Appliance manufacturers are facing numerous challenges in today’s ever-changing global market. Government regulations, customer expectations, competitive forces and application innovations are fueling the integration of new technologies into many appliances. Bringing these technology advancements to market can be even more challenging with shorter deadlines, the pressure to maintain and grow market share and the constant need to innovate. In addition, finding partners and technical solutions to enable these goals can be daunting and drain your resources.

Microchip Technology can help you implement the new features and functionality required for your next appliance design. By providing solutions for user interface, motor control, sensing, connectivity and more, your design teams can focus on implementing the application.

Microchip’s cost-effective tools enable your design to reach the market faster. Our free MPLAB® IDE Integrated Design Environment provides a single development platform for all of our 8-, 16- and 32-bit microcontrollers and 16-bit Digital Signal Controllers (DSCs). Microchip makes it easy to develop your code and migrate to higher performance solutions as needed. Learning curves are minimized even when changing cores due to feature creep, code size increase or the need for more computing power.

Application Design Centers
Please visit one of our on-line design centers for complete technical resources including circuit diagrams, application notes, eLearning, development tools, recommended products and device samples.

www.microchip.com/designcenters

- mTouch™ Sensing Solutions
- QVGA Graphics
- Segmented LCD
- Audio & Speech
- Motor Control
- Connectivity
- Lighting
- And more...

Small package options from Microchip can help reduce your board size and minimize your development costs.

www.microchip.com/appliance
Enabling the user to communicate and interface with your appliance is critical to its functionality and value. Today consumers are demanding the same sleek and intuitive interfaces in their appliances as those found in various high-end consumer electronics. Ensuring the safe and correct usage of the appliance by the end user is also a factor in creating an appropriate user interface.

Microchip can assist with a broad range of microcontrollers that help integrate functions such as LCD display, touch screens, capacitive and inductive (touch through metal) touch buttons, audio feedback and LED lighting. We offer many complete turnkey solutions along with extensive free technical resources which help minimize design time and reduce development costs.

Let us show you how our unique technologies can help differentiate your product from the competition. Innovations such as our Inductive Touch technology enable distinctive user interfaces that make appliances more appealing and easier to use, with improved quality and reliability.

**Capacitive Touch**

**Inductive Touch**

**Segmented LCD Display**

**QVGA Graphics Display**

**Audio & Speech**

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This demonstration unit showcases the capability of a 16-bit PIC24 MCU controlling inductive and capacitive touch sensing, in addition to QVGA, USB and ZigBee® technology. Request a demonstration of our human interface solutions by contacting your local Microchip sales office.
The need for advanced motor control continues to increase due to user expectations for quiet operation and expanding government regulations to reduce energy consumption. To achieve these goals, motors require a much higher level of electronic control.

Microchip offers a wide array of motor control solutions to meet the needs of your motor configuration and functionality. These include our low pin count 8-bit PIC16 microcontrollers, high-performance 8-bit PIC18 family and 16-bit dsPIC® digital signal controllers which offer highly optimized motor control solutions. Our software libraries and routines help develop your application and empower your engineering team. We also offer extensive motor control expertise and technical support through our field application engineers, motor control teams and a dedicated Home Appliance Solutions Group applications team.

**FOC Sensorless PMSM or ACIM**

Are you looking for top-of-the-line dynamic torque response and efficiency, and the lowest system cost motor control solution? Download Microchip’s sensorless field-oriented control application notes AN1078 (PMSM) and AN1162 (ACIM). The dsPIC DSC provides a very cost effective solution to this complex algorithm.

The dsPIC DSC’s 10-bit A/D module samples the motor voltage and currents. Clarke and Park transformations convert the A/D information to feed two PI loops controlling torque and flux. Motor speed and position are determined by an estimator which models the motor. The outputs of the PI loops are transformed using Space Vector Modulation to control the Motor Control PWM Module’s outputs. Sinusoidal (180°) outputs provide smoother, quieter motor operation.

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**Getting Started**

Visit the Motor Control Design Center to access these resources and many more at: [www.microchip.com/motor](http://www.microchip.com/motor)

**Application Notes**

- AN895 Brush DC (BLDC) Motor Fundamentals
- AN887 AC Induction Motor Fundamentals
- AN893 Low-Cost Bidirectional Brushed DC Motor Control Using the PIC16F684
- AN901 Using the dsPIC30F & dsPIC33F DSCs for Sensorless BLDC Control
- AN908 Using the dsPIC30F/ dsPIC33F for Vector Control of an ACIM
- AN992 Sensorless BLDC Motor Control Using dsPIC30F2010
- AN1017 Sinusoidal Control of PMSM Motors with dsPIC30F/dsPIC33F DSC
- AN1078 Sensorless Field Oriented Control of PMSM Motors using dsPIC30F or dsPIC33F Digital Signal Controllers
- AN1083 Sensorless BLDC Control with Back EMF Filtering
- AN1106 Power Factor Correction in Power Conversion Applications Using the dsPIC® DSC
- AN1208 Integrated Power Factor Correction (PFC) and Sensorless Field Oriented Control (FOC) System

Additional application notes available at: [www.microchip.com/appnotes](http://www.microchip.com/appnotes)

**Web Seminars**

- Sensorless BLDC Motor Control Using a Majority Function
- Sensorless Field Oriented (FOC) Control for AC Induction Motors
- Sensorless Field Oriented Control for PMSM
- [www.microchip.com/webseminars](http://www.microchip.com/webseminars)

**Regional Training Center Classes**

- MCT0301  BLDC Motor Control Workshop Using dsPIC® DSCs
- [www.microchip.com/rtc](http://www.microchip.com/rtc)
Connectivity

Consumers today want appliances that have more features and functionality, including the ability to communicate with other systems. Many products inside the home are becoming more connected, providing owners with enhanced user experiences. Whether you are considering wired or wireless connectivity, Microchip supports a wide variety of communications protocols with extensive design resources and software libraries.

Microchip addresses the growing demand for a small, low-cost embedded Ethernet solution with the ENC28J60 device and the PIC18F97J60 family, which are IEEE 802.3 compliant and fully compatible with 10/100 Base-T networks. Microchip's Ethernet solution also includes a free and robust TCP/IP stack and a broad range of development tools to enhance the user’s experience. Microchip's TCP/IP stack is optimized for the PIC18, PIC24 and PIC32 microcontroller and DSC families.

Microchip’s MRF24J40MA is an IEEE 802.15.4™ RF transceiver module developed specifically for Microchip PIC® microcontroller customers. The MRF24J40MA module operates in the non-licensed 2.4 GHz frequency band and is FCC, IC and ETSI certified. The integrated module design frees the integrator from extensive RF and antenna design and regulatory compliance testing, allowing quicker time to market. Connect via a simple 4-wire SPI interface and the system is wirelessly enabled.

Getting Started
Visit the Connectivity Design Center to access these resources and much more at: www.microchip.com/connectivity

Application Notes
AN1232 Microchip ZigBee® 2006 Protocol Stack
AN1066 MiWi™ Wireless Networking Protocol Stack
AN1204 Microchip MiWi P2P Wireless Protocol
AN1192 MRF24J40 Radio Driver
AN833 Microchip TCP/IP Stack Application Note
AN731 Embedding PIC® MCUs in the Internet
AN1120 Ethernet Theory of Operation
AN724 Using PIC® MCUs to Connect to Internet via PPP
AN236 X.10 Home Automation using the PIC16F877A

Additional application notes available at: www.microchip.com/appnotes

Web Seminars
TCP/IP Networking Parts 1, 2 and 3
Embedded Ethernet Made Easy
www.microchip.com/webseminars

Regional Training Center Classes
270TCP1 Overview of Ethernet and TCP/IP Connectivity Solutions
COM4201 Designing TCP/IP Monitor and Control Application
www.microchip.com/rtc

Microchip’s MRF24J40MA is an IEEE 802.15.4™ RF transceiver module developed specifically for Microchip PIC® microcontroller customers. The MRF24J40MA module operates in the non-licensed 2.4 GHz frequency band and is FCC, IC and ETSI certified. The integrated module design frees the integrator from extensive RF and antenna design and regulatory compliance testing, allowing quicker time to market. Connect via a simple 4-wire SPI interface and the system is wirelessly enabled.

www.microchip.com/connectivity
Sensors

While nearly all of Microchip’s microcontrollers and DSCs can be utilized in sensor applications, sometimes only a simple microcontroller is necessary when placed at or near a remote sensor. If just a few I/Os are necessary, our cost-effective 6-, 8- and 14-pin microcontrollers can be utilized. Because of their cost and size advantages, these devices have been designed into many applications that would not normally consider embedded control.

Serialization of an Analog Sensor

[Image of an analog sensor diagram]

In addition to providing microcontrollers and DSCs for sensor applications, Microchip offers a broad portfolio of thermal management products, including logic output, voltage output and serial output temperature sensors. These products allow you to implement the device that best meets your application requirements. Key features include high accuracy, low power, extended temperature range and small packages.

Getting Started

Application Notes
- AN929 Temperature Measurement Circuits for Embedded Applications
- AN1001 IC Temperature Sensor Accuracy Compensation with a PIC® Microcontroller
- AN1016 Detecting Small Capacitive Sensors Using the MCP6291 and PIC16F690 Devices

Additional application notes available at: www.microchip.com/appnotes

Web Seminars
- PIC10F Development Tools: Small Tools For Small Parts
- Control the World with the World’s Smallest Microcontrollers
- Hardware Conditioning of Sensor Signals
- Selecting the Ideal Temperature Sensor

www.microchip.com/webseminars

Regional Training Center Classes
- ASP2201 Analog Sensor Conditioning in Embedded Systems

www.microchip.com/rtc

Common Methods of Interfacing a Sensor

[Image of sensor interfacing diagram]
Support
Microchip is committed to supporting its customers in developing products faster and more efficiently. We maintain a worldwide network of field applications engineers and technical support ready to provide product and system assistance. In addition, the following service areas are available at www.microchip.com:

- **Support** link provides a way to get questions answered fast: [http://support.microchip.com](http://support.microchip.com)
- **Sample** link offers evaluation samples of any Microchip device: [http://sample.microchip.com](http://sample.microchip.com)
- **Forum** link provides access to knowledge base and peer help: [http://forum.microchip.com](http://forum.microchip.com)
- **Buy** link provides locations of Microchip Sales Channel Partners: [www.microchip.com/sales](http://www.microchip.com/sales)

Training
If additional training interests you, then Microchip can help. We continue to expand our technical training options, offering a growing list of courses and in-depth curriculum locally, as well as significant online resources – whenever you want to use them.

- Regional Training Centers: [www.microchip.com/rtc](http://www.microchip.com/rtc)
- MASTERs Conferences: [www.microchip.com/masters](http://www.microchip.com/masters)
- Worldwide Seminars: [www.microchip.com/seminars](http://www.microchip.com/seminars)
- eLearning: [www.microchip.com/webseminars](http://www.microchip.com/webseminars)
- Resources from our Distribution and Third Party Partners: [www.microchip.com/training](http://www.microchip.com/training)

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