User's Manual

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RX210 Group

Renesas Starter Kit User's Manual

RENESAS MCU
RX Family / RX200 Series

Renesas Electronics
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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 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 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 RX210 Group. 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.	RSKRX210 User Manual	R20UT0302EG
Software Manual	Describes the functionality of the sample code, and its interaction with the Renesas Peripheral Driver Library (RPDL)	RSKRX210 Software Manual	R20UT0305EG
Tutorial	Provides a guide to setting up RSK environment, running sample code and debugging programs.	RSKRX210 Tutorial Manual	R20UT0303EG
Quick Start Guide	Provides simple instructions to setup the RSK and run the first sample, on a single A4 sheet.	RSKRX210 Quick Start Guide	R20UT0304EG
Schematics	Full detail circuit schematics of the RSK.	RSKRX210 Schematics	R20UT0301EG
Hardware Manual	Provides technical details of the RX210 microcontroller.	RX210 Group Hardware Manual	R01UH0037EJ

2. List of Abbreviations and Acronyms

Abbreviation	Full Form
ADC	Analogue-to-Digital Converter
bps	bits per second
CAN	Controller-Area Network
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
DIP	Dual In-line Package
DMA	Direct Memory Access
DMAC	Direct Memory Access Controller
E1	On-chip Debugger
EEPROM	Electronically Erasable Programmable Read Only Memory
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
HEW	High-performance Embedded Workshop
IIC	Phillips™ Inter-Integrated Circuit Connection Bus
IRQ	Interrupt Request
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MCU	Micro-controller Unit
MTU	Multifunction Timer Unit
NMI	Non Maskable Interrupt
PC	Program Counter
PWM	Pulse Width Modulation
RSK	Renesas Starter Kit
RSPI	Renesas Serial Peripheral Interface
SDRAM	Synchronous Dynamic Random Access Memory
SFR	Special Function Register
SPI	Serial Peripheral Interface
SRAM	Static Random Access Memory
TFT	Thin Film Transistor
UART	Universal Asynchronous Receiver/Transmitter

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.

2. Power Supply

2.1 Requirements

This RSK is supplied with an E1 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. All RSK and RSK+ boards have an optional centre positive supply connector using a 2.0mm barrel power jack.

Details of the external power supply requirements for the RSK, and connections are shown in **Table 2-1** below.

Connector	Supply Voltages
PWR	Regulated, 5V DC

Table 2-1: Main Power Supply Requirements

The main power supply connected to PWR1 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' or stand-alone code from the example tutorial code pre-programmed into the Renesas microcontroller. On powering up the board the user LEDs will start to flash. After 200 flashes or after pressing any switch, the LEDs will flash at a rate controlled by the potentiometer.

3. Board Layout

3.1 Component Layout

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

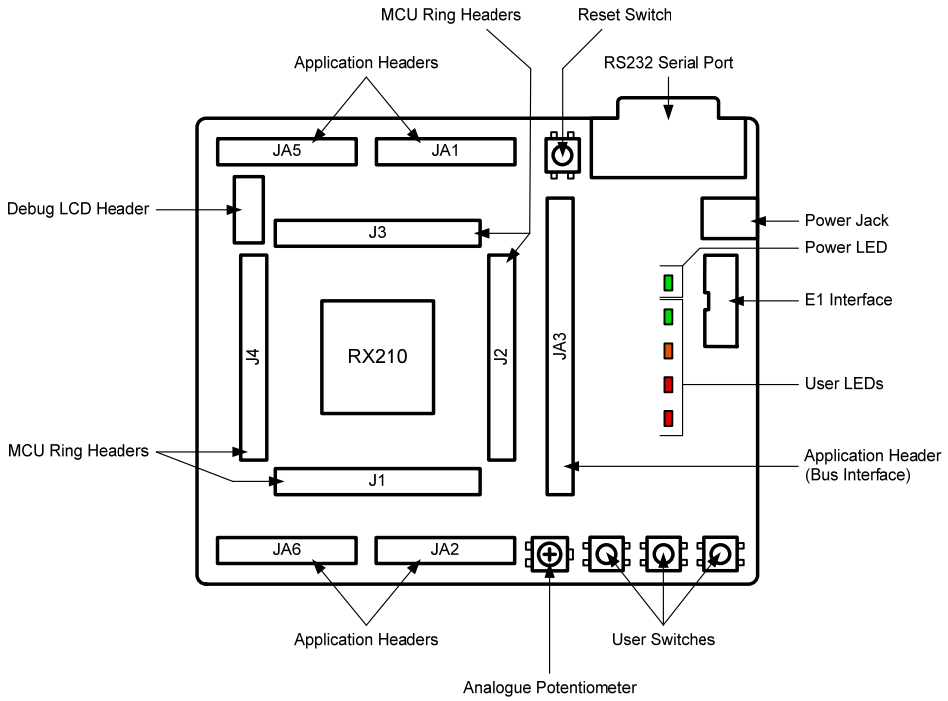

Figure 3-1: Board Layout

3.2 Board Dimensions

Figure 3-2 below gives the board dimensions and connector positions. All the through-hole connectors are on a common 0.1 inch grid for easy interfacing.

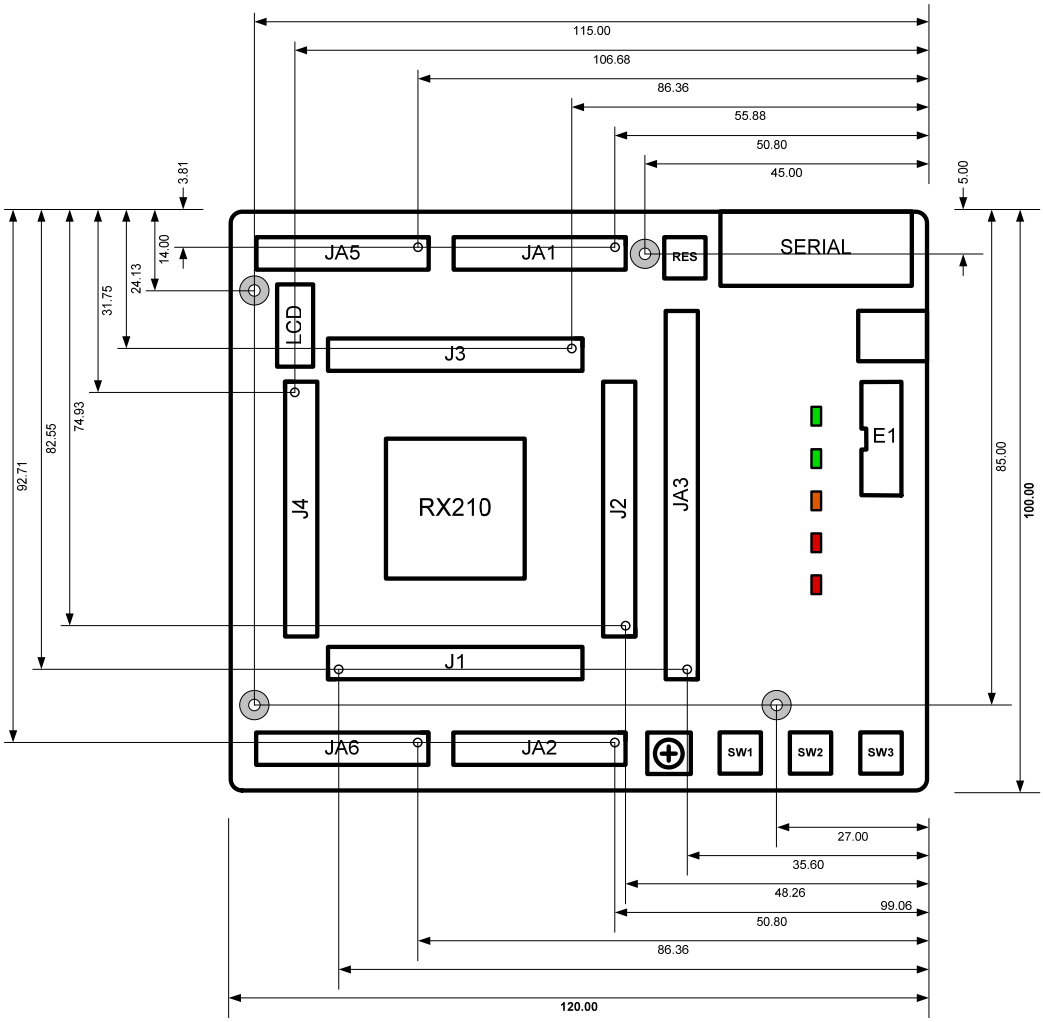

Figure 3-2: Board Dimensions

3.3 Component Placement

Figure 3-3 below shows placement of individual components on the top-side PCB. Component types and values can be looked up using the board schematics.

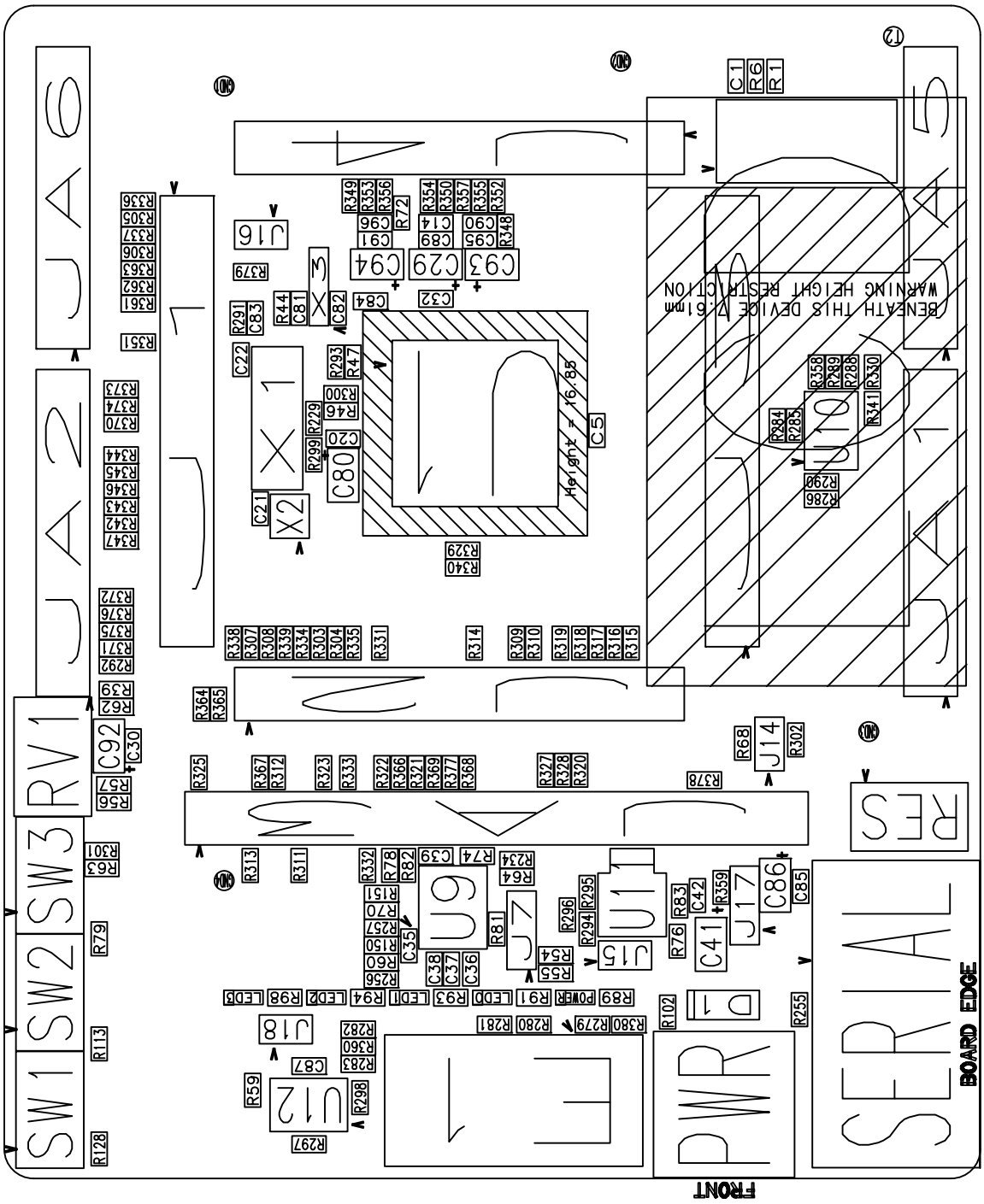

Figure 3-3: Top-Side Component Placement

4. Connectivity

4.1 Internal RSK Connections

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

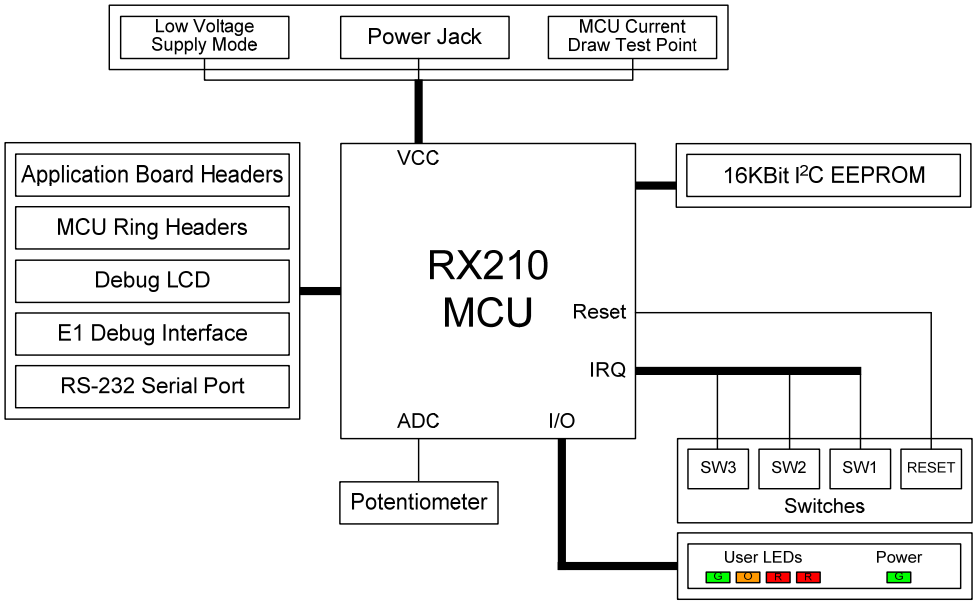

Figure 4-1: Internal RSK Block Diagram

4.2 Debugger Connections

The diagram below shows the connections between the RSK, E1 debugger and the host PC.

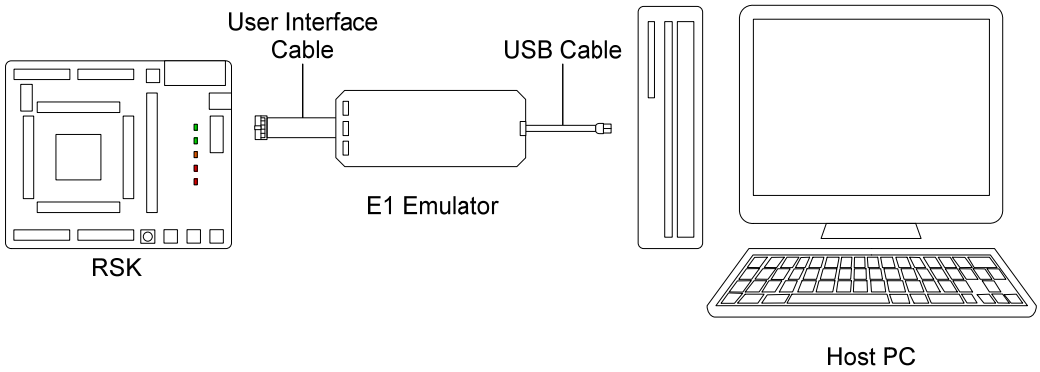

Figure 4-2: Debugger Connection Diagram

5. User Circuitry

5.1 Reset Circuit

A reset control circuit is not fitted to the RSK, as the MCU is capable of voltage and power-on detection. Resets are handled internally, and reset switch is connected directly to nRES on the MCU (pin 10).

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 RX210 hardware manual for details regarding the clock signal requirements, and the RSKRX210 board schematics for information regarding the clock circuitry in use on the RSK. Details of the oscillators fitted to the RSK are listed in **Table 5-1** below.

Crystal	Function	Default Placement	Frequency	Device Package
X1	Main MCU crystal.	Fitted	20MHz	Encapsulated, SMT
X2	External clock oscillator	Not fitted	20MHz	Encapsulated, SMT
X3	Real time Clock	Fitted	32.768kHz	Encapsulated, SMT

Table 5-1: Oscillators

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 RSKRX210 board schematics.

Switch	Function	MCU Connection
RES	When pressed, the microcontroller is reset.	nRES, Pin 10
SW1	Connects to an IRQ input for user controls.	IRQ1, Pin 19
SW2	Connects to an IRQ input for user controls.	IRQ3, Pin 17
SW3/ADTRG	Connects to an IRQ input for user controls. The switch is also connected to an ATRG input, and is used to trigger AD conversions.	IRQ4, Pin 16 & ADTRG0n*, Pin 98

Table 5-2: Switch Connections

* Connected via link resistor R301

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**.

LED	Colour	Function	MCU Connection
POWER	Green	Indicates the power status	No connection
LED0	Green	User operated LED.	P14, Pin 32
LED1	Orange	User operated LED.	P15, Pin 31
LED2	Red	User operated LED.	P16, Pin 30
LED3	Red	User operated LED.	P17, Pin 29

Table 5-3: LED Connections

5.5 Potentiometer

A single-turn potentiometer is connected as a potential divider to analogue input AN000, pin 95. The potentiometer can be used to create a voltage between AVCC and ground (by default, AVCC is connected to the board power supply Board_VCC).

The potentiometer is fitted to offer an easy method of supplying a variable analogue input to the microcontroller. It does not necessarily reflect the accuracy of the controller's ADC. Refer to the device hardware manual for further details.

5.6 Debug LCD Module

A debug LCD module is supplied with the RSK, and should be connected to the LCD header.

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 debug LCD module uses a 4-bit interface to reduce pin allocation. No contrast control is provided, as this is set by a resistor supplied on the display module. Connection information for the debug LCD module is provided in **Table 5-4** below.

Debug LCD Header					
Pin	**Circuit Net Name**	**MCU Pin**	**Pin**	**Circuit Net Name**	**MCU Pin**
1	Ground	-	2	5V	-
3	No Connection	-	4	DLCDRS	PJ1, Pin 6
5	R/W (Pulled to ground)	-	6	DLCDE (pulled to ground)	PJ3, Pin 4
7	No Connection	-	8	No Connection	-
9	No Connection	-	10	No Connection	-
11	DLCD4	PH0, Pin 38	12	DLCD5	PH1, Pin 37
13	DLCD6	PH2, Pin 36	14	DLCD7	PH3, Pin 35

Table 5-4: LCD Header Connections

5.7 RS232 Serial Port

Connections between the RS232 header and the microcontroller are listed in **Table 5-5** below.

SCI Signal	Function	MCU Connection	RS232 Connection
TXD0	SCI0 Transmit Signal.	P20, pin 28	Pin 2
RXD0	SCI0 Receive Signal.	P21, pin 27	Pin 3
TXD1	SCI1 Transmit Signal.	P26, pin 22	Pin 2*
RXD1	SCI1 Receive Signal.	P30, pin 20	Pin 3*
TXD9	SCI9 Transmit Signal.	PB7, pin 53	Pin 8*
RXD9	SCI9 Receive Signal.	PB6, pin 54	Pin 7*
RS232TX	External SCI Transmit Signal.	n/a	Pin 2*
RS232RX	External SCI Receive Signal.	n/a	Pin 3*

Table 5-5: Serial Port Connections

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

5.8 I²C Bus (Inter-IC Bus)

The RX210 features one I²C (Inter-IC Bus) interface module, which is connected to a 16Kbit EEPROM (Electronically-Erasable Programmable Read Only Memory). Specific details of the EEPROM device and the connections can be found in the board schematics.

This EEPROM only supports one concurrent device on a single I2C bus, as it responds to all possible addresses.

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 or by configuration DIP switches

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 RSK is supplied with. Refer to the component placement diagram (§3) to locate the option links, jumpers and DIP switches.

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 RSK.

When modifying a link resistor, always check the related option links to ensure there is no possible signal contention or short circuits. Because some of the MCU's pins are multiplexed, some of the peripherals must be used exclusively. Refer to the RX210 hardware manual and RSKRX210 board schematics for further information.

6.2 MCU Operating Modes

Table 6-1 below details the function of the jumpers associated with the MCU operating modes.

Reference	Position One	Position Two	Position Three	Related Ref.
J16	**All pins open. MCU starts in normal mode.**	All pins closed. MCU starts in CPU boot mode.	n/a	-
J18	**All pins open. Disconnects UB (MCU, pin 45) to Board_VCC.** **Puts the MCU into Boot Mode (SCI).**	All pins closed. Connects UB (MCU, pin 45) to Board_VCC. Puts the MCU into User Boot Mode.	n/a	R283

Table 6-1: MCU Operating Mode Jumper Settings

6.3 ADC Configuration

Table 6-2 below details the function of the option links associated with the Analogue-to-Digital circuit.

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R39	Connects the MCU (AVSS0, pin 99) to CON_AVSS.	**Disconnects the MCU (AVSS0, pin 99) from CON_AVSS.**	R62
R56	**Connects the potentiometer (RV1, pin 3) to Board_VCC.**	Disconnects the potentiometer (RV1, pin 3) from Board_VCC.	R57
R57	Connects the potentiometer (RV1, pin 3) to CON_AVCC.	**Disconnects the potentiometer (RV1, pin 3) from CON_AVCC.**	R56
R62	**Connects the MCU (AVSS0, pin 99) to GROUND.**	Disconnects the MCU (AVSS0, pin 99) from GROUND.	R39
R72	**Connects the MCU (VREFH, pin 1) to UC_VCC.**	Disconnects the MCU (VREFH, pin 1) from UC_VCC.	R356
R348	**Connects the MCU (VREFL0, pin 94) to GROUND.**	Disconnects the MCU (VREFL0, pin 94) from GROUND.	R352
R349	**Connects the MCU (VREFL, pin 3) to GROUND.**	Disconnects the MCU (VREFL, pin 3) from GROUND.	R353
R350	**Connects the MCU (AVCC0, pin 97) to UC_VCC.**	Disconnects the MCU (AVCC0, pin 97) from UC_VCC.	R354
R352	Connects the MCU (VREFL0, pin 94) to CON_VREFL0.	**Disconnects the MCU (VREFL0, pin 94) from CON_VREFL0.**	R348
R353	Connects the MCU (VREFL, pin 3) to CON_VREFL.	**Disconnects the MCU (VREFL, pin 3) from CON_VREFL.**	R349
R354	Connects the MCU (AVCC0, pin 97) to CON_AVCC.	**Disconnects the MCU (AVCC0, pin 97) from CON_AVCC.**	R350
R355	Connects the MCU (VREFH0, pin 96) to CON_VREFH0.	**Disconnects MCU (VREFH0, pin 96) from CON_VREFH0.**	R357
R356	Connects the MCU (VREFH, pin 1) to CON_VREH.	**Disconnects the MCU (VREFH, pin 1) from CON_VREF.**	R72
R357	**Connects the MCU (VREFH0, pin 96) to UC_VCC.**	Disconnects the MCU (VREFH0. pin 96) from UC_VCC.	R355

Table 6-2: ADC Option Links

6.4 E1 Debugger Interface

Table 6-3 below details the function of the option links associated with serial port configuration.

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R279	**Connects SCK1 (MCU, pin 21) to the E1 connector (pin 1).**	Disconnects SCK (MCU, pin 21) from the E1 connector (pin 1).	R363, R380
R280	**Connects TXD1 (MCU, pin 22) to the E1 connector (pin 5).**	Disconnects TXD1 (MCU, pin 22 from the E1 connector (pin 5).	R60, R362, R344, R378
R281	**Connects MODE (MCU, pin 7) to the E1 connector (pin 7).**	Disconnects MODE (MCU, pin 7) from the E1 connector (pin 7).	J16
R282	**Connects RXD1 (MCU, pin 20) to the E1 connector to the E1 connector (pin 11).**	Disconnects RXD1 (MCU, pin 20) from the E1 connector to the E1 connector (pin 11).	R70, R361

Table 6-3: E1 Debugger Interface Option Links

6.5 RS232 Serial Port Configuration

Table 6-4 below details the function of the option links associated with serial port configuration.

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R54	Connects the RS232 IC (U9, pin 9) to the serial port (pin 7).	**Disconnects the RS232 IC (U9, pin 9) from the serial port (pin 7).**	R55
R55	Connects the RS232 IC (U9, pin 8) to the serial port (pin 8).	**Disconnects the RS232 IC (U9, pin 8) from the serial port (pin 8).**	R54
R60	Connects TXD1 (MCU, pin 22) to the RS232 IC (U9, pin 13).	**Disconnects TXD1 (MCU, pin 22) from the RS232 IC (U9, pin 13).**	R150, R256, R280, R378
R64	Connects TXD9 (MCU, pin 53) to the RS232 IC (U9, pin 12).	**Disconnects TXD9 (MCU, pin 53) to the RS232 IC (U9, pin 12).**	R81, R331
R70	Connects RXD1 (MCU, pin 20) to the RS232 IC (U9, pin 15).	**Disconnects RXD1 (MCU, pin 22) from the RS232 IC (U9, pin 13).**	R151, R257, R282, R361
R78	Connects the RS232 IC (U9, pin 20) to GROUND.	**Disconnects the RS232 IC (U9, pin 20) from GROUND.**	R82
R81	Connects RXD9 (MCU, pin 54) to the RS232 IC (U9, pin 10).	**Disconnects RXD9 (MCU, pin 54) to the RS232 IC (U9, pin 10).**	R64, R332
R82	**Connects SHDNn (U9, pin 20) to Board_VCC.**	Disconnects SHDNn (U9, pin 20) from Board_VCC.	R78
R150	**Connects TXD0 (MCU, pin 28) to the RS232 IC (U9, pin 13).**	Disconnects TXD0 (MCU, pin 28) from the RS232 IC (U9, pin 13).	R60, R256, R280, R378
R151	**Connects RXD0 (MCU, pin 27) to the RS232 IC (U9, pin 15) via R365.**	Disconnects RXD0 (MCU, pin 27) from the RS232 IC (U9, pin 15).	R70, R257, R282, R361
R255	Connects the serial port connector shield to ground.	**Disconnects the serial port connector shield from ground.**	-
R256	Connects RS232TX (JA6, pin 5) to the RS232 IC (U9, pin 13).	**Disconnects RS232TX (JA6, pin 5) from the RS232 IC (U9, pin 13).**	R60, R150, R280, R378
R257	Connects RS232RX (JA6, pin 6) to the RS232 IC (U9, pin 15).	**Disconnects RS232RX (JA6, pin 6) from the RS232 IC (U9, pin 15).**	R70, R151, R282, R361

Table 6-4: RS232 Serial Port Option Links

6.6 External Bus Configuration

Table 6-5 below details the function of option links related to configuring the MCU's external bus.

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R309	**Connects A19_MTIOC4D (MCU, pin 49) to the application header (JA2, pin 18).**	Disconnects A19_MTIOC4D (MCU, pin 49) from the application header (JA2, pin 18).	
R310	**Connects A18_MTIOC4B (MCU, pin 50) to the application header (JA2, pin 17).**	Disconnects A18_MTIOC4B (MCU, pin 50) from the application header (JA2, pin 17).	
R311	**Connects A8_MTIC5W (MCU, pin 61) to the application header (JA6, pin 16).**	Disconnects A8_MTIC5W (MCU, pin 61) from the application header (JA6, pin 16).	
R312	**Connects A9_MTIOC0C (MCU, pin 59) to the application header (JA2, pin 23) via R370.**	Disconnects A9_MTIOC0C (MCU, pin 59) from the application header (JA2, pin 23).	R370
R313	**Connects A4_MTIC5U (MCU, pin 66) to the application header (JA6, pin 14).**	Disconnects A4_MTIC5U (MCU, pin 66) from the application header (JA6, pin 14).	
R314	Connects D7_POE0 (MCU, pin 79) to the application header (JA2, pin 24).	**Disconnects D7_POE0 (MCU, pin 79) from the application header (JA2, pin 24).**	-
R315	**Connects D15_IO7 (MCU, pin 71) to the application header (JA1, pin 22).**	Disconnects D15_IO7 (MCU, pin 71) from the application header (JA1, pin 22).	-
R316	**Connects D14_IO6 (MCU, pin 72) to the application header (JA1, pin 21).**	Disconnects D14_IO6 (MCU, pin 72) from the application header (JA1, pin 21).	-
R317	**Connects D13_IO5 (MCU, pin 73) to the application header (JA1, pin 20).**	Disconnects D13_IO5 (MCU, pin 73) from the application header (JA1, pin 20).	-
R318	**Connects D12_IO4 (MCU, pin 74) to the application header (JA1, pin 19).**	Disconnects D12_IO4 (MCU, pin 74) from the application header (JA1, pin 19).	-
R319	**Connects D11_IO3 (MCU, pin 75) to the application header (JA1, pin 18).**	Disconnects D11_IO3 (MCU, pin 75) from the application header (JA1, pin 18).	-
R320	**Connects D10_IO2 (MCU, pin 76) to the application header (JA1, pin 17).**	Disconnects D10_IO2 (MCU, pin 76) from the application header (JA1, pin 17).	-
R321	**Connects D2_IRQ2 (MCU, pin 84) to the application header (JA2, pin 23).**	Disconnects D2_IRQ2 (MCU, pin 84) from the application header (JA2, pin 23).	-
R322	**Connects D0_IRQ0 (MCU, pin 86) to the application header (JA2, pin 7).**	Disconnects D0_IRQ0 (MCU, pin 86) from the application header (JA2, pin 7).	-
R323	**Connects A11_MTIOC0A (MCU, pin 57) to the application header (JA2, pin 7) via R371.**	Disconnects A11_MTIOC0A (MCU, pin 57) from the application header (JA2, pin 7).	R371
R325	**Connects A1_MTIOC0B (MCU, pin 69) to the application header (JA2, pin 9) via R372.**	Disconnects A1_MTIOC0B (MCU, pin 69) from the application header (JA2, pin 9).	R372

Table 6-5: External Bus Option Links (Continued Overleaf)

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R327	**Connects D9_IO1 (MCU, pin 77) to the application header (JA1, pin 16).**	Disconnects D9_IO1 (MCU, pin 77) from the application header (JA1, pin 16).	-
R328	**Connects D8_IO0 (MCU, pin 78) to the application header (JA1, pin 15).**	Disconnects D8_IO0 (MCU, pin 78) from the application header (JA1, pin 15).	-
R331	**Connects A15_TXD9 (MCU, pin 53) to the RS232 IC (U9, pin 12) via R64.**	Disconnects A15_TXD9 (MCU, pin 53) from the RS232 IC (U9, pin 12) via R64.	R64
R332	**Connects A14_RXD9 (MCU, pin 54) to the RS232 IC (U9, pin 10) via R81.**	Disconnects A14_RXD9 (MCU, pin 54) from the RS232 IC (U9, pin 10) via R81.	R81
R333	**Connects A13_SCK9 (MCU, pin 55) to the application header (JA6, pin 11).**	Disconnects A13_SCK9 (MCU, pin 55) from the application header (JA6, pin 11).	
R342	**Connects MTIOC4A_CS0n (MCU, pin 24) to the application header (JA2, pin 15).**	Disconnects MTIOC4A_CS0n (MCU, pin 24) from the application header (JA2, pin 15).	R347
R343	**Connects MTIOC4C_CS1n (MCU, pin 23) to the application header (JA2, pin 16).**	Disconnects MTIOC4C_CS1n (MCU, pin 23) from the application header (JA2, pin 16).	R346
R344	**Connects TXD1_CS2n (MCU, pin 22) to RS232 IC (U9, pin 13) via R60.**	Disconnects TXD1_CS2n (MCU, pin 22) from RS232 IC (U9, pin 13).	R60, R150, R256, R378
R366	**Connects D1_IRQ1 (MCU, pin 85) to the application header (JA2, pin 9).**	Disconnects D1_IRQ1 (MCU, pin 85) from the application header (JA2, pin 9).	-
R367	**Connects A6_MTIC5V (MCU, pin 64) to the application header (JA6, pin 15).**	Disconnects A6_MTIC5V (MCU, pin 64) from the application header (JA6, pin 15).	
R368	**Connects D5_IRQ5 (MCU, pin 81) to the application header (JA5, 10).**	Disconnects D5_IRQ5 (MCU, pin 81) from the application header (JA5, 10).	-
R369	**Connects D3_IRQ3 (MCU, pin 83) to the application header (JA1, pin 23).**	Disconnects D3_IRQ3 (MCU, pin 83) from the application header (JA1, pin 23).	-
R377	**Connects D4_IRQ4 (MCU, pin 82) to the application header (JA5, pin 9).**	Disconnects D4_IRQ4 (MCU, pin 82) from the application header (JA5, pin 9).	-

Table 6-5: External Bus Option Links (Continuation)

6.7 IRQ & General I/O Pin Configuration

Table 6-6 below details the function of the option links associated with IRQ and general I/O pin configuration.

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R303	Connects LED1_MTCLKB (MCU, pin 31) to the application header (JA2, pin 26).	**Disconnects LED1_MTCLKB (MCU, pin 31) from the application header (JA2, pin 26).**	-
R304	**Connects LED0_MTCLKA (MCU, pin 32) to the application header (JA2, pin 25).**	Disconnects LED0_MTCLKA (MCU, pin 32) from the application header (JA2, pin 25).	-
R305	Connects DLCDE_MTIOC3C to the application header (JA2, pin 11).	**Disconnects DLCDE_MTIOC3C from the application header (JA2, pin 11).**	R336
R306	**Connects DLCDRS_MTIOC3A (MCU, pin 6) to the application header (JA6, pin 13).**	Disconnects DLCDRS_MTIOC3A (MCU, pin 6) from the application header (JA6, pin 13).	R336
R307	**Connects LED3_MTIOC3B (MCU, pin 29) to the application header (JA2, pin 11).**	Disconnects LED3_MTIOC3B (MCU, pin 29) from the application header (JA2, pin 11).	-
R308	**Connects LED2_MTIOC3D (MCU, pin 30) to the application header (JA2, pin 14).**	Disconnects LED2_MTIOC3D (MCU, pin 30) from the application header (JA2, pin 14).	-
R334	**Connects LED1_MTCLKB (MCU, pin 31) to LED1.**	Disconnects LED1_MTCLKB (MCU, pin 31) from LED1.	-
R335	**Connects LED0_MTCLKA (MCU, 32) to LED0.**	Disconnects LED0_MTCLKA (MCU, pin 32) from LED0.	-
R336	**Connects DLCDE_MTIOC3C (MCU, pin 4) to the debug LCD connector (LCD, pin 6).**	Disconnects DLCDE_MTIOC3C (MCU, pin 4) from the debug LCD connector (LCD, pin 6).	R305
R337	**Connects DLCDRS_MTIOC3A (MCU, pin 6) to the debug LCD connector (LCD, pin 4).**	Disconnects DLCDRS_MTIOC3A (MCU, pin 6) from the debug LCD connector (LCD, pin 4).	R307
R338	**Connects LED3_MTIOC3B (MCU, pin 29) to LED3.**	Disconnects LED3_MTIOC3B (MCU, pin 29) from LED3.	-
R339	**Connects LED2_MTIOC3D (MCU, pin 30) to LED2.**	Disconnects LED2_MTIOC3D (MCU, pin 30) from LED2.	-
R351	Connects NMIn (MCU, pin 15) to ground.	**Disconnects NMIn (MCU, pin 15) from ground.**	-
R364	Connects RXD0_MTIOC1B (MCU, pin 27) to the application header JA2, pin 23 (via R373).	**Disconnects RXD0_MTIOC1B (MCU, pin 27) from the application header JA2, pin 23.**	R365, R373
R365	**Connects RXD0_MTIOC1B (MCU, pin 27) to the RS232 IC (U9, pin 15) via R151.**	Disconnects RXD0_MTIOC1B (MCU, pin 27) from the RS232 IC (U9, pin 15).	R151, R364
R370	Connects A9_MTIOC0C (MCU, pin 59) to the application header JA2, pin 23 (via R312).	**Disconnects A9_MTIOC0C (MCU, pin 59) from the application header JA2, pin 23.**	R312, R373, R374
R371	Connects A11_MTIOC0A (MCU, pin 57) to the application header JA2, pin 7 (via R232).	**Disconnects A11_MTIOC0A (MCU, pin 57) to the application header JA2, pin 7.**	R323, R375

Table 6-6: IRQ & General I/O Option Links (continued overleaf)

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R372	Connects A1_MTIOC0B (MCU, pin 69) to the application header JA2, pin 9 (via R325).	**Disconnects A1_MTIOC0B (MCU, pin 69) from the application header JA2, pin 9.**	R325, R376
R373	Connects RXD0_MTIOC1B (MCU, pin 27) to the application header JA2, pin 23 (via R364).	**Disconnects RXD0_MTIOC1B (MCU, pin 27) from the application header JA2, pin 23.**	R364, R370, R374
R374	**Connects D2_IRQ2 (MCU, pin 84) to the application header JA2, pin 23 (via R321).**	Disconnects D2_IRQ2 (MCU, pin 84) from the application header JA2, pin 23.	R321
R375	**Connects D0_IRQ0 (MCU, pin 86) to the application header JA2, pin 7 (via R322).**	Disconnects D0_IRQ0 (MCU, pin 86) from the application header JA2, pin 7.	R322, R371
R376	**Connects D1_IRQ1 (MCU, pin 85) to the application header JA2, pin 9 (via R366).**	Disconnects D1_IRQ1 (MCU, pin 85) from the application header JA2, pin 9.	R366, R372

Table 6-6: IRQ & General I/O Option Links (continuation)

6.8 User Switch Configuration

Table 6-7 below details the function of the option links associated with user switches.

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R59	**Connects the MCU (nRES, pin 10) directly to the RES switch.**	Disconnects the MCU (nRES, pin 10) from the RES switch.	-
R63	**Connects the switch SW3 to SW3_IRQ4 (MCU, pin 16).**	Disconnects the switch SW3 from ADTRG0n (MCU, pin 16).	R301
R301	Connects the switch SW3 to ADTRG0n (MCU, pin 98).	**Disconnects the switch SW3 from the MCU (P07, pin 98).**	R63

Table 6-7: User Switch Option Links

6.9 Power Supply Configuration

Table 6-8 below details the function of the option links associated with power supply configuration.

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R68	**Bypasses current measurement jumper J14.**	Allows the current consumption of the MCU to be measured across J14.	J14
R76	**Connects CON_5V to the power socket, via R102.**	Disconnects CON_5V from the power socket (PWR pin).	R83, R102
R83	**Connects 5V to the power socket, via R102.**	Disconnects 5V from the power socket (PWR pin).	R76, R102
R102	**Connects the power socket (PWR pin) to the voltage regulator (U11, pin 3).**	Connects the Power socket (PWR pin) from the voltage regulator (U11, pin 3).	-
R302	Connects CON_3V3 to J17, pin 2.	**Disconnects CON_3V3 from J17, pin 2.**	R359
R359	Connects the voltage regulator output (U11, pin 2) to Board_VCC (bypassing J17).	**Disconnects the voltage regulator output (U11, pin 2) from Board_VCC (still connectable via J17).**	J17

Table 6-8: Power Supply Option Links

Table 6-9 below details the function of the jumpers associated with power supply configuration.

Reference	Position One	Position Two	Position Three	Related Ref.
J15*	**All pins open. The voltage regulator U11 is set to supply Board_VCC with 3.3V.**	All pins closed. The voltage regulator U11 is set to supply Board_VCC with 1.62V.**	n/a	-
J17	All pins open. Disconnects Board_VCC from the voltage regulator U11. (bypassed by R359 when fitted, unfitted by default)	Pins 1 and 2 connected. The voltage regulator U11 is bypassed, and Board_VCC is supplied directly from the power socket (5V).	**Pins 2 and 3 connected. Board_VCC is connected to the voltage regulator U11, supplying either 3.3V or 1.62V.**	-

Table 6-9: Power Supply Jumpers

* By default, this jumper is not fitted to the RSK. The default position is therefore all pins open.
** This option will disable the debug LCD. Refer to the power supply section, §2, for further information.

6.10 Clock Configuration

Table 6-10 below details the function of the option links associated with clock configuration.

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R44	Connects CON_XCOUT (J1, pin 9) to the MCU (XCOUT, pin 9).	**Disconnects CON_XCOUT (J1, pin 9) to the MCU (XCOUT, pin 9).**	R47, R293
R46	**Connects the crystal X1 to the MCU (XTAL, pin 11).**	Disconnects the crystal X1 from the MCU (XTAL, pin 11).	R299, R300
R47	Connects CON_XCIN (J1, pin 8) to the MCU (XCIN, pin 8).	**Disconnects CON_XCIN (J1, pin 8) to the MCU (XCIN, pin 8).**	R44, R293
R293	**Connects the crystal X3 to the MCU (XCOUT, pin 9).**	Disconnects the crystal X3 from the MCU (XCOUT, pin 9).	R44, R47
R299	Connects CON_EXTAL (J1, pin 13) to the MCU (EXTAL, pin 13).	**Disconnects CON_EXTAL (J1, pin 13) from the MCU (EXTAL, pin 13).**	R46, R300
R300	Connects CON_XTAL (J1, pin 11) to the MCU (XTAL, pin 11).	**Disconnects CON_XTAL (J1, pin 13) from the MCU (EXTAL, pin 13).**	R46, R229

Table 6-10: Clock Option Links

6.11 Debug LCD Configuration

Table 6-11 below details the function of the option links associated with debug LCD configuration.

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R329	Connects DLCD5_TMO0 (MCU, pin 37) to the TMO0 (JA2, pin 19).	**Disconnects DLCD5_TMO0 (MCU, pin 37) from the TMO0 (JA2, pin 19)**	R340
R330	Connects SDA_TMO3 (MCU, pin 33) to the TMO3 (JA2, pin 20).	**Disconnects SDA_TMO3 (MCU, pin 33) from TMO3 (JA2, pin 20).**	R341
R340	**Connects DLCD5_TMO0 (MCU, pin 37) to the DLCD5 (LCD, pin 12).**	Disconnects DLCD5_TMO0 (MCU, pin 37) from the DLCD5 (LCD, pin 12)	R329
R341	**Connects SDA_TMO3 (MCU, pin 33) to the SDA (U10, pin 5).**	Disconnects SDA_TMO3 (MCU, pin 33) from SDA (U10, pin 5).	R330

Table 6-11: Debug LCD Option Links

7. Headers

7.1 Microcontroller Ring Headers

This RSK is fitted with MCU ring headers, which are used to access all the MCU's pins.

Table 7-1 below lists the connections of the ring header, J1.

Ring Header J1					
Pin	**Circuit Net Name**	**MCU Pin**	**Pin**	**Circuit Net Name**	**MCU Pin**
1	CON_VREFH	1*	2	DA0	2
3	CON_VREFL	3*	4	DLCDE_MTIOC3C	4
5	NC	nc	6	DLCDRS_MTIOC3A	6
7	MODE	7	8	CON_XCIN	8*
9	CON_XCOUT	9*	10	RESET_N	10
11	CON_XTAL	11*	12	GROUND	-
13	CON_EXTAL	13*	14	UC_VCC	-
15	NMIn	15	16	SW3_IRQ4	16
17	SW2_IRQ3	17	18	P32	18
19	SW1_IRQ1	19	20	RXD1	20
21	SCK1	21	22	TXD1_CS2n	22
23	MTIOC4C_CS1n	23	24	MTIOC4A_CS0n	24
25	CTS0RTS0	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 7-1: Ring Header J1 Connections

* Connection made through option link

Table 7-2 below lists the connections of the ring header, J2.

Ring Header J2					
Pin	**Circuit Net Name**	**MCU Pin**	**Pin**	**Circuit Net Name**	**MCU Pin**
1	SCK0	26	2	RXD0_MTIOC1B	27
3	TXD0	28	4	LED3_MTIOC3B	29
5	LED2_MTIOC3D	30	6	LED1_MTCLKB	31
7	LED0_MTCLKA	32	8	SDA_TMO3	33
9	SCL	34	10	DLCD7	35
11	DLCD6	36	12	DLCD5_TMO0	37
13	DLCD4	38	14	nWAIT	39
15	ALE	40	16	BCLK_P53	41
17	nRD	42	18	nWR1	43
19	nWR	44	20	UB	45
21	A22	46	22	A21	47
23	A20	48	24	A19_MTIOC4D	49
25	A18_MTIOC4B	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 7-2: Ring Header J2 Connections

Table 7-3 below lists the connections of the ring header, J3.

Ring Header J3					
Pin	**Circuit Net Name**	**MCU Pin**	**Pin**	**Circuit Net Name**	**MCU Pin**
1	A17	51	2	A16	52
3	A15_TXD9	53	4	A14_RXD9	54
5	A13_SCK9	55	6	A12	56
7	A11_MTIOC0A	57	8	A10	58
9	A9_MTIOC0C	59	10	UC_VCC	-
11	A8_MTIC5W	61	12	GROUND	-
13	A7	63	14	A6_MTIC5V	64
15	A5	65	16	A5_MTIC5U	65
17	A3	67	18	A2	68
19	A1_MTIOC0B	69	20	A0	70
21	D15_IO7	71	22	D14_IO6	72
23	D13_IO5	73	24	D12_IO4	74
25	D11_IO3	83	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 7-3: Ring Header J3 Connections

Table 7-4 below lists the connections of the ring header, J4.

Ring Header J4					
Pin	**Circuit Net Name**	**MCU Pin**	**Pin**	**Circuit Net Name**	**MCU Pin**
1	D10_IO2	76	2	D9_IO1	77
3	D8_IO0	78	4	D7_POE0	79
5	D6	80	6	D5_IRQ5	81
7	D4_IRQ4	82	8	D3_IRQ3	83
9	D2_IRQ2	84	10	D1_IRQ1	85
11	D0_IRQ0	86	12	AN007	87
13	AN006	88	14	AN005	89
15	AN004	90	16	AN003	91
17	AN002	92	18	AN001	93
19	CON_VREFL0	94*	20	AD_POT	nc
21	CON_VREFH0	96*	22	AVCC	-
23	ADTRG0n	98	24	GROUND	nc
25	DA1	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 7-4: Ring Header J4 Connections

7.2 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 7-5 below lists the connections of the application header, JA1.

Application Header JA1					
Pin	**Circuit Net Name**	**MCU Pin**	**Pin**	**Circuit Net Name**	**MCU Pin**
1	5V	-	2	0V	-
3	3V3	-	4	0V	-
5	AVCC	-	6	AVSS	-
7	AVREF	-	8	ADTRG	-
9	AD0	95	10	AD1	93
11	AD2	92	12	AD3	91
13	DAC0	2	14	DAC1	100
15	IO_0	78	16	IO_1	77
17	IO_2	76	18	IO_3	75
19	IO_4	74	20	IO_5	73
21	IO_6	72	22	IO_7	71
23	IRQ3	83	24	IIC_EX	nc
25	IIC_SDA	33*	26	IIC_SCL	34*

Table 7-5: Application Header JA1 Connections

Table 7-6 below lists the connections of the application header, JA2.

Application Header JA2					
Pin	**Circuit Net Name**	**MCU Pin**	**Pin**	**Circuit Net Name**	**MCU Pin**
1	RESn	10	2	EXTAL	13*
3	NMI	15	4	Vss1	-
5	WDT_OVF	nc	6	SCIaTX	28
7	IRQ0	86	8	SCIaRX	27
9	IRQ1	85	10	SCIaCK	26
11	M1_UD	4	12	CTSRTS	25
13	M1_UP	29	14	M1_UN	30
15	M1_VP	24	16	M1_VN	23
17	M1_WP	50	18	M1_WN	49
19	TMR0	37*	20	TMR1	33*
21	TRIGa	98	22	TRIGb	nc
23	IRQ2	84/59/27*	24	M1_POE	79
25	M1_TRCCLK	32	26	M1_TRDCLK	31

Table 7-6: Application Header JA2 Connections

* Connection made through option link

Table 7-7 below lists the connections of the BUS application header, JA3

Bus Application Header JA3					
Pin	**Circuit Net Name**	**MCU Pin**	**Pin**	**Circuit Net Name**	**MCU Pin**
1	A0	70	A1	A1	69
3	A2	68	4	A3	67
97	A4	66	6	A5	65
7	A6	64	8	A7	63
9	A8	61	10	A9	59
11	A10	58	12	A11	57
13	A12	56	14	A13	55
15	A14	54	16	A15	53
17	D0	86	18	D1	85
19	D2	84	20	D3	83
21	D4	82	22	D5	81
23	D6	80	24	D7	79
25	RDn	42	26	WRn	44
27	CSan	24	28	CSbn	23
29	D8	78	30	D9	77
31	D10	76	32	D11	75
33	D12	74	34	D13	73
35	D14	72	36	D15	71
37	A16	52	38	A17	51
39	A18	50	40	A19	49
41	A20	48	42	A21	47
43	A22	46	44	-	nc
45	CScn	22	46	ALE	40
Q	HWRn	43	48	LWRn	44
49	CAS	nc	50	RAS	nc

Table 7-7: Bus Application Header JA3 Connections

Table 7-8 below lists the connections of the application header, JA5.

Application Header JA5					
Pin	**Circuit Net Name**	**MCU Pin**	**Pin**	**Circuit Net Name**	**MCU Pin**
1	AD4	90	2	AD5	89
3	AD6	88	4	AD7	87
5	CAN1TX	nc	6	CAN1RX	nc
7	CAN2TX	nc	8	CAN2RX	nc
9	IRQ4	82	10	IRQ5	81
11	M2_UD	nc	12	M2_Uin	nc
13	M2_Vin	nc	14	M2_Win	nc
15	M2_Toggle	nc	16	M2_POE	nc
17	M2_TRCCLK	nc	18	M2_TRDCLK	nc
19	M2_Up	nc	20	M2_Un	nc
21	M2_Vp	nc	22	M2_Vn	nc
23	M2_W	nc	24	M2_Wn	nc

Table 7-8: Application Header JA5 Connections

Table 7-9 below lists the connections of the application header, JA6.

Application Header JA6					
Pin	**Circuit Net Name**	**MCU Pin**	**Pin**	**Circuit Net Name**	**MCU Pin**
1	DREQ	NC	2	DACK	NC
3	TEND	NC	4	STBYn	NC
5	RS32TX	-	6	RS232RX	-
7	SCIbRX	20	8	SCIbTX	22
9	SCIcTX	53	10	SCIbCK	21
11	SCIcCK	55	12	SCIcRX	54
13	M1_Toggle	6	14	M1_Uin	66
15	M1_Vin	64	16	M1_Win	61
17	Reserved	nc	18	Reserved	nc
19	Reserved	nc	20	Reserved	nc
21	Reserved	nc	22	Reserved	cn
23	Unregulated_VCC	-	24	GROUND	-

Table 7-9: Application Header JA6 Connections

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 debugger. An E1 debugger is supplied with this RSK product.

For further information regarding the debugging capabilities of the E1/E20 debuggers, refer to E1/E20 Emulator 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, Boot and USB Boot modes, which are configured on the RSK board. Details of the modifications required can be found in §6. All other MCU operating modes are configured within the MCU's registers, which are listed in the RX210 group hardware manual.

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 E1 emulator (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 RX Family E1/E20 Emulator User's Manual (R20UT0398EJ).

8.5 Address Space

Figure 8-1 below details the address space of MCU in its different operating modes. For further details, refer to the RX210 group hardware manual.

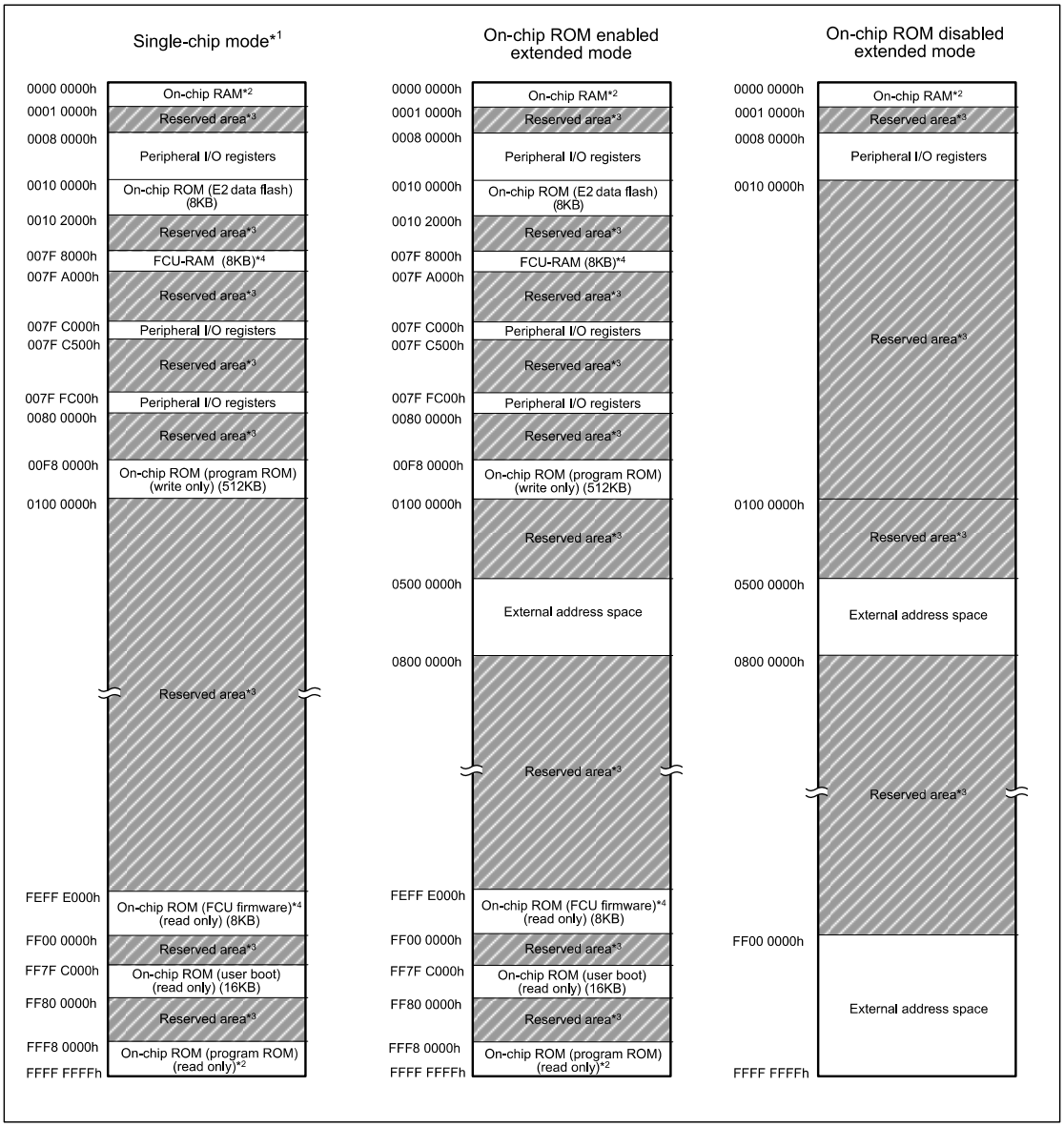

Figure 8-1: MCU Address Space Diagram

9. Additional Information

Technical Support
For details on how to use High-performance Embedded Workshop (HEW), refer to the HEW manual available on the CD or from the web site.

For information about the RX210 series microcontrollers refer to the RX210 Group hardware manual.

For information about the RX assembly language, refer to the RX200 Series Software Manual.

Online technical support and information is available at: http://www.renesas.com/rskrx210

Technical Contact Details
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Japan: csc@renesas.com

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

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