RENESAS

# RX671 Group

## Evaluation Kit for RX671 Microcontroller Group
### EK-RX671 v1
### User's Manual

## Renesas RX Family
### RX600 Series

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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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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.

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Renesas RX Family

# EK-RX671 v1 User's Manual

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## 1.   Kit Overview

The EK-RX671, an Evaluation Kit for RX671 MCU Group, enables users to seamlessly evaluate the features of the RX671 MCU group and develop embedded systems applications using Firmware Integration Technology (FIT) and e² studio IDE. The users can utilize 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-RX671 board are categorized in three groups (consistent with the architecture of the kit) as follows:

**MCU Native Pin Access**

- R5F5671EHDFB[1] MCU (referred to as RX MCU)
- 120 MHz, 32-bit RX CPU (RXv3)
- 2 MB ROM, 384 kB RAM
- 144 pins, LFQFP package
- Native pin access through 6 x 2-pin, 18 x 2-pin and 11 x 2-pin male headers
- MCU current measurement points for current consumption measurement
- Multiple clock sources - Providing 24.000 MHz and 32.768 kHz reference clock. Additional low-precision clocks are available internal to the RX MCU
- DIP switch to select RX MCU operating mode configuration, and signals from/to microSD card, external SDRAM and QSPI flash memory

**Special Feature Access**

- microSD card slot[2][3]
- Audio interface
- 128 Mbit external SDRAM (16-bit data width) [3][4]
- 64 Mbit external QSPI flash memory[3][4]
- Touch interface with 2 touch buttons[4]

**System Control and Ecosystem Access**

- Four +5 V input sources
  — USB (USB DEBUG1, USB FULL SPEED, USB SERIAL)
  — External power supply (using surface mount clamp test points and power input vias)
- Two Debug modes
  — Debug on-board (E2 emulator On Board (referred to as E2 OB): FINE interface)
  — Debug in (JTAG or FINE interface)
- User LEDs and switches
  — Three User LEDs (red, blue, green)
  — Power LED (white) indicating availability of regulated power
  — Debug LED (yellow) indicating the debug connection
  — Two User switches
  — One Reset switch
- Five most popular ecosystems expansions
  — 2 Seeed Grove® system (I2C / Analog) connectors
  — SparkFun® Qwiic® connector
  — 2 Digilent Pmod™ (UART / SPI / I2C) connectors
  — Arduino® (Uno R3) connector
  — MikroElektronika mikroBUS™ connector
- USB serial converter interface
- RX671 USB Full speed host and function

*1: R5F5671EHDFB has a built in security function.

*2: The RX671 Group incorporate an SD Host Interface (SDHI) which is compliant with the SD Specifications. When developing host devices that are compliant with the SD Specifications, the user must enter into the SD Host/Ancillary Product License Agreement (SD HALA).

*3: The microSD card, external SDRAM and QSPI flash memory on the EK-RX671 board cannot be used simultaneously because RX MCU pins of these functions are multiplexed. One out of 3 functions (microSD card, external SDRAM and QSPI flash memory) can be used.

*4: QSPI flash memory, external SDRAM and 2 touch buttons connected to touch interface are not implemented on Special Feature Access Area, however, these functions are functionally categorized into Special Feature Access.
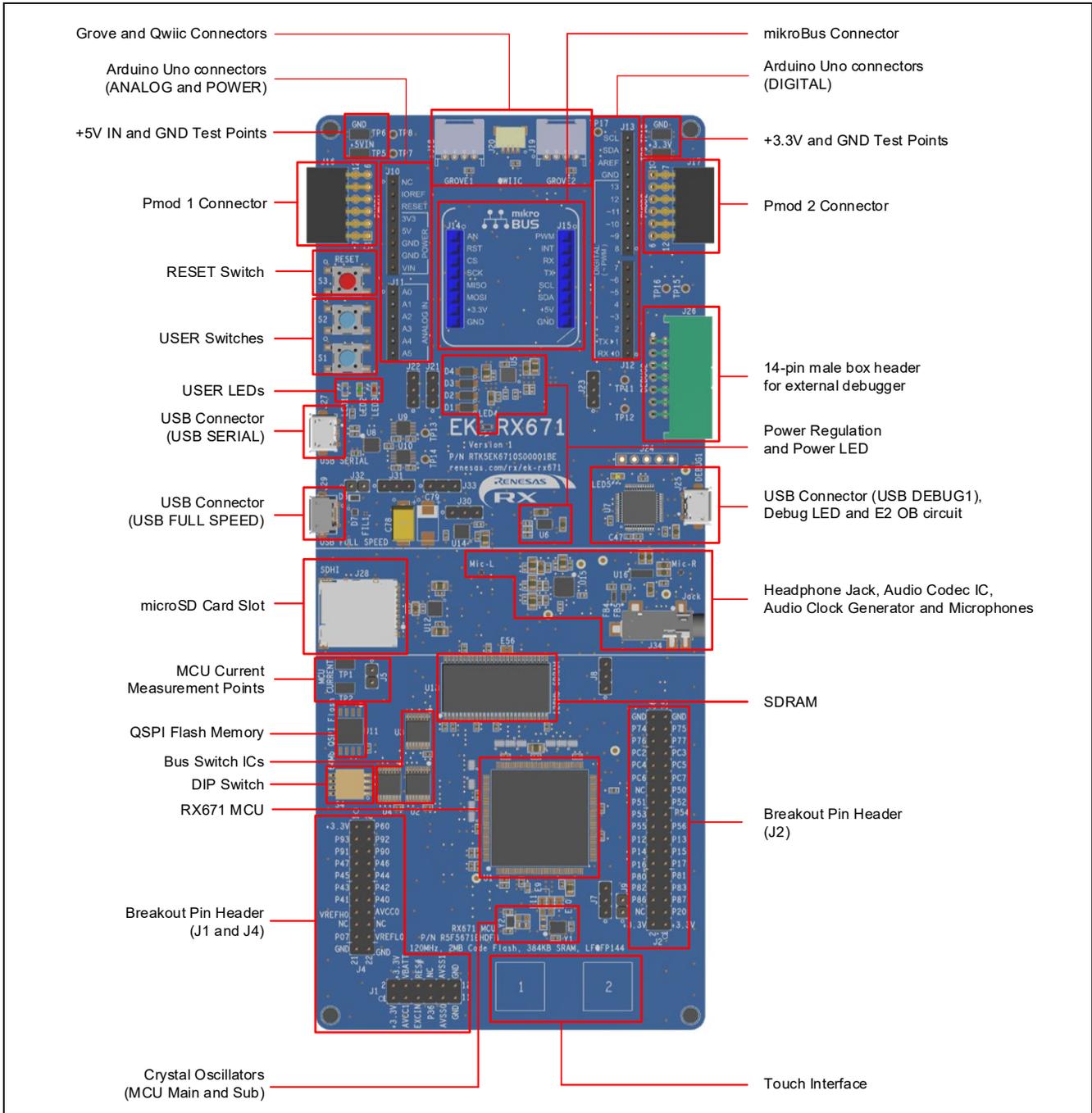


**Figure 1-1.   EK-RX671 Board Top Side**
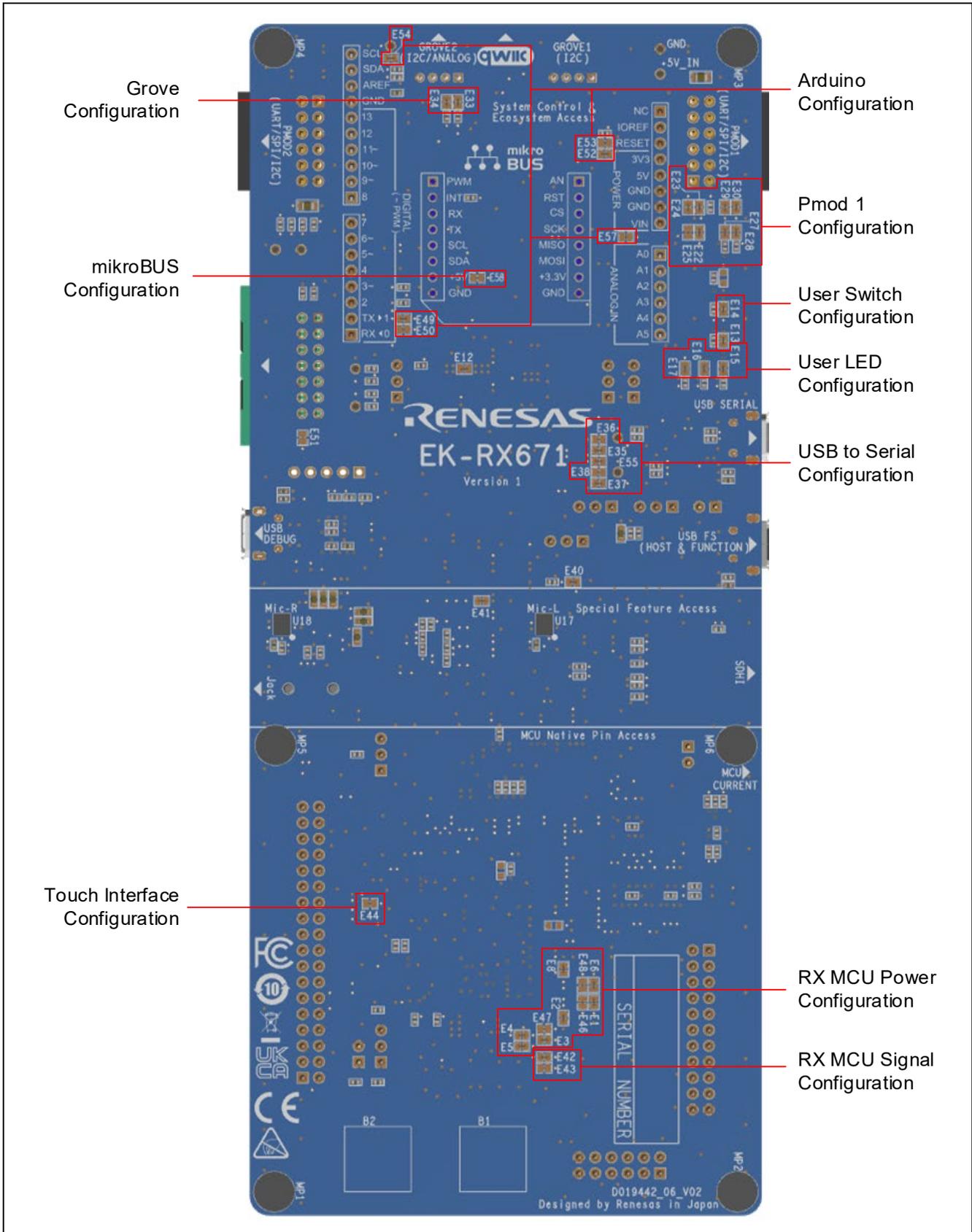
**Figure 1-2.   EK-RX671 Board Bottom Side**

## 1.1   Assumptions and Advisory Notes

1.  It is assumed that the user has basic understanding of microcontrollers and embedded systems hardware.

2.  It is recommended that the user refers to the *EK-RX671 Quick Start Guide* to get acquainted with the kit and the Quick Start example project that EK-RX671 board comes pre-programmed with.

3.  Firmware Integration Technology (FIT) and Integrated Development Environment (IDE) such as e$^2$ studio are required to develop embedded applications on EK-RX671 kit.

4.  Instructions to download and install software, import example projects, build them and program the EK-RX671 board are provided in the quick start guide.

5.  The MCU fitted to the EK-RX671 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-RX671 v1 board   x 1
2.  Micro USB function cable (type-A male to micro-B male)   x 1
3.  Micro USB host cable (type-A female to micro-B male)   x 1
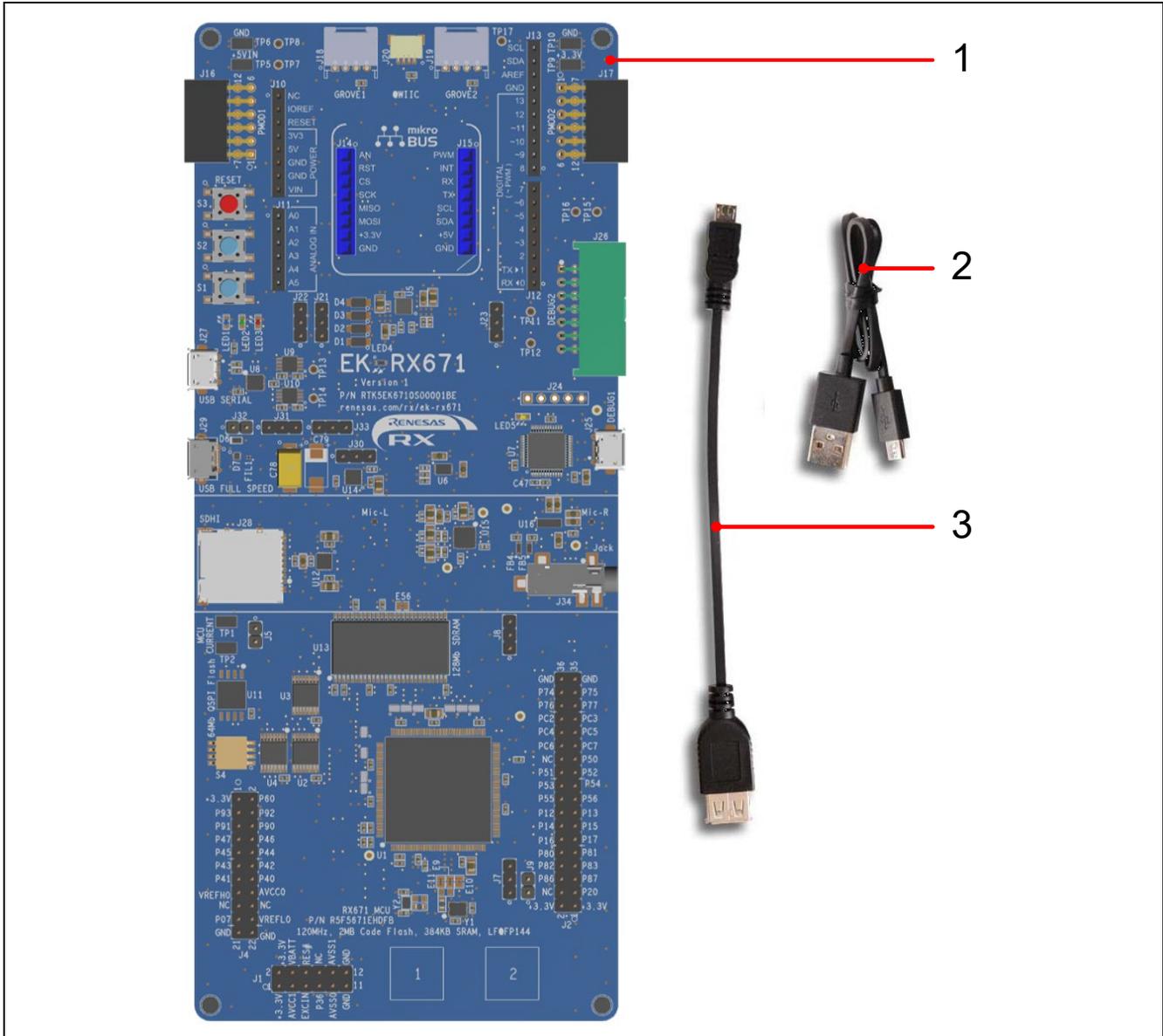


**Figure 2-1.   EK-RX671 Kit Contents**

## 3.  Ordering Information

- EK-RX671 v1 kit orderable part number:  RTK5EK6710S00001BE

   Note: The underlined character in the orderable part number represents the kit version.

- EK-RX671 board dimensions: 80 mm (width) x 190 mm (length)

## 4.  Hardware Architecture and Default Configuration

## 4.1   Kit Architecture

The EK-RX671 board is designed with three 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 4-1.  Kit Architecture**

| Kit area | Area features | Area present on all similar kits | Functionality is: |
|---|---|---|---|
| MCU Native Pin Access Area | RX MCU, breakout pin headers for MCU I/O and power, current measurement | Yes | MCU dependent |
| Special Feature Access Area [*1] | MCU special features: Audio, SDHI, SDRAM controller, QSPIX, Touch interface | Optional | MCU dependent |
| System Control and Ecosystem Access Area | Power, E2 OB circuit, User LEDs and switches, reset switch, ecosystem connectors, USB Full Speed Host and Function, USB serial converter interface | Yes | Same or similar across similar kits |

*1: QSPI flash memory, external SDRAM and 2 touch buttons connected to touch interface are not implemented on Special Feature Access Area, however, these functions are functionally categorized into Special Feature Access.
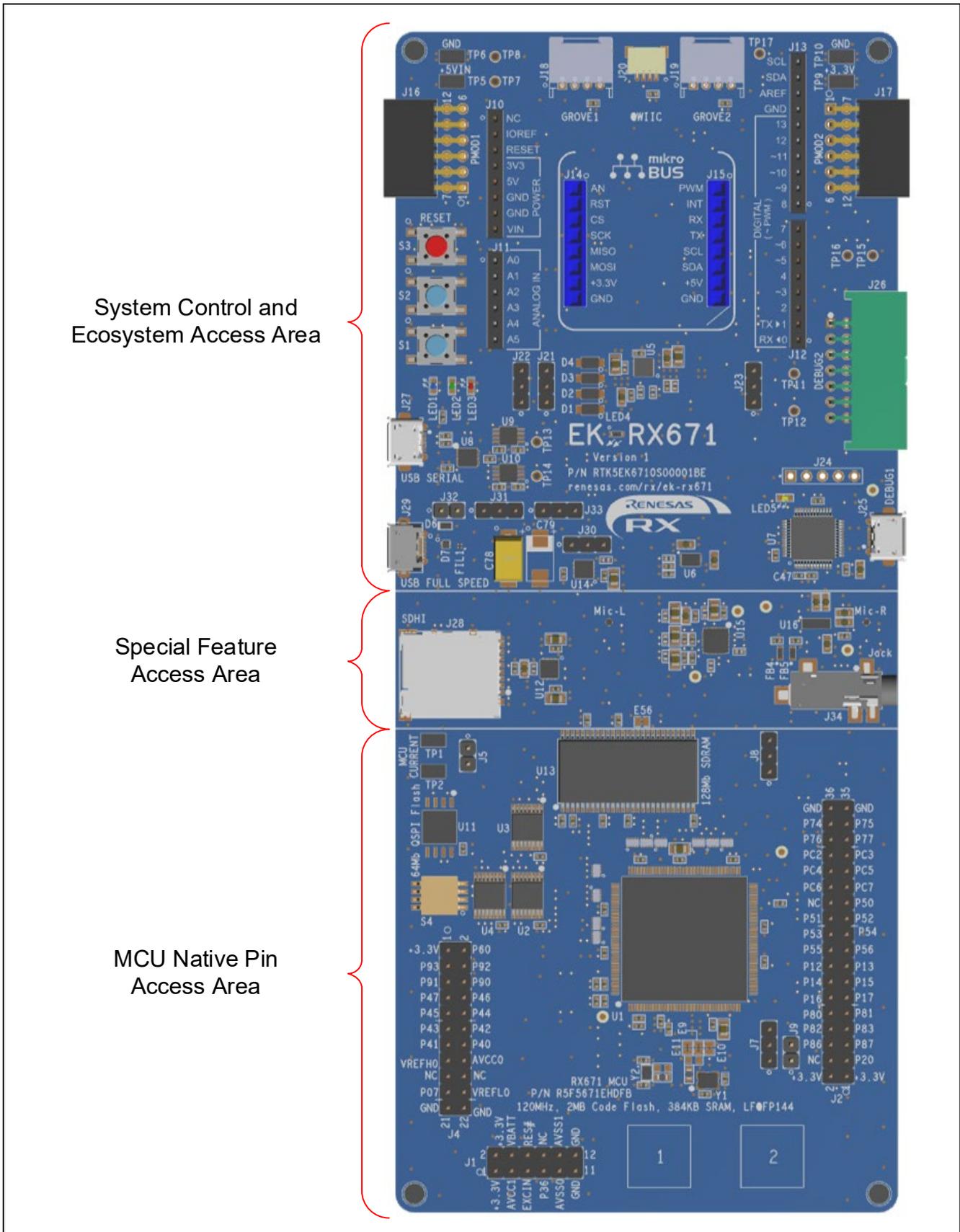
**Figure 4-1.   EK-RX671 Board Area Definitions**

## 4.2   System Block Diagram
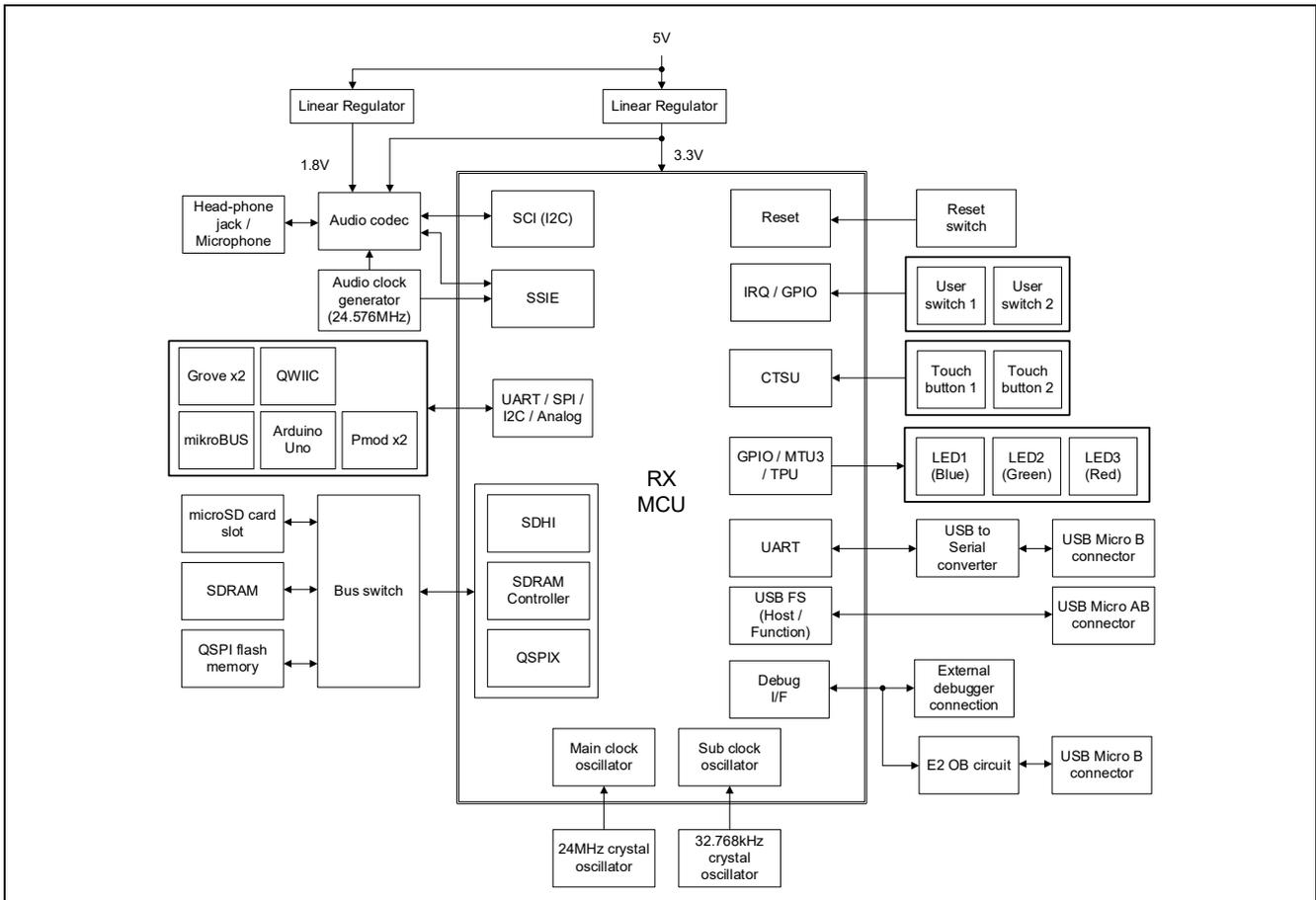


**Figure 4-2.   EK-RX671 Board Block Diagram**

## 4.3   Jumper Settings

Two types of jumpers are provided on the EK-RX671 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. 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 may be placed across the two pads and soldered in place. A zero-ohm SMT 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.)
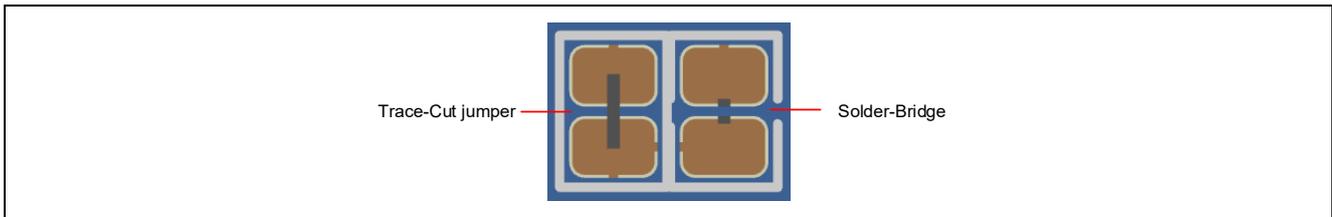
**Figure 4-3. Copper Jumpers**

### 4.3.2 Traditional Pin Header Jumpers

The traditional pin jumpers on the EK-RX671 board are 2.54 mm pitch headers. These jumpers are traditional pitch jumpers that require an external shunt to open/close them.

### 4.3.3 Default Jumper and DIP Switch Configuration

The following table describes the default settings for copper jumpers (Ex designation), traditional pin jumpers (Jx designation) and DIP switch (S4 designation) on the EK-RX671 board.

The Circuit Group for each jumper and DIP switch is the designation found in the board schematic (available in the Design Package).

**Table 4-2. Default Jumper Settings**

| Location | Circuit Group | Default | Function |
|---|---|---|---|
| J5 | RX671 MCU | Short | RX MCU Current Measurement |
| J7 | RX671 Signal Select | Jumper on pins 2-3 | Set RX MCU to "Single Chip mode or Debug in mode" |
| J8 | RX671 Signal Select | Jumper on pins 2-3 | (Refer to section 5.2.2 regarding to Debug in mode.) |
| J9 | RX671 Signal Select | Open | |
| S4 Pin1 | RX671 Signal Select | OFF | |
| S4 Pin2 | RX671 Signal Select | ON | |
| S4 Pin3 | RX671 Signal Select | OFF | Set bus switch to select QSPI flash memory (Refer to section 7.4 regarding to bus switch.) |
| S4 Pin4 | RX671 Signal Select | OFF | |
| J21 | Pmod | Jumper on pins 1-2 | Connect P86 to Pmod 1 (RXD010 / SMISO010) |
| J22 | Pmod | Jumper on pins 1-2 | Connect P80 to Pmod 1 (RTS010# / SCK010) |
| J23 | Pmod | Jumper on pins 1-2 | Connect P75 to Pmod 2 (RTS011# / SCK011) |
| J30 | USB FS | Jumper on pins 1-2 | Connect P16 to USB0_VBUS |
| J31 | USB FS | Jumper on pins 2-3 | Set USB FS to function mode |
| J32 | USB FS | Short | Set USB FS to function mode |
| J33 | USB FS | Jumper on pins 1-2 | Connect USB0_VBUS to +3.3 V (Bus powered) |
| E1 | RX671 MCU | Short | Connect AVCC0 to +3.3 V |
| E46 | RX671 MCU | Open | Connect AVCC0 to +3V3_MCU |
| E2 | RX671 MCU | Short | Connect AVSS0 to GND |
| E3 | RX671 MCU | Short | Connect AVCC1 to +3.3 V |
| E47 | RX671 MCU | Open | Connect AVCC1 to +3V3_MCU |
| E4 | RX671 MCU | Short | Connect AVSS1 to GND |
| E5 | RX671 MCU | Short | Connect VBATT to +3.3 V |
| E6 | RX671 MCU | Short | Connect VREFH0 to +3.3 V |
| E48 | RX671 MCU | Open | Connect VREFH0 to +3V3_MCU |
| E8 | RX671 MCU | Short | Connect VREFL0 to GND |
| E9 | RX671 MCU | Short | Connect EXTAL to crystal oscillator |
| E10 | RX671 MCU | Open | Connect EXTAL to breakout pin header J1 |

| Location | Circuit Group | Default | Function |
|---|---|---|---|
| E11 | RX671 MCU | Short | Connect XTAL to crystal oscillator |
| E42 | RX671 MCU | Short | Connect PJ3 to USB to Serial (CTS) |
| E43 | RX671 MCU | Open | Connect PJ3 to breakout pin header J1 |
| E44 | RX671 MCU | Open | Connect PC4 to breakout pin header J2 |
| E13 | User LEDs & Switches | Short | Connect PC3 to user switch S1 |
| E14 | User LEDs & Switches | Short | Connect PC5 to user switch S2 |
| E15 | User LEDs & Switches | Short | Connect P56 to user LED1 |
| E16 | User LEDs & Switches | Short | Connect P82 to user LED2 |
| E17 | User LEDs & Switches | Short | Connect P25 to user LED3 |
| E54 | Arduino Uno, Pmod, Grove and QWIIC | Short | Connect P12 and P13 to +3.3 V (Pull-up) |
| E49 | Arduino Uno | Short | Connect PC7 to Arduino Uno (D1 / TX) |
| E50 | Arduino Uno | Open | Connect P71 to Arduino Uno (D1) |
| E52 | Arduino Uno | Short | Connect RES# to Arduino Uno (RESET) |
| E53 | Arduino Uno | Open | Connect P02 to Arduino Uno (RESET) |
| E57 | Arduino Uno | Open | Connect +5 V to Arduino Uno (+5 V) |
| E22 | Pmod | Short | Connect P83 to Pmod 1 (CTS / CS / INT) |
| E23 | Pmod | Short | Connect P82 to Pmod 1 (TXD / MOSI) |
| E24 | Pmod | Short | Connect +3.3 V to Pmod 1 |
| E25 | Pmod | Open | Connect +5 V to Pmod 1 |
| E27 | Pmod | Short | Connect P32 to Pmod 1 (INT) |
| E28 | Pmod | Short | Connect P47 to Pmod 1 (RESET) |
| E29 | Pmod | Short | Connect P15 to Pmod 1 (GPIO) |
| E30 | Pmod | Short | Connect P72 to Pmod 1 (GPIO) |
| E33 | Grove | Short | Connect P01 to +3.3 V (Pull-up) |
| E34 | Grove | Short | Connect P00 to +3.3 V (Pull-up) |
| E58 | mikroBUS | Open | Connect +5 V to mikroBUS (+5 V) |
| E35 | USB to Serial | Short | Connect P00 to USB to Serial (RXD) |
| E36 | USB to Serial | Open | Connect P26 to USB to Serial (RXD) |
| E37 | USB to Serial | Short | Connect P01 to USB to Serial (TXD) |
| E38 | USB to Serial | Open | Connect P30 to USB to Serial (TXD) |
| E55 | USB to Serial | Short | Connect PF5 to USB to Serial (RTS) |
| E56 | USB to Serial | Open | Connect PB2 to USB to Serial (RTS) |

## 5.  System Control and Ecosystem Access Area

The following figure shows the System Control and Ecosystem Access area on the EK-RX671 board. Subsequent sections detail the features and functionality provided in the area.
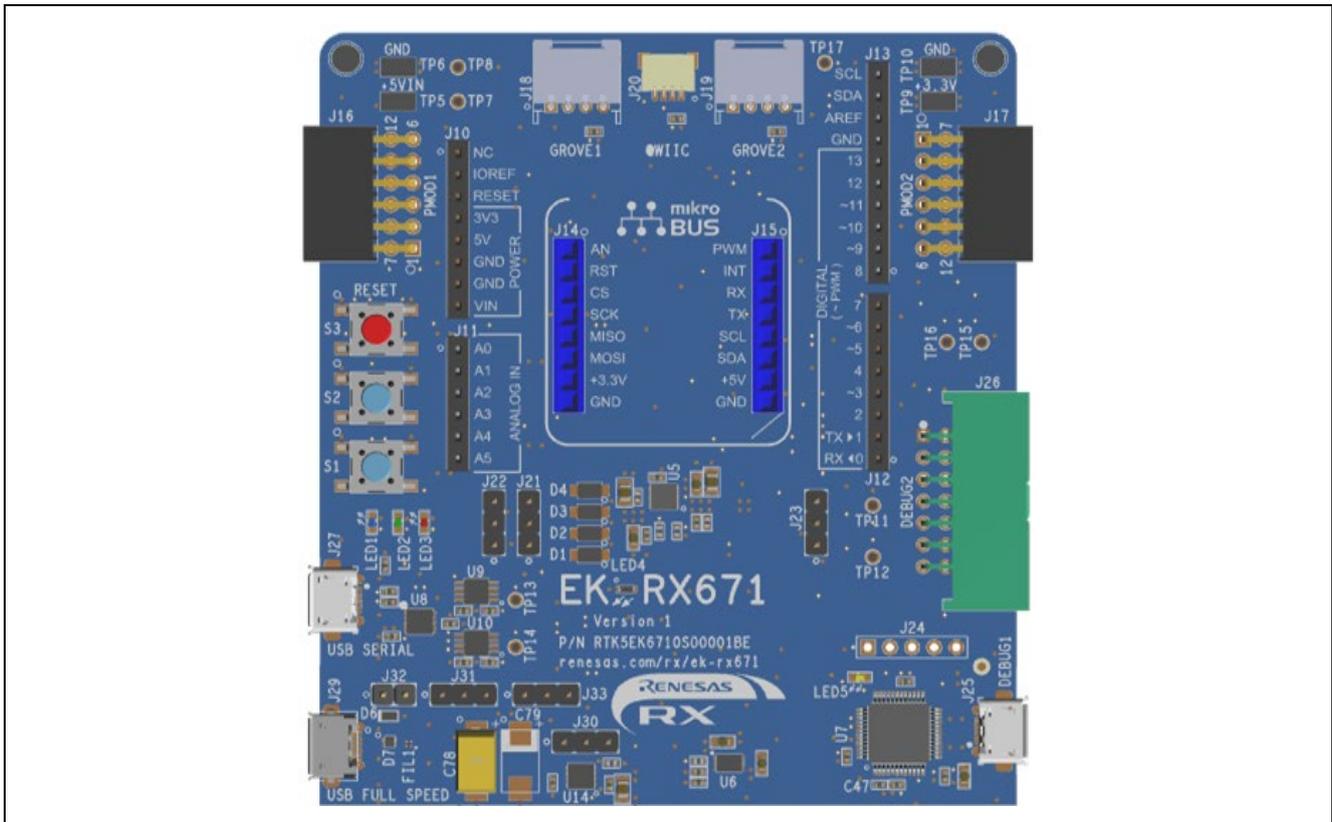


**Figure 5-1.   System Control and Ecosystem Access Area**

### 5.1  Power

The EK-RX671 kit is designed for +5 V operation. An on-board Linear Regulator is used to convert the +5 V supply to +3.3 V and +1.8 V supply. The +3.3 V supply is used to power the RX MCU and other peripheral features. The +1.8 V supply is used to power the Audio codec IC.

### 5.1.1  Power Supply Options

This section describes the different ways in which EK-RX671 kit can be powered. Power from each source is connected to the Main System 5 V Power (+5 V). Reverse current protection is provided between each power input connector and the Main System 5 V Power so multiple power sources may be connected to the EK-RX671 board simultaneously.

**Note: Power to the EK-RX671 board can't be supplied by external debugger (ex. E2 emulator Lite).**

**Figure 5-2.   Power Supply Options**

### 5.1.1.1   Option 1:  USB DEBUG1

+5 V may be supplied from an external USB host to the USB connector (J25) labelled DEBUG1 on the board.

### 5.1.1.2   Option 2:  USB FULL SPEED

+5 V may be supplied from an external USB host to the USB connector (J29) labelled USB FULL SPEED on the board.

### 5.1.1.3   Option 3:  USB SERIAL

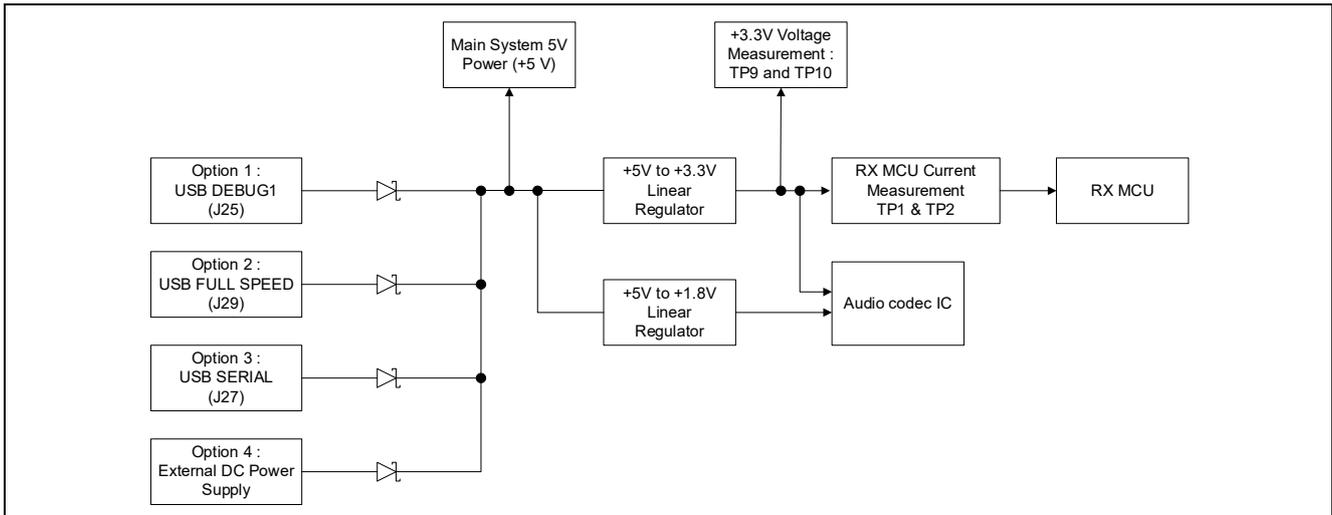+5 V may be supplied from an external USB host to the USB connector (J27) labelled USB SERIAL on the board.

### 5.1.1.4   Option 4:  External DC Power Supply

+5 V may be supplied from an external power supply to test points on the board. TP5 (+5 V) and TP6 (GND) are loop-style test points, and TP7 and TP8 are large via style test points. The two types of test points are electrically equivalent, and both are provided for user convenience.

### 5.1.2   Power Supply Considerations

Voltage of Main System 5 V Power will be lower than the power supply voltage because of the forward voltage (max 0.55V@1A) of the reverse current protection diode. Please note the voltage drop, because Main System 5 V Power is +5 V power source which supplies to external devices connected to Arduino, mikroBUS and USB Full Speed (when the USB Full Speed module of the RX MCU operates at host mode).

Note:   The maximum current that could be supplied to the EK-RX671 is 1 A. Please be aware that the larger the current is, higher the temperature of reverse current protection diode and 3.3V linear regulator are.

### 5.1.3   Power-up Behavior

When powered, the white LED near the center of the board (the "dash" in the EK-RX671 name) will light up. For more details on initial power up behavior, see the *EK-RX671 Quick Start Guide*.

## 5.2   Debug

The EK-RX671 board supports the following two debug modes.

Table 5-1.   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 | E2 OB circuit | RX MCU (on-board) | FINE | USB DEBUG1 connector (J25) |
| Debug in | External debugging tools (ex. E2 emulator Lite) | RX MCU (on-board) | JTAG, FINE | 14-pin male box header (J26) |

Notes:
- See Table 5-3 for the USB DEBUG1 connector pin definition.
- See Table 5-7 for the 14-pin male box header definition.

The following table summarizes the DIP switch (S4) setting and the jumper setting for each of the debug modes.

Table 5-2.   DIP switch and Jumper Connection Summary for Different Debug Modes

| Debug Modes | S4 Pin1 | S4 Pin2 | J7 | J8 | J9 |
|---|---|---|---|---|---|
| Debug on-board | OFF | OFF | Jumper on pins 2-3 | Jumper on pins 2-3 | Open |
| Debug in | OFF | ON | Jumper on pins 2-3 | Jumper on pins 2-3 | Open |
| Debug in with hot plug-in function[1] | OFF | ON | Jumper on pins 1-2 | Jumper on pins 2-3 | Open |

*1: The hot plug-in function is to allow the debugger to be connected during user system operation with "program execution continued", "no reset applied", and "program contents not modified". When you use hot plug-in, install a capacitor between the RES# and GND in order to suppress a noise to the RES# pin that would occur when the emulator is connected. However, raise time of RES# must be satisfied. Refer to the external debugger manual regarding the rise time. The EK-RX671 board provides through holes (TP15 and TP16) for installing the capacitor.
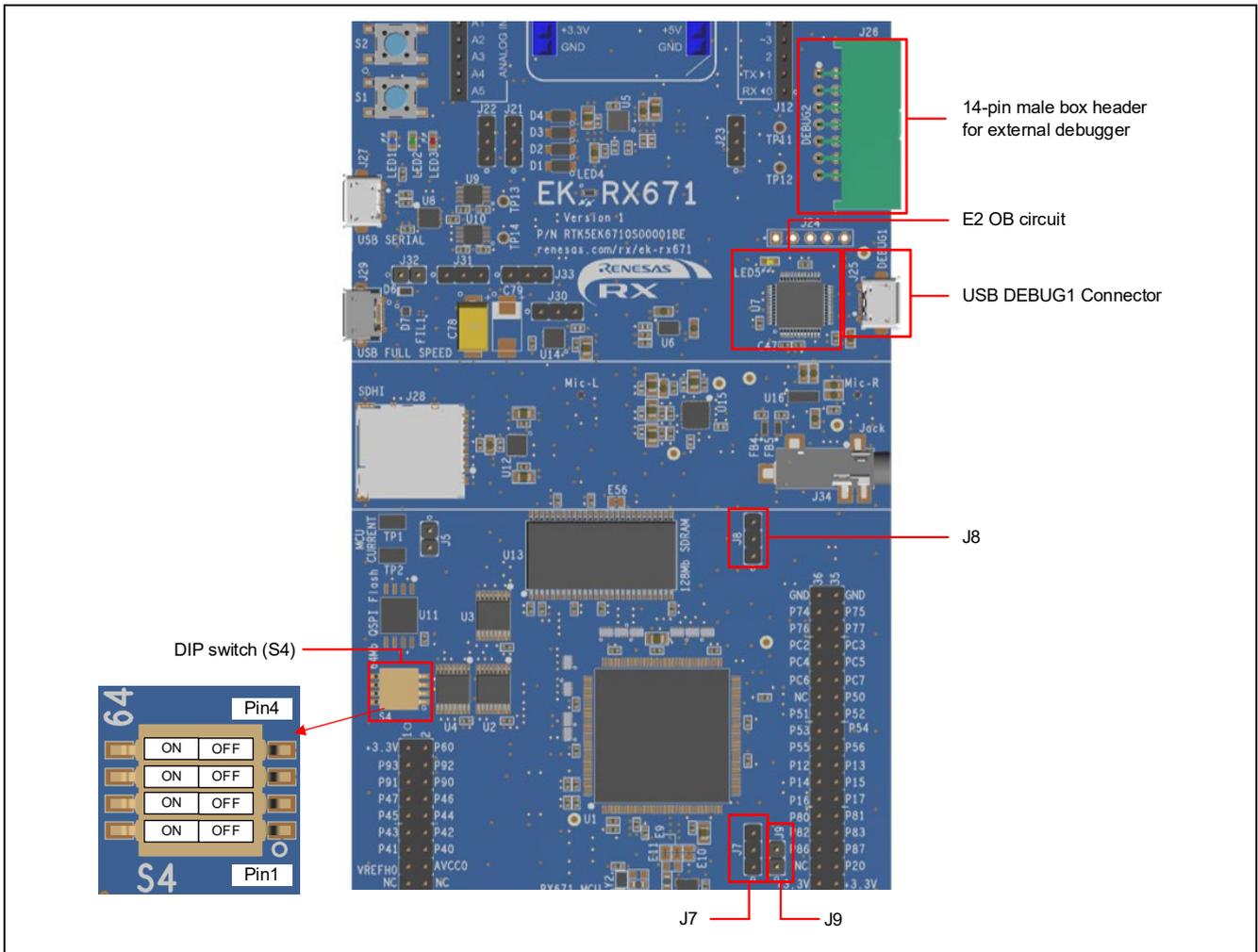
**Figure 5-3.   EK-RX671 Debug Interface**

### 5.2.1  Debug On-Board

The debug on-board functionality is provided using E2 OB circuit on the EK-RX671 board. USB DEBUG1 connector (J25) connects the E2 OB circuit to a host PC, allowing re-programming and debugging of the target RX MCU firmware.

The E2 OB circuit connects to the target RX MCU using the FINE interface. Please note that connecting the same host PC to multiple EK-RX671 boards is not possible.

**Table 5-3.   USB DEBUG1 Connector**

| USB DEBUG1 Connector | | EK-RX671 |
|---|---|---|
| Pin | Description | Signal |
| J25-1 | +5VDC | +5V_USB_DBG |
| J25-2 | Data- | USBDBG_DM |
| J25-3 | Data+ | USBDBG_DP |
| J25-4 | USB ID, jack internal switch, cable inserted | N.C. |
| J25-5 | Ground | GND |

A yellow indicator, LED5, shows the visual status of the debug interface. When the EK-RX671 board is powered on, and LED5 is blinking, it indicates that the host PC recognizes the E2 OB circuit. When LED5 is on solid, it indicates that the host PC is connected to the E2 OB circuit.

To configure the EK-RX671 board to use the Debug on-board mode, configure the DIP switch and the jumpers using the following table.

**Table 5-4.   Debug On-Board DIP switch and Jumper Configuration**

| Location | Configuration | Function |
|---|---|---|
| S4 Pin1 | OFF | MD / FINED connected to +3.3 V through a pull-up resistor |
| S4 Pin2 | OFF | E2 OB circuit enabled |
| J7 | Jumper on pins 2-3 | EMLE connected to GND through a pull-down resistor |
| J8 | Jumper on pins 2-3 | UB connected to GND through a pull-down resistor |
| J9 | Open | UPSEL connected to +3.3 V through a pull-up resistor |

### 5.2.2   Debug In

One 14-pin male box header at J26 supports JTAG and FINE debug. Either JTAG or FINE may be used for external debug of the target RX MCU.

**Note: Power to the EK-RX671 board can't be supplied by external debugger (ex. E2 emulator Lite).**

To configure the EK-RX671 board to use the Debug in mode, configure the DIP switch and the jumpers using the following table.

**Table 5-5.   Debug In Mode DIP switch and Jumper Configuration**

| Location | Configuration | Function |
|---|---|---|
| S4 Pin1 | OFF | MD / FINED connected to +3.3 V through a pull-up resistor |
| S4 Pin2 | ON | E2 OB circuit disabled |
| J7 | Jumper on pins 2-3 | EMLE connected to GND through a pull-down resistor |
| J8 | Jumper on pins 2-3 | UB connected to GND through a pull-down resistor |
| J9 | Open | UPSEL connected to +3.3 V through a pull-up resistor |

**Table 5-6.   Debug In with hot plug-in Mode DIP switch and Jumper Configuration**

| Location | Configuration | Function |
|---|---|---|
| S4 Pin1 | OFF | MD / FINED connected to +3.3 V through a pull-up resistor |
| S4 Pin2 | ON | E2 OB circuit disabled |
| J7 | Jumper on pins 1-2 | EMLE connected to +3.3 V through a pull-up resistor |
| J8 | Jumper on pins 2-3 | UB connected to GND through a pull-down resistor |
| J9 | Open | UPSEL connected to +3.3 V through a pull-up resistor |

**Table 5-7.   14-pin male box header for external debugger**

| 14-pin male box header for external debugger | | | EK-RX671 |
|---|---|---|---|
| Pin | JTAG Pin Name | FINE Pin Name | Signal |
| J26-1 | TCK | N.C. | P27 |
| J26-2 | GND | GND | GND |
| J26-3 | TRST# | N.C. | P34 |
| J26-4 | EMLE | EMLE | EMLE |
| J26-5 | TDO | N.C. | P26 [1] |
| J26-6 | N.C. | N.C. | N.C. |
| J26-7 | MD | MD / FINED | MD_FINED |
| J26-8 | +3.3 V | +3.3 V | +3.3 V |
| J26-9 | TMS | N.C. | P31 |
| J26-10 | N.C. | N.C. | N.C. |
| J26-11 | TDI | N.C. | P30 [1] |
| J26-12 | GND | GND | GND |
| J26-13 | RES# | RES# | RES# |
| J26-14 | GND | GND | GND |

Note 1: The signals are available as TXD and RXD at using Renesas Flash Programmer.

## 5.3 Ecosystem

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

1. Two Seeed Grove® system (I2C / Analog) connectors
2. SparkFun® Qwiic® connector
3. Two Digilent Pmod™ (UART / SPI / I2C) connectors
4. Arduino® (Uno R3) connector
5. MikroElektronika mikroBUS™ connector

**Note.1: We do not guarantee connection to all types of third party add-on modules. Confirm the specifications of this product against any third party add-on modules you intend to use.**

**Note.2: Third party add-on modules may not be able to connect the EK-RX671 board simultaneously because the RX MCU pins which are connected to third party add-on modules are multiplexed. Confirm the specifications of this product and RX671 Group User's Manual: Hardware.**

### 5.3.1 Seeed Grove® Connectors
#### 5.3.1.1 Grove 1

A Seeed Grove I2C connector is provided at J18. The RX MCU acts as a two-wire serial master, and a connected module acts as a two-wire serial slave. (Data lines shared with Arduino, mikroBUS, Pmod 1 and Qwiic.)

**Table 5-8. Grove 1 Connector**

| Grove 1 Connector | | EK-RX671 |
| --- | --- | --- |
| Pin | Description | Signal |
| J18-1 | SCL | P12 (SCLHS0[FM+/HS]) [1] |
| J18-2 | SDA | P13 (SDAHS0[FM+/HS]) [1] |
| J18-3 | VCC | +3.3 V |
| J18-4 | GND | GND |

[1]: The signals are shared with Arduino, mikroBUS, Pmod 1 and Qwiic.

#### 5.3.1.2 Grove 2

A Seeed Grove I2C connector is provided at J19. The RX MCU acts as a two-wire serial master, and a connected module acts as a two-wire serial slave. Alternatively, this port can be configured to support two analog (ADC) inputs.

The pull-up resistors, R36 and R37, must be fitted when using I2C and removed when using as analog. The pull-up resistors may also be disconnected by cutting trace between pads of trace-cut jumper E33 and E34.

**Table 5-9. Grove 2 Connector**

| Grove 2 Connector | | EK-RX671 |
| --- | --- | --- |
| Pin | Description | Signal |
| J19-1 | SCL / AN | P01 (SSCL6 / AN110) [1] |
| J19-2 | SDA / AN | P00 (SSDA6 / AN111) [1] |
| J19-3 | VCC | +3.3 V |
| J19-4 | GND | GND |

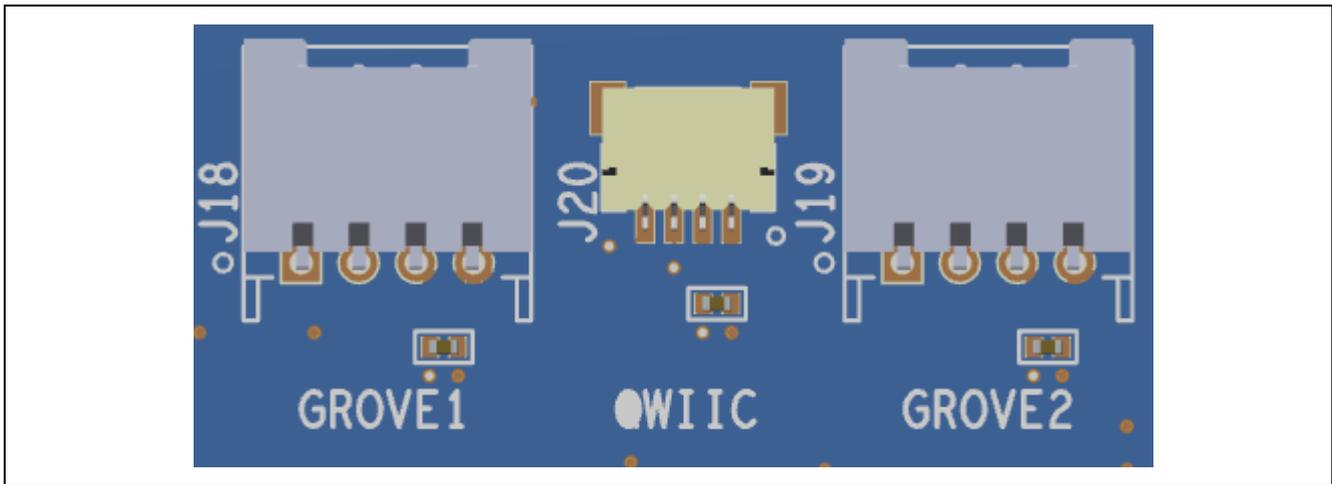[1]: The signals are shared with USB to serial interface.

**Figure 5-4.   Seeed Grove and SparkFun Qwiic Connectors**

### 5.3.2   SparkFun® Qwiic® Connector

A SparkFun® Qwiic® connector is provided at J20. The RX MCU acts as a two-wire serial master, and a connected module acts as a two-wire serial slave. (Data lines shared with Arduino, mikroBUS, Pmod 1 and Grove 1.)

**Table 5-10.   Qwiic Connector**

| Qwiic Connector | | EK-RX671 |
|---|---|---|
| Pin | Description | Signal |
| J20-1 | GND | GND |
| J20-2 | VCC | +3.3V |
| J20-3 | SDA | P13 (SDAHS0[FM+/HS]) [1] |
| J20-4 | SCL | P12 (SCLHS0[FM+/HS]) [1] |

*1: The signals are shared with Arduino, mikroBUS, Pmod 1 and Grove 1.

### 5.3.3  Digilent Pmod™ Connectors

Two 12-pin connectors are provided to support Pmod modules where the RX MCU acts as the master, and the connected module acts as a slave device.

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

### 5.3.3.1  Pmod 1

A 12-pin Pmod connector is provided at J16, Pmod 1.

**Table 5-11.   Pmod 1 Connector**

| Pmod 1 Connector | | | EK-RX671 | Pmod 1 Configuration | |
|---|---|---|---|---|---|
| Pin | Description Type-2A / Type-3A | Option Type 6A | Signal | Short | Open |
| J16-1 | CS / CTS / GPIO | INT | P83 (CTS010# / IRQ3) [*3] [*4] | | |
| J16-2 | MOSI / TXD | RESET | P82 (TXD010 / SMOSI010) [*3] [*4] [*5] | | |
| J16-3 | MISO / RXD | | P86 (RXD010 / SMISO010) [*3] [*4] | J21 Pin 1-2 | |
| | | SCL | P12 (SCLHS0[FM+/HS]) [*2] [*6] | J21 Pin 2-3 | |
| J16-4 | SCK / RTS / GPIO | | P80 (SCK010 / RTS010#) [*3] [*4] | J22 Pin 1-2 | |
| | | SDA | P13 (SDAHS0[FM+/HS]) [*2] [*6] | J22 Pin 2-3 | |
| J16-5 | GND | | GND | | |
| J16-6 | VCC | | +3.3 V | E24 | E25 |
| | | | +5 V [*1] | E25 | E24 |
| J16-7 | GPIO / INT (slave to master) | | P32 (IRQ2-DS) [*3] | E27 | |
| J16-8 | GPIO / RESET (master to slave) | | P47 | E28 | |
| J16-9 | GPIO / CS2 | | P15 | E29 | |
| J16-10 | GPIO / CS3 | | P72 | E30 | |
| J16-11 | GND | | GND | | |
| J16-12 | VCC | | +3.3 V | E24 | E25 |
| | | | +5 V [*1] | E25 | E24 |

*1: Either +3.3 V or +5 V can be selected. Default configuration is +3.3 V. The Type-6A (I2C) may support +5 V devices, however, ensure that Pmod 1 signals are isolated other than I2C because some RX MCU ports which are connected to Pmod1 are not 5 V tolerant.

*2: Open at shipping.

*3: The signals are shared with Arduino.

*4: The signals are shared with mikroBUS.

*5: The signal is shared with LED2.

*6: The signals are shared with Arduino, mikroBUS, Qwiic and Grove 1.
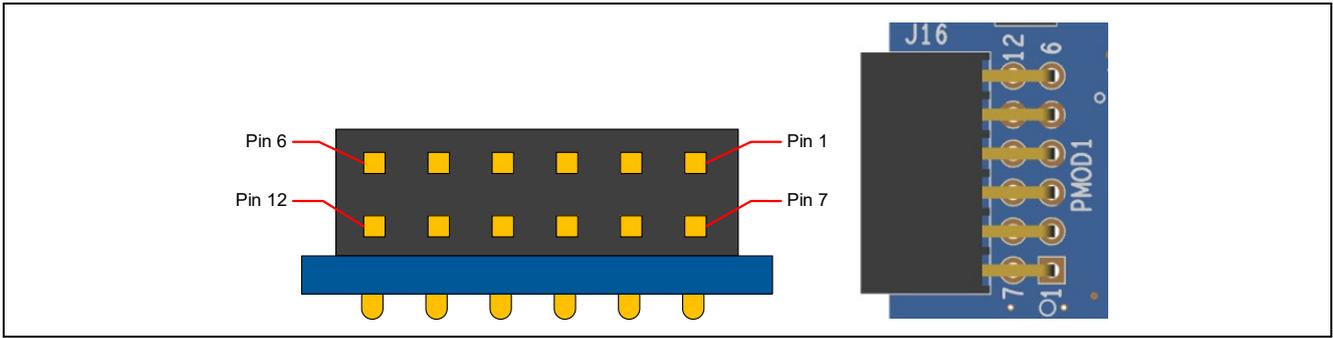
**Figure 5-5.   Pmod 1 connector**

**Pmod 1 Type-6A connection**

The option for Type-6A (I2C) can be configured at Pmod1 and supports +3.3 V / +5 V devices. To configure the EK-RX671 board to use the I2C devices with +3.3 V / +5 V operation, configure the pin header jumpers and the copper jumpers using Table 5-11. Following figures show the pin header jumpers and copper jumpers to use the I2C devices.

**Note: Exercise caution while modifying power source trace jumpers, E24 and E25. Permanent damage to the EK-RX671 board and/or connected modules may result.**
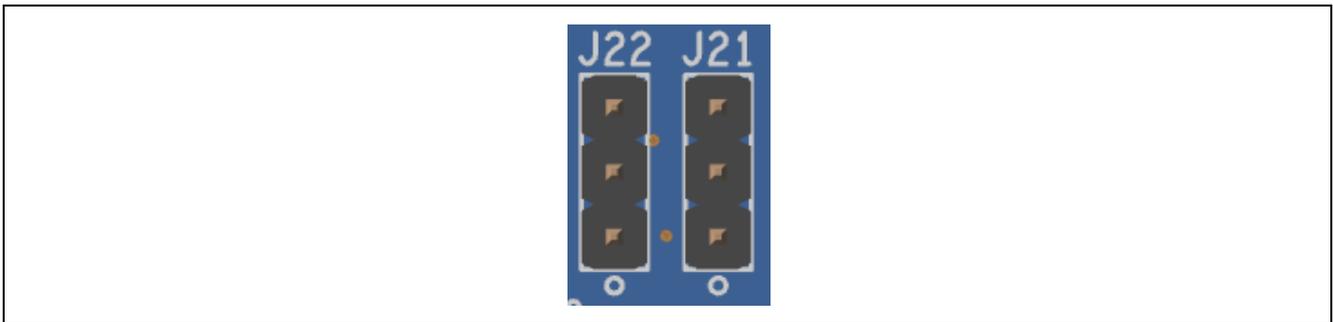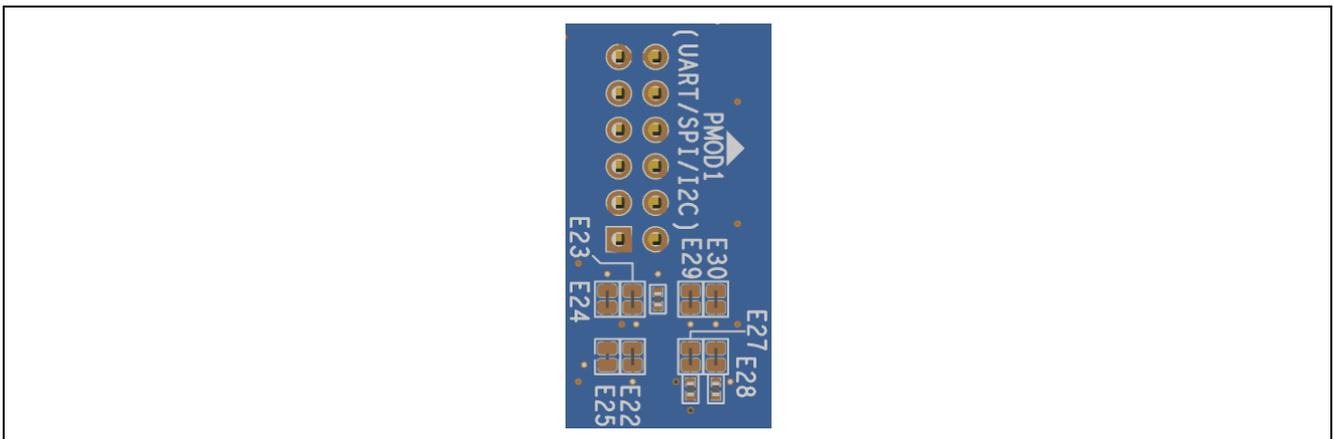


**Figure 5-6.   Pmod 1 Pin header jumpers (top side)**



**Figure 5-7.   Pmod 1 Copper jumpers (bottom side)**

### 5.3.3.2   Pmod 2

A 12-pin Pmod connector is provided at J17, Pmod 2.

**Table 5-12.   Pmod 2 Connector**

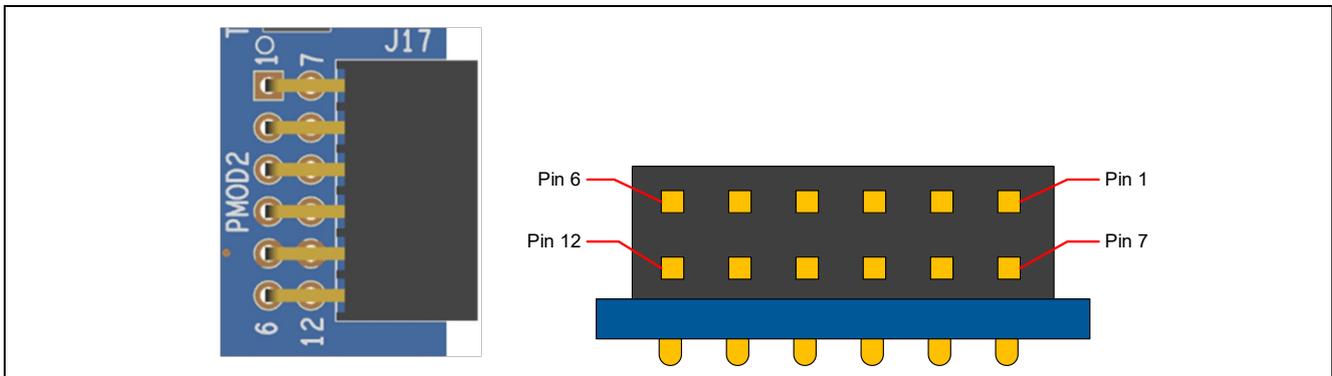| Pmod 2 Connector | | | EK-RX671 | Pmod 2 Configuration | |
|---|---|---|---|---|---|
| **Pin** | **Description Type-2A / Type-3A** | **Option Type 6A** | **Signal** | **Short** | **Open** |
| J17-1 | CS / CTS / GPIO | INT | P74 (CTS011# / IRQ12) | | |
| J17-2 | MOSI / TXD | RESET | P77 (TXD011 / SMOSI011) | | |
| J17-3 | MISO / RXD | SCL | P76 (RXD011 / SMISO011 / SSCL011) | | |
| J17-4 | SCK / RTS / GPIO | | P75 (SCK011 / RTS011#) | J23 Pin 1-2 | |
| | | SDA | PB7 (SSDA011) [1] | J23 Pin 2-3 | |
| J17-5 | GND | | GND | | |
| J17-6 | VCC | | +3.3V | | |
| J17-7 | GPIO / INT (slave to master) | | P46 (IRQ14-DS) | | |
| J17-8 | GPIO / RESET (master to slave) | | PC0 | | |
| J17-9 | GPIO / CS2 | | PC1 | | |
| J17-10 | GPIO / CS3 | | PC2 | | |
| J17-11 | GND | | GND | | |
| J17-12 | VCC | | +3.3V | | |

[1]: Open at shipping.



**Figure 5-8.   Pmod 2 connector**

**Pmod 2 Type-6A connection**

The option for Type-6A (I2C) can be configured at Pmod2 and supports +3.3 V devices. To configure the EK-RX671 board to use the I2C devices with +3.3 V operation, configure the pin header jumper using Table 5-12. Following figures show the pin header jumper to use the I2C devices.
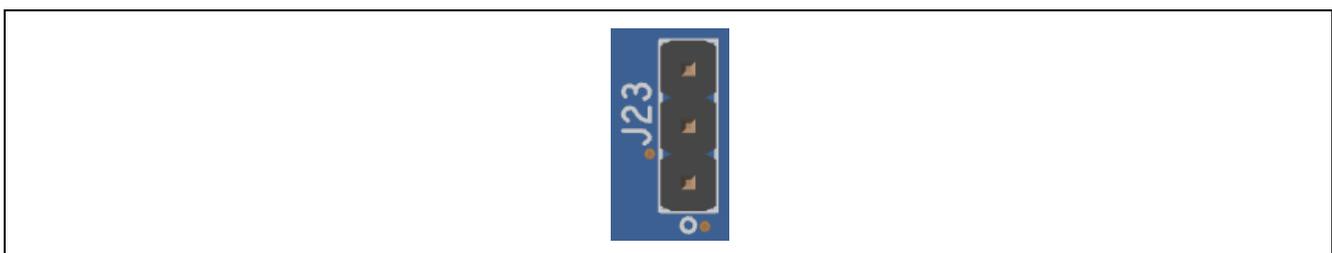


**Figure 5-9.   Pmod 2 Pin header jumpers (top side)**

### 5.3.4  Arduino® Connector

Near the center of the System Control and Ecosystem Access area is an Arduino Uno R3 compatible connector interface.

**Table 5-13.  Arduino Uno Connections**

| Arduino Compatible Connector | | | | EK-RX671 | Configuration | |
|---|---|---|---|---|---|---|
| Pin | Description | | | Signal | Short | Open |
| J10-1 | NC | | | NC | | |
| J10-2 | IOREF | | | +3.3V | | |
| J10-3 | RESET | | | RES# | E52 | E53 |
| | | | | P02 [*1] | E53 | E52 |
| J10-4 | +3.3 V | | | +3.3V | | |
| J10-5 | +5 V | | | +5V [*1] | E57 | |
| J10-6 | GND | | | GND | | |
| J10-7 | GND | | | GND | | |
| J10-8 | VIN | | | NC | | |
| J11-1 | A0 | | | P40 (AN000) [*2] | | |
| J11-2 | A1 | | | P41 (AN001) | | |
| J11-3 | A2 | | | P42 (AN002) | | |
| J11-4 | A3 | | | P43 (AN003) | | |
| J11-5 | A4 | | | P44 (AN004) | | |
| J11-6 | A5 | | | P45 (AN005) | | |
| J12-1 | D0 | RXD | | PC6 (RXD10) [*2] | | |
| J12-2 | D1 | TXD | | PC7 (TXD10) [*2][*3] | E49 | E50 |
| | | | | P71 [*1] | E50 | E49 |
| J12-3 | D2 | INT0 | | P05 (IRQ13) | | |
| J12-4 | D3 | INT1 | PWM | P87 (TIOCA2 / IRQ15) | | |
| J12-5 | D4 | | | P93 | | |
| J12-6 | D5 | | PWM | P25 (TIOCA4) [*8] | | |
| J12-7 | D6 | | PWM | P32 (MTIOC0C) [*4] | | |
| J12-8 | D7 | | | P55 | | |
| J13-1 | D8 | | | PJ5 | | |
| J13-2 | D9 | | PWM | P56 (MTIOC3C) [*2][*6] | | |
| J13-3 | D10 | SPI_SS | PWM | P83 (SS010# / MTIOC4C) [*2][*4] | | |
| J13-4 | D11 | SPI_MOSI | PWM | P82 (SMOSI010 / MTIOC4A) [*2][*4][*7] | | |
| J13-5 | D12 | SPI_MISO | | P86 (SMISO010) [*2][*4] | | |
| J13-6 | D13 | SPI_SCK | | P80 (SCK010) [*2][*4] | | |
| J13-7 | GND | | | GND | | |
| J13-8 | AREF | | | VREFH0 | | |
| J13-9 | I2C_SDA | | | P13 (SDAHS0[FM+/HS]) [*5] | | |
| J13-10 | I2C_SCL | | | P12 (SCLHS0[FM+/HS]) [*5] | | |

*1: Open at shipping.

*2: The signals are shared with mikroBUS.

*3: The signal is shared with UB.

*4: The signals are shared with Pmod 1.

*5: The signals are shared with Pmod 1, mikroBUS, Qwiic and Grove 1.

*6: The signal is shared with LED1.

*7: The signal is shared with LED2.

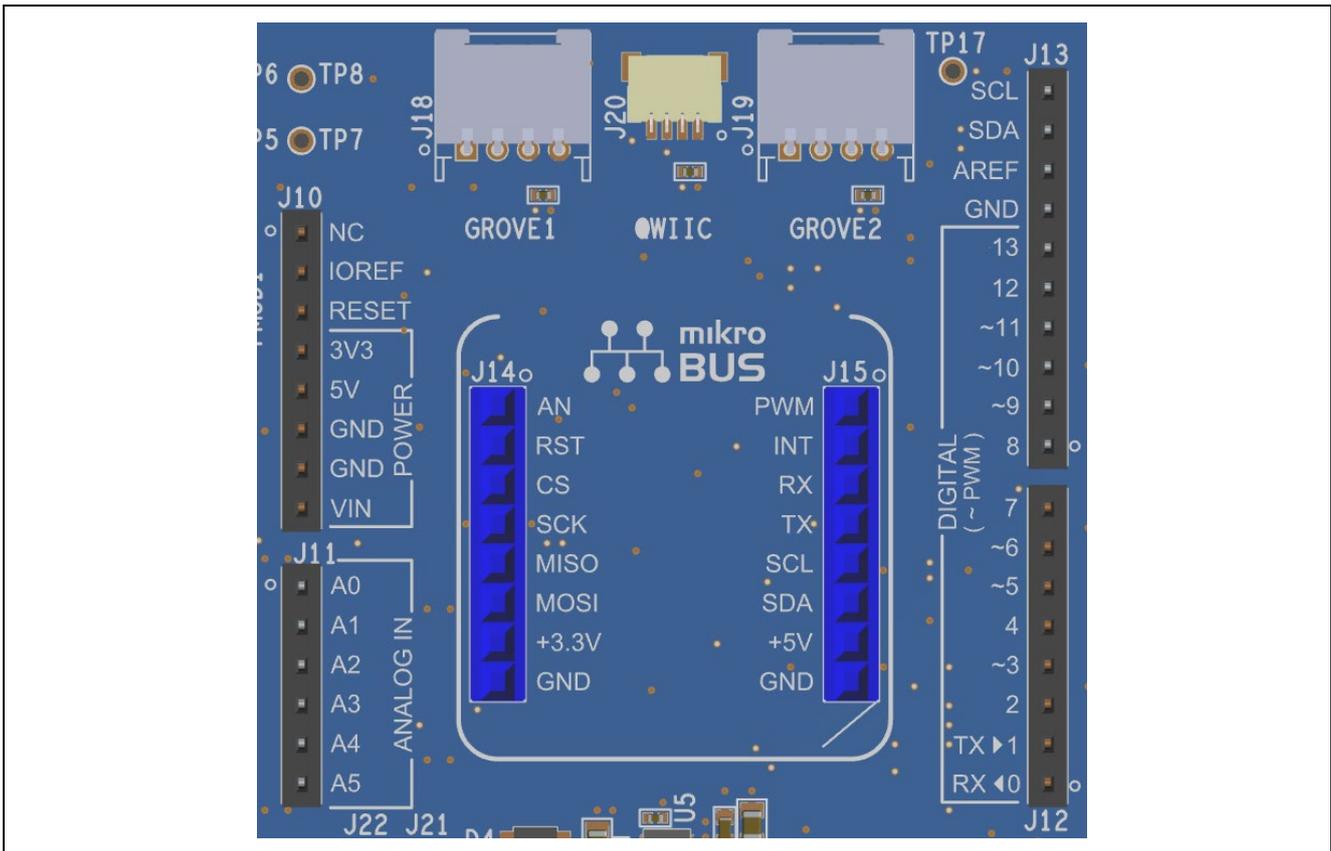*8: The signal is shared with LED3.

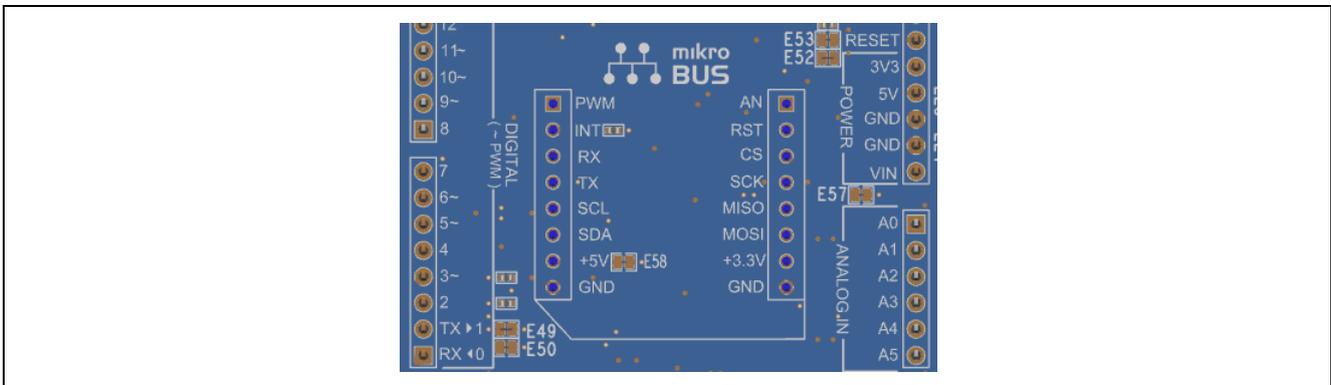Figure 5-10.   Arduino Uno Connectors (J10, J11, J12 and J13)



Figure 5-11.   Arduino Uno Copper jumpers (bottom side)

**Arduino Shield Considerations**

AREF (J13-Pin 8) output from Arduino Shield can supply +3.3V power to VREFH0 (Analog reference voltage supply pin for the 12-bit A/D converter) of RX MCU, however, on-board LDO supplies +3.3 V power to VREFH0 at default condition. When Arduino AREF supplies +3.3V power to VREFH0, the user must disconnect VREFH0 from on-board +3.3 V power.  Copper jumper E44 is provided on the EK-RX671 board to disconnect VREFH0 from on-board +3.3 V power.

The EK-RX671 board can supply +5 V power to J10-Pin 5 of Arduino Shield by shorting copper jumper E57, however, some of the RX MCU pins which are connected to Arduino Shield are not 5 V tolerant. When the EK-RX671 board supplies +5 V power to Arduino Shield, the user must confirm the RX671 Group User's Manual: Hardware and the specification of Arduino Shield you intend to use.

### 5.3.5 MikroElektronika mikroBUS™ Connector

In the center of the System Control and Ecosystem Access area is a mikroBUS compatible connector interface. This interface is compliant with mikroBUS Standard Specifications revision 2.00.

**Table 5-14. mikroBUS Connections**

| mikroBUS Connector | | EK-RX671 | Configuration | |
|---|---|---|---|---|
| Pin | Description | Signal | Short | Open |
| J14-1 | AN (Analog) | P40 (AN000) [*2] | | |
| J14-2 | RST (Reset) | P03 | | |
| J14-3 | CS (SPI Chip Select) | P83 (SS010#) [*2 *3] | | |
| J14-4 | SCK (SPI Clock) | P80 (SCK010) [*2 *3] | | |
| J14-5 | MISO | P86 (SMISO010) [*2 *3] | | |
| J14-6 | MOSI | P82 (SMOSI010) [*2 *3 *7] | | |
| J14-7 | +3.3 V | +3.3V | | |
| J14-8 | GND | GND | | |
| J15-1 | PWM | P56 (MTIOC3C) [*2 *6] | | |
| J15-2 | INT (Hardware Interrupt) | P91 (IRQ9) | | |
| J15-3 | RX (UART Receive) | PC6 (RXD10) [*2] | | |
| J15-4 | TX (UART Transmit) | PC7 (TXD10) [*2 *4] | | |
| J15-5 | SCL (I2C Clock) | P12 (SCLHS0[FM+/HS]) [*5] | | |
| J15-6 | SDA (I2C Data) | P13 (SDAHS0[FM+/HS]) [*5] | | |
| J15-7 | +5 V | +5V [*1] | E58 | |
| J15-8 | GND | GND | | |

*1: Open at shipping.

*2: The signals are shared with Arduino.

*3: The signals are shared with Pmod 1.

*4: The signal is shared with UB.

*5: The signals are shared with Pmod 1, mikroBUS, Qwiic and Grove 1.

*6: The signal is shared with LED1.
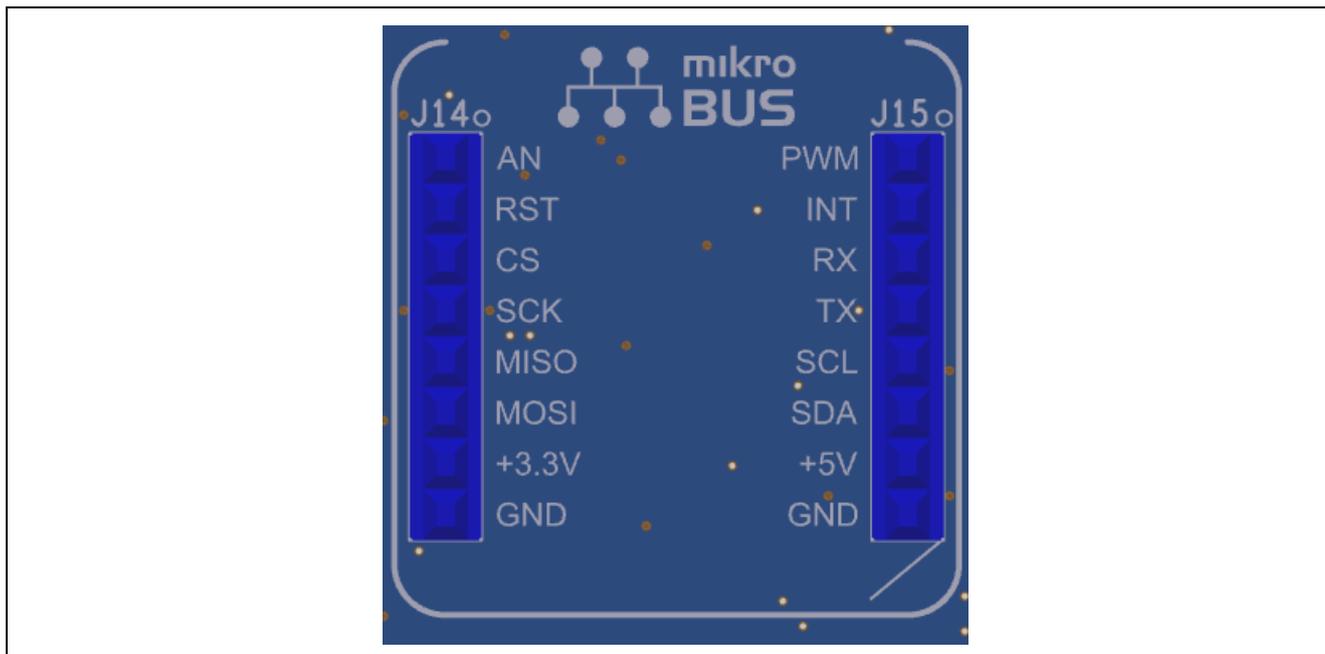
*7: The signal is shared with LED2.

**Figure 5-12.   mikroBUS Connectors**

**mikroBUS CLICK BOARD<sup>TM</sup> Considerations**

The EK-RX671 board can supply +5 V power to J15-Pin 7 of mikroBUS CLICK BOARD by shorting copper jumper E58, however, some of the RX MCU pins which are connected to mikroBUS CLICK BOARD are not 5 V tolerant. When the EK-RX671 board supplies +5 V power to mikroBUS CLICK BOARD, the user must confirm the RX671 Group User's Manual: Hardware and the specification of mikroBUS CLICK BOARD you intend to use.

## 5.4   Connectivity

### 5.4.1   USB to Serial

The USB Micro-B connecter (J27) connects the RX MCU SCI interface to an external USB interface through FTDI FT234XD-T (U8) with maximum baud rate of 3Mbps. The RX MCU SCI can be configured either SCI6 (default configuration) or SCI1. Power from an external USB Host on this connection can be used to provide power to the EK-RX671 board.

**Table 5-15.   USB to Serial Connector**

| USB to Serial Connector | | EK-RX671 |
|---|---|---|
| **Pin** | **Description** | **Signal** |
| J27-1 | +5 VDC | +5V_USB_SER |
| J27-2 | Data- | USB_DM |
| J27-3 | Data+ | USB_DP |
| J27-4 | USB ID, jack internal switch, cable inserted | N.C. |
| J27-5 | Ground | GND |

**Table 5-16.   FT234XD-T and RX MCU Connection**

| FT234XD-T | | EK-RX671 | | Configuration | |
|---|---|---|---|---|---|
| **Pin** | **Description** | **Signal** | **Function** | **Short** | **Open** |
| U8-10 | RXD | P26 (TXD1) [*1] | SCI 1 Transmit Data | E36 | E35 |
| | | P00 (TXD6) | SCI 6 Transmit Data | E35 | E36 |
| U8-7 | TXD | P30 (RXD1) [*1] | SCI 1 Receive Data | E38 | E37 |
| | | P01 (RXD6) | SCI 6 Receive Data | E37 | E38 |
| U8-8 | RTS# | PF5 (IRQ4) [*2] | Clear to Send | E55 | E56 |
| | | PB2 (CTS6#) [*1] | SCI 6 Clear to Send | E56 | E55 |
| U8-11 | CTS# | PJ3 (RTS6#) | Request to Send | | |

*1: Open at shipping.

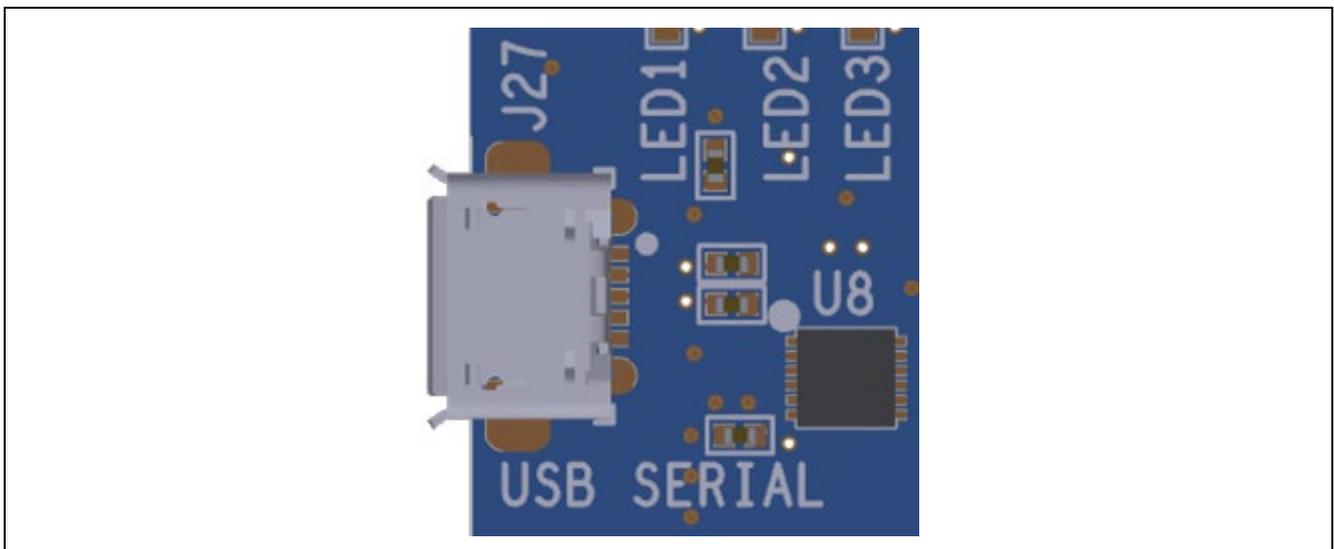*2: The signal is substitute signal of PB2(CTS6#).


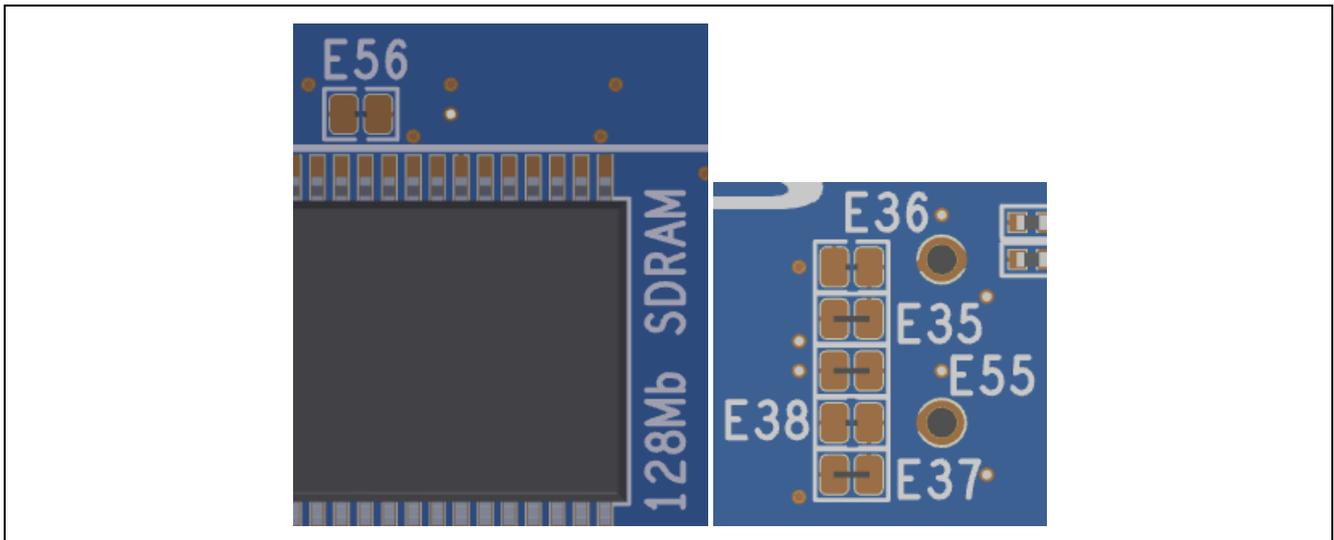
**Figure 5-13.   USB to Serial Connector**

**Figure 5-14.   USB to Serial Copper jumpers (E56: top side, Others: bottom side)**

The user must install FTDI Virtual COM Port (VCP) driver from FTDI's web site to use FT234XD-T.

https://ftdichip.com/

## 5.4.2   USB Full Speed

The USB Micro-AB connecter (J29) connects the RX MCU USB Full Speed interface to an external USB interface, allowing communications for testing and use of the RX MCU firmware. This connection can be configured as either an USB Function or an USB Host interface.

The USB Function mode can be configured as either bus-power or self-power mode. For the USB Function configuration (with bus-power mode or self-power mode), set jumpers according to Table 5-18, and configure the RX MCU firmware to use the USB Full Speed ports in function mode. Power from an external USB Host on this connection can be used to provide power to the EK-RX671 board.

For the USB Host configuration, set jumpers according to Table 5-18, and configure the RX MCU firmware to use the USB Full Speed ports in host mode. In this configuration, power to J29 is supplied from U14 (Power supply IC). The total current available from U14 is 500 mA. To enable U14 and monitor overcurrent detection of U14, configure the RX MCU firmware according to Table 5-19. Note that the input power sources must be configured with enough power for both the EK-RX671 board and the USB Full Speed port in host mode. Connect the included USB type-A female to micro-B male cable to J29. USB function cables or function can be connected to the USB Full Speed port using this cable.

**Table 5-17.   USB Full Speed Connector**

| USB Full Speed Connector | | EK-RX671 |
|---|---|---|
| Pin | Description | Signal |
| J29-1 | +5 VDC | +5V_USBFS (Function Mode) <br> +5V_H_USBFS (Host Mode) |
| J29-2 | Data- | PH2 (USB0_DM) |
| J29-3 | Data+ | PH1 (USB0_DP) |
| J29-4 | USB ID, jack internal switch, cable inserted | N.C. |
| J29-5 | Ground | GND |

**Table 5-18.   USB Full Speed Pin Header Jumper Configuration**

| USB Operating Mode | | J30 | J31 | J32 | J33 |
|---|---|---|---|---|---|
| Host Mode | | Jumper on pins 2-3 | Jumper on pins 1-2 | Open | Don't care |
| Function Mode | Bus-power | Jumper on pins 1-2 | Jumper on pins 2-3 | Short | Jumper on pins 1-2 |
| | Self-power | Jumper on pins 1-2 | Jumper on pins 2-3 | Open | Jumper on pins 2-3 |

**Table 5-19.   USB FS Power Supply IC**

| U14 Power Supply IC | | EK-RX671 |
|---|---|---|
| Pin | Function | Signal |
| U14-3 | VBUS supply enable signal | P16 (USB0_VBUS / USB0_VBUSEN) [*1] |
| U14-8 | Overcurrent detection signal | P14 (USB0_OVRCURA) |

*1: USB0_VBUSEN is multiplexed with USB0_VBUS (USB cable connection monitor). At using Function mode, configure the RX MCU firmware to use USB0_VBUS and set the pin header jumpers according to Table 5-18.
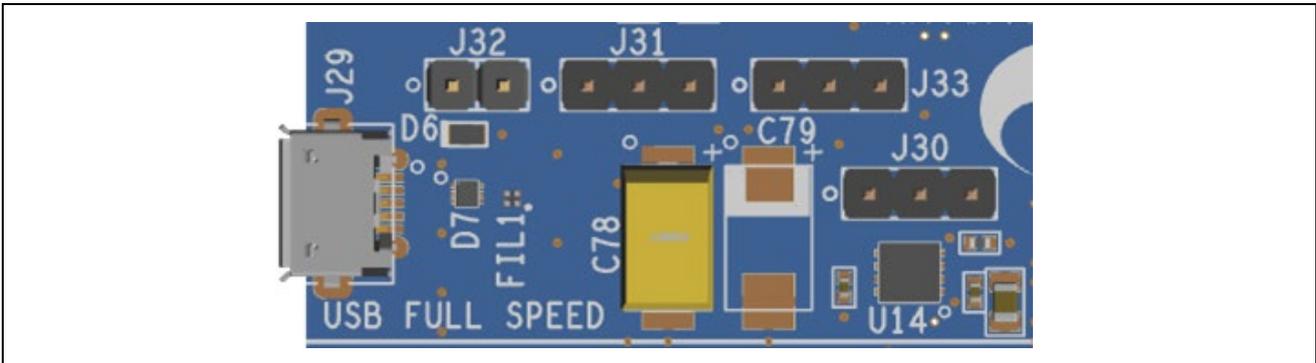


**Figure 5-15.   USB Full Speed Connector**

## 5.5   Miscellaneous

### 5.5.1   LED

5 LEDs are provided on the EK-RX671 board.

Behavior of the LEDs on the EK-RX671 board is described in the following table. User LEDs are active high on the RX MCU ports.

**Table 5-20.   EK-RX671 Board LED Functions**

| LED | | | EK-RX671 | Configuration | |
|---|---|---|---|---|---|
| Designator | Color | Function | Signal | Short | Open |
| LED1 | Blue | User LED | P56 (MTIOC3C) | E15 | |
| LED2 | Green | User LED | P82 (MTIOC4A) | E16 | |
| LED3 | Red | User LED | P25 (TIOCA4) | E17 | |
| LED4 | White | Power on indicator | +3.3V | | |
| LED5 | Yellow | Debug LED | E2 OB circuit | | |

The User LEDs may be isolated from the Main MCU, so the associated ports can be used for other purposes. To separate LED1 from P56, Trace Cut Jumper E15 must be open. To separate LED2 from P82, Trace Cut Jumper E16 must be open. To separate LED3 from P25, Trace Cut Jumper E17 must be open.
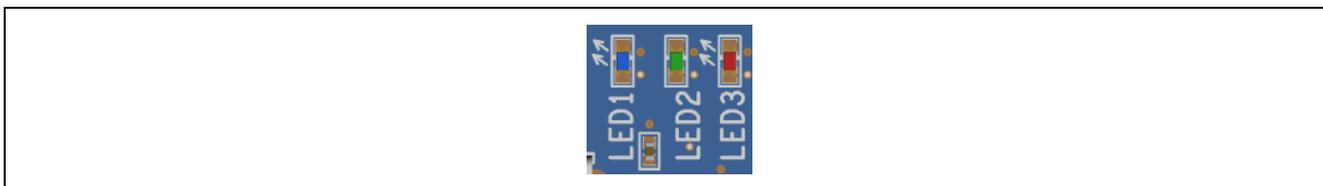


**Figure 5-16.   User LEDs**



**Figure 5-17.   Power LED**
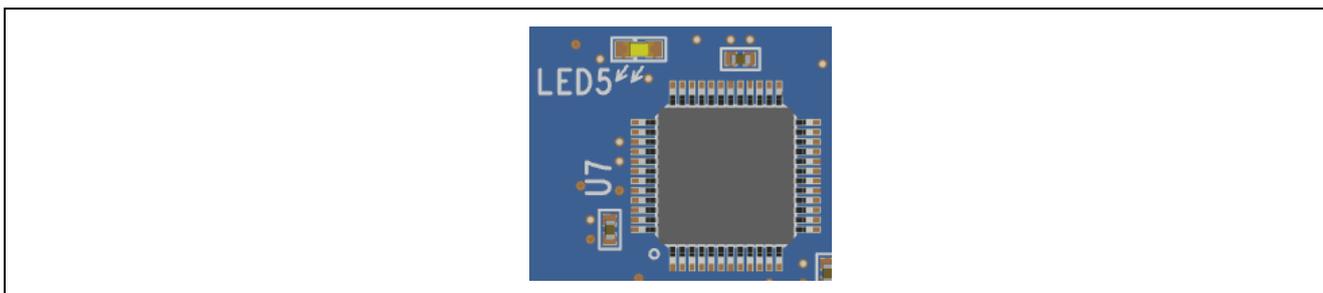


**Figure 5-18.   Debug LED**
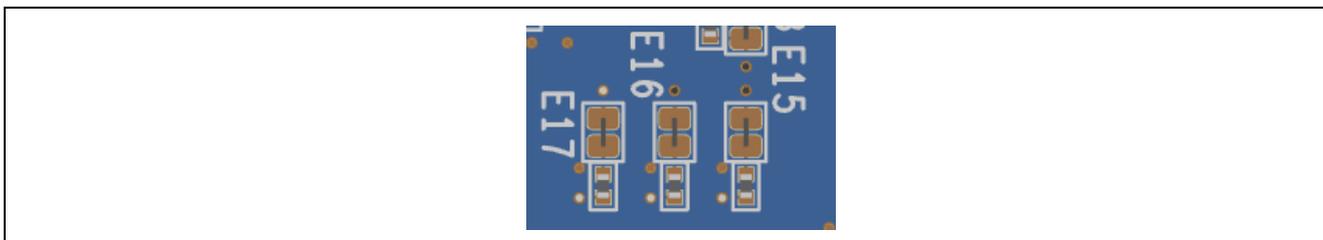


**Figure 5-19.   User LEDs Copper jumpers (bottom side)**

### 5.5.2 User and Reset Switches

Three miniature, momentary, mechanical push-button type SMT switches are mounted on the EK-RX671 board.

Pressing the Reset switch (S3) generates a reset signal to restart the RX MCU.

**Table 5-21. EK-RX671 Board Switches**

| Switch | | | EK-RX671 | Configuration | |
|---|---|---|---|---|---|
| Designator | Function | Color | Signal | Short | Open |
| S3 | MCU Reset Switch | Red | RES# | | |
| S2 | User Switch | Blue | PC5 (IRQ5) | E14 | |
| S1 | User Switch | Blue | PC3 (IRQ11) | E13 | |

The User Switches S1 and S2 may be isolated from the RX MCU, so the associated ports can be used for other purposes. To separate S1 from PC3, Trace Cut Jumper E13 must be open. To separate S2 from PC5, Trace Cut Jumper E14 must be open.
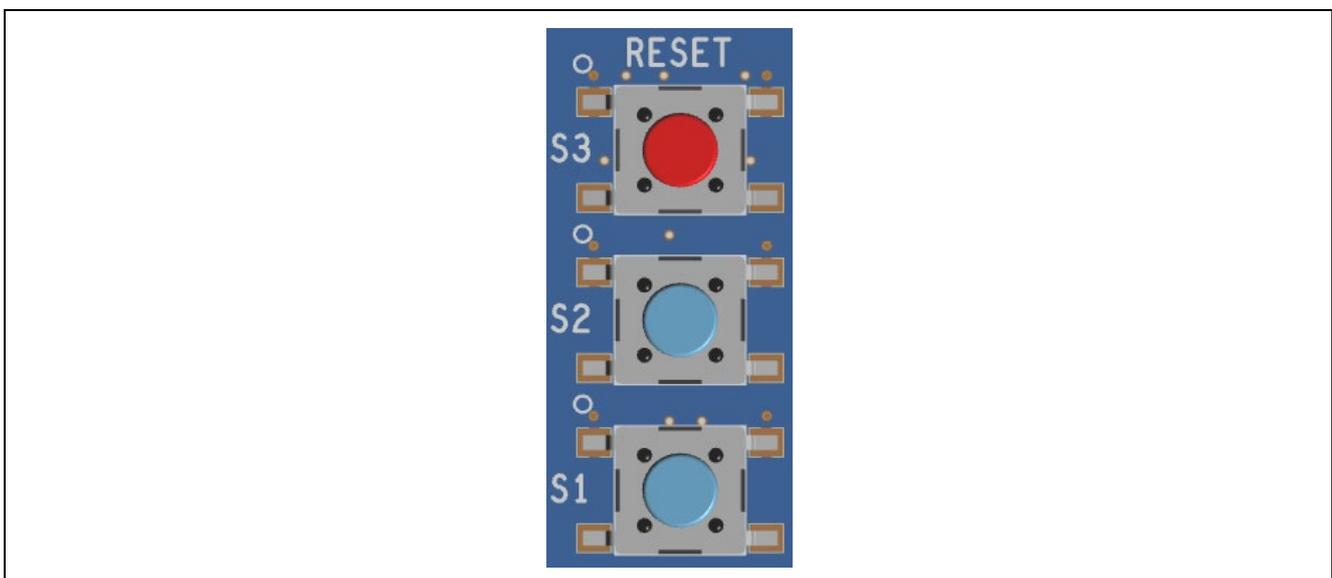


**Figure 5-20. Reset and User Switches**
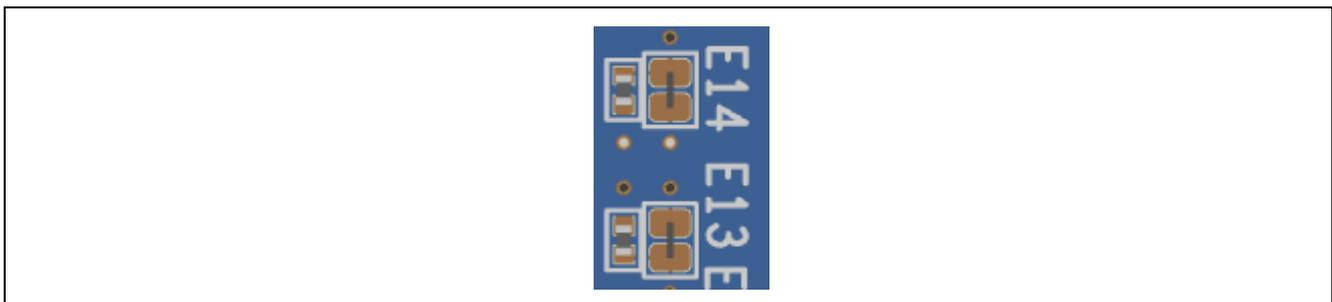


**Figure 5-21. User switches Copper jumpers (bottom side)**

# 6.    Special Feature Access Area

The Special Feature Access area provides features specific to the RX MCU group such as SDHI, Audio interface, SDRAM controller, QSPIX and Touch interface.
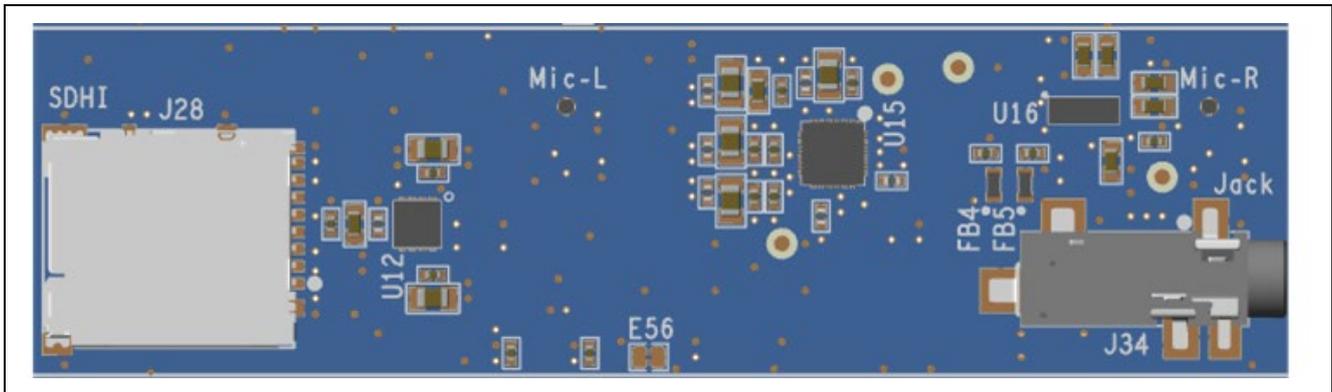


**Figure 6-1.    Special Feature Access Area**

## 6.1    SD Host Interface (SDHI)

The microSD card slot (J28) connects the RX MCU SDHI to a microSD card, allowing communications for testing and use of the RX MCU firmware. Refer to RX671 Group User's Manual: Hardware about details of SDHI specification.

SW_A and SW_B are pins of a card detection switch in the microSD card slot. The switch between SW_A and SW_B closes when a microSD card is inserted into the card slot.

The microSD card cannot be configured with external SDRAM and QSPI flash memory simultaneously because RX MCU pins of these functions are multiplexed. Refer to section 7.4 to select microSD card.

Power (+3.3 V) to the microSD card is supplied from U12 (Power supply IC). To enable U12 and monitor overcurrent detection of U12, configure the RX MCU firmware according to Table 6-2.

**Table 6-1.    SDHI Connection**

| microSD Card Slot | | EK-RX671 | RX MCU |
|---|---|---|---|
| Pin | Description | Signal | Port |
| J28-1 | DAT2 | SDHI_D2-B | PD2 |
| J28-2 | CD / DATA3 | SDHI_D3-B | PD3 |
| J28-3 | CMD | SDHI_CMD-B | PD4 |
| J28-4 | VDD | +3V3_SD | - |
| J28-5 | CLK | SDHI_CLK-B | PD5 |
| J28-6 | VSS | GND | - |
| J28-7 | DAT0 | SDHI_D0-B | PD6 |
| J28-8 | DAT1 | SDHI_D1-B | PD7 |
| J28-9 | SW_A | GND | - |
| J28-10 | SW_B | P81 (SDHI_CD) | P81 |

**Table 6-2.    SDHI Power Supply IC**

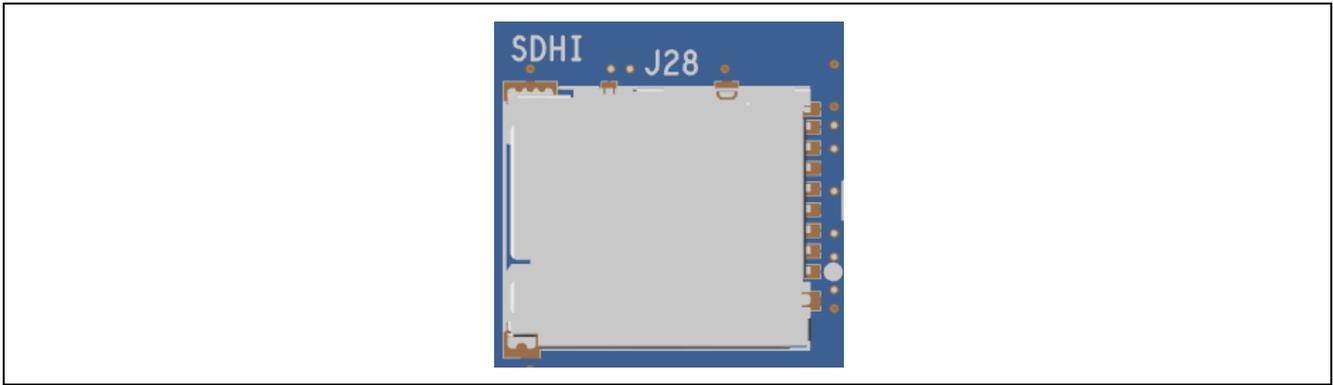| U12 Power Supply IC | | EK-RX671 |
|---|---|---|
| Pin | Function | Signal |
| U12-3 | +3V3_SD supply enable signal | P51 |
| U12-8 | Overcurrent detection signal | P73 (IRQ8) |

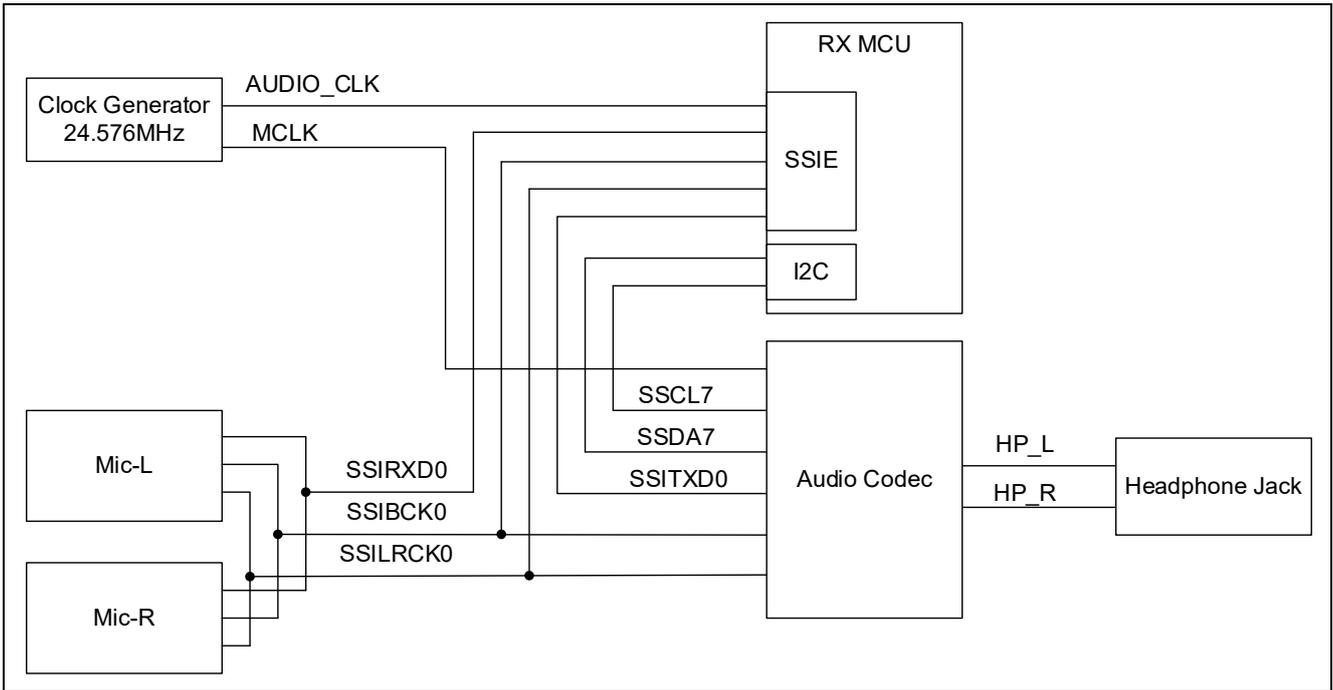**Figure 6-2.   microSD card slot**

## 6.2   Audio Interface



**Figure 6-3.   Block Diagram for Audio Interface**

An audio codec IC, a clock generator IC for audio, 2 microphones (Microphone-Left and Microphone-Right) and a headphone jack (3.5 mm, stereo, audio jack) are provided on the EK-RX671 board. The RX MCU incorporates Serial Sound Interface (SSIE).

**Table 6-3.   Clock Generator Connection**

| EK-RX671 | | RX MCU |
|---|---|---|
| **Signal** | **Function** | **Port** |
| AUDIO_CLK | Audio Clock | P22 |
| MCLK | Master Clock | - |

**Table 6-4.   Audio Codec Connection**

| EK-RX671 | | RX MCU |
|---|---|---|
| **Signal** | **Function** | **Port** |
| SSILRCK0 | Mic-L / Mic-R Channel Select | P21 |
| SSIBCK0 | Bit Clock | P23 |
| SSITXD0 | Data Output | P17 |
| SSCL7 | Control Interface Clock | P92 |
| SSDA7 | Control Interface Data | P90 |

**Table 6-5.   Microphone Connection**

| EK-RX671 | | RX MCU |
|---|---|---|
| **Signal** | **Function** | **Port** |
| SSILRCK0 | Mic-L / Mic-R Channel Select | P21 |
| SSIBCK0 | Bit Clock | P23 |
| SSIRXD0 | Data Input | P20 |

**Table 6-6.   Headphone Jack Connection**

| EK-RX671 | | RX MCU |
|---|---|---|
| **Signal** | **Function** | **Port** |
| HP_L | Headphone Output (Left) | - |
| HP_R | Headphone Output (Right) | - |
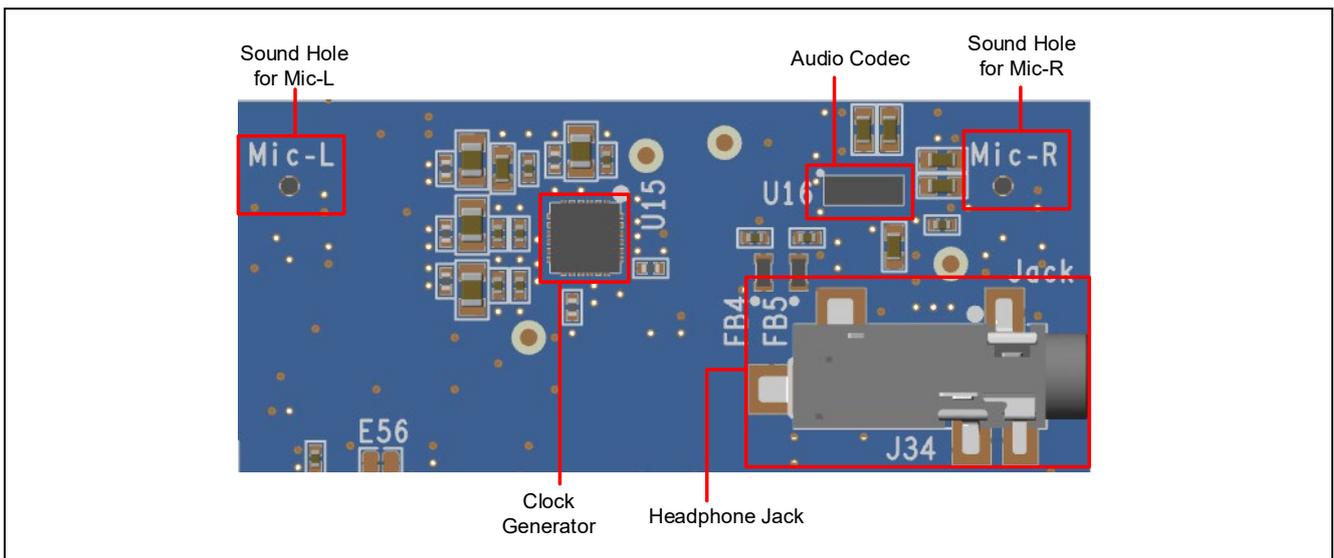


**Figure 6-4.   Audio Interface**

## 6.3   SDRAM

Included on the EK-RX671 board is an Alliance Memory 128 Mbit Synchronous DRAM (AS4C8M16SA) with a 16-bit width. The external SDRAM (U13) is connected to the SDRAM controller on the RX MCU.

The external SDRAM cannot be configured with Quad-SPI and microSD card simultaneously because RX MCU pins of these functions are multiplexed. Refer to section 7.4 to select the external SDRAM.

**Table 6-7.   Overview of the external SDRAM**

| Specification | Description |
|---|---|
| Type Name | AS4C8M16SA-7TCN |
| Constitution | 2Meg x 16bit x 4bank |
| Capacity | 128Mbit |
| Row Address | 12bit |
| Column Address | 9bit |
| Number of banks | 4 |
| Row Cycle Time (tRC) | Min. 63ns (same bank) |
| Initialization Auto Refresh Count | Min. 2 |
| Precharge Command Period (tRP) | Min. 21ns (same bank) |
| Auto Refresh Request Period | 15.625us (64ms / 4096) |
| CAS Latency (CL) | 2 or 3 |
| Write Recovery Period (tWR) | Min. 14ns |
| Active-to-Precharge Command Period (tRAS) | Min. 42ns (same bank) |
| Active-to-Read or Write Delay (tRCD) | Min. 21ns (same bank) |
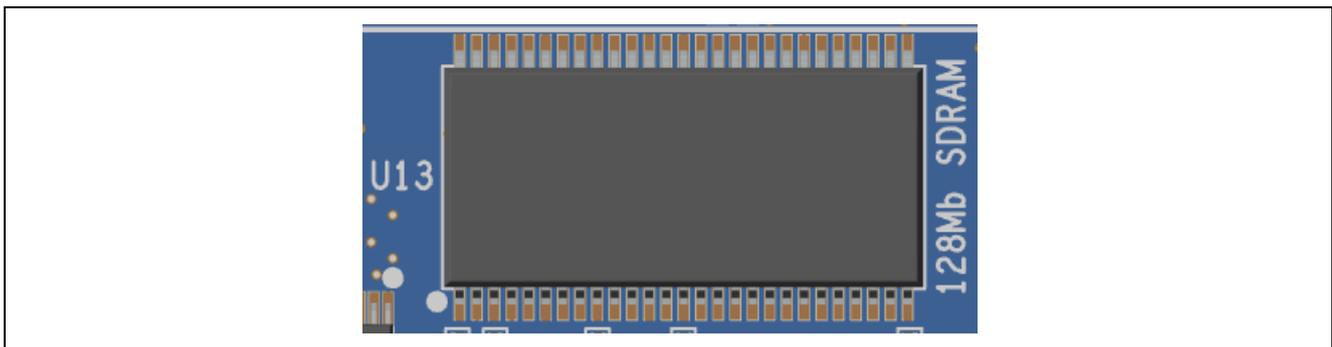


**Figure 6-5.   External SDRAM**

Note: The external SDRAM IC is implemented on MCU Native Pin Access area, however, the external SDRAM is described in section 6 "Special Feature Access Area" because the external SDRAM is functionally categorized into Special Feature Access.

## 6.4   QSPIX

Included on the EK-RX671 board is a Renesas 64 Mbit SPI Serial Flash Memory (AT25QF641B). The SPI Serial Flash device (U11) connects to the Quad-SPI Memory Interface (QSPIX) on the RX MCU and defaults to standard SPI mode initially. The flash memory is enabled for XIP (Execute-in-place) mode directly after power-on.

The Quad-SPI cannot be configured with the external SDRAM and microSD card simultaneously because RX MCU pins of these functions are multiplexed. Refer to section 7.4 to select the QSPI flash memory.

**Table 6-8.   Quad-SPI Flash Memory Port Assignments**

| EK-RX671 | | RX MCU |
|---|---|---|
| **Signal** | **Function** | **Port** |
| QSSL-B | Chip Select | PD4 |
| QSPCLK-B | Clock | PD5 |
| QIO0-B | Bi-directional Data 0 | PD6 |
| QIO1-B | Bi-directional Data 1 | PD7 |
| QIO2-B | Bi-directional Data 2 | PD2 |
| QIO3-B | Bi-directional Data 3 | PD3 |
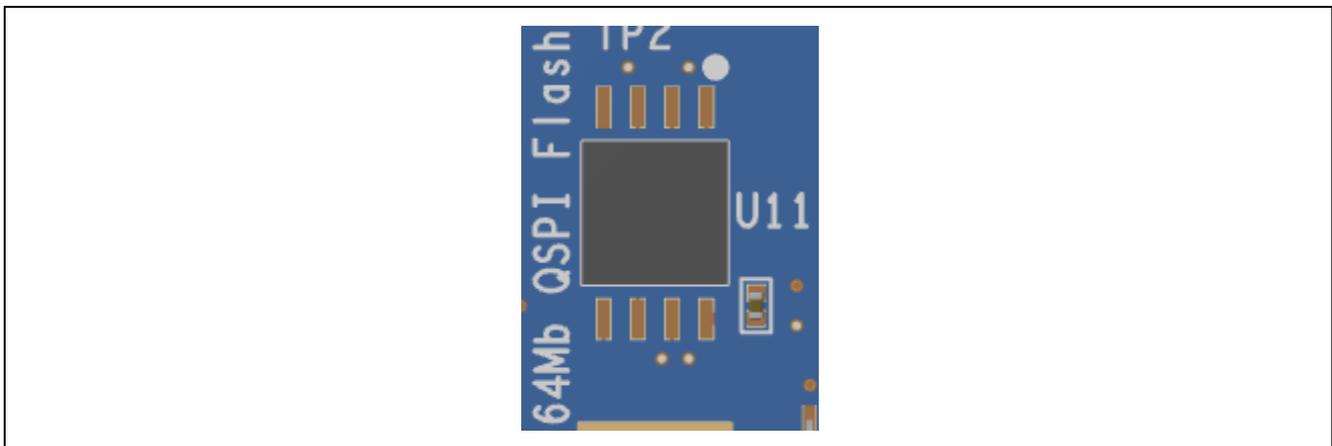


**Figure 6-6.   Quad-SPI Flash**

Note: The QSPI flash memory is implemented on MCU Native Pin Access area, however, the Quad-SPI Flash is described in section 6 "Special Feature Access Area" because the Quad-SPI Flash is functionally categorized into Special Feature Access.

## 6.5   Touch Interface

The RX MCU incorporates Capacitive Touch Sensing Unit (CTSUa), and the CTSU is connected to 2 touch buttons on the EK-RX671 board.

**Table 6-9.   Touch Interface**

| EK-RX671 | | RX MCU | Configuration | |
|---|---|---|---|---|
| **Signal** | **Function** | **Port** | **Short** | **Open** |
| TS1 | Electrostatic capacitance measurement pin (Touch Button 1) | P33 | - | - |
| TS5 | Electrostatic capacitance measurement pin (Touch Button 2) | P24 | - | - |
| TSCAP | LPF (Low-pass filter) connection pin | PC4 | - | E44 |
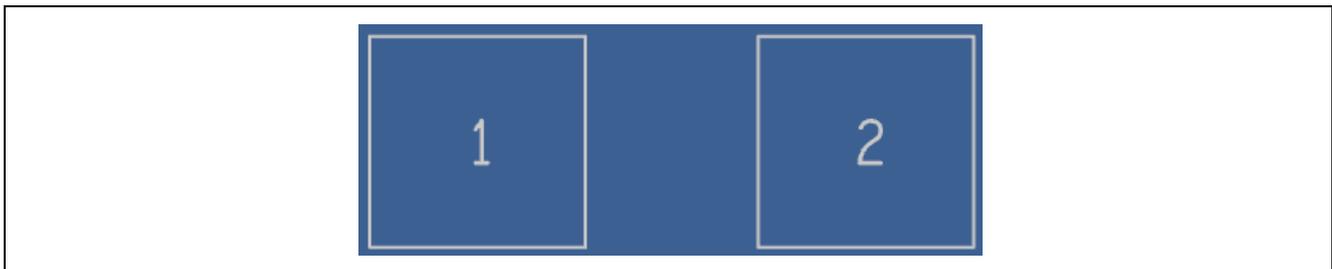


**Figure 6-7.   Touch Buttons**



**Figure 6-8.   Touch Interface Copper Jumpers (bottom side)**

Note: Two touch buttons are implemented on MCU Native Pin Access area, however, the Touch Interface is described in section 6 "Special Feature Access Area" because the Touch Interface is functionally categorized into Special Feature Access.

## 7. MCU Native Pin Access Area
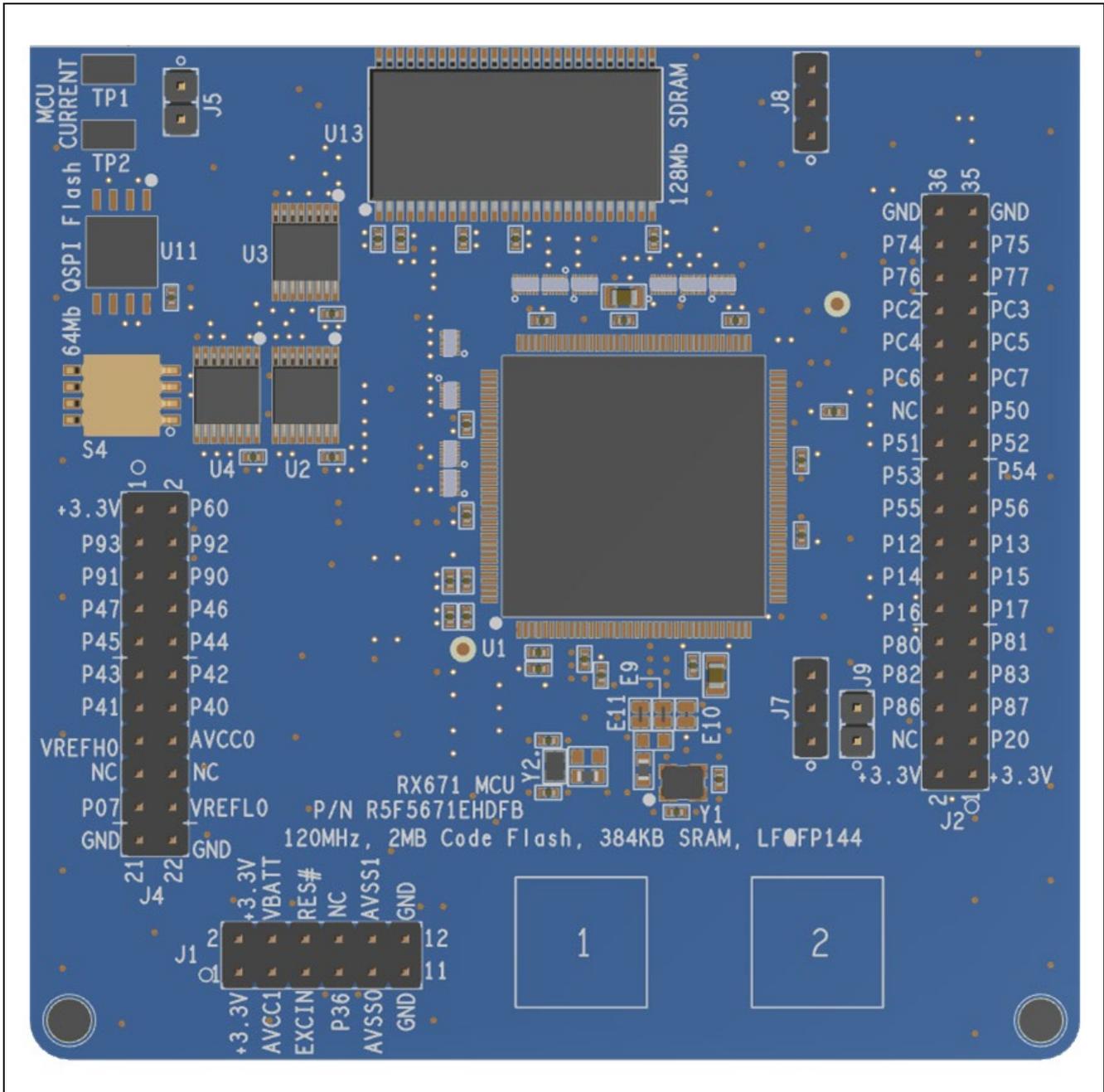


**Figure 7-1.  Native Pin Access Area**

## 7.1  Breakout Pin Headers

The EK-RX671 board pin headers, J1, J2 and J4, provide access to RX MCU signals. Each header pin is labeled with the voltage or port connected to that pin. Refer to the RX671 Group User's Manual: Hardware for details of each port function, and the EK-RX671 board schematic for pin header port assignments.

The placement of the breakout pin headers allows for a standard 2.54 mm (0.100") center breadboard to be placed on all three pin headers simultaneously. This can be used for prototyping and testing of custom circuitry for use with the RX MCU.

## 7.2 MCU Current Measurement

Included in the Native Pin Access area are current measurement test points to measure the RX MCU current.

The EK-RX671 board provides 2 test points (TP1 and TP2) for current measurement of the main +3.3 V MCU power. Set an ammeter between TP1 and TP2 without shunt jumpers at J5, and then measure the main +3.3 V MCU power current.
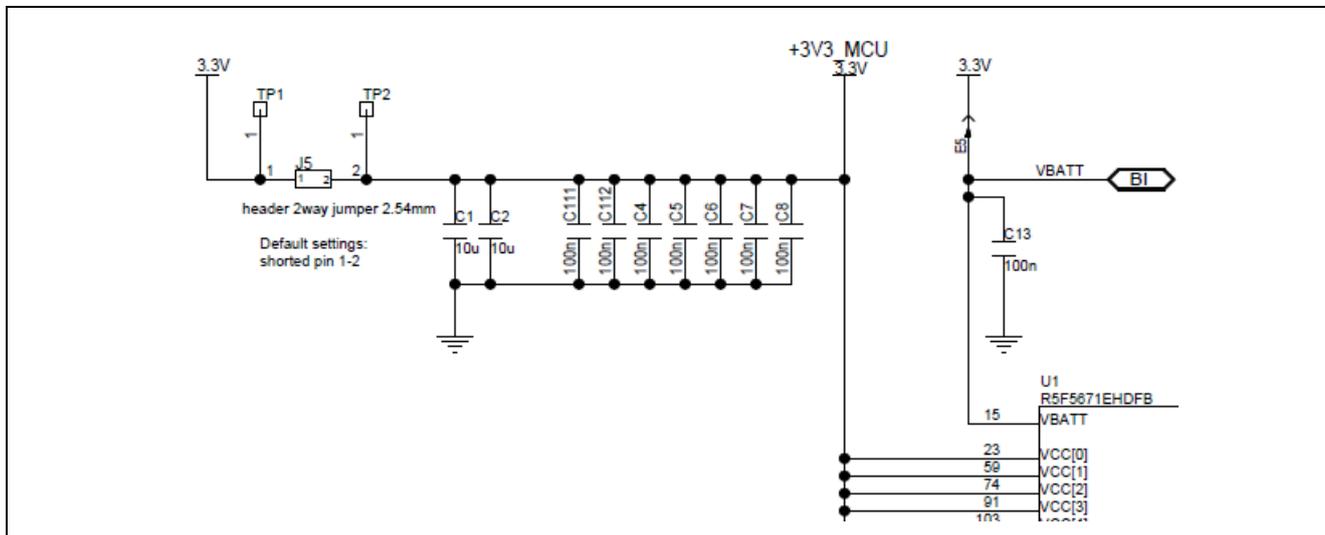


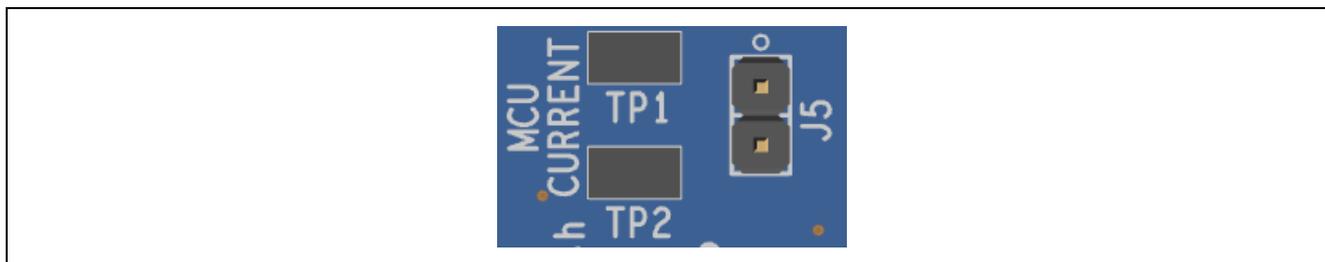**Figure 7-2.  RX MCU Current Measurement Circuit**



**Figure 7-3.  Pin Header Jumper J5**

## 7.3 MCU Operating Mode

MCU operating mode is configured by DIP switch (S4) and pin header jumpers (J7, J8 and J9).

**Table 7-1.  MCU Operating Mode Configuration**

| S4 Pin1 | S4 Pin2 | J7 | J8 | J9 | Description |
|---------|---------|----|----|----|-------------|
| OFF | OFF | Jumper on pins 2-3 | Jumper on pins 2-3 | Open | Debug on-board mode |
| OFF | ON | Jumper on pins 2-3 | Jumper on pins 2-3 | Open | Single Chip mode or Debug in mode |
| OFF | ON | Jumper on pins 1-2 | Jumper on pins 2-3 | Open | Single Chip mode or Debug in with hot plug-in mode |
| ON | ON | Jumper on pins 2-3 | Jumper on pins 1-2 | Open | USB Boot mode (Bus powered) |
| ON | ON | Jumper on pins 2-3 | Jumper on pins 1-2 | Short | USB Boot mode (Self powered) |
| ON | ON | Jumper on pins 2-3 | Jumper on pins 2-3 | Open | SCI Boot mode |

## 7.4   Bus Switch

The microSD card, external SDRAM and QSPI flash memory on the EK-RX671 board cannot be used simultaneously because RX MCU pins of these functions are multiplexed. The multiplexed signals are connected to each device through 3 bus switch ICs (U2, U3 and U4). The user must set DIP switch S4 Pin 3 and Pin 4 to select one function.

**Table 7-2.   DIP Switch Configuration**

| S4 Pin3 | S4 Pin4 | Available Function |
|---------|---------|--------------------|
| OFF | OFF | QSPI flash memory |
| ON | OFF | External SDRAM |
| OFF | ON | N/A (Do not select) |
| ON | ON | microSD card |
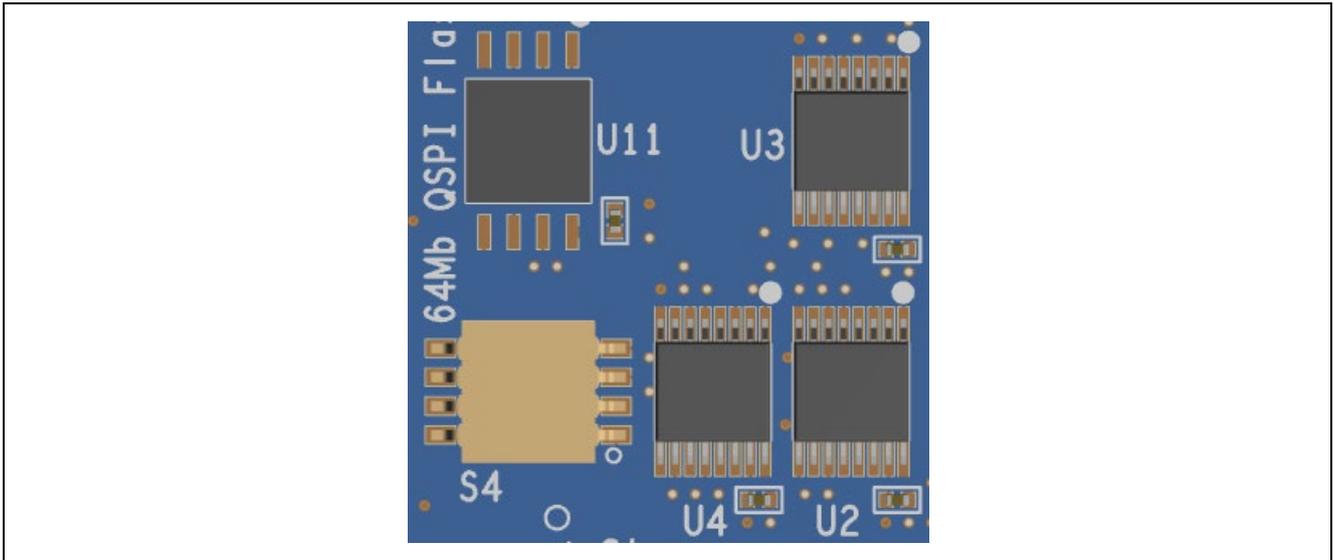


**Figure 7-4.   DIP switch (S4) and Bus Switch ICs (U2, U3 and U4)**

## 8.  Certifications

The EK-RX671 v1 kit meets the following certifications/standards. See page 3 of this user's manual for the disclaimer and precautions.

### 8.1   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 requried 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 requried 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

### 8.2   Material Selection, Waste, Recycling and Disposal Standards

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

### 8.3   Safety Standards

- UL 94V-0

## Revision History

| Rev. | Date | Description | |
|------|------|------|------|
| | | **Page** | **Summary** |
| 1.00 | Jan.31.23 | — | Initial release |

# EK-RX671 v1 – User's Manual