

RL78/L12 Group

Renesas Starter Kit User's Manual
For CubeSuite+

RENESAS MCU
RL78 Family / L1X Series

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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 RL78/L12 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.	RSKRL78L12 User's Manual	R20UT0922EG
Tutorial	Provides a guide to setting up RSK environment, running sample code and debugging programs.	RSKRL78L12 Tutorial Manual	R20UT0923EG
Quick Start Guide	Provides simple instructions to setup the RSK and run the first sample, on a single A4 sheet.	RSKRL78L12 Quick Start Guide	R20UT0924EG
Schematics	Full detail circuit schematics of the RSK.	RSKRL78L12 Schematics	R20UT0921EG
Hardware Manual	Provides technical details of the RL78/L12 microcontroller.	RL78/L12 Group Hardware Manual	R01UH0330EJ

2. List of Abbreviations and Acronyms

Abbreviation	Full Form
ADC	Analog-to-Digital Converter
bps	bits per second
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
DTC	Data Transfer Controller
E1	On-chip Debugger
ELC	Event Link Controller
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
IIC	Philips™ Inter-Integrated Circuit Connection Bus
IRQ	Interrupt Request
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MCU	Micro-controller Unit
PC	Personal Computer
PWM	Pulse Width Modulation
RSK	Renesas Starter Kit
SAU	Serial Array Unit
SFR	Special Function Register
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus

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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 options are shown in **Table 2-1** below.

J5 Setting	J6 Setting	Supply Source	Supply Input Voltages	Regulator IC Output
Pin1-2 shorted	shorted / open	E1	5V / 3.3V	None
Pin1-2 shorted	shorted / open	PWR connector	5V	None
Pin2-3 shorted	open		5V	3.3V
Pin2-3 shorted	Pin1-2 shorted		5V	1.8V
Pin2-3 shorted	Pin2-3 shorted		5V	1.62V

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 LCD panel segments will start to flash. After 200 flashes or after pressing any switch, the text on the display will change and the heart symbol 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.

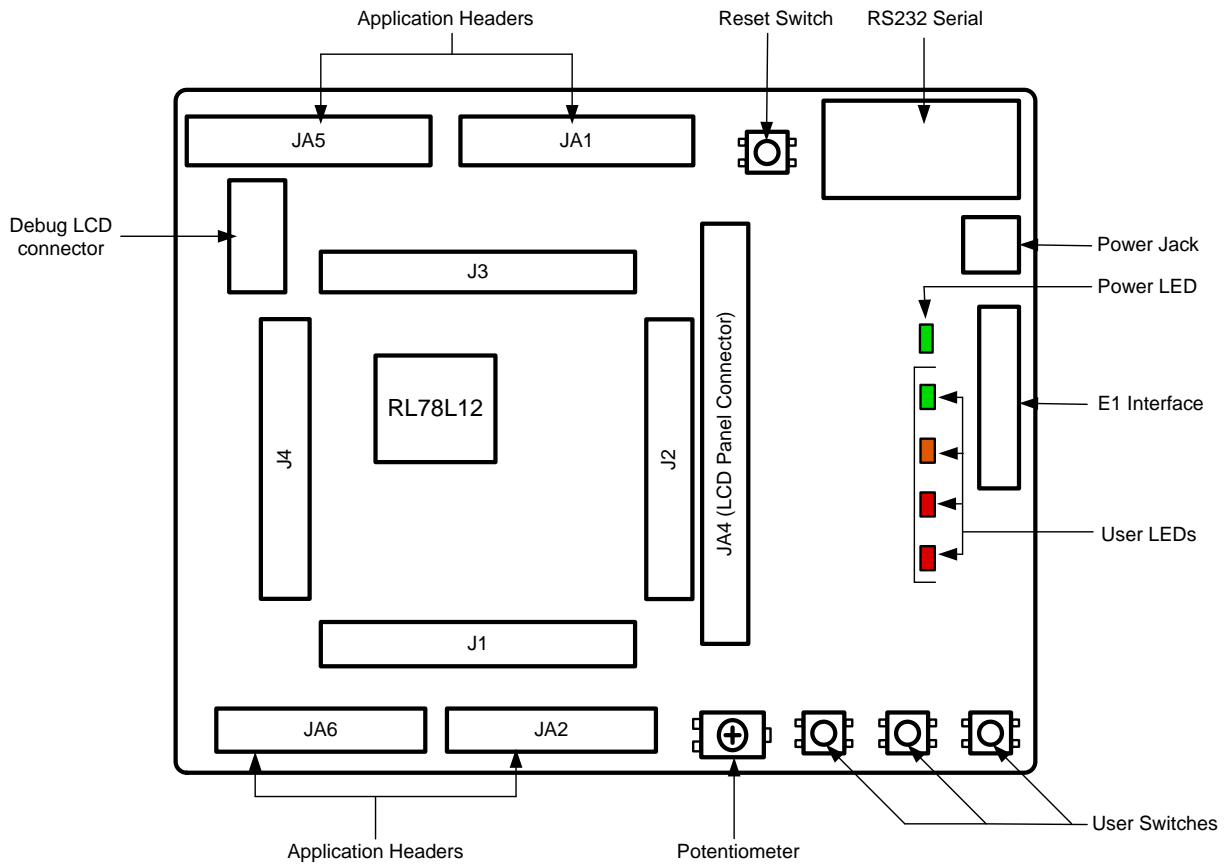


Figure 3-1: Board Layout

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.

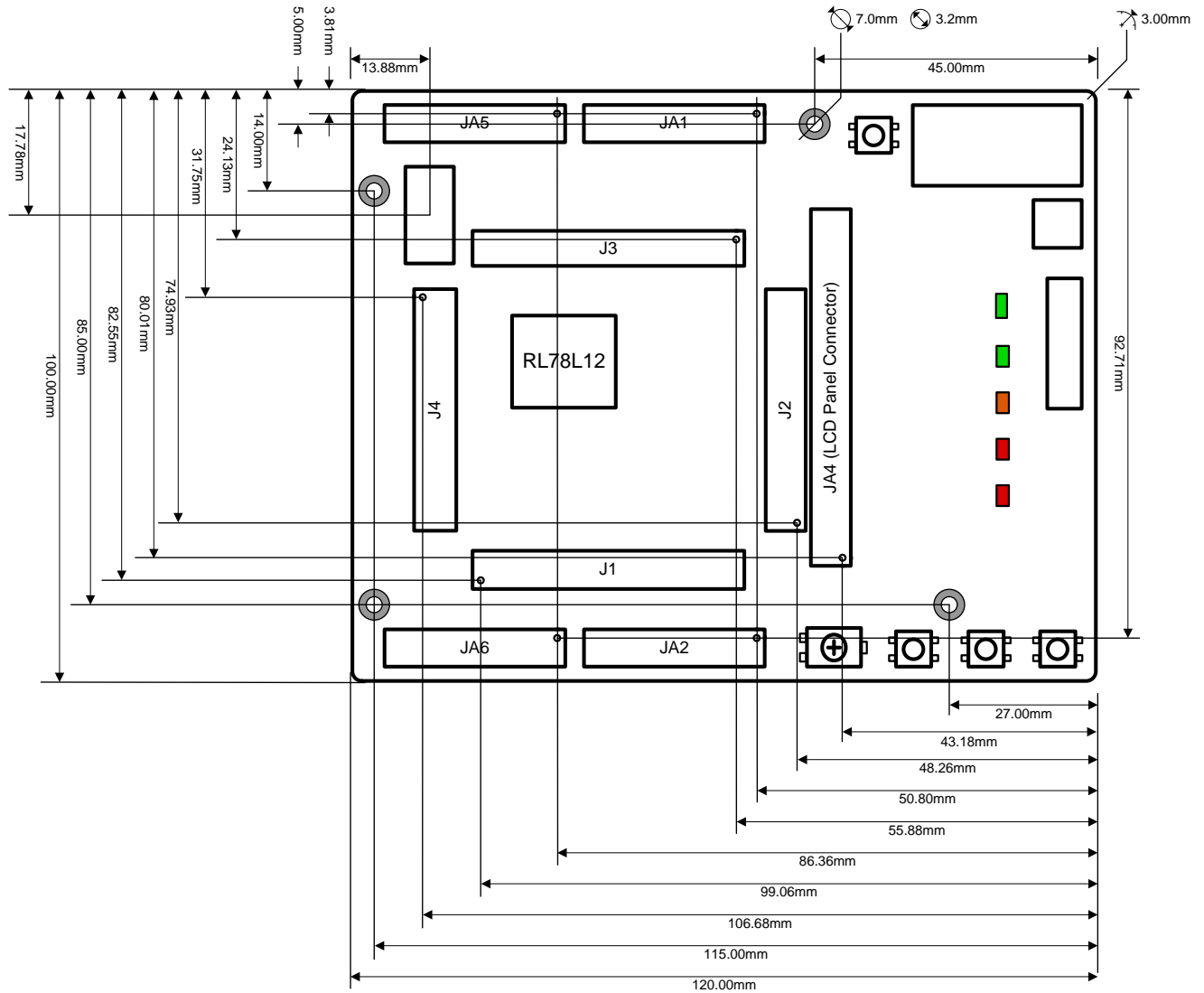


Figure 3-2: Board Dimensions

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.

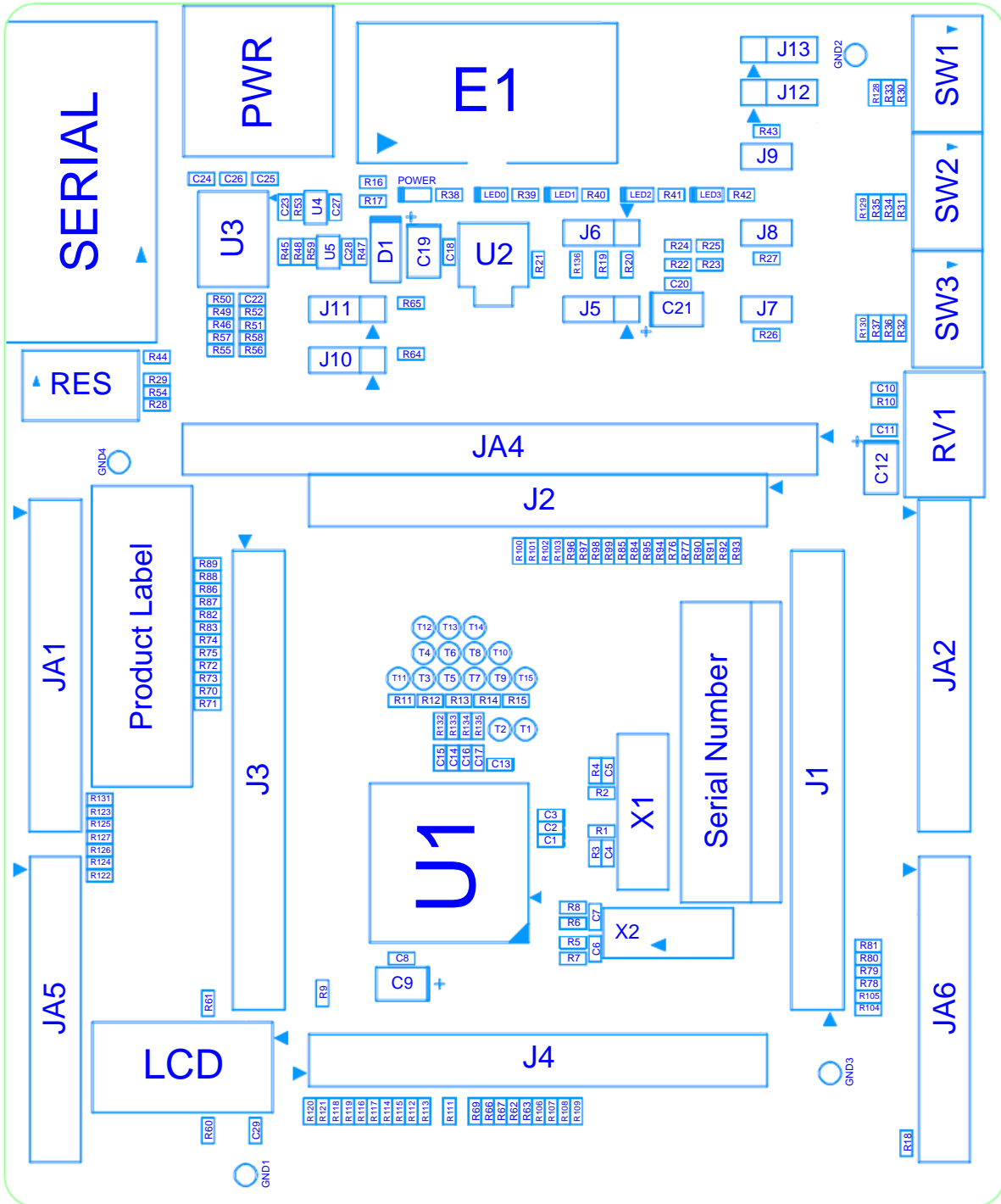


Figure 3-3: Top-Side Component Placement

4. Connectivity

4.1 Internal RSK Connections

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

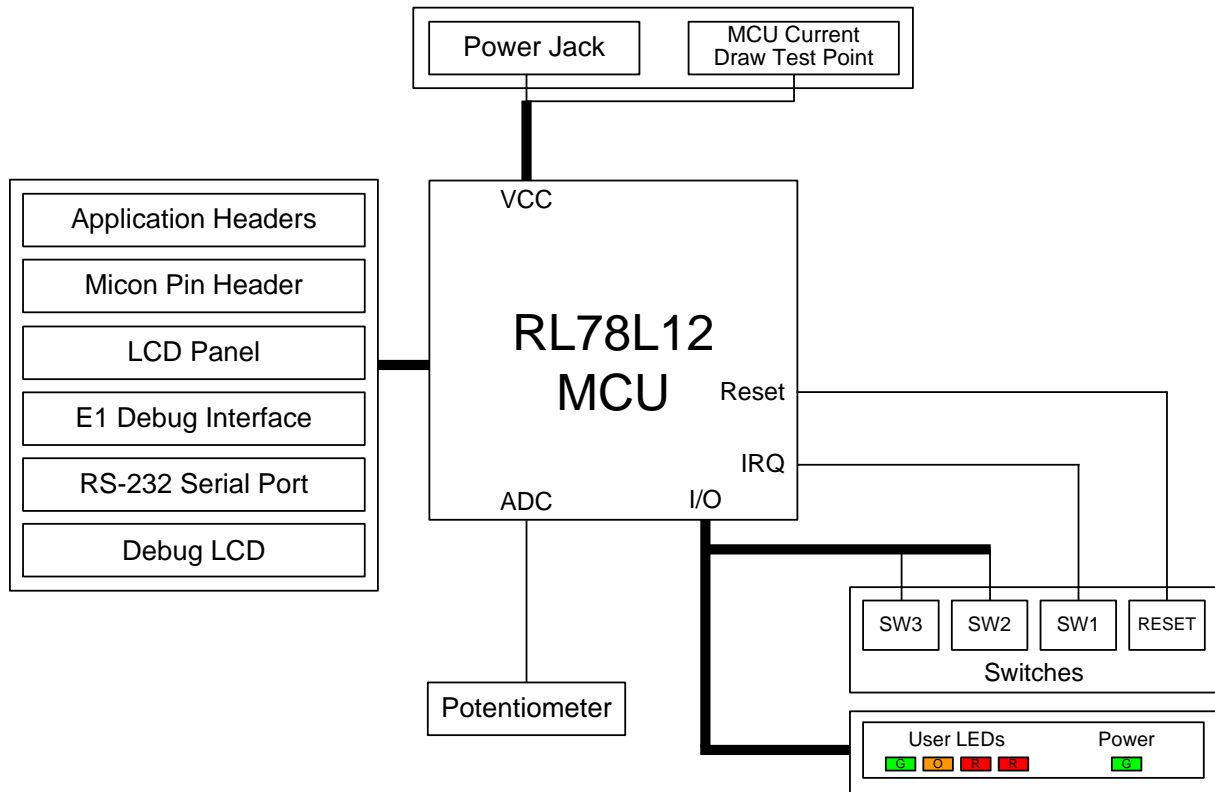


Figure 4-1: Internal RSK Block Diagram

4.2 Debugger Connections

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

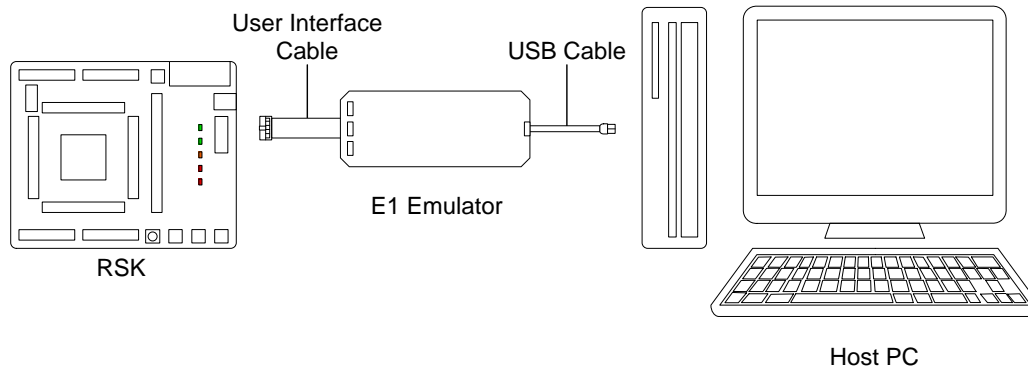


Figure 4-2: Debugger Connection Diagram

5. User Circuitry

5.1 Reset Circuit

A reset control circuit is not fitted to the RSK, as the MCU is capable of voltage and power-on detection. Resets are handled internally, and the reset switch is connected directly to the RESET pin on the MCU (pin 6).

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 RL78/L12 Group Hardware Manual for details regarding the clock signal requirements, and the RSKRL78L12 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	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 RSKRL78L12 board schematics.

Switch	Function	MCU Connection
RES	When pressed, the microcontroller is reset.	RESET, Pin 6
SW1	Connects to an IRQ input for user controls.	INTP0, Pin 9
SW2	Connects to a port pin for user controls.	P14, Pin 58
	Connects to a port pin for user controls.	P126, Pin 20
SW3	Connects to a port pin for user controls.	P142, Pin 57
	Connects to a port pin for user controls.	P127, Pin 19

Table 5-2: Switch Connections

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**. Note that, with the exception of the power LED, the LEDs are disabled when the LCD panel is in use. Refer to §6.10 for detail of LCD panel configuration.

LED	Colour	Function	MCU Connection
POWER	Green	Indicates the power status	No connection
LED0	Green	User operated LED.	P30, Pin 25
LED1	Orange	User operated LED.	P42, Pin 3
LED2	Red	User operated LED.	P51, Pin 36
LED3	Red	User operated LED.	P52, Pin 35

Table 5-3: LED Connections

5.5 Potentiometer

A single-turn potentiometer is connected as a potential divider to analog input ANI0, pin 50. 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 RL78/L12 Group Hardware Manual for further details.

5.6 LCD Panel

A versatile LCD display panel is supplied with the RSK, and should be connected to the JA4 header. The panel is directly driven by circuitry inside the MCU. Connection information for the LCD panel is provided in table **Table 5-4** below.

LCD Panel Header (JA4)					
Pin	Circuit Net Name	MCU Pin	Pin	Circuit Net Name	MCU Pin
1	VL4	VL4, Pin 23	2	VL3	VL3, Pin 24
3	VL2	VL2, Pin 22	4	VL1	VL1, Pin 21
5	Ground	-	6	Ground	-
7	COM0	COM0, Pin 48	8	COM1	COM1, Pin 47
9	COM2	COM2, Pin 46	10	COM3	COM3, Pin 45
11	SEG0	SEG0, Pin 44	12	SEG1	SEG1, Pin 43
13	SEG2	SEG2, Pin 42	14	SEG3	SEG3, Pin 41
15	SEG4	SEG4, Pin 40	16	SEG5	SEG5, Pin 39
17	SEG6	SEG6, Pin 38	18	SEG7_DLCDRS	SEG7, Pin 37
19	SEG8_LED2	SEG8, Pin 36	20	SEG9_LED3	SEG9, Pin 35
21	SEG10	SEG10, Pin 34	22	SEG11	SEG11, Pin 33
23	SEG12	SEG12, Pin 32	24	SEG13_DLCD7	SEG13, Pin 31
25	SEG14_DLCD6	SEG14, Pin 30	26	SEG15_DLCD5	SEG15, Pin 29
27	SEG16_DLCD4	SEG16, Pin 28	28	SEG19_LED0	SEG19, Pin 25
29	SEG20	SEG20, Pin 18	30	SEG21	SEG21, Pin 17
31	SEG22	SEG22, Pin 4	32	SEG23_LED1	SEG23, Pin 3
33	SEG24	SEG24, Pin 2	34	SEG25	SEG25, Pin 1
35	SEG26	SEG26, Pin 64	36	SEG27	SEG27, Pin 63
37	SEG28	SEG28, Pin 62	38	SEG31	SEG31, Pin 59
39	SEG32	SEG32, Pin 58*	40	SEG33	SEG33, Pin 57*
41	SEG34	SEG34, Pin 56	42	SEG35	SEG35, Pin 55
43	SEG36	SEG36, Pin 54	44	SEG37	SEG37, Pin 53
45	SEG38	SEG38, Pin 52	46	SEG17	SEG17, Pin 27
47	SEG18	SEG18, Pin 26	48	SEG29	SEG29, Pin 61*
49	SEG30	SEG30, Pin 60*	50	NC	

Table 5-4: LCD Header Connections

* These segments are connected to the MCU via jumpers - refer to §6.10 for the required jumper settings.

5.7 Debug LCD Module

A debug LCD header is fitted to the RSK; however the two-line debug LCD is not supplied with this kit. It is not possible to use the debug LCD and the LCD panel at the same time, and they should not both be fitted to the RSK.

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. Connection information for the debug LCD module is provided in **Table 5-5** 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	P50, Pin 37
5	R/W (pulled to ground)	-	6	DLCDE (pulled to ground)	P130, Pin 51
7	No Connection	-	8	No Connection	-
9	No Connection	-	10	No Connection	-
11	DLCDD4	P70, Pin 28	12	DLCDD5	P71, Pin 29
13	DLCDD6	P72, Pin 30	14	DLCDD7	P73, Pin 31

Table 5-5: LCD Header Connections

5.8 RS232 Serial Port

An RS232 serial port is fitted to the RSK and connected via a level shifter to the microcontroller Serial Array Unit (SAU). Connections between the RS232 header and the microcontroller are listed in **Table 5-6** below.

Signal Name	Function	MCU Connection	RS232 Connection
TxD0	SAU0 Channel 0 Transmit Signal.	TxD0, pin 60	Pin 2
RxD0	SAU0 Channel 0 Receive Signal	RxD0, pin 61	Pin 3
RS232TX	External SCI Transmit Signal.	n/a	Pin 2*
RS232RX	External SCI Receive Signal.	n/a	Pin 3*

Table 5-6: Serial Port Connections

* This connection is a not available in the default RSK configuration - refer to §6.4 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.

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 (§3.3) 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 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 RL78/L12 Group Hardware Manual and RSKRL78L12 board schematics for further information.

6.2 ADC Configuration

Table 6-1 below details the function of the option links associated with the Analog-to-Digital circuit.

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R9	Connects the MCU (AVREFP, pin 50) to AVREFP (JA1, pin 7)	Disconnects the MCU (AVREFP, pin 50) from AVREFP (JA1, pin 7)	R10
R10	Connects the MCU (AVREFP, pin 50) to the potentiometer.	Disconnects the MCU (AVREFP, pin 50) from the potentiometer.	R9, C8, C9
R67	Connects the MCU (ANI18, pin 59) to ANI18 (JA1, pin 11).	Disconnects the MCU (ANI18, pin 59) from ANI18 (JA1, pin 11).	R66
R69	Connects the MCU (ANI19, pin 58) to ANI19 (JA1, pin 12).	Disconnects the MCU (ANI19, pin 58) from ANI19 (JA1, pin 12)	J13
R79	Connects the MCU (ANI16, pin 2) to ANI16 (JA1, pin 9).	Disconnects the MCU (ANI16, pin 2) from ANI16 (JA1, pin 9).	R78
R105	Connects the MCU (ANI17, pin 1) to ANI17 (JA1, pin 10).	Disconnects the MCU (ANI17, pin 1) from ANI17 (JA1, pin 10).	R104
R111	Connects the MCU (ANI20, pin 57) to ANI20 (JA5, pin 1).	Disconnects the MCU (ANI20, pin 57) from ANI20 (JA5, pin 1).	J12
R113	Connects the MCU (ANI21, pin 56) to ANI21 (JA5, pin 2).	Disconnects the MCU (ANI21, pin 56) from ANI21 (JA5, pin 2).	R112
R115	Connects the MCU (ANI22, pin 55) to ANI22 (JA5, pin 3).	Disconnects the MCU (ANI22, pin 55) from ANI22 (JA5, pin 3).	R114
R117	Connects the MCU (ANI23, pin 54) to ANI23 (JA5, pin 4).	Disconnects the MCU (ANI23, pin 54) from ANI23 (JA5, pin 4).	R116

Table 6-1: ADC Option Links

6.3 E1 Debugger Interface

Table 6-2 below details the function of the option links associated with serial port configuration.

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R53	Connects U4 (Y, pin 4) to the MCU (RESET, pin 6)	Disconnects U4 (Y, pin 4) from the MCU (RESET, pin 6)	-
R54	Connects TRESET (E1, pin 6) to the MCU (RESET, pin 6) via R29.	Disconnects TRESET (E1, pin 6) from the MCU (RESET, pin 6).	-

Table 6-2: E1 Debugger Interface Option Links

6.4 RS232 Serial Port Configuration

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.
R44	Connects the serial port connector shield to Ground.	Disconnects the serial port connector shield from Ground.	-
R48	Connects U3 (SHDn, pin 20) to Ground.	Disconnects U3 (SHDn, pin 20) from Ground.	-
R49	Connects U3 (T1IN, pin 13) to the MCU and App Header (via R57 and R55 respectively).	Disconnects U3 (T1IN, pin 13) from the MCU and App Header.	R50, R55, R57
R50	Connects U3 (T1IN, pin 13) to TOOL0 (E1, pin 5).	Disconnects U3 (T1IN, pin 13) from TOOL0 (E1, pin 5).	R49
R51	Connects U3 (R1OUT, pin 15) to the MCU and App Header (via R56 and R58 respectively).	Disconnects U3 (R1OUT, pin 15) from the MCU and App Header.	R52, R56, R58
R52	Connects U3 (R1OUT, pin 15) to U5 (OE, pin 1).	Disconnects U3 (R1OUT, pin 15) from U5 (OE, pin 1).	R51
R55	Connects U3 (T1IN, pin 13) to RS232TX (JA6, pin 5), via R49.	Disconnects U3 (T1IN, pin 13) from RS232TX (JA6, pin 5).	R49, R57
R56	Connects U3 (R1OUT, pin 15) to RS232RX (JA6, pin 6), via R51.	Disconnects U3 (R1OUT, pin 15) from RS232RX (JA6, pin 6).	R51, R58
R57	Connects U3 (T1IN, pin 13) to the MCU (TxD0, pin 60) via R49 and J11.	Disconnects U3 (T1IN, pin 13) from the MCU (TxD0, pin 60).	R49, R55, R65, J11
R58	Connects U3 (R1OUT, pin 15) to the MCU (RxD0, pin 61) via R51 and J10.	Disconnects U3 (R1OUT, pin 15) from the MCU (RxD0, pin 61).	R51, R56, R64, J10
R64	Connects U3 (R1OUT, pin 15) to the MCU (RxD0, pin 61) via R51 and R58.	Disconnects U3 (R1OUT, pin 15) from the MCU (RxD0, pin 61), unless bypassed by J10.	R51, R58, J10
R65	Connects U3 (T1IN, pin 13) to the MCU (TxD0, pin 60) via R49 and R57.	Disconnects U3 (T1IN, pin 13) from the MCU (TxD0, pin 60), unless bypassed by J11.	R49, R57, J11

Table 6-3: RS232 Serial Port Option Links

6.5 IRQ & General I/O Pin Configuration

Table 6-4 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.
R63	Connects the MCU (SCK00n, pin 62) to SCK00n (JA2, pin 10).	Disconnects the MCU (SCK00n, pin 62) from SCK00n (JA2, pin 10).	R62
R71	Connects the MCU (SCK01, pin 40) to SCK01n (JA6, pin 11).	Disconnects the MCU (SCK01, pin 40) from SCK01n (JA6, pin 11).	R70
R73	Connects the MCU (SIO1, pin 39) to SIO1 (JA6, pin 12).	Disconnects the MCU (SIO1, pin 39) from SIO1 (JA6, pin 12).	R72
R75	Connects the MCU (SO01, pin 38) to SO01 (JA6, pin 9).	Disconnects the MCU (SO01, pin 38) from SO01 (JA6, pin 9).	R74
R77	Connects the MCU (INTP3, pin 26) to INTP3 (JA2, pin 9).	Disconnects the MCU (INTP3, pin 26) from INTP3 (JA2, pin 9).	R76
R81	Connects the MCU (INTP7, pin 4) to INTP7 (JA1, pin 23).	Disconnects the MCU (INTP7, pin 4) from INTP7 (JA1, pin 23).	R80
R83	Connects the MCU (TO06, pin 36) to TO06 (JA2, pin 20).	Disconnects the MCU (TO06, pin 36) from TO06 (JA2, pin 20).	R82
R85	Connects the MCU (INTP4, pin 27) to INTP4 (JA2, pin 23).	Disconnects the MCU (INTP4, pin 27) from INTP4 (JA2, pin 23).	R84
R87	Connects the MCU (TI07, pin 34) to TI07 (JA2, pin 22).	Disconnects the MCU (TI07, pin 34) from TI07 (JA2, pin 22).	R86
R89	Connects the MCU (P54, pin 33) to IO5 (JA1, pin 20).	Disconnects the MCU (P54, pin 33) from IO5 (JA1, pin 20).	R88
R91	Connects the MCU (SCLA0, pin 17) to SCLA0 (JA1, pin 26) via R123.	Disconnects the MCU (SCLA0, pin 17) from SCLA0 (JA1, pin 26).	R90
R93	Connects the MCU (SDAA0, pin 18) to SDAA0 (JA1, pin 25) via R122.	Disconnects the MCU (SDAA0, pin 18) from SDAA0 (JA1, pin 25).	R92
R95	Connects the MCU (P70, pin 28) to IO0 (JA1, pin 15).	Disconnects the MCU (P70, pin 28) from IO0 (JA1, pin 15).	R94
R97	Connects the MCU (P71, pin 29) to IO1 (JA1, pin 16).	Disconnects the MCU (P71, pin 29) from IO1 (JA1, pin 16).	R96
R99	Connects the MCU (P72, pin 30) to IO2 (JA1, pin 17).	Disconnects the MCU (P72, pin 30) from IO2 (JA1, pin 17).	R98
R101	Connects the MCU (P73, pin 31) to IO3 (JA1, pin 18).	Disconnects the MCU (P73, pin 31) from IO3 (JA1, pin 18).	R100
R103	Connects the MCU (P74, pin 32) to IO4 (JA1, pin 19).	Disconnects the MCU (P74, pin 32) from IO4 (JA1, pin 19).	R102
R107	Connects the MCU (TO00, pin 63) to TO00 (JA2, pin 19).	Disconnects the MCU (TO00, pin 63) from TO00 (JA2, pin 19).	R106
R109	Connects the MCU (TI00, pin 64) to TI00 (JA2, pin 21).	Disconnects the MCU (TI00, pin 64) from TI00 (JA2, pin 21).	R108
R119	Connects the MCU (P146, pin 53) to IO6 (JA1, pin 21).	Disconnects the MCU (P146, pin 53) from IO6 (JA1, pin 21).	R118
R121	Connects the MCU (P147, pin 52) to IO7 (JA1, pin 22).	Disconnects the MCU (P147, pin 52) from IO7 (JA1, pin 22).	R120
R126	Connects IIC pull up resistors to Board_EVDD.	Disconnects IIC pull up resistors from Board_EVDD.	R127
R127	Connects IIC pull up resistors to Board_5V.	Disconnects IIC pull up resistors from Board_5V.	R126

Table 6-4: IRQ & General I/O Option Links

6.6 User Switch Configuration

Table 6-5 below details the function of the option links associated with the user switches.

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R33	Connects the switch SW1 to the MCU (INTP0, pin 9)	Disconnects the switch SW1 from the MCU (INTP0, pin 9)	-
R34	Connects the switch SW2 to the MCU (P126, pin 20).	Disconnects the switch SW2 from the MCU (P126, pin 20).	R35
R35	Connects the switch SW2 to the MCU (P14, pin 58) via J13.	Disconnects the switch SW2 from the MCU (P14, pin 58).	R34, J13
R36	Connects the switch SW3 to the MCU (P127, pin 19).	Disconnects the switch SW3 from the MCU (P127, pin 19).	R37
R37	Connects the switch SW3 to the MCU (P142, pin 57) via J12.	Disconnects the switch SW3 from the MCU (P142, pin 57).	R36, J12

Table 6-5: User Switch Option Links

6.7 LED Configuration

Table 6-6 below details the function of the option link associated with the LEDs.

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R43	Connects LED0, LED1, LED2 and LED3 to Board_EVDD*.	Disconnects LED0, LED1, LED2 and LED3 from Board_EVDD unless bypassed by J9	J9

Table 6-6: LED Option Link

Table 6-7 below details the function of the jumper associated with the LEDs.

Reference	Shorted	Open	Related Ref.
J9	Connects LED0, LED1, LED2 and LED3 to Board_EVDD*.	Disconnects LED0, LED1, LED2 and LED3 from Board_EVDD, unless bypassed by R43.	R43

Table 6-7: LED Configuration Jumper

* Do not fit J9 or R43 if the LCD panel is connected.

6.8 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.
R16	Connects the power socket (PWR pin) to the voltage regulator (U2, pin 3) and Board_5V.	Disconnects the Power socket (PWR pin) from the voltage regulator (U2, pin 3) and Board_5V.	-
R17	Connects CON_5V (JA1, pin 1) to the power socket (PWR pin).	Disconnects CON_5V (JA1, pin 1) from the power socket (PWR pin).	R16, R18
R18	Connects Unregulated_VCC (JA6, pin 23) to the power socket (PWR pin).	Disconnects Unregulated_VCC (JA6, pin 23) from the power socket (PWR pin).	R16
R22	Connects external power supply to Board_VDD.	Disconnects external power supply from Board_VDD.	J5, R26, R23
R23	Connects Board_VDD to CON_3V3 (JA1, pin 3).	Disconnects Board_VDD from CON_3V3 (JA1, pin 3).	R25, R22
R24	Connects external power supply to Board_EVDD.	Disconnects external power supply from Board_EVDD.	J5, R27, R25
R25	Connects Board_EVDD to CON_3V3 (JA1, pin 3).	Disconnects Board_EVDD from CON_3V3 (JA1, pin 3).	R23, R24
R26	Connects UC_VDD to Board_VDD, bypassing J7.	Disconnects UC_VDD from Board_VCC.	J7, R22
R27	Connects UC_EVDD to Board_EVDD, bypassing J8.	Disconnects UC_EVDD from Board_EVDD.	J8, R24

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.
J5	All pins open. Disconnects Board_VDD and Board_EVDD from voltage regulator (U2, pin 2) and power socket (PWR pin).	Pins 1 and 2 connected. The voltage regulator U2 is bypassed, and Board_VDD and Board_EVDD are supplied directly from the power socket (PWR pin).	Pins 2 and 3 connected. Connects Board_VDD and Board_EVDD to the voltage regulator (U2, pin 2).	-
J6	All pins open. The voltage regulator U2 is set to supply 3.3V.	Pins 1 and 2 connected. The voltage regulator U2 is set to supply 1.8V.	Pins 2 and 3 connected. The voltage regulator U2 is set to supply 1.6V	J5
J7	All pins open. Disconnects UC_VDD from Board_VDD (unless bypassed by R26).	Pins 1 and 2 connected. Connects UC_VDD to Board_VDD. Replace jumper with an ammeter to measure MCU current.	N/A	R26
J8	All pins open. Disconnects UC_EVDD from Board_VDD (unless bypassed by R27).	Pins 1 and 2 connected. Connects UC_EVDD to Board_EVDD. Replace jumper with an ammeter to measure MCU current.	N/A	R27

Table 6-9: Power Supply Jumpers

6.9 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.
R1	Connects the crystal X1 to the MCU (X2, pin 10).	Disconnects the crystal X1 from the MCU (X2, pin 10).	R3
R2	Connects the crystal X1 to the MCU (X1, pin 11).	Disconnects the crystal X1 from the MCU (X1, pin 11).	R4
R3	Connects CON_X2 (J1, pin 10) to the MCU (X2, pin 10).	Disconnects CON_X2 (J1, pin 10) from the MCU (X2, pin 10).	R1
R4	Connects CON_X1 (J1, pin 11) to the MCU (X1, pin 11).	Disconnects CON_X1 (J1, pin 11) from the MCU (X1, pin 11).	R2
R5	Connects the crystal X2 to the MCU (XT2, pin 7).	Disconnects the crystal X2 from the MCU (XT2, pin 7).	R7
R6	Connects the crystal X2 to the MCU (XT1, pin 8).	Disconnects the crystal X2 from the MCU (XT1, pin 8).	R8
R7	Connects CON_XT2 (J1, pin 7) to the MCU (XT2, pin 7).	Disconnects CON_XT1 (J1, pin 7) from the MCU (XT2, pin 7).	R5
R8	Connects CON_XT1 (J1, pin 8) to the MCU (XT1, pin 8).	Disconnects CON_XT1 (J1, pin 8) from the MCU (XT1, pin 8).	R6

Table 6-10: Clock Option Links

6.10 LCD Panel Configuration

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

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R11	Connects the LCD panel (JA4, pin 1) to Board_VDD.	Disconnects the LCD panel (JA4, pin 1) from Board_VDD.	R132
R132	Connects the MCU (VL4, pin 23) to the LCD panel (JA4, pin 1).	Disconnects the MCU (VL4, pin 23) from the LCD panel (JA4, pin 1).	R11
R133	Connects the MCU (VL3, pin 24) to the LCD panel (JA4, pin 2).	Disconnects the MCU (VL3, pin 24) from the LCD panel (JA4, pin 2).	-
R134	Connects the MCU (VL2, pin 22) to the LCD panel (JA4, pin 3).	Disconnects the MCU (VL2, pin 22) from the LCD panel (JA4, pin 3).	-
R135	Connects the MCU (VL1, pin 21) to the LCD panel (JA4, pin 4).	Disconnects the MCU (VL1, pin 21) from the LCD panel (JA4, pin 4).	-
R62	Connects the MCU (SEG28, pin 62) to the LCD panel (JA4, pin 37).	Disconnects the MCU (SEG28, pin 62) from the LCD panel (JA4, pin 37).	R63
R66	Connects the MCU (SEG31, pin 59) to the LCD panel (JA4, pin 38).	Disconnects the MCU (SEG31, pin 59) from the LCD panel (JA4, pin 38).	R67
R70	Connects the MCU (SEG4, pin 40) to the LCD panel (JA4, pin 15).	Disconnects the MCU (SEG4, pin 40) from the LCD panel (JA4, pin 15).	R71
R72	Connects the MCU (SEG5, pin 39) to the LCD panel (JA4, pin 16).	Disconnects the MCU (SEG5, pin 39) from the LCD panel (JA4, pin 16).	R73
R74	Connects the MCU (SEG6, pin 38) to the LCD panel (JA4, pin 17).	Disconnects the MCU (SEG6, pin 38) from the LCD panel (JA4, pin 17).	R75
R76	Connects the MCU (SEG18, pin 26) to the LCD panel (JA4, pin 47).	Disconnects the MCU (SEG18, pin 26) from the LCD panel (JA4, pin 47).	R77
R78	Connects the MCU (SEG24, pin 2) to the LCD panel (JA4, pin 33).	Disconnects the MCU (SEG24, pin 2) from the LCD panel (JA4, pin 33).	R79
R80	Connects the MCU (SEG22, pin 4) to the LCD panel (JA4, pin 31).	Disconnects the MCU (SEG22, pin 4) from the LCD panel (JA4, pin 31).	R81
R82	Connects the MCU (SEG8, pin 36) to the LCD panel (JA4, pin 19) and LED2.	Disconnects the MCU (SEG8, pin 36) from the LCD panel (JA4, pin 19) and LED2.	R83
R84	Connects the MCU (SEG17, pin 27) to the LCD panel (JA4, pin 46).	Disconnects the MCU (SEG17, pin 27) from the LCD panel (JA4, pin 46).	R85
R86	Connects the MCU (SEG10, pin 34) to the LCD panel (JA4, pin 21).	Disconnects the MCU (SEG10, pin 34) from the LCD panel (JA4, pin 21).	R87
R88	Connects the MCU (SEG11, pin 33) to the LCD panel (JA4, pin 22).	Disconnects the MCU (SEG11, pin 33) from the LCD panel (JA4, pin 22).	R89
R90	Connects the MCU (SEG21, pin 17) to the LCD panel (JA4, pin 30).	Disconnects the MCU (SEG21, pin 17) from the LCD panel (JA4, pin 30).	R91
R92	Connects the MCU (SEG20, pin 18) to the LCD panel (JA4, pin 29).	Disconnects the MCU (SEG20, pin 18) from the LCD panel (JA4, pin 29).	R93
R94	Connects the MCU (SEG16, pin 28) to the LCD panel (JA4, pin 27) and the debug LCD header (pin 11).	Disconnects the MCU (SEG16, pin 28) from the LCD panel (JA4, pin 27) and the debug LCD header (pin 11).	R95
R96	Connects the MCU (SEG15, pin 29) to the LCD panel (JA4, pin 26) and the debug LCD header (pin 12).	Disconnects the MCU (SEG15, pin 29) from the LCD panel (JA4, pin 26) and the debug LCD header (pin 12).	R97

Table 6-11: LCD Panel Option Links (continued overleaf)

Reference	Link Fitted Configuration	Link Removed Configuration	Related Ref.
R98	Connects the MCU (SEG14, pin 30) to the LCD panel (JA4, pin 25) and the debug LCD header (pin 13).	Disconnects the MCU (SEG14, pin 30) from the LCD panel (JA4, pin 25) and the debug LCD header (pin 13).	R99
R100	Connects the MCU (SEG13, pin 31) to the LCD panel (JA4, pin 24) and the debug LCD (pin 14).	Disconnects the MCU (SEG13, pin 31) from the LCD panel (JA4, pin 24) and the debug LCD (pin 14).	R101
R102	Connects the MCU (SEG12, pin 32) to the LCD panel (JA4, pin 23).	Disconnects the MCU (SEG12, pin 32) from the LCD panel (JA4, pin 23).	R103
R104	Connects the MCU (SEG25, pin 1) to the LCD panel (JA4, pin 34).	Disconnects the MCU (SEG25, pin 1) from the LCD panel (JA4, pin 34).	R105
R106	Connects the MCU (SEG27, pin 63) to the LCD panel (JA4, pin 36).	Disconnects the MCU (SEG27, pin 63) from the LCD panel (JA4, pin 36).	R107
R108	Connects the MCU (SEG26, pin 64) to the LCD panel (JA4, pin 35).	Disconnects the MCU (SEG26, pin 64) from the LCD panel (JA4, pin 35).	R109
R112	Connects the MCU (SEG34, pin 56) to the LCD panel (JA4, pin 41).	Disconnects the MCU (SEG34, pin 56) from the LCD panel (JA4, pin 41).	R113
R114	Connects the MCU (SEG35, pin 55) to the LCD panel (JA4, pin 42).	Disconnects the MCU (SEG35, pin 55) from the LCD panel (JA4, pin 42).	R115
R116	Connects the MCU (SEG36, pin 54) to the LCD panel (JA4, pin 43).	Disconnects the MCU (SEG36, pin 54) from the LCD panel (JA4, pin 43).	R117
R118	Connects the MCU (SEG37, pin 53) to the LCD panel (JA4, pin 44).	Disconnects the MCU (SEG37, pin 53) from the LCD panel (JA4, pin 44).	R119
R120	Connects the MCU (SEG38, pin 52) to the LCD pane (JA4, pin 45).	Disconnects the MCU (SEG38, pin 52) from the LCD pane (JA4, pin 45).	R121

Table 6-11: LCD Panel Option Links (continuation)

Table 6-12 below details the function of the jumpers associated with LCD panel configuration.

Reference	Position One	Position Two	Position Three	Related Ref.
J10	All pins are open. Disconnects the MCU (SEG29/RxD0, pin 61) from the RS232 IC and the LCD panel.	Pins 1 and 2 connected. Connects the MCU (RxD0, pin 61) to U3 (R1OUT, pin 15) via R51 and R58.	Pins 2 and 3 connected. Connects the MCU (SEG29, pin 61) to the LCD panel (JA4, pin 48).	R51, R58, R64
J11	All pins are open. Disconnects the MCU (SEG30/TxD0, pin 60) from the RS232 IC and the LCD panel.	Pins 1 and 2 connected. Connects the MCU (TxD0, pin 60) to U3 (T1IN, pin 13) via R49 and R57.	Pins 2 and 3 connected. Connects the MCU (SEG30, pin 60) to the LCD panel (JA4, pin 49).	R49, R57, R65
J12	All pins are open. Disconnects the MCU (SEG33/P142, pin 57) from the LCD panel and switch SW3.	Pins 1 and 2 connected. Connects the MCU (SEG33, pin 57) to the LCD panel (JA4, pin 40).	Pins 2 and 3 connected. Connects the MCU (P142, pin 57) to switch SW3 via R37.	R37, R111
J13	All pins are open. Disconnects the MCU (SEG32/P14, pin 58) from the LCD panel and switch SW2.	Pins 1 and 2 connected. Connects the MCU (SEG32, pin 58) to the LCD panel (JA4, pin 39).	Pins 2 and 3 connected. Connects the MCU (P14, pin 58) to switch SW2 via R35.	R35, R69

Table 6-12: LCD Panel Jumpers

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.

Note that JA4 has been omitted from this list as it is the LCD panel connector, and connections are described in §5.6

Table 7-1 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	NC	NC	6	AVSS	-
7	AVREFP	50 (via R9)	8	NC	NC
9	ANI16	2 (via R79)	10	ANI17	1 (via R105)
11	ANI18	59 (via R67)	12	ANI19	58 (via R69)
13	NC	NC	14	NC	NC
15	IO0	28 (via R95)	16	IO1	29 (via R97)
17	IO2	30 (via R99)	18	IO3	31 (via R101)
19	IO4	32 (via R103)	20	IO5	33 (via R89)
21	IO6	53 (via R119)	22	IO7	52 (via R121)
23	INTP7	4 (via R81)	24	NC	NC
25	JA1_SDAA0	18 (via R93)	26	JA1_SCLA0	17 (via R91)

Table 7-1: Application Header JA1 Connections

Table 7-2 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	RESETn	6	2	CON_X2	10 (via R3)
3	NC	NC	4	GROUND	-
5	NC	NC	6	TxD0	60 (via J11/R65)
7	SW1	9	8	RxD0	61 (via J10/R64)
9	INTP3	26 (via R77)	10	SCK00n	62 (via R63)
11	NC	NC	12	NC	NC
13	NC	NC	14	NC	NC
15	NC	NC	16	NC	NC
17	NC	NC	18	NC	NC
19	TO00	63 (via R107)	20	TO06	36 (via R83)
21	TI00	64 (via R109)	22	TI07	34 (via R87)
23	INTP4	27 (via R85)	24	NC	NC
25	NC	NC	26	NC	NC

Table 7-2: Application Header JA2 Connections

Table 7-3 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	ANI20	57 (via R111)	2	ANI21	56 (via R113)
3	ANI22	55 (via R115)	4	ANI23	54 (via R117)
5	NC	NC	6	NC	NC
7	NC	NC	8	NC	NC
9	NC	NC	10	NC	NC
11	NC	NC	12	NC	NC
13	NC	NC	14	NC	NC
15	NC	NC	16	NC	NC
17	NC	NC	18	NC	NC
19	NC	NC	20	NC	NC
21	NC	NC	22	NC	NC
23	NC	NC	24	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	Circuit Net Name	MCU Pin	Pin	Circuit Net Name	MCU Pin
1	NC	NC	2	NC	NC
3	NC	NC	4	NC	NC
5	RS232TX	60*	6	RS232RX	61*
7	NC	NC	8	NC	NC
9	SO01	38 (via R75)	10	NC	NC
11	SCK01n	40 (via R71)	12	SI01	39 (via R73)
13	NC	NC	14	NC	NC
15	NC	NC	16	NC	NC
17	NC	NC	18	NC	NC
19	NC	NC	20	NC	NC
21	NC	NC	22	NC	NC
23	Unregulated_VCC	-	24	GROUND	-

Table 7-4: Application Header JA6 Connections

* Multiple option links connect this pin to the MCU, see §6.4 for details.

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	SEG25_ANI17	1	2	SEG24_ANI16	2
3	SEG23_LED1	3	4	SEG22_INTP7	4
5	TOOL0	5	6	RESETn	6
7	CON_XT2	7*	8	CON_XT1	8*
9	SW1	9	10	CON_X2	10*
11	CON_X1	11*	12	NC	NC
13	GROUND	-	14	GROUND	-
15	UC_VDD	-	16	UC_EVDD	-
17	NC	NC	18	NC	NC
19	NC	NC	20	NC	NC
21	NC	NC	22	NC	NC
23	NC	NC	24	NC	NC
25	NC	NC	26	NC	NC
27	NC	NC	28	NC	NC
29	NC	NC	30	NC	NC
31	NC	NC	32	NC	NC
33	NC	NC	34	NC	NC
35	NC	NC	36	NC	NC

Table 7-5: Microcontroller Pin Header J1 Connections

* Connection made through option link

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	SEG21_SCLA0	17	2	SEG20_SDAA0	18
3	CAPH	19	4	CAPL	20
5	VL1	21	6	VL2	22
7	VL4	23	8	VL3	24
9	SEG19_LED0	25	10	SEG18_INTP3	26
11	SEG17_INTP4	27	12	SEG16_DLCDD4_IO0	28
13	SEG15_DLCDD5_IO1	29	14	SEG14_DLCDD6_IO2	30
15	SEG13_DLCDD7_IO3	31	16	SEG12_IO4	32
17	NC	NC	18	NC	NC
19	NC	NC	20	NC	NC
21	NC	NC	22	NC	NC
23	NC	NC	24	NC	NC
25	NC	NC	26	NC	NC
27	NC	NC	28	NC	NC
29	NC	NC	30	NC	NC
31	NC	NC	32	NC	NC
33	NC	NC	34	NC	NC
35	NC	NC	36	NC	NC

Table 7-6: Microcontroller Pin Header J2 Connections

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	SEG11_IO5	33	2	SEG10_TI07	34
3	SEG9_LED3	35	4	SEG8_LED2_TO06	36
5	SEG7_DLCDRS	37	6	SEG6_SO01	38
7	SEG5_SIO1	39	8	SEG4_SCK01n	40
9	SEG3	41	10	SEG2	42
11	SEG1	43	12	SEG0	44
13	COM3	45	14	COM2	46
15	COM1	47	16	COM0	48
17	NC	NC	18	NC	NC
19	NC	NC	20	NC	NC
21	NC	NC	22	NC	NC
23	NC	NC	24	NC	NC
25	NC	NC	26	NC	NC
27	NC	NC	28	NC	NC
29	NC	NC	30	NC	NC
31	NC	NC	32	NC	NC
33	NC	NC	34	NC	NC
35	NC	NC	36	NC	NC

Table 7-7: Microcontroller Pin Header J3 Connections

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	AVREFM	49	2	ADPOT_AVREFP	50
3	DLCDE	51	4	SEG38_IO7	52
5	SEG37_IO6	53	6	SEG36_ANI23	54
7	SEG35_ANI22	55	8	SEG34_ANI21	56
9	SEG33_ANI20_SW3	57	10	SEG32_ANI19_SW2	58
11	SEG31_ANI18	59	12	SEG30_TxD0	60
13	SEG29_RxD0	61	14	SEG28_SCK00n	62
15	SEG27_TO00	63	16	SEG26_TI00	64
17	NC	NC	18	NC	NC
19	NC	NC	20	NC	NC
21	NC	NC	22	NC	NC
23	NC	NC	24	NC	NC
25	NC	NC	26	NC	NC
27	NC	NC	28	NC	NC
29	NC	NC	30	NC	NC
31	NC	NC	32	NC	NC
33	NC	NC	34	NC	NC
35	NC	NC	36	NC	NC

Table 7-8: Microcontroller Pin Header J4 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 (R20UT1994EJ).

8.2 Compiler Restrictions

The compiler supplied with this RSK will build a maximum of 64k code and data. To use the compiler with programs greater than this size you need to purchase a compiler license from your Renesas supplier.

8.3 Mode Support

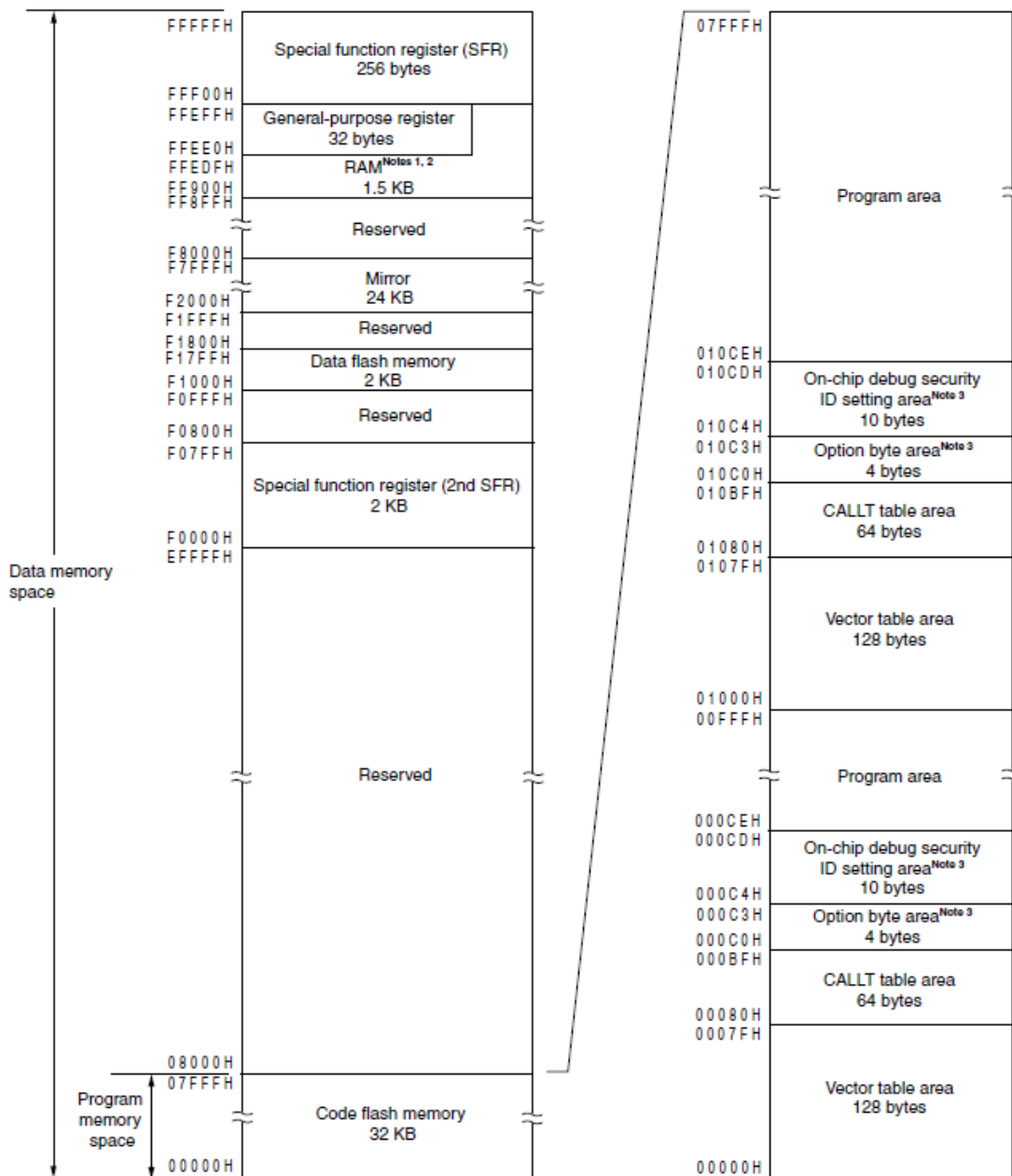
The RL78/L12 microcontroller only supports single-chip operating mode.

8.4 Debugging Support

The E1 emulator (as supplied with this RSK) supports hardware break points, software break points and basic trace functionality. For further details, refer to the E1/E20 Emulator User's Manual (R20UT0398EJ).

8.5 Address Space

Figure 8-1 below details the address space of the MCU. The MCU fitted to the RSK has 32KB of ROM. For further details, refer to the RL78/L12 Group Hardware Manual.



- Notes 1.** Use of the area FF900H to FFC89H is prohibited when using the self-programming function and data flash function, because this area is used for self-programming library.
- 2.** Instructions can be executed from the RAM area excluding the general-purpose register area.
- 3.** Set the option bytes to 000C0H to 000C3H, and the on-chip debug security IDs to 000C4H to 000CDH.

Caution When executing instructions from the RAM area while RAM parity error resets are enabled (RPERDIS = 1), be sure to initialize the used RAM area + 10 bytes.

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.

For information about the RL78/L12 series microcontrollers refer to the RL78/L12 Group Hardware Manual.

For information about the RL78 assembly language, refer to the RL78 Series 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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