

DEM09S08LC60

Demonstration Board for Freescale MC9S08LC60

User's Manual



Development Tools for the EmbeddedWorld

DEMO9S08LC60

Demonstration Board for Freescale MC9S08LC60 (80-Pin LQFP)



Revision 1.0



Development Tools for the EmbeddedWorld

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SofTec Microsystems

E-mail (general information): info@softecmicro.com

E-mail (marketing department): marketing@softecmicro.com

E-mail (technical support): support@softecmicro.com

Web: http://www.softecmicro.com

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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:
 - o 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 onscreen 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.

Hardwar	re Installation
	The software you are installing for this hardware: uDART In-Circuit Debugger has not passed Windows Logo testing to verify its compatibility with Windows XP. [Tell me why this testing is important] Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.
	Continue Anyway STOP Installation

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.
- 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)
- Start CodeWarrior for HC(S)08 Development Studio by selecting it in the Windows Start menu.
- 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.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.



 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.

True-Time Simulator & Real-Time Debugger C:\Program Files\Freescale\CodeWarrior for	r HC08 V5.1\(CodeWarrior_Examples)\HCS08\Ev 🔳 🗖 🗙
File View Run SofTec-HCS08 Component Memory Window Help	
□☞■ ४୭፪ १Ҟ → २ - 4 - ●	
Source	Assembly
C:\Documents and Settings\dcoral\Desktop\DEM09S08LC60\C\Demo\Sources\main.c Line: 174	main
// A	8181 PSHH
// Entry point	8182 T3X 8183 CLR .X
void main(void)	8184 JSR 0x8092
{ IP	8187 JSR 0x8241
unsigned char adc=0x00;	816B LDHX #0x8691
	818E LDA #0xC8
// Initializes Peripherals PeriphInit():	
TrDnnffStete().	Register
	HCS08 Auto
P Procedure	
	SR 6A Status VHTNZC
main ()	PC 8181
🕅 Data:1	Memory
main c Auto Sumb Global	Auto
SOFTI <1> volatile SOFTISTR	0080 FF FF 57 F7 4F C7 D7 FB
E _ICGTRM <1> volatile ICGTRMSTR	0088 B7 FB 35 F3 F2 A7 BD 115
NVICGTRM <1> volatile NVICGTRMSTR NVICGTRM <1> volatile ICCCISTR	0090 00 40 80 00 01 04 84 C8 .0
E ICGC2 <1> volatile ICGC2STR	00A0 FC B7 A7 25 3D D9 98 FA
🖥 Data: 2	Command
Auto Symbol Local	STADIED
ade 129 unsigned char	RUNNING
and and anti-special count	Breakpoint
	in> 🗸
For Help, press F1 Automatic (triggers, breakpoints, watchpoints, and trace possible)	MC9508LC60 Breakpoint

- 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	1 VLCD	IO1 ENABLE	
	VDD	Installed	The indicated microcontroller line is
	• • PTA0	instancu.	connected to the indicated user I/O
	• • PTA1	Not Installed	tunction (default) The indicated microcontroller line is not
	PTC3	Not motanou.	connected to the indicated user I/O
	PTC4		function
	PTC5		
	PTC7		
J103	РТВО	CLOCK ENABLE	
	• • PTB1	All installed:	The crystal oscillator is connected to the microcontroller (default)
		Not Installed:	The crystal oscillator is not connected to the microcontroller
J202	1	POWER SELECTIC	DN
	2 • 3	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	1	PTA7 SELECTION	
	2 () 3 ()	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)

Name	Reference	Description/Pi	nout		
J302	g-Sel2 g-Sel1	G SELECTION Selects the accelerometer sensitivity according to the followin table.		ving	
		g-Sel2	g-Sel1	Selection	
		0	0	1.5 g (800 mV/g) (default)	
		0	1	2.0 g (600 mV/g)	
		1	0	4.0 g (300 mV/g)	
		1	1	6.0 g (200 mV/g)	
J303	1 2 3	ACCELEROME	TER SLEE Accel (defa	P MODE SELECTION	
1304		LO2 ENABLE	Accel	erometer in sleep mode	
J304	1 PTA2/GX PTA3/GY PTA4/GZ PTC0/RX PTC1/TX PTC2/SPK RESET# BKGD	Not Installed:	The in conne funct The ir conne functi	ndicated microcontroller line i ected to the indicated user I/O ion (default) ndicated microcontroller line is n ected to the indicated user I/O on	s ' ot
J401		LED ENABLE	The L micro The L micro	EDs are connected to the ocontroller (default) EDs are not connected to the controller.	

7.2 Connectors

Name	Reference		Description/Pinout	
J101	1 🔳 🌒 2	2	40-Pin I/O Header Female Connector	
	3 • • 2	4		
	5	6	1. 2	VDD (3.3 V)
	7	2	2. 3	GND
		10	4.	RST#
	9 • • 1	10	5.	PTC1
	11 🔴 🔴 1	12	6.	BKGD
	13 🔴 🌒 1	14	7.	PTC0
	15 🕒 🌒 1	16	8.	N.C.
	17 🔴 🌒 1	18	9.	PTC4
	19	20	10.	PTA0
			11.	PTC5
	21 • • 2	22	12.	PTA1
	23 • • 2	24	13.	PTC2
	25 🔴 🌒 2	26	14.	PTA2
	27	28	15.	
	29 🔴 🔴 3	30	10.	PTR5
	31	32	17.	ΡΤΔ4
			19	PTB4
	33 🗨 🛡 3	34	20.	PTA5
	35 🕒 🔴 3	36	21.	PTB6
	37 🔴 🌒 3	38	22.	PTA6
	39 🕒 🔴 4	40	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.	
			33. 24	
			34.	
			36 36	GND
			37.	GND
			38.	VDD (3.3 V)
			39.	VLCD
			40.	VDD (3.3 V)

Name	Reference	Description/Pinout
J104	1 🔳 🌒 2	BDM Connector (Not Populated)
	$3 \bigcirc 4 \\ 5 \bigcirc 6 \\ 6$	 BKGD GND N.C. RESET/VPP N.C. VDD
J201	\sim	12 V DC Power Supply Input Connector
0201	2-(•)-1	
		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. 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).

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Наши контакты:

Телефон: +7 812 627 14 35

Электронная почта: sales@st-electron.ru

Адрес: 198099, Санкт-Петербург, Промышленная ул, дом № 19, литера Н, помещение 100-Н Офис 331