

Motor Control with Wireless Sensors

Overview

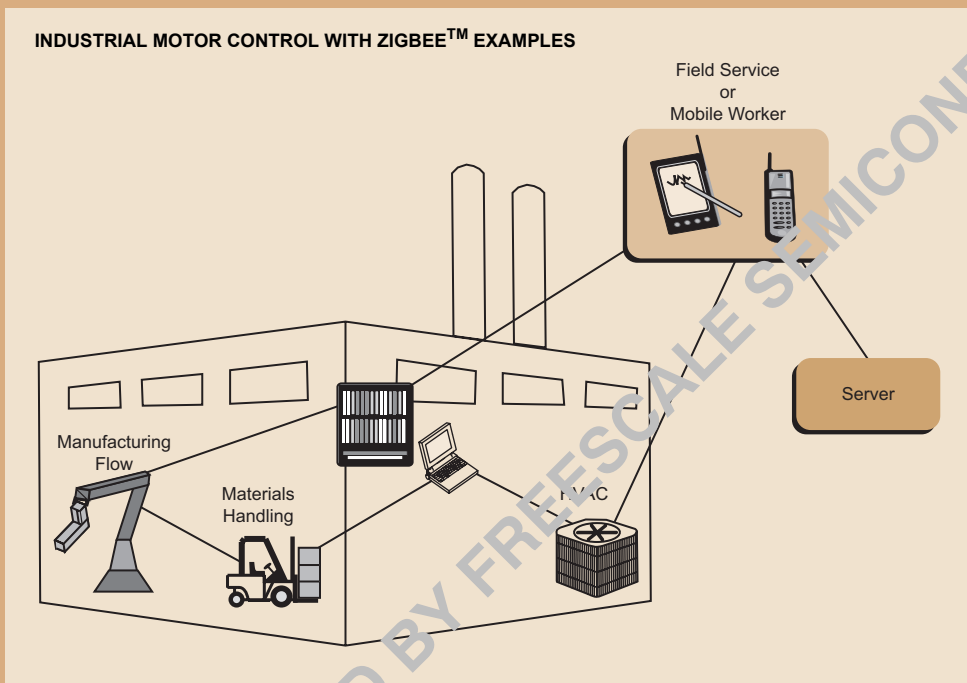
A single hybrid architecture device incorporating both a Microcontroller (MCU) and a Digital Signal Processor (DSP) offers the peripherals and processing power needed to control electrical motors, analog

sensors, and ZigBee™ transceivers. This powerful combination allows development of industrial motor control applications, which can be monitored wirelessly.

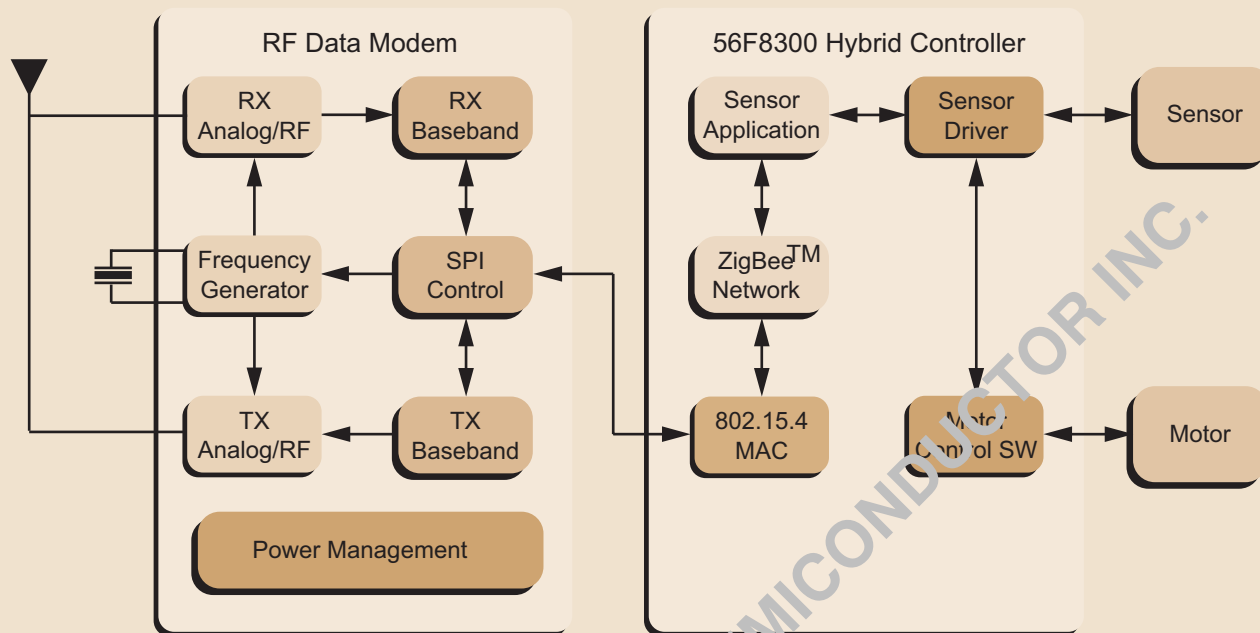
Key Benefits

- > Combines MCU functionality with DSP processing power
- > Complete Freescale Semiconductor solution for motor control, sensing, and wireless connectivity
- > Single-device solution controls motor, sensors, and wireless transceiver
- > Out-of-the-box software components designed to expedite time-to-market and reduce development costs

INDUSTRIAL MOTOR CONTROL WITH ZIGBEE™ EXAMPLES



56F8300 ZIGBEE™ EXAMPLE BLOCK DIAGRAM FOR SENSOR APPLICATION



Freescale Ordering Information

Part Number	Product Highlights	Additional Information
MC56F8323	60 MHz, 60 MIPS, 48KB Flash and 12KB RAM with 2 SPI, 2 SCI, 2 ADC, PWM, COP, PLL, Decoder, 2 Quad Timers, FlexCAN, an MCU-friendly instruction set, Enhanced OnCE for debug, on-chip relaxation oscillator, and temperature sensor.	Industrial (-40°C to 105°C) and Extended (-40°C to 125°C) Temperature Ranges with up to 27 GPIOs in a 64-pin LQFP
MC56F8123	40 MHz, 40 MIPS, 48KB Flash and 8KB RAM with 2 SPI, 2SCI, ADC, COP, PLL, 2 Quad Timers, an MCU-friendly instruction set, Enhanced OnCE for debug	Industrial (-40°C to 105°C) with up to 27 GPIOs in a 64-pin LQFP
MC56F801x Family	Up to 32 MHz, 32 MIPS, and up to 16KB Flash, 4KB Unified Data/Program RAM, EEPROM emulation capability, SCI with LIN, SPI, I ² C, ADC, PWM, GPIO, COP/ Watchdog, MCU-style software stack support, JTAG/OnCE for debug	www.freescale.com
MMA2260D	Integral Signal Conditioning, Linear Output, 2nd Order Bessel Filter, Calibrated Self-test, EPROM Parity Check Status, Transducer Hermetically Sealed, High Shock Survivability, and Sensing Direction is X-Axis.	Offered in a 16-pin SOIC
MC13192	ZigBee Transceiver	www.freescale.com ^{Note}
MMA1260D	Integral Signal Conditioning, Linear Output, 2nd Order Bessel Filter, Calibrated Self-test, EPROM Parity Check Status, Transducer Hermetically Sealed, High Shock Survivability, and Sensing Direction is Z-Axis.	Offered in a 16-pin SOIC

Note: Search on the listed part number.

Design Challenges

On the factory floor, in light industrial and commercial space, and even at home, opportunities for low-data-rate networks are plentiful. But potentially enormous savings in energy consumption and gains in operating efficiencies remain

unrealized because of the high cost of wired network solutions—and the fragmented nature of proprietary wireless solutions.

As new wireless standards try to address these issues, they tend to be software

intensive, and application developers will be faced with the choice of adding new processors to existing industrial applications to handle wireless communication processing overhead.

Freescale Semiconductor Solution

Freescale Semiconductor's wireless transceivers that support ZigBee technology help reduce development time for the Original Equipment Manufacturer (OEM), as well as offer reliability, security, interoperability and certification. Along with the Freescale Semiconductor 56F8300 series of hybrid controllers, which are used in industrial motor control applications, and which are more than capable of handling the additional overhead of ZigBee communication protocol stack, Freescale Semiconductor provides very cost competitive solution for wireless industrial motor control applications.

Freescale Semiconductor also has developed a family of sensors compatible with ZigBee technology.

Designers accustomed to creating wire line control networks will find it much easier to migrate to ZigBee technology by incorporating Freescale Semiconductor's acceleration and pressure sensors. Based on Micro-Electro Mechanical Systems (MEMS) technology, the sensors use standard OEM hardware interfaces.

The figure on page 2 illustrates a typical wireless industrial motor control application design utilizing a 56F8300 series hybrid controller. Using pre-developed and factory-tested motor control algorithms, which are included as part of the development tools, an application developer can control a wide range of electrical motors, from BLDC motors, to ACIM motors, to Stepper motors. Motor control application

feedback can be achieved either via the on-chip quadrature decoder (for speed feedback), or the on-chip ADC (for sensorless feedback), or utilizing external acceleration sensors, which can also provide motor alignment information. The status of this application can be passed to a central location wirelessly, using a ZigBee transceiver, which connects to the 56F8300 hybrid controller via the on-chip SPI interface.

The key to this wireless motor control design is the hybrid nature of the 56F8300 series of controllers, which can deploy DSP functionality for efficient control of an electrical motor and to manage sensor inputs, as well as MCU functionality to efficiently execute the ZigBee communication protocol stack.

Development Tools

Tool Type	Product Name	Vendor	Description
Software	CW568X	Freescale Semiconductor	CodeWarrior™ Development Studio for Freescale Semiconductor DSP56800/E Controllers (Metrowerks)
Hardware	MC56F8323EVM	Freescale Semiconductor	Demonstrates the abilities of the 56F8323 and provides a hardware tool allowing the development of applications that use the 56F8323.
Hardware	RD1986MMA2260D	Freescale Semiconductor	TRIAX demo board that combines many of the available demos for accelerometer applications.
Hardware	DEMO56F8013	Freescale Semiconductor	Demonstration kit for the 56F8013
Hardware	DEMO56F8014	Freescale Semiconductor	Demonstration kit for the 56F8014

Disclaimer

This document may not include all the details necessary to completely develop this design. It is provided as a reference only and is intended to demonstrate the variety of applications for the device.

Notes

ARCHIVED BY FREESCALE SEMICONDUCTOR INC.

Learn More: Contact the Technical Information Center at +1-800-521-6274 or +1-480-768-2130.
For more information about Freescale products, please visit www.freescale.com.

Freescale™ and the Freescale logo are trademarks of Freescale Semiconductor, Inc.
All other product or service names are the property of their respective owners.
© Freescale Semiconductor, Inc. 2005. All rights reserved.