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elcome to the 36th annual *EDN* Microprocessor/Microcontroller Directory. There are so many processor options available for embedded-system applications that it is easy to miss the perfect fit just because you do not know it even exists. The company roster and product listings in this directory continue to evolve and encompass new companies, and it is a testament to the variety of processors available and the tremendous variation among requirements, features, and types of applications for which designers are using microprocessors and microcontrollers. *EDN* is constantly uncovering companies that did not exist during publication of previous editions of the directory. If you notice that we overlooked a company, please let that company and us know that you missed it and would like to see it in the next update of the directory.

The print version of this directory is but a small fraction of the entire directory that stresses a company overview and new announcements since last year's directory. Visiting the online version at www.edn.com/microdirectory is the only way to examine all of the information available because it spans hundreds of pages—well beyond the capacity of the print update. The print version lists the companies selling software-programmable processors and cores and provides an overview for each as well as identifies the latest developments over the previous year at each company.

The online material lists third-party-software-development companies as a companion directory that is cross-linked on the main pages of each listing. This directory aims to provide designers and system architects enough visibility into processor options to quickly narrow the list of candidate processors for each project. The expanded online section presents each processor with detailed information and block diagrams. The directory uses a common taxonomy for describing and categorizing target applications that helps you to quickly find and compare competing processors for your projects. The Web material has more details on the common application taxonomy so that you can comment on it and we can refine it as appropriate.

The “Where are they now?” sidebar on the Web helps you find companies that we no longer list, whether because they closed their doors, they changed their focus, another company acquired them, or they spun off into a different company. As always, the Web site duplicates and greatly expands upon the material you find in the print version.

If this directory helps you find or choose a device or core, please let the vendor know how you found its part. Help us continue to improve the directory by visiting us at www.edn.com/microdirectory or by sending your comments and feedback to microdirectory@edn.com.

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ACTEL

Actel (www.actel.com) offers low-power and mixed-signal FPGAs that support ARM and 8051 cores, including a license- and royalty-free, 32-bit, FPGA-optimized ARM Cortex-M1 processor. The company's low-power ProASIC3L FPGAs feature 40 and 90% lower dynamic and static power, respectively, than its ProASIC3 FPGAs. The company's Igloo PLUS family of FPGAs focuses on power-, area-, logic-, and feature-per-I/O ratios in a programmable device. Actel's Libero IDE (integrated development environment) supports power-driven layout, advanced power analysis, and battery-life estimation.

ADVANCED MICRO DEVICES

AMD's (Advanced Micro Devices', www.amd.com) x86-based products span the consumer embedded-system market and serve enterprise-class servers and workstations, extending the x86 ISA (instruction-set architecture) across 32- and 64-bit PC, server, and workstation platforms with AMD64 technology. The company's x86 Geode processors target applications for the entertainment, business, education, and embedded-system markets. Opteron processors with Direct Connect Architecture and HyperTransport technology deliver 32-bit performance and enable the transition to 64-bit computing. Athlon 64 processors provide dual- and single-core computing for desktops that can run 32-bit applications at full speed while enabling new 64-bit software applications. The Mobile Sempron processor features range from lower power to full-sized mobile computing.

ALTERA

Altera's (www.altera.com) Nios II family of soft embedded processors features a general-purpose, 32-bit RISC CPU architecture in three configurations. The Nios II/f core emphasizes processing performance, the Nios II/e focuses on economy, and the standard Nios II/s core configuration balances performance and core size. The Nios II embedded-design suite includes 32-bit, single-precision, IEEE 754-compatible, floating-point support and the Nios II C2H compiler. Designers can add Nios II processors to their systems using the SOPC (system-on-programmable-chip) Builder tool. The Nios II C2H (C-to-hardware)-acceleration compiler enables developers to convert performance-critical C-language subroutines into hardware accelerators and integrate them into FPGA-based Nios II subsystems.

ALTium

Altium (www.altium.com) provides next-generation electronics-design software. Altium De-

signer's unified electronics-design environment encompasses all aspects of electronics-product design into one process within a single application. This helps designers manage their projects across broad design ecosystems and create connected, intelligent designs.

Altium Designer supports interactive FPGA-system design for vendor-independent electronic-product development using soft, hybrid, and discrete processors. It includes a number of royalty-free, 8- and 32-bit, FPGA-based soft processors, such as the 8051, Z80, PIC, and FPGA-independent TSK3000 32-bit RISC core. The software also features complete support for a number of processors, such as ARM7, Nios II, and Microblaze.

ANALOG DEVICES

Analog Devices' (www.analog.com) ADuC product family combines ARM7 or 8052 microcontroller cores with integrated precision converters; references; and sensor peripherals to target automation, industrial, and automotive applications. The ADuC706x family incorporates two 24-bit sigma-delta ADCs and analog peripherals with a 32-bit ARM7 core to target precision sensing applications. The company's Blackfin processor family combines signal-processing capabilities with control functions in a single 16/32-bit core.

AMCC

AMCC (Applied Micro Circuits Corp, www.amcc.com) offers embedded Power Architecture processors targeting control-plane, imaging, wireless-access, industrial-control, storage, and networking applications. The AMCC Power Architecture supports low-power operation, high-performance PCIe (Peripheral Component Interconnect Express) and PCI-X (PCI extended) 2.0 I/O interfaces, interfacing to DRAM, such as DDR2 SDRAM, accelerated GbE (gigabit Ethernet), and state-of-the-art security.

The PowerPC 460GT and PowerPC 460GTx target enterprise-class networking, storage, and wireless-infrastructure applications. AMCC also announced the PowerPC 460SX storage processor for high-throughput RAID (redundant-array-of-inexpensive-disks) acceleration.

AMCC's Titan core relies on Intrinsic's Fast14 logic to reach clock speeds as high as 2 GHz in 90-nm bulk CMOS and consumes 2.5W. Titan is part of a dual-core "processor complex" that supports coherent multiprocessing.

ARC INTERNATIONAL

ARC International (www.arc.com) licenses consumer IP (intellectual property) in the form of multimedia subsystems and related technologies.

Sonic Focus, an ARC International company, licenses audio-enhancement software. The ARC Sound 210E subsystem targets high-quality audio for a low-power budget. ARC's new Energy Pro technology reduces SOC (system-on-chip) power consumption by as much as fourfold. ARC subsystems include a set of optimized and pre-integrated audio, imaging, and video codecs, as well as development tools. The ARCHitect configuration tool enables developers to explore and create an ARC subsystem or processor tailored to an application's requirements.

ARM

ARM (www.arm.com) licenses semiconductor IP (intellectual property), including processors, peripherals, interconnect, and physical libraries targeting mobile, automotive, consumer-entertainment, imaging, networking, storage, security, and wireless applications. The company's range of processors includes the ARM7, ARM9, ARM10, and ARM11 families and the Cortex family featuring Thumb-2 technology. ARM also offers the SecurCore processor family targeting secure applications, such as smart cards and SIMs (subscriber-identity modules), and the Mali family of graphics processors. ARM's supporting software includes TrustZone technology for data security and DRM (digital-rights management), Jazelle execution-environment-acceleration software, IEM (Intelligent Energy Manager) technology, and RealView development tools.

The high-performance ARM Cortex-A9 MP-Core multicore processor features energy-efficient, scalable performance. The ARM Cortex-A8 processor targets consumer products running multichannel video, audio, and gaming applications with a power consumption of less than 300 mW in a 65-nm technology. The midrange Cortex-R4 processor targets next-generation embedded products. The ultracompact ARM Cortex-M3 processor targets cost-sensitive embedded-system applications, such as automotive-body systems, white goods, and networking devices. The ARM Cortex-M1 processor is developed for implementation in FPGAs.

ASIX ELECTRONICS

Asix Electronics (www.asix.com.tw) offers non-PCI (Peripheral Component Interconnect)-Ethernet controllers, USB (Universal Serial Bus) 2.0-to-Ethernet NIC (network-interface-card) controllers, and network SOCs (systems on chips) targeting embedded networking applications, such as home appliances, factory/building automation, industrial equipment, security systems, remote-control/monitoring/management, and streaming-media applications. Over the last

year, Asix has focused on Wi-Fi speaker and Wi-Fi IP (intellectual-property)-camera reference designs that the company based on its new Wi-Fi SOC technology. The single-chip AX220xx microcontroller family has an SOC with TCP/IP (Transmission Control Protocol/Internet Protocol) and 802.11 WLAN (wireless-local-area-network) MAC (media-access controller)/baseband.

ATMEL

Atmel (www.atmel.com) offers microcontrollers and microprocessors that it bases on its proprietary 8- and 16-bit RISC AVR; 32-bit AVR32; and ARM's Cortex-M3, ARM7, ARM9, and ARM11. This year, the company introduced the six-pin picoPower AVR Tiny10, which draws 200 μ A while operating at 12 MIPS, 25 μ A while idling, and less than 100 nA during sleep. The 32-bit AVR32 UC3L, with a built-in capacitive-touch interface and event system, consumes 0.5 mW/MHz in active mode, less than 2 μ A with a 32-kHz RTC, and 100 nA in sleep. The 32-MIPS AVR Xmega with DMA, event system, and multilevel interrupts supports a worst-case 65.2-nsec response time.

The company's new Cortex M3-based SAM3, AVR32-based UC3A3, and ARM9-based SAM945G offer HS (high-speed) USB (Universal Serial Bus), plus interfaces for dual high-speed SD (secure-digital) card/MMC (multimedia card), SDRAM, and NAND flash with SLC (single-level cell) and MLC (multilevel-cell) ECC (error-correcting code). The AVR32 UC3A3 digital-signal controller has a built-in DSP that allows it to decode stereo MP3 at less than 25 MHz and AAC (Advanced Audio Coding) at 66 MHz. New reference designs include the Digital Audio Gateway kit and the plug-and-play CryptoAuthentication kit.

AUSTRIAMICROSYSTEMS AG

Austriamicrosystems (www.austriamicrosystems.com) offers high-performance analog ICs with a focus on power management, sensors and sensor interfaces, and portable audio. The company's 200-MIPS, ARM9TDMI-based AS3525/27 integrated-audio-processor system combines strong calculating power, high-performance-audio features, and system-power-management options for battery-powered devices. The AS353x family integrates hardware accelerators for MP3, WMA (Windows Media Audio), and AAC (Advanced Audio Coding) for audio; WMV9 (Windows Media Video Version 9) Main Profile and Sorenson Spark for video; and high-performance postprocessing for enhanced GUIs (graphical user interfaces).

BEYOND SEMICONDUCTOR

Beyond Semiconductor (www.beyondsemi.com)

licenses two families of 32-bit processor cores available as a Verilog RTL (register-transfer-logic) source or ChipX hard macros. All processors come with industry-standard software-development tools and operating-system support, including Linux and eCos. The modern, superscalar Beyond BA14 processor features dual-issue, out-of-order execution. With DSP instructions and an optional double-precision floating-point unit, it targets applications with demanding performance requirements. Implementing four-way cache and TLBs (translation-look-aside buffers) enables the Beyond BA22 to run modern Linux-multimedia applications.

BROADCOM

Broadcom (www.broadcom.com) provides a family of high-performance, low-power, integrated processors targeting data-networking and communications applications, as well as security, storage, 3G (third-generation)-wireless infrastructure, and high-density computing. The Broadcom broadband CMP (chip-multiprocessing) systems integrate as many as four 64-bit MIPS processor cores onto a single die. CMP scales system performance by sharing the workload across multiple cores.

CAMBRIDGE CONSULTANTS

Cambridge Consultants' (www.cambridgeconsultants.com) XAP processor soft-IP (intellectual-property) cores offer advanced computing functions at low cost and energy consumption. The latest XAP4 and XAP5 target applications such as wireless sensors, and their architecture minimizes the size of program and data memories to achieve small die area, especially when memory is embedded on-chip or integrated in an SIP (system in package).

Since announcing the latest 16/32-bit XAP5 in 2008, Cambridge Consultants has released new versions of its xIDE (integrated device environment) software-development and -debugging tools for XAP processors, including updates to GCC and other enhancements to improve programming productivity. Evaluation versions of xIDE for XAP4 and XAP5 are available.

CAST

Cast (www.cast-inc.com) offers IP (intellectual-property) cores for general-purpose 8-, 16-, and 32-bit processors. A configurable 8051 core executes instructions with one clock per cycle. Additional cores include 8-bit Z80 and 16-bit 68000- and 80186EB-compatible devices. Cast's 32-bit APS cores target embedded systems needing more performance than an 8051 can offer. They require as few as 7000 gates,

perform at 0.6 Dhrystone MIPS/MHz, and use as little as 18 μ W/MHz of power. A coprocessor architecture enables performance improvement for specific applications, and an ASP-DSP coprocessor is available.

CAVIUM NETWORKS

Cavium Networks (www.caviumnetworks.com) offers security and single-core and multicore MIPS64-based processors targeting networking, wireless, storage, and control-plane applications. The Octeon MIPS64 processors integrate one to 32 MIPS64 cores with high-performance networking, multicore acceleration, memory controllers, and advanced hardware-acceleration coprocessors. The Nitrox Security processors accelerate IPsec (Internet Protocol Security), SSL (Secure Sockets Layer), and WLAN (wireless-local-area-network) and encryption algorithms.

CIRRUS LOGIC

Cirrus Logic (www.cirrus.com) supplies high-precision analog- and mixed-signal and embedded processors for the audio and industrial markets. In the general-purpose-processor segment, Cirrus Logic offers highly integrated ARM9- and ARM7-based embedded processors targeting industrial and networked consumer applications. Cirrus Logic's NineSeries of ARM9-based products includes the EP9301, EP9302, EP9307, EP9312, and flagship EP9315. The entry-level EP9301 integrates Ethernet and two USB (Universal Serial Bus) 2.0 host ports, and the EP9302 adds MaverickCrunch and MaverickKey to go along with increased processing power and memory. The EP9307 adds a graphics accelerator, touchscreen and keypad support, and three USB ports. The EP9312 supports high-quality audio and an integrated development environment. The flagship EP9315 adds support for the PCMCIA (Personal Computer Memory Card International Association) interface in a single device.

COREWORKS

Coreworks (www.coreworks.pt) this year released the five-stage-pipeline, modified-32-bit-Harvard-architecture FireWorks, featuring a high-speed programming interface and DSP instructions. The architecture includes a 32-bit ALU (arithmetic-logic unit) and 32 \times 32-bit registers. You can configure it to include a hardware multiplier, a barrel shifter, and a serial divider. It supports external interrupt requests, data caches, and instruction caches. A DMA core is also available. FireWorks uses an AMBA (Advanced Microcontroller Bus Architecture)/AHB (Advanced



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High-Performance Bus) interface, into which you can plug peripherals.

CPU TECHNOLOGY

CPU Technology (www.cputech.com) offers multicore SOC (system-on-chip) devices and development tools that target computers and peripherals, communication/wired, general-purpose, imaging and video, industrial, medical, military/aerospace, mobile/wireless, and test-and-measurement applications. The Acalis family of field-programmable multicore chips provides security functions that protect IP (intellectual property) without impacting performance. The Acalis chips readily scale to more than 100,000 chips.

The CPU872 contains dual PowerPC 440 cores with floating-point units, dual streaming processors, dual MPI (message-passing-interface) processors, dual embedded DRAMs, and dual external DRAM interfaces. The CPU878 contains eight complete computational nodes on a chip for higher computational density with the same functions and protections as the CPU872.

CRADLE TECHNOLOGIES

Cradle's (www.cradle.com) CT3600 family of scalable MDSP (multicore-digital-signal-processing) processors integrates multiple general-purpose processors with multiple DSPs to improve processor efficiency for control code and computationally intensive media-processing algorithms. The CT3600 family comprises two products containing eight to 16 DSP processors on a single chip. The larger version, with 16 DSPs and eight general-purpose processors, operates at 350 MHz, supports 16 channels of CIF (common-intermediate-format)-resolution Simple Profile MPEG-4 encoding.

CYAN TECHNOLOGY

Cyan Technology's (www.cyantech.com) low-power, 16-bit, embedded-communications, flash-based eCOG1k microcontroller implements a 25-MHz RISC Harvard architecture that includes internal flash memory, RAM, and cache. The external-memory interface supports addressability of 32 Mbytes. Additional features include a smart-card interface, a 12-bit ADC, a temperature sensor, and a proprietary port-configuration device.

CYBERNETIC MICRO SYSTEMS

Cybernetic Micro Systems (www.controlchips.com) produces ASICs to interface to peripherals that would be difficult to control from a general-purpose computer. The 100-pin, 8-bit P-51 microcontroller either sits between the host computer and the peripheral device or becomes the peripheral device. With a dual-port RAM interface

on the host side in a PC104/ISA (industry-standard-architecture) format, the P-51 looks like memory to the host, but it has the intelligence and capability of an 8051.

CYPRESS SEMICONDUCTOR

Cypress' (www.cypress.com) PSoC (programmable system on chip) integrates configurable digital and analog peripherals, an 8- or 32-bit microcontroller, and three types of embedded memory. Target applications include automotive, communications, computers and peripherals, consumer, industrial, medical, motor control, and mobile/wireless devices. This year, Cypress introduced the PSoC 3 architecture, which is based on an 8-bit 8051 processor, and the PSoC 5 architecture, which includes a 32-bit ARM Cortex-M3 processor. The two new architectures feature high-precision integrated analog with 20-bit resolution and a PLD (programmable-logic-device)-based digital system with as many as 48 cascading datapaths.

The new TMA300 PSoC-based TrueTouch touchscreen-controller family marks Cypress' second generation of technology that can simultaneously interpret as many as 10 inputs from all areas of the screen.

The PowerPSoC family of single-chip, integrated embedded power controllers both controls and drives high-power LEDs. The PowerPSoC family integrates four constant-current regulators and four 32V MOSFETs with a PSoC.

DIGI INTERNATIONAL

Digi International (www.digi.com) offers net-centric Net+ARM processors that the company based on ARM7 and ARM9 cores. The NS9215 and NS921 networking processors with ARM926EJ-S cores operate at 75 and 150 MHz; both chips feature 10/100-Mbps Ethernet. The NS9360, NS9750, and NS9775 employ the ARM926EJ-S core. The NS9360 operates at 177 MHz and integrates 10/100-Mbps Ethernet, USB (Universal Serial Bus), an LCD, IEEE 1284, and serial I/O. The NS9750 operates at 200 MHz and includes all of the NS9360 features, plus PCI (Peripheral Component Interconnect) support. The NS9775 color-laser-printer processor operates at 200 MHz and integrates 10/100-Mbps Ethernet, USB, and PCI to improve the cost performance of color laser printers. Digi based the NS7520 on the ARM7TDMI core. It operates at 55 MHz and integrates 10/100-Mbps Ethernet, serial I/O, and general-purpose interfaces.

DIGITAL CORE DESIGN

DCD (Digital Core Design, www.dcd.pl) provides VHDL- and Verilog-synthesizable, ISO

9001:2000-certified IP (intellectual-property) cores of 8-, 16-, and 32-bit processors and bus interfaces, as well as fixed- and floating-point arithmetic coprocessors. DCD's DP8051XP/DP80390XP soft core is 100%-binary-compatible with the industry-standard, 8-bit 8051 microcontroller. DCD's microcontrollers implement fast 16- and 32-bit integer operations and single- and double-precision floating-point operations. The D68HC11 is fully compatible with the 68HC11A and the 68HC11E.

E2V

In partnership with Freescale Semiconductor, E2V (www.e2v.com) this year added products to its suite of high-reliability microprocessors and MRAMs (magnetic-random-access memories). In partnership with Tundra Semiconductor, E2V also introduced broadband-data converters, ASICs, and ISM (industrial/scientific/medical) transceivers targeting defense, space, avionics, telecom, industrial, medical, and automotive applications. E2V's microprocessor products range from the 68K family to the new-generation PowerPC devices and support peripherals. In addition to test and service facilities, the company offers long-term availability on the complete family of products.

EM MICROELECTRONIC

EM Microelectronic (www.emmicroelectronic.com) offers ultralow-power, low-voltage digital-, analog-, and mixed-signal ICs targeting battery-operated and field-powered devices in consumer, automotive, and industrial applications. EM Microelectronic's 4- and 8-bit microcontrollers target battery-operated devices, which often have low-standby-power requirements and perform periodic or on-demand actions.

FREESCALE SEMICONDUCTOR

Freescale Semiconductor (www.freescale.com) offers communications processors, microcontrollers, embedded processors, sensors, RF components, analog/power-management technology, and supporting software for automotive, consumer, industrial, networking, and wireless applications. Freescale bases its PowerQUICC (quad-integrated-communications-controller) processors on Power Architecture cores. PowerQUICC processors provide data- and control-plane processing for wireless and wire-line infrastructure, industrial control, enterprise networking, home and SOHO (small-office/home-office) networking, and pervasive computing. The QorIQ line is the next generation of Freescale's PowerQUICC-processors, targeting developers migrating to multicore designs. The company's Flexis-series devices target consumer and industrial

markets. Flexis pin-for-pin-compatible 8- and 32-bit microcontrollers come with a set of on-chip peripherals and development tools.

Freescale's i.MX application processors target embedded, general-purpose-system and multimedia applications for homes, handheld devices, and vehicles. The processors employ Smart Speed technology to balance high performance with battery life.

FUJITSU MICROELECTRONICS

Fujitsu's (www.fujitsu.com) 8-, 16-, and 32-bit microcontrollers include general-purpose and application-specific versions targeting automotive, communications, computer-peripheral, industrial, and consumer applications. The F2MC (Fujitsu flexible-microcontroller) line includes the 8-bit F2MC-8L and F2MC-8FX series and the 16-bit F2MC-16L/16LX/16F series. The FR (Fujitsu RISC) series has a stepper motor and LCD controllers for auto, communications, computer-peripheral, industrial, consumer, and security applications.

GAINSPAN

GainSpan (www.gainspan.com), a Wi-Fi semiconductor and software provider, targets applications such as temperature monitoring for energy management, condition monitoring of industrial equipment, and monitoring streetlights for metropolitan areas. The GainSpan GS1010 Wi-Fi SOC (system on chip) integrates an 802.11b/g radio, an ARM7 microcontroller, and a power-management unit. The GMS (GainSpan management-system) software manages Wi-Fi devices that are asleep as much as possible to conserve energy. GMS resides in the network as an always-on intelligent interface.

HYPERSTONE

Hyperstone (www.hyperstone.com) offers the general-purpose E1 processors, the HyNet networking processors, and the NAND-flash controllers that the company based on a unified RISC/DSP architecture. This year, Hyperstone introduced the S7(B) SD (secure-digital) cards and MMCs (multimedia cards) and the F4 CF/PATA (CompactFlash/parallel-advanced-technology-attachment) NAND-flash-memory controllers. The CFA3.0/ATA6F4 controller targets uses in high-performance CF cards and SSD (solid-state-disk) drives. The S7(B) and F4 controllers support MLC (multilevel-cell) and SLC (single-level-cell) flash from all NAND-flash vendors.

IBM

IBM Global Engineering Solutions (www.ibm.com/technology) offers embedded microproces-

sor cores and microprocessors employing IBM Power Architecture technology. IBM's offerings include the 32-bit PowerPC 4xx family of embedded cores, along with 32- and 64-bit power- and performance-optimized microprocessors. IBM's PowerPC 405, 440, and 460 families of embedded cores offer scalable performance for custom-SOC (system-on-chip) integration. The cores are available in both fab-optimized and fully synthesizable versions.

IBM's PowerPC 750 family of 32-bit microprocessors targets cost- and power-sensitive embedded-system applications. The PowerPC 970 family of microprocessors offers performance-driven, 64-bit architecture with native 32-bit application compatibility. IBM's 970 family includes both single- and dual-core, VMX-enabled microprocessor offerings.

IDT

The IDT (Integrated Device Technology, www.idt.com) Interprise family of integrated communications processors delivers data processing at line-rate speed. IDT based the processor cores on the 32-bit MIPS ISA (instruction-set architecture). Interprise processors target SOHO (small-office/home-office) routers, Ethernet switches, WAPs (wireless-access points), and VPN (virtual-private-network) equipment.

IMEC

IMEC's (Interuniversity Microelectronic Centre's, www.imec.be) flexible ADRES (architecture for dynamically reconfigurable embedded system) consists of a tightly coupled VLIW (very-long-instruction-word) processor and a coarse-grained, reconfigurable array. The architecture template consists of computational, storage, and routing resources. The routing resources connect the computational and storage resources in a topology to form the ADRES array. Data accesses to the memory of the unified architecture take place through load/store operations. A script-based technique allows designers to generate instances.

IMSYS TECHNOLOGIES

Imsys (www.imsys.com) develops reconfigurable-processor platforms. The company offers Internet-enabled reference modules that Imsys ships as ready-to-go subsystems. The integrated hardware and software platform targets wired and wireless communications, graphics-display technologies, and image processing in telecom, automotive, industrial automation, and consumer electronics.

INFINEON TECHNOLOGIES AG

Infineon Technologies AG (www.infineon.com)

provides 8-, 16-, and 32-bit microcontrollers for motor control with dedicated hardware peripherals that reduce software overhead and external components. New 8-bit devices this year are the XC878 and XC864 families for sensorless field-oriented control of a PMSM (permanent-magnet synchronous motor). The new XE16xM additions to the XE166 family of real-time digital-signal controllers offer memory-protection and memory-checker functions. More demanding systems, such as ac servo drives, can take advantage of the new 32-bit TC1167 and TC1197 TriCore controllers, which offer dual MAC units. Infineon also extended its 16/32-bit automotive portfolio with two new series. The XC2300 family offers safety features for air-bag and power-steering applications. The XC2700 series targets use in electronic-engine control in motorcycles. The 32-bit Auto-Future microcontroller allows manufacturers to meet evolving standards for efficiency and emission reduction.

INNOVASIC

Innovasic Semiconductor (www.innovasic.com) supplies extended-life microcontrollers for industrial applications. The 32-bit fido1100 communications controller targets real-time Ethernet applications with RTOS-like features, including single-cycle task switching, scheduling, and programmable peripherals. Innovasic also supplies 16-bit 186 microcontrollers, such as the IA186EB and the IA186XLt 186, for new and legacy applications. They are fully compatible with their respective Intel devices. All Innovasic products come with an obsolescence-protection guarantee.

INTEL

In 2009, Intel (www.intel.com) released the L5518 and L5508 versions of Intel Xeon processors that target communications-market segments. These processors include options for applications in thermally constrained environments, such as blades and appliances for communication infrastructure. The Atom is the company's smallest and lowest-power processor; it targets small devices and low power and maintains the Intel Core 2 Duo instruction set. The newest generation of Atom offers four versions of processors and two new system-controller hub additions to Intel's embedded-system-business-division product lineup. The new products for the Atom processor Z5xx series include industrial-temperature options, as well as package choices better suited for in-car infotainment devices, media phones, ecological technologies, and other industrial-strength applications. Intel's N270 processor and 945GSE



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Express chip set target the low-power needs of embedded-system markets.

INTELLASYS

IntellaSys (www.intellasys.net) based its multi-core chips on the proprietary SEA (scalable-embedded-array) platform, which uses a dual-stack, synchronous, scalable architecture. The SEAForth-24 family packs a 634-processor array of 18-bit processors, each of which can operate at 1 BOPS (billion operations per second). Designers can dedicate any of the 24 cores individually or in groups to perform tasks. The SEAForth-24 directly drives an antenna, eliminating the need for external data converters.

JENNIC

Fabless semiconductor company Jennic (www.jennic.com) targets wireless-connectivity applications, such as energy and environmental management, active RFID (radio-frequency identification), and consumer electronics. The company's integrated wireless microcontrollers focus on IEEE 802.15.4, ZigBee Pro, and 6LoWPAN (Internet Protocol Version 6-over-low-power-wireless-personal-area-network) standards. The company's products include low-power wireless microcontrollers, modules, development platforms, protocols, and application software.

This year, Jennic announced a networking stack to enable a single-chip implementation of 6LoWPAN. The company also announced a single-chip, 32-bit wireless microcontroller, which is based on the ZigBee Pro and IEEE 802.15.4 standards and combines low operating-current consumption and high memory density in a single-chip, wireless microcontroller. Jennic also announced the Time of Flight ranging engine that will enable the development of next-generation wireless mesh networks for battery-powered and data-rich applications.

K-MICRO

K-Micro's (Kawasaki Microelectronics', www.k-micro.us) ASIC technologies and design support target the consumer-electronics, computer, office-automation, networking, and storage markets. K-Micro's computing subsystem includes a MIPS32 24Kf processor, the Sonics SiliconBackplane and Sonics3220 Smart interconnects, and the SafeNet SafeXcel security engine. Single- and dual-core processors are available.

LATTICE SEMICONDUCTOR

Lattice's (www.latticesemi.com) open-source LatticeMico32 soft microprocessor core combines a full 32-bit-wide instruction set with 32 general-purpose registers. The microprocessor

has a Harvard architecture with independent instruction paths and datapaths. These paths terminate in individual Wishbone buses.

The LatticeMico32 license agreement is downloadable from the Lattice Web site. The license preserves the open nature of the core by permitting use alongside proprietary designs and allows hardware implementation and distribution without the need for a subsequent license agreement. This feature provides users with visibility into the microarchitecture's flexible implementation and portability to ASICs or future FPGAs. The MSB (Mico System Builder) tool generates LatticeMico32-based systems in Verilog.

Lattice also provides the open-source 8-bit LatticeMico8, the 8051, 68xx series, PIC, and 6502 microcontrollers through its partners Cast, Digital Core Design, and Western Design Center.

MAXIM INTEGRATED PRODUCTS

Maxim Integrated Products (www.maxim-ic.com) offers 8-, 16-, and 32-bit microcontrollers for embedded-system applications. Maxim expanded its product offering in early 2009 by acquiring Innova Card and the Zatar and Crimzon product lines from Zilog. In addition to its recent acquisitions, Maxim introduced several new MAXQ products, targeting a mixture of low-power, high-security, and metering applications.

The MAXQ610 16-bit microcontroller combines nanowatt stop-mode current, high performance, and peripherals targeting power-conscious consumer applications. Maxim's MAXQ1103 and MAXQ1850 secure microcontrollers provide fast encryption accelerators and tamper-detection circuitry to respond to attacks. The MAXQ3108 comprises a 16-bit DSP core for intensive data processing and a 16-bit user core for supervisory functions.

MICROCHIP TECHNOLOGY

This year, Microchip Technology (www.microchip.com) introduced 8- and 16-bit PIC microcontroller families with nanoWatt XLP (extreme-low-power) technology and sleep currents as low as 20 nA. Microchip's inductive-touch-sensing technology works with all of the company's microcontrollers, and it enables touch-sensing, including through gloves and on surfaces with liquids present and through plastic, stainless steel, or aluminum panels. The dsPIC33 DSCs (digital-signal controllers) enable digital power and lighting with as much as twice the performance at a lower price than first-generation devices. The enhanced, midrange, 8-bit PIC-microcontroller-core families provide more memory, greater efficiency, faster operation, more communications, touch-sensing, and low-power operation.

Microchip's PIC microcontrollers and dsPIC DSCs span more than 600 8-, 16-, and 32-bit devices. The portfolio spans low-cost, six-pin, 8-bit microcontrollers through the high-performance, cost-effective, 64- and 100-pin, 80-MHz, 32-bit PIC32 family.

MIPS TECHNOLOGIES

MIPS Technologies (www.mips.com) offers processor architectures that target home entertainment, communications, networking, and portable multimedia products. MIPS recently ported Android to the MIPS architecture. Initially targeting mobile phones, Android now targets DTVs (digital televisions), mobile Internet devices, digital picture frames, VOIP (voice-over-Internet Protocol) devices, and set-top boxes.

NEC ELECTRONICS AMERICA

NEC Electronics America (www.am.necel.com) offers highly integrated, reliable, low-power, all-flash microcontrollers for multipurpose designs and application-specific devices. The company's 32-bit V850 series microcontrollers feature low-voltage operation, DSP functions, and on-chip peripherals.

NETRONOME

Netronome (www.netronome.com) develops programmable semiconductor products for intelligent flow processing in network and communications devices. The company's products include network-flow processors and acceleration cards that scale to more than 20 Gbps. The new NFP (network-flow-processor)-32 family of processors and acceleration cards finds use in carrier-grade and enterprise-class communications products. They combine high-performance network, content, and security processing with general-purpose processors, such as Intel's IA, through I/O virtualization. The NFP-32xx is backward-compatible with the Intel IXP28XX.

NXP

NXP (www.nxp.com) offers a portfolio of several hundred Cortex-M3, ARM7-, ARM9-, and 80C5-based microcontrollers. NXP's ARM-based LPC1000, LPC2000, and LPC3000 families include highly integrated peripherals. The Cortex-M3-based LPC1300 series is the latest addition to the LPC1000 family and targets low power consumption and low cost. The Cortex-M3-based LPC1700 series operates as fast as 100 MHz and provides users of the ARM7-based LPC2300 series with a pin-compatible upgrade path to Cortex-M3. The LPC3200 and LPC3100 series add 10 new devices to the ARM926-based LPC3000 family. This year, NXP presented its implementa-

tion of ARM's new Cortex-MO architecture. The ARM-based LH7 and LH7A families feature high-performance integrated LCD controllers.

OKI SEMICONDUCTOR

Oki Semiconductor's (www.okisemi.com) Advantage Microcontroller family comprises ARM-core based products ranging from the ML671000 with a built-in USB (Universal Serial Bus) controller to the high-performance, 120-MHz, ARM946E-based 6200 series with instruction and data caches. Oki's 4060, 4050, 675K, and 674K series ARM7 Advantage microcontrollers offer variations in frequencies, memory sizes, caches, features, and packages.

PMC-SIERRA

PMC-Sierra's (www.pmc-sierra.com) MIPS-based processors target metropolitan-transportation, storage-area-networking, wireless-equipment, VOIP (voice-over-Internet Protocol), Internet-routing-equipment, enterprise-switch, and multifunction- and laser-printer applications. PMC-Sierra's family of 64-bit, integrated, 1-GHz CPUs delivers high performance, low latency, and low power consumption. The MSP (multi-service-processor) family targets use in CPE (customer-premises equipment), such as wired and wireless VOIP-terminal adapters, home gateways, voice-enabled routers, and NAS (network-attached storage).

RABBIT SEMICONDUCTOR

Rabbit Semiconductor (www.rabbit.com), a Digi International company, provides high-performance, 8-bit microprocessors and development tools for embedded control, communications, and Ethernet connectivity.

RAMTRON

Ramtron's (www.ramtron.com) FRAM (ferroelectric-random-access-memory)-enhanced Versa 8051 microcontrollers combine a high-performance SOC (system on chip) with nonvolatile FRAM. FRAM writes at bus speed with virtually unlimited endurance and low power for guaranteed data integrity in systems that require rapid and frequent writes and low power consumption. Versa 8051 microcontrollers let designers upgrade 8-bit applications without a costly investment in a new architecture and code.

RENESAS TECHNOLOGY

Renesas' (www.renesas.com) processor offerings for embedded systems extend from low-power, 8- and 16-bit microcontrollers to high-performance, 32-bit microprocessors. The R8C/Tiny series targets electronic ballasts, handheld

power tools, and motor-control systems. Devices in the R8C/3x group target automotive-body-control applications and operate from 1.8 to 5.5V. The H8S/2153 targets advanced communication equipment, and the H8SX/2164 targets baseboard-management-controller applications. In the M16C series, the 64-MHz R32C/100 series incorporates advanced peripherals, such as FlexRay controllers.

The SuperH SH72544R series targets next-generation automotive power trains. SH7262 and SH7264 microcontrollers target digital-audio systems, media-player accessories, and graphical-display applications. The SH7730 series for industrial applications achieves 480-MIPS performance and includes FPUs (floating-point units) and MMUs (memory-management units).

SH-Mobile application processors include the 266-MHz SH-MobileL3V2 that handles many video formats and provides high-resolution video capture. The SH-MobileR2 targets use in personal navigation devices, portable media players, and video and VOIP (voice-over-Internet Protocol) terminals.

SAMSUNG ELECTRONICS

Samsung (www.samsungsemi.com) offers 16- to 32-bit processors targeting handheld-system applications, including smartphones, VOIP (voice-over-Internet Protocol) phones, portable GPS (global-positioning-system) devices, gaming systems, and PDAs (personal digital assistants). Samsung's family of mobile application processors features ARM920T-, ARM926EJ-, and ARM1176-based RISC cores.

SEMTECH

Semtech (www.semtech.com) offers 8- to 22-bit microcontrollers that interface sensors and radio transceivers and target autonomous, battery-operated, wireless devices. These devices operate at a constant one instruction per clock that is independent of the type of operation and addressing mode. The Radio Machine device for ISM (industrial/scientific/medical)-band-transceiver interfacing includes a low-power RISC core with the BitJockey, a serial interface for radio protocols, and a UART. The Sensing Machine device includes a low-power RISC core with the high-resolution ZoomingADC sigma-delta ADC and a programmable preamplifier.

SILICON LABORATORIES

Silicon Laboratories' (www.silabs.com) portfolio of mixed-signal, 8-bit microcontrollers integrates high-performance analog peripherals and a high-speed core in a tiny footprint. This year, the company expanded its F900 family of low-volt-



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age, low-power devices, targeting portable- and space-constrained-system applications. Silicon Labs also introduced the F7xx family of high-pin-count, capacitive-touch-sense controllers. The company expanded its F5xx automotive-microcontroller family for space-constrained LIN (local-interconnect-network)- and CAN (controller-area-network)-gateway and body-electronics applications. Silicon Labs offers a complete embedded-wireless approach for applications requiring less-than-1-GHz speeds with the combination of the low-power, high-performance EZRadio receiver family and the low-power F9xx microcontrollers.

SST

SST (Silicon Storage Technology, www.sst.com) based its FlashFlex family of 8-bit microcontroller products on the company's SuperFlash CMOS-semiconductor-process technology. These microcontrollers implement the 8051 instruction set and are pin-for-pin compatible with standard 8051 microcontroller devices. FlashFlex devices are available in single- or dual-block configurations, and they are ISP (in-system-programmable) and IAP (in-application-programmable).

These microcontrollers target consumer, communication/wired, imaging and video, audio, industrial, and motor-control applications.

STMICROELECTRONICS

STMicroelectronics (www.st.com) offers a comprehensive portfolio of 8-bit microcontrollers and high-performance, 32-bit ARM-based microcontrollers with a wide range of peripherals. The 32-bit STM32 family, which employs an ARM Cortex-M3 processor, now provides 46 fully compatible devices. The 72-MHz Performance Line stresses new levels of performance and energy efficiency. The 32-bit Access Line stresses 32-bit processing at a 16-bit cost. The STM8 core is a cost-sensitive, 8-bit-microcontroller family.

STRETCH

Fabless semiconductor company Stretch (www.stretchinc.com) provides software-configurable processors for computationally intensive applications. Stretch's S6000 series targets high-speed video and image processing. With these applications in mind, Stretch has developed two reference-design kits using S6000 family software-configurable processors, a PCIe (Pe-

ripheral Component Interconnect Express) DVR (digital-video recorder), and an IP (Internet Protocol) camera.

TENSILICA

Tensilica (www.tensilica.com) offers 32-bit customizable data-plane processors, DSPs, and standard processor cores. All of Tensilica's processor cores, even the Xtensa configurable processors, come with software-tool chains that automatically match any changes the designer makes. This year, the company introduced its next generation of customizable processors, the Xtensa 8 and Xtensa LX3. Xtensa 8 has all the basic configurable capabilities, and Xtensa LX3 offers designers opportunities to bypass the system bus with direct FIFO (first-in/first-out) and GPIO (general-purpose-input/output) capabilities. It introduced the ConnX baseband engine, creating a processor core for computationally intensive receiver and demodulation units, and the ConnX D2 DSP engine, creating an efficient, basic dual-MAC (multiply/accumulate)-unit DSP. It also introduced codecs for the HiFi 2 audio engine, including support for all international digital-radio

standards, a Bluetooth SBC (subband-codec) decoder, a DTS-HD (Digital Theater Systems high-definition) Master Audio decoder, a Real Audio decoder, and a Dolby DAB+ decoder. The company ported the RealVideo codec to the 388VDO video engine.

TERIDIAN SEMICONDUCTOR

Teridian Semiconductor (www.teridian.com) designs, sells, and provides engineering support for its mixed-signal ICs, which find use in energy, automation, networking, and secure-access systems. These ICs connect customers' digital systems to the analog inputs in utility-metering, industrial-automation, set-top-box, digital-TV, VOIP (voice-over-Internet Protocol), electronic-identity, and point-of-sale applications. The 78Q8430 targets Ethernet applications requiring reliable connectivity and QOS (quality-of-service) levels, such as industrial-networking, set-top-box, digital-television, and other consumer-broadband or audio/video equipment. The 71M653x family includes residential-single-phase and commercial- and industrial-three-phase ICs, offering as much as 256 kbytes of storage with 10-MIPS processing power.

TEXAS INSTRUMENTS

Texas Instruments' (www.ti.com) microcontroller portfolio includes the ultralow-power, 16-bit MSP430, the 32-bit Stellaris ARM Cortex-M3, and the TMS320C2000 microcontrollers for real-time control. TI acquired Luminary Micro and added devices to the MSP430- and C2000-platform families. Expanding the MSP430 portfolio, TI introduced the MSP430F55xx family with embedded full-speed, 12-Mbps USB (Universal Serial Bus), with more than 35 device options offering enhanced peripheral and analog integration, increased memory and package selections, and several low-cost devices with prices starting at less than \$1. The new LM3S9000 series of ARM Cortex-M3-based Stellaris microcontrollers features a fully integrated 10/100 Ethernet MAC (media-access controller)-plus PHY (physical)-layer, USB 2.0 full speed OTG (On-the-Go), and integrated Bosch CAN (controller-area-network) technology. The Stellaris devices also include larger on-chip memories, enhanced power management, and expanded I/O and control capabilities. The TMS320C2834x Delfino floating-point controllers double performance to 300 MHz and include 516 kbytes of single-cycle access RAM,

high-resolution PWM (pulse-width-modulation) outputs, 32-bit quadrature-encoder modules, and other control-oriented features.

TILERA

Tilera (www.tilera.com) offers high-performance multicore processors targeting embedded networking, security, and multimedia-processing applications. The Tile64 processor SOC (system on chip) has 64 full-featured processor cores plus a rich suite of system-integration blocks. The device includes 5 Mbytes of cache, and each processor core can independently run a full operating system, such as Linux. Tilera based the Tile64 family on a tiled multicore architecture with a mesh-based on-chip interconnect.

TOSHIBA AMERICA

Toshiba America Electronic Components (www.toshiba.com/taec) offers highly integrated, 8-, 16-, and 32-bit CISC microcontrollers with embedded SuperFlash memory and 32- and 64-bit, MIPS-based TX RISC microprocessors. TX RISC microcontrollers suit calculation-intensive applications that require large memory capacity and DSP-like functions, such as consumer digital-



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camera lenses, digital camcorders, and automotive-air-bag systems. Both the CISC and TX families have peripherals for handheld information consoles, home-security systems, calculators, toys, HVAC (heating/ventilation/air conditioning), instrumentation, digital TV, IP (Internet Protocol) set-top boxes, home-entertainment gateways, white goods, and automotive-body controls. Toshiba continues to support its family of 8-bit, low-power microcontrollers with TLC5870/C1 cores that process one instruction in a single clock cycle.

UBICOM

Ubicom (www.ubicom.com) develops communications and media processors and software platforms that target real-time interactive applications and multimedia-content delivery in homes. The company provides to OEMs optimized system-level products, including wireless routers, access points, bridges, VOIP (voice-over-Internet Protocol) gateways, connected digital-photo frames, streaming-media devices, and other network devices. The StreamEngine 7000 series of processors delivers nearly twice the performance with lower power in a smaller package than the StreamEngine 5000 family.

VIA TECHNOLOGIES

VIA Technologies (www.via.com.tw), a fabless supplier of power-efficient x86 processor platforms, targets the PC, client, ultramobile-system, and embedded-system markets. The company supports a spectrum of computing and communication platforms, including its ultracompact main boards.

WESTERN DESIGN CENTER

Western Design Center (www.westerndesigncenter.com) licenses its 65xx microprocessor IP (intellectual property). The company's product line includes the 8-bit W65C02SRTL and 8/16-bit W65C816SRTL licensable IP. The company also offers 8- and 8/16-bit processor devices.

XILINX

Xilinx (www.xilinx.com) provides programmable-logic products, including embedded processors, FPGA platforms, and development tools that find use in aerospace and defense, wired- and wireless-communications, automotive, audio- and video-broadcast, industrial-control, test-and-measurement, and consumer applications. The Virtex family of high-performance FPGAs includes the PowerPC 32-bit hard core.

The configurable, general-purpose, 32-bit MicroBlaze soft core is available for use with the Spartan family of low-cost FPGAs and Virtex-platform FPGAs.

XMOS

XMOS (www.xmos.com) provides a new type of programmable chip, software-defined silicon, which the company based on an array of high-performance, event-driven processors. You create designs in high-level languages, delivering hardware performance from a software-based design flow. XMOS devices blend a high-performance processor architecture with a responsive I/O structure to provide designers custom silicon that solves a class of design problems.

ZILOG

Zilog (www.zilog.com) offers the 8-bit Z8, Z8 Encore!, and Z80 Acclaim microcontroller families targeting industrial and consumer markets. The company this year sold its Crimzon and Zatarra product families to Maxim. Zilog also offers single-board computers, application-specific software stacks, and development tools targeting energy-management, monitoring, metering, and motion-detection applications.