To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

Send any inquiries to http://www.renesas.com/inquiry.

RENESAS

RENESAS

Renesas Starter Kit for R32C/118

User's Manual

RENESAS SINGLE-CHIP MICROCOMPUTER
R32C/100 Series

Renesas Electronics
www.renesas.com

Rev.1.00   2009.02

Disclaimer

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

Precautions

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 is 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.

Table of Contents

Chapter 1. Preface

Cautions

This document may be, wholly or partially, subject to change without notice.

Trademarks

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

Copyright

Website: http://www.renesas.com/

Glossary

ADC	Analog to Digital Converter	DAC	Digital to Analog Converter
E8A	"E8A " emulator	HEW	High-Performance Embedded Workshop
I/O	Input / Output	LCD	Liquid Crystal Display
LED	Light Emitting Diode	MCU	Microcontroller Unit
RSK	Renesas Starter Kit	UART	Universal Asynchronous Receiver / Transmitter
USB	Universal Serial Bus		

Chapter 2. Purpose

This RSK is an evaluation tool for Renesas microcontrollers.

Features include:

- Renesas Microcontroller Programming.

- User Code Debugging.

- User Circuitry such as switches, LEDs and potentiometer(s).

- Sample Application.

- Sample peripheral device initialisation code.

The RSK board contains all the circuitry required for microcontroller operation.

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.

Chapter 3. Power Supply

3.1. Requirements

This RSK board operates from a 5V DC power supply.

A diode provides reverse polarity protection only if a current limiting power supply is used.

All RSK boards are supplied with an E8A debugger. This product is able to power the RSK board with up to 300mA. When the RSK is connected to another system then that system should supply power to the RSK.

All RSK boards have an optional centre positive supply connector using a 2.0mm barrel power jack.

Warning

The RSK board is neither under nor over voltage protected. Use a centre positive supply for this board.

3.2. Power–up Behaviour

When the RSK is purchased the RSK board has the 'Release' or stand-alone code from the example tutorial code pre-programmed into the Renesas microcontroller. On powering up the board the user LEDs will start to flash. After 200 flashes or after pressing any switch the LEDs will flash at a rate controlled by the potentiometer.

Chapter 4. Board Layout

4.1. Component Layout

The following diagram shows the top layer component layout of the board.
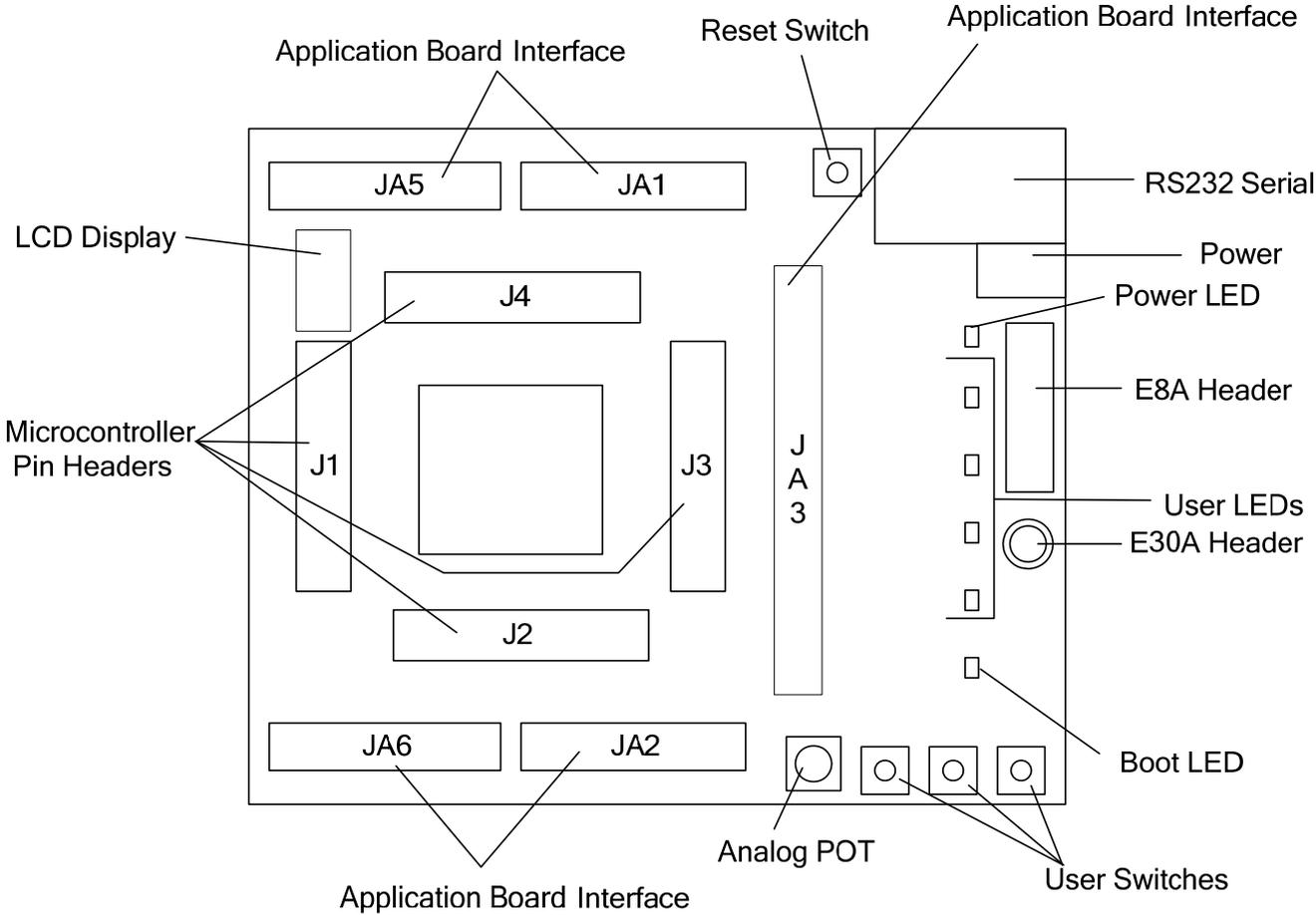
Figure 4-1: Board Layout

4.2. Board Dimensions

The following diagram gives the board dimensions and connector positions. All through-hole connectors are on a common 0.1" grid for easy interfacing.
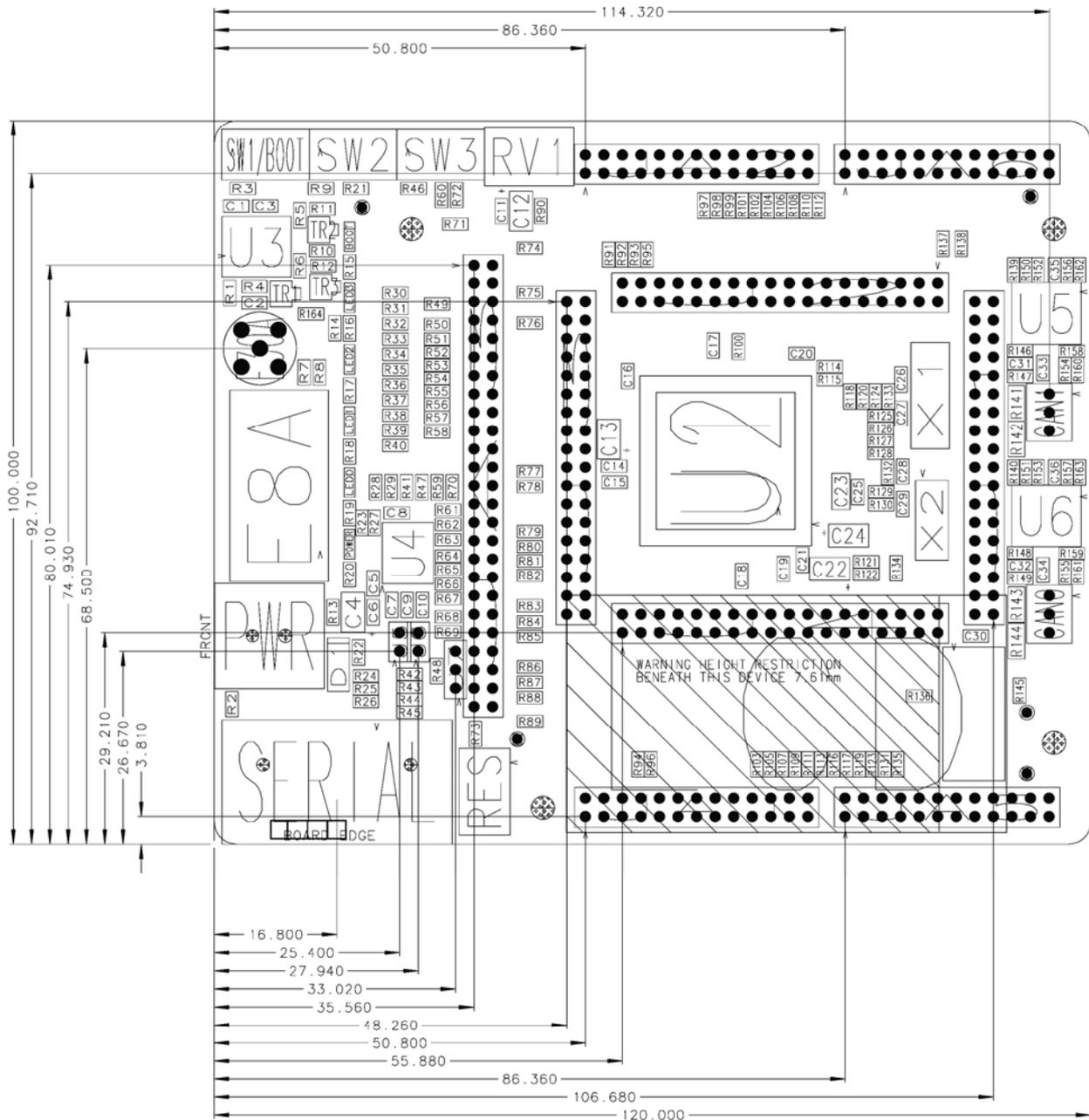
Figure 4-2 : Board Dimensions

4.3.Dual Footprint
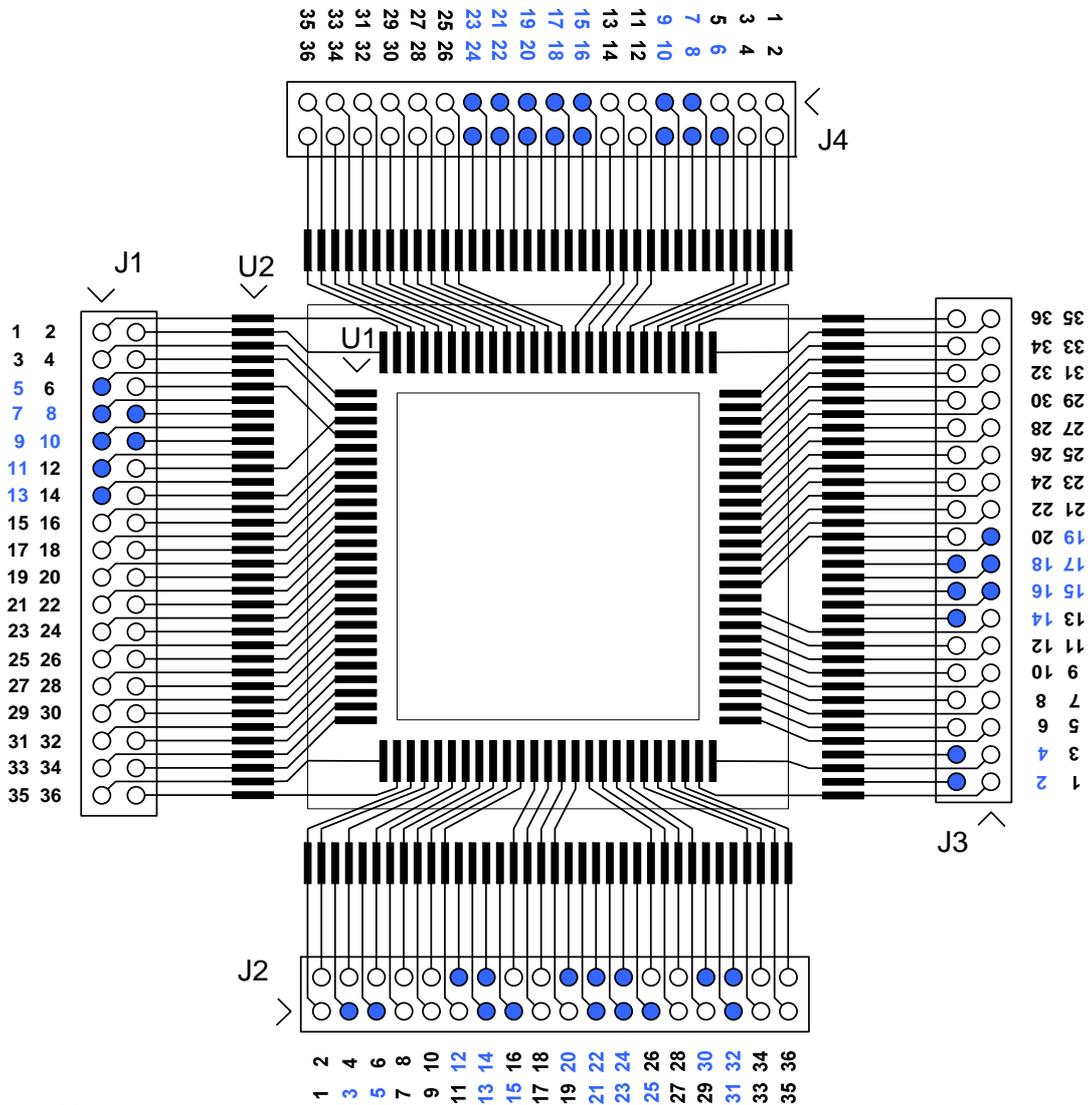
Note:

Pins marked in blue color not available for use on 100 pin package

Figure 4-3 : Dual Footprint Connection
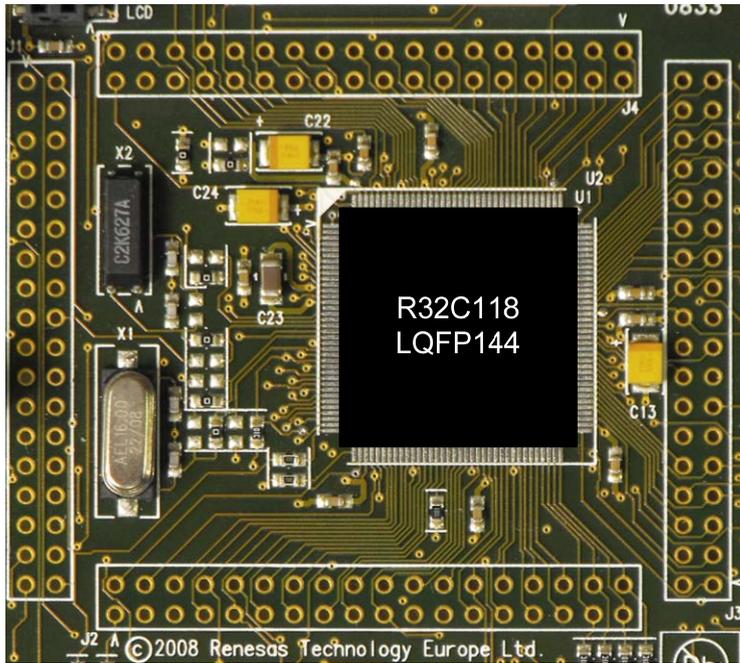
Figure 4-4 : R32C118 (LQFP144) fitted on board
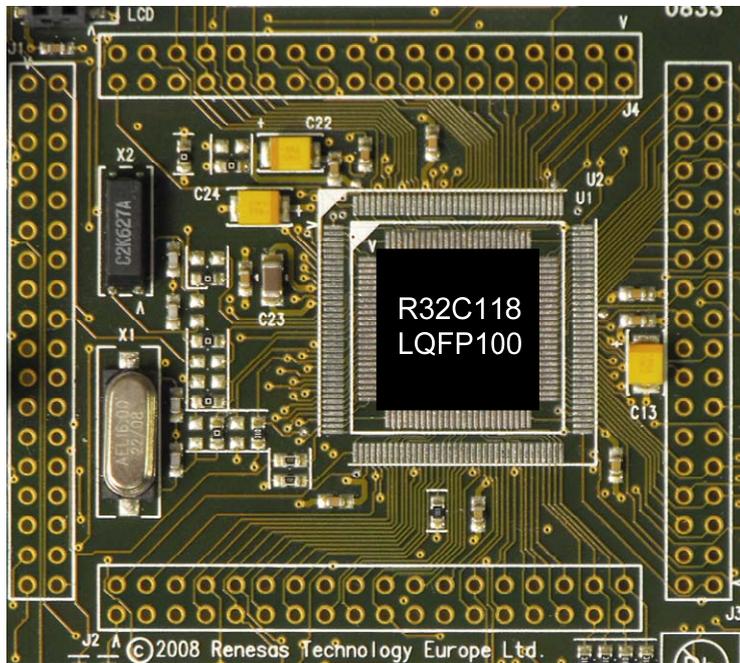
Figure 4-5 : R32C118 (LQFP100) fitted on board

Chapter 5. Block Diagram

Figure 5-1 shows the RSK board components and their connectivity.
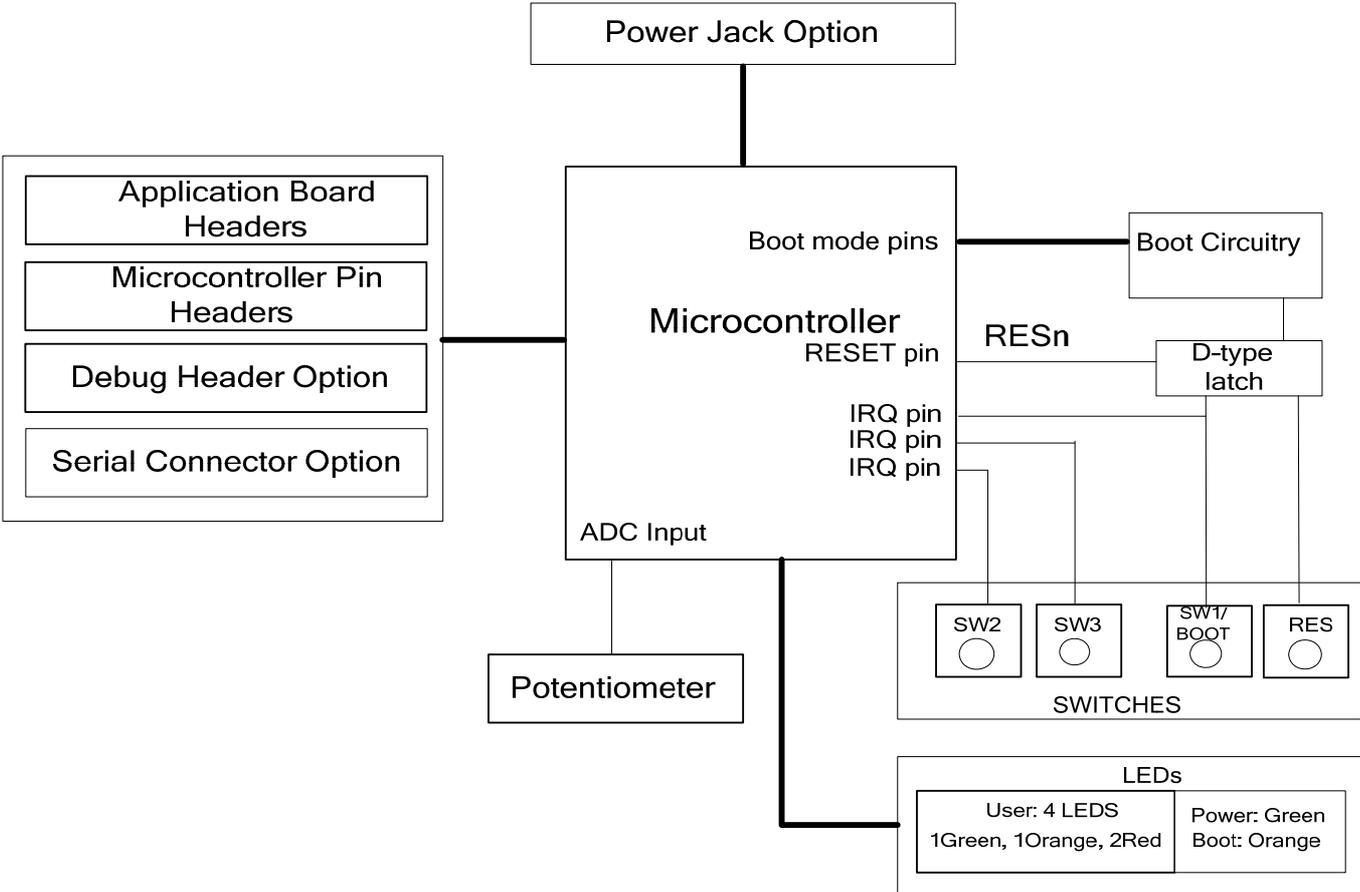
Figure 5-1: Block Diagram

Figure 5-2 shows the E8A connections to the RSK.
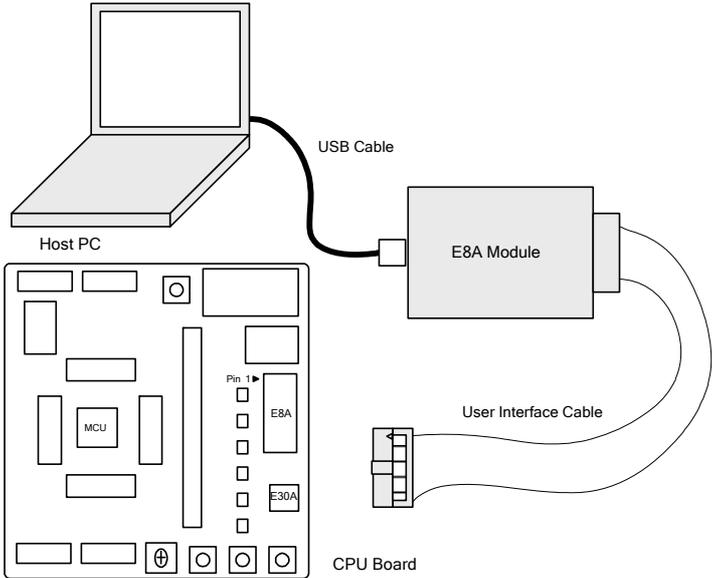
Figure 5-2: E8A RSK Connections

Chapter 6. User Circuitry

6.1. Switches

There are four switches located on the RSK board. The function of each switch and its connection are shown in Table 6-1: Switch Functions

Switch	Function	Microcontroller
RES	When pressed, the microcontroller is reset.	**RESn**, Pin 19
SW1 / BOOT*	Connects to an IRQ input for user controls.	**INT0n**, Pin 27 (Port 8, bit 2)
SW2*	Connects to an IRQ line for user controls.	**INT1n**, Pin 26 (Port 8, bit 3)
SW3*	Connects to an IRQ line for user controls. The same switch may also function as an ADC trigger input.	**INT2n**, Pin 25 (Port 8, bit 4)

Table 6-1: Switch Functions

*Refer to the schematic for detailed connectivity information.

6.2. LEDs

There are six LEDs on the RSK board. The green 'POWER' LED lights when the board is powered. The orange BOOT LED indicates the device is in BOOT mode when lit. The four user LEDs are connected to an I/O port and will light when their corresponding port pin is set low. Table 6-2 below shows the LED pin references and their corresponding microcontroller port pin connections.

LED Reference (As shown on silkscreen)	Colour	Microcontroller Port Pin function	Microcontroller Pin Number
LED0	Green	Port 4 bit 0	78
LED1	Orange	Port 4 bit 1	77
LED2	Red	Port 4 bit 2	75
LED3	Red	Port 4 bit 3	73

Table 6-2: LED Port

6.3. Potentiometer

A single-turn potentiometer is connected to pin AN0 (p10_0, pin 141) of the microcontroller. This may be used to vary the voltage at this pin between AVCC and Ground.

Note:

The potentiometer is fitted to offer an easy way of supplying a variable analogue input to the controller. It does not necessarily reflect the accuracy of the controllers ADC. Please see the device manual for details.

6.4. Serial port

Serial port UART0 is connected to the standard RS232 header. Serial port UART1 can optionally be connected to the RS232. The connections to be fitted are listed in the Table 6-3.

Description	Function	Microcontroller Port Pin	Fit for RS232	Remove for RS232
UART0	Default serial port (TX)	Port 6_3	R47	R70, R59
UART0	Default serial port (RX)	Port 6_2	R41	R28, R29
UART1	Spare Serial Port (TX)	Port 6_7	R59	R47, R70
UART1	Spare Serial Port (RX)	Port 6_6	R28	R29, R41

Table 6-3: Serial Options Links

The board is designed to accept a straight-through RS-232 male-to-female cable.

The second transceiver channels are connected to a 0.1" header, J7.   UART2 can be connected to this channel by fitting 0Ω link resistors to R63 and R64.

6.5. Debug LCD Module

The LCD module supplied with the RSK can be connected to the connector 'LCD' for use with the tutorial code. Any module that conforms to the pin connections and has a KS0066u-compatible controller can be used. The LCD module uses a 4-bit interface to reduce the pin allocation. No contrast control is provided; this must be set on the display module.

Table 6-4 shows the pin allocation and signal names used on this connector.

The module supplied with the RSK board only supports 5V operation.

LCD					
Pin	Circuit Net Name	Device Pin	Pin	Circuit Net Name	Device Pin
1	Ground	-	2	5V Only	-
3	No Connection	-	4	DLCDRS (p2_0)	101
5	R/W (Wired to Write only)	-	6	DLCDE (p2_1)	100
7	No Connection	-	8	No Connection	-
9	No Connection	-	10	No Connection	-
11	DLCDD4 (p2_4)	97	12	DLCDD5 (p2_5)	96
13	DLCDD6 (p2_6)	95	14	DLCDD7 (p2_7)	94

Table 6-4: Debug LCD Module Connections

6.6. Option Links

In this section the default configuration is indicated by BOLD text.

Table 6-5 below describes the function of the option links associated with serial port configuration.

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R23	Serial Port Configuration	Disables the RS-232 Transceiver. (Must be removed if R27 is fitted.)	Enables the RS-232 Transceiver	R27
R27	Serial Port Configuration	Enables the RS-232 Transceiver. (Must be removed if R23 is fitted.)	Disables the RS-232 Transceiver	R23
R28	Serial Port Configuration	Connects the programming port (Rx) to external serial connectors	Disconnects the programming port (Rx) to external serial connectors	R29, R30, R41
R29	Serial Port Configuration	Routes the RS-232 serial port (Rx) to application board interface (JA6-6)	Disconnects the RS-232 serial port (Rx) from application board interface (JA6-6)	R28, R41
R41	Serial Port Configuration	Connects serial port RXD0 to CH1 of RS-232 transceiver	Disconnects serial port RXD0 to CH1 of RS-232 transceiver	R28, R29
R47	Serial Port Configuration	Connects serial port TXD0 to CH1 of RS-232 transceiver	Disconnects serial port TXD0 to CH1 of RS-232 transceiver	R59, R70
R59	Serial Port Configuration	Connects the serial programming port (Tx) to external connectors (not E8A)	Disconnects the serial programming port (Tx) to external serial connectors	R36, R47, R70
R63	Serial Port Configuration	Connects UART2 (Tx) to the RS-232 transceiver	Disconnects UART2 (Tx) from the RS-232 transceiver	R69
R64	Serial Port Configuration	Connects UART2 (Rx) to the RS-232 transceiver	Disconnects UART2 (Rx) from the RS-232 transceiver	R73
R69	Serial Port Configuration	Connects UART2 (Rx) to the D-type connector	Disconnects UART2 (Rx) from the D-type connector	R64
R70	Serial Port Configuration	Routes RS232 serial port (Tx) to application connector (JA6-5).	Disconnects RS232 serial port (Tx) from application board interface (JA6-5)	R47, R59
R73	Serial Port Configuration	Connects UART2 (Tx) to the D-type connector	Disconnects UART2 (Tx) from the D-type connector	R63

Table 6-5: Serial port configuration links

Table 6-6 below describes the function of the option links associated with E8A configuration.

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R30	E8A Configuration	Connects the serial programming port (Rx) to the E8A connector	Disconnects the serial programming port (Rx) from the E8A connector	R28
R36	E8A Configuration	Connects the serial programming port (Tx) to the E8A connector	Disconnects the serial programming port (Tx) from the E8A connector	R59
R40	E8A Configuration	Connects the serial programming port (CK) to the E8A connector	Disconnects the serial programming port (CK) from the E8A connector	-
R33	E8A Configuration	Connects the CPU port pin p5_0 to the E8A connector	Disconnects the CPU port pin p5_0 from the E8A connector	-

Table 6-6: E8A Configuration Links

Table 6-7 below describes the function of the option links associated with Power Source configuration.

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R13	Power Source	Board can be powered from the PWR connector.	Disconnects the supply from the PWR connector.	R22, R44
R22	Power source	Connects Board_VCC2 to PWR supply.	Disconnects Board_VCC2 from PWR supply.	R13, R25, R26
R24	Microcontroller Power Supply	Supply power to the Microcontroller pin VCC2.	Disables 5V power supply to the MCU pin VCC2. Supply current to the sections powered from VCC2 pin of the MCU can be measured across J5	-
R25	Power source	Connect Board_VCC2 to CON_3V3.	Disconnect Board_VCC2 from CON_3V3.	R22, R26
R26	Power source	Connect Board_VCC2 to CON_5V.	Disconnect Board_VCC2 from CON_5V.	R22, R25
R42	Power source	Connect Board_VCC1 to CON_3V3.	Disconnect Board_VCC1 from CON_3V3.	R43, R44
R43	Power source	Connect Board_VCC1 to CON_5V.	Disconnect Board_VCC1 from CON_5V.	R42, R44
R44	Power source	Connect Board_VCC1 to PWR supply.	Disconnect Board_VCC1 from PWR supply.	R13, R22, R42, R43
R48	Microcontroller Power Supply	Supply power to the Microcontroller pin VCC1.	Disables 5V power supply to the MCU pin VCC1 Supply current to the sections powered from VCC1 pin of the MCU can be measured across J6	-

Table 6-7: Power configuration links

Table 6-8 below describes the function of the option links associated with Analog Voltage Source configuration.

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R89	Analog Voltage Source	Links the analog ground to the digital ground.	Isolates the analog ground from the digital ground.	-
R90	Analog Voltage Source	Connects AVCC to CON_AVCC on JA1.	Disconnects AVCC from CON_AVCC.	R134
R121	Voltage Reference Source	Connects VREF to Board_VCC1.	Disconnects VREF from Board_VCC1.	R122
R122	Voltage Reference Source	Connects VREF to CON_VREF on JA1.	Disconnects VREF from CON_VREF.	R121
R134	Analog Voltage Source	Connects AVCC to Board_VCC1.	Disconnects AVCC from Board_VCC1.	R90

Table 6-8: Analog configuration links

Table 6-9 below describes the function of the option links associated with application board interface.

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R49	Application Board Interface	Connects MCU port pin p2_4 (pin 97) to DLCDD4 on Debug LCD Header	Disconnects MCU port pin p2_4 (pin 97) from DLCDD4 on Debug LCD Header	R75, R50, R76
R50	Application Board Interface	Connects MCU port pin p2_6 (pin 95) to DLCDD6 on Debug LCD Header	Disconnects MCU port pin p2_6 (pin 95) from DLCDD6 on Debug LCD Header	R75, R49, R76
R51	Application Board Interface	Connects MCU port pin p3_0 (pin 92) to IO0 at JA1-15	Disconnects MCU port pin p3_0 (pin 92) from IO0	-
R52	Application Board Interface	Connects MCU port pin p3_1 (pin 85) to IO1 at JA1-16	Disconnects MCU port pin p3_1 (pin 85) from IO1	-
R53	Application Board Interface	Connects MCU port pin p3_2 (pin 84) to IO2 at JA1-17	Disconnects MCU port pin p3_2 (pin 84) from IO2	-
R54	Application Board Interface	Connects MCU port pin p3_3 (pin 83) to IO3 at JA1-18	Disconnects MCU port pin p3_3 (pin 83) from IO3	-
R55	Application Board Interface	Connects MCU port pin p3_4 (pin 82) to IO4 at JA1-19	Disconnects MCU port pin p3_4 (pin 82) from IO4	-
R56	Application Board Interface	Connects MCU port pin p3_5 (pin 81) to IO5 at JA1-20	Disconnects MCU port pin p3_5 (pin 81) from IO5	-
R57	Application Board Interface	Connects MCU port pin p3_6 (pin 80) to IO6 at JA1-21	Disconnects MCU port pin p3_6 (pin 80) from IO6	-
R58	Application Board Interface	Connects MCU port pin p3_7 (pin 79) to IO7 at JA1-22	Disconnects MCU port pin p3_7 (pin 79) from IO7	-
R65	Application Board Interface	Connects MCU port pin p1_5 (pin 104) to D13 at JA3-34	Disconnects MCU port pin p1_5 (pin 104) from D13	R66
R66	Application Board Interface	Connects MCU port pin p1_5 (pin 104) to INT3n at JA1-23	Disconnects MCU port pin p1_5 (pin 104) from INT3n	R65
R67	Application Board Interface	Connects MCU port pin p4_0 (pin 78) to LED0.	Disconnects MCU port pin p4_0 (pin 78) from LED0.	-
R68	Application Board Interface	Connects MCU port pin p4_2 (pin 75) to LED2.	Disconnects MCU port pin p4_2 (pin 75) from LED2.	-
R71	Application Board Interface	Connects MCU port pin p2_0 (pin 101) to DLCDRS on Debug LCD Header	Disconnects MCU port pin p2_0 (pin 101) from DLCDRS on Debug LCD Header	-
R74	Application Board Interface	Connects MCU port pin p2_1 (pin 100) to DLCDE on Debug LCD Header	Disconnects MCU port pin p2_1 (pin 100) from DLCDE on Debug LCD Header	-

R75	Application Board Interface	Connects MCU port pin p2_5 (pin 96) to DLCDD5 on Debug LCD Header	Disconnects MCU port pin p2_5 (pin 96) from DLCDD5 on Debug LCD Header	-
R76	Application Board Interface	Connects MCU port pin p2_7 (pin 94) to DLCDD7 on Debug LCD Header	Disconnects MCU port pin p2_7 (pin 94) from DLCDD7 on Debug LCD Header	-
R77	Application Board Interface	Connects MCU port pin p5_0 (pin 65) to WRn at JA3-26	Disconnects MCU port pin p5_0 (pin 65) from WRn	R78
R78	Application Board Interface	Connects MCU port pin p5_0 (pin 65) to WRLn at JA3-48	Disconnects MCU port pin p5_0 (pin 65) from WRLn	R77
R79	Application Board Interface	Connects MCU port pin p1_7 (pin 102) to CAN1_ERR	Disconnects MCU port pin p1_7 (pin 102) from CAN1_ERR	R80
R80	Application Board Interface	Connects MCU port pin p1_7 (pin 102) to D15 at JA3-36	Disconnects MCU port pin p1_7 (pin 102) from D15	R79
R81	Application Board Interface	Connects MCU port pin p1_6 (pin 103) to CAN0_ERR	Disconnects MCU port pin p1_6 (pin 103) from CAN0_ERR	R82
R82	Application Board Interface	Connects MCU port pin p1_6 (pin 103) to D14 at JA3-35	Disconnects MCU port pin p1_6 (pin 103) from D14	R81
R83	Application Board Interface	Connects MCU port pin p4_1 (pin 77) to LED1.	Disconnects MCU port pin p4_1 (pin 77) from LED1.	-
R84	Application Board Interface	Connects MCU port pin p4_3 (pin 73) to LED3.	Disconnects MCU port pin p4_3 (pin 73) from LED3.	-
R85	Application Board Interface	Connects MCU port pin p4_5 (pin 71) to A21 at JA3-42	Disconnects MCU port pin p4_5 (pin 71) from A21	R86
R86	Application Board Interface	Connects MCU port pin p4_5 (pin 71) to CS2n at JA3-45	Disconnects MCU port pin p4_5 (pin 71) from CS2n	R85
R87	Application Board Interface	Connects MCU port pin p4_6 (pin 70) to A22 at JA3-43	Disconnects MCU port pin p4_6 (pin 70) from A22	R88
R88	Application Board Interface	Connects MCU port pin p4_6 (pin 70) to CS1n at JA3-28	Disconnects MCU port pin p4_6 (pin 70) from CS1n	R87
R94	Application Board Interface	Connects MCU port pin p10_0 (pin 141) to Analog pot	Disconnects MCU port pin p10_0 (pin 141) from Analog pot	R96
R96	Application Board Interface	Connects MCU port pin p10_0 (pin 141) to AN0 at JA1-9	Disconnects MCU port pin p10_0 (pin 141) from AN0	R94
R97	Application Board Interface	Connects MCU port pin p7_2 (pin 26) to CLK2 at JA6-10	Disconnects MCU port pin p7_2 (pin 26) from CLK2	R98
R98	Application Board Interface	Connects MCU port pin p7_2 (pin 35) to Vp at JA2-15	Disconnects MCU port pin p7_2 (pin 35) from Vp	R97

R99	Application Board Interface	Connects MCU port pin p7_4 (pin 33) to Wp at JA2-17	Disconnects MCU port pin p7_4 (pin 33) from Wp	R101
R101	Application Board Interface	Connects MCU port pin p7_4 (pin 33) to TA2OUT at JA2-19	Disconnects MCU port pin p7_4 (pin 33) from TA2OUT	R99
R102	Application Board Interface	Connects MCU port pin p7_5 (pin 32) to Wn at JA2-18	Disconnects MCU port pin p7_5 (pin 32) from Wn	R104
R103	Application Board Interface	Connects MCU port pin p7_0 (pin 37) to TxD2 at JA6-8 via a 22R resistor	Disconnects MCU port pin p7_0 (pin 37) from TxD2	R105
R104	Application Board Interface	Connects MCU port pin p7_5 (pin 32) to TA2IN at JA2-21	Disconnects MCU port pin p7_5 (pin 32) from TA2IN	R102
R105	Application Board Interface	Connects MCU port pin p7_0 (pin 37) to IIC_SDA at JA1-25 via a 22R resistor	Disconnects MCU port pin p7_0 (pin 37) from IIC_SDA	R103
R106	Application Board Interface	Connects MCU port pin p8_0 (pin 29) to Up at JA2-13	Disconnects MCU port pin p8_0 (pin 29) from Up	R108
R107	Application Board Interface	Connects MCU port pin p7_1 (pin 36) to RxD2 at JA6-7 via a 22R resistor	Disconnects MCU port pin p7_1 (pin 36) from RxD2	R109
R108	Application Board Interface	Connects MCU port pin p8_0 (pin 29) to TA4OUT at JA2-20	Disconnects MCU port pin p8_0 (pin 29) from TA4OUT	R106
R109	Application Board Interface	Connects MCU port pin p7_1 (pin 36) to IIC_SCL at JA1-26 via a 22R resistor	Disconnects MCU port pin p7_1 (pin 36) from IIC_SCL	R107
R110	Application Board Interface	Connects MCU port pin p8_1 (pin 28) to Un at JA2-14	Disconnects MCU port pin p8_1 (pin 28) from Un	R112
R111	Application Board Interface	Connects MCU port pin p10_4 (pin 136) to CAN0_EN	Disconnects MCU port pin p10_4 (pin 136) from CAN0_EN	R113
R112	Application Board Interface	Connects MCU port pin p8_1 (pin 28) to TA4IN at JA2-22	Disconnects MCU port pin p8_1 (pin 28) from TA4IN	R110
R113	Application Board Interface	Connects MCU port pin p10_4 (pin 136) to AN4 at JA5-1	Disconnects MCU port pin p10_4 (pin 136) from AN0	R111
R116	Application Board Interface	Connects MCU port pin p10_5 (pin 135) to AN5 at JA5-2	Disconnects MCU port pin p10_5 (pin 135) from AN5	R117
R117	Application Board Interface	Connects MCU port pin p10_5 (pin 135) to CAN0_STBn	Disconnects MCU port pin p10_5 (pin 135) from CAN0_STBn	R116
R119	Application Board Interface	Connects MCU port pin p10_6 (pin 134) to AN6 at JA5-3	Disconnects MCU port pin p10_6 (pin 134) from AN6	R123
R123	Application Board Interface	Connects MCU port pin p10_6 (pin 134) to CAN1_EN	Disconnects MCU port pin p10_6 (pin 134) from CAN1_EN	R119
R131	Application Board Interface	Connects MCU port pin p10_7 (pin 133) to AN7 at JA5-4	Disconnects MCU port pin p10_7 (pin 133) from AN7	R135

R135	Application Board Interface	Connects MCU port pin p10_7 (pin 133) to CAN1_STBn	Disconnects MCU port pin p10_7 (pin 133) from CAN1_STBn	R131

Table 6-9: Application Board Interface configuration links

Table 6-10 below describes the function of the option links associated with Clock configuration.

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R120	Main clock	Connects the external clock to the MCU.	On-board clock (X1) can be connected	R124
R124	Main clock	Connects the on-board clock (X1) to the MCU.	External Clock Source can be connected.	R120
R125	Main clock	Connects the on-board clock (X1) from the MCU.	External Clock Source can be connected.	R126
R126	Main clock	Connects the external clock from the MCU.	On-board clock (X1) can be connected	R125
R127	Sub-clock	Connects the external clock from the MCU.	On-board sub-clock (X2) can be connected	R128
R128	Sub-clock	Connects the on-board clock from the MCU.	External Clock Source can be connected.	R127
R129	Sub-clock	Connects the on-board clock to the MCU.	External Clock Source can be connected.	R130
R130	Sub-clock	Connects the external clock to the MCU.	On-board sub-clock (X2) can be connected	R129
R132	Sub-clock	Parallel resistor for X2	Not fitted.	-
R133	Main clock	Parallel resistor for X1	Not fitted.	-

Table 6-10: Clock configuration links

6.7. Oscillator Sources

A crystal oscillator is fitted on the RSK board and used to supply the main clock input to the Renesas microcontroller. The oscillators that are fitted and alternative footprints provided on this RSK board are detailed in Table 6-11

Component		
Crystal (X1)	Fitted	16.0MHz (HC49/4H package)
Crystal (X2)	Fitted	32.768 KHz (90SMX package)

Table 6-11: Oscillators / Resonators

Warning: When replacing the default oscillator with that of another frequency, the debugging monitor may not function until the debugger settings are modified to suit the debugger.

6.8. Reset Circuit

The RSK board includes a simple latch circuit that links the mode selection and reset circuit. This provides an easy method for swapping the device between Boot Mode and User mode. This circuit is not required on customers' boards as it is intended for providing easy evaluation of the operating modes of the device on the RSK. Please refer to the hardware manual for more information on the requirements of the reset circuit.

The reset circuit operates by latching the state of the boot switch (SW1) on pressing the reset button. This control is subsequently used to modify a port pin state to select which code is executed.

The reset is held in the active state for a fixed period by a resistor / capacitor network. Please check the reset requirements carefully to ensure the reset circuit on the user's board meets all the reset timing requirements.

Chapter 7. Modes

The MCU can be configured in User mode and Boot mode. User mode may be used to run and debug user code, while Boot mode may only be used to program the MCU with program code via the serial interface. Further details of programming the flash are available in the R32C/118 device hardware manual.

The RSK board provides the capability of changing between User and Boot / User Boot modes using a simple latch circuit. This is only to provide a simple mode control on this board when the E8A debugger is not in use.

To manually enter boot mode, press and hold the SW1/BOOT. The mode pins are held in their boot states while reset is pressed and released. Release the boot button. The BOOT LED will be illuminated to indicate that the microcontroller is in boot mode.

More information on the operating modes can be found in the device hardware manual.

7.1. Boot mode

The boot mode settings for this RSK board are shown in Table 7-1 below:

CNVSS	CEn	EPMn	LSI State after Reset End
1	1	0	Boot Mode

Table 7-1: Boot Mode pin settings

7.2. User Mode

The R32C/118 supports single-chip and microprocessor modes. The default user mode for the RSKR32C118 is Single-chip.

CNVSS	CEn	EPMn	LSI State after Reset End
0	0	1	Single-chip Mode
1	0	1	Microprocessor Mode

Table 7-2: User Mode pin settings

Chapter 8. Programming Methods

The board is intended for use with HEW and the supplied E8A debugger only. Please refer to R32C/118 Group Hardware Manual for details of the programming methods using the on-chip serial port and without using E8A debugger.

Chapter 9. Headers

9.1. Microcontroller Ring Headers

The microcontroller pin headers and their corresponding microcontroller connections are detailed in Table 9-1 to Table 9-4.

Pin	Circuit Net Name	Device pin	Pin	Circuit Net Name	Device pin
1	CAN1_OUT	1	2	CAN1_IN	2
3	DA1	3	4	DA0	4
5	P9_2	5	6	P9_1	6
7	P9_0	7	8	P14_6	8
9	P14_5	9	10	P14_4	10
11	P14_3	11	12	NC	-
13	P14_1	13	14	NC	-
15	NC	-	16	E8_CNVSS	16
17	CON_XCIN	17 (via R130)	18	CON_XCOUT	18 (via R127)
19	RESn	19	20	CON_XOUT	20 (via R126)
21	GROUND	21	22	CON_XIN	22 (via R120)
23	UC_VCC1	23	24	NMIn	24
25	INT2n	25	26	INT1n	26
27	INT0n	27	28	TA4IN_Un	28
29	TA4OUT_Up	29	30	CAN0_IN	30
31	CAN0_OUT	31	32	TA2IN_Wn	32
33	TA2OUT_Wp	33	34	Vn	34
35	CLK2_Vp	35	36	IICSCL_RxD2	36 (via R115)

Table 9-1: J1 microcontroller header

Pin	Circuit Net Name	Device pin	Pin	Circuit Net Name	Device pin
1	IIC_SDA_TxD2	37 (via R114)	2	PTTX	38
3	UC_VCC1	-	4	PTRX	40
5	GROUND	-	6	PTCK	42
7	E8_BUSY	43	8	TxD0	44
9	RxD0	45	10	CLK0	46
11	CTSRTS	47	12	P13_7	48
13	P13_6	49	14	P13_5	50
15	P13_4	51	16	RDYn	52
17	ALE	53	18	E8_EPM	54
19	UD	55	20	P13_3	56
21	GROUND	-	22	P13_2	58
23	UC_VCC1	-	24	P13_1	60
25	P13_0	61	26	TRSTn	62
27	RDn	63	28	WRHn	64
29	WRLn_WRn	65	30	P12_7	66
31	P12_6	67	32	P12_5	68
33	A23_CS0n	69	34	A22_CS1n	70
35	A21_CS2n	71	36	A20_CS3n	72

Table 9-2: J2 microcontroller header

Pin	Circuit Net Name	Device pin	Pin	Circuit Net Name	Device pin
1	A19_LED3	73	2	UC_VCC1	-
3	A18_LED2	75	4	GROUND	-
5	A17_LED1	77	6	A16_LED0	78
7	A15_IO7	79	8	A14_IO6	80
9	A13_IO5	81	10	A12_IO4	82
11	A11_IO3	83	12	A10_IO2	84
13	A9_IO1	85	14	P12_4	86
15	P12_3	87	16	P12_2	88
17	P12_1	89	18	P12_0	90
19	UC_VCC2	UC_VCC1	20	A8_IO0	92
21	GROUND	-	22	A7_DLCDD7	94
23	A6_DLCDD6	95	30	A5_DLCDD5	96
25	A4_DLCDD4	97	31	A3	98
27	A2	99	32	A1_DLCDE	100
29	A0_DLCDRS	101	33	D15_CAN1_ERR	102
31	D14_CAN0_ERR	103	34	D13_INT3n	104
33	D12	105	35	D11	106
35	D10	107	36	D9	108

Table 9-3: J3 microcontroller header

Pin	Circuit Net Name	Device pin	Pin	Circuit Net Name	Device pin
1	D8	109	2	D7	110
3	D6	111	4	D5	112
5	D4	113	6	P11_4	114
7	P11_3	115	8	P11_2	116
9	P11_1	117	10	P11_0	118
11	D3	119	12	D2	120
13	D1	121	14	D0	122
15	P15_7	123	16	P15_6	124
17	P15_5	125	18	P15_4	126
19	P15_3	127	20	P15_2	128
21	P15_1	129	22	GROUND	-
23	P15_0	131	24	UC_VCC1	-
25	AN7_CAN1_STBn	133	26	AN6_CAN1_EN	134
27	AN5_CAN0_STBn	135	28	AN4_CAN0_EN	136
29	AN3	137	30	AN2	138
31	AN1	139	32	AVSS	140
33	ADPOT_AN0	141	34	CON_VREF	142 (via R122)
35	CON_AVCC	143 (via R90)	36	ADTRGn	144

Table 9-4: J4 microcontroller header

9.2. Application Headers

Standard application header connections are detailed in Table 9-5 to Table 9-9.

Pin	Generic Header Name	RSK board Signal Name	Device Pin	Pin	Generic Header Name	RSK board Signal Name	Device pin
1	5V	CON_5V	-	2	0V(5V)	GROUND	-
3	3V3	CON_3V3	-	4	0V(3V3)	GROUND	-
5	AVcc	CON_AVCC	-	6	AVss	AVSS	94
7	AVref	CON_VREF	-	8	ADTRG	ADTRGn	98
9	AD0	AN0	141	10	AD1	AN1	139
11	AD2	AN2	138	12	AD3	AN3	137
13	DAC0	DA0	4	14	DAC1	DA1	3
15	IO_0	IO0	92	16	IO_1	IO1	85
17	IO_2	IO2	84	18	IO_3	IO3	83
19	IO_4	IO4	82	20	IO_5	IO5	81
21	IO_6	IO6	80	22	IO_7	IO7	79
23	IRQ3	INT3n	104	24	IIC_EX	NC	---
25	IIC_SDA	IIC_SDA	37 (via R114)	26	IIC_SCL	IIC_SCL	36 (via R115)

Table 9-5: JA1 Standard Generic Header

Pin	Generic Header Name	RSK board Signal Name	Device Pin	Pin	Generic Header Name	RSK board Signal Name	Device Pin
1	RESn	RESn	19	2	EXTAL	CON_XIN	13(via R120)
3	NMIn	NMIn	24	4	Vss1	GROUND	-
5	WDT_OVF	NC	---	6	SCIaTX	TxD0	44
7	IRQ0	INT0n	27	8	SCIaRX	RXD0	45
9	IRQ1	INT1n	26	10	SCIaCK	CLK0	46
11	UD	UD	55	12	CTSRTS	CTSRTS	47
13	Up	Up	29	14	Un	Un	28
15	Vp	Vp	35	16	Vn	Vn	34
17	Wp	Wp	33	18	Wn	Wn	32
19	TMR0	TA2OUT	33	20	TMR1	TA4OUT	29
21	TRIGa	TA2IN	32	22	TRIGb	TA4IN	28
23	IRQ2	INT2n	25	24	TRISTn	TRSTn	62
25	Reserved	NC	---	26	Reserved	NC	---

Table 9-6: JA2 Standard Generic Header

Pin	Generic Header Name	RSK board Signal Name	Device Pin	Pin	Generic Header Name	RSK board Signal Name	Device Pin
1	A0	A0_DLCDRS	101	2	A1	A1_DLCDE	100
3	A2	A2	99	4	A3	A3	98
5	A4	A4_DLCDD4	97	6	A5	A5_DLCDD5	96
7	A6	A6_DLCDD6	95	8	A7	A7_DLCDD7	94
9	A8	A8_IO0	92	10	A9	A9_IO1	85
11	A10	A10_IO2	84	12	A11	A11_IO3	83
13	A12	A12_IO4	82	14	A13	A13_IO5	81
15	A14	A14_IO6	80	16	A15	A15_IO7	79
17	D0	D0	122	18	D1	D1	121
19	D2	D2	120	20	D3	D3	119
21	D4	D4	113	22	D5	D5	112
23	D6	D6	111	24	D7	D7	110
25	RDn	RDn	63	26	WRn	WRn	65
27	CSan	A23_CS0n	69	28	CSbn	CS1n	70
29	D8	D8	109	30	D9	D9	108
31	D10	D10	107	32	D11	D11	106
33	D12	D12	105	34	D13	D13	104
35	D14	D14	103	36	D15	D15	102
37	A16	A16_LED0	78	38	A17	A17_LED1	77
39	A18	A18_LED2	75	40	A19	A19_LED3	73
41	A20	A20_CS3n	72	42	A21	A21	71
43	A22	A22	70	44	SDCLK	NC	---
45	CScn	CS2n	71	48	LWRn	WRLn	65
47	HWRn	WRHn	64	46	ALE	ALE	53
49	CASn	NC	---	50	RASn	NC	---

Table 9-7: JA3 Standard Generic Header

Pin	Generic Header Name	RSK board Signal Name	Device Pin	Pin	Generic Header Name	RSK board Signal Name	Device Pin
1	AD4	AN4	136	2	AD5	AN5	135
3	AD6	AN6	134	4	AD7	AN7	133
5	CAN1TX	CAN0_OUT	31	6	CAN1RX	CAN0_IN	30
7	CAN2TX	CAN1_OUT	1	8	CAN2TX	CAN1_IN	2
9	AD8	NC	---	10	AD9	NC	---
11	AD10	NC	---	12	AD11	NC	---
13	TIOC0A	NC	---	14	TIOC0B	NC	---
15	TIOC0C	NC	---	16	M2_TRISTn	NC	---
17	TCLKC	NC	---	18	TCLKD	NC	---
19	M2_Up	NC	---	20	M2_Un	NC	---
21	M2_Vp	NC	---	22	M2_Vn	NC	---
23	M2_Wp	NC	---	24	M2_Wn	NC	---

Table 9-8: JA5 Standard Generic Header

Pin	Generic Header Name	RSK board Signal Name	Device Pin	Pin	Generic Header Name	RSK board Signal Name	Device Pin
1	DREQ	NC	---	2	DACK	NC	---
3	TEND	NC	---	4	STBYn	NC	---
5	RS232TX	RS232TX	---	6	RS232RX	RS232RX	---
7	SCIbRX	RxD2	36	8	SCIbTX	TxD2	37
9	SCIcTX	NC	---	10	SCIbCK	CLK2	35
11	SCIcCK	NC	---	12	SCIcRX	NC	---
13	Reserved	NC	---	14	Reserved	NC	---
15	Reserved	NC	---	16	Reserved	NC	---
17	Reserved	NC	---	18	Reserved	NC	---
19	Reserved	NC	---	20	Reserved	NC	---
21	Reserved	NC	---	22	Reserved	NC	---
23	Reserved	NC	---	24	Reserved	NC	---

Table 9-9: JA6 Standard Generic Header

Chapter 10. Code Development

10.1. Overview

Note: For all code debugging using Renesas software tools, the RSK board must either be connected to a PC serial port via a serial cable or a PC USB port via an E8A.

Due to the continuous process of improvements undertaken by Renesas the user is recommended to review the information provided on the Renesas website at www.renesas.com to check for the latest updates to the Compiler and Debugger manuals.

10.2. 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 linker will limit the object size to a maximum of 64kB. To use the compiler with programs greater than this size you will need to purchase the full tools from your distributor.

Warning: 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.

10.3. Breakpoint Support

This RSK is supplied with an E8A emulator which supports breakpoints in ROM. For more details on breakpoints & E8A functions please refer to the '*E8A-USB Emulator User's Manual'.*

10.4. Memory Map

The memory map shown below gives the locations of each memory area.

Internal RAM

Capacity	XXXXXXXXh
48 Kbytes	0000C400h
63 Kbytes	00010000h

Internal ROM

Capacity	YYYYYYYYh
640 Kbytes	FFF60000h
768 Kbytes	FFF40000h
1 Mbyte	FFF00000h

Notes:
1. Additional two 4-Kbyte spaces (blocks A and B) for storing data are provided in the flash memory version.
2. This space can be used in memory expansion mode or microprocessor mode. Addresses from 02000000h to FDFFFFFFh are inaccessible.
3. This space is reserved in memory expansion mode. It can be external space in microprocessor mode.
4. This space can be used in single-chip mode or memory expansion mode. It can be external space in microprocessor mode.
5. The watchdog timer interrupt shares the vector table with the oscillation stop detection interrupt and low-voltage detection interrupt.
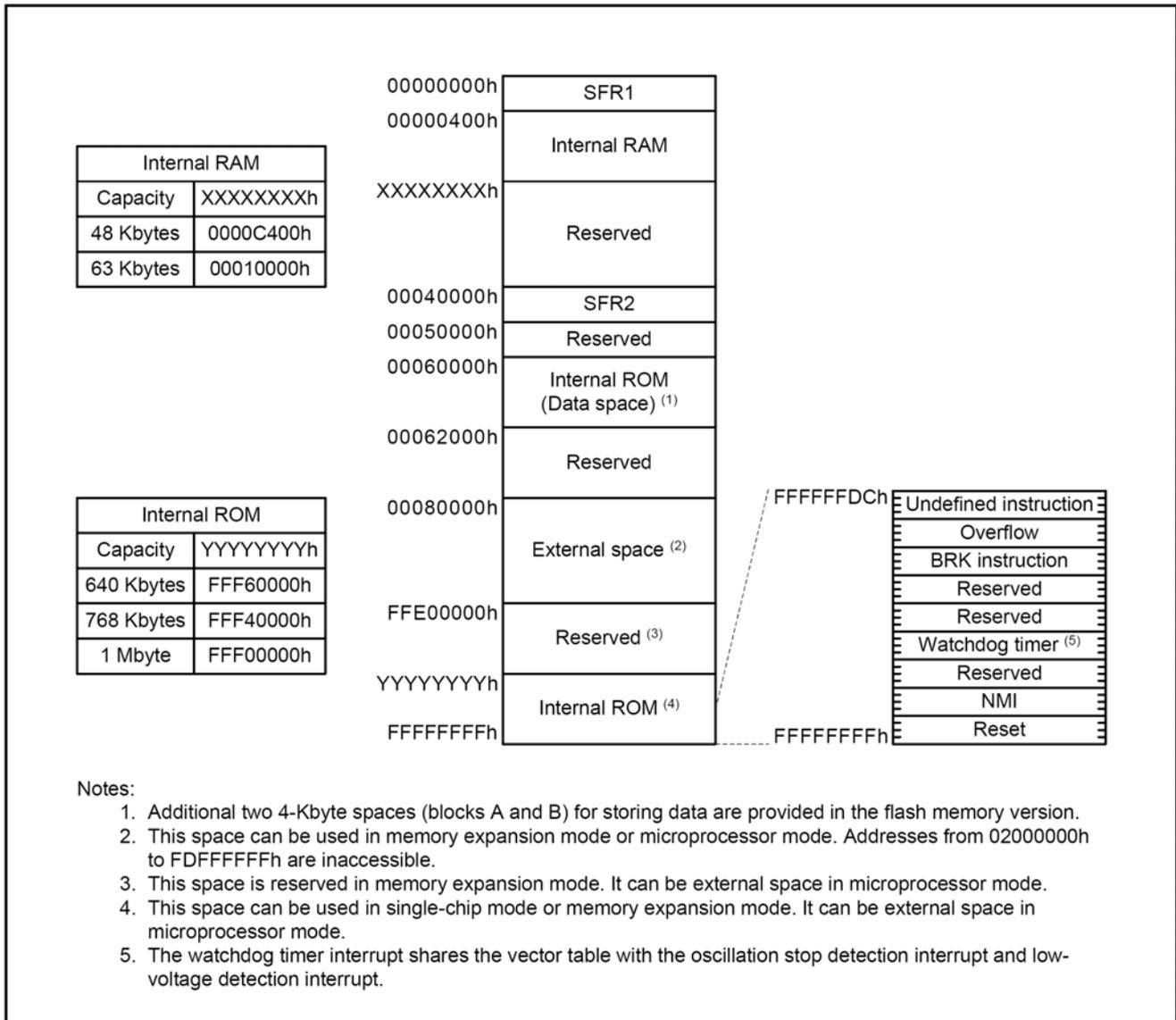
Figure 10-1: Memory Map

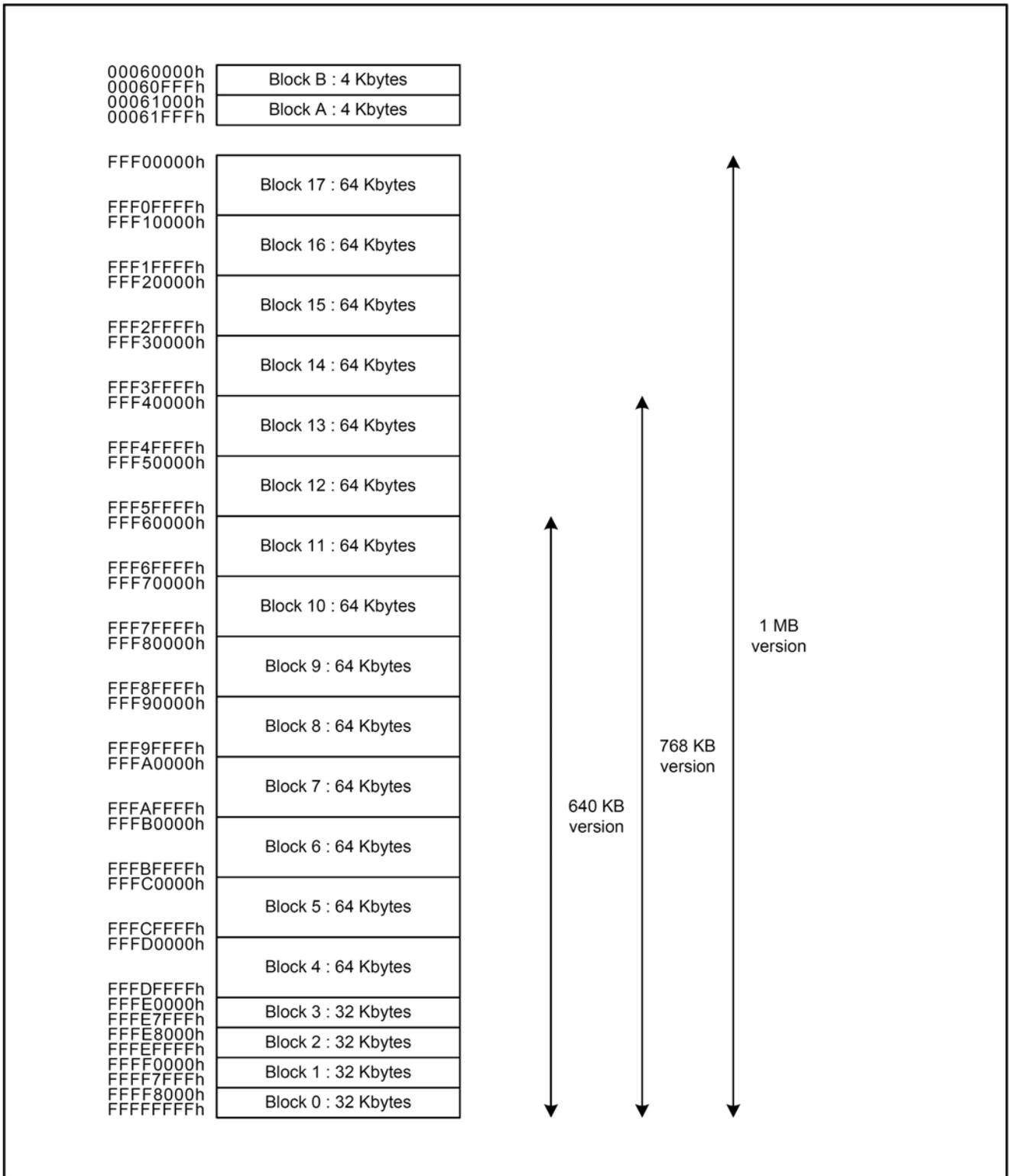For more details please refer to the R32C/118 Hardware manual.

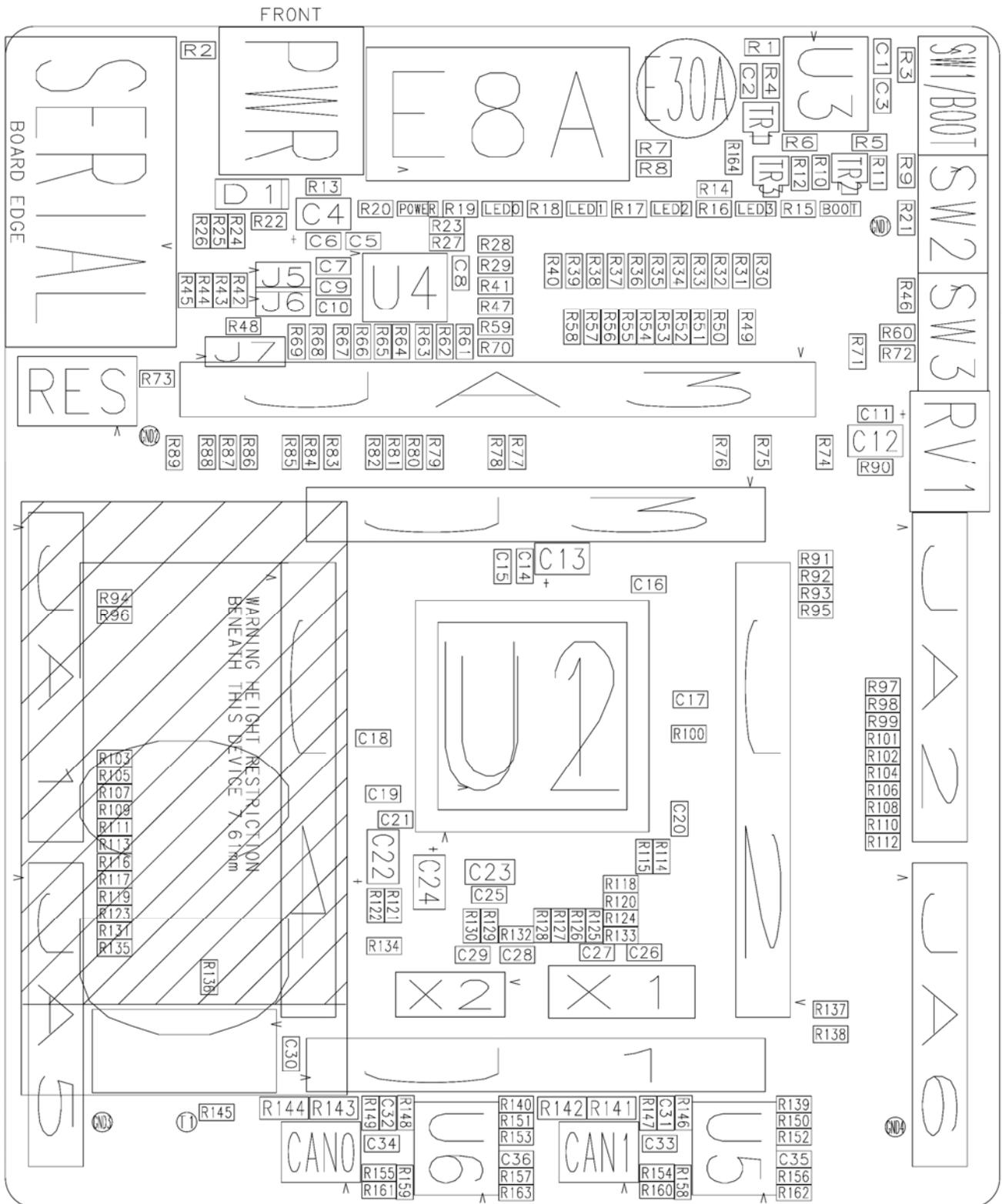Figure 10-2: Flash memory map

Chapter 11. Component Placement

Figure 11-1: Component Placement (Top Layer)

Chapter 12. Additional Information

For details on how to use High-performance Embedded Workshop (HEW), refer to the HEW manual available on the CD or installed in the Manual Navigator.

For information about the R32C/118 microcontrollers refer to the R32C/118 Group *Hardware Manual*

For information about the R32C/118 assembly language, refer to the R32C/100 *Software Manual*

For information about the E8A Emulator, please refer to the *E8A Emulator User's Manual*

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

Technical Contact Details

America: techsupport.rta@renesas.com

Europe: tools.support.eu@renesas.com

Japan: csc@renesas.com

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

Renesas Starter Kit for R32C/118
User's Manual