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User's Manual

Renesas Starter Kit for R8C/2F

User's Manual

RENESAS SINGLE-CHIP MICROCOMPUTER M16C FAMILY

Renesas Electronics
www.renesas.com

Rev.1.00 2008.04

Table of Contents

Chapter 1. Preface

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Glossary

CPU	Central Processing Unit	HEW	High-performance Embedded Workshop
LED	Light Emitting Diode	RSK	Renesas Starter Kit
PC	Program Counter	E8A	On-chip debugger module
LCD	Liquid Crystal Display	LIN	Local Interconnect Network

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.
- User or Example Application.
- Sample peripheral device initialisation code.

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

Chapter 3. Power Supply

3.1. Requirements

This RSK operates from a 5V 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 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 a switch the LEDs will flash at a rate controlled by the potentiometer.

Chapter 4. Board Layout

4.1. Component Layout

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

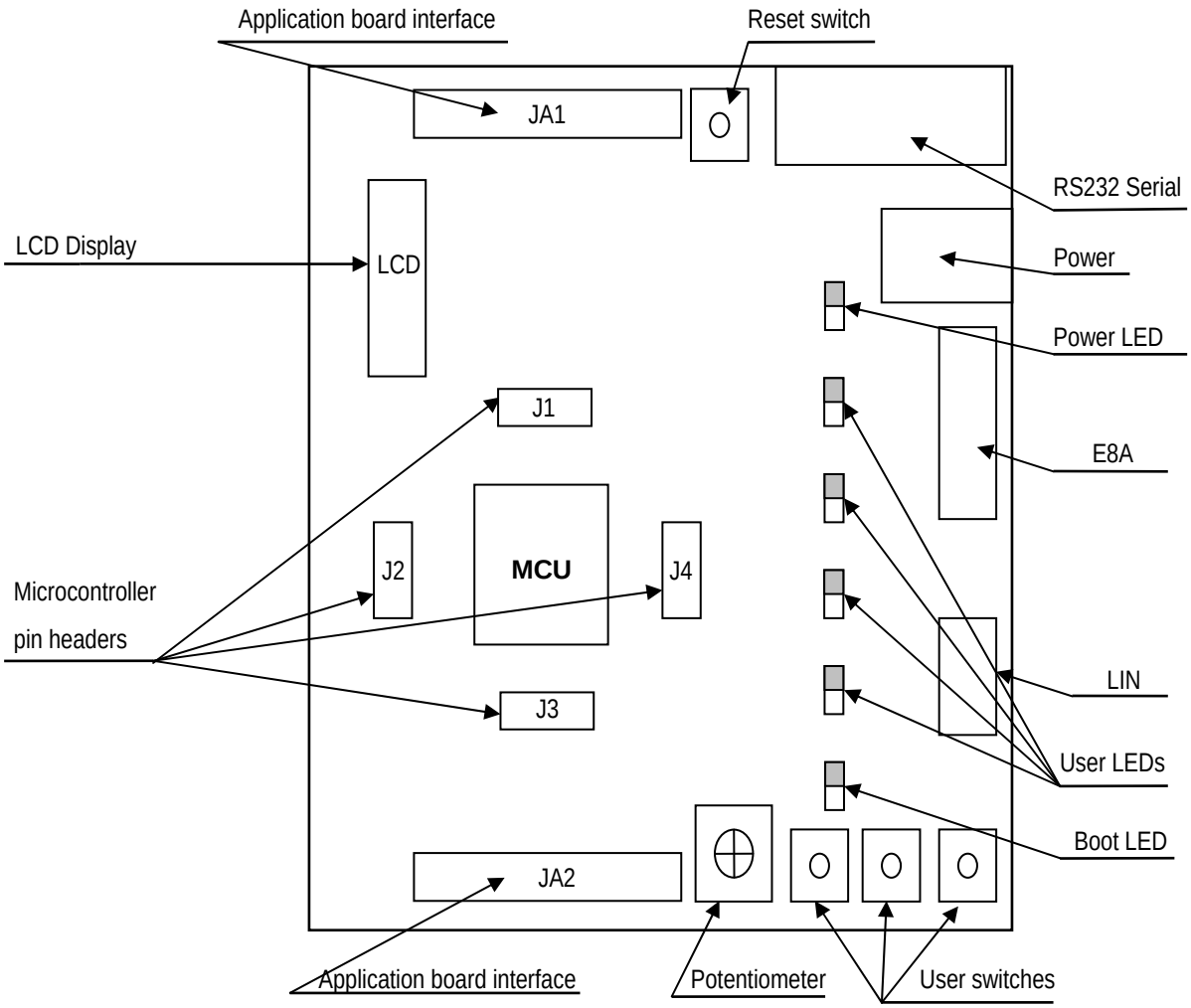


Figure 4-1: Board Layout

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.

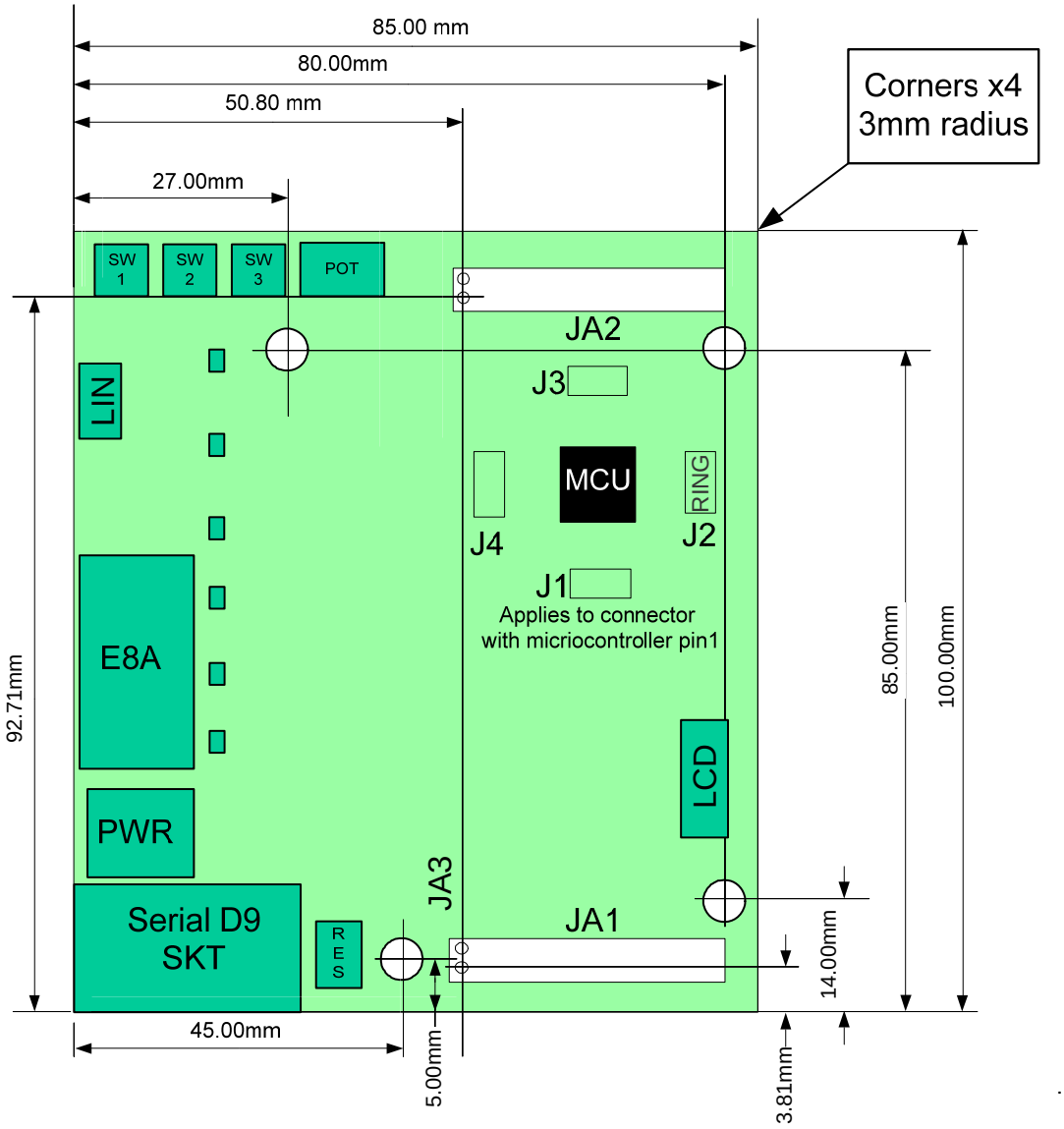


Figure 4-2: Board Dimensions

Chapter 5. Block Diagram

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

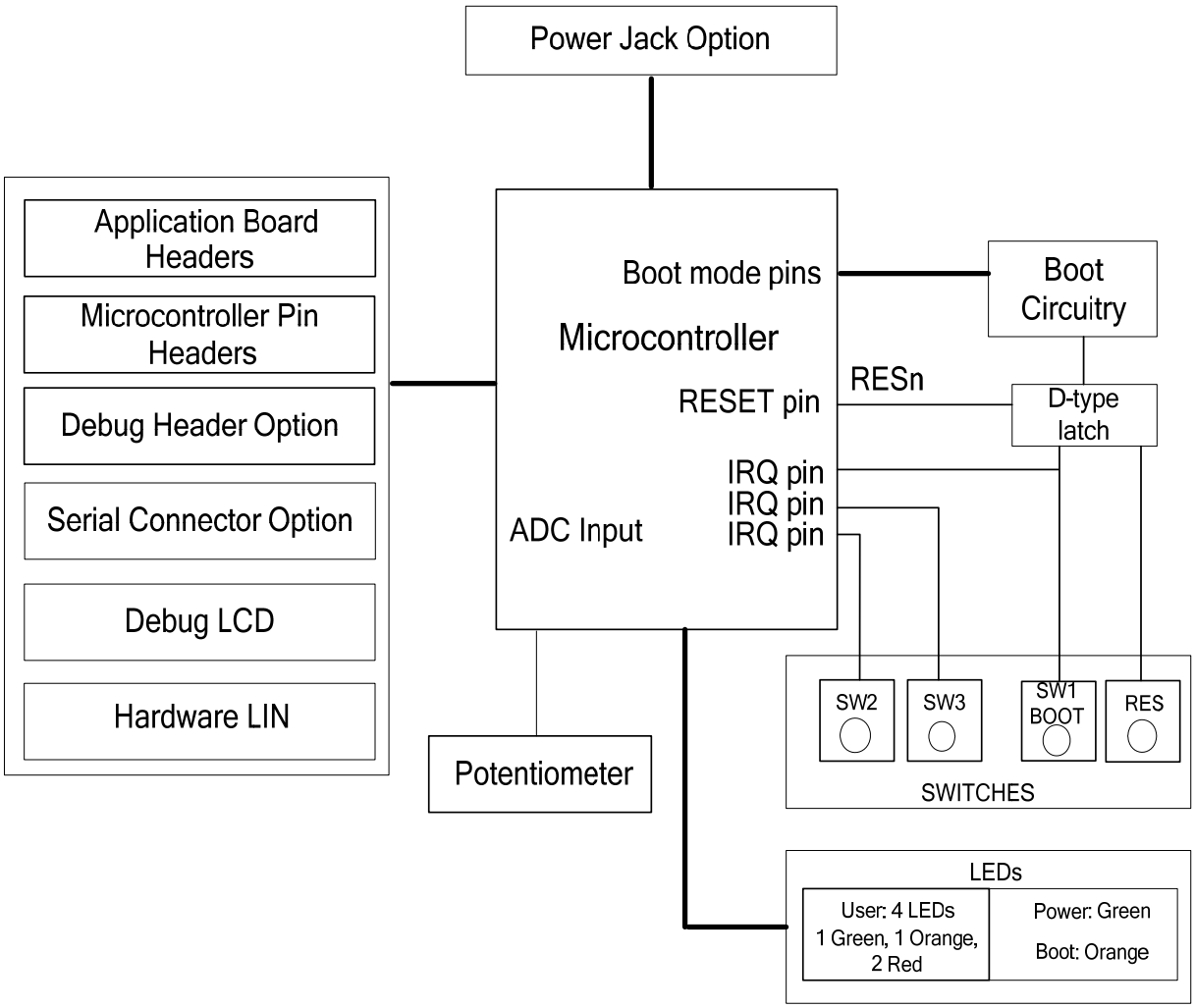


Figure 5-1: Block Diagram

Figure 5-2 shows the connections to the RSK.

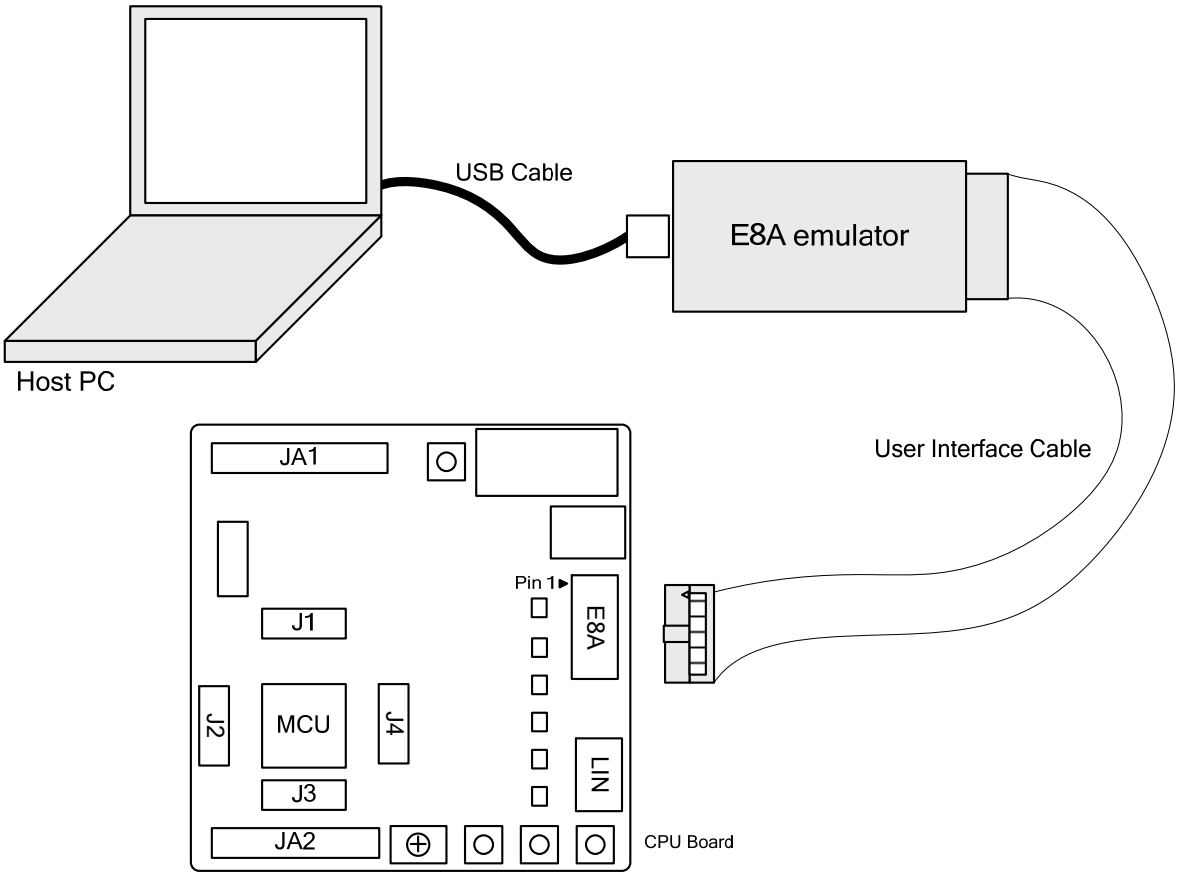


Figure 5-2: RSK Connections

Chapter 6. User Circuitry

6.1. Switches

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

Switch	Function	Microcontroller
RES	When pressed, the RSK microcontroller is reset.	RESETn, Pin 3
SW1/BOOT*	Connects to an IRQ 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.	INT0n, Pin 9 (Port 4 pin 5)
SW2*	Connects to an IRQ line for user controls.	INT1n, Pin 11 (Port 3, pin 6)
SW3*	Connects to key interrupt line.	KI3n, Pin 18 (Port 1, pin 3)

Table 6-1: Switch Functions

*Refer to 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 IO 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 1.2	19
LED1	Orange	Port 3.4	24
LED2	Red	Port 3.5	1
LED3	Red	Port 1.7	10

Table 6-2: LED Port

6.3. Potentiometer

A single turn potentiometer is connected to channel AN2 (P0.5, pin 27) of the microcontroller. This may be used to vary the input analogue voltage value to this pin between VCC and Ground.

6.4. Serial port

Serial port SCI0 is connected to the standard RS232 header. The connections are listed in the Table 6-3.

Description	Function	Circuit Net Name	CPU's Pin	Fit for RS232
SCI0	Default serial port	TXD0	17	R40
SCI0	Default serial port	RXD0	16	R29

Table 6-3: Serial Port settings

The SCI0 port is also available on J2/J3 (R28 and R61 must be fitted) and JA2 headers.

6.5. Hardware LIN

Hardware LIN could be connected to TXD0, RXD0 and CLK0 pins. The connections to be fitted are listed in the Table 6-4.

Description	Function	Circuit Net Name	CPU's Pin	Fit for Hardware LIN	Remove for Hardware LIN
LIN	TXD	TXD0	17	R22	R40
LIN	RXD	RXD0	16	R25	R29
LIN	NSLP	CLK0	15	R23	-

Table 6-4: Hardware LIN settings

Hardware LIN can be selected as Master or Slave. Jumper selections are listed in the Table 6-5.

Master and Slave Selection		
Jumper	Master	Slave
L_MD0	Fit	No Fit
L_MD1	Fit	No Fit

Table 6-5: LIN Master and Slave Selection

6.6. 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 between J1 and JA1. 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. The module supplied with the RSK only supports 5V operation.

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

LCD					
Pin	Circuit Net Name	Device Pin	Pin	Circuit Net Name	Device Pin
1	Ground	-	2	5V Only	-
3	No Connection	-	4	DLCDRS (P10)	22
5	R/W (Wired to Write only)	-	6	DLCDE + 100k pull down to ground (P11)	21
7	No Connection	-	8	No connection	-
9	No Connection	-	10	No connection	-
11	DLCDD4 (P00)	32	12	DLCDD5 (P01)	31
13	DLCDD6 (P02)	30	14	DLCDD7 (P03)	29

Table 6-6: Debug LCD Module Connections

6.7. Option Links

Table 6-7 below describes the function of the option links associated with application board interface. The default configuration is indicated by **BOLD** text.

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R36	Application board interface	Use AD_POT for RV1.	Use AN2 of application board interface.	R37
R37	Application board interface	Use AN2 of application board interface.	Use AD_POT for RV1.	R36
R32	Application board interface	Use AN0 of application board interface.	Use DA1 of application board interface.	R33
R33	Application board interface	Use DA1 of application board interface.	Use AN0 of application board interface.	R32
R34	Application board interface	Use AN1 of application board interface.	Use DA0 of application board interface.	R35
R35	Application board interface	Use DA0 of application board interface.	Use AN1 of application board interface.	R34
R47	Application board interface	Use DLCDRS for LCD.	Use IO_0 of application board interface.	R48
R48	Application board interface	Use IO_0 of application board interface.	Use DLCDRS for LCD.	R47
R50	Application board interface	Use DLCDE for LCD.	Use IO_1 of application board interface.	R53
R53	Application board interface	Use IO_1 of application board interface.	Use DLCDE for LCD.	R50
R61	Application board interface	Use TXD0 for U4.	Use IO_4 of application board interface	R59
R59	Application board interface	Use IO_4 of application board interface	Use TXD0 for U4.	R61
R28	Application board interface	Use RXD0 for U4	Use IO_5 of application board interface	R27
R27	Application board interface	Use IO_5 of application board interface	Use RXD0 for U4	R28
R67	Application board interface	Use CLK0 for U4	Use IO_6 of application board interface	R69
R69	Application board interface	Use IO_6 of application board interface	Use CLK0 for U4	R67
R56	Application board interface	Use to connect LED0	Use IO_2 of application board interface	R57
R57	Application board interface	Use IO_2 of application board interface	Use to connect LED0	R56

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R68	Application board interface	**Use to connect LED3**	Use IO_7 of application board interface	R70
R70	Application board interface	Use IO_7 of application board interface	**Use to connect LED3**	R68
R64	Application board interface	**Use KI3n to connect SW3**	Use IO_3 of application board interface	R65
R65	Application board interface	Use IO_3 of of application board interface	**Use KI3n to connect SW3**	R64

Table 6-7: Application board interface links.

Table 6-8 below describes the function of the option links associated with power source. The default configuration is indicated by BOLD text.

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R8	Power source	**Enables external 5V power supply from 'PWR' connector.**	Disables power supply from 'PWR' connector.	R15, R18
R15	Power source	**Must be fitted if input power supply is regulated 5V.**	Must be removed if input power supply is higher than 5V.	R8, R18
R18	Power source	Must be fitted if supplying voltage is higher than 5V at PWR jack	**Must be removed if supplying voltage from CON_5V**	R8, R15
R42	Power source	Board can be powered from external source CON_5V.	**Board can't be powered from external source CON_5V.**	R15, R18
R19	Power source	**Enables 5V power supply for the microcontroller**	Disables 5V power supply for microcontrollers. Current can measured across R19	R19

Table 6-8: Power configuration links.

Table 6-9 below describes the function of the option links associated with clock configuration. The default configuration is indicated by BOLD text.

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R60	20 MHz Clock Oscillator	Routes XIN CPU pin to J1 and JA2 headers.	**XIN CPU pin and J1 and JA2 headers are not connected**	R49, R52, R58
R49	20 MHz Clock Oscillator	Routes XOUT CPU pin to J1 header	**XOUT CPU pin and J1 header are not connected**	R52, R58, R60
R58	20 MHz Clock Oscillator	**On-board main clock source is used for XIN**	External clock source is used for XIN	R49, R52, R60
R52	20 MHz Clock Oscillator	**On-board main clock source is used for XOUT**	External clock source is used for XOUT	R49, R58, R60
R55	20 MHz Clock Oscillator	Parallel resistor for a crystal is fitted	**Parallel resistor for a crystal is not fitted**	-

Table 6-9: Clock configuration links.

Table 6-10 below describes the function of the option links associated with reference voltage. The default configuration is indicated by BOLD text.

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R38	Reference Voltage Source	**Reference voltage source is set to Board_VCC**	Reference voltage source is taken from the external connector to AD_POT	R31
R31	Reference Voltage Source	Reference voltage source is taken from the external connector to AD_POT	**Reference voltage source is set to Board_VCC**	R38

Table 6-10: Analog power supply links.

6.8. Oscillator Sources

A crystal oscillator is fitted on the RSK and used to supply the main clock input to the Renesas microcontroller. Table 6-11 details the oscillator that is fitted:

Component		
Crystal (X1)	Fitted	20.0 MHz (HC49/4H package)

Table 6-11: Oscillators / Resonators

6.9. Reset Circuit

The CPU 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 customer's 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 on pressing the reset button. This control is subsequently used to modify the mode pin states as required.

The mode pins should change state only while the reset signal is active to avoid possible device damage.

The reset is held in the active state for a fixed period by a pair of resistors and a capacitor. 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

This RSK supports two Boot modes and Single Chip mode.

Details of programming the FLASH memory is described in the R8C/2E, R8C/2F Group Hardware Manual. Boot or Single Chip mode could be selected by MODE pin.

7.1. Boot mode

The software supplied with this RSK supports debugging with E8A which supports Boot mode. To enter the Boot mode manually, do not connect the E8A in this case. Press and hold the SW1/BOOT. The BOOT LED will be illuminated to indicate that the microcontroller is in boot mode.

7.2. Single chip mode

In Single Chip mode user ROM area is rewritten by executing software commands from the CPU.

Chapter 8. Programming Methods

The board is intended for use with HEW and the supplied E8A debugger. Refer to R8C/2E, R8C/2F Group Hardware Manual for details of programming the microcontroller without using these tools.

Chapter 9. Headers

9.1. Microcontroller Headers

Table 9-1 to Table 9-4 show the microcontroller pin headers and their corresponding microcontroller connections. The header pins connect directly to the microcontroller pin unless otherwise stated.

J1					
Pin	Circuit Net Name	Device Pin	Pin	Circuit Net Name	Device Pin
1	LED2	1	2	TMR0	2
3	RESETn	3	4	CON_XOUT	4
5	GROUND	5	6	CON_XIN	6
7	UC_VCC	7	8	MODE	8

Table 9-1: J1

J2					
Pin	Circuit Net Name	Device Pin	Pin	Circuit Net Name	Device Pin
1	INT0n	9	2	LED3_IO7	10
3	INT1n	11	4	TMR1	12
5	TRIGa	13	6	TRIGb	14
7	CLK0_IO6	15	8	RXD0_IO5	16

Table 9-2: J2

J3					
Pin	Circuit Net Name	Device Pin	Pin	Circuit Net Name	Device Pin
1	TXD0_IO4	17	2	KI3n_IO3	18
3	LED0_IO2	19	4	CON_VREF	20
5	DLCDE_IO1	21	6	DLCDRS_IO0	22
7	INT3n	23	8	LED1	24

Table 9-3: J3

J4					
Pin	Circuit Net Name	Device Pin	Pin	Circuit Net Name	Device Pin
1	AN0_DA1	25	2	AN1_DA0	26
3	AN2_ADPOT	27	4	AN3	28
5	DLCDD7	29	6	DLCDD6	30
7	DLCDD5	31	8	DLCDD4	32

Table 9-4: J4

9.2. Application Headers

Table 9-5 to Table 9-6 below show the standard application header connections.

JA1							
Pin	Generic Header Name	CPU board Signal Name	Device Pin	Pin	Generic Header Name	CPU board Signal Name	Device Pin
1	5V	CON_5V	-	2	0V	GROUND	-
3	3V3	NC	-	4	0V	NC	-
5	AVCC	NC	-	6	AVss	NC	-
7	AVref	CON_VREF	20	8	ADTRG	NC	-
9	AD0	AN0	25	10	AD1	AN1	26
11	AD2	AN2	27	12	AD3	AN3	28
13	DAC0	DA0	26	14	DAC1	DA1	25
15	IO_0	IO0	22	16	IO_1	IO1	21
17	IO_2	IO2	19	18	IO_3	IO3	18
19	IO_4	IO4	17	20	IO_5	IO5	16
21	IO_6	IO6	15	22	IO_7	IO7	10
23	INT3n	IRQ3n	23	24	IIC_EX	NC	-
25	IIC_SDA	NC	-	26	IIC_SCL	NC	-

Table 9-5: JA1 Standard Generic Header

JA2							
Pin	Generic Header Name	CPU board Signal Name	Device Pin	Pin	Generic Header Name	CPU board Signal Name	Device Pin
1	RESn	RESETn	3	2	EXTAL	CON_XIN	6
3	NMIn	NC	-	4	VSS1	GROUND	-
5	WDT_OVF	NC	-	6	SCIaTX	TxD0	17
7	IRQ0	INT0n	9	8	SCIaRX	RxD0	16
9	IRQ1	INT1n	11	10	SCIaCK	CLK0	15
11	UD	NC	-	12	CTSRTS	NC	-
13	Up	NC	-	14	Un	NC	-
15	Vp	NC	-	16	Vn	NC	-
17	Wp	NC	-	18	Wn	NC	-
19	TMR0	TMR0	2	20	TMR1	TMR1	12
21	TRIGa	TRIGa	13	22	TRIGb	TRIGb	14
23	IRQ2	KI3n	18	24	TRISTn	NC	-
25	-	-	-	26	-	-	-

Table 9-6: JA2 Standard Generic Header

Table 9-7 below shows the LIN header connections.

LIN		
Pin	Function	Signal Name
1	Power Supply (for LIN module)	VBAT
2	LIN Bus Line	LIN
3	GROUND	GND

Table 9-7: 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. An E8A pod is supplied with the RSK product.

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 compiler will default to a maximum of 64k code and data. To use the compiler with programs greater than this size you 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

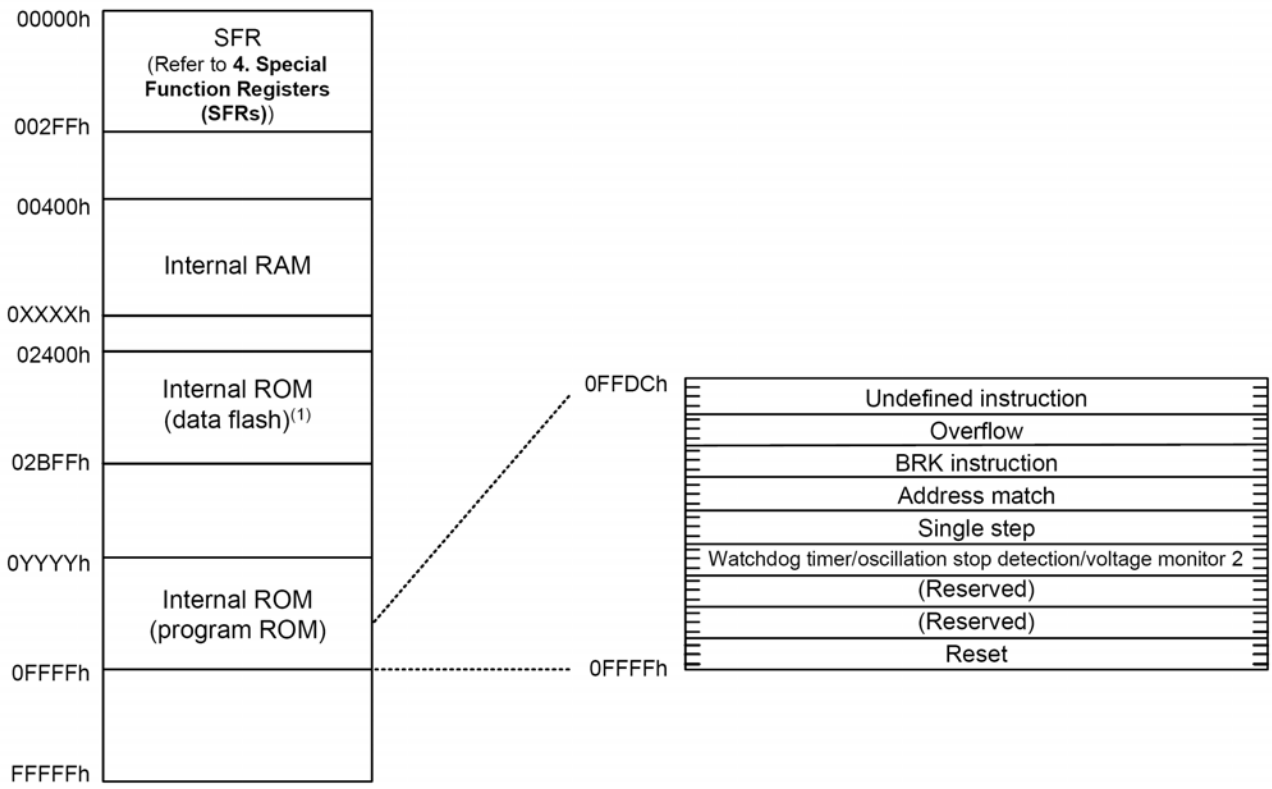
HEW connects to the Microcontroller and programs it via the E8A. Mode support is handled transparently to the user.

10.4. Breakpoint Support

HEW supports breakpoints on the user code, both in RAM and ROM.

Double clicking in the breakpoint column in the code sets the breakpoint. Breakpoints will remain unless they are double clicked to remove them.

10.5. Memory Map



NOTES:
1. Data flash block A (1 Kbyte) and B (1 Kbyte) are shown.
2. The blank regions are reserved. Do not access locations in these regions.

Part Number	Internal ROM		Internal RAM	
	Size	Address 0YYYYh	Size	Address 0XXXXh
R5F212F2NFP, R5F212F2DFP, R5F212F2NXXXFP, R5F212F2DXXXFP	8 Kbytes	0E000h	512 bytes	005FFh
R5F212F4NFP, R5F212F4DFP, R5F212F4NXXXFP, R5F212F4DXXXFP	16 Kbytes	0C000h	1 Kbyte	007FFh

Figure 10-1: Memory Map

Chapter 11. Component Placement

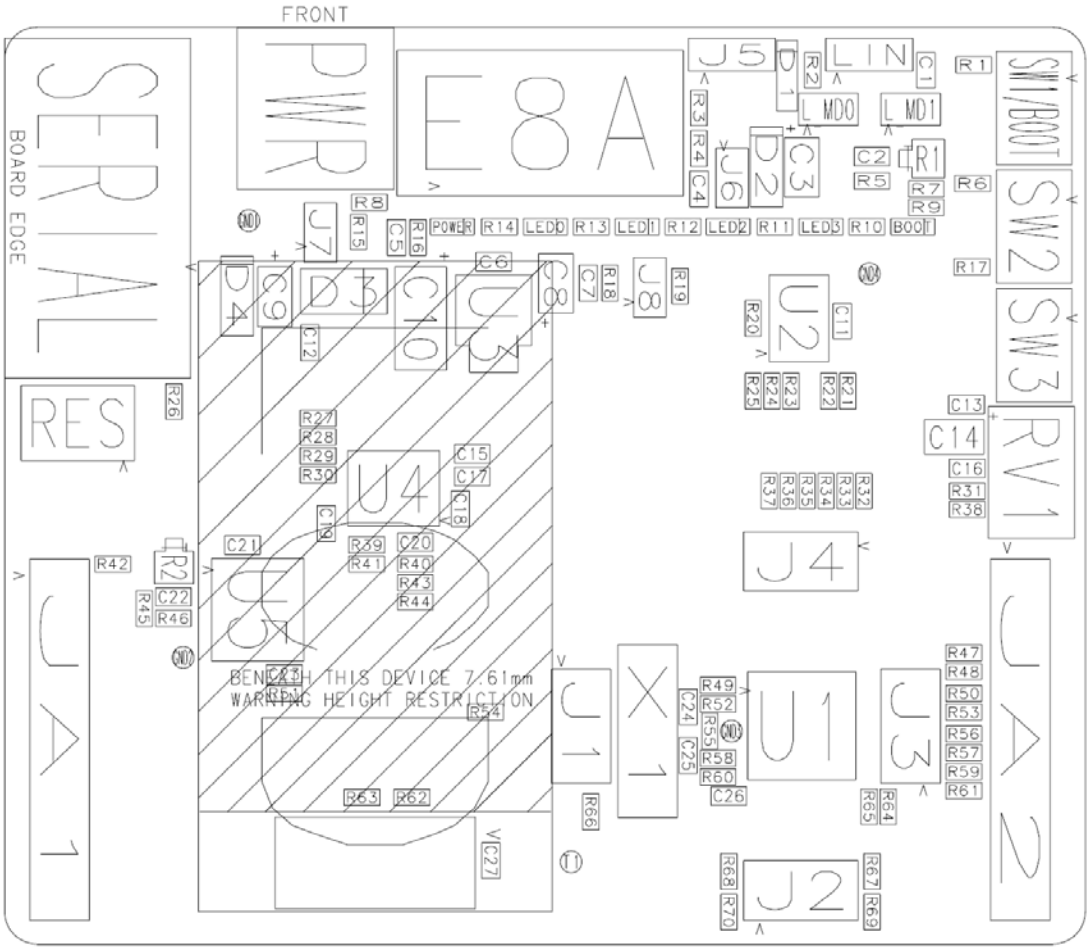


Figure 11-1: Component Placement – Front view

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 from the web site.

For information about the R8C series microcontrollers refer to the R8C/2E, R8C/2F Group hardware manual.

For information about the R8C/2F assembly language, refer to the R8C/Tiny Series Software Manual.

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

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