DEMO9S08SE8

Demonstration Board for Freescale MC9S08SE8 Microcontroller

USER GUIDE

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REVISION

Date	Rev	Comments
July 29, 2008	A	Initial Release

CAUTIONARY NOTES

1) Electrostatic Discharge (ESD) prevention measures should be used when handling this product. ESD damage is not a warranty repair item.

2) Axiom Manufacturing does not assume any liability arising out of the application or use of any product or circuit described herein; neither does it convey any license under patent rights or the rights of others.

3) EMC Information on the DEMO9S08SE8 board:

   a) This product, as shipped from the factory with associated power supplies and cables, has been verified to meet with FCC requirements as a CLASS A product.

   b) This product is designed and intended for use as a development platform for hardware or software in an educational or professional laboratory.

   c) In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate prevention measures.

   d) Attaching additional wiring to this product or modifying the product operation from the factory configuration may affect its performance and cause interference with other apparatus in the immediate vicinity. If such interference is detected, suitable mitigating measures should be taken.

TERMINOLOGY

This development module utilizes option select jumpers to configure default board operation. Terminology for application of the option jumpers is as follows:

Jumper – a plastic shunt that connects 2 terminals electrically

Jumper on, in, or installed = jumper is a plastic shunt that fits across 2 pins and the shunt is installed so that the 2 pins are connected with the shunt.

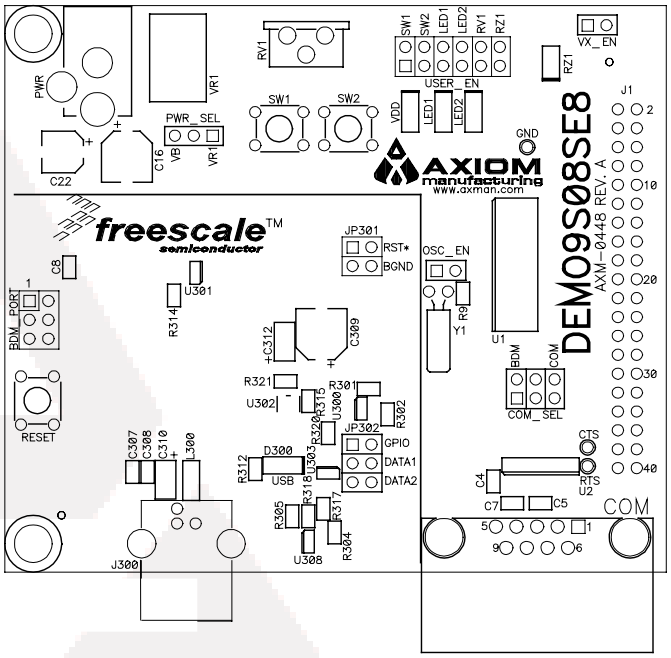
Jumper off, out, or idle = jumper or shunt is installed so that only 1 pin holds the shunt, no 2 pins are connected, or jumper is removed. It is recommended that the jumpers be placed idle by installing on 1 pin so they will not be lost.

Cut-Trace – a circuit trace connection between component pads. The circuit trace may be cut using a knife to break the default connection. To reconnect the circuit, simply install a suitably sized 0-ohm resistor or attach a wire across the pads.

Signal names followed by an asterisk (*) denote active-low signals.

FEATURES

The DEMO9S08SE8 is an evaluation or demonstration board for the MC9S08SE8 microcontroller. Development of applications is quick and easy with the integrated USB-BDM, sample software tools, and examples. An optional BDM_PORT port is also provided to allow use of a BDM_PORT cable. A 40-pin connector allows connecting the DEMO9S08SE8 board to an expanded evaluation environment.



- MC9S08SE8 CPU, 28SOIC
  - 8K Byte Flash
  - 512 Bytes RAM
  - Internal 32 kHz Oscillator, trimmable to ±0.2%
  - Timer Interface Module
  - SCI Communication Ports
  - 8 KBI inputs
  - 2-Ch, 16-bit, Timer Interface
  - 8-Ch, 10-bit Analog to Digital Converter (ATD)
- Integrated USB-BDM
- RS-232 Serial Port w/ DB9 Connector
- External 32.768 kHz Clock Oscillator (not installed)
- Power Input Selection Jumper
  - Power input from USB-BDM
  - Power input from on-board regulator
  - Power input from Connector J1
  - Power output through Connector J1
- User Components Provided
  - 3 Push Switches; 2 User, 1 Reset
  - 3 LED Indicators; 2 User, 1 VDD
- Jumpers
  - USER_EN
  - PWR_SEL
  - COM_SEL
  - VX_EN
  - OSC_EN (not installed)
  - JP301, JP302
- Connectors
  - 32-pin MCU I/O Connector
  - 2.0mm Barrel Connector
  - BDM_PORT Pin Header (not installed)
  - DB9 Serial Connector
  - USB-B Connector

Specifications:

- Board Size 3.0” x 3.0”
- Power Input:
  - USB Cable – 500mA max
  - PWR Connector - 9VDC typical, +7VDC to +18VDC

REFERENCES

Reference documents are provided on the support CD in Acrobat Reader format.

DEMO9S08SE8_UG.pdf	DEMO9S08SE8 User Guide (this document)
DEMO9S08SE8_SCH_C.pdf	DEMO9S08SE8 Board Schematic, Rev. C

GETTING STARTED

To get started quickly, please refer to the DEMO9RS08SE8 Quick Start Guide. This quick start will help the user connect the board to a PC, install the correct version of CodeWarrior Development Studio, and run a simple demo program.

SOFTWARE DEVELOPMENT

Software development requires the use of an HCS08 assembler or compiler and a host PC running a BDM interface. CodeWarrior Development Studio is supplied with this board for debugging and flash programming.

MEMORY MAP

The table below shows the MC9S08SE8 memory map. Attempting to access unimplemented memory locations causes an illegal-address reset. The memory map is grouped into 3 broad categories; Registers, RAM, and Flash. In the memory map below, the non-volatile registers and vector table are located at the top of the Flash block.

Table 1: Memory Map

0x0000 0x007F	Direct Page Registers
0x0080 0x027F	RAM
0x0280 – 0x17FF	Unimplemented
0x 1800 – 0x185F	High Page Registers
0x1860 – 0xDFFF	Unimplemented
0xE000 – 0xFFFF	FLASH

NOTE: Accessing unimplemented memory locations causes an illegal-address reset.

DEVELOPMENT SUPPORT

Application development and debug for the target MC9S08SE8 is supported through the BDM interface. The debug interface consists of an integrated USB-BDM debugger and an optional 6-pin header (BDM_PORT). The BDM_PORT header is not installed in default configuration and may be installed by the user if needed.

Integrated BDM_PORT

The DEMO9S08SE8 board features an integrated USB-BDM debugger from P&E Microcomputer Systems. The integrated debugger supports application development and debugging via the background debug mode. A USB, type B, connector provides connectivity between the target board to the host PC.

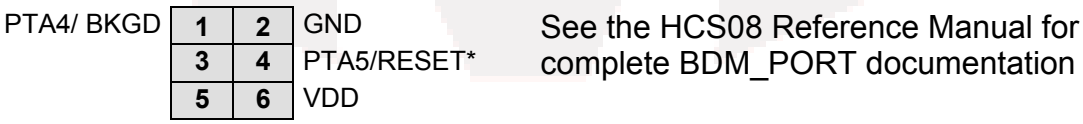
The integrated debugger provides power and ground to the target, thereby eliminating the need to power the board externally. When used, power from the USB-BDM circuit is derived from the USB bus; therefore, total current consumption for the target board, and all connected circuitry, must not exceed **500mA**. Excessive current drain will violate the USB specification causing the USB bus to disconnect; power is removed from the target forcing a POR.

CAUTION: Violating the USB specification will cause the USB bus to disconnect forcing the target to reset.

BDM_PORT Header

An HCS08/HC(S)12 BDM cable may be attached to a 6-pin BDM_PORT port header. However, this header is not installed in default configuration. Use of this port requires the user to install a 2x3, 0.1” center, pin header. Refer to the BDM cable documentation for details on the use of the BDM cable. The BDM_PORT header pin-out is shown below.

Figure 1: BDM Port



NOTE: This header is not installed in default configuration.

POWER

The DEMO9S08SE8 is designed to be powered from the USB_BDM during application development. A 2.0mm barrel connector has been applied to support stand-alone operation. In addition, the board may be powered through connector J1. The board may also be configured to supply power through connector J1 to external circuitry.

When using the integrated USB-BDM, the board draws power from the USB bus. Total current consumption of the board and connected circuitry, therefore, must be limited to less than **500mA**. Excessive current drain will violate the USB specification causing the USB bus to disconnect. This will force a power-on-reset (POR).

CAUTION: Violating the USB specification will cause the USB bus to disconnect, forcing the target to reset.

A 2.0mm, center-positive, barrel connector input has been provided to allow stand-alone operation. Voltage input at this connector must be limited to between +5V and +18V. An LDO voltage regulator at VR1 converts the input voltage to the +5.0V rail on the target board. VR1 will shut down if the connected circuit draws excessive current. Stand-alone operation is also supported through connector J1.

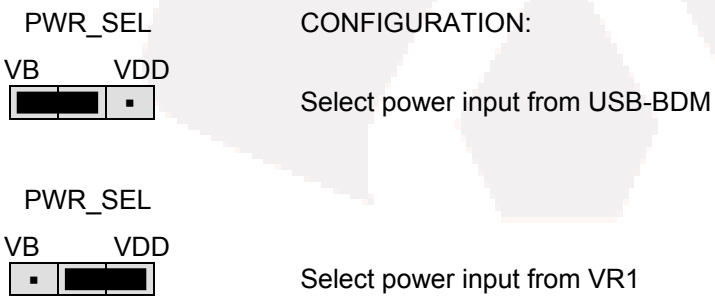
POWER SELECT

Power may be applied to the board through the integrated USB-BDM circuitry, the 2.0mm barrel connector, or through connector J1. Power selection is achieved by using 2 option headers: PWR_SEL option header and the VX_EN option header.

The PWR_SEL option header selects power input either from the integrated USB-BDM circuitry or from the on-board voltage regulator. Power input selection, from the USB-BDM or the on-board power supply, is mutually exclusive. This prevents power-input contention from damaging the board. The figure below details the PWR_SEL header connections.

PWR_SEL

Figure 2: PWR_SEL Option Header



Power from the integrated BDM is drawn from the USB bus and is limited to **500mA**. Excessive current drain will violate the USB specification will cause the USB bus to disconnect.

CAUTION: Violating the USB specification will cause the USB bus to disconnect. This will cause the board to reset.

The on-board voltage regulator (VR1) accepts power input through a 2.0mm barrel connector (PWR). Input voltage may range from +5V to +18V. The voltage regulator (VR1) provides a +5.0V fixed output limited to 500mA. Over-temperature and over-current limits built into the voltage regulator protects the device from excessive stresses.

The user should consider the maximum output current limit of the selected power source when attempting to power off-board circuitry through connector J1.

VX_EN

The VX_EN option header is a 2-pin jumper that connects the target board voltage rail to J1-1. J1-3 is connected directly to the ground plane. Use of this feature requires a regulated +5.0V input power source. This power input is decoupled to minimize noise input but is not regulated. Care should be exercised when using this feature; no protection is applied on this input and damage to the target board may result if over-driven. Also, do not attempt to power the target board through this connector while also applying power through the USB-BDM or the PWR connector; damage to the board may result.

Power may be sourced to off-board circuitry through the J1 connector. The current limitation of the USB bus or the on-board regulator must be considered when attempting to source power to external circuitry. Excessive current drain may damage the target board, the host PC USB hub, or the on-board regulator. The figure below details the VX_EN option header connections.

Figure 3. VX_EN Option Header



ON Enable power connection to connector J1

VX_EN



OFF Disable power connection to connector J1

VX_EN

CAUTION: Do not apply power to connector J1 while also sourcing power from either the PWR connector or the USB-BDM circuit. Damage to the board may result.

NOTE: Do not exceed available current supply from the USB-BDM cable or on-board regulator when sourcing power through connector J1 to external circuitry.

RESET SWITCH

The RESET switch provides a method to apply an asynchronous reset to the MCU and is connected directly to the PTA5/RESET* input on the MCU. Pressing the RESET switch forces the MCU RESET* input low. The MC9S08SE8 MCU applies an internal pull-up on the RESET* line to prevent spurious resets and allow normal operation.

The RESET* input on the MC9S08SE8 is multiplexed. Refer to the MC9S08SE8 Reference Manual for details on using this input.

LOW VOLTAGE DETECT

The MC9S08SE8 utilizes an internal Low Voltage Detect (LVD) to protect against under-voltage conditions. The LVD is enabled out of RESET. Consult the MC9S08SE8 Reference Manual for details on configuring LVD operation.

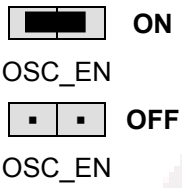
TIMING

By default, the DEMO9S08SE8 uses timing provided from an internal 32 kHz frequency reference and an internal frequency-locked loop (FLL). The FLL output is trimmable to ± 0.2% of nominal. Refer to the MC9S08SE8 Reference Manual for further details on clock operation.

Component pads for an optional 32.768 kHz crystal oscillator circuit have also been provided to support external timing input. The external crystal is connected to the PTB6/XTAL and PTB7/EXTAL MCU inputs. This alternate timing source is configured for Pierce mode operation.

The alternate timing source components are not installed in default configurations. Refer to the board schematic to populate this option and associated support components.

Figure 4: OSC_EN Option Header



NOTE: This option header is not installed in default configuration.

COMMUNICAITONS

Serial communications on the DEMO9S08SE8 board are support through an RS-232 physical layer interface and DB-9 connector and through a virtual serial port implemented in the USB-BDM. The COM_SEL option header selects between the applied serial function.

COM Port

An RS-232 transceiver provides RS-232 to TTL/CMOS logic level translation between the COM connector and the MCU. The COM connector is a 9-pin Dsub, right-angle connector. A ferrite bead on shield ground provides conducted immunity protection. Communication signals TXD and RXD are routed from the transceiver to the MCU. These signals are also available on connector J1. Hardware flow control signals RTS and CTS are available on the logic side of U3 and are routed to test point vias located near the transceiver (U4). RTS has been biased properly to provide handshaking if required.

RS-232 signals TXD and RXD are connected to the MCU through the COM_SEL option header. Table 2

Table 2: COM Connections

MCU Port	COM Signal	I/O PORT CONNECTOR
PTB1/KBIP5/TXD/ADP7	TXD	J1-5
PTB0/KBIP4/RXD/ADP6	RXD	J1-7

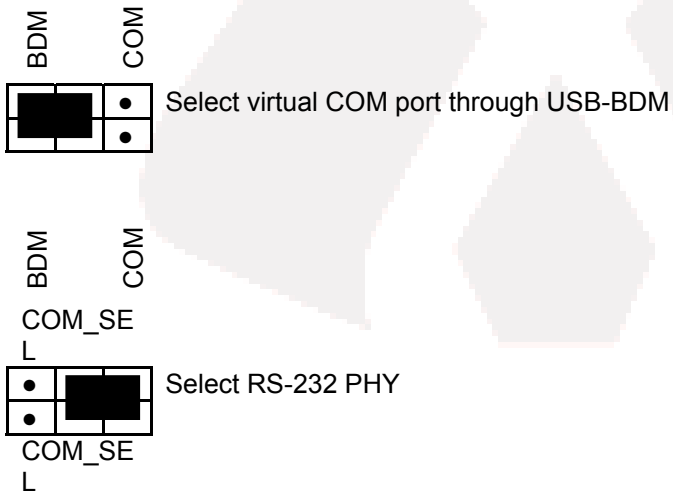
Virtual Serial Port

The DEMO9S08SE8 provides a virtual serial port through the USB-BDM. Use of the virtual serial port requires the P&E Toolkit. The Toolkit is available on the DVD supplied with the demo board.

COM_SEL

The COM_SEL option header select between the virtual serial port implemented through the USB-BDM or the RS-232 PHY. Table 3 below shows the shunt positions to select between the two options.

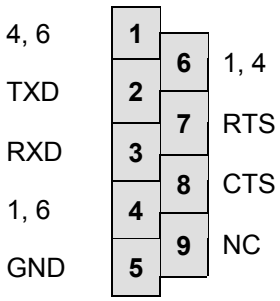
Table 3: COM_EN Option Header



COM Connector

A standard 9-pin Dsub connector provides external connections for the SCI port. The Dsub shell is connected to board ground through a ferrite bead. The ferrite bead provides noise isolation on the RS-232 connection. Figure 5 below, shows the pin-out of the DB9 connector.

Figure 5: COM Connector



Female DB9 connector that interfaces to the HC(S)08 internal SCI1 serial port via the U2 RS232 transceiver. It provides simple 2-wire asynchronous serial communications without flow control. Flow control is provided at test points on the board.

Pins 1, 4, and 6 are connected together.

USER OPTIONS

The DEMO9S08SE8 includes various input and output devices to aid application development. User I/O devices include 2 momentary pushbutton switches, 2 green LEDs, 1 potentiometer, and 1 phototransistor. Each device may be enabled or disabled individually by the USER_EN option header. Each user enable is clearly marked as to functionality.

Pushbutton Switches

Two push button switches provide momentary, active-low input, for user applications. Pull-ups internal to the MCU must be enabled to provide error free switch operation. Pushbutton switches SW1 and SW2 are enabled to the MCU I/O ports by the USER option bank. Table 4 below details the user jumper settings and MCU connections.

LED Indicators

Two LEDs provide visual output for user applications. Both LEDs are configured for active-low operation. Table 4 below details the user jumper settings and MCU connections.

Potentiometer

A 5k ohm, thumb-wheel type, potentiometer at RV1 provides variable resistance input for user applications. The output is the result of a voltage divider that changes as the thumb-wheel is turned. The potentiometer is connected between VDD and GND with the center tap providing the divider output. Table 4 below details the user jumper settings and MCU connection.

Photocell

A surface-mount phototransistor provides light sensitive, variable input for user applications. Current flow within the phototransistor is inversely proportional to light intensity incident on the surface of the device. A rail-to-rail operational amplifier boosts the photocell output. Table 4 below details the user jumper settings and MCU connections.

Table 4: User Option Jumper Settings

Jumper	On	Off	MCU PORT	MCU PIN
SW1	Enable SW1	Disable SW1	PTA2/KBIP2	14
SW2	Enable SW2	Disable SW2	PTA3/KBIP3	13
LED1	Enable LED1	Disable LED1	PTB6/TPM1CH0	6
LED2	Enable LED2	Disable LED2	PTB7/TPM1CH1	5
RV1	Enable RV1	Disable RV1	PTA0/ADP4	16
RZ1	Enable RZ1	Disable RZ1	PTA1/ADP5	15

I/O PORT CONNECTOR

This port connector provides access to DEMO9S08SE8 I/O signals. Signal positions not shown listed are not connected on the board.

Figure 6: MCU I/O Port Connector

VDD	1	2	PTA5/IRQ/TCLK/RESET*
VSS	3	4	PTA5/IRQ/TCLK/RESET*
PTB1/KBIP5/TXD/ADP7	5	6	PTA4/BKGD/MS
PTB0/KBIP4/RXD/ADP6	7	8	PTB7/EXTAL
PTA2/KBIP2/ADP2	9	10	PTB6/XTAL
PTA3/KBIP3/ADP3	11	12	
PTA0/KBIP0/TPM1CH0/ADP0	13	14	
PTB6/XTAL	15	16	
PTB3/KBIP7/ADP9	17	18	PTA1/KBIP1/TPM1CH1/ADP1
PTB4/TPM2CH0	19	20	PTA0/KBIP0/TPM1CH0/ADP0
PTB2/KBIP6/ADP8	21	22	
PTB5	23	24	
PTC0	25	26	PTB1/KBIP5/TXD/ADP7
PTC1	27	28	PTB0/KBIP4/RXD/ADP6
PTC2	29	30	PTA6/TPM1CH0/ADP4
PTC3	31	32	PTA7/TPM1CH1/ADP5
PTC4	33	34	PTC7
PTC5	35	36	PTC6
	37	38	
	39	40	