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April 1st, 2010
Renesas Electronics Corporation

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Renesas Starter Kit for 3803L

User's Manual

RENESAS SINGLE-CHIP 8-BIT CMOS
MICROCOMPUTER
740 FAMILY

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Chapter 1. Preface

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Glossary

ADC	Analog to Digital Converter	IRQ	Interrupt ReQuest
CPU	Central Processing Unit	LCD	Liquid Crystal Display
DAC	Digital to Analog Converter	LED	Light Emitting Diode
E8a	E8a On-chip debugger module	LSI	Large Scale Integration
HEW	High-performance Embedded Workshop	MCU	Microcontroller

Chapter 2. Purpose

This Renesas Starter Kit 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 Renesas Starter Kit board contains all the circuitry required for microcontroller operation.

NOTE: This manual describes the technical details of the Renesas Starter Kit for 3803L 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 Renesas Starter Kit operates from a 3V to 5V power supply.

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

All Renesas Starter Kit boards are supplied with an E8a debugger. This product is able to power the board with up to 300mA. When the Renesas Starter Kit is connected to another system then that system should supply power to the Renesas Starter Kit.

All Renesas Starter Kit boards have an optional centre positive supply connector using a 2.1mm barrel power jack.

Warning

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

3.2. Power – Up Behaviour

When the Renesas Starter Kit is purchased the Renesas Starter Kit 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.

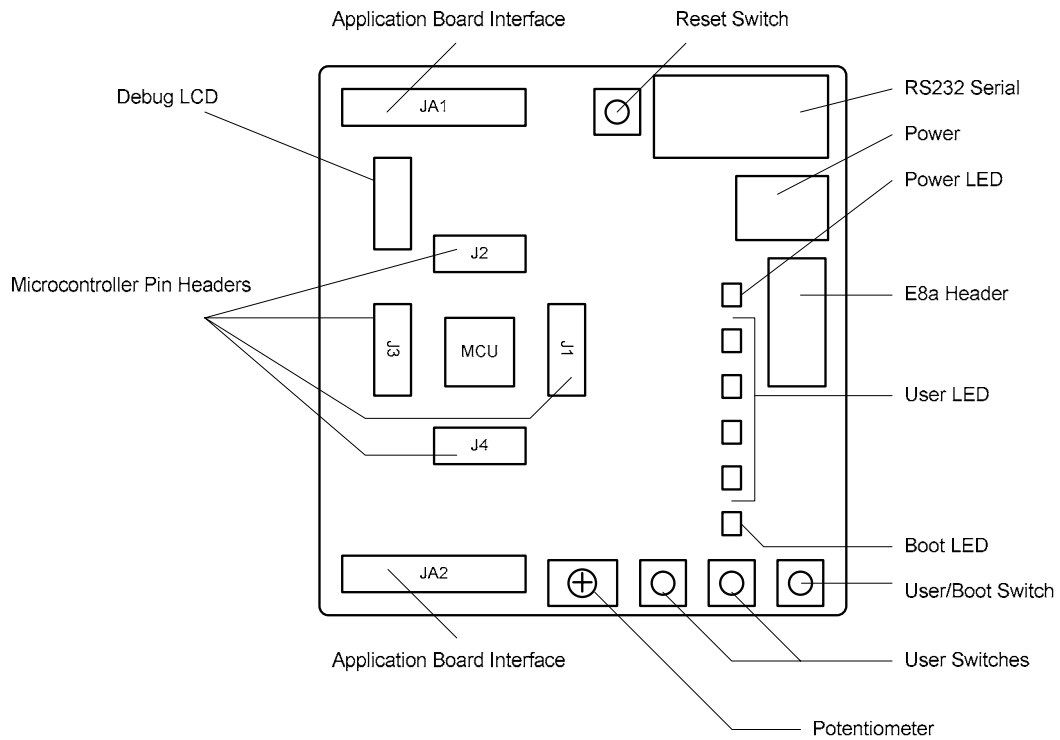


Figure 4-1: Board Layout

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.

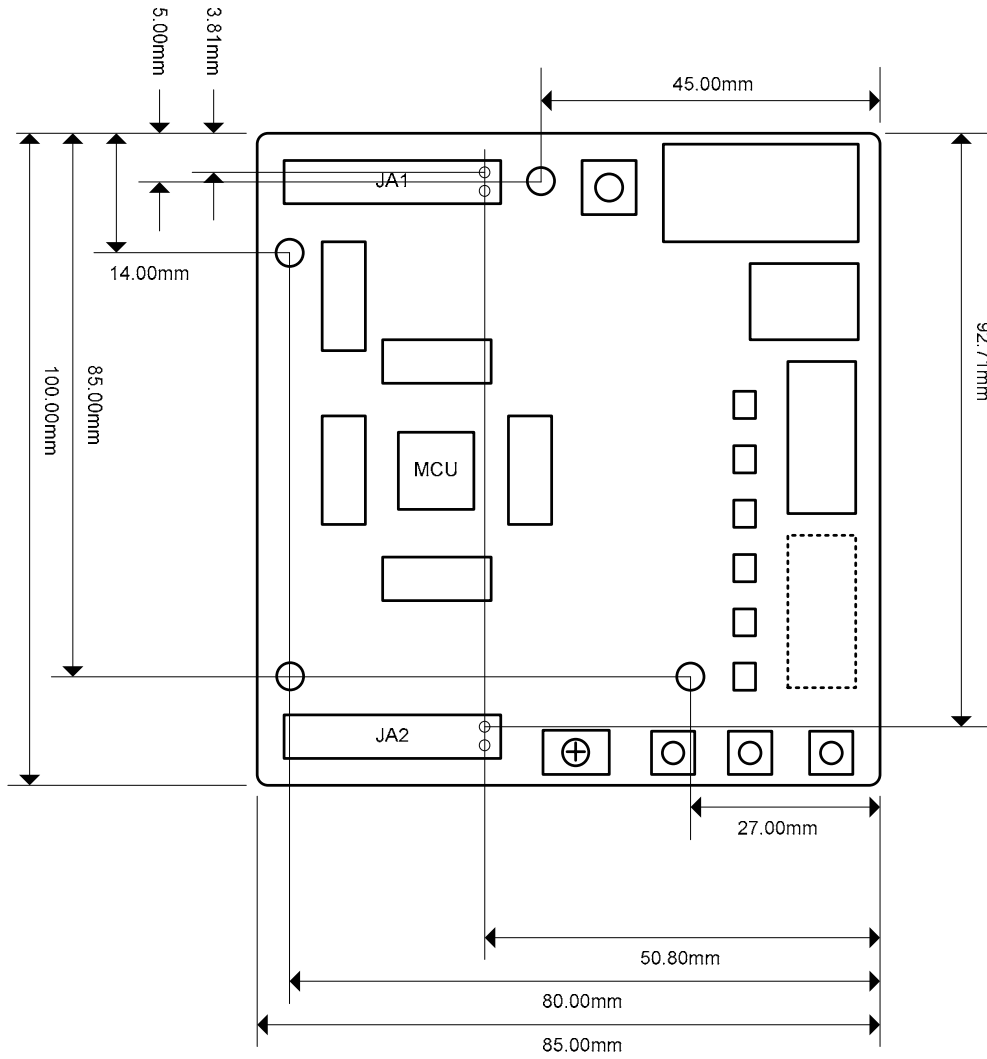


Figure 4-2 : Board Dimensions

Chapter 5. Block Diagram

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

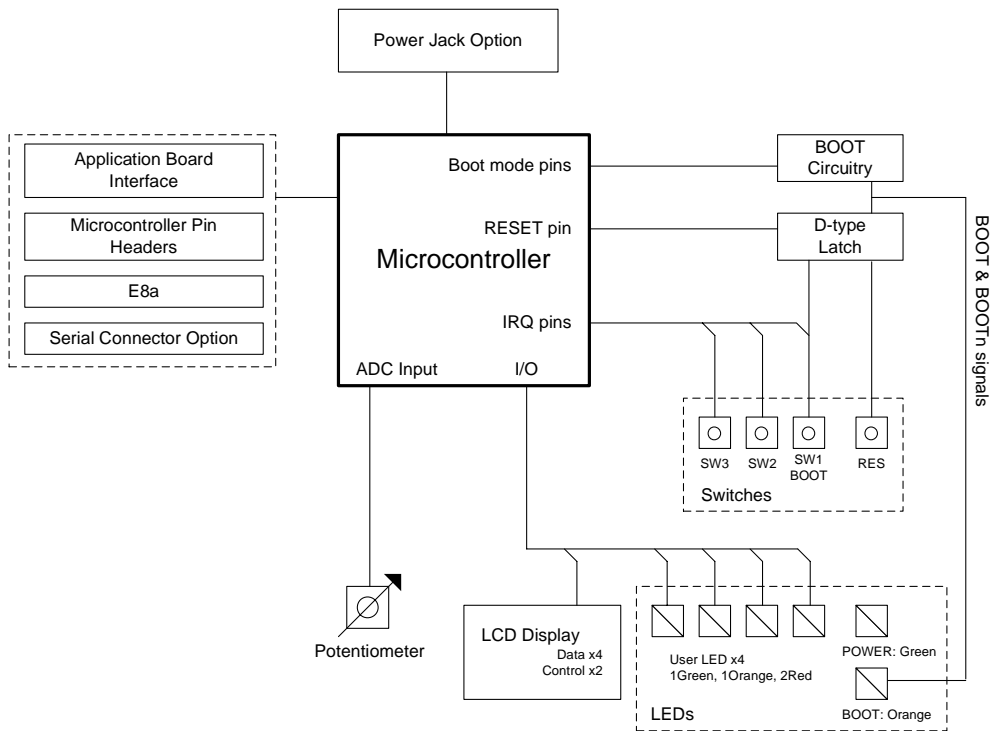


Figure 5-1: Block Diagram

Figure 5-2 is representative of the connections required to the Renesas Starter Kit.

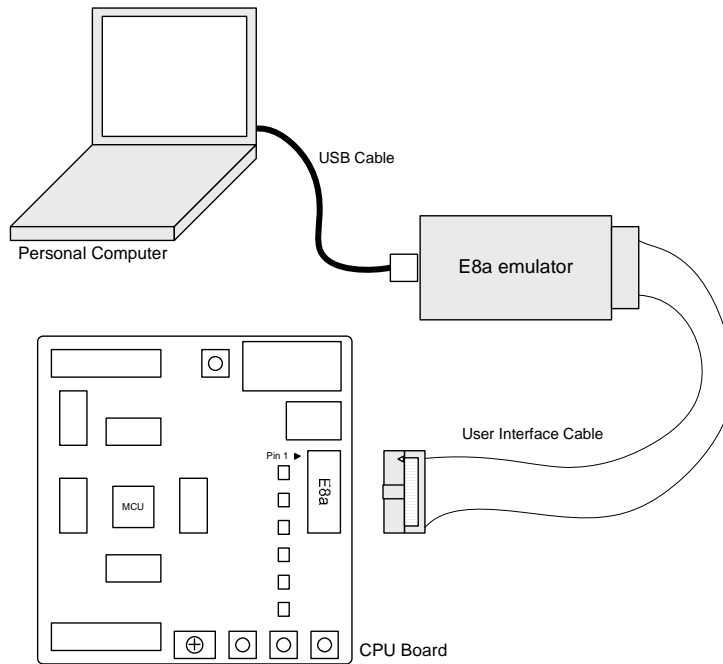


Figure 5-2 : Renesas Starter Kit Connections

Chapter 6. User Circuitry

6.1. Switches

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

Switch	Function	Microcontroller
RES	When pressed, the Renesas Starter Kit microcontroller is reset.	RESET Pin19
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_1 Pin39 (Port 1, pin 1)
SW2*	Connects to a CNTR Interrupt input line for user controls.	CNTR1 Pin6 (Port 5, pin 5)
SW3*	Connects to an IRQ input for user controls.	INT1 Pin17 (Port 4, pin 2)

Table 6-1: Switch Functions

*Refer to schematic for detailed connectivity information.

6.2. LEDs

There are six LEDs on the Renesas Starter Kit 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 2.0	32
LED1	Orange	Port 2.1	31
LED2	Red	Port 2.2	30
LED3	Red	Port 2.3	29

Table 6-2: LED Port

6.3. Potentiometer

A single turn potentiometer is connected to AN4 (P6.4) of the microcontroller. This may be used to vary the input analog voltage value to this pin between VREF and Ground.

6.4. Serial port

The microcontroller programming serial port 1 is connected to the E8a connector. 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	R38
RxD1	Programming Serial Port	R41

Table 6-3: Serial Port settings

Other serial port is connected to the application headers.

6.5. LCD Module

An LCD module is supplied to be connected to the connector J8. This should be fitted so that the LCD module lies over J2. 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 Renesas Starter Kit 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	10
5	R/W (Wired to Write only)	-	6	LCD_E	11
7	No Connection	-	8	No Connection	-
9	No Connection	-	10	No Connection	-
11	LCD_D4	36	12	LCD_D5	35
13	LCD_D6	34	14	LCD_D7	33

Table 6-4: LCD Module Connections

6.6.Option Links

Table 6-5 below describes the function of the option links associated with Power configuration. The default configuration is indicated by **BOLD** text.

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R35	Board VCC	Supply to board from DC Power Jack (J5)	Disconnected	R32
R32	Board VCC	Connects Board_VCC supply to board voltage line	Board_VCC disconnected from board voltage line	R30, R33, R34, R35
R33	Board VCC	Connects External 3V3 (CON_3V3) to Board_VCC	External 3V3 disconnected from Board_VCC	R30, R32, R34
R34	Board VCC	Connects External 5V (CON_5V) to Board_VCC	External 5V disconnected from Board_VCC	R30, R32, R33
R30	Microcontroller VCC	Supply to microcontroller	Fit Low ohm resistor to measure current	R32, R33, R34
R22	User I/O Power Supply	Connects Board_VCC supply to SW2, 3 and LED0-3	Board_VCC disconnected from SW2, 3 and LED0-3	

Table 6-5: Power Configuration Links

Table 6-6 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
R1	Main Clock Oscillator	Connects X1 clock to microcontroller	X1 clock disconnected from microcontroller	R2, R3, R4
R2	Main Clock Oscillator	Connects X1 clock to microcontroller	X1 clock disconnected from microcontroller	R1, R3, R4
R3	Main Clock Oscillator	Connects External Microcontroller header pins to microcontroller	Disconnects sensitive microcontroller signals from external pins	R1, R2, R4
R4	Main Clock Oscillator	Connects External Microcontroller header pins to microcontroller	Disconnects sensitive microcontroller signals from external pins	R1, R2, R3
R14	Sub Clock Oscillator	Parallel resistor for X2 clock	Not fitted	R5, R6
R5	Sub Clock Oscillator	Connects X2 clock to microcontroller	X2 clock disconnected from microcontroller	R14, R6, R7, R8,
R6	Sub Clock Oscillator	Connects X2 clock to microcontroller	X2 clock disconnected from microcontroller	R14, R5, R7, R8
R7	Sub Clock Oscillator	Connects External Microcontroller header pins to microcontroller	Disconnects sensitive microcontroller signals from external pins	R5, R6, R8
R8	Sub Clock Oscillator	Connects External Microcontroller header pins to microcontroller	Disconnects sensitive microcontroller signals from external pins	R5, R6, R7

Table 6-6: Clock Configuration Links

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

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R36	RS232 Transceiver	Disables RS232 Serial Transceiver	Enables RS232 Serial Transceiver	R38, R41
R38	Programming Serial Port	Connects RS232 port to Programming SCI port	Disconnected	R36, R41
R41	Programming Serial Port	Connects RS232 port to Programming SCI port	Disconnected	R36, R38

Table 6-7: Serial Configuration Links

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

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R10	Analog Supply	Connects Board GROUND to Analog Ground	Analog Ground MUST be provided from external interface	R31
R31	Analog Supply	Connects Board_VCC supply to Reference Voltage supply	Reference Voltage MUST be provided from external interface	R10

Table 6-8: Analog Configuration Links

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

Option Link Settings				
Reference	Function	Fitted	Alternative (Removed)	Related To
R23	SW1	Connects SW1 to INT0_1 Input	Disconnected	
R43	E8a	Enables E8a Connection	Do not remove a option resistor	
R48	Microcontroller Pin Function Select	Connects microcontroller pin 40 to TRIGb	MUST be removed if R49 fitted	R49
R49	Microcontroller Pin Function Select	Connects microcontroller pin 40 to IRQ1	Should be removed if R48 fitted	R48

Table 6-9: Other Option Links

6.7.Oscillator Sources

Crystal oscillators are fitted on the Renesas Starter Kit board and used to supply the main and sub clock input to the Renesas microcontroller. Table 6-10 details the oscillator that is fitted and alternative footprints provided on this Renesas Starter Kit:

Component		
Main clock (X1)	Fitted	16 MHz (HC/49U package)
Sub clock (X2)	Fitted	32.768 kHz (90SMX package)

Table 6-10: Oscillators

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 and Single chip 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 Renesas Starter Kit. 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 CNVss pin states as required.

The CNVss pin 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 customers' board meets all the reset timing requirements.

Chapter 7. Modes

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

Details of programming the FLASH memory is described in the 3803 Group (Spec.L) Datasheet.

7.1. Boot mode

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

CNVss	LSI State after Reset End
High	Boot Mode

Table 7-1: Boot Mode pin settings

The software supplied with this Renesas Starter Kit supports Boot mode using an E8a and High-performance Embedded Workshop only. However, hardware exists to enter boot mode manually, do not connect the E8a in this case. Press and hold the SW1/BOOT. The CNVss 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 CNVss pin is pulled low by a 4.7k resistor.

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

7.2. Single chip mode

Because the CNVss pin is pulled low, 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 3803 Group (Spec.L) Datasheet for details of Single chip mode.

CNVss	LSI State after Reset End
Low	Single Chip Mode

Table 7-2: Single Chip Mode pin settings

Chapter 8. Programming Methods

The board is intended for use with High-performance Embedded Workshop and the supplied E8a debugger. Refer to 3803 Group (Spec.L) Datasheet 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.

J1					
Pin	Circuit Net Name	Device Pin	Pin	Circuit Net Name	Device Pin
1	AD2	1	2	AD1	2
3	AD0	3	4	IRQ3	4
5	PWM	5	6	TMR1	6
7	TMR0	7	8	P53	8
9	P52	9	10	LCD_RS	10
11	LCD_E	11	12	E8_BUSY	12
13	E8_SCLK	13	14	PTTX	14
15	PTRX	15	16	IRQ2	16

Table 9-1: J1

J2					
Pin	Circuit Net Name	Device Pin	Pin	Circuit Net Name	Device Pin
1	TRIGa	17	2	E8_CNVSS	18
3	RESn	19	4	XCIN	20
5	XCOUT	21	6	CON_XIN	22
7	CON_XOUT	23	8	GROUND	24
9	P27	25	10	P26	26
11	P25	27	12	P24	28
13	LED3	29	14	LED2	30
15	LED1	31	16	LED0	32

Table 9-2: J2

J3					
Pin	Circuit Net Name	Device Pin	Pin	Circuit Net Name	Device Pin
1	LCD_D7	33	2	LCD_D6	34
3	LCD_D5	35	4	LCD_D4	36
5	P13	37	6	TRISTn	38
7	IRQ0	39	8	IRQ1/TRIGb	40
9	IO_7	41	10	IO_6	42
11	IO_5	43	12	IO_4	44
13	IO_3	45	14	IO_2	46
15	IO_1	47	16	IO_0	48

Table 9-3: J3

J4					
Pin	Circuit Net Name	Device Pin	Pin	Circuit Net Name	Device Pin
1	CTS/RTS	49	2	SClACK	50
3	SClTX	51	4	SClRX	52
5	P33	53	6	P32	54
7	DAC1	55	8	DAC0	56
9	UC_VCC	57	10	CON_VREF	58
11	CON_AVSS	59	12	AD7	60
13	AD6	61	14	AD5	62
15	AD4	63	16	AD3	64

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	Circuit Net Name	Device Pin	Pin	Header Name	Circuit Net 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	CON_AVSS	59
7	Analogue Reference	CON_VREF	58	8	ADTRG	NC	-
9	ADC0	AD0	3	10	ADC1	AD1	2
11	ADC2	AD2	1	12	ADC3	AD3	64
13	DAC0	DAC0	56	14	DAC1	DAC1	55
15	IOPort0	IO_0	48	16	IOPort1	IO_1	47
17	IOPort2	IO_2	46	18	IOPort3	IO_3	45
19	IOPort4	IO_4	44	20	IOPort5	IO_5	43
21	IOPort6	IO_6	42	22	IOPort7	IO_7	41
23	IRQ3	IRQ3	4	24	I ² C Bus (3rd pin)	NC	-
25	I ² C Bus	NC	-	26	I ² C Bus	NC	-

Table 9-5: JA1 Standard Generic Header

JA2							
Pin	Header Name	Circuit Net Name	Device Pin	Pin	Header Name	Circuit Net Name	Device Pin
1	Reset	RESn	19	2	External Clock Input	CON_XIN	22
3	Interrupt	NC	-	4	Regulated Supply 1	GROUND	-
5	WDT overflow	NC	-	6	Serial Port	SClTX	51
7	Interrupt	IRQ0	39	8	Serial Port	SClRX	52
9	Interrupt	IRQ1*	40	10	Serial Port	SClCK	50
11	Motor up/down	NC	-	12	Serial Port Handshake	CTS/RTS	49
13	Motor control	NC	-	14	Motor control	NC	-
15	Motor control	NC	-	16	Motor control	NC	-
17	Motor control	NC	-	18	Motor control	NC	-
19	Timer Output	TMR0	7	20	Timer Output	TMR1	6
21	Timer Input	TRIGa	17	22	Timer Input	TRIGb*	40
23	Interrupt	IRQ2	16	24	Tristate Control	TRISTn	38
25	SPARE	PWM	5	26	SPARE	XCIN	20

Table 9-6: JA2 Standard Generic Header

Chapter 10.Code Development

10.1. Overview

Note: For all code debugging using Renesas software tools, the Renesas Starter Kit board must be connected to a Personal Computer USB port via an E8a. An E8a is supplied with the Renesas Starter Kit product.

10.2. Mode Support

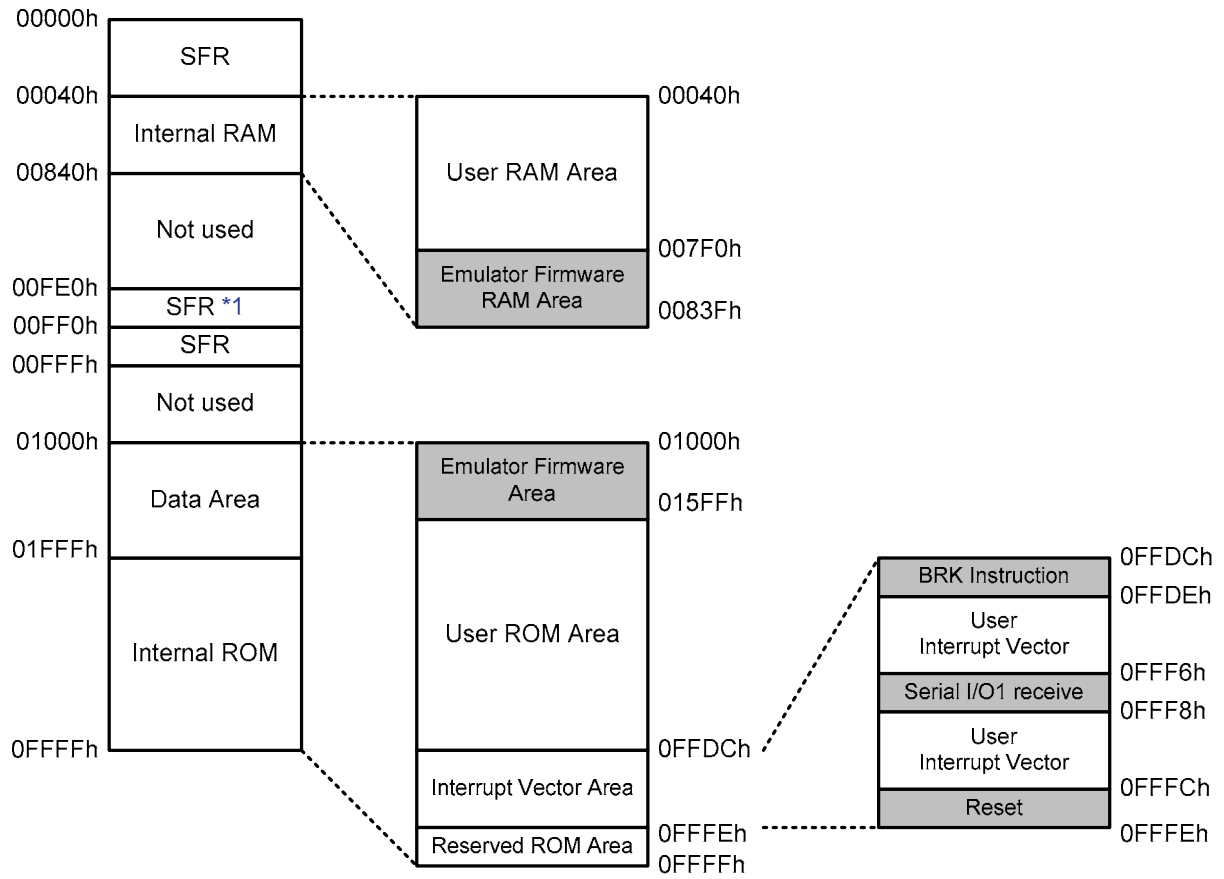
High-performance Embedded Workshop connects to the Microcontroller and programs it via the E8a. Mode support is handled transparently to the user.

10.3. Breakpoint Support

High-performance Embedded Workshop 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



*1: This area is available in the flash memory version only.

Figure 10-1: Memory Map

Chapter 11. Component Placement

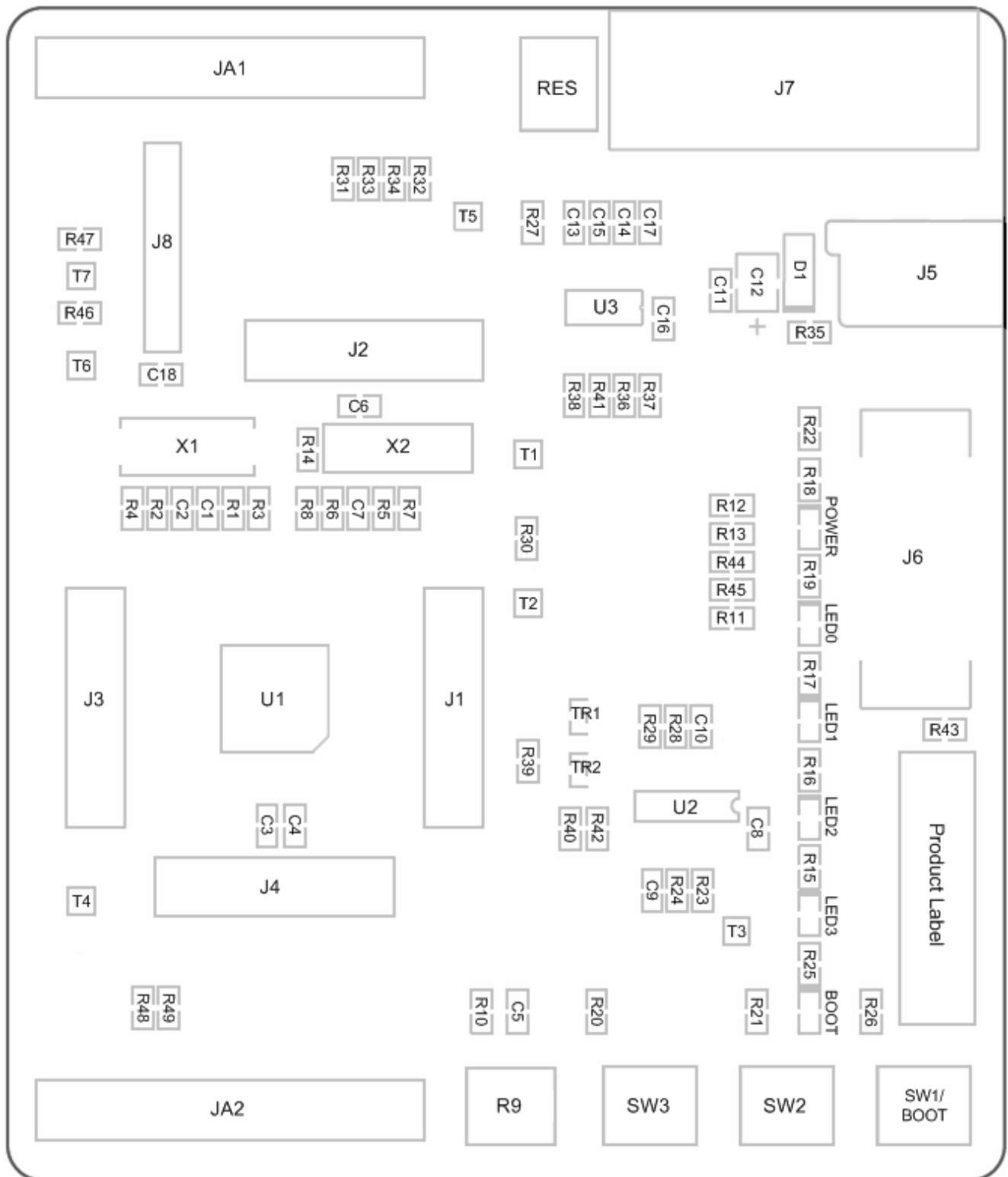


Figure 11-1: Component Placement

Chapter 12. Additional Information

For details on how to use High-performance Embedded Workshop, refer to the High-performance Embedded Workshop manual available on the CD or from the web site.

For information about the 3803 group (Spec.L) microcontrollers refer to the 3803 Group (Spec.L) Datasheet.

For information about the 3803 assembly language, refer to the 740 Family Software Manual.

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

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