Applications Engineering

Powerful Processors – Easy to Use™

SKP32C8x

User's Manual

Rev. 1.1
October 2004

www.renesas.com

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1.0 Introduction

The SKP32C8x group of StarterKit Plus (SKP's) are low-cost development environment for evaluating M32C/8x group microcontrollers (MCU) and Renesas software development tools. The kit comes with a complete software development tool chain including, HEW (IDE, GUI), NC30WA (C-compiler, assembler, and linker), KD30 (Debugger), and FoUSB (Flash-over-USB™ Programmer).

A real-time, source-level debug environment is implemented using the KD3083 debugging software with the RTA-FoUSB-MON Flash Programmer/In-Circuit Debugger (ICD). The Flash-over-USB™ (FoUSB) Programmer software, with the ICD, allows in-system programming of the M32C/8x flash MCUs.

The ICD and firmware provide a convenient USB (Universal Serial Bus) interface between the SKP32C8x boards and the host PC. This interface reduces resource requirements on the M32C/8x MCUs, allows faster code downloads and, can also be used with many other Renesas Flash MCU's, SKP's, and user target boards.

The SKP32C8x Group of SKPs comes in five varieties, SKP32C83, SKP32C84, SKP32C85, SKP32C83-CL, SKP32C85-CL and SKP32C85-100-CL. Throughout this document the kits will be commonly referred to as SKP32C8x and the MCUs will be referred to as M32C/8x. All 'CL' kits come with a 'Comms-Lite' expansion board which provides CAN, LIN and RS-232 interfaces as well as an on-board power supply. Please see the Comms-Lite Users Manual for more details regarding the expansion board. The following table shows the MCU configurations for each kit.

Kit	MCU	Freq (Xin)	ROM	RAM	Pins	Comms
SKP32C83	M30835FJGP	20 MHz	512+4k	31k	144	No
SKP32C84	M30845FJGP	8 MHz	512+4k	24k	144	No
SKP32C85	M30855FHGP	8 MHz	384+4k	24k	144	No
SKP32C83-CL	M30835FJGP	20 MHz	512+4k	31k	144	Yes
SKP32C85-CL	M30855FHGP	8 MHz	384+4k	24k	144	Yes
SKP32C85-100-CL	M30853FHGP	8 MHz	384+4k	24k	100	Yes

2.0 Contents of Product Package

This section describes the contents of the SKP32C83, SKP32C84 and SKP32C85 product packages. When unpacking your SKP32C8x, please check to see that all products listed below are included.

2.1 SKP32C8x StarterKit Plus Product List

Table 2-1 lists the products included in the SKP32C8x.

Table 2-1 SKP32C8x Product List

Product Name	Quantity	Remark
SKP32C8x Board	1	M32C/8x SKP Board
RTA-FoUSB-MON (ICD)	1	KD3083 Debugger/ FoUSB Programmer Interface Device
6" 10-Pin Target Cable	1	Connects SKP32C8x Board (J5) and the ICD
6' Mini USB Cable	1	Connects ICD to the Host PC
SKP CD-ROM	1	Auto-install program HEW (IDE) NC308WA (C-compiler, assembler, and linker) KD3083 Debugger FoUSB Programmer Manuals Tutorials Sample programs

2.1.1 SKP CD-ROM

The CD-ROM contains the electronic manuals and software necessary for developing programs. Your computer must have Netscape Navigator® or Microsoft®'s Internet Explorer to view the help files and Acrobat Reader to view the manuals.

Insert the enclosed CD into your computer and SKP installer will auto-start. The SKP installer program will create a C:\HEW3 and C:\MTOOL folder on your machine. All development tools (HEW, NC308WA, KD3083 Debugger, and FoUSB Programmer) can be found under C:\MTOOL. Documentation, sample code, and other SKP related files are in the C:\MTOOL\ SKP32C83 (or SKP32C84 or SKP32C85) folder.

If the SKP installer program does not start up, browse the CD's root folder and double-click on '***skp_installer.exe***' to start installation.

3.0 Limited Guarantee and Support

Renesas Technology America, Inc., warrants the SKP32C83, SKP32C84, SKP32C85, SKP32C83-CL, SKP32C85-CL and SKP32C85-100-CL to be free from component or assembly defect for a period of 180 days from the date of purchase. Settlement is limited to repair or replacement of the product only. Renesas Technology America, Inc., does not assume any liability arising out of the application or use of any product, circuit or procedure described herein. No other liability or warranty apply, expressed or implied. Software warranty is limited to replacement of the CD only. While every attempt has been made to ensure accurate documentation, Renesas Technology America, Inc., cannot be held responsible for error or omissions and reserves the right to make changes without further notice.

4.0 System Connectivity

The following lists the hardware and software products required for using the SKP32C8x StarterKit Plus.

- Host Computer (supplied by user)
- SKP32C8x Board
- RTA-FoUSB-MON (ICD)
- Mini USB Cable
- Target Cable
- Software Tools (HEW IDE, NC308 Compiler/Linker, KD3083 Debugger, FoUSB Programmer)

Figure 4-1 shows the system connectivity for the SKP32C8x.

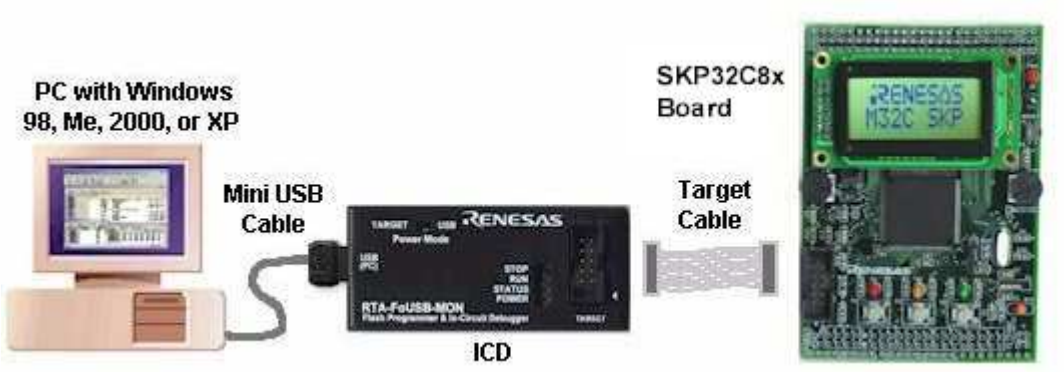

Figure 4-1 SKP32C8x System Connectivity

4.1 Host Computer Requirements

The minimum requirement to be able to use the software that comes with the SKP32C8x is a PC with a USB port and Microsoft Windows 98, ME, 2000, or XP.

4.2 SKP32C8x Board

The SKP32C8x board provides an evaluation and development environment for the M32C/8x group MCUs. See section 5.0 ‘Hardware’ for more details.

4.3 In-Circuit Debugger (RTA-FoUSB-MON)

The ICD provides a plug-and-play debugging and programming interface to the SKP32C8x board via the host computer’s Universal Serial Bus (USB). The USB port also provides power to the SKP32C8x board and ICD thereby eliminating the need for an external power supply.

4.4 Software Development Tools

The SKP installer program installs all the development tools. For details on installation, see the Quick Start Guide or instructions in the Appendix of this manual. A brief description of all the included tools follows. Please refer to the individual Tool manuals for detailed information.

4.4.1 HEW (High-performance Embedded Workshop)

HEW provides a Graphical User Interface (GUI) that integrates the software development tools and includes the C-compiler, assembler, linker, and editor.

4.4.2 NC308WA Entry Version

The NC308WA Entry version C-compiler included in the SKP has no time expiration, but has the following limits:

1. The software comes without warranty.
2. The compiler always compile with "-fansi" option.
3. The compiler optimization settings is fixed and cannot be changed
4. The '-finfo' option for other software tools such as stack viewer, etc. is not supported.

If your development needs exceed the above limitations, please go to the following web site http://www.renesas.com/eng/products/mpumcu/toolhp/datsheet/m16c80_e/nc308wa.htm and download the full version (4 calendar month trial).

4.4.3 KD3083 Debugger

KD3083 is a remote debugger that runs on the host PC. While communicating with a kernel (i.e. a ROM monitor program) on the target MCU through the ICD, KD3083 provides a highly efficient evaluation environment. KD3083 features include:

- Source-line debug for assembly language, structured assembly language, C language
- Run command with up to 8 breakpoints for M32C/8x (will depend on the M32C MCU)
- RAM monitor function
- C variable "watch" window

4.4.4 FoUSB (Flash-over-USB™) Programmer

The Flash Over USB Programmer application provides In-System Programming capability for the starter kit or any target board using an M16C family flash MCU (i.e.: R8C, M16C, M32C). Please see the RTA-FoUSB-MON Users Manual for more details.

5.0 Hardware

5.1 SKP32C8x Board

Figure 5-1 shows the SKP32C8x Board with major components identified.

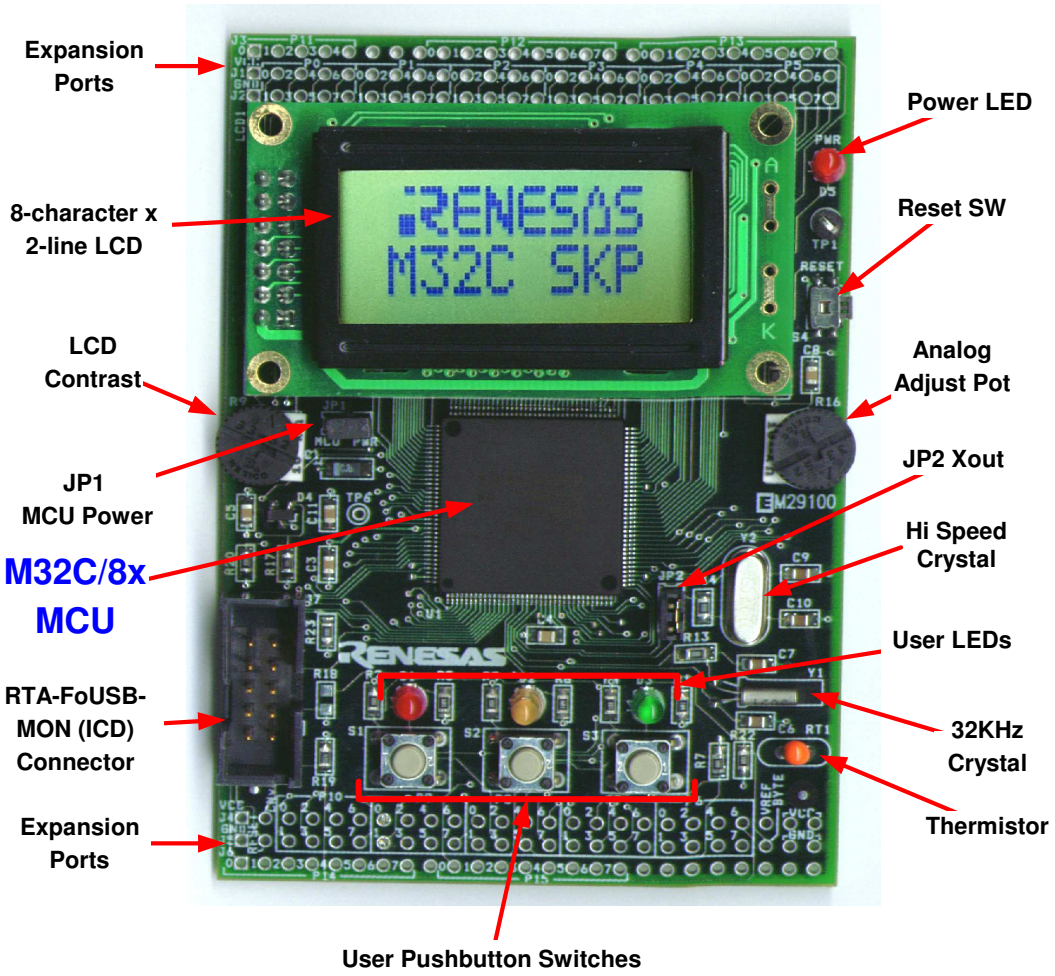

Figure 5-1. SKP32C8x Board

5.2 SKP32C8x Board Block Diagram

The SKP32C8x boards incorporate a M32C/8x group microcontroller designated as U1. Figure 5-2 shows the SKP32C8x block diagram.

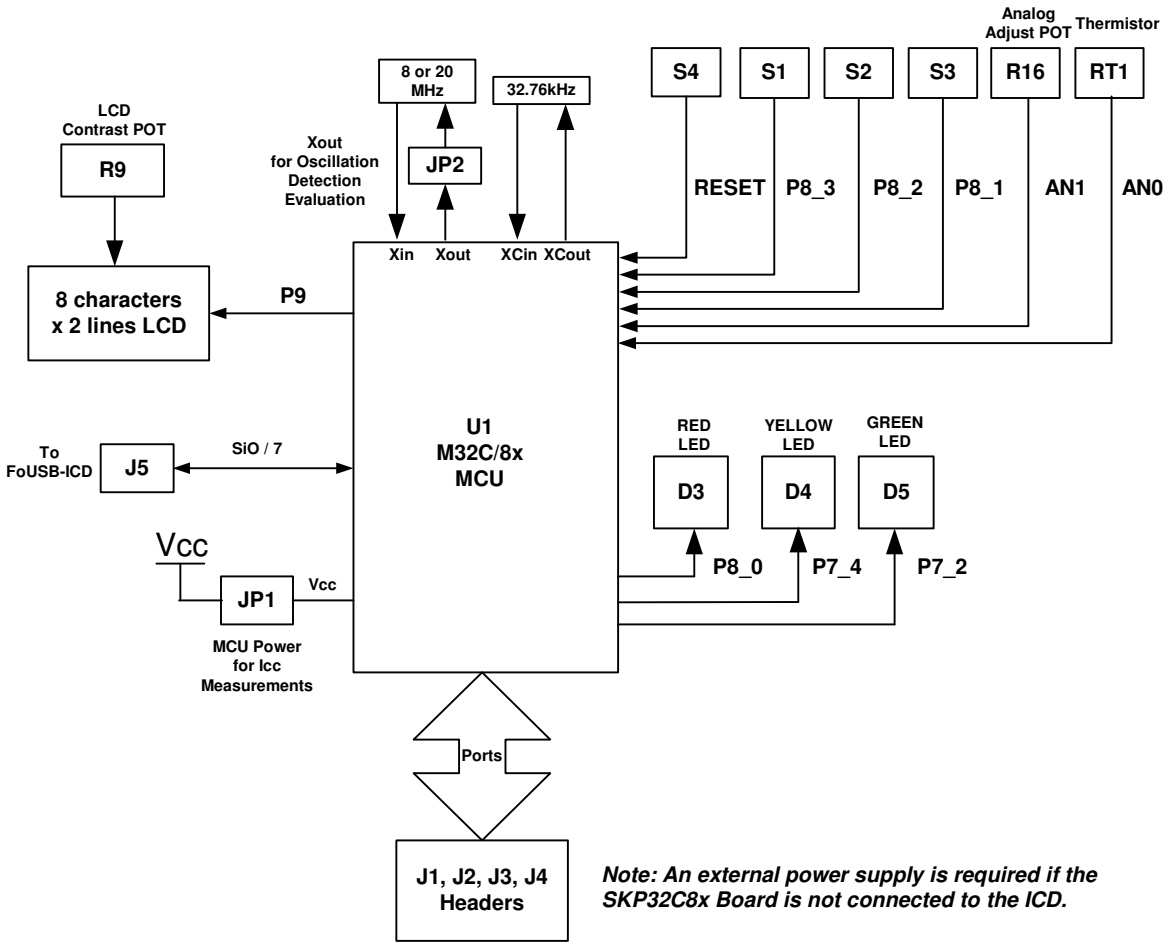

Figure 5-2. SKP32C8x Block Diagram

5.3 M32C/8x Group of MCUs

M32C/8x group of 16-bit flash microcontrollers (MCU) is part of the M16C family and M32C/80 series of MCUs. The hardware and software manuals for the M32C/8x group of microcontrollers can be found under C:\MTOOL \SKP32C8x\Docs folder of your PC or from the Start menu (Start > Programs > RENESAS-TOOLS > SKP32C8x > Document Descriptions) after SKP software installation.

5.4 SKP32C8x Board Jumper Configuration

5.4.1 JP1: MCU (U1) Power

JP1 is used to connect the Vcc pins of the M32C/8x MCU to the Vcc/MCU Power of the board. It can be used to measure current/power consumption of the MCU during various modes of operation. For normal operations, JP1 must be shorted.

JP1 is shorted by default.

5.4.2 JP2: Xout

JP2 is used to connect the output of the MCU's internal amplifier to the crystal for oscillation. It can be used to disconnect Xout when an externally driven clock is connected to Xin. For normal operations, JP2 must be shorted.

JP2 is shorted by default.

5.4.3 Default Jumper Settings

Jumper	JP1 MCU Power	JP2 Xout
Setting	Shorted	Shorted

5.5 LCD (Liquid Crystal Display)

The LCD is a 2-line by 8-character display with a KS0066 controller IC.

6.0 System Operation & Limitations

The SKP32C8x provides sophisticated debugging features at a low cost but it does have some limitations when used with the KD3083 Debugger and ICD. Section 6.1 introduces the kernel (ROM monitor) program and its purpose. The limitations when this kernel is running with the user program are listed in table 6-1.

Table 6-1 Systems Limitations (when used with KD3083)

Item	Please Refer To
User Limitations	6.2 Pin and Peripheral Limitations
	6.3 Memory Map
	6.4 Status After Reset
	6.5 Register Operation Limitations
	6.6 Limitations on Interrupts
Debugger Limitations	6.7 Stop or Wait Mode Limitations
	6.8 User Program's Real-time Capability

6.1 Kernel (ROM Monitor) Introduction

During debug (used with the KD3083 debugger), a small program, called a kernel, is downloaded to the M32C/8x. The kernel communicates with the KD3083 Debugger through the ICD regarding MCU status during user code debugging operations.

There are no special steps required in the user program to make use of the ICD. The operation of the kernel is transparent to the user but there are some limitations and these are discussed from section 6.2.

After starting KD3083, the ICD downloads the kernel to the M32C/8x if it does not exist (e.g. blank device or programmed with FoUSB Programmer). After downloading the kernel, KD3083 opens the Program Window and the M32C/8x is ready for downloading code.

Connecting the ICD without starting KD3083 will not affect the lines connected between the ICD and the M32C/8x – the ICD keeps the lines in high-impedance state. The ICD only drives the pins after KD3083 or FoUSB Programmer is started.

After program debug and verification, you can then create and download a binary, Intel (.hex) or Motorola (.mot), file to the M32C/8x. This operation erases the kernel and only leaves the user program.

6.2 Pin and Peripheral Limitations

SIO/UART1 pins are used for communication between the SKP32C8x board kernel and KD3083 Debugger through the ICD. Do not connect these pins to any other circuit, as UART1 cannot be used in the user program. For details, please see ICD (RTA-FoUSB-MON) User Manual on Target MCU Resources or related ICD application notes.

6.3 Memory Map

The amount of memory and locations of the kernel program used to communicate with the KD3083 and ICD are shown in Figure 6-2.

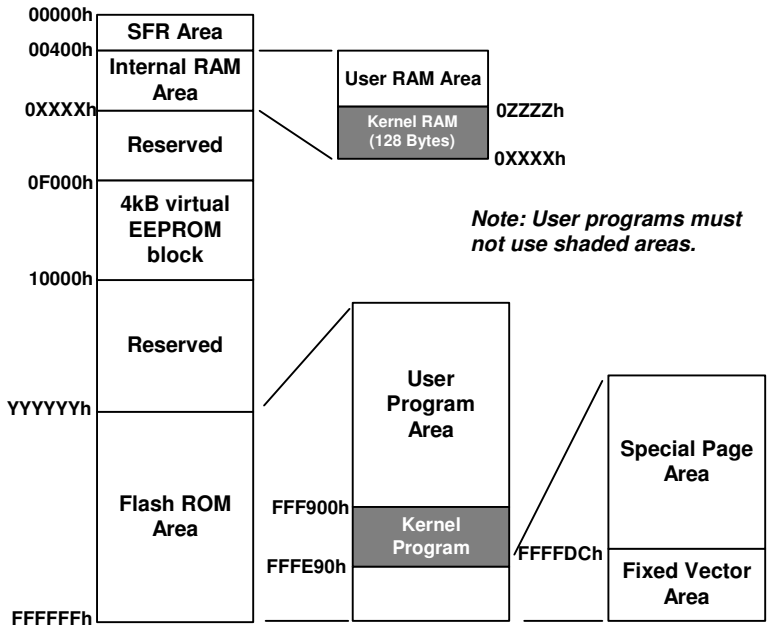

Figure 6-2 M32C/8x Memory Map with the Kernel Program

Note: The kernel occupies memory associated with special-page vector numbers 18-19 and 184-255. The user reset vector is re-mapped to address FFFFD8h by the kernel.

The following table provides specific memory map information for each kit/MCU.

Kit	MCU	Address XXXXh	Address YYYYYYh	Address ZZZZh
SKP32C85	M30855FH	0063FFh	FA0000h	0062FFh
SKP32C85-CL				
SKP32C85-100-CL	M30853FH			
SKP32C83	M30835FJ	007FFFh	F80000h	007EFFh
SKP32C83-CL				

6.4 Register Operation Limitations

Table 6-3 lists the limitations on register operation. The registers are inhibited from any modification. If register contents are modified in any way, kernel operation cannot be guaranteed.

Table 6-3. Limitations on Register Operation

Register Name	Restriction
User Interrupt Stack Pointer	Range 7F00H ~ 7FFFH (M32C/83) and 6300H ~ 63FF (M32C/85) is used by the kernel
UART1 Transmit/Receive Mode Register UART1 Transmit/Receive Control Register 0 UART1 Transmit/Receive Control Register 1	Do not change
UART1 Interrupt Control Register 0	Do not change
UART Transmit/Receive Control Register 2	Do not change bits 0 and 2
UART1 Transmit Buffer Register	Do not write to this register
UART1 Receive Buffer Register	Do not read this register
Port 6 and Port 6 DDR	To prevent changes on P6_4 data and direction, use read-modify-write only instructions (BSET, BCLR, AND, OR, etc)

6.5 Limitations on Interrupts - Vectors that Reside in the Hardware Vector Table

Table 6-4 lists the limitations on hardware interrupt vector addresses.

Table 6-4. Interrupt Vector Addresses

Interrupt Cause	M32C/8x Vector Address	Kit Specification
Undefined	FFFFDCH ~ FFFFDFH	User available
Overflow	FFFFE0H ~ FFFFE3H	User available
BRK Instruction	FFFFE4H ~ FFFFE7H	User inhibited
Address Match	FFFFE8H ~ FFFFEBH	User inhibited
Single-step	FFFFECH ~ FFFFEFH	User inhibited
Watchdog Timer	FFFFF0H ~ FFFFF3H	User available (Note 1)
DBC	FFFFF4H ~ FFFFF7H	User inhibited
NMI	FFFFF8H ~ FFFFFBH	User available
RESET	FFFFFCH ~ FFFFFFH	Reset vector (Note 2)

NOTES:

(1) The Watchdog Timer vector is shared with the oscillation stop and voltage detection interrupt. The vector is available for oscillation stop and voltage detection interrupts, but not Watchdog Timer interrupts.

(2) The kernel transparently relocates the Reset vector to FFFFD8H.

6.6 Stop or Wait Mode Limitations

The kernel cannot be run in STOP or WAIT modes. Do not use these modes when debugging your program.

6.7 User Program's Real-Time Capability

Please be aware that while the kernel is in a "STOP" state, the hardware peripherals will continue to run. Therefore, interrupts may not be serviced properly. Also, the watchdog timer will not be serviced and will likely time out if active.

While the kernel is in a "RUN" state, there is no overhead on the application code, UNLESS a RAM monitor window is open in KD3083. This window requires periodic communication with the MCU. This communication suspends normal application operation while servicing the request (approximately 2000 BCLK cycles for each 16 bytes of data displayed in the window are used per window update). The user must determine whether or not this behavior is acceptable.

6.8 Performing Debug Using Symbols

Normally when a new project is started using HEW, debugging symbols are enabled. If you are unable to debug your program using symbols in KD3083, add the debug option [**-g**] in HEW before compiling the programs. To enable the [**-g**] option, perform the following:

- Open the workspace and project in HEW.
- Select [Renesas M32C Standard Toolchain] from Options pull-down menu.
- Click on Link tab.
- Select [Output] under the [Category] list box.
- Click on checkbox for [**-g**] 'Outputs source debug information….'
- Click on [OK] button

For more information, see the HEW user's manual.

7.0 SKP32C8x Board Specifications

7.1 Hardware Specifications

Table 7-1 lists the specifications of the SKP32C8x Board.

Table 7-1. SKP32C8x Board Specifications

Item	Specification
MCU	M30835FJGP, M30853FHGP or M30855FHGP
Clocks	Main Clock: 8MHz (M32C/85) or 20MHz (M32C/83) crystal (32MHz max), ceramic resonator, ring oscillator, or PLL Sub Clock: 32.768KHz crystal
Memory (Internal with KD3083 + ICD)	RAM: 24 (M32C/85) or 31kB (M32C/83) High E/W Data Block: 4kB Flash ROM: 384 (M32C/85) or 512kB (M32C/83)
Connectors	[J1-J3, J4-J6]: 2, 75 pin (user supplied) headers (for user target connection) [J7]: Serial interface connector (UART1 for KD3083 + ICD)
Jumpers	[JP1]: MCU Power for Icc Measurements [JP2]: Xout to main crystal Y2
Switches	[S1]: pushbutton (connected to P8_3) [S2]: pushbutton (connected to P8_2) [S3]: pushbutton (connected to P8_1) [S4]: pushbutton (connected to Reset)
LED's	[D1] (Red): User output (connected to P8_0) [D2] (Yellow): User output (connected to P7_4) [D3] (Green): User output (connected to P7_2)
LCD	2-line x 8-character LCD with KS0066 controller IC

7.2 Power Supply Requirements

The SKP32C8x Board will draw 35mA (max). With the ICD, the current draw will be about 85mA.

7.3 Operating Environment

Table 7-3 lists the environmental conditions for using and storing the SKP32C8x board. When storing the board, place it in a conductive bag and then in the packing box your product was shipped in from the factory.

Table 7-2. Operating Environment

Environmental Condition	Ambient Temperature	Ambient Humidity
Operating	0 - 55°C (No corrosive gas allowed)	30 to 80% (non-condensing)
Storage	-30 to 75°C (No corrosive gas allowed)	30 to 80% (non-condensing)

Appendix A. Troubleshooting Guide

This section discusses possible problems you may encounter while installing the software (and drivers) and while running the KD3083 or FoUSB Programmer applications. This section also discusses the countermeasures and solutions to resolve these problems.

If, for any reason, you cannot resolve the problem, please contact your Renesas representative for assistance.

A.1 USB Driver Problems

This section discusses the usual problems with the driver installation and how to fix it. The most common problem encountered is that Windows did not properly install the driver and so the ICD is not recognized. This may also cause the device status to indicate that the device is not working properly. An indication of this problem is the ICD status yellow LED - it blinks about 2-3 times a second. When the driver is installed properly, the yellow LED should only blink every second.

Before trying the following steps, try restarting your PC and see if this resolves the problem. You can check the status using the Device Manager. If the ICD appears under the Universal Serial Bus Controllers with NO red X or yellow exclamation point, the driver was installed properly.

NOTE: If you are using Windows 2000 or XP, you need Administrator privileges to install the drivers.

For cases where the 'Device Status' states the device is not working properly, please try the following:

- Double-click on 'Renesas USB-Monitor' and a Renesas USB-Monitor Properties dialog box appears.
- Click on 'Driver' tab and click on 'Update Driver' button.
- Select 'Display a list…' and click on 'Have Disk' button.
- Specify and locate the C:\MTOOL\FoUSB\USB Drivers folder on your PC and install 'usbmon.sys' driver.

If you encounter problems on installing the drivers, you can try the following.

(1) Windows 2000

i. Copy the **fousb.inf** and **usbmon.inf** files from ***\USB Drivers*** folder to \WINNT\INF folder.
ii. Copy the **fousb.sys** and **usbmon.sys** files from ***\USB Drivers*** folder to \WINNT\SYSTEM32\drivers folder.

(2) Windows 98 or XP

i. Copy the **fousb.inf** and **usbmon.inf** files from ***C:\MTOOL\FoUSB\USB Drivers*** folder to \WINDOWS\INF folder.
ii. Copy the **fousb.sys** and **usbmon.sys** files from ***C:\MTOOL\FoUSB\USB Drivers*** folder to WINDOWS\SYSTEM32\drivers folder.

A.2 KD3083 Problems

This section discusses the cause of the problem and countermeasures to resolve it. The common problems encountered with KD3083 are:

- USB option cannot be selected from the initialization screen
- Cannot connect to target
- KD3083 already exists
- Issues that may come up during debug operations

A.2.1 USB Option Unavailable

When USB cannot be selected from KD3083's Init dialog box, you might be using an old version of KD3083 that does not support USB. Uninstall this version of KD3083 and install latest version of KD3083 from the \Tools\KD3083 directory of the SKP CD.

A.2.2 Cannot Connect to Target

When the message 'Can't connect with the target' is displayed after KD3083 startup, there are several reasons that may cause this message to appear. Each cause and the corresponding countermeasure are discussed below.

- The SKP is not connected correctly.

Please connect the ICD to your PC. Note: Regardless of whether the ICD is bus or target-powered, please connect target board to ICD board first before plugging the USB cable to your PC. Please see section 4 on system (SKP32C8x) connectivity.

- The ICD has no power (Power LED on ICD is off).

Please ensure that the Power Mode switch on the ICD is on the 'USB' side. In 'Target' position, the ICD is powered from the target side.

- USB was not selected on the Init dialog box.

Please select 'USB' from the Init dialog box that is displayed right after you start KD3083.

- The selected MCU on the ICD board and the actual target MCU (M32C/8x) do not match.

Close the error message by clicking on 'OK' button, and then click on the 'Cancel' button of the KD3083 Init window to close KD3083. Make sure you select 'M30835FJGP.mcu' or 'M30855FJGP.mcu'. If the MCU loaded on the ICD is different, KD3083 will re-program the ICD to match it.

- The target MCU is damaged.

Try a different target board and see if KD3083 will come up as you may have a damaged board or MCU.

A.2.3 KD3083 Already Exist

When a message 'KD3083 already exists' is displayed, the usual cause of this problem is that the KD3083 application was not properly closed. Please check if KD3083 is already running by looking at your task bar. If KD3083 cannot be found there, bring up Task Manager (press CTRL-ALT-DEL once and click on 'Task Manager' button). Select KD3083.exe on the 'Processes' list and click on 'End Process' to terminate KD3083.

A.2.4 Issues that may come up During Debug Operations

While using KD3083 to debug user code, some issues may come up because the limitations discussed in section 6 were not satisfied. These common issues are listed on table A.2, including the countermeasures.

Table A.2. Problems while using KD3083

Problem	Possible Cause/s and Solution
After stepping a few instructions, KD3083 hangs	• Changes made to UART1 SFR's.
Breakpoints do not seem to work	• KD3083 is in "FreeRun" mode. Change the RUN mode to "Sampling" from the "Init" window (Environment > Init).
KD3083 locks up (cannot stop program) or Communication error message is displayed.	• Changes made to UART1 SFR's. • Ensure no limitations in Section 7 were violated. • Re-initialize the system without closing KD3083. See note below. • Do a hardware reset. User-program runaway may be corrupting kernel RAM or interrupt vectors, flags, etc. Close KD3083, hit S1 on the SKP32C8x to reset the board, and then restart KD3083.
Download Issues	• Filenames or directory names contain spaces or special characters. • HEW project not properly set up (startup files missing or out of order, files added to wrong member, etc). Try creating a new project and adding your source files to it. For details, please see HEW user's manual.

To re-initialize the system without closing KD3083, try the following:

- Press the [OK] button in the error dialog box to close it.
- When an Exit dialog box appears, press the [Cancel] button to close it.
- Hit reset button on the SKP32C8x board.
- Press KD3083 reset button.

After initialization, debugging can resume. However, it is recommended that you download your program again before debugging.

Note: If it has been identified that there are problems with the ICD, please see the ICD's (RTA-FoUSB-MON) user's manual and troubleshooting section of this manual.

Appendix B. Reference Manuals

Item	Title	Description
1.	**SKP32C8x Quick Start Guide**	Gets you up and running with the SKP32C8x.
2.	**SKP32C8x User's Manual**	SKP32C8x Starter Kit User's Manual.
3.	**SKP32C8x Board Schematic**	Schematic diagram for the SKP32C8x Starter Kit board.
4.	**SKP32C8x Board BOM**	Bill of materials for the SKP32C8x Starter Kit board.
5.	**M32C/8x Group Hardware Manual**	Operation and Specifications for the M32C/8x MCU's.
6.	**M16C/80 Series C-Language Programming Manual**	C-language programming guide for the M16C/80 series MCUs.
7.	**M16C/80 Series Assembly Language Programming Manual**	Assembly language programming guide for the M16C/80 series MCUs.
8.	**M16C/80 Series Software Manual**	Instruction set manual for the M16C/80 series CPU cores.
9.	**M16C/80 Series Sample Programs**	Sample programs and application notes for the M16C/80 series MCUs.
10.	**HEW User's Manual**	High-performance Embedded Workshop User's Manual.
11.	**AS308 User's Manual**	AS30 Assembler User's Manual.
12.	**NC308 User's Manual**	NC308 C-Compiler User's Manual.
13.	**RTA-FoUSB-MON User's Manual**	In-Circuit Debugger / Flash Programmer User's Manual.

Appendix C. Expansion Headers

J1 Pin	Function (100 and 144 pin versions)
1	Vcc
2	P0_0
3	P0_2
4	P0_4
5	P0_6
6	P1_0
7	P1_2
8	P1_4
9	P1_6
10	P2_0
11	P2_2
12	P2_4
13	P2_6
14	P3_0
15	P3_2
16	P3_4
17	P3_6
18	P4_0
19	P4_2
20	P4_4
21	P4_6
22	P5_0
23	P5_2
24	P5_4
25	P5_6

J2 Pin	Function (100 and 144 pin versions)
1	GND
2	P0_1
3	P0_3
4	P0_5
5	P0_7
6	P1_1
7	P1_3
8	P1_5
9	P1_7
10	P2_1
11	P2_3
12	P2_5
13	P2_7
14	P3_1
15	P3_3
16	P3_5
17	P3_7
18	P4_1
19	P4_3
20	P4_5
21	P4_7
22	P5_1
23	P5_3
24	P5_5
25	P5_7

J3 Pin	Function (144 pin versions only)
1	P11_0
2	P11_1
3	P11_2
4	P11_3
5	P11_4
6	
7	
8	
9	P12_0
10	P12_1
11	P12_2
12	P12_3
13	P12_4
14	P12_5
15	P12_6
16	P12_7
17	
18	P13_0
19	P13_1
20	P13_2
21	P13_3
22	P13_4
23	P13_5
24	P13_6
25	P13_7

J4 Pin	Function (100 and 144 pin versions)
1	Vcc
2	CNVss
3	P10_0
4	P10_2
5	P10_4
6	P10_6
7	P9_0
8	P9_2
9	P9_4
10	P9_6
11	P8_0
12	P8_2
13	P8_4
14	P8_6
15	P7_0
16	P7_2
17	P7_4
18	P7_6
19	P6_0
20	P6_2
21	P6_4
22	P6_6
23	Vref
24	Vcc
25	Vcc

J5 Pin	Function (100 and 144 pin versions)
1	GND
2	RESET
3	P10_1
4	P10_3
5	P10_5
6	P10_7
7	P9_1
8	P9_3
9	P9_5
10	P9_7
11	P8_1
12	P8_3
13	P8_5
14	P8_7
15	P7_1
16	P7_3
17	P7_5
18	P7_7
19	P6_1
20	P6_3
21	P6_5
22	P6_7
23	BYTE
24	GND
25	GND

J6 Pin	Function (144 pin versions only)
1	P14_0
2	P14_1
3	P14_2
4	P14_3
5	P14_4
6	P14_5
7	P14_6
8	
9	
10	P15_0
11	P15_1
12	P15_2
13	P15_3
14	P15_4
15	P15_5
16	P15_6
17	P15_7
18	
19	
20	
21	
22	
23	
24	
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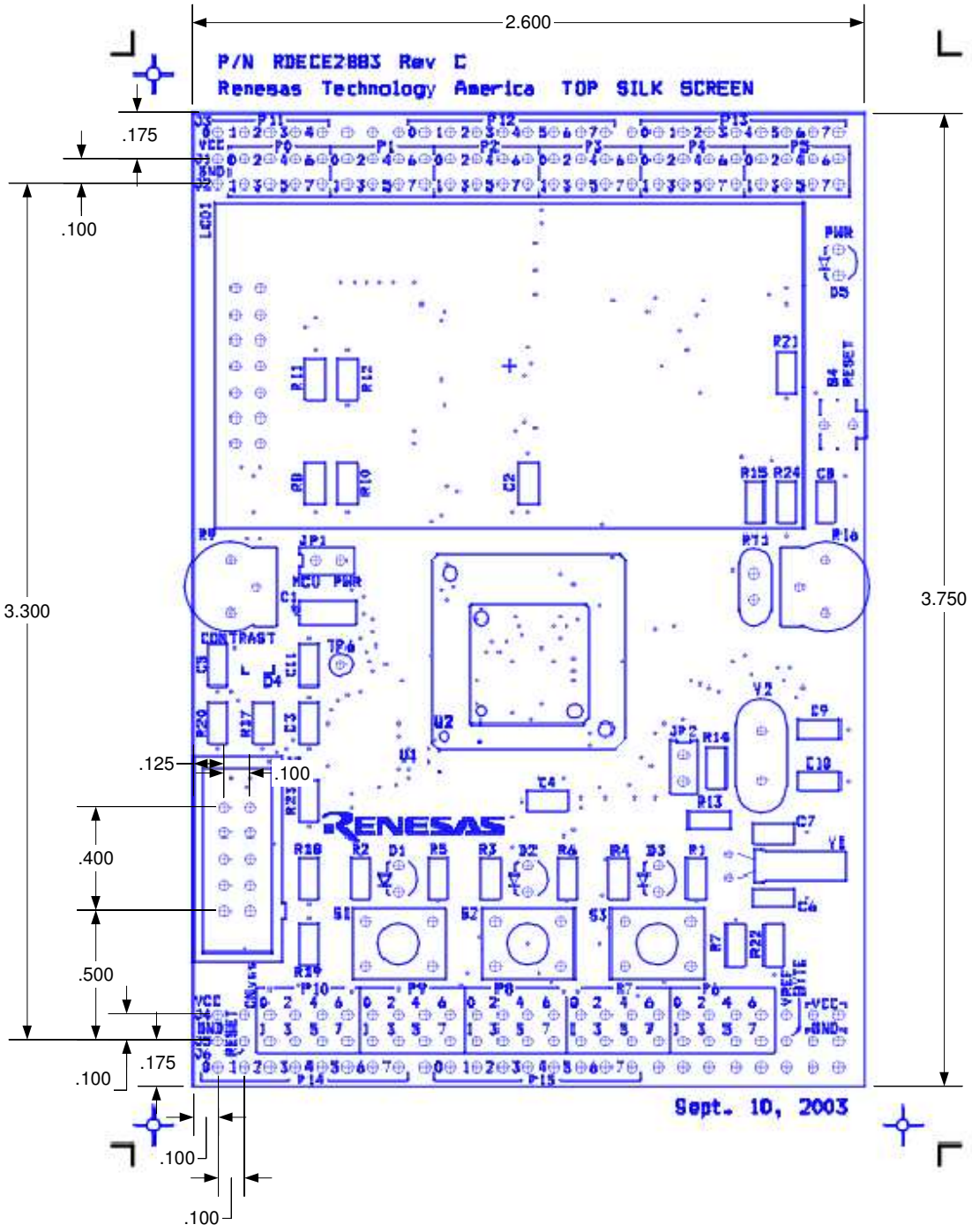
Appendix D. SKP32C8x Schematics and Bill Of Materials

The SKP32C8x Schematic is available as a separate document, SKP32C8x_Schematic.pdf.
The SKP32C8x Bill of Materials is available as a separate document, SKP32C8x_BOM.pdf.

Appendix E. SKP Board Dimensions



Appendix F. RTA-FoUSB-MON (ICD)

For details on how to use the ICD, please see RTA-FoUSB-MON User's Manual.