

# RL78G22\_48PIN FAST PROTOTYPING BOARD USER'S MANUAL

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# 1.OVERVIEW

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This user's manual describes the RL78/G22 48 pin Fast Prototyping Board (hereinafter referred to as “this product”).

## ■1.1 Purpose

- This product is an evaluation tool for a Renesas MCU. This user's manual describes the hardware specifications, ways of setting switches, and the basic setup procedure.

## ■1.2 Features

- Programming of the Renesas MCU
- Debugging of user code
- User circuits for switches , LEDs , Cap touch and so on

# 1.OVERVIEW

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## ■ 1.3 Preparation

- Watch the video on “Getting Started with Fast Prototyping Board for RL78 Family”.
  - ✓ <https://www.renesas.com/video/getting-started-fast-prototyping-board-rl78-family>
- Install the integrated development environment (IDE) and required software on the host PC.
  - ✓ <https://www.renesas.com/development-tools>
- Prepare a micro-USB cable for data transfer.
- Refer to the following Web page and prepare the Com Port debug if required
  - ✓ <https://www2.renesas.cn/cn/en/document/apn/rl78-debugging-functions-using-serial-port-application-note>
- Refer to the following Web page and prepare the E2 emulator if required.
  - ✓ <https://www.renesas.com/e2>
- Refer to the following Web page and prepare the E2 emulator Lite if required.
  - ✓ <https://www.renesas.com/e2lite>

# 1.OVERVIEW

## ■ 1.4 Board Specification Table

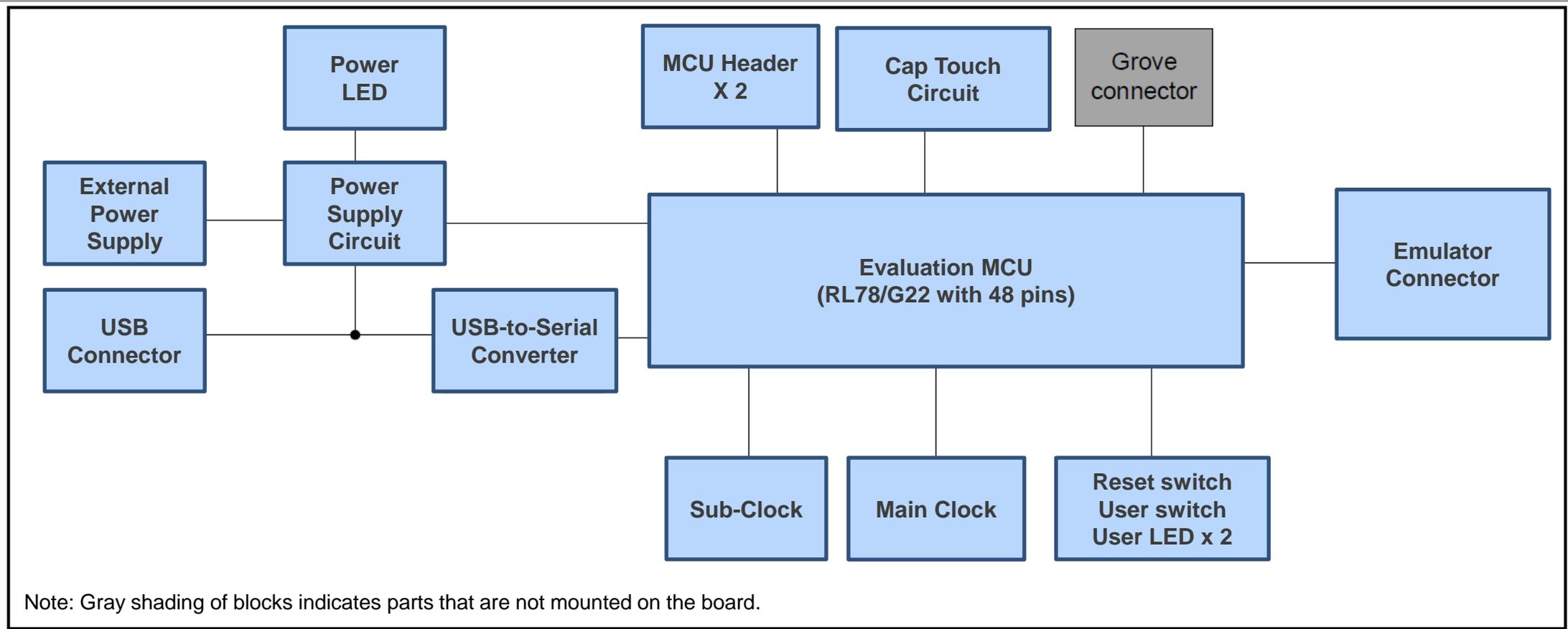
- The below table shows the board specifications

Item	Specification
Evaluation MCU (RL78/G22 with 48 pins)	Part No.: R7F102GGExFB
	Package: 48-pin LFQFP
	On-chip memory: 128-KB ROM, 16-KB RAM, 8-KB data flash memory
Board size	82 mm x 60 mm
Power-supply voltage	VDD: 1.6 V to 5.5 V (EVDD is the same voltage as VDD.)
Power-supply circuit	USB connector: VBUS (5 V)
	External power supply: 1.6 V to 5.5 V
	E2 emulator or E2 emulator Lite
Current drawn	Max. 200 mA
Main clock	OSC1: Crystal oscillator (surface-mount technology (SMT)) for the main system clock
Sub-clock	OSC3: Crystal oscillator (SMT) for the sub-clock
Push switches	Reset switch x 1
	User switch x 1
LEDs	Power indicator: green x 1
	User: green x 2
USB connector	Connector: Micro USB Type-B
MCU headers	Headers: 24 pins x 2
USB-to-serial converter	Used as the interface with the RL78 COM port debug tool.
	CH340G x 1
Power-supply selection header	Header: 3 pins x 1
Emulator connector	14-pin connector for connecting an E2 emulator or E2 emulator Lite
Grove connector	Interface for Grove modules

# 1.OVERVIEW

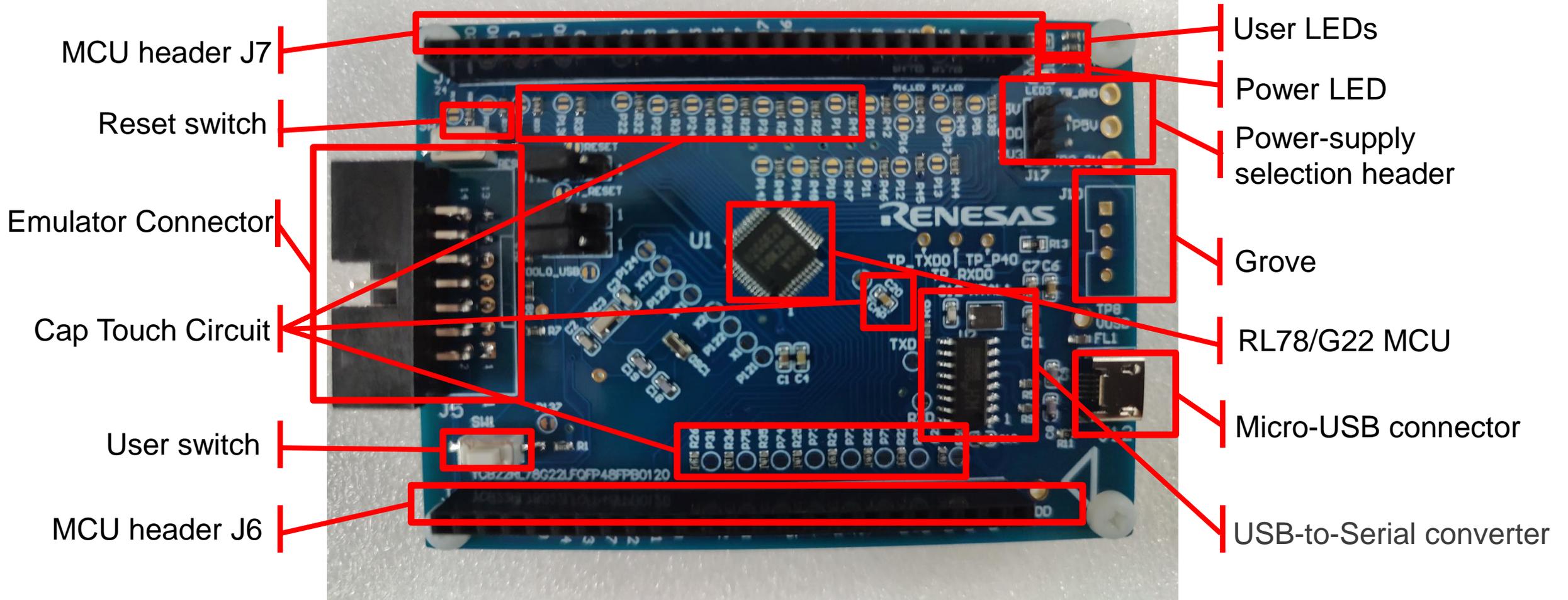
## ■ 1.5 Block Diagram

- The below picture shows the block diagram of this product.



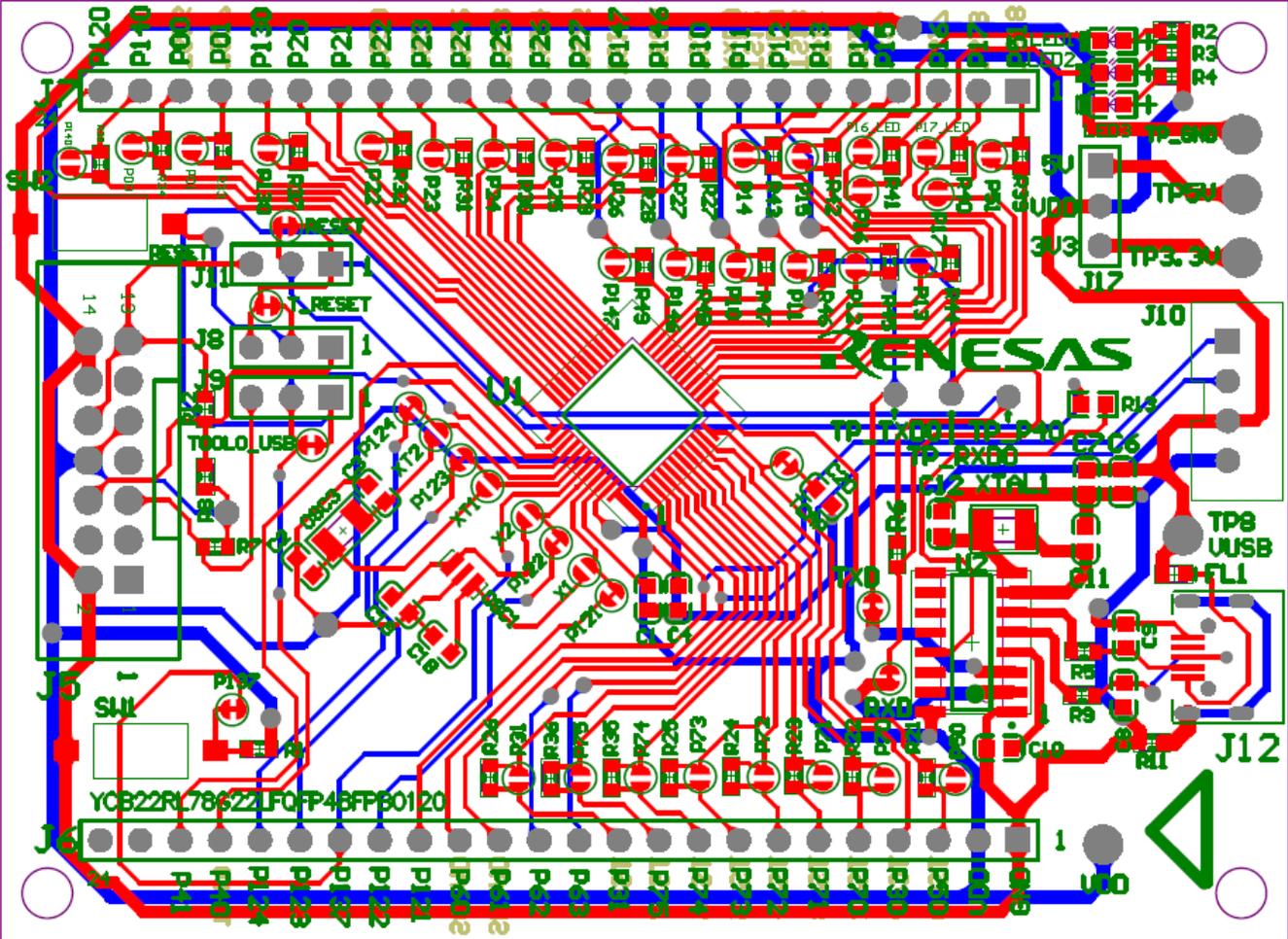
## 2. BOARD LAYOUT

■ The below picture shows the external appearance of the top side of this product.



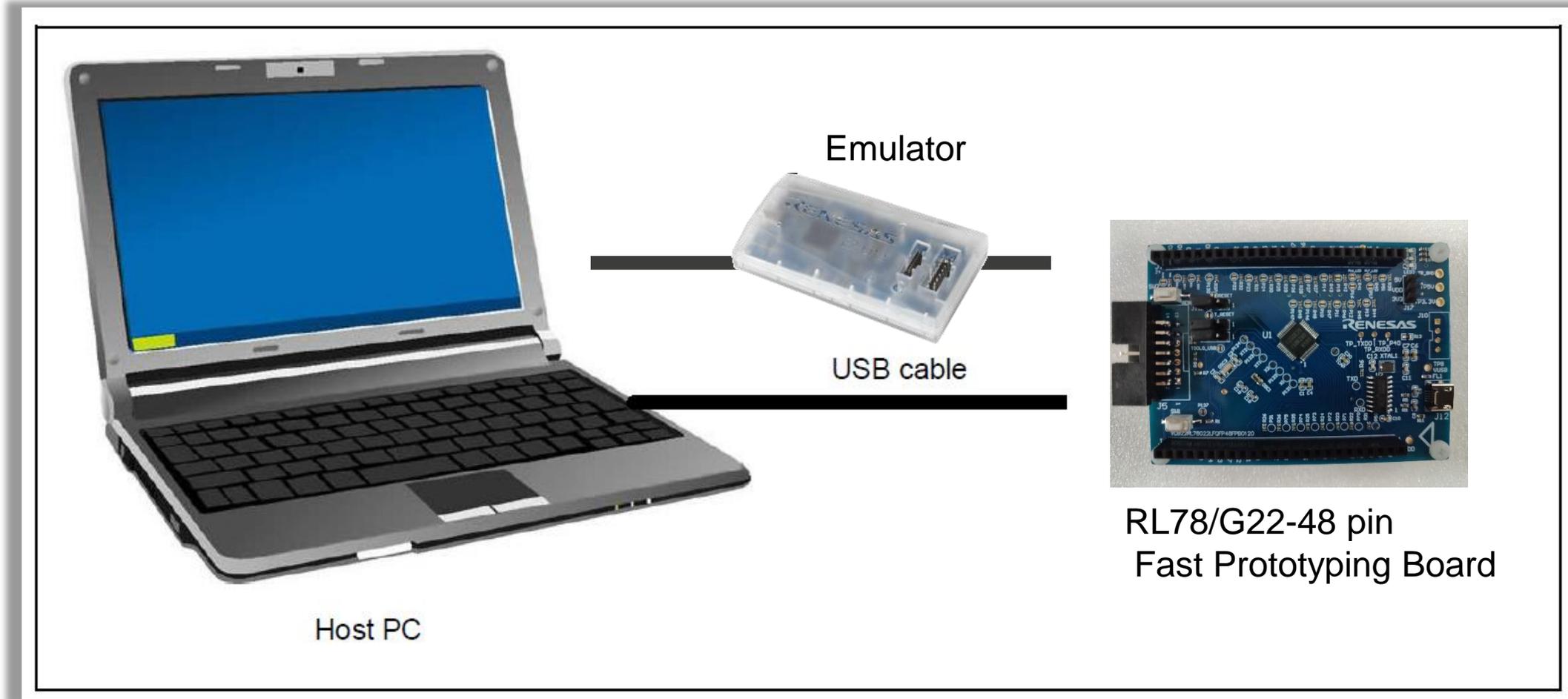
# 3.PARTS LAYOUT

■ The below picture shows the parts layout of this product.



# 4. OPERATING ENVIRONMENT

- The below picture shows the operating environment of this product. Install the IDE on the host PC.



# 5.USER CIRCUITS

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- 5.1 Evaluation MCU
- 5.2 USB Connector
- 5.3 Power LED
- 5.4 User LEDs
- 5.5 MCU Headers
- 5.6 Clock
- 5.7 Reset Switch
- 5.8 User Switch
- 5.9 USB-to-Serial Converter
- 5.10 Power Supply Selection
- 5.11 Emulator Connector
- 5.12 Debugging Functions Using the Serial Port
- 5.13 Cap touch circuit
- 5.14 Grove connector

# 5.USER CIRCUITS – EVALUATION MCU

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## ■ 5.1 Evaluation MCU

- ◆ The specifications for the power supply, system clock, and reset of the evaluation MCU (RL78/G22 with 48 pins) at the time of shipment are as follows.
  - ✓ Power supply: 5 V (VBUS) supplied from the USB
  - ✓ System clock: Operation with an on-chip oscillator
  - ✓ Reset: Directed by the reset switch or IDE

# 5.USER CIRCUITS – USB CONNECTOR

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## ■ 5.2 USB Connector

- ✓ The connector shape is micro-USB Type-B. It serves as a power-supply input and an interface for communications with the RL78 COM port debug tool (through USB-to-serial conversion).
- ✓ Connect the USB connector to the computer by a USB cable. If the power supply on the host side is on, the power is supplied to this product at the same time as connection of the cable.

# 5.USER CIRCUITS – POWER LED

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## ■ 5.3 Power LED

◆ While the power LED is illuminated, VDD power is being supplied. The LED is green.

Note: The LED may not be illuminated when the power supply voltage is 2.2 V or lower.

# 5.USER CIRCUITS – USER LEDS

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## ■ 5.4 User LEDs

- ◆ The optional user LEDs can be used for any purpose.
- ◆ LED1 and LED2 are mounted on the board and are respectively connected to the following ports.
- ◆ The LEDs are green.
  - ✓ LED1: Pin 16, connected to port P16
  - ✓ LED2: Pin 15, connected to port P17

Note: The LED may not be illuminated when the power supply voltage is 2.2 V or lower.

# 5.USER CIRCUITS – MCU HEADERS

## ■ 5.5 MCU Headers

- The MCU headers are provided as through holes; J6 includes the headers for a total of 24 pins and J7 includes the headers for a total of 246 pins. The pin headers have a pitch of 2.54 mm and the evaluation MCU is connected to the through holes for the headers.

### ■ J6

Part No. in the Circuit Schematics	RL78/G22 with 48 Pins							
	Pin	Power Supply	Port	Analog	Timer	Serial	Cap touch	Others
J6-1		GND						
J6-2		VDD						
J6-3	13		P50			SI11/SDA11	TS00	INTP1
J6-4	12		P30			SCK11/SCL11	Tscap	INTP3
J6-5	11		P70			SCK21/SCL21	TS02	KR0
J6-6	10		P71			SDA21/RxDA0	TS03	KR1
J6-7	9		P72			TxDA0	TS04	KR2
J6-8	8		P73				TS05	KR3
J6-9	7		P74			SDA01	TS06	INTP8/KR4
J6-10	6		P75			SCL01	TS07	INTP9/KR5
J6-11	5		P31			TI03/TO03	TS01	INTP4
J6-12	4		P63			SDAA1		
J6-13	3		P62			SCLA1		
J6-14	2		P61			SDAA0		
J6-15	1		P60			SCLA0		
J6-16	45		P121					X1
J6-17	44		P122					X2
J6-18	43		P137					INTP0
J6-19	42		P123					XT1
J6-20	41		P124					XT2
J6-21	39		P40					TOOL0
J6-22	38		P41		TI07/TO07	RxDA1		
J6-23								
J6-24								

# 5.USER CIRCUITS – MCU HEADERS

## ■ 5.5 MCU Headers

### ■ J7

Part No. in the Circuit Schematics	RL78/G22 with 48 Pins							
	Pin	Power Supply	Port	Analog	Timer	Serial	Cap touch	Others
J7-1	14		P51			SO11		
J7-2	15		P17		TI02/TO02	TxD0		
J7-3	16		P16		TI01/TO01	RxD0		
J7-4	17		P15		TI02/TO02	SCK00/SCL00		
J7-5	18		P14		TI03/TO03	RxD2/SCK20/SCL20		
J7-6	19		P13		TI04/TO04	TxD2/SDAA0		
J7-7	20		P12		TI05/TO05	TxD0		TOOLTxD
J7-8	21		P11		TI06/TO06	RxD0/SDA00		TOOLRxD
J7-9	22		P10		TI07/TO07	SCK00/SCL00		
J7-10	23		P146					
J7-11	24		P147	ANI18				
J7-12	25		P27	ANI7			TS25	
J7-13	26		P26	ANI6			TS24	
J7-14	27		P25	ANI5			TS23	
J7-15	28		P24	ANI4			TS22	
J7-16	29		P23	ANI3			TS21	
J7-17	30		P22	ANI2			TS20	
J7-18	31		P21	ANI1				
J7-19	32		P20	AN0				
J7-20	33		P130					
J7-21	34		P01		TO00	RxD1	TS27	
J7-22	35		P00		TI00	TxD1	TS26	
J7-23	36		P140					INTP6
J7-24	37		P120	ANI19		TxDA1		

# 5.USER CIRCUITS – CLOCK

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## ■ 5.6 Clock

- Clock circuits are provided to handle the clock sources for the evaluation MCU.
- For details on the specifications of the evaluation MCU, refer to the RL78/G22 User’s Manual: Hardware.
- For details on the clock circuit of this product, refer to the circuit schematics of the RL78/G23-64p Fast Prototyping Board.
- The below table shows the details of the clocks on the RL78/G22-48pin Fast Prototyping Board.

Clock	Function and Usage	State as Shipped	Frequency	Package for the oscillator
OSC1	Crystal oscillator for the main system clock	Mounted	12MHz	SMT
OSC3	Crystal oscillator for the sub-clock	Mounted	32.768 kHz	SMT

**Note:** Use the main system clock by cutting the patterns for cutting [P121] and [P122] and short-circuiting the short-circuit pads [X1] and [X2].

# 5.USER CIRCUITS – RESET SWITCH

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## ■ 5.7 Reset Switch

- Pressing the reset switch (SW2:RESET) applies a hardware reset to the evaluation MCU.

# 5.USER CIRCUITS – USER SWITCH

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## ■ 5.8 User Switch

- An optional user switch (SW1) is mounted. It is connected to pin 43 of the evaluation MCU, which operates as pin function P137. The INTP0 interrupt is multiplexed on the same pin.

# 5.USER CIRCUITS – USB-TO-SERIAL CONVERTER

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## ■ 5.9 USB-to-Serial Converter

- A USB-to-serial converter (CH340G) is mounted on the board and is usable with the standard driver of Windows 10.
- It is recognized as a COM port when the host PC is connected to this board via a USB cable.
- As the interface with the RL78 COM port debug tool, the USB-to-serial converter enables debugging and programming of the evaluation MCU.
- Note that the P40, P11, and P12 pins of the evaluation MCU are respectively occupied as the TOOL0, TOOLRxD, and TOOLTxD functions.
- For the method of COM port debugging, refer to the application note, RL78 Debugging Functions Using the Serial Port (R20AN0632).
- When the USB-to-serial converter is not used as the interface with the RL78 COM port debug tool, using the RxD0 and TxD0 functions of the P11 and P12 pins enables UART communications between the host PC and the evaluation MCU. The user needs to prepare the terminal software, such as TeraTerm.

# 5.USER CIRCUITS – POWER SUPPLY SELECTION

## ■ 5.10 Power Supply Selection

- The operating power (VDD) of the evaluation MCU can be set to

- ◆ 1.External power with the use of a header (J17).

- ✓ **5V**

- Connect external 5V/GND to TP\_5V/TP\_GND
    - Short 5V and VDD of J17 by a jumper

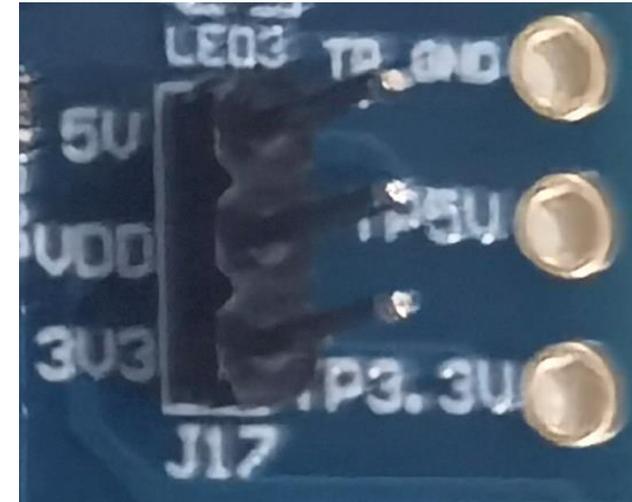
- ✓ **3.3V or others**

- Connect external 3.3V/GND to TP\_3.3V/TP\_GND
    - Short 3.3V and VDD of J17 by a jumper

- ◆ 2.Supply from the emulator (This is the default setting as shipped)

- ◆ 3.Supply from the USB connector (This is the default setting as shipped)

- ◆ **Do not use external power at this case**



External power  
Default Setting

# 5.USER CIRCUITS – EMULATOR CONNECTOR

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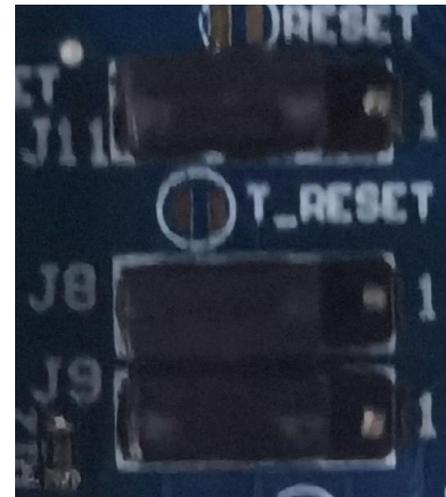
## ■ 5.11 Emulator Connector

- This 14-pin connector (J5) is used to connect this product to an on-chip debugging E2 emulator or E2 emulator Lite, from Renesas Electronics, incorporating programming facilities.
- The emulator is used for programming or debugging the evaluation MCU.
- To use the emulator, make the following settings.

**J8** : pins 2-3 are short-circuit

**J9** : pins 2-3 are short-circuit

**J11**: pins 2-3 are short-circuit

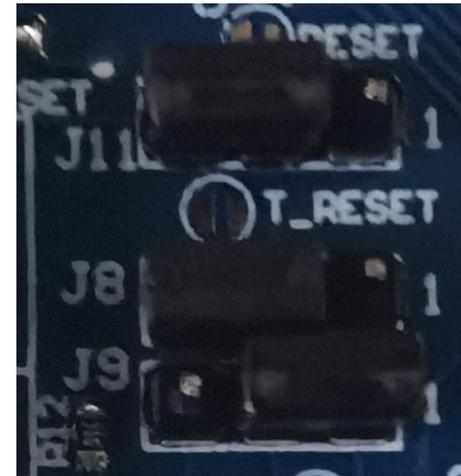


Use the emulator

# 5.USER CIRCUITS – DEBUGGING FUNCTIONS USING THE SERIAL PORT

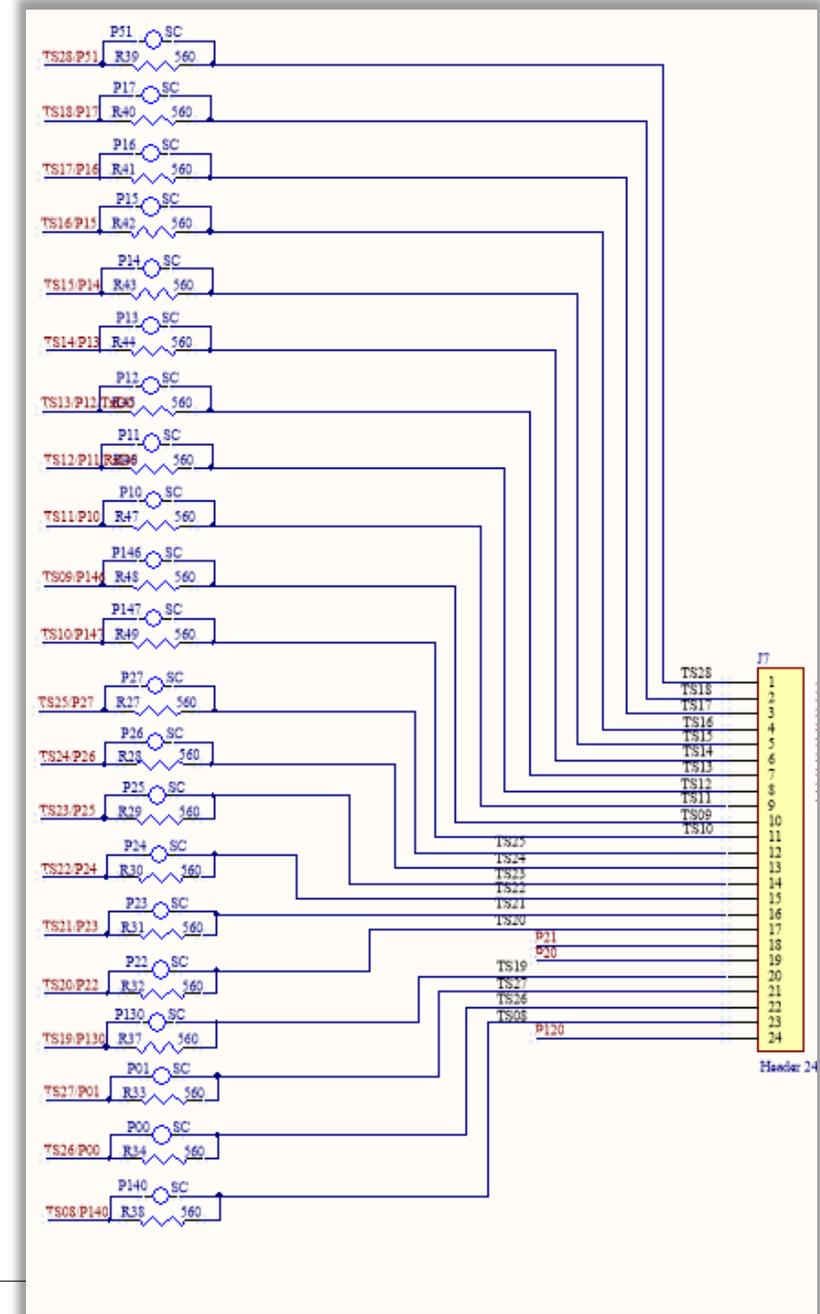
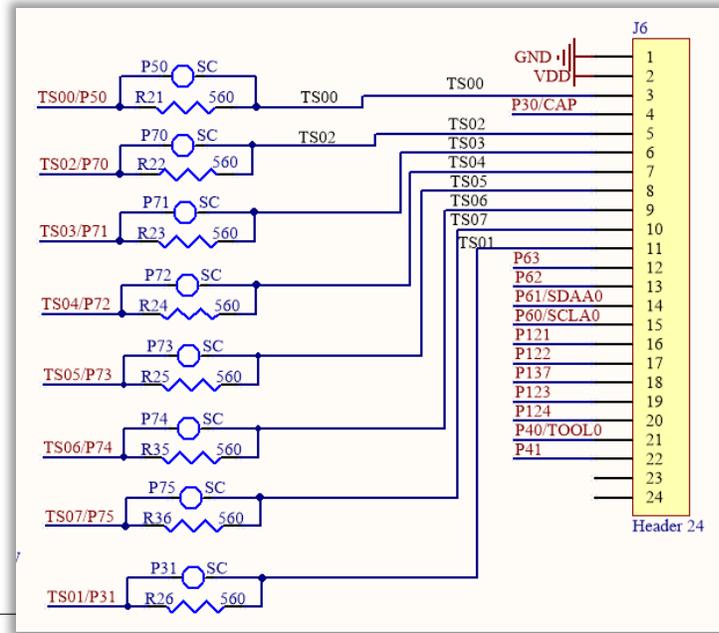
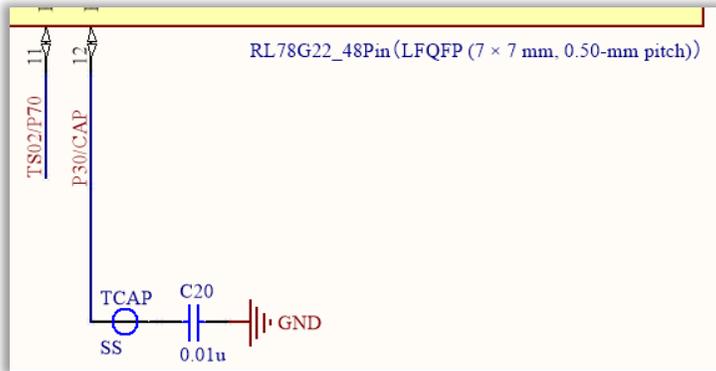
## ■ 5.12 Debugging Functions Using the Serial Port

- With the COM Port debugging system, you perform debugging by connecting to the target board from a USB port of the host machine via a USB-to-serial conversion adapter instead of an emulator such as E2 Lite.
- The USB-to-serial conversion adapter is recognized as the COM Port of the host machine when communicating with the target device using the serial port.
- It enables debugging of target devices using a commercially available USB-to-serial conversion adapter.
- To use the COM Port debugging, make the following settings.
  - J8** : pins 2-3 are short-circuit
  - J9** : pins 1-2 are short-circuit
  - J11**: pins 2-3 are short-circuit



# 5.USER CIRCUITS – CAP TOUCH CIRCUIT

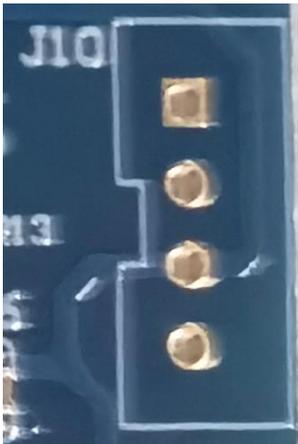
- 5.13 Cap touch circuit
- The RL78/G22 48 pin Fast Prototyping Board has 16 the CTSU2L output channels(TS00 toTS28)
- In the circuit schematics, P30/Tscap has been connected to 10nF capacitor and all the TS ports have been connected to 560ohm resistor as default.



# 5.USER CIRCUITS – GROVE CONNECTOR

## ■ 5.14 Grove connector

- This connector (J10) is assumed to be connected to Grove modules (through I2C). If a connector is mounted, however, connection to all Grove modules (through I2C) is not guaranteed. Use this connector after having confirmed the specifications of this product and Grove modules (through I2C) you intend to use.
- The below picture shows the pin assignments of the Grove connector (the connector is not mounted).



the Grove connector

Part No. in the Circuit Schematics	RL78/G22 with 48 Pins			
Circuit Schematics	Pin	Power Supply	Port	I2C
J10-1	1			SCLA0
J10-2	2			SDAA0
J10-3		VDD		
J10-4		GND		

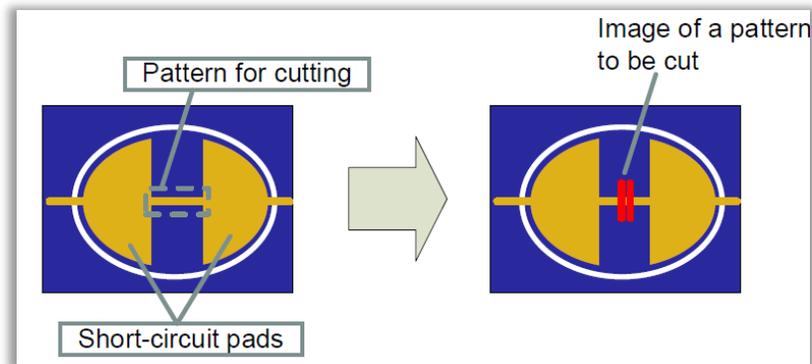
# 6. HANDLING PRECAUTIONS

## 6.1 Power to be Supplied

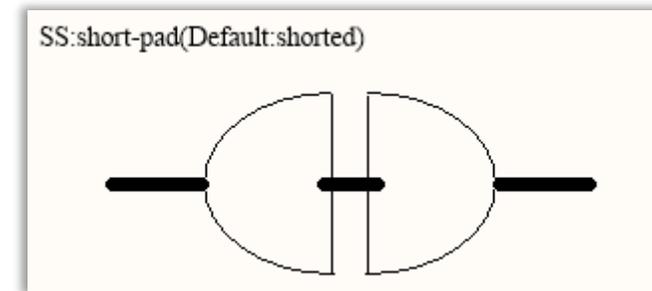
- When power is supplied to this product through the USB or external power supply, or from an emulator, note that the total current of VDD, 5 V, and 3.3 V should not exceed the maximum current of 200 mA.

## 6.2 Remodeling the Board

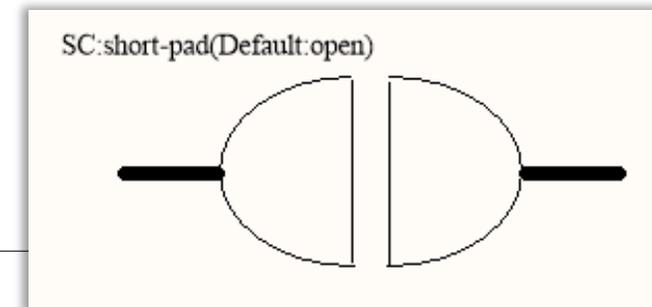
- Any modification of the board (including cutting the patterns for cutting) shall be conducted at the user's own responsibility.
- In this document, "short-circuit pads" refers to pairs of pads for short-circuiting by solder.
- "Pattern for cutting" refers to a narrow signal pattern in the middle part between two short-circuit pads. When you cut the pattern for cutting, do not cut over the silkscreened frame of a white ellipse.



- In the circuit schematics, the symbol below indicates that there is a pattern for cutting between short-circuit pads.



- In the circuit schematics, the symbol below indicates that there are only short-circuit pads without any pattern for cutting.



# 6. HANDLING PRECAUTIONS

## 6.3 Debugging Functions Using the Serial Port

- The right picture shows the debug configuration of the e2 studio when it is to be connected to the RL78/G22-48pin Fast Prototyping Board.

- **[Debug hardware]:** Select **[COM port (RL78)]**.
- **[Target Device]:** Select **[R7F100GGE]**.
- **[Connection Settings]:**
- **[COM Port]:** Select the COM port number for assignment to the RL78/G22-48 pin FPB from the pull-down list.
- **[Reset control pin]:** Select **[DTR]**.

- The below picture shows the system configuration in smart configuration

- **[On-chip Debug setting]:** Select **[COM port]**.

