

EDN LEADING EDGE

WHAT'S HOT IN THE DESIGN COMMUNITY

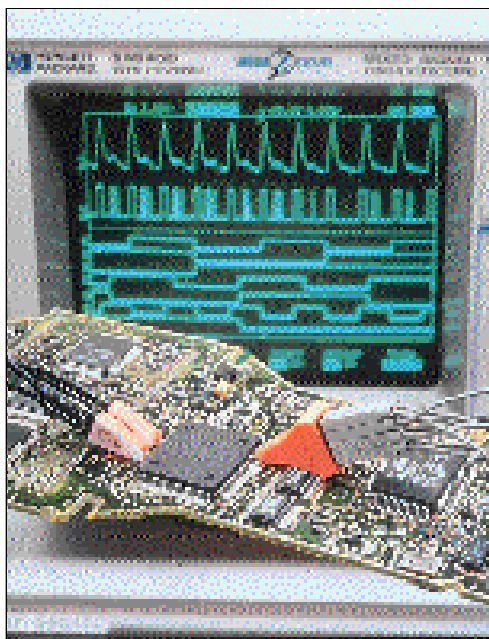
EDITED BY FRAN GRANVILLE

Inexpensive wedge device eases probing of fine-pitch IC leads

With leads as close as 0.65 and 0.5 mm center to center, ICs in TQFPs and PQFPs daily challenge the vision and manual dexterity of EEs. The IC leads are too small to see without a magnifier and too close together for most probes to contact them without shorting to the surrounding pins. Often, attempts to attach probes damage the frail leads, necessitating time-consuming replacement of costly, and sometimes scarce, ICs. So far, devices for probing the tiny leads have been expensive and difficult to use successfully.

Hewlett-Packard's HP Wedge probe adapter makes probing closely spaced leads immeasurably easier. Moreover, the device saves time and frustration and is reasonably priced: \$39 to \$79 each, depending on the number of leads on the probe and the number of probes in a package.

Instead of hooking onto leads,



Instead of hooking onto tiny IC leads, the business end of the HP Wedge squeezes into the space between leads, gently sandwiching each lead between a pair of contact surfaces.

as many other probes do, the HP Wedge squeezes into the space between the leads, sandwiching the device lead between a pair of contacts. The wedge incorporates insulators to keep adjacent probes from shorting together. Compared with hooks, this attachment method is gentler on the IC leads and does not require actuating a plunger. The probes attach to groups of three to eight IC pins. You attach larger pins on the end of the wedge device opposite the IC package under test. Despite the HP Wedge's small size, the probes are durable. The probing surfaces are more compact than those of probes that hook onto IC leads and thus are less likely to bend or deform.

—by Dan Strassberg

Hewlett-Packard Co., Santa Clara, CA. 1-800-452-4844, www.tmo.hp.com. **Circle No. 419**

Internal dithering improves A/D converter's performance

Dithering—the addition of stochastic noise to an A/D converter's signal—is an established technique for improving converter performance and spurious-free dynamic range (SFDR). The CSP1152A IC from Lucent Technologies incorporates an internal user-switchable dither function, thus saving you the cost and complexity of adding it externally. The 14-bit, 65M-sample/sec converter features a 1-GHz, 3-dB bandwidth, making the device suitable for IF downconversion in GSM, CDMA, and TDMA base stations. The 5V device features low-glitch LVDS (low-voltage differential signaling) digital output buffers to interface to your system processor; these buffers can operate from rails as low as 2.7V.

SFDR for this converter is greater than 95 dB when the input signal level is at least 5 dB below full-scale.

You can undersample a 170-MHz IF at a maximum rate of 65M samples/sec and achieve a minimum SFDR of 83 dB for input signals that are 1 dB or more below full-scale. In addition to integral dithering circuitry, the CSP1152A includes a reference, an S/H amplifier, and differential input circuitry. Because full-speed converter-core power consumption is 565 mW and the IC's output buffers need 185 mW operating from 3.3V, the total full-speed power dissipation is 750 mW. You can also run the converter at other speed-versus-power points. The 64-pin TQFP IC costs \$35 (50,000).

—by Bill Schweber

Lucent Technologies, Microelectronics Group, Allentown, PA. 1-800-372-2447, fax 1-610-712-4106, www.lucent.com/micro. **Circle No. 420**

"Bulletproof" data-acquisition unit captures "any" signal, connects to many buses

Considering what it does and the punishment it withstands, the eight-channel, 1.52×7.29×9-in. DI-730 data-acquisition unit from Dataq is quite reasonably priced: \$2995 for the version with a parallel-port interface. At \$1195, the unit's 32-channel stable mate, the DI-720, which lacks the DI-730's 1000V differential-overvoltage protection and channel-to-channel isolation, offers a per-channel price of \$37.

Dataq combines old and new technologies—gas-discharge overvoltage protectors and depletion-mode MOSFET current limiters—to endow the DI-730 with unusual immunity to overloads. Kilovolt differential or common-mode overloads cause no damage, even on the most sensitive range. The analog inputs are ohmically isolated from each other, from the output, and from the chassis. The inputs are unusual, too, because of their greater-than-10-kHz bandwidth, high common-mode rejection



By moving the data-acquisition functions outside the PC, the DI-730 does away with external signal conditioners in many applications. The unit withstands kilovolt common-mode and differential overloads.

(thanks to the ohmic isolation, typically more than 160 dB at dc), and wide range of full-scale inputs. The six software-programmable ranges offer full-scale sensitivities of ±10 mV to ±800V. Resolution is 16 bits, with a sampling rate of 250k samples/sec. The DI-720 shares the DI-730's sampling rate and resolution and offers four full-scale ranges of ±1.25 to ±10V.

Sampling rate is another of these units' unusual features. Thanks to "intelligent oversampling," a DSP-based technique, you need not store massive numbers of

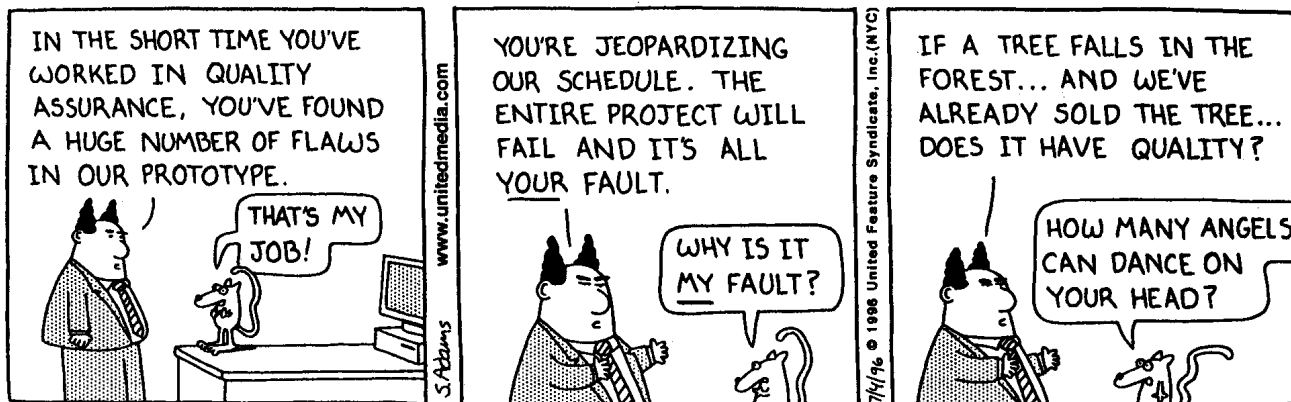
samples of high-frequency signals whose properties change slowly. Instead, you can have the units sample at a high rate but determine and report at relatively infrequent intervals only the short-term maximum, minimum, or average signal values. The built-in averaging is also useful for reducing superimposed noise.

Interface flexibility also distinguishes these units. A parallel-port interface is standard, but you can add either a \$220 USB interface or a \$395 Ethernet interface. The units operate from 9 to 36V dc, which you can derive from an external ac-operated power supply. However, the dc power input makes the units ideal companions for notebook PCs in automotive data acquisition.—by Dan Strassberg.

Dataq Instruments, Akron, OH.
1-800-533-9006, 1-330-668-1444,
fax 1-330-666-5434,
info@dataq.com, www.dataq.com.

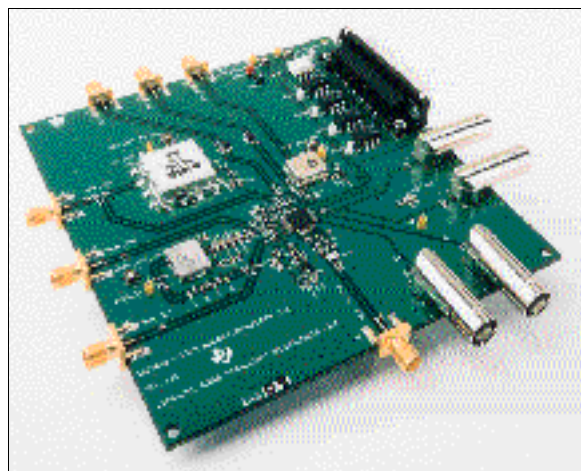
Circle No. 421

DILBERT® by Scott Adams



Providing the necessary analog and mixed-signal functions for cell phones is a challenge for IC vendors, yet OEMs' expectations are growing for more and better features in fewer devices. The TRF3040 modulator/synthesizer from Texas Instruments is designed for dual-band/dual-mode systems that operate in both the 900-MHz AMPS environment and the 900-MHz/1.9-GHz IS-136 digital world. The 48-pin TQFP IC includes a 2.2-GHz, fractional-N main PLL synthesizer for fast lock, low noise, and low spurious-energy content, plus a 900-MHz transmit modulator and a 200-MHz auxiliary synthesizer with prescaler; using this IC requires no separate 900-MHz upconverter. The TRF3040 typically delivers as much as 11 dBm from its output driver amplifier. In addition, the system can monotonically adjust the driver power via a variable-gain amplifier (VGA) over a 45-dB range. This VGA linearity minimizes spectral regrowth of the carrier frequency and allows you to use lower cost, lower linearity power amplifiers. Carrier suppression is better than 33 dB, and sideband suppression exceeds 35 dB, both regardless of gain setting, which further contributes to low spurious output content and lets you use simpler, lower cost filters.

Multimode RF IC squeezes more functions into smaller space



The TRF3040 modulator synthesizer for dual-band/dual-mode wireless systems includes complex analog RF/mixed-signal functions in a 48-pin package; you can characterize its performance in your application using an evaluation board.

The TRF3040 modulator/synthesizer from Texas Instruments is designed for dual-band/dual-mode systems that operate in both the 900-MHz AMPS environment and the 900-MHz/1.9-GHz IS-136 digital world. The 48-pin TQFP IC includes a 2.2-GHz, fractional-N main PLL synthesizer for fast lock, low noise, and low spurious-energy content, plus a 900-MHz transmit modulator and a 200-MHz auxiliary synthesizer with prescaler; using this IC requires no separate 900-MHz upconverter.

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The \$6.07 (10,000), 3.75V IC requires 150 mA in normal operation and 2 mA in sleep mode; its system interface is a three-wire (data, clock, strobe) connection. Texas Instruments also offers an evaluation board to let you more easily evaluate the device's performance in your final application.—by Bill Schweber

Texas Instruments Inc., Dallas, TX. 1-800-477-8924, ext 4500, www.ti.com/sc/rf.

Circle No. 422

New SOC technology really packs in the gates

The latest player in the hot, sub-0.25- μm chip arena, NEC Electronics, has two new processes available—the UC3 at 0.18- μm -drawn (0.13- μm -effective) channel length and the high-performance UR3 at 0.15- μm -drawn (0.10- μm -effective) channel length. NEC designed both processes for system-on-chip (SOC) designs, letting you put as many as 34 million usable gates on a chip measuring 20 mm per side. The low-power UC3 has a power dissipation of 19 nW/MHz/gate. The high-performance UR3 lets you run on-chip logic as fast as 500 MHz. Core operating voltage for each technology is 1.8V, with I/Os supporting 2.5 and 3.3V in addition to 1.8V.

Both the UC3 and UR3 use a seven-layer metal-interconnection process, employing an aluminum-copper alloy. Metal pitch is 0.56 μm for the first five metal layers (side-by-side contact regions) and 1.12 μm for metal layers six and seven. Chip-pad pitch is only 30 μm , and NEC is developing BGA packages with as many as 3000 pins.

A variety of new logic cores gives you more ASIC-design flexibility. NEC offers three new 64-bit MIPS RISC cores operating as fast as 200 MHz for the UR3 and 0.25- μm processes. NEC is also developing an

embedded-DRAM core for 133-MHz operation at 2.5V. You can configure the DRAM with as much as 32 Mbits in 1-Mbit increments and 8- to 256-bit-wide words. NEC plans in October to offer a 0.25- μm version of the core, allowing a maximum of 64 Mbits of on-chip DRAM. In early 2000, the company will release a 0.18- μm DRAM core for as much as 128 Mbits of memory. NEC is also developing additional 0.15- μm cores for IEEE 1394-bus, Ethernet, and JPEG applications.

Samples of both the low-power, 0.18- μm UC3 and high-performance, 0.15- μm UR3 families will be available in the fourth quarter, and the company plans production for the second quarter of 1999. NEC is also developing a copper-interconnect version of the process to improve chip speed and reliability. Expect samples of copper-metal versions of both families in the fourth quarter of next year. You'll be able to get production quantities of copper-metallized chips in early 2000.—by Jim Lipman

NEC Electronics, Santa Clara, CA. 1-408-588-6000, fax 1-408-588-6130, www.nec.com.

Circle No. 423

THERMAL-PRINTER SUBASSEMBLIES TARGET KIOSKS

The Speed Module Series of thermal-printer subassemblies from Seiko Instruments' Micro Printer Division suits label, bar-code, point-of-sale, gaming, and gas-tank kiosk applications. The 2.95×5.05×6-in. modules are available in 60-, 80-, and 112-mm-wide paper. Print resolution is 8 dots/mm, printing speed is 75 mm/sec (or 6.75 cps), and current consumption from a 24V supply is 1.8 to 4.3A. The printers accommodate a 2-in. paper roll and include paper-advance, cutter-activation, error, and paper-out indicators.



Thermal printers, such as the Speed Module from Seiko, are supplanting impact printers in many dedicated kiosk applications.

All Seiko's kiosk subassemblies include the company's page-mode Thermal Control Language (TCL) software/firmware, which allows you to design and store templates for any application. TCL operates under Windows and provides a command set that includes line- and box-drawing functions, text bar codes, and PCX graphics. The printers store the templates in flash memory, which accepts upgrades through the serial or parallel communications interface. Unit prices for the 60-, 80-, and 112-mm printers are \$683, \$730, and \$751, respectively.

—by Bill Travis

Host-based modem matches V.90 spec



By using host-based signal processing and a silicon DAA, the HSP56 MicroModem lowers cost and features a highly integrated three-chip design.

PC-Tel now offers a 56-kbps host-based modem that both minimizes implementation costs and simplifies pc-board design and layout. The HSP56 MicroModem chip set meets the requirements of the new V.90 standard for 56-kbps communications and also supports the de facto K56Flex standard. Like all PC-Tel modems, the new design relies on the host processor to handle the data-pump, signal-processing chores, thereby eliminating a dedicated DSP and lowering cost. The three-chip set includes an ASIC with a PCI interface, buffers, and the codec serial interface. The two 16-pin companion ICs implement a data-access arrangement (DAA) in silicon.

Most modems use external, transformer-based DAA designs with numerous passive components. The silicon DAA results in a more highly integrated design that in turn lowers cost and greatly simplifies pc-board design. The chip set will be available for sampling this quarter and will sell for \$30 (10,000).—by Maury Wright

PC-Tel, Milpitas, CA. 1-408-383-0452, www.pctel.com. **Circle No. 425**

Cascade of compact dc/dc-converter components continues

The need for tiny dc/dc converters that can transform and regulate low battery voltages is spurring many vendor offerings. Maxim's MAX1654 series of step-up ICs, for example, targets one- or two-cell applications, starts up at 1.1V, and operates at voltages as low as 0.7V. Outputs for these eight- or 10-pin-package devices (half the size of an SO-8 and just 1.1 mm high) are 3.3 or 5V, though you can make them adjustable from 2 to 5.5V with a resistor divider. Each device in the family includes a 0.3Ω n-channel MOSFET switch and a synchronous rectifier to achieve as much as 94% efficiency and eliminate the need for an external Schottky diode. The various family members support current-output limits as high as 1A. Prices begin at \$1.85 (1000).

If you need 3-to-2 step-up (boost) conversion or 2-to-3 step-down (buck) conversion of 3.3 to 5V, National Semiconductor's LM3351 switched-capacitor converter offers both with efficiencies as high as 94% with a 50-mA output, depending on how you connect the IC. Typical operating frequency is 200 kHz, and you add just four external small capacitors; the device requires no inductors. The mini SO-8 device features typical step-up/step-down output impedances of 4.2 and 1.8Ω, respectively, to minimize output-voltage droop. Shutdown quiescent current is 250 nA for this \$1.19 (1000) device.

—by Bill Schweber

Maxim Integrated Products, Sunnyvale, CA. 1-408-737-7600, fax 1-408-737-7194, www.maxim-ic.com.

Circle No. 426

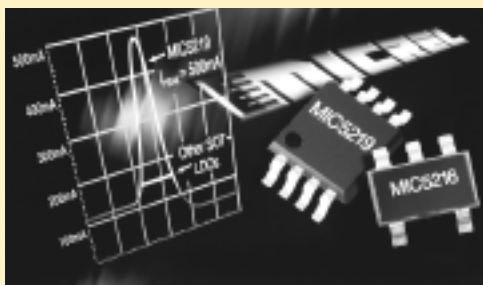
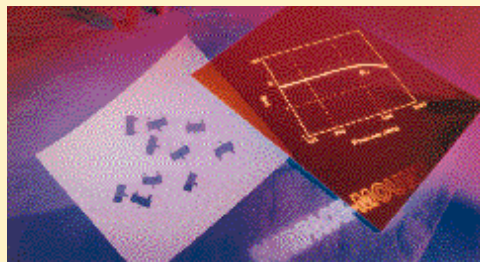
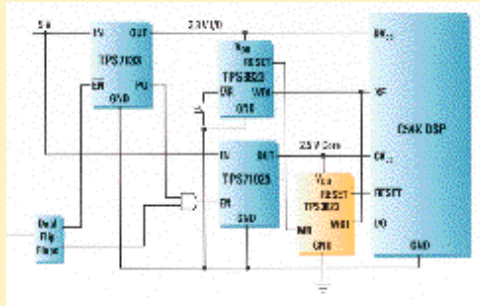
National Semiconductor Corp., Santa Clara, CA. 1-800-272-9959, www.national.com.

SOT-23s: tiny packages for diverse analog functions

Vendors are increasingly putting their analog IC functions—sometimes with pinout constraints—into the 3.6×1.6×1-mm SOT-23 package intended as a small-outline transistor housing (“Good things come in small (IC) packages,” *EDN*, Feb 3, 1997, pg 73). If you’re not yet using these packages in your designs, you may need to learn how—and soon.

The venerable 555-family timer IC exemplifies this trend. GMT Microelectronics has taken this device (which some surveys reckon as the most produced IC ever), split it into its two basic operating configurations—monostable and astable modes—and put each into a five-pin SOT-23. The CMOS components, designated GMT-1555 and GMT1557, respectively, operate from supplies spanning 2.7 to 18V, typically consuming 110 μ A with a 5V supply. The “one-shot” GMT-1555 produces pulses of 0.1 μ sec to several hours wide, and the GMT1557 multivibrator oscillates as fast as 5 MHz when you complement them with a suitably sized external resistor and capacitor. Either part costs \$0.60 (1000).

If you need supervisory ICs for low-voltage μ P systems, you might consider the Texas Instruments TPS3823 family of 2.5V devices, also in five-pin SOT-23s. The TPS3823 and TPS3824 series monitor and signal discrepancies between the system power supply and timing. The reset output goes active when the supply voltage exceeds 1.1V; reset threshold voltage is accurate to 2%. You can get these devices in 2.5, 3, 3.3, and 5V ratings. The two families differ in one aspect: The TPS3823 has a manual reset capability, whereas the TPS-3824 generates a reset with a high or a low voltage. Otherwise, the



You can now get an increasingly varied array of analog functions in the SOT-23 IC package, such as (from top) derivatives of the 555-timer from GMT Microelectronics, a 2.5V processor supervisory circuit from TI, JFETs from Siliconix that were originally in TO-92 packages, and Micrel’s MIC5216 and MIC5219 LDO regulators.

\$0.92 (1000) ICs are functionally identical.

Pushing the SOT-23 back to its origins as a three-terminal device, Vishay Siliconix (formerly, Temic

Semiconductors) has created 15 devices—10 for new regulator diodes and five for widely used JFETs that previously came in TO-92 packages. The SST5xx current regulators for current limiting, timing circuits, and current control provide current ranges of 0.43 to 4.7 mA with operating voltages as low as 1V for some of the devices. The JFETs, SSTJ21x for n-channel and SST546x for p-channel devices, feature leakage currents in single-digit picoamperes; the n-channel devices have a typical gain of 12 dB at 400 MHz. Prices range from \$0.15 to \$0.45 (100,000).

If you’re looking for a low-dropout (LDO) regulator that can supply more than the 150-mA load current of many SOT-23 devices, Micrel’s MIC5219 and similar MIC5216 deliver as much as 500 mA through the use of a fused lead frame for improved thermal characteristics. The LDO regulators (also available in MSOP-8s) have 300-mV dropout voltage at full load, 80- μ A quiescent current, and 1% initial accuracy. As with most LDO regulators, the \$0.84 (1000) devices include current-limiting, thermal-shutdown, and reverse-battery protection; they have a 20V maximum input range, which minimizes the adverse effect of supply spikes.—by Bill Schweber

GMT Microelectronics Corp, Norristown, PA. 1-610-666-7950, fax 1-610-666-2500, www.gmtme.com.

Circle No. 428

Micrel Inc, San Jose, CA, 1-408-944-0800, fax 1-408-944-0970, www.micrel.com.

Circle No. 429

Texas Instruments Inc, Dallas, TX. 1-800-477-8924, ext 4500, www.ti.com. **Circle No. 430**

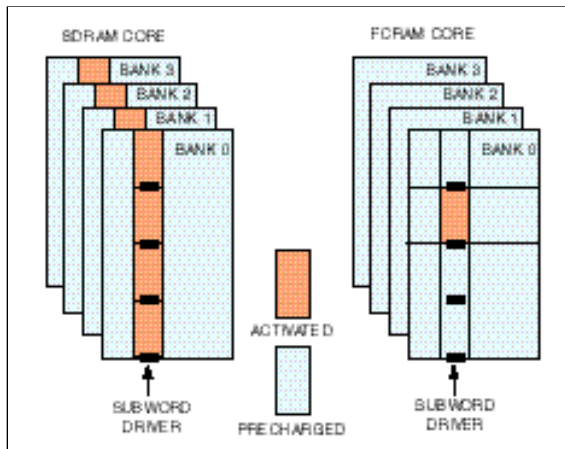
Vishay Siliconix, Santa Clara, CA. 1-408-567-8220, fax 1-408-567-8995, www.siliconix.com. **Circle No. 431**

DRAM redesign: not just plastic surgery

For almost two years, manufacturing overcapacity has plagued the DRAM industry. The result, continuously plummeting prices, is good news for system engineers buying parts but bad news for semiconductor vendors. Their responses are varied; some are plunging ahead, hoping that advanced-process lithographies and the high densities they enable will lead to more profitable results. Some are scaling back on DRAM R&D and devoting their fab capacity to ASICs and other devices.

Yet others are continuing to focus on DRAM but broadening their product lines beyond multisourced commodity memories to more application-specific devices. Vendors include Enhanced Memory (www.edram.com) with ESDRAM, Mitsubishi (www.mitsubishi.com) with CDRAM, MoSys (www.mosys.com) with MDRAM, and NEC (www.nec.com) with Virtual Channel DRAM (see "DRAM gets to the core of the problem," *EDN*, Jan 1, 1998, pg 14). Their common message is that, by focusing on advanced interfaces while leaving the DRAM core intact, the DRAM industry has boosted sequential-access (cache-line-fill-burst) and intracolumn performance but made virtually no improvement in random-access speeds.

What's the problem with this unbalanced improvement? As a result, as L1 and L2 caches become more robust, the probability diminishes that consecutive code-cache-line-fill cycles will hit the same DRAM column. With data, the access pattern is even more random. For example, a traditional graphics controller's frame buffer may contain arrays of x, y, and alpha data,



FCRAM modifies the DRAM core to reduce the percentage of the total device active during any access. The claimed result is faster block-access time and fewer required sense amplifiers.

plus depth (Z), overlay, stencil, and texture buffers, all scattered throughout the memory map and all accessed one or multiple times to generate each finished pixel.

Add Fujitsu to the list of fast-random-access advocates. The company's fast-cycle RAM (FCRAM), which it revealed at the recent IEEE VLSI Symposium, modifies not only the external interface, but also the memory core. By dividing the array not only into multiple banks but also small blocks within a bank, Fujitsu significantly decreases each block's access time to less than 30 nsec. Multistage pipelining hides postaccess precharge coincident with input-signal latching and data transfer to the output latch. A nonmultiplexed address bus eliminates the multiclock, multiclock row/column-address input delays.

Fujitsu is also targeting SRAM replacement, specifically the large L3 caches in workstations, disk arrays, and high-end networking equipment. Although the company's test-chip die is approximately 40% larger than that of an equivalent commodity SDRAM, the one-transistor, one-capacitor bit structure is much smaller and less complex than SRAM's four- or six-transistor bit architec-

ture. However, one factor you need to consider with FCRAM, but not SRAM, is refresh and its occasional access collisions and corresponding statistical impact on performance.

Fujitsu hopes to release its first production FCRAM, a 64-Mbit device with a 64-bit data bus and targeted less-than-20% incremental die size over standard SDRAM, in the second half of next year. A 128-Mbit FCRAM should follow in early 2000. Fujitsu vows to pursue industry standardization and alternative-sourcing opportunities. With other DRAM manufacturers' hands already full with double-data-rate SDRAM, Direct DRAM, and SyncLink Rambus DRAM programs, though, it's unclear how many interested partners Fujitsu will find.—by Brian Dipert

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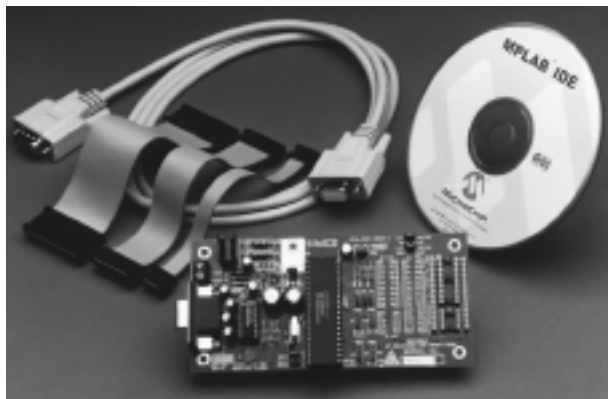
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Simulator yields low-cost PICmicro system debugging

Debugging help is on the way for Microchip Technology's popular PIC12C5XX, PIC12CE5XX, and PIC16C5X 8-bit RISC microcontrollers. The new Simice hardware simulator provides non-real-time I/O-port emulation and works with the vendor's Mplab-Sim software simulator. With Simice, a developer runs simulator code to drive the target system.



The Simice hardware simulator provides low-cost system debugging.

Responses from the target provide input to the simulator for interactive debugging without manually generated stimulus files. Simice provides unlimited software breakpoints, serial PC communications, and support of source-level debugging.

The Mplab-Sim simulator is a part

of Microchip's Mp-lab integrated development environment (IDE) for editing, compiling, emulating, and device programming from one user interface. Mplab is available free from Microchip's Web site.

The complete Simice hardware simulator costs \$129 and includes a hardware I/O-port-emulator board, an RS-232C cable, three PICmicro probe cables, and Mplab IDE software. Simice is available immediately.

—by Warren Webb

Microchip Technology Inc, Chandler, AZ. 1-602-786-7668, www.microchip.com. **Circle No. 433**

EYEPIECE SHORTENS TIME TO MARKET FOR MICRODISPLAY

The LookingGlass magnifying eyepiece from MicroDisplay Corp works with the company's MicroMonitor Series of miniature displays. The eyepiece provides a prototype viewfinder to aid in evaluating the displays. The LookingGlass operates with the MicroMonitor evaluation kit, which includes a 640×480-pixel-resolution, gray-scale display that operates in reflective mode. The eyepiece magnifies the 0.5-in.-diagonal display so that it appears as an 8-in.-diagonal virtual image seen 24 in. away from the eye. The eyepiece/display assembly has a luminous intensity of 70 cd/m², approaching the brightness of white paper under a reading light. With the eyepiece held approximately 1 in. from the eye, the 15-mW LookingGlass provides a field of view that measures approximately 19° diagonal. The LookingGlass is available as an upgrade for the MicroMonitor Evaluation Kit. The kit costs \$999, and the LookingGlass costs \$250.

—by Bill

Travis

The MicroDisplay Corp, San Pablo, CA. 1-510-243-9515, fax 1-510-243-9522, www.microdisplay.com. **Circle No. 435**

MEDIA PROCESSOR DRIVES DOWN PC COSTS

With the market for sub-\$1000 PCs continuing to explode, system designers are looking for ways to further reduce the bill-of-materials cost of new designs. Chromatic Research offers one approach to cost reduction through its multifunction Mpack 2 media processor. The company has unveiled the Stingray reference design that it claims will drive system prices below \$800. The media-processor IC shoulders several tasks in the reference design, including 3-D graphics, digital-versatile-disk video decoding, Dolby Digital surround sound, and 64-voice wavetable audio. The reference design also supports Motorola's (www.motorola.com) host-based, 56-kbps modem. The company developed two reference motherboards for the Socket 7 and Slot 1 processor buses. Both four-layer board designs use the ATX form factor. Chromatic claims that OEMs can build fully configured motherboards for less than \$550 with a Socket 7 processor.—by Maury Wright

Chromatic Research, Sunnyvale, CA. 1-408-752-9100, www.chromatic.com. **Circle No. 434**

CALENDAR

July 16 to 17

Cooling Electronics, Austin, TX, is a seminar and workshop in which five industry experts explore thermal-engineering issues. Session topics include fundamental concepts in fluid flow and heat transfer, design and optimization of heat sinks for electronic devices, thermal design of electronic equipment, and experimental methods in electronics cooling. Registration costs \$495. The workshop is also being held in Minneapolis, MN, from Aug 20 to 21; East Brunswick, NJ, from Sept 17 to 18; and Orlando, FL, from Dec 10 to 11. Flomerics Inc, Marlborough, MA. 1-508-460-0112.