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User's Manual

# Renesas Starter Kit 2 for SH7286

## User's Manual

RENESAS SINGLE-CHIP MICROCOMPUTER
SuperH™ RISC engine

Renesas Electronics
www.renesas.com

Rev.1.00 2008.10

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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.

# Table of Contents

# Chapter 1. Preface

**Cautions**

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**Glossary**

| | |
|---|---|
| ADC | Analog to Digital Converter |
| DAC | Digital to Analog Converter |
| HEW | High-Performance Embedded Workbench |
| I/O | Input / Output |
| LCD | Liquid Crystal Display |
| LED | Light Emitting Diode |
| MCU | Microcontroller Unit |
| UART | Universal Asynchronous Receiver / Transmitter |
| USB | Universal Serial Bus |

# Chapter 2. Purpose

This RSK is an evaluation tool for Renesas microcontrollers.

Features include:

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

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

This manual describes the technical details of the RSK hardware. The Quick Start Guide and Tutorial Manual provide details of the software installation and debugging environment.

# Chapter 3. Power Supply

## 3.1. Requirements

This MCU board operates from a 5V DC power supply (supplied).

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

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

**Warning**

**The MCU 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 MCU 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. Pressing any switch will cause the LEDs to 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.

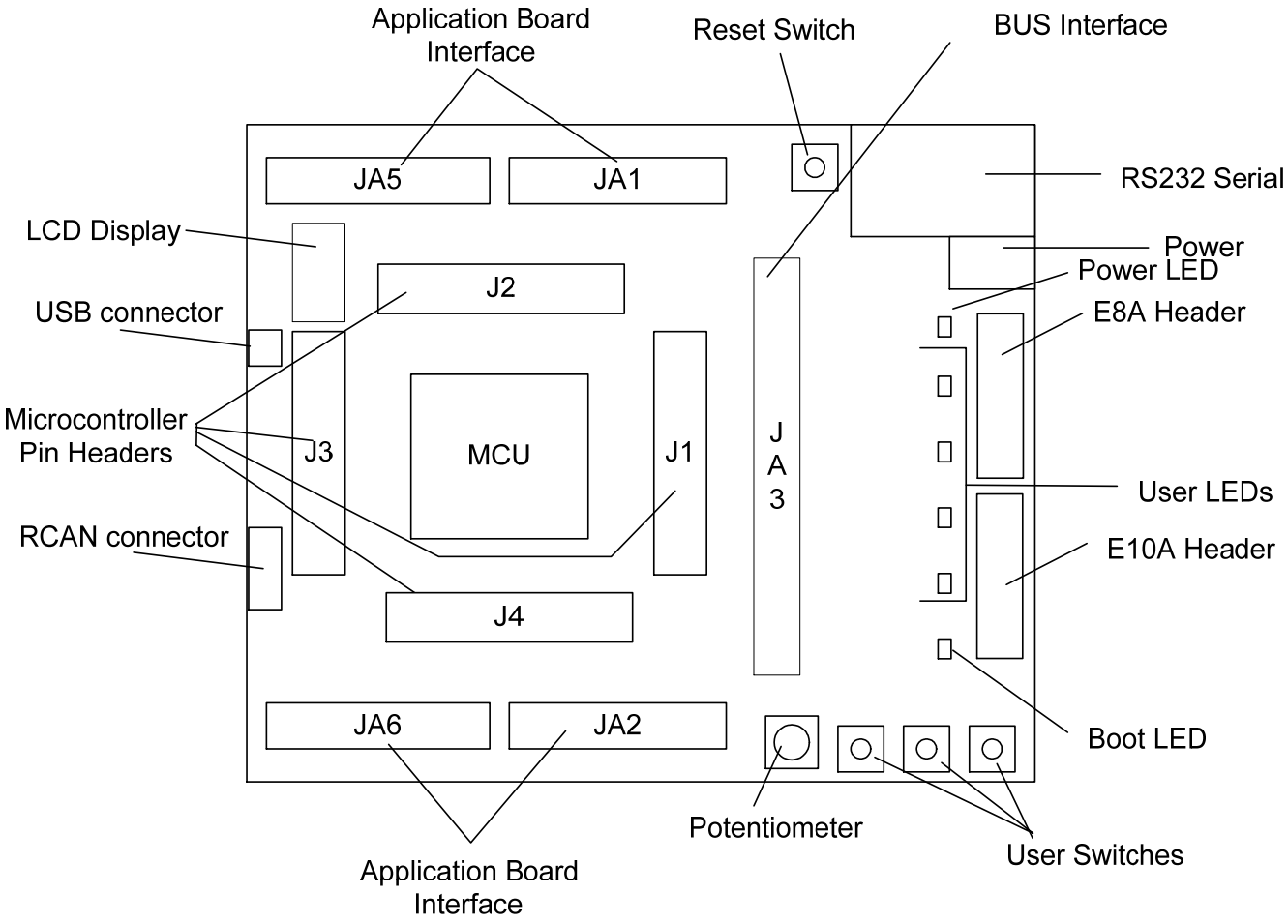


**Figure 4-1: Board Layout**

## 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.

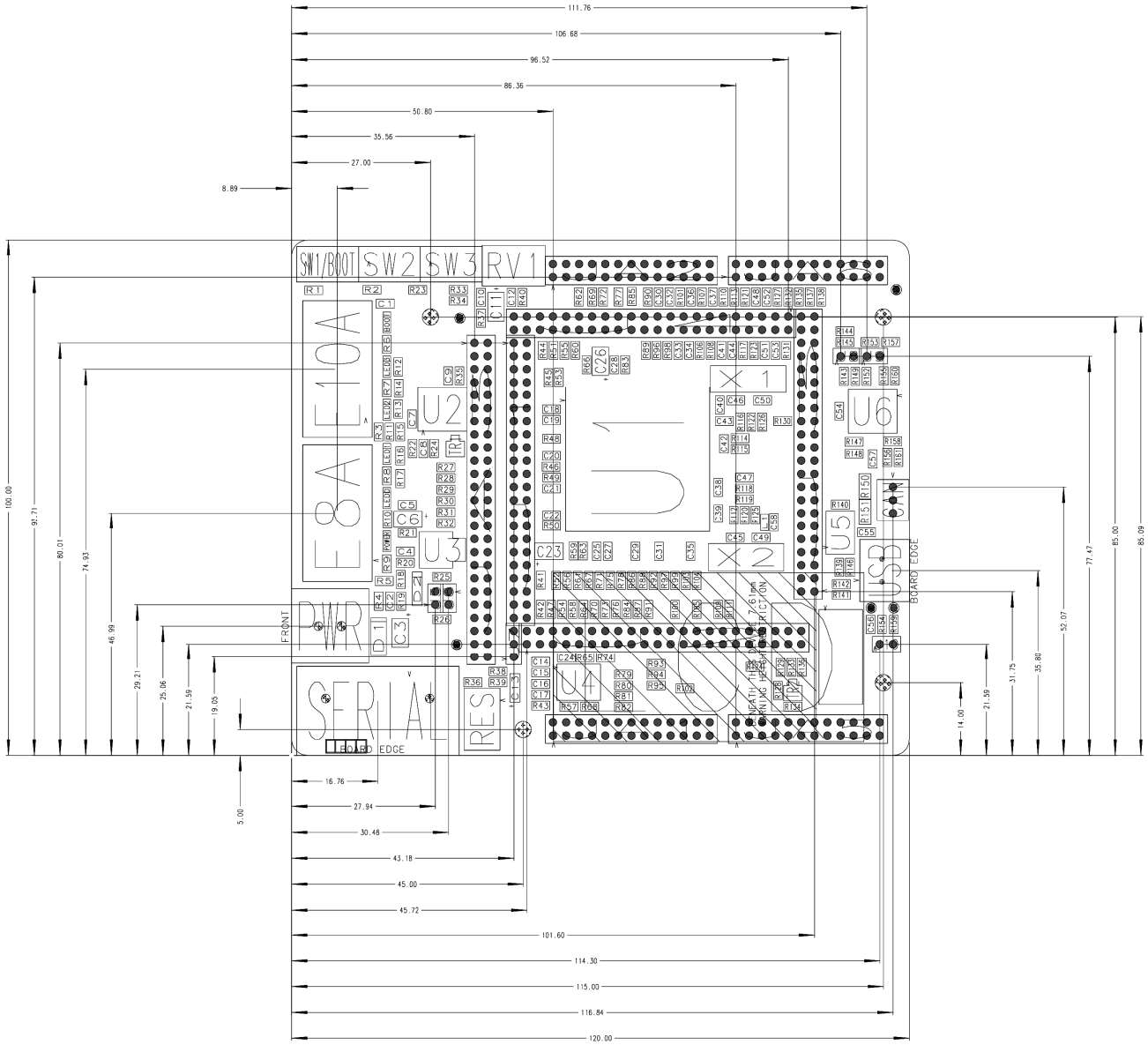


**Figure 4-2 : Board Dimensions**

# Chapter 5. Block Diagram

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

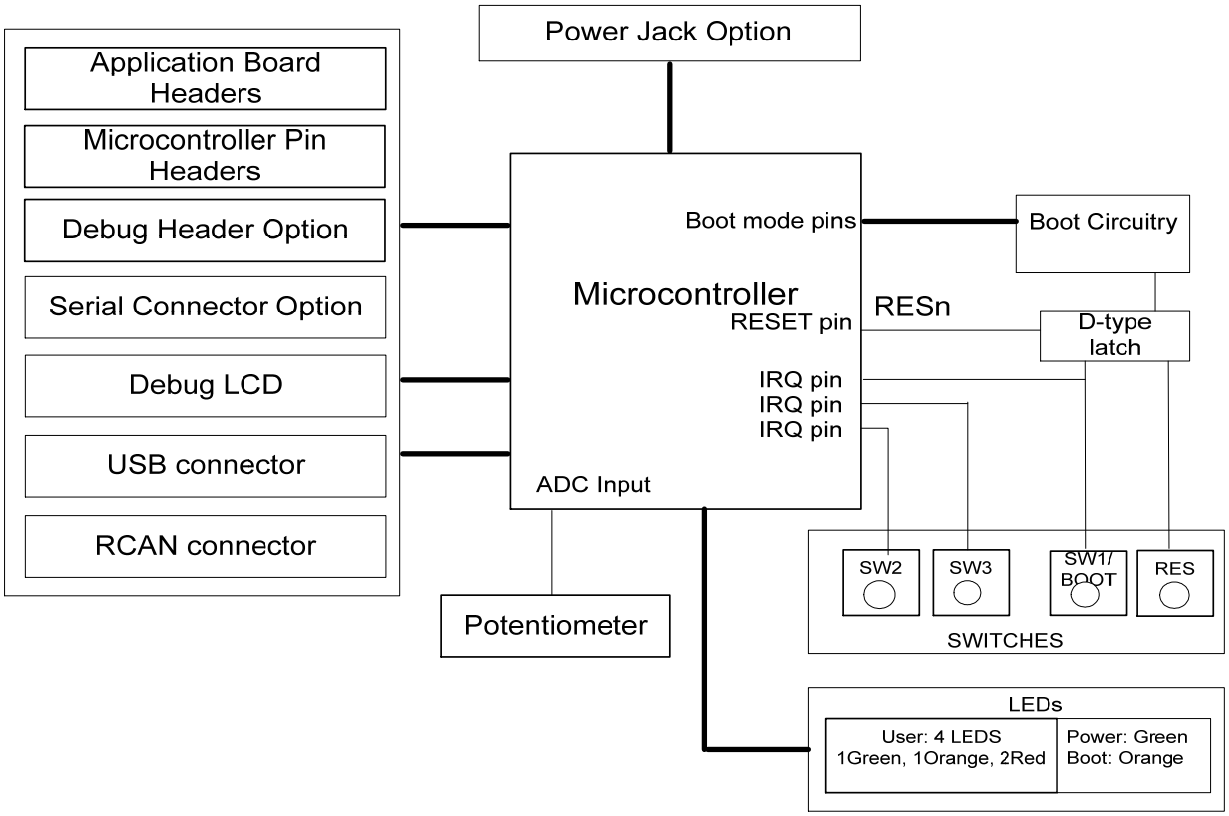


**Figure 5-1: Block Diagram**

Figure 5-2 shows the connections to the RSK.

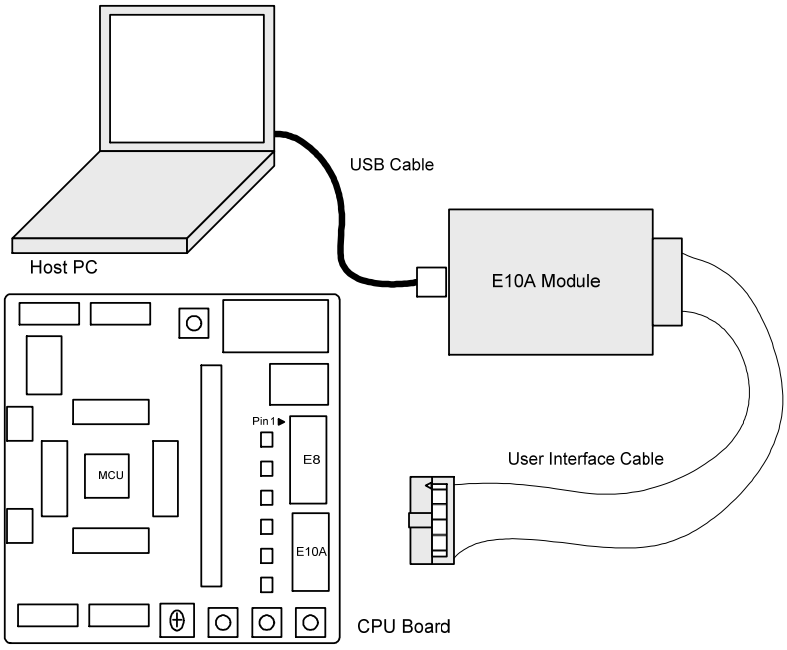


**Figure 5-2 : RSK Connections**

# Chapter 6. User Circuitry

## 6.1. Switches

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

| Switch | Function | Microcontroller |
|---|---|---|
| RES | When pressed, the MCU board microcontroller is reset. | **RESn**, Pin 133 |
| SW1/BOOT* | Connects to an IRQ input for user controls. | **IRQ0**, Pin 57 (Port D, bit 16) |
| SW2* | Connects to an IRQ line for user controls. | **IRQ1**, Pin 58 (Port D, bit 17) |
| SW3* | Connects to an IRQ line for user controls. The same switch may also function as an ADC trigger input. | **IRQ2**, Pin 59 (Port D, bit 18) |

**Table 6-1: Switch Functions**

*Refer to the schematic for detailed connectivity information.

## 6.2. LEDs

There are six LEDs on the MCU 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.

The LED pin references and their corresponding microcontroller port pin connections are shown in **Table 6-2: LED Port**

| LED Reference (As shown on silkscreen) | Microcontroller Port Pin function | Microcontroller Pin Number | Polarity |
|---|---|---|---|
| LED0 | Port B bit 12 | 130 | Active Low |
| LED1 | Port B bit 17 | 98 | Active Low |
| LED2 | Port B bit 18 | 99 | Active Low |
| LED3 | Port B bit 19 | 100 | Active Low |

**Table 6-2: LED Port**

## 6.3. Potentiometer

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

## 6.4. Serial port

One UART channel is connected to the D-type plug in position 'SERIAL' via an RS-232 transceiver. Other channels can be used by changing the 0Ω link resistors. The links to be fitted are listed in **Table 6-3: Serial Options Links**

| Serial port | R81 | R93 | R80 | R95 | R43 | R68 | R39 | R38 |
|---|---|---|---|---|---|---|---|---|
| SCI1 (default) | No fit | No fit | Fit | Fit | No fit | No fit | No fit | No fit |
| SCI2 | No fit | No fit | No fit | No fit | Fit | Fit | No fit | No fit |
| External serial | Fit | Fit | No fit | No fit | No fit | No fit | No fit | No fit |

**Table 6-3: Serial Options Links**

The SCI1 and SCI2 port pins are also available on JA6 header.

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

## 6.5. Debug LCD Module

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

The pin allocation and signal names used on this connector are shown in **Table 6-4:LCD Module connections**

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

| LCD | | | | | |
|---|---|---|---|---|---|
| **Pin** | **Circuit Net Name** | **Device Pin** | **Pin** | **Circuit Net Name** | **Device Pin** |
| 1 | Ground | - | 2 | 5V Only | - |
| 3 | No Connection | - | 4 | DLCDRS | 65 |
| 5 | R/W (Wired to Write only) | - | 6 | DLCDE | 64 |
| 7 | No Connection | - | 8 | No connection | - |
| 9 | No Connection | - | 10 | No connection | - |
| 11 | DLCD4 | 70 | 12 | DLCD5 | 71 |
| 13 | DLCD6 | 72 | 14 | DLCD7 | 73 |

**Table 6-4: LCD Module Connections**

## 6.6.USB Module

The USB module can be used for USB device modes at full speed. **Table 6-5: USB connections** contain details of the signal descriptions and pin connections.

| Description | Function | Microcontroller Pin Number | Header Pins |
|---|---|---|---|
| VBUS_DET | Device mode:<br>External USB power supply monitor pin. | 106 | J3-18 |
| USD+ | USB data I/O pin | 108 | Not available |
| USD- | USB data I/O pin | 109 | Not available |
| CON_USBEXTAL | USB clock pin | 104 | J3-16 |
| CON_USBXTAL | USB clock pin | 103 | J3-15 |

**Table 6-5: USB Connections**

## 6.7.RCAN Module

The RCAN module can be used for CAN interface. **Table 6-6: RCAN connections** contain details of the pin connections.

| Description | Function | Microcontroller Pin Number | Header Pins |
|---|---|---|---|
| CAN H | CAN HIGH differential line | - | CAN-1 |
| CAN L | CAN LOW differential line | - | CAN-3 |
| GROUND | GROUND | - | CAN-2 |

**Table 6-6: CAN Connections**

## 6.8. Option Links

**Table 6-7** below describes the function of the option links contained on this RSK board and associated with Serial Port Configuration.

The default configuration is indicated by **BOLD** text.

| Serial Port Option Link Settings | | | |
|---|---|---|---|
| **Reference** | **Fitted** | **Not fitted** | **Related To** |
| R69 | **Connects the programming port (Rx) to the E8A connector.** | Disconnects the programming port (Rx) from the E8A connector. | R55,R60,R72 |
| R60 | **Connects the programming port (Tx) to the E8A connector.** | Disconnects the programming port (Tx) from the E8A connector. | R69, R55, R72 |
| R74 | Disables the RS-232 Transceiver | **Enables the RS-232 Transceiver** | R65 |
| R68 | Connects the alternate serial port (TXD2) to the D-type connector | **Disconnects the alternate serial port (TXD2) from the D-type connector.** | R38,R39,R43 |
| R43 | Connects serial port RXD2 to the SERIAL D-type connector. | **Disconnects serial port RXD2 from the SERIAL D-type connector.** | R38,R39,R68 |
| R80 | **Connects serial port TXD1 to the SERIAL D-type connector.** | Disconnects serial port TXD1 from the SERIAL D-type connector. | R95 |
| R95 | **Connects serial port RXD1 to the D-type connector.** | Disconnects serial port RXD1 from the D-type connector. | R80 |
| R81 | Routes RS232 serial port TXD1 to application connector (JA6). | **Disconnects RS232 serial port TXD1 from application connector (JA6).** | R80,R95,R93 |
| R93 | Routes the RS-232 serial port RXD1 to application connector (JA6). | **Disconnects the RS-232 serial port RXD1 from application connector (JA6).** | R95,R81,R80 |

**Table 6-7 : Serial port configuration links**

**Table 6-8** below describes the function of the option links contained on this RSK board and associated with Power Configuration.

The default configuration is indicated by **BOLD** text.

| Power Supply Option Link Settings | | | | |
|---|---|---|---|---|
| **Reference** | **Function** | **Fitted** | **Not fitted** | **Related To** |
| R4 | Power Source | **Board can be powered from the PWR connector.** | Disconnects the supply from the PWR connector. | R25, R20 |
| R20 | Power | **Connect Board_VCC to CON_5V.** | Disconnect Board_VCC from CON_5V. | R4, R25, R20 |
| R25 | Power Source | **Connects regulated 5V voltage source to Board_VCC.** | Disconnects regulated 5V voltage source from Board_VCC. | R4, R20 |
| R28 | Microcontroller Power Supply | **Supply power to the Microcontroller.** | Fit a Low ohmic resistor to measure the MCU current. | R4, R25, R20 |
| R32 | Power Source | Connects regulated 3.3V voltage source to Board_VCC. | **Disconnects regulated 3.3V voltage source from Board_VCC.** | R4, R25 R31 |

**Table 6-8: Power configuration links**

**Table 6-9** below describes the function of the option links contained on this RSK board and associated with Vref and Analog supply Configuration.

The default configuration is indicated by **BOLD** text.

| Vref and Analog supply Option Link Settings | | | | |
|---|---|---|---|---|
| **Reference** | **Function** | **Fitted** | **No fitted** | **Related To** |
| R40 | Analog Voltage Source | **Links the analog ground to the digital ground.** | Isolates the analog ground from the digital ground. | - |
| R66 | Voltage Reference Source | Connects VREF to CON_VREF on JA1. | **Disconnects VREF from CON_VREF.** | R83 |
| R83 | Voltage Reference Source | **Connects VREF to Board_5V.** | Disconnects VREF from Board_5V. | R66 |
| R89 | Analog Voltage Source | Connects AVCC to CON_AVCC on JA1. | **Disconnects AVCC from CON_AVCC.** | R96 |
| R96 | Analog Voltage Source | **Connects AVCC to Board_5V.** | Disconnects AVCC from Board_5V. | R89 |

**Table 6-9: Analog configuration links**

**Table 6-10** below describes the function of the option links contained on this RSK board and associated with Pin function.

The default configuration is indicated by **BOLD** text.

| Pin Function select Option Link Settings | | | | |
|---|---|---|---|---|
| **Reference** | **Function** | **Fitted** | **No fitted** | **Related To** |
| R113 | Pin function select | **Connects PIN 169 to RXD2 on JA6.** | Disconnects PIN 169 from RXD2. | R85, R43 |
| R59 | Pin function select | **Connects PIN 79 WRLn on JA3.** | Disconnects PIN 79 from WRLn. | R63 |
| R63 | Pin function select | Connects PIN 79 to WRn on JA3. | **Disconnects PIN 79 from WRn.** | R59 |
| R138 | Pin function select | Connects PIN 171 to M1_TRISTn_SCK2 on JA2. | **Disconnects PIN 171 from M1_TRISTn.** | R137 |
| R44 | Pin function select | **Connects PIN 165 to SCK0 on JA2.** | Disconnects PIN 165 from SCK0. | R51 |
| R47 | Pin function select | Connects PIN 50 to D12 on JA3. | **Disconnects PIN 50 from D12.** | R54 |
| R51 | Pin function select | Connects PIN 165 to CS2n on JA3. | **Disconnects PIN 165 from CS2n.** | R44 |
| R52 | Pin function select | Connects PIN 48 to D10 on JA3. | **Disconnects PIN 48 from D10.** | R56 |
| R54 | Pin function select | **Connects PIN 50 to M2_Vp on JA5.** | Disconnects PIN 50 from M2_Vp. | R47 |
| R55 | Pin function select | Connects PIN 164 to CS1n on JA3. | **Disconnects PIN 164 from CS1n.** | R60 |
| R56 | Pin function select | **Connects PIN 48 to M2_Up on JA5.** | Disconnects PIN 48 from M2_Up. | R52 |
| R58 | Pin function select | Connects PIN 52 to D14 on JA3. | **Disconnects PIN 52 from D14.** | R64 |
| R60 | Pin function select | **Connects PIN 164 to the E8A.** | Disconnects PIN 164 from the E8A. | R55 |
| R61 | Pin function select | Connects PIN 49 to D11 on JA3. | **Disconnects PIN 49 from D11.** | R67 |
| R64 | Pin function select | **Connects PIN 52 to M2_Vn on JA5.** | Disconnects PIN 52 from M2_Vn. | R58 |
| R67 | Pin function select | **Connects PIN 49 to M2_Un on JA5.** | Disconnects PIN 49 from M2_Un. | R61 |
| R69 | Pin function select | **Connects PIN 163 to the E8A.** | Disconnects PIN 163 from the E8A. | R72 |
| R70 | Pin function select | Connects PIN 51 to D13 on JA3. | **Disconnects PIN 51 from D13.** | R73 |

| | | | | |
|---|---|---|---|---|
| R71 | Pin function select | **Connects PIN 10 to IO_1 on JA1.** | Disconnects PIN 10 from IO_1. | R75 |
| R72 | Pin function select | Connects PIN 163 to CS0n on JA3. | **Disconnects PIN 163 from CS0n.** | R69 |
| R73 | Pin function select | **Connects PIN 51 to M2_Wp on JA5.** | Disconnects PIN 51 from M2_Wp. | R70 |
| R75 | Pin function select | Connects PIN 10 to A1 on JA3. | **Disconnects PIN 10 from A1.** | R71 |
| R76 | Pin function select | Connects PIN 53 to D15 on JA3. | **Disconnects PIN 53 from D15.** | R84 |
| R77 | Pin function select | Connects PIN 172 to UD on JA2. | **Disconnects PIN 172 from UD.** | R135 |
| R78 | Pin function select | **Connects PIN 9 to IO_0 on JA1.** | Disconnects PIN 9 from IO_0. | R86 |
| R84 | Pin function select | **Connects PIN 53 to M2_Wn on JA5.** | Disconnects PIN 53 from M2_Wn. | R76 |
| R86 | Pin function select | Connects PIN 9 to A0 on JA3. | **Disconnects PIN 9 from A0.** | R78 |
| R87 | Pin function select | **Connects PIN 138 to AD_POT.** | Disconnects PIN 138 from AD_POT. | R91 |
| R88 | Pin function select | **Connects PIN 12 to IO_3 on JA1.** | Disconnects PIN 12 from IO_3. | R92 |
| R91 | Pin function select | Connects PIN 138 to AN0 on JA1. | **Disconnects PIN 138 from AN0.** | R87 |
| R92 | Pin function select | Connects PIN 12 to A3 on JA3. | **Disconnects PIN 12 from A3.** | R88 |
| R97 | Pin function select | **Connects PIN 11 to IO_2 on JA1.** | Disconnects PIN 11 from IO_2. | R99 |
| R99 | Pin function select | Connects PIN 11 to A2 on JA3. | **Disconnects PIN 11 from A2.** | R97 |
| R100 | Pin function select | **Connects PIN 14 to IO_5 on JA1.** | Disconnects PIN 14 from IO_5. | R45 |
| R103 | Pin function select | **Connects PIN 13 to IO_4 on JA1.** | Disconnects PIN 13 from IO_4. | R104 |
| R45 | Pin function select | Connects PIN 14 to A5 on JA3. | **Disconnects PIN 14 from A5.** | R100 |
| R104 | Pin function select | Connects PIN 13 to A4 on JA3. | **Disconnects PIN 13 from A4.** | R103 |

| | | | | |
|---|---|---|---|---|
| R105 | Pin function select | **Connects PIN 16 to IO_7 on JA1.** | Disconnects PIN 16 from IO_7. | R53 |
| R53 | Pin function select | Connects PIN 16 to A7 on JA3. | **Disconnects PIN 16 from A7.** | R105 |
| R109 | Pin function select | **Connects PIN 15 to IO_6 on JA1.** | Disconnects PIN 15 from IO_6. | R111 |
| R111 | Pin function select | Connects PIN 15 to A6 on JA3. | **Disconnects PIN 15 from A6.** | R109 |
| R41 | Pin function select | Connects PIN 46 to D8 on JA3. | **Disconnects PIN 46 from D8.** | R42 |
| R42 | Pin function select | **Connects PIN 46 to M2_TRISTn on JA5.** | Disconnects PIN 46 from M2_TRISTn. | R41 |
| R135 | Pin function select | **Connects PIN 172 to TXD2 on JA6.** | Disconnects PIN 172 from TXD2. | R77 |
| R137 | Pin function select | **Connects PIN 171 to SCK2 on JA6.** | Disconnects PIN 171 from SCK2. | R138 |
| R85 | Pin function select | Connects PIN 169 to TRIGb on JA2. | **Disconnects PIN 169 from TRIGb.** | R113 |

**Table 6-10: Pin function configuration links**

**Table 6-11: Clock configuration links** below describes the function of the option links associated with Clock configuration. The default configuration is indicated by **BOLD** text.

| Clock Configuration Option Link Settings | | | | |
|---|---|---|---|---|
| **Reference** | **Function** | **Fitted** | **Not fitted** | **Related To** |
| R112 | USB clock oscillator | Connects the external USB clock from the MCU | **Disconnects the external USB clock from the MCU** | R120, R118, R119 |
| R115 | Clock Oscillator | Connects the external clock to the MCU. | **Disconnects the external clock connection to the MCU.** | R116, R114, R122 |
| R118 | USB clock oscillator | Connects the external USB clock to the MCU | **Disconnects the external USB clock to the MCU** | R120, R112, R119 |
| R120 | USB clock oscillator | **Connects the on-board USB clock to the MCU.** | External Clock Source can be connected. | R112, R118, R119 |
| R119 | USB clock oscillator | **Connects the on-board USB clock from the MCU.** | External Clock Source can be connected. | R112, R120, R118 |
| R126 | Clock Oscillator | Parallel resistor for crystal. | **Not fitted.** | - |
| R122 | Clock Oscillator | **Connects the on-board clock from the MCU.** | External Clock Source can be connected. | R115, R114, R116 |
| R116 | Clock Oscillator | Connects external clock from MCU. | **Disconnects the external clock connection to the MCU.** | R115, R114, R122 |

**Table 6-11: Clock configuration links**

## 6.9. Oscillator Sources

A crystal oscillator is fitted on the MCU board and used to supply the main clock input to the Renesas microcontroller. The oscillators that are fitted and alternative footprints provided on this MCU board are detailed in **Table 6-12: Oscillators / Resonators**

| Component | | |
|---|---|---|
| Crystal (X1) | Fitted | 12.5MHz (HC49/4H package) |
| Crystal (X2) | Fitted | 48MHz (HC49/4H package) |

**Table 6-12: Oscillators / Resonators**

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

## 6.10. Reset Circuit

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

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

The reset is held in the active state for a fixed period by a 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 MCU board can be configured in User mode and Boot mode. User mode may be used to run and debug user code, while Boot mode may only be used to program the Renesas microcontroller with program code via the SCI1 interface. Further details of programming the flash are available in the SH7286 device hardware manual.

**The MCU board provides the capability of changing between User and Boot / User Boot modes using a simple latch circuit. This is only to provide a simple mode control on this board when the E10A debugger is not in use.**

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

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

## 7.1. Boot mode

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

| FWE | MD1 | MD0 | LSI State after Reset End |
|---|---|---|---|
| 1 | 0 | 0 | Boot Mode |

**Table 7-1: Boot Mode pin settings**

## 7.2. User Mode

The SH7286 supports various user modes. The default user program mode for the RSKSH7286 is as shown in Table 7-2.

| WE | MD1 | MD0 | LSI State after Reset End |
|---|---|---|---|
| 1 | 1 | 0 | User Program Mode |

**Table 7-2: User Program Mode pin settings**

The SH7286 supports another user mode. The user boot mode for the RSKSH7286 is shown in Table 7-3.

| WE | MD1 | MD0 | LSI State after Reset End |
|---|---|---|---|
| 1 | 0 | 1 | User Boot Mode |

**Table 7-3: User Boot Mode pin settings**

# Chapter 8. Programming Methods

The board is intended for use with HEW and the supplied E10A debugger only. Please refer to S*H7280 Group Hardware Manual* for details of the programming methods using the on-chip serial port SCI0 and without using E10A debugger.

# Chapter 9. Headers

## 9.1. Microcontroller Headers

The microcontroller pin headers and their corresponding microcontroller connections are detailed in this section (Table 9-1 to Table 9-4). The header pins connect directly to the microcontroller pins.

| J1 | | | | | |
|---|---|---|---|---|---|
| **Pin** | **Circuit Net Name** | **Device Pin** | **Pin** | **Circuit Net Name** | **Device Pin** |
| 1 | M1_Vn | 1 | 23 | Ground | 23 |
| 2 | M1_Wn | 2 | 24 | A13 | 24 |
| 3 | UC_VCC | 3 | 25 | A14 | 25 |
| 4 | Not connected | 4 | 26 | A15 | 26 |
| 5 | Ground | 5 | 27 | A16 | 27 |
| 6 | PIN6 | 6 | 28 | A17 | 28 |
| 7 | CASn | 7 | 29 | SCL | 29 |
| 8 | RASn | 8 | 30 | SDA | 30 |
| 9 | A0_IO_0 | 9 | 31 | A18 | 31 |
| 10 | A1_IO_1 | 10 | 32 | A19 | 32 |
| 11 | A2_IO_2 | 11 | 33 | A20 | 33 |
| 12 | A3_IO_3 | 12 | 34 | UC_VCC | 34 |
| 13 | A4_IO_4 | 13 | 35 | Ground | 35 |
| 14 | A5_IO_5 | 14 | 36 | D0 | 36 |
| 15 | A6_IO_6 | 15 | 37 | D1 | 37 |
| 16 | A7_IO_7 | 16 | 38 | D2 | 38 |
| 17 | A8 | 17 | 39 | D3 | 39 |
| 18 | A9 | 18 | 40 | D4 | 40 |
| 19 | A10 | 19 | 41 | D5 | 41 |
| 20 | A11 | 20 | 42 | D6 | 42 |
| 21 | A12 | 21 | 43 | D7 | 43 |
| 22 | UC_VCC | 22 | 44 | UC_VCC | 44 |

**Table 9-1: J1 microcontroller header**

| J2 | | | | | |
|---|---|---|---|---|---|
| **Pin** | **Circuit Net Name** | **Device Pin** | **Pin** | **Circuit Net Name** | **Device Pin** |
| 1 | Ground | 45 | 23 | Ground | 67 |
| 2 | D8_M2_TRISTn | 46 | 24 | DREQ | 68 |
| 3 | D9 | 47 | 25 | DACK | 69 |
| 4 | D10_M2_Up | 48 | 26 | DLCD4 | 70 |
| 5 | D11_M2_Un | 49 | 27 | DLCD5 | 71 |
| 6 | D12_M2_Vp | 50 | 28 | DLCD6 | 72 |
| 7 | D13_M2_Wp | 51 | 29 | DLCD7 | 73 |
| 8 | D14_M2_Vn | 52 | 30 | ADTRGn | 74 |
| 9 | D15_M2_Wn | 53 | 31 | UC_VCC | 75 |
| 10 | Not connected | - | 32 | Ground | 76 |
| 11 | UC_VCC | 55 | 33 | CAN_EN | 77 |
| 12 | Ground | 56 | 34 | RDn | 78 |
| 13 | IRQ0 | 57 | 35 | WRn_WRLn | 79 |
| 14 | IRQ1 | 58 | 36 | WRHn | 80 |
| 15 | IRQ2 | 59 | 37 | CAN_ERRn | 81 |
| 16 | IRQ3 | 60 | 38 | CAN_STBn | 82 |
| 17 | SCK4 | 61 | 39 | TCLKD | 83 |
| 18 | TXD4 | 62 | 40 | TCLKC | 84 |
| 19 | RXD4 | 63 | 41 | SCK3 | 85 |
| 20 | DLCDE | 64 | 42 | PIN86 | 86 |
| 21 | DLCDRS | 65 | 43 | UC_VCC | 87 |
| 22 | UC_VCC | 66 | 44 | Ground | 88 |

**Table 9-2: J2 microcontroller header**

| J3 | | | | | |
|---|---|---|---|---|---|
| **Pin** | **Circuit Net Name** | **Device Pin** | **Pin** | **Circuit Net Name** | **Device Pin** |
| 1 | TDI | 89 | 23 | PB10 | 111 |
| 2 | TDO | 90 | 24 | Ground | 112 |
| 3 | TCK | 91 | 25 | CON_XTAL | 113 |
| 4 | TMS | 92 | 26 | UC_VCC | 114 |
| 5 | TRSTn | 93 | 27 | CON_EXTAL | 115 |
| 6 | UC_VCC | 94 | 28 | NMI | 116 |
| 7 | Ground | 95 | 29 | Ground | 117 |
| 8 | A21 | 96 | 30 | NC | - |
| 9 | A22 | 97 | 31 | NC | - |
| 10 | LED1 | 98 | 32 | TIOC0A | 120 |
| 11 | LED2 | 99 | 33 | TIOC0B | 121 |
| 12 | LED3 | 100 | 34 | TIOC0C | 122 |
| 13 | UC_VCC | 101 | 35 | TEND | 123 |
| 14 | Ground | 102 | 36 | TMR0 | 124 |
| 15 | CON_USBXTAL | 103 | 37 | TMR1 | 125 |
| 16 | CON_USBEXTAL | 104 | 38 | TRIGa | 126 |
| 17 | USPND | 105 | 39 | UC_VCC | 127 |
| 18 | VBUS_DET | 106 | 40 | Ground | 128 |
| 19 | NC | - | 41 | PIN129 | 129 |
| 20 | NC | - | 42 | LED0 | 130 |
| 21 | NC | - | 43 | CAN1TX | 131 |
| 22 | NC | - | 44 | CAN1RX | 132 |

**Table 9-3: J3 microcontroller header**

| J4 | | | | | |
|---|---|---|---|---|---|
| **Pin** | **Circuit Net Name** | **Device Pin** | **Pin** | **Circuit Net Name** | **Device Pin** |
| 1 | RESn | 133 | 23 | AVSS | 155 |
| 2 | FWE_ASEBRKn | 134 | 24 | AVCC | 156 |
| 3 | ASEMD0n | 135 | 25 | AVSS | 157 |
| 4 | AVSS | 136 | 26 | DA0 | 158 |
| 5 | AVCC | 137 | 27 | DA1 | 159 |
| 6 | AN0_ADPOT | 138 | 28 | MD0 | 160 |
| 7 | AN1 | 139 | 29 | MD1 | 161 |
| 8 | AN2 | 140 | 30 | WDT_OVFn | 162 |
| 9 | AN3 | 141 | 31 | PTRX_CS0n | 163 |
| 10 | AN4 | 142 | 32 | PTTX_CS1n | 164 |
| 11 | AN5 | 143 | 33 | SCK0_CS2n | 165 |
| 12 | AN6 | 144 | 34 | RXD1 | 166 |
| 13 | AN7 | 145 | 35 | TXD1 | 167 |
| 14 | VREF | 146 | 36 | SCK1 | 168 |
| 15 | AVSS | 147 | 37 | TRIGb_RXD2 | 169 |
| 16 | AVCC | 148 | 38 | Ground | 170 |
| 17 | AVSS | 149 | 39 | M1_TRISTn_SCK2 | 171 |
| 18 | AN8 | 150 | 40 | UD_TXD2 | 172 |
| 19 | AN9 | 151 | 41 | M1_Up | 173 |
| 20 | AN10 | 152 | 42 | M1_Un | 174 |
| 21 | AN11 | 153 | 43 | M1_Vp | 175 |
| 22 | VREF | 154 | 44 | M1_Wp | 176 |

**Table 9-4: J4 microcontroller header**

## 9.2. Application Headers

Standard application header connections are detailed in this section (Table 9-5 to Table 9-9).

* marks pins where a link to the microcontroller pin is via a fitted 0Ω link

| JA1 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Pin** | **Header Name** | **MCU board Signal Name** | **Device Pin** | **Pin** | **Header Name** | **MCU board Signal Name** | **Device Pin** |
| 1 | 5V | CON_5V | --- | 14 | DAC1 | DA1 | 159 |
| 2 | 0V(5V) | GROUND | --- | 15 | IO_0 | IO_0 | 9* |
| 3 | 3V3 | CON_3V3 | --- | 16 | IO_1 | IO_1 | 10* |
| 4 | 0V(3V3) | GROUND | --- | 17 | IO_2 | IO_2 | 11* |
| 5 | AVcc | CON_AVCC | 137, 148, 156 | 18 | IO_3 | IO_3 | 12* |
| 6 | AVss | CON_AVSS | 136, 149, 157 | 19 | IO_4 | IO_4 | 13* |
| 7 | AVref | CON_VREF | 146, 154 | 20 | IO_5 | IO_5 | 14* |
| 8 | ADTRG | ADTRGn | 74 | 21 | IO_6 | IO_6 | 15* |
| 9 | AD0 | AN0 | 138* | 22 | IO_7 | IO_7 | 16* |
| 10 | AD1 | AN1 | 139 | 23 | IRQ3 | IRQ3 | 60 |
| 11 | AD2 | AN2 | 140 | 24 | IIC_EX | NC | --- |
| 12 | AD3 | AN3 | 141 | 25 | IIC_SDA | SDA | 30 |
| 13 | DAC0 | DA0 | 158 | 26 | IIC_SCL | SCL | 29 |

**Table 9-5: JA1 Standard Generic Header**

| JA2 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Pin** | **Header Name** | **MCU board Signal Name** | **Device Pin** | **Pin** | **Header Name** | **MCU board Signal Name** | **Device Pin** |
| 1 | RESn | RESn | 133 | 14 | Un | M1_Un | 174 |
| 2 | EXTAL | CON_EXTAL | 115 | 15 | Vp | M1_Vp | 175 |
| 3 | NMI | NMI | 116 | 16 | Vn | M1_Vn | 1 |
| 4 | Vss1 | GROUND | - | 17 | Wp | M1_Wp | 176 |
| 5 | WDT_OVF | WDT_OVFn | 162 | 18 | Wn | M1_Wn | 2 |
| 6 | SCIaTX | PTTX | 164 | 19 | TMR0 | TMR0 | 124 |
| 7 | IRQ0 | IRQ0 | 57 | 20 | TMR1 | TMR1 | 125 |
| 8 | SCIaRX | PTRX | 163 | 21 | TRIGa | TRIGa | 126 |
| 9 | IRQ1 | IRQ1 | 58 | 22 | TRIGb | TRIGb | 169 |
| 10 | SCIaCK | SCK0 | 165 | 23 | IRQ2 | IRQ2 | 59 |
| 11 | UD | UD | 172 | 24 | TRISTn | M1_TRISTn | 171 |
| 12 | CTSRTS | NC | --- | 25 | Reserved | NC | - |
| 13 | Up | M1_Up | 173 | 26 | Reserved | NC | - |

**Table 9-6: JA2 Standard Generic Header**

| JA3 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pin | Header Name | MCU board Signal Name | Device Pin | Pin | Header Name | MCU board Signal Name | Device Pin |
| 1 | A0 | A0 | 9* | 26 | WRn | WRn | 79* |
| 2 | A1 | A1 | 10* | 27 | CS0n | CS0n | 163* |
| 3 | A2 | A2 | 11* | 28 | CS1n | CS1n | 164* |
| 4 | A3 | A3 | 12* | 29 | D8 | D8 | 46* |
| 5 | A4 | A4 | 13* | 30 | D9 | D9 | 47 |
| 6 | A5 | A5 | 14* | 31 | D10 | D10 | 48* |
| 7 | A6 | A6 | 15* | 32 | D11 | D11 | 49* |
| 8 | A7 | A7 | 16* | 33 | D12 | D12 | 50* |
| 9 | A8 | A8 | 17 | 34 | D13 | D13 | 51* |
| 10 | A9 | A9 | 18 | 35 | D14 | D14 | 52* |
| 11 | A10 | A10 | 19 | 36 | D15 | D15 | 53* |
| 12 | A11 | A11 | 20 | 37 | A16 | A16 | 27 |
| 13 | A12 | A12 | 21 | 38 | A17 | A17 | 28 |
| 14 | A13 | A13 | 24 | 39 | A18 | A18 | 31 |
| 15 | A14 | A14 | 25 | 40 | A19 | A19 | 32 |
| 16 | A15 | A15 | 26 | 41 | A20 | A20 | 33 |
| 17 | D0 | D0 | 36 | 42 | A21 | A21 | 96 |
| 18 | D1 | D1 | 37 | 43 | A22 | A22 | 97 |
| 19 | D2 | D2 | 38 | 44 | SDCLK | NC | --- |
| 20 | D3 | D3 | 39 | 45 | CS2n | CS2n | 165* |
| 21 | D4 | D4 | 40 | 46 | ALE | NC | --- |
| 22 | D5 | D5 | 41 | 47 | WRHn | WRHn | 80 |
| 23 | D6 | D6 | 42 | 48 | WRLn | WRLn | 79* |
| 24 | D7 | D7 | 43 | 49 | CASn | CASn | 7 |
| 25 | RDn | RDn | 78 | 50 | RASn | RASn | 8 |

**Table 9-7: JA3 Standard Generic Header**

| JA5 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pin | Header Name | MCU board Signal Name | Device Pin | Pin | Header Name | MCU board Signal Name | Device Pin |
| 1 | AD4 | AN4 | 142 | 13 | TIOC0A | TIOC0A | 120 |
| 2 | AD5 | AN5 | 143 | 14 | TIOC0B | TIOC0B | 121 |
| 3 | AD6 | AN6 | 144 | 15 | TIOC0C | TIOC0C | 122 |
| 4 | AD7 | AN7 | 145 | 16 | M2_TRISTn | M2_TRISTn | 46* |
| 5 | CAN1TX | CAN1TX | 131 | 17 | TCLKC | TCLKC | 84 |
| 6 | CAN1RX | CAN1RX | 132 | 18 | TCLKD | TCLKD | 83 |
| 7 | CAN2TX | NC | --- | 19 | M2_Up | M2_Up | 48* |
| 8 | CAN2RX | NC | --- | 20 | M2_Un | M2_Un | 49* |
| 9 | AD8 | AN8 | 150 | 21 | M2_Vp | M2_Vp | 50* |
| 10 | AD9 | AN9 | 151 | 22 | M2_Vn | M2_Vn | 51* |
| 11 | AD10 | AN10 | 152 | 23 | M2_Wp | M2_Wp | 52* |
| 12 | AD11 | AN11 | 153 | 24 | M2_Wn | M2_Wn | 53* |

**Table 9-8: JA5 Standard Generic Header**

| JA6 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pin | Header Name | MCU board Signal Name | Device Pin | Pin | Header Name | MCU board Signal Name | Device Pin |
| 1 | DREQ | DREQ | 68 | 13 | Reserved | NC | - |
| 2 | DACK | DACK | 69 | 14 | Reserved | NC | - |
| 3 | TEND | TEND | 123 | 15 | Reserved | NC | - |
| 4 | STBYn | NC | --- | 16 | Reserved | NC | - |
| 5 | RS232TX | RS232TX | --- | 17 | Reserved | NC | - |
| 6 | RS232RX | RS232RX | --- | 18 | Reserved | NC | - |
| 7 | SCIbRX | RXD1 | 166 | 19 | Reserved | NC | - |
| 8 | SCIbTX | TXD1 | 167 | 20 | Reserved | NC | - |
| 9 | SCIcTX | TXD2 | 172* | 21 | Reserved | NC | - |
| 10 | SCIbCK | SCK1 | 168 | 22 | Reserved | NC | - |
| 11 | SCIcCK | SCK2 | 171* | 23 | Reserved | NC | - |
| 12 | SCIcRX | RXD2 | 169* | 24 | Reserved | NC | - |

**Table 9-9: JA6 Standard Generic Header**

# Chapter 10. Code Development

## 10.1. Overview

Note: For all code debugging using Renesas software tools, the MCU board must either be connected to a PC serial port via a serial cable or a PC USB port via an E10A.

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 256kB. To use the compiler with programs greater than this size you will need to purchase the full tools from your distributor.

**Warning: The protection software for the compiler will detect changes to the system clock. Changes to the system clock back in time may cause the trial period to expire prematurely.**

## 10.3. Breakpoint Support

This RSK is supplied with an E10A emulator which supports breakpoints in ROM.Instead of using breakpoints the User should use ‘Eventpoints’.

‘Eventpoints’ are available for the both RAM and ROM memories. Up to 11 ‘Eventpoints’ can be set into the user source code.

Double clicking in the ’Event’ column in the code sets the ‘Eventpoint’. ‘Eventpoints’ will remain unless they are double clicked to remove them.

## 10.4. Memory Map

The memory map shown below gives the locations of each memory area when operating the RSK in the default mode (Mode 2).

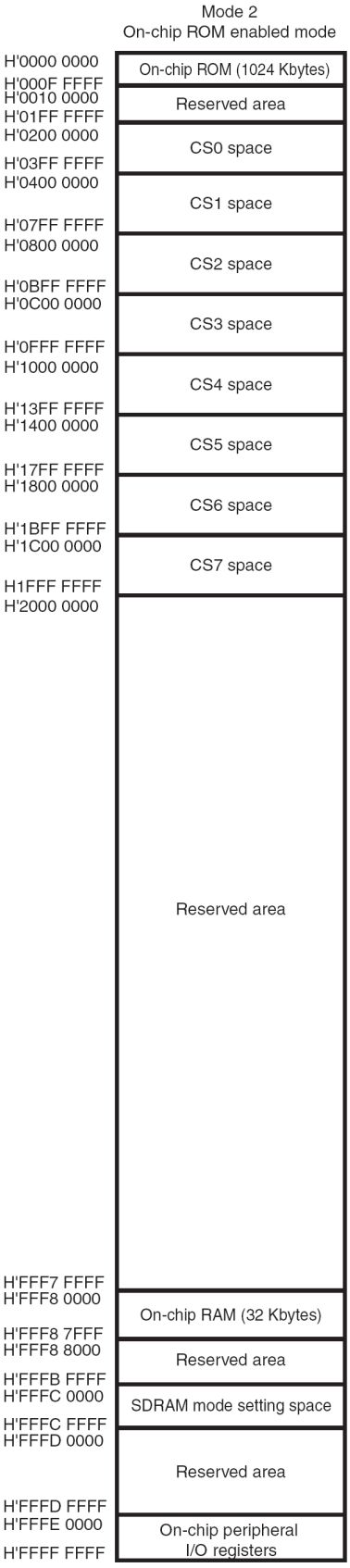


**Figure 10-1: Memory Map**

# Chapter 11. Component Placement

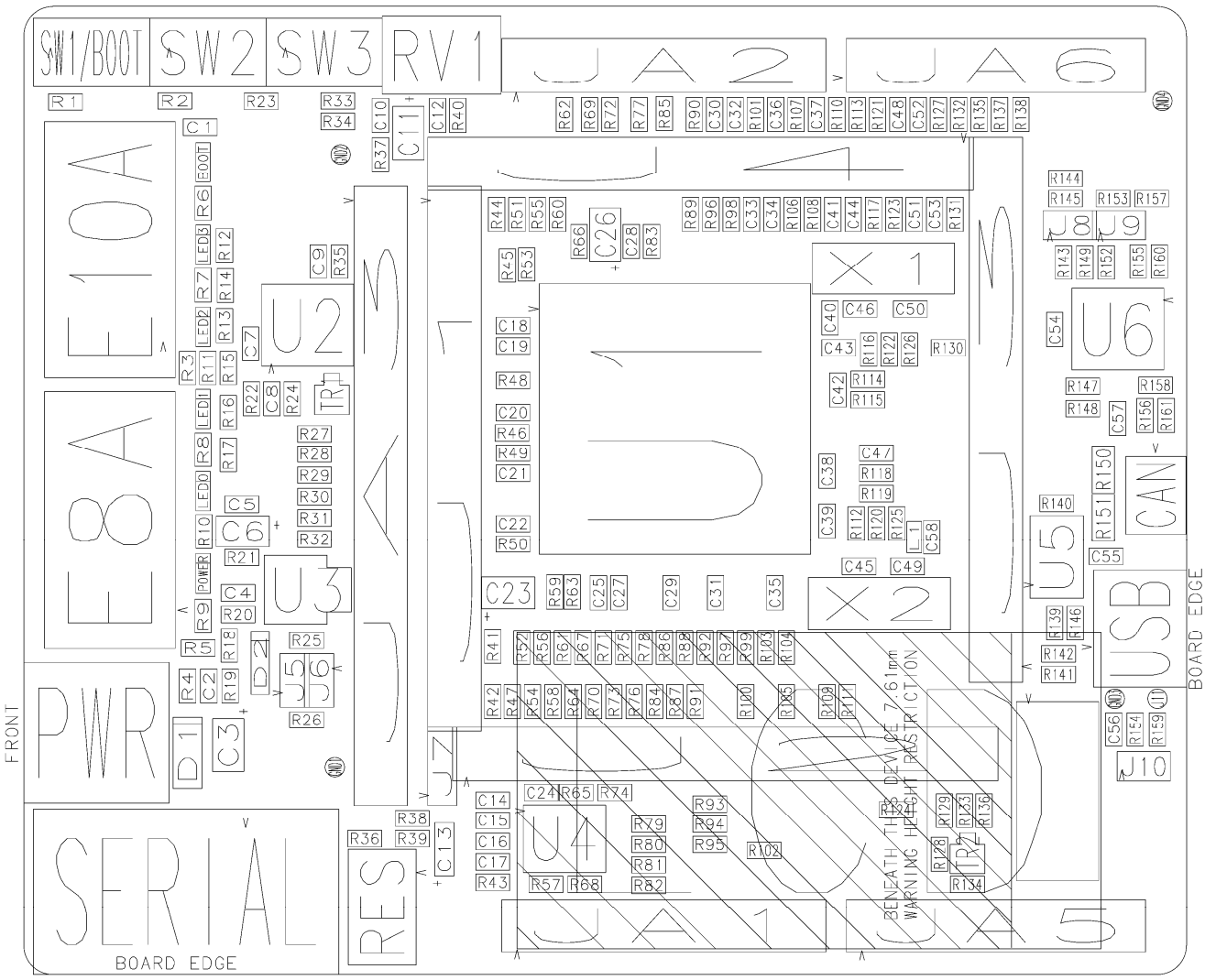


**Figure 11-1: Component Placement (Top Layer)**

# Chapter 12. Additional Information

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

For information about the SH7286 microcontrollers refer to the SH7280 Group *Hardware Manual*

For information about the SH7286 assembly language, refer to the SH-1/SH-2/SH-DSP *Software Manual*

For information about the E10A Emulator, please refer to the S*H Family E10A-USB Emulator User's Manual*

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

**Technical Contact Details**

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

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# Renesas Starter Kit 2 for SH7286
# User's Manual

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