User's Manual

RA4C1 Group

Evaluation Kit for RA4C1 Microcontroller Group
EK-RA4C1 v1
User's Manual

Renesas RA Family
RA4 Series

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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.

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Precautions

This Evaluation 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 into an outlet on a circuit different from that which the receiver is connected.

• 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 Evaluation Kit does not represent an ideal reference design for an end product and does not fulfill the regulatory standards for an end product.

Renesas RA Family

EK-RA4C1 v1

Contents

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1. Kit Overview

The EK-RA4C1, an Evaluation Kit for the RA4 Series, enables users to seamlessly evaluate the features of the RA4C1 MCU group and develop embedded systems applications using Flexible Software Package (FSP) and the e^2 studio IDE. The users can use rich on-board features along with their choice of popular ecosystems add-ons to bring their big ideas to life.

The key features of the EK-RA4C1 board are categorized in three groups (consistent with the architecture of the kit) as follows:

MCU Native Pin Access

- R7FA4C1BD3CFP MCU (referred to as RA MCU)
  - 80 MHz, Arm® Cortex®-M33 core
  - 512 KB Code Flash, 96 KB SRAM
  - 100 pins, LQFP package
- Native pin access through 3 x 26-pin headers (not populated)
- Tamper Detection embedded into J4
- Segment LCD Board Interface
- MCU current measurement points for precision current consumption measurement
- Multiple clock sources – RA MCU oscillator and sub-clock oscillator crystals, providing precision 8.000 MHz and 32,768 Hz reference clocks. Additional low-precision clocks are available internal to the RA MCU

System Control and Ecosystem Access

- Two 5 V input sources
  - USB (Debug)
  - External Power Supply 2-pin header (not populated)
- Three Debug modes
  - Debug on-board (SWD)
  - Debug in (SWD)
  - Debug out (SWD, SWO and JTAG)
- User LEDs and buttons
  - Three User LEDs (red, blue, green)
  - Power LED (white) indicating availability of regulated power
  - Debug LED (yellow) indicating the debug connection
  - Two User buttons
  - One Reset button
- Five most popular ecosystems expansions
  - Two Seeed Grove® system (I^{2}C/Analog) connectors (not populated)
  - SparkFun® Qwiic® connector (not populated)
  - Two Digilent Pmod™ (SPI, UART and I^{2}C) connectors
  - Arduino™ (UNO R3) connector
  - MikroElektronika mikroBUS™ connector (not populated)
- MCU boot configuration jumper
- Low Voltage Mode voltage input and operation

Special Feature Access

- 32 MB (256 Mb) External Quad-SPI NOR Flash
- CAN-FD (3-pin header)
- External Battery Connector
- Configuration Switch

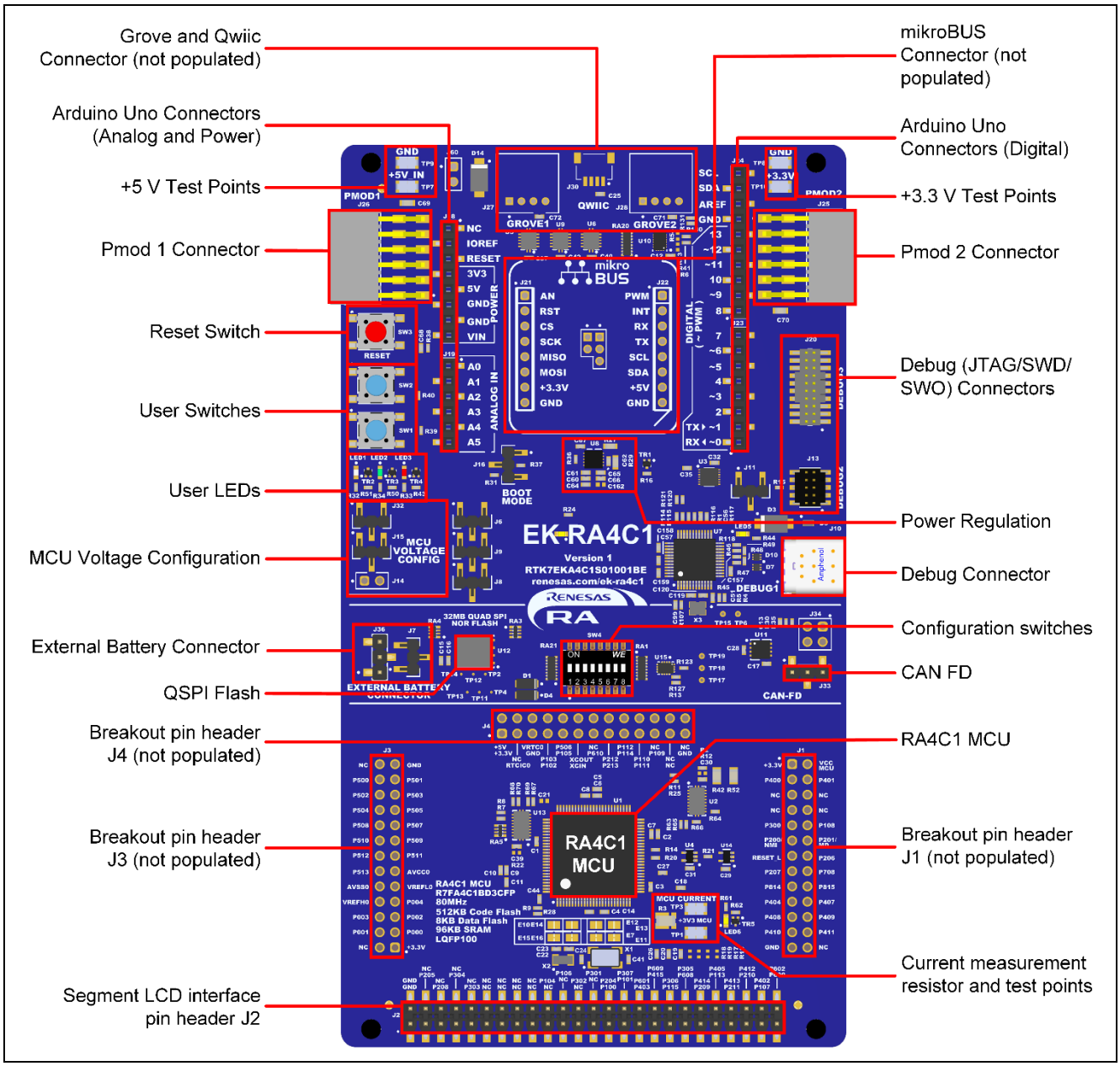

Figure 1. EK-RA4C1 Board Top Side

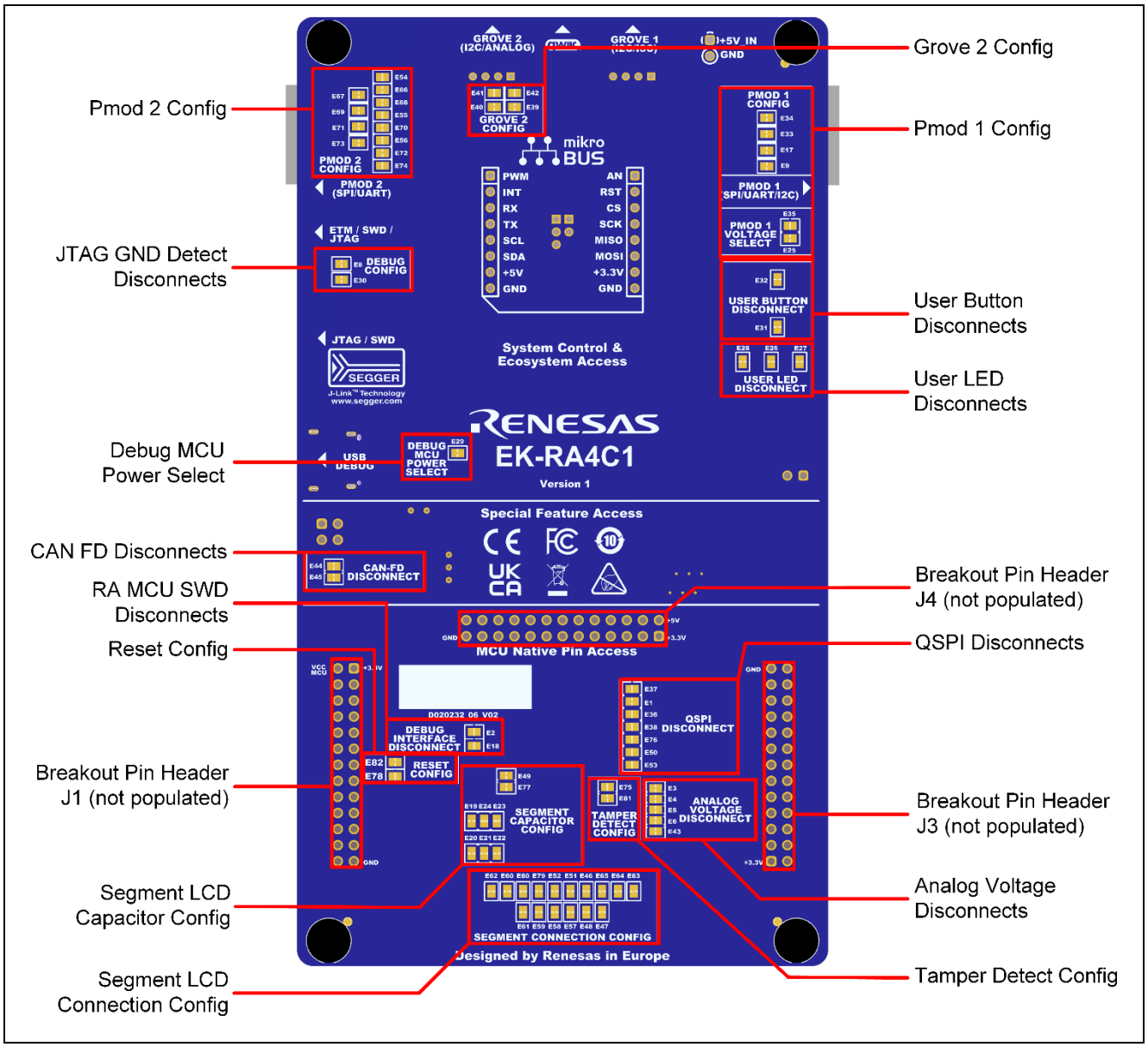

Figure 2. EK-RA4C1 Board Bottom Side

1.1 Assumptions and Advisory Notes

1. It is assumed that the user has a basic understanding of microcontrollers and embedded systems hardware.
2. It is recommended that the user refers to the *EK-RA4C1 Quick Start Guide* to get acquainted with the kit and the Quick Start example project that EK-RA4C1 board comes pre-programmed with.
3. Flexible Software Package (FSP) and Integrated Development Environment (IDE) such as e^2 studio are required to develop embedded applications on EK-RA4C1 kit.
4. Instructions to download and install software, import example projects, build them and program the EK-RA4C1 board are provided in the quick start guide.
5. The MCU fitted to the EK board may not contain the latest version of the on-chip boot firmware.

2. Kit Contents

The following components are included in the kit:

1. EK-RA4C1 v1 board
2. USB-C to USB-C cable
3. USB-A to USB-C cable
4. Segment LCD board
5. Display mounting hardware (spacers and fixing screws)

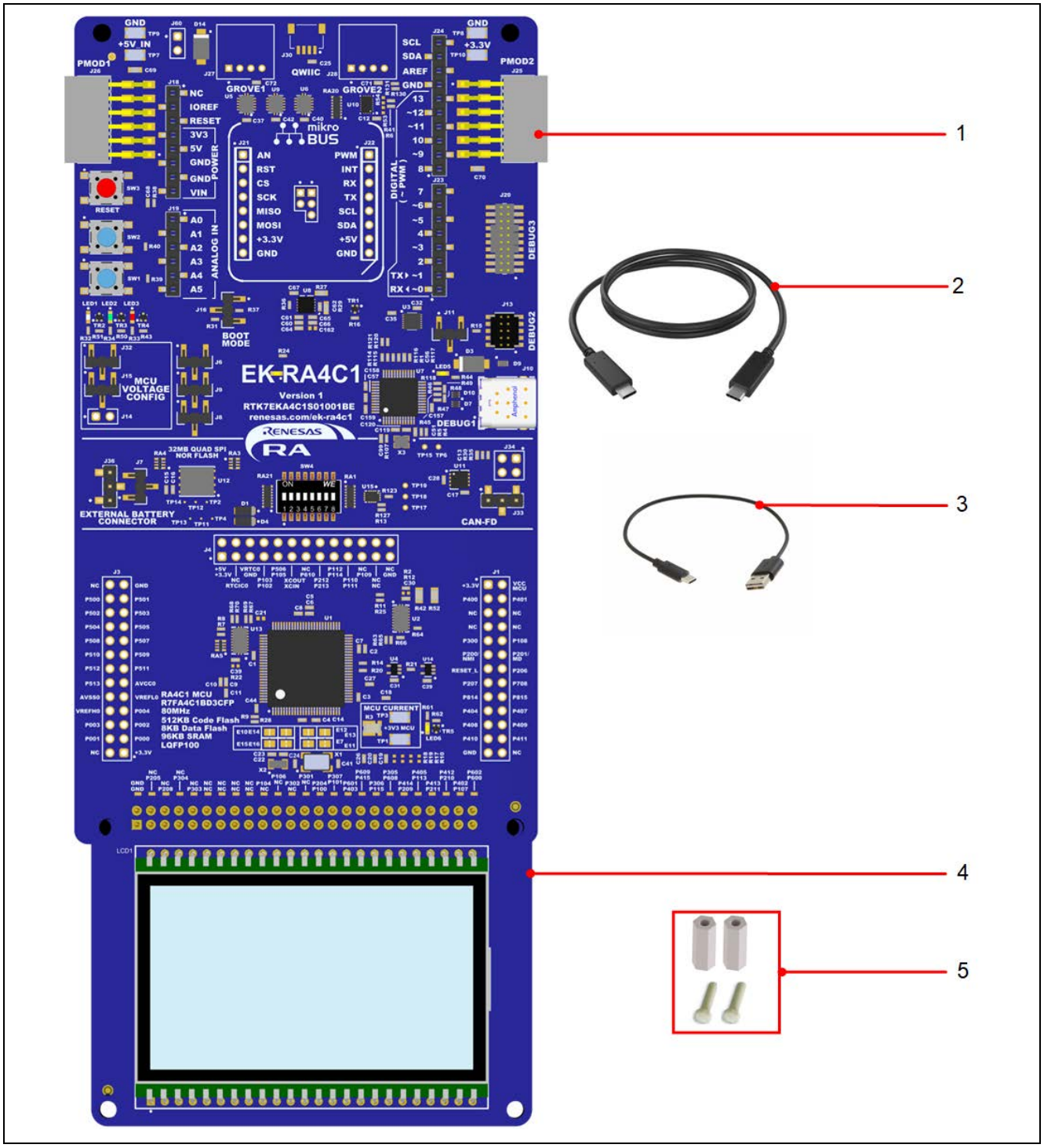

Figure 3. EK-RA4C1 Kit Contents

3. Ordering Information

- EK-RA4C1 v1 kit orderable part number: RTK7EKA4C1S01001BE

  Notes:

  1. The underlined character in the orderable part number represents the kit version.
  2. The Segment LCD Board orderable part number: RTKLCDSEG1S00001BE

- EK-RA4C1 board dimensions: 84 mm (width) x 150 mm (length)
- Segment LCD Board dimensions: 80 mm (width) x 60 mm (length)

4. Hardware Architecture and Default Configuration

4.1 Kit Architecture

The EK-RA4C1 board is designed with three sections or areas to help shorten the learning curve of the users and maximize the design and knowledge reuse among similar kits. The contents of these three areas are conceptually standardized among similar kits.

Table 1. Kit Architecture

Kit area	Area features	Area present on all similar kits	Functionality is:
MCU Native Pin Access Area	RA MCU, Breakout Pin Headers for all MCU I/O and Power, Current Measurement and Segment LCD Board Connector	Yes	MCU dependent
Special Feature Access Area	Configuration Switches MCU Special Features: Quad-SPI Flash, CAN FD, External Battery Connector	No	MCU dependent
System Control and Ecosystem Access Area	Power, Debug MCU, User LED and Buttons, Reset, Ecosystem Connectors, Low Voltage Input, Tamper Detection and Boot Configuration	Yes	Same or similar across similar kits

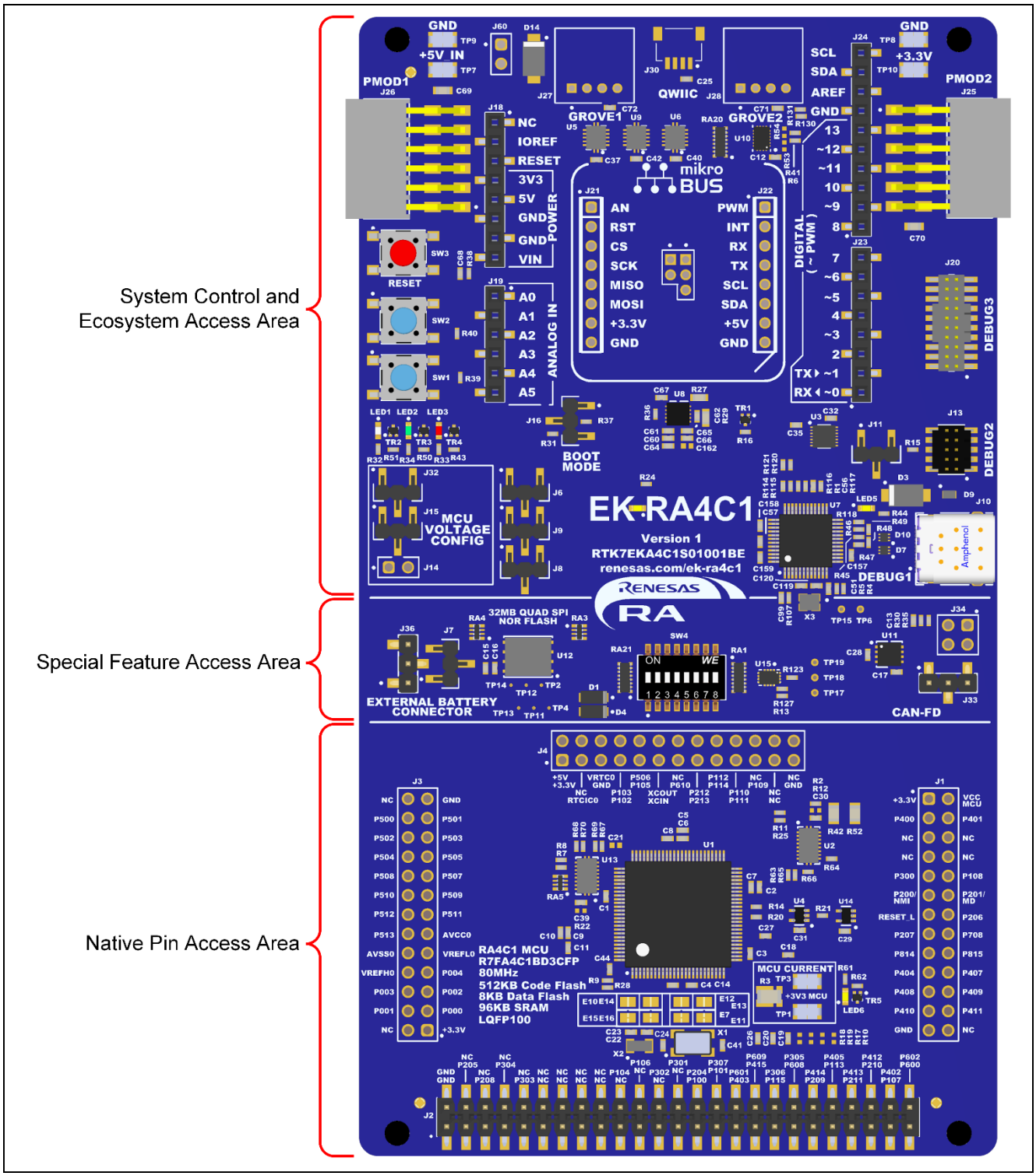

Figure 4. EK-RA4C1 Board Functional Area Definitions

4.2 System Block Diagram

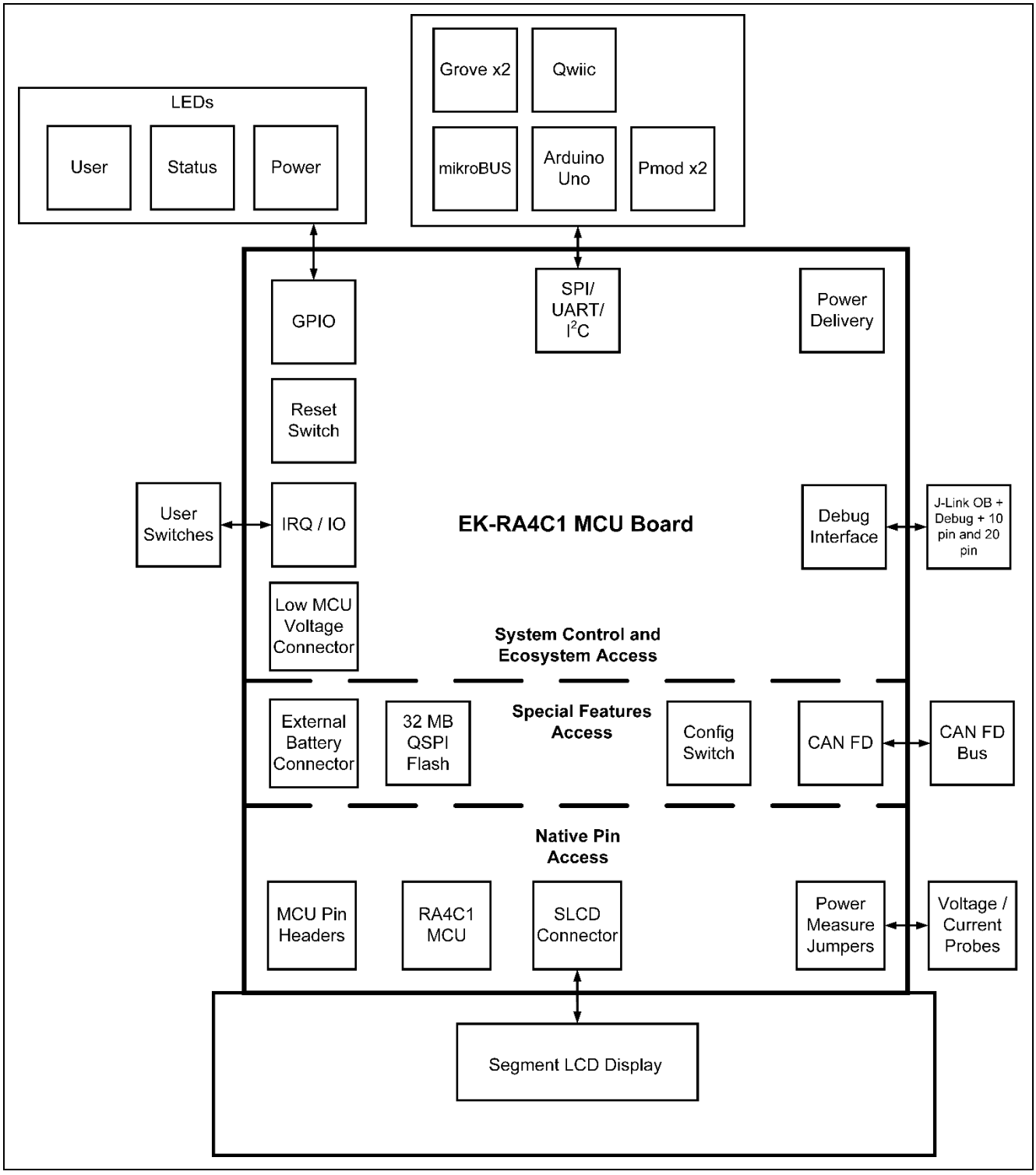

Figure 5. EK-RA4C1 Board Block Diagram

4.3 Jumper Configuration

Two types of jumpers are provided on the EK-RA4C1 board.

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

The following sections describe each type and their default configuration.

4.3.1 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.)

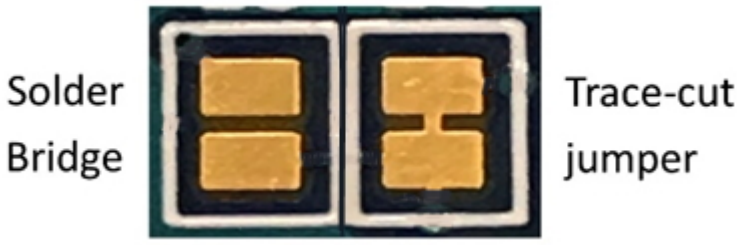

Figure 6. Copper Jumpers

4.3.2 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 EK-RA4C1 board are 2 mm pitch headers and require compatible 2 mm shunt jumpers.

4.3.3 Default Jumper Configuration

The following table describes the default configuration for each jumper on the EK-RA4C1 board. This includes copper jumpers (Ex designation) and traditional pin jumpers (Jx designation).

The Circuit Group for each jumper is the designation found in the board schematic (available in the Design Package). Functional details for many of the listed jumpers may be found in sections associated with each functional area of the kits.

Table 2. Default Jumper Configuration

Location	Circuit Group	Default Open/Closed	Function
J6	J-Link OB	Jumper on pins 2-3	Configures J-Link OB connection to MCU mode
J8	J-Link OB	Jumper on pins 1-2	Configures the MCU for normal operation
J9	J-Link OB	Jumper on pins 2-3	Configures JLOB_RESET_L for on-board debugger mode
J16	MCU Boot Mode	Jumper on pins 2-3	Configures the MCU for normal boot mode

Location	Circuit Group	Default Open/Closed	Function
J15	MCU Low Power Mode	Jumper on pins 1-2	Connects EXT_V_L to GND
J32	MCU Low Power Mode	Jumper on pins 1-2	Configures MCU operation mode
J7	MCU RTC Power supply	Jumper on pins 1-2	Supply MCU_VOLTAGE to VRTC0
J14 (Not fitted)	Power	Not fitted	External +3.3 V to +1.6 V power source connector
J36	Power	Fitted	Real Time Clock backup supply battery connector
J60 (Not fitted)	Power	Not fitted	External +5 V power source connector
E1	QSPI	Closed	Connects P500 to QSPI_SCLK
E3	MCU Power	Closed	Connects AVCC0 to VCC_MCU
E4	MCU Power	Closed	Connects AVSS0 to GND
E5	MCU Power	Closed	Connects VREFL0 to GND
E6	MCU Power	Closed	Connects VREFH0 to VCC_MCU
E7	MCU Clock	Closed	Connects P213/XTAL to 8 MHz crystal
E11	MCU Clock	Closed	Connects P212/EXTAL to 8 MHz crystal
E12	MCU Clock	Open	Connects P213/XTAL pin to pin headers J4 pin 15
E13	MCU Clock	Open	Connects P212/EXTAL pin to pin headers J4 pin 16
E10	MCU Clock	Open	Connects XCIN to pin headers J4 pin 11
E14	MCU Clock	Open	Connects XCOUT to pin headers J4 pin 12
E15	MCU Clock	Closed	Connects XCIN pin to 32 KHz crystal
E16	MCU Clock	Closed	Connects XCOUT pin to 32 KHz crystal
E8	Debug Out	Closed	Connects debugger JLOB_TRST# to J20
E30	Debug Out	Closed	Connects the JTAG GND Detect pin on J20 and J13 to GND
E29	Debug MCU Power	Closed	Connects the Debug MCU power to +3.3 V
E2	Debug EXT	Open	Connects P108 to J1 pin 9
E18	Debug EXT	Open	Connects P300 to J3 pin 9
E26	User LED	Closed	Connects P407 to User LED2
E27	User LED	Closed	Connects P610 to User LED1
E28	User LED	Closed	Connects P404 to User LED3
E31	User Switch	Closed	Connects P513 to User Switch SW1
E32	User Switch	Closed	Connects P105 to User Switch SW2
E43	Arduino	Closed	Connects ARDUINO_AREF to VREFH0
E25	Pmod 1	Closed	Connects +3.3 V to Pmod 1 pin 6 and pin 12
E35	Pmod 1	Open	Connects +5.0 V to Pmod 1 pin 6 and pin 12
E9	Pmod 1	Closed	Connects P708 (IRQ11) to Pmod 1 pin 7
E17	Pmod 1	Closed	Connects P402 (GPIO/RST) to Pmod 1 pin 8
E33	Pmod 1	Closed	Connects P210 (GPIO) to Pmod 1 pin 9
E34	Pmod 1	Closed	Connects P209 (GPIO) to Pmod 1 pin 10
E66	Pmod 2	Closed	Connects P411 (SSL3) to Pmod 2 pin 1
E67	Pmod 2	Closed	Connects P414 (IRQ9) to Pmod 2 pin 7
E68	Pmod 2	Closed	Connects P410 (MOSI3) to Pmod 2 pin 2
E69	Pmod 2	Closed	Connects P305 (GPIO/RST) to Pmod 2 pin 8
E70	Pmod 2	Closed	Connects P409 (MISO3) to Pmod 2 pin 3
E71	Pmod 2	Closed	Connects P413 (GPIO) to Pmod 2 pin 9
E72	Pmod 2	Closed	Connects P408 (RSPCK3) to Pmod 2 pin 4

Location	Circuit Group	Default Open/Closed	Function
E73	Pmod 2	Closed	Connects P204 (GPIO) to Pmod 2 pin 10
E54	Pmod 2	Open	Connects P412 (CTS3) to Pmod 2 pin 1
E55	Pmod 2	Open	Connects P409 (TXD3) to Pmod 2 pin 2
E56	Pmod 2	Open	Connects P408 (RXD3) to Pmod 2 pin 3
E74	Pmod 2	Open	Connects P411 (RTS3) to Pmod 2 pin 4
E39	Grove 2	Closed	Connects P400 (I^2C SCL) to Grove 2 pin 1
E40	Grove 2	Closed	Connects P401 (I^2C SDA) to Grove 2 pin 2
E41	Grove 2	Open	Connects P004 (AN002) to Grove 2 pin 2
E42	Grove 2	Open	Connects P003 (AN001) to Grove 2 pin 1
E44	CAN FD	Closed	Connects CANL to J34 pin 1 and termination resistors
E45	CAN FD	Closed	Connects CANH to J34 pin 3 and termination resistors
E19	MCU Pins	Closed	Connects P408/VL3 to external capacitor
E20	MCU Pins	Closed	Connects P409/VL4 to external capacitor
E21	MCU Pins	Closed	Connects P410/VL2 to external capacitor
E22	MCU Pins	Closed	Connects P411/VL1 to external capacitor
E23	MCU Pins	Open	Connects +5 V pull up circuit to VL 1-4
E24	MCU Pins	Open	Connects +3.3 V pull up circuit to VL 1-4
E46	SLCD	Closed	Connects P301 (SLCD_SEG22) to J2 pin 26
E47	SLCD	Closed	Connects P100 (SLCD_SEG41) to J2 pin 27
E48	SLCD	Closed	Connects P101 (SLCD_SEG40) to J2 pin 29
E49	SLCD	Closed	Connects P814 (SLCD_CAPL) to C27
E51	SLCD	Closed	Connects P204 (SLCD_SEG14) to J2 pin 28
E52	SLCD	Closed	Connects P305 (SLCD_SEG20) to J2 pin 38
E57	SLCD	Closed	Connects P403 (SLCD_SEG7) to J2 pin 31
E58	SLCD	Closed	Connects P415 (SLCD_SEG9) to J2 pin 33
E59	SLCD	Closed	Connects P209 (SLCD_SEG17) to J2 pin 39
E60	SLCD	Closed	Connects P412 (SLCD_SEG12) to J2 pin 46
E61	SLCD	Closed	Connects P210 (SLCD_SEG16) to J2 pin 45
E62	SLCD	Closed	Connects P402 (SLCD_SEG6) to J2 pin 48
E63	SLCD	Closed	Connects P104 (SLCD_SEG37) to J2 pin 20
E64	SLCD	Closed	Connects P106 (SLCD_SEG35) to J2 pin 22
E65	SLCD	Closed	Connects P302 (SLCD_SEG21) to J2 pin 24
E77	SLCD	Closed	Connects P815 (SLCD_CAPH) to C27
E79	SLCD	Closed	Connects P414 (SLCD_SEG10) to J2 pin 40
E80	SLCD	Closed	Connects P413 (SLCD_SEG11) to J2 pin 44
E36	QSPI	Open	Connects P501 (QSPI_SSL) to J3 pin 23
E37	QSPI	Open	Connects P500 (QSPI_CLK) to J3 pin 24
E38	QSPI	Open	Connects P502 (QSPI_IO0) to J3 pin 22
E50	QSPI	Open	Connects P504 (QSPI_IO2) to J3 pin 20
E53	QSPI	Open	Connects P505 (QSPI_IO3) to J3 pin 19
E76	QSPI	Open	Connects P503 (QSPI_IO1) to J3 pin 21
E75	Tamper Detection	Open	Connects RTCIC0 to GND
E81	Tamper Detection	Closed	Connects RTCIC0 to +3.3 V
E78	Reset circuit	Open	Connects external reset signals between U4 and U14 for input.
E82	Reset circuit	Closed	Connect external reset signals to the Reset switch for output purposes.

4.3.4 Configuration Switch Settings

The EK-RA4C1 features an I²C I/O Port Expander (TCAL6408RSVR) at U15 and has the I²C address 0x20. The port expander is connected to the configuration switches SW4 and allows the settings to be read (when the associated pin is set to an input) or overridden (when the pin is set to an output).

The following table describes the function and default configuration for each switch that selects the operational peripheral pins on the EK-RA4C1 board.

Functional details for many of the listed switches may be found in sections associated with each functional area of the kits.

Table 3. Configuration Switch (SW4) Settings

Switch	Switch Definition	Position (Default)	Function	Conflict
SW4-1	Pmod 1 Mode Select 1	**OFF**	Pmod 1 connectivity switch between I²C/UART/SPI Please see Table 18 for details.	BOOT SERIAL function
		ON		
SW4-2	Pmod 1 Mode Select 2	**OFF**		
		ON		
SW4-3	CAN silent mode config	**OFF**	CAN silent mode disabled	-
		ON	CAN silent mode enabled	-
SW4-4	DEBUG IN config	**OFF**	DEBUG IN enabled	-
		ON	DEBUG IN disabled	-
SW4-5	BOOT SERIAL config	**OFF**	BOOT SERIAL disabled. Serial port pins are available to accessory headers.	-
		ON	BOOT SERIAL connected to debugger.	Pmod 1 all connectivity
SW4-6	TP17	**OFF**	Test Point	-
		ON		-
SW4-7	TP18	**OFF**	Test Point	-
		ON		-
SW4-8	TP19	**OFF**	Test Point	-
		ON		-

Table 4. Permitted Switch Configuration (SW4)

IMPORTANT: Ensure that invalid switch configuration is not made to avoid potential failures

X: Indicates invalid switch configuration, all other configurations are valid

SWITCH SW4		SW4-1 Pmod 1 Mode Select 1		SW4-2 Pmod 1 Mode Select 2		SW4-3 CAN silent mode config		SW4-4 DEBUG IN config		SW4-5 BOOT SERIAL config		SW4-6 TP17		SW4-7 TP18		SW4-8 TP19	
		OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
SW4-1 Pmod 1 Mode Select 1	OFF																
	ON				X												
SW4-2 Pmod 1 Mode Select 2	OFF																
	ON																
SW4-3 CAN silent mode config	OFF																
	ON																
SW4-4 DEBUG IN config	OFF																
	ON																
SW4-5 BOOT SERIAL config	OFF																
	ON																
SW4-6 TP17	OFF																
	ON																
SW4-7 TP18	OFF																
	ON																
SW4-8 TP19	OFF																
	ON																

5. System Control and Ecosystem Access Area

The following figure shows the System Control and Ecosystem Access area on the EK-RA4C1 board. Subsequent sections detail the features and functionality provided in the area.

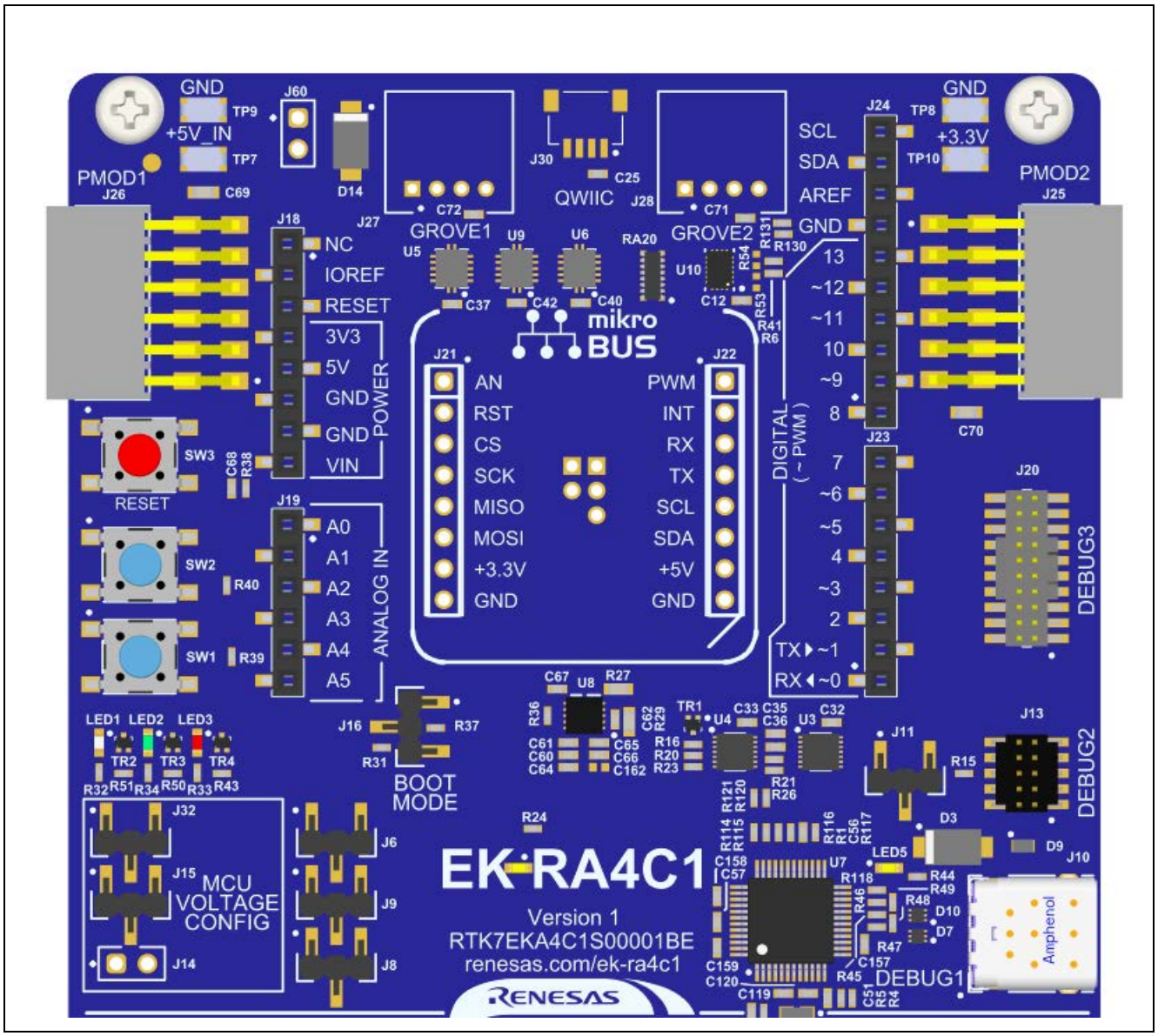

Figure 7. System Control and Ecosystem Access Area

5.1 Power

The EK-RA4C1 kit is designed for +5 V operation. An on-board Low Dropout Regulator (ISL80103IRAJZ) is used to convert the 5 V supply to a 3.3 V supply. The 3.3 V supply is used to power the RA MCU and other peripheral features. The kit can also be operated at a low voltage of +1.6 V.

5.1.1 Power Supply Options

This section describes the different ways in which EK-RA4C1 kit can be powered.

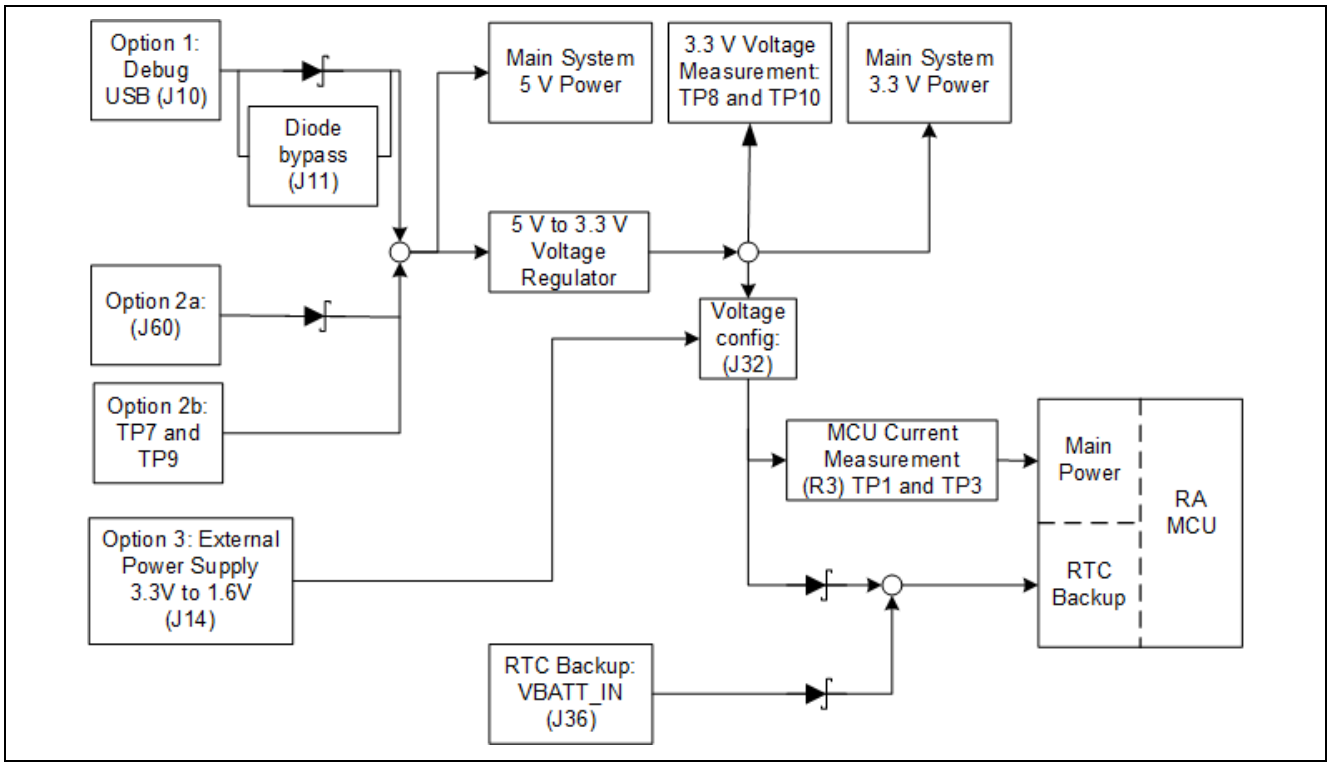

Figure 8. Power Supply Options

5.1.1.1 Option 1: Debug USB

5 V may be supplied from an external USB host to the USB Debug connector (J10) labelled DEBUG1 on the board. Power from this source is connected to the Main System 5 V Power. Reverse current protection is provided between this connector and the Main System 5 V Power.

5.1.1.2 Option 2: 5 V Test Points

5 V may be supplied from an external power supply to test points on the board. TP7 (5 V) and TP9 (GND) are loop-style test points, and J60 provides large via style test points that can accommodate a 0.1” pin header or connector. Reverse current protection is provided at J60-1 whereas TP7 directly connects to the 5 V input pin of the voltage regulator U8 and to the Main System 5 V Power. Care must be taken before applying an external supply to this test point to ensure that that the polarity is correct. Failure to do so could result in damage to components on the PCB.

These test points can be found at the top left of the board above Pmod 1.

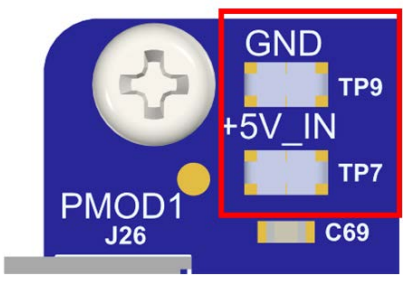

Figure 9. Test Point Location

5.1.1.3 Option 3: Low Voltage Input

EK-RA4C1 supports operation at a low power mode. A regulated voltage of +1.6 V can be supplied through J14 (not populated). Refer Section 7.3 for the jumper configurations.

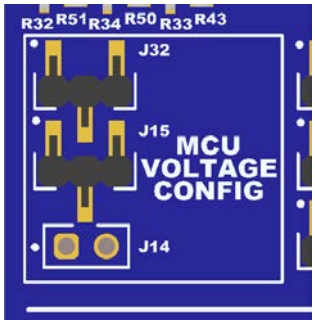

Figure 10. External Low Voltage Connector J14 (not populated)

5.1.1.4 RTC Backup: VBATT Supply

The MCU provides a battery backup function that maintains power to certain MCU peripherals (for example the Real Time Clock) in the event of a power loss. A battery (lithium coin cell etc.) can be connected to J36 to provide this power. For further details see the MCU hardware manual.

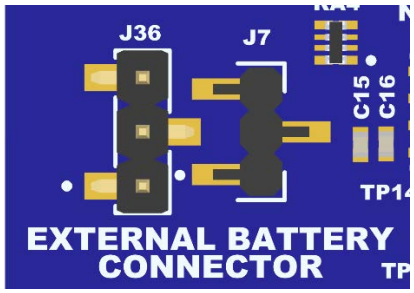

Figure 11. External Battery Connector Location

5.1.2 Power Supply Considerations

The on-board LDO regulator which supplies +3.3 V has a built-in current limit of 3.0 A. Make sure the total current required by the RA MCU, any active on-board features and any connected peripheral devices do not exceed this limit.

Note: The total current available depends on the configuration of the host USB port, for example an enumerated USB-A port has a maximum output current capability of 500 mA. In these cases, multiple power sources may be required.

5.1.3 Power-up Behavior

When powered, the white LED near the center of the board (the “dash” in the EK-RA4C1 name) will light up. For more details on initial power up behavior, see the *EK-RA4C1 Quick Start Guide*.

5.2 Debug

The EK-RA4C1 board supports the following three debug modes.

Table 5. Debug Modes

Debug Modes	Debugger MCU (the device that connects to the IDE on PC)	Target MCU (the device that is being debugged)	Debugging Interface/Protocol	Connector Used
Debug on-board	RA4M2 (on-board)	RA4C1 (on-board)	SWD	USB-C (J10)
Debug in	External debugging tools	RA4C1 (on-board)	SWD	20-pin connector (J20) or 10-pin connector (J13)
Debug out	RA4M2 (on-board)	Any external RA MCU	SWD, SWO, JTAG	USB-C (J10) plus either 20-pin connector (J20) or 10-pin connector (J13)

Notes:

- See Table 7 for the Debug USB connector pin definition
- See Table 10 for the 20-pin JTAG connector pin definition
- See Table 11 for the 10-pin JTAG connector pin definition

The EK-RA4C1 supports debug in both normal operation and low power mode operation. The following tables summarize the jumper configuration for each of the debug modes in both operation modes.

Table 6. Jumper Connection Summary for Different Debug Modes

Debug Modes	J6	J8	J9	SW4-4
Debug on-board	Jumper on pins 2-3	Jumper on pins 1-2	Jumper on pins 2-3	OFF
Debug in	Jumper on pins 2-3	Jumper on pins 1-2	Jumper on pins 1-2	OFF
Debug out	Jumper on pins 2-3	Jumper on pins 2-3	Jumper on pins 2-3	ON

5.2.1 Debug On-Board

The on-board debug functionality is provided using Renesas RA4M2 Debug MCU and SEGGER J-Link® firmware. Debug USB-C connector (J10) connects the RA4M2 Debug MCU to an external USB Full Speed Host, allowing reprogramming and debugging of the target RA MCU firmware. This connection is the default debug mode for the EK-RA4C1 board.

The RA4M2 Debug MCU connects to the target RA MCU using the SWD interface.

Table 7. Debug USB Port Assignments

Debug USB Port Assignments		EK-RA4C1
Pin	**Description**	**Signal/Bus**
J10-A1	GND	GND
J10-A2	TX1+	NC
J10-A3	TX1-	NC
J10-A4	VBUS	+5V_USB_DBG
J10-A5	CC1	USB_JLOB_CC1
J10-A6	DA+	USB_JLOB_P
J10-A7	DA-	USB_JLOB_N
J10-A8	SBU1	NC
J10-A9	VBUS	+5V_USB_DBG
J10-A10	RX2-	NC
J10-A11	RX2+	NC
J10-A12	GND	GND
J10-B1	GND	GND
J10-B2	TX2+	NC

Debug USB Port Assignments		EK-RA4C1
Pin	**Description**	**Signal/Bus**
J10-B3	TX2-	NC
J10-B4	VBUS	+5V_USB_DBG
J10-B5	CC2	USB_JLOB_CC2
J10-B6	DB+	USB_JLOB_P
J10-B7	DB-	USB_JLOB_N
J10-B8	SBU2	NC
J10-B9	VBUS	+5V_USB_DBG
J10-B10	RX1-	NC
J10-B11	RX1+	NC
J10-B12	GND	GND
J10-S1	SHIELD	GND
J10-S2	SHIELD	GND
J10-S3	SHIELD	GND
J10-S4	SHIELD	GND

A yellow indicator, LED5, shows the visual status of the debug interface. When the EK-RA4C1 board is powered on, and LED5 is blinking, it indicates that the RA4M2 Debug MCU is not connected to a programming host. When LED5 is solidly on, it indicates that the RA4M2 Debug MCU is connected to a programming interface.

To configure the EK-RA4C1 board to use the Debug On-Board mode, configure the jumpers using the following table.

Table 8. Debug On-Board Jumper Configuration

Location	Default Open/Closed	Function
J6	Jumper on pins 2-3	Target RA MCU MD connected to debug
J8	Jumper on pins 1-2	Target RA MCU RESET_L connected to debug RESET_L
J9	Jumper on pins 2-3	RA4M2 Debug MCU in normal operation mode
SW4-4	OFF	Enable Debug In function

To use this debug mode in low power mode operation, configure the jumpers following Table 28.

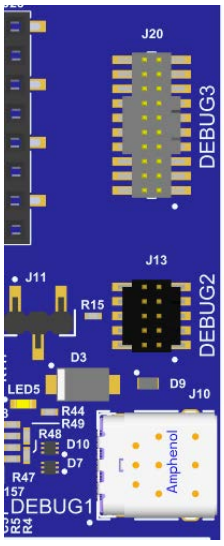

Figure 12. EK-RA4C1 Debug Interface

5.2.2 Debug In

One 20-pin Cortex® Debug Connector at J20 and one 10-pin Cortex® Debug Connector at J13 support SWD. Either of these connectors may be used for external debug of the target RA MCU.

To configure the EK-RA4C1 board to use the Debug In mode, configure the jumpers using the following table.

Table 9. Debug In Mode Jumper Configuration

Location	Default Open/Closed	Function
J6	Jumper on pins 2-3	Target RA MCU MD connected to debug
J8	Jumper on pins 1-2	Target RA MCU RESET_L connected to debug RESET_L
J9	Jumper on pins 1-2	RA4M2 Debug MCU is held in RESET
SW4-4	OFF	Enable Debug In function

To use this debug mode in low power mode operation, configure the jumpers following Table 28.

Table 10. JTAG/SWD Port Assignments (J20)

JTAG/SWD Port Assignments			EK-RA4C1
Pin	**JTAG Pin Name[*1]**	**SWD Pin Name**	**Signal/Bus**
J20-1	Vtref	Vtref	+3V3
J20-2	TMS	SWDIO	P108/SWDIO
J20-3	GND	GND	GND
J20-4	TCK	SWCLK	P300/SWCLK
J20-5	GND	GND	GND
J20-6	TDO	SWO	P109/BOOT_SERIAL
J20-7	Key	Key	NC
J20-8	TDI	N/A	P110/BOOT_SERIAL
J20-9	GNDDetect	GNDDetect	GND (cut E30 to open)
J20-10	nSRST	nSRST	RESET_L (via J8)
J20-11	GND	GND	GND
J20-12	NC	NC	NC
J20-13	GND	GND	GND
J20-14	NC	NC	NC
J20-15	GND	GND	GND
J20-16	RESET	RESET	TRST
J20-17	GND	GND	GND
J20-18	NC	NC	NC
J20-19	GND	GND	GND
J20-20	NC	NC	NC

[*1] Only for debug out.

Table 11. JTAG/SWD Port Assignments (J13)

JTAG/SWD Port Assignments			EK-RA4C1
Pin	**JTAG Pin Name[*1]**	**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	SWO	P109/BOOT_SERIAL
J13-7	Key	Key	NC
J13-8	TDI	N/A	P110/BOOT_SERIAL
J13-9	GNDDetect	GNDDetect	GND (cut E30 to open)
J13-10	nSRST	nSRST	RESET_L (via J8)

[*1] Only for debug out.

Note: The Cortex® Debug Connector is fully described in the Arm® CoreSight™ Architecture Specification.

5.2.3 Debug Out

The EK-RA4C1 board can be configured to use the RA4M2 Debug MCU to debug a target RA MCU on an external board.

A yellow indicator, LED5, shows the visual status of the debug interface. When the EK-RA4C1 board is powered on, and LED5 is blinking, this indicates that the RA4M2 Debug MCU is not connected to a programming host. When LED5 is solidly on, this indicates that the RA4M2 Debug MCU is connected to a programming interface. When the debug interface is actively in use, the LED will flicker randomly.

To configure the EK-RA4C1 board for Debug Out mode, configure the jumpers according to the following table.

Table 12. Debug Out Jumper Configuration

Location	Default Open/Closed	Function
J6	Jumper on pins 2-3	No connection to RA MCU
J8	Jumper on pins 2-3	On-board RA MCU is held in RESET
J9	Jumper on pins 2-3	RA4M2 Debug MCU in normal operation mode
SW4-4	ON	Disable Debug In function

To use this debug mode in low power mode operation, configure the jumpers following Table 28.

5.2.4 Debug Serial

The debug port can act as a virtual COM port that supports serial communication. Please note that the virtual COM port cannot be used in low power mode.

Table 13. Debug Serial Port Assignments

Debug Serial Port Assignments	EK-RA4C1 Port
U7-P301 (RXD2)	P207
U7-P302 (TXD2)	P206
U7-P409 (CTS)	TP6
U7-P408 (RTS)	TP15

5.3 Ecosystem

The System Control and Ecosystem area provides users the option to simultaneously connect several third-party add-on modules compatible with five most popular ecosystems using the following connectors:

1. Two Seeed Grove® system (I²C/Analog) connectors (not populated)
2. SparkFun® Qwiic® connector (not populated)
3. Two Digilent Pmod™ (SPI, UART and I²C) connectors
4. Arduino™ (UNO R3) connector
5. MikroElektronika mikroBUS™ connector (not populated)

5.3.1 Seeed Grove® Connections

5.3.1.1 Grove 1

A Seeed Grove® I²C connector footprint is provided at J27. The RA MCU acts as a two-wire serial master in I²C mode, and a connected module acts as a two-wire serial slave. Do not use this connector during low power operation.

Table 14. Grove 1 Port Assignments

Grove 1 Port Assignments		EK-RA4C1
Pin	**Description**	**Signal/Bus**
J27-1	I²C_SCL	P400 (SCL1)
J27-2	I²C_SDA	P401 (SDA1)
J27-3	VCC	+3.3 V
J27-4	GND	GND

5.3.1.2 Grove 2

A Seeed Grove® I²C connector footprint is provided at J28. The RA MCU acts as a two-wire serial master, and a connected module acts as a two-wire serial slave. Do not use this connector during low power operation.

Option links E39, E40, E41 and E42 provide the capability to convert this connector to an analog Seeed Grove® implementation.

Table 15. Grove 2 Port Assignments

Grove 2 Port Assignments		EK-RA4C1	
Pin	**Description**	**Signal/Bus**	
J28-1	SCL	P400 (SCL1)	P003 (AN001) *1
J28-2	SDA	P401 (SDA1)	P004 (AN002) *1
J28-3	VCC	+3.3 V	
J28-4	GND	GND	

*1 Jumpers E39 and E40 are open, E41 and E42 are closed

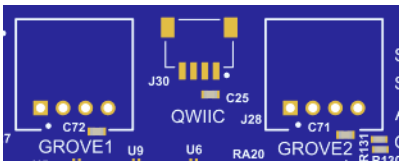

Figure 13. Seeed Grove® and SparkFun® Qwiic® Connector Footprints

5.3.2 SparkFun® Qwiic® Connections

A SparkFun® Qwiic® connector footprint is provided at J30. The Main MCU acts as a two-wire serial master, and a connected module acts as a two-wire serial slave (data lines shared with Grove 1). Do not use this connector during low power operation.

Table 16. Qwiic Port Assignments

Qwiic Port Assignments	EK-RA4C1

Pin	Description	Signal/Bus
J30-1	GND	GND
J30-2	VCC	+3.3 V
J30-3	SDA	P401 (SDA1)
J30-4	SCL	P400 (SCL1)

5.3.3 Digilent Pmod™ Connectors

Two 12-pin connectors are provided to support Pmod modules where the RA MCU acts as the master, and the connected module acts as a slave device. During low power operation, do not connect any devices to either Pmod connector.

The Segment LCD function conflicts with both Pmod connectors and connections can be isolated using the Segment Connection Configuration E-pads. If it is required to use the Segment LCD and Pmod at the same time, then specific E-pads can be cut depending on which functionality is most needed on the Segment LCD or Pmod. Please refer to EK-RA4C1 schematic in the design package for further details.

These connectors may be configured in firmware to support several Pmod types such as Type-2A (expanded SPI) and Type-3A (expanded UART).

Pmod 1 can also be configured as Pmod Type-6A (I^2C).

The default 12-pin Pmod interface supports +3.3 V devices. Please ensure that any Pmod device installed is compatible with a +3.3 V supply.

Note that both Pmods use the SCI peripheral in “Simple SPI” mode and so do not offer the full functionality of the SPI peripheral. Please see the MCU hardware manual for full details of the SCI “Simple SPI” mode.

5.3.3.1 Pmod 1

A 12-pin Pmod connector is provided at J26, Pmod 1.

This Pmod connector is controlled by switch options (SW4-1) and (SW4-2).

Table 17. Pmod 1 Port Assignments

Pmod 1 Port Assignments				EK-RA4C1	Pmod 1 Configuration	
Pin	**Option Type-2A (SPI)[*1]**	**Option Type-3A (UART)[*1]**	**Option Type-6A (I^2C)[*1]**	**Signal/Bus**	**Short**	**Open**
J26-1	SS	-	-	P112 (SSLA0)	-	-
	-	CTS	-	P114 (CTS9)	-	-
	-	-	INT	P110 (IRQ3)	-	-
J26-2	MOSI	TXD	-	P109 (MOSIA/TXD9)	-	-
	-	-	RST	P111 (RST)	-	-
J26-3	MISO	RXD	-	P110 (MISOA/RXD9)	-	-
	-	-	SCL	P400 (SCL1)	-	-
J26-4	SCK	-	-	P111 (RSPCKA)	-	-
	-	RTS	-	P112 (RTS9)	-	-
	-	-	SDA	P401 (SDA1)	-	-
J26-5	GND			GND	-	-
J26-6	VCC[*2]			+3.3 V	E25	E35
				+5.0 V	E35	E25
J26-7	IRQ			P708 (IRQ11)	E9	-
J26-8	RESET (master to slave)			P402	E17	-
J26-9	GPIO			P210	E33	-
J26-10	GPIO			P209	E34	-
J26-11	GND			GND	-	-
J26-12	VCC[*2]			+3.3 V	E25	E35
				+5.0 V	E35	E25

[*1] Option is selected by setting switches SW4-1 and SW4-2 as follows:

Table 18. Pmod 1 Function Selection

SW4-1	SW4-2	Selected function
Off	Off	SPI (Default)
On	Off	UART
Off	On	I^2C
On	On	None

*2 Caution: 5 V optional supply is provided (J26-6 and J26-12), however the interface must only be driven with 3 V signals from the Pmod 1. The EK-RA4C1 will only provide 3.3 V signal levels to the Pmod 1.

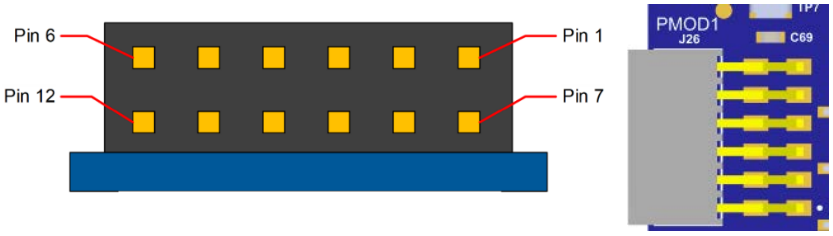

Figure 14. Pmod 1 Connector

5.3.3.2 Pmod 2

A 12-pin Pmod connector is provided at J25, Pmod 2.

The Segment LCD requires capacitors that are connected to ports shared with Pmod 2 pins 1-4. To use Pmod 2 for SPI and UART functions, please disconnect E19, E20, E21 and E22 to isolate the pins from these capacitors.

Table 19. Pmod 2 Port Assignments

Pmod 2 Port Assignments			EK-RA4C1	Pmod 2 Configuration	
Pin	Option Type-2A (SPI)	Option Type-3A (UART)	Signal/Bus	Short	Open
J25-1	SS	-	P411 (SSLB)	E66	E54
J25-1	-	CTS	P412 (CTS3)	E54	E66
J25-2	MOSI	-	P410 (MOSIB)	E68	E55
	-	TXD	P409 (TXD3)	E55	E68
J25-3	MISO	-	P409 (MISOB)	E70	E56
	-	RXD	P408 (RXD3)	E56	E70
J25-4	RSPCK	-	P408 (RSPCKB)	E72	E74
J25-4	-	RTS	P411 (RTS3)	E74	E72
J25-5	GND		GND	-	-
J25-6	VCC		+3.3 V	-	-
J25-7	IRQ		P414 (IRQ9)	E67	-
J25-8	RESET (master to slave)		P305	E69	-
J25-9	GPIO		P413	E71	-
J25-10	GPIO		P204	E73	-
J25-11	GND		GND	-	-
J25-12	VCC		+3.3 V	-	-

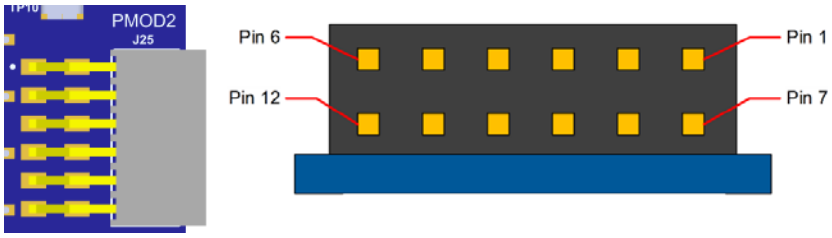

Figure 15. Pmod 2 Connector

5.3.4 Arduino™ Connectors

Near the center of the System Control and Ecosystem Access area is an Arduino™ UNO R3 compatible connector interface. Do not use this interface during low power operation.

Please note that the full functionality of the Arduino interface is not available when the Segment LCD is in use (see Table 20). If it is required to use the Segment LCD and Arduino interface at the same time, then specific E-pads can be cut depending on which functionality is most needed on the Segment LCD or Arduino. Please refer to the EK-RA4C1 schematic in the design package for further details.

Table 20. Arduino UNO Port Assignments

Arduino UNO Port Assignments				**EK-RA4C1**
Pin	**Description**			**Signal/Bus**
J18-1	NC			NC
J18-2	IOREF			+3.3 V
J18-3	RESET			RESET_L
J18-4	3.3 V			+3.3 V
J18-5	5 V			+5 V
J18-6	GND			GND
J18-7	GND			GND
J18-8	VIN			NC
J19-1	A0			P002 (AN000)
J19-2	A1			P003 (AN001)
J19-3	A2			P004 (AN002)
J19-4	A3			P512 (AN023)
J19-5	A4			P001 (AN006)
J19-6	A5			P000 (AN005)
J23-1	D0	RXD		P301 (GPIO/RXD5/IRQ6/GTIOC4B) *1
J23-2	D1	TXD		P302 (GPIO/TXD5/IRQ5/GTIOC4A) *1
J23-3	D2	INT0		P403 (GPIO/IRQ14) *1
J23-4	D3	INT1	PWM	P415 (GPIO/IRQ8/GTIOC0A) *1
J23-5	D4			P106 (GPIO)*1
J23-6	D5		PWM	P100 (GPIO/IRQ2/GTIOC5B) *1
J23-7	D6		PWM	P101 (GPIO/IRQ1/GTIOC5A) *1
J23-8	D7			P510 (GPIO)
J24-1	D8			P511 (GPIO)
J24-2	D9		PWM	P600 (GPIO/GTIOC2B) *1
J24-3	D10	SPI_SS		P509 (GPIO/SSLC0)
J24-4	D11	SPI_MOSI	PWM	P506 (GPIO/MOSIC/GTIOC4A)
J24-5	D12	SPI_MISO		P507 (GPIO/MISOC/GTIOC4B)
J24-6	D13	SPI_SCK		P508 (GPIO/RSPCKC)
J24-7	GND			GND
J24-8	ARDUINO_AREF			+3.3 V

Arduino UNO Port Assignments		EK-RA4C1
Pin	**Description**	**Signal/Bus**
J24-9	I²C_SDA	P401 (SDA1)
J24-10	I²C_SCL	P400 (SCL1)

*1 Pin cannot be used when using the Segment LCD unless corresponding E-Link is cut

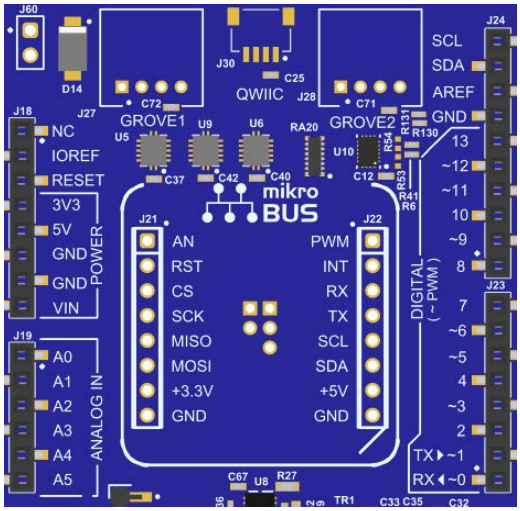

Figure 16. Arduino UNO Connectors

5.3.5 MikroElektronika mikroBUS™ Connectors (Not Populated)

In the center of the System Control and Ecosystem Access area is a mikroBUS™ compatible connector footprint. This interface is compliant with mikroBUS™ Standard Specifications revision 2.00. Do not use this interface during low power operation.

Please note that the full functionality of the mikroBUS™ connectors is not available when the Segment LCD is in use (see Table 21). If it is required to use the Segment LCD and mikroBUS™ at the same time, then specific E-pads can be cut depending on which functionality is most needed on the Segment LCD or mikroBUS™. Please refer to the EK-RA4C1 schematic in the design package for further details.

Table 21. mikroBUS™ Port Assignments

mikroBUS™ Port Assignments		EK-RA4C1
Pin	**Description**	**Signal/Bus**
J21-1	AN (Analog)	P000 (AN005)
J21-2	RST (Reset)	P104 (MIKROBUS RESET_L) *1
J21-3	CS (SPI Chip Select)	P509 (SSLC0)
J21-4	SCK (SPI Clock)	P508 (RSPCKC)
J21-5	MISO	P507 (MISOC)
J21-6	MOSI	P506 (MOSIC)
J21-7	+3.3 V	+3.3 V
J21-8	GND	GND
J22-1	PWM	P101 (GTIOC5A) *1
J22-2	INT (Hardware Interrupt)	P415 (IRQ-8) *1
J22-3	RX (UART Receive)	P301 (RXD5) *1
J22-4	TX (UART Transmit)	P302 (TXD5) *1
J22-5	SCL (I²C Clock)	P400 (SCL1)
J22-6	SDA (I²C Data)	P401 (SDA1)
J22-7	+5 V	+5 V
J22-8	GND	GND

*1 Pin cannot be used when using the Segment LCD unless corresponding E-Link is cut

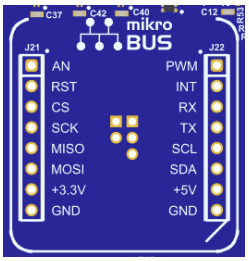

Figure 17. mikroBUS™ Connector

5.4 Miscellaneous

5.4.1 User and Power LEDs

Six LEDs are provided on the EK-RA4C1 board.

The function of the LEDs on the EK-RA4C1 board is described in the following table.

Table 22. EK-RA4C1 Board LED Functions

Designator	Color	Function	MCU Control Port
LED1	Blue	User LED	P610
LED2	Green	User LED	P407
LED3	Red	User LED	P404
LED4	White	Power on indicator	+3.3 V
LED5	Yellow	Debug LED	J-Link OB MCU
LED6	White	MCU Power Available	MCU Power

The User LEDs may be isolated from the main MCU, so the associated ports can be used for other purposes. To separate LED1 from P609, trace cut jumper E27 must be open. To separate LED2 from P610, trace cut jumper E26 must be open. To separate LED3 from P601, trace cut jumper E28 must be open.

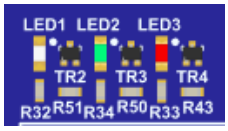

Figure 18. User LEDs

Figure 19. Power LED

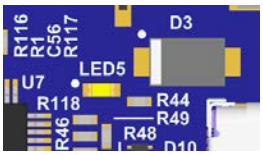

Figure 20. Debug LED

Figure 21. MCU Power LED

5.4.2 User and Reset Switches

Three miniature, momentary, mechanical push-button type SMT switches are mounted on the EK-RA4C1 board.

Pressing the reset switch (SW3) generates a reset signal to restart the RA MCU.

Table 23. EK-RA4C1 Board Switches

Designator	Function	MCU Control Port	Button Color
SW3	MCU Reset Switch	RESET_L	Red
SW2	User Switch	P105 (IRQ0)	Blue
SW1	User Switch	P513 (IRQ15)	Blue

The user switches SW1 and SW2 may be isolated from the main MCU, so the associated ports can be used for other purposes. To separate SW1 from P513, trace cut jumper E31 must be open. To separate SW2 from P105, trace cut jumper E32 must be open.

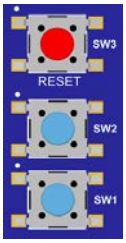

Figure 22. Reset and User Switches

5.4.3 MCU Boot Mode

A three-pin header (J16) is provided to select the boot mode (P201) of the RA MCU. For normal operation, or Single-Chip mode, place a jumper on J16 pins 2-3. To enter SCI Boot mode or USB boot mode, place a jumper on J16 pins 1-2.

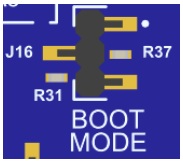

Figure 23. Boot Mode

6. Special Feature Access Area

The Special Feature Access area provides features specific to the RA MCU group such as Quad-SPI Flash and CAN FD.

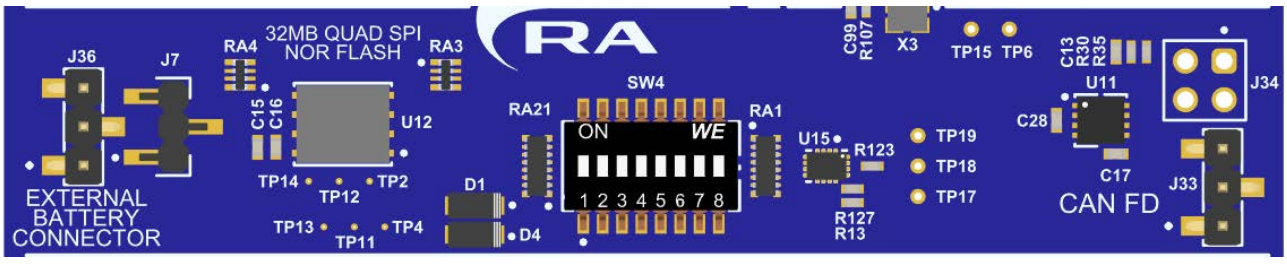

Figure 24. Special Feature Access Area

6.1 CAN FD Bus

The EK-RA4C1 board provides a CAN FD bus transceiver (MCP2558FDT-H/MF) that is connected directly to the RA MCU. External connection to the CAN FD bus is made using the 0.1” pitch 3-pin male header J33. The links E44 and E45 provide termination resistors which can be removed by cutting the circuit links. This can be reconnected through J34. Please note, during low power mode there will be no connection between CAN FD(U11) and the RA MCU.

Table 24. CAN FD Bus Connections Between U11 and RA4C1

CAN FD Signal Description	U11 pin	EK-RA4C1 Port / Net
RXD	4	P103
TXD	1	P102
S	8	CAN_SILENT_SEL_L

Table 25. CAN FD Port Assignments

CAN FD Connector (J33)	Function
1	CANH
2	CANL
3	GND

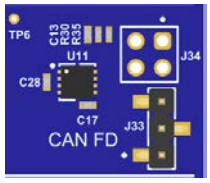

Figure 25. CAN FD Connector and Chip

6.2 Quad-SPI NOR Flash

Included on the EK-RA4C1 board is a 256 Mb (32 MB) Quad-SPI serial NOR flash memory (MX25L25645GZNI-08G). The Quad-SPI serial flash device (U12) connects to the Quad-SPI peripheral on the RA MCU and defaults to standard SPI mode initially. The flash memory is enabled for XIP (Execute-In-Place) mode directly after power-on. Please note, during low power mode there will be no connection between the QSPI flash (U12) and the RA MCU.

Table 26. Quad-SPI Flash Assignments

Quad-SPI Flash	EK-RA4C1
Description	**Signal/Bus**
QSPI_CS_L	P501
QSPI_SCLK	P500
QSPI_SIO0/SI	P502
QSPI_SIO1/SO	P503
QSPI_SIO2/WP_L	P504
QSPI_SIO3/RESET_L	P505
GND	GND
VCC	+3.3 V

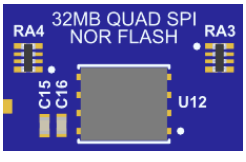

Figure 26. Quad-SPI Flash

6.3 Segment LCD Board Interface

The RA MCU supports interface to a Segment LCD Board at port J2. Table 27 shows the port assignments of the segment LCD board and its corresponding signals to the RA MCU.

Please note that when the Segment LCD is in use, the following cannot be used: Arduino, Pmod1, Pmod2 and mikroBUS.

Trace-Cut Jumpers may be cut to isolate some pins from the Segment LCD, enabling simultaneous use with the above connectors. Please refer to Table 2 and the schematic diagram for details.

Table 27. Segment LCD Board Interface Assignments

Segment LCD Board Port Assignments		**EK-RA4C1**
Pin	**Description**	**Signal/Bus**
J2-1	GND	GND
J2-2	GND	GND
J2-3	SLCD_COM0	P205*
J2-4	NC	NC
J2-5	SLCD_COM1	P208*
J2-6	NC	NC
J2-7	SLCD_COM2	P304*
J2-8	NC	NC
J2-9	SLCD_COM3	P303*
J2-10	NC	NC
J2-11	NC	NC
J2-12	NC	NC
J2-13	NC	NC
J2-14	NC	NC
J2-15	NC	NC
J2-16	NC	NC
J2-17	NC	NC
J2-18	NC	NC
J2-19	NC	NC
J2-20	SLCD_SEG37	P104*
J2-21	NC	NC
J2-22	SLCD_SEG35	P106*
J2-23	NC	NC
J2-24	SLCD_SEG21	P302*
J2-25	NC	NC
J2-26	SLCD_SEG22	P301*
J2-27	SLCD_SEG41	P100*
J2-28	SLCD_SEG14	P204*
J2-29	SLCD_SEG40	P101*
J2-30	SLCD_SEG18	P307
J2-31	SLCD_SEG7	P403*
J2-32	SLCD_SEG32	P601
J2-33	SLCD_SEG9	P415*
J2-34	SLCD_SEG29	P609
J2-35	SLCD_SEG27	P115
J2-36	SLCD_SEG19	P306
J2-37	SLCD_SEG28	P608
J2-38	SLCD_SEG20	P305*
J2-39	SLCD_SEG17	P209*
J2-40	SLCD_SEG10	P414*

Segment LCD Board Port Assignments		EK-RA4C1
Pin	**Description**	**Signal/Bus**
J2-41	SLCD_SEG25	P113
J2-42	SLCD_SEG24	P405
J2-43	SLCD_SEG15	P211
J2-44	SLCD_SEG11	P413*
J2-45	SLCD_SEG16	P210*
J2-46	SLCD_SEG12	P412*
J2-47	SLCD_SEG34	P107
J2-48	SLCD_SEG6	P402*
J2-49	SLCD_SEG33	P600*
J2-50	SLCD_SEG31	P602

*Segment LCD pin is shared with mikroBUS, Arduino or Pmod

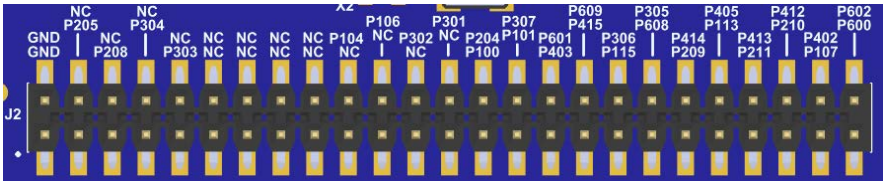

Figure 27. Segment LCD Board Port Connector

7. MCU Native Pin Access Area

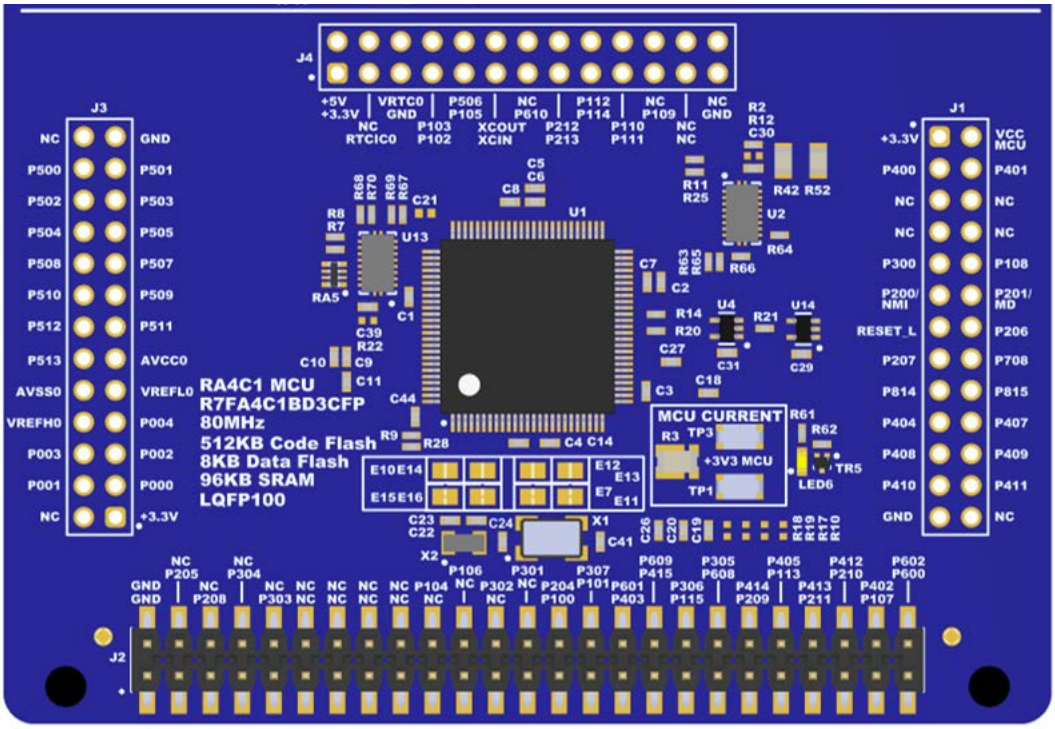

Figure 28. Native Pin Access Area

7.1 Breakout Pin Headers (not populated)

The EK-RA4C1 board pin header footprints, J1, J3, and J4 provide access to nearly all RA MCU interface signals, and to voltages for all RA MCU power ports. Each pin location is labelled with the voltage or port connected to it. Refer to the RA MCU Group User's Manual for details of each port function, and the EK-RA4C1 board schematic for pin header port assignments.

7.2 MCU Current Measurement

Included in the Native Pin Access area are current measurement resistors and test points to measure the MCU core power supply current.

The EK-RA4C1 board provides precision 5 mΩ resistors (Yageo, part number PS0612FKE070R005L) for current measurement of the main 3.3 V MCU power. Measure the voltage drop across these resistors and use Ohm's Law to calculate the current. For convenience, TP1 and TP3 are provided to measure the main 3.3 V MCU power.

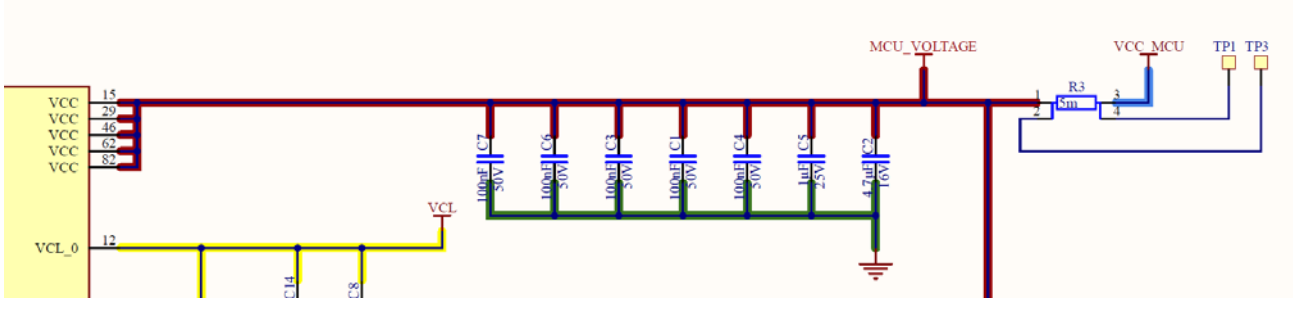

Figure 29. RA +3.3 V Current Measurement Circuit

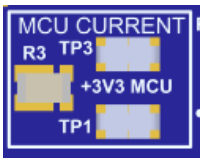

Figure 30. RA MCU Current Measurement

7.3 Low Voltage Mode Operation

The EK-RA4C1 supports operation in a low power mode by reducing the MCU voltage. A regulated voltage of at least +1.6 V can be supplied through J14 subject to the cautionary notes below.

Ensure the voltage supply for the MCU is powered first, followed by the board power, to provide adequate reset time for the reset pin.

CAUTION: Improper connections may damage the board and are not covered by manufacturer's warranty.

No over-voltage protection is provided on the VCC_EXT rail when providing an external supply.

The input voltage shall not exceed the minimum or absolute maximum ratings of the MCU.

The external supply shall be applied before or simultaneously with other external sources.

The USB debug connector can power the board, but it should not be connected before the MCU power.

The following table summarizes the configuration to operate EK-RA4C1 in low voltage mode and normal mode.

Table 28. Configuration for Low Power Mode and Normal Operation

Jumper/Switch	Low Power Mode Operation	Normal Operation
J15	Jumper on pins 2-3	Jumper on pins 1-2
J32	Jumper on pins 2-3	Jumper on pins 1-2

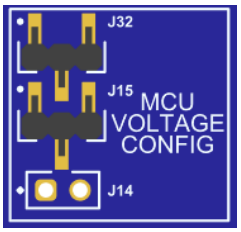

Figure 31. Low Power Input Location

8. Recommended Parts

Table 29 lists recommended part numbers for optional components that can be fitted as required.

Table 29. Part Numbers

Designator(s)	Description	Manufacturer	Part Number
J1, J3, J4	26-way male header	Würth Elektronik	61302621121
J21, J22	MikroElektronika mikroBUS™ Connector	Samtec	CES-108-01-T-S
J27, J28	Seeed Grove® system connector	Seeed Studio	110990037
J30	SparkFun® Qwiic® connector	JST	SM04B-SRSS-TB-LFSN
J34	CAN-FD Jumper header	Würth Elektronik	61300421121

9. Certifications

The EK-RA4C1 v1 kit meets the following certifications/standards. See page 3 of this user's manual for the disclaimer and precautions.

9.1 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 2014/30/EU.

  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.
- UKCA Class A (EMC)

  This product is in conformity with the following relevant UK Statutory Instrument(s) (and its amendments): 2016 No. 1091 Electromagnetic Compatibility Regulations 2016.

  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.
- Taiwan: Chinese National Standard 13438, C6357 compliance, Class A limits
- Australia/New Zealand AS/NZS CISPR 32:2015, Class A

9.2 Material Selection, Waste, Recycling and Disposal Standards

- EU RoHS
- WEEE
- China SJ/T 113642014, 10-year environmental protection use period.

9.3 Safety Standards

- UL 94V-0

10. Design and Manufacturing Information

The design and manufacturing information for the EK-RA4C1 v1 kit is available in the "EK-RA4C1 v1 Design Package" available on renesas.com/ek-ra4c1.

Design packages:

1. EK-RA4C1 Board design package: ek-ra4c1-v1-designpackage.zip
2. Segment LCD Board design package: app_lcd-ek_seg_1-v1-designpackage.zip

Table 30. EK-RA4C1 Board Design Package Contents

File Type	Content	File/Folder Name
File (PDF)	Schematics	ek-ra4c1-v1-schematics
File (PDF)	Mechanical Drawing	ek-ra4c1-v1-mechdwg
File (PDF)	3D Drawing	ek-ra4c1-v1-3d
File (PDF)	BOM	ek-ra4c1-v1-bom
Folder	Manufacturing Files	Manufacturing Files
Folder	Design Files	Design Files - Altium

Table 31. Segment LCD Board Design Package Contents

File Type	Content	File/Folder Name
File (PDF)	Schematics	app_lcd-ek_seg_1-v1-schematic
File (PDF)	Mechanical Drawing	app_lcd-ek_seg_1-v1-mechdwg
File (PDF)	3D Drawing	app_lcd-ek_seg_1-v1-3d
File (PDF)	BOM	app_lcd-ek_seg_1-v1-bom
Folder	Manufacturing Files	Manufacturing Files
Folder	Design Files	Design Files - Altium

11. 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.

EK-RA4C1 Resources	renesas.com/ek-ra4c1
RA Kit Information	renesas.com/ra/kits
RA Product Information	renesas.com/ra
RA Product Support Forum	renesas.com/ra/forum
RA Videos	renesas.com/ra/videos
RA Flexible Software Package (FSP)	renesas.com/software-tool/flexible-software-package-fsp
Renesas Support	renesas.com/support

Revision History

Rev.	Date	Description	
		Page	Summary
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