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PC/104 and small form factors

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THE JOURNAL of MODULAR EMBEDDED DESIGN

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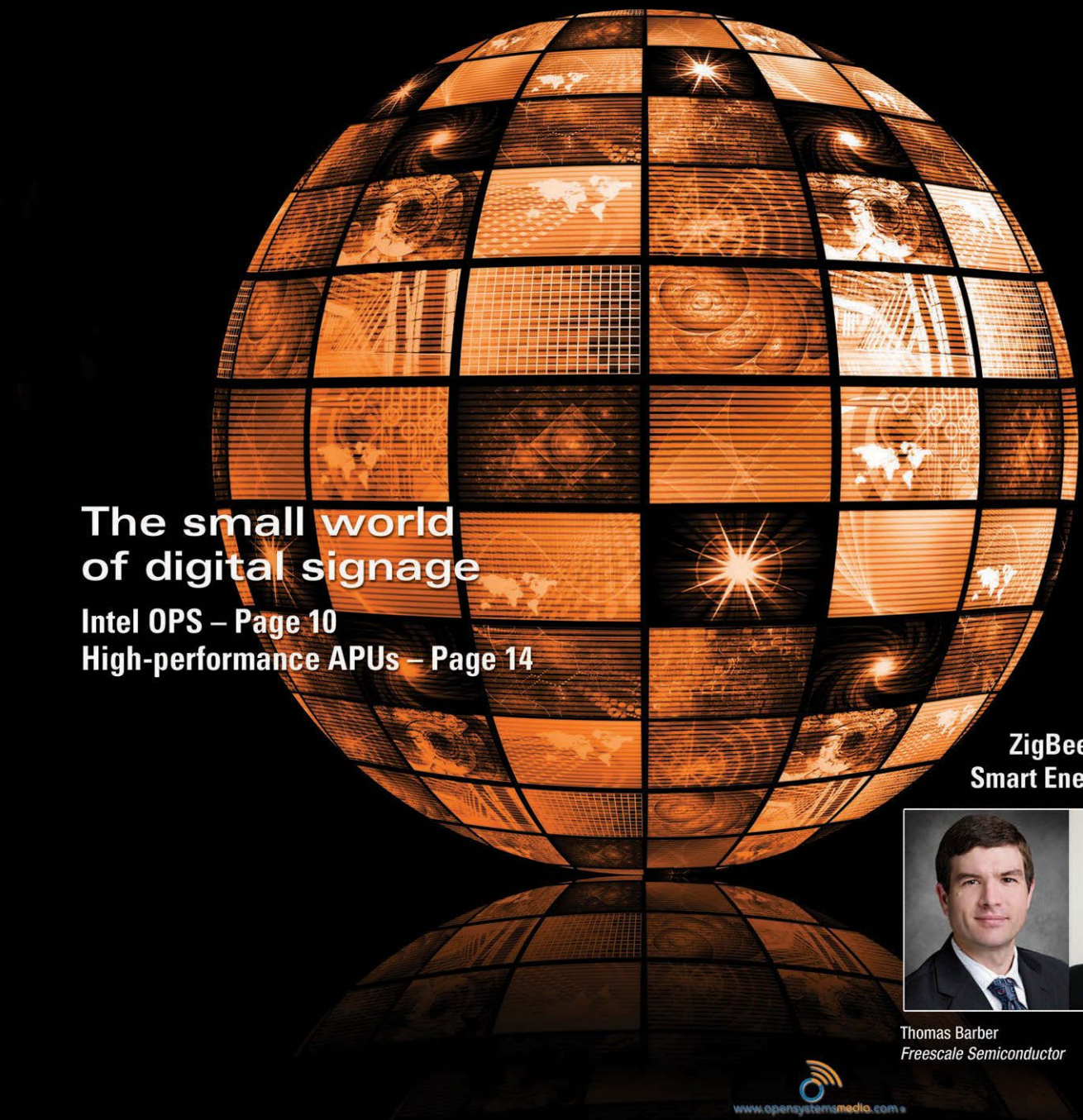
2013 Resource Guide



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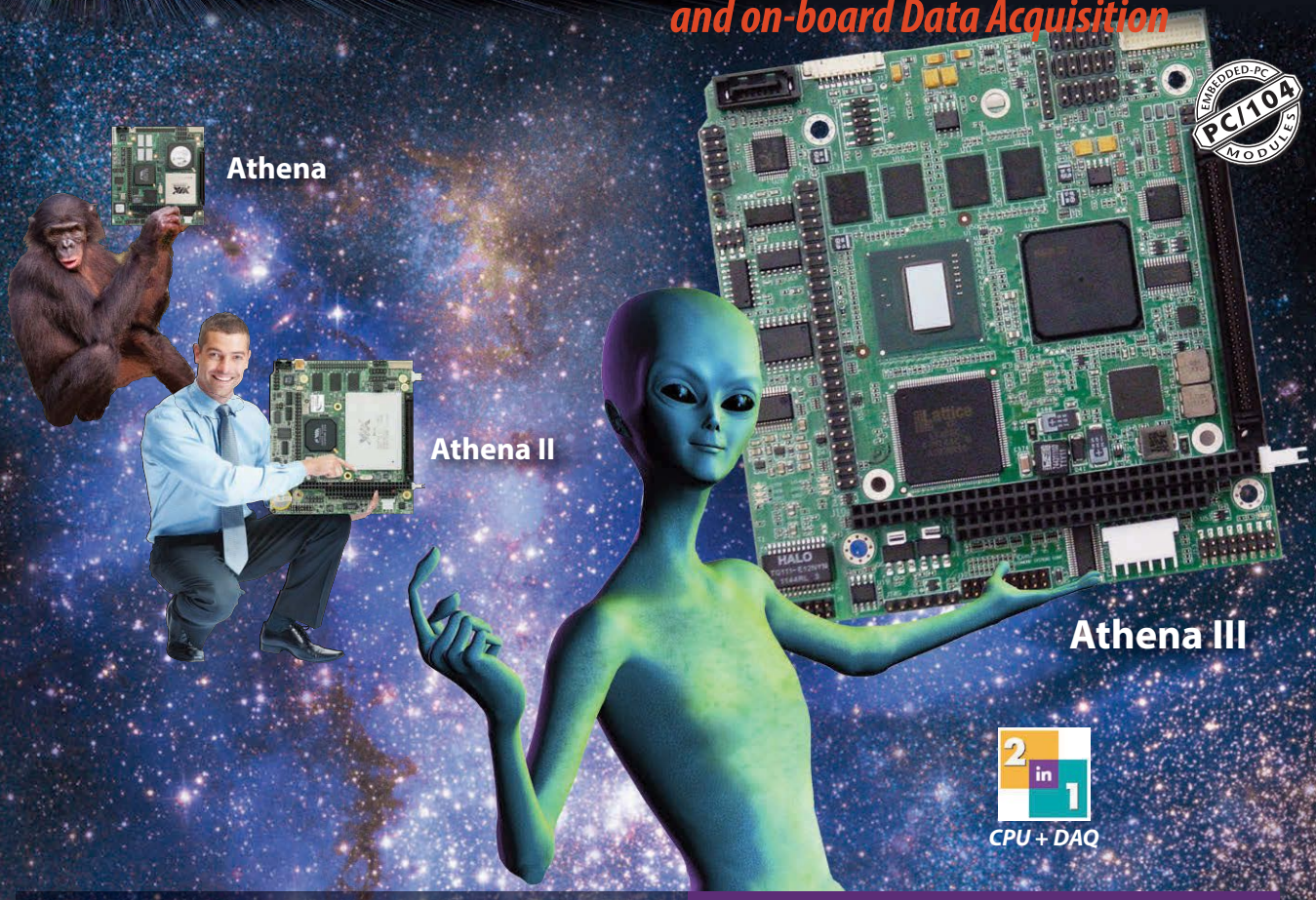

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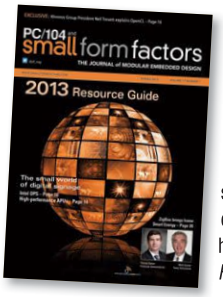

ON THE COVER:
The world of digital signage is a small one after all, and semiconductor companies are taking note. Intel and AMD offer their interpretations on SFFs the digital signage space, and ZigBee member companies talk smart energy for the home in the *PC/104 and Small Form Factors* 2013 Resource Guide!

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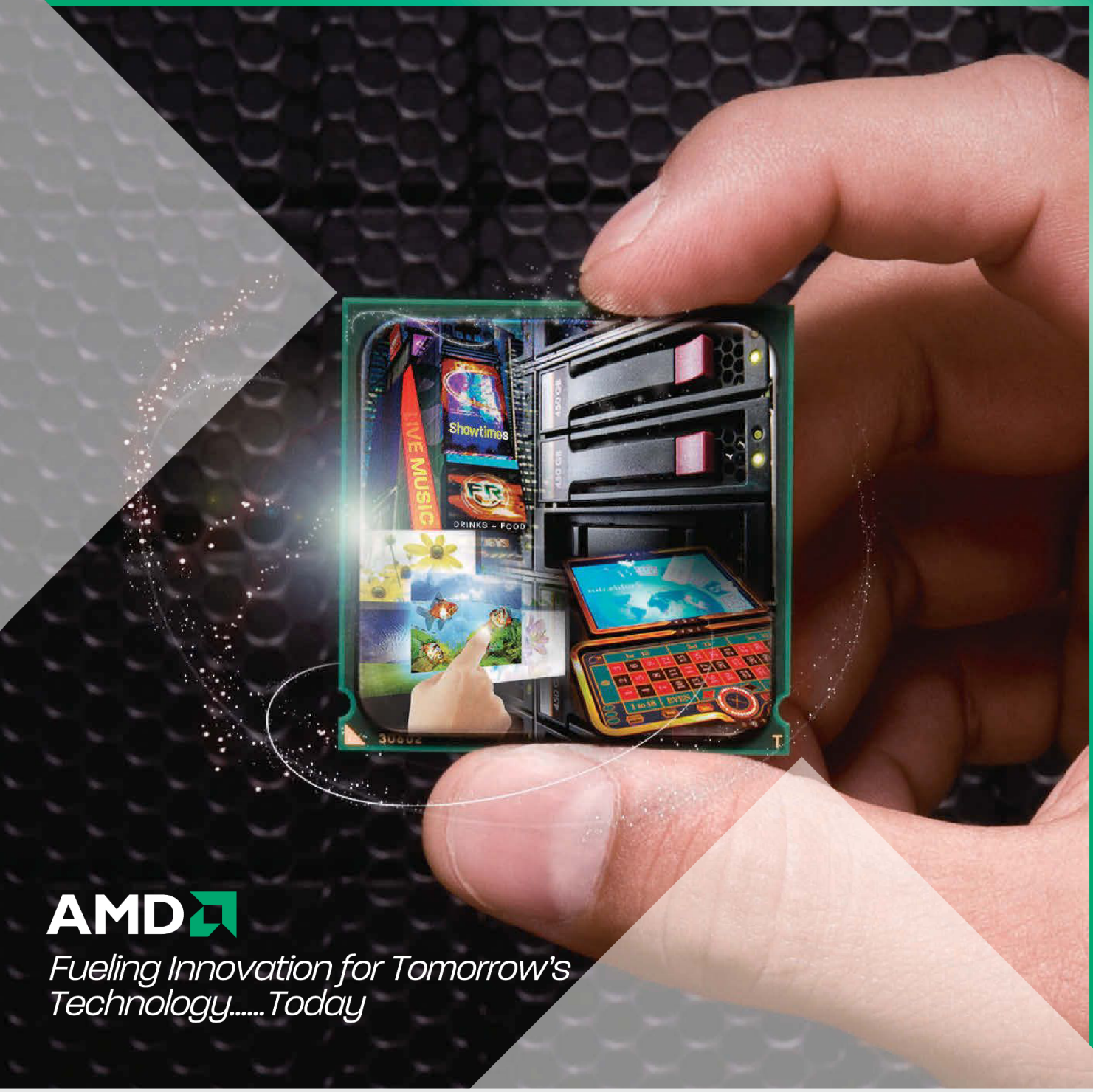

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small MATTERS

By Brandon Lewis

Power and programming

New processors, new programming problems

Multicore processors – they've been here for some time now, and it appears as though they're here to stay. So perhaps a better question than "what's *after* multicore?" is "what comes next *for* multicore?"

Traditionally, multicore processors have been a collection of homogeneous CPUs arranged in either cache-coherent Non-Uniform Memory Architecture (ccNUMA) or Symmetric Multi-Processor (SMP) groups. Today, however, as designers are increasingly concerned with saving board real estate while improving the price/performance ratio of their offerings, conventional concepts of the multicore architecture have begun to change.

The latter was a topic of discussion at the Real-Time & Embedded Computing Conference (RTECC) in Phoenix, AZ this past December, where representatives from AMD and multicore programming startup Texas Multicore Technologies turned the conversation to heterogeneous processor architectures. Unlike traditional multicore, heterogeneous architectures look to unlock the power of diverse processors so that a pool of programmable, high-performance graphics processing elements can be integrated and applied to non-graphics data (this architecture is often in reference to combining a CPU and GPUs, but can be extended to a range of embedded processors).

Eventually the goal of this type of design is to combine the memory of the various regions of the processor into a unified model so that the communications overhead involved with copying data between CPU and GPU memory is removed. For now, however, this presents basic challenges for programmers, as a framework for simultaneously programming multiple processor resources with shared memory has not existed. In the Digital Signage section of this issue, Dave Jessel of AMD goes into further detail about heterogeneous processing, and Neil Trevett, President of the Khronos Group and VP of Mobile Content at NVIDIA, explains how the OpenCL framework can help ease heterogeneous programming pains. More information on heterogeneous processing can also be found through the Heterogeneous System Architecture (HSA) Foundation at www.hsafoundation.com, or the Khronos Group website at www.khronos.org.

> "... in the world of technology things move pretty fast, often too fast for end users to keep track of currently available products that can help them day in and day out."

The power of knowledge

Something that can't be stressed enough in the world of small form factors is power, particularly in more commercialized applications that often measure consumption on the scale of hundreds or thousands of units. Speaking on smart energy for the ZigBee feature in The Big Yet Small Picture section, Mark Grazier, ZigBee Alliance member and Program Manager, Wireless Sensor Networks and Worldwide Third Party Developer Network, Texas Instruments, emphasized the importance of educating consumers on the availability of power-saving technologies and the importance of energy consumption.

As he described to me a refrigerator magnet technology being developed that can indicate how much energy is being consumed by a household at a particular moment, Grazier stressed that it will take time for consumers to become aware of even simple, cost-effective technologies, and that some entity (in this case the utility provider) must assume the responsibility of spreading the word about useful new products. The point being that in the world of technology things move pretty fast, often too fast for end users to keep track of currently available products that can help them day in and day out.

Although the technologies we cover aren't typically geared directly at the mass consumer market, *PC/104 and Small Form Factors* is in the business of making sure that the latest small form factor embedded tools and solutions are exposed to the engineers, product managers, and executives that can use them. Some of these are available in the 2013 Resource Guide beginning on page 26, including COM, SBC, I/O, Packaging, and Application Specific products.

In a final word on power, our summer issue will focus on low power solutions and medical systems. If you or your company are interested in contributing expertise on either topic, please feel free to send along a short abstract.

Brandon Lewis
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Small Form Factor SIG

By Alexander Lochinger, SFF-SIG President

Where advertising meets connector technology

Whether for commercial, industrial, or consumer markets, advertising plays an undeniable role in the marketing and sales cycle. The case for Return On Investment (ROI) is compelling as long as ads reach the target markets. With digital advertising mainstream by now, system "uptime" gets lost by integrators and installers who heavily prioritize price when selecting digital signage players, Point Of Sale/Point Of Interaction (POS/POI) terminals, kiosks, and video wall systems. Poor reliability can impact ad revenue directly.

Much of the growth in these segments is for outdoor use – along freeways, at gas station pumps, and so on. Wide temperature operation becomes a factor, such as not overheating during Phoenix summers and successfully booting and re-booting during Chicago winters. Other than the LCD itself, which is certainly challenged when it comes to temperature extremes, the "media player" computer board is challenged in several ways. Besides the obvious limitations of consumer-grade motherboards in outdoor settings, more ruggedized embedded boards can still fall short of reliability requirements when designed with consumer market connectors.

Losing your memory

Low-cost motherboards feature vertical DIMM slots or horizontal SODIMM sockets that hold system RAM. The modules and sockets were developed for computers that sit on desks and in data centers, not for outdoor environments where temperatures vary over wide ranges. Rapid temperature changes create conditions known as "thermal shock." If the connector pins don't wipe the gold-plated card-edge fingers well enough, tiny air pockets can form between the metal surfaces, causing code and data bit errors due to intermittent contacts or open circuits. The risk is worse depending on humidity and dust in the environment, and even shocks caused by nearby trucks rolling over potholes.

By contrast, board-to-board mated connectors are designed for high-reliability and harsh environments. They have substantial connector wiping during insertion and strong retention forces. Several memory module manufacturers used this approach and collaborated with embedded Single Board Computer (SBC) manufacturers to define a truly rugged-by-design module standard called XR-DIMM. This standard was created within the Small Form Factor Special Interest Group (SFF-SIG), a trade group that targets rugged and reliable embedded applications rather than consumer and enterprise markets.

Closing the remaining loopholes

In the non-backplane embedded computing SFF space, there are two product types: SBCs and Computers-On-Module (COMs). If the required feature set can be satisfied with an off-the-shelf SBC and I/O cards (if needed), this approach minimizes time-to-market and up-front design effort. If not, a COM and a carrier board is the new popular approach to just-right I/O.

Since both approaches (SBC and COM) are popular now, the SFF-SIG has several standards that also use board-to-board connectors for ultra-reliability. The Stackable Unified Module Interconnect Technology (SUMIT) is an expansion bus connector for mezzanine I/O cards (in other words, cards that mount horizontally, parallel to the SBC) that are secured with four mounting holes, screws, and standoffs. SUMIT consists of a mix of high-speed and easy connectivity buses in a single, compact 52-pin Samtec QFS/QMS mated connector pair. The center "blade" provides a reliable ground to the mezzanine module, even under shock and vibration loads.

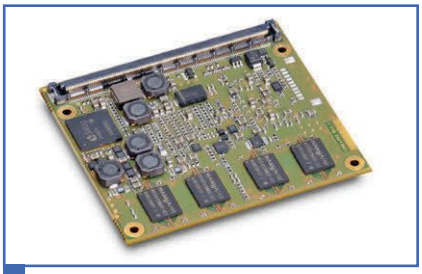

Figure 1 | A CoreExpress module from SysLogic targets compact customized display applications.

Similarly, the CoreExpress specification uses Tyco board-to-board connectors for all signals that pass from processor module to custom carrier board. CoreExpress, adopted and maintained by the SFF-SIG, even goes a step further as a purely digital module. The Ethernet PHY goes on the carrier board so that analog signals do not go through the additional set of connectors, unlike other COM standards. For both SBCs and COMs, the SFF-SIG has closed the shock/vibration high-reliability connectivity loophole.

The SFF-SIG has provided a full family of specifications that can be used for computer/player boards and memory modules alike. Discriminating outdoor signage integrators and installers will need to maximize uptime and advertising revenue while greatly reducing field service "truck rolls." In outdoor display market segments, reputations are at stake as advertisers can quickly pull ads if the coveted Frequency x Reach = Impressions equation plunges due to equipment downtime. More information about the CoreExpress, SUMIT, and XR-DIMM specifications can be found at www.sff-sig.org.

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PC/104 Consortium

By Dr. Paul Haris, PC/104 Consortium Board Director

PC/104 architecture: Solid

Evaluation of the challenges of the embedded marketplace is a never-ending saga. Each technology has its benefits and drawbacks, and each feeds the ideas of tomorrow. Throughout its history, the PC/104 Consortium has taken the approach of stressing the characteristics of stability, evolution, backward compatibility, interoperability, maintainability, and upgradability for its PC/104 architecture. These characteristics have enabled its long-term survivability and have provided embedded developers and end users a mechanism to maximize product lifecycle investments and reductions in costs.

The PC/104 specifications begin by focusing on the evaluation of mainstream bus architectures for their soundness and acceptance in the marketplace. This provides a solid foundation from which everything else can evolve. Testaments to the effectiveness of this approach are the PC/104 stackable ISA and PCI-104 stackable PCI buses, which have proven themselves for over 20 years in the harshest of conditions, leading to their vast adoption.

But as the computer industry accelerated in its advancements, so did the complexity and choice of bus architectures, making the creation of next-generation stackable specifications that much harder. As high-speed, low-voltage differential serial interfaces came onto the market, new challenges emerged for PCB and connector construction that had to be addressed for future evolution. This evolution came quickly with refinements to transfer rates, protocols, and encoding schemes, leading to PCI Express alone seeing a move from Gen 1 (2.5 GTps) to Gen 2 (5 GTps) to Gen 3 (8 GTps) in 2003, 2007, and 2010, respectively. And so too did the speeds of USB and SATA increase.

Therefore, the Consortium chose for its PCIe/104 specification a high quality, surface mount connector with signal bandwidth headroom and mechanical properties that were specifically developed to account for standoff tolerances and provide large connector-to-connector wipe. It was also developed with ruggedness in mind for products that might be exposed to the entire spectrum of environmental conditions, from the static in ambient temperatures to the worst shock and vibration in extreme temperatures. And this choice has paid off since, as this is being written, a new revision of the PCIe/104 specification that incorporates the ability to run PCI Express Gen 2 and 3 is being released to Consortium members for a vote. If adopted, this capability provides two benefits: overall increased bus bandwidth and potential reductions in the number of high-speed serial links needed to connect to a peripheral card functionality since more data can be transferred for a given link number.

The surface mount characteristics of the stackable PCIe/104 connector also allow the top and bottom side connectors to be electrically detached if the board developer so desires. This feature can expand the potential capabilities of the stack by allowing simultaneous up and down stacking, doubling of the number of available bus links, and having different bus configurations, such as Type 1 going down and Type 2 going up. The choices are limited as a function of the processor of choice, PCI Express switches involved, or bandwidth sharing incorporated. And since the connector is surface mount, one can even eliminate the top or bottom connector on a host if stacking in one direction is desired, thereby realizing additional usable PCB real estate. Compound this with the universal configuration of each functionality found on the PCIe/104 connector,

Figure 1 | PCIe/104 provides paths to evolving mainstream bus architectures while allowing users to continue leveraging past investments..

and versatility, compatibility, and interchangeability of the specification are maximized.

By paying close attention to optimizing backward compatibility with their other specifications, the PC/104 Consortium provides paths to evolving mainstream bus architectures while allowing users to continue leveraging past investments (Figure 1). This helps minimize software changes, mechanical system modifications, and recertification requirements. And these standards will remain viable as long as processor manufactures, FPGA IP cores, and peripheral device vendors continue to support the embedded market. This is what gives all of the Consortium's specifications lasting power, and why there are so many products available using stackable PCI Express, PCI, and ISA busses today.

The versatile family of complementary, stackable specifications based on the PC/104 architecture has been providing long-term solutions for a vast array of applications for more than 20 years, and is still finding itself in new areas every day.

For more information visit the PC/104 Consortium website at www.pc104.org.

Q & A

Inside Intel's Open Pluggable Specification

Interview with James Tan, Intel

As we continue the march into the age of intelligent systems, digital signage platforms will play a large part in the evolution of the commercial and retail markets. Noticing fragmentation in the digital signage space, Intel released the Open Pluggable Specification (OPS) in 2010, defining a modular, integrated hardware architecture that could link digital signage media players and their corresponding displays to create cost-efficient intelligent signage platforms that use EPIC and smaller sized boards. In this PC/104 and Small Form Factors interview, spec author James Tan describes how the OPS is enabling intelligent and connected digital signage deployment. Edited excerpts follow.

SFF: ***What were the drivers behind the development of the Intel Open Pluggable Specification (OPS) for digital signage?***

TAN: When Intel started to focus on the digital signage industry roughly four years ago, the first thing we noticed was how fragmented the market was, not only in terms of software offerings, but also for the computing system solutions (commonly known as the digital signage media player) available in the marketplace itself. There was no standard solution in place; each digital signage media player provider was pretty much offering their own proprietary solution. While this was acceptable for an independent, standalone media player system that you can easily attach to a display panel, there was a growing demand for integrated solutions, especially from display providers and system integrators as they expanded their product portfolios into total solutions rather than separate display panels and media players. Also, as the digital signage segment matured, there was a need to address the inefficiency around system deployment, usage, maintenance, and infrastructure upgrades.

While there were a few integrated solutions out there at that time – some with an internal motherboard into the display and some with modular solutions that could easily attach and detach from the display – there was no standard hardware architecture in place when it came to the integration between the display panel and media player. Due to this, some key display vendors and signage providers that we engaged with voiced concern about the limited compatibility and interoperability between a display panel and media player, which was halting the strategic growth of the digital signage solution space. Developers (especially display companies) also had to fork out substantial amounts of funding and resources each time they wanted to upgrade their systems, as they had to modify the display architecture and form factor to fit in a new integrated media player as those solutions were most likely outsourced from a third-party vendor that provided their own proprietary solutions. Taking all these factors into account, we decided to take the initiative to lead the industry, and together with some key ecosystem partners such as NEC, Microsoft, and Taiwan Digital Signage Special Interest Group (Taiwan DS SIG), the OPS was launched by Intel in October 2010.

SFF: ***What is the importance of using small form factor boards in the development of digital signage systems, and why in particular does the specification call for EPIC and smaller-sized boards?***

TAN: This relates closely to the practical sense of things. Digital signage media players are mostly attached to the back of the screen or embedded inside the screen (as is the case with the OPS) where space or system real estate could be limited, so small form factor boards are obviously desirable. As to the question of why EPIC-and-smaller boards were selected for the OPS, we knew from the start that we did not want too big of a system for OPS modules since displays are getting slimmer with a variety of sizes to fit retail and signage applications. We did some studies on practical component placement, as well as thermal simulation for mainstream Intel mobile processors, and found that EPIC-sized boards were a good fit. There are only a few key baseline features that

you would really need for signage applications, so you can focus on designing a board that is very lean and highly effective to service the signage requirements, and strip out other features that are not needed – so, practically, you do not really need a board bigger than the EPIC size. From a thermal perspective, we had to ensure that the form factor of the OPS module was reasonably adequate for thermal dissipation when plugged into the display panel.

SFF: ***What are the physical dimensions of an OPS system? Does this make it more viable for particular sizes or types of digital signage?***
TAN: The overall dimension of an OPS module, including the mounting frame, is 200 mm x 119 mm x 30 mm (discounting the mounting frame, which is 10 mm on each side, the physical volume of the body of the module is actually at 180 mm x 119 mm x 30 mm (Figures 1 and 2). This is ideal for 32" display sizes and above, however the module is still fairly compact and we have seen it go into screens as small as 24", which is mainly in space-constrained environments such as buses or trains.

SFF: ***Does an Intel OPS-compliant system have the ability to handle multiple displays simultaneously? Can it be used for video walls?***
TAN: It is important to note that OPS defines the scope of interoperability and integration between a media player to a single display panel, so the specification basically just covers that. As to whether it can handle multiple displays, that is inherent to the media player (OPS module) platform capabilities, and most Intel-based OPS platforms can definitely support additional display interfaces if they are being designed externally, which is not limited by the OPS spec. The same goes for video wall solutions: developers can leverage the OPS architecture and provide additional features and benefits on top of it to position their products better as a whole and create differentiation in the marketplace.

SFF: ***What are the thermal design considerations that developers using the OPS need to account for?***

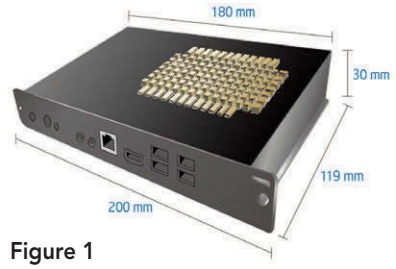
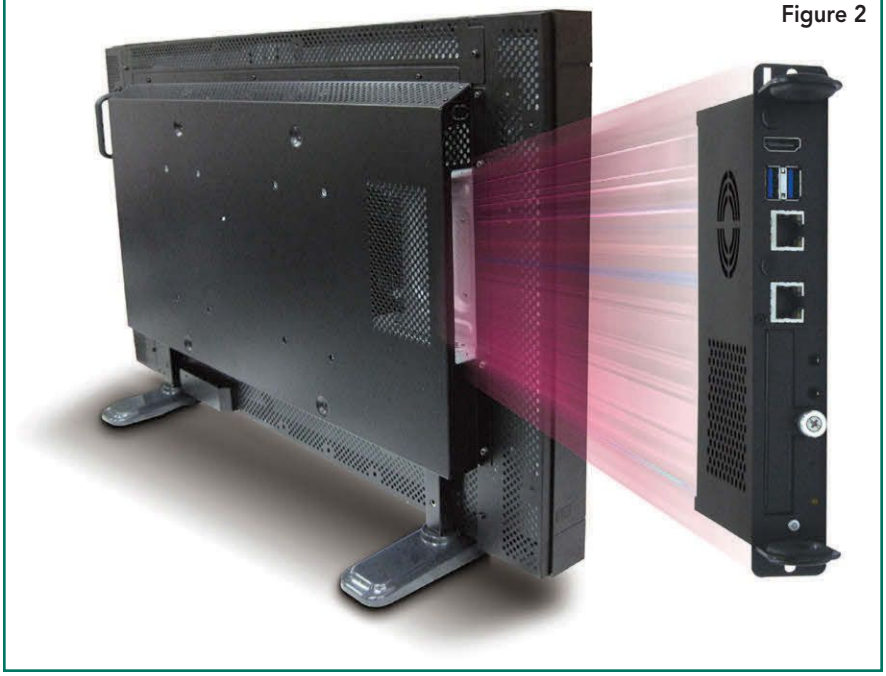


Figure 1

Figure 1 and 2 | The dimensions of an OPS module are 200 mm x 119 mm x 30 mm (7.87" x 4.69" x 1.18"), including the mounting frame.

Figure 2



TAN: For the module developers, the thermal requirement is pretty straightforward. Regardless of the platform, the module designed must be able to operate at up to 45 °C (113 °F). This means that all the major components in the module such as memory, storage, voltage regulators, and so on, including the processor, are still operational within the thermal spec in an ambient temperature of up to 45 °C. There is also the condition of sufficient airflow either from the environment or from an active cooling solution provided by the module itself.

As for the display developers, due to different designs and implementations of the display panel in the market we try to be as "flexible and open" as possible with regards to a display's thermal requirements. Touching on a couple of key examples, the spec merely states that there must be sufficient airflow provided to the module. Subjectively, this can mean that airflow is provided by the fan from the OPS module (if it is an active cooling module) and/or that airflow is provided by the system fan within the display panel itself. Also, there is a defined minimum vent hole area, which can provide better exposure of the module to ambient air, dramatically helping dissipate heat. As long as these baseline requirements serve as a guiding factor, display developers have the freedom to design products as they see fit while still factoring in the thermal considerations of OPS modules.

SFF: ***Why was the 80-pin JAE plug and receptacle connector chosen as the interface model, and what type of signaling does it support? What capabilities does this enable between media player and display?***
TAN: Since this is an open spec, one important aspect is that the connector chosen had to be easily sourced by

developers and had to come from a reliable supplier. The other criteria mainly focused on the electrical, thermal, and mechanical aspects of the connector. The 80-pin JAE TX24/TX25 connector series allows a sufficient current rating (1 A per pin with 8 total pins allocated for power), which is important in ensuring that the module is sufficiently powered, as the OPS actually relies on the Power Supply Unit (PSU) from the display side to operate. Signal integrity is also an important factor, and this connector is capable of supporting higher speed signals such as DisplayPort. Thermally, it can support a wide range of operating temperatures, from -40 °C to +80 °C. The connector can also sustain at least 500 insertion lifecycles, and is very robust when it comes to shock/vibration environments. All of these factors coupled with the fact that it is cost effective (roughly $1 per connector) made the 80-pin JAE TX24/TX25 connector a suitable choice for OPS.

As for the signaling through the JAE connector, we defined key features that are instrumental in turning a normal professional-grade display into a smart, intelligent, and connected screen. This enables the display panel to work seamlessly with the OPS module so that they function effectively as a single entity. Besides being powered up natively within the display, which eliminates the need for a separate power cable/adapter for the media player, the module also provides multimedia features to the display through the options of TMDS for DVI and HDMI or DisplayPort and audio. The OPS architecture also allows expansion capability through USB 2.0 and USB 3.0 ports, which can be used for integrating devices within displays such as cameras, touchscreens, RFID readers, and the like, or even serve as a USB hub for the display. UART signals are also available for increased communication and control functions between the display and the module.

In addition, there are also a few OPS control signals that can be utilized by developers. These signals can enhance the functionality of displays through capabilities such as detecting the presence of the module and of its power status; system fan control; pluggable signal ON, which can be used to power up/down the module from the display side (as when using a remote control); and also HDMI Consumer Electronics Control (CEC), which is basically a single wired control signal that can be used to detect the status of the display and even configure settings like brightness, contrast, and display audio volume.

> “Developers can easily integrate touchscreen, gesture technologies, or even RFID or NFC readers and devices into an OPS system using the interfaces provided, effectively revolutionizing the usage model of the digital signage by making it something that the viewer can engage and interact with rather than just a dumb advertising screen.”

SFF: ***Are Intel OPS systems able to operate as “intelligent systems” that interact with people and other intelligent devices? If so, what is the technology behind this?***

TAN: Absolutely. There are many other key features that Intel is evangelizing in parallel with the OPS that can enrich OPS systems and increase their functionality in this area. As mentioned previously, the OPS enables the digital signage ecosystem to turn a normal display into a smart, intelligent, and connected screen.

From a Return On Investment (ROI) standpoint, advertisers or screen owners can now measure the effectiveness of their screens by observing demographics through sensors or cameras integrated in the OPS system that can anonymously detect gender, age group, and impression time by using the Intel Audience Impression Metric (AIM) Suite anonymous viewer analytics software. The data collected can be sent back to a server or the cloud for further analytics by the advertiser, which can, for example, be used to crosscheck the sales data of a particular product being advertised through the screen. The AIM application also makes the screen intelligent, as it can then be applied to run specific content that is closely related to the viewer’s demographic, enabling smarter and more effective digital signage.

In terms of Total Cost of Ownership (TCO), the OPS architecture encourages display developers to design a so-called vPRO-capable display, which supports the usage model of remote manageability through Intel Active Management Technology (AMT). If you are managing multiple screens it can be very troublesome and costly to manage over time, particularly at locations like airports where the number of displays could be in the hundreds or thousands and you have to send an IT person or technician on-site to repair a signage screen every time an issue is being flagged. The issue could be either a hardware or software conflict or sometimes both, and more often than not faulty signage can be easily troubleshot by doing a software fix or reboot. AMT expects the signage to be connected to the management server all the time (either through wired LAN or Wi-Fi) so that the IT person is able to manage all of the screens remotely, and AMT-enabled OPS systems can be managed out-of-band, which means that even when the Operating System (OS) is corrupt or not running, you can still access the system remotely and perform hardware diagnostics through AMT’s various features and attempt to fix the system. Only if all else fails and it is found to be a hardware issue in which some parts need to be replaced would it require sending a technician on-site. In addition, AMT also allows you to do system ON/OFF scheduling, which makes your signage smarter and saves on the electricity bill.

Also, modular and integrated system architectures like OPS can further boost system-level initiatives, especially in the areas of interactivity. Developers can easily integrate touchscreen, gesture technologies, or even RFID or NFC readers and devices into an OPS system using the interfaces provided, effectively revolutionizing the usage model of the digital signage by making it something that the viewer can engage and interact with rather than just a dumb advertising screen.

SFF: ***Do OPS developers need to be particular in their processor selection? Are there recommended processors for use with the OPS, and if so, why?***

TAN: While this is an open spec, which means that OPS developers have the complete freedom to choose the processor type that suits them, in order to reap the maximum benefits of what an OPS architecture has to offer for the usage models and technologies I just explained, it is highly recommended that an Intel Core i5 processor or above is used to meet processing requirements and leverage technology support like AMT. Features like audience measurement with AIM will also require higher processing capability for viewer analytics, which runs perfectly on i5 and above processors since it is optimized for the Core series and can simultaneously run multimedia signage content such as HD videos, flash, and tickers. As for thermal considerations, OPS platforms are scalable to support different types of processor with an ideal range of up to 40 W.

SFF: ***How has the Intel OPS spec faired in the industry to date?***

TAN: Since its launch, more than twenty ecosystem partners and counting that have designed and launched OPS-based products in the marketplace. This shows that the industry is responding well to the standardization effort, and with OPS settling in to become a de-facto hardware standard for digital signage, we hope more and more solution providers will adopt the architecture and reap its benefits and advantages. **SFF**

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Digital Signage Open Pluggable Specification:
http://www.intel.com/content/www/us/en/intelligent-systems/digital-signage/open-pluggable-specification-simplify-digital-signage-development.html

Intel Embedded Board Planner:
www.intel.com/p/en_US/embedded/designcenter/tools/board-builder/planner

Achieving ultra-compact, multi-display digital signage systems with high-performance Accelerated Processing Units

By Dave Jessel

Designers of digital signage systems have long been challenged to achieve high-end graphics and video performance with conventional CPU- and discrete GPU-based embedded boards that present board area and cooling challenges. With the advent of Accelerated Processing Units (APUs), however, digital signage system designers are equipped to achieve new levels of multimedia performance and visual immersion while striking a balance of form and function in small form factor, power-efficient solutions.

With the continued evolution of embedded system technology, digital signage designers are better equipped than ever before to achieve ambitious design goals that meet customers' exacting multimedia performance and functionality requirements. Designing on x86 embedded boards and modules enables these designers to achieve PC-caliber performance and agility complemented by a rich ecosystem of industry-standard, x86-optimized software, applications, and development environments. Collectively, these efficiencies yield significantly leaner cost structures for embedded board providers and designers alike, and help provide smooth scalability from low-end digital signage offerings to high-end offerings via a single underlying embedded processing platform.

Yet digital signage designers continue to bump up against frustrating performance and flexibility limitations when using embedded boards built around conventional processing platforms and/or ad-hoc chipsets, particularly when developing HD-enabled, multi-display signage systems for space-constrained environments. Where previously power-hungry multicore CPUs and add-on graphics cards dominated the digital signage technology landscape, the emergence of embedded boards and modules equipped with new-generation APUs is facilitating advanced graphics capabilities within an extremely small footprint. The merging of advanced x86 computing capabilities with the parallel processing power of a General-Purpose Graphics Processing Unit (GPGPU) in a single device allows OEMs to design graphics-intensive digital signage systems that deliver advanced multimedia experiences in single-screen and/or multi-screen configurations.

APUs for advanced processing performance and space savings

Conventional chipset architectures that integrate graphics processing rely on the CPU to interface with the GPU via a North Bridge connection, sending calls to the GPU to invoke code running on the co-processor that would then send results back to the CPU. This serial data processing approach adds considerable memory latency, consumes system power, and uses more board space.

High-performance APUs combine a CPU and advanced HD-caliber GPU in a tightly integrated, power efficient, and extremely compact form factor (Figure 1). The CPU takes care of the scalar processing, including memory, networking, and storage processing, and runs the Operating System (OS), applications, and User Interface (UI). The on-die GPU offloads graphics and multimedia processing using Single Instruction, Multiple Data (SIMD) parallel

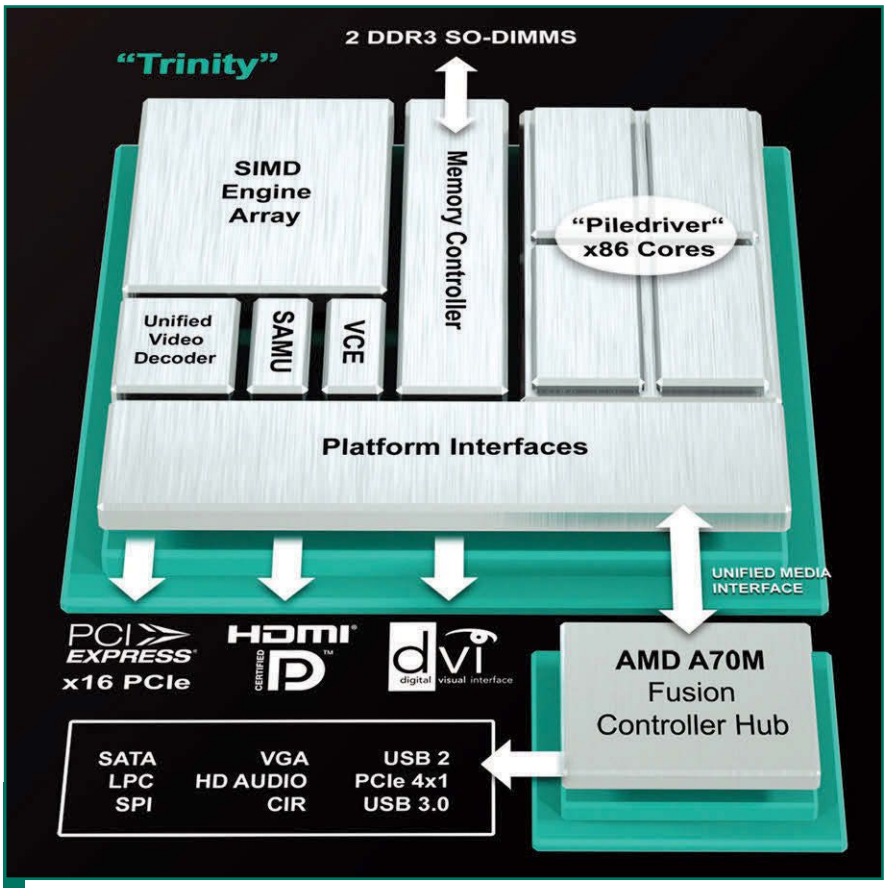


Figure 1 | A Heterogeneous System Architecture (HAS) combines a CPU and GPU into one Accelerated Processing Unit (APU), which is then coupled with a companion controller hub to produce an efficient two-chip processing architecture.

Consolidating heterogeneity with OpenCL

By Brandon Lewis

As the emphasis in computing has shifted away from clock speed and toward multiple cores, programming paradigms have begun to fall short. With the integration of multicore CPUs, GPUs, and other processors onto the same die, general-purpose programming models that traditionally focused on extracting maximum performance from a single processor have struggled with splitting algorithms and programs to get the most out of diverse sets of processor resources, a problem that is compounded by the memory sharing that typically occurs between processing elements within Heterogeneous System Architectures (HSAs). Furthermore, GPU and accelerator models provided by semiconductor companies are typically hardware, platform, or vendor specific, making it difficult for developers to access the compute horsepower of heterogeneous architectures from a single code base.

"There has not been a single programming framework that enables all of these compute resources to be programmed together," says Neil Trevett, President of the Khronos Group and Vice President of Mobile Content for NVIDIA. "Open standard graphics APIs include compute shaders that enable programmers to write GLSL shaders that can be very effective at providing GPU compute acceleration for diverse tasks within the context of the graphics pipeline. However, compute shaders do not enable more than a single GPU, or general-purpose C code, to be used. Standards such as OpenMP enable multiple CPUs to be effectively programmed, but do not provide programming of accelerators and GPUs."

Unlocking data-parallelism and portability with OpenCL

In 2008 the Khronos group began work on the Open Computing Language (OpenCL) specification, an open-standard, multi-platform development programming interface for writing task-based and data-parallel programs that can leverage all of an HSA's resources. In a general sense, OpenCL achieves data-parallel programming tasks by hierarchically indexing compute instructions in an N-dimensional space, which allows developers to define the number of work items to execute in parallel and divide them into working groups. Alternatively, the task-based programming model executes kernel instances independent of an index, translating to a single-item work group that can use vector data types or queues to express parallelism.

"OpenCL is designed to be a low-level programming framework that provides a high degree of control over where and how compute kernels are executed," says Trevett. "It includes an API framework to define and control the platform in terms of a host (the CPU) and one or more compute devices (GPUs), plus a C99-based programming language for writing kernel programs that are executed across those compute devices." These characteristics have made OpenCL an excellent acceleration and porting layer for high-level languages, Trevett says, and help simplify heterogeneous programming across particular platforms and domains.

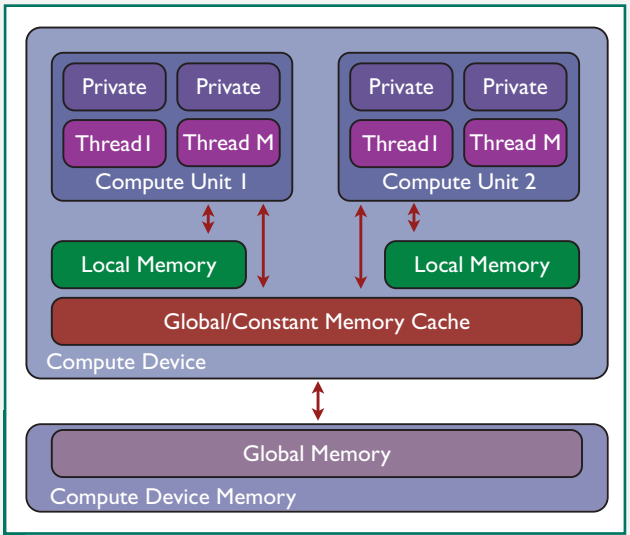
OpenCL affords a high degree of portability across device and hardware implementations because it is a device-agnostic framework. Programmers must be aware of architectural system differences and may be required to make code adjustments when porting, Trevett says, but OpenCL compliance supports compute-intensive data-parallel algorithms across embedded processors, DSPs, FPGAs, and other architectures. Compliance is ensured by an extensive set of functional and numeric conformance tests, available through the Khronos Group.

Memory jogging and food for thought

Because OpenCL's programming kernel is based on standard C99 language with limited changes, controlling parallelism and the layout of data in the OpenCL memory model should be familiar to programmers. However, for OpenCL novices Trevett identifies how the framework's memory and execution models control a system's parallel resources as perhaps the biggest learning curve (Figure 1). "It is relatively straightforward to write OpenCL code that is functionally portable," he says. "However, as is normal in parallel programming, the key step is almost always understanding how to exploit parallelism in your application, regardless of the programming environment you use. OpenCL is powerful, but it is not magic."

Programming frameworks will be a prerequisite for maximizing compute resources as the transition to heterogeneous architectures continues in the embedded space. "The OpenCL working group is actively working on a major release following the current OpenCL 1.2 specification," says Trevett. "OpenCL is widely available on desktop systems today, but the next 12-18 months should see mobile and embedded OpenCL-capable systems coming to market."

More information on OpenCL can be found at www.khronos.org/opencl/resources.



Sidebar Figure 1 | OpenCL contains a unique memory model.

Sidebar 1 | Programming HSAs with OpenCL

processing, while driving high-definition video displays through DisplayPorts or HDMI.

This CPU plus GPU combination onto a single APU die provides a robust architecture. APUs can offload data parallel processing from the CPU to the GPU, including multimedia streaming. Freed from this task, the CPU can focus on compute, memory, and I/O requests with much lower latency, thereby improving real-time graphics processing performance via a fully optimized data path and shared access to the memory controller. Additionally, with both CPU and GPU architectures collocated on the same die, an application can be written as one program using OpenCL thus reducing latency and overhead (Sidebar 1). This CPU plus GPU combination is called the Heterogeneous System Architecture (HSA).

An APU eliminates the need for add-on graphics cards for digital signage systems, and reduces the footprint of a traditional three-chip platform to just two chips – the APU and the companion controller hub. This two-chip architecture simplifies design complexity through a reduction in embedded board layers, enabling digital signage designers to achieve aggressive form factor goals while driving down overall system cost (Figure 2).

By providing native, high-performance graphics processing at the silicon level, APUs also preclude the need for right-edge connectors that are usually required by add-on graphics cards. In space-constrained designs, an edge connector takes up more space (card-edge boards are typically 3" to 5" taller) and exposes the board to additional shock and vibration that can lead to signal integrity issues. Designing APU-caliber graphics capabilities directly onto a carrier board is a more rugged, long-term option, ultimately yielding book-sized digital signage systems that can fit into tight spaces behind wall-mounted video displays.

Power and cooling considerations

For retailers deploying high-end digital signage systems using high-performance APU-based embedded boards, electricity costs deriving from the power consumption of the media player itself may not be the most critical consideration. Indeed, for these types of installations, the combined power draw of the displays may dwarf the power consumption of the media player itself. However, embedded board-level power consumption remains an especially important consideration with regard to system cooling, and here APUs afford several advantages.

Fan-cooled digital signage can, of course, be vulnerable to airborne particulates and debris, as well as shock and vibration – all of which are common environmental factors in high-traffic (pedestrian and/or vehicular) environments. Digital signage designers are therefore understandably wary of fan cooling mechanisms due to the inherent risk of failure. Passively cooled, ventless signage systems are the ideal end goal for these designers.

The net Performance Per Watt (PPW) gains enabled by APUs bring greater power efficiency and lower heat dissipation, which in turn can preclude the need for fan cooling within digital signage systems, thus helping preserve board space while limiting system noise and lowering Bill of Material (BoM) costs. Because the integration of the CPU and GPU on the same die eliminates the need for a PCIe or MXM graphics card, APUs equip designers to save considerable power – at least 25-35 W.

With between 128 and 384 compute units delivering a calculated 172-563 SP GFLOPs[1] of performance and a Thermal Design Power (TDP) ranging from 17-35 W (average power below 13 W), the PPW advantages yielded by AMD Embedded R-Series APUs help provide greater power efficiency and lower heat dissipation than comparably-performing conventional processing platforms. Though R-Series APUs are deployed with fan cooling at the board level in most cases, continued advancements in heat pipe cooling technology are beginning to yield improved reliability in a new generation of fanless, R-Series APU-based digital signage systems.

Multi-screen, multimedia immersion

The ability to support multiple displays simultaneously from a single digital

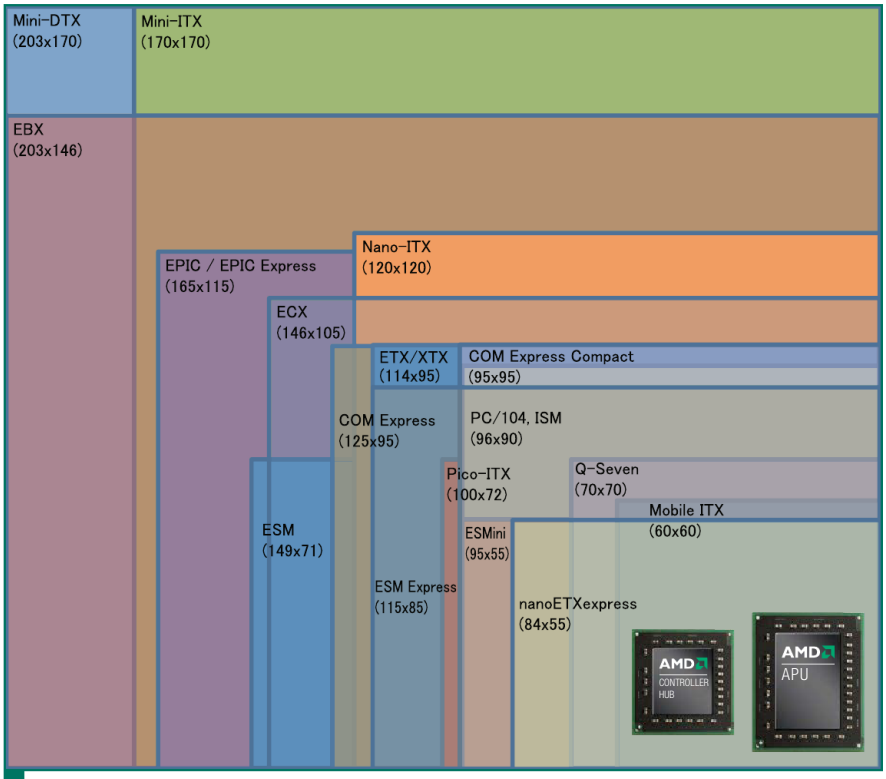


Figure 2 | The reduced two-chip architecture of APUs plays well into the tight space requirements of small form factor COTS boards.

signage system is emerging as a key requirement for realizing immersive, eye-catching displays and independent multimedia content feeds. But many designers remain challenged to unlock the full promise of multi-display digital signage, and are therefore limited in their ability to transcend conventional "single screen" visual experiences in favor of panoramic, "surround sight" display configurations. Today, many digital signage systems require one controller to power each individual screen – far from ideal in terms of space conservation, as well as power and cost efficiencies.

As mentioned previously, the on-die GPU in APUs utilizes the Video Electronics Standards Association's (VESA's) royalty-free DisplayPort connectivity standard to interface high-definition displays, DisplayPort is built upon a micro-packet architecture that enables the addressing and control of several displays through one DisplayPort connector, otherwise known as daisy-chaining. Where DVI and HDMI both require a dedicated clock source for each display, DisplayPort only requires a single reference clock source to drive as many DisplayPort streams as there are display pipelines in the processing platform.

Signage systems with advanced APU-enabled multi-display capabilities can therefore be optimized to present multiple feeds of dynamic video content cycling across multiple independent displays, or present a single multimedia feed distributed across a multi-panel display, both in full HD resolution. In the case of AMD R-Series-based embedded boards, up to four displays are supported from a single APU. AMD R-Series APUs also feature an option to include an additional onboard AMD Radeon GPU, which can be utilized in combination with the APU to power up to ten screens using AMD EyeFinity technology.

Accelerating digital signage

With APUs at the heart of a new generation of x86 embedded boards and modules, digital signage OEMs and customers alike are afforded dramatic gains in both media performance and space savings, with additional power and cooling efficiencies and multi-display flexibility rounding out the value proposition. In this way, APUs are enabling digital signage developers to provide visually-arresting multimedia capabilities that exceed those of traditional static and/or single-screen signage systems built on conventional processing platforms. **SFF**

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[1] Calculated SP GFLOPs = (Number of x86 cores * (128-bit (FPUs)/32-bit (SP Operation)) * CPU Base Frequency) + (Number of shader units * (64-bit (shader)/32-bit (SP Operation)) * GPU Max Frequency)

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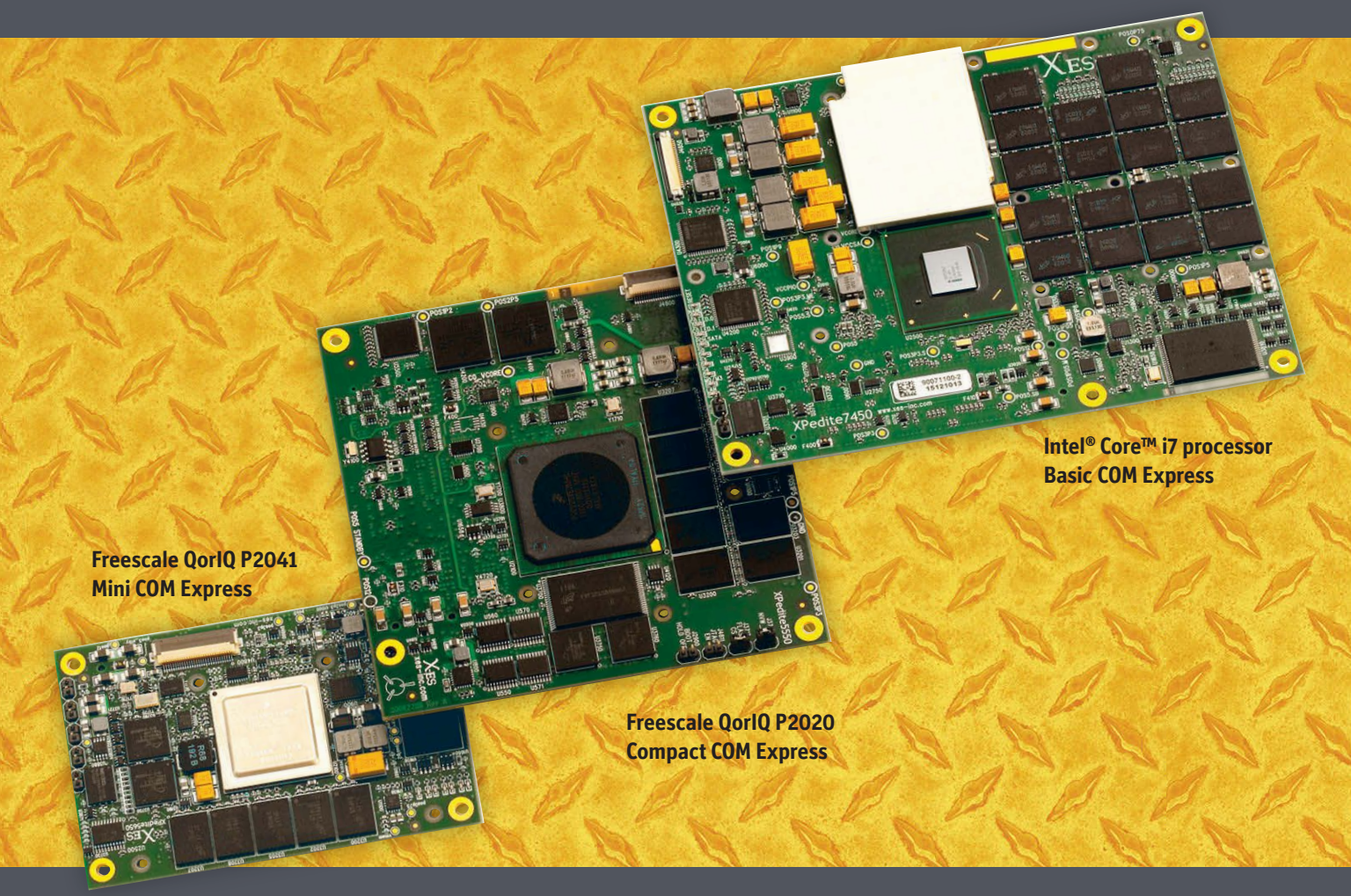

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Q & A

ZigBee Application Profiles converge to bring smart energy home

Q&A with Thomas Barber, Silicon Laboratories, and Mark Grazier, Texas Instruments

In the context of the residential space, the term "smart energy" can be in reference either to the intelligent infrastructure that powers the home, or the smart energy products and applications that reside within it. Silicon Labs' Thomas Barber and Mark Grazier of Texas Instruments explain how ZigBee Smart Energy, Home Automation, and related features are coming together to provide convenience and energy savings on both sides of the utility meter.

SFF: ***What are the steps that the ZigBee Alliance has taken to ensure inexpensive, low-power solutions for wireless communications?***

GRAZIER: The concept of a ZigBee mesh is to rely on other devices to route messages to end devices that for whatever reason can't be connected directly via a star or point-to-point system. By having devices route messages through other participants, we can lower the total average current consumption without polluting or putting excess radio energy out in the space; in other words, we don't have to shout when we can whisper.

The intent here is to create a low-power mesh network. What we want to do is keep end devices off and only powered when they need to send some sort of message, something has fallen out of exception, or when we want to initiate a transaction, at which point the device will turn on, report its data, and then go back to sleep.

BARBER: The ZigBee communications protocol was designed to allow sleeping end devices to control their battery life. Sleeping end devices set their own schedule for waking and interacting with the network to allow designers to determine the proper balance between battery life and data updates. In addition, the ZigBee protocol does not require any resynchronization of the sleeping end device when it wakes, so the data transfer to its parent is very efficient. On average, ZigBee nodes consume 100x less power than Wi-Fi and 10x less power than Bluetooth.

ZigBee is a hybrid-mesh network that includes powered routers and battery-powered end devices. When an end device sends a message to its parent, the parent is then responsible for ensuring the data reaches its destination in the network. If necessary, the message is retried by the parent device to ensure delivery. This allows the battery-operated device to minimize its awake time while still providing reliable communications. In addition, parent devices can hold messages for sleeping end devices, which allows the end device to wake and retrieve messages over one hop rather than wait for the messages to transfer across the network. This minimizes the on time for the end device and increases battery life.

Using these techniques, designers have built devices with 5-7 year battery life using standard batteries. Using specialized low-leakage batteries, manufacturers are building long-life devices, such as gas meters, with a 20-year battery life.

SFF: ***What have been the Alliance's form factor considerations with ZigBee modules, and what must small form factor developers account for when planning to incorporate ZigBee modules?***

GRAZIER: From a form factor perspective, the ZigBee Alliance has spent a lot of time making sure we don't have a lot of external components outside of the radio for the matching network. We've chosen IEEE 802.15.4 technology, which in very specific terms uses Direct-Sequence Spread Spectrum (DSSS) modulation; in layman's terms what we're doing is smoothing the amount of energy sent out in a particular transmission in a way that the receiver can pick it up and quickly acknowledge it, and then have the transmitting or far device turn back to sleep.

BARBER: Since the limiting factor in many designs is the size of the battery, low power consumption is a key factor in small form factor designs. The area required for two AA alkaline batteries is almost 10x larger than the area required for a single coin cell (CR2032) battery, so there is a strong desire to use coin cell batteries. However, a typical coin cell battery has a capacity of 225 mAh and a

peak current of 15-20 mA. To achieve a 10-year battery life, the average power consumption of the device must be less than 2.5 µA, which means the circuit must have extremely low leakage and support low-duty cycle transmission. To keep the peak current under 15-20 mA, the transmit output power must be limited to 3-6 dBm.

Achieving good performance in small form factor RF designs can be challenging. As the size of the antenna is reduced, the efficiency is reduced. The 2.4 GHz frequency band used by ZigBee is ideal for small form factors because a high-efficiency 2.4 GHz antenna requires less than half the area of an equivalent antenna for one of the sub-GHz Industrial, Scientific, and Medical (ISM) frequencies. When the RF components are closely spaced, the amount of interference is increased. This increase in interference can be mitigated by using a single-chip solution where all of the RF and processing is integrated in a single device. A single-chip solution also requires less PCB area, which enables smaller form factors.

ZigBee is a wireless networking standard, so developers must be aware of the RF regulations in their target market. The 2.4 GHz ISM frequency band used by ZigBee is available worldwide, but the maximum output power varies by region. Even though the 2.4 GHz ISM band is unlicensed, ZigBee devices typically must be certified by the local regulator such as the FCC in the U.S. There are a number of test houses than can provide certification services.

SFF: ***What is the significance of ZigBee's Applications Profiles, and what is the relationship of the Smart Energy Profile to home energy savings in particular?***

BARBER: Unlike Wi-Fi, which is purely a data communications network, ZigBee has defined Applications Profiles to allow devices to interoperate. A data communications stack only provides the method of transferring messages between devices, but does not define what messages should be passed between devices. ZigBee Applications Profiles define a common "language" for devices so they can interoperate. Bluetooth also has defined "profiles" to enable devices to interoperate. However, since Bluetooth has evolved as a PC and mobile phone standard, most of the Bluetooth profiles define connections between a PC or mobile phone and a Bluetooth peripheral. Since ZigBee has always been focused on low-power wireless sensing and control networks, ZigBee has defined Applications Profiles for applications such as Smart Energy, Home Automation, and Lighting.

ZigBee Home Automation, Building Automation, and Smart Energy all use the ZigBee PRO communications protocol, so in theory all Home/Building Automation and Smart Energy devices could reside on the same network and exchange messages. In practice, the utility companies manage the Smart Energy network and tightly control access to that network, so a typical home or business would have a ZigBee Smart Energy network and a ZigBee Home/Building Automation network.

GRAZIER: When we talk about the Smart Energy Profile what we're really talking about is the ability for energy providers to reduce total demand. The way we can do that is if the devices in the home can report back on how much energy they're using to the consumer, the consumer can take action by either reducing the amount of time they're on or switching to off periods to get a cost savings.

There's a clear differentiator between the smart grid that goes to the meter from the energy generation facilities, and from the meter inside the home. From a regulatory and business model perspective, the electric market wanted a clear firewall between the meter and the devices in the home because they did not want to incur the maintenance responsibility of deploying to an issue inside the home like a broken thermostat. So as a result, Smart Energy is about how we control devices from the meter into the home via the energy service portal or firewall (Figure 1).

The original ZigBee PRO stack supports both the domain that resides within the electric meter communicating to the utility provider, and it also supports the Home Area Network (HAN). Basically, 99 percent of all of the devices in the home will be on the Home Automation Profile side of this, whereas the Smart Energy side is really just how the electric meter and the gas meter report their data back. So it's no surprise that the Department of Energy funded the major meter and infrastructure providers to get that piece jumpstarted. That's really how the emphasis started in the Smart Energy space, as opposed to the Home Automation space, which is all about connecting devices that heretofore would really not have been logically connected, or if they were connected, would have been limited.

SFF: ***What is the concept behind the recently released, battery-free ZigBee Green Power feature, and what kind of benefits does it afford?***

BARBER: The Green Power feature reduces the power consumption of ZigBee by another order of magnitude and enables the use of self-powered devices (Figure 2). To enable lower power operation, the communications protocol was redesigned to scale to the amount of energy available. For a device like an energy harvesting switch that produces a short burst of power only when used, the protocol reduces to transmitting as many times as the available energy allows. For a device that uses a solar cell with an energy storage device, the accumulated energy can be tracked, and two-way communication is possible if the energy is available.

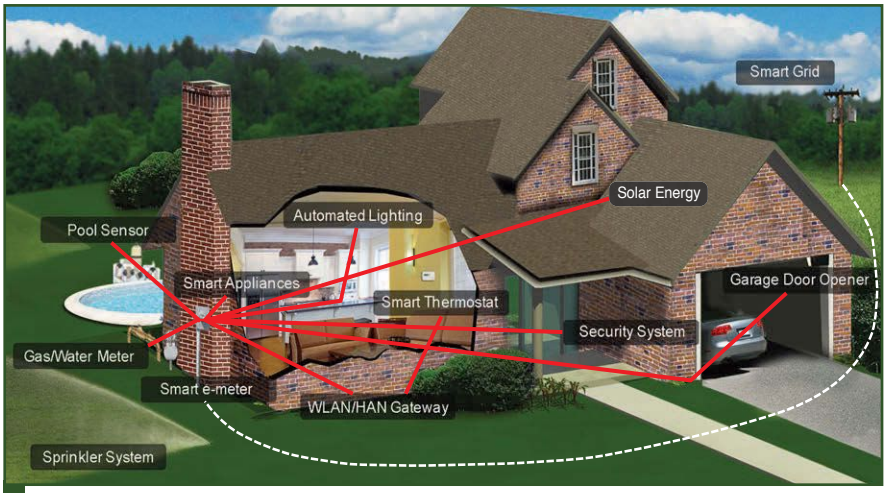

Figure 1 | Though complementary, ZigBee Smart Energy and Home Automation reside on opposite sides of the utility meter. The Home Automation Profile facilitates communications between devices on the Home Area Network (HAN) and the utility meter, while Smart Energy controls communications from the meter to the energy provider.

GRAZIER: The idea is that a green power device does not have a battery so it has to get its energy somewhere – in most cases, this is a very simple piezoelectric harvester that pushes an iron core through a coiled copper wire to generate electricity. Within the ZigBee protocol there is a very specific packet that has a sync bit and preamble, as compared to Green Power that has a more truncated packet of information. Because Green Power devices use smaller packet sizes, they're typically one-way applications that are transmitting to a proxy that's always on and listening for messages from these end switches or simple alarm systems. The proxy receives this telegram of information saying, "I'm a light switch, I just sent my packet, dim that light bulb on the network down to a set amount of lumens."

BARBER: Self-powered devices can reduce installation and maintenance costs and are environmentally friendly. Since no wires are required, Green Power devices can be added to existing systems without the need to run new wiring through existing structures. For new construction, the amount of wiring can be reduced, saving both material and labor costs. Since Green Power devices do not include a battery that needs to be replaced, they are virtually maintenance free and eliminate the need to dispose of discharged batteries.

SFF: ***How are the various Profiles and features working together to enable ubiquitous connectivity, and what does this mean for consumers and utilities alike?***

GRAZIER: What we're seeing now is a convergence of Home Automation and Smart Energy application layers. They do reside in different locations, but some of these devices will be sitting in the same product – a thermostat is a great example of that. So, ZigBee member companies are making sure that we have enough flash in our SoCs to accommodate both Profiles. Again, most cases on the Smart Energy side are just recording how much energy you're using through an in-home display so somebody can act on it, or it's passed back through the firewall to the energy utility reporting how much energy my home has consumed today as opposed to another.

Figure 2 | The ZigBee Green Power feature provides an additional order of magnitude of energy savings in ZigBee networks, consuming only 200 micro joules.

BARBER: Recently, new multi-network devices have been introduced that can act as a bridge between the Smart Energy network and the Home/Building Automation network. The bridge device is typically a router on the Home/Building Automation network and a sleeping end device on the Smart Energy network, but may be a router on both networks. These bridge devices allow a device on the Home Automation network, such as a smart appliance, to request billing information from the Smart Energy network.

For the utility, a bridge device allows the consumer to access the energy data without the utility company providing and managing a large number of devices. For consumers, the availability of energy data from the meter allows them to optimally manage their energy consumption by automatically shifting demand, enabling them to take advantage of lower utility rates.

SFF: ***What do you see in the future of ZigBee and smart energy in general, and what kind of innovation is needed to realize those predictions reality?***

GRAZIER: We see Smart Energy and Home Automation operating in parallel but very important paths. As the build out continues with electric meters using ZigBee Smart Energy, we're going to see more and more devices in the home network space hanging off that and reporting energy. For example, smart plugs where you would plug your white hood appliance or a light into a wall switch can be installed on a network very quickly. As these devices become more and more prevalent on the Smart Energy side, we're going to see many more Home Automation devices become part of this network and offer the consumer more flexibility without having to worry about the control lighting architecture or the security wire that you have to restring through a typical system now.

BARBER: We are at the beginning of the smart energy era. Over the past five years, smart meters have been deployed in most of the U.S. to connect the utility to the home. This connection allows customers to receive real-time data on their energy consumption and real-time pricing. The next step in the evolution of smart energy is development of in-home smart energy networks that can take advantage of the energy data.

The in-home smart energy network will start with relatively expensive devices such as in-home displays and smart appliances where the differential cost of adding wireless connectivity is relatively small today. As the cost of adding wireless decreases, the smart energy network will expand until the consumer can monitor each individual outlet or light fixture in the home. Small, low-cost smart energy devices are required for mass deployment of in-home smart energy networks. A standard 110 V outlet costs less than $0.50 retail, while the equivalent smart energy outlet costs more than $20. Innovative solutions are required to enable the cost of smart energy devices to approach the much lower cost of standard devices.

The final step in the smart energy evolution is the development of monitoring and control systems that allow you to access your energy data and manage your energy consumption on any device. These systems will allow you to do everything from remotely turning off the oven you accidently left on when you left the house to programming your lights to turn on and off at random times while you are on vacation. **SFF**

Thomas Barber *is the Director of Marketing for wireless consumer products in Silicon Labs' Embedded Systems group.*

Mark Grazier *is the program manager wireless sensor networks and worldwide third party developer network, Low Power RF at Texas Instruments. He is also a member of the ZigBee, EnOcean, and IPSO Alliances.*

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- Synchro/Resolver
- Video Control
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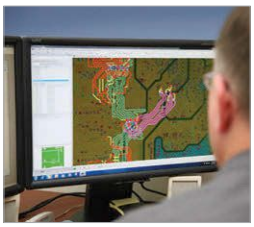



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RTD Embedded Technologies, Inc.

Welcome to the *PC/104 and Small Form Factors* 2013 Resource Guide!

If there's one thing for certain in computing, it's that size DOES matter. In all aspects of embedded, getting the most performance out of the smallest footprint is critical to reducing power, shedding heat, and cutting costs, three aspects of design that won't be going out of style.

Whether you prefer Computers-On-Module or Single Board Computers, proven PC/104 or cutting-edge COM Express, the *PC/104 and Small Form Factors* 2013 Resource Guide contains solutions from across the SFF space to help combat the demanding Size, Weight, Power and Cost (SWaP-C) constraints of today's embedded applications. We hope that what follows is instrumental in helping you realize your aggressive form factor goals.

Sincerely,

Brandon Lewis, Associate Editor
blewis@opensystemsmedia.com

2013 PROFILE INDEX

Resource Guide

WinSystems®
An Employee-Owned Company

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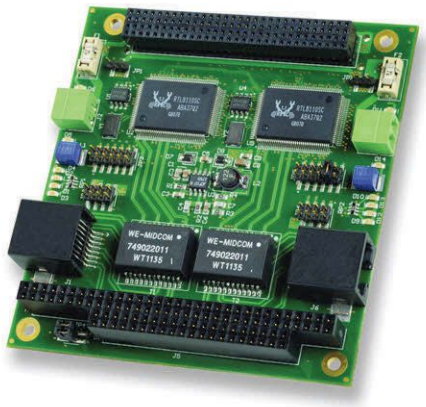
PC/104-*Plus* Dual Gigabit Module with POE PSE

WinSystems' PPM-GIGE-2-POE is a PC/104-*Plus* compliant dual channel, Gigabit Ethernet module with Power over Ethernet (POE) PSE support. This add-in module can provide power to two 802.3af/at compliant POE devices from an external DC source supporting up to 25W each.

The module's Gigabit Ethernet controllers combine triple-speed IEEE 802.3 compliant MAC and Ethernet transceivers. It offers high-speed transmission over CAT 5 UTP cable. The device supports the 32-bit PCI v2.2 interface for host communications and is compliant with the IEEE 802.3 specification for 10/100Mbps Ethernet and the IEEE 802.3ab specification for 1000Mbps Ethernet.

WinSystems also offers single and dual channel, with or without the POE supply.



FEATURES

- Two Gigabit Ethernet channels on a PC/104-*Plus* module
- Each channel is IEEE 802.3at/af POE compliant
- Up to 25W for single port PSE applications
- Auto-Negotiation with Next Page capability
- IEEE 802.3x-compliant full duplex flow control support
- 64Kbyte Rx and 8Kbyte Tx packet FIFO per channel
- Support for Windows®, Linux, and other x86 RTOS
- -40°C to +85°C temperature operation
- Models: PPM-GIGE-2-POE and PPM-GIGE-1-POE

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ADLINK TECHNOLOGY INC.®

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HPERC-IBR – High Performance Extreme Rugged™ Computer System

Sealed, Rugged COTS Computing Platform

Built around the emerging SWaP and rugged form factor standard VITA 75, HPERC's standards-based design provides a non-proprietary solution with ultimate cost/value ratio. The system's rugged capabilities are ideal for ground, air, and sea deployments. HPERC systems survive shock, resist corrosion and galvanic oxidation, and perform in the humid jungle, the heat of the desert, and the bitter cold of frozen mountain passes.

Inside the tiny footprint of HPERC™ lives the power of Intel® 3rd generation Core™ i7 processor and optional GPGPU parallel processing engine. Dual removable Secure Erase RAID-0 SSDs provide a screaming 12Gb/s throughput and security for deployment in hostile environments. Easy configuration and expansion allows for fast integration of custom rugged embedded applications. HPERC reserves connector pins for expansion interfaces. GPGPU sits on a 16-lane 3rd generation PCI Express interface. Uniquely-keyed MIL-DTL-38999 connectors provide a wide array of fast I/O.

FEATURES

- Intel® Gen3 Core™ i7 Processor
- Soldered DDR3L-1333 8GB – Up to 16GB RAM
- Quad Gigabit Ethernet
- Ultra-Fast 12GB/s Solid-State-RAID with Secure Erase
- 16-lane 3rd Generation PCI Express to optional GPGPU
- Small SWaP2C2-efficient Sealed Enclosure
- Three Digital DisplayPort/HDMI/DVI
- Simple Expansion and Configuration

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Touch Panel Computers

start at
$415
qty 100

Industrial Touch Panel Computers

Technologic Systems offers three industrial TPCs powered by ARM CPUs with hardware video acceleration. They are ideal for applications requiring a touch screen human interface, such as industrial automation, home automation, self-service machines, and point-of-sale terminals. They offer an excellent value with a full range of features and industry standard connectors. Technologic Systems TPCs are powered by fanless, low power TS-SOCKET Macrocontrollers (computer on modules) that allow a simple migration path between power efficient and high performance modules.

All 3 touchscreens support a choice of three video enabled TS-SOCKET Macrocontrollers
TS-4700 – 800MHz ARM9 with 256MB RAM
TS-4710 – 1066MHz ARM9 with 512MB RAM
TS-4800 – 800 MHz Cortex-A8 with 256MB RAM

7" 800x480 - TS-TPC-8390 Touch Screen Computer
The TS-TPC-8390 is a panel mount computer that features 2 Ethernet ports, 1 PoE, 4 USB Host ports, 3 RS232, up to 2 RS485 ports, up to 2 CAN ports, DIO, I2C, built in speaker, RTC, and 6 channels of 16-bit A/D. Quantity 100 starts at $415.

7" 800x480 - TS-TPC-8380 Low Cost Fully Enclosed Touch Screen Computer
The TS-TPC-8380 includes 1 Modbus RJ45, 2 Ethernet ports, 1 USB, built in speaker, RTC, XBee socket, and support for a Multitech Cellular modem or a built in wireless 802.11BGN adapter. This touch screen computer is fully enclosed in a low cost DIN mountable plastic enclosure. Quantity 100 starts at $345.

10.4" 800x600 - TS-TPC-8900 Touch Screen Computer
The TS-TPC-8900 is a panel mount computer that features 2 Ethernet ports, 1 PoE, 2 USB ports, 2 RS232, up to 2 RS485 ports, an XBee socket, DIO, I2C, built in speaker, and RTC. The TS-TPC-8900 also includes a 64 pin PC/104 bus that can be used to expand the functionality to many of Technologic Systems off-the-shelf PC/104 peripherals. Quantity 100 starts at $599.

FEATURES

- Resistive touchscreen
- LED backlit display
- Gasketed construction
- Tough powder coated finish
- Fanless operation from -20 °C to +70 °C
- 1066MHz or 800MHz ARM CPU
- Up to 512MB RAM
- 256MB SLC XNAND or DoubleStore SD
- MicroSD slot
- Programmable FPGA
- Fast Startup (under 3 seconds)
- Debian Linux
- Dual Ethernet
- USB ports
- CAN
- RS-232 ports
- RS-485
- Mono speaker on PCB
- Stereo Audio Output Jack
- SPI
- I2C
- DIO

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ADLINK TECHNOLOGY INC.

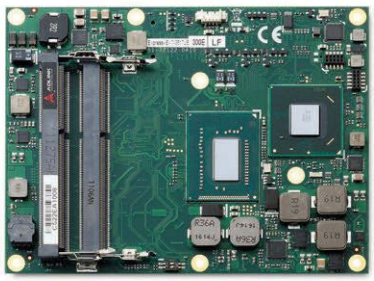
www.adlinktech.com

Express-IB

The COM Express modular form factor provides value by enabling multi-vendor board customization based on pricing and performance requirements, and reduces risk by enabling easy upgrades without touching the customized baseboard.

ADLINK's Express-IB high performance COM.0 R2.0 Type 6 module targets applications in government, military, medical, digital signage and communications markets, and is ideal for those customers with advanced processing performance and graphics requirements looking to reduce development time by outsourcing the base design of their system and focusing on application functionality.

The Express-IB features an Intel® Core™ i7/i5/i3 processor supporting Intel® HD Graphics integrated on the CPU with three independent displays. The Express-IB also supports Intel® Advance Vector Extensions (Intel® AVX v1.0), with its improved Floating Point Intensive Applications, and offers the benefits of increased bandwidth provided by USB 3.0.



FEATURES

- Intel® Quad or Dual Core™ i7/i5/i3 Processor
- Mobile Intel® QM77 Express Chipset
- Up to 16GB Dual Channel DDR3 SDRAM at 1600MHz
- Three Digital Display Interfaces (DDI) for DisplayPort /HDMI/DVI/ SDVO
- Seven PCIe x1, one PCIe x16 (Gen3) for graphics (or general purpose x8/4/1)
- Two SATA 3 Gb/s, two SATA 6 Gb/s, Gigabit Ethernet, four USB 3.0, four USB 2.0

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Contact: info@adlinktech.com

AVNET Integrated

www.avnetintegrated.com/pinnacle_home/

AMD Socket S1 COM Express Module

Avnet's AMD Socket S1 COM Express Module (COMX-S1) is a low cost, compact, embeddable computing core with the capability to drive a broad range of OEM applications. Built around AMD's x86-based Socket S1 processors, it enables 64-bit computing at a progression of performance levels from the ultra-low-power AMD Sempron™ 2100+ to the dual-core muscle of the AMD Turion™ X2 TL-62.

The Computer-on-Module design is fully compliant with PICMG COM Express Type 2 specifications, offering a large variety of interfaces for high-speed data, audio, high-resolution graphics, and more. Avnet's companion COM Express Carrier Board (COMX-CB) provides a plug-and-go platform with physical ports for virtually all of the I/O types supported by the COM Express Module.

FEATURES

- Supports AMD Socket S2 processor family including AMD Turion™ 64 X2 dual-core mobile and Mobile AMD Sempron™
- Up to 4GB DDR2 SDRAM
- Video – Dual-channel LVDS, VGA, option TV Out
- AC'97 audio interface, optional HD Audio
- 4 x PCI Express interfaces (x8, x1, x1, x1)
- 8 x USB Ports
- 4 x SATA II Ports
- 1 x Ethernet port (10/100/1000)
- PICMG COM Express Type 2-compatible pinout
- MicroATX Carrier Board available for rapid startup
- Extended availability assured, 3rd-party integration welcome

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Technologic Systems Industrial Controllers

Technologic Systems offers three powerful computers targeting industrial process control, TS-8820-BOX, TS-7558-BOX, and TS-7520-BOX. With Technologic Systems controllers, an intelligent automation system can be implemented at low cost with a minimal number of components.

The TS-7558-BOX

The TS-7558-BOX is a complete solution for extremely low cost industrial control applications. Designed around the mature Cavium 250MHz ARM9 architecture, the TS-7558-BOX is priced at $199 (qty 100) including the plastic enclosure. Screw terminals bring out 16 I/O-isolated inputs, isolated outputs, and 4 ADC. TS-7520-BOX with 50 DIO and 8 ADC is also available.

The TS-7520-BOX

The TS-7520-BOX is a versatile solution with very dense I/O available through 12 RS485 ports. This includes DAC, 8x 12-bit ADC channels, pulse counters, CAN, RS232, and 2 Modbus RJ45 ports. The TS-7520-BOX also features the Cavium 250MHz ARM9 processor.

The TS-8820-BOX

The TS-8820-BOX is a powerful solution for a wide variety of industrial applications. This controller features an 800MHz CPU housed in a rugged extruded aluminum enclosure that exposes the I/O on screw terminals while protecting the more sensitive electronics. 120 screw terminals on the TS-8820-BOX bring out 16 I/O-ADC, DAC, optional H-bridges, relays, isolated CAN, isolated RS-232, and isolated RS-485. TS-8820-BOX is priced at $588 (qty 100), including the enclosure.

Modbus Peripherals

Technologic Systems controllers feature a 2W-Modbus RS-485 port that allows power and data to be sent over a single CAT5 to communicate with multiple peripherals. Technologic Systems industrial controllers and peripherals support legacy modbus communication, as well as high speed communication up to 4096K baud.

FPGA Flexibility

Our industrial controller products feature FPGAs making them an ideal solution for applications requiring additional UARTs, non-standard bus interfaces, PWM outputs, quadrature decoding, CAN, pulse timing, digital counters, or other custom logic. Technologic Systems can integrate that functionality into a custom FPGA configuration for an elegant and cost effective solution. For our customers who prefer to do their own FPGA development, Technologic Systems has open-core Verilog projects for most controllers.

Software

Technologic Systems Industrial Controllers boot Linux in under 3 seconds, allowing your application to start working immediately. The Linux kernel can be loaded from a DoubleStore SD card or from an industrial SLC XNAND drive, for a guaranteed bootup. Full Debian Linux is also supported, allowing sophisticated software solutions such as database servers, web servers, and custom applications in Java, PHP, Python, Perl, or any language supported by Debian.

Industrial Controllers

start at
$199
qty 100

Picture of TS-8820-BOX

FEATURES

- ARM CPUs from 1066MHz to 250MHz
- Fanless operation from -40°C to +85°C
- Program in C/C++, or many other languages
- 2W-Modbus RS-485
- Expandable Modbus Temperature Sensors, DIO, ADC
- Rugged industrial screw-down connectors
- Opto-isolated digital I/O
- 16-bit or 12-bit ADC
- Digital counters
- PoE capable 10/100 Ethernet
- USB Host ports
- RS-232, RS-485, CAN
- Industrial SLC XNAND drive
- Industrial DoubleStore file storage
- User-programmable opencore FPGA
- DIN mount option

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MSC C6B-7S

The design of the MSC C6B-7S module is based on Intel's 22nm CPU technology, enabling the highest performance levels for embedded applications. The 3rd generation of Core™ processors brings triple independant display support, DirectX 11, fast DDR3-1600 memory and USB 3.0 on a compact module. Different Core i3, i5, i7 and Celeron processors are supported by this design. Besides an extensive set of interfaces and features, the MSC C6B-7S offers turbo boost capabilities for CPUs and graphics controllers, accelerated video encoding/decoding and hardware based security compliant to the requirements of TCG (Trusted Computing Group). The new Type 6 pin-out allows direct access to the latest digital display interfaces like DisplayPort, HDMI and DVI. USB 3.0 interfaces support the fastest peripheral devices currently available.

FEATURES

- Intel® Ivy Bridge with Core™ i7, i5, and i3 offerings
- Intel® HD Graphics 4000
- Intel® 7-Series PCH
- Up to 16GB DDR3-1600 SDRAM, dual channel
- Four SATA-300 mass storage interfaces
- Three DisplayPort/HDMI/DVI interfaces
- Two Embedded DisplayPort interfaces
- LVDS (24-bit, dual channel) and CRT interface
- Triple independent display support
- DirectX 11, OpenGL 3.1, OpenCL 1.1
- Resolution up to 2560x1600
- Seven PCI Express™ x1 lanes
- Four USB 3.0 and four USB 2.0 interfaces
- UEFI Firmware

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XPedite5550 Freescale QorIQ P2020 COM Express Module

The XPedite5550 is a ruggedized COM Express module that complies with the COM Express Compact form factor (95mm x 95mm) and supports an enhanced Type 5 pinout. COM Express provides a standards-based form factor to bring processing to a wide range of applications. With dual PowerPC e500v2 cores running at up to 1.2 GHz, the P2020 delivers enhanced performance and efficiency for today's network information processing and other embedded computing applications.

The XPedite5550 provides a high-performance, feature-rich solution for current and future generations of embedded applications. For customers seeking lower overall power consumption, the XPedite5550 can be designed with the Freescale P1020 processor. Operating system support packages for the XPedite5550 include Wind River VxWorks, Green Hills INTEGRITY, and Linux 2.6.

FEATURES

- Freescale QorIQ P2010 and P2020 processors with dual PowerPC e500v2 cores at up to 1.2 GHz
- Air- or conduction-cooled
- Extended shock and vibration tolerance
- Up to 8 GB of DDR3-800 ECC SDRAM
- x2 PCI Express interface
- x1 PCI Express interface
- Three Gigabit Ethernet ports
- Two Serial ports
- USB 2.0 Port
- Up to 256 MB of NOR flash (with redundancy)
- Up to 16 GB of NAND flash

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COMs and SOMs: COM Express

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XPedite7450 Intel® Core™ i7 COM Express Module

The XPedite7450 is an enhanced, Type 6 COM Express module based on the 2nd generation Intel Core i7 processor or 3rd generation Intel Core i7 processor and Intel QM67 chipset. COM Express provides a standards-based form factor to bring PC processing to a wide range of applications. The XPedite7450 is ideal for the high-bandwidth and processing-intensive requirements of today's commercial, industrial, and military applications. The small footprint and standards-based form factor make the XPedite7450 perfect for portable and rugged environments, while providing an upgrade path for the future.

The XPedite7450 uses the latest Unified Extensible Firmware Interface (UEFI) BIOS customized with BIT support. Wind River VxWorks and Linux Board Support Packages (BSPs) are available, as well as Microsoft Windows drivers.

FEATURES

- Supports 2nd generation Intel Core i7 processors and 3rd generation Intel Core i7 processors
- Dual- or quad-core processor with Intel Hyper-Threading Technology
- Standard COM Express™ Basic form factor with ruggedization enhancements
- Up to 16 GB of DDR3-1600 ECC SDRAM in two channels
- Two x8 PCI Express, one x4 PCI Express, and two x1 PCI Express ports
- Two 10/100/1000BASE-T Gigabit Ethernet ports
- Four USB 2.0 ports
- Six SATA 3.0 Gb/s ports
- Two digital display interfaces (DP/DVI/HDMI)
- Intel High Definition Audio port
- 32 MB NOR boot flash and up to 16 GB of NAND flash

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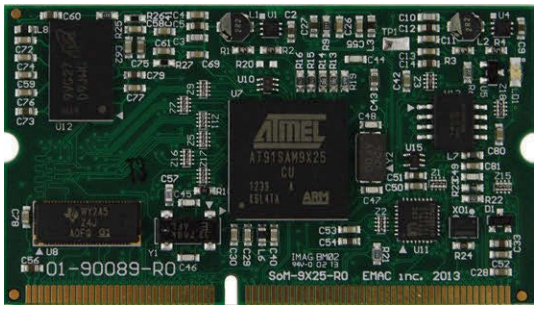

SoM-9x25

Designed and manufactured in the USA, the SoM-9x25 uses the same small SODIMM form factor utilized by other EMAC SoM modules, and is the ideal processor engine for your next design. All of the ARM processor core is included on this tiny board, including: Flash, Memory, Serial Ports, Ethernet, SPI, I2C, I2S Audio, CAN 2.0B, PWMs, Timer/Counters, A/D, Digital I/O lines, Clock/Calendar, and more. The SoM-9x25 is designed to plug into a custom or off-the-shelf carrier board containing all the connectors and any additional I/O components that may be required. The System on Module approach provides the flexibility of a fully customized product at a greatly reduced cost. Quantity 1 price begins at $180.

FEATURES

- Wide-temperature SoM-9X25 based on the Atmel AT91SAM9X25 400MHz Processor
- 10/100 BaseT Ethernet with on-board PHY (2nd Ethernet Optional)
- 6 serial ports, 3 with handshake
- 2 USB 2.0 (Full Speed) Host ports & 1 USB 2.0 (Full Speed) Device port
- SD/MMC Flash Card Interface
- 2 SPI & 2 I2C ports, 2 CAN 2.0B ports, 1 I2S Audio port

EMAC, Inc. | 618-529-4525

Contact: info@emacinc.com
http://www.emacinc.com

Technologic Systems

www.embeddedARM.com

series starts at **$92** qty 100

TS-SOCKET MACROCONTROLLERS

JUMP-START YOUR EMBEDDED SYSTEM DESIGN

The TS-SOCKET Macrocontrollers are a series of embedded computers based on the TS-SOCKET connector standard. These CPU core modules securely connect to your custom base board, enabling drastically reduced design time and complexity. Start your embedded system design around one of our TS-SOCKET Macro-controllers to reduce your overall project risk and accelerate time-to-market.

TS-SOCKET MACROCONTROLLER STANDARD

TS-SOCKET is an embedded computer standard designed and controlled by Technologic Systems, Inc. It defines both a form factor and a connection pin-out and is based on two 100-pin low-profile connectors, allowing secure connection between a Macrocontroller and a base board.

A TS-SOCKET Macrocontroller is an embedded CPU board that implements the TS-SOCKET specification. The form factor is 75 mm x 55 mm, about the size of a credit card. In addition to two 100-pin off-board male connectors, TS-SOCKET Macrocontrollers feature CPU, RAM, NAND Flash, SD Card socket, Ethernet MAC/PHY and requires a single 5 V power source. Peripherals can include USB host and device, I2C, CAN, GPIO, external bus, video, touchscreen, audio, SPI, and UART. All parts are soldered-on and no moving parts are used, ensuring embedded ruggedness and reliability.

A TS-SOCKET base board can be any piece of hardware, supplied by the customer or Technologic Systems, that interfaces with a Macrocontroller through the dual TS-SOCKET standard connectors.

INEXPENSIVE CUSTOM DESIGNS, FAST TIME-TO-MARKET

All TS-SOCKET Macrocontrollers are designed with a common pin-out, which means that they are interchangeable. This gives the developer more options and flexibility when selecting an embedded system, since a base board can be used with multiple Macrocontrollers. As an application example, a base board designed to provide video and touchscreen functionality can have its CPU easily upgraded to improve video playback performance or later as a second generation upgrade. Lower design costs and faster time-to-market directly result from the TS-SOCKET board interchangeability feature because the standardization significantly reduces design complexity.

FEATURES

- 75 mm x 55 mm (credit card sized)
- Dual 100-pin connectors
- Secure connection with mounting holes
- Common pin-out interface
- Low profile with 6 mm spacing

BENEFITS

- Simplifies custom embedded systems
- Rapid design process gets products to market faster
- Several COTS base boards for evaluation and development
- Design your own base board or use our design services
- Macrocontrollers are interchangeable for future upgrades

TS-SOCKET MACROCONTROLLER PROJECTS

- TS-4200: Atmel ARM9 with super low power
- TS-4300: Cavium ARM11 with 25K LUT FPGA, SATA & PCIe
- TS-4600: 450MHz at extremely low cost + 2 Ethernets
- TS-4710: Marvell PXA168 with video and 1066MHz CPU
- TS-4712: like TS-4710 + 2 Ethernets
- TS-4800: FreeScale iMX515 with video and 800MHz CPU

PRICE AND AVAILABILITY

- Macrocontrollers are available now. TS-4600 available April 2013.
- Several COTS development base boards are also available.
- TS-TPC-8390 is available as a complete touch panel computer product using either TS-4700 or TS-4800 Macrocontroller CPUs.
- Prices start at $92 at quantity 100.

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COMs and SOMs: Other COMs and SOMs

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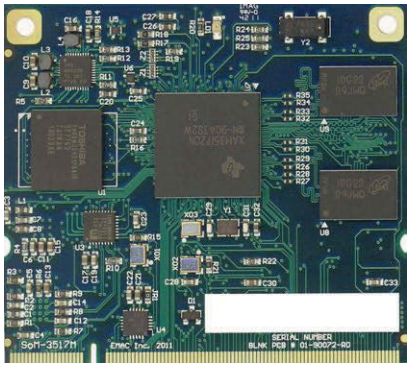
SoM-3517M



Designed and manufactured in the USA, the SoM-3517 uses the same small SODIMM form factor utilized by other EMAC SoM modules, and is the ideal processor engine for your next design. All of the ARM processor core is included on this tiny board, including: Flash, Memory, Serial Ports, Ethernet, SPI, I2C, I2S Audio, CAN 2.0B, PWMs, Timer/Counters, A/D, Digital I/O lines, Video, Clock/Calendar, and more. The SoM-3517M additionally provides a math coprocessor, and 2D/3D accelerated video with image scaling/rotation. Like other modules in EMAC's SoM product line, the SoM-3517 is designed to plug into a custom or off-the-shelf carrier board containing all the connectors and any additional I/O components that may be required. Quantity 1 Price begins at $198.

FEATURES

- TI ARM Cortex-A8 600 MHz Fanless Processor
- Up to 512 MB of DDR2 SDRAM, Up to 2GB of eMMC Flash
- 2 High Speed USB 2.0 Host ports, 1 USB 2.0 OTG port
- 4 Serial Ports, 2 I2C & 2 SPI ports, CAN 2.0B Controller
- 10/100 BaseT Fast Ethernet
- 2D/3D LCD Video w/ Touch

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Contact: info@emacinc.com
http://www.emacinc.com

COMs and SOMs: Qseven

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msc

www.mscembedded.com

MSC Q7-IMX6

The design of the MSC Q7-IMX6 module is based on Freescale's new i.MX 6 CPU, offering quad-core, dual-core and single-core ARM® Cortex™-A9 compute performance at very low power consumption, excellent graphics performance, and a high degree of functional integration. It incorporates the Freescale i.MX 6 ARM Cortex-A9 CPU (single, dual, or quad core) with up to 1.2 GHz, up to 4 GB DDR3 DRAM, and up to 8 GB Flash memory, as well as an extensive set of interface controllers. The module provides the standard Qseven interface, allowing simple integration with Qseven baseboards. For evaluation and design-in of the Q7-IMX6 modules, MSC provides a development platform, target platform and a starter kit. The MSC Q7-IMX6 module is supported by Linux, Windows Embedded Compact 7, and other OSs.

FEATURES

- Qseven Standard Form Factor
- Freescale™ i.MX 6 ARM® Cortex™-A9 CPU:i.MX6 Quad, Dual, DualLite, Solo up to 1.2GHz
- "Triple-Play" Graphics and Video Subsystem
- Up to 4 GB DDR3 SDRAM
- Up to 8 GB NAND Flash
- Gigabit Ethernet
- PCI Express x1 Port
- HDMI/DVI up to 1920x1200 @30 Hz
- Dual-Channel LVDS 18/24-bit up to 1920x1200
- Triple independent display support
- One SATA-II Interface (3 Gbit/s, not for Single-Core CPU)
- Up to 8 USB 2.0 ports
- AC'97 Audio
- Linux and Windows EC7 Support (Android on request)

MSC Embedded | 650-616-4068

info@mscembedded.com

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ACCES I/O PRODUCTS, INC.

http://acces.io

USB-104-HUB – Rugged, Industrial Grade, 4-Port USB Hub

This small industrial/military grade hub features extended temperature operation (-40°C to 85°C), high retention USB connectors, and an industrial steel enclosure for shock and vibration mitigation. The OEM version (board only) is PC/104 sized and can easily be installed in new or existing PC/104-based systems as well. The USB-104-HUB now makes it easy to add additional USB-based I/O to your embedded system or to connect peripherals such as external hard drives, keyboards, GPS, wireless and more. Real-world markets include Industrial Automation, Embedded OEM, Laboratory, Kiosk, Transportation/Automotive, and Military/Government.

This versatile four port hub can be bus powered or self powered. You may choose from three power input connectors: DC power input jack, screw terminals, or 3.5" drive power connector (Berg). Mounting provisions include DIN rail, 3.5" front panel drive bay mounting, and various panel mounting plates.

FEATURES

- Rugged, industrialized, four-port USB hub
- High-speed USB 2.0 device, USB 3.0 and 1.1 compatible
- Extended temperature operation (-40°C to +85°C)
- Data transfer rates up to 480 Mbps
- Supports bus-powered and self-powered modes
- Three power input connectors (power jack, screw terminals, or 3.5" drive Berg power connector)
- LED status indicators for power and overcurrent fault conditions for each downstream port
- USB/104 form factor for OEM embedded applications
- OEM version (board only) features PC/104 module size and mounting
- Includes micro-fit embedded USB header connectors in parallel with all standard USB connectors
- Industrial grade USB connectors feature high-retention design
- Small (4" x 4" x 1"), low profile, steel enclosure
- 3.5" front panel drive bay mounting provision

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I/O Boards: Data acquisition

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Multifunction DAQ-PACK Series (Up to 128 Channels)

The DAQ-PACK Series is a highly integrated multifunction data acquisition and control system. The system offers an ideal solution for adding portable, easy-to-install high-speed analog and digital I/O capabilities to any PC or embedded system with a USB port. It performs signal conditioning such as RC filtering, current inputs, RTD measurement, bridge completion, thermocouple break detection, voltage dividers, small signal inputs, and sensor excitation voltage supply.

The small, compact, multifunction I/O DAQ-PACK Series units provide the user with everything needed to start acquiring, measuring, analyzing, and monitoring in a variety of applications. These data acquisition and control devices can be used in many current real-world applications such as precision measurement, analysis, monitoring, and control in countless embedded applications.

FEATURES

- 32, 64, 96, or 128-channel single-ended or differential analog inputs
- High-speed USB 2.0 multifunction DAQ
- Sustained sampling speeds up to 500kHz
- 12 or 16-bit resolution A/D converter
- Flexible, software configured functionality
- 18 input ranges, 9 unipolar and 9 bipolar, per 8-channel programmable
- Wide range of flexible signal conditioning types
- Autocalibration and oversampling for real-time accurate data
- A/D starts via software, timer, or external trigger
- Two 16-bit analog outputs and 16 high-current digital I/O lines
- 16-bit programmable counter/timer

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I/O Boards: Digital

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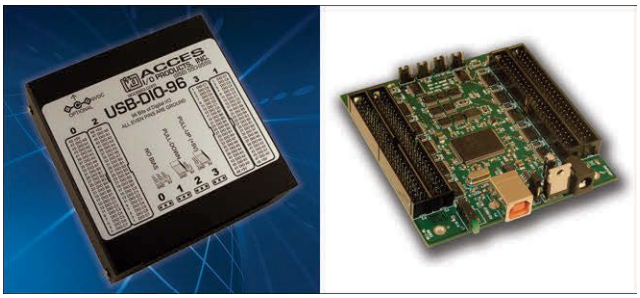

USB-DIO-96 High-Density Digital I/O

Designed for compact control and monitoring applications, this product features 96 or 48 industrial strength TTL digital I/Os. This USB device is an ideal solution for adding portable, easy-to-install digital I/O to any PC or embedded system with a USB port. The USB-DIO-96 is useful for monitoring dry contacts or generating outputs for controlling external devices such as LEDs and other indicators or system equipment. Applications include home, portable, laptop, education, laboratory, industrial automation, and embedded OEM.

These boards use 2 or 4 industry standard 50 pin IDC-type shrouded headers with 24 lines per connector. Utility 5VDC is available on pin 49 of each connector with grounds on all even numbered pins to reduce crosstalk and maintain industry compatibility. A mini USB header connector is provided in parallel with the high retention type B connector for stacking and embedded applications. Available accessories include a wide variety of cables and screw terminal boards for quick and easy connectivity.

FEATURES

- 96 or 48 lines of digital I/O
- High-speed USB 2.0 device, USB 1.1 backward-compatible
- Twelve or six 8-bit ports independently selectable for inputs or outputs
- All I/O lines buffered with 32mA source, 64mA sink current capabilities
- I/O Buffers can be enabled or tri-stated under program control
- Jumper selectable I/O pulled up to 5V for contact monitoring, down to ground, or floating
- Resettable fused +5VDC outputs per 50-pin connector
- OEM version (board only) features PC/104 module size and mounting compatibility

ACCES I/O Products, Inc. | 858-550-9559

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I/O Boards: Multifunction

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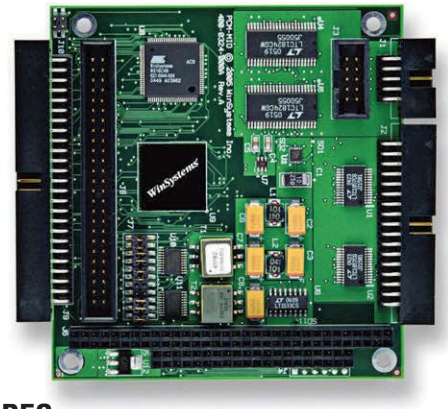

Multifunction PC/104 A/D, D/A & DIO Module

The PCM-MIO is a versatile, PC/104-based analog input, analog output, and digital I/O board. The board's precision converters and voltage references require no calibration.

It will support up to 16 single-ended or 8 differential analog-to-digital (A/D) input channels. The software programmable input ranges are ±5V, ±10V, 0-5V, and 0-10V. There are also eight, 12-bit digital-to-analog (D/A) outputs with individual software programmable voltage ranges of ±5V, ±10V, 0-5V, and 0-10V. A total of 48 bidirectional TTL-compatible digital I/O lines can be software configured as input, output, or output with readback.

The PCM-MIO operates over the industrial temperature range of -40° to +85°C. Software drivers are available for DOS, Windows®, and Linux.

FEATURES

- 16-bit 100K samples/sec Analog-to-Digital (A/D) converter
- Two quad 12-bit Digital-to-Analog (D/A) converters
- 48 bi-directional TTL-compatible digital I/O lines
- Software drivers in DOS, Windows®, and Linux
- -40° to +85°C temperature operation
- Low cost A/D and digital I/O only version available
- Low cost D/A and digital I/O only version available
- Product evaluation program
- Long-term product availability
- Model: PCM-MIO

WinSystems, Inc. | 817-274-7553

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P104-WDG-CSMA PC/104-*Plus* Watchdog Timer Board

This feature-rich Watchdog board will vigilantly stand guard over your system and will help avoid costly system failures. The board can be used to monitor the operation of your application program as well as operating system and will initiate a system reset in case of lockup. In addition, the P104-WDG-CSMA can monitor and control a variety of system hardware parameters such as temperature, voltage, fan speed, humidity, and more. The board was designed to allow for complete peace of mind when planning your next PC/104-based embedded system. Applications include kiosks, industrial automation, military/mission-critical, asset management and tracking, retail, medical, embedded OEM, temperature measurement, and many others which require self-reliant embedded systems.

Want more?! One general purpose optically isolated input, two isolated digital outputs to control/switch external events, two non-isolated digital outputs, two general purpose A/D inputs, and even a security light sensor that can be used to detect if the darkened interior of an enclosure is opened.

FEATURES

- PC/104-*Plus* watchdog timer card with software selectable timeout from 4µsec
- Watchdog open collector reset outputs
- Temperature measurement, monitor, and alarm
- Fan status and speed control
- PCI/104 power monitor/limit alarm interrupt
- Opto-isolated input to trigger reset
- General purpose opto-isolated input, two outputs
- Two general purpose 8-bit A/D inputs
- External fused 5V and 12V power
- Light sensor for enclosure security
- Extended temperature (-40°C to +85°C) available

ACCES I/O Products, Inc. | 858-550-9559

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PCIe-Mini-AD8200

The PCIe-Mini-AD8200 with 1X Lane PCI Express Mini card and a simultaneously sampled A/D, offers a mix of up to 8 single-ended or 4 differential analog input channels. All channels feature programmable gain 1 or 2 and can be programmed to handle analog input with a single-ended or differential configuration.

The 16-bit A/D converters can provide a global acquisition and conversion time of ≤5µsec per sample per channel. The board offers a programmable digital filter with ±5 V range and the –3 dB frequency is typically 15 kHz. In the ±10 V range the –3 dB frequency is typically 23 kHz.

Alphi Technology offers a variety of PCI Express Mini cards: PCIe-Mini-DA16, PCIe-Mini-1553, PCIe-Mini-ARINC429, PCIe-Mini-CAN, PCIe-Mini-DIO and more.

FEATURES

- 8 channels 16-bit A/D converter simultaneously sampled
- Fast throughput rate: 200 KSps for all 8 channels
- 8 channels SE or 4 pseudo differentials
- Single-ended or 4 differential channels
- True bipolar analog input ranges: ±10 V, ±5 V – selection applies to all channels
- Analog input clamp protection
- 1MΩ analog input impedance
- Programmable 2nd order anti-alias analog filter
- Over-sampling capability with digital filter
- PCI Express compliant

Alphi Technology Corporation | 480-838-2428

Contact: sales@AlphiTech.com

Mezzanines and Carriers: Carrier Boards

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www.connecttech.com/sub/Products/Qseven.asp?l1=qseven

Qseven Carrier Boards & Single Board Computers

Connect Tech's Qseven Carrier Boards range from light and low cost options to full-featured PCI-104 and PCIe/104 embedded computing solutions.

Qseven Carrier Boards offer embedded processor options including AMD, Intel®, Freescale, TI, NVIDIA and VIA, which are easily upgradeable to accommodate future generations. These bus-independent carrier boards offer Mini-PCIe and SIM-card expansion capability.

For applications that require deep I/O functionality and a rugged form factor, Connect Tech's PCI-104 and PCIe/104 Single Board Computers are completely scalable and can be used with any industry-standard I/O from the extensive PC/104 ecosystem. The on-board connectors provide access to 2x SATA, 1x Gigabit Ethernet, 4x USB 2.0, LVDS and VGA video, 2x RS-232 and 2x RS-422/485 serial ports.

FEATURES

- Pico-ITX, PCIe/104 and PCI-104
- AMD, Intel®, Freescale, TI, NVIDIA and VIA
- Mini-PCIe & SIM Card Expansion
- Board features: 2x SATA, 1x Gigabit Ethernet, 4x USB 2.0, LVDS & VGA video, 2x RS-232 and 2x RS-422/485 serial ports
- -20°C to 70°C (-4°F to 158°F), optional -40°C to 85°C (-40°F to 185°F)
- Scalable and compatible with industry standard I/O options
- Multi-vendor support from both Qseven and PC/104
- Custom solutions
- Lifetime warranty
- Free technical support

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Mezzanines and Carriers: Carrier Boards

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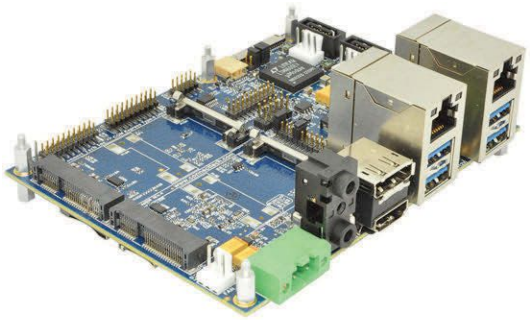
COM Express® Type 6 Carrier Boards

Connect Tech's COM Express® Type 6 Ultra Lite Carrier Board is a unique small carrier which matches the size of a COM Express® Basic module (95 x 125mm), making it ideal for space-constrained applications. Although small in size, the Ultra Lite carrier is also feature-rich and includes Mini-PCIe expansion, Micro SD card, 4x SATA ports, 5 serial ports, 4x USB 2.0/3.0 ports, 2 Gigabit Ethernet, 8-bit GPIO, and LVDS/VGA/HDMI video.

COM Express® Type 6 PMC/XMC Carrier Board is a feature-rich carrier board which offers dual PMC and XMC expansion. Quickly create an application-specific solution by selecting from an extensive range of PMC, XMC or Mini-PCIe add-on cards including wireless, video capture, data acquisition, high speed Ethernet, cellular and user customizable FPGA modules.

The COM Express® Type 6 Ultra Lite and PMC/XMC carrier boards support the latest in high performance processors, including Third Generation Intel® Core™ i7 processors for improved processing power and performance.



FEATURES

- Type 6 and Type 2 compatibility
- PMC, XMC, Mini-PCIe, mSATA expansion
- 125mm x 95mm, for space-restricted use
- 428mm x 190mm, for 1U rackmount use
- Extended temperature, -40 to +85 degrees C
- Custom Design Services

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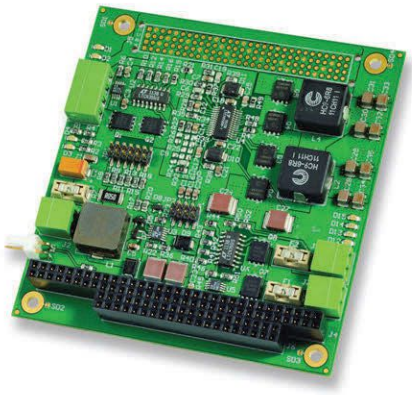
PC/104 DC/DC Modules for Renewable Energy

WinSystems' PC/104 and PC/104-*Plus* highly integrated, power supply modules are built for remote applications requiring renewable power sources. The PS394 series of DC/DC supplies support two inputs from solar panels, wind turbines, or other DC sources. These modules include a controller for battery charging and uninterruptable power supply (UPS) operation making them ideal for applications not able to run off the standard AC power grid.

Available in three standard configurations, each of the modules require only convection cooling for extended temperature operation and do not require a heat sink. For applications such as telemetry, pipelines, outdoor signage, military, transportation, and security, these modules are cost-effective, highly-integrated solutions.



FEATURES

- Dual fused inputs accept solar panel, wind turbine, or other DC sources
- Wide input range: 9V to 32VDC
- Voltage output: +5V @ 10A (other options available)
- UPS operation with battery pack
- MPPT charging supported for solar panels
- Outputs have short circuit/overload protection
- -40° to +85°C operation supported
- Custom configurations available
- Long-term product availability
- Models: PCM-PS394-500, PPM-PS394-533, and ISM-PS394-533

WinSystems, Inc. | 817-274-7553

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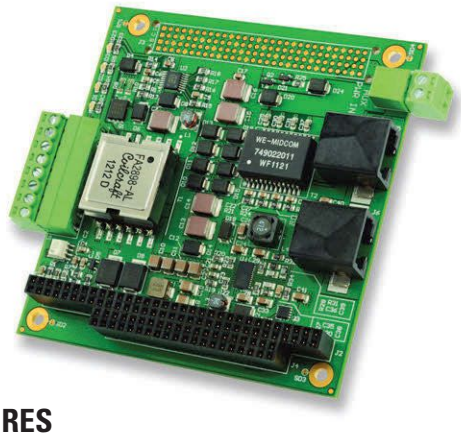
PC/104 POE-PD Power Supply Module

The PCM-PS397-POE-1 is a PC/104 compatible Power over Ethernet Powered Device (POE-PD) DC/DC supply. Configured as either an endpoint or midspan device, it is designed to extract power from a conventional twisted pair CAT 5 Ethernet cable and conforms to the IEEE 802.3af and 802.3at POE standard with two stage class detection.

The PCM-PS397-POE-1 accepts positive or negative polarity power in the 42 – 57VDC range from the RJ45 Ethernet interface. It converts the power to three rails: +5VDC, +12VDC, and -12VDC. These three output power rails are available to the PC/104 and auxiliary output connectors. The PCM-PS397-POE-1 can alternatively take power from an auxiliary input power connector rather than from the Ethernet POE interface. The auxiliary input power range is from 16 – 60VDC.

The PS397 is available in two additional standard configurations and can be customized for OEM applications.



FEATURES

- PC/104 POE Powered Device power supply
- POE input voltage: 42 – 57VDC
- Dual Polarity Power Sourcing Equipment (PSE) supported
- 802.3af/at compliant with support for Class 4 signature
- Auxiliary 16 – 60VDC input supported
- Isolated voltage outputs: +5VDC, +12VDC, and -12VDC
- Line and load regulation ±100mV for all outputs
- -40°C to +85°C fanless temperature operation
- Long-term product availability
- Models: PCM-PS397-POE-1, PPM-PS397-POE-1, and ISM-PS397-POE-1

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Packaging: Power Supplies

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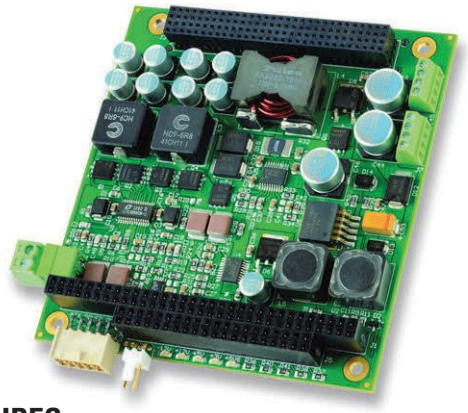
PC/104-*Plus* ATX-compatible DC/DC Power Supply Module



WinSystems' PPM-DC-ATX-P is a DC/DC power supply designed for PC/104, EPIC, and EBX Single Board Computers (SBCs) that support ATX power controls.

Well suited for harsh, rugged environments, it features a wide voltage input range from 10 to 50 volts. The module will operate from 12, 24, or 48 volt battery-operated or distributed DC power systems. It generates five regulated DC output voltages from one common DC input. The PPM-DC-ATX-P can also support software controlled shutdown and power monitoring for SBCs with advanced CPU chip-sets employing sleep modes and active power management.

WinSystems offers this module in three off-the-shelf configurations. All configurations will operate from -40° to +85°C without fans or heat sinks.

FEATURES

- PC/104-*Plus* ATX DC/DC power supply
- Wide 10V to 50VDC input range
- Voltage outputs: +5V, +3.3V, +12V, -12V, and +5VSB
- Power On/Off, Power Good, and +5 VSB supported for power management and sleep modes
- Outputs have short circuit/overload protection
- -40° to +85°C fanless temperature operation
- Custom OEM configurations available
- Off-the-shelf product availability
- Long-term product availability
- Model: PPM-DC-ATX-P

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PC/104: PC/104

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Connect Tech Inc.
Embedded Computing Experts

www.connecttech.com/sub/Products/Xtreme-Multi-IO.asp

Xtreme/Multi-I/O

Connect Tech's Xtreme/Multi-I/O features dual SJA1000 CANbus controllers, isolated serial and CAN ports, and two MultiTech Universal compatible sockets on a single PC/104 board design. This high-density communication board offers an all-in-one communication solution. This innovative product takes full advantage of the latest technologies in jumperless configuration, high-voltage isolation and advanced communication functionality.

On-board FPGA and PIC32 microcontroller facilitate jumperless configuration of the board, with the FPGA providing a full-featured J1708 controller. Xtreme/Multi-I/O includes two galvanic isolated CANbus controllers with 2500V isolation protection and advanced networking and configuration capabilities.

The 4x RS-232 ports and 1x RS-485/J1708 port features 2500V isolation protection and individual +5VDC isolated power supplies, providing less noise and increased system protection. With USB connectivity and jumperless setup, extended operating temperature, and versatile options, Connect Tech's Xtreme/Multi-I/O is ideal for CANbus, serial, wired and wireless communication.

FEATURES

- 2500V isolation protection
- 2x SJA 1000 controllers, 1Mbps
- 4x RS-232/1x RS-485/J1708
- 2x MultiTech compatible sockets
- 5x isolated LEDs, 1x USB
- Extended operating temperature
- Custom solutions
- Lifetime warranty
- Free technical support

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www.peak-system.com

PCAN-PC/104

CAN Interface for PC/104

The PCAN-PC/104 card enables the connection of one or two CAN networks to a PC/104 system. Multiple PCAN-PC/104 cards can easily be operated using interrupt sharing. The card is available as a single or dual-channel version. The opto-decoupled versions also guarantee galvanic isolation of up to 500 Volts between the PC and the CAN sides. The package is also supplied with the CAN monitor PCAN-View for Windows® and the programming interface PCAN-Basic.

FEATURES

- PC/104 form factor
- Multiple PC/104 cards can be operated in parallel (interrupt sharing)
- 14 port and 8 interrupt addresses are available for configuration using jumpers
- Bit rates up to 1 Mbit/s
- Compliant with CAN specifications 2.0A and 2.0B
- Connection to CAN bus through D-Sub slot bracket, 9-pin (in accordance with CiA® 102)
- NXP SJA1000 CAN controller, 16 MHz clock frequency
- NXP PCA82C251 CAN transceiver
- 5-Volt supply to the CAN connection can be connected through a solder jumper, e.g. for external bus converter
- Extended operating temperature range from -40 to 185 °F

PEAK-System Technik GmbH
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E-Mail: info@peak-system.com
Website: www.peak-system.com

www.WinSystems.com

Dual Channel Isolated CAN PC/104 Module

WinSystems' PCM-CAN-2-ISO is built for operation in high-voltage renewable energy, industrial control, or unpredictable transportation applications.

This PC/104 module's high-speed isolated data couplers and power supplies provide 1000V protection between its two CAN controllers and the network interface. Each CAN channel can provide isolated +5VDC power or receive isolated +5 to +12VDC power from the interface for additional flexibility.

This module is offered in four off-the-shelf configurations. The PCM-CAN-2 is a dual channel, non-isolated unit. The PCM-CAN-1 is a single channel, non-isolated unit. The PCM-CAN-1-ISO is a single channel, isolated unit. Special OEM configurations are also available.

FEATURES

- PC/104-compatible Control Area Network (CAN) card
- Compliant with CAN specifications 2.0A (11-bit ID) and 2.0B (29-bit ID)
- Transfer rates to 1 Megabits per second
- Channel-to-channel and channel-to-system isolation
- Onboard isolated 1W power supply for interface
- -40° to +85°C operating temperature
- Software drivers available for Linux and Windows®
- Non-isolated and single channel versions are available
- Long-term product availability

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PC/104: PC/104

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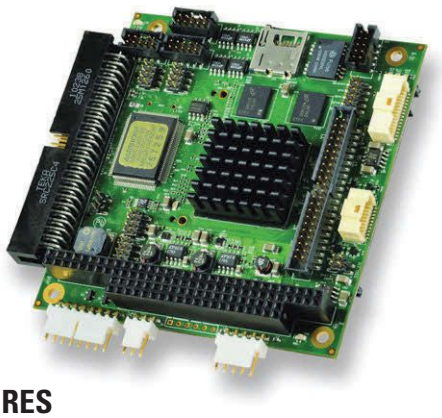
-40° to +85°C PC/104 SBC with Dual Ethernet

The PCM-VDX-2 is a highly-integrated PC/104-compatible Single Board Computer designed for space-limited and low-power applications. It is a full-featured SBC that includes a 1GHz Vortex86DX, 512KB DRAM, and 1MB battery-backed SRAM. I/O support includes two 10/100 Ethernet channels, four USB 2.0 ports and four serial ports. Its low power dissipation permits fanless operation over a temperature range from -40°C to +85°C. This board is well suited for rugged applications requiring excellent processor performance in an embedded PC design.

The PCM-VDX-2 has x86 PC software compatibility, which assures a wide range of tools to aid in your application's program development. It supports Linux, DOS and other x86 operating systems. WinSystems provides technical phone support to assist customers with system integration of our SBCs and I/O modules in their designs.



FEATURES

- Fanless 1GHz Vortex86DX processor
- Two 10/100 Mbps Ethernet controllers
- Four USB 2.0 ports with overcurrent protection
- Four serial RS-232/422/485 channels with FIFOs
- 16 digital I/O lines with event sense
- LPT, PS/2 keyboard and mouse support
- CompactFlash and PATA supported
- MiniPCI and PC/104 expansion connectors
- -40°C to +85°C operating temperature
- Model: PCM-VDX-2

WinSystems, Inc. | 817-274-7553

Contact: Info@WinSystems.com
Twitter: WinSystemsInc • **Facebook:** WinSystemsInc
LinkedIn: WinSystems, Inc.

PC/104: PC/104-*Plus*

smallformfactors.com/p9910403

PEAK® System

www.peak-system.com

PCAN-PC/104-*Plus*

CAN Interface for PC/104-*Plus*

The PCAN-PC/104-*Plus* card enables the connection of one or two CAN networks to a PC/104-*Plus* system. Up to four cards can be operated with each piggy-backing off the next. The CAN bus is connected using a 9-pin D-Sub plug on the slot bracket supplied. The card is available as a single or dual-channel version. The opto-decoupled versions also guarantee galvanic isolation of up to 500 Volts between the PC and the CAN sides. The package is also supplied with the CAN monitor PCAN-View for Windows® and the programming interface PCAN-Basic.

FEATURES

- PC/104 form factor
- Use of the 120-pin connection for the PCI bus
- Up to four cards can be used in one system
- Bit rates up to 1 Mbit/s
- Compliant with CAN specifications 2.0A and 2.0B
- Connection to CAN bus through D-Sub slot bracket, 9-pin (in accordance with CiA® 102)
- NXP SJA1000 CAN controller, 16 MHz clock frequency
- NXP PCA82C251 CAN transceiver
- 5-Volt supply to the CAN connection can be connected through a solder jumper, e.g. for external bus converter
- Extended operating temperature range from -40 to 185 °F

PEAK-System Technik GmbH
Phone: +49 (0) 6151-8173-20 • Fax: +49 (0) 6151-8173-29

E-Mail: info@peak-system.com
Website: www.peak-system.com

PEAK System

www.peak-system.com

PCAN-PC/104-*Plus* Quad

Four-Channel CAN Interface for PC/104-*Plus*

The PCAN-PC/104-*Plus* Quad card enables the connection of four CAN networks to a PC/104-*Plus* system. Up to four cards can be operated with each piggy-backing off the next. The CAN bus is connected using a 9-pin D-Sub plug on the slot brackets supplied. There is galvanic isolation of up to 500 Volts between the computer and CAN sides. The package is also supplied with the CAN monitor PCAN-View for Windows® and the programming interface PCAN-Basic.

FEATURES

- PC/104 form factor
- Use of the 120-pin connection for the PCI bus
- Up to four cards can be used in one system
- Bit rates up to 1 Mbit/s
- Compliant with CAN specifications 2.0A and 2.0B
- Connection to CAN bus through D-Sub slot brackets, 9-pin (in accordance with CiA® 102)
- NXP SJA1000 compatible CAN controller (FPGA implementation)
- NXP PCA82C251 CAN transceiver
- Galvanic isolation on the CAN connection up to 500 V, separate for each CAN channel
- 5-Volt supply to the CAN connection can be connected through a solder jumper, e.g. for external bus converter
- Extended operating temperature range from -40 to 185 °F

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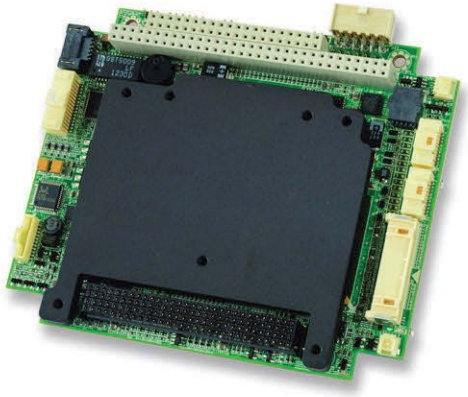
E-Mail: info@peak-system.com
Website: www.peak-system.com

WinSystems®
An Employee-Owned Company

www.WinSystems.com

Extended Temperature Intel® Atom™ PC/104-*Plus* SBC



WinSystems' PPM-C393, featuring high-integration with PC/104-*Plus* expansion, provides a flexible and cost-effective solution for demanding embedded applications. This combination provides designers access to the low power performance of Intel Atom processors and to the thousands of PC/104, PC/104-*Plus*, and PCI-104 modules available worldwide.

It is well suited for new applications and for upgrading existing designs. The PPM-C393's -40ºC to +85ºC operation and low power opens up applications such as security, Mil/COTS, medical, transportation, data acquisition, and communications in a small, rugged, form factor proven in these industries.

It supports Linux, Windows®, and other x86-compatible real-time operating systems.

FEATURES

- 1.66GHz N455 Intel® Atom™ CPU
- Up to 2GB of DDR3 SODIMM supported
- Simultaneous LVDS and CRT video
- Intel Gigabit Ethernet controller
- Four serial COM ports (two RS-232, two RS-232/422/485)
- Eight USB 2.0 ports with polyfuse protection
- SATA (2.0) channel and CompactFlash supported
- Runs Linux, Windows® and other x86 operating systems
- Long-term product availability
- Model: PPM-C393

WinSystems, Inc. | 817-274-7553

Contact: Info@WinSystems.com
Twitter: WinSystemsInc • **Facebook:** WinSystemsInc
LinkedIn: WinSystems, Inc.

PC/104: PCI/104-Express

smallformfactors.com/p9910449

Connect Tech Inc.

Embedded Computing Experts

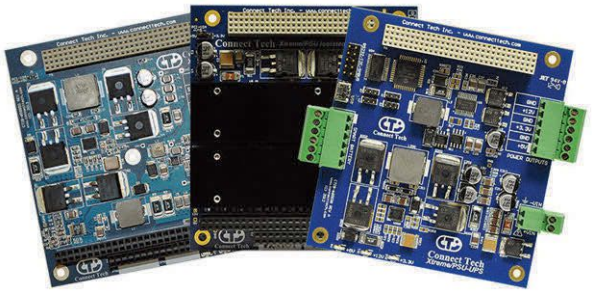
www.connecttech.com/sub/Products/power-supply-solutions.asp?l1=PSU

Power Supplies (Xtreme/PSU, Xtreme/PSU-XP, Xtreme/PSU-UPS)

Connect Tech's Power Supplies are high efficiency, high powered PC/104 form factor power supply solutions with extended temperature capabilities and directly power all of the PC/104 family expansion buses such as PC/104, PC104-*Plus*, PCI-104, PCI/104-Express and PCIe/104. Built and specifically designed for use in a broad range of rugged applications, Connect Tech's Power Supplies are suitable for military, industrial, as well as air and ground vehicles.

Choose from a number of power supply options offering wide input ranges and up to 195W of output power all designed with advanced protection features to withstand the harshest environments. Additional options include isolation and smart charging UPS solutions.

All Connect Tech power supplies are built using current components allowing our power supplies to fully meet the PC/104 standard as well as operate without a heat sink.



FEATURES

- Wide input voltage ranges, from -6V to +36V DC
- Up to 195W of total output power
- Meets PC/104 component height requirements
- Uses latest generation highest efficiency power controllers, inductors, and MOSFETs
- Oversized MOSFETs for improved thermal performance (heat sinking not required)
- Extended Operating Temperature , -40 to +85 degrees C
- Custom solutions
- Free technical support

Connect Tech Inc. | 519-836-1291 | 800-426-8979

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PC/104: PCI/104-Express

smallformfactors.com/p9910405

PEAK System

www.peak-system.com

PCAN-PCI/104-Express

CAN Interface for PCI/104-Express

The PCAN-PCI/104-Express card enables the connection of one or two CAN networks to a PCI/104-Express system. Up to three cards can be stacked together. The CAN bus is connected using a 9-pin D-Sub plug on the slot bracket supplied. The card is available as a single or dual-channel version. The opto-decoupled versions also guarantee galvanic isolation of up to 500 Volts between the PC and the CAN sides. The package is also supplied with the CAN monitor PCAN-View for Windows® and the programming interface PCAN-Basic.

FEATURES

- PCI/104-Express card, 1 lane (x1)
- PC/104 form factor
- Up to 3 cards can be used in one system
- Bit rates up to 1 Mbit/s
- Compliant with CAN specifications 2.0A and 2.0B
- Connection to CAN bus through D-Sub slot bracket, 9-pin (in accordance with CiA® 102)
- NXP SJA1000 CAN controller, 16 MHz clock frequency
- NXP PCA82C251 CAN transceiver
- 5-Volt supply to the CAN connection can be connected through a solder jumper, e.g. for external bus converter
- Extended operating temperature range from -40 to 185 °F

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Phone: +49 (0) 6151-8173-20 • Fax: +49 (0) 6151-8173-29

E-Mail: info@peak-system.com
Website: www.peak-system.com

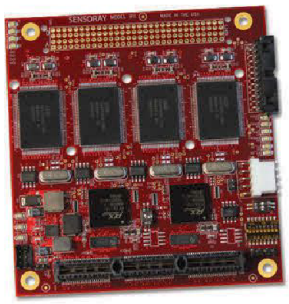
SENSORAY
embedded electronics

www.sensoray.com

Sensoray Model 911, PCI/104-Express 4-Channel Frame Grabber with Audio Capture

Designed and manufactured in the USA, the Sensoray Model 911 PCI/104-Express 4-Channel Frame Grabber with Audio Capture simultaneously captures four channels of analog video and four channels of stereo audio. It captures raw video frames from each channel at up to full frame rate, resulting in an aggregate frame capture rate of up to 120 FPS for NTSC and 100 FPS for PAL. The high frame capture rate, through two x1 links of PCIe bus interface, makes it well-suited for applications that require uncompromised capturing of multiple video sources in a compact form factor, such as remote video surveillance and traffic monitoring.

The board's PCI/104-Express connectors support both stack-up and stack-down, and its full conformance to the PCI/104-Express specification guarantees that it won't mechanically interfere with adjacent boards.



FEATURES

- 4 input channels: 4 NTSC/PAL composite/S-Video + 4 stereo audio
- Simultaneously captures full frame rate video on all channels; up to 120 FPS for NTSC and 100 FPS for PAL
- Captures raw RGB or YUV video
- 4 general-purpose digital I/O signals are provided for controlling cameras and illumination sources, alarm signal monitoring and can be configurable as inputs or outputs
- Supports both stack-up and stack-down
- SDKs for both Windows and Linux

Sensoray Co., Inc. | 503-684-8005

Contact: sales@sensoray.com
www.sensoray.com/products/911.htm

PC/104: PCIe/104

smallformfactors.com/p9910321

Embedded Solutions™

www.adl-usa.com

ADLQM67PC – Intel® Core™ Processor Performance, Dual and Quad Core

The ADLQM67PC is a stackable PC/104-based form factor SBC utilizing second generation Intel® Core™ processors, codename Sandy Bridge. This small, highly-rugged form factor is ideal for applications where ruggedness and processor performance are critical. It brings unparalleled performance to applications such as radar and sonar processing, image signal processing, tactical command and control, surveillance and reconnaissance, transportation and railway. The stackable nature of this SBC form factor coupled with a large ecosystem of stackable peripherals make this a perfect solution for a broad variety of transportation applications with evolving or variable specification requirements.

FEATURES

- Second generation Intel® Core™ processors in dual and quad core variants.
- Board is drop-in compatible with future third generation Intel Core processors, codename Ivy Bridge.
- Extended temperature -40ºC to +85ºC available.
- Broad portfolio of alternate PC/104 SBCs based on Intel® Atom™ processors Z510/Z530, D525 and N2600, Intel® Pentium® M, Intel® Core™ Duo, Intel® Core™ 2 Duo processors 2nd and 3rd generation Intel Core processors, and the Mobile Intel® GS45 Express chipset.
- Peripheral possibilities include: GSM, WLAN, WWAN, GPS, 3G cellular, storage drives, power supplies and many more functions including custom board services for specialty applications.
- Small stack footprints ranging from 95mm x 96mm for Intel Atom processors to 96mm x 115mm for Intel Core processors.
- **Custom enclosures can be designed!**

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PC/104: PCIe/104

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Sundance Multiprocessor Technology
embedded signal processing solutions

www.PCI104.biz

ICE105: Embedded I/O Programmable System

SUNDANCE is a worldwide supplier and manufacturer of industrial-class **PCIe/104** digital signal processing (DSP), configurable small form factors and **COTS** embedded systems.

The **ICE105** is a **rugged** system built around a complete range of PCIe/104 small form factor, stackable **I/O-configurable** and **programmable** solutions compatible with our wide range of mezzanine cards including:

- *Multichannel A/D for high-resolution Radars*
- *High-speed D/A converters for Arbitrary Waveform Generators*
- *2.3-5GHz RF Front-ends for Wireless applications*
- *Multi-gigabit Ethernet for Network communications*
- *GigE, Camera-Link, DVI transceivers for Vision systems.*

FEATURES

The new range **ICE** small form factor systems for the PC/104 form factor modules features:

- *Light weight*
- *Rugged enclosure*
- *Anti-shock with vibration isolator*
- *Up to IP67 water-tight seal*
- *Extended industrial-grade temperature*

The **ICE enclosure** is the best hosting solution to integrate your **Series-1** platforms in harsh environments found in **Industrial, Military, Avionics and Transportation applications.**

For more information, please visit:
www.PCI104.biz or **www.SUNDANCE.com**

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Contact: pci104@sundance.com

SBCs and Boards: Other SBCs and Boards

smallformfactors.com/p9910364

DIAMOND SYSTEMS

www.diamondsystems.com/products/athenaiii

Athena III PC/104 Single Board Computer

Athena III is the newest incarnation of Diamond's highly popular Athena embedded SBC series, bringing you latest generation embedded computing and I/O technologies in a popular, compact form factor. Athena III provides CPU and data acquisition integrated onto a single board, giving you state-of-the-art, rugged performance in a highly compact form factor with PC/104 expansion.

Standard Diamond rugged features include soldered on-board memory, full -40°C to +85°C operating temperature, and fanless cooling. Athena III can be customized for increased ruggedness. Options include latching connectors, hardwired configuration settings, rugged heat sink mounting, conformal coating, and BIOS modifications. Special order options include 1.6GHz E680T CPU, and 2GB of on-board DRAM.

FEATURES

- 1GHz Intel Atom E-Series CPU with 1GB memory soldered on board
- 1 Gigabit Ethernet
- VGA CRT and LVDS LCD display support
- 1 SATA port for hard drive
- 4 RS-232/422/485 serial ports; 4 USB 2.0 ports
- PS/2 keyboard & mouse
- 24 programmable digital I/O lines
- PC/104 ISA expansion bus
- -40°C to +85°C operation
- 16 analog inputs, 16-bit A/D
- 150KHz max sampling rate
- Interrupt-based A/D sampling with 512 FIFO
- Programmable input ranges
- 4 analog outputs, 12-bit D/A
- 2 programmable counter/timers
- Supported by Universal Driver software

Diamond Systems Corporation | 650-810-2500

Contact: sales@diamondsystems.com

www.icoptech.com/pddetail.aspx?id=171&pid=4

800MHz VMXP-6453 PC/104 SBC

The VMXP-6453 SBC is based on the Vortex86MX System-on-Chip (SoC), an x86-based processor designed for embedded and industrial applications. At 800MHz, this low-power SBC draws 920mA at 5VDC. The SBC's soldered-on DDR2 RAM, fanless design, low-profile heat-sink that meets the PC/104 stacking specification, along with the integrated Video/LCD, Ethernet, Audio, USB 2.0, serial ports, Parallel, IDE storage, GPIOs, PWM, keyboard/mouse and RTC, provides the ideal hardware platform to develop broad range of device for the industrial-automation, medical and retail markets. This SBC supports popular modern embedded OSs such as Linux, Windows Embedded Compact 7, Windows CE, Windows XP Embedded and WES 2009. Support is also available for legacy applications running on older versions of Linux, Windows and DOS.

FEATURES

- 800Mhz Vortex86MX CPU, L1 and L2 Cache, 512MB or 1GB RAM
- Integrated VGA/LCD, 10/100 Mbps LAN, 3 Serial, Parallel, 4 USB 2.0 and Audio
- Soldered-on system memory (available in 512MB and 1024MB)
- Onboard bootable flash storage (option: 512MB, 1GB, 2GB or 4GB)
- Two watchdog timer, 16-bit GPIO configurable to function as PWM
- Single 5VDC @ 920mA
- -20°C to +85°C industrial operating temperature range
- Support available for Windows XP, Windows XP Embedded, Windows Embedded CE 5.0/6.0, Linux and popular RTOSs

ICOP Technology, Inc. | 626-444-6666
12328 Valley Blvd #B • El Monte, CA 91732

Contact: info@icoptech.com
Datasheet: www.icoptech.com/DB/upload/sheet/6453_datasheet.pdf

www.micro-technic.com/sbc2800

SBC-2800

Micronix SBC-2800 is a Single Board CPU module based on Atmel's AT91SAM9260 microcontroller.

A combination of a power supply/charger for an external Li-Ion battery, a GSM/GPRS modem, a GPS receiver and analog and digital I/O makes this module very useful in many standalone applications. SBC-2800 uses Telit's GE863-GPS with a quad band (900/950/1800/1900MHz) cellular engine and a SiRFstarIII™ single chip GPS receiver. The modem is controlled by AT commands, supported by an on-board UART, and is fully compatible with the AT command set.

The power supply can be backed-up by an external Li-Ion battery. Built-in charger will insure that the battery is fully charged. 16 isolated analog (±10V or 0-2.0V) inputs and 16 digital I/O channels. It is ideal for data logging and alarm systems, and withstands extended temperatures, shock and vibration of mobile equipment.

Online demo: www.micro-technic.com/2800

FEATURES

- **Multipurpose SBC module including:** ARM9 CPU, 180MHz, Linux bootloader, support for microSD Flash
- **Communication:** GSM/GPRS modem (quad-band), GPS receiver, GPS data via AUX port
- 8-50V power supply integrated; power supply, UPS circuitry, battery charger for Li-Ion
- Data accquisition and control I/O, 16 isolated 24-bit A/D ch, 16 isolated digital I/O
- **USB connectivity:** 2x USB host and USB device, wide temperature range: -20° to +70°C
- **Applications:** vehicular data logging; track, control and monitor everything that moves
- Also available as a box solution – Nanobird MS-2800

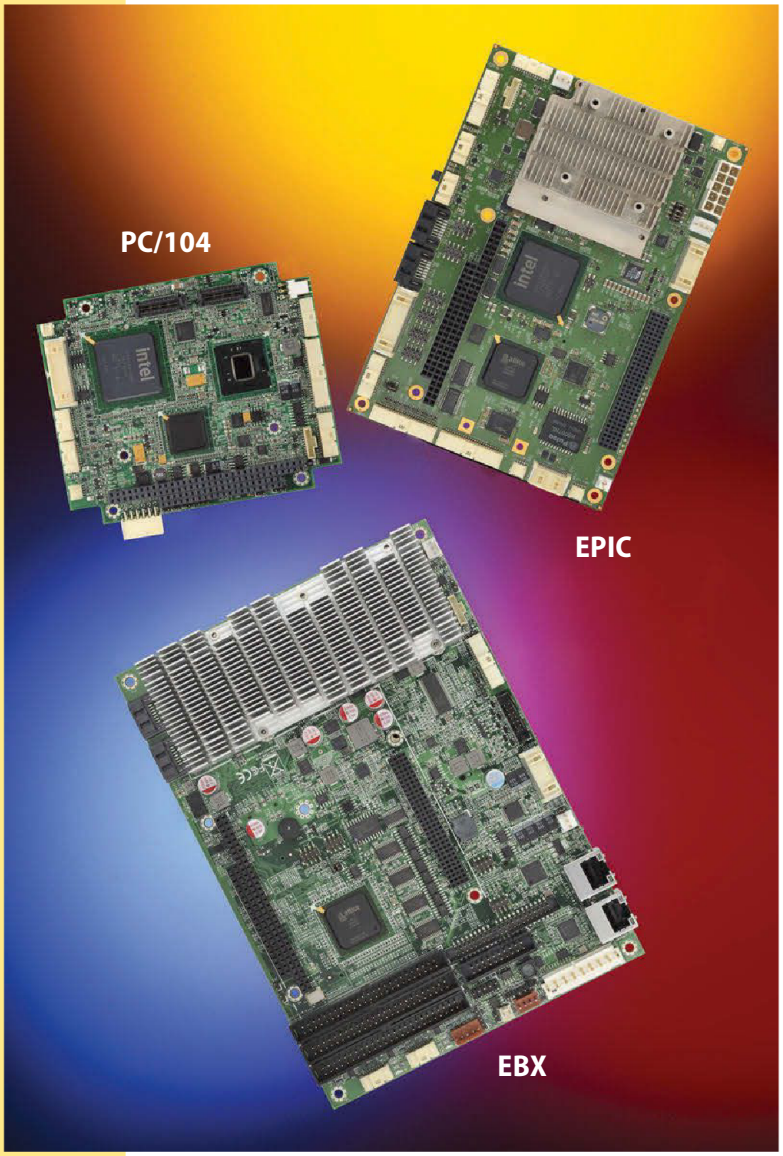
Micro Technic A/S | +45 6615 3000

Contact: sales@micro-technic.com
http://www.linkedin.com/company/micro-technic-a-s

Atom™ Powered SBCs
High-Performance, Small and Fanless

For your next design, select rugged WinSystems' single board computers powered with single- or dual-core Intel® Atom™ processors. Our Industry Standards-based SBCs have a wealth of onboard I/O, plus expansion capabilities.

- Long-life Intel® Atom™ CPUs
- Simultaneous VGA and LVDS Video
- Gigabit Ethernet Port(s)
- Eight USB 2.0 Ports
- Four Serial Ports
- SATA and CompactFlash Interface
- Digital I/O with Event Sense
- -40°C to +85°C Operation
- Outstanding Technical Support
- Industry Standard Platforms
  - PC/104 – 3.6 x 3.8 inches
  - PC/104-*Plus* – 3.6 x 3.8 inches
  - SUMIT-ISM™ – 3.6 x 3.8 inches
  - EPIC – 4.5 x 6.5 inches
  - EBX – 5.75 x 8.00 inches
- Software Support: Windows®, Linux, and x86-compatible RTOS



Our SBCs are the right choice for industrial, pipeline, communications, transportation, medical, instrumentation, and MIL/COTS applications.

Go to WinSystems' SBC Selection Guide at **www.WinSystems.com/SBCsPC**

Ask about our evaluation program.

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