# RX671 Group

Renesas Solution Starter Kit
Capacitive Touch Evaluation System
User's Manual

RENESAS 32-Bit MCU

RX Family∕RX600 Series

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

# Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall be responsible for determining what licenses are required from any third parties, and obtaining such licenses for the lawful import, export, manufacture, sales, utilization, distribution or other disposal of any products incorporating Renesas Electronics products, if required.
5. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
6. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
    "Standard":  Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.
    "High Quality":  Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.
    Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.
7. No semiconductor product is absolutely secure. Notwithstanding any security measures or features that may be implemented in Renesas Electronics hardware or software products, Renesas Electronics shall have absolutely no liability arising out of any vulnerability or security breach, including but not limited to any unauthorized access to or use of a Renesas Electronics product or a system that uses a Renesas Electronics product. RENESAS ELECTRONICS DOES NOT WARRANT OR GUARANTEE THAT RENESAS ELECTRONICS PRODUCTS, OR ANY SYSTEMS CREATED USING RENESAS ELECTRONICS PRODUCTS WILL BE INVULNERABLE OR FREE FROM CORRUPTION, ATTACK, VIRUSES, INTERFERENCE, HACKING, DATA LOSS OR THEFT, OR OTHER SECURITY INTRUSION ("Vulnerability Issues"). RENESAS ELECTRONICS DISCLAIMS ANY AND ALL RESPONSIBILITY OR LIABILITY ARISING FROM OR RELATED TO ANY VULNERABILITY ISSUES. FURTHERMORE, TO THE EXTENT PERMITTED BY APPLICABLE LAW, RENESAS ELECTRONICS DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO THIS DOCUMENT AND ANY RELATED OR ACCOMPANYING SOFTWARE OR HARDWARE, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.
8. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
12. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
13. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
14. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.
(Note1)  "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.
(Note2)  "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.5.0-1   October 2020)

## Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan

www.renesas.com

## Contact information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact/.

## Trademarks

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

# 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.

# How to Use This Manual

1. Purpose and Target Readers

   This is a manual for users to understand the outline and hardware functions of the RX671 Group Capacitive Touch Evaluation System (RTK0EG0044S01001BJ). This manual is intended for users who use this CPU board. A basic knowledge of electric circuits, logical circuits, and MCUs is necessary in order to use this manual.

   > Particular attention should be paid to the precautionary notes when using the manual. These notes occur within the body of the text, at the end of each section, and in the Usage Notes section.

   > The revision history summarizes the locations of revisions and additions. It does not list all revisions. Refer to the text of the manual for details.

# Renesas RTK0EG0044S01001BJ Disclaimer

By using this RTK0EG0044S01001BJ, the User accepts the following terms, which are in addition to, and control in the event of disagreement, with Renesas' General Terms and Conditions available at https://www.renesas.com/en-us/legal/disclaimer.html.

The RTK0EG0044S01001BJ is not guaranteed to be error free, and the entire risk as to the results and performance of the RTK0EG0044S01001BJ is assumed by the User. The RTK0EG0044S01001BJ is provided by Renesas on an "as is" basis without warranty of any kind whether express or implied, including but not limited to the implied warranties of good workmanship, fitness for a particular purpose, title, merchantability, and non-infringement of intellectual property rights. Renesas expressly disclaims any implied warranty.

Renesas does not consider the RTK0EG0044S01001BJ to be a finished product and therefore the RTK0EG0044S01001BJ may not comply with some requirements applicable to finished products, including, but not limited to recycling, restricted substances and electromagnetic compatibility regulations. Refer to Certifications section, for information about certifications and compliance information for the RTK0EG0044S01001BJ. It is the kit User's responsibility to make sure the kit meets any local requirements applicable to their region.

Renesas or its affiliates shall in no event be liable for any loss of profit, loss of data, loss of contract, loss of business, damage to reputation or goodwill, any economic loss, any reprogramming or recall costs (whether the foregoing losses are direct or indirect) nor shall Renesas or its affiliates be liable for any other direct or indirect special, incidental or consequential damages arising out of or in relation to the use of this RTK0EG0044S01001BJ, even if Renesas or its affiliates have been advised of the possibility of such damages.

Renesas has used reasonable care in preparing the information included in this document, but Renesas does not warrant that such information is error free nor does Renesas guarantee an exact match for every application or parameter to part numbers designated by other vendors listed herein. The information provided in this document is intended solely to enable the use of Renesas products. No express or implied license to any intellectual property right is granted by this document or in connection with the sale of Renesas products. Renesas reserves the right to make changes to specifications and product descriptions at any time without notice. Renesas assumes no liability for any damages incurred by you resulting from errors in or omissions from the information included herein. Renesas cannot verify, and assumes no liability for, the accuracy of information available on another company's website.

# Precautions

This 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.

## Safety Items

Definitions of Symbols

A variety of symbols are used in this document and on the product itself to prevent in advance danger to you the user or any third parties and to prevent in advance damage to any physical property.
This section, Safety Items, presents these symbols and their meanings. It also presents safety notes to assure that this produce is used safely and correctly.
This product should only be used after fully understanding the material presented in this section.

⚠ **Warning**      Warning items indicate things that, if not avoided, could lead to death or serious injury.

⚠ **Caution**      Caution items indicate both latent dangers that can lead to minor or moderately severe injury and latent dangers that can lead to property damage if not avoided.

In addition to the above two markings, the following are displayed at the same time if appropriate.

**[Important]** Indicates a point that can lead to equipment failure or malfunction if incorrectly set when setting up this product.

A triangular mark △ indicates a warning or caution.
Example:

⚡ Electrical Shock Hazard

The ⊘ mark indicates something that is forbidden.
Example: :

🚫 Do Not Disassemble

Warning

| ⚠ **Warning** |
| --- |
| Handling related warnings:<br>Do not disassemble or modify this product. Renesas does not guarantee this product if it has been disassembled or modified.<br>The power supply for this product can be selected to be either the USB bus or a DC jack. A jumper is used to select the power supply.<br>If, during either use or storage of this product, any abnormality in the product itself (including abnormal odors, heating, color changes, or shape changes to the product itself) are observed, disconnect the USB cable and power supply cable immediately. |
| Installation:<br>Do not install this equipment in a location that has a high humidity or where water or other fluids could get on it. This equipment may be damaged if water or other fluids could get on it. |
| Ambient temperature:<br>The upper limit for the ambient temperature under which this product may be used is 35°C.<br>This maximum rated ambient temperature must not be exceeded. |

Caution

# ⚠Caution

**Handling related cautions:**

Use the antistatic band. Failure to do so could cause malfunction or unstable motion or be damaged Internal components.

This product must be handled carefully. Do not drop, knock over, or apply any strong mechanical shocks to this product.

When connecting or disconnecting cables from this product, hold the parts of the cable intended to be grasped (such as the plugs) and avoid putting stress on the cable. Do not pull on this product when it is connected to a communications cable or user system connection cable. Stress on the cable can result in internal disconnections in the cable. When connecting a cable to a connector, be careful not to insert the plug in the reverse orientation. Reverse insertion can result in damage to this product itself or to connected equipment.

The power supply for this product can be selected from two options (the DC jack or the USB cable). The jumper JP4 (on the top side of the circuit board) is used to select the power supply. Always check the jumper position before connecting a power source. An incorrect jumper position can result in damage to this product or the PC connected over the USB cable.

Do not handle this product with wet hands. This can lead to failure of the product.

**Transport methods:**

When transporting this product, use the product's packing box and cushioning materials and ship it with precision equipment handling. If the products packing is insufficient, it may be damaged during shipping.

If it must be transported by some other method, pack it carefully as precision equipment. When packing this product, always use the antistatic pouch included with this product.

If some other pouch is used, damage to the product may be caused by electrostatic discharge.

**Abnormal operation:**

If operation of this product becomes abnormal due to interference from, for example, external noise, apply the following procedure.
1. Turn off the power.
2. Wait 10 seconds and then turn the power back on.

**Disposal:**

When disposing of this product, handle it as industrial waste according to all applicable laws.

European Union regulatory notices:

The WEEE （Waste Electrical and Electronic Equipment） regulations put responsibilities on producers for the collection and recycling or disposal of electrical and electronic waste. Return of WEEE under these regulations is applicable in the European Union only. This equipment （including all accessories） is not intended for household use. After use the equipment cannot be disposed of as household waste, and the WEEE must be treated, recycled and disposed of in an environmentally sound manner. Renesas Electronics Europe GmbH can take back end of life equipment, register for this service at "http://www.renesas.eu/weee".

# Table of Contents

# 1. Overview

## 1.1 Purpose

The RX671 Group Capacitive Touch Evaluation System (RTK0EG0044S01001BJ) is a kit created for evaluating the Renesas Electronics RX671 Group of MCUs. This manual describes the RX671 Cap Touch Evaluation System's hardware.

## 1.2 Main Characteristics and Functions

The main functions of the RX671 Group Capacitive Touch Evaluation System are as follows:

- Renesas Microcontroller programming and debugging
  — E2/E2 Lite debugger connector
- General purpose switches and LEDs
- Capacitive Touch Sensor (CTSUa)
  — 17 channels available
- Pmod™ interface
  — PMOD1: Pmod Type 2A, Type 3A, and Type 6A
  — PMOD2: Pmod Type 2A
- Connects to Renesas Capacitive Touch Evaluation System Application Board (option)
  — Includes self-capacitance touch electrode application board

## 1.3 Board Specifications

### Table 1-1 CPU Board Specifications

| Item | Specifications |
|---|---|
| Board part No | RTK0EG0043C01001BJ |
| MCU | Model No.: R5F5671EHDFP |
| | Package: 100pin LFQFP |
| | On-chip memory: ROM 2MB, RAM 384KB, DataFlash 8KB |
| | High-speed on-chip oscillator (HOCO):<br>Selectable from 16MHz, 18MHz, and 20MHz |
| External resonator connection | Main clock: 12MHz (option) |
| | Sub clock: 32.768KHz (option) |
| Power supply | Operation voltage: 5.0V<br>• DC jack (2.1mm Center Positive): 5.0V input<br>• USB bus powered (VBUS): 5V<br>Board Device Porer: 3.3V<br>• Voltage regulator (LDO): 3.3V |
| Debug interface | Renesas Electronics E2/E2 Lite 14-pin box header |
| Slide switch | MCU operating mode selection: 1 pole x 1<br>TS pins / SCI Boot Mode programming pins switch: 2 poles x 1, 1 pole x 1 |
| Push switches | Reset switch: x 1 |
| | User switches: x 2 |
| LEDs | Power status: red x 1 |
| | User LEDs: green x 1, yellow x 1 |
| USB serial conversion interface | Connector: USB Micro B |
| | Driver: FT234XD USB serial IC manufactured by FTDI |
| Application board interface (GPIO) | 2.54mm pitch, 16 pins x 1 (CN1) |
| Application board interface (CTSU) | 2.54mm pitch, 40 pins x 1 (CN2) |
| Pmod interface | 2.54mm pitch, 12 pins x 2<br>• PMOD1: Pmod Type 2A, Type3A, Type 6A (with switch circuit)<br>• PMOD2: Pmod Type 2A |
| Current consumption | 500mA or less (Total with all interfaces in use) |
| Operating Temperature Range | When operating: 10 to 35℃, in storage: -10 to 50℃ (no condensation) |
| Board dimensions (L x W x H) | 89mm x 95mm x 18mm (including connectors) |

### Table 1-2 Application Board Specifications

| Item | Specifications |
|---|---|
| Board part No | RTK0EG0019B01002BJ |
| Self-capacitance detection touch electrodes | Buttons: 3<br>Wheel (4-electrode configuration): 1<br>Sliders (5-electrode configuration): 1 |
| Touch electrode shields | Button, wheel, and slider areas: 1 shield each |
| LEDs | 16 |
| Renesas MCU Cap Touch CPU board interface | 2.54mm pitch, 16 pins x 1 (CN1)<br>2.54mm pitch, 40 pins x 1 (CN2) |
| Overlay panel | 2mm-thick acrylic panel |
| Current consumption | 500mA or less |
| Operating Temperature Range | When operating: 10 to 35℃, in storage: -10 to 50℃ (no condensation) |
| Board dimensions (L x W x H) | 110mm x 116mm x 11mm (including connectors) |

## 1.4    Regulatory Compliance Notices

### 1.4.1    European Union regulatory notices

This product complies with the following EU Directives. (These directives are only valid in the European Union.)

CE Certifications:
・Electromagnetic Compatibility (EMC) Directive 2014/30/EU
           EN61326-1 : 2021 Class A

---

WARNING:          This is a Class A product. This equipment can cause radio frequency noise when used in the residential area. In such cases, the user/operator of the equipment may be required to take appropriate countermeasures under his responsibility.

---

・Information for traceability
   ・Authorised representative
        Name:      Renesas Electronics Corporation
        Address:   Toyosu Foresia, 3-2-24, Toyosu, Koto-ku, Tokyo 135-0061, Japan
   ・Manufacturer
        Name:      Renesas Electronics Corporation
        Address:   Toyosu Foresia, 3-2-24, Toyosu, Koto-ku, Tokyo 135-0061, Japan
   ・Person responsible for placing on the market
        Name:      Renesas Electronics Europe GmbH
        Address:   Arcadiastrasse 10, 40472 Dusseldorf, Germany
   ・Trademark and Type name
        Trademark:      Renesas
        Product name:   RX671 Group Capacitive Touch Evaluation System
        Type name:      RTK0EG0044S01001BJ

Environmental Compliance and Certifications:
・Waste Electrical and Electronic Equipment (WEEE) Directive 2012/19/EU

# 2. CPU Board

## 2.1 System Block Diagram

Figure 2-1 shows the system block diagram of the CPU board.
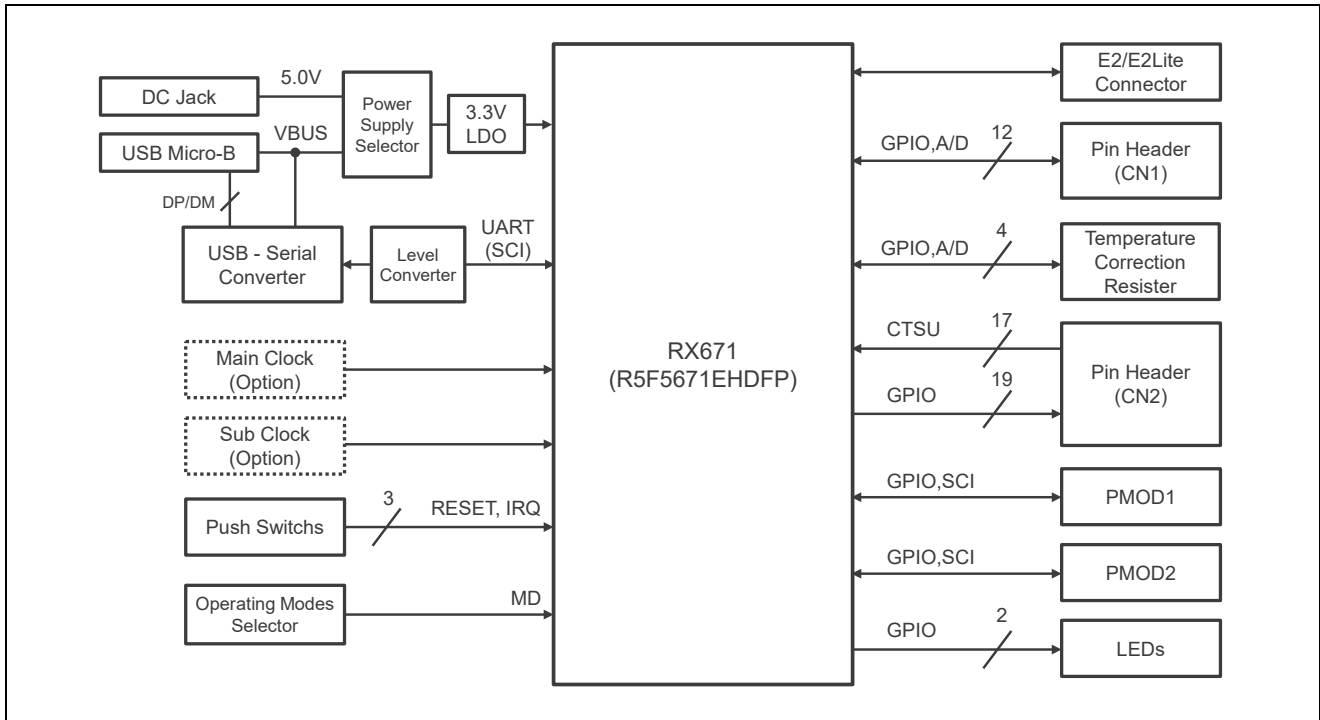


**Figure 2-1. System Block Diagram**

## 2.2 Product Configuration

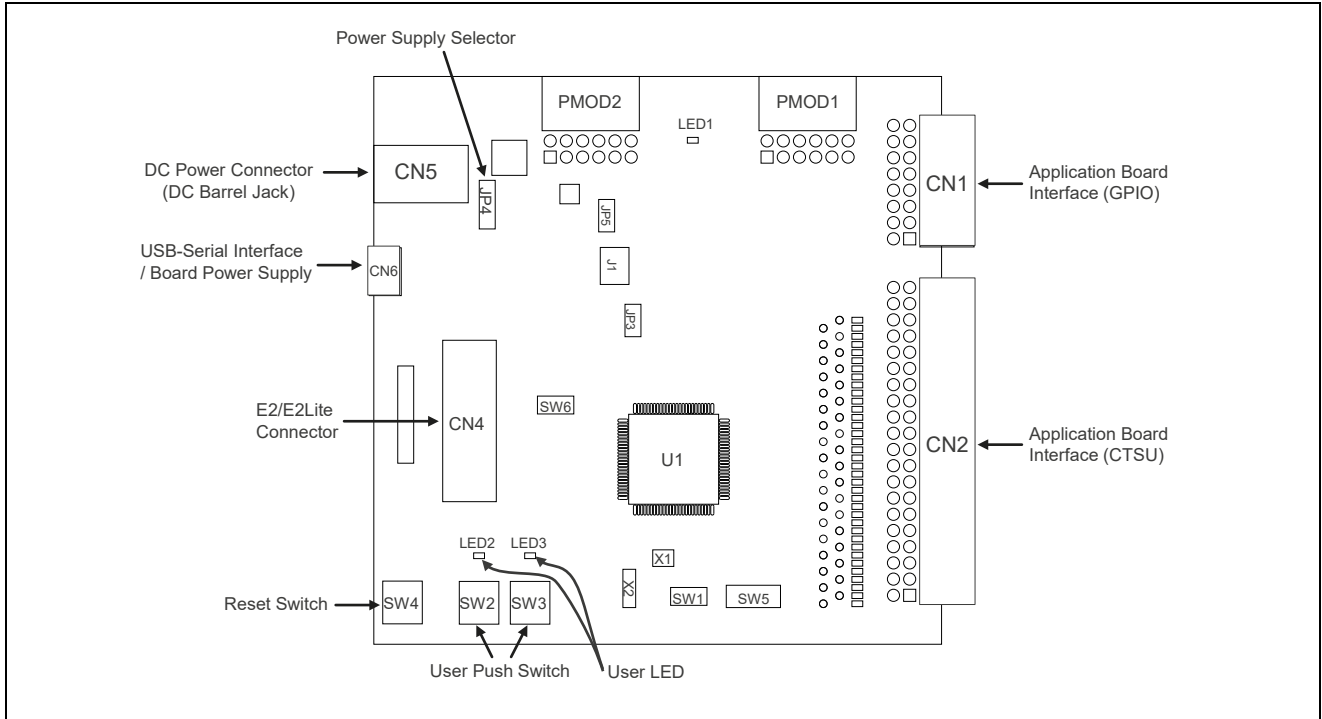Figure 2-2 shows the parts location. Figure 2-3 shows the board dimensions.
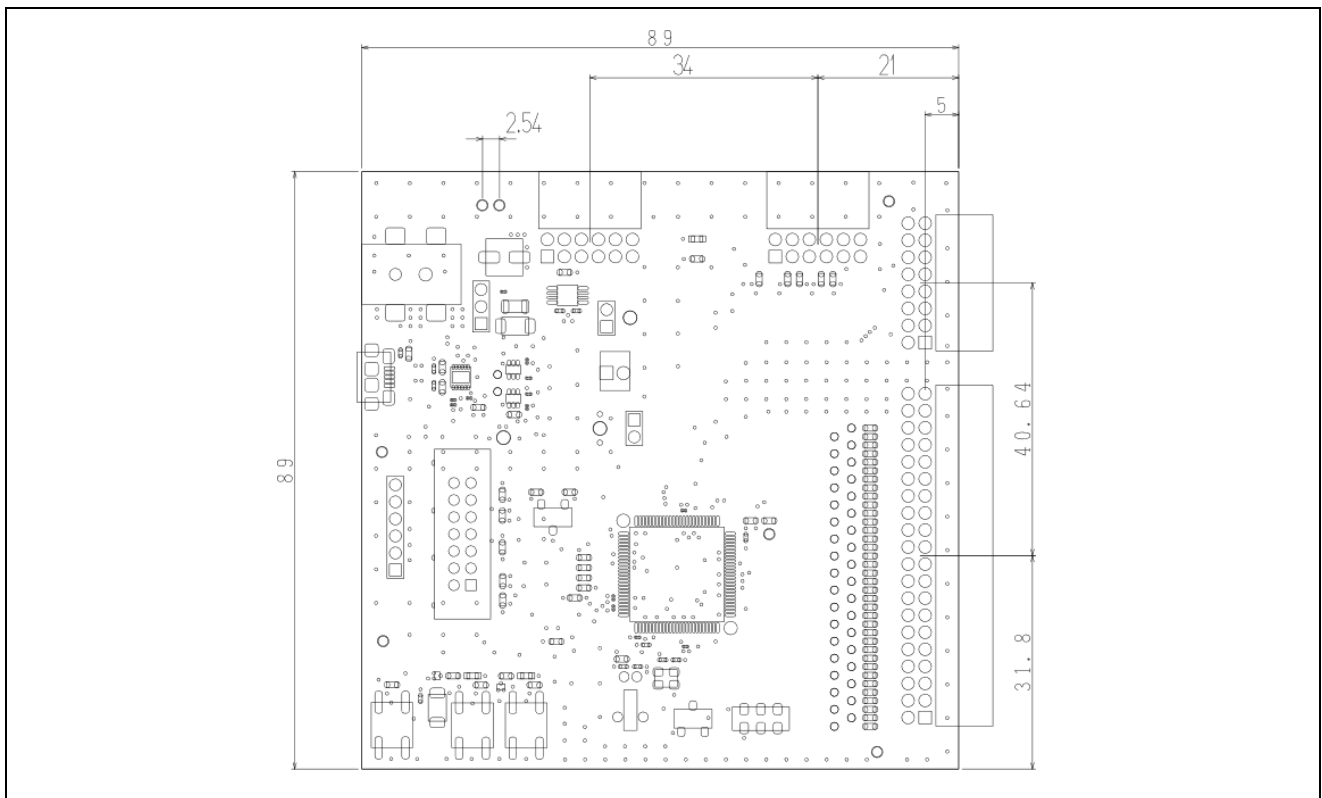


**Figure 2-2.   Parts Location**



**Figure 2-3.   Board Dimensions**

## 2.3    Hardware Details

### 2.3.1    Default Jumper Settings

Figure 2-4. shows the default positions of the jumpers.Table 2-1 lists the default jumper settings.
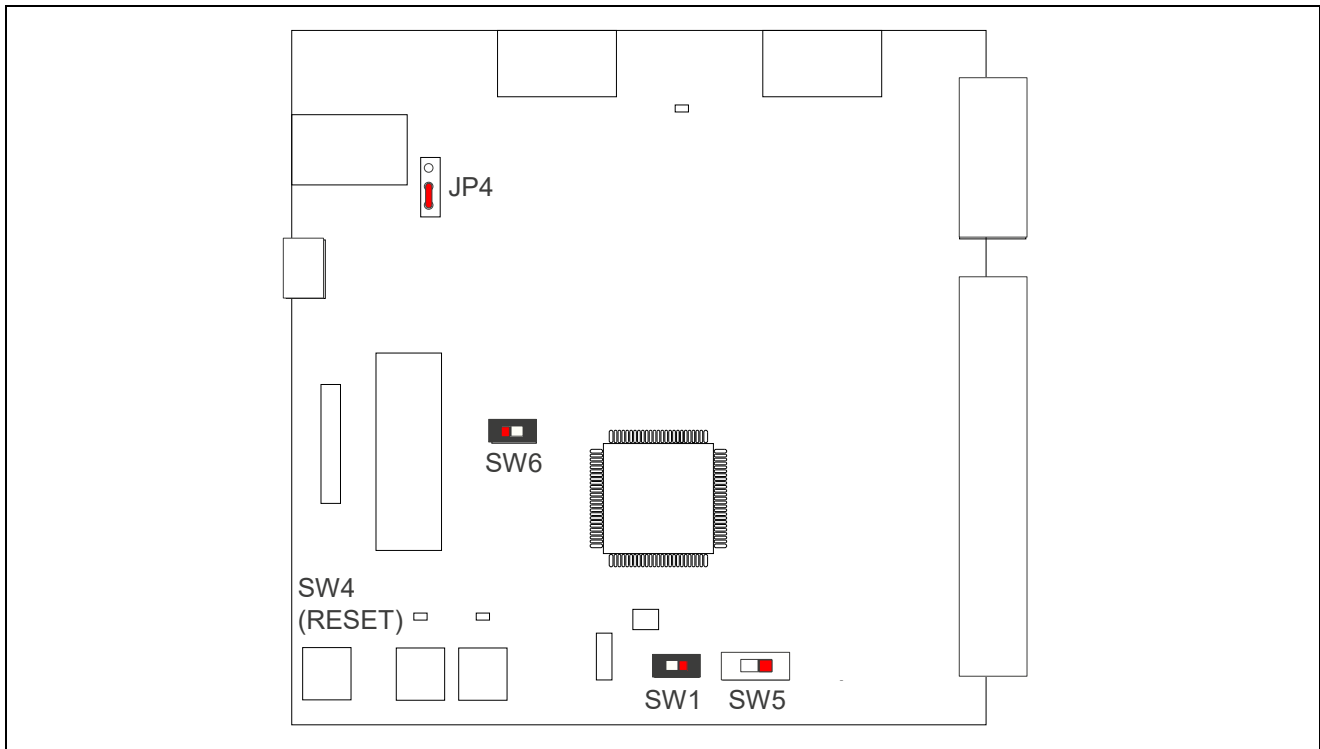


**Figure 2-4.    Default Jumper Positions**

**Table 2-1.    Default Jumper Settings**

| Reference | Circuit Group | Default State | Description |
|-----------|---------------|---------------|-------------|
| JP4 | Power supply | Shorted Pin 1-2 | Supplies USB power to board USB |
| SW1 | Capacitive touch / Debug interface | OFF | Uses P34/TS0/TRST# as TS pin. |
| SW5 | | OFF | Uses P27/TS2/TCK and P26/TS3/TXD1 as TS pins.. |
| SW6 | MCU operating mode settings | OFF | MCU operates in Single Chip Mode |
| R101 | Pmod (PMOD1) | Short | Uses CN3 as Pmod Type 2A or Type 3A |
| R102 | | Short | |
| R103 | | Open | |
| R104 | | Open | |

### 2.3.2    MCU Operating Mode Settings

Table 2-2 provides the RX671 operating mode settings.

**Table 2-2.  RX671 Operating Mode Settings**

| Reference | Position | Default Setting (X) | MCU Operating Mode |
|---|---|---|---|
| SW6 | OFF (pins 2-3) | X | Single Chip Mode |
| | ON (pins 1-2) | | SCI Boot Mode |

Table 2-3 lists the switch specifications for capacitive touch and debug interface settings..

**Table 2-3. Switch Specifications for Capacitive Touch and Debug Interface Settings**

| Reference | Position | Default Setting (X) | Description |
|---|---|---|---|
| SW1 | OFF (2-3 pin) | X | Uses P34/TS0/TRST# as TS pin. (Note1) |
| | ON (1-2 pin) | | Uses P34/TS0/TRST# as debug pin. (Note2) |
| SW5 | OFF (1-2, 4-5 pin) | X | Uses P27/TS2/TCK and P26/TS3/TXD1 as TS pins. (Note1) |
| | ON (2-3, 5-6 pin) | | Uses P27/TS2/TCK and P26/TS3/TXD1 as debug pins. (Note2) |
| Note1: FINE connection is available for the debugger. JTAG connection is not available. | | | |
| Note2: FINE or JTAG connection is available for the debugger. Cannot be used as TS pins. | | | |

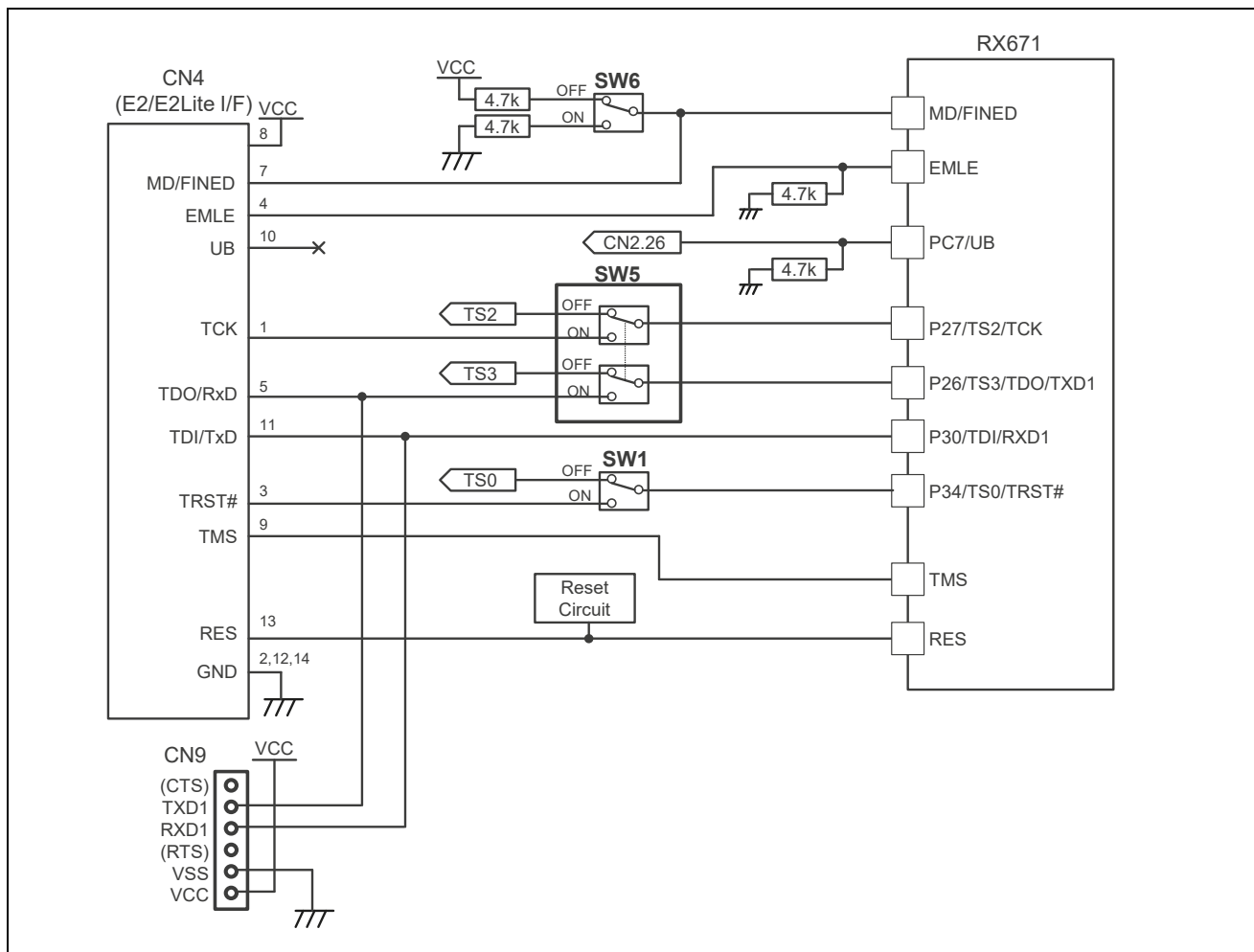Figure 2-5 shows the RX671 operating mode setting circuit. Use these settings.



**Figure 2-5.   RX671 Operating Mode Setting CircuitPower Supply**

### 2.3.3    Power Supply

Table 2-4 provides the power supply jumper settings. This CPU board can be supplied with 5V power by USB or a 2.1mm center positive DC barrel jack connector.  The device on this CPU board is designed to run at 3.3V. The total current available from the onboard 3.3V Low Dropout Regulator (LDO) is 400 mA. Any power supply can be connected to J1 to provide more current to the board power supply. Open JP5/PAD3 when using J1.

**Table 2-4.   Power Source Jumper Settings**

| Reference | Jumper Setting | Default Setting (X) | Description |
|---|---|---|---|
| JP4 | Shorted Pins 1-2 | X | Supplies USB power source to LDO. |
| | Shorted Pins 2-3 | | Supplies DC jack (CN5) to LDO |
| JP5 / PAD3 | Shorted Pins 1-2 | X | Supplies LDO power source to board power source |
| | Open | | Disconnect LDO and board power source |
| JP3 / PAD1 | Shorted Pins 1-2 | X | Supplies board power source to MCU |
| | Open | | MCU current consumption measurement setting |

Figure 2-6 shows the power source system diagram. Figure 2-7 shows the J1 pin assignments
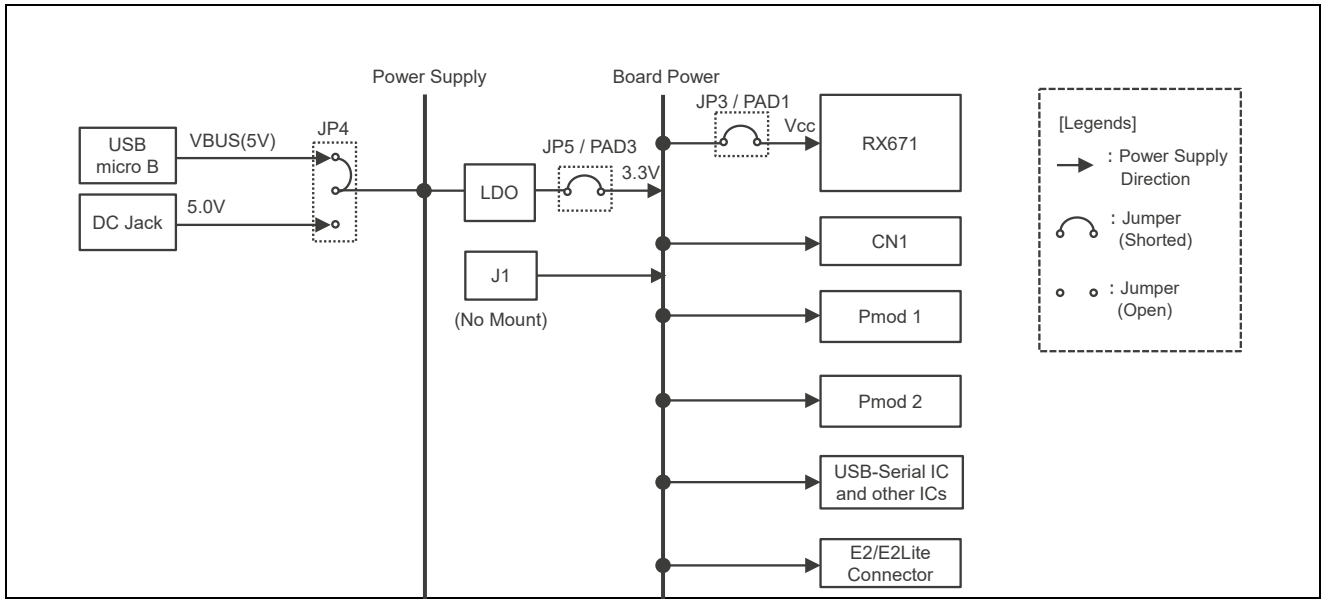
**Figure 2-6.    Power Source System Diagram**



| Pin | Connection |
|-----|------------|
| 1 | VCC（Board Power） |
| 2 | GND |
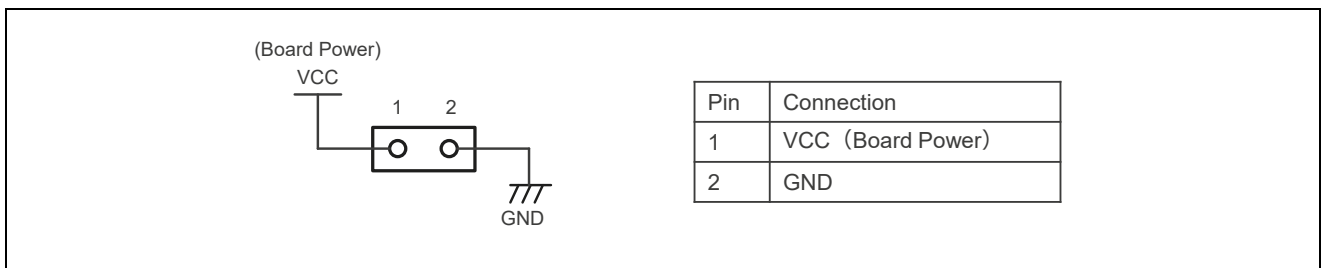
**Figure 2-7.   J1 Pin Assignments**

### 2.3.4    Clock Circuit

Table 2-5  lists the clock specifications of the CPU board. Figure 2-8 shows the clock circuit.

**Table 2-5.    Clock Specifications**

| Clock | Function | Default State | Frequency | Package |
|-------|----------|---------------|-----------|---------|
| X1 | Main clock (crystal resonator) | Not mounted | 12MHz | 3.2mm x 2.5mm SMD |
| X2 | Sub clock | Not mounted | 32.768kHz | 1.88mm x 6.00mm<br>Cylinder type, wire lead product |
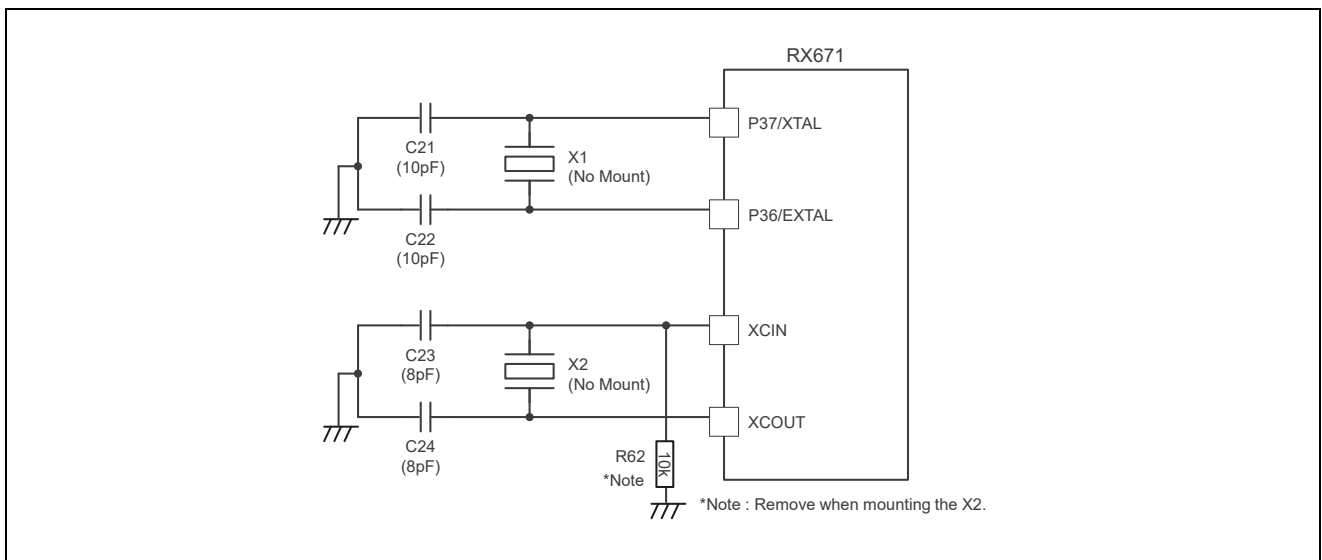


**Figure 2-8.    Clock Circuit**

### 2.3.5 Reset Circuit

The RX671 CPU Board is equipped with a reset switch (SW4) which generates a reset signal to restart the main MCU.

### 2.3.6 Push Switch

Table 2-6. lists the push switch specifications. Figure 2-9 shows the push switch circuit.

**Table 2-6. Push Switch Specifications**

| Reference | MCU Control Port | Function |
|---|---|---|
| SW4（Reset） | RES# | Resets the MCU. |
| SW2 | PJ3 / IRQ11 | User controllable switch. |
| SW3 | P32 / IRQ2-DS | User controllable switch. |



**Figure 2-9. Push Switch Circuit**

### 2.3.7 LEDs

Table 2-7 provides the connection port and function of each LED. Figure 2-10 shows the LED circuit.

**Table 2-7.   LED Functions and Connections**

| LED | MCU Control Port | Function | Color |
|---|---|---|---|
| LED1 (Power) | VCC | Power status display | Red |
| LED2 | P07 | User LED | Green |
| LED3 | P05 | User LED | Yellow |
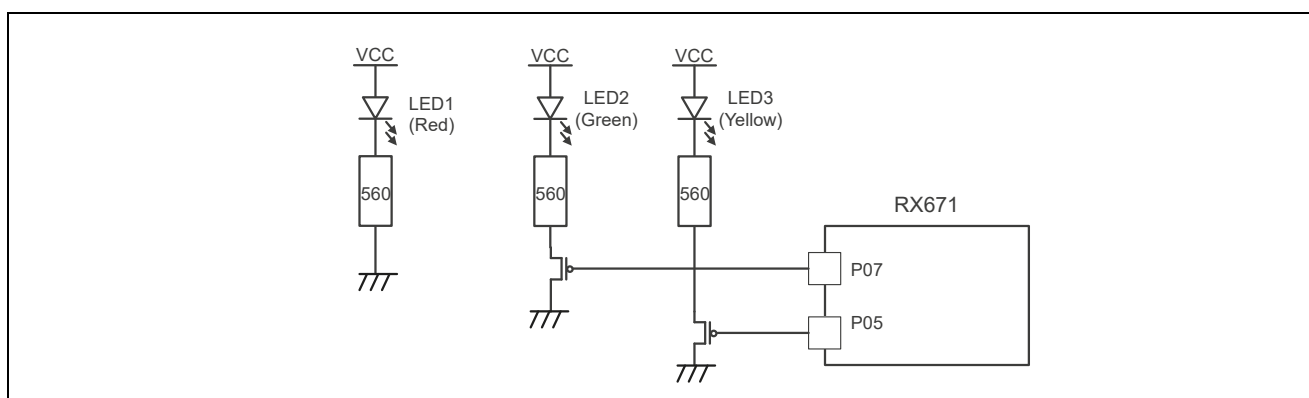


**Figure 2-10.   LED Circuit**

### 2.3.8 USB Serial Conversion
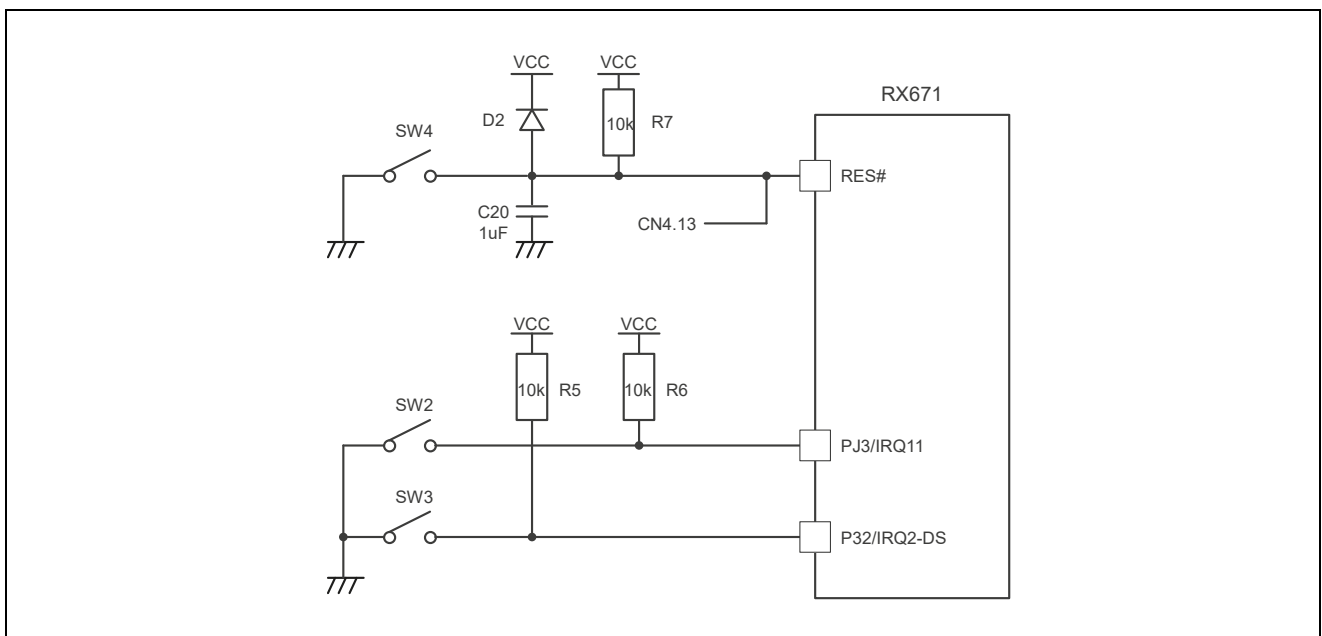
Table 2-8 lists connections for USB serial IC and MCU controller. The RX671 Cap Touch Evaluation System Board is equipped with USB serial IC FT234XD (FTDI Ltd.) for USB serial conversion. The FT234XD is connected to the RX671's serial communication interface (SCI) module.

**Table 2-8   USB Serial Conversion**

| Signal Name | MCU Control Port | Function |
|---|---|---|
| TXD | PE1 / TXD12 | SCI12 transmit data signal |
| RXD | PE2 / RXD12 | SCI12 receive data signal |

### 2.3.9 Debug Interface

The CPU board is equipped with an E2/E2 Lite connector (14-pin box connector) for use as debugging interface. For details, refer to Reference Materials [2].

### 2.3.10    Application Header

The two application headers, CN1 and CN2, can be used as interface for the user's own board.

CN1 is used for GPIO pins. For more details regarding peripheral functions not listed here, refer to the User's Manual Hardware Version.

CN2 is mainly used for CTSU pins. Fix the GPIO pins to low by software. Do not connect anything to TSCAP.

**Table 2-9.    Application Header (CN1)**

| CN1 | MCU | | CN1 | MCU | |
|-----|------|------------|-----|------|------------|
| Pin | Port | Peripheral | Pin | Port | Peripheral |
| 16 | VSS（GND） | | 15 | VCC | |
| 14 | P47 | AN007 | 13 | P46 | |
| 12 | P45 | | 11 | P44 | |
| 10 | PA0 | | 9 | PA5 | |
| 8 | PA6 | | 7 | PA7 | |
| 6 | PE0 | | 5 | PE3 | |
| 4 | PE4 | | 3 | PE7 | MISOB-B |
| 2 | PE5 | RSPCKB-B | 1 | PE6 | MOSIB-B |

**Table 2-10.    Application Header (CN2)**

| CN2 | MCU | | CN2 | MCU | |
|-----|------|------|-----|------|------|
| Pin | Port | CTSU | Pin | Port | CTSU |
| 40 | PC4 | TSCAP | 39 | — | — |
| 38 | — | — | 37 | — | — |
| 36 | PC0 | TS16 | 35 | PB5 | — |
| 34 | PC1 | TS15 | 33 | PB6 | — |
| 32 | PB7 | — | 31 | PC5 | TS14 |
| 30 | PC3 | — | 29 | PC2 | — |
| 28 | PC6 | TS13 | 27 | P50 | — |
| 26 | PC7/UB (Note) | — | 25 | P51 | — |
| 24 | P52 | — | 23 | P54 | — |
| 22 | P53 | TS12 | 21 | P14 | TS11 |
| 20 | P55 | — | 19 | PH1 | — |
| 18 | PH2 | — | 17 | P12 | — |
| 16 | P15 | TS10 | 15 | P13 | — |
| 14 | P16 | — | 13 | P31/TMS | — |
| 12 | P30/TDI/RXD1 | — | 11 | P17 | — |
| 10 | P20 | TS9 | 9 | P21 | TS8 |
| 8 | P22 | TS7 | 7 | P23 | TS6 |
| 6 | P24 | TS5 | 5 | P25 | TS4 |
| 4 | P33 | TS1 | 3 | P26/TDO/TXD1 | TS3 |
| 2 | P34/TRST# | TS0 | 1 | P27/TCK | TS2 |

ー : Not Applicable

### 2.3.11    CTSU Related Circuits

#### 2.3.11.1 CTSU correction circuit

This circuit improves the absolute accuracy of the CTSU's capacitive measurement. The resistor and control software required for the correction function are sold separately. When not using the correction control software, no resistor is necessary.

**Table 2-11.    CTSU Correction Circuit Settings**

| Reference | MCU Control Port | Default Setting | Spec | Package |
|---|---|---|---|---|
| R10 | P43 | Not mounted | 100K Ohm | 1.6mm x 0.8mm SMD |
| R11 | P42 | Not mounted | 68K Ohm | |
| R12 | P41 | Not mounted | 51K Ohm | |
| R13 | P40 / AN000 | Not mounted | 0 Ohm | |

### 2.3.12    Pmod Interface

Table 2-12 lists connections PMOD1 pin assignments. Header PMOD1 is the interface for Pmod Type 2A and Type 3A. PMOD1 can also be used for Pmod Type 6A by using the Pmod interface switch circuit. When connecting the Pmod module, check the pin position and be careful not to misalign the pin position or stick it backwards.

**Table 2-12.    PMOD1 Pin Assignments**

| Pin | Type 2A/3A Function | MCU Port | Pin | Type 6A Function | MCU Port |
|---|---|---|---|---|---|
| 1 | CS/CTS | PB2/CTS6#/SS6# | 1 | NC | PB2/CTS6#/SS6# |
| 2 | MOSI/TXD | PB1/SMOSI6/TXD6/SSDA6 (Note) | 2 | NC | PB3/SCK6 (Note) |
| 3 | MISO/RXD | PB0/SMISO6/RXD6/SSCL6 | 3 | SCL | PB0/SMISO6/RXD6/SSCL6 |
| 4 | SCK/RTS | PB3/SCK6 (Note) | 4 | SDA | PB1/SMOSI6/TXD6/SSDA6 (Note) |
| 5 | GND | VSS(GND) | 5 | GND | VSS(GND) |
| 6 | VCC | VCC | 6 | VCC | VCC |
| 7 | GPIO | PA2 | 7 | GPIO | PA2 |
| 8 | GPIO | PA4/TXD5 | 8 | GPIO | PA4/TXD5 |
| 9 | GPIO | PA3/RXD5 | 9 | GPIO | PA3/RXD5 |
| 10 | GPIO | PA1/SCK5 | 10 | GPIO | PA1/SCK5 |
| 11 | GND | VSS(GND) | 11 | GND | VSS(GND) |
| 12 | VCC | VCC | 12 | VCC | VCC |

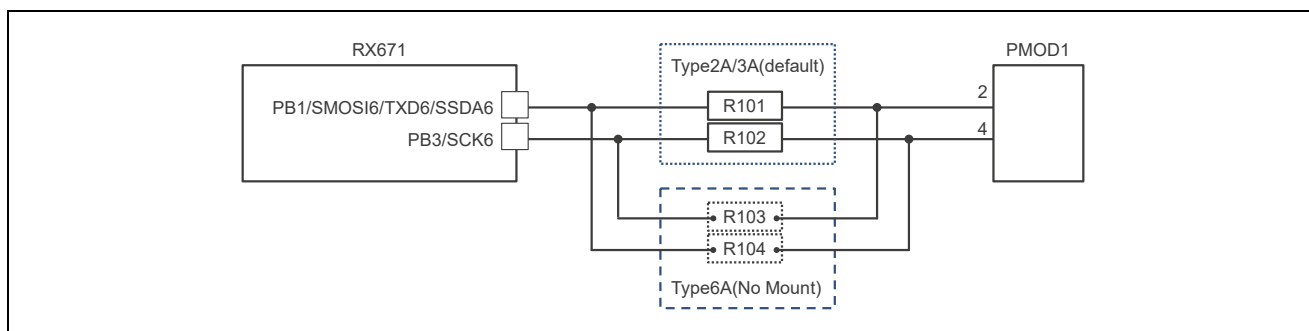Note: Replace resistors of R101, R102, R103, and R104.



**Figure 2-11.    PMOD1 Interface Switch Circuit**

Table 2-13 lists connections PMOD2 pin assignments.

**Table 2-13. PMOD2 Pin Assignments**

| Pin | Type2A Function | MCU Port |
|-----|-----------------|----------|
| 1 | CS | PD4/SSLC0-A |
| 2 | MOSI | PD1/MOSIC-A |
| 3 | MISO | PD2/MISOC-A |
| 4 | SCK | PD3/RSPCKC-A |
| 5 | GND | VSS(GND) |
| 6 | VCC | VDD |
| 7 | GPIO | PD0/IRQ0 |
| 8 | GPIO | PD5/SSLC1-A |
| 9 | GPIO | PD6/SSLC2-A |
| 10 | GPIO | PD7/SSLC3-A |
| 11 | GND | VSS(GND) |
| 12 | VCC | VCC |

# 3. Application Board (Self-Capacitance Electrode Board)

## 3.1 Board Layout

Figure 3-1 shows the layout of the application board.
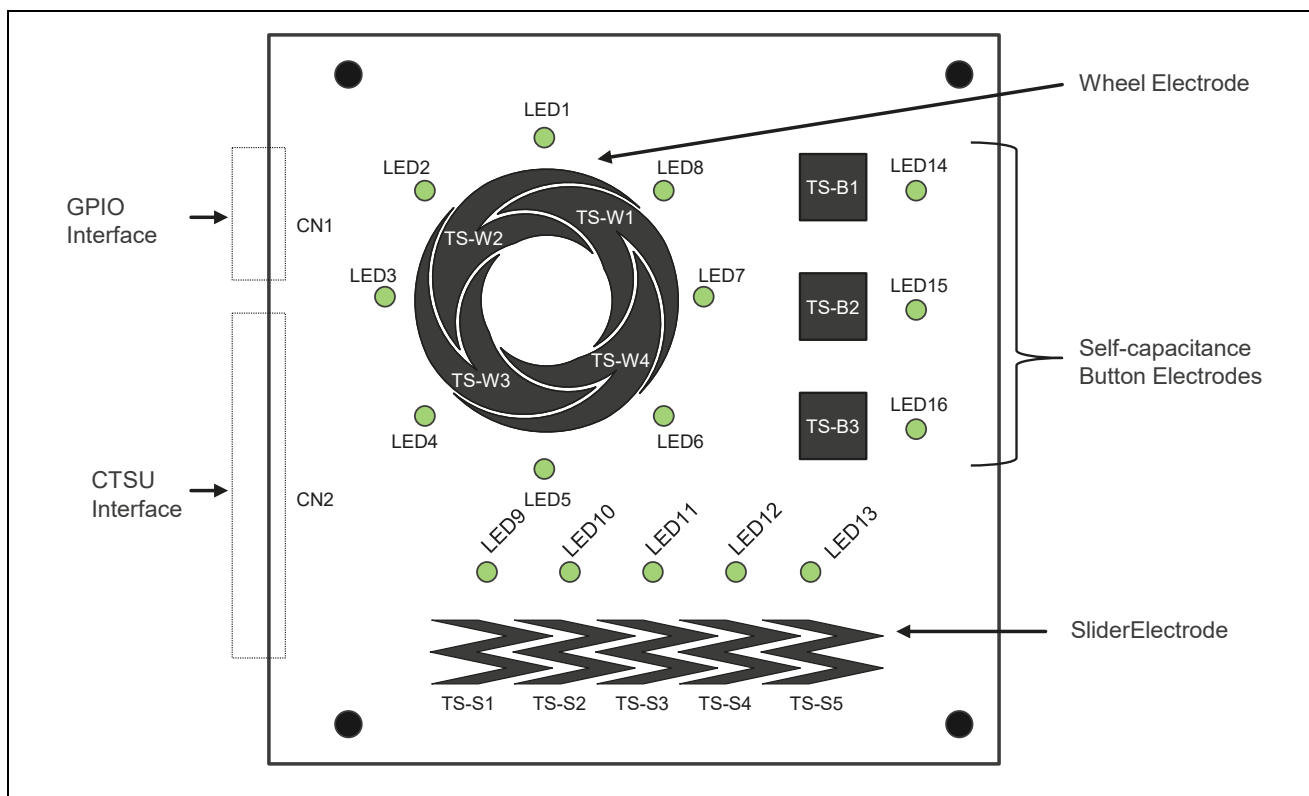


**Figure 3-1. Board Layout and TS Pin Assignments**

## 3.2 Application Headers

Application headers CN1 and CN2 are the interface for connection to the Renesas Capacitive Touch Evaluation System CPU board. Table 2-9 lists the pin assignments for CN1. Table 2-10 lists the pin assignments for CN2.

**Table 3-1. Application Header (CN1)**

| Pin | Function | MCU Connection | Pin | Function | MCU Connection |
|-----|----------|----------------|-----|----------|----------------|
| 15 | LED_VCC | VCC | 16 | LED_VSS（GND） | VSS（GND） |
| 13 | LED_ROW0 | P46 | 14 | LED_ROW1 | P47 |
| 11 | LED_ROW2 | P44 | 12 | LED_ROW3 | P45 |
| 9 | — | — | 10 | — | — |
| 7 | LED_COL3 | PA7 | 8 | — | — |
| 5 | LED_COL1 | PE3 | 6 | LED_COL2 | PE0 |
| 3 | — | — | 4 | LED_COL0 | PE4 |
| 1 | — | — | 2 | — | — |

－ : Not Applicable

**Table 3-2.    Application Header (CN2)**

| Pin | Touch Electrode | CTSU (RX671) (Note1) | Pin | Touch Electrode | CTSU (RX671) (Note1) |
|---|---|---|---|---|---|
| 39 | — | — | 40 | — | TSCAP |
| 37 | — | — | 38 | — | — |
| 35 | — | — | 36 | TS-W1 | TS16 |
| 33 | — | — | 34 | TS-W2 | TS15 |
| 31 | TS-W3 | TS14 | 32 | — | — |
| 29 | — | — | 30 | — | — |
| 27 | — | — | 28 | TS-W4 | TS13 |
| 25 | — | — | 26 | — | — |
| 23 | — | — | 24 | — | — |
| 21 | — | — | 22 | SHIELD-W1 | P53 (Note2) |
| 19 | — | — | 20 | — | — |
| 17 | — | — | 18 | — | — |
| 15 | — | — | 16 | — | |
| 13 | — | — | 14 | — | — |
| 11 | — | — | 12 | — | — |
| 9 | TS-B1 | TS8 | 10 | TS-B2 | TS9 |
| 7 | SHIELD-B1 | P23 (Note2) | 8 | TS-B3 | TS7 |
| 5 | TS-S1 | TS4 | 6 | SHIELD-S1 | P24 (Note2) |
| 3 | TS-S3 | TS3 | 4 | TS-S2 | TS1 |
| 1 | TS-S5 | TS2 | 2 | TS-S4 | TS0 |

－ : Not Applicable

Note 1: Set output of all unassigned pins to low by software.

Note 2: SHIELD-S1, SHIELD-W1 and SHIELD-B1 are shield electrodes. To enable the function, set the pin to low by software.

# 4.    Reference Materials

[1].    Renesas RX671 Group User's Manual: Hardware (01UH0899)

[2].    E1/E20/E2 Emulator, E2 Emulator Lite Additional Document for User's Manual (Notes on Connection of RX Devices) (R20UT0399)

# 5.      Additional Information

**Support**

Refer to the Integrated Development Environment help menu for more information on how to use the IDE.

Refer to the RX671 Group User's Manual Hardware Version for more information on RX671 Group MCUs.


For general information on Renesas mirccontrollers, visit : https://www.renesas.com/


**Trademarks**

All trade names and product names used in this document are trademarks or registered trademarks of their

respective companies or organizations.


**Copyright**

All or part of this manual may be changed without notice.

Renesas Electronics Corporation holds the copyright for this document.

Reproduction, in whole or in part, without the written consent of Renesas Electronics Corporation is

prohibited.


© 2022 Renesas Electronics Corporation.

# Appendix: Self-Capacitance Touch Electrode Board Connection

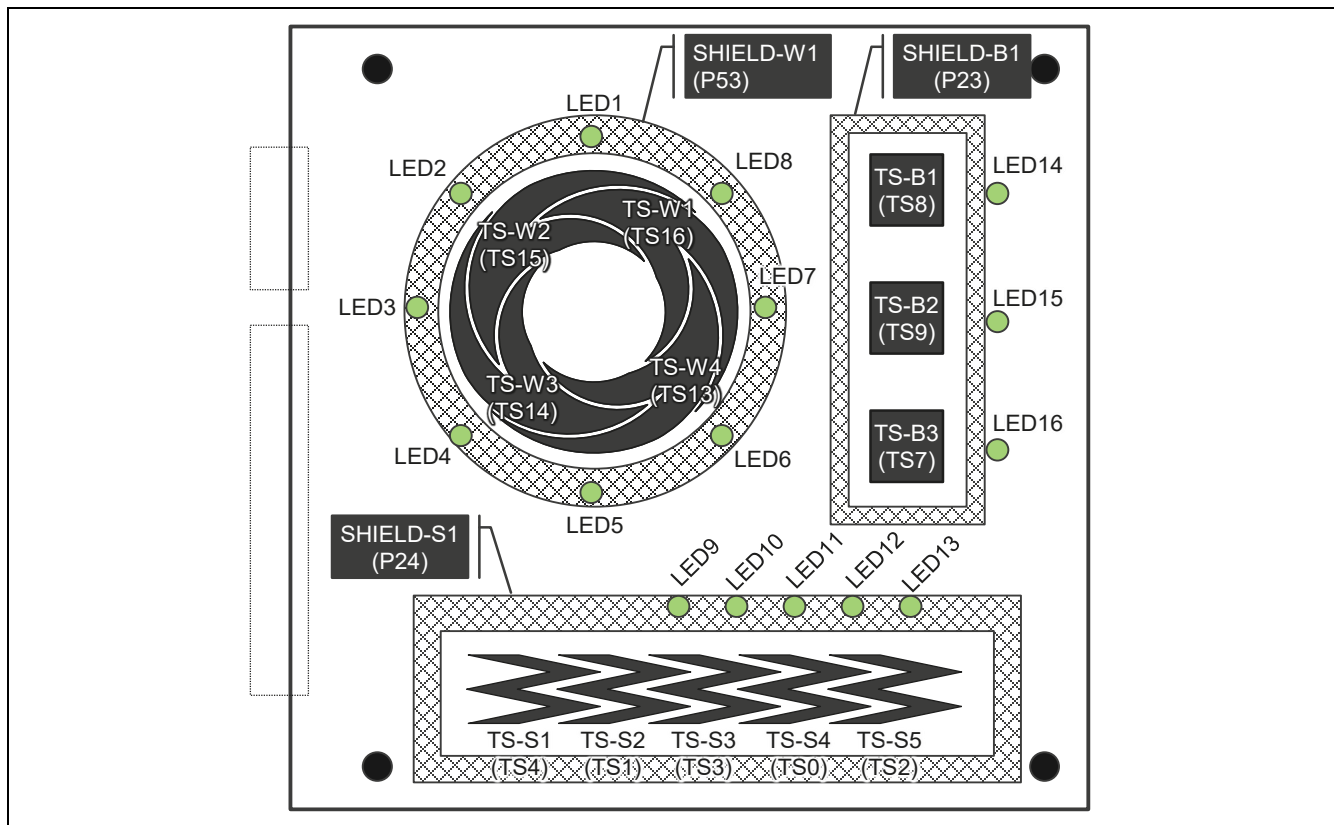The following describes how to use the Renesas Self-Capacitance Touch Electrode Board (RTK0EG0019B01002BJ).



**Figure 2. Board Layout and TS Pin Assignments**

**Table 1. TS Pin (CN2) Assignments**

| Touch Electrode | CTSU (RX671) | Description |
|---|---|---|
| TS-W1 | TS16 | Wheel Electrode |
| TS-W2 | TS15 | |
| TS-W3 | TS14 | |
| TS-W4 | TS13 | |
| SHIELD-W1 | P53 (Note) | Wheel Shield Electrode |
| TS-B1 | TS8 | Button Electrode |
| TS-B2 | TS9 | |
| TS-B3 | TS7 | |
| SHIELD-B1 | P23 (Note) | Button Shield Electrode |
| TS-S1 | TS4 | Slider Electrode |
| TS-S2 | TS1 | |
| TS-S3 | TS3 | |
| TS-S4 | TS0 | |
| TS-S5 | TS2 | |
| SHIELD-S1 | P24 (Note) | Slider Shield Electrode |

Note: Set the pin to low by software.

**Table 2. TS Pin (CN2) Assignments**

| Signal | RX671 Port | Description |
|---|---|---|
| LED_ROW0 | P46 | LED Matrix, High Side Transistor Drive |
| LED_ROW1 | P47 | |
| LED_ROW2 | P44 | |
| LED_ROW3 | P45 | |
| LED_COL0 | PE4 | LED Matrix, Low Side Transistor Drive |
| LED_COL1 | PE3 | |
| LED_COL2 | PE0 | |
| LED_COL3 | PA7 | |
| LED_VCC | VCC | VCC |
| LED_GND | GND | GND |

**Table 3. LED Matrix Table**

| | LED_COL0 | LED_COL1 | LED_COL2 | LED_COL3 |
|---|---|---|---|---|
| LED_ROW0 | LED1 | LED5 | LED13 | LED9 |
| LED_ROW1 | LED2 | LED6 | LED14 | LED10 |
| LED_ROW2 | LED3 | LED7 | LED15 | LED11 |
| LED_ROW3 | LED4 | LED8 | LED16 | LED12 |

**Table 4. LED Status and Pin Output Settings**

| LED | LED_ROWn Connection Pin | LED_COLn Connection Pin |
|---|---|---|
| On | Low | High |
| Off | High | Low |

Note: n=0~3

| Revision History | RX671 Group Capacitive Touch Evaluation System<br>User's Manual |
| --- | --- |

| Rev. | Date | Description | |
| --- | --- | --- | --- |
| | | **Page** | **Summary** |
| 1.00 | Sep.30.22 | — | First Edition issued |
| | | | |