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Renesas Electronics Corporation

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User's Manual

Renesas Starter Kit for R8C/L3AC

User's Manual

Renesas Single-Chip Microcomputer
R8C Family

Renesas Electronics
www.renesas.com

Rev.1.00 2010.02

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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.

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Chapter 1. Preface

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Glossary

ADC	Analog to Digital Converter	CD	Compact Disc
CPU	Central Processing Unit	DAC	Digital to Analog Converter
E8a	E8a on-chip debugger module	EMC	Electromagnetic compatibility
ESD	Electrostatic Discharge	HEW	High-Performance Embedded Workshop
I/O	Input / Output	LCD	Liquid Crystal Display
LED	Light Emitting Diode	LIN	Local Interconnect Network
MCU	Microcontroller Unit	PC	Personal Computer
RAM	Random Access Memory	ROM	Read-Only Memory
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.

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.

Features include:

- Renesas Microcontroller Programming.
- User Code Debugging.
- User Circuitry such as switches, LEDs and potentiometer.
- Sample Application.
- Sample peripheral device initialisation code.

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

Note:

* The option links for the user LEDs are not fitted by default. To use LEDs fit R76, R78, R80, R82 and disconnect Renesas LCD Panel from JA4.

** The option link for DLCDE pin is not fitted by default. To use Debug LCD fit R92 and disconnect Renesas LCD Panel from JA4.

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.

This RSK board is 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, all the segments of Renesas LCD panel connected to JA4 will start to flash. After 200 flashes or after pressing any switch the LCD panel will show ADC value controlled by the potentiometer.

Chapter 4. Board Layout

4.1. Component Layout

The following diagram shows the top layer component layout of the board.

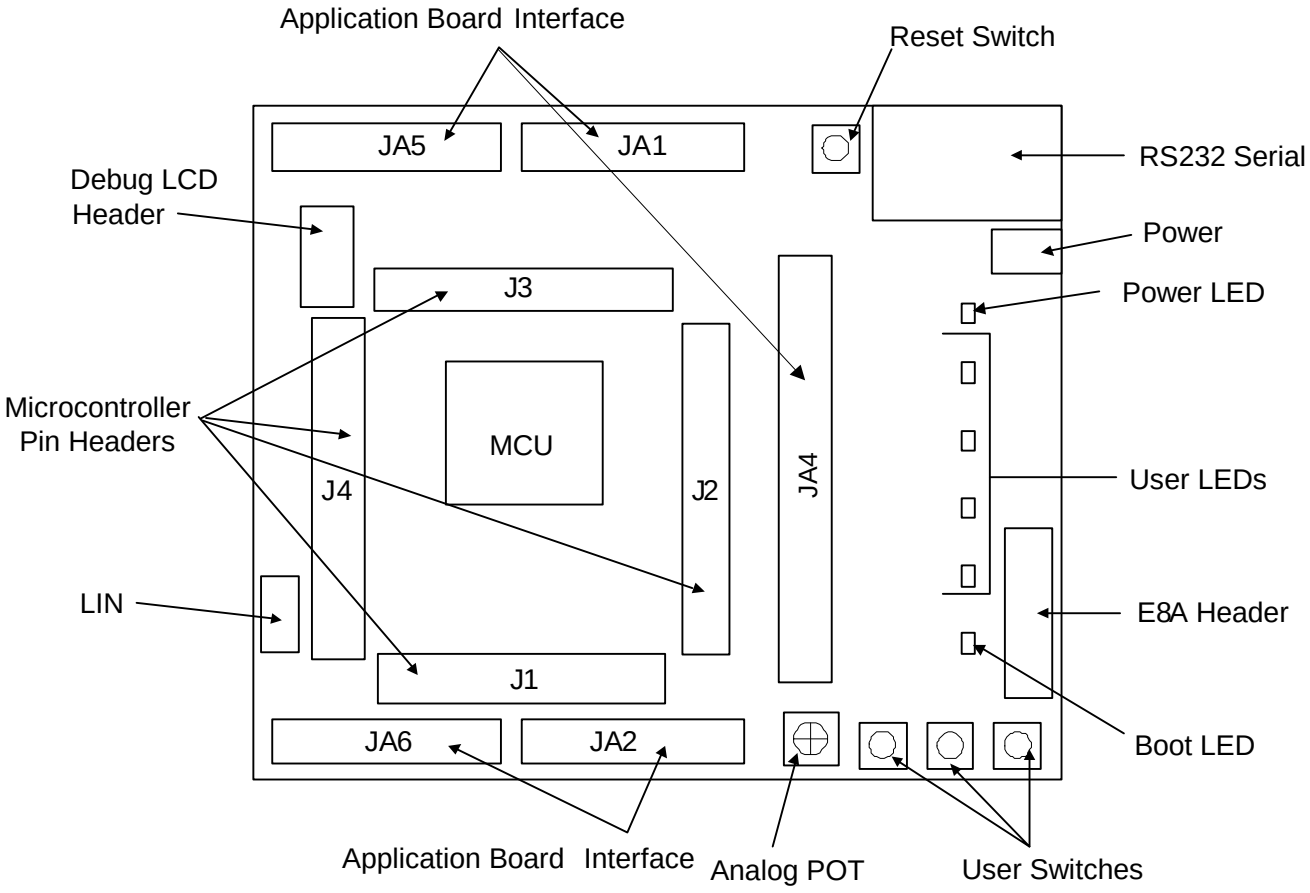


Figure 4-1: Board Layout

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.

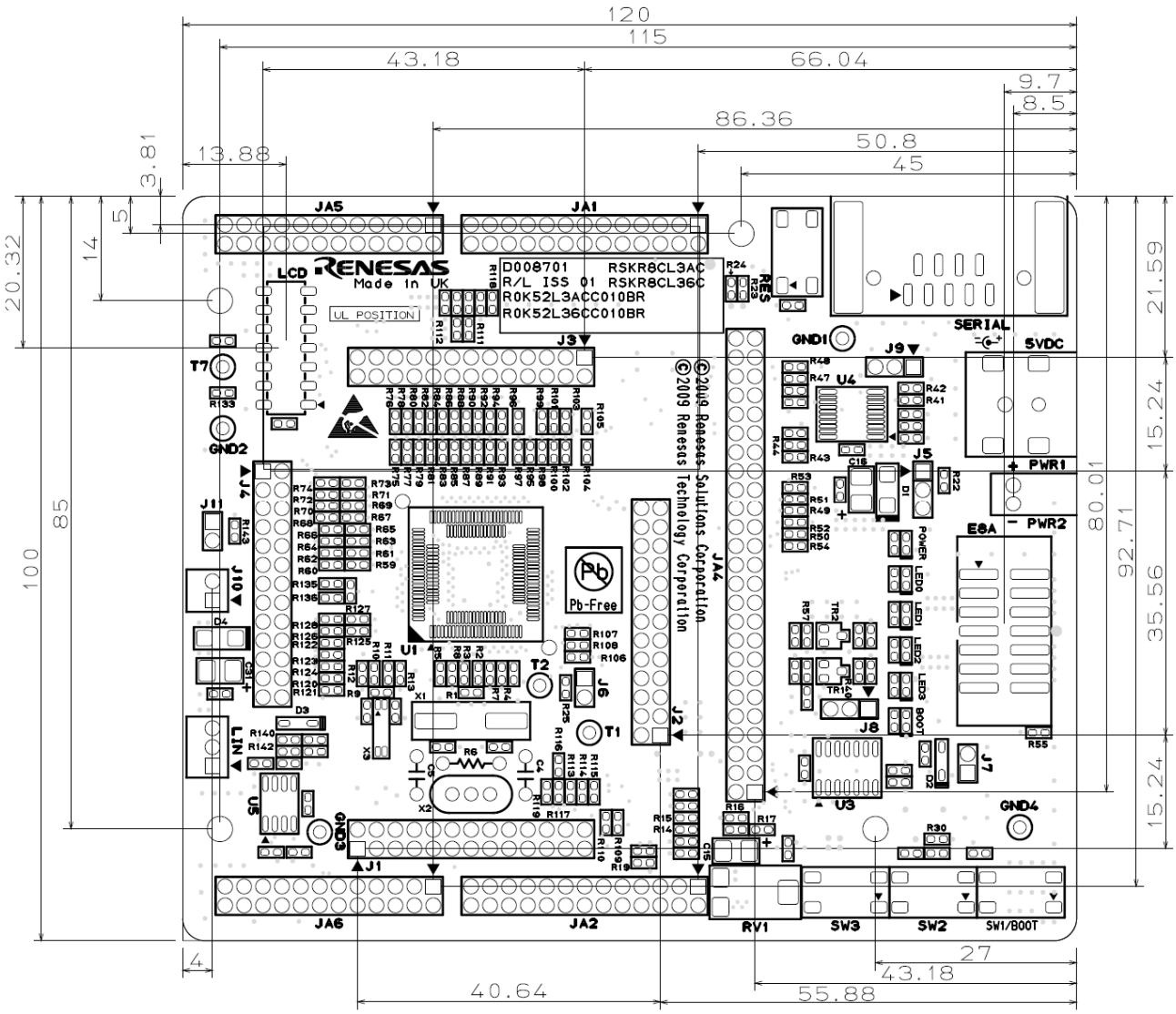


Figure 4-2: Board Dimensions

Chapter 5. Block Diagram

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

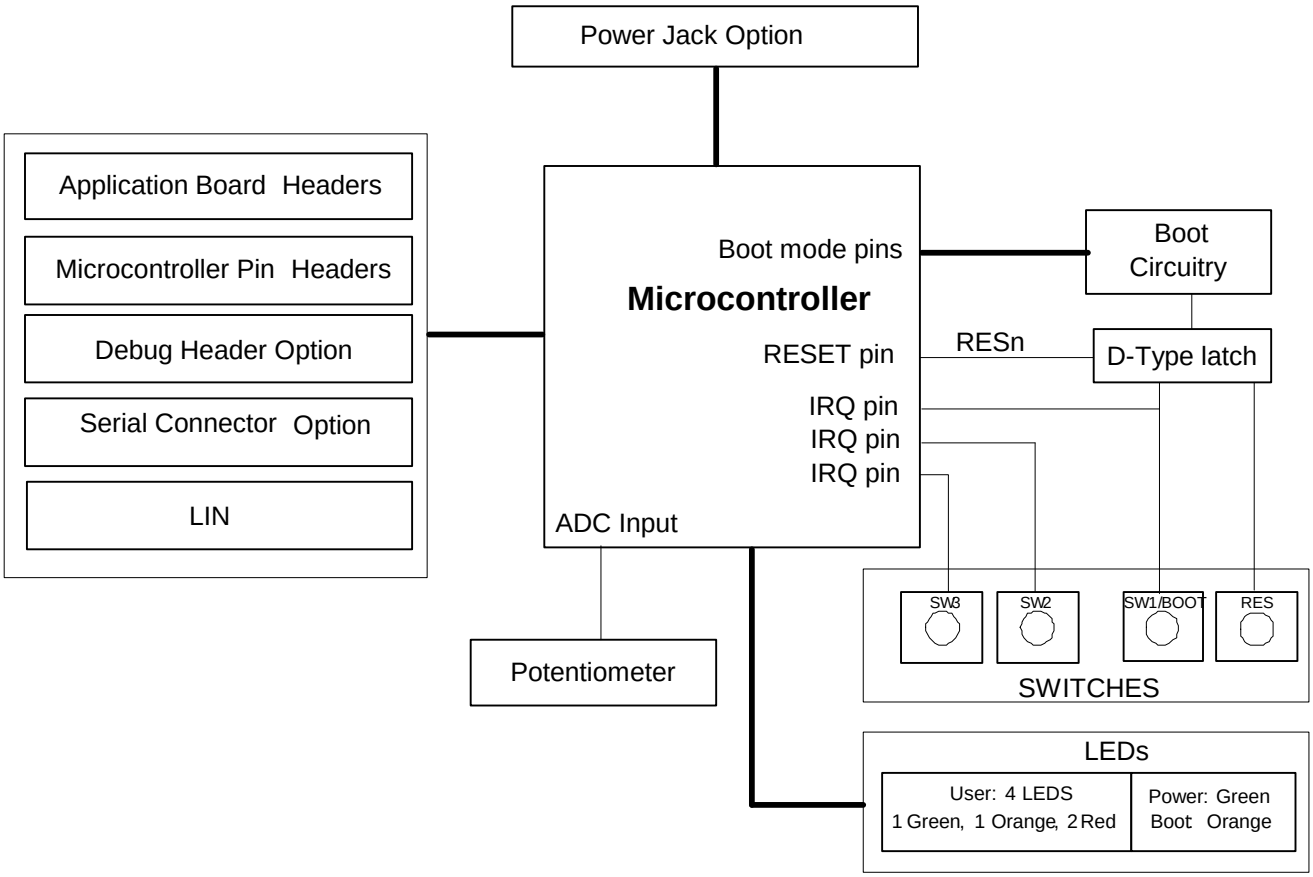


Figure 5-1: Block Diagram

Figure 5-2 shows E8a connections to the RSK.

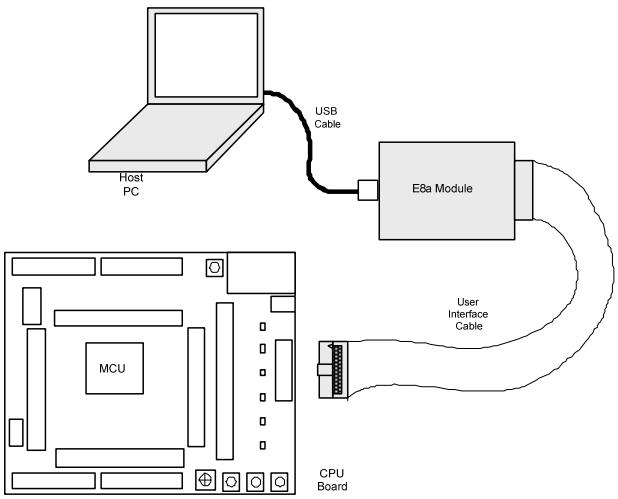


Figure 5-2: E8a RSK Connections

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	Function	Microcontroller
RES	When pressed, the microcontroller is reset.	RESETn, Pin 10
SW1 / BOOT*	Connects to an INT input for user controls. The switch is also used in conjunction with the RES switch to place the device in BOOT mode when not using the E8a debugger. The same MCU pin also function as Timer RA I/O.	INT4n, Pin 18 (Port 11, bit 4)
SW2*	Connects to an INT line for user controls.	INT5n, Pin 17 (Port 11, bit 5)
SW3*	Connects to an INT line for user controls. Connects to an ADTRG input for AD trigger controls	INT6n, Pin 16 (Port 11, bit 6)

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 2, bit 4	70
LED1*	Orange	Port 2, bit 5	69
LED2*	Red	Port 2, bit 6	68
LED3*	Red	Port 2, bit 7	67

Table 6-2: LED Port

Note:

* The option links for the user LEDs are not fitted by default. To use LEDs fit R76, R78, R80, R82 and disconnect Renesas LCD Panel from JA4.

6.3. Potentiometer

A single-turn potentiometer is connected to pin AN0 (Port 13 bit 0, pin 4) of the microcontroller. This may be used to vary the input analog voltage value to this pin between AVCC and Ground.

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

6.4. Serial port

Serial port UART2 is connected to the standard RS232 header. Serial port UART0 can optionally be connected to the RS232 transceiver by moving option resistors. The connections to be moved are listed in the Table 6-3.

Description	Function	Microcontroller Port Pin	Fit for RS232	Remove for RS232
UART2	Default serial port (TX)	20 (Port 11, bit 2)	R53	R49, R51
UART2	Default serial port (RX)	21 (Port 11, bit 1)	R54	R50, R52
UART0	Spare Serial Port (TX)	3 (Port 13, bit 1)	R51, R123	R49, R53, R122, R124
UART0	Spare Serial Port (RX)	2 (Port 13, bit 2)	R52, R125	R50, R54, R126
UART1	UART1 Serial Port (TX)	58 (Port 4, bit 0)	R47, R99	R98
UART1	UART1 Serial Port (RX)	57 (Port 4, bit 1)	R48, R101	R100

Table 6-3: Serial port settings

The serial channel UART0 can also be accessed at 'J1' and 'JA6'; UART1 can be accessed at 'J3' and 'JA6'; UART2 can be accessed at 'J1' and 'JA2'.

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

The UART0 port is shared with the LIN module. For more details please refer to the section 6.6.

6.5. Debug LCD Module

A debug LCD module is supplied to be connected to the connector LCD. This should be fitted so that the debug LCD module lies over 'J3'. Care should be taken to ensure the pins are inserted correctly into LCD. The debug LCD module uses a 4 bit interface to reduce the pin allocation. No contrast control is provided; this is set by a resistor on the supplied 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	-
3	No Connection	-	4	DLCDRS	61 (Port 3, bit 5)
5	R/W (Wired to write only using 10K pull down))	-	6	DLCDE * (+ 100k pull down to ground)	62 (Port 3, bit 4)
7	No Connection	-	8	No Connection	-
9	No Connection	-	10	No Connection	-
11	DLCDD4	66 (Port 3, bit 0)	12	DLCDD5	65 (Port 3, bit 1)
13	DLCDD6	64 (Port 3, bit 2)	14	DLCDD7	63 (Port 3, bit 3)

Table 6-4: Debug LCD Module Connections

Note:

* The option link for DLCDE is not fitted by default. To use Debug LCD fit R92 and disconnect Renesas LCD Panel from JA4.

6.6. LIN

The serial port UART0 also functions as LIN port pins. The options links to be configured are listed in the Table 6-5

Description	Function	Circuit Net Name	Device Pin	Fit for Hardware LIN	Remove for Hardware LIN
LIN	TXD	LINTXD	3	R124	R122, R123
LIN	RXD	LINRXD	2	R126	R125
LIN	NSLP	LINNSLP	1	R128	R127

Table 6-5: Hardware LIN Settings

When resistors R140 and R142 are fitted LIN device will be in master mode, when they are removed it will be Slave.

6.7. Option Links

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

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

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R41	Serial Port Configuration	Connects channel 2 (Tx pin) of the RS232 transceiver to pin 8 of the D-type serial port connector	Disconnects Channel 2 (TX pin) of the RS232 transceiver from the D-type serial port connector	R47
R42	Serial Port Configuration	Connects channel 2 (Rx pin) of the RS232 transceiver to pin 7 of the D-type serial port connector	Disconnects Channel 2 (RX pin) of the RS232 transceiver from the D-type serial port connector	R48
R43	Serial Port Configuration	Disables the RS-232 Transceiver.	Enables the RS-232 Transceiver	-
R99	Serial Port Configuration	Connects the TxD pin of serial port UART1 to pin 9 of the application header 'JA6'	Disconnects the TxD pin of serial port UART1 from the application header 'JA6'	R98
R101	Serial Port Configuration	Connects the RxD pin of serial port UART1 to pin 12 of the application header 'JA6'	Disconnects the RxD pin of serial port UART1 from the application header 'JA6'	R100
R49	Serial Port Configuration	Connects the RS232 serial port (Tx) to the application board interface (JA6-5).	Disconnects the RS232 serial port (Tx) from application board interface (JA6-5)	R51, R53
R50	Serial Port Configuration	Connects 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)	R52, R54
R53	Serial Port Configuration	Connects the TxD pin of serial port UART2 to the D-type connector via the RS232 transceiver	Disconnects the TxD pin of serial port UART2 from the D-type connector	R49, R51, R111, R112
R54	Serial Port Configuration	Connects the RxD pin of serial port UART2 to the D-type connector via the RS232 transceiver	Disconnects the RxD pin of serial port UART2 from the D-type connector	R50, R52, R109, R110
R51	Serial Port Configuration	Connects the TxD pin of serial port UART0 to the D-type connector via the RS232 transceiver	Disconnects the TxD pin of serial port UART0 from the D-type connector	R49, R53, R122, R123, R124

R52	Serial Port Configuration	Connects the RxD pin of serial port UART0 to the D-type connector via the RS232 transceiver	Disconnects the RxD pin of serial port UART0 from the D-type connector	R50, R54, R125, R126
R47	Serial Port Configuration	Connects the TxD pin of serial port UART1 to the D-type connector via the RS232 transceiver	Disconnects the TxD pin of serial port UART1 from the D-type connector	R98
R48	Serial Port Configuration	Connects the RxD pin of serial port UART1 to the D-type connector via the RS232 transceiver	Disconnects the RxD pin of serial port UART1 from the D-type connector	R100

Table 6-6: Serial port 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
R22	Power Source	Connects the voltage source from PWR1 to Board_VCC	Disconnects the Board_VCC from PWR1 connector	-
R23	Power Source	Connects the net CON_5V (JA1-1) to Board_VCC. External 5V supply can be connected at CON_5V. (R22 and R24 Must be removed if supplying 5V from CON_5V)	Disconnects CON_5V from Board_VCC	R24
R24	Power Source	Connects the net CON_3V3 (JA1-3) to Board_VCC. External 3.3V supply can be connected at CON_3V3. (R22 and R23 Must be removed if supplying 3.3V from CON_3V3)	Disconnects CON_3V3 from Board_VCC	R23
R25	Microcontroller Power Supply	Supply power to the Microcontroller VCC pin	Disables 5V power supply to the microcontroller VCC pins. Supply current to 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
R121	Analog Input	Connects on-board potentiometer ADPOT to the analog input pin AN0 of the MCU (Port pin P13_0)	Disconnects the ADPOT from analog input AN0	R120
R16	Analog Voltage Source	Connects UC_VCC to the potentiometer RV1 and MCU pin VREF	Disconnects UC_VCC from potentiometer RV1 and MCU pin VREF	R17
R17	Analog Reference Voltage	Connects MCU pin VREF to CON_VREF (JA1-7)	Disconnects MCU pin VREF from UC_VCC and CON_VREF	R16

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
R59	Application Board Interface	Connects MCU port pin P0_0 (pin 90) to SEG0 at JA4-11	Disconnects MCU port pin P0_0 (pin 90) from SEG0	R60
R60	Application Board Interface	Connects MCU port pin P0_0 (pin 90) to AN4 at JA1-9	Disconnects MCU port pin P0_0 (pin 90) from AN4	R59
R61	Application Board Interface	Connects MCU port pin P0_1 (pin 89) to SEG1 at JA4-12	Disconnects MCU port pin P0_1 (pin 89) from SEG1	R62
R62	Application Board Interface	Connects MCU port pin P0_1 (pin 89) to AN5 at JA1-10	Disconnects MCU port pin P0_1 (pin 89) from AN5	R61
R63	Application Board Interface	Connects MCU port pin P0_2 (pin 88) to SEG2 at JA4-13	Disconnects MCU port pin P0_2 (pin 88) from SEG2	R64
R64	Application Board Interface	Connects MCU port pin P0_2 (pin 88) to AN6 at JA1-11	Disconnects MCU port pin P0_2 (pin 88) from AN6	R63
R65	Application Board Interface	Connects MCU port pin P0_3 (pin 87)to SEG3 at JA4-14	Disconnects MCU port pin P0_3 (pin 87) from SEG3	R66
R66	Application Board Interface	Connects MCU port pin P0_3 (pin 87) to AN7 at JA1-12	Disconnects MCU port pin P0_3 (pin 87) from AN7	R65
R67	Application Board Interface	Connects MCU port pin P0_4 (pin 86)to SEG4 at JA4-15	Disconnects MCU port pin P0_4 (pin 86) from SEG4	R68
R68	Application Board Interface	Connects MCU port pin P0_4 (pin 86) to AN8 at JA5-1	Disconnects MCU port pin P0_4 (pin 86) from AN8	R67
R69	Application Board Interface	Connects MCU port pin P0_5 (pin 85) to SEG5 at JA4-16	Disconnects MCU port pin P0_5 (pin 85) from SEG5	R70
R70	Application Board Interface	Connects MCU port pin P0_5 (pin 85)to AN9 at JA5-2	Disconnects MCU port pin P0_5 (pin 85) from AN9	R69
R71	Application Board Interface	Connects MCU port pin P0_6 (pin 84) to SEG6 at JA4-17	Disconnects MCU port pin P0_6 (pin 84) from SEG6	R72
R72	Application Board Interface	Connects MCU port pin P0_6 (pin 84) to AN10 at JA5-3	Disconnects MCU port pin P0_6 (pin 84) from AN10	R71
R73	Application Board Interface	Connects MCU port pin P0_7 (pin 83) to SEG7at JA4-18	Disconnects MCU port pin P0_7 (pin 83) from SEG7	R74
R74	Application Board Interface	Connects MCU port pin P0_7 (pin 83) to AN11 at JA5-4	Disconnects MCU port pin P0_7 (pin 83) from AN11	R73
R75	Application Board Interface	Connects MCU port pin P2_4 (pin 70) to SEG20 at JA4-19	Disconnects MCU port pin P2_4 (pin 70) from SEG20	R76
R76	Application Board Interface	Connects MCU port pin P2_4 (pin 70) to LED0	Disconnects MCU port pin P2_4 (pin 70) from LED0	R75

R77	Application Board Interface	Connects MCU port pin P2_5 (pin 69) to SEG21 at JA4-20	Disconnects MCU port pin P2_5 (pin 69) from SEG21	R78
R78	Application Board Interface	Connects MCU port pin P2_5 (pin 69) to LED1	Disconnects MCU port pin P2_5 (pin 69) from LED1	R77
R79	Application Board Interface	Connects MCU port pin P2_6 (pin 68) to SEG22 at JA4-21	Disconnects MCU port pin P2_6 (pin 68) from SEG22	R80
R80	Application Board Interface	Connects MCU port pin P2_6 (pin 68) to LED2	Disconnects MCU port pin P2_6 (pin 68) from LED2	R79
R81	Application Board Interface	Connects MCU port pin P2_7 (pin 67) to SEG23 at JA4-22	Disconnects MCU port pin P2_7 (pin 67) from SEG23	R82
R82	Application Board Interface	Connects MCU port pin P2_7 (pin 67) to LED3	Disconnects MCU port pin P2_7 (pin 67) from LED3	R81
R83	Application Board Interface	Connects MCU port pin P3_0 (pin 66) to SEG24 at JA4-23	Disconnects MCU port pin P3_0 (pin 66) from SEG24	R84
R84	Application Board Interface	Connects MCU port pin P3_0 (pin 66) to DLCD4	Disconnects MCU port pin P3_0 (pin 66) from DLCD4	R83
R85	Application Board Interface	Connects MCU port pin P3_1 (pin 65) to SEG25 at JA4-24	Disconnects MCU port pin P3_1 (pin 65) from SEG25	R86
R86	Application Board Interface	Connects MCU port pin P3_1 (pin 65) to DLCD5	Disconnects MCU port pin P3_1 (pin 65) from DLCD5	R85
R87	Application Board Interface	Connects MCU port pin P3_2 (pin 64) to SEG26 at JA4-25	Disconnects MCU port pin P3_2 (pin 64) from SEG26	88
R88	Application Board Interface	Connects MCU port pin P3_2(pin 64) to DLCD6	Disconnects MCU port pin P3_2 (pin 64) from DLCD6	87
R89	Application Board Interface	Connects MCU port pin P3_3 (pin 63) to SEG27 at JA4-26	Disconnects MCU port pin P3_3 (pin 63) from SEG27	90
R90	Application Board Interface	Connects MCU port pin P3_3 (pin 63) to DLCD7	Disconnects MCU port pin P3_3 (pin 63) from DLCD7	89
R91	Application Board Interface	Connects MCU port pin P3_4 (pin 62) to SEG28 at JA4-27	Disconnects MCU port pin P3_4 (pin 62) from SEG28	R92
R92	Application Board Interface	Connects MCU port pin P3_4 (pin 62) to DLCDE	Disconnects MCU port pin P3_4 (pin 62) from DLCDE	R91
R93	Application Board Interface	Connects MCU port pin P3_5 (pin 61) to SEG29 at JA4-28	Disconnects MCU port pin P3_5 (pin 61) from SEG29	R94
R94	Application Board Interface	Connects MCU port pin P3_5 (pin 61) to DLCDRS	Disconnects MCU port pin P3_5 (pin 61) from DLCDRS	R93
R95	Application Board Interface	Connects MCU port pin P3_7 (pin 59) to SEG31 at JA4-30	Disconnects MCU port pin P3_7 (pin 59) from SEG31	R96, R97

R96	Application Board Interface	Connects MCU port pin P3_7 (pin 59) to ADTRGn at JA1-8	Disconnects MCU port pin P3_7 (pin 59) from ADTRGn	R95, R97
R97	Application Board Interface	Connects MCU port pin P3_7 (pin 59) to SW3	Disconnects MCU port pin P3_7 (pin 59) from SW3	R95, R96, R119
R98	Application Board Interface	Connects MCU port pin P4_0 (pin 58) to SEG32 at JA4-31	Disconnects MCU port pin P4_0 (pin 58) from SEG32	R99
R99	Application Board Interface	Connects MCU port pin P4_0 (pin 58) to TXD1 at JA6-9	Disconnects MCU port pin P4_0 (pin 58) from TXD1	R98
R100	Application Board Interface	Connects MCU port pin P4_1 (pin 57) to SEG33 at JA4-32	Disconnects MCU port pin P4_1 (pin 57) from SEG33	R101
R101	Application Board Interface	Connects MCU port pin P4_1 (pin 57) to RXD1 at JA6-12	Disconnects MCU port pin P4_1 (pin 57) from RXD1	R100, R148
R102	Application Board Interface	Connects MCU port pin P4_2 (pin 56) to SEG34 at JA4-33	Disconnects MCU port pin P4_2 (pin 56) from SEG34	R103
R103	Application Board Interface	Connects MCU port pin P4_2 (pin 56) to CLK1 JA6-11	Disconnects MCU port pin P4_2 (pin 56) from CLK1	R102
R104	Application Board Interface	Connects MCU port pin P4_5 (pin 53) to SEG37 at JA4-36	Disconnects MCU port pin P4_5 (pin 53) from SEG37	R105
R105	Application Board Interface	Connects MCU port pin P4_5 (pin 53) to TRCIOB at JA5-15	Disconnects MCU port pin P4_2 (pin 53) from TRCIOB	R104
R106	Application Board Interface	Connects MCU port pin P11_0 (pin 22) to CLK2 at JA2-10	Disconnects MCU port pin P11_0 (pin 22) from CLK2	R107, R108
R107	Application Board Interface	Connects MCU port pin P11_0 (pin 22) to SCL at JA1-26	Disconnects MCU port pin P11_0 (pin 22) from SCL	R106, R108
R108	Application Board Interface	Connects MCU port pin P11_0 (pin 22) to IVREF1 at JA2-25	Disconnects MCU port pin P11_0 (pin 22) from IVREF1	R106, R107
R109	Application Board Interface	Connects MCU port pin P11_1 (pin 21) to RXD2 at JA2-8	Disconnects MCU port pin P11_1 (pin 21) from RXD2	R110
R110	Application Board Interface	Connects MCU port pin P11_1 (pin 21) to IVCMP1 at JA2-26	Disconnects MCU port pin P11_1 (pin 21) from IVCMP1	R109
R111	Application Board Interface	Connects MCU port pin P11_2 (pin 20) to TXD2 at JA2-6	Disconnects MCU port pin P11_2 (pin 20) from TXD2	R53, R112
R112	Application Board Interface	Connects MCU port pin P11_2 (pin 20) to SDA at JA1-25	Disconnects MCU port pin P11_2 (pin 20) from SDA	R111
R113	Application Board Interface	Connects MCU port pin P11_4 (pin 18) to INT4n at JA2-9	Disconnects MCU port pin P11_4 (pin 18) from INT4n	R114, R115
R114	Application Board Interface	Connects MCU port pin P11_4 (pin 18) to TRAIO at JA2-22	Disconnects MCU port pin P11_4 (pin 18) from TRAIO	R113, R115

R115	Application Board Interface	Connects MCU port pin P11_4 (pin 18) to SW1	Disconnects MCU port pin P11_4 (pin 18) from SW1	R113,R114
R116	Application Board Interface	Connects MCU port pin P11_5 (pin 17) to INT5n at JA2-23	Disconnects MCU port pin P11_5 (pin 17) from INT5n	R117
R117	Application Board Interface	Connects MCU port pin P11_5 (pin 17) to SW2	Disconnects MCU port pin P11_5 (pin 17) from SW2	R116
R118	Application Board Interface	Connects MCU port pin P11_6 (pin 16) to INT6n at JA2-23	Disconnects MCU port pin P11_6 (pin 16) from INT6n	R119
R119	Application Board Interface	Connects MCU port pin P11_6 (pin 16) to SW3	Disconnects MCU port pin P11_6 (pin 16) from SW3	R118
R120	Application Board Interface	Connects MCU port pin P13_0 (pin 4) to DA0 at JA1-13	Disconnects MCU port pin P13_0 (pin 4) from DA0	R121
R121	Application Board Interface	Connects MCU port pin P13_0 (pin 4) to ADPOT	Disconnects MCU port pin P13_0 (pin 4) from ADPOT	R120
R122	Application Board Interface	Connects MCU port pin P13_1 (pin 3) to DA1 at JA1-14	Disconnects MCU port pin P13_1 (pin 3) from DA1	R123, R124
R123	Application Board Interface	Connects MCU port pin P13_1 (pin 3) to TXD0 at JA6-8	Disconnects MCU port pin P13_1 (pin 3) from TXD0	R51, R122, R124
R124	Application Board Interface	Connects MCU port pin P13_1 (pin 3) to LINTXD	Disconnects MCU port pin P13_1 (pin 3) from LINTXD	R122, R123
R125	Application Board Interface	Connects MCU port pin P13_2 (pin 2) to RXD0 at JA6-7	Disconnects MCU port pin P13_2 (pin 2) from RXD0	R52, R126
R126	Application Board Interface	Connects MCU port pin P13_2 (pin 2) to LINRXD	Disconnects MCU port pin P13_2 (pin 2) from LINRXD	R125
R127	Application Board Interface	Connects MCU port pin P13_3 (pin 1) to CLK0 at JA6-10	Disconnects MCU port pin P13_3 (pin 2) from CLK0	R128
R128	Application Board Interface	Connects MCU port pin P13_3 (pin 1) to LINNSLP	Disconnects MCU port pin P13_3 (pin 2) from LINNSLP	R127

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
R1	Main clock	Parallel resistor for oscillator 'X1'	Not fitted	-
R2	Main clock	On board clock X1 connected to the MCU as main clock	External clock source can be connected to the MCU	R3, R4, R7, R1
R3	Main clock	On board clock X1 connected to the MCU as main clock	External clock source can be connected to the MCU	R2, R5, R1, R8
R4	Main clock	Routes MCU clock input pin XIN to J1 header (at J1-13)	MCU pin XIN is disconnected from J1 header	R2, R5, R7
R5	Main clock	Routes MCU clock output pin XOUT to J1 (at J1-11) (External clock source is used for XOUT)	MCU pin XOUT is disconnected from J1 header	R4, R3, R8
R6	Main clock	Parallel resistor for oscillator 'X2'	Not fitted	-
R7	Main clock	On board clock X2 can be connected to the MCU as main clock	X2 is disconnected from MCU main clock input pins	R2, R4, R6, R8
R8	Main clock	On board clock X2 can be connected to the MCU as main clock	X2 is disconnected from MCU main clock input pins	R3, R5, R6, R7
R9	Sub clock	Parallel resistor for on-board sub clock X3	Not fitted	-
R10	Sub clock	On board clock X3 connected to the MCU as sub clock	X3 is disconnected for XCIN	R9, R11, R12
R11	Sub clock	On board clock X3 connected to the MCU as sub clock	X3 is disconnected for XCOUT	R9, R10, R13
R12	Sub clock	Routes MCU clock input pin XCIN to J1 header (at J1-8)	MCU pin XCIN is disconnected from J1 header	R10, R13
R13	Sub clock	Routes MCU clock input pin XCOUT to J1 header (at J1-9)	MCU pin XCOUT is disconnected from J1 header	R11, R12

Table 6-10: Clock configuration links

Table 6-11 below describes miscellaneous options links.

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R14	LCD	Disconnect signal VL3 to capacitor C9	Connect signal VL3 from capacitor C9	R15
R15	LCD	Connect signal VL3 to signal VL2 and C10	Disconnect signal VL3 from signal VL2 and C10	R14
R40	HW Reset Circuit	Connects the reset signal generated from on-board reset circuit to the MCU at reset pin (pin 10)	Disconnects the reset signal generated from on-board reset circuit from the MCU reset pin (pin 10)	-
R55	HW Reset Circuit	Connects the pin 14 of E8a to GROUND	Disconnect pin 14 of E8A connector from ground	-
R135		Connect signal CL2 to RING_P12_3	Disconnect signal CL2 from RING_P12_3 (J4-19)	R136
R136		Connect signal CL1 to RING_P12_2	Disconnect signal CL1 from RING_P12_2 (J4-20)	R135
R140	LIN	Set LIN Master mode (with R142)	Set LIN Slave mode (with R142)	R142
R142	LIN	Set LIN Master mode (with R140)	Set LIN Slave mode (with R140)	R140
R143	LIN	Connects the Board_VCC to VBAT	Disconnects the Board_VCC from VBAT	-

Table 6-11: Miscellaneous Option Links

6.8. Oscillator Sources

Crystal oscillators are fitted on the board and used to supply the main/sub clock input to the Renesas microcontroller.

Table 6-12 details the oscillators that are fitted on this RSK:

Component		
Crystal (X1)	Fitted	20 MHz (HC49/4U package)
Crystal (X2)	Not Fitted	For test purpose only
Crystal (X3)	Fitted	32.768 KHz (SSP-T7-FL package)

Table 6-12: Oscillators / Resonators

6.9. Reset Circuit

A dual D flip flop IC (i.e. MC74HC74ADR2G) has been used to generate the reset signal required for the R8C/L3AC CPU.

Please check the hardware manual for the detailed reset requirements to ensure the reset circuit on the user's board meets all the reset timing requirements.

6.10. LCD Application Board

LCD application board can be attached to connector JA4 (LCD application header).

Please refer to the 'LCD Application Board User's Manual.

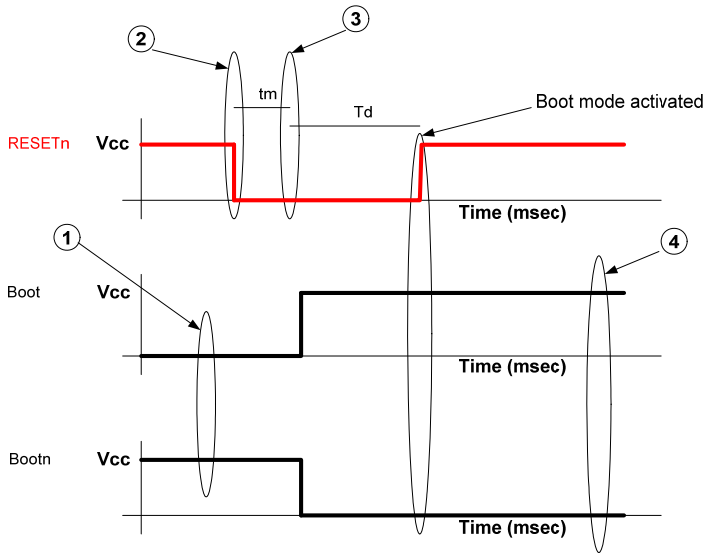
Chapter 7. Modes

The Renesas Starter Kit supports Boot mode and Single chip mode.

Details of programming the FLASH memory is described in the R8C/L3AC Group Hardware Manual.

This circuit is not required on customer's boards as it is intended for providing easy evaluation of the operating modes of the device on the RSK.

To manually enter the 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.



Boot Procedure

1- Press and Hold SW1/Boot switch
2- Press and Hold Reset switch
3- Release Reset switch *
4- Release SW1/Boot switch

tm = Time in msec during the Reset switch is pressed.
td = Reset time in msec for RC circuit after Reset switch released

Note:

Please see page-3 of the schematics (D008702_04) for boot and reset circuit.

* Boot mode activates after releasing reset switch in step-3

Figure 7-1: RSKR8CL3AC Boot Sequence

When neither the E8a is connected nor the board is placed in Boot mode, the MODE pin is pulled high by a 4.7k resistor.

When an E8a is used the MODE pin is controlled by the E8a.

More information on the operating modes and programming the flash memory can be found in the R8C/L3AC Group hardware manual.

7.1. Boot modes

The Boot mode settings for this Renesas Starter Kit are shown in Table 7-1 below:

Mode	LSI State after Reset End
Low	Boot Mode

Table 7-1: Boot Mode pin settings

7.2. Single chip mode

Because the MODE pin is pulled high, this Renesas Starter Kit will always boot in Single chip mode when the E8a is not connected and the boot switch is not depressed. Refer to R8C/L3AC Group Hardware Manual for details of Single chip mode.

Mode	LSI State after Reset End
High	Single chip Mode

Table 7-2: Single chip mode settings

Chapter 8. Programming Methods

The board is intended for use with HEW and the supplied E8a debugger. Refer to R8C/L3AC Group Hardware Manual for details of programming the microcontroller without using these tools.

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.

Header Pin	Circuit Net Name	Device pin	Header Pin	Circuit Net Name	Device pin
1	CLK0_ LINNSLP	1	2	RXD0_LINRXD	2
3	DA1_TXD0_LINTXD	3	4	DA0_ADPOT	4
5	WKUP0n	5	6	VREF	6
7	MODE	7	8	CON_XCIN	8
9	CON_XCOUT	9	10	RESETn	10
11	CON_XOUT	11	12	GROUND	12
13	CON_XIN	13	14	UC_VCC	14
15	TREO	15	16	INT6n_SW3	16
17	INT5n_SW2	17	18	INT4n_TRAIO_SW1	18
19	CTS2RTS2	19	20	TXD2_SDA	20
21	RXD2_IVCMP1	21	22	CLK2_SCL_IVREF1	22
23	Wn	23	24	Vn	24
25	Wp	25	26	-	-

Table 9-1: J1 microcontroller header

Header Pin	Circuit Net Name	Device pin	Header Pin	Circuit Net Name	Device pin
1	Vp	26	2	Un	27
3	TRDIOC0	28	4	Up	29
5	TRDIOA0	30	6	COM0	31
7	COM1	32	8	COM2	33
9	COM3	34	10	SEG55	35
11	SEG54	36	12	SEG53	37
13	SEG52	38	14	SEG51	39
15	SEG50	40	16	SEG49	41
17	SEG48	42	18	SEG47	43
19	SEG46	44	20	SEG45	45
21	SEG44	46	22	P5_3	47
23	P5_2	48	24	TRISTn	49
25	UD	50	26	-	-

Table 9-2: J2 microcontroller header

Header Pin	Circuit Net Name	Device pin	Header Pin	Circuit Net Name	Device pin
1	SEG39	51	2	SEG38	52
3	SEG37_TRCIOB	53	4	SEG36	54
5	SEG35	55	6	SEG34_CLK1	56
7	SEG33_RXD1	57	8	SEG32_TXD1	58
9	SEG31_ADTRGn_SW3	59	10	SEG30	60
11	SEG29_DLCDRS	61	12	SEG28_DLCDE	62
13	SEG27_DLCDD7	63	14	SEG26_DLCDD6	64
15	SEG25_DLCDD5	65	16	SEG24_DLCDD4	66
17	SEG23_LED3	67	18	SEG22_LED2	68
19	SEG21_LED1	69	20	SEG20_LED0	70
21	IO3	71	22	IO2	72
23	IO1	73	24	IO0	74
25	IO7	75	26	-	-

Table 9-3: J3 microcontroller header

Header Pin	Circuit Net Name	Device pin	Header Pin	Circuit Net Name	Device pin
1	IO6	76	2	IO5	77
3	IO4	78	4	AN15	79
5	AN14	80	6	AN13	81
7	AN12	82	8	SEG7_AN11	83
9	SEG6_AN10	84	10	SEG5_AN9	85
11	SEG4_AN8	86	12	SEG3_AN7	87
13	SEG2_AN6	88	14	SEG1_AN5	89
15	SEG0_AN4	90	16	VL1	91
17	VL2	92	18	VL3	93
19	RING_P12_3	94	20	RING_P12_2	95
21	VL4	96	22	TRGCLKB	97
23	TRGIOB	98	24	TRGCLKA	99
25	TRGIOA	100	26	-	-

Table 9-4: J4 microcontroller header

9.2. Application Headers

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

Header Pin	Generic Header Name	RSK board Signal Name	Device Pin	Header 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	---	---	6	AVss	---	---
7	AVref	CON_VREF	---	8	ADTRG	ADTRGn	59*
9	AD0	AN4	90*	10	AD1	AN5	89*
11	AD2	AN6	88*	12	AD3	AN7	87*
13	DAC0	DA0	4*	14	DAC1	DA1	3*
15	IO_0	IO0	74	16	IO_1	IO1	73
17	IO_2	IO2	72	18	IO_3	IO3	71
19	IO_4	IO4	78	20	IO_5	IO5	77
21	IO_6	IO6	76	22	IO_7	IO7	75
23	IRQ3	INT6n	16	24	IIC_EX	---	---
25	IIC_SDA	SDA	20*	26	IIC_SCL	SCL	22*

Table 9-5: JA1 Standard Generic Header

Header Pin	Generic Header Name	RSK board Signal Name	Device Pin	Header Pin	Generic Header Name	RSK board Signal Name	Device Pin
1	RES	RESETn	10	2	EXTAL	CON_XIN	---
3	NMI	---	---	4	Vss1	GROUND	---
5	WDT_OVF	---	---	6	SCIaTX	TXD2	20*
7	IRQ0/WKUP	WKUP0n	5	8	SCIaRX	RXD2	21*
9	IRQ1	INT4n	18*	10	SCIaCK	CLK2	22*
11	MO_up/down	UD	50	12	CTSRTS	CTS2RTS2	19
13	MO_Up	Up	29	14	MO_Un	Un	27
15	MO_Vp	Vp	26	16	MO_Vn	Vn	24
17	MO_Wp	Wp	25	18	MO_Wn	Wn	23
19	TMR0	TRDIOC0	28	20	TMR1	TREO	15
21	TRIGa	TRDIOA0	30	22	TRIGb	TRAIO	18*
23	IRQ2	INT5n	17	24	TRISTn	TRISTn	49
25	Spare	IVREF1	22*	26	Spare	IVCMP1	21*

Table 9-6: JA2 Standard Generic Header

Header Pin	Generic Header Name	RSK board Signal Name	Device Pin	Header Pin	Generic Header Name	RSK board Signal Name	Device Pin
1	V1	VL4	96	2	V2	VL3	93
3	V3	VL2	92	4	V4	VL1	91
5	GROUND	VSS	--	6	GROUND	VSS	--
7	COM1	COM0	31	8	COM2	COM1	32
9	COM3	COM2	33	10	COM4	COM3	34
11	SEG1	SEG0	90*	12	SEG2	SEG1	89*
13	SEG3	SEG2	88*	14	SEG4	SEG3	87*
15	SEG5	SEG4	86*	16	SEG6	SEG5	85*
17	SEG7	SEG6	84*	18	SEG8	SEG7	83*
19	SEG9	SEG20	70*	20	SEG10	SEG21	69*
21	SEG11	SEG22	68*	22	SEG12	SEG23	67*
23	SEG13	SEG24	66*	24	SEG14	SEG25	65*
25	SEG15	SEG26	64*	26	SEG16	SEG27	63*
27	SEG17	SEG28	62*	28	SEG18	SEG29	61*
29	SEG19	SEG30	60	30	SEG20	SEG31	59*
31	SEG21	SEG32	58*	32	SEG22	SEG33	57*
33	SEG23	SEG34	56*	34	SEG24	SEG35	55
35	SEG25	SEG36	54	36	SEG26	SEG37	53*
37	SEG27	SEG38	52	38	SEG28	SEG39	51
39	SEG29	SEG52	38	40	SEG30	SEG53	37
41	SEG31	SEG54	36	42	SEG32	SEG55	35
43	SEG33	SEG44	46	44	SEG34	SEG45	45
45	SEG35	SEG46	44	46	SEG36	SEG47	43
47	SEG37	SEG48	42	48	SEG38	SEG49	41
49	SEG39	SEG50	40	50	SEG40	SEG51	39

Table 9-7: JA4 Standard Generic Header

Header Pin	Generic Header Name	RSK board Signal Name	Device Pin	Header Pin	Generic Header Name	RSK board Signal Name	Device Pin
1	AD4	AN8	86*	2	AD5	AN9	85*
3	AD6	AN10	84*	4	AD7	AN11	83*
5	CAN1TX	---	---	6	CAN1RX	---	---
7	CAN2TX	---	---	8	CAN2RX	---	---
9	AD8	AN12	82	10	AD9	AN13	81
11	AD10	AN14	80	12	AD11	AN15	79
13	TIOCoA	TRGIOA	100	14	TIOCoB	TRGIOB	98
15	TIOCoC	TRCIOB	53	16	M2_TRISTn	---	---
17	TCLKC	TRGCLKA	99	18	TCLKD	TRGCLKB	97
19	M2_Up	---	---	20	M2_Un	---	---
21	M2_Vp	---	---	22	M2_Vn	---	---
23	M2_Wp	---	---	24	M2_Wn	---	---

Table 9-8: JA5 Standard Generic Header

Header Pin	Generic Header Name	RSK board Signal Name	Device Pin	Header Pin	Generic Header Name	RSK board Signal Name	Device Pin
1	DREQ	---	---	2	DACK	NC	---
3	TEND	---	---	4	STBYn	NC	---
5	RS232TX	RS232TX	---	6	RS232RX	RS232RX	---
7	SCIbRX	RXD0	2*	8	SCIbTX	TXD0	3*
9	SCIcTX	TXD1	58	10	SCIbCK	CLK0	1*
11	SCIcCK	CLK1	56	12	SCIcRX	RXD1	57
13	Reserved	---	---	14	Reserved	---	---
15	Reserved	---	---	16	Reserved	---	---
17	Reserved	---	---	18	Reserved	---	---
19	Reserved	---	---	20	Reserved	---	---
21	Reserved	---	---	22	Reserved	---	---
23	Unregulated_Vcc	---	---	24	Vss	---	---

Table 9-9: JA6 Standard Generic Header

Note: Pins marked with '*' are connected via option links.

Header Pin	Generic Header Name	RSK board Signal Name	Device Pin	Header Pin	Generic Header Name	RSK board Signal Name	Device Pin
1	VBAT	VBAT	---	2	GROUND	GROUND	---

Table 9-10: J10 BATTERY Header

.

Header Pin	Generic Header Name	RSK board Signal Name	Device Pin	Header Pin	Generic Header Name	RSK board Signal Name	Device Pin
1	VBAT	VBAT	---	2	LIN	LIN	---
3	GROUND	GROUND					

Table 9-11: LIN Header

Chapter 10. Code Development

10.1. Overview

Note: For all code debugging using Renesas software tools, the RSK board must be connected to 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 64k code and data. 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. Mode Support

High-performance Embedded Workspace connects to the Microcontroller and programs it via the E8a. Mode support is handled transparently to the user.

10.4. Breakpoint Support

This RSK is supplied with an E8a emulator which supports breakpoints in ROM and RAM. Double clicking in the breakpoint column in the code sets the breakpoint. Breakpoints will be retained unless they are double clicked to remove them. For more details on breakpoints & E8a functions please refer to the '*E8A-USB Emulator User's Manual*'.

10.5. Memory Map

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

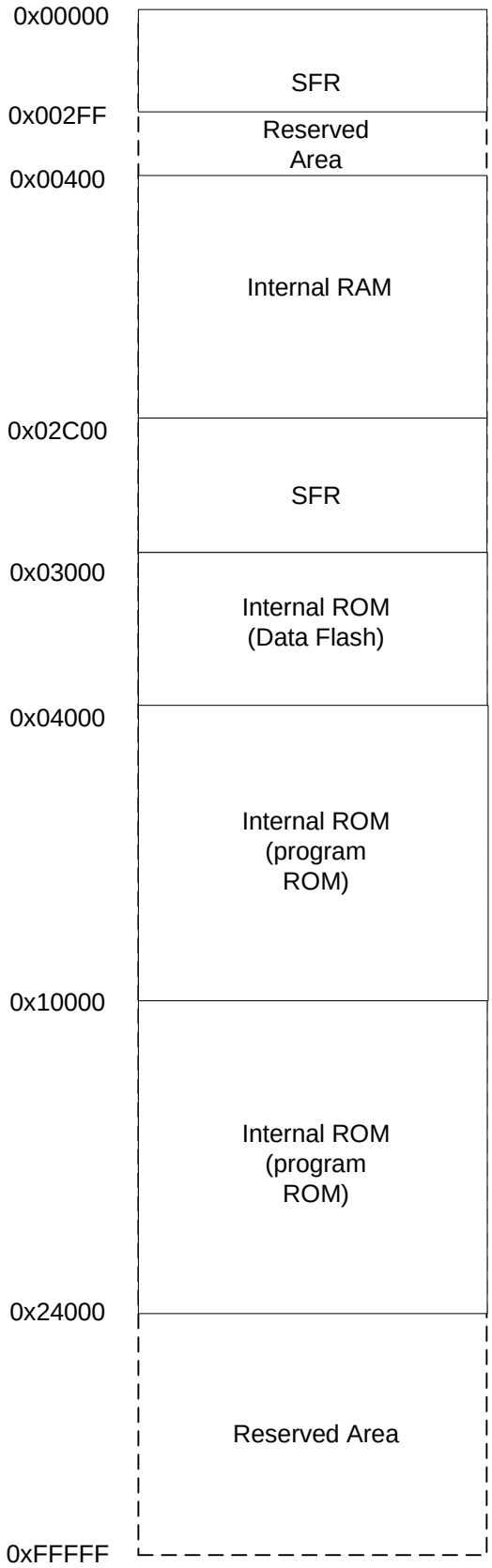


Figure 10-1: CPU memory map (Part Number - R5F2L3ACCNFP)

Chapter 11. Component Placement

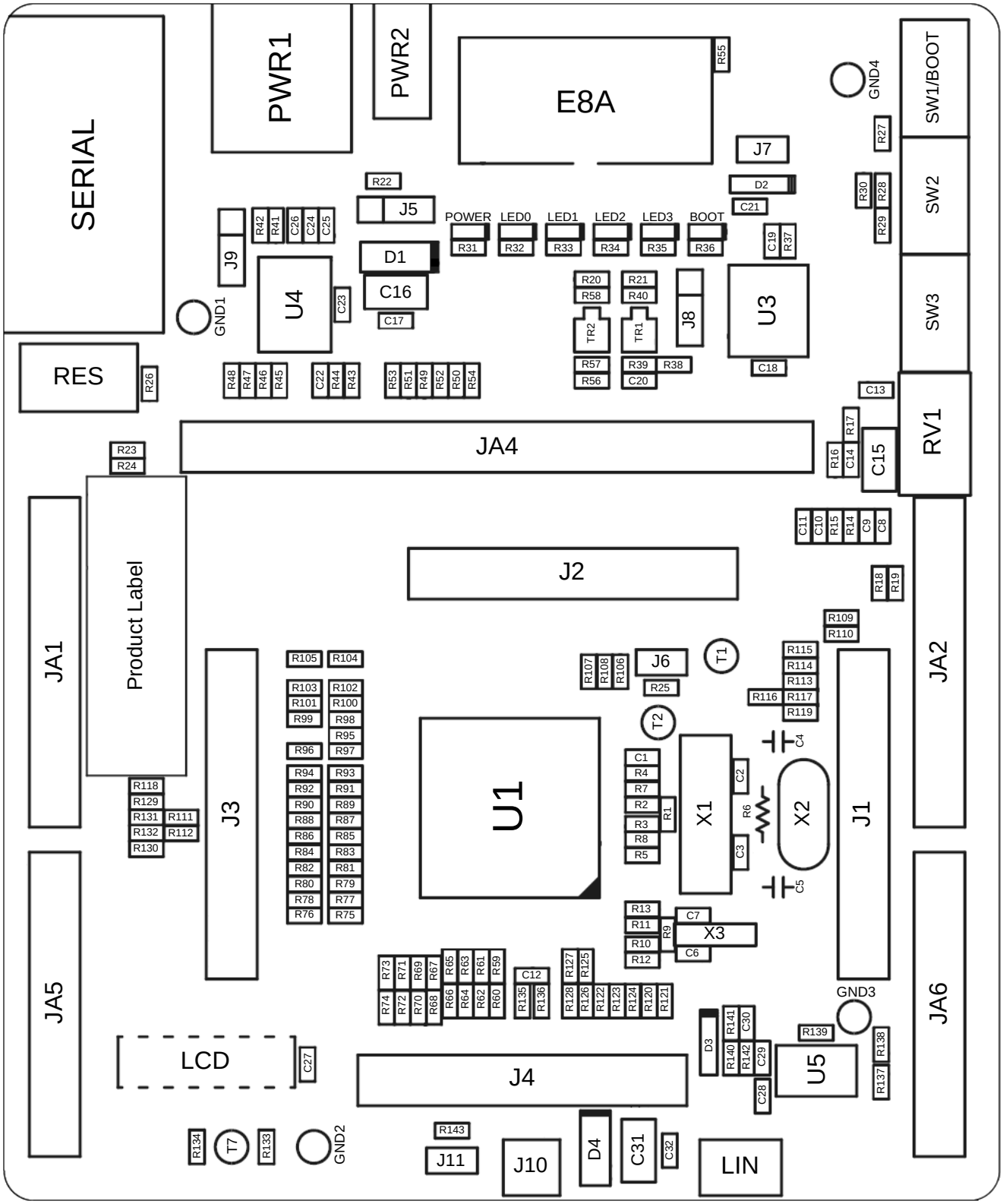


Figure 11-1: Component Placement (Top Layer)

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 R8C/L3AC microcontrollers refer to the R8C/L3AC Group Hardware Manual

For information about the R8C/L3AC assembly language, refer to the R8C Family Software Programming Manual

For information about the E8a Emulator, please refer to the E8A-USB Emulator User's Manual

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

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

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