

QSEVEN'S SECRET FORMULA FOR LONGEVITY

POSSIBILITIES START HERE

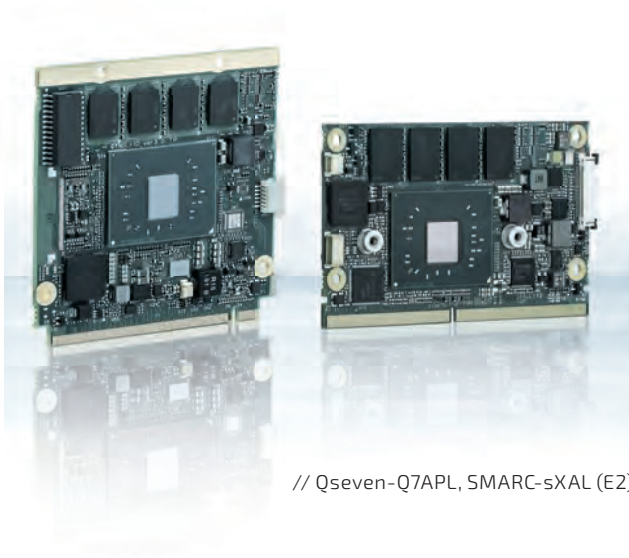


kontron
S&T Group

EXECUTIVE SUMMARY:	// 4
QSEVEN CONTINUES TO DEMONSTRATE VALUE	
INTRODUCTION:	// 4
SMALL FORM FACTOR COMS IN BIG DEMAND	
WHICH SMALL COM FORMAT?	// 4
THE CHOICE IS YOURS	
QSEVEN: GAME CHANGERS	// 4
QSEVEN: LATEST PROCESSOR SOLUTIONS	// 4
QSEVEN: DESIGN BENEFITS AND APPLICATIONS	// 4
KONTRON: AT THE FOREFRONT OF QSEVEN COM SOLUTIONS	// 4
MAXIMIZING SECURITY - APPROTECT	// 4
KONTRON AND QSEVEN: VALUE ADDED	// 4
SUMMARY	// 4



A decade since its inception, the popularity of SGET's Qseven small form factor architecture for Computer-on-Module shows no sign of fading. With new Intel and ARM processor Qseven modules on the market there are more good reasons why developers and users should stick to an architecture they know and trust.



// Qseven-Q7APL, SMARC-sXAL (E2)

EXECUTIVE SUMMARY: QSEVEN CONTINUES TO DEMONSTRATE VALUE

Qseven is well-proven as one of the embedded computing's most established and reliable form factor architectures for small Computer-on-Modules (COMs). Many legacy programs continue to opt for Qseven modules for upgrades or tech refreshes: For many applications it simply isn't cost-effective, practical or technically necessary to replace it for the promise of a higher performing form factor.

Existing users, already in possession of carrier boards, power supplies and displays for their embedded products can be assured of a straightforward upgrade path, taking advantage of the latest x86 and ARM

processors supported. At the same time, availability of the latest Qseven modules from large global embedded manufacturers such as Kontron allows those completely new to this form factor to enjoy a seamless experience.

Ratified by SGET (Standardization Group for Embedded Technologies) in 2008, Qseven's extensive and long-established ecosystem has been the key to its longevity. It offers designers and users considerable flexibility on development time and cost savings when it comes to design options, avoiding the need for architectural redesigns and replacement of existing specialized Qseven boards.

In this arena, where reliability and technology familiarity are perhaps the most important factors, Qseven continues to survive and thrive as a trusted platform. Based on market reports, Qseven technology is predicted to be in significant demand for many years to come, ensuring it remains one of the most popular industry standard 'credit card size' formats on the market.

This white paper considers the reasons behind Qseven's ongoing success and why, despite the emergence of SMARC and the ubiquitous presence of the Internet of Things (IoT), it still has much to offer developers and end user customers contending with the unique challenges presented by small embedded systems design.

In addition, the most recent Qseven technology developments are discussed including the introduction of Kontron's new Qseven product line and the benefits of comprehensive worldwide support.

INTRODUCTION: SMALL FORM FACTOR COMS IN BIG DEMAND

The many advantages of adopting COMs for building embedded applications are widely understood and accepted by system developers. Compared to total custom designs, they can offer a faster, more flexible and scalable approach, reducing development costs and time to market.

As part of this, industry requirements for standardized small form factor COMs are rising dramatically. This is due to meeting the continuing demands of mobile device makers and also the rapidly growing pull from the Internet of Things (IoT), and its industrial counterpart, the IIoT. Here, edge- and fog-based computing applications are often reliant on devices and sensors being deeply embedded in remote, harsh, space constrained environments.

Out of necessity, therefore, this special breed of COM must not only be very small, thin and lightweight, but also robust and low in power consumption. At the same time it must have sufficient space to accommodate the necessary processors and memory while offering multiple interface options for peripherals, connectivity, graphics, camera, audio, and more.

KEY GROWTH SECTORS FOR SMALL FORM FACTOR COMS:

- ▶ Factory floor
- ▶ Oil & Gas exploration
- ▶ Transportation
- ▶ Medical
- ▶ Infotainment

The more youthful SMARC (Smart Mobile Architecture) format undoubtedly has much to offer when starting with completely new, non-legacy applications. However, Qseven provides customers with maturity and continuity with a large, diverse installed base and loyal developer 'ecosystem'. These factors, combined with the release of Version 2.1 in 2016 and recent availability of the first of a new wave of processor options, demonstrates Qseven still has plenty to offer developers for many years to come.

WHICH SMALL FACTOR COM? THE CHOICE IS YOURS

Developers and designers have three modular, scalable, industry standard small format COMs to choose from. Qseven was launched in 2008, COM Express Mini in this specification in 2010, and SMARC in 2013. However, those focused on both x86 and ARM-powered applications will most likely use Qseven or SMARC over COM Express Mini which is just x86 based. Furthermore, their flat edge connectors allow much slimmer designs.

FORM FACTOR	PINS	SIZE	AREA	AREA/PIN
SMARC small	314	82 x 50 mm	4100 mm ²	13,06
SMARC full	314	82 x 80 mm	6560 mm ²	20,89
Qseven	220	70 x 70 mm	4900 mm ²	22,27
μQseven	220	70 x 70 mm	2800 mm ²	12,72

// The number of pins determines how many interfaces can be connected, as shown above; Qseven has fewer pins (220) compared to SMARC (314) but offers a lower pin density, favoring deeply embedded edge and industrial IIoT applications.



GRAPHICS INTERFACES	LVDS DDI CAMERA INPUTS	Max. 3 independent 2x dual channel LVDS/eDP 1x DV/HDMI/DP	Max. 4 independent 2x dual channel LVDS/eDP/MIPI DSI 1x HDMI/DP++ & 1x DP++
	AUDIO	2x MIPI CSI (flat foil connector on module)	2x MIPI CSI
	WIRELESS	1x HDA/I ² S	1x HDA & 2x i ² S
CONNECTIVITY		1x Gbit Ethernet	2x Gbit Ethernet Bluetooth & WLAN optional
STORAGE		-	
		2x SATA	1x SATA
EXPANSIONS	PCI EXPRESS	4 lanes	4 lanes
	USB	8x USB 2.0 / 2x USB 3.0	6x USB 2.0 / 2x USB 3.0
	INDUSTRIAL I/O	1x SER / 1x CAN	2x SER/CAN bus
	GPIO	8x	12x
	SPI	1x	1x
	LPC	1x	1x eSPI
	SMB	1x	1x
	I²C	1x	1x

// Qseven's multiple USB and serial interfaces and a CAN bus provide excellent peripheral support; The new i.MX7 version offers 1x Gigabit Ethernet ports making it ideal as a rugged, low cost IoT connectivity solution in gateway and routing applications.

QSEVEN: GAME CHANGERS

Qseven has often been characterized as a small form factor better suited to highly embedded industrial designs, whereas SMARC's superior graphics interface attributes have made it the more obvious choice for feature rich multimedia applications - such as infotainment and real-time signage.

In the future, however, such perceived wisdom may require some adjustment:

- ▶ In February 2016, eight years after the initial release of the Qseven form-factor, SGET released version 2.1. This updated version signaled a new chapter in Qseven's long history with support for the latest high speed buses such as USB, SATA, Gigabit Ethernet, Display Port and LVDS.
- ▶ Since that time, new processor variants have also emerged:
For x86 the entire range of Intel's latest IoT-ready embedded processors including the Intel Atom® processor E3900 series, as well as Intel Pentium® processor N4200 and Intel Celeron® processor N3350. This offers the potential for high computing performance and graphics-intensive applications.
For ARM, the latest NXP i.MX7 processors; delivering improved efficiency over i.MX6; for ultra-low battery powered applications such as smart phones and tablets and embedded routing and gateway devices in IIoT environments.

In addition, i.MX8X, due for release in XXX, will offer ARM developers processing performance comparable to that of the Intel Atom®, and much improved graphics capabilities.

- ▶ Last but not least, Kontron entered the Qseven arena in 2018 with a long-term technology roadmap. This has commenced with the launch of one of the first i.MX7 based module ranges as well as the latest x86 solutions. Kontron's proven reputation as an innovator and 'standardiser' of Computer-on-Modules, extensive support, and long-term product availability, will help ensure the future of the standard bringing added peace of mind to developers and users.

QSEVEN: LATEST PROCESSOR SOLUTIONS

ARM-based

The latest version uses NXP's i.MX7 processors with the Cortex-A7 core. These are more cost-efficient and intended for less demanding applications consuming less power. The team that designed the A7 had in fact studied how different apps interact with the Android OS; the A7 core is actually tailor-made for applications in this segment.

In addition to the A7 core, i.MX 7 processors have an M4 core that executes a parallel real-time operating system that is more efficient in terms of power consumption.

During standby or when low to moderate performance is required, the A7 core can be shut down. The M4 core runs slower at 200 MHz, thereby reducing power consumption.

- ▶ Up to 2 GByte RAM
- ▶ Dual channel LVDS interface
- ▶ Up to 3x PCIe, 4x USB2.0

x86-based

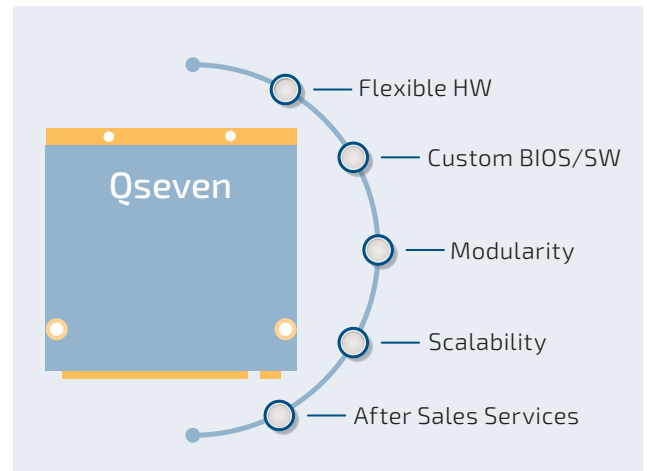
These are geared toward applications that require high computing performance. With the aforementioned Intel processors they are particularly suited to applications requiring a superior graphical user interface, for example remote monitoring of a high resolution video camera; built-in graphic accelerators can perform, among others, High Efficiency Video Coding (HEVC) and Advanced Video Coding (MPEG-4 AVC). With 2 and 4 core variants available, power consumption is between 5W to 10W and should be used in situations where a power supply is usually available (typical rechargeable batteries cannot power these for many continuous hours).

- ▶ Up to 8 GByte onboard DDR3L memory down (ECC / non ECC)
- ▶ Dual display support
- ▶ 2 x USB 3.0, 4 x USB 2.0 (1 x OTG), 2 x SATA, eMMC onboard
- ▶ Industrial grade temperature

QSEVEN: DESIGN BENEFITS AND APPLICATIONS

As already discussed, Qseven based COMs offer developers a high degree of flexibility when designing embedded applications:

- ▶ Low-power embedded architecture platform for Computer-on-Modules based on ARM and X86 technologies
- ▶ Scalable building blocks architecture reduces development costs; faster time to market
- ▶ Purpose-designed for creating mobile, embedded, connected solutions
- ▶ Optimized pin-out definition for versatile architectures
- ▶ Ultra low-power, low-profile solutions
- ▶ Constructed to withstand harsh industrial environments



// The new ruggedized i.MX7 processor module is designed to provide continuous availability in a wide and diverse range of often harsh and space-constrained environments, prone to extreme temperatures, dust, moisture, vibration and shock.

KONTRON: AT THE FOREFRONT OF QSEVEN SOLUTIONS

As part of its extensive COMs solutions portfolio, Kontron now offers a choice of x86 and ARM based Qseven modules plus Evaluation Carrier. These ideally complement its SMARC and COM Express ranges. As with all current Kontron embedded boards and controllers they are IoT-ready and benefit from deep software integration.

A further advantage for developers is the integration of Kontron's standard hardware-based embedded Security Solution Approtect; Kontron is the first ECT manufacturer to offer full security protection embedded in its COM and motherboard offerings. In addition, the inherent long-term availability of all Kontron embedded solutions, together with the company's global professional services support, ensures extended product lifecycle, peace of mind, and reduced cost of ownership (TCO).

KONTRON Q7-AMX7:

Enabling scalable ultra-low power application

The extreme low power Kontron Qseven-Q7AMX7 modules feature the latest single or dual core NXP i.MX7 processors. These cover a very wide performance range and are intended for small and power critical applications. Based on the ARM Cortex A7 technology, they enable efficient development of smart devices in an extremely compact, fanless design with balanced processor and graphics performance.

- ▶ Based on NXP i.MX 7 Family
- ▶ Up to 2x 1 GHz Cortex® A7 + 200 MHz M4 processor
- ▶ Up to 2 GByte RAM
- ▶ Dual channel LVDS interface
- ▶ Up to 1x GByte Ethernet, 3x PCIe, 4x USB 2.0
- ▶ Highly secure – APPROTECT Protected

KONTRON Q7-AL:

Powerful real-time computing performance and graphics

With state-of-the-art image processing and graphics capabilities, the Qseven-Q7AL provides extensive real-time computing power in an energy-efficient and standardized Computer-on-Module form factor. Users benefit from a significantly improved computing performance and an impressive performance-per-watt ratio.

- ▶ Up to 8 GByte DDR3L memory down (ECC / non ECC)
- ▶ Dual display support (triple display on request)
- ▶ 2x USB 3.0, 4x USB 2.0 (1x USB OTG), 2x SATA, eMMC onboard
- ▶ Highly secure - APPROTECT Protected

EVALUATION PLATFORM

In order to facilitate decision-making on the best module for an application, Kontron's evaluation carrier board is available. This offers a rich feature set that allows adopters to experience the interfacing capabilities that the modules offer. The carrier conforms to the Qseven 2.1 specifications and can be used for both the x86- and ARM-based modules offered.

It supports a broad range of interface options dedicated for low power applications including 1x Gigabit Ethernet support, SD-card socket, USB2.0 and 3.0, mSATA, PCIe and many more. The implementation of LVDS, HDMI and DP++ allows multimedia applications. The intelligent audio implementation allows also HDA and I2S to be used on the same audio connectors with modules that support the function. The rich feature set of the carrier increases the flexibility of highly sophisticated applications.

MAXIMIZING SECURITY

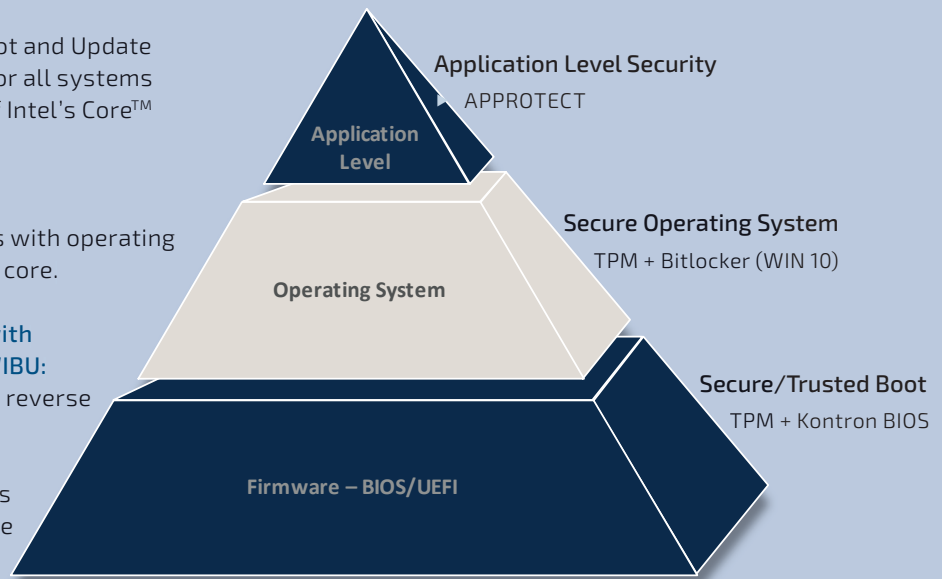
Especially important in today's hyper-connected IoT world, Kontron's Qseven modules feature a comprehensive, cross-platform security framework.

Kontron APPROTECT consists of hardware and software which can be activated after purchase to protect customer software. This security solution is unique in this form and available for all current Kontron embedded products, enabling new, innovative value creation and licensing models. In addition, there is a Trusted Platform Module (TPM) optionally available for all current Kontron embedded motherboards to support custom or legacy solutions.

SECURITY SOLUTION KONTRON

3 levels of security ensure highest level of security for embedded systems

- ▶ **System Boot-Time Security:**
Offering Secure/Trusted-Boot and Update implementations available for all systems with the latest generation of Intel's Core™ and Atom® CPUs.
- ▶ **Secure Operatin Systems:**
Offering attractive bundlings with operating systems like Windows 10 IoT core.
- ▶ **Application Level Security with APPROTTECT powered by WIBU:**
Offering copy protection and reverse engineering protection with hardware based encryption; on top enabling new business models by restricting runtime or features of any custom application.for all the above services.



The APPROTECT security framework is based on the well-known and proven solution from German manufacturer WIBU Systems. It can be used on all Kontron systems with the corresponding TPM module. It contains modules for copy protection, IP protection (licensing), protection against reverse engineering and tampering. This allows for extensive license management and completely new licensing and business models, such as time-of-use billing or limited test phases for specific features. The TPM chip ensures maximum safety and can also be retrofitted to many legacy systems.

APPROTECT features the broadest scalability of all integrated security solutions on the market today. Support ranges from low resourced nano-systems with a single computing core to large multi-core server modules.

This assures customers of company-wide security with investment and license protection, using a uniform solution that scales from small IoT devices up to mainframes.

KONTRON AND QSEVEN: VALUE ADDED

Further extending confidence in Qseven platforms, Kontron's broad services portfolio allows faster time-to-market, reduced risk and the need for additional engineering resources. For instance, Kontron extended warranty programs protect technology investments, ensuring worry-free support with comprehensive product protection plans. The portfolio also includes extended support services offered on a tiered basis and packaged for simplicity. This allows customers to select the right service level for their specific needs, based on projected response times and support for critical and major issues.

- ▶ **Long-term product availability:** typically 10 years
- ▶ **Long-term support:** throughout extended warranty periods and beyond (up to 15 years)
- ▶ **Qualified experts:** a team with extensive practical experience across a diverse range of embedded technology platforms and application areas
- ▶ **Active worldwide:** Kontron service - including on-site - available wherever customers are located

Important for long-term Qseven designs is Kontron's value-added professional services for development support throughout the entire product lifecycle: from design, integration and customization to testing, prototyping and after-market technical support. The company's professional services are designed to speed application development with fewer valuable resources. Kontron can help by using its dedicated resources for on-site design specification all the way to sustaining engineering and lifecycle management.

SUMMARY

The Qseven small form factor COM architecture continues to offer embedded solutions designers many benefits, today and in the future. In particular, those creating deeply embedded applications for deployment in remote, often very harsh industrial IIoT environments.

The secret to Qseven's success and longevity is reliability and technology familiarity. This is fully recognized by Kontron whose deep knowledge of the embedded computing industry makes it ideally placed to support and nurture the thriving global Qseven developer ecosystem.

Furthermore, as one of the world's major embedded computing technology manufacturers, Kontron fully intends to be at the forefront of future Qseven product innovation, reinforced and enhanced by its extended lifecycle guarantee and global professional support services. The company's new Qseven 2.1 compliant modules include one of the first using i.MX7 processors, underlining its strong commitment to this architecture.

- ▶ For more information about Kontron's new Qseven-Q7AL and Q7-AMX7 solutions please visit Kontron at <https://www.kontron.com/products/boards-and-standard-form-factors/qseven>

About Kontron | Member of the S&T Group

Kontron is a global leader in IoT/embedded computing technology (ECT). As a part of technology group S&T, Kontron offers a combined portfolio of secure hardware, middleware and services for Internet of Things (IoT) and Industry 4.0 applications. With its standard products and tailor-made solutions based on highly reliable state-of-the-art embedded technologies, Kontron provides secure and innovative applications for a variety of industries. As a result, customers benefit from accelerated time-to-market, reduced total cost of ownership, product longevity and the best fully integrated applications overall.

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