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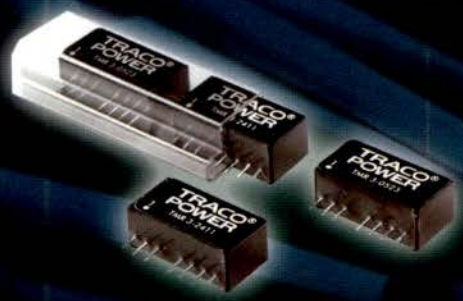

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A THING OF THE PAST?

Nice organisation, nice venue, fantastic looking promo posters – shame about the turnout. I'm describing the state of the recent show called National Electronics Week that took place at London's Earl's Court between 17th and 19th of June.

This is by no means a reflection on the organising team, who in their own words "have pulled all the stops out" to deliver a "premier electronics show" with "everything you [–in the industry–] need". I think it is more a reflection on the status of the electronics industry here in the UK.

And judging by the statements made prior to the launch of this event, it was to be expected. For months beforehand, there were various press announcements being released about the "high profile of exhibitors" and "widespread industry support" for this exhibition.

The promotional material touted: "The UK has a vibrant and innovative electronics industry but we lack a single international electronics event that attracts tens of thousands of visitors to the UK. This cannot be good for our global competitiveness. It would be great to see a single international event in the UK that united the industry."

The show was hailed "fresh", "new" and a lot "broader" in the nature of the exhibitors, but this somehow still failed to impress those who had to come to it. Admittedly, I didn't go the full three days myself (there was no point), but what I saw was a nice big hall, relatively full of exhibitors, however with exhibitors standing around, twiddling their thumbs. One or two said that it has been a quiet event, but that queries they received were of "good quality". Hopefully this comment will work on the boss too, who had to sign off on setting up a stand, sending staff to it and accommodating that staff for several days (plus the costs of productivity loss associated with key personnel being away from their desks).

Admittedly NEW wasn't the only quiet show in the UK this year. The annual Southern Manufacturing event earlier in the year wasn't that very well attended either.

So, one has to ask the question: are the hustling/bustling electronics shows in the UK – the likes of yesteryear's Nepcon – a thing of the past? And, more importantly, why? You can see why there's an interest from the exhibitors' point of view to have such an event, but why aren't many engineers and purchasers interested in coming along to them?

It would be interesting to hear your opinions on the subject. Did you go to this event or any other this year? Was that show in the UK or elsewhere, and what are your views on the future of such events? Please write to me at svetlana.josifovska@stjohnpatrick.com.

Svetlana Josifovska
Editor

Check out Electronics World's new website by clicking on **www.electronicsworld.co.uk**

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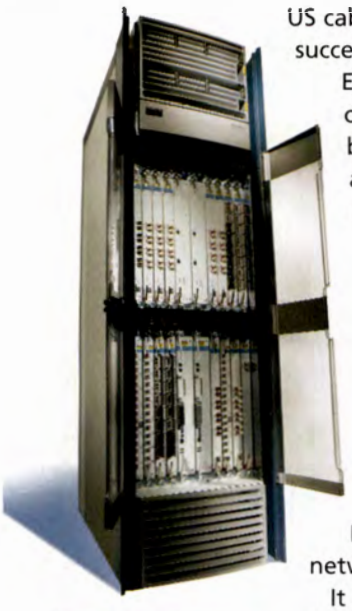
Comcast and Cisco achieve networking speeds of 100Gbit/s



The CRS-1 is Cisco's most powerful optical router

US cable operator Comcast has successfully tested a 100 Gigabit Ethernet (GE) communications link over its backbone infrastructure between the city of Philadelphia and the small community of McLean in Virginia.

The tests were carried out using the industry's first 100GE router interface developed for the Cisco CRS-1 routing system. The new interface uses Comcast's existing optical infrastructure to enable transmissions of 100Gbit/s over its Dense Wavelength Division Multiplexing (DWDM) fibre optic network.

It is expected that this new speed grade in the optical networking industry will enable telecommunication carriers to increase bandwidth per wavelength by a factor of ten over their initial deployed capability.

The technology should also create efficiencies by simplifying routing and operations through the use of statistically multiplexed 100GE links, instead of carrying the same amount of traffic split over more commonly used 10GE links.

"This demonstration is another important step in the future of 100GE networking and we are pleased with Cisco's latest advancements," said John Schanz, executive vice president of national engineering and technical operations with Comcast Cable. "Comcast's single converged core IP network already carries more video, voice and data traffic than any other, and this new achievement will allow us to scale for tomorrow, while continuing to drive capital and operational efficiencies today," he added.

Kelly Ahuja, Cisco's vice president and general manager of the core routing business unit, said that the Cisco CRS-1 was purpose-built to deal with the exploding growth in IP traffic that has been fuelled by the rapid take-up of bandwidth-intensive applications such as video streaming and file sharing. "By developing a 100GE interface for the Cisco CRS-1 platform, providers like Comcast can take advantage of economies of scale and flexibility, while increasing their quality of service delivery as they move towards 100G IPoDWDM networks," he said.

The implementation tested by Comcast and Cisco is consistent with the emerging IEEE 802.3ba 100GE standard. It also validates the use of 100GE and IPoDWDM technologies over Comcast's own production network, which was the first – and is currently the world's largest – 40G IPoDWDM platform.

Photon-Counting Device Breakthrough Will Aid Quantum Computing

European scientists at Toshiba Research have developed the first practical semiconductor device that can count the photons in light signals. This is a significant step towards creating viable quantum computers and communication systems, which exploit the particle-like properties of light.

The lack of a suitable photon number resolving detector has been a major obstacle to real-world deployment of quantum technologies. Although some alternative technologies have shown limited photon number resolving capability in the lab, they all required cryogenic cooling (to 4 Kelvin, or -269^{0}C) and have low efficiencies, a small active area or long integration times, rendering them impractical.

Until now, the most common semiconductor detector, the avalanche photo-diode, has been able to register only the presence or absence of one or more photons. The new compact, easy-to-use detector developed by Toshiba, however, is able to count the number of individual photons in a pulse; the first practical device with this capability.

The breakthrough is a result of a new technique developed by Toshiba to detect weak photon-induced avalanches. The electrical current caused by a single photon in a semiconductor is much too weak to be detected quickly. Avalanche photo-diodes work by amplifying this tiny current million-fold using an avalanche effect to multiply the strength of the current. Usually, however, the strength of the final current does not depend on the number of photons that initiated it.

The breakthrough is expected to accelerate the development of quantum information technologies. Quantum computers based on photons, for example, need to distinguish between one and two photons on each output. Another application where the breakthrough is significant is for quantum teleportation, which may be used to send secret digital keys over longer distances than currently possible.

Femtocell Standardisation Begins

Operators like the femtocell concept because it helps them offload backhaul and base station electricity costs – both suddenly met by subscribers

Industry association the Femto Forum has agreed to work on standardised technology that could help bring economies of scales to cellular operators looking to deploy femtocells.

The tiny base-stations are being marketed as an answer to the problem of patchy cellular coverage inside homes, thanks to their use of fixed broadband links as the method of backhauling traffic. However, mobile operators have so far been left with no option but to consider proprietary interfaces for the integration of the first generation of femtocells into their radio networks.

"Although this won't affect the numerous deployments planned in the short term, operators and vendors have agreed that a united approach in the longer term is essential," wrote the Femto Forum in a statement.

In order to achieve interoperability on the so-called "Fa interface" (between femtocell access points and femto gateways), members decided to adopt a single definition of this interface, with specific modules defined for each radio technology.

A "collapsed" architecture will also be adopted, with the NodeB/BTS (base transceiver station) and RNC/BSC (radio network controller) functionality placed in the femtocell device, in order to optimise signalling and performance over the broadband connection. Interfaces from the gateway to the core network will use existing standards.

Cellular industry standards bodies 3GPP and 3GPP2 have accepted the Femto Forum as a "market representation partner". Meanwhile, both the DSL Forum and the GSM Association have established cooperation agreements with the body.

As part of the same interoperability drive, the 3GPP is simultaneously developing the so-called "Iuh interface", which standardises communications between femtocells and the gateways in mobile operators' networks.

Ubiquisys, the number one vendor of femtocells according to ABI Research, has announced it has become is the first equipment supplier to commit to the Iuh interface. The manufacturer will support the spec (scheduled to be approved by the end of this year) in all new femtocells, while those devices already deployed in the field will be remotely upgraded.

IN BRIEF

● **Industry analyst house Gartner says that worldwide silicon wafer revenue reached $12.5bn in 2007, showing an increase of 22.5% on the 2006 revenue of $10.2bn. The increase has been pegged down to two factors: a continued rise in demand for 300mm wafers, which commanded a price premium, and the general benefit of high wafer prices, partly caused by a shortage of polysilicon.**
However, in contrast to 300mm wafer demand, the 200mm segment – in which shipments reached a high in 2006 – showed signs of deceleration during and after the second quarter. Shipments fell to 5.4 million wafers per month in the fourth quarter.

● **Intel, Samsung and TSMC have agreed that there's a need for industry-wide collaboration to target a transition to larger, 450mm-sized wafers starting in 2012.**
The transition to larger wafers will enable continued growth of the semiconductor industry and help maintain a reasonable cost structure for future integrated circuit manufacturing and applications. The three companies will cooperate with the semiconductor industry to help ensure that all of the required components, infrastructure and capability are developed and tested for a pilot line by this target date.
Manufacturing with larger wafers helps increase the ability to produce semiconductors at a lower cost, but also it offers more efficient use of energy, wafer and other resources.

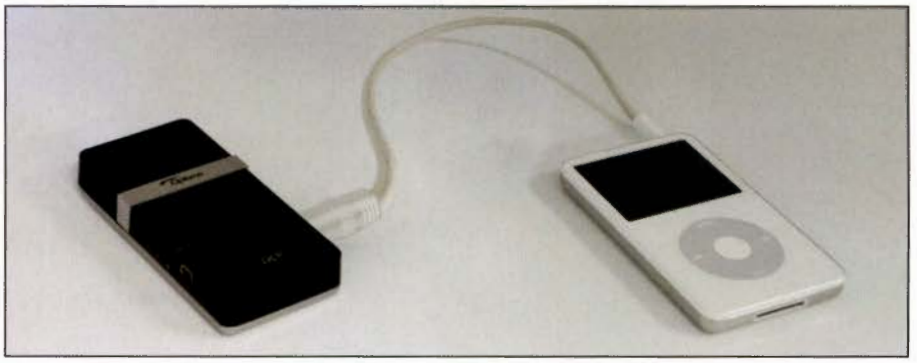
● **The European components distribution experienced a further decline of its sales in the first quarter of 2008. According to the Distributors' and Manufacturers' Association of Semiconductor Specialists (DMASS), the semiconductor distributor and manufacturer members achieved quarterly distribution revenues of 1.38bn Euro in Q1/2008, which represents a decline of 7.9%. Sequentially (against Q4/2007), sales were up 12.3%. Ian Bass, Chairman of DMASS, commented on the first quarter data: "We expected a drop in Q1 as we were up against the all time high quarter of European semiconductor distribution history. Unless something severe happens – like a sinking demand in volumes – the cycle should ease out over the course of the year."**

● Bill Gates, the co-founder of Microsoft – who we need to thank for the Windows software that's been largely running our PCs for nearly three decades – has stepped down from the day-to-day running of the firm.
Instead he will focus on charitable projects, on which he has pledged to spend some $22bn, a fortune amassed during his Microsoft years. As for the firm, he will still remain chairman and get involved in some technical projects.
Gates set up Microsoft with his friend, Paul Allen. In 1980 they signed an agreement with IBM to work on a new operating system; the rest is history.

● A new ETB finding reveals that only 27% of women with science, engineering and technology degrees go into jobs within these fields, compared with 54% of their male counterparts, and asks what can be done to prevent the current leakage of female talent that threatens the UK's economic competitiveness.
Statistically women make up only 3% of registered engineers.
Dr John Morton, Chief Executive of the ETB, said: "In order to increase the nation's engineering and technology skills base and ensure the UK remains globally competitive, government, business and industry, educationalists and the science and engineering communities must come together to ensure young women are better informed about the benefits of these careers."

● University of the West of Scotland's new MSc Sensor Design course, being offered from September 2008, is set to help meet the projected global demand for skilled graduates in this burgeoning multi-million pound sector. It also offers successful candidates the chance to gain paid work experience with sector leaders in sensor design.
The course, unique in the UK, has been developed in conjunction with Honeywell, a diversified technology and manufacturing firm. The programme is aimed at recently-qualified graduates or existing engineers/technologists wanting to either commence their career or further their career by undertaking a Masters-level qualification to become Sensor Design Engineers or Technologists.

Home theatre projectors get rid of the lamps



Optoma's new pico projector uses a similar LED-based illumination system to that now adopted by TI in its new home theatre lamp-free gadget

Texas Instruments (TI) DLP Products has introduced the world's first home theatre lamp-free projector. Using an LED light source instead, combined with the company's BrilliantColor multi-colour processing chipset, the projector can deliver a 1080p picture, while eliminating typical maintenance costs associated with lamp and filter replacements.

TI claims that, due to the inherent switching speed of the DLP chip and advancements in LED technology from its partner Luminus, this new breed of lamp-free projectors will increase picture quality and reliability. The reflective nature of the micro mirrors designed inside the DLP chip allows more light to reach the screen. This results in a 50% increase in colour gamut range, producing more than 200 trillion colours and a contrast ratio in excess of 500,000:1.

Because they come with their optics system sealed, DLP projectors are prepared to withstand dusty environments, which makes the use of a protective filter redundant. Most DLP projectors are filter-free and the company insists this will remain the case with its new lamp-free projectors.

The novel illumination system is also able to reduce power consumption by up to 30% compared with traditional lamp-based systems, according to the vendor.

TI says a number of its customers are planning to develop lamp-free, LED-based projectors, including original equipment manufacturer Optoma, which expects to start shipping units before the end of this year.

Home theatre systems are likely to be the initial target for the new projectors, before education and corporate sector product lines follow suit.

In a separate development, Optoma has also announced it is working on a "pico projector" that will be powered by TI's DLP Pico chipset. About the size of a regular mobile phone, the micro-portable, handheld projector (pictured here) can be carried in a pocket to let users connect it to a smart phone, PDA or digital camera in order to share the stored photos or video content.

The product, which was first shown in Las Vegas during this year's InfoComm trade show, will be available in limited distribution in Europe and Asia in late 2008, with a worldwide launch planned later in 2009.

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Core	Flash Program Memory	Pins	USB Type
8-bit	Up to 128 Kbytes	20 - 80	Device
16-bit	Up to 256 Kbytes	64 - 100	Device, Embedded Host, Dual Role, OTG
32-bit	Up to 512 Kbytes	64 - 100	Device, Embedded Host, Dual Role, OTG

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SAMSUNG TARGETS NEXT-GENERATION LAPTOPS WITH POWERFUL SSD

Compact solid-state drives are starting to get powerful enough to drive hard disk drives out of laptop computers

Samsung Electronics has developed what it claims is the world's fastest 2.5-inch, 256GB multi-level cell (MLC) based compact solid-state drive (SSD).

The device, which comes equipped with a SATA II interface for connectivity, has a sequential read speed of 200MB per second and sequential write speed of 160MB/s. This, according to the manufacturer, makes it about 2.4 times faster than a typical hard disk drive.

The SSD is only 9.5mm thick and measures 100.3 x 69.85mm. Once mass-production kicks off by year end, it will mark the largest capacity SSD from the Korean company. Lack of enough density in SSD technology has been blamed as one of main barriers for its adoption in the consumer space. But Samsung is confident this new powerful gadget will place SSD drives as a seriously valid alternative, particularly for laptop manufacturers.

"With the development of the 256GB SSD, the notebook PC is on the brink of a second stage of evolution," said Jim Elliott, vice president of memory marketing at Samsung Semiconductor. "This change is comparable to the evolution from the Sony Walkman to NAND memory-based MP3 players, representing an initial step in the shift to thinner, smaller SSD-based notebooks, with significantly improved performance and more than ample storage."

With a mean time between failures (MTBF) of one million hours, reliability of the new SSD is said to match that of more expensive, SLC-based SSD drives. Power consumption is 0.9 watts in active mode.

The drive has been fitted with a sophisticated data encryption process which, according to Samsung, prevents data stored on it from being accessed in an unauthorised manner, even after the SSD is removed from the PC.

A 1.8-inch version of the 256GB SSD is also expected to be available in the fourth quarter of 2008.

According to iSuppli estimates, the SSD market will grow at an annual average of 124% between 2008 and 2012. Sales are projected to increase by an additional 35% in 2009 over what the semiconductor market research firm had projected last year, 51% more in 2010 and 89% more in 2011.

IBM Supercomputer Breaks the Petaflop Barrier

IBM has put together a supercomputer that achieves running speeds of a petaflops (a thousand trillion floating operations per second), the closest to real time yet.

The machine, named Roadrunner, now supersedes the speeds of the fastest machine to date, which is Blue Gene – another IBM creation. Blue Gene has been running at speeds of several hundred teraflops, using several hundred thousand processors.

Roadrunner, on the other hand, uses some 20,000 chips, since they are based on a stream-lined chip technology, similar to that used in the Playstation 3 – the so-called 'cell' chip.

General computations are handled by standards processors, but for each of them almost two additional accelerators are also being used.

Several parties have already shown interest in Roadrunner, as it will come in handy in calculations and research carried out in genomics, astronomy, the financial world and others.

The Top Ten Lies of Venture Capitalists

01. I liked your company, but my partners didn't

In other words, "no". The venture capitalist who is saying this is telling you that he's the good guy, the smart guy and the guy who gets it; the "others" didn't, so don't blame him. This is a copout; it's not that the other partners didn't like the deal as much as the sponsor wasn't a true believer. A true believer would get it done.

02. If you get a lead, we will follow

In other words, "no". The venture capitalist is saying: "We don't really believe, but if you can get a lead, we'll jump on the pile." In other words, once you don't need more investors, the venture capitalist would be happy to invest.

What you want to hear, however, is: "If you can't get a lead, we will lead the deal." That's a believer.

03. Show us some traction and we'll invest

In other words, "no". This lie translates to: "I don't believe your story, but if you can prove it by achieving significant revenue, then you might convince me. However, I don't want to tell you "no" because I might be wrong and, by golly, you may sign up a *Fortune 500* customer and then I'd look like a total idiot."

04. We love to co-invest with other venture capitalists

Like the sun rising and Canadians playing hockey, you can depend on the greed of venture capitalists. Greed in this business translates to: "If this is a good deal, I want it all."

What you want to hear is: "We want the whole round. We don't want any other investors." Then it's your job to convince them why other investors can make the pie bigger instead of re-configuring the slices.

05. We're investing in your team

This is an incomplete statement. While it's true that they are investing in the team, you are hearing: "We won't fire you. Why would we fire you if we invested because of you?"

That's not what the venture capitalist is saying at all. What she is saying is: "We're investing in your team as long as things are going well, but if they go bad we will fire you because no one is indispensable."

06. I have lots of bandwidth to dedicate to your company

Maybe the venture capitalist is talking about the data line into his office, but he's not talking about his personal calendar because he's already on ten boards. Including board meetings, an entrepreneur should assume that a venture capitalist will spend five hours a month on your company. That's it. Deal with it and don't be fooled.

07. Do you mind if one of our associates accompanies me to your board meetings?

This isn't a lie per se, and it looks like a harmless request. It isn't what you might delude yourself into thinking: "These guys are so interested in our company that they want two people helping us."

If you agree to the request, you board meetings will become a training class for an MBA who knows nothing about running a company but will nevertheless be offering his learned opinion.

08. This is a 'vanilla' term sheet

There is no such thing as a 'vanilla' term sheet. Do you think corporate finance attorneys are paid $500 per hour to push out 'vanilla' term sheets? If venture capitalists insist on using a flavour of ice cream to describe term sheets, the only flavour that works is Rocky Road. This is why entrepreneurs need their own $500/hour attorney too.

09. We can open up doors for you at our client companies

This is a double whammy of a lie. First, a venture capitalist can't always open up doors at client companies because the management of that company may hate him. The worst thing in the world is a referral from him. Second, even if the venture capitalist can open the door, you can't seriously expect the company to commit to your product – that is, something that isn't much more than a slick pitch.

10. We like early-stage investing

Venture capitalists fantasise about putting $1m into a $2m pre-money company and end up owning 33% of the next Google. That's early-stage investing.

Do you know why we all know about Google's amazing return on investment? The same reason we all know about Michael Jordan: Googles and Michael Jordans hardly ever happen! If they were common, no one would write about them.

If you scratch beneath the surface, venture capitalists want to invest in proven teams (for example, the founders of Cisco) with proven technology (for example, the basis of a Nobel Prize) in a proven market (for example, growing 30% per year) with no competition. They are remarkably risk-averse considering it's not even their money.

What should you do when you hear these lies? First, when a venture capitalist is telling you "no", you should just move on. A venture capitalist is either performing due diligence (calling references, talking to your customers and meeting more of your team), or she isn't interested. If she's not interested, don't waste your time or hers.

Second, understand the other venture capitalists' lies so that there is no problem later because of your wishful thinking.

The game shouldn't work like this, but it does. And don't get self-righteous with me because can always discuss the lies that you would tell!

Guy Kawasaki is Managing Director of an early-stage venture capital firm called Garage Technology Ventures, and a former Fellow at Apple Computer. He has his own blog and websites (Design.alltop.com, Programming.alltop.com, Linux.alltop.com), as well writing regularly for entrepreneur style magazines.

TRACKING SATELLITES

INDUSTRY AND UNIVERSITY COLLABORATION HAS MANY BENEFITS AS **STEVE ROGERSON** DISCOVERED WHEN HE INVESTIGATED A SOFTWARE-DEFINED RADIO PROJECT IN THE EAST MIDLANDS, THE UK

The skies above the Earth are set to become pretty cluttered over the next few years. As well as the existing US GPS satellites, various other countries are planning their own satellite positioning systems including Europe's Galileo, China's Compass, India's Irnss and Japan's QZSS; added to this are Russia's plans to restore Glonass.

The problem this poses is that they will all run on different technologies, meaning that the equipment manufacturers will have headaches making separate receivers for each system, unless they could make one design and just change the software depending on which satellite group it was aimed. This even opens up the possibility of dual-system receivers, allowing, for example, a driver in Europe to log onto the GPS or Galileo system, whichever was providing the better coverage at the time.

This technique is known as software-defined radio (SDR) and has been used by the military for some time but is now coming into the commercial world. One company looking to use this is Nottingham Scientific.

The firm was a spinout from the University of Nottingham in 1998 to exploit the potential interest in Galileo and has since then built itself a team of 20 engineers and resides in the Riverside Business Park, a short distance from Nottingham's city centre in the UK.

However, the company's expertise was mostly on the software side. The engineers had devised clever algorithms that could add value to navigation systems and they had worked out how software-defined radio could take them forward, but they needed to have control of the hardware as well as the software. "In 2006, we decided we needed our own technology in the market," said Nottingham Scientific's general manager Mark Dumville. "So, we decided to build our own receiver."

However, the company needed engineers with hardware experience and they do not come cheap. As such, Dumville successfully sought the help of a local university and is now involved in a project partly funded by the government in which the hardware is being jointly developed using the talent from De Montfort University in Leicester. The university has even employed an RF design engineer – Yacine Adane – who is working full time at Nottingham Scientific.

"Nottingham Scientific contacted us," said John Gow, senior lecturer at the university and lead researcher on the project. "They'd identified that software-defined radio could help them exploit satellite navigation further and we had a research project. This was in early 2007."

After considering their options, the company and the university decided to take the Knowledge Transfer Partnership (KTP) route. KTP is basically the continuation of the government's Teaching Company Scheme that dates back to the 1970s. The idea is that a partnership is formed between a university, a company and an individual who works as a full-time member of staff, who in this case was Adane.

"We recruited him," said the university's Eric Goodyer, who is managing the project. "He is on our payroll and working at Nottingham Scientific. The knowledge that is in John Gow's head is transferred into the company through Yacine. The hope is that he will end up as a full-time employee. It is an opportunity for a recent graduate to get straight into industry."

Adane is excited by the chance this has provided, especially as it gives him control over his own training. "I get personal training," he said. "I get management training. I even get a budget to choose the type of training myself."

This KTP over two years will cost £115,000, of which the government is putting in two thirds and Nottingham Scientific the rest, for which it gets a full-time employee, a training programme and research facilities.

The main advantage for the university in this partnership is that its researchers are exposed to industry so they are up to date in the work they are doing. "We need to know what industry wants so we are working at the right level," said Goodyer.

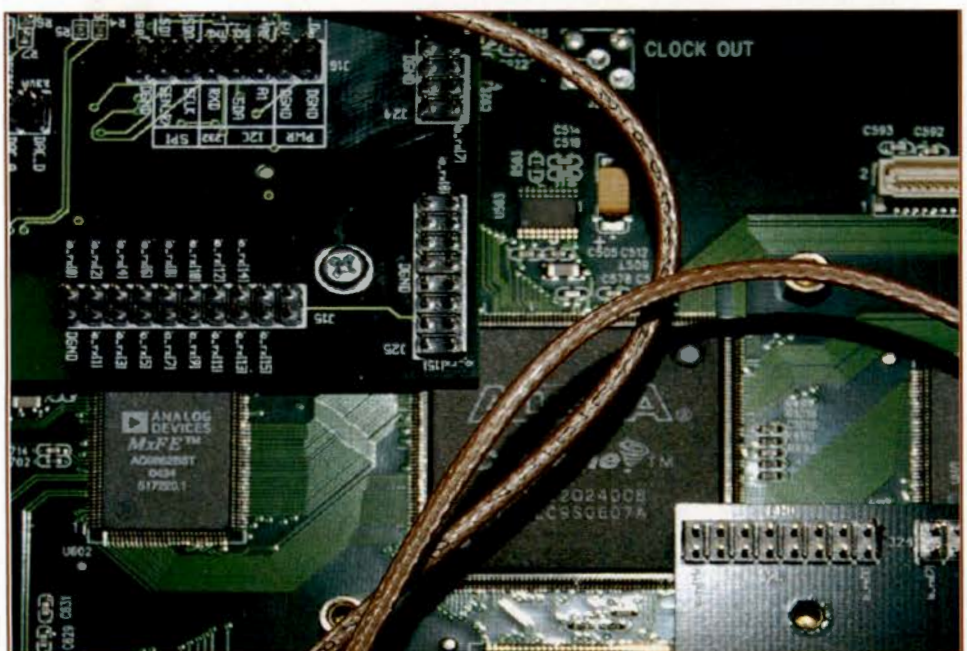

Figure 1: Nottingham Scientific's universal software radio peripheral used to capture the GPS signal spectrum

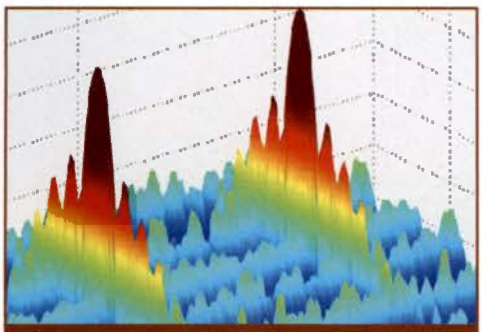

Figure 2: The 3D capture of the cross-correlation function between a PRN code and the captured GPS signal (Z axis). The Doppler frequency shift and the code delay, representing a bi-dimensional acquisition search space, are reported on the Y and X axis respectively

This policy seems to be working as the university has about 20 KTP schemes running, with a growing track record of commercial success through them. "It is not difficult to get the money if you have a genuine case," said Goodyer. "There must be a genuine need to fill a gap in the company's knowledge and there must be a clear transfer of knowledge from the university to the company. Nottingham Scientific is a software house. They don't have the hardware development expertise to design the product. They have working software. We are producing the embedded hardware. In two years' time, we want a working product."

Dumville added: "We are not a hardware company. That is why this exchange with De Montfort University is ideal."

The initial contact with the KTP came from Dumville. He got in touch with the regional organiser and it was he who suggested De Montfort University. Under the rules of the scheme there has to be less than two hours travel time between the company and the university. "We had an initial discussion," said Dumville. "They checked out that we were a viable company. We were asked probing questions about cash flow and so on and potential application revenues for this idea."

What was attractive about this project is that it also has short-term design goals that could themselves lead to commercial products, the first of which is scheduled to be out this summer and will be an RF front-end with a USB interface that will provide a digitised radio stream for a software-defined radio package to process on a laptop or even a PDA.

"We'd set ourselves six months to reach that stage," said Dumville. "But within six weeks Adane has done what we thought would take us six months."

The product has already shown it works. Within a week of Galileo putting its second test satellite into orbit, the product was able to track it. The commercial version of the product will be called Primo and will be aimed at research institutes and the military. "It is a tool rather than a consumer product," said Dumville.

Dumville's plan is that over the next two years the project will produce something new every six months. "The first product will implant us in the market," he said, "and we will have the final product within two years. But we want to be able to break out at each of the six month points if we have something that is commercially viable."

The second stage will be to have the software-defined radio algorithm running on an embedded processor as a stepping stone to the final stage when it will use the team's own FPGA. There will be some embedded DSP on the board, but most of it will be in the form of programmable logic. As the government money is coming via the East Midlands Development Agency, the aim will be to find a local company to manufacture the hardware.

The final product will be aimed at applications where the location is critical in some way, such as in aviation, shipping, train signalling, offender tracking and so on. However, there is the possibility that as the technology becomes established it will become cheap enough for more mass-market applications.

"I'd be very surprised if it didn't eventually filter down to in-car satnav," said Gow. "It will probably be used on road tolling systems as well." ■

ELECTRONICS WORLD

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Gary Nevison is chairman of the AFDEC RoHS team, and Customer Support Manager, Legislation and Environmental Affairs at Premier Farnell. As such he is our industry expert who will try and answer any questions that you might have relating to the issues of RoHS, WEEE and REACH. Your questions will be published together with Gary's answers in the following issues of Electronics World.

LIGHTING – ENVIRONMENTAL AND LEGISLATIVE ISSUES (PART1)

Lighting is essential in homes, offices, factories, for transport and open areas, such as roads and sports arenas. Lighting is under review because of the huge amount of energy that it consumes. It is estimated that lighting devours up to 10% of all electricity generated in the developed world.

In Europe it is estimated that the use of incandescent light bulbs alone results in the emission of 40 million tones of CO2 per year, which is the equivalent to eight 1Gigawatt power stations. Not surprisingly, governments around the world are targeting lighting as a means of reducing carbon emissions to prevent global warming. In order to understand the reasons for recently proposed legislation, it is first useful to appreciate the main different types of lighting equipment.

Types of Lighting Equipment and Lamps

Lighting consists of lamps (or bulbs), luminaires (lamp holders, shades and covers) and ancillary equipment used to control the power supply, such as ballasts for fluorescent lamps and transformers for providing specific voltages.

• *Incandescent lamps*

These lamps consist of a fine tungsten coiled wire in an inert gas, usually argon, at low pressure. When electricity passes through the filament, it glows white-hot. This is of course very inefficient as 95% of the energy is converted into heat and only 5% to light.

• *Halogen lamps*

These are types of filament lamps but which contain chemicals that boost the light output. They are therefore more efficient than standard incandescent lamps but are less efficient than fluorescent lamps.

• *Compact fluorescent lamps (CFL)*

Fluorescent lamps contain small electrodes situated at each end of a tube filled with an inert gas and a small amount of mercury. This emits ultra-violet light, which is converted into white visible light by special fluorescent coatings that are deposited on the inside of the tube. The electrodes are powered by ballast, which is small and integral to the lamp. CFLs are designed to replace less energy efficient incandescent lamps and, so, have the same type of fittings and are of a similar size.

• *Straight fluorescent lamps*

CFLs have coiled tubes to enable them to fit into small spaces and this reduces their energy efficiency. Better energy efficiency is possible with straight tubes that are used with separate ballasts. These have been on the market much longer than CFLs; the technology has developed over the last 30 years.

The main problem with all types of fluorescent lamps, including CFLs, is that they contain mercury which is toxic. This does not pose a risk if end-of-life lamps are recycled correctly and the mercury is recovered, but with lamps being made of glass, there is always a risk of breakage and mercury release.

The risk from mercury has, however, been significantly lowered as manufacturers have been able to reduce the quantity in each lamp. In the 1980s, 100mg of mercury per lamp was typical whereas today, 5mg or less is used in most lamps, which makes the risk from breaking one lamp practically negligible.

High Intensity Discharge (HID) Lamps

These lamps contain various materials, usually metal halides that vaporise and at very high temperature emit a very bright light. HID lamps are very energy-efficient and the colour of the light emitted can be controlled through changing the materials used. HID lamps do, however, contain mercury.

• *Sodium lamps*

Sodium lamps are a type of HID lamp that contains a small amount of sodium metal and mercury. When the arc starts, the light emitted is from discharge through the gas and is not very bright but produces sufficient heat to melt and vaporise the sodium metal which creates an intense yellow light. Sodium lamps are the most energy-efficient and are used mainly for street lighting.

• *Light emitting diodes (LEDs)*

Recent research has resulted in the emergence of much brighter and highly efficient LEDs such that they are now a serious alternative to many other forms of lighting. They also give designers a high degree of flexibility and have extremely long life-cycles.

Environmental Issues

As lighting accounts for such a large proportion of energy production, there is a clear incentive to increase energy efficiency.

IN EUROPE IT IS ESTIMATED THAT THE USE OF INCANDESCENT LIGHT BULBS ALONE RESULTS IN THE EMISSION OF 40 MILLION TONES OF CO2 PER YEAR, WHICH IS THE EQUIVALENT TO EIGHT 1GIGAWATT POWER STATIONS

The largest energy savings will be possible by replacing incandescent lamps with CFL or fluorescent lamps which emit 3-4 times more visible light per watt and also last much longer. Replacement of all incandescent lamps in the EU by CFL would avoid the emission of 20M tonnes of CO2 per year and save an estimated £5.4bn in fuel.

Changing to fluorescent lamps would initially appear to pose a risk from large quantities of mercury being used but the overall effect of changing actually reduces mercury emissions for the following reason: Although fluorescent lamps contain small amounts of mercury, significantly more is emitted from coal and oil-fired power stations when they generate the power used by lamps. Electricity generation also emits cadmium, lead and arsenic, as well as mercury because these are present at low concentrations in coal and oil and it is not possible to collect 100% of these when they are burned.

The European Lamp Companies Federation has calculated the quantities of mercury emitted into the atmosphere as a result of the generation of electricity in the EU to run various types of lamps. Mercury emissions from running standard incandescent lamps are more than four times the quantity than from running equivalent CFLs. The difference when compared to the most efficient straight fluorescent tubes is larger with about seven times more mercury emitted. The savings in mercury emissions from using CFL and straight fluorescent lamps instead of incandescent lamps easily exceeds the quantity of mercury contained in the lamp, which should not be released at end-of-life. The WEEE directive requires them to be collected and recycled with recovery of the mercury for reuse.

Luminaires

Luminaire design impacts energy efficiency as they can block significant proportions of emitted light. Lamps tend to emit light in all directions, whereas it is usually required to direct illumination, therefore reflectors are necessary.

Due to the delicate nature of most types of lamp, luminaires also need to provide a degree of impact protection. It is however a common problem that the luminaire becomes dirty and this reduces light output. Cleaning is often difficult and usually never carried out. This is particularly a problem with streetlights. Luminaire design can, therefore, have a significant impact on long-term energy efficiency in terms of useful light output per watt. The voluntary standards organisation "Energy Star" has developed standards not only for CFLs but also for luminaries.

The second part of this article will look at how specific pieces of legislation such as RoHS, WEEE and EuP impact the lighting sector.

Please email your questions to:
svetlana.josifovska@stjohnpatrick.com
marking them as RoHS or WEEE.

THE RISING RISK OF PRODUCT RECALLS

ROB DENTON, MANAGING DIRECTOR OF NAVIGATOR CUSTOMER MANAGEMENT, OUTLINES THE BEST WAYS TO HANDLE PRODUCT RECALLS, WHICH ARE ON THE RISE

Whilst there may be some discussion amongst specialists about what exactly constitutes a product recall, all the main data sources on the subject agree on one thing – that total product recalls in the UK have been steadily rising since the new millennium. Between 2006 and 2007, there was a staggering 35% increase in product recalls and safety notices in the UK.

The annual total of product recalls in the UK has been increasing across all sectors, but most noticeably in the consumer goods industry. Electronic goods account for 25% of all product recalls in non-food consumer goods. Furthermore, risk of electric shock accounts for 14% of all product recalls; only risk of choking and risk of suffocation account for more.

In 2007, a wide variety of electrical goods were affected by product recalls, from fan heaters that posed a fire hazard, to hair straighteners that risked an electric shock, to a 'flammable gas monitoring device' that was recalled because it carried the potential to cause explosions. It is clear that product recalls are a concern for all aspects of the electronic consumer goods industry.

There are various reasons for this increase, most notably the introduction in 2005 of product safety legislation that requires manufacturers to inform both the authorities and consumers of any potential risk from their products. Secondly, there is a growing awareness amongst consumers and authorities about the potential health and safety issues. Thirdly, manufacturers are also sourcing ingredients, components and packaging from further afield, meaning they have less control over their supply chain and, thus, a higher risk of recalls. Next, an increasing volume of goods are being imported from countries outside the EU, notably China, whose legislation is not wholly in-line with that of Europe.

That product recalls have a damaging effect not just on brand sales, but also mid-term perceptions and choice of the brand, is beyond question. A series of research studies have provided evidence to this effect. Most recently, a poll from survey group Harris Interactive found that, following a product recall for health and safety reasons, 55% of customers would "temporarily purchase another brand and then purchase the recalled brand once it was safe", 15% would "purchase another brand and never purchase the recalled brand again", and 21% would "avoid using any brand made by the manufacturer of the recalled product".

The factors driving the increase in product recalls in electronics are unlikely to reduce. In fact, they are much more likely to rise in future as companies continue to outsource their production to overseas locations in order to save on manufacturing costs. Furthermore, in the light of recent recalls, the moves by the European Commission towards stricter regulation suggest little chance of relaxation.

The upward trend has exposed an area of brand risk where many brands simply do not have contingency facilities in place. And no worse impression is created, nor brand damage done, than in the situation where a company is not contactable or unhelpful, just when consumer concerns have been escalated by a product recall.

In order to provide this, companies must have the facilities available to deal with the increase in calls. Too often, call centre facilities designed to cope with day-to-day demand are inadequate when faced with the influx of calls resulting from a product recall. Yet, concern is rising that the rate at which contingency facilities are being set up, is lagging behind the increasing risk/rate of product recall.

As a result of the rising tide of recalls, brand managers are anxiously and urgently investigating how they can set up access, advice and enquiry channels that allow consumers to get through to the company, even in times of crisis when there is a sudden spike of enquiries, without the whole contact infrastructure being very expensive.

The key to an effective recall is clear and efficient communication between the company, the consumer and the media. Worried consumers must be able to get in touch with people who can provide information and reassurance. Brands have found, in recall crises, that simply to rely on existing careline facilities is quite inadequate, especially in the light of previous research which shows that day-to-day contact and careline standards amongst various brand categories show wide variations. As a result, consumers and journalists are unable to talk to anyone who can provide them with clear, relevant information.

Those who have invested in emergency contact centre facilities have already experienced how a well-handled product recall period can elicit compliments and expressions of loyalty from satisfied customers. ■

The factors driving the increase in product recalls in electronics are unlikely to reduce

CLAIMS AND DATASHEETS

by Myk Dormer

Every radio module manufacturer in the world has been known to give inaccurate information in their datasheets; ambiguities and stuff that is not going to make life necessarily easy for you. I am, of course, referring to the *operating range* claims made by ISM band wireless module manufacturers in their advertising literature and their datasheets.

If you look at the information issued alongside the module you're planning to buy, you will undoubtedly find some claim of 'typical' link range; usually a bald statement like "range exceeds 1000m", or occasionally something slightly more meaningful like "75m indoors, over 150m outdoors". And it means nothing, because the author of the datasheet has missed out almost all of the supporting information which would let you know how the module was really performing.

EVEN THEN, IT IS VITALLY IMPORTANT TO TEST *YOUR* HARDWARE USING *YOUR* AERIALS IN *YOUR* ENVIRONMENT. NOTHING ELSE WILL GUARANTEE A RELIABLE LINK

The actual, achievable, range of a wireless data link can be a highly unpredictable thing. In theory – and in unobstructed free space – you can meaningfully calculate a path loss, relate that to the performance of the radio components and get an absolute range. But, not in the real world! Firstly, the actual propagation will be nothing even vaguely like the free space model (compare the equations in **Notes 1** and **2**). The presence of obstructions, the curvature of the earth limiting the line of sight "horizon", the proximity of the ground itself (causing diffraction losses), all mess up the propagation of your radio waves.

The quality ("antenna gain") of the aerials obviously makes a difference; so does the elevation of the aerials (height above ground). On top of the basic radio's sensitivity there is the decoding algorithm's efficiency – its ability to deal with degraded signal to noise ratio. This can vary by over 10dB between edge-triggered UARTs and proper biphase decoders, and the actual data rate (on basic -120dBm sensitivity narrowband link hardware I've measured actual decoder performance between -116 and -126dBm, simply by changing data rate from 4kbit/s to 62bit/s).

And these are just the predictable factors. Reflection from obstacles causes multipath fading – specific localised "nulls" or reductions of signal strength, often by 10 to 20dB, or more, well inside the calculated 'path loss' maximum range. Sometimes, those obstacles are moving vehicles, making these fades time-variable.

Buildings will cause huge variations: wood framed light domestic constructions are almost radio-transparent, but a steel framed industrial unit can resemble a Faraday Cage. Older brick or stone structures can be totally unpredictable. Environmental factors can also intrude. Remember that 2.4GHz is a water absorption band. Dew soaked foliage in the morning can add tens of dBs to the path loss, changing as it dries out through the day.

Of course, unexpected effects can also increase range: reduced path loss is sometimes seen down the "waveguide" formed by straight roads between tall buildings. Range is greatly increased across water, or between the sides of a valley. And at VHF frequencies there are infrequent atmospheric effects such as sporadic propagation which can cause greatly extended (shortwave-like), unexpected, over-horizon range for short periods.

My message here is one frequently said: "Test everything". It is never enough to assume the claims made in manufacturers' datasheets can be totally relied on, unless their technical support engineers can actually substantiate the claim with real tests.

Even then, it is vitally important to test *your* hardware using *your* aerials in *your* environment. Nothing else will guarantee a reliable link.

IT IS NEVER ENOUGH TO ASSUME THE CLAIMS MADE IN A MANUFACTURER'S DATA SHEET CAN BE BELIEVED, UNLESS THEIR TECHNICAL SUPPORT ENGINEERS CAN ACTUALLY SUBSTANTIATE THE CLAIM WITH REAL TESTS

Finally, let's consider a real world example I've actually seen in print: Several distributors sell a particular 2.4GHz Zigbee module as having "up to 24km" range. Adverts and editorials claiming this range have appeared in reputable technical publications, and are repeated on-line.

Closer inspection of the data reveals +20dBm output power and -106dBm sensitivity. So the unit should (optimistically, assuming no fades) function over a 126dB loss path.

The calculated free space path loss at 24km = 127dB.

Egli's model suggests 200 meters for 127dB path loss at 2.4GHz, but this model is only characterised between VHF and 1GHz so shouldn't be relied on at these frequencies.

But then refer to the manufacturer's detailed datasheet:

- "Indoor/Urban: up to 1200' (370m)" – which is possible, if optimistic!
- "Outdoor line-of-sight: up to 15 miles (24km) w/ high gain antenna".

So, the advertised range is in an open field, unobstructed site, with a clear line of sight between two (undefined) high gain aerials, either looking across a deep valley or mounted on towers at least 11m high (horizon distance due to earth's curvature). And "high gain antenna" at 2.4GHz could well mean a highly directional type with a gain of 15-20dBi, or more.

The only comment I can add after that is "Let the buyer beware!".

Note 1: For reference, here is the Egli irregular terrain path loss model, expressed in dB terms: (remember it refers to a path gain, so the answer is always negative):

Path gain (dB) = 32.4 – 40 x log(d) – 20 x log(F) + 20 x log ((Hr x Ht)) + Gt + Gr

F = frequency in MHz

d = distance in meters

Gt, Gr = transmit and receive antenna gain (dBi)

Ht, Hr = height above ground of transmit and receive aerials (in meters)

Note 2: And here is the "free space" model:

Path gain (dB) = -32.44 – 20log(F) – 20log(D)

D = distance in km

The free space model is "optimistic" in the extreme. Take an imagined 433MHz radio link with 115dB link budget (-105dBm Rx, +10dBm Tx).

Eigli's model gives 230m range (assuming 0dBm aerials at 1m elevation), which is typical for measurements on ISM links in this performance category.

The free space model would predict 31 kilometers.

A good, although necessarily maths-heavy, discussion of propagation modelling can be found at:

http://people.seas.harvard.edu/~jones/es151/prop_models/propagation.html#fsl

Myk Dormer is Senior RF Design Engineer at Radiometrix Ltd
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AMC SYSTEMS – A NEW GENERATION OF SYSTEMS FOR INDUSTRIAL APPLICATIONS

STEPHAN RUPP OF KONTRON GIVES AN OVERVIEW OF THE TECHNOLOGY AND SYSTEM DESIGN OF ADVANCED MEZZANINE CARDS (AMCS) USED WIDELY NOT ONLY IN TELECOMS BUT NOW IN INDUSTRIAL APPLICATIONS TOO

A large range of Advanced Mezzanine Cards (AMCs) have appeared in a very short period of time. They enable the implementation of systems that comply with the MicroTCA standard but whose application goes well beyond telecommunication. AMCs also represent an excellent base for implementing multi-processor systems in the industrial sector.

System Components and Standards

AMCs (Advanced Mezzanine Cards) originate from AdvancedTCA (ATCA), an industrial standard of the PICMG that is connected with the success of CompactPCI. The technical differences lie in the following:

(1) The use of serial interfaces on the backplane instead of traditional parallel busses for different transport systems (e.g. Ethernet, PCI, SAS, Serial Rapid I/O); and

(2) Systematic operation of all hardware components through IPMI (Intelligent Platform Management Interface).

The base specifications (PICMG 3.0, AMC.0) lay the foundations, i.e. mechanics, IPMI as well as different topologies and the physical properties of the cables. The sub-specifications define the use of special transport systems: AMC.1 for PCI Express, AMC.2 for Gigabit Ethernet, AMC.3 for storage media and AMC.4 for Serial Rapid I/O. This ensures that the standard remains open for possible future extensions. Two cable pairs (one for sending and one for receiving) are connected to an AMC port.

Several protocols can be used in a single chassis. Compatibility is checked via electronic keying to prevent damage when a board is accidentally placed into the wrong slot. A system becomes specialised only once it has been configured.

For AMC systems there is a second standard: MicroTCA.0. MicroTCA defines the use of up to 12 AMCs in a system together with the shelf management, power management and switch functions. The AMCs remain unchanged. The additional functions are stored in specific MicroTCA components, i.e. the MCH (MicroTCA Carrier Hub) and power modules.

Application Areas

As standards from the telecommunication sector, the AMC and MicroTCA specifications are extremely stable and provide a reliable and long-term basis for systems. The areas of application go well beyond traditional telecommunication applications. They can be split into three categories: telecoms, industrial and medical.

The group of communication applications includes private branch exchanges, base stations and radio network controllers for mobile radio, communication systems for public authorities and organisations that perform security functions (e.g. Professional Mobile Radio systems such as Tetra or P25), and communication applications and signal processing in the military and aerospace sectors.

The group of industrial applications includes image processing and control, i.e. applications that demand a lot of processing power and that typically require multi-processor systems (e.g. image processing or motion control).

Medical applications form the third group and also require multi-processor systems to deal with the growing number of images in diagnostics.

System Architecture

In contrast to traditional bus systems such as VME and CPCI, the AMC and MicroTCA standards are more flexible and provide more options when it comes to system implementation. In its serial form of PCI Express, PCI forms a subset of the system architecture. From the perspective of an AMC, the system can be seen in the following ways:

Management

Each AMC is connected to a manager that checks the system configuration and only activates the AMC's power supply when the power supply has been successfully checked. These functions are known as e-keying and power management and are part of the function of the MCH (MicroTCA Carrier Hub).

The MCH can also deactivate the AMC's feeding voltage via the power

Figure 1: *MicroTCA basis system with IPMI and GbE*

management, when it needs to be removed or replaced during run time (hot-swapping). External interfaces, for example via SNMP, are also part of the management function.

Network

AMCs usually have one or two Ethernet ports that are connected to an Ethernet switch. This enables AMCs in the same system to communicate with each other via the network. They can also communicate with the outside world via the MCH's external Ethernet port.

PCI Express

Like PC-based systems, processor AMCs can communicate with AMCs for peripheral devices via PCI Express. For this, the AMC standard defines a clock for running PCI Express and PCI Express ports with up to four serial lanes. In the simplest case the PCI Express lanes are implemented as point-to-point connections on the backplane as shown in **Figure 2**.

Instead of point-to-point connections, the PCI Express lanes can be run to the MCH and then on to the AMC slots. In this case, the MCH needs to have a PCI switch. In both cases the individual system slots have special functions from the point of view of PCI: processor AMCs (PCI root or up stream) and peripheral devices

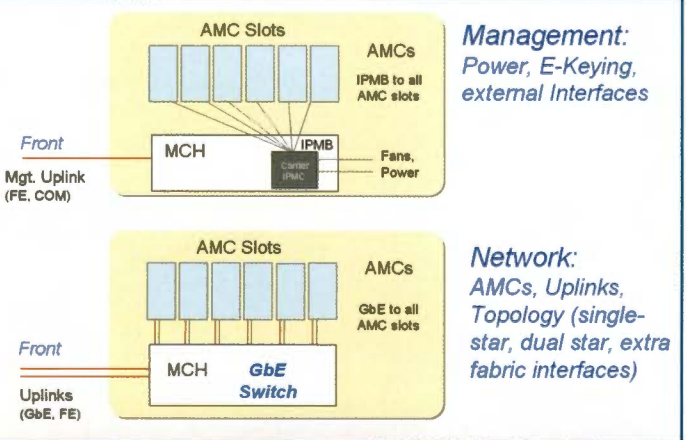

Figure 2: *PCI-Express*

(PCI nodes or down stream). A PCI Express switch enables these functions to be flexibly configured: each slot can be either a root or a node. Moreover, by using a PCI Express switch it is easy to distribute the processor AMC's PCI ports amongst several peripheral devices.

Additional capacity for Ethernet or Serial Rapid IO

The AMC standard provides the option of having further ports between the AMCs in a single system for additional capacity. These include extra Ethernet slots (1GbE per AMC Port or 10GbE with four AMC ports) and Serial Rapid IO (SRIO, also with 10 Gbits per second on four AMC ports).

In general, the additional capacity is needed for processor communication in a multi-processor system and is implemented via the MCH. Depending on the system configuration, it is possible to use one or more MCH with Ethernet switches or SRIO.

Figure 1 shows the features that are always available in an AMC system, according to the AMC standard. The two basic

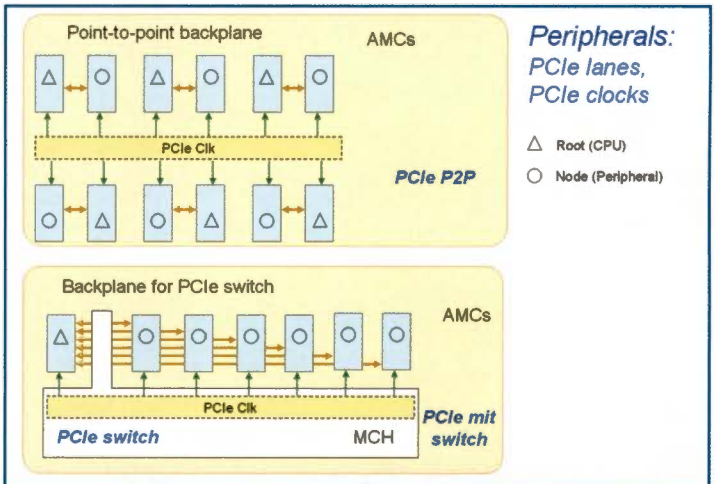

Figure 3: *AMC port mapping and backplane*

functions – management and network – run together on the MCH. For implementing the management function, the MCH is connected to the AMCs, fans and power supply via the I2C bus and the IPMB protocol.

All AMCs also have an IPMI controller with its own power supply (3.3V) so that system management is independent of the AMC's feeding voltage. The feeding voltage of 12V is independent and is individually connected from the MCH for each AMC.

The overview of the system architecture shows a significant difference to traditional parallel bus systems. The backplane of an AMC system or MicroTCA system is not fixed but instead independent of the respective application. The standard only specifies the AMC port and MCH port assignments. There are conventions for mapping AMC ports to MCH ports.

One popular approach is SCOPE alliance port mapping as shown in **Figure 3**. A basis system supports management, clocks and Ethernet on the lower AMC ports and in the MCH (clocks and common options). AMC ports 2 and 3 are reserved for storage media. In addition, there are the "fat pipes" and

"extended options" that can be used for PCI Express (ports 4-7) and additional capacity (GbE, SRIO). It makes sense to separate PCI Express and GbE or SRIO when both systems are in use at the same time. AMC ports 4-7 enable the same backplane and the same chassis to be used with either PCI Express or SRIO.

System Design

How are AMC systems actually implemented? **Figure 4** shows a basic system with communication via Ethernet. A typical application would be an extension line for Voice over IP (VoIP) with connection to a traditional telephone network. A processor, a signal processor and an interface board are used as AMCs.

All AMCs communicate with each other via Ethernet. The processor AMC is the control centre and responsible for establishing and terminating connections; the signal processor recodes the data stream between the IP packets and the continuous data stream; the interface boards establish connection to the telephone network. The application is structured according to protocols for control (control plane) and data streams (user plane) as well as protocol layers. In terms of system architecture, Ethernet on the AMC port 0 and an Ethernet switch in the MCH are sufficient.

The serial version of PCI – PCI Express – is also a part of AMC systems (ports 4-7).

Figure 5 shows an example configuration with a processor AMC and two peripheral cards (a graphic card for an external display and cards for external interfaces). In the simplest case, the AMC ports are run to the MCH via a PCIe switch. This enables the processor to use its four PCI Express lanes for both peripheral devices.

For external displays there is also an interesting alternative that requires neither a video cable nor a graphic AMC: by using a display with built in web browser (e.g. the Kontron Micro Client) it is possible to connect over the Internet from any distance. A web server that supports the GUIs through dynamic websites (Web 2.0) runs on the processor AMC.

Processor AMCs boot either from an existing Compact Flash or over the network. Hard drives can also be used for operating systems and applications. Hard drives for SAS or SATA are available in AMC format or as external drives. Hard drives on the AMC are connected directly to the processor AMC via the backplane (AMC ports 2 or 3). AMC hard drives are integrated into the system management, i.e. run time configuration and replacement is controlled by the MCH.

There are different solutions for external hard drives:

(1) Connection via external SAS interfaces and a host bus adapter on the AMC. The host bus adapter is connected to the processor AMC via PCI Express.

(2) Connection via Fibre Channel and a host bus adapter. In contrast to SAS, Fibre Channel is a network protocol and allows external storage media to be organised as storage networks.

(3) Connection via Ethernet with iSCSI, whereby the SAS or SCSI messages are transported over the IP and Ethernet protocols. The external storage medium is connected to the system via Ethernet. A host bus adapter can take some of the burden from the processor AMC, but it is not essential for iSCSI.

Second Generation Systems

AMCs and MicroTCA have quickly established themselves as industry standards. Originating from the telecommunication industry, they are extremely stable and well designed. There are different ways of implementing the standard.

First generation systems can be recognised by the AMC power module that is implemented in addition to the power supply. The power module is controlled from the MCH and connects the AMC's feeding voltage.

Second generation systems do this in a much more cost-effective and space saving way: the backplane connects the feeding voltage and has a control module for implementing control functions via the MCH. Standard power supplies can be used.

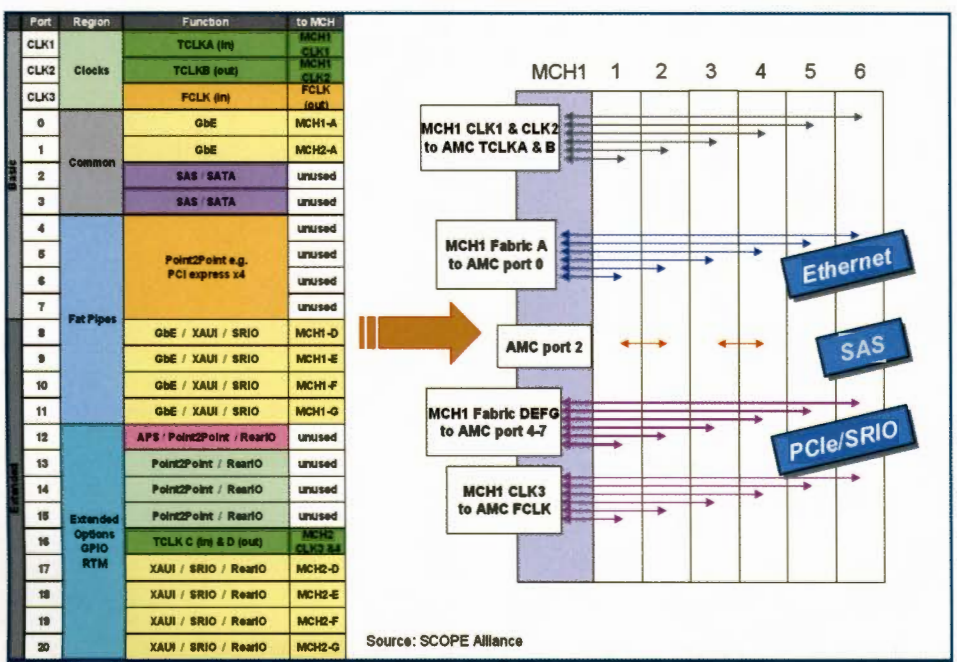

Figure 4: Ethernet

Eliminating Cost from MicroTCA

For AMC systems it is mandatory that all AMCs that conform to the AMC standard can be used, as well as standard MCHs. Cost drivers can be avoided by the following approach to system design:

- Active backplanes instead of power modules;
- PCI lanes and PCI clocks on the backplane instead of PCIe switches;
- MCH reduced to management and Ethernet (basic version: unmanaged switch);
- Double width format allows complete CPU including graphics and HDD on a single AMC;
- When Ethernet is not needed, it is possible to run without an MCH (CPU takes over the management);
- Cube-shape chassis design for six AMCs or 12 AMCs (single width) facilitates cooling;
- Pluggable power supplies for different supply voltages and performance.

Managed or Unmanaged Switch

An Ethernet switch passes on Ethernet frames arriving at one port to a suitable destination. For this purpose, the switch is able to memorise MAC addresses of incoming frames at its ports. More complex switches support additional functions such as virtual LANs (VLAN). They support the forwarding of Ethernet frames depending on the VLAN identifier or depending on information from the IP header.

The additional functions need to be configured, i.e. the switch needs an administration or management function. This means an additional microprocessor with "switch controller" software, in order to implement the administration and the user interface, as well as a more complex switch. For this reason, a managed switch is much more complex and expensive than a simple unmanaged switch.

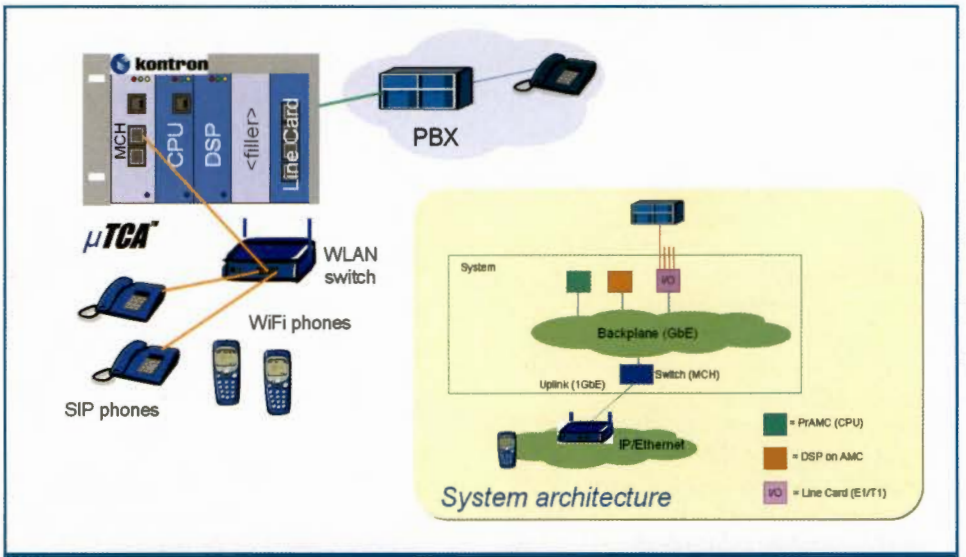

Figure 5: *PCI Express*

Second Generation AMCs – the Kontron Way

Figure 6 provides an overview of second generation systems with different designs. The system at the top is a 2U server in 19-inch format for eight AMCs (Kontron OM5080). This system incorporates full redundancy: the management function, Ethernet switches, fans and power supply all come with redundant duplicates. There is no single point of failure, so it is ideal for high-availability solutions in the telecommunication and enterprise IT sectors.

The system comes with an alarm panel with external management interfaces on the front side as well as uplinks for 8x GbE or 4x GbE and 2x 10GbE. The system can be equipped with processor AMCs, network processors or DSPs as required for media processing, communication, packet filtering, web server or appliance applications.

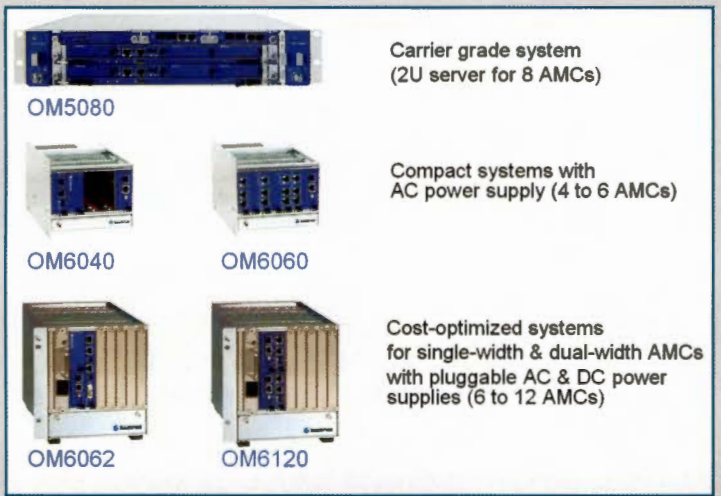

Figure 6: *AMC systems*

The middle row shows compact systems for 4-6 AMCs. The Kontron OM6040 (four AMCs) and OM6060 (six AMCs) systems support PCI Express, Gigabit Ethernet and Serial Rapid I/O for all standard AMCs. For this, the system comes with a complete MCH with Ethernet switch as well as PCI Express or SRIO switch.

A further second generation system family is shown at the bottom of Figure 6. The Kontron OM6062 offers space for six AMCs in single or double width format. This design affords optimal ventilation that can be implemented at low cost. A double width processor AMC such as the Kontron AM5010 offers space for a disk drive and graphics on an AMC slot for further cost savings. The larger front can accommodate two GbE slots, USB ports and DVI.

The AM5010 supports either a 4x PCI Express lane or four single PCI Express lanes. The PCI Express clocks are on the backplane which means that only a simple MCH with the basic management and Ethernet switch is needed. On the front the system has pluggable power supply units for AC and input voltages. The power management function can either be implemented in the power supply (power module with integrated AC power supply) or alternatively be integrated into the backplane. The latter case offers the chance for further cost-savings through the use of regular power supplies.

The OM6120 is a system with a further backplane variation that supports up to 12 single-width AMCs with one or two MCHs. ■

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NFC IS GOING SOLO

IAN KEEN OF INNOVISION RESEARCH & TECHNOLOGY OUTLINES THE CASE FOR NFC INTEGRATION, HIGHLIGHTING THE KEY CONSIDERATIONS WHEN IMPLEMENTING CUSTOM NFC DESIGN

NFC enabled 'Seeing eye phone' is designed for visually impaired people who are unable to read product information in shops and other places. A user can hold an NFC-enabled phone up to a tag (containing product-specific data, such as the price, use-by date etc), the text-based information is then retrieved and the phone's text-to-speech synthesiser feeds the information directly to the user in their chosen language

The success of Near Field Communication (NFC) across a range of applications depends on its large-scale adoption. This means simple, low-cost implementation of the technology in mass-market electronic devices, from mobile phones and laptops to point-of-sale terminals and ticket machines.

One way NFC can be integrated cost-effectively is through System on Chip (SoC) implementation in other common chipsets. In high-volume products, SoC implementation of NFC offers significant unit cost savings and very efficient integration, with lower overall space, processing and power requirements.

Integration – It's Only Natural

Integration is an established fact of life in the consumer electronics product lifecycle. Usually, the first products to market are built from discrete components and their typically high sale price reflects high production costs and small production volumes. As a product becomes more popular, manufacturers invest in progressively greater integration of components to drive down costs as volumes increase.

For consumer electronic devices, integration of a new technology follows a well-trodden path. When a new technology comes along, the first products might be external devices connected via a cable for example. The next step is to have card accessories that can be plugged into the device. Then comes a chipset that sits on the motherboard. What follows is a closer integration of the technology with other functionality on the motherboard – where it makes technical and economic sense.

Technologies undergo a similar process of integration within the devices themselves. A good example is the development of the GSM mobile phone from single-band only operation, through multi-band GSM operation to multi-mode operation. As these new capabilities were introduced, multi-band and multi-mode blocks were typically added for the digital logic and signal processing parts.

Initially, however, the different RF parts were implemented as separate blocks, as digital logic and RF technology were developing at different rates and market demand for the different combinations of RF bands was not well established. Today, RF design and market acceptance have moved to the point where the RF part is common for all frequencies. Over time, it has become possible and desirable to move commonality further down the mobile phone functionality stack.

The key issue facing electronic product designers and manufacturers today is where and how closely NFC should be integrated into their products.

NFC Integration Story

When to integrate NFC with other technologies and which interfaces to provide to the host system, are key considerations. Integrate too late and you could be left behind in the race to meet volume demand from a mass market cost-effectively.

The choice of interface point is a key market success factor, especially when different technologies are developing at different speeds. If integration is performed with interfaces at the wrong point – with stable technologies integrated with less

mature ones – adding or developing capabilities on the 'integrated' side of the divide could become much more costly than if they had been left on the other side of the interface. The integration point shifts with time and changing market conditions. The trick is to know when to move to the next level of integration.

NFC is going through the classic integration process. The first prototype implementations in mobile phones were as cover units that clipped on to the back. While useful for accessing and testing the market for NFC-enabled phones, they were unlikely to take off as a mass-market product – the NFC covers cost nearly the same for 10,000 units as complete phones cost for 10 million units.

As NFC moves to the next level of integration, designers have the choice of developing NFC chipsets to sit on electronic device motherboards, or moving to SoC implementations.

How about some Parrot speakers, the very latest NFC enabled product to hit the market incorporating Innovision Topaz NFC tags

The 'Virtual wallet' is used in a current NFC 02 consumer trial taking place in London

The benefit of greater integration is a significant cost benefit in high-volume production, which should more than cover up-front design and development costs. But before jumping in, designers and engineers should consider what role NFC will play in the device and whether there are 'overlap' areas with other circuitry on the host device's existing silicon.

The SoC Opportunity

Like any RF-based technology today, NFC requires a certain amount of analogue circuitry for transmitting and receiving analogue radio waves. Around 99% of silicon is purely digital (mostly memory) and there is little scope for building extra processes on this. But there are several areas of combined digital/analogue circuitry in mobile devices, including Bluetooth, WiFi and UWB chipsets, which provide ideal hosts for NFC processes.

Using such hosts for SoC implementations of NFC makes sense financially. The additional cost of including a stand-alone NFC chipset on the typical electronic device motherboard can be between $3 and $5 per unit and requires 25-30 connector pins. Implementing the same NFC functionality as a custom IP block on a Bluetooth chipset typically adds less than $1 per unit, requires 6-8 connector pins (including test pins) and needs no separate chip. The NFC IP block

can be placed in the corner of the Bluetooth chipset using on-chip connections.

The financial attractions of SoC are clear when addressing a mass market. There are up-front costs for developing custom IP for SoC implementations, but these will be repaid quickly through production savings in high volumes. With 300 million Bluetooth chipsets sold annually, it would be very quick to recoup even a $1m development investment if the manufacturer can charge an extra $0.50 per unit for built-in NFC capability.

The reduction in pin connectors is also significant, because motherboard 'real estate' in devices like mobile phones and digital cameras is limited and expensive.

Integrating NFC with existing chipsets also makes sense technically. Many of the processes and components needed by these RF-based technologies are the same: antenna, power, clock, data bus, etc. Having the NFC IP block on-chip also avoids the need for it to have its own ESD protection and drivers to ensure it works over the distances involved.

The choice between a custom IP block for SoC and a custom chip implementation is determined by the project emphasis – memory, size, power requirement, for example – or if additional functionality is required for an existing SoC. For example, to add NFC capability to a Bluetooth SoC, the challenges stem from the fact that different semiconductor vendors use different SoC design procedures. Some emphasise memory optimisation, others focus on size, layout or power consumption. Providing an NFC IP block that is optimised for use across these different environments requires extensive experience of the fab industry tools, individual vendors' procedures, an in-depth understanding of customers' requirements and design-flow.

Customising It

Assuming there is sufficient volume to justify the development costs, custom IC design – whether for stand-alone or SoC implementations – offers the advantage of enabling a designer to focus on meeting customer requirements in a way that cannot be achieved using standard products.

In a nutshell, custom IC design optimises the cost of IP ownership and contains exclusively non-recurrent engineering. This means that for a given application, power usage, silicon area and memory can be optimised to a specific requirement. Using custom IC design for NFC SoC implementations also means the host chipset designers do not need to become experts in a new area.

As NFC becomes more widely adopted as a mass-market technology, the advantages of SoC implementations become more compelling. Bluetooth chipset manufacturers have shown that Bluetooth/FM integration is a successful business model in the mobile phone market and the potential for NFC integration in consumer electronic devices is huge. ■

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Agilent (HP) 8713B 300kHz – 3GHz Network Analyser	£4500
Agilent (HP) 8592B 9kHz – 22GHz Spectrum Analyser	£6250
Amplifier Research 10W1000B Power Amplifier (1 GHz)	£4700
Rohde & Schwarz XSRM Rubidium Frequency Standard	£3750
R&S SMG (0.1 – 1 GHz) Sig. Gen.	£1750
Tektronix THS 720A 100MHz 2 Channel Hand-held Oscilloscope	£1250
W&G PFJ 8 Error & Jitter Test Set	£4500
Wayne Kerr AP 6050A Power Supply (60V – 50A)	£1850
Wayne Kerr 3260A+3265A Precision Mag. An. with Bias Unit	£5500
Wayne Kerr 3245 Precision Ind. Analyser	£1750
Various other calibrators in stock. Call for stock / prices	

THE MOBILE PHONE CAN BE THE PERFECT PAYMENT TOOL

With the latest advances in Information and Communication Technologies (ICT), using different technologies for electronic-payment has become a major issue in the retail market. The use of portable communication devices became a particularly attractive option when the versatility, security and simplicity features of payment technologies are being considered.

In this article, we investigate the use of mobile communication devices as versatile, secure and simple micro-payment tools, which satisfy the related financial, technological, computational and managerial requirements.

The versatility and security of the method comes from the use of a mobile phone and a Variable Transaction Number (VTN) in each transaction. Experimental results have shown that, the systematic requirements for the implementation of this technology are minimal and the costs involved are very much reasonable.

Keeping Losses at Bay

Due to the fraudulent use, loss or damage of the card-based electronic payment (e-payment) devices such as Visa, MasterCard, Card Plus and American Express, there is a significant annual financial loss. In addition, the implementation of electronic signature introduced other security problems due to the lack of facilities to enter the Personal Identification Number (PIN) at the Point of Sale (POS) terminals. A simple but yet versatile and secure electronic payment technology could be implemented by the use of Mobile Phones (MP), that will eliminate the security related problems due to the use of card based electronic payment devices.

MPs could be used in e-payment in several different ways, such as, SMS, IrDa, Bluetooth, RFID etc. These methods have the common ground of charging the mobile phone for the purchases made and integrate the purchasing expenses as well as the mobile phone bill.

HASAN AMCA AND **ERBUG CELEBI,** OF THE ELECTRICAL AND ELECTRONIC ENGINEERING DEPARTMENT AT THE EASTERN MEDITERRANEAN UNIVERSITY AND THE COMPUTER ENGINEERING DEPARTMENT AT THE CYPRUS INTERNATIONAL UNIVERSITY RESPECTIVELY, PRESENT THEIR SOLUTION OF USING THE MOBILE PHONE AS OPERATOR-INDEPENDENT, SECURE MICRO-PAYMENT TOOL

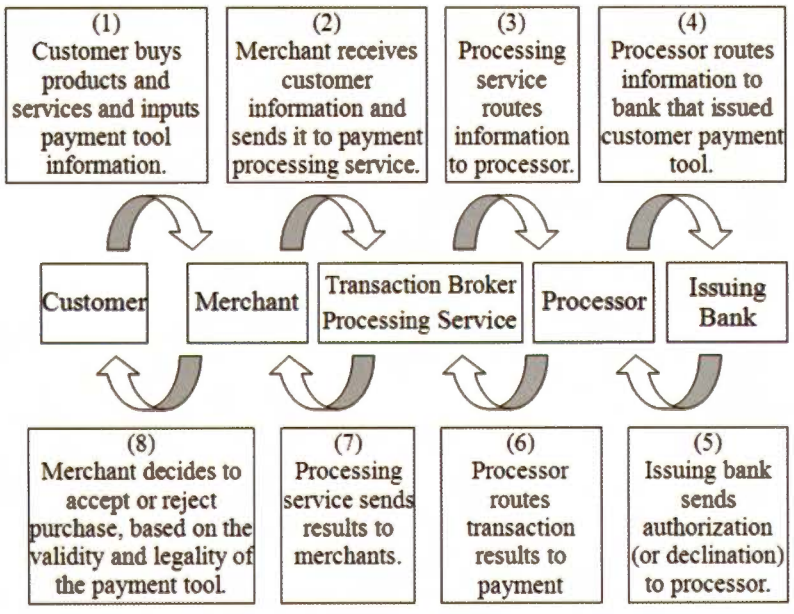


Figure 1: *Payment processing authorisation cycle*

The SMS method allows users to anonymously and securely pay for the products and services they purchased via their mobile phone by sending a text message to a premium number. The customers are then charged on their mobile phone invoice.

The SMS method is designed to work in batch processing mode and, therefore, might take a long time to confirm credit approval by the bank and complete the transaction.

Despite the well defined IrDa specifications, the relatively long set-uptime renders IrDa useless for mobile payment (m-payment). The "express payment", designed to reduce the set-uptime, reduces the transaction time significantly. However, it also reduces the security level by giving the privilege to the devices to bill the consumer without authentication and making them potentially vulnerable to financial fraud.

Bluetooth requires a relatively long set-

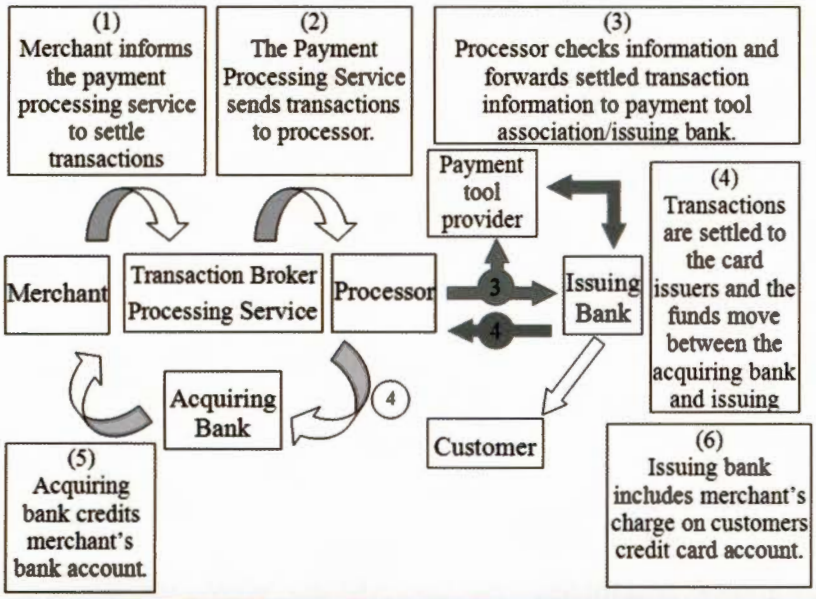


Figure 2: *Payment processing settlement cycle*

uptime before the payment process starts. Plus, it has a non-selective nature. A Bluetooth device will search for all devices within a short range. This might mean a large number of Bluetooth devices in a shopping centre, for example.

The usage of RFID in m-payment could be comparable to Bluetooth and, as such, is also seen as delay and complexity limited.

The method we propose in this article uses a credit provider-generated, secure, transaction number, unique to each transaction. This number is transmitted through the GPRS channel and transformed into a barcode by the MP that can easily be read by the merchant's barcode reader. This allows for the shortcomings in terms of latency, security and usability mentioned above, to be overcome.

This method of payment could be made available in societies where the Mobile Phone usage is more widespread than the Credit Card (CC). Most of the underdeveloped and developing countries have higher rate of mobile phone penetration than CC. Hence, m-payment in such countries can help improve the spread of electronic payment technologies by using MPs instead of CCs.

Online Payment Processing Methods

Electronic payment could be referred to as payment for the purchase of goods or services without using cash. An electronic payment solution should be versatile, secure and easy to use so that the common fraud-related risks such as product, identity or cash theft will be avoided. To satisfy these requirements, an electronic payment solution should consist of two steps: 1) authorisation and 2) settlement.

Authorisation verifies that the payment tool is active and the customer has sufficient credit to make the transaction. This is shown in **Figure 1**. Settlement is the process of charging the customer's payment account and transferring money from the customer's account to the merchant's account through a transaction broker such as PayPal, for example. This is depicted in **Figure 2**.

VTNB Method

The repetitive use of the fixed credit cards and the fixed verification numbers in all transactions poses a major threat on the use of card-based electronic payment systems, since such numbers are easy to remember and relatively easy for some attackers to steal. More common ways of unlawfully obtaining credit card information such as shoulder surfing, dumpster-diving, packet intercepting and database stealing, also exist.

Due to the fraudulent use, loss or damage problems, yearly, there is a significant financial loss. Not only does the CC fraud cause money loss, but also significant worry among customers. Hence, a successful method for payment should eliminate these problems and allow customers to make payments without worry.

As a candidate for secure payment method, the Variable Transaction Number Barcode (VTNB) method should depend on different factors such as: systematic simplicity and feasibility, open architecture, short transaction delay, ease of use by the target customers, interoperability between different vendors and security. The VTNB method uses existing telecommunications infrastructure and it satisfies all of the above criteria, as presented here.

Simplicity and Feasibility

The systematic simplicity and feasibility refers to the additional hardware and software required to build the VTNB over the existing payment system. The VTNB system should also be fast, traversing minimum number of proprietary networks. This way, payment of small amounts is possible since network usage is limited and the overhead is low. This can be better understood with reference to **Figures 3** and **4**. The VTNB method of payment is basically similar to the credit card method except that, in the former the onscreen barcode is read by the barcode reader and manipulated by the terminal device replacing the POS terminal. The terminal device is a single board computer with a GPRS support and a USB sockets. A PC104 running on Linux could be used to produce the terminal device, as shown in **Figure 5**.

Layered Protocol Architecture

The widespread acceptance of the VTNB method depends on the choice of the architecture and the communication protocol used. The architecture should support the Open System Interconnection (OSI) architecture so that different vendors could produce electronic equipment such as the VTNB processor compatible with the barcode reader and the merchants stock control system. The layers of VTNB protocol stack are shown in **Figure 6**.

The application layer of VTNB hosts the application program responsible for receiving the VTN through the GPRS

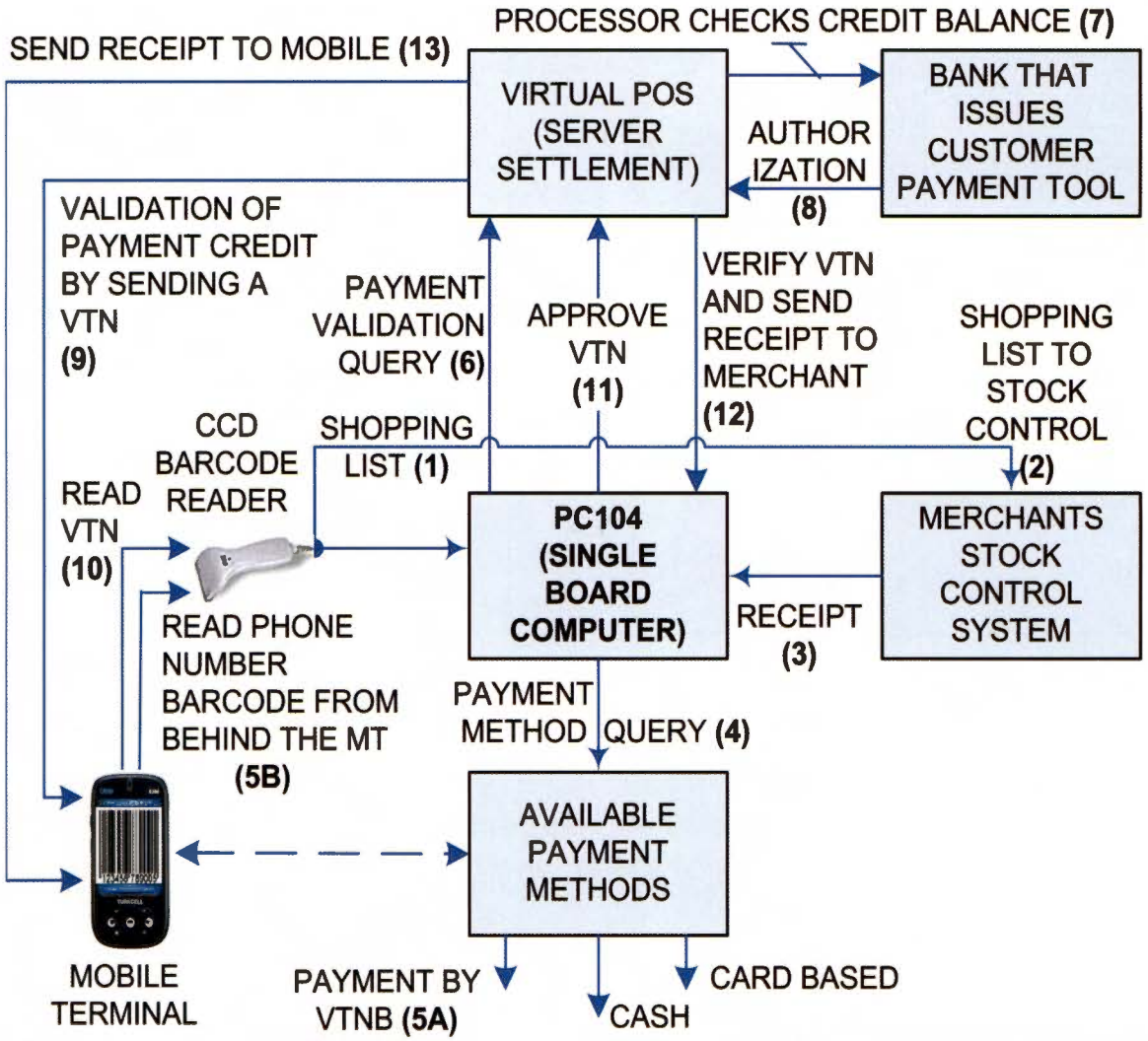


Figure 3: *VTNB payment processing authorisation cycle*

channel and performing the necessary operations. Steps 5, 9, 10 and 13 in Figure 3 are defined in the VTNB Application Layer Protocol and are described in the following steps.

After the transaction amount is displayed on the merchant's terminal screen, the customer decides to pay by VTNB method. Payment is initiated by reading the MP phone number in the form of barcode from the back cover of the MP (5B).

The phone number is sent to the VPOS through wireline network and the VPOS sends the VTN to the MP if the phone number is authorised for such payment. The VTNB is presented to the merchant's Charge Coupled Device (CCD) barcode reader to finalise the payment process (steps 5 to 10). This is followed by verification of the VTN by the VPOS (12). The on-line connection to the VPOS is provided by the module on the cash register instead of the POS device.

An additional security level is created by introducing the entry of a PIN to the MP during the payment cycle right after step 7. Once the user accepts (by entering the PIN code on the MP) to pay the amount on the merchants screen, the payment process is completed.

The VTNB payment system is suitable for different types of applications including in petrol stations, vending machines, buses, car parks, ATMs, cinemas and theatres, classroom attendance checks etc.

Transaction Delay

Transaction delay is one of the most important factors for acceptability of an electronic payment system. Literature survey has shown that, ideally, such a delay should be less than one second. The transaction delay in a VTNB system is expected to be shorter than that of the Bluetooth, RFID and IrDA, but similar to that of the conventional Credit Card (CC) method. The delay is due to the reading of the phone number barcode, applying to the VPOS for a VTN, validation and granting of VTN, reading VTN by barcode reader, verification of VTN and billing mechanism.

The VTN is randomly drawn from a set with a negotiation between the financial

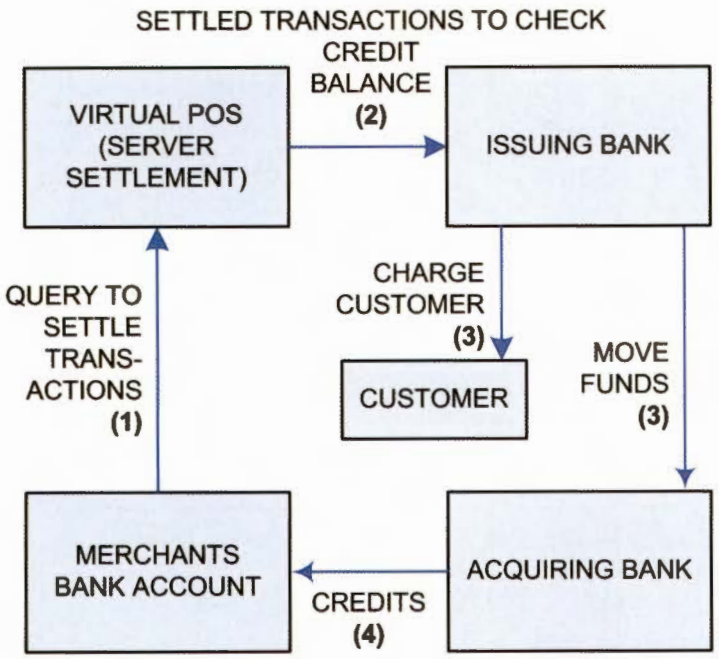


Fig. 4: VTNB payment processing system settlement cycle.

Figure 4: *VTNB payment processing system settlement cycle*

service provider and the mobile terminal (MT), preferably as a function of the International Mobile Equipment Identity (IMEI) number of the MT. The provision of the VTN is the major challenge in the proposed method of payment and more research is to be made to eliminate delay in generating VTN without compromising security. The delays involved are presented in **Figure 7**.

Parameters effecting delay are: set-up time, connection time, data transfer time, processing time, security verification time and disconnection time. The following section clarifies the delay mechanism, which starts after reading and transmitting the MP number barcode from the back cover of the mobile phone (5B). The LOOP delay in VTNB Mobile Payment System includes:

T_1: Payment validation query transmitted to the VPOS (6);

T_2: Credit balance check and validation (7,8);

T_3: Validation of the payment credit by sending a VTN to the MP (9);

T_4: Reading the VTNB (10);

T_5: Sending the VTNB to the VPOS for approval (11);

T_6: Verifying the VTN and sending the receipt to both, the merchant and the customer (12,13).

Ease of Use by the Target Customer

The usage of the VTNB technology is as simple as sliding a product in front of the barcode reader, which means we can treat the mobile phone as nothing more than just a 'product' too.

The users are not expected to have any special skills to adapt to the method. The only requirement is the need to register for the service prior to usage. In countries where the use of credit cards is not widespread but the MP penetration rate is high, the VTNB system is expected to find high levels of public acceptance.

Vendor Interoperability

A set of global foundational m-payment standards need to be agreed upon in order for content providers to reach a critical mass of paying customers who, in turn, will then have a plentiful supply of applications and services to choose from. This will enable widespread availability of m-payment and the target customer range will also increase.

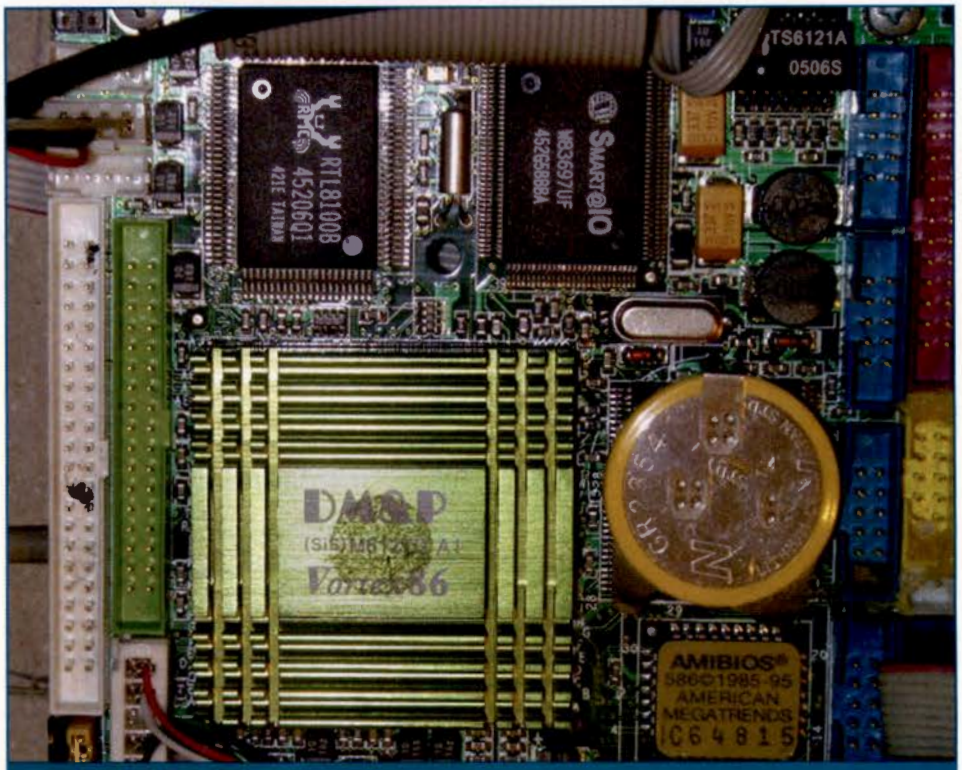


Figure 5: *PC104 single-board computer running on Linux used to recreate the terminal device*

For the VTNB method to pick up easily and spread all around the world, a standardised communication and interconnection standard should be adapted in order for the equipment manufacturers to produce devices that will interoperate with the VTNB system. This requirement is satisfied by the use of an open architecture.

Security

The VTN is created randomly in order to avoid reproduction without the MP holder's consent. The VTN should be accompanied by the PIN of the MP user. The process of entering the PIN at the POS machine could easily be replaced by entering the PIN on a mobile phone, in privacy and comfort of the user. User portability is provided by the SIM card and the MP number barcode can be situated at the back of the phone.

Keeping and protecting paper receipts for future reference is also a security issue in m-payment methods. Paper receipts can be lost and cause consumer inconvenience and dissatisfaction in CC payment systems. However, the storage nature of the electronic receipts helps to protect them and work them out easily in electronic form.

Set-up and Results

The VTNB system, which is designed with an embedded system approach, is implemented on an x86 based Single Board Computer (SBC) running on Ubuntu Linux, which has been especially designed for embedded systems, with low memory and CPU resources.

In the embedded system approach, the system is designed to run for a relatively long time without errors. In the case of errors, a self recovery mechanism, such as a watchdog timer, is usually employed. No mechanical or moving parts such as hard disks are included.

The embedded systems are less tolerant of errors. Therefore, they have a more sophisticated and thorough testing procedures.

The final system prototype is made up of a 133MHz CPU, 64MB RAM, IDE interface, 2 × USB ports, PCI interface, a parallel port, 2 × RS232 ports, AGP compliant VGA interface, 44-pin IDE flash disk to store the system and application programs, keyboard, VGA display and +5V power supply. In addition, there's a Hitachi HD44780-based 20 × 4 character LCD controller with an LCD4 Linux driver as the display means.

This SBC will replace the POS terminal at the merchants counter. An application program using LibCurl (this is a common library used to grant web access to mobile devices) is developed and installed on the SBC as shown in Figure 5. An application program that generates the VTN is also developed to run on the web server. In addition to VTN management, this application program will be responsible for bank transactions, keeping authorisation logs, managing the database and generating records to enable system tracking. A Java application program that will aid receiving the VTN and converting it into a barcode is also developed using Midlets, for installation on the MT.

The preliminary test results have shown that the MP can be used as an electronic payment device along with the VTNB support framework. The loop delay is estimated through empirical measurements and timing calculations between the source and destination, resulting in $T_1 = 0.2s$, $T_2 = 0.2s$, $T_3 = 2s$, $T_4 = 1s$, $T_5 = 0.2s$, $T_6 = 2s$. The overall delay is therefore around 5.6 seconds, which is of the same order as the CC usage delay as our empirical study has shown.

The security checks are fully operational and no run-time errors or defects is observed during 120-hour test run.

A Solid Alternative

Card-based electronic payment services have been widely used throughout the world for several decades. However, due to the security gap in these services, alternative solutions have been sought out by the financial service providers. The use of mobile phones appeared to be the closest contender to card-based payments due to the advanced security features, reliability, interoperability between different vendors, ease of use by the target customers, high penetration rate, simplicity in implementation and technical feasibility. The system also guarantees that, the service provisioning by banks, operators and terminal manufacturers are also independent from each other.

The mobile phone based VTNB system, which is introduced as an alternative electronic-payment scheme, has proven to be efficient, fast and highly secure. Through the use of PINs for authentication, VTNB could yield an even higher level of security. The method could easily be customised to support either credit or debit-based payment schemes. ■

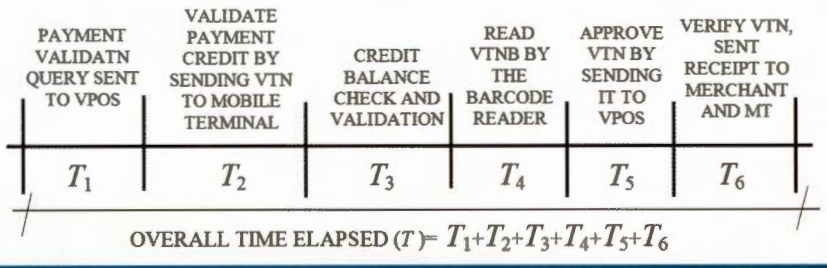


Figure 6: *The 7-layer protocol stack for connection management between the MT and the POS terminal*

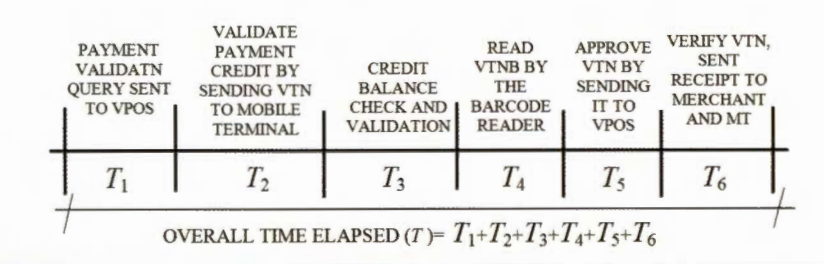


Figure 7: *The delays involved in the VTNB method*

COMMUNICATION TECHNOLOGIES FOR PMSE EQUIPMENT

MIKE MARTINDELL, CONSULTANT AT UK-BASED PLEXTEK,

EXAMINES THE SPECIFIC REQUIREMENTS OF PROGRAMME MAKING AND SPECIAL EVENTS (PMSE) EQUIPMENT AND POSSIBLE TECHNICAL SOLUTIONS FOR RADIO TRANSMISSION

The move of terrestrial television from analogue to digital transmission is freeing up a range of UHF broadcast frequencies, some of which are currently used for radio microphones and similar PMSE equipment.

PMSE equipment suppliers have used analogue FM for over 40 years as a transmission method. With the squeeze on spectrum and a range of digital transmission techniques now available, are there new, more spectrum-efficient solutions?

Performance Related

PMSE applications can be divided into two main areas: low-to-medium quality communications links, such as talk-back and intercom applications, and performance-grade audio systems, such as radio microphones.

For basic communications links, voice intelligibility is the key, so limited dynamic range and some interference and latency can be tolerated. In this application, speech quality digital technologies such as DECT are sufficient for purpose, transmitting

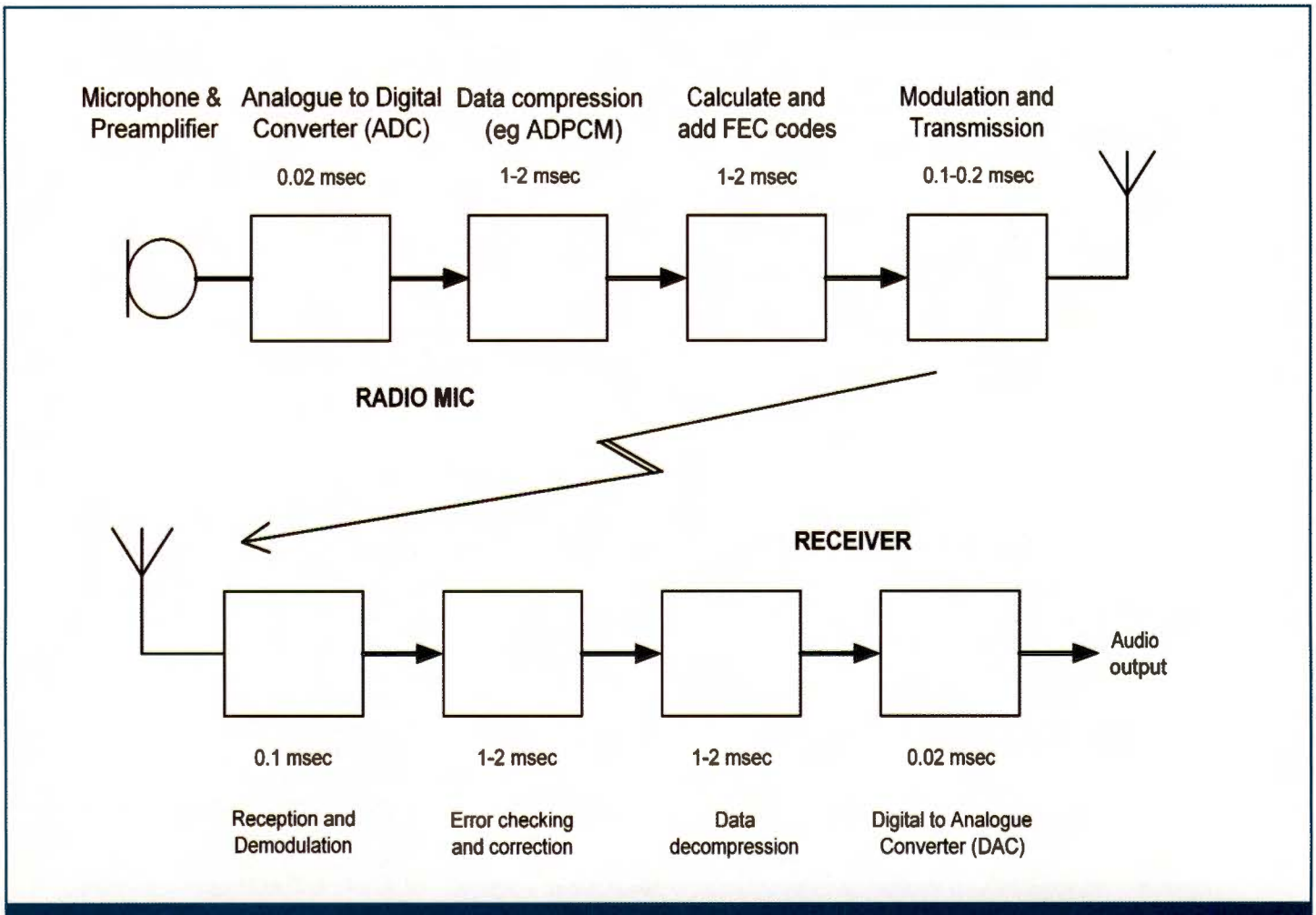


Figure 1: *A simple digital radio microphone system*

typically at 64kbs in an unlicensed radio band.

However, performance-grade microphones and monitoring systems require similar performance standards to studio microphones. Here, performance parameters such as a wide dynamic range (95-105dB = 16 or 18 digital data sample size); frequency response (10Hz –20kHz = 44 or 48kHz sampling frequency); low latency (0-5ms); good battery life (8-40hrs); physical size; freedom from interference and low cost, are all key factors.

Using these parameters, we can investigate the radio bandwidth needed for a digital transmission system.

Digital, Audio, Radio Transmission System

Figure 1 shows the basic blocks required for a digital radio system. Typical latency values are shown for each block. The total system latency is the sum of these individual values.

Digital system data rate

The required bandwidth is dependent on the digital data rate and the modulation method.

Based on the Pulse Code Modulation (PCM) scheme, the data rate is given by the sample size multiplied by the sampling frequency, so for a 16-bit sample taken at 44kHz rate, the data rate is 16 x 44 = 704kbs.

This is raw audio data that will need the addition of between 50% to 300% additional data for error correction and synchronisation. Taking the best case of 50%, this gives a transmission data rate of 1.5 x 704kbs = 1056kbs.

Transmission efficiency

The radio bandwidth required to transmit data depends on the modulation type. Simple modulation schemes such as Gaussian Minimum Shift Keying (GMSK) and Quadrature Phase Shift Keying (QPSK) have efficiencies of 1.24 to 1.66bps/Hz bandwidth.

With the previously calculated data rate, this gives a required radio bandwidth of between 852kHz and 636kHz. Compared with an FM analogue transmission bandwidth of nominally 140kHz, on a 200kHz channel spacing, a simple digital transmission, without data compression, is very poor at spectrum efficiency.

Improving Transmission Efficiency

There are three areas where the radio transmission bandwidth for simple digital transmission can be improved:

Lowering the data rate

Reducing the number on transmitted bits is practical by using Adaptive Differential Pulse Code Modulation (ADPCM). ADPCM techniques are the only practicable data reduction method with low latency. Low audio quality ADPCM has been used in digital links between telephone exchanges for forty years. Realistically, to keep an acceptable audio quality, the minimum ADPCM word length needs to be on average around 4 bits per sample.

Minimising the forward error correction overhead

A data overhead of 50% is probably the least amount of forward error correction (FEC) that can be considered in practice. Note that by decreasing the audio data rate, the 50% overhead generally scales down proportionally.

Using higher order modulation schemes

High order modulation methods can improve spectrum efficiency. However, higher order schemes are more subject to interference and corruption, and require more error correction overhead, so there is a compromise required for optimum overall performance and efficient transmission.

A modulation technique such as 16QAM gives a bandwidth efficiency of 3.18 bits per Hz, however the overhead will reduce the theoretical gains in efficiency. In addition, the transmitter topology becomes considerably more complex and power-hungry, reducing power consumption and increasing size. This method is not compatible with small battery-powered portable equipment.

Simpler modulation schemes such as Binary Phase Shift Keying (BPSK), GMSK and up to QPSK provide an optimum solution.

Improved Digital System Bandwidths

Example:

ADPCM sample size: 4 bits
Sampling frequency: 44kHz
FEC overhead: 50%
Therefore, the raw data rate = 4 x 44kHz = 176kbs
With 50% FEC added = 264kbs
– Using GMSK modulation (1.24bps/Hz) gives 264/1.24 = 213kHz transmission bandwidth.
– Using QPSK modulation (1.66bps/Hz) gives 264/1.66 = 159kHz transmission bandwidth.

The exact figures used for this example and the assumptions made for audio quality and overall performance can be open to debate, and this should be considered a minimal level quality audio solution.

For comparison, audio compression by NICAM digital stereo encoding, as used in TV broadcasting is 728kbs, or 364kbs in mono.

Fundamentally, these examples demonstrate that at the minimum, a quality digital transmission will have similar spectrum requirements as the nominal 200kHz channel spacing used for analogue FM transmission by radio microphones.

High Quality Demands

High quality PMSE equipment demands low latency, otherwise users are unable to create a live performance as a coherent group of performers.

High degrees of digital compression require large blocks of data to work on. This demands long latency periods, in practice the amount of data compression appropriate for PMSE equipment is extremely limited.

While spectrum efficiency can be improved by using higher orders of modulation, high order modulation schemes require higher levels of error correction and latency. In addition, the technology required to generate higher order modulation schemes is power-hungry, making it unsuitable for battery-powered portable applications.

Low latency limits the amount of error correction available to cope with a noisy transmission environment. Error recovery from burst type interference is only possible for interference burst lengths of less than 50% of the total latency time, therefore the digital audio transmission channel must be relatively clean of interference, which tightly constrains the use of shared spectrum.

In conclusion, digital solutions for PMSE equipment offer only a marginal improvement over analogue transmissions for radio spectrum efficiency, with an increase in complexity. However, digital transmission systems do offer robustness, more system flexibility and enable dynamic modes of operation such as frequency hopping, which are not available to analogue systems.

Audio Compression Techniques

MP3 Encoding

MP3 is a data reduction method that uses psychoacoustic modelling to reduce audio data rate. High quality audio requires an MP3 bit rate of typically 256kbs. Due to the complexity of the filtering process to reduce the bit rate, the encoding latency is typically 100-200ms, which is far in excess of live microphone latency requirements.

Data Reduction Techniques

Data reduction, otherwise termed compression, involves looking at a sequence of data, identifying common or redundant elements, and identifying the differences between data samples. In order to carry out data reduction a sequence of data has to be collected to identify the common and difference patterns.

A live, low latency application such as radio microphones offers little opportunity to collect, analyse and process a useful amount of data, so data compression techniques have very limited use in this application. The most applicable low latency data compression technique is ADPCM.

ADPCM

ADPCM works by coding the difference in value between sequential audio data samples. This is more efficient than using the absolute value of each sample. Therefore, a 16-bit audio sample can be reduced to an average of a 4-bit "difference" word, without losing significant audio quality. Using an average word size smaller than 4 bits significantly increases the error in coding the difference values, and the decoded and reconstructed audio suffers excessively.

Radio Technologies

New radio technologies can allow more efficient use of the radio spectrum, provided the usage environment and system requirements are carefully considered.

Software Defined Radio (SDR)

A software-defined radio is a flexible adaptable receiver that permits easier implementation of a cognitive radio solution.

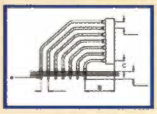
Cognitive Radio

Cognitive radio is a relatively new term, referring to a type of radio link that adapts to different radio environments. The radio link has to be two-way to achieve this, for example the receiver detects interference or degradation of the link and signals back to the transmitter to either change frequency or to change to a more robust modulation mode. The change of mode has to be synchronised.

For a radio microphone application, the mic transmitter must be replaced by a transceiver and a control microprocessor, increasing complexity and cost. Transceiver ICs are available with low enough power consumption and small size to make this possible.

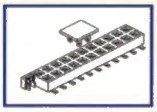
A number of practical engineering factors need to be considered. Some overall management of the system may be required. For example, if two nearby microphones encounter interference and independently decide to switch to the same new channel, then there will still be an interference problem, but potentially far more serious. ■

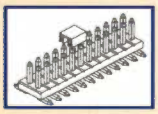
E-tec Manufacturing Socket & Connector Solutions

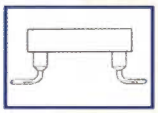

LED Sockets vertical & horizontal


BGA Sockets

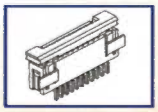

Female Connectors 1.27, 2.00, 2.54mm pitch


Ultra low profile 2.00mm pitch


Low Profile SMD headers 1.27, 2.00, 2.54 pitch


SMD turned pin socket


Elevated Sockets PC104 and PC104+


ZIF, FPC connectors/cables

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ELECTRONICALLY TUNABLE MULTIFUNCTION VOLTAGE-MODE FILTER

Voltage-mode filters employing current conveyors have been receiving attention nowadays. Moreover, it is good for a circuit to employ grounded passive elements only – especially grounded capacitors – and not require passive component-matching conditions, thus very convenient for fully integrated circuit technology.

Also, the designs of operational transconductance amplifiers together with capacitor (OTA-C) filter circuits require no resistors. Therefore, they are more suitable to monolithic integration than other, currently available conveyors.

Recently, the use of differential difference current conveyors (DDCCs) in filter design has received considerable attention as its can utilise the addition and subtraction operators at the port X terminal. Of particular interest here is the use of OTAs and DDCC for designing an electronically-tunable versatile universal voltage-mode filter.

Here, I present a new electronically tunable multifunction voltage-mode filter. The proposed circuit offers the following features:

– realisation of highpass, bandpass and lowpass signals from the same configuration;
– the use of two grounded capacitors, ideal for integrated circuit implementation;
– no requirement for component-matching conditions;
– high input impedance good for cascadability;
– electronic tunability.

The OTA is a differential voltage-controlled current source with transconductance gain g_m, which can be characterised by the port relations of:

$$I_o = g_m(V_+ - V_-)$$

The positive DDCC can be characterised by the port relations of:

$$I_{Y1} = I_{Y2} = I_{Y3} = 0 \quad V_X = V_{Y1} - V_{Y2} + V_{Y3}$$

and $I_Z = +I_X$

The proposed circuit, as shown in **Figure 1**, employs two OTAs, one DDCC and two grounded capacitors. The configuration does not employ external resistors, thus is an active-C filter. Routine analysis of the circuit gives the following filter transfer functions in **Equation 1:**

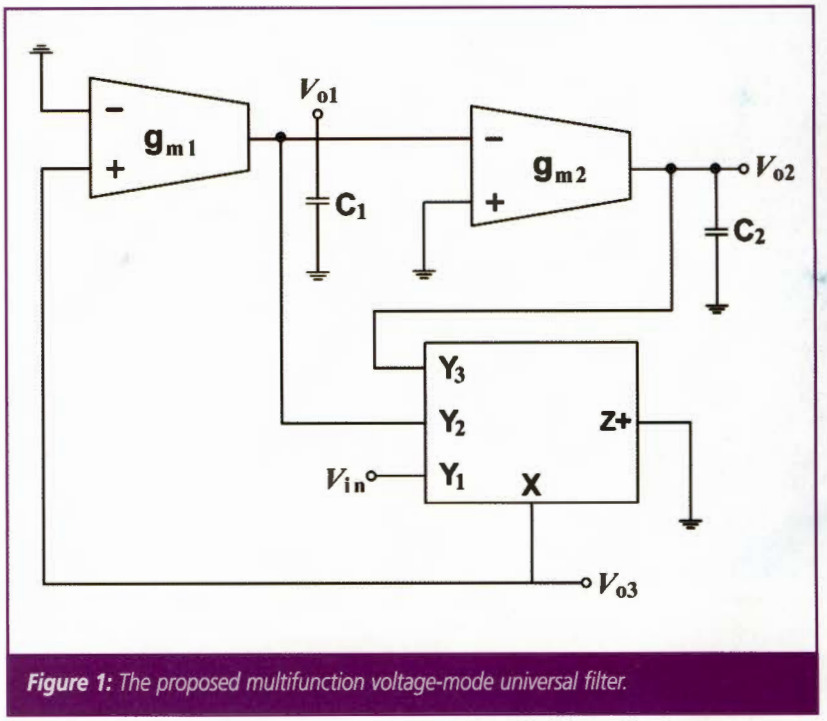

Figure 1: *The proposed multifunction voltage-mode universal filter.*

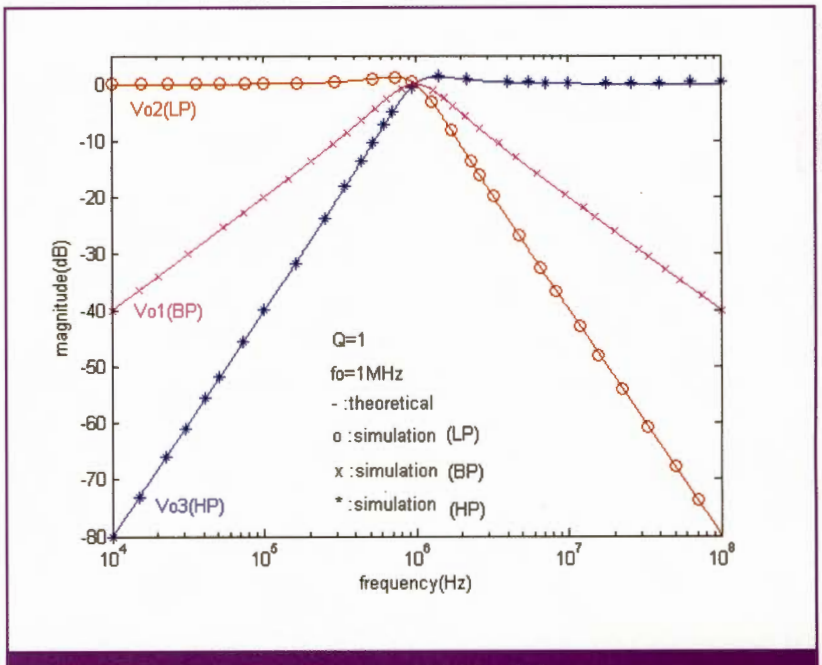

Figure 2: *Simulated frequency responses of HP, BP and LP.*

$$\frac{V_{o1}}{V_{in}} = \frac{sC_2 g_{m1}}{s^2 C_1 C_2 + sC_2 g_{m1} + g_{m1} g_{m2}}$$

$$\frac{V_{o2}}{V_{in}} = \frac{-g_{m1} g_{m2}}{s^2 C_1 C_2 + sC_2 g_{m1} + g_{m1} g_{m2}}$$

$$\frac{V_{o3}}{V_{in}} = \frac{s^2 C_1 C_2}{s^2 C_1 C_2 + sC_2 g_{m1} + g_{m1} g_{m2}}$$

The resonance angular frequency and quality factor Q are obtained in **Equation 2:**

$$\omega_o = \sqrt{\frac{g_{m1} g_{m2}}{C_1 C_2}} \quad Q = \sqrt{\frac{C_1 g_{m2}}{C_2 g_{m1}}}$$

The low passive sensitivities of and Q are obtained in **Equation 3:**

$$S^{\omega_o}_{g_{m1}} = S^{\omega_o}_{g_{m2}} = = - S^{\omega_o}_{C_1} = - S^{\omega_o}_{C_2} = \frac{1}{2};$$

$$S^{Q}_{C_1} = S^{Q}_{g_{m2}} = - S^{Q}_{C_2} = - S^{Q}_{g_{m1}} = \frac{1}{2}.$$

To validate the theoretical prediction of Figure 1, a simulation using H-Spice with TSMC 0.25μm process was performed. The component values in Figure 1 were given by:

$g_{m1} = g_{m2}$

= 317μS and C_1=C_2=50pF, leading to a centre frequency of

$f_o = 1MH_Z$

and quality factor of Q = 1.

Figure 2 shows the simulated and theoretical responses of highpass (HP), bandpass (BP) and lowpass (LP) configurations. As can be seen, there is a close agreement between theory and simulation.

Hua-Pin Chen
Department of Electronic Engineering,
De-Lin Institute of Technology,
Taiwan

PC TEMPERATURE ALARM

If your PC overheats it could damage expensive components. The circuit in this project will warn you when it is getting warm.

Over the years, the complexity of PCs has increased substantially. Modern PCs have more complex processors, more memory and more sophisticated graphics cards than the PCs of yesteryear.

Paradoxically, the amount of power consumed by the average PC has actually reduced, but only slightly. Modern technology has given us computers that have most of the circuitry in just a handful of chips, and the reduced power consumption is a by-product of this LSI and VSLI approach. Some PCs, however, still have power supplies that are capable of supplying around 200W, but few PCs actually consume anything approaching this figure.

On the other hand, apart from some portable and small desktop computers that use the latest micro-power components, most PCs still consume significant amount of power and generate a certain amount of heat.

The temperature inside the average PC starts to rise well above the ambient temperature, soon after power-up. Some of the larger integrated circuits run quite hot and if the temperature inside the PC rises too high, there is a risk that these devices will not be able to lose heat at a fast enough rate. This could, in turn, lead to them malfunctioning before too long.

Keeping Heat at Bay

Various means of combating overheating are available and these range from simple temperature alarms to up-market devices, such as temperature-activated fans to keep the microprocessors cool.

The simple device featured here is a temperature alarm, which activates an audio 'beeper' when the temperature inside the PC exceeds a preset threshold level. This temperature is user-adjustable and can be anything from 0 to 100 degrees Centigrade.

The unit is in the form of a small PC expansion card, which is simply plugged into any available slot in the host PC. The unit is powered from the PC and its current consumption is only about 12mA.

Operation

Figure 1 shows a block diagram for the PC temperature alarm. The basis of the unit is a semiconductor temperature sensor. All semiconductors are affected by temperature changes, which can cause problems. A semiconductor temperature sensor puts this phenomenon to good use.

A forward-biased silicon diode forms the basis of most semiconductor temperature sensors. There is potential of about 0.65V developed across a forward-biased silicon diode, but the exact voltage is dependent, to some extent, on the bias current used

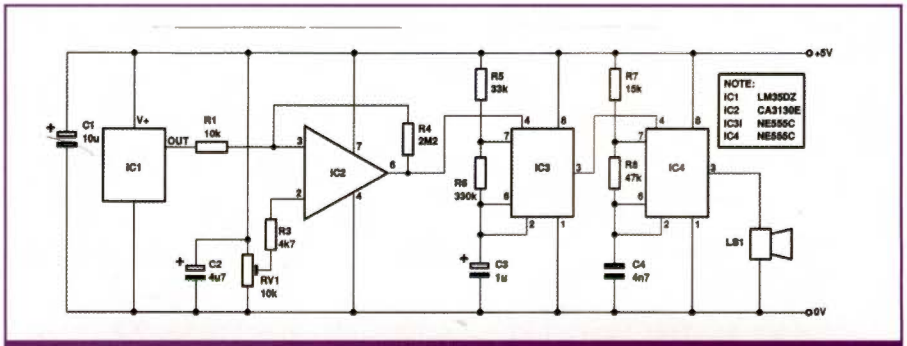

Figure 1: Block diagram of the PC temperature alarm

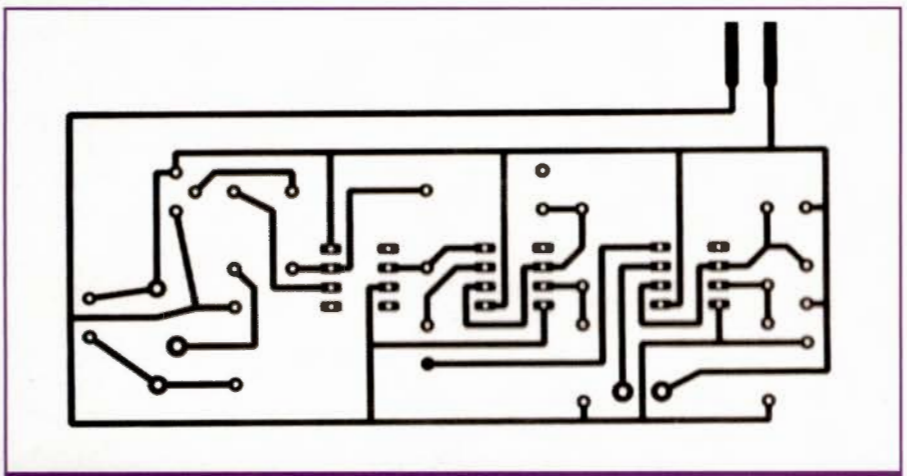

Figure 2: The printed circuit components overlay of the PC temperature alarm circuit

PARTS LIST

Resistors
R1 10K
R2 39K
R3 4K7
R4 2M2
R5 33K
R6 330K
R7 15K
R8 47K
VR1 10K 18 turn trim pot

Capacitors
C1 100uf/25V radial
C2 4u7 / polyester
C3 1uf/50V radial elect
C4 4n7 polyester

Semiconductors
IC1 LM35DZ
IC2 CA3140E
IC3, IC4 NE555C
Miscellaneous
LS1 Cased ceramic resonator
Printed circuit board
8 pin DIL IC HOLDER (3 OFF)
WIRE, SOLDER, ETC.

and the temperature of the diode. If the diode is biased with a constant current, the output voltage is only dependent on the diode's temperature.

Even quite large changes in the temperature do not provide major changes in the output voltage. The change is typically about two or three millivolts per degree Centigrade, with positive changes in temperature giving a reduction in the output voltage.

The linearity is quite good however, which makes semiconductor temperature sensors a good choice for temperature measurement, as well as simply detecting a certain temperature. In order to use a diode sensor in most practical application, it is necessary to use certain amount of amplification, plus some level shifting or other signal conditioning.

The sensor used in this project provides a substantial amount of on-chip signal conditioning, including amplification, level shifting and phase inversion. As a result of this it provides an output potential that is equal to 10mV per degree Centigrade. It, therefore, provides an output voltage of 0 to 1V over its operating range.

A voltage detector stage compares the output voltage of the temperature sensor with a preset reference voltage. The output of the comparator goes high if the output potential from the sensor exceeds the reference voltage. When this happens, the voltage comparator switches on a low frequency oscillator, which in turn pulses an audio oscillator on and off. This generates a simple 'beep-beep' alarm sound, which is adequate for an application of this type. The reference voltage determines the temperature at which the alarm is activated.

The required reference voltage (in millivolts) is equal to the required threshold temperature, multiplied by ten. For example, for a threshold temperature of 37 degrees Centigrade, a reference voltage of 370mV (0.37V) is needed.

Easy to Use

IC1 is the temperature sensor and this is very easy to use. It is a basic three-terminal device (two supply leads plus the output) and it will operate over a wide supply voltage range of 4 to 20V. It its current consumption is a mere 56 microamps, which together with a 5V supply potentially gives totally insignificant self-heating.

IC2 is an operational amplifier which is used here as a voltage comparator. VR1 provides a reference voltage that can be set anywhere from 0V to approximately 1V, which matches the output voltage range of IC1. This reference voltage is applied to the inverting input of IC2 and output of IC1 is coupled to the non-inverting input. Consequently, the output of IC2 is low if the output of IC1 is below the reference voltage, or high if the output of IC1 exceeds the reference voltage.

When the output of IC1 is very close to the reference voltage there is a risk of instability, with a lot of noise being produced at the output IC2. There are several factors that can contribute to these problems, but the main cause is the noise generated within IC2 itself. The positive feedback provided by R4 results in the output of IC2 switching clearly and rapidly once the output from IC1 reaches a high enough voltage under standby conditions, with the output of IC2 slightly lower.

As the output switches to high state, R4 tends to pull the voltage at the non-inverting input, fractionally higher. This produces a slightly difference between the input voltage at which IC2 triggers to high state and the input voltage at which it switches back to the low state again. This slight reluctance to change states (known as 'hysteresis') is sufficient to prevent instability.

The low frequency oscillation is biased on IC3 and this is a standard 555 astable circuit. It is gated via the reset input at pin 4, which holds the output at pin 3 low when IC3 is gated off (when the output of IC2 is low). This prevents IC4 from oscillating. This is another 555 astable-type circuit; again gated via its reset input it has an operating frequency of approximately 2.5kHz.

When IC3 is activated, its output provides a roughly square wave signal over 1Hz. This pulses IC4 on and off, resulting in LS1 being fed with bursts of tone from IC4, which produces the alarm signal from LS1 – a ceramic resonator.

Construction

Normally, a PC expansion card has to be a double-sided PCB. However, in this case the circuit is reasonably simple and it only requires connections to the ground and +5V terminals of the expansion bus. A signal-sided board is therefore sufficient for this project. The printed circuit components overlay appears in **Figure 2**.

The CA3130E specified for IC2 is a MOS device and it therefore requires the standard anti-static handling precautions. In particular, a holder should be used for these components, but it should not be fitted into the holder until the board is finished in other respects. Until then, it should be left in its anti-static packing.

I would not recommend the use of anything other than a CA3130E for IC2. Most other operational amplifiers will not work properly on a supply potentially as low as 5V and many of those that will work do not provide a low enough output voltage to hold IC3 in the reset state. Some devices that will otherwise operate properly on a 5V supply tend to suffer from 'latch-up' problems when used in a comparator circuit (including the CA3140E). It is unlikely that satisfactory results will be obtained using anything other a CA3130E.

Construction of the board is largely straightforward, but there is little minor point that is worthy of note. Do not overlook the single link-wire just above R4. In order to fit into this layout properly, VR1 must be an 18-turn Cermets preset. C4 should be a type having 7.5mm (0.3in) lead spacing. LS1 is a cased ceramic resonator. Connections to this component are made via its 'flying' leads. Although the leads are often red and black, this is not a polarised component and the leads can be wired to be the board either way round. It is mounted on the board via two BA (metric M2) screws and mounting nuts. These are not normally supplied with the resonator. Alternatively, it can simply be glued in place, using any general purpose adhesive.

I would not recommend the use of an ordinary moving coil loudspeaker with this project. Performance could be a bit erratic and, even with a high impedance loudspeaker, quite high output current could flow from IC4.

Adjustment

The alarm can be fitted into any spare expansion slot of the PC, but be careful to fit it in the right way round. C2 must be towards the rear.

Before setting VR1 for a suitable threshold temperature, you must decide just what that temperature should be. The technical specification in your computer's manual might provide some assistance with that. Practical test on a few PCs having one of the more advanced processors has shown that the difference is about a couple of degrees more than this.

If we assume that the room temperatures will not normally much more than about 25 degrees Centigrade, the interior temperature of the computer would normally be no more than about 35 degrees Centigrade. Unless you have good reason to use a different threshold temperature, VR1 should therefore be set for a potential wiper voltage of 350mV.

Trial and error can be used in the absence of test equipment to enable VR1 to be set for for a suitable reference voltage. I suppose that that this is actually the more reliable method of setting VR1, but it could be a bit time-consuming. It is just a matter of finding the setting for VR1 that gives the lowest wiper voltage without the alarm sounding, once the computer has been operating for a while (i.e. set the wiper of VR1 as far down the track as possible without the alarm activating once the computer has warmed up).

There is a slight complication in that the computer's outer casing must be at least partially removed to provide access to VR1, but once VR1 has been adjusted, the outer casing must be put back into place so that the interior of the computer can warm up in the normal way. You must, therefore, allow time for the temperature inside the computer to rise back to its normal operating each time VR1 is readjusted.

With a little experimentation, it should be possible to find a setting that does not give problems with false alarms but still sets a low enough threshold temperature. ■

Raj K Gorkhali
Nepal

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ELECTRONICS WORLD

A BRIGHT VISION OF THE FUTURE

By Chris Williams, UKDL

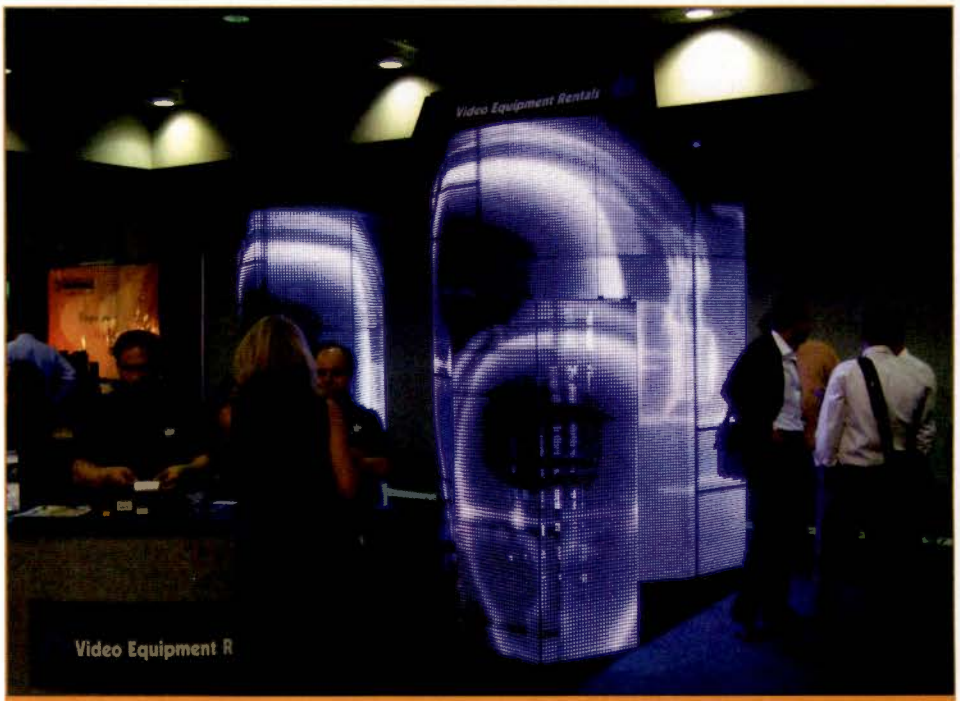
This month's column features comments about the Infocomm exhibition and Projection Summit conference, which were held in Las Vegas in June. Infocomm is one of the world's largest AV exhibitions and Projection Summit conference (PS08) is the projection summit conference. This year's focus at the conference was on the opportunities for digital signage in retail areas and public places in general using projection devices, and the emerging opportunities for "pico projectors".

Pico projectors are the tiny, fit in the hand size projectors that are expected (by the manufacturers) to carve out a massive market share amongst the mobile phone makers. Not only will you be able to use your phone to take pictures, you will (they hope) be able to then project the pictures, from the phone, onto any available surface. That might be a table-top, a wall, or even a shirt – provided of course the material allows for some reflection, and the colour change caused by metamerism doesn't totally destroy the image.

At the PS08 conference, Dr Coggshall, President of Pacific Media Associates predicted that pico projectors will grow from sales of 70,000 units this year to in excess of six million by 2012. Dr James Grochocinski of Corning then gave a fascinating insight into the business model for making these products. He quoted research analysis that showed that for a picture with contrast of

PICO PROJECTORS ARE THE TINY, FIT-IN -THE-HAND SIZE PROJECTORS THAT ARE EXPECTED TO CARVE OUT A MASSIVE MARKET SHARE AMONGST THE MOBILE PHONE MAKERS

Departure lounge



LED tapes as a cube

Closeup of LED tape

10:1, a 10 lumen projector would give a (readable) 8" diagonal picture in an ambient light level of 50 lux, a 6" picture in a light level of 100 lux, and a 3.5" picture in a brightness level of 300 lux. If the image was used at a contrast ratio of 3:1, the largest image became 17" picture at 50 lux, 12" at 100 lux and 7" at 300 lux. These sizes drop sharply to two inches and four inches respectively at 1,000 lux. Sounds okay, but, even a contrast of 10:1 is unacceptably low in a world where we have LCD TV and Plasma TV makers claiming contrast ratios (in dark rooms) of 1,000:1 and on up to 1,000,000 to 1.

Early samples were on show in the demonstration room, most using LED light sources for the projector assembly and one using laser diodes. As depicted in the comment above, the typical brightness that each projector was able to create with a power budget of around 1-2 watts was about 10 lumens. Engineering marvels, they each produced a competent picture, provided the room lighting was turned down low.

Bottom line, from what I saw, is that these little projectors are marvelous examples of engineering, but I believe they will only have a very limited appeal. The general public wants readable displays, with good image quality and that is not going to be available from these devices in most common viewing conditions.

In my own view, they are good, but just not good enough (yet!). As an engineer, I can't see how the laws of physics can be overcome to give a bright enough image to allow good contrast in most daylight indoor scenarios and still maintain an excellent battery life. Tough challenge; maybe laser diodes will help here if the speckle problem can be overcome. We'll report back here as the technology develops.

Digital Projection

So, let's go on to Infocomm. It's a huge exhibition full of big boys' toys. Projection systems, direct view displays, digital signage, LED columns and ribbon displays... plus sound systems you'd love to own. It's great to know that several of the best sets of kit on show were from Britain – both on the audio side and the projection side. Digital Projection, a Manchester-based company, is amongst the world's leaders in the creation of large venue projectors. Based on Texas Instruments's DLP chipsets, these are very powerful projectors designed for professional use, and if you have been to a pop concert recently, you have probably seen this kit in use.

The first picture shows a selection of the projectors in use at the DLP stand and the second shows an example of the flagship projector – it isn't small (but it is beautiful)!

Perhaps the most impressive contender for penetration of new technology will prove to be high-brightness LEDs. Shown in very many flavours of design and construction technique, the following gives you a small impression of what it was like. Next picture is of a typical "LED ribbon", which can then be fashioned into a variety of shapes and used in different applications. One example, as shown, is with the LED ribbons assembled into a cube and then random patterns of light displayed on them. A very effective eye catching unit!

Alternatively, the LEDs were draped as overhead coverings and flags. Another good example of the use of these LED tapes is where the tapes had been assembled into a roughly cylindrical shape.

Finally, in case you hadn't already got a headache from the sheer number of lumens being projected, displayed and sparkled at you, the theatrical LED spot lights here were the final touch.

Conclusions: is the show worth going to? If you have any interest – amateur or professional – in AV equipment, then this is a show that you would really enjoy. ■

Chris Williams is Network Director at the UK Display & Lighting Knowledge Transfer Network (UKDL KTN)

LPRS WIRELESS MODULES HELP TO TARGET CLAY PIGEONS

LPRS, EUROPE'S LEADING SUPPLIER OF SHORT-RANGE RADIO DEVICES IS PROVIDING LASERSPORT INTERNATIONAL WITH A WIRELESS SOLUTION FOR A NOVEL CLAY PIGEON SHOOTING SYSTEM. BRIDGNORTH BASED LASERSPORT INTERNATIONAL HAS BEEN MANUFACTURING THEIR SYSTEM SINCE 1989 AND THERE ARE NOW HUNDREDS OF LASERSPORT SYSTEMS OPERATING IN ALMOST 70 COUNTRIES. THE SYSTEM HAS BECOME ONE OF THE MOST POPULAR ACTIVITIES FOR BOTH CORPORATE EVENTS AND HOLIDAY AND LEISURE RESORTS.

The end product is a total shooting system that can be used outdoors, indoors, during daytime and at night. It is not only very popular with the public but it is also a very profitable investment for leisure venues, primarily because it is exciting, competitive and can be played by people of all ages and skill levels.

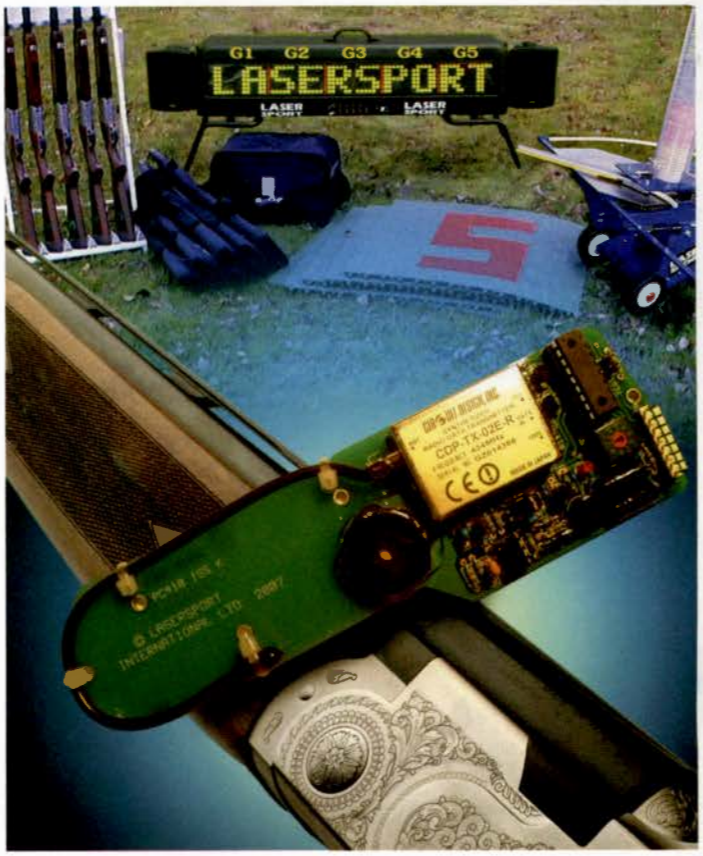
When played outdoors it is like ordinary clay pigeon shooting except that up to 5 people shoot at the same target at the same time. The Lasersport guns are de-activated "over and under" 12 bore shotguns which fire harmless infra red beams at reflective and re-usable clays, the clays are launched from the Lasersport clay launcher, and the speed and angle at which the clays fly can be adjusted to suit the skill levels of the people playing Lasersport. The scores of each player are displayed on the large electronic scoreboard and there are several games within the system.

The automatic clay launcher has a built in device that charges the luminous clays, which then glow brightly in the night sky. Fluorescent clays are provided for daytime use. Each of the guns has its own identity and the scores of each player are shown on an electronic scoreboard, in essence Lasersport replicates clay pigeon shooting without any danger or harm to the environment.

As the Lasersport guns have to communicate with the scoreboard and be easy to use they cannot have cables between the guns and the scoreboards, therefore each gun has it's own transmitter and in the scoreboard there are individual receivers for each gun.

Iain Reddihough, Managing Director of Lasersport International Ltd said, "In our latest products all the electronics are housed in the shotgun and therefore have to be compact and more importantly the components used have to be reliable. The majority of our systems are used for 6 to 8 hours a day, 365 days a year and with 70% of our systems being exported it is vital that they are reliable and in the event of failure, easy to replace. The CDP radio transmitters supplied by LPRS have proven to fit that bill, and additionally, as it is simple to change their operating frequencies, service and or replacement is simple for our customers to undertake.

For the Lasersport application LPRS supplied wireless modules from Circuit Design, a leading manufacturer of low power radio



products. Circuit Design designs and supplies low power narrow-band standard radio modules for short-range applications. For this application LPRS specified the CDP-TX-02E-R transmitter module, which has a typical range of 1Km. Barry Gillbrand, Managing Director of LPRS comments, "All of our RF modules are designed to provide easy to use wireless solutions. We have a wealth of experience in providing design and software support to simplify our customers design process and ensure the fastest possible time to market."■

For more information please visit, www.lprs.co.uk or call +44 (0)1993 709418

TIP: TRUE RAIL-TO-RAIL, HIGH INPUT IMPEDANCE ADC SIMPLIFIES PRECISION MEASUREMENTS

by Mark Thoren, Linear Technology

High input impedance and a wide input range are two highly desirable features in a precision analogue-to-digital converter, and the LTC2449 delta sigma ADC has both. With just a few external components, the LTC2449 forms an exceptional measurement system with very high input impedance and an input range that extends 300mV beyond the supply rails.

A designer may trade off the LTC2449's 200nV resolution for faster conversion rates, but otherwise, the LTC2449 requires few to no performance tradeoffs. It simultaneously achieves 1ppm linearity, 200nV input resolution and a 5V input span.

Ten filter oversample ratios are available, providing data rates from 6.8 samples per second to 3500 samples per second. Normal mode rejection of 50Hz and 60Hz is better than 87dB in the 6.8sps mode. All DC specifications hold for all speeds, only the resolution changes. Such persistent high performance simplifies the design of otherwise challenging applications, such as 6-digit voltmeters, sensor interfaces and industrial control. In addition, the LTC2449 digital interface and timing are extremely simple, and the 'No Latency' architecture eliminates concerns about filter settling when scanning multiple input channels.

SOLVING COMMON ISSUES

One unique feature of the LTC2449 is that the analogue inputs are routed to the MUXOUT pins, and an external buffer isolates these signals from the switched capacitor ADC inputs (see **Figure 1**). The external buffer yields high impedance through the multiplexer and back to the analogue inputs. This has a distinct advantage over integrated buffers because the analogue inputs are truly rail-to-rail, and slightly beyond, with appropriate buffer supply voltages.

The LTC6241 is a precision CMOS amplifier with 1pA bias current and impressive DC specifications: the maximum offset is 125µV and the open loop gain is 1.6 million typical. While the offset is not important in this application because it is removed by the LTC2449's multiplexer switching technique, the high open loop gain ensures that the 10ppm typical gain error of the LTC2449 does not degrade. Figure 1 shows proper interfacing of the LTC6241 to the LTC2449. The amplifier's 0.01µF capacitive load and compensation network provides the LTC2449 with a charge reservoir to average the ADC's sampling current while the 2.5k feedback resistor maintains DC accuracy.

The LTC6241 has a rail-to-rail output stage and an input common mode range from the negative supply to 1.5V lower than the positive supply. Since no rail-to-rail amplifier can actually pull its outputs to the rails, an LT3472 boost/inverting regulator is used to create a –2.5/7.5V op-amp supply from the 5V supply as shown in **Figure 2**. This regulator can provide enough current for several amplifiers and other circuitry that really needs to swing to the rails. In addition, the LT3472's 1.1MHz switching frequency is close to the middle of the LTC2449 digital filter stopband. The centre of the stopband is 900kHz when using the internal conversion clock and is independent of the selected speed mode.

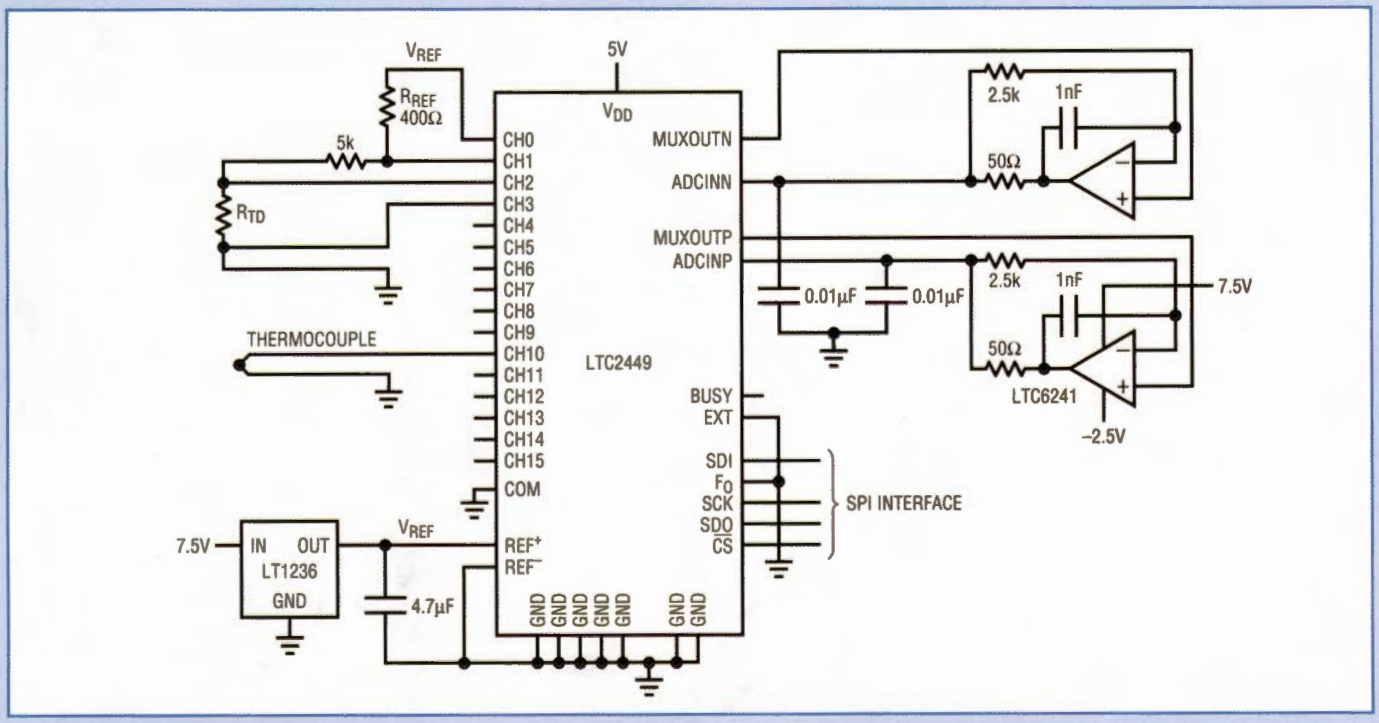


***Figure 1:** Application example*

APPLICATIONS

The LTC2449 is commonly used with thermocouples and RTDs as shown in Figure 1. Thermocouple outputs produce very small changes (tens of microvolts per degree C) and the output will be negative if the thermocouple is colder than the "cold junction" connection from the thermocouple to the copper traces on the PCB.

The RTD is measured by comparing the voltage across the RTD to the voltage across a reference resistor. This provides a very precise resistance comparison and it does not require a precise current source. Grounding the sensors as shown is a good first line of defense for reducing noise pickup, however the ADC must accommodate input signals that are very close to or slightly outside the supply rails. The LTC2449 handles these signals perfectly.

SOLVING PROBLEMS

The LTC2449 solves many of the problems that designers encounter when trying to apply delta-sigma ADCs in demanding applications. High impedance, rail to rail inputs and a very simple serial interface simplify both hardware and software design.

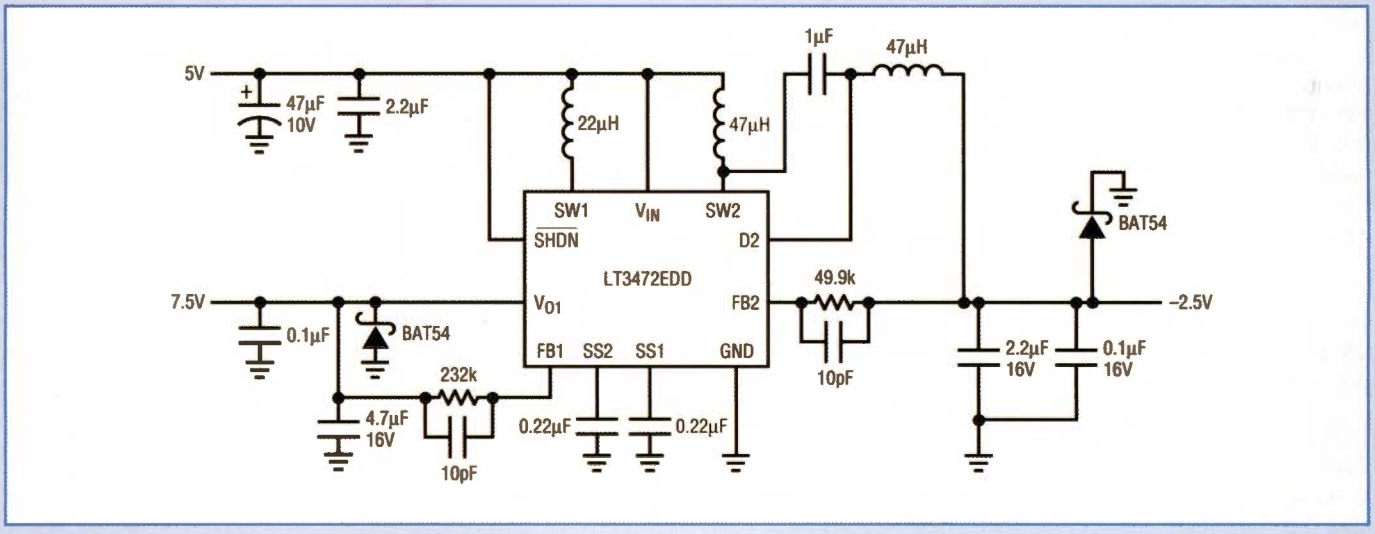


Figure 2: Power supply for buffers

No Compromise Oscilloscope

pico Technology

Other oscilloscopes in this price range force you to compromise on one of the key specifications:

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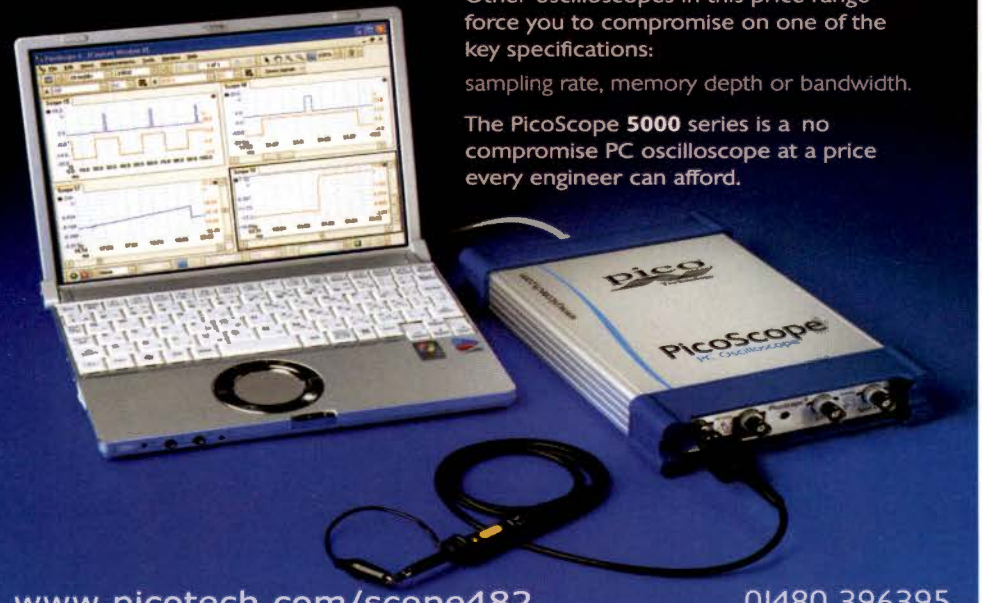

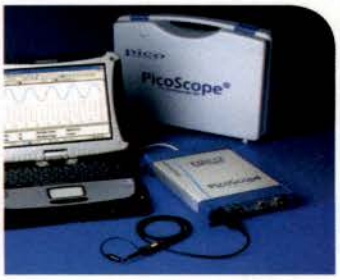

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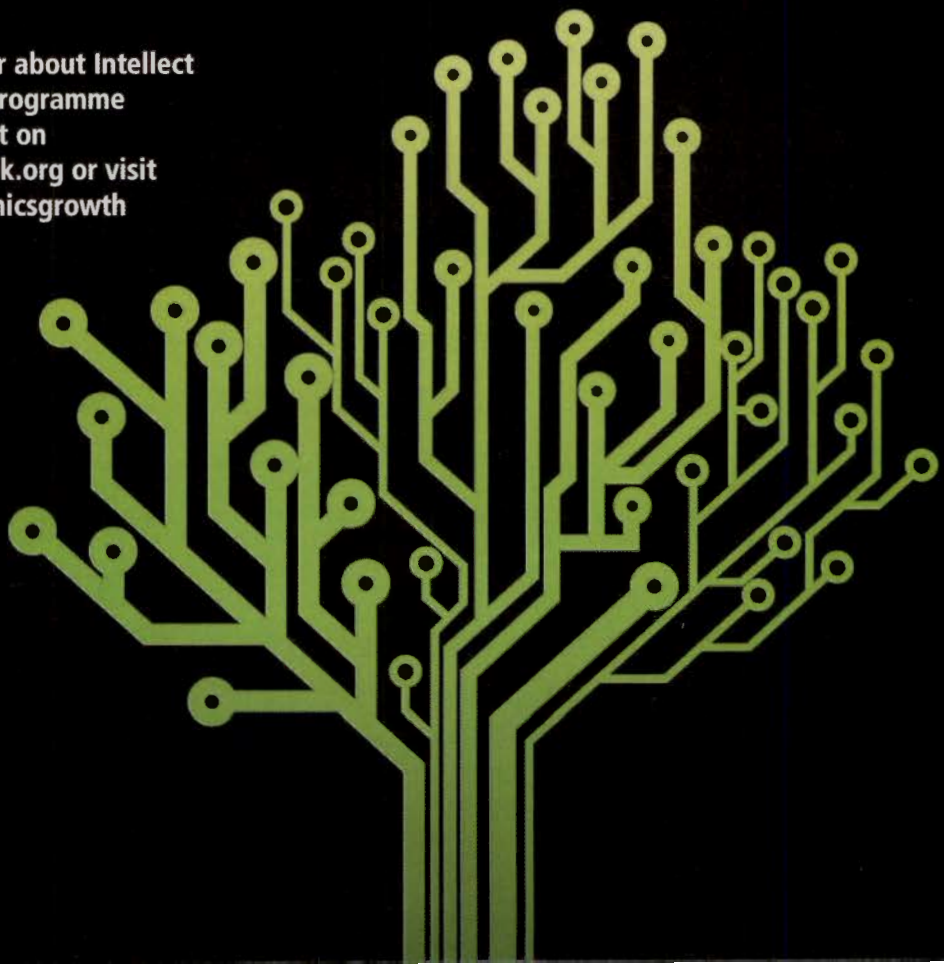


New Sick Direct Part Marketing Guide

A ready-reference guide to Direct Part Marking technology has been published by Sick, manufacturer of intelligent sensors and sensor solutions. The comprehensive 120-page book guides the engineer through the choice of technologies for permanent identification of components and finished products in the electronics industry.

The Sick Competence Guide to Direct Marking has been produced as an objective and unbiased source on the available technologies and their most appropriate applications. It covers the principles of coding, the techniques used in direct marking and the key requirements for reliably reading DPM codes in factory automation.

Realising there was no professional and comprehensive reference guide available, Sick has gathered together a knowledge source to discuss the merits of different technologies and how best to address issues of traceability, combating fraud, security and the increasing legal and regulatory requirements.

The Sick Guide is essential reading for anyone thinking of implementing or upgrading a part marking system. Normally costing £10, the guide is available free of charge for a limited period. For your copy please contact: Ann Attridge or Andrea Hornby on 01727 831121 or email ann.attridge@sick.co.uk or Andrea.hornby@sick.co.uk.

www.sick.co.uk

PC Keyboard in a Remote For Only £4.80

Noritake Itron has introduced the KBC56A keyboard which is designed to meet a wide range of applications for remote data editing where a conventional keyboard or PC notebook would be too large, inconvenient or expensive to use.

Typical applications include system text editing, product set-up and parameter changes, diagnostics and status readings, as well as adding user-advertising to vending, POS and amusement displays. An additional advantage is that users can set up or change foreign language text locally to suit their personnal needs.

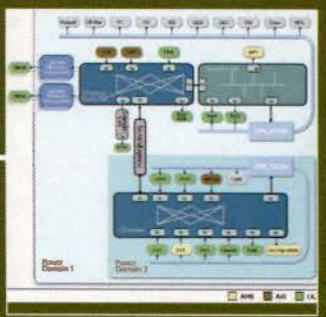
The 56 keys offer PC emulation capability in a compact ergonomic design with a 10 metre range and a low stand-by current of < 5uA using two AAA batteries.

The cost of an IR receiver is very competitive and simple to implement at a system or CPU level. Each key is independently transmitted allowing flexibility in the receiver to implement functionality to suit the application. The user can create their own IR receiver or choose one of the receiver modules available which convert the RC5 IR codes into ASCII data and control commands.

The KBC56A has its own dedicated website:

www.kbc56a.com

New SonicsSX with IMT SMART Interconnect Solution



Sonics Inc, a supplier of system-on-chip (SoC) SMART Interconnect solutions, announced the availability of the SonicsSX with IMT SMART Interconnect solution. Designed for SoCs requiring high quality, high definition (HQHD) video support, SonicsSX eases subsystem development and global integration of the subsystems onto a single chip.

The addition of Sonics's new Interleaved Multchannel Technology (IMT) is also provided, to improve overall shared memory bandwidths. IMT enables SoC architectures to seamlessly transition from single to multiple DRAM channels, or multichannel, while automatically balancing the traffic among the channels and operates transparently to software and other hardware.

To improve image quality and support higher resolutions, HQHD video requires the adoption of upgraded video protocols, more image resolution enhancement and scaling up to 120Hz. This is causing a shift towards utilising matched groups of processors and supporting elements, or subsystems, that supply the on-chip processing required to achieve HQHD video performance.

The transition to subsystems means that SoC architectures must now become hierarchical. Interconnects within the subsystems are needed to support the local data throughput requirements of the subsystems.

www.sonicsinc.com

Emerson Network Power Shortform 2008 Catalogue Now Available

Emerson Network Power has published a new 2008 shortform catalogue that covers all standard Astec and Artesyn power conversion products. Containing 64 information-packed pages, the catalogue is an invaluable source of reference data for electronics engineers and system developers.

The catalogue covers all standard Astec and Artesyn ac-dc power supplies and dc-dc converters – offering literally thousands of configuration options – and includes power sources for medical applications. This latest edition of the catalogue introduces several new ac-dc power adapters, a new series of 500 watt ac-dc power supplies and a number of new bulk front-end power supplies for distributed power applications. The catalogue also includes an entirely new section on ac-dc and dc-dc power modules for MicroTCA systems.

Emerson Network Power's combined portfolio of Astec and Artesyn products is one of the broadest in the industry, spanning ac-dc power supplies from 3W to 5kW and isolated dc-dc converters from sixteenth to full-brick. The dc-dc line-up includes intermediate bus converters for distributed power applications, together with specialised memory and processor-power modules. Most of these products are available off-the-shelf or with very short lead times.

www.powerconversion.com/shortform
www.emersonnetworkpower.com

Enhanced Performance FlashFlex Microcontroller

SST (Silicon Storage Technology), flash memory technology supplier, announced a new addition to its FlashFlex family of 8-bit microcontrollers (MCUs), the SST89C58RC. The new device is the industry's first 8051-based MCU to feature two system management buses (SMBus), each supporting up to 400kbit per second data throughput, in a 6mm x 6mm QFN package.

The SST89C58RC supports operating voltages from 2.7V to 5.5V for implementation in applications with a variety of power supply requirements. Its dual SMBus feature, small form-factor and support for a wide range of operating voltages make the SST89C58RC MCU an ideal solution for numerous applications, including HDMI, HDTVs, A/V receivers, home appliances, industrial instruments, notebook PCs, DVD players, Blu-ray players, RF modules and security applications such as fingerprint identification.

The SST89C58RC is the latest member of the FlashFlex family of 8-bit microcontroller products with SST patented and proprietary SuperFlash nonvolatile flash memory cells. SuperFlash memory uses a split-gate cell design and a thick-oxide tunneling injector to offer significant cost and reliability benefits to customers. All devices in the FlashFlex family use the 8051 instruction set and are pin-for-pin compatible with standard 8051 microcontroller devices.

www.sst.com

New Specification for Embedded Computer Modules Now Released

The Qseven consortium has officially released and published version 1.0 of the Qseven specification. This now provides the ability for manufacturers of embedded computer modules to start their Qseven designs.

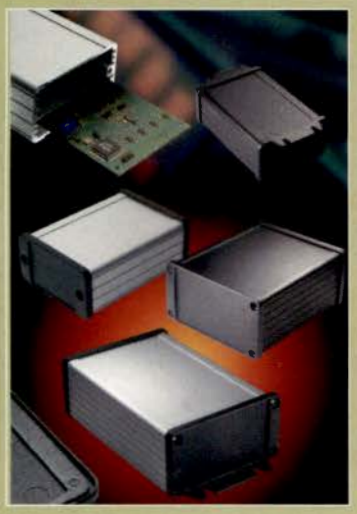
Qseven is unlike previous Computer-On-Modules (COM) standards due to its primary focus being directed towards mobile and ultra mobile applications. It defines fast serial differential interfaces, such as PCI Express and Serial ATA but omits support for legacy interfaces like EIDE and PCI, in order to provide ideal support for today as well as future CPUs and chipsets.

Qseven is the first COM standard that defines an integrative software interface. This Application Programming Interface (API) covers these important embedded features: watchdog timer, I2C bus, LCD brightness control, bios user memory and system temperature. Qseven modules from different manufacturers can thus be easily exchanged without modifications to hardware or software.

The SDIO interface is also a new COM feature. Rugged and cheap SD cards can be used as bulk memory. Qseven defines an 8-bit SDIO interface that is capable of supporting MMC 4.0 cards, thereby providing a maximum data transition rate of 52MB/s.

www.Qseven-standard.org
www.congatec.com

Stylish yet Rugged IP65 Sealed Enclosure



Hammond's new 1457 range extends the capabilities of the 1455 extruded aluminium family of small enclosures with the addition of IP65 sealed die-cast aluminium end-panels, enabling the enclosure to be used in dusty and wet environments.

The end panels are available with or without integral flanges that enable the enclosure to be mounted to an external surface.

The 1457 Series is designed to house PCBs, mounted horizontally into internal slots in the body of the case; they can also be used to house any small electronic, electrical or pneumatic components. They are available with clear anodised or textured black painted finish for good resistance to wear and tear. The IP65 sealing is achieved through the use of o-ring screw seals and closed cell polyethylene sealing gaskets.

An initial six 1457 sizes are available, ranging from 80 x 59 x 31mm to 160 x 104 x 55mm; the largest size will accept a standard 160 x 100mm Eurocard.

www.hammondmfg.com

1U 19" Standard, Filtered and Intelligent Fan Trays

Verotec has extended its range of 19" 1U standard fan trays. Two depths are available, a 250mm deep unit fitted with three fans and a 350mm deep unit with six fans. All sizes are offered with a choice of 12, 24 or 48 VDC fans or 115 or 230 VAC fans, and each unit is available with or without a replaceable filter. Each DC fan is rated at 170m^3/h, the 115 VAC fans at 180m^3/h and the 230VAC fans at 160m^3/h.

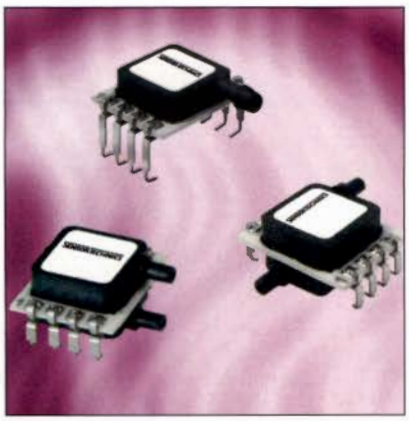
The fan trays are fully compatible with the Diplomat range of 19" desk-top enclosures and are also designed to provide forced cooling up through the active area of a sub-rack in any standard 19" rack or cabinet.

The intelligent units are managed by a programmed controller that restricts the fans at half speed up to 35°C, subsequently linearly increases the speed to maximum at 55°C, ensuring that sound levels and energy consumption are optimised. The intelligent versions are available in either auto-ranging AC or -48V DC input versions.

The units are designed to provide localised cooling of 19" rack mounted or desktop equipment and can be used to provide forced draught cooling from below or above the heat generating equipment.

www.verotec.co.uk

Miniature HCE Pressure Sensors with Digital SPI Output Signals



Sensortechnics's new HCE series offers precision pressure measurement from 10mbar up to 10bar. The HCE sensors perform digital signal conditioning to provide highly accurate digital and analogue output signals. They comply with the SPI bus protocol and can directly communicate with microcontrollers and microprocessors. I2C bus, switching or custom specific outputs are available on request.

The HCE series utilises the latest ASIC technologies to achieve high total accuracies, with an excellent Total Error Band (TEB) better than ±0.5%FSS, including all temperature effects. A 3V supply voltage and special low power versions (optional) make these sensors ideal for battery-powered portable device applications.

Miniature SMT housings (DIP and SIL versions on request) with straight or barbed pressure ports allow for highly flexible OEM designs and space-saving PCB-mounting.

Typical applications of the new HCE pressure sensors include medical devices, instrumentation, environmental controls and HVAC.

For all HCE pressure sensors Sensortechnics can provide fast and flexible modifications based on custom specific requirements.

www.sensortechnics.com

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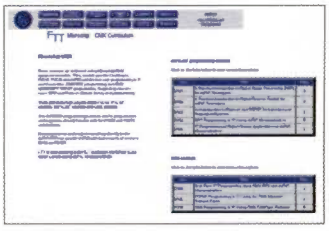

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AWARDS

Silver Award for AWS Group Recognises SC21 Leadership Position

AWS Group, one of UK's independent Electronic Manufacturing Solutions (EMS) providers, has been presented with the SBAC's Silver Award for exceeding targets set by the Society in its SC21 (21st Century Supply Chain) change programme.

AWS Group is the first company to be awarded, and has already been acknowledged by the Society of British Aerospace Companies as leading the field of about 350 suppliers signed up to the UK Aerospace market initiative.

SC21 has been designed by the SBAC to accelerate the competitiveness of the UK's aerospace and defence industry by raising the performance of its supply chains. It has three levels: bronze, silver and gold.

AWS's 12 months delivery performance to its sponsor, General Dynamics UK was above 99% and quality was measured at 248 defects per million opportunities (DPMO). The company scored over 500 on its lean manufacturing and business excellence framework performance and the combined assessment means that AWS has been assessed as meriting a silver award. AWS has become the first company under SC21 to achieve this level – a truly significant achievement in under 12 months.

CEO Paul Deehan (left) said: "I believe that successful companies are the ones that drive themselves - those who don't sit back - and in particularly the ones who are pro-active in driving continuous improvement in operations across their own business and down into their own supply chain."

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Submission Topics:

Waveform Diversity & Design Communication

- Adaptive modulation schemes
- Error control coding
- MIMO design and application
- Multipath diversity
- Software critical
- Software defined radio and cognitive radio design
- Synchronisation
- UWB design and application
- Waveform diversity

Radar and Sonar

- Delectability and localisation issues
- Interference suppression/reduction
- Matched illumination waveforms
- Modulation schemes
- Multistatic and MIMO radar systems
- Optimal and multifunction waveform
- Radar waveform signal processing
- Software defined systems
- Spectral efficiency
- STAP and spatial control
- System design methodology and technology

From Active Modules towards Digital Radar

- Requirements
- Radar control
- Antenna architectures
- Semiconductor technologies
- Waveform generation
- Detection, tracking and identification
- Interference suppression
- Digital beamforming, multi-channel processing including STAP
- Software defined systems
- Radar system design methodology and technology

Abstracts must be submitted online by Monday, 11 August 2008
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Authors will be notified of their acceptance by Monday, 1 September 2008 and full papers are to be submitted by Wednesday, 1 October 2008

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