32

RX130 Group

Renesas Starter Kit User's Manual

RENESAS 32-Bit MCU
RX Family / RX100 Series

Renesas Electronics

Rev. 1.00 Jan 2017

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.

2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other disputes involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawing, chart, program, algorithm, application examples.

3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.

4. You shall not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copy or otherwise misappropriation of Renesas Electronics products.

5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
   "Standard":   Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots etc.
   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.
   Renesas Electronics products are neither intended nor authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems, surgical implantations etc.), or may cause serious property damages (space and undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for which the product is not intended by Renesas Electronics.

6. When using the Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat radiation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions or failure or accident arising out of the use of Renesas Electronics products beyond such specified ranges.

7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please ensure to implement safety measures to guard them against the possibility of bodily injury, injury or damage caused by fire, and social damage in the event of failure or malfunction of Renesas Electronics products, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures by your own responsibility as warranty for your products/system. Because the evaluation of microcomputer software alone is very difficult and not practical, please evaluate the safety of the final products or systems manufactured by you.

8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please investigate applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive carefully and sufficiently and use Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.

9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall not use Renesas Electronics products or technologies for (1) any purpose relating to the development, design, manufacture, use, stockpiling, etc., of weapons of mass destruction, such as nuclear weapons, chemical weapons, or biological weapons, or missiles (including unmanned aerial vehicles (UAVs)) for delivering such weapons, (2) any purpose relating to the development, design, manufacture, or use of conventional weapons, or (3) any other purpose of disturbing international peace and security, and you shall not sell, export, lease, transfer, or release Renesas Electronics products or technologies to any third party whether directly or indirectly with knowledge or reason to know that the third party or any other party will engage in the activities described above. When exporting, selling, transferring, etc., Renesas Electronics products or technologies, you shall comply with any applicable export control laws and regulations promulgated and administered by the governments of the countries asserting jurisdiction over the parties or transactions.

10. Please acknowledge and agree that you shall bear all the losses and damages which are incurred from the misuse or violation of the terms and conditions described in this document, including this notice, and hold Renesas Electronics harmless, if such misuse or violation results from your resale or making Renesas Electronics products available any third party.

11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.

12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.3.0-1   November 2016)

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. Handling of Unused Pins

    Handle unused pins in accordance with the directions given under Handling of Unused Pins in the manual.

    ¾ 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 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. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

    The state of the product is undefined at the moment when power is supplied.

    ¾ The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment 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 moment 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 moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

    Access to reserved addresses is prohibited.

    ¾ The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

    After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.

    ¾ 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. Moreover, 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.

5. Differences between Products

    Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

    ¾ The characteristics of Microprocessing unit or Microcontroller unit products in the same group but having a different part number may differ in terms of the 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.

Disclaimer

By using this Renesas Starter Kit (RSK), the user accepts the following terms:

The RSK is not guaranteed to be error free, and the entire risk as to the results and performance of the RSK is assumed by the User. The RSK is provided by Renesas on an "as is" basis without warranty of any kind whether express or implied, including but not limited to the implied warranties of satisfactory quality, fitness for a particular purpose, title and non-infringement of intellectual property rights with regard to the RSK. Renesas expressly disclaims all such warranties. Renesas or its affiliates shall in no event be liable for any loss of profit, loss of data, loss of contract, loss of business, damage to reputation or goodwill, any economic loss, any reprogramming or recall costs (whether the foregoing losses are direct or indirect) nor shall Renesas or its affiliates be liable for any other direct or indirect special, incidental or consequential damages arising out of or in relation to the use of this RSK, even if Renesas or its affiliates have been advised of the possibility of such damages.

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 RSK hardware functionality, and electrical characteristics. It is intended for users designing sample code on the RSK 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. Further details regarding setting up the RSK and development environment can be found in the tutorial 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.

The following documents apply to the RSKRX130-512KB. 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.	RSKRX130-512KB User's Manual	R20UT3921EG
Tutorial Manual	Provides a guide to setting up RSK environment, running sample code and debugging programs.	RSKRX130-512KB Tutorial Manual	CS+: R20UT3922EG e^2 studio: R20UT3925EG
Quick Start Guide	Provides simple instructions to setup the RSK and run the first sample, on a single A4 sheet.	RSKRX130-512KB Quick Start Guide	CS+: R20UT3923EG e^2 studio: R20UT3926EG
Smart Configurator Tutorial	Provides a guide to code generation and importing into the e2 studio IDE.	RSKRX130-512KB Smart Configurator Tutorial Manual	CS+: R20UT3924EG e^2 studio: R20UT3927EG
Schematics	Full detail circuit schematics of the RSK.	RSKRX130-512KB Schematics	R20UT3920EG
Hardware Manual	Provides technical details of the RX130 microcontroller.	RX130 Group Hardware Manual	R01UH0560EJ

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
CRC	Cyclic Redundancy Check
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
GPT	General PWM Timer
I^2C (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	Realtime Clock
SAU	Serial Array Unit
SCI	Serial Communications Interface
SFR	Special Function Registers
SPI	Serial Peripheral Interface
SSI	Serial Sound Interface
TAU	Timer Array Unit
TFT	Thin Film Transistor
TPU	Timer Pulse Unit
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
WDT	Watchdog Timer

All trademarks and registered trademarks are the property of their respective owners.

Table of Contents

1. Overview

1.1 Purpose

This RSK is an evaluation tool for Renesas microcontrollers. This manual describes the technical details of the RSK hardware. The Quick Start Guide and Tutorial Manual provide details of the software installation and debugging environment.

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 application
- 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.

Item	Specification
Microcontroller	Part No : R5F51308ADFP
	Package : 100-pin LFQFP
	On-Chip Memory : ROM 512KB+8KB, RAM 48KB
On-Board Memory	I²C EEPROM : 2Kbit
Input Clock	RX130 Main : 8MHz
	RX130 Sub : 32.768MHz
	RL78/G1C Main: 12MHz
Power Supply *1	DC Power Jack : 5 V Input
	Power Supply IC : 5V Input, 3.3V/1.86V Output
Debug Interface	E1/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
LIN *2	Connector : 2.54mm pitch, 3-pin x 1
	LIN Driver x 1
Touch Interface	Slider x 1, Key x2
Remote Control Receiver *2	Anti electromagnetic induction noise type
USB to Serial Converter Interface	Connector : USB-MiniB
	Driver : RL78/G1C Microcontroller (Part No R5F10JBCANA)
Pmod™	PMOD1 : Angle type, 12-pin Connector
	PMOD2 *2 : Straight type, 12-pin Connector
Application Board Interface *2	2.54mm pitch, 26-pin x 2 (JA1, JA2), 24-pin x 2 (JA5, JA6)

Table 1-1: Board Specification

*1: Board can also supply 5V into RX130 microcontroller without LDO regulator.
*2: The connector is not included in the product.

2. Power Supply

2.1   Requirements

This RSK is supplied with an E1 debugger or E2 Lite debugger. The debugger is able to power the RSK board with up to 200mA. When the RSK is connected to another system then that system should supply power to the RSK. This board has an optional centre positive supply connector using a 2.0mm barrel power jack.

Details of the external power supply requirements for the RSK, and configuration are shown in **Table 2-1** , **Table 2-2** below. The default RSK power configuration is shown in **bold, blue text.**

Connector	Supply voltage
PWR	Input 5VDC

Table 2-1: PWR Connector Requirements

J6 Setting (DNF)	R63 Setting	R150 Setting	Supply Source	Board_5V	Board_3V3	Board_VCC UC_VCC
Pin1-2 shorted	Don't care	Don't care	E1(3V3) / E2 Lite(3V3) / JA1-3V3	0V [*1]	3.3V	3.3V
		DNF	PWR Connector / Unregulated_VCC / JA1-5V	5V	3.3V	3.3V
		Fit	PWR Connector / Unregulated_VCC / JA1-5V	5V	1.86V	1.86V [*1, *2, *3, *4]
Pin2-3 shorted	DNF	Don't care	E1(5V)	5V	3.3V	5V [*2]
		DNF	PWR Connector / Unregulated_VCC / JA1-5V	5V	3.3V	5V [*2]
		Fit	PWR Connector / Unregulated_VCC / JA1-5V	5V	1.86V	5V [*2]
All Open	**Fit**	Don't care	E1(3V3) / E2 Lite(3V3) / JA1-3V3	0V [*1]	3.3V	3.3V
		DNF	**PWR Connector / JA1-5V / Unregulated_VCC**	**5V**	**3.3V**	**3.3V**
		Fit	PWR Connector / JA1-5V / Unregulated_VCC	5V	1.86V	1.86V [*1, *2, *3, *4]

Table 2-2: Main Power Supply Requirements

[*1]: Can not use LIN.
[*2]: Can not use Pmod™.
[*3]: Can not use LED
[*4]: Can not use Remote Control Receiver

The main power supply connected to PWR should supply a minimum of 5W to ensure full functionality.

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.
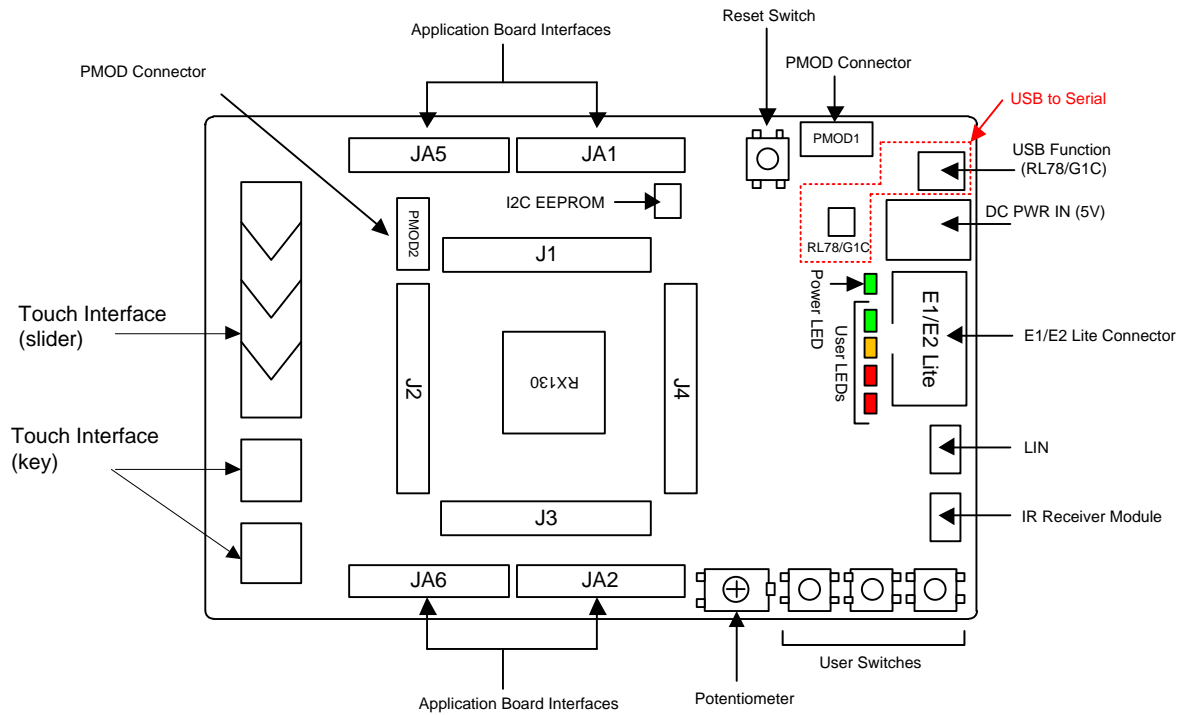
Figure 3-1: Board Layout

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 grid for easy interfacing.
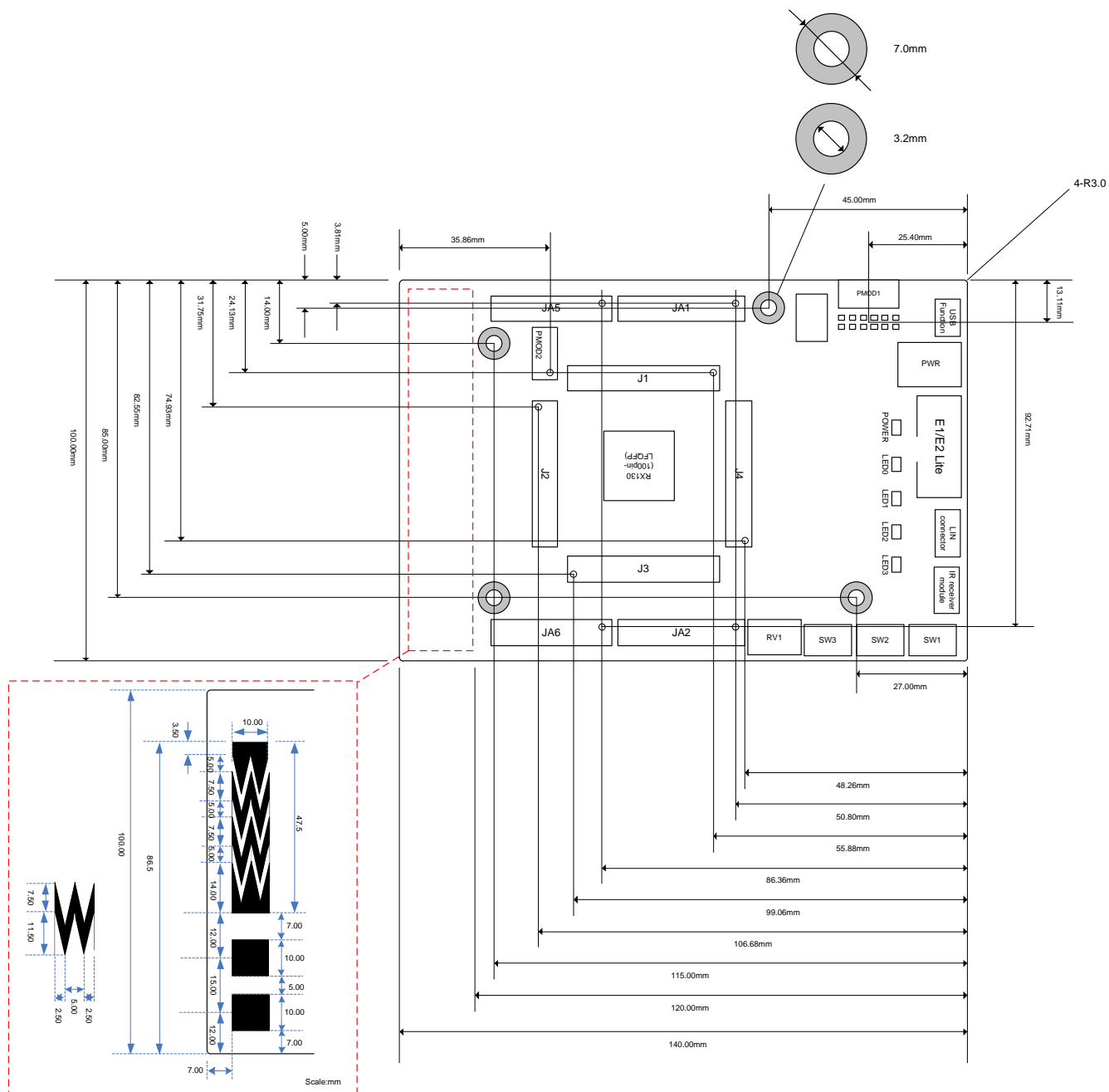
Figure 3-2: Board Dimensions

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.
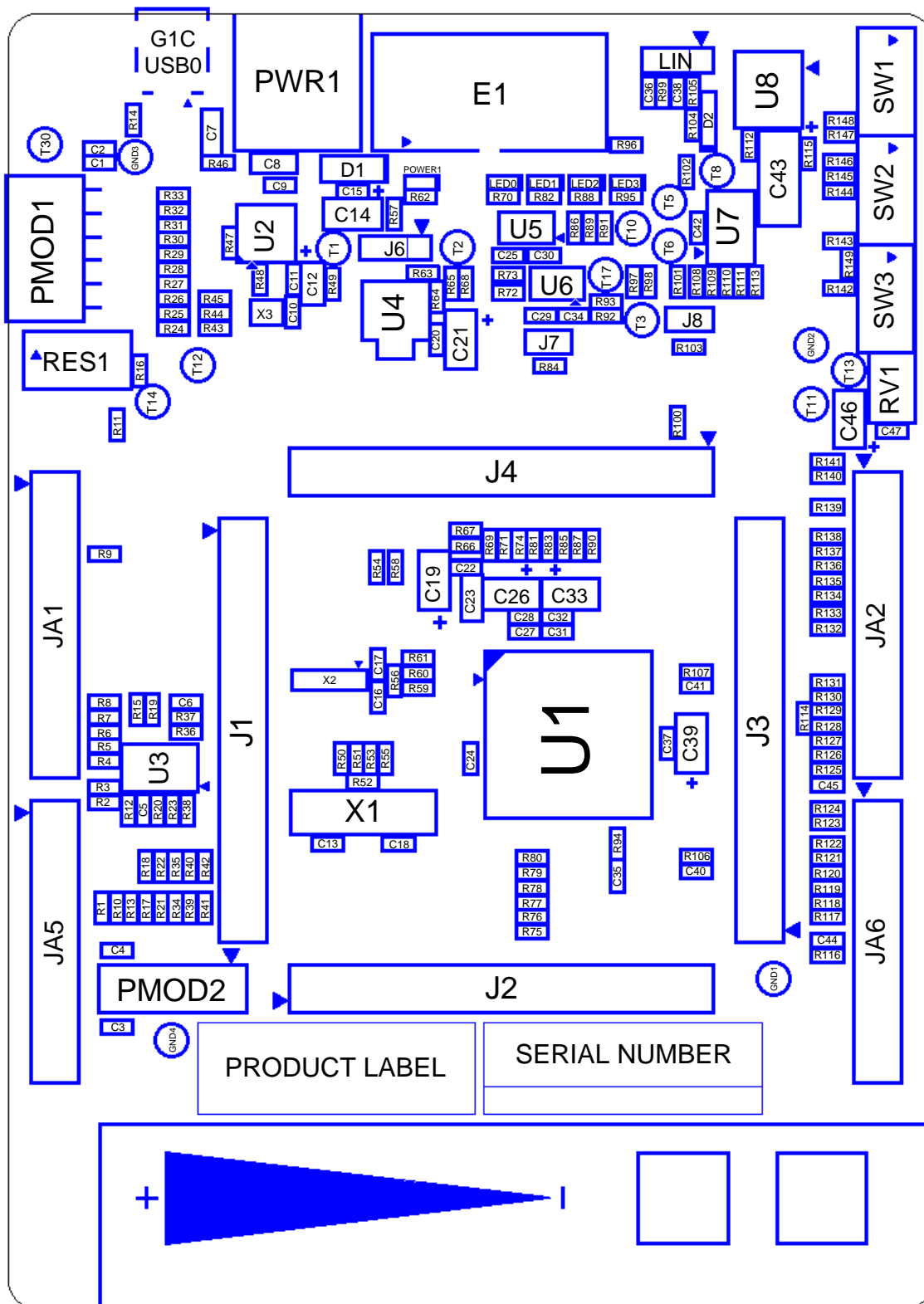
Figure 3-3 Top-Side Component Placement
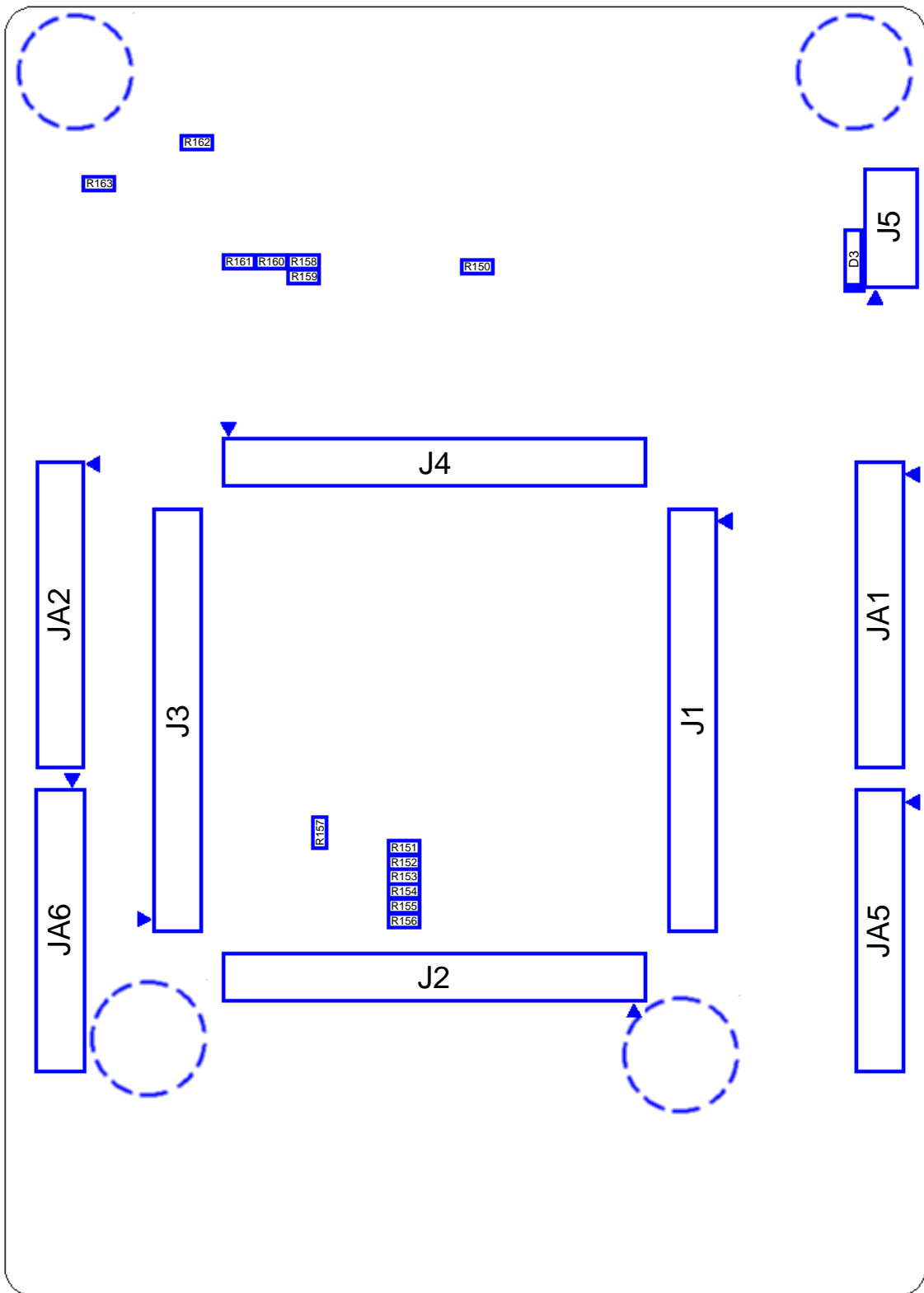
Figure 3-4 Bottom-Side Component Placement

4. Connectivity

4.1   Internal RSK Connections

Figure 4-1 below shows the RSK board components and their connectivity to the MCU.
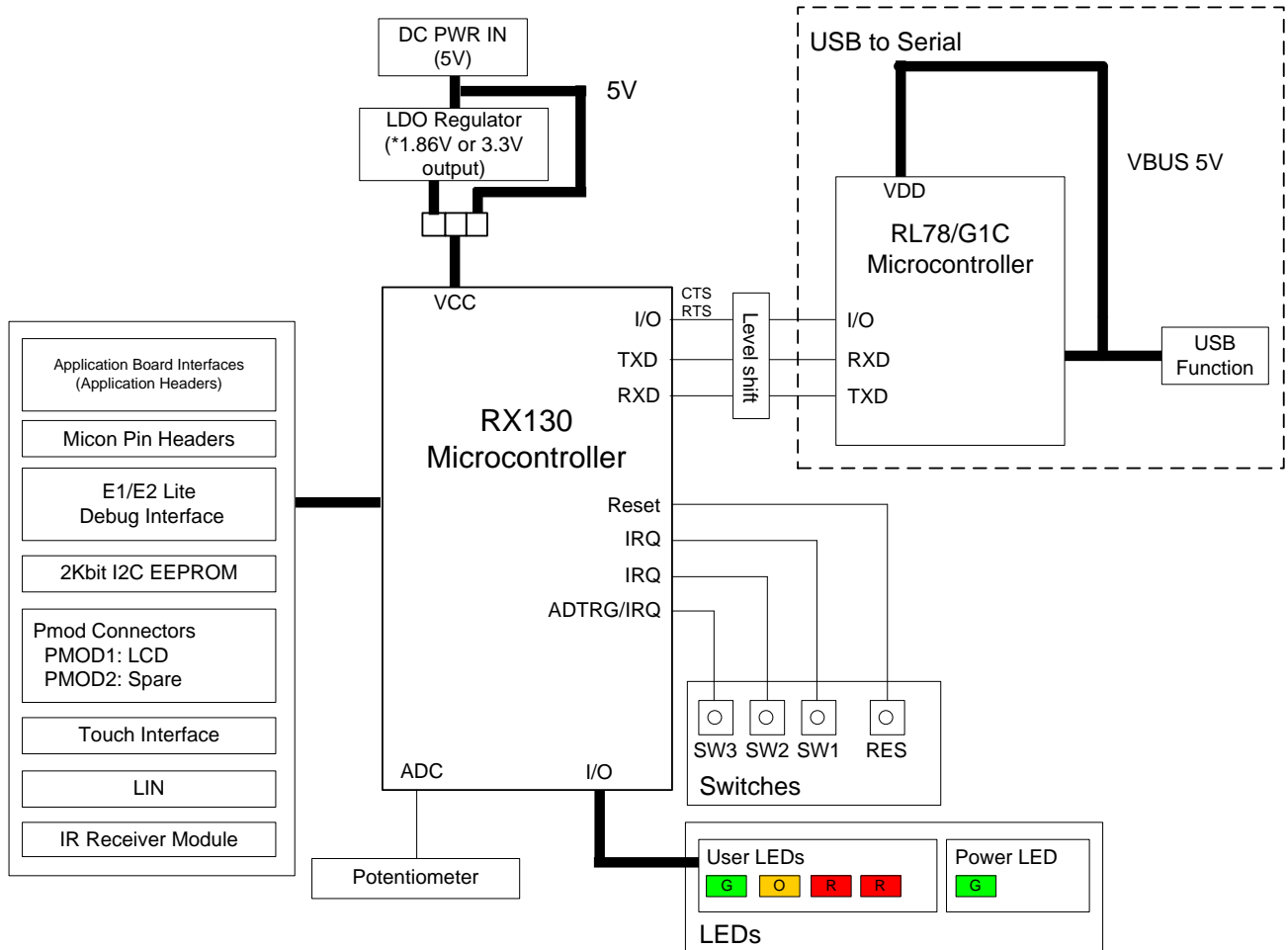
Figure 4-1: Internal RSK Block Diagram

*1: Default setting is 3.3V - output refer to §2.1 or §6.4 for the required modifications.

4.2 Debugger Connections

Figure 4-2 below shows the connections between the RSK, E1/E2 Lite debugger and the host PC.
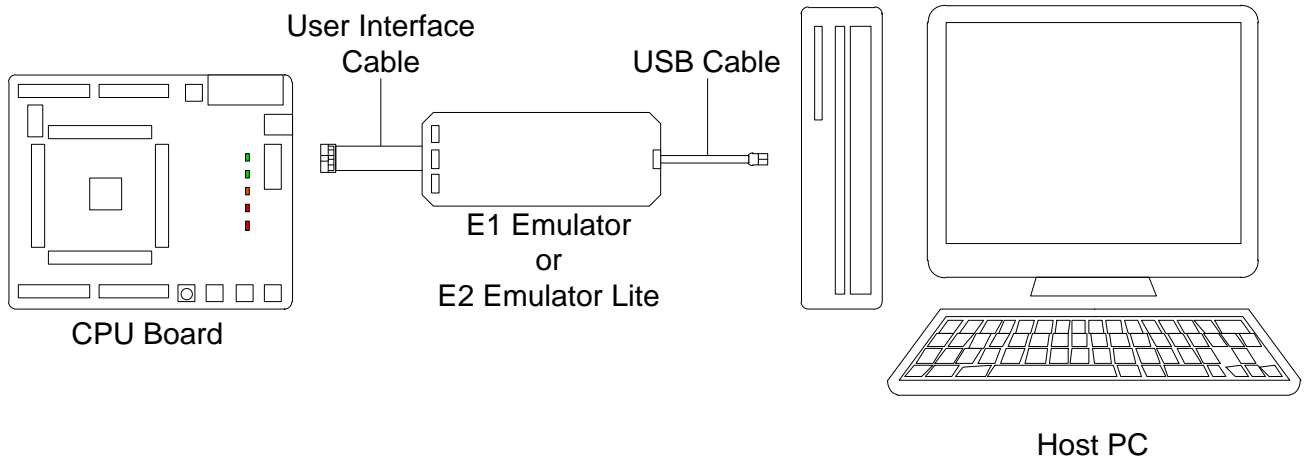
Figure 4-2: Debugger Connection Diagram

5.   User Circuitry

5.1   Reset Circuit

A reset control circuit is fitted to the RSK to generate a reset signal from the RES switch. Refer to the RX130 Group Hardware Manual for details regarding the reset signal timing requirements, and the RSK schematics for information regarding the reset circuitry in use on the board.

5.2   Clock Circuit

A clock circuit is fitted to the RSK to generate the required clock signal to drive the MCU, and associated peripherals. Refer to the RX130 Group Hardware Manual for details regarding the clock signal requirements, and the RSKRX130-512KB board schematics for information regarding the clock circuitry in use on the RSK. Details of the oscillators fitted to the board are listed in **Table 5-1** below.

Crystal	Function	Default Placement	Frequency	Device Package
X1	RX130 Main oscillator	Fitted	8MHz	Encapsulated, SMT
X2	RX130 Sub oscillator	Fitted	32.768kHz [1]	Encapsulated, SMT
X3	RL78/G1C Main oscillator	Fitted	12MHz	Encapsulated, SMT

Table 5-1: Oscillators

[1]: The Sub clock oscillator drive circuit is low power to achieve excellent standby power consumption. The Crystal and associated capacitors must have a capacitance equal or less than 6pF to ensure this oscillator is accurate. The oscillator will function at higher loads, but operation to specification is not guaranteed.

5.3   Switches

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

Switch	Function	MCU	
		Signal	Pin
RES	When pressed, the microcontroller is reset.	RESn	10
SW1	Connects to an IRQ1 input for user controls.	P31	19
SW2	Connects to an IRQ2 input for user controls.	P32	18
SW3	Connects to IRQ6 and ADTRG0 input, and is used to trigger AD conversions.	P16	30

Table 5-2: Switch Connections

5.4   LEDs

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

LED	Colour	Function	MCU	
			Port	**Pin**
POWER	Green	Indicates the status of the Board_VCC power rail	-	-
LED0	Green	User operated LED	PD3	83
LED1	Orange	User operated LED	PD4	82
LED2	Red	User operated LED	PE6	72
LED3	Red	User operated LED	PE7	71

Table 5-3: LED Connections

5.5   Potentiometer

A single-turn potentiometer is connected as a potential divider to analog input AN000 (Port P40, Pin 95). 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 RX130 Group Hardware Manual for further details.

5.6   Pmod™

The RSK board is equipped with connectors for Digilent Pmod™ interface. Please connect the PMOD1 connector that is compatible with Debug LCD.

> 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.

The Digilent Pmod™ Compatible headers uses an SPI interface. **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 Revision: November 20, 2011.
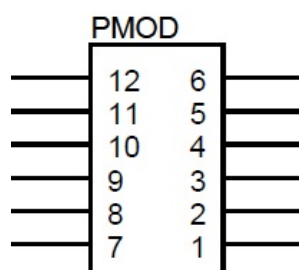
Figure 5-1: Digilent Pmod™ Compatible Header Pin Numbering

Digilent Pmod™ Compatible Header (PMOD1) Connections							
Pin	Circuit Net Name	MCU		Pin	Circuit Net Name	MCU	
		Port	Pin			Port	Pin
1	PMOD1-CS	PB2	58	7	PMOD1-IO0	PD0	86
2	PMOD1-MOSI	PB1	59	8	PMOD1-IO1	P17	29
3	PMOD1-MISO	PB0	61	9	PMOD1-IO2	PC2	50
4	PMOD1-SCK	PB3	57	10	PMOD1-IO3	PC3	49
5	GROUND	-	-	11	GROUND	-	-
6	Board_3V3	-	-	12	Board_3V3	-	-

Table 5-4: Pmod™1 Header Connections

Digilent Pmod™ Compatible Header (PMOD2) Connections							
Pin	Circuit Net Name	MCU		Pin	Circuit Net Name	MCU	
		Port	Pin			Port	Pin
1	PMOD2-CS	PA6	64	7	PMOD2-IO0 [1]	P34	16
2	PMOD2-MOSI [1]	PA4	66	8	PMOD2-IO1	P15	31
3	PMOD2-MISO [1]	PA2	68	9	PMOD2-IO2	PE3	75
4	PMOD2-SCK [1]	PA1	69	10	PMOD2-IO3	PE4	74
5	GROUND	-	-	11	GROUND	-	-
6	Board_3V3	-	-	12	Board_3V3	-	-

Table 5-5: Pmod™2 Header Connections

[1]: This connection as used on **Table 5-6** for the option links.

5.7   USB Serial Port

A USB serial port is implemented in a Renesas low power microcontroller (RL78/G1C) and is connected to the RX130 Serial Communications Interface (SCI) module. Multiple options are provided to allow the selection of the connected SCI1 port. Connections between the USB to Serial converter and the microcontroller are listed in **Table 5-6** below.

Signal Name	Function	MCU	
		Port	**Pin**
SERIAL-TXD	SCI1 Transmit Signal	P26	22
	SCI5 Transmit Signal[1]	PA4	66
	SCI12 Transmit Signal[1]	PE1	77
SERIAL-RXD	SCI1 Receive Signal	P30	20
	SCI5 Receive Signal[1]	PA2	68
	SCI12 Receive Signal[1]	PE2	76
SERIAL-CTS	Clear To Send	P34	16
SERIAL-RTS	Request To Send	PJ3	4

Table 5-6: Serial Port Connections

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

When the RSK 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 for 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.
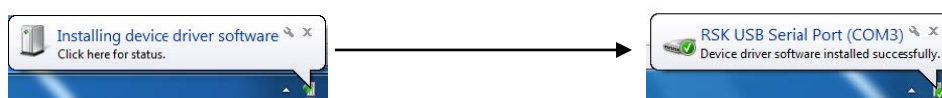
Figure 5-2: USB-Serial Windows™ Installation message

5.8   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 RX130 Group Hardware Manual. Connections between the LIN connector and microcontroller are listed in **Table 5-7** below.

Signal Name	Function	MCU	
		Port	**Pin**
LIN-TXD	LIN Transmit Signal	PE1	77
LIN-RXD	LIN Receive Signal	PE2	76
LIN-NSLP	LIN Transceiver Device Sleep Control	PC5	47

Table 5-7: LIN Connections

5.9   I²C Bus (Inter-IC Bus)

The RX130 features one I²C (Inter-IC Bus) interface module. RIIC0 is connected to a 2Kbit EEPROM. Specific details of the EEPROM device and the connections can be found in the board schematics.

5.10   Remote Control Signal Receiver

The RSK board is fitted with a Remote Control Signal Receiver for remote control receive function. **Table 5-8** below details the connected devices, and their connections to the MCU.

Signal Name	Function	MCU	
		Port	Pin
RCR-PMC0	External pulse signal input	P51	43

Table 5-8: Remote Control Signal Receiver Connections

5.11   Touch Interface

The RSK Board is fitted with a Touch Interface (slider) and two Touch Interfaces (key). **Table 5-9** below details the connected devices, and their connections to the MCU.

Touch Interface Signal	Function	MCU	
		Port	Pin
TS7	Electrostatic capacitive measurement pin (touch slider)	PH3	35
TS8	Electrostatic capacitive measurement pin (touch slider)	PH2	36
TS9	Electrostatic capacitive measurement pin (touch slider)	PH1	37
TS10	Electrostatic capacitive measurement pin (touch slider)	PH0	38
TS11	Electrostatic capacitive measurement pin (touch key)	P55	39
TS12	Electrostatic capacitive measurement pin (touch key)	P54	40
TSCAP	LPF (Low-pass filter) connection pin	PC4	48

Table 5-9: Touch Interface Connections

6.   Configuration

6.1   Modifying the RSK

This section lists the option links that are used to modify the way RSK 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 connect 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 RSK is supplied with. Refer to the component placement diagram (§3) to locate the option links and jumpers.

> When removing soldered components, always ensure that the RSK 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 RX130 Group Hardware Manual and RSKRX130-512KB schematics for further information.

6.2   MCU Operating Modes

Table 6-1 below details the option links associated with configuring the MCU operating modes.

Reference	Configuration	Explanation	Related Ref.
J7 *1	All open	Single Chip Mode	-
	Shorted Pin1-2	Boot Mode (SCI)	-

Table 6-1: MCU Option Links

*1: By default, jumper J7 is not fitted to the RSK. Therefore, it becomes the same setting as 'J7 All open'.

6.3   E1 / E2 Lite Debugger Configuration

Table 6-2 below details the function of the option links associated with E1 / E2 Lite Debugger configuration.

| Signal name | MCU | | MCU Peripheral Selection | | | Destination Selection | | |
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P26	22	P26	SERIAL-TXD	R36	R160, R91, R117	U5.3	-	R122
			JA2-TXDa	R138	R160	JA2.6	-	-
			E1-TXD	R160	R36, R138	E1.5	-	-
P30	20	P30	SERIAL-RXD	R97	R161, R158, R159	U6.3	-	R121
			JA2-RXDa	R136	R161	JA2.8	-	-
			E1-RXD	R161	R97, R136	E1.11	-	-
MD_FINED	7	MD_FINED	E1-MD_FINED	-	-	E1.7	-	-
			JP-MD_FINED	-	-	J7.2	-	-
RESn	10	RESn	E1-RESn	-	-	E1.13	-	-
			SW-RESn	-	-	RES	-	-
			JA2-RESn	-	-	JA2.1	-	-

Table 6-2: E1 / E2 Lite Debugger Option Links

Items shown in **bold** are the Fit / Do Not Fit (DNF) default configuration that the RSK is supplied with.

6.4   Power Supply Configuration

Table 6-3 and Table 6-4 below details the function of the option links associated with power supply configuration.

Reference	Configuration	Explanation	Related Ref.
J8 *1	Shorted Pin1-2	Connects Board_VCC to UC_VCC.	U4, R103
	All open	Enables current probe for MCU current consumption.	U4, R103
R150	Fit	Enables 1.86V regulator output.	U4
	DNF	Enables 3.3V regulator output.	U4
J6 *2	Shorted Pin1-2	Connects regulator output to Board_VCC.	U4, R63
	Shorted Pin2-3	Connects regulator input (Board_5V) to Board_VCC. In this case, R63 do not fit.	U4, R63
	All open	DO NOT USE	U4, R63

Table 6-3: Power Supply Option Links (1)

*1: By default, jumper J8 is not fitted to the RSK. R103 is fitted by default and becomes the same setting as 'J8 Shorted Pin1-2'.
*2: By default, jumper J6 is not fitted to the RSK. R63 is fitted by default and becomes the same setting as 'J6 Shorted Pin1-2'.

Reference	Explanation	Fit	DNF	Related Ref.
PWR	Connects 5V power rail to Board_5V.	-	-	U4, J6
Unregulated_VCC	Connects Unregulated_VCC to Board_5V.	R57	-	U4, JA6.23
	Disconnects Unregulated_VCC from Board_5V.	-	R57	-
JA1-5V	Connects JA1-5V to Board_5V.	R49	-	U4, JA1.1
	Disconnects JA1-5V from Board_5V.	-	R49	-
JA1-3V3	Connects JA1-3V3 to Board_3V3.	R11	-	J6, JA1.3
	Disconnects JA1-3V3 from Board_3V3.	-	R11	-
Board_VCC	Connects Board_VCC to UC_VCC.	R103/J8.1-2	-	U1(VCC, AVCC0, VREFH0)
	Disconnects Board_VCC from UC_VCC. Enables current probe for MCU current consumption.	J8.Open	R103	U1(VCC, AVCC0, VREFH0)
Board_5V	Connects Board_5V to VBAT.	R102	-	U7
	Disconnects Board_5V from VBAT.	-	R102	U7

Table 6-4: Power Supply Option Links (2)

6.5   Clock Configuration

Table 6-5 below details the function of the option links associated with clock configuration.

Reference	Explanation	Fit	DNF	Related Ref.
XTAL, EXTAL, JA2-EXTAL	Connects 8MHz crystal (X1) to RX130.	R51, R53	R50, R55	U1(EXTAL, XTAL)
	Connects JA2-EXTAL to RX130.	R55	R51, R53	U1(EXTAL), JA2.2
XCIN, XCOUT	Connects 32.768kHz crystal (X2) to RX130.	R59, R60	-	U1(XCIN, XCOUT)
	Disconnects 32.768kHz crystal (X2) from RX130.	-	R59, R60	U1(XCIN, XCOUT)

Table 6-5: Clock Option Links

Items shown in **bold** are the Fit / Do Not Fit (DNF) default configuration that the RSK is supplied with.

6.6   Analog Power & ADC & DAC Configuration

Table 6-6 below details the function of the option links associated with Analog Power & ADC & DAC configuration.

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
JA1-DAC0	2	P03	JA1-DAC0	-	-	JA1.13	-	-
JA1-DAC1	100	P05	JA1-DAC1	-	-	JA1.14	-	-
P16	30	P16	SW3	R149	-	SW3	-	-
			JA1-ADTRG	R9	-	JA1.8	-	-
P40	95	P40	RV1-ADC	R66	-	RV1	-	-
			JA1-ADC0	R67	-	JA1.9	-	-
JA1-ADC1	93	P41	JA1-ADC1	-	-	JA1.10	-	-
JA1-ADC2	92	P42	JA1-ADC2	-	-	JA1.11	-	-
JA1-ADC3	91	P43	JA1-ADC3	-	-	JA1.12	-	-
JA5-ADC4	90	P44	JA5-ADC4	-	-	JA5.1	-	-
JA5-ADC5	89	P45	JA5-ADC5	-	-	JA5.2	-	-
JA5-ADC6	88	P46	JA5-ADC6	-	-	JA5.3	-	-
JA5-ADC7	87	P47	JA5-ADC7	-	-	JA5.4	-	-
VREFH0	96	PJ6	UC_VCC	R83	R85	-	-	-
			JA1-VREFH	R85	R83	JA1.7	-	-
VREFL0	94	PJ7	GROUND	R87	R90	-	-	-
			JA1-AVSS	R90	R87	JA1.6	-	-
AVCC0	97	-	UC_VCC	R81	R74, R140, R141	-	-	-
			JA1-AVCC	R74	R81, R140, R141	JA1.5	-	-
			Board_VCC	R140, R141	R81, R74	-	-	-
AVSS0	99	-	GROUND	R69	R71	-	-	-
			JA1-AVSS	R71	R69	JA1.6	-	-

Table 6-6: Analog Power & ADC & DAC Option Links

6.7   General I/O & LED Configuration

Table 6-7 below details the function of the option links associated with the General I/O & LED configuration.

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
JA1-IO0	27	P21	JA1-IO0	-	-	JA1.15	-	-
JA1-IO1	26	P22	JA1-IO1	-	-	JA1.16	-	-
JA1-IO2	44	P50	JA1-IO2	-	-	JA1.17	-	-
P51	43	P51	RCR-PMC0	R112	R162	U8.1	-	-
			JA1-IO3	R162	R112	JA1.18	-	-
JA1-IO4	42	P52	JA1-IO4	-	-	JA1.19	-	-
JA1-IO5	41	P53	JA1-IO5	-	-	JA1.20	-	-
JA1-IO6	52	PC0	JA1-IO6	-	-	JA1.21	-	-
JA1-IO7	51	PC1	JA1-IO7	-	-	JA1.22	-	-
LED0	83	PD3	LED0	-	-	LED0	R96	-
LED1	82	PD4	LED1	-	-	LED1	R96	-
LED2	72	PE6	LED2	-	-	LED2	R96	-
LED3	71	PE7	LED3	-	-	LED3	R96	-

Table 6-7: General I/O & LED Option Links

Items shown in **bold** are the Fit / Do Not Fit (DNF) default configuration that the RSK is supplied with.

6.8   I²C & EEPROM Configuration

Table 6-8 and **Table 6-9** below detail the function of the option links associated with I2C & EEPROM Configuration.

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P12	34	P12	E2P-SCL	-	-	U3.6	-	-
			JA1-SCL	-	-	JA1.26	-	-
P13	33	P13	E2P-SDA	R6	R135	U3.5	-	-
			JA1-SDA	R6	R135	JA1.25	-	-
			JA2-IRQb_M1HSIN1	R135	R6	JA2.9	-	-

Table 6-8: I2C & EEPROM Option Links (1)

Reference	Explanation	Fit	DNF	Related Ref.
E2P-SDA, E2P-SCL	Connect pull-up resistor to Board_5V.	R20	R12	U3
	Connect pull-up resistor to Board_3V3.	R12	R20	U3

Table 6-9: I2C & EEPROM Option Links (2)

6.9   IRQ & Switch Configuration

Table 6-10 below details the function of the option links associated with the IRQ & Switches configuration.

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P13	33	P13	E2P-SDA	R6	R135	U3.5	-	-
			JA1-SDA	R6	R135	JA1.25	-	-
			JA2-IRQb_M1HSIN1	R135	R6	JA2.9	-	-
PMOD2-IO1	31	P15	PMOD2-IO1	-	-	PMOD2.8	-	-
P16	30	P16	SW3	R149	-	SW3	-	-
			JA1-ADTRG	R9	-	JA1.8	-	-
PMOD1-IO1	29	P17	PMOD1-IO1	-	-	PMOD1.8	-	-
P31	19	P31	SW1	R147	-	SW1	-	-
			JA1-IRQd	R8	-	JA1.23	-	-
P32	18	P32	SW2	R145	-	SW2	-	-
			JA2-IRQc_M1HSIN2	R144	-	JA2.23	R127	R128
P34	16	P34	SERIAL-CTS	R93	R40, R137	U6.2	-	-
			PMOD2-IO0	R40	R93, R137	PMOD2.7	-	-
			JA2-IRQa_M1HSIN0	R137	R93, R40	JA2.7	-	-
JA2-NMIn	15	P35	NMI	-	-	JA2.3	-	-
PMOD1-IO0	86	PD0	PMOD1-IO0	-	-	PMOD1.7	-	-

Table 6-10: IRQ & Switch Option Links

Items shown in **bold** are the Fit / Do Not Fit (DNF) default configuration that the RSK is supplied with.

6.10   LIN Configuration

Table 6-11 below details the function of the option links associated with LIN Configuration.

Signal name /Reference	MCU Pin	MCU Port	MCU Peripheral Selection Signal	Fit	DNF	Destination Selection Interface /Function	Fit	DNF
LIN-NSLP	47	PC5	LIN-NSLP	-	-	U7.2	-	-
PE1	77	PE1	SERIAL-TXD	R117	R111, R118, R36, R91	U5.3	-	R122
			LIN-TXD	R111	R117, R118	U7.4	-	-
			JA6-TXDc	R118	R117, R111	JA6.9	-	-
PE2	76	PE2	SERIAL-RXD	R159	R109, R116, R97, R158	U6.3	-	R121
			LIN-RXD	R109	R159, R116	U7.1	-	-
			JA6-RXDc	R116	R159, R109	JA6.12	-	-
LIN Operating Mode	-	-	-	-	-	Master mode	R99, R105	-
						Slave mode	-	R99, R105

Table 6-11: LIN Configuration Option Links

6.11   MTU & POE Configuration

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

Signal name	MCU Pin	MCU Port	MCU Peripheral Selection Signal	Fit	DNF	Destination Selection Interface /Function	Fit	DNF
P13	33	P13	E2P-SDA	R6	R135	U3.5	-	-
			JA1-SDA	R6	R135	JA1.25	-	-
			JA2-IRQb_M1HSIN1	R135	R6	JA2.9	-	-
P20	28	P20	JA2-M1ENC	R114	R129	JA2.23	R128	R127
			JA2-TIMIN1	R129	R114	JA2.22	-	-
JA2-M1TRCCLK	24	P24	JA2-M1TRCCLK	-	-	JA2.25	-	-
JA2-M1TRDCLK	23	P25	JA2-M1TRDCLK	-	-	JA2.26	-	-
P32	18	P32	SW2	R145	-	SW2	-	-
			JA2-IRQc_M1HSIN2	R144	-	JA2.23	R127	R128
P34	16	P34	SERIAL-CTS	R93	R40, R137	U6.2	-	-
			PMOD2-IO0	R40	R93, R137	PMOD2.7	-	-
			JA2-IRQa_M1HSIN0	R137	R93, R40	JA2.7	-	-
JA2-M1VP	70	PA0	JA2-M1VP	-	-	JA2.15	-	-
JA2-TIMIN0	67	PA3	JA2-TIMIN0	-	-	JA2.21	-	-
JA2-M1POE	55	PB5	JA2-M1POE	R125	-	JA2.24	-	-
PB6	54	PB6	JA2-M1UN	R133	R130	JA2.14	-	-
			JA2-TIMOUT1	R130	R133	JA2.20	-	-
PB7	53	PB7	JA2-M1UP	R132	R131	JA2.13	-	-
			JA2-TIMOUT0	R131	R132	JA2.19	-	-
JA2-M1UD	46	PC6	JA2-M1UD	-	-	JA2.11	-	-
JA2-M1WP	85	PD1	JA2-M1WP	-	-	JA2.17	-	-
JA2-M1WN	84	PD2	JA2-M1WN	-	-	JA2.18	-	-
JA6-M1WIN	81	PD5	JA6-M1WIN	-	-	JA6.16	-	-
JA6-M1VIN	80	PD6	JA6-M1VIN	-	-	JA6.15	-	-
JA6-M1UIN	79	PD7	JA6-M1UIN	-	-	JA6.14	-	-
JA2-M1VN	73	PE5	JA2-M1VN	-	-	JA2.16	-	-
JA6-M1TOGGLE	6	PJ1	JA6-M1TOGGLE	-	-	JA6.13	-	-

Table 6-12: MTU & POE Option Links

Items shown in **bold** are the Fit / Do Not Fit (DNF) default configuration that the RSK is supplied with.

6.12   PMOD1 Interface Configuration

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

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
PMOD1-IO1	29	P17	PMOD1-IO1	-	-	PMOD1.8	-	-
PMOD1-MISO	61	PB0	PMOD1-MISO	-	-	PMOD1.3	-	-
PMOD1-MOSI	59	PB1	PMOD1-MOSI	-	-	PMOD1.2	-	-
PMOD1-CS	58	PB2	PMOD1-CS	-	-	PMOD1.1	-	-
PMOD1-SCK	57	PB3	PMOD1-SCK	R106	-	PMOD1.4	-	-
PMOD1-IO2	50	PC2	PMOD1-IO2	-	-	PMOD1.9	-	-
PMOD1-IO3	49	PC3	PMOD1-IO3	-	-	PMOD1.10	-	-
PMOD1-IO0	86	PD0	PMOD1-IO0	-	-	PMOD1.7	-	-

Table 6-13: PMOD1 Interface Option Links

6.13   PMOD2 Interface Configuration

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

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
PMOD2-IO1	31	P15	PMOD2-IO1	-	-	PMOD2.8	-	-
P34	16	P34	SERIAL-CTS	R93	R40, R137	U6.2	-	-
			PMOD2-IO0	R40	R93, R137	PMOD2.7	-	-
			JA2-IRQa_M1HSIN0	R137	R93, R40	JA2.7	-	-
PA1	69	PA1	PMOD2-SCK	R107, R124	R123	PMOD2.4	-	-
			JA6-SCKb	R107, R123	R124	JA6.10	-	-
PA2	68	PA2	SERIAL-RXD	R158	R18, R120, R97, R159	U6.3	-	R121
			PMOD2-MISO	R18	R158, R120	PMOD2.3	-	-
			JA6-RXDb	R120	R158, R18	JA6.7	-	-
PA4	66	PA4	SERIAL-TXD	R91	R35, R119, R36, R117	U5.3	-	R122
			PMOD2-MOSI	R35	R91, R119	PMOD2.2	-	-
			JA6-TXDb	R119	R91, R35	JA6.8	-	-
PMOD2-CS	64	PA6	PMOD2-CS	-	-	PMOD2.1	-	-
PMOD2-IO2	75	PE3	PMOD2-IO2	-	-	PMOD2.9	-	-
PMOD2-IO3	74	PE4	PMOD2-IO3	-	-	PMOD2.10	-	-

Table 6-14: PMOD2 Interface Option Links

Items shown in **bold** are the Fit / Do Not Fit (DNF) default configuration that the RSK is supplied with.

6.14   Remote Control Signal Receiver Configuration

Table 6-15 below details the function of the option links associated with Remote Control Signal Receiver configuration.

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P51	43	P51	RCR-PMC0	R112	R162	U8.1	-	-
			JA1-IO3	R162	R112	JA1.18	-	-

Table 6-15: Remote Control Signal Receiver Option Links

6.15   Serial & USB to Serial Configuration

Table 6-16 below details the function of the option links associated with Serial & USB to Serial configuration.

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
JA2-CTSaRTSa	32	P14	JA2-CTSaRTSa	-	-	JA2.12	-	-
P26	22	P26	SERIAL-TXD	R36	R160, R91, R117	U5.3	-	R122
			JA2-TXDa	R138	R160	JA2.6	-	-
			E1-TXD	R160	R36, R138	E1.5	-	-
JA2-SCKa	21	P27	JA2-SCKa	R37	-	JA2.10	-	-
P30	20	P30	SERIAL-RXD	R97	R161, R158, R159	U6.3	-	R121
			JA2-RXDa	R136	R161	JA2.8	-	-
			E1-RXD	R161	R97, R136	E1.11	-	-
P34	16	P34	SERIAL-CTS	R93	R40, R137	U6.2	-	-
			PMOD2-IO0	R40	R93, R137	PMOD2.7	-	-
			JA2-IRQa_M1HSIN0	R137	R93, R40	JA2.7	-	-
PA1	69	PA1	PMOD2-SCK	R107, R124	R123	PMOD2.4	-	-
			JA6-SCKb	R107, R123	R124	JA6.10	-	-
PA2	68	PA2	SERIAL-RXD	R158	R18, R120, R97, R159	U6.3	-	R121
			PMOD2-MISO	R18	R158, R120	PMOD2.3	-	-
			JA6-RXDb	R120	R158, R18	JA6.7	-	-
PA4	66	PA4	SERIAL-TXD	R91	R35, R119, R36, R117	U5.3	-	R122
			PMOD2-MOSI	R35	R91, R119	PMOD2.2	-	-
			JA6-TXDb	R119	R91, R35	JA6.8	-	-
JA6-SCKc	78	PE0	JA6-SCKc	R100	-	JA6.11	-	-
PE1	77	PE1	SERIAL-TXD	R117	R111, R118, R36, R91	U5.3	-	R122
			LIN-TXD	R111	R117, R118	U7.4	-	-
			JA6-TXDc	R118	R117, R111	JA6.9	-	-
PE2	76	PE2	SERIAL-RXD	R159	R109, R116, R97, R158	U6.3	-	R121
			LIN-RXD	R109	R159, R116	U7.1	-	-
			JA6-RXDc	R116	R159, R109	JA6.12	-	-
SERIAL-RTS	4	PJ3	SERIAL-RTS	-	-	U5.2	-	-

Table 6-16: Serial & USB to Serial Option Links

Items shown in **bold** are the Fit / Do Not Fit (DNF) default configuration that the RSK is supplied with.

6.16   Touch Interface Configuration

Table 6-17 below details the function of the option links associated with Touch Interface configuration.

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
TS12	40	P54	TS12	R75	R156	KEY2	-	-
			MCUPIN-P54	R156	R75	-	-	-
TS11	39	P55	TS11	R76	R155	KEY1	-	-
			MCUPIN-P55	R155	R76	-	-	-
TS10	38	PH0	TS10	R77	R154	SLIDER1.S4	-	-
			MCUPIN-PH0	R154	R77	-	-	-
TS9	37	PH1	TS9	R78	R153	SLIDER1.S3	-	-
			MCUPIN-PH1	R153	R78	-	-	-
TS8	36	PH2	TS8	R79	R152	SLIDER1.S2	-	-
			MCUPIN-PH2	R152	R79	-	-	-
TS7	35	PH3	TS7	R80	R151	SLIDER1.S1	-	-
			MCUPIN-PH3	R151	R80	-	-	-
TSCAP	48	PC4	TSCAP	R94	R157	C35	-	-
			MCUPIN-PC4	R157	R94	-	-	-

Table 6-17: Touch Interface Option Links

Items shown in **bold** are the Fit / Do Not Fit (DNF) default configuration that the RSK is supplied with.

7. Headers

7.1   Application Headers

This RSK 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.

Pin	Header Name	MCU Pin	Pin	Header Name	MCU Pin
	Circuit Net Name			Circuit Net Name	
1	5V	-	2	0V	-
	JA1-5V			GROUND	
3	3V3	-	4	0V	-
	JA1-3V3			GROUND	
5	AVCC	97	6	AVSS	99
	JA1-AVCC			JA1-AVSS	
7	AVREF	96	8	ADTRG	30
	JA1-VREFH			JA1-ADTRG	
9	ADC0	95	10	ADC1	93
	JA1-ADC0			JA1-ADC1	
11	ADC2	92	12	ADC3	91
	JA1-ADC2			JA1-ADC3	
13	DAC0	2	14	DAC1	100
	JA1-DAC0			JA1-DAC1	
15	IO_0	27	16	IO_1	26
	JA1-IO0			JA1-IO1	
17	IO_2	44	18	IO_3	43
	JA1-IO2			JA1-IO3	
19	IO_4	42	20	IO_5	41
	JA1-IO4			JA1-IO5	
21	IO_6	52	22	IO_7	51
	JA1-IO6			JA1-IO7	
23	IRQd/IRQAEC/M2_HSIN0	19/NC/NC	24	IIC_EX	NC
	JA1-23PIN			NC	
25	IIC_SDA	33	26	IIC_SCL	34
	JA1-SDA			JA1-SCL	

Table 7-1: Application Header JA1 Connections

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

Application Header JA2						
Pin	**Header Name**	**MCU Pin**	**Pin**	**Header Name**	**MCU Pin**	
	Circuit Net Name			**Circuit Net Name**		
1	RESET	10	2	EXTAL	13	
	JA2-RESn			JA2-EXTAL		
3	NMI	15	4	Vss1	-	
	JA2-NMIn			GROUND		
5	WDT_OVF	NC	6	SCIaTX	22	
	NC			JA2-TXDa		
7	IRQa/WKUP/M1_HSIN0	16/NC/16	8	SCIaRX	20	
	JA2-7PIN			JA2-RXDa		
9	IRQb/M1_HSIN1	33/33	10	SCIaCK	21	
	JA2-9PIN			JA2-SCKa		
11	M1_UD	46	12	CTSaRTSa	32	
	JA2-M1UD			JA2-CTSaRTSa		
13	M1_UP	53	14	M1_UN	54	
	JA2-M1UP			JA2-M1UN		
15	M1_VP	70	16	M1_VN	73	
	JA2-M1VP			JA2-M1VN		
17	M1_WP	85	18	M1_WN	84	
	JA2-M1WP			JA2-M1WN		
19	TimerOut0	53	20	TimerOut1	54	
	JA2-TIMOUT0			JA2-TIMOUT1		
21	TimerIn0	67	22	TimerIn1	28	
	JA2-TIMIN0			JA2-TIMIN1		
23	IRQc/M1_EncZ/M1_HSIN2	18/28/18	24	M1_POE	55	
	JA2-23PIN			JA2-M1POE		
25	M1_TRCCLK	24	26	M1_TRDCLK	23	
	JA2-M1TRCCLK			JA2-M1TRDCLK		

Table 7-2: Application Header JA2 Connections

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

	Header Name	MCU Pin	Pin	Header Name	MCU Pin
Pin	Circuit Net Name			Circuit Net Name	
1	ADC4	90	2	ADC5	89
	JA5-ADC4			JA5-ADC5	
3	ADC6	88	4	ADC7	87
	JA5-ADC6			JA5-ADC7	
5	CAN1TX	NC	6	CAN1RX	NC
	NC			NC	
7	CAN2TX	NC	8	CAN2RX	NC
	NC			NC	
9	IRQe/M2_EncZ/M2_HSIN1	NC/NC/NC	10	IRQf/M2_HSIN2	NC/NC
	NC			NC	
11	M2_UD	NC	12	M2_Uin	NC
	NC			NC	
13	M2_Vin	NC	14	M2_Win	NC
	NC			NC	
15	M2_Toggle	NC	16	M2_POE	NC
	NC			NC	
17	M2_TRCCLK	NC	18	M2_TRDCLK	NC
	NC			NC	
19	M2_UP	NC	20	M2_UN	NC
	NC			NC	
21	M2_VP	NC	22	M2_VN	NC
	NC			NC	
23	M2_WP	NC	24	M2_WN	NC
	NC			NC	

Application Header JA5

Table 7-3: Application Header JA5 Connections

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

Pin	Header Name	MCU Pin	Pin	Header Name	MCU Pin
	Circuit Net Name			Circuit Net Name	
1	DREQ	NC	2	DACK	NC
	NC			NC	
3	TEND	NC	4	STBYn	NC
	NC			NC	
5	RS232TX	NC	6	RS232RX	NC
	JA6-RS232TX			JA6-RS232RX	
7	SCIbRX	68	8	SCIbTX	66
	JA6-RXDb			JA6-TXDb	
9	SCIcTX	77	10	SCIbCK	69
	JA6-TXDc			JA6-SCKb	
11	SCIcCK	78	12	SCIcRX	76
	JA6-SCKc			JA6-RXDc	
13	M1_Toggle	6	14	M1_Uin	79
	JA6-M1TOGGLE			JA6-M1UIN	
15	M1_Vin	80	16	M1_Win	81
	JA6-M1VIN			JA6-M1WIN	
17	EXT_USB_VBUS	NC	18	Reserved	NC
	NC			NC	
19	EXT_USB_BATT	NC	20	Reserved	NC
	NC			NC	
21	EXT_USB_CHG	NC	22	Reserved	NC
	NC			NC	
23	Unregulated_VCC	-	24	Vss	-
	Unregulated_VCC			GROUND	

Note: Application Header JA6 title row spans top of table.

Table 7-4: Application Header JA6 Connections

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.

Microcontroller Pin Header J1					
Pin	**Circuit Net Name**	**MCU Pin**	**Pin**	**Circuit Net Name**	**MCU Pin**
1	P06	1	2	JA1-DAC0	2
3	P04	3	4	SERIAL-RTS	4
5	NC	NC	6	JA6-M1TOGGLE	6
7	MD_FINED	7	8	NC	NC
9	NC	NC	10	RESn	10
11	MCUPIN-XTAL	11	12	GROUND	-
13	JA2-EXTAL	13	14	UC_VCC	-
15	JA2-NMIn	15	16	P34	16
17	P33	17	18	P32	18
19	P31	19	20	P30	20
21	JA2-SCKa	21	22	P26	22
23	JA2-M1TRDCLK	23	24	JA2-M1TRCCLK	24
25	P23	25	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 7-5: Microcontroller Pin Header, J1

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

Microcontroller Pin Header J2					
Pin	**Circuit Net Name**	**MCU Pin**	**Pin**	**Circuit Net Name**	**MCU Pin**
1	JA1-IO1	26	2	JA1-IO0	27
3	P20	28	4	PMOD1-IO1	29
5	P16	30	6	PMOD2-IO1	31
7	JA2-CTSaRTSa	32	8	P13	33
9	P12	34	10	MCUPIN-PH3	35
11	MCUPIN-PH2	36	12	MCUPIN-PH1	37
13	MCUPIN-PH0	38	14	MCUPIN-P55	39
15	MCUPIN-P54	40	16	JA1-IO5	41
17	JA1-IO4	42	18	P51	43
19	JA1-IO2	44	20	PC7	45
21	JA2-M1UD	46	22	LIN-NSLP	47
23	MCUPIN-PC4	48	24	PMOD1-IO3	49
25	PMOD1-IO2	50	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: Microcontroller Pin Header, J2

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

Microcontroller Pin Header J3					
Pin	Circuit Net Name	MCU Pin	Pin	Circuit Net Name	MCU Pin
1	JA1-IO7	51	2	JA1-IO6	52
3	PB7	53	4	PB6	54
5	JA2-M1POE	55	6	PB4	56
7	PMOD1-SCK	57	8	PMOD1-CS	58
9	PMOD1-MOSI	59	10	UC_VCC	-
11	PMOD1-MISO	61	12	GROUND	-
13	PA7	63	14	PMOD2-CS	64
15	PA5	65	16	PA4	66
17	JA2-TIMIN0	67	18	PA2	68
19	PA1	69	20	JA2-M1VP	70
21	LED3	71	22	LED2	72
23	JA2-M1VN	73	24	PMOD2-IO3	74
25	PMOD2-IO2	75	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: Microcontroller Pin Header, J3

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

Microcontroller Pin Header J4					
Pin	Circuit Net Name	MCU Pin	Pin	Circuit Net Name	MCU Pin
1	PE2	76	2	PE1	77
3	JA6-SCKc	78	4	JA6-M1UIN	79
5	JA6-M1VIN	80	6	JA6-M1WIN	81
7	LED1	82	8	LED0	83
9	JA2-M1WN	84	10	JA2-M1WP	85
11	PMOD1-IO0	86	12	JA5-ADC7	87
13	JA5-ADC6	88	14	JA5-ADC5	89
15	JA5-ADC4	90	16	JA1-ADC3	91
17	JA1-ADC2	92	18	JA1-ADC1	93
19	VREFL0	94	20	P40	95
21	VREFH0	96	22	AVCC0	97
23	P07	98	24	AVSS0	99
25	JA1-DAC1	100	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: Microcontroller Pin Header, J4

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 E1/E20/E2 Lite debugger.

For further information regarding the debugging capabilities of the E1/E20/E2 Lite debuggers, refer to E1/E20 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), which are configured on the RSK board. Details of the modifications required can be found in §6.2. All other MCU operating modes are configured within the MCU's registers, which are listed in the RX130 Group Hardware Manual.

> Only 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 E1 Emulator or 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 E1/E20 Emulator User's Manual (R20UT0398EJ) or E2 Emulator Lite User's Manual (R20UT3240EJ).

8.5   Address Space

For the MCU address space details, refer to the 'Address Space' section of RX130 Group Hardware Manual.

9. Additional Information

Technical Support

For information about the RX130 Group microcontrollers refer to the RX130 Group Hardware Manual.

For information about the RX assembly language, refer to the RX Family Software Manual.

Technical Contact Details

Please refer to the contact details listed in section 8 of the "Quick Start Guide"

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

Trademarks

All brand or product names used in this manual are trademarks or registered trademarks of their respective companies or organisations.

Copyright

This document may be, wholly or partially, subject to change without notice. All rights reserved. Duplication of this document, either in whole or part is prohibited without the written permission of Renesas Electronics Europe Limited.

Rev.	Date	Description	
		Page	Summary
1.00	Jan 31, 2017	—	First Edition issued

RENESAS

RX130 Group