User's Manual

16

RL78/F22

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

16-Bit Single-Chip Microcontrollers

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

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

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

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 RL78/F22 Capacitive Touch Evaluation System (RTK7F122FGST0000BJ). 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.

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Precautions

This Evaluation Kit is only intended for use in a laboratory environment under ambient temperature and humidity conditions. A safe separation distance should be used between this and any sensitive equipment. Its use outside the laboratory, classroom, study area, or similar such area invalidates conformity with the protection requirements of the Electromagnetic Compatibility Directive and could lead to prosecution.

The product generates, uses, and can radiate radio frequency energy and may cause harmful interference to radio communications. There is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off or on, you are encouraged to try to correct the interference by one or more of the following measures:

• Ensure attached cables do not lie across the equipment.

• Reorient the receiving antenna.

• Increase the distance between the equipment and the receiver.

• Connect the equipment into an outlet on a circuit different from that which the receiver is connected.

• Power down the equipment when not in use.

• Consult the dealer or an experienced radio/TV technician for help.

Note: It is recommended that wherever possible shielded interface cables are used.

The product is potentially susceptible to certain EMC phenomena. To mitigate against them it is recommended that the following measures be undertaken:

• The user is advised that mobile phones should not be used within 10 m of the product when in use.

• The user is advised to take ESD precautions when handling the equipment.

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

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:

The ⃠ mark indicates something that is forbidden.

Example:

Warning

⚠ Warning
Handling related warnings:  Do not disassemble or modify this product. Renesas does not guarantee this product if it has been disassembled or modified. 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. 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:  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:  The upper limit for the ambient temperature under which this product may be used is 35°C. 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 JP2 (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”.

Electromagnetic Environment

⚠Electromagnetic Environment

⚠

- This product generates electromagnetic emissions in an industrial environment. Use in a residential environment may affect other equipment.
- This product requires special EMC precautions and should be used in accordance with the EMC information provided below.

EMI: Electro Magnetic Interference			
Standard		Level	Guidance for EMC protection
Test Item	EN 55011 :2016/A1:2017/A2:2021	Group1 Class A	This product has no intentional external emissions, but internal RF emissions may affect nearby electromagnetically sensitive electronic equipment.
Radiated Emissions			
Conducted Emissions			

EMS: Electro Magnetic Susceptibility			
Standard		Level	Guidance for EMC protection
Radio Frequency Electromagnetic Field	EN IEC 61000-4-3: 2020	A[*1]	This product is intended for use in electromagnetic environments in industrial settings. The user of the product should pay particular attention to the following electromagnetic immunity. ・Power supply quality ・Protection against static electricity ・Protection against external high-power radio waves ・Protection against external magnetic fields
Electrical Fast Transient / Burst	EN 61000-4-4: 2012	B[*2]	
Surge	EN 61000-4-5: 2014/A1:2017	B[*3]	
Conducted Disturbance, Induced by Radio Frequency	EN 61000-4-6:2014	A[*4]	
Power Frequency Magnetic Field	EN 61000-4-8: 2010	A[*5]	
Voltage Dips and Interruptions	EN IEC 61000-4-11: 2020	B or C[*6]	

*1 Test Condition of Radio Frequency Electromagnetic Field

Test Level	Dwell Time	Modulation	Frequency Step	Antenna Polarization	Result
3V/m (80MHz – 1.0GHz)	1.0sec	1kHz AM 80%	1.0%	Horizontal / Vertical	Pass
3V/m (1.4GHz – 6.0GHz)					Pass

*2 Test Condition of Electrical Fast Transient / Burst

Test Level	Wave Form	Repetition Frequency	Testing Duration	Result
±1.0kV	Rise time: 5.0nsec Pulse Duration: 50nsec	5kHz	60sec	Pass
		100kHz		Pass

*3 Test Condition of Surge

Test Level	Wave form Specification	Phase Angle	Result
±0.5kV	Front time: 1.2 / 8.0 μsec Time to half value: 50 / 20 μsec	0º, 90º,180º, 270º	Pass
			Pass

*4 Test condition of Conducted Disturbance, Induced by Radio Frequency

Test Level	Dwell Time	Modulation	Frequency Step	Result
3V (0.15MHz – 80MHz)	1.0 sec	1kHz AM 80%	1.0%	Pass

*5 Test Condition of Power Frequency Magnetic Field

Test Level	Applied Power Frequency	Test Duration	Result
3A/m (rms)	50Hz	60sec	Pass
	60Hz		Pass

*6 Test Condition of Voltage Dips and Interruptions

Test Item	Test Level	Duration	Phase Angle	Result
Voltage Dips	0%	0.5 cycles	0º, 180º	Pass
		1.0 cycles		Pass
	70%	25 cycles		Pass
Voltage Interruptions	0%	250 cycles		Pass

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RL78/F22
Capacitive Touch Evaluation System User's Manual

1. Overview

1.1 Purpose

The RL78/F22 Capacitive Touch Evaluation System (RTK7F122FGST0000BJ) is a kit created for evaluating the RL78/F22 Capacitive Touch Sensing Unit (CTSU). This manual describes the RL78/F22 Capacitive Touch Evaluation System's hardware.

1.2 Main Characteristics and Functions

The main functions of the RL78/F22 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 (CTSU2SLa)
  - 12 channels available
- 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
Model name	RTK7F122FGCT0000BJ
MCU	Model No.: R7F122FGG
	Package: 48-pin LFQFP
	On-chip memory: ROM 128 KB, RAM 12 KB, Data flash memory 8 KB
	High-speed on-chip oscillator (f_{IH}): Max. 40 MHz
Input clock	Main clock: 2 MHz to 20 MHz (option)
	Sub clock: 32.768 KHz (option)
Power supply	Operation voltage: 3.3 V to 5.0 V • DC jack: 7 V to 12 V (+/- 5 %) • USB bus powerd (VBUS): 5 V
Debug interface	Renesas Electronics E2/E2 Lite 14-pin box header
Push switches	Reset switch × 1
	User switches × 2
LEDs	Power status: Red × 1
	User LEDs: Green × 2
USB serial conversion interface	Connector: USB Type C
	Driver: FT234XD USB serial IC (manufactured by FTDI)
Application board interface (GPIO)	2.54 mm pitch, 16 pins × 1 (CN1)
Application board interface (CTSU)	2.54 mm pitch, 40 pins × 1 (CN2)
MCU interface	2.54 mm pitch, 20 pins × 2 (CN6, CN7: option)
Current consumption	500 mA or less (Total value when all interfaces are used)
Operating temperature range	When operating: 10 to 35 [°C], In storage: - 10 to 50 [°C] (no condensation)
Board dimensions (L × W × H)	89 mm × 95 mm × 18 mm (including connectors)

Table 1-2 Application Board Specifications

Item	Specifications
Model name	RTK0EG0019B01002BJ
Self-capacitance detection touch electrodes	• Buttons: 3 • Wheel (4-electrode configuration): 1 • Sliders (5-electrode configuration): 1
Touch electrode shields	1 shield each for button, wheel, and slider areas
LEDs	16
Renesas MCU Cap Touch CPU board interface	• 2.54 mm pitch, 16 pins × 1 (CN1) • 2.54 mm pitch, 40 pins × 1 (CN2)
Overlay panel	2mm-thick acrylic panel
Current consumption	500 mA or less
Operating temperature range	When operating: 10 to 35 [°C], In storage: - 10 to 50 [°C] (no condensation)
Board dimensions (L × W × H)	110 mm × 116 mm × 11 mm (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
EN IEC 61326-1: 2021 Group1 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.

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    Address: Toyosu Foresia, 3-2-24, Toyosu, Koto-ku, Tokyo 135-0061, Japan
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  ・ Trademark and Type name
    Trademark: Renesas
    Product name: RL78/F22 Group Capacitive Touch Evaluation System
    Type name: RTK7F122FGST0000BJ

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.

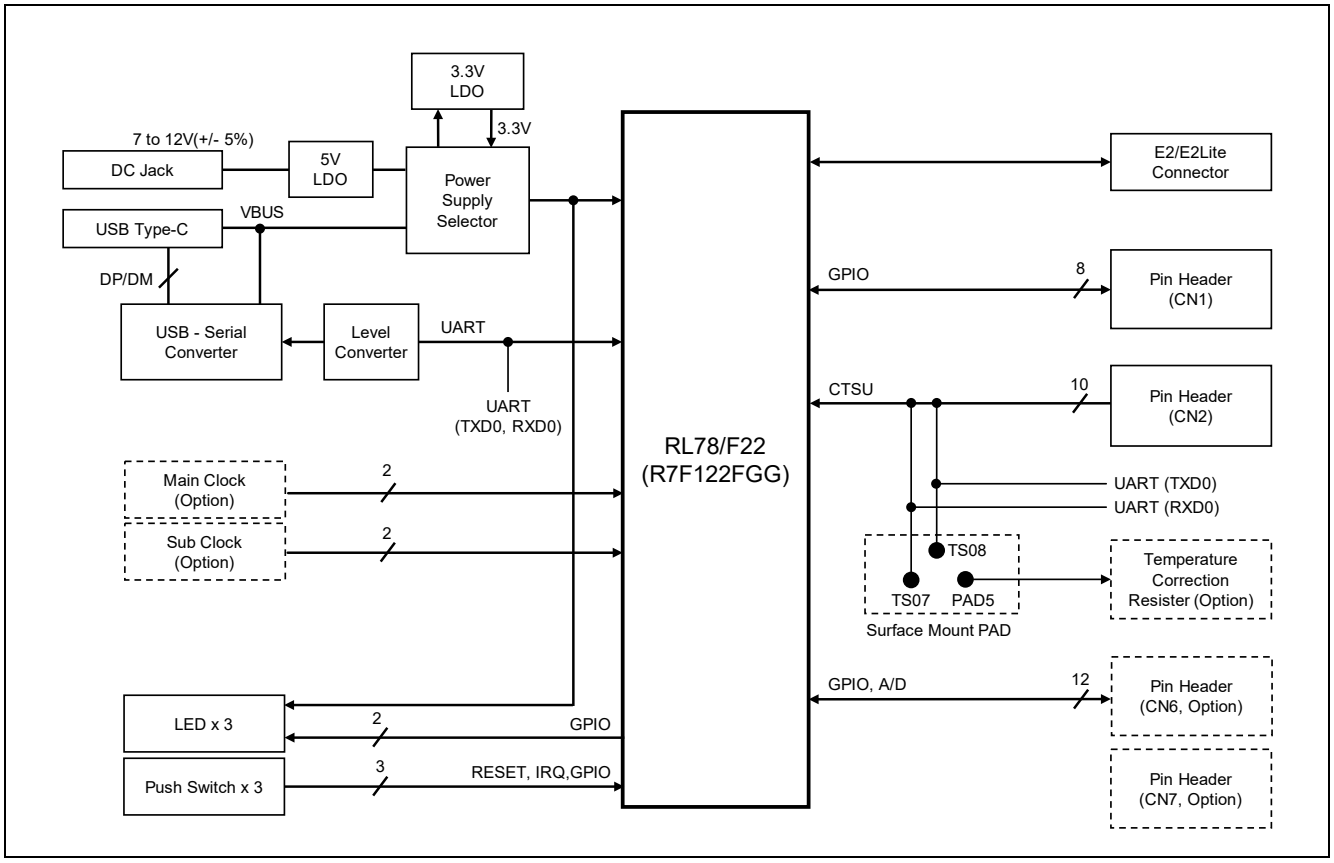

Figure 2-1. System Block Diagram

2.2 Product Configuration

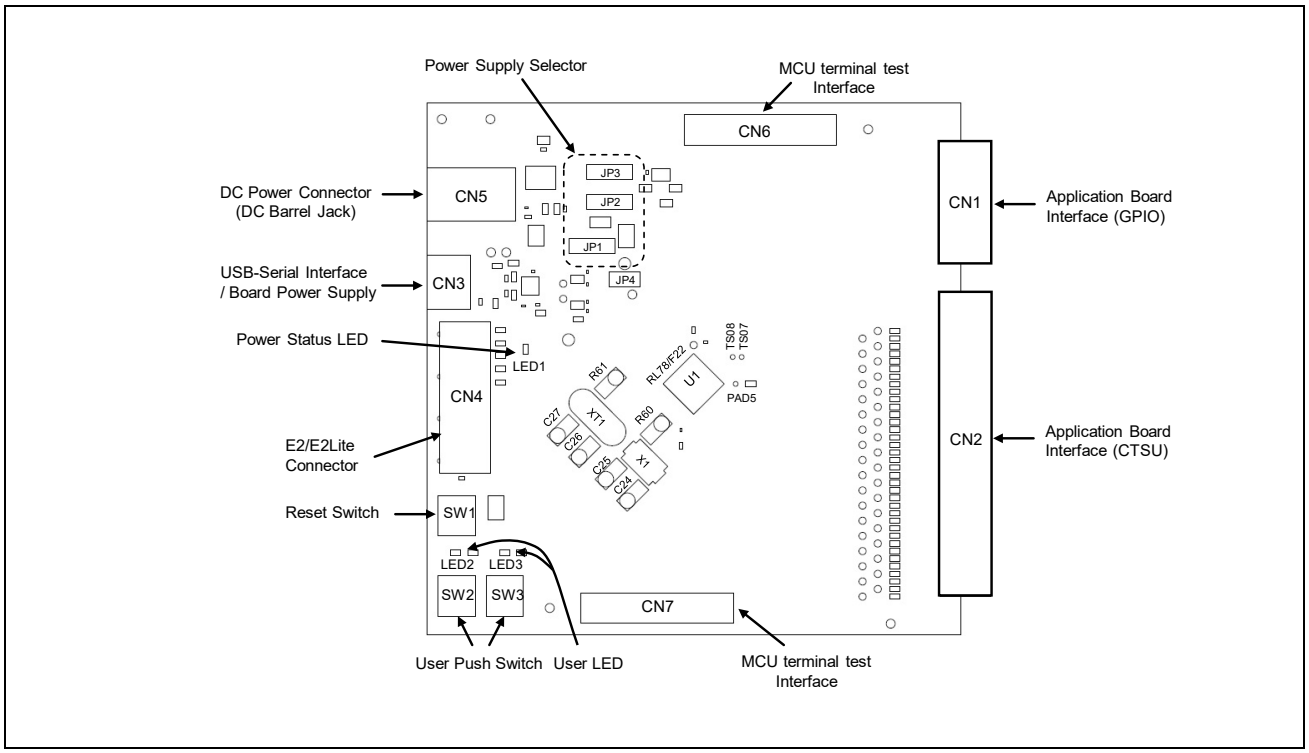

Figure 2-2. RL78/F22 Cap Touch CPU System Board (Top side)

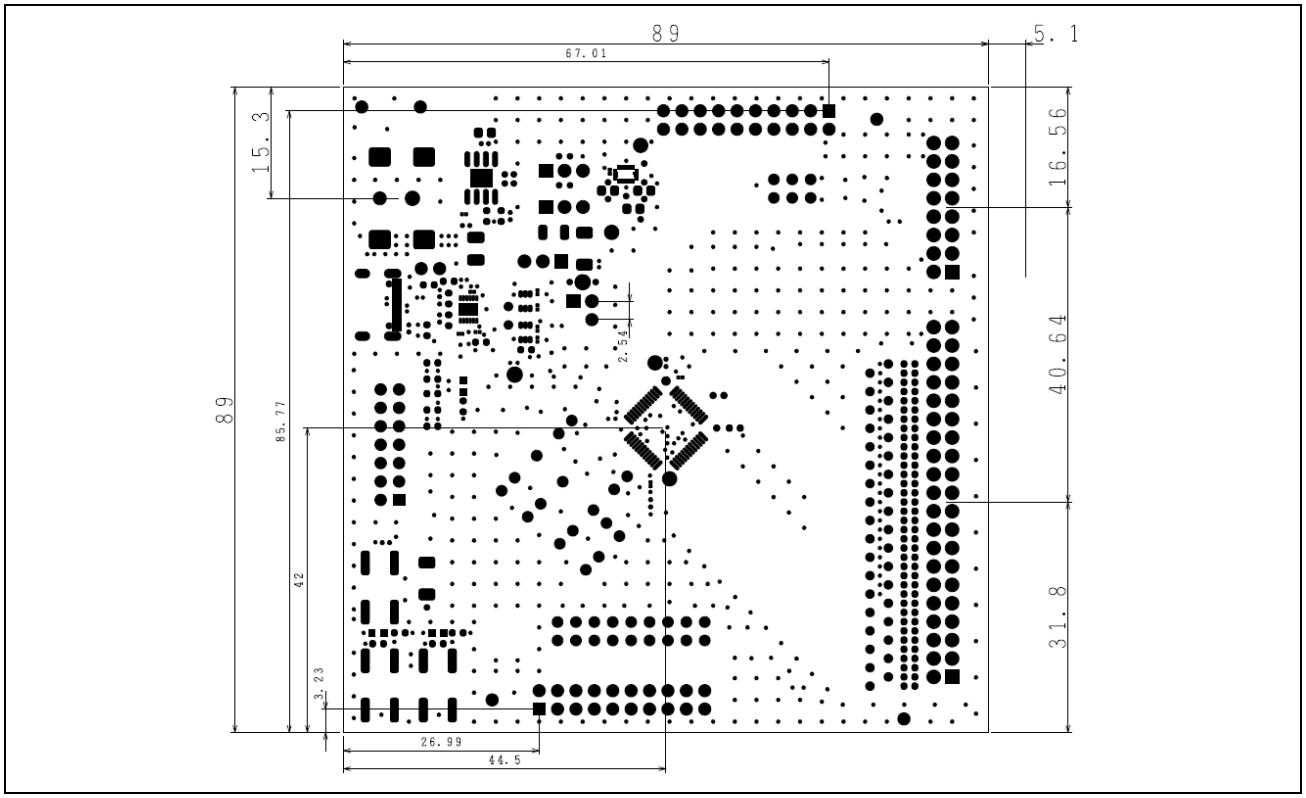

Figure 2-3. RL78/F22 Cap Touch CPU System Board Dimensions

2.3 Hardware Details

2.3.1 Default Jumper and Slide Switch Settings

Figure 2-4 shows the default positions of the jumpers and slide switches.

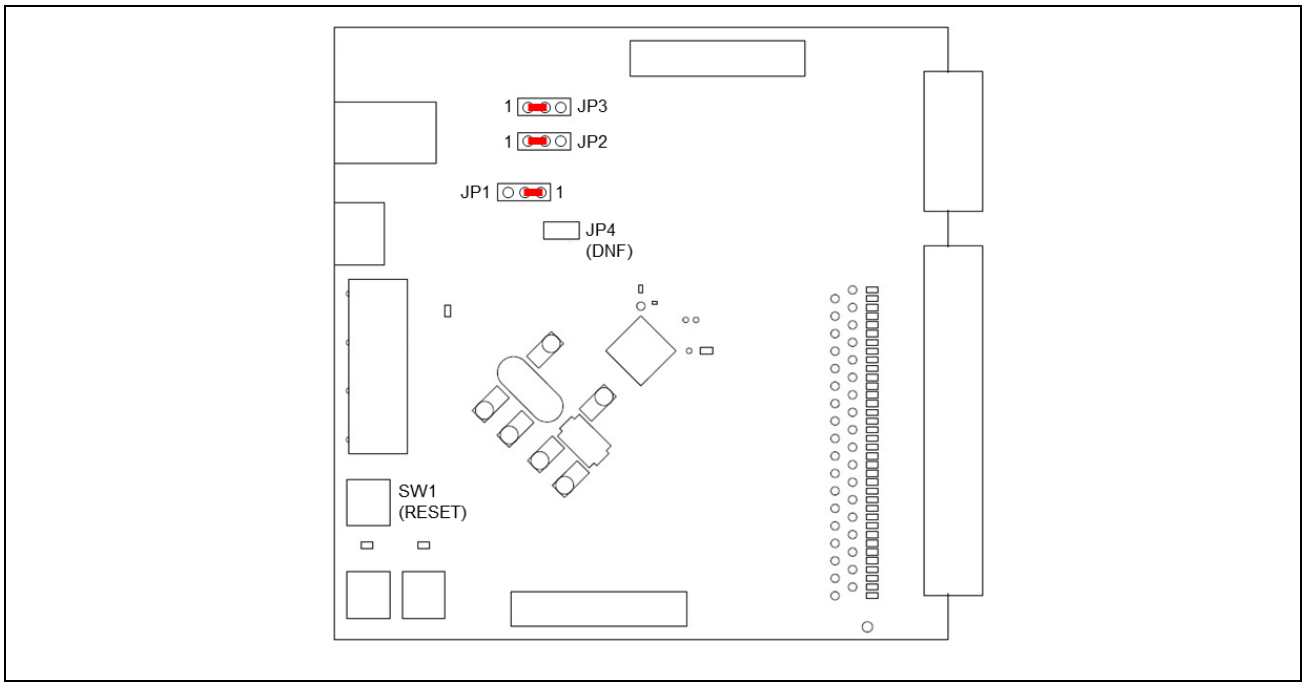

Figure 2-4. Default Jumper Positions

Table 2-1 Default Jumper and Slide Switch Settings

Reference	Overview	Default state	Description
JP1	Power supply (USB or DC jack)	Supplies USB power to board	2.3.2 Power Supply
JP2, 3	Use of LDO (3.3 V)	LDO not used	

2.3.2 Power Supply

Table 2-2 provides the power supply jumper settings. Figure 2-5 the power source system diagram. Use jumpers (JP1, 2, 3, and 4) to select the power supply to be used. This CPU board can be supplied with power by USB or a 2.1mm DC barrel jack connector (center: + pin).

Table 2-2 Power Supply Source Jumper Settings

Reference	Jumper setting	Default setting (X)	Description
JP1	Shorted Pin 1-2	X	Select USB power supply for CPU board power supply
	Shorted Pin 2-3		Select DC jack (CN5) power supply for CPU board power supply
JP2, JP3	Shorted Pin 1-2	X	Select JP1 power supply for CPU board power supply
	Shorted Pin 2-3		Select LDO (3.3 V) for CPU board power supply
JP4 / PAD1	Shorted	X	Provides board power to the MCU
	Open		MCU current consumption measurement setting

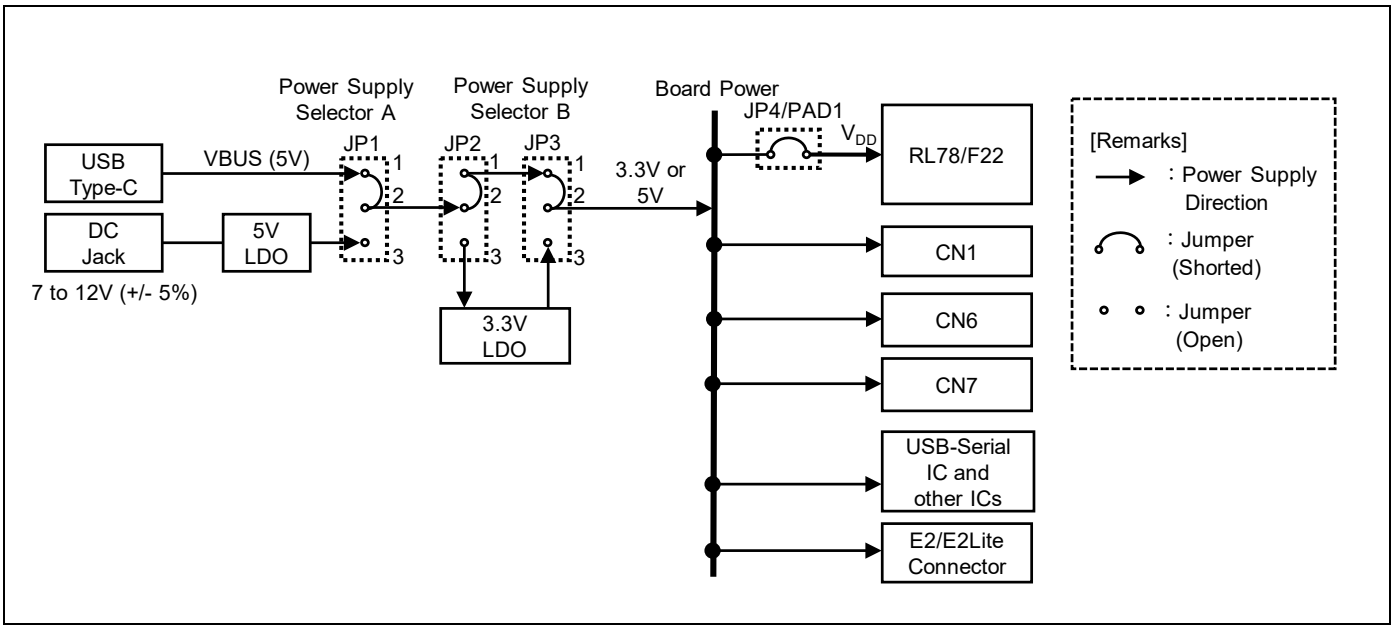

Figure 2-5. Power Supply System Diagram

2.3.3 Clock Circuit

This CPU board does not have an oscillator mounted on X1 and XT1. This CPU board is equipped with a socket so that an oscillator circuit can be mounted if necessary. In addition, the capacitors and resistors in the clock circuit are implemented via sockets as shown in Figure 2-6. The initial implementation of these pins is in the unused pin processing state. When using an external oscillator, please change these as well.

Table 2-3 Clock Circuit Specifications

Reference	Function	Default state	Frequency	Socket type
X1	Main clock	Not mounted	2 to 20 MHz	3-pin (2.54 mm pitch)
XT1	Sub clock	Not mounted	32.768 kHz	2-pin (5.08 mm pitch)

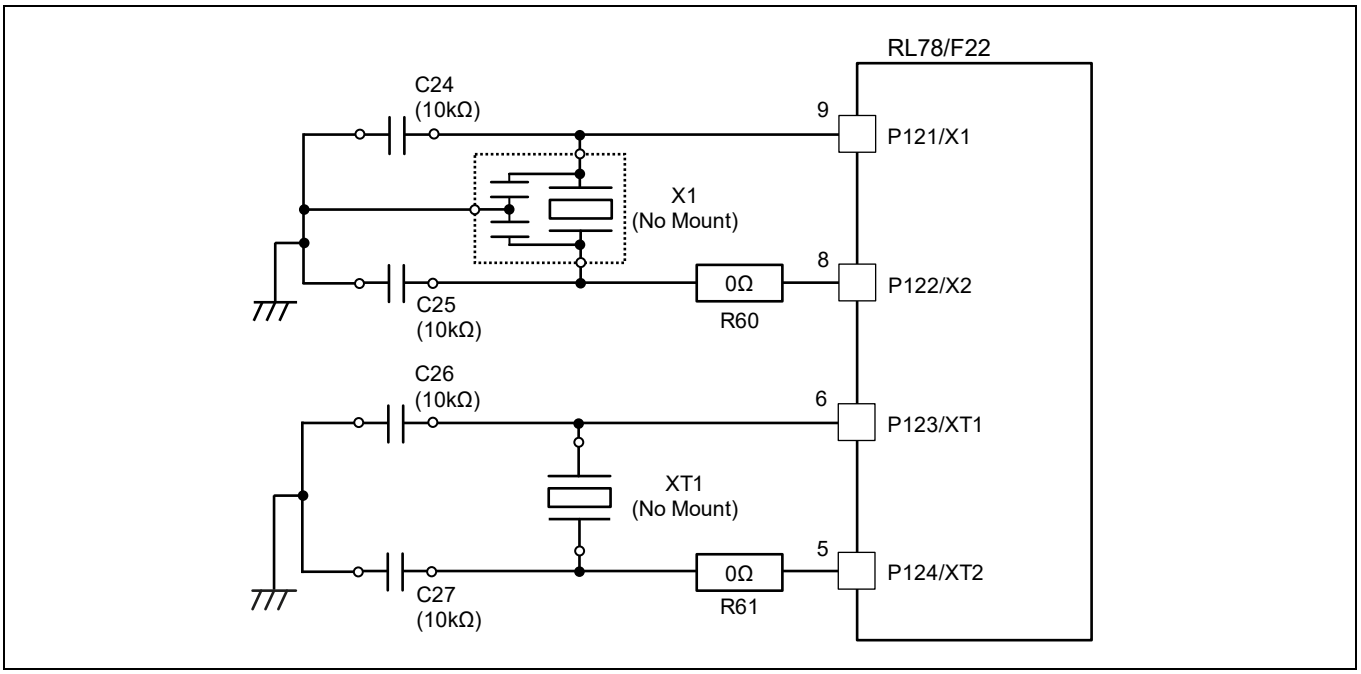

Figure 2-6. Clock Circuit

2.3.4 Reset Circuit and On-chip Debug Interface

This CPU board can generate a reset signal using the reset switch (SW1) on the CPU board.
This CPU board provides E2/E2 Lite emulator connector (14-pin box connector) for the debug interface.
Figure 2-7 shows the connection diagram between RL78/F22 product and debug interface connector (CN4).
For details on the debug interface, see [2] in "4. Reference Materials".

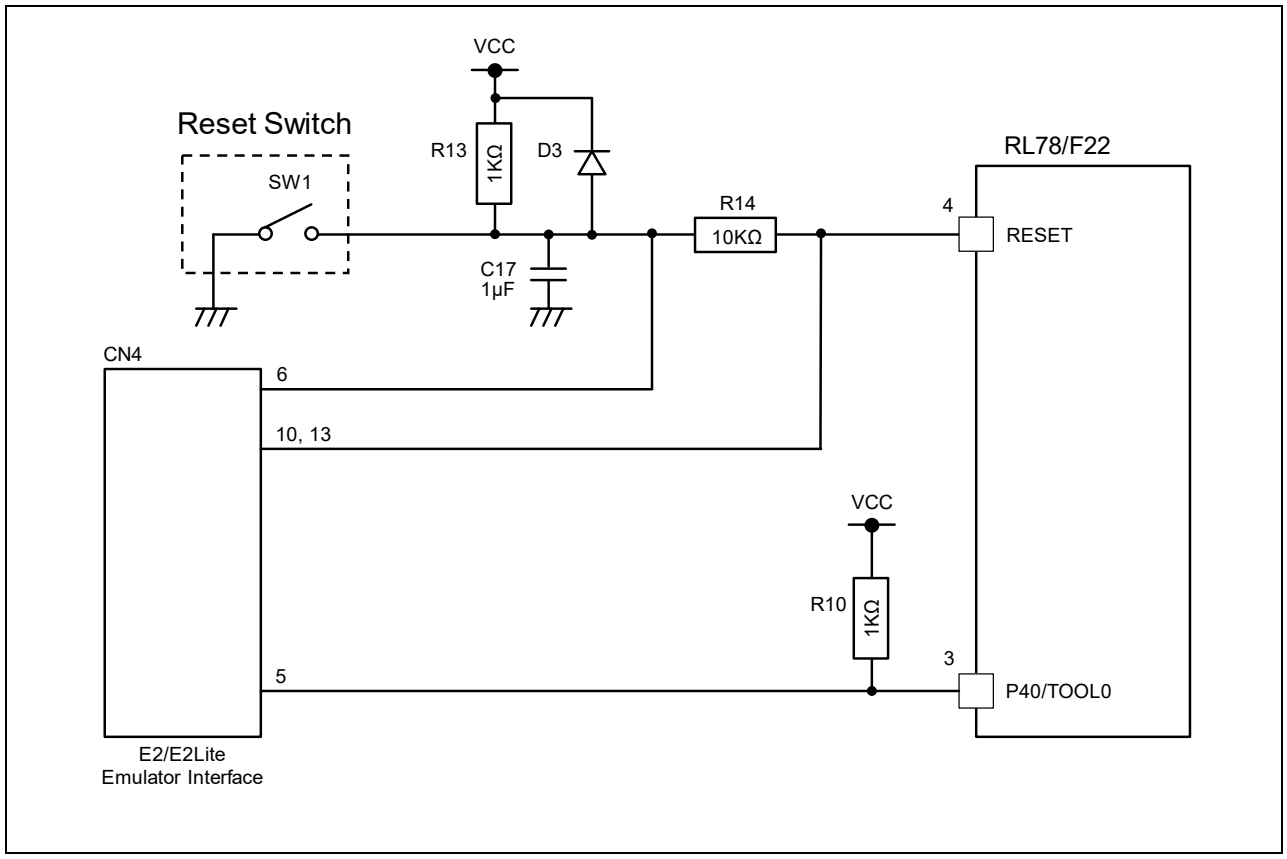

Figure 2-7. Reset Circuit and Debug Interface

2.3.5 Push Switch and LED Specifications

Table 2-4 Push Switch Specifications

Switch	Connection to MCU	Function
SW1 (Reset)	RESET	Resets the MCU.
SW2	P11	User controllable switch.
SW3	P137/INTP0	User controllable switch.

Table 2-5 LED Specifications

LED	Connection to	Function	Color
LED1 (Power)	VCC	Power supply status	Red
LED2	P41	User controllable LED	Green
LED3	P120	User controllable LED	Green

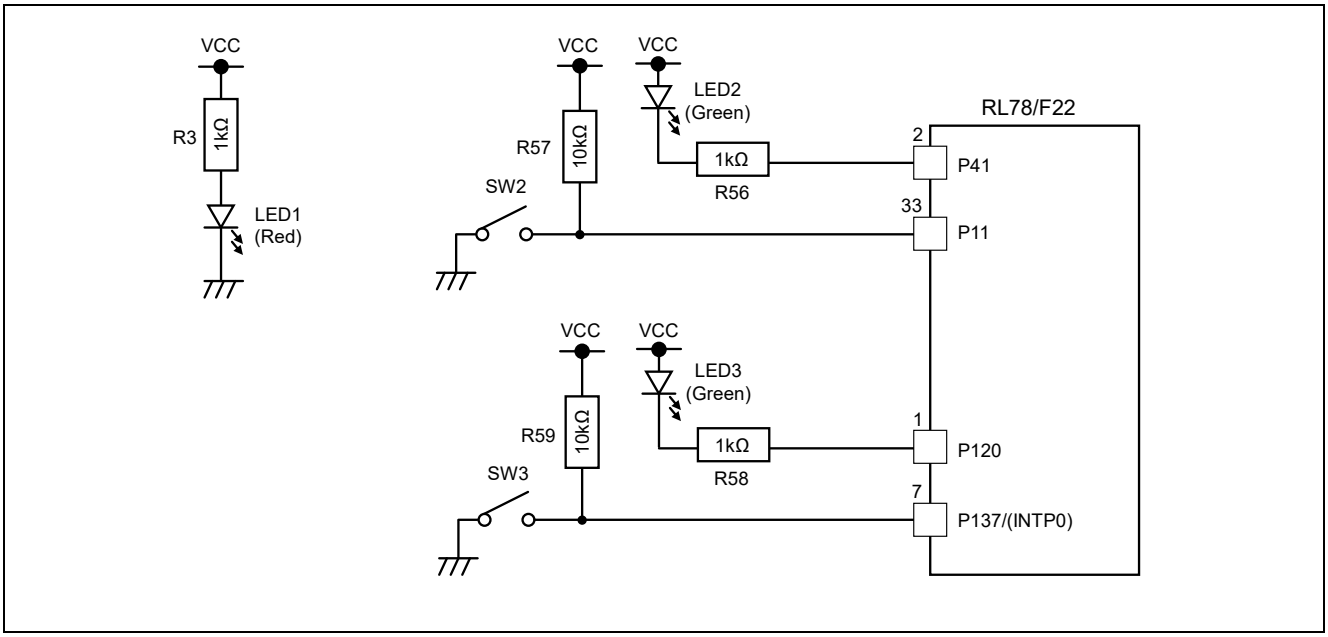

Figure 2-8. Push Switch and LED Circuit

2.3.6 USB Serial Conversion

The RL78/F22 Cap Touch Evaluation System Board is equipped with USB serial IC FT234XD (FTDI Ltd.) for USB serial conversion. The FT234XD is connected to the RL78/F22 serial array unit (SAU).

Table 2-6 MCU Port Used for USB Serial Conversion

Signal name	MCU control pin	Function
TXD1	P15/TXD0/TS8	UART1 transmit data signal (TXD1)
RXD1	P16/RXD0/TS7	UART1 receive data signal (RXD1)

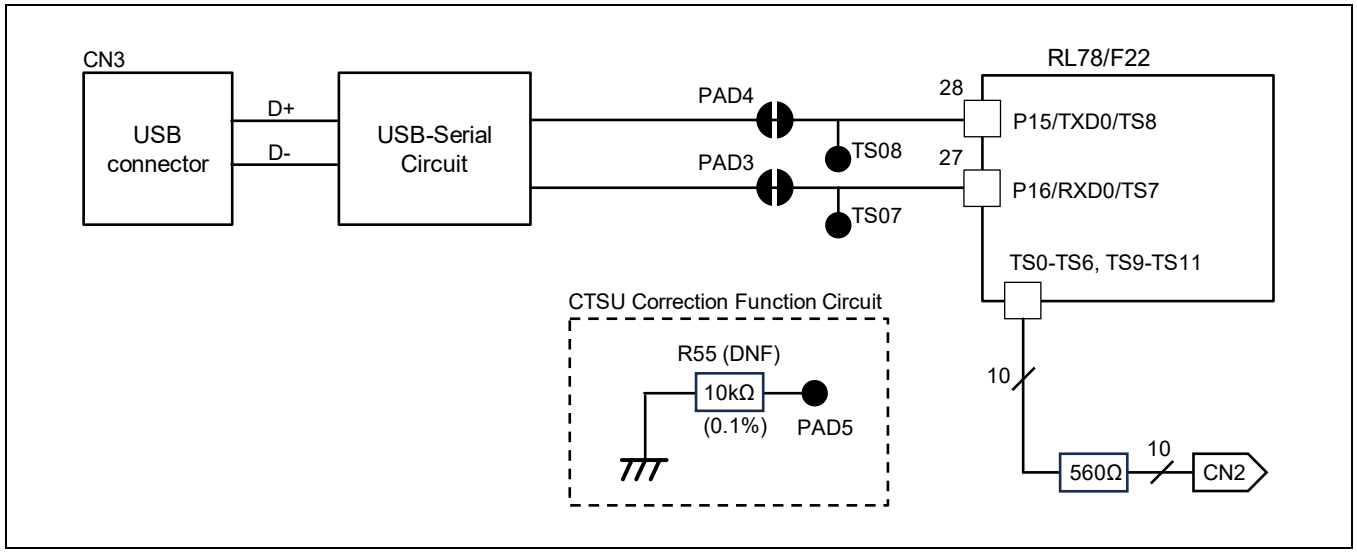

Figure 2-9. USB Serial Conversion Circuit and CTSU Correction Function Circuit (Optional)

2.3.7 CTSU Correction Function Circuit

This circuit is designed to improve the accuracy of capacitance measurement using the CTSU. This function requires separate control software. After mounting the resistor (R55) on the board, connect one of the TSx pin of RL78/F22 product to the PAD5 and use the control software.

The following shows how to connect TSx pin to the PAD5.

- Cut either Short-Pad (PAD3 or PAD4) and connect the PAD5 to “PAD TS07” or “PAD TS08”.
- Remove one of the resistors (R45 to R54) from TS0 to TS6 and TS9 to TS11 pins and connect a PAD5 to that foot pattern.

2.3.8 Expansion Connector Specifications

On this CPU board, the pins of MCU (RL78/F22) are connected to connectors CN6 and CN7. The CN6 and CN7 connectors are not mounted when the product is shipped.

Table 2-7 Expansion Connector (CN6)

Pin	MCU Signal	Remarks	Pin	Port	Remarks
1	V_{DD} (VCC)		2	V_{SS} (GND)	
3	—	Note 1	4	—	Note 1
5	—	Note 1	6	—	Note 1
7	—	Note 1	8	—	Note 1
9	P80/ANI0		10	P81/ANI1	
11	P82/ANI2		12	P83/ANI3	
13	P84/ANI4		14	P85/ANI5	
15	P86/ANI6		16	P87/ANI7	
17	P90/ANI8		18	P91/ANI9	
19	P92/ANI10		20	P125/ANI22	

Note 1: Pins 3 to 8 of CN6 are not connected. There is a test pin (through holes) for connecting jumper wires.

Table 2-8 Expansion Connector (CN7)

Pin	MCU Signal	Remarks	Pin	Port	Remarks
1	V_{DD} (VCC)		2	V_{SS} (GND)	
3	—	Note 1	4	—	Note 1
5	—	Note 1	6	—	Note 1
7	—	Note 1	8	—	Note 1
9	—	Note 1	10	—	Note 1
11	—	Note 1	12	—	Note 1
13	—	Note 1	14	—	Note 1
15	—	Note 1	16	—	Note 1
17	—	Note 1	18	—	Note 1
19	—	Note 1	20	—	Note 1

Note 1: Pins 3 to 20 of CN7 are not connected. There is a test pin (through holes) for connecting jumper wires.

2.3.9 Application Header Specifications

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.
CN2 is mainly used for CTSU pins. Fix the GPIO pins to low by software.

Table 2-9 Application Header Connector (CN1)

Pin	MCU Signal	Remarks	Pin	MCU Signal	Remarks
16	V_{SS} (GND)		15	V_{DD}	
14	P30/TI01/TO01/TRDIOD1/ SSI00/INTP2		13	P31/(INTP2)/STOPST	
12	P32/(SO11)/INTP7		11	P70/ANI24/SI11/SDA11/ INTP8	
10	—	Not connected	9	—	Not connected
8	—	Not connected	7	P71/ANI25/SCK11/SCL11/ INTP6	
6	P130/RESOUT		5	P140/TRD1RES/PCLBUZ0	
4	P00/(TI05)/(TO05)/INTP9		3	—	Not connected
2	—	Not connected	1	—	Not connected

Table 2-10 Application Header Connector (CN2)

Pin	MCU Signal	Remarks	Pin	MCU Signal	Remarks
40	—	Not connected	39	—	Not connected
38	—	Not connected	37	—	Not connected
36	V_{SS} (GND)		35	V_{SS} (GND)	
34	V_{SS} (GND)		33	V_{SS} (GND)	
32	V_{SS} (GND)		31	V_{SS} (GND)	
30	V_{SS} (GND)		29	V_{SS} (GND)	
28	V_{SS} (GND)		27	V_{SS} (GND)	
26	V_{SS} (GND)		25	V_{SS} (GND)	
24	V_{SS} (GND)		23	V_{SS} (GND)	
22	V_{SS} (GND)		21	V_{SS} (GND)	
20	V_{SS} (GND)		19	V_{SS} (GND)	
18	V_{SS} (GND)		17	V_{SS} (GND)	
16	V_{SS} (GND)		15	V_{SS} (GND)	
14	V_{SS} (GND)		13	V_{SS} (GND)	
12	V_{SS} (GND)		11	V_{SS} (GND)	
10	P10/TI13/TO13/TRJO0/ SCK10/SCL10/TS11	TS11	9	P13/TI04/TO04/TRDIOA0/ TRDCLK0/SI01/SDA01/ LTXD0/TS10	TS10
8	P14/TI06/TO06/TRDIOC0/ SCK01/SCL01/LRXD0/TS9	TS9	7	P17/TI00/TO00/TRDIOB1/ SCK00/SCL00/INTP3/TS6	TS6
6	P72/ANI26/SO11/TS4	TS4	5	P73/ANI27/SSI11/TS4	TS4
4	P63/(TO07)/(SSI00)/SDAA0/ TS3	TS3	3	P62/(TO03)/(SO00)/(TXD0)/ SCLA0/TS2	TS2
2	P61/(TO02)/(SI00)/(SDA00)/ (RXD0)/TS1	TS1	1	P60/(TO01)/(SCK00)/(SCL00)/ TS0	TS0

3. Application Board (Self-capacitance electrode board)

3.1 Board Layout

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

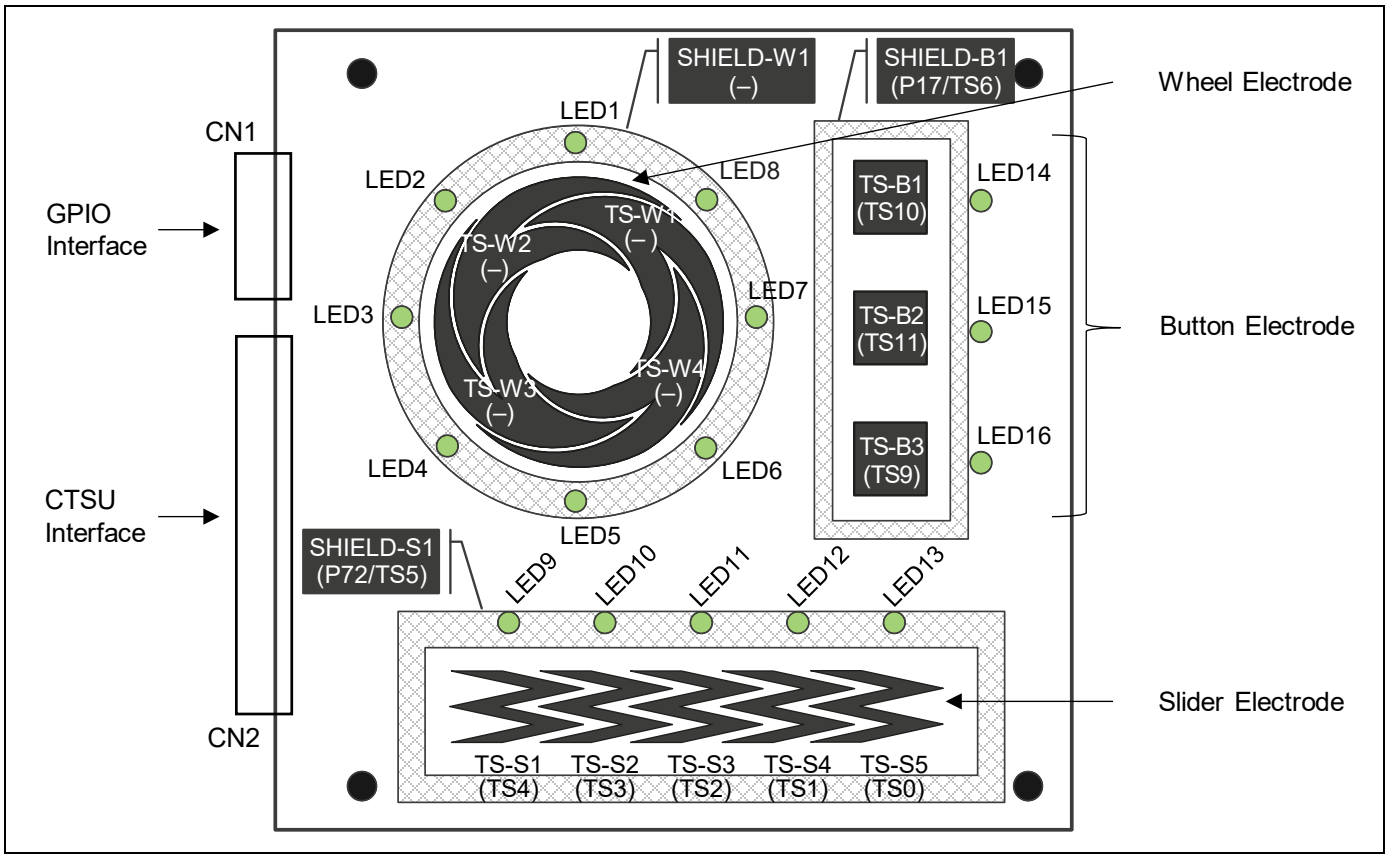

Figure 3-1. Layout of Application Board

3.2 Application Headers

Application headers (CN1, CN2) are the interface for connection to the Renesas Capacitive Touch Evaluation System CPU board. Table 3-1 lists the pin assignments for CN1. Table 3-2 lists the pin assignments for CN2.

Table 3-1 Application Header (CN1)

Pin	Function	MCU Connection	Pin	Function	MCU Connection
15	LED_VCC	V_{DD}	16	LED_VSS (GND)	V_{SS} (GND)
13	LED_ROW0	P31	14	LED_ROW1	P30
11	LED_ROW2	P70	12	LED_ROW3	P32
9	—	—	10	—	—
7	LED_COL3	P71	8	—	—
5	LED_COL1	P140	6	LED_COL2	P130
3	—	—	4	LED_COL0	P00
1	—	—	2	—	—

Remark —: Not applicable

Table 3-2 Application Header (CN2)

Pin	Touch Electrode	CTSU (RL78/F22) (Note 1)	Pin	Touch Electrode	CTSU (RL78/F22) (Note 1)
39	—	—	40	—	—
37	—	—	38	—	—
35	—	—	36	TS-W1	—
33	—	—	34	TS-W2	—
31	TS-W3	—	32	—	—
29	—	—	30	—	—
27	—	—	28	TS-W4	—
25	—	—	26	—	—
23	—	—	24	—	—
21	—	—	22	SHIELD-W1	—
19	—	—	20	—	—
17	—	—	18	—	—
15	—	—	16	—	—
13	—	—	14	—	—
11	—	—	12	—	—
9	TS-B1	TS10	10	TS-B2	TS11
7	SHIELD-B1	TS6/P17 (Note 2)	8	TS-B3	TS9
5	TS-S1	TS4	6	SHIELD-S1	TS5/P72 (Note 2)
3	TS-S3	TS2	4	TS-S2	TS3
1	TS-S5	TS0	2	TS-S4	TS1

Remark —: Not applicable

Note 1: Set output of all unassigned pins to low by software.
Note 2: SHIELD-S1 and SHIELD-B1 are shield electrodes. Set the shield electrode to active shield or the pin output of the shield signal to low by software.

Table 3-3 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 3-4 LED Status and Pin Output Settings

LED condition	Condition of connected pin [LED_ROWn]	Condition of connected pin [LED_COLn]
ON	Low	High
OFF	High	Low

Remark n = 0 to 3

4. Reference Materials

[1]. Renesas RL78/F22, F25 Group User’s Manual: Hardware [R01UH1061]

[2]. E1/E20/E2 Emulator, E2 Emulator Lite Additional Document for User’s Manual (Notes on Connection of RL78 Devices) [R20UT1994]

5. Additional Information

Support

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

Refer to the RL78/F22, F25 Group User's Manual Hardware for more information on RL78/F22 MCUs.

Online technical support, information and more is available at:

https://www.renesas.com/support/contact.html

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

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RL78/F22

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