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EVB9S08DZ60

Demonstration Board
for Freescale
MC9S08DZ60

User's Manual

SofTec®
MICROSYSTEMS

Development Tools
for the Embedded World

EVB9S08DZ60

Evaluation Board for Freescale MC9S08DZ60 (64-Pin LQFP)

User's Manual

Revision 1.0

SofTec ®
MICROSYSTEMS

Development Tools
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Contents

1 Introduction

1.1 Overview

The EVB9S08DZ60 Evaluation Board has been designed for the evaluation, demonstration and debugging of the Freescale MC9S08DZ60 microcontroller.

The EVB9S08DZ60 can be used as a standalone application, or via its built-in USB-to-BDM interface.

1.2 Package Contents

The EVB9S08DZ60 package includes the following items:

- The EVB9S08DZ60 evaluation board;
- A USB cable;
- A universal, 12 V DC power supply;
- 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 EVB9S08DZ60 Evaluation Board supports the following devices:

- MC9S08DZ60.

1.4 Recommended Reading

- Freescale microcontroller-specific datasheets and application notes;
- EVB9S08DZ60 Schematic.

2 Hardware Features

2.1 Evaluation Board Features

The EVB9S08DZ60 board features:

1.   An "MCU" section containing:

   ▪   A MC9S08DZ60 microcontroller (in 64-pin LQFP package, already programmed with a demo application);
   ▪   A clock module, a crystal oscillator, and a connector for providing an external clock source, together with jumpers to select the clock source;
   ▪   A BDM connector for in-circuit debugging/programming with an external instrument;
   ▪   Four header connectors with all of the MCU signals.

2.   A power supply section containing:

   ▪   A 12 V DC barrel input connector (2.1 mm);
   ▪   Two banana input connectors (12 V DC and GND);
   ▪   A power on/off switch.

3.   A built-in "USB TO BDM INTERFACE" section which allows the host PC to communicate with the microcontroller through a standard USB interface.
4.   An "INPUTS" section containing:

   ▪   A Reset push-button;
   ▪   Four additional push-button;
   ▪   Two potentiometers;
   ▪   Eight dip-switches;
   ▪   A series of jumpers to connect/disconnect the above controls to/from the microcontroller.

5.   An "OUTPUTS" section containing ten LEDs together with the relative jumpers to connect/disconnect them to/from the microcontroller.
6.   A "CAN" section containing a CAN connector with two CAN transceivers (high speed and single wire) together with a series of jumpers to select the CAN physical layer to be used.

7. A "LIN" section containing two LIN connectors together with a LIN enable jumper and a "WAKE" push-button.

8. An "RS-232" section containing two RS-232 connectors (although only one transceiver is provided) together with a series of jumpers to set the RS-232 mode.

9. A "SERIAL SETTINGS" section containing two jumpers to select which transceiver (the RS-232_0 or LIN) is connected to the microcontroller's shared TXD1 and RXD1 serial lines.

10. A prototype area.
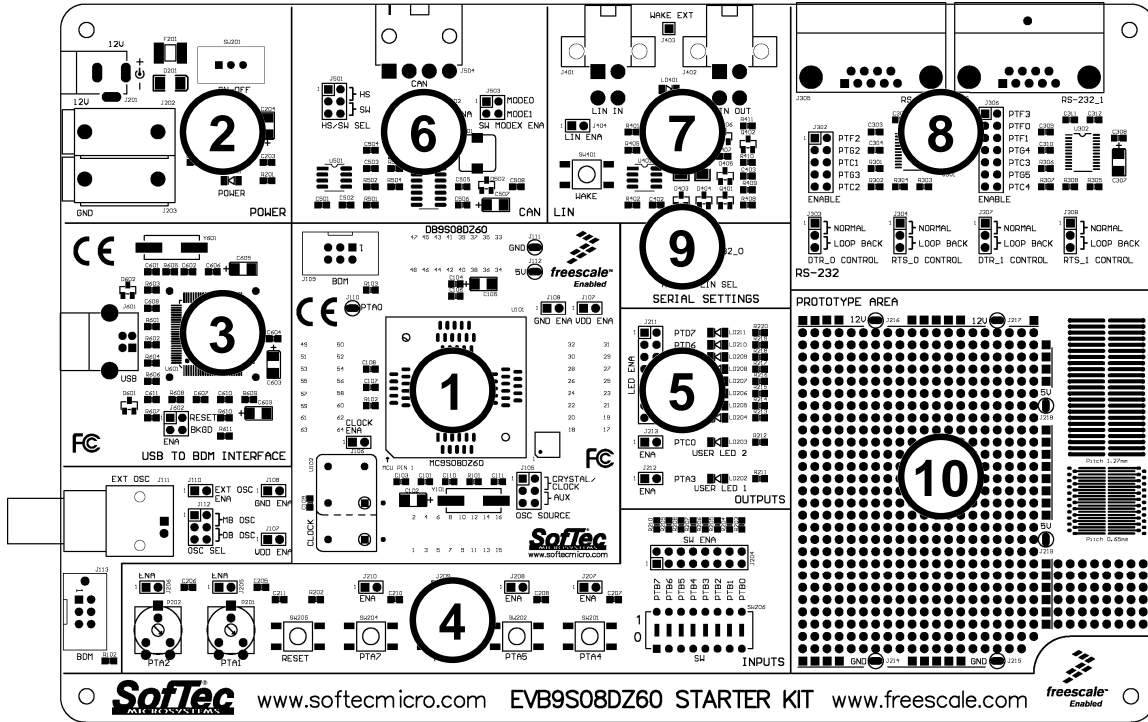
The EVB9S08DZ60 Evaluation Board

3 Software Setup

3.1 Overview

> **i**
>
> **Note**: *before connecting the Evaluation 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 Evaluation Board.*

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

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

3.2 Host System Requirements

The Evaluation Board is controlled by CodeWarrior Development Studio. The following hardware and software are required to run the CodeWarrior user interface together with the Evaluation 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 Evaluation Board's USB driver;
- The software plug-in for CodeWarrior;
- Examples;
- Evaluation Board's user's manual;
- Evaluation 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.

> **i**
>
> **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 Evaluation 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. Power the board through either the barrel connector or the banana connectors.
3. Make sure the "ON-OFF" switch is in the "ON" position. The "POWER" LED will turn on.
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 Evaluation Board.
6. The first time the Evaluation 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 Evaluation 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 Evaluation Board's USB driver is now installed on your system.

5 Operating Modes

5.1 Overview

The Evaluation 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 board is powered on.
- Ensure that all of the jumpers in the "INPUTS" and "OUTPUTS" sections are inserted.
- Press the "PTA4" push-button. The value of the "PTA1" potentiometer will be displayed on the "PTDx" LEDs.
- Press the "PTA5" push-button. The value of the "PTA2" potentiometer will be displayed on the "PTDx" LEDs.
- Press the "PTA6" push-button. The "USER LED 2" LED will turn on if the value of the "PTA2" potentiometer is greater than the value of the "PTA1" potentiometer, off otherwise.
- Press the "PTA7" push-button. The value of the "PTBx" DIP-switches will be displayed on the "PTDx" LEDs.

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.*

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

- Make sure that the board is powered on;
- Make sure that the "RESET ENABLE" and "BKGD ENABLE" jumpers in the "USB TO BDM INTERFACE" section are inserted;
- 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
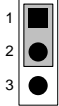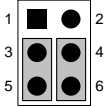
The sample application is the same as the one described in the *"Standalone Mode"* section above.
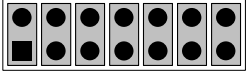
1. Set up the board so that it works in host mode (see "Host Mode" above).
2. Ensure that the Evaluation Board is connected to the PC (via the USB cable) and that the board is powered on.
3. Start CodeWarrior by selecting it in the Windows Start menu.
4. From the CodeWarrior main menu, choose **"File > Open"** and choose the **"\Program Files\Freescale\CodeWarrior for HC08 V5.1\(CodeWarrior Examples)\HCS08\Evaluation Board Examples\EVB9S08DZ60\C\Demo\Demo.mcp"**.
5. Click **"Open"**. The *Project* window will open.
6. The code of this example is contained in the **"main.c"** 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 evaluation 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.
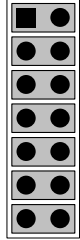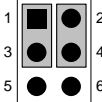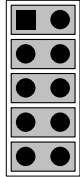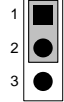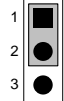
Congratulations! You have successfully completed this tutorial! You can continue to experiment with the CodeWarrior user interface and discover by yourself its potentialities. For an in-depth guide of all of the user interface features, select **"Help > CodeWarrior Help"** from CodeWarrior Development Studio's main menu.
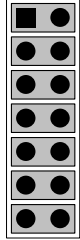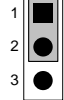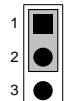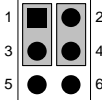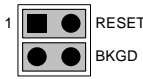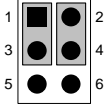
7 Jumper and Connector Settings

7.1 Mother Board Jumpers

Name	Reference	Description/Pinout
J105	1 ■ 2 ● 3 ●	**VREFH SELECTION** **1-2 ("VDDA"):** **VREFH tied to VDDA (default)** 2-3 ("USER"): VREFH connected to the J104 connector
J107	■ ●	**VDD ENABLE** **Installed:** **The microcontroller's VDD lines are supplied with a 5 V DC voltage (default)** Not Installed: The microcontroller's VDD lines are floating
J108	■ ●	**GND ENABLE** **Installed:** **The microcontroller's GND lines are tied to GND (default)** Not Installed: The microcontroller's GND lines are floating
J109	■ ●	**CLOCK ENABLE** **Installed:** **Connects the clock module's OUT pin to pin 3 of the "OUT SEL"jumper (default)** Not Installed: Disconnects the clock module's OUT pin from pin 3 of the "OUT SEL"jumper (default)
J110	■ ●	**EXTERNAL OSCILLATOR ENABLE** **Installed:** **Connects the external clock source (J111) to pin 3 of the "OUT SEL"jumper (default)** Not Installed: Disconnects the external clock source from pin 3 of the "OUT SEL"jumper (default)
J112	1 ■ ● 2 3 ● ● 4 5 ● ● 6	**OSCILLATOR SELECTION** 1-3, 2-4 ("MB OSC"): All clock signals routed to the Mother Board **3-5, 4-6 ("DB OSC"):** **All clock signals routed to the Daughter Board (default)**

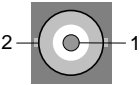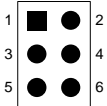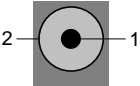| Name	Reference	Description/Pinout
J204		**DIP-SWITCH ENABLE**
		Installed: — **The DIP-switches are connected to the PTB[7..0] ports of the microcontroller (default)**
		Not Installed: — The DIP-switches are not connected to the microcontroller.
J205		**POTENTIOMETER "PTA1" ENABLE**
		Installed: — **The "PTA1" potentiomenter is connected to the microcontroller's PTA1 line (default)**
		Not Installed: — The "PTA1" potentiomenter is not connected to the microcontroller's PTA1 line
J206		**POTENTIOMETER "PTA2" ENABLE**
		Installed: — **The "PTA2" potentiomenter is connected to the microcontroller's PTA2 line (default)**
		Not Installed: — The "PTA2" potentiomenter is not connected to the microcontroller's PTA2 line
J207		**PUSH-BUTTON "PTA4" ENABLE**
		Installed: — **The "PTA4" push-button is connected to the microcontroller's PTA4 line (default)**
		Not Installed: — The "PTA4" push-button is not connected to the microcontroller's PTA4 line
J208		**PUSH-BUTTON "PTA5" ENABLE**
		Installed: — **The "PTA5" push-button is connected to the microcontroller's PTA5 line (default)**
		Not Installed: — The "PTA5" push-button is not connected to the microcontroller's PTA5 line
J209		**PUSH-BUTTON "PTA6" ENABLE**
		Installed: — **The "PTA6" push-button is connected to the microcontroller's PTA6 line (default)**
		Not Installed: — The "PTA6" push-button is not connected to the microcontroller's PTA6 line
J210		**PUSH-BUTTON "PTA7" ENABLE**
		Installed: — **The "PTA7" push-button is connected to the microcontroller's PTA7 line (default)**
		Not Installed: — The "PTA7" push-button is not connected to the microcontroller's PTA7 line

Name	Reference	Description/Pinout	
J211		**LED ENABLE**	
		Installed:	**The "PTDx" LEDs are connected to the PTD[7..0] ports of the microcontroller (default)**
		Not Installed:	The "PTDx" LEDs are not connected to the microcontroller.
J212		**USER LED 1 ENABLE**	
		Installed:	**The "USER LED 1" LED is connected to the microcontroller's PTA3 line (default)**
		Not Installed:	The "USER LED 1" LED is not connected to the microcontroller
J213		**USER LED 2 ENABLE**	
		Installed:	**The "USER LED 2" LED is connected to the microcontroller's PTC0 line (default)**
		Not Installed:	The "USER LED 2" LED is not connected to the microcontroller
J301		**RS-232/LIN SELECTION**	
		1-3, 2-4 ("RS-232_0"):	**The microcontroller's TXD1 and RXD1 lines are routed to the RS-232_0 transceiver (default)**
		3-5, 4-6 ("LIN"):	The microcontroller's TXD1 and RXD1 lines are routed to the LIN transceiver
J302		**RS-232_0 ENABLE**	
		All Installed:	**Enables the RS-232_0 transceiver (default)**
		Not Installed:	Disables the RS-232_0 transceiver
J303		**DTR_0 CONTROL**	
		1-2 ("NORMAL"):	**Normal DTR mode (default)**
		2-3 ("LOOP BACK"):	Loop back mode
J304		**RTS_0 CONTROL**	
		1-2 ("NORMAL"):	**Normal RTS mode (default)**
		2-3 ("LOOP BACK"):	Loop back mode
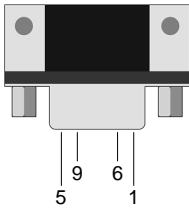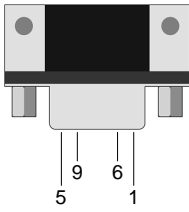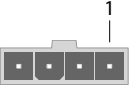
Name	Reference	Description/Pinout
J306		**RS-232_1 ENABLE** **All Installed:** **Enables the RS-232_1 transceiver (default)** Not Installed: Disables the RS-232_1 transceiver
J307		**DTR_1 CONTROL** **1-2 ("NORMAL"):** **Normal DTR mode (default)** 2-3 ("LOOP BACK"): Loop back mode
J308		**RTS_1 CONTROL** **1-2 ("NORMAL"):** **Normal RTS mode (default)** 2-3 ("LOOP BACK"): Loop back mode
J404		**LIN ENABLE** **Installed:** **Enables the LIN transceiver. Requires that the software properly drives the PTE4 pin (default)** Not Installed: Puts LIN transceiver in sleep mode
J501		**CAN HIGH-SPEED/SINGLE-WIRE SELECTION** **1-3, 2-4 ("HS"):** **High-speed CAN mode (default)** 3-5, 4-6 ("SW"): Single-wire CAN mode
J502		**HIGH-SPEED CAN STANDBY** **Installed:** **HS CAN transceiver's STB line connected to the microcontroller. Requires that the software properly drives the PTE5 pin (default)** Not Installed: Puts HS CAN transceiver in standby mode
J503		**SINGLE-WIRE CAN SLEEP** **All Installed:** **SW CAN transceiver's MODE0 and MODE1 lines connected to the microcontroller. Requires that the software properly drives the PTE2 and PTE3 pins (default)** Not Installed: Puts SW CAN transceiver in sleep mode
J602	RESET BKGD	**USB TO BDM ENABLE** **All installed:** **The USB to BDM interface is enabled (default)** Not Installed: The USB to BDM interface is disabled

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7.2 Daughter Board Jumpers

Name	Reference	Description/Pinout	
J105	1 ■ ● 2 3 ● ● 4 5 ● ● 6	**OSCILLATOR SOURCE**	
		1-3, 2-4 ("CRYSTAL/CLOCK"):	**Oscillator source is either the clock module or the crystal present on the daughter board (default)**
		3-5, 4-6 ("AUX"):	Oscillator source is taken from the "EXT OSC" connector (in the Mother Board)
J106	■ ●	**CLOCK ENABLE**	
		Installed:	**Connects the clock module's OUT pin to pin 3 of the "OSC SOURCE"(default)**
		Not Installed:	Disconnects the clock module's OUT pin from pin 3 of the "OSC SOURCE"
J107	■ ●	**VDD ENABLE**	
		Installed:	**The microcontroller's VDD lines are supplied with a 5 V DC voltage (default)**
		Not Installed:	The microcontroller's VDD lines are floating
J108	■ ●	**GND ENABLE**	
		Installed:	**The microcontroller's GND lines are tied to GND (default)**
		Not Installed:	The microcontroller's GND lines are floating

7.3 **Connectors**

Name	Reference	Description/Pinout
J106		Microcontroller PTA0/MCLK Test Point
J111	2 — ⊙ — 1	**External Oscillator** 1. Clock Signal 2. GND
J113	1 ■ ● 2 3 ● ● 4 5 ● ● 6	**BDM Connector** 1. BKGD 2. GND 3. N.C. 4. RESET 5. N.C. 6. VDD
J201	2 — ⦿ — 1	**12 V DC Power Supply Input Connector (Barrel, 2.1 mm)** 1. 12 V DC 2. GND
J202		12 V DC Power Supply Input Connector (Banana, Red, 4 mm)
J203		GND Input Connector (Banana, Black, 4 mm)
J214, J215		GND Test Point
J216, J217		12 V Test Point
J218, J219		5 V Test Point

Name	Reference	Description/Pinout
J305	9 6 5 1	RS-232_0 Connector 1. DSR 2. RX 3. TX 4. DTR 5. GND 6. DSR 7. RTS 8. CTS 9. N.C.
J309	9 6 5 1	RS-232_1 Connector 1. DSR 2. RX 3. TX 4. DTR 5. GND 6. DSR 7. RTS 8. CTS 9. N.C.
J401	4 3 2 1	LIN IN Connector 1. GND 2. External Wake 3. VBAT – LIN Bus Power Supply (12 V DC) 4. LIN – LIN Signal
J402	4 3 2 1	LIN OUT Connector 1. GND 2. External Wake 3. VBAT – LIN Bus Power Supply (12 V DC) 4. LIN – LIN Signal
J504	1	CAN Connector 1. CANH 2. CANL 3. GND 4. Single-wire bus line

Name	Reference	Description/Pinout
J601		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 Evaluation Board to the PC before installing the SofTec Microsystems Additional Components, the Evaluation 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 Evaluation 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 Evaluation 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 the "BKGD ENABLE" and "RESET ENABLE" jumpers in the "USB TO BDM INTERFACE" section are inserted.
2. Make sure that the microcontroller is powered:

    ▪ Make sure that the "ON-OFF" switch in the "POWER SUPPLY" section selects the "ON" position;
    ▪ Make sure that the "VDD ENA" and "GND ENA" jumpers in the "MCU" sections are both installed.