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DEM09S08LC60

Demonstration Board
for Freescale
MC9S08LC60

User's Manual

SofTec®
MICROSYSTEMS
Development Tools
for the EmbeddedWorld

DEMO9S08LC60

Demonstration Board for Freescale MC9S08LC60 (80-Pin LQFP)

User's Manual

Revision 1.0

SofTec® MICROSYSTEMS

Development Tools for the Embedded World

DC01175

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Contents

1 Introduction

1.1 Overview

The DEMO9S08LC60 Demonstration board has been designed for the evaluation, demonstration and the debugging of the Freescale MC9S08LC60 microcontroller.

The DEMO9S08LC60 can be used as a standalone application, or via its built-in USB-to-BDM bridge, or together the Freescale Student Learning Kit (Freescale code: MCUSLK) through an external 40-pin I/O header female connector.

1.2 Package Contents

The DEMO9S08LC60 package includes the following items:

- The DEMO9S08LC60 evaluation board;
- A USB cable;
- The SofTec Microsystems “System Software” CD-ROM;
- The CodeWarrior Development Studio Special Edition CD-ROM;
- A Quick Start Guide sheet;
- This user’s manual.

1.3 Supported Devices

The DEMO9S08LC60 Demonstration Board supports the following devices:

- MC9S08LC60.

1.4 Recommended Reading

- Freescale S08 microcontroller-specific datasheets;
- DEMO9S08LC60 Schematic.

Note: *the MC9S08LC60 datasheet is available for download at www.freescale.com.*

2 Hardware Features

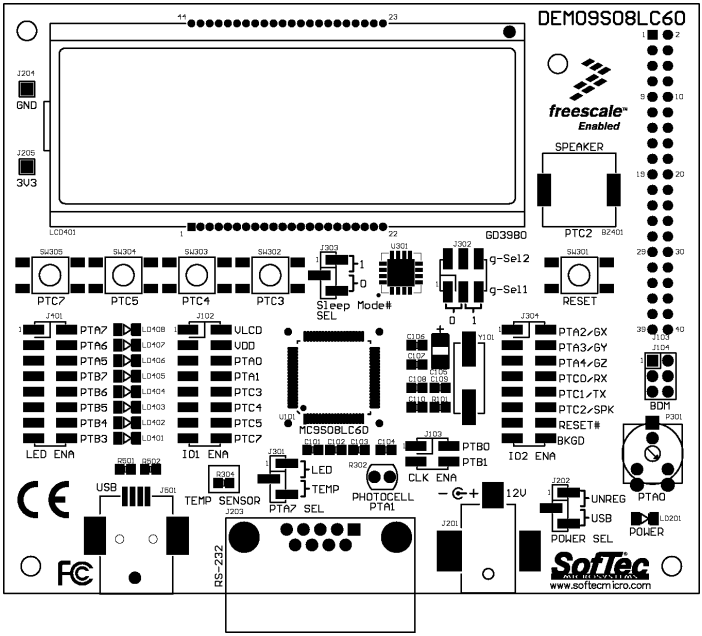
2.1 Demonstration Board Features

The DEMO9S08LC60 board features:

- A MC9S08LC60 microcontroller (in 80-pin LQFP package, already programmed with a demo application);
- One clock sources: a 32.768 KHz crystal, selectable via the “CLK ENA” jumpers.
- A 12 V DC Power Supply Input Connector;
- Power input selection jumpers for selecting the input voltage source:
    - 12 V DC input connector;
    - USB connector;
- A built-in USB-to-BDM circuitry which allows the host PC to communicate with the microcontroller through a standard USB interface. USB 2.0 is fully supported. When using an external in-circuit debugger (via the “BDM” connector), the USB-to-BDM circuitry must be bypassed by removing the BKGD and RESET# jumpers in the “IO2 ENA” jumper strip.
- A Reset push-button connected to the MCU Reset pin.
- A series of inputs:
    - Four push-buttons together with jumpers to connect/disconnect them to/from the microcontroller;
    - A potentiometer, together with a jumper to connect/disconnect it to/from the PTA0 pin of the microcontroller;
    - An NTC-based temperature sensor, together with a jumper to connect/disconnect it to/from the PTA7 pin of the microcontroller;
    - A photocell, together with a jumper to connect/disconnect it to/from the PTA1 pin of the microcontroller;
    - An accelerometer (Freescale MMA7260Q). All of the sensor’s input/output lines are connected to the microcontroller via jumpers.
- An series of outputs:
    - Eight high-efficiency (low-current) LEDs together with jumpers to connect/disconnect them to/from the microcontroller;

- A piezoelectric speaker, together with a jumper to connect/disconnect it to/from the PTC2 pin of the microcontroller;
- A custom LCD.

- An RS-232 channel connected to the microcontroller's SCI serial communication interface. The microcontroller's PTC0/RxD and PTC1/TxD lines are used by the RS-232 channel.



The DEMO9S08LC60 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 Special Edition and SofTec Microsystems Additional Components be installed in the host PC.

Note: *CodeWarrior Development Studio for HC(S)08 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 Special Edition, 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

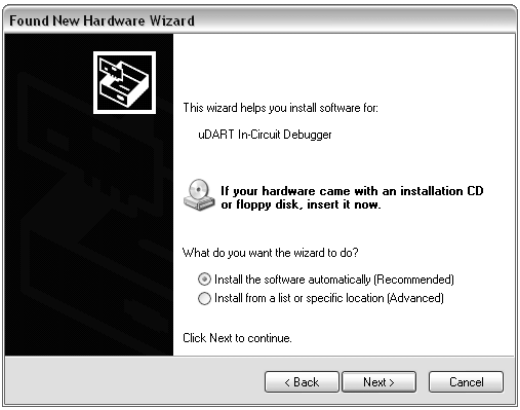
4.1 First Connection

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. Insert one end of the USB cable into a free USB port.
4. Insert the other end of the USB cable into the USB connector on the Demonstration Board.
5. 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.

6. The following dialog box will appear.



Click the **"Next >"** button.

7. 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.

8. 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.

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

4.2 Power Supply

The Demonstration Board can be powered in three ways:

- 12 V DC input connector;
- USB connector;
- I/O header connector.

The "POWER SEL" jumper allows you to power the board through either the 12 V DC input connector or the USB connector.

When using the I/O header connector, its pin 1 is always connected to the 3.3 V DC line of the carrier board.

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 which shows the value of the potentiometer on the display.

To run the built-in example:

1. Ensure that both the “CLK ENA” jumpers are inserted.
2. Ensure that all of the “IO1” and “IO2” jumpers are inserted.
3. Ensure that all of the “LED ENA” jumpers are inserted.
4. Ensure that both the “g-Sel1” and “g-Sel2” jumpers select the “0” position.
5. Ensure that the “Sleep Mode# SEL” jumper selects the “1” position.
6. Ensure that the “POWER SEL” jumper selects the “USB” position.
7. Power on the board via a USB cable. Alternatively, you can power the Demonstration Board through a 12 V DC plug-in power supply (not included in the kit). In this case, the “POWER SEL” jumper must select the “UNREG” position.
8. The green “POWER” LED on the board should turn on.
9. Rotate the potentiometer. Its value will be shown on the display.

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 S08 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 PTC6 line and the RESET line is shared with the PTB2 line. The user program, therefore, must not use the PTC6 line when working in host mode.

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

- Make sure that both the “RESET#” and “BKGD” jumpers in the “IO2 ENA” jumper strips are inserted.
- Make sure that the “POWER SEL” jumper is in the “USB” position.
- Connect the host PC to the board through the provided USB cable.

6 Application Tutorial

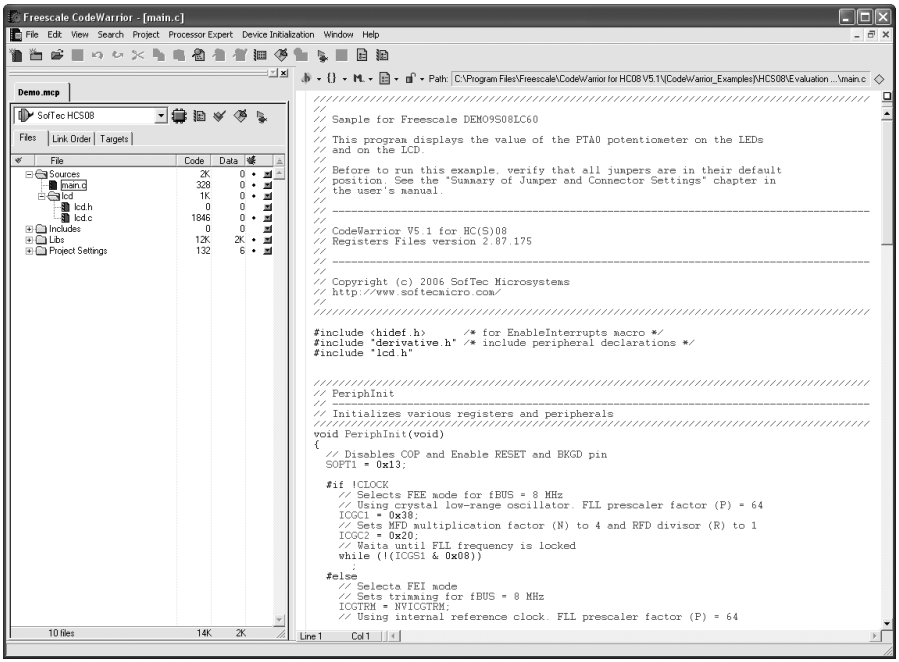
6.1 Overview

This section will provide a step-by-step guide on how to launch your first project and get started with the CodeWarrior for HC(S)08 user interface.

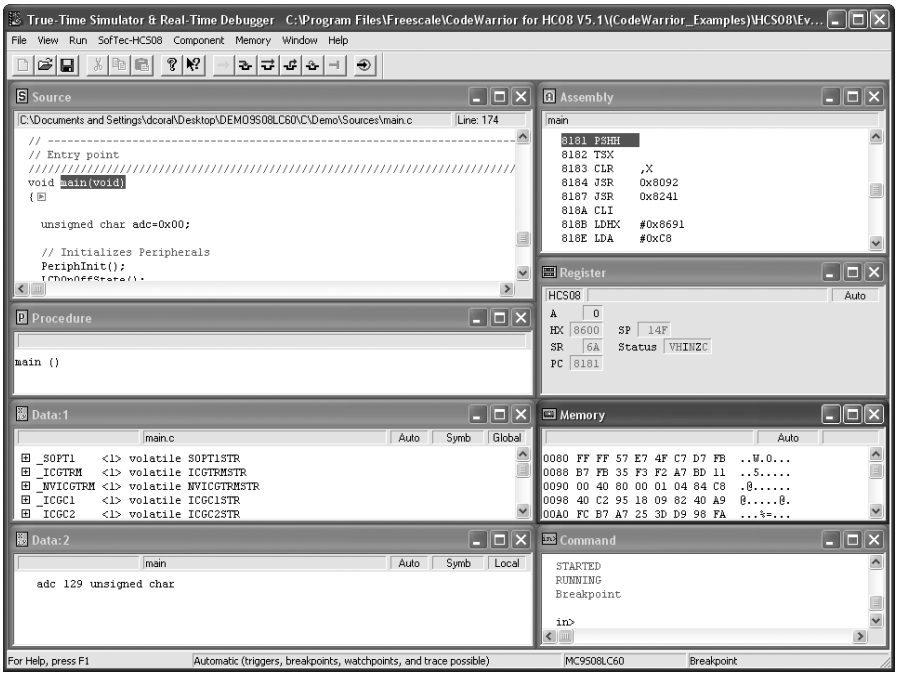
6.2 Step-by-Step Tutorial

The sample application is the same as the one described in the *"Standalone Mode"* section above.

1. Ensure that the Demonstration Board is connected to the PC (via the USB cable) and that the board is powered on.
2. Make sure that all of the Demonstration Board jumpers are set to their factory position (see chapter "7.1 Jumpers" for details)
3. Start CodeWarrior for HC(S)08 Development Studio by selecting it in the Windows Start menu.
4. From the CodeWarrior main menu, choose **"File > Open"**. From the CodeWarrior main menu, choose **"File > Open"** and choose the **"\Program Files\Freescale\CodeWarrior for HC08 V5.1\(CodeWarrior Examples)\HCS08\Evaluation Board Examples\DEMO9S08LC60\C\Demo\Demo.mcp"**.
5. Click **"Open"**. The *Project Window* will open.
6. The C code of this example is contained in the **"main.c"** file. Double click on it to open it.



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. A new debugger environment will open.



8. 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!

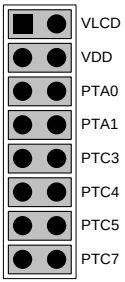
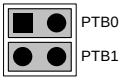
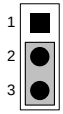
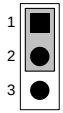
Two additional examples are provided in the **"\Program Files\Freescale\CodeWarrior for HC08 V5.1\(CodeWarrior Examples)\HCS08\Evaluation Board Examples\DEMO9S08LC60\C\"** directory:

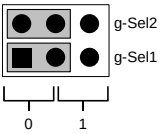
- **Accelerometer:** variation of acceleration along one of the three axis varies the output on the LCD and emits a sound on the speaker.
- **SCI:** prints on the LCD a line of text sent by the PC through an RS-232 terminal application.

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.

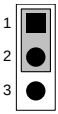
7 Summary of Jumper and Connector Settings

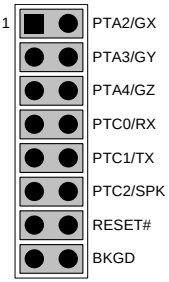
7.1 Jumpers

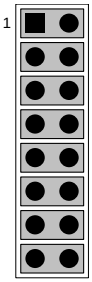
Name	Reference	Description/Pinout
J102		**IO1 ENABLE** **Installed:** **The indicated microcontroller line is connected to the indicated user I/O function (default)** Not Installed: The indicated microcontroller line is not connected to the indicated user I/O function
J103		**CLOCK ENABLE** **All installed:** **The crystal oscillator is connected to the microcontroller (default)** Not Installed: The crystal oscillator is not connected to the microcontroller
J202		**POWER SELECTION** 1-2 (“UNREG”): The power supply is taken from the power supply connector (J201) **2-3 (“USB”):** **The power supply is taken from the USB connector (default)**
J301		**PTA7 SELECTION** **1-2:** **The pin PTA7 of the microcontroller is connected to the pin 1 of the “LED ENA” jumper strip (default)** 2-3: The pin PTA7 of the microcontroller is connected to the NTC sensor (default)

<table>
<tr><th>Name</th><th>Reference</th><th>Description/Pinout</th></tr>
<tr><td>J302</td><td> 
</td><td>G SELECTION

Selects the accelerometer sensitivity according to the following table.

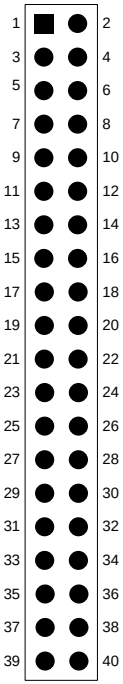
<table>
<tr><th>g-Sel2</th><th>g-Sel1</th><th>Selection</th></tr>
<tr><td>0</td><td>0</td><td>1.5 g (800 mV/g) (default)</td></tr>
<tr><td>0</td><td>1</td><td>2.0 g (600 mV/g)</td></tr>
<tr><td>1</td><td>0</td><td>4.0 g (300 mV/g)</td></tr>
<tr><td>1</td><td>1</td><td>6.0 g (200 mV/g)</td></tr>
</table></td></tr>
<tr><td>J303</td><td> 
</td><td>ACCELEROMETER SLEEP MODE SELECTION

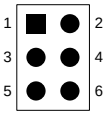
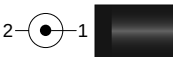
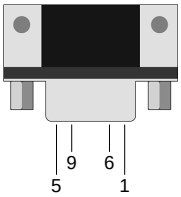
1-2: Accelerometer not in sleep mode (default)
2-3: Accelerometer in sleep mode</td></tr>
<tr><td>J304</td><td> 
</td><td>IO2 ENABLE

Installed: The indicated microcontroller line is connected to the indicated user I/O function (default)
Not Installed: The indicated microcontroller line is not connected to the indicated user I/O function</td></tr>
<tr><td>J401</td><td> 
</td><td>LED ENABLE

Installed: The LEDs are connected to the microcontroller (default)
Not Installed: The LEDs are not connected to the microcontroller.</td></tr>
</table>

7.2 Connectors

Name	Reference	Description/Pinout
J101		**40-Pin I/O Header Female Connector** 1. VDD (3.3 V) 2. PTC7 3. GND 4. RST# 5. PTC1 6. BKGD 7. PTC0 8. N.C. 9. PTC4 10. PTA0 11. PTC5 12. PTA1 13. PTC2 14. PTA2 15. PTC3 16. PTA3 17. PTB5 18. PTA4 19. PTB4 20. PTA5 21. PTB6 22. PTA6 23. PTB7 24. PTA7 25. N.C. 26. N.C. 27. N.C. 28. N.C. 29. N.C. 30. PTA2 31. N.C. 32. PTA3 33. N.C. 34. GND 35. VDD (3.3 V) 36. GND 37. GND 38. VDD (3.3 V) 39. VLCD 40. VDD (3.3 V)

Name	Reference	Description/Pinout
J104		**BDM Connector (Not Populated)** 1. BKGD 2. GND 3. N.C. 4. RESET/VPP 5. N.C. 6. VDD
J201		**12 V DC Power Supply Input Connector** 1. 12 V DC 2. Ground
J203		**RS-232 Connector** 1. N.C. 2. TX 3. RX 4. N.C. 5. GND 6. N.C. 7. N.C. 8. N.C. 9. N.C.
J501		**USB Connector** 1. 5 V DC USB Bus Power Supply Line 2. USB D- 3. USB D+ 4. GND

8 Troubleshooting

8.1 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.

8.2 Communication Problems between the PC and the Demo Board

1. Make sure that both the "BKGD" and "RESET#" jumpers in the "IO2 ENA" jumper strip are inserted.
2. Make sure that the "VDD ENA" jumper in the "IO1 ENA" jumper strip is installed.
3. Make sure that the "POWER SEL" jumper selects the appropriate power source (typically "USB" when the board is connected to the PC).

Стандарт Электрон Связь

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