ELECTRONICS WORLD

FEBRUARY 2005 £3.25

Select your FPGA with confidence

Bioelectronic sensors

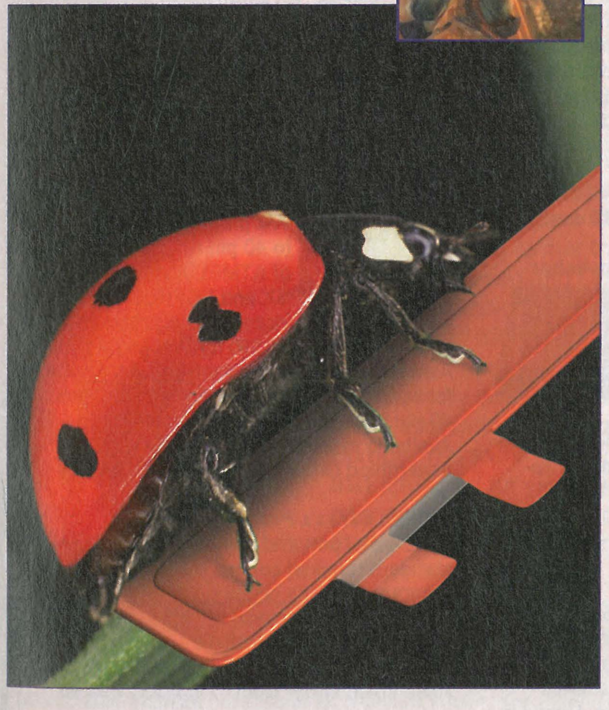
Smartcard batteries

9 770959 833097 02

Contents

February 2005 Volume 111 Number 1826

Top: TransFlash introduces a new size memory package – News, p7
Right: Brand new sections are being introduced on p14 and p37
Below: Products section starts on p52



The front cover comes courtesy of Varta Microbattery GmbH. Varta's new Cardpower battery addresses the powering needs of future smartcard applications.

Editor's comment 3
Always the bridesmaid...

Technology 4

Top Ten Tips 9

Insight 13
Good architecture with great timing

Focus: Second chance 14

Shedding light on the vision sector 16
The machine vision sector is providing bright opportunities for the electronics and semiconductor industries, says Matthew Peach

Match made in heaven? 20
Christopher MacLeod discusses the new advances in biotechnology that could lead to innovative electronic devices

ADCs: demanding performance 26
Adrian Grindon gives a detailed overview of how to get the best performance from an ADC or DAC

FPGA solution in digital displays 32
Ever wondered how to best select an FPGA with DSP functions for your digital display design? Bart Borosky has the answers

Games 37

Wireless Column 39
Heading toward auto-nursing

Circuit Ideas 40
- Efficient bench power supply
- 2V DC-DC converter
- Sky box dropout zapper
- Replacing a pulse relay
- Early warning system
- Simple mains power – improved

Letters 47

Products 52

Always the bridesmaid...

Medea+, a EU-sponsored R&D programme in microelectronics and nanotechnology, is meant to define the future of the European microelectronics industry. It is said that the technological potential of the microelectronics industry is such that its positive effects on the development of the economy's productivity are guaranteed for a long time in the future.

So, how come for several years now, Medea+ organisers and participants complain that the there's not enough money being ploughed into this and similar programmes (see news story on page 6)? Year after year, one and the same message emerges from Medea gatherings, and that is that other fields receive more public money than microelectronics programmes do. Agriculture is one big sticking point. It is always being mentioned as one area that seems to suck up most of EU's money, some €45bn of it. This year, it turns out that the tobacco industry is being sub-sidised with €1bn, a sum equivalent to what the information and communications techno-logy (ICT) field receives from the EU.

But, is Europe's success in the field of electronics just down to money or are there other reasons why Europe still lags behind the US and Japan in microelectronics development? Europe's lead – if the opportunity really ever existed – is further threatened by new countries. Taiwan and China are growing strong very rapidly in microelectronics development and manufacture. But going back to the old nemesis: the US – even today, with the continuously weakening dollar – seems to be doing a lot better in microelectronics than Europe. The same goes for Japan, a country that struggled for years to pick itself out of the economic doldrums it had entered into during the 90s. Europe, however, always appeared to be on the back footing to these two – 'always the bridesmaid never the bride'. It had always appeared sluggish in comparison, and just simply not as creative. Why is that?

Some industry executives I spoke to recently offered the answer that Japan and the US are both single countries and that Europe, with all its states, cannot be organised as a single entity and as such be as agile and responsive. But, is there more to it than that? Would you say that in addition to lack of money (for programmes, projects, small and medium sized firms, start-ups and even engineers) there is a lack of enthusiasm within European organisations, too? There is certainly a lack of aggressiveness, but is there, perhaps, a lack of creativity – or could that be, whatever creativity exists it is stifled?

Not that long ago, an internal EU report on productivity surfaced that admitted that, if the EU business model was the same as the that of the US, EU productivity would increase by 12%. At this year's meeting, the Medea+ executives agreed that closer cooperation between European R&D programmes and Brussels is necessary, as well as a clearer vision of the strategy for Europe in the field of micro- and nanoelectronics.

That is a good way forward, not only to negotiate more money for the programme and the industry in general, but to possibly acquaint politicians with what it is to be an engineer, what it takes to oil the wheels of creation and innovation and how to best nurture that environment to prime it for competitiveness. Maybe only then, we could make other countries' electronics industries start fearing Europe.

Svetlana Josifovska
Editor

EDITOR: Svetlana Josifovska **E-mail:** s.josifovska@highburybiz.com **EDITORIAL E-mail:** EWeditor@highburybiz.com
EDITORIAL ADMINISTRATION: +44 (0) 1322 611274 **E-mail:** EWadmin@highburybiz.com
CONTRIBUTING WRITERS: Nick Flaherty, Matthew Peach, Keri Allan **PRODUCTION EDITOR/DESIGNER:** Jane Massey
SUBSCRIPTIONS: Highbury Fulfilment Services, Link House, 8 Bartholomew's Walk, Ely Cambridge, CB7 4ZD. **Telephone:** +44 (0) 1353 654431
MANAGING EDITOR: Bill Evett • **PUBLISHING DIRECTOR:** Tony Greville
GROUP SALES: +44 (0) 1322 611254 • **PRODUCTION EXECUTIVE:** Dean Turner +44 (0) 1322 611206 **E-mail:** d.turner@highburybiz.com
PRINTER: William Gibbons Ltd • **ORIGINATION:** Impress Repro A1 Parkway, Southgate Way, Orton Southgate, Peterborough, PE2 6YN
NEWSTRADE: Distributed bySeymour Distribution Ltd, 86 Newman St, London W1T 3EX.
If you are experiencing problems getting copies through your newsagent, please call Debbie Jenner on +44 (0) 1322 611210

ISSN 0959-8332

HIGHBURY BUSINESS

ABC

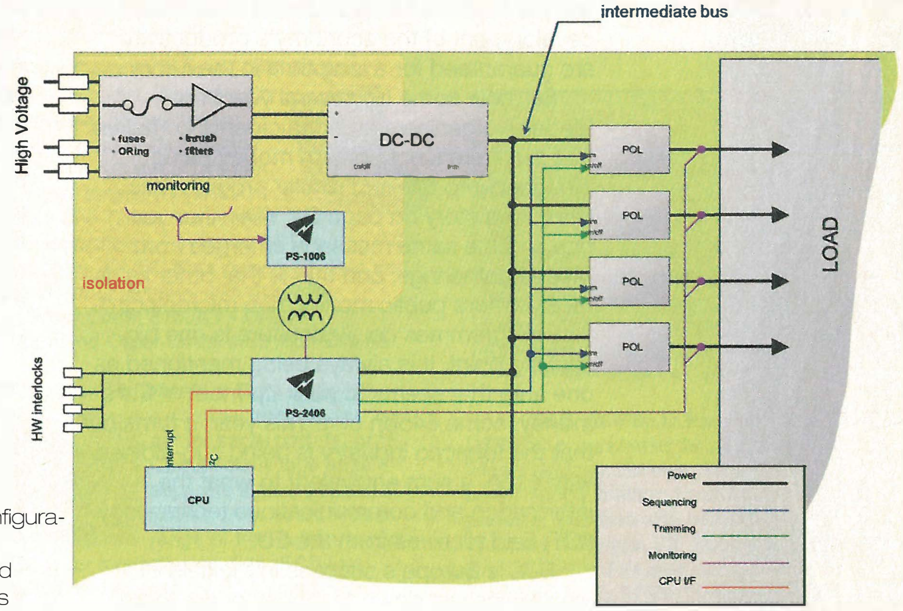
Electronics World is published monthly by Highbury Business, Media House, Azalea Drive, Swanley, Kent, BR8 8HU Highbury Business is a trading name of Highbury Business Communications Limited, a subsidiary of Highbury House Communications PLC. Registered in England. Registered Number 4189911. Registered Office: The Publishing House, 1-3 Highbury Station Road, Islington, London N1 1SE

Digital tool warns against system power failures

Power system designers can rest easier about failure risks thanks to a new power management software/hardware combination introduced by Canadian firm Potentia Semiconductor.

"In complex systems in applications like communications, computer, industrial and medical, there are a lot of power rails, a lot of different voltages – sequencing, high currents and so on, and power is a big risk of introducing failures into such systems," said Ian McGill, VP of business development at Potentia.

Potentia has a range of standalone ICs based on state machines only (no processors involved as McGill says, "BIOS makes customers nervous") that act as either isolators (PS1005/1006) where the input voltages are high, say 44V, or power controllers (PS2406) where they can "monitor" and "control" up to four different points off load (POL) at one time. For a higher number of POLs, cascading PS2610 chips will help. The software that sits above the system – PowerCentre Designer – then allows system developers to configure the ICs for thresholds, delays and trim for each rail, to keep system failures down to a minimum but also remedy problems quickly.



Typical configuration of the PS1006 and PS2406 ICs

There are several such points: first threshold voltage point can be adjusted according to the fail-safe voltage of the system; the second threshold voltage point can be adjusted to allow a different rail to 'fire up' after a given time; alarm- as well as fault-thresholds can be set up, where a rail is monitored for over-voltages over a certain period of time. Then there's a shutdown interlock that allows the system's rails to power down in reversed order to which they started, for full system safety.

"There are so many technical challenges in systems today that tools like ours are needed more and more. It's our belief that there's a transformation happening in the power management industry, from time-consuming, hardware-dependent, black art, analogue design, to fast, configurable, knowledge-based tools that are digital," added Ian.

In addition, the software contains a 'field analysis' capability that will help designers to fault-find more precisely within complex circuits.

Potentia's ICs contain 10-bit, 1% accuracy ADCs for each channel, which have also been developed by the firm, and non-volatile OTP memory.

Silicon lever may spell the end for viruses

Viruses, bacteria and toxic organic chemicals can be detected easier now thanks to a microscopic silicon device developed by researchers at US-based Cornell University.

The device consists of silicon paddles only 6μm to 10μm long, half a μm wide and about 150nm thick, with 1μm square pad at the end.

The experiment to detect pathogens revolves around pinpointing the natural frequency of vibrations that depend on its mass. Large array of paddles are mounted on a piezo-electric crystal and are made to vibrate at frequencies of 5-10MHz. When the frequency matches the paddles' resonant frequency, they begin to vibrate. This can be measured by focusing a laser on them and noting the change in reflected light, a process called optical interferometry.

A single silicon paddle weighs around 1.2pg and vibrates at frequencies around 10MHz. The virus used in the experiment weighs about 1.5fg. Adding just a few virus particles to a paddle is enough to change the resonant frequency.

The research could lead to simple detectors capable of differentiating between wide varieties of organic materials.

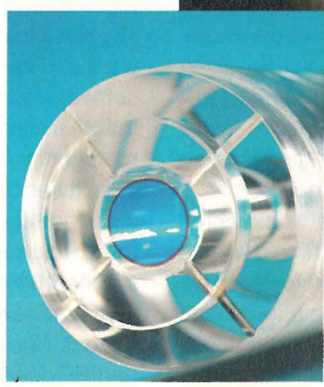
UK scientists break the world's time-measurement accuracy record

The UK's National Physical Laboratory (NPL) has found of new way of measuring time that is three times more accurate than any other method in the world.

The implications could be dramatic as they may lead to changing the way we measure time. In the nearer future, though, they are likely to enable improved levels of accuracy in deep space navigation and exploration.

"We are not there yet, but we know now that we have a working blue print that proves we can do it," said Professor Patrick Gill, who conducted the research.

Prof Gill and his research team used a strontium ion trap to create a stable optical frequency that is then measured.



Above: The ovens and electrodes of the NPL strontium ion end-cap trap, viewed in situ in a vacuum chamber

Left: The ultra-low-expansion glass cavity used to stabilise the 674 nm "clock" laser used in the world's most accurate opical frequency measurement

[Photos: National Physical Laboratory, Crown Copyright 2004 – Reproduced with the permission of the controller of HMSO and Queen's Printer for Scotland]

To create the frequency, a single ion of strontium is trapped and isolated in a vacuum, and then chilled to near absolute zero (-273°C) with a blue laser beam (wavelength of 422nm). The laser "bombards" the ion with millions of photons, and as each is absorbed and re-emitted causes the ion to lose a small amount of energy. Eventually, the ion "cools down".

A second mono chromatic red laser (674 nm) is then aimed at the cold ion and tuned to two very precisely defined energy states that it now has. Once the laser is locked on to this precise energy – or frequency interval – it becomes very stable. This laser now provides the optical frequency that NPL believes will lead towards the world's most accurate clock, possibly able to measure the second down to one part in 1018. That is nearly a thousand times more accurate than the best clocks of today.

The very stable laser light is sent down an optical fibre to a nearby laboratory where its frequency is measured against a laser frequency 'comb'. These are very short pulses of laser light that cover the spectrum from blue to infrared.

Each "tooth" of the comb is referenced to the Caesium fountain clock, which, as the current instrument defining the second, represents the highest level of accuracy.

In July 2001, the first big breakthrough in time measurement was announced by US scientists at the National Institute of Standards and Technology (NIST). They created a prototype clock based on the optical frequency of a single mercury ion (an atom with one electron stripped away).

The MultiBand OFDM Alliance Special Interest Group (MBOA-SIG) has completed its physical layer (PHY) 1.0 specifications and is now making them available to its members. The move enables many companies in consumer electronics, personal computing, mobile phone and the semiconductors business to finalise their standards-based ultra wideband (UWB) chip and board-level designs. This is particularly important to over 16 silicon developers that are now developing customer samples, and will result in pre-production interoperability testing.

"We are proceeding quickly to ensure interoperable consumer products in mass production," said Stephen Wood, strategic marketing manager at Intel's R&D division and a member of the MBOA-SIG steering committee.

Ω

Temple University in Philadelphia, US, has used functional magnetic resonance imaging (fMRI) technology to scan for lies. The scientists say that scanning the brain with fMRI has highlighted that when people lie activation occurs within seven brain areas, compared to four brain areas when people are telling the truth. Using fMRI as a lie detector is expensive, but in some cases, such as questioning terror suspects or in severe criminal cases, it could be worthwhile, says Dr Scott Faro of Temple University.

Ω

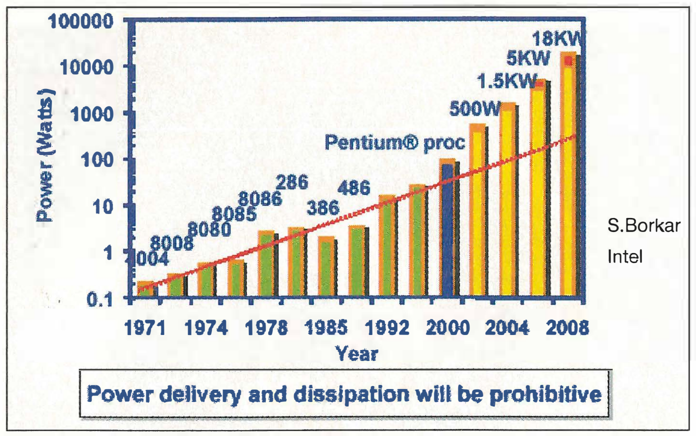
Taiwanese power supplies maker FSP Group, has formed a new technology company in Germany to compliment its portfolio range. The new firm is named Amacrox and among its new products will be computer peripherals, lenses for mobile phone cameras and MP3 transmitters. Amacrox is setting up sales offices in the US, the UK, China and Taiwan. It is establishing an R&D division and manufacturing centre in Shanghai to develop and make new products. A design facility and procurement centre has been set up in Taiwan.

Ω

Today's MPU architectures fall foul of Moore's Law

Today's microprocessor architectures will no longer be suitable for system design when transistor scaling goes beyond100nm, said Hugo de Man, co-founder of Belgian research institute IMEC at the recent Medea+ gathering. "Power in today's computing is very inefficient – power dissipation doubles up every three years – it's an anti-Moore's Law. So, we need to think of other, new, architectures," he said.

Power savings can be made in various ways: through new technologies, new materials, better software programming, better tools, better distribution of instructions and data, localisation of memories and so on. Each step could deliver power savings of up to 30%. But, according to Prof de Man, the industry needs to make 14 steps in design and technology to make significant improvements. "That's a major architectural change."



Microprocessor power is Moore's Law in the wrong direction

Prof de Man has several ideas of how to move on, but it does mean abandoning the old, trusted ways. "First, get rid of the Von Neumann microprocessor architecture that's programmed in a classical way [as transistors are used for more cache and not so much for computation]. We should use only fast and flexible architectures for parallel processing, and software 'washing' machines to save on power. For that, we will require a new class of designers and architects, new methodologies and new tools."

Prof de Man also had a go at the EDA industry, which he claims is not doing enough now to prepare tools for the 45nm scaling that is expected in several years' time. "It takes ten years before concepts get into the EDA world. We need to get into it [building EDA tools] now but there's no money in it for them [the EDA tool companies] now. So they are not doing anything about it."

When transistor scaling below 100nm, in addition to architectural problems, there are physics matters that need to be resolved, too. They have been cumulatively named 'the hell of physics' and consist of gate leakage, voltage headroom, increased gate variability, irregular lithography layout, signal integrity, global interconnect delays and others.

To be able to resolve all these issues, Prof de Man suggests to "lock up hardware and energy-aware software designers with 'nano' aware architects and start getting somewhere". This, it seems, will give rise to a new category of engineer, the so-called "silicon platform architect", who will be well versed in software programming, as well as mixed signal and RF design.

EU strong on R&D cooperation but not on funding

European cooperative R&D research like Medea+ is a success for Europe, claim government officials, even though little money is invested in the programme and countries like the US and Japan are still in the lead in microelectronics development.

"The Eureka formula – bottom-up, lean and flexible organisation – has always been a strong asset in supporting Europe's economy," said Patrick Devedjian, the French Minister of Industry. He said that over €22bn of public and private funding has already been used in Eureka projects of which Medea+ is one.

Controversially, the biggest bugbear for Medea+ participants and organisers is the lack of government money, which will adversely affect Europe's competitiveness in ICT (information and communication technologies). Half of the EU budget, or some €45bn, is spent on agriculture. In comparison, only €3bn per year supports innovation and, of that, just a fraction – €1bn – is spent on ICT. This is the same amount with which Europe subsidises the tobacco industry.

"Is it right for the ICT industry to get less than the tobacco industry?" asked Doug Dunn, CEO and president of Dutch lithography equipment maker ASML. "Now is the time to act to avoid Europe becoming a 'ghost ship' on the ocean."

At this year's meeting, the Medea+ executives agreed that closer cooperation between Medea and Brussels is needed, as well as a clearer vision of the strategy for Europe in the field of micro- and nanoelectronics. In addition, they conceded that more emphasis should be placed on SMEs.

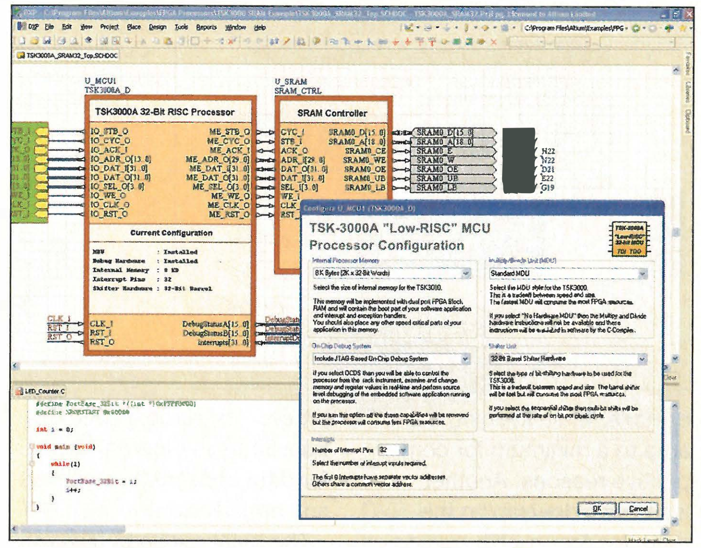
Medea+ is a pre-competitive cooperation: It takes from one to 1.5 years for process technology and between two and 2.5 years for equipment to be brought to market after Medea. The top three participants in the programme, each with thousands of proposed projects, are France, followed by Germany and the Netherlands.

'Easy' 32-bit processor created specially for FPGA designs

An Australian EDA company has launched its own, royalty-free, 'easy to use' 32-bit processor for FPGAs – the TSK3000.

Altium develops design tools for FPGAs and circuit boards with its Nexar and P-CAD tools, and has teamed up with FPGA software tool developer Tasking to design a 32-bit Harvard architecture core with a five stage pipeline, combined with an 8-bit open-standard Wishbone interconnect bus. Wishbone is a system-on-a-chip (SoC) interconnect bus for portable semiconductor IP cores that allows flexible design methodology.

The aim is to provide a core for designers to use in FPGA-based reconfigurable systems, rather than SoC devices, supported by a compiler and debugger from Tasking. The main advantage is the ability to use one such processor core, and therefore one code base, across multiple types of devices. The processor can be used on any target FPGA family with no licensing issues. So, one processor can be applied across multiple FPGA devices from different vendors in different projects.



Tasking has provided the tools to support Altium's new TSK3000 processor

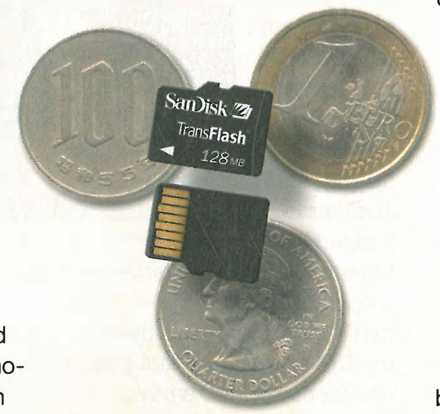
"We think reprogrammable hardware will be a driving force over the next decade," said Klaus Pontius, European director of support at Altium.

Unlike other processors for FPGAs such as Altera's Nios and Xilinx's MicroBlaze, the TSK3000 comes pre-synthesised and pre-verified. "We want to remove the barrier of VHDL or Verilog while allowing experienced designers to use HDLs if they want," said Pontius.

Providing pre-synthesised IP means there are different versions of the core available for each of the main FPGA lines from Altera, Xilinx and Actel.

Tiny memory package hits big industry

Sandisk has developed an industrial version of its miniature TransFlash flash memory card with 256MB of storage. The original version was developed with Motorola for smartphones, but demand from the industry has led to an industrial version, necessary for applications where space is an issue and designs want scalable memory, where more memory can be added later using the same connector.



The TransFlash package measures 11x15x1mm and is a third the size of current SD cards – indeed, an SD card is used as the mechanical carrier to link TransFlash to a PC. The current density is 256MB using Sandisk's 90nm NAND flash memory technology that stores four bits in each cell.

The UK-based BTG is seeking an exclusive licensee for a technology on transparent cathodes in polymer organic light emitting diode (OLED) devices. The technology is based on US Patent 5,955,834 titled *Light Emitting Devices Utilising High Work Function Electrode*. BTG licensed it from the Ohio State University covering OLED technologies in the field of information displays. Now, it wants to license it to one OLED manufacturing company.

BTG has already invested funding, equivalent to that of a seed-stage round by a third party investor.

Ω

Recent research from the UK-based City & Guilds has identified that many businesses find it difficult to cope with work placement schemes and are calling on the government to provide more support. The research states that 71% of UK businesses believe there should be stronger government support to improve the current schemes. Businesses also want tax breaks to help them prepare the young for the workplace, better dialogue with schools and colleges, and stronger guidance on how to develop and run effective work placement schemes. However, up to a quarter of the questioned claimed that they've never found a way of making a work placement scheme successful.

Ω

A new Lean Manufacturing Initiative has been launched in Scotland to help local manufacturers. It aims to aid manufacturers in cutting costs, increasing quality and improving the bottom line. The initiative promises to save an average £150,000 in the first 12 months for each participating company. Other specialist advice on manufacturing best practice models, training opportunities as well as encourage networking and communication will also form part of the programme.

The main funding comes from the Scottish Executive and is delivered via Scottish Enterprise by the Society of British Aerospace Companies.

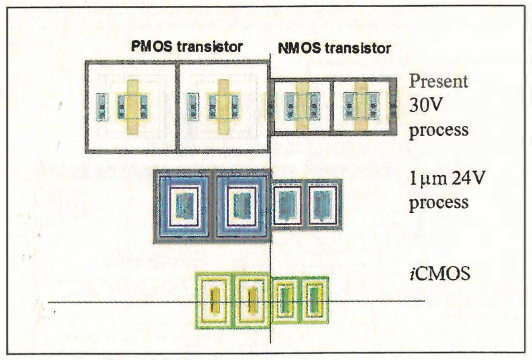
Ω

CMOS process combines logic and 30V transistors

Analog Devices (ADI) has developed a new chip-making process that combines 30V devices with logic standard CMOS for the first time for industrial applications in noisy environments.

Traditionally, high voltage devices are built on 2μm to 3μm specialist processes such as bipolar, which limits the amount of logic that can be integrated onto the chip. Another way is to combine high voltage and standard CMOS die in the same package, which can be expensive.

In comparison, the iCMOS (industrialCMOS) process developed at ADI's plant in Limerick, Ireland, is a standard 0.6μm CMOS process that isolates the high voltage devices with wells of silicon dioxide. To date, the difficulty in building such devices was in developing a process that had both the wells for the 30V isolation and the 5V CMOS devices, while keeping the area to a minimum for competitive reasons. Another issue was developing the modules for on-chip components such as capacitors.



Comparison in chip sizes when created with 30V, 1μm 24V and iCMOS processes

Now the thickness of the wells can be varied, depending on the mix of devices needing isolation, and this is used in different process modules with different combinations of devices for various applications.

As such, 30V vertical bipolar transistors can be used alongside digital signal processing vertical CMOS transistors in different ways for data converters, switches and amplifiers.

The higher voltage gives larger input swings for analogue to digital converters (up to +/-10V), greater linearity for higher accuracy digital to analogue converters (up to 16-bits with 1 LSB), multiplexers with R_{on} of 3Ω, 85% lower than previous devices, and amplifiers that are 60% smaller. ADI has launched a range of parts using the technology, including a 1MS/s, 12mW ADC with 8 +/-10V inputs that use standard logic to make them software selectable, rather than having to use a network of resistors to select the inputs.

As the process is in standard CMOS with different 'flavours' for different combinations of devices, it scales down to 0.25μm lithography and allows analogue devices to take advantage of the lower power and lower costs driven by Moore's Law, for the first time. The silicon dioxide wells may be relatively larger to provide sufficient isolation and reduced leakage current, but that is only for the high voltage devices that tend to be at the input or output of the chip.

As well as reducing the feature size to reduce the power consumption and cost, the company is also looking at a 50V version for even higher signal swings.

New touch for harsh environments

A new kind of touch screen technology that can be used on bigger screens and in industrial environments is now available from 3M.

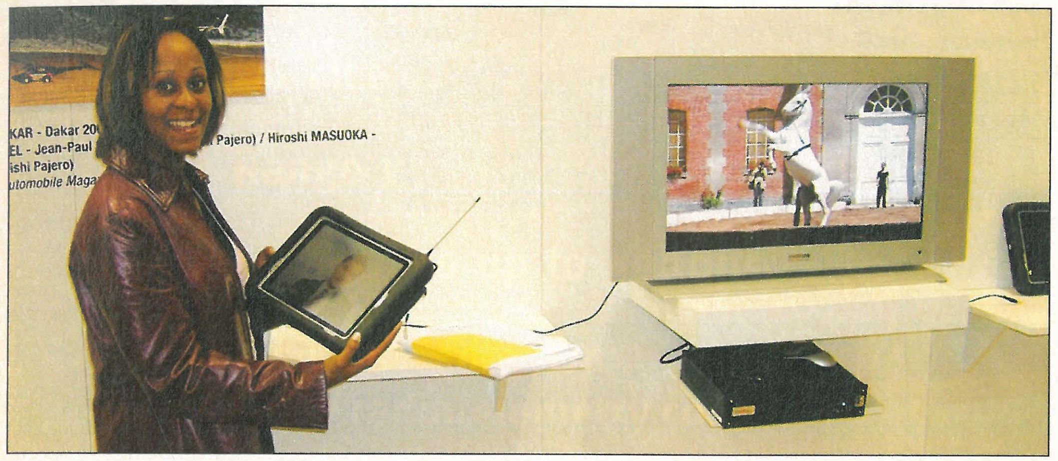
The Dispersive Signal Technology (DST) measures the vibrations created in a sheet of glass when it is touched. There are four piezoelectric sensors at the corners of the glass overlay on the screen, and a digital signal processor (DSP) uses this data to calculate the position of the touch. This means that the touchscreen can be used with gloves and in rugged environments where the capacitative and resistive approaches are not so reliable. The current algorithm gives 1% accuracy.

3M demonstrated a 40in LCD with a DST touchscreen at Electronica in Germany for the first time in Europe. It is planning volume production in 2005. At the same time, it is evaluating the DSP used for the screen, said Doug Keller, product manager, with the performance of the DSP depending on what features they want to add to future products.

Because the touchscreen is a standard piece of glass, it can also be used in a speaker. The company has teamed up with flat speaker maker NXT to integrate a speaker behind the glass. This means the DSP has to filter out the vibrations created by the speaker when analysing the vibrations created by someone touching the screen.

The Dispersive Signal Technology (DST) touchscreen makes an appearance at a trade show

DVB-H mobile TV silicon makes an appearance


DiBcom demonstrates its DVB-H chip capabilities

Several chipmakers are developing silicon for the new DVB-H (DVB-Handheld) standard that allows TV to be broadcast to mobile terminals such as mobile phones and personal digital assistants (PDAs).

The first to market is DiBcom, a Paris-based chip design firm. "As DVB- H is very close to DVB-T [DVB-Terrestrial], just adding the 4K mode, forward error correction and time slicing – so the design and development is quite straightforward – and the DVB-H chip will benefit of the same advantages concerning portable and mobile performance," said Gerard Pousset, business development manager at DiBcom.

The company has demonstrated a laptop PC using its DIB3000-MC 2K/8K COFDM demodulator chip and a SmartMPEG chip from Fujitsu Microelectronics. With two antennas on a vehicle and the more complex 64QAM modulation, data rates can go up to 24Mbit/s at 250km/h. With a single antenna, the chip supports 16QAM modulation, with data rates of up to 18Mbit/s at up to 150km/h.

The next step is to have a more cost-effective 4K version with 3409 active carriers specifically for DVB-H. The challenge after that is its integration into mobile phones.

UK silicon design provider Imagination Technologies is using its Universal Communications Coprocessor (UCC) multimedia processor core, which is also used for DAB chips and Digital Multimedia Broadcast (DMB) terminals, for its version of DVB-H. It will be ready in for terminals at the end of 2005. The UCC, developed by Imagination's Ensigma division, is essentially three processors, each with its own dedicated signal processing task. The Signal Conditioning Processor (SCP) performs IF to baseband conversion, while the Modulation and Coding Processor (MCP) performs data modulation and demodulation. The output from the MCP is a stream of soft decisions suitable for error correction. The data passes through the Error Correction Processor (ECP) before being decoded by the host processor. The DVB-H design also includes the link layer and demodulator for DVB-H so all that is needed is a separate RF tuner chip and an applications processor to handle the video decoding. This allows the existing applications processor in a phone to be used. The designs will be ready by the end of this year, says Simon Hambly, mobile TV product manager at Imagination. "There's a great deal of interest in the solution," he said.

Texas Instruments will add DVB-H capability to its DSP-based multimedia platform OMAP. It is a new single chip codenamed 'Hollywood' that combines the RF receiver, tuner and demodulator. Evaluation boards will be available at the end of 2005, samples in 2006 and full production will start in 2007.

Philips Semiconductor aims to have a chip in the market early next year, as it plans to have terminals ready by the year-end, says Steve Turner, business development manager for consumer and multimedia products. It is working with Nokia on the trials in Oxford and Berlin and has demonstrated a tablet PC receiving DVB-H in Singapore.

Escaping the Power Anti-Moore's Law

- Get rid of the classical Von Neumann microprocessor architecture
- Use only flexible and fast parallel architectures
- Create software 'washing' machines to reduce power
- Explore optimised memory hierarchy
- Introduce parallelism – it's better to use 20 processors at 100MHz than one at 2GHz
- Exploit dynamic nature of algorithms to adapt V_{DD}, f_{cl}, I_{DDQ} of processors
- Use tile-based GALS (global asynchronous, local synchronous) architectures with regular networks on chip
- Use error correcting communication techniques for networks on chip
- Create efficient software (co-design)
- Close the gap between system software and platform architecture including the programming environment, mixed-signal and even the RF link

This month's Top Ten Tips were extracted from a Medea+ lecture given by Professor Hugo de Man of the University of Leuven and co-founder of the IMEC research facility in Belgium. For more information see News Story on p6.

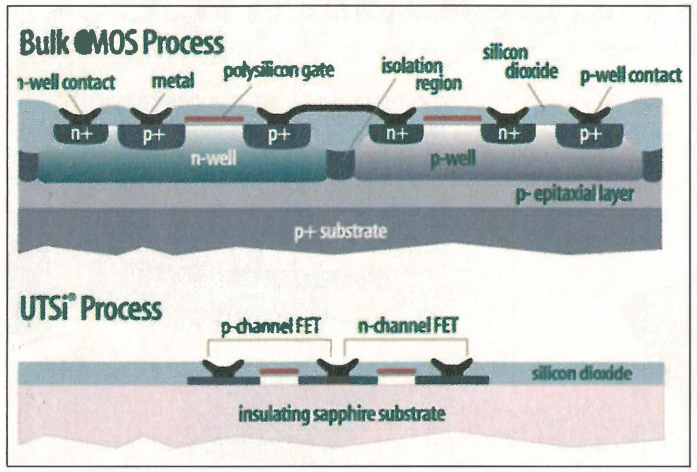
If you'd like to send us your top five or top ten tips on any subject you like, please write to the Editor at **EWadmin@highburybiz.com**

Silicon on Sapphire moves into the mainstream

Peregrine Semiconductor is pioneering the use of sapphire substrates with standard CMOS process technology that tackles one of the largest problems in today's chips – leakage current.

The fully depleted 200Å layer of Silicon on Sapphire (SoS) used in its UltraCMOS process has an immeasurable leakage current, says Rodd Novak, director of marketing at Peregrine. "It's less than a picoamp," he said.

This gives much higher isolation for higher voltages and higher swings, as well as letter linearity for RF elements such as phase locked loops



Bulk CMOS process versus the Peregrine Silicon on Sapphire solution

and tuners. The company has just launched a 75Ω switch for cable TV boxes that provides isolation of 70dB at 750MHz and ESD tolerance of iKV even in a non-powered state.

By combining two different n-channel transistors, the PE4274 switch can still pass current through the device at 0V, allowing other equipment, particularly games consoles, to be attached to the cable TV box and still operate even when the box is off. This level of isolation is only possible with SoS, says Novak.

The company, which has its own 6-inch fab in Australia, also has a deal with Oki Semiconductor, which is using the technology in two fabs in Japan for low power devices, as well as using it in its design centre in Provence, France.

Good architecture with great timing

The world of the telecom equipment makers is changing yet again, and now to engulf AdvancedTCA, says Fred Yentz

The telecommunications industry today is beginning to seriously evaluate Advanced Telecom Computing Architecture (AdvancedTCA) compliant products. Acceptance of AdvancedTCA and the proliferation of solutions that conform to the standard is the result of work conducted by PICMG (PCI Industrial Computer Manufacturers Group), a consortium of more than 450 companies who collaboratively develop open specifications for high performance telecommunications and industrial computing applications.

In the late 1990s, the telecommunications industry was booming. This was also a period when the market was defined by infinite cash and an overabundance of opportunities. Acquisitions, mergers and takeovers were also rampant and left in their wake a plethora of proprietary platforms for organisations to manage. It didn't take long to realise that a new standard was needed to allow for common, modular platforms.

PICMG was maturing as a standards body and was, for the first time, joined by many of the industry's largest Telecom Equipment Manufacturers (TEMs). With more than 100 participating companies, PICMG set out to develop a new standard for next generation carrier grade communications equipment. The driving force were a more robust architecture, larger form-factors to accommodate more processing power and a consolidated view on management due to the parallel efforts of the Service Availability Forum (SAForum). Additionally, a new standard would provide TEMs with more choice. AdvancedTCA was the promise of interoperable blades.

For users, it held the promise of better interoperability, scalability and serviceability, which would lead to accelerated deployment of next generation services and ultimately improve time-to-money.

As the AdvancedTCA specification matured, the industry began one of the largest corrections of all time. A precipitant drop in revenues and available cash, combined with enormous debt, resulted in a drastic transformation of the industry. The shakeout created a market that had been completely redefined. In this time of recovery, many TEMs focused their limited resources on quick upgrades to network elements and system boosts. These were small tweaks that offered incremental increases in performance and function.

As TEMs adjusted to a renewed focus on return on investment and core competencies, AdvancedTCA offered solutions. It would allow TEMs to spend critical resources on developing feature-rich applications and services rather than building the next compute or switch blade for their proprietary platform.

Even though TEMs improved some of their older network elements with speed and application adjustments, many of the architectures and platforms were in need of a significant refresh. Upgrading this variety of legacy platforms with fewer people due to massive downsizing was a monumental task. The most probable solution appeared to be AdvancedTCA.

It didn't take long for the industry to appreciate the value in a strong ecosystem made up of suppliers that provide both, AdvancedTCA-compliant building blocks and common platforms.

Today, the world of interoperable solutions has opened up. Many AdvancedTCA-compliant solutions will be in test environments in 2005. However, once these solutions proliferate, TEMs will be faced with integrating different building blocks, from different vendors, to form complete systems. This will require significant time and resources, which are both in short supply. TEMs will need to rely on vendors to handle the integration and validation of various components, from a variety of suppliers and trust that they will deliver proven, tested, application-ready platforms.

TEMs may view this as a risky endeavor and be apprehensive to give up functions they have traditionally managed – in finite detail, to a new group of market and technology participants. Many will need to step up to the challenge by hiring the best system architects and validation engineers, and investing in laboratories and equipment. Suppliers must become expert system architects, provide unequaled service and manage lifecycle and supply chain management functions with a keen eye on customer ROI.

> *"TEMs may view this as a risky endeavor and be apprehensive to give up functions they have traditionally managed"*

AdvancedTCA was the brainchild of several movers and shakers in the telecom industry. The standard has matured through the telecom depression and emerged as a stable architecture with a strong ecosystem of technology companies, several of which have stepped up to the challenge of providing application-ready platforms.

Fred Yentz is services vice president at RadiSys and is based in the US.

Second chance

Regrouped and with a sharpened focus, ARC International hits the market place with a line-up of new platforms

By Svetlana Josifovska

ARC International, the UK-based creator of reconfigurable microprocessor cores, is trying to turn its fortunes around. To achieve this, the firm has acquired new management and is launching a series of pre-configured platforms for key markets based on its cores.

The firm has been losing money for several years now. In its June 21, 2004 announcement of its results, ARC showed turnover of £10.7m and net loss of £20.7m, which increased 1% on the same period the year before. "ARC has not been a profitable company," confirms Derek Meyer, the firm's vice president of sales who joined it only a few months ago and used to work for MIPS Technologies, one of ARC's rivals. "The goal [with the new management] is to grow the company's profits."

Carl Schlachte is ARC International's new CEO. He joined in March 2004. With him, he brought a series of high-flying executives with technical and commercial background that has been trimmed at successful companies like ARM, MIPS, Texas Instruments and Cadence among others.

The management immediately divested the USB business that ARC acquired some years ago to re-focus solely on the firm's core competency that is reconfigurable processors and supporting tools. ARC still offers its range of highly flexible microprocessor cores. The code for these is delivered in C so that application designers can tune it to fit their requirements. They can modify the instructions sets or the memory configurations, unlike with ARM processors, for example, that offer fixed functions.

ARC's management also plans to keep the MQX real-time operating system (RTOS) that is used mostly in industrial applications. ARC acquired MQX when it bought Precise Software Technologies in 2000. This RTOS supports ARC and non-ARC processors.

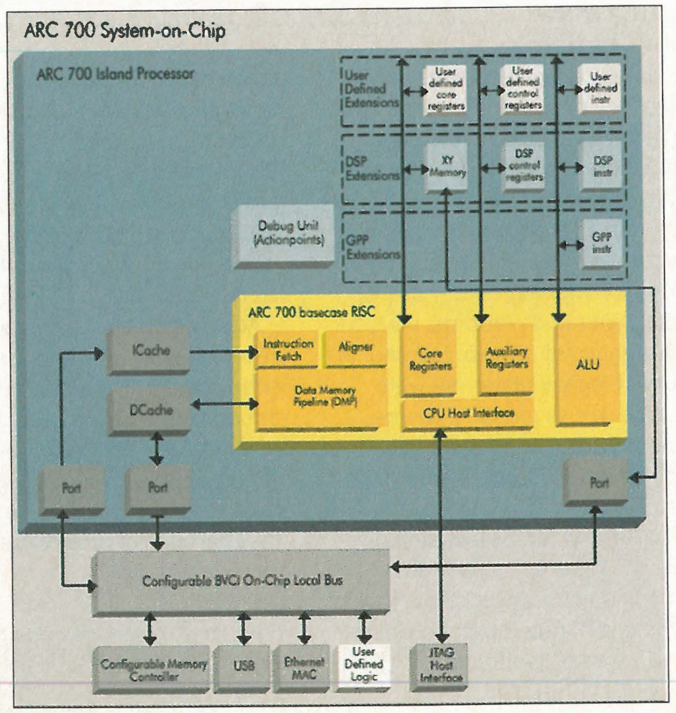
What ARC is offering in addition to these solutions is a series of pre-configured licensable platforms for volume markets such as consumer electronics, for example.

ARC was formed in 1998 when it de-merged from the UK games and graphics chips developer Argonaut Software. Back then, its CEO was Bob Terwilliger, who - when first saw what ARC can do said it was like spotting "diamond sparkling in the coal". Terwilliger left the company at the end of 2001. Since then the firm drifted. "On the business side, the company didn't bring people in from ARM and MIPS and others. They [the management of the day] didn't know about [the business of] CPUs and operating systems."

Even though it slipped off many customers' radar screens, Meyer says that ARC was still the second largest selling processor in 2004 with nearly 100 million units shipped and 100 licensees. The full potential of these licences, however, is yet to make an impact on ARC's balance sheet.

The number of registered configuration variations on the ARC 600 currently stands at 3600. "There's a strong correlation between configurability and high volume," said Mayer.

Recent agreements with TTPCom and Broadcom will get the company further into the mobile phone market. "Broadcom already has an ARM and MIPS license but now they are taking an ARC licence, too. TTPCom will need it for their 2.75G baseband. This should put us in even higher volumes," said Meyer.



Block diagram of a typical system-on-a-chip based on the ARC 700 processor

ARC's portfolio consists of several configurable processors such as the Tangent-A4, Tangent-A5, ARC 600 and ARC 700. The ARC 600 and ARC 700 are 32-bit RISC processors that are available with or without DSP extensions – dual 16-bit or 24-bit multiply/accumulate/subtract. In addition, ARC 700 runs Linux, as well as other embedded operating systems (OS). This core is scalable up to 400MHz.

Users can profile the software programs they intend running on the processor, identify areas of the code that could be accelerated through hardware and add that to the processor. Examples of these types of instructions are bit manipulation functions, which are highly inefficient when handled by software. Speeding them up in hardware can yield improvements of up to 1000 times, depending on the programs and the level of extension used.

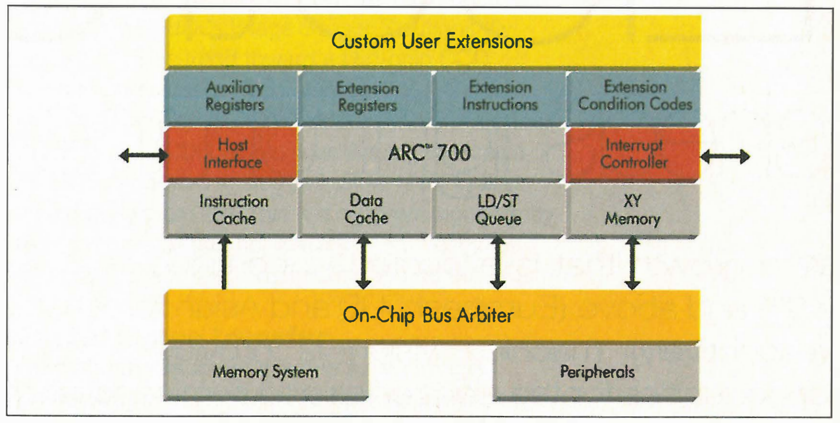
To make configurability easier, ARC has expanded its ARChitect2 tool with the Extension Interface Automation (EIA) technology. EIA provides a graphical interface with which designers can create a library of processor components. Before the introduction of EIA, customers were given access to the ARC extension interface that is tied into the processor internals. Although this allowed flexibility, it required detailed knowledge by the user.

> *"Pre-configured sub-systems are the next level in our [IP] industry. Audio is the first step."*
> *Derek Meyer, VP of sales, ARC International*

EIA simplifies this complexity by allowing the designer to simply describe the function of their extension, which it then automatically connects to the processor internals along with the necessary support logic. It then generates the connections to the processor, including the models of the instructions for software tools, and describes the instruction to the compiler to allow it to be easily used. With EIA, implementation time is shortened from days to minutes.

Extensions can be described in Verilog and System C with which 95% of designers are familiar.

ARC's reconfigurable devices find their greatest fans in the digital consumer electronics, networking and storage applications space. That's why ARC went the extra mile to deliver a specific subsystem that will cut time-to-market for some of these customers. The first in this series is the ARCsound Audio Subsystem. It consists of audio software, the ARC processor with custom audio extensions and a suite of hardware and software development tools. The total area of the module's footprint, replaced with Linux if required, says Meyer.



Block diagram of ARC 700 processor core

The subsystem conforms to MPEG-2/4 audio, MP3, WMA and AC-3 standards and uses a library of all the codecs. As Meyer says: "use them or don't use them, but they are there."

"Our solution includes hardware and software, whilst competitors' [similar] platforms do not offer the software side of it, just the processing and the [audio] extensions. The software is 'third party'," he added.

"Pre-configured sub-systems are the next level in our [IP] industry. Audio is the first step – the key is to fully understand which [elements] you need to deliver for a series of media related subsystems."

The firm is planning other platforms, which, it says, will launch at the target market's "sweet spot". After all, application-specific solutions can generate three times more revenue than microprocessors alone. Building a pre-configured system - with certified software – will carry a greater premium, says Meyer.

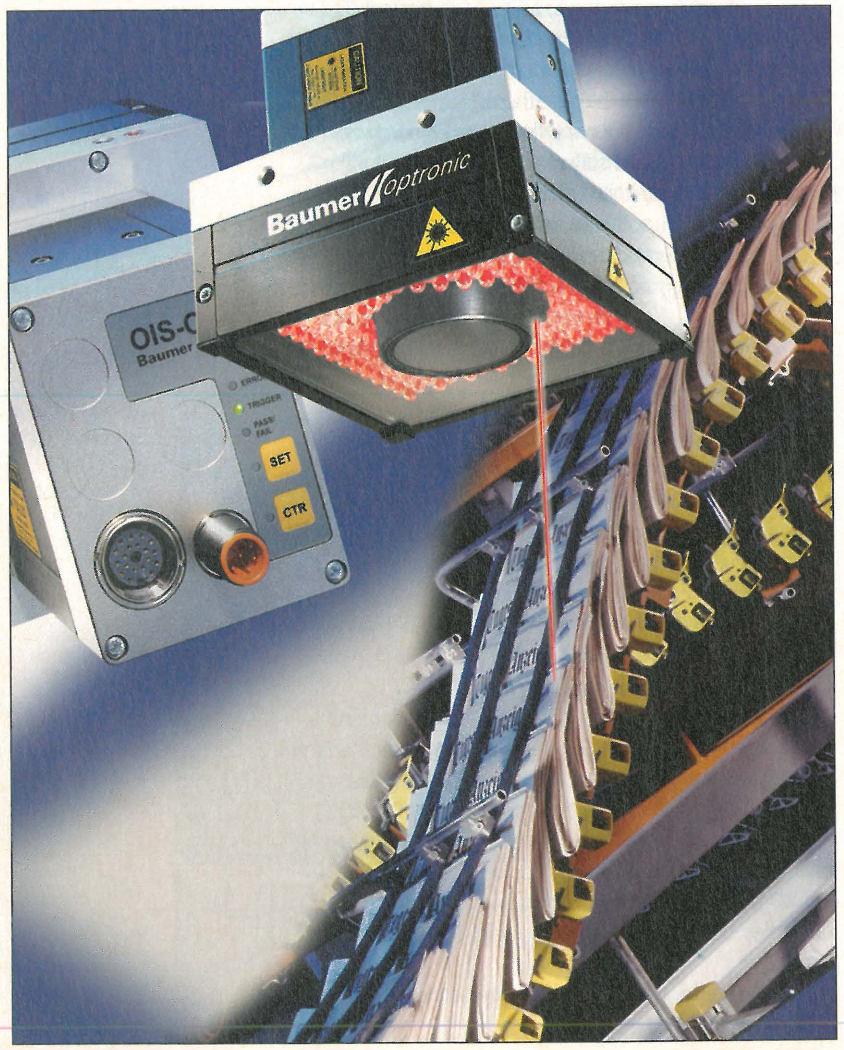
So, what's next for ARC? "We'll need another range [of configurable processors] above the ARC 700 that runs Linux in 0.13µm CMOS implementation."

"The working trend to do is to bring a new microarchitecture every 12 months. But this is a pace faster than the embedded market can handle. You need compilers, software, tools - all sorts of things - to go with it. There are other ways to achieve performance without having to change the microarchitecture. You can do it with DSPs – it is SIMD [single instruction, multiple data] based today but it may be the vector-type approach [next], for example."

"Sub-systems will clearly be an interesting business for IP companies."

Electronics sheds light on the vision sector

With growth that is expected to continue at 20%, 40% and above (European, US and Asian forecasts, respectively) machine vision is providing bright opportunities for the electronics and semiconductor industries, says **Matthew Peach**



At the beginning of the 21st century, the vision sector is clearly transitioning from specialist custom solutions towards off-the-shelf packaged systems that are finding wider application. According to the Advanced Imaging Association, the key markets for vision systems are semiconductor manufacturing, electronics, transport, wood and food processing and pharmaceuticals.

Vision systems are the focus of intense research and development worldwide and the development objectives are bound up in the aims of product and system improvement in the electronics sector. As in microelectronics, vision system companies are working to solve the quintessential high technology challenge: reducing component size and power consumption while driving performance up and price down. At the same time, characteristics of hitherto diverse and disparate vision systems are becoming more streamlined as standards evolve, especially in the fields of communication protocol and connector technologies.

Machine vision (MV) is reaping the benefits from developments in other areas of the PC and electronics industries. Particularly, the 64-bit PCI Express bus specification, which is soon to be released, is a result of the pressure being exerted by the PC gaming industry. The 64-bit PCI Express bus raises data rates to 528MB/s with a theoretical limit of 660MHz dependent on hardware.

US firm Coreco Imaging, for example, has a range of boards: the X64 series, capable of interfacing with this new bus, and which can achieve high transfer rates for existing and new cameras. These boards, in turn, allow the current crop of high-resolution cameras to realise their full potential, according to Colin Geer marketing manager at UK-based distributor Firstsight Vision.

The speed of the on-board processors, coupled with the advancing capability of associated software, is pushing many machine vision solutions into areas that were once the domain of "full-blown" PC systems. The latest DVT smart sensor range, for example, uses new DSPs, from the TMS320C6000 Texas Instruments (TI) series, that runs roughly at the speed of 500MHz.

Camera resolutions are also improving. The next generation of cameras is entering the market with 3, 5, 8 and even 22 Megapixel image sizes, with the prospect of higher resolutions yet to come. This is the other side of the same equation. With pixel resolutions reaching these levels, the hardware needs to be in place to manage the data generated, which is where the new interfaces will come into their own.

Image transfer protocols and interconnect technologies are proliferating. The Camera Link standard is an MV-driven protocol that has produced many benefits including far higher data transfer rates, up to 900Mbit/s, and it has simplified what was a confusing cabling situation by putting in place a defined interconnect standard. It includes standardised interconnects between cameras and frame grabbers and it is based on National Semiconductor's Channel Link LVDS (Low Voltage Differential Signalling) chipset for data transfer.

The other key communications protocols PC-to-peripheral interconnect standards are Gigabit Ethernet, FireWire b (IEEE-1394b) and USB 2.0. These technologies are built on established PC industry standards and take advantage of the general impulse to increase the speed and simplicity of PC peripheral connection.

FireWire has been used in machine vision for some time now and there are many manufacturers of 'industrial' FireWire cameras, including Sony, Allied Vision Technology and Unibrain. These cameras include resolutions from standard CCIR/EIA up to 8 Megapixels. FireWire interface cards are available to cater for the machine vision market specifically in both the original and b versions.

USB 2.0 is also a method of connecting peripherals to PCs to enable data transfer rates of up to 480Mbit/s for devices such as external hard disks, video and printers.

This standard is being adopted for use in MV and there is a range of new products arriving on the market, such as the uEye. This camera range also demonstrates one of the other trends in the machine vision world for size reduction; the uEye has a physical size of just 25x25x20mm (the lens mount increases it to 25x25x32mm).

Gigabit Ethernet (GigE) is another technology that promises a revolution in device interconnection by using standard networking hardware and routing technology. Several manufacturers are already targeting the Gigabit Ethernet sector. Japanese-Danish cooperation JAI/PULNiX has several GigE cameras in the pipeline, saying it sees GigE as "an important future strategy". Another large camera manufacturer, Dalsa, also has a number of GigE products that are likely be released in the next few months, in addition to its Camera Link-to-GigE converter that is already available.

So how is electronic component integration occurring in MV systems? Terry Guy, marketing manager in Kodak's Image Sensor Solutions division says: "This trend toward a two-chip CCD solution continues with combining AFE, TG, and horizontal and vertical clock drivers into one device. Our KAI-0340 CDU employs an Analog Devices's AD9995 integrated analogue front-end (AFE) and timing generator (TG). This arrangement significantly reduces the size and complexity of the design by taking the specialised timing circuitry into the AFE."

Faster image transfer

German firm Baumer Optronic's new image processing sensors' improved processing speeds are being attained using the Baumer's own FEX (Feature EXtraction Processor) technology. FEX integrates image sensors, a lens system, illumination, the FEX pre-processing step, a microprocessor and industrial interfaces (I/Os, Ethernet, CAN and others). The 'pre-processing' stage uses FPGAs (Field Programmable Gate Arrays) to handle the parallel image processing. Baumer uses Xilinx FPGAs such as the Spartan 3 and Virtex in different versions of the system. Conventional image filters 'feed' the FPGAs with data to calculate the description of the objects and their characteristics – so called feature extraction – in real time. Once the image capture is complete, the data is then handled by a microprocessor. Most recently Baumer started

Opposite page: Baumer's FEX-based smart vision sensor usesFPGAs for parallel image processing tasks

Below: National Instruments's PCI Express frame grabber, PCIe-1429, uses the Camera Link standard. The board itself can acquire data at up to 800MB/s

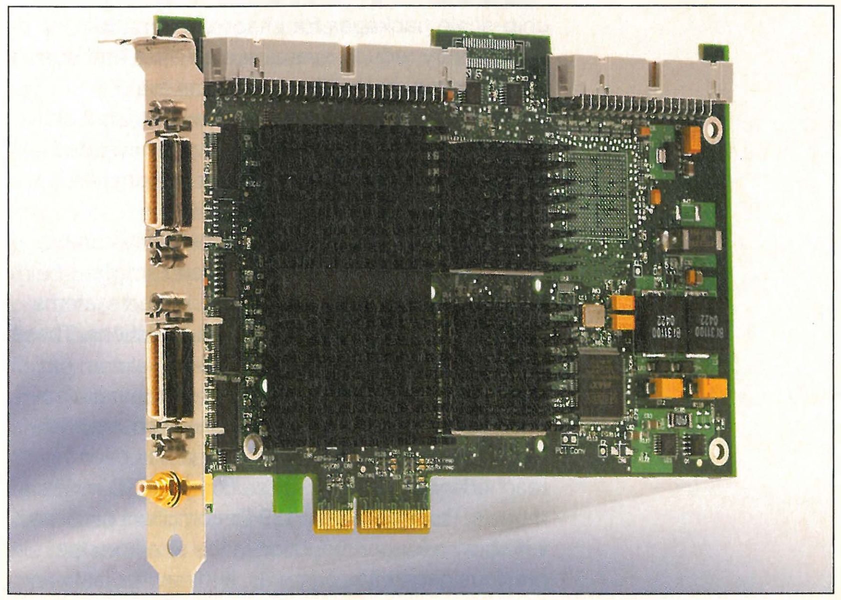
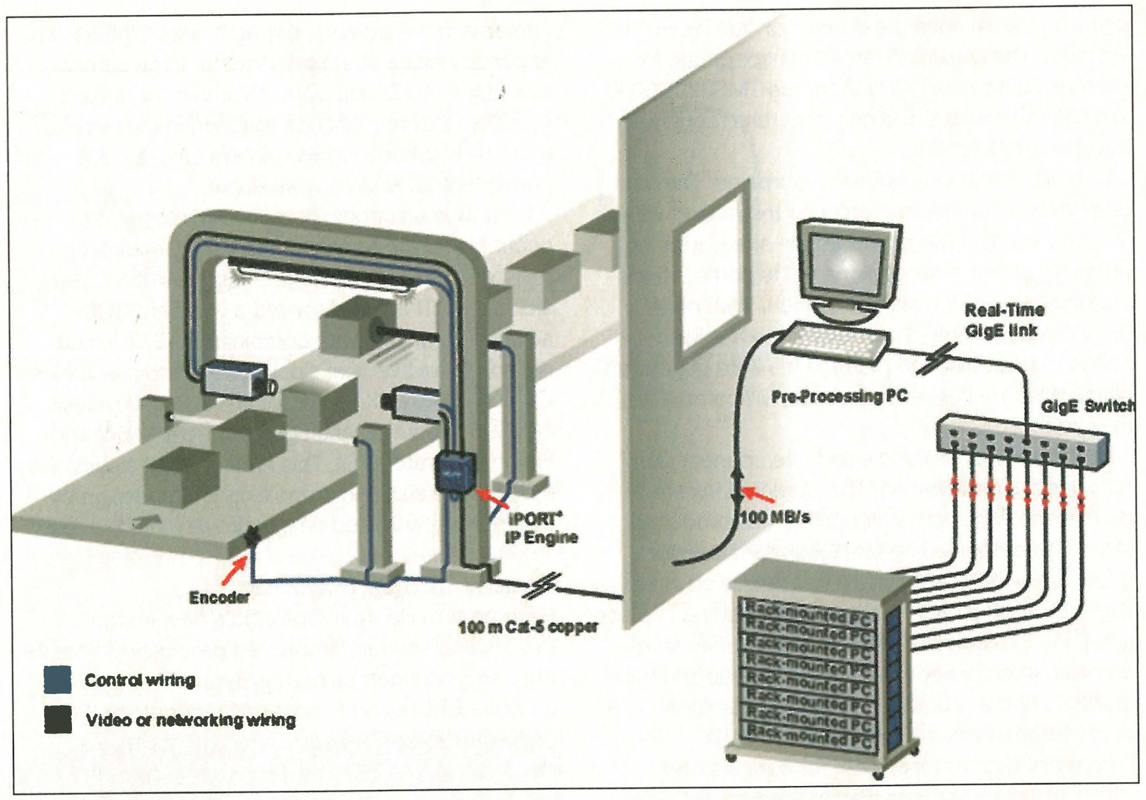


Diagram of Pleora's iPORT IP device driver operation



using MicroBlaze, an embedded 32-bit RISC soft core from Xilinx that is Virtex compatible.

A new generation of smart vision sensors now becomes "plug and play", where the user does not have to define specific properties of the objects for inspection – such as smaller image details or fixed grayscale thresholds.

Camera design

Kodak's Terry Guy says that there are several notable areas in MV camera development. "Emerging new sensor package options, notably chip-scale packages for image sensors, will significantly reduce overall system size and cost. Image sensor subsystem elements are increasingly being integrated into multifunction ICs; high performance, economical embedded computing options can provide additional functionality without increasing size.

Japanese giant Sony reports that its MV camera customers are requesting smaller and smaller cameras for integration into space-limited systems such as automation and medical applications. These demands are linked with lighter cameras.

Mathieu Forget, Sony's product marketing manager, Europe, says: "With analogue cameras, we can consider that a kind of size limit has been reached with our current ultra compact XC series models. Our new digital 1394b-compliant platform will show a further reduction in the size from the previous generation cameras; it measures just 44x29x57mm. And our new digital Camera Link-compatible cameras are the smallest in the market." At Vision 2004, Sony showed a prototype of smart camera that will bring an elegant, compact, all-in-one solution to the company's portfolio.

Canadian company Pleora Technologies is integrating its iPORT IP engines that take imaging data in any format and convert it to IP packets for real-time delivery to PCs over standard GigE networks. The PT2000-CLM IP 'engine' is designed for high-bandwidth vision applications that send imaging data to PCs for immediate processing, such as high-speed inspection systems used by manufacturers of flat panel displays and semiconductor wafers. The 'engine' streams Camera Link data at 200MB/s over standard GigE connections.

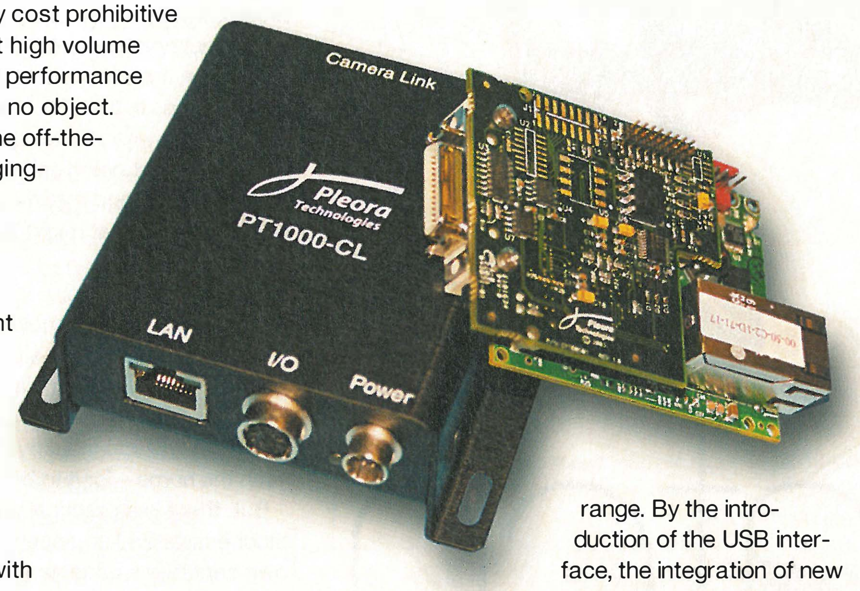
Marketing manager Wendy Doyle says: "Many camera manufacturers are integrating our IP engines directly into their cameras to create GigE cameras. Others are using the boxed versions of our IP engines beside their cameras. In either case, speciality connectors, such as Camera Link and LVDS, are no longer required. This approach reduces the cost and complexity of vision systems."

"At Pleora, we think Camera Link, LVDS, USB 2.0 and 1394b will ultimately be replaced by either GigE or its next generation successor, 10GigE. The Automated Imaging Association's GigE Vision Standard committee will soon release the first version of its standard, which will feed the already considerable market momentum for GigE connectivity in vision systems."

The protocols Camera Link, USB 2.0, FireWire and Gigabit Ethernet are bringing to a close the age of large connectors and bulky cable assemblies for vision systems. All of these interfaces share a common trait: the parallel data from an image system is serialised and sent at a high bit-rate over a modest number of wire pairs. The availability of highly integrated and high volume ICs to accomplish this serialisation/deserialisation process has made possible this change, and interfaces like these are likely to continue increasing in performance and decreasing in size and cost.

ASIC vision

The increasing costs of ASIC design make such devices practically cost prohibitive in MV systems in all but high volume products or the highest performance products, where cost is no object. For modest volumes, the off-the-shelf availability of imaging-oriented digital signal processors (DSPs) can provide a high level of functionality at a reasonable development cost and power. The cost of FPGAs is coming down at the same time that their capabilities are growing. Therefore, implementing imaging functions in an FPGA, with or without a DSP, can be a good option as well.



Pleora's iPORT IP The driver streams image data into the PC using only a small fraction of the CPU. The 99% of its capability is available to support vision processing.

National Instruments (NI) says that dedicated ASIC design for MV applications has become less and less common as FPGAs gain in popularity. The company points to a 2003 survey by UK firm Celoxica, the *"Survey of System Design Trends"*, which says that system designers use FPGAs three times more often than ASICs. "With the release of NI's LabVIEW FPGA, our in-house designers and customers can reconfigure and customise FPGAs to fit their application," says vision product manager Kyle Voosen.

Four years ago, NI worked with camera manufacturers and other image-acquisition hardware providers to develop Camera Link. Even though Camera Link specifies transfer rates up to 680MB/s, most Camera Link image acquisition boards were based on the PCI bus, which provides about 100MB/s of bandwidth. Camera Link's full potential has finally been realised with the introduction of PCI Express.

Although PCI has enjoyed great success, it now faces a series of challenges, including bandwidth limitations, host pin-count limitations, lack of real-time data transfer services such as isochronous data transfers (where data is delivered within certain time constraints), and the lack of features required for next-generation I/O requirements, such as quality of service, power management and I/O virtualisation. As PCI clock frequencies have become inadequate in certain applications, the PCI derivates such as PCI-X and Advanced Graphics Port (AGP) have sought to provide bandwidth relief by increasing bus frequencies.

Another proliferating connection protocol is high-speed USB (or USB 2.0), which has recently been added to the portfolio of Matrix Vision's camera range. By the introduction of the USB interface, the integration of new components in existing systems has been revolutionised, the company claims. USB 2.0 achieves data transfer rates of up to 480Mbit/s, at least as fast as the Firewire/IEEE1394 interface, which is typically around 400Mbit/s.

At the recent Vision show in Stuttgart a lot more technologies suggested that we are far from exhausting the range of possible machine vision solutions. The exhibition stands were groaning with possibilities and the potential applications were mind-boggling: adaptable illumination to differentiate components of similar colouring (Vision Light Tech from the Netherlands), economical video cameras to fit into mobile phones (Philips from the Netherlands) and vision systems to recognise the driver of a car and adjust the seat accordingly (Anafocus from Spain) are just a few. But wherever the industry heads next it will be inextricably wedded to the developments in the supporting electronics, materials and software. Undoubtedly, the machine vision market is definitely one to keep an eye on

Match made in heaven

Christopher MacLeod discusses the new advances in biotechnology that could lead to innovative devices

We are living in the midst of a quiet revolution. It's a revolution that's every bit as important and profound as the one in microelectronics. However, because it hasn't started to affect our daily lives just yet, most of us are scarcely aware of it. It's a revolution in biotechnology.

In the last few years, scientists have discovered how to manipulate and fingerprint DNA – the very core of life itself. It can now be changed and reintroduced into other organisms, effectively creating new species of plants and animals. We have even mapped the human genome and cloned animals from adult cells – until recently the subject of science fiction. Development is proceeding at a breathtaking pace.

This technology more than any other will change our lives in the 21st century, mimicking the growth of electronics in the 20th. However, that change will only happen when biotechnology unites with our other great technological achievements – computing and nano- and micro-electronics. This article is about one way that might happen.

Wetware

At the moment biotechnology is still 'wet', done in laboratory test tubes by skilled technicians. The next stage of its development is to integrate it with the power of electronics and computing and move it out of the lab and into industry, the doctor's surgery and even the home – for it to become bioelectronics.

But, there is a practical problem. Up until now, biochemists and engineers have been living in their own separate worlds and their paths have seldom crossed. This means that there is a lack of communication and understanding between them. They, effectively, speak different technical languages and use different concepts, and very few people are trained in both disciplines. To understand how integration can take place we first have to understand the technology and what it can do.

The chemistry link

Our bodies, like those of all other organisms, are made from cells. Each cell is a living chemical factory. It takes raw materials from the outside world (air, light and water in the case of plants, and various foods in the case of animals) and manufactures complex products from them such as skin and hair, for example.

Each cell works in the same way. It has a built-in code – the DNA, which is continually being read by another chemical, called RNA. RNA, in turn, goes to make the chemical workhorses of the cell – the proteins. **Figure 1** illustrates the process.

It is the proteins that are the most important part

of the system. They do all the work in the cell: making new material, breaking up old and sensing and signalling changes in the cell's environment.

All proteins bind to other chemicals. Some synthesise new molecules by joining their component parts together or by breaking them up. Such proteins are called enzymes. They manipulate chemicals at the atomic level (**Figure 2**). The atoms that make up the protein have a particular physical shape, which is so precise that only the correct target chemical can fit into it. Often the shape is a type of "grove" in the atomic structure of the protein. Enzymes that synthesise new chemicals work by letting two simpler molecules attach to the protein in such close proximity that they bond together to form a polymer. This process allows the synthesis of highly complex and useful chemicals, which could not be made any other way because of the high energy and difficulty involved in forming the bonds.

Those which break down chemicals do the opposite, allowing a molecule to bond and then breaking it apart is shown in **Figure 3**.

Both this and synthesis are often helped by the thermodynamic movement of the protein or by a third chemical attaching elsewhere on the protein, which changes its shape, so ripping apart the bound molecule. Commonly, this third chemical is a substance that contains a "high energy" bond – one that has the capacity to release a large amount of energy when broken. The most common substance with this ability is called ATP (Adenosine Triphosphate). **Figure 4** illustrates the idea.

Making electronic proteins

Since proteins are the key to biological systems, all sorts of possibilities open up if we can work out how to make controllable, artificial, ones. The logical way to try and do this electronically is on a silicon wafer. In theory, we could make binding sites on a chip as shown in **Figure 5**. The trouble is that the atoms that make up the binding groves of real proteins are far too close together to be fabricated using standard photolithography. Atom diameters are measured in angstroms (10^{-10}m), whereas we can only routinely fabricate features of tens or hundreds of nanometers (10^{-9}m).

However, there is hope and it's coming through research in the new science of nanotechnology. Already scientists have used Atomic Force Microscopes to manipulate and re-order the individual atoms of a silicon wafer – even 'writing' words with single gold atoms. Such technology is presently highly experimental and expensive. Only time will tell whether it becomes commonplace or not (or indeed, if it does, whether it's accurate enough to create active artificial proteins).

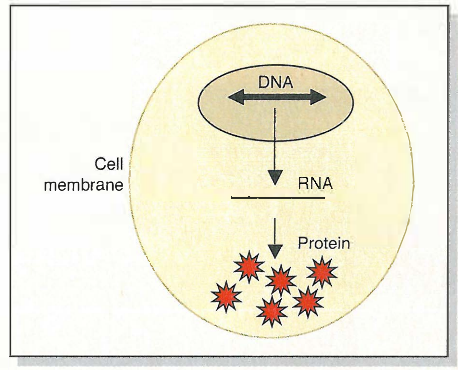


Figure 1 (Inset): How the DNA code of the cell makes proteins

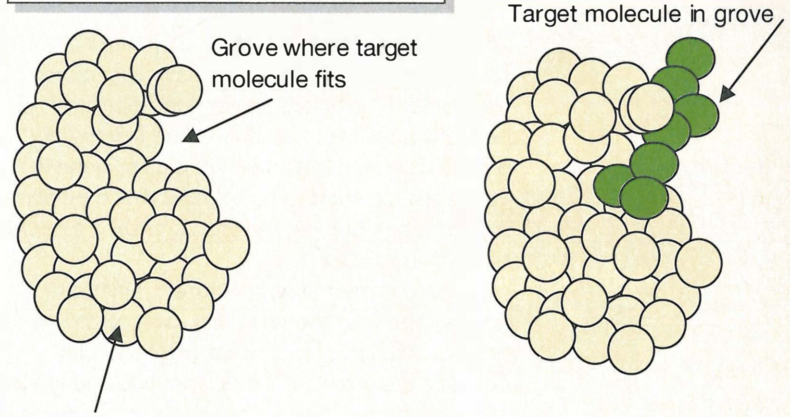


Figure 2: Proteins bind to other chemicals because they have the correct shape

Figure 3: Protein bonds rip target molecule apart

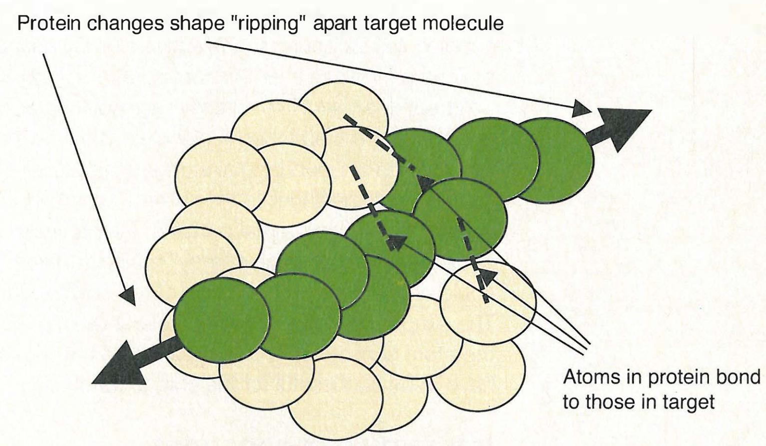


Figure 4: Attachment of another molecule changes the protein's shape

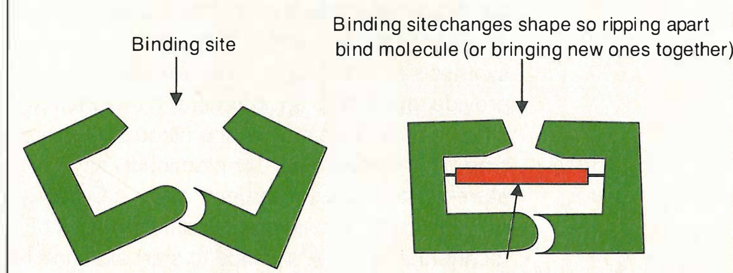


Figure 5: An electronic protein

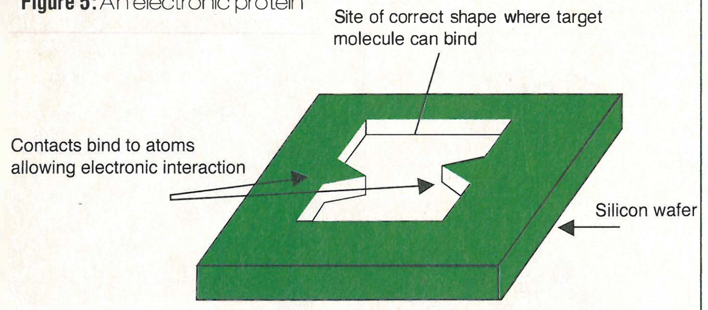
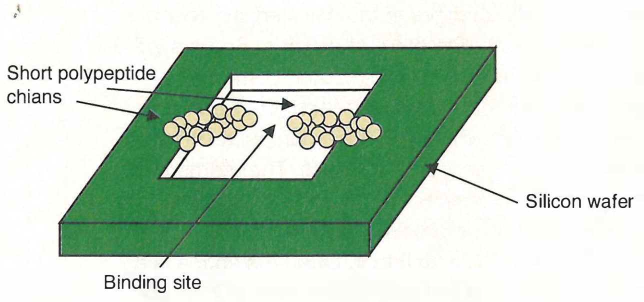


Figure 6: A hybrid electronic protein



Fortunately, there is another alternative. We can combine existing protein chemistry with current electronics to produce a hybrid technology. It is perfectly possible to produce short lengths of protein molecule (called polypeptides) in the lab. These are too short to be used for much practical biochemistry, but exactly what is needed to produce bioelectronic chips.

The idea is illustrated in **Figure 6**. Here, the polypeptides are shown in-situ, on a chip. They can be bound to the chip by electrostatic forces between the atoms of the polypeptide and the pads of the chip (not shown). The geometry of the pad ensures that the positioning is correct and that different polypeptides can be assembled (by adding them at different times) and simultaneously placing the appropriate charges on the correct pads.

By monitoring the charge on the pads, we can see if a molecule has bound to the active site. By changing the charge we can alter the configuration of the polypeptides to act like an enzyme – splitting or synthesising the attached molecules. This may need the addition of bound metal atoms, to act as electron-carrying intermediaries in the system, a trick which nature herself uses in real proteins. Alternatively, the binding of another "high energy" molecule like ATP could change the configuration of the polypeptides. The simple formation of many thousands of pads and therefore sensors on a chip means that not all of them have to be successful for the chip to function.

Interesting applications

There are many obstacles to overcome before we can finally fabricate such systems successfully. Apart from the fabrication of the silicon and the synthesis of the polypeptides, we also have to provide an on-chip environment to ensure that the organic molecules stay in one piece once assembled. This means a pH-, contaminant- and temperature-controlled environment, which can prove a real challenge. However, the various pieces of technology are now in place to start experimenting with such systems.

And the applications are endless. Perhaps one of the most obvious is in sensing. If we can synthesise binding sites for different chemicals, we can detect their presence by measuring changes at the anchoring pads. In theory, this would allow us to sense the presence of substances at molecular level. Obviously, such sensors could have many applications in environmental monitoring and medicine, particularly in the interface between man and machine.

A step beyond this is changing the configuration of the polypeptides by changing the electrical conditions at the pads or by bonding another chemical to the system. An application is the breakdown of unwanted substances into shorter chains. In this case, the substance binds to the assembly and a change in configuration brought about by changing the charge on the pads or binding rips it apart as explained before. The elimination of pollutants and production of hydrogen and oxygen from water are two examples.

Synthesis is the opposite of this and is probably more difficult to achieve. However, it's also the application with probably the most potential. It could allow us to make artificial versions of natural materials that are currently beyond our capabilities like skin or spider's silk (which is incredibly strong).

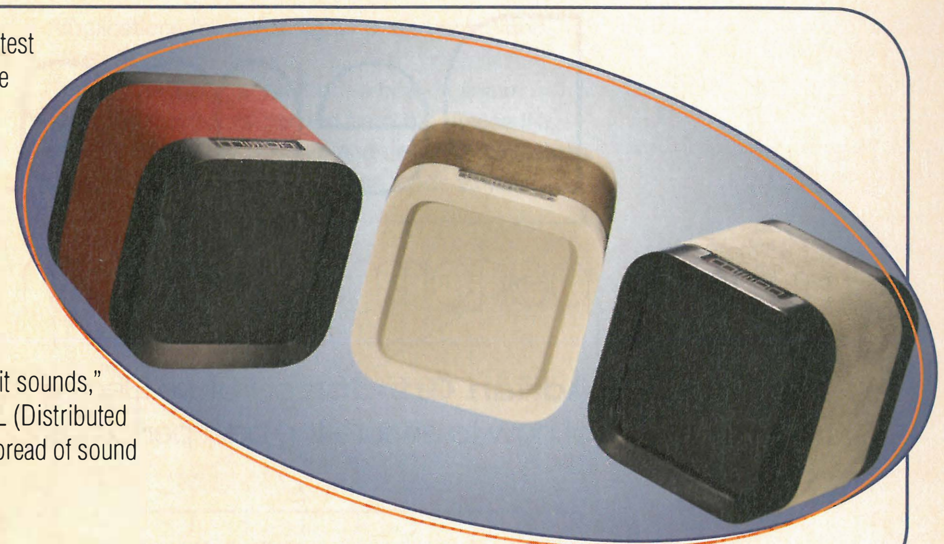
In the longer term, perhaps the power of ATP or similar "high energy" molecules could be harnessed to produce power for small machines in an analogous way to its use in living organisms, for example by "burning" carbohydrates. One can even envisage a time when we abandon the clumsy internal combustion engine for more biological forms of power (engines might end up looking more like bagpipes). After all, if a horse can get through the day on a few mouthfuls of oats and a human on a plateful of sandwiches, why can't we devise engines similarly capable? In the very long term even systems like fusion power might yield to a similar approach.

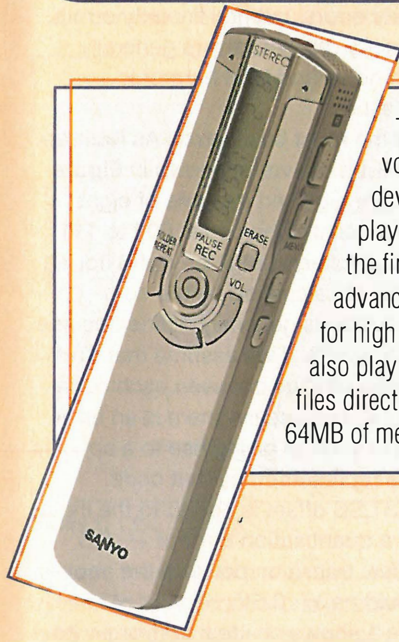
The final application worth mentioning is the manipulation of DNA itself (as well as the other chemicals of life). This could allow us to sequence and analyse DNA on chip and, perhaps, in the long term, even synthesise custom drugs in the surgery.

In the mood for music? You will be with Mission's latest "mood-adapting" home theatre system, M-Cube. The 5.1 system consists of five individual cubed 'satellites' and a sub-woofer (with 250W amp and twin 8" drive units) that can be either mounted on the wall or standalone. The system comes with different colour fabric strips that wrap around the speakers to complement modern interior colour schemes and "match your mood", says Mission. "Never before have we dedicated as much time and development to how a product looks as well as how it sounds," said Jean-Marc Galiana, Mission's CEO. It uses DML (Distributed Mode Loudspeaker) engineering to create an even spread of sound throughout the entire room.

From £1199, available from selected dealers

www.mission-cube.com





The latest in the Sanyo range of voice recorders is the ICR B170 device that doubles up as an MP3 player and data storage system. It is the first digital product to use an advanced built-in stereo microphone for high quality MP3 recordings. It can also play back WMA music. It stores data files directly from the PC, since it offers 64MB of memory.

The ICR B170 can record over 8.5 hours mono and over four hours of stereo sound. By connecting it to the PC, files like Word, PowerPoint and Excel, and emails can be stored and carried around with it. The device allows discreet recording and listening of confidential information.

An LCD display allows easy navigation and quick storage retrieval.

From under £80 from selected dealers

www.sanyo.com

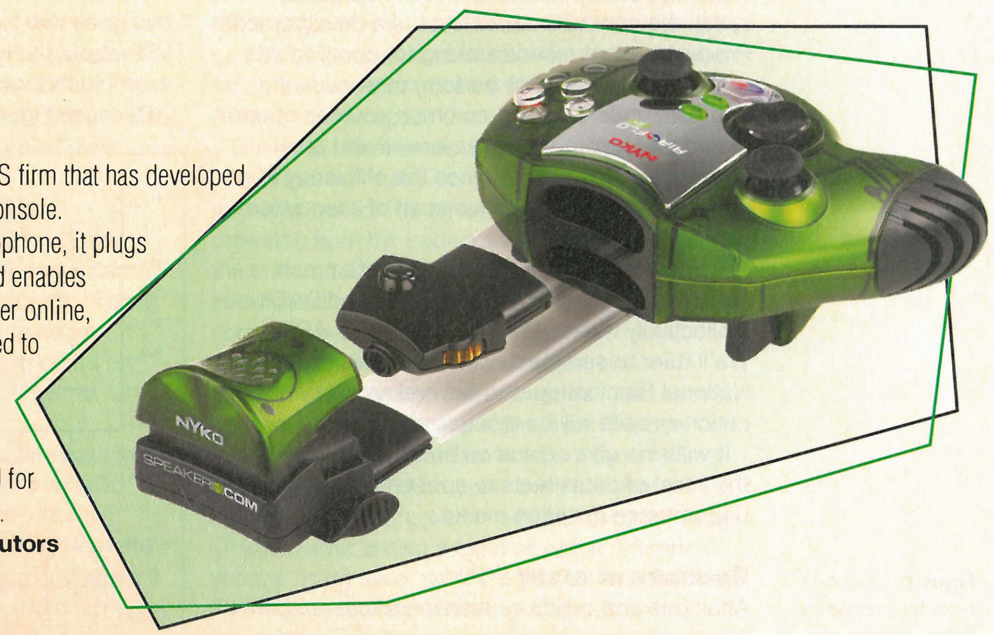
No need to shout, says Nyko, the US firm that has developed SpeakerCom for the Xbox games console.

It has an in-built speaker and microphone, it plugs straight into the Xbox controller and enables groups of people to talk to each other online, unlike the headsets which are limited to one-to-one conversations.

The SpeakerCom is wireless and comes with volume control. As the controller powers it, there's no need for batteries or separate power sources.

From £19.99 from Nyko distributors

www.nyko.com



Demanding

performance from data conversion

Adrian Grindon of Future Electronics Europe gives a detailed overview of how to ensure the best performance from an ADC or DAC

In automotive electronics, particularly in an automatic breaking system (ABS) or electronic stability programmes (ESP), the quality of analogue and digital data conversion could literally mean the difference between life and death. Any delay-induced sluggishness or inaccuracy will reduce the ability of the electronics to safeguard the vehicle's occupants under emergency conditions. Although this is an extreme example, it does illustrate how data conversion quality can impact the end-performance of a digital, microprocessor-based application that is used to interface or control analogue electronics.

Conversion quality is ultimately dictated by the quality of the analogue to digital converters (ADC) and digital to analogue converters (DACs) used, and the supporting components and technical design employed in the signal chain.

Cost is also an issue as maximising quality within the commercial confines of a development. Product budget means looking for components that offer the best cost-performance value. In addition, understanding common sources of error in terms of layout and noise issues and other technical pitfalls will influence the efficiency of a design and the quality (thus cost) of associated components required.

This article will examine the most common sources of error found within ADCs and DACs (collectively referred to from now on as ADCs). We'll refer to sample devices from Microchip and National Semiconductor. Several sample application circuits will be discussed in detail.

It will also give advice on how to 'read between the lines' of datasheets to spot any obvious performance question marks.

Sources of error

Analogue and digital conversion errors are best sub-categorised into direct current (DC) and alternating current (AC) related errors. DC errors fall into one of four categories: quantisation errors, differential linearity errors, integral linearity errors, and offset and gain errors. AC errors generally relate to signal to noise and total harmonic distortion (THD) issues.

Quantisation is the most basic error. As illustrated by the simple 3-bit converter shown in **Figure 1**, input voltages are digitised into one of eight discrete levels represented by codes 000 to 111. Each code spans a voltage range of Vref/8 (for an n-bit converter this is calculated by the sum Vref/2n). The code size is generally defined as one least significant bit (LSB). If we assume that Vref = 8V, then the voltage change between each code would represent 1V. This means there is an error between the actual voltage giving rise to a specific code and voltage represented by that code. Usually, small 0.5 LSB offset is added to the input, this gives rise to a quantisation error of +/- 0.5 LSB about the ideal transition point. In the above example this would be +/- 0.5V.

Because Figure 1 shows an ideal converter, its

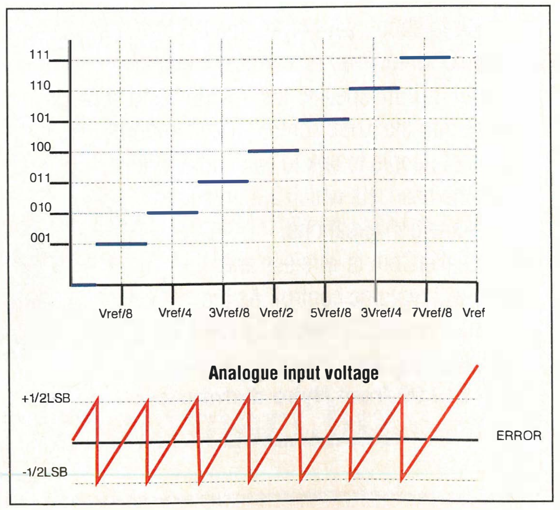


Figure 1: Ideal A/D transfer characteristic

code-to-code transition points are 1 LSB apart. In practical ADCs, however, this is not the case. This gives rise to differential non-linearity (DNL) errors. As illustrated in **Figure 2**, the transition between codes 010 and 011 has a DNL of 0 since it is exactly 1 LSB. The transition 000 001, however, has a DNL of + 0.2 LSB since it has a code width of 1.2 LSB. If the DNL error is specified as greater than +/- 1 LSB then it is possible that the converter may have missing codes. The code 100 never appears at the output because the converter has a DNL of 2.2 for the code value 101. It should be noted that if the DNL figure is not stated explicitly in the datasheet then it might be interpreted as the converter having 'no missing codes', implying that the converter has a DNL of better than +/- 1 LSB. For example, the Microchip MCP320X 12-bit converter range headlines the +/-1 LSB DNL in the datasheet.

If a converter is used in a closed loop control

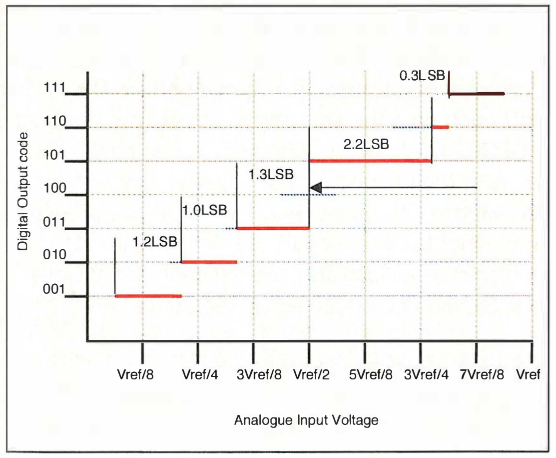


Figure 2: DNL characteristic

system, the effect of a poor DNL may be to cause the system to 'hunt' (continuously oscillate about a setpoint and not settle into a steady condition). It also tends to degrade the signal-to-noise ratio (SNR).

Mathematical integral of DNL

However, it is not always necessary to choose an ADC with a +/- 1 LSB DNL. A 16-bit converter with a +/- 4 LSB DNL (i.e. 14 bits with no missing codes), for instance, would be adequate for a design requiring 13-bit resolution and could be cheaper than a 16-bit converter that has no missing codes.

Integral non-linearity (INL) is the mathematical integral of the DNL errors. This means an ADC with good INL guarantees good DNL. The INL describes the deviation of the converter from the ideal linear transfer function as shown in **Figure 3**. Manufacturers generally have two different methods of measuring INL, which can have important implications for the designer's 'end point' and 'best fit'.

With the 'best fit' method, a best-fit linear transfer function is derived from the device INL that balances the positive and negative deviations from the transfer function. This tends to yield

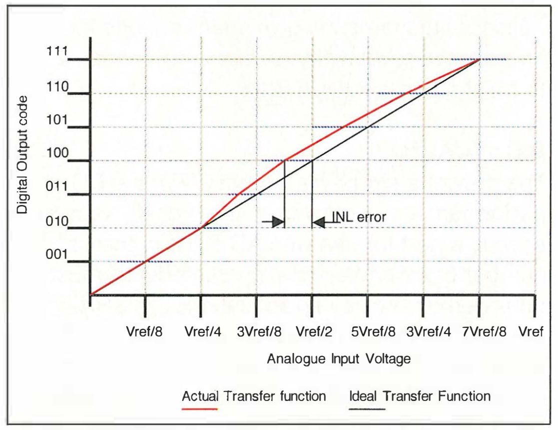


Figure 3: INL characteristic

better INL figures than those given by the 'end point' method. In order to realise these figures in practice, however, the user must adjust each converter board for gain and offset not practical or desirable for most designers.

For the end-point method, a linear transfer function is defined that connects the first and last code transitions. The INL is then specified as a deviation from this line. This gives a more conservative result but is more useful to the designer as it gives the worst case INL that can be expected by simply making adjustments to the two end-points. Companies such as National Semiconductor use the 'end point' method. Since neither INL nor DNL can be calibrated or corrected for, they are important parameters to observe when choosing an ADC to meet a specific error budget.

Gain and offset errors also occur within ADC converters but these can be calibrated out using a microcontroller. The offset voltage error is the deviation from the code transition points across all the output codes, usually measured at the first code transition point. It is worth noting that if the converter is to be used in a unipolar scheme, although this error can be calibrated out, it will result in some loss of dynamic range. Gain error defines the deviation of the part from the ideal analogue to digital transfer function. Determining the last code transition point and subtracting from it the value of the offset error can calculate its value. The gain error is also a function of the reference voltage being used, so it is important to note from the datasheet whether an internal or external reference is used to determine the gain error.

Another figure sometimes stated is the total unadjusted error or absolute error. This is a specification of all sources of error, including linearity, gain and offset errors. It gives the designer a straightforward way of determining if a part will meet a specific error budget without need for further calibration.

Most datasheets will give specifications for the errors listed to allow the designer to choose a part to meet a given error budget.

AC signals

The previous errors are a measure of the DC performance of a converter. If the designer is to specify a part for use with AC signals, then a number of other electrical characteristics must be considered. The key specifications are SNR, signal-to-noise and distortion ratio (SINAD), THD, spurious-free dynamic range (SFDR) and effective number of bits (ENOB). The latter is a specification that helps to quantify the dynamic performance.

SNR is the ratio of the output signal amplitude to output noise, not including harmonics and DC. There are three components to this quantisation: noise, noise generated within the converter itself and application noise. Quantisation noise is a function of the converter resolution. The noise within the converter is primarily a function of how well the input comparators function. Since this accuracy degrades at higher slew rates, it is worth noting the frequency at which the SNR is defined. The theoretical maximum SNR is:

$$\text{SNR max (dB)} = 6.02n + 1.76,$$

where n = converter resolution (bits)

THD is an indication of the linearity of the converter in terms of its effect on the harmonic content of a signal. It is the RMS value of the root-sum-square of the harmonics and noise relative to the root-mean-square (RMS) value of a sinusoidal input.

A more useful value to look for in the datasheets is SINAD as this is a measure of noise harmonics and distortion introduced by the ADC. In a perfect converter SINAD and SNR will be the same. It is possible to gain a more meaningful idea of the quality of a converter by converting the SINAD figure to effective number of bits (ENOB), although many manufacturers specify ENOB in the datasheets. The relationship is:

$$\text{ENOB} = (\text{SINAD} - 1.76)/6.02$$

ENOB, as the name suggests, represents the number of bits resolution a perfect converter would have to give the same SINAD. Again, it should be noted that the sampling frequency and test conditions must be specified. ENOB will degrade as frequency approaches the Nyquist rate. A method of improving SNR is to oversample the signal of interest. The noise floor is reduced by 3dB each time the sampling frequency is doubled.

SFDR is defined as difference between the RMS value of the desired output signal to the highest amplitude output frequency, which is not present at the input defined in dB. It is important to the designer as it illustrates the minimum signal level that can be distinguished by the converter.

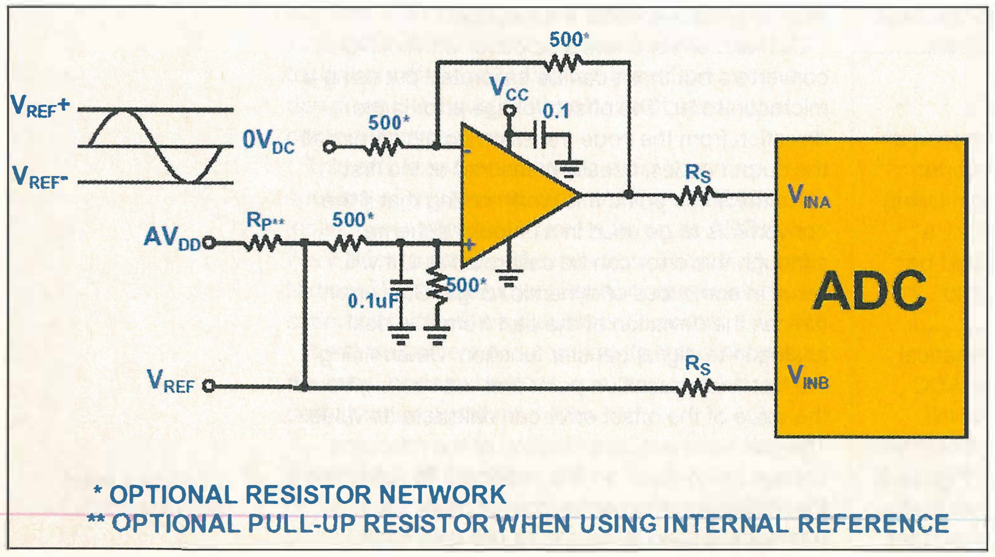
Circuit design issues

Having understood how ADC datasheets define the errors within the semiconductor, it is now important to understand how poor circuit design can cripple converter performance. There is usually the requirement for some signal conditioning between the signal source and the ADC. Any resistors used will introduce noise. In order to minimise this, the values chosen should be as low as practical.

Figure 4 shows a straightforward buffer circuit. The use of resistor packs should also be avoided, as the capacitance between devices is quite high and this can result in high frequency coupling into the signal path. The capacitance between the output side of the feedback resistor and resistors connected to the positive terminal of the op-amp can cause oscillation. This may manifest itself as a DC offset.

The selection of the op-amp is also important. The specifications of the amplifier that will influence the system performance will be offset error voltage and the output noise figure. There are other subtle problems that can occur with signal conditioning buffers.

Figure 4: Simple input buffer



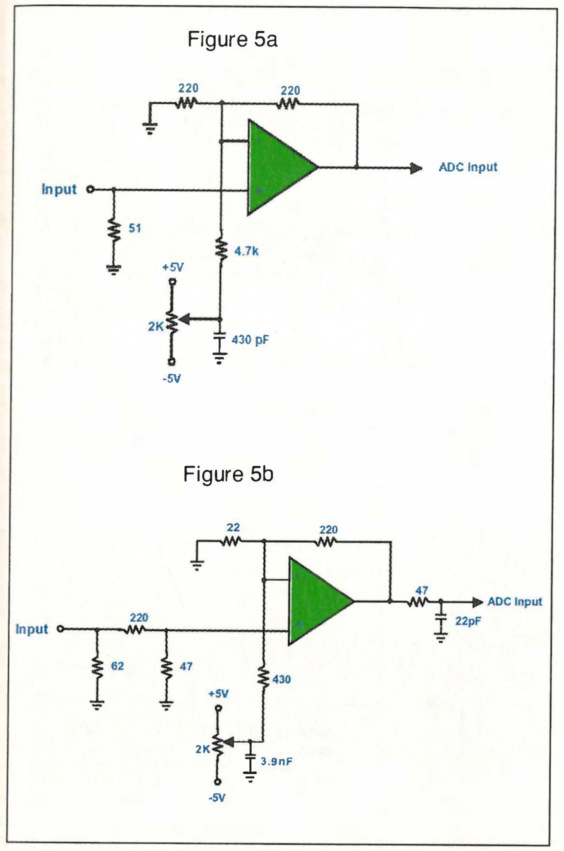


Figure 5a shows a buffer with a gain of 2. There are two potential problems here. First, the input of most sampling ADCs is a switched capacitor load. This type of circuit can output energy from the input pin so it is possible that this will cause the amplifier output to ring or oscillate. A wise precaution is to decouple the output with an RC network as shown in **Figure 5b**.

Second, operating the amplifier with a low gain can make it more susceptible to oscillation. This problem can be highlighted by attenuating the input signal and increasing the gain of the amplifier.

Inadequate power supply decoupling can also result in poor data-conversion performance. When the ADC outputs change state, the output drivers can draw high dynamic currents because they are suddenly driving capacitive loads. This can cause noise in two ways. Firstly, any currents that are sunk by the outputs pass through the substrate of the device (chip ground) and can cause a common mode as this voltage is effectively subtracted from the input when the conversion is made. Minimising the distance between ADC and microprocessor and using a series resistor can limit this effect.

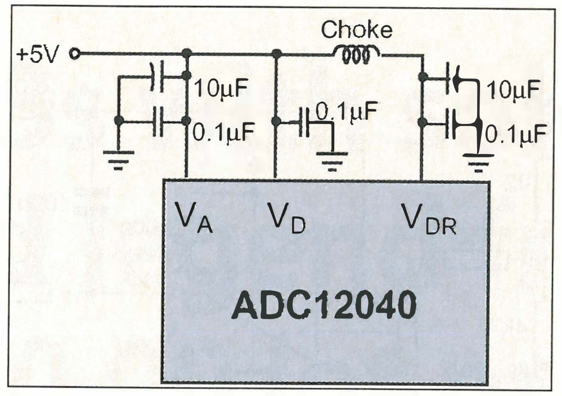


Figure 6: Typical decoupling scheme for an ADC

Secondly, if the outputs source current then these high currents can cause noise on the power supply pin. If the analogue and digital power supply pins are not adequately decoupled then this noise will couple into the analogue circuitry.

A good decoupling scheme

Figure 6 shows a good decoupling scheme for a National ADC12040. Choosing an ADC and buffer with a good PSRR (Power Supply Rejection Ratio) will also reduce this effect (but note that the PSRR degrades with increasing frequency).

The use of ground planes can also be beneficial in reducing noise, although care should be taken to ensure that breaks in the ground plane are parallel to the signal path.

The clock used to drive the converter can also cause problems to the unwary. The first way in which it can reduce performance is by coupling into the signal path, so take care to route it away from analogue signals. A more pronounced effect could occur if the clock has excessive jitter (i.e. it exhibits a cycle-to-cycle variation in duty cycle). This jitter can be caused by the poor layout, incorrect termination of the clock line and poor clock circuitry. It is wise to treat the clock line as a

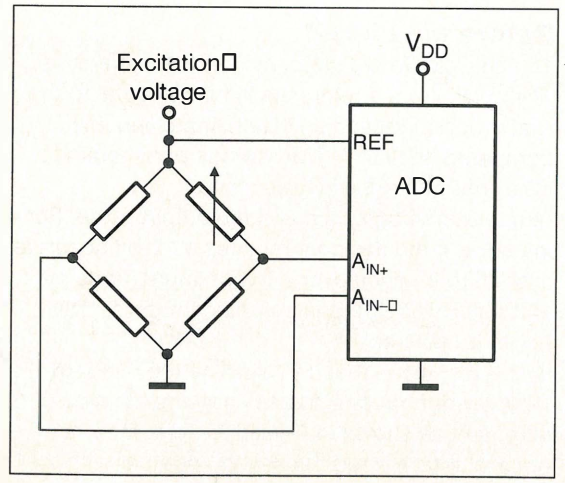


Figure 7: Using a ratiometric technique to null out reference drift

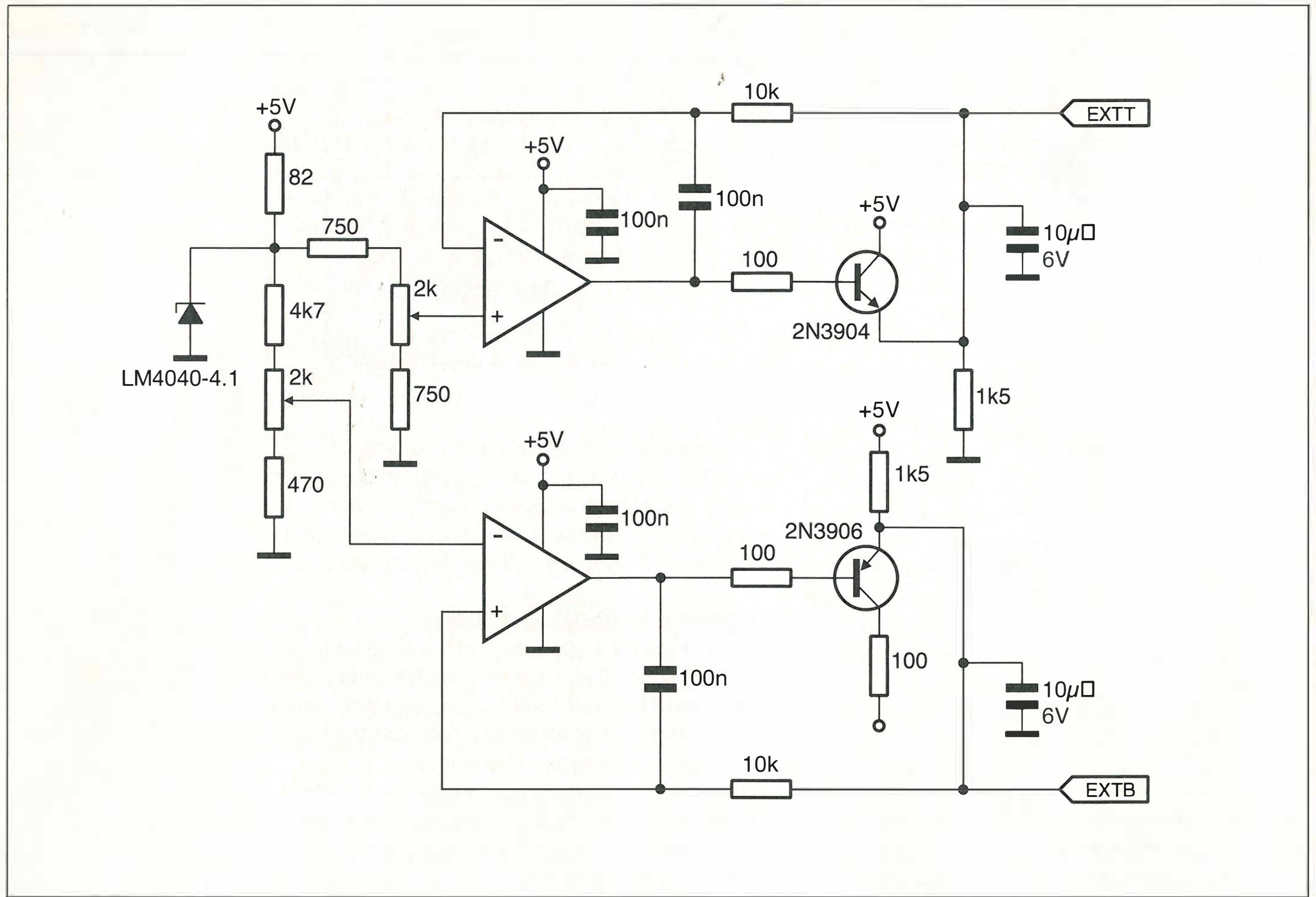


Figure 8: Typical example of a reference circuit

transmission line and correctly terminate it. It is vital to do this if the delay caused by the length of track is greater than 6x the clock rise-time. The delay for FR4 board is typically 6ps per millimeter. This would mean, for example, that with a 2ns rise time, a clock line longer than 55mm must be considered a transmission line and be correctly terminated.

Reference circuit

The final circuit area to consider is the reference. The quality of the reference is fundamental to the system performance as the analogue input is compared against it. The obvious parameters to take note of are the initial accuracy, the temperature coefficient and the output noise. For instance, if the designer requires a 12-bit accurate system to function over a temperature range of –40°C7 to +85°C then a reference of better than 4ppm is required.

One technique that can alleviate the need for very low drift parts is to use a ratiometric measurement as shown in **Figure 7**. Here, the reference is used to feed the sensor together with the ADC, which effectively cancels out any drift in the reference voltage as it affects both ADC and the analogue input.

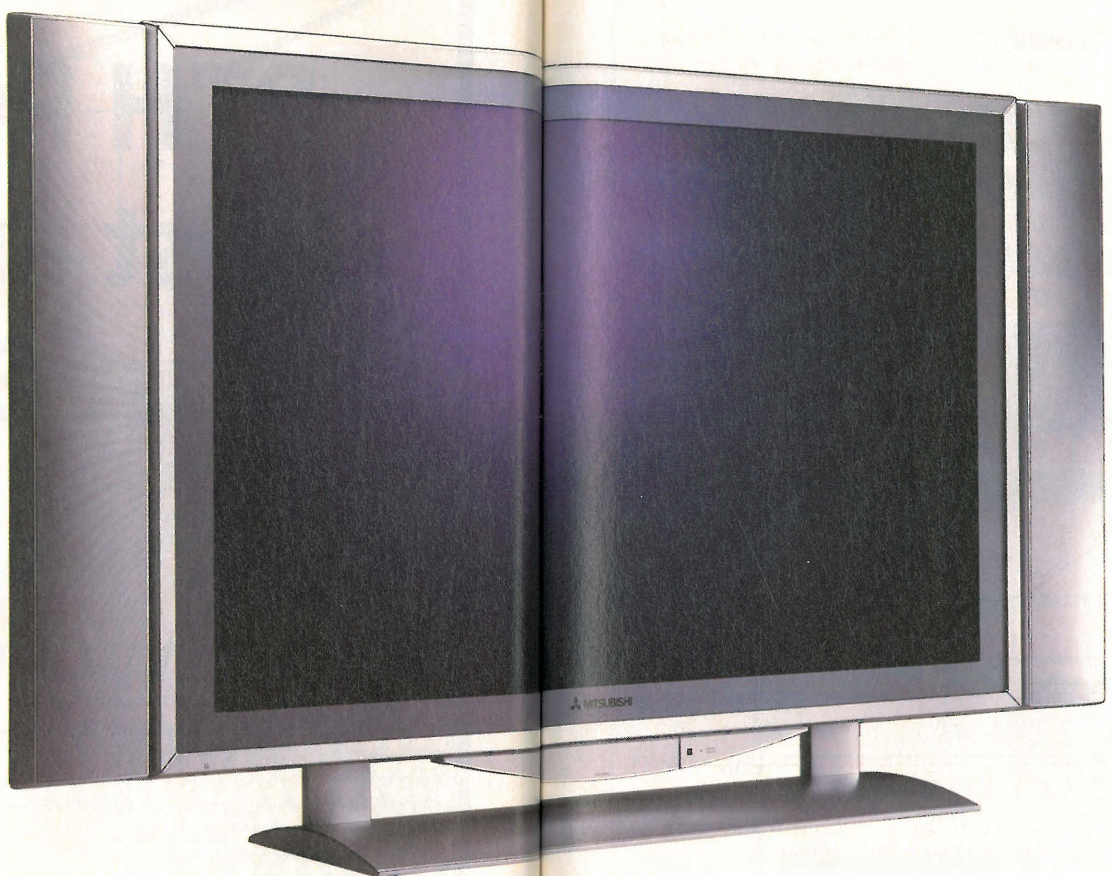
Figure 8 shows a typical reference circuit that may be used to speed up low power ADCs such as the National ADC1175. The reference output is buffered to provide the low impedance drive required by the inputs of the ADC. The value of pull-up resistor is chosen to be low enough to ensure that the reference diode will have low drift over its temperature range.

Beware the pitfalls

Clearly, there are many potential sources of error when designing with ADCs and each can take its toll on the overall performance and cost of an application. Being aware of the common trouble hot-spots, however, means that they can be more easily identified and avoided.

This is crucially important because the impact of data conversion performance on most end-applications and products will have a direct influence on the likelihood of their commercial success.

FPGAs



FPGA solution in digital displays

Bart Borosky of Lattice Semiconduc gives ideas of how to best select an FPGA with DSP functions for digital display de

The majority of variable costs in a digital display today is the panel itself. For this reason, supply chain management is an important factor in digital display design. Also, there's a growing interest in the ability to support evolving image processing algorithms and standards to address the needs of different geographies, over time. The goal of supply chain management is to ensure all components in the OEM end-product are procured at the lowest cost and are available to meet demand, while minimising inventory.

The earliest supply chain management decisions are made during system definition. At this point in the design cycle, a decision to proceed with a platform-based display design can reduce procurement costs significantly (**Table 1**). By supporting multiple panel sizes, OEMs can achieve higher volume discounts from one supplier. By supporting multiple panel vendor specifications, OEMs can create a competitive sourcing situation, which typically leads to lower prices. These two savings more than offset the increase in price due to the additional components required, such as an FPGA, to enable platform-based display design. In addition, multiple vendor support reduces risks to continuity of supply.

To maximise the savings and flexibility provided by a platform-based approach, system designers must select components for the system electronics, based upon the following criteria:

- Graphics processor requirements vary widely by geography-programmable support for multiple standards and formats throughout the world.
- Overall system I/O interface and control logic integration for support of bridging functions from existing designs/ASSP chipsets such as 802.11a or HiperLAN2 and customised user interface logic.
- Field re-programmability support for changing standards and incremental upgrades in image processing algorithms.

Evaluating the components

A key factor in system design is the balance of tradeoffs among CPU/software, ASICs, ASSPs and FPGA solutions, and determining which functions are best served by programmable solutions in a platform-based display design. In general, three circuitry requirements need to be evaluated in the selection of programmable components:

- RSDS (Reduced Swing Differential Signalling) and LVDS (Low Voltage Differential Signalling) support for the panel interface.
- DDR (Double Data Rate) SDRAM support for image processing memory.
- DSP functionality and performance for image processing functions.

Figure 1 illustrates an FPGA solution that meets these requirements. Inputs into the FPGA include a graphics processing chip and other ASSPs such as wireless Ethernet. Outputs include the panel driver circuitry and display timing generator. In addition, the FPGA block in the middle of the figure performs image-processing functions to support multiple panel vendors, sizes and geographical requirements.

For the input section, FPGAs help designers bridge ASSP functions to the graphics processor or system processor. Examples of bridges include wireless Ethernet (802.11a/g, HiperLAN2) and user interface control logic. Next generation displays and projectors may support wireless Ethernet via 802.11a or HiperLAN2, depending upon geography. In addition, customised user interface logic helps differentiate displays from competitors. Both functions are bridged / controlled with an FPGA solution.

For the image processing section, FPGAs provide scaling, aspect ratio conversion, colour space conversion, noise reduction and other DSP functions on the video frames to support multiple panel sizes and vendors. Some of these image-processing algorithms, such as sharpness enhancement, can be proprietary and lead to product differentiation, particularly with incremental improvements to the algorithms over time.

This re-programmable image processing is facilitated by FPGAs that have embedded DSP. Some FPGAs with embedded DSP in the range of below $10 support over 3,000 MMACs. This is less than 0.3 cents per MMAC – a cost-effective solution for image processing functions. Typically, FPGAs with embedded DSP functions include several blocks of multipliers, but some FPGAs also have embedded adders, subtractors and accumulators that can significantly increase image-processing performance. Although low-cost FPGAs typically operate at less than 300MHz-system clock frequency, the high DSP throughput (3,000 MMACs) can be achieved by performing multiple DSP functions in parallel in the multiple DSP blocks on the chip.

In addition, FPGAs can provide memory control and interface for the image processing frame buffer, which is often DDR SRAM. DDR memories capture data words both on the rising and falling edges of the system clock, effectively doubling the throughput over traditional SDR (Single Data Rate) memories at the same clock speed. DDR SDRAMs are often used for frame buffer memory, in which a large amount of cost-effective, faster speed memory is required to store entire frames for image processing.

Manipulating data

The DM data-masking capability of DDR SDRAM devices is used to simplify the manipulation of data for graphic display applications. Instead of performing READ-MODIFY-WRITE cycles to change part of a wide word, masked WRITE cycles are used in conjunction with the DM mask signals to enable and disable the writing of individual bytes within the wide word. Since the READ-MODIFY-WRITE cycle is replaced with a single WRITE cycle, the benefit to the system performance is obvious. Masked writes simplify changing selected bits in a block of data and increase the performance of tasks such as color management of the display.

At lower (100MHz and below) clock speeds, the DDR memory controller interface is straightforward and can be implemented in an FPGA using the general- purpose I/O and logic capabilities. At higher frequencies, however, FPGAs with dedicated circuits are required to ensure a robust DDR memory interface. These dedicated circuits include special routing and DLL-based phase shifting for the DQS strobe,

Table 1: Platform-based display design lowers supply chain costs

	30 inches	32 inches	37 inches	42 inches	46 inches	Total
Price Per Inch	$50	$55	$60	$65	$80	$57
Panel Price	$1,500	$1,760	$2,220	$2,730	$3,680	$1,932
%Discount[1]	2%	2%	2%	2%	2%	2%
Panel Savings	$30	$35	$44	$55	$74	$39
Extra Component Costs[2]	$10	$10	$10	$10	$10	$10
Total Savings Per Display	$20	$25	$34	$45	$64	$29
Annual Units Sold	100,000	50,000	50,000	25,000	10,000	235,000
Total Annual Savings	$2,000,000	$1,260,000	$1,720,000	$1,115,000	$636,000	$6,731,000
	30%	19%	26%	17%	9%	100%

Notes: [1] Due to competition and volume discounts during procurement [2]FPGA cost to support platform-based design

Table 2: RSDS and LVDS electrical characteristics

Characteristic	RSDS	LVDS
VOD, Output Voltage Swing	+/- 200 mV	+/- 350 mV
RTERM, Termination	100 Ω	100 Ω
IOD, Output Drive Current	2 mA	3.5 mA
Content	RGB Data	RGB Data & Control

DQ data-valid circuits to signal the start of memory READ bursts, preamble and postamble detectors to correctly handle the DQS strobe as it exits and re-enters tristate, and on-chip termination circuits to provide maximum signal integrity. Not all FPGA families contain these dedicated circuits and the cost and complexity of implementing high-speed DDR memory interfaces varies considerably, depending on the specific FPGA family.

During memory READ cycles, the DQ data and DQS strobe signals are driven edge-aligned by the memory device. To allow the FPGA to capture the data using the strobe, the strobe must be phase shifted by exactly 90 degrees relative to the data, then routed in such a way that it captures all data bits simultaneously. Since the DQS strobe is not a free-running signal, a master-slave DLL approach can be used in the FPGA in which the master DLL is locked to the system clock and is then used to control a slave delay line that shifts the strobe by exactly 90 degrees.

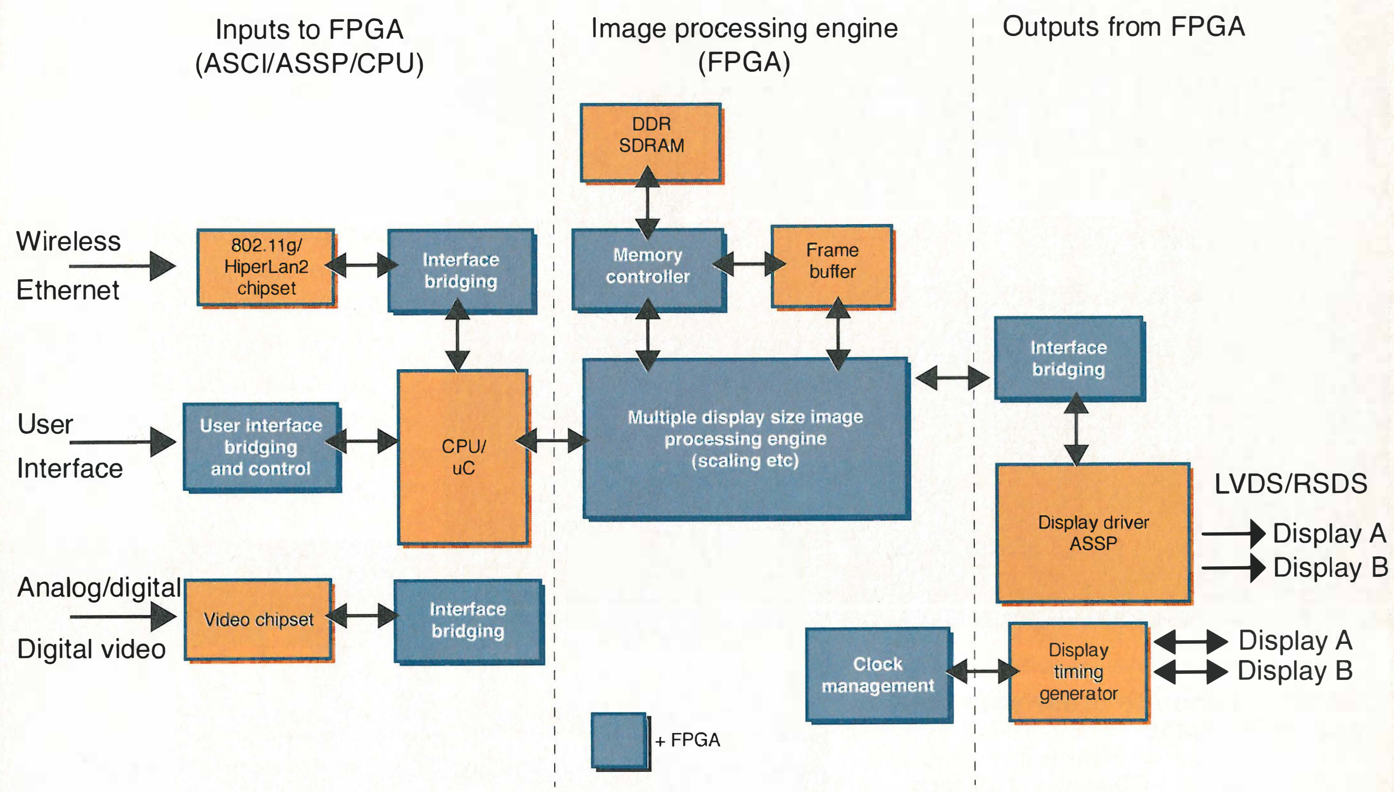
Monitoring activity

The round-trip device and circuit board delays from the FPGA to the memory device, and back to the FPGA, are usually unknown and can vary with temperature and voltage. The time from issuing a memory READ command until valid data arrives at the FPGA is therefore uncertain. A DQ data-valid circuit in the FPGA can be used to monitor activity on the DQS strobe and signal the start of a READ burst, and therefore the start of valid data. Generally, this requires some method of detecting the transition of the strobe from tristate to active at the start of the READ burst preamble.

Since DDR memories use SSTL and HSTL electrical interfaces that are parallel terminated to half supply, signals in tristate always float to the threshold voltage of the input buffer. This can result in spurious oscillation of DQ data and DQS strobe signals unless dedicated circuits are available to prevent this behavior. FPGAs may include dual threshold input buffers and minimum pulse width detectors to prevent oscillation of the DQS strobe prior to the READ preamble and after the READ postamble.

DDR SRAM and SDRAM devices use various combinations of single-ended and differential SSTL and HSTL electrical signalling. The clock inputs to these memories are differential, so the skew between the positive and negative signals must be minimised by

Figure 1: Reconfigurable FPGA supports multiple panel sizes, I/O standards and changing image-processing algorithms



the FPGA output driver. Also, to ensure maximum signal integrity at the memory interface, FPGAs with on-chip series and parallel termination capability should be used to drive and receive the various signals that constitute the interface.

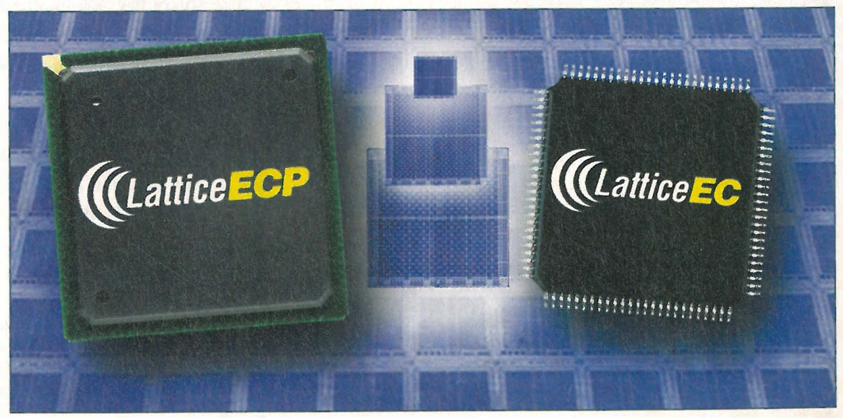
Current generation DDR memory systems use static parallel termination that is always present, either on the circuit board or on-chip in the memory controller. To reach even higher speeds, while reducing system termination power at the same time, newer generation DDR2 memory devices make use of switchable parallel termination and controlled output impedance drivers in both the memories and the controller. FPGAs targeted towards DDR2 applications may include these capabilities.

For the output section, FPGAs interface the image processing to the panel driving circuitry via LVDS or the newly emerging RSDS standard. LVDS and RSDS are low-noise, low-power, low-amplitude differential signalling methods for sending high-speed (gigabits per second) data transmission over copper wire. RSDS has a lower voltage swing and output drive current than standard LVDS, resulting in lower EMI and lower power consumption, as shown in **Table 2.**

Choose wisely

Choosing an FPGA that supports differential signalling standards such as LVDS and RSDS makes integration of the panel driving circuitry into the FPGA a possibility.

Supply chain management starts at the display system architecture level and is driven by OEMs' desire to reduce costs. In addition, system designers look to FPGA manufacturers for intellectual property and easy to use design tools to further reduce costs and speed time-to-market.



£11.99

Available from *Electronics World*

All tracks on this CD were recorded on DAT from cylinders produced in the early 1900s. Considering the age of the cylinders, and the recording techniques available at the time, these tracks are of remarkable quality, having been carefully replayed using modern electronic technology by historian Joe Pengelly.

21 tracks – 72 minutes of recordings made between 1900 and 1929. These electronically derived reproductions are no worse than – and in many cases better than – reproductions of early 78rev/min recordings – some are stunning...

Pandora's drums

Unique and atmospheric music recorded in the early 1900s – the days *before* 78s.

Use this coupon to order your copy of Pandora's drums

Please send me .... CD(s) at £11.99 each including VAT

Cheque ❑

Credit card details ❑ tick as appropriate

Name

Address

Phone number

Total amount £..........

Make cheques payable to TELEVISION

Or, please debit my credit card.

Card type (Master/Visa)

Card No

Expiry date

Please mail this coupon to *Electronics World*, together with payment.

Address orders and all correspondence relating to this order to Pandora's drums, *Electronics World*, Highbury Business Communications, Nexus House, Azalea Drive, BR8 8HU

Track

1 Washington Post March, Band, 1909
2 Good Old Summertime, The American Quartet 1904
3 Marriage Bells, Bells & xylophone duet, Burckhardt & Daab with orchestra, 1913
4 The Volunteer Organist, Peter Dawson, 1913
5 Dialogue For Three, Flute, Oboe and Clarinet, 1913
6 The Toymaker's Dream, Foxtrot, vocal, B.A. Rolfe and his orchestra, 1929
7 As I Sat Upon My Dear Old Mother's Knee, Will Oakland, 1913
8 Light As A Feather, Bells solo, Charles Daab with orchestra, 1912
9 On Her Pic-Pic-Piccolo, Billy Williams, 1913
10 Polka Des English's, Artist unknown, 1900
11 Somebody's Coming To My House, Walter Van Brunt, 1913
12 Bonny Scotland Medley, Xylophone solo, Charles Daab with orchestra, 1914
13 Doin' the Raccoon, Billy Murray, 1929
14 Luce Mia! Francesco Daddi, 1913
15 The Olio Minstrel, 2nd part, 1913
16 Peg O' My Heart, Walter Van Brunt, 1913
17 Auf Dem Mississippi, Johann Strauss orchestra, 1913
18 I'm Looking For A Sweetheart And I Think You'll Do, Ada Jones & Billy Murray, 1913
19 Intermezzo, Violin solo, Stroud Haxton, 1910
20 A Juanita, Abrego and Picazo, 1913
21 All Alone, Ada Jones, 1911

Star Wars Knights of the Old Republic II: The Sith Lords (KOTOR II)

Xbox, PC

KOTOR II is the next chapter to the award-winning role playing game of 2003. With seven worlds to explore and a large degree of free choice, this game allows you to take the story in whatever direction you wish.

You begin 'neutral' as such, and your actions allow you to become either a Lightside character, or you can choose to give in to the Darkside and become an evil character.

In order to survive, this game makes you use your brains as well as brawn, and for an RPG with so many options; the game is really in-depth when it comes to choosing weapons, clothing and abilities. The controls are amazingly simple to get to grips with. Also, people new to this game will find it easy to pick up, so don't be put off if you missed the first one. Instead, look forward to choosing your destiny, and expect great value for money, because every time you play it you create a totally different experience.

★★★★☆

Unreal Championship 2: The Liandri Conflict

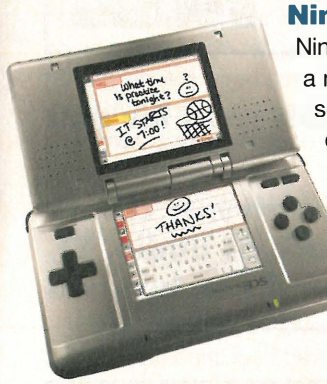
Xbox

Unreal Championship 2 (UC 2) has improved gameplay and abilities on the original. Players can chose from any of the 14 characters available from the 'Unreal' universe, and are pitted against each other in multiplayer mode via eight-person Xbox Live matches with gamers globally and, also, via system link games.

A new, two-part, single-player story mode has also been added, allowing players to choose from a variety of uniquely-skilled characters, and battle their way to the top.

As an evolution of the original, UC 2 now offers hand-to-hand combat as well as improved third party navigation, plus new adrenaline powers enable players to invoke powers for new offensive and defensive tactics. For a pick-up and blast-away title, this might be a worthy purchase for your collection...

★★★½☆



Nintendo DS

Nintendo's latest handheld console – the DS, offers a new type of experience, thanks to its new touch screen, voice recognition and wireless gaming capabilities.

Hitting European in spring this year, it still has the well-known buttons and directional pad, plus a stylus for the touch screen has now been added. The console's only downside is its size, which after the GBA SP, takes a little getting used to.

The most important aspect of the DS's introduction is that its new capabilities will allow for a much wider scope of gameplay options, and it will be interesting to see what developers do with the machine.

In addition to gaming, the DS comes with PictoChat, a function similar to texting, which uses the DS's wireless connection abilities for you to message up to 16 other friends. This allows you to draw, write and add to received messages, and could become a popular way of messaging friends! ★★★★☆

Mercenaries

PS2, Xbox

If you can see it – you can steal it, use it or blow it up – sounds good!

Mercenaries is a third person combat-action game, set in North Korea where a coup has plunged the nation into chaos. As a lone mercenary, you're dispatched to track down representing fugitives before they launch a nuclear attack. Liven your action movie fantasies through combat and non-linear gameplay in large interactive environments. Motivated by cash, you can choose alliances and get the opportunity to pilot 20+ ground and air vehicles, as well as 30+ deadly weapons. The action is complete with a havoc physics engine where the world is always active and you can affect everything within it.

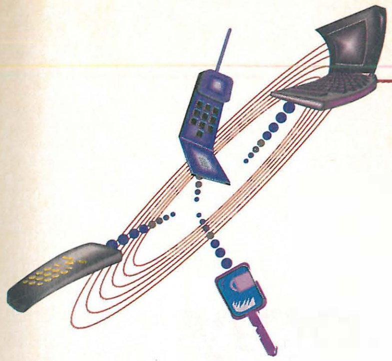
Great value for money, each fugitive provides a separate mission, meaning you'll need more than the odd evening or weekend to complete this!

EyeToy: Chat

PS2

Chat uses your broadband connection to turn your PS2 into a videophone. The first of its kind on a console, it allows you to chat with other EyeToy users globally via text, voice, video mail and one-to-one video chat. The 'text chat' rooms allow 256 people to talk together, whilst voice chats allow for 16.

The main selling point of Chat is its video capabilities, which, in a nutshell, is like using a webcam on your PC, just transposed to the living room. It would be wrong to offer a console product without gaming capabilities, however, so when in video chat mode, you can challenge your friend to a game of Draughts, Chess or 'Naval War'.



Heading toward auto-nursing

By Mike Brookes

Everyone must be aware by now of the widespread use of heart pacemakers. Every day one reads of the quality of life improvement, occasioned from the implantation into the bodies of sufferers of small, long-life, battery-powered devices that regulate heartbeat.

If such implants require 'tuning', how many people really consider how this is achieved. The answer is, of course, very short-range radio (SRDs) since a wired connection is not practical. A 'programmer' is sited close to the implanted patient and a wireless 'dialogue' established between implant and programmer. No contact – no pain – no risk.

Today, things have moved on. With the continued development of sophisticated but low-cost integrated and miniature sensor/radios and the parallel improvements in battery technology, implanted sensors now exist that can monitor heart rate, blood pressure and even changes in blood vessels. They can detect changes in aneurisms and pick up on other potentially fatal conditions. In parallel, a number of companies are developing equivalent 'stick on' radio 'patches'. These attach to patients' skin and continuously monitor physiological parameters and transmit them to a 'wrist watch' style monitor.

From the 'wrist watch', acquired data may be retransmitted via radio telemetry to remote databases in which individual patients/alarm limits will have been pre-programmed so that any potentially dangerous variation can be monitored and detected.

> *"It might seem obvious that such systems ought to operate on harmonised frequencies, with common operating procedures"*

This gives the medical team the opportunity of taking preventative action.

The concept clearly has enormous implications. It is a powerful tool in assisting medical staff, but it also offers huge benefit to patients as it allows them mobility.

Radio standards are already in place to give a basis for manufacturers to develop suitable products and these, too, are under regular review to keep them in line with the pace of technological change. Within the European Telecommunications Standards Institute (ETSI), a dedicated Task Group – TG30 – is working to develop Ultra Low Power (ULP) radio standards that encourage the development of new products.

There are a few snags, however. It might seem obvious that such systems ought to operate on harmonised frequencies, with common operating procedures to promote product interoperability and to ensure that 'on body' monitoring devices can be used freely in any country. This would not only aid medical staff in reducing training needs – multiple incompatible products in an operating theatre seems not such a good idea, but would also allow much greater freedom for patients.

Such thinking is perhaps naive. Medical device companies are under pressure to use proprietary and thus incompatible data transmission protocols to reduce liability to malfunction through interference. In addition, all SRDs operating frequencies have shared secondary occupancy. The current ULP band is shared with Radiosondes, for example. To be jammed by a weather balloon may seem bizarre but it is possible.

Real concentration on interoperability by manufacturers and harmonised spectrum availability from regulators is needed to guarantee the success of mobile "body area networking". For once, cost is not the issue!

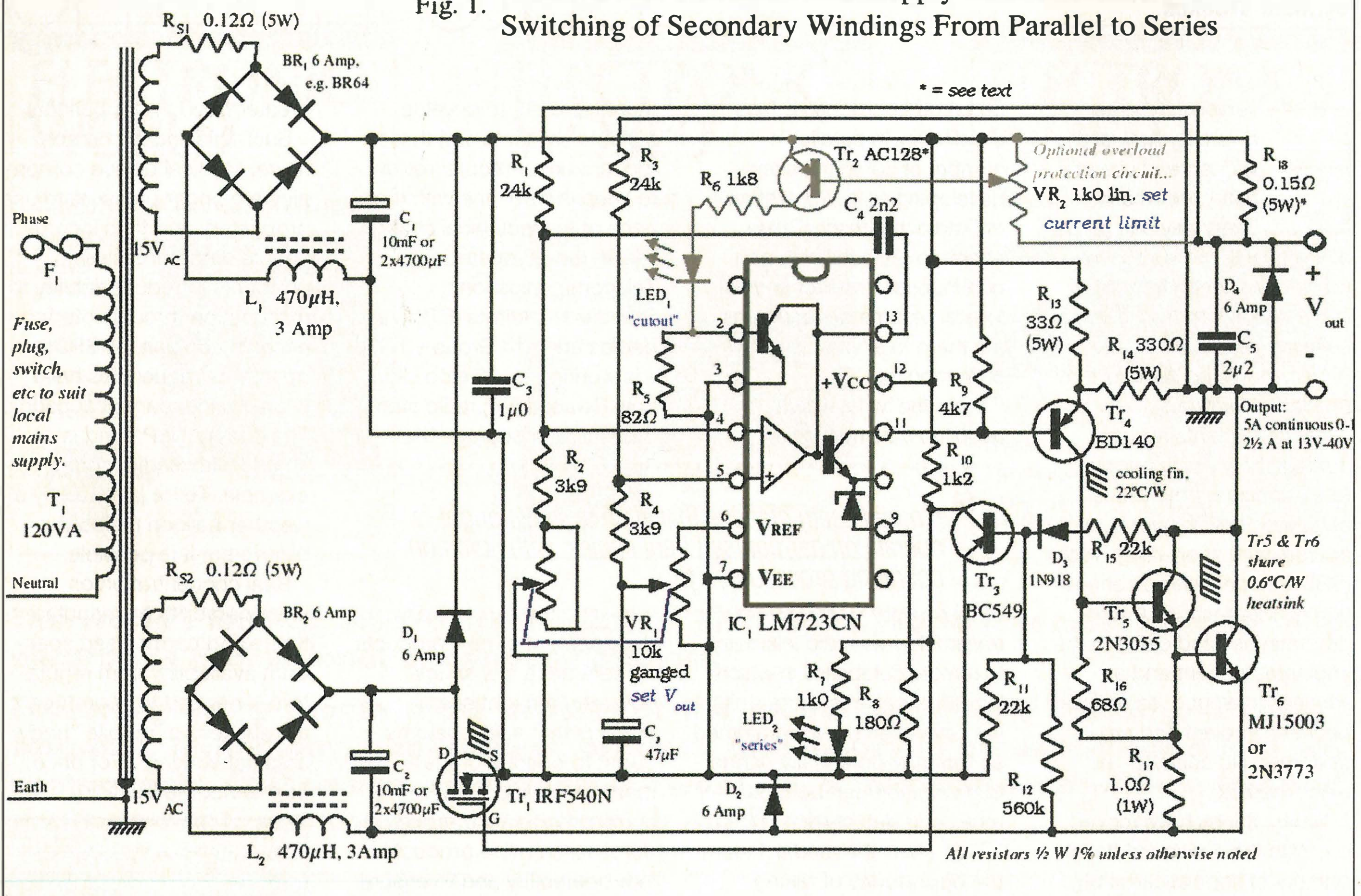
The Low Power Radio Association (LPRA) has several active members on the ETSI TG30 Task Group working on ULP standards.

The LPRA is a European trade body that represents manufacturers and users of SRDs. It is active in the production of SRD radio standards and regulations.

Mike Brookes is LPRA's chairman.

Efficient bench power supply

Fig. 1. Variable 0-40v Bench Power Supply with Automatic Switching of Secondary Windings From Parallel to Series



Variable power supplies usually have poor current capability at low output voltages (unless you can tolerate the noise and complications of switch-mode regulators). To reduce the power consumption in the pass transistors and deliver the maximum current at low voltages, we can automatically switch two secondary windings from series to parallel when low voltages are required. The following circuit, Figure 1, does this without the normal DPDT switch or relay; it changes quickly as the voltage required comes close to the output of a single winding using the method outlined in

Fig. 2: One-switch Series/Parallel Changeover (Only for DC Supplies)

(a) Parallel (Double Amps). (b) Series (Double Volts)

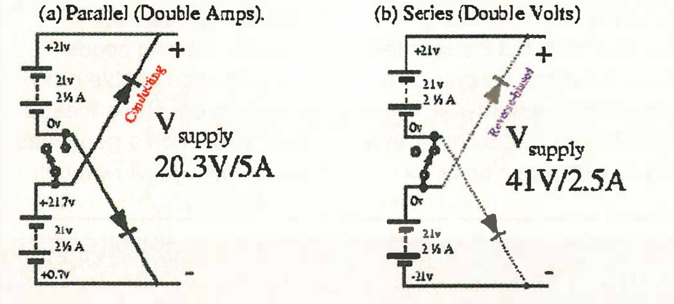


Figure 2. This is much simpler than Gregory Freeman's preregulator (Electronics World, April 1995, p336) but only provides a choice of two, instead of three, voltages to the regulator.

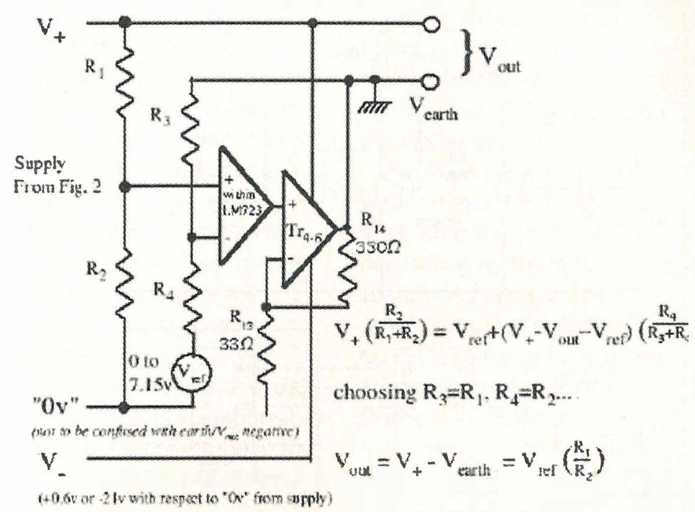
In low voltage mode, Figure 2a, with the switch open (Tr1 in Figure 1 off), both supplies (with similar internal resistances and diode voltage drops) share the current load equally, giving a 20V/5A supply. When the switch is closed, as Figure 2b shows, the supplies are in series, with D1 and D2 non-conducting, doubling the output voltage. Using a power FET for the switch after the rectifier/capacitor sections, voltage supplied to the regulator can be dropped quickly and efficiently when the regulator's output is low, as sensed by Tr3 in Figure 1.

Although almost any regulator circuit could be used, the novel arrangement of a 723 IC in Figure 1 has some interesting features, in particular the voltage difference circuit (shown in Figures 3), allows the power transistors (Tr5 and Tr6) to be connected directly to an earthed heatsink or chassis, and means the output voltage is continuously variable from 0 to VREF times (R1/R2); 723 circuits normally only provide variation from 2V to 7V or 7V to 37V. The three-transistor current booster also removes the 37V output restriction of that chip (it's VEE, and the series/parallel sensing transistor's emitter, are fed from half the possible supply voltage marked "0V" in Figure 2). Regulation performance depends on the matching of R1 to R4, and the tracks of VR1; the internal resistance can be slightly negative.

The 723's own current overload sensing transistor (pins 2 and 3 in the 14-pin DIP) cannot directly be used with our circuit; we need an external transistor. By using an AC128 germanium transistor for Tr2 a wider range of cut-out currents can be set using the same 0.15Ω series resistor and its increased sensitivity to temperature can be advantageous.

Mark Aitchinson
Christchurch
New Zealand

Fig. 3: Operation of Regulator Circuit



2V DC-DC converter

With the advent of micro-processors requiring low-voltage, high-current supplies, many good low-Z components are now widely available.

This DC-DC converter makes use of them in a 2V design to run a 9W compact fluorescent lamp (CFL) from a single lead-acid cell.

The circuit is a fairly standard, single-ended, forward converter with resonant fly-back. The frequency is selected so that the secondary winding capacitance provides the correct amount of tuning.

With optimum operation the FET sees a half-wave rectified sign wave drain waveform. The circuit works at a fixed duty, with the output regulation tracking the input.

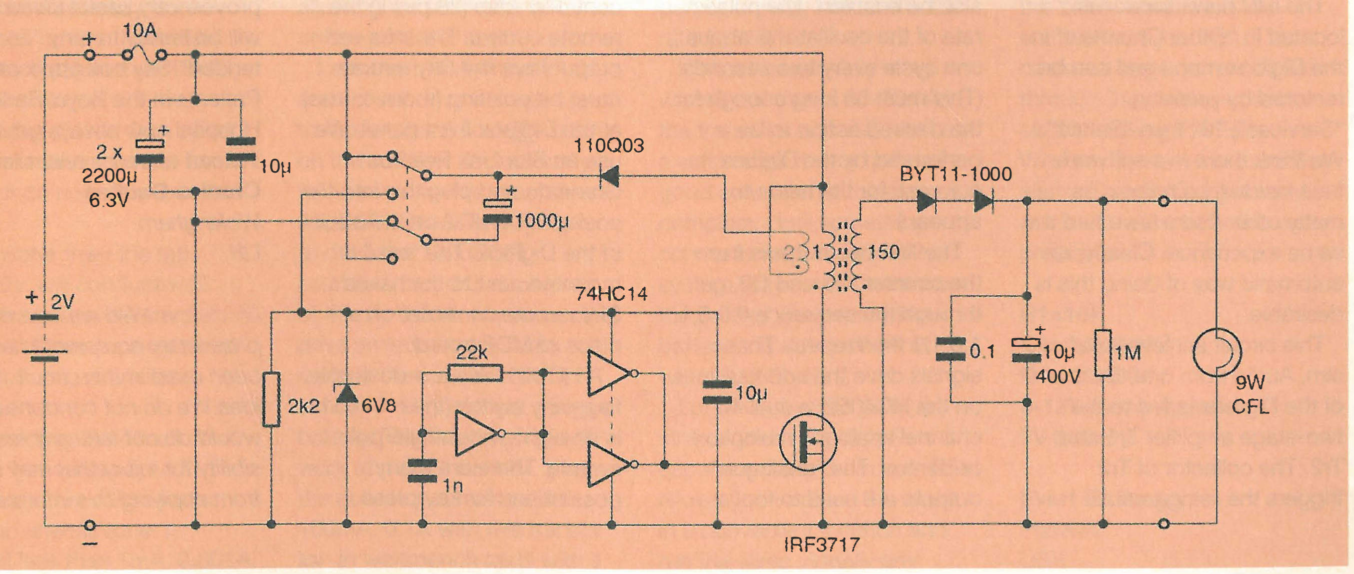
The output voltage is approximately 300V DC determined by the 150:1 turns ratio. The transformer core is an ungapped RM10 in 3C85, or similar.

The transistor drive is provided by a 74HC14 hex Schmitt buffer with a boot-strapped supply.

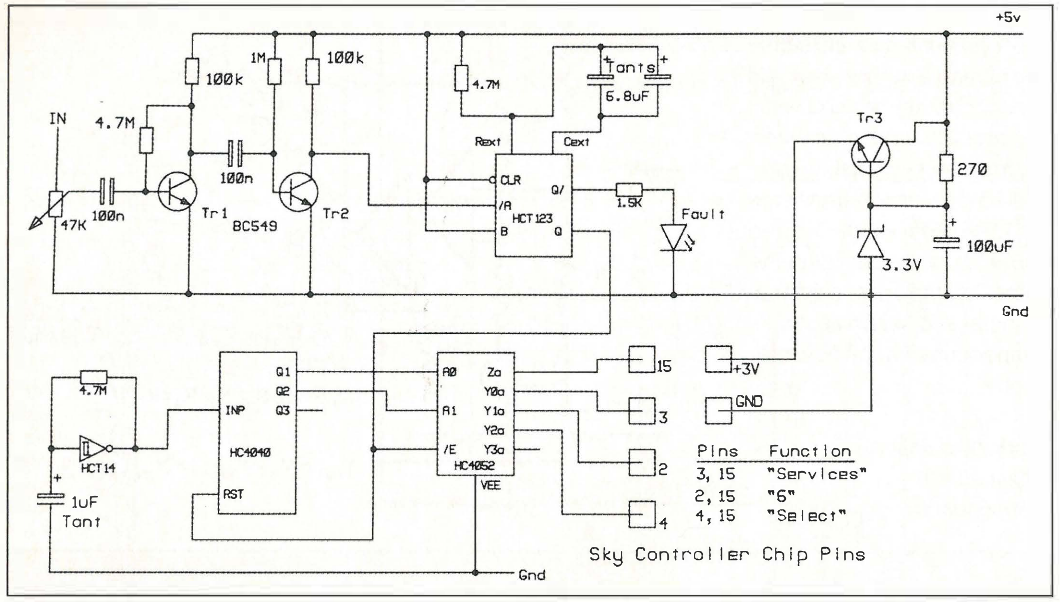
To guarantee the circuit starts, the 1000μF is charged from the battery via the switch when the circuit is off. When first turned on, the capacitor is connected in series with the battery to provide 4V start-up. This then guarantees start-up as logic FETs can still have thresholds as high as 2V.

Tight layout and low ESR capacitors are essential to efficiency. The FET used is a 5mΩ, 20V device.

Paul Bennett
Bristol
UK



Sky box dropout zapper



Our local hospital radio service uses a dedicated Sky Digibox for its news feed. The box is tuned to IRN News on the Hotbird 4 satellite but if the signal is lost due to bad weather, a thunderstorm or light shower anywhere south of Basingstoke, it doesn't always come back. When the hospital evening presenter announces, "Now here is the news from IRN", there is sometimes an awkward silence.

The IRN news service is located in "Other Channels" in the Digibox menu and can be restored by pressing "Services", "6" then "Select". We think there is a software fault inside the Digibox, as many other users have had the same experience. Clearly, an automatic way of doing this is desirable.

This circuit achieves that aim. Audio from one channel of the Digibox is fed to the two-stage amplifier Tr1 and Tr2. The collector of Tr2 triggers the retriggerable, monostable, HCT123. This has a time constant of about 30s (2 x 6.8µF with 4.7M resistor). As long as there are no audio gaps longer than 30s, the monostable Q output will remain high, holding the counter (HC4040) reset and disabling the HC4052.

When a long gap is seen, the Q output will go low and the counter will start to count pulses from the HCT14 oscillator. The HC4052 outputs will also be enabled. The pulse rate of the oscillator is about one cycle every two seconds. (This must be long enough for the desired action to be performed by the Digibox, in our case for the audio to appear.)

The first two outputs from the counter, Q1 and Q2, go through the sequence 0,0 0,1, 1,0 1,1 then repeat. These signals drive the address lines on the HC4052, a dual 4-channel analogue multiplexor/demux. The "analogue" outputs are used to fool a butchered Sky remote control unit into thinking that the buttons have been pressed. The relevant outputs from the 4052 are wired straight to the pins of the remote controller chip. The analogue switches have an 'on' resistance of around 70Ω and this is easily enough to simulate a pressed button on the remote control. See Figure 2 for a complete list of all keys and their corresponding connection to the controller chip (28 pin) in the remote control. The infra-red output from the Sky remote must be pointing (more or less) at the Digibox front panel. We use an SLx Link Eye from Grandata and plug this into the socket RF OUT 2 on the back of the Digibox. The "eye" is mounted next to the naked Sky remote controller on a piece of MDF board.

A HC4052 is like a dual-pole, four-way switch (the HC4051 is an eight-way, single-pole switch). There are many possibilities for key press combinations. Multiple HD4052s or HC4051s could be used. A total of twelve outputs are available on the HC4040 counter.

Note that only one gate of the HCT14 is used - half the HC4052 and half the HCT123, thus leaving spare functions for ingenious use. The VEE pin on the 4052 needs to be grounded for this application. The Sky remote control is fussy about its 3V supply. Anything below about 2.8V gives a warning on the screen that the batteries need replacing, and at much above 3V it doesn't work at all.

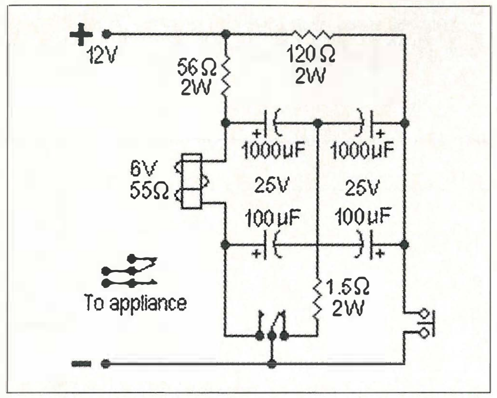
Not all Sky remotes may conform to Figure 2 by the way. Sky+ has extra buttons for instance and may well be different inside. In this case, you'll have to work out the wiring of your remote control using a meter. You can buy Sky remotes and the SLx Link Eye from Grandata – Tel: 020 8900 2329.

I used components that were readily to hand for this project. It can probably be realised using fewer parts but has proved very useful indeed. It will be handy for any "unattended" Sky box applications. Patients in the Royal Berkshire Hospital now always get news instead of occasional silence.

Charles Coultas
Wokingham
UK

Disclaimer: We are aware that proprietary equipment has been used in this circuit idea.We do not condone it and would do not take any responsibility for injury that may result from applying this information.

Replacing pulse relay



House elecrical wiring, occasionally, requires the use of a pulse relay, which is activated and deactivated by a press of a button. It will avoid going around with the relatively high voltage of the mains wiring, thus improving safety in certain areas.

Normally, there are purpose built relays but they are expensive and difficult to find. By using a few additional components and a relay with two sets of contacts, it is possible to get the same operation without resorting to delicate electronic components. Just as its original counterpart, it draws no current when idle and is operated by a negative pulse. It draws power in the 'on' state, though.

The chosen relay has 5A contacts, good enough to switch most household appliances. However, the circuit can be modified for other relays and ratings. The resistors in series with the coil should have a value similar to the coil resistance. The other resistor should be twice the coil resistance. Relay voltage should be half the supply voltage. The capacitor's value is also proportional to the coil resistance: the higher the resistance, the lower the capacitor's value.

The charge/discharge cycle of the capacitors is responsible for the operation. Although the contacts are in the discharge path of the capacitors, there is no sparking at the contact points as they actually do not switch during the fast discharge and most of the energy is dissipated by the pushbutton. However, a 1.5Ω resistor is provided in order to limit the peak current from the bigger capacitor.

The shortest time between two consecutive operations of the button is from 0.5 to 1s, depending on the supply voltage. An unregulated 12V power supply of suitable power is required to feed one or more of these units.

Domenico Di Mario
Milan
Italy

Early warning system

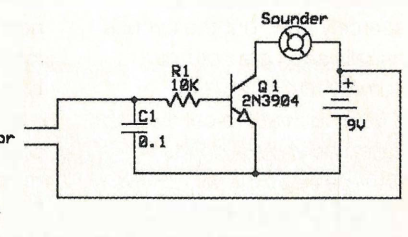


Figure 2. Amplified water sensor

A simple solution to the problem of washing machine hoses that go quietly in the night comes in the form of a battery, a transistor, a resistor and a piezo sounder (see Figure 2).

While Figure 1 uses only the two parts, a battery and a sounder, it lacks sufficient sensitivity to give reliable results.

Soft water makes a good insulator. Absolutely pure water will have a theoretical resistance of just over 18MΩ, when measured with two electrodes placed 1cm apart. You can make a sensor for that but do not need to in this case.

The water from the tap, normally, will conduct well enough to pass the small amount of base current needed to turn on a transistor switch.

Connecting the circuit of Figure 1 to wires about 5-10mm apart in a little water gave an anemic tone. It passed less than 1mA, 0.001A. The sound level meter registered around 72dBSPL; about the same loudness as polite conversation – a level unlikely to give an early warning.

In Figure 2, the 10,000Ω resistor limits the base current to a safe level. If the leads touch each other or the water conducts exceptionally well, the base current stays within safe limits. It protects the emitter-base junction while allowing the transistor to turn on the collector load.

Less than 1mA of base current will drive a small-signal transistor, hard enough to turn on the sounder at practically full volume: in this case, over 80dBSPL. It has enough gain to drive the 102dBSPL sounders that draw upwards of 40mA, 0.04A. If you want to drive an extra heavy load, replace the sounder with a sensitive relay and get a bigger battery. The listed values will work at more than 12V. Keep the collector current under 100mA, 0.1A with this transistor. In workbench tests with a relay coil that drew

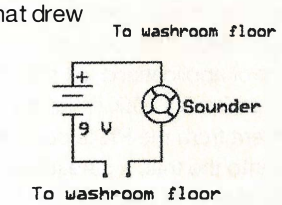


Figure 1. Simple water sensor with piezo alarm

30mA, the transistor showed about 200mV, 0.2V drop from collector to emitter. This particular relay has contacts rated at 10A.

With a heavier-duty relay whose coil draws 60-70mA, the transistor showed just over a volt across it. Not quite as good saturation but it did not complain. Until something connects the two leads, the system draws no current from the battery. For an alkaline battery, expect shelf life of typically 2-3 years.

Long wires could pick up stray signals. The 0.1µF capacitor filters them out. This allows you to place the alarm in a convenient location and run the wires virtually any practical distance.

When the wires have become partially immersed in water, current flows from the battery through the base–resistor into the emitter-base junction. This causes a large current to flow through the emitter-collector circuit causing the Early Warning System to sound the alarm. This should get someone's attention to fix the water problem.

R1=10K
C1=0.1µF 15V
Q1= 2N3904
3-12V piezo sounder
9V battery

Evert Fruitman
Phoenix
USA

Simple mains power improved

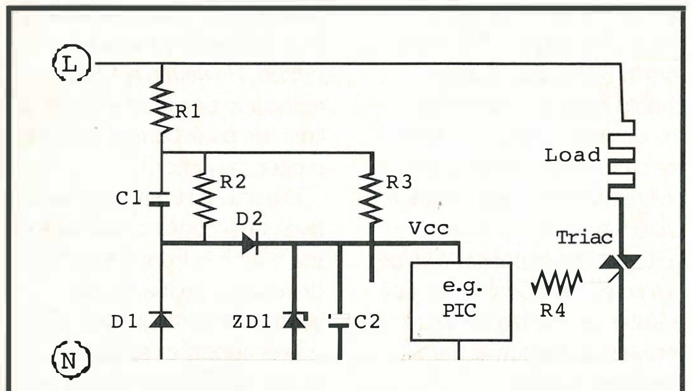


Figure 1

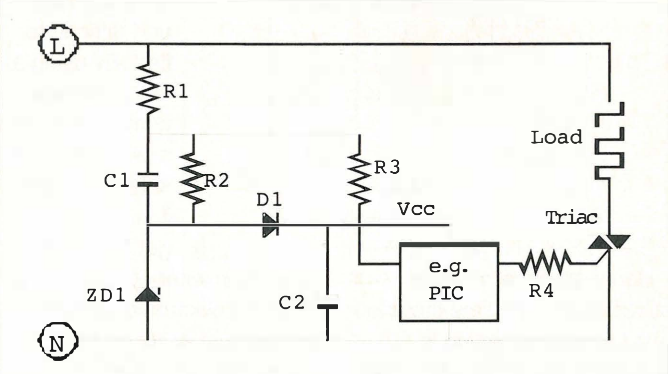


Figure 2

Simple mains power supplies, not isolated and using capacitive dropping, are scarcely new, but the circuits usually seen are actually somewhat flawed.

Let's look at typical standard circuit as shown in Figure 1. C1 – perhaps 0.1 to 1μF – is the actual dropper. It has capacitive reactance, and is in theory lossless. Capacitance of 0.22μF is a good starting value; this will pass some 15mA at 240V RMS (50Hz), allowing a practical load of say 5-10mA. R2 (several megs) bleeds charge from C1 in the absence of a supply to avoid unexpected shocks to the user. R1 – 47Ω or so – helps to suppress any transients, and also makes a good fuse if it's suitably rated.

The current passed by the capacitor flows through D1 on negative cycles, and through D2 and ZD1 on the positive ones, charging C2. Vcc is then close to the Zener voltage, which will be perhaps 5.1V. C2's value will depend on allowable ripple; this circuit needs 470μF or more, assuming that a couple of milliamps is drawn from Vcc.

Supply circuits like this are often used in simple triac control applications, as shown. R4, perhaps 220Ω, limits the current from the PIC's output pin into the triac's gate (use a sensitive-gate type). This voltage will be pulsed with an "on" time of a few tens of microseconds: enough to operate the triac, but not enough to cause supply droop. R3 provides the PIC with zero-crossing information. Keep it high in value, and watch its voltage rating. A couple of 10M resistors in series is good. Obviously other components such as switches or opto-couplers, LEDs, perhaps a VDR, and filtering and snubbing round the triac will be needed in actual applications, but we are really only interested in the power supply at the moment.

The bad news about the Figure 1 circuit is that ripple or cycle-by-cycle droop is greater than it need be, precisely because the Zener and the smoothing capacitor are in parallel.

Figure 2 is more efficient both in component use and performance. C1, R1, and R2 are unchanged, but ZD1 is put in D1's old position. Make it a 5.6V device for a nominal 5V rail. C1 should not exceed 1μF, which will put 75mA through the Zener: that's 250mW when averaged for forward and reverse half-cycles. As we saw earlier, 0.1 or 0.22μF gives quite enough to run a PIC.

C2 is now charged through the remaining diode and can only discharge through the target circuitry: it can be half its previous value for the same performance.

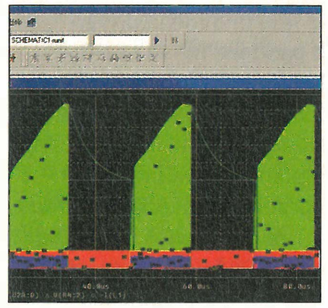
One important point is that C1 must withstand the full mains voltage continuously, so it must be appropriately rated to Class X or Class Y for safety.

And the most important point of all: because it is connected directly to the mains, this type of circuit is potentially lethal! Never assume that the mains neutral wire is at earth potential, as it is supposed to be at least in the UK. If you must work on non-isolated mains circuits such as this, while they are live stand on an insulating mat or perhaps wear wellies, keep one hand safely in a pocket, and move wires only with the back of a finger (less important with AC, which doesn't cause muscles to clench).

If you have any doubt as to the safety of the finished device, add more insulation. You have been warned!

Nick Cornford
Berkhamsted
UK

Send new circuit ideas to:
The Editor, Highbury Business, Media House, Azalea Drive, Swanley, Kent BR8 8HU
or email to: **ewcircuit@highburybiz.com**



Go XP, go!

Regarding Alistair McFarlane's article in the December 2004 issue ["Mixed spices part 2", p32], firstly, there seems to be some misunderstanding on what information was transmitted to Alistair versus what was received or understood. Regarding the claims of hanging behaviour with SuperSpice, at no time was it suggested that there were issues with SuperSpice running on XP versus Win95/98. SuperSpice usually runs extremely well on any of these systems, and essentially, never crashes. Indeed, in five years, there have been maybe only one or two reports of a crash.

What I did note was that XP systems are far, far more reliable, by at least an order of magnitude, than the earlier systems, and as such I recommend that operating systems (OSs) prior to XP be replaced as soon as practical. The technicalities of Windows seem to be missed by so many. It is not debatable; XP is way ahead of the earlier systems. For example, the earlier OSs will run out of GUI memory and hard crash the whole OS once it uses up its scant 64KB of specialised reserved GUI memory. This is despite having 1GB of main RAM. This fact alone is enough to dispense with the older systems. There are many other technical issues that I won't go into here, but the older OSs still sit on top of DOS.

Alistair mentioned that some vendors have indicated certain issues with XP and actually recommend staying with the earlier systems. This may be more due to 16-bit legacy code in their products then the merits of XP, or it may be ignorance on their part as, fundamentally, those that claim such matters are usually mistaken. So, whilst Alistair may not be certain about XP/98, I am. XP is the only realistic way to go today.

I am still unclear as to what the reason for Alistair's problems were, however. SuperSpice is specifically set up to produce results with minimum effort. Running examples is just a matter of pressing a button. After the run, graphs of the correct type and size will be displayed automatically. One possibility for graph size is that he inadvertently disabled the "lock graph size to window size" check box. This is a special feature to allow for graphs to be sized and placed anywhere on the schematic.

SuperSpice has been run on many systems, including Unix under an emulator. None of the issues Alistair mentioned have arisen on these systems. I have personally used SuperSpice for 1000s of hours, on many systems, with no hanging problems like Alistair's. My best guess here is that Alistair's system has a fundamental problem, either hardware or software.

Kevin Aylward
Anasoft
Basildon,
UK

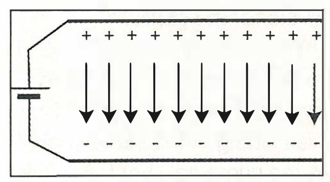
Hot debate

With audio power amplifier distortion mechanisms currently hotly debated, I would like to add to it by proposing an audible distortion reducing mechanism I call 'class half-A'.

The idea is to trade some large-signal power handling in return for the elimination of small-signal crossover distortion. With a class AB power output stage, up to 25% of the stage's maximum power output may usefully be turned to partially bias the AB output stage as a small-signal class-A amplifier. Crossover distortion may thereby be removed from the dynamic range of small signals.

With a typical audio amplifier design, an output pull-down is a simple way to achieve this effect. A pull-down resistor tied between the output node and the negative supply rail is the crudest approach, but a constant current pull-down gives more usable class-A power. The pull-down current should be designed not to steal too much power when the output stage is giving its full pull-up voltage. For the more adventurous, it may be possible to adjust an amplifier's feedback to achieve a similar effect.

Allan Campbell
Newcastle-upon-Tyne,
UK



Check the current

I have comments on "The Catt anomaly" article in EW October 2004, page 38.

The explanation by Ian Hickman is very good, but I wish to take issue with his comments on displacement current, eg. "displacement current is not a flow of real current". My reasons are:

1) Maxwell's equations indicate that the displacement current is proportional to the rate of change of the electric field, has the dimensions of current and it generates a magnetic field identical to one that would be produced by a "real" current in a conductor. For example, consider a capacitor constructed from two parallel metal plates. When it is charging, the electric field between the plates is increasing in intensity. The changing electric field creates the displacement current, which is said to flow between the plates and is perpendicular to them. The magnetic field is perpendicular to the current and the lines of electric flux.

2) Ian and Ivor assume that a"real current" is the movement of charge carriers such as electrons. This has been taught by generations of physics teachers and is the accepted concept. But, I suggest that future developments may alter this viewpoint. Physicists from Einstein onwards (and possibly earlier) have been searching for the "theory of everything". I feel that, when this theory is devised, it may include a new definition of electric current.

The other point I wish to raise is Ian's comment that, "the electrons may be moving at a snail's pace relative to the speed of light, but the disturbance just described propagates along the line at the speed of light".

I don't see how the "disturbance" can propagate at the speed of light when it is due to the movement of "snail's pace" electrons. If the disturbance of one electron is due to the movement of the one beside it, how can the disturbance propagate at the speed of light? I feel that the "theory of everything" will produce a better explanation.

As I understand it, the most promising contender for the "theory of everything" is string theory. So electric current may be a flow of strings. Such a current may be able pass through dielectrics such a vacuum, air, plastic, etc. The movement of charge carriers may be simply because they are being pulled along by the "string current". As an analogy, consider a river of clear, slowly flowing (ie. non turbulent) water. The current is virtually impossible to see unless there is a marker of some kind such as a floating leaf or a colouring of the water by a blob of dye, etc.

Len Cox
Forest Hill
Australia

A mistake of triac proportions

Thanks for the continually interesting and useful EW Circuit Ideas section. I must raise a concern about Ian Benton's "Dual Rate Thermostat" as published in the December 2004 issue [p45].

No criticism of his circuit is intended. The triac CSR1 in the diagram seems (to me) to have been mistakenly drawn, with its main terminals transposed, putting the gate on the wrong end of the device. Correct operation requires that the trigger pulse flows from supply positive, through the triac's 'main terminal 1 to gate' region, via R5 to TR1's emitter. As drawn, the triac gate is at full mains potential with respect to the PIC positive supply, which looks to me incorrect and liable to damage the transistor and PIC.

Jeremy Jago
Nottingham, UK

Dare-devil

I was sorry to see some of the criticism of Graham's articles. Whilst I would have to agree that the writing style was at times repetitive, two very important messages came out for me:

1) The "establishment" has paid far too little attention to First Cycle distortion one only has to see a piano note or a triangle being struck on an oscilloscope to see how sharp the first cycle edges can be.

2) In particular, the effect on speaker loading of the first cycle behaviour had not been obvious to me.

I would add that even at professionally organised gigs there seems to be a widely varying standard of ampilfication. By way of example, I have been fortunate enough to be at Eric Clapton concerts twice in the last few years. The first was the 'Reptile' tour, the second in May of this year. I particularly remember the brilliantly clear transparent PA of the first despite, perhaps unnecessarily, high sound-levels for the genre.

The second, though, I found to be definitely too loud and disappointingly muddled. I was sitting in the same seats in the same hall, yet there was a huge difference in the clarity.

I would be most interested in an analysis of the equipment and speakers used for the two gigs. I would be particularly interested in such an analysis by someone like Mr. Maynard who seems to have genuine real-world experience and a drive to get to the bottom of the differences he hears in that world.

How about it, Graham?

Chris Miller
UK

Unnecessary criticism

Having read Phil Denniss's long letter in the December issue of EW, in which he criticises (to put it mildly) Graham Maynard "Class A Imagineering" articles, I can't help feeling he was unduly harsh, dismissive and unfair towards Graham. Graham's writing does ramble on a bit, repeat itself and make tough reading, but it does manage to communicate his fervent enthusiasm for and belief in his message, which I gather has evolved through years of personal experience. I, for one, am intrigued by his theories and remain open-minded.

The human ear/brain takes a very big cue from the initial transient of any signal because it contains the directional information, in addition to information on how the sound was created. The memory of that initial instant is still important a long time (comparatively speaking) after it has passed.

Would that very information not be critical in the correct portrayal of a stereo sound stage?

So, Graham, I know it's been a marathon task for you, but unfortunately it's not quite finished. As a final conclusion, how about a double blind test using your best audio set-up, with results to appear in a future EW? I'm sure many, like me, will be eager to learn.

Nick Ham
Philips Power Semiconductors,
Stockport,
UK

Is this mere hypocrisy?

It saddens me to see the letter from Mr. Denniss following in the footsteps of Doug Self et al in expressing a point of view in such an aggressive manner. I've read "Wireless World" since the early 1960s and, throughout that time, the pointless argument between the objectivists and subjectivists has raged on the subject of audio equipment design.

I've spent nearly 40 years in the hi-fi and audio industries and been responsible for nearly 300 commercial designs. I was a founder director of Mission Electronics and Cambridge Audio, worked for numerous British, American and Japanese companies and, finally, semi-retired after being Chairman of Wharfedale loudspeakers and Quad Electroacoustics. I also, incidentally, bear the responsibility of giving Doug Self his first job in the audio industry.

Let me first dispel the wrong assumption that the aim of a hi-fi audio designer (as distinct from a professional audio designer) is to create, say, the perfect amplifier. Not true. The aim of the designer is to create an amplifier that will sell. So, the really successful designer has to identify which measurable characteristics translate into manipulations of sound that people can identify and hopefully like. Sometimes, the designer may be unable to accept that this is what he is doing, but the fact remains that once they find that customers like a particular design, they stick to the formula or recipe that works. To give an example, in the 1980s and early 1990s I designed a hugely successful series of amplifiers for Rotel which, despite having a reasonably flat frequency response, did emphasise the bass guitar and bass drum sounds so that a "foot tapping" sound was produced. And tap their feet was what the public did whilst buying the products in hundreds of thousands.

Some years ago, a well-known magazine reviewer, who swears by the importance of measured performance, tested one of my products and found that it turned into a mediocre set of results. This left him with a quandary because he found that he just loved listening to his favourite music through this product.

I've always measured my products and, to this day, keep a set of audio precision equipment at home, but I also use those measurements to tailor the audible sound to suit the target market. And it works, because "my" proucts have received no end of "5 Star" reviews and awards from the consumer magazines. That doesn't mean that I cannot design an "accurate" product when I need to. The Quad ESL-989 loudspeaker significantly improves upon the performance of Peter Walker's original and brilliant work. Why? Because, again, that was what the market would respond to.

Certainly all this talk of "long established scientific knowledge" and "valid science" has about it the whiff of hypocrisy. I'm afraid that engineers have a poor reputation with the buying public. Remember the early transistor amplifiers, which had such low distortion, compared to valve amplifiers but then turned out to have crossover distortion and output stages which blew-up quickly (Ah, that smell of burning resistors)?

Then, there was the "perfect" new medium of compact discs, perfect – once we'd sorted out some of the first generation problems. And the list goes on. Furthermore, anyone who has any involvement with the academic world knows well that results and findings are routinely "spun" to give either a more politically correct result or one which will facilitate the next round of funding. Alas, science is as corruptible as any other form of human endeavour.

Finally, I must take task with the comment that subjectivists "cannot or will not produce the slightest shred of credible evidence for their claims". I tend to stand with a foot in each camp but I can tell you that in the early 1980s a contingent of most of the "golden ears" magazine reviewers visited Abbey Road studios, where Decca kindly set up a double blind test with pieces of music simultaneously recorded on both analogue and digital recorders. The aim was to establish if we could identify any difference. The listening was performed in a rigorous manner and subsequently written up in "Hi-Fi for Pleasure" magazine. I can report that I achieved a statistically valid result in correctly identifying a difference most of the time. Unfortunately, the recordings I credited as being digital turned out to be analogue and vice versa. But then life is like that.

Stan Curtis
Ramsey
UK

Continuing puzzle

I was puzzled by Ivor Catt's opening paragraph in his article "Not me, guv" in the May issue of Electronics World. It closes with the assertion that "minimal area within the ((hysteresis) curve (of a mains transformer) indicates maximum remnant magnetism". I would have thought that minimal area within the curve would occur if the hysteresis loop could be made so thin that it became a line through the origin and there was no remanent magnetism at all.

However, there is no need to invoke remanence to explain large switching-on surges in mains transformers. This has been explained before, in Wireless World, by Cathode Ray or Mixer, if I remember rightly. In a steady-state condition, the integral of voltage with respect to time during one half-cycle of the mains voltage changes the magnetising current in the transformer from its negative peak value to its positive peak value or vice versa. However, if the mains switch is closed at the beginning of a half-cycle, and the transformer behaves linearly, the current starts from zero and reaches twice the normal peak value. The current has a DC component that dies away with the usual time-constant of L/R. If the core saturates, the peak current will be considerably greater.

It's not entirely true to say that switching-on surges have been ignored by the EMC community. Since 1993, the German NAMUR NE21 EMC standard for industrial process control equipment has stipulated that if a switching-on surge has a "half-life" longer than 5 milliseconds, its peak value must not exceed 15 times the peak value of the nominal current consumption. All devices must continue to work with no loss of stored data after a 20-millisecond interruption of the supply. NAMUR stands for User Association of Process Control in Chemical and Pharmaceutical Industries. (If one reads it in German the derivation is equally obscure.)

The (US) Information Technology Industry Council specifies similar requirements for immunity to voltage interruptions and dips (see "Plug in: Safeguard AC Powerline Quality", EDN Europe, March 2004). IEC 61000-4-11 (for AC supplies) and IEC 61000-4-29 (for DC supplies) cover the methods by which the testing is done.

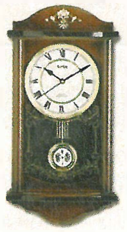
Ivor has in the past criticised the EMC community for use of jargon. Some readers may find the following explanations useful: "Symmetrical" refers to a test signal applied to a pair of wires in differential mode, but not necessarily balanced, and now sometimes called "line to line". "Asymmetrical" means common mode. "Unsymmetrical" means that the test signal is applied between the reference ground of the test set-up and an individual wire. The test is applied in turn to each of the wires connected to a port (input, output, supply etc.) of the equipment under test. Not surprisingly it is now sometimes called "line to ground". Confusingly, the latest (bilingual) version of NE21 has "unsymmetrisch" translated to "asymmetrical", presumably because the word "unsymmetrical" doesn't officially exist in English.

In the European Union, one also needs to master some non-technical jargon. “New Approach” refers to a directive from the European Commission that describes only its essential requirements, leaving everyone in as much confusion as possible about what they have to do to demonstrate compliance with the directive. The “Technical Adaptation Committee” decides what a directive means, if the Commission, which issued it, doesn’t know itself. “SLIM” or Simpler Legislation in the Internal Market, seems to mean legislation in which the same rule is applicable to everything, no matter what absurdities result or how many people’s lives it complicates (the sort of thing George Orwell called Newspeak).

Examples include making the Automotive EMC Directive applicable to simple resistive loads such as map-reading lights and absorption refrigerators, and the current proposal to make the Low Voltage Directive applicable to extra low-voltage equipment. A third example would have greatly impressed King Canute’s servant or Mr. Scott of the Enterprise, because it seems to demand a change in the laws of physics:

In the UK and much of Europe it has been normal practice for several years to run portable gas appliances from butane at 28 millibars gauge pressure or propane at 37 millibars to get similar performance with either gas. However, from this year, installations in caravans will have to comply with EN1949, which stipulates that the pressure will always be 30 millibars, and appliances will jolly well have to accept it.

Hugh Mirams
Oldham
UK



Not synchronised

In the January’s letter section, under the heading “Pendulum Conundrum” [p53], C Holwill asks how pendulums on quartz clocks maintain synchronism. Some time ago I was amused to observe one of these in action. The question is easily answered - they aren’t synchronised.

Alan Robinson
Holgate
UK

Teaching students

The following is an attempt to answer one or two issues raised by Mr Trevor Skeggs under the title ‘Powers that be’ in the September issue Letters pages.

Most students studying engineering in particular will experience the problem of not immediately comprehending certain points, whether attending a course or reading a textbook. Unless positively and repeatedly encouraged to do so – which will not normally be the case – most students in a class are naturally reluctant to advertise their inability to understand particular points when first encountered. Where this is the case, students should take the matter into their own hands and help one another.

A student with a particular difficulty should feel free to ask other members of the class for an explanation during a break. If the class experiences a common difficulty, a ‘brain storming’ session over coffee can sometimes clear the matter up. A help line, whether by telephone or e-mail, can save hours of frustration and discouragement.

Obviously, assessed work handed in for marking must be the students’ own; cheating is to be condemned as untrustworthy and ultimately self-defeating. That said, engineering today is generally of such large scale and complexity that most people will work much of the time collaboratively as members of a team, so adopting a team approach to study usefully mirrors this fact and can also serve to improve social skills. If a point in class presents an initial difficulty, it is often helpful to consult several textbooks covering that point, whether in a library or a bookshop. Often, an alternative textbook will clear the matter up. Sometimes reading on ahead of the point of difficulty will reveal a subsequent explanation later in the text.

Modern technology increasingly and inescapably involves the application of mathematical physics in an engineering context, and thus abstract theory and the associated mathematics cannot be avoided. This makes it increasingly necessary to appreciate the key fact that mathematics centres on the recognition and appreciation of pattern, in the case of indices, that of a simple sequence as will be shown. Also, mathematics has to be rule-based to ensure consistency. Many mathematical operations, for example division, can be carried out in more than one way, in this instance algorithmically using the ‘long division’ method or by employing logarithms. In many cases, there are three or more different ways to carry out the same mathematical operation. For specific inputs and to the same precision, every method must yield the same result for the mathematical consistency to be obtained, for reasons that are self-evident.

To take Mr Skeggs specific problem if an index of zero always yields unity, this is something many people have difficulty with on first acquaintance. The reason is that it arises from a mathematical pattern not always made explicit, in this case, the pattern being a simple numerical sequence. The matter can be made clear by setting out two identical sequences, one below the other, but having alternative format; the index form at the top, the rational form below:

10-2,	**10-1,**	**10x,**
101,	**102,**	**103,**
1/100,	**1/10,**	**1,**
10,	**100,**	**1000, ….**

The value in the upper sequence between 10^{-1} and 101 has been written as 10x where x is assumed initially to be unknown. Clearly, the rule for generating the lower sequence is to multiply the previous value by ten to obtain the next value in order when moving from left to right. Similarly the rule for generating the corresponding upper index form sequence is to add one to the previous index when moving one place to the right, so: -2+1=-1, -1+1 =0, 0+1=1, 1+1=2 etc.

With this rule applied to the index sequence, it becomes obvious that the necessary value for x is zero, i.e. x = 0. Thus the mathematical pattern in the index case is simply an integer sequence. From observation the mathematician defines 100 =1 for consistency.

The power of mathematics derives from its ability to generalise. In the above example, where the base equals 10, if the value 10 is replaced by the symbol b, the two identical sequences become:

b-2,	**b-1,**	**b0,**
b1,	**b2,**	**b3,**
….1/bxb,	**1/b,**	**1,**
b,	**bxb,**	**bxbxb,….**

Again, the lower sequence is obtained by multiplying the previous value by b, while the upper index sequence is unchanged except for the substitution of base 10 by symbol b. Hence, the numerical value of base b is of no consequence; b could be equal to, say, the lottery magnitude number 7 294 628 and it would still be the case that 72946280 = 1. For generality, the mathematician again defines b0 =1 and –b0 = -1 for consistency, whatever finite value b may take. On first acquaintance the notation 72946280 = 1 does not immediately strike one as being self-evidently true, and this is the cause of the difficulty when this sort of statement is first encountered. But, once the logic of the pattern-derived rule is laid out, the matter becomes obvious enough.

Mr Skeggs should not despair, most of us have been in the same position on many occasions. The celebrated Professor Silvanus P. Thompson FRS, author of the textbook Calculus Made Easy, wrote a prologue containing a statement known to a generation of students: “Considering how many fools can calculate, it is surprising that it should be thought either a difficult or a tedious task for any other fool to learn how to master the same tricks. What one fool can do, another can”.

How very true!

P. Welch
Horsham
UK

Corrections

In my circuit idea ‘Precision A-weighting filter’ published in the Electronics World December 2004 issue on page 46 there are several minor corrections to be mentioned:

1. Figures 4 and 5: x-axis is frequency from 20Hz to 20kHz (log scale)
2. Figure 5: black trace = X; red trace = Y
3. Appendix 4.: a (B) is valid for non-equalised white noise only

Burkhard Vogel
Stuttgart, Germany

Please send your letters to:
“Electronics World”
Highbury Business,
Media House,
Azalea Drive, Swanley,
Kent BR8 8HU

e-mail:
ewletters@highburybiz.com
using the heading ‘Letters’

Electronics World reserves the right to edit all correspondence.

Smart and ultra thin

Measuring just 29x22x0.4mm and weighting only 0.6g, the Cardpower battery from VARTA Microbattery GmbH aims to address the powering needs of smartcard applications. The primary battery offers energy density of 270Wh/l or 110Wh/kg and a capacity of 3V at 25mAh.

The batteries are capable of delivering a maximum current of 5mA and will operate under normal conditions for more than three years. The series offers pulse load capability at 80mV and volt drop at C/5.

The Cardpower battery fits neatly between the layers of a smartcard, connecting directly to the processing die and any additional circuitry, such as a display and RF circuitry. Applications for these cards range from security utilising biometrics, to audio cards, as well as transportation cards and various other types of payment cards.

www.varta-microbattery.com

Ignios announces product System Weaver v1.0

Ignios Ltd, a recent entrant in the embedded multicore System-on-Chip (SoC) market, recently announced the availability of SystemWeaver version 1.0.

SystemWeaver addresses the software challenges of multicore architectures in the embedded IC market.

It consists of the parameterisable, synthesisable SystemWeaver IP core and the SystemWeaver API. A SystemC model of the core and reference models of SystemWeaver-enabled SoCs are also included. The SystemWeaver API provides a unified abstraction layer for complex multicore devices. This abstraction allows embedded systems designers to develop and debug multicore applications more effectively, improving time to market.

The key underlying system management and communications functions are implemented natively in a SystemWeaver IP core that is integrated on-chip.

SystemWeaver is compatible with existing and proposed interconnect, RTOS and processor technologies and requires minimal changes to the host chip architecture.

www.ignios.com

Matlab's 64-bit Linux support

The MathWorks today announced new support for the Matlab and Simulink product families on AMD64 and Intel EM64T processors.

The MathWorks developed a version for the Linux x86-64 platform in response to the most frequent customer requests: large data set access and manipulation and optimal computational performance.

Matlab support for the x86-64 architecture removes the 4GB memory limit imposed by 32-bit operating systems that restricts the size of applications' data files. As a result, users can work with much larger data sets.

"Often, customers make current platform decisions based on future application requirements. Many have indicated they plan on moving to x86-64 platforms," said Leslie Mehrez, Matlab marketing manager at The MathWorks.

Support for the 64-bit version of the Linux operating system on x86-64 processors is currently available with the recently released Matlab 7 and Simulink 6.

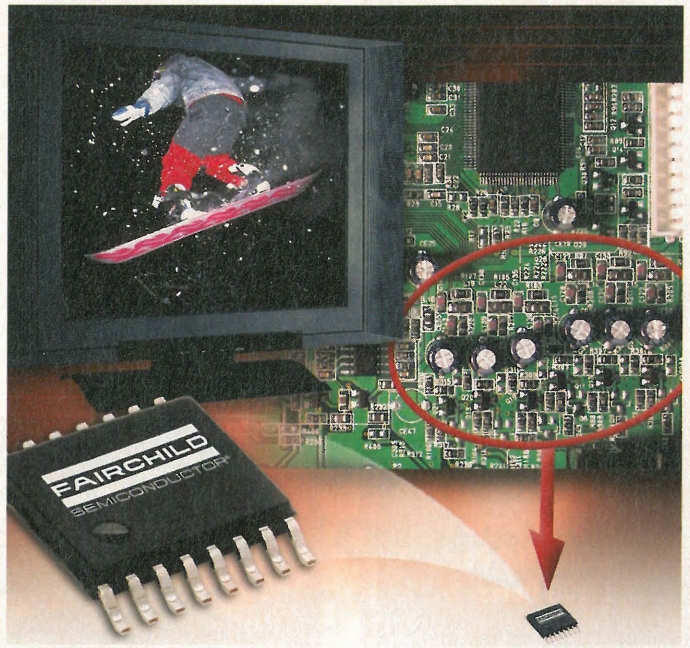
www.mathworks.com

New video filter/drivers reduce board space

Fairchild Semiconductor has announced a new family of highly integrated video filter/drivers. They can replace as many as 80 parts to help designers lower pick-and-place design costs and reduce board space by up to 20% in video applications.

The new Fairchild FMS6143, FMS6145 and FMS6146 multi-channel devices significantly decrease test- and design-time, and increase image quality in DVD, LCD, TV, set-top box and other digital consumer products.

The 3-, 5- and 6-channel, 4th order filter/drivers improve image quality when used to replace discrete products in traditional 3rd order passive solutions. Compared to passive designs, they provide better inband and stopband filter characteristics that reduce artefacts in video signals and result in higher image quality. By providing 8MHz cut-off frequency and 48dB stopband attenuation, these devices meet standard definition (SD) video requirements, while allowing them to be used as anti-aliasing or reconstruction 'video out' filter drivers. Internal diode clamps and bias circuitry enable the video filter/drivers to accommodate AC- or DC-coupled input signals.



The outputs on each device can drive AC- or DC-coupled single (15Ω) or dual (75Ω) coaxial cable loads.

www.fairchildsemi.com

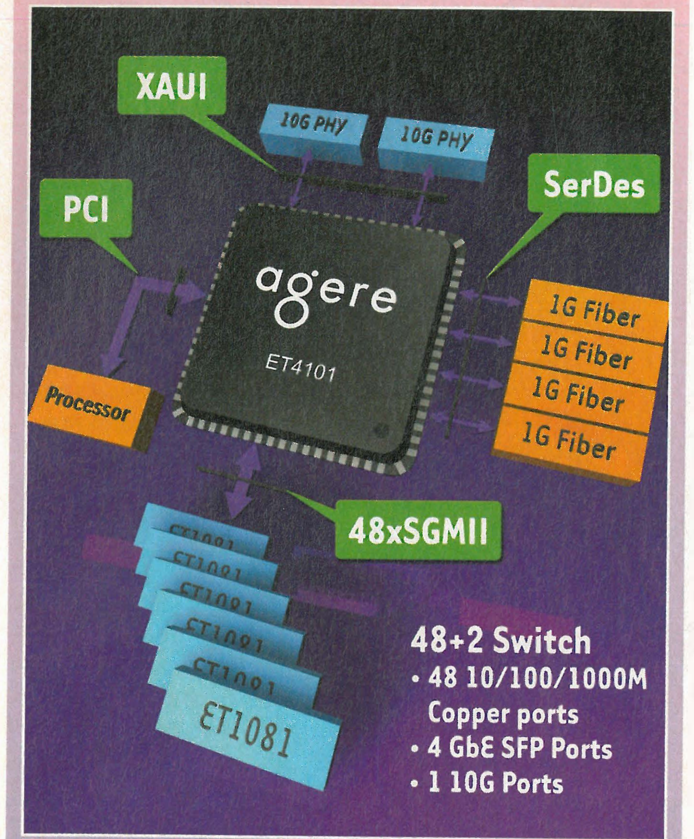
Bridge chips simplify USB to serial connectivity

Intelligent USB to serial port bridge chips from Oxford Semiconductor provide serial port peripherals with the instant plug-and-play connectivity and high-speed data transfer of full-speed USB2.0. The single UART OXUSB950 and quad UART OXUSB954 feature an integral 12Mbps transceiver and serial interface engine and support baud rates up to 230kbps.

Supported by a complete set of royalty-free USB host device drivers, the bridge chips create transparent interfaces between USB and serial ports that require no firmware changes. For legacy applications, the OXUSB95x chips provide a simple means to upgrade peripherals from serial to USB communication. Power economy is assured by the integral USB suspend/resume function.

Handling USB transaction and control data processing is the bridge chip's advanced 16-bit microcontroller. Operating at 5MIPS and featuring 3kB of on-board RAM and masked ROM, the controller also offers the flexibility and processing power to enable development of peripherals able to process data before it is passed to the host PC.

www.oxsemi.com



Industry's first single-chip 48-port GbE

Agere Systems launched what it claims is industry's first single-chip 48-port Gigabit Ethernet (GbE) switching chip and the lowest power GbE octal physical layer device (PHY) for enterprise networking equipment.

The solution uses seven chips – one switch system on a chip (SoC) and six octal PHYs – to build a complete 48-port GbE switch with two 10Gbit/s Ethernet ports.

The TruePHY ET1081 octal PHY has a power consumption of less than 500mW per port. Inherent in the TruePHY architecture is highly advanced cable diagnostics, with the precision and accuracy to pinpoint a break in 100m or more of standard CAT5 cabling.

The four new GbE switch-on-a-chip devices are part of Agere's ET4K family of switching silicon. The ET4000 supports 24 10/100/1000Mbit/s Ethernet ports and four Gigabit SerDes ports. The ET4100 supports 24 10/100/1000Mbit/s Ethernet ports, with four Gigabit SerDes ports and two 10Gbit/s Ethernet ports. The ET4001 supports 48 10/100/1000Mbit/s Ethernet ports and four Gigabit SerDes ports. The ET4101 supports 48 10/100/1000Mbit/s Ethernet ports, four Gigabit SerDes ports and two 10Gbit/s Ethernet ports.

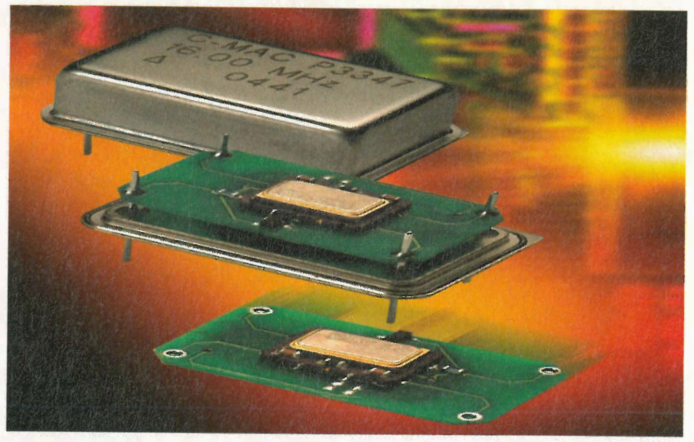
www.agere.com

TC-OCXO technology promises OCXO stability

C-MAC MicroTechnology has unveiled TC-OCXOs (temperature-compensated oven-controlled crystal oscillators), designed to deliver the high stability of an OCXO from a device with low power consumption, small size and light weight comparable to those of a TCXO. Capable of stabilities better than ±0.05ppm over the full operating temperature range, C-MAC TC-OCXOs will initially be aimed at mobile, battery powered and remote applications such as GPS, satellite comms, distress beacons and secure radio.

Ambient temperature variation is one of the main causes of frequency variation in a crystal oscillator. To overcome this, C-MAC TC-OCXOs use a hybrid combination of limited temperature control, by use of an oven, and further reduction of the remaining frequency error through C-MAC's proprietary Pluto temperature compensation ASIC.

www.cmac.com



MultiSwitch can be powered by two sources

Riello Galatrek has launched a new product called MultiSwitch - an intelligent automatic transfer switch. It can be powered from two independent power sources to achieve standby power protection should one source fail suddenly. Up to eight separately connected network devices can be powered from its output sockets.

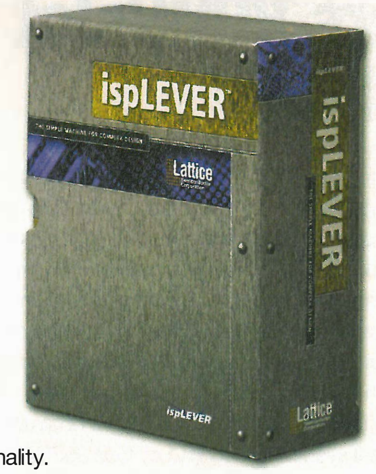
MultiSwitch is ideal for complex computer and Voice over IP (VoIP) networks requiring maximum uptime, and provides the added advantage of allowing users to monitor and control their connected devices.

The power sources to a MultiSwitch can be a combination of two independent mains supplies, uninterruptible power supplies or a combination of the two. Each source has to be rated to support the full load placed on the eight output sockets.

MultiSwitch can be installed with a single power source to allow the dual feed option to be activated at a late stage of growth of the network.

www.riello-ups.co.uk

Upgraded logic tool is comprehensive



The next generation of ispLEVER programmable logic design tool suite is now available from Lattice Semiconductor. The ispLEVER 4.2 release is a comprehensive upgrade and enhancement of the design tool suite's performance and functionality.

FPGA Fmax performance has been increased by an average of 22% and map, place and route run-times have been reduced by 24% for a typical design, lessening the demand on computing resources. Enhancements include an I/O Assistant for efficient placement of mixed I/O types, new Power Calculator and ispTRACY Logic Analyzer tools, a new Project Creation Wizard, major upgrades in static timing analysis, floorplanning and DSP design, and a significantly faster and more fully featured ModelSim Simulator from Mentor Graphics. The tool suite includes Synplicity's Synplify 7.7 as a standard feature.

http://www.latticesemi.com/

MCUs with 512k Flash

Supporting the industry migration from 8-bit to 32-bit microcontrollers (MCUs), Royal Philips Electronics announced the first five of a series of 32-bit MCUs with up to 512kB of on-chip Flash memory. Philips's LPC2130 series establishes a new price/performance ratio for the 32-bit ARM7 segment. Designed for a wide variety of embedded system applications, including industrial control, computing peripheral and medical markets, the LPC2130 series offers the fastest Flash memory available on 0.18µm CMOS technology, ultra-low-power operation and built-in error correction.

On-chip Flash memory is a critical component in systems that require additional computing muscle and real-time response. The LPC2130 series (LPC2131, LPC2132, LPC2134, LPC2136 and LPC2138) uses 128bit-wide Flash memory. This enables four 32-bit words to be accessed in a single fetch, allowing the CPU to run at 60MHz (54MIPS) without wait-states.

www.semiconductors.philips.com

40Gbit/s InP modulators ready now

The Centre for Integrated Photonics (CIP) has launched a range of electro-absorption modulators fabricated using indium-phosphide (InP). Available in 40Gbit/s and 10Gbit/s versions for either single wavelength or DWDM communications applications, the devices offer compelling advantages as building blocks for next-generation optical networks including low insertion loss, very small size, high bandwidth and low drive voltages.

A key feature of CIP's electro-absorption modulator (EAM) device design is low insertion loss. Figures of 4.5dB or 4dB typical for the 40Gbit/s and 10Gbit/s variants respectively provide good power margins for system design. This feature stems from novel structures employed in the devices including buried heterostructure geometry.

The 40Gbit/s version of the device – 40G-SR-EAM – offers bandwidth of 32GHz, typical for high-quality error-free transmissions and a drive voltage of just 2.9V. These parameters compare well to modulators fabricated from lithium-niobate but result in a dramatically smaller footprint.

The 10Gbit/s version of the device – 10G-LR-EAM – offers a minimum bandwidth of 10GHz and a drive voltage of 2.9V. Both devices are offered in a compact package with a K connector, or in chip-on-carrier form.

The CIP has a long pedigree in optoelectronics, having previously been part of Corning, and before that, British Telecom's Photonic Technology Research Centre. The organisation has its own semiconductor fabrication plant and is able to create variants of the EAM devices with application-specific performance requirements.

www.ciphotonics.com

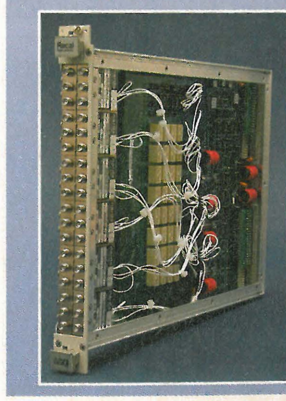
New platform provides three times VXI switches' density

Racal Instruments has introduced the 1260-67M, six-position, single-slot VXI, modular, microwave, switch platform. With it users can specify up to twelve combinations of various 18GHz and/or 26GHz switches, thereby receiving up to three times the density of competing 26GHz VXI switch modules.

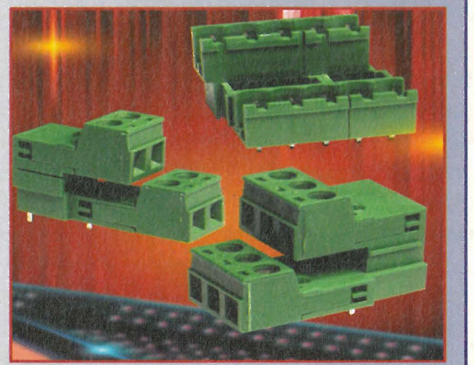
The 1260-67M platform provides a choice of eight switch types, including 18GHz and 26GHz 1x2, multi-throw and transfer switches. This modular approach means that there is no need to purchase separate C-size cards for each type of microwave switch needed in a system. The inherent modularity of the platform addresses sparing as well as upgrading. Should relay replacement be necessary, relays can be removed and replaced in less than five minutes, without removing the module from the VXI system. This approach not only facilitates the replacement of failed relays, but also enhances the field upgrade capability of this switch card.

Maximising system uptime, facilitating field upgrades and sparing and reducing MTTR are inherent significant features of this high-performance switch platform.

www.racalinstrumentsgroup.com



Double-decker PCB connectors



A new range of double-decker PCB connectors is now available from Camden Electronics. They are designed for use in applications where a high-density of connections is required.

The CTB9350DD series is available in two and three pole versions and are end-stackable. They interlock to allow any number of poles to be built up to customer specification.

The double-decker construction enables twice the number or poles to be connected in the same space as single decker versions. Pins are available in straight or 90^0, enabling cables to be connected in either orientation. Two versions are available with 5mm and 5.08mm pitch, respectively.

The connectors are moulded from UL94V0 green PA68 and feature tin-plated copper contacts rated at 12A for 450/750 operation. Insulation resistance is equal or greater to 5MΩ and dielectric strength is 2500V AC. PCB mounting hole diameter is 1.6mm. Maximum operating temperature is 125^{0}C.

www.camdenelec.com

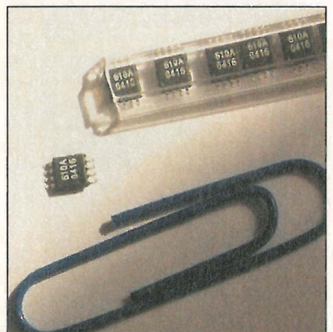
CPCI Ventus chassis offers 80W/slot cooling

The new entry-level Ventus 12U, 21-slot IEEE1101.10-compliant chassis from APW Electronic Solutions provides 80W per slot cooling. Power consumption and system packaging density continue to rise inexorably, but for reliable long-term operation, maximum allowable silicon die temperature has remained stable at around 85°C.

Ventus chassis cooling is provided by APW's patented, hybrid serial/parallel fan arrangement. Three hot-swap, pluggable FRUs, each containing three separate fans, provide airflow of 850LFM (linear feet/minute) through all 21 slots with 70% obstruction in each slot position. Total system throughput of air is 255CFM (cubic feet/minute). In the event of a single fan failure, airflow is maintained at just under 800LFM per slot or 240CFM total. The chassis has positions for up to three, independently cooled, AC or DC input, 600W power supply units. These are hot swappable and can be populated as required to suit the power demands and configuration of the system.

www.apw.com

Monolithic magnetic digital isolators designed for hybrids



Fully monolithic digital isolators, which have low power dissipation, can be used to replace opto-couplers in isolation functions, as line voltage window comparators or as isolated RS422 receivers, isolated relay drives and isolated wired-or alarms.

The couplers are failsafe and DC-stable but, unlike optocouplers, have no intrinsic wear out mechanism. The new range has floating coil input, which is simple to interface to any input voltage from 0.5V to 400V through a current limiting resistor. The series allows data rates of up to 40MBd and pulse width distortions of 7ns.

The MSOP package option makes this range one of the smallest isolators available. The isolator is also available in a single die for easy mounting on hybrids. The range offers isolation of up to 2500V rms in PDIP and SOIC packages and 1000V rms in an MSOP package.

There are two output configurations, CMOS and open drain for wire-or connection. Approval to UL1577 and IEC061010 is pending.

www.rhopoint.co.uk

ADVERT INDEX

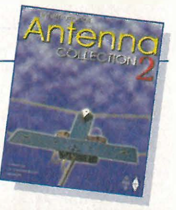
CLASS D	P63
CRICKLEWOOD	P51
DERBY UNIVERSITY	I.F.C
EASYSYNC	P12
JOHNS RADIO	P63
JPG	P63
NEWBURY	P31
OLSON	P23
P.C INSTRUMENT	P24
PEAK ELECTRONIC DESIGN	I.B.C
QUASAR	P2
STEWARTS OF READING	P30
TEST EQUIP SOLUTIONS	O.B.C
TELNET	P10
TIE PIE	P45
WARWICK WIRELESS	P11
WESTDEV	P11

The Electronics World Book Service offers you access to our team of specialist publishing experts. Through us you can order any book currently in print from **War and Peace** to **Reference Data for Engineers**. Simply use the form opposite to place an order, all books are delivered free of charge* within the UK.

For Credit Card orders or any queries, call 01737 81 27 27 or fax 01737 81 35 26. These order/helplines are open from 9am to 5pm Monday to Friday. For out-of-hours orders you can leave a message on the above line or, alternatively, e-mail us at boffinbooks@tiscali.co.uk. When placing an order please quote your Name, Address (Home and Delivery), Contact Telephone Number, Debit/Credit Card Number, Expiry Date/Issue Number, Details of your order.

Please note: Printed prices may change but are correct at time of going to press.

INTERNATIONAL ANTENNA COLLECTION
Edited by George Brown



This book collects together some of the best articles from around the world on the subject of antennas. It will appeal to radio amateurs in general, whether they be antenna enthusiasts or not. It is a follow-up to the successful The International Antenna Collection, compiled by the same editor.

2003

£11.99 Code 1-8723-0993-3

BACKYARD ANTENNAS
Peter Dodd

Radio amateurs and short-wave listeners all want to achieve the very best from their HF and VHF equipment. Receivers and transmitters are available to professional standards, but very few people have the real estate to erect the sort of antenna used by a commercial radio station. The book covers end-fed and centre-fed antennas, rotary beams, loops, tuning units, VHF/UHF antennas, antenna and mast construction, transmission lines, and how to estimate and measure the performance of your antenna.

2000 • 208 pages • PB

£18.99 Code 1-8723-0959-3

RSGB YEARBOOK 2005
Edited by Steve White

New for the 2005 edition of the RSGB Yearbook is the 'Contesting Guide', your complete guide to RSGB contests from HF to microwave. You will also find features on Topband Direction Finding and the Mills Weekend. This edition contains a huge list of all the Foundation, Intermediate and Advanced amateur radio courses available, plus a list of Examination Centres. IOTA receives extensive coverage, with a feature on IOTA's 40th Anniversary, information on the awards scheme, the Honour Roll and Annual Listing.

2000 • 488 pages

£16.99 Code 1-8723-0998-4

CALLSEEKER PLUS 2005
Edited by Steve White

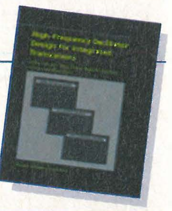
As **RSGB Yearbook 2005** in CD-ROM format. Callseeker Plus is ideal for every radio amateur who prefers to search for data electronically rather than look it up in a book. It is essential for those who require the callsigns and addresses of amateurs in the European countries covered.

Whether or not you have the RSGB Yearbook, you should get a copy of Callseeker Plus 2005 for your PC!

CD-ROM • Compatible with windows 95/98 or greater

£11.99 Code 1-8723-CSP2005

HIGH-FREQUENCY OSCILLATOR DESIGN
Johan van der Tang, Dieter Kasperkovitz & Arthur van Roermund

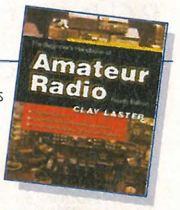


This text covers the analysis and design of all high-frequency oscillators required to realize integrated transceivers for wireless and wired applications. This includes the design of oscillator types as single-phase LC oscillators, I/Q LC oscillators, multi-phase LC oscillators, and ring oscillators in various IC technologies such as bipolar, BiCMOS, CMOS, and SOI (silicon on insulator). Starting from an in depth review of basic oscillator theory, the authors discuss key oscillator specifications, numerous oscillator circuit topologies, and introduce the concepts of design figures of merit (FOMs) and benchmark FOMs.

2003 • 343 pages • HB

£78.00 Code 1-4020-7564-2

BEGINNERS HANDBOOK OF AMATEUR RADIO
Clay Laster



This text provides the reader with the necessary electronics background to begin "hamming" and to help with preparations for the FCC novice or "no-code" technician class license examinations. It covers the basics of wave propagation, power supplies and electronic circuits.

4th edition • 2000 • 550 pages • PB

£25.99 Code 0-0713-6187-1

AN ANALOG ELECTRONICS COMPANION
Scott Hamilton

Engineers and scientists frequently find themselves having to get involved in electronic circuit design even though this may not be their specialty. This book is specifically designed for these situations, and has two major advantages for the inexperienced designer: it assumes little prior knowledge of electronics and it takes a modular approach, so you can find just what you need without working through a whole chapter. A major bonus and learning aid is the inclusion of a CD with the student edition of the PSpice simulation software, together with models of most of the circuits described in the book.

April 2003 • 668 pages & CD • HB

£75.00 Code 0-5217-9838-8

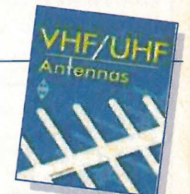
ANTENNA TOPICS
Pat Hawker

If you are interested in antennas this book is a goldmine of information and ideas on the subject. Pat Hawker has been writing his "Technical Topics" column in Radcom since 1958 and in this time has produced much excellent work in this time. This book is a chronological collection of cuttings of Pat's words over the years. Hundreds of areas and subjects are covered and many a good idea is included. Carefully indexed this book is not only a great reference work but also a history of over forty years of antenna design. At 384 pages this book is excellent value and asset to any amateur interested in antennas.

2002 • 384 pages • PB

£18.99 Code 1-8723-0989-5

VHF/UHF ANTENNAS
Ian Poole



This great new book from the popular author Ian Poole investigates the exciting area of VHF and UHF antennas. The VHF and UHF bands provide an exciting opportunity for those wishing to experiment, whilst the antenna sizes at these frequencies mean that they do not occupy great amounts of space.

2002 • 128 pages

£13.99 Code 1-8723-0976-3

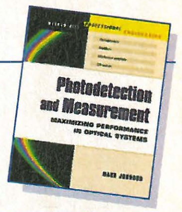
RSGB RADIO AMATEUR CALL BOOK
Radio Society of Britain

For the First Time you can get up to date UK call information on a CD with World Call data. Taking over from the **Pegasus Flying Horse CD** is the **RSGB Radio Amateur Call Book**. Using the very latest UK, Europe and US call data, makes this the most up-to-date and very best World Call CD available. Requiring no hard disk installation this CD has an easy to use and effective interface. The "RSGB Radio Amateur Call Book" is compatible with existing logging software and all operating systems from DOS to Windows XP.

Summer 2004 Edition • CD-ROM

£39.99 Code RSGB CD Amateur

PHOTODETECTION AND MEASUREMENT
Mark Johnson



Using basic theory, fully-worked calculation, circuit snippets and rules-of-thumb, this book conveys the know-how of good opto-electronic design, from low-noise receivers to synchronous detection. "TRY IT" topics provide light-hearted demonstrations of key points. The grad student starting in photonics and the engineer optimising an opto-electronic product will benefit particularly!

2003 • 298 pages • HB

Special Offer - Only £40.00 - normally £45.00 Code 0-0714-0944-0

ADVANCED TECHNIQUES IN RF POWER AMPLIFIER DESIGN
Steve C. Cripps

A reference tool for RF-, digital- and system-level designers, this book discusses the most critical topics for professionals in the field, including envelope power-management schemes and linearization. This volume builds on the author's work, "RF Power Amplifiers for Wireless Communications".

2002 • 400 pages • HB

£75.00 Code 1-5805-3282-9

BASIC ENGINEERING CIRCUIT ANALYSIS
J. Irwin

Presentation of first and second-order transient circuits has been streamlined, derivations have been eliminated and MATLAB solutions have been added. In addition, practical examples have been added throughout.

7th edition • 2003 • 704 pages • HB

£36.95 Code 0-4713-8049-0

HANDS-ON ELECTRONICS A PRACTICAL INTRODUCTION TO ANALOG AND DIGITAL CIRCUITS
Daniel M. Kaplan

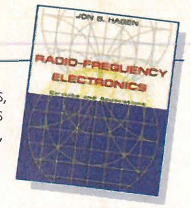
Packed full of real circuits to build and test, Hands-On Electronics is a unique introduction to analog and digital electronics theory and practice. Ideal both as a college textbook and for self-study, the friendly style, clear illustrations and construction details included in the book encourage rapid and effective learning of analog and digital circuit design theory.

May 2003 • 226 pages • PB

£19.95 Code 0-5218-9351-8

ELECTRONICS WORLD www.boffinbooks.com BOOKS

RADIO-FREQUENCY ELECTRONICS: CIRCUITS AND APPLICATIONS
Jon B. Hagen



This accessible and comprehensive book provides an introduction to the basic concepts and key circuits of radio frequency systems, covering fundamental principles which apply to all radio devices, from wireless data transceivers on semiconductor chips to high-power broadcast transmitters. Topics covered include filters, amplifiers, oscillators, modulators, low-noise amplifiers, phase-locked loops, and transformers. Applications of radio frequency systems are described in such areas as communications, radio and television broadcasting, radar, and radio astronomy.

1997 • 372 pages • HB

£29.95 Code 0-5215-5356-3

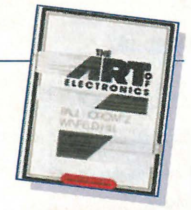
NAZI WIRELESS PROPAGANDA: LORD HAW-HAW AND BRITISH OPINION IN THE SECOND WORLD WAR
Martin Doherty

An analysis of the Nazi wireless broadcasts to Britain during the Second World War and the impact of the propaganda on the British public. Propaganda is presented in context: the purposes behind it, the changing patterns, themes, styles and techniques employed, and the impact upon the target audience and its morale.It is accompanied by a compact disc containing recordings of 24 German wartime broadcasts to Britain.

2000 • 256 pages & CD • PB

£19.00 Code 0-7486-1363-3

THE ART OF ELECTRONICS
Paul Horowitz

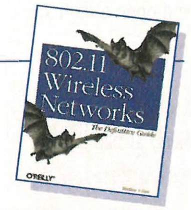


Best selling Electronics title of all time! Widely accepted as the single authority text and reference on electronic circuit design, both analog and digital.

2nd edition • 1989 • 1152 pages • HB

£50.00 Code 0-521-37095-7

802.11 WIRELESS NETWORKS: THE DEFINITIVE GUIDE
Matthew S. Gast

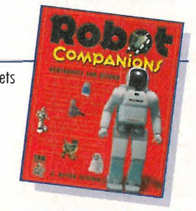


As a network administrator, architect, or security professional, you need to understand the capabilities, limitations, and risks associated with integrating wireless LAN technology into your current infrastructure. This guide offers the information needed to analyze and deploy wireless networks.

2002 • 464 pages • PB

£31.95 Code 0-596-00183-5

ROBOT COMPANIONS: MENTORBOTS AND BEYOND
Oliver Severin



Robots are everywhere in the hobbyist market, but they are also being used in very practical markets for companionship, supervision and tutoring. This work explores this burgeoning field with instructions on how to build your own companion robot.

2003 • 320 pages • PB

£17.99 Code 0-07-142212-9

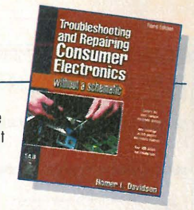
C IS FOR CONTROL: A LABORATORY TEXT FOR HARDWARE INTERFACING WITH C AND C++
John Blankenship

Designed for those with minimal C/C++ knowledge, this unique and practical book covers the use of C for controlling external devices and focuses on C's application and on interfacing the computer to the outside world.

1999 • 245 pages • PB

£45.99 Code 0-0231-0742-1

TROUBLESHOOTING AND REPAIRING CONSUMER ELECTRONICS WITHOUT A SCHEMATIC
Homer L. Davidson

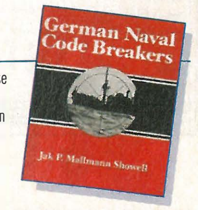


In this updated new edition of his bestselling guide, Homer Davidson, one of the most respected names in the field of consumer electronics, provides experienced, hands-on information and advice on how to troubleshoot and repair a wide range of electronic units when you don't have the benefit of schematic diagrams. This edition has been revised to be part of the TAB Electronics Technician Library, with special troubleshooting flowcharts added.

3rd edition • 2004 • 560 pages • PB

£21.99 Code 0-0714-2181-5

GERMAN NAVAL CODE BREAKERS
Jak P. Mallmann Showell



Less well-known than their British equivalents at Bletchley Park, the successes and failures of those working in the branch of German naval intelligence tasked with breaking Allied codes also had a significant impact on the progress of World War II. Significant new light is shed on many events in the war at sea.

2003 • 160 pages • HB

£24.99 Code 0-7110-2888-5

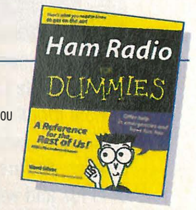
PRACTICAL ELECTRONICS FOR INVENTORS
Paul Scherz

Aimed at students and hobbyists, this book gives all would-be inventors an introduction to the fundamentals of electronics, covering everything from equipment and devices to components and products.

1999 • 600 pages • PB

Special Offer - Only £25.00 - normally £29.99 Code 0-07-058078-2

HAM RADIO FOR DUMMIES
Silver



Explains what ham radio is, what readers need to get started, how to become a licensed operator. The contents include: What Is Ham Radio All About? Getting a Handle on Ham Radio Technology. Finding Other Hams: Your Support Group. The Licensing Process. Making Contact and everything you would ever wish to know about Ham radio.

2004 • 384 pages • PB

£14.99 Code 0-7645-5987-7

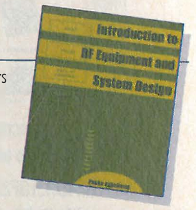
WI-FOO: THE SECRET OF WIRELESS HACKING
Andrew Vladimirov

The first book devoted entirely to Wireless LAN penetration testing. Asks "How can wireless security be compromised?" and "What can be done about it?".

2004 • 555 pages • PB

£29.99 Code 0-3212-0217-1

INTRODUCTION TO RF EQUIPMENT AND SYSTEM DESIGN
Pekka Eskelinen



An excellent resource for engineers and engineering students alike this practical design guide offers you a comprehensive overview of the most important aspects and components of radio frequency equipment and systems.

2004 • 280 pages • HB

£66.00 Code 1-5805-3665-4

ELECTRONICS WORLD ORDER FORM

CODE	DESCRIPTION	QTY	PRICE
....	....	....	....
....	....	....	....
....	....	....	....
....	....	....	....

(POSTAGE AND PACKING **FREE** TO UK ADDRESSES*) **TOTAL** ....

NAME .... DAYTIME TEL ....

ADDRESS ....

.... POSTCODE ....

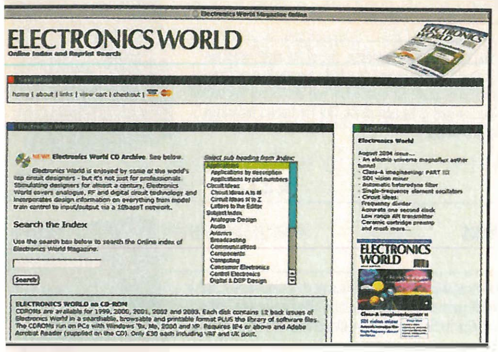
EMAIL ADDRESS ....

I ENCLOSE A CHEQUE / POSTAL ORDER FOR £.......... PAYABLE TO 'BOFFIN BOOK SERVICES LTD' **OR** PLEASE DEBIT MY ACCESS / VISA / SWITCH / DELTA CARD ISSUE NUMBER ...... EXPIRY DATE ....

CARD NUMBER .... SIGNED ....

POST TO **BOFFIN BOOK SERVICES LTD, 24 WALTON STREET, WALTON-ON-THE-HILL, TADWORTH, SURREY KT20 7RT, UK** * for postage charges to addresses outside the UK, please contact our sales team

Tel 01737 812727 • Fax 01737 813526 • E-mail boffinbooks@tiscali.co.uk

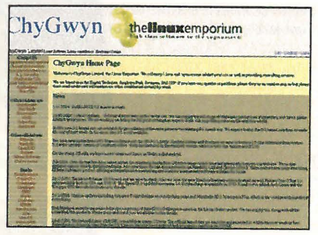


www.ewmag.co.uk

To reserve your web site space phone Ed Robinson e.robinson@highburybiz.com tel: 01322 611260 fax: 01322 616339

CHYGWYN

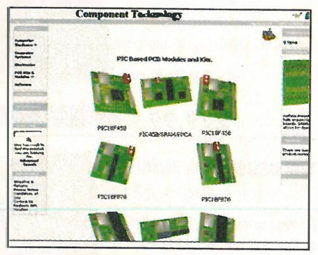
www.chygwyn.com



ChyGwyn Limited offers electronic design and embedded software development for remote monitoring, embedded appliances, set-top boxes and similar devices. We are experts in customisation of Linux and write device drivers for custom hardware.

COMPONENT TECKNOLOGY

www.component-tecknology.co.uk



- PIC microcontroller kits and modules for students and hobbyist.
- 18F45X,16F87X Proto-Boards for ease and fast development of project ideas.
- Infrared Illuminators for CCTVs in low ambient light security areas.
- Analogue 8-channel high voltage isolator. Data logging.
- 5% discount code 'elwwdir2004' for Electronics World readers.
- Consultancy
- TIG control systems – REIS interface.
- Real-time X-ray Imaging.

DB TECHNOLOGY

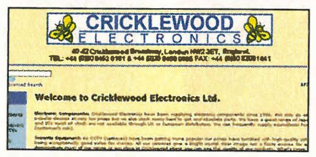
www.dbtechnology.co.uk/

Anechoic chamber and open area test site.

- Compliance Tests
- Fixes included. FCC Listed.
- Flexible hourly booking available.
- Rapid, accurate pre-compliance tests.

CRICKLEWOOD ELECTRONICS

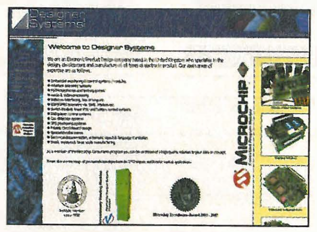
www.cricklewoodelectronics.co.uk



Cricklewood Electronics stock one of the widest ranges of components, especially semiconductors including ICs, transistors, capacitors, all at competitive prices.

DESIGNER SYSTEMS CO

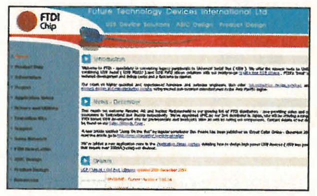
www.designersystems.co.uk



Electronic product design company with over a decade of experience promoting it's own product range and designing and manufacturing innovative products for client companies/individuals.

FUTURE TECHNOLOGY DEVICES INTL LTD

www.ftdichip.com



FTDI designs and sells USB-UART and USB-FIFO interface i.c.'s. Complete with PC drivers these devices simplify the task of designing or upgrading USB peripherals

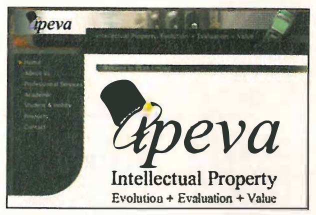
GREENWELD

www.greenweld.co.uk

Whether your interest is in electronics, model engineering, audio, computer, robots or home and leisure products (to name just a few) we have a wide range of new and surplus stock available.

IPEVA

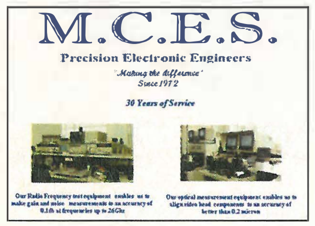
www.ipeva.com



Buy 'Morph-IC and other USB based FPGA development kits' Online.
Professional ASIC, FPGA and PCB design services, using Cadence, Mentor Graphics, NEXAR, PROTEL tools.
Tel 0870 080 2340

MCES LTD

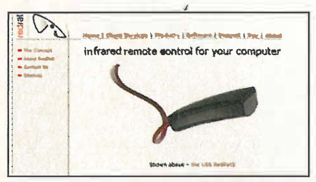
Web: www.mces.co.uk



MCES are a specialist electronics company providing a high quality repair, rework and re-manufacturing service to electronic modules and sub assemblies, including handling both large and small volume production and rework for major manufacturers. Established in 1972 we have continued to make large investments in specialised test equipment, surface mount technology and tooling enabling us to diagnose repair and verify a wide range of electronic modules to a very high standard. We also operate a fitting service for surface mount multi pin IC's and BGA's

REDRAT LTD

www.redrat.co.uk



Infrared remote control input and output for computers – USB and TCP/IP. Applications areas include:

- Home automation
- PC based multimedia installations
- Consumer electronics test systems
- Broadcast monitoring
- Show and theatre control

SOFTCOPY

www.softcopy.co.uk

As a PC data base or hard copy, SoftCopy can supply a complete index of Electronics World articles over the past ten years. Photo copies of articles from back issues are also available.

TELONIC

www.telonic.co.uk

Telonic specialists in laboratory AC & DC Power Supplies, Electronic AC & DC Loads, Electrical Safety Testing and complete test systems. Plus RF Filters, Attenuators, Diesel Engine Smoke Measurement, Quartz Crystal Microbalances.
Tel +44 (0) 118 9786911

TR CONTROL SOLUTIONS

www.trcontrolsolutions.com

We specialise in products and services for serial communications, protocol conversion, wireless communications and embedded ethernet.
Tel: +44 (0) 208 823 9230.

...and you thought advertising was expensive!

Call Ed Robinson on 01322 611260 and find out how you could reach 15,000 electronics engineers from just £2.89 per day!

Fax back this form on 01322 616339

Name ....

Company name..................................

Web address ....

Address ....

....

....

Postcode ....

Telephone number..............................

Fax number.......................................

Entry – no more than 100 words.

....

....

....

....

....

....

....

....

....

....

....

....

....

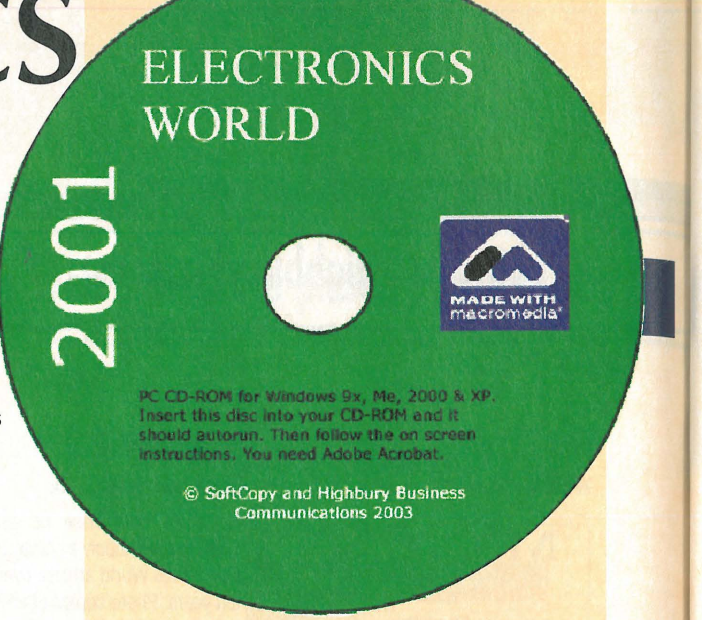
Include screenshot? Yes ❐ No❐

INTRODUCE YOUR WEBSITE TO 15,000 ELECTRONICS ENGINEERS

Linage only will cost £150 + vat for a full year. Lineage with colour screen shot will cost £350 + vat for a full year

ELECTRONICS WORLD

On CD-ROM

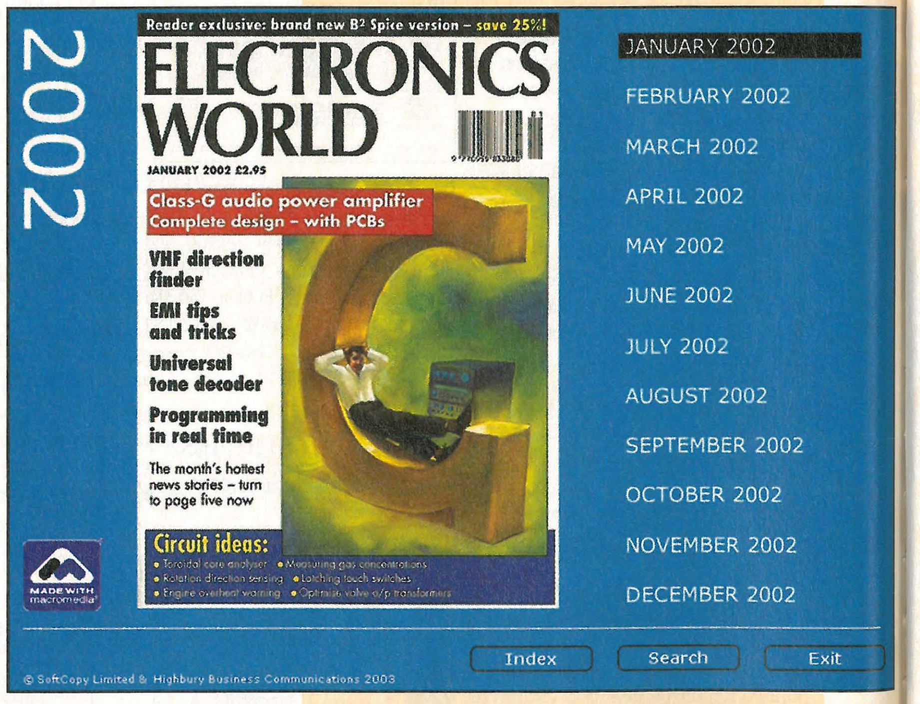


Electronics World is enjoyed by some of the world's top circuit designers - but it's not just for professionals. Stimulating designers for almost a century. *Electronics World* covers analogue, RF and digital circuit technology and incorporates design information on everything from model train control to input/output via a 10baseT network.. and it's now available all on CD-ROM.

- 12 issues on each CD-ROM
- Full text and diagrams of all articles, circuit ideas, letters etc
- Easy to browse
- Fully searchable by keywords and index
- High-quality print in colour
- Full software listings included
- easy to use

1999, 2000, 2001, 2002, and 2003

CDROMS are available for 1999, 2000, 2001, 2002 and 2003. Each disk contains 12 back issues of Electronics World in a searchable, browsable and printable format PLUS the library of software files. The CDROMS run on PCs with Windows '9x, Me, 2000 and XP. requires IE4 or above and Adobe Acrobat Reader (supplied on the CD).
The CDROMs are only £30 each including VAT and UK post, add £1 extra postage for Europe, £5 extra postage for rest of the world, exclusively available from SoftCopy Limited, address below.



Limited special offer for readers of Electronics World - all five CDs for the price of four.

Please send the following CD-ROMS

____qty 1999	NAME ____________
____qty 2000	Address ____________
____qty 2001	____________
____qty 2002	____________
____qty 2003	Card Number ____________ Expiry ________

Order now at:

www.ewmag.co.uk

SoftCopy Limited, 1 Vineries Close, Cheltenham GL53 0NU, UK
Tel: +44 (0) 1242 241455 Fax: +44 (0) 1242 241468 sales@softcopy.co.uk

WEB SITE WWW.JOHNSRADIO-UK.COM WWW.JOHNRADIO.COM
JOHNSRADIO ELECTRONICS TEST AND COMMUNICATION EQPT

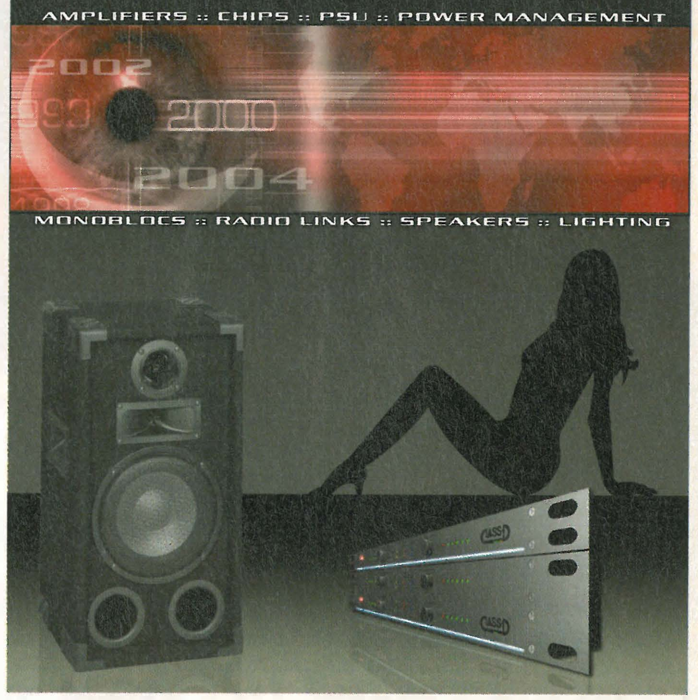
LARGE QUANTITY SALE EX M.O.D.

MARCONI TF2019A Synthesized Signal Generators - 80Khz to 1040Mc/s AM - FM - High Class with many functions - £285 each.
TEKTRONIX 2445 A OSCILLOSCOPE 150Mc/s Four Channel £300.
HP COMMUNICATION TEST SET 8922M - 10 - 1000Mc/s + GMS 83220E Converter 1710 - 1900Mc/s - DCS - PCS - MS £500
HP COMMUNICATION TEST SET 8922M OPT 010(Dual) etc, £750.
ALL UNITS AND PRICED EX WORKS WITH INSTRUCTIONS - TESTED BASIC WORKING. CARR + PACKING IF REQUIRED EXTRA.
Phone for appointment or to request item lists, photos, site map.
All welcome, Private or Trade, sales, workshop repairs or calibration
PLEASE CONTACT PATRICIA AT WHITEHALL WORKS, 84 WHITEHALL ROAD EAST, BIRKENSHAW, BRADFORD, WEST YORKSHIRE, BD11 2ER.
Tel: 01274 684007 Fax: 01274 651160
WEB SITE WWW.JOHNSRADIO-UK.COM WWW.JOHNRADIO.COM

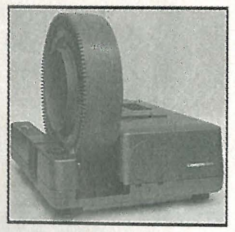
www.class-d.com

Class-D
45 Robin Hood Road,
Blidworth, Mansfield,
Notts, UK, NG21 0ST
Tel: 44 01623 405830
email: sales@class-d.com

class-d



WATCH SLIDES ON TV
MAKE VIDEOS OF YOUR SLIDES
DIGITISE YOUR SLIDES
(using a video capture card)



"Liesgang diatv" automatic slide viewer with built in high quality colour TV camera. It has a composite video output to a phono plug (SCART & BNC adaptors are available). They are in very good condition with few signs of use. For further details see www.diatv.co.uk ....£91.91+ vat = £108.00

Board cameras all with 512x582 pixels 8.5mm 1/3 inch sensor and composite video out. All need to be housed in your own enclosure and have fragile exposed surface mount parts. They all require a power supply of between 10 and 12v DC 150mA.

47MIR size 60x36x27mm with 6 infra red LEDs (gives the same illumination as a small torch but is not visible to the human eye)........£37.00 + vat = £43.48

30MP size 32x32x14mm spy camera with a fixed focus pin hole lens for hiding behind a very small hole........£35.00 + vat = £41.13

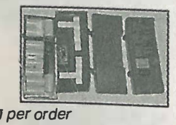
40MC size 39x38x27mm camera for 'C' mount lens these give a much sharper image than with the smaller lenses........£32.00 + vat = £37.60

Economy C mount lenses all fixed focus & fixed iris
VSL1220F 12mm F1.6 12x15 degrees viewing angle........£15.97 + vat = £18.76
VSL4022F 4mm F1.22 63x47 degrees viewing angle........£17.65 + vat = £20.74
VSL6022F 6mm F1.22 42x32 degrees viewing angle........£19.05 + vat = £22.38
VSL8020F 8mm F1.22 32x24 degrees viewing angle........£19.90 + vat = £23.38

Better quality C Mount lenses
VSL1614F 16mm F1.6 30x24 degrees viewing angle........£26.43 + vat = £31.06
VWL813M 8mm F1.3 with iris 56x42 degrees viewing angle........£77.45 + vat = £91.00

1206 surface mount resistors E12 values 10 ohm to 1M ohm 100 of 1 value £1.00 + vat 1000 of 1 value £5.00 + vat

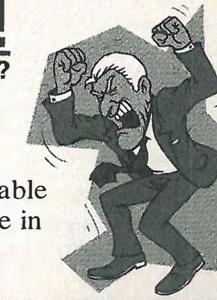
866 battery pack originally intended to be used with an orbitel mobile telephone it contains 10 1.6Ah sub C batteries (42x22dia the size usually used in cordless screwdrivers etc.) the pack is new and unused and can be broken open quite easily........ £7.46+vat = £8.77



Please add 1.66 + vat = £1.95 postage & packing per order

JPG ELECTRONICS
Shaws Row, Old Road, Chesterfield, S40 2RB
Tel 01246 211202 Fax 01246 550959 Mastercard/Visa/Switch
Callers welcome 9:30 a.m .to 5:30 p.m. Monday to Saturday

FRUSTRATED!



Looking for ICs TRANSISTORS?
A phone call to us could get a result. We offer an extensive range and with a World-wide database at our fingertips, we are able to source even more. We specialise in devices with the following prefix (to name but a few).

2N 2SA 2SB 2SC 2SD 2P 2SJ 2SK 3N 3SK 4N 6N 17 40 AD ADC AN AM AY BA BC BD BDT BDV BDW BDX BF BFR BFS BFT BFW BFX BFY BLY BLX BS BR BRX BRY BS BSS BSV BSW BSX BT BTA BTB BRW BU BUK BUT BUV BUW BUX BUY BUZ CA CD DX CXA DAC DG DM DS DTA DTC GL GM HA HCF HD HEF ICL ICM IRF J KA KIA L LA LB LC LD LF LM M M5M MA MAB MAX MB MC MDA J MJE MJF MM MN MPS MPSA MPSH MPSU MRF NJM NE OM OP PA PAL PIC PN RC S SAA SAB SAD SAJ SAS SDA SG SI SL SN SO STA STK STR STRD STRM STRS SV1 T TA TAA TAG TBA TC TCA TDA TDB TEA TIC TIP TIPL TEA TL TLC TMP TMS TPU U UA UAA UC UDN ULN UM UPA UPC UPD VN X XR Z ZN ZTX + many others

Please visit our website at
www.cricklewoodelectronics.com
17 thousand components in stock

Mail, phone, Fax, Credit Card orders & callers welcome.

Cricklewood Electronics Ltd
40-42 Cricklewood Broadway, London NW2 3ET
Tel: 020 8452 0161 Fax: 020 8208 1441
Visit our new www.cricklewoodelelectronics.com
Email: sales@cricklewoodelectronics.com

Service Link

ARTICLES WANTED

TOP PRICES PAID

For all your valves, tubes, semi conductors and ICs.

Langrex Supplies Limited

1 Mayo Road, Croydon, Surrey CR0 2QP
TEL: 020 8684 1166 FAX: 020 8684 3056

WANTED

BEST CASH PRICES PAID

FOR VALVES KT88, PX4 AND MOST AUDIO/OTHER TYPES.

Tel: 01403 784961

Billington Export Ltd
Sussex RH14 9EZ
Fax 01403 783519
Email: sales@bel-tubes.co.uk
Visitors by appointment

SERVICES

PCB-POOL®

FREE LAYOUT SOFTWARE!

- *Prototypes at a fraction of the cost*
- *Tooling and setup included*
- *Industry standard quality*
- *Any contour*
- *Follow up Services Runs*
- *CAM/CAD Consulting*
- *ONLINE Quotations*
- *ISO-Approved*

FREE with first order (while stocks last)

Freephone 0800-3898560

WWW.PCB-POOL.COM

Beta LAYOUT
Tel.: +353 (0)61 701170
Fax: +353 (0)61 701164
sales@beta-layout.com

SERVICES

From Concept To Production

X4 Rover

Electronic design and manufacturing services:

- Embedded monitoring & control
- PSTN telephones and test equipment
- Datacom interfacing, line driving etc.
- Printed Circuit Board design
- Industrial control and Safety systems
- Robotic products (wireless, GPS, control)
- LCD serial backer products
- Technical documentation, schematic layout & language translation
- Wireless telemetry systems
- Audio & Video processing and routing systems
- GSM telemetry via. SMS or data (TCP/IP)
- DVD player control products
- GPS positioning systems
- Small, medium & large scale manufacturing

Email: sales@designersystems.co.uk
Tel/Fax: +44 (0) 1872 223306

for more information see our web site @ http://www.designersystems.co.uk

Microchip Excellence Award 2001-2004

MICROCHIP Consultant Program Member

Member since 1998

Designer Systems .co.uk — Design & manufacturing in the UK

For a FREE consultation on how best to market your products/services to a professional audience ring ED on 01322 611260

To market your products/services to a professional audience ring ED on 01322 611260

POWER SUPPLY DESIGN

Switched Mode PSU
Power Factor Correction
designed to your specification
Tel/Fax: 01243 842520
e-mail: eugen_kus@cix.co.uk
Lomond Electronic Services

Service Link