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DEM09RS08KA2

Demonstration Board
for Freescale
MC9RS08KA2

User's Manual

SofTec®
MICROSYSTEMS

Development Tools
for the EmbeddedWorld

DEMO9RS08KA2

Demonstration Board for Freescale MC9RS08KA2 (8-Pin DIP)

User's Manual

Revision 1.0



*Development Tools
for the EmbeddedWorld*

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1 Introduction

1.1 Overview

The DEMO9RS08KA2 Demonstration board has been designed for the evaluation, demonstration and debugging of the Freescale MC9RS08KA2 microcontroller.

The DEMO9RS08KA2 can be used as a standalone application, or via its built-in USB-to-BDM interface.

1.2 Package Contents

The DEMO9RS08KA2 package includes the following items:

- The DEMO9RS08KA2 evaluation board;
- Two MC9RS08KA2 samples;
- A USB cable;
- The SofTec Microsystems "System Software" CD-ROM;
- The CodeWarrior Development Studio CD-ROM;
- A Quick Start Guide sheet;
- This user's manual.

1.3 Supported Devices

The DEMO9RS08KA2 Demonstration Board supports the following devices:

- MC9RS08KA2 family;
- And any future pin-to-pin compatible device.

1.4 Recommended Reading

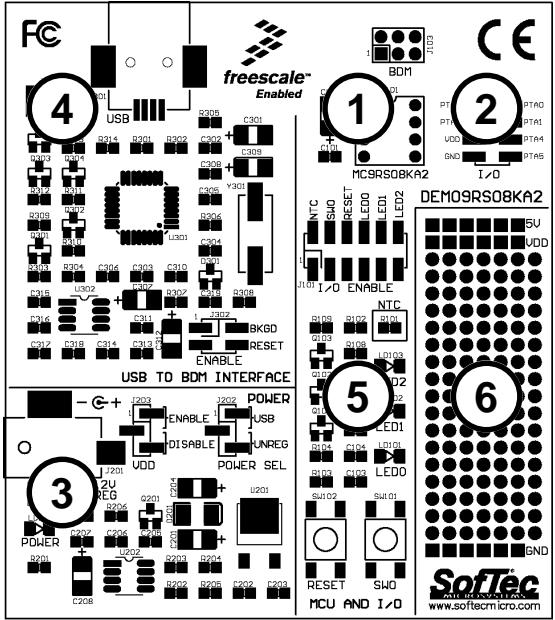
- Freescale RS08 microcontroller-specific datasheets and application notes;
- DEMO9RS08KA2 Schematic.

2 Hardware Features

2.1 Demonstration Board Features

The DEMO9RS08KA2 board features:

1. A MC9RS08KA2 microcontroller (in 8-pin DIP package, already programmed with a demo application—in addition, you can also use any other pin-to-pin-compatible device);
2. A header connector with all of the microcontroller signals;
3. A power supply section containing:
 - A 9-12 V DC Power Supply Input Connector;
 - Power input selection jumpers to select the input voltage input source:
 - 9-12 V DC input connector;
 - USB connector.
4. A built-in “USB TO BDM INTERFACE” section which allows the host PC to communicate with the microcontroller through a standard USB interface.
5. An input/output area containing:
 - A Reset push-button;
 - One additional push-button;
 - Three user LEDs;
 - An NTC-based temperature sensor;
 - A series of jumpers to connect/disconnect the above controls to/from the microcontroller.
6. A prototype area.



The DEMO9RS08KA2 Demonstration Board

3 Software Setup

3.1 Overview



Note: *before connecting the Demonstration Board to the PC, it is recommended that you install all of the required software first (see below), so that the appropriate USB driver will be automatically found by Windows when you connect the Demonstration Board.*

The Demonstration Board requires that both CodeWarrior Development Studio and SofTec Microsystems Additional Components be installed in the host PC.



Note: *CodeWarrior Development Studio must be installed first.*

3.2 Host System Requirements

The Demonstration Board is controlled by CodeWarrior Development Studio. The following hardware and software are required to run the CodeWarrior user interface together with the Demonstration Board:

- A 200-MHz (or higher) PC compatible system running Windows 98, Windows 2000 or Windows XP;
- 128 MB of available system RAM plus 1 GB of available hard disk space;
- A USB port;
- CD-ROM drive for installation.

3.3 Installing CodeWarrior Development Studio

To install the CodeWarrior Development Studio, insert the CodeWarrior CD-ROM into your computer's CD-ROM drive. A startup window will automatically appear. Follow the on-screen instructions.

3.4 Installing SofTec Microsystems Additional Components

The SofTec Microsystems Additional Components install all of the other required components to your hard drive. These components include:

- The Demonstration Board's USB driver;
- The software plug-in for CodeWarrior;
- Examples;
- Demonstration Board's user's manual;
- Demonstration Board's schematic;
- Additional documentation.

To install the SofTec Microsystems Additional Components, insert the SofTec Microsystems "**System Software**" CD-ROM into your computer's CD-ROM drive. A startup window will automatically appear. Choose "**Install Instrument Software**" from the main menu. A list of available software will appear. Click on the "**Additional Components**" option. Follow the on-screen instructions.



Note: *to install the Additional Components on Windows 2000 or Windows XP, you must log in as Administrator.*

4 Hardware Setup

4.1 First Connection

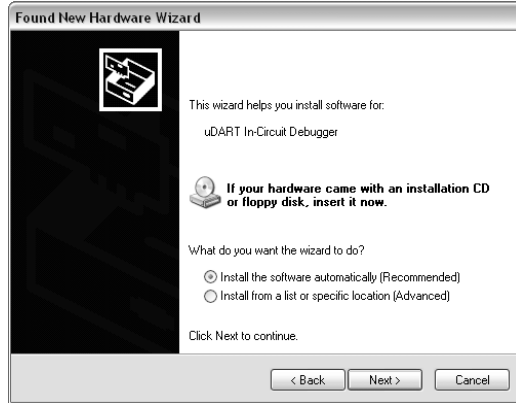
The Demonstration Board is connected to a host PC through a USB port. Connection steps are listed below in the recommended flow order:

1. Install all the required system software as described in the previous section.
2. Make sure the “POWER SEL” jumper is in the “USB” position.
3. Make sure the “VDD” jumper is in the “ENABLE” position.
4. Insert one end of the USB cable into a free USB port of the PC.
5. Insert the other end of the USB cable into the USB connector on the Demonstration Board. The “POWER” LED will turn on.
6. The first time the Demonstration Board is connected to the PC, Windows recognizes the instrument and starts the “**Found New Hardware Wizard**” procedure, asking you to specify the driver to use for the instrument. On Windows XP (SP2) the following dialog box will appear.



Select the “**No, not this time**” option and click the “**Next >**” button.

7. The following dialog box will appear.



Click the “Next >” button.

8. Depending on your Windows settings, the following warning may appear.



Note: *this warning is related to the fact that the USB driver used by the Demonstration Board is not digitally signed by Microsoft, and Windows considers it to be potentially malfunctioning or dangerous for the system. However, you can safely ignore the warning, since every kind of compatibility/security test has been carried out by SofTec Microsystems.*

Click the “Continue Anyway” button.

9. Windows will install the driver files to your system. At the end of the installation, the following dialog box will appear.



Click the **“Finish”** button to exit from the **“Found New Hardware Wizard”** procedure.

10. The Demonstration Board's USB driver is now installed on your system.

5 Operating Modes

5.1 Overview

The Demonstration Board can work in two modes: “standalone” mode and “host” mode.

5.2 Standalone Mode

In standalone mode, no PC connection is required. The microcontroller is factory programmed with a sample application.

To run the built-in example:

- Ensure that the “POWER SEL” jumper selects the “UNREG” position.
- Ensure that the “VDD” jumper selects the “ENABLE” position.
- Ensure that all of the “I/O ENABLE” jumpers are inserted.
- Power on the Demonstration Board through the 12 V DC plug-in power supply.
- The green “POWER” LED on the board should turn on.
- Depending on the temperature sensed by the NTC network, the “LED0”, “LED1” and “LED2” LEDs will turn on as illustrated below.

| Sensed Temperature | LEDs |
|-----------------------|----------------------------|
| < 10°C | ○ LED2 ○ LED1 ○ LED0 |
| between 10°C and 20°C | ○ LED2 ○ LED1 ● LED0 |
| between 20°C and 30°C | ○ LED2 ● LED1 ● LED0 |
| > 30°C | ● LED2 ● LED1 ● LED0 |

- Press the “SW0” push-button. The “LED0”, “LED1” and “LED2” LEDs will blink.

5.3 Host Mode

In host mode the program execution is controlled by the host PC through the “USB” connector. You can use the PC to debug the application by, for example, executing the program step by step and watching how the microcontroller registers vary, using the provided CodeWarrior Development Studio.



Note: *all MCUs in the RS08 family contain a single-wire background debug interface which supports in-circuit programming of on-chip non-volatile memory. This system does not interfere with normal application resources. It does not use any user memory or locations in the memory map. The Background Debug Module (also known as Background Debug Controller, BDC) uses a single-wire communication interface (via the BKGD line) to allow non-intrusive access to target system memory and registers.*

Please note that the BKGD line is shared with the PTA3 line and the RESET line is shared with the PTA2 line. The user program, therefore, must not use the PTA3 line when working in host mode.

To work in host mode (using the built-in USB to BDM interface):

- Make sure that the two “ENABLE” jumpers in the “USB TO BDM INTERFACE” section are inserted;
- Make sure that the “POWER SEL” jumper is in the “USB” position;
- Make sure that the “VDD” jumper selects the “ENABLE” position;
- Connect the host PC to the board through the provided USB cable.

6 Application Tutorial

6.1 Overview

This section will provide a step-by-step guide on how to launch your first project and get started with the CodeWarrior user interface.

6.2 Step-by-Step Tutorial

The sample application is the same as the one described in the “*Standalone Mode*” section above, with the exception that the “LED0” LED is not used (since this line is shared with the BKGD line needed for BDM communication).

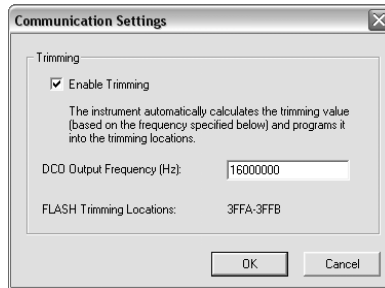
1. Set up the board so that it works in host mode (see “Host Mode” above).
2. Ensure that the Demonstration Board is connected to the PC (via the USB cable) and that the board is powered on.
3. Start CodeWarrior by selecting it in the Windows Start menu.
4. From the CodeWarrior main menu, choose “**File > Open**” and choose the “**\Program Files\Freescale\CW08 V5.1\CodeWarrior Examples\RS08\Evaluation Board Examples\DEMO9RS08KA2\Asm\Demo\Demo.mcp**”.
5. Click “**Open**”. The *Project Window* will open.
6. The code of this example is contained in the “**main.asm**” file. Double click on it to open.
7. From the main menu, choose “**Project > Debug**”. This will compile the source code, generate an executable file and download it to the demo board.
8. A new debugger environment will open. From the main menu, choose “**Run > Start/Continue**”. The program will be executed in real-time.
9. From the main menu, choose “**Run > Halt**”. The program execution will stop. The next instruction to be executed is highlighted in the *Source* window.
10. From the main menu, choose “**Run > Single Step**”. The instruction highlighted in the *Source* window will be executed, and the program execution will be stopped immediately after.
11. From the main menu, choose “**Run > Start/Continue**”. The application will restart from where it was previously stopped.

Congratulations! You have successfully completed this tutorial! You can continue to experiment with the CodeWarrior user interface and discover by yourself its potentialities. For an in-depth guide of all of the user interface features, select “**Help > CodeWarrior Help**” from CodeWarrior Development Studio’s main menu.

7 Internal Oscillator Trimming

The MC9RS08KA2 microcontroller features an internal reference clock (32 KHz) which, through an FLL circuitry, can be used to generate the microcontroller system clock. The internal reference clock can be calibrated (trimmed) with precision. To do so, open the *Communication Settings* dialog box.

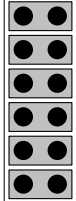
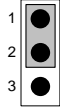
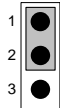

To open the *Communication Settings* dialog box, enter a CodeWarrior debugging session and select “**MCU Configuration**” from the “**SofTec-RS08**” menu. The following dialog box will appear.



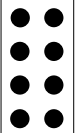



The MC9RS08KA2 microcontroller's ICSTRM register and the FTRIM bit in the ICSSC register will be then programmed with a specific value which will result in the DCO output frequency specified.

8 Jumper and Connector Settings

8.1 Jumpers

| Name | Reference | Description/Pinout |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| J101 |  <p>PTA0 NTC PTA1 SW0 PTA2 RESET PTA3 LED0 PTA4 LED1 PTA5 LED2</p> | <p>I/O ENABLE</p> <p>Installed: The indicated microcontroller line is connected to the indicated user I/O function (default)</p> <p>Not Installed: The indicated microcontroller line is not connected to the indicated user I/O function</p> |
| J202 |  <p>1 2 3</p> | <p>POWER SELECTION</p> <p>1-2 ("USB"): The power supply is taken from the USB connector (default)</p> <p>2-3 ("UNREG"): The power supply is taken from the power supply connector (J201)</p> |
| J203 |  <p>1 2 3</p> | <p>VDD SELECTION</p> <p>1-2 ("ENABLE"): Connects the 3.3V line to the microcontroller's VDD pin and to the user I/O area (default)</p> <p>2-3 ("DISABLE"): No voltage supplied to the microcontroller and user I/O area</p> |
| J302 |  <p>BKGD RESET</p> | <p>USB TO BDM ENABLE</p> <p>All installed: The USB to BDM interface is enabled (default)</p> <p>Not Installed: The USB to BDM interface is disabled</p> |

8.2 Connectors

| Name | Reference | Description/Pinout |
|------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| J102 |  | <p>8-Pin Header Male Connector</p> <p>Replicates all of the microcontroller signals</p> |
| J103 |  | <p>BDM Connector (Not Populated)</p> <ol style="list-style-type: none"> 1. BKGD 2. GND 3. N.C. 4. RESET/VPP 5. N.C. 6. VDD |
| J201 |  | <p>9-12 V DC Power Supply Input Connector</p> <ol style="list-style-type: none"> 1. 9-12 V DC 2. Ground |
| J301 |  | <p>USB Connector</p> <ol style="list-style-type: none"> 1. 5 V DC USB Bus Power Supply Line 2. USB D- 3. USB D+ 4. GND |

9 Troubleshooting

9.1 USB Driver Problems

If you connected the Demonstration Board to the PC before installing the SofTec Microsystems Additional Components, the Demonstration Board's USB driver may not have been correctly installed on your system. Unplugging and replugging the USB cable is of no use, since Windows has marked the device as "disabled". As a consequence, the PC cannot communicate with the Demonstration Board.

To restore the USB driver (provided the SofTec Microsystems Additional Components have been installed), perform the following steps under Windows XP:

1. Connect the Demonstration Board to the PC.
2. Open the Control Panel (**Start > Settings > Control Panel**).
3. Open the "**System**" options.
4. Select the "**Hardware**" tab.
5. Click the "**Device Manager**" button.
6. The "**uDART In-Circuit Debugger**" device will be shown with an exclamation mark next to it. Double click on this device.
7. In the "**General**" tab, click the "**Reinstall Driver**" button. Follow the on-screen instructions.

9.2 Communication Problems between the PC and the Demo Board

1. Make sure that the "BKGD" and "RESET" jumpers in the "USB TO BDM INTERFACE" section are inserted.
2. Make sure that the microcontroller is powered (The "VDD" jumper in the "POWER" section must select the "ENABLE" position).
3. Make sure that the "POWER SEL" jumper selects the appropriate power source (typically "USB" when the board is connected to the PC).
4. Make sure that the microcontroller is correctly inserted in its socket.

9.3 "LED0" LED Always Turned On

The "LED0" LED shares the BKGD line (used for the BDM communication). If you want to use this line as a generic user I/O you must enable this feature in your application software and remove the "BKGD" jumper in the "USB TO BDM INTERFACE" section of the board. Doing so,

however, will make BDM communication between the host PC and the microcontroller impossible.

