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3DK2218U USB Kit

User's Manual

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Preface

Cautions

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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 3DK2218 USB kit has code pre-programmed into the Renesas microcontroller which allows it to enumerate as a Mass Storage Class USB device. On powering up the board, the red user LEDs will start to flash in a sequential manner and upon connecting the USB cable the H8S/2218 enumerates as a mass storage device.

3. Purpose

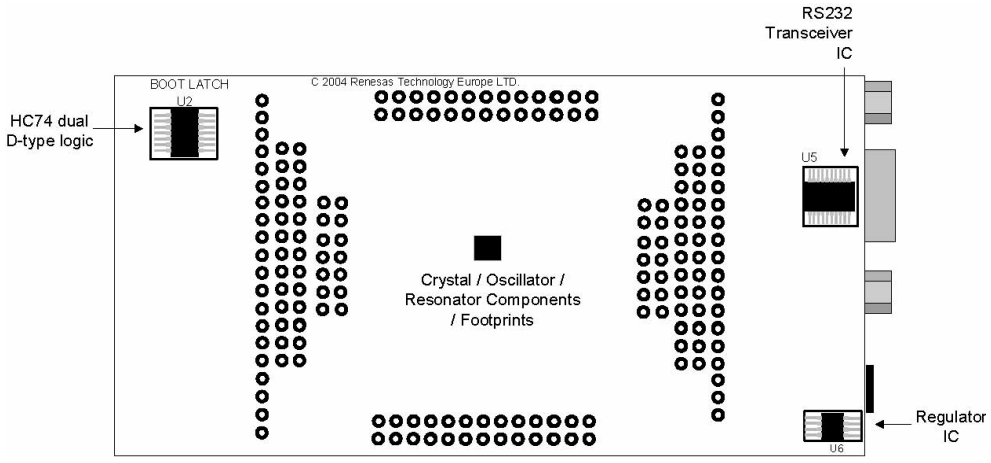
This 3DK2218 USB kit is an evaluation tool for the H8S/2218 Renesas microcontroller and on-chip USB peripheral.
Features include:

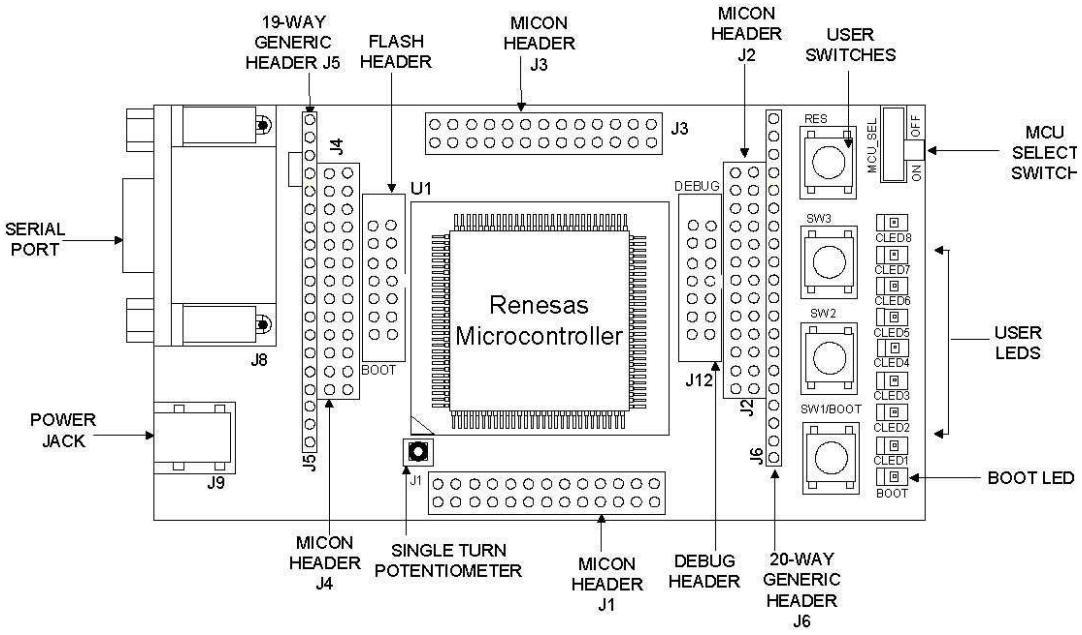
a. Renesas Microcontroller Programming
b. User Code Debugging
c. User Circuitry such as Switches, LEDs and potentiometer(s)
d. User or Base Board Connectivity

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

4. Board Layout

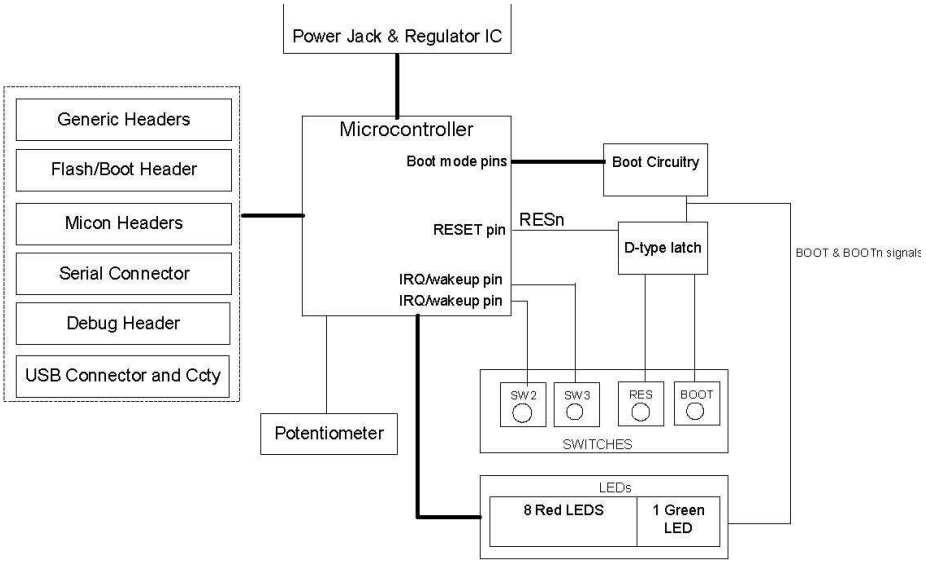
The following diagram shows the component layout top layer component of the board.
Note: The diagram below is for illustrative purposes and does not accurately reflect the 3DK detailed in this manual.





5. Block Diagram

The following diagram 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.	IRQ2 (Pin 97)
SW2	This switch is connected via a 0R link to an IRQ line capable of waking up the microcontroller device from sleep mode.	IRQ4 (Pin 24)
SW3	This switch is connected via a 0R link to another IRQ line capable of waking up the microcontroller device from sleep mode.	IRQ7 (Pin 25)
RES	This switch when pressed resets the 3DK microcontroller.	RESn

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	PE0	Pin 64
CLED2	PE1	Pin 65
CLED3	PE2	Pin 66
CLED4	PE3	Pin 67
CLED5	PE4	Pin 68
CLED6	PE5	Pin 69
CLED7	PE6	Pin 70
CLED8	PE7	Pin 71

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.

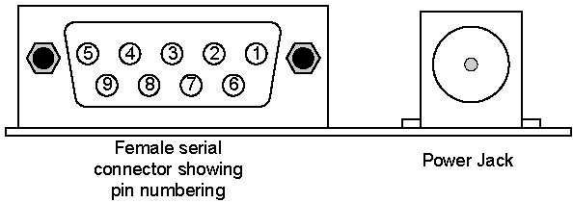
6.4. Serial port

The microcontroller programming serial port (SCI2) is connected to the D.type connector J8 via an RS232 transceiver. A secondary microcontroller serial port (SCI2) is connected to generic header, J6 via the second channel of the RS232 transceiver. The serial baud rates supported by this 3DK are shown in table 6-2 below. Note: these values are calculated from the frequency value of the main oscillating source fitted by default on this 3DK.

Baud Rate Settings for Serial Communication Rates												
Values are calculated for 24MHz 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	106	110	-0.44
300	invalid	invalid	invalid	invalid	invalid	invalid	155	300	0.16	38	300	0.16
1200	invalid	invalid	invalid	155	1202	0.16	38	1202	0.16	9	1172	-2.34
2400	invalid	invalid	invalid	77	2404	0.16	19	2344	-2.34	4	2344	-2.34
4800	155	4808	0.16	38	4808	0.16	9	4688	-2.34	1	5859	22.07
9600	77	9615	0.16	19	9375	-2.34	4	9375	-2.34	0	11719	22.07
19200	38	19231	0.16	9	18750	-2.34	1	23438	22.07	Invalid	Invalid	Invalid
38400	19	37500	-2.34	4	37500	-2.34	0	46875	22.07	Invalid	Invalid	Invalid
57600	12	57692	0.16	2	62500	8.51	invalid	invalid	invalid	Invalid	Invalid	Invalid
115200	6	107143	-6.99	1	93750	-18.62	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**	**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 (2-way connector)
J11	UVCC power Measurement	Bypasses R11, a 1206 0R resistor, for current measurement	R11 must be fitted to power UVCC	Footprint only
J14	FWE (Flash Write Enable)	Disables all flash programming, even in BOOT mode	Enables Flash programming	Footprint only
J15	EMLE	Disables the E10A interface.	Enables the E10A interface	Jumper pins fitted (2-way connector)

Table 6-3: 2-pin jumpers

7. Oscillator Sources

A crystal 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	Footprint Only (4.1mm x 4.7mm)	24MHz (recommended)	Serial Baud Rate: 115200
Crystal	Fitted (7.5mm x 5.0mm)	24MHz	Serial Baud Rate: 115200
Subclock	Yes	32.76KHz	N\A

Table 7-1: Oscillators / Resonators

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 of the device

8. Modes

The 3DK supports User mode and Boot mode. User mode may be used to run, debug and program user code, while Boot mode may only be used to program the Renesas microcontroller with code. To enter boot mode, the mode pins are held in their boot states while reset is pressed and released. 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:

MD2	MD1	MD0	LSI State after Reset End
1	1	0	User Mode
0	1	X (MD0 pin pulled low on 3DK)	Boot Mode

Table 8-1: Mode pin settings

8.2. 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 H8S/2218U supports single advanced mode, advanced mode with ROM enabled and advanced mode with ROM disabled.

9. Programming Methods and 2218UF Kernels

There are two methods of programming. These are boot mode programming and user mode programming. The device must be in the boot mode for boot mode programming and in a user mode (with ROM enabled) for user mode programming.

9.1. Boot Mode

Boot mode may be used to program a blank device. Once in boot mode, the boot loader program stored in 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. All data in the flash memory will be erased before programming of the device will begin. When in boot mode, the H8S/2218UF device attempts communication with a host via the USB port. The user cannot change this boot programming port to another port.

9.2. User Mode

User mode programming is used to program a microcontroller device when the device is in user mode (with ROM enabled). This programming method also allows the user to program the device without first erasing all of its flash memory. To initiate user mode programming, the device must already contain user mode programming code in its Flash memory. In user mode, the user mode programming code stored in the device executes and attempts a connection with a host. The host may then erase some of the device's memory, perform a blank check, upload data from the device and program the device. The H8S/2218UF user mode kernels are written to establish a connection with a host via the serial port.

9.3. 2218F Kernels and Programming ports

The H8S/2218UF kernels are designed to program the device via the USB port when in boot mode, and the serial port when in user programming mode.

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

Programming port table – Programming port pins and their 3DK signal names				
Boot Mode programming via the USB port	USB	D+, pin 32	D-, pin33	
	3DK Signal Name	USD_Plus	USD_Minus	
User Mode programming via the serial port	SCI2	TXD2, pin 100	RXD2, pin 99	SCK2, pin 98
	3DK Signal Name	PTXD	PRXD	PSCK

Table 9-1: Serial Port Boot Channel

9.4. Boot Programming Procedure

The microcontroller must enter boot mode for boot programming. The programming port (USB) 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 USB 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

9.5. 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 FDM is not supported by this 3DK as this device uses the USB port for boot mode programming.

9.6. E10A Header

The Renesas E10A Debugger is a tool for debugging Renesas microcontrollers, available separately from Renesas. The device may be debugged and programmed using the E10A. The E10A utilises H-UDI pins on the H8S/2218U device.

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

1. Jumper link J15 must be removed

9.7. 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

NOTE: When providing power to the 3DK2218 via a user board, the user MUST remove the regulator (U4). Back-powering of the 3DK2218 board via another board with the regulator in place will damage the 3DK2218 regulator. This does not apply if power is being taken from the 3DK2218 to power a user board.

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.

J1 Pin	Circuit Net Name	U1 pin number	J1 pin number	Circuit Net Name	U1 pin number
1		1	2		2
3		3	4		4
5		5	6		6
7		7	8		8
9		9	10		10
11		11	12		12
13		13	14		14
15		15	16		16
17		17	18		18
19		19	20		20
21		21	22		22
23		23	24		24

Table 10-1: J1

J2 Pin	Circuit Net Name	U1 pin number	J2 pin number	Circuit Net Name	U1 pin number
1		25	2		26
3		27	4		28
5		29	6		30
7	Board_Vcc	31	8	NC	32
9	NC	33	10	Ground	34
11		35	12		36
13		37	14		38
15		39	16		40
17	CON_Vref	41	18		42
19		43	20		44
21		45	22	Ground	46
23		47	24	Board_Vcc	48
25		49	26		50

Table 10-2: J2

J3 Pin	Circuit Net Name	U1 pin number	J3 pin number	Circuit Net Name	U1 pin number
1		51	2		52
3	CON_OSC2	53	4	CON_OSC1	54
5		55	6		56
7		57	8		58
9	Ground	59	10	CON-Xtal	60
11	CON_Extal	61	12	Board_Vcc	62
13		63	14		64
15		65	16		66
17		67	18		68
19		69	20		70
21		71	22		72
23		73	24		74

Table 10-3: J3

J4 Pin	Circuit Net Name	U1 pin number	J4 pin number	Circuit Net Name	U1 pin number
1		75	2		76
3		77	4		78
5		79	6		80
7		81	8		82
9		83	10		84
11		85	12		86
13		87	14	Board Vcc	88
15		89	16	Ground	90
17		91	18		92
19		93	20		94
21		95	22		96
23		97	24		98
25		99	26		100

Table 10-4: J4

10.2. Generic Headers

Table 10-5 below 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	Spare SCI Tx pin RS232 levels	IOPORT_TXD	22
2	Xin	CON_Xtal	61*	2	Spare SCI Tx pin RS232 levels	IOPORT_RXD	23
3	Vcc	Vcc1	N/A	3	TIOCA1	IOPORT_T1	6
4	Vss	Ground	N/A	4	TIOCB1	IOPORT_T2	7
5	Vcc	Vcc2	N/A	5	TIOCA2	IOPORT_T3	8
6	Vss	Ground	N/A	6	TIOCB2	IOPORT_T4	9
7	AVcc	NC	N/A	7	IOPORT_U	NC	N/A
8	AVss	Ground	N/A	8	IOPORT_V	NC	N/A
9	Vref	CON_Vref	41*	9	IOPORT_W	NC	N/A
10	AN0	Pin 45 (AN0)	45	10	PE0	IOPORT_0	64
11	AN1	Pin 44 (AN1)	44	11	PE1	IOPORT_1	65
12	AN2	Pin 43 (AN2)	43	12	PE2	IOPORT_2	66
13	AN3	Pin 42 (AN3)	42	13	PE3	IOPORT_3	67
14	AN14	NC	N/A	14	PE4	IOPORT_4	68
15	AN15	NC	N/A	15	PE5	IOPORT_5	69
16	not connected	NC	N/A	16	PE6	IOPORT_6	70
17	not connected	NC	N/A	17	PE7	IOPORT_7	71
18	not connected	NC	N/A	18	/Reset	RESn	58
19	not connected	NC	N/A	19	/NMI	IOPORT_INT	81*
				20	Vss	Ground	N/A

Table 10-5: Generic Headers

- Connected via either a 0R link or a DNF 0R link, refer to the schematic for further details.
- Connected via a transceiver chip

11 Code Development

For all code debugging using Renesas software tools, the 3DK2218 board must be connected to a PC via the E10A-USB debugger (not supplied with the USB kit). After installing the tools (Compiler and HEW), copy the included workspaces to C:\Workspace before running them; opening them from any other location will cause a "This workspace has moved…" warning. If you wish to run the workspace from another location select "OK" and continue.

11.1. 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 website.
For information about the H8S/2218UF series microcontrollers refer to the H8S/2212, 2218 *Series Hardware Manual* available on the CD or from the website.
For information about the H8S/2218UF assembly language, refer to the H8S *Series Programming Manual*

Further information available for this product can be found on the Renesas web site at:
http://www.america.renesas.com/

For technical support/information send an email to techsupport.rta@renesas.com