

To our customers,

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# Renesas Starter Kit

RSKM32C87 User's Manual

RENEASAS SINGLE-CHIP MICROCOMPUTER  
M32C FAMILY

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# Chapter 1. Preface

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## Glossary

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

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## Chapter 2. Purpose

This RSK is an evaluation tool for Renesas microcontrollers.

Features include:

- Renesas Microcontroller Programming.
- User Code Debugging.
- User Circuitry such as Switches, LEDs and potentiometer(s).
- User or Example Application.
- Sample peripheral device initialisation code.

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

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## 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 2.1mm barrel power jack.

#### Warning

**The RSK is neither under nor over voltage protected. Use a centre positive supply for this board.**

### 3.2. Power – Up Behaviour

When the RSK is purchased the RSK board has the 'Release' or stand alone code from the example tutorial code pre-programmed into the Renesas microcontroller. On powering up the board the user LEDs will start to flash. After 200 flashes, or after pressing a switch the LEDs will flash at a rate controlled by the potentiometer.

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# Chapter 4. Board Layout

## 4.1. Component Layout

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

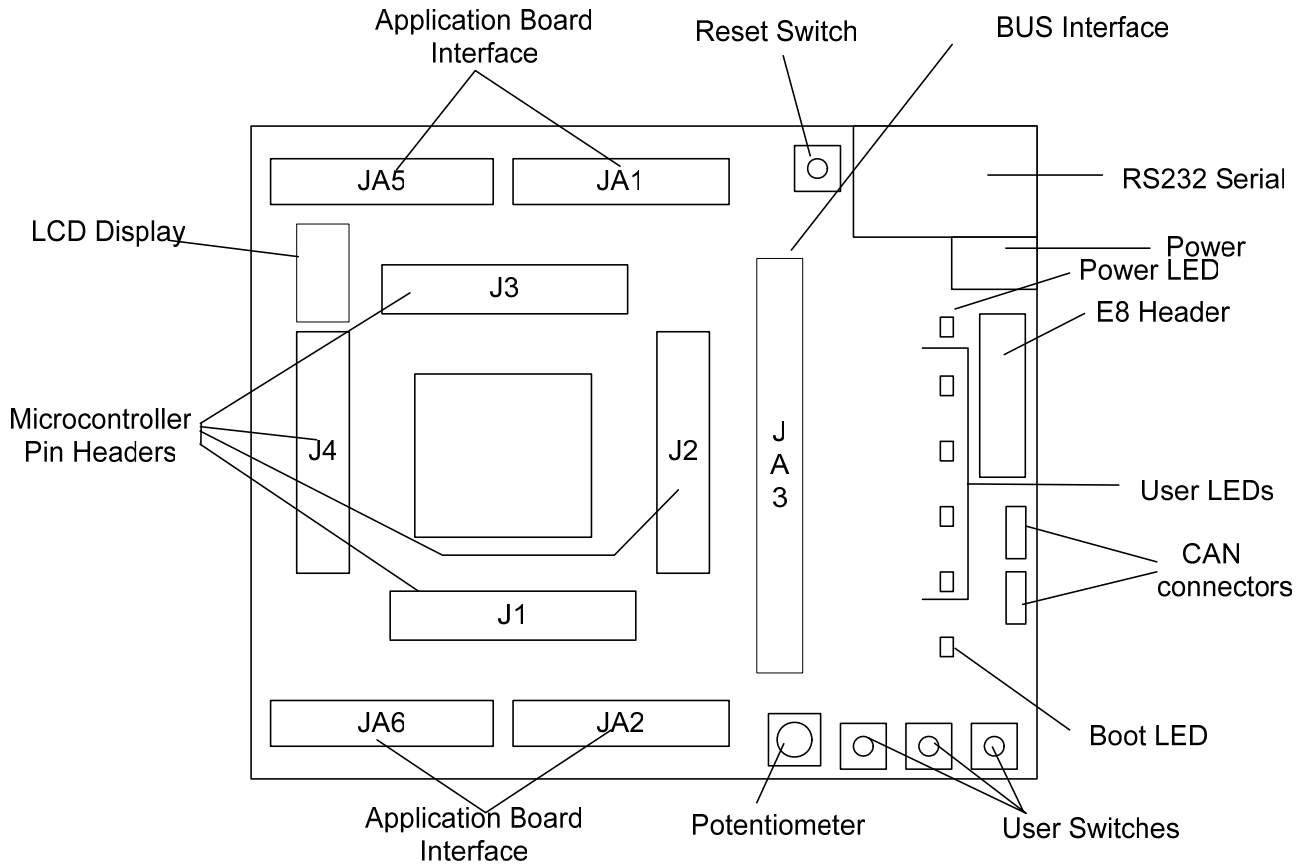


Figure 4-1: Board Layout



## 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.

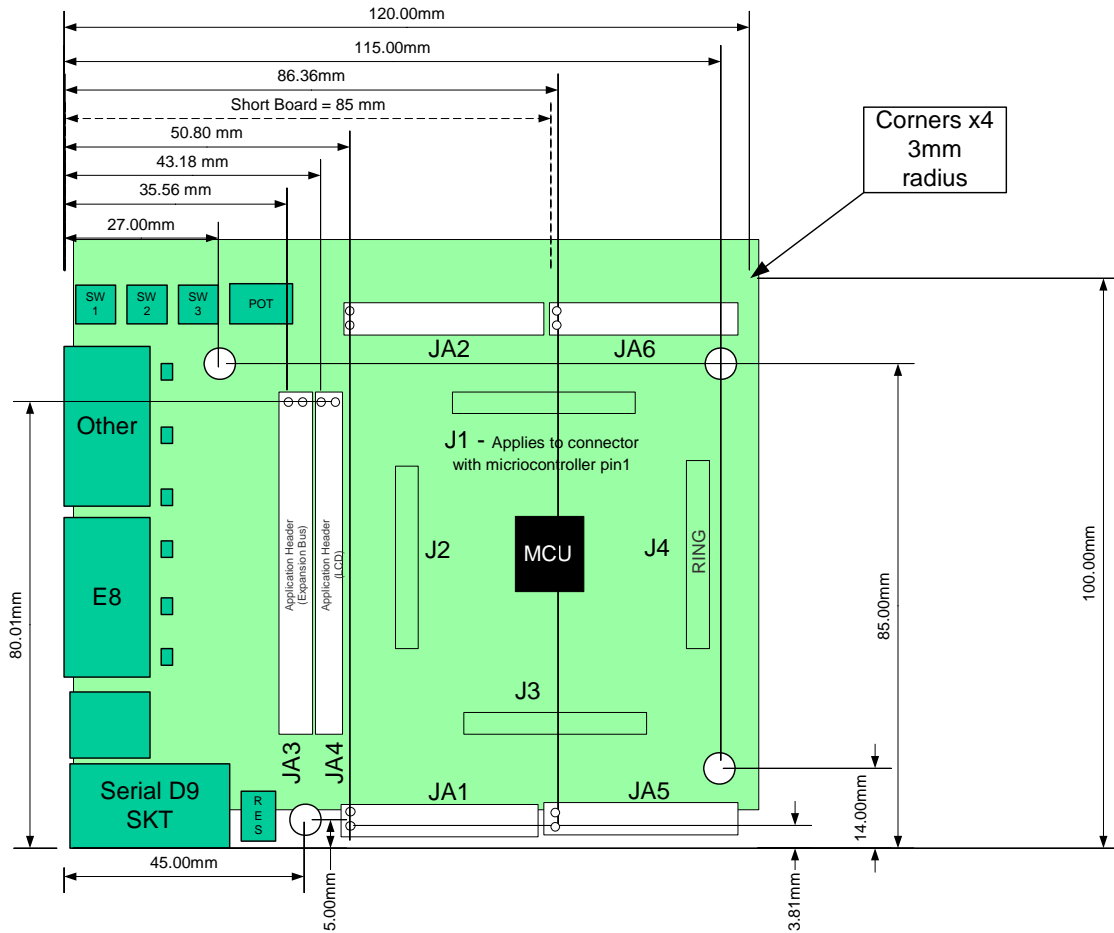


Figure 4-2 : Board Dimensions

# Chapter 5. Block Diagram

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

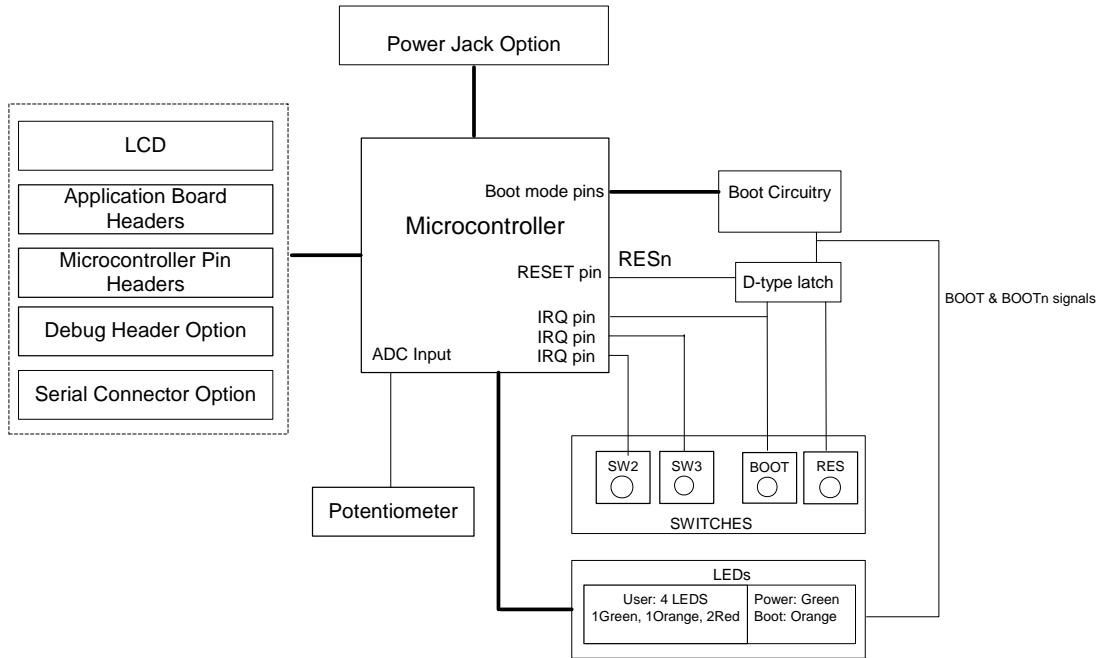


Figure 5-1: Block Diagram

Error! Reference source not found. is representative of the connections required to the RSK.

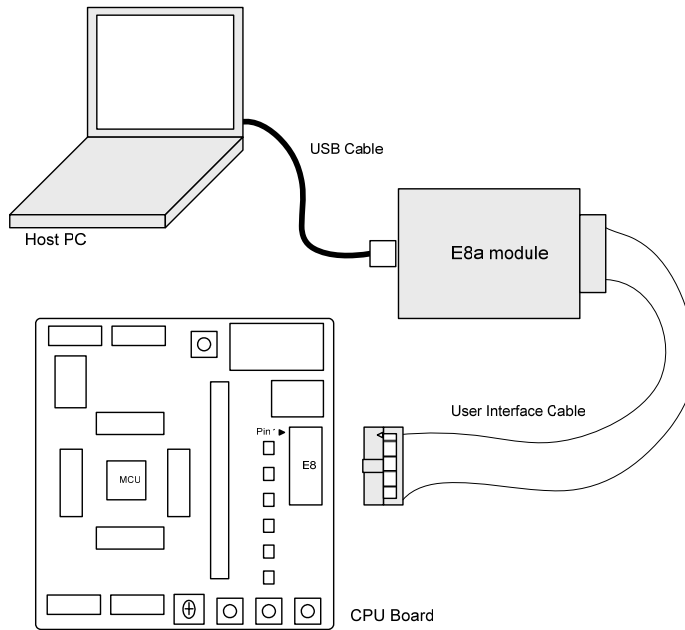


Figure 5-2 : RSK Connections

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## Chapter 6. User Circuitry

### 6.1. Switches

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

| Switch    | Function  | Microcontroller   |
|-----------|---|---|
| RES       | When pressed the RSK microcontroller is reset.  | RESn  |
| 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. | INT0 Pin18<br>(Port 8, pin 2)   |
| SW2*      | Connects to an IRQ line for user controls.  | INT1 Pin17<br>(Port 8, pin 3)   |
| SW3*      | Connects to the ADC trigger input. Option link allows connection to IRQ line. The option is a pair of OR links.   | ADTRG Pin 98<br>(Port 9, pin 7)<br><b>OR</b><br>INT2 Pin16<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) | Microcontroller Port Pin function | Microcontroller Pin Number |
|--|-----------------------------------|----------------------------|
| LED0                                   | Port 4.0                          | 52                         |
| LED1                                   | Port 4.1                          | 51                         |
| LED2                                   | Port 4.2                          | 50                         |
| LED3                                   | Port 4.3                          | 49                         |

Table 6-2: LED Port

### 6.3. Potentiometer

A single turn potentiometer is connected to AN0.0 (P10.0) of the microcontroller. This may be used to vary the input analogue voltage value to this pin between AVCC and Ground.

## 6.4. Serial port

The microcontroller programming serial port 1 is connected to the E8a connector. A serial port can be used by moving option resistors and fitting the D connector. This can be connected to serial channel 1 if the E8a is disabled from using channel 1; or serial channel 0 while the E8a is enabled.

| Description | Function                | Fit For E8a | Remove for E8a | Fit for RS232 Channel 0 | Remove for RS232 Channel 0 | Fit for RS232 Channel 1 | Remove for RS232 Channel 1 |
|-------------|-------------------------|-------------|----------------|-------------------------|----------------------------|-------------------------|----------------------------|
| TxD1        | Programming Serial Port | R13         | R68            | R69                     | R68                        | R68                     | R69, R13                   |
| RxD1        | Programming Serial Port | R12         | R44            | R47                     | R44                        | R44                     | R47, R12                   |
| CLK1        | Programming Serial Port | R14         | NA             | NA                      | NA                         | NA                      | R14                        |

Table 6-3: Serial port connections

If a serial port is used the D-connector U3 must be fitted and the RS232 transceiver enabled.

| Description              | Function                              | Fit For RS232 Enable | Remove for RS232 Enable | Fit For RS232 Disable | Remove for RS232 Disable |
|--------------------------|---------------------------------------|----------------------|-------------------------|-----------------------|--------------------------|
| RS232 Transceiver Enable | Disables/Enables U3 RS232 Transceiver | R42                  | R39                     | R39                   | R42                      |

Table 6-4: RS232 enable

An additional serial port is connected to the application headers.

---

## 6.5. LCD Module

A LCD module is supplied to be connected to the connector J11. This should be fitted so that the LCD module lies over J3. Care should be taken to ensure the pins are inserted correctly into J11. The LCD module uses a 4 bit interface to reduce the pin allocation. No contrast control is provided; this is set by a resistor on the supplied display module. The module supplied with the RSK only supports 5V operation.

Table 6-5 shows the pin allocation and signal names used on this connector.

| J11 |                           |            |     |                  |            |
|-----|---------------------------|------------|-----|------------------|------------|
| Pin | Circuit Net Name          | Device Pin | Pin | Circuit Net Name | Device Pin |
| 1   | Ground                    | -          | 2   | 5V Only          | -          |
| 3   | No Connection             | -          | 4   | DLCDRS           | 70         |
| 5   | R/W (Wired to Write only) | -          | 6   | DLCDE            | 69         |
| 7   | No Connection             | -          | 8   | No Connection    | -          |
| 9   | No Connection             | -          | 10  | No Connection    | -          |
| 11  | DLCD4                     | 66         | 12  | DLCD5            | 65         |
| 13  | DLCD6                     | 64         | 14  | DLCD7            | 63         |

Table 6-5 LCD Module Connections

## 6.6. Option Links

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

| Option Link Settings |                                       |  |  |               |
|----------------------|---------------------------------------|--|--|---------------|
| Reference            | Function                              | Fitted   | Alternative (Removed)  | Related To    |
| R14                  | Programming<br>Serial Port            | <b>Connects SCK to E8a</b>                                     | SCK disconnected from E8a  |               |
| R12                  | Programming<br>Serial Port            | <b>Connects E8a to<br/>Programming Serial port.</b>            | MUST be removed if R44 fitted.   | R44           |
| R13                  | Programming<br>Serial Port            | <b>Connects E8a to<br/>Programming Serial port.</b>            | Should be removed if R68 fitted.   | R68           |
| R44                  | Programming<br>Serial Port            | Connects RS232 port to<br>Programming SCI port                 | <b>MUST be removed if R12, R47<br/>or R49 fitted.</b>                            | R12, R47, R49 |
| R68                  | Programming<br>Serial Port            | Connects RS232 port to<br>Programming SCI port                 | <b>MUST be removed if R13, R69<br/>or R72 fitted.</b>                            | R13, R69, R72 |
| R42                  | RS232 Driver                          | Enables RS232 Serial<br>Transceiver                            | <b>MUST be removed if R39<br/>Fitted</b>   | R39           |
| R39                  | RS232 Driver                          | <b>Disables RS232 Serial<br/>Transceiver</b>                   | MUST be removed if R42 Fitted  | R42           |
| R41                  | Serial Connector                      | Connects Alternate serial (CH2)<br>to D connector              | <b>Disconnects Alternate serial<br/>from D connector.</b>                        | R40           |
| R40                  | Serial Connector                      | Connects Alternate serial (CH2)<br>to D connector              | <b>Disconnects Alternate serial<br/>from D connector.</b>                        | R41           |
| R55                  | Alternate Serial                      | Connects Alternate Serial (CH2<br>- SC1b) to RS232 Transceiver | <b>Should be removed if SC1b<br/>not used for RS232.</b>                         | R50           |
| R50                  | Alternate Serial                      | Connects Alternate Serial (CH2<br>- SC1b) to RS232 Transceiver | <b>Should be removed if SC1b<br/>not used for RS232.</b>                         | R55           |
| R72                  | RS232 Serial on<br>Application Header | Connects Application Header to<br>RS232 Transceiver            | <b>MUST be removed if R68 or<br/>R69 fitted.</b>                                 | R68, R69      |
| R49                  | RS232 Serial on<br>Application Header | Connects Application Header to<br>RS232 Transceiver            | <b>MUST be removed if R44 or<br/>R47 fitted.</b>                                 | R44, R47      |
| R69                  | RS232 Serial on<br>SC1a CH0           | Connects Serial Channel 0 to<br>RS232 Transceiver              | <b>MUST be removed if R68 or<br/>R72 fitted.</b>                                 | R68, R72      |
| R47                  | RS232 Serial on<br>SC1a CH0           | Connects Serial Channel 0 to<br>RS232 Transceiver              | <b>MUST be removed if R44 or<br/>R49 fitted.</b>                                 | R44, R49      |
| R96                  | External Oscillator                   | Connects External Ring header<br>pins to Microcontroller       | <b>Disconnects sensitive<br/>microcontroller signals from<br/>external pins.</b> | R100          |

| Option Link Settings |                              |   |  |            |
|----------------------|------------------------------|---|--|------------|
| Reference            | Function                     | Fitted  | Alternative (Removed)  | Related To |
| R100                 | External Oscillator          | Connects External Ring header pins to Microcontroller | Disconnects sensitive microcontroller signals from external pins.        | R96        |
| R97                  | External Oscillator          | Parallel resistor for crystal                         | Not fitted   |            |
| R103                 | External Subclock Oscillator | Connects External Ring header pins to Microcontroller | Disconnects sensitive microcontroller signals from external pins.        | R105       |
| R105                 | External Subclock Oscillator | Connects External Ring header pins to Microcontroller | Disconnects sensitive microcontroller signals from external pins.        | R103       |
| R106                 | External Subclock Oscillator | Parallel resistor for crystal                         | Not fitted   |            |
| R9                   | Board VCC                    | Supply to board from J5                               | Fit Low ohm resistor to measure current                                  |            |
| R32                  | Microcontroller VCC1         | Supply to microcontroller VCC1                        | Fit Low ohm resistor to measure current                                  | R33        |
| R33                  | Microcontroller VCC2         | Supply to microcontroller VCC2                        | Fit Low ohm resistor to measure current                                  | R32        |
| R25                  | Board VCC1                   | Board VCC1 connected to Connector 3V3                 | Disconnected   | R23,28     |
| R28                  | Board VCC1                   | Board VCC1 connected to Connector 5V                  | Disconnected   | R23,R25    |
| R23                  | Board VCC1                   | Board VCC1 connected to Connector J5                  | Disconnected   | R25,R28    |
| R26                  | Board VCC2                   | Board VCC2 connected to Connector 3V3                 | Disconnected   | R24,29     |
| R29                  | Board VCC2                   | Board VCC2 connected to Connector 5V                  | Disconnected   | R24,R26    |
| R24                  | Board VCC2                   | Board VCC2 connected to Connector J5                  | Disconnected   | R26,R29    |
| R31                  | Analogue Power               | Connects Board VCC1 supply to Analogue supply         | Analogue supply MUST be provided from external interface pins. (Fit R43) | JA1,R43    |
| R43                  | Analogue Power               | Connects AVCC supply to Application headers           | R31 must be fitted   | R31        |

| Option Link Settings |                                     |  |   |            |
|----------------------|-------------------------------------|--|---|------------|
| Reference            | Function                            | Fitted   | Alternative (Removed)   | Related To |
| R109                 | VREF                                | Connects Board VCC1 supply to VREF                 | VREF can be provided from external interface pins. (Fit R110) | JA1,R110   |
| R110                 | VREF                                | VREF to Application headers                        | <b>R109 should be fitted</b>                                  | R109       |
| R35                  | SW3                                 | Connects SW3 to Analogue Trigger input             | <b>Disconnected</b>   | R34        |
| R34                  | SW3                                 | <b>Connects SW3 to INT2 input</b>                  | Disconnected  | R35        |
| R82                  | Microcontroller pin function select | <b>Connects microcontroller pin 28 to IICSDA</b>   | MUST be removed if R80 fitted.                                | R80        |
| R80                  | Microcontroller pin function select | Connects microcontroller pin 28 to TXD2 pin        | <b>Should be removed if R82 fitted.</b>                       | R82        |
| R78                  | Microcontroller pin function select | <b>Connects microcontroller pin 27 to IICSCS</b>   | MUST be removed if R80 fitted.                                | R76        |
| R76                  | Microcontroller pin function select | Connects microcontroller pin 27 to RXD2            | <b>Should be removed if R78 fitted.</b>                       | R78        |
| R114                 | Microcontroller pin function select | <b>Connects microcontroller pin 95 to ADPOT</b>    | MUST be removed if R115 fitted.                               | R115       |
| R115                 | Microcontroller pin function select | Connects microcontroller pin 95 to AN0             | <b>Should be removed if R114 fitted.</b>                      | R114       |
| R60                  | Microcontroller pin function select | Connects microcontroller pin 44 to Wrn pin         | <b>MUST be removed if R61 fitted.</b>                         | R61        |
| R61                  | Microcontroller pin function select | <b>Connects microcontroller pin 44 to WRLn pin</b> | Should be removed if R60 fitted.                              | R60        |
| R94                  | Microcontroller pin function select | Connects microcontroller pin 20 to TA4OUT pin      | <b>MUST be removed if R93 fitted.</b>                         | R93        |
| R93                  | Microcontroller pin function select | <b>Connects microcontroller pin 20 to Up pin</b>   | Should be removed if R94 fitted.                              | R94        |
| R92                  | Microcontroller pin function select | Connects microcontroller pin 19 to TA4IN pin       | <b>MUST be removed if R92 fitted.</b>                         | R90        |
| R90                  | Microcontroller pin function select | <b>Connects microcontroller pin 19 to Un pin</b>   | Should be removed if R92 fitted.                              | R92        |
| R84                  | Microcontroller pin function select | Connects microcontroller pin 26 to CLK2 pin        | <b>MUST be removed if R83 fitted.</b>                         | R90        |
| R83                  | Microcontroller pin function select | <b>Connects microcontroller pin 26 to Vp pin</b>   | Should be removed if R84 fitted.                              | R92        |
| R87                  | Microcontroller pin function select | Connects microcontroller pin 24 to TA2OUT pin      | <b>MUST be removed if R85 fitted.</b>                         | R87        |



| Option Link Settings |                                     |  |  |            |
|----------------------|-------------------------------------|--|--|------------|
| Reference            | Function                            | Fitted   | Alternative (Removed)                  | Related To |
| R85                  | Microcontroller pin function select | Connects microcontroller pin 24 to Wp pin        | Should be removed if R87 fitted.       | R85        |
| R88                  | Microcontroller pin function select | Connects microcontroller pin 23 to TA2IN pin     | <b>MUST be removed if R86 fitted.</b>  | R86        |
| R86                  | Microcontroller pin function select | Connects microcontroller pin 23 to Wn pin        | Should be removed if R88 fitted.       | R88        |
| R128                 | Microcontroller pin function select | Connects microcontroller pin 47 to A21 pin       | <b>MUST be removed if R130 fitted.</b> | R130       |
| R130                 | Microcontroller pin function select | Connects microcontroller pin 47 to CS2N pin      | Should be removed if R128 fitted.      | R128       |
| R118                 | Microcontroller pin function select | Connects microcontroller pin 46 to A22 pin       | <b>MUST be removed if R116 fitted.</b> | R116       |
| R116                 | Microcontroller pin function select | Connects microcontroller pin 46 to CS1N pin      | Should be removed if R118 fitted.      | R118       |
| R131                 | Microcontroller pin function select | Connects microcontroller pin 90 to AN4 pin       | <b>MUST be removed if R129 fitted.</b> | R129       |
| R129                 | Microcontroller pin function select | Connects microcontroller pin 90 to CAN0 EN pin   | Should be removed if R131 fitted.      | R131       |
| R117                 | Microcontroller pin function select | Connects microcontroller pin 89 to AN5 pin       | <b>MUST be removed if R117 fitted.</b> | R119       |
| R119                 | Microcontroller pin function select | Connects microcontroller pin 89 to CAN0 STBn pin | Should be removed if R119 fitted.      | R117       |
| R67                  | Microcontroller pin function select | Connects microcontroller pin 88 to AN6 pin       | <b>MUST be removed if R66 fitted.</b>  | R66        |
| R66                  | Microcontroller pin function select | Connects microcontroller pin 88 to CAN1 EN pin   | Should be removed if R67 fitted.       | R67        |
| R45                  | Microcontroller pin function select | Connects microcontroller pin 87 to AN7 pin       | <b>MUST be removed if R46 fitted.</b>  | R46        |
| R46                  | Microcontroller pin function select | Connects microcontroller pin 87 to CAN1 STBn pin | Should be removed if R45 fitted.       | R45        |

Table 6-6 Option 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 6-7 details the oscillators that are fitted and alternative footprints provided on this RSK:

| Component     |        |                           |
|---------------|--------|---------------------------|
| Crystal (X1)  | Fitted | 10MHz (HC/49U package)    |
| Subclock (X2) | Fitted | 32.768kHz (90SMX package) |

Table 6-7: Oscillators / Resonators

## 6.8. Reset Circuit

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

The Reset circuit operates by latching the state of the boot switch on pressing the reset button. This control is subsequently used to modify the mode pin states as required.

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

The reset is held in the active state for a fixed period by a pair of resistors and a capacitor. Please check the reset requirements carefully to ensure the reset circuit on the user's board meets all the reset timing requirements.

---

# Chapter 7. Modes

The RSK supports Boot mode and Single chip mode.

Details of programming the FLASH memory is described in the M32C/87 Group Hardware Manual.

## 7.1. Boot mode

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

| CNVSS | P5.0 | P5.5 | LSI State after Reset<br>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 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 (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 100k resistor and the CNVSS is pulled low by a 100k resistor.

When an E8a is used these three pins are controlled by the E8a.

## 7.2. Single chip mode

This RSK is configured to always boot in Single Chip mode when the E8a is not connected and the boot switch is not depressed as CNVSS is pulled down by a 100k resistor. Refer to M32C/87 Group Hardware Manual for details of Single chip mode.

| CNVSS | P5.0 | P5.5 | LSI State after Reset<br>End |
|-------|------|------|------------------------------|
| 0     | 1    | 1    | Single Chip Mode             |

Table 7-2: Single Chip Mode pin settings

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## Chapter 8. Programming Methods

The board is intended for use with HEW and the supplied E8a debugger. Refer to the M32C/87 Group Hardware Manual for details of programming the microcontroller without using these tools.

# Chapter 9. Headers

## 9.1. Microcontroller Headers

Table 9-1 to Table 9-4 show the microcontroller pin headers and their corresponding microcontroller connections. The header pins connect directly to the microcontroller pins. \* Marked pins are subject to option links.

| J1  |                   |            |     |                  |            |
|-----|-------------------|------------|-----|------------------|------------|
| Pin | Circuit Net Name  | Device Pin | Pin | Circuit Net Name | Device Pin |
| 1   | CAN1OUT           | 99         | 2   | CAN1IN           | 100        |
| 3   | DA1               | 1          | 4   | DA0              | 2          |
| 5   | TXD2              | 3          | 6   | RXD2             | 4          |
| 7   | CLK3              | 5          | 8   | BYTE             | 6          |
| 9   | E8_CNVSS          | 7          | 10  | CON_XCIN         | 8          |
| 11  | CON_XCOUT         | 9          | 12  | RESn             | 10         |
| 13  | CON_XOUT          | 11         | 14  | GROUND           | 12         |
| 15  | CON_XIN           | 13         | 16  | UC_VCC1          | 14         |
| 17  | NMI <sub>in</sub> | 15         | 18  | INT2             | 16         |
| 19  | INT1              | 17         | 20  | INT0             | 18         |
| 21  | TA4IN_Un*         | 19         | 22  | TA4OUT_Up*       | 20         |
| 23  | CAN0IN            | 21         | 24  | CAN0OUT          | 22         |
| 25  | TA2IN_Wn          | 23         | 26  | TA2OUT_Wp*       | 24         |
| 27  | Vn                | 25         | 28  | CLK2_Vp*         | 26         |
| 29  | IIC_SCL_RXD2*     | 27         | 30  | IICSDA_TXD2*     | 28         |

Table 9-1: J1

| J2  |                                    |            |     |                                   |            |
|-----|------------------------------------|------------|-----|-----------------------------------|------------|
| Pin | Circuit Net Name                   | Device Pin | Pin | Circuit Net Name                  | Device Pin |
| 1   | PTTX                               | 29         | 2   | PTRX                              | 30         |
| 3   | PTCK                               | 31         | 4   | E8_BUSY                           | 32         |
| 5   | TXD0                               | 33         | 6   | RXD0                              | 34         |
| 7   | CLK0                               | 35         | 8   | CTSRTS                            | 36         |
| 9   | RDY                                | 37         | 10  | ALE                               | 38         |
| 11  | E8_EPM                             | 39         | 12  | UD                                | 40         |
| 13  | TRST <sub>n</sub>                  | 41         | 14  | RD <sub>n</sub>                   | 42         |
| 15  | WRH <sub>n</sub>                   | 43         | 16  | WRL <sub>n</sub> _WR <sub>n</sub> | 44         |
| 17  | A23 <sub>n</sub> _CS0 <sub>n</sub> | 45         | 18  | A22_CS1 <sub>n</sub>              | 46         |
| 19  | A21_CS2 <sub>n</sub>               | 47         | 20  | A20_CS3 <sub>n</sub>              | 48         |

Table 9-2: J2

| J3  |                  |            |     |                  |            |
|-----|------------------|------------|-----|------------------|------------|
| Pin | Circuit Net Name | Device Pin | Pin | Circuit Net Name | Device Pin |
| 1   | A19_LED3         | 49         | 2   | A18_LED2         | 50         |
| 3   | A17_LED1         | 51         | 2   | A16_LED0         | 52         |
| 5   | A15_IO7          | 53         | 6   | A14_IO6          | 54         |
| 7   | A13_IO5          | 55         | 8   | A12_IO4          | 56         |
| 9   | A11_IO3          | 57         | 10  | A10_IO2          | 58         |
| 11  | A9_IO1           | 59         | 12  | UC_VCC2          | 60         |
| 13  | A8_IO0           | 61         | 14  | GROUND           | 62         |
| 15  | A7_DLCD7         | 63         | 16  | A6_DLCD6         | 64         |
| 17  | A5_DLCD5         | 65         | 18  | A4_DLCD4         | 66         |
| 19  | A3               | 67         | 20  | A2               | 68         |
| 21  | A1_DLCD0         | 69         | 22  | A0_DLCD0         | 70         |
| 23  | D15              | 71         | 24  | D14              | 72         |
| 25  | D13              | 73         | 26  | D12              | 74         |
| 27  | D11              | 75         | 28  | D10              | 76         |
| 29  | D9               | 77         | 30  | D8               | 78         |

Table 9-3: J3

| J4  |                  |            |     |                  |            |
|-----|------------------|------------|-----|------------------|------------|
| Pin | Circuit Net Name | Device Pin | Pin | Circuit Net Name | Device Pin |
| 1   | D7               | 79         | 2   | D6               | 80         |
| 3   | D5               | 81         | 4   | D4               | 82         |
| 5   | D3               | 83         | 6   | D2               | 84         |
| 7   | D1               | 85         | 8   | D0               | 86         |
| 9   | AN7_CAN1STBn     | 87         | 10  | AN6_CAN1EN       | 88         |
| 11  | AN5_CAN0STBn     | 89         | 12  | AN4_CAN0EN       | 90         |
| 13  | AN3              | 91         | 14  | AN2              | 92         |
| 15  | AN1              | 94         | 16  | AVss             | 94         |
| 17  | ADPOT_AN0        | 96         | 18  | CON_AVREF        | 96         |
| 19  | CON_AVCC         | 97         | 20  | ADTRG            | 99         |

Table 9-4: J4

## 9.2. Application Headers

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

| JA1 |                      |        |                 |            |     |                                  |    |                 |            |
|-----|----------------------|--------|-----------------|------------|-----|----------------------------------|----|-----------------|------------|
| Pin | Generic Header Name  |        | RSK Signal Name | Device Pin | Pin | Header Name                      |    | RSK Signal Name | Device Pin |
| 1   | Regulated Supply 1   |        | 5V              |            | 2   | Regulated Supply 1               |    | GROUND          |            |
| 3   | Regulated Supply 2   |        | 3V3             |            | 4   | Regulated Supply 2               |    | GROUND          |            |
| 5   | Analogue Supply      |        | AVcc            | 97         | 6   | Analogue Supply                  |    | AVss            | 94         |
| 7   | Analogue Reference   |        | AVref           | 96         | 8   | ADTRG                            |    | ADTRG           | 98         |
| 9   | ADC0                 | I0     | ADPot_AN0*      | 95         | 10  | ADC1                             | I1 | AN1             | 93         |
| 11  | ADC2                 | I2     | AN2             | 92         | 12  | ADC3                             | I3 | AN3             | 91         |
| 13  | DAC0                 |        | DA0             | 2          | 14  | DAC1                             |    | DA1             | 1          |
| 15  | IOPort               |        | A8_IO_0         | 61         | 16  | IOPort                           |    | A9_IO_1         | 59         |
| 17  | IOPort               |        | A10_IO_2        | 58         | 18  | IOPort                           |    | A11_IO_3        | 57         |
| 19  | IOPort               |        | A12_IO_4        | 56         | 20  | IOPort                           |    | A13_IO_5        | 55         |
| 21  | IOPort               |        | A14_IO_6        | 54         | 22  | IOPort                           |    | A15_IO_7        | 53         |
| 23  | Interrupt            | IRQAEC | D13_INT3        | 73         | 24  | I <sup>2</sup> C Bus - (3rd pin) |    | NC              | -          |
| 25  | I <sup>2</sup> C Bus |        | IIC_SDA*        | 28         | 26  | I <sup>2</sup> C Bus             |    | IIC_SCL*        | 27         |

Table 9-5: JA1 Standard Generic Header

| JA2 |               |  |                 |            |     |                       |  |                 |            |
|-----|---------------|--|-----------------|------------|-----|-----------------------|--|-----------------|------------|
| Pin | Header Name   |  | RSK Signal Name | Device Pin | Pin | Header Name           |  | RSK Signal Name | Device Pin |
| 1   | Reset         |  | RESn            | 10         | 2   | External Clock Input  |  | EXTAL           | -          |
| 3   | Interrupt     |  | NMIIn           | 15         | 4   | Regulated Supply 1    |  | Vss1            |            |
| 5   | SPARE         |  | -               | -          | 6   | Serial Port           |  | TxD0            | 33         |
| 7   | Interrupt     |  | INT0            | 18         | 8   | Serial Port           |  | RxD0            | 34         |
| 9   | Interrupt     |  | INT1            | 17         | 10  | Serial Port           |  | CLK0            | 35         |
| 11  | Motor control |  | UD              | 40         | 12  | Serial Port Handshake |  | CTSRTS          | 36         |
| 13  | Motor control |  | Up*             | 20         | 14  | Motor control         |  | Un*             | 19         |
| 15  | Output        |  | Vp*             | 26         | 16  | Motor control         |  | Vn              | 25         |
| 17  | Input         |  | Wp*             | 24         | 18  | Motor control         |  | Wn*             | 23         |
| 19  | Output        |  | TA2OUT*         | 23         | 20  | Output                |  | TA4OUT          | 20         |
| 21  | Input         |  | TA2IN*          | 20         | 22  | Input                 |  | TA4IN           | 19         |
| 23  | Open drain    |  | INT2            | 16         | 24  | Tristate Control      |  | TRSTn           | 41         |
| 25  | SPARE         |  | -               |            | 26  | SPARE                 |  | -               |            |

Table 9-6: JA2 Standard Generic Header

Table 9-7 to Table 9-9 below show the optional generic header connections. \* Marked pins are subject to option links.

| JA3 |             |                 |            |     |             |                 |            |
|-----|-------------|-----------------|------------|-----|-------------|-----------------|------------|
| Pin | Header Name | RSK Signal Name | Device Pin | Pin | Header Name | RSK Signal Name | Device Pin |
| 1   | A0          | A0              | 70         | 2   | A1          | A1              | 69         |
| 3   | A2          | A2              | 68         | 4   | A3          | A3              | 67         |
| 5   | A4          | A4              | 66         | 6   | A5          | A5              | 65         |
| 7   | A6          | A6              | 64         | 8   | A7          | A7              | 63         |
| 9   | A8          | A8              | 61         | 10  | A9          | A9              | 59         |
| 11  | A10         | A10             | 58         | 12  | A11         | A11             | 57         |
| 13  | A12         | A12             | 56         | 14  | A13         | A13             | 55         |
| 15  | A14         | A14             | 54         | 16  | A15         | A15             | 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        | A23_CS0n        | 45         | 28  | CSbn        | CS1n            | 46         |
| 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             | 52         | 38  | A15         | A15             | 51         |
| 39  | A18         | A18             | 50         | 40  | A19         | A19             | 49         |
| 41  | A20         | A20             | 48         | 42  | A21         | A21             | 47         |
| 43  | A22         | A22             | 46         | 44  | SDCLK       | ---             | ---        |
| 45  | CScn        | CS2n            | 47         | 46  | ALE         | ALE             | 38         |
| 47  | HWRn        | WRHn            | 43         | 48  | LWRn        | WRLn            | 44         |
| 49  | CASn        | ---             | ---        | 50  | RASn        | ---             | ---        |

Table 9-7: JA3 Optional Generic Header



| JA5 |             |    |                 |            |     |             |    |                 |            |
|-----|-------------|----|-----------------|------------|-----|-------------|----|-----------------|------------|
| Pin | Header Name |    | RSK Signal Name | Device Pin | Pin | Header Name |    | RSK Signal Name | Device Pin |
| 1   | ADC4        | I4 | AN4*            | 90         | 2   | ADC5        | I5 | AN5*            | 89         |
| 3   | ADC6        | I6 | AN6*            | 88         | 4   | ADC7        | I7 | AN7*            | 97         |
| 5   | CAN         |    | CAN0OUT         | 22         | 6   | CAN         |    | CAN0IN          | 21         |
| 7   | CAN         |    | CAN1OUT         | 99         | 8   | CAN         |    | CAN1IN          | 100        |
| 9   | Reserved    |    |                 |            | 10  | Reserved    |    |                 |            |
| 11  | Reserved    |    |                 |            | 12  | Reserved    |    |                 |            |
| 13  | Reserved    |    |                 |            | 14  | Reserved    |    |                 |            |
| 15  | Reserved    |    |                 |            | 16  | Reserved    |    |                 |            |
| 17  | Reserved    |    |                 |            | 18  | Reserved    |    |                 |            |
| 19  | Reserved    |    |                 |            | 20  | Reserved    |    |                 |            |
| 21  | Reserved    |    |                 |            | 22  | Reserved    |    |                 |            |
| 23  | Reserved    |    |                 |            | 24  | Reserved    |    |                 |            |

Table 9-8: JA5 Optional Generic Header.

| JA6 |             |             |                 |            |     |                      |             |                 |            |
|-----|-------------|-------------|-----------------|------------|-----|----------------------|-------------|-----------------|------------|
| Pin | Header Name |             | RSK Signal Name | Device Pin | Pin | Header Name          |             | RSK Signal Name | Device Pin |
| 1   | DMA         |             | ---             | ---        | 2   | DMA                  |             | DACK            | --         |
| 3   | DMA         |             | ---             | ---        | 4   | Standby (Open drain) |             | STBYn           | ---        |
| 5   | Host Serial | SCIdTX      | RS232TX         | ---        | 6   | Host Serial          | SCIdRX      | RS232RX         | ---        |
| 7   | Serial Port |             | RXD2*           | 27         | 8   | Serial Port          |             | TxD2*           | 28         |
| 9   | Serial Port | Synchronous | TXD3*           | 3          | 10  | Serial Port          |             | CLK2            | 26         |
| 11  | Serial Port | Synchronous | CLK3            | 5          | 12  | Serial Port          | Synchronous | RxD3*           | 4          |
| 13  | Reserved    |             |                 |            | 14  | Reserved             |             |                 |            |
| 15  | Reserved    |             |                 |            | 16  | Reserved             |             |                 |            |
| 17  | Reserved    |             |                 |            | 18  | Reserved             |             |                 |            |
| 19  | Reserved    |             |                 |            | 20  | Reserved             |             |                 |            |
| 21  | Reserved    |             |                 |            | 22  | Reserved             |             |                 |            |
| 23  | Reserved    |             |                 |            | 24  | Reserved             |             |                 |            |
| 25  | Reserved    |             |                 |            | 26  | Reserved             |             |                 |            |

Table 9-9: JA6 Optional Generic Header

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Table 9-10 below shows the CAN connections

| J14 |               |             |            |
|-----|---------------|-------------|------------|
| Pin | Function      | Signal Name | Device Pin |
| 1   | CAN0 Positive | CAN0H       | 21         |
| 2   | GROUND        |             |            |
| 3   | CAN0 Negative | CAN0L       | 22         |
| J15 |               |             |            |
| Pin | Function      | Signal Name | Device Pin |
| 1   | CAN1 Positive | CAN1H       | 100        |
| 2   | GROUND        |             |            |
| 3   | CAN1 Negative | CAN1L       | 99         |

Table 9-10: CAN Headers

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# Chapter 10. Code Development

## 10.1. Overview

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

## 10.2. Mode Support

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

## 10.3. Breakpoint Support

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

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

## 10.4. Memory Map

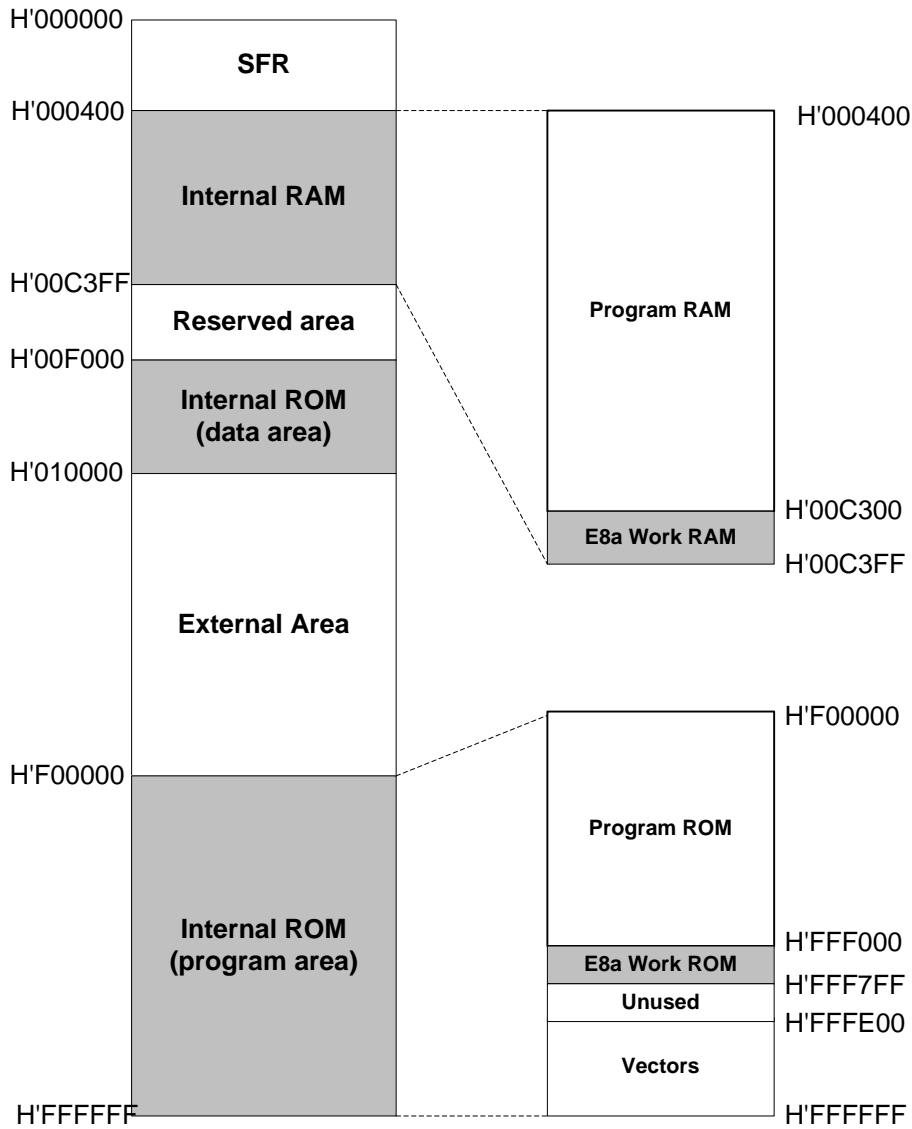


Figure 10-1: Memory Map



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## Chapter 12. Additional Information

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

For information about the M32C/87 series microcontrollers refer to the M32C/87Group Hardware Manual

For information about the M32C/87 assembly language, refer to the M32C/80SeriesSoftware Manual.

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

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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 for M32C/87

User's Manual

Publication Date Rev.03.00 25.OCT.2007

Published by: **Renesas Technology Europe Ltd.**  
Duke's Meadow, Millboard Road, Bourne End  
Buckinghamshire SL8 5FH, United Kingdom

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# Renesas Starter Kit for M32C/87 User's Manual



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REG10J0010-0300