# Your Technology and Solution Partner.

## TQ-Embedded
**Product Catalogue 2021**

# Content

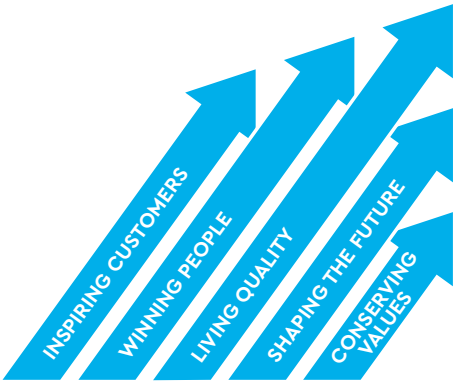
# Content

# 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

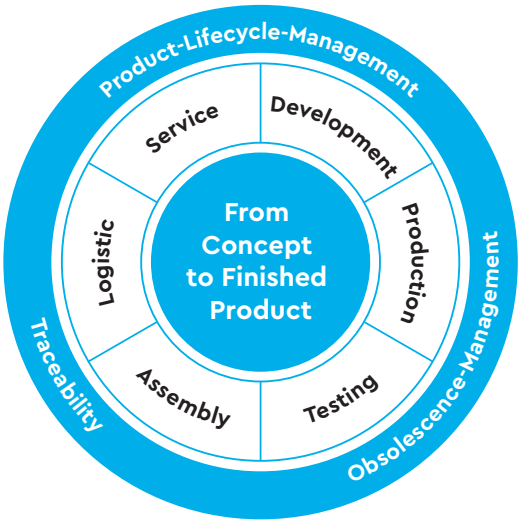
TQ-Embedded offers a comprehensive and wide-ranging service covering the whole spectrum of components for embedded systems. We guarantee our customers a reliable supply at ideal economic conditions.

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

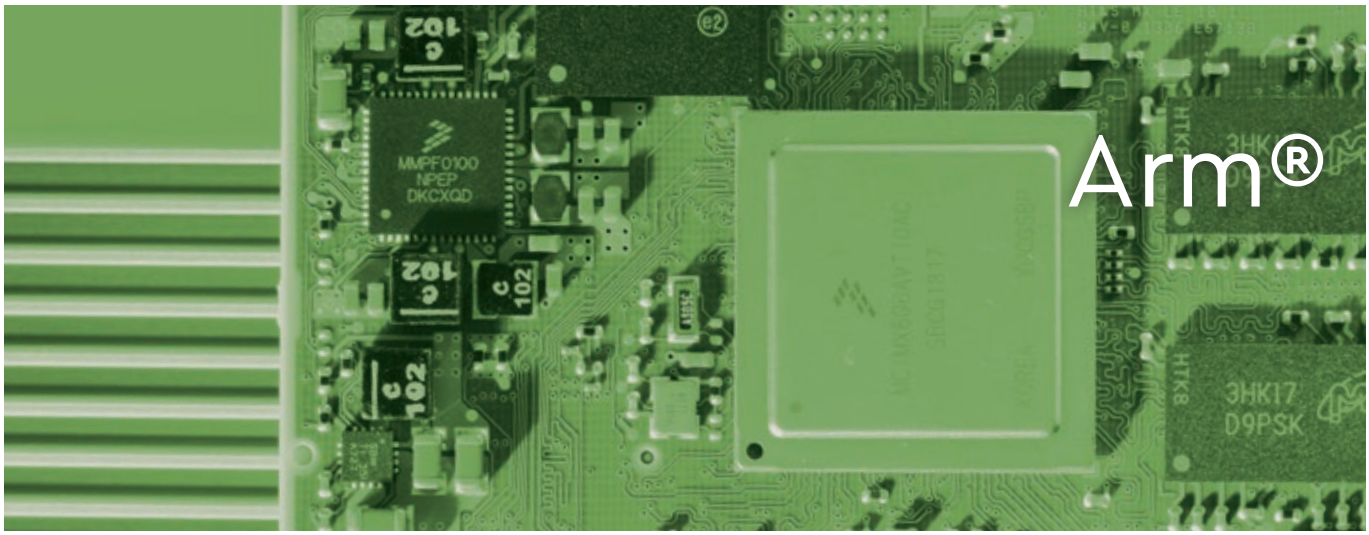
RENESAS

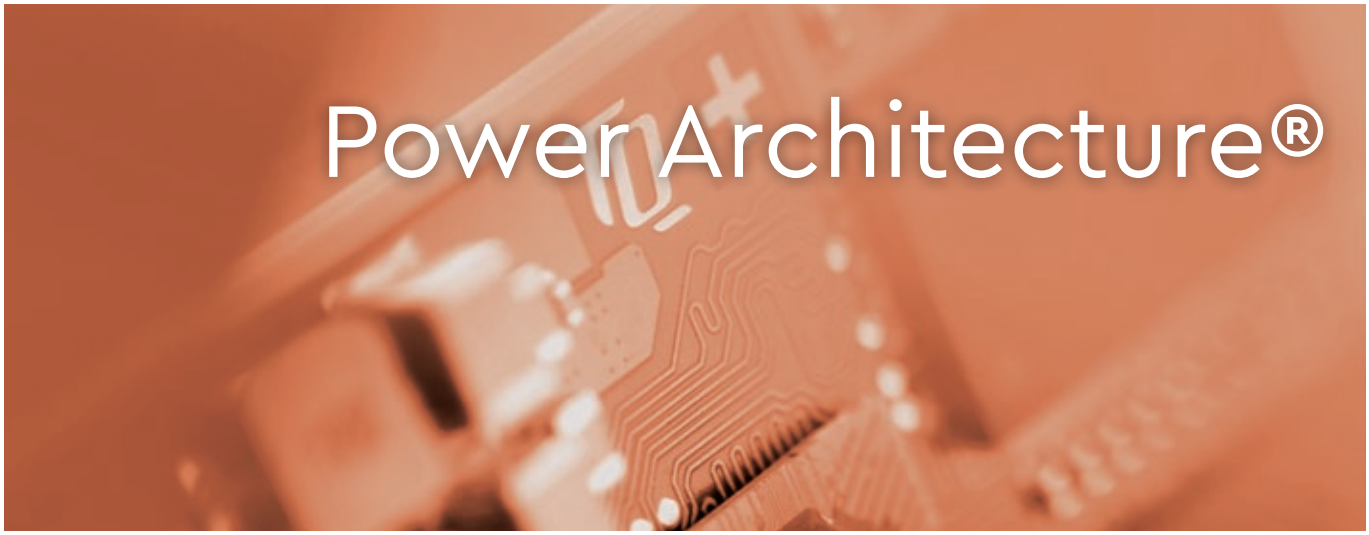
intel partner Titanium

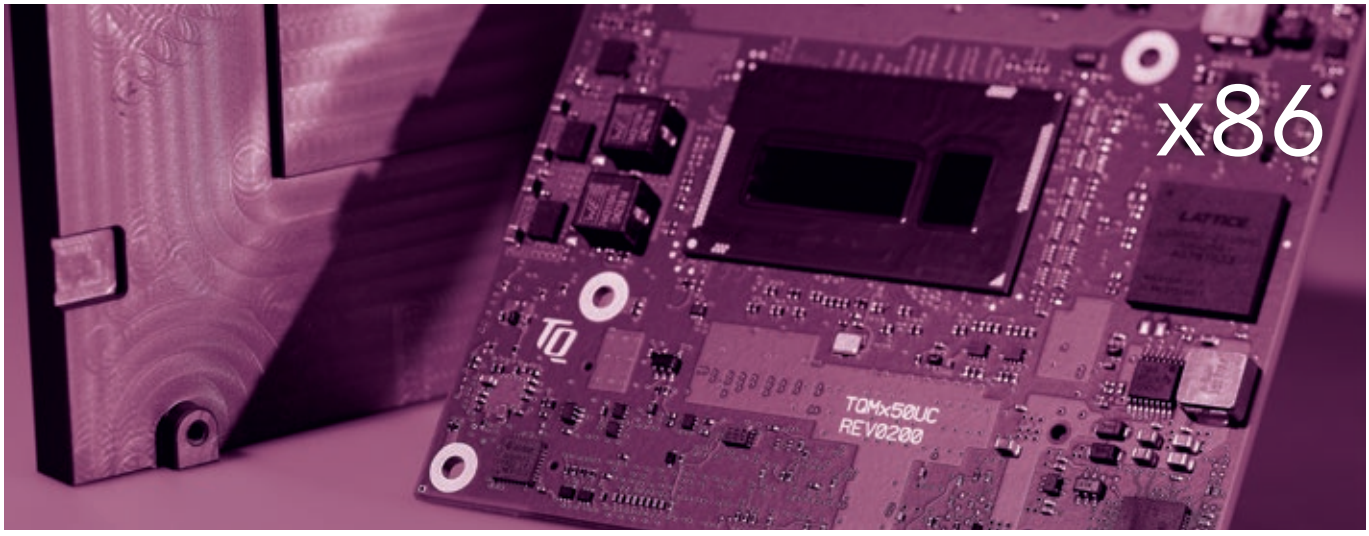
# Processor architectures

## 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**

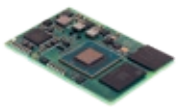
## X86

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. To ensure long-term availability of 15 years we focus on CPUs from Intel's IOTG raodmap with long-term and extended embedded use condition support.

## 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 DDR4–3200 high speed memory**
- **Rich set of ultra high speed interfaces**
- **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<br><br>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<br><br>eMMC Flash: Up to 32 GB | Linux,<br><br>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<br><br>eMMC Flash: Up to 16 GB | Linux, QNX<br><br>On request: VxWorks, PikeOS, Integrity | 3.3 V<br>Voltage monitoring (optional) | Up to 512 MB<br>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<br>Quad SPI NOR | 55 × 44 mm |
|  **TQMLX2160A** | Arm® Cortex®–A72 LX2160, LX2120, LX2080 | 2x DDR4-SDRAM: Up to 64 GB<br><br>eMMC Flash: Up to 64 GB | Linux<br><br>On request: VxWorks | 5 V | Up to 512 MB<br>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 + ECC<br><br>eMMC Flash: Up to 64 MB | Linux, PikeOS<br><br>On request: Android, QNX | 3.3 V | Up to 256 MB<br>Quad SPI NOR | 55 × 44 mm |
|  **TQMa8Xx4** | Arm® Cortex®-A35 i.MX8 DualX, i.MX8 DualX Plus i.MX8 QuadX Plus | LPDDR4-SDRAM: Up to 4 GB<br><br>eMMC Flash: Up to 64 MB | Linux, PikeOS<br><br>On request: Android, QNX | 3.3 V | Up to 256 MB<br>Quad SPI NOR | 55 × 44 mm |
|  **TQMa8XxS (SMARC)** | Arm® Cortex®-A35 i.MX8 DualX, i.MX8 DualX Plus i.MX8 QuadX Plus | LPDDR4-SDRAM: Up to 4 GB<br><br>eMMC Flash: Up to 64 MB | Linux, PikeOS<br><br>On request: Android, QNX | 3.3 V | Up to 256 MB<br>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<br><br>eMMC Flash: Up to 64 MB | Linux, Android | 5 V | Up to 256 MB<br>Quad SPI NOR | 55 × 36 mm |

# Overview
## Arm® Modules

| Arm® Modules | CPU | Memory (RAM/Flash) | Operating System | Power Supply | NOR Flash | Dimensions |
|---|---|---|---|---|---|---|
|  **TQMa8MxML** | Arm® Cortex®-A53<br>i.MX8M Mini Solo<br>i.MX8M Mini Dual<br>i.MX8M Mini Quad | LPDDR4-SDRAM:<br>Up to 4 GB<br><br>eMMC Flash:<br>Up to 64 GB | Linux<br><br>On request:<br>Android | 5 V | Up to 256 MB<br>Quad SPI NOR | 38 × 38 mm |
|  **TQMa8MxNL** | Arm® Cortex®-A53<br>i.MX8M Nano Solo<br>i.MX8M NanoDual<br>i.MX8M Nano Quad | LPDDR4-SDRAM:<br>Up to 2 GB | Linux<br><br>On request:<br>Android | 5 V | Up to 256 MB<br>Quad SPI NOR | 38 × 38 mm |
|  **TQMa8MPxL** | Arm® Cortex®-A53<br>i.MX 8M<br>Plus Quad 8 ML/AI,<br>Plus Quad 6 Video;<br>Plus Quad 4 Lite | LPDDR4-SDRAM:<br>Up to 4 GB | Linux<br><br>On request:<br>Android | 5 V | Up to 256 MB<br>Quad SPI NOR | 38 × 38 mm |
| **Q3/2021** **TQMa117xL** | Arm® Cortex®-M7<br>i.MX RT1171, i.MX RT1172, i.MX RT1173, i.MX RT1175, i.MX RT1176 | LP4-SDRAM:<br>Up to 64 MB | Free RTOS | 5 V | Up to 256 MB<br>Quad SPI NOR | 31 × 31 mm |
|  **TQMa57xx** | Arm® Cortex®-A15<br>AM571x, AM572x, AM574x | DDR3L-SDRAM:<br>Up to 4 GB<br><br>eMMC Flash:<br>Up to 32 GB | Linux<br><br>On request:<br>VxWorks, QNX | 5 V | Up to 256 MB | 75 × 55 mm |
|  **TQMa65xx** | Arm® Cortex®-A53<br>AM6526, AM6528, AM6546, AM6548 | DDR4-SDRAM:<br>Up to 4 GB + ECC<br><br>eMMC Flash:<br>Up to 64 GB | Linux<br><br>On request:<br>QNX, Android | 5 V | Up to 512 MB<br>Quad SPI NOR | 77 × 55 mm |
| **Q4/2021** **TQMa64xxL** | Arm® Cortex®-A53 / R5F<br>AM6442, AM6441, AM6421, AM6412, AM6411 | LP4-SDRAM:<br>Up to 2 GB | Linux,<br>Free RTOS | 5 V | Up to 256 MB<br>Quad SPI NOR | 38 × 38 mm |
| **Q1/2022** **TQMa243xL** | Arm® Cortex®-R5F<br>AM2434, AM2432, AM2431 | eMMC Flash:<br>up to 64 GB | Free RTOS | 5 V | Up to 256 MB<br>Quad SPI NOR | 38 × 38 mm |
|  **TQMaRZG2x** | Arm® Cortex®-A53/A57<br>RZ/G2H, RZ/G2M, RZ/G2N | LPDDR4-SDRAM:<br>Up to 8 GB<br><br>eMMC Flash:<br>Up to 64 GB | Linux<br><br>On request:<br>QNX, Android | 5 V | Up to 512 MB<br>Quad SPI NOR | 77 × 55 mm |

# Overview
## Arm® Modules

| Arm® Modules | CPU | Memory (RAM/Flash) | Operating System | Power Supply | NOR Flash | Dimensions |
|---|---|---|---|---|---|---|
|  TQMa6ULx(L) | Arm® Cortex®-A7 i.MX6UL (G1, G2, G3) I.MX6ULL (Y0, Y1, Y2) | DDR3L-SDRAM: Up to 1 GB<br>eMMC Flash: Up to 32 GB | Linux, QNX | TQMa6ULx: 5 V<br>TQMa6ULxL: 3.3 V | Up to 256 MB | TQMa6ULx 46 × 32 mm<br>TQMa6ULxL 38 × 38 mm |
|  TQMa7x | Single-/Dual-Core Arm® Cortex®-A7 core i.MX7 (Solo, Dual) | DDR3L-SDRAM: Up to 2 GB<br>eMMC Flash: Up to 32 GB | Linux, 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<br>eMMC Flash: Up to 16 GB | Linux, VxWorks, QNX, Integrity<br>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<br>eMMC Flash: Up to 16 GB | Linux, QNX, Windows Embedded Compact 2013<br>On request: VxWorks, Android | 3.3 V<br>Voltage monitoring (optional) | TQMa335x Up to 128 MB | TQMa335x 54 × 38 mm<br>TQMa335xL 38 × 38 mm |
|  TQMa28(L) | i.MX28 with an Arm® 926 core i.MX287, i.MX283 | DDR2-SDRAM: Up to 256 MB<br>eMMC Flash: Up to 16 GB | Linux, WinCE 6.0, QNX<br>On request: VxWorks | 5 V | - | TQMa28 26 × 40 mm<br>TQMa28L 31 × 31 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<br>TQMT1022: T1022 Dual-Core | DDR3L-SDRAM: Up to 8 GB + ECC<br>eMMC Flash: Up to 8 GB (opt.) | Linux<br>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 + ECC<br>eMMC Flash: Up to 8 GB (opt.) | Linux<br>On request: PikeOS, VxWorks, Wind River Linux | 5 V | Up to 256 MB | 74 × 54 mm |

# Overview
## x86 Modules

| x86 Modules | CPU | Memory (RAM/Flash) | Operating System | Power Supply | Temperature | Form factor/ Dimensions |
|---|---|---|---|---|---|---|
|  **TQMx110EB** | Intel® Core™ 11000H series (Tiger Lake-H) | DDR4-SDRAM: Up to 64 GB, dual-channel (SO-DIMM) | Windows, Linux | 14.5 V – 20 V | 0°C...+60°C | COM Express® Basic Type 6 95 × 125 mm |
|  **TQMx80UC** | Intel® Core™ 8000UE series (Whiskey Lake-U) | 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 (+ 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™ 7000E series Intel® Xeon® E3-1500L v5 series (Kaby Lake-H) | DDR4-SDRAM: Up to 32 GB, dual-channel (+ ECC) (2 SO-DIMMs) | Windows, Linux<br>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 |
|  **TQMx50UC** | Intel® Core™ 5000U series (Broadwell-U) | DDR3L-SDRAM: 4 – 16 GB, dual-channel soldered | Windows, Linux<br>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 |
|  **TQMxE40S** | Intel Atom® x6000E Series Intel® Pentium® and Celeron® N and J Series (Elkhart Lake) | LPDDR4X: 4 – 16 GB + IBECC<br>eMMC: 8 – 256 GB | Windows, Linux<br>On request: VxWorks | 4.75 – 5.25 V | 0°C...+60°C -40°C...+85°C | SMARC 2.1 82 × 50 mm |
|  **TQMxE40M** | Intel Atom® x6000E Series Intel® Pentium® and Celeron® N and J Series (Elkhart Lake) | LPDDR4X: 4 – 16 GB + IBECC<br>eMMC: 8 – 256 GB | Windows, Linux<br>On request: VxWorks | 4.75 – 20 V | 0°C...+60°C -40°C...+85°C | COM Express® Mini Type 10 55 × 84 mm |
|  **TQMxE40C1** | Intel Atom® x6000E Series Intel® Pentium® and Celeron® N and J Series (Elkhart Lake) | LPDDR4X: 4 – 16 GB + IBECC<br>eMMC: 8 – 256 GB | Windows, Linux<br>On request: VxWorks | 4.75 – 20 V | 0°C...+60°C -40°C...+85°C | COM Express® Compact Type 6 95 × 95 mm |
|  **TQMxE40C2** | Intel Atom® x6000E Series Intel® Pentium® and Celeron® N and J Series (Elkhart Lake) | DDR4: 8 – 64 GB<br>eMMC: 8 – 256 GB | Windows, Linux<br>On request: VxWorks | 4.75 – 20 V | 0°C...+60°C -40°C...+85°C | COM Express® Compact Type 6 95 × 95 mm |

# Overview
## x86 Modules

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

# Overview
## x86 Mainboards

| x86 Mainboards | Form Factor | Supported Modules | Module Standard |
|---|---|---|---|
|  MB-M10-1 | Embedded NUC<br>100 × 100 mm | TQMxE38M<br>TQMxE39M | COM Express Mini, Type 10 |
|  MB-M10-2 | Embedded NUC<br>100 × 100 mm | TQMxE39M | COM Express Mini, Type 10 |

# Overview
## x86 Mainboards

| x86 Mainboards | Form Factor | Supported Modules | Module Standard |
|---|---|---|---|
|  MB-COME10-1 | Mini-ITX<br>170 × 170 mm | TQMxE38M<br>TQMxE39M | COM Express Mini, Type 10 |
|  MB-COME10-2 | Mini-ITX<br>170 × 170 mm | TQMxE40M | COM Express Mini, Type 10 |
|  MB-COME6-1 | Mini-ITX<br>170 × 170 mm | TQMxE38C<br>TQMx50UC<br>TQME39C1/C2 | COM Express Basic, Type 6 |
|  MB-COME6-2 | Mini-ITX<br>170 × 170 mm | TQMx60EB<br>TQMx70EB<br>TQMxE39C1/C2 | COM Express Basic, Type 6 |
|  MB-COME6-3 | Mini-ITX<br>170 × 170 mm | TQMx60EB<br>TQMx70EB<br>TQMx80UC | COM Express Basic, Type 6 |
| **Q3/2021** MB-COME6-4 | Mini-ITX<br>170 × 170 mm | TQMx110EB | COM Express Basic, Type 6 |
|  MB-SMARC-1 | Mini-ITX<br>170 × 170 mm | TQMxE39S | SMARC 2.0 |
|  MB-SMARC-2 | Mini-ITX<br>170 × 170 mm | TQMxE39S<br>TQMa8XxS | SMARC 2.0 |
|  MB-SMARC-3 | Mini-ITX<br>170 × 170 mm | TQMxE40S | SMARC 2.1 |

# Overview
## Arm® Hardwarekits

| Arm® Hardwarekits | Performance Class/ Scalability | Suitable CPU Module standard | Form factor/ dimensions | Integration Levels |
|---|---|---|---|---|
|  **MBLX2160A** | Arm® Cortex®-A72 LX2160A, LX2120A, LX2080A | TQMLX2160A | 331 × 228 mm | Hardware Kit |
|  **MBLS10xxA** | Arm® Cortex®-A53/A72 LS1046A, LS1043A, LS1026A, LS1023A, LS1088A | TQMLS1043A TQMLS1046A TQMLS1088A | 210 × 250 mm | Hardware Kit |
|  **MBa57xx** | Arm® Cortex®-A15 AM571x, AM572x, AM574x | TQMa57xx | 170 × 230 mm | Hardware Kit |
|  **MBa8Xx** | Arm® Cortex®-A35 i.MX8XD, i.MX8XDP, i.MX8XQP | TQMa8Xx TQMa8Xx4 | 170 × 170 mm | Hardware Kit |
|  **MBa8Mx** | Arm® Cortex®-A35 i.MX8M Dual, i.MX8M Quad Lite, i.MX8M Quad | TQMa8Mx TQMa8MxML TQMa8MxNL | 170 × 170 mm | Hardware Kit |
|  **MBa6ULx** | Arm® Cortex®-A7 i.MX6UL (G1, G2, G3) I.MX6ULL (Y0, Y1, Y2) | TQMa6ULx | 170 × 170 mm | Hardware Kit |
|  **MBa7x** | Single-/Dual-Core Arm® Cortex®-A7 core i.MX7 (Solo, Dual) | TQMa7x | 170 × 170 mm | Hardware Kit |
|  **MBa6x** | Arm® Cortex®-A9 (i.MX6 Dual Plus/ i.MX6 Quad Plus) | TQMa6x | 170 × 170 mm | Hardware Kit |
|  **MBLS1028A** | Arm® Cortex®-A72 LS1017A, LS1027A, LS1018A, LS1028A | TQMLS1028A | 170 × 170mm | Hardware Kit |

# Overview
## Arm® Hardwarekits

| Arm® Hardwarekits | Performance Class/ Scalability | Suitable CPU Module standard | Form factor/ dimensions | Integration Levels |
|---|---|---|---|---|
|  **MBaRZG2x** | Arm® Cortex®-A53/ A57 RZ/G2N, RZ/G2M, RZ/G2H | TQMaRZG2x | 170 × 170mm | Hardware Kit |
|  **MBa65xx** | Arm® Cortex®-A53 AM6526, AM6528, AM6546, AM6548 | TQMa65xx | 230 × 170 mm | 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 | TQMLS1012AL | 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 |
|  **MBa8MPxL** | Arm® Cortex®-A53 i.MX 8M Plus Quad 8 ML/AI i.MX 8M Plus Quad 6 Video i.MX 8M Plus Quad 4 Lite | TQMa8MPxL | 160 × 100 mm | Hardware Kit |
| Q3/2021 **MBa117xL** | Arm® Cortex®-M7 i.MX RT1171, i.MX RT1172, i.MX RT1173, i.MX RT1175, i.MX RT1176 | TQMa117xL | 160 × 100 mm | Hardware Kit |
| Q4/2021 **MBax4xxL** | Arm® Cortex®-A53 / R5F AM6442, AM6441, AM6421, AM6412, AM6411, AM2434, AM2432, AM2431 | TQMax4xxL | 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:<br>T1042 Quad-Core<br>TQMT1040:<br>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 |
|---|---|---|---|---|
| **Q4/2021**<br>**STKx110EB set** | Intel® Core™<br>Tiger Lake-H | COM Express Compact Type 6 | Mini-ITX<br>170 × 170 mm | Starterkit/Hardwarekit incl. Mainboard, Module and Cooling |
|  **STKx80UC set** | Intel® Core™<br>Whiskey Lake-U | COM Express Compact Type 6 | Mini-ITX<br>170 × 170 mm | Starterkit/Hardwarekit incl. Mainboard, Module and Cooling |
|  **STKx70EB set** | Intel® Core™<br>KabyLake-H | COM Express® Basic Type 6 | Mini-ITX<br>170 × 170 mm | Starterkit/Hardwarekit incl. Mainboard, Module and Cooling |
|  **STKx60EB set** | Intel® Core™<br>SkyLake-H | COM Express® Basic Type 6 | Mini-ITX<br>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 |
|---|---|---|---|---|
| **Q4/2021**<br>**STKxE40C1 set** | Intel Atom® x6000E Elkhart Lake | COM Express® Compact Type 6 | Mini-ITX 170 × 170 mm | Starterkit/Hardwarekit incl. Mainboard, Module and Cooling |
| **Q4/2021**<br>**STKxE40C2 set** | Intel Atom® x6000E Elkhart Lake | COM Express® Compact Type 6 | Mini-ITX 170 × 170 mm | Starterkit/Hardwarekit incl. Mainboard, Module and Cooling |
|  <br>**STKxE39C1 set** | Intel Atom® Apollo Lake | COM Express® Compact Type 6 | Mini-ITX 170 × 170 mm | Starterkit/Hardwarekit incl. Mainboard, Module and Cooling |
|  <br>**STKxE39C2 set** | Intel Atom® Apollo Lake | COM Express® Compact Type 6 | Mini-ITX 170 × 170 mm | Starterkit/Hardwarekit incl. Mainboard, Module and Cooling |
| **Q3/2021**<br>**STKxE40M set** | Intel Atom® x6000E Elkhart Lake | COM Express® Mini Type 10 | Mini-ITX 170 × 170 mm | Starterkit/Hardwarekit incl. Mainboard, Module and Cooling |
|  <br>**STKxE39M set** | Intel Atom® Apollo Lake | Com Express® Mini Type 10 | Mini-ITX 170 × 170 mm | Starterkit/Hardwarekit incl. Mainboard, Module and Cooling |
|  <br>**STKxE38M set** | Intel Atom® Bay Trail | Com Express® Mini Type 10 | Mini-ITX 170 × 170 mm | Starterkit/Hardwarekit incl. Mainboard, Module and Cooling |
| **Q3/2021**<br>**STKxE40S set** | Intel Atom® x6000E Elkhart Lake | SMARC 2.1 | Mini-ITX 170 × 170 mm | Starterkit/Hardwarekit incl. Mainboard, Module and Cooling |
|  <br>**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-LS1012AL | Arm® Cortex®-A53 LS1012AL | 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/MBox-R-E39** | Intel Atom® E3800/E3900 | Industrial/various | ✓ | 130 x 103 x 57 mm |
|  **MBox-V(H)** | Intel Atom® E3800 | Industrial/IoT | ✓ | 110 x 103 x 40/55 mm |
|  **MBox-V(H)-E39** | Intel Atom® E3900 | Industrial/IoT | ✓ | 110 x 103 x 40/55 mm |
|  **MBox-ADV** | Intel Atom® E3900 | IoT/Security/ Machine Vision | ✓ | 170 x 103 x 43 mm |
|  **COMBox-V8** | 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<br>2.5 G N-BASE T<br>1x USB 2.0 high speed w/ULPI<br>1x USB 3.0 high speed w/PHY<br>Up to 2x UART |
| **Periphery interfaces** | Up to 2x SDIO/MMC 3.0<br>Up to 1x $I^2C$<br>Up to 1x SPI<br>Up to 5x $I^2S$<br>Up to 1x SATA 3.0<br>Up to 1x PCIe<br>Up to 1x QSPI (NOR Flash) |
| **Memory** | DDR3L-SDRAM: Up to 1 GB<br>Quad SPI NOR: Up to 256 MB<br>EEPROM: 0/64-kbit |

| | |
|---|---|
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>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)<br>Up to 10x Ethernet 10/100/1000 Mbit<br>Up to 3x USB 3.0 high speed HOST interface (2x LS1088A)<br>Up to 4x UART |
| **Periphery interfaces** | Up to 1x SDIO/MMC<br>Up to 4x $I^2C$<br>Up to 1x SPI<br>Up to 1x SATA 3.0<br>Up to 3x PCIe 3.0 (LS1043A PCIe 2.0) |
| **Memory** | DDR4-SDRAM: Up to 8 GB (LS1043A and LS1023A up to 4GB)<br>Up to 64 GB eMMC<br>Quad SPI NOR: Up to 512 MB<br>EEPROM: 0/64-kbit<br>ECC protection |

| | |
|---|---|
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>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 |

# 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)<br>Up to 4x FlexCAN<br>Up to 1x USB 2.0 high speed OTG<br>Up to 1x USB 3.0 high speed HOST<br>Up to 6x UART |
| **Periphery interfaces** | Up to 1x SDIO/MMC<br>Up to 3x $I^2C$<br>Up to 2x SPI<br>Up to 4x $I^2S$<br>Up to 1x SATA 3.0<br>Up to 2x PCIe<br>SPDIF |
| **Graphic** | LCD interface (only LS1021A) |
| **Memory** | DDR3L-SDRAM: Up to 2 GB<br>Quad SPI NOR: Up to 512 MB<br>eMMC: Up to 16 GB<br>EEPROM: 0/64-kbit<br>ECC protection (only LS1020A, LS1021A) |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>CPU JTAG interface<br>Extended power management (optional)<br>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<br>Up to 1x TSN Ethernet up to 2.5 Gbit<br>Up to 1x Ethernet 1 Gbit<br>Up to 2x USB 3.0<br>Up to 6x UART<br>Up to 2x CAN |
| **Periphery interfaces** | Up to 2x SDIO/MMC<br>Up to 8x I²C<br>Up to 2x SPI<br>Up to 6x SAI<br>Up to 1x SATA 3.0<br>Up to 2x PCIe 3.0 |
| **Graphic** | 4K LCD Controller with eDP/DP Phy<br>3D GPU |

| | |
|---|---|
| **Memory** | DDR4-SDRAM: Up to 8 GB<br>ECC Protection<br>Quad SPI NOR: Up to 512 MB<br>EEPROM: 0/256 kbit |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>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 |

# Arm® Modules

## TQMLx2160A – The module based on LX2160A 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<br>Up to 2x 40/50/100 G-Ethernet<br>Up to 16x 1/2.5/10/25 G-Ethernet<br>Up to 2x USB 3.0 OTG interface<br>Up to 2x UART<br>Up to 2x CAN FD<br>Up to 4x SATA 3.0 |
| **Periphery interfaces** | Up to 2x SDIO/eMMC<br>Up to 6x PCIe Gen3 (up to 24 lanes)<br>Up to 6x I2C<br>Up to 3x SPI<br>Up to 1x QSPI (8-bit)<br>Up to 32 GPIO |
| **Memory** | 2x DDR4-SDRAM: Up to 64 GB<br>Quad SPI NOR: Up to 512 MB (TBD)<br>eMMC Flash: Up to 64 GB<br>EEPROM: 0/64-kbit |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>CPU JTAG interface |
| **Power supply** | 5 V |
| **Ambient conditions** | Standard temperature range: -25°C...+85°C<br>Extended temperature range: -40°C...+85°C |
| **Dimensions** | 126 × 78 mm (TBD) |
| **Plug-in system** | Board-to-board plug-in system<br>560 pins 0.5 mm Pitch (TBD) |
| **Operating systems** | Linux |
| **Operating systems on request** | QNX, VxWorks |

# Arm® Modules

## TQMa8Xx – The module based on i.MX 8X 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<br>i.MX8X Dual, i.MX8X Dual Plus<br>i.MX8X Quad Plus |
| **System interfaces** | Up to 2x Ethernet 10/100/1000 Mbit<br>Up to 1x USB 3.0 OTG interface<br>Up to 2x USB 2.0 OTG interface<br>Up to 4x UART<br>Up to 3x CAN FD |
| **Periphery interfaces** | 1x SDIO/MMC<br>1x PCIe<br>Up to 8x $I^2C$<br>Up to 4x SPI<br>Up to 2 Q-SPI<br>Up to 2x SPDIF<br>Up to 4x ESAI<br>Up to 32 GPIO |
| **Graphic** | Dual LVDS Interface / 2xMIPI DSI<br>1x MIPI CSI |

| | |
|---|---|
| **Memory** | DDR3L-SDRAM: Up to 2 GB<br>Quad SPI NOR: Up to 256 MB<br>Up to 64 GB eMMC Flash<br>EEPROM: 0/64-kbit |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>CPU JTAG interface |
| **Power supply** | 3.3 V |
| **Ambient conditions** | Standard temperature range: -25°C...+85°C<br>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, PikeOS |
| **Operating systems on request** | QNX, Android |

# Arm® Modules

## TQMa8Xx4 – The module based on i.MX 8X technology for general embedded applications

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

## 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**

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | Cortex®-A35 Technology<br>i.MX8X Dual, i.MX8X Dual Plus<br>i.MX8X Quad Plus |
| **System interfaces** | Up to 2x Ethernet 10/100/1000 Mbit<br>Up to 1x USB 3.0 OTG interface<br>Up to 2x USB 2.0 OTG interface<br>Up to 4x UART<br>Up to 3x CAN FD |
| **Periphery interfaces** | 1x SDIO/MMC<br>1x PCIe<br>Up to 8x $I^2C$<br>Up to 4x SPI<br>Up to 2 Q-SPI<br>Up to 2x SPDIF<br>Up to 4x ESAI<br>Up to 32 GPIO |
| **Graphic** | Dual LVDS Interface / 2xMIPI DSI<br>1x MIPI CSI |
| **Memory** | LPDDR4: Up to 4 GB<br>Quad SPI NOR: Up to 256 MB<br>Up to 64 GB eMMC Flash<br>EEPROM: 0/64-kbit |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>CPU JTAG interface |
| **Power supply** | 3.3 V |
| **Ambient conditions** | Standard temperature range: -25°C...+85°C<br>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, PikeOS |
| **Operating systems on request** | QNX, Android |

# Arm® Modules

## TQMa8XxS (SMARC) – The SMARC module based on i.MX 8X 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<br>i.MX8 QuadXPlus, i.MX8 DualXPlus<br>i.MX8 DualX |
| **System interfaces** | Up to 2x Ethernet 10/100/1000 Mbit (IEEE 1588)<br>Up to 1x USB 3.0<br>Up to 2.0 OTG<br>Up to 5x USB 2.0 (USB Hub)<br>Up to 2x UART<br>Up to 2x CAN FD |
| **Periphery interfaces** | Periphery interfaces<br>1x SDIO/MMC<br>2x $I^2C$<br>1x SPI<br>1x $I^2S$<br>1x PCIe<br>GPIO |
| **Graphic** | 2x LVDS, 1x eDP<br>1x Camera Sensor Interface (CSI MIPI) |

| | |
|---|---|
| **Memory** | LPDDR4-SDRAM: Up to 4 GB<br>Quad SPI NOR: Up to 256 MB<br>Up to 64 GB eMMC Flash<br>EEPROM: 0/64 kbit |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>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<br>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, PikeOS |
| **Operating systems on request** | QNX, Android |

# Arm® Modules

## TQMa8Mx – Module based on i.MX 8M 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)<br>Up to 1x USB 3.0 OTG interface<br>Up to 1x USB 2.0 OTG interface<br>Up to 4x UART |
| **Periphery interfaces** | 1x SDIO/MMC<br>Up to 4x $I^2C$<br>Up to 3x SPI<br>Up to 2x QSPI<br>Up to 6x $I^2S$/SAI<br>S/PDIF Rx & Tx<br>2x PCIe<br>GPIO |
| **Graphic** | Monitor Interface (HDMI)<br>DSI Display (MIPI DSI 4 lane)<br>Up to 2x MIPI CSI2 |
| **Memory** | LPDDR4-SDRAM: Up to 4 GB<br>Quad SPI NOR: Up to 256 MB (TBD)<br>Up to 64 GB eMMC Flash<br>EEPROM: 0/64-kbit |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>CPU JTAG interface |
| **Power supply** | 5 V |
| **Ambient conditions** | Standard temperature range: -25°C...+85°C<br>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, Android |

# Arm® Modules

## TQMa8MxML – Module based on i.MX 8M 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<br>i.MX8M Mini Dual/Dual Lite<br>i.MX8M Mini Quad/Quad Lite |
| **System interfaces** | Up to 1x Ethernet 10/100/1000 Mbit<br>Up to 1x USB 2.0 OTG interface<br>Up to 1x USB 2.0 Host interface<br>Up to 4x UART |
| **Periphery interfaces** | Up to 3x SDIO/eMMC<br>Up to 1x PCIe 2.0<br>Up to 4x I2C<br>Up to 3x SPI<br>Up to 1x QSPI<br>Up to 20x $I^2S$<br>Up to 8x PDM Mic.<br>Up to 1x SPDIF |
| **Graphic** | LCD Interface: 1x MIPI DSI; (4 Lanes)<br>Camera: 1x MIPI CSI2 (4 Lanes) |

| | |
|---|---|
| **Memory** | LPDDR4-SDRAM: Up to 4 GB<br>Quad SPI NOR: Up to 256 MB<br>eMMC Flash: Up to 64 GB<br>EEPROM: 0/64-kbit |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>CPU JTAG interface |
| **Power supply** | 5 V |
| **Ambient conditions** | Standard temperature range: -25°C...+85°C<br>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

## TQMa8MxNL – Module based on i.MX8M Nano with enhanced Video properties

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

## HIGHLIGHTS

- **Advanced Audio properties**
- **Integrated Cortex® M7**
- **High-speed communication via 1x Gbit Ethernet and 1x USB 2.0 interface**
- **Low power consumption (typ. 3 W)**
- **Integrated security functions**

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | i.MX8M Nano Solo/ i.MX8M Nano Solo Lite<br>i.MX8M Nano Dual/ i.MX8M Nano Dual Lite<br>i.MX8M Nano Quad/ i.MX8M Nano Quad |
| **Interfaces** | Up to 1x Ethernet 10/100/1000 Mbit<br>Up to 1x USB 2.0 Host interface<br>Up to 4x UART |
| **Periphery interfaces** | Up to 3x SDIO/eMMC<br>Up to 4x I2C<br>Up to 3x SPI<br>Up to 1x QSPI<br>Up to 10x I²S<br>Up to 5x SAI<br>Up to 8x PDM Mic.<br>Up to 1x SPDIF |
| **Graphic** | LCD Interface: 1x MIPI DSI; (4 Lanes)<br>Camera: 1x MIPI CSI2 (4 Lanes) |
| **Memory** | LPDDR4-SDRAM: Up to 2 GB<br>Quad SPI NOR: Up to 256 MB<br>eMMC Flash: Up to 64 GB<br>EEPROM: 0/64-kbit |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>CPU JTAG interface |
| **Power supply** | 5 V |
| **Ambient conditions** | Standard temperature range: -25°C...+85°C<br>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

## TQMa8MPxL – Module based on i.MX 8M Plus with Machine Learning Accelerator

Embedded Cortex®-A53 module based on
i.MX 8M Plus with Machine Learning Accelerator.

## HIGHLIGHTS

- **Advanced Audio properties with HiFi4 DSP**
- **Machine Learning Accelerator 2.3 TOPS**
- **Integrated Cortex®-M7**
- **High-speed communication via 2x Gbit Ethernet (1x TSN), 1x PCIe and 2x USB 3.0 interface**
- **Low power consumption (typ. 4 W)**
- **Integrated security functions**

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | i.MX 8M Plus Quad 8 ML/AI<br>i.MX 8M Plus Quad 6 Video<br>i.MX 8M Plus Quad 4 Lite |
| **Interfaces** | Up to 2x Gbit-Ethernet (1x TSN)<br>Up to 2x USB 3.0<br>Up to 2x CAN FD<br>Up to 4x UART |
| **Periphery interfaces** | Up to 3x SDIO / eMMC<br>Up to 1x PCIe 3.0<br>Up to 6x I2C<br>Up to 3x SPI<br>Up to 1x QSPI<br>Up to 18x I²S<br>Up to 8x PDM Mic.<br>Up to 1x SPDIF |
| **Graphic** | LCD Interface: 1x MIPI DSI; (4 Lanes)<br>LVDS (4/8 Lanes), HDMI 2.0a<br>Camera: 2x MIPI CSI2 (4 Lanes) |

| | |
|---|---|
| **Memory** | LPDDR4-SDRAM: Up to 4 GB<br>Quad SPI NOR: Up to 256 MB<br>eMMC Flash: Up to 256 GB<br>EEPROM: 0 / 64-kbit |
| **Other** | Real Time Clock (RTC)<br>Secure Element SE050<br>Temperature sensor<br>CPU JTAG interface |
| **Power supply** | 5 V |
| **Ambient conditions** | Standard temperature range:<br>-25°C...+85°C<br>Extended temperature range:<br>-40°C...+85°C |
| **Dimensions** | 38 × 38 mm |
| **Plug-in system** | LGA (Land Grid Array) 362 pins |
| **Operating systems** | Linux |
| **Operating systems on request** | Android |

# Arm® Modules

## TQMa117xL – LGA Module based on i.MX RT1170 with Real-Time Functionality


Embedded Cortex®-M7 module based on i.MX RT1170 with Real-Time Functionality.

## HIGHLIGHTS

- **Display up to WXGA (1280×800) @ 60 fps**
- **Up to 3x CAN FD**
- **Integrated Cortex M4**
- **High-speed communication via 2x Gbit Ethernet (1x TSN/1x AVB ) and 2x USB 2.0 interface**
- **Low power consumption (typ. 1 W)**
- **Integrated security functions**

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | i.MX RT1171, i.MX RT1172, i.MX RT1173, i.MX RT1175, i.MX RT1176 |
| **Interfaces** | Up to 2x Gbit-Ethernet (1x TSN/1x AVB)<br>Up to 1x 10/100 Ethernet w/IEEE1588<br>Up to 2x USB 2.0 interface<br>Up to 3x CAN FD<br>Up to 12x UART |
| **Periphery interfaces** | Up to 2x SDIO 3.0/eMMC 5.0<br>Up to 6x I2C<br>Up to 6x SPI<br>Up to 2x QSPI<br>Up to 4x SAI<br>Up to 8-ch. DMIC<br>Up to 1x SPDIF<br>Up to 2x FlexIO |
| **Graphic** | LCD Interface:<br>1x MIPI DSI; (2 Lanes) Parallel LCD<br>Camera:<br>1x MIPI CSI (2 Lanes), Parallel CSI |
| **Memory** | LP-SDRAM: Up to 64 MB<br>NOR: Up to 256 MB<br>EEPROM: 0/64-kbit |
| **Other** | Real Time Clock (RTC)<br>Secure Element SE050<br>Temperature sensor<br>CPU JTAG interface |
| **Power supply** | 5 V |
| **Ambient conditions** | Standard temperature range:<br>-25°C...+85°C<br>Extended temperature range:<br>-40°C...+85°C |
| **Dimensions** | 31 × 31 mm (TBD) |
| **Plug-in system** | LGA (Land Grid Array) 240 pins (TBD) |
| **Operating systems** | Free RTOS |
| **Operating systems on request** | (TBD) |

# Arm® Modules

## TQMa57xx – The module based on AM57xx 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)<br>Up to 4x Ethernet 10/100 (PRU)<br>Up to 2x CAN<br>1x USB 2.0 high speed OTG<br>Up to 1x USB 3.0 high speed Host<br>Up to 10x UART |
| **Periphery interfaces** | Up to 2x SDIO/MMC<br>Up to 3x I²C<br>Up to 4x SPI<br>Up to 4x I²S<br>Up to 1x SATA 3.0<br>Up to 2x PCIe |
| **Graphic** | LCD Interface (2x 24-bit RGB), HDMI-Interface<br>Camera sensor interface (2x 24b/2x 8b) |

| | |
|---|---|
| **Memory** | DDR3L-SDRAM: Up to 4 GB<br>ECC Protection<br>Quad SPI NOR: Up to 256 MB<br>Up to 32 GB eMMC flash<br>EEPROM: 0/64-kbit |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>CPU JTAG interface |
| **Power supply** | 5 V |
| **Ambient conditions** | Standard temperature range: -25°C...+85°C<br>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 |

# Arm® Modules

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

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

## HIGHLIGHTS

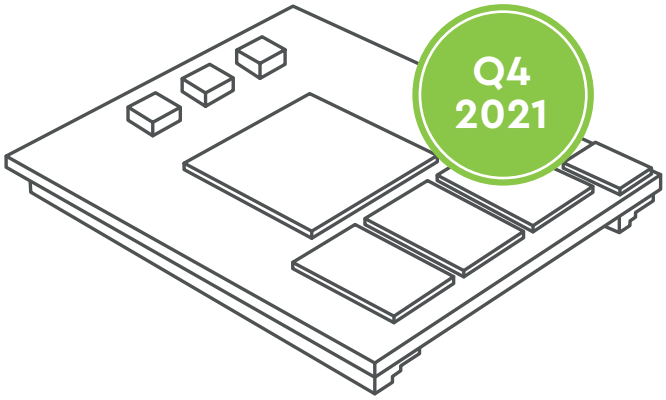
- **Graphic with 3D Support**
- **DDR4 with ECC Support**
- **6x Real Time Gbit Ethernet TSN (PRU)**
- **1x Gbit Ethernet, 2x PCIe and 1x USB 3.1 interface**
- **Low power consumption (typ. 6 W)**
- **2x CAN FD**
- **Integrated Cortex® R5F MPU**

## TECHNICAL SPECIFICATION

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

# Arm® Modules

## TQMa64xxL – LGA module based on AM64xx for applications with real – time demands




Embedded Cortex®-A53/R5F module based on TI AM64xx for headless Applications with Real –time demand.

## HIGHLIGHTS

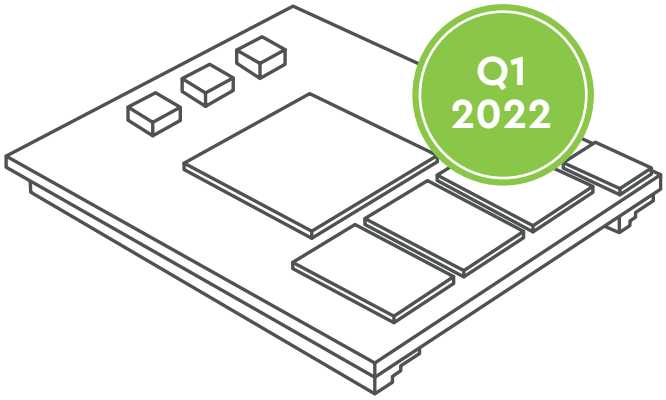
- **4x Real-time GBit Ethernet for Fieldbus**
- **Up to 2x CAN FD**
- **Integrated Cortex®-M4**
- **High-speed communication via 2x Gbit Ethernet, 1x USB 2.0 interface**
- **Low power consumption (typ. 1–2 W)**
- **Integrated security functions**

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | AM6442, AM6441, AM6421, AM6412, AM6411 |
| **Interfaces** | Up to 2x Gbit-Ethernet<br>Up to 4x Real-time Gbit Ethernet (PRU)<br>Up to 1x USB 2.0 interface<br>Up to 2x CAN FD<br>Up to 1x SerDes (PCIe/USB 3.0)<br>Up to 9x UART |
| **Periphery interfaces** | Up to 2x SDIO<br>Up to 6x I2C<br>Up to 7x MCSPI<br>Up to 1x OSPI or QSPI<br>Up to 1x ADC<br>Up to 9x PWM |
| **Memory** | SDRAM: Up to 2 GB<br>NOR: Up to 256 MB (TBD)<br>eMMC: Up to 64 GB (TBD)<br>EEPROM: 0/64-kbit |
| **Other** | Real Time Clock (RTC)<br>Secure Element SE050<br>Temperature sensor<br>CPU JTAG interface |
| **Power supply** | 5 V |
| **Ambient conditions** | Standard temperature range: -25°C...+85°C<br>Extended temperature range: -40°C...+85°C |
| **Dimensions** | 38 × 38 mm (TBD) |
| **Plug-in system** | LGA (Land Grid Array) xxx pins (TBD) |
| **Operating systems** | Real-time Operating System (TBD)<br>Linux (Cortex®-A53) |
| **Operating systems on request** | (TBD) |

# Arm® Modules

## TQMa243xL – LGA Module based on AM243x for applications with real – time demands




## HIGHLIGHTS

- **4x Real-time GBit Ethernet for Fieldbus**
- **Up to 2x CAN FD**
- **Integrated Cortex®-M4**
- **High-speed communication via 2x Gbit Ethernet, 1x USB 2.0 interface**
- **Low power consumption (typ. 1–2 W)**
- **Integrated security functions**

Embedded Cortex®-R5F module based on TI AM243x for headless Applications with Real – time demand.

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | AM2434 – AM2431 |
| **Interfaces** | Up to 2x Gbit-Ethernet<br>Up to 4x Real-time Gbit Ethernet (PRU)<br>Up to 1x USB 2.0 interface<br>Up to 2x CAN FD<br>Up to 1x SerDes (PCIe/USB 3.0)<br>Up to 9x UAR |
| **Periphery interfaces** | Up to 2x SDIO<br>Up to 6x I²C<br>Up to 7x MCSPI<br>Up to 1x OSPI or QSPI<br>Up to 1x ADC<br>Up to 9x PWM |
| **Memory** | SDRAM: Up to 2 GB<br>NOR: Up to 256 MB (TBD)<br>eMMC: Up to 64 GB (TBD)<br>EEPROM: 0/64-kbit |
| **Other** | Real Time Clock (RTC)<br>Secure Element SE050<br>Temperature sensor<br>CPU JTAG interface |
| **Power supply** | 5 V |
| **Ambient conditions** | Standard temperature range:<br>-25°C...+85°C<br>Extended temperature range:<br>-40°C...+85°C |
| **Dimensions** | 38 × 38 mm (TBD) |
| **Plug-in system** | LGA (Land Grid Array) xxx pins (TBD) |
| **Operating systems** | Real-time Operating System (TBD) |

# 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 – FD**
- **Integrated security functions**

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | RZ/G2N, RZ/G2M, RZ/G2H |
| **Interfaces** | Up to 1x Ethernet 10/100/1000 Mbit<br>Up to 1x USB 3.0 OTG interface<br>Up to 2x USB 2.0 OTG interface<br>Up to 6x UART<br>Up to 5x H-UART<br>Up to 2x CAN FD<br>Up to 1x SATA (not RZ/G2M) |
| **Periphery interfaces** | Up to 4x SDIO/eMMC<br>Up to 2x PCIe 2.0<br>Up to 7x I2C<br>Up to 4x SPI<br>Up to 1x QSPI<br>Up to 10x I²S<br>Up to 32 GPIO |
| **Graphic** | 1x HDMI 2.0, 1x LVDS, 1x Digital RGB<br>Camera: 2x MIPI CSI2 |

| | |
|---|---|
| **Memory** | LPDDR4-SDRAM: Up to 8 GB (ECC Optional)<br>Quad SPI NOR: Up to 512 MB<br>eMMC Flash: Up to 64 GB<br>EEPROM: 0/64-kbit |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>CPU JTAG interface |
| **Power supply** | 5 V |
| **Ambient conditions** | Standard temperature range: -25°C...+85°C<br>Extended temperature range: -40°C...+85°C |
| **Dimensions** | 77 × 55 mm |
| **Plug-in system** | Board-to-board plug-in system<br>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)<br>i.MX6ULL (Y0, Y1, Y2) |
| **System interfaces** | Up to 2x Ethernet 10/100 Mbit<br>Up to 2x CAN<br>Up to 2x USB 2.0 high speed OTG<br>Up to 8x UART |
| **Periphery interfaces** | Up to 2x SDIO/MMC<br>Up to 4x I²C<br>Up to 4x SPI<br>Up to 3x I²S |
| **Graphic** | LCD Interface (24-bit RGB)<br>1x 16-bit Camera Sensor Interface |
| **Memory** | DDR3L-SDRAM: Up to 1 GB<br>Quad SPI NOR: Up to 256 MB<br>Up to 32 GB eMMC-Flash<br>EEPROM: 0/64-kbit |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>CPU JTAG Interface |
| **Power supply** | 5 V |
| **Ambient conditions** | Standard temperature range: -25°C...+85°C<br>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

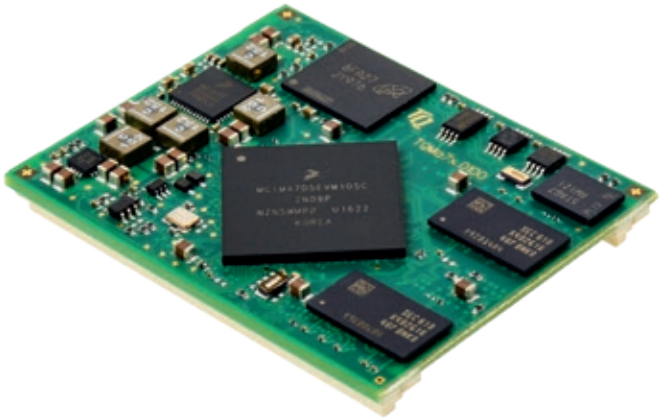
- **Graphic**
- **Extended temperature range**
- **2x Ethernet with IEE1588**
- **Low power consumption (typ. 1 W)**
- **Camera sensor interface**
- **Security functions**
- **Long term availability**

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | i.MX6UL (G1, G2, G3)<br>i.MX6ULL (Y0, Y1, Y2) |
| **System interfaces** | Up to 2x Ethernet 10/100 Mbit<br>Up to 2x CAN<br>Up to 2x USB 2.0 high speed OTG<br>Up to 8x UART |
| **Periphery interfaces** | Up to 2x SDIO/MMC<br>Up to 4x I²C<br>Up to 4x SPI<br>Up to 3x I²S |
| **Graphic** | LCD Interface (24-bit RGB)<br>1x 16-bit Camera Sensor Interface |
| **Memory** | DDR3L-SDRAM: Up to 1 GB<br>Quad SPI NOR: Up to 256 MB<br>Up to 32 GB eMMC Flash<br>EEPROM: 0/64-kbit |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>CPU JTAG Interface |
| **Power supply** | 3.3 V |
| **Ambient conditions** | Standard temperature range: -25°C...+85°C<br>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<br>Up to 2x CAN<br>Up to 2x USB 2.0 high speed OTG<br>Up to 1x USB 2.0 high speed HOST<br>Up to 7x UAR |
| **Periphery interfaces** | Up to 3x SDIO/MMC<br>Up to 4x $I^2C$<br>Up to 4x SPI<br>Up to 3x $I^2S$<br>Up to 1x Smart Card<br>Up to 1x PCIe |
| **Graphic** | LCD Interface (24-bit RGB)<br>Up to 2 Camera Sensor Interface (24-bit/MIPI) |
| **Memory** | DDR3L-SDRAM: Up to 2 GB<br>Quad SPI NOR: Up to 256 MB<br>Up to 32 GB eMMC flash<br>EEPROM: 0/64-kbit |
| **Other** | Integrated Cortex®-M4<br>Real Time Clock (RTC)<br>Temperature sensor<br>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)<br>2x FlexCAN<br>1x USB 2.0 high speed OTG interface<br>1x USB 2.0 high speed HOST interface<br>Up to 5x UART |
| **Periphery interfaces** | WEIM Bus<br>Up to 3x SDIO/MMC<br>Up to 2x $I^2C$<br>Up to 5x SPI<br>Up to 3x SSI/$I^2S$<br>ESAI<br>2x 16-bit Camera I/F<br>SATA<br>PCIe<br>SPDIF |
| **Graphic** | DVI (HDMI)<br>Parallel 2x 24-bit (RGB)<br>Dual LVDS |
| **Memory** | DDR3L-SDRAM: Up to 2 GB (MCIMX6 Solo with 1 GB)<br>eMMC: Up to 16 GB<br>NOR: Up to 128 MB<br>EEPROM: 0/64-kbit |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>CPU JTAG Interface |
| **Power supply** | 5 V |
| **Ambient conditions** | Standard temperature range: -25°C...+85°C<br>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)<br>Up to 2x CAN 2.0 B<br>Up to 6x UART<br>2x USB 2.0 high speed OTG interface<br>Up to 2x SDIO/MMC<br>Up to 3x I2C<br>Up to 2x McASP (4ch)<br>Up to 2x SPI<br>GPIO<br>Up to 8x 12-bit ADC channels<br>Up to 3x PWM |
| **Graphic** | 24-bit TFT Interface |
| **Memory** | DDR3L-SDRAM: up to 512 MB<br>eMMC flash: up to 16 GB<br>NOR flash: up to 128 MB<br>EEPROM: 0/64-kbit |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>CPU JTAG Interface |
| **Power supply** | 3.3 V |
| **Ambient conditions** | Standard temperature range: -25°C...+85°C<br>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**

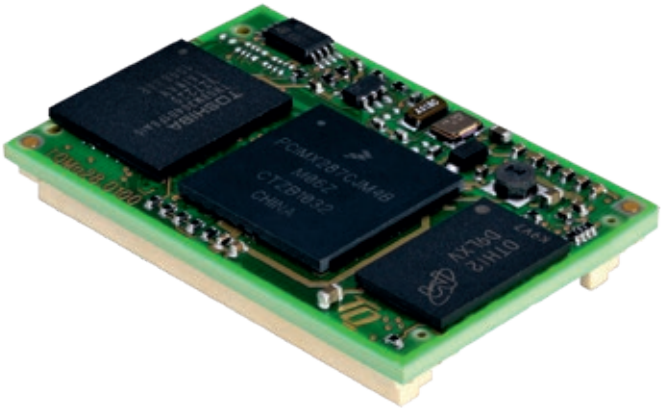
Embedded LGA module based on Cortex®-A8 (AM335x) with graphics and real-time support.

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | AM3352, AM3354, AM3358, AM3359 (Up to 1 GHz) |
| **Interfaces** | Up to 2x Ethernet 10/100/1000 Mbit (L2 Switch)<br>Up to 2x CAN 2.0 B<br>Up to 6x UART<br>2x USB 2.0 high speed OTG interface<br>Up to 2x SDIO/MMC<br>Up to 3x I2C<br>Up to 2x McASP (4 ch)<br>Up to 2x SPI<br>GPIO<br>Up to 8x 12-bit ADC channels<br>Up to 3x PWM |
| **Graphic** | 24-bit TFT Interface |
| **Memory** | DDR3L-SDRAM: up to 512 MB<br>eMMC Flash: up to 16 GB |
| **Other** | Real Time Clock (RTC)<br>CPU JTAG Interface |
| **Power supply** | 3.3 V |
| **Ambient conditions** | Standard temperature range: -25°C...+85°C<br>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

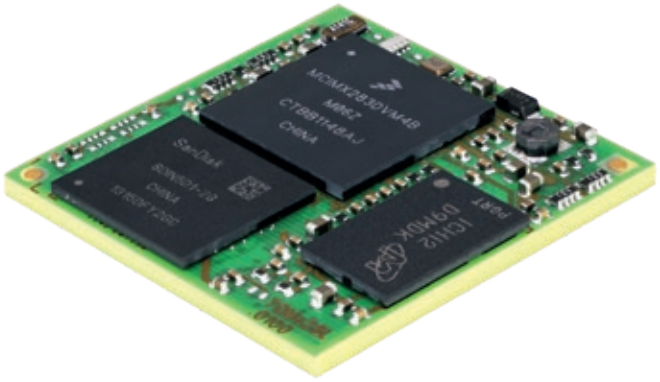
- **Smallest Arm® 9 module**
- **Low-cost due to highest level of integration**
- **Extended temperature range**
- **2x IEEE1588 Ethernet (L2 Switch)**
- **Low power consumption (typ. 1 W)**
- **Long-term availability**
- **IEC 61850 stack**

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | i.MX287 (450 MHz) |
| **Interfaces** | Up to 2x Ethernet 10/100 Mbit (L2 Switch)<br>Up to 2x CAN 2.0 B<br>Up to 5x UART<br>1x USB 2.0 high-speed HOST interface<br>1x USB 2.0 high-speed OTG interface<br>1x SDIO/MMC<br>Up to 2x I2C<br>Up to 2x I2S<br>Up to 2x SPI<br>GPIO<br>Up to 8x 12-bit ADC channels<br>Up to 8x PWM |
| **Graphic** | 24-bit TFT Interface |
| **Memory** | DDR2-SDRAM: up to 256 MB<br>eMMC flash: up to 16 GB<br>EEPROM: 0/64-kbit |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>CPU JTAG Interface<br>Supervisor 5 V |
| **Power supply** | 5 V |
| **Ambient conditions** | Standard temperature range: -25°C...+85°C<br>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)<br>Up to 2x CAN 2.0 B<br>Up to 5x UART<br>1x USB 2.0 high-speed HOST interface<br>1x USB 2.0 high-speed OTG interface<br>1x SDIO/MMC<br>Up to 2x I2C<br>Up to 2x I2S<br>Up to 2x SPI<br>GPIO<br>Up to 8x 12-bit ADC channels<br>Up to 8x PWM |
| **Graphic** | 24-bit TFT Interface |
| **Memory** | DDR2-SDRAM: up to 256 MB<br>eMMC flash: up to 16 GB |
| **Other** | Real Time Clock (RTC)<br>CPU JTAG Interface |
| **Power supply** | 5 V |
| **Ambient conditions** | Standard temperature range: -25°C...+85°C<br>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)<br>Dual T1022 Power Architecture® e5500 cores (64bit) |
| **Interfaces** | 5x Gbit Ethernet (with IEEE® 1588v2)<br>2x USB 2.0 High Speed Host/Device/OTG<br>2x SATA 2.0<br>4x PCIe, 2.0 Controller up to 5.0 Gbit/s according to PCI Express specification 2.0 as Root-Complex or Endpoint<br>4x I²C, max. 400 kHz<br>1x Integrated Flash Controller (IFC), 16-bit<br>1x eSPI Controller<br>2x DUART, max. 115 kBaud (RS232)<br>Up to 32x GPIOs<br>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*)<br>NOR flash: up to 256 MB<br>EEPROM: 32 KB<br>eMMC (optional): up to 8 GB<br>Simple expansion for example via MMC/SDHC, USB |
| **Other** | Real Time Clock (RTC)<br>Watchdog<br>JTAG Interface<br>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<br>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)<br>8-Port Gbit Ethernet Switch<br>2x USB 2.0 High Speed Host/Device/ OTG<br>2x SATA 2.0<br>4x PCIe, 2.0 Controller up to 5.0 Gbit/s according to PCI Express specification 2.0 as Root-Complex or Endpoint<br>4x I²C, max. 400 kHz<br>1x Integrated Flash Controller (IFC), 16-bit<br>1x eSPI Controller<br>2x DUART, max. 115 kBaud (RS232)<br>Up to 32x GPIOs<br>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*)<br>NOR flash: up to 256 MB<br>EEPROM: 32 KB<br>eMMC (optional): up to 8 GB<br>Simple expansion for example via MMC/ SDHC, USB |
| **Other** | Real Time Clock (RTC)<br>Watchdog<br>JTAG Interface<br>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<br>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

# TQ Technology inside

# x86 Modules

## TQMx110EB – COM Express® Basic Type 6 Module with 11th Gen. Intel® Core™ Processor

COM Express® Basic Type 6 Module with 11th Generation Intel® Core™ Processors.

## HIGHLIGHTS

- **11th Generation Intel® Core™ i7 and Intel® Core™ i5 processors**
- **Desktop / Mobile Workstation Performance**
- **Up to 8 Cores / 16 Threads with up to 4.6 GHz Turbo and 24 MB cache**
- **New outstanding Intel® Iris® Xᵉ Graphics performance with 8 K high-resolution outputs**
- **Flexible high-speed Memory Configuration with up to 64 GB DDR4–3200**
- **High-bandwidth extendability through PCIe Gen4 x16 PEG Port**
- **High-speed peripheral interfaces with USB 3.2 Gen 2 (10 Gb/s) support**
- **2.5 Gb Ethernet**
- **High CPU power effiency with max. 45 W TDP**

Based on

COM Express

intel partner Titanium

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | Intel® Core™ i7–11800H (8 × 2.4 GHz / 4.6 GHz Turbo, 24 MB Cache, 45 W (cTDP 35 W), 0° C – 100° C)<br>Intel® Core™ i5–11400H (6 × 2.6 GHz / 4.5 GHz Turbo, 12 MB Cache, 45 W (cTDP 35 W), 0° C – 100° C) |
| **Memory** | DDR4–3200: up to 64 GB, 2 SO-DIMMs<br>Onboard soldered NVMe SSD (PCIe Gen3 x4) up to 1 Tbyte (option)<br>EEPROM: 32 kbit (24AA32) (option) |
| **Graphics** | Up to 4 independant display outputs:<br>3x Digital Display Interface / DP++ with up to 8K; DisplayPort 1.4a with support for Multi-Stream Transport (MST)<br>1x Embedded Digital Display Interface (eDP 1.4b) or dual channel LVDS interface |
| **Additional components and controller** | 1x TPM 2.0 (SLM9670) (option) or internal firmware TPM (FTPM)<br>TQMx86 board controller with watchdog and TQ-flexiCFG<br>Hardware monitor for thermal management |
| **Interfaces** | 1x 2.5 Gigabit Ethernet (Intel® i225)<br>4x USB 3.2 Gen2 (up to 10 Gb/s) with USB 3.0 compatibility<br>8x USB 2.0<br>1x PEG-Port with PCIe Gen4 (up to 16 Gb/s per lane) (1×16, 2×8 or 2×4+1×8)<br>8x PCIe Gen3 (up to 8 Gb/s) (8×1, 4×2 or 2×4)<br>4x SATA Gen3 (up to 6 Gb/s)<br>1x LPC or eSPI<br>1x I2C (master/slave capable), 2nd port opt.<br>1x SMBus<br>1x SPI (for external UEFI BIOS flash)<br>2x UART (Rx/Tx) (4-wire optional through TQ flexiCFG)<br>8x GPIO through TQ flexiCFG |
| **Power supply** | Volatge: 14.5 V – 20 V, 5 V Standby (opt.), 3 V battery<br>Power: typ. 25 W – 30 W / max. 60 W (preliminary) |
| **Environment** | Temperature: 0°C...+60°C |
| **Form factor/ dimensions** | COM Express® Basic, Type 6<br>125 × 95 mm |

# 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 partner Titanium

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

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

## 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")<br>Xeon E3-1505M v5 (4x 2.8/3.7 GHz, 8 MB, GT2, 45/35 W)<br>Xeon E3-1505L v5 (4x 2.0/2.8 GHz, 8 MB, GT2, 25 W)<br>Intel® Core™ 6000E series („Skylake-H")<br>Core i7-6820EQ (4x 2.8/3.5 GHz, 8 MB, GT2, 45/35 W)<br>Core i7-6822EQ (4x 2.0/2.8 GHz, 8 MB, GT2, 25 W)<br>Core i5-6440EQ (4x 2.7/3.4 GHz, 6 MB, GT2, 45/35 W)<br>Core i5-6442EQ (4x 1.9/2.7 GHz, 6 MB, GT2, 25 W)<br>Core i3-6100E (2x 2.7 GHz, 3 MB, GT2, 35 W)<br>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<br>EEPROM: 32-kBit (24LC32) |
| **Graphic** | Three independent display outputs:<br>3x Digital Display Interface/DP++ with up to 4K @ 60 Hz for DP 1.2a/HDMI 1.4 with multi stream transport (MST)<br>LVDS Interface (18/24-bit, Single/Dual Channel) (optional eDP 1.3 with 4 lanes instead of LVDS)<br>Intel® Quick Sync Video and Wireless Display support |
| **Additional components and controller** | TPM (SLB9660 TPM 1.2, alternatively SLB9665 TPM 2.0)<br>TQMx86 board controller with watchdog and flexiCFG<br>Hardware monitor for thermal management |

| | |
|---|---|
| **Interfaces** | 1x Gbit Ethernet (Intel® i219-LM)<br>4x USB 3.0 (with USB 2.0 backward compatibility)<br>8x USB 2.0 (incl. USB 3.0 ports)<br>4x SATA Gen3 (up to 6 Gb/s)<br>1x PEG Port with PCIe x16 Gen 3<br>8x PCIe Gen 3 (4 × 1 or 1 × 4)<br>1x LPC bus<br>1x Intel® HD audio (HDA)<br>1x I2C, (2nd I2C optional) (master/slave capable)<br>1x SMBus<br>1x SPI (for external uEFI BIOS flash)<br>2x Serial Port (Rx/Tx, legacy compatible) (4 wire optional through TQ flexiCFG)<br>8x GPIO |
| **Power supply** | Voltage: 8.5 V – 20 V<br>5 V Standby (optional)<br>3 V battery<br>Power: typ. 25–30 W/max. 60 W<br>(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<br>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 partner Titanium

## 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")<br>i7-5650U: 2x 2.2 GHz/3.2 GHz Turbo, 4 MB Cache, HD6000<br>i5-5350U: 2x 1.8 GHz/2.9 GHz Turbo, 3 MB Cache, HD6000<br>i3-5010U: 2x 2.1 GHz, 3 MB Cache, HD5500<br>Celeron® 3765U: 2x 1.9GHz/no Turbo, 2MB Cache, 5th Gen HD graphics<br>Hyper-Threading and Virtualization support<br>15 W TDP max. (configurable down to 9.5/10 W) |
| **Memory** | DDR3L-1600: 4 GB, 8 GB, 16 GB, soldered down<br>EEPROM: 32-kbit (24LC32) |
| **Graphic** | Three independent display outputs:<br>2x Digital Display Interface/DP++ with up to 4K @ 60 Hz<br>LVDS Interface (18/24-bit, Single/Dual Channel), up to 4K<br>(optional eDP 1.3 with 4 lanes instead of LVDS)<br>Intel® Quick Sync Video and Wireless Display support |
| **Additional components and controller** | TPM (SLB9660 TPM 1.2, alternatively SLB9665 TPM 2.0)<br>TQMx86 board controller with watchdog and flexiCFG<br>Industrial real time clock (iRTC) with high accuracy<br>Hardware monitor for thermal management |
| **Interfaces** | 1x Gbit ethernet (Intel® i218-LM) with IEEE1588<br>2x USB 3.0 (with USB 2.0 backward compatibility)<br>8x USB 2.0 (incl. USB 3.0 ports)<br>4x SATA Gen 3 (up to 6 Gb/s)<br>4x PCIe 2.0 (up to 5 Gb/s) (4 × 1 or 1 × 4)<br>1x LPC bus<br>1x Intel® HD audio (HDA)<br>1x I2C, (2nd I2C optional) (master/slave capable)<br>1x SMBus<br>1x SPI (for external uEFI BIOS flash)<br>2x Serial Port (Rx/Tx, legacy compatible)<br>8x GPIO |
| **Power supply** | Voltage: 8.5 V – 20 V<br>5 V Standby (optional)<br>3 V battery/GoldCAP on carrier (optional)<br>Power: typ. 10 W/max. 18 W<br>(Green ECO-Off: < 0.1 W) |
| **Environment** | Temperature: 0°C...+60°C<br>-40°C...+85°C (on request) |
| **Form factor/ dimensions** | COM Express™ Compact, type 6, PICMG COM.0 R2.1<br>95 × 95 mm |

# x86 Modules

## TQMxE40S – SMARC Module (SMARC 2.1) with Intel Atom® x6000E

SMARC 2.1 Module with Intel Atom® x6000E Series processors ("Elkhart Lake").

Based on

SMARC module

intel partner Titanium

## HIGHLIGHTS

- **6th Generation Intel Atom® x6000E Series processors ("Elkhart Lake")**
- **Dual/Quad core computing power with up to 3.0 GHz**
- **Up to 16 GB soldered LPDDR4/4x with inband ECC (option)**
- **2x Gbit Ethernet**
- **2x USB 3.2 (Gen2), 4x USB 2.0 and 4 PCIe lanes (Gen3)**
- **Triple display support with 2x DP++ (4K) and eDP (4K)/ LVDS (Dual Channel)**
- **Up to 256 GB eMMC Flash, soldered**
- **Small size (82 mm x 50 mm)**
- **Extended temperature support from -40°C...+85°C**

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | Intel Atom® x6000E Series and<br>Intel® Pentium® and Celeron® N and J Series processors |
| **Memory** | LPDDR4/4x: 4, 8, 16 GB with IBECC |
| **eMMC** | 8 – 256 GB |
| **EEPROM** | 32-kbit |
| **Graphics** | 1x eDP (4K @ 60 Hz) or Dual Channel LVDS (18/24-bit)<br>2x DP++ / Digital Display Interface (DDI) (4K @ 60 Hz) |
| **Interfaces** | 2x Gbit Ethernet, IEEE 1588 Trigger signals<br>2x USB 3.2 (Gen2)<br>4x USB 2.0 |
| **Security components** | TPM 2.0 (SLM9670 TPM 2.0) (configuration option) |
| **Others** | TQMx86 board controller with watchdog and flexiCFG Hardware monitor |

| | |
|---|---|
| **Peripheral interfaces** | 1x SATA 3.0 (up to 6 Gb/s)<br>4x PCIe 3.0 (up to 8 Gb/s)<br>1x eSPI<br>1x HD audio (HDA)/1x I2S<br>1x I2S<br>4x I2C<br>2x CAN<br>1x SMBus<br>1x SPI (for exteral uEFI BIOS flash)<br>4x Serial port (4x Rx/Tx, 2x RTS/CTS)<br>1x SD card<br>14x GPIO |
| **Power supply** | Main Voltage: 4.75 V – 5.25 V<br>RTC Batterie Voltage: 3 V<br>Power: typ. 3 – 8 W/max. 14 W |
| **Environment** | Standard temperature: 0°C...+60°C<br>Extended temperature: -40°C...+85°C |
| **Form factor/ dimensions** | SMARC 2.1,<br>82 × 50 mm |

# x86 Modules

## TQMxE40M – COM Express® Mini Module (Type 10) with Intel Atom® x6000E

## HIGHLIGHTS

- **6th Generation Intel Atom® x6000E Series processors ("Elkhart Lake")**
- **Dual/Quad core computing power with up to 3.0 GHz**
- **Up to 16 GB LPDDR4/4x soldered with inband ECC (option)**
- **1x Gbit Ethernet**
- **2x USB 3.2 (Gen2) and 8x USB 2.0**
- **Up to 4 PCIe lanes (Gen3)**
- **Dual Display support with DP (4K) and eDP (4K) or LVDS (Single Channel)**
- **Up to 256 GB eMMC Flash, soldered**
- **Extended temperature support from -40°C...+85°C**

COM Express® Mini Type 10 Module with Intel Atom® x6000E Series processors ("Elkhart Lake").

Based on

COM Express

intel partner Titanium

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | Intel Atom® x6000E Series and<br>Intel® Pentium® and Celeron® N and J Series processors |
| **Memory** | LPDDR4/4x: 4, 8, 16 GB with IB |
| **eMMC** | 8 – 256 GB |
| **EEPROM** | 32-kbit |
| **Graphics** | 1x eDP (4K @ 60 Hz) or Single Channel LVDS (18/24 bit)<br>1x DP++ / Digital Display Interface (DDI) (4K @ 60 Hz) |
| **Interfaces** | 1x Gbit Ethernet, IEEE 1588 Trigger signal<br>2x USB 3.2 (Gen2)<br>8x USB 2.0 |
| **Security components** | TPM 2.0 (SLM9670 TPM 2.0) (configuration option) |
| **Others** | TQMx86 board controller with watchdog and flexiCFG Hardware monitor |

| | |
|---|---|
| **Peripheral interfaces** | 2x SATA 3.0 (up to 6 Gb/s)<br>4x PCIe 3.0 (up to 8 Gb/s)<br>1x LPC/eSPI<br>1x Intel HD audio (HDA)<br>1x I2C<br>1x SMBus<br>1x SPI (for exteral uEFI BIOS flash)<br>2x Serial port (2x Rx/Tx, 2x RTS/CTS optional through TQ flexiCFG)/2x CAN<br>1x SD card/8x GPIO |
| **Power supply** | Main Voltage: 4.75 V – 20 V<br>Standby Voltage: 4.75 V – 5.25 V<br>RTC Battery Voltage: 3 V<br>Power: typ. 3 – 8 W/max. 14 W (Green ECO-Off: < 0.1 W) |
| **Environment** | Standard temperature: 0°C...+60°C<br>Extended temperature: -40°C...+85°C |
| **Form factor/ dimensions** | COM Express® Mini, type 10, 84 × 55 mm |

# x86 Modules

## TQMxE40C1 – COM Express® Compact Module (Type 6) with Intel Atom® x6000E, soldered LPDDR4/IBECC


COM Express® Compact Type 6 Module with Intel Atom® x6000E Series processors ("Elkhart Lake").

Based on

COM Express

intel partner Titanium

## HIGHLIGHTS

- **6th Generation Intel Atom® x6000E Series processors ("Elkhart Lake")**
- **Dual/Quad core computing power with up to 3.0 GHz**
- **Up to 16 GB soldered LPDDR4/4x with inband ECC (option)**
- **1x Gbit Ethernet**
- **2x USB 3.2 (Gen2), 8x USB 2.0 and 8x PCIe (Gen3)**
- **Triple display support with 2x DP++ (4K) and eDP (4K)/LVDS (Dual Channel)**
- **Extended Temperature support from -40°C to +85°C**
- **Highest reliability, 24/7 certified**
- **On custom request: conformal coating**

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | Intel Atom® x6000E Series and<br>Intel® Pentium® and Celeron® N and J Series processors |
| **Memory** | Soldered LPDDR4/4x: 4, 8, 16 GB with IBECCC<br>eMMC: 8–256 GB<br>EEPROM: 32-kbit |
| **Graphics** | 1x eDP (4K @ 60 Hz) or Dual Channel LVDS (18/24 bit)<br>2x DP++ / Digital Display Interface (DDI) (4K @ 60 Hz) |
| **Interfaces** | 1x Gbit Ethernet, IEEE 1588 Trigger signal<br>2x USB 3.2 (Gen 2)<br>8x USB 2.0 |
| **Security components** | TPM 2.0 (SLM9670 TPM 2.0) (configuration option) |
| **Others** | TQMx86 board controller with watchdog and flexiCFG Hardware monitor |

| | |
|---|---|
| **Peripheral interfaces** | 2x SATA 3.0 (up to 6 Gb/s)<br>8x PCIe 3.0 (up to 8 Gb/s)<br>1x LPC bus / eSPI<br>1x Intel HD audio (HDA)<br>1x I2C<br>2x CAN<br>1x SMBus<br>1x SPI (for exteral uEFI BIOS flash)<br>2x Serial port (2x Rx/Tx, 2x RTS/CTS optional through TQ flexiCFG)/2x CAN<br>1x SD card/8x GPIO |
| **Power supply** | Main Voltage: 4.75 V – 20 V<br>Standby Voltage: 4.75 V – 5.25 V<br>RTC Battery Voltage: 3 V<br>Power: typ. 3 – 8 W/max. 14 W<br>(Green ECO-Off: < 0.1 W) |
| **Environment** | Standard temperature: 0°C...+60°C<br>Extended temperature: -40°C...+85°C |
| **Form factor/ dimensions** | COM Express® Compact, Type 6, 95 × 95 mm |

# x86 Modules

## TQMxE40C2 – COM Express® Compact Module (Type 6) with Intel Atom® x6000E and DDR4 SO-DIMM


## HIGHLIGHTS

- **6th Generation Intel Atom® x6000E Series processors ("Elkhart Lake")**
- **Dual/Quad core computing power with up to 3.0 GHz**
- **Up to 64 GB SO-DIMM DDR4 with inband ECC (option)**
- **1x Gbit Ethernet**
- **2x USB 3.2 (Gen2), 8x USB 2.0 and 8x PCIe (Gen3)**
- **Triple display support with 2x DP++ (4K) and eDP (4K)/LVDS (Dual Channel)**
- **Extended Temperature support from -40°C to +85°C**
- **Highest reliability, 24/7 certified**
- **On custom request: conformal coating**

COM Express® Compact Type 6 Module with Intel Atom® x6000E Series processors ("Elkhart Lake").

Based on

COM Express

intel partner Titanium

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | Intel Atom® x6000E Series and<br>Intel® Pentium® and Celeron® N and J Series processors |
| **Memory** | SO-DIMM DDR4; up to 64 GB with IBECC<br>eMMC: 8–256 GB<br>EEPROM: 32-kbit |
| **Graphics** | 1x eDP (4K @ 60 Hz) or Dual Channel LVDS (18/24 bit)<br>2x DP++ / Digital Display Interface (DDI) (4K @ 60 Hz) |
| **Interfaces** | 1x Gbit Ethernet, IEEE 1588 Trigger signal<br>2x USB 3.2 (Gen 2)<br>8x USB 2 |
| **Security components** | TPM 2.0 (SLM9670 TPM 2.0) (configuration option) |
| **Others** | TQMx86 board controller with watchdog and flexiCFG Hardware monitor |

| | |
|---|---|
| **Peripheral interfaces** | 2x SATA 3.0 (up to 6 Gb/s)<br>8x PCIe 3.0 (up to 8 Gb/s)<br>1x LPC bus / eSPI<br>1x Intel HD audio (HDA)<br>1x I2C<br>2x CAN<br>1x SMBus<br>1x SPI (for exteral uEFI BIOS flash)<br>2x Serial port (2x Rx/Tx, 2x RTS/CTS optional through TQ flexiCFG)/2x CAN<br>1x SD card/8x GPIO |
| **Power supply** | Main Voltage: 4.75 V – 20 V<br>Standby Voltage: 4.75 V – 5.25 V<br>RTC Battery Voltage: 3 V<br>Power: typ. 3 – 8 W/max. 14 W (Green ECO-Off: < 0.1 W |
| **Environment** | Standard temperature: 0°C...+60°C<br>Extended temperature: -40°C...+85°C |
| **Form factor/ dimensions** | COM Express® Compact, Type 6, 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 partner Titanium

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

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

## 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")<br>Atom® x5-E3930 2x 1.8 GHz, 6.5 W<br>Atom® x5-E3940 4x 1.8 GHz, 9.5 W<br>Atom® x7-E3950 4x 2.0 GHz, 12 W |
| **System interfaces** | 1x Gbit Ethernet (Intel® i210) (external IEEE1588 sync optional through TQ flexiCFG)<br>3x USB 3.0<br>5x USB 2.0 |
| **Periphery interfaces** | 2x SATA 3.0 (up to 6Gb/s), eSATA capable<br>4x PCIe 2.0 (up to 5 Gb/s)<br>1x LPC bus<br>1x Intel® HD audio (HDA)<br>1x I2C (master/slave capable)<br>1x SMBus<br>1x SPI (for exteral uEFI BIOS flash)<br>2x Serial port (Rx/Tx, legacy compatible)<br>(4 wire optional through TQ flexiCFG)<br>1x SD card interface/on request:<br>8x GPIO (multiplexed) |
| **Graphic** | 2x Digital Display Interface (DDI) for DP 1.2a, HDMI 1.4b<br>1x eDP 1.4/Dual Channel LVDS |
| **Memory** | DDR3L: 4/8 GB ECC, Dual Channel, ECC<br>eMMC: 8–64 GB<br>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<br>4.75 V – 20 V Standby (optional)<br>3 V Battery for RTC<br>Power: typ. 3 – 8 W/max. 14 W<br>(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 partner Titanium

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | Intel Atom® x5/x7 E3900 („Apollo Lake-I")<br>Atom® x5-E3930 2×1.8 GHz, 6.5 W<br>Atom® x5-E3940 4×1.8 GHz, 9.5 W<br>Atom® x7-E3950 4×2.0 GHz, 12 W<br>Celeron® N3350 2×2,4 GHz, 6 W<br>Pentium® N4200 4×2,5 GHz, 6 W |
| **System interfaces** | 1x Gbit Ethernet (Intel® i210) (external IEEE1588 sync optional through TQ flexiCFG)<br>3x USB 3.0<br>5x USB 2.0 |
| **Periphery interfaces** | 2x SATA 3.0 (up to 6 Gb/s), eSATA capable<br>4x PCIe 2.0 (up to 5 Gb/s)<br>1x LPC bus<br>1x Intel® HD audio (HDA)<br>1x I2C (master/slave capable)<br>1x SMBus<br>1x SPI (for exteral uEFI BIOS flash)<br>2x Serial port (Rx/Tx, legacy compatible)<br>(4 wire optional through TQ flexiCFG)<br>1x SD card interface/on request:<br>8x GPIO (multiplexed) |
| **Graphic** | 2x Digital Display Interface (DDI) for DP 1.2a, HDMI 1.4b<br>1x eDP1.4/Dual Channel LVDS |
| **Memory** | DDR3L: 4/8 GB non-ECC, Dual Channel (2 SO-DIMMS) eMMC: 8–64 GB<br>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<br>4.75 V – 20 V Standby (optional)<br>3 V Battery for RTC<br>Power: typ. 3 – 8 W/max. 14 W<br>(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

## 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 partner Titanium

## 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")<br>E3815: 1x 1.46 GHz, 512 KB L2-Cache,5 W<br>E3805: 2x 1.33 GHz, 1 MB L2-Cache, 3 W, without graphics<br>E3825: 2x 1.33 GHz, 1 MB L2-Cache, 6 W<br>E3826: 2x 1.46 GHz, 1 MB L2-Cache, 7 W<br>E3827: 2x 1.75 GHz, 1 MB L2-Cache, 8 W<br>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)<br>1x USB 3.0<br>3x USB 2.0<br>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<br>EEPROM: 32-kbit (24LC32) |
| **Security components** | TPM (SLB9660 TPM 1.2, alternatively SLB9665 TPM 2.0) |
| **Others** | TQMx86 board controller with watchdog and flexiCFG<br>Industrial real time clock (iRTC)<br>Hardware monitor |

| | |
|---|---|
| **Peripheral interfaces** | 2x SATA 2.0 (up to 3 Gb/s), eSATA capable<br>3x PCIe 2.0 (up to 5 Gb/s) (4th lane optional, if no Ethernet)<br>1x LPC bus<br>1x Intel® HD audio (HDA)<br>1x I2C, (2nd I2C optional) (master/slave capable)<br>1x SMBus<br>1x SPI (for exteral uEFI BIOS flash)<br>2x Serial port (Rx/Tx, legacy compatible) (4 wire optional through TQ flexiCFG)<br>1x SD card interface/optional 8x GPIO (multiplexed) |
| **Power supply** | Voltage: 4.75 V – 20 V<br>4.75 V – 20 V Standby (optional)<br>3 V Battery/GoldCAP (optional)<br>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 |

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

# Arm® ODM Platforms

## LBox-LS1012AL – 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<br>4x Ethernet 10/100/1000Mbit (Ethernet Switch)<br>2x USB 3.0<br>1x SATA 3.0 (M.2)<br>2x Mini PCIe (1x only USB, SIM-Card)<br>1x SD-Card |
| **Periphery interfaces (optionaly) (Pin Header 2.54 mm)** | Up to 1x $I^2C$<br>Up to 1x UART<br>Up to 5x GPIO |
| **Memory** | DDR3L-SDRAM: Up to 1 GB<br>Quad SPI NOR: Up to 256 MB<br>EEPROM: 0/64-kbit |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>CPU JTAG Interface<br>USB-Debug (RS232) |
| **Power supply** | 16 - 28 V DC |
| **Ambient conditions** | Extended temperature range: -25°C...+70°C<br>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<br>up to 1 Gbit<br>1x TSN Ethernet 1 Gbit<br>1x Ethernet 1 Gbit<br>2x USB 3.0<br>2x CAN<br>1x USB 3.0 OTG<br>1x SATA 3.0 (M.2)<br>1x Mini PCIe (SIM-Card support)<br>1x Micro SD.Card |
| **Periphery interfaces Pin Header 1.27 mm** | 1x SDIO<br>2x I²C<br>2x SPI |
| **Graphic** | eDP/DP Phy |

| | |
|---|---|
| **Memory** | DDR4-SDRAM: Up to 8 GB<br>ECC Protection<br>eMMC: Up to 64 GB<br>Quad SPI NOR: Up to 512 MB<br>EEPROM: 0/256 kbit |
| **Other** | Real Time Clock (RTC)<br>Temperature sensor<br>CPU JTAG Interface<br>USB-Debug UART |
| **Power supply** | 18 – 28 V |
| **Ambient conditions** | Extended temperature range:<br>-40°C...+70°C |
| **Dimensions** | 170 × 103 × 43 mm |
| **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")<br>E3845: 4x 1.91 GHz, 2 MB L2-Cache, 10 W<br>E3827: 2x 1.75 GHz, 1 MB L2-Cache, 8 W<br>E3826: 2x 1.46 GHz, 1 MB L2-Cache, 7 W<br>E3825: 2x 1.33 GHz, 1 MB L2-Cache, 6 W<br>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++)<br>(DP 1.1a, max. resolution 2560×1600) |
| **Interfaces** | 2x Gbit Ethernet (Intel® i210)<br>1x USB 3.0 (with USB 2.0 backward compatibility)<br>1x USB 2.0<br>2x RS-232 Sub-D9 (option) |
| **Wireless and fieldbus communication (opt.)** | On request |
| **Internal extension sockets** | 1x Mini PCIe full-size (PCIe & USB), with micro SIM socket<br>1x Mini PCIe half-size (PCIe & USB) |
| **Internal mass storage** | 1x mSATA full-size<br>(16 – 512 GB, others on request)<br>1x Micro SD card socket |
| **Security components** | TPM 1.2/2.0 (option) |
| **Power supply** | Voltage: 9 V – 30 V<br>Connector type: Phoenix MC1,5/2-G-3,5<br>Power: typ. 3 – 10 W/max. 15 W<br>Battery: CR2032 (replaceable) |
| **Environment** | Passive cooled (no fan)<br>Standard temperature: 0°C...+50/60°C<br>Extended temperature: -40°C...+70°C (option) |
| **Form factor/ dimensions** | Integrated hardware kit:<br>100 × 100 × 23 mm<br>Chassis:<br>104 × 110 × 56 mm<br>(excl. wall mount wings)<br>104 × 130 × 56 mm<br>(incl. wall mount wings) |
| **Operating Systems** | Windows 7, Windows 10<br>(Standard and Embedded/IoT)<br>Linux (e.g. Ubuntu)<br>Others on request<br>Custom specific software images can be pre-installed. |

# x86 ODM Platforms

## MBox-R-E39 – Robust BoxPC platform for embedded PC applications and enhanced IoT edge gateways

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

## HIGHLIGHTS

- **Intel Atom® E3900 series (Apollo Lake-I)**
- **Up to 8 GB DDR3L**
- **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® E3900 series ("Apollo Lake-I")<br>E3930: 2x 1.3/1.8 GHz, 6.5 W<br>E3940: 4x 1.6/1.8 GHz, 9.5 W<br>E3950: 4x 1.6/2.0 GHz, 12 W |
| **Memory** | 2 GB, 4 GB, 8 GB DDR3L with ECC |
| **Graphics interfaces** | 2x Mini DisplayPort (DP / DP++)<br>(max. resolution 4k UHD) |
| **Interfaces** | 2x Gbit Ethernet (Intel® i210)<br>2x USB 3.0<br>2x RS-232 Sub-D9 (option) |
| **Wireless and fieldbus communication (opt.)** | On request |
| **Internal extension sockets** | 1x Mini PCIe full-size (PCIe & USB),<br>with micro SIM socket<br>1x Mini PCIe half-size (PCIe & USB) |
| **Internal mass storage** | 1x mSATA full-size<br>(16 – 512 GB, others on request)<br>1x Micro SD card socket |
| **Security components** | TPM 1.2/2.0 (option) |
| **Power supply** | Voltage: 9 V – 30 V<br>Connector type: Phoenix MC1,5/2-G-3,5<br>Power: typ. 3 – 10 W/max. 15 W<br>Battery: CR2032 (replaceable) |
| **Environment** | Passive cooled (no fan)<br>Standard temperature: 0°C...+50/60°C<br>Extended temperature: -40°C...+70°C<br>(option) |
| **Form factor/ dimensions** | Integrated hardware kit:<br>100 × 100 × 23 mm<br>Chassis:<br>104 × 110 × 56 mm<br>(excl. wall mount wings)<br>104 × 130 × 56 mm<br>(incl. wall mount wings) |
| **Operating Systems** | Windows 10<br>(Standard and Embedded/IoT)<br>Linux (e.g. Ubuntu)<br>Others on request<br>Custom specific software images<br>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")<br>E3845: 4x 1.91 GHz, 2 MB L2-Cache, 10 W<br>E3827: 2x 1.75 GHz, 1 MB L2-Cache, 8 W<br>E3826: 2x 1.46 GHz, 1 MB L2-Cache, 7 W<br>E3825: 2x 1.33 GHz, 1 MB L2-Cache, 6 W<br>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++)<br>(DP 1.1a, max. resolution 2560×1600) |
| **Interfaces** | 2x Gbit Ethernet (Intel® i210)<br>1x USB 3.0 (with USB 2.0 backward compatibility)<br>1x USB 2.0 |
| **Wireless and fieldbus communication (opt.)** | On request |
| **Internal extension sockets** | 1x Mini PCIe full-size (PCIe & USB), with micro SIM socket<br>1x Mini PCIe half-size (PCIe & USB) |
| **Internal mass storage** | 1x mSATA full-size (16 – 512 GB, others on request)<br>1x Micro SD card socket |
| **Security components** | TPM 1.2/2.0 (option) |
| **Power supply** | Voltage: 9 V – 30 V<br>Connector type: Phoenix MC1,5/2-G-3,5<br>Power: typ. 3 – 10 W/max. 15 W<br>Battery: CR2032 (replaceable) |
| **Environment** | Passive cooled (no fan)<br>Standard temperature: 0°C...+50/60°C<br>Extended temperature: -40°C...+70°C (option) |
| **Form factor/ dimensions** | Integrated hardware kit:<br>100 × 100 × 23 mm<br>Chassis: 103 × 110 × 40 mm |
| **Operating Systems** | Windows 7, Windows 10 (Standard and Embedded/IoT)<br>Linux (e.g. Ubuntu)<br>Others on request<br>Custom specific software images can be pre-installed. |

# x86 ODM Platforms

## MBox-V(H)-E39 – Ultra compact BoxPC platform for embedded PC applications and enhanced IoT edge gateways

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

## HIGHLIGHTS

- **Intel Atom® E3900 series (Apollo Lake-I)**
- **Up to 8 GB DDR3L**
- **Optimized for ultra low power**
- **High-Speed IO such as 2x Gb ETH, 2x USB (3.0)**
- **2x Mini DisplayPort to connect two monitors**
- **TPM 1.2/2.0 (option)**
- **Prepared for wireless connectivity**
- **Extended temperature support (option)**
- **Highly customizable sheet metal chassis**
- **Individual configurations and ODM branding**

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | Intel Atom® x5 / x7 E3900 (Apollo Lake-I)<br>x5-E3930 2x 1.3 / 1.8 GHz, 6.5 W<br>x5-E3940 4x 1.6 / 1.8 GHz, 9.5 W<br>x7-E3950 4x 1.6 / 2.0 GHz, 12 W |
| **Memory** | 2 / 4 GB DDR3L (8 GB on request) |
| **Graphics interfaces** | 2x Mini DisplayPort<br>(1x DP++ with up to 4K UHD and 1x DP 1.1) |
| **Interfaces** | 2x Gbit Ethernet (Intel® i210)<br>2x USB 3.0 |
| **Wireless and fieldbus communication (options)** | On request |
| **Internal extension sockets** | 1x Mini PCIe full-size (PCIe & USB), with micro SIM socket<br>1x Mini PCIe half-size (PCIe & USB) |
| **Internal mass storage** | 1x mSATA full-size (16 – 512 GB, others on request)<br>1x Micro SD card socket |
| **Security components** | TPM 1.2/2.0 (option) |
| **Power supply** | Voltage: 9 V – 30 V<br>Connector type: Phoenix MC1,5/2-G-3,5<br>Power: typ. 3 – 15 W/max. 30 W<br>Battery: CR2032 (replaceable) |
| **Environment** | Passive cooled (no fan)<br>Standard temperature: 0°C...+50/60°C<br>Extended temperature: -20°C...+50/60°C (see ordering information) |
| **Form factor/ dimensions** | Integrated hardware kit:<br>100 × 100 × 23 mm<br>Chassis: 103 × 110 × 40 mm |
| **Operating Systems** | Windows 10<br>(Standard and Embedded/IoT)<br>Linux (e.g. Ubuntu)<br>Others on request<br>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")<br>E3950: 4x 1.6/2.0 GHz, 2 MB L2-Cache<br>E3940: 4x 1.6/1.8 GHz, 2 MB L2-Cache<br>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)<br>2x USB 3.0 (with USB 2.0 backward compatibility)<br>1x RS-232 for Console<br>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)<br>1x eMMC (up to 128 GB MLC) |
| **Security components** | TPM 1.2/2.0 (option) |

| | |
|---|---|
| **Power supply** | Voltage: 9 V – 30 V<br>Connector type (lockable): Phoenix MC1,5/2-G-3,5-LR<br>Power: typ. 3–10 W/max. 15 W<br>Battery: CR2032 (replaceable) |
| **Environment** | Passive cooled (no fan)<br>Standard temperature: 0°C...+60°C<br>Extended temperature: -40°C...+70°C (option)<br>Relative Humidity: 10% to 90% (not condensing)<br>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)<br>Linux (e.g. Ubuntu)<br>Others on request<br>Custom specific software images can be pre-installed. |

# x86 ODM Platforms

## COMBox-V8 – Fanless Industrial BoxPC

Fanless industrial BoxPC with 8th Generation Intel® Core™ Processor.

## HIGHLIGHTS

- **High End Embedded Computing with up to Quad Core 4.4 GHz / 8 MB cache**
- **Fast DDR4–2400 Dual-Channel Memory up to 64 GByte**
- **High-Speed IO like 2x GBit ETH, 4x USB3.1 Gen 2 (10 GBit/s)**
- **Two independent high resolution display outputs**
- **Individual mass storage configurations with M.2 NVMe and 2.5" SSD**
- **Prepared for Wireless Communication**
- **Highly customizable sheet metal chassis**
- **Individual configurations and ODM branding**

## TECHNICAL SPECIFICATION

| | |
|---|---|
| **CPU** | Intel® Core™ mobile processors<br>Core™ i7–8565UE<br>(4x 1.7 / 4.4 GHz, 8 M, 15 W)<br>Core™ i5–8365UE<br>(4x 1.6 / 4.1 GHz, 6 M, 15 W) |
| **Memory** | Dual Channel DDR4–2400<br>8 GByte, 16 GByte, 32 GByte, 64 GByte, non-ECC |
| **Graphics interfaces** | 2x DisplayPort (DP++) with up to 4K @ 60 Hz resolution |
| **Interfaces** | 2x Gbit Ethernet (Intel® i210/i219)<br>4x USB USB3.1 Gen 2 (10 GBit/s) (Type-A connectors)<br>Audio 2x 3.5 mm (headphone out, microphone in) |
| **Internal mass storage and extension sockets** | 1x Mini PCIe socket (PCIe and USB)<br>1x M.2 2230 Key E socket (PCIe and USB)<br>1x M.2 2280 Key M socket (PCIe x4) for NVMe SSD modules<br>1x 2.5'' HDD/SSD socket (mounting kit separately available) |
| **Security components** | TPM 2.0 (SLB9665) (option) |
| **Power supply** | Voltage: 12 V DC<br>Connector type: Phoenix MSTBA2,5/2-G-5,08<br>Power: typ. 20 W/max. 80 W<br>Battery: CR2032 (replaceable) |
| **Environment** | Passive cooled (no fan)<br>Standard temperature: 0°C...+50°C<br>Relative Humidity: 10%...90% (not condensing)<br>IP20 |
| **Form factor/ dimensions** | 190 × 174 × 68 mm |
| **Mounting options** | Desktop, VESA100, DIN rail/wall mount adapter kit separately available |
| **Operating systems** | Windows 10 (64 Bit, Standard and Embedded/IoT)<br>Linux (e.g. Ubuntu)<br>Others on request<br>Custom specific software images can be pre-installed. |



## 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