The Wave of the Future

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New Things on the Horizon

By Robert Brennan – Product Marketing Communications Manager

We’re back! After a brief hiatus, MicroSolutions is back and better than ever! As you can see, we have completely revamped the design and found even better content to include plus we’ve done a lot of tweaking and massaging.

We hope you enjoy this new design going forward as we have tried to pack it full of product details, articles, tools, and spotlights that are relevant to you. As we close out the year and bring in the new one with this new design, the MicroSolutions newsletter will hit your inbox six times a year instead of the customary twelve. We did this to ensure we give you the best content possible in a readable format. Beauty takes time and this is a beautiful piece... At least we like to think so.

This new edition of MicroSolutions features the latest and greatest technology from Microchip including our newly released GestIC® products that have received a lot of attention in the press recently – and rightly so. If you want to read more about it, just turn the page! In addition, we have information on several exciting new products such as the wireless audio platform, high voltage analog buck PWM controllers, USB portfolio expansion, and memory products, to name a few.

We hope you enjoy consuming this new format and content as much as we did putting it together. If you want to tell us your thoughts and opinions on MicroSolutions and its new look, feel free to email us at MSFeedback@microchip.com.

Find us on these social channels:
The Wave of the Future

Microchip’s New GestIC® Technology Enables Mobile-Friendly 3D Gesture Interfaces

Introducing the World’s First E-Field-Based 3D Gesture Controller

Ready to meet the latest wave in human-machine interactivity, Microchip’s exciting new GestIC technology enables the next dimension in intuitive, gesture-based, non-contact user interfaces for a broad range of end products.

The patented GestIC technology achieves the exceptionally high gesture-recognition rates required by today’s consumer products through an on-chip library of intuitive and natural human gestures called the Colibri Suite. The Colibri Suite uses a Hidden Markov model (HMM) and features high-resolution x/y/z hand position tracking, flick, circle and symbol gestures to perform input commands such as open application, point, click, zoom, scroll, mouse-over and many others without the need to touch the device. Designers can use this library to get to market quickly and reduce development risks, by simply matching their system commands to Microchip’s extensive set of predetermined and proven gestures.

Utilizing thin sensing electrodes made of any conductive material, such as Printed Circuit Board (PCB) traces or a touch sensor’s Indium Tin Oxide (ITO) coating, the GestIC technology enables invisible integration behind a device’s housing. This allows for visually appealing industrial designs at very low total system costs. Additionally, its 100% surface coverage eliminates the “angle of view” blind spots found in other technologies.

Microchip is already working with input-device and other product manufacturers to implement exciting and efficient user-input controls. Example applications include keyboards that take advantage of the advanced interface capabilities in the new Windows® 8 operating system, using hovering motions and free-space gesture controls, instead of reaching over to touch a screen.

MGC3130 3D Tracking and Gesture Controller

Based on the GestIC technology, the configurable MGC3130 is the world’s first electrical-field (E-field)-based 3D gesture controller. It offers low-power, precise, fast and robust hand position tracking with free-space gesture recognition. With power consumption as low as 150 microwatts in its active sensing state, the MGC3130 enables always-on 3D gesture recognition – even for battery-powered products.

Benefits of GestIC Technology

- Very low power design
- From 0 (touch) to 15 cm detection range
- No detection blind spots
- Usage of thin, low-cost sensing electrodes
- Electrodes hidden behind housing
- No ambient influences (light/sound)
- High sensitivity
- 70-130 kHz carrier frequency – no RF interference

Applications

- Notebooks/Keyboards/PC Peripherals
- Mobile phones
- Tablet computers
- Electronic readers
- Remote controls
- Game controllers
where power budgets are extremely tight. In fact, the MGC3130’s low-power design and variety of configurable power modes provide the lowest power consumption of any 3D sensing technology – up to 90% lower than camera-based gesture systems.

With a detection range of up to 15 cm, the MGC3130 is the ideal technology for products designed to be used in close proximity for direct user-to-device interaction. Additionally, the chip provides developers the flexibility to utilize pre-filtered electrode signals for additional functionality in their applications. With its range of configurable, smart features, the MGC3130 uniquely enables the next breakthrough in human-machine-interface design across various industries.

**MGC3130 Features:**

- 150 DPI, mouse-like resolution, and a 200 Hz sampling rate to sense even the fastest hand and finger motions
- Super-low-noise analog front end for high-accuracy interpretation of electrode sensor inputs
- Configurable Auto Wake-Up on Approach at 150 microwatts current consumption, enabling always-on gesture sensing in power-constrained mobile applications
- Automated self calibration, for continued high accuracy over a product’s lifetime
- 32-bit digital signal processing, for real-time processing of x/y/z positional data and the Colibri Suite gesture library
- Integrated Flash memory for the easy upgrading of deployed products, in the field
- 70-130 kHz E-field with frequency hopping to eliminate RF interference, and resistant to ambient light and sound interference

**Development Support**

Microchip’s Sabrewing MGC3130 Single Zone Evaluation Kit enables development with the MGC3130 by providing a selectable electrode size of 5” or 7”. The kit comes with the AUREA Graphical User Interface – also available via a free download – which allows designers to easily match their system commands to Microchip’s Colibri Suite.

**Availability**

Kits available in early February 2013. Visit Microchip Direct to pre-order.

**MGC3130 Video**

Microchip’s MGC3130 Demonstration

MGC3130 is World’s First E-Field-Based, Configurable 3D Gesture Controller! In Mic...
The Power Team

High-Voltage Analog Buck PWM Controller with Integrated MOSFET Drivers and High-Speed, Low-Figure of Merit MOSFET Family

Enabling Higher-Voltage, Higher-Power DC/DC Applications at Increasing Levels of Integration

Addressing the industry trend toward smaller power-conversion systems, as well as enabling higher-voltages and higher efficiencies, Microchip recently announced the new MCP19035 family of power-conversion controllers and the MCP87XXX, its first-ever family of power MOSFET devices. These new Pulse Width Modulation (PWM) controllers and the complementary family of low-Figure of Merit (FOM) MOSFET products combine to support high-efficiency DC/DC power-conversion designs, covering a broad array of consumer and industrial applications.

The MCP19035 is an analog-based PWM controller family with integrated synchronous MOSFET drivers offering outstanding transient performance. The MCP19035 family is offered in a small 3 x 3 mm 10-pin DFN package. The MCP19035 devices operate over a wide 4.5-30V DC range, have a 300 kHz switching-frequency, and offer a factory-adjustable dead-time setting, allowing designers to optimize the performance across a wide selection of MOSFET devices.

The MCP87XXX family of high-speed MOSFETs offers very low FOMs and is packaged in industry-standard 5 x 6 mm and 3.3 x 3.3 mm PDFN packages. The MCP87022, MCP87050, and MCP87055 devices, which offer on-state resistance of 2.2 mΩ, 5.0 mΩ, and 5.5 mΩ respectively, enable high-efficiency power-conversion designs.

The MCP19035 family of PWM controllers expands the range of choices for design engineers in solving their application power-conversion needs. Combined with the MCP87XXX family, Microchip’s first-ever, high-speed MOSFET offerings, they deliver fast and efficient DC/DC power-conversion solutions, yielding efficiencies exceeding 96%.

Applications

Computing
• Server
• Desktop
• Embedded Controllers

Consumer
• Set-Top Box
• Gaming

Networking
• Networking
• Telecom

NEW PRODUCT

CHECK OUT OUR END OF YEAR SALE
GOING ON RIGHT NOW
Amp Up for High Data Rates

Microchip’s 5 GHz RF Power Amplifier for New IEEE 802.11ac Wi-Fi® Standard Delivers Low EVM at High Power for WLAN Applications

Amplifier Boosts Transmission Range for Ultra High Data Rate of Up to 3 Gbps

If you are looking for longer range on your ultra high data rate Wi-Fi, then Microchip has the RF portfolio to meet your needs. The SST11CP16 5 GHz power amplifier products support these ultra high data rate Wi-Fi standards for 351 Mbps with 1.8% Error Vector Magnitude (EVM) at 19 dBM output power. Additionally, the SST11CP16 provides low operating current of 360 mA at 22 dBm, which enables more transmission channels at a higher data rate, per system. For those designers looking to conserve space, this portfolio of RF products is offered in a 3 x 3 x .45 mm, 16-pin QFN package.

In conjunction with high-efficiency operation, this new power amplifier can significantly extend the range of 802.11ac systems.

The SST11CP16’s low EVM and high linear power provide an attractive option for set-top boxes, routers, access points and other Wi-Fi devices that require data rates of up to 3 Gbps for applications such as wireless streaming video. Additional features of this new PA include a 50 ohm on-chip input match and simple output match for ease of use and smaller board sizes. Additionally, the SST11CP16 includes a linear power detector that is temperature-stable and insensitive to voltage standing wave ratios.

Existing 802.11 standards can also take advantage of the SST11CP16’s features, at the following performance rates:

• 802.11a: 3% added EVM for 54 Mbps at 22 dBm; spectrum-mask compliant up to 25.5 dBm using Orthogonal Frequency-Division Multiplexing
• 802.11n: Spectrum-mask compliant up to 24.5 dBm using High-Throughput 20 Mhz mode

Benefits of the SST11CP16

• High output power with extra-low EVM
• Low operating current of 360 mA at 22 dBm
• 3 x 3 x .45 mm, 16-pin QFN
• 50 ohm on-chip input match
• Temperature-stable linear power detector

Applications

• Set-top boxes
• Routers
• Access points
• Wireless streaming video

Development Support

Developers can begin designing today with the SST11CP16 Evaluation Board (SST11CP16-QXCE-K), which is available now, via any Microchip sales representative.
The Trifecta

Microchip Expands USB Portfolio with Three New Enhanced Midrange 8-bit Families

15 Scalable MCUs Offer Substantial System Cost Savings

Microchip’s new certified Full-Speed USB 2.0 Device PIC® microcontroller portfolio has three new Enhanced Midrange 8-bit families comprising 15 scalable MCUs. These MCUs range from 14 to 100 pins with up to 128 KB of Flash. All products in this family feature an internal clock source with the 0.25% clock accuracy necessary for USB communication. Additionally, all three families are eXtreme Low Power compliant, with power consumption down to 35 µA/MHz Active and 20 nA in Sleep mode.

The 14- and 20-pin PIC16F145X MCUs are Microchip’s lowest-cost and smallest-form-factor USB MCUs to date. Available in packages as small as 4 x 4 mm and featuring a wide array of integrated peripherals. The PIC18F2X/4XK50 devices, available in 28- and 40/44-pins, offer a cost-effective, pin-compatible migration option for customers utilizing legacy PIC18 USB MCUs. The full-featured PIC18F97J94 family is Microchip’s first to offer integrated LCD control, RTCC with V batt, and USB on a single 8-bit PIC microcontroller. Available in 64, 80 and 100 pins, the nine-member family offers a 60 x 8 LCD controller (for a total of 480 segments), which eliminates the need for an external controller in applications with large segmented displays.

Development Support

To help speed development times, the downloadable and open-source USB Framework within the free Microchip Library of Applications (MLA) includes USB drivers for many common USB classes. In addition to providing free USB software drivers and stacks, Microchip hardware development tools are available for purchase. The Low Pin Count USB Development Kit for use with the PIC16F145X family and the PICDEM™ FS-USB Board for use with the PIC18FXK50 family. Additional products supporting the PIC18F97J94 and PIC18F87J94 are available and information and documentation can be found on Microchip’s USB & LCD Design Centers.

8-bit USB PIC® MCUs with No Crystal Required

Key Features

- No External crystal needed
- 14 to 100 pins, packages as small as 4 x 4 mm
- Up to 4 KB RAM, 128 KB Flash
- Active current as low as 35 µA/MHz
- Sleep current as low as 20 nA
- Internally generated USB-accurate clock source
- Saves space, lowers BOM cost, reduces complexity
- Support mTouch™ capacitive sensing
- Easily implement low-cost battery charging or high-power LED drive
- High-density LCD, CTMU measurement, and RTCC available

Applications

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The Trifecta
The serial SRAM portfolio is expanding with four new devices that feature the industry's largest densities and speeds. They are also the industry's first with 5V operation, which remains prevalent in automotive and industrial applications. These 512 Kb and 1 Mb SPI devices maintain the portfolio’s low power consumption and small, 8-pin packages. Speeds of up to 80 Mbps are achieved via the quad-SPI, or SQI™, protocol, providing the zero write-cycle times with near instantaneous data movement needed for offloading graphics, data buffering, data logging, displays, math, audio, video and other data-intensive functions.

Two additional products – the 23LCV512 and 23LCV1024 – offer the industry’s most cost-effective options for non-volatile, unlimited-endurance RAM, via battery backup. In fact, with their fast dual-SPI (SDI) throughput of 40 Mbps and low active and sleep currents, these serial NVSRAM devices feature high-speed operation without the high pin counts of parallel NVSRAM, and comparable power consumption to FRAM, all at a fraction of the price.

The new 1 Mbit SRAMs enable designers to fill the need for more RAM at a much lower cost than moving to a larger microcontroller or processor, and with lower power consumption, pin counts and cost than parallel SRAM. For applications requiring non-volatile RAM, Microchip also added two devices with battery backup, which offer significantly lower cost than any other type of non-volatile RAM.

The EEPROM market has completely moved to serial interfaces, and the Flash market is rapidly making this transition, due to the higher cost, board space and power consumption of parallel devices. Microchip expects SRAM to follow this trend, and the company’s serial SRAM portfolio offers compelling options to the embedded market.
Operating with a single supply voltage as low as 1.6V and a quiescent current as low as 7.5 µA, the ultra-high-performance MCP6V11 and MCP6V31 single amplifiers offer some of the industry’s lowest quiescent current for the given bandwidth without sacrificing the optimal performance essential for portable applications in the consumer, industrial and medical markets.

With an aging world population in need of new therapies and early diagnostic tools, devices like the MCP6V11/31 enable the development of portable medical products integrated with higher efficiency, and signal conditioning hardware and software, which is critical to accommodate the continued push for lower costs and faster times to market. As well, designers of industrial applications – such as portable sensor conditioning and instrumentation requiring low power, smaller form factors, temperature considerations and cost-management – can benefit from the optimized performance, low quiescent current and low operating voltage made possible by the MCP6V11/31 op amps.

Employing Microchip’s advanced CMOS technology, the devices require less current to operate the amplifier while simultaneously delivering longer battery life and minimal thermal-related challenges. The self-correcting architecture of the MCP6V11/31 family provides a maximum input offset voltage of 8 µV for ultra-low-offset and low-offset drift, enabling maximum accuracy across time and temperature. The MCP6V11 offers 80 kHz of gain bandwidth product, with a low typical quiescent current of only 7.5 µA; while the MCP6V31 provides 300 kHz of gain bandwidth product, coupled with a low typical quiescent current of 23 µA.

Additionally, the MCP6V11 and MCP6V31 single amplifiers are both available in small 5-pin SOT-23 and 5-pin SC-70 packages, enabling minimal use of board space, ease of system design and reduced cost.

The MCP6V11 and MCP6V31 zero-drift op amps leverage Microchip’s expertise in high-precision amplifier design to provide an extremely low-power, small-package alternative to Microchip’s existing portfolio of devices. They raise the bar to a new level of ultra-precision, low-power amplifier design.
Two Boards Are Better Than One

Microchip Launches Parallel SuperFlash® Development Kit

New Kit Enables Designers to Evaluate Microchip’s Parallel Flash Products Using Existing Microchip Development Tools

The Parallel SuperFlash Kit 1 enables designers to evaluate Microchip’s Parallel Flash products utilizing Microchip’s modular development tools to help speed up time to market.

The Parallel SuperFlash Kit 1 includes two Parallel Flash PICtail™ Plus daughter boards. One board uses an SST38VF6401 64 Mbit device from the Advanced MPF+ family. The other uses an SST39VF1601C 16 Mbit device from the MPF+ family. The Parallel Flash PICtail Plus daughter boards interface with the PICtail Plus connector found on Microchip’s Modular Explorer 16 Development Board. These daughter boards also work with the MPLAB® X Integrated Development Environment, to enable the quick creation of code and shorten the overall development time.

Example code and software drivers for the two Parallel Flash devices written using the MPLAB X IDE are available via free download. Additionally, these daughter boards can support any 3V Parallel Flash products from Microchip. Utilizing these tools code (e.g., Program, Read, Erase, Protect and Unprotect Memory, Read ID) can be done quickly by writing software routines in the MPLAB X IDE using known good hardware.

Key Features
• 16-pin header for easy access to probe and evaluate
• 32-pin right-angled header for easy access to the address and control pins for probing and evaluation
• 2-pin header/jumper for either on-board power or an external power supply
• Can be used in conjunction with the many other functional PICtail daughter boards for the modular Explorer 16 Dev board.

Development Tools Now Ship Overnight

Now Standard for In-Stock Development tools to Domestic US locations

Details about Overnight Service:
• Order an in-stock development tool or software by 11AM Arizona time and receive it the next day
• Applies for US domestic deliveries

Reduced Freight Rates Now Available for Europe!

Go to http://www.microchipdirect.com or speak with one of our microchipDIRECT team members
PIC32 GUI Development Board Facilitates Cost-Effective Multitouch Displays

The PIC32 GUI Development Board with Projected Capacitive Touch makes it easy for designers to add the combination of multitouch projected-capacitive interfaces, and high-quality 16-bit color graphics to WQVGA displays in any application. In combination with Microchip’s free graphics and multitouch software, this board enables rich, modern user interfaces for cost-sensitive designs in a broad range of markets, such as consumer, industrial and medical. More Information.

Free MPLAB® XC32++ Offers Unlimited Code Generation

The MPLAB XC32++ supports all of Microchip’s 32-bit PIC32 microcontrollers. This compiler enables designers to develop and re-use C++ projects by making all of Microchip’s C language extensions available in an environment that is compliant with the majority of C++98 and C++2003 ANSI standards. Additionally, the Compiler includes Dinkumware® standard C, C++, and template libraries. The Free version of the MPLAB XC32++ Compiler has no time or memory limits, and can be used in commercial applications. More Information.

New Embedded Wi-Fi® Development Boards Integrate TCP/IP Stack; Enable Internet of Things Via Simple Serial Connection

The RN-131 and RN-171 PICtail™/PICtail Plus daughter boards are the first two products developed by Microchip based on Roving Networks modules. These modules use a simple serial interface to connect with any PIC® microcontroller, and expand Microchip’s wireless portfolio with the industry’s lowest power consumption along with an integrated TCP/IP stack in a certified Wi-Fi® solution. No external processor drivers are required, enabling Wi-Fi connectivity for 4, 8, 16 and 32-bit processors. More Information.
Industry’s First Audio Mixer Development Boards Make it Easy to Create 24-bit Audio Designs

Two new development boards, each powered by Microchip’s PIC32MX250F128 32-bit MCU, enable audio and voice device development for a broad range of applications. The DM320014, a USB digital audio accessory board, utilizes standard USB 2.0 Mini-B connectivity. The DM320413, a digital audio mixer board, offers Apple® portable device connectivity. Key features include interfaces for digital audio via USB Mini-B or the Apple iOS interface, line-in and microphone-in for convenient connectivity to analog audio sources, such as microphones or instrument pickups, and line-out and headphone out, for line-level output and headphone connectivity. More Information.

Wi-Fi® Evaluation Kit for the RN171XV Module

Easily evaluate the RN-XV, an 802.11™ b/g solution for existing 802.15.4™ architecture, with the WPS pushbutton evaluation platform. The board connects to a PC via a standard USB cable (included in the kit), and provides 2 pushbutton switches to control WPS mode and to reset the module. More Information.

RN-42-HID-RD1 Reference Design

Discover the HID (Human Interface Device) profile for Bluetooth using this battery-powered, pushbutton remote control reference design. This HID reference design offers three modes of operation: Presenter mode - enables the control of presentation software such as Microsoft® PowerPoint®. Music mode enables the control of music functions such as pause, play, volume controls and switching tracks on devices such as iPhones® and iPods®. Custom mode enables programming of each button to send a sequence of keys. More Information.

RN-174-K Evaluation Kit

Quickly add Wi-Fi connectivity to your embedded application using the RN-174-K, an evaluation kit for the ultra-low power RN-171 Wi-Fi module. The RN-174-K comes with complete on-board TCP/IP stack, accessories and documentation to assist developers to quickly evaluate the potential of the RN-171 module and reduce development times. The kit includes: RN-174 evaluation board, RS232 cable with male DB9 connector, USB to serial cable, Null modem, 9V battery clip, documentation, tools, drivers and utilities. More Information.
Boosting Performance with 32-bit PIC32MX1/MX2 MCUs

With an increased speed of 50 MHz or 83 DMIPS, the PIC32 MX1/MX2 MCUs now offer a 25% performance boost in addition to their feature-packed peripherals and 4-channel DMA. The PIC32MX1/MX2 series includes Microchip’s smallest 32-bit MCUs with sizes down to 5 mm x 5 mm, and a 0.5 mm pitch, as well as the lowest-cost PIC32 MCUs. These devices include up to 128K Flash and 32K RAM, and integrate peripherals for touch-sensing, audio-processing and advanced-control applications in the consumer, industrial, medical and other markets. More Information.

Turnkey Controllers for Multitouch, Proximity Detection and Haptic Feedback

The mTouch™ Sensing Portfolio has been expanded to include four new turnkey controllers. The MTCH6301 is a projected-capacitive touch controller that makes it easy for designers to add popular multitouch and gesture interfaces. The small MTCH101 and MTCH112 controllers provide an easy way to add robust proximity detection with a range of up to 8 inches. The MTCH810, the first in a family of controllers based on Microchip’s license of Immersion’s TouchSense® haptic feedback technology, enables the easy addition of haptic tactile feedback to any capacitive-touch button or slider interface. More Information.

Three New 12V Families of Low-Power Op Amps Enable Wider Signal Input Range

The MCP6H7X/8X/9X expands the range of Microchip’s low-voltage, low-power op amp portfolio to 12V supply voltages. They maintain the same pin outs and features of the existing 6V and 16V families of devices, allowing designers to easily migrate to the ideal voltage rail, along with the new families’ higher-speed Gain Bandwidth Product (GBWP) range of 2.7-10 MHz. All nine devices in the MCP6H7X/8X/9X families are available in single, dual and quad configurations. More Information.
Low-Cost dsPIC® Digital Signal Controllers and PIC24F Microcontrollers Include Low Pin Count Options

Developed for cost-sensitive motor control, consumer, medical and industrial applications that require up to 16 MIPS performance with an optional DSP engine, the dsPIC33FJ32MC104 family delivers a low-cost 16-bit solution with powerful peripherals in packages ranging from 18 to 44 pins. Offering greater energy efficiency, sensorless operation and more precise control, the dsPIC33FJ32M104 is an excellent solution for a variety of motor control applications. More Information.

70 MIPS DSCs and MCUs Provide 32 KB to 256 KB Flash for Easy Memory Migration

The new dsPIC33E and PIC24E devices reduce the costs of high-performance motor control systems with cost-effective 70 MIPS devices that include innovative technology. New on-chip peripherals, such as integrated op amps, reduce board space and the need for external components. These op amps can be used in a variety of sensing applications where signal amplification is required. With a rich feature set and low cost, the dsPIC33E and PIC24E devices can be used in sensor, communications, automotive, industrial and emerging applications. More Information.

New dsPIC® DSCs Optimized for Digital Power and Lighting Applications

Expanding Microchip’s successful dsPIC DSC portfolio, the dsPIC33FJ09GS302 family adds lower-cost options for digital-power conversion. The new family of DSCs also brings new features while lowering power consumption, enabling higher efficiency in AC-DC and DC-DC power supplies, HID & LED lighting, solar inverters, and other power conversion applications. They also offer the lowest power dissipation of any of the GS family members, and are the first available in a 20-pin SSOP package and an even smaller 36-pin VTLA package, which has a 5 x 5 mm footprint. More Information.

New 28-pin MCUs Feature eXtreme Low Power Technology and 10-bit ADC with Automated Touch Sampling

Microchip has expanded its 8-bit eXtreme Low Power (XLP) Enhanced Midrange Core PIC® microcontrollers (MCUs), with the new PIC16F1512/13 devices. These new 28-pin MCUs offer a combination of advanced digital and analog peripherals, along with XLP for the extended battery life that many applications require. These features make the general-purpose PIC16F1512/13 MCUs ideal for a broad range of applications in the appliance, medical, consumer and automotive markets, among many others. More Information.
Multipurpose Flash Plus Devices Deliver Low Power, Small Footprint, and Impressive Program and Erase Speed

Microchip debuts four new compact 256K x 16 Parallel Flash CMOS devices: the SST39VF401C, SST39F402C, SST39LF401C and the SST39LF402C. Manufactured with high-performance CMOS SuperFlash® technology, these compelling low-power, 2.7-3.6V, x 16 Parallel NOR Flash devices boast a split-gate design and thick-oxide tunneling injector for superior reliability and design simplicity. All four devices help reduce engineering design cycles, and improve overall product performance and responsiveness, which enables a better end-user experience. More Information.

Low-Power, Low-Cost 6-bit Volatile DAC with Command Code Features 1.8-5.5V Wide Operating Voltage Range

The volatile MCP47A1 Digital-to-Analog Converter (DAC) features a 1.8-5.5V wide operating voltage range, and is offered in a 6-pin SC-70 package. The MCP47A1 is ideal for applications in the automotive, audio and industrial markets, such as portable, handheld battery-operated products, and applications such as set-point or offset trimming and sensitive mechanical-trim pot replacement. The extended temperature range of -40 to +125 degrees Celsius allows for use in high-temperature automotive and industrial applications. Additionally, the small SC-70 packaging allows for more portable and space-constrained consumer applications. More Information.

Mid-Range, SPI Real-Time Clock/Calendars (RTCC) Now Come in Smaller Packages

The new 10-pin, SPI MCP795XX family offers many of the same features as the larger 14-pin MCP795WXX family, including superior timekeeping performance. The devices also feature power-failure monitoring and on-chip nonvolatile memory. Reducing overall component count in the system and eliminating the user programming costs for a serial ID, the MCP795XX RTCC family is an ideal choice for the handheld, wireless and consumer markets. More Information.
What’s in a Name?

Defining Zero-Drift Operational Amplifiers

Semiconductor companies are constantly attempting to find new ways to brand their products and concisely highlight the feature set of their products. This is certainly true within the world of operational amplifiers. As the need for highly precise operational amplifiers continues to increase, the use of self-correcting architectures – designs that continuously correct for offset error – has become more and more popular.

In order to highlight the high precision architecture of such devices, leading manufacturers such as Texas Instruments, Analog Devices and Linear Technology have adopted the industry standard term “zero-drift” to refer to any amplifier that uses a continuously self-correcting architecture, regardless if it is auto-zero topology or a chopper-stabilized topology. The goal of zero-drift amplifiers, whatever specific architecture is employed, is to minimize offset, drift and 1/f noise. In the process other DC characteristics, such as common-mode and power supply rejection, are also greatly improved.

The auto-zero architecture, implemented on Microchip’s MCP6V01/2/3, MCP6V06/7/8 and MCP6V26/7/8, contains a main amplifier that is always connected to the input. There are also secondary “nulling” amplifiers that are continuously correcting their own offset and then applying an offset correction - via charge held on a capacitor - to the main amplifier. This is illustrated in Figure 1 on the next page. For additional details, please refer to section 4 of the MCP6V01 datasheet, which describes the functionality of the auto-zero architecture.

Microchip’s MCP6V2X implements the auto-zero architecture
A chopper-stabilized architecture, implemented in the new MCP6V11 and MCP6V31, also uses a high bandwidth main amplifier that is always connected to the input. There is also an “auxiliary” amplifier that uses switches to chop the input signal and provide offset correction to the main amplifier. This is illustrated in Figure 2 below. Although the internal operation is different than that of the auto-zero architecture, the goal is the same – minimize offset, drift and 1/f noise and consequently provide superior common-mode and power-supply rejection. Section 4 of the MCP6V11 datasheet describes the functionality of the chopper-stabilized architecture.

In order to avoid confusion, Microchip has adopted the industry standard term "zero-drift", which is applied to all MCP6VXX products regardless of the actual internal architecture that is implemented. For a complete listing of all zero-drift amplifiers offered by Microchip, visit the zero-drift operational amplifier parametric page on Microchip’s website.

Figure 1: Simplified Auto-zeroed Functional Diagram

Figure 2: Simplified Chopper-stabilized Functional Diagram
Need help with your Wireless design?

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Smaller, Thinner, Lighter

New Thermal Leadless Array Package Offers Higher I/O Density at Lower Cost

The Thermal Leadless Array (TLA) is a lead frame based wire bonded interconnect package that provides the highest I/O count for devices of comparable body size. Its design allows I/Os to be placed even in the corners of the package. When compared to other package types with the same pin count, its smaller footprint results in a significant reduction in board size.

Considered a close cousin of the QFN package, the smaller, thinner and lighter TLA incorporates the best characteristics of both the QFN and area array packages such as the fpBGA, BGA, and LGA. The TLA offers improved thermal and electrical performance as well as better moisture sensitivity and shorter manufacturing times. The TLA is offered in several different thickness options. A VTLA package has a maximum thickness of 1.0 mm and a WTLA package has a maximum thickness of 0.8 mm.

Having passed the JEDEC Solid State Technology Association’s prescribed package qualification process, the TLA is a reliable package option to be considered for your next design.

Saving Board Space

Figure 1 compares the TLA with QFP and LPCC/QFN packages with the same pin count. As illustrated, the TLA occupies only 25% of the PCB area occupied by the QFP, resulting in an approximate 75% reduction in space. This reduces the cost per I/O as well as the overall system cost.

Figure 1: Package Size Comparison (Source - UTAC Group)
DESIGN ARTICLE

Excellent Electrical and Thermal Performance
Smaller signal and wire lengths play a significant role in an application that is electrically challenging. As TLA packages have shorter wire lengths, the parasitics associated with these wires are reduced, thereby minimizing distortion and facilitating cleaner signals. TLAs also offer efficient heat dissipation and excellent thermal performance. As shown in Figure 2, the Die Attach Pad (DAP) extends out and is soldered to the printed circuit board to provide a direct thermal path from the die to the copper planes on the board.

Figure 2: TLA Cross Section (Source - UTAC Group)

TLA Applications
A TLA package should be evaluated for any application that is electrically challenging and requires excellent thermal performance and a higher I/O count in a small body size. Some applications which would benefit from a TLA package include high speed networks, RF designs, telecommunications and hand-held products.

Microchip Products in VTLA Packages
Microchip currently offers several devices in 36-pin, 44-pin and 124-pin VTLA packages. In its MCU product area, these include the PIC32MX1/MX2 Series and the PIC24EP64GP/MCX03/04. In its DSC product area, these are the dsPIC33EP64GP/MCX03/X04. The specifications for the 36-pin, 44-pin and 124-pin VTLA packages are shown in Table 1 below.

As the consumer world continues to drive the design of slim and stylish products, there is an ongoing need for smaller, thinner and lighter packages. Microchip continues to offer innovative packaging options to not only meet the space and weight constraints of today’s product designs, but to also deliver higher I/O density, superior thermal and electrical characteristics and effectively reduce overall system cost for its customers.

Table 1 - VTLA Package Specifications

<table>
<thead>
<tr>
<th>Package</th>
<th>36-Pin VTLA</th>
<th>44-Pin VTLA</th>
<th>124-Pin VTLA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layout</td>
<td>Single Row</td>
<td>Single Row</td>
<td>Dual Row</td>
</tr>
<tr>
<td>Pin Count</td>
<td>36</td>
<td>44</td>
<td>124</td>
</tr>
<tr>
<td>Size</td>
<td>5 x 5 mm</td>
<td>6 x 6 mm</td>
<td>9 x 9 mm</td>
</tr>
<tr>
<td>Thickness</td>
<td>0.9 mm</td>
<td>0.9 mm</td>
<td>0.9 mm</td>
</tr>
<tr>
<td>Pitch</td>
<td>0.5 mm</td>
<td>0.5 mm</td>
<td>0.5 mm</td>
</tr>
</tbody>
</table>
Turning Down the Noise

Important Factors in Selecting Low Noise Operational Amplifiers

System designers have many choices when it comes to selecting operational amplifiers. Manufacturers offer a huge variety of op amps specializing in high speed, low power, high precision, low input leakage, high output drive or low noise just to name a few options. But when it comes to low noise op amps, a designer must consider a number of factors, including voltage and current noise of the actual amplifier and also how the amplifier will be used within the application.

In most cases, manufacturers will tout the voltage noise density specification of an operational amplifier when discussing noise. Although this is an important specification, it is not the only one in terms of noise. Current noise may be a bigger concern. The input voltage noise density is specified where the white noise of the amplifier dominates (eliminating the effects of 1/f noise). Current noise density is also specified where the white noise of the amplifier is dominant, and can be critical for applications in which the input resistance is high. Let’s look at a simple example using two operational amplifiers, Microchip’s MCP621S and Texas Instruments LMP7731. Table 1 highlights some of the key specifications of these two amplifiers.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>MCP621S</th>
<th>LMP7731</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Input Offset (µV) Voltage</td>
<td>200</td>
<td>500</td>
</tr>
<tr>
<td>GBWP (MHz)</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>Supply Voltage Range (V)</td>
<td>2.5-5.5</td>
<td>1.8-5.5</td>
</tr>
<tr>
<td>Voltage Noise Density (nV/√Hz)</td>
<td>13</td>
<td>2.9</td>
</tr>
<tr>
<td>Current Noise Density (fA/√Hz)</td>
<td>4</td>
<td>1100</td>
</tr>
</tbody>
</table>

These two op amps are similar in terms of offset performance, speed and operating supply range. The noise specifications on the other hand vary considerably. TI promotes the LMP7731 as a low noise amplifier, boasting a voltage noise density under 3 nV/√Hz, which is indeed very...
impressive. But is this low noise op amp always superior in terms of noise performance? A simple voltage follower circuit is shown in Figure 1. Although actual circuit design must take into consideration noise from a multitude of sources including internal noise of the ICs, thermal noise of all components as well as external noise sources, this example will focus only on the noise associated with the amplifier and the thermal noise of the input resistance, noted here as $R_{\text{IN}}$.

When the source impedance is zero, there is no noise component due to thermal considerations or due to the current noise of the amplifier, since this current must flow through an impedance to cause a voltage error. In this case, the noise is dominated by the voltage noise of the amplifier, in which case the LMP7731 offers superior performance, as can be seen in Table 2.

However, if the source impedance is increased to 10 kΩ, the contribution of the thermal noise associated with this resistance begins to factor in. Also, the amplifier current noise of the LMP7731 becomes a factor, which isn’t the case for the MCP621S. Finally, in the case where the source impedance is increased to 100 kΩ, the thermal noise of the resistance is the dominant factor for the MCP621S. However, in the case of the LMP7731, the amplifier current noise becomes dominant.

This simple example highlights the effects of these various noise sources under different conditions. For a high impedance application, such as a pH meter or oven oscillator, using an amplifier with a low current noise is critical as that source can quickly become the dominant noise factor.

![Figure 1: Simple Voltage Follower Circuit](image-url)

### Table 2: Noise contributions in nV/√Hz

<table>
<thead>
<tr>
<th>Noise Source</th>
<th>MCP621S Values of $R_{\text{IN}}$</th>
<th>LMP7731 Values of $R_{\text{IN}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 Ω</td>
<td>10 kΩ</td>
</tr>
<tr>
<td>Amplifier Voltage Noise</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Amplifier Current Noise</td>
<td>0</td>
<td>0.04</td>
</tr>
<tr>
<td>Thermal Noise of $R_{\text{IN}}$</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Total Noise</td>
<td>13</td>
<td>18</td>
</tr>
</tbody>
</table>
Power Minus the Noise

MCP1754 Provides High Voltage and PSRR Performance for Electronic Circuits

In many of today’s electronics applications, circuits must be able to function reliably in environments that contain both electrical and magnetic noise. This noise is generated when switching transients and RF signals get coupled onto the supply lines. Designers of applications that are sensitive to power supply noise – such as GFCI and AFCI circuit-breakers, automotive power adapters, cell phones and medical devices – should consider including a high power supply rejection ratio (PSRR) low dropout (LDO) device in their circuit designs to allow them to operate properly.

Circuits such as RF oscillators, RF amplifiers, and GFI circuit breaker are sensitive to noise on the supply line. LC filters and large electrolytic capacitors are commonly used to filter out noise. An LDO with a high PSRR can be helpful in controlling the amount of noise or ripple in a given power rail. Many applications also use DC-DC switching converters to efficiently convert a higher voltage to the lower voltage required by the circuit. The addition of an LDO to these applications will help to suppress the noise or ripple generated by switching transients while also providing the secondary voltage required. An LDO can also be used in highly-noisy environments, such as automotive applications which are subject to noise as the alternator, motors, solenoids, and relays are turned on and off.

PSRR is a measure of how well the LDO rejects noise coming from the input power supply at various frequencies. The formula below shows PSRR ratio as a function of frequency.

\[
\text{PSRR} = 20 \log \left( \frac{V_{\text{out}} @ f_o}{V_{\text{in}} @ f_o} \right)
\]

*Figure 1: PSRR Ratio Formula*
Microchip’s MCP1754/MCP1754S is a family of CMOS LDO voltage regulators that can deliver up to 150 mA of current while consuming only 56.0 μA of quiescent current (typical). The input operating range is specified from 3.6V to 16.0V, making it an ideal choice for four to six primary cell battery-powered applications, 12V mobile applications and one- to three-cell Li-Ion powered applications. A typical application for the MCP1754S, with ripple and noise at the input, is shown below.

The plot in Figure 3 below shows the ripple/noise rejection as a function of frequency. This performance does come at the cost of a higher quiescent current.

The MCP1754/MCP1754S delivers 70 dB of ripple rejection at 1 kHz with 56 μA of quiescent current. As shown, the PSRR varies with the output current. With an output current of 10 mA, the PSRR is -90 dB from 10 Hz to almost 300 Hz. The PSRR at 150 mA output current has a sweet spot at 1 kHz with a PSRR of -80 dB.

Designers need a high-PSRR LDO to reject power-supply noise in their sensitive electronic circuits, and the MCP1754/MCP1754S LDOs are fully able to meet that need.

Figure 2: Typical MCP1754S Application

Figure 3: Ripple/Noise Rejection
Help is at Hand

mTouch™ Sensing Solutions Library for PIC18, PIC24, PIC32

Capacitive Sensing

The mTouch Sensing Solutions Library provides APIs to assist in the development of capacitive touch and proximity applications using either the Charge Time Measurement Unit (CTMU) or the Capacitive Voltage Divider (CVD) scanning methods on PIC18, PIC24, and PIC32 microcontrollers. It uses the same noise algorithms as the mTouch Framework, allowing Microchip to offer noise-robust capacitive sensing on all of its microcontroller families.

Built-in communications support provides an easy way to view sensor data in real-time using the provided one-way mTouch GUI, or capture the data in a terminal program for processing in other programs.

Example projects are available for a wide variety of configurations:

- Basic Buttons
- Two and four channel sliders
- Slider gesture recognition
- Matrix Keypad Layouts with coordinate outputs
- Proximity sensing
- USB Logger demo application
- mTouch Capacitive Evaluation Kit default source code

The library also integrates seamlessly with the other Microchip Application Libraries (MLA), such as the TCP/IP, graphics, and USB stacks, to provide the developer with a quick solution for a variety of applications. The Microchip Application Libraries with full source code, example projects, documentation, and GUI are available for download at [http://www.microchip.com/MLA](http://www.microchip.com/MLA).
Get Ready for an ‘Internet of Things’

Microchip Partners with WIZnet to Enable Internet Connected Designs

In the beginning, the Internet was created to provide a standard and robust way for computers to communicate with each other i.e. ‘C2C’ (‘Computer-to-Computer’). Now we are poised to enter a new ‘Internet of Things’ (‘IoT’) era that will take the Internet to the next level.

You can start developing your IoT designs today with the TWIZ5200 Ethernet PICtail™ Plus Board. It works with a wide variety of PIC MCU development platforms including Explorer 16 (DM240001), PIC32 I/O Expansion Board (DM320002), PICDEM.net 2 (DM163024), PIC18 Explorer (DM183032) and others.

The TWIZ 5200 Ethernet PICtail Plus Board is a complete Ethernet 10/100 interface solution combining a WIZnet W5200 smart Ethernet chip, RJ45 connector (with magnetics) and a Microchip 2K-bit SPI EEPROM (p/n 25AA02E48) factory programmed with ‘EUI48™’ Extended Universal Identifier (i.e. MAC address). WIZnet provides MPLAB compatible W5200 driver software and ‘C’ code examples (see www.wiznettechnology.com/microchip/) to kickstart network applications that take full advantage of the W5200 hardware features.

The W5200 is an Ethernet transceiver with a big advantage. Going beyond the usual specs (auto-negotiation and crossover, LED outputs, Wake-on-LAN), the W5200 adds intelligence that handles Internet protocols (ex: TCP, UDP, etc.) in hardware.

Compared to a traditional software TCP/IP stack, the W5200 hardware stack solution reduces the host MCU processing and memory burden. With the W5200 handling the network chores even a low-cost 8/16-bit PIC® MCU can get online. This means existing (i.e. non-networked) designs can be upgraded with Internet features without an expensive and time consuming system and software redesign. After prototyping a design with PIC MCU and the TWIZ5200 it’s a simple matter to move to production using the WIZ820io which combines the W5200 and RJ-45 jack with magnetics in a tiny easy-to-use module.

Continued on next page
More sophisticated designs can take advantage of the W5200’s unique hardware features as well. Consider a PIC32 MCU running an OS (e.g., Embedded Linux or RTOS) which includes a software TCP/IP stack. In this case, one of the eight available W5200 sockets can be configured to bypass the hardware protocol logic to act as a ‘raw’ Ethernet transceiver (i.e., MAC+PHY) working with the software TCP/IP stack in the usual way. But at the same time, the additional sockets remain available for direct communication via the W5200 hardware stack. These ‘sideband’ channels provide a fast and non-intrusive way to communicate with an application that is simultaneously processing traffic through the software stack. Another option is to explicitly allocate priority traffic to the W5200 high-speed hardware-managed connections, reducing the burden on the software stack and freeing MCU cycles and RAM for use by the application.

Larger systems can also use the W5200 to boost security and reliability. Handling the Internet protocols and buffering data on-chip, the W5200 provides a firewall-like first line of defense against network errors or attacks. Data from the network can never reach the host MCU or main memory without host permission. With protocol handling in hardware, the W5200 provides a robust Internet lifeline for remote system diagnosis and repair.

Figure 1: W5200 Block Diagram

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- mTouch™ Capacitive Sensing capability
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- From 14 KB to 128 KB of Flash

Three New 8-bit PIC® MCU Families
Microchip is pleased to announce that six of its products released in the past year have been named to EDN’s list of the year’s Hot 100 Products. Some of these devices are featured in this issue of MicroSolutions. Here are the devices, shown by EDN’s product categories:

**MCUs, Processors, Programmable Logic**
MGC3130 electrical-field-based 3D gesture controller

**EDA/IP & Memory Storage**
23A1024/23LC1024, 23A512/23LC512, and 23LCV51/23LCV1024 serial SRAM family

**Boards & Development Tools**
MPLAB® XC compilers
RN-131 and RN-171 PICtail™/PICtail Plus Wi-Fi® development boards

**Communications/Networking & RF/Microwave**
PIC12LF1840T48A MCU/RF transmitter

**Analog**
MCP47A1 DAC

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