ADLINK
Leading EDGE COMPUTING

Technical Article

As Industry 4.0 evolves:
Why choose SMARC® for your smart factory project?



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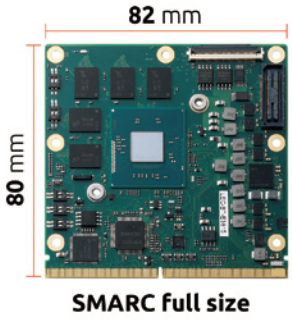
Introduction

Over the last decade X86 technology based platforms have dominated the industrial market. They have proven to be reliable and to perform well from small single core systems to big multicore servers. While using mostly Linux-based OS architectures the widely standardized hardware has enabled a huge ecosystem of software and middleware. Computing efficiency has significantly increased and technologies like speed-step and burst can help to further decrease power consumption without compromising in performance.

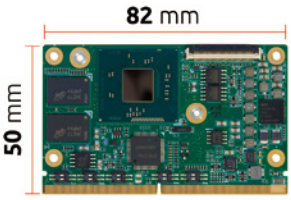
Over the years the main challenges in industrial computing have shifted from hardware to software. Demands are highest in the areas of quality, reliability and time-to-market. Computer-on-Modules (COMs) simplify the use of embedded technology by employing pre-integrated, ready-to-use platforms. By using COM boards, companies can focus on their core competencies which local, custom-built carrier boards can interface with remote sensors, actuators and entire machines using IPs in algorithms and machine interfaces, reducing the the needs for technicians to leave their local sites. Specific challenges of today's highly integrated computing systems like high-speed capable layout routing, costly HDI (High-Density Interconnect) manufacturing technology, and tedious OS integration can be outsourced to an experienced COM supplier. The application-ready modules themselves can be arbitrarily scaled to the specific demand and updated/upgraded when needed without immoderate integration efforts.

What is the right COM Standard for today's industrial demands?

The top three up-to-date standards for COM standards supporting X86 architecture are COM Express, Qseven and SMARC. While all three standards offer space and power saving advantages, the SMARC standard may provide the optimum for most contemporary systems. COM Express with its high pin count and multiple layout types fits many high-end applications very well. Even its "compact" form factor requires no less than 95 by 95 mm² in space. However, with today's power saving CPUs, in most of the cases, neither the higher power envelope of more than 15 Watts nor the big number of PCI express lanes (up to 32!) of the COM Express standard is required for most industrial applications.



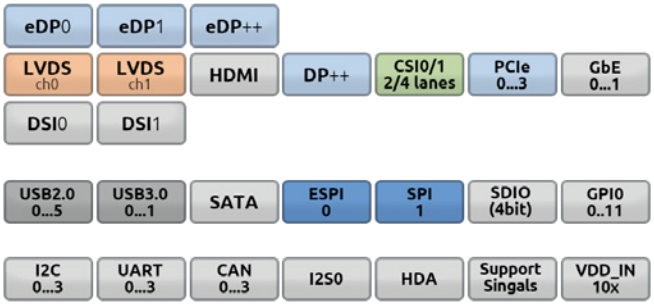
SMARC full size



SMARC short size

SMARC with 82 by 80 mm² (Full Size) and 82 by 50 mm² (Short Size) as well as Qseven with 70 by 70 mm² (Standard) and 70 by 45 mm² (Compact) demand significantly less space than the typically used "basic" and "compact" formats of COM Express. The "mini" COM Express format would be conveniently small (84 by 55 mm²) however this size today is only used for Type 10 modules which have significantly feature limitations like only single channel LVDS and fewer less interfaces in general because they only come with one single 220 pin connector.

SMARC and Qseven use MXM edge connectors which offer cost benefits and enable a smaller total height of the module/baseboard combination. The saved extra space can be used for bigger passive cooling interfaces, which are mandatory for robust industrial devices. While both standards work with about the same power envelopes of up to 15 Watts, SMARC comes with a significant advantage for industrial applications: Its MXM3 connector has with its 314 pins about 40% more pins available than the 230-pin MXM2 connector used by Qseven to route signals from the COM to the interface baseboard.



So there are more (industrial) interfaces available with SMARC COMs. Most significantly, there are extra software definable pins (SDP) to enable direct hardware support for Precision Time Protocol (PTP) over Ethernet (IEEE 1588 Precision Time Protocol). This is a big plus for most time-sensitive applications and pays well for the minimal price difference to Qseven. From the beginning, SMARC was designed for industrial applications and for use with industrial busses, while Qseven was more intended to be a compact generic and multimedia platform. SMARC also offers more display interfaces than Qseven, to better support the evolution of graphics capabilities.

SMARC - The right choice for low power Industry 4.0 computing

SMARC is a proven standard, based on reliable technology. It offers many industrial interfaces natively on the module, and custom interfaces can be quickly and easily designed into a carrier board. This way, support are long-term available and perfectly scalable and upgradeable with a simple module exchange and with no need to redesign the peripherals. The devices are extremely compact in size and work in most cases, with passive cooling. With these benefits SMARC module based solutions cover most of the requirements of the factory of the future: Quickly to implementation, standardization, small size, widely scalable design, low power, power-efficiency and future-proof upgradability.

X86 on SMARC: Tailored for Smart Factory computing tasks

ADLINK's LEC-AL SMARC 2.0 modules comes in the ultra - compact 82 by 50 mm² (Short Size) format, which fits into literally any case. The available CPUs are based on the 14nm Intel® Atom™E3900 series platform with corresponding updated technologies and scale from a dual core Atom™ E3930 with up to 1.8 GHz and HD500 Graphics to a quad core Pentium® N4200 with up to 2.5 GHz and HD505, and Graphics. The 12 (HD500) respectively 18 (HD505) execution units can drive three independent displays with resolutions of up to 3840 x 2160 (HDMI), and respectively 4096 x 2160 pixels (DP++) with up to 60 Hz. Dual channel LVDS with 18/24 bit is available, too. DirectX 12, Open GL4.2 and a variety of HW-accelerators including latest H.265 decoders ensure smooth video performance. For camera inputs, two MIPI-CSI interfaces with 4/2 lanes are available. The GPUs also support OpenCL1.2 for powerful parallel computing, e.g. for fast motion calculation in production robots.

The Configurable Thermal Power Dissipation (cTDP) ranges from 6 to 12 Watts and specific heat spreaders as well as active and passive cooling solutions are available from ADLINK for requested power consumptions. The operating temperature range is from -40°C to +85°C with the Atom modules, Pentium and Celeron® modules feature an operating temperature ranges from 0°C to 60°C. Off-the-shelf configurations of the LEC-AL are equipped with 2, 4, or 8 GB of DDR3L memory and 8 or 32 GB eMMC. The required single 3.0 V~5.25 V DC supply voltage can be found in any industrial device; the low power demand of less than 15W (depending on chosen processor) can be easily run or buffered with batteries. The built-in 1x 10/100/100 Gigabit Ethernet interface uses Intel I210 AT/IT controllers and supports IEEE1588 trigger signals for Precision Timing Protocol.



IEEE 1588 PTP (Precision Time Protocol) function in the Smart factory

Quick time to market by pre-integration

ADLINK's built-in Smart Embedded Management Agent (SEMA) controller offers various remote and analysis interfaces. To further shorten time-to-product ADLINK offers its brand new LEC-Starterkit 2.0 which contains a SMARC 2.0 compliant LEC-BASE 2.0 carrier board, a 7"-LCD display, display cables, SD card and USB Stick, ATX power supply, and power cords. Just add a LEC-AL module, your cooling solution of choice, and a Board Support Package (BSP) for the preferred Operating System and you are set to develop your applications, resolving the challenges of Industry 4.0. Standard Operating Systems with application-ready, pre-integrated BSPs including Windows 10 IoT Enterprise, Windows 10 IoT, Core and Yocto Linux, VxWorks, and Android BSPs are available on request.



Long life and highest quality for industry demands

ADLINK is one of the few embedded companies who not just design but also manufacture theirboards themselves. Decades of experience in manufacturing as well as direct access and control over all processes and technologies result in significant advantages compared to other vendors. Customers profit on superior quality with long life even under harsh industrial conditions at production sites. Together with Long range availability of the products and reliable support, this results in lower total cost of ownership (TCO).

On Top, custom carrier boards can be designed and manufactured as a service. ADLINK offers the entire development of SMARC carrier boards for various form factors, including full custom designs and system integration – from concept to volume production. ADLINK's many years of development experience and extensive expertise in the area of Computer-on-Modules and carrier board development are the guarantee for delivery of highest quality within a very short time.

Join the winners: SMARC, X86 and ADLINK

SMARC is a great standard for industrial automation. It supports an overall power consumption of up to 15 Watts, is extremely compact, widely scalable, and features most onboard interfaces. LEC-AL is the perfect solution for entry and standard level modular industrial solutions. Latest Intel processors, X86 architecture and a choice of pre-integrated operating systems keep time-to-market low to quickly follow the challenges of today's factory projects with Industry 4.0. ADLINK is one of the inventors of SMARC and has thorough experience with embedded computing boards. This builds a strong team and makes LEC-AL and SMARC the right choice for your company's success.

About ADLINK

ADLINK Technology is leading edge computing with solutions that drive data-to-decision applications across industries. ADLINK offers a variety of building blocks and both generic and market-specific Industrial Internet of Things (IIoT) platforms to serve the automation, communications, medical, transportation, and defense/government verticals. Our products include motherboards, blades, chassis, modules, gateways, systems, and end-to-end solutions based on industry standard form factors, as well as an extensive line of test & measurement products and smart touch computers, displays, and handhelds that support the global transition to always connected systems. Many products are Extreme Rugged™, supporting extended temperature ranges, shock and vibration.

ADLINK is a Premier Member of the Intel® Internet of Things Solutions Alliance and is active in several standards organizations and interoperability initiatives, including PCI Industrial Computer Manufacturers Group (PICMG), PXI Systems Alliance (PXISA), Standardization Group for Embedded Technologies (SGeT), European Telecommunications Standards Institute (ETSI), and Open Compute Project (OCP).

ADLINK is a global company with a local touch. Headquartered in Taiwan, ADLINK offers manufacturing in Taiwan and China; R&D and integration in the US, Germany, Taiwan and China; an extensive network of worldwide sales and support offices; and a continually expanding partner ecosystem. ADLINK is ISO-9001, ISO-14001, ISO-13485 and TL9000 certified and is publicly traded on the TAIEX Taiwan Stock Exchange (stock code: 6166).

ADLINK SMARC® 2.0 Selection Guide

LEC-AL



SMARC® 2.0 Short Size Module with Intel® Atom E3900 Series, Pentium™ N4200 or Celeron™ N3350 Processor

CPU	Intel® Atom™ E3900 Series or Pentium® N4200 or Celeron® N3350 Processor SoC
Memory	Up to 8 GB DDR3L at 1867 MHz
Graphics Features	DirectX 12, OpenGL 4.2, OpenCL 1.2
Integrated Graphics	9th generation Intel® graphics core architecture, supports 3 independent displays 4K graphic resolution
LAN	Intel® i210IT MAC/PHY 10/100/1000 GbE
USB	1x USB 3.0 OTG, 1x USB 3.0 host, 1x USB 2.0 OTG, 5x USB 2.0 host
Serial ATA	1x SATA 3.0 (6 Gbit/s), 1x SDIO/SD, Onboard eMMC
PCI Express	4x PCIe x1
Power Supply	Module Input Voltage: 3.00 ~ 5.25V Power Pins: 10 pins, 5A at 3V Typical IO Voltage: 1.8V
Operating Temperature	0°C to +60°C -40°C to +85°C
Operating Systems	Windows 10 IoT Enterprise, Windows 10 IoT Core, Yocto Linux

LEC-Starter Kit 2.0



Starter kit for SMARC 2.0 modules

Features	• SMARC 2.0 compliant LEC-BASE 2.0 carrier board • SD card and USB stick • LVDS display • ATX power supply, US power cord, EU power cord
Items	• SMARC 2.0 compliant LEC-BASE 2.0 carrier board • 7” LCD TFT LVDS display and cables • SD card, 4GB SDHC Card (Class 10) • USB stick (8GB USB2.0 flash drive) • ATX power supply, 300W • US power Cord 10A, 125V • EU power cord 220V
Optional Items	• LEC-AL module • Heatspreader

Note: All specifications are subject to change without further notice.

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