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User's Manual

Renesas Starter Kit for R8C/25

User's Manual

RENESAS SINGLE-CHIP MICROCOMPUTER
M16C FAMILY / R8C/Tiny SERIES

Renesas Electronics
www.renesas.com

Rev.2.00 2007.10

Table of Contents

Chapter 1. Preface

Cautions

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Glossary

CPU	Central Processing Unit	RTE	Renesas Technology Europe Ltd.
HEW	High-performance Embedded Workshop	RSO	Renesas Solutions Organisation.
LED	Light Emitting Diode	RSK	Renesas Starter Kit
PC	Program Counter		

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).
- 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 3V to 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 module. 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 2.1mm 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 the top layer component layout of the board.

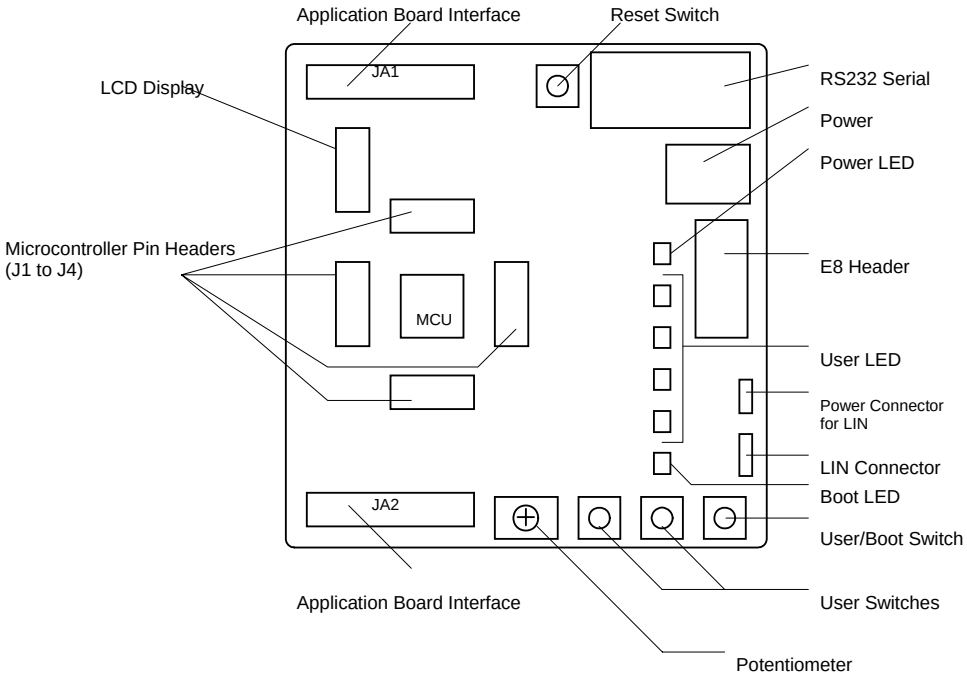

Figure 4-1: Board Layout

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.

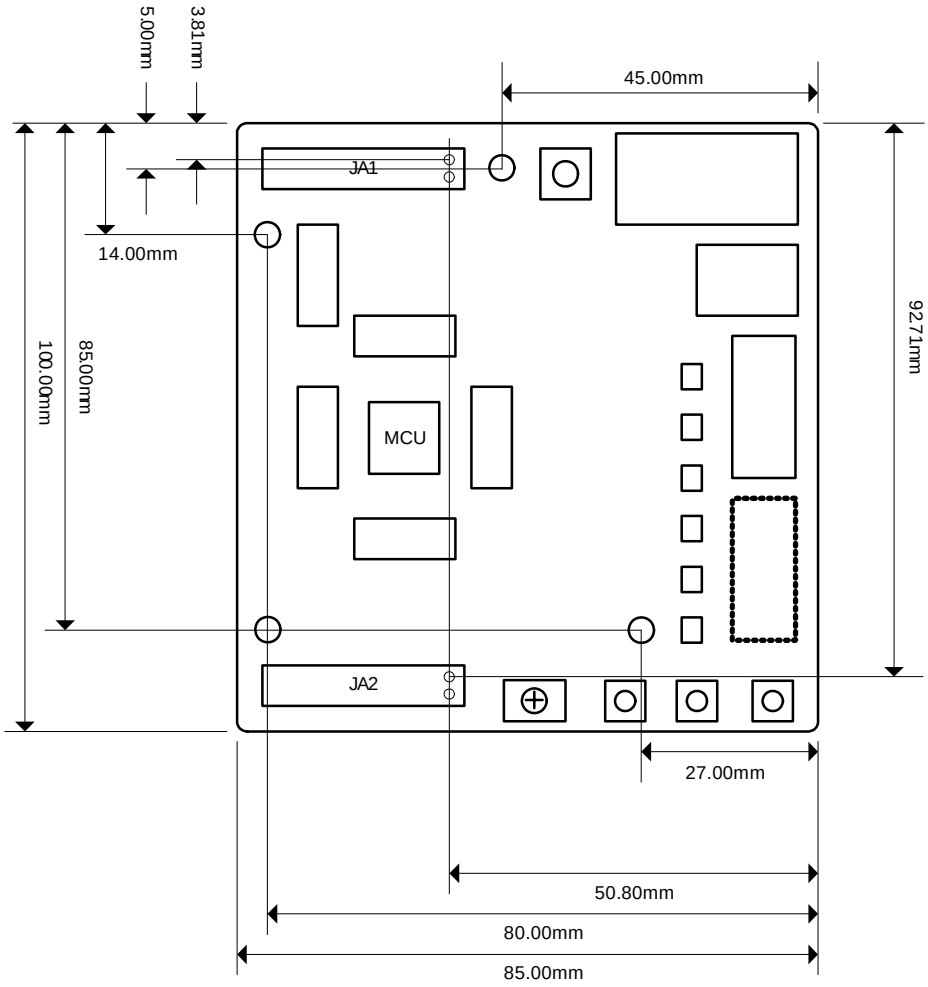

Figure 4-2 : Board Dimensions

Chapter 5. Block Diagram

Figure 5-1 is representative of the CPU board components and their connectivity.

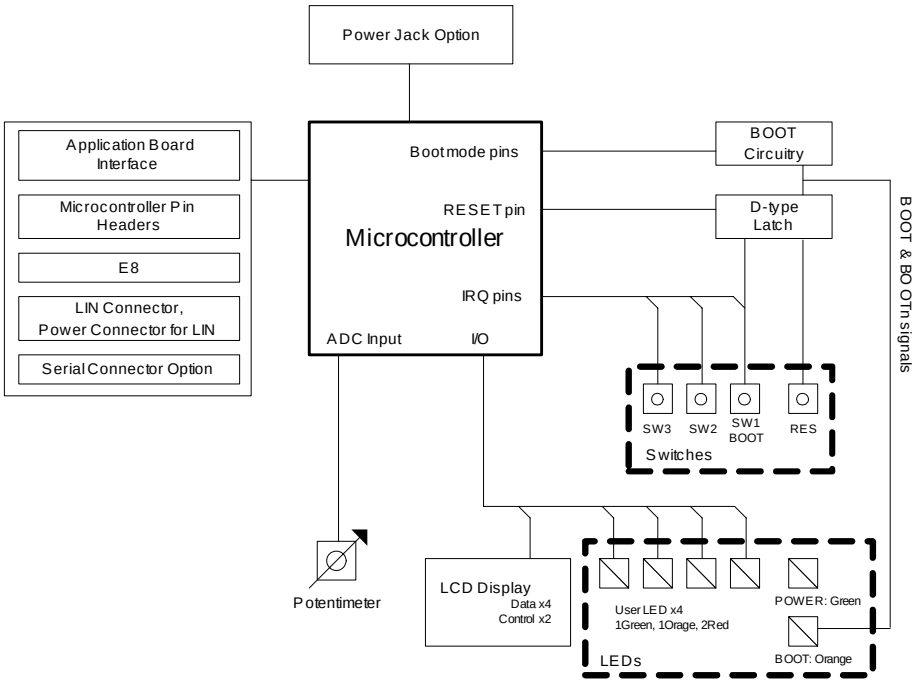

Figure 5-1: Block Diagram

Figure 5-2 is representative of the connections required to the RSK.

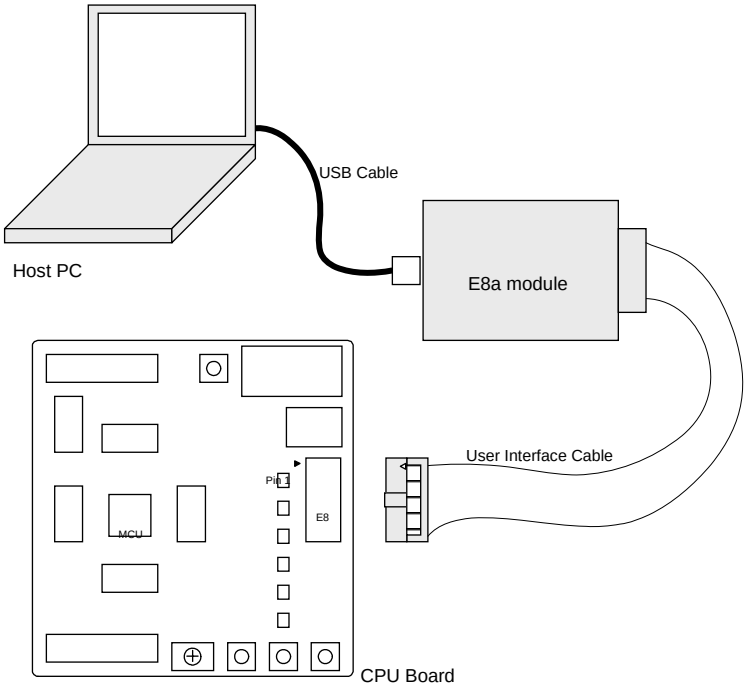

Figure 5-2 : RSK Connections

Chapter 6. User Circuitry

6.1. Switches

There are four switches located on the RSK. 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.	RESET Pin8
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.	INT0 Pin27 (Port 4, pin 5)
SW2*	Connects to an IRQ Interrupt input line for user controls.	INT1 Pin21 (Port 1, pin 7)
SW3*	Connects to a Key In Interrupt input line for user controls	KI3 Pin25 (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 2.4	16
LED1	Orange	Port 2.5	15
LED2	Red	Port 2.6	14
LED3	Red	Port 2.7	13

Table 6-2: LED Port

6.3. Potentiometer

A single turn potentiometer is connected to AN8 (P1.0) of the microcontroller. This may be used to vary the input analogue voltage value to this pin between VREF and Ground.

6.4. Serial port

The microcontroller programming serial port 1 is connected to the RS232 transceiver. This serial port can optionally be connected to the RS232 transceiver as well by fitting option resistors. The connections to be fitted are listed in the table 6-3.

Description	Function	Fit for RS232
TxD1	Programming Serial Port	R45
RxD1	Programming Serial Port	R46

Table 6-3: Serial Port settings

A Secondary serial port is connected to the application headers. This is shared with the LIN module.

6.5. LCD Module

A LCD module is supplied to be connected to the connector J8. This should be fitted so that the LCD module lies over J1. Care should be taken to ensure the pins are inserted correctly into J8.The 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 6-4 shows the pin allocation and signal names used on this connector.

J8					
Pin	Circuit Net Name	Device Pin	Pin	Circuit Net Name	Device Pin
1	Ground	-	2	5V Only	-
3	No Connection	-	4	LCD_RS	31
5	R/W (Wired to Write only)	-	6	LCD_E	30
7	No Connection	-	8	No Connection	-
9	No Connection	-	10	No Connection	-
11	LCD_D4	51	12	LCD_D5	50
13	LCD_D6	49	14	LCD_D7	48

Table 6-4: LCD Module Connections

6.6.Option Links

Table 6-5 below describes the function of the option links contained on this RSK board.

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R7	Reference Voltage	Connects Reference Voltage to microcontroller	Reference Voltage disconnected from microcontroller	R19
R8	Oscillator (Main clock)	Connects External Microcontroller header pins to microcontroller	Disconnects sensitive microcontroller signals from external pins	R10, R11, R12
R10	Oscillator (Main clock)	Connects External Microcontroller header pins to microcontroller	Disconnects sensitive microcontroller signals from external pins	R8, R11, R12
R11	Oscillator (Main clock)	Connects main clock (X1) to microcontroller	Main clock disconnected from microcontroller	R8, R10, R12
R12	Oscillator (Main clock)	Connects main clock (X1) to microcontroller	Main clock disconnected from microcontroller	R8, R10, R11
R13	Oscillator (Sub clock)	Connects sub clock (X2) to microcontroller	Sub clock disconnected from microcontroller	R14, R15, R16, R17
R14	Oscillator (Sub clock)	Connects sub clock (X2) to microcontroller	Sub clock disconnected from microcontroller	R13, R15, R16, R17
R15	Oscillator (Sub clock)	Connects External Microcontroller header pins to microcontroller	Disconnects sensitive microcontroller signals from external pins	R13, R14, R16
R16	Oscillator (Sub clock)	Connects External Microcontroller header pins to microcontroller	Disconnects sensitive microcontroller signals from external pins	R13, R14, R15
R17	Oscillator (Sub clock)	Parallel resister for sub clock (X2)	Not fitted	R13, R14
R18	Board VCC	Supply to board from DC Power Jack (J5)	Disconnected	R20
R19	Reference Voltage	Connects Board_VCC supply to Reference Voltage supply	Reference Voltage MUST be provided from external interface	R7
R20	Board VCC	Connects Board_VCC supply to board voltage line	Board_VCC disconnected from board voltage line	R18, R19, R21, R22, R23
R21	Board VCC	Connects External 5V (CON_5V) to Board_VCC	External 5V disconnected from Board_VCC	R20, R22

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R22	Board VCC	Connects External 3V3 (CON_3V3) to Board_VCC	External 3V3 disconnected from Board_VCC	R20, R21
R23	Microcontroller VCC	Supply to microcontroller	Fit Low ohm resister to measure current	
R30	User I/O Power Supply	Connects Board_VCC supply to SW2, 3 and LED0-3	Board_VCC disconnected from SW2, 3 and LED0-3	
R31	SW1	Connects SW1 to INT0 Input	Disconnected	
R44	RS232 Transceiver	Disables RS232 Serial Transceiver	Enables RS232 Serial Transceiver	R45, R46
R45	Programming Serial Port	Connects RS232 port to Programming SCI port	Disconnected	R44, R46
R46	Programming Serial Port	Connects RS232 port to Programming SCI port	Disconnected	R44, R45
R47	E8	Enables E8a Connection	Do not connect a option resister	
R50	Microcontroller pin function select	Connects microcontroller pin 28 to IRQ1	MUST be removed if R51 fitted	R51
R51	Microcontroller pin function select	Connects microcontroller pin 28 to IO_6	Should be removed if R50 fitted	R50
R52	Microcontroller pin function select	Connects microcontroller pin 29 to IRQ2	MUST be removed if R53 fitted	R53
R53	Microcontroller pin function select	Connects microcontroller pin 28 to IO_7	Should be removed if R52 fitted	R52
R54	Microcontroller pin function select	Connects microcontroller pin 27 to IRQ0	MUST be removed if R55 fitted	R55
R55	Microcontroller pin function select	Connects microcontroller pin 27 to TRIGa	Should be removed if R54 fitted	R54
R56	LIN	For Master Mode	For Slave Mode	R59, R60, R61
R59	LIN	Connects microcontroller pin 22 to LIN-NSLP	Disconnected	R56, R60, R61
R60	LIN	Connects microcontroller pin 23 to LIN-RXD0	Disconnected	R56, R59, R61
R61	LIN	Connects microcontroller pin 23 to LIN-TXD0	Disconnected	R56, R59, R60
R62	CAN	Do not use CAN function, R8C/25 Microcontroller do not have CAN function	Do not use CAN function, R8C/25 Microcontroller do not have CAN function	

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R64	CAN	Do not use CAN function, R8C/25 Microcontroller do not have CAN function	Do not use CAN function, R8C/25 Microcontroller do not have CAN function	
R66	CAN	Do not use CAN function, R8C/25 Microcontroller do not have CAN function	Do not use CAN function, R8C/25 Microcontroller do not have CAN function	

Table 6-5: Option Links

6.7.Oscillator Sources

A crystal oscillator is fitted on the RSK and used to supply the main and sub clock input to the Renesas microcontroller.

Table 6-6: Oscillators / Resonators

details the oscillators that are fitted and alternative footprints provided on this RSK:

Component		
Crystal (X1)	Fitted	20 MHz (HC/49U package)
Sub clock (X2)	Fitted	32.768 kHz (90SMX package)

Table 6-6: Oscillators / Resonators

6.8.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, User 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 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

The RSK supports Boot mode and Single chip mode.

Details of programming the FLASH memory is described in the R8C/25 Group Hardware Manual.

7.1. Boot mode

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

MODE	LSI State after Reset End
Low	Boot Mode

Table 7-1: Boot Mode pin settings

The software supplied with this RSK supports Boot mode using an E8a and HEW only. However, hardware exists to enter boot mode manually, do not connect the E8a in this case. Press and hold the SW1/BOOT. The mode pin is held in its boot state 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.

When neither the E8a is connected nor the board is placed in boot mode as above, the Mode pin is pulled high by a 4.7k resistor.

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

7.2. Single chip mode

Because the Mode pin is pulled high, this RSK will always boot in Single Chip mode when the E8a is not connected and the boot switch is not depressed. Refer to R8C/25 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 pin settings

Chapter 8. Programming Methods

The board is intended for use with HEW and the supplied E8a debugger. Refer to R8C/25 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 pins. * Marked pins are subject to option links.

J1					
Pin	Circuit Net Name	Device Pin	Pin	Circuit Net Name	Device Pin
1	No Connection	-	2	IIC_SCL	2
3	TRISTn	3	4	IIC_SDA	4
5	MODE_E8B	5	6	RING_P4_3	6
7	RING_P4_4	7	8	RESn	8
9	CON_XOUT	9	10	VSS	10
11	CON_XIN	11	12	UC_VCC	12
13	MO_Wn	13	14	No Connection	-

Table 9-1: J1

J2					
Pin	Circuit Net Name	Device Pin	Pin	Circuit Net Name	Device Pin
1	MO_Vn	14	2	MO_Wp	15
3	MO_Vp	16	4	MO_Un	17
5	TMR0	18	6	MO_Up	19
7	P2_0	20	8	TRIGb	21
9	SCIaCK	22	10	SCIaRX	23
11	SCIaTX	24	12	IRQ3	25
13	No Connection	-	14	No Connection	-

Table 9-2: J2

J3					
Pin	Circuit Net Name	Device Pin	Pin	Circuit Net Name	Device Pin
1	IRQ0/TRIGa*	27	2	IRQ1/IO_6*	28
3	IRQ2/IO_7*	29	4	LCD_E	30
5	LCD_RS	31	6	AD_POT	32
7	P3_1	33	8	TMR1	34
9	IO_5	35	10	IO_4	36
11	IO_3	37	12	AD0	38
13	No Connection	-	14	No Connection	-

Table 9-3: J3

J4					
Pin	Circuit Net Name	Device Pin	Pin	Circuit Net Name	Device Pin
1	No Connection	-	2	AD1	41
3	AD2	42	4	AD3	43
5	P4_2/VREF	44	6	IO_0	45
7	IO_2	46	8	IO_1	47
9	LCD_D7	48	10	LCD_D6	49
11	LCD_D5	50	12	LCD_D4	51
13	MO_UD	52	14	No Connection	-

Table 9-4: J4

9.2. Application Headers

Table 9-5 and Table 9-6 below show the standard application header connections. * Marked pins are subject to option links.

JA1							
Pin	Header Name	RSK Signal Name	Device Pin	Pin	Header Name	RSK Signal Name	Device Pin
1	Regulated Supply 1	CON_5V	-	2	Regulated Supply 1	GROUND	-
3	Regulated Supply 2	CON_3V3	-	4	Regulated Supply 2	GROUND	-
5	Analogue Supply	NC	-	6	Analogue Supply	NC	-
7	Analogue Reference	CON_VREF	44	8	ADTRG	NC	-
9	ADC0	AD0	38	10	ADC1	AD1	41
11	ADC2	AD2	42	12	ADC3	AD3	43
13	DAC0	NC	-	14	DAC1	NC	-
15	IOPort0	IO_0	45	16	IOPort1	IO_1*	47
17	IOPort2	IO_2	46	18	IOPort3	IO_3	37
19	IOPort4	IO_4	36	20	IOPort5	IO_5	35
21	IOPort8	IO_6*	28	22	IOPort7	IO_7*	29
23	IRQ3	IRQ3	25	24	I²C Bus (3rd pin)	NC	-
25	I²C Bus	IIC_SDA	4	26	I²C Bus	IIC_SCL	2

Table 9-5: JA1 Standard Generic Header

JA2							
Pin	Header Name	RSK Signal Name	Device Pin	Pin	Header Name	RSK Signal Name	Device Pin
1	Reset	RESn	8	2	External Clock Input	CON_XIN	11
3	Interrupt	NC	-	4	Regulated Supply 1	GND	-
5	SPARE	NC	-	6	Serial Port	SCIaTX	24
7	Interrupt	IRQ0*	27	8	Serial Port	SCIaRX	23
9	Interrupt	IRQ1*	28	10	Serial Port	SCIaCK	22
11	Motor up/down	MO_UD*	52	12	Serial Port Handshake	NC	-
13	Motor control	MO_Up	19	14	Motor control	MO_Un	17
15	Motor control	MO_Vp	16	16	Motor control	MO_Vn	14
17	Motor control	MO_Wp	15	18	Motor control	MO_W	13
19	Timer Output	TMR0	18	20	Timer Output	TMR1	34
21	Timer Input	TRIGa*	27	22	Timer Input	TRIGb	21
23	Interrupt	IRQ2*	29	24	Tristate Control	TRISTn	3
25	SPARE	P2_0	20	26	SPARE	P3_1	33

Table 9-6: JA2 Standard Generic Header

J9		
Pin	Function	Signal Name
1	Power Supply (for LIN module)	VBAT
2	GROUND	GND
J10		
Pin	Function	Signal Name
1	Power Supply (for LIN module)	VBAT
2	LIN Bus Line	LIN
3	GROUND	GND

Table 9-7: LIN Headers

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 is supplied with the RSK product.

10.2. Mode Support

HEW connects to the Microcontroller and programs it via the E8a. Mode support is handled transparently to the user.

10.3. 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.

10.4. Memory Map

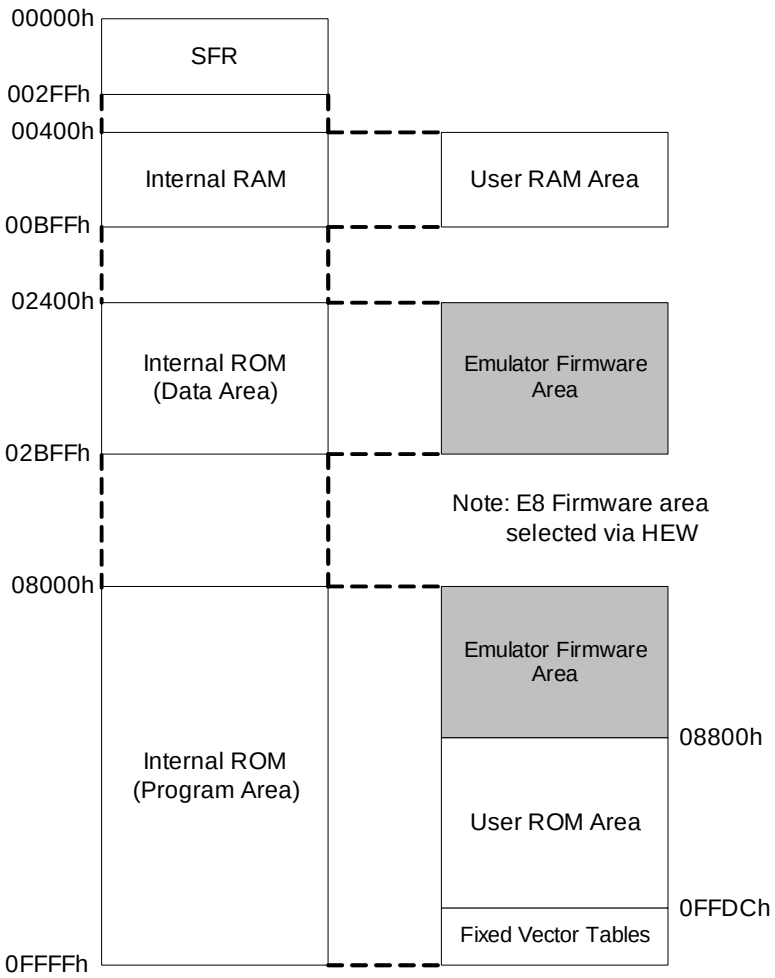

Figure 10-1: Memory Map

Chapter 11. Component Placement

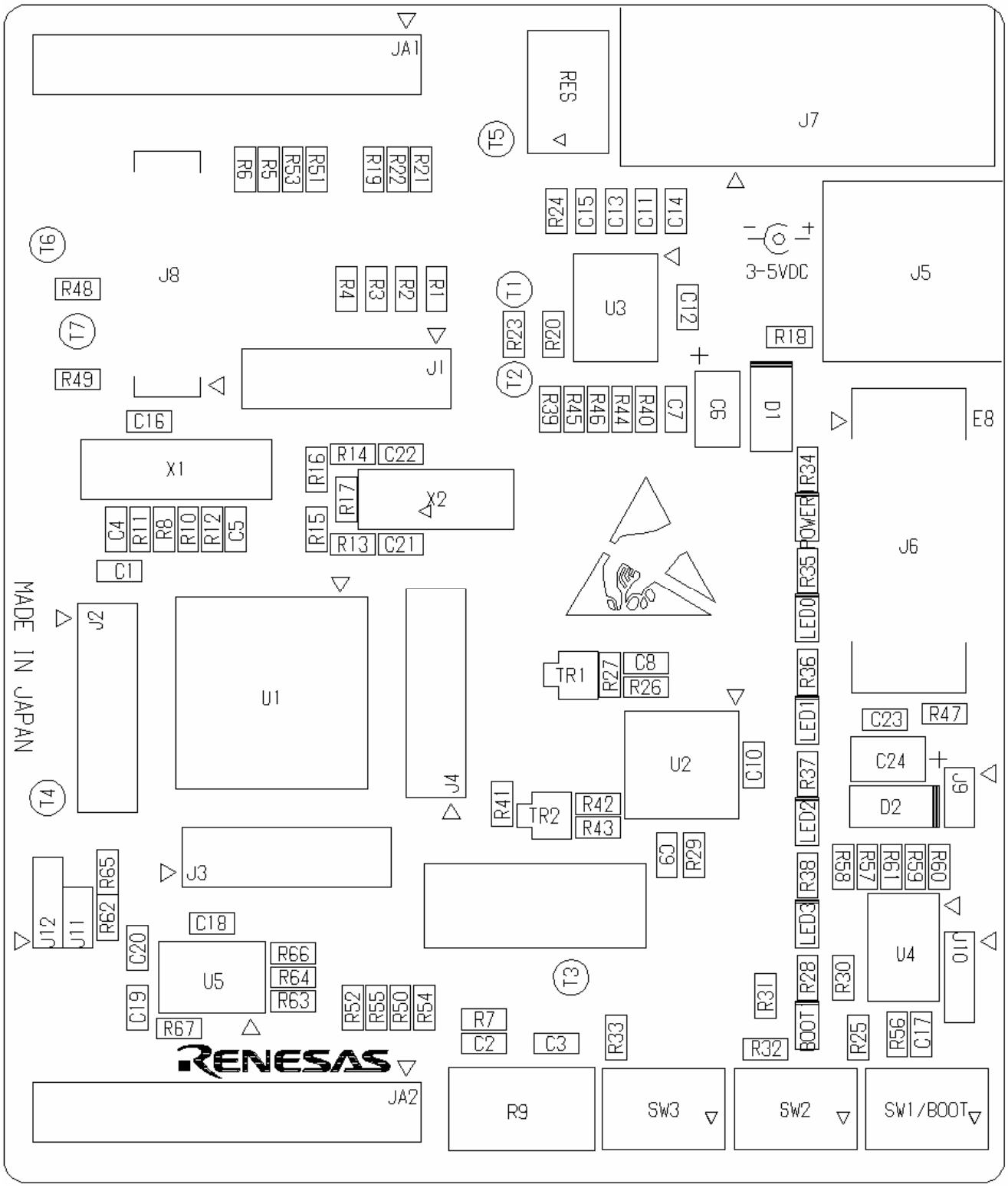

Figure 11-1: Component Placement

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/25 group microcontrollers refer to the R8C/25 Group Hardware Manual

For information about the R8C/25 assembly language, refer to the R8C/Tiny Series Software Programming Manual.

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

Technical Contact Details

America: techsupport.rta@renesas.com

Europe: tools.support.eu@renesas.com

Japan: csc@renesas.com

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Renesas Electronics Corporation
1753, Shimonumabe, Nakahara-ku, Kawasaki-shi, Kanagawa 211-8668 Japan

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