



TWR-MCF51CN

User Manual

Rev. 1.1

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Revision History

Revision	Date	Changes
1.0	May 15, 2009	Initial Release
1.1	July 8, 2009	Added I/O Connector & Pin Usage table; added OSBDM section

1 Overview

The MCF51CN Tower MCU Module (TWR-MCF51CN) is a low-cost evaluation, demonstration and development board. The TWR-MCF51CN 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-MCF51CN:

- Tower compatible microcontroller module
- MCF51CN128 in an 80 LQFP package
- MC9S08JM60 based Open Source Debug (OSBDM) circuit
- 4 user controlled LEDs
- Two DIP Switches and three 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-MCF51CN is shown in the figure below.

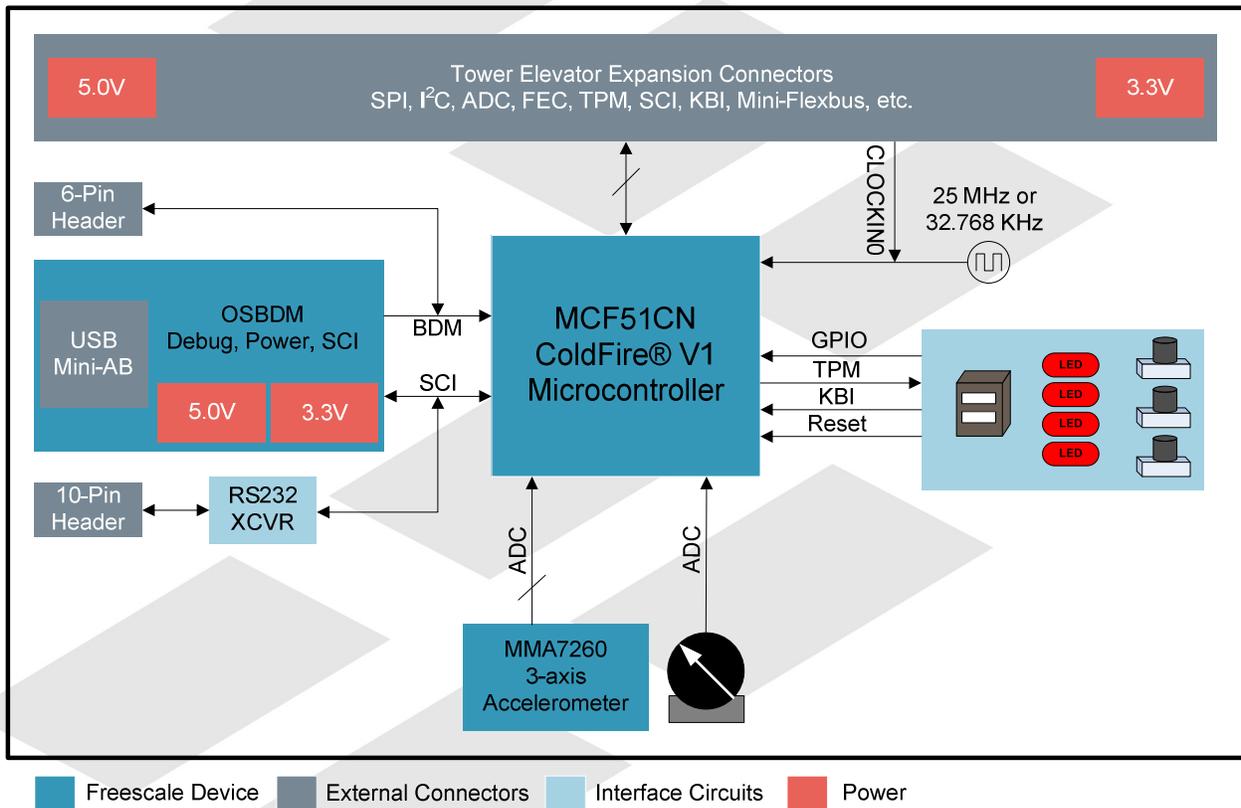


Figure 1. TWR-MCF51JCN Block Diagram

2 Reference Documents

The documents listed below should be referenced for more information on the Freescale Tower system and the TWR-MCF51CN. Refer to <http://www.freesale.com/tower> for the latest revision of all Tower documentation.

- *Freescale Tower Electromechanical Specification*
- *TWR-MCF51CN Module Pinout*
- *TWR-MCF51CN Schematics*
- *TWR-MCF51CN Quick Start Guide*
- *TWR-MCF51CN-KIT Lab Tutorial*
- *MCF51CN128 Reference Manual*
- *MCF51CN128 Data Sheet*
- *AN3561, USB Bootloader for the MC9S08JM60*

3 Hardware Features

This section provides more details about the features and functionality of the TWR-MCF51CN.

3.1 Clocking

Three options are provided for clocking the MCF51CN128 device:

1. 32.768 KHz crystal
2. 25 MHz crystal
3. External clock input from Primary Elevator (CLOCKIN0)

Selection of the clock input is determined by the J11 and J12 settings. The 25 MHz crystal option is selected by default. Refer to Table 1 for more details.

3.2 System Power

The TWR-MCF51CN can be powered by the OSBDM circuit via the Mini-B USB connector, J14, or a Functional Elevator via the Mini-B USB connector, J5. A standard USB A male to Mini-B male cable (supplied) 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, J6, can be used to isolate the 3.3V supply from the microcontroller. This connection can be used to measure the power usage of the MCF51CN microcontroller.

3.3 Debug Interface

An on-board, MC9S08JM60 based Open Source BDM (OSBDM) circuit provides a debug interface to the MCF51CN. A standard USB A male to Mini-B male cable (supplied) can be used for debugging via

the USB connector, J14. Refer to section x for information on other modes of operation of the OSBDM.

3.4 RS232 Interface

An RS232 transceiver on the TWR-MCF51CN connects to a standard 2x5 pin header. Selection jumpers J9 and J10 allow SCI1 signals to be routed to either the RS232 transceiver or the OSBDM circuit. Refer to Table 1 for more details.

3.5 Elevator Connections

The TWR-MCF51CN 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-MCF51CN, while the Secondary Elevator connector only makes connections to ground (GND). The pinout details for the TWR-MCF51CN can be found in the *TWR-MCF51CN Module Pinout* document.

3.6 Mechanical Form Factor

The TWR-MCF51CN 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.

Table 1. TWR-MCF51CN Jumper Table

Jumper	Option	Setting	Description
J2	PTD7/RGPIO7/SPSCK2/ADP3 Usage Selection	1-2	Connect to DIP Switch Position 1
		2-3	Connect to Potentiometer
		OFF	Only connected to Primary Elevator (SPI1_CLK, B7)
J3	Analog Isolation Jumpers: OFF setting isolates signals from Primary Elevator	1-2	Connect PTE2/KBI2P2/SS2/ADP0 to SPI1_CS0 (B9) and IRQ_D (B59)
		3-4	Connect PTE1/KBI2P1/MOSI2/ADP1 to SPI1_MOSI (B10) and IRQ_C (B60)
		5-6	Connect PTE0/KBI2P0/MISO2/ADP2 to SPI1_MISO (B11) and IRQ_B (B61)
		7-8	Connect PTD3/RGPIO3/RXD2/ADP4 to RXD1 (A43)
		9-10	Connect PTD2/RGPIO2/TXD2/ADP5 to TXD1 (A44)
		11-12	Connect PTD1/RGPIO1/RXD1/ADP6 to RXD0 (A41) and J10
		13-14	Connect PTD0/RGPIO0/TXD1/ADP7 to TXD0 (A42) and J9

J5	Peripheral Selection Jumpers	1-2	Connect PTH3/FB_D6/TPM2CH0 to LED4
		3-4	Connect PTE5/KBI2P5/IRQ/TPM1CH2 to LED3
		5-6	Connect PTG5/KBI1P5/FB_D3 to LED2
		7-8	Connect PTE3/KBI2P3/TPM1CH0 to LED1
		9-10	Connect PTE0/KBI2P0/MISO2/ADP2 to Accelerometer Z-axis
		11-12	Connect PTE1/KBI2P1/MOSI2/ADP1 to Accelerometer Y-axis
		13-14	Connect PTE2/KBI2P2/SS2/ADP0 to Accelerometer X-axis
J6	MCU Power	ON	Supply 3.3V to MCU
		OFF	Isolate MCU from Power (current measurement option)
J9	UART TXD1 Routing Selection	1-2	Route TXD1 to RS232 transceiver
		2-3	Route TXD1 to OSBDM
J10	UART RXD1 Routing Selection	1-2	Route RXD1 to RS232 transceiver
		2-3	Route RXD1 to OSBDM
J11	EXTAL Selection	1-2	25MHz Crystal
		3-4	32.768KHz Crystal
		5-6	CLOCKIN0 from Primary Elevator (B24)
J12	XTAL Selection	1-2	25MHz Crystal
		2-3	32.768KHz Crystal
J13	MiniBus Latch Enable	1-2	Latch Disabled
		2-3	Latch Enabled
J16	OSBDM Bootloader Select	ON	Bootloader mode
		OFF	Debugger mode

5 Input/Output Connectors and Pin Usage Table

The following tables provides details on which MCF51CN pins are using to communicate with the TWR-MCF51CN sensors, LEDs, switches, and other I/O interfaces.

Table 2. I/O Connectors and Pin Usage Table

TWR-MCF51CN		MCF51CN128			
I/O Component	I/O Label	Default Function	Alternate 1	Alternate 2	Alternate 3
Dip Switch	SW1-1	PTD7/ RGPIO7	Reserved	SPSCK2	ADP3
	SW1-2	PTH2	Reserved	FB_D7	TMRCLK1
Push Button	SW2	PTG6	KBI1P6	FB_D2	Reserved
	SW3	PTG7	KBI1P7	FB_D1	Reserved
	SW4 (RST)	RESETB	PTC3	Reserved	Reserved
LED	LED1	PTE3	KBI2P3	Reserved	TPM1CH0
	LED2	PTG5	KBI1P5	FB_D3	Reserved
	LED3	PTE5	KBI2P5	IRQ	TPM1CH2
	LED4	FTH3	Reserved	FB_D6	TPM2CH0
Accelerometer MMA7260QT	X_OUT	PTE2	KBI2P2	SS2B	ADP0
	Y_OUT	PTE1	KBI2P1	MOSI2	ADP1
	Z_OUT	PTE0	KBI2P0	MISO2	ADP2
Potentiometer	POT	PTD7/ RGPIO7	Reserved	SPSCK2	ADP3

RS232	T1IN	PTD0/ RGPIO0	Reserved	TXD1	ADP7
ICL3232	R1OUT	PTD1/ RGPIO1	Reserved	RXD1	ADP6
OSBDM	TXD1	PTD1/ RGPIO1	Reserved	RXD1	ADP6
USB to Serial	RXD1	PTD0/ RGPIO0	Reserved	TXD1	ADP7

Note:

Refer to Section 2.3, Pin Mux Controls, in *MCF51CN128 Reference Manual* to configure pin to appropriate alternate function. All pins default to Default Function out of reset.

6 OSBDM

6.1 Bootloader Mode

The MC9S08JM60 device used in the OSBDM circuit is preprogrammed with OSBDM debugger firmware and a USB Bootloader. Jumper J16 determines which application will run following a power-on reset. If Bootloader Mode is chosen (jumper ON J16), the bootloader will be executed, allowing in-circuit reprogramming of the JM60 flash memory via USB. This enables the OSBDM firmware to be upgraded by the user when upgrades become available. For details on the USB Bootloader, refer to [Application Note AN3561](http://www.freescale.com) on the Freescale website (<http://www.freescale.com>).

The USB Bootloader communicates with a GUI application running on a host PC. The GUI application can be found on the [Freescale website](http://www.freescale.com); 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.

6.2 Stand-Alone Debug Interface

The OSBDM circuit is designed so that it can program the on-board MCF51CN device, or be isolated from the on-board circuitry and be used as a programmer for other ColdFire V1 devices. The steps necessary to operate the OSBDM in this mode are listed here:

1. Remove 0 ohm resistor, SH1
2. Connect J8 (2x3 header) from TWR-MCF51CN to target debug connector



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