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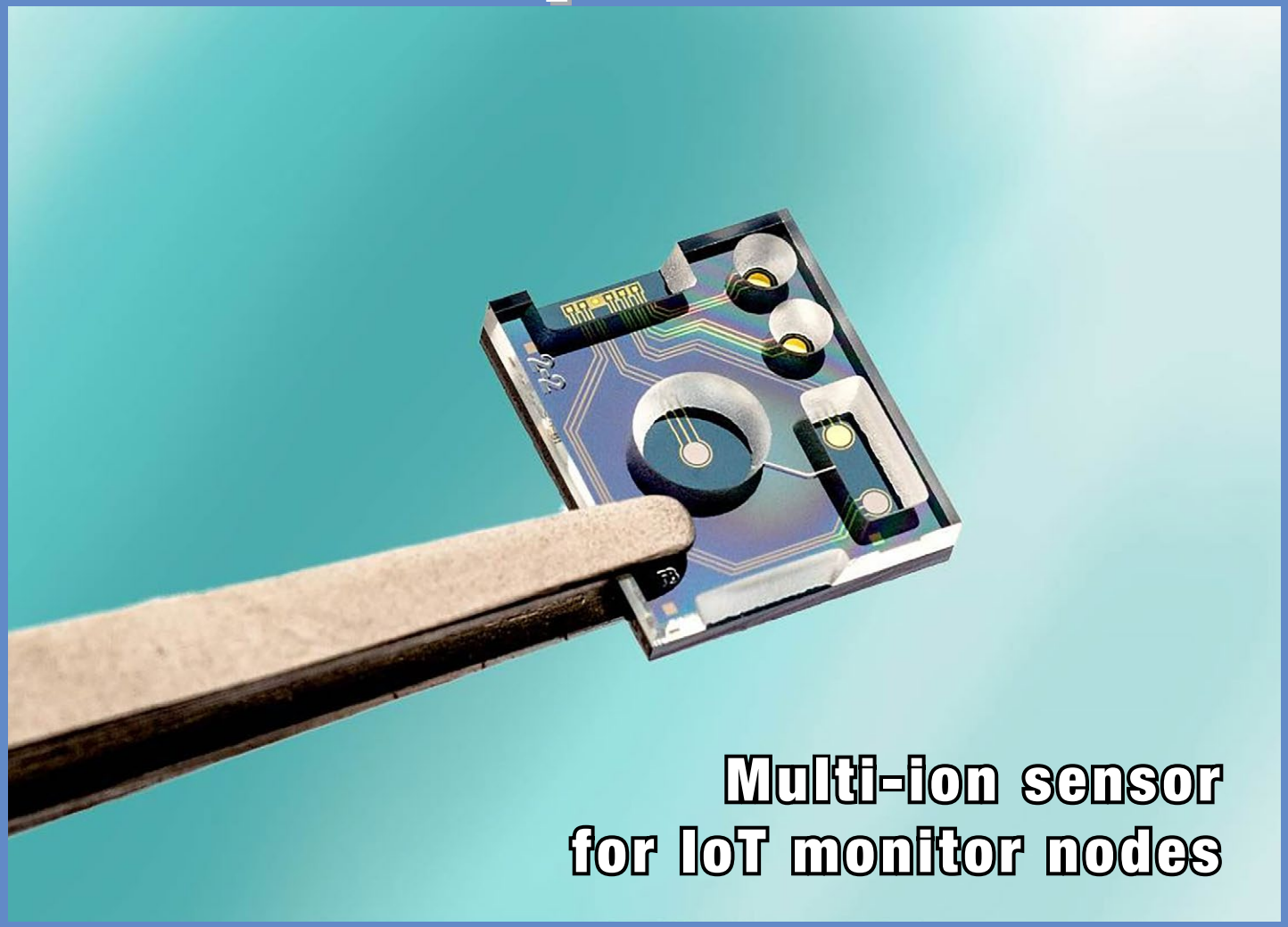
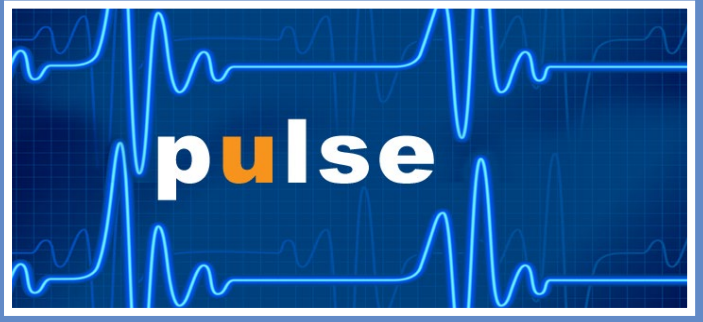
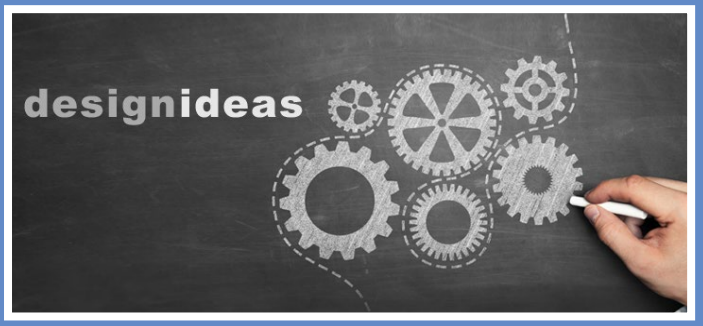


Multi-ion sensor for IoT monitor nodes





COVER

Solid-state multi-ion sensor for IoT applications

Researchers at Imec and Holst Centre (Leuven, Belgium, and Eindhoven, The Netherlands) believe they have a world-first with a miniaturized sensor that simultaneously determines pH and chloride (Cl^-) levels in fluid. This innovation is a must-have for accurate long-term measurement of ion concentrations in applications such as environmental monitoring, precision agriculture and diagnostics for personalized healthcare. With the possibilities of SoC (system on chip) integration it may enable massive and cost-effective deployments in Internet-of-Things (IoT) settings. Its innovative electrode design results in a similar or better performance compared to today's standard equipment for measuring single ion concentrations and allows for additional ion tests.

Sensors based on ion-selective membranes, imec says, are considered the "gold standard" to measure ion concentrations in many applications, such as water quality, agriculture, and analytical chemistry. They consist of two electrodes, the ion-sensitive electrode with the membrane (ISE) and a reference electrode (RE). When these electrodes are immersed in a fluid, a potential is generated that scales with the logarithm of the ion activity in the fluid, forming a measure for the concentration. However, the precision of the sensor depends on the long-term stability of the miniaturized RE, a challenge that imec says has now been overcome. More, here.

FEATUREARTICLES

ONLINE THIS MONTH

Utilizing GaN transistors in 48V communications DC-DC converter design

White Paper; AnDapt: Introduction to configurable PMICs

Optimising RS-485 for lowest EMI and lowest power

EDN's columns

HERE'S LISTENING TO YOU, KID

by Graham Prophet, Editor

There may, I think be scope for a self-help group, in the manner of those who come to the aid of those in the grip of addictions, for those marginalised by indifference to some of technology's fashion trends. Social media provides an example. One might introduce oneself; "My name is... and I have no social media presence."
If you now are expecting this column to be a rant against social media in all its forms; it is not that. For the record, I do indeed have negligible social media footprint, but I don't obsessively believe that the whole social media construct is the Work of Dark Forces. As a social media 'refusenik', it would be more accurate to say that it doesn't offer me anything I particularly want; or, at least, that I haven't the bandwidth or attention span, or the time to invest, to penetrate it. "Ah-ha," (I hear you say), "what you mean is, you can't be bothered." Which just about sums it up. Not so much a refusenik, more a can't-see-the-point-nik.

There are legitimate concerns about matters such as privacy and, as with every other area of rapidly-advancing technology, we should always be aware of the phenomenon of shifting perspectives. That which was exceptional or even outrageous yesterday, becomes acceptable today and will be commonplace tomorrow. Never, in other words, say, "never".

In fact, I don't have an exactly-zero footprint: who does? I have friends, business contacts, [some] family who use assorted social media platforms. It's feasible that as the algorithms digest the meta-data of that traffic, they might observe the faintest outline of a person whose existence is hinted at, but for whom there is no account (how socially deviant!). There must be many millions of such "ghosts". Despite their denials, it seems likely that the social platforms build "shadow" profiles of those ghosts, ready to spring into action fully-formed, if their real-world owners ever get around to signing up. "Hi! Welcome! Here are some folks on the network you might already know!"

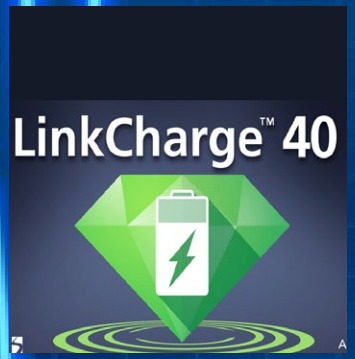
If therefore, you say, "I see those concerns, but what this medium offers me is valuable enough that I'm happy to set those worries aside," - that's fine by me, even if I don't find it convincing. However, and turning to another "on-trend" piece of tech, when it comes to the household assistant (Amazon's Echo being the highest-profile example) my indifference turns to incredulity. You have a powerful computing resource sitting in your environment, powered-up at all times. You know it has cloud connectivity, because that's how it works. You know it has a lot of DSP capability and it is analysing, recording and forwarding what its microphones receive. You know that it was designed by, and is operated by, an organisation whose appetite for data and meta-data on every aspect of its customers'/users' lives is essentially unlimited. They declare that the box does nothing with what it hears until triggered by a key-word, but without a lab full of test gear (and perhaps not even then) you have no way of verifying those assurances.

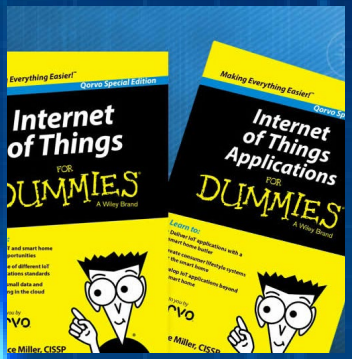
As various news outlets have gleefully reported, that other well-known law governing introductions of new technology – the law of unintended consequences – has already shown its hand. A San Diego, California television reporter repeated on-air the words of a 6-year-old girl which had prompted her family's Echo to go ahead and place orders on Amazon. The reporter's words then leading to further instances of orders being placed from living rooms where the television was within earshot – or should that be mike-shot? That can be viewed as merely amusing – but a degree of paranoia about the capabilities of such a system is not entirely unreasonable.

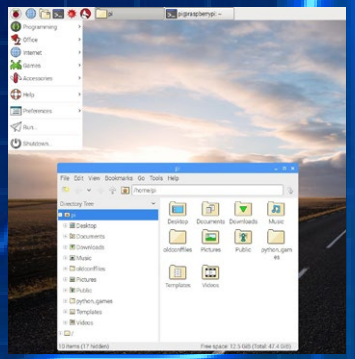
So; I'll never have one of these, right? Recall what I said about the altered perspective – no-one is immune to that, never say "never". But if I ever do find a use for one, it's very likely to have its covers removed and some hard-wired switching added. "Hey, box; 'off' means 'off'."

pulse


Vega
D's Next-Generation GPU Architectu


LinkCharge™ 40


Internet of Things FOR DUMMIES
Internet of Things Applications FOR DUMMIES




AQUANTIA


SensorTile kit
Connectable sensor node

AMD's Vega graphics architecture will handle "virtually unlimited" workloads

Disclosing a completely new, high performance GPU architecture that is designed to remove many traditional constraints from gaming, VR, professional design and machine intelligence arenas, AMD has issued preliminary details of its forthcoming GPU architecture, Vega.

The Vega architecture enables new possibilities that traditional GPU architectures have not been able to address effectively, AMD asserts. Data-intensive workloads are becoming the new normal, and the parallel nature of the GPU lends itself ideally to tackling them. However, processing these huge new datasets requires fast access to massive amounts of memory. The Vega architecture's memory subsystem enables GPUs to address very large data sets spread across a mix of memory types. The high-bandwidth cache controller in Vega-based GPUs can access on-package cache and off-package memories in a flexible, programmable fashion using fine-grained data movement, "...to solve gigabyte-scale data problems in gaming to exabyte-scale data problems in machine intelligence... we designed the

Vega architecture to build on this ability, with the flexibility to address the extraordinary breadth of problems GPUs will be solving not only today but also five years from now. Our high-bandwidth cache is a pivotal disruption that has the potential to impact the whole GPU market," said Raja Koduri, senior vice president and chief architect, Radeon Technologies Group, AMD.

The Vega GPU architecture's advances include an advanced GPU memory architecture, featuring a new high-bandwidth cache and its controller. The cache features leading-edge HBM2 technology which is capable of transferring terabytes of data every second, doubling the bandwidth-per-pin over the previous generation HBM technology. HBM2 also enables much greater capacity at less than half the footprint of GDDR5 memory. Vega architecture is optimized for streaming very large datasets and can work with a variety of memory types with up to 512TB of virtual address space. Other significant elements include a new, next-generation compute engine built on flexible compute units that can natively process 8-bit, 16-bit, 32-bit or 64-bit operations in each clock cycle; and an advanced pixel engine, that employs a Draw Stream Binning Rasterizer, designed to improve performance and power efficiency. It allows for "fetch once, shade once" of pixels through the use of a smart on-chip bin cache and early culling of pixels invisible in a final scene.

Complete article, here

Wireless charging extended to 40W power levels

Semtech has demonstrated ultra-high power, 40W, wireless charging technology at the Consumer Electronics Show, CES 2017. Its LinkCharge 40 Series is a backwards-compatible and efficient wireless charging solution that supports Qi standards in a small form factor.

"The addition of this 40-Watt, highly differentiated, ultra-high power wireless charging capability to Semtech's LinkCharge platform makes our robust and scalable wireless charging technology

available for products of all sizes and power requirements," said Ruwanga Dassanayake, Product Line Manager for Semtech's Power and High-Reliability Products Group. "One of the unique features that sets LinkCharge 40 apart is that its transmitter is backwards compatible, supporting Qi-enabled phones while maintaining small form factor at both ends of the solution."

The high power system architecture of the LinkCharge 40 uses a flexible firmware-based approach and proprietary communication protocol between the transmitter and receiver at 40W and uses the WPC (Wireless Power Consortium) or Qi standard protocol at lower power.

Features of the LinkCharge 40 include; high DC-DC efficiency at 85%; 19Vout / 2A at the receiver; capable of supporting multiple coil configurations; and it supports dynamic loads.

Complete article, here

Intel packages CPUs, FPGAs as GO to target automated driving systems

Intel has created the Intel GO branding for automated driving products, including the Intel GO In-Vehicle Development Platform for Automated Driving with Intel [formerly Altera] FPGAs sitting alongside either an Intel Atom or Intel Xeon processor. Automotive system supplier Denso has been a collaborator in assembling the package of CPUs, FPGAs and software.

GO is intended to be a scalable, car-to-cloud system as a step towards a 'driverless future' (pictured; development system). Information available at time of writing implies a system configuration that continues to employ discrete Intel CPU chips alongside [former Altera] FPGAs. The latter now include an Arria 10 chip available as a automotive-specification part. Intel says this will be the highest performance processing automotive FPGA, offering one speed grade performance advantage over competing devices. There seems, for the present at least, no intention to integrate these elements on a single die.

Specifically, the new automotive-grade Arria 10GX mid-range FPGA for autonomous driving is up to 40% lower power than previous generation FPGAs and features hard floating-point digital signal processing blocks. The Arria 10 automotive-grade FPGA offers more than 320 Gbps of DDR4 bandwidth and more than 200 Gbps of transceiver bandwidth. It also supports 12G serial protocols, 1.5K variable-precision DSP

blocks and up to 24 transceivers. Comprising hardware and software development kits, the full Intel GO system includes:
- Two versions of Intel GO In-Vehicle Development Platforms for Automated Driving. Scaling from next-gen Intel Atom processors to high-performance Intel Xeon processors plus Arria 10 FPGAs, these two platforms provide the computing resource to perform a range of automated driving functions including perception, fusion and decision-making.
- The Intel GO Automotive 5G Platform offers a 5G-ready platform for the automotive segment allowing car makers to develop and test a wide range of use cases and applications ahead of the expected rollout of 5G in 2020.
- The Intel GO Automotive SDK provides several key tools specific to the automated driving industry – including deep learning tool kits – and promises a consistent development experience to help engineers maximize hardware capabilities while speeding the pace of design.

Intel further comments that, "The importance of 5G to our self-driving future cannot be overstated. Automated vehicles will both generate and take in huge amounts of data in order to navigate and react to sudden changes. Today's communications systems simply were not designed to handle the massive bandwidth required to support this. That's where 5G comes in, delivering faster speeds, ultra-low latency and vehicle-to-vehicle (V2V) connectivity for the era of automated driving."

Complete article, here

Barometric pressure sensor – accurate altitude tracking for consumer devices

Bosch Sensortec's BMP380 is the company's smallest and best performing barometric pressure sensor, with a size of 2.0 x 2.0 x 0.75 mm. It can be applied in a range of altitude tracking applications, with improved accuracy and smaller footprint over previous parts, and with reduced power consumption. Pressure and temperature data can be stored in a built-in 512 Byte FIFO; the FIFO and interrupt functionality provide simple access to data and storage. This improves ease of use while helping to reduce power consumption to 2.7 µA at 1 Hz during full operation.

The sensor is more accurate than its predecessors, covering a wide measurement range from 300 hPA to 1250 hPA. Tests in real-life environments have verified a relative accuracy of ±0.06 hPa (±0.5m) over a temperature range from 25°C to 40°C. The absolute accuracy between 300 and 1100 hPa is ±0.5 hPa over a temperature range from 0°C to 65°C. The BMP380 is aimed at gaming, sports and health management, as well as indoor and outdoor navigation. By measuring barometric pressure, the sensor enables drones, smartphones, tablets, wearables and other mobile devices to accurately determine altitude changes, in both indoor and outdoor environments. Typical applications for the BMP380 include altitude stabilization in drones, where altitude information is utilized to improve flight stability and landing accuracy.

Complete article, here

Cryptographic controller for embedded devices

Maxim Integrated has posted initial details of its DeepCover cryptographic controller, MAXQ1061, designed to protect the confidentiality, authenticity and integrity of software IP, communication and revenue models, in connected embedded devices, industrial networking, PLC, and network appliances.
Maxim describes the device as a turnkey solution for secure storage, digital signature, encryption, secure boot, and TLS/SSL communication. DeepCover embedded security devices apply multiple layers of advanced physical security to provide the most secure key storage possible. An embedded cryptographic toolbox provides key generation and storage up to full SSL/TLS/DTLS support by offering a high level of abstraction including TLS/DTLS key negotiation, ECDSA-based TLS/DTLS authentication, digital signature generation and verification, SSL/TLS/DTLS packet encryption, and MAC algorithms.
It can also serve as a secure bootloader for an external generic microcontroller.
32 kB of user-programmable EEPROM securely store certificates, public keys, private and secret keys, monotonic counters, and arbitrary data. A flexible file system manages access rights for the objects. The device is controlled over a SPI or I²C interface. Protocols for life cycle management and a secure key loading are provided.

Complete article, here

NXP aims i.MX 8M processor series at IoT audio, voice, video home apps

NXP has configured the ARM-based i.MX 8M family of applications processors for audio and video system requirements in smart home and smart mobility applications. Their capabilities support full 4K UltraHD resolution, High Dynamic Range and advanced HMI for streaming media applications.

The i.MX 8M family has been designed to meet the needs of applications such as over-the-top (OTT) set-top boxes, digital media adapters, surround sound, sound bars, A/V receivers, voice control, voice assistance, digital signage and general purpose human machine interface (HMI) solutions. The processors, NXP says, address the 'major inflection points' currently underway in streaming media: voice recognition and networked speakers in audio, and the move to 4K High Dynamic Range (HDR) and the growth of smaller, more compact form factors in video.

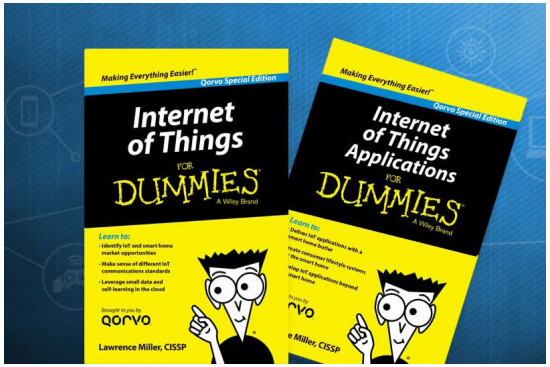
NXP's i.MX 8M family of processors has up to four 1.5 GHz ARM Cortex-A53 and Cortex-M4 cores, flexible memory options and high-speed connectivity interfaces. The processors also feature full 4K UltraHD resolution and HDR (Dolby Vision, HDR10 and HLG) video quality, the highest levels of pro audio fidelity, up to 20 audio channels and DSD512 audio. The i.MX 8M family is tailored to streaming video devices, streaming audio devices and voice control applications. "Prior to this, there weren't any viable processing solutions that addressed voice, video and audio requirements without being overkill," said Martyn Humphries, vice president of consumer and industrial applications processors at NXP. "With i.MX 8M, customers can get the exact solution for their specific A/V and versatility needs."

Complete article, here

ARM-based, multi-protocol SoC targets smart, secure homes apps

Qorvo (Greensboro, North Carolina), from its RF product line, has a complete system on chip (SoC) for smart home devices that delivers multi-protocol support with best-in-class power consumption. The new platform, Qorvo asserts, helps mitigate uncertainty surrounding future IoT standards. The company is also offering free-download ebooks on the subject.

From the product line that was previously



Greenpeak Technologies (acquired by Qorvo) the GP695 SoC integrates multiple communication protocols, including IEEE 802.15.4, ZigBee 3.0, Thread and Bluetooth Low Energy (BLE) for sensors and actuators and smart home networking ...while optimizing energy efficiency and extending battery life. It is based on an ARM Cortex-M4 core.

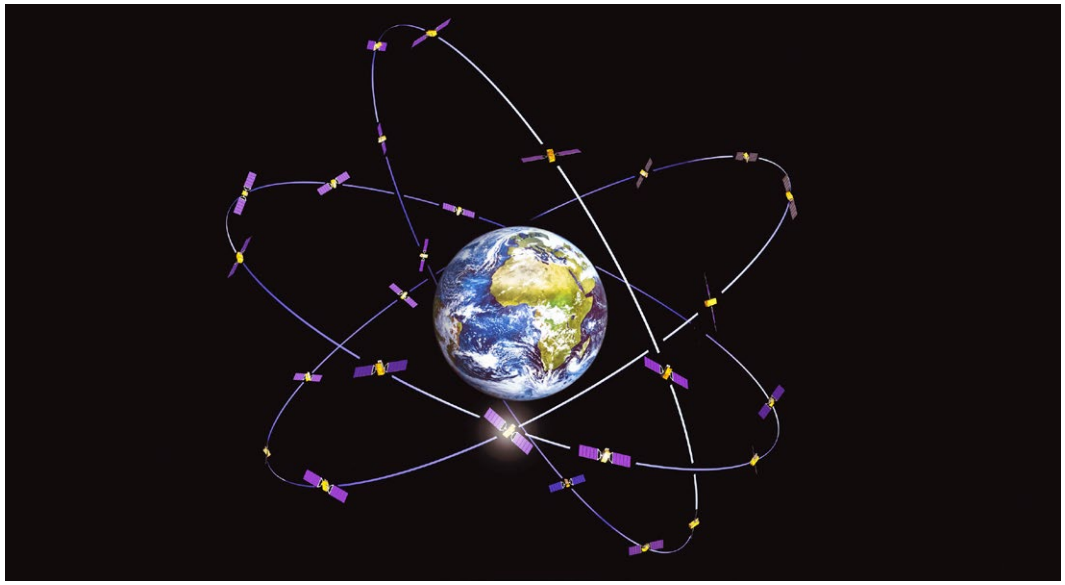
Supporting these different connectivity options allows for a

single development platform and a single SKU, independent of the communication protocol used.
With this, BLE-based smart phone connectivity for proximity-based services can combine with Thread or ZigBee 3.0 for smart home services.
More information about the IoT is available by downloading the newest Qorvo free e-book series, «Internet of Things For Dummies.» (pictured) The two-volume series is designed to help technical and non-technical professionals understand the intricacies of the IoT. The e-books are available at: www.qorvo.com/iot-for-dummies

Complete article, here

Europe's Galileo GNSS goes 'live'

Thursday 15th December 2016 saw Europe's Global satellite navigation system finally switched on. After 17 years and more than €10 billion euros ($11 billion) later, the Galileo satnav system promises to, "outperform US and Russian systems while boosting regional self-reliance."
Initial services will be free to use worldwide on smartphones and navigation boxes fitted with Galileo-compatible chips. Some devices – according to The European Commission and galileognss.eu – may only need a software update to start using the new technology, as several smartphone companies were already making chips compatible with it.
The official statement says that, "at first the signals might be a little weak" - which appears to refer to the incomplete constellation, meaning that well-positioned satellites will often not be available,



rather than RF signals being lower than they might be - "but will be boosted with help from satellites in the US military-run GPS system, and grow stronger over time as orbiters are added", to the current count of 18.
According to the European Space Agency (ESA), Galileo should be fully operational by 2020, providing time and positioning data of unprecedented accuracy. Once complete, the system will consist of 24 operational satellites and ground infrastructure for the provision of positioning, navigation and timing services.
Galileo also has [will have] more satellites than either GPS or GLONASS, with better signals that carry more information. With these features, Galileo's free Open Service will be able to track positions to within 1m, compared to several metres for GPS and GLONASS.
Its signal will eventually reach areas where which have not been possible so far i.e. inside traffic tunnels and in 'urban canyons'.
A subscription service will allow clients to track locations even closer, to within centimetres, and governments will have access to an encrypted continued service for use in times of crisis

Complete article, here

Biometric sensor platform for wearables and IoT, by ST and Valencell

A scalable development kit integrates ST SensorTile with Valencell's Benchmark biometric sensor system to accelerate smart wearable and IoT product development. Valencell (Raleigh, North Carolina) is a company active in high-performance biometric data sensor technology; in a joint announcement with STMicroelectronics the two companies have disclosed an accurate and scalable development kit for biometric wearables that includes ST's compact SensorTile turnkey multi-sensor module integrated with Valencell's Benchmark biometric sensor system. Together, SensorTile and Benchmark comprise the most useful portfolio of sensors to support the most advanced wearable use cases, according to their designers.

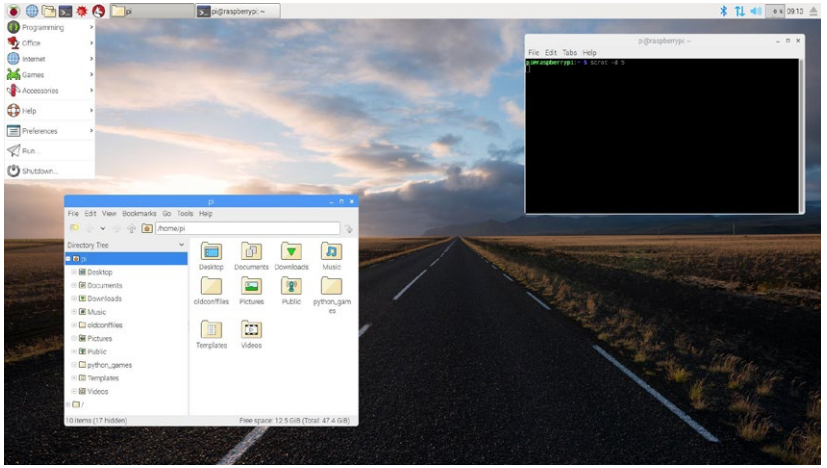
The SensorTile is an IoT module (13.5 x 13.5 mm) that hosts an STM32L4 microcontroller, a Bluetooth Low Energy chipset, a wide spectrum of high-accuracy motion and environmental MEMS sensors (accelerometer, gyroscope, magnetometer, pressure, temperature sensor), and a digital MEMS microphone.

At just over 180 mm², STMicroelectronics' SensorTile can be used as a sensing and connectivity hub for developing firmware and shipping in products such as wearables, gaming accessories, and smart-home or IoT devices. Valencell's PerformTek sensor systems provide accurate, robust and flexible technology, powering biometric hearing devices and wearables.

Complete article, here

Raspberry Pi's PIXEL desktop, now on x86/PC/Mac

In September 2016, the Foundation released PIXEL, its desktop environment (a Linux/Debian distribution, basically) for the Pi. Now, there is a bootable version that will bring up exactly the same user experience on PC or Mac hardware – including some "mature" and limited-resource machines. Raspberry Pi's founder Eben Upton calls it, "...the GNU/Linux we would want to use," and explains, "we asked ourselves one simple question: if we like PIXEL so much, why ask people to buy Raspberry Pi hardware in order to run it? There is a massive installed base of PC and Mac hardware out there, which can run x86 Debian just fine. Could we do something for the owners of those machines? [The result is] an experimental version of Debian+PIXEL for x86 platforms. Simply download the image, burn it onto a DVD or flash it onto a USB stick, and boot straight into the familiar PIXEL desktop environment on your PC or Mac."



Complete article, here

Testing prepares for Bluetooth 5

Rohde & Schwarz has expanded the functional range of its CMW wideband radio communication testers to cover the Bluetooth 5 specification. The R&S CMW software encompasses all RF tests needed for development and production, including the new test cases for Bluetooth SIG pre-certification.

The Bluetooth Special Interest Group (SIG) has specified new low-energy (LE) features in Bluetooth 5 that are tailored primarily to Internet of Things (IoT) applications. A key criterion for these applications is the lowest possible power consumption. An option is now available that makes it possible to quadruple the range of Bluetooth connections by transmitting data multiple times. The new specification permits transmission speeds of 1 Mbit/sec and now also 2 Mbit/sec. This optional stable modulation index has been integrated into the Rohde & Schwarz test software.

The CMW-KM721 software option is used to measure power, modulation and adjacent channel power (ACP) on the transmitter. With the software option, receiver measurements can be performed to determine the packet error rate and receiver sensitivity. R&S says that the CMW testers are currently the only products on the market that deliver RF tests on Bluetooth and cellular radio signals such as LTE-A, WCDMA, GSM and CDMA2000, as well as non-cellular radio signals such as WLAN, ZigBee and GNSS, using a single instrument.

Complete article, here

Multi-gigabit Ethernet chips allow Cat 5E wiring to carry 5G data

Aquantia's AQtion product line of multi-gigabit Ethernet controllers is aimed at extending the carrying capacity – and life – of existing data cabling at the "enterprise" level by sending data at 2.5G or 5G speeds over 100-metre distances, using in-place Cat 5E wiring.

The company previously announced technology to extend the capacity of copper to data rates as high as 100G – that being on direct point-to-point copper links within large data centres. Now it is turning its attention to allowing in-building wiring in commercial environments to support higher data rates without upgrading the cable infrastructure – increasing speeds from established gigabit Ethernet. A big driver, the company says, its the advent of the IEEE 802.11ac wireless standard; routers supporting many lined clients need a "wide pipe" to feed them. Aquan-

tia has experience of the PHY aspect of 5G in this domain; with this announcement it is offering an integrated MAC + PHY product, to address the client part of the market. A spokesman declined to reveal whether the Aquantia package contains a monolithic device, or if it is a closely-integrated system-in-package.
The AQtion line of Multi-Gigabit Ethernet BASE-T controllers, AQC107 and AQC108, support 5 and 2.5 Gigabit Ethernet over copper, or 2.5/5GBASE-T, and are compliant with the NBASE-T specification and the new IEEE 802.3bz standard that was formally ratified in September 2016. Both devices also support backward compatibility with 100MbE and Gigabit Ethernet. The AQC107 has the extra feature of supporting up to 10 Gigabit Ethernet, or 10GBASE-T, on Cat6A copper cables, complying with the IEEE standard 802.3an. An auto-negotiation and cable-characterisation sequence maximises the data rates that any given link will sustain. The devices are structured as 1port-per-chip devices, and Aquantia anticipates they will be designed into both motherboards and PCIe cards. Aquantia further states that design-in of the devices should be no more challenging than for standard gigabit Ethernet ports, and should not require any "exotic" layout or signal handling.

Complete article, here

SoC from Nordic is "Bluetooth-5-ready"

The single-chip Bluetooth low energy nRF52840 System-on-Chip (SoC) develops Nordic Semiconductor's nRF52 series SoC lineup in terms of both performance and feature improvements, with 4x range, 2x bandwidth, and enhanced security with on-chip ARM CryptoCell cryptographic accelerator.
Capabilities include support for the Bluetooth 5 specification, plus radio support for IEEE 802.15.4, more extensive Flash and RAM memory availability, and a new radio hardware architecture with increased output power and link budget. Together this – Nordic asserts – "redefines the performance envelope of single-chip Bluetooth low energy applications". In addition to Bluetooth 5 support, the nRF52840 SoC includes IEEE 802.15.4 capability. 802.15.4 wireless technology forms the basis of smart home technologies such as ZigBee and Thread (with additional upper layers not defined by the standard). IEEE 802.15.4 can also be employed as a Network Adaptation Layer with 6LoWPAN and standard Internet Protocols. The nRF52840 SoC's support for 802.15.4 extends the product's capability as an interoperable foundation technology for IoT, smart home, or industrial sensor wireless networks using several different wireless technologies. Intended to support applications that were previously not possible with a single-chip solution, nRF52840 SoC employs the 64 MHz, 32-bit ARM Cortex M4F processor employed on Nordic's nRF52832 SoC. The nRF52840 SoC's hardware enhancements include a new radio architecture with on-chip PA boosting output power, and extending the link budget for 'whole house' applications; a doubling of Flash memory to 1 MB and a quadrupling of RAM memory to 256 kB; support for Bluetooth 5, 802.15.4, ANT, and proprietary 2.4GHz wireless technologies; a full speed USB 2.0 controller; and new peripherals (many with EasyDMA) including a quad-SPI interface.
The nRF52840 can also operate from power supplies above 5V, such as re-chargeable battery power sources. The nRF52840 SoC incorporates the ARM CryptoCell-310 cryptographic accelerator ading security for Cortex-M based SoCs.

Complete article, here

Bluetooth 5 spec released: multiplies range & throughput

The Bluetooth Special Interest Group (SIG) has officially adopted Bluetooth 5 as the latest version of the Bluetooth core specification. Key updates to Bluetooth 5 include longer range, faster speed, and larger broadcast message capacity, as well as improved interoperability and coexistence with other wireless technologies.

Key points include;
- 4x range increase to deliver robust, reliable connections that make full-home and building and outdoor uses cases much more viable
- 2x speed from 1 MBps to 2 MBps, without the need for additional energy. Doubling speed while maintaining low-power energy consumption will provide faster data transfers, optimise responsiveness, and lower latency that are critical for scenarios where speed is a priority.
- An 800% increase in broadcast messaging capacity, enabling Bluetooth to transmit richer, more intelligent data. This will further drive the adoption and deployment of beacons and propel the next generation of “connectionless” services like location-relevant information and navigation.
- Coexistence with other technologies, such as Wi-Fi and LTE, to provide more robust connections.

Complete article, here

Software hardening at executable/binary level to secure IoT devices

GrammaTech's (Ithaca, New York) software hardening techniques complement the company’s static analysis tools and expertise with the aim of improving the current and future robustness of embedded software. Analyzing application binaries allows GrammaTech's rewriting tools to discover the use of potentially problematic code patterns, libraries, or OS functions. The rewritten binaries have wrappers around such code to prevent erroneous behaviour. For example, function call stack usage can be instrumented to prevent stack overflow and subsequent code injection. Another example would be preventing calls to known problematic library functions such as *strcpy()* from causing buffer overflow errors.

Rewriting a binary executable into a robust hardened version provides quality and security assurance for any version of the application -- current and future versions are protected. GrammaTech's hardening tools static rewrite binaries into more robust and secure applications.

Binary rewriting techniques comprise confinement and diversification. The goal of confinement is to prevent undetected vulnerabilities from causing a failure in an executing application. Techniques to detect and prevent certain specific classes of vulnerabilities already exist to some extent, but often lead to a program failure state - which, in turn, leads to a denial of service.

Diversification techniques are used to alter the default code and memory layout to prevent potential exploits. By rearranging the subroutine calling sequence, stack, heap, and global data layout, it's possible to prevent vulnerabilities from being exploited. Stack overflow errors that lead to code injection exploits, for example, can be thwarted with these techniques.

Complete article, here

FPGAs take on multi-sensor signal processing at IoT edge nodes

Lattice Semiconductor positions its iCE40 UltraPlus Devices as the smallest FPGAs with enhanced memory and DSPs; they can improve system performance, reduce system cost, power consumption and time-to-market, while enabling always on, distributed processing.

Energy-efficient parallel processing allows always-on monitoring and accelerated computation; flexible

I/Os simplify board-level design; and the devices are configured to offer IoT-edge memory with up to 1 Mbit of embedded memory for sensor data buffering. Lattice cites the increasingly common case of devices with multiple different sensor inputs, that may use a variety of different interface buses. In both architectural terms and in the physical space (a simple interface between two PCBs), the designer might aggregate GPIOs, SPI, UART, I²C, I³C/MIPI signals and more over a single PCB trace to eliminate routing contention issues. You might, a Lattice spokesman proposes, “scatter a few of these [chips] around a system, to keep the load off the main processor.”

iCE40 UltraPlus FPGAs are, Lattice says, an energy-efficient and programmable mobile heterogeneous computing (MHC) solution. This addition to the iCE40 Ultra family has eight times more memory (1.1 Mbit RAM), twice the digital signal processors (8x DSPs), and improved I/Os over previous generations. Available in multiple package sizes, Lattice suggests uses in smartphones, wearables, drones, 360 cameras, human-machine interfaces (HMIs) and industrial automation, as well as security and surveillance products.

In MHC, the concept is to provide an energy-efficient method for computing algorithms quickly and locally using dissimilar processors to offload power hungry applications processors (APs) in battery-powered devices. More DSPs offer the ability to compute higher-quality algorithms, while increased memory allows data to be buffered for longer low-power states. The flexible I/Os enable a more distributed heterogeneous processing architecture. This combination provides flexibility to enable OEMs and the “maker” market to deliver key innovations, such as always-on sensor buffers and acoustic beam forming.

Complete article, here

SIC RETROFITS REJUVENATE OLDER POWER SYSTEMS

By John Mookken, Wolfspeed

Silicon carbide (SiC) power devices, including SiC MOSFETs and Schottky diodes, have been at the forefront of advanced power systems development for the past 20 years. They have recently earned recognition as a more mainstream option for power electronics engineers, and especially those who design next-generation power conversion systems.

The superior material properties of SiC, combined with a competitive cost-per-Amp for the latest devices, allow designers to develop new power converters that are smaller, cooler, and much more efficient than silicon-equipped converters. Designers don't even have to start with a clean sheet design to take advantage of SiC device benefits. They can also retrofit older, existing power conversion systems with SiC devices to dramatically improve overall performance while reusing many of the original components. Figure 1 shows the component cost breakdown of a typical PV string inverter, and many designers may be surprised to find that the semiconductors only account for roughly 10% of the total system cost. That isn't uncommon, though. In other types of power converters, the value of power semiconductors typically spans between 5% and 25% of the total system cost. In order to make the retrofit case for SiC, we have to investigate the cost/benefit equation and address the few technical hurdles users may have to surmount when introducing a high-speed switching device into an older power system designed to use slower silicon (Si) IGBT devices.

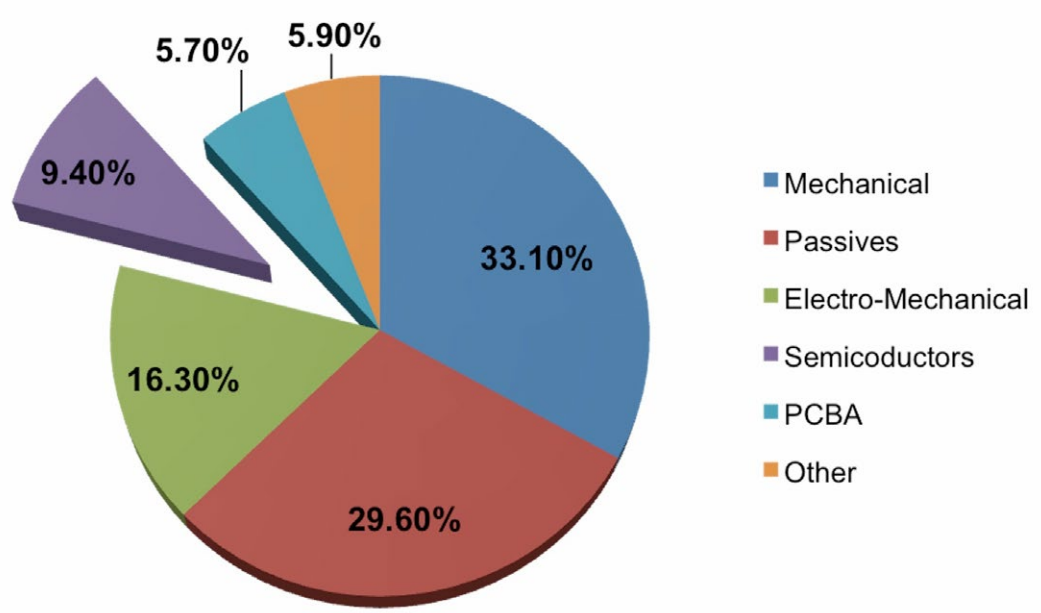


Figure 1. *The typical cost breakdown of a 5kW PV string inverter [Ref. 3].*

Benefits of SiC over Si

SiC MOSFETs provide several key advantages over Si IGBTs with the same current and voltage ratings. Two of the foremost advantages are the ability to reduce switching losses approximately six-fold and conduction losses by more than 50% at operating temperatures. This is especially true when comparing devices capable of blocking 900V and higher. Figure 2 clearly illustrates the difference in forward voltage curves between two similarly rated Si IGBTs and a SiC MOSFET. When operating the devices at any current level below the rated DC current, which is typical of most designs, the SiC MOSFET will have the advantage in conduction losses.

Some of the other benefits of SiC devices include avalanche capability and a higher breakdown voltage margin. In order to take full advantage of SiC and its benefits, it's extremely important to accurately size the required device Amps, and to identify the optimal switching frequency to minimize the cost of the passive components in the system. To facilitate these processes and make it easy to right-size SiC devices for your unique application, Wolfspeed offers the SpeedFit Design Simulator (www.wolfspeed.com/speedfit), a free online simulation tool completely dedicated to simulating and evaluating SiC power devices.

Economics of the SiC retrofit option

There are several ways to upgrade an existing power system to take advantage of SiC benefits. At one extreme, designers have a new or clean sheet power converter design featuring custom components especially designed to maximize SiC performance benefits. This option gives the greatest value for every euro or dollar spent on SiC, as it allows you to optimize the entire system for efficiency and power density. Another option is to maintain the form factor of the existing system, replace and optimize internal components to maximize the value of SiC, and reuse or recycle as many of the mechanical parts as possible. This option is often preferable if the unit is part of a larger system, and it's essential to maintain the same form and fit of the legacy power converter.

A third option is the retrofit option, in which case the goal is to minimize the number of components affected by the use of SiC while still extracting as many SiC benefits as possible. Most retrofits avoid making changes to the controller, leaving the switching frequency of the power devices unchanged, which somewhat diminishes the impact of the biggest benefit SiC has to offer: 6x lower switching losses compared to Si IGBTs. However, there's still a strong case to be made for retrofitting SiC into some applications, as static and dynamic losses can still be reduced.

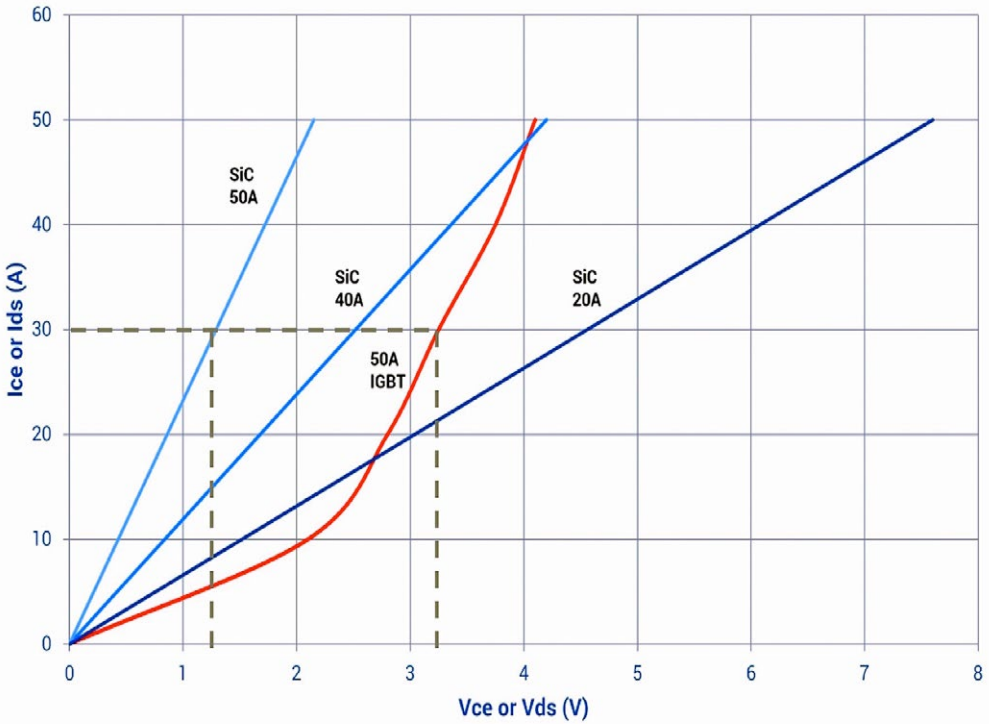


Figure 2. *This graph depicts the characteristic knee in the IV curve of a 50A IGBT as compared to the pure Ohmic losses of a family of SiC MOSFETs.*

The article continues with a case study of the practicalities and cost/benefits of a retrofit where power switches were exchanged in a commercial inverter design – click for full pdf

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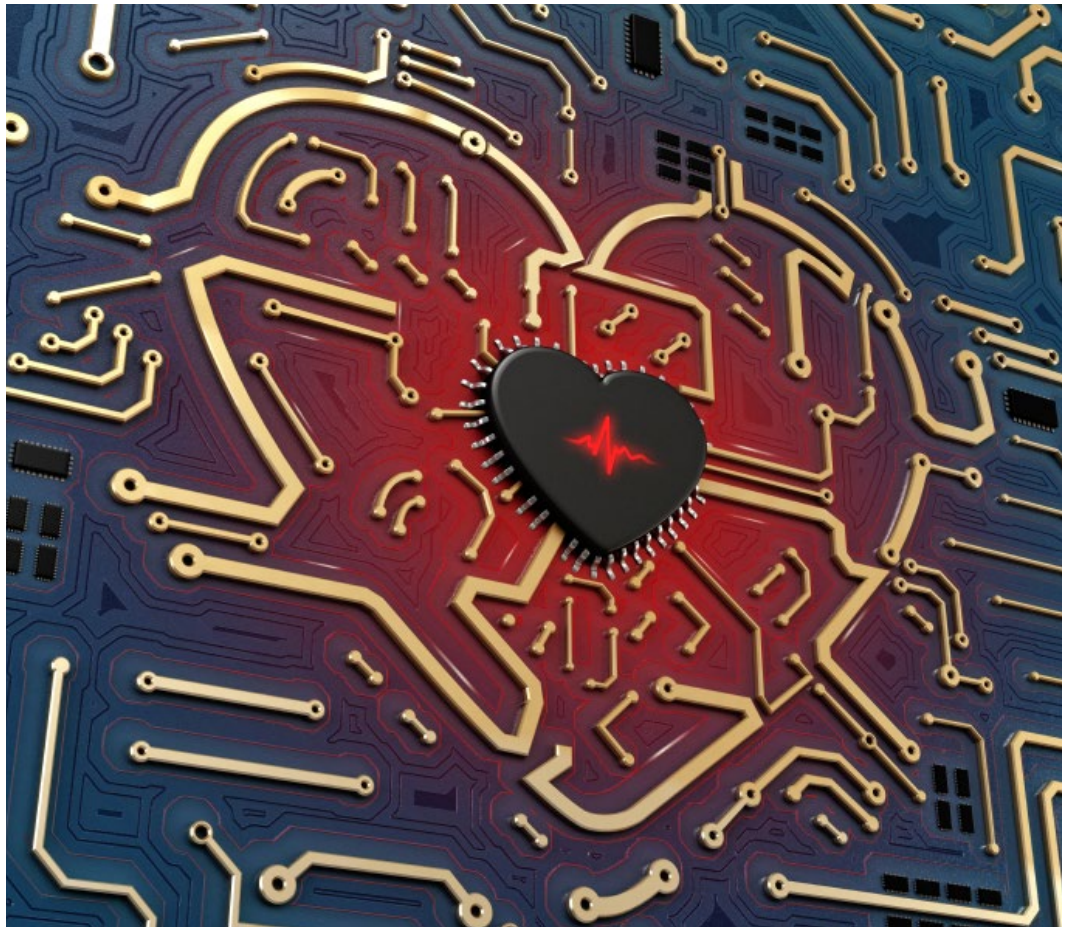
PUTTING THE IOT IN WEARABLE HEALTHCARE DESIGNS

By Andrew Baker, Maxim Integrated

When Wilson Greatbatch invented the first implantable pacemaker in 1960, he gave heart patients worldwide a new lease on life. Today's pacemakers provide an added dimension of care. In addition to tracking every heartbeat, checking for abnormal rhythms, and monitoring their own voltage settings and battery life, many modern pacemakers are also equipped with WiFi. That means that patients get the reassurance that their doctors can monitor their conditions from afar.

Connected pacemakers are one example of an array of wearable fitness and healthcare devices that are now available on the market. Indeed, continued growth is on the horizon for the industry. MarketResearch.com [Ref. 1] forecasts a $117 billion market for healthcare internet of things (IoT) by 2020.

A variety of underlying technologies—from sensors and low-power processors to wireless communications such as Bluetooth Low Energy and near-field communication (NFC)—is fuelling the rise of these so-called internet of medical things (IoMT) products. Because the area is relatively new, there's a lot of innovation happening, as well as plenty of room for more. This article will take a look at some of the technology challenges and opportunities for designing IoMT applications.



Addressing technical challenges

Smart glucose monitors provide continuous blood-sugar monitoring, and smartphone apps that work with them trigger alerts when blood sugar is high or low, even sharing this information with caregivers. Fitness trackers measure not only steps and calories burned but also heart rate and sleep quality. They can also give advice about readiness for strenuous exercise. There's even a wearable patch that continuously monitors the hearts of patients who are suspected of having an irregular heartbeat or arrhythmia (e.g. atrial fibrillation), which affects roughly one-third of Americans. The iRhythm ZIO patch offers a very small and unobtrusive solution to monitor

for heart arrhythmias and provides advanced analytics to help cardiologists make a diagnosis and suggest treatment. These are just a few examples of the wearable fitness/healthcare devices already available on the market.

The most obvious technical challenges in designing wearable fitness and healthcare devices are the small form factor, low-power requirements, and the need to deliver reliable, accurate performance in an unpredictable environment (namely, the human body). In addition, wearable devices must interface with a variety of different analogue sensors, so integration is important. Typically, each of these sensors has its own signal interface level, type, and noise issues.

Design teams also face pressures related to time to market, budget, market demands, and more. Since many companies are breaking new ground in this area, there's a tendency to focus on individual components to address solution requirements, rather than looking at the system as a whole. A more holistic, system-based approach would be a more pragmatic way to ensure that all of the components work well together to result in a high-performing product.

Developing a custom board with human body sensors can be a complicated endeavour. First, designers have to create custom hardware and firmware to validate their concepts. Next, they need to build prototypes to support field trials. They also have to spend a lot of time evaluating sensors and existing solutions. Reference designs—especially those that provide more than just a schematic diagram—can help save time and effort. Using a reference design, designers can prove whether their assumptions will actually work as desired, for example, or they can use the platform to evaluate specific components. *(continues)*

Click the link below to download the pdf of the complete article.

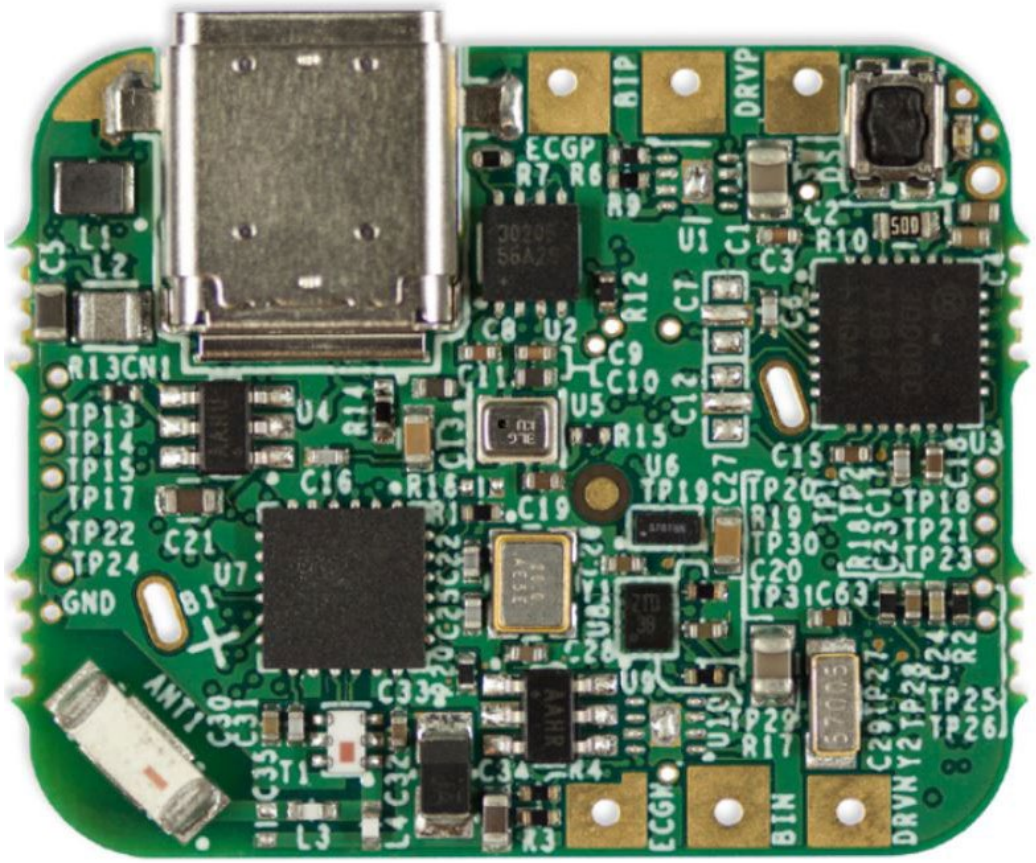


Figure A *One example of a multi-functional reference design (which also serves as a development and evaluation platform) is Maxim's hSensor Platform. At 30.5 x 25.4 mm, it is equipped with a temperature sensor, an electrocardiogram (ECG) analogue front end (AFE), a pulse oximeter and heart-rate sensor, and an integrated power management IC.*

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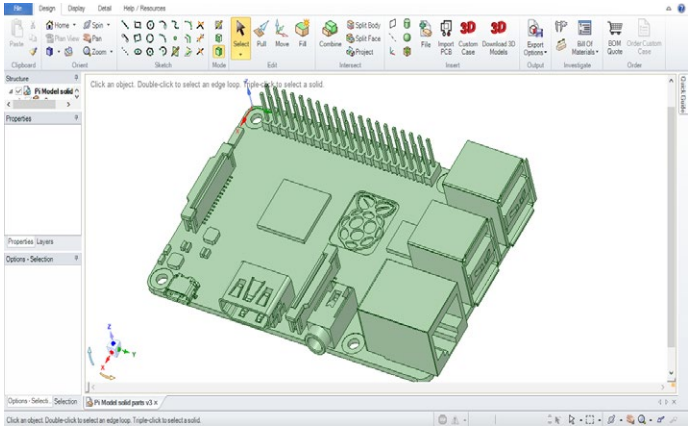
MECHANICAL DESIGN TOOLS FOR THE NON-SPECIALIST CAD USER

By Joydipto Choudhuri, RS Components

A number of trends are evident as the electronics industry enters 2017. One of these is the availability of an increasing number of fully featured embedded single board computers. This has led to embedded developers adopting these platforms in place of embarking on their own design, and has opened up the market to a host of new developers.

Many of these new entrants are lean start-up organisations that do not have the traditional hardware and software infrastructure of established manufacturing organisations. Typically the focus for these organisations is getting the product into the market in the shortest possible time, often with a limited number of people that need to juggle between many different tasks.

The combined effect of using a ready-made proven platform approach is that the overall development life cycle has shortened considerably. In many ways the embedded software and hardware aspects of the design are – or become – relatively short, which presents a challenge to keep the product's 3D mechanical design in step with the embedded cycle. In an attempt to speed up and closer integrate the mechanical aspects of the design, engineers are turning to a variety of mechanical design software tools. These tools enable them to focus on the product's aesthetics and the essential mechanical packaging necessary to turn



Sketched in a 3D view and rendered - Raspberry Pi 3

an idea into a tangible product. Another trend that is significantly influencing and driving this approach is the adoption of rapid prototyping techniques made possible by 3D printing technologies. Mechanical design software has evolved to incorporate visualisation and modelling functions that bring a tight integration between the mechanical design workflow and rapid prototyping techniques.

When researching which 3D mechanical design tool to adopt engineers will be faced with a wide range of choices. Some are traditional desktop software applications sold on a per licence or enterprise licence basis, while at the other extreme there are those that are free and work in any web browser. Deciding on which one is best for your requirements will be made easier by understanding what you need to get out of it. A designer's own particular experience may steer them towards a particular route.
For example, for time-served senior mechanical design engineers it is highly likely that they have been using a high end CAD workstation such as SolidWorks, and will be very familiar with their features and functionality. These fully featured offerings are likely to be expensive, often to the tune of tens-of-thousands of euro (or £/$) per-seat licence once all the optional extras have been fitted or activated. More appropriate to those employed in a full time mechanical design role, such applications might be daunting for an engineer who is having to take care of many aspects of a development, not only the mechanical format. The high end 3D CAD systems also are likely to require a fairly high-specification graphics workstation as a platform, so a company is likely to be look-

ing at a significant investment that is likely to swallow up the savings made by using a readily available embedded board.

At the other end of the scale there are a number of free browser-based applications that fulfil the basic requirements of a 3D design package, but as we'll see further on in this article, they are likely to fall short of some of the functions a more integrated approach warrants. Also, being totally reliant on internet connectivity, they don't provide an off-line working option or might prove to be unreliable should interruptions occur.

Being able to embrace the rapid prototyping techniques that 3D printing offers should be a core requirement of any selected 3D CAD application. Also, ideally it should be able to accommodate a direct modelling approach, where the user creates a component's shape through visual sketch, pull and move commands, in addition to the parametric, dimensions-based approach that high-end 3D CAD applications tend to favour.

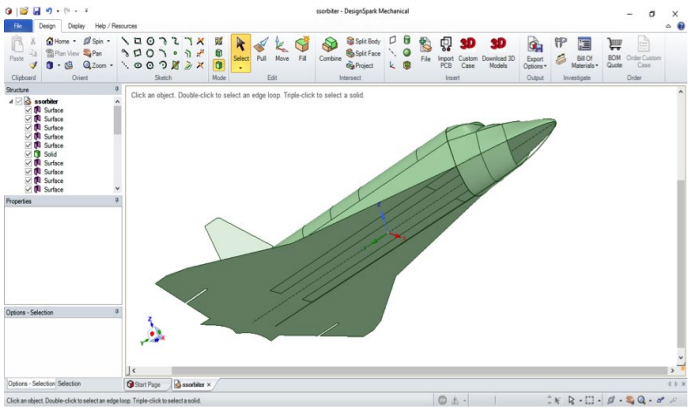


Figure 1. *Direct modelling using DesignSpark Mechanical*

It is worth considering what other aspects of a product's design might need to be incorporated. For example, those working on electronics-based designs might require the capability to integrate the outputs from PCB design software into the mechanical design. There is also the question of importing pre-created models of other components into the design. Ensuring the space envelope within the design accommodates other parts is essential and provides a far more holistic approach to rendering your final 3D mechanical design.

An example of a 3D mechanical CAD application that fits the above criteria is DesignSpark Mechanical (DS Mechanical). This software, available for free download from RS Components' DesignSpark website, provides a comprehensive range of features but does

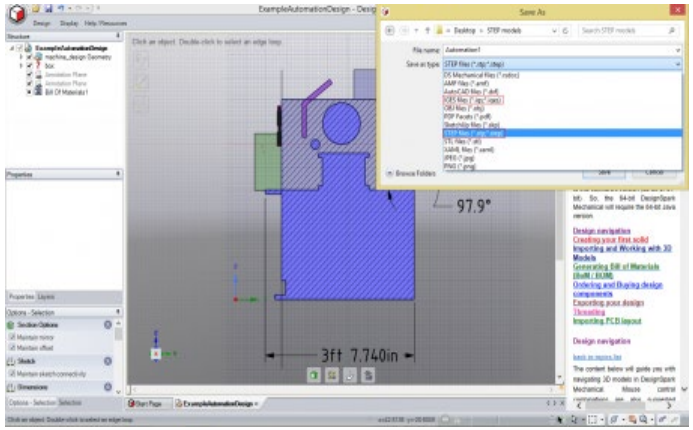


Figure 2. *Import and export using a variety of standard file formats*

not require any special computing platform resources. Available for Microsoft Windows 7 upwards it also accommodates a full GUI interface for use with touch based Microsoft Windows tablets or PCs. DS Mechanical is positioned as a middle range product, and includes many features not usually associated with a free product offering. It provides a low-cost starting point for engineers needing access to comprehensive 3D mechanical design features but without having to make significant investments.

article continues – click for pdf

10 + 1 STEPS TO MEASURING POWER ACCURATELY

By Anoop Gangadharan, Yokogawa

As energy efficiency becomes an important consideration for governments, industries and markets, engineers are looking to optimise product efficiency by optimising power consumption and reducing losses. This has made accurate measurement of power an important element of quality control all the way from the design phase through to production and field operation.
This article looks at key factors that affect power measurement accuracy and at how they influence a choice of measurement instrument.

1. It's not just about voltage and current uncertainties

For accurate analysis of power consumption, measurements must go beyond just voltage or current uncertainty and take power uncertainty as a whole into consideration. Parameters such as crest factor, phase angle error, temperature range, warm-up time, stability period and common-mode rejection all influence the overall accuracy of a power measurement and as such should be specified and accounted for.

2. Validity of accuracy

Manufacturers of power measurement instruments often use 'typical value' specifications on their data sheets based on best case expectations from their product. These are not 100% guaranteed, certainly not without calibration anyway. Moreover, the accuracy of a power measurement varies depending on the measurement range. So any specified accuracy value should be accompanied by the range over which it is valid. Without this, a user cannot determine whether the accuracy values are valid only at a single point, a few points within a measurement range, or over the entire range. Be wary of instruments that offer impressive looking 'typical' values, they may not be as accurate as they claim.

3. Crest factor capability of the instrument

The crest factor of a waveform is its peak value divided by its RMS value; therefore a perfect sine wave has a crest factor of √2 or 1.414. Distorted waveforms, particularly in switch mode power supplies, can have very large crest factors. A power measuring instrument therefore needs to be able to handle waveforms with high crest factors accurately. Power measuring instruments with peak ranges typically specify maximum crest factors of 20.
However, instruments with RMS ranges are specified differently. For example, when a crest factor of 3 is selected on an RMS ranging instrument, it means that the instrument can handle this crest factor when the RMS input is at full scale. Therefore if the accuracy of the input is specified down to 1% of the measuring range, the instrument is capable of handling crest factors of 300, or even 600 when a crest factor of 6 is selected. Engineers should be aware of this when comparing instruments because this indicates how accurately an instrument can measure a signal and its distortions within a specified range.

In the continuation of this article, the author considers other important aspects of the specifications of a power analyser, including peak or RMS measurement rating, harmonics, and phase errors. Click for pdf

PHASE STABILITY MEASUREMENT OF A RANGING TONE

by Francesco Spadaforaat and Giuseppe Savoia, Keysight Technologies

The world's first artificial satellite, which became known as Sputnik- I, was launched by the Soviet Union 50 years ago, this year (2017). The United States' Explorer-I followed the launch of Sputnik-I in January 1958. These two great events opened up a new era of practical use of outer space.

It is fundamental to maintain control of the orbit of a spacecraft or a satellite; all the involved technologies, both hardware and software, have to ensure a high-level of reliability. A failure anywhere in the communication or processing chain can lead to unimaginable damage and large financial loss.

The usual method for establishing a satellite's orbit is based on measuring the distances between the satellite and the Earth Station. These distances are determined by measuring the time needed for a radio signal to make the round trip between the antenna on the Earth Station and the satellite/spacecraft. The system that performs this type of measurement it is known as Ranging tone System.

A classical radar system could be used to determine the range, but such a system requires high-powered pulse generators and a great deal of dedicated equipment. Ranging-tone systems take advantage of the existing communication equipment between a spacecraft and a ground station by transmitting a range tone from the ground station to the satellite, and by retransmitting the same signal back to the Earth station. A comparison circuit of the phases between the two signals provides the correct distance.

Both the basic concept of the Ranging Tone operation mode and the issue of the phase stability are discussed in the first section of this article. In the second section, a valid way to perform the phase stability measurement of a ranging tone system, using Keysight Technologies' UXA N9040B and VSA89600B, is proposed.

Ranging tone basics

As noted in the previous section the ranging tone system is used to measure the distance between a satellite or spacecraft and the ground station. Figure 1 depicts a simplified block diagram of a ranging tone system.

A base band source generates the CW tone, the modulator performs the up-conversion to a desired carrier frequency then the signal is transmitted to the satellite by the antenna. The satellite transponder transmits, again, the same signal to Earth station where the down-conversion and the phase comparison between the Tx and Rx signal are performed. Usually all the processes are controlled by a host PC.

The phase shift between the Tx and Rx signal is directly proportional to the turn-around signal travel time and thus to the distance between the earth station and the satellite.

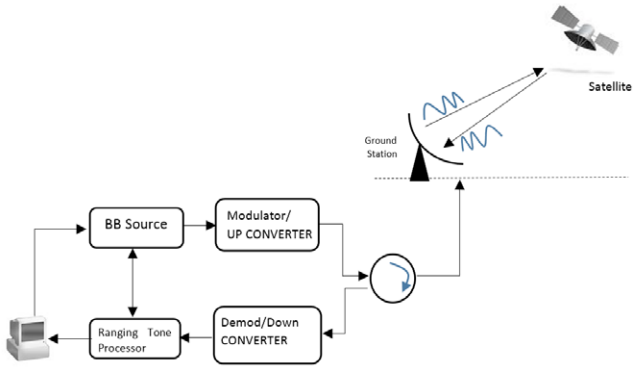


Figure 1. *Ranging tone block diagram*

The following equations show how the phase shift between the two tones is related to the distance between the satellite and the Earth Station.
Considering a simplified approach, the complex Tx signal transmitted by the earth stations can be expressed as:

$$Tx_{tone} = Ae^{jwt} = A\,e^{j2\pi ft} \qquad (1)$$

Where A is the amplitude of the signal and f is the carrier frequency.

The corresponding received signal retransmitted by the satellite transponder can be expressed like an attenuated and phase shifted copy of the Tx tone.

$$Rx_{tone} = ae^{j\omega(t-\tau)} = ae^{j\omega\left(t-\frac{2R}{c}\right)} \qquad (2)$$

In the phase term of equation 2, the propagation delay τ is equal to 2R/c where R is the distance between the antenna and the satellite and c is the speed of light [3*10^8 m/sec].

The computing of the range between the earth station and satellite is performed by analysing the phase difference between the Tx and Rx signal.

$$\phi_{tx} - \phi_{rx} = \omega t - \omega\left(t - \frac{2R}{c}\right) = \frac{2R}{c} \qquad (3)$$

In the ranging tone system design ±15m of accuracy in the computing of the satellite distance is acceptable and this translates to ±100 nsec accuracy in the measurement of propagation delay τ.
In the real world, both signals are a little bit different, for example in the Tx signal at least an additional phase term has to be considered.

$$Tx_{tone} = e^{jwt+\phi} \qquad (4)$$

The φ term represents the phase fluctuations on the transmitter side. This term can be introduced by several factor such as temperature, instability of the mixer and inaccuracy of the local oscillator; these factors depend on time. Therefore, they can compromise the correct measurement of the satellite range.

Since this term will be also present in the phase of the RX signal, the phase fluctuations at the output of the Tx, have to be limited as much as possible, in order to have an accurate determination of the satellite position; this means the phase must remain constant and negligible with respect to 2R/c.

In the next section, we are going to explain how to perform the phase stability measurement on the Tx side of a ranging tone system using the X series spectrum analyser UXA N9040B and VSA software 89600B.

Figure 2 shows the test setup; in this case the measurement is performed at the output of the Up-converter; the instrument used to accomplish this measurement is the X series Spectrum Analyser N9040B with the VSA 89601B software used to perform the demodulation and phase measurement and log.

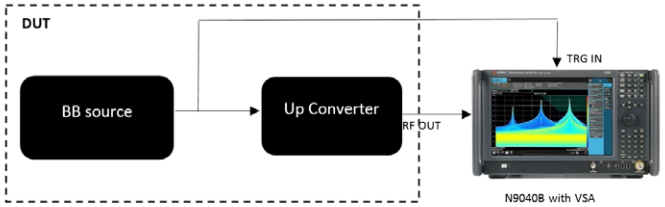


Figure 2. *Ranging tone measurement setup*

The article continues with a further description of the test procedure – click for pdf.

NOISE SENSITIVE APPLICATIONS NEED ULTRALOW NOISE LDO REGULATORS

By Amit P. Patel and Steve Knoth, Linear Technology

Linear regulators step a voltage down from a higher voltage to a lower voltage without the need of an inductor. The low dropout linear regulator (LDO) is a particular type of linear regulator in which the dropout voltage – the differential between the input-to-output voltages needed to maintain regulation – is typically below 400 mV.

Early linear regulator designs offered dropouts on the order of ~1.3V, meaning for a 5V input, the maximum achievable output was only ~3.7V for the device to stay in regulation. More recently, "low" dropout is considered to be 500 mV or less. In these days of more sophisticated design techniques and wafer fabrication processes, "low" dropout is lower, typically in the region of 100-300 mV.

Although the LDO is rarely the most expensive system component in any given system, it is often one of the most valuable components from a cost/benefit basis. One of the LDO's tasks – in addition to its regulation function – is to protect expensive downstream loads from harsh environmental conditions such as voltage transients, power supply noise, reverse voltage, current surges and related effects. In short, its design must be robust and also contain all of the protection features needed to "absorb the punishment" from its environment while protecting the load. Many low-cost LDO linear regulators do not have the necessary protection features and thus fail, often causing damage not only to the regulator itself, but also the downstream load.

LDOs vs other regulators

Low voltage step-down conversion and regulation can be achieved via a variety of methods. Switching regulators operate with high efficiency over a wide range of voltages but require external components such as inductors and capacitors for operation, thus taking up a relatively larger board space. Inductorless charge pumps (or switched capacitor voltage converters) can also be used to achieve lower voltage conversion but are limited in output current capability, suffer from poor transient performance, and require more external components compared to a linear regulator.

Today's generation of fast, higher current, low voltage digital ICs such as FPGAs, DSPs, CPUs, GPUs and ASICs have placed stringent demands on supplies that power the core and I/O channels. Traditionally, efficient switching regulators have been used to power these devices but they can have potential noise interference issues, transient response and layout limitations. As a result, LDOs are becoming an alternative in these applications, as well as other low voltage systems. Thanks to recent product innovations and feature enhancements, LDOs offer some performance benefits that make them more desirable.

Furthermore, when it comes to powering noise-sensitive analogue/RF applications (such as commonly found in test and measurement systems, where the measurement accuracy of the machine or equipment needs to be orders of magnitude better than the entity being measured), LDOs are generally preferred over their switching counterparts. Low noise LDO regulators power a wide range of analogue/RF designs, including frequency synthesizers (PLLs/VCOs), RF mixers and modulators, high speed and high resolution data converters (ADCs and DACs) and precision sensors. Nevertheless, these applications have reached sensitivities that are testing the limits of conventional low noise LDOs. For instance, in many high-end VCOs, power supply noise directly affects the

VCO output phase noise (jitter). To meet overall system efficiency requirements, the LDO usually post-regulates the output of a relatively noisy switching converter, so the high frequency power supply ripple rejection (PSRR) performance of the LDO becomes paramount.

LDO design challenges

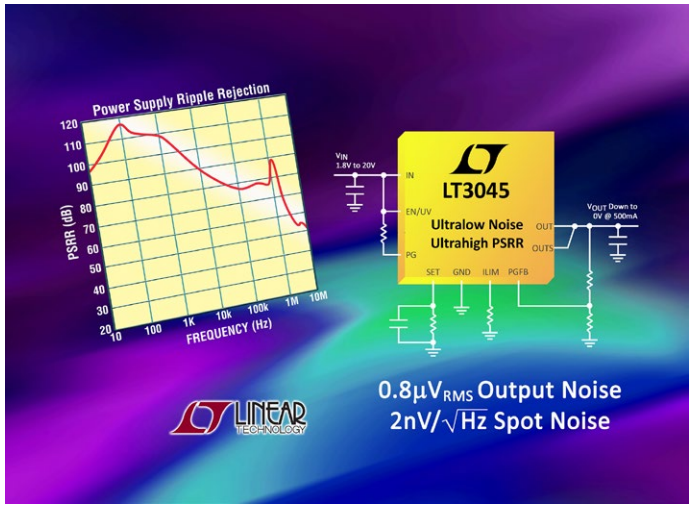
Many industry-standard linear regulators perform the low dropout operation with a single voltage supply, yet most cannot achieve the combination of very low voltage conversion with low output noise, wide ranging input/output voltages and extensive protection features. PMOS LDOs achieve the dropout and run on a single supply but are limited at low input voltages by the pass transistor's Vgs characteristics as well as lacking the many protection features found in high performance regulators. NMOS-based devices offer fast transient response but require two supplies to bias the device. NPN regulators offer wide input and output voltage range but either require two supply voltages or have higher dropout. By contrast, with the proper design architecture, a PNP regulator can achieve low dropout, high input voltage, low noise, high PSRR and very low voltage conversion with "bulletproof" protection – while operating from a single supply rail.

For best overall efficiency, many high performance analogue and RF circuits are powered from LDOs post-regulating the output of a switching converter. This requires high power supply ripple rejection (PSRR) and low output voltage noise at low input-to-output differentials across the LDO. An LDO with high PSRR easily filters and rejects noise from the switcher's output without requiring bulky filtering components. Further, a device with low output voltage noise across a wide bandwidth is beneficial for today's modern rails where noise-sensitivity is a key consideration. Low output voltage noise at high currents is clearly a necessary specification.

Ultralow noise, ultrahigh PSRR LDO family

An a LDO solution that solves the issues outlined above should therefore have the following attributes:

- Very low output noise
- Low dropout operation
- High PSRR across a broad range of frequencies
- Single supply operation (for ease of use and relaxed supply sequencing challenges)
- Fast transient response time
- Operation over a wide input/output voltage range



- Moderate output current capability
- Excellent thermal performance
- Compact footprint

Having summarised the demands placed on the low-noise LDO, the authors conclude by outlining the characteristics of a recently-introduced family of ultrahigh PSRR, ultralow noise LDO regulators conceived to address these specific needs – click for pdf

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NOISE ANALYSIS OF PRECISION DATA ACQUISITION SIGNAL CHAIN

BY MAITHIL PACHCHIGAR, ANALOG DEVICES

In many applications, the analogue front end takes either a single-ended or differential signal and performs gain or attenuation, antialiasing filtering, and level shifting as required, and then drives the inputs of the ADC at the full-scale level. This article gives an insight in to noise analysis of the precision data acquisition signal chain and takes a 'deep dive' to figure out the overall noise contribution from this signal chain.

As shown in Figure 1, the low power, low noise, fully differential amplifier, ADA4940-1, drives the differential inputs of the AD7982, 18-bit, 1 MSPS PulSARADC and the ADR435, low noise, precision 5V reference is used to supply the 5V needed for the ADC. This signal chain eases analogue signal conditioning by eliminating the need for an extra driver stage and reference buffer, resulting in board space and cost savings. A single-pole, 2.7 MHz, RC (22Ω, 2.7 nF) low-pass filter is placed between the ADC driver output and the ADC inputs to help limit the noise at the ADC inputs and reduce the effect of kickbacks coming from the capacitive DAC input of an Successive approximation register (SAR) ADC.

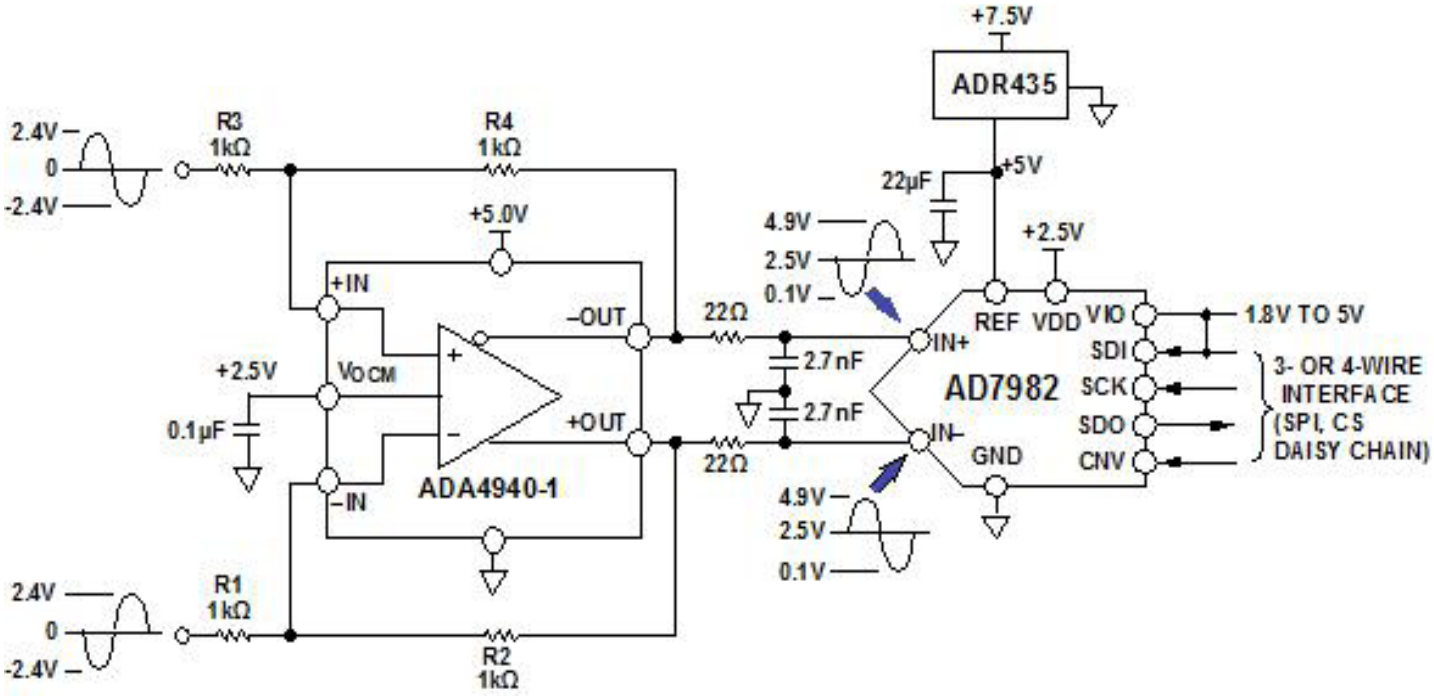


Figure 1 *Low power, fully differential, 18-bit, 1 MSPS data acquisition signal chain (simplified schematic: all connections and decoupling not shown).*

When used as an ADC driver, the ADA4940-1 allows the user to do the necessary signal conditioning including level shifting and attenuating or amplifying the signal for more dynamic range using four resistors, thus eliminating the need for an extra driver stage. The ratio of feedback resistors (R2 = R4) to gain resistors (R1 = R3) sets the gain, where R1 = R2 = R3 = R4 = 1 kΩ.

For a balanced differential input signal, the effective input impedance would be 2× gain resistor (R1 or R3) = 2 kΩ, and for an unbalanced (single-ended) input signal, the effective impedance would be approximately 1.33 kΩ using the equation;

$$\frac{R3}{1-\frac{R4}{2\times(R3+R4)}}$$

A termination resistor in parallel with the input can be used if required.

The ADA4940-1internal common-mode feedback loop forces common-mode output voltage to equal the voltage applied to the V_{OCM} input and offers an excellent output balance. The differential output voltage depends on V_{OCM} when two feedback factors β1 and β2 are not equal and any imbalance in output amplitude or phase produces an undesirable common-mode component in the output and causes a redundant noise and offset in the differential output. Therefore, it's imperative that the combination of input source impedance and R1 (R3) should be 1 kΩ in this case (that is, β1 = β2) to avoid the mismatch in the common-mode voltage of each output signal and prevent the increase in common-mode noise coming from the ADA4940-1.

As signals travel through the traces of a printed-circuit board (PCB) and long cables, system noise accumulates in the signals and a differential input ADC rejects any signal noise that appears as a common-mode voltage.

The expected signal-to-noise ratio (SNR) of this 18-bit, 1 MSPS data acquisition system can be calculated theoretically by taking the root sum square (RSS) of each noise source – ADA4940-1, ADR435 and AD7982.

The ADA4940-1offers low noise performance of typically 3.9 nV/√Hz at 100 kHz as shown in Figure 2.

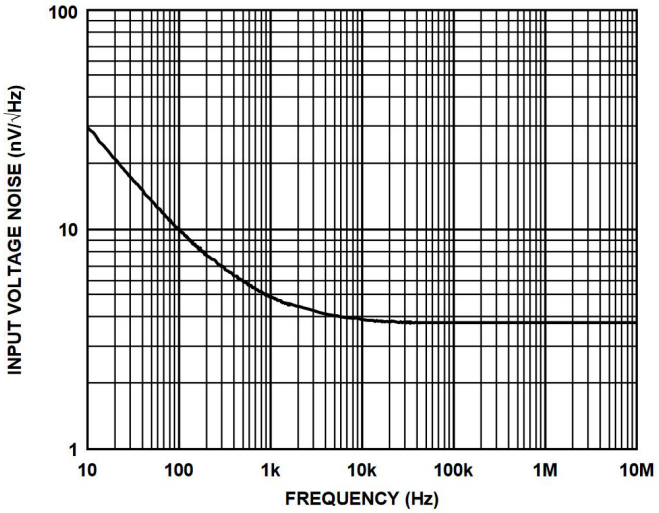


Figure 2 *ADA4940 input voltage noise spectral density vs. frequency.*

It is important to calculate the noise gain of the differential amplifier in order to find its equivalent output noise contribution. The noise gain of the differential amplifier is:

$$NG=\frac{2}{(\beta 1+\beta 2)}=2\ \text{V/V}$$ where;

$$\beta 1=\frac{R1}{R1+R2}=0.5 \quad \text{and} \quad \beta 2=\frac{R3}{R3+R4}=0.5$$

are two feedback factors.

The following differential amplifier noise sources should be taken into account:

Since the ADA4940-1 input voltage noise is 3.9 nV/√Hz, its differential output noise would be 7.8 nV/√Hz. The ADA4940-1's common-mode input voltage noise (e_{OCM}) is 83 nV/√Hz from the data sheet, so its output noise would be;

$$-e_{OCM}\times(\beta 1-\beta 2)\times NG=0$$

Noise from the R1, R2, R3, and R4 resistors can be calculated based on the Johnson-Nyquist noise equation for a given bandwidth.

$$e_{Rn}=\sqrt{(4kB\ TR)}$$

where kB is the Boltzmann constant, (1.38065×10^{-23} J/K), T is the resistor's absolute temperature in Kelvin, and R is the resistor value in ohms (Ω).

The noise from the feedback resistors would be;
$e_{R2} = e_{R4} = 4.07$ nV/√Hz
The noise from the R1 would be;
$e_{R1} \times (1 - \beta 1) \times NG = 4.07$ nV/√Hz and from R3 would be;
$e_{R3} \times (1 - \beta 2) \times NG = 4.07$ nV/√Hz.

The ADA4940-1 current noise is 0.81 pA/√Hz from the data sheet.
Inverting input voltage noise:
$i_{IN}- \times R1 || R2 \times NG = 0.81$ nV/√Hz.
Noninverting input voltage noise:
$i_{IN}+ \times R3 || R4 \times NG = 0.81$ nV/√Hz.

So, the equivalent output noise contribution from the ADA4940 would be:
$= \sqrt{[(7.9e\text{-}9)^2 + (0)^2 + 4 \times (4.07e\text{-}9)^2 + 2 \times (0.81e\text{-}9)^2]} = 11.33$ nV/√Hz.

The total integrated noise at the ADC input (after RC filter) would be;
11.33 nV/√Hz × √(2.7e6 × π/2) = 23.26 µV rms.

The rms noise of AD7982 can be calculated from its typical signal-to-noise ratio (SNR) of 98 dB for a 5V reference.

$$e_{AD7982} = 10^{\left(-\frac{SNR}{20}\right)} \times V_{signal-rms} = 10^{\left(-\frac{98}{20}\right)} \times 3.353\,\text{V} = 44.50\,\mu\text{V rms}$$

Using these numbers, the total noise contribution from the ADC driver and ADC would be
$V_{noise\text{-}rms} = \sqrt{[(23.26e\text{-}6)^2 + (44.50e\text{-}6)^2]} = 50.22$ µV rms

Note that the noise contribution from the ADR435 reference is ignored in this case as it's negligible.
So, the theoretical SNR of the data acquisition system can be estimated as shown below.

$$SNR = 20 \times log\left(\frac{V_{signal-rms}}{V_{noise-rms}}\right) = 20 \times log\left(\frac{3.353\ \text{V}}{50.22\ \mu\text{V rms}}\right) = 96.95\ \text{dB}$$

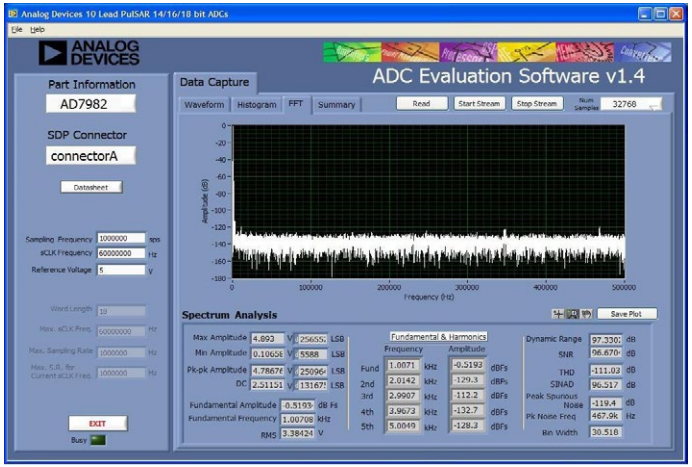


Figure 3 *FFT plot, fIN = 1 kHz, FS = 1 MSPS (ADA4940-1 configured as fully differential driver).*

The AD7982 achieves typically 96.67 dB of SNR and –111.03 dB of THD for a 1 kHz input signal as shown in its FFT performance of Figure 3. The measured SNR of 96.67 dB in this case is pretty close to the theoretical estimated SNR of 96.95 dB above. The actual loss from the target SNR of data sheet specified 98 dB is attributed to the equivalent output noise contribution from the ADA4940-1 differential amplifier circuit.

The noise is one of the important specifications besides scrutinizing the bandwidth, settling time, input and output headroom/footroom, and power requirements when selecting an ADC driver for driving the SAR ADC for a given application. For more information on recommended amplifiers for driving the high resolution precision PulSAR ADCs, refer to the Analog Devices ADC driver Selection Guide. For designing differential amplifier circuits, download free and easy to use intuitive Analog Devices DiffAmpCalc tool.


productroundup

productroundup

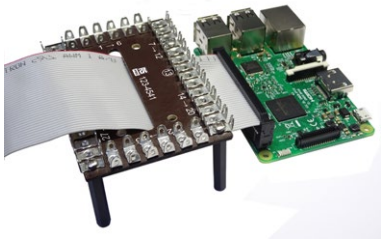
Arduino-compatible multi-sensor evaluation kit

This kit is intended to assist in building a sensor environment for prototyping and initial set development; ROHM Semiconductors' expansion board comes equipped with seven sensors (accelerometer, barometric pressure, magnetic field), and is designed for use with existing open-source prototyping platforms such as Arduino and mbed. Connect the SensorShield-EVK-001 to an existing open-source MCU-based platform such as Arduino Uno and incorporate software to measure acceleration, temperature, and other physical quantities and conditions.

Complete article, here

'Retro' solder tag prototyping for Raspberry Pi developers

Distributor and Raspberry Pi source RS Components has introduced an easy-to-solder prototyping board for engineers and students, for use with the single-board computer. It comprises an array of traditional-style solder tags for ad-hoc wiring.It is the same size as the Pi and its 40 terminals match the 40 pins on the Raspberry Pi. Connecting via the Raspberry Pi's GPIO header connector, the RS Pro board provides a simple means of soldering and de-soldering components; in a further reflection of its retro credentials, the board material is SRBP, making it a low cost and readily-replaceable item.



Complete article, here

Integrated multiprotocol controller for home automation

PanL is a home automation concept from Bridgetek – spin-off from USB specialists FTDI Chip – that aims to enable the consumer to control the various lighting, air conditioning, heating and security systems that are present in their house/apartment via one single point of contact. PanL home automation hubs comprise an array of different wireless and wireline connectivity options - including Wi-Fi (802.11 b/g/n), Bluetooth Low Energy (BLE) 4.2, Zigbee and PoE-enabled Ethernet (100Base-T). This gives them the scope to connect with numerous systems simultaneously.

Complete article, here

ST adds features to STM32 (Cortex-M4) MCUs

STMicroelectronics' STM32F413/423 MCUs increase energy efficiency, flexibility, and feature integration at the high end of the STM32F4 Access Line for high-performance embedded designs. Qualified up to 125°C, these STM32 devices target always-on sensor acquisition and general-purpose industrial applications, and are a cost-effective upgrade from STM32F1 MCUs. The STM32F413 and crypto-enhanced STM32F423 integrate up to 1.5 MB flash and 'unusually dense' SRAM of 320 kB. These are the most highly featured of the STM32F4 Access Lines, with rich audio capabilities including a Serial Audio Interface (SAI) and an enhanced voice-acquisition interface with multi-channel Digital Filter for Sigma-Delta Modulators (DFSDM) that enables low-power sound localization and beam forming. The devices also provide higher levels of peripheral integration, with two 12-bit DACs, up to 10 UARTs, and three CAN 2.0B Active interfaces.

Complete article, here

productroundup

MEMS sensors for activity/fitness apps adds compass

STMicroelectronics has assembled a package of motion sensors for "social-fitness" activity-tracking devices, promising additional smart functions, better accuracy, longer battery life, and faster time to market. An enhanced "eCompass" boosts dead-reckoning tracking precision.

These sensors, the LIS2DS12 3-axis "pico" accelerometer, LSM6DSL/M 6-axis inertial module, and the new LSM303AH eCompass help track movement continuously with minimal impact on battery life by performing motion-related calculations on-chip instead of using the main system processor.

Complete article, here

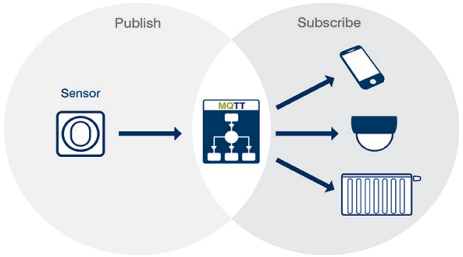
7th generation Intel Core on COM Express modules

Avnet Embedded has announced the MSC C6C-KLU and MSC C6B-KLH Type 6 COM Express module families based on the 7th generation Intel Core processors (codenamed "Kaby Lake"). Designed and manufactured by MSC Technologies (an Avnet Company) in Germany, these COM Express modules offer at least a 7-year lifecycle from the date of introduction. The 95 x 95 mm units draw between 17W and 19W, typical with operating temperature from 0° to 60°C. Four variants use the dual-core processors Intel Core i7-7600U, i5-7300U, i3-7100U, and Intel Celeron 3965U.

Complete article, here

Software client enables device-device IoT communications

Segger's MQTT client implementation helps IoT devices to communicate with each other, using wired or wireless connections, anywhere that is accessible by internet protocol. The lightweight communication is suited constrained environments such as IoT and machine to machine (M2M) contexts. Its minimal size, in terms of both RAM and ROM, means it fits onto resource-constrained embedded processors. Segger's client implementation of the MQTT protocol implements version 3.1.1 of the OASIS standard and talks to any compliant MQTT broker.



Complete article, here

Low-temp solder & polyester substrates form cost-effective flexies

Molex has introduced Solder on Polyester Substrate, offering it as a flexible, economical alternative to rigid PCB and polyimide. The technology, Molex says, delivers cost-effective circuitry supporting high-density surface-mount components. Surface Mount (SMT) components, including fine-pitched ICs are attached with low-temperature solder and encapsulated on a polyester substrate. Custom designed products can be used for capacitive touch buttons, capacitive fluid level sensors and membrane switches in consumer, medical and industrial applications.

Complete article, here

productroundup

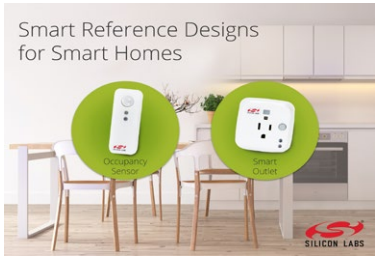
320W DC/DC regulated & isolated converters in compact outline

Vicor has extended its range of DCM modules using its own VIA package format; three additional 48V input nominal modules (36-75V range), in a 3414 VIA package (3.38 x 1.40 x 0.37 in, or 86 x 35.5 x 9.4 mm), have output voltages of 12, 24, and 48V, with power levels of 320W, achieving a power density up to 183 W/in³. With regulation accuracy of ±0.5%, and with integral heatsinking in the VIA package, the devices are modular DC-DC converters operating from an unregulated, wide range input, to generate an isolated and regulated high efficiency output with higher power density.

Complete article, here

Smart home reference designs for connected-device developers

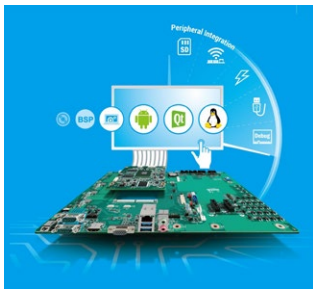
Silicon Labs has created pre-certified occupancy sensor and smart outlet designs that employ its multiprotocol Wireless Gecko MCUs and ZigBee Mesh Stack. There are two wireless occupancy sensor and smart outlet reference designs for the home automation market to provide IoT connected devices. The FCC and UL-pre-certified reference designs include all of the hardware, firmware and software tools required to create connected home products based on Silicon Labs' ZigBee "Golden Unit" Home Automation (HA 1.2) software stack and multiprotocol Wireless Gecko system-on-chip (SoC) range.



Complete article, here

ARM-based starter kit presents complete design environment

Distributor Rutronik (Ispringen, Germany) has ARM-based Starter Kits from Advantech; they are presented as allowing a user to begin the ARM development with only ten minutes of setup time; and that the kits include all key elements of a development environment. The kits host NXP and TI processors for ARM platform evaluation and development. They include key elements of a development environment including main boards with CPU cables, adapter cards, LCD panel and power adapter. A built-in OS image in Linux allows users to start their evaluation immediately.



Complete article, here

RTOS visualization tool looks deeper into running code

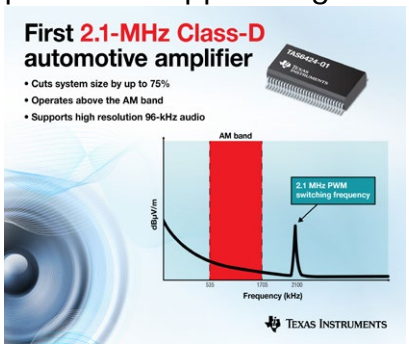
Percepio AB (Västerås, Sweden), in its Percepio Tracealyzer 3.1 Release, offers improved tools that add support for trace streaming over USB, and provide detection of dynamic memory leaks, among a range of updates. The trace recorder library is now easier to configure for streaming over custom interfaces, and includes support for USB streaming on STM32 (easily adapted for other MCUs). USB offers excellent performance for RTOS tracing and over 600 kB/sec has been measured on an STM32 using USB 2, several times more than required. Other stream ports include TCP/IP (example for lwIP) and SEGGER J-Link debug probes. Tracealyzer 3.1 can also receive trace streams via Windows COM ports, e.g. from USB CDC connections, UART connections or any virtual COM port provided by other target interfaces. Tracealyzer v3.1 has also been extended to identify memory leaks in systems that use dynamic memory allocation.

Complete article, here

productroundup

2.1-MHz class-D amp for automotive audio designs

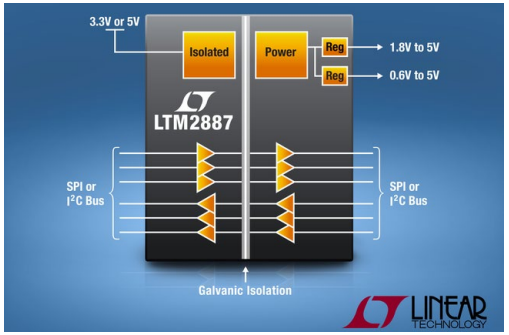
Texas Instruments presents this four-channel amplifier as delivering high-resolution audio quality in the smallest footprint. The first 2.1-MHz Class-D audio amplifier specifically designed for automotive applications supports high-resolution 96-kHz digital input. The TAS6424-Q1 enables the use of smaller external filters and eliminates up to 18 external components ompared to existing Class-D solutions. With maximum output power of 75W per channel, the device features the highest-available switching rate and is the only audio amplifier that switches above the AM band.



Complete article, here

SPI/I²C micromodule isolator has 2x 5V regulators

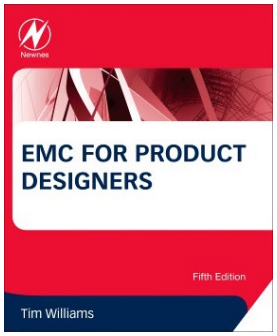
LTM2887 is a 6-channel SPI/Digital or I²C µModule ("micromodule"") isolator with dual rail regulated power that targets low voltage components, including newer DSPs and microprocessors. No external components are required. A single 3.3V or 5V supply powers both sides of the interface through an integrated, isolated DC/DC. Two regulated adjustable supply rails (up to 5V) deliver more than 100 mA over the isolation barrier, with up to 62% efficiency. The voltages may be adjusted as low as 0.6V for the auxiliary supply, while the isolated logic supply may be as low as 1.8V for SPI interfaces.



Complete article, here

Newly published; "EMC for Product Designers"

Now in its 5th edition, this text shows how to incorporate EMC principles in product design, avoiding cost and performance penalties to meet the needs of specific EMC compliance standards. A specific addition covers issues around functional safety. The book aims to present a complete introduction to EMC for product design,written by a practising consultant in the field. It includes short case studies that demonstrate how EMC product design is put into practice; and it provides the latest 2016 mandatory regulations of both the RTTE Directive and EMC Directive.



Complete article, here

Resistive RAM EEPROM improves embedded-system security

Adesto Technologies (Santa Calara, California) is a maker of resistive-RAM memory. The company's Mavriq DS memory is presented as an ultra low power EEPROM device family that is able to provide improved IoT security, with high levels of write endurance and hack-resistant one-time programmable (OTP) security registers. The Mavriq 'DS' (Digital Security) Series claims low-power operation, excellent endurance and features to enable better security in IoT and other connected devices. It performs read and write operations with 4x less power than competitive solutions, and, in ultra-deep power down mode, uses as much as 50x less power. DS devices can automatically enter the ultra-deep power-down mode following write operations, reducing controller operations and overall system energy. The new products also provide users over 100,000 write cycle endurance across the full temperature and voltage range.

Complete article, here

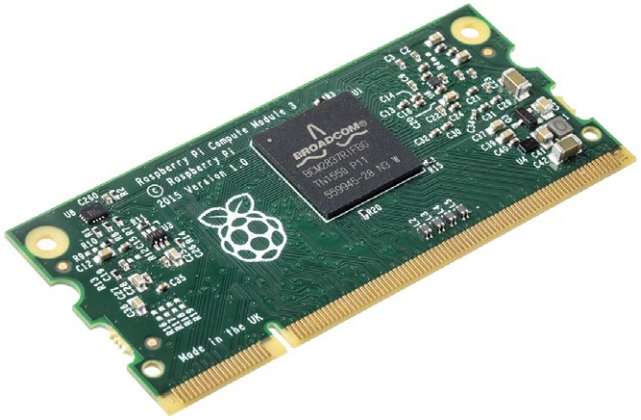
Raspberry Pi 3, now in Compute Module format

Targeting embedded systems designers developing industrial applications, the Raspberry Pi organisation has taken the core compute elements of the 3rd generation Pi (with quad-core processing power), and put that into the SO-DIMM card footprint pioneered by the original Compute Module.

Distributor RS Components (RS) and Allied Electronics, (Electrocomponents) are building the Raspberry Pi Compute Module 3 (CM3) based based on the Raspberry Pi 3 architecture. Designed for professional engineers to develop embedded systems, the new Raspberry Pi 3 Compute Module (CM3) fits into a standard DDR2 SODIMM socket.

RS' Rob Maycroft, product manager for Raspberry Pi, comments on the continuing "huge" growth of the Pi product line, and relates it to the wider trend to open-source software, plus off-the-shelf hardware; "80% of new embedded designs [in the immediate future] will start with a modular board-level product."

In common with the Raspberry Pi 3, CM3 incorporates a 64-bit Broadcom BCM2837 application processor, built around an ARM Cortex-A53 quad-core processor running at up to 1.2 GHz, and 1 GB of LPDDR2 RAM. It provides 4 GB of on-board eMMC Flash storage, and retains an identical pin-out to the original Compute Module (CM1). It has almost the same profile, with an identical footprint that is 1 mm deeper (thicker) than the original CM.



RS and Allied are stocking the new low-cost Raspberry Pi 3 Compute Module Lite (CM3L). This includes the BCM2837 application processor and 1 GB RAM, but has no on-board Flash storage. Developers can provide an eMMC device or SD card socket on their application-specific base board.

Raspberry Pi Founder Eben Upton adds that there is considerable demand for the non-flash version from industrial users. The Lite version trims $5 from the $30 cost of the CM3.

With the intention to penetrate the industrial design sector, and asked if the intellectual property in the CM3 might be available to license, Upton commented that it would not be ruled out, however, "People tend to underestimate the benefits to be had from the modular approach," referring to the detail design work and many iterations that have gone into optimising the layout, performance and manufacturability of the module. "In a real cost/benefit analysis, [the switch from module to integrating the IP] would be at a much higher volume point than many people would expect. Even if you take the Gerber files etc. there is still a lot of complexity... in the SO-DIMM module, a lot of the high-tech part is taken care of." Running a full workload with all cores loaded, the CM3 can consume up to 4W, Upton says.

The Raspberry Pi 3 Compute Module can also be obtained from RS and Allied as part of a development kit, bundled together with the Compute Module IO Board. This simple, open-source, development board brings out all of the IO connectivity of CM1, CM3 or CM3L to pin headers and flexi connectors, and allows the developer to program on-board eMMC Flash over USB.

More at; www.edn-europe.com/news/raspberry-pi-3-now-compute-module-format

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