



# TWR-LCD

## User's Manual

Rev. 1.3

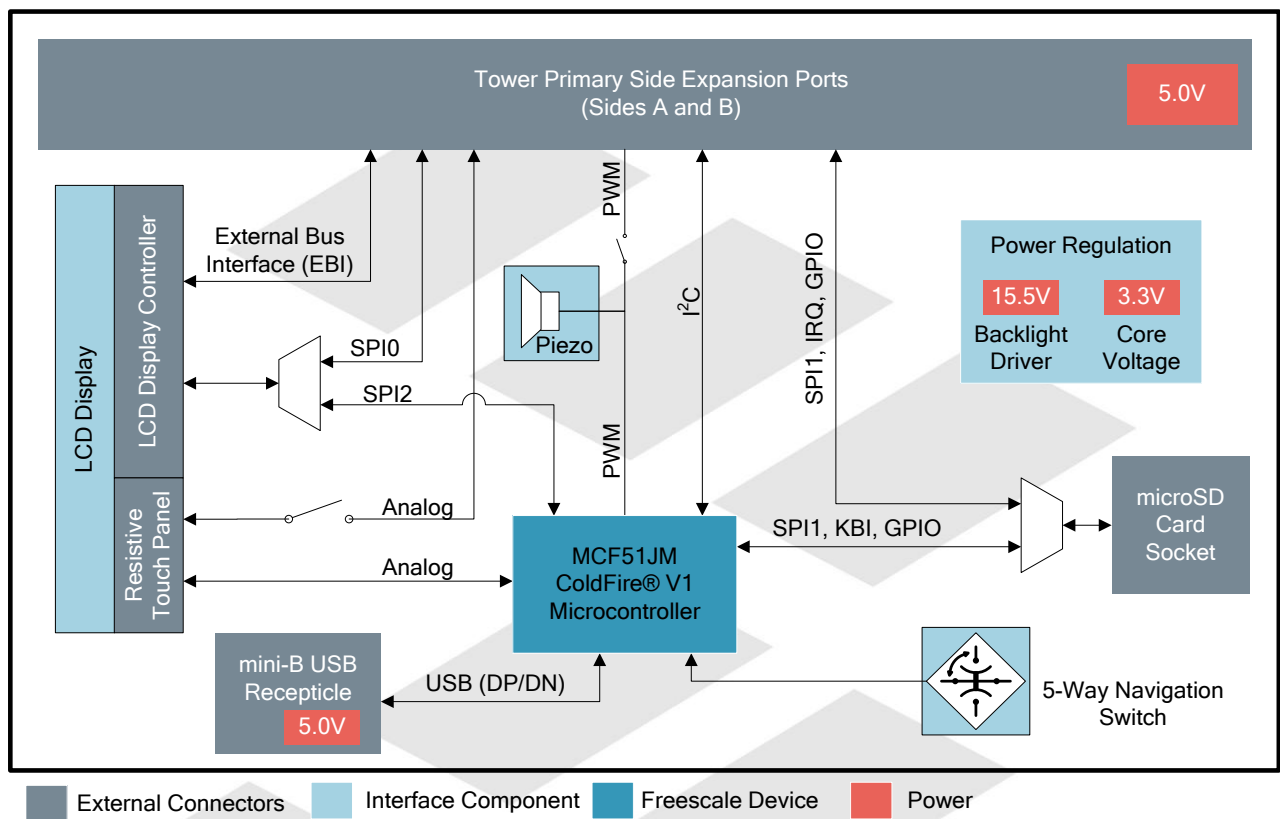
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# 1 Overview

The Tower LCD Module (TWR-LCD) adds a side mounting TFT QVGA Display to the Freescale Tower System. It can be used with a wide variety of Tower Processor Modules through a SPI and/or external bus interface (EBI).

The TWR-LCD features a 3.2" QVGA TFT LCD Display with touch sensitive overlay, 5-way navigation control, MicroSD Card slot, dedicated MCF51JM microcontroller, and a Piezo Buzzer for audible feedback. The LCD Display Controller is accessible to the dedicated MCF51JM microcontroller through the SPI. The LCD Display Controller is also accessible to any capable Tower MCU module utilizing either the SPI or the EBI. A block diagram for the TWR-LCD is shown in the figure below.



**Figure 1 - TWR-LCD Block Diagram**



Figure 2 - Tower System with TWR-LCD

## 2 Reference Documents

The documents listed below should be referenced for more information on the Freescale Tower system and the TWR-LCD. Refer to <http://www.freescale.com/tower> for the latest revision of all Tower documentation.

- *TWR-LCD Schematics*
- *TWR-LCD Quick Start Guide*
- *Truly TFT2N0451-E LCD Module Specification*

## 3 Hardware Features

This section provides more details about the features and functionality of the TWR-LCD.

### 3.1 Power Supply

The TWR-LCD can be powered as a standalone device from the Mini-B USB connector. The TWR-LCD can also be powered from a source in an assembled Tower System via the 5.0V supply on the TWR-ELEV Side Expansion Port. When attached to a Tower Elevator board, it is required that the board be externally powered from the Elevator board; additionally the USB connector on the TWR-LCD can still be used to communicate over USB to the on-board MCF51JM MCU. On-board power regulation will provide the necessary core voltage (3.3V) and backlight driver voltage (15.5V).

## 3.2 LCD Display / Controller

The TWR-LCD features a Truly Semiconductor 3.2" TFT LCD with an analog resistive touch overlay.

### 3.2.1 Communication Mode

The LCD utilizes a 240 RGB x 320 QVGA display controller. The display controller is accessible to the on-board MCF51JM MCU through SPI. The controller is also accessible to any compatible Tower MCU module through SPI or the External Bus Interface (EBI) via the primary Tower Side Expansion Ports.

Use SW1-DIP1 and DIP2 to configure the desired interface mode (SPI or EBI). Refer to Section 4 for more configuration details.

**Table 1 - LCD Communication Mode Settings**

| SW1-DIP1<br>(PS2) | SW1-DIP 2<br>(PS0) | Description  |
|-------------------|--------------------|--|
| OFF               | ON                 | Enables SPI communication mode to the LCD Display; can be driven by SPI0 on the Primary Elevator or by the on-board MCF51JM, selectable by JM/ELE (SW1-DIP3) |
| ON                | OFF                | Enables EBI (16b mode) communication to the LCD Display<br>This interface is only accessible from the Tower Elevator MCU                                     |
| ON                | ON                 | Enables EBI (8b mode) communication to the LCD Display<br>This interface is only accessible from the Tower Elevator MCU                                      |

### 3.2.2 MCU Selection

The LCD can be controlled by either the on-board MCF51JM MCU or a compatible Tower MCU Module.

Use SW1-DIP3 to specify which MCU has access to the display controller. Refer to Section 4 for more configuration details.

**Table 2 - Display Driver MCU Selection**

| JM/ELE<br>(SW1-DIP3) | ON  | Enables SPI connection from SPI0 of Primary Elevator Connector |
|----------------------|-----|--|
|                      | OFF | Enables SPI connection from on-board MCF51JM MCU               |

Setting the JM/ELE (SW1-DIP3) configuration switch to the "Off" position will isolate the SPI signals from the Tower MCU allowing a direct connection between the on-board MCF51JM MCU and the LCD display controller.

Setting the JM/ELE configuration switch to the "On" position will cause both the on-board MCF51JM MCU and Tower MCU SPI signals to be simultaneously connected to the LCD display controller. It is required that on-board MCF51JM MCU firmware detect the status of the JM/ELE signal and tri-state the on-board MCF51JM MCU SPI signals.

If utilizing a Tower MCU module to drive the SPI to the LCD display controller, use SW1-DIP5 to specify the desired SPI chip select.

**Table 3 - Tower MCU SPI CS Selection**

|                                  |     |  |
|----------------------------------|-----|--|
| <b>SPI CS SEL<br/>(SW1-DIP5)</b> | ON  | Select SPI0 CS1 as the chip-select for LCD SPI interface |
|                                  | OFF | Select SPI0 CS0 as the chip-select for LCD SPI interface |

### 3.2.3 Resistive Touch Overlay

The TWR-LCD display features an integrated analog resistive touch panel. The panel can be access by either the on-board MCF51JM MCU or a compatible Tower MCU module. The selection of which MCU interfaces the Touch Panel is independent of which MCU is driving the LCD display controller (designated by JM/ELE).

Use SW1-DIP6 to specify which MCU has access to the resistive touch panel. Refer to Section 4 for more configuration details.

**Table 4 - Resistive Touch MCU Selection**

|                              |     |  |
|------------------------------|-----|--|
| <b>TP SEL<br/>(SW1-DIP6)</b> | ON  | Disables MCF51JM connection to the LCD Touch Panel<br>Use SW5 to enable ADC connection from Primary Elevator Connector |
|                              | OFF | Enables MCF51JM connection to the LCD Touch Panel<br>Ensure that all switches on SW5 DIP are OFF                       |

Setting the TP SEL (SW1-DIP6) configuration switch to the “Off” position will indicate to the on-board MCF51JM MCU that it is the interfacing MCU to the touch panel’s analog signals.

Setting the TP SEL configuration switch to the “On” position will indicate to the on-board MCF51JM MCU that the tower MCU Module is the interfacing MCU to the touch panel’s analog signals. It is required that on-board MCF51JM MCU firmware detect the status of the To SEL signal and tri-state the respective on-board MCF51JM MCU ADC signals.

SW5 is used to isolate the touch panel’s analog signals from the Tower Elevator Side Expansion Port. This ensures correct isolation of the analog signals when the on-board MCF51JM MCU is used. SW5-DIP[4:1] should all be set to the “Off” position if the on-board MCF51JM MCU is being used to interface the resistive touch panel.

**Table 5 - Resistive Touch Analog Isolation Settings**

|           |                              |     |  |
|-----------|------------------------------|-----|--|
| SW5-DIP 1 | Touch Panel Isolation (XPLS) | ON  | Connects AN4 (TWR-ELEV) to XPLS Touch Panel Signal |
|           |                              | OFF | Disconnects AN4 from Touch Panel                   |
| SW5-DIP 2 | Touch Panel Isolation (XMNS) | ON  | Connects AN5 (TWR-ELEV) to XMNS Touch Panel Signal |
|           |                              | OFF | Disconnects AN5 from Touch Panel                   |
| SW5-DIP 3 | Touch Panel Isolation (YMNS) | ON  | Connects AN6 (TWR-ELEV) to YMNS Touch Panel Signal |
|           |                              | OFF | Disconnects AN6 from Touch Panel                   |
| SW5-DIP 4 | Touch Panel Isolation (YPLS) | ON  | Connects AN7 (TWR-ELEV) to YPLS Touch Panel Signal |
|           |                              | OFF | Disconnects AN7 from Touch Panel                   |

### 3.3 MicroSD Card

The Tower System defines a Secure Digital interface as shown in 0. The SD Card interface is multiplexed over the SPI1 signals and two GPIOs such that the host can communicate with the SD memory card in the SD Card slot using the SPI mode or the one- or four-bit SD mode.

The MicroSD Card slot is accessible to either the on-board MCF51JM MCU or a compatible Tower MCU Module. Use SW1 –DIP4 to select which MCU has access to the MicroSD Card slot. Refer to Section 4 for more configuration details.

**Table 6 - MicroSD Card Slot MCU Selection**

|                    |     |  |
|--------------------|-----|--|
| ELE uSD (SW1-DIP4) | ON  | MicroSD is connected to the SPI1 of Primary Elevator Connector |
|                    | OFF | MicroSD is connected to the on-board MCF51JM MCU               |

Setting the EuSD (SW1-DIP4) configuration switch to the “Off” position will isolate the SD signals from the Tower MCU allowing a direct connection between the on-board MCF51JM MCU and the MicroSD Card slot.

Setting the EuSD configuration switch to the “On” position will cause both the on-board MCF51JM MCU and Tower MCU SD signals to be simultaneously connected to the MicroSD Card slot. It is required that on-board MCF51JM MCU firmware detects the status of the EuSD signal and tri-state the on-board MCF51JM MCU SD signals.

**Table 7 - Tower System SD Card Interface Pinout**

| Elevator Pin # | Name                 | Group        | Description                                | I/O |
|----------------|----------------------|--------------|--|-----|
| B7             | SDHC_CLK / SPI1_CLK  | SDHC / SPI 1 | SDHC or SPI Clock                          | O   |
| B9             | SDHC_D3 / SPI1_CS0_b | SDHC / SPI 1 | SDHC Chip Select / Data or SPI Chip Select | O   |
| B10            | SDHC_CMD / SPI1_MOSI | SDHC / SPI 1 | SDHC Command or SPI Master Out / Slave In  | O   |
| B11            | SDHC_D0 / SPI1_MISO  | SDHC / SPI 1 | SDHC Data or SPI Master In / Slave Out     | I   |
| B22            | GPIO2 / SDHC_D1      | GPIO / SDHC  | General Purpose I/O or SDHC Data           | I/O |
| A10            | GPIO8 / SDHC_D2      | GPIO / SDHC  | General Purpose I/O or SDHC Data           | I/O |

The SD Card Detect signal is connected to KBI7 on the on-board MCF51JM MCU and, if configured via EuSD (SW1-DIP4), IRQ\_H on the Primary Tower Elevator. This will allow the host controller to monitor the presence of an SD memory card. To ensure that the SD Card Detect is handled properly, the MCF51JM must configure the SD Card Detect GPIO/KBI (PTG3 / KBIP7) as an internal pull-up. This is done by setting the appropriate register values for PTEPE (PTGPE3=1) for GPIO and additionally KBI1ES (KBEDG7=0) for KBI functionality. Refer to the MCF51JM128 Reference Manual, Section 9, for additional details. The SD Card Detect signal must be configured as an internal pull-up regardless of which host MCU is accessing the MicroSD Card slot.

### 3.4 5-way Navigation Switch

The TWR-LCD features a 5-way Navigation Switch. This switch will allow user interaction with the TWR-LCD providing a method to indicate Up (North), Down (South), Right (East), Left (West), and Select (Center). The corresponding directional signals are connected to the on-board MCF51JM MCU. It is intended that the on-board MCF51JM MCU firmware either respond directly to the Navigation Switch or relay the signal detection to the Tower MCU module through the I2C interface.

It is possible to connect the 5-way Navigation Switch directly to the Tower Elevator by making a hardware modification to the TWR-LCD.

The following registers should be populated to create a direct connection to the Tower Elevator: R19, R22, R23, R24, R26, R28, R29, R32, R41, R44

The registers are intentionally unpopulated in the final design to ensure maximum compatibility with additional Freescale Tower MCU and Peripheral Modules.

Populating these registers will enable the following connections:

| Navigation Direction | Tower Elevator Connection |
|----------------------|---------------------------|
| Up (North)           | GPIO7 (Pin A11)           |
| Down (South)         | GPIO8 (Pin A10)           |
| Right (East)         | GPIO5 (Pin B52)           |
| Left (West)          | GPIO1 (Pin B21)           |
| Select (Center)      | GPIO9 (Pin A9)            |

Refer to the “Optional Nav Switch Connections to Elevator” section within the TWR-LCD schematics for additional details.

### 3.5 Mini-B USB Connection

The TWR-LCD features a Mini-B USB connection on the lower right corner of the module. The USB connector is used to provide power to the TWR-LCD module when operating in stand-alone mode (not



connected to the tower system). The USB data signals are connected to the on-board MCF51JM MCU allow a connection to exist between a host device and the TWR-LCD.

In Boot Loader mode, if the USB cable is connected to a host PC, the TWR-LCD will enumerate as a Mass Storage Device. If an appropriate compiled binary (.s19) file is placed in the root directory of the enumerated storage drive, the TWR-LCD will parse the binary file and reprogram the main application running on the TWR-LCD. Refer to Section 3.6 for more details.

## 3.6 Bootloader

The TWR-LCD includes a USB bootloader that allows simple “drag and drop” reprogramming. This section will describe how to use the bootloader.

### 3.6.1 Obtaining the S19 file

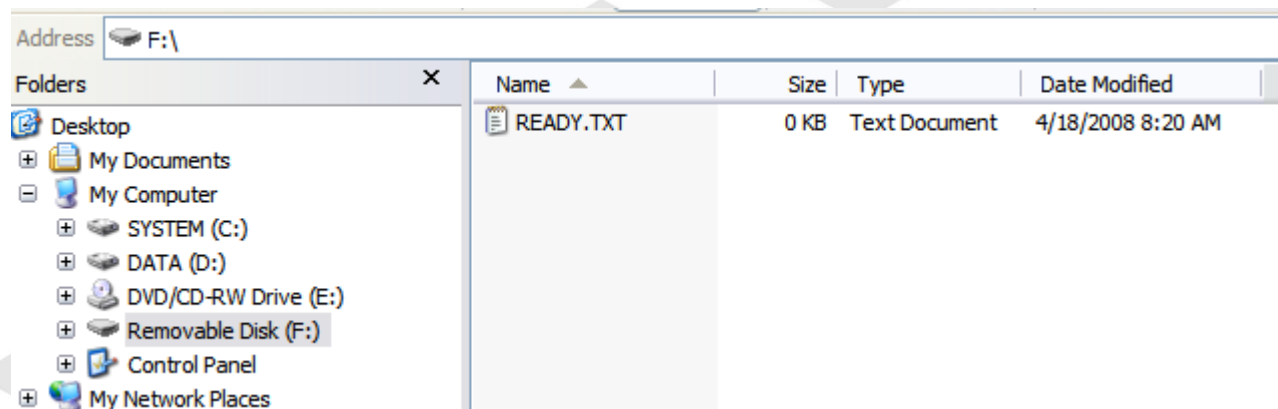
The bootloader accepts srecord or S19 files that it uses to program the board. In the example projects this file can be found in the <project directory>/bin/ folder and will end in an “.s19” file extension. This file will get overwritten every time the project is compiled.

To create an S19 file, click on the “Standard Settings...” button on your project, and look for the Linker category. Select “ColdFire Linker” and make sure that the “Generate S-Record File” option is checked. Also make sure that the “Max S-Record Length” field is set to 32.

### 3.6.2 Using the Bootloader

Connect the on-board USB connector to a Windows computer using the included mini-B to A USB cable and press reset while holding down the BTLD push button.

The badge board will then enumerate as a Mass Storage Device. Inside the newly added storage device, there will be an empty file named “READY.TXT”.



Copy and paste the S19 file into the enumerated drive. Upon successful programming, you will hear two beeps from the board and the S19 file will appear on the removable drive.

Reset or power cycle to TWR-LCD to execute the new application.

For additional information regarding using and creating the TWR-LCD Bootloader refer to the TWR-LCD Lab Guide Document.

### 3.7 Elevator Connections

The TWR-LCD features two 80-pin connectors that interface to the Side Expansion Ports on the Primary Elevator board in a Tower System. The Primary Elevator Side Expansion Port connectors, comprised of sides A and B, are utilized by the TWR-LCD. The table below provides the pinout for the Primary Elevator Connector. An “X” in the “Used” column indicated that there is a connection from the TWR-LCD to that pin on the Elevator connector. An “X” in the “Jmp” column indicates that a jumper is available that can configure or isolate the connection from the Elevator connector.

**Table 8 - TWR-LCD Primary Elevator Expansion Pinout**

| TWR-LCD Primary Connector |                      |                         |      |     |     |                   |           |      |     |
|---------------------------|----------------------|-------------------------|------|-----|-----|-------------------|-----------|------|-----|
| Pin                       | Name                 | Usage                   | Used | Jmp | Pin | Name              | Usage     | Used | Jmp |
| B1                        | 5V                   | 5V Power                | X    |     | A1  | 5V                | 5V Power  | X    |     |
| B2                        | GND                  | Ground                  | X    |     | A2  | GND               | Ground    | X    |     |
| B3                        | 3.3V                 |                         |      |     | A3  | 3.3V              |           |      |     |
| B4                        | ELE_PS_SENSE         |                         |      |     | A4  | 3.3V              |           |      |     |
| B5                        | GND                  | Ground                  | X    |     | A5  | GND               | Ground    | X    |     |
| B6                        | GND                  | Ground                  | X    |     | A6  | GND               | Ground    | X    |     |
| B7                        | SDHC_CLK / SPI1_CLK  | uSD Clock               | X    | X   | A7  | SCL0              |           | X    |     |
| B8                        | SDHC_D3 / SPI1_CS1_b |                         |      |     | A8  | SDA0              |           | X    |     |
| B9                        | SDHC_D3 / SPI1_CS0_b | uSD Chip Select / Data3 | X    | X   | A9  | GPIO9 / CTS1      |           |      |     |
| B10                       | SDHC_CMD / SPI1_MOSI | uSD MOSI / Command      | X    | X   | A10 | GPIO8 / SDHC_D2   | uSD Data2 | X    | X   |
| B11                       | SDHC_D0 / SPI1_MISO  | uSD MISO / Data0        | X    | X   | A11 | GPIO7 / SD_WP_DET |           |      |     |
| B12                       | ETH_COL              |                         |      |     | A12 | ETH_CRS           |           |      |     |
| B13                       | ETH_RXER             |                         |      |     | A13 | ETH_MDC           |           |      |     |
| B14                       | ETH_TXCLK            |                         |      |     | A14 | ETH_MDIO          |           |      |     |
| B15                       | ETH_TXEN             |                         |      |     | A15 | ETH_RXCLK         |           |      |     |
| B16                       | ETH_TXER             |                         |      |     | A16 | ETH_RXDV          |           |      |     |
| B17                       | ETH_TXD3             |                         |      |     | A17 | ETH_RXD3          |           |      |     |
| B18                       | ETH_TXD2             |                         |      |     | A18 | ETH_RXD2          |           |      |     |
| B19                       | ETH_TXD1             |                         |      |     | A19 | ETH_RXD1          |           |      |     |
| B20                       | ETH_TXD0             |                         |      |     | A20 | ETH_RXD0          |           |      |     |
| B21                       | GPIO1 / RTS1         |                         |      |     | A21 | SSI_MCLK          |           |      |     |
| B22                       | GPIO2 / SDHC_D1      | SD Data1                | X    | X   | A22 | SSI_BCLK          |           |      |     |
| B23                       | GPIO3                |                         |      |     | A23 | SSI_FS            |           |      |     |
| B24                       | CLKIN0               |                         |      |     | A24 | SSI_RXD           |           |      |     |
| B25                       | CLKOUT1              |                         |      |     | A25 | SSI_TXD           |           |      |     |
| B26                       | GND                  | Ground                  | X    |     | A26 | GND               |           |      |     |
| B27                       | AN7                  | Touch Panel YPLS        | X    | X   | A27 | AN3               |           |      |     |

| TWR-LCD Primary Connector |                     |                     |          |     |     |             |               |          |     |
|---------------------------|---------------------|---------------------|----------|-----|-----|-------------|---------------|----------|-----|
| Pin                       | Name                | Usage               | Used     | Jmp | Pin | Name        | Usage         | Used     | Jmp |
| B28                       | AN6                 | Touch Panel XMNS    | X        | X   | A28 | AN2         |               |          |     |
| B29                       | AN5                 | Touch Panel YMNS    | X        | X   | A29 | AN1         |               |          |     |
| B30                       | AN4                 | Touch Panel XPLS    | X        | X   | A30 | ANO         |               |          |     |
| B31                       | <b>GND</b>          | <b>Ground</b>       | <b>X</b> |     | A31 | <b>GND</b>  | <b>Ground</b> | <b>X</b> |     |
| B32                       | DAC1                |                     |          |     | A32 | DAC0        |               |          |     |
| B33                       | TMR3                |                     |          |     | A33 | TMR1        |               |          |     |
| B34                       | TMR2                |                     |          |     | A34 | TMR0        |               |          |     |
| B35                       | GPIO4               |                     |          |     | A35 | GPIO6       |               |          |     |
| B36                       | <b>3.3V</b>         |                     |          |     | A36 | <b>3.3V</b> |               |          |     |
| B37                       | PWM7                |                     |          |     | A37 | PWM3        |               |          |     |
| B38                       | PWM6                |                     |          |     | A38 | PWM2        |               |          |     |
| B39                       | PWM5                |                     |          |     | A39 | PWM1        |               |          |     |
| B40                       | PWM4                |                     |          |     | A40 | PWM0        | Piezo Buzzer  | X        | X   |
| B41                       | CANRX0              |                     |          |     | A41 | RXD0        |               |          |     |
| B42                       | CANTX0              |                     |          |     | A42 | TXD0        |               |          |     |
| B43                       | 1WIRE               |                     |          |     | A43 | RXD1        |               |          |     |
| B44                       | SPIO_MISO           | LCD SPI MISO        | X        | X   | A44 | TXD1        |               |          |     |
| B45                       | SPIO_MOSI           | LCD SPI MOSI        | X        | X   | A45 | Analog VDD  |               |          |     |
| B46                       | SPIO_CS0_b          | LCD SPI Chip Select | X        | X   | A46 | Analog VSS  |               |          |     |
| B47                       | SPIO_CS1_b          | LCD SPI Chip Select | X        | X   | A47 | Analog Vref |               |          |     |
| B48                       | SPIO_CLK            | LCD SPI Clock       | X        | X   | A48 | Analog Vref |               |          |     |
| B49                       | <b>GND</b>          | <b>Ground</b>       | <b>X</b> |     | A49 | <b>GND</b>  |               |          |     |
| B50                       | SCL1                |                     |          |     | A50 | GPIO14      |               |          |     |
| B51                       | SDA1                |                     |          |     | A51 | GPIO15      |               |          |     |
| B52                       | GPIO5 / SD_CARD_DET |                     |          |     | A52 | GPIO16      |               |          |     |
| B53                       | USB0_DP_PDOWN       |                     |          |     | A53 | GPIO17      |               |          |     |
| B54                       | USB0_DM_PDOWN       |                     |          |     | A54 | USB0_DM     |               |          |     |
| B55                       | IRQ_H               | SD Detect           | X        | X   | A55 | USB0_DP     |               |          |     |
| B56                       | IRQ_G               |                     |          |     | A56 | USB0_ID     |               |          |     |
| B57                       | IRQ_F               |                     |          |     | A57 | USB0_VBUS   |               |          |     |
| B58                       | IRQ_E               |                     |          |     | A58 | TMR7        |               |          |     |
| B59                       | IRQ_D               |                     |          |     | A59 | TMR6        |               |          |     |
| B60                       | IRQ_C               |                     |          |     | A60 | TMR5        |               |          |     |
| B61                       | IRQ_B               |                     |          |     | A61 | TMR4        |               |          |     |
| B62                       | IRQ_A               |                     |          |     | A62 | RSTIN_b     |               |          |     |
| B63                       | EBI_ALE / EBI_CS1_b |                     |          |     | A63 | RSTOUT_b    | Reset         | X        |     |
| B64                       | EBI_CS0_b           | LCD EBI Chip Select | X        | X   | A64 | CLKOUT0     |               |          |     |
| B65                       | <b>GND</b>          | <b>Ground</b>       | <b>X</b> |     | A65 | <b>GND</b>  | <b>Ground</b> | <b>X</b> |     |
| B66                       | EBI_AD15            | LCD EBI             | X        |     | A66 | EBI_AD14    | LCD EBI       | X        |     |
| B67                       | EBI_AD16            | LCD EBI             | X        |     | A67 | EBI_AD13    | LCD EBI       | X        |     |
| B68                       | EBI_AD17            |                     |          |     | A68 | EBI_AD12    | LCD EBI       | X        |     |
| B69                       | EBI_AD18            |                     |          |     | A69 | EBI_AD11    | LCD EBI       | X        |     |
| B70                       | EBI_AD19            |                     |          |     | A70 | EBI_AD10    | LCD EBI       | X        |     |
| B71                       | EBI_R/W_b           | LCD EBI R/W_b       | X        |     | A71 | EBI_AD9     | LCD EBI       | X        |     |
| B72                       | EBI_OE_b            |                     |          |     | A72 | EBI_AD8     | LCD EBI       | X        |     |

| TWR-LCD Primary Connector |        |       |      |     |     |         |         |      |     |
|---------------------------|--------|-------|------|-----|-----|---------|---------|------|-----|
| Pin                       | Name   | Usage | Used | Jmp | Pin | Name    | Usage   | Used | Jmp |
| B73                       | EBI_D7 |       |      |     | A73 | EBI_AD7 | LCD EBI | X    |     |
| B74                       | EBI_D6 |       |      |     | A74 | EBI_AD6 | LCD EBI | X    |     |
| B75                       | EBI_D5 |       |      |     | A75 | EBI_AD5 | LCD EBI | X    |     |
| B76                       | EBI_D4 |       |      |     | A76 | EBI_AD4 | LCD EBI | X    |     |
| B77                       | EBI_D3 |       |      |     | A77 | EBI_AD3 | LCD EBI | X    |     |
| B78                       | EBI_D2 |       |      |     | A78 | EBI_AD2 | LCD EBI | X    |     |
| B79                       | EBI_D1 |       |      |     | A79 | EBI_AD1 | LCD EBI | X    |     |
| B80                       | EBI_D0 |       |      |     | A80 | EBI_AD0 | LCD EBI | X    |     |

## 4 Jumper Table

There are several configuration switches provided for isolation, configuration, and feature selection. Refer to the following table for details. The default installed dip switch settings are shown in **\*bold\***.

**Table 9 - TWR-LCD Configuration Table**

| Configuration Settings |               | Option     | Setting   |  | Description  |
|------------------------|---------------|------------|---|--|--|
| SW1                    | DIP 1 / DIP 2 | PS2 / PS0  | DIP 1 (PS2)   | DIP 2 (PS0)  |  |
|                        |               |            | OFF   | OFF  | Not a valid setting  |
|                        |               |            | <b>*OFF*</b>  | <b>*ON*</b>  | Enables SPI communication mode to the LCD Display; can be driven by SPI0 on the Primary Elevator or by the on-board MCF51JM, selectable by JM/ELE (SW1-DIP3) |
|                        |               |            | ON  | OFF  | Enables EBI (16b mode) communication to the LCD Display<br>This interface is only accessible from the Tower Elevator MCU                                     |
|                        | ON            | ON         | Enables EBI (8b mode) communication to the LCD Display<br>This interface is only accessible from the Tower Elevator MCU |  |  |
|                        | DIP 3         | JM/ELE     | ON  | Enables SPI connection from SPI0 of Primary Elevator Connector   |  |
|                        |               |            | <b>*OFF*</b>  | Enables SPI connection from on-board MCF51JM MCU   |  |
|                        | DIP 4         | ELE uSD    | ON  | MicroSD is connected to the SPI1 of Primary Elevator Connector   |  |
|                        |               |            | <b>*OFF*</b>  | MicroSD is connected to the on-board MCF51JM MCU   |  |
|                        | DIP 5         | SPI CS SEL | ON  | Select SPI0 CS1 as the chip-select for LCD SPI interface   |  |
|                        |               |            | <b>*OFF*</b>  | Select SPI0 CS0 as the chip-select for LCD SPI interface   |  |
|                        | DIP 6         | TP SEL     | ON  | Disables MCF51JM connection to the LCD Touch Panel<br>Use SW5 to enable ADC connection from Primary Elevator Connector |  |
|                        |               |            | <b>*OFF*</b>  | Enables MCF51JM connection to the LCD Touch Panel<br>Ensure that SW5 DIP[4:1] are OFF                                  |  |
|                        | DIP 7         | LCD BL     | ON  | Enables LCD Backlight  |  |
|                        |               |            | OFF   | Disables LCD Backlight   |  |
|                        | DIP 8         | ELE PWM0   | ON  | Piezo Buzzer is controlled by PWM0 of Primary Elevator Connector and on-board MCF51JM                                  |  |
| <b>*OFF*</b>           |               |            | Piezo Buzzer is controlled by on-board MCF51JM only   |  |  |

| Configuration Settings |           | Option                       | Setting        | Description   |
|------------------------|-----------|------------------------------|----------------|---|
| SW2                    | 5-way Nav | 5-way Navigation Switch      | North (Up)     | Indicates "North" signal to onboard MCU                               |
|                        |           |                              | East (Right)   | Indicates "East" signal to onboard MCU                                |
|                        |           |                              | South (Down)   | Indicates "South" signal to onboard MCU                               |
|                        |           |                              | West (Left)    | Indicates "West" signal to onboard MCU                                |
|                        |           |                              | Center (Enter) | Indicates "Center" signal to onboard MCU                              |
| SW5                    | DIP 1     | Touch Panel Isolation (XPLS) | ON             | Connects AN4 of Primary Elevator Connector to XPLS Touch Panel Signal |
|                        |           |                              | *OFF*          | Disconnects AN4 from Touch Panel                                      |
|                        | DIP 2     | Touch Panel Isolation (XMNS) | ON             | Connects AN5 of Primary Elevator Connector to XMNS Touch Panel Signal |
|                        |           |                              | *OFF*          | Disconnects AN5 from Touch Panel                                      |
|                        | DIP 3     | Touch Panel Isolation (YMNS) | ON             | Connects AN6 of Primary Elevator Connector to YMNS Touch Panel Signal |
|                        |           |                              | *OFF*          | Disconnects AN6 from Touch Panel                                      |
|                        | DIP 4     | Touch Panel Isolation (YPLS) | ON             | Connects AN7 of Primary Elevator Connector to YPLS Touch Panel Signal |
|                        |           |                              | *OFF*          | Disconnects AN7 from Touch Panel                                      |

## 4.1 Mechanical Form Factor

The TWR-LCD is designed for the Freescale Tower System as a side mounting peripheral and complies with the electrical and mechanical specification as described in *Freescale Tower Electromechanical Specification*.



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