3DK1657

USER MANUAL

FOR H8SX/1657 ON-CHIP FLASH MICROCONTROLLER

Warning

Check the silkscreen around the power jack (J9) for the minimum and maximum voltage input levels for this 3DK.
Always use a centre positive supply for this board.
DO NOT USE AN E6000 POWER SUPPLY with this 3DK

Preface

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Document Information

Product Code: D005463_11

Version: 1

Date: 23/11/2004

Website: http://www.eu.renesas.com/

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1. Power Requirements

All 3DK boards are centre positive with a 2.5mm barrel power jack.
The diode, D1 provides reverse polarity protection.
A 9V, centre positive supply is suitable for use with this board.

Warning
Check the silkscreen around the power jack (J9) for the minimum and maximum voltage input levels for this 3DK.
The 3DK is neither under nor over voltage protected.
Always use a centre positive supply for this board.
DO NOT USE AN E6000 POWER SUPPLY with this 3DK

2. Power – Up Behaviour

The 3DK board has code pre-programmed into the Renesas microcontroller. On powering up the board, pressing switch 2 will cause the red user LEDs to flash. Switches 2 and 3 as well as the potentiometer can be used to modify the LED flashing pattern.

3. Purpose

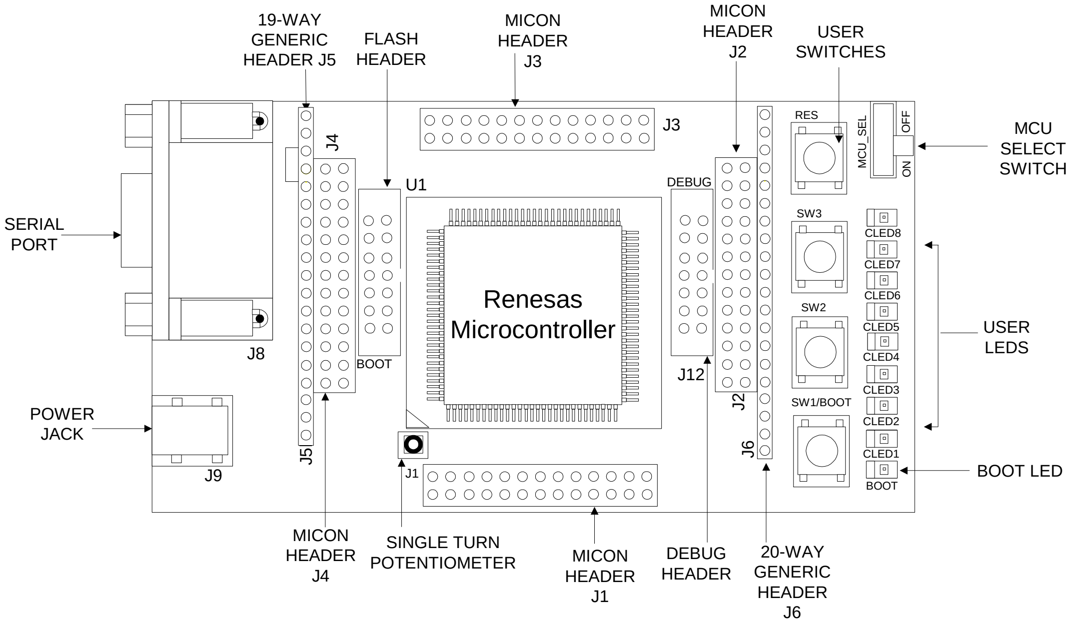
This 3DK board is an evaluation tool for Renesas microcontrollers.
Features include:

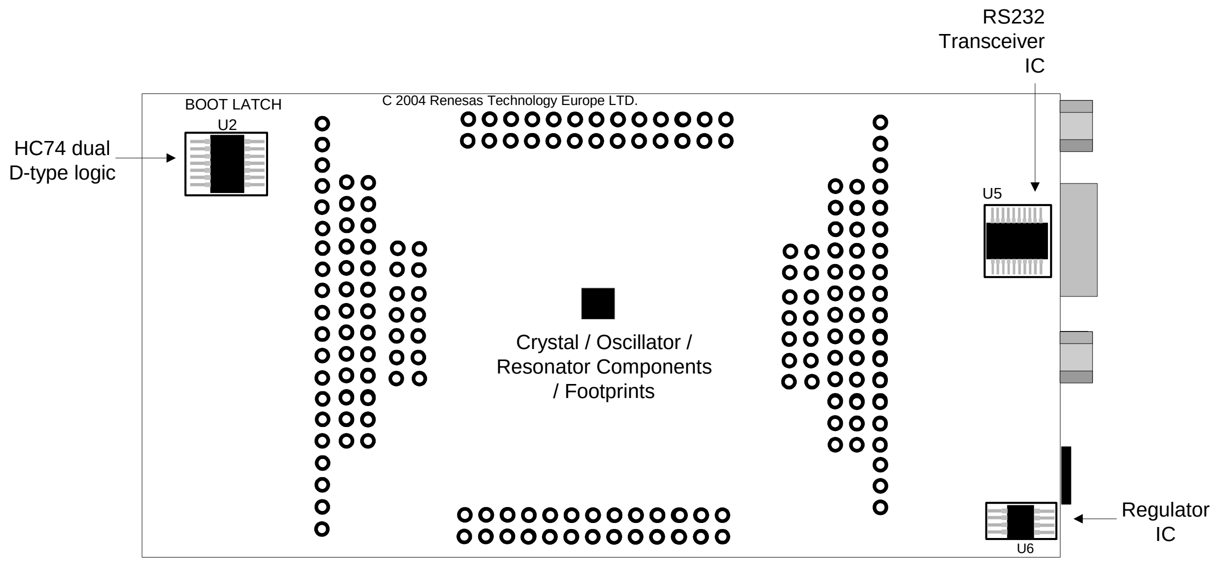
a. Renesas Microcontroller Programming
b. User Code Debugging
c. User Circuitry such as Switches, LEDs and potentiometer(s)
d. User or Base Board Connectivity

The 3DK board contains all the circuitry required for microcontroller operation.

4. Board Layout

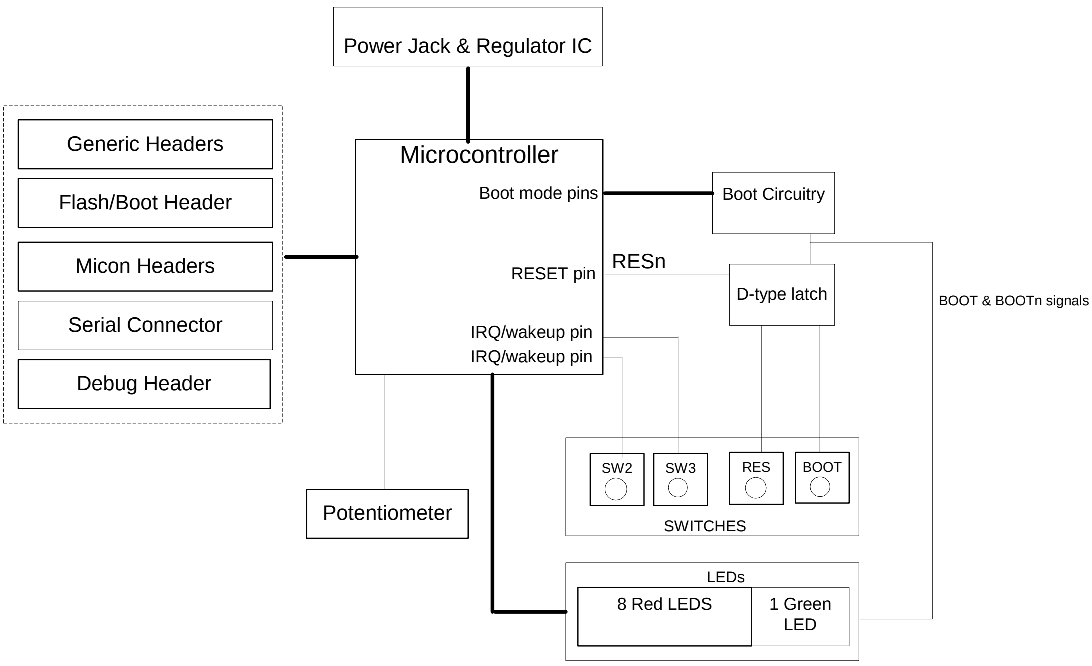
The following diagram shows top layer component layout of the board.
Note: The diagram below is for illustrative purposes and does not accurately reflect the 3DK detailed in this manual.





5. Block Diagram

Diagram x.1 is representative of the 3DK components and their connectivity.



6. User Circuitry

6.1. Switches

There are four switches located on the 3DK. These are:

Switch	Function	Microcontroller
SW1/BOOT	This switch is used in conjunction with the RES switch to place the device in BOOT mode.	IRQ0-A, Pin 72 (Port 1, pin 0)
SW2	This switch is connected via a 0R link to an IRQ line capable of waking up the microcontroller device from sleep mode.	IRQ1-A , Pin73 (Port 1, pin 1)
SW3	This switch is connected via a 0R link to another IRQ line capable of waking up the microcontroller device from sleep mode.	IRQ2-A, Pin 74 (Port 1, pin 2)
RES	This switch when pressed resets the 3DK microcontroller.	RESn

NB. Refer to schematic for detailed connectivity information.

6.2. LEDS

There are nine LEDs on the 3DK board. The green BOOT LED indicates the device is in boot mode when lit. The eight red LEDs are connected to an IO port and will light when their corresponding port pin is set low.
Table 6-1, 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
CLED1	PH0	53
CLED2	PH1	54
CLED3	PH2	55
CLED4	PH3	56
CLED5	PH4	58
CLED6	PH5	59
CLED7	PH6	60
CLED8	PH7	61

Table 6-1:LED Port

6.3. POTENTIOMETER

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

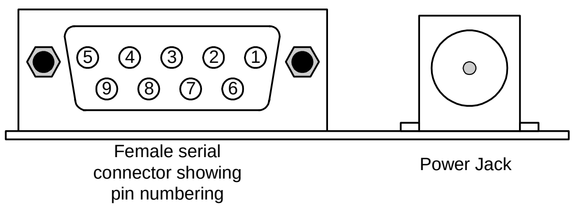
6.4. SERIAL PORT

The microcontroller programming serial port (SCI4) is connected to the D–type connector J8 via an RS232 transceiver.
A secondary microcontroller serial port (SCI1) is connected to generic header, J6 via the second channel of the RS232 transceiver.
The serial baud rates supported by this 3DK are shown below. Note: these values are calculated from the frequency value of the main oscillating source fitted by default on this 3DK.

Baud Rate Register Settings for Serial Communication Rates												
Values are calculated for 29.4984MHz clock												
SMR Setting:	**0**			**1**			**2**			**3**		
Comm. Baud	**BRR setting**	**Actual Rate**	**ERR (%)**	**BRR setting**	**Actual Rate**	**ERR (%)**	**BRR setting**	**Actual Rate**	**ERR (%)**	**BRR setting**	**Actual Rate**	**ERR (%)**
110	invalid	invalid	invalid	invalid	invalid	invalid	invalid	invalid	invalid	64	111	0.70
300	invalid	invalid	invalid	invalid	invalid	invalid	95	300	0.00	23	300	0.00
1200	invalid	invalid	invalid	95	1200	0.00	23	1200	0.00	5	1200	0.00
2400	191	2400	0.00	47	2400	0.00	11	2400	0.00	2	2400	0.00
4800	95	4800	0.00	23	4800	0.00	5	4800	0.00	1	3600	-25.00
9600	47	9600	0.00	11	9600	0.00	2	9600	0.00	invalid	invalid	invalid
19200	23	19200	0.00	5	19200	0.00	1	14400	-25.00	invalid	invalid	invalid
38400	11	38400	0.00	2	38400	0.00	invalid	invalid	invalid	invalid	invalid	invalid
57600	7	57600	0.00	1	57600	0.00	invalid	invalid	invalid	invalid	invalid	invalid
115200	3	115200	0.00	0	115200	0.00	invalid	invalid	invalid	invalid	invalid	invalid

Table 6-2 : BRR Settings

This serial port may be used as a debugging communication port or as a normal serial communication port when the device is in user mode.



6.5. JUMPERS

Table 6-3 below describes the function of the 2-Pin jumpers contained on this 3DK board.

2-Pin Jumper Settings				
Reference	Jumper Function	Fitted	Alternative (Removed)	Footprint for jumper only/Jumper pins fitted
J10	RX Disable	PRXD from the RS232 device to U1 is enabled. This enables serial port communication.	Disabled. This allows the FDM to program the microcontroller	Jumper pins fitted
J11	UVCC power Measurement	Bypasses R11, a 1206 0R resistor, for current measurement	R11 must be fitted to power UVCC	Footprint only
J13	User Boot	A transition to user mode is made once a boot switch sequence is performed by the user	A transition to boot mode is made once a boot switch sequence is performed by the user	
J14	Regulator Bypass	Bypasses the regulator; power to board is taken directly from external supply (additionally R87 must be fitted and R85 removed)	Board supply is taken via regulator	

Table 6-4: 2-Pin jumpers

7. OSCILLATOR SOURCES

A ceramic resonator is fitted on the 3DK and used to supply the main clock input to the Renesas microcontroller. Table 7-1 details the oscillators that are fitted and alternative footprints provided on this 3DK:

Component	Details		
Resonator (X1)	Footprint Only &/or fitted*	14.7458MHz (4.1mm x 4.7mm package)	115200
Crystal (X2)	Footprint Only &/or fitted*	14.745MHz (low profile package 5mm x 7mm x 1.3mm)	115200
Crystal (X3)	Footprint only	14.7456MHz recommended value (HC/49U package)	115200
Subclock	None		

Table 7-1: Oscillators / Resonators

* Either X1 or X2 will be fitted on this board.
Warning: When replacing the default oscillator with that of another frequency, the FDT programming kernels supplied will need rebuilding. The supplied HMON debugging monitor will not function. The user is responsible for code written to support operating speeds other than the default. See the HMON user manual for details of making the appropriate modifications in the code to accommodate different operating frequencies.

8. MODES

The 3DK supports User mode, Boot mode and User 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. User Boot mode can only be used to program the User Mat (the main area, 768Kbytes, of Flash ROM on the device). It does not support programming of the user boot area. User Boot mode is used to run a user bootloader program stored in the user boot MAT (the smaller area, 8Kbytes, of Flash ROM). To program the user boot MAT, the device must be in Boot mode. Further details of programming the MATs are available in the H8SX/1657 hardware manual.
To enter boot mode, press and hold the boot button so that the mode pins are held in their boot states while reset is pressed and released. Then release the boot button. The BOOT LED will be illuminated to indicate that the microcontroller is in boot mode.

8.1. BOOT MODE

The boot mode settings for this 3DK are shown in Table 8-1 below:

MD0	MD1	MD2	LSI State after Reset End
1	1	1	User Mode
1	0	0	Boot Mode

Table 8-1: Mode pin settings

8.2. USER BOOT MODE

A Note on Mats:

The H8SX/1657 possesses two distinct areas of Flash, User MAT (768KByte) and User Boot MAT (8KByte). The User Boot MAT is a separate area of FLASH from User MAT, intended to hold user boot code.

A custom boot stub could be programmed into User Boot MAT which allows programming and erasing of the User MAT in User Mode, without erasing the contents of the User Boot MAT. Once User Boot Mode is entered, code contained in the User Boot MAT is executed. This differs to Boot mode, as Boot mode erases all User MAT and requires an auto-baud on a fixed SCI port to be performed. The existence of the user boot Mat therefore allows an alternative communications port to be used for further code download to the User MAT. Programming of the user boot mat may only be performed in boot mode.

The user may place the H8SX/1657 device provided on a 3DK1657 board in user boot mode by fitting jumper J13. The Boot procedure must then be performed for entry into user boot mode. The Boot LED should light, suggesting a transition to user boot mode.

The user boot mode settings for this 3DK are shown in Table 8-1 below:

MD0	MD1	MD2	LSI State after Reset End
0	1	0	User Boot Mode

Table 8-2: Mode pin settings

8.3. USER MODE

For the device to enter User Mode, reset must be held active while the microcontroller mode pins are held in states specified for User Mode operation. 100K pull up and pull down resistors are used to set the pin states during reset.
The H8SX/1657 supports 4 user modes. The memory map in all of these modes is 16Mbyte in size. The default user mode for 3DK1657 is 7.

9. PROGRAMMING METHODS

All of the Flash ROM on the device (i.e. both MATs) can be programmed when the device is in Boot mode. Once in boot mode, the bootloader program pre-programmed into the microcontroller executes and attempts a connection with a host (for example, a PC). The host, on establishing a connection with the microcontroller, may then transmit program data to the microcontroller via the appropriate programming port.

Table 9-1below shows the programming port for this Renesas Microcontroller and its associated pins

Programming Port Table – Programming port pins and their 3DK signal names			
SCI4	TXD4, PIN 89	RXD4, PIN 90	SCK4, PIN 91
3DK Signal Name	PTXD	PRXD	PSCK

Table 9-1: Serial Port Boot Channel

9.1. Port Programming

The microcontroller must enter boot mode for programming, and the programming port must be connected to a host for program download. To execute the boot transition, and allow programs to download to the microcontroller, the user must perform the following procedure:

1. Connect a 1:1 serial cable between the host PC and the 3DK board
2. Depress the RESET switch and keep this held down
3. Depress the BOOT switch once, and release
4. Release the RESET switch

9.2. FDM Header

The Renesas FDM (Flash Debug Module) is a USB based programming tool for control and programming of Renesas microcontrollers, available separately from Renesas. The 3DK serial programming signals PTXD, PRXD, PSCK and the microcontroller mode pins as well as the microcontroller reset signal are all connected to this header. The FDM, when connected to the Flash Programming header, is therefore capable of forcing the microcontroller into boot mode, programming and resetting the 3DK microcontroller.

To utilise this header the user must make the following changes to the board configuration.

1. Jumper link J10 must be removed.

9.3. E7, E10A and E10T Headers

This device does not currently support any of the E7, E10A or E10T programming tools.

9.4. Off-Board Programming

All 3DKs are capable of programming an alternative microcontroller on a secondary board. The user is responsible for providing this second board containing the alternative microcontroller, its supporting circuitry and an FDM or FoUSB header for the microcontroller.

To program the alternative microcontroller, the user should perform the following steps

- Connect a cable between the 3DK programming header and that located on the secondary board.
- Slide switch MCU_SEL to the off-board programming position (OFF). This holds the microcontroller on the 3DK in reset, preventing it from being programmed.

10. HEADERS

10.1. MICON HEADERS

Table 10-1 to Table 10-4 shows the micon headers and their corresponding microcontroller connections. The header pins connect directly to the micon pin unless otherwise stated.

Table 10-1: J1

J1 Pin	Circuit Net Name	U1 pin number	J1 pin number	Circuit Net Name	U1 pin number
1	PB1	1	2	PB2	2
3	PB3	3	4	MD2	4
5	PF7	5	6	PF6	6
7	PF5	7	8	PF4	8
9	PF3	9	10	GROUND	10
11	PF2	11	12	PF1	12
13	PF0	13	14	PE7	14
15	PE6	15	16	PE5	16
17	GROUND	17	18	PE4	18
19	BOARD_VCC	19	20	PE3	20
21	PE2	21	22	PE1	22
23	PE0	23	24	PD7	24
25	PD6	25	26	GROUND	26
27	PD5	27	28	PD4	28
29	PD3	29	30	PD2	30

Table 10-2: J2

J2 Pin	Circuit Net Name	U1 pin number	J2 pin number	Circuit Net Name	U1 pin number
1	PD1	31	2	PD0	32
3	EMLE	33	4	P20	34
5	P21	35	6	P22	36
7	P23	37	8	P24	38
9	RXD1	39	10	TXD1	40
11	P27	41	12	GROUND	42
13	P30	43	14	BOARD_VCC	44
15	P31	45	16	P32	46
17	P33	47	18	P34	48
19	P35	49	20	P36	50
21	P37	51	22	NMI	52
23	PH0	53	24	PH1	54
25	PH2	55	26	PH3	56
27	GROUND	57	28	PH4	58
29	PH5	59	30	PH6	60

Table 10-3: J3

J3 Pin	Circuit Net Name	U1 pin number	J3 pin number	Circuit Net Name	U1 pin number
1	PH7	61	2	Board_Vcc	62
3	PI0	63	4	PI1	64
5	PI2	65	6	PI3	66
7	GROUND	67	8	PI4	68
9	PI5	69	10	PI6	70
11	PI7	71	12	P10	72
13	P11	73	14	P12	74
15	P13	75	16	GROUND	76
17	RESn	77	18	NC (Vcl Pin)	78
19	P14	79	20	P15	80
21	WDTOVFn	81	22	GROUND	82
23	XTAL	83	24	EXTAL	84
25	BOARD_VCC	85	26	P16	86
27	P17	87	28	STBYn	88
29	PTXD	89	30	P61	90

Table 10-4: J4

J1 Pin	Circuit Net Name	U1 pin number	J1 pin number	Circuit Net Name	U1 pin number
1	P62	91	2	NC (PLL Pin)	92
3	P63	93	4	NC (PLL Pin)	94
5	P64	95	6	P65	96
7	MD0	97	8	P50	98
9	P51	99	10	P52	100
11	CON_AVCC	101	12	P53	102
13	CON_AVSS	103	14	P54	104
15	CON_VREF	105	16	P55	106
17	P56	107	18	P57	108
19	MD1	109	20	PA0	110
21	PA1	111	22	PA2	112
23	PA3	113	24	PA4	114
25	PA5	115	26	PA6	116
27	GROUND	117	28	PA7	118
29	BOARD_VCC	119	30	PB0	120

10.2. Generic Headers

Table 10-5below shows the generic header connections

19 way generic Header				20 way generic Header			
Pin Number	Generic Header Name	3DK Signal Name	Micon Pin	Pin Number	Generic Header Name	3DK Signal Name	Micon Pin
1	Supply	Supply	N\A	1	IOPORT_TXD	IOPORT_TXD	N\A
2	Xin	CON_EXTAL	N\A	2	IOPORT_RXD	IOPORT_RXD	N\A
3	Vcc	Board_VCC	N\A	3	IOPORT_T1	IOPORT_T1	48
4	Vss	Ground	N\A	4	IOPORT_T2	IOPORT_T2	49
5	Vcc	Board_VCC	N\A	5	IOPORT_T3	IOPORT_T3	50
6	Vss	Ground	N\A	6	IOPORT_T4	IOPORT_T4	51
7	AVcc	AVCC	101	7	IOPORT_U	NC	N\A
8	AVss	AVSS	103	8	IOPORT_V	NC	N\A
9	Vref	VREF	105	9	IOPORT_W	NC	N\A
10	AN_0	PIN98	98	10	IOPORT_0	IOPORT_0	53
11	AN_1	PIN99	99	11	IOPORT_1	IOPORT_1	54
12	AN_2	PIN100	100	12	IOPORT_2	IOPORT_2	55
13	AN_3	PIN102	102	13	IOPORT_3	IOPORT_3	56
14	DAC0	PIN107	107	14	IOPORT_4	IOPORT_4	58
15	DAC1	PIN108	108	15	IOPORT_5	IOPORT_5	59
16	SCL	N\A	N\A	16	IOPORT_6	IOPORT_6	60
17	SDA	N\A	N\A	17	IOPORT_7	IOPORT_7	61
18	CTX	N\A	N\A	18	/Reset	RESn	77
19	CRX	N\A	N\A	19	IOPORT_INT	NMIn	52
				20	V_{SS}	GROUND	N\A

Table 10-5: Generic Headers

* Connected via a DNF 0R Link, refer to schematic for further details.

11. Code Development

11.1. Overview

Note: For all code debugging using Renesas software tools, the 3DK board must either be connected to a PC serial port via a serial cable or a PC USB port via an FDM (Flash Debug Module).

The HMON embedded monitor code is modified for each specific 3DK Renesas Microcontroller. HMON enables HEW to establish a serial connection to the 3DK microcontroller, and control code execution on the microcontroller. Breakpoints may be set in memory to halt code execution at a specific point. The code may be started from this point.
The HMON embedded monitor code must be compiled with user software and downloaded to the 3DK, allowing the users' code to be debugged within HEW.

11.2. Mode Support

The HMON library is built to support 16Mbyte advanced Mode for the H8SX family only.

11.3. BREAKPOINT SUPPORT

The device has no break controller. No breakpoints can be located in ROM code. However, code located in RAM may have multiple breakpoints limited only by the size of the On-Chip RAM.

11.4. CODE LOCATED IN RAM

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

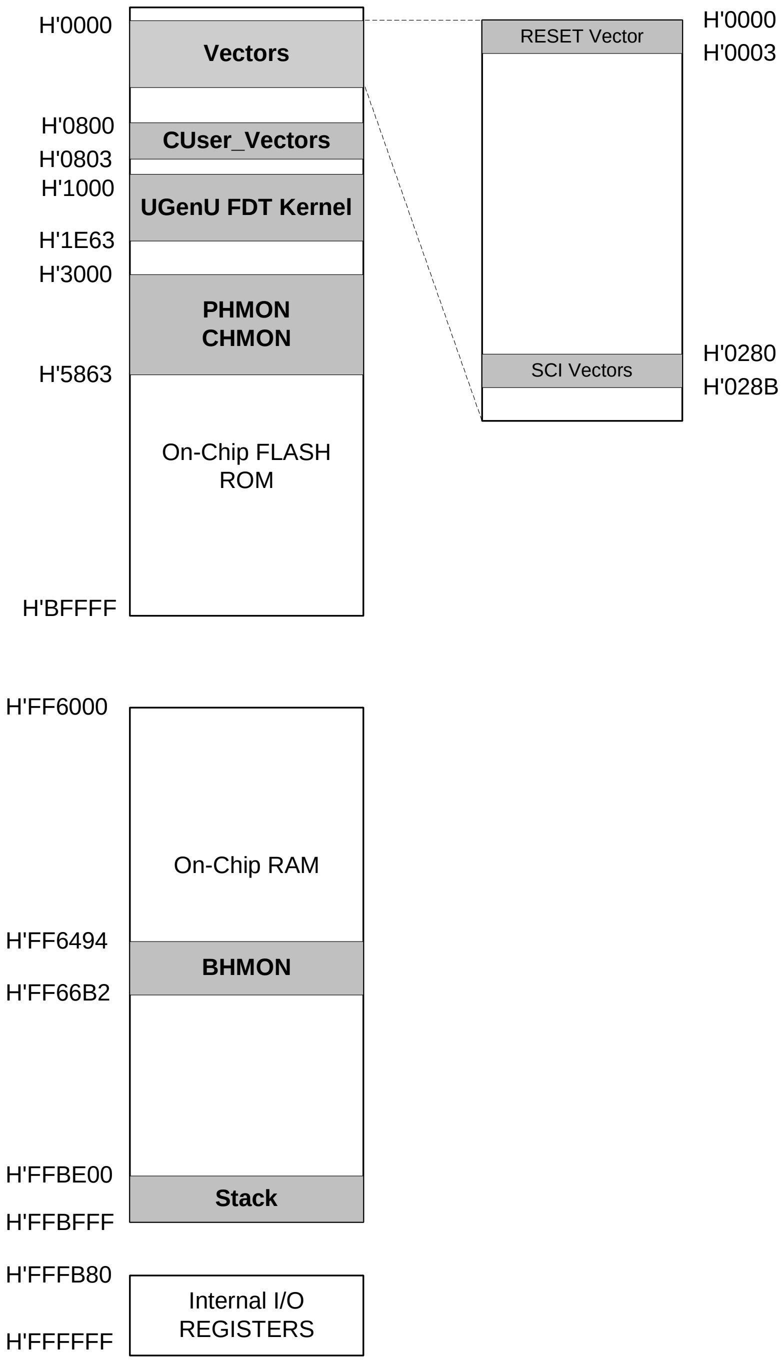
11.5. HMON CODE SIZE

HMON is built along with the debug code. Certain elements of the HMON code must remain at a fixed location in memory. The following table details the HMON components and their size and location in memory. For more information, refer to the map file when building code.

Section	Description	Start Location	Size (H'bytes)
RESET_VECTOR	HMON Reset Vector (Vector 0) Required for Startup of HMON	H' 0000 0000	4
SCI_VECTORS	HMON Serial Port Vectors (Vector 160, 161, 162, 163) Used by HMON when EDK is configured to connect to the default serial port.	H'0000 0280	F
PHMON	HMON Code	H'0000 3000	2730
CHMON	HMON Constant Data	H'0000 5730	134
BHMON	HMON Uninitialised data	H'00FF 6494	21F
UGenU	FDT Kernel. This is at a fixed location and must not be moved. Should the kernel need to be moved it must be re-compiled.	H'0000 1000	E64
CUser_Vectors	Pointer used by HMON to point to the start of user code.	H'0000 0800	4

11.6. MEMORY MAP

The memory map shown in this section visually describes the locations of program code sections related to HMON, the FDT kernels and the supporting code within the ROM/RAM memory areas of the microcontroller.



11.7. Baud Rate Setting

HMON is initially set to connect at 115200 Baud. The value set in the baud rate register for the microcontroller must be altered if the user wishes to change either the serial communication baud rate of the serial port or the operating frequency of the microcontroller. This value is held in the HMONserialconfiguser.c file, as SCI_CFG_BRR (see the Serial Port section for baud rate register setting values). The project must be re-built and the resulting code downloaded to the microcontroller once the BRR value is changed. Please refer to the HMON User Manual for further information.

11.8. Interrupt mask sections

HMON has an interrupt priority of 6. The serial port has an interrupt priority of 7. Modules using interrupts should be set to lower than this value (6 or below), so that serial communications and debugging capability is maintained.

11.9. Additional Information

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

For information about the H8SX/1657 series microcontrollers refer to the H8SX/1657 *Series Hardware Manual*

For information about the H8SX/1657 assembly language, refer to the H8 *Series Programming Manual*

Further information available for this product can be found on the Renesas web site at:

http://www.eu.renesas.com/tools

General information on Renesas Microcontrollers can be found at the following URLs.

Global: http://www.renesas.com/