MICRO SOLUTIONS
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MAR/APR 2018

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contents

Employees Are Our Greatest Strength

Every issue of MicroSolutions gives you a window into the latest products and technologies at Microchip and, we hope, provides you with some inspiration and the information you need to develop some amazing applications. But did you know that, behind the scenes, there is a continually growing and evolving global team that is committed to supporting thousands of diverse customer applications using our solutions?

We believe that our customers benefit greatly from Microchip's unique company culture, which is defined by our Guiding Values. One of these values is that "Customers are Our Focus." Other values emphasize quality, continuous improvement, cycle time optimization, professional ethics and communication. As a result, employees around the world are focused on serving our customers while working in unison to achieve the company's goals of quality, profits and technological advancements. That is why "Employees Are Our Greatest Strength" is another one of our Guiding Values.

Microchip's emphasis on employee development and empowerment, as well as its pledge to foster a positive employee environment, has lead the company to be recognized year after year as a top place to work in a number of locations where we have offices. Microchip also provides internship opportunities for students who are enrolled in accredited academic programs and actively recruits new college graduates who have the skills and enthusiasm to embark on their careers with us.

This means that you will find a dedicated team behind the Microchip brand that is working to fulfill our vision to be the very best embedded control solutions company ever. Our unified goal is to provide you with timely, innovative, reliable and cost-effective products and the support that you need to bring your innovative designs to life.

As always, we would be happy to get your feedback on MicroSolutions. Feel free to email us at **MSFeedback@microchip.com**.

Microchip Technology Inc.
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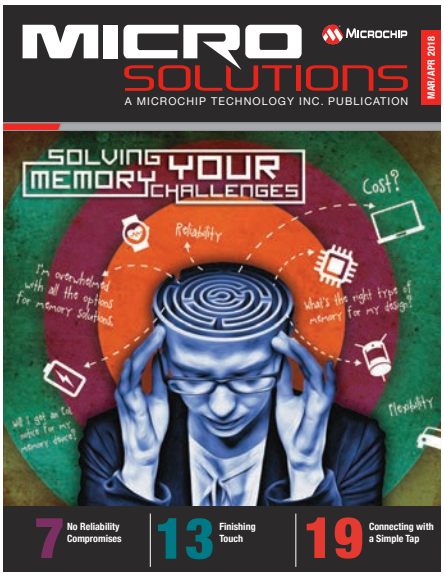

Don't Miss the Next Issue of MicroSolutions

Published six times a year, MicroSolutions is a valuable resource for product and technology news about Microchip's innovative solutions. Subscribe today to receive email notifications when each new issue of MicroSolutions is ready. Use the link below:

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SOLVING YOUR MEMORY CHALLENGES

How Can You Select the Right Type of Memory and Vendor for Your Design?

Microchip's Memory Portfolio Offers Reliable Products, Reliable Support and a Reliable Supply Throughout Your Product's Lifecycle

At the heart of many of the electronic products and systems that we use every day is some sort of memory product. Virtually every consumer, communication, computing, automotive and medical device requires some type of memory to store software code and parametric or other data. Picking the best memory option for your design can be a mind-boggling and time-consuming process. And, there are plenty of manufacturers of memory devices out there vying for your business by promising you low prices. But many a design engineer has learned the hard way that saving a few cents per device isn't worth the risk of designing in an unreliable memory device that may fail sometime during a product's lifetime. Or, they design in a product only to have it appear later in an End-of-Life notification from their vendor.

(continued on page 5)

So, how do you get started with solving your memory challenges? First of all, maybe you need some guidance on selecting the right type of memory for your design. Here is a quick overview of the types of memory products that Microchip offers in our extensive portfolio. You can use the links that are embedded in each description to click through to our website, where you will find more details about specific devices and helpful resources to assist you in zeroing in on a memory device that will best meet your requirements.

Serial EEPROM

Serial EEPROMs are low-power, nonvolatile memory devices with wide operating ranges, small sizes and byte alterability, making them ideal for data and program storage. There are versions for use with the I²C, UNI/O®, Microwire, SPI and Single-Wire buses. The Serial EEPROM family includes some specialty products or features: EUI-48™/EUI-64™ MAC address chips, software write protection, I²C and SPI EEPROMs with options ranging from –55°C to 150°C, and EEPROMs that are pre-programmed with serial numbers and unique IDs.

Our serial EEPROMs can be written more than one million times and retain data for over 200 years. They are available in a wide variety of tiny, innovative packages to help save board space, minimize size and reduce costs in designs like sensors, hearing aids, medical disposables and other space-constrained applications.

With their innovative low-power designs and our extensive testing, our serial EEPROMs offer industry-leading endurance and best-in-class quality. This new video gives you an overview of our EEPROM Triple Test, a process we have developed to ensure that we deliver products with the lowest failure rate in the market.

Watch this video describing Microchip's Triple Test process.

Serial EERAM

EERAM is a nonvolatile SRAM with a shadow EEPROM backup, all in a single, low-cost, low-power chip. The EERAM uses a small external capacitor to provide the necessary energy to automatically store the contents of the SRAM onto the EEPROM when system power is lost. Unlike NVSRAM, EERAM does not require an external battery. Combining the reliability of an EEPROM with the performance of an SRAM, EERAM also offers unlimited read and write cycles to the memory. It is well suited for applications that need to constantly update data and that need to reliably preserve data on power down or during an inadvertent loss of power.

Serial SRAM and Serial NVSRAM

If you need an easy and inexpensive way to add more RAM to your application, then our 8-pin, SPI-compatible **Serial SRAM and Serial NVSRAM** devices are good options. Our Serial SRAM products are standalone volatile memory devices that use less power and fewer I/O connections than parallel SRAM. They allow you to use a smaller microcontroller (MCU) in your design rather than moving to a larger MCU just to get more on-board RAM. Our serial NVSRAMs have unlimited endurance and zero nonvolatile write times via an external battery. These devices support unlimited instantaneous writes to the memory array and are ideal for applications like meters, data loggers, data recorders and black boxes that need to write very often to memory.

NOR Serial and Parallel Flash

Our **SuperFlash®** technology is an innovative, highly reliable and versatile type of NOR Flash memory. This technology's split-gate cell architecture uses a robust thick-oxide process that requires fewer mask steps, resulting in a lower-cost nonvolatile memory solution with extremely fast erase time, excellent data retention and higher reliability. We offer both serial and parallel Flash memory products. You can choose from our 25 Series of Serial SPI Flash devices or 26 Series of Serial Quad I/O™ (SQI™) Flash devices. If you need a parallel Flash device, we offer our 39 Series of Multi-Purpose Flash (MPF) and Multi-Purpose Flash Plus (MPF+) products and our 38 Series of Advanced Multi-Purpose Flash Plus (Advanced MPF+) products.

Parallel EEPROM

Parallel EEPROMs enable stored data to be updated byte-by-byte or by full sector for design flexibility and offer faster read times than serial interface protocols. Our portfolio

(continued on page 6)

of parallel EEPROMs includes a selection of densities (from 64 Kbits to 1 Mbit), operating voltages and package types. Our Battery-Voltage (2.7V), low-voltage (3V) and 5V devices are used extensively across a broad spectrum of products, including telecommunications, avionics and military applications.

One-Time Programmable EPROMs

One-Time Programmable (OTP) EPROMs are widely used for embedded code storage in applications like cordless phones, video game players, printers, graphics cards, instrumentation, automotive, medical devices, telecommunications, networking, industrial control equipment and hard disk drives. We have one of the broadest portfolios of parallel OTP EPROMs, with 5V, 3V and Battery-Voltage (2.7V) options, densities ranging from 256 Kbits to 8 Mbits, speeds as fast as 45 ns and a variety of packages including PDIP and PLCC.

CryptoMemory® ICs

If security is your concern, our **CryptoMemory** family of ICs offers cost-efficient, high-security EEPROMs and host-side security for applications requiring comprehensive data protection, including mutual authentication between devices and host. CryptoMemory ICs include a 64-bit embedded hardware encryption engine, four sets of non-readable 64-bit authentication keys and four sets of non-readable 64-bit session encryption keys. This provides you with a truly secure means of preventing product counterfeiting and piracy. Devices are available in a range of memory densities and are easy to implement in a variety of applications.

Design Resources

When you visit our **Memory Design Center**, you will find comprehensive information about all of our memory products, including links to specific devices and their datasheets. In many cases, the application notes and technical briefs that we offer will point you directly to the part you should use.

Our **MemoryLink Product Selection Tool** is an excellent discovery tool that provides a comprehensive overview of all of our memory products and supporting development boards. This interactive PDF can be downloaded and then opened in a PDF viewer so that you can use the embedded links to quickly navigate to product-specific information.

You can also learn about some helpful development tools, like our free **Total Endurance™ Software Model** for use with our serial EEPROMs. As the only tool of its kind, this software provide a user-friendly interface that enables you to enter your application's operating conditions into an advanced mathematical model, which will then predict the endurance and reliability of your selected serial EEPROM within that environment.

We also offer some web seminars about memory topics that you may find educational, or to get high-level, industry-insider information on some memory technology topics, you can watch our **"What Is…?"** series of videos on YouTube.

Partnering with Microchip

We know that you have many options when it comes to selecting a vendor for memory devices. Our goal is to partner with you to reduce your design risk, save you money and help you bring your product quickly and successfully to market. We are here to help throughout the lifecycle of your product by offering you reliable products, reliable support and a reliable supply. You can leverage our many years of experience and leadership in providing memory products and our commitment to exceptional quality to be confident that you will get the right solution for your latest design. And, when other suppliers are issuing End-of-Life notices for their memory products, Microchip's client-driven obsolescence policy ensures that, until you decide you no longer need a product, we will continue to supply it.

If you are overwhelmed with all the options for memory solutions, contact your local **Microchip Sales Office** and discuss your requirements with one of the members of our knowledgeable sales staff or Field Applications Engineers (FAEs). They will be happy to help guide you through the process of selecting a product that will turn your toughest memory challenge into a successful design.

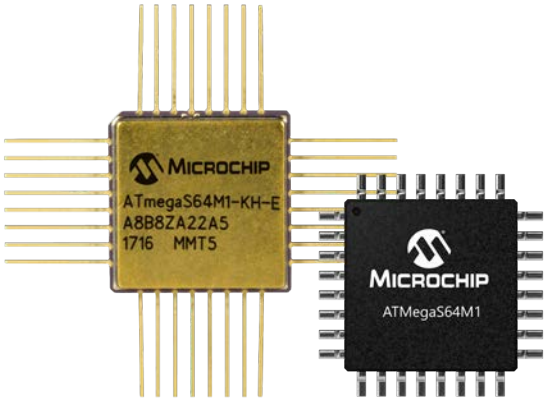
Want More Information?

Visit the website at:

www.microchip.com/memory

No Reliability Compromises

ATmegaS64M1 Microcontroller Decreases Time to Market and Cost for the NewSpace Market



Allows Designers to Begin Application Development with a Commercial Device Before Moving to a Radiation-Tolerant Version

To survive multi-year missions in a harsh environment, space applications require the highest level of reliability. Historically, this meant that developers of radiation-hardened systems faced long lead times and high costs. Today's NewSpace and other critical aerospace applications require solutions that enable faster development and reduced costs. To meet these needs, Microchip now offers a new microcontroller (MCU) that combines specified radiation performance with low-cost development associated with Commercial Off-The-Shelf (COTS) devices.

The **ATmegaS64M1** is the second 8-bit megaAVR® MCU from Microchip that uses a development approach called COTS-to-radiation-tolerant. This approach takes a proven automotive-qualified device—the ATmega64M1 in this case—and creates pinout-compatible versions in both high-reliability plastic and space-grade ceramic packages. These devices are designed to meet radiation tolerances with the following targeted performances:

The ATmegaS64M1 enables faster development and reduced costs for the NewSpace market.

- Fully immune from Single-Event Latchup (SEL) up to 62 MeV.cm²/mg
- No Single-Event Functional Interrupts (SEFI) that secure memory integrity
- Accumulated Total Ionizing Dose (TID) between 20 to 50 Krad(Si)
- Single Event Upset (SEU) characterization for all functional blocks

This new device joins the ATmegaS128, a radiation-tolerant MCU that has already been designed into several critical space missions including a Mars exploration plus a megaconstellation of several hundred Low Earth Orbit (LEO) satellites.

> The COTS-to-radiation-tolerant approach results in a no-compromise, space-grade component.

The ATmega64M1 COTS device, along with its full development toolchain that includes development kits and a code configurator, can be used to begin development of hardware, firmware and software. When the final system is ready for the prototype phase or production, the COTS device can be replaced with a pinout compatible, radiation-tolerant version in a 32-lead ceramic package (QFP32) with the same functionality as the

(continued on page 8)

original device. This leads to significant cost savings while also reducing development time and risk.

This COTS-to-radiation-tolerant approach results in a no-compromise, space-grade component and not merely an up-screened or enhanced device that is targeted to the aerospace industry. The ATmegaS64M1 meets the high operating temperature range of –55° C to +125° C. It is the first COTS-to-radiation-tolerant MCU to combine a Controller Area Network (CAN) bus, Digital-to-Analog Converter (DAC) and motor control capabilities. These features make it ideal for a variety of subsystems like remote terminal controllers and data handling functions for satellites, constellations, launchers or critical avionic applications.

Development Support

To ease the design process and accelerate time to market, the **STK600 Starter Kit** (ATSTK600) is a complete development board for the ATmegaS64M1. It offers advanced features for prototyping and testing new designs and is supported by **Atmel Studio Integrated Development Environment** (IDE) for developing, debugging and software libraries.

The ATmegaS64M1 family of devices is available in four derivatives:

- ATmegaS64M1-KH-E in ceramic prototype QFP32 package
- ATmegaS64M1-KH-MQ, ceramic space-grade QFP32 package, QMLQ qualified
- ATmegaS64M1-KH-SV, ceramic space-grade QFP32 package, QMLV qualified
- ATmegaS64M1-MD-HP in plastic QFP32 package, AQEC high-reliability qualified for volume programs

For additional information, pricing or to purchase products, contact any **Microchip sales representative or authorized local distributor**.

Want More Information?

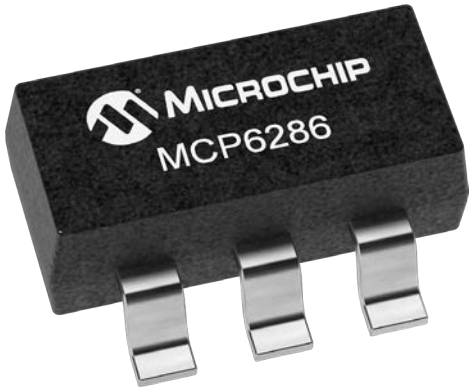
Visit the website at:

www.microchip.com/ATmegaS64M1

FEATURED PRODUCT

Standing Out in the Crowd

An Operational Amplifier for Single-Supply, Low-Noise, Battery-Powered Applications



MCP6286 Offers Combination of Features to Meet Many of Today's Applications

System designers have many choices when it comes to selecting operational amplifiers (op amps). Manufacturers offer a huge variety of op amps specializing in high speed, low power, high precision, low input leakage, low noise or high output drive, just to name a few possible options. However, most applications that are being designed today require some combination of these features, and that's how the MCP6286 stands out in the crowd.

The **MCP6286** single op amp offers low noise (5.4 nV/√Hz) and low power (540 µA typical) with a gain bandwidth product of 3.5 MHz, all in a 5-pin SOT-23 package. Are there lower-noise amplifiers on the market? Yep. Are there lower-power amplifiers on the market? You bet. But for applications that require a low-noise amplifier and need to be power conscious, the MCP6286 offers a best-in-class solution.

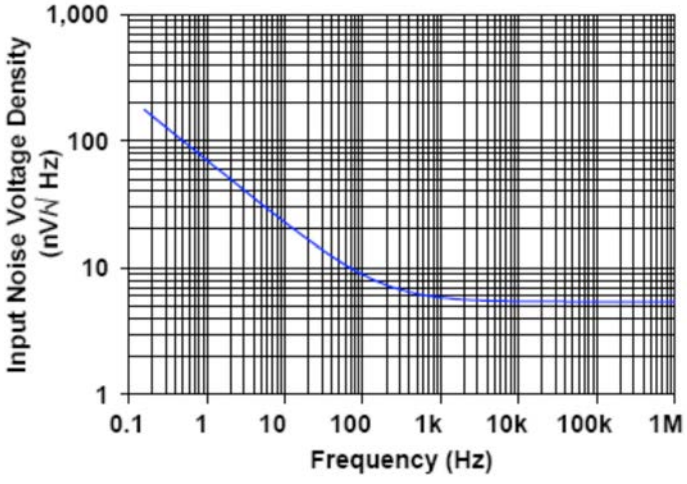
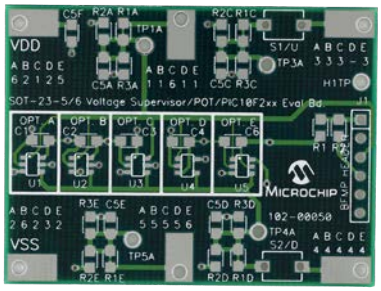


Figure 1: MCP6286 Input Noise Voltage Density vs. Frequency

These features make the MCP6286 well suited for single-supply, low-noise, battery-powered applications, such as noise-canceling headphones or a microphone pre-amp on portable devices. In either application, noise is a critical specification. An easy way to get a lower-noise design is for the amplifier to simply consume more current in the input stage. But wait. Portable audio devices or noise-canceling headphones are battery powered, which means that the system designer for these types of products has a really tight power budget. This makes a low-power amplifier a must, which is where the MCP6286 comes into play.



When you select the MCP6286 for your design, we offer a blank PCB that makes evaluating the MCP6286 a snap. The **Voltage Supervisor SOT23-5/6 Evaluation Board** (VSUPEV2) offers test point connections for each pin, along with pads for supporting passive components such as power supply filtering, output filtering and bypass capacitors. This solution will speed up your development time so that you can get your product to market more quickly.

The MCP6826 can be purchased from **microchipDIRECT** or from **Microchip's worldwide distribution network**. For more information on the MCP6286 operational amplifier, visit the **MCP6286 product page**.

NEW TOOL

In a Heartbeat

New Medical Customer Engagement Demo Design Eases Development of Portable or Wearable Electrocardiogram Devices

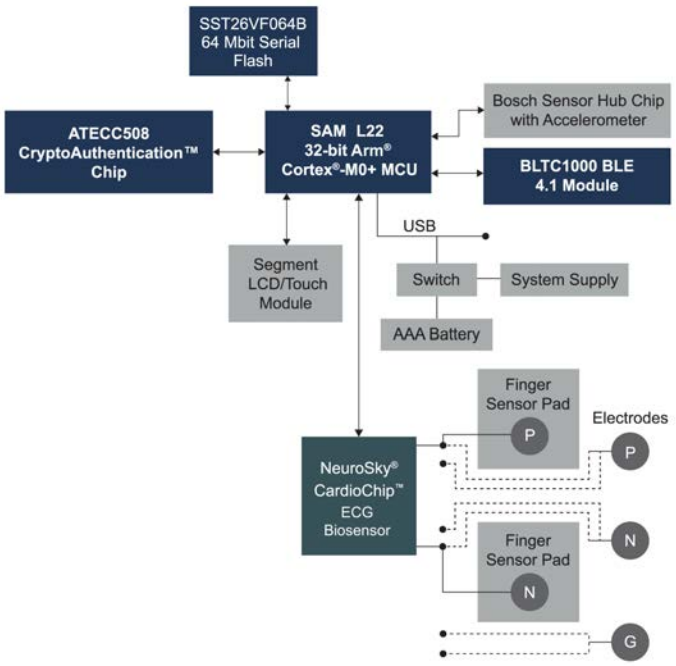
Combines Some Powerful Technology for Designing Remote Patient Monitoring and Diagnostic Systems

Electrocardiography (ECG) provides doctors and other healthcare providers with helpful insight into how well a human heart is performing. The ability to measure cardiac health and performance is becoming an essential requirement for many medical device designs as well as a key feature in a variety of fitness applications. With the rapid expansion of the Internet of Things (IoT), the medical community is also looking for remote patient monitoring solutions, including wearable ECG devices, to help reduce healthcare delivery costs while making healthcare more accessible to patients who might not be able to travel to their doctor's office, a clinic or a hospital.

If you are considering developing a portable or wearable ECG design that connects to the IoT, our new **Connected Wearable ECG Demo** combines some powerful technology to speed the development of remote patient monitoring and diagnostic systems as well as advanced fitness tracking devices*. The demo is powered by a high-performance, 32-bit Arm® Cortex®-M0+ based **SAM L22** microcontroller (MCU) with ultra-low-power technology. To implement a solution for the IoT, an **ATBTLC1000** Bluetooth® Low Energy (BLE) 4.1 module allows the demo to wirelessly communicate with devices like tablets, smartphones or PCs. Since securing patient data and preventing attacks by hackers is essential, the design also includes the **ATECC508A** crypto element that employs ultra-secure hardware-based key storage and cryptographic countermeasures that are more secure than software-based key storage.

Powered by a single AAA battery, this demonstration platform uses the ECG method of measuring heart rate, which can give a better picture of overall cardiac health than other methods.

The ECG data is detected and processed by a **NeuroSky® CardioChip™ ECG Biosensor.** The demo measures heart rate and computes heart rate variability, heart age and stress using the ECG data. Patient movement is also tracked via an on-board accelerometer. The demo can be used with standard ECG leads as well as with the sensor pads that are supplied. The Connected Wearable ECG Demo can also be used as a development platform for devices that offer more advanced ECG measurements. NeuroSky can assist with developing advanced ECG algorithms.



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Due to its high level of integration, this reference design offers a low overall BOM cost. To help you get started with your wearable ECG design, we offer a user guide, schematics and 'C' source code that can be downloaded for free from the **Connected Wearable ECG Demo** page on our website. If you would like to see a working demonstration of this reference design or have any questions about it, please contact your local **Microchip Sales Representative**.

NEW TOOL

**Microchip medical reference designs and demos are intended for evaluation and development purposes only. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use.*

How Can You Improve Security in Your IoT Devices?

Click on the play symbol to listen to a Google-hosted webinar where Nicolas Schieli from Microchip and Antony Passemard from Google Cloud IoT Core discuss how to use the ATECC608A to implement a hardware root of trust to isolate private keys and protect against side channel attacks.

NEW SOFTWARE

Serving Up Power Savings

PAC1934 Linux® Driver Provides Support for Web Servers, Navigation, Networking and Infotainment Applications

Actively Measure Power in Emerging Linux-Based Designs to Save Overall System Power

When people hear "server," they tend to think of hardware from companies like HP, Dell and Microsoft, but they do not always associate it with the Linux® operating system (OS). But did you know that UNIX® and UNIX-like operating systems power 67% of all web servers, and at least half of these devices run on Linux?

Starting as early as 2002, companies started to look to Linux for system solutions. Some of the appeal was motivated by the open-source nature of these solutions. These continually emerging server applications are running from multiple voltages and need power management. So, what makes our **PAC1934** four-channel DC power/energy monitor IC uniquely suited for these systems? Doing a cursory search, you'll discover that there are very few multi-rail monitors for power ICs. The PAC1934, with its wide dynamic measurement range, is a perfect fit for a multi-voltage rail system. As a result, the PAC1934 Linux driver may be serving up your Internet soon.

To transition from Internet traffic to data traffic, there are server applications that support networking and telecommunication systems. Communications systems developers, like other embedded designers, desire both network throughput and deterministic response to activities. Embedded Linux provides both these benefits. Therefore, whether the goal is to manage web traffic or data traffic, the PAC1934 power monitor with a Linux driver is a natural fit for networking and telecom systems.

Many of our data traffic customers are looking for a solution to actively measure DC power to reduce power consumption in their systems. Using a PAC1934 to actively measure power enables a low power load to be treated differently from a high one, resulting in overall power savings in networking traffic.

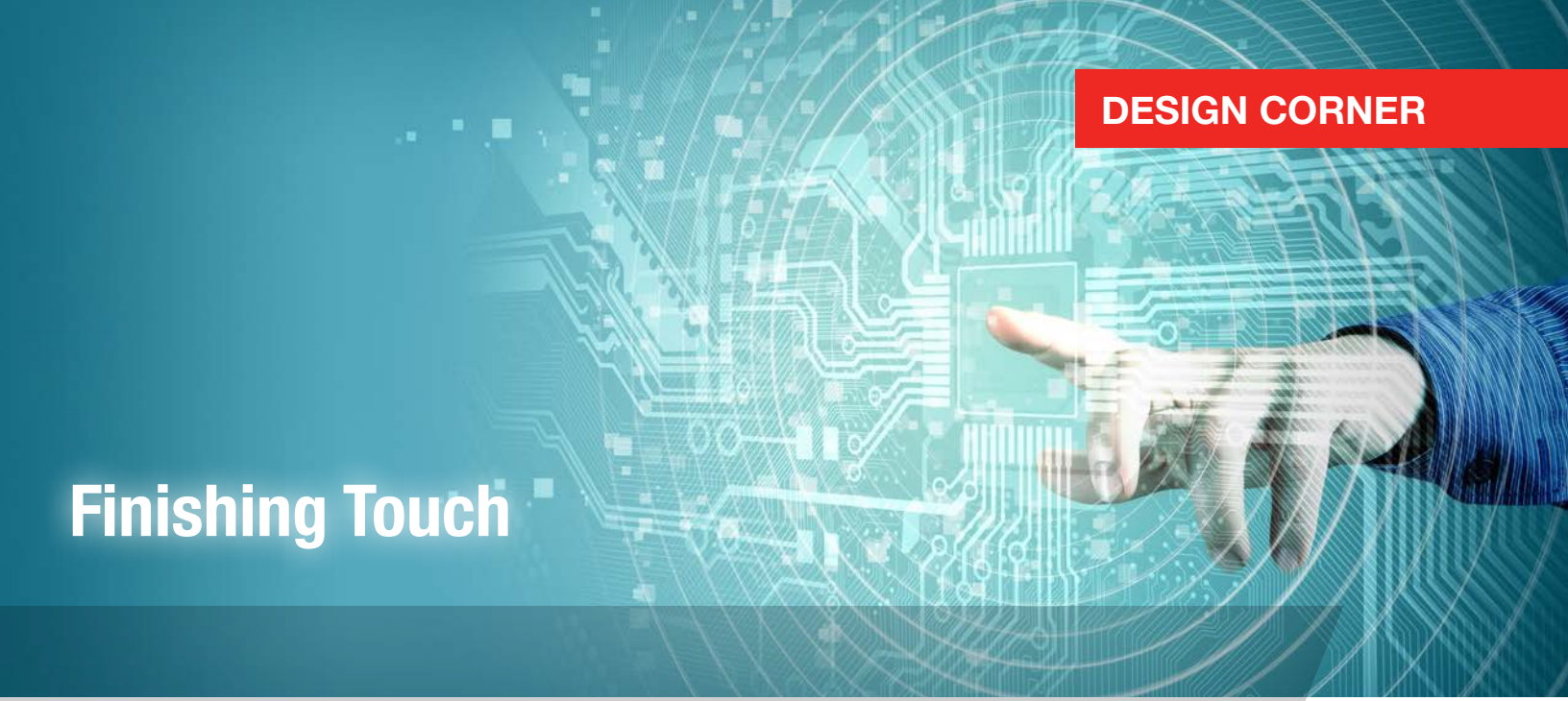
But helping to efficiently manage information traffic is not all that the PAC1934 can do. It also has an important role in automotive navigation and infotainment applications. Hidden in most modern car dashboards is a Linux operating system that consists of an ASIC, SoC or microprocessor-based system. Many of these systems, in fact, already interact with touchscreens that use our maXTouch® touchscreen controllers. Since these systems need power measurement, either for USB Type-C™ connector charging or for system management, the PAC1934 and its Linux driver are a perfect fit. This is especially true for hybrid and electric vehicles, where power monitoring is essential.

So, whether you are working on a Linux-based server application, an automotive navigation or infotainment solution or some other system that needs accurate DC power monitoring, check out the PAC1934 and its new Linux driver.

Want More Information?

Visit the website at:

www.microchip.com/PAC1934



Finishing Touch

Development Tools for Microchip Touch Solutions Ease Design and Speed Your Time to Market

In the "Accelerate Your Touch Design" article that appeared in the **January/February 2018 edition of MicroSolutions**, we discussed how Microchip's code configurators for PIC®, AVR® and SAM microcontrollers (MCUs) speed up the design of touch applications. To keep you on the fast track to launching a successful—and profitable—touch design, Microchip offers an extensive selection of touch development kits, design guides, example projects and more. We are continuously adding new touch development kits to provide you with easy access to our latest touch technology.

Turnkey Touch Products

Our wide selection of **turnkey touch products** delivers an out-of-the-box touch experience without any need for complicated programming. A turnkey touch solution is usually the fastest way to add touch to your user interface, streamlining and speeding the path to generating revenue with your product. Select solutions from these families of products:

MTCH10x	CAP1xx	AT42QTxxx
• 1 to 8 sensing channels • Digital output • Water-tolerant touch • Simple tuning process • Direct button replacement	• 3 to 14 sensing channels • I²C interface • Water-tolerant touch • LED driver—high-resolution PWM	• 1 to 64 sensing channels • UART/SPI/I²C interface • EN/IEC 60730 certification on AT42QT1481 and others

These development kits are available for our families of turnkey touch solutions:

MTCH10x Evaluation Board *(DM160229)*

CAP1188 Evaluation Kit *(DM160222)*

CAP1298 Evaluation Kit *(DM160223)*

MCUs with Touch

Microchip has the largest portfolio of "MCUs with Touch" in the industry. These are MCUs that feature the following dedicated Core Independent Peripherals to offload touch functionality from the core:

- Hardware Capacitive Voltage Divider (HCVD) for PIC MCUs
- ADC2 with computations and HCVD for PIC MCUs
- Peripheral Touch Controller (PTC) for AVR/SAM devices

These hardware touch peripherals enable us to offer industry-leading touch technology in self- and mutual-capacitance measurements that can be combined in the same

(continued on page 14)

design and can even use the same touch sensor. Because of their autonomous operation, CIPs minimize the use of CPU resources and power consumption in your design while also delivering automatic sensor tuning and calibration, 15V+ conducted noise immunity and high water tolerance even in harsh environments.

To experience the best in touch, we recommend you use these development kits for our "MCUs with Touch". For designs that are based on PIC MCUs, the Curiosity boards provide a cost-efficient, fully integrated development platform that is designed to take full advantage of the MPLAB® X Integrated Development Environment (IDE). This series of boards also includes an integrated programmer/debugger and requires no additional hardware to get started with developing your touch design.

Curiosity Development Board *(DM164137)*

The touch capabilities of AVR and SAM devices with a PTC are best explored using the Xplained Mini and Xplained Pro series of evaluation boards. Capacitive touch buttons are incorporated into the boards, and the extension header of the Xplained Pro boards provides connectivity to a number of dedicated Xplained Pro touch extension boards. Here are several examples, but you will find a complete list in the "Tools" area on the **1D Touch web page**:

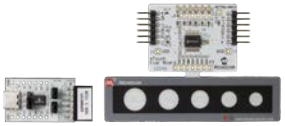
ATtiny817 Xplained Mini Evaluation Kit *(ATTINY817-XMINI)*

ATtiny817 Xplained Pro Evaluation Kit *(ATTINY817-XPRO)*

QT7 Xplained Pro Extension Kit *(ATQT7-XPRO)*

In addition to the MCU-based kits, we offer dedicated touch development kits that focus on key features of our touch solutions, such as water tolerance or low-power operation.

ATtiny817 Water Tolerance Demo Kit *(ATTINY817-QTMOISTD)*



Low-Cost mTouch® Evaluation Kit *(DM160227)*

Tools that will enable you to engage with another dimension—2D touch surface sensing for touchpads and touchscreens—will be available in the second quarter of 2018 to help you create innovative touch-based applications based on our PIC, AVR and SAM MCUs. Our 2D touch surface library includes support for water-tolerant touch tracking and gestures including swipes, rotations and the versatile pinch/zoom.

MikroElektronika click boards™

Most of our MCU-based evaluation kits feature a mikroBUS™ socket to support a vast number of MikroElektronika click boards. These small boards are the easiest way to add sensors, human interface (touch) control, or wireless communications interfaces to your design. You'll find a number of click boards featuring touch capacity on **MikroElektronika's website**, but here are a couple of examples:

TouchKey 2 click *(MIKROE-2474)*

TouchPad click *(MIKROE-1995)*

Cap Touch click *(MIKROE-2888)*

Design Documentation

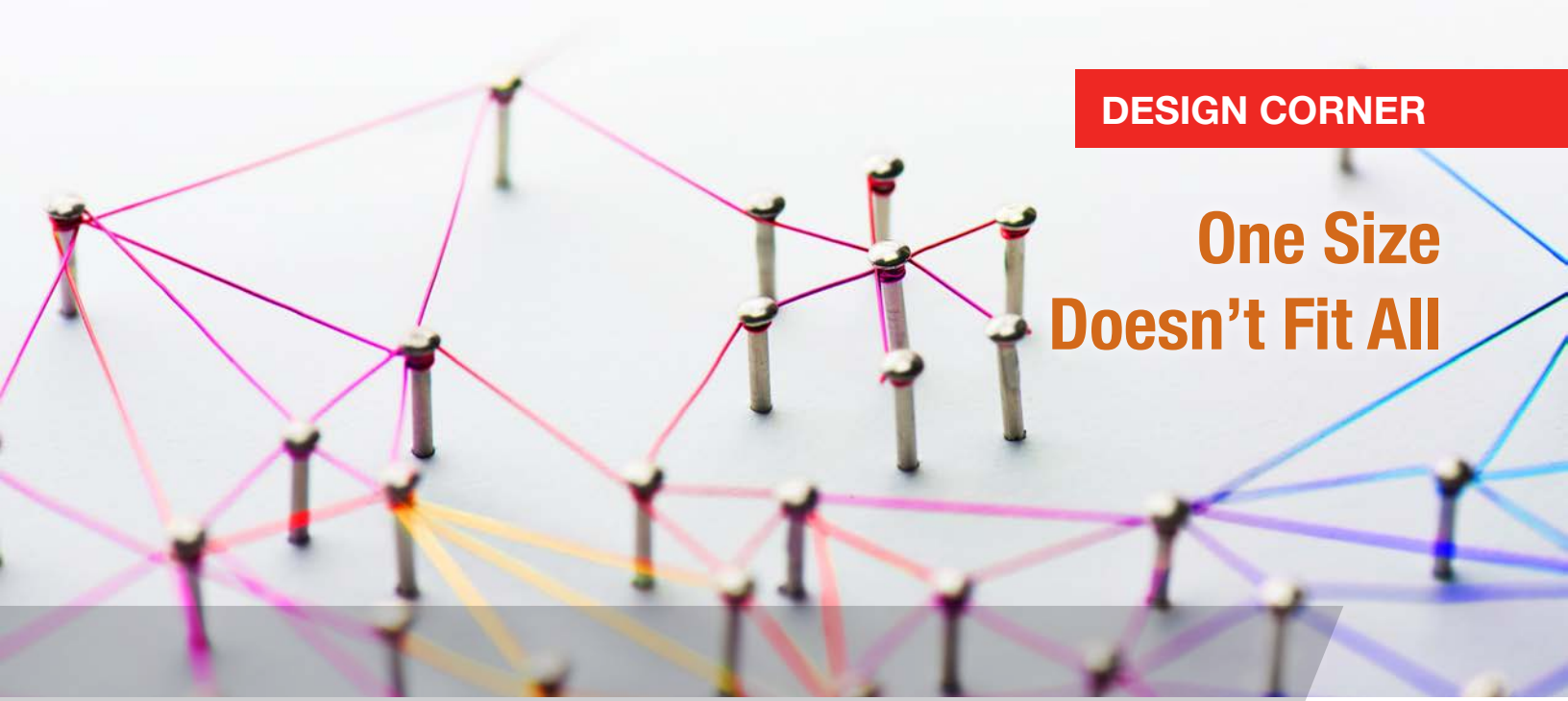
To quickly get you up to speed with your touch design, we provide an extensive selection of documentation, step-by-step design guides, application notes, reference designs and more. You'll find a number of helpful resources on our **Developer Help** website and in the Documentation sections that you find in our **Touch Design Center**.

We hope you enjoy your experience working with our touch solutions. And, if you run across a design challenge, you can get assistance from our touch experts via our online **Technical Support** platform. We can help you get your innovative touch interface out of the design phase and into the hands of your customers quickly.

Want More Information?

Visit the website at:

www.microchip.com/touch



One Size Doesn't Fit All

Customize Your Cloud-Connected Embedded Systems with Microchip Solutions and Expanded Offering from Amazon Web Services

Cloud-connected systems are becoming increasingly important across a wide range of industries. From agriculture to smart cities and consumer to industrial, real-time accessibility to systems and data is a game-changing element for these industries, accelerating both the pace and efficiency of business.

To enable the creation of smart and connected designs that require enhanced security, Microchip has expanded its collaboration with **Amazon Web Services** (AWS) to support cloud-connected embedded systems from the node to the cloud. With solutions that now are compatible with **Amazon FreeRTOS**, **AWS Greengrass** and **AWS Internet of Things** (IoT), we provide all the components, tools, software and support you need to rapidly develop secure cloud-connected systems.

Amazon FreeRTOS is an Operating System (OS) that makes compact, low-powered edge devices easy to program, deploy, secure and maintain. Our **PIC32MZ EF** series of microcontrollers (MCUs) now includes support for Amazon FreeRTOS. These high-performance MCUs incorporate industry-leading connectivity options, ample Flash memory, rich peripherals and a robust toolchain that empower embedded designers to rapidly build complex applications. Amazon FreeRTOS includes software libraries that make it easy to securely deploy over-the-air updates. They also enable you to connect devices locally to AWS Greengrass or directly to the cloud, providing a variety of data processing location options.

For systems requiring data collection and analysis at a local level, you can use one of our **SAMA5D2** series of microprocessors (MPUs) with integrated AWS Greengrass software. This solution will enable systems to securely run local compute, messaging, data caching and sync capabilities for connected devices. It provides improved event response, conserves bandwidth and enables more cost-effective cloud computing. The SAMA5D2 devices, also available in System-in-Package (SiP) variants, offer full Amazon Greengrass compatibility in a low-power, small-form-factor MPU targeted at industrial and long-life gateway and concentrator applications. The integrated security features and extended temperature range allow these MPUs to be deployed in physically insecure and harsh environments.

Security and ease of use are vital to any cloud-connected design. Our **ATECC608A** CryptoAuthentication™ device enables enhanced system security as well as easy-to-use registration. This secure element provides a unique, trusted and protected identity to each device that can be securely authenticated to protect a brand's intellectual property and revenue. In addition to enhancing system security, the ATECC608A allows AWS customers to instantly connect to the cloud through the device's Just-in-Time-Registration (JITR) powered by AWS IoT.

A breakout session held at AWS re:Invent 2017 entitled "IoT Security from Manufacturing to Maintenance" discussed how to mitigate threats and implement end-to-end security right from the start of a design. A portion of this session discussed the

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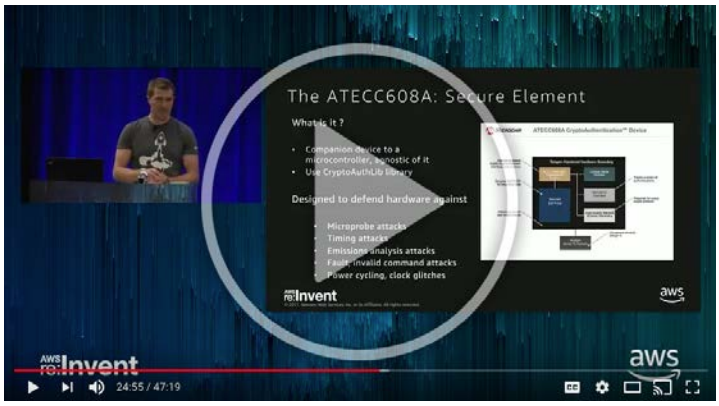
capabilities of the ATECC608A secure element. Click on the image below to watch the presentation on YouTube.



There is no one-size-fits-all approach to developing cloud-connected systems. Our support for multiple AWS services with a variety of our products gives you the flexibility to choose the parts and platforms that best meet your system needs. You can take advantage of our extensive toolchain for rapid and reliable development of your connected design.

Development Tools

Jumpstart your development of Amazon FreeRTOS-based designs with the **Amazon FreeRTOS Curiosity PIC32MZ EF Bundle** (DM320104-BNDL). This fully integrated 32-bit development platform also includes two mikroBUS™ expansion sockets so you can easily add more functionality to your design, such as Wi-Fi® connectivity, using the WINC1510-based **WiFi 7 click** from MikroElektronika.

The **SAMA5D2 Xplained Ultra** (SAMA5D2C-XULT), a fast prototyping and evaluation platform for the SAMA5D2 series of MPUs, can be used with AWS Greengrass designs. The **CryptoAuth Xplained Pro** (ATCRYPTOAUTH-XPRO-B) evaluation and development kit is an add-on board for rapid prototyping of secure solutions on AWS IoT and is compatible with any of Microchip's Xplained or Xplained Pro evaluation boards.

As a Microchip Security Design Partner, AWS is also able to support your development with their tools and technical expertise to help you create amazing applications. Visit our **AWS Internet of Things** design center to find out how you can get started developing reliable and secure cloud-connected embedded systems.

Want More Information?

Visit the website at:

www.microchip.com/aws-iot

DESIGN CORNER

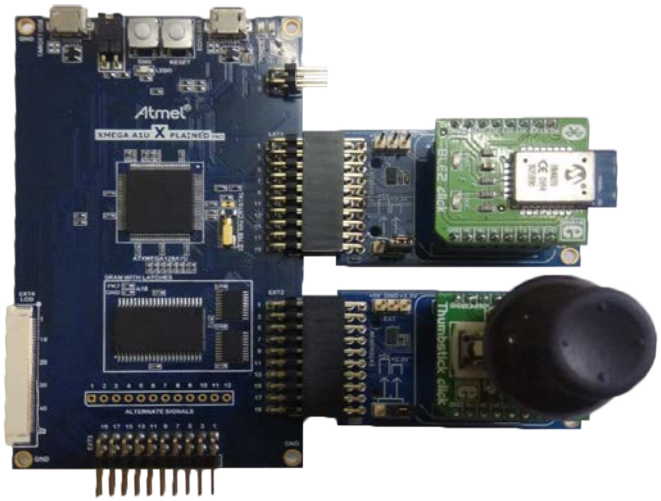
An Ingenious ClickBOT in Just Minutes

Custom Remote-Controlled Robot Design Showcases Rapid Development Using Microchip Code Configurators for PIC® and AVR® Microcontrollers

Sir Arthur C. Clarke once said, "Any sufficiently advanced technology is indistinguishable from magic." Attendees at the 2017 India MASTERs that was held in Bangalore in early December were able to see a demonstration of some Microchip "magic." This was in the form of a custom, remote-controlled robot, known as ClickBOT. While remote-control toys have been around for a number of years. ClickBOT was designed to demonstrate how easy it is to develop a modern application in a matter of just minutes using PIC and AVR microcontrollers (MCUs), a selection of MikroElektronika click boards™ and our free code configuration tools.

ClickBOT's design incorporates two different components. The motion-based portion of the application is implemented using an **MPLAB® Xpress Evaluation Board** with a PIC16F18855 MCU onboard. A **BLE2 click**, featuring our RN4020 Bluetooth® 4.1 module, plugs into the Curiosity board's mikroBUS™ socket to act as a receiver. This portion of the ClickBOT's design is programmed using **MPLAB Code Configurator** (MCC). MCC's intuitive graphical user interface makes it easy to generate application code that is used to configure the clock, pins, interrupts and peripherals. MCC also includes quick-start software libraries for a growing number of click boards, so it is easy to add functionality, like Bluetooth communications, to a project.

The control system for the ClickBOT is based on an **XMEGA A1U Xplained Pro Evaluation Kit** with an ATxmega128A1U MCU. It also incorporates a BLE2 click and a **Thumbstick click**, featuring our MCP3204 12-bit A/D converter. These two click boards are connected to the Xplained Pro board using two **mikroBUS Xplained Pro** extension boards. The web-based **Atmel START** is used to configure this system's driver and middleware. Just like MCC, Atmel START now offers quick-start libraries for click boards to help implement the application layer.



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As the attendees at India MASTERs discovered, MCC and Atmel START make it easy to get the basic functions of the ClickBOT—including the click boards—up and running in less than five minutes. The ClickBOT can also be easily turned into a more advanced robot using other click boards to add sensors and other functionality to the basic design. The possibilities are only limited by your imagination.

While ClickBOT is not available to purchase, there's no reason why you can't use its basic concepts to develop your own remote-controlled robot or other design. If you are feeling inspired to create your own amazing applications using our MCU development boards along with the wide range of MikroElektronika click boards, our code configurators will help bring your ideas to life. In addition to the quick-start libraries, the user guides include information on the key features of the supported click boards and even include links to make it easy to purchase the boards online. Visit the **Click into MCC** and the **Click START** pages on our website, where you will find the steps that you need to follow to quickly get started developing your project.

Connecting with a Simple Tap

Flexible and Interactive e-Ink Badges Make Networking at Events Easier and More Engaging

Contributed by Blendology

The human engineering spirit is on a quest to digitize and automate as many operations as possible, from converting the audio on magnetic tape to high-quality digital audio capable of being streamed over the Internet, to using mobile technology and data services to develop creative new businesses like Uber. We can expect to see even more of this creative drive in years to come as artificial intelligence and robotics become mainstream. Everything will need some sort of hardware, embedded software, wired/wireless communications, apps and servers.

Driven by this same spirit of innovation, Blendology decided to digitize the humble business card. This was a tall order considering that these cards have been around since the seventeenth century, and during the intervening years, nothing really comparable has come along to replace the simple exchange and etiquette of business cards. Our vision is to create a wearable device that stores a person's contact details and to enable the exchange of this information with others by tapping two of these devices together. While this is an exciting prospect, the technology required and the cost of producing this type of device are pushing the optimal wearable solution off to sometime in the future.

In 2011, Blendology started out in the events market by providing both a badging solution and a business card exchange tool all in one device. Blendology's badges are worn around the neck and can be tapped together to connect and exchange delegates' contact information in split second. It took us five years to perfect the patented oneTap technology that delivers instant communications. In 2016, we implemented Phase 2 by creating a paperless oneTap badge based on a 32-bit Arm® Cortex®-M0+ based SAM D09 microcontroller (MCU) that also features a glass-free e-ink display provided by Plastic Logic and two 2.4 GHz radio chips. Looking to the future, Phase 3 will focus on miniaturization and creating a cost-effective wearable for consumers.

Blendology's oneTap badges make it easy for people to connect.

Changing the Way People Interact

While to some extent the Blendology oneTap badge is offered as a technical solution, it primarily is intended to influence human behavior and provide a convenient means of interaction

(continued on page 20)

at events. The badges serve as an excellent ice-breaker, helping people overcome their natural hesitation to start conversations by offering a fun and easy way to connect. Requiring just a tap of badges, they enable more face-to-face networking, in some cases resulting in a 30% increase in interactions. Delegates can concentrate on making the best use of their time in meeting new people and growing their professional or personal networks. These in-person social interactions can result in significantly better first impressions than electronic introductions offer.

Meanwhile, a special dashboard provides the event organizer with a high-level view on these interactions and the option of including room counting and anonymous footfall analysis to help them evaluate attendee behavior once their event is over.

Attendee interactions are displayed on special dashboard.

The oneTap badge offers other benefits. It is extremely robust and features a glass-free e-ink display. In addition to enabling very fast and flexible creation of badges, it requires no paper to create the delegate badges and even event agendas, so it is environmentally friendly. The badge can also be reused at other events and can last a number of years.

Badge Programming and Operation

Prior to an event, the attendee list is uploaded to Blendology's server and accounts are created for each delegate. The oneTap badges are loaded into numbered slots in trays that hold up to 40 badges. Blendology has created a custom hub that communicates with the server via Wi-Fi® and with the badges via Bluetooth® LE (BLE). One hub can be used to wirelessly batch program up to 40 badges at a time, merging the delegate information with the template for the badge's first page. Multiple hubs can be used to quickly program hundreds of badges. Other information, like daily agendas and a map of the venue, can also be uploaded to the badges during this process. Existing badges can be easily edited and new registrations can be quickly added on an individual basis onsite at the event.

At the event, the trays are set up and numbered, and hubs are strategically distributed around the venue. An iPad® running a Blendology app and a registration wand are used to help check in delegates and to streamline the badge distribution process. A host uses the app to look up a delegate's name and locate that individual's badge in its numbered tray and slot. The host then shows the delegate how to use the badge and demonstrates how the lights and haptic feedback confirm that the badge is connected and working. New badges or changes can be easily be done using the badge, registration wand and app. The new information is entered in the iPad, and the badge is tapped with the registration wand to transfer the delegate's information over to the badge and register the badge to the delegate. Once it is turned on, the badge will work for up to five days with no additional user setup needed.

Scrollable agenda and promotions are uploaded to the badges.

During the event, the hubs are used to seamlessly upload the connections made by delegates in real time. When two badges are tapped together, a tag is wirelessly exchanged between the badges. An in-range hub connects to the badge, reads the tags and sends them to the server to be decoded. This allows delegates to view their new contact information and timeline of activity almost immediately on Blendology's online portal, which they can even access after the event is over and they have returned their badges. This video provides an overview of the oneTap badges in action:

(continued on page 21)

Hardware Configuration

The Blendology badge contains four major subsystems as shown in Figure 1:

1. Microchip SAM D09: The supervisory system is based on a low-power **ATSAMD09D14** MCU. This system uses the Hall effect sensor to turn on and off the badge, manages time, controls and measures the power to other parts of the system and provides state memory storage. This extremely low-power subsystem is always on.
2. Bluetooth LE: The Bluetooth LE system allows communication between the badge and the Blendology hub and app. It also communicates with the Plastic Logic electronic screen. Other tasks include controlling the LEDs, motors and bleeper, setting the time and storing state and connections.
3. Plastic Logic Driver: This circuitry provides the high and precise voltage levels to raise and lower the bubbles of ink in the Plastic Logic e-ink display. (The tail of the display, which also has some components, is shown on the left side of Figure 1.)
4. oneTap 2.4 GHz Radio: This is the oneTap engine that has Blendology's patented oneTap implementation. It uses the 2.4 GHz radio and embedded software protocol to enable the oneTap connection. It also controls the LEDs and signals the activation of motor/haptic feedback.

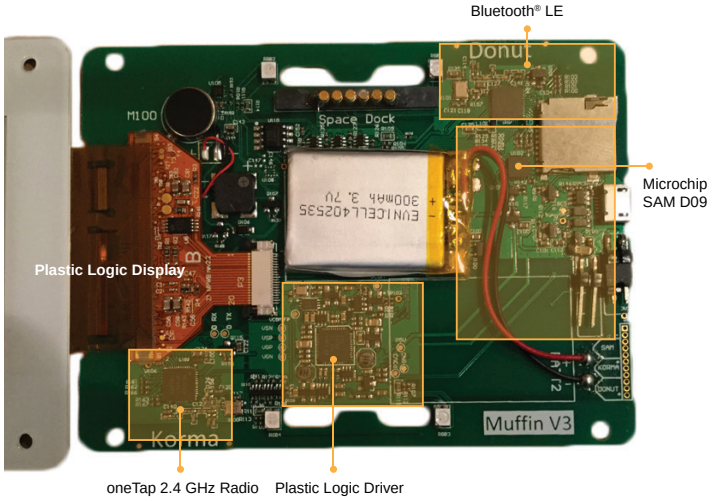

Figure 1: Blendology oneTap Badge Subsystems

Blendology selected a SAM D09 MCU for this project because it was the most compact and cost-effective solution, delivering the necessary features, as shown in Table 1, in a single package that would increase the design's reliability.

Features Required	SAM D09 Features
Real-Time Clock/Calendar (RTCC)	32-bit Real-Time Counter (RTC) with clock/calendar function
Timer to drive the bleeper	Two 16-bit Timer/Counters (TC)
Low power in sleep	Idle and standby sleep modes; SleepWalking peripherals
Input and output expansion for bleeper and Hall sensor; power controller for other parts of the system	12 GPIO pins
Measuring battery voltage	12-bit, 350 ksps Analog-to-Digital Converter (ADC)
Critical state memory Flash	8 KB in-system self-programmable Flash; 4 KB SRAM
Communications with rest of system for software upgrade and messages	Serial Communication Interfaces (SERCOM)
Software flexibility	Arm® Cortex®-M0+ based CPU running at up to 48 MHz
Cost effective	30% of discrete component cost

Table 1: Blendology Design Requirements and SAM D09 MCU Features that Meet These Requirements

We believe we have the most efficient Bluetooth LE master hub. It also uses a Microchip processor. That may be the subject of a future article. In the meantime, our goal is to continue to improve and refine our state-of-the-art event badging system to encourage more opportunities for professional and personal networking. Visit **www.blendology.com** to learn more about our services and solutions.

Made to Measure

A Quartz Crystal Microbalance Based on a dsPIC® Digital Signal Controller

Contributed by Elbatech Srl, Fabcrea Srl and the National Research Council, Italy

In the world of nanoscience, understanding the processes at the root of macroscopic effects is the main challenge. Many advances in this field have been made possible because of scientific instrumentation. Devices that are able to provide valuable insight into the nanoworld are divided into two primary classes: high-resolution microscopes to observe molecules and their interactions, and sensing devices to quantitatively detect the presence of compounds or reaction products. The Quartz Crystal Microbalance (QCM) belongs to the latter group. It is capable of detecting very small changes in mass occurring on the surface of a quartz crystal during chemical and biophysical experiments.

An Overview of the Quartz Crystal Microbalance (QCM)

When a force from an external signal is applied to a simple harmonic oscillator, like an ideal spring, it tends to oscillate at its resonance frequency. This depends on the oscillator's stiffness (the elastic constant of the spring) and its mass. A change in the oscillator's mass results in a shift towards lower values of the resonance frequency that can be detected and used to measure the added mass.

In a QCM, the spring is a quartz crystal oscillating at a natural frequency in the MHz range. It can be used to measure tiny mass variations per unit area[1]. Any mass adhering to the QCM's surface will modify the resonance frequency. A similar effect is also experienced when the crystal is vibrated inside a solution. In this case, the coupling of the crystal dynamics with the surrounding liquid can cause a measurable shift associated with the physical properties—primarily the viscosity—of the solution. Because it is capable of measuring small changes in mass or viscosity, a QCM is a very useful and versatile instrument. When used to detect variations in viscosity, the quartz crystal is included in a flow-through measuring chamber.

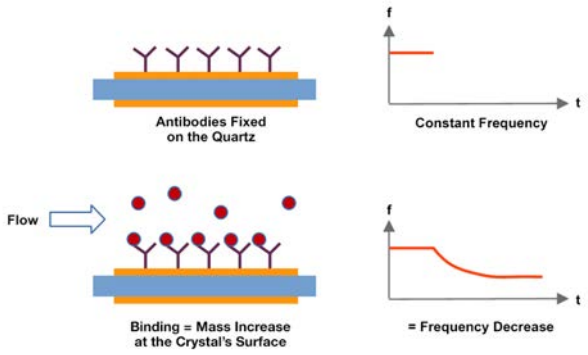

Figure 1: Decrease in Oscillation Frequency As Antibodies "Capture" Antigens

A typical use for a QCM is in the field of protein-protein or ligand-receptor interactions. For example, a layer of antibodies can be biochemically fixed onto the crystal surface. When the corresponding antigen flows onto the sensor, bindings occur between these molecules and the antigens get "captured" by the antibodies, thus forming a heavier layer and yielding to

(continued on page 23)

a corresponding oscillation frequency decrease as shown in Figure 1. The final reading is then directly and quantitatively correlated to the amount of antigens present in the "unknown" solution under test.

A QCM Implementation Based on EpsilonPi Technology

QCMagic is a QCM based on ElbaTech's **EpsilonPi**, which combines the popular Raspberry Pi® platform and a board based on a dsPIC Digital Signal Controller (DSC) to provide real-time response capability. A **dsPIC33EP512MC806** was selected because of its powerful and rich set of features, speed and number of built-in hardware modules. Complying with the RaspberryPi.org Foundation's mechanical and electrical standards to qualify as an official "HAT," the dsPIC DSC-based board can be directly plugged on top of the Raspberry Pi.

The EpsilonPi can also be equipped with task-specific companion cards (e.g. fast and high-resolution Analog-to-Digital and Digital-to-Analog Converters) for signal acquisition and processing. The EpsilonPi is organized as a "Logical State Machine" with an open command-based interface. Therefore, it is possible to program any desired sequence of actions and to implement virtually any device functionality. Ethernet connectivity can also be enabled using **ZeroMQ** (ZMQ), a very efficient, versatile and easy-to-deploy communication layer. The dsPIC DSC's large on-chip memory allows a sufficiently long circular buffer to be programmed to hold data samples during temporary off periods on the Ethernet side. The dsPIC DSC communicates with the Raspberry Pi through UART for commands and through SPI2 for high-throughput data transfer. Data is processed by the Raspberry Pi and published over Ethernet, exploiting a PUB-SUB software architecture inherited from Internet of Things (IoT) frameworks.

The implementation firmware for the EpsilonPi is written in C using MPLAB® X Integrated Development Environment and MPLAB XC16 Compiler. The client software is written in Python 3 and runs on a target computer.

Introducing the QCMagic HAT

The QCMagic HAT includes a built-in oscillator circuit that drives the sensing quartz crystal, typically in the 1–10 MHz range. This circuit can sustain oscillations even in moderately damped situations, where the load at the quartz surface is considerably high, as is the case with liquid environments that are frequently encountered in the fields of biophysics and biochemistry. The HAT also has a general-purpose input buffer to allow the connection of an external quartz oscillator circuit. This can be useful in situations where the damping is extremely high—for example, when using highly viscous solutions or when very heavy masses are deposited onto the sensing surface—and where closed-loop, finely controlled circuitry is needed to sustain the oscillation.

Featuring the built-in dsPIC DSC-based Analog-to-Digital Converter (ADC) module, the QCMagic HAT also includes a generic voltage input connector that is internally preamplified and conditioned and intended for use with external oscillators with Quality factor (Q factor) outputs. These show a voltage output proportional to the Q factor of the crystal, or to its inverse, the dissipation factor. This information is sometimes useful, in addition to the frequency data, to more accurately describe the running experiment.

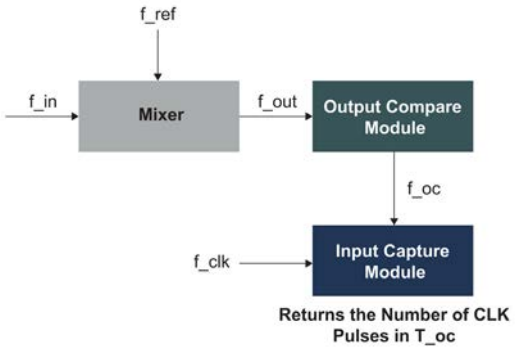

Figure 2: Simple Block Diagram of QCMagic HAT

As shown in Figure 2, the QCMagic HAT combines two dsPIC DSC-powered modules to form a precision frequency meter. The signal under measurement is output by a mixer, an electronic circuit that multiplies the input with a known- and fixed-frequency local time base, lowering the carrier frequency information to smaller values.

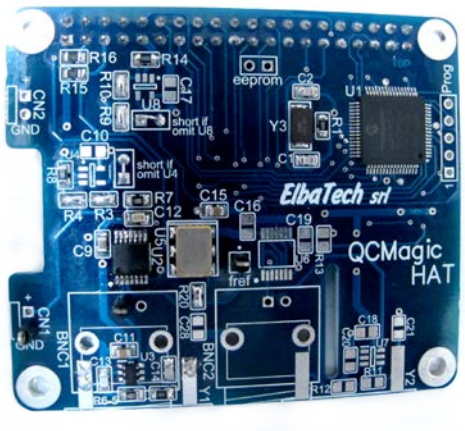

Figure 3: QCMagic HAT

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The dsPIC DSC—labeled "U1" in the photo of the QCMagic HAT (Figure 3)—counts a fixed number of the input signal's pulses via the output compare module. This module outputs a square wave with a varying period if the input frequency also varies. This square wave is fed into an input capture module with the system clock used as a time base (60 or 70 MHz for the dsPIC33EP512MC806). The input capture module counts the number of system clock periods present inside a period of the input square wave to obtain a value directly related to the frequency of the incoming signal. The dsPIC DSC's firmware then performs all the backwards calculations to recover that quantity, which is then transferred to the Raspberry Pi via SPI2, and from there over Ethernet via the ZMQ protocol to a host computer that is running a data acquisition program.

This precision measurement solution is the latest offering from ElbaTech, a private company that designs and develops solutions for environmental monitoring. Visit **www.elbatech.it** to learn more about their products and services.

References:

1. Sauerbrey, Günter (April 1959), "Verwendung von Schwingquarzen zur Wägung dünner Schichten und zur Mikrowägung", Zeitschrift für Physik, 155 (2): 206–222

Meet the Makers of 2017

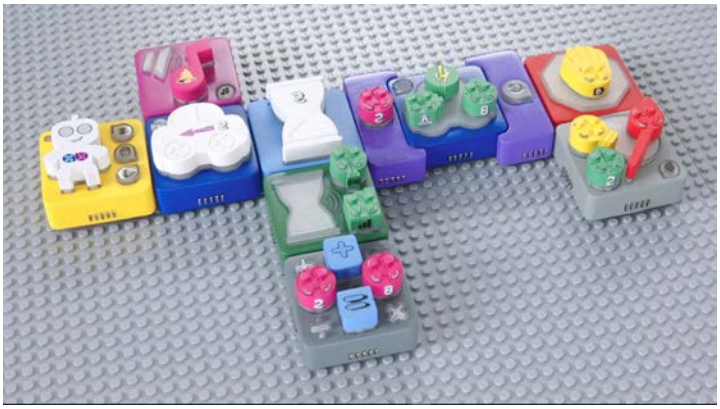
A New Wave of Brilliant, Successfully Crowdfunded Designs that Incorporate Microchip's Products

Last year, crowdfunding sites were once again great places to find the next wave of innovative, entrepreneurial and aspirational inventors as they shared their ideas with the world and watched support flow in from eager backers and like-minded Makers. The projects that we came across during 2017 ranged from ideas that pushed existing designs to the limits, to those that offered new and creative learning tools, while some projects were made for pure, simple enjoyment. Due to the popularity of the open-source Arduino® platform among the Maker and inventor communities, many of these designs featured microcontrollers (MCUs) from our ATmega product line, although we also saw projects using some of our PIC® MCUs and other products. Since several of these campaigns exceeded their funding goals in such a spectacular way, we thought you would enjoy hearing about them.

Algobrix – Helping Kids to Learn to Code with Building Blocks

Getting children involved with programming or robotics can be a difficult endeavor. They often see it as boring or confining, as Algobrix CEO, Danny Eizicovits, points out. But **Algobrix** takes conventional building bricks and turns them into programmable robots called Algobots, all while teaching children the basics of coding and robotics. They do this through the use of an Arduino-compatible Algobot Brain that helps control the Algobot. Children can also use function and parameter blocks to physically build their code and program the robot. The functions range from sound, to controlling LEDs, to movement and more. It's even possible to attach sensors to the AlgoBot Brain and have the robot respond with different code when certain sensors are triggered. This makes the programming challenge slightly more complex and the learning experience more interactive.

The pledge kits included at least one Algobot robot kit, so backers can build a variety of cute little inventions displayed on the Algobrix website. Since the Algobrix building blocks are also compatible with LEGO® bricks, children can build their own designs and robots and program them with the same intuitive blocks. Parents don't even need to know how to code to help their kids use Algobrix. The kits come with activity cards and boards to guide parents and children through the process, and online tutorials are also available to make it easy to start building and coding projects.



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This project incorporates multiple Microchip products—chosen as the best alternative by the Algobrix engineering team (Ofer Zvik, Ido Volansky and Tal Ofer)—including an 8-bit PIC16 MCU in each of the function blocks. A PIC32 MCU was specifically chosen for the play function block to start the code and communicate with the robot. The robot uses an 8-bit ATmega328PB MCU. Designed by education technology entrepreneur Amir Asor, and Danny Eizicovits, who has a Ph.D. in robotics, the project gained a lot of positive attention during its campaign. Reaching its funding goal in under 24 hours and raising a final total of $1.15 million, this project has attracted nearly 3,700 backers who are now eager to get their Algobrix in the mail and start programming robots with their kids in a whole new way.

GameShell by Clockwork Tech, Inc. – The Retro Gaming and STEAM Portable Console

The **GameShell** is an open-source retro gaming console that can be used for STEAM applications as well as Maker projects. Utilizing a GNU/Linux® operating system, the GameShell allows users to play games on a module-based handheld console. It also supports programming in C, Python, Lua, LISP and more to allow users to modify, write or design their own games. Even more exciting, this project is both open source and serves as an all-in-one development kit that includes five different modules to inspire creativity in the Maker community.

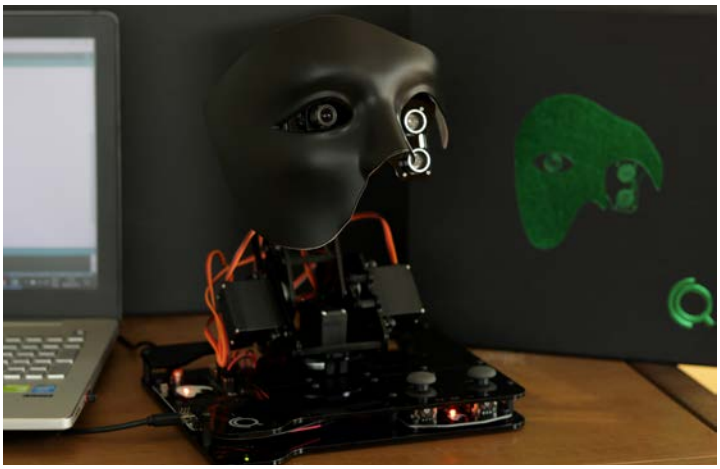
The design combines a clockwork PI development board with an Arduino-compatible, programmable keypad module that uses an ATmega168P. The other three modules include a screen, a battery and a speaker. These modules can be used for developing a variety of design applications. This adaptability makes the potential of creating projects based on GameShell seemingly endless. And, in case you are wondering just how people are creatively using this handy console, Clockwork has created a **forum** where users can share their ideas and build the community.

A startup company comprised of passionate and experienced engineers and designers that are geeks and gamers at heart, Clockwork's R&D center is based in Hangzhou, China, with production taking place in Shenzhen. They also have sales, PR and STEAM coordinators located in Los Angeles and San Francisco, as well as in Sydney, Australia.

GameShell's Kickstarter campaign was fully funded in just 13 hours, reaching over 2,600 people worldwide and ultimately raising $290,000. Clockwork also created a GameShell campaign on Indiegogo where it additionally raised almost $311,000. Their ultimate goal is to sell the GameShell in the retail market and create STEAM products that are not only appealing to younger users, but also to moms and dads.

Nova by Creoqode – DIY Artificial Intelligence Robot

As one of many robotic, artificial intelligence (AI) campaigns that emerged in the last year, Creoqode's **Nova** features a sophisticated and aesthetically striking design to deliver a DIY hardware and software platform that helps teach robotics and programmable AI. Nova can recognize and track faces, identify colors, measure distances and move in five different axes, or it can simply be controlled with the joysticks that come in the kit. A variety of sensors and other devices can be connected to customize Nova and to add new functionalities, such as voice recognition, target shooting or even mobility. This all-inclusive kit provides an introduction to coding and electronics as well as more complicated concepts like computer vision, image processing, kinematics and control theory.



Creoqode's goal was to bridge the gap between hardware and software education. They believe this starts with understanding the hardware fundamentals of each device, which can be best learned by actually building a project. Because of this, Nova can be built right out of the box without the need for any additional tools. It can then be further adapted or customized as the user wishes. It was designed to be an easy way for beginners to learn

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basic hardware and software skills, while still providing pros with advanced and creative options to exercise their knowledge.

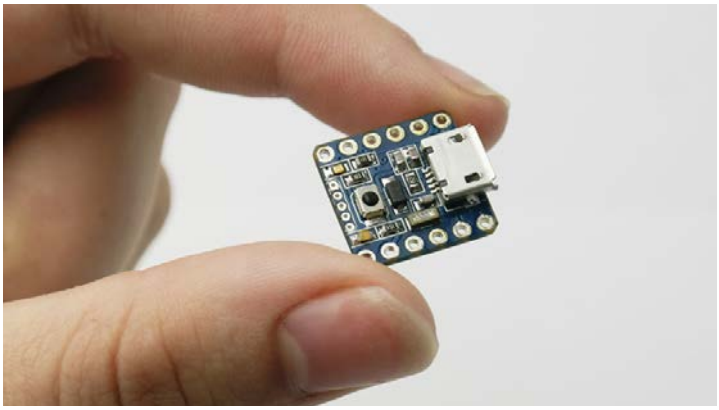
At the heart of Nova's hardware design is the Creoqode Mini Mega Development Board, which is powered by an ATmega2650 MCU. Because Nova is Arduino-compatible, both new learners and experienced programmers can develop code to start controlling Nova in just a couple of hours. To further enhance the programming experience, Creoqode offers tutorials and other materials through their Qode Share online community.

After their Kickstarter campaign ended in November of 2017, Creoqode had successfully doubled their goal and raised almost $60,000 from 273 backers to bring Nova to life. Creoqode will be taking Nova to several different shows early this year and, although the campaign has ended, Nova can still be purchased from the Creqode website for delivery in May 2018.

Exen Mini by Nerdonic – A Small but Powerful 32-bit Development Board

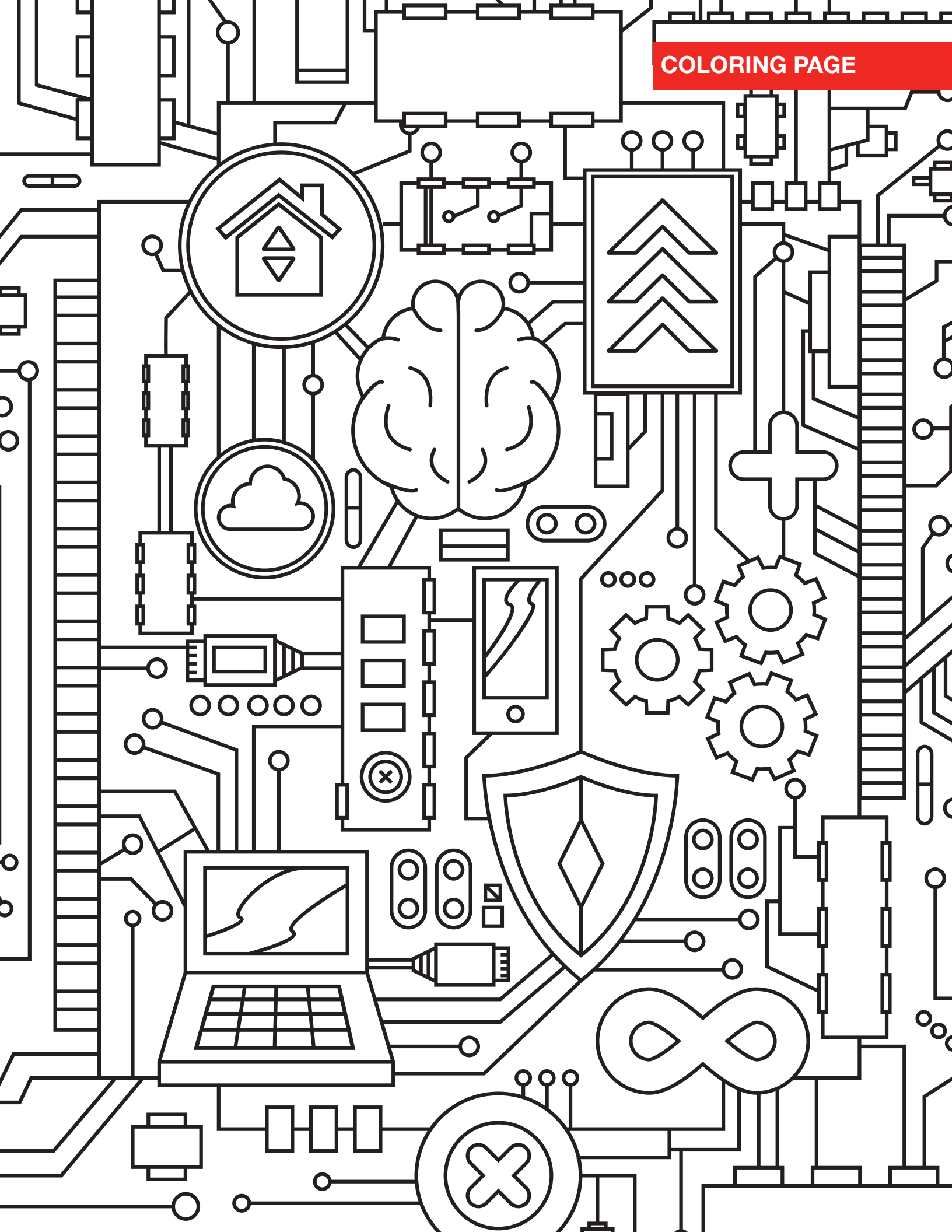
Elegant, fast and powerful, the **Exen Mini** is one of the smallest Arduino- and breadboard-compatible development boards featuring a 32-bit MCU. This board by Nerdonic weighs less than a gram and measures just under 15 × 15 mm. That's about a third of the size of the comparable Arduino Nano and under half the size of the Arduino Pro Mini.

Although small, the Exen Mini still manages to provide many different design options. It features a programmable LED and eight multifunction I/O pins that offer serial and I²C options, along with PWM, digital, analog and other capabilities. Powered by a tiny Arm® Cortex®-M0+ based 32-bit SAM D21 MCU, the Exen Mini runs at 48 MHz and offers 256 KB ROM and 32 KB RAM to manage a wide range of applications. It also includes a regulated 3.3V output pin, two power input pins and a 5V input option via an on-board microUSB connector. The Exen Mini comes preloaded with the Arduino Zero bootloader, so users can get started with their programming right away.



Nerdonic's goal is to produce and deliver quality products to the world while pushing the boundaries. This tiny microcontroller board has made such a big impact that people took notice. The campaign on Indiegogo was successfully funded at almost 1375% of the original goal in under 22 hours, ultimately raising just over $20,000. The orders are already starting to ship, and Nerdonic is looking forward to seeing the amazing projects that backers will create with the Exen Mini.

COLORING PAGE



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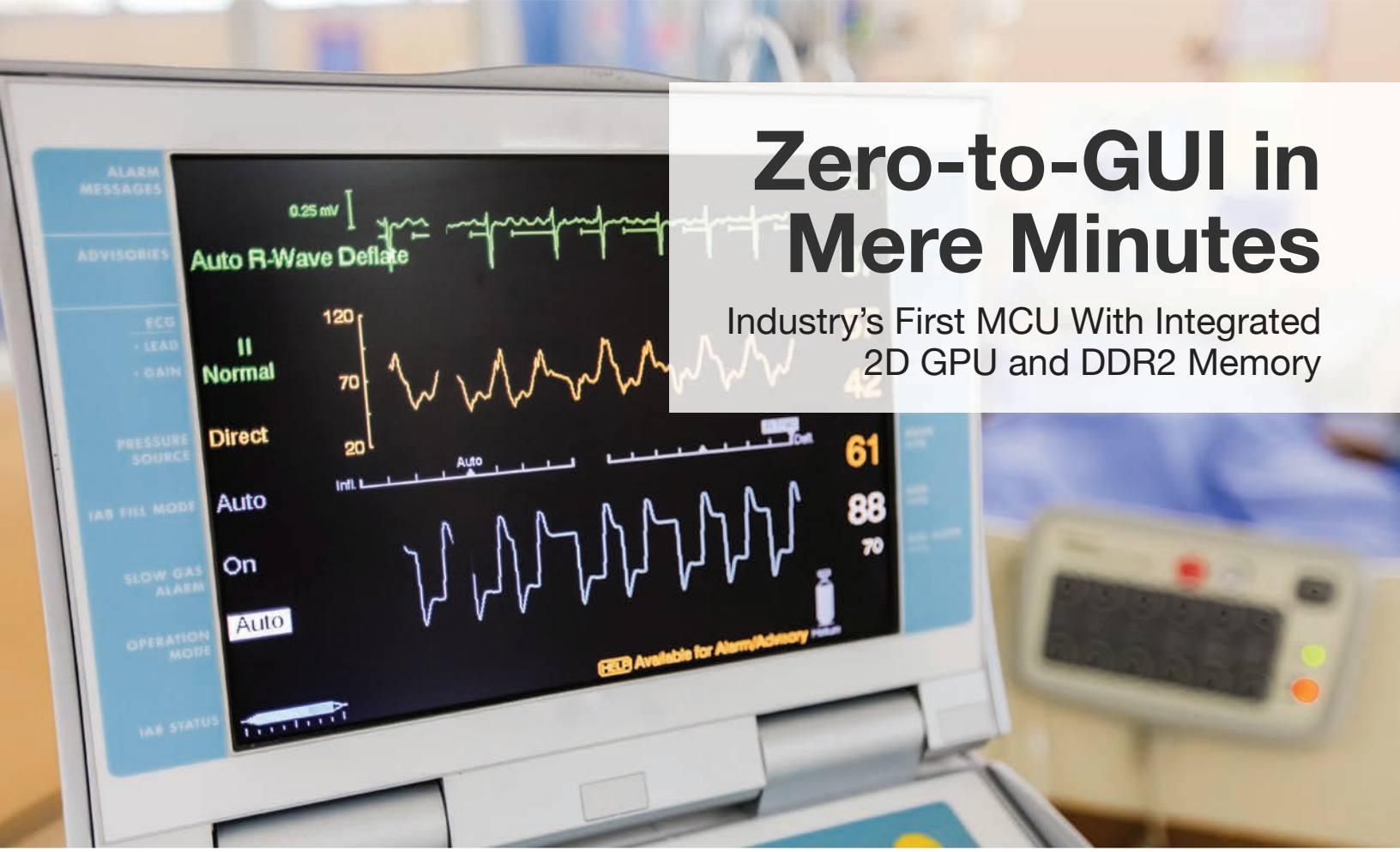

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