DEMO9S08QG8

Demonstration Board for Freescale MC9S08QG8
Also Applies to the CSM9S08QG8SLK

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FIGURES

TABLES

REVISION

Date	Rev	Comments
September 19, 2005	A	Initial Release.
September 22, 2005	B	Corrected header size in Features and updated Reference file names.
November 1	C	Added reference to CSM9S08QG8SLK. Added 2x14 pin header to BOM.
January 30, 2006	D	Corrected minor editing errors
February 16, 2006	E	Corrected document number on opening page

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 DEMO9S08QG8 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 board uses option selection jumpers. A jumper is a plastic shunt that connects 2 terminals electrically. Terminology for application of the option jumpers is as follows:

Jumper on, in, or installed - jumper is installed such that 2 pins are connected together.

Jumper off, out, or idle - jumper is installed on 1 pin only. It is recommended that jumpers be idled by installing on 1 pin so they will not be lost.

CSM9S08QG8SLK

The CSM9S08QG8SLK is a Student Learning Kit that applies a pin header to the socket header on the DEMO9S08QG8 board. This allows the CSM9S08QG8SLK to be installed on the MCU Project Board MCU Port. See the MCU Project board user documents for more details on using the CSM9S08QG8SLK.

Throughout this document, where used, the name DEMO9S08QG8 applies equally to the DEMO9S08QG8 and to the CSM9S08QG8SLK.

FEATURES

The DEMO9S08QG8 is an evaluation or demonstration board for the MC9S08QG8 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 32-pin connector allows connecting the DEMO9S08QG8 board to an expanded evaluation environment.

- MC9S08QG8 CPU, 16-pin DIP, Socketed
  - 8K Byte Flash
  - 512 Bytes RAM
  - Internal 32 kHz Oscillator, trimmable to ±0.2%
  - 12 GPIO, 1 Input Only, 1 Output only
  - Timer Interface Module
  - SCI and SPI Communication Ports
  - IIC Module
  - 8 KBI inputs
  - 2-Ch, 16-bit, Timer Interface
  - 8-Ch, 10-bit Analog to Digital Converter (ATD)
  - Analog Comparator w/ internal compare
- Integrated USB-BDM
- RS-232 Serial Port w/ DB9 Connector
- SPI, IIC ports available on Connector J1
- 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)
- Connectors
  - 32-pin MCU I/O Connector
  - 2.0mm Barrel Connector
  - BDM_PORT Pin Header (not installed)
  - DB9 Serial Connector
- **Specifications:**
  - Board Size 2.9" x 2.5"
  - Power Input:
    - USB Cable – 500mA max
    - PWR Connector - 9VDC typical, +7VDC to +18VDC

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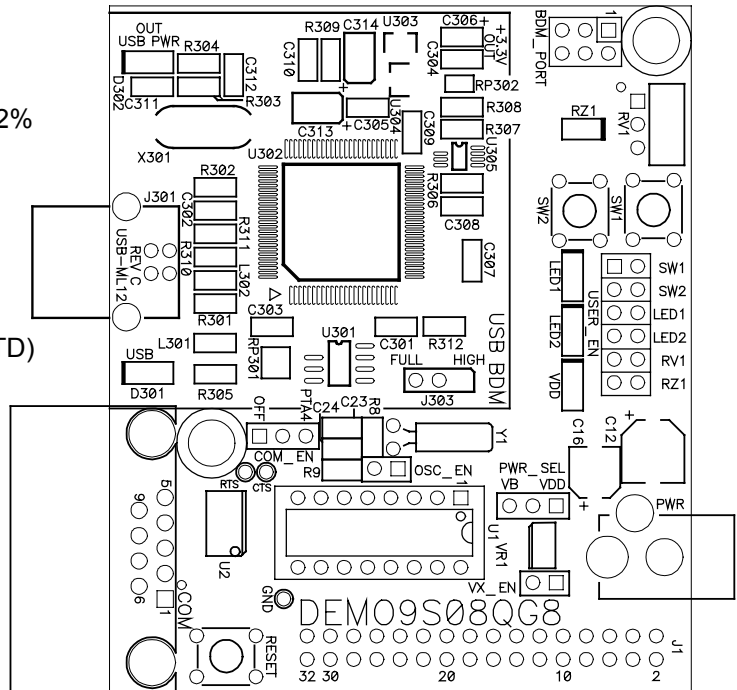
REFERENCES

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

DEMO9S08QG8_UG.pdf   DEMO9S08QG8 User Guide (this document)
DEMO9S08QG8_SCH_C.pdf   DEMO9S08QG8 Board Schematic, Rev. C
DEMO9S08QG8_QSG.pdf   DEMO9S08QG8 Quick Start Guide
DEMO9S08QG8_APP_UG.pdf   DEMO9S08QG8 Test Application User Guide
DEMO_S08QG8_Test.zip   CodeWarrior LED Demonstration application
DEMO9S08QG8_APP.zip   CodeWarrior Feature Demonstration application
AN2627.pdf   Cycle-by-Cycle Instruction Details for HC(S)08 MCU's

GETTING STARTED

To get started quickly, please refer to the DEMO9S08QG8 Quick Start Guide included with the development kit. This quick start shows how to connect the board to the PC, run an LED test program, install the correct version of CodeWarrior Development Studio, and load an Analog to Digital (ATD) test program using CodeWarrior.

OPERATING MODES

The DEMO9S08QG8 board operates in two basic modes Run Mode, or Debug Mode. Run Mode supports user application operation from Power-On or Reset. Debug Mode supports the development and debug of applications via the BDM_PORT. See the related sections below for quickly starting the board in the desired mode of operation.

The board has been preloaded with a demonstration program that operates in the Run Mode. The VDD LED is lit when power is applied to the board and the PWR_SEL option header is set correctly.

RUN Mode

Run mode allows the user application to execute when power is applied to the board or the RESET button is pressed. Use the following settings to configure the DEMO908QG8 board for RUN Mode using the USB bus to power the board. See the POWER section below for details on configuring the board for alternate power input.

1. Connect a serial cable (not included) between the board and a host PC if needed.

2. Connect auxiliary equipment to board if needed.

3. Configure the board option jumpers as shown.

Table 1: Run Mode Setup

PWR_SEL	Set to VB
COM_EN	Set to PTA4
VX_EN	ON if required
USER_EN	ALL ON

4. Connect the USB cable to an open USB port on the host PC and attach to the USB port on the target board. The USB, USB_PWR, and VDD LEDs will light and the loaded application will begin to execute.

Debug Mode

Debug Mode supports application development and debug using the HCS08/HC(S)12 background debug mode (BDM). Background mode is accessible using either the integrated USB-BDM or an external HCS08/HC(S)12 BDM cable. Use of the integrated BDM requires only a host PC with an available USB port and an A/B USB cable. The USB cable used must be USB 2.0 compliant. A 6-pin BDM_PORT header supports the use of an external BDM cable. This header is not installed in default configurations. The steps below describe using the integrated USB-BDM. See the POWER section below for details on configuring the board for alternate power input.

1. Connect a serial cable (not included) between the board and a host PC if needed.

2. Connect auxiliary equipment to board if needed.

3. Install and launch CodeWarrior Development Studio for HC(S)08, P&E PKGHCS08, or other software capable of communicating with the HCS08 MCU.

4. Configure the board option jumpers as shown.

Table 2: Debug Mode Setup

PWR_SEL	Set to VB
COM_EN	Set to PTA4
VX_EN	ON If Required
USER_EN	ON if Required

5. Connect the supplied USB cable between an available USB port on the host PC and the USB connector on the board.

6. Hosting development software will establish background communication.

SOFTWARE DEVELOPMENT

Software development requires the use of an HCS08 assembler or compiler and a host PC running a BDM interface. CodeWarrior Development Studio for HC(S)08 is supplied with this board for debugging and flash programming.

MEMORY MAP

The table below shows the MC9S08QG8 memory map. Attempting to access unimplemented memory locations will cause 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 3: Memory Map

0x0000 – 0x005F	Direct Page Registers	96 bytes
0x0060 – 0x025F	RAM	512 bytes
0x0260 – 0x17FF	Unimplemented	5,536 bytes
0x 1800 – 0x184F	High Page Registers	80 bytes
0x1850 – 0xDFFF	Unimplemented	51,120 bytes
0xE000 – 0xFFAF	FLASH	8192 bytes
0xFFB0 – 0xFBFF	Non-Volatile Registers	
0xFC00 – 0xFFFF	Vectors	

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

DEVELOPMENT SUPPORT

Application development and debug for the target MC9S08QG8 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 DEMO9S08QG8 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

PTA4/ BKGD	1	2	GND
	3	4	PTA5/RESET*
	5	6	VDD

See the HCS08 Device User Guide for complete BDM_PORT documentation

> **NOTE:** This header is not installed in default configuration.

POWER

The DEMO9S08QG8 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 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 +3.3V 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.
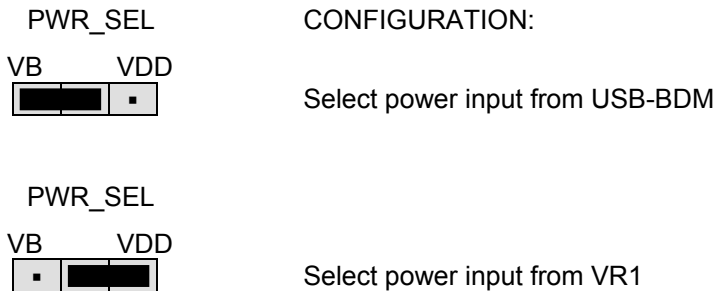
POWER SELECT

Power may be applied to the board through the integrated USB-BDM circuitry, a 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

PWR_SEL   CONFIGURATION:

VB   VDD
                                 Select power input from USB-BDM

PWR_SEL

VB   VDD
                                 Select power input from VR1

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 +3.3V fixed output limited to 250mA. 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 +3.3V 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
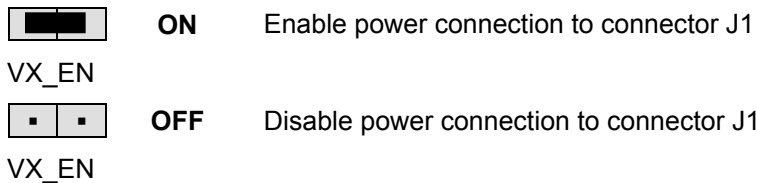
CAUTION: Do not apply power to connector J1 while also sourcing power from either the PWR connector or the USB-BDM circuit. Damage to the board may result.

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 MC9S08QG8 MCU applies an internal pull-up on the RESET* line to prevent spurious resets and allow normal operation.

LOW VOLTAGE DETECT

The MC9S08QG8 utilizes an internal Low Voltage Detect (LVD) to protect against undervoltage conditions. The LVD is enabled out of RESET. Consult the MC9S08QG8 Device User Guide for details on configuring LVD operation.

STOP MODES

The MC9S08QG8 can be configured for three different low power stop modes. If stop1 or stop2 modes are entered, an external pull-up resistor must be placed between the PTA5/RESET*/IRQ*/TCLK pin and VDD. This pull-up resistor is not included on the DEMO9S08QG8 board. If these modes will be used with this board, a 10K – 50K ohm resistor can be placed between pins J1-1 and J1-2 to ensure proper operation of the MCU. The jumper for the VX_EN header must also be in place in this case. Consult the MC9S08QG8 Device User Guide for more details on configuring the low power stop modes.

TIMING

By default, the DEMO9S08QG8 uses timing provided from an internal 32 kHz frequency refer-ence and an internal frequency-locked loop (FLL). The FLL output is trimmable to ± 0.2% of nominal. Refer to the MC9S08QG8 Device User Guide 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 opera-tion.

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

ON   Enables Crystal Oscillator Input to MCU

OSC_EN

OFF

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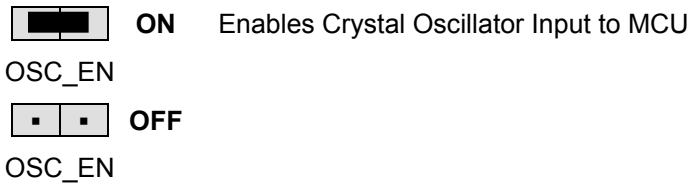
NOTE: This option header is not installed in default configuration.

COMMUNICATIONS

The DEMO9S08QG8 board provides a Serial Communications Interface (SCI) port, a Serial Peripheral Interface (SPI) port, and an Inter-Integrated Controller (IIC) port. RS-232 communi-cations are supported through a DB9 connector. SPI and IIC communications are supported through connector J1. The COM_EN option header enables SCI operation on the board.

SCI 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.

Communications signals TXD and RXD connect to general purpose Port B signals. The RS-232 transceiver should be disabled via the COM_EN option header if these signals are used as GPIO. The transceiver should also be disabled if the TXD and RXD signal inputs at connector J1 are used.

COM_EN

The COM_EN option header determines the operational status of the RS-232 transceiver. In the OFF position, the transceiver is disabled and all outputs are tri-stated. In the PTA4 position, the transceiver may be turned on or off using MCU GPIO signal PTA4. With the option jumper removed, the transceiver is always on. When the transceiver is ON, the AutoShutoff feature of the device is disabled.

Table 4: COM_EN Option Header

OFF   PTA4

▪ ███ ███   MCU controls RS-232 Transceiver

COM_EN

OFF   PTA4

███ ███ ▪   RS-232 Transceiver disabled

COM_EN

OFF   PTA4

▪ ▪ ▪   RS-232 Transceiver always ON. AutoShutoff disabled

COM_EN

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. The DB9 connector pin-out is shown below.

Figure 5: COM Connector

4, 6	**1**		
		6	1, 4
TXD	**2**		
		7	RTS
RXD	**3**		
		8	CTS
1, 6	**4**		
		9	NC
GND	**5**		
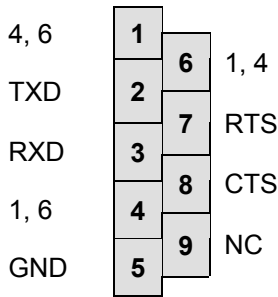
Female DB9 connector that interfaces to the HC(S)08 internal SCI1 serial port via the U2 RS232 transceiver. It provides simple 2-wire asynchronous serial communications without flow control. Flow control is provided at test points on the board.

Pins 1, 4, and 6 are connected together.

SPI Port

SPI signaling connects directly between connector J1 and the MCU. Refer to the MC9S08QG8 Device User Guide for details on using the SPI interface.

IIC Port

IIC signaling connects directly between connector J1 and the MCU. Refer to the MC9S08QG8 Device User Guide for details on using the IIC interface.

USER OPTIONS

The DEMO9S08QG8 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. SW1 and SW2 connect to input ports PTA2 and PTA3 respectively. Table 5 below details the user jumper settings.

LED Indicators

Indicators LED1 and LED2 are enabled from HC(S)08 I/O ports by the USER option bank. Each LED is active-low and illuminates when a logic low signal is driven from the respective MCU I/O port. MCU ports PTB6 and PTB7 drive LED1 and LED2 respectively. Table 5 below details the user jumper settings.

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. This center tap is connected to the MCU on signal PTA0. Table 5 below details the user jumper settings.

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 OP amp at U2 boosts the photocell output to useable levels. This signal is available to the MCU on signal PTA1. Table 5 below details the user jumper settings.

Table 5: User Option Jumper Settings

Jumper	On	Off	MCU PORT	MCU PIN
SW1	Enable SW1	Disable SW1	PTA2	14
SW2	Enable SW2	Disable SW2	PTA3	13
LED1	Enable LED1	Disable LED1	PTB6	6
LED2	Enable LED2	Disable LED2	PTB7	5
RV1	Enable RV1	Disable RV1	PTA0	16
RZ1	Enable RZ1	Disable RZ1	PTA1	15

I/O PORT CONNECTOR

This port connector provides access to DEMO9S08QG8 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/RESET*/IRQ*/TCLK
VSS	3	4	PTA5/ RESET*/IRQ*/TCLK
PTB1/KBI1P5/ADC1P5/TXD1	5	6	PTA4/BKGD/MS/ACMP10
PTB0/KBI1P4/ADC1P4/RXD1	7	8	PTB7/SCL1/EXTAL
PTA2/KBI1P2/ADC1P2/SDA1	9	10	PTB6/SDA1/XTAL
PTA3/KBI1P3/ADC1P3/SCL1	11	12	
PTA5/ RESET*/IRQ*/TCLK	13	14	
PTA0/KBI1P0/ADC1P0/TPM1CH0/AMCP+	15	16	
PTB3/KBI1P7/ADC1P7/MOSI1	17	18	PTA1/KBI1P1/ADC1P1/ACMP1-
PTB4/MISO1	19	20	PTA0/KBI1P0/ADC1P0/TPM1CH0/AMCP+
PTB2/KBI1P6/ADC1P6/SPSCK1	21	22	
PTB5/TPM1CH1/SS1	23	24	
PTA1/KBI1P1/ADC1P1/ACMP1-	25	26	
PTB6/SDA1/XTAL	27	28	
PTB7/SCL1/EXTAL	29	30	
PTA4/BKGD/MS/ACMP10	31	32	

APPENDIX A

BILL OF MATERIALS

Item	Qty	Ref(m)	Title	Detail	Vendor	Vend-P/N
Top						
1	0	C23,C24	Cap-Not Installed			
2	3	C303,C310,C21	Cap-Cer-Smt	(0805) .01uF,50V	Emtek	MA0805XR103K500
3	18	C301,C302,C304,C305,C307,C308,C309,C2, C3,C6,C7,C10,C13, C14,C15,C18,C19,C22	Cap-Cer-Smt	(0805) .1uF,50V	Emtek	MA0805XR104K500
4	3	C4,C5,C8	Cap-Cer-Smt	(0805) 1uF,16V	Emtek	MA0805XR105K160
5	2	C311,C312	Cap-Cer-Smt	(0805) 22pF,50V,npo/cog,5%		
6	1	C9	Cap-Cer-Smt	(0805) .47uF,16V,Y5V	Digi-Key	445-1353-1-ND
7	1	C16	Cap-Elec-Smt	(SVC) 10uF,35V, Alum	Digi-Key	493-2117-1-ND
8	1	C12	Cap-Elec-Smt	(SVD) 100uF,16V, Alum	Digi-Key	493-2105-1-ND
9	3	C1,C17,C20	Cap-Tant-Smt	(SMB) 10uF,10V	FAI	TAJB106KO1OR
10	3	C306,C313,C314	Cap-Tant-Smt	(SMA) 4.7uF,16V	Digi-Key	PCS3475CT-ND
11	1	D2	Dio-Smt	(Sot23) MMBD6050SA,Sw, 70V,200mA	Digi-Key	MMBD6050LT1OSCT-ND
12	1	D1	Dio-Smt	(Sot23) BAT54C,Schtky,30V, 200mA,Dual Com Cat	Emtek	BAT54C
13	4	D301,LED2,LED1,VDD	LED-SMT	(1206) Green,w/Reflector	FAI	SML-010MTT86
14	1	D302	LED-SMT	(1206) Yellow,w/Reflector	FAI	SML-010YTT86
15	1	PWR	Conn-Barrel-Thru	Plug 2mm Barrel,RA	Emtek	SCD-014
16	1	COM	Conn-DB9-Thru	Socket (Female),RA	Emtek	DNRO9SJB-SG
17	1	VX_EN	Conn-Pin Hdr-Thru	1x2 Header		
18	2	PWR_SEL,COM_EN	Conn-Pin Hdr-Thru	1x3 Header		
19	1	USER_EN	Conn-Pin Hdr-Thru	2x6 Header		
20	1	J1 (install on bottom)	Conn-Hdr Skt-Smt	2x16 Header Socket,Pass Thru	E-call	116-2819-320
21	1	J301	Conn-Spec-Thru	USB-B,RA	Mouser	154-2442
22	2	L301,L302	Ind-FB-Smt	(1206) 26 Ohms,Ferrite,EMI,1.5A	Digi-Key	240-1027-1-ND
23	1	FB1	Ind-FB-Smt	(0805) 330 Ohms@100M,1.5A	Mouser	81-BLM21P331SG
24	1	L2	Ind-Pwr-Smt	(1812) 15uH,10%	Digi-Key	445-1165-1-ND
25	1	L1	Ind-Filter-Smt	(1812) 680uH,10%	Digi-Key	DN12684JTR-ND
26	1	U301	IC-Lvl Det5V-Smt	(Soic8) MC34164D,Reset	Digi-Key	MC34164D-5R2OSCT-ND

27	1	U303	Trans-Mosfet-Smt	(Sot23) IRLML6402CT,P-Ch, 20V,3.7A	Digi-Key	IRLML6402CT-ND
28	1	U304	Trans-Mosfet-Smt	(Sot23) NTR4501NT1G,N-Ch, 20V,3.2A	Digi-Key	NTR4501NT1G
29	1	RZ1	Trans-Photo-Smt	(0805) RPM-075PT,600Nm	Digi-Key	511-1356-1-ND
30	1	R306	Res-Carb-Smt	(0805) 1K Ohm,5%	Emtek	CR10-102J-TR
31	4	R312,R5,R7,R12	Res-Carb-Smt	(0805) 10K Ohm,5%	Emtek	CR10-103J-TR
32	2	R303,R11	Res-Carb-Smt	(0805) 1M Ohm,5%	Emtek	CR10-105J-TR
33	1	R302	Res-Carb-Smt	(0805) 1.5K Ohm,5%	Emtek	CR10-152J-TR
34	1	R4	Res-Carb-Smt	(0805) 20K Ohm,5%	Emtek	CR10-203J-TR
35	3	R1,R2,R10	Res-Carb-Smt	(0805) 330 Ohm,5%	Emtek	CR10-331J-TR
36	1	R3	Res-Carb-Smt	(0805) 3.3K Ohm,5%	Emtek	CR10-332J-TR
37	2	R307,R308	Res-Carb-Smt	(0805) 47 Ohm,5%	Emtek	CR10-470J-TR
38	1	R6	Res-Carb-Smt	(0805) 47K Ohm,5%	Emtek	CR10-473J-TR
39	1	R301	Res-Carb-Smt	(0805) 510 Ohm,5%	Emtek	CR10-511J-TR
40	2	R304,R305	Res-Carb-Smt	(0805) 680 Ohm,5%	Emtek	CR10-681J-TR
41	2	R310,R311	Res-Metal Film-Smt	(0805) 33.0 Ohm,1%		
42	0	R8,R9,R309	Res-Not Installed			
43	1	RP301	Res-Netw-Smt	(74C083) 1K Ohm,8P4R,Iso	Digi-Key	742C083102JCT-ND
44	1	RP302	Res-Netw-Smt	(743C043) 4.7K Ohm,4P2R,Iso	Digi-Key	742C043472JCT-ND
45	1	RV1	Res-Pot-Thru	(3352) 5K Ohm,Thumb Wheel	Digi-Key	3352W-502-ND
46	0	CTS,RTS	Misc-Not Installed			
47	3	RESET,SW1,SW2	Sw-PB-Thru	Tact Sw,5mm Sq	Emtek	TC-00104-00
48	1	SU1	IC-Skt-Dip	16 Pins	Avnet	
49	1	U1	IC-Microp-Thru	(Dip16) MC689S08QG8,MCU	Freescale	MC68908QG8CPB
50	1	U305	IC-Switch-Smt	(DCT8) SN74LVC2G66DCT, Analog Sw,Bilateral,Dual	Digi-Key	296-13271-1-ND
51	1	U2	IC-RS232-Smt	(Ssop20) MAX3218,Dual Xcvr,1.8V-4.5V,ESD	Digi-Key	MAX3218CAP-ND
52	1	U3	IC-Op Amp-Smt	(Sot23-5) LMV321,Quad,R/R	Digi-Key	LMV321M5CT-ND
53	0	Y1	Crystal- Not Installed			
53	1	U302	IC-MCU-Smt	(Tqfp100) MC9S12UF32PU, Prog'd,USB-ML12, ID 0x02	P&E	UF32-12-3.3V
54	1	VR1	VReg-3.3V-Smt	(Soic8) L4931CD33, 250mA,Ldo	Mouser	511-L4931CD33
55	1	X301	Crystal-Smt	(HC49-US) 12.000MHz,20PF	Digi-Key	300-6127-1-ND
56	3		HDW-Screw	4-40x3/8 Pan,St Steel	Mouser	0406MPPSS
57	3		HDW-Standoff	4-40x3/8,Hex,Thd,Alum	Digi-Key	2202K-ND
58	9	User_En (6),Pwr_Sel, Vx_En,Com_En	HDW-Shunt	.10 Shunt	Emtek	MJ-5.97
59	1		Pcb	DEMO9S08QG8 2.95x2.5 2 Lyr	Tex Cktry	AXM0363
60	0	Bdm_Port,Osc_En,J303	Header-Not Installed			
61	1		Cable-USB	A-B,1.8M,Black	Mouser	172-1024

62	1		Media-CD	HC(S)08 Support	Axiom	
63	1		Media-Document	User Guide	Axiom	DOC-0362-010
64	1		Media-Document	Quick Start Guide	Freescale	
65	1		Pack-Foam			
66	1		Box-Cardboard			
	CSM9S08QG8SLK ONLY					
	1	J1	Conn-Pin Hdr-Thru	2X16 Header		