User's Manual

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RX111 Group

Renesas Starter Kit User's Manual
For CubeSuite+

RENESAS MCU
RX Family / RX100 Series

Renesas Electronics
www.renesas.com

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(2012.4)

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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	R20UT2193EG
Tutorial	Provides a guide to setting up RSK environment, running sample code and debugging programs.	RSKRX111 Tutorial Manual	R20UT2194EG
Quick Start Guide	Provides simple instructions to setup the RSK and run the first sample, on a single A4 sheet.	RSKRX111 Quick Start Guide	R20UT2195EG
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
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
E1	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
PmodTM	This is a Digilent Pmod™ Compatible connector. PmodTM is registered to Digilent Inc. Digilent-Pmod_Interface_Specification (Link valid at 14 Apr, 2014)
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

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 5.0mm 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	UC_VCC
Open	**Open**	**E1(3.3V)/PWR Connector/CON_5V /Unregulated_VCC**	**3.3V**
Open	Pin1-2 shorted	PWR Connector/CON_5V /Unregulated_VCC	1.8V
Pin2-3 shorted	Open	VBUS	3.3V
Pin2-3 shorted	Pin1-2 shorted	VBUS	1.8V
Pin1-2 shorted	Open	EXT_BATT	3.3V
Pin1-2 shorted	Pin1-2 shorted	EXT_BATT	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.

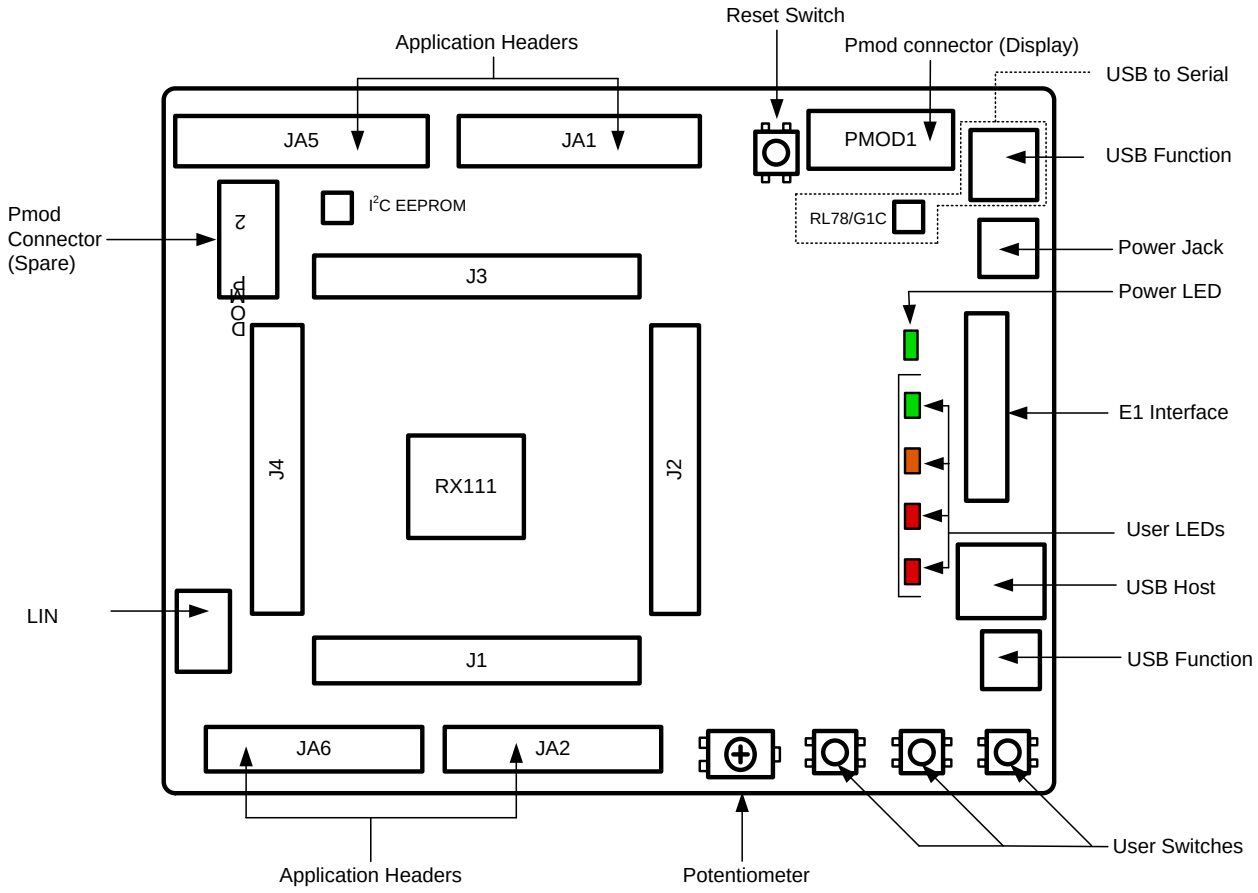


Figure 3-1: Board Layout

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.

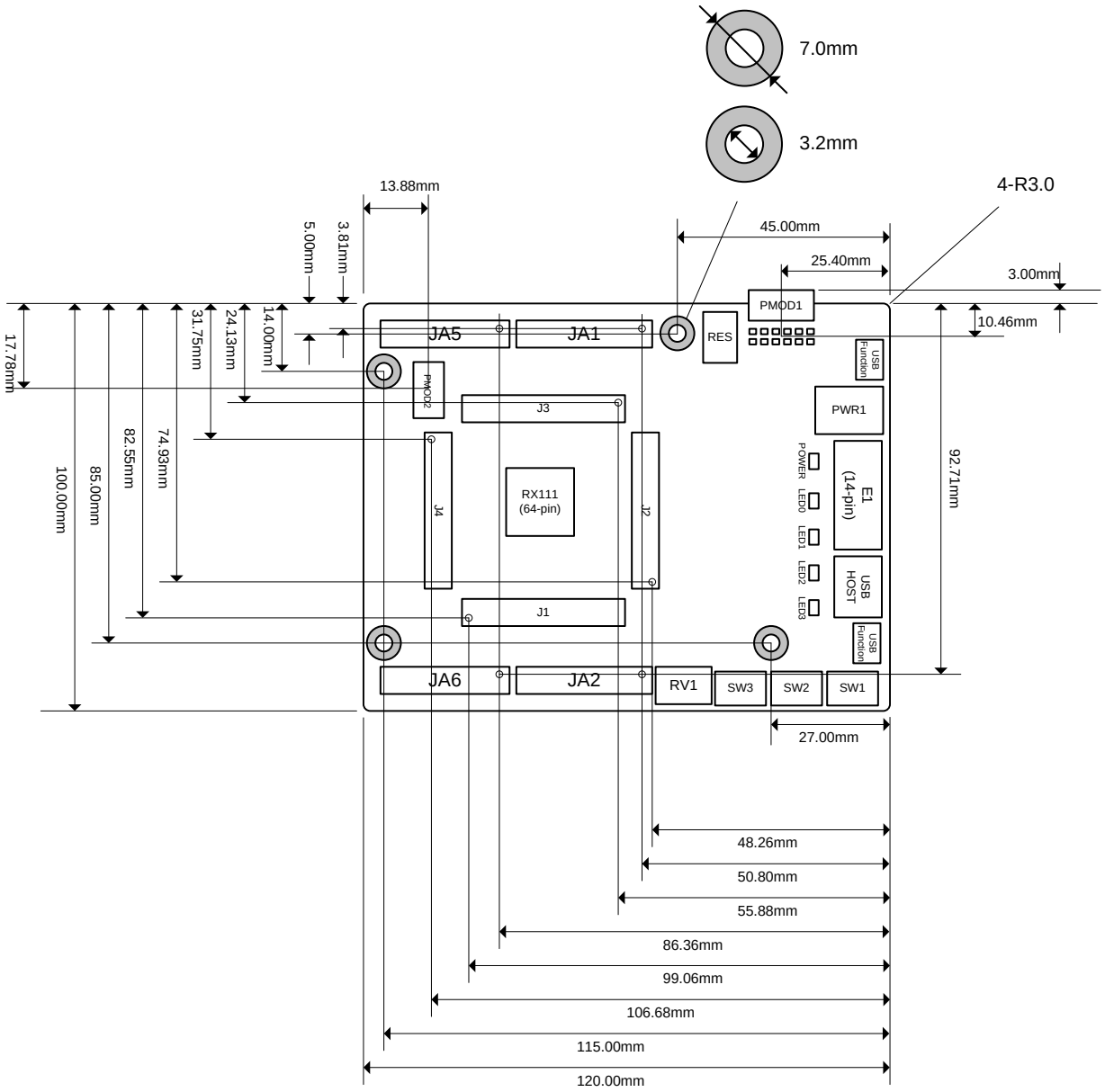


Figure 3-2: Board Dimensions

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.

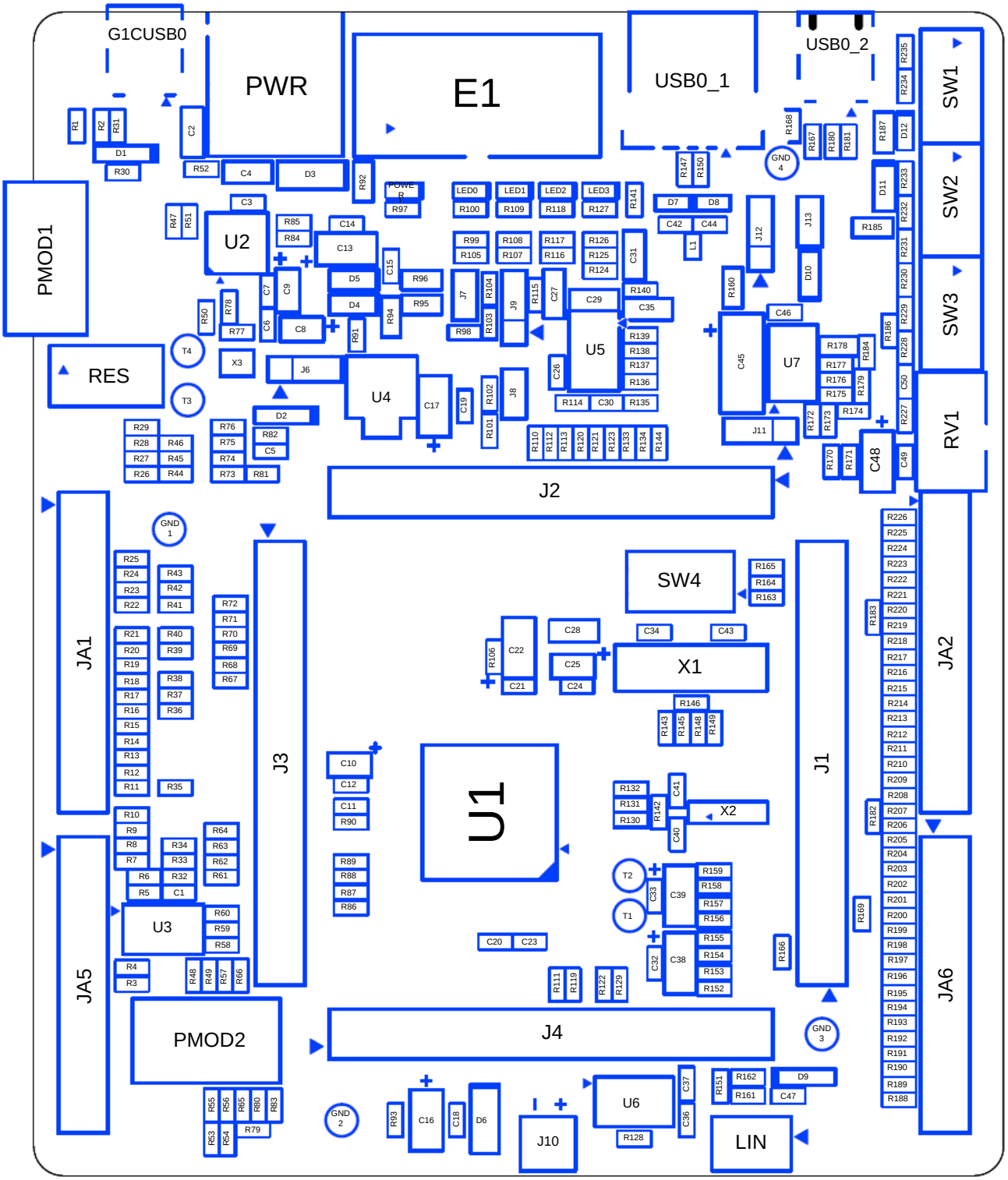


Figure 3-3: Top-Side Component Placement

4. Connectivity

4.1 Internal RSK Connections

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

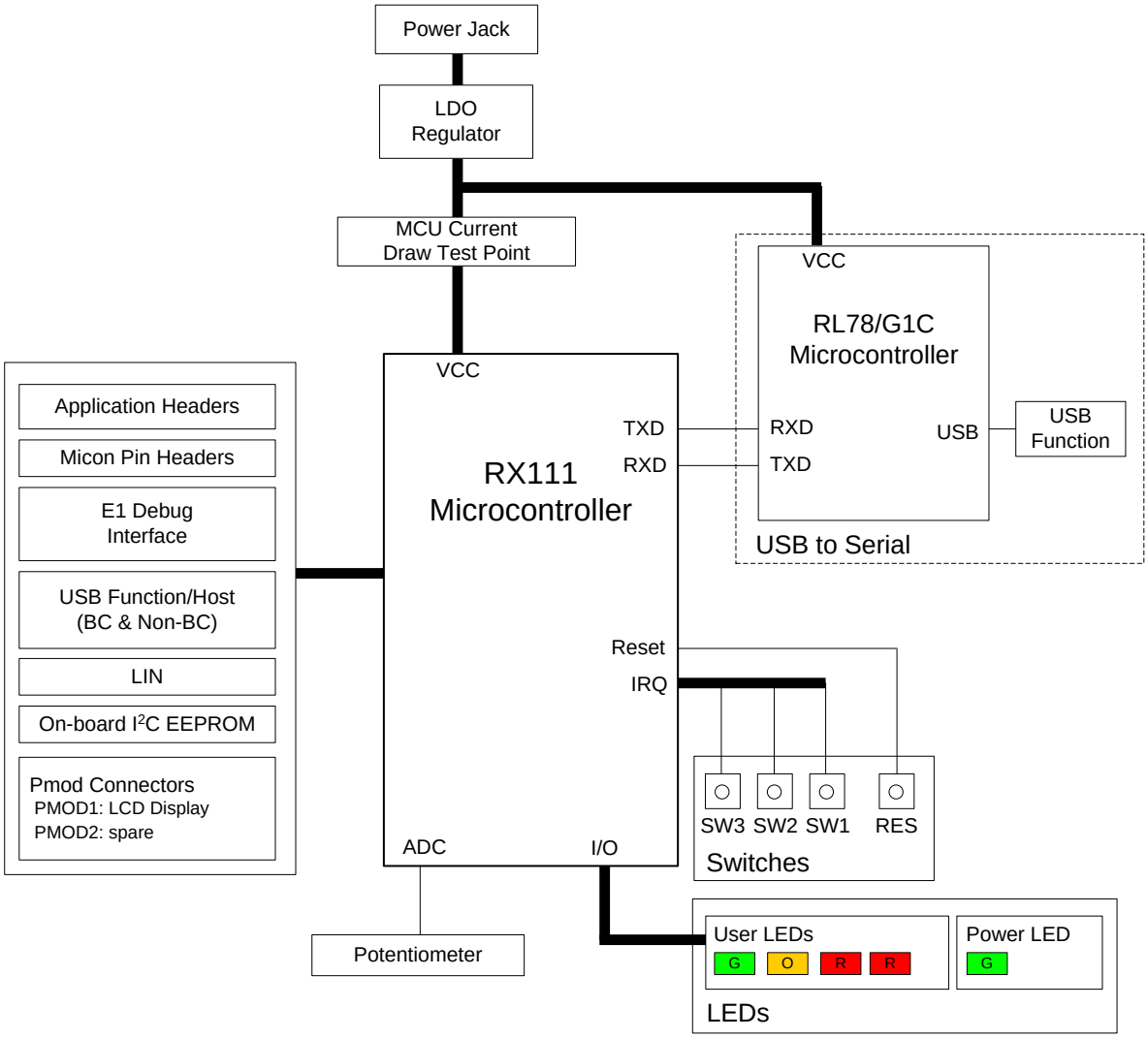


Figure 4-1: Internal RSK Block Diagram

4.2 Debugger Connections

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

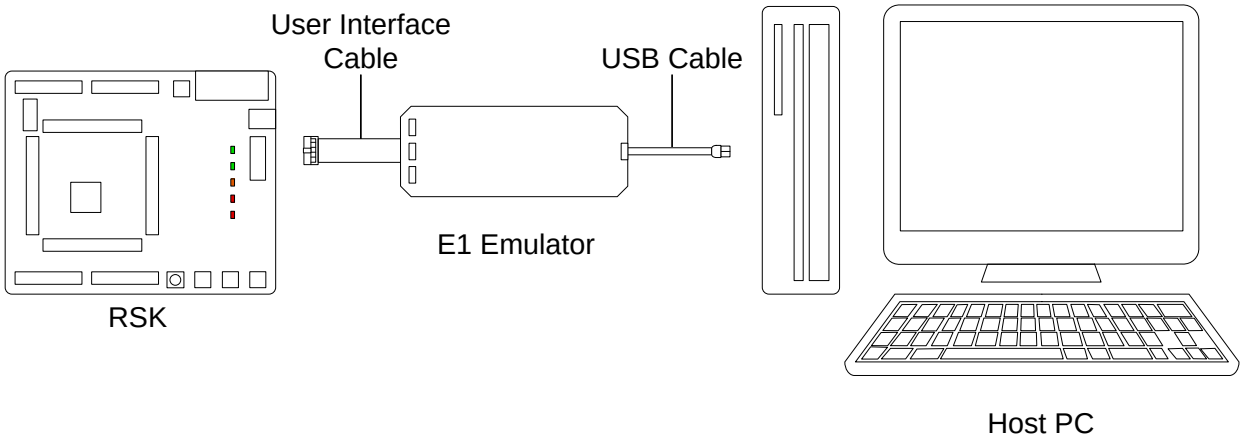


Figure 4-2: Debugger Connection Diagram

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	Encapsulated, SMT
X2	RX111 Sub oscillator	Fitted	32.768kHz *	Encapsulated, SMT
X3	RL78/G1C Main oscillator	Fitted	12MHz	Encapsulated, SMT

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.	RES#	7
SW1	Connects to an IRQ input for user controls.	IRQ0 (P30)	4
SW2	Connects to an IRQ input for user controls.	IRQ1 (P31)	5
SW3	Connects to an IRQ input for user controls. The switch is also connected to an ADTRG input, and is used to trigger AD conversions.	IRQ4 (PE4)	47
		ADTRG0# (PB0)	39

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_3V3 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 analogue input AN000, pin 60. The potentiometer can be used to create a voltage between Board_3V3 and ground.

The potentiometer offers 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 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

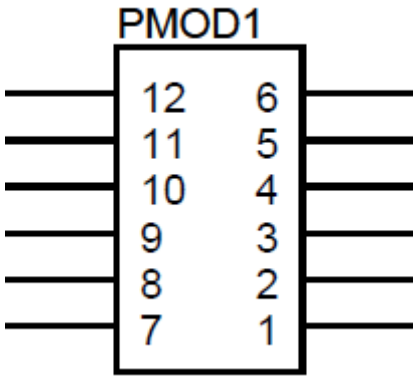


Figure 5-1: Digilent Pmod™ Compatible Header Pin Numbering

Digilent Pmod™ Compatible Header Connections							
Pin	Circuit Net Name	MCU		Pin	Circuit Net Name	MCU	
		Port	Pin			Port	Pin
1	PMOD1_PIN1*	PA6/PC7	41/27	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_3V3 / Board_5V *	-	-	12	Board_3V3 / Board_5V *	-	-

Table 5-4: Pmod™1 Header Connections

* It can be configured by modifying option links.

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
A-TXD1	SCI1 Transmit Signal.	P16	18
MTIOC0B_A-RXD1_P-RXD1	SCI1 Receive Signal	P15	19
A-TXD5_P-TXD5*	SCI5 Transmit Signal.	PC3	31
A-RXD5_P-RXD5*	SCI5 Receive Signal	PC2	32
LINTXD_IO1_TXD12*	SCI12 Transmit Signal.	PE1	50
LINRXD_IO2_RXD12*	SCI12 Receive Signal	PE2	49
RS232TX*	External SCI Transmit Signal.	-	-
RS232RX*	External SCI Receive Signal.	-	-
RL78G1C_CTS	Clear To Send	P03	1
RL78G1C_RTS	Request to Send	P05	64

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 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 RX111 Group Hardware Manual.

Connections between the LIN connector and the microcontroller are listed in **Table 5-6** below.

LIN Signal	Function	MCU	
		Port	Pin
LINTXD	LIN Transmit Signal	PE1	50
LINRXD	LIN Receive Signal	PE2	49
LINNSLP	LIN Transceiver Device Sleep Control	PB1	37

Table 5-6: LIN Connections

5.9 Universal Serial Bus (USB)

This RSK device is fitted with a USB host socket (type A) and a function socket (type Mini B). USB module USB0 is connected to the host and function socket, and can operate as either a host or function device. The connections for the USB0 module are shown in **Table 5-7** below.

USB Signal	Function	MCU	
		Port	Pin
USB0DP	Positive differential data signal.	USB0_DP	23
USB0DM	Negative differential data signal.	USB0_DM	22
USB0VBUS	Cable monitor pin.	P16	18
USB0VBUSEN	VBUS power supply enable.	P26	3
USB0OVRCURA	Over-current detection signal A.	PB3	36
USB0OVRCURB	Over-current detection signal B.	PC7	27
USB0EXICEN	OTG Low-power control signal	PC6	28
USB0ID	ID input signal	PC5	29

Table 5-7: USB0 Module Connections

Note:

- When evaluating OTG, ensure to replace the default USB connector (USB0_3) with a USB Micro-AB connector.
- Connectors such as the one manufactured by Hirose Electric with part number ZX62R-AB-5P, can be used.

5.10 I²C Bus (Inter-IC Bus)

The RX111 features one I²C (Inter-IC Bus) interface modules. RIIC 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.

The first bit of the device address can be configured by modifying option links – refer to §6 for further details.

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 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.

6.2 MCU Operating Modes

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

Reference	Pin 1	Pin2	Comment	Related Ref.
SW4	**OFF**	**OFF**	**Single Chip Mode**	-
	OFF	ON	Single Chip Mode	-
	ON	OFF	Boot Mode (SCI)	-
	ON	ON	Boot Mode (USB)	R225

Table 6-1: MCU Option Links (1)

Table 6-2 below details the option links associated with configuring the Boot Mode (USB) Power Configuration.

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R225	Boot Mode (USB): Self-Powered	Boot Mode (USB): **Bus Powered**	SW4

Table 6-2: MCU Option Links (1)

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
VBUS	Connects VBUS to power supply line of 5V.	U4.IN	J6	2-3	-
	Disconnect.	**-**	**J6**	1-2 / **All open**	**-**
VBUS	Bus-Powered	-	J9	1-2	-
	Self-Powered	**-**	**J9**	**2-3**	**-**
EXT_BATT	Connects EXT_BATT to power supply line of 5V.	U4.IN	J6	1-2	-
	Disconnect.	**-**	**J6**	2-3 / **All open**	**-**
CON_5V	**Connects CON_5V to power supply line of 5V.**	**U4.IN**	**JA1.1**	**R94**	**-**
	Disconnect.	-	-	-	R94
USB_5V	**Connects USB_5V to USB Host power control IC.**	**U7.VIN**	**-**	**R96, R178**	**-**
	Disconnect.	-	-	-	R96
Unregulated_VCC	Connects Unregulated_VCC to power supply line of 5V.	U4.IN	JA6.23	R95	-
	Disconnect.	-	-	-	**R95**
REGSEL	**Configures regulator IC output as 3V3.**	**U4.OUT**	**J7**	**open**	**-**
	Configures regulator IC output as 1V8.	U4.OUT	J7	shorted-pin	-
CON_3V3	**Connects CON_3V3 to power supply line of 3V3.**	**U4.OUT**	**JA1.3**	**R101**	**-**
	Disconnect.	-	-	-	R101
EXT_CHG	Enable Battery Charge Function.	-	J13	1-2	-
	Disable Battery Charge Function.	**-**	**J13**	**open**	**-**
EXT_VBUS	**Connects EXT_VBUS to line of VBUS.**	-	-	R185	-
	Disconnect.	**-**	**JA6.17**	**-**	**R185**
PWR	**Connects PWR connector to power supply line of 5V.**	**-**	**-**	**R92**	**-**
	Disconnect.	-	-	-	R92
PWR/VBUS/EXT_BATT /CON_5V /Unregulated_VCC	**Connects PWR/VBUS/EXT_BATT /CON_5V/Unregulated_VCC to Board_5V and regulator IC.**	**U4.IN**	**-**	**R91**	**-**
	Disconnect.	-	-	-	R91
UC_VCC	**Connected to the power supply MCU.**	**-**	**J8**	**R102** / J8:shorted	**-**
	Enable current probe(J7) for MCU	-	J8	**J8: open**	R102
VBAT, Board_5V	Connects VBAT to BAT of LIN transceiver.	U5.7	J10.1	-	R93
	Connects Board_5V to BAT of LIN transceiver.		**-**	**R93**	**-**

Table 6-3: Power Supply Option Links

6.4 Clock Configuration

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

Signal Name	Exclusive Function	Header connection		
	Function	Header Pin	Fit	Remove
CON_XTAL	Connects external clock or Micro controller pin headers to MCU.	JA2.2, J1.11	R149	R148
	Disconnect.		**-**	**R149**
XTAL	**Connect the crystal X1.1.**	**-**	**R148**	**R149**
	Disconnect.	-	-	R148
CON_EXTAL	Connect Micro controller pin headers to MCU.	J1.12	R143	R145
	Disconnect.		**-**	**R143**
EXTAL	**Connect the crystal X1.2.**	**-**	**R145**	**R143**
	Disconnect.	-	-	R145
XCOUT	**Connect the crystal X2.1.**	**-**	**R130**	**-**
	Disconnect.	-	-	R130
XCIN	**Connect the crystal X2.4.**	**-**	**R131**	**R132**
	Disconnect.	-	R132	R131

Table 6-4: Clock Option Links

6.5 ADC & DAC Configuration

Table 6-5 below details the function of the option links associated with ADC & DAC configuration.

Signal Name	MCU		Exclusive function				Header connection		
	Port	MCU Pin	Signal	Fit	Remove	Header Pin	Fit	Remove	Port
VREFL0	PJ7	59	**GROUND**	**-**	**R153**	**R152**	**-**	**-**	**-**
			CON_VREFL0	-	R152	R153	J4.11	-	-
VREFH0	PJ6	61	**UC_VCC**	**-**	**R155**	**R154**	**-**	**-**	**-**
			CON_VREFH0	-	R154	R155	JA1.7, J4.13	-	-
IO7_AN015	PE7	52	IO7	-	R12	R7	JA1.22	-	-
			AN015	**-**	**R7**	**R12**	**JA5.4**	**-**	**-**
IO6_AN014	PE6	53	IO6	-	R13	R8	JA1.21	-	-
			AN014	**-**	**R8**	**R13**	**JA5.3**	**-**	**-**
P46_AN006	P46	54	**P46**	**-**	**R44**	**R9**	**PMOD1.10**	**-**	**-**
			AN006	-	R9	R44	JA5.2	-	-
P44_AN004	P44	55	**P44**	**-**	**R45**	**R10**	**PMOD1.9**	**-**	**-**
			AN004	-	R10	R45	JA5.1	-	-
AN000	R40	60	**ADPOT(RV1)**	**-**	**R227**	**R22, R43**	**JA1.9**	**-**	**-**
			AN000	**-**	**R23**	**R22, R43**	**JA1.9**	**-**	**-**
			AN000 (partial pressure)	-	R22, R43,	R23, R227	JA1.9	-	-
RL78G1C_RTS_DA1	P05	64	RL78G1C_RTS	U2.9	R39	R20	-	-	-
			DA1	**-**	**R20**	**R39**	**JA1.14**	**-**	**-**
RL78G1C_CTS_DA0	P03	1	RL78G1C_CTS	U2.10	R40	R21	-	-	-
			DA0	**-**	**R21**	**R40**	**JA1.13**	**-**	**-**
AVCC0	-	63	**UC_VCC**	**-**	**R159**	**R158, R170/R171**	**-**	**-**	**-**
			CON_AVCC0	-	R158	R159, **R170/R171**	JA1.5, J4.15	-	-
			Board_3V3	-	**R170**, R171	R159, **R158**	-	-	-
AVSS0	-	62	**GROUND**	**-**	**R157**	**R156**	**-**	**-**	**-**
			CON_AVSS0	-	R156	R157	JA1.6, J4.14	-	-

Table 6-5: ADC & DAC Option Links

6.6 E1 Debugger Configuration

Table 6-6 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	Port
P27	P27	2	**P27**	**-**	**R105**	**-**	**E1.1**	**-**	**-**
				-	**-**	**-**	**J1.2**	**-**	**-**
MTIOC3C_A-TXD1_P-TXD1_USB0VBUS	P16	18	MTIOC3C	-	R216	**R87, R107,** J11: open	JA2.11	-	-
			A-TXD1	**U2.15**	**R224, J11.1-2**	**R38, R87, R107, R120, R199, R216**	**JA2.6**	**-**	**-**
				-	**J11.1-2**	**R87, R107, R216**			
			P-TXD1	-	R87	**R216, R107,** J11: open	PMOD2.2	-	-
			USB0VBUS	-	J11.2-3	**R87, R107, R216**	J9.2	**R144**	**R121**
			MTIOC3C_A-TXD1_P-TXD1_USB0VBUS	-	R107	**R87**, **R216**, J11: open	E1.5	-	-
				-	**-**	**-**	**J2.2**	**-**	**-**
MTIOC0B_A-RXD1_P-RXD1	P15	19	MTIOC0B	-	R183	**R88, R125**, R220	JA2.9	R219	R218
			A-RXD1	**-**	**R220**	**R88, R125, R183**	**JA2.8**	**-**	**-**
			P-RXD1	-	R88	**R183, R125,** R220	PMOD2.3	-	-
			MTIOC0B_A-RXD1_P-RXD1	**U2.16**	**R116**	**R37, R88, R110, R125, R183, R198,** R220	**-**	**-**	**-**
				-	R125	**R88, R183,** R220	E1.11	-	-
				-	**-**	**-**	**J2.3**	**-**	**-**
P14_A-CTS1RTS1_P-CTS1RTS1	P14	20	**P14**	**-**	**R117, R165**	**R86, R215**	**E1.10**	**-**	**-**
				SW4.2	**R165**		**-**	**-**	**-**
			A-CTS1RTS1	-	R215	**R86**, R165	JA2.12	-	-
			P-CTS1RTS1	-	R86	R165, **R215**	PMOD2.1	-	-

Table 6-6: E1 Debugger Option Links

6.7 I2C EEPROM Configuration

Table 6-7 below details the function of the option links associated with I2C EEPROM configuration.

Signal Name/Function	MCU		Exclusive function				Header connection		
	Port	MCU Pin	Signal	IC Pin	Fit	Remove	Fit	Remove	Port
MTIC5W_SCL_ADTRG0n	PB0	39	MTIC5W	-	R188	**R25,** R61	JA6.16	-	-
			SCL	**U3.6**	**R59, R61**	**R25, R188**	**JA1.26**	**-**	**-**
				-	**R61**				
			ADTRG0n	-	R25, R186	R61, **R188,** R229	SW3	-	-
				-	R25	-	JA1.8	-	-
MTIC5V_SDA_CTS5RTS5	PA6	41	MTIC5V	-	R189	R64, **R69**	JA6.15	-	-
			SDA	**U3.5**	**R58, R64**	**R69, R189**	**JA1.25**	**-**	**-**
				-	**R64**				
			CTS5RTS5	-	R70, R69	R71, R64, **R189**	PMOD1.1	-	-
Board_5V (Pull-up)	-	-	-	-	R6	R5	-	-	-
Board_3V3 (Pull-up)	**-**	**-**	**-**	**-**	**R5**	**R6**	**-**	**-**	**-**
Enable write protect	-	-	-	U3.7	R32	-	-	-	-
Disable write protect	**-**	**-**	**-**	**U3.7**	**-**	**R32**	**-**	**-**	**-**

Table 6-7: I2C EEPROM Option Links

6.8 I/O Port Configuration

Table 6-8 below details the function of the option links associated with the I/O Port configuration.

Signal Name	MCU		Exclusive function				Header connection		
	Port	MCU Pin	Signal	IC Pin	Fit	Remove	Header Pin	Fit	Remove
IO7_AN015	PE7	52	IO7	-	R12	R7	JA1.22	-	-
			AN015	-	**R7**	**R12**	**JA5.4**	**-**	**-**
IO6_AN014	PE6	53	IO6	-	R13	R8	JA1.21	-	-
			AN014	**-**	**R8**	**R13**	**JA5.3**	**-**	**-**
IO5_MTIOC4C	PE5	46	IO5	-	R14	R213	JA1.20	-	-
			MTIOC4C	**-**	**R213**	**R14**	**JA2.16**	**-**	**-**
IO4_MTIOC1A_IRQ4	PE4	47	IO4	-	R15	**R204**,R203	JA1.19	-	-
			MTIOC1A	-	R204	**R15**,R203	JA2.23	R205	R206, **R207**
			IRQ4	**-**	**R203**	**R15,R204**	**JA2.23**	**R206**	**R205, R207**
				SW3	**R203, R229**	**R15, R186, R204**	**-**	**-**	**-**
IO3_MTIOC0A	PE3	48	**IO3**	**-**	**R16**	**R36**	**JA1.18**	**-**	**-**
			MTIOC0A	-	R36	R16	JA2.7	R221	R222
LINRXD_IO2_RXD12	PE2	49	**LINRXD**	**U6.1**	**R122**	**R17, R192**	**-**	**-**	**-**
			IO2	-	R17	R122, **R192**	JA1.17	-	-
			RXD12	-	R192	**R17**, R122	JA6.12	-	-
			LINRXD_IO2_RXD12	U2.16	R37	**R17, R110,** R116, R122, **R192, R198**	-	-	-
				-	**-**	**-**	**J4.1**	**-**	**-**
LINTXD_IO1_TXD12	PE1	50	**LINTXD**	**U6.4**	**R111**	**R18, R195**	**-**	**-**	**-**
			IO1	-	R18	R111, **R195**	JA1.16	-	-
			TXD12	-	R195	**R18**, R111	JA6.9	-	-
			LINTXD_IO1_TXD12	U2.15	R38	**R18, R120,** R111, **R195, R199**, R224	-	-	-
				-	**-**	**-**	**J4.2**	**-**	**-**
IO0_SCK12	PE0	51	IO0	-	R19	R193	JA1.15	-	-
			SCK12	**-**	**R193**	**R19**	**JA6.11**	**-**	**-**

Table 6-8: I/O Port Option Links

6.9 IRQ & Switch Configuration

Table 6-9 below details the function of the option links associated with the IRQ & Switches configuration.

Signal Name	MCU		Exclusive function				Header connection		
	Port	MCU Pin	Signal	IC Pin	Fit	Remove	Header Pin	Fit	Remove
IO4_MTIOC1A_IRQ4	PE4	47	IO4	-	R15	**R204**,R203	JA1.19	-	-
			MTIOC1A	-	R204	**R15**,R203	JA2.23	R205	R206, **R207**
			IRQ4	**-**	**R203**	**R15,R204**	**JA2.23**	**R206**	**R205, R207**
				SW3	**R203, R229**	**R15, R186, R204**	**-**	**-**	**-**
MTIC5W_SCL_ADTRG0n	PB0	39	MTIC5W	-	R188	**R25,** R61	JA6.16	-	-
			SCL	**U3.6**	**R59, R61**	**R25, R188**	**JA1.26**	**-**	**-**
				-	**R61**				
			ADTRG0n	-	R25, R186	R61, **R188,** R229	SW3	-	-
				-	R25	-	JA1.8	-	-
IRQ5_MTIC5U	PA4	42	**IRQ5**	**-**	**R68**	**R190**	**PMOD1.7**	**-**	**-**
			MTIC5U	-	R190	R68	JA6.14	-	-
POE0_A-IRQ6_P-IRQ6	PA3	43	POE0	-	**R90,** R202	**R11**, R46	JA2.24	-	-
			A-IRQ6	-	R11, **R90**	R46, **R202**	JA1.23	-	-
			P-IRQ6	**-**	**R46, R90**	**R202, R11**	**PMOD1.8**	**-**	**-**
A-IRQ1_P-IRQ1	P31	5	**A-IRQ1**	**-**	**R169**	**R79**	**JA2.9**	**R218**	**R219**
			P-IRQ1	-	R79	R169	PMOD2.8	-	-
			A-IRQ1_P-IRQ1	**SW2**	**R231**	**R79,** R169	**-**	**-**	**-**
				-	**-**	**-**	**J1.5**	**-**	**-**
A-IRQ0_P-IRQ0	P30	4	**A-IRQ0**	**-**	**R223**	**R83**	**JA2.7**	**R222**	**R221**
			P-IRQ0	-	R83	R223	PMOD2.7	-	-
			A-IRQ0_P-IRQ0	**SW1**	**R234**	**R83,** R223	**-**	**-**	**-**
				-	**-**	**-**	**J1.4**	**-**	**-**

Table 6-9: IRQ & Switches Option Links

6.10 LIN Configuration

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

Signal Name	MCU		Exclusive function				Header connection		
	Port	MCU Pin	Signal	IC Pin	Fit	Remove	Header Pin	Fit	Remove
LINRXD_IO2_RXD12	PE2	49	**LINRXD**	**U6.1**	**R122**	**R17, R192**	**-**	**-**	**-**
			IO2	-	R17	R122, **R192**	JA1.17	-	-
			RXD12	-	R192	**R17**, R122	JA6.12	-	-
			LINRXD_IO2_RXD12	U2.16	R37	**R110,** R116**, R198**	-	-	-
				-	**-**	**-**	**J4.1**	**-**	**-**
LINTXD_IO1_TXD12	PE1	50	**LINTXD**	**U6.4**	**R111**	**R18, R195**	**-**	**-**	**-**
			IO1	-	R18	R111, **R195**	JA1.16	-	-
			TXD12	-	R195	**R18**, R111	JA6.9	-	-
			LINTXD_IO1_TXD12	U2.15	R38	**R120, R199**, R224	-	-	-
				-	**-**	**-**	**J4.2**	**-**	**-**
LIN Master mode	-	-	**-**	**-**	**R151, R161**	**-**	**-**	**-**	**-**
LIN Slave mode	-	-	-	-	-	R151, R161	-	-	-

Table 6-10: LIN Option Links

6.11 MTU & POE Configuration

Table 6-11 and Table 6-12 below details the function of the option links associated with MTU & POE configuration.

Signal Name	MCU		Exclusive function				Header connection		
	Port	MCU Pin	Signal	IC Pin	Fit	Remove	Header Pin	Fit	Remove
MTIC5W_SCL_ADTRG0n	PB0	39	MTIC5W	-	R188	**R25,** R61	JA6.16	-	-
			SCL	**U3.6**	**R59, R61**	**R25, R188**	**JA1.26**	**-**	**-**
				-	**R61**				
			ADTRG0n	-	R25, R186	R61, **R188,** R229	SW3	-	-
				-	R25	-	JA1.8	-	-
MTIC5V_SDA_CTS5RTS5	PA6	41	MTIC5V	-	R189	R64, **R69**	JA6.15	-	-
			SDA	**U3.5**	**R58, R64**	**R69, R189**	**JA1.25**	**-**	**-**
				-	**R64**				
			CTS5RTS5	-	R70, R69	R71, R64, **R189**	PMOD1.1	-	-
IRQ5_MTIC5U	PA4	42	**IRQ5**	**-**	**R68**	**R190**	**PMOD1.7**	**-**	**-**
			MTIC5U	-	R190	R68	JA6.14	-	-
POE0_A-IRQ6_P-IRQ6	PA3	43	POE0	-	**R90,** R202	**R11,** R46	JA2.24	-	-
			A-IRQ6	-	R11, **R90**	R46, **R202**	JA1.23	-	-
			P-IRQ6	**-**	**R46, R90**	**R202, R11**	**PMOD1.8**	**-**	**-**
P32_MTIOC0C	P32	16	P32	-	R54	R182	PMOD2.9	-	-
			MTIOC0C	**-**	**R182**	**R54**	JA2.23	R207	**R205,** R206
							JA2.19	**R211**	**-**
MTIOC3A_A-SCK1_P-SCK1	P17	17	MTIOC3A	-	R191	**R89,** R217	JA6.13	-	-
			A-SCK1	**-**	**R217**	**R89, R191**	**JA2.10**	**-**	**-**
			P-SCK1	-	R89	**R191,** R217	PMOD2.4	-	-
MTIOC3C_A-TXD1_P-TXD1_USB0VBUS	P16	18	MTIOC3C	-	R216	**R87, R107,** J11: open	JA2.11	-	-
			A-TXD1	**U2.15**	**R224, J11.1-2**	**R38, R87, R107, R120, R199, R216**	**JA2.6**	**-**	**-**
				-	**J11.1-2**	**R87, R107, R216**		**-**	**-**
			P-TXD1	-	R87	**R216, R107,** J11: open	PMOD2.2	-	-
			USB0VBUS	-	J11.2-3	**R87, R107, R216**	J9.2	**R144**	**R121**
			MTIOC3C_A-TXD1_P-TXD1_USB0VBUS	-	R107	**R87, R216,** J11: open	E1.5	-	-
				-	**-**	**-**	**J2.2**	**-**	**-**
MTIOC0B_A-RXD1_P-RXD1	P15	19	MTIOC0B	-	R183	**R88, R125,** R220	JA2.9	R219	R218
			A-RXD1	**-**	**R220**	**R88, R125, R183**	**JA2.8**	**-**	**-**
			P-RXD1	-	R88	**R183, R125,** R220	PMOD2.3	-	-
			MTIOC0B_A-RXD1_P-RXD1	**U2.16**	**R116**	**R37, R88, R110, R125, R183, R198,** R220	**-**	**-**	**-**
				-	R125	**R88, R183,** R220	E1.11	-	-
				-	**-**	**-**	**J2.3**	**-**	**-**

Table 6-11: MTU & POE Option Links (1)

Signal Name	MCU		Exclusive function				Header connection		
	Port	MCU Pin	Signal	IC Pin	Fit	Remove	Header Pin	Fit	Remove
PC7_MTCLKB_USB0OVRCURB	PC7	27	**PC7**	**-**	**R71, R72**	**R70,R200, R134**	**PMOD1.1**	**-**	**-**
			MTCLKB	-	R200	R72, **R134**	JA2.26	-	-
			USB0OVRCURB	U5.6	R134	R72, **R200**	-	-	-
MTCLKA_USB0EXICEN	PC6	28	**MTCLKA**	**-**	**R201**	**R133**	**JA2.25**	**-**	**-**
			USB0EXICEN	U5.11	R133	R201	-	-	-
IO5_MTIOC4C	PE5	46	IO5	-	R14	R213	JA1.20	-	-
			MTIOC4C	**-**	**R213**	**R14**	**JA2.16**	**-**	**-**
IO4_MTIOC1A_IRQ4	PE4	47	IO4	-	R15	**R204**,R203	JA1.19	-	-
			MTIOC1A	-	R204	**R15**,R203	JA2.23	R205	R206, **R207**
			IRQ4	**-**	**R203**	**R15,R204**	**JA2.23**	**R206**	**R205, R207**
				SW3	**R203, R229**	**R15, R186, R204**	**-**	**-**	**-**
IO3_MTIOC0A	PE3	48	**IO3**	**-**	**R16**	**R36**	**JA1.18**	**-**	**-**
			MTIOC0A	-	R36	R16	JA2.7	R221	R222
MTIOC3D	PB6 /PC0	34	**MTIOC3D**	**LED3**	**-**	**-**	**JA2.14**	**R214**	**-**
					-	**-**	**JA2.20**	**R210**	**-**
					-	**-**	**J3.2**	**-**	**-**
PB5_MTIOC1B	PB5	35	PB5	-	R53	R209	PMOD2.10	-	-
			MTIOC1B	**-**	**R209**	**R53**	**JA2. 21**	**-**	**-**
MTIOC4D	P55	25	**MTIOC4D**	**-**	**-**	**-**	**JA2.18**	**R212**	**-**
					-	**-**	**JA2.22**	**R208**	**-**
					-	**-**	**J2.9**	**-**	**-**

Table 6-12: MTU & POE Option Links (2)

6.12 PMOD1 Interface Configuration

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

Signal Name	MCU		Exclusive function				Header connection		
	Port	MCU Pin	Signal	IC Pin	Fit	Remove	Header Pin	Fit	Remove
PC7_MTCLKB_USB0OVRCURB	PC7	27	**PC7**	**-**	**R71, R72**	**R70,R200, R134**	**PMOD1.1**	**-**	**-**
			MTCLKB	-	R200	R72, **R134**	JA2.26	-	-
			USB0OVRCURB	U5.6	R134	R72, **R200**	-	-	-
A-TXD5_P-TXD5	PC3	31	A-TXD5	-	R196	R113	JA6.8	-	-
			P-TXD5	**-**	**R113**	**R196**	**PMOD1.2**	**-**	**-**
			A-TXD5_P-TXD5	U2.15	R120	**R199**, R224, **R38**	-	-	-
				-	**-**	**-**	**J2.15**	**-**	**-**
A-RXD5_P-RXD5	PC2	32	A-RXD5	-	R197	R112	JA6.7	-	-
			P-RXD5	**-**	**R112**	**R197**	**PMOD1.3**	**-**	**-**
			A-RXD5_P-RXD5	U2.16	R110	**R37,** R116, **R198**	-	-	-
				-	**-**	**-**	**J2.16**	**-**	**-**
MTIC5V_SDA_CTS5RTS5	PA6	41	MTIC5V	-	R189	R64, **R69**	JA6.15	-	-
			SDA	**U3.5**	**R58, R64**	**R69, R189**	**JA1.25**	**-**	**-**
				-	**R64**				
			CTS5RTS5	-	R70, R69	R71, R64, **R189**	PMOD1.1	-	-
IRQ5_MTIC5U	PA4	42	**IRQ5**	**-**	**R68**	**R190**	**PMOD1.7**	**-**	**-**
			MTIC5U	-	R190	R68	JA6.14	-	-
POE0_A-IRQ6_P-IRQ6	PA3	43	POE0	-	**R90,** R202	**R11**, R46	JA2.24	-	-
			A-IRQ6	-	R11, **R90**	R46, **R202**	JA1.23	-	-
			P-IRQ6	**-**	**R46, R90**	**R202, R11**	**PMOD1.8**	**-**	**-**
A-SCK5_P-SCK5	PA1	44	A-SCK5	-	R194	R81	JA6.10	-	-
			P-SCK5	**-**	**R81**	**R194**	**PMOD1.4**	**-**	**-**
P46_AN006	P46	54	**P46**	**-**	**R44**	**R9**	**PMOD1.10**	**-**	**-**
			AN006	-	R9	R44	JA5.2	-	-
P44_AN004	P44	55	**P44**	**-**	**R45**	**R10**	**PMOD1.9**	**-**	**-**
			AN004	-	R10	R45	JA5.1	-	-
Board_5V	-	-	-	-	R51	R47	**PMOD1.6, PMOD1.12**	-	-
Board_3V3	-	-	**-**	**-**	**R47**	**R51**		**-**	**-**

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		Exclusive function				Header connection		
	Port	MCU Pin	Signal	IC Pin	Fit	Remove	Header Pin	Fit	Remove
PB5_MTIOC1B	PB5	35	PB5	-	R53	R209	PMOD2.10	-	-
			MTIOC1B	**-**	**R209**	**R53**	**JA2.21**	**-**	**-**
P32_MTIOC0C	P32	16	P32	-	R54	R182	PMOD2.9	-	-
			MTIOC0C	**-**	**R182**	**R54**	JA2.23	R207	**R205**, R206
							JA2.19	**R211**	**-**
A-IRQ1_P-IRQ1	P31	5	**A-IRQ1**	**-**	**R169**	**R79**	**JA2.9**	**R218**	**R219**
			P-IRQ1	-	R79	R169	PMOD2.8	-	-
			A-IRQ1_P-IRQ1	**SW2**	**R231**	**R79,** R169	**-**	**-**	**-**
				-	**-**	**-**	**J1.5**	**-**	**-**
A-IRQ0_P-IRQ0	P30	4	**A-IRQ0**	**-**	**R223**	**R83**	**JA2.7**	**R222**	**R221**
			P-IRQ0	-	R83	R223	PMOD2.7	-	-
			A-IRQ0_P-IRQ0	**SW1**	**R234**	**R83,** R223	**-**	**-**	**-**
				-	**-**	**-**	**J1.4**	**-**	**-**
MTIOC3A_A-SCK1_P-SCK1	P17	17	MTIOC3A	-	R191	**R89**, R217	JA6.13	-	-
			A-SCK1	**-**	**R217**	**R89, R191**	**JA2.10**	**-**	**-**
			P-SCK1	-	R89	**R191**, R217	PMOD2.4	-	-
MTIOC3C_A-TXD1_P-TXD1_USB0VBUS	P16	18	MTIOC3C	-	R216	**R87, R107,** J11: open	JA2.11	-	-
			A-TXD1	**U2.15**	**R224, J11.1-2**	**R38, R87, R107, R120, R199, R216**	**JA2.6**	**-**	**-**
				-	**J11.1-2**	**R87, R107, R216**		**-**	**-**
			P-TXD1	-	R87	**R216, R107,** J11: open	PMOD2.2	-	-
			USB0VBUS	-	J11.2-3	**R87, R107, R216**	J9.2	**R144**	**R121**
			MTIOC3C_A-TXD1_P-TXD1_USB0VBUS	-	R107	**R87**, **R216**, J11: opne	E1.5	-	-
				-	**-**	**-**	**J2.2**	**-**	**-**
MTIOC0B_A-RXD1_P-RXD1	P15	19	MTIOC0B	-	R183	**R88, R125**, R220	JA2.9	R219	R218
			A-RXD1	**-**	**R220**	**R88, R125, R183**	**JA2.8**	**-**	**-**
			P-RXD1	-	R88	**R183, R125,** R220	PMOD2.3	-	-
			MTIOC0B_A-RXD1_P-RXD1	**U2.16**	**R116**	**R37, R88, R110, R125, R183, R198,** R220	**-**	**-**	**-**
				-	R125	**R88, R183,** R220	E1.11	-	-
				-	**-**	**-**	**J2.3**	**-**	**-**
P14_A-CTS1RTS1_P-CTS1RTS1	P14	20	**P14**	**-**	**R117, R165**	**R86, R215**	**E1.10**	**-**	**-**
				SW4.2	**R165**		**-**	**-**	**-**
			A-CTS1RTS1	-	R215	**R86**, R165	JA2.12	-	-
			P-CTS1RTS1	-	R86	R165, **R215**	PMOD2.1	-	-
Board_5V	-	-	-	-	R3	R4	**PMOD2.6,**	-	-
Board_3V3	-	-	**-**	**-**	**R4**	**R3**	**PMOD2.12**	**-**	**-**

Table 6-14: PMOD2 Interface Option Links

6.14 SCI & RS232 Serial Port Configuration

Table 6-15 below details the function of the option links associated with serial port configuration.

Signal Name	MCU		Exclusive function				Header connection		
	Port	MCU Pin	Signal	IC Pin	Fit	Remove	Header Pin	Fit	Remove
LINRXD_IO2_RXD12	PE2	49	**LINRXD**	**U6.1**	**R122**	**R17, R192**	**-**	**-**	**-**
			IO2	-	R17	R122, **R192**	JA1.17	-	-
			RXD12	-	R192	**R17**, R122	JA6.12	-	-
			LINRXD_IO2_RXD12	U2.16	R37	**R17, R110,** R116, R122, **R192, R198**	-	-	-
			-	**-**	**-**	**-**	**J4.1**	**-**	**-**
LINTXD_IO1_TXD12	PE1	50	**LINTXD**	**U6.4**	**R111**	**R18, R195**	**-**	**-**	**-**
			IO1	-	R18	R111, **R195**	JA1.16	-	-
			TXD12	-	R195	**R18**, R111	JA6.9	-	-
			LINTXD_IO1_TXD12	U2.15	R38	**R18, R120,** R111, **R195, R199**, R224	-	-	-
			-	**-**	**-**	**-**	**J4.2**	**-**	**-**
IO0_SCK12	PE0	51	IO0	-	R19	R193	JA1.15	-	-
			SCK12	**-**	**R193**	**R19**	**JA6.11**	**-**	**-**
A-TXD5_P-TXD5	PC 3	31	A-TXD5	-	R196	R113	JA6.8	-	-
			P-TXD5	**-**	**R113**	**R196**	**PMOD1.2**	**-**	**-**
			A-TXD5_P-TXD5	U2.15	R120	**R199**, R224,**R38**	-	-	-
			-	**-**	**-**	**-**	**J2.15**	**-**	**-**
A-RXD5_P-RXD5	PC 2	32	A-RXD5	-	R197	R112	JA6.7	-	-
			P-RXD5	**-**	**R112**	**R197**	**PMOD1.3**	**-**	**-**
			A-RXD5_P-RXD5	U2.16	R110	**R37**, R116 , **R198**	-	-	-
			-	**-**	**-**	**-**	**J2.16**	**-**	**-**
MTIC5V_SDA_CTS5RTS5	PA6	41	MTIC5V	-	R189	R64, **R69**	JA6.15	-	-
			SDA	**U3.5**	**R58, R64**	**R69, R189**	**JA1.25**	**-**	**-**
				-	**R64**				
			CTS5RTS5	-	R70, R69	R71, R64, **R189**	PMOD1.1	-	-
A-SCK5_P-SCK5	PA1	44	A-SCK5	-	R194	R81	JA6.10	-	-
			P-SCK5	**-**	**R81**	**R194**	**PMOD1.4**	**-**	**-**
MTIOC3A_A-SCK1_P-SCK1	P17	17	MTIOC3A	-	R191	**R89**, R217	JA6.13	-	-
			A-SCK1	**-**	**R217**	**R89, R191**	**JA2.10**	**-**	**-**
			P-SCK1	-	R89	**R191**, R217	PMOD2.4	-	-
MTIOC3C_A-TXD1_P-TXD1_USB0VBUS	P16	18	MTIOC3C	-	R216	**R87, R107,** J11: open	JA2.11	-	-
			A-TXD1	**U2.15**	**R224, J11.1-2**	**R38, R87, R107, R120, R199, R216**	**JA2.6**	**-**	**-**
			-	**J11.1-2**	**R87, R107, R216**			**-**	**-**
			P-TXD1	-	R87	**R216, R107,** J11: open	PMOD2.2	-	-
			USB0VBUS	-	J11.2-3	**R87, R107, R216**	J9.2	**R144**	**R121**
			MTIOC3C_A-TXD1_P-TXD1_USB0VBUS	-	R107	**R87**, **R216**, J11: open	E1.5	-	-
				-	**-**	**-**	**J2.2**	**-**	**-**
MTIOC0B_A-RXD1_P-RXD1	P15	19	MTIOC0B	-	R183	**R88, R125**, R220	JA2.9	R219	R218
			A-RXD1	**-**	**R220**	**R88, R125, R183**	**JA2.8**	**-**	**-**
			P-RXD1	-	R88	**R183, R125,** R220	PMOD2.3	-	-
			MTIOC0B_A-RXD1_P-RXD1	**U2.16**	**R116**	**R37, R88, R110, R125, R183, R198,** R220	**-**	**-**	**-**
				-	R125	**R88, R183,** R220	E1.11	-	-
				-	**-**	**-**	**J2.3**	**-**	**-**
P14_A-CTS1RTS1_P-CTS1RTS1	P14	20	**P14**	**-**	**R117, R165**	**R86, R215**	**E1.10**	**-**	**-**
				SW4.2	**R165**		**-**	**-**	**-**
			A-CTS1RTS1	-	R215	**R86**, R165	JA2.12	-	-
			P-CTS1RTS1	-	R86	R165, **R215**	PMOD2.1	-	-
RS232TX	-	-	RS232TX	U2.15	R199	**R38, R120**, R224	JA6.5	-	-
RS232RX	-	-	RS232RX	U2.16	R198	**R37, R110**, R116	JA6.6	-	-

Table 6-15: SCI & RS232 Serial Port Option Links

6.15 USB Configuration

Table 6-16 below details the function of the option links associated with the USB Configuration.

Signal Name	MCU		Exclusive function				Header connection		
	Port	MCU Pin	Signal	IC Pin	Fit	Remove	Header Pin	Fit	Remove
PC7_MTCLKB_USB0OVRCURB	PC7	27	**PC7**	**-**	**R71, R72**	**R70,R200, R134**	**PMOD1.1**	**-**	**-**
			MTCLKB	-	R200	R72, **R134**	JA2.26	-	-
			USB0OVRCURB	U5.6	R134	R72, **R200**	-	-	-
MTCLKA_USB0EXICEN	PC6	28	**MTCLKA**	**-**	**R201**	**R133**	**JA2.25**	**-**	**-**
			USB0EXICEN	U5.11	R133	R201	-	-	-
RL78G1C_RES_USB0ID	PC5	29	**RL78G1C_RES**	**U2.3**	**R123**	**R139**	**-**	**-**	**-**
			USB0ID	U5.3	R139	R123	-	-	-
USB0OVRCURA (HOST)	PB3	36	**USB0OVRCURA**	**U7.2**	**R175**	**R136**	**J3.4**	**-**	**-**
USB0OVRCURA (OTG)	PB3	36	USB0OVRCURA	U5.5	R136	R175	-	-	-
USB0VBUSEN (HOST)	P26	3	**USB0VBUSEN**	**U7.1**	**R173**	**R137**	**J1.3**	**-**	**-**
USB0VBUSEN (OTG)	P26	3	USB0VBUSEN	U5.4	R137	R173	-	-	-
MTIOC3C_A-TXD1_P-TXD1_USB0VBUS	P16	18	MTIOC3C	-	R216	**R87, R107,** J11: open	JA2.11	-	-
			A-TXD1	**U2.15**	**R224, J11.1-2**	**R38, R87, R107, R120, R199, R216**	**JA2.6**	**-**	**-**
				-	**J11.1-2**	**R87, R107, R216**		**-**	**-**
			P-TXD1	-	R87	**R216, R107,** J11: open	PMOD2.2	-	-
			USB0VBUS	-	J11.2-3	**R87, R107, R216**	J9.2	**R144**	**R121**
			MTIOC3C_A-TXD1_P-TXD1_USB0VBUS	-	R107	**R87, R216,** J11: open	E1.5	-	-
				-	**-**	**-**	**J2.2**	**-**	**-**

Table 6-16: USB Option Links

Table 6-17 below details the function of the option links associated with the USB mode select.

Mode	Jumper Position	Option Link Resistor	
		Fit	Remove
Host mode	J12: 1-2 shorted.	**-**	**R140**
Function mode	**J12: 2-3 shorted**		
OTG mode	J12: All open	R140	-

Table 6-17: USB Option Links (mode)

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** **Circuit Net Name**	**MCU Pin**	**Pin**	**Header Name** **Circuit Net Name**	**MCU Pin**
1	5V CON_5V	-	2	0V GROUND	-
3	3V3 CON_3V3	-	4	0V GROUND	-
5	AVCC CON_AVCC0	63	6	AVSS CON_AVSS0	62
7	AVREF CON_VREFH0	61	8	ADTRG ADTRG0n	39
9	ADC0 JA1_AN000	60	10	ADC1 AN001	58
11	ADC2 AN002	57	12	ADC3 AN003	56
13	DA0 DA0	1	14	DA1 DA1	64
15	IO_0 IO0	51	16	IO_1 IO1	50
17	IO_2 IO2	49	18	IO_3 IO3	48
19	IO_4 IO4	47	20	IO_5 IO5	46
21	IO_6 IO6	53	22	IO_7 IO7	52
23	IRQ3/IRQAEC/M2_HSIN0 A-IRQ6/NC/NC	43/NC/NC	24	IIC_EX NC	NC
25	IIC_SDA JA1_SDA	41	26	IIC_SCL JA1_SCL	39

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** **Circuit Net Name**	**MCU Pin**	**Pin**	**Header Name** **Circuit Net Name**	**MCU Pin**
1	RESET RESn	7	2	EXTAL CON_XTAL	11
3	NMI NMIn	10	4	Vss1 GROUND	-
5	WDT_OVF NC	NC	6	SCIaTX A-TXD1	18
7	IRQ0/WKUP/M1_HSIN0 A-IRQ0/NC/MTIOC0A	4/NC/48	8	SCIaRX A-RXD1	19
9	IRQ1/M1_HSIN1 A-IRQ1/MTIOC0B	5/19	10	SCIaCK A-SCK1	17
11	M1_UD MTIOC3C	18	12	CTSRTS A-CTS1RTS1	20
13	M1_Up MTIOC3B	33	14	M1_Un MTIOC3D	34
15	M1_Vp MTIOC4A	45	16	M1_Vn MTIOC4C	46
17	M1_Wp MTIOC4B	26	18	M1_Wn MTIOC4D	25
19	TimerOut MTIOC0C	16	20	TimerOut MTIOC3D	34
21	TimerIn MTIOC1B	35	22	TimerIn MTIOC4D	25
23	IRQ2/M1_EncZ/M1_HSIN2 IRQ4/MTIOC1A/MTIOC0C	47/47/16	24	M1_POE POE0	43
25	M1_TRCCLK MTCLKA	28	26	M1_TRDCLK MTCLKB	27

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** / **Circuit Net Name**	**MCU Pin**	**Pin**	**Header Name** / **Circuit Net Name**	**MCU Pin**
1	ADC4 / AN004	55	2	ADC5 / AN006	54
3	ADC6 / AN014	53	4	ADC7 / AN015	52
5	CAN1TX / NC	NC	6	CAN1RX / NC	NC
7	CAN2TX / NC	NC	8	CAN2RX / NC	NC
9	IRQ4/M2_EncZ/M2HSIN1 / NC	NC / NC / NC	10	IRQ5/M2_HSIN2 / NC	NC / NC
11	M2_UD / NC	NC	12	M2_Uin / NC	NC
13	M2_Vin / NC	NC	14	M2_Win / NC	NC
15	M2_Toggle / NC	NC	16	M2_POE / NC	NC
17	M2_TRCCLK / NC	NC	18	M2_TRDCLK / NC	NC
19	M2_Up / NC	NC	20	M2_Un / NC	NC
21	M2_Vp / NC	NC	22	M2_Vn / NC	NC
23	M2_Wp / NC	NC	24	M2_Wn / NC	NC

Table 7-3: Application Header JA5 Connections

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

Application Header JA6					
Pin	**Header Name** **Circuit Net Name**	**MCU Pin**	**Pin**	**Header Name** **Circuit Net Name**	**MCU Pin**
1	DREQ NC	NC	2	DACK NC	NC
3	TEND NC	NC	4	STBYn NC	NC
5	RS232TX RS232TX	NC	6	RS232RX RS232RX	NC
7	SCIbRX A-RXD5	32	8	SCIbTX A-TXD5	31
9	SCIcTX TXD12	50	10	SCIbCK A-SCK5	44
11	SCIcCK SCK12	51	12	SCIcRX RXD12	49
13	M1_Toggle MTIOC3A	17	14	M1_Uin MTIC5U	42
15	M1_Vin MTIC5V	41	16	M1_Win MTIC5W	39
17	EXT_USB_VBUS * EXT_VBUS	NC	18	Reserved NC	NC
19	EXT_USB_BATT * EXT_BATT	NC	20	Reserved NC	NC
21	EXT_USB_CHG * EXT_CHG	NC	22	Reserved NC	NC
23	Unregulated_VCC Unregulated_VCC	NC	24	Vss GROUND	-

Table 7-4: Application Header JA6 Connections

: 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**	**Pin**	**Circuit Net Name**	**MCU Pin**
1	RL78G1C_CTS_DA0	1	2	P27	2
3	USB0VBUSEN	3	4	A-IRQ0_P-IRQ0	4
5	A-IRQ1_P-IRQ1	5	6	MD_FINED	6
7	RESn	7	8	NC	-
9	NC	-	10	NMIn	10
11	CON_XTAL	11	12	CON_EXTAL	12
13	NC	-	14	GROUND	-
15	UC_VCC	15	16	P32_MTIOC0C	16
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 7-6 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	MTIOC3A_A-SCK1_P-SCK1	17	2	MTIOC3C_A-TXD1_P-TXD1_USB0VBUS	18
3	MTIOC0B_A-RXD1_P-RXD1	19	4	P14_A-CTS1RTS1_P-CTS1RTS1	20
5	VCCUSB	21	6	NC	-
7	NC	-	8	GROUND	24
9	MTIOC4D	25	10	MTIOC4B	26
11	PC7_MTCLKB_USB0OVRCURB	27	12	MTCLKA_USB0EXICEN	28
13	RL78G1C_RES_USB0ID	29	14	PC4	30
15	A-TXD5_P-TXD5	31	16	A-RXD5_P-RXD5	32
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 7-6: 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	MTIOC3B	33	2	MTIOC3D	34
3	PB5_MTIOC1B	35	4	USB0OVRCURA	36
5	LINNSLP	37	6	UC_VCC	38
7	MTIC5W_SCL_ADTRG0n	39	8	GROUND	40
9	MTIC5V_SDA_CTS5RTS5	41	10	IRQ5_MTIC5U	42
11	POE0_A-IRQ6_P-IRQ6	43	12	A-SCK5_P-SCK5	44
13	MTIOC4A	45	14	IO5_MTIOC4C	46
15	IO4_MTIOC1A_IRQ4	47	16	IO3_MTIOC0A	48
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, 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	LINRXD_IO2_RXD12	49	2	LINTXD_IO1_TXD12	50
3	IO0_SCK12	51	4	IO7_AN015	52
5	IO6_AN014	53	6	P46_AN006	54
7	P44_AN004	55	8	AN003	56
9	AN002	57	10	AN001	58
11	CON_VREFL0	59	12	AN000	60
13	CON_VREFH0	61	14	CON_AVSS0	62
15	CON_AVCC0	63	16	RL78G1C_RTS_DA1	64
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, 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 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 and Boot modes (SCI and USB), 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 RX111 group hardware manual.

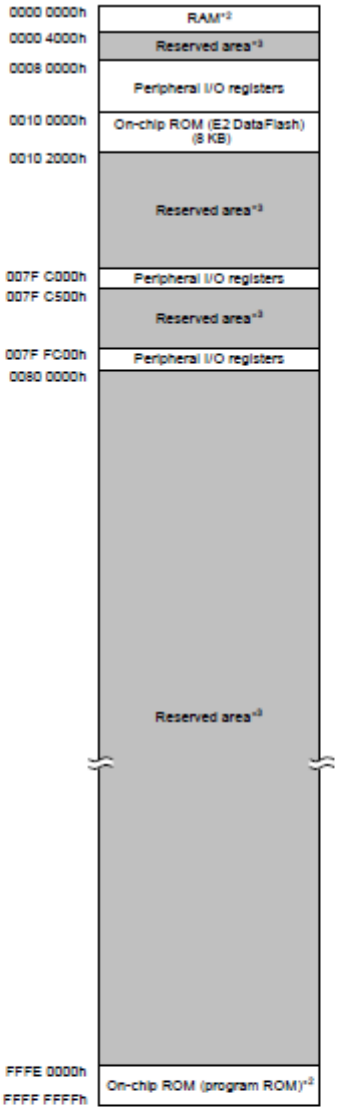
Only ever change the MCU operating mode whilst the RSK is in reset, or turned off; otherwise the MCU may become damaged as a result.

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 the MCU. This diagram is taken from the Hardware Manual version 0.2. The MCU fitted to the RSK has 128KB 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.

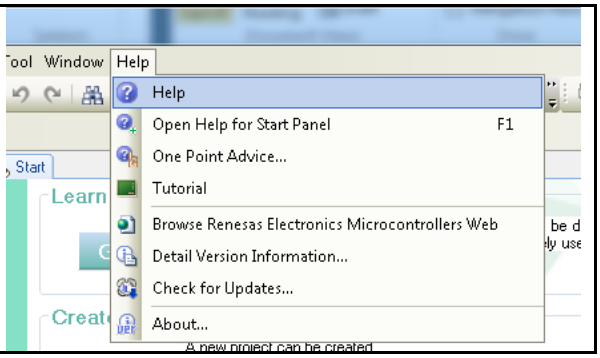
Note 3. Reserved areas should not be accessed.

Figure 8-1: MCU Address Space Diagram

9. Additional Information

Technical Support

For details on how to use CubeSuite+, refer to the manual available on the DVD or from the web site. Alternatively, refer to the help file by opening CubeSuite+ then selecting Help > Help from the menu bar.



For information about the RX111 Group microcontrollers refer to the RX111 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:
http://www.renesas.com/

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Renesas Electronics America Inc.
2801 Scott Boulevard Santa Clara, CA 95050-2549, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
1101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada
Tel: +1-905-898-5441, Fax: +1-905-898-3220

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-585-100, Fax: +44-1628-585-900

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 1709, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100191, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, P. R. China 200333
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited
Unit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852 2886-9022/9044

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics Korea Co., Ltd.
12F., 234 Teheran-ro, Gangnam-Ku, Seoul, 135-920, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

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