Ka-Ro electronics GmbH
System-on-Modules

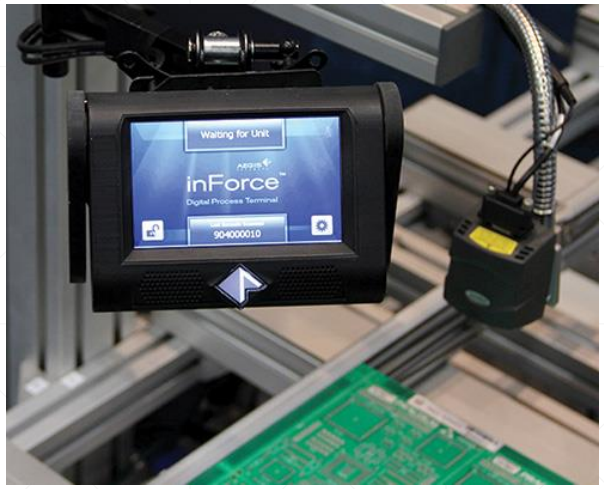
Proven Solutions for Successful Product Development

Ka-Ro Background

- **Design/Manufacturing expertise**
  - 1988 – Founded in Aachen Germany
- **Advanced SMT production capabilities**
  - 3 full Fujji/Hitachi high-speed production lines
  - Over 200K components/hour capacity
  - Component lot tracking and traceability
  - AOI/X-Ray inspection and testing
  - Prototyping to full production

Ka-Ro SOM Target Markets

- **Industrial, Industrial, Industrial**
  - Automotive Test
  - Control and Automation
  - Energy control and monitoring
- **Industrial HMI and displays**
- **Transportation Applications**
  - Passenger counting on buses/trains
  - Emissions monitoring
- **Medical Devices**
  - Patient diagnostic – display and networking
  - Handheld devices
- **Internet of Things – Edge processing**



Quality and reliability
Pin-compatible
Lot traceability
Industrial temp
Proven form factor
Guaranteed long life

SOM strategy: driven by customer success

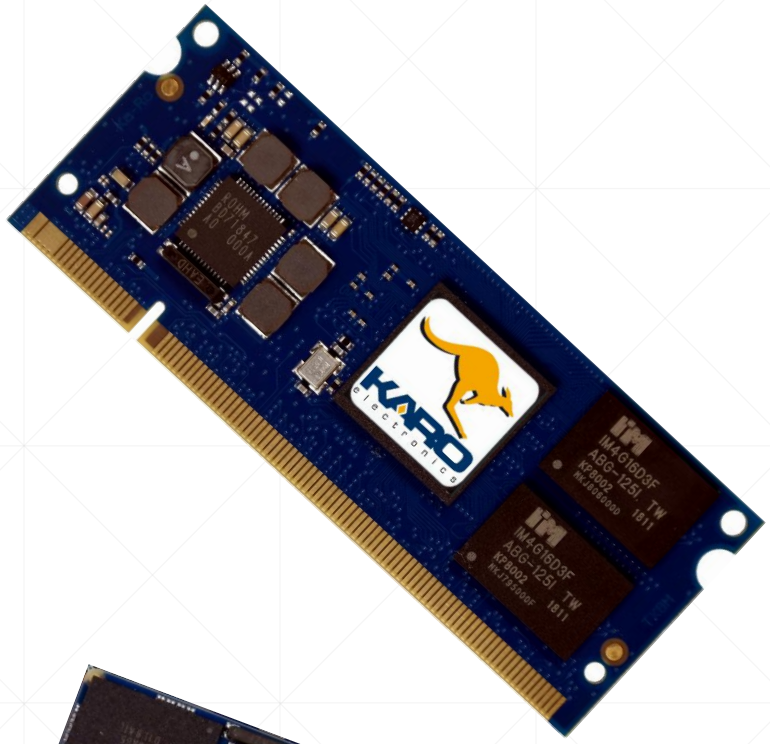
- **SOM is a great solution for product development, launch and lifecycle**
  - Simultaneous hardware/software development accelerates time-to-market
  - SOM isolates high-speed logic, enabling simple low-cost baseboard
  - Custom baseboard and application adds unique customer value proposition and IP
- **Ka-Ro provides a Proven Solution with SOMs**
  - Made-in-Germany Quality and complete solution: Hardware, software security and support
  - Technical Support directly from Ka-Ro engineers speeds development
  - Long-term availability creates stable product with extended lifecycle (12-years minimum)
  - TX- and QS- Family and continuing BSP development for easy product upgrades

Ka-Ro SOMs: A Proven Solution

- Outstanding solution for industrial product development
- All design, development and production in single location
- No outsourcing of design or development – ever!
- TX Family Concept for easy upgrades or cost optimization
- High-reliability SOM in a proven form factor
- Customer Support for successful product development
- Continuing software development
- Guaranteed long-term availability

Ka-Ro SOMs: Since 2001

- **Designed and manufactured in Aachen Germany**
  - Ka-Ro focuses exclusively on SOMs – no other products
  - Integrated design, production and test at single facility
  - Experienced hardware and software developers
  - “Made in Germany” design and production quality (ISO 9001)
  - Freescale/NXP Proven Partner since 2010
  - ST Authorized Partner since 2019
- **Over 3 million SOMs shipped**
  - Proven form factor – quality, reliability and performance
  - Never any outsourcing in the process



Two basic SOM families available

TX Family

QS Family

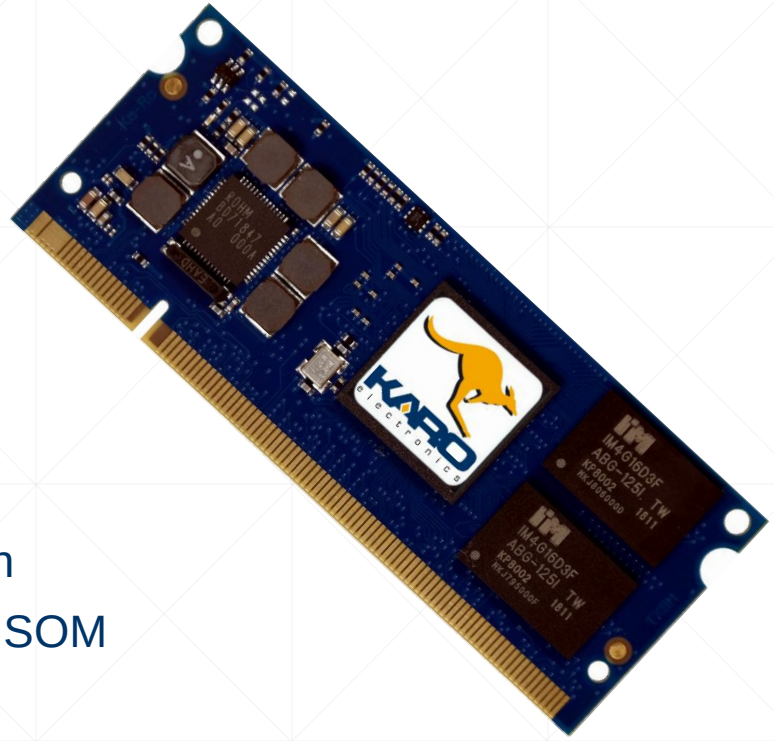
TX Family Concept: The Ka-Ro Advantage

- **All TX modules are pin-compatible**
  - Designed for embedded, common functions on same pins
  - Scalable architecture across processor cores and families
- **Designed for long embedded product lifetimes**
  - **Guaranteed** minimum12-year availability from processor launch
  - **Standard** industrial/extended temperature range
  - BOM lot control for component traceability
  - All components selected for long-term availability
  - Advance Product Change Notification for any BOM changes
  - 1-year warranty on modules

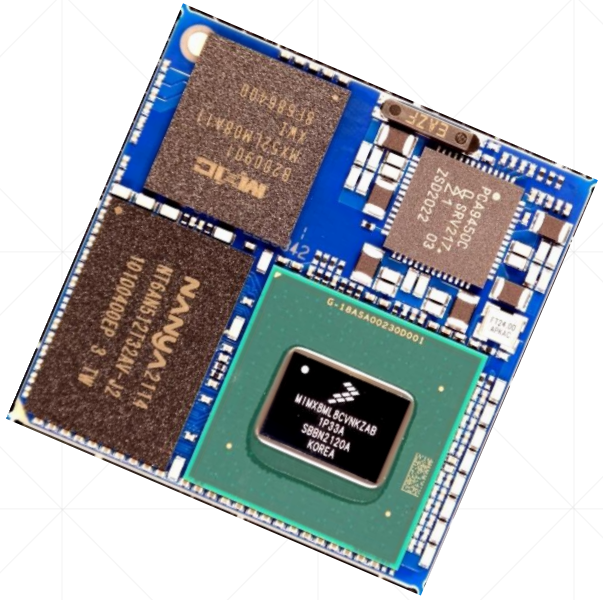
TX Family ideal for product platform development

TX Family Edge Connector

- **Sound mechanical design prevents movement**
  - Four fastening screws prevent movement in 3 dimensions
  - Can be further constrained across top edge if needed
  - Low SOM weight and dimensions limits mechanical stress
- **SO-DIMM socket provides good electrical connection**
  - Designed for high speed PC memory - provides large pin contact area
- **Lowest cost connector strategy for SOMs**
  - Production: JIT delivery, insert in baseboard and test in final production
  - Single inexpensive SO-DIMM socket on baseboard, no connectors on SOM
- **Low profile for flexible product design (just 4mm high)**
- **Customer products have passed shock/vibration testing using TX SOMs**



QS Family Concept: when size matters

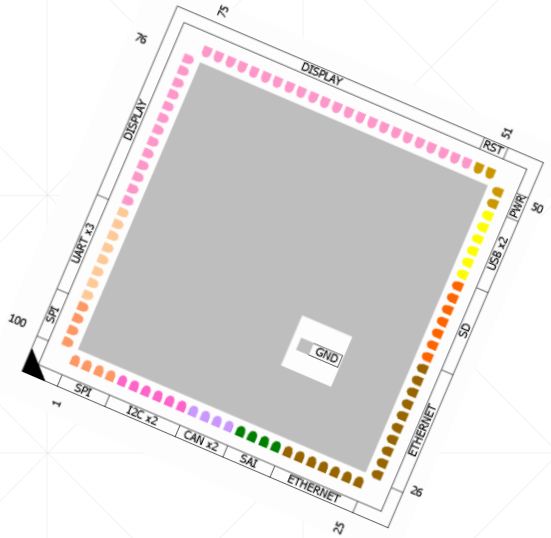


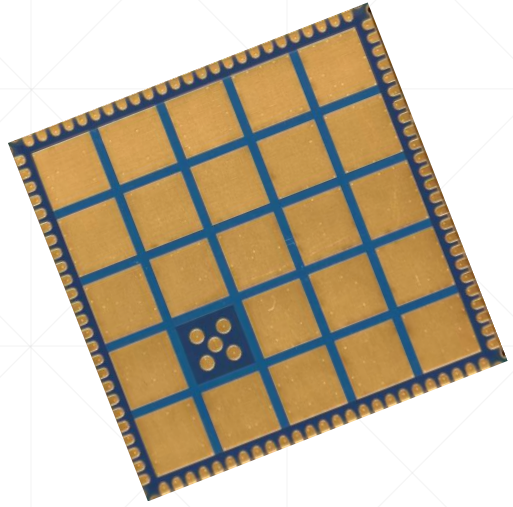
QS Module Features:

- Small footprint:
  QS series represents a highly integrated and very compact surface-mounted QFN Computer-On-Module.
- No cut-out:
  A component free bottom side enables designs with no cut-outs requirements for the base board.
- Cost-effective:
  The pin-optimized QS concept enables the use of a simple, cost-effective 2-layer base board. No human handling during production and test.
- Easy optical inspection:
  All signal connections are located at the module edges, providing easy optical inspection of soldering.

Design advantages of using QS modules

- small board space and over-all height
- Large ground pad on the bottom side makes a defined ground plane connection available for all signals.
- The pinout leads to an easy wiring without crossings.
- Ground will be connected near the signal pin to avoid loop areas.
- High speed signals can be routed on the top layer at a defined impedance.
- Ground pad holds the component at a defined height during soldering.
- The central ground pads additionally act as thermal pads.





STM32MP25 Modules

TXMP2

- Dual 1.5 GHz ARM® Cortex®-A35 cores
- Single 400 MHz ARM® Cortex®-M33 core
- STM32MP255 processor
- 1 GB LPDDR4
- 4 GB eMMC
- -40 °C to 85 °C
- 68 x 26 x 4 mm

STM32MP25 Modules

QSMP2

- Dual 1.5 GHz ARM® Cortex®-A35 cores
- Single 400 MHz ARM® Cortex®-M33 core
- STM32MP255 processor
- 1 GB LPDDR4
- 4 GB eMMC
- -40 °C to 85 °C
- 29 x 29 x 2.6 mm

Future i.MX 95 Module

QS95

- Six 1.8 GHz ARM® Cortex®-A55 cores
- Single 800 MHz ARM® Cortex®-M33 core
- Single 800 MHz ARM® Cortex®-M7 core
- i.MX 95 processor
- 2 GB LPDDR4
- 32 GB eMMC
- -25 °C to 85 °C
- 29 x 29 x 4 mm

Software Support

- **Embedded Linux**
  - BSPs released to Mainline Linux Long-term Support (LTS) kernel
  - All sources available via github
  - Current versions Linux 6.6, Yocto Scarthgap
  - Continuing development of low-level BSPs (device drivers)
  - Customization/configuration of bootloaders
  - Technical Support directly by the software developers
  - Custom device driver development available

Production-ready BSPs are CRITICAL to customer success!

Great Development Support – in a Kit!

- **Rapid and accurate Technical Support directly from Ka-Ro development team**
- Development Kits available for headless or display development
- All required power supplies and cables included
- Complete Design Guide, baseboard schematics and Bill of Material included
- **Free Design Review** of module connections before your customer orders their first prototype baseboards
- Custom Development available Ka-Ro at reasonable costs
  - Secure Boot Support
  - Software device drivers
  - Custom BSPs
  - Custom baseboards and modifications

Where to find information

- https://www.karo-electronics.com
  - Detailed product datasheets with complete pin assignments
  - Online TX- and QS- Selection Guide: (scroll down)
  - Customer support area (registration required)
  - quick start guide for each product
- http://docs.karo-electronics.com
  - Complete software repository
  - Sources and documentation