Freescale Technology Forum

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Industrial Control and Networking Roadmap
AZ131

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Global Industrial Segment Lead – Factory Automation & Drives
Agenda

► Factory automation market
  • Target applications
  • Market trends
  • Freescale alignment with trends

► Factory automation solutions
  • Generic applications
  • Freescale factory automation processors
  • Applications Examples
    ▪ Industrial networking solutions
    ▪ Industrial control solutions

► Factory automation tools and enablement
Factory Automation Market

Factory Network

Industrial Control

Industrial Networking

Human Machine Interface (HMI)

Industrial Drives

Industrial Peripherals

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Factory Automation – Industrial Control and Networking

► Factory Automation equipment is ruggedized for harsh environment and communicates with industrial protocols

► Industrial Control
  • Programmable Logic Control (PLC)
  • Programmable Automation Control (PAC)
  • DCS
  • Process/temperature control
  • Motion/position control

► Industrial Networking (wired and wireless)
  • Routers and Gateways
  • Managed and Unmanaged Switches
  • Converters and Hubs
# Factory Automation – Market Trends

<table>
<thead>
<tr>
<th>Market Trend</th>
<th>Customer Requirements</th>
</tr>
</thead>
</table>
| Reuse software, hardware, and tools across platforms | Port software across same platform from 50 to 1500+ DMIPS  
Use libraries and reference designs for common functions  
Tools to develop increasingly complex algorithms |
| Reduce power consumption                          | Intelligent motor control - 2008 was 5\textsuperscript{th} year >10\% growth (IMS)  
Fanless operation at -40\textdegree{} C to +85\textdegree{} C ambient  
MPU <4 W max at >1000 DMIPS, with power management |
| Migrate from fieldbus to standardized Ethernet and wireless | Bridge from legacy fieldbus to industrial Ethernet >10 years  
Industrial wireless emerging in process, sensor arrays and automation |
| Cost-effective safety and security                | IEC regulatory approval requires single-bit failure detection  
On-chip security to protect against IP cloning and network data hacking  
Improve system-level cost and development cycle |
## Factory Automation – Freescale Alignment with Trends

<table>
<thead>
<tr>
<th>Market Trend</th>
<th>Freescale Alignment with Customer Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reuse software, hardware, and tools across platforms</td>
<td>- A history of shipping industrial products 10 to 15 years, with high quality and strong customer support  &lt;br&gt; ...</td>
</tr>
<tr>
<td>Reduce power consumption</td>
<td>- DSC portfolio for cost-effective and efficient motor control  &lt;br&gt; - MPU &lt;1 W max, 400 DMIPS, with power management  &lt;br&gt; ...</td>
</tr>
<tr>
<td>Migrate from fieldbus to standardized Ethernet and wireless</td>
<td>- Many devices support both legacy fieldbus and industrial Ethernet and/or wireless  &lt;br&gt; ...</td>
</tr>
<tr>
<td>Cost-effective safety and security</td>
<td>- Secure SRAM, on-chip data fusing to protect against IP cloning  &lt;br&gt; - Hardware encryption to protect against network data hacking  &lt;br&gt; ...</td>
</tr>
</tbody>
</table>
Factory Automation Solutions

Generic Applications
Factory Network Applications and Connectivity

Corporate Office

Industrial Networking (ruggedized)

- Gateway or Firewall
  - Ethernet
  - Office LAN

- Ethernet Switch
  - Ethernet

- Hub
  - Converter
  - Ethernet

- Operator Console
  - Ethernet

- HMI

Peripheral Equipment

- External Device Server
  - Ethernet
  - 802.15.4 Wireless

- PLC Rack
  - Comm. Bridge
  - PLC
  - PLC IO

- PAC
  - Ethernet
  - FIELD BUS *

- Process Controller
  - Ethernet
  - FIELD BUS *

- Motion Controller
  - Ethernet
  - FIELD BUS *

- Operator Console
  - Ethernet

- HMI
  - Ethernet

- Proprietary I/O **

- Variable Speed Drive
  - Motor Drive
  - Sensors
  - I/O Devices
  - Robotics
  - Actuators

* FIELD BUS = PROFIBUS, Modbus RTU, DeviceNet
*** Wireless = WirelessHART, ISA100, ZigBee
** I/O = Discrete, Analog, Thermocouple, Other
Generic Industrial Control Applications and Connectivity

Chassis-mounted I/O Modules
Digital/Analog

Fieldbus or Ethernet Communications

Remote Servo Controller

Remote I/O Modules
Digital/Analog

Remote PLC

Wireless sensor Networking Gateway

Remote I/O Modules
Digital/Analog

Remote PLC

Fieldbus or Ethernet link to HMI, Higher-level Control, or Enterprise Network
Factory Automation Solutions

Freescale Factory Automation Processors
Newest Products Targeting Factory Automation

► MC13224
  • Platform in a package integrates ARM core with radio for ISA100, ZigBee®, WirelessHART™ industrial wireless communications

► MCF5225x with MQX RTOS
  • ColdFire V2 MPU ideal for low-performance industrial I/O, PLC and process control

► i.MX25 and i.MX35
  • ARM9 and ARM11 MPU ideal for HMI

► P2010/20 QorIQ
  • Single-core and dual-core Power Architecture® MPU (e500) ideal for high-performance Networking and Control
**MCF5225x Features**

- Up to 76 Dhrystone 2.1 MIPS @ 80 MHz
- Flash/SRAM options
  - 512K/64K
  - 256K/64K
  - 256K/32K
- MiniBus expansion supports up to 1M byte memory without ALE; 256M byte with ALE
- 10/100 Ethernet controller with encryption
- CAN controller
- USB 2.0 OTG controller
- 3 x UARTs, I²C, QSPI
- High precision ADC and many timers
- eMAC provides low-cost DSP performance
- Pin-out supports Ethernet in 2-layer board
- Ready-to-go MQX RTOS software
i.MX Applications Processors

i.MX25 On-chip Security

► High Assurance Boot
  • Protection against rogue software; only authenticated software can run on device
  • Needed for secure residential gateways, biometric devices, point-of-sale

► Tamper detection, key storage
  • Voltage, frequency, temperature monitors
  • Fast key erasure upon threat detection
  • Secure 47-bit time counter
  • Secure 32-bit monotonic counter
  • Volatile key storage

► True Random Number Generator

► User Programmable e-Fuses

i.MX Features

| Connectivity – Ethernet, CAN, USB PHY, I²C, SPI, UART, SSI/I²S, Camera I/F |
| LCD and Touchscreen Controllers |
| Memory – DDR2, SDIO, |
| On-chip Security |
| Industrial qualification and long product life |
| WinCE and Linux BSP support |
| Optimized performance and <1 W power consumption |
QorIQ™ P1 Platform

QorIQ™ P1020 and P1011 Block Diagram

Security Acceleration
XOR
Power Management

Power Architecture® e500 Core
32 KB L1 I-Cache
32 KB L1 D-Cache

256 KB L2 Cache

Power Architecture® e500 Core
32 KB L1 I-Cache
32 KB L1 D-Cache

Not on P1011

Coherency Module
System Bus

TDM
3 x Gigabit Ethernet

On-Chip Network
2 x PCI Express® 4-ch. DMA Controller

4-lane SerDes

DDR2/DDR3 SDRAM Controller
DUART, 2 x PC, Timers, Interrupt Control, SD/MMC, SPI, USB 2.0/ULP1
Enhanced Local Bus Controller (eLBC)
<table>
<thead>
<tr>
<th>Category</th>
<th>DMIPS Range</th>
<th>Power Consumption</th>
<th>Price Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-End Networking</td>
<td>1000 DMIPS and up</td>
<td>4W - 10 W</td>
<td>&gt; $20</td>
</tr>
<tr>
<td>High-End PLC/PAC</td>
<td>500 – 1500 DMIPS</td>
<td>&lt; 2.5 W – 5 W</td>
<td>&gt; $15</td>
</tr>
<tr>
<td>PLC/PAC and HMI</td>
<td>300 – 800 DMIPS</td>
<td>&lt; 1.5 W</td>
<td>&lt; $10 - 20</td>
</tr>
<tr>
<td>I/O Control</td>
<td>200 – 400 DMIPS</td>
<td>&lt; 1 W</td>
<td>&lt; $10</td>
</tr>
<tr>
<td>Process Control</td>
<td>~100 DMIPS</td>
<td>&lt; 0.5 W</td>
<td>&lt; $5</td>
</tr>
</tbody>
</table>

- **MPC8640**
- **MPC8610**
- **MPC8544**
- **MPC8360**
- **MPC837x**
- **MPC8314/15**
- **MPC8313**
- **i.MX31**
- **i.MX27L**
- **MCF5445x**
- **MCF532x**
- **MCF527x**
- **MCF5235**
- **MCF551x**
- **MCF525x**
- **MCF5xxx**
- **i.MX51x**
- **i.MX35x**
- **i.MX25x**
- **Power®**
- **ARM®**
- **ColdFire®**
- **LCD Control**
- **P1020 QorIQ®**
- **P1011 QorIQ®**
- **P10xx QorIQ®**
- **P2020 QorIQ®**
- **P2010 QorIQ®**
- **MPC8536**

*Pin Compatible*
Factory Automation and Drives
Analog, Sensor and Wireless Processors

Sensors
- MPX5050D
- MPX5999D
- MP3V5004
- MPR084
- MMA736xL
- MMA745xL
- MPR031
- MMA7660
- MPR121
  - More inputs

Proximity
- Inertial
- Pressure
  - RF (2.4 GHz, UHF)

Wireless
- MC33x96
- MC1320x
- MC1319x
- MC13213
- MC13224

Analog
- MC34670 (PoE)
- H-bridges
  - MC33880, 87
  - MC33926, 32
- CAN PHY
  - MCZ33897
- MC34783
- MC34704
- MC13783
- MC34700
- MC34700
- i.MX PMUIC
  - MC34892
- LED backlight
  - MC34844, 46
- Signal Conditioning
  - MC33972, 75
- Power Supply
  - MC34727, 26
- Linear Regulator
  - MC33742
  - MC33910, 11, 12
- Pre-driver
  - MC33937

2008

2009

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Factory Automation Solutions

Industrial Networking Application Examples
**Industrial Gateway (Router)**

- Connect two or more typically large networks.
- Signals directed only to ports where needed
- Gateway can convert between standard Ethernet and industrial Ethernet protocols
- Gateway can convert between wireless and wired interfaces

**Recommended Devices**
- P2010/20, P1020/11 QorIQ™ multicore processors for highest performance
- MPC8313, MPC8360/58, MPC837x, MPC8536 PowerQUICC® processors for Gigabit or 8 x 10/100 Ethernet
- MC13224, MC13213 2.4 GHz RF plus MCU for WirelessHART™, ISA100 or ZigBee®
Industrial Ethernet Switch

- Intelligent hub learns preferred destination of signals appearing at any port
- Directs signals only to ports where needed. Can give priority to certain ports
- Managed switch has extra port for user to set functionality

**Recommended Devices**

- P2010/20, P1020/11 QorIQ™ multicore processors for highest performance
- MPC8313, MPC8360/58, MPC837x, MPC8536 PowerQUICC® processors for Gigabit or 8 x 10/100 Ethernet
- MCF54453, MCF5225x ColdFire® processor CAN, 10/100 Ethernet, more UARTs, lower cost
- MC13224, MC13213 2.4 GHz RF plus MCU for WirelessHART™, ISA100 or ZigBee®
Industrial Ethernet Converter (Bridge)

Converts between Ethernet and another communication technology, such as:

- Fieldbus: PROFIBUS, DeviceNET™ or CAN
- Industrial Ethernet: PROFINET, EtherNet/IP, EtherCAT, Modbus TCP
- Industrial Wireless: ZigBee®, WirelessHART, ISA100

Recommended Devices

- MPC8313, MPC8360/58 PowerQUICC® processors for Gigabit or 8 x 10/100 Ethernet
- MCF54453, MCF5225x ColdFire® processor for CAN, Ethernet, more UARTs, low cost
- i.MX25x, i.MX35x applications processors for ARM® core, CAN, Ethernet, UARTs, LCD
- MC13224, MC13213 2.4 GHz RF plus MCU for WirelessHART™, ISA100 or ZigBee®
Industrial Ethernet Hub

- Junction point for multiple Ethernet connections
- Signal at one port connects to all other ports

Recommended Devices
- MPC8313, MPC8360/58 PowerQUICC® processors for Gigabit or 8 x 10/100 Ethernet
- MCF54453, MCF532x, MCF5225x, MCF52235, MCF5234 ColdFire® processor for 10/100 Ethernet, more UARTs, lower cost
<table>
<thead>
<tr>
<th>Device Family</th>
<th>i.MX25x (i.MX)</th>
<th>MCF54453 ColdFire</th>
<th>MPC8313 PowerQUICC</th>
<th>MPC8360/58 PowerQUICC</th>
<th>MPC837x PowerQUICC</th>
<th>P2010/20 QorIQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Application</td>
<td>Simple converters</td>
<td>Simple hubs, converters</td>
<td>Hubs, converters, switches, gateways</td>
<td>Hubs, converters, switches, gateways</td>
<td>Hubs, switches, gateways</td>
<td>Gateways, routers, switches</td>
</tr>
<tr>
<td>Core Type</td>
<td>ARM9 400 DMIPS 400 MHz</td>
<td>ColdFire V4 410 DMIPS 266 MHz</td>
<td>e300 Power 760 DMIPS 266 to 400 MHz</td>
<td>e300 Power 760 DMIPS 266 to 400 MHz</td>
<td>e300 Power 1267 DMIPS 400 to 667 MHz</td>
<td>e500 Power 2760 DMIPS 533 to 1200 MHz</td>
</tr>
<tr>
<td>Core Frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethernet MAC</td>
<td>1 x 10/100</td>
<td>2 x 10/100</td>
<td>2 x 10/100/GbE or up to 8 x 10/100</td>
<td>2 x 10/100/GbE</td>
<td>2 x 10/100/GbE</td>
<td>3 x 10/100/GbE</td>
</tr>
<tr>
<td>MAC H/W timestamp</td>
<td>No</td>
<td>No</td>
<td>IEEE 1588</td>
<td>IEEE 1588</td>
<td>IEEE 1588</td>
<td>IEEE 1588</td>
</tr>
<tr>
<td>PCI or PCI Express</td>
<td>No</td>
<td>1 PCI</td>
<td>1 PCI</td>
<td>1 PCI</td>
<td>1 PCI, 2 PCI-Express (8377/78)</td>
<td>3 PCI-Express</td>
</tr>
<tr>
<td>SPI</td>
<td>3</td>
<td>1 DSPI</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>USB</td>
<td>High speed, OTG, with 2 PHY</td>
<td>High Speed OTG</td>
<td>High Speed host/device OTG with HS PHY</td>
<td>Low/Full Speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other interfaces</td>
<td>5 x UART, 3 x I²C, 2 x CAN, 2 x SDIO, 2 x SSI</td>
<td>3 x UART, I²C, SSI</td>
<td>2 x UART, 1 x I²C</td>
<td>2 x UART, 2 x I²C</td>
<td>2 x UART, 2 x I²C</td>
<td>2 x UART, 2 x I²C</td>
</tr>
<tr>
<td>Max power @ 85°C</td>
<td>&lt;1 W</td>
<td>1.5 W</td>
<td>2 W</td>
<td>6.8 W for MPC8360 5.0 W for MPC8358</td>
<td>4.1 W</td>
<td>8 W (est)</td>
</tr>
<tr>
<td>Security Hardware</td>
<td>IP cloning protection</td>
<td>Network crypto</td>
<td>Optional network crypto</td>
<td>Optional network crypto</td>
<td>Optional network crypto</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>LCD controller, 12-bit ADC</td>
<td>Power management controller, boot from NOR/NAND</td>
<td>PROFIBUS support by QUICC Engine</td>
<td>SATA on MPC8377 and MPC8379</td>
<td>Dual core on P2020</td>
<td></td>
</tr>
</tbody>
</table>

Extended Temperature -40° to 85°C ambient
Factory Automation Solutions

Industrial Control Application Examples
Programmable Logic Control (PLC)

- Control machines and processes with fast, deterministic operation
- Manage logic, timing, sequencing, counting, and arithmetic algorithms
- Support binary and some analog inputs/outputs

**Recommended Devices**

- P2010/20, P1020/11 QorIQ™ multicore processors for highest performance
- MPC8313, MPC8360/58, MPC837x, MPC8536 PowerQUICC® processors for most Ethernet
- MCF54453, MCF5225x ColdFire® processor for CAN, Ethernet, more UARTs, low cost
- i.MX25x, i.MX35x applications processors for ARM® core, CAN, Ethernet, UARTs, LCD
- MC13224, MC13213 2.4 GHz RF plus MCU for WirelessHART™, ISA100 or ZigBee®
Programmable Logic Control (PLC) with Multicore

- **QorIQ™ P2020**
  - External AC to high voltage DC
  - Local power rail management
  - Shared L2 Cache
  - DDR2/3

- **Backplane**
  - Ethernet link to HMI, higher-level control, or enterprise network
  - Ethernet PHY
  - sRIO
  - PCIe
  - RGMII
  - USB PHY
  - USB HS
  - MMC/SD

- **Ethernet links to smaller PLC or I/O devices:**
  - EtherNet/IP™
  - CIP Sync™
  - PROFINET
  - EtherCAT
  - POWERLINK
  - Modbus TCP

- **Fieldbus to end nodes:**
  - PROFIBUS
  - DeviceNet™
  - Modbus RTU

- **Ethernet links to:**
  - EtherNet/IP™
  - CIP Sync™
  - PROFINET
  - EtherCAT
  - POWERLINK
  - Modbus TCP

- **Diagnostics, Maintenance**
  - MMC/SD
  - USB PHY
  - USB HS
  - PCIe
  - SPI
  - FPGA or ASIC
  - Ethernet PHY
  - DDR SDRAM

- **Removable Storage MMC/SD Card**
I/O Controller

- Control machines and processes with fast, deterministic operation
- Manage logic, timing, sequencing, counting, and arithmetic algorithms
- Multiple binary and analog inputs/outputs
- Intrinsically safe systems connect via 4 to 20 mA current loops, level translation and optical isolation

Recommended Devices

- MPC8313, MPC8360/58, MPC837x, MPC8536 PowerQUICC® processors for most Ethernet
- MCF54453, MCF5225x ColdFire® processor for CAN, Ethernet, more UARTs, low cost
- i.MX25x, i.MX35x applications processors for ARM® core, CAN, Ethernet, UARTs, LCD
- MC13224, MC13213 2.4 GHz RF plus MCU for WirelessHART™, ISA100 or ZigBee®
Process/Temperature Control

- Control processes and temperature
- High accuracy temperature comparison XO
- Support multiple binary and analog inputs/outputs. Intrinsically safe systems connect via 4 to 20 mA current loops, level translation and optical isolation to avoid spark
- For wireless systems, 2-3 year battery life, < 7 mA receive and <20 mA transmit

Recommended Devices
- MPC8313, MPC8314/15 PowerQUICC® processors for Ethernet
- MCF54453, MCF532x, MCF5225x, MCF52235, MCF5234 ColdFire® processor for CAN, Ethernet, more UARTs, low cost
- i.MX25x, i.MX35x applications processors for ARM® core, CAN, Ethernet, UARTs, LCD
- MC13224, MC13213 2.4 GHz RF plus MCU for WirelessHART™, ISA100 or ZigBee®
### Industrial Control Processor Examples

<table>
<thead>
<tr>
<th>Device Family</th>
<th>MCF5225x ColdFire</th>
<th>MCF54453 ColdFire</th>
<th>i.MX35x i.MX</th>
<th>MPC8314/15 PowerQUICC</th>
<th>MPC837x PowerQUICC</th>
<th>P2010/20 QorIQ</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Application</strong></td>
<td>PLC, IO, Process, Temperature</td>
<td>PLC, IO, Process</td>
<td>PLC, IO, Process</td>
<td>PLC, IO, Process</td>
<td>PLC, PAC, Motion</td>
<td>PLC, PAC, Motion</td>
</tr>
<tr>
<td><strong>Core Type</strong></td>
<td>ColdFire V2 76 DMIPS 80 MHz</td>
<td>ColdFire V4 410 DMIPS 266 MHz</td>
<td>ARM11 532 DMIPS 532 MHz</td>
<td>e300 Power 760 DMIPS 266 to 400 MHz</td>
<td>e300 Power 1267 DMIPS 400 to 667 MHz</td>
<td>e500 Power Up to 2760 DMIPS 533 to 1200 MHz</td>
</tr>
<tr>
<td><strong>Core Frequency</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ethernet MAC</strong></td>
<td>1 x 10/100</td>
<td>2 x 10/100</td>
<td>1 x 10/100</td>
<td>2 x 10/100/GbE</td>
<td>2 x 10/100/GbE</td>
<td>3 x 10/100/GbE</td>
</tr>
<tr>
<td><strong>MAC H/W timestamp</strong></td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>IEEE 1588</td>
<td>IEEE 1588</td>
<td>IEEE 1588</td>
</tr>
<tr>
<td><strong>PCI or PCI Express</strong></td>
<td>1 PCI</td>
<td>1 PCI</td>
<td>No</td>
<td>1 PCI, 2 PCI-Express</td>
<td>1 PCI, 2 PCI-Express (8377/78)</td>
<td>3 PCI-Express</td>
</tr>
<tr>
<td><strong>SPI</strong></td>
<td>1 DSPI</td>
<td>1 DSPI</td>
<td>3 SPI</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>USB</strong></td>
<td>Full-speed Host/Device OTG</td>
<td>High Speed OTG</td>
<td>HS Host, HS OTG with 2 x PHY</td>
<td>High Speed Host, Device, or OTG with PHY</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Other interfaces</strong></td>
<td>CAN, 3 x UART, I2C, SSI</td>
<td>3 x UART, I2C, SSI</td>
<td>2 x CAN, 3 x UART, 3 x I2C, 2 x SDIO, 2 x SSI</td>
<td>2 x UART, 1 x I2C</td>
<td>2 x UART, 2 x I2C</td>
<td>2 x UART, 2 x I2C</td>
</tr>
<tr>
<td><strong>Max power @ 85°C</strong></td>
<td>1.5 W</td>
<td>1.5 W</td>
<td>&lt;1 W</td>
<td>2 W</td>
<td>4.1 W</td>
<td>8 W (est)</td>
</tr>
<tr>
<td><strong>Security Hardware</strong></td>
<td>Encryption CAU</td>
<td>Network crypto</td>
<td>IP clone protection</td>
<td>Network crypto (opt)</td>
<td>Network crypto (opt)</td>
<td>Network crypto (opt)</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>512K bytes Flash, PWM</td>
<td></td>
<td>LCD control, touchscreen, 12-bit ADC, ATA, OpenVG</td>
<td>SATA on MPC8315, Power management, boot from NOR/NAND</td>
<td>SATA on MPC8377 and MPC8379</td>
<td>Dual core on P2020</td>
</tr>
</tbody>
</table>

Extended Temperature -40° to 85°C ambient
Factory Automation

Tools and Enablement
MQX RTOS Enables Factory Automation

Backed by Freescale

• Source code, rights to distribute and modify

Proven and Reducing Cost

• Market-proven software has been on Freescale processors for over 15 years
• Supporting millions of Fortune 500 companies’ products
• Eliminates initial software investment hurdle
• $95K worth of software from day one

Simple and Scalable

• Reuse of software
• Small, configurable footprint
• Integrated 3rd party software – Industrial protocols 1588, CAN Open, GUI (PEG)
• Support Low Footprint ColdFire® V1 up to Power Architecture™
• Code size is feature selectable
• Supports multiprocessor communication

www.freescale.com/mqx
ColdFire M52259EVB

M52259EVB Evaluation Board

- Power
- MRAM
- USB Connector for Debugger (P&E)
- Signal Header
- Altera CPLD w/ Compact Flash Controller
- Compact Flash Connector
- USB
- Ethernet
- RS-232
**Freescale i.MX25 Product Development Kit (PDK)**

**CPU Module**
- i.MX25 ARM926EJ-S™ Processor
- Freescale MC34704B PMIC
- Freescale SGTL5000 Audio Codec
- 512Mb DDR2
- 2GB NAND Flash

**Personality Module**
- 5.7” VGA LCD with Touchscreen
- USB 2.0 OTG, USB 2.0 Host, 10/100 Ethernet
- SD/MMC Connector
- Smartcard and CAN Connectors
- CMOS Image Sensor

**Software**
- Windows Embedded 6.0 r2 BSP
- Linux 2.6.26 BSP
- ATK Flash Utility

**Debug Module**
- Debug Ethernet, Serial, JTAG
- Reset, Interrupt, Boot Switches
- Debug Display/LED’s
- Current/Power Monitoring
### Safety Solution – Automation, Medical, Transport

(IEC61508 / CENELEC 50128, FDA, IEC62304)

- **Automation Platform (SIL2)**
  - Esterel
  - IEC 61131-3 + Customer Control/Safety Applications
  - VxWorks® 6.6 CERT
    - IEC 61508 Safety & Control
  - VxWorks

- **Medical**
  - Wind River Partner ECO System
    - Safety Applications
  - VxWorks 6.6 CERT
    - DO-178B Safety & Control
  - Linux®
    - BT, WiFi, Consumer Connectivity
  - OR
    - VxWorks PID
      - SOAP, XML, OPC, CAN

- **Non-Safe Applications**
  - Tilcon
    - KW-SW, Acontis, Rockwell, Tilcon
  - Linux (PCD, GPP) or VxWorks
  - WRS Hypervisor
    - CPU 1 (Single Core or Multi Core)
      - QorIQ P1010
  - SIL 1/SIL 2 - Time Separation

**Automation, Transport, Medical**
- Medical Therapy (Class 2-3)
  - NA Driven – FDA 510(k)
  - EMEA Driven – IEC 62304

**Non-Safe Applications**

- **Safety & Control**
  - DO-178B
  - Safety & Control

- **Software**
  - VxWorks 6.6 CERT
  - Linux®
  - VxWorks PID

- **Hardware**
  - QorIQ P1010

**Conclusion**

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### Comprehensive Partner Ecosystem

<table>
<thead>
<tr>
<th>Professional</th>
<th>Value Priced</th>
<th>Free</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tools</strong></td>
<td><strong>Tools</strong></td>
<td><strong>Open Source Tools</strong></td>
</tr>
<tr>
<td>Compliers, Debuggers</td>
<td>Compliers, Debuggers</td>
<td>Compliers, Debuggers</td>
</tr>
<tr>
<td>Montavista, Wind River, Quadros, Express Logic, QNX</td>
<td>Montavista, Wind River, Quadros, Express Logic, QNX</td>
<td>GNU, Eclipse, Linux</td>
</tr>
<tr>
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</tr>
<tr>
<td>WebOS, Microsoft, Mentor Graphics</td>
<td>WebOS, Microsoft, Mentor Graphics</td>
<td>WebOS, Microsoft, Mentor Graphics</td>
</tr>
<tr>
<td>Micrium</td>
<td>Micrium</td>
<td>Micrium</td>
</tr>
</tbody>
</table>

**Tools and Software**
- Professional tools: Montavista, Wind River, Quadros, Express Logic, QNX
- Value Priced tools: IAR Systems, Macraigor Systems
- Free tools: GNU, Eclipse, Linux

**Open Source**
- Free compiler, debugger, TCP/IP stack

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### Industrial Protocol Vendor Support

<table>
<thead>
<tr>
<th>Industrial Network Protocol</th>
<th>ColdFire Processors</th>
<th>PowerQUICC Processors</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFIdrive</td>
<td>IXXAT</td>
<td>IXXAT</td>
</tr>
<tr>
<td>EtherNet/IP</td>
<td>IXXAT</td>
<td>IXXAT</td>
</tr>
<tr>
<td>CIP Sync</td>
<td>IXXAT</td>
<td>IXXAT</td>
</tr>
<tr>
<td>Modbus-IDa</td>
<td>IXXAT</td>
<td>IXXAT</td>
</tr>
<tr>
<td>EtherCAT® Technology Group</td>
<td>IXXAT</td>
<td>IXXAT</td>
</tr>
<tr>
<td>CANopen</td>
<td>IXXAT</td>
<td>IXXAT</td>
</tr>
<tr>
<td>PROFIdrive® BUS</td>
<td>IXXAT</td>
<td>DoGav Systems</td>
</tr>
<tr>
<td>IEEE® 1588</td>
<td>IXXAT</td>
<td>IXXAT</td>
</tr>
<tr>
<td>Type</td>
<td>Title</td>
<td>Weblink</td>
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<td>--------------</td>
<td>----------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>CAN PHY</strong></td>
<td>Solutions</td>
<td><a href="http://www.freescale.com/webapp/sps/site/taxonomy.jsp?nodeId=01435940586393">http://www.freescale.com/webapp/sps/site/taxonomy.jsp?nodeId=01435940586393</a></td>
</tr>
<tr>
<td><strong>Demo</strong></td>
<td>ColdFire Processor Demo: M52259DEMOKIT</td>
<td><a href="http://www.freescale.com/coldfire">www.freescale.com/coldfire</a></td>
</tr>
<tr>
<td><strong>ColdFire</strong></td>
<td>processor development kit: M5234BCCKIT, M52259EVB</td>
<td><a href="http://www.freescale.com/coldfire">www.freescale.com/coldfire</a></td>
</tr>
<tr>
<td><strong>i.MX</strong></td>
<td>processors development kits: i.MX25PDK, i.MX35PDK</td>
<td><a href="http://www.freescale.com/imx">www.freescale.com/imx</a></td>
</tr>
<tr>
<td><strong>SW &amp;</strong></td>
<td>MFX Software Solutions for MCF5225x and future devices</td>
<td><a href="http://www.freescale.com/mqx">www.freescale.com/mqx</a></td>
</tr>
<tr>
<td><strong>Tools</strong></td>
<td>KITPROXIMITYEVM Proximity Sensing Software Evaluation Add-on Kits for MCUs</td>
<td><a href="http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=KITPROXIMITYEVM&amp;tid=mSDTfts">www.freescale.com/webapp/sps/site/prod_summary.jsp?code=KITPROXIMITYEVM&amp;tid=mSDTfts</a></td>
</tr>
<tr>
<td><strong>3rd Party</strong></td>
<td>IXXAT (IEEE 1588, CANopen, POWERLINK)</td>
<td><a href="http://www.ixxat.com">www.ixxat.com</a></td>
</tr>
<tr>
<td><strong>Solution</strong></td>
<td>Real-Time Automation (Modbus TCP, EtherNet/IP™, DeviceNet™)</td>
<td><a href="http://www.rtautomation.com">www.rtautomation.com</a></td>
</tr>
<tr>
<td><strong>National</strong></td>
<td>Semiconductor (Precision PHYTER® - 10/100 Ethernet PHY for IEEE 1588)</td>
<td><a href="http://www.national.com/analog/interface/ethernet">www.national.com/analog/interface/ethernet</a></td>
</tr>
<tr>
<td><strong>Green Hills</strong></td>
<td>safety-certified RTOS for PowerQUICC and ColdFire processors</td>
<td><a href="http://www.greenhills.com">www.greenhills.com</a></td>
</tr>
</tbody>
</table>
Additional Information

► Freescale:
  - Industrial segment – [www.freescale.com/industrial](http://www.freescale.com/industrial)
  - Industrial protocols – [www.freescale.com/connectivity](http://www.freescale.com/connectivity)
  - 8-bit microcontrollers – [www.freescale.com/8bit](http://www.freescale.com/8bit)
  - 16-bit DSC – [www.freescale.com/dsc](http://www.freescale.com/dsc)
  - 16-bit microcontrollers – [www.freescale.com/16bit](http://www.freescale.com/16bit)
  - Analog products – [www.freescale.com/analog](http://www.freescale.com/analog)

► Partners:
  - Real-time Automation (RTA): [www.rtautomation.com](http://www.rtautomation.com)
  - IXXAT: [www.ixxat.com](http://www.ixxat.com)
  - National Semiconductor: [www.ethernet.national.com](http://www.ethernet.national.com)
  - DoGav Systems Limited: [www.dogav.net](http://www.dogav.net)
Freescale Introduces Product Longevity Program

► The embedded market needs long-term product support, which allows OEMs to provide assurance to their customers

► Freescale has a longstanding track record of providing long-term production support for our products

► Freescale is pleased to introduce a formal product longevity program for the market segments we serve
  • For the automotive and medical segments, Freescale will manufacture select devices for a minimum period of 15 years
  • For all other market segments in which Freescale participates, Freescale will manufacture select devices for a minimum period of 10 years

► A list of applicable Freescale products is available at www.freescale.com
Summary

► Freescale aligns with Factory Automation market requirements

► Many devices support both legacy fieldbus and industrial Ethernet protocols
  ► PowerQUICC®, QorIQ™, mobileGT®, i.MX and ColdFire® processors
  ► Solutions, enablement and 3rd party protocol stacks available
    ► PROFIBUS, CANopen, DeviceNet™, Modbus RTU
    ► PROFINET, EtherNet/IP™, Modbus TCP, EtherCAT
    ► ZigBee®, WirelessHART™, ISA100.11a

► Rugged devices with long life and reliability
  ► Industrial products ship 10+ years, with high quality and strong customer support
  ► Processor performance from 80 to >3000 DMIPS, for fanless operation at -40C to 85C

► Energy Efficiency
  ► MPU <1 W max @ 400 DMIPS and <4 W max @ >1000 DMIPS, with power management
  ► DSC portfolio for cost-effective and efficient motor control

► Cost-effective safety and security on-chip
  ► Protect against IP cloning, network data hacking and soft errors
Thank you for attending this presentation. We’ll now take a few moments for the audience’s questions and then we’ll begin the question and answer session.