New Form Factor for Power Architecture® Technology in Industrial Applications

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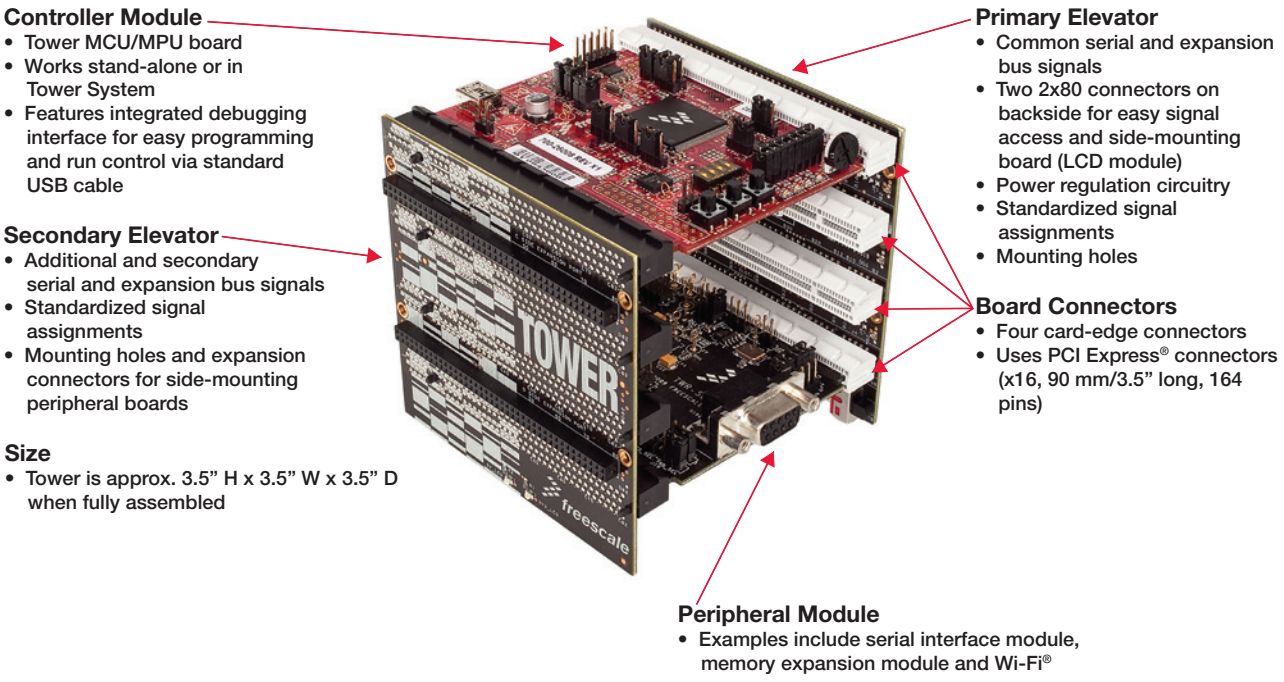
Introduction

The Freescale Tower System is a set of feature-rich modular development solutions that support cost-effective rapid prototyping and simpler software migration. Tower boards are interchangeable and reusable modules that include open source design files to enable you to easily customize a design. The expansion of a Tower System from a development tool into a development platform is simple and cost-effective. The Tower System helps you save months of development time—now and in the future—through rapid prototyping and tool re-use, and allows you to take advantage of our extensive Tower infrastructure with more than 50 Tower System modules or kits currently available.

Bringing Power Architecture® Technology to the Tower System

The most recent roadmap enhancement for the popular Tower System modular development platform introduced solutions based on the widely used Power Architecture® technology. The strategy behind adding Power Architecture technology to our existing Tower platform was to leverage the ecosystem expansion capability of Tower infrastructure solutions and to provide our customers with a flexible design tool.

Figure 1: Freescale Tower System



The newest modules in the Tower System series feature the cost-effective, highly versatile MPC8309 PowerQUICC communications processor and the multicore, high-performance QorIQ P1025 communications processor, which are ideal for robotics, factory automation, programmable logic controllers and industrial networking applications. The TWR-MPC8309 and TWR-P1025 controller modules along with the PX series of MCU Tower System modules bring Power Architecture technology to the Tower System.

Features and Benefits

The advanced Tower System modules, based on Power Architecture technology, are designed to deliver the richest feature sets yet offered in a Tower System form factor, with performance ranging from 130 to 2558 Dhrystone million instructions per second (DMIPS). A shared MQX™ real-time operating system (RTOS) and CodeWarrior integrated development environment (IDE) allow the Tower System platforms to easily facilitate customer application migration from MCUs to the more powerful Power Architecture MPUs with a rich variety of performance and connectivity options.

The Tower System Industrial Networking Development Platforms

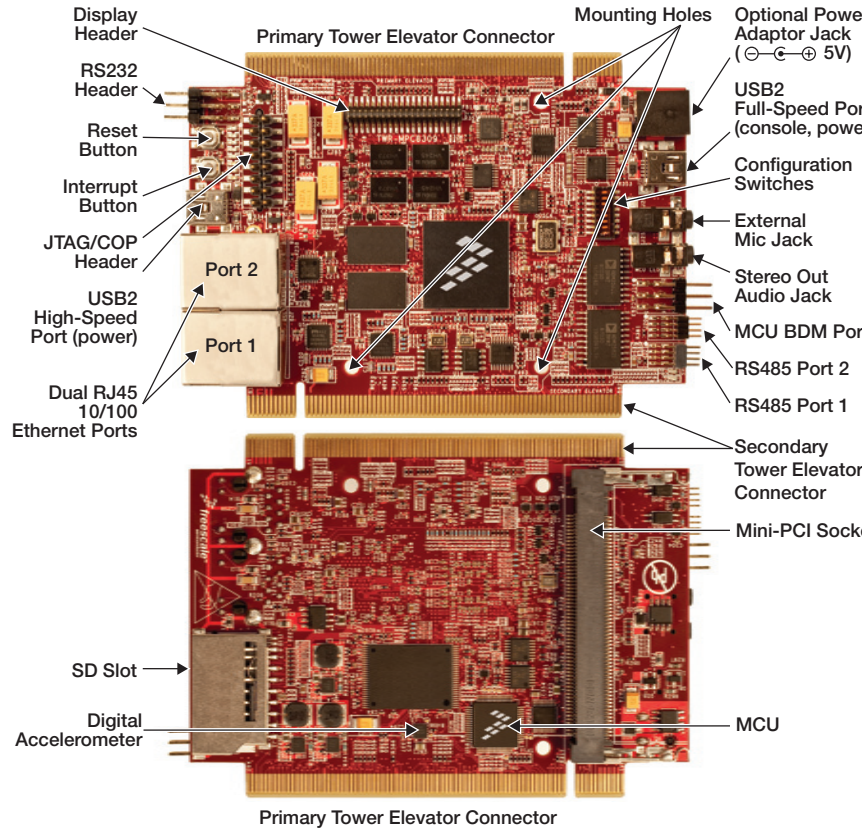
At the heart of advanced Tower System modules based on Power Architecture technology are the highly versatile MPC8309 PowerQUICC II Pro communications processor and the multicore, high-performance QorIQ P1025 communications processor.

The MPC8309 features an e300c3 Power Architecture core with double precision floating point, 16 KB of instruction and data cache and up to 835 DMIPS (@417 MHz) of performance, while consuming less than 1.6 watts of power.

Table 1: Freescale Tower System: Features and Benefits

Features	Benefits
Cost effective	• Peripheral modules can be re-used with all Tower System controller modules, eliminating the need to purchase redundant hardware for future designs • Enabling technologies such as LCD, serial and memory interfacing are offered off the shelf at a low cost to provide a customized enablement solution
Modular and expandable	• Processor/controller modules provide easy-to-use, reconfigurable hardware • Interchangeable peripheral modules—serial, memory and graphical LCD—make customization easy • Open-source hardware and standardized specifications promote the development of additional modules for added functionality and customization
Speeds development time	• Open source hardware and software allows quick development with proven designs • On-board debug hardware for easy programming and debugging using only a standard USB cable
Software enablement and support	• Freescale, along with a strong alliance network, offers comprehensive solutions including development tools, debuggers, programmers and software

Figure 2: TWR-MPC8309 Processor Module



The QorIQ P1 Tower module can be used stand-alone as a development board for various applications or as a rapid-prototyping Tower System development platform. The dual-core P1025 processor CPU cores run up to 533 MHz, and the device features a large L2 cache, DDR3 memory controller and Gigabit Ethernet support.

Both the MPC8309 and QorIQ P1025 feature an integrated QUICC Engine protocol offload processor, which can reduce BOM cost and design complexity by supporting industrial protocols such as PROFINET, PROFIBUS, EtherNet/IP™ or EtherCAT® on-chip, instead of using an expensive external ASIC or FPGA. One more striking feature of both modules is that, in spite of the small form factor, they have the same functionality and complexity of an MCU processor module, including SPI, RS232, IRQs, I²C, discrete flash and DDR2/DDR3 memory support, as seen in Figures 2, 3 and 4.

Figure 3: TWR-P1025 Processor Module

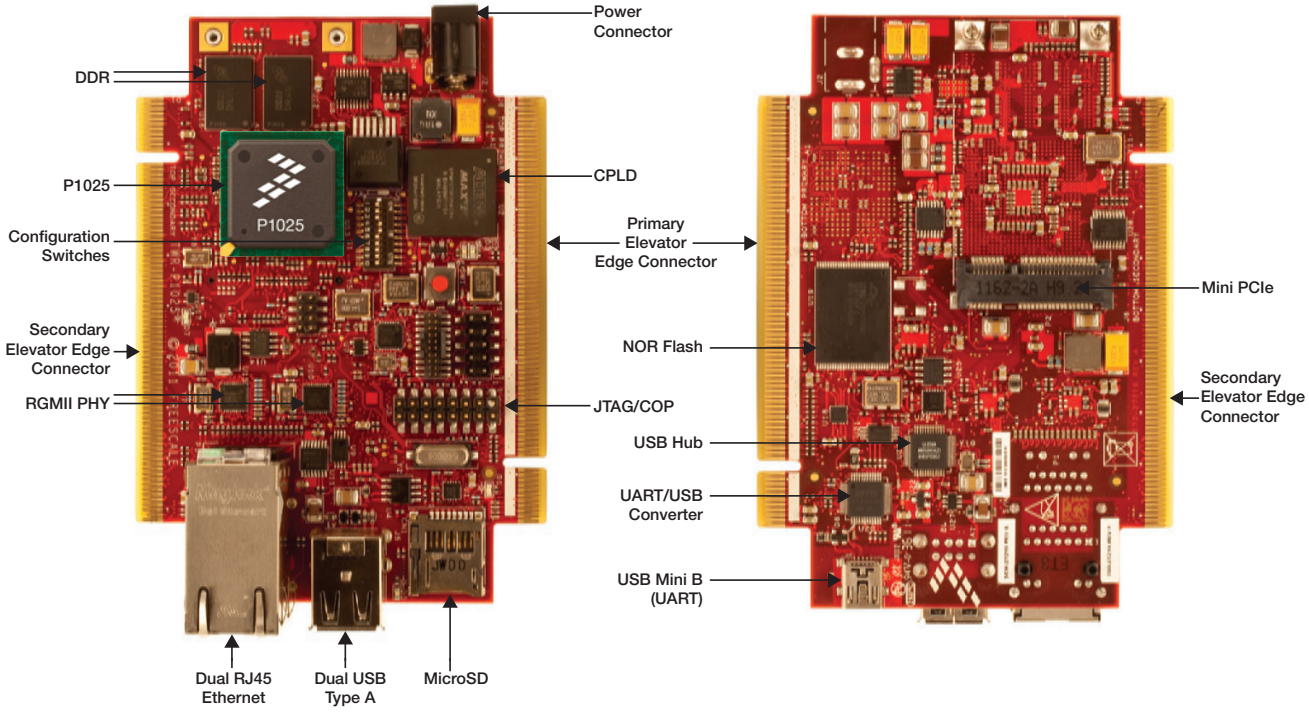
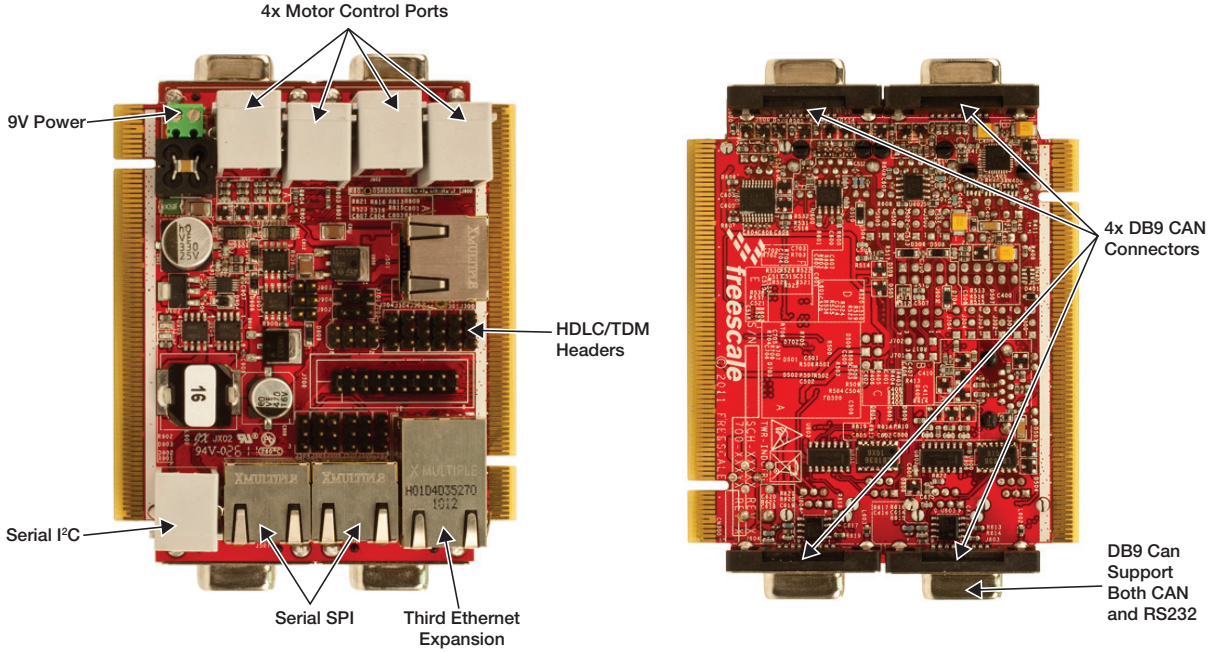


Figure 4: TWR-INDCTRL Industrial Control Expansion Peripheral Module



Coming in late 2012, the MPC8309 industrial development kit (TWR-MPC8309-KIT) will consist of three main components:

- The MPC8309 processor module (TWR-MPC8309, shown in Figure 2 above), measuring only 64 mm x 110 mm, supports comprehensive connectivity such as dual 10/100 Ethernet ports with IEEE® 1588 support, dual USB 2.0 connectors, twin RS-485 headers for PROFIBUS support, audio ports for headphone and microphone jacks, a mini-PCI connector and an SD card slot.
- The industrial applications peripheral module (TWR-INDCTRL, shown in Figure 3 above) provides a broad array of industrial interface ports, including four DB9 connectors for CAN protocol support, two SPI ports, an I^2C port, an RS232 port and a third 10/100 Ethernet port.
- The Tower elevator module (TWR-ELEV) allows the TWR-MPC8309 main processor module to be connected to the industrial applications expansion card, as well as to other standard Tower peripheral modules.

An optional touch LCD daughter card (MPC830x-TLCD) features a 640 x 480 color LCD display with 12-key capacitive touch keypad. The TWR-MPC8309 main processor module can be used with the MPC830x-TLCD daughter card as a stand-alone single board computer (SBC) for applications such as programmable logic controllers (PLC), gateways and operator interface terminals. Combined with the industrial control expansion module in the conventional Tower System configuration, the TWR-MPC8309-KIT can support the development of robotics, test and measurement and other factory automation applications.

- The optional touch LCD daughter card (MPC830x-TLCD) features a 3.2" QVGA color LCD touchscreen with 12-key capacitive touch keypad. It can be attached directly to the TWR-MPC8309 main board in any configuration to support SBC functionality.
- The Tower serial card (TWR-SER) features a subset of the TWR-INDCTRL interfaces including one DB9 connector for CAN, one RS232 and a third 10/100 Ethernet port. It can be utilized to enable the full set of industrial connectivity supported by MPC8309 until TWR-INDCTRL becomes available.

Tower Board Infrastructure Based on Power Architecture Technology

Table 2 demonstrates the list of boards currently planned to be available on the Tower infrastructure based on the Power Architecture platform. It also gives the details of key features available with each of those boards and their primary targeted applications.

Advanced Tower System Modules Based on PX Series MCUs

Industrial market requirements for processing performance, safety and integration are rapidly increasing. The Freescale PX series of MCUs is designed for complex industrial control applications such as motion control, power generation, medical, aerospace and defense, motor drives, renewable energy conversion and robotics.

Based on the e200 Power Architecture core, the PX series MCUs offer single-core performance up to 600 DMIPS, multicore options and up to 4 MB of embedded flash memory. A single MCU can control up to six motors, process complex math algorithms and manage more than the typical three communications connections at the same time. Its embedded safety architecture helps meet challenging industrial safety, reliability and environmental requirements with integrated features to simplify safety approvals for IEC 61511 and IEC 61508 (SIL3), FAA DO-178B Level A and FDA Class II to III. Advanced Tower System modules featuring the PX series of Power Architecture MCUs are planned for availability in early 2012.

Table 2: Examples of Boards in Tower Infrastructure Based on Power Architecture®

	TWR-PXD10	TWR-PXD20	TWR-PXN20	TWR-PXS20	TWR-PXS30	TWR-PXR40	TWR-MPC8309	TWR-P1025
Application	Industrial Display	Industrial Display	Industrial Gateways	Functional Safety	Functional Safety	Real-Time Applications: Motor Control	Industrial, Networking and Automation	Industrial, Networking and Automation
Flash/SRAM	1 MB/48 KB	2 MB/96 KB	2 MB/592 KB	1 MB/128 KB	2 MB/512 KB	4 MB/256 KB	Embedded 0 MB/0 MB	64 MB (NOR)
Board Flash/ DRAM							32 MB/128 MB	32 MB/128 MB
Code Warrior IDE	✔	✔	✔	✔	✔	✔	✔	✔
RAppID Dev Tool				✔	✔	✔		
Motor Control				✔	✔		✔	✔
Debug Interface	JTAG/Nexus3 OSJTAG	JTAG/Nexus3 OSJTAG	JTAG/Nexus3 OSJTAG	JTAG/Nexus3 OSJTAG	JTAG/Nexus3 OSJTAG	JTAG/Nexus3 OSJTAG	JTAG/COP	JTAG/COP
Fault Correction				✔	✔			
Display	✔	✔					✔	
Audio							✔	
Potentiometer	✔	✔	✔	✔	✔	✔	✔	
Accelerometer	✔	✔	✔	✔	✔	✔		✔
Fieldbus							✔	✔
CAN	✔	✔	✔	✔	✔	✔	✔	
UART			✔	✔	✔	✔	✔	✔
USB 2.0							✔	✔
Ethernet					✔		✔	✔
PCI							✔	✔
SPI							✔	✔
ADC				✔	✔	✔		
SD/SDIO							✔	✔
SPI Memory		✔				✔		✔
TWRPI Socket		✔		✔	✔			
eTPU						✔		
IEEE® 1588							✔	✔
OS Support	MQX™	MQX	MQX	MQX	MQX	MQX	MQX Linux® with RT Support GHS INTEGRITY QNX Neutrino	MQX Linux OS QNX Neutrino

Take Your Design to the Next Level

For a complete list of development kits and modules offered as part of the Freescale Tower System series based on Power Architecture technology, please visit **freescale.com/TowerPower**.

TowerGeeks.org is an online design engineer community that allows members to interact, develop designs and share ideas with the Tower System.

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