TWR-S08

Demonstration Board for Freescale MC9S08LL and MC9S08LH Families of Microcontrollers

USER GUIDE

Web Site: www.axman.com

Support: support@axman.com

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REVISION

Date	Rev	Comments
October 5, 2009	A	Initial Release
October 6, 2009	B	Updated board name to TWR-S08 thru-out
October 7, 2009	C	Updated References section to correct document names and remove Support CD. Updated Figures to show board reference designators
March 23, 2010	D	Removed References section.
April 1, 2010	E	Added Differential ADC input section. Updated document format
April 27, 2010	F	Added External BDM Cable section

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 TWR-S08 board:

   a) This product as shipped from the factory with associated power supplies and cables, has been verified to meet with requirements of CE and the FCC 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 products operation from the factory default as shipped may effect its performance and cause interference with nearby electronic equipment. 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.

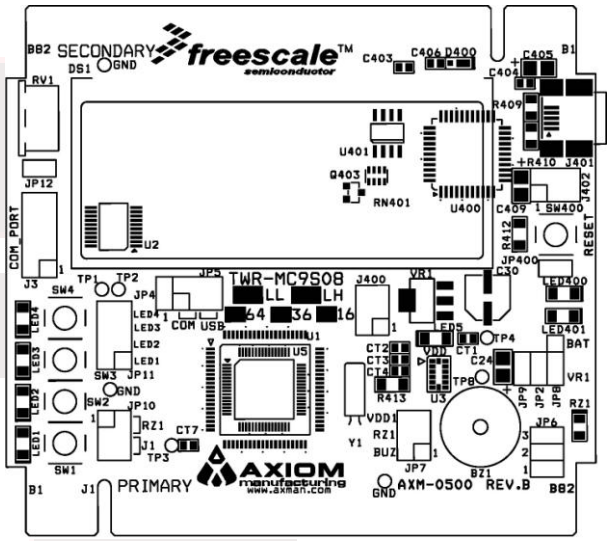
Cut-Trace – a circuit trace connection between component pads. The circuit trace may be cut using a knife to break the default connection. To reconnect the circuit, simply install a suitably sized 0-ohm resistor or attach a wire across the pads.

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

FEATURES

The TWR-S08 demonstration board is designed to accept any member of the MC9S08LL or MC9S08LH family of MCU's from Freescale. The board is designed to interface with the Freescale Tower System, a modular development platform which aids in rapid prototyping and tool-reuse. The integrated Open-Source BDM, software tools, and examples provided with the development board make application development and debug quick and easy. All MCU signals are available on one or both edge connectors.

For purposes of this document, the TWR-S08 is described without regard to the MCU installed. Exceptions will be clearly noted.



- MCU
  - MC9S08LL64/36/16
  - MC9S08LH64/36/16
    - 64K/36K/16K Bytes Flash
    - 4K Bytes RAM
    - Internal Oscillator
    - Integrated LCD Driver
    - 10 MHz Bus Frequency
- Dual Footprint for 80LQFP or 64LQFP
- MMA7361L Analog Accelerometer
- RS-232 Serial Interface w/ 2x5 pin header
- Open-Source BDM fully supported by CodeWarrior
- BDM_PORT header for external BDM cable support (not installed)
- On-board +3.3V regulator
- Battery holder for coin-cell battery (mounted on bottom)
- Optional Power from USB-BDM or Tower System through edge connectors
- Power Input Selection Jumpers
  - Power input from USB-BDM
  - Power input from on-board regulator
  - Power from battery holder, CR2325
  - Power input from Tower System edge connector
- User Components Provided
  - 4 Push Switches
  - 4 LED Indicators
  - 5K ohm POT w /LP Filter
  - Light Sensor w/ LP Filter and Op Amp
  - 2.4kHz External Drive Piezo Buzzer
- Option Jumpers to disconnect Peripherals
- Connectors
  - BDM_PORT (not installed)
  - USB Connector
  - 2x5 RS-232 Header

Specifications:
Board Size 3.55" x 3.20" overall
Power Input: +5V from USB connector or from Tower System

GETTING STARTED

To get started quickly, please refer to the TWR-S08_QSG Quick Start Guide. This quick start will illustrate connecting the board to a PC, installing the correct version of CodeWarrior Development Studio, and running a simple LCD program.

MEMORY MAP

The TWR-S08 is designed to support the complete line of MC9S08LL and MC9S08LH MCU's. Refer to the associated target MCU Reference Manual (RM) for details on the target MCU memory map.

SOFTWARE DEVELOPMENT

Software development requires the use of a compiler or an assembler supporting the HCS08 instruction set and a host PC operating a debug interface. CodeWarrior Development Studio for Microcontrollers is supplied with this board for application development and debug.

DEVELOPMENT SUPPORT

Application development and debug for the target TWR-S08 board is supported through the Open-Source Background Debug Mode (OSBDM) interface. The OSBDM is fully supported in CodeWarrior and provides direct, non-intrusive access to the target device internals. While in BDM mode, no internal resources are used. Code stepping and break-points are fully supported.

Connection between a host PC and the target device is provided via a mini-B, USB connector. The OSBDM is capable of providing power to the target board eliminating the need for external power. Please note that power supplied by the OSBDM is limited by the USB specification. When powered through the OSBDM, total current draw, including the OSBDM, TWR-S08 board, and Tower System must remain less that 500mA. Otherwise, the USB bus will cause the host PC to disconnect the board. Damage to the host PC, target board, or Tower System may result if this current limit is violated.

NOTE:

The OSBDM will not connect to the TWR-S08 board if the target MCU is in STOP mode. Wake the target device with an external event then connect to the target.

CAUTION:

When powered from the USB bus, do not exceed the 500mA maximum allowable current drain. Damage to the target board or host PC may result

OSBDM Bootloader

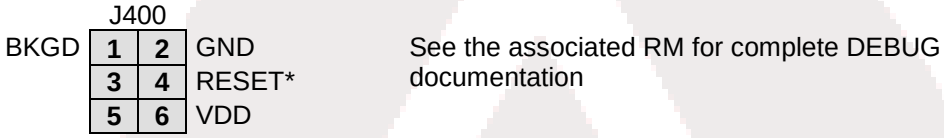
The OSBDM is pre-programmed with a bootloader application to allow field updates. The USB bootloader communicates with a GUI application running on a host PC. The GUI application enables OSBDM firmware to be updated at any. Option jumper JP400 enables the bootloader at startup. Option header JP400 is not populated in default configuration. Refer to Freescale Application Note AN3561 for details on using the GUI application and bootloader. The application note may be found at www.freescale.com or at www.axman.com/support.

BDM_PORT Header

A compatible HCS12 BDM cable can also be attached to the 6-pin BDM interface header at J400. This header is not installed in default configurations. This header is provide to allow the use of alternate programming/debug cables. Refer to the external programming/debug cable documentation for details on use.

The figure below shows the pin-out for the DEBUG header. This information is included for completeness.

Figure 1: BDM_PORT Header, J400



NOTE: This header is not installed in default configuration.

EXTERNAL BDM CABLE

The integrated BDM allows the user to simply and quickly develop and debug application code. A BDM port header location is provided for use of an external BDM cable if desired. However, this BDM port header is not populated in default configurations. Use of an external BDM cable requires the user to install 6-pin header and to remove a 0-ohm resistor. The user must also provide power to the board unless power is provided through the external BDM cable. The P&E Multilink BDM cable used most often with Freescale microprocessors does not provide power to the target board.

To use an external BDM cable, the user must install a header at location J400. A resistor at R411 must also be removed to prevent contention between the external BDM cable and the OSBDM.

To use an external BDM, the user must also apply power to the board. Power may be applied through the OSBDM or at the COM header. Simply connecting the USB cable to the USB connector will apply power to the board. The user may also apply power to the COM connector at J3. Apply +3.3VDC at J3-10 and GND at J3-9. Please note that no over-voltage or transient protection is applied at this power input.

CAUTION:

Do not apply excessive voltage at input J3-9 and J3-10. Neither over-voltage nor transient protection is applied at this input.

CAUTION:

Do not apply power to COM connector J3 while also powering the board through the OSBDM. Damage to the board may result.

The external BDM is now ready for use.

POWER

The TWR-S08 board may be powered from the OSBDM or from the Tower System. A 190mAH battery holder is applied for battery-powered operation. The USB current limit must be observed while using the USB connection from the host PC to supply power to the target board. Damage to the target board, Tower System, or host PC may otherwise occur.

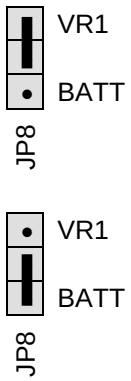
POWER SELECT

Option headers V_SEL and VDD_EN select the source of input power to the target board. When powered from the Tower System, the OSBDM voltage output is disabled.

V_SEL

The V_SEL option header allows the user to select power input either the on-board regulator or the battery holder. The on-board regulator is supplied from the OSBDM voltage output. Figure 2 below shows the PWR_SEL header settings.

Figure 2: V_SEL Option Header, JP8



Enables voltage input from on-board regulator. This option should be selected when powered from the integrated OSBDM (default)

Enables voltage input from battery holder. This option should be selected when battery-powered operation is desired

Power from the integrated BDM is drawn from the USB bus and is limited to **500 mA** total. This current limit accounts for the total current supplied over the USB cable to the BDM circuit, the target board, and any connected circuitry. Current drain in excess of 500 mA violates the USB specification and causes the USB bus to disconnect the offending device. This may cause the board to exhibit power cycling where the board appears to turn on then off continually. In this case, LED400 will flash on and off. If this condition is allowed to persist, damage to the host PC or the target board result.

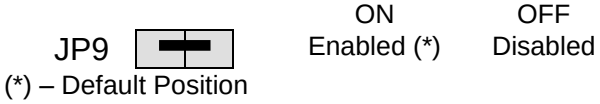
The on-board voltage regulator (VR1) creates the +3.3V rails used by the target MCU from the +5V input provided by the OSBDM.

The battery holder at BATT accepts a 3.3V, 23mm, 190mAH lithium, coin-cell battery, PN CR-2325.

VDD_EN

The VDD_EN option header enables and disables VDD to the target board peripherals. Power to the MCU is unaffected by this option jumper. Removing this option jumper, along with others, allows the user to take accurate MCU current measurements. The figure below shows the VDD_EN option jumper connections.

Figure 3: VDD_EN Option Header, JP9



RESET SWITCH

The RESET switch applies an asynchronous RESET to the MCU. The RESET switch is connected directly to the RESET* input on the MCU. Pressing the RESET switch applies a low voltage level to the RESET* input. A pull-up bias resistor allows normal MCU operation. Shunt capacitance ensures an adequate input pulse width.

LOW VOLTAGE RESET

The target MCU applies an internal Low Voltage Detect (LVD) circuit. The LVD holds the MCU in reset until applied voltage reaches an appropriate level. The LVD also protect against under-voltage conditions. Consult the target device RM for details on LVD operation.

TIMING

The TWR-S08 uses the MC9S08LL or MC9S08LH internal timing source by default. An external 32 kHz XTAL oscillator, configured for low-power operation, is also provided. Consult the target device RM for details on configuring the selected timing source.

COMMUNICATIONS

The TWR-S08 board supports serial communications through an on-board, low-voltage, RS-232 physical layer transceiver (PHY) connected to a 2x5, 0.1", pin header. The PHY supports valid RS-232 signaling for input voltage levels down to +1.8V. The COM_SEL header selects the serial path applied.

> NOTE:
>
> The COM_SEL header allows the SCI signals to be routed to the OSBDM. However, the OSBDM does not support serial communications at this time.

RS-232

An RS-232 translator provides RS-232 to TTL/CMOS logic level translation on the COM connector. The COM_PORT connector is a 2x5, 0.1", pin header. Communication signals TXD1 and RXD1 are routed from the transceiver to the MCU. Hardware flow control signals RTS and CTS are available on the logic side of the transceiver. These signals are routed to vias located near the transceiver. RTS has been biased properly to support 2-wire RS-232 communications. Figure 4 below shows the COM signal connections.

Figure 4: COM Signal Connections

MCU Signal	COM Signal
PTC1/TXD	TXD
PTC0RXD	RXD

COM Connector

A 2x5, 0.1”, pin-header provides external connections for the SCI port. Figure 5 below shows the COM_PORT pin-out.

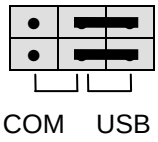
Figure 5: COM_PORT Connector, J3

2, 7	1	2	1, 7
TXD	3	4	CTS
RXD	5	6	RTS
1, 2	7	8	NC
GND	9	10	VDD_MCU

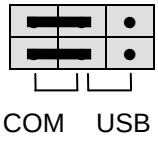
COM_SEL

The COM_SEL option header connects the MCU SCI port to either the SCI PHY or the USB-BDM connection. Figure 6below shows the settings for COM_SEL option header

Figure 6: COM_SEL Option Header, JP5



Select USB serial communications. NOTE: USB serial COM is not supported at this time



Select serial RS-232 communications (default)

LCD

The TWR-S08 applies a GD-5306P, 2x28 chip-on-glass, LCD connected directly to the target MCU. The target MCU provides the internal charge-pump and regulated LCD reference voltage required by the LCD. LCD contrast is trimmable under MCU control. Refer to the target device RM for further details on configuring using the LCD interface. The GD-5306P datasheet may be found on the Support CD included with the board. The LCD datasheet may also be found at www.axman.com/support.

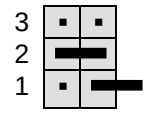
ACCELEROMETER

The TWR-S08 applies the MMA7361L, 3-axis, analog accelerometer for tilt and motion-sense applications. The accelerometer supports 2 user selectable sensitivities - 1.5g / 6g. The SLEEP* input allows the device to be placed in a low-power mode. Separate X-, Y-, and Z-axis readings are routed to the MCU. Output filtering is applied to remove fast transients.

Configuration

Accelerometer sensitivity configuration is controlled manually using option select header JP2. The SLEEP* input is configurable manually or under MCU control. Figure 7 below shows the setting to configure the accelerometer output.

Figure 7: Accelerometer Sensitivity Select, JP6



	Shunt	
	On	**Off**
3	Accel in SLEEP mode	Disabled (*)
2	Enable PTB5 control to Accel(*)	Disabled
1	Selects ±6g Sensitivity	Disabled(*)

(*) – Default position

Cut-traces on the accelerometer output signals allow the user to disconnect the accelerometer output if necessary. Once cut, simply install a 1206 sized, 0-ohm resistor to reconnect the accelerometer output. Figure 8 below shows how the accelerometer output connects to the target MCU.

Figure 8: Accelerometer Output Cut-Traces

Signal	Cut-Trace	MCU Input
X	CT2	PTA1/ADP5
Y	CT3	PTA2/ADP6
Z	CT4	PTA3/ADP7

USER I/O

User I/O includes 1 piezo buzzer, 1 Light Sensor, 4 push-button switches, 4 green LEDs, and 1 potentiometer for user I/O. Each user peripheral may be enabled or disabled using an associated option header.

VDD1 Enable

The VDD1 option jumper disconnects the BUZZER, and Light sensor from board power for low-power operation. Figure 9: below shows the option header settings for use with the VDD1_EN

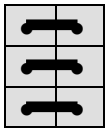
Buzzer

The TWR-S08 board provides an externally modulated piezo-buzzer for audible applications. A push-pull drive circuit allows the target MCU to easily drive the buzzer at a center frequency of 2400 Hz. Figure 9: below shows the option header settings for use with the buzzer.

Light Sensor

A surface-mount phototransistor, at RZ1, 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 U5 boosts the photocell output to useable levels. Figure 9: below shows the option header settings for use with the light sensor

Figure 9: USER1 Option Header, JP7



	Signal	ON	OFF
Buzzer	PTC2/TPM1CH0	Enabled (*)	Disabled
RZ1	PTA6/ADP6	Enabled (*)	Disabled
VDD1	VDD	Enabled (*)	Disabled

JP7

(*) – Default Position

CAUTION:

SW1 and RZ1 share a common MCU signal input. If both components are enabled at the same time, SW 1 may not function properly.

Pushbutton Switches

The TWR-S08 applies 4, normally open, push-button switches for user input. Each push-button switch is configured for active-low operation. A 22pF capacitor is applied to each push-button switch to minimize switch bounce. An external pull-up is applied to SW4 for use as and IRQ* input; however, no bias is applied to the remaining push-button inputs. Use of target MCU internal pull-ups is required for proper operation.

Figure 10 below shows the user switch connections to the target MCU. Since each push-button switch is normally-open, no option header is applied.

Figure 10: Pushbutton Switch Signal Connections

	Signal
SW1	PTA6/KBIP6
SW2	PTA7/KBIP7
SW3	PTA0/KBIP0
SW4	PTB6

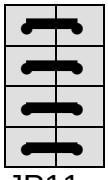
CAUTION:

SW1 and RZ1 share a common MCU signal input. If both components are enabled at the same time, SW 1 may not function properly.

User LED's

The TWR-S08 target board provides 4, green, LEDs for output indication. Each LED is configured for active-low operation. A series, current-limit resistor prevents excessive diode current. Figure 11 below shows the USER2 enable position and associated signal for each user LED.

Figure 11: USER2 Option Header, JP11



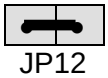
	Signal	ON	OFF
LED1	PTC2/TPM1CH0	Enabled (*)	Disabled
LED2	PTC3/TPM1CH1	Enabled (*)	Disabled
LED3	PTC4/TPM2CH0	Enabled (*)	Disabled
LED4	PTC5/TPM2CH1	Enabled (*)	Disabled

JP11
(*) – Default Position

Potentiometer

The TWR-S08 board provides a 5K ohm potentiometer (POT) to simulate analog input. The POT is decoupled to minimize noise during adjustment. Figure 12 below shows the USER enable position and associated signal for the buzzer.

Figure 12: POT Enable Option Header, JP12



Signal	ON	OFF
PTA0/ADP4	Enabled (*)	Disabled

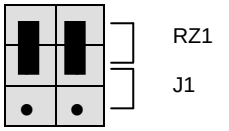
JP12
(*) – Default Position

Differential ADC Input

The TWR-S08LH64 board provides a differential ADC input to the MC9S08LH64. Option header JP10 allows the user to route the output and feedback from the Light Sensor (RZ1) to the MC9S08LH64 differential ADC input. To use this feature correctly, the user should remove the RZ1 jumper at JP7.

This option header is not populated on the TWR-S08LL version of this board. Figure 13 below shows the USER2 enable position and associated signal for each user LED.

Figure 13: Option Header, JP10



(*) – Default Position

Connects RZ1 output to MCU (default)

Connects edge connector to MCU

NOTE:

Differential input signals ADP0 & ADP0_J1 (refer to schematic) are shorted on Rev B boards.

EDGE CONNECTOR PIN-OUT

The TWR-S08 board connects to the Freescale Tower System using the 2 PCIe Edge Connectors. Note that according to the PCIe specification, the Bx signals are located on the top of the board and the Ax signals are located on bottom. Pin B1 for the primary and secondary connectors are at opposite ends of the board. The figures below show the pin-out of each edge connector.

The primary connector is located on the side opposite the LCD. Edge connector positions with no signal name are not connected.

Figure 14: Primary Edge Connector, J1

5.0V Power	Pri_B01	Pri_A01	**5.0V Power**
Ground	Pri_B02	Pri_A02	**Ground**
3.3V Power	Pri_B03	Pri_A03	**3.3V Power**
Elevator Power Sense	Pri_B04	Pri_A04	**3.3V Power**
Ground	Pri_B05	Pri_A05	**Ground**
Ground	Pri_B06	Pri_A06	**Ground**
PTB6/RxD2/SPSCK	Pri_B07	Pri_A07	PTB5/MOSI/SCL
	Pri_B08	Pri_A08	PTB4/MISO/SDA
PTB7/TXD2/SS	Pri_B09	Pri_A09	
PTB5/MOSI/SCL	Pri_B10	Pri_A10	
PTB4/MISO/SDA	Pri_B11	Pri_A11	

	Mechanical Key		
	Pri_B12	Pri_A12	
	Pri_B13	Pri_A13	
	Pri_B14	Pri_A14	
	Pri_B15	Pri_A15	
	Pri_B16	Pri_A16	
	Pri_B17	Pri_A17	
	Pri_B18	Pri_A18	
	Pri_B19	Pri_A19	
	Pri_B20	Pri_A20	
PTC6/ACMPO/BKGD/MS	Pri_B21	Pri_A21	
PTC7/IRQ/TCLK	Pri_B22	Pri_A22	
	Pri_B23	Pri_A23	
	Pri_B24	Pri_A24	
	Pri_B25	Pri_A25	
Ground	Pri_B26	Pri_A26	**Ground**
	Pri_B27	Pri_A27	PTA6/KBIP6/ADP10/ACMP+
	Pri_B28	Pri_A28	PTA7/KBIP7/ADP11/ACMP-
	Pri_B29	Pri_A29	ADP12
	Pri_B30	Pri_A30	ADP0
Ground	Pri_B31	Pri_A31	**Ground**
	Pri_B32	Pri_A32	VREFO1
PTC4/TPM1CH0	Pri_B33	Pri_A33	PTC2/TMP1CH0
PTC5/TPM2CH1	Pri_B34	Pri_A34	PTC3/TPM1CH1
	Pri_B35	Pri_A35	
3.3V Power	Pri_B36	Pri_A36	**3.3V Power**
	Pri_B37	Pri_A37	
	Pri_B38	Pri_A38	
	Pri_B39	Pri_A39	
	Pri_B40	Pri_A40	
	Pri_B41	Pri_A41	PTC0/RXD1
	Pri_B42	Pri_A42	PTC1/TXD1
	Pri_B43	Pri_A43	PTB6/RXD2/SPSCK
	Pri_B44	Pri_A44	PTB7/TXD2/SS*
	Pri_B45	Pri_A45	PTB0/EXTAL
	Pri_B46	Pri_A46	PTB1/XTAL
	Pri_B47	Pri_A47	PTB2/RESET*
	Pri_B48	Pri_A48	-
Ground	Pri_B49	Pri_A49	**Ground**
	Pri_B50	Pri_A50	-
	Pri_B51	Pri_A51	-
	Pri_B52	Pri_A52	-
	Pri_B53	Pri_A53	-
	Pri_B54	Pri_A54	
PTA1/SPSCK/KBIP1/ADP5	Pri_B55	Pri_A55	
PTA2/MISO/SDA/KBIP2/ADP6	Pri_B56	Pri_A56	
PTA3/MOSI/SDA/KBIP3/ADP7	Pri_B57	Pri_A57	
PTA4/KBIP4/ADP8/LCD43	Pri_B58	Pri_A58	
	Pri_B59	Pri_A59	
	Pri_B60	Pri_A60	

	Pri_B61	Pri_A61	
PTC7/IRQ/TCLK	Pri_B62	Pri_A62	
	Pri_B63	Pri_A63	
	Pri_B64	Pri_A64	
Ground	Pri_B65	Pri_A65	**Ground**
	Pri_B66	Pri_A66	
	Pri_B67	Pri_A67	
	Pri_B68	Pri_A68	
	Pri_B69	Pri_A69	
	Pri_B70	Pri_A70	
	Pri_B71	Pri_A71	
	Pri_B72	Pri_A72	
	Pri_B73	Pri_A73	
	Pri_B74	Pri_A74	
	Pri_B75	Pri_A75	
	Pri_B76	Pri_A76	
	Pri_B77	Pri_A77	
	Pri_B78	Pri_A78	
	Pri_B79	Pri_A79	
	Pri_B80	Pri_A80	
Ground	Pri_B81	Pri_A81	**Ground**
3.3V Power	Pri_B82	Pri_A82	**3.3V Power**

Figure 15: Secondary Edge Connector, J2

5.0V Power	Sec_B01	Sec_A01	**5.0V Power**
Ground	Sec_B02	Sec_A02	**Ground**
3.3V Power	Sec_B03	Sec_A03	**3.3V Power**
Elevator Power Sense	Sec_B04	Sec_A04	**3.3V Power**
Ground	Sec_B05	Sec_A05	**Ground**
Ground	Sec_B06	Sec_A06	**Ground**
	Sec_B07	Sec_A07	
	Sec_B08	Sec_A08	
	Sec_B09	Sec_A09	
	Sec_B10	Sec_A10	
	Sec_B11	Sec_A11	
	Mechanical Key		
	Sec_B12	Sec_A12	PTC2/TMP1CH0
	Sec_B13	Sec_A13	
	Sec_B14	Sec_A14	
	Sec_B15	Sec_A15	
PTB4/MISO/SDA	Sec_B16	Sec_A16	
PTB5/MOSI/SCL	Sec_B17	Sec_A17	PTB7/TXD2/SS*
PTB6/RXD2/SPSCK	Sec_B18	Sec_A18	PTC3/TPM1CH1
	Sec_B19	Sec_A19	
	Sec_B20	Sec_A20	
	Sec_B21	Sec_A21	
	Sec_B22	Sec_A22	
	Sec_B23	Sec_A23	

	Sec_B24	Sec_A24	
	Sec_B25	Sec_A25	
Ground	Sec_B26	Sec_A26	**Ground**
PTA4/KBIP4/ADP8/LCD43	Sec_B27	Sec_A27	
PTA5/KBIP5/ADP9/LCD42	Sec_B28	Sec_A28	
	Sec_B29	Sec_A29	
	Sec_B30	Sec_A30	
Ground	Sec_B31	Sec_A31	**Ground**
LCD41	Sec_B32	Sec_A32	PTC4/TPM1CH0
	Sec_B33	Sec_A33	
	Sec_B34	Sec_A34	
	Sec_B35	Sec_A35	
3.3V Power	Sec_B36	Sec_A36	**3.3V Power**
	Sec_B37	Sec_A37	
	Sec_B38	Sec_A38	
	Sec_B39	Sec_A39	
	Sec_B40	Sec_A40	
	Sec_B41	Sec_A41	
	Sec_B42	Sec_A42	
	Sec_B43	Sec_A43	
LCD40	Sec_B44	Sec_A44	
LCD39	Sec_B45	Sec_A45	
LCD38	Sec_B46	Sec_A46	
LCD37	Sec_B47	Sec_A47	
LCD36	Sec_B48	Sec_A48	
Ground	Sec_B49	Sec_A49	**Ground**
	Sec_B50	Sec_A50	LCD35
	Sec_B51	Sec_A51	LCD34
LCD33	Sec_B52	Sec_A52	LCD32
LCD31	Sec_B53	Sec_A53	LCD30
LCD29	Sec_B54	Sec_A54	LCD28
	Sec_B55	Sec_A55	LCD27
	Sec_B56	Sec_A56	LCD26
	Sec_B57	Sec_A57	LCD25
	Sec_B58	Sec_A58	
	Sec_B59	Sec_A59	
	Sec_B60	Sec_A60	
	Sec_B61	Sec_A61	
	Sec_B62	Sec_A62	LCD24
LCD23	Sec_B63	Sec_A63	LCD22
LCD21	Sec_B64	Sec_A64	PTE7/LCD20
Ground	Sec_B65	Sec_A65	**Ground**
PTE6/LCD19	Sec_B66	Sec_A66	PTE5/LCD18
PTE4/LCD17	Sec_B67	Sec_A67	PTE3/LCD16
	Sec_B68	Sec_A68	PTE2/LCD15
	Sec_B69	Sec_A69	PTE1/LCD14
	Sec_B70	Sec_A70	PTE0/LCD13
	Sec_B71	Sec_A71	LCD12
	Sec_B72	Sec_A72	LCD11
	Sec_B73	Sec_A73	LCD10

	Sec_B74	Sec_A74	LCD9
	Sec_B75	Sec_A75	LCD8
	Sec_B76	Sec_A76	PTD7/LCD7
	Sec_B77	Sec_A77	PTD6/LCD6
PTD5/LDC5	Sec_B78	Sec_A78	PTD4/LCD4
PTD3/LCD3	Sec_B79	Sec_A79	PTD2/LCD2
PTD1/LCD1	Sec_B80	Sec_A80	PTD0/LCD0
Ground	Sec_B81	Sec_A81	**Ground**
3.3V Power	Sec_B82	Sec_A82	**3.3V Power**