

RENESAS
RA8 Series
Voice Kit
Micro
Controller



RENESAS RA8 Series Voice Kit Micro Controller User Manual

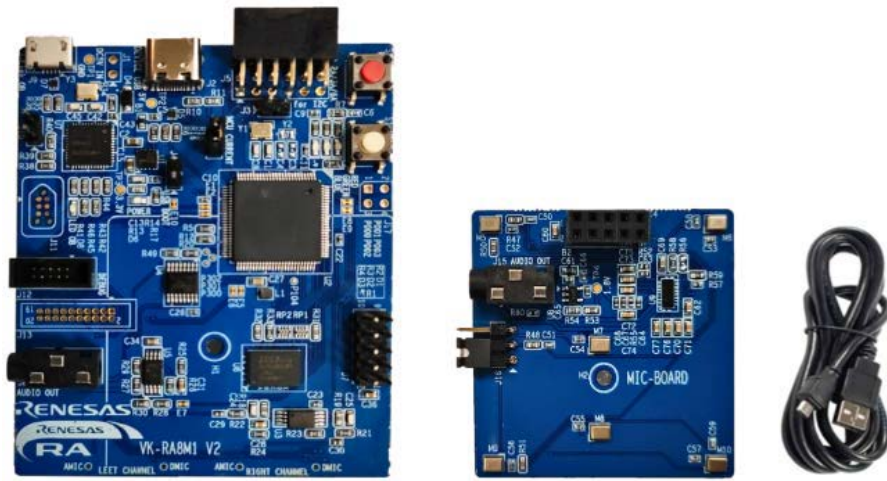
[Home](#) » [RENESAS](#) » RENESAS RA8 Series Voice Kit Micro Controller User Manual 

Contents

- 1 RENESAS RA8 Series Voice Kit Micro Controller
- 2 Specifications
- 3 Introduction
- 4 Installation
- 5 Configuration
- 6 Usage
- 7 FAQs
- 8 PRODUCT INTRODUCTION
- 9 Kit Contents
- 10 Kit Ordering Information
- 11 Kit Overview
- 12 Kit Architecture
- 13 MCU Port Mapping
- 14 Implementation Details
- 15 FCC
- 16 Design and Manufacturing Information
- 17 Website and Support
- 18 Contact information
- 19 Documents / Resources
 - 19.1 References
- 20 Related Posts



RENESAS RA8 Series Voice Kit Micro Controller



Specifications

- Product Name: Voice Kit for RA8M1 Microcontroller Group VK-RA8M1 V2
- Product Family: Renesas RA Family
- Microcontroller Group: RA8 Series
- Revision: 1.00 May 2024

Introduction

- The Voice Kit for RA8M1 Microcontroller Group VK-RA8M1 V2 is designed to enhance the functionality of the RA8 Series microcontrollers from Renesas. It provides voice capabilities for various applications.

Installation

Follow these steps to install the Voice Kit:

1. Ensure that your RA8M1 microcontroller is powered off.
2. Connect the Voice Kit to the designated port on the microcontroller.
3. Power on the microcontroller and ensure that the connection is secure.

Configuration

To configure the Voice Kit:

1. Refer to the user manual for specific configuration settings.
2. Adjust any necessary parameters according to your application requirements.

Usage

- Once installed and configured, you can start using the Voice Kit for voice-related tasks in your applications. Refer to the user manual for details on utilizing the voice capabilities effectively.

FAQs

Q: Can the Voice Kit be used with other microcontroller families?

A: The Voice Kit is specifically designed for use with the RA8 Series microcontrollers from Renesas. Compatibility with other microcontroller families may vary.

Q: Is there a programming interface for custom voice commands?

A: The Voice Kit may support custom voice commands through programming interfaces provided by Renesas. Refer to the user manual or contact Renesas Electronics for more information on implementing custom voice commands.

Q: How can I troubleshoot connectivity issues with the Voice Kit?

A: If you experience connectivity issues, ensure that the connections are secure and follow the troubleshooting steps outlined in the user manual. If problems persist, contact Renesas Electronics for further assistance.

PRODUCT INTRODUCTION

- 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>).

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 depend 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 outlined in this document.
13. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without the 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.
- Corporate Headquarters
- TOYOSU FORESIA, 3-2-24 Toyosu,
- Koto-ku, Tokyo 135-0061, Japan
- www.renesas.com

Trademarks

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

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's 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 the 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 VIL (Max.) and VIH (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 VIL (Max.) and VIH (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 micro processing 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.

Renesas VK-RA8M1 Disclaimer

- By using this VK-RA8M1, the User accepts the following terms, which are in addition to, and control in the event

of disagreement, with Renesas' General Terms and Conditions available at <https://www.renesas.com/en-us/legal/disclaimer.html>.

The VK-RA8M1 is not guaranteed to be error-free, and the entire risk as to the results and performance of the VK-RA8M1 is assumed by the User. The VK-RA8M1 is provided by Renesas on an "as is" basis without warranty of any kind whether express or implied, including but not limited to the implied warranties of good workmanship, fitness for a particular purpose, title, merchantability, and non-infringement of intellectual property rights. Renesas expressly disclaims any implied warranty.

Renesas does not consider the VK-RA8M1 to be a finished product and therefore the VK-RA8M1 may not comply with some requirements applicable to finished products, including, but not limited to recycling, restricted substances and electromagnetic compatibility regulations. Refer to the Certifications section, for information about certifications and compliance information for the VK-RA8M1. It is the kit User's responsibility to make sure the kit meets any local requirements applicable to their region.

Renesas or its affiliates shall in no event be liable for any loss of profit, loss of data, loss of contract, loss of business, damage to reputation or goodwill, any economic loss, any reprogramming or recall costs (whether the foregoing losses are direct or indirect) nor shall Renesas or its affiliates be liable for any other direct or indirect special, incidental or consequential damages arising out of or in relation to the use of this VK-RA8M1, even if Renesas or its affiliates have been advised of the possibility of such damages. Renesas has used reasonable care in preparing the information included in this document, but Renesas does not warrant that such information is error-free nor does Renesas guarantee an exact match for every application or parameter to part numbers designated by other vendors listed herein. The information provided in this document is intended solely to enable the use of Renesas products. No express or implied license to any intellectual property right is granted by this document or in connection with the sale of Renesas products. Renesas reserves the right to make changes to specifications and product descriptions at any time without notice. Renesas assumes no liability for any damages incurred by you resulting from errors in or omissions from the information included herein. Renesas cannot verify and assumes no liability for, the accuracy of information available on another company's website.

Precautions

- This Voice Kit is only intended for use in a laboratory environment under ambient temperature and humidity conditions. A safe separation distance should be used between this and any sensitive equipment. Its use outside the laboratory, classroom, study area, or similar such area invalidates conformity with the protection requirements of the Electromagnetic Compatibility Directive and could lead to prosecution. The product generates, uses, and can radiate radio frequency energy and may cause harmful interference to radio communications. There is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off or on, you are encouraged to try to correct the interference by one or more of the following measures:
 - Ensure attached cables do not lie across the equipment.
 - Reorient the receiving antenna.
 - Increase the distance between the equipment and the receiver.
 - Connect the equipment to an outlet on a circuit different from that which the receiver is connected to.
 - Power down the equipment when not in use.
 - Consult the dealer or an experienced radio/TV technician for help. Note: It is recommended that wherever

possible shielded interface cables are used. The product is potentially susceptible to certain EMC phenomena. To mitigate against them it is recommended that the following measures be undertaken:

- The user is advised that mobile phones should not be used within 10 m of the product when in use.
- The user is advised to take ESD precautions when handling the equipment. The Voice Kit does not represent an ideal reference design for an end product and does not fulfill the regulatory standards for an end product.

Kit Contents

The following components are included in the kit:

1. VK-RA8M1 board
2. Mic Board
3. Micro USB device cable (type-A male to micro-B male)

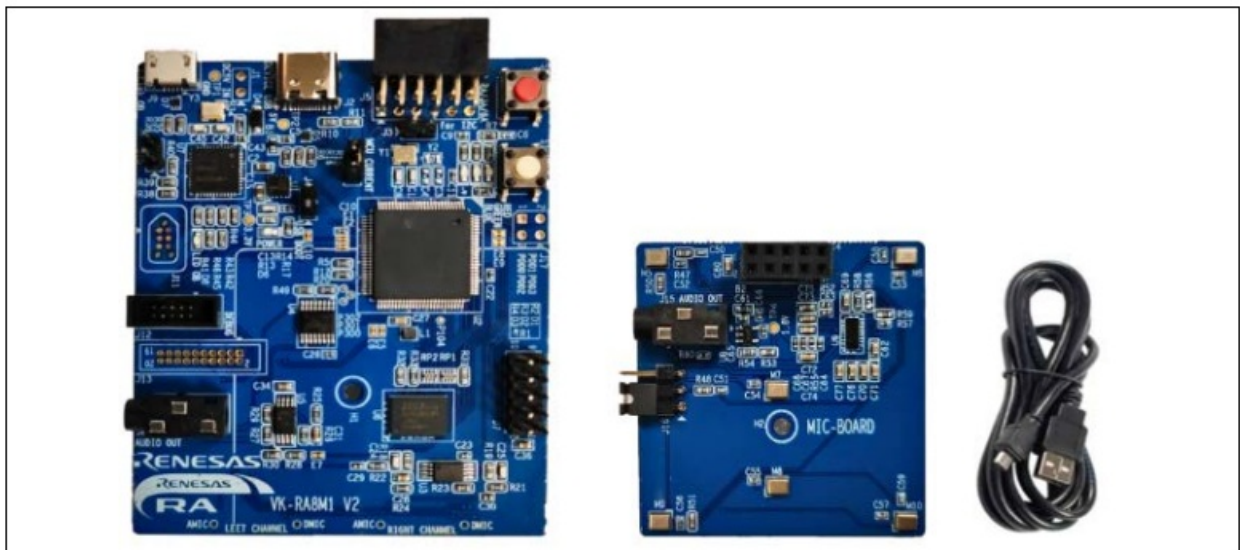


Figure 1. VK-RA8M1 Kit Contents

Kit Ordering Information

VK-RA8M1 kit orderable part number: RTK0EG0005D00001BE

Kit Overview

VK-RA8M1 is an edge voice user interface Voice kit designed to be used by Ecosystem Partners, Application Engineers, Field Application Engineers, and for Business Development opportunities. The primary purpose is to evaluate the functionality of projects developed by Ecosystem Partners and to facilitate the development of additional partner projects. The kit design uses the RA8M1 MCU with LQFP 100pin package as the core logic device, with OSPI flash, OPAMP and power devices chosen from the Renesas product portfolio.

- Renesas RA8M1 Microcontroller Group
 - Arm® Cortex®-M85 core with Helium™
 - LQFP 100pin package
 - Maximum operating frequency: 480 MHz
 - 2MB code flash memory
 - 12KB data flash memory

- Flash Cache (FCACHE)
- 1MB SRAM
- 1KB Standby SRAM
- Connectivity
 - One USB micro AB full-speed connector for the Main MCU
 - SEGGER J-Link® On-board (OB) interface for debugging and programming. A 10 pin JTAG/SWD interface is also provided for connecting optional external debuggers and programmers.
 - One PMOD connector
 - One Auxiliary Port connector
- Multiple Clock Sources
 - Main clock oscillator (MOSC) (8 to 48 MHz)
 - Sub-clock oscillator (SOSC) (32.768 kHz)
 - High-speed on-chip oscillator (HOCO) (16/18/20/32/48 MHz)
 - Middle-speed on-chip oscillator (MOCO) (8 MHz)
 - Low-speed on-chip oscillator (LOCO) (32.768 kHz)
- Microphones: 2 I2S MEMS digital microphones and 2 MEMS analog microphones.
- Mic-Board Microphones: 6 MEMS digital microphones
- Audio out: One stereo audio headphone jack supporting mono output on both channels.
- Mic-Board Audio out: One stereo audio headphone jack supporting mono output on both channels.
- LEDs: Five LEDs, D1 (Red), D2 (Green) and D3 (Blue) configurable by user, D6 (Blue) as a 3.3V power indicator, D8(Green) as a JLOB (J-LINK on board) indicator.
- Buttons: One RESET button (S2), and one USER button (S1).
- Debug: J-Link On-Board debug interface, supporting JTAG or SWD debug port.
- USB: Micro USB-B (J9) for power input and J-Link On-Board function, USB-C (J2) for power input and RA8M1 USB Full Speed port as a USB device.

Kit Architecture

System Block Diagram

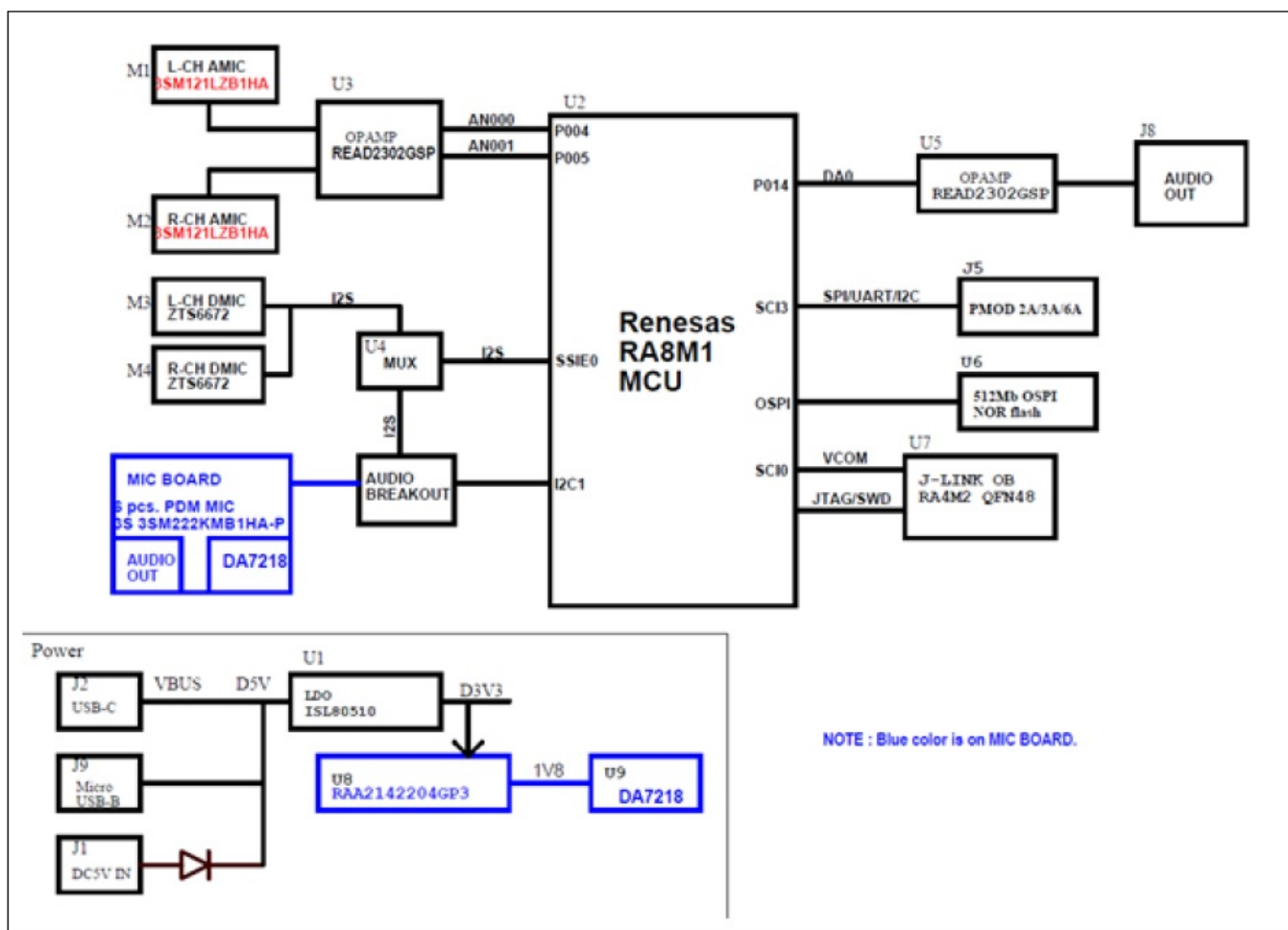


Figure 2. System Block Diagram

Jumper Settings

Two types of jumpers are provided on the VK-RA8M1 board.

1. Traditional pin header jumpers copper jumpers
2. Copper jumpers (trace-cut type and solder bridge type)

Traditional Pin Header Jumpers

- These jumpers are traditional small-pitch jumpers that require an external shunt to open/close them. The traditional pin jumpers on the VK-RA8M1 board are 2.54mm pitch headers and require compatible 2.54mm shunt jumpers. Default Jumper Configuration The following table describes the default settings for each jumper on the VK-RA8M1 board. This includes copper jumpers (Ex designation) and traditional pin jumpers (Jx designation.) Functional details for many of the listed jumpers may be found in sections associated with each functional area of the kits.

Table 1. Default Jumper Settings

Location	Default Open/Closed	Function
J3	Open	Short to route I2C SDA signal to PMOD connector pin 4
J4	Open	Close to configuring the RA8M1 MCU enter USB boot mode, code can be downloaded through J2 USB TYPE-C connector.
J6	Short	For MCU current measurement, remove this jumper wire and serial with a current meter to measure MCU current.
J7	Open	Short with MIC Board to enable Audio breakout
J10	Open	Short with a jumper wire to set on board debug RA4M2 MCU(U7) in RESET for disable on board debug.

Copper Jumpers

Copper jumpers are of two types, designated trace-cut and solder-bridge. A trace-cut jumper is provided with a narrow copper trace connecting its pads. The silk screen overlay printing around a trace-cut jumper is a solid box. To isolate the pads, cut the trace between pads adjacent to each pad, then remove the connecting copper foil either mechanically or with the assistance of heat. Once the etched copper trace is removed, the trace-cut jumper is turned into a solder-bridge jumper for any later changes.

A solder-bridge jumper is provided with two isolated pads that may be joined together by one of three methods:

- Solder may be applied to both pads to develop a bulge on each and the bulges joined by touching a soldering iron across the two pads.
- A small wire may be placed across the two pads and soldered in place.
- A SMT resistor, size 0805, 0603, or 0402, may be placed across the two pads and soldered in place. A zero-ohm resistor shorts the pads together.

For any copper jumper, the connection is considered closed if there is an electrical connection between the pads (default for trace-cut jumpers.) The connection is considered open if there is no electrical connection between the pads (default for the solder-bridge jumpers.)

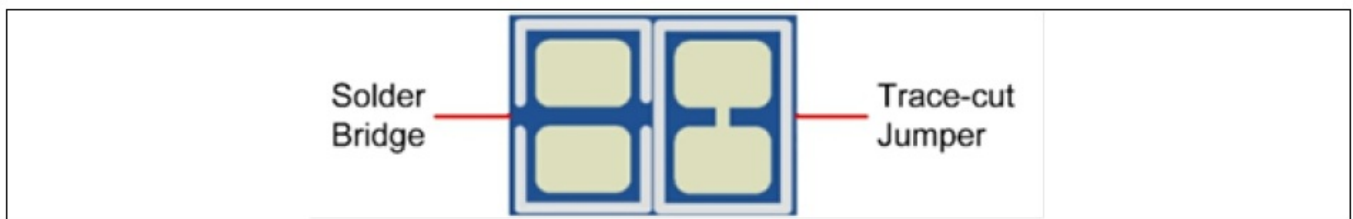


Figure 3. Copper Jumpers

Table 2. Default Copper Jumper Settings

Location	Default Open/Closed	Function
E1		SWCLK
E2		SWDIO
E5		VCOM_TXD
E6		VCOM_RXD
E7		DA0/ DA out to OPAMP, audio out
E8		AN000 to VOUT2 U3, Analog microphone left channel
E9		AN001 to VOUT1 U3, Analog microphone right channel
E10		P201/MD signal, cut it then the J12, J13 can be debug out function

MCU Port Mapping

Table 3. MCU Port Assignments

Port	Assigned Function(s)
P000	Optional header for GPIOs
P001	Optional header for GPIOs
P002	Optional header for GPIOs
P003	Optional header for GPIOs
P004	Analog microphone left channel
P005	Analog microphone right channel
P006	Not Used
P007	Not Used
P008	Not Used
P013	VREFL
P014	DA0/ DA out to OPAMP, audio out
P015	Not Used
P100	OSPI_DQ0
P101	OSPI_DQ3
P102	OSPI_DQ4
P103	OSPI_DQ2
P104	Test point P104
P105	OSPI_INT#
P106	OSPI_RESET
P107	OSPI_CS#

P112	SSISCK0
P113	SSILRCK0
P114	SSIRXD0
P115	SSITXD0
P201	NMI, pull-high with 10K
P200	Boot Mode, The MCU enter SCI and USB boot mode if the MD pin is held low on release the reset signal, it is for download code to MCU flash memory.
P205	SCL1 of J7 Audio breakout to MIC board
P206	SDA1 of J7 Audio breakout to MIC board
P208	TDIR
P209	TUDOR
P210	STUDIO
P211	SWCLK
P212	Clock Crystal, optional, not populated on this kit
P213	Clock Crystal, optional, not populated on this kit
P300	Test point P300
P301	Test point P301
P302	Test point P302
P303	Not Used
P304	Not Used
P305	Not Used
P306	Not Used
P307	Not Used
P308	Not Used
P400	IRQ0 for user button S1
P401	Not Used
P402	Not Used

Port	Assigned Function(s)
P403	Not Used
P404	User LED, red color
P405	User LED, green color
P406	User LED, blue color
P407	USB VBUS, USB cable connection monitor pin
P408	PMOD SPI MISO / UART RXD / I2C SCL
P409	PMOD SPI MOSI / UART TXD / I2C SDA
P410	PMOD SCK
P411	PMOD SS / UART CTS_RTS
P412	PMOD GPIO
P413	PMOD GPIO
P414	PMOD GPIO
P415	PMOD IRQ8
P600	DA7218# of J7 Audio breakout to MIC board
P609	VCOM_RXD to J-LINK OB
P610	VCOM_TXD to J-LINK OB
P708	Not Used
P800	OSPI_DQ5
P801	OSPI_DS
P802	OSPI_DQ6
P803	OSPI_DQ1
P804	OSPI_DQ7
P808	OSPI_CK
P809	Not Used
P814	USBFS_DP
P815	USBFS_DM

Implementation Details

OSPI NOR flash

There is one OSPI Flash on board. The device is ISSI IS25LX512M-JHLE 512 Mbit, 133 MHz in a 24-ball TFBGA 6x8mm (5×5 ball array) package.

Table 4. OSPI Flash Port Assignments

MCU Port	OSPI Signal	OSPI Pin
P808	CLK	C2
P107	Chip Select	B2
P100	DQ0	D3
P803	DQ1	D2
P103	DQ2	C4
P101	DQ3	D4
P102	DQ4	D5
P800	DQ5	E3
P802	DQ6	E2
P804	DQ7	E1

PROD

One PMOD type 2A/3A/6A connector (2×6 pin, dual row, right angle socket) is included.

Table 5. PMOD Port Assignments (J5)

MCU Port	PMOD Type 2A Signal	PMOD Type 3A Signal	PMOD Type 6A Signal	PMOD connector Pin
P411	CS	CTS_RTS	NC	1
P409	MOSI	TXD	NC	2
P408	MISO	RXD	SCL	3
P410	SCK		SDA	4
	GND	GND	GND	5
	+3.3V	+3.3V	+3.3V	6
P415	INT	INT	INT	7
P414	GPIO	GPIO	GPIO	8
P413	GPIO	GPIO	GPIO	9
P412	GPIO	GPIO	GPIO	10
	GND	GND	GND	11
	+3.3V	+3.3V	+3.3V	12

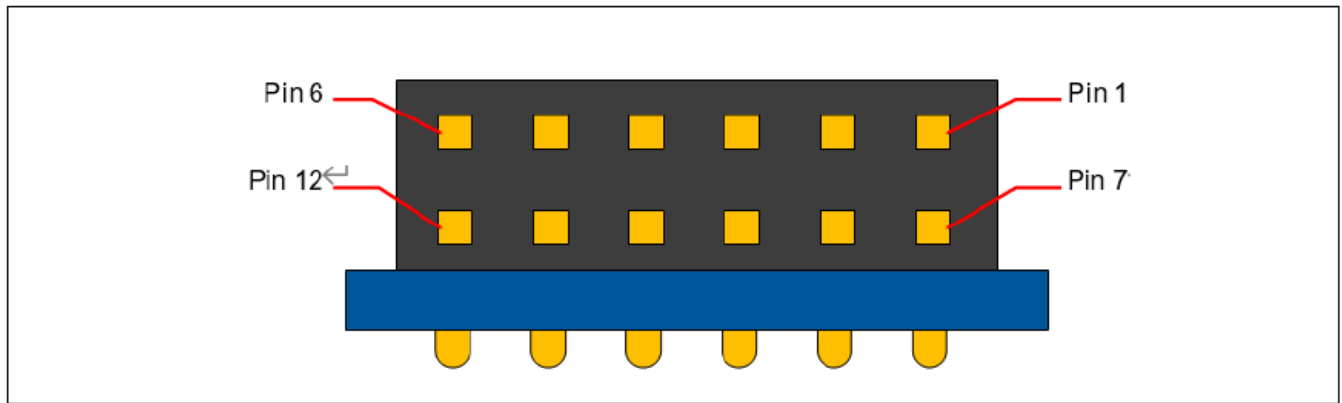


Figure 4. PMOD connector

Microphones

This board includes a pair of analog MEMS microphones (M1 & M2, 3SM121LZB1HA). These 2 analog microphone signals are amplified by Renesas READ2302GSP OPAMP, then fed to RA8M1 AN channels 0 & 1. A pair of digital I2S MEMS microphone (M3 & M4, ZillTek ZTS6672) is also provided, which is connected to RA8M1 SSI channel. The physical distance between each microphone is 14mm.

Table 6. Analog MEMS Microphone left channel (M1) Port Assignments

MCU Port	MEMS microphone Pin
P005	M1.1 – OUT
	M1.2 – GND
	M1.3 – GND
	M1.4 – GND
	M1.5 – VDD

Table 7. Analog MEMS Microphone left channel (M2) Port Assignments

MCU Port	MEMS microphone Pin
P004	M2.1 – OUT
	M2.2 – GND
	M2.3 – GND
	M2.4 – GND
	M2.5 – VDD

Table 8. Digital I2S MEMS Microphone channels (M3) Port Assignments

MCU Port	SSI Signal		MEMS microphone Pin
P113	SSILRCK0		M3.1 – LRC
	GND – for Select as left channel		M3.2 – SELECT
	GND		M3.3 – GND
P114	SSIRXD0		M3.4 – BCLK
	3.3V		M3.5 – VDD
	SSIBCK0		M3.6 – DATA
			M3.7 – CONFIG

Table 9. Digital I2S MEMS Microphone channels (M4) Port Assignments

MCU Port	SSI Signal		MEMS microphone Pin
P113	SSILRCK0		M4.1 – LRC
	3.3V – for Select as right channel		M4.2 – SELECT
	GND		M4.3 – GND
P114	SSIRXD0		M4.4 – BCLK
	3.3V		M4.5 – VDD
	SSIBCK0		M4.6 – DATA
			M4.7 – CONFIG

Audio out

- A headphone jack is connected to the MCU DAC. The DAC signals are connected through an OPAMP. The device is Renesas READ2302GSP, in ultra-small 8 pins TSSOP packages.

Table 10. Headphone Jack Pin Assignments

MCU Port	Audio out Signal	Headphone Jack Pin
P014 (DA0)	VOUT1	1 (Sleeve)
	VOUT2	2 (Mono signal)
	VOUT2	3 (Mono signal)

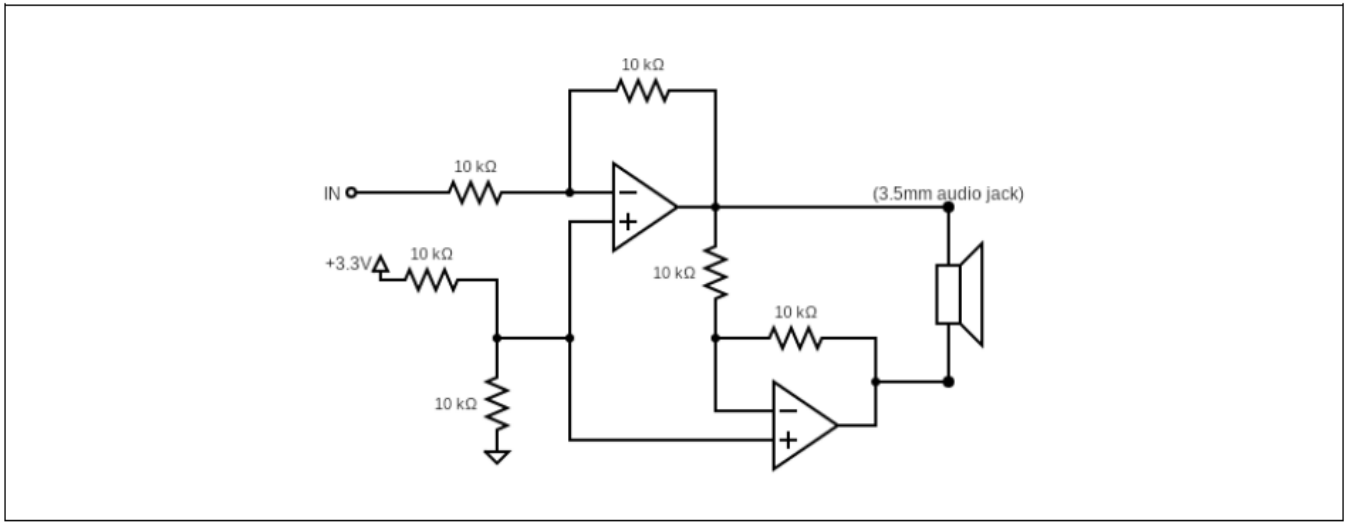


Figure 5. Audio out

LEDs

- 3 LEDs are included on the board and are connected to the MCU I/O. These are Red, Green, and Blue, and can be used for any user defined functions.

Table 11. User LED Port Assignments

MCU Port	Connected User LED
P404	Red (D1)
P405	Green (D2)
P406	Blue (D3)

D6 (blue) is power LED, and D8 (Green) is debug status LED to indicate the status of the JLOB connection.

Buttons

- There are two mechanical push-button switches on the board. One button is for system/MCU reset (S2). The second button is a user programmable button (S1).

Table 12. User Button Port Assignment (S1)

MCU Port	User Button Interrupt
P400	IRQ0

Audio breakout to MIC board

One connector (2×5 pin, dual row, right angle socket) is included (J7) and is used for the Audio Breakout connector. Plug with MIC BOARD will pull low DA7218#, I2S bus will automatic mux to DA7218.

Table 13. Connector Port Assignment (J7)

MCU Port	Connector Signal	Connector Pin
	GND	1
	+3.3V	2
P600	DA7218#	3
	NA	4
	I2S_DAT_IN1	5
	I2S_DAT_OUT1	6
	2S_LRCK1	7
	I2S_BCK1	8
P205	SCL1	9
P206	SDA1	10

Debug

The VK-RA8M1 board supports the following three debug modes.

Table 14. Supported Debug Modes

Debug Modes	Debug MCU (one that connects to the IDE on PC)	Target MCU (one that is being debugged)	Debugging Interface/Protocol	Connector Used
Debug on-board	RA4M2 (on-board)	RA8M1 (on-board)	SWD, JTAG	Micro USB (J9)
Debug in	External debugging tools	RA8M1 (on-board)	SWD, JTAG	20-pin connector (J13) NoP or 10-pin connector (J12)
Debug out	RA4M2 (on-board)	Any external RA MCU	SWD, JTAG	20-pin connector (J13) NoP or 10-pin connector (J12)

Notes:

- Please cut E10 for Debug out function
- See Table 16 for the Debug USB connector pin definition.
- See Table 17 for the 10-pin JTAG connector pin definition.
- See Table 18 for the 20-pin JTAG connector pin definition.

Table 15. Jumper Connection Summary for Different Debug

Debug Modes	J10
Debug on-board	Open
Debug in	Closed
Debug out	Open

- The J-Link On-Board (JLOB) debug interface supports the JTAG, and SWD debug interface and also supports the VCOM (Virtual COM port) function. The debug MCU is a Renesas RA4M2, programmed with J-Link firmware licensed by SEGGER. This interface includes one USB micro-B connector (J9) for host debug through the J-Link MCU, one 10-pin and one 20-pin debug header (supporting JTAG and SWD).

Table 16. Debug USB Connector

Debug USB Connector(J9)		RA4M2
Pin	Description	Signal / Bus
J9-1	+5VDC	VBUS2 / TP5
J9-2	Data-	D_N
J9-3	Data+	D_P
J9-4	USB ID, jack internal switch, cable inserted	N.C.
J9-5	Ground	GND

Table 17. 10-pin JTAG/SWD Connector (J12)

Pin	JTAG Pin Name	SWD Pin Name	Signal/Bus
J12-1	Vtref	Vtref	+3V3
J12-2	TMS	SWDIO	P108/SWDIO
J12-3	GND	GND	GND
J12-4	TCK	SWCLK	P300/SWCLK
J12-5	GND	GND	GND
J12-6	TDO		
J12-7	Key	Key	N.C.
J12-8	TDI		
J12-9	GND Detect	GND Detect	GND
J12-10	nSRST	nSRST	RESET#

Table 18. 20-pin JTAG/SWD Connector (J13)

Pin	JTAG Pin Name	SWD Pin Name	Signal/Bus
J13-1	Vtref	Vtref	+3V3
J13-2	TMS	SWDIO	P108/SWDIO
J13-3	GND	GND	GND
J13-4	TCK	SWCLK	P300/SWCLK
J13-5	GND	GND	GND
J13-6	TDO		P109
J13-7	Key	Key	N.C.
J13-8	TDI		P110
J13-9	GND Detect	GND Detect	GND
J13-10	nSRST	nSRST	RESET#
J13-11	N/A	N/A	GND
J13-12	N/A	N/A	N.C.
J13-13	N/A	N/A	GND
J13-14	N/A	N/A	N.C.
J13-15	N/A	N/A	GND
J13-16	N/A	N/A	N.C.
J13-17	N/A	N/A	GND
J13-18	N/A	N/A	N.C.
J13-19	N/A	N/A	GND
J13-20	N/A	N/A	N.C.

Table 19. Debug Port Signal Assignments

RA8M1 MCU Port	Debug signal usage
P108	TMS/SWDIO
P109	TDO
P110	TDI
P300	TCK/SWCLK

Power Requirements

VK-RA8M1 is designed for +5V operation. An on-board Low Dropout Regulator (LDO) is used to convert the 5V supply to 3.3V, which is then used to power the main MCU and many of the peripheral features of the VK-RA8M1.

Power Supply Options

VK-RA8M1 can be powered in three different ways as described in this section.

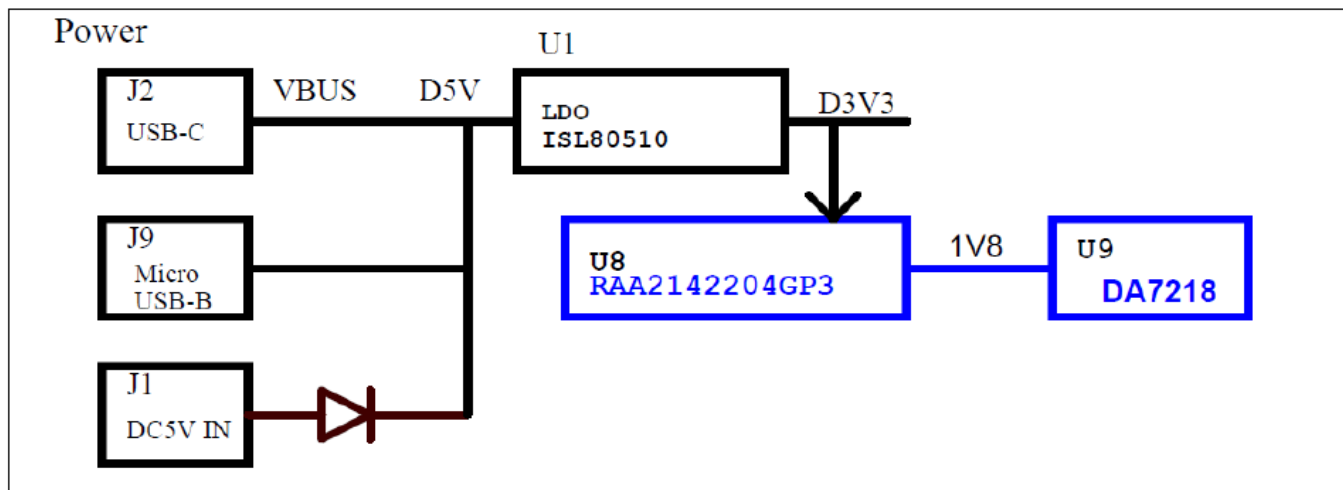


Figure 6. Power Supply Options

Option 1: Debug USB

5V may be supplied from an external USB host to the USB Debug connector (J9). Power from this source is connected to the Main System 5V Power. Reverse current protection is provided between this connector and the Main System 5V Power.

Option 2: USB C Full Speed

5V may be supplied from an external USB host to the USB C connector (J2) labeled USB C on the board. Power from this source is connected to the Main System 5V Power. Reverse current protection is provided between this connector and the Main System 5V Power.

Option 3: External Power Supply

5V may be supplied from an external header (J1).

Power-up Behavior

When powered, the blue D6 LED will light up. See the VK-RA8M1 Getting Started Guide for further information on initial power-up behavior.

USB

The board includes one USB TYPE-C connector (J2), supporting USB Full Speed device mode.

Table 20. USB Type-C Signal Assignments (J2)

MCU Port	USB-C Signal Name	USB-C Connection
	Ground	A1
	TX1+	A2
	TX1-	A3
	VBUS	A4
	Configuration Detection (CC1)	A5
DA_P	DP1	A6
DA_N	DN1	A7
	Configuration Detection (SBU1)	A8
	VBUS	A9
	RX2-	A10
	RX2+	A11
	Ground 2	A12
	Ground 2	B1
	TX2+	B2
	TX2-	B3
	VBUS	B4
	Configuration Detection (CC2)	B5
DA_P	DP2	B6
DA_N	DN2	B7
	Configuration Detection 2(SBU 2)	B8
	VBUS	B9
	RX1-	B10
	RX1+	B11
	Ground G	B12

MIC-Board

- MIC-Board can be connected to J7 in VK-RA8M1 to add I2S MEMS microphones.

Microphones

- This board includes 6 digital I2S MEMS microphones (M5, M6, M7, M8, M9 & M10, 3SM222KMB1HA). Uses two topologies. Topology 1: Square array of 4 mics spaced by 40mm (edge length). Microphones M5, M6, M7,

M8. (short J16, pin1-2).Topology 2: Equilateral triangle array of 3 mics located to the corners, spaced by 40mm (edge length), and the fourth mic at the center. Microphones M5, M6, M9, M10. (short J16, pin2-3). MIC board includes the Renesas DA7218 IC Audio codec.

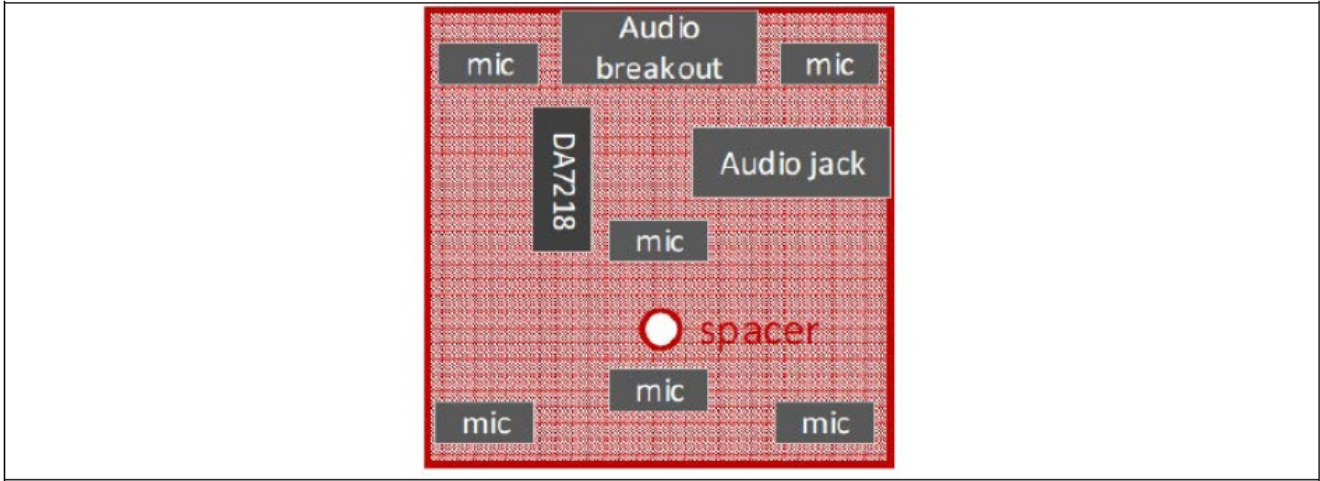


Figure 7. MIC-Board view

Table 21. Digital PDM MEMS Microphone channels (M5) Port Assignments

MCU Port	DA7218 Port	MEMS microphone Pin
	DMIC1N	M5.1 – LRC
		M5.2 – SELECT – GND
		M5.3 – GND
	DMIC1CLK	M5.4 – CLK
		M5.5 – VDD
P112_SSISCK0	I2S_BCK1	
P113_SSILRCK0	I2S_LRCK1	
P115_SSITXD0	I2S_DAT_IN1	
P114_SSIRXD0	I2S_DAT_OUT1	

Table 22. Digital PDM MEMS Microphone channels (M6) Port Assignments

MCU Port	DA7218 Port	MEMS microphone Pin
	DMIC1N	M6.1 – LRC
		M6.2 – SELECT – 3.3V
		M6.3 – GND
	DMIC1CLK	M6.4 – CLK
		M6.5 – VDD
P112_SSISCK0	I2S_BCK1	
P113_SSILRCK0	I2S_LRCK1	
P115_SSITXD0	I2S_DAT_IN1	
P114_SSIRXD0	I2S_DAT_OUT1	

Table 23. Digital PDM MEMS Microphone channels (M7) Port Assignments

MCU Port	DA7218 Port	MEMS microphone Pin
	DMIC2N	M7.1 – LRC
		M7.2 – SELECT – GND
		M7.3 – GND
	DMIC2CLK	M7.4 – CLK
		M7.5 – VDD
P112_SSISCK0	I2S_BCK1	
P113_SSILRCK0	I2S_LRCK1	
P115_SSITXD0	I2S_DAT_IN1	
P114_SSIRXD0	I2S_DAT_OUT1	

Table 24. Digital PDM MEMS Microphone channels (M8) Port Assignments

MCU Port	DA7218 Port	MEMS microphone Pin
	DMIC2N	M8.1 – LRC
		M8.2 – SELECT – 3.3V
		M8.3 – GND
	DMIC2CLK	M8.4 – CLK
		M8.5 – VDD
P112_SSISCK0	I2S_BCK1	
P113_SSILRCK0	I2S_LRCK1	
P115_SSITXD0	I2S_DAT_IN1	
P114_SSIRXD0	I2S_DAT_OUT1	

Table 25. Digital PDM MEMS Microphone channels (M9) Port Assignments

MCU Port	DA7218 Port	MEMS microphone Pin
	DMIC2N	M9.1 – LRC
		M9.2 – SELECT – GND
		M9.3 – GND
	DMIC2CLK	M9.4 – CLK
		M9.5 – VDD
P112_SSISCK0	I2S_BCK1	
P113_SSILRCK0	I2S_LRCK1	
P115_SSITXD0	I2S_DAT_IN1	
P114_SSIRXD0	I2S_DAT_OUT1	

Table 26. Digital PDM MEMS Microphone channels (M10) Port Assignments

MCU Port	DA7218 Port	MEMS microphone Pin
	DMIC2N	M10.1 – LRC
		M10.2 – SELECT – 3.3V
		M10.3 – GND
	DMIC2CLK	M10.4 – CLK
		M10.5 – VDD
P112_SSISCK0	I2S_BCK1	
P113_SSILRCK0	I2S_LRCK1	
P115_SSITXD0	I2S_DAT_IN1	
P114_SSIRXD0	I2S_DAT_OUT1	

Audio out

A stereo headphone jack is connected to the Audio CODEC. The device is Renesas DA7218.

Table 27. Stereo Headphone Jack Pin Assignments

Audio CODEC Port	Audio out Signal	Headphone Jack Pin
B4	HP_SENSE	1 (Sleeve)
A5	HPL	2 (Mono signal)
A3	HRP	3 (Mono signal)

Audio breakout

- One interface (2×5 pin, dual row, right angle socket) is included (J14) and is used as Audio Breakout connector with J7 in the VK-RA8M1 Motherboard. Plug with MIC BOARD, I2S bus will automatically mux to DA7218.

Table 28. MIC-Board PMOD Port Assignments (J14)

Audio CODE C Port	J7 Connector Port	MCU Port	Interface Signal	PMOD connector Pin
			GND	1
			+3.3V	2
			GND	3
			NA	4
C7	1B1		I2S_DAT_IN1	5
C9	4B1		I2S_DAT_OUT1	6
D8	2B1		2S_LRCK1	7
D6	3B1		I2S_BCK1	8
C11		P205	SCL1	9
D12		P206	SDA1	10

FCC

EMC/EMI Standards

- FCC Notice (Class A)
- This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
NOTE- This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.
- This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
 - Reorient or relocate the receiving antenna.
 - Increase the separation between the equipment and receiver.
 - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
 - Consult the dealer or an experienced radio/television technician for help.
- Innovation, Science and Economic Development Canada ICES-003 Compliance: CAN ICES-3 (A)/NMB-3(A)
- CE Class A (EMC)
- This product is herewith confirmed to comply with the requirements set out in the Council Directives on the Approximation of the laws of the Member States relating to Electromagnetic Compatibility Directive 2004/108/EEC.

Warning – This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures to correct this interference.

Design and Manufacturing Information

The design and manufacturing information for the VK-RA8M1 V2 kit is available in the “VK-RA8M1 V2 Design Package” available on renesas.com/vk-ra8m1.

- Design package file name: VK-RA8M1-V2-designpackage.zip
- Design package contents

Table 29. VK-RA8M1 Design Package Contents

Design Package Contents File Type	Content	File/Folder Name
File (PDF)	Schematics	VK-RA8M1-V2-schematics
File (PDF)	Mechanical Drawing	VK-RA8M1-V2-mechdwg
File (PDF)	3D Drawing	VK-RA8M1-V2-3d
File (PDF)	BOM	VK-RA8M1-V2-bom
Folder	Manufacturing Files	Manufacturing Files
Folder	Design Files	Design Files-Altium

Website and Support

Visit the following URLs to learn about the kit and the RA family of microcontrollers, download tools and documentation, and get support.

- VK-RA8M1 Resources www.renesas.com/vk-ra8m1
RA Product Information www.renesas.com/ra
RA Product Support Forum www.renesas.com/ra/forum
Renesas Support www.renesas.com/support

Revision History


Rev.	Date	Description	
		Page	Summary
1.00	May.31.24	–	First release document

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/

Documents / Resources

	<p>RENESAS RA8 Series Voice Kit Micro Controller [pdf] User Manual VK-RA8M1 V2, RA8 Series Voice Kit Micro Controller, RA8 Series, Voice Kit Micro Controller, Kit Micro Controller, Micro Controller, Controller</p>
---	---

References

- [R VK-RA8M1 - RA8M1 Voice User Reference Kit | Renesas](#)
- [R Renesas Electronics Corporation](#)
- [R Contact Us | Renesas](#)
- [R RA ARM Cortex-M 32-bit MCUs, Cortex-M33, M23 and M4 | Renesas](#)
- [R Renesas Engineering Community](#)
- [R Technical Support Services | Support Forums & Ticket Assistance - Renesas | Renesas](#)
- [R VK-RA8M1 - RA8M1 Voice User Reference Kit | Renesas](#)
- [R Renesas Electronics Corporation](#)
- [R Contact Us | Renesas](#)
- [R Legal Notices | Renesas](#)
- [R RA ARM Cortex-M 32-bit MCUs, Cortex-M33, M23 and M4 | Renesas](#)
- [R Renesas Engineering Community](#)
- [R Technical Support Services | Support Forums & Ticket Assistance - Renesas | Renesas](#)
- [User Manual](#)

[Manuals](#), [Privacy Policy](#)

This website is an independent publication and is neither affiliated with nor endorsed by any of the trademark owners. The "Bluetooth®" word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. The "Wi-Fi®" word mark and logos are registered trademarks owned by the Wi-Fi Alliance. Any use of these marks on this website does not imply any affiliation with or endorsement.