# TWR-LCD-RGB

## User's Manual

Rev. 1.0

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# 1 Overview

The Tower LCD RGB Module (TWR-LCD-RGB) adds a side mounting TFT WQVGA Display to the Freescale Tower System. It can be used with Tower Processor Modules featuring an RGB interfacing LCD Controller.

The TWR-LCD-RGB features a 4.3” WQVGA TFT LCD Display with touch sensitive overlay. The LCD interfaces to the Tower System through a 24-bit RGB interface. The 4-wire resistive touch overlay can interface directly with a compatible Tower Processor Module using GPIO enabled ADC lines, or can offload the resistive touch sensing to the on-board Xtrinsic Touch Sensing Platform (CRTouch).

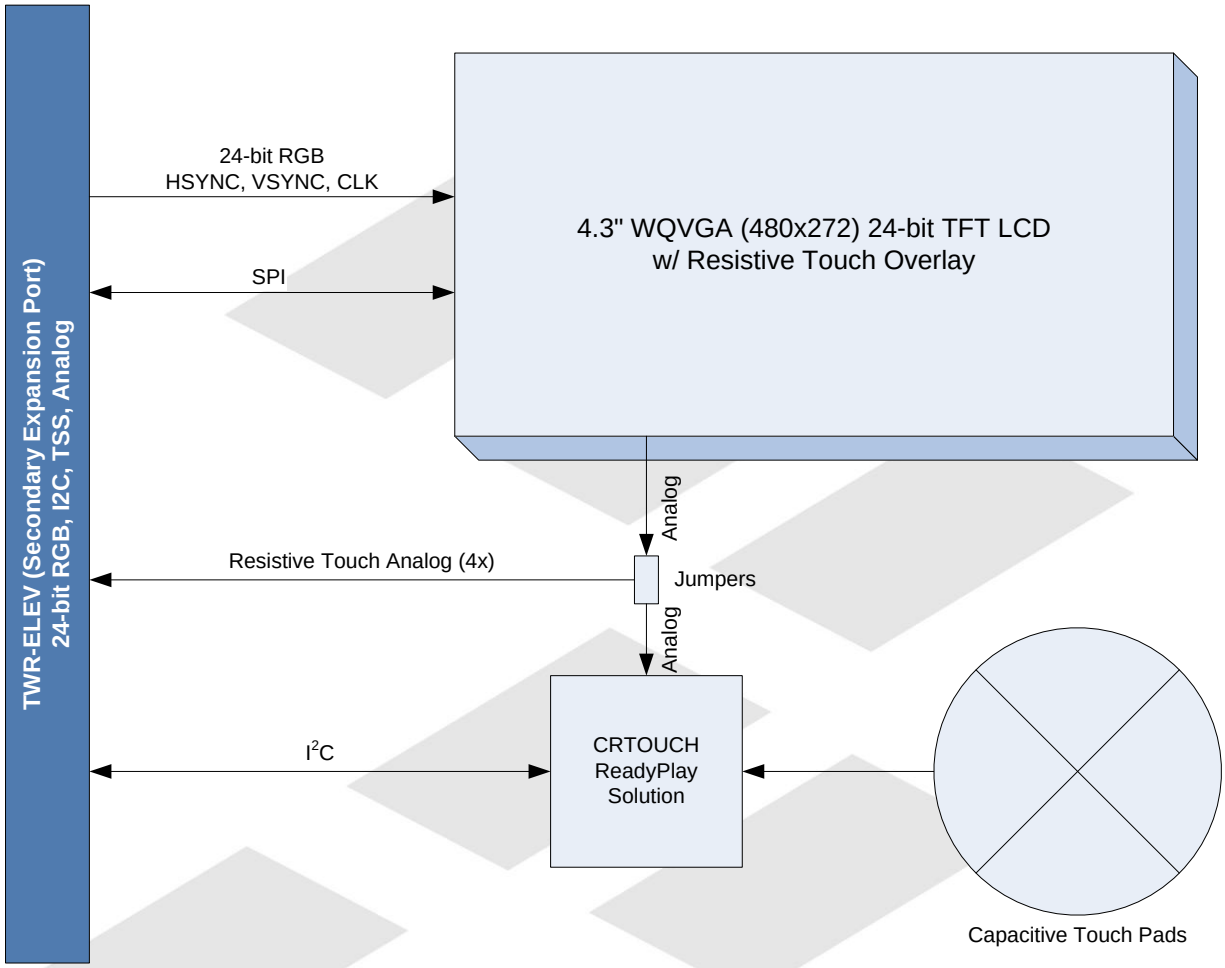


**Figure 1 - TWR-LCD-RGB Block Diagram**

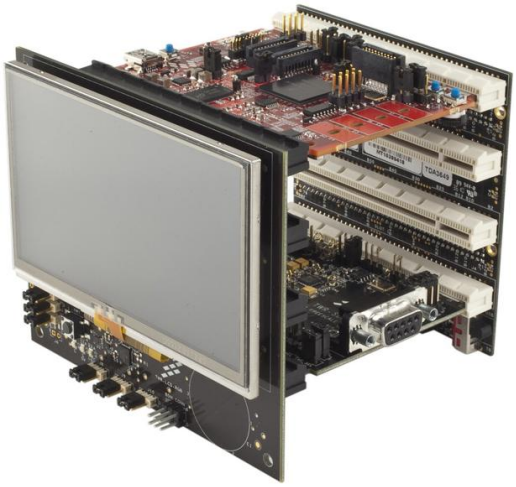

**Figure 2 - Tower System with TWR-LCD-RGB**

# 2 Reference Material

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

- *TWR-LCD-RGB Schematics*
- *TWR-LCD-RGB Quick Start Guide*
- *Example Binary Application featuring Swell Software*

For additional software applications supporting the TWR-LCD-RGB refer to:

- http://freescale.com/eGUI
- http://freescale.com/peg
- http://swellsoftware.com

# 3 Hardware Features

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

## 3.1 Tower System connection

The TWR-LCD-RGB is designed to interface with the secondary side of the Freescale Tower System. The TWR-LCD-RGB comes pre-attached to an additional TWR-SELE (Secondary Elevator). The LCD module can be detached from the included TWR-SELE, but it is recommended that the modules remain attached to avoid any damage to the LCD glass when attempting to reconnect the modules. For Tower System assemblies that require use of the TWR-LCD-RGB, use the included pre-assembled TWR-LCD-RGB + TWR-SELE.

## 3.2 Power Supply

The TWR-LCD-RGB is designed to be powered via the Tower System and does not require a direct power source. The Freescale Tower System is capable of being powered directly over USB using the TWR-ELEV, the Processor Module, or specific peripheral modules. Depending on the number of modules in the Tower System and the amount of power required for each module it may be required to use a power source that can supply more than 500mA. Up to 2A may be required depending on the Tower System configuration. This can be accomplished by either a USB wall adapter or a 5V power supply, attached to the screw terminal of the TWR-ELEV.

## 3.3 LCD Display / Driver

The TWR-LCD features an NEC color LCD module (NL4827HC19-05B), which his composed of an amorphous silicon thin film transistor liquid crystal display (a-Si TFT LCD) panel structure with driver LSIs for driving the TFT array, touch panel, and backlight. The display panel a 4.3" a-Si TFT active matrix with 16,777,216 colors, 480(H) x 272 (V) pixels, 24-bit RGB (8-bit per signal).

### 3.3.1 Timing parameters

The following "typical" timing parameters are taken from the NL4827HC19-05B specification, for complete details refer to NEC for the latest data.

**Table 1 - NEC TFT Timing Parameters**

| Parameter | Typical Value | Unit |
|---|---|---|
| Clock Frequency | 10.87 | MHz |
| HSYNC Cycle | 20.7 | kHz |
| HSYNC Display Period | 480 | CLK |
| HSYNC Front porch | 2 | CLK |
| HSYNC Pulse width | 41 | CLK |
| HSYNC Back porch | 2 | CLK |
| VSYNC Cycle | 75 | Hz |
| VSYNC Display Period | 272 | CLK |
| VSYNC Front porch | 1 | H |
| VSYNC Pulse width | 2 | H |
| VSYNC Back porch | 1 | H |

### 3.3.2 Communication Mode

The TWR-LCD-RGB is accessible through the 24-bit RGB interface defined on the Secondary Tower Elevator Pin out. The integrated 4-wire resistive touch panel is accessible via the CRTouch using the I2C interface or optionally through the ADC signals.

The signal specification required to drive the display is as follows:

**Table 2 – TWR-LCD-RGB TFT Signals**

| TWR-SELE | Description |
|---|---|
| LCD_D[23:16] | 8-bit Red data signal: LCD_D[23:16] -> R[7:0] |
| LCD_D[15:8] | 8-bit Green data signal: LCD_D[15:8] -> G[7:0] |
| LCD_D[7:0] | 8-bit Blue data signal: LCD_D[7:0] -> B[7:0] |
| LCD_HSYNC | Horizontal Sync Signal |
| LCD_VSYNC | Vertical Sync Signal |
| LCD_CLK | Clock |
| LCD_DE | Data Enable |
| GPIO22 | Backlight Enable Signal ON/OFF signal, requires jumper **J9** shunted on pins **2-3** |
| PWM15 | Backlight Dimming Control signal, requires jumper **J9** shunted on pins **1-2** |

Either GPIO22 or PWM15 must be appropriately driven.

### 3.3.3 Resistive Touch Overlay

The TWR-LCD-RGB display features an integrated analog resistive touch panel. The panel can be access by either the on-board CRTouch Xtrinsic Touch Sensing Solution or a compatible Tower MCU module. The CRTouch is the preferred interface, allowing the most compatibility within the Freescale Tower System. The CRTouch features gesture detection such as slide, two-point zoom, and two-point rotate.

The signal specification available to interface the 4-wire resistive touch overlay using the on-board CRTouch Xtrinsic Touch Sensing Solution is as follows:

**Table 3 – TWR-LCD-RGB 4-Wire Resistive Overlay Digital Signals**

| TWR-SELE | Description |
|---|---|
| SDA2 | I2C SDA signal from the CRTouch |
| SCL2 | I2C SCL signal from the CRTouch |
| IRQ_I | Optional Touch Pending Interrupt from CRTouch, Requires jumper **J10** shunted on pins **1-2** |
| IRQ_M | Optional Touch Pending Interrupt from CRTouch, Requires jumper **J10** shunted on pins **2-3** |

The signal specification available to interface the 4-wire resistive touch overlay directly from the MCU using GPIO capable ADC signals is as follows:

**Table 4 – TWR-LCD-RGB 4-Wire Resistive Overlay Analog Signals**

| TWR-SELE | Description |
|---|---|
| AN11 | X-axis right analog signal (XR) direct access to MCU ADC, requires jumper **J8** shunted on pins **2-3** |
| AN10 | Y-axis down analog signal (YD) direct access to MCU ADC, requires jumper **J5** shunted on pins **2-3** |
| AN9 | X-axis left analog signal (XL) direct access to MCU ADC, requires jumper **J3** shunted on pins **2-3** |
| AN8 | Y-axis up analog signal (YU) direct access to MCU ADC, requires jumper **J2** shunted on pins **2-3** |

## 3.4 4-way Navigation Pad

The TWR-LCD-RGB features a 4-way navigation pad implemented using capacitive electrodes. The touch enables electrodes are accessible only through the CRTouch Xtrinsic Touch Sensing Solution. Refer to the CRTouch datasheet for details in reading the capacitive electrode states.

# 4 Software Features

This section provides more details about the software specific features and enablement of the TWR-LCD-RGB.

## 4.1 Swell Software - http://swellsoftware.com

Swell Software provides Graphical User Interface (GUI) Solutions for Embedded Devices. Swell's PEG Pro, PEG+ and C/PEG product offering includes a Graphical User Interface (GUI) library for embedded development that works tightly with real-time operating systems. The development tool allows developers to layout user interface screens and controls using the PEG library and external resources to generate C/C++ code. The PEG WindowBuilder automatically generates C++ source code that is ready to be compiled and linked into any application, further accelerating the deployment of the final product.

The TWR-LCD-RGB is supported in PEG Pro and PEG+ versions of the Swell Software GUI development suite. Official support is included PEG v2.3.13 and later.

Screen drivers featuring the TWR-LCD-RGB are included for the following Tower Controller Modules:

- TWR-K70F120M
- TWR-PXD10
- TWR-PXD20
- TWR-VF65GS10

Selection of the TWR-LCD-RGB specific pre-defined Screen Driver is done using the “Screen Driver Configuration” panel within the Swell Window Builder application. The use of the CRTouch is specified using the appropriate pre-defined Touch Screen driver from the “Input/Output Configuration” panel within the Swell Window Builder application.

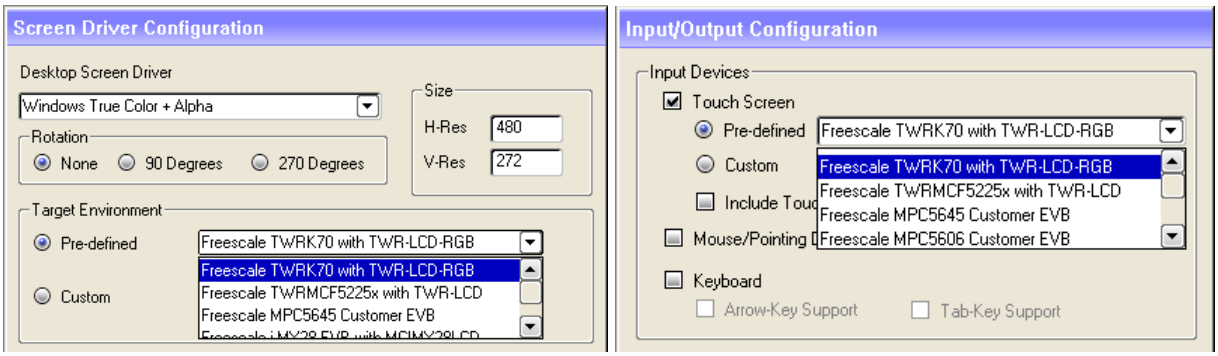


**Figure 3 - Window Builder Configuration**

Example projects are included with the installation of PEG Pro and PEG+. Additionally example pre-compiled applications are available for download at from the TWR-LCD-RGB webpage located on http://freescale.com/tower

## 4.2 eGUI Software - http://freescale.com/eGUI

The complimentary Freescale embedded graphical user interface (eGUI) allows single chip microcontroller (MCU) systems to implement a graphical user interface and drive the latest generation of color graphics LCD panels with integrated display RAM and simple serial peripheral interface (SPI) or parallel bus interface.

The TWR-LCD-RGB is officially supported in eGUI 3.0 and later releases.

Selection of a low-level driver that utilizes the TWR-LCD-RGB is done through the **d4d_user_cfg.h** header file included with the installation of eGUI.

As an reference example, below are the defines required to support the TWR-K70F120M with the TWR-LCD-RGB

```
#define D4D_LLD_LCD    d4dlcd_frame_buffer
#define D4D_LLD_LCD_HW d4dlcdhw_k70_lcdc
#define D4D_LLD_TCH    d4dtch_cr_touch
```

## 4.3 Loading Example Pre-Compiled Applications

Several example applications are posted on the TWR-LCD-RGB webpage. The section below provides details regarding loading these applications on to the Tower System.

These specific instructions detail flashing an example application on the TWR-K70F120M with the TWR-LCD-RGB.

### 4.3.1 Setup the Tower System

Install the Tower System with the following Tower System modules:

- TWR-ELEV (Primary Elevator)
- Preassembled TWR-LCD-RGB + TWR-SELE (Secondary Elevator)
- TWR-K70F120M
- TWR-SER

Attach the miniUSB connector between the TWR-K70F120M and the host PC. This will enable programming the TWR-K70F120M over the Open Source JTAG interface.

Be aware that the example projects include a large amount of graphical assets that are compiled directly into the application. This results in a fairly large flash file. Using the Open Source JTAG interface can result in approximately a 5 minute flash process.

### 4.3.2 Create a New Project for Flashing the TWR-K70F120M

#### Using CodeWarrior for MCU version 10.x

1. Open CodeWarrior for MCU v10.x
2. If required specify the desired workspace
3. Create a new project: **File -> New -> Bareboard Project**
4. Project a Project name, select **Next**
5. Select the following device: **Kinetis -> K70 Family -> K70 (120 MHz) Family -> MK70FN1M0**, select **Finish**
6. Right-click the newly created project and select **Run -> Run Configuration**
7. From the CodeWarrior Download section, select the ***<project_name>*_MK70FN1M0_INTERNAL_FLASH_PnE U-Multilink** option
8. From the C/C++ application section, select the **Browse** option associates with the **Application** field
9. Navigate to the location of the downloaded **.out** file and select **Open**
10. Select **Run**

### Using IAR Embedded Workbench

1. Open IAR Embedded Workbench for ARM 6.40
2. Create a new workspace: **File -> New -> Workspace**
3. Create a new project within blank workspace: **Project -> Create New Workspace**
4. Tool chain: **ARM**, Project Template: **Externally built executable**
5. Save the resulting project (.ewp) to a desired location
6. Right-click the project and select **Options**
   - General Options: Under Processor variant select **Device** and choose **Freescale -> K70 -> Freescale MK70FN1M0xxx12**
   - Debugger: Under the Setup tab, Select the **PE Micro** Driver
   - Debugger: Under the Download tab, check the **Use flash loader(s)** option.
7. Add the **.out** file to the project: **Project -> Add Files**, navigate to the location of the **.out** file and select **Open** (make sure the File Filter is set to **All Files (*.*)**
8. Save the resulting workspace (.eww) to a desired location using **File -> Save Workspace As**
9. Flash the project using **Project -> Download and Debug**
10. Run the resulting application using **Debug -> Go**

# 5 Elevator Connections

The TWR-LCD features two 80-pin connectors that interface to the Side Expansion Ports on the Secondary Elevator board in a Tower System. The Secondary Elevator Side Expansion Port connectors, comprised of sides C and D, are utilized by the TWR-LCD-RGB. The table below provides the pinout for the Secondary Elevator Connector. An "X" in the "Used" column indicated that there is a connection from the TWR-LCD-RGB 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 5 - TWR-LCD-RGB Secondary Elevator Expansion Pinout**

| TWR-LCD-RGB Secondary Connector | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Pin | Name | Usage | Used | Jmp | Pin | Name | Usage | Used | Jmp |
| D1 | **5V** | **5.0V Power** | **X** | | C1 | **5V** | **5.0V Power** | **X** | |
| D2 | **GND** | **Ground** | **X** | | C2 | **GND** | **Ground** | **X** | |
| D3 | **3.3V** | **3.3V Power** | **X** | | C3 | **3.3V** | **3.3V Power** | **X** | |
| D4 | ELE_PS_SENSE | Elevator Power Sense | | | C4 | **3.3V** | **3.3V Power** | **X** | |
| D5 | **GND** | **Ground** | **X** | | C5 | **GND** | **Ground** | **X** | |
| D6 | **GND** | **Ground** | **X** | | C6 | **GND** | **Ground** | **X** | |
| D7 | SPI2_CLK | | | | C7 | SCL2 | CRTOUCH SCL | **X** | |
| D8 | SPI2_CS1_b | | | | C8 | SDA2 | CRTOUCH SDA | **X** | |
| D9 | SPI2_CS0_b | | | | C9 | GPIO25 | RESET_IN_B | **X** | **X** |
| D10 | SPI2_MOSI | | | | C10 | ULPI_STOP | | | |
| D11 | SPI2_MISO | | | | C11 | C11 | | | |
| | | | | | | | | | |
| D12 | ETH_COL | | | | C12 | GPIO26 | | | |
| D13 | ETH_RXER | | | | C13 | ETH_MDC | | | |

| TWR-LCD-RGB Secondary Connector | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Pin | Name | Usage | Used | Jmp | Pin | Name | Usage | Used | Jmp |
| D14 | ETH_TXCLK | | | | C14 | ETH_MDIO | | | |
| D15 | ETH_TXEN | | | | C15 | ETH_RXCLK | | | |
| D16 | GPIO18 | | | | C16 | ETH_RXDV | | | |
| D17 | GPIO19 / SDHC_D4 | | | | C17 | GPIO27 / SDHC_D6 | | | |
| D18 | GPIO20 / SDHC_D5 | | | | C18 | GPIO28 / SDHC_D7 | | | |
| D19 | ETH_TXD1 | | | | C19 | ETH_RXD1 | | | |
| D20 | ETH_TXD0 | | | | C20 | ETH_RXD0 | | | |
| D21 | ULPI_NEXT / USB1_DM | | | | C21 | ULPI_DATA0 / USB3_DM | | | |
| D22 | ULPI_DIR / USB1_DP | | | | C22 | ULPI_DATA1 / USB3_DP | | | |
| D23 | UPLI_DATA5 / USB2_DM | | | | C23 | ULPI_DATA2 / USB4_DM | | | |
| D24 | ULPI_DATA6 / USB2_DP | | | | C24 | ULPI_DATA3 / USB4_DP | | | |
| D25 | ULPI_DATA7 | | | | C25 | ULPI_DATA4 | | | |
| D26 | **GND** | **Ground** | **X** | | C26 | **GND** | **Ground** | **X** | |
| D27 | LCD_HSYNC / LCD_P24 | RGB_Hsync | **X** | | C27 | AN11 | Resistive Touch XR | **X** | **X** |
| D28 | LCD_VSYNC / LCD_P25 | RGB_Vsync | **X** | | C28 | AN10 | Resistive Touch YD | **X** | **X** |
| D29 | AN13 | | | | C29 | AN9 | Resistive Touch XL | **X** | **X** |
| D30 | AN12 | | | | C30 | AN8 | Resistive Touch YU | **X** | **X** |
| D31 | **GND** | **Ground** | **X** | | C31 | **GND** | **Ground** | **X** | |
| D32 | LCD_CLK / LCD_P26 | RGB_CLK | **X** | | C32 | GPIO29 | | | |
| D33 | TMR11 | | | | C33 | TMR9 | | | |
| D34 | TMR10 | | | | C34 | TMR8 | | | |
| D35 | GPIO21 | | | | C35 | GPIO30 | | | |
| D36 | **3.3V** | **3.3V Power** | **X** | | C36 | **3.3V** | **3.3V Power** | **X** | |
| D37 | PWM15 | LED_PWM | **X** | **X** | C37 | PWM11 | | | |
| D38 | PWM14 | | | | C38 | PWM10 | | | |
| D39 | PWM13 | | | | C39 | PWM9 | | | |
| D40 | PWM12 | | | | C40 | PWM8 | | | |
| D41 | CANRX1 | | | | C41 | RXD2 / TSI0 | | | |
| D42 | CANTX1 | | | | C42 | TXD2 / TSI1 | | | |
| D43 | GPIO22 / Backlight | LCD_ENABLE | **X** | **X** | C43 | RTS2 / TSI2 | | | |
| D44 | LCD_OE / LCD_P27 | RGB_DE | **X** | | C44 | CTS2 / TSI3 | | | |
| D45 | LCD_D0 / LCD_P0 | BLUE Data Signal B0 (LSB) | **X** | | C45 | RXD3 / TSI4 | | | |
| D46 | LCD_D1 / LCD_P1 | BLUE Data Signal B1 | **X** | | C46 | TXD3 / TSI5 | | | |
| D47 | LCD_D2 / LCD_P2 | BLUE Data Signal B2 | **X** | | C47 | RTS3 / TSI6 | | | |
| D48 | LCD_D3 / LCD_P3 | BLUE Data Signal B3 | **X** | | C48 | CTS3 / TSI7 | | | |
| D49 | **GND** | **Ground** | **X** | | C49 | **GND** | **Ground** | **X** | |
| D50 | GPIO23 | | | | C50 | LCD_D4 / LCD_P4 | BLUE Data Signal B4 | **X** | |
| D51 | GPIO24 | | | | C51 | LCD_D5 / LCD_P5 | BLUE Data Signal B5 | **X** | |
| D52 | LCD_D12 / LCD_P12 | GREEN Data Signal G4 | **X** | | C52 | LCD_D6 / LCD_P6 | BLUE Data Signal B6 | **X** | |
| D53 | LCD_D13 / LCD_P13 | GREEN Data Signal G5 | **X** | | C53 | LCD_D7 / LCD_P7 | BLUE Data Signal B7 (MSB) | **X** | |
| D54 | LCD_D14 / LCD_P14 | GREEN Data Signal G6 | **X** | | C54 | LCD_D8 / LCD_P8 | GREEN Data Signal G0 (LSB) | **X** | |

| TWR-LCD-RGB Secondary Connector | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Pin | Name | Usage | Used | Jmp | Pin | Name | Usage | Used | Jmp |
| D55 | IRQ_P / SPI2_CS2_b | | | | C55 | LCD_D9 / LCD_P9 | GREEN Data Signal G1 | X | |
| D56 | IRQ_O / SPI2_CS3_b | | | | C56 | LCD_D10 / LCD_P10 | GREEN Data Signal G2 | X | |
| D57 | IRQ_N | | | | C57 | LCD_D11 / LCD_P11 | GREEN Data Signal G3 | X | |
| D58 | IRQ_M | | | | C58 | TMR16 | | | |
| D59 | IRQ_L | | | | C59 | TMR15 | | | |
| D60 | IRQ_K | IRQ_B | X | X | C60 | TMR14 | | | |
| D61 | IRQ_J | | | | C61 | TMR13 | | | |
| D62 | IRQ_I | IRQ_A | X | X | C62 | LCD_D15 / LCD_P15 | GREEN Data Signal G7 (MSB) | X | |
| D63 | LCD_D18 / LCD_P18 | RED Data Signal R2 | X | | C63 | LCD_D16 / LCD_P16 | RED Data Signal R0 (LSB) | X | |
| D64 | LCD_D19 / LCD_P19 | RED Data Signal R3 | X | | C64 | LCD_D17 / LCD_P17 | RED Data Signal R1 | X | |
| D65 | **GND** | **Ground** | X | | C65 | **GND** | **Ground** | X | |
| D66 | EBI_AD20 / LCD_P42 | | | | C66 | EBI_BE_32_24_b / LCD_P28 | | | |
| D67 | EBI_AD21 / LCD_P43 | | | | C67 | EBI_BE_23_16_b / LCD_P29 | | | |
| D68 | EBI_AD22 / LCD_P44 | | | | C68 | EBI_BE_15_8_b / LCD_P30 | | | |
| D69 | EBI_AD23 / LCD_P45 | | | | C69 | EBI_BE_7_0_b / LCD_P31 | | | |
| D70 | EBI_AD24 / LCD_P46 | | | | C70 | EBI_TSIZE0 / LCD_P32 | | | |
| D71 | EBI_AD25 / LCD_P47 | | | | C71 | EBI_TSIZE1 / LCD_P33 | | | |
| D72 | EBI_AD26 / LCD_P48 | | | | C72 | EBI_TS_b / LCD_P34 | | | |
| D73 | EBI_AD27 / LCD_P49 | | | | C73 | EBI_TBST_b / LCD_P35 | | | |
| D74 | EBI_AD28 / LCD_P50 | | | | C74 | EBI_TA_b / LCD_P36 | | | |
| D75 | EBI_AD29 / LCD_P51 | | | | C75 | EBI_CS4_b / LCD_P37 | | | |
| D76 | EBI_AD30 / LCD_P52 | | | | C76 | EBI_CS3_b / LCD_P38 | | | |
| D77 | EBI_AD31 / LCD_P53 | | | | C77 | EBI_CS2_b / LCD_P39 | | | |
| D78 | LCD_D20 / LCD_P20 | RED Data Signal R4 | X | | C78 | EBI_CS1_b / LCD_P40 | | | |
| D79 | LCD_D21 / LCD_P21 | RED Data Signal R5 | X | | C79 | GPIO31 / LCD_P41 | | | |
| D80 | LCD_D22 / LCD_P22 | RED Data Signal R6 | X | | C80 | LCD_D23 / LCD_P23 | RED Data Signal R7 (MSB) | X | |

# 6 Jumper Table

The following 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 6 - TWR-LCD-RGB Configuration Table**

| Jumper | Option | Setting | Description |
|---|---|---|---|
| J2 | Y+ Selection | **1-2** | Use the onboard CRTouch |
| | | 2-3 | Routes the Y+ signal to the AN8 (ELEV C30) |
| J3 | X- Selection | **1-2** | Use the onboard CRTouch |
| | | 2-3 | Routes the X- signal to the AN9 (ELEV C29) |
| J5 | Y- Selection | **1-2** | Use the onboard CRTouch |
| | | 2-3 | Routes the Y- signal to the AN10 (ELEV C28) |
| J8 | X+ Selection | **1-2** | Use the onboard CRTouch |
| | | 2-3 | Routes the X+ signal to the AN11 (ELEV C27) |
| J9 | LED DIM Control | **1-2** | Uses PWM15 (ELEV D37) to control the LED brightness |
| | | 2-3 | Uses GPIO22 (ELEV D43) to control the LED on/off state |
| J10 | IRQ Selection | **1-2** | CRTouch IRQ is connected to IRQ_I (ELEV D62) |
| | | 2-3 | CRTouch IRQ is connected to IRQ_K (ELEV D64) |

## 6.1 Mechanical Form Factor

The TWR-LCD-RGB 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*. The TWR-LCD-RGB is intended for use on the secondary side only and come pre-assembled to the TWR-SELE.

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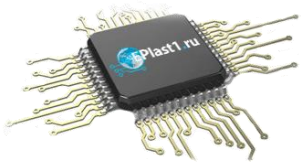
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.




**Как с нами связаться**

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