3 and Pin4 are also connected to MICBIAS terminal.

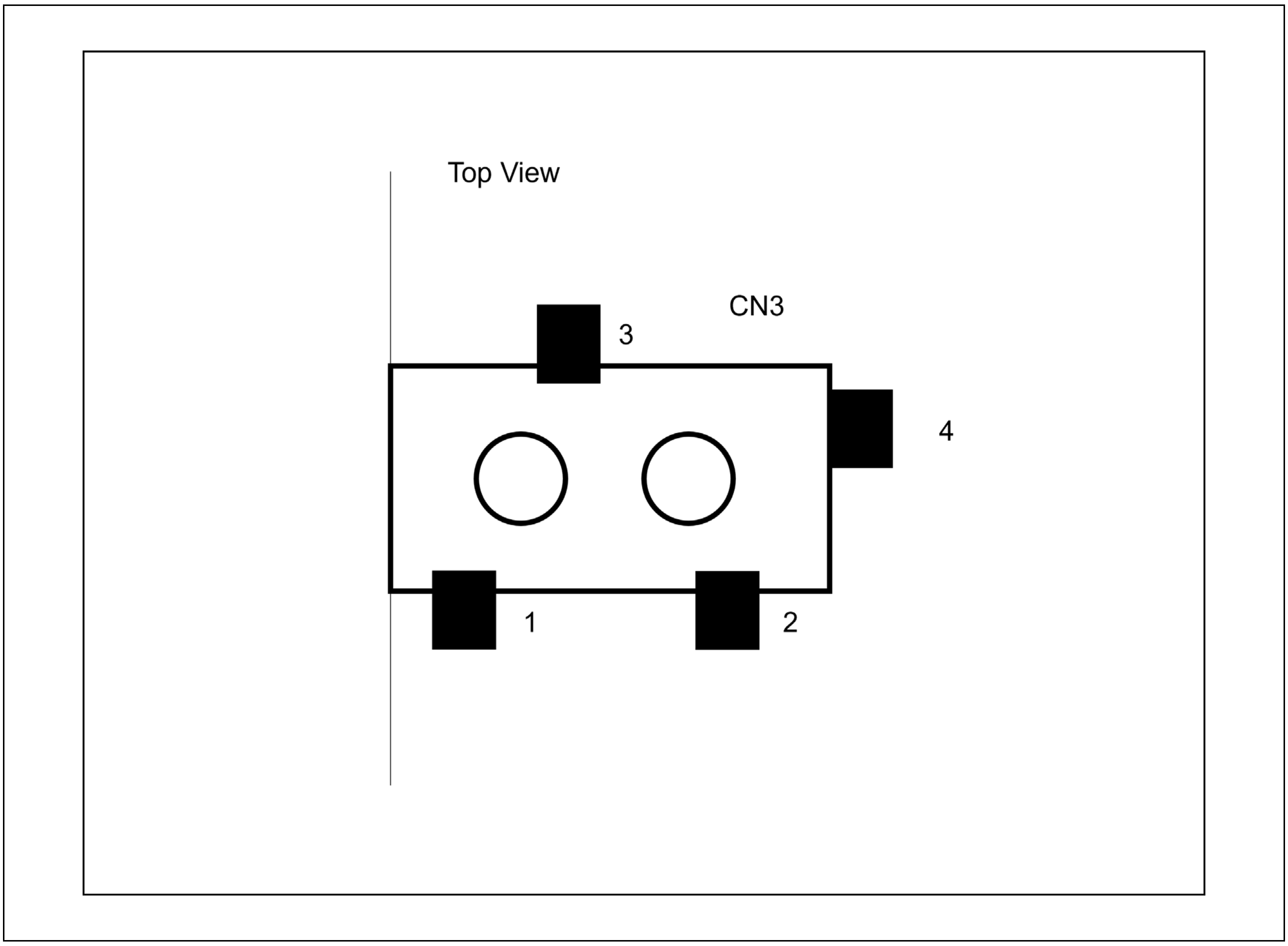


Figure 3.4 Layout of Audio Input Jack (CN3) Layout Diagram

Table 3.3 Audio Input Jack (CN3) Layout Table

Pin	Signal Name
1	GND
2	L2 (Audio Codec Lch analog input pin)
3	R2 (Audio Codec Rch analog input pin)
4	—

3.1.4 USB Type-C Receptacle

RTK97X4XXXB00000BE contains a USB Type-C Receptacle (CN6).

Figure 3.5 illustrates the layout of USB Type-C Receptacle pins. **Table 3.4** shows the assignment of USB Type-C Receptacle pins.

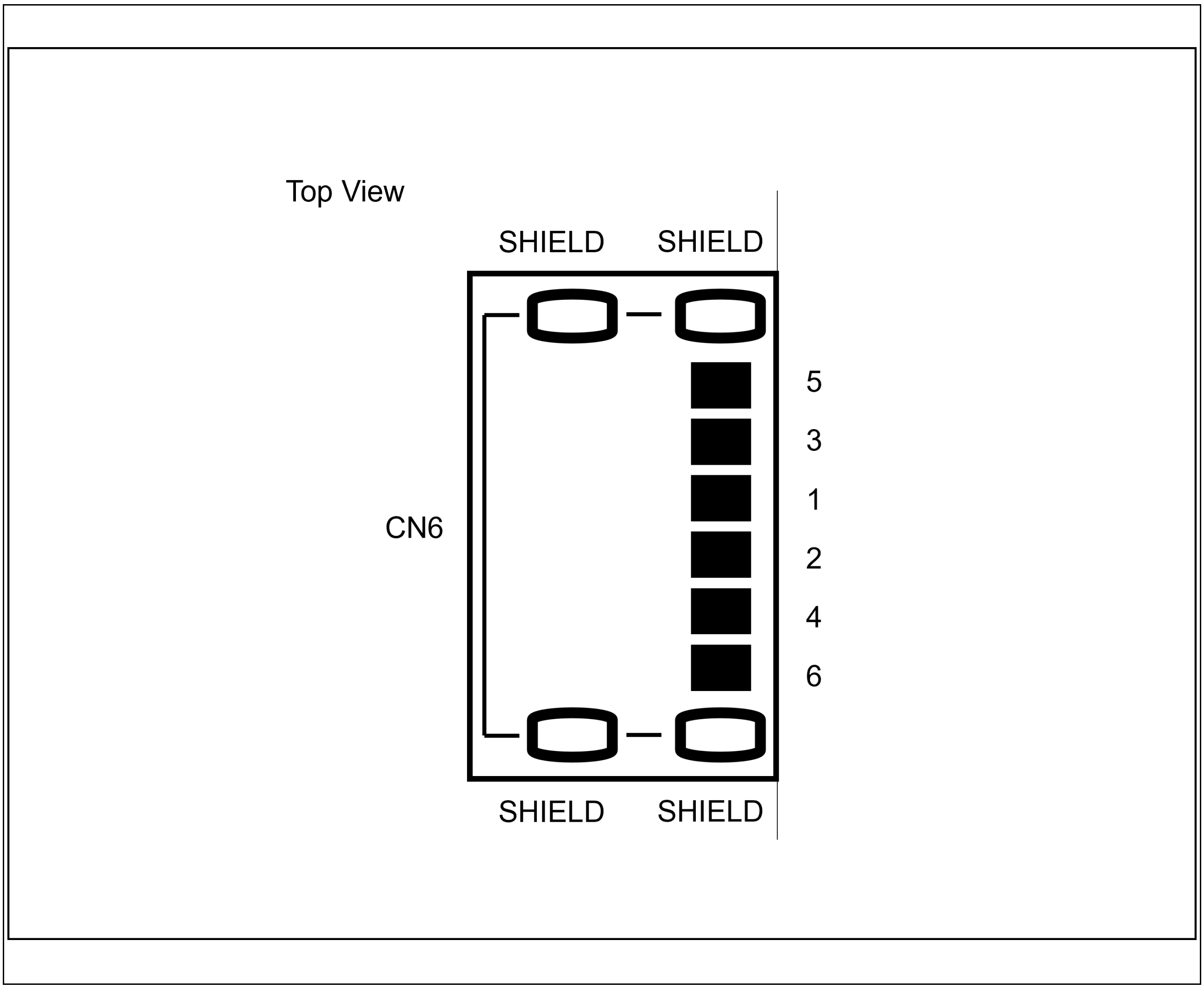


Figure 3.5 USB Type-C Receptacle (CN6) Pin Layout Diagram

Table 3.4 USB Type-C Receptacle (CN6) Pin Layout Table

Pin	Signal Name
1	CC1
2	CC2
3	VBUS
4	VBUS
5	GND
6	GND

3.1.5 PMOD0/1 Connector (J1, CN7)

RTK97X4XXXB00000BE contains a PMOD0/1 connector (J1, CN7).

Figure 3.6 illustrates the layout of PMOD0 connector pins. **Table 3.5** shows the assignment of PMOD0 connector pins.

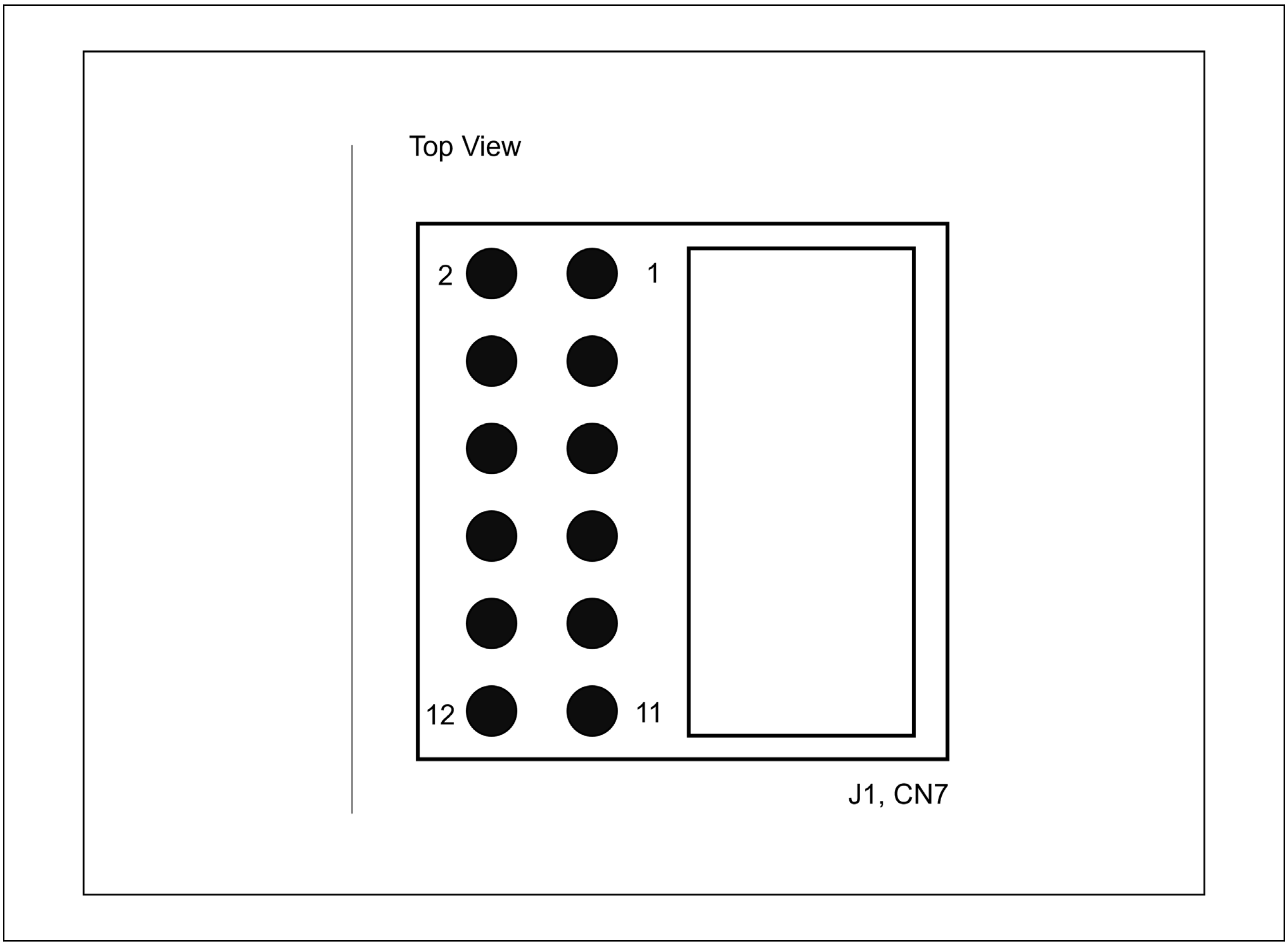


Figure 3.6 PMOD0 Connector (J1, CN7) Pin Layout Diagram

Table 3.5 PMOD0 Connector (J1) Pin Layout Table

Pin	Signal Name
1	SPI_CS0#
2	SPI1_DO
3	SPI1_DIN
4	SPI1_CK
5	GND
6	PWR_PMOD0
7	INT
8	RESET
9	GPIO
10	GPIO
11	GND
12	PWR_PMOD0

Table 3.6 shows the assignment of PMOD1 connector pins.

Table 3.6 PMOD1 Connector (CN7) Pin Layout Table

Pin	Signal Name
1	SER_CTS#/INT
2	SER0_TX/RESET
3	SER0_RX/I2C_GP_CK
4	SER0_RTS#/I2C_GP_DATA
5	GND
6	PWR_PMOD1
7	GPIO10
8	INT/GPIO
9	RESET/GPIO
10	GPIO
11	GND
12	PWR_PMOD1

3.1.6 LAN0/1 Connector (CN8, CN9)

RTK97X4XXXB00000BE contains a LAN0/1 Connector (CN8, CN9).

Figure 3.7 illustrates the layout of LAN0/1 Connector pins. **Table 3.7** shows the assignment of LAN0 Connector pins.

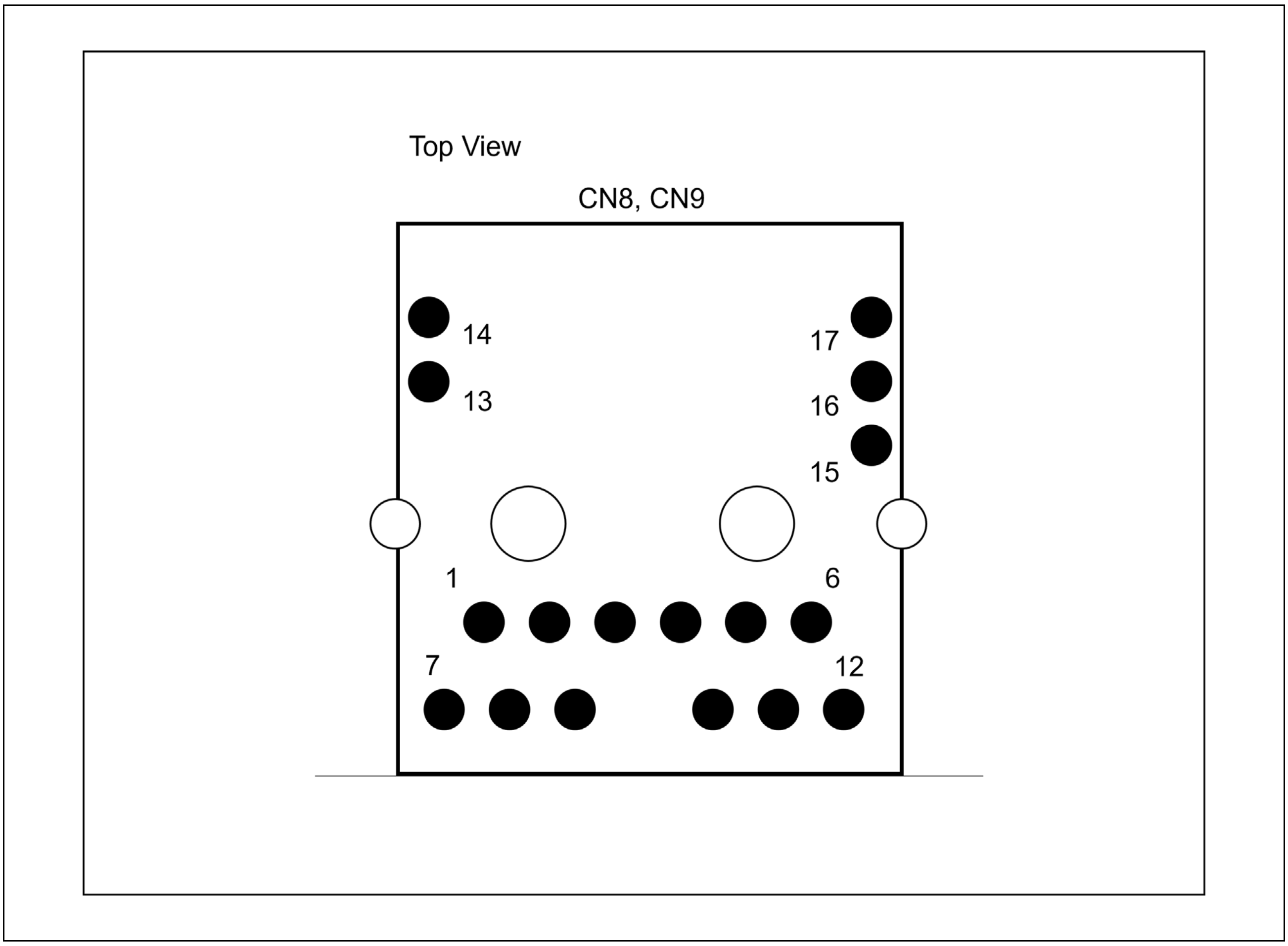


Figure 3.7 LAN Connector (CN8, CN9) Pin Layout Diagram

Table 3.7 LAN0 Connector (CN8) Pin Layout Table

Pin	Signal Name
1	GND
2	GBE0_MDI2-
3	GBE0_MDI2+
4	GBE0_MDI1-
5	GBE0_MDI1+
6	GND
7	GND
8	GBE0_MDI3-
9	GBE0_MDI3+
10	GBE0_MDI0-
11	GBE0_MDI0+
12	GND
13	GBE0_LINK_ACT#
14	3.3V
15	GBE0_LINK_100#
16	3.3V
17	GBE0_LINK_1000#

Table 3.8 shows the assignment of LAN1 Connector pins.

Table 3.8 LAN1 Connector (CN9) Pin Layout Table

Pin	Signal Name
1	GND
2	GBE1_MDI2-
3	GBE1_MDI2+
4	GBE1_MDI1-
5	GBE1_MDI1+
6	GND
7	GND
8	GBE1_MDI2-
9	GBE1_MDI2+
10	GBE1_MDI2-
11	GBE1_MDI2+
12	GND
13	GBE1_LINK_ACT#
14	3.3V
15	GBE1_LINK_100#
16	3.3V
17	GBE1_LINK_1000#

3.1.7 microSD Card Slot (CN10)

RTK97X4XXXB00000BE contains a microSD card slot (CN10).

Figure 3.8 illustrates the layout of microSD card slot pins. **Table 3.9** shows the assignment of microSD card slot pins.

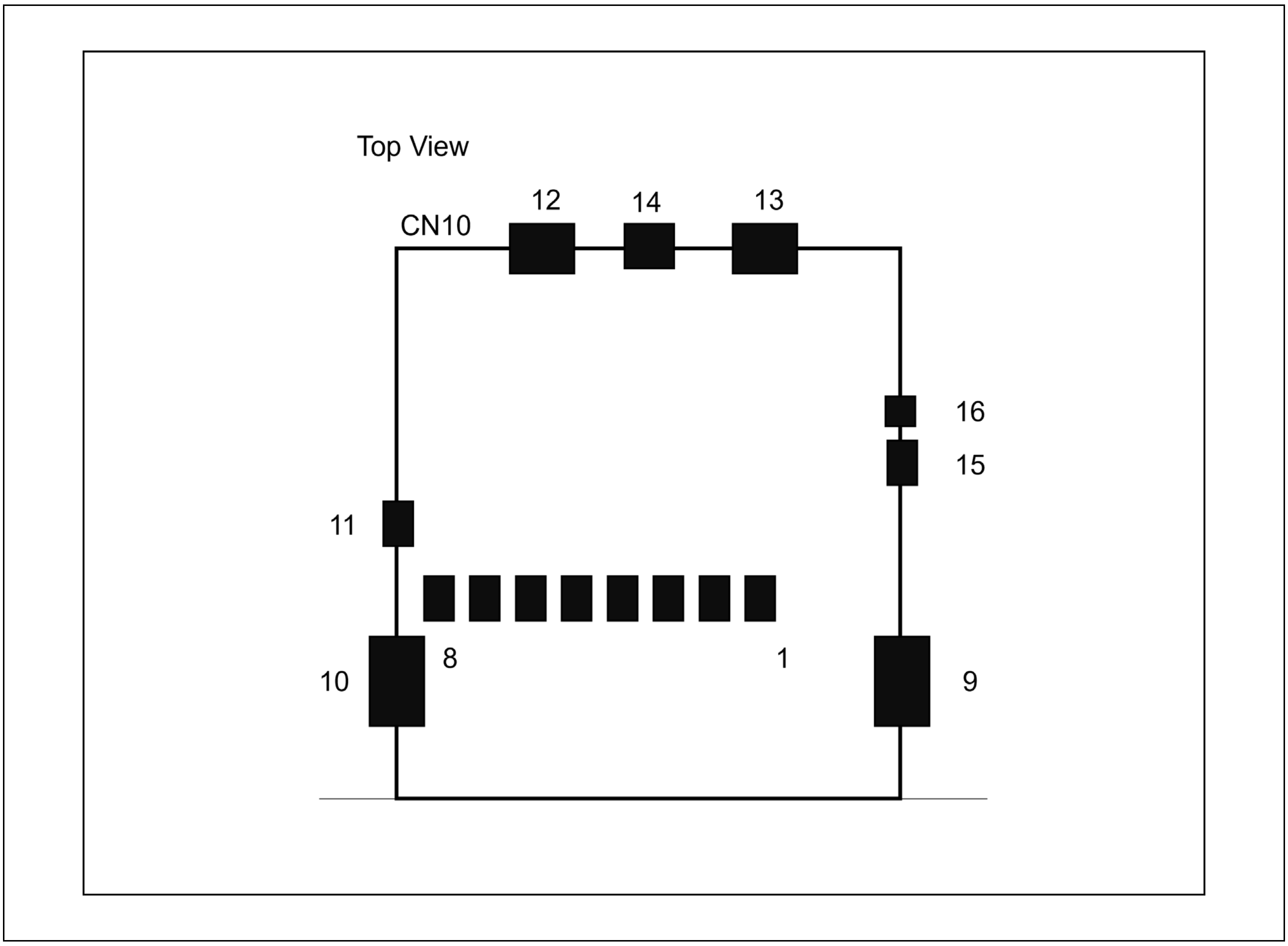


Figure 3.8 microSD Card Slot (CN10) Pin Layout Diagram

Table 3.9 microSD Card Slot (CN10) Pin Layout Table

Pin	Signal Name
1	SDIO_D2
2	SDIO_D3
3	SDIO_CMD
4	SD0_PVDD
5	SDIO_CK
6	GND
7	SDIO_D0
8	SDIO_D1
9	SDIO_CD#
10	GND
11	GND
12	GND
13	GND
14	GND
15	GND
16	GND

3.1.8 MicroUSB Type-AB Receptacle (CN11, CN14)

RTK97X4XXXB00000BE contains a microUSB Type-AB Receptacle (CN11, CN14).

Figure 3.9 illustrates the layout of microUSB Type-AB Receptacle pins. **Table 3.10** shows the assignment of microUSB Type-AB Receptacle pins.

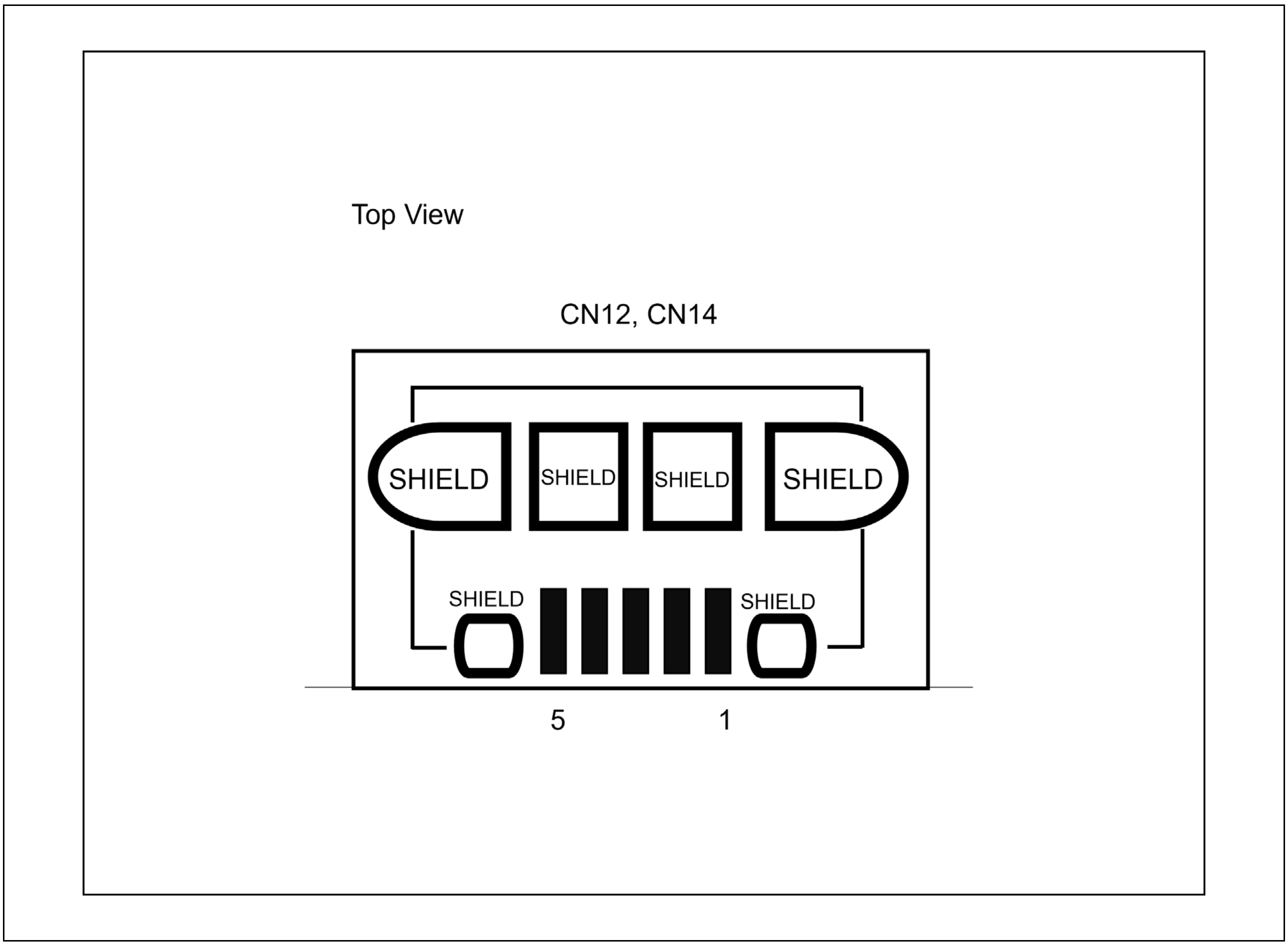


Figure 3.9 microUSB Type-AB Receptacle (CN12, CN14) Pin Layout Diagram

Table 3.10 microUSB Type-AB Receptacle (CN11) Pin Layout Table

Pin	Signal Name
1	VBUS
2	USB0-
3	USB0+
4	USB0_OTG_ID
5	GND

Table 3.11 shows the assignment of microUSB Type-AB Receptacle pins.

Table 3.11 microUSB Type-AB Receptacle (CN14) Pin Layout Table

Pin	Signal Name
1	VBUS
2	SER3_RX
3	SER3_TX
4	—
5	GND

3.1.9 USB Type-A receptacle (CN12)

RTK97X4XXXB00000BE contains a USB Type-A Receptacle (CN12).

Figure 3.10 illustrates the layout of USB Type-A Receptacle pins. **Table 3.12** shows the assignment of USB Type-A Receptacle pins.

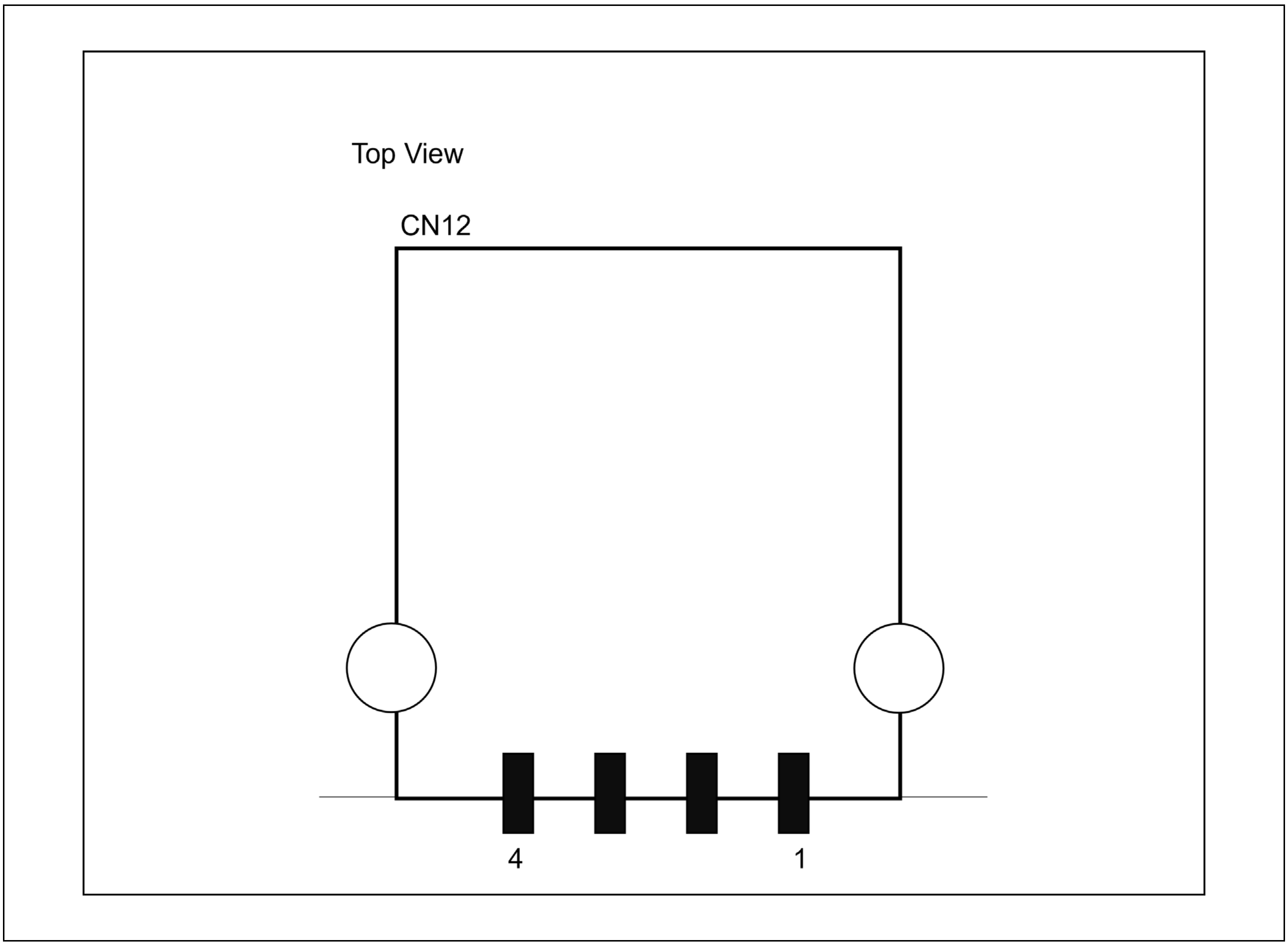


Figure 3.10 USB Type-A Receptacle (CN12) Pin Layout Diagram

Table 3.12 USB Type-A Receptacle (CN12) Pin Layout Table

Pin	Signal Name
1	VBUS
2	USB1-
3	USB1+
4	GND

3.1.10 MicroHDMI Connector (CN13)

RTK97X4XXXB00000BE contains a microHDMI Connector (CN13).

Figure 3.11 illustrates the layout of microHDMI Connector pins. **Table 3.13** shows the assignment of microHDMI Connector pins.

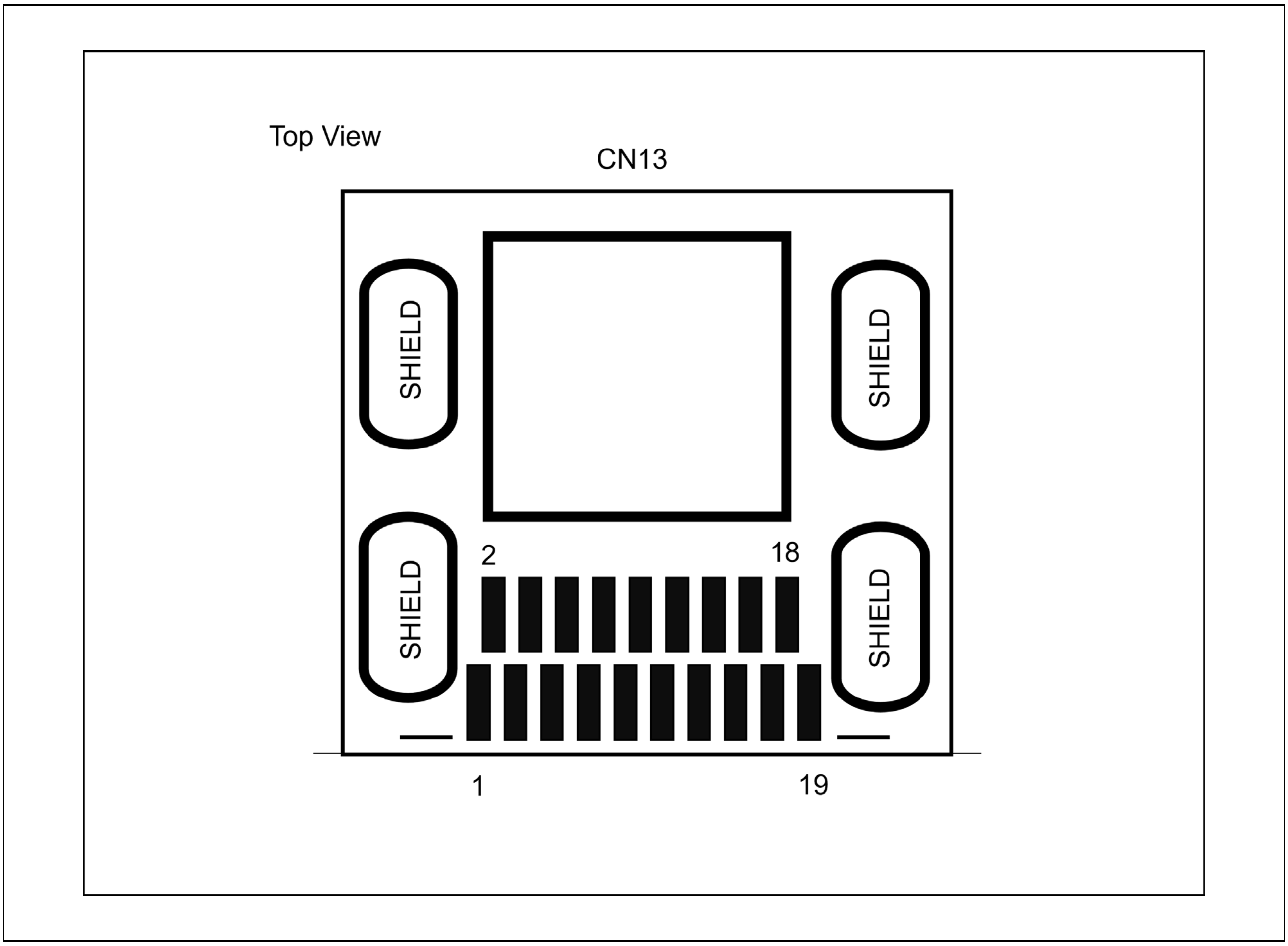


Figure 3.11 microHDMI Connector (CN13) Pin Layout Diagram

Table 3.13 microHDMI Connector (CN13) Pin Layout Table

Pin	Signal Name
1	HDMI_HPD_3V3
2	—
3	HDMI_TX2_P(DSI0_D2+)
4	HDMI_TX2_N(DSI0_D2-)
5	GND
6	HDMI_TX1_P(DSI0_D1+)
7	GND
8	HDMI_TX1_N(DSI0_D1-)
9	HDMI_TX0_P(DSI0_D0+)
10	GND
11	HDMI_TX0_N(DSI0_D0-)
12	HDMI_TXC_P(DSI0_CLK+)
13	GND
14	HDMI_TXC_N(DSI0_CLK-)
15	HDMI_CEC
16	GND
17	DCD_SCL(I2C_LCD_CK)
18	DCD_SDA(I2C_LCD_DAT)
19	HDMI_5V

3.1.11 CAN0/1 Connector (CN15, CN16)

RTK97X4XXXB00000BE contains a CAN0/1 Connector (CN13).

Figure 3.12 illustrates the layout of CAN0/1 Connector pins. **Table 3.14** shows the assignment of CAN0 Connector pins.

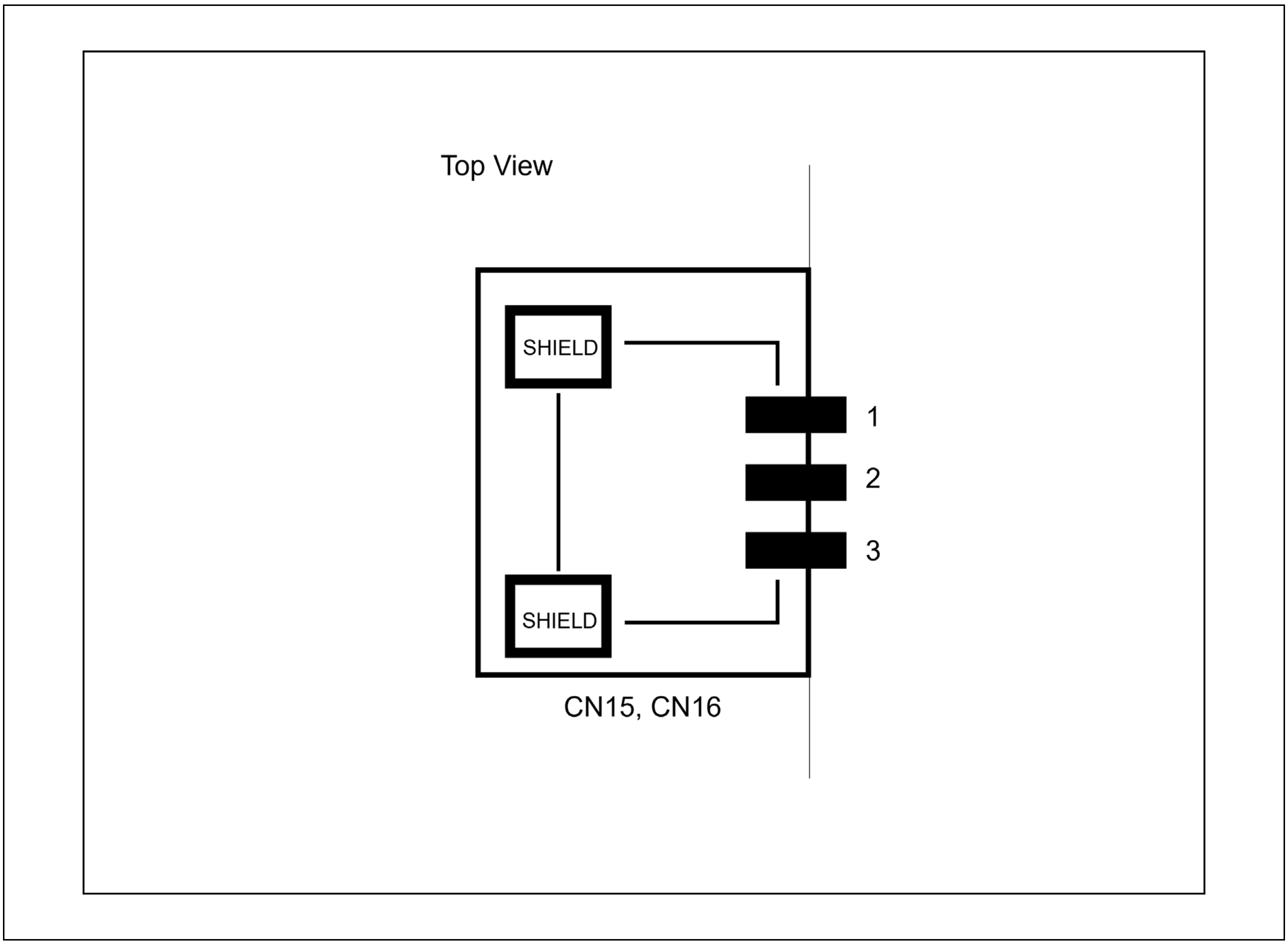


Figure 3.12 CAN0/1 Connector (CN15, CN16) Pin Layout Diagram

Table 3.14 CAN0 Connector (CN15) Pin Layout Table

Pin	Signal Name
1	CAN0_TX
2	CAN0_RX
3	GND

Table 3.15 shows the assignment of CAN1 Connector pins.

Table 3.15 CAN1 Connector (CN16) Pin Layout Table

Pin	Signal Name
1	CAN1_TX
2	CAN1_RX
3	GND

3.1.12 SMARC edge Connector (CN5)

RTK97X4XXXB00000BE can be connected to an external expansion board through the Module board connecting connector (CN5).

Figure 3.13 illustrates the layout of Carrier board connecting connector pins. For the assignment of Carrier board connecting connector pins, please refer to the section4 "MODULE PIN-OUT MAP" of the document "SMARC module 2.1 Specification (sget.org)".

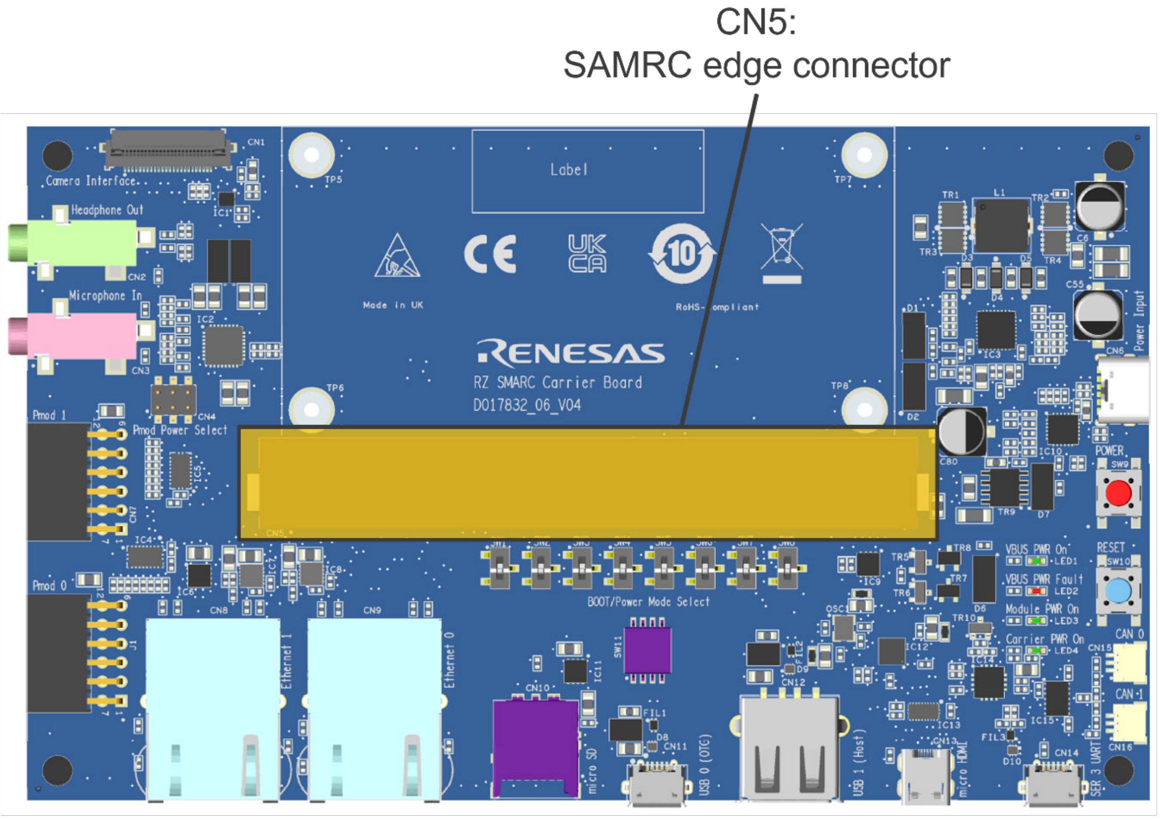


Figure 3.13 Layout of Carrier Board Connecting Pins

3.2 Layout of Operation Components

Figure 3.14 illustrates the layout of operation components of RTK97X4XXXB00000BE.

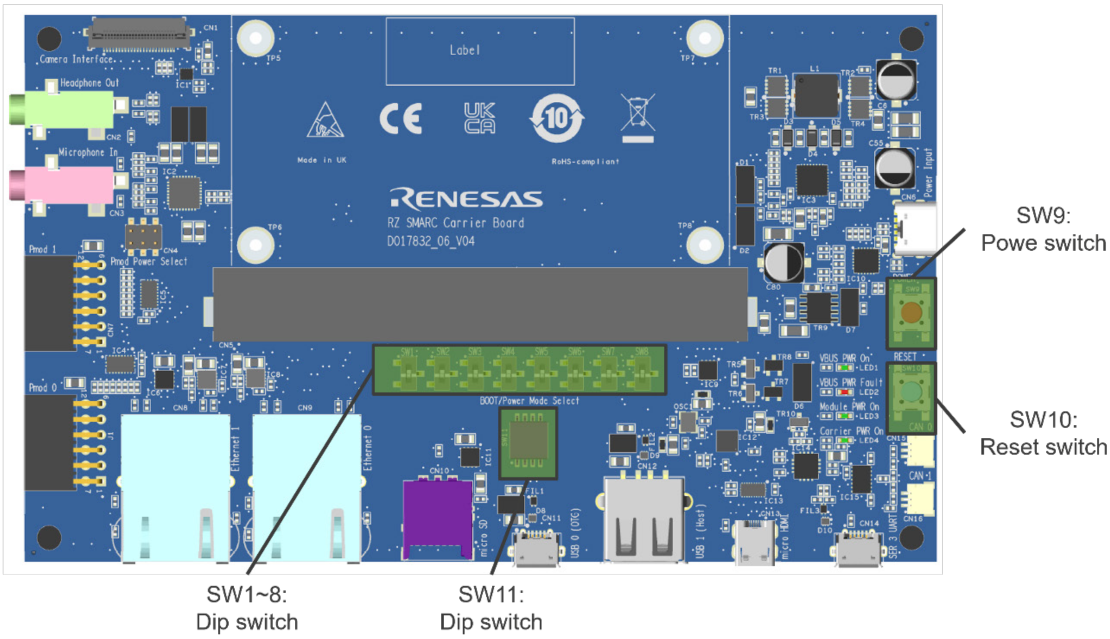


Figure 3.14 Layout of Operation Components of RTK97X4XXXB00000BE

3.2.1 Functions of Switches and Mode Terminals

RTK97X4XXXB00000BE contains one switch.

Table 3.16 lists mounted switches. **Table 3.17** provides functions of the DIP switch.

Table 3.16 Switches Mounted on RTK97X4XXXB00000BE

No.	Function	Note
SW1	System setting DIP switch	For details, see **Table 3.17**
SW2		
SW3		
SW4		
SW5		
SW6		
SW7		
SW8		
SW9	Power supply switch	
SW10	Reset switch	Refer to **section 2.7** for details.
SW11	Boot Mode setting DIP switch	For details, see **Table 3.18**

Table 3.17 Functions of System Setting DIP Switch (SW1~8)

No.	Setting		Function
SW1	OFF	SCIF2_CTS#=“H”	Used as Type-3A
	ON	P3_1=“L”	Used as Type-6A
SW2	OFF	SCIF2_TX =“H”	Used as Type-3A
	ON	P5_2=“L”	Used as Type-6A
SW3	OFF	SCIF2_RX =“H”	Used as Type-3A
	ON	RIIC3_SCL =“L”	Used as Type-6A
SW4	OFF	SCIF2_RTS =“H”	Used as Type-3A
	ON	RIIC3_SDA=“L”	Used as Type-6A
SW5	OFF	P3_1=“H”	Used as Type-3A
	ON	P42_2=“L”	Used as Type-6A
SW6	OFF	P5_2=“H”	Used as Type-3A
	ON	P42_3=“L”	Used as Type-6A
SW7	OFF	P42_2=“H”	Used as CAN0
	ON	P42_2=“L”	Used as PMOD1
SW8	OFF	P42_3=“H”	Used as CAN0
	ON	P42_3=“L”	Used as PMOD1

Figure 3.15 shows a block diagram of the System Setting interface. **Table 3.18** provides functions of mode terminals.

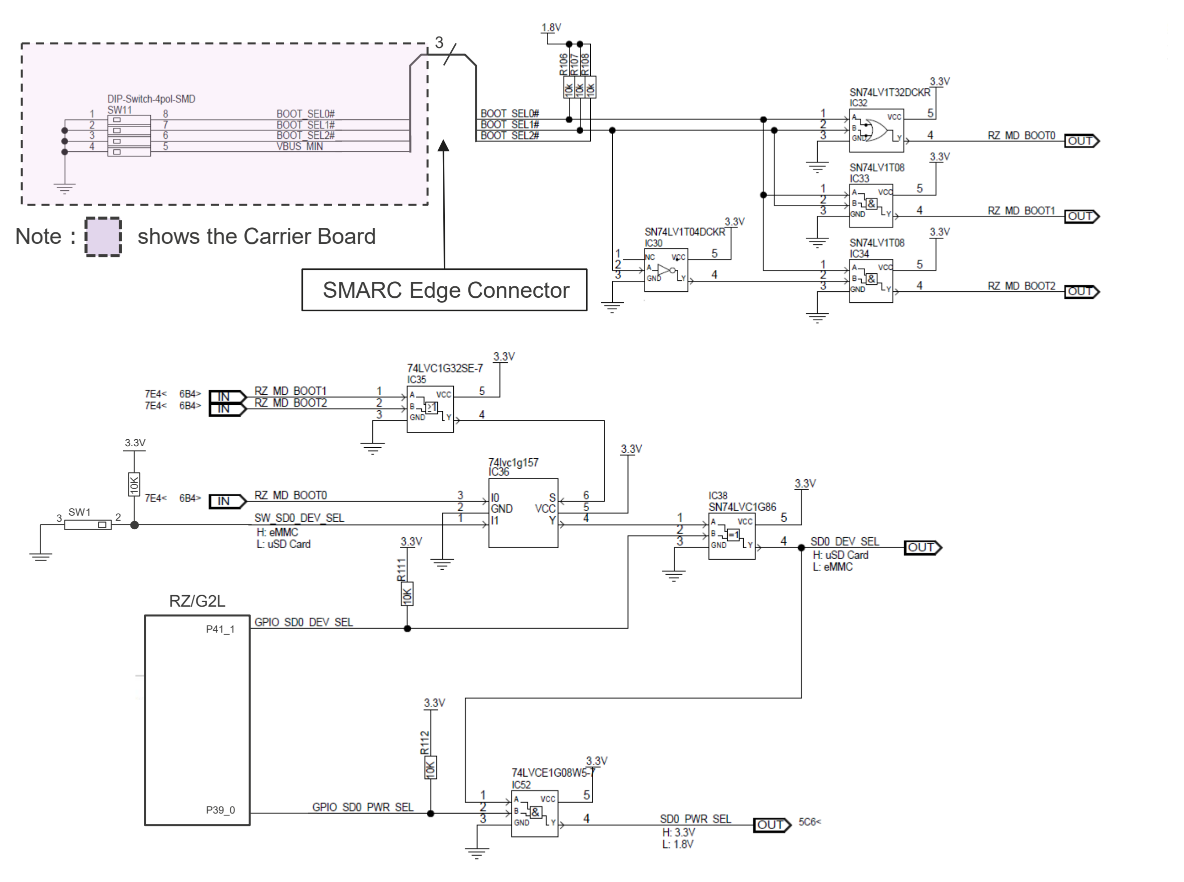


Figure 3.15 Block Diagram of System Setting I/F

Table 3.18 Functions of System Setting

No.			Setting			Function	Setting			Function	
CARRIER BOOT_SEL (SW11) (*1)			RZ_MD_BOOT			Boot Mode	MODULE (SW1-2) SW_SD0_DEV_SEL(*2)	P41_1 (extenal pull-up) GPIO_SD0_DEV_SEL	P39_0 (extenal pull-up) GPIO_SD0_PWR_SEL	Device connected to SD0 (P0_0 Read Only) SD0_DEV_SEL (*3)	SD0_PVDD (SD0_PWR_SEL) (*4)
0#	1#	2#	0	1	2						
Off	On	On	0	0	0	eSD (start up 3.3V)	x	1	1	uSD Card	3.3V
Off	Off	On	1	0	0	eMMC (1.8V)	x	1	x	eMMC	1.8V
Off	Off	Off	1	1	0	Single/Quad/ Octal (1.8V)	Off	1	x	eMMC	1.8V
Off	Off	Off	1	1	0	Single/Quad/ Octal (1.8V)	On	1	1	uSD Card	3.3V
Off	On	Off	1	0	1	SCIF download	Off	1	x	eMMC	1.8V
Off	On	Off	1	0	1	SCIF download	On	1	1	uSD Card	3.3V

Note: “x” means that it does not depend on the DIP SW setting.

Note 1. “On” of “BOOT_SEL0#”, “BOOT_SEL1#” and “BOOT_SEL2#” signal means 0(=“H”).
“Off” means 1(=”L”).

Note 2. “On” of “SW_SD0_DEV_SEL” signal means to connect microSD card(=“H”).
“Off” means to connect eMMC memory(=“L”).

Note 3. “On” of “SD0_DEV_SEL” signal means to connect eMMC memory(=“H”).
“Off” means to connect microSD card(=“L”).

Note 4. “On” of “SD0_PWR_SEL” signal means to supply 1.8V(=“H”).
“Off” means to supply 3.3V(=“L”).

3.2.2 Functions of LEDs

RTK97X4XXXB00000BE contains four LEDs.

Figure 3.16 illustrates the layout of LEDs. **Table 3.19** lists mounted LEDs.

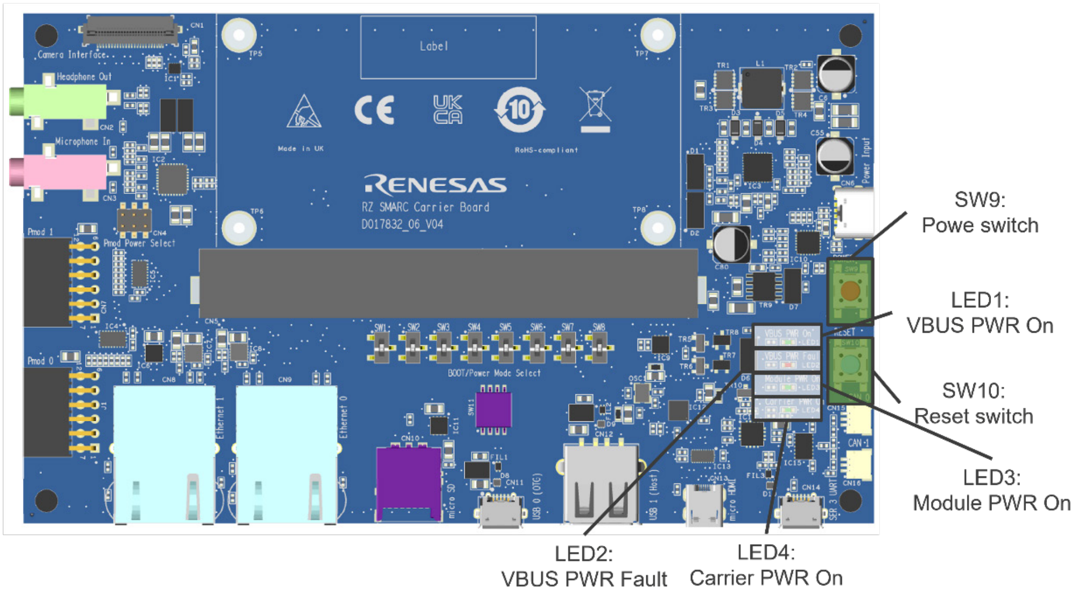


Figure 3.16 Layout of LEDS Mounted on RTK97X4XXXB00000BE

Table 3.19 LEDs Mounted on RTK97X4XXXB00000BE

No.	Color	Function
LED1	Green	VBUS PWR On (Lit while 5V is supplied)
LED2	Green	VBUS PWR Fault
LED3	Green	Module PWR On (Lit while 5V is supplied)
LED4	Green	Carrier PWR On (Lit while SW9 is presssed)

REVISION HISTORY	RZ Family / RZ/G, RZ/V Series RZ SMARC Series Carrier Board

Rev.	Date	Description	
		Page	Summary
1.00	Sep 27, 2021	—	First edition issued
1.01	Oct 07, 2021	1	For front cover, it is changed the description from "RZ SMARC Series Carrier Board RTK97X4XXXB00000BE" to "RZ SMARC Series Carrier Board". It is changed from "RZ Family / RZ/G Series" to "RZ Family / RZ/G, RZ/V Series"
		7	For Tytle, it is changed the description from "RZ Family / RZ/G Series RZ SMARC Series Carrier Board RTK97X4XXXB00000BE" to "RZ Family / RZ/G, RZ/V Series RZ SMARC Series Carrier Board".
		8	For section "Configuration", it is added the description "RTK9754L23C01000BE(RZ/V2L SMARC Module Board)".
		17	For section "MPU", it is added the description "Please refer to the function list (section 2.2.2) in the user's manual of each module board". For section "Overview of RZ/G2L", it is removed the description. For section "List of RZ/G2L functions", it is removed the description.
		58	For Revision History, it is changed the description from "RZ Family / RZ/G Series RZ SMARC Series Carrier Board RTK97X4XXXB00000BE" to "RZ Family / RZ/G, RZ/V Series RZ SMARC Series Carrier Board".
		60	For back cover, it is changed the description from "RZ Family / RZ/G Series" to "RZ Family / RZ/G, RZ/V Series".

RZ Family / RZ/G, RZ/V Series User's Manual: Hardware

Publication Date: Rev.1.00 Sep 27, 2021
Rev.1.01 Oct 07, 2021

Published by: Renesas Electronics Corporation

RZ Family / RZ/G, RZ/V Series

Renesas Electronics Corporation