User's Manual

32

RX140 Group

Renesas Starter Kit for RX140
User's Manual

RENESAS 32-Bit MCU
RX Family / RX100 Series

Renesas Electronics
www.renesas.com

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

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

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

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Precautions

The following precautions should be observed when operating any RSK product:

This Renesas Starter 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. However, 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 10m of the product when in use.
- The user is advised to take ESD precautions when handling the equipment.

The Renesas Starter Kit does not represent an ideal reference design for an end product and does not fulfil the regulatory standards for an end product.

How to Use This Manual

1. Purpose and Target Readers

This manual is designed to provide the user with an understanding of the CPU Board hardware functionality, and electrical characteristics. It is intended for users designing sample code on the CPU Board platform, using the many different incorporated peripheral devices.

The manual comprises of an overview of the capabilities of the RSK product, but does not intend to be a guide to embedded programming or hardware design.

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.

The following documents apply to the RSKRX140. Make sure to refer to the latest versions of these documents. The newest versions of the documents listed may be obtained from the Renesas Electronics Web site.

Document Type	Description	Document Title	Document No.
User's Manual	Describes the technical details of the RSK hardware.	Renesas Starter Kit for RX140 User's Manual	R20UT5026EG
Tutorial Manual	Provides a guide to setting up RSK environment, running sample code and debugging programs.	Renesas Starter Kit for RX140 Tutorial Manual	CS+: R20UT5027EG e^2 studio: R20UT5030EG
Quick Start Guide	Provides simple instructions to setup the RSK and run the first sample.	Renesas Starter Kit for RX140 Quick Start Guide	CS+: R20UT5028EG e^2 studio: R20UT5031EG
Smart Configurator Tutorial	Provides a guide to code generation and importing into the e^2 studio/CS+ IDE.	Renesas Starter Kit for RX140 Smart Configurator Tutorial Manual	CS+: R20UT5029EG e^2 studio: R20UT5032EG
Schematics	Full detail circuit schematics of the CPU Board.	Renesas Starter Kit for RX140 Schematics	R20UT5025EG
Hardware Manual	Provides technical details of the RX140 microcontroller.	RX140 Group Hardware Manual	R01UH0905EJ

2. List of Abbreviations and Acronyms

Abbreviation	Full Form
ADC	Analog-to-Digital Converter
BC	Battery Charging
bps	bits per second
CAN	Controller Area Network
CPU	Central Processing Unit
DAC	Digital-to-Analog Converter
DIP	Dual In-line Package
DMA	Direct Memory Access
DMAC	Direct Memory Access Controller
DNF	Do Not Fit
E1 / E2 Lite	Renesas On-chip Debugging Emulator
EEPROM	Electronically Erasable Programmable Read Only Memory
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
GLCDC	Graphic LCD Controller
I2C (IIC)	Philips™ Inter-Integrated Circuit Connection Bus
IRQ	Interrupt Request
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LIN	Local Interconnect Network
MCU	Micro-controller Unit
MTU	Multi-Function Timer Pulse Unit
n/a (NA)	Not Applicable
n/c (NC)	Not Connected
NMI	Non-maskable Interrupt
OTG	On The Go™
PC	Personal Computer
PDC	Parallel Data Capture Unit
PLL	Phase Locked Loop
Pmod™	This is a Digilent Pmod™ Compatible connector. Pmod™ is registered to Digilent Inc. Digilent-Pmod_Interface_Specification
POE	Port Output Enable
PWM	Pulse Width Modulation
RAM	Random Access Memory
ROM	Read Only Memory
RSK	Renesas Starter Kit
RTC	Real Time Clock
SCI	Serial Communications Interface
SPI	Serial Peripheral Interface
SSI	Serial Sound Interface
TFT	Thin Film Transistor
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
WDT	Watchdog Timer

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1.Overview

1.1 Purpose

This CPU Board is an evaluation tool for Renesas microcontrollers. This manual describes the technical details of the CPU Board hardware.

1.2 Features

This RSK provides an evaluation of the following features:

- Renesas microcontroller programming
- User code debugging
- User circuitry such as switches, LEDs and a potentiometer
- Sample applications
- Sample peripheral device initialisation code

The RSK board contains all the circuitry required for microcontroller operation.

1.3 Board specification

Board specification was shown in **Table 1-1** below.

Table 1-1: Board Specification

Item	Specification
Microcontroller	Part No : R5F51406BDFN *3
	Package : 80-pin PLQP0080KB-B
	On-Chip Memory : ROM 256KB, RAM 64KB
On-Board Memory	I^2C EEPROM: 2Kbit
Input Clock	RX140 Main : 8MHz
	RX140 Sub : 32.768kHz
	RL78/G1C Main: 12MHz
Power Supply *1	DC Power Jack : 5 V Input
	Power Supply IC : 5V Input, 3.3V/1.8V Output
Debug Interface	E2 Lite 14-pin box header
Push Switch	Reset Switch x 1
	User Switch x 3
Potentiometer(for ADC)	Single-turn, 10kΩ
LED	Power indicator: green x 1
	User : green x 1, orange x 1, red x 2
CAN	Connector : 2.54mm pitch, 3-pin x 1
	CAN Driver x 1
LIN *2	Connector : 2.54mm pitch, 3-pin x 1 *2
	LIN Driver x 1
USB to Serial Converter Interface	Connector : USB-MiniB
	Driver : RL78/G1C Microcontroller (Part No R5F10JBCANA)
Pmod™	PMOD1 : Angle type, 12-pin Connector
	PMOD2 : Straight type, 12-pin Connector
Touch Interface	Slider x 1, Button x 2
Application Board Interface *1	2.54 mm pitch, 26-pin x 2 (JA1, JA2), 24-pin x 2 (JA5, JA6)

*1: Board can also supply 5V into RX140 microcontroller without Power Supply IC.

*2: The connector is not included in the product.

*3: R5F51406BDFN has a built-in security function.

2. Power Supply

2.1 Requirements

This board has an optional centre positive supply connector using a 2.0mm barrel power jack (PWR). The main power supply connected to PWR should supply a minimum of 10W to ensure full functionality. When the board is connected to another system then that system should supply power to the board.

This CPU board supports one external voltage input. Details of the external power supply connection are shown in **Table 2-1 and Table 2-2** below. The default power configuration is shown in **bold, blue text.**

Table 2-1: PWR connector Requirements

Connector	Supply voltage
PWR	Input 5VDC

There are RSK products which supports the 12V voltage input. Since this board is supporting the 5V voltage input, be careful not to connect the power supply of a high-voltage output accidentally.
Moreover, the main power supply connected to PWR should supply a minimum of 10W to ensure full functionality.

Table 2-2: Main Power Supply Requirements

J6 Setting	J7 Setting	R37	R44*1	Supply Source	Board_VCC UC_VCC
1-2 Shorted	**Open**	**Don't care**	**Don't care**	**E2-Lite** (3V3) / JA1-3V3	**3.3V** *2
1-2 Shorted	1-2 Shorted	Fit	DNF	PWR / Unregulated_VCC / JA1-5V	3.3V *3
1-2 Shorted	1-2 Shorted	DNF	Fit	PWR / Unregulated_VCC / JA1-5V	1.8V *4
2-3 Shorted	1-2 Shorted	Don't care	Don't care	PWR / Unregulated_VCC / JA1-5V	5V *5

*1: The resistor is not included to a product.
*2: CAN, LIN and 5V Pmod™ interface can't be used.
*3: 5V Pmod™ interface can't be used.
*4: 5V Pmod™, Pmod™ LCD and LED, CAN, LIN can't be used.
*5: Pmod™ LCD and 3V3 interface can't be used.

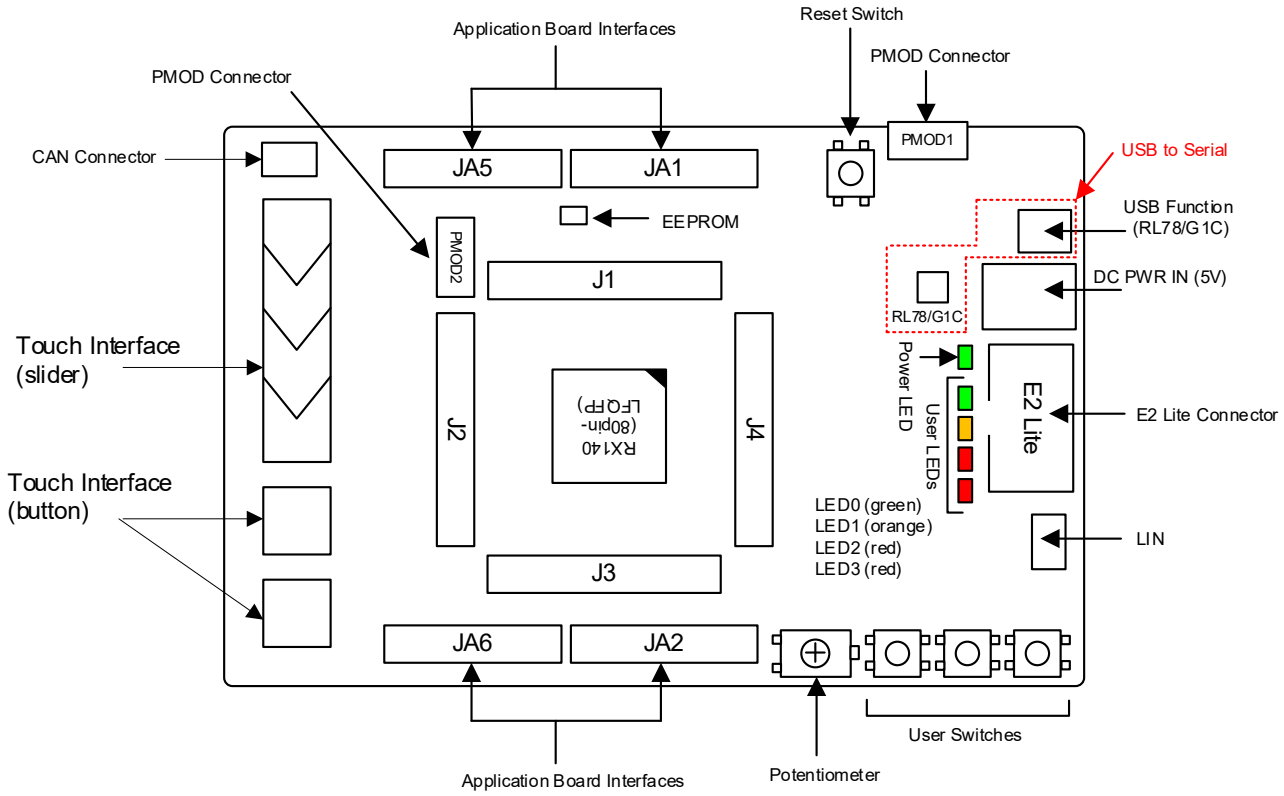
2.2 Power-Up Behaviour

When the RSK is purchased, the RSK board has the 'Release' build of the example tutorial software pre-programmed into the Renesas microcontroller. Please consult the 'Renesas Starter Kit Smart Configurator Tutorial Manual' for further information of this example.

3. Board Layout

3.1 Component Layout

Figure 3-1 below shows the top component layout of the board.



* J1 to J4 : 36-pin Micon Pin Headers

Figure 3-1: Board Layout

3.2 Board Dimensions

Figure 3-2 below gives the board dimensions and connector positions. All the through-hole connectors are on a common 2.54mm pitch grid for easy interfacing.

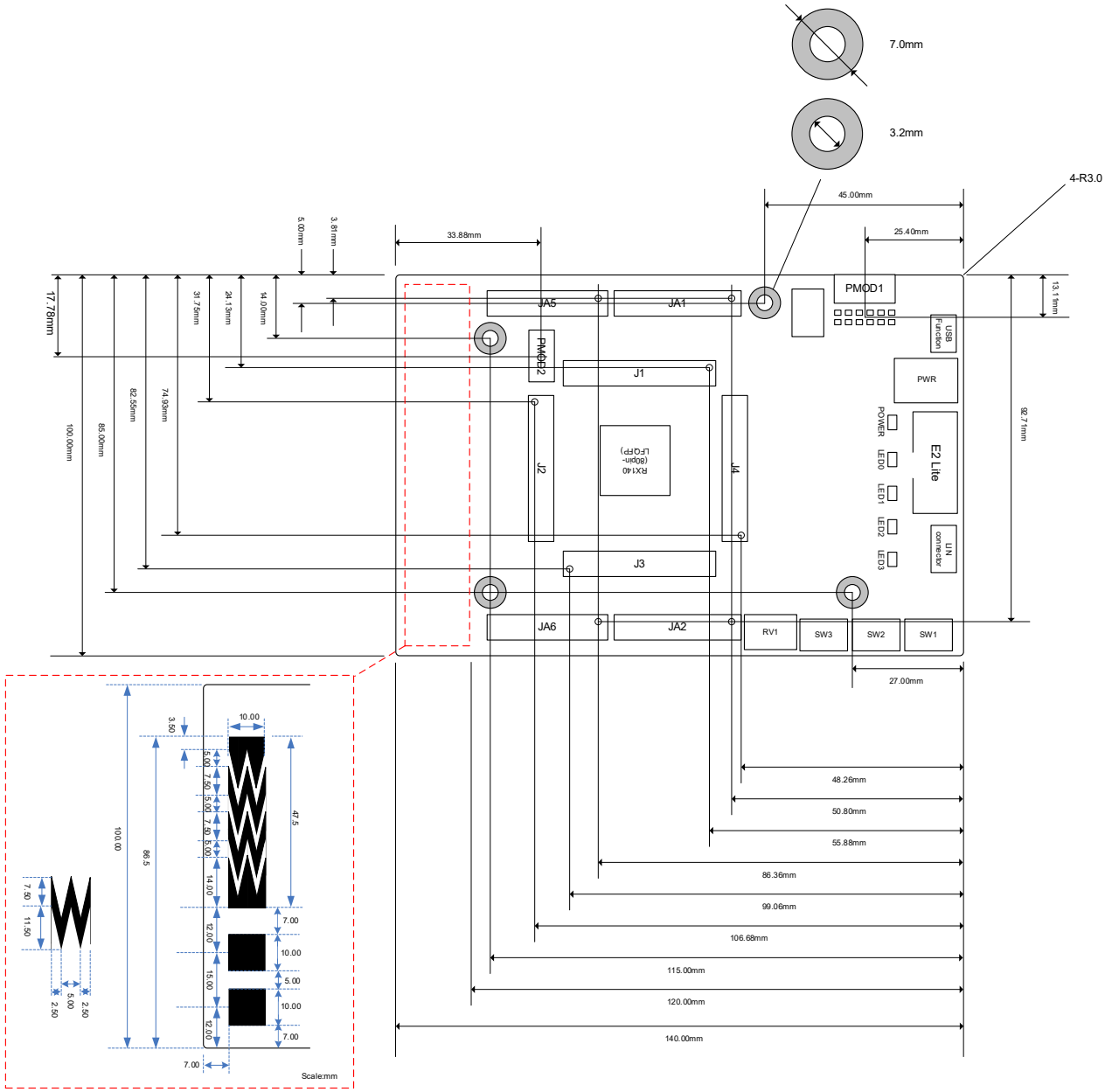


Figure 3-2: Board Dimensions

3.3 Component Placement

Figure 3-3 below shows placement of individual components on the top-side PCB – bottom-side component placement can be seen in **Figure 3-4.** Component types and values are shown on the board schematics.

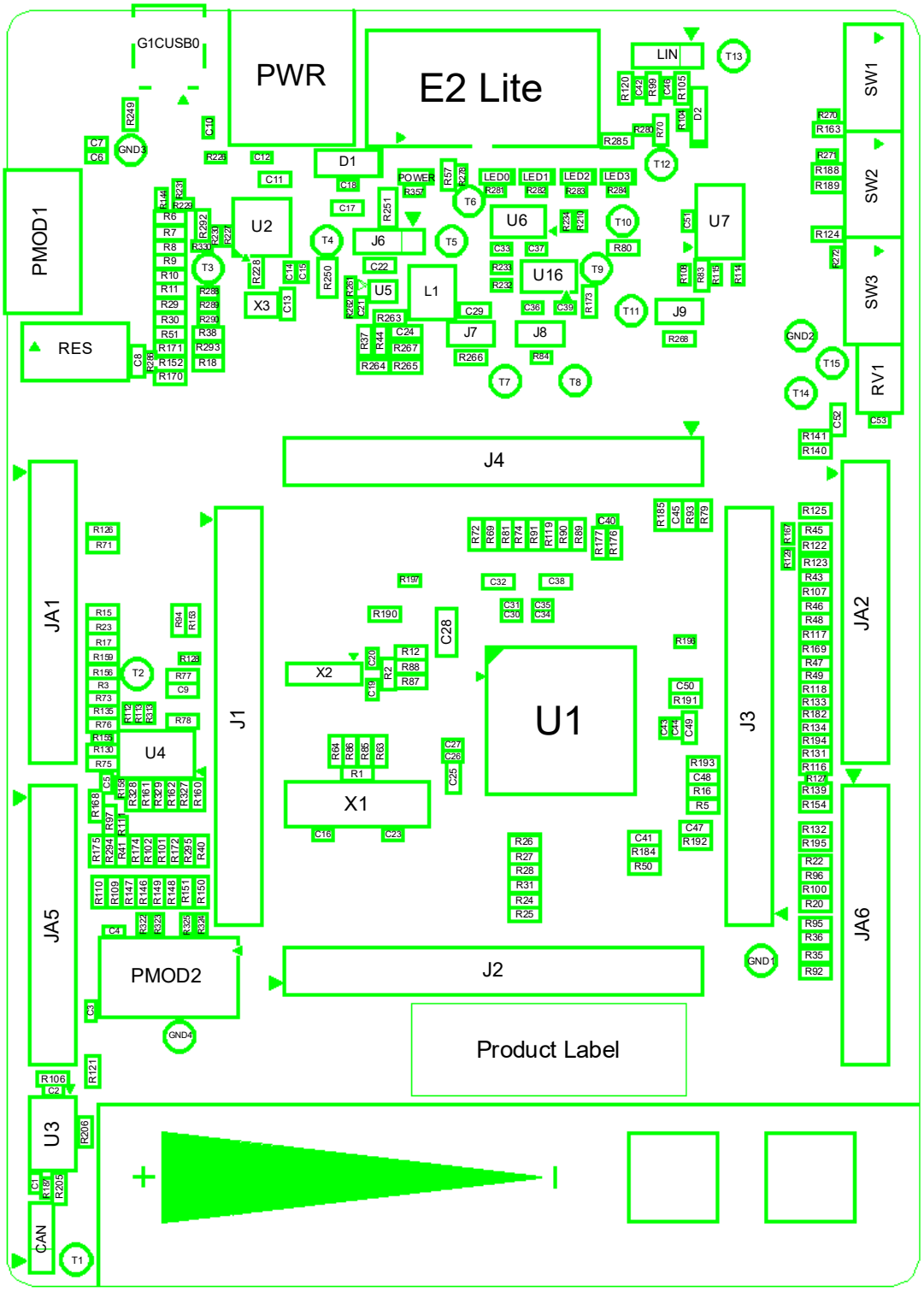


Figure 3-3: Top-Side Component Placement

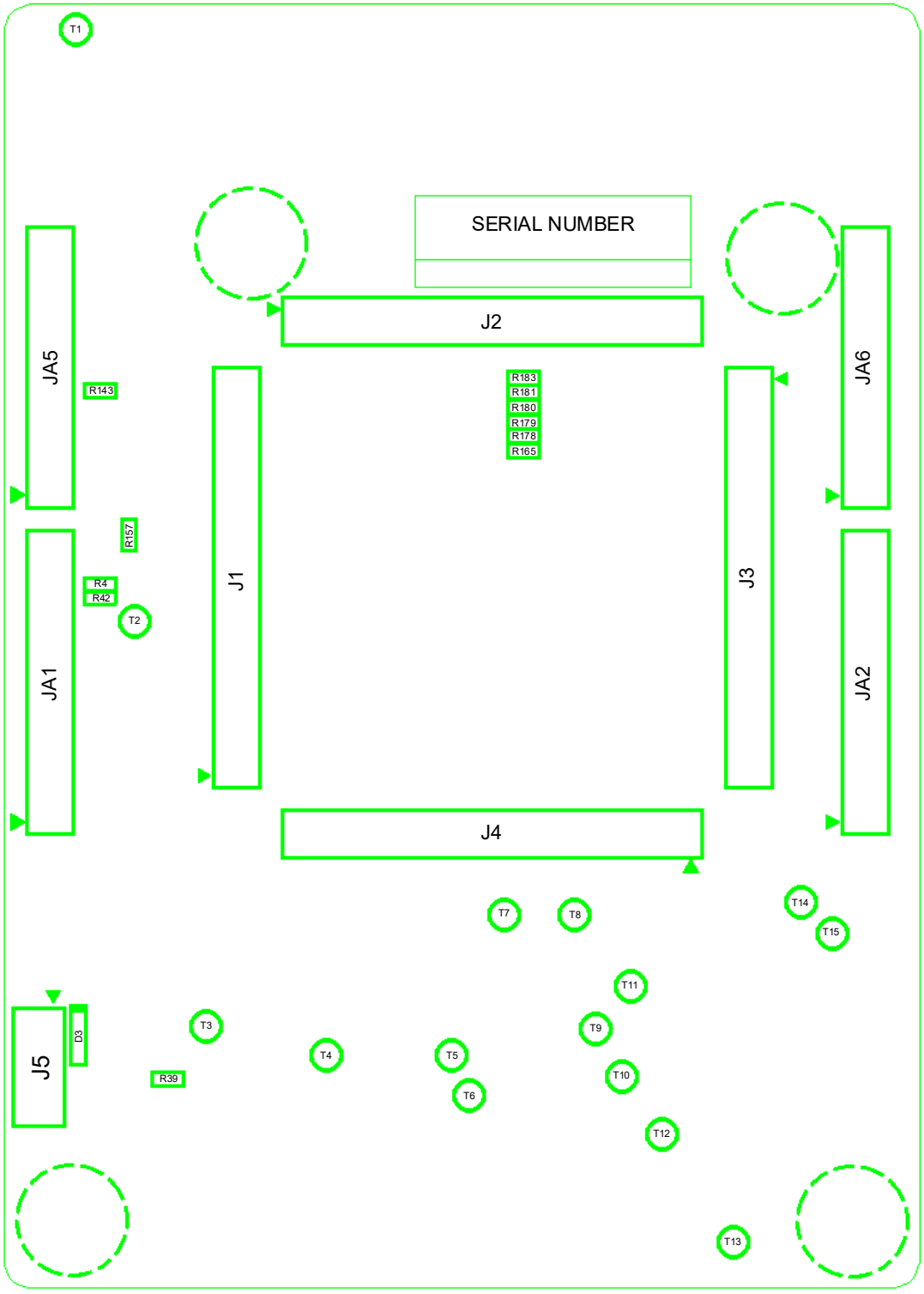


Figure 3-4: Bottom-Side Component Placement

4. Connectivity

4.1 Internal Board Connections

The diagram below shows the CPU board components and their connectivity to the MCU.

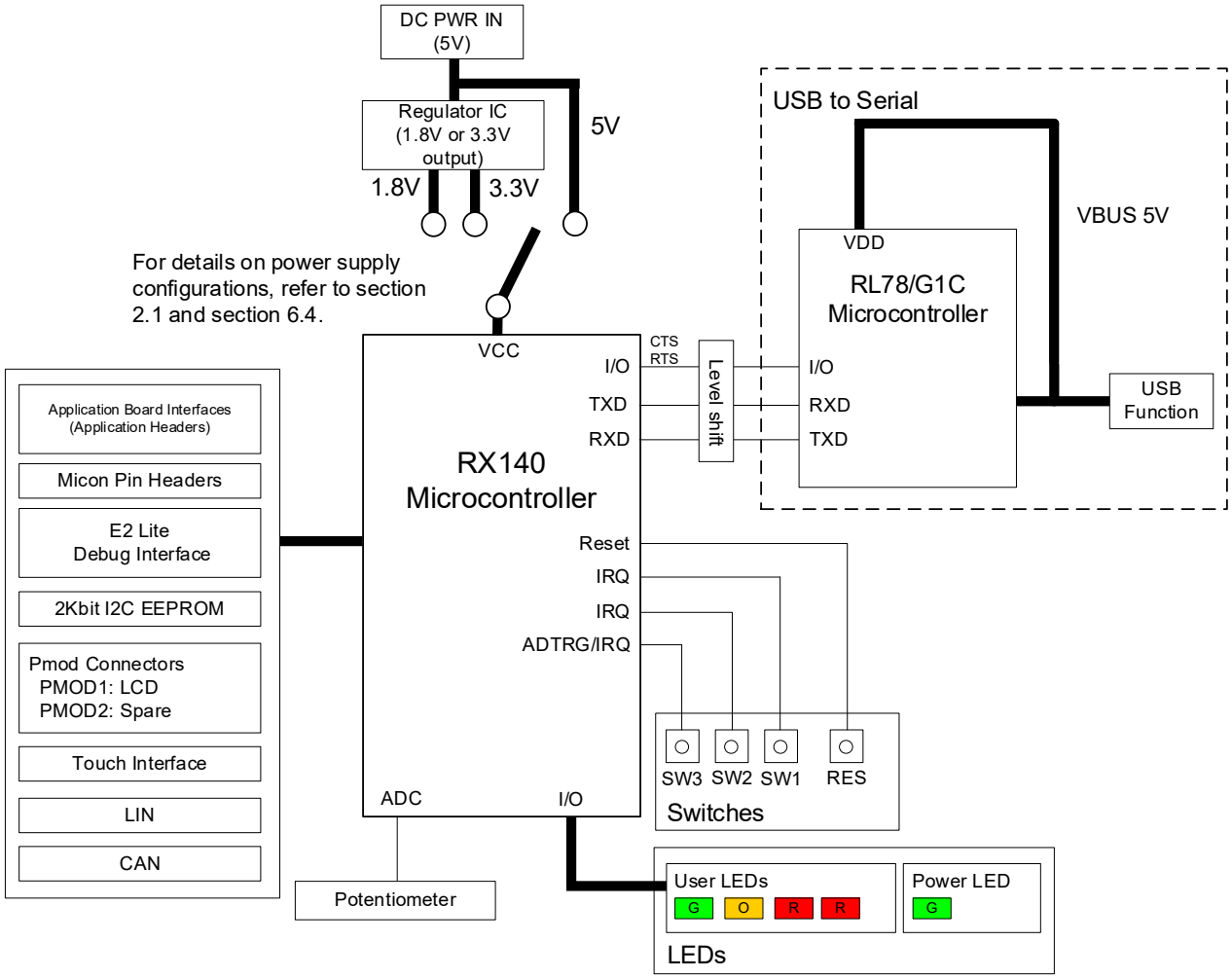


Figure 4-1: Internal Board Block Diagram

4.2 Debugger Connections

Figure 4-2 below shows the connections between the CPU board, E2 Lite debugger and the host PC.

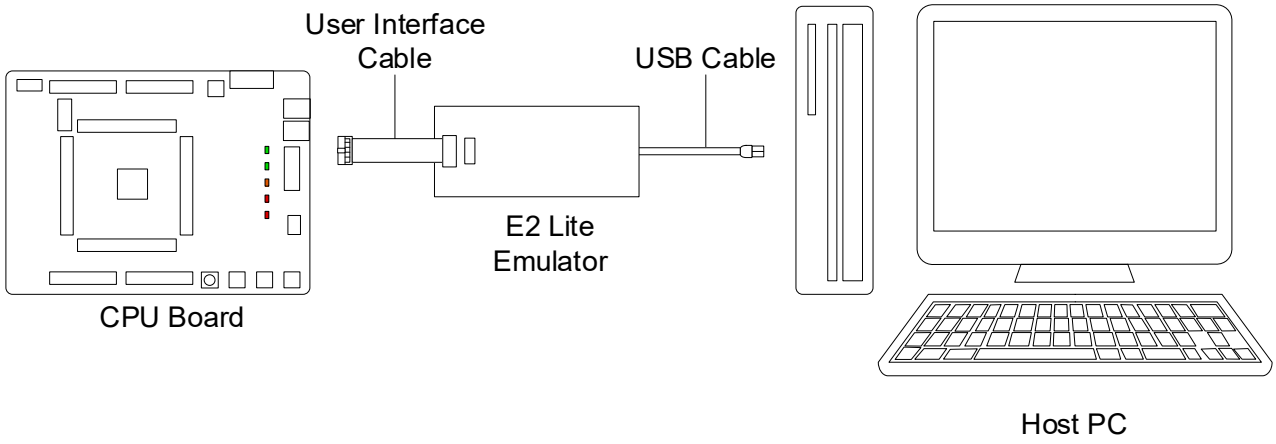


Figure 4-2: Debugger Connection Diagram

5. User Circuitry

5.1 Reset Circuit

A reset control circuit is fitted to the CPU board to generate the required reset signal, and is triggered from the RES switch. Refer to the RX140 Group User's Manual: Hardware for details regarding the reset signal timing requirements, and the CPU board schematics for information regarding the reset circuitry in use on the board.

5.2 Clock Circuit

A clock circuit is fitted to the CPU board to generate the required clock signal to drive the MCU, and associated peripherals. Refer to the RX140 Group Hardware Manual and the RL78/G1C hardware manual for details regarding the clock signal requirements, and the CPU board schematics for information regarding the clock circuitry in use on the CPU board. Details of the oscillators fitted to the board are listed in **Table 5-1** below.

Table 5-1: Crystal

Crystal	Function	Default Placement	Frequency	Device Package
X1	Main MCU crystal for RX140	Fitted	8MHz	Encapsulated, SMT
X2	Real time Clock for RX140	Fitted	32.768kHz	Encapsulated, SMT
X3	Main MCU crystal for RL78/G1C	Fitted	12MHz	Encapsulated, SMT

5.3 Switches

There are four switches located on the CPU board. The function of each switch and its connection is shown in **Table 5-2**. For further information regarding switch connectivity, refer to the CPU board schematics.

Table 5-2: Push Switch Connections

Switch	Function	MCU	
		Signal (Port)	Pin
RES	When pressed, the microcontroller is reset.	RES#	9
SW1	Connects to an IRQ1 input for user controls.	P31	17
SW2	Connects to an IRQ2 input for user controls.	P32	16
SW3	Connects to an IRQ6 input for user controls. Connects to an ADTRG0 input for ADC controls.	P16	24

5.4 LEDs

There are five LEDs on the RSK board. The function of each LED, its colour, and its connections are shown in **Table 5-3**.

Table 5-3: LED Connections

LED	Colour	Function	MCU	
			Port	Pin
POWER	Green	Indicates the status of the Board_VCC power rail.	NC	NC
LED0	Green	User operated LED.	P21	21
LED1	Orange	User operated LED.	P04	3
LED2	Red	User operated LED.	P06	1
LED3	Red	User operated LED.	P07	78

5.5 Potentiometer

A single-turn potentiometer is connected as a potential divider to analog input AN000 (Port P40, pin 75). The potentiometer can be used to create a voltage between Board_VCC and AVSS0.
Refer to the maker site for specification of the potentiometer (VISHAY with part number TS53 series).

The potentiometer offers an easy method of supplying a variable analog input to the microcontroller. It does not necessarily reflect the accuracy of the controller's ADC. Refer to the RX140 Group User's Manual: Hardware for further details.

5.6 Pmod™

The RSK board is equipped with connectors for Digilent Pmod™ interface. Please connect the provided LCD module to the PMOD1 connector.

> Care should be taken when installing the LCD module to ensure pins are not bent or damaged. The LCD module is vulnerable to electrostatic discharge (ESD); therefore appropriate ESD protection should be used.

Figure 5-1 below shows Digilent Pmod™ Compatible Header Pin Numbering. Connection information for the Digilent Pmod™ Compatible header is provided in **Table 5-4** and **Table 5-5** below.

Please note that the connector numbering adheres to the Digilent Pmod™ standard and is different from all other connectors on the RSK designs. Details can be found in the Digilent Pmod™ Interface Specification.

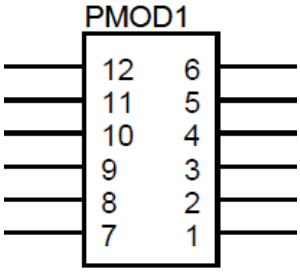


Figure 5-1: Digilent Pmod™ Compatible Header Pin Numbering

Table 5-4: Pmod™1 Header Connections

Pin	Pmod™ Interface			MCU	
	Type 2A (SPI)	Type 3A (UART)	Type 6A (I2C)	Port	Pin No.
1	CS	CTS/GPIO	INT	PB2/CTS6#	46
				P17/IRQ7*2	23
2	MOSI	TXD	RESET	PB1/TXD6/SMOSI6/SSDA6	47
3	MISO	RXD	SCL	PB0/RXD6/SMISO6/SSCL6	49
4	SCK	RTS/GPIO	SDA	PB3/SCK6	45
				PD0/TXD6/SMOSI6/SSDA6*2	66
5	GND	GND	GND	-	-
6	3V3/5V*1	3V3/5V*1	3V3/5V*1	-	-
7	GPIO/INT	GPIO/INT	GPIO	P31/IRQ1*2	17
8	GPIO/RESET	GPIO/RESET	GPIO	PE4	59
9	GPIO/CS2	GPIO	GPIO	PC7/TXD8/SMOSI8/SSDA8*3	35
10	GPIO/CS3	GPIO	GPIO	PC6/RXD8/SMISO8/SSCL8*3	36
11	GND	GND	GND	-	-
12	3V3/5V*1	3V3/5V*1	3V3/5V*1	-	-

*1: This board allows you to choose between 3V3 and 5V, and the default RSK configuration is 3V3.
*2: This connection is a not available in the default RSK configuration - refer to section 6 for the required modifications.
*3: TXD8 and RXD8 are special assignments for connecting with Renesas Silex WiFi Pmod.

Table 5-5: Pmod™2 Header Connections

Pin	Pmod™ Interface			MCU	
	Type 2A (SPI)	Type 3A (UART)	Type 6A (I2C)	Port	Pin No.
1	CS	CTS/GPIO	INT	PA6/CTS5#	51
				PE5/IRQ5*2	58
2	MOSI	TXD	RESET	PA4/TXD5/SMOSI5/SSDA5	53
3	MISO	RXD	SCL	PA2/RXD5/SMISO5/SSCL5	55
4	SCK	RTS/GPIO	SDA	PA1/SCK5/SSLA2	56
				PC3/SSDA5*2	39
5	GND	GND	GND	-	-
6	3V3/5V*1	3V3/5V*1	3V3/5V*1	-	-
7	GPIO/INT	GPIO/INT	GPIO	P34/IRQ4	15
8	GPIO/RESET	GPIO/RESET	GPIO	PC2	40
9	GPIO/CS2	GPIO	GPIO	PB7/PC1/TXD9/SMOSI9/SSDA9*3	41
10	GPIO/CS3	GPIO	GPIO	PB6/PC0/RXD9/SMISO9/SSCL9*3	42
11	GND	GND	GND	-	-
12	3V3/5V*1	3V3/5V*1	3V3/5V*1	-	-

*1: This board allows you to choose between 3V3 and 5V, and the default RSK configuration is 3V3.
*2: This connection is a not available in the default RSK configuration - refer to section 6 for the required modifications.
*3: TXD9 and RXD9 are special assignments for connecting with Renesas Silex WiFi Pmod.

5.7 USB Serial Port

A USB serial port is implemented in a Renesas low power microcontroller (RL78/G1C) and is connected to the RX140 Serial Communications Interface (SCI) module. Multiple options are provided to allow the selection of the connected SCI12 port. Connections between the USB to Serial converter and the microcontroller are listed in **Table 5-6** below.

Table 5-6: Serial Port Connections

Signal Name	Function	MCU	
		Port	Pin
SERIAL-TXD	SCI1 Transmit Signal.	P26	20
	SCI12 Transmit Signal. *1	PE1	62
	External RS232 Transmit Signal. *1	-	-
SERIAL-RXD	SCI1 Receive Signal.	P30	18
	SCI12 Receive Signal. *1	PE2	61
	External RS232 Receive Signal. *1	-	-
SERIAL-CTS *2	Clear To Send. *1	P34	15
SERIAL-RTS *2	Request To Send.	PE3	60

*1: This connection is a not available in the default RSK configuration - refer to section 6 for the required modifications.

*2: Flow control is a signal provided for expansion and is not currently supported. There is no schedule of function expansion at present.

When the CPU board is first connected to a PC running Windows™ with the USB/Serial connection, the PC will look for a driver. This driver is installed during the installation process, so the PC should be able to find it. The PC will report that it is installing a driver and then report that a driver has been installed successfully, as shown in **Figure 5-2**. The exact messages may vary depending upon operating system.

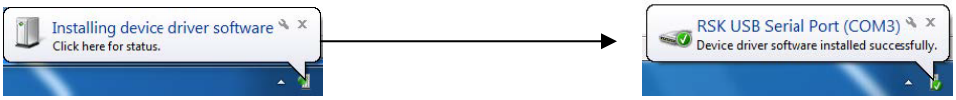


Figure 5-2: USB-Serial Windows™ Installation message

If you do not have the driver, please download the driver installer from the following URL.

https://www.renesas.com/document/rsk-usb-serial-driver?language=en

5.8 Controller Area Network (CAN)

A CAN transceiver IC is fitted to the RSK board, and connected to the CAN MCU peripheral. For further details regarding the CAN protocol and supported modes of operation, please refer to the RX140 Group User's Manual: Hardware. The connections for the CAN microcontroller signals are listed in **Table 5-7** below.

Table 5-7: CAN Connections

CAN Signal	Function	MCU	
		Port	Pin
CAN-TX JA5-CAN1TX *1	CAN Data Transmission.	P14	26
CAN-RX JA5-CAN1RX *1	CAN Data Reception.	P15	25

*1: This connection is a not available in the default RSK configuration - refer to section 6 for the required modifications.

5.9 Local Interconnect Network (LIN)

A LIN transceiver IC is fitted to the RSK and connected to the Extended serial mode MCU peripheral. For further details regarding the supported modes of operation, please refer to the RX140 Group User's Manual: Hardware. Connections between the LIN connector and microcontroller are listed in **Table 5-8** below.

Table 5-8: LIN Connections

LIN signal	Function	MCU	
		Port	Pin
LIN-TX	LIN Transmit Signal	PE1	62
LIN-RX	LIN Receive Signal	PE2	61
LIN-NSLP	LIN Transceiver Device Sleep Control	PC5	37

5.10 I²C Bus (Inter-IC Bus)

The RX140 features I²C (Inter-IC Bus) interface (RIICa). RIIC0 is connected to a 2Kbit EEPROM. The connections for the I²C Bus Interface signals are listed in **Table 5-9** below.

Table 5-9: I²C Bus Connections

I²C Bus signal	Function	MCU	
		Port	Pin
E2P-SDA	Data	P13	27
E2P-SCL	Clock	P12	28

5.11 Touch Interface

The RSK Board is fitted with a Touch Interface (slider x 1, button x 2). The connections for the Touch Interface signals are listed in **Table 5-10** below.

Table 5-10: Touch Interface Connections

Touch Interface signal	Function	MCU	
		Port	Pin
TS12	Electrostatic capacitive measurement pin (touch button)	P54	34
TS11	Electrostatic capacitive measurement pin (touch button)	P55	33
TS10	Electrostatic capacitive measurement pin (touch slider)	PH0	32
TS9	Electrostatic capacitive measurement pin (touch slider)	PH1	31
TS8	Electrostatic capacitive measurement pin (touch slider)	PH2	30
TS7	Electrostatic capacitive measurement pin (touch slider)	PH3	29
TSCAP	LPF (Low-pass filter) connection pin	PC4	38

6. Configuration

6.1 Modifying the RSK

This section lists the option links that are used to modify the way CPU board operates in order to access different configurations. Configurations are made by modifying link resistors or headers with movable jumpers.

A link resistor is a 0Ω surface mount resistor, which is used to short or isolate parts of a circuit. Option links are listed in the following sections, detailing their function when fitted or removed. **Bold, blue text** indicates the default configuration that the CPU board is supplied with. Refer to the component placement diagram (section 3) to locate the option links, jumpers.

When removing soldered components, always ensure that the CPU board is not exposed to a soldering iron for intervals greater than 5 seconds. This is to avoid damage to nearby components mounted on the board.

When modifying a link resistor, always check the related option links to ensure there is no possible signal contention or short circuits. Because many of the MCU's pins are multiplexed, some of the peripherals must be used exclusively. Refer to the RX140 Group User's Manual: Hardware and CPU board schematics for further information.

In the table in this section, "pin" expression is omitted, so please read as follows.
Example: U6.3 -> U6.3pin

6.2 MCU Operating Modes

Table 6-1 below details the function of the jumpers associated with configuring the MCU Operating Modes.

Table 6-1: MCU Operating Modes Configuration Jumper Settings

J8 *1	Explanation
Open / DNF	**Single Chip Mode**
Shorted Pin	Boot Mode (SCI)

*1: Jumper J8 are not mounted on the board at the time of product shipment.

6.3 E2 Lite Debugger Configuration

Table 6-2 below details the function of the option links associated with E2 Lite Debugger Configuration.

Table 6-2: E2 Lite Debugger Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P30	18	P30	JA2-RXDa	R122	**R70**, R77	JA2.8	-	-
			RXD1	R70	**R122**, R77	E2Lite.11	-	-
			SERIAL-RXD	**R77**	**R122, R70**	**U16.3**	**-**	**R132, R79**
P26	20	P26	JA2-TXDa	R125	**R57**, R78	JA2.6	-	-
			TXD1	R57	**R125**, R78	E2Lite.5	-	-
			SERIAL-TXD	**R78**	**R125, R57**	**U6.3**	**-**	**R195, R80**
RES#	9	-	**RESn**	-	-	**E2Lite.13**	-	-
						RES(Switch)	-	-
						JA2.1	-	-
MD_FINED	6	PG7	**MD_FINED**	-	-	**E2Lite.7**	-	-
						J8.2	-	-

6.4 Power Supply Configuration

Table 6-3 below details the function of the option links associated with Power Supply Configuration.

Table 6-3: Power Supply Configuration Option Links

Reference	Explanation	Fit	DNF
Unregulated_VCC	**Connect 5V power rail to Unregulated_VCC.**	**R251**	-
JA1-5V	**Connect 5V power rail to JA1-5V.**	**R250**	-
Board_5V	**Connect 5V power rail to Board_5V.**	-	-
JA1-3V3	**Disconnect JA1-3V3 from Power Supply IC output. (Power supply source: E2 Lite (3.3V), JA1-3V3)**	**R266**	**J7.Open**
	Connect JA1-3V3 to Power Supply IC output. (Power supply source: Unregulated_VCC, JA1-5V)	**R266,** J7.Short	-
Board_3V3	**Disconnect Board_3V3 from Power Supply IC output. (Power supply source: E2 Lite (3.3V), JA1-3V3)**	-	**J7.Open**
	Connect Board_3V3 to Power Supply IC output. (Power supply source: Unregulated_VCC, JA1-5V)	J7.Short	-
UC_VCC	**Connect UC_VCC to Board_VCC power rail.**	J9.Short or **R268**	-
	Enable current probe for measurement MCU current consumption.	-	**J9.Open,** R268
Power Supply IC output	**3.3V**	**R37**	**R44**
	1.8V	R44	R37

Table 6-4 below details the function of the jumpers associated with the Power Supply Configuration.

Table 6-4: Power Supply Configuration Jumper Settings

Reference	Jumper Position	Explanation
J9(DNF) *1	**Shorted**	**Connect UC_VCC to Board_VCC power rail.**
	All open	Enable current probe for measurement MCU current consumption.
J6	**Shorted Pin 1-2**	**Connect Board_3V3 to Board_VCC.**
	Shorted Pin 2-3	Connect Board_5V to Board_VCC.
	All open	DO NOT SET.
J7	Shorted	Connect Power Supply IC output to Board_3V3.
	All open	**Disconnect Power Supply IC output from Board_3V3.**

*1: Jumper J9 is not fitted on the default CPU board. Same as Jumper Position “shorted” setting by resistor R268.

6.5 Clock Configuration

Table 6-5 below details the function of the option links associated with Clock Configuration.

Table 6-5: Clock Configuration Option Links

Reference	Explanation	Fit	DNF
XTAL, EXTAL	**Connect 8MHz crystal (X1) to RX140.**	**R86, R85**	**R64, R63**
	Connect JA2-EXTAL to RX140.	R64, R63	R86, R85
XCIN, XCOUT	**Connect 32.768kHz crystal (X2) to RX140.**	**R88, R87**	**R12**
	Disconnect X2 from RX140.	R12	R88, R87

6.6 Analog Power, ADC and DAC Configuration

Table 6-6 below details the function of the option links associated with Analog Power, ADC and DAC Configuration.

Table 6-6: Analog Power, ADC and DAC Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P16	24	P16	**SW3**	**R124**	-	**SW3**	-	-
			JA1-ADTRG	**R71**	-	**JA1.8**	-	-
JA5-ADC7	67	P47	**JA5-ADC7**	-	-	**JA5.4**	-	-
JA5-ADC6	68	P46	**JA5-ADC6**	-	-	**JA5.3**	-	-
JA5-ADC5	69	P45	**JA5-ADC5**	-	-	**JA5.2**	-	-
JA5-ADC4	70	P44	**JA5-ADC4**	-	-	**JA5.1**	-	-
JA1-ADC3	71	P43	**JA1-ADC3**	-	-	**JA1.12**	-	-
JA1-ADC2	72	P42	**JA1-ADC2**	-	-	**JA1.11**	-	-
JA1-ADC1	73	P41	**JA1-ADC1**	-	-	**JA1.10**	-	-
P40	75	P40	**RV1-ADC**	**R176**	**R177**	**RV1**	-	-
			JA1-ADC0	R177	R176	JA1.9	-	-
VREFH0	76	PJ6	UC_VCC	-	R91, R119	-	-	-
			JA1-VREFH	-	R119, R91	JA1.7	-	-
VREFL0	74	PJ7	GROUND	-	R89, R90	-	-	-
			JA1-AVSS_VREFL	-	R90, R89	JA1.6	-	-
AVCC0	77	-	**UC_VCC**	**R81**	**R74, R141**	-	-	-
			JA1-AVCC	R74	R81, **R141**	JA1.5	-	-
AVSS0	79	-	**GROUND**	**R69**	**R72**	-	-	-
			JA1-AVSS_VREFL	R72	R69	JA1.6	-	-
JA1-DAC0	2	P03	**JA1-DAC0**	-	-	**JA1.13**	-	-
JA1-DAC1	80	P05	**JA1-DAC1**	-	-	**JA1.14**	-	-

6.7 CAN Configuration

Table 6-7 below details the function of the option links associated with CAN Configuration.

Table 6-7: CAN Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P15	25	P15	**CAN-RX**	**R106**	**R154, R168**	**U3.4**	-	-
			JA2-M1TRDCLK	R154	R106, **R168**	JA2.26	-	-
			JA5-CAN1RX	R168	R106, **R154**	JA5.6	-	-
P14	26	P14	**CAN-TX**	**R121**	**R107, R139, R143**	**U3.1**	-	-
			JA2-CTSaRTSa	R107	R121, **R139, R143**	JA2.12	-	-
			JA2-M1TRCCLK	R139	R121, **R107, R143**	JA2.25	-	-
			JA5-CAN1TX	R143	R121, **R107, R139**	JA5.5	-	-

6.8 General IO & LED Configuration

Table 6-8 below details the function of the option links associated with General IO & LED Configuration.

Table 6-8: General IO & LED Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
LED3	78	P07	**LED3**	-	-	**LED3.K**	**R285**	-
LED2	1	P06	**LED2**	-	-	**LED2.K**	**R285**	-
LED1	3	P04	**LED1**	-	-	**LED1.K**	**R285**	-
LED0	21	P21	**LED0**	-	-	**LED0.K**	**R285**	-
PC7	35	PC7	**PMOD1-IO6_CS1_WIFITXD**	**R170**	**R42**	**PMOD1.9**	-	-
			JA1-IO7	R42	R170	JA1.22	-	-
PB5	43	PB5	**JA2-M1POE**	**R116**	**R4**	**JA2.24**	-	-
			JA1-IO6	R4	R116	JA1.21	-	-
JA1-IO5	44	PB4	**JA1-IO5**	-	-	**JA1.20**	-	-
PB3	45	PB3	**PMOD1-IO3_SCK_RTS**	**R5**	**R16**	**PMOD1.4**	**R292**	**R39**
			JA1-IO4	R16	R5	JA1.19	-	-
PB2	46	PB2	**PMOD2-IO0_CS0_CTS**	**R18**	**R17**	**PMOD1.1**	**R293**	**R38**
			JA1-IO3	R17	R18	JA1.18	-	-
JA1-IO2	52	PA5	**JA1-IO2**	**-**	**-**	**JA1.17**	-	-
PA3	54	PA3	**JA2-TIMIN0**	**R118**	**R15**	**JA2.21**	-	-
			JA1-IO1	R15	R118	JA1.16	-	-
PA0	57	PA0	**JA2-M1VP**	**R117**	**R23**	**JA2.15**	-	-
			JA1-IO0	R23	R117	JA1.15	-	-

6.9 I2C & EEPROM Configuration

Table 6-9 and **Table 6-10** below detail the function of the option links associated with I2C & EEPROM Configuration.

Table 6-9: I2C & EEPROM Configuration Option Links (1)

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P12	28	P12	**E2P-SCL**	**R130**	-	**U4.6**	-	-
			JA1-SCL	**R75**	-	**JA1.26**	-	-
P13	27	P13	**E2P-SDA**	**R135**	**R123**	**U4.5**	-	-
			JA1-SDA	**R76**	**R123**	**JA1.25**	-	-
			JA2-IRQb_M1HSIN1	R123	R135, R76	JA2.9	-	-

Table 6-10: I2C & EEPROM Configuration Option Links (2)

Reference	Explanation	Fit	DNF
EEPROM Power	**Supply Board_3V3 and connect pull-up resistor to Board_3V3.**	**R159**	**R156**
	Supply Board_5V and connect pull-up resistor to Board_5V.	R156	R159
WP	**Disable EEPROM Write protect**	**-**	**R157**
	Enable EEPROM Write protect	R157	-
A0, A1, A2	**Device address (0xA6).**	**R329, R328, R160**	**R162, R161, R327**
	Device address (0xA4).	R162, **R328, R160**	R329, **R161, R327**

6.10 IRQ & Switch Configuration

Table 6-11 below details the function of the option links associated with IRQ & Switch Configuration.

Table 6-11: IRQ & Switch Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P16	24	P16	**SW3**	**R124**	-	**SW3**	-	-
			JA1-ADTRG	**R71**	-	**JA1.8**	-	-
JA2-NMIn	14	P35	**JA2-NMIn**	-	-	**JA2.3**	-	-
P32	16	P32	**SW2**	**R188**	-	**SW2**	-	-
			JA2-IRQc_M1HSIN2	**R189**	-	**JA2.23**	**R134**	**R194**
P31	17	P31	**SW1**	**R163**	**R51**	**SW1**	-	-
			JA1-IRQd	**R73**	**R51**	**JA1.23**	-	-
			PMOD1-IO4_INT1_WIFIWKUP	R51	R163, R73	PMOD1.7	-	-
P13	27	P13	**E2P-SDA**	**R135**	**R123**	**U4.5**	-	-
			JA1-SDA	**R76**	**R123**	**JA1.25**	-	-
			JA2-IRQb_M1HSIN1	R123	R135, R76	JA2.9	-	-
P34	15	P34	**PMOD2-IO4_INT1_WIFIWKUP**	**R172**	**R173, R45**	**PMOD2.7**	-	-
			SERIAL-CTS	R173	R172, **R45**	U16.2	-	-
			JA2-IRQa_M1HSIN0	R45	R172, **R173**	JA2.7	-	-
RES#	9	-	**RESn**	-	-	**E2Lite.13**	-	-
						RES(Switch)	-	-
						JA2.1	-	-

6.11 MTU & POE & Timer Configuration

Table 6-12 below details the function of the option links associated with MTU & POE & Timer Configuration.

Table 6-12: MTU & POE & Timer Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
JA6-M1TOGGLE	5	PJ1	**JA6-M1TOGGLE**	-	-	**JA6.13**	-	-
PB0	49	PB0	**PMOD1-IO2_MISO_RXD_SCL**	**R152**	**R92**	**PMOD1.3**	-	-
			JA6-M1WIN	R92	R152	JA6.16	-	-
PA6	51	PA6	**PMOD2-IO0_CS0_CTS**	**R94**	**R35**	**PMOD2.1**	**R295**	**R40**
			JA6-M1VIN	R35	R94	JA6.15	-	-
PA4	53	PA4	**PMOD2-IO1_MOSI_TXD_RESET0**	**R101**	**R96, R36**	**PMOD2.2**	-	-
			JA6-TXDb	R96	R101, R36	JA6.8	-	-
			JA6-M1UIN	R36	R101, R96	JA6.14	-	-
PA3	54	PA3	**JA2-TIMIN0**	**R118**	**R15**	**JA2.21**	-	-
			JA1-IO1	R15	R118	JA1.16	-	-
P15	25	P15	**CAN-RX**	**R106**	**R154, R168**	**U3.4**	-	-
			JA2-M1TRDCLK	R154	R106, **R168**	JA2.26	-	-
			JA5-CAN1RX	R168	R106, **R154**	JA5.6	-	-
P14	26	P14	**CAN-TX**	**R121**	**R107, R139, R143**	**U3.1**	-	-
			JA2-CTSaRTSa	R107	R121, **R139, R143**	JA2.12	-	-
			JA2-M1TRCCLK	R139	R121, **R107, R143**	JA2.25	-	-
			JA5-CAN1TX	R143	R121, **R107, R139**	JA5.5	-	-
JA2-M1WN	64	PD2	**JA2-M1WN**	**-**	**-**	**JA2.18**	-	-
JA2-M1WP	65	PD1	**JA2-M1WP**	-	-	**JA2.17**	-	-
PE5	58	PE5	**JA2-M1VN**	**R169**	**R153**	**JA2.16**	-	-
			PMOD2-INT0	R153	R169	PMOD2.1	R40	R295
PB5	43	PB5	**JA2-M1POE**	**R116**	**R4**	**JA2.24**	-	-
			JA1-IO6	R4	R116	JA1.21	-	-
P13	27	P13	**E2P-SDA**	**R135**	**R123**	**U4.5**	-	-
			JA1-SDA	**R76,**	**R123**	**JA1.25**	-	-
			JA2-IRQb_M1HSIN1	R123	R135, R76	JA2.9	-	-
PA0	57	PA0	**JA2-M1VP**	**R117**	**R23**	**JA2.15**	-	-
			JA1-IO0	R23	R117	JA1.15	-	-
PB7/PC1	41	PB7/PC1	**PMOD2-IO6_CS1_WIFITXD**	**R174**	**R46, R47**	**PMOD2.9**	-	-
			JA2-M1UP	R46	R174, **R47**	JA2.13	-	-
			JA2-TIMOUT0	R47	R174, **R46**	JA2.19	-	-
PB6/PC0	42	PB6/PC0	**PMOD2-IO7_CS2_WIFIRXD**	**R175**	**R48, R49**	**PMOD2.10**	-	-
			JA2-M1UN	R48	R175, **R49**	JA2.14	-	-
			JA2-TIMOUT1	R49	R175, **R48**	JA2.20	-	-
P20	22	P20	JA2-M1ENC	R131	R133	JA2.23	R194	R134
			JA2-TIMIN1	**R133**	**R131**	**JA2.22**	-	-
P34	15	P34	**PMOD2-IO4_INT1_WIFIWKUP**	**R172**	**R173, R45**	**PMOD2.7**	-	-
			SERIAL-CTS	R173	R172, **R45**	U16.2	-	-
			JA2-IRQa_M1HSIN0	R45	R172, **R173**	JA2.7	-	-
P32	16	P32	**SW2**	**R188**	-	**SW2**	-	-
			JA2-IRQc_M1HSIN2	**R189**	-	**JA2.23**	**R134**	**R194**
PC6	36	PC6	**PMOD1-IO7_CS2_WIFIRXD**	**R171**	**R43**	**PMOD1.10**	-	-
			JA2-M1UD	R43	R171	JA2.11	-	-

6.12 PMOD1 Configuration

Table 6-13 below details the function of the option links associated with PMOD1 Configuration.

Table 6-13: PMOD1 Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
PB2	46	PB2	**PMOD1-IO0_CS0_CTS**	**R18**	**R17**	**PMOD1.1**	**R293**	**R38**
			JA1-IO3	R17	R18	JA1.18	-	-
PMOD1-INT0	23	P17	PMOD1-INT0	-	-	PMOD1.1	R38	R293
PMOD1-IO1_MOSI_TXD_RESET0	47	PB1	**PMOD1-IO1_MOSI_TXD_RESET0**	-	-	**PMOD1.2**	-	-
PB0	49	PB0	**PMOD1-IO2_MISO_RXD_SCL**	**R152**	**R92**	**PMOD1.3**	-	-
			JA6-M1WIN	R92	R152	JA6.16	-	-
PB3	45	PB3	**PMOD1-IO3_SCK_RTS**	**R5**	**R16**	**PMOD1.4**	**R292**	**R39**
			JA1-IO4	R16	R5	JA1.19	-	-
PMOD1-SDA	66	PD0	PMOD1-SDA	-	-	PMOD1.4	R39	R292
P31	17	P31	**SW1**	**R163**	**R51**	**SW1**	-	-
			JA1-IRQd	**R73**	**R51**	**JA1.23**	-	-
			PMOD1-IO4_INT1_WIFIWKUP	R51	R163, R73	PMOD1.7	-	-
PMOD1-IO5_RESET1_WIFIMDRES	59	PE4	**PMOD1-IO5_RESET1_WIFIMDRES**	-	-	**PMOD1.8**	-	-
PC7	35	PC7	**PMOD1-IO6_CS1_WIFITXD**	**R170**	**R42**	**PMOD1.9**	-	-
			JA1-IO7	R42	R170	JA1.22	-	-
PC6	36	PC6	**PMOD1-IO7_CS2_WIFIRXD**	**R171**	**R43**	**PMOD1.10**	-	-
			JA2-M1UD	R43	R171	JA2.11	-	-

6.13 PMOD2 Configuration

Table 6-14 below details the function of the option links associated with PMOD2 Configuration.

Table 6-14: PMOD2 Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
PA6	51	PA6	**PMOD2-IO0_CS0_CTS**	**R94**	**R35**	**PMOD2.1**	**R295**	**R40**
			JA6-M1VIN	R35	R94	JA6.15	-	-
PE5	58	PE5	**JA2-M1VN**	**R169**	**R153**	**JA2.16**	-	-
			PMOD2-INT0	R153	R169	PMOD2.1	R40	R295
PA4	53	PA4	**PMOD2-IO1_MOSI_TXD_RESET0**	**R101**	**R96, R36**	**PMOD2.2**	-	-
			JA6-TXDb	R96	R101, **R36**	JA6.8	-	-
			JA6-M1UIN	R36	R101, **R96**	JA6.14	-	-
PA2	55	PA2	**PMOD2-IO2_MISO_RXD_SCL**	**R102**	**R22**	**PMOD2.3**	-	-
			JA6-RXDb	R22	R102	JA6.7	-	-
PA1	56	PA1	**PMOD2-IO3_SCK_RTS**	**R97**	**R20**	**PMOD2.4**	**R294**	**R41**
			JA6-SCKb	R20	R97	JA6.10	-	-
PMOD2-SDA	39	PC3	PMOD2-SDA	-	-	PMOD2.4	R41	R294
P34	15	P34	**PMOD2-IO4_INT1_WIFIWKUP**	**R172**	**R173, R45**	**PMOD2.7**	-	-
			SERIAL-CTS	R173	R172, **R45**	U16.2	-	-
			JA2-IRQa_M1HSIN0	R45	R172, **R173**	JA2.7	-	-
PMOD2-IO5_RESET1_WIFIMDRES	40	PC2	**PMOD2-IO5_RESET1_WIFIMDRES**	-	-	**PMOD2.8**	-	-
PB7/PC1	41	PB7/PC1	**PMOD2-IO6_CS1_WIFITXD**	**R174**	**R46, R47**	**PMOD2.9**	-	-
			JA2-M1UP	R46	R174, **R47**	JA2.13	-	-
			JA2-TIMOUT0	R47	R174, **R46**	JA2.19	-	-
PB6/PC0	42	PB6/PC0	**PMOD2-IO7_CS2_WIFIRXD**	**R175**	**R48, R49**	**PMOD2.10**	-	-
			JA2-M1UN	R48	R175, **R49**	JA2.14	-	-
			JA2-TIMOUT1	R49	R175, **R48**	JA2.20	-	-

6.14 Serial & USB to Serial Configuration

Table 6-15 below details the function of the option links associated with Serial & USB to Serial Configuration.

Table 6-15: Serial & USB to Serial Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P34	15	P34	**PMOD2-IO4_INT1_WIFIWKUP**	**R172**	**R173, R45**	**PMOD2.7**	-	-
			SERIAL-CTS	R173	R172, **R45**	U16.2	-	-
			JA2-IRQa_M1HSIN0	R45	R172, **R173**	JA2.7	-	-
P30	18	P30	JA2-RXDa	R122	R77, **R70**	JA2.8	-	-
			RXD1	R70	R77, **R122**	E2Lite.11	-	-
			SERIAL-RXD	**R77**	**R122, R70**	**U16.3**	-	**R132, R79**
JA2-SCKa	19	P27	**JA2-SCKa**	-	-	**JA2.10**	-	-
P26	20	P26	JA2-TXDa	R125	R57, R78	JA2.6	-	-
			TXD1	R57	R125, R78	E2Lite.5	-	-
			SERIAL-TXD	**R78**	**R125, R57**	**U6.3**	**-**	**R195, R80**
SERIAL-RTS	60	PE3	**SERIAL-RTS**	-	-	**U6.2**	**-**	-
PE1	62	PE1	**LIN-TX**	**R93**	**R100, R80**	**U7.4**	-	-
			JA6-TXDc	R100	R93, **R80**	JA6.9	-	-
			SERIAL-TXD	R80	R93, **R100**	U6.3	-	**R195,** R78
PE2	61	PE2	**LIN-RX**	**R83**	**R95, R79**	**U7.1**	-	-
			JA6-RXDc	R95	R83, **R79**	JA6.12	-	-
			SERIAL-RXD	R79	R83, **R95**	U16.3	-	**R132,** R77
JA6-SCKc	63	PE0	**JA6-SCKc**	-	-	**JA6.11**		
PA4	53	PA4	**PMOD2-IO1_MOSI_TXD_RESET0**	**R101**	**R96, R36**	**PMOD2.2**	-	-
			JA6-TXDb	R96	R101, R36	JA6.8	-	-
			JA6-M1UIN	R36	R101, R96	JA6.14	-	-
PA2	55	PA2	**PMOD2-IO2_MISO_RXD_SCL**	**R102**	**R22**	**PMOD2.3**	-	-
			JA6-RXDb	R22	R102	JA6.7	-	-
PA1	56	PA1	**PMOD2-IO3_SCK_RTS**	**R97**	**R20**	**PMOD2.4**	**R294**	**R41**
			JA6-SCKb	R20	R97	JA6.10	-	-
-	-	-	JA6-RS232RX	R132	**-**	U16.3	-	R77, **R79**
-	-	-	JA6-RS232TX	R195	**-**	U6.3	-	R78, **R80**

6.15 LIN Configuration

Table 6-16 and **Table 6-17** below details the function of the option links associated with LIN Configuration.

Table 6-16: LIN Configuration Option Links (1)

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
LIN-NSLP	37	PC5	**LIN-NSLP**	-	-	**U7.2**	-	-
PE1	62	PE1	**LIN-TX**	**R93**	**R100, R80**	**U7.4**	-	-
			JA6-RXDc	R100	R93, **R80**	JA6.9	-	-
			SERIAL-RXD	R80	R93, **R100**	U6.3	-	**R195,** R78
PE2	61	PE2	**LIN-RX**	**R83**	**R95, R79**	**U7.1**	-	-
			JA6-TXDc	R95	R83, **R79**	JA6.12	-	-
			SERIAL-TXD	R79	R83, **R95**	U16.3	-	**R132,** R77

Table 6-17: LIN Configuration Option Links (2)

Reference	Explanation	Fit	DNF
LIN Operating Mode	**Master mode**	**R99, R105**	-
	Slave mode	-	R99, R105

6.16 Touch Interface Configuration

Table 6-18 below details the function of the option links associated with Touch Interface Configuration.

Table 6-18: Touch Interface Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
TS12	34	P54	TS12	-	-	BUTTON2	-	
TS11	33	P55	TS11	-	-	BUTTON1	-	-
TS10	32	PH0	TS10	-	-	SLIDER1.S4	-	-
TS9	31	PH1	TS9	-	-	SLIDER1.S3	-	-
TS8	30	PH2	TS8	-	-	SLIDER1.S2	-	-
TS7	29	PH3	TS7	-	-	SLIDER1.S1		
PC4	38	PC4	TSCAP	R184	R50	C41	-	-
			MCUPIN-TSCAP	R50	R184	-	-	-

7. Headers

7.1 Application Headers

This RSK board is fitted with application headers, which can be used to connect compatible Renesas application devices or as easy access to MCU pins.

Table 7-1 below lists the connections of the application header, JA1.

Table 7-1: Application Header JA1 Connections

Application Header JA1					
Pin	**Header Name** **Circuit Net Name**	**MCU Pin**	**Pin**	**Header Name** **Circuit Net Name**	**MCU Pin**
1	5V JA1-5V	-	2	0V GROUND	-
3	3V3 JA1-3V3	-	4	0V GROUND	-
5	AVCC JA1-AVCC	77	6	AVSS JA1-AVSS_VREFL	74, 79
7	AVREF JA1-VREFH	76	8	ADTRG JA1-ADTRG	24
9	ADC0 JA1-ADC0	75	10	ADC1 JA1-ADC1	73
11	ADC2 JA1-ADC2	72	12	ADC3 JA1-ADC3	71
13	DAC0 JA1-DAC0	2	14	DAC1 JA1-DAC1	80
15	IO_0 JA1-IO0	57	16	IO_1 JA1-IO1	54
17	IO_2 JA1-IO2	52	18	IO_3 JA1-IO3	46
19	IO_4 JA1-IO4	45	20	IO_5 JA1-IO5	44
21	IO_6 JA1-IO6	43	22	IO_7 JA1-IO7	35
23	IRQd / IRQAEC / M2_HSIN0 JA1-IRQd	17 / NC / NC	24	IIC_EX NC	NC
25	IIC_SDA JA1-SDA	27	26	IIC_SCL JA1-SCL	28

Table 7-2 below lists the connections of the application header, JA2.

Table 7-2: Application Header JA2 Connections

Application Header JA2					
Pin	**Header Name** **Circuit Net Name**	**MCU Pin**	**Pin**	**Header Name** **Circuit Net Name**	**MCU Pin**
1	RESET RESn	9	2	EXTAL JA2-EXTAL	12
3	NMI JA2-NMIn	14	4	Vss1 GROUND	-
5	WDT_OVF NC	NC	6	SCIaTX JA2-TXDa	20
7	IRQa / WKUP / M1_HSIN0 JA2-IRQa_M1HSIN0	15 / NC / 15	8	SCIaRX JA2-RXDa	18
9	IRQb / M1_HSIN1 JA2-IRQb_M1HSIN1	27 / 27	10	SCIaCK JA2-SCKa	19
11	M1_UD JA2-M1UD	36	12	CTSaRTSa JA2-CTSaRTSa	26
13	M1_UP JA2-M1UP	41	14	M1_UN JA2-M1UN	42
15	M1_VP JA2-M1VP	57	16	M1_VN JA2-M1VN	58
17	M1_WP JA2-M1WP	65	18	M1_WN JA2-M1WN	64
19	TimerOut0 JA2-TIMOUT0	41	20	TimerOut1 JA2-TIMOUT1	42
21	TimerIn0 JA2-TIMIN0	54	22	TimerIn1 JA2-TIMIN1	22
23	IRQc / M1_EncZ / M1_HSIN2 JA2-23PIN	16 / 22 / 16	24	M1_POE JA2-M1POE	43
25	M1_TRCCLK JA2-M1TRCCLK	26	26	M1_TRDCLK JA2-M1TRDCLK	25

Table 7-3 below lists the connections of the application header, JA5.

Table 7-3: Application Header JA5 Connections

Application Header JA5					
Pin	**Header Name** **Circuit Net Name**	**MCU Pin**	**Pin**	**Header Name** **Circuit Net Name**	**MCU Pin**
1	ADC4 JA5-ADC4	70	2	ADC5 JA5-ADC5	69
3	ADC6 JA5-ADC6	68	4	ADC7 JA5-ADC7	67
5	CAN1TX JA5-CAN1TX	26	6	CAN1RX JA5-CAN1RX	25
7	CAN2TX NC	NC	8	CAN2RX NC	NC
9	IRQe / M2_EncZ / M2HSIN1 NC	NC / NC / NC	10	IRQf / M2_HSIN2 NC	NC / NC
11	M2_UD NC	NC	12	M2_Uin NC	NC
13	M2_Vin NC	NC	14	M2_Win NC	NC
15	M2_Toggle NC	NC	16	M2_POE NC	NC
17	M2_TRCCLK NC	NC	18	M2_TRDCLK NC	NC
19	M2_UP NC	NC	20	M2_Un NC	NC
21	M2_VP NC	NC	22	M2_Vn NC	NC
23	M2_WP NC	NC	24	M2_Wn NC	NC

Table 7-4 below lists the connections of the application header, JA6.

Table 7-4: Application Header JA6 Connections

Application Header JA6					
Pin	**Header Name** **Circuit Net Name**	**MCU Pin**	**Pin**	**Header Name** **Circuit Net Name**	**MCU Pin**
1	DREQ NC	NC	2	DACK NC	NC
3	TEND NC	NC	4	STBYn NC	NC
5	RS232TX JA6-RS232TX	NC	6	RS232RX JA6-RS232RX	NC
7	SCIbRX JA6-RXDb	55	8	SCIbTX JA6-TXDb	53
9	SCIcTX JA6-TXDc	62	10	SCIbCK JA6-SCKb	56
11	SCIcCK JA6-SCKc	63	12	SCIcRX JA6-RXDc	61
13	M1_Toggle JA6-M1TOGGLE	5	14	M1_Uin JA6-M1UIN	53
15	M1_Vin JA6-M1VIN	51	16	M1_Win JA6-M1WIN	49
17	Reserved NC	NC	18	Reserved NC	NC
19	Reserved NC	NC	20	Reserved NC	NC
21	Reserved NC	NC	22	Reserved NC	NC
23	Unregulated_VCC Unregulated_VCC	-	24	Vss GROUND	-

7.2 Microcontroller Pin Headers

This RSK is fitted with MCU pin headers, which are used to access all the MCU's pins.
Table 7-5 below lists the connections of the microcontroller pin header, J1.

Table 7-5: Microcontroller Pin Header, J1

Microcontroller Pin Header J1					
Pin	**Circuit Net Name**	**MCU Pin**	**Pin**	**Circuit Net Name**	**MCU Pin**
1	LED2	1	2	JA1-DAC0	2
3	LED1	3	4	NC	NC
5	JA6-M1TOGGLE	5	6	MD_FINED	6
7	NC	NC	8	NC	NC
9	RESn	9	10	MCUPIN-XTAL	10
11	GROUND	-	12	JA2-EXTAL	12
13	UC_VCC	-	14	JA2-NMIn	14
15	P34	15	16	P32	16
17	P31	17	18	P30	18
19	JA2-SCKa	19	20	P26	20
21	NC	NC	22	NC	NC
23	NC	NC	24	NC	NC
25	NC	NC	26	NC	NC
27	NC	NC	28	NC	NC
29	NC	NC	30	NC	NC
31	NC	NC	32	NC	NC
33	NC	NC	34	NC	NC
35	NC	NC	36	NC	NC

Table 7-6 below lists the connections of the microcontroller pin header, J2.

Table 7-6: Microcontroller Pin Header, J2

Microcontroller Pin Header J2					
Pin	**Circuit Net Name**	**MCU Pin**	**Pin**	**Circuit Net Name**	**MCU Pin**
1	LED0	21	2	P20	22
3	PMOD1-INT0	23	4	P16	24
5	P15	25	6	P14	26
7	P13	27	8	P12	28
9	MCUPIN-TS7	29	10	MCUPIN-TS8	30
11	MCUPIN-TS9	31	12	MCUPIN-TS10	32
13	MCUPIN-TS11	33	14	MCUPIN-TS12	34
15	PC7	35	16	PC6	36
17	LIN-NSLP	37	18	MCUPIN-TSCAP	38
19	PMOD2-SDA	39	20	PMOD2-IO5_RESET1_WIFIMDRES	40
21	NC	NC	22	NC	NC
23	NC	NC	24	NC	NC
25	NC	NC	26	NC	NC
27	NC	NC	28	NC	NC
29	NC	NC	30	NC	NC
31	NC	NC	32	NC	NC
33	NC	NC	34	NC	NC
35	NC	NC	36	NC	NC

Table 7-7 below lists the connections of the microcontroller pin header, J3.

Table 7-7: Microcontroller Pin Header, J3

Microcontroller Pin Header J3					
Pin	**Circuit Net Name**	**MCU Pin**	**Pin**	**Circuit Net Name**	**MCU Pin**
1	PB7/PC1	41	2	PB6/PC0	42
3	PB5	43	4	JA1-IO5	44
5	PB3	45	6	PB2	46
7	PMOD1-IO1_MOSI_TXD_RESET0	47	8	UC_VCC	-
9	PB0	49	10	GROUND	-
11	PA6	51	12	JA1-IO2	52
13	PA4	53	14	PA3	54
15	PA2	55	16	PA1	56
17	PA0	57	18	PE5	58
19	PMOD1-IO5_RESET1_WIFIMDRES	59	20	SERIAL-RTS	60
21	NC	NC	22	NC	NC
23	NC	NC	24	NC	NC
25	NC	NC	26	NC	NC
27	NC	NC	28	NC	NC
29	NC	NC	30	NC	NC
31	NC	NC	32	NC	NC
33	NC	NC	34	NC	NC
35	NC	NC	36	NC	NC

Table 7-8 below lists the connections of the microcontroller pin header, J4.

Table 7-8: Microcontroller Pin Header, J4

Microcontroller Pin Header J4					
Pin	**Circuit Net Name**	**MCU Pin**	**Pin**	**Circuit Net Name**	**MCU Pin**
1	PE2	61	2	PE1	62
3	JA6-SCKc	63	4	JA2-M1WN	64
5	JA2-M1WP	65	6	PMOD1-SDA	66
7	JA5-ADC7	67	8	JA5-ADC6	68
9	JA5-ADC5	69	10	JA5-ADC4	70
11	JA1-ADC3	71	12	JA1-ADC2	72
13	JA1-ADC1	73	14	VREFL0	74
15	P40	75	16	VREFH0	76
17	AVCC0	77	18	LED3	78
19	AVSS0	79	20	JA1-DAC1	80
21	NC	NC	22	NC	NC
23	NC	NC	24	NC	NC
25	NC	NC	26	NC	NC
27	NC	NC	28	NC	NC
29	NC	NC	30	NC	NC
31	NC	NC	32	NC	NC
33	NC	NC	34	NC	NC
35	NC	NC	36	NC	NC

8. Code Development

8.1 Overview

For all code debugging using Renesas software tools, the RSK board must be connected to a PC via an E2 Lite debugger. An E2 Lite debugger is supplied with this RSK product.

For further information regarding the debugging capabilities of the E2 Lite debuggers, refer to E2 emulator Lite User's Manual (R20UT3240EJ), E1/E20/E2 Emulator, E2 Emulator Lite Additional Document for User's Manual (R20UT0399EJ).

8.2 Compiler Restrictions

The compiler supplied with this RSK is fully functional for a period of 60 days from first use. After the first 60 days of use have expired, the compiler will default to a maximum of 128k code and data. To use the compiler with programs greater than this size you need to purchase the full tools from your distributor.

The protection software for the compiler will detect changes to the system clock. Changes to the system clock back in time may cause the trial period to expire prematurely.

8.3 Mode Support

The MCU supports Single Chip and Boot Modes (SCI and FINE), which are configured on the RSK board. Details of the modifications required can be found in section 6.2. All other MCU operating modes are configured within the MCU's registers, which are listed in the RX140 Group User's Manual: Hardware.

Only ever change the MCU operating mode whilst the RSK is in reset, or turned off; otherwise the MCU may become damaged as a result.

8.4 Debugging Support

The E2 Emulator Lite (as supplied with this RSK) supports break points, event points (including mid-execution insertion) and basic trace functionality. It is limited to a maximum of 8 on-chip event points, 256 software breaks and 256 branch/cycle trace. For further details, refer E2 Emulator Lite User's Manual (R20UT3240EJ).

8.5 Address Space

For the MCU address space details, refer to the 'Address Space' section of RX140 Group User's Manual: Hardware.

9. Additional Information

Technical Support
For information about the RX140 Group microcontrollers refer to the ‘RX140 Group Manual: Hardware’.

For information about the RX assembly language, refer to the ‘RX Family User’s Manual: Software’.

Technical Contact Details
America: techsupport.america@renesas.com
Europe: https://www.renesas.com/eu/en/support/contact.html
Global & Japan: https://www.renesas.com/support/contact.html

General information on this product can be found on the Renesas website at:
https://www.renesas.com/rskrx140

General information on Renesas microcontrollers can be found on the Renesas website at:
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