User's Manual

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RX111 Group

Renesas Starter Kit User's Manual
For e^2 studio

RENESAS MCU
RX Family / RX100 Series

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

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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 RX111 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.	RSKRX111 User's Manual	R20UT2196EG
Tutorial	Provides a guide to setting up RSK environment, running sample code and debugging programs.	RSKRX111 Tutorial Manual	R20UT2197EG
Quick Start Guide	Provides simple instructions to setup the RSK and run the first sample, on a single A4 sheet.	RSKRX111 Quick Start Guide	R20UT2198EG
Schematics	Full detail circuit schematics of the RSK.	RSKRX111 Schematics	R20UT2192EG
Hardware Manual	Provides technical details of the RX111 microcontroller.	RX111 Group Hardware Manual	R01UH0365EJ

2. List of Abbreviations and Acronyms

Abbreviation	Full Form
ADC	Analog-to-Digital Converter
E1	On-chip Debugger
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
IIC	Philips™ Inter-Integrated Circuit Connection Bus
IRQ	Interrupt Request
KR	Key Return
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MCU	Micro-controller Unit
n/a	Not applicable
n/c	Not connected
PC	Personal Computer
RSK	Renesas Starter Kit
SAU	Serial Array Unit
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus

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. 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** below. The default RSK power configuration is shown in **bold, blue text.**

J6 Setting	J7 Setting	Supply Source	Supply Input Voltages	Regulator IC Output
Pin 2-3 shorted	Open	Ext 5V or USB-VBUS	5V	3.3V
Pin 2-3 shorted	Pin1-2 shorted	Ext 5V or USB-VBUS		1.8V
Pin 1-2 shorted	Open	Ext 5V or USB-Battery		3.3V
Pin 1-2 shorted	Pin1-2 shorted	Ext 5V or USB-Battery		1.8V
Open	**Open**	**Ext 5V**		**3.3V**
Open	Pin1-2 shorted	Ext 5V		1.8V

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 software pre-programmed into the Renesas microcontroller. On powering up the board the LEDs will start to flash. After 200 flashes or after pressing any switch, the text on the LCD display will change and the LED’s will begin to 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.

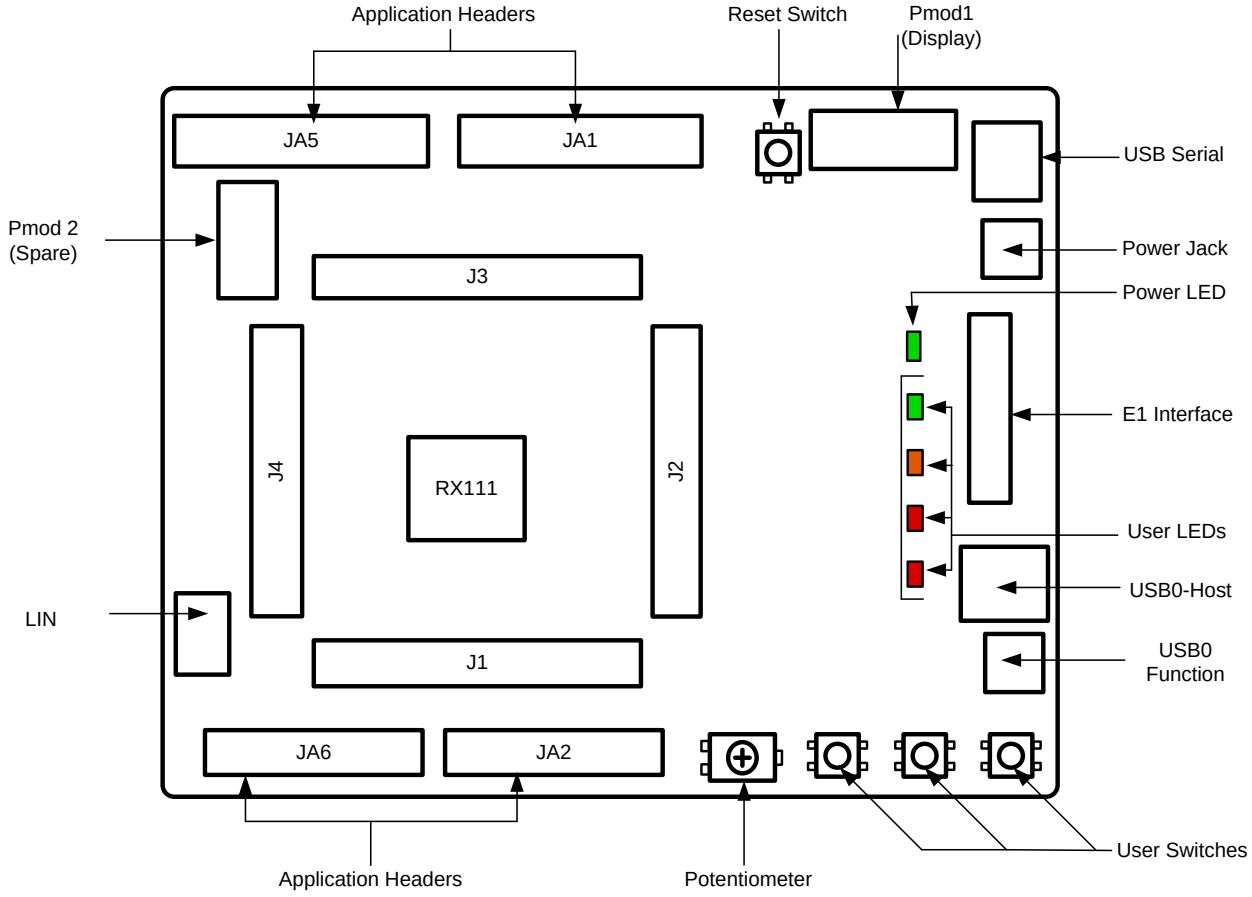


Figure 3-1: Board Layout

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.

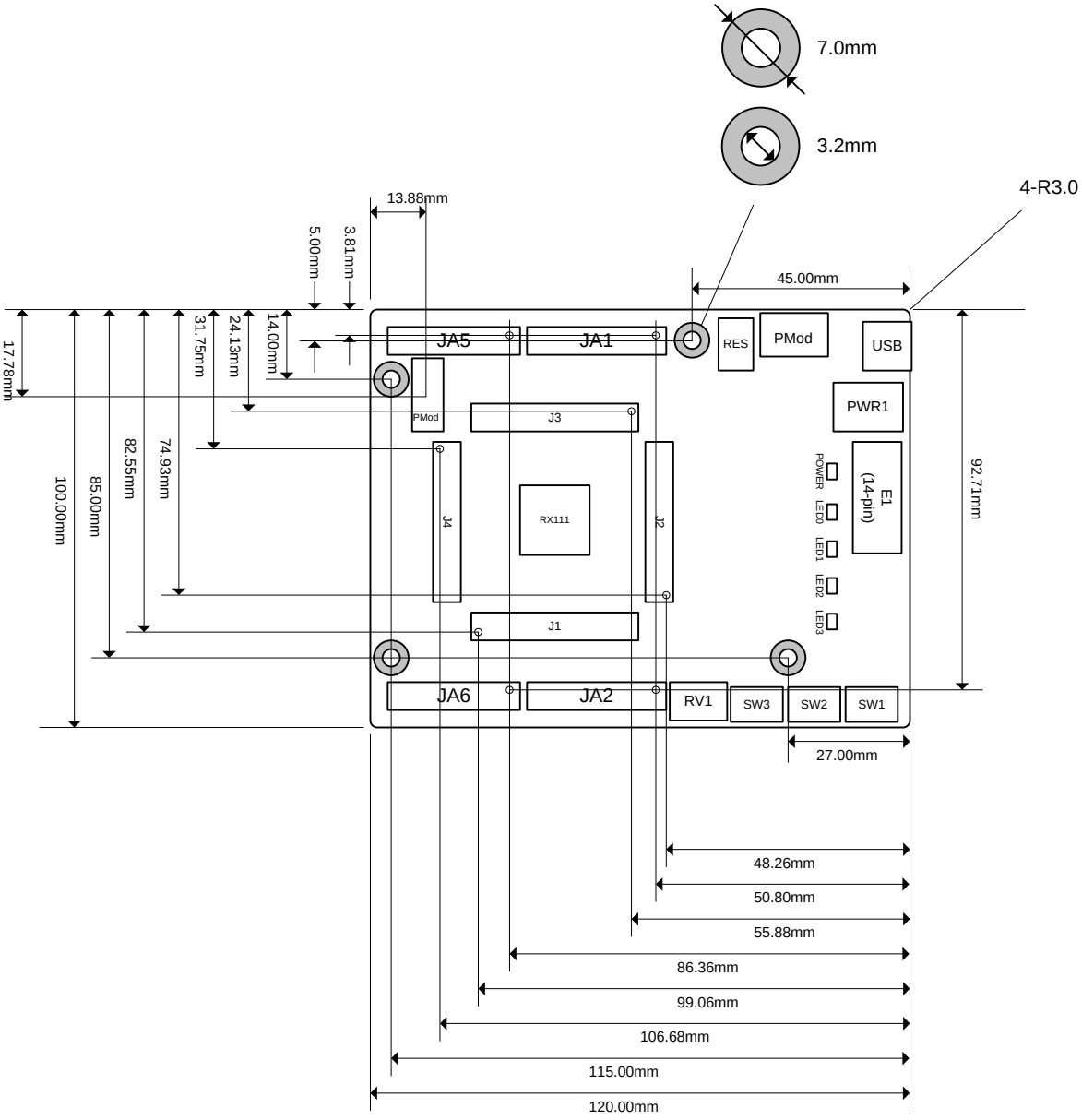


Figure 3-2: Board Dimensions

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.

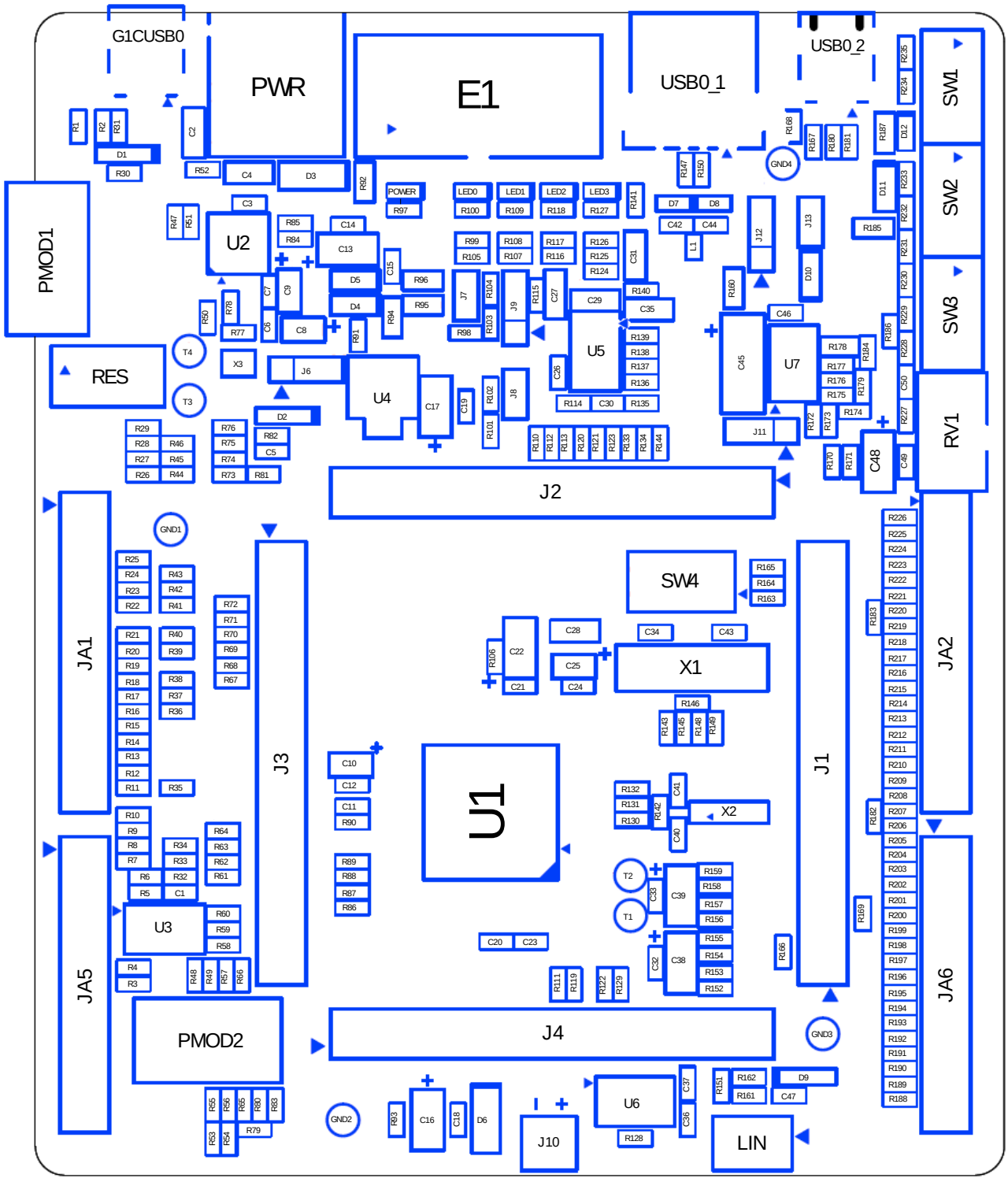


Figure 3-3: Top-Side Component Placement

4. Connectivity

4.1 Internal RSK Connections

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

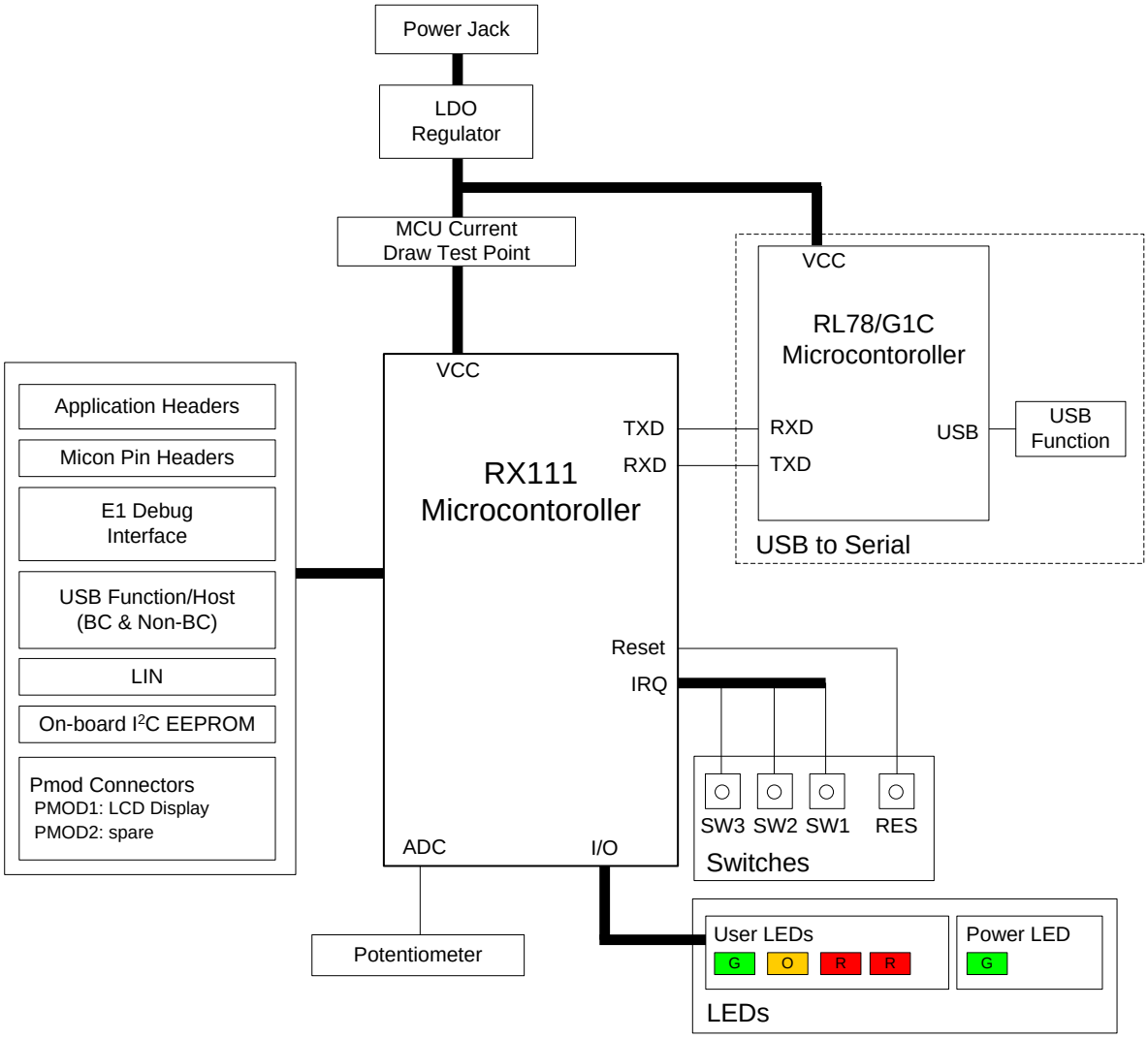


Figure 4-1: Internal RSK Block Diagram

4.2 Debugger Connections

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

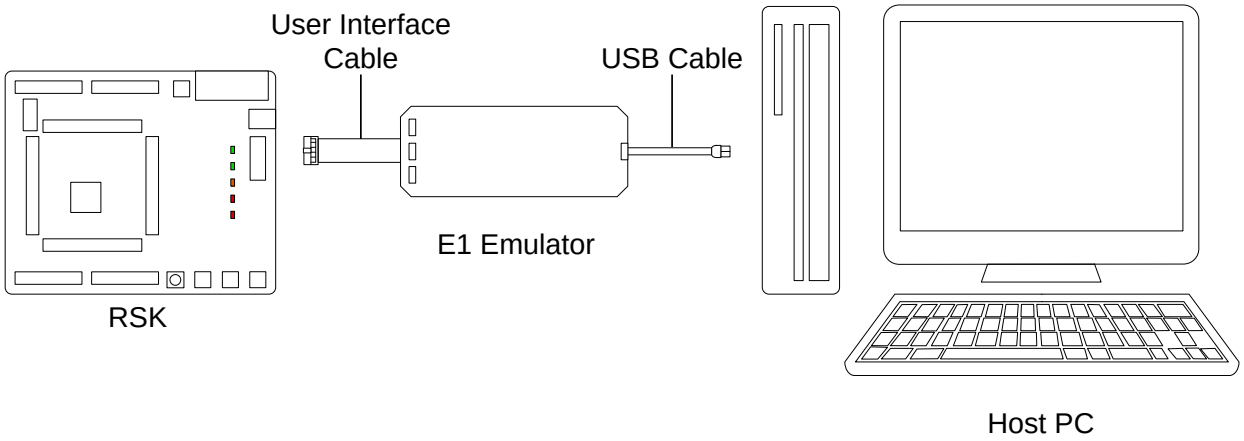


Figure 4-2: Debugger Connection Diagram

5. User Circuitry

5.1 Reset Circuit

A reset control circuit is fitted to the RSK to generate the required reset signal, and is triggered from the RES switch. Refer to the RX111 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 RX111 Group Hardware Manual for details regarding the clock signal requirements, and the RSKRX111 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	Main MCU oscillator.	Fitted	16MHz	HC49/4U
X2	Sub MCU oscillator	Fitted	32.768kHz*	90SMX

Table 5-1: Oscillators

* 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 (Port)	Pin
RES	When pressed, the microcontroller is reset.	RESn	7
SW1	Connects to an IRQ input for user controls.	A-IRQ0_P-IRQ0 (P30)	4
SW2	Connects to an IRQ input for user controls.	A-IRQ1_P-IRQ1 (P31)	5
SW3	Connects to a Key input for user controls.	IRQ4 (PE4)	47

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_VDD power rail.	-	-
LED0	Green	User operated LED.	PB7/PC1	33
LED1	Orange	User operated LED.	PA0	45
LED2	Red	User operated LED.	P54	26
LED3	Red	User operated LED.	PB6/PC0	34

Table 5-3: LED Connections

5.5 Potentiometer

A single-turn potentiometer is connected as a potential divider to analog input AN000, pin 60. The potentiometer can be used to create a voltage between Board_VDD and ground.

The potentiometer is fitted to offer 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 RX111 Group Hardware Manual for further details.

5.6 Pmod™ Debug LCD Module

A Pmod™ Compatible debug LCD module is supplied with the RSK, and should be connected to the PMOD1 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 Digilent Pmod™ Compatible header uses a SPI interface. Some RSKs will be provided with a monochrome display, others will have a colour display. Code for the appropriate display will be included in the product software support. Connection information for the Digilent Pmod™ Compatible header is provided in **Table 5-4** 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

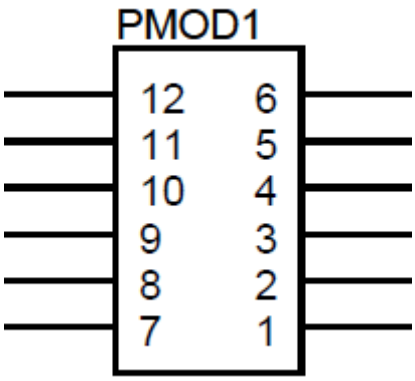


Figure 5-1: Digilent Pmod™ Compatible Header Pin Numbering

Digilent Pmod™ Compatible Header Connections							
Pin	Circuit Net Name	MCU		Pin	Circuit Net Name	MCU	
		Port	Pin			Port	Pin
1	PMOD1_PIN1	PC7	27	7	IRQ5	PA4	42
2	P-TXD5	PC3	31	8	P-IRQ6	PA3	43
3	P-RXD5	PC2	32	9	P44	P44	55
4	P-SCK5	PA1	44	10	P46	P46	54
5	GROUND	-	-	11	GROUND	-	-
6	Board_xVx *	-	-	12	Board_xVx *	-	-

Table 5-4: Pmod™1 Header Connections

* Board_xVx indicates the supply voltage is variable according to the configuration.

5.7 USB Serial Port

A USB serial port implemented in another Renesas low power microcontroller (RL78/G1C) is fitted on the RSK to the microcontroller Serial Communications Interface (SCI) module. Multiple options are provided to allow re-use of the serial interface.
Connections between the USB to Serial converter and the microcontroller are listed in **Table 5-5** below.

Signal Name	Function	MCU	
		Port	Pin
TxD1	SCI1 Transmit Signal.	P16	18
RxD1	SCI1 Receive Signal	P15	19
TxD5	SCI5 Transmit Signal.	PC3	31
RxD5	SCI5 Receive Signal	PC2	32
TxD12	SCI12 Transmit Signal.	PE1	50
RxD12	SCI12 Receive Signal	PE2	49
RS232TX	External SCI Transmit Signal.	n/a	
RS232RX	External SCI Receive Signal.	n/a	
RL78G1C_CTS	Clear To Send	PO3	1
RL78G1C_RTS	Request to Send	PO5	64

Table 5-5: Serial Port Connections

* This connection is a not available in the default RSK configuration - refer to §6.3 for the required modifications.

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.

Table 6-1 below shows the RSKRX111 default configuration with respect to the peripheral functionality. **Bold, blue text** indicates the default configuration that the RSK is supplied with. It is noted that certain peripheral functions are disabled by default, as shown in Table 6.1 in the column entitled **Secondary Function**. It is possible to activate these disabled peripherals, but at the expense of the default peripheral functions as shown in the Table. Refer to the sections cited in the Table in order to perform any required modifications.

The following sub-sections contain Tables illustrating which link resistors need to added/removed to enable/disable specific functions. A single horizontal line in the Table traces an individual signal path from the MCU on the left of the Table, through any intermediate connections, to any header connections on the right side of the Table. Each line in the Table thereby shows how the MCU signal can be configured for each of its multiplexed functions. Default RSK functional configurations are shown in **bold, blue text.**

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. Refer to the component placement diagram (§3.3) 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 RX111 Group Hardware Manual and RSKRX111 schematics for further information.

Primary Function	See Section(s)	Secondary Function	See Section(s)
ADC Configuration – POT	6.2	ADC Channel to Application header	6.2
Serial communication	6.4	PMOD2 Interface	6.7
LIN interface	6.2	Serial Communication	6.2
I2C EEPROM (on PCB)	6.8	External I2C Interface on Application header	6.8
PMOD1 Interface	6.6	Serial Communication	6.4
LIN Master	6.9	LIN Slave	6.9

Table 6-1: RSK Default Configuration by Function

6.2 ADC Configuration

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

Signal Name	MCU		Exclusive function			Header connection		
	Port	Pin	Signal	Fit	Remove	Header Pin	Fit	Remove
VREFH0	PJ6	61	UC_VCC	R155		JA1, 7	R154	-
AVCC0	-	63	UC_VCC	R159		JA1, 5	R158	-
AVSS0	-	62	GROUND	R157		JA1, 6	R156	-
VREFL0	PJ7	59	GROUND	R153		J4, 11	R152	-
AN000 (POT)	**P40**	**60**	**AN000**	**R227**	**R22**	**JA1, 9**	**R23**	-
AN000 (to JA1)	P40	60	AN000		R227	JA1, 9	R23	R227, R22, R43
AN000 (* 0.6667)	P40	60	AN000	R43, R22	R227	JA1, 9	R43	R23

Table 6-2: ADC Option Links

6.3 Power Supply Configuration

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

Signal Name	Exclusive Function		Header connection		
	Function	IC Pin	Header Pin	Fit	Remove
Board_5V	Supply VBUS/EXT PWR	-	J6	2-3	-
	Not connected to VBUS/EXT PWR	-	J6	1-2 / Open	-
Board_5V	Supply Battery Power	-	J6	1-2	-
	No Battery Power	-	J6	2-3 / Open	-
Board_5V	Connected to CON_5V	-	JA1-1	R94	-
	Not connected to CON_5V	-	JA1-1	-	R94
Board_5V	Connected to Unregulated_VCC	-	JA6-23	R95	-
	Not connected to Unregulated_VCC	-	JA6-23	-	R95
Board_3V3	Connected to U4 OUT	-	-	-	-
	Connected to CON_3V3	-	JA1-3	R101	-
Board_3V3	Bypass current probe (J8) for MCU	-	-	R102	-
	Enable current probe(J8) for MCU	-	J8	J8	R102
USB Bus Power	Host Power	-	J12	1-2	2-3
	Function VBus	-	J12	2-3	1-2
USB Battery Charge	Enable Battery Charging	-	J13	1-2	-
	Disable Battery Charging	-	J13	-	1-2
USB Bus Power	Self Powered	-	J9	1-2	2-3
	Bus Powered	-	J9	2-3	1-2

Note: 1. Alternatively, use J6 and J7 as detailed in Table 2.1 in §2.1.

Table 6-3: Power Supply Configuration

6.4 USB Serial Port Configuration

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

Signal Name	MCU		Exclusive function			Header connection		
	Port	Pin	Signal	Fit	Remove	Header Pin	Fit	Remove
MTIOC3C_A-TXD1_P-TXD1_USB0VBUS	**P16**	**18**	**A_TXD1**	**R224, J11 1-2**	**R199, R120, R38**	**JA2-6**	**J11 1-2**	
MTIOC0B_A-RXD1_P-RXD1	**P15**	**19**	**MTIOC0B_A-RXD1_P-RXD1**	**R116**	**R198, R110, R37**	**JA2-8**	**R220**	
A_TXD5_P-TXD5	PC3	31	A_TXD5_P-TXD5	R120	R199, R224, R38	JA6-8	R196	
A_RXD5_P-RXD5	PC2	32	A_RXD5_P-RXD5	R110	R198, R116, R37	JA6-7	R197	
LINTXD_IO1_TXD12	PE1	50	LINTXD_IO1_TXD12	R38	R199, R224, R120	JA6-9	R195	
LINRXD_IO2_RXD12	PE2	49	LINRXD_IO2_RXD12	R37	R198, R116, R110	JA6-12	R192	
RS232RX	-	-		R199	R224, R120, R38	JA6-6		
RS232TX	-	-		R198	R116, R110, R37	JA6-5		

Table 6-3: RS232 Serial Port Option Links

6.5 E1 Debugger Interface

Table 6-5 below details the function of the option links associated with E1 Debugger configuration.

Signal Name	MCU		Exclusive function			Header connection		
	Port	MCU Pin	Signal	Fit	Remove	Header Pin	Fit	Remove
P27	**P27**	**2**	**P27**	**R105**	**-**	**E1-1**	**-**	**-**
MTIOC0B_A-RXD1_P-RXD1	P15	19	MTIOC0B_A-RXD1_P-RXD1	R125	-	E1-11	-	-
MTIOC3C_A-TXD1_P-TXD1_USB0VBUS	P16	18	MTIOC3C_A-TXD1_P-TXD1_USB0VBUS	R107	-	E1-13	-	-
P14_A-CTS1RTS1_P-CTS1RTS1	**P14**	**20**	**P14**	**R117**	**-**	**E1-10**	**-**	**-**

Table 6-5: E1 Debugger Interface Option Links

6.6 PMOD1 Interface Configuration

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

Signal Name	MCU		Exclusive function			Header connection		
	Port	Pin	Signal	Fit	Remove	Header Pin	Fit	Remove
PC7_MTCLKB_USB0OVRCURB	PC7	27	PC7	R71, R72	R70,R200,R134	PMOD1-1		
MTIC5V_SDA_CTS5RTS5	PA6	41	CTS5RTS5	R70, R69	R71, R64, R189			
A_TXD5_P-TXD5	PC3	31	P-TXD5	R113	R196	PMOD1-2		
A_RXD5_P-RXD5	PC2	32	P_RXD5	R112	R197	PMOD1-3		
A-SCK5_P-SCK5	PA1	44	P_SCK5	R81	R194	PMOD1-4		
Board_5V	-	-		R51	R47	PMOD1-6, PMOD1-12		
Board_3V3	-	-		R47	R51			
IRQ5_MTIC5U	PA4	42	IRQ5	R68	R190	PMOD1-7		
POE0_A-IRQ6_P-IRQ6	PA3	43	P_IRQ6	R46	R202, R11	PMOD1-8		
P44_AN004	P44	55	P44	R45	R10	PMOD1-9		
P46_AN006	P46	54	P46	R44	R9	PMOD1-10		

Table 6-6: PMOD1 Option Links

6.7 PMOD2 Interface Configuration

Table 6-7 below details the function of the option links associated with PMOD1 interface configuration.

Signal Name	MCU		Exclusive function			Header connection		
	Port	Pin	Signal	Fit	Remove	Header Pin	Fit	Remove
P14_A-CTS1RTS1_P-CTS1RTS1	P14	20	P-RTS1CTS1	R86	R165, R215	PMOD2-1		
MTIO3C3_A-TXD1_P-TXD1_USB0VBUS	P16	18	P-TXD1	R87	R216, J11 open	PMOD2-2		
MTIOC0B_A-RXD1_P-RXD1	P15	19	P_RXD1	R88	R220, R183	PMOD2-3		
MTIOC3A_A-SCK1_P-SCK1	P17	17	P_SCK1	R89	R191, R217	PMOD2-4		
Board_5V	-	-		R3	R4	PMOD2-6, PMOD2-12		
Board_3V3	-	-		R4	R3			
A-IRQ0_P-IRQ0	P30	4	P_IRQ0	R83	R223	PMOD2-7		
A-IRQ1_P-IRQ1	P31	5	P_IRQ1	R79	R169	PMOD2-8		
P32_MTIOC0C	P32	16	P32	R54	R182	PMOD2-9		
PB5_MTIOC1B	PB5	35	PB5	R53	R209	PMOD2-10		

Table 6-7: PMOD2 Option Links

6.8 I2C EEPROM Configuration

Table 6-8 below details the function of the option links associated with the I2C EEPROM Configuration.

Function	MCU		Exclusive function			Header connection		
	Port	Pin	Signal	Fit	Remove	Header Pin	Fit	Remove
Board_5V	-	-	-	R6	R5	-	-	-
Board_3V3	**-**	**-**	**-**	**R5**	**R6**	**-**	**-**	**-**
Internal I2C devices disabled, External I2C devices enabled				R61, R64	R25, R58, R59, R69, R188, R189	JA1_SCL JA1_SDA	-	-
Internal I2C devices enabled, External I2C devices disabled				**R58, R59, R61, R64**	**R25, R69, R189**		**-**	**-**

Table 6-8: I2C EEPROM Option Links

6.9 LIN Configuration

Table 6-9 below details the function of the option links associated with the I2C EEPROM Configuration.

LIN Function	MCU		Exclusive function			Header connection		
	Port	Pin	Signal	Fit	Remove	Header Pin	Fit	Remove
LIN Master				**R151, R161**	**-**	**-**	**-**	**-**
LIN Slave				-	R151, R161		-	-

Table 6-9: LIN Option Links

6.10 Switch Configuration

Table 6-10 below details the function of the option links associated with the I2C EEPROM Configuration.

Switch Function	MCU		Exclusive function			Header connection		
	Port	Pin	Signal	Fit	Remove	Header Pin	Fit	Remove
SW1 Enabled	**P30**	**4**	**A-IRQ0_P-IRQ0**	**R234**	**-**	**-**	**-**	**-**
SW1 Disabled	P30	4		-	R234		-	-
SW2 Enabled	**P31**	**5**	**A-IRQ1_P-IRQ1**	**R231**	**-**	**-**	**-**	**-**
SW2 Disabled	P31	5		-	R231		-	-
SW3 Enabled	**PE4**	**47**	**IRQ4**	**R229, R203**	**R15, R204**	**-**	**-**	**-**
SW3 Disabled	PE4	47		-	R229, R203		-	-

Table 6-10: Switch Option Links

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.

Application Header JA1					
Pin	**Header Name**	**MCU Pin**	**Pin**	**Header Name**	**MCU Pin**
1	5V	-	2	0V	
3	3V3	-	4	0V	
5	AVCC	63	6	AVSS	62
7	AVREF	61	8	ADTRG	39 (PB0)
9	ADC0	60 (P40)	10	ADC1	58 (P41)
11	ADC2	57 (P42)	12	ADC3	56 (P43)
13	DAC0	1 (PO3)	14	DAC1	64 (PO5)
15	IO_0	51 (PE0)	16	IO_1	50 (PE1)
17	IO_2	49 (PE2)	18	IO_3	48 (PE3)
19	IO_4	47 (PE4)	20	IO_5	46 (PE5)
21	IO_6	53 (PE6)	22	IO_7	52 (PE7)
23	IRQ3/IRQAEC/M2_HSIN0	43 (PA3)	24	IIC_EX	-
25	IIC_SDA	41 (PA6)	26	IIC_SCL	39 (PB0)

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**
1	RESET	7	2	EXTAL	12
3	NMI	10	4	Vss1	-
5	WDT_OVF	-	6	SCIaTX	18 (P16)
7	IRQ0/WKUP/M1_HSIN0	4 (P30) 48 (PE3)	8	SCIaRX	19 (P15)
9	IRQ1/M1_HSIN1	5 (P31) 19 (P15)	10	SCIaCK	17 (P17)
11	M1_UD	18 (P16)	12	CTSRTS	20 (P14)
13	M1_UP	33 (PB7/PC1)	14	M1_UN	34 (PB6/PC0)
15	M1_VP	45 (PA0)	16	M1_VN	46 (PE5)
17	M1_WP	26 (P54)	18	M1_WN	25 (P55)
19	TimerOut	16 (P32)	20	TimerOut	34 (PB6/PC0)
21	TimerIn	35 (PB5)	22	TimerIn	25 (P55)
23	IRQ2/M1_EncZ/M1_HSIN2	16 (P32) 47 (PE4)	24	M1_POE	43 (PA3)
25	M1_TRCCLK	28 (PC6)	26	M1_TRDCLK	27 (PC7)

Table 7-2: Application Header JA2 Connections

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

Application Header JA5					
Pin	**Header Name**	**MCU Pin**	**Pin**	**Header Name**	**MCU Pin**
1	ADC4	55 (P54)	2	ADC5	54 (P46)
3	ADC6	53 (PE6)	4	ADC7	52 (PE7)
5	CAN1TX	-	6	CAN1RX	-
7	CAN2TX	-	8	CAN2RX	-
9	IRQ4/M2_EncZ/M2HSIN1	-	10	IRQ5/M2_HSIN2	-
11	M2_UD	-	12	M2_Uin	-
13	M2_Vin	-	14	M2_Win	-
15	M2_Toggle	-	16	M2_POE	-
17	M2_TRCCLK	-	18	M2_TRDCLK	-
19	M2_UP	-	20	M2_UN	-
21	M2_VP	-	22	M2_VN	-
23	M2_WP	-	24	M2_WN	-

Table 7-3: Application Header JA5 Connections

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

Application Header JA6					
Pin	**Header Name**	**MCU Pin**	**Pin**	**Header Name**	**MCU Pin**
1	DREQ	-	2	DACK	-
3	TEND	-	4	STBYn	-
5	RS232TX	-	6	RS232RX	-
7	SCIbRX	32 (PC2)	8	SCIbTX	31 (PC3)
9	SCIcTX	50 (PE1)	10	SCIbCK	44 (PA1)
11	SCIcCK	51 (PE0)	12	SCIcRX	49 (PE2)
13	M1_Toggle	17 (P17)	14	M1_Uin	42 (PA4)
15	M1_Vin	41 (PA6)	16	M1_Win	39 (PB0)
17	* EXT_USB_VBUS	-	18	Reserved	-
19	* EXT_USB_BATT	-	20	Reserved	-
21	* EXT_USB_CHG	-	22	Reserved	-
23	Unregulated_VCC		24	Vss	-

Table 7-4: Application Header JA6 Connections

* Caution: Pins marked with an '*' have connections that are on reserved pins of for the application headers and are intended to support the USB Battery charging functions of the device. Be aware that connection of incompatible Application boards will be possible and may cause a failure.

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 (Port)**	**Pin**	**Circuit Net Name**	**MCU Pin (Port)**
1	RL78G1C_CTS_DA0	1 (PO3)	2	P27	2 (P27)
3	USB0VBUSEN	3 (P26)	4	A-IRQ0_P-IRQ0	4 (P30)
5	A-IRQ1_P-IRQ1	5 (P31)	6	MD_FINED	6
7	RESn	7	8	NC	-
9	NC	-	10	NMIn	10 (P35)
11	CON_XTAL	11	12	CON_EXTAL	12
13	NC	-	14	GROUND	-
15	UC_VCC	15	16	P32_MTIOC0C	16 (P32)
17	NC	-	18	NC	-
19	NC	-	20	NC	-
21	NC	-	22	NC	-
23	NC	-	24	NC	-
25	NC	-	26	NC	-
27	NC	-	28	NC	-
29	NC	-	30	NC	-
31	NC	-	32	NC	-
33	NC	-	34	NC	-
35	NC	-	36	NC	-

Table 7-5: Microcontroller Pin Header, J1

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

Microcontroller Pin Header J2					
Pin	**Circuit Net Name**	**MCU Pin (Port)**	**Pin**	**Circuit Net Name**	**MCU Pin (Port)**
1	MTIOC3A_A-SCK1_P-SCK1	17 (P17)	2	MTIOC3C_A-TXD1_P-TXD1_USB0VBUS	18 (P16)
3	MTIOC0B_A-RXD1_P-RXD1	19 (P15)	4	P14_A-CTS1RTS1_P-CTS1RTS1	20 (P14)
5	VCCUSB	21	6	NC	-
7	NC	-	8	GROUND	-
9	MTIOC4D	25 (P55)	10	MTIOC4B	26 (P54)
11	PC7_MTCLKB_USB0OVRCURB	27 (PC7)	12	MTCLKA_USB0EXICEN	28 (PC6)
13	RL78G1C_RES_USB0ID	29 (PC5)	14	PC4	30 (PC4)
15	A-TXD5_P-TXD5		16	A-RXD5_P-RXD5	32 (PC2)
17	NC	-	18	NC	-
19	NC	-	20	NC	-
21	NC	-	22	NC	-
23	NC	-	24	NC	-
25	NC	-	26	NC	-
27	NC	-	28	NC	-
29	NC	-	30	NC	-
31	NC	-	32	NC	-
33	NC	-	34	NC	-
35	NC	-	36	NC	-

Table 7-7: Microcontroller Pin Header, J2

Table 7-8 below lists the connections of the microcontroller pin header, J3.

Microcontroller Pin Header J3					
Pin	**Circuit Net Name**	**MCU Pin (Port)**	**Pin**	**Circuit Net Name**	**MCU Pin (Port)**
1	MTIOC3B	33 (PB7/PC1)	2	MTIOC3D	34 (PB6/PC0)
3	PB5_MTIOC1B	35 (PB5)	4	USB0OVRCURA	36 (PB3)
5	LINNSLP	37 (PB1)	6	UC_VCC	38
7	MTIC5W_SCL_ADTRG0n	39 (PB0)	8	GROUND	40
9	MTIC5V_SDA_CTS5RTS5	41 (PA6)	10	IRQ5_MTIC5U	42 (PA4)
11	POE0_A-IRQ6_P-IRQ6	43 (PA3)	12	A-SCK5_P-SCK5	44 (PA1)
13	MTIOC4A	45 (PA0)	14	IO5_MTIOC4C	46 (PE5)
15	IO4_MTIOC1A_IRQ4	47 (PE4)	16	IO3_MTIOC0A	48 (PE3)
17	NC	-	18	NC	-
19	NC	-	20	NC	-
21	NC	-	22	NC	-
23	NC	-	24	NC	-
25	NC	-	26	NC	-
27	NC	-	28	NC	-
29	NC	-	30	NC	-
31	NC	-	32	NC	-
33	NC	-	34	NC	-
35	NC	-	36	NC	-

Table 7-8: Microcontroller Pin Header, J3

Table 7-9 below lists the connections of the microcontroller pin header, J4.

Microcontroller Pin Header J4					
Pin	**Circuit Net Name**	**MCU Pin (Port)**	**Pin**	**Circuit Net Name**	**MCU Pin (Port)**
1	LINRXD_IO2_RXD12	49 (PE2)	2	LINTXD_IO1_TXD12	50 (PE1)
3	IO0_SCK12	51 (PE0)	4	IO7_AN015	52 (PE7)
5	IO6_AN014	53 (PE6)	6	P46_AN006	54 (P46)
7	P44_AN004	55 (P44)	8	AN003	56 (P43)
9	AN002	57 (P42)	10	AN001	58 (P41)
11	CON_VREFL0	59 *	12	AN000	60 (P40)
13	CON_VREFH0	61 *	14	CON_AVSS0	62 *
15	CON_AVCC0	63 *	16	RL78G1C_RTS_DA1	64 (PO5)
17	NC	-	18	NC	-
19	NC	-	20	NC	-
21	NC	-	22	NC	-
23	NC	-	24	NC	-
25	NC	-	26	NC	-
27	NC	-	28	NC	-
29	NC	-	30	NC	-
31	NC	-	32	NC	-
33	NC	-	34	NC	-
35	NC	-	36	NC	-

Table 7-9: Microcontroller Pin Header, J4

* Connection made through option link

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.

8.3 Mode Support

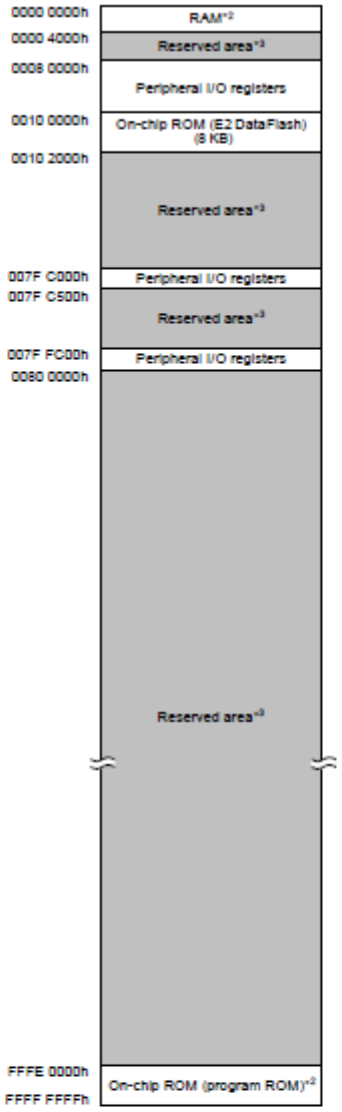
The RX111 microcontroller only supports single-chip operating mode.

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 the MCU. This diagram is taken from the Hardware Manual version 0.2. The MCU fitted to the RSK has 32KB of ROM. For further details, refer to the RX111 Group Hardware Manual.



Note 1. The address space in boot mode is the same as the address space in single-chip mode.
Note 2. The capacity of ROM/RAM differs depending on the products.

ROM (bytes)		RAM (bytes)	
Capacity	**Address**	**Capacity**	**Address**
128 K	FFFE 0000h to FFFF FFFFh	16 K	0000 0000h to 0000 3FFFh
96 K	FFFE 8000h to FFFF FFFFh		
64 K	FFFF 0000h to FFFF FFFFh	10 K	0000 0000h to 0000 27FFh
32 K	FFFF 8000h to FFFF FFFFh		
16 K	FFFF C000h to FFFF FFFFh	8 K	0000 0000h to 0000 1FFFh

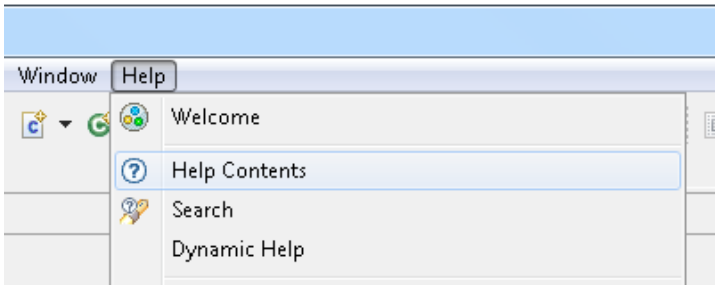
Note: • See Table 1.3, List of Products, for the product type name.

Note 3. Reserved areas should not be accessed.

Figure 8-1: MCU Address Space Diagram

9. Additional Information

Technical Support
For details on how to use e^2 studio, refer to the help file by opening e^2 studio, then selecting Help > Help Contents from the menu bar.



For information about the RX111 series microcontrollers refer to the RX111 Group Hardware Manual.

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

Technical Contact Details

***Please refer to the contact details listed in section 7 of the* "Quick Start Guide"**

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

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Colophon 1.3

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