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Renesas Electronics Corporation

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User's Manual

# Renesas Starter Kit for M16C65

User's Manual
Renesas Single-Chip Microcomputer
M16C Family

Renesas Electronics
www.renesas.com

Rev.1.00 2009.10

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By using this Renesas Starter Kit (RSK), the user accepts the following terms. The RSK is not guaranteed to be error free, and the entire risk as to the results and performance of the RSK is assumed by the User. The RSK is provided by Renesas on an “as is” basis without warranty of any kind whether express or implied, including but not limited to the implied warranties of satisfactory quality, fitness for a particular purpose, title and non-infringement of intellectual property rights with regard to the RSK. Renesas expressly disclaims all such warranties. Renesas or its affiliates shall in no event be liable for any loss of profit, loss of data, loss of contract, loss of business, damage to reputation or goodwill, any economic loss, any reprogramming or recall costs (whether the foregoing losses are direct or indirect) nor shall Renesas or its affiliates be liable for any other direct or indirect special, incidental or consequential damages arising out of or in relation to the use of this RSK, even if Renesas or its affiliates have been advised of the possibility of such damages.

## Precautions

This Renesas Starter Kit is only intended for use in a laboratory environment under ambient temperature and humidity conditions. A safe separation distance should be used between this and any sensitive equipment. Its use outside the laboratory, classroom, study area or similar such area invalidates conformity with the protection requirements of the Electromagnetic Compatibility Directive and could lead to prosecution.

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 | CD | Compact Disc |
| CPU | Central Processing Unit | E8A | E8A on-chip debugger module |
| EMC | Electromagnetic compatibility | ESD | Electrostatic Discharge |
| HEW | High-performance Embedded Workshop | LCD | Liquid Crystal Display |
| LED | Light Emitting Diode | MCU | Microcontroller Unit |
| PC | Personal Computer | RAM | Random Access Memory |
| ROM | Read Only Memory | RSK | Renesas Starter Kit |
| UART | Universal Asynchronous Receiver/Transmitter | USB | Universal Serial Bus |

# Chapter 2. Purpose

This RSK is an evaluation tool for Renesas microcontrollers.

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

Features include:

- Renesas Microcontroller Programming.
- User Code Debugging.
- User Circuitry such as Switches, LEDs and potentiometer.
- 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.

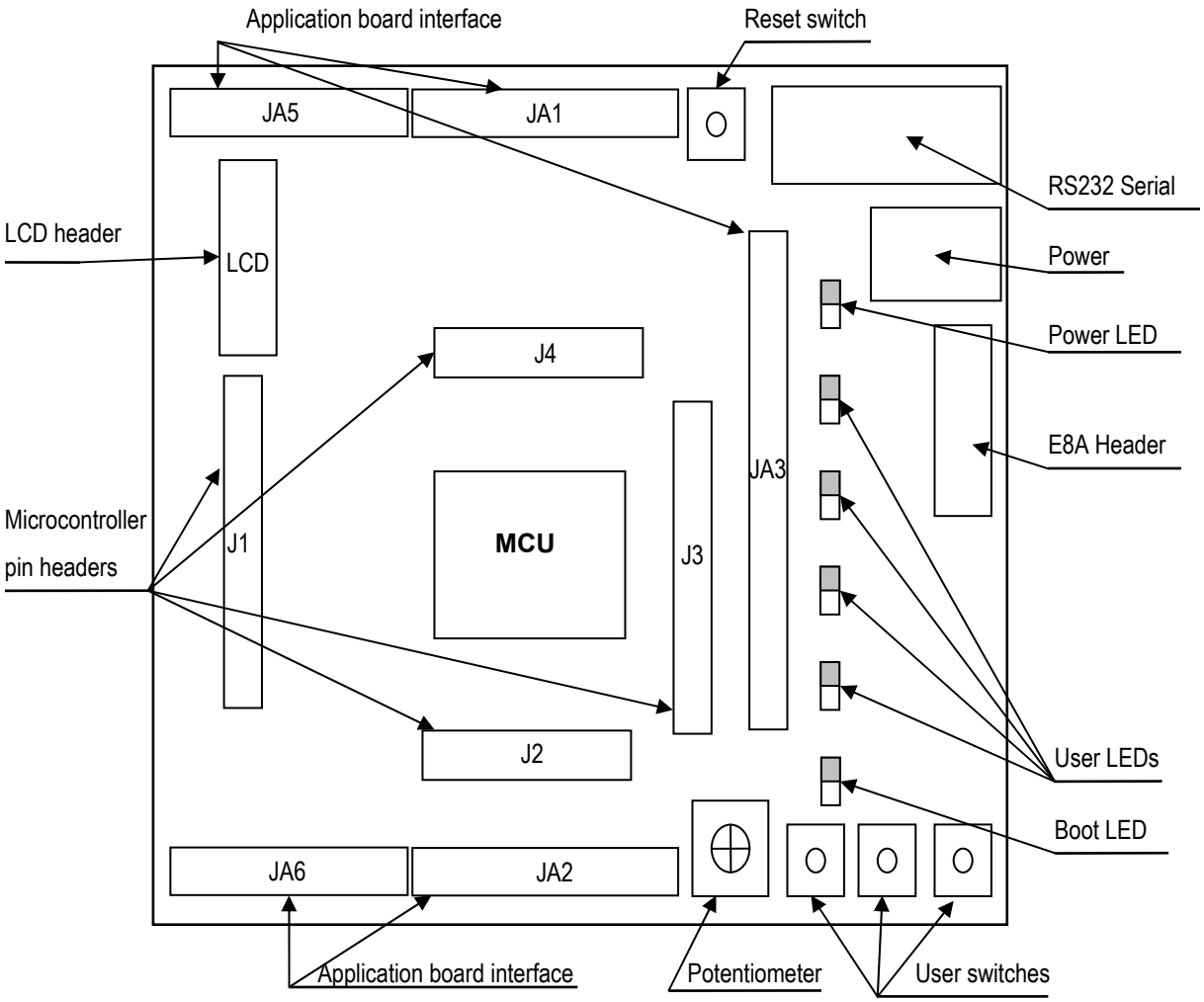


**Figure 4-1: Board Layout**

# 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.

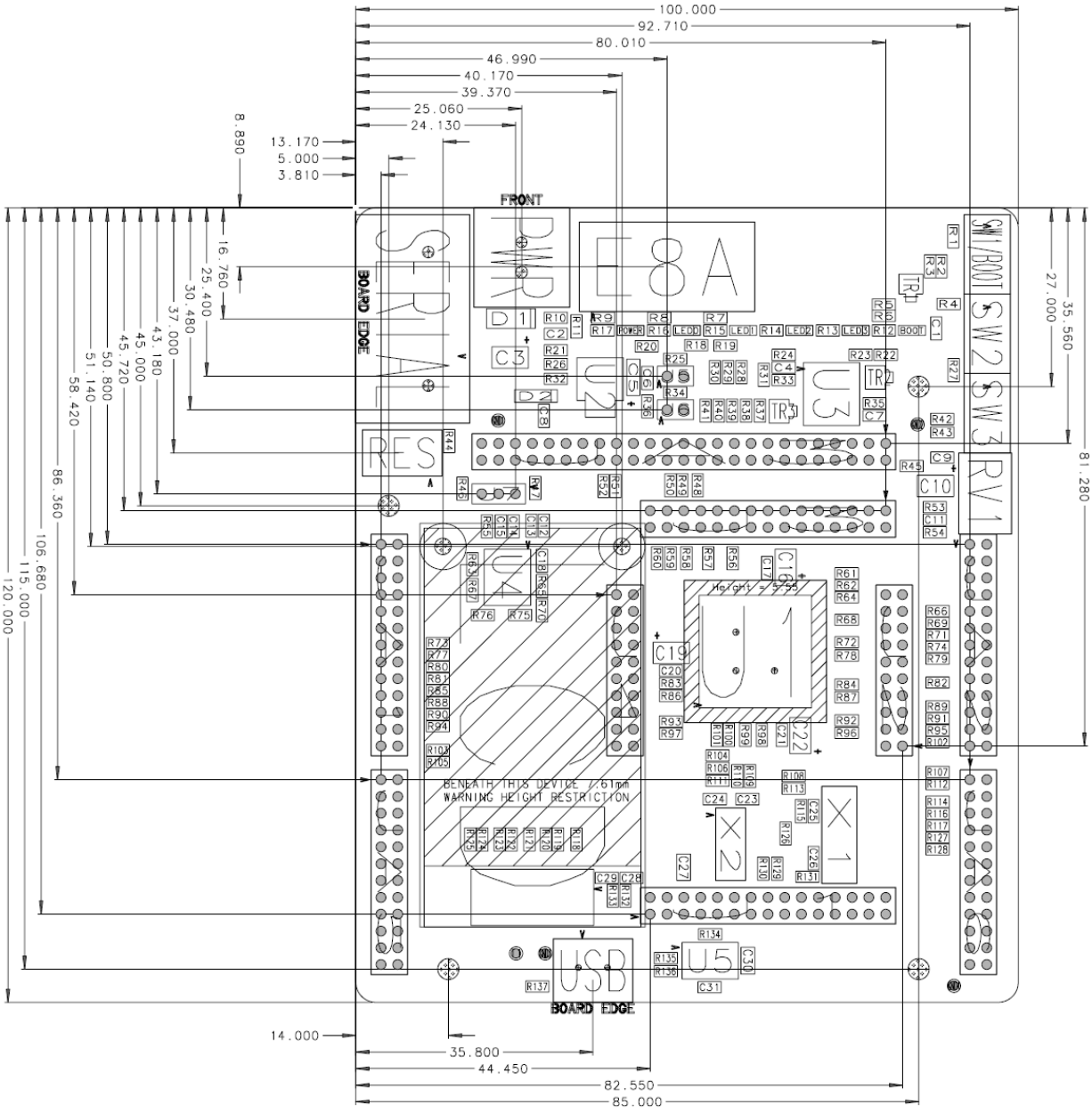


**Figure 4-2: Board Dimensions**

# Chapter 5. Block Diagram

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

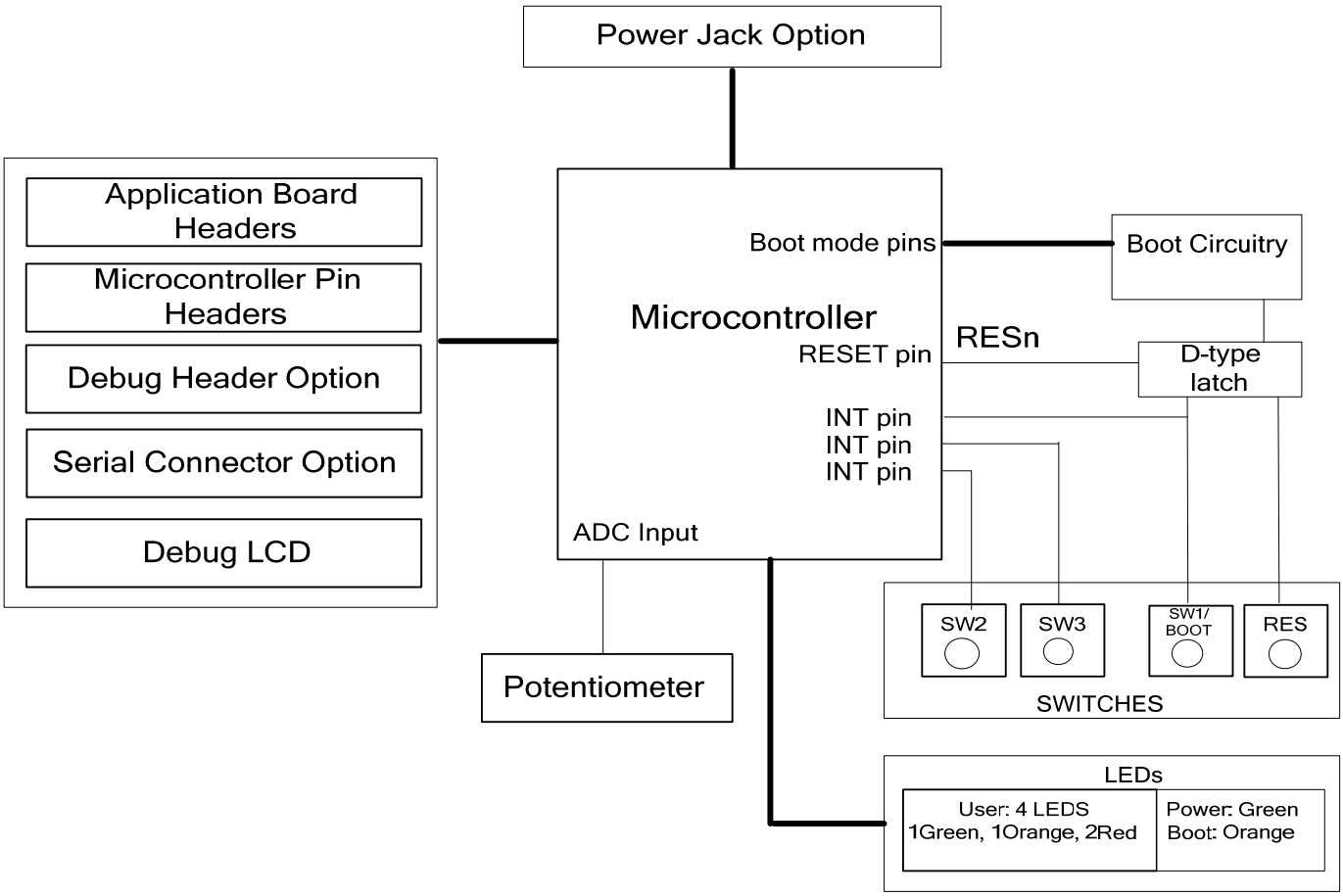


**Figure 5-1: Block Diagram**

Figure 5-2 shows the connections to the RSK.

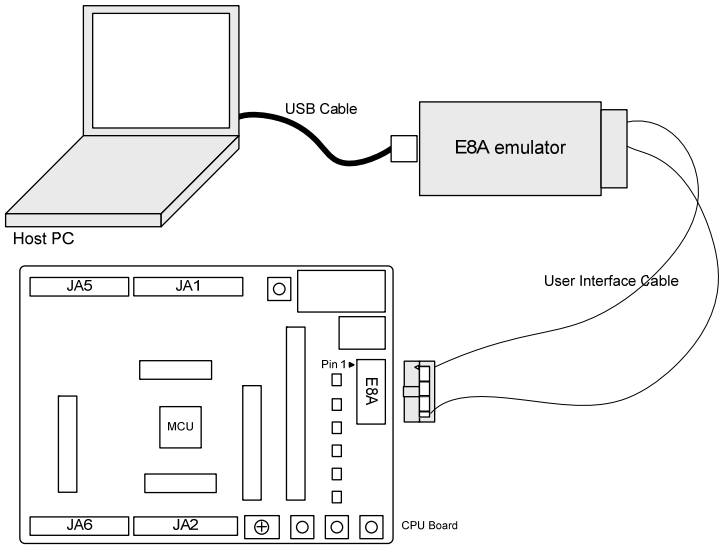


**Figure 5-2: RSK Connections**

# 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. | **RESn**, Pin 10 |
| SW1/BOOT* | Connects to an IRQ input for user controls.<br>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 18<br>(Port 8, pin 2) |
| SW2* | Connects to an IRQ line for user controls. | **INT1n**, Pin 17<br>(Port 8, pin 3) |
| SW3* | Connects to the IRQ input line. Option link allows connection to ADC trigger input. For more details on option links, please refer to Sec 6.6. | **INT2n**, Pin 16<br>(Port 8, pin 4) |

**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 | Microcontroller Pin Number |
|---|---|---|---|
| LED0 | Green | Port 4_0 | 52 |
| LED1 | Orange | Port 4_1 | 51 |
| LED2 | Red | Port 4_2 | 50 |
| LED3 | Red | Port 4_3 | 49 |

**Table 6-2: LED Port**

## 6.3. Potentiometer

A single turn potentiometer is connected to channel AN0 (Port 10_0) of the microcontroller. This may be used to vary the input analog voltage value to this pin between AVCC and Ground.

Note:

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

## 6.4. Serial port

The microcontroller programming serial port (UART1) is connected to the E8A connector. This serial port can optionally be connected to the RS232 transceiver by moving option resistors and fitting the D connector. The connections to be moved are listed in **Table 6-3**

| Description | Function | Microcontroller Port Pin | Fit for RS232 | Remove for RS232 |
|---|---|---|---|---|
| UART0 | Default serial port (TX) | Port 6_3 | R128 | R127, R76 |
| UART0 | Default serial port (RX) | Port 6_2 | R114 | R116, R75 |
| UART1 | Spare Serial Port (TX) | Port 6_7 | R76 | R127, R128 |
| UART1 | Spare Serial Port (RX) | Port 6_6 | R75 | R114, R116 |

**Table 6-3: Serial Port settings**

The UART0 port is also available on J2 and JA2. The UART1 port is available on J1.

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

## 6.5. Debug LCD Module

A debug LCD module is supplied to be connected to the connector LCD. This should be fitted so that the debug LCD module lies over J4. 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 6-4** 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 | - |
| 3 | No Connection | - | 4 | DLCDRS (Port 2_0) | 70 |
| 5 | R/W (Wired to write only using 10K pull down) | - | 6 | DLCDE (Port 2_1) (+ 100k pull down to ground) | 69 |
| 7 | No Connection | - | 8 | No connection | - |
| 9 | No Connection | - | 10 | No connection | - |
| 11 | DLCD4 (Port 2_4) | 66 | 12 | DLCD5 (Port 2_5) | 65 |
| 13 | DLCD6 (Port 2_6) | 64 | 14 | DLCD7 (Port 2_7) | 63 |

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

## 6.6. Option Links

**Table 6-5** 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** | **Function** | **Fitted** | **Alternative (Removed)** | **Related To** |
| R46 | Serial Port Configuration | Connects Channel 2 (RX pin) of the RS232 transceiver to the 9-pin D-type serial port connector | **Disconnects Channel 2 (RX pin) of the RS232 transceiver from the 9-pin D-type serial port connector** | R47, R55, R67 |
| R47 | Serial Port Configuration | Connects Channel 2 (TX pin) of the RS232 transceiver to the 9-pin D-type serial port connector | **Disconnects Channel 2 (TX pin) of the RS232 transceiver from the 9-pin D-type serial port connector** | R46, R55, R67 |
| R55 | Serial Port configuration | Connects Channel 2 (TX pin) of the RS232 transceiver to the TX pin of the UART2 port of the microcontroller | **Disconnects Channel 2 (TX pin) of the RS232 transceiver from the TX pin of the UART2 port of the microcontroller** | R46, R47, R67 |
| R67 | Serial Port configuration | Connects Channel 2 (RX pin) of the RS232 transceiver to the RX pin of the UART2 port of the microcontroller | **Disconnects Channel 2 (RX pin) of the RS232 transceiver from the RX pin of the UART2 port of the microcontroller** | R46, R47, R55 |
| R70 | Serial Port configuration | Disables the RS232 Serial Transceiver | **Enables the RS232 Serial Transceiver** | - |
| R128 | Serial Port Configuration | **Connects Channel 1 (TX pin) of the RS232 transceiver to the UART0 port of the microcontroller** | Disconnects Channel 1 (TX pin) of the RS232 transceiver from the UART0 port of the microcontroller | R114, R75 |
| R114 | Serial Port Configuration | **Connects Channel 1 (RX pin) of the RS232 transceiver to the UART0 port of the microcontroller** | Disconnects Channel 1 (RX pin) of the RS232 transceiver from the UART0 port of the microcontroller | R128, R76 |
| R127 | Serial Port Configuration | Connects Channel 1 (TX In pin) of RS232 transceiver to JA6-5 (RS232TX) | **Disconnects channel 1 (TX In pin) of RS232 transceiver from JA6-5 (RS232TX)** | R116, R76 |
| R116 | Serial Port Configuration | Connects Channel 1 (RX pin) of the RS232 transceiver to JA6-6 (RS232RX) | **Disconnects Channel 1 (RX pin) of the RS232 transceiver from JA6-6 (RS232RX)** | R127, R75 |
| R75 | Serial Port Configuration | Connects Channel 1 (RX pin) of the RS232 transceiver to the UART1 port of the microcontroller | **Disconnects Channel 1 (RX pin) of the RS232 transceiver from the UART1 port of the microcontroller** | R114, R116 |
| R76 | Serial Port Configuration | Connects Channel 1 (TX pin) of the RS232 transceiver to the UART1 port of the microcontroller | **Disconnects Channel 1 (TX pin) of the RS232 transceiver from the UART1 port of the microcontroller** | R127, R128 |

**Table 6-5: Serial port configuration links**

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

| Application board interface option link settings | | | | |
|---|---|---|---|---|
| **Reference** | **Function** | **Fitted** | **Alternative (Removed)** | **Related To** |
| R93 | Application board interface | Connects the microcontroller port pin p10_0 to AN0 (JA1-9) of application board interface. | **Disconnects the microcontroller port pin p10_0 from AN0 (JA1-9) of application board interface.** | R97 |
| R97 | Application board interface | **Connects the microcontroller port pin p10_0 to ADPOT.** | Disconnects the microcontroller port pin p10_0 from ADPOT. | R93 |
| R49 | Application board interface | Connects the microcontroller port pin p5_0 to WRn (JA3-26) of application board interface. | **Disconnects the microcontroller port pin p5_0 from WRn (JA3-26) of application board interface.** | R50 |
| R50 | Application board interface | **Connects the microcontroller port pin p5_0 to WRLn (JA3-48) of application board interface.** | Disconnects the microcontroller port pin p5_0 from WRLn (JA3-48) of application board interface. | R49 |
| R51 | Application board interface | Connects the microcontroller port pin p1_5 to D13 (JA3-34) of application board interface. | **Disconnects the microcontroller port pin p1_5 from D13 (JA3-34) of application board interface.** | R52 |
| R52 | Application board interface | **Connects the microcontroller port pin p1_5 to INT3n (JA1-23) of application board interface.** | Disconnects the microcontroller port pin p1_5 from INT3n (JA1-23) of application board interface. | R51 |
| R66 | Application board interface | Connects the microcontroller port pin p8_0 to Up (JA2-13) of application board interface. | **Disconnects the microcontroller port pin p8_0 from Up (JA2-13) of application board interface.** | R69 |
| R69 | Application board interface | **Connects the microcontroller port pin p8_0 to TA4OUT (JA2-20) of application board interface.** | Disconnects the microcontroller port pin p8_0 from TA4OUT (JA2-20) of application board interface. | R66 |
| R89 | Application board interface | **Connects the microcontroller port pin p8_1 to TA4IN (JA2-22) of application board interface.** | Disconnects the microcontroller port pin p8_1 from TA4IN (JA2-22) of application board interface. | R91 |
| R91 | Application board interface | Connects the microcontroller port pin p8_1 to Un (JA2-14) of application board interface. | **Disconnects the microcontroller port pin p8_1 from Un (JA2-14) of application board interface.** | R89 |
| R71 | Application board interface | Connects the microcontroller port pin p7_4 to Wp (JA2-17) of application board interface. | **Disconnects the microcontroller port pin p7_4 from Wp (JA2-17) of application** | R74 |

| Application board interface option link settings | | | | |
|---|---|---|---|---|
| **Reference** | **Function** | **Fitted** | **Alternative (Removed)** | **Related To** |
| | | | **board interface.** | |
| R74 | Application board interface | **Connects the microcontroller port pin p7_4 to TA2OUT (JA2-19) of application board interface.** | Disconnects the microcontroller port pin p7_4 from TA2OUT (JA2-19) of application board interface. | R71 |
| R95 | Application board interface | Connects the microcontroller port pin p7_5 to Wn (JA2-18) of application board interface. | **Disconnects the microcontroller port pin p7_5 from Wn (JA2-18) of application board interface.** | R102 |
| R102 | Application board interface | **Connects the microcontroller port pin p7_5 to TA2IN (JA2-21) of application board interface.** | Disconnects the microcontroller port pin p7_5 from TA2IN (JA2-21) of application board interface. | R95 |
| R59 | Application board interface | **Connects the microcontroller port pin p5_3 to TRISTn (JA2-24) of application board interface.** | Disconnects the microcontroller port pin p5_3 from TRISTn (JA2-24) of application board interface. | R60 |
| R60 | Application board interface | Connects the microcontroller port pin p5_3 to BCLK (JA3-44) of application board interface. | **Disconnects the microcontroller port pin p5_3 from BCLK (JA3-44) of application board interface.** | R59 |
| R73 | Application board interface | Connects the microcontroller port pin p3_0 to IO0 (JA1-15) of application board interface. | **Disconnects the microcontroller port pin p3_0 from IO0 (JA1-15) of application board interface.** | - |
| R77 | Application board interface | Connects the microcontroller port pin p3_1 to IO1 (JA1-16) of application board interface. | **Disconnects the microcontroller port pin p3_1 from IO1 (JA1-16) of application board interface.** | - |
| R80 | Application board interface | Connects the microcontroller port pin p3_2 to IO2 (JA1-17) of application board interface. | **Disconnects the microcontroller port pin p3_2 from IO2 (JA1-17) of application board interface.** | - |
| R81 | Application board interface | Connects the microcontroller port pin p3_3 to IO3 (JA1-18) of application board interface. | **Disconnects the microcontroller port pin p3_3 from IO3 (JA1-18) of application board interface.** | - |
| R85 | Application board interface | Connects the microcontroller port pin p3_4 to IO4 (JA1-19) of application | **Disconnects the microcontroller port pin p3_4** | - |

| Application board interface option link settings | | | | |
|---|---|---|---|---|
| **Reference** | **Function** | **Fitted** | **Alternative (Removed)** | **Related To** |
| | | board interface. | **from IO4 (JA1-19) of application board interface.** | |
| R88 | Application board interface | Connects the microcontroller port pin p3_5 to IO5 (JA1-20) of application board interface. | **Disconnects the microcontroller port pin p3_5 from IO5 (JA1-20) of application board interface.** | - |
| R94 | Application board interface | Connects the microcontroller port pin p3_6 to IO6 (JA1-21) of application board interface. | **Disconnects the microcontroller port pin p3_6 from IO6 (JA1-21) of application board interface.** | - |
| R90 | Application board interface | Connects the microcontroller port pin p3_7 to IO7 (JA1-22) of application board interface. | **Disconnects the microcontroller port pin p3_7 from IO7 (JA1-22) of application board interface.** | - |
| R105 | Application board interface | **Connects the microcontroller port pin p7_0 to IICSDA (JA1-25) of application board interface.** | Disconnects the microcontroller port pin p7_0 from IICSDA (JA1-25) of application board interface. | R103 |
| R103 | Application board interface | **Connects the microcontroller port pin p7_1 to IICSCL (JA1-26) of application board interface.** | Disconnects the microcontroller port pin p7_1 from IICSCL (JA1-26) of application board interface. | R105 |
| R107 | Application board interface | Connects the microcontroller port pin p7_2 to Vp (JA2-15) of application board interface. | **Disconnects the microcontroller port pin p7_2 from Vp (JA2-15) of application board interface.** | R112 |
| R112 | Application board interface | **Connects the microcontroller port pin p7_2 to CLK2 (JA6-10) of application board interface.** | Disconnects the microcontroller port pin p7_2 from CLK2 (JA6-10) of application board interface. | R107 |
| R130 | Application board interface | **Connects the microcontroller port pin p8_5 to NMIn (JA2-3) of application board interface.** | Disconnects the microcontroller port pin p8_5 from NMIn (JA2-3) of application board interface. | - |

**Table 6-6: Application board interface configuration links**

**Table 6-7** below describes the function of the option links associated with E8A debugger. The default configuration is indicated by **BOLD** text.

| E8A debugger option link settings | | | | |
|---|---|---|---|---|
| **Reference** | **Function** | **Fitted** | **Alternative (Removed)** | **Related To** |
| R19 | E8A | **E8A_A enabled.** | E8A_A disabled. | - |
| R8 | E8A | **E8A Tx enabled.** | E8A Tx disabled. | - |
| R7 | E8A | **E8A Rx enabled.** | E8A Rx disabled. | - |
| R11 | E8A | **E8A_SCLK enabled.** | E8A_SCLK disabled. | - |
| R9 | E8A | **E8A_CNVSS enabled.** | E8A_CNVSS disabled. | - |
| R20 | E8A | E8A_B enabled. | **E8A_B disabled.** | - |
| R18 | E8A | **E8A_BUSY enabled.** | E8A_BUSY disabled. | - |

**Table 6-7: E8A debugger configuration links**

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

| Power option link settings | | | | |
|---|---|---|---|---|
| **Reference** | **Function** | **Fitted** | **Alternative (Removed)** | **Related To** |
| R26 | Power source | **CON_5V source signal will be powered from PWR connector via R10.** | CON_5V source signal will not be powered from PWR connector. | R10, R32 |
| R32 | Power source | **CON_5V source signal will be powered from external source.** | CON_5V source signal will not be powered from external source. | R10, R26 |
| R10 | Power source | **Enables power to board from PWR connector.** | Disables power to board from PWR connector. | R26, R32 |
| R21 | Power source | 5V supply to on-board 3.3v regulator is enabled. | **Disconnects PWR connector from on board 3.3v voltage regulator.** | - |
| R36 | Power source | Connects on board 3.3v output of voltage regulator to Board_VCC1 via R41 and Board_VCC2 via R30. | **Disconnects on board 3.3v output of voltage regulator from Board_VCC1 and Board_VCC2.** | R30, R41 |
| R30 | Power source | **Connects on board 3.3v output of the voltage regulator to Board_VCC2.** | Disconnects on board 3.3v output of the voltage regulator from Board_VCC2. | R36 |
| R41 | Power source | **Connects on board 3.3v output of the voltage regulator to Board_VCC1.** | Disconnects on board 3.3v output of the voltage regulator from Board_VCC1. | R36 |
| R38 | Power source | **Connects E8A_VCC to Board_VCC1.** | Disconnects E8A_VCC from Board_VCC1. | - |
| R40 | Power source | **Connects 5V supply to Board_VCC1** | Disconnects Board_VCC1 from PWR connector | R10 |
| R39 | Power source | Connects CON_3V3 to Board_VCC1 | **Disconnects CON_3V3 from Board_VCC1.** | - |
| R28 | Power source | Connects CON_3V3 to Board_VCC2 | **Disconnects CON_3V3 from Board_VCC2.** | - |
| R29 | Power source | **Connects 5V supply to Board_VCC2** | Disconnects Board_VCC2 from PWR connector | R10 |
| R34 | MCU power supply | **Supply to MCU.** | CPU current can be measured across R34 | - |
| R45 | Ground | **Connects Analog & Digital grounds together.** | Separates Analog & Digital grounds. | - |

**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.

| Clock option link settings | | | | |
|---|---|---|---|---|
| **Reference** | **Function** | **Fitted** | **Alternative (Removed)** | **Related To** |
| R115 | Clock Oscillator | Parallel resistor for crystal X1 | **Not fitted** | - |
| R108 | Clock Oscillator | **On-board clock source is used.** | External clock source can be used. | R131, R113,R126 |
| R131 | Clock Oscillator | **On-board clock source is used.** | External clock source can be used. | R108, R113, R126 |
| R113 | Clock Oscillator | External clock source is used. | **On-board clock source can be used.** | R108, R131, R126 |
| R126 | Clock Oscillator | External clock source is used. | **On-board clock source can be used.** | R108, R113, R131 |
| R111 | Clock Oscillator | Parallel resistor for crystal X2 | **Not fitted** | - |
| R106 | Clock Oscillator | **On-board clock source is used.** | External clock source can be used | R109, R104, R110 |
| R110 | Clock Oscillator | **On-board clock source is used** | External clock source can be used | R106, R109, R104 |
| R109 | Clock Oscillator | External clock source can be used | **On-board clock source is used** | R104, R106, R110 |
| R104 | Clock Oscillator | External clock source can be used | **On-board clock source is used** | R106, R110, R109 |

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

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

| Voltage reference option link settings | | | | |
|---|---|---|---|---|
| **Reference** | **Function** | **Fitted** | **Alternative (Removed)** | **Related To** |
| R86 | Voltage Reference Source | **VREF is set to Board_VCC1.** | VREF is not set to Board_VCC1. | R83 |
| R83 | Voltage Reference Source | VREF to be supplied from external source (JA1- 7). | **VREF is not supplied from external source (JA1- 7).** | R86 |

**Table 6-10: Voltage reference configuration links**

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

| Analog power supply option link settings | | | | |
|---|---|---|---|---|
| **Reference** | **Function** | **Fitted** | **Alternative (Removed)** | **Related To** |
| R54 | Analog Voltage Source | AVCC to be supplied from external source (JA1-5). | **AVCC is not supplied from external source (JA1-5).** | R53 |
| R53 | Analog Voltage Source | **AVCC is set to Board_VCC1.** | AVCC is not set to Board_VCC1. | R54 |

**Table 6-11: Analog power supply configuration links**

**Table 6-12** below describes the function of the option links associated with switches configuration. The default configuration is indicated by **BOLD** text.

| Switches option link settings | | | | |
|---|---|---|---|---|
| **Reference** | **Function** | **Fitted** | **Alternative (Removed)** | **Related To** |
| R42 | Switch | **Connects INT2n (MCU port pin p8_4) to SW3** | Disconnects INT2n (MCU port pin p8_4) from SW3. | R43 |
| R43 | Switch | Connects ADTRGn (MCU port pin p9_7) to SW3 | **Disconnects ADTRGn (MCU port pin p9_7) from SW3** | R42 |

**Table 6-12: Switches configuration links**

## 6.7. Oscillator Sources

A crystal oscillator is fitted on the RSK and used to supply the main clock input to the Renesas microcontroller. **Table 6-13** details the oscillators that are fitted and alternative footprints provided on this RSK:

| Component | | |
|---|---|---|
| Crystal (X1) | Fitted | 8 MHz (HC49/4H package) |
| Crystal (X2) | Fitted | 32.768KHz (HC49/4H package) |

**Table 6-13: 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 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

The RSK supports Boot mode and Single chip mode.

Details of programming the FLASH memory is described in the M16C65 Group Hardware Manual.

## 7.1. Boot mode

The Boot mode settings for this RSK are shown in **Table 7-1**.

| CNVSS | P5.0 | P5.5 | LSI State after Reset End |
|---|---|---|---|
| 1 | 1 | 0 | Boot Mode |

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

The software supplied with this RSK only supports Boot mode using an E8A and HEW. However, hardware exists to enter Boot mode manually, do not connect the E8A in this case. Press and hold the SW1/BOOT. The mode pins above are held in their boot states while reset is pressed and released. Release the Boot switch. 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 (with CNVSS and P5.5 being pulled low during reset) as above, the P5.5 pin is pulled high by a 10k resistor, the P.5.0 pin is pulled high by a 4k7 resistor and the CNVSS is pulled low by a 4k7 resistor.

When an E8A is used these three pins are controlled by the E8A.

## 7.2. Single-Chip mode

As CNVSS is being pulled down by a 4k7 resistor, this RSK will always boot in Single-Chip mode when the E8A is not connected and the Boot switch is not depressed. Refer to M16C65 Group Hardware Manual for details of Single-Chip mode

| CNVSS | P5.0 | P5.5 | LSI State after Reset End |
|---|---|---|---|
| 0 | 1 | 1 | 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 M16C65 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 | DA1 | 1 | 2 | DA0 | 2 |
| 3 | NC | - | 4 | NC | - |
| 5 | NC | - | 6 | BYTE | 6 |
| 7 | CNVSS | 7 | 8 | CON_XCIN | 8 |
| 9 | CON_XCOUT | 9 | 10 | RESn | 10 |
| 11 | CON_XOUT | 11 | 12 | GROUND | 12 |
| 13 | CON_XIN | 13 | 14 | UC_VCC1 | 14 |
| 15 | NMIn | 15 | 16 | INT2n | 16 |
| 17 | INT1n | 17 | 18 | INT0n | 18 |
| 19 | TA4IN_Un | 19 | 20 | TA4OUT_Up | 20 |
| 21 | P77 | 21 | 22 | P76 | 22 |
| 23 | TA2IN_Wn | 23 | 24 | TA2OUT_Wp | 24 |
| 25 | Vn | 25 | 26 | CLK2_Vp | 26 |
| 27 | IICSCL_RxD2 | 27 | 28 | IICSDA_TxD2 | 28 |
| 29 | PTTX | 29 | 30 | PTRX | 30 |

**Table 9-1: J1**

| J2 | | | | | |
|---|---|---|---|---|---|
| Pin | Circuit Net Name | Device Pin | Pin | Circuit Net Name | Device Pin |
| 1 | PTCK | 31 | 2 | BUSY | 32 |
| 3 | TxD0 | 33 | 4 | RxD0 | 34 |
| 5 | CLK0 | 35 | 6 | CTSRTS | 36 |
| 7 | RDYn | 37 | 8 | ALE | 38 |
| 9 | EPM | 39 | 10 | UD | 40 |
| 11 | TRISTn_BCLK | 41 | 12 | RDn | 42 |
| 13 | WRHn | 43 | 14 | WRLn_WRn | 44 |
| 15 | CS3n | 45 | 16 | CS2n | 46 |
| 17 | CS1n | 47 | 18 | CS0n | 48 |
| 19 | A19_LED3 | 49 | 20 | A18_LED2 | 50 |

**Table 9-2: J2**

| J3 | | | | | |
|---|---|---|---|---|---|
| Pin | Circuit Net Name | Device Pin | Pin | Circuit Net Name | Device Pin |
| 1 | A17_LED1 | 51 | 2 | A16_LED0 | 52 |
| 3 | A15_IO7 | 53 | 4 | A14_IO6 | 54 |
| 5 | A13_IO5 | 55 | 6 | A12_IO4 | 56 |
| 7 | A11_IO3 | 57 | 8 | A10_IO2 | 58 |
| 9 | A9_IO1 | 59 | 10 | UC_VCC2 | 60 |
| 11 | A8_IO0 | 61 | 12 | GROUND | 62 |
| 13 | A7_DLCD7 | 63 | 14 | A6_DLCD6 | 64 |
| 15 | A5_DLCD5 | 65 | 16 | A4_DLCD4 | 66 |
| 17 | A3 | 67 | 18 | A2 | 68 |
| 19 | A1_DLCDE | 69 | 20 | A0_DLCDRS | 70 |
| 21 | D15 | 71 | 22 | D14 | 72 |
| 23 | D13_INT3n | 73 | 24 | D12 | 74 |
| 25 | D11 | 75 | 26 | D10 | 76 |
| 27 | D9 | 77 | 28 | D8 | 78 |
| 29 | D7 | 79 | 30 | D6 | 80 |

**Table 9-3: J3**

| J4 | | | | | |
|---|---|---|---|---|---|
| Pin | Circuit Net Name | Device Pin | Pin | Circuit Net Name | Device Pin |
| 1 | D5 | 81 | 2 | D4 | 82 |
| 3 | D3 | 83 | 4 | D2 | 84 |
| 5 | D1 | 85 | 6 | D0 | 86 |
| 7 | AN7 | 87 | 8 | AN6 | 88 |
| 9 | AN5 | 89 | 10 | AN4 | 90 |
| 11 | AN3 | 91 | 12 | AN2 | 92 |
| 13 | AN1 | 93 | 14 | AVss | 94 |
| 15 | ADPOT_AN0 | 95 | 16 | CON_VREF | - |
| 17 | CON_AVCC | - | 18 | ADTRGn | 98 |
| 19 | P96 | 99 | 20 | P95 | 100 |

**Table 9-4: J4**

## 9.2. Application Headers

**Table 9-5** to **Table 9-9** 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 | CON_3V3 | - | 4 | 0V | GROUND | - |
| 5 | AVCC | CON_AVCC | - | 6 | AVss | AVSS | 94 |
| 7 | AVref | CON_VREF | - | 8 | ADTRG | ADTRGn | 98 |
| 9 | AD0 | AN0 | 95 | 10 | AD1 | AN1 | 93 |
| 11 | AD2 | AN2 | 92 | 12 | AD3 | AN3 | 91 |
| 13 | DAC0 | DA0 | 2 | 14 | DAC1 | DA1 | 1 |
| 15 | IO_0 | IO0 | 61 | 16 | IO_1 | IO1 | 59 |
| 17 | IO_2 | IO2 | 58 | 18 | IO_3 | IO3 | 57 |
| 19 | IO_4 | IO4 | 56 | 20 | IO_5 | IO5 | 55 |
| 21 | IO_6 | IO6 | 54 | 22 | IO_7 | IO7 | 53 |
| 23 | IRQ3 | INT3n | 73 | 24 | IIC_EX | NC | - |
| 25 | IIC_SDA | IICSDA | 28 | 26 | IIC_SCL | IICSCL | 27 |

**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 | RESn | 10 | 2 | EXTAL | CON_XIN | - |
| 3 | NMIn | NMIn | 15 | 4 | Vss1 | GROUND | - |
| 5 | WDT_OVF | NC | - | 6 | SCIaTX | TxD0 | 33 |
| 7 | IRQ0 | INT0n | 18 | 8 | SCIaRX | RxD0 | 34 |
| 9 | IRQ1 | INT1n | 17 | 10 | SCIaCK | CLK0 | 35 |
| 11 | UD | UD | 40 | 12 | CTSRTS | CTSRTS | 36 |
| 13 | Up | Up | 20 | 14 | Un | Un | 19 |
| 15 | Vp | Vp | 26 | 16 | Vn | Vn | 25 |
| 17 | Wp | Wp | 24 | 18 | Wn | Wn | 23 |
| 19 | TMR0 | TA2OUT | 24 | 20 | TMR1 | TA4OUT | 20 |
| 21 | TRIGa | TA2IN | 23 | 22 | TRIGb | TA4IN | 19 |
| 23 | IRQ2 | INT2n | 16 | 24 | TRISTn | TRISTn | 41 |
| 25 | - | NC | - | 26 | - | NC | - |

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

| JA5 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pin | Generic Header Name | CPU board Signal Name | Device Pin | Pin | Generic Header Name | CPU board Signal Name | Device Pin |
| 1 | AD4 | AN4 | 90 | 2 | AD5 | AN5 | 89 |
| 3 | AD6 | AN6 | 88 | 4 | AD7 | AN7 | 87 |
| 5 | CAN1TX | NC | - | 6 | CAN1RX | NC | - |
| 7 | CAN2TX | NC | - | 8 | CAN2RX | NC | - |
| 9 | Reserved | NC | - | 10 | Reserved | NC | - |
| 11 | Reserved | NC | - | 12 | Reserved | NC | - |
| 13 | Reserved | NC | - | 14 | Reserved | NC | - |
| 15 | Reserved | NC | - | 16 | Reserved | NC | - |
| 17 | Reserved | NC | - | 18 | Reserved | NC | - |
| 19 | Reserved | NC | - | 20 | Reserved | NC | - |
| 21 | Reserved | NC | - | 22 | Reserved | NC | - |
| 23 | Reserved | NC | - | 24 | Reserved | NC | - |

**Table 9-7: JA5 Standard Generic Header**

| JA6 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Pin** | **Generic Header Name** | **CPU board Signal Name** | **Device Pin** | **Pin** | **Generic Header Name** | **CPU board Signal Name** | **Device Pin** |
| 1 | DREQ | NC | - | 2 | DACK | NC | - |
| 3 | TEND | NC | - | 4 | STBYn | NC | |
| 5 | RS232TX | RS232TX | - | 6 | RS232RX | RS232RX | - |
| 7 | SCIbRX | IICSCL_RxD2 | 27 | 8 | SCIbTX | IICSDA_TxD2 | 28 |
| 9 | SCIcTX | NC | - | 10 | SCIbCK | CLK2 | 26 |
| 11 | SCIcCK | NC | - | 12 | SCIcRX | NC | - |
| 13 | Reserved | NC | - | 14 | Reserved | NC | - |
| 15 | Reserved | NC | - | 16 | Reserved | NC | - |
| 17 | Reserved | NC | - | 18 | Reserved | NC | - |
| 19 | Reserved | NC | - | 20 | Reserved | NC | - |
| 21 | Reserved | NC | - | 22 | Reserved | NC | - |
| 23 | Reserved | NC | - | 24 | Reserved | NC | - |

**Table 9-8: JA6 Standard Generic Header**

| JA3 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Pin** | **Generic Header Name** | **CPU board Signal Name** | **Device Pin** | **Pin** | **Generic Header Name** | **CPU board Signal Name** | **Device Pin** |
| 1 | A0 | A0_DLCDRS | 70 | 2 | A1 | A1_DLCDE | 69 |
| 3 | A2 | A2 | 68 | 4 | A3 | A3 | 67 |
| 5 | A4 | A4_DLCD4 | 66 | 6 | A5 | A5_DLCD5 | 65 |
| 7 | A6 | A6_DLCD6 | 64 | 8 | A7 | A7_DLCD7 | 63 |
| 9 | A8 | A8_IO0 | 61 | 10 | A9 | A9_IO1 | 59 |
| 11 | A10 | A10_ IO2 | 58 | 12 | A11 | A11_ IO3 | 57 |
| 13 | A12 | A12_ IO4 | 56 | 14 | A13 | A13_ IO5 | 55 |
| 15 | A14 | A14_ IO6 | 54 | 16 | A15 | A15_ IO7 | 53 |
| 17 | D0 | D0 | 86 | 18 | D1 | D1 | 85 |
| 19 | D2 | D2 | 84 | 20 | D3 | D3 | 83 |
| 21 | D4 | D4 | 82 | 22 | D5 | D5 | 81 |
| 23 | D6 | D6 | 80 | 24 | D7 | D7 | 79 |
| 25 | RDn | RDn | 42 | 26 | WRn | WRn | 44 |
| 27 | CSan | CS0n | 48 | 28 | CSbn | CS1n | 47 |
| 29 | D8 | D8 | 78 | 30 | D9 | D9 | 77 |
| 31 | D10 | D10 | 76 | 32 | D11 | D11 | 75 |
| 33 | D12 | D12 | 74 | 34 | D13 | D13 | 73 |
| 35 | D14 | D14 | 72 | 36 | D15 | D15 | 71 |
| 37 | A16 | A16_LED0 | 52 | 38 | A17 | A17_LED1 | 51 |
| 39 | A18 | A18_LED2 | 50 | 40 | A19 | A19_LED3 | 49 |
| 41 | A20 | NC | - | 42 | A21 | NC | - |
| 43 | A22 | NC | - | 44 | BCLK | BCLK | 41 |
| 45 | CScn | CS2n | 46 | 46 | AHn | ALE | 38 |
| 47 | HWRn | WRHn | 43 | 48 | LWRn | WRLn | 44 |
| 49 | NC | NC | - | 50 | NC | NC | - |

**Table 9-9: JA3 Standard Generic 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 emulator is supplied with the RSK product.

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 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 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

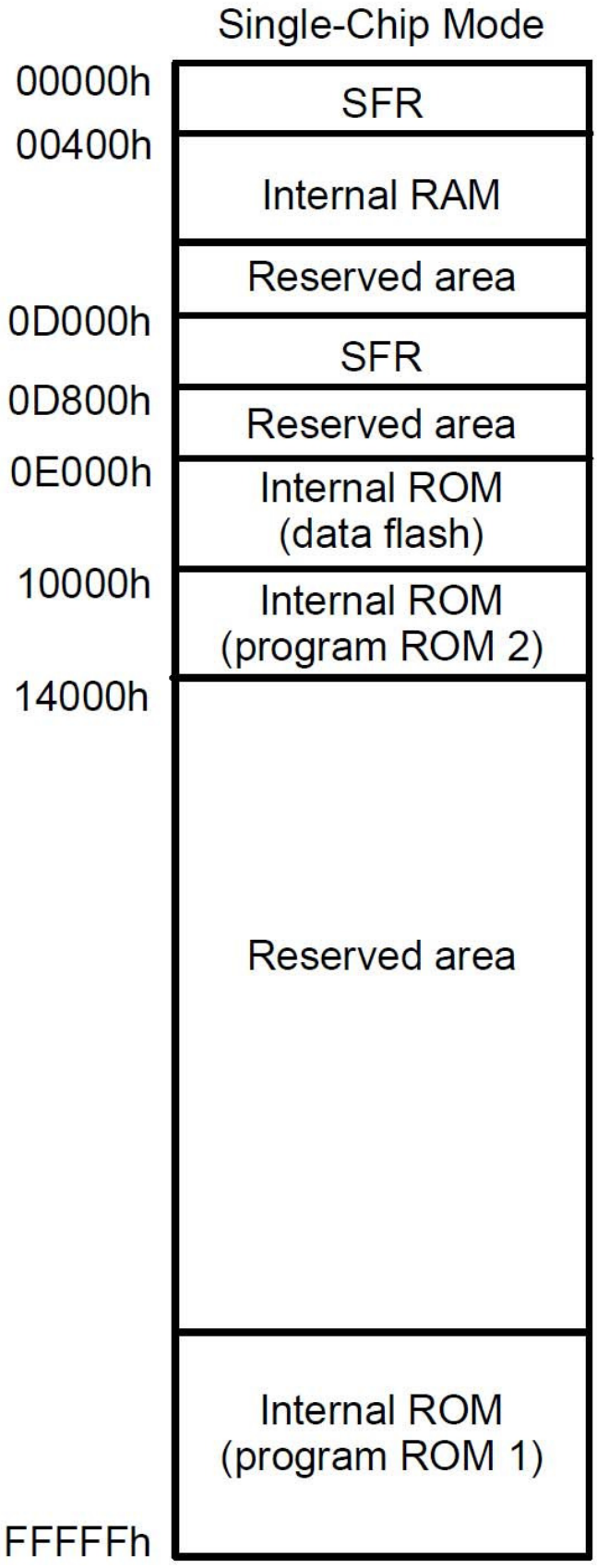


**Figure 10-1: Memory Map**

# Chapter 11. Component Placement

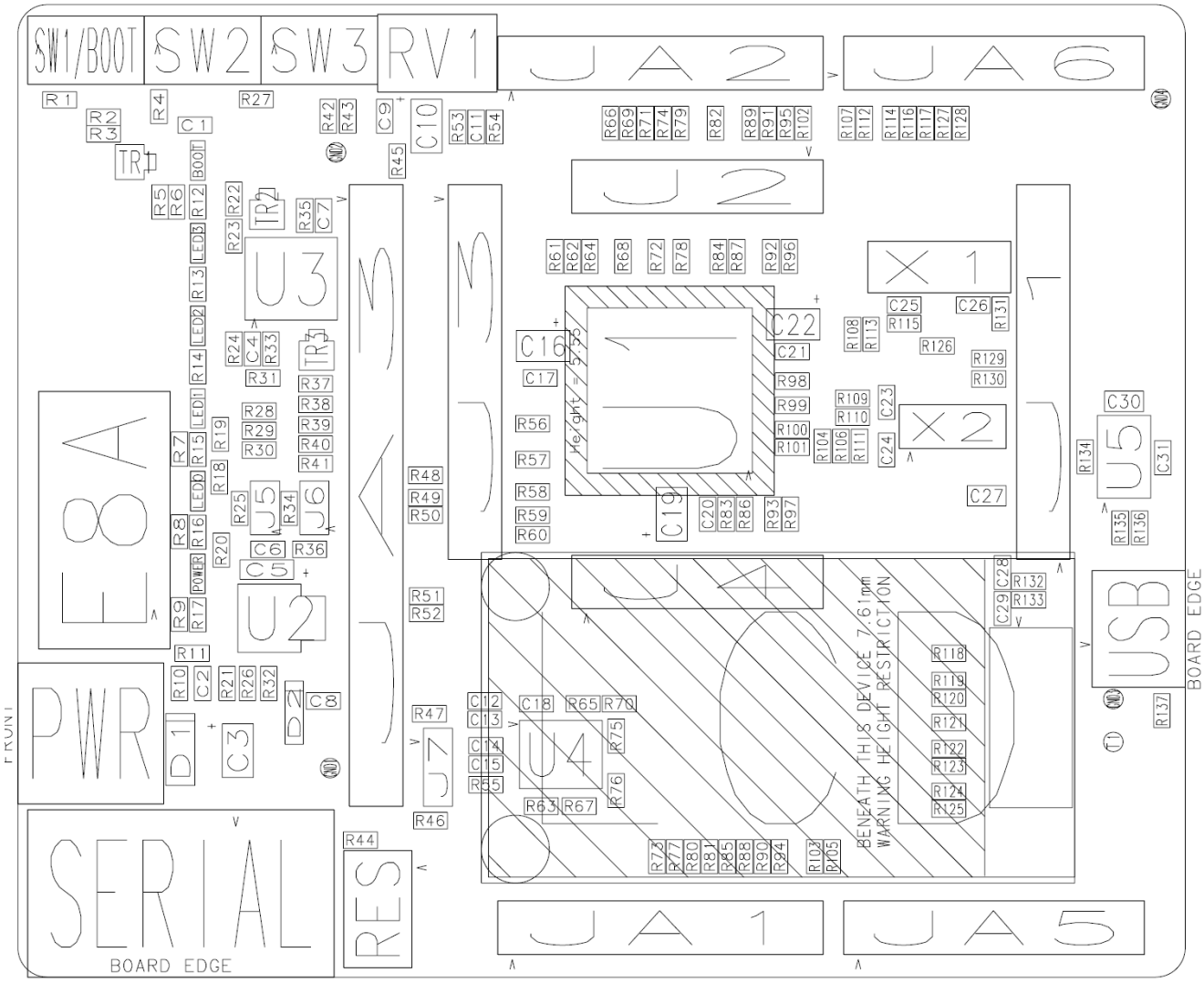


**Figure 11-1: Component Placement**

# 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 installed in the Manual Navigator.

For information about the M16C65 series microcontrollers refer to the M16C65 Group hardware manual.

For information about the M16C65 assembly language, refer to the M16C Series Software Manual.

For information about the E8A Emulator, please refer to the *E8a Emulator User's Manual.*

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

**Technical Contact Details**

America: techsupport.rta@renesas.com

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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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User's Manual
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# Renesas Starter Kit for M16C65
# User's Manual

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