



# TWR-MCF5225X

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User Manual

Rev. 1.0

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## Revision History

Revision	Date	Changes
1.0	Sept 23, 2009	Initial Release

# 1 Overview

The MCF5225X Tower MCU Module (TWR-MCF5225X) is a low-cost evaluation, demonstration and development board. The TWR-MCF5225X can operate stand-alone or as the main control board in a Tower System with peripheral modules.

The following list summarizes the features of the TWR-MCF5225X:

- Tower compatible microcontroller module
- MCF52259 in an 144 LQFP package
- MC9S08JM60 based Open Source Debug (OSBDM) circuit
- 4 user controlled LEDs
- Four DIP Switches and two push buttons for user input
- Potentiometer
- MMA7260 three-axis accelerometer
- RS232 transceiver and 2x5 pin header
- Expansion via Primary Elevator connector

A block diagram for the TWR-MCF5225X is shown in the figure below.

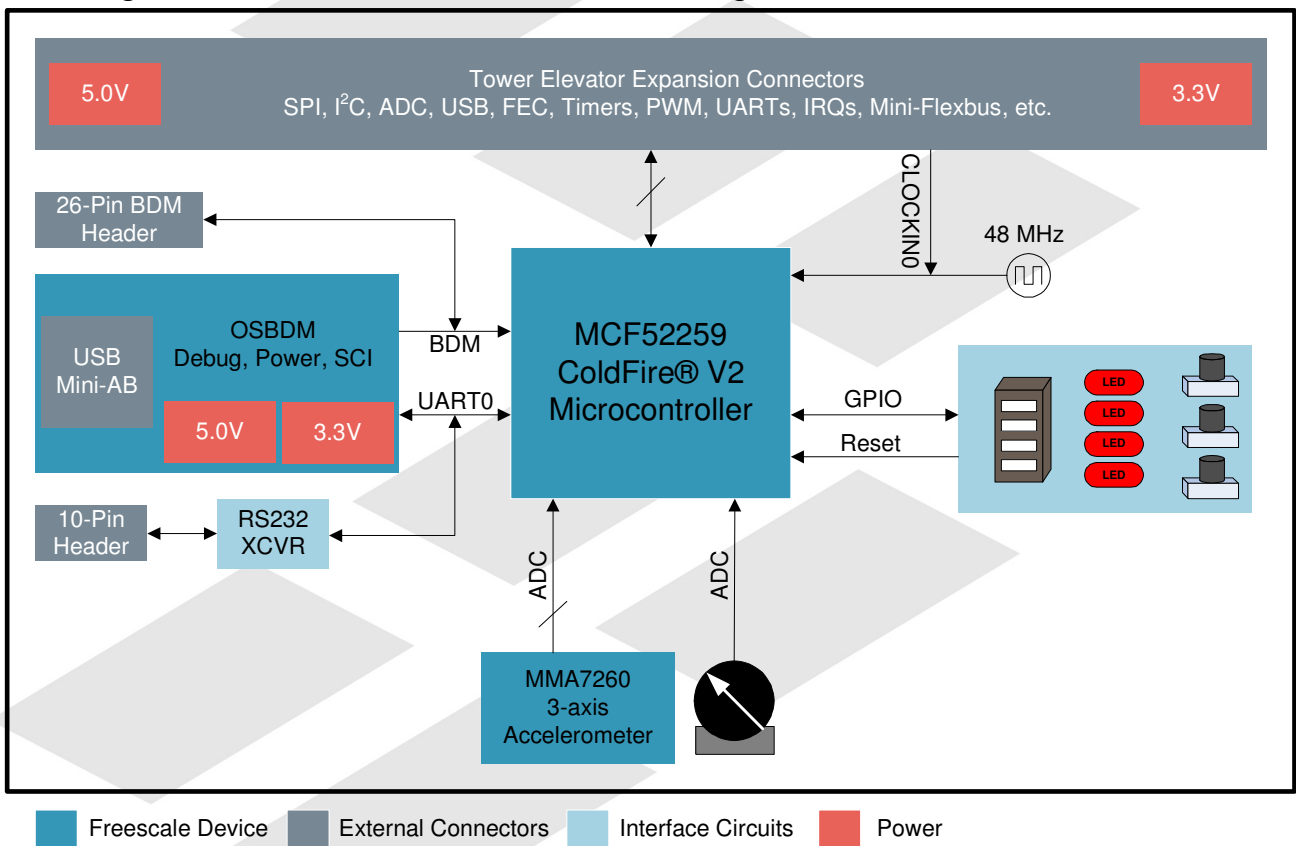


Figure 1. TWR-MCF5225X Block Diagram

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## 2 Reference Documents

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The documents listed below should be referenced for more information on the Freescale Tower system and the TWR-MCF5225X. Refer to <http://www.freesale.com/tower> for the latest revision of all Tower documentation.

- *TWR-MCF5225X Schematics*
- *TWR-MCF5225X Quick Start Guide*
- *TWR-MCF5225X-KIT Lab Tutorial*
- *MCF52259 Reference Manual*
- *MCF52259 Data Sheet*
- *AN3561, USB Bootloader for the MC9S08JM60*

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## 3 Hardware Features

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This section provides more details about the features and functionality of the TWR-MCF5225X.

### 3.1 Clocking

Two options are provided for clocking the MCF5225X device:

1. 48 MHz crystal
2. External clock input from Primary Elevator (CLOCKIN0)

Selection of the clock input is determined by the J5 jumper setting. The 48 MHz crystal option is selected by default. Refer to Table 1 for more details.

### 3.2 System Power

The TWR-MCF5225X can be powered by the OSBDM circuit via the Mini-B USB connector, J17, or from a source in an assembled Tower System. A standard USB A male to Mini-B male cable (provided) can be used to supply power from a USB Host or powered USB Hub. Optionally, an AC to DC adapter with a USB A female receptacle (not provided) can be used as the power source.

Power will automatically be sourced from the Elevator connector if power is available on both the Elevator and the OSBDM.

A jumper, J4, can be used to isolate the 3.3V supply from the microcontroller. This connection can be used to measure the power usage of the MCF5225X microcontroller.

### 3.3 Debug Interface

An on-board, MC9S08JM60 based Open Source BDM (OSBDM) circuit provides a debug interface to the MCF5225X. A standard USB A male to Mini-B male cable (provided) can be used for debugging via the USB connector, J17. Refer to Section 6 for information on other modes of operation of the OSBDM.

### 3.4 RS232 Interface

An RS232 transceiver on the TWR-MCF5225X connects to a standard 2x5 pin header (refer to Figure 2). Selection jumpers J12 and J13 allow UART0 signals to be routed to either the RS232 transceiver or the OSBDM circuit. Refer to Table 1 for more details.

MCF5225X Signal	Pin		MCF5225X Signal
No Connect	1	2	No Connect
TXD	3	4	CTS
RXD	5	6	RTS
No Connect	7	8	No Connect
GND	9	10	3.3V

Figure 2. RS232 2x5 Pin Header Connections

### 3.5 Elevator Connections

The TWR-MCF5225X features two expansion card-edge connectors that interface to Elevator boards in a Tower system: the Primary and Secondary Elevator connectors. The Primary Elevator connector, comprised of sides A and B, is utilized by the TWR-MCF5225X, while the Secondary Elevator connector only makes connections to ground (GND).

### 3.6 Mechanical Form Factor

The TWR-MCF5225X is designed for the Freescale Tower System and complies with the electrical and mechanical specification as described in *Freescale Tower Electromechanical Specification*.

## 4 Jumper Table

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

Table 1. TWR-MCF5225X Jumper Table

Jumper	Option	Setting	Description
J3	Default Clock Mode Selection (CLKMOD1)	<b>1-2</b>	Disable PLL at startup
		2-3	Enable PLL at startup
J4	MCU Power Connection	<b>ON</b>	Supply 3.3V to MCU
		<b>OFF</b>	Isolate MCU from Power (connect an ammeter to measure current)
J5	Clock Input Source Selection	<b>1-2</b>	Connect EXTAL to the on-board Crystal
		2-3	Connect EXTAL to the CLKIN0 signal on the Elevator Connector
J6	Default Clock Mode Selection	<b>1-2</b>	Do not use Crystal Oscillator at startup

	(CLKMOD0)	2-3	Use Crystal Oscillator at startup
J7	Peripheral Selection	1-2	Connect AN3 to Potentiometer
		3-4	Connect TIN3/TOUT3/PWM6 to LED4
		5-6	Connect TIN2/TOUT2/PWM4 to LED3
		7-8	Connect TIN1/TOUT1/PWM2 to LED2
		9-10	Connect TIN0/TOUT0/PWM0 to LED1
		11-12	Connect AN2 to Accelerometer Z-access
		13-14	Connect AN1 to Accelerometer Y-access
		15-16	Connect AN0 to Accelerometer X-access
J10	Default Clock Mode Selection (XTAL)	1-2	Bypass Crystal Oscillator at startup (if CLKMOD0 = 0)
		2-3	Enable Internal Relaxation Oscillator at startup (if CLKMOD0 = 0)
		OFF	Use Crystal Oscillator at startup
J11	UART Hardware Flow Control Connections	1-2	Connect CTS0 to the RS232 transceiver for flow control
		3-4	Connect RTS0 to the RS232 transceiver for flow control
J12	UART TXD0 Routing Selection	1-2	Connect TXD0 to the RS232 transceiver
		2-3	Connect TXD0 to the OSBDM debugger interface circuit
J13	UART RXD0 Routing Selection	1-2	Connect RXD0 to the RS232 transceiver
		2-3	Connect RXD0 to the OSBDM debugger interface circuit
J14	BDM / JTAG Enable Selection	1-2	BDM mode
		2-3	JTAG mode
J15	TCLK/PSTCLK Routing Selection	1-2	Connect TCLK/PSTCLK to PSTCLK for BDM mode
		2-3	Connect TCLK/PSTCLK to TCLK for JTAG mode
J16	TCLK/PSTCLK/CLKOUT Routing Selection	1-2	Connect TCLK/PSTCLK/CLKOUT to TCLK/PSTCLK for BDM/JTAG mode
		2-3	Connect TCLK/PSTCLK/CLKOUT to CLKOUT0 on the Elevator Connector
J20	OSBDM Bootloader Selection	ON	OSBDM bootloader mode (OSBDM firmware reprogramming)
		OFF	Debugger Mode
J21	RESET Select	ON	Suspend MCU in Reset state (hold RSTIN low)
		OFF	Release RSTIN so it can be controlled by SW4 to initiate reset sequences

## 5 Input/Output Connectors and Pin Usage Table

The following tables provides details on which MCF5225X pins are using to communicate with the TWR-MCF5225X sensors, LEDs, switches, and other I/O interfaces.

**Table 2.** I/O Connectors and Pin Usage Table

TWR-MCF5225X		MCF5225X			
I/O Component	I/O Label	Default	Alt 1	Alt 2	Alt 3
Dip Switch	SW2-1	DDATA0	—	—	GPIO
	SW2-2	DDATA1	—	—	GPIO
	SW2-3	DDATA2	—	—	GPIO
	SW2-4	DDATA3	—	—	GPIO
Push Button	SW1	GPT0	—	PWM1	PTA0
	SW3	GPT1	—	PWM3	PTA1
	SW4	RSTI	—	—	—
LED	LED1	DTIN0	DTOUT0	PWM0	PTC0
	LED2	DTIN1	DTOUT1	PWM2	PTC1
	LED3	DTIN2	DTOUT2	PWM4	PTC2
	LED4	DTIN3	DTOUT3	PWM6	PTC3
Accelerometer MMA7260QT	X_OUT	AN0	—	—	PAN0
	Y_OUT	AN1	—	—	PAN1
	Z_OUT	AN2	—	—	PAN2
Potentiometer	POT	AN3	—	—	PAN3
RS232 ICL3232	232_RXD	URXD0	—	—	PUA1
	232_TXD	UTXD0	—	—	PUA0
	CTS	UCTS0	—	USB_VBUSE	PUA3
	RTS	URTS0	—	USB_VBUSD	PUA2
OSBDM USB↔Serial	T_RXD1	URXD0	—	—	PUA1
	T_TXD1	UTXD0	—	—	PUA0

**Note:**

Refer to Chapter 15, General Purpose I/O Module, in *MCF5225X Reference Manual* to configure pin to appropriate alternate function.

## 6 OSBDM

An on-board, MC9S08JM60 based Open Source BDM (OSBDM) circuit provides a debug interface to the MCF5225X. The MC9S08JM60 is a USB-enabled microcontroller with an 8-bit HC9S08 core. The OSBDM circuit provides a USB-to-debug interface that allows run-control and debugging of the MCF5225X target device. The USB drivers required to communicate with the OSBDM are provided in development tools such as Freescale CodeWarrior. This single USB connection can also be used to power the TWR-MCF5225X stand-alone or in a fully assembled Tower System.

### 6.1 Bootloader Mode

The MC9S08JM60 device used in the OSBDM circuit is preprogrammed with OSBDM debugger firmware and a USB Bootloader. The bootloader mode can be used to update the OSBDM debugger firmware if an update becomes available. Jumper J20 determines which application will run following a power-on reset. If Bootloader Mode is chosen (jumper shunt on J20), the bootloader will be executed,

allowing in-circuit reprogramming of the JM60 flash memory via USB. Refer to [Application Note AN3561](#) on the Freescale website (<http://www.freescale.com>) for details on the USB Bootloader.

The USB Bootloader communicates with a GUI application running on a host PC. The GUI application can be found on the [Freescale website](#); search keyword “JM60 GUI”. Refer to section 2.5 and 3.3 of AN3561 for details on installing and running the application.

**Note:**

The JM60 GUI Installer should be run before connecting the OSBDM in Bootloader Mode to a host USB port. Otherwise, the JM60 USB device will not be recognized and the proper drivers will not be loaded.





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