Your Technology and Solution Partner.

TQ-Embedded

Product Catalogue 2020

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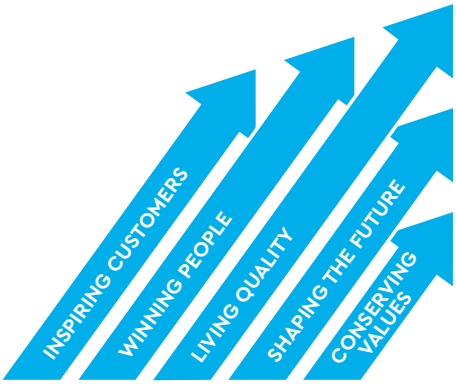
TQ – Who?
Technology in Quality

TQ stands for technology with highest quality standards. For us this name represents a challenge which we do our best to meet at every single step of the process – from the original idea right through to the finished product. We see ourselves in this context as partners for our customers and support them in the pursuit of their strategic objectives. As a corporate group we cover the whole bandwidth of this comprehensive product and service spectrum and we can thus meet the special wishes of all our customers with great flexibility. TQ – your reliable partner for the whole world of electronics.

As an electronics service provider (E^2MS supplier and CEM) TQ offers the complete range of services from development, through production and service right up to product life cycle management. The services cover assemblies, equipment and systems including hardware, software and mechanics. Customers can obtain all services from TQ on a modular basis as individual services and also as a complete package according to their individual requirements. We offer standard products such as microcontroller modules (minimodules) and drive motors. Through the combination of electronics services and finished system components, TQ offers customer-specific products as ODM products and thereby addresses customers who would like to receive finished products and at the same time benefit from the advantages of a customer-specific solution. ODM products are provided on time and economically using a comprehensive solution kit. The set includes finished electronic, mechanical and software components including certification and licenses.

Successful together



We are the leading solution provider for innovative technologies.

Our motto "Successful together" is visible throughout all our activities.

Highlights

- **TQ offers the complete range of services – from concept to finished product.**
- **All services are available on a modular basis or as a complete package – highly customized.**
- **Our product range covers various areas such as drive motors as well as minimodules.**
- **Embedded modules enable cost-efficient and time-saving solutions to keep up with today's rapidly developing high technology market.**

TQ-Embedded Modules

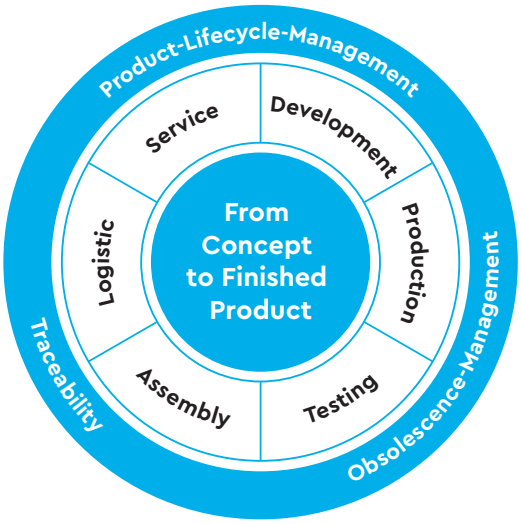
TQ-Embedded offers a comprehensive and wide-ranging service covering the whole spectrum of components for embedded systems. We guarantee our customers a reliable supply at ideal economic conditions.

To remain competitive in today's rapidly evolving high-tech markets, companies must keep on presenting new and more powerful products at ever shorter intervals. This often leaves no room for completely new developments. To improve our customers' situation, we have developed our modular concepts. Designing a device on a modular basis will, for its further development, bring substantial savings in time and cost. In virtually all applications nowadays microprocessors take up a central position. And the processor environment is usually organized along similar lines, with its memory structure and a corresponding number of interfaces. One very sensible step is to use a microprocessor module. For the customer this brings not only the benefits of saving time and cost but also other key advantages, e.g. flexibility, continuity, and a saving on space requirements.

TQ – What?
E²MS and Obsolescence Management

From the initial product idea right through to readiness for series production: TQ, a competent partner for a wide variety of industrial concerns, develops and produces electronic modules and devices exactly to customer specifications. An active Obsolescence Management rounds out the spectrum of services and makes TQ a lifelong partner for you – at least for your product lifecycle.

From Concept to Finished Product



DEVELOPMENT – Using the newest technologies, we provide sophisticated hardware and software solutions – from the initial concept right through to readiness for series production – for virtually all areas of electronics (e.g. automation technology, medical engineering, and measuring systems).

PRODUCTION – Using state-of the-art production equipment – from high-speed automatic placement – by way of nitrogen soldering – right through to automatic bonding – we produce electronic PCB assemblies with both conventional and the latest innovative technologies.

TESTING – Our products are tested using up-to-date measuring and testing procedures – from in-circuit tests – by way of flying-probe tests, boundary-scan tests and burn-in tests, right through to end-to-end functional tests – individually and exactly to customer specifications. The hardware and software needed is put together by our in-house test resources development and construction department.

ASSEMBLY – In our assembly works we manufacture complex electro-mechanical, optical modules and devices – on request also in our clean-room environment.

LOGISTICS – Our experienced purchasing department ensures, through its policy of continuously monitoring market developments, stockpiling all critical parts, and procuring parts on a worldwide, manufacturer-independent basis, that all parts are available for our customers at any time – and that it is thus able to meet demands exactly and at optimal conditions.

SERVICE –Our service department offers rapid and competent routine maintenance, calibration, repair, and retooling– from individual board level right through to the complete device.

Obsolescence Management

Obsolescence is the lack of delivery by the original supply source and the consequent lack of availability due to various influences. The result of obsolescence is that the required product availability, which can exceed 50 years in many business sectors, can no longer be achieved. In addition, an efficient strategy for handling Product Change Notifications (PCNs) and Product Discontinuance Notifications (PDNs) is absolutely necessary.

TQ is operating an active Obsolescence Management. Particularly in new developments, it is a great advantage to incorporate the current lifecycle status of the components. Monitoring current assemblies allows clients to be proactive rather than reactive. All in all, the long-term availability of assemblies and systems benefits clients because of the considerable added value. Their products are protected against obsolete components, costly redesigns, uncertain sources and high cost brokerware. Information from the supply chain is absolutely necessary to be proactive in Obsolescence Management. For this reason, TQ yet again relies on the support of vendors and manufacturers.

Advantages of an active Obsolescence Management at TQ

- **Combination of the services offered in any manner**
- **Early identification of at-risk components**
- **Avoid unexpected redesigns and re-qualifications**
- **Dispense with high-cost brokerware**
- **Overview of the total product lifecycle cost**
- **Flexible operating times**
- **Above-average on-time delivery performance**
- **Highest data quality via active integration into the supply chain**
- **A direct contact in our OM corporate department**
- **Consistency due to clearly defined, stable processes**

TQ – Where?
Overview of Industries

TQ offers electronic manufacturing and engineering services as well as embedded systems for the following industry fields (among others). For all services and products, the high and specific requirements in terms of quality, reliability, service life and long-term availability are taken into account. We are aware of and consider the applicable standards as well as the diverse customer and product-specific requirements. Regardless your industry – your particular requirements are handled with experience, care and thoroughness.

Drive technology
Our platform solutions for Embedded Drives exceeds existing standards due to high torque combined with very compact design.

Automotive
Based on our ISO/TS 16949 certification, we develop and produce customer-specific products using automotive processes while obeying the pertinent standards and regulations.

Energy | Smart Grid
Based on our know-how of power electronics and control technology, we are creating regulations for transformers to secure the network against sudden power surges, for example.

Building automation
Our smart products in distributed building control point the way to added efficiency in building automation. This renders complex building automation tasks easy to handle.

Industry | Automation
Our solutions are used for various industrial applications, e.g. as mechanical engineering, automation, measurement, control and regulation-, process-, and monitoring technology.

Aerospace
As an aviation customer you benefit from our expertise which has already been incorporated into a wide variety of different development and production projects.

Medical
We offer a wide spectrum of electronic modules and complete devices for medical-technology companies – ranging from pocket-format end-user devices up to large equipment for clinics.

Maritime Traffic
We manufacture control and guidance systems for maritime applications. Displays and operating units (HMIs) complement our customers applications. Additionally we manufacture switchgears from individual terminal boxes to high-tech controls.

Telecommunication
In telecommunications fast and efficient networking is crucial. Large quantities of data must be processed in a short time. Our solutions additionally imply long-term availability, industrial capability and use in an expanded temperature range.

Transportation
Our products and solutions in this area are widely used from ticket printers over forklifts to locomotive controls. We design and manufacture controls and display units which fulfill challenging requirements set, in particular those relating to the temperature range.

IoT
Intelligent objects, secure data communication, worldwide management as well as centralized and, to some extent, decentralized storage and data processing require reliable and secure systems on all levels.

TQ – Why?

We offer everything from one source

TQ-Systems, your competent partner for a wide variety of industrial concerns, develops and produces electronic modules and devices exactly to customer specifications. Many years of experience, comprehensive know-how, and a highly efficient organization together form the right foundations for customer satisfaction and on-going partnership and cooperation.

Choosing a modular solution has wide-ranging consequences, so it is therefore very important to make the right decision. During the decision process, you have to think about module and technologies as well as potential suppliers. In any case, the goal is to find a long-term, reliable solution, as the one-off investment to purchase a modular design should have lasting positive effects.

TQ is optimally positioned as your solution provider and long-term partner to grow with you. We offer software support as well as hardware development support. Our support does not only cover the module itself but we also offer assistance for your individual application board. We have comprehensive experience in various industries and application environments. Our design support, like schematic review, speeds up the modular design and improves safety and security. This helps you prevent any mistakes. Beside the development and layout phase, we provide production services, which enables us to react more quickly and more flexibly to your requests. Our proven record with respect to longevity show that your choice for TQ covers all aspects for a positive and value oriented long-term cooperation.

Highlights

- **Application kit (starterkit)**
- **BSP Support**
- **Schematic mainboard review**
- **Mainboard layout and production**
- **Customer specific mainboard design**
- **Complete system design, well-founded application design knowledge**
- **Own production ISO 13485, EN 9100 & ISO 16949 certified**

Partnerships

Due to increasing complexity and decreasing product life cycle times it is essential to concentrate on core competencies. TQ-Embedded modules have been developed therefore with the objective of offering exactly the right solution in as many applications as possible. As hardware specialist for embedded systems we have sought to close ranks with leading specialists in the development tools and software sector. We are working in close partnership with all leading semiconductors and operating system vendors.

NXP GOLD PARTNER

Texas Instruments

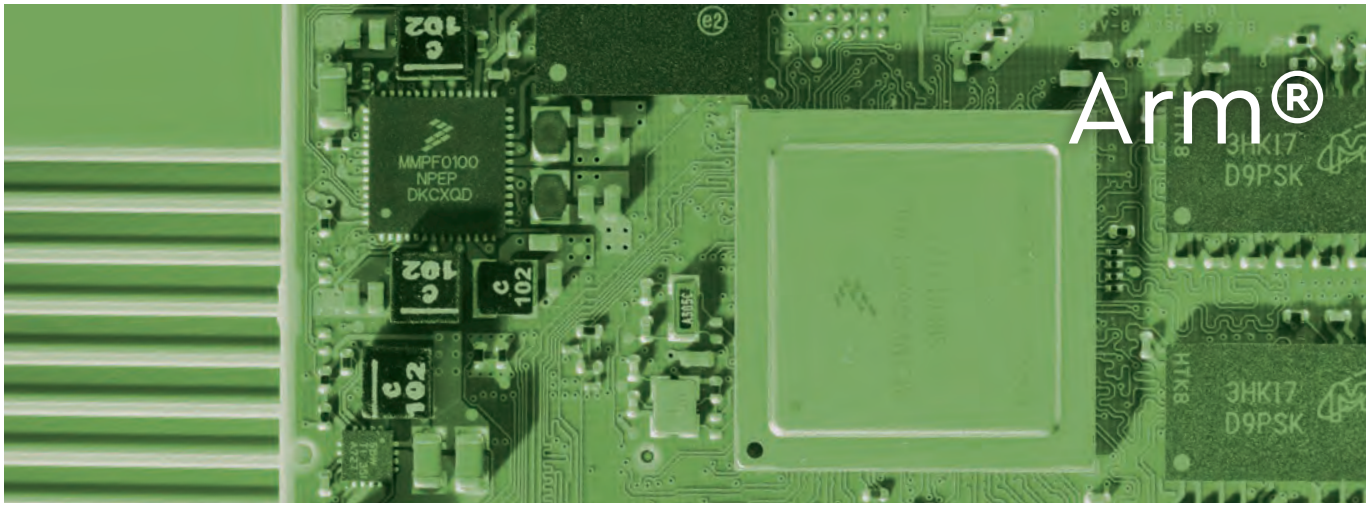
intel Technology Provider Platinum 2020

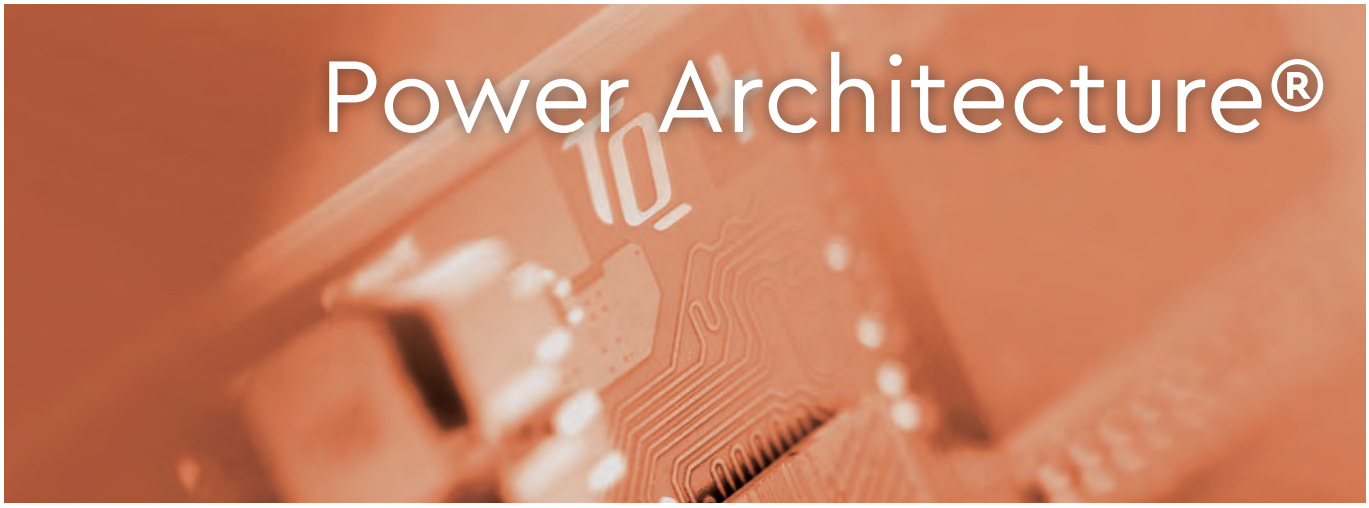
RENESAS

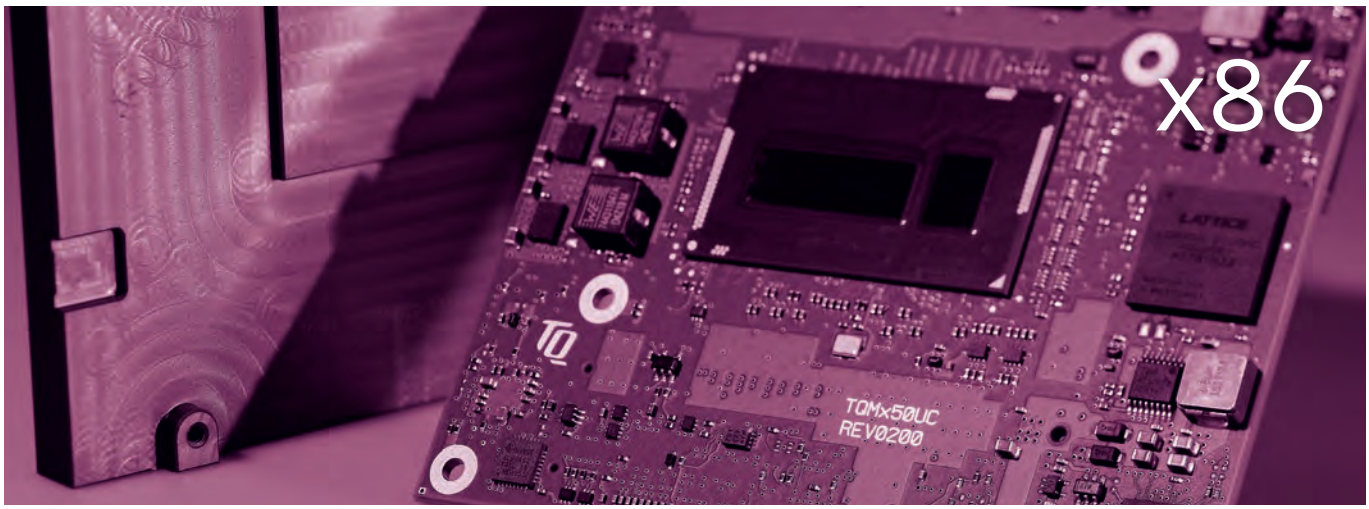
Processor architectures

Arm® | Power Architecture® | x86

TQ is one of very few suppliers worldwide, offering solutions on all common processor architectures – from Arm®, Power Architecture® up to x86, we cover the whole product range with our wide embedded module spectrum.







ARM®

Arm® based minimodules represent a very high integration of functionalities and CPU-interfaces, which enable cost-optimized systems. Using the latest processor technology from NXP or Texas Instruments. Arm® minimodules are not only state-of-the-art, but already ahead of today's industry's world. Additionally Arm® based systems operate at low power consumption and optimized processing power. The high availability of interfaces enables most system requirements to be implemented with minimal time effort. This interface variety, a free choice of the operating system and the optimal application support for various industries makes Arm® based modules universally applicable. We offer a long-term availability of 10–15 years for our Arm® modules.

KEY FEATURES

- **High integration**
- **Cost-optimized systems**
- **Low power loss with optimized processing power**
- **Versatility of interfaces**
- **Free choice of operating system**
- **Long-term availability**

POWER ARCHITECTURE®

The Power Architecture® based modules are a perfect fit for all applications requiring high computing and I/O performance combined with robustness, reliability and long-term availability. The latest generation supports 64-bit QorIQ® T-series processors from NXP offering unique scalability within the product portfolio and multiple I/O connectivity at low power consumption. The integrated multicore technology and optional encryption engines, combined with dedicated operating systems, enable also the realization of safety and security critical applications. The longevity of supply period covers at least 10–15 years, which makes it easy to support durable solutions and industrial goods in a wide area of markets.

KEY FEATURES

- **High computing performance**
- **Outstanding I/O performance**
- **64-bit single- and multicore processors**
- **Robust and reliable**
- **Linux operating system**
- **Longevity of supply**

X86

The TQMx86 product portfolio is based on latest Intel® 64-bit embedded CPUs in the mid to high range performance class. To support scalability and interchangeability, all CPU modules are based on industrial standards like COM Express® and SMARC. This enables future proof platform concepts with most flexibility in CPU, graphics and interface performance. The x86 architecture which is a CISC (complex instruction set computing) architecture with full backward compatibility guarantees easiest software implementation and cost efficient usage of existing functions and ready-made software applications. There are additional innovations such as separated video encode/decode engines, security and advanced management, hyper threading (HT), TurboBoost and virtualization.

KEY FEATURES

- **Wide range scalability with full software compatibility**
- **Most flexible in software/operating systems**
- **Plug-and-Play for hardware and software**
- **Up to high end integrated graphics**
- **Up to 64 GB Dual-Channel DDR4–2400 high speed memory (> 30 Gb/s)**
- **Performance-per-Watt optimized by intelligent power management and Intel®'s leading fabrication processes**

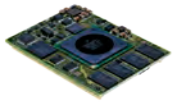
Overview
Arm® Modules

Arm® Modules	CPU	Memory (RAM/Flash)	Operating System	Power Supply	NOR Flash	Dimensions
 **TQMLS1012AL**	Arm® Cortex®-A53 LS1012A	DDR3L-SDRAM: Up to 1 GB	Linux On request: QNX, INTEGRITY	3.3 V	Up to 256 MB	31 × 31 mm
 **TQMLS10xxA**	Arm® Cortex®-A53/A72 LS1046A, LS1026A, LS1043A, LS1023A, LS1088A	DDR3L-SDRAM: Up to 8 GB, eMMC Flash: Up to 32 GB	Linux, On request: VxWorks, other TBD	5 V	Up to 512 MB	80 × 60 mm
 **TQMLS102xA**	Arm® Dual Cortex®-A7 LS1020A, LS1021A, LS1022A	DDR3L-SDRAM: Up to 2 GB eMMC Flash: Up to 16 GB	Linux, QNX On request: VxWorks, PikeOS, Integrity	3.3 V Voltage monitoring (optional)	Up to 512 MB Quad SPI NOR	55 × 44 mm
 **TQMLS1028A**	Layerscape LS1028A, LS1018A, LS1027A, LS1017A	DDR4-SDRAM: Up to 2 GB	Linux	5 V	Up to 512 MB Quad SPI NOR	55 × 44 mm
 **TQMLX2160A**	Arm® Cortex®–A72 LX2160, LX2120, LX2080	2x DDR4-SDRAM: Up to 64 GB eMMC Flash: Up to 64 GB	Linux On request: VxWorks	5 V	Up to 512 MB Quad SPI NOR	126 × 78 mm (TBD)
 **TQMa8Xx**	Arm® Cortex®-A35 i.MX8 DualX, i.MX8 DualX Plus i.MX8 QuadX Plus	DDR3L-SDRAM: Up to 2 GB, eMMC Flash: Up to 64 MB	Linux, On request: Windows 10, QNX	3.3 V (TBD)	Up to 256 MB Quad SPI NOR	55 × 44 mm
 **TQMa8XxS (SMARC)**	Arm® Cortex®-A35 i.MX8 DualX, i.MX8 DualX Plus i.MX8 QuadX Plus	DDR3L-SDRAM: Up to 2 GB, eMMC Flash: Up to 64 MB	Linux, On request: Windows 10, QNX	3.3 V	Up to 256 MB Quad SPI NOR	82 × 50 mm
 **TQMa8Mx**	Arm® Cortex®-A53 i.MX8M Dual, i.MX8M Quad Lite, i.MX8M Quad	LPDDR4-SDRAM: Up to 4 GB eMMC Flash: Up to 64 MB	Linux, On request: Android	5 V	Up to 256 MB Quad SPI NOR	55 × 36 mm
Q1/2020 **TQMa8MxML**	Arm® Cortex®-A53 i.MX8M Mini Solo i.MX8M Mini Dual i.MX8M Mini Quad	LPDDR4-SDRAM: Up to 4 GB eMMC Flash: Up to 64 GB	Linux, On request: Android	5 V	Up to 256 MB Quad SPI NOR	38 × 38 mm

Overview
Arm® Modules

Arm® Modules	CPU	Memory (RAM/Flash)	Operating System	Power Supply	NOR Flash	Dimensions
 **TQMa57xx**	Arm® Cortex®-A15 AM571x, AM572x, AM574x	DDR3L-SDRAM: Up to 4 GB, eMMC Flash: Up to 32 GB	Linux On request: VxWorks, QNX	5 V	Up to 256 MB	75 × 55 mm
Q3/2020 **TQMa65xx**	Arm® Cortex®-A53 AM6526, AM6527, AM6528, AM6546, AM6548	DDR4-SDRAM: Up to 4 GB + ECC eMMC Flash: Up to 64 GB	Linux On request: QNX, Android	5 V	Up to 512 MB Quad SPI NOR	77 × 55 mm
Q3/2020 **TQMaRZG2x**	Arm® Cortex®-A53/A57 RZ/G2M, RZ/G2N	LPDDR4-SDRAM: Up to 8 GB eMMC Flash: Up to 64 GB	Linux On request: QNX, Android	5 V	Up to 512 MB Quad SPI NOR	77 × 55 mm
 **TQMa6ULx(L)**	Arm® Cortex®-A7 i.MX6UL (G1, G2, G3) I.MX6ULL (Y0, Y1, Y2)	DDR3L-SDRAM: Up to 1 GB eMMC Flash: Up to 32 GB	Linux On request: QNX	TQMa6ULx: 5 V TQMa6ULxL: 3.3 V	Up to 256 MB	38 × 38 mm
 **TQMa7x**	Single-/Dual-Core Arm® Cortex®-A7 core i.MX7 (Solo, Dual)	DDR3L-SDRAM: Up to 2 GB eMMC Flash: Up to 32 GB	Linux On request: QNX	5 V	Up to 256 MB	54 × 44 mm
 **TQMa6x**	Arm® Cortex®-A9 i.MX6 (Solo, Dual, Quad, Dual Plus, Quad Plus, Dual Lite)	DDR3L-SDRAM: Up to 2 GB eMMC Flash: Up to 16 GB	Linux, VxWorks, QNX, Integrity On request: Windows Embedded 7, Android	5 V	Up to 128 MB	70 × 46 mm
 **TQMa335x(L)**	Arm® Cortex®-A8 AM3352, AM3354, AM3357, AM3359	DDR3L-SDRAM: Up to 512 MB eMMC Flash: Up to 16 GB	Linux, QNX, Windows Embedded Compact 2013 On request: VxWorks, Android	3.3 V Voltage monitoring (optional)	TQMa335x Up to 128 MB	TQMa335x 54 × 38 mm TQMa335xL 38 × 38 mm
 **TQMa28(L)**	i.MX28 with an Arm® 926 core i.MX287, i.MX283	DDR2-SDRAM: Up to 256 MB eMMC Flash: Up to 16 GB	Linux, WinCE 6.0, QNX On request: VxWorks	5 V	-	TQMa28 26 × 40 mm TQMa28L 30 × 30 mm

Overview
Power Architecture® Modules

Power Architecture® Modules	CPU	Memory (RAM/Flash)	Operating System	Power Supply	NOR Flash	Dimensions
 TQMT1042/T1022	TQMT1042: T1042 Quad-Core TQMT1022: T1022 Dual-Core	DDR3L-SDRAM: Up to 8 GB w.ECC eMMC Flash: Up to 8 GB (optional)	Linux On request: PikeOS, VxWorks, Wind River Linux	5 V	Up to 256 MB	74 × 54 mm
 TQMT1040	TQMT1040: T1040 Quad-Core with 8-Port Switch	DDR3L-SDRAM: Up to 8 GB w.ECC eMMC Flash: Up to 8 GB (optional)	Linux On request: PikeOS, VxWorks, Wind River Linux	5 V	Up to 256 MB	74 × 54 mm
 TQMP1020/P2020	TQMP1020: P1020 Dual-Core TQMP2020: P2020 Dual-Core	DDR3-SDRAM: Up to 4 GB w.ECC DDR3-SDRAM: Up to 8 GB w.ECC	Linux, QNX On request: VxWorks	3.3 V	128 MB	74 × 54 mm

Overview
x86 Modules

x86 Modules	CPU	Memory (RAM/Flash)	Operating System	Power Supply	Temperature	Form factor/ Dimensions
 TQMx80UC	Intel® Core™ 8000UE series (Whiskey-Lake UE)	DDR4-SDRAM: Up to 64 GB, dual-channel (SO-DIMM)	Windows, Linux	8.5 – 20 V	0°C...+60°C -40°C...+85°C (opt.)	COM Express® Compact Type 6 95 × 95 mm
 TQMx70EB	Intel® Core™ 7000E series Intel® Xeon® E3-1500 v6 series (Kaby Lake-H)	DDR4-SDRAM: Up to 32 GB, dual-channel (w.ECC) (2 SO-DIMMs)	Windows, Linux	8.5 – 20 V	0°C...+60°C -40°C...+85°C (opt.)	COM Express® Basic Type 6 95 × 125 mm
 TQMx60EB	Intel® Core™ 6000E series Intel® Xeon® E3-1500 v5 series (Skylake-H)	DDR4-SDRAM: Up to 32 GB, dual-channel (w.ECC) (2 SO-DIMMs)	Windows, Linux On request: VxWorks, QNX	8.5 – 20 V	0°C...+60°C -40°C...+85°C (opt.)	COM Express® Basic Type 6 95 × 125 mm

x86 Modules	CPU	Memory (RAM/Flash)	Operating System	Power Supply	Temperature	Form factor/ Dimensions
 **TQMx50UC**	Intel® Core™ 5000U series (Broadwell-U)	DDR3L-SDRAM: 4 – 16 GB, dual-channel soldered	Windows, Linux On request: VxWorks, QNX	8.5 – 20 V	0°C...+60°C -40°C...+85°C (opt.)	COM Express® Compact Type 6 95 × 95 mm
 **TQMxE39S**	Intel Atom® E3900 series (Apollo Lake)	LPDDR4-SDRAM: 2/4/8 GB, dual-channel soldered 4 – 64 GB eMMC	Windows, Linux On request: VxWorks, QNX	4.75 – 5.25 V	0°C...+60°C -40°C...+85°C	SMARC 2.0 82 × 50 mm
 **TQMxE39C1**	Intel Atom® E3900 series (Apollo Lake)	DDR3L-SDRAM: 4/8 GB, w.ECC dual-channel soldered 4 – 64 GB eMMC	Windows, Linux On request: VxWorks, QNX	4.75 – 20 V	0°C...+60°C -40°C...+85°C	COM Express® Compact Type 6 95 × 95 mm
 **TQMxE39C2**	Intel Atom® E3900 series (Apollo Lake)	DDR3L-SDRAM: Up to 8 GB, dual-channel (2 SO-DIMMs) 4 – 64 GB eMMC	Windows, Linux On request: VxWorks, QNX	4.75 – 20 V	0°C...+60°C -40°C...+85°C (opt.)	COM Express® Compact Type 6 95 × 95 mm
 **TQMxE39M**	Intel Atom® x5/x7 E3900 series (Apollo Lake-I)	DDR3L-SDRAM: 2/4/(8) GB, dual-channel soldered 4 – 64 GB eMMC	Windows, Linux On request: VxWorks, QNX	4.75 – 20 V	0°C...+60°C -40°C...+85°C	COM Express® Mini Type 10 55 × 84 mm
 **TQMxE38C**	Intel Atom® E3800 series (Bay Trail-I)	DDR3L-SDRAM: 2/4/(8) GB, w.ECC soldered 4 – 64 GB eMMC	Windows, Linux On request: VxWorks, QNX	4.75 – 20 V	0°C...+60°C -40°C...+85°C	COM Express® Compact Type 6 95 × 95 mm
 **TQMxE38M**	Intel Atom® E3800 series (Bay Trail-I)	DDR3L-SDRAM: 2/4/(8) GB, w.ECC soldered	Windows, Linux On request: VxWorks, QNX	4.75 – 20 V	0°C...+60°C -40°C...+85°C	COM Express® Mini Type 10 55 × 84 mm

Overview
x86 Mainboards

x86 Mainboards	Form Factor	Supported Modules	Module Standard
 MB-M10-1	Embedded NUC 100 × 100 mm	TQMxE38M TQMxE39M	COM Express Mini, Type 10
 MB-M10-2	Embedded NUC 100 × 100 mm	TQMxE39M	COM Express Mini, Type 10
 MB-MI4	Euro 100 × 160 mm	TQMxE39M	COM Express Mini, Type 10
 MB-COME10-1	Mini-ITX 170 × 170 mm	TQMxE38M TQMxE39M	COM Express Mini, Type 10
 MB-COME6-1	Mini-ITX 170 × 170 mm	TQMxE38C TQMx50UC TQME39C1/C2	COM Express Basic, Type 6
 MB-COME6-2	Mini-ITX 170 × 170 mm	TQMx60EB TQMx70EB TQMxE39C1/C2	COM Express Basic, Type 6
 MB-COME6-3	Mini-ITX 170 × 170 mm	TQMx60EB TQMx70EB TQMx80UC	COM Express Basic, Type 6
 MB-SMARC-1	Mini-ITX 170 × 170 mm	TQMxE39S	SMARC 2.0
 MB-SMARC-2	Mini-ITX 170 × 170 mm	TQMxE39S TQMa8XxS	SMARC 2.0

Overview
Arm® Hardwarekits

Arm® Hardwarekits	Performance Class/ Scalability	Suitable CPU Module standard	Form factor/ dimensions	Integration Levels
 **MBLS10xxA**	Arm® Cortex®-A53/A72 LS1046A, LS1043A, LS1026A, LS1023A, LS1088A	–	210 × 250 mm	Hardware Kit
 **MBa57xx**	Arm® Cortex®-A15 AM571x, AM572x, AM574x	–	170 × 230 mm	Hardware Kit
 **MBa8Xx**	Arm® Cortex®-A35 i.MX8XD, i.MX8XDP, i.MX8XQP	–	170 × 170 mm	Hardware Kit
 **MBa8Mx**	Arm® Cortex®-A35 i.MX8M Dual, i.MX8M Quad Lite, i.MX8M Quad	–	170 × 170 mm	Hardware Kit
 **MBa6ULx**	Arm® Cortex®-A7 i.MX6UL (G1, G2, G3) I.MX6ULL (Y0, Y1, Y2)	–	170 × 170 mm	Hardware Kit
 **MBa7x**	Single-/Dual-Core Arm® Cortex®-A7 core i.MX7 (Solo, Dual)	–	170 × 170 mm	Hardware Kit
 **MBa6x**	Arm® Cortex®-A9 (i.MX6 Dual Plus/ i.MX6 Quad Plus)	–	170 × 170 mm	Hardware Kit
 **MBLS1028A**	Arm® Cortex®-A72 LS1017A, LS1027A, LS1018A, LS1028A	–	170 × 170mm	Hardware Kit

Overview
Arm® Single Board Computer

Arm® Hardwarekits	Performance Class/ Scalability	Suitable CPU Module standard	Form factor/ dimensions	Integration Levels
 MBLS1012AL	Arm® Cortex®-A53 LS1012A	TQMLS1012A	160 × 100 mm	Hardware Kit
 MBa6ULxL	Arm® Cortex® A7 i.MX6UL (G1, G2, G3) I.MX6ULL (Y0, Y1, Y2)	TQMa6ULxL	100 × 100 mm	Hardware Kit
 MBLS1028A-IND	Arm® Cortex®-A72 LS1017A, LS1027A, LS1018A, LS1028A	TQMLS10128A	160 × 100 mm	Hardware Kit

Overview
Power Architecture® Hardwarekits

Power Architecture® Hardwarekits	Performance Class/ Scalability	Suitable CPU Module standard	Form factor/ dimensions	Integration Levels
 STKT104x	TQMT1042: T1042 Quad-Core TQMT1040: T1040 Quad-Core with 8-Port Switch	–	240 × 170 mm	Hardware Kit

Overview
x86 Hardwarekits

x86 Hardwarekits	Performance Class/ Scalability	Suitable Module standard	Form factor/ dimensions	Integration Levels
 STKx80UC set	Intel® Core™ Whiskey Lake-U	COM Express Compact Type 6	Mini-ITX 170 × 170 mm	Starterkit/Hardwarekit incl. Mainboard, Module and Cooling

Overview
x86 Hardwarekits

x86 Hardwarekits	Performance Class/ Scalability	Suitable Module standard	Form factor/ dimensions	Integration Levels
 **STKx70EB set**	Intel® Core™ KabyLake-H	COM Express® Basic Type 6	Mini-ITX 170 × 170 mm	Starterkit/Hardwarekit incl. Mainboard, Module and Cooling
 **STKx60EB set**	Intel® Core™ SkyLake-H	COM Express® Basic Type 6	Mini-ITX 170 × 170 mm	Starterkit/Hardwarekit incl. Mainboard, Module and Cooling
 **STKx50UC set**	Intel® Core™ Broadwell-U	COM Express® Compact Type 6	Mini-ITX 170 × 170 mm	Starterkit/Hardwarekit incl. Mainboard, Module and Cooling
 **STKxE39C1 set**	Intel Atom® Apollo Lake	COM Express® Compact Type 6	Mini-ITX 170 × 170 mm	Starterkit/Hardwarekit incl. Mainboard, Module and Cooling
 **STKxE39C2 set**	Intel Atom® Apollo Lake	COM Express® Compact Type 6	Mini-ITX 170 × 170 mm	Starterkit/Hardwarekit incl. Mainboard, Module and Cooling
 **STKxE38C set**	Intel Atom® Bay Trail	COM Express® Compact Type 6	Mini-ITX 170 × 170 mm	Starterkit/Hardwarekit incl. Mainboard, Module and Cooling
 **STKxE39M set**	Intel Atom® Apollo Lake	Com Express® Mini Type 10	Mini-ITX 170 × 170 mm	Starterkit/Hardwarekit incl. Mainboard, Module and Cooling
 **STKxE38M set**	Intel Atom® Bay Trail	Com Express® Mini Type 10	Mini-ITX 170 × 170 mm	Starterkit/Hardwarekit incl. Mainboard, Module and Cooling
 **STKxE39S set**	Intel Atom® Apollo Lake	SMARC 2.0	Mini-ITX 170 × 170 mm	Starterkit/Hardwarekit incl. Mainboard, Module and Cooling

Overview
ODM Platform Concepts

Arm® ODM Platforms	Performance Class/ Scalability	Focus Markets	Box PC	Size/Dimensions
 **ABox-6ULxL**	Arm® Cortex®-A7 i.MX6UL (G1, G2, G3) I.MX6ULL (Y0, Y1, Y2)	Industrial/various	✓	110 x 103 x 35 mm
 **LBox-LS1012A**	Arm® Cortex®-A53 LS1012A	Industrial/various	✓	170 x 103 x 35 mm
 **LBox-LS1028A**	Arm® Cortex®-A72 LS1017A, LS1027A, LS1018A, LS1028A	Industrial/various	✓	170 x 103 x 43 mm

x86 ODM Platforms	Performance Class/ Scalability	Focus Markets	Box PC	Size/Dimensions
 **MBox-R**	Intel Atom®	Industrial/various	✓	130 x 103 x 57 mm
 **MBox-V/MBox-VH**	Intel Atom®	Industrial/IoT	✓	110 x 103 x 40/55 mm
 **MBox-ADV**	Intel Atom®	IoT/Security/ Machine Vision	✓	170 x 103 x 43 mm
 **COMBox-V**	Intel Atom® up to Intel® Core™ i7	Industrial computing/ Machine Vision	✓	190 x 172 x 68 mm

TQ Technology inside

Arm® Modules

TQMLS1012AL – The module based on Arm® and QorIQ® technology opens new frontiers

Small embedded Cortex®-A53 module based on LS1012A with high speed interfaces and very low power consumption.

HIGHLIGHTS

- **Extended temperature range**
- **High-Speed communication via 2x Gbit Ethernet, 1x PCIe, 1x USB 3.0 and 1x SATA 3.0 interface**
- **Low power consumption (typ. 1 – 2 W)**
- **QorIQ Trust Architecture and Arm® TrustZone®**
- **Packet Acceleration Engine**

TECHNICAL SPECIFICATION

CPU	QorIQ LS1012A
System interfaces	Up to 2x Ethernet 10/100/1000 Mbit 2.5 G N-BASE T 1x USB 2.0 high speed w/ULPI 1x USB 3.0 high speed w/PHY Up to 2x UART
Periphery interfaces	Up to 2x SDIO/MMC 3.0 Up to 1x I^2C Up to 1x SPI Up to 5x I^2S Up to 1x SATA 3.0 Up to 1x PCIe Up to 1x QSPI (NOR Flash)
Memory	DDR3L-SDRAM: Up to 1 GB Quad SPI NOR: Up to 256 MB EEPROM: 0/64-kbit
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG interface
Power supply	3.3 V
Ambient conditions	Extended temperature range: -40°C...+85°C
Dimensions	31 × 31 mm
Plug-in system	LGA (Land Grid Array) 155 Pins
Operating systems	Linux

Arm® Modules

TQMLS10xxA – The module based on Arm® and QorIQ® technology opens new frontiers

HIGHLIGHTS

- **2x 10 Gbit Ethernet**
- **DDR4 + ECC protection**
- **High speed communication via 8x Gbit Ethernet, 3x PCIe and 3x USB 3.0 interface**
- **Extended temperature range**
- **Up to 8 Arm® Cortex®-A53 Cores**
- **QorIQR Trust Architecture and Arm® TrustZone®**
- **Security functions**

Embedded Cortex®-A53/A72 module based on LS102xA with 10 Gbit Ethernet interfaces for many network applications.

TECHNICAL SPECIFICATION

CPU	Layerscape LS1046A, LS1026A, LS1043A, LS1023A, LS1088A
System interfaces	Up to 2x Ethernet 10 Gbit (1x LS1043A) Up to 10x Ethernet 10/100/1000 Mbit Up to 3x USB 3.0 high speed HOST interface (2x LS1088A) Up to 4x UART
Periphery interfaces	Up to 1x SDIO/MMC Up to 4x I^2C Up to 1x SPI Up to 1x SATA 3.0 Up to 3x PCIe 3.0 (LS1043A PCIe 2.0)
Memory	DDR4-SDRAM: Up to 8 GB (LS1043A and LS1023A up to 4GB) Up to 64 GB eMMC Quad SPI NOR: Up to 512 MB EEPROM: 0/64-kbit ECC protection
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG interface
Power supply	5 V
Ambient conditions	Extended temperature range: -40°C...+85°C
Dimensions	80 × 60 mm
Plug-in system	Board-to-board plug-in system 420 pins
Operating systems	Linux
Operating systems on request	VxWorks, other TBD

Arm® Modules

TQMLS102xA – For the networks of tomorrow

HIGHLIGHTS

- **Graphic**
- **QorIQ QUICC Engine**
- **High speed communication via 3x Gbit Ethernet, 2x PCIe and one USB 3.0 interface**
- **Low power consumption (typ. 3 W)**
- **ECC protection**
- **Cache Coherent Interconnect bus system**
- **IEEE 1588 hardware support**
- **Security functions**

Embedded Dual Cortex®-A7 module based on LS102xA with high speed interfaces and graphics for many network applications.

TECHNICAL SPECIFICATION

CPU	QorIQ LS1020A, LS1021A, LS1022A
System interfaces	Up to 3x Ethernet 10/100/1000 Mbit (IEEE 1588) Up to 4x FlexCAN Up to 1x USB 2.0 high speed OTG Up to 1x USB 3.0 high speed HOST Up to 6x UART
Periphery interfaces	Up to 1x SDIO/MMC Up to 3x I^2C Up to 2x SPI Up to 4x I^2S Up to 1x SATA 3.0 Up to 2x PCIe SPDIF
Graphic	LCD interface (only LS1021A)
Memory	DDR3L-SDRAM: Up to 2 GB Quad SPI NOR: Up to 512 MB eMMC: Up to 16 GB EEPROM: 0/64-kbit ECC protection (only LS1020A, LS1021A)
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG interface Extended power management (optional) Voltage monitoring (optional)
Power supply	3.3 V
Ambient conditions	Extended temperature range: -40°C...+85°C
Dimensions	55 × 44 mm
Plug-in system	Board-to-board plug-in system 280 Pins
Operating systems	Linux
Operating systems on request	VxWorks, QNX

Arm® Modules

TQMLS1028A – The module based on LS1028A for Real time demands

Embedded Cortex®-A72 module based on LS1028A with 4 Port TSN Gbit Ethernet Switch for Real time demands.

HIGHLIGHTS

- **1x TSN Ethernet up to 2.5 Gbit**
- **1x 4 Port TSN Ethernet Switch**
- **Graphics with 3D GPU and 4K support**
- **Extended temperature range**
- **Low power consumption**
- **Security functions**

TECHNICAL SPECIFICATION

CPU	QorIQ Layerscape LS1028A, LS1018A, LS1027A, LS1017A
System interfaces	1x 4 Port TSN Ethernet Switch up to 2.5 Gbit Up to 1x TSN Ethernet up to 2.5 Gbit Up to 1x Ethernet 1 Gbit Up to 2x USB 3.0 Up to 6x UART Up to 2x CAN
Periphery interfaces	Up to 2x SDIO/MMC Up to 8x I²C Up to 2x SPI Up to 6x SAI Up to 1x SATA 3.0 Up to 2x PCIe 3.0
Graphic	4K LCD Controller with eDP/DP Phy 3D GPU
Memory	DDR4-SDRAM: Up to 8 GB ECC Protection Quad SPI NOR: Up to 512 MB EEPROM: 0/256 kbit
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG Interface
Power supply	5 V
Ambient conditions	Extended temperature range: -40°C...+85°C
Dimensions	55 × 44 mm
Plug-in system	Board-to-board plug-in system 240 pins
Operating systems	Linux
Operating systems on request	other TBD

Arm® Modules

TQMLx2160A – The module based on LX2160 with enhanced data and networking performance

Embedded Cortex®-A72 module based on LX2160 with enhanced data and networking performance.

HIGHLIGHTS

- **10G/100G Ethernet**
- **High-speed communication via 24x SerDes lanes**
- **2x DDR4 with ECC Support**
- **100Gb/s Data Compression Engine**
- **2x CAN FD, 2x USB 3.0, PCIe Gen3**
- **Integrated security function**

TECHNICAL SPECIFICATION

CPU	LX2160, LX2120, LX2080
System interfaces	Up to 2x Ethernet 10/100/1000 Mbit Up to 2x 40/50/100 G-Ethernet Up to 16x 1/2.5/10/25 G-Ethernet Up to 2x USB 3.0 OTG interface Up to 2x UART Up to 2x CAN FD Up to 4x SATA 3.0
Periphery interfaces	Up to 2x SDIO/eMMC Up to 6x PCIe Gen3 (up to 24 lanes) Up to 6x I2C Up to 3x SPI Up to 1x QSPI (8-bit) Up to 32 GPIO
Memory	2x DDR4-SDRAM: Up to 64 GB Quad SPI NOR: Up to 512 MB (TBD) eMMC Flash: Up to 64 GB EEPROM: 0/64-kbit
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG interface
Power supply	5 V
Ambient conditions	Standard temperature range: -25°C...+85°C Extended temperature range: -40°C...+85°C
Dimensions	126 × 78 mm (TBD)
Plug-in system	Board-to-board plug-in system 560 pins 0.5 mm Pitch (TBD)
Operating systems	Linux
Operating systems on request	QNX, VxWorks

Arm® Modules

TQMa8Xx – The module based on Arm® Cortex®-A35 technology for general embedded applications

HIGHLIGHTS

- **Graphic with 4 K Support**
- **DSP for audio processing**
- **High-speed communication via 2x Gbit Ethernet, 1x PCIe and 1x USB 3.0**
- **Low power consumption (typ. 4 W)**
- **Integrated 1x Cortex® M4 CPU (Real Time/Security)**
- **3x CAN FD**
- **Integrated security functions**

Embedded Cortex®-A35 module based on i.MX8X with high computing power combined with high-speed interfaces.

TECHNICAL SPECIFICATION

CPU	Cortex®-A35 Technology i.MX8X Dual, i.MX8X Dual Plus i.MX8X Quad Plus
System interfaces	Up to 2x Ethernet 10/100/1000 Mbit Up to 1x USB 3.0 OTG interface Up to 2x USB 2.0 OTG interface Up to 4x UART Up to 3x CAN FD
Periphery interfaces	1x SDIO/MMC 1x PCIe Up to 8x I^2C Up to 4x SPI Up to 2 Q-SPI Up to 2x SPDIF Up to 4x ESAI Up to 32 GPIO
Graphic	Dual LVDS Interface / 2xMIPI DSI 1x MIPI CSI
Memory	DDR3L-SDRAM: Up to 2 GB Quad SPI NOR: Up to 256 MB Up to 64 GB eMMC Flash EEPROM: 0/64-kbit
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG interface
Power supply	3.3 V (TBD)
Ambient conditions	Standard temperature range: -25°C...+85°C Extended temperature range: -40°C...+85°C
Dimensions	55 × 44 mm
Plug-in system	Board-to-board plug-in system 280 pins
Operating systems	Linux
Operating systems on request	QNX, Android

Arm® Modules

TQMa8XxS (SMARC) – The SMARC module based on Arm® Cortex®-A35 technology for smart designs

HIGHLIGHTS

- **Graphic with 4K support**
- **DSP for audio processing**
- **High-speed communication via 2x Gbit, Ethernet, 1x PCIe and 1x USB 3.0 interface**
- **Low power consumption (typ. 4 W)**
- **Integrated 1x Cortex®-M4 CPU (Real-time/security)**
- **Integrated security functions**
- **2x CAN FD**

Embedded Cortex®-A35 SMARC 2.0 module based on i.MX8X with high computing power combined with high-speed interfaces.

Based on

SMARC module

TECHNICAL SPECIFICATION

CPU	Cortex®-A35 Technology i.MX8 QuadXPlus, i.MX8 DualXPlus i.MX8 DualX
System interfaces	Up to 2x Ethernet 10/100/1000 Mbit (IEEE 1588) Up to 1x USB 3.0 Up to 2.0 OTG Up to 5x USB 2.0 (USB Hub) Up to 2x UART Up to 2x CAN FD
Periphery interfaces	Periphery interfaces 1x SDIO/MMC 2x I^2C 1x SPI 1x I^2S 1x PCIe GPIO
Graphic	2x LVDS, 1x eDP 1x Camera Sensor Interface (CSI MIPI)
Memory	DDR3L-SDRAM: Up to 2 GB Quad SPI NOR: Up to 256 MB Up to 64 GB eMMC Flash EEPROM: 0/64 kbit
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG interface (optional)
Power supply	3.3 V (optional 3.0 V...5.25 V)
Ambient conditions	Standard temperature range: -25°C...+85°C Extended temperature range: -40°C...+85°C
Dimensions	82 × 50 mm
Plug-in system	SMARC 2.0 Board-to-board plug-in system 314 pins
Operating systems	Linux
Operating systems on request	QNX, Android

Arm® Modules

TQMa8Mx – Module based on i.MX8M with advanced audio and video features

HIGHLIGHTS

- **Graphic with VP9/4K HDR10 support**
- **High performant audio processing**
- **High-speed communication via 1x Gbit Ethernet, 2x PCIe and 2x USB 3.0 interface**
- **Low power consumption (typ. 4 W)**
- **Integrated 1x Cortex®-M4 Security CPU**
- **Integrated security functions**

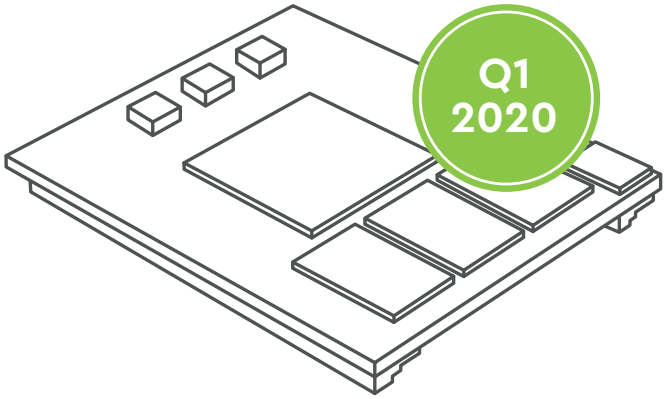
Embedded Cortex®-A53 module based on i.MX8M with advanced audio and video features.

TECHNICAL SPECIFICATION

CPU	i.MX8M Dual, i.MX8M Quad Lite, i.MX8M Quad
System interfaces	Up to 1x Ethernet 10/100/1000 Mbit (IEEE 1588) Up to 1x USB 3.0 OTG interface Up to 1x USB 2.0 OTG interface Up to 4x UART
Periphery interfaces	1x SDIO/MMC Up to 4x I^2C Up to 3x SPI Up to 2x QSPI Up to 6x I^2S/SAI S/PDIF Rx & Tx 2x PCIe GPIO
Graphic	Monitor Interface (HDMI) DSI Display (MIPI DSI 4 lane) Up to 2x MIPI CSI2
Memory	LPDDR4-SDRAM: Up to 4 GB Quad SPI NOR: Up to 256 MB (TBD) Up to 64 GB eMMC Flash EEPROM: 0/64-kbit
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG interface
Power supply	5 V
Ambient conditions	Standard temperature range: -25°C...+85°C Extended temperature range: -40°C...+85°C
Dimensions	55 × 36 mm
Plug-in system	Board-to-board plug-in system 340 pins
Operating systems	Linux
Operating systems on request	Android

Arm® Modules

TQMa8MxML – Module based on i.MX8M Mini with enhanced Audio properties



Embedded Cortex®-A53 module based on
i.MX8M Mini with enhanced Audio properties.

HIGHLIGHTS

- **Advanced Audio properties**
- **Integrated Cortex®-M4**
- **High-speed communication via 1x Gbit Ethernet, 1x PCIe and 2x USB 2.0 interface**
- **Low power consumption (typ. 4 W)**
- **Integrated security functions**

TECHNICAL SPECIFICATION

CPU	i.MX8M Mini Solo i.MX8M Mini Dual/Dual Lite i.MX8M Mini Quad/Quad Lite
System interfaces	Up to 1x Ethernet 10/100/1000 Mbit Up to 1x USB 2.0 OTG interface Up to 1x USB 2.0 Host interface Up to 4x UART
Periphery interfaces	Up to 3x SDIO/eMMC Up to 1x PCIe 2.0 Up to 4x I2C Up to 3x SPI Up to 1x QSPI Up to 20x I^2S Up to 8x PDM Mic. Up to 1x SPDIF
Graphic	LCD Interface: 1x MIPI DSI; (4 Lanes) Camera: 1x MIPI CSI2 (4 Lanes)

Memory	LPDDR4-SDRAM: Up to 4 GB Quad SPI NOR: Up to 256 MB eMMC Flash: Up to 64 GB EEPROM: 0/64-kbit
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG interface
Power supply	5 V
Ambient conditions	Standard temperature range: -25°C...+85°C Extended temperature range: -40°C...+85°C
Dimensions	38 × 38 mm
Plug-in system	LGA (Land Grid Array) 280 pins
Operating systems	Linux
Operating systems on request	Android

Arm® Modules

TQMa57xx – The module based on Arm® Cortex®-A15 technology for the design of tomorrow

Embedded Cortex®-A15 module based on AM57xx for applications with real-time requirements.

HIGHLIGHTS

- **Graphic with HD support**
- **Extended temperature range**
- **High-speed communication via with up to: 2x GbE, 4x Real-Time Ethernet 10/100-Base, 2xPCIe, 1x USB 3.0, 1x USB 2.0 OTG, CAN-FD support**
- **Low power consumption (typ. 4 W)**
- **Integrated 2x Cortex®-M4**
- **IEEE 1588 hardware support**
- **Security functions**

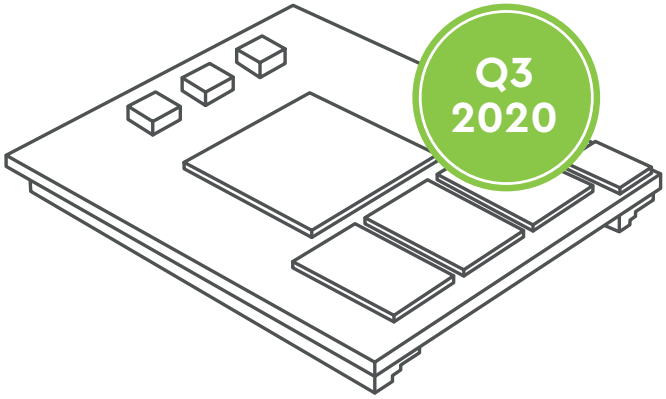
TECHNICAL SPECIFICATION

CPU	AM571x, AM572x, AM574x
System interfaces	Up to 2x Ethernet 10/100/1000 Mbit (IEEE 1588) Up to 4x Ethernet 10/100 (PRU) Up to 2x CAN 1x USB 2.0 high speed OTG Up to 1x USB 3.0 high speed Host Up to 10x UART
Periphery interfaces	Up to 2x SDIO/MMC Up to 3x I^2C Up to 4x SPI Up to 4x I^2S Up to 1x SATA 3.0 Up to 2x PCIe
Graphic	LCD Interface (2x 24-bit RGB), HDMI-Interface Camera sensor interface (2x 24b/2x 8b)

Memory	DDR3L-SDRAM: Up to 4 GB ECC Protection Quad SPI NOR: Up to 256 MB Up to 32 GB eMMC flash EEPROM: 0/64-kbit
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG interface
Power supply	5 V
Ambient conditions	Standard temperature range: -25°C...+85°C Extended temperature range: -40°C...+85°C
Dimensions	75 × 55 mm
Plug-in system	Board-to-board plug-in system 400 pins
Operating systems	Linux
Operating systems on request	VxWorks, QNX, Android

Arm® Modules

TQMa65xx – The module based on AM65xx for applications with enhanced real-time requirements.



HIGHLIGHTS

- **Graphic with 3D Support**
- **DDR4 with ECC Support**
- **6x Real Time Gbit Ethernet TSN (PRU)**
- **1x Gbit Ethernet, 2x PCIe and 1x USB 3.1 interface**
- **Low power consumption (typ. 6 W)**
- **2x CAN FD**
- **Integrated Cortex® R5F MPU**

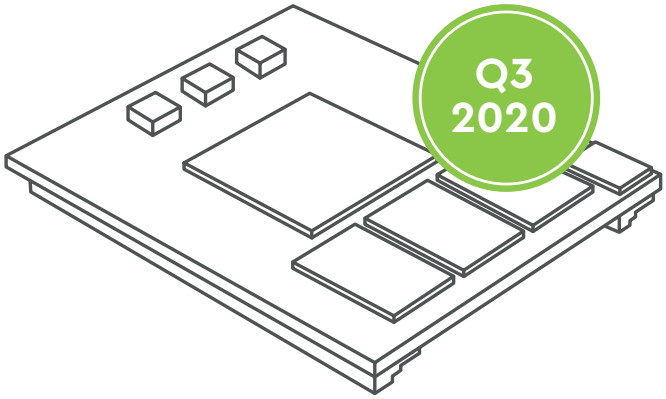
Embedded Cortex®-A53 module based on AM65xx for applications with enhanced real-time requirements.

TECHNICAL SPECIFICATION

CPU	AM6526, AM6527, AM6528, AM6546, AM6548
System interfaces	Up to 1x Ethernet 10/100/1000 Mbit Up to 6x Ethernet 1000 Mbit (PRU) Up to 1x USB 3.1 interface Up to 1x USB 2.0 interface Up to 5x UART Up to 2x CAN FD
Periphery interfaces	Up to 2x SDIO/MMC Up to 2x PCIe 3.0 Up to 6x I2C Up to 8x SPI Up to 2x QSPI Up to 3x McASP/I²S Up to 2x ADC Up to 32 GPIO
Graphic	LCD Interface: 1x 24bit RGB LCD, 1x LVDS Camera: 1x MIPI CSI2, 1x 16-bit Video IN
Memory	DDR4-SDRAM: Up to 4 GB + ECC Quad SPI NOR: Up to 512 MB eMMC Flash: Up to 64 GB EEPROM: 0/64-kbit
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG interface
Power supply	5 V
Ambient conditions	Standard temperature range: -25°C...+85°C Extended temperature range: -40°C...+85°C
Dimensions	77 × 55 mm
Plug-in system	Board-to-board plug-in system 560 pins 0.5 mm Pitch
Operating systems	Linux
Operating systems on request	QNX, Android

Arm® Modules

TQMaRZG2x – The module based on RZ/G2 with enhanced performance and graphics properties.



Embedded Cortex®-A53/A57 module based on RZ/G2 with enhanced performance and graphics properties.

HIGHLIGHTS

- **Graphic with 4K Support/Quad Core**
- **LPDDR4 with ECC Support**
- **Highspeed communication via 1x Gbit Ethernet, 2x PCIe and 1x USB 3.0 interface**
- **Low power consumption (typ. 6 W)**
- **2x CAN**
- **Integrated security functions**

TECHNICAL SPECIFICATION

CPU	RZ/G2M, RZ/G2N
System interfaces	Up to 1x Ethernet 10/100/1000 Mbit Up to 1x USB 3.0 OTG interface Up to 2x USB 2.0 OTG interface Up to 6x UART Up to 5x H-UART Up to 2x CAN FD Up to 1x SATA (only RZ/G2N)
Periphery interfaces	Up to 4x SDIO Up to 2x eMMC Up to 2x PCIe 2.0 Up to 7x I2C Up to 4x SPI Up to 1x QSPI Up to 10x I²S Up to 32 GPIO
Graphic	LCD Interface (1x HDMI 2.0, 1x LVDS, 1x Digital RGB) Camera: 2x MIPI CSI2
Memory	LPDDR4-SDRAM: Up to 8 GB Quad SPI NOR: Up to 512 MB eMMC Flash: Up to 64 GB EEPROM: 0/64-kbit
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG interface
Power supply	5 V
Ambient conditions	Standard temperature range: -25°C...+85°C Extended temperature range: -40°C...+85°C
Dimensions	77 × 55 mm
Plug-in system	Board-to-board plug-in system 440 Pins 0.5 mm Pitch
Operating systems	Linux
Operating systems on request	QNX, Android

Arm® Modules

TQMa6ULx – Energy efficient for future designs (plug-in connector + directly soldered)

Energy-efficient and future-oriented Cortex® A7 module based on i.MX6UL and i.MX6ULL.

HIGHLIGHTS

- **Graphic**
- **Extended temperature range**
- **2x Ethernet with IEE1588**
- **Low power consumption (typ. 1 W)**
- **Camera Sensor Interface**
- **Security functions**
- **Long term availability**

TECHNICAL SPECIFICATION

CPU	i.MX6UL (G1, G2, G3) i.MX6ULL (Y0, Y1, Y2)
System interfaces	Up to 2x Ethernet 10/100 Mbit Up to 2x CAN Up to 2x USB 2.0 high speed OTG Up to 8x UART
Periphery interfaces	Up to 2x SDIO/MMC Up to 4x I^2C Up to 4x SPI Up to 3x I^2S
Graphic	LCD Interface (24-bit RGB) 1x 16-bit Camera Sensor Interface
Memory	DDR3L-SDRAM: Up to 1 GB Quad SPI NOR: Up to 256 MB Up to 32 GB eMMC-Flash EEPROM: 0/64-kbit
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG Interface
Power supply	5 V
Ambient conditions	Standard temperature range: -25°C...+85°C Extended temperature range: -40°C...+85°C
Dimensions	46 × 32 mm
Plug-in system	Board-to-board plug-in system 200 pins
Operating systems	Linux, QNX
Operating systems on request	VxWorks

* Optional WEIM bus or parallel 24 bit graphic interface usable

Arm® Modules

TQMa6ULxL – Energy efficient for future designs (plug-in connector + directly soldered)

Energy-efficient and future-oriented Cortex® A7 LGA module based on i.MX6UL and i.MX6ULL.

HIGHLIGHTS

- **Graphic**
- **Extended temperature range**
- **2x Ethernet with IEE1588**
- **Low power consumption (typ. 1 W)**
- **Camera sensor interface**
- **Security functions**
- **Long term availability**

TECHNICAL SPECIFICATION

CPU	i.MX6UL (G1, G2, G3) i.MX6ULL (Y0, Y1, Y2)
System interfaces	Up to 2x Ethernet 10/100 Mbit Up to 2x CAN Up to 2x USB 2.0 high speed OTG Up to 8x UART
Periphery interfaces	Up to 2x SDIO/MMC Up to 4x I²C Up to 4x SPI Up to 3x I²S
Graphic	LCD Interface (24-bit RGB) 1x 16-bit Camera Sensor Interface
Memory	DDR3L-SDRAM: Up to 1 GB Quad SPI NOR: Up to 256 MB Up to 32 GB eMMC Flash EEPROM: 0/64-kbit

Other	Real Time Clock (RTC) Temperature sensor CPU JTAG Interface
Power supply	3.3 V
Ambient conditions	Standard temperature range: -25°C...+85°C Extended temperature range: -40°C...+85°C
Dimensions	38 × 38 mm
Plug-in system	LGA (Land Grid Array) 226 Pins
Operating systems	Linux, QNX
Operating systems on request	VxWorks

Arm® Modules

TQMa7x – Energy efficient and optimized for secure applications

Security-oriented Dual Cortex®-A7 module based on i.MX7 with integrated Cortex®-M4 and smart card interface.

HIGHLIGHTS

- **Graphic with full HD support**
- **Extended temperature range**
- **High-Speed communication via 2x Gbit Ethernet and 1x PCIe interface**
- **Low power consumption (typ. 2 W)**
- **Integrated Cortex®-M4**
- **IEEE 1588 hardware support**
- **Security functions**

TECHNICAL SPECIFICATION

CPU	i.Mx7S, i.Mx7D
System interfaces	Up to 2x Ethernet 10/100/1000 Mbit Up to 2x CAN Up to 2x USB 2.0 high speed OTG Up to 1x USB 2.0 high speed HOST Up to 7x UAR
Periphery interfaces	Up to 3x SDIO/MMC Up to 4x I^2C Up to 4x SPI Up to 3x I^2S Up to 1x Smart Card Up to 1x PCIe
Graphic	LCD Interface (24-bit RGB) Up to 2 Camera Sensor Interface (24-bit/MIPI)
Memory	DDR3L-SDRAM: Up to 2 GB Quad SPI NOR: Up to 256 MB Up to 32 GB eMMC flash EEPROM: 0/64-kbit
Other	Integrated Cortex®-M4 Real Time Clock (RTC) Temperature sensor CPU JTAG Interface
Power supply	5 V
Ambient conditions	Standard temperature range: -20°C...+85°C
Dimensions	55 × 44 mm
Plug-in system	Board-to-board plug-in system 320 pins
Operating systems	Linux
Operating systems on request	VxWorks, QNX, WIN EC 2013

Arm® Modules

TQMa6x – Scalable performance and multimedia module

HIGHLIGHTS

- **Graphic**
- **Extended temperature range**
- **eMMC Flash**
- **NOR Flash**
- **Low power consumption (typ. 4 W)**
- **Long-term availability**
- **IEEE 1588 support**
- **Security functions**

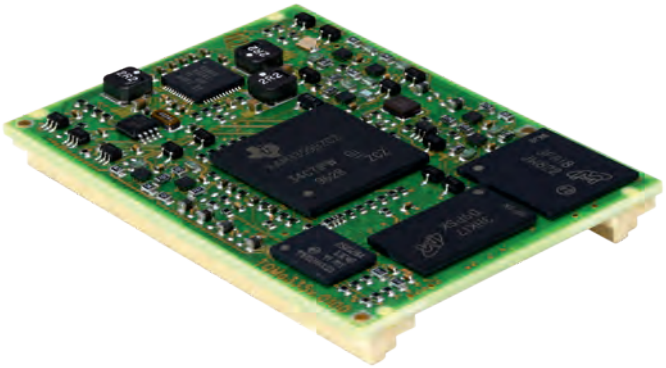
Embedded Cortex®-A9 module based on i.MX6 with scalable computing and graphics performance.

TECHNICAL SPECIFICATION

CPU	i.MX6 Solo/Dual Lite/Dual/Quad/ Dual+/Quad+
System interfaces	1x Ethernet 10/100/1000 Mbit (IEEE 1588) 2x FlexCAN 1x USB 2.0 high speed OTG interface 1x USB 2.0 high speed HOST interface Up to 5x UART
Periphery interfaces	WEIM Bus Up to 3x SDIO/MMC Up to 2x I^2C Up to 5x SPI Up to 3x SSI/I^2S ESAI 2x 16-bit Camera I/F SATA PCIe SPDIF
Graphic	DVI (HDMI) Parallel 2x 24-bit (RGB) Dual LVDS
Memory	DDR3L-SDRAM: Up to 2 GB (MCIMX6 Solo with 1 GB) eMMC: Up to 16 GB NOR: Up to 128 MB EEPROM: 0/64-kbit
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG Interface
Power supply	5 V
Ambient conditions	Standard temperature range: -25°C...+85°C Extended temperature range: -40°C...+85°C
Dimensions	70 × 46 mm
Plug-in system	Board-to-board plug-in system 360 pins
Operating systems	Linux, VxWorks, QNX

Arm® Modules

TQMa335x – Multifunctional talent for universal applications (plug-in connector + directly soldered)



HIGHLIGHTS

- **Real time communications subsystem**
- **Low-cost due to highest level of integration**
- **Extended temperature range**
- **2x IEEE1588 Ethernet (int. Switch)**
- **Low power consumption (2 W)**
- **Long-term availability**

Embedded module based on Cortex®-A8 (AM335x) with graphics and real-time support.

TECHNICAL SPECIFICATION

CPU	AM3352, AM3354, AM3358, AM3359 (Up to 1 GHz)
Interfaces	Up to 2x Ethernet 10/100/1000 Mbit (L2 Switch) Up to 2x CAN 2.0 B Up to 6x UART 2x USB 2.0 high speed OTG interface Up to 2x SDIO/MMC Up to 3x I2C Up to 2x McASP (4ch) Up to 2x SPI GPIO Up to 8x 12-bit ADC channels Up to 3x PWM
Graphic	24-bit TFT Interface
Memory	DDR3L-SDRAM: up to 512 MB eMMC flash: up to 16 GB NOR flash: up to 128 MB EEPROM: 0/64-kbit
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG Interface
Power supply	3.3 V
Ambient conditions	Standard temperature range: -25°C...+85°C Extended temperature range: -40°C...+85°C
Plug-in system	Board-to-Board plug-in system (240 Pins) 2* 120
Operating systems	Linux, QNX, Windows Embedded Compact 2013
Dimensions	54 × 38 mm

Arm® Modules

TQMa335xL – Multifunctional talent for universal applications (plug-in connector + directly soldered)

HIGHLIGHTS

- **Real time communications subsystem**
- **Recommended for high quantity use**
- **Low-cost due to highest level of integration**
- **Extended temperature range**
- **2x IEEE1588 Ethernet (int. Switch)**
- **Low power consumption (2 W)**
- **Long-term availability**

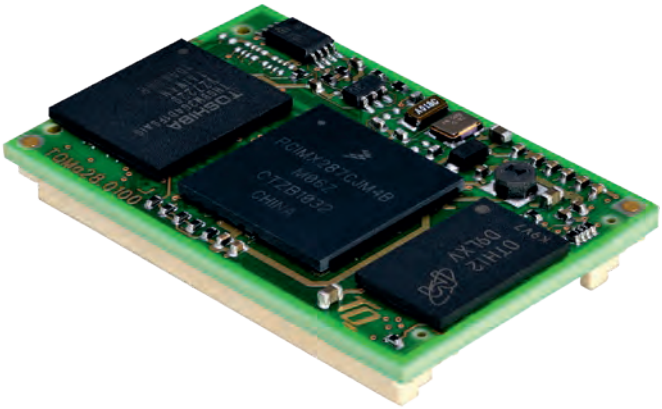
Embedded LGA module based on Cortex®-A8 (AM335x) with graphics and real-time support.

TECHNICAL SPECIFICATION

CPU	AM3352, AM3354, AM3358, AM3359 (Up to 1 GHz)
Interfaces	Up to 2x Ethernet 10/100/1000 Mbit (L2 Switch) Up to 2x CAN 2.0 B Up to 6x UART 2x USB 2.0 high speed OTG interface Up to 2x SDIO/MMC Up to 3x I2C Up to 2x McASP (4 ch) Up to 2x SPI GPIO Up to 8x 12-bit ADC channels Up to 3x PWM
Graphic	24-bit TFT Interface
Memory	DDR3L-SDRAM: up to 512 MB eMMC Flash: up to 16 GB
Other	Real Time Clock (RTC) CPU JTAG Interface
Power supply	3.3 V
Ambient conditions	Standard temperature range: -25°C...+85°C Extended temperature range: -40°C...+85°C
Dimensions	38 × 38 mm
Plug-in system	LGA (Land Grid Array) 209 pins
Operating systems	Linux, QNX, Windows Embedded Compact 2013

Arm® Modules

TQMa28 – Functional talent for various applications (plug-in connector + directly soldered)



Smallest Arm® 9 module based on i.MX28 with good graphics and computing power.

HIGHLIGHTS

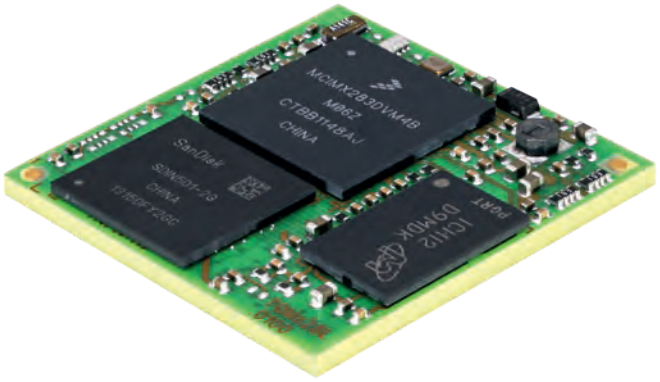
- **Smallest Arm® 9 module**
- **Low-cost due to highest level of integration**
- **Extended temperature range**
- **2x IEEE1588 Ethernet (L2 Switch)**
- **Low power consumption (typ. 1 W)**
- **Long-term availability**
- **IEC 61850 stack**

TECHNICAL SPECIFICATION

CPU	i.MX287 (450 MHz)
Interfaces	Up to 2x Ethernet 10/100 Mbit (L2 Switch) Up to 2x CAN 2.0 B Up to 5x UART 1x USB 2.0 high-speed HOST interface 1x USB 2.0 high-speed OTG interface 1x SDIO/MMC Up to 2x I2C Up to 2x I2S Up to 2x SPI GPIO Up to 8x 12-bit ADC channels Up to 8x PWM
Graphic	24-bit TFT Interface
Memory	DDR2-SDRAM: up to 256 MB eMMC flash: up to 16 GB EEPROM: 0/64-kbit
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG Interface Supervisor 5 V
Power supply	5 V
Ambient conditions	Standard temperature range: -25°C...+85°C Extended temperature range: -40°C...+85°C
Dimensions	26 × 40 mm
Plug-in system	Board-to-Board plug-in system (160 Pins) 2* 80
Operating systems	Linux, Win CE 6.0, QNX
Operating systems on request	VxWorks

Arm® Modules

TQMa28L – Functional talent for various applications (plug-in connector + directly soldered)



HIGHLIGHTS

- **Smallest Arm® 9 module**
- **High quantity use**
- **Extended temperature range**
- **2x IEEE1588 Ethernet (L2 Switch)**
- **Low power consumption (typ. 1 W)**
- **Long-term availability**
- **IEC 61850 stack**

Smallest Arm® 9 LGA module based on i.MX28 with good graphics and computing power.

TECHNICAL SPECIFICATION

CPU	i.MX283, i.MX287 (450 MHz)
Interfaces	Up to 2x Ethernet 10/100 Mbit (L2 Switch) Up to 2x CAN 2.0 B Up to 5x UART 1x USB 2.0 high-speed HOST interface 1x USB 2.0 high-speed OTG interface 1x SDIO/MMC Up to 2x I2C Up to 2x I2S Up to 2x SPI GPIO Up to 8x 12-bit ADC channels Up to 8x PWM
Graphic	24-bit TFT Interface
Memory	DDR2-SDRAM: up to 256 MB eMMC flash: up to 16 GB
Other	Real Time Clock (RTC) CPU JTAG Interface
Power supply	5 V
Ambient conditions	Standard temperature range: -25°C...+85°C Extended temperature range: -40°C...+85°C
Dimensions	31 × 31 mm
Plug-in system	LGA (Land Grid Array) 191 pins
Operating systems	Linux, Win CE 6.0, QNX
Operating systems on request	VxWorks

TQ Technology inside

Power Architecture® Modules

TQMT1042/T1022 – Higher Performance and Less Power Consumption with the new Processors

Quad/Dual Core Power Architecture® module with multiple I/O connectivity and strong computing performance at low power budget.

HIGHLIGHTS

- **Quad/Dual Core up to 1400 MHz in 28 nm SOI for the best Performance/Watt ratio**
- **High-speed communication with up to 5x Gbit Ethernet, 4x PCIe and two USB 2.0 High Speed interfaces**
- **Dual SATA interfaces for data storage**
- **Easy function extensions via PCIe, eSPI, I²C and IFC (Local Bus)**
- **IEEE 1588 time synchronization in hardware**
- **Extremely compact module dimensions**
- **Display Interface Unit**

TECHNICAL SPECIFICATION

CPU	Quad T1042 Power Architecture® e5500 cores (64-bit) Dual T1022 Power Architecture® e5500 cores (64bit)
Interfaces	5x Gbit Ethernet (with IEEE® 1588v2) 2x USB 2.0 High Speed Host/Device/OTG 2x SATA 2.0 4x PCIe, 2.0 Controller up to 5.0 Gbit/s according to PCI Express specification 2.0 as Root-Complex or Endpoint 4x I²C, max. 400 kHz 1x Integrated Flash Controller (IFC), 16-bit 1x eSPI Controller 2x DUART, max. 115 kBaud (RS232) Up to 32x GPIOs 2x TDM (via QUICC Engine)
Graphics	Display controller for TFT LCD displays (up to 24-bit RGB)
Memory	DDR3L-SDRAM: up to 8 GB with ECC*) NOR flash: up to 256 MB EEPROM: 32 KB eMMC (optional): up to 8 GB Simple expansion for example via MMC/SDHC, USB
Other	Real Time Clock (RTC) Watchdog JTAG Interface Real-Time Debug Interface (Aurora)
Power supply	5 V
Power consumption	Typ. 5 W up to 8 W
Ambient conditions	Standard temperature range: 0°C...+70°C Extended temperature range: -40°C...+85°C
Dimensions	74 × 54 mm
Plug-in system	Board-to-board plug-in system 360 Pins
Operating systems	Linux
Operating systems on request	PikeOS™, Wind River Linux

* Up to 4 GB with ECC for extended temperature range

Power Architecture® Modules

TQMT1040 – Higher Performance and Less Power Consumption with the new Processors

Quad-core Power Architecture® module with multiple I/O connectivity and strong computing performance at low power budget.

HIGHLIGHTS

- **Quad core up to 1400 MHz in 28 nm SOI for the bestPerformance/Watt ratio**
- **High speed communication with a combination of up to 4x Gbit Ethernet and integrated 8-Port Switch, 4x PCIe and two USB 2.0 interfaces**
- **Dual SATA interfaces for data storage**
- **Easy function extensions via PCIe, eSPI, I²C and IFC (Local Bus)**
- **IEEE 1588 time synchronization in hardware**
- **Extremely compact module dimensions**
- **Display Interface Unit**

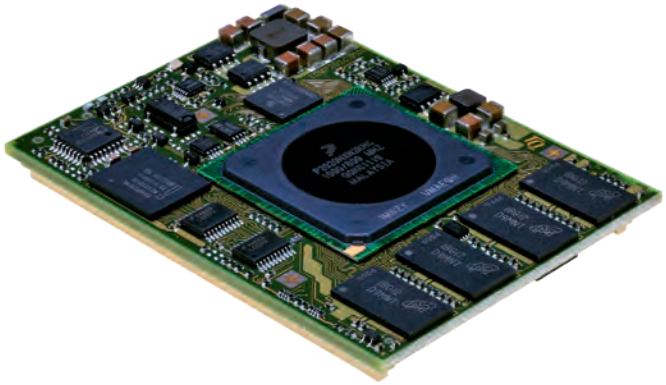
TECHNICAL SPECIFICATION

CPU	Quad T1044 Power Architecture® e5500 cores (64-bit)
Interfaces	4x Gbit Ethernet (with IEEE® 1588v2) 8-Port Gbit Ethernet Switch 2x USB 2.0 High Speed Host/Device/ OTG 2x SATA 2.0 4x PCIe, 2.0 Controller up to 5.0 Gbit/s according to PCI Express specification 2.0 as Root-Complex or Endpoint 4x I²C, max. 400 kHz 1x Integrated Flash Controller (IFC), 16-bit 1x eSPI Controller 2x DUART, max. 115 kBaud (RS232) Up to 32x GPIOs 2x TDM (via QUICC Engine)
Graphics	Display controller for TFT LCD displays (up to 24-bit RGB)
Memory	DDR3L-SDRAM: up to 8 GB with ECC*) NOR flash: up to 256 MB EEPROM: 32 KB eMMC (optional): up to 8 GB Simple expansion for example via MMC/ SDHC, USB
Other	Real Time Clock (RTC) Watchdog JTAG Interface Real-Time Debug Interface (Aurora)
Power supply	5 V
Power consumption	Typ. 7 W up to 9 W
Ambient conditions	Standard temperature range: 0°C...+70°C Extended temperature range: -40°C...+85°C
Dimensions	74 × 54 mm
Plug-in system	Board-to-board plug-in system 360 Pins
Operating systems	Linux
Operating systems on request	PikeOS™, Wind River Linux, VxWorks

* Up to 4 GB with ECC for extended temperature range

Power Architecture® Modules

TQMP1020/P2020 – The move-in of Multicore



HIGHLIGHTS

- **Easiest migration of Power QUICC III on QorIQ by approved e500v2 Core**
- **Single- and MultiCore(s) of 400 up to 1200 MHz in 45nm SOI for best Performance/Watt ratio**
- **High-Speed communication via 3x Gbit Ethernet, 3x PCIe and one USB 2.0 interface**
- **Simple function extension via PCIe, SPI, I²C and flexible local bus**
- **IEEE 1588 synchronization on time in Hardware**
- **Extremely compact with only 74 x 54 mm**

With one or two e500 cores and a clock speed ranging from 400 MHz to 2×1200 MHz, the TQ modules with its QorIQ™ processor offers an optimal balance between data processing speed and power dissipation.

TECHNICAL SPECIFICATION

CPU	Dual (P1020/P1021/P2020) or single (P1011/P1012/P2010) high-performance Power Architecture e500v2 Cores
Interfaces	3x Gbit Ethernet 1 USB 2.0 HOST 3x PCIe (2x), 1.0a Controller up to 2.5 Gbit/s according to PCI Express specification 1.0a as Root-Complex or Endpoint 1x Enhanced Local Bus 16 bit, max. 66 MHz 2x I²C, max. 400 kHz 1x SPI DUART, max. 115 kBaud (RS232) Up to 16 GPIOs 2x Serial Rapid I/O (SRIO) 1x TDM

Memory	DDR3-SDRAM: up to 2 GB (higher memory sizes on request) NOR flash: 128 MB (higher memory sizes on request) EEPROM: 32 KByte Simple expansion for example via MMC, SDHC, USB
Other	Real Time Clock (RTC) Watchdog JTAG Interface
Power supply	3.3 V
Ambient conditions	Standard temperature range: 0°C...+70°C Extended temperature range: -40°C...+85°C
Dimensions	74 × 54 mm
Plug-in system	Board-to-board plug-in system 360 Pins
Operating systems	Linux, QNX
Operating systems on request	VxWorks and more

TQ Technology inside

x86 Modules

TQMx80UC – COM Express® Compact Type 6 Module with 8th Gen. Intel® Core™ Processor

COM Express® Compact Type 6 Module with 8th Gen. Intel® Core™ Processor.

Based on COM Express

intel Technology Provider Platinum 2020

HIGHLIGHTS

- **High end Intel® CoreTM performance up to Quad Core 4.6 GHz/8 M cache**
- **Fast DDR4-2400 SO-DIMM Memory up to 64 GByte**
- **Onboard eMMC flash from 8 GByte to 128 GByte**
- **4x USB 3.1 Gen 2 (10 GBit/s)**
- **3 independent displays with up to 4K resolution**
- **Options for LVDS, TPM**

TECHNICAL SPECIFICATION

CPU	8th Gen. Intel® Core™ Processor Core™ i7-8665UE (4x 1.7/4.4 GHz, 8 MB, 15 W) Core™ i5-8265U (4x 1.6/4.1 GHz, 6 MB, 15 W) Core™ i5-8365UE (4x 1.6/4.1 GHz, 6 MB, 15 W) Core™ i3-8145UE (2x 2.2/3.9 GHz, 4 MB, 15 W) Celeron® 4305UE (2x 2.0/2.0 GHz, 2 MB, 15 W)
Memory	Dual Channel DDR4-2400; 8 GByte, 16 GByte, 32 GByte, 64 GByte SO-DIMM On special request: memory down EEPROM: 32-kbit
Graphic	Three independent displays: 1x embedded DP with up to 4K @ 60 Hz or 1x LVDS Interface (18/24-bit, Single/ Dual Channel) 1x DP 1.2 with up to 4K @ 60 Hz 1x HDMI 1.4 with up to 4K @ 30 Hz Intel® UHD Graphics 620
Additional components and controller	TPM 2.0 (SLB9665) TQMx86 board controller with watchdog and flexiCFG Hardware monitor for thermal management
Interfaces	1x Gbit Ethernet (Intel® i219-LM) 4x USB 3.1 Gen 2 8x USB 2.0 2x SATA Gen 3 (up to 6 Gb/s) 1x PEG Port with PCIe x1 Gen 3 8x PCIe Gen 3 (4 × 1 or 1 × 4 or 2 × 2) 1x LPC bus 1x Intel® HD audio (HDA) 1x I2C (master/slave capable) 1x SMBus (HW monitor) 1x SPI (for external uEFI BIOS flash) 2x Serial Port (Rx/Tx, legacy compatible) (4 wire optional through TQ flexiCFG) 8x GPIO or SD Card
Power supply	Input Voltage: 8.5...20 V
Environment	Standard Temperature: 0 °C...+60 °C Extended Temperature: -40 °C...+85 °C Storage temperature: -40 °C...+85 °C
Form factor/ dimensions	COM Express® Compact, type 6, PICMG COM.0 R3.0 95 × 95 mm

x86 Modules

TQMx70EB – COM Express® Basic Module (Type 6) with 7th Gen. Intel® Core™ and Xeon®

COM Express® Basic Type 6 Module with Intel® Core™ (7th Gen.) 7000E series („Kaby Lake-H") and Intel® Xeon® E3-1500 v6 series.

Based on COM Express

intel Technology Provider Platinum 2020

HIGHLIGHTS

- **High end performance up to Quad-Core 3.7 GHz/ 8 MB cache**
- **Impressive graphics performance (Intel® Iris™ Pro 630) with hardwarebased 10-bit HEVC and VP9 en-/decoding**
- **Intel® Optane™ 3D XPoint SSD support**
- **Best in class power optimization**
- **Up to 32 GB Dual-Channel DDR4 (2 SO-DIMMs), ECC**
- **High bandwidth with up to 24 PCIe Gen. 3 lanes (incl. PCIe x16 PEG port)**
- **TQMx86 board controller with flexible customization options (flexiCFG)**
- **Mobile Intel® 100 series chipset (CM238)**
- **TPM 1.2/2.0**
- **"Green ECO-Off" (minimum of standby power)**
- **Watchdog und thermal management**
- **Highest reliability, 24/7 certified**
- **Quality Made-in-Germany**

TECHNICAL SPECIFICATION

CPU	Intel® Xeon® E3-1500 v6 series („Kaby Lake-H") Xeon E3-1505L v6 (4x 2.2/3.0 GHz, 8 MB, 25 W) Intel® Core™ 7000E series („Kaby Lake-H") Core i7-7820EQ (4x 3.0/3.7 GHz, 8 MB, 45/35 W) Core i5-7440EQ (4x 2.9/3.6 GHz, 6 MB, 45/35W) Core i5-7442EQ (4x 2.1/2.9 GHz, 6 MB, 25 W) Core i3-7100E (2x 2.9, 3 MB, 35 W) Core i3-7102EQ (2x 2.1 GHz, 3 MB, 25 W)
Memory	DDR4-2400: up to 32 GB, w. ECC option, 2 SO-DIMMs EEPROM: 32-kBit (24LC32)
Graphic	Three independent display outputs: 3x Digital Display Interface/DP++ with up to 4K @ 60Hz LVDS Interface (18/24-bit, Single/Dual Channel) (optional eDP 1.4 with 4 lanes instead of LVDS) Intel® Quick Sync Video and Wireless Display
Additional components and controller	TPM (SLB9660 TPM 1.2, alternatively SLB9665 TPM 2.0) TQMx86 board controller with watchdog and flexiCFG Hardware monitor for thermal management
Interfaces	1x Gbit Ethernet (Intel® i219-LM) 4x USB 3.0 (with USB 2.0 backward compatibility) 8x USB 2.0 (incl. USB 3.0 ports) 4x SATA Gen3 (up to 6 Gb/s) 1x PEG Port with PCIe x16 Gen 3 8x PCIe Gen 3 (4 × 1 or 1 x w4) 1x LPC bus 1x Intel® HD audio (HDA) 1x I2C, (2nd I2C optional) (master/slave capable) 1x SMBus 1x SPI (for external uEFI BIOS flash) 2x Serial Port (Rx/Tx, legacy compatible) (4 wire optional through TQ flexiCFG) 8x GPIO
Power supply	Voltage: 8.5 V – 20 V, 5 V Standby (optional), 3 V battery Power: typ. 25–30 W/max. 60 W, (Green ECO-Off: < 0.1 W)
Environment	Temperature: 0°C...+60°C
Form factor/ dimensions	COM Express® Basic, Type 6, PICMG COM.0 R2.1 125 × 95 mm

x86 Modules

TQMx60EB – COM Express® Basic Module (Type 6) with 6th Gen. Intel® Core™ and Xeon®

COM Express® Basic Type 6 Module with Intel® Core™ (6th Gen.) 6000E series („Skylake-H").

Based on COM Express

intel Technology Provider Platinum 2020

HIGHLIGHTS

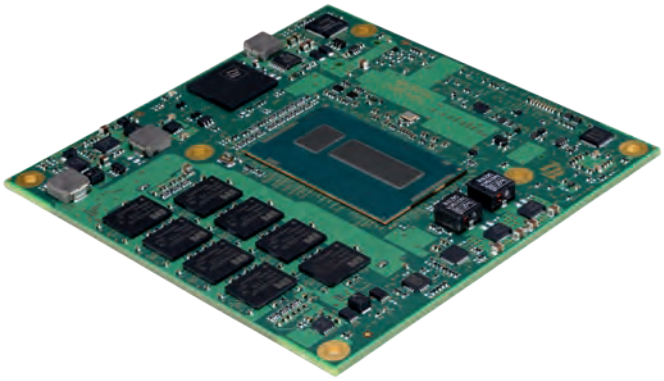
- **High end performance up to Quad-Core 3.7 GHz/ 8 MB cache**
- **Impressive graphics performance (Intel® Iris™ Pro)**
- **Best in class power optimization**
- **Up to 32 GB Dual-Channel DDR4 (2 SO-DIMMs), ECC**
- **High bandwidth with up to 24 PCIe Gen. 3 lanes (incl. PCIe x16 PEG port)**
- **TQMx86 board controller with flexible customizationoptions (flexiCFG)**
- **Mobile Intel® 100 series chipset (CM236)**
- **TPM 1.2/2.0**
- **"Green ECO-Off" (minimum of standby power)**
- **Watchdog und thermal management**
- **Highest reliability, 24/7 certified**
- **Quality Made-in-Germany**

TECHNICAL SPECIFICATION

CPU	Intel® Xeon® E3-1500 v5 series („Skylake-H") Xeon E3-1505M v5 (4x 2.8/3.7 GHz, 8 MB, GT2, 45/35 W) Xeon E3-1505L v5 (4x 2.0/2.8 GHz, 8 MB, GT2, 25 W) Intel® Core™ 6000E series („Skylake-H") Core i7-6820EQ (4x 2.8/3.5 GHz, 8 MB, GT2, 45/35 W) Core i7-6822EQ (4x 2.0/2.8 GHz, 8 MB, GT2, 25 W) Core i5-6440EQ (4x 2.7/3.4 GHz, 6 MB, GT2, 45/35 W) Core i5-6442EQ (4x 1.9/2.7 GHz, 6 MB, GT2, 25 W) Core i3-6100E (2x 2.7 GHz, 3 MB, GT2, 35 W) Core i3-6102E (2x 1.9 GHz, 3 MB, GT2, 25 W)
Memory	DDR4-2133: up to 32 GB, w. ECC option, 2 SO-DIMMs EEPROM: 32-kBit (24LC32)
Graphic	Three independent display outputs: 3x Digital Display Interface/DP++ with up to 4K @ 60 Hz for DP 1.2a/HDMI 1.4 with multi stream transport (MST) LVDS Interface (18/24-bit, Single/Dual Channel) (optional eDP 1.3 with 4 lanes instead of LVDS) Intel® Quick Sync Video and Wireless Display support
Additional components and controller	TPM (SLB9660 TPM 1.2, alternatively SLB9665 TPM 2.0) TQMx86 board controller with watchdog and flexiCFG Hardware monitor for thermal management
Interfaces	1x Gbit Ethernet (Intel® i219-LM) 4x USB 3.0 (with USB 2.0 backward compatibility) 8x USB 2.0 (incl. USB 3.0 ports) 4x SATA Gen3 (up to 6 Gb/s) 1x PEG Port with PCIe x16 Gen 3 8x PCIe Gen 3 (4 × 1 or 1 × 4) 1x LPC bus 1x Intel® HD audio (HDA) 1x I2C, (2nd I2C optional) (master/slave capable) 1x SMBus 1x SPI (for external uEFI BIOS flash) 2x Serial Port (Rx/Tx, legacy compatible) (4 wire optional through TQ flexiCFG) 8x GPIO
Power supply	Voltage: 8.5 V – 20 V 5 V Standby (optional) 3 V battery Power: typ. 25–30 W/max. 60 W (Green ECO-Off: < 0.1 W)
Environment	Temperature: 0°C...+60°C
Form factor/ dimensions	COM Express® Basic, type 6, PICMG COM.0 R2.1 125 × 95 mm

x86 Modules

TQMx50UC – COM Express® Compact Module (Type 6) with 5th Gen. Intel® Core™



COM Express® Compact Type 6 Module with Intel® Core™ (5th Gen.) 5000U series („Broadwell-U").

Based on COM Express

intel Technology Provider Platinum 2020

HIGHLIGHTS

- **Intel® Core™ 5000U series („Broadwell-U") with up to 3.2 GHz/4 MB cache**
- **Up to 16 GB DDR3L on board memory**
- **Best Performance-per-Watt ratio (15 W TDP)**
- **Feature-rich uEFI BIOS with easy-config, multisetup and touch support**
- **TQMx86 board controller with flexible customization options (flexiCFG)**
- **TPM 1.2/2.0**
- **iRTC (highly accurate industrial real time clock)**
- **"Green ECO-Off" (minimum of standby power)**
- **Watchdog und thermal management**
- **Highest reliability, 24/7 certified**
- **Rugged design/Conformal coating capability**
- **Quality Made-in-Germany**

TECHNICAL SPECIFICATION

CPU	Intel® Core™ 5000U series („Broadwell-U") i7-5650U: 2x 2.2 GHz/3.2 GHz Turbo, 4 MB Cache, HD6000 i5-5350U: 2x 1.8 GHz/2.9 GHz Turbo, 3 MB Cache, HD6000 i3-5010U: 2x 2.1 GHz, 3 MB Cache, HD5500 Celeron® 3765U: 2x 1.9GHz/no Turbo, 2MB Cache, 5th Gen HD graphics Hyper-Threading and Virtualization support 15 W TDP max. (configurable down to 9.5/10 W)
Memory	DDR3L-1600: 4 GB, 8 GB, 16 GB, soldered down EEPROM: 32-kbit (24LC32)
Graphic	Three independent display outputs: 2x Digital Display Interface/DP++ with up to 4K @ 60 Hz LVDS Interface (18/24-bit, Single/Dual Channel), up to 4K (optional eDP 1.3 with 4 lanes instead of LVDS) Intel® Quick Sync Video and Wireless Display support
Additional components and controller	TPM (SLB9660 TPM 1.2, alternatively SLB9665 TPM 2.0) TQMx86 board controller with watchdog and flexiCFG Industrial real time clock (iRTC) with high accuracy Hardware monitor for thermal management

Interfaces	1x Gbit ethernet (Intel® i218-LM) with IEEE1588 2x USB 3.0 (with USB 2.0 backward compatibility) 8x USB 2.0 (incl. USB 3.0 ports) 4x SATA Gen 3 (up to 6 Gb/s) 4x PCIe 2.0 (up to 5 Gb/s) (4 × 1 or 1 × 4) 1x LPC bus 1x Intel® HD audio (HDA) 1x I2C, (2nd I2C optional) (master/slave capable) 1x SMBus 1x SPI (for external uEFI BIOS flash) 2x Serial Port (Rx/Tx, legacy compatible) 8x GPIO
Power supply	Voltage: 8.5 V – 20 V 5 V Standby (optional) 3 V battery/GoldCAP on carrier (optional) Power: typ. 10 W/max. 18 W (Green ECO-Off: < 0.1 W)
Environment	Temperature: 0°C...+60°C -40°C...+85°C (on request)
Form factor/ dimensions	COM Express™ Compact, type 6, PICMG COM.0 R2.1 95 × 95 mm

x86 Modules

TQMxE39S – SMARC Module (SMARC 2.0) with Intel Atom® E3900

SMARC 2.0 Short Size Module with Intel Atom® x5/x7 E3900 ("Apollo Lake-I") and soldered LPDDR4.

Based on

SMARC module

intel Technology Provider Platinum 2020

HIGHLIGHTS

- **Intel Atom® x5/x7 E3900 series ("Apollo Lake-I"), Pentium® N4200 and Celeron® N3350 processors**
- **Dual/Quad core computing power with up to 2.5 GHz**
- **Up to 8 GB LPDDR4**
- **High-speed interconnected with Gbit Ethernet, 6x USB (3.0/2.0) and up to 4 PCIe lanes**
- **Triple display support (up to 4K UHD) and eDP/LVDS**
- **Up to 64 GB eMMC Flash, soldered**
- **Small size (82 × 50 mm)**
- **Extended temperature support**

TECHNICAL SPECIFICATION

CPU	Intel Atom® x5/x7 E3900 („Apollo Lake-I") Atom® x5-E3930 2x 1.8 GHz, 6.5 W Atom® x5-E3940 4x 1.8 GHz, 9.5 W Atom® x7-E3950 4x 2.0 GHz, 12 W Celeron® N3350 2x 2.4 GHz, 6 W Pentium® N4200 4x 2.5 GHz, 6 W
System interfaces	1x Gbit Ethernet (Intel® i210) (external IEEE1588 sync optional through TQ flexiCFG) 2x USB 3.0 4x USB 2.0 1x USB 2.0 OTG
Periphery interfaces	1x SATA 3.0 (up to 6 Gb/s), eSATA capable Up to 4x PCIe 2.0 (up to 5 Gb/s) 1x Intel® HD audio (HDA) 1x I2C (master/slave capable) 1x SMBus 1x SPI (for exteral uEFI BIOS flash) 4x Serial port (Rx/Tx, legacy compatible) 1x SD card interface 2x MIPI CSI
Graphic	1x Digital Display Interface (DDI) for DP 1.2a, HDMI 1.4b 1x eDP1.4/Dual Channel LVDS 1x HDMI 1.4b
Memory	LPDDR4: 2/4/8 GB eMMC: 8–64 GB (optional) EEPROM: 32-kbit (24LC32) (optional)
Others	TQMx86 board controller with watchdog and flexiCFG Hardware monitor
Power supply	Voltage: 4.75 V – 5.25 V, 3 V Battery for RTC Power: typ. 3–8 W/max. 14W
Environment	Standard temperature: 0°C...+60°C Extended temperature: -40°C...+85°C
Form factor/ dimensions	SMARC 2.0, 82 × 50 mm

x86 Modules

TQMxE39C1 – COM Express® Compact Module (Type 6) with Intel Atom® E3900, soldered DDR3L/ECC

COM Express® Compact Type 6 Module with Intel Atom® x5/x7 E3900 ("Apollo Lake-I") and soldered DDR3L with ECC support.

Based on COM Express

intel Technology Provider Platinum 2020

HIGHLIGHTS

- **Intel Atom® x5/x7 E3900 series ("Apollo Lake-I")**
- **Dual/Quad core computing power with up to 2.5 GHz**
- **4/8 GB DDR3L (dual channel), soldered, ECC**
- **High-speed interconnected with Gbit Ethernet, 8x USB (3.0/2.0) and up to 4 PCIe lanes**
- **Triple display support (up to 4K UHD) and eDP/LVDS**
- **Up to 64 GB eMMC Flash, soldered**
- **Extended temperature support**
- **Watchdog und thermal management**
- **Highest reliability, 24/7 certified**
- **Conformal coating (on request) and optimized cooling solutions for ruggedized applications**

TECHNICAL SPECIFICATION

CPU	Intel Atom® x5/x7 E3900 („Apollo Lake-I") Atom® x5-E3930 2x 1.8 GHz, 6.5 W Atom® x5-E3940 4x 1.8 GHz, 9.5 W Atom® x7-E3950 4x 2.0 GHz, 12 W
System interfaces	1x Gbit Ethernet (Intel® i210) (external IEEE1588 sync optional through TQ flexiCFG) 3x USB 3.0 5x USB 2.0
Periphery interfaces	2x SATA 3.0 (up to 6Gb/s), eSATA capable 4x PCIe 2.0 (up to 5 Gb/s) 1x LPC bus 1x Intel® HD audio (HDA) 1x I2C (master/slave capable) 1x SMBus 1x SPI (for exteral uEFI BIOS flash) 2x Serial port (Rx/Tx, legacy compatible) (4 wire optional through TQ flexiCFG) 1x SD card interface/on request: 8x GPIO (multiplexed)
Graphic	2x Digital Display Interface (DDI) for DP 1.2a, HDMI 1.4b 1x eDP 1.4/Dual Channel LVDS
Memory	DDR3L: 4/8 GB ECC, Dual Channel, ECC eMMC: 8–64 GB EEPROM: 32-kbit (24LC32)
Security components	TPM (SLB9660 TPM 1.2, alternatively SLB9665 TPM 2.0) (on request)
Others	TQMx86 board controller with watchdog and flexiCFG Hardware monitor
Power supply	Voltage: 4.75 V – 20 V 4.75 V – 20 V Standby (optional) 3 V Battery for RTC Power: typ. 3 – 8 W/max. 14 W (Green ECO-Off: < 0.1 W)
Environment	Extended temperature: -40°C...+85°C
Form factor/ dimensions	COM Express™ Compact, Type 6, 95 × 95 mm

x86 Modules

TQMxE39C2 – COM Express® Compact Module (Type 6) with Intel Atom® E3900 and SO-DIMM

HIGHLIGHTS

- **Intel Atom® x5/x7 E3900 series ("Apollo Lake-I"), Pentium® N4200 and Celeron® N3350 processors**
- **Dual/Quad core computing power with up to 2.5 GHz**
- **Up to 8 GB DDR3L (2 SO-DIMMs), non-ECC**
- **High-speed interconnected with Gbit Ethernet, 8x USB (3.0/2.0) and up to 4 PCIe lanes**
- **Triple display support (up to 4K UHD) and eDP/LVDS**
- **Up to 64 GB eMMC Flash, soldered**
- **Watchdog und thermal management**
- **Highest reliability, 24/7 certified**

COM Express® Compact Type 6 Module with Intel Atom® x5/x7 E3900 ("Apollo Lake-I") and SODIMM DDR3L.

Based on COM Express

intel Technology Provider Platinum 2020

TECHNICAL SPECIFICATION

CPU	Intel Atom® x5/x7 E3900 („Apollo Lake-I") Atom® x5-E3930 2×1.8 GHz, 6.5 W Atom® x5-E3940 4×1.8 GHz, 9.5 W Atom® x7-E3950 4×2.0 GHz, 12 W Celeron® N3350 2×2,4 GHz, 6 W Pentium® N4200 4×2,5 GHz, 6 W
System interfaces	1x Gbit Ethernet (Intel® i210) (external IEEE1588 sync optional through TQ flexiCFG) 3x USB 3.0 5x USB 2.0
Periphery interfaces	2x SATA 3.0 (up to 6 Gb/s), eSATA capable 4x PCIe 2.0 (up to 5 Gb/s) 1x LPC bus 1x Intel® HD audio (HDA) 1x I2C (master/slave capable) 1x SMBus 1x SPI (for exteral uEFI BIOS flash) 2x Serial port (Rx/Tx, legacy compatible) (4 wire optional through TQ flexiCFG) 1x SD card interface/on request: 8x GPIO (multiplexed)
Graphic	2x Digital Display Interface (DDI) for DP 1.2a, HDMI 1.4b 1x eDP1.4/Dual Channel LVDS
Memory	DDR3L: 4/8 GB non-ECC, Dual Channel (2 SO-DIMMS) eMMC: 8–64 GB EEPROM: 32-kbit (24LC32)
Security components	TPM (SLB9660 TPM 1.2, alternatively SLB9665 TPM 2.0) (on request)
Others	TQMx86 board controller with watchdog and flexiCFG Hardware monitor
Power supply	Voltage: 4.75 V – 20 V 4.75 V – 20 V Standby (optional) 3 V Battery for RTC Power: typ. 3 – 8 W/max. 14 W (Green ECO-Off: < 0.1 W)
Environment	Standard temperature: 0°C...+60°C
Form factor/ dimensions	COM Express™ Compact, Type 6, 95 × 95 mm

x86 Modules

TQMxE39M – COM Express® Mini Module (Type 10) with Intel Atom® E3900

COM Express® Mini Type 10 Module with Intel Atom® x5/x7 E3900 ("Apollo Lake-I").

Based on

COM Express

intel Technology Provider Platinum 2020

HIGHLIGHTS

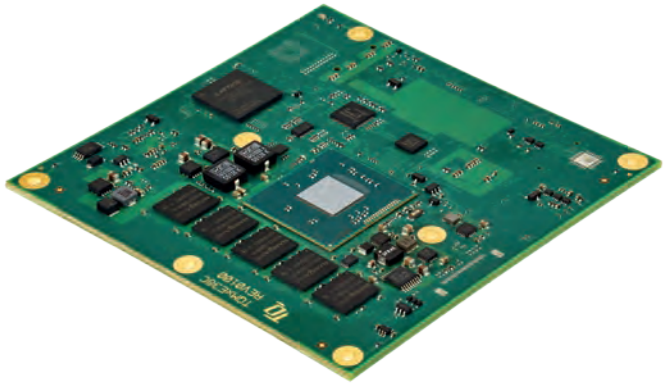
- **Intel Atom® x5/x7 E3900 series ("Apollo Lake-I"), Pentium® N4200 and Celeron® N3350 processors**
- **Dual/Quad core computing power with up to 2.5 GHz**
- **4/8 GB DDR3L (dual channel), soldered**
- **High-speed interconnected with Gbit Ethernet,**
- **8x USB (3.0/2.0) and up to 4 PCIe lanes**
- **Dual Display support with DP/HDMI (up to 4K UHD) and eDP or LVDS**
- **Up to 64 GB eMMC Flash, soldered**
- **Extended temperature support**
- **Watchdog und thermal management**
- **Highest reliability, 24/7 certified**
- **Conformal coating (optional) and optimized cooling solutions for ruggedized applications**

TECHNICAL SPECIFICATION

CPU	Intel Atom® x5/x7 E3900 („Apollo Lake-I") Atom™ x5-E3930 2×1.8 GHz, 6.5 W Atom™ x5-E3940 4×1.8 GHz, 9.5 W Atom™ x7-E3950 4×2.0 GHz, 12 W Celeron® N3350 2×2.4 GHz, 6 W Pentium® N4200 4×2.5 GHz, 6 W
System interfaces	1x Gbit Ethernet (Intel® i210) (external IEEE1588 sync optional through TQ flexiCFG) 2x USB 3.0 6x USB 2.0
Periphery interfaces	2x SATA 3.0 (up to 6 Gb/s), eSATA capable 4x PCIe 2.0 (up to 5 Gb/s) 1x LPC bus 1x Intel® HD audio (HDA) 1x I2C, (2nd I2C optional) (master/slave capable) 1x SMBus 1x SPI (for exteral uEFI BIOS flash) 2x Serial port (Rx/Tx, legacy compatible) (4 wire optional through TQ flexiCFG) 1x SD card interface/optional 8x GPIO (multiplexed)
Graphic	1x Digital Display Interface (DDI) for DP 1.2a, eDP 1.3, HDMI 1.4b 1x eDP1.4/Single Channel LVDS (also usable for second external monitor)
Memory	DDR3L: 4/8 GB non-ECC, Dual Channel eMMC: 4–64 GB EEPROM: 32-kbit (24LC32)
Security components	TPM (SLB9660 TPM 1.2, alternatively SLB9665 TPM 2.0)
Others	TQMx86 board controller with watchdog and flexiCFG Hardware monitor
Power supply	Voltage: 4.75 V – 20 V, 4.75 V – 20 V Standby (optional), 3 V Battery Power: typ. 3 – 8 W/max. 14 W (Green ECO-Off: < 0.1 W)
Environment	Standard temperature: 0°C...+60°C Extended temperature: -40°C...+85°C
Form factor/ dimensions	COM Express™ Mini, type 10, 84 × 55 mm

x86 Modules

TQMxE38C – COM Express® Compact Module (Type 6) with Intel Atom® E3800



COM Express® Compact Type 6 Module with Intel® AtomTM E3800 ("Bay Trail-I").

Based on COM Express

Intel Technology Provider Platinum 2020

HIGHLIGHTS

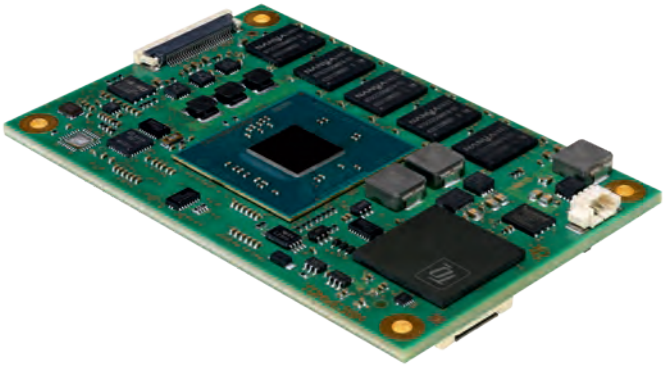
- **Intel® Atom™ E3800 ("Bay Trail-I")**
- **Up to 8 GB DDR3L with ECC support**
- **Optimized for ultra low power**
- **Extended temperature support**
- **Feature-rich uEFI BIOS with easy-config, multi-setup and touch support**
- **TQMx86 board controller with flexible customization options (flexiCFG)**
- **TPM 1.2/2.0**
- **iRTC (highly accurate industrial real time clock)**
- **"Green ECO-Off" (minimum of standby power)**
- **Watchdog und thermal management**
- **Highest reliability, 24/7 certified**
- **Very robust design**
- **Conformal coating capability**

TECHNICAL SPECIFICATION

CPU	Intel Atom® E3800 („Bay Trail-I") E3815: 1x 1.46 GHz, 512 KB L2-Cache, 5 W E3805: 2x 1.33 GHz, 1 MB L2-Cache, 3 W, without graphics E3825: 2x 1.33 GHz, 1 MB L2-Cache, 6 W E3826: 2x 1.46 GHz, 1 MB L2-Cache, 7 W E3827: 2x 1.75 GHz, 1 MB L2-Cache, 8 W E3845: 4x 1.91 GHz, 2 MB L2-Cache, 10 W
System interfaces	1x Gbit Ethernet (Intel® i210) (external IEEE1588 sync optional through TQ flexiCFG) 1x USB 3.0 (with USB 2.0 backward compatibility) 7x USB 2.0 (includes 4 ports via onboard HSIC USB Hub)
Periphery interfaces	2x SATA 2.0 (up to 3 Gb/s), eSATA capable 3x PCIe 2.0 (up to 5 Gb/s) (4th lane optional, if no Ethernet) 1x LPC bus 1x Intel® HD audio (HDA) 1x I2C, (2nd I2C optional) (master/slave capable) 1x SMBus 1x SPI (for exteral uEFI BIOS flash) 2x Serial port (Rx/Tx, legacy compatible) (4 wire optional through TQ flexiCFG) 1x SD card interface (default)/optional 8x GPIO (assembly option)
Graphic	2x Digital Display Interface (DDI)/LVDS a) for DP 1.1a, DVI, HDMI 1.4a b) for DP 1.1a, DVI, HDMI 1.4a or LVDS Interface (18/24 bit, Single/Dual Channel) 1x VGA (CRT) (max. 2 independent display outputs)
Memory	DDR3L: 2 GB, 4 GB, 8 GB, ECC support, soldered down EEPROM: 32-kbit (24LC32) eMMC: up to 64 GB
Security components	TPM (SLB9660 TPM 1.2, alternatively SLB9665 TPM 2.0)
Others	TQMx86 board controller with watchdog and flexiCFG Industrial real time clock (iRTC), Hardware monitor
Power supply	Voltage: 4.75 V – 20 V 5 V Standby (optional) 3 V Battery/GoldCAP (optional) Power: typ. 2 – 6 W/max. 13 W (Green ECO-Off: < 5 mW)
Environment	Standard temperature: 0°C...+60°C Extended temperature: -40°C...+85°C
Form factor/ dimensions	COM Express™ Compact, type 6, 95 × 95 mm

x86 Modules

TQMxE38M – COM Express® Mini Module (Type 10) with Intel Atom® E3800



COM Express® Mini Type 10 Module with Intel Atom® E3800 ("Bay Trail-I").

Based on COM Express

intel Technology Provider Platinum 2020

HIGHLIGHTS

- **Intel® Atom™ E3800 ("Bay Trail-I")**
- **Up to 8 GB DDR3L with ECC support**
- **Optimized for ultra low power**
- **Extended temperature support**
- **Feature-rich uEFI BIOS with easy-config, multi-setup and touch support**
- **TQMx86 board controller with flexible customization options (flexiCFG)**
- **TPM 1.2/2.0**
- **iRTC (highly accurate industrial real time clock)**
- **"Green ECO-Off" (minimum of standby power)**
- **Watchdog und thermal management**
- **Highest reliability, 24/7 certified**
- **Very robust design, formal coating capability**

TECHNICAL SPECIFICATION

CPU	Intel® Atom™ E3800 („Bay Trail-I") E3815: 1x 1.46 GHz, 512 KB L2-Cache,5 W E3805: 2x 1.33 GHz, 1 MB L2-Cache, 3 W, without graphics E3825: 2x 1.33 GHz, 1 MB L2-Cache, 6 W E3826: 2x 1.46 GHz, 1 MB L2-Cache, 7 W E3827: 2x 1.75 GHz, 1 MB L2-Cache, 8 W E3845: 4x 1.91 GHz, 2 MB L2-Cache, 10 W
System interfaces	1x Gbit Ethernet (Intel® i210) (external IEEE1588 sync optional through TQ flexiCFG) 1x USB 3.0 3x USB 2.0 1x USB 3.0 device
Graphic	2x Digital Display Interface (DDI) for eDP 1.3, DP 1.1a, DVI, HDMI 1.4a or LVDS (with external converter)
Memory	DDR3L: 2 GB, 4 GB, (8 GB) with ECC support EEPROM: 32-kbit (24LC32)
Security components	TPM (SLB9660 TPM 1.2, alternatively SLB9665 TPM 2.0)
Others	TQMx86 board controller with watchdog and flexiCFG Industrial real time clock (iRTC) Hardware monitor

Peripheral interfaces	2x SATA 2.0 (up to 3 Gb/s), eSATA capable 3x PCIe 2.0 (up to 5 Gb/s) (4th lane optional, if no Ethernet) 1x LPC bus 1x Intel® HD audio (HDA) 1x I2C, (2nd I2C optional) (master/slave capable) 1x SMBus 1x SPI (for exteral uEFI BIOS flash) 2x Serial port (Rx/Tx, legacy compatible) (4 wire optional through TQ flexiCFG) 1x SD card interface/optional 8x GPIO (multiplexed)
Power supply	Voltage: 4.75 V – 20 V 4.75 V – 20 V Standby (optional) 3 V Battery/GoldCAP (optional) Power: typ. 3 – 6 W/max. 12W (Green ECO-Off: < 0.1 W)
Environment	Extended temperature: -40°C...+85°C
Form factor/ dimensions	COM Express™ Mini, type 10, 84 × 55 mm

x86 Mainboards

MB-M10-1 – Carrier Board (eNUC) for COM Express® Mini Modules (Type 10) with eDP Display

Embedded NUC Carrier Board for COM Express Type 10 Mini Modules.

Based on

COM Express

HIGHLIGHTS

- **Compact platform for COM Express type 10 mini modules**
- **Supports eDP (not LVDS) pinout of COM Express specification**
- **Low profile for optimized mechanical and thermal integration**
- **Dual screen support for visualization**
- **High speed IO interfaces like Gbit Ethernet and USB 3.0**
- **Easy to extend functionality with 2x Mini PCIe**
- **Robust and reliable with extended temperature support**
- **Embedded NUC (eNUC) compatible (specified by SGeT SDT.03)**

TECHNICAL SPECIFICATION

Supported modules	COM Express Type 10 (mini) (with eDP pinout configuration)
External interfaces (front IO)	2x Mini DisplayPort with up to 4K 2x Gbit Ethernet 2x USB 3.0/2.0
External interfaces (back IO)	Power and reset button
Internal interfaces	2x RS-232 (incl. flow-control) 1x Fan (5 V, 3-pin, PWM controlled) 1x power-control/status 1x USB 2.0 (not assembled by default)
Mass storage and extension sockets	1x Mini PCIe full size (PCIe&USB), with micro SIM card socket 1x Mini PCIe half size (PCIe&USB) 1x mSATA (full size) 1x Micro SD card socket
Power supply	Voltage: 9...36 V Connector type: Phoenix MC1,5/2-G-3,5 (Mating connector: e.g. Phoenix FMC1,5/2-ST-3,5) Battery: 3 V, CR2032 (replaceable)
Environment	Operating temperature: -20°C...+85°C Storage temperature: -40°C...+85°C
Form factor/ dimensions	Embedded NUC (eNUC), 100 × 100 mm

x86 Mainboards

MB-M10-2 – Carrier Board (eNUC) for COM Express® Mini Modules (Type 10) with LVDS Display

Embedded NUC Carrier Board for COM Express Type 10 Mini Modules.

Based on

COM Express

HIGHLIGHTS

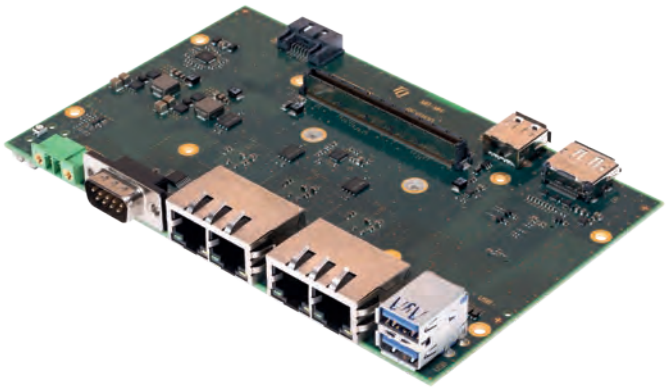
- **Compact platform for COM Express type 10 mini modules**
- **Low profile for optimized mechanical and thermal integration**
- **Supports dual screnn mode with external and internal interface**
- **High speed IO interfaces like Gbit Ethernet and USB 3.0**
- **Easy to extend functionality with Mini PCIe**
- **Robust and reliable with extended temperature support**
- **Embedded NUC (eNUC) compatible (specified by SGeT SDT.03)**

TECHNICAL SPECIFICATION

Supported modules	COM Express Type 10 (mini)
External interfaces (front IO)	1x Mini DisplayPort (DP++) with up to 4K 2x Gbit Ethernet 2x USB 3.0/2.0 Power and reset button
Internal interfaces	1x Single channel LVDS + backlight control/power 2x RS-232 (incl. flow-control) 1x Fan (5 V, 3-pin, PWM controlled) 1x power-control/status 1x USB 2.0
Mass storage and extension sockets	1x Mini PCIe half/full size (PCIe&USB), with micro SIM card socket 1x mSATA (full size) 1x Micro SD card socket
Power supply	Voltage: 14...36 V Connector type: Phoenix MC1,5/2-G-3,5 (Mating connector: e.g. Phoenix FMC1,5/2-ST-3,5) Battery: 3 V, CR2032 (replaceable)
Environment	Operating temperature: -20°C...+85°C Storage temperature: -40°C...+85°C
Form factor/ dimensions	Embedded NUC (eNUC), 100 × 100 mm

x86 Mainboards

MB-MI4 – Carrier Board (Euro) for COM Express® Mini Modules (Type 10), 4x Gbit Ethernet



HIGHLIGHTS

- **Compact platform for COM Express type 10 mini modules**
- **Optimized for high speed comunication**
- **4 full-featured and independant Gbit Ethernet ports**
- **High speed IO with USB 3.0**
- **RS-232 for console redirect or sensor control**
- **Back side with DP++ and USB 2.0 for visualization/HMI**
- **Robust and reliable with extended temperature support**

Carrier Board for COM Express Type 10 Mini Modules.

Based on

COM Express

TECHNICAL SPECIFICATION

Supported modules	COM Express Type 10 (mini)
External interfaces (front IO)	4x Gbit Ethernet (independant controllers, IEEE1588/TSN support) 2x USB 3.0 1x RS-232 (incl. flow-control) Power and reset button
External interfaces (back IO)	1x DisplayPort (DP++) with up to 4K 1x USB 2.0
Internal interfaces	1x SATA 1x USB 2.0 (option)
Mass storage and extension sockets	1x M.2 2242/2280, Key B (SATA & USB)
Power supply	Voltage: 9...36 V Connector type: Phoenix MC1,5/2-GF-3,5-LR (with screw-lock) (Mating connector: e.g. Phoenix FMC1,5/2-STF-3,5) Battery: 3 V, CR2032 (replaceable)
Environment	Operating temperature: -40°C...+85°C Storage temperature: -40°C...+85°C
Form factor/ dimensions	"Euro", 100 × 160 mm

x86 Mainboards

MB-COME10-1 – Carrier Board (mITX) for COM Express® Mini Modules (Type 10)

Mini ITX Carrier Board for COM Express Type 10 Mini Modules.

HIGHLIGHTS

- **Universal platform for COM Express type 10 mini modules**
- **Supports eDP (not LVDS) pinout of COM Express specification**
- **Low profile for optimized mechanical and thermal integration**
- **DP++ support to be used for DisplayPort and HDMI screens**
- **Second screen on eDP/LVDS or additional DP++**
- **High Speed IO Interfaces like Gbit Ethernet and USB 3.0**
- **Easy to extend functionality with Mini PCIe and flexible riser interface (PCIe x1 and USB)**
- **2.5" HDD/SSD integration without cables**
- **Robust and reliable with extended temperature support**

Based on

COM Express

TECHNICAL SPECIFICATION

Supported modules	COM Express Type 10 (mini) (with eDP pin configuration)
External interfaces (front IO)	1x DisplayPort (DP++) with up to 4K 1x DisplayPort (DP++) (option) 2x Gbit Ethernet 2x USB 3.0 2x USB 2.0 1x RS-232 Power and reset button
Internal interfaces (options)	1x eDP/single channel LVDS (auto-muxed) + backlight control/power (option) 1x USB 2.0 1x RS-232 1x RS-422 Audio (headphone out, microphone in) Speaker out R+L (2x 2 W) 1x Fan (12 V, 4-pin, PWM controlled) 1x Fan (5 V, 3-pin, PWM controlled) SPI BIOS flash socket for test/debug Front panel control SMB/I2C/Smart Battery/Debug/CTRL
Mass storage and extension sockets	1x Mini PCIe socket (full size, with SIM card support) 1x SD-Card 1x mSATA (full size) 1x 2.5'' HDD/SSD socket (mounting kit seperately available)
Riser interface	1x PCIe x1 and 2x USB 2.0 on goldfinger contacts to be used with adapters
Power supply	Voltage: 12 V (+/– 5 %) Connector type: Phoenix MSTBA2,5/2-G-5,08 (Mating connector: Phoenix MSTBA2,5/4-ST-5,08) Battery: 3 V, CR2032 (replaceable)
Environment	Operating temperature: -20°C...+85°C Storage temperature: -40°C...+85°C
Form factor/ dimensions	Mini ITX, 170 × 170 mm

x86 Mainboards

MB-COME6-1 – Carrier Board (mITX) for COM Express® Basic/Compact Modules (Type 6), Revision 1

HIGHLIGHTS

- **Universal platform for COM Express type 6 compact modules**
- **Low profile for optimized mechanical and thermal integration**
- **Dual DP++ monitor output for visualization**
- **High Speed IO Interfaces like Gbit Ethernet and USB 3.0**
- **Easy to extend functionality with Mini PCIe and flexible riser interface (2x PCIe x1 and USB)**
- **2.5" HDD/SSD integration without cables**
- **Robust and reliable with extended temperature support**

Mini ITX Carrier Board for COM Express Type 6 Compact Modules.

Based on

COM Express

TECHNICAL SPECIFICATION

Supported modules	COM Express Type 6 (compact)
External interfaces (front IO)	2x DisplayPort (DP++) with up to 4K 2x Gbit Ethernet 2x USB 3.0 2x USB 2.0 1x RS-232 Power and reset button
Internal interfaces	1x Dual channel LVDS + backlight control/power 3x USB 2.0 1x RS-232 1x RS-422 1x SATA Audio (headphone out, microphone in) Speaker out R+L (2x 2 W) 1x Fan (12 V, 4-pin, PWM controlled) 1x Fan (5 V, 3-pin, PWM controlled) SPI BIOS flash socket for test/debug Front panel control SMB/I2C/Smart Battery/Debug/CTRL
Mass storage and extension sockets	1x Mini PCIe socket (full size, with SIM card support) 1x CFast 1x Micro SD-Card 1x mSATA (full size) 1x 2.5'' HDD/SSD socket (mounting kit seperately available)
Riser interface	2x PCIe x1 and 2x USB 2.0 on goldfinger contacts to be used with adapters.
Power supply	Voltage: 12 V (+/– 5 %) Connector type: Phoenix MSTBA2,5/2-G-5,08 (Mating connector: Phoenix MSTBA2,5/4-ST-5,08) Battery: 3 V, CR2032 (replaceable)
Environment	Operating temperature: -20°C...+85°C Storage temperature: -40°C...+85°C
Form factor/ dimensions	Mini ITX, 170 × 170 mm

x86 Mainboards

MB-COME6-2 – Carrier Board (mITX) for COM Express® Basic/Compact Modules (Type 6), Revision 2

Mini ITX Carrier Board for COM Express Type 6 Compact/Basic Modules with PEG (PCIe x16) Support on Riser.

Based on

COM Express

HIGHLIGHTS

- **Universal platform for high end COM Express type 6 modules**
- **Low profile for optimized mechanical and thermal integration**
- **DP++ and HDMI monitor outputs for high resolution visualization**
- **2x Gbit Ethernet with 4 kV isolation for usage in medical devices**
- **Easy to extend with M.2, Mini PCIe and riser interface (PCIe x16)**
- **2.5" HDD/SSD integration without cables**
- **Variants optimized for BoxPC and PanelPC integration**
- **Robust and reliable with extended temperature support**

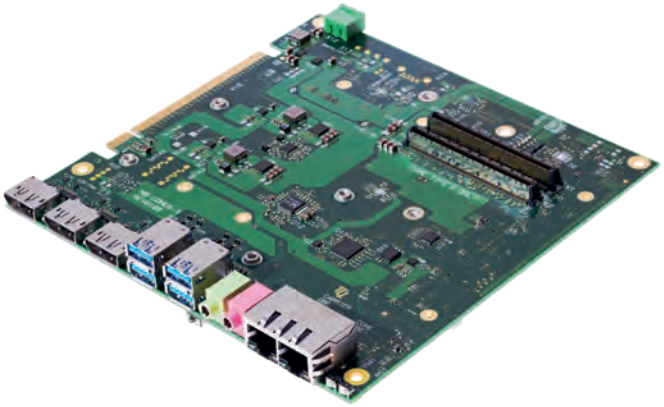
TECHNICAL SPECIFICATION

Supported modules	COM Express Type 6 in compact and basic format
External interfaces (front IO)	1x DisplayPort (DP++) with up to 4K 2x HDMI with up to 4K 2x Gbit Ethernet, 4 kV isolation 4x USB 3.0 Audio 2x 3.5 mm (headphone out, microphone in) Power and reset button
Internal interfaces (options)	1x Dual channel LVDS or eDP (depends on variant) + backlight control/power 3x USB 2.0 (via internal USB hub) 1x USB 2.0 (Type A) on back side 1x RS-232 2x SATA (with 5 V power connector) Speaker out R+L (2x 1.4 W) 1x Fan (12 V, 3-pin, PWM controlled) SPI BIOS flash socket for test/debug
Riser interface	PCIe x16 (alt. x8/x8) on goldfinger contacts to be used with adapters (support depends on CPU module PEG-port configuration)

Mass storage and extension sockets	1x Mini PCIe socket (full size, with micro-SIM card support) 1x M.2 2230 Key E socket (PCIe x1 and USB 2.0) for IO 1x M.2 2280 Key M socket (default SATA, optional PCIe x4) for SSD 1x 2.5'' HDD/SSD socket (mounting kit seperately available)
Special options (not assembled by default)	Internal connector for IO extension with I2C/UART/CTRL Internal connector for SMB/I2C/Smart Battery Touch button soluttion connector for HMI front control USB 3.0 support for USB port on back side (only with special module config.) Assembly option for integrated Sentinel license dongle chip
Power supply	Voltage: 12 V (+/– 5 %) Connector type: Phoenix MSTBA2,5/2-G-5,08 (Mating connector: Phoenix MSTBA2,5/4-ST-5,08) Battery: 3 V, CR2032 (replaceable)
Environment	Operating temperature: -20°C...+85°C Storage temperature: -40°C...+85°C
Form factor/ dimensions	Mini ITX, 170 × 170 mm

x86 Mainboards

MB-COME6-3 – Carrier Board (mITX) for COM Express® Basic/Compact Modules (Type 6), Revision 3



Mini ITX Carrier Board for COM Express Type 6 Compact/Basic Modules with PEG (PCIe x16) Support on Riser.

Based on

COM Express

HIGHLIGHTS

- **Universal platform for high end COM Express type 6 modules**
- **Low profile for optimized mechanical and thermal integration**
- **Triple DP++ monitor output for high resolution visualization**
- **Full-featured network capabilities**
- **Easy to extend with M.2, Mini PCIe and riser interface (PCIe x16)**
- **2.5" HDD/SSD integration without cables**
- **Variants optimized for BoxPC and PanelPC integration**
- **Robust and reliable with extended temperature support**

TECHNICAL SPECIFICATION

Supported modules	COM Express Type 6 in compact and basic format
External interfaces (front IO)	3x DisplayPort (DP++) with up to 4K 2x Gbit Ethernet 4x USB 3.0/3.1 Audio 2x 3.5 mm (headphone out, microphone in) Power and reset button
Internal interfaces (options)	1x Dual channel LVDS or eDP (depends on variant) + backlight control/power 3x USB 2.0 (via internal USB hub) 1x USB 2.0 (Type A) on back side 1x RS-232 2x SATA (with 5 V power connector) Speaker out R+L (2x 1.4 W) 1x Fan (12 V, 3-pin, PWM controlled) SPI BIOS flash socket for test/debug
Riser interface	PCIe x16 (alt. x8/x8) on goldfinger contacts to be used with adapters (support depends on CPU module PEG-port configuration)
Mass storage and extension sockets	1x Mini PCIe socket (full size, with micro-SIM card support) 1x M.2 2230 Key E socket (PCIe x1 and USB 2.0) for IO 1x M.2 2280 Key M socket (default SATA, optional PCIe x4) for SSD 1x 2.5'' HDD/SSD socket (mounting kit seperately available)
Special options (not assembled by default)	Internal connector for IO extension with I2C/UART/CTRL Internal connector for SMB/I2C/Smart Battery Touch button soluttion connector for HMI front control USB 3.0 support for USB port on back side (only with special module config.) Assembly option for integrated Sentinel license dongle chip
Power supply	Voltage: 12 V (+/– 5 %) Connector type: Phoenix MSTBA2,5/2-G-5,08 (Mating connector: Phoenix MSTBA2,5/4-ST-5,08) Battery: 3 V, CR2032 (replaceable)
Environment	Operating temperature: -20°C...+85°C Storage temperature: -40°C...+85°C
Form factor/ dimensions	Mini ITX, 170 × 170 mm

x86 Mainboards

MB-SMARC-1 – Carrier Board (mITX) for SMARC 2.0 x86 Modules (TQMxE39S)

SMARC 2.0 Carrier Board for x86 Modules.

HIGHLIGHTS

- **SMARC 2.0 compliant carrier board with MXM3 connector**
- **Board size of 170 mm x 170 mm**
- **Compatible with both short and full size SMARC 2.0 modules**
- **Supports dual channel LVDS or eDP, HDMI, DP++**
- **Dual GbE**
- **Connector for MIPI CSI camera add-on card**
- **USB Type C**

Based on

SMARC module

SGeT STANDARDIZATION GROUP FOR EMBEDDED TECHNOLOGIES

TECHNICAL SPECIFICATION

Supported Modules	SMARC 2.0 full size or short size x86 module with SMARC 2.0 compliant pinout
External Interfaces	1x Dual channel LVDS (configuration option AA) with backlight power and backlight control 1x eDP (configuration option AB) 1x HDMI 1x DP 2x GbE (1x on carrier GbE controller I210) 1x USB 3.0 1x USB Type C (1x USB 3.0) 1x USB 2.0 1x USB 2.0 pin header 1x Audio jack for microphone and line out/headphone 2x MIPI CSI pin header 1x micro SD card holder 1x M.2 Key E (USB 2.0, PCIe) for WLAN/BT 1x M.2 Key B (USB 2.0, micro SIM card) 1x M.2 Key B (SATA)
External Interfaces	1x M.2 Key M (PCIe A/B) 2x RS232 transceiver (4 serial interfaces) 1x SIM card slot Power in: 12 Volt DC 1x 12 Volt fan 1x battery holder CR2032 1x SPI socket with boot select jumper 1x HD audio codec (Realtek ALC262-VC2-GR), Reset and power button 1x SMBus, I2C, COM signal header Force Recovery, LID, PCIe wake signals

x86 Mainboards

MB-SMARC-2 – Carrier Board (mITX) for SMARC 2.0 x86 and Arm® Modules (TQMxE39S, TQMa8xXs)

HIGHLIGHTS

- **Arm® and x86 modules can be used without any changes**
- **Based on the MINI ITX form factor 170 × 170mm**
- **Compatible with both short and full size SMARC 2.0 modules**
- **Supports dual channel LVDS or eDP, HDMI, DP++**
- **Dual GbE**
- **Connector for MIPI CSI camera add-on card**
- **USB 3.0**

SMARC 2.0 Carrier Board for Arm® and x86 Modules.

Based on

SMARC module

SGeT STANDARDIZATION GROUP FOR EMBEDDED TECHNOLOGIES

TECHNICAL SPECIFICATION

Supported Modules	SMARC 2.0 full size or short size Arm® and x86 module with SMARC 2.0 compliant pinout
External Interfaces	1x Dual channel LVDS with backlight power and backlight control 1x eDP 1x HDMI 1x DP 2x Gbit Ethernet 1x USB 3.0 OTG 1x USB 3.0 1x USB 2.0 1x USB 2.0 pin header 2x CAN FD (galv. Isolated) 1x Audio jack for microphone line in/out and headphone 2x MIPI CSI pin header 1x PCIe x1 Connector 1x micro SD card holder 1x M.2 Key E (USB 2.0, PCIe) for WLAN/BT 1x Mini PCIe (PCIe, USB 2.0, micro SIM card) 1x M.2 Key B (SATA)

External Interfaces	2x RS232 transceiver (2 serial interfaces) 1x RS232 (via FTDI and Micro USB) 1x SIM card slot Power in: 14–36 Volt DC 1x 12 Volt fan 1x battery holder CR2032 1x SPI socket with boot select jumper 1x HD audio codec (x86) 1x I²S Audio Codec (Arm®) Reset and power button 1x SMBus, I2C, COM signal header Force Recovery, LID, PCIe wake signals
Supportet Featurs	TQMxE39S and TQMa8XxS: LVDS, DP0, RJ45 (GBE0), USB 3.0 Type A, USB 2.0 Type A, USB 2.0 (mPCIe Socket, M.2 Key E), PWR- und RST-Button, mPCIe Socket inklusive Micro SIM, Micro SD-Card, Serial Port 0/1, Micro USB (Debug), FAN, CSI, Audio Only TQMa8XxS: DSI, RJ45 (GBE1), CAN, USB 2.0 OTG, Audio (I²S) Only TQMxE39S: HDMI, eDP, RJ45 (PCIe), USB 3.0 OTG, M.2 Key M, M.2 Key E (PCIe), Audio (HDA), Serial Port 2/3

Arm® ODM Platforms

ABox-6ULxL – An ideal Platform for IOT and Industry 4.0 Gateways

Box PC based on MBa6ULxL as a cost-effective and smart platform.

HIGHLIGHTS

- **Extended temperature range**
- **2x Ethernet, 2x Mini PCIe based on USB 2.0**
- **Low power consumption (typically 2–3 W)**
- **2x CAN galvanic isolated**
- **Wide voltage input range**
- **Modularly expandable**

TECHNICAL SPECIFICATION

CPU	MX6UL2, MX6UL3, MX6ULL2
System interfaces	2x Ethernet 10/100/Mbit 1x USB OTG 2.0 2x USB Host 2.0 Up to 2x CAN (galvanic Isolated) Up to 2x Mini PCIe (only USB) Up to 1x SIM Card (mini PCIe) Up to 1x SD-Card
Periphery interfaces (optionaly) (Pin Header 2.54 mm)	Up to 1x I^2C Up to 2x UART RS232 Up to 8x GPIO
Memory	DDR3L-SDRAM: Up to 1 GB Quad SPI NOR: Up to 256 MB eMMC Up to 32 GB EEPROM: 0/64-kbit
Other	Real Time Clock (RTC) Temperature sensor USB-Debug (RS232)
Power supply	8 – 30 V DC
Ambient conditions	Extended temperature range: -25°C...+70°C Industrial temperature range: -40°C...+85°C
Dimensions	110 × 103 × 35mm
Operating systems	Linux
Operating systems on request	QNX, INTEGRETY

Arm® ODM Platforms

LBox-LS1012A – An ideal Platform for edge Gateways, Routers

HIGHLIGHTS

- **Extended temperature range**
- **High-speed communication via 5x Gbit**
- **Ethernet, 2x Mini PCIe and 2x USB 3.0 interface**
- **Low power consumption (typ. 2 – 3 W)**
- **QorIQ Trust Architecture and Arm® TrustZone®**
- **Packet Acceleration Engine**
- **Modularly expandable**

Box PC based on MBLS1012AL as a high speed platform for smart IIOT solutions.

TECHNICAL SPECIFICATION

CPU	QorIQ LS1012A
System interfaces	1x Ethernet 10/100/1000 Mbit 4x Ethernet 10/100/1000Mbit (Ethernet Switch) 2x USB 3.0 1x SATA 3.0 (M.2) 2x Mini PCIe (1x only USB, SIM-Card) 1x SD-Card
Periphery interfaces (optionaly) (Pin Header 2.54 mm)	Up to 1x I^2C Up to 1x UART Up to 5x GPIO
Memory	DDR3L-SDRAM: Up to 1 GB Quad SPI NOR: Up to 256 MB EEPROM: 0/64-kbit
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG Interface USB-Debug (RS232)
Power supply	16 - 28 V DC
Ambient conditions	Extended temperature range: -25°C...+70°C Industrial temperature range: -40°C...+85°C
Dimensions	170 × 103 × 35 mm
Operating systems	Linux

Arm® ODM Platforms

LBox-LS1028A – A high speed Platform with 4 Port TSN Gbit Ethernet Switch for Real time demands

Box PC based on TQMLS10128A as a high speed platform with 4 Port TSN Gbit Ethernet Switch for Real time demands.

HIGHLIGHTS

- **1x TSN Ethernet 1 Gbit**
- **1x 4 Port TSN Gbit Ethernet Switch**
- **Graphics with 3D GPU and 4K support**
- **Extended temperature range**
- **Low power consumption**
- **Security functions**

TECHNICAL SPECIFICATION

CPU	QorIQ Layerscape LS1028A, LS1018A, LS1027A, LS1017A
System interfaces	1x 4 Port TSN Ethernet Switch up to 1 Gbit 1x TSN Ethernet 1 Gbit 1x Ethernet 1 Gbit 2x USB 3.0 2x CAN 1x USB 3.0 OTG 1x SATA 3.0 (M.2) 1x Mini PCIe (SIM-Card support) 1x Micro SD.Card
Periphery interfaces Pin Header 1.27 mm	1x SDIO 2x I²C 2x SPI
Graphic	eDP/DP Phy

Memory	DDR4-SDRAM: Up to 8 GB ECC Protection eMMC: Up to 64 GB Quad SPI NOR: Up to 512 MB EEPROM: 0/256 kbit
Other	Real Time Clock (RTC) Temperature sensor CPU JTAG Interface USB-Debug UART
Power supply	18 – 28 V
Ambient conditions	Extended temperature range: -40°C...+70°C
Dimensions	170 × 103 × 43mm
Operating systems	Linux
Operating systems on request	other TBD

x86 ODM Platforms

MBox-R – Robust BoxPC platform for embedded PC applications and IoT edge gateways

Robust BoxPC platform for embedded PC applications and IoT edge gateways.

HIGHLIGHTS

- **Intel Atom® E3800 series (Bay Trail-I)**
- **Up to 8 GB DDR3L with ECC**
- **Optimized for ultra low power**
- **High-Speed IO such as 2x Gb ETH, 2x USB (3.0/2.0)**
- **2x Mini DisplayPort to connect two monitors**
- **TPM 1.2/2.0 (option)**
- **Watchdog und thermal management**
- **Highest reliability, 24/7 certified**
- **Extended temperature support (option)**
- **Very robust design**
- **Individual configurations and ODM branding**

TECHNICAL SPECIFICATION

CPU	Intel Atom® E3800 series („Bay Trail-I") E3845: 4x 1.91 GHz, 2 MB L2-Cache, 10 W E3827: 2x 1.75 GHz, 1 MB L2-Cache, 8 W E3826: 2x 1.46 GHz, 1 MB L2-Cache, 7 W E3825: 2x 1.33 GHz, 1 MB L2-Cache, 6 W E3815: 1x 1.46 GHz, 512 KB L2-Cache, 5 W
Memory	2 GB, 4 GB, 8 GB DDR3L with ECC
Graphics interfaces	2x Mini DisplayPort (DP++) (DP 1.1a, max. resolution 2560×1600)
Interfaces	2x Gbit Ethernet (Intel® i210) 1x USB 3.0 (with USB 2.0 backward compatibility) 1x USB 2.0 2x RS-232 Sub-D9 (option)
Wireless and fieldbus communication (options)	WLAN Dual Band AC/Bluetooth 4.0 2G/3G/LTE CAN, ProfiNet, ProfiBus, DeviceNet, ModBus Others on request
Internal extension sockets	1x Mini PCIe full-size (PCIe & USB), with micro SIM socket 1x Mini PCIe half-size (PCIe & USB)
Internal mass storage	1x mSATA full-size (16 – 512 GB, others on request) 1x Micro SD card socket
Security components	TPM 1.2/2.0 (option)
Power supply	Voltage: 9 V – 36 V Connector type: Phoenix MC1,5/2-G-3,5 Power: typ. 3 – 10 W/max. 15 W Battery: CR2032 (replaceable)
Environment	Passive cooled (no fan) Standard temperature: 0°C...+50/60°C Extended temperature: -40°C...+70°C (option)
Form factor/ dimensions	Integrated hardware kit: 100 × 100 × 23 mm Chassis: 104 × 110 × 56 mm (excl. wall mount wings) 104 × 130 × 56 mm (incl. wall mount wings)
Operating Systems	Windows 7, Windows 10 (Standard and Embedded/IoT) Linux (e.g. Ubuntu) Others on request Custom specific software images can be pre-installed.

x86 ODM Platforms

MBox-V(H) – Ultra compact BoxPC platform for embedded PC applications and IoT edge gateways

Ultra compact BoxPC platform for embedded PC applications and IoT edge gateways.

HIGHLIGHTS

- **Intel Atom® E3800 series (Bay Trail-I)**
- **Up to 8 GB DDR3L with ECC**
- **Optimized for ultra low power**
- **High-Speed IO such as 2x Gb ETH, 2x USB (3.0/2.0)**
- **2x Mini DisplayPort to connect two monitors**
- **TPM 1.2/2.0 (option)**
- **Watchdog und thermal management**
- **Highest reliability, 24/7 certified**
- **Extended temperature support (option)**
- **Highly customizable sheet metal chassis**
- **Individual configurations and ODM branding**

TECHNICAL SPECIFICATION

CPU	Intel Atom® E3800 series („Bay Trail-I") E3845: 4x 1.91 GHz, 2 MB L2-Cache, 10 W E3827: 2x 1.75 GHz, 1 MB L2-Cache, 8 W E3826: 2x 1.46 GHz, 1 MB L2-Cache, 7 W E3825: 2x 1.33 GHz, 1 MB L2-Cache, 6 W E3815: 1x 1.46 GHz, 512 KB L2-Cache, 5 W
Memory	2 GB, 4 GB, 8 GB DDR3L with ECC
Graphics interfaces	2x Mini DisplayPort (DP++) (DP 1.1a, max. resolution 2560×1600)
Interfaces	2x Gbit Ethernet (Intel® i210) 1x USB 3.0 (with USB 2.0 backward compatibility) 1x USB 2.0
Wireless and fieldbus communication (options)	WLAN Dual Band AC/Bluetooth 4.0 2G/3G/LTE Others on request
Internal extension sockets	1x Mini PCIe full-size (PCIe & USB), with micro SIM socket 1x Mini PCIe half-size (PCIe & USB)
Internal mass storage	1x mSATA full-size (16 – 512 GB, others on request) 1x Micro SD card socket
Security components	TPM 1.2/2.0 (option)
Power supply	Voltage: 9 V – 36 V Connector type: Phoenix MC1,5/2-G-3,5 Power: typ. 3 – 10 W/max. 15 W Battery: CR2032 (replaceable)
Environment	Passive cooled (no fan) Standard temperature: 0°C...+50/60°C Extended temperature: -40°C...+70°C (option)
Form factor/ dimensions	Integrated hardware kit: 100 × 100 × 23 mm Chassis: 103 × 110 × 40 mm
Operating Systems	Windows 7, Windows 10 (Standard and Embedded/IoT) Linux (e.g. Ubuntu) Others on request Custom specific software images can be pre-installed.

x86 ODM Platforms

MBox-Advanced (MBox-ADV) – Multi-network platform for security, gateway and machine vision applications

Industrial Firewall and BoxPC platform based on Intel Atom® E3900 processor series.

HIGHLIGHTS

- **Intel Atom® E3900 series (Apollo Lake-I) in Dual- or Quad-Core configuration**
- **Up to 8 GB DDR3L**
- **4x Gbit Ethernet (Intel® i210)**
- **2x USB 3.0, 1x RS-232**
- **AES-NI-Support, TPM 1.2/2.0 (option)**
- **Extended temperature support (option)**
- **Ultra compact design**
- **Quality Made-in-Germany**
- **Individual configurations and ODM branding**

TECHNICAL SPECIFICATION

CPU	Intel Atom® E3900 series („Apollo Lake-I") E3950: 4x 1.6/2.0 GHz, 2 MB L2-Cache E3940: 4x 1.6/1.8 GHz, 2 MB L2-Cache E3930: 2x 1.3/1.8 GHz, 2 MB L2-Cache
Memory	2 GB, 4 GB or 8 GB DDR3L
Graphics interfaces	DisplayPort (DP++) with 4K UHD (on back side)
Interfaces	4x Gbit Ethernet (Intel® i210), (directly connected to CPU, not switched) 2x USB 3.0 (with USB 2.0 backward compatibility) 1x RS-232 for Console 1x USB 2.0 (on back side)
Internal extension sockets	1x M.2 2242/2280 (key B+M) socket (SATA+USB) (shared with M.2 mass storage socket)
Internal mass storage (options)	1x M.2 2242/2280 (key B+M) socket (SATA+USB) (8 GB up to 512 GB MLC, SLC/ SuperMLC on request) 1x eMMC (up to 128 GB MLC)
Security components	TPM 1.2/2.0 (option)

Power supply	Voltage: 9 V – 36 V Connector type (lockable): Phoenix MC1,5/2-G-3,5-LR Power: typ. 3–10 W/max. 15 W Battery: CR2032 (replaceable)
Environment	Passive cooled (no fan) Standard temperature: 0°C...+60°C Extended temperature: -40°C...+70°C (option) Relative Humidity: 10% to 90% (not condensing) IP20
Form factor/ dimensionsw	170 × 103 × 42 mm
Mounting options	Desktop, VESA75, DIN rail (with adapter kit)
Operating systems on request	Windows 10 (Standard and Embedded/IoT) Linux (e.g. Ubuntu) Others on request Custom specific software images can be pre-installed.

x86 ODM Platforms

COMBox-V – Fanless Industrial BoxPC

Fanless industrial BoxPC based on Intel® Core™ mobile processor series (6th and 7th Gen.).

HIGHLIGHTS

- **High End Embedded Computing**
- **Up to 32 GB DDR4–2400 with ECC-Option**
- **3x 4K Display Outputs (DisplayPort/HDMI)**
- **Impressive video and multimedia performance**
- **2x Gbit Ethernet**
- **4x USB 3.0**
- **Audio**
- **Prepared for wireless communication**
- **Fanless design**
- **Quality Made-in-Germany**
- **Individual configurations and ODM branding**

TECHNICAL SPECIFICATION

CPU	Intel® Core™ mobile processors (Kaby Lake-H) Xeon E3–1505L v6 (4x 2.2/3.0 GHz, 8 MB, 25 W) Core i7–7820EQ (4x 3.0/3.7 GHz, 8 MB, 45 W/35 W) Core i5–7442EQ (4x 2.1/2.9 GHz, 6 MB, 25 W) Core i3–7102E (2x 2.1 GHz, 3 MB, 25 W) Others (6th/7th Gen.) on request
Memory	8 GB, 16 GB or 32 GB DDR4, Dual Channel (ECC option for Core i3/Xeon)
Graphics interfaces	1x DisplayPort (DP++) with up to 4K UHD resolution 2x HDMI v1.4b with up to 4K UHD resolution
Interfaces	2x Gbit Ethernet, 4 kV isolation (meets medical specs) 4x USB 3.0 (with USB 2.0 backward compatibility) Audio 2x 3.5 mm (headphone out, microphone in)
Internal mass storage and extension sockets	1x Mini PCIe socket (full size, with micro-SIM card support) 1x M.2 2230 Key E socket (PCIe x1 and USB 2.0) for IO 1x M.2 2280 Key M socket (PCIe x4 and SATA) for SSD 1x 2.5'' HDD/SSD socket (mounting kit available)
Security components	TPM 1.2/2.0 (option)
Power supply	Voltage: 12 V DC Connector type: Phoenix MSTBA2,5/2-G-5,08 Power: typ. 10–35 W/max. 80 W (Green ECO-Off: < 5 mW) Battery: CR2032 (replaceable)
Environment	Passive cooled (no fan) Standard temperature: 0°C...+50°C (CPU TDP max. 35W) Relative Humidity: 10% to 90% (not condensing) IP20
Form factor/ dimensions	190 × 174 × 68 mm
Mounting options	Desktop, VESA100, DIN rail/wall mount (with adapter kit)
Operating systems	Windows 10 (Standard and Embedded/ IoT) Linux (e.g. Ubuntu) Others on request Custom specific software images can be pre-installed.
Notes	Various internal interface connectors (USB, RS-232, 2xSATA, Audio speaker,...) can be used to extend functionality within customized chassis.

Notes

Notes

Contact

TQ-Systems GmbH | TQ-Embedded
Gut Delling | Mühlstraße 2 | 82229 Seefeld | Germany
Phone +49 8153 9308-0 | Fax: +49 8153 4223
info@tq-group.com | www.tq-group.com