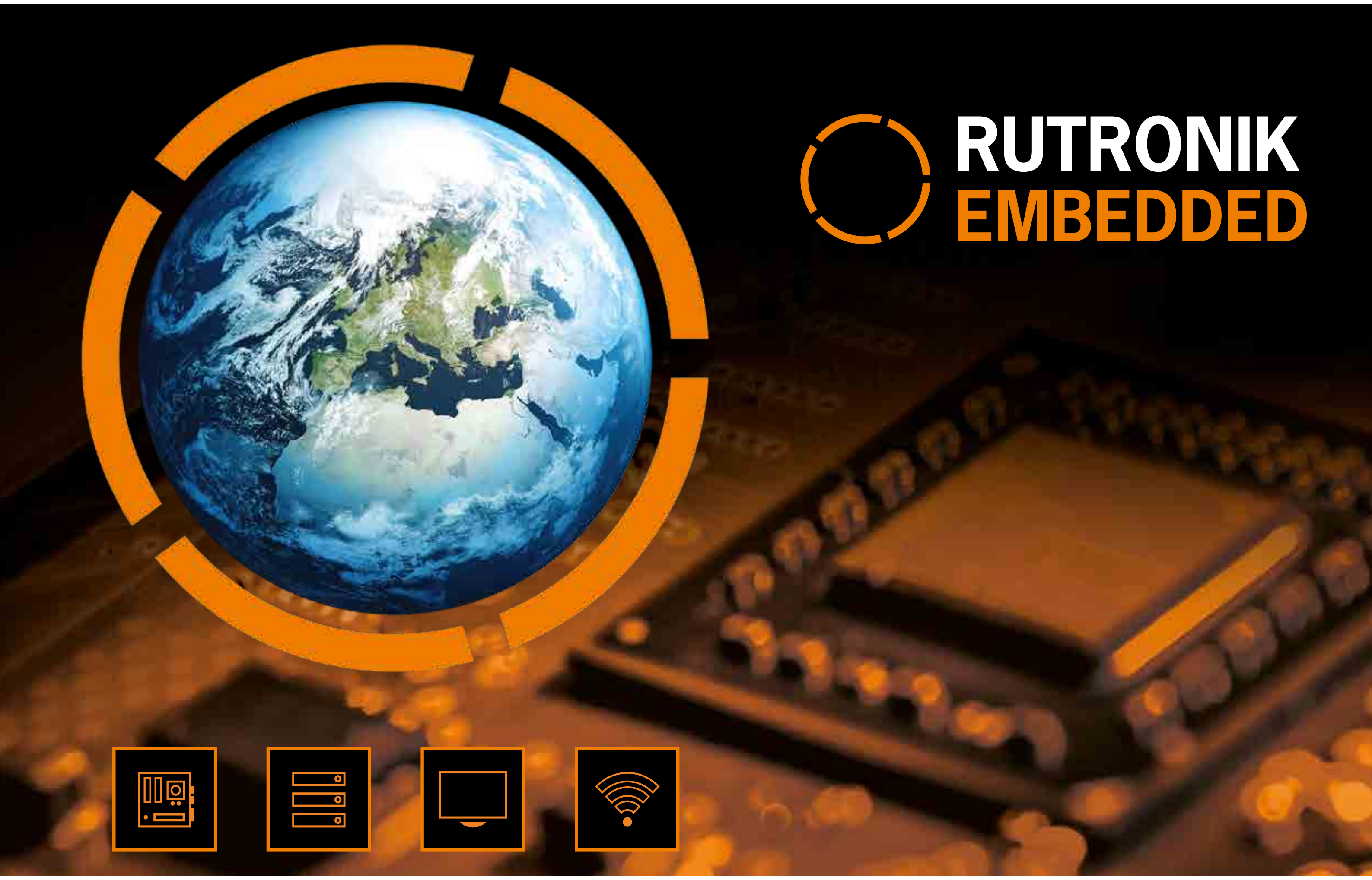
Committed to excellence

RUTRONIK
ELECTRONICS WORLDWIDE

Embedded Highlights



V6.0

Combine Technologies
Realize EMBEDDED Designs

Ready-to-use computer systems, barebones and components in perfect symbiosis with wireless connectivity, displays and storage solutions

Content

Committed to Excellence

Consult – Know-how. Built-in.

The Technical Competence from RUTRONIK

Worldwide and individual consulting on the spot: by competent sales staff, application engineers and product specialists.

Components – Variety. Built-in.

The Product Portfolio from RUTRONIK

Wide product range of semiconductors, passive and electromechanical components, displays & monitors, boards & systems, storage and wireless technologies for optimum coverage of your needs.

Logistics – Reliability. Built-in.

The Delivery Service from RUTRONIK

Innovative and flexible solutions: from supply chain management to individual logistics systems.

Quality – Security. Built-in.

Quality Management without Compromise

The integrated management system (IMS) encompasses quality control, information security, environmental protection, occupational health and safety.

Combine Technologies – Realize EMBEDDED Designs

RUTRONIK EMBEDDED – the most reliable option for future-orientated purchase of embedded components from one hand. We are well-known as distributor of embedded boards & systems, power supplies, storage components, TFT displays, passive LCDs, professional monitors, as well as wireless connectivity solutions, sensors and all needed electromechanical components to build up an intelligent embedded system for the emerging IoT market.

Boards & Systems

- **Embedded Boards & Systems**
  Whether industrial mainboards, single board computers, computer-on-modules or complete embedded systems, like panel PCs, box PCs, 19" rack systems, or industrial monitors for harsh environments, with our selected partners we cover almost any customers requirement.

- **Power Supply**
  One of the most critical part in any embedded system is the power supply, so that a reliable partner is needed, to build up a reliable system. RUTRONIK EMBEDDED is taking care of this issue with its partners. So we can provide solutions with medical approvals as well as standard industrial power supplies in the well-known standards and as open frame solutions.

  More and more systems in the IoT market need to resist against power grid failures with an uninterruptable power supply.

  This can be realized by a classic battery driven UPS or by Super Caps. Our specialists can guide you through your system design, starting with the power supply and ending with the intelligent platform above.

- **Electromechanical Components**
  The whole world of IoT can't work without connectors and hard wiring, so at the end, RUTRONIK EMBEDDED is also taking care of your wired connectivity. Even inside an embedded system or DIN-rail mounted, we can provide you the needed solutions in combination with all the other components.

Storage

Flash memories become more and more important in industrial applications, even as a simple 2.5" SSD or as a flash card in different form factors. Also HDDs, RAM and ODDs for industrial and rough applications with high reliability in industrial grade quality and with a reasonable longevity, are still needed. With our partners we can provide all of the demanded solutions in a good balance between reliability and price.

Displays & Monitors

With our portfolio of active TFT solutions, passive LCDs, OLEDs and professional monitors, we can fulfill every demand for the visible front-end of an embedded system. Standards are also available, as well as fully customized or semi customized solutions. Especially with passive LCDs we still can offer different technologies to take care of the uncountable new and smart entry level designs for the IoT market. The latest touch technologies, as well as the best picture quality, RUTRONIK EMBEDDED is offering a huge portfolio for your embedded system design.

Wireless

Make your application embedded by connecting it wirelessly to the Internet of Things. RUTRONIK EMBEDDED has the newest solutions for using a smartphone, WiFi access point or a mobile communication network as gateway for your device. Our understanding of the right wireless solution covers hardware, drivers or transmission protocol, application profiles, security aspects, certifications, long-term considerations as well as political aspects regarding standards, compatiblity and consortia.

RUTRONIK
EMBEDDED

Boards & Systems | Storage | Displays | Wireless

Individual System Solutions

Combine Technologies

The performance of embedded systems is growing disproportionately; one of the reasons for this is the improvement of intelligent sensors and actuators. There are more and more autonomous systems which record and process data, responding very specifically to it. When the systems are networked together wirelessly or wired via IP protocol this creates the Internet of Things. Machines, systems, appliances and small smart everyday objects will become part of the so-called Cyber Physical Systems (CPS) in the future.

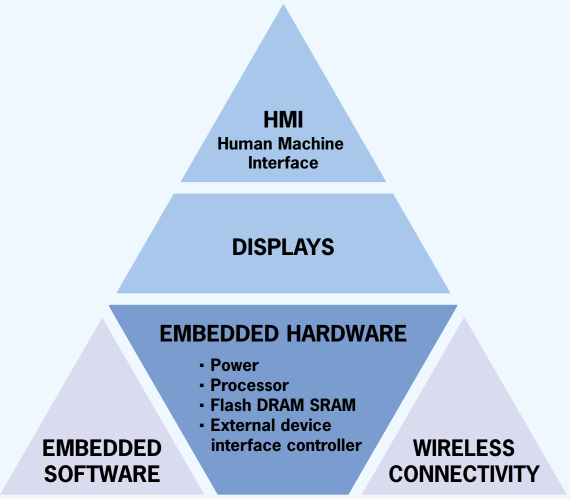
All systems are characterized by certain common characteristics: Programming capability, storage capacity, functional user interfaces and communication links.
Embedded systems require integrated vision when selecting the components because there are complex dependencies between the real physical and the virtual digital world.
RUTRONIK EMBEDDED complies stringently with this integrated analysis, enabling it to develop always the right solution.

- Boards & Systems
  based on ever faster, more powerful, smaller and energy-saving components. Suitable and standardized power supplies, sensors and electromechanical components which guarantee functional reliability even under extreme operating conditions

- Storage
  solutions in compact sizes with any number of read/write cycles with the highest storage density

- Displays
  and touch systems, which provide the user a perfect visualization and operation of the real world and facilitate intuitive operation and the interaction of extremely complex systems

- Wireless
  technologies facilitate the global linking of processes and databases in all conventional transmission standards and in a matter of seconds



Cyber Physical Systems (CPS) comprise the networking of embedded systems via wired or wireless communications networks

Boards & Systems

Storage

RUTRONIK
EMBEDDED

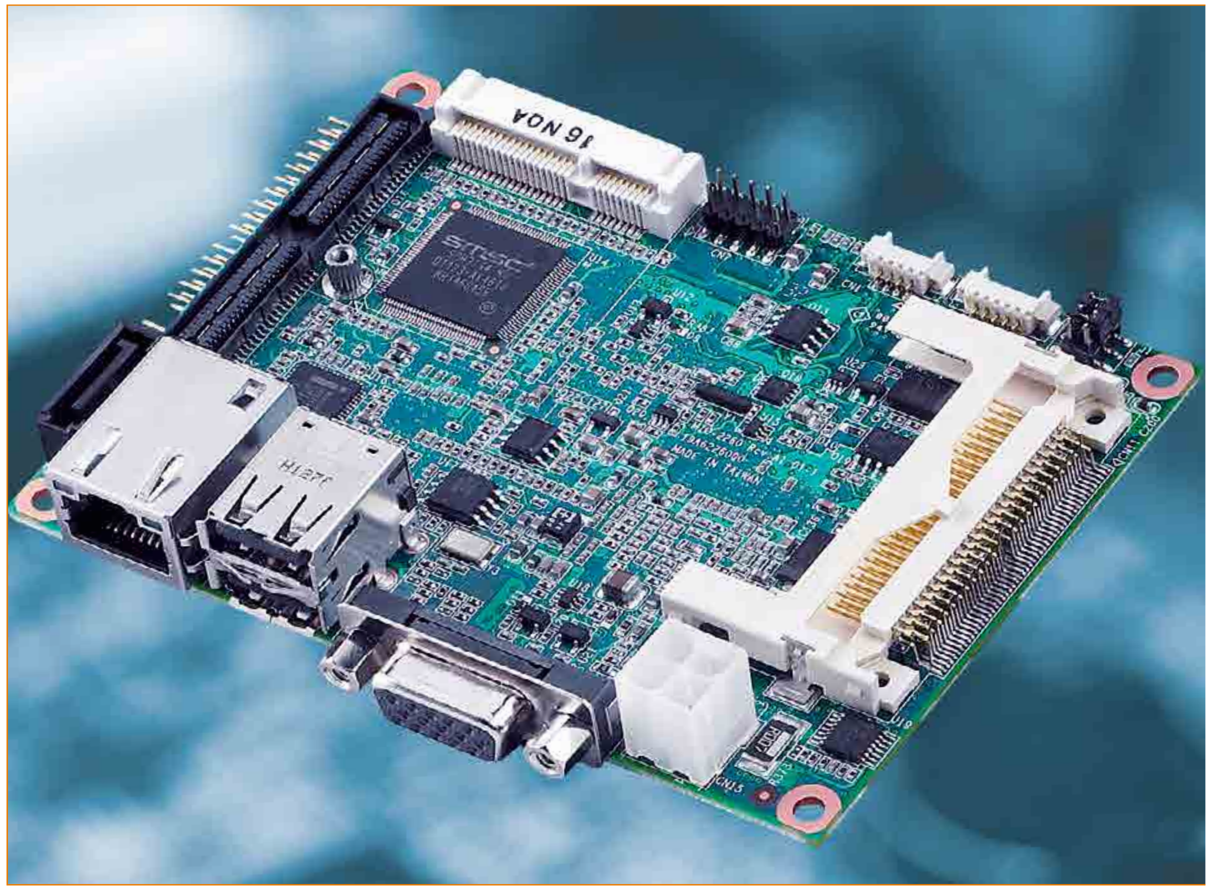
The Result:
More Capabilities

Displays

Wireless

Boards & Systems

RUTRONIK EMBEDDED offers a huge portfolio of mainboards, specially designed for industrial and semi-industrial applications. The selection ranges from industrial mainboards, single board computers, computer-on-modules (COM), PC/104, blade computers, PICMG and backplanes, IPC and servers to box and panel PCs and HMI. These include ARM-based solutions as well as boards with the latest x86 processors.



Suppliers

AAEON an ASUS assoc. co.
ADVANTECH Enabling an Intelligent Planet
ASUS IN SEARCH OF INCREDIBLE
DELTA
DFI
e))COUNT embedded
EKL electronics cooling
F&S Elektronik Systeme
FSP FSP POWER SOLUTION GMBH
HMS
iEi
intel
kontron
SECO
Teleconnect Verbindungen in die Zukunft
VIA we connect

Boards

	Advantech	ASUS	DFI	F&S	Intel	Kontron	Seco	Via
Industrial Mainboards	■	■	■			■		■
Server Mainboards	■	■	■		■	■		
Workstation Mainboards		■	■		■	■		
Desktop Mainboards		■				■		
Computer on Modules	■		■	■	■	■	■	■
Base- / Evaluationboards	■		■	■	■	■	■	■
Single Board Computer	■	■	■	■		■	■	■
Slot Single Board Computer	■		■		■			
Backplanes	■		■					
Blade Computing	■					■		

Accessories

	Aaeon	Advantech	ASUS	DELTA	DFI	Ecount	EKL	F&S	FSP	HMS	iEi	Intel	Kontron	Seco	Via
Digital LCD Controllers (Scaler)						■									
AI Accelerator Modules & Cards	■	■	■								■	■	■		
Controller Cards (Digital Analog / Mixed Signal)		■			■					■			■		
Graphic Cards		■	■		■							■	■		
HPC Cards		■	■									■			
Coolers & Heatspreaders		■	■		■		■					■	■	■	
Cables & Adapters		■	■	■	■	■		■	■			■	■	■	■

Embedded Systems

	Advantech	ASUS	DFI	Intel	Kontron	Seco	Via
Industrial Servers	■				■		
Datacenter Servers		■		■			
Embedded Box-PCs	■	■	■	■	■	■	■
Embedded Panel PCs / Touch Panel PCs	■		■		■	■	■
Desktop PCs	■	■	■	■			
Mobile PCs / Ind. Tablet PCs / Compute-Sticks	■			■			
Industrial Chassis	■		■		■		

Wired Communication Modules & Systems

	Advantech	ASUS	HMS	Intel	Kontron	Teleconnect
Network Cards	■			■	■	
Network Switches / KVM Switches	■	■		■	■	
Industrial Bus & Protocol Solutions	■		■			
Wired Long-Range Network Solutions						■

Processors

	Intel
Mobile Processors	■
Desktop Processors	■
Server Processors	■
Chipsets	■

Power Supplies

	DELTA	DFI	FSP	Kontron
Industrial PC (IPC)	■		■	
Redundant Power Supplies	■		■	
AC/DC Adapter	■		■	■
DC/DC Converters	■	■	■	
Uninterruptable Power Supplies (UPS)			■	

Industrial Motherboards by Kontron

Kontron offers a comprehensive portfolio of high quality, longevity and competitive motherboards from small pico-ITX up to full-size ATX form factor. They support latest processors and chipset platforms and provide a proven set of features to fulfill the demands of various applications of different vertical markets like Industrial Automation, POS/POI, KIOSK, Digital Signage, Medical, Casino Gaming, Video Surveillance or Transportation. The Kontron motherboards offer an outstanding quality "Made in Germany". In addition, a corresponding portfolio on chassis kit solutions (SMARTCASE™), add on cards and related 3rd party accessories is also available.

R&D
- Design know-how based on more than 30 years of experience with motherboard design
- Comprehensive validation tests, extensive functional tests and certifications

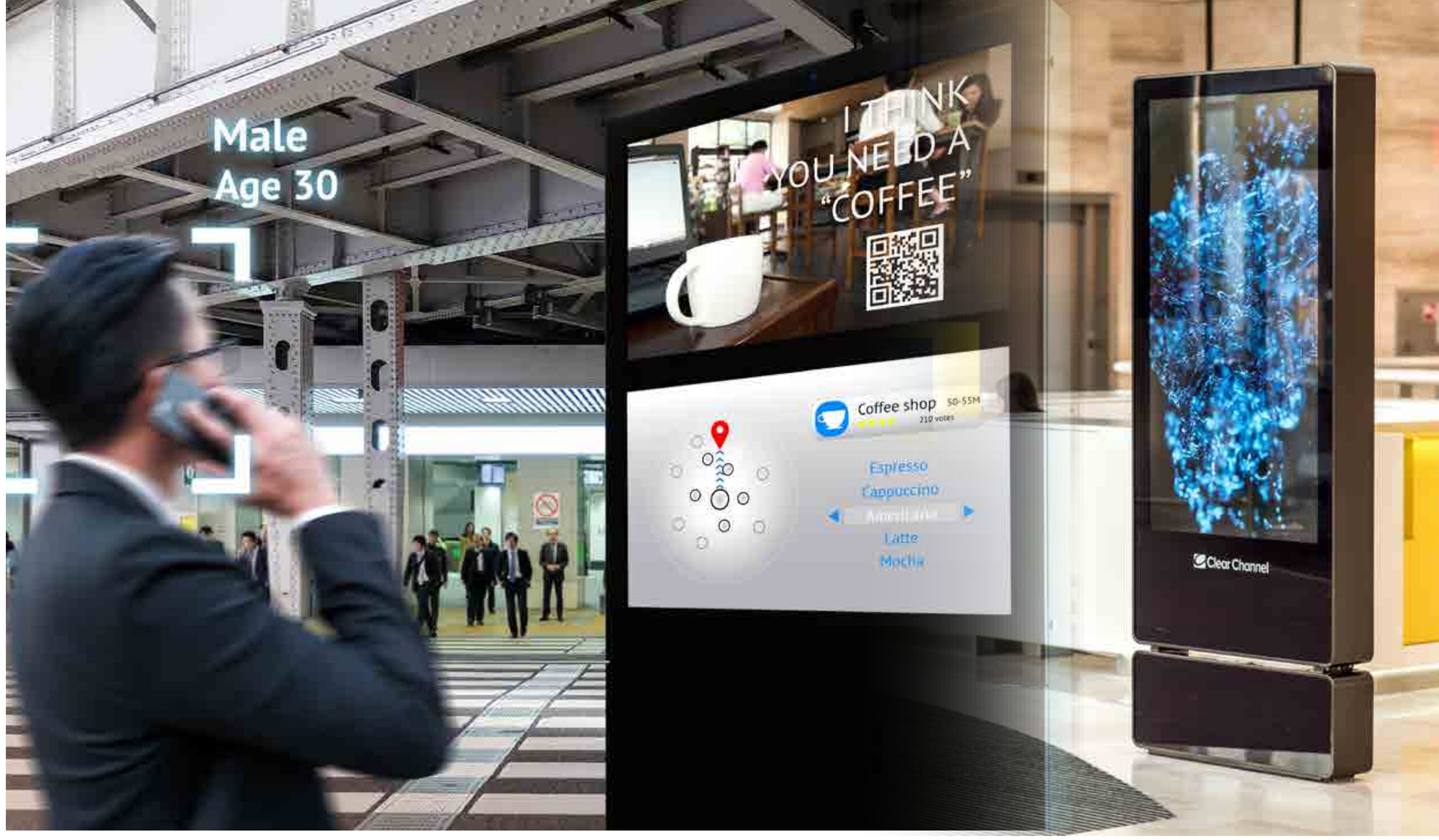
Quality
- 100% 3D-AOI (automated optical inspection), ICT (in circuit test), FFT (final function test)
- High degree of automation (approx. 96%)

Reliability
- Optimized Motherboard designs (less components)
  - less heat
  - less power consumption
  - less risks
- 1st supplier qualified material only

Longevity
- Professional Lifecycle Management (ECN/PDN/LTB/EOL) announcement
- Longterm availability

Innovation
- Optimized Feature and design to reduce power consumption
- Simplify product selection with new features

Technical Support
- 1st level support: Distribution partners
- 2nd level support: Direct technical support from Kontron
- Competitive price models



Kontron Motherboards powered by the latest Intel® and AMD Technology Platforms

intel authorized distributor

12th/13th Gen Intel® Core™ i Processor Series

K3832-Q mITX
- Mini-ITX
- Intel® Q670E chipset
- LGA1700 socket

K3833-Q mITX
- Mini-ITX
- Intel® Q670E chipset
- LGA1700 socket

K3841-Q µATX
- µATX
- Intel® Q670E chipset
- LGA1700 socket

K3851-R ATX
- ATX
- Intel® R680E chipset
- LGA1700 socket

K3842-Q µATX
- µATX
- Intel® Q670 chipset
- LGA1700 socket

K3843-B µATX
- µATX
- Intel® B660 chipset
- LGA1700 socket

AMD Ryzen™ Embedded R2000 Processor Series (SoC)

D3724-R mSTX
- Mini-STX
- AMD FP5 SoC

D3723-R mITX
- Mini-ITX
- AMD FP5 SoC

SMARTCASE™ Kit Solution

intel authorized distributor

Flexible. Versatile. Long Term Availability.

The chassis kit solutions are available in different versions and designed for different motherboards. The thin and smart chassis allows the usage in horizontal and vertical position, partly even in enhanced temperature related environments.

SMARTCASE™ Series

S511
- Mini-STX
- AMD Ryzen™ Embedded R2000 Technology
- 0.87 liter

S520
- Mini-STX
- 9th Gen Intel® Core™ i technology (LGA1151)
- 0.87 liter

S711
- Mini-ITX
- AMD Ryzen™ Embedded R2000 Technology
- 2.48 liter

S720
- Mini-ITX
- 9th Gen Intel® Core™ i technology (LGA1151)
- 2.48 liter

Embedded Boards & Systems by SECO

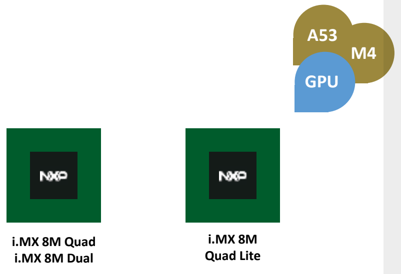
Ideal Technological Partner for Cutting-Edge Solutions

SECO is an Italian industrial group with a strong international presence that operates in the sector of high technology in the miniaturization of computers and the Internet of Things (IoT). SECO designs and produces in-house embedded systems and IoT solutions: from the single microcomputer to integrated and “ready-to-use” systems.

The company offers its customers a complete range of products and services with specific expertise in numerous industrial sectors

i.MX 8M Family

i.MX 8M Quad Family



i.MX 8M Quad
i.MX 8M Dual

i.MX 8M
Quad Lite

Pin Compatible

Advanced Audio,
Voice, 4K Video, 3D GPU, ML,
Broad Connectivity

i.MX 8M Mini Family

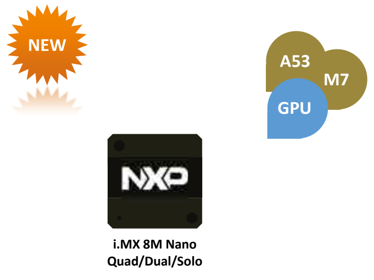
i.MX 8M Mini
Quad/Dual/Solo

i.MX 8M Mini
QuadLite/Dual
Lite/SoloLite

Pin Compatible

Advanced Audio,
Voice, 1080p Video, 3D GPU, ML,
Power Efficient 14FF

i.MX 8M Nano Family



i.MX 8M Nano
Quad/Dual/Solo

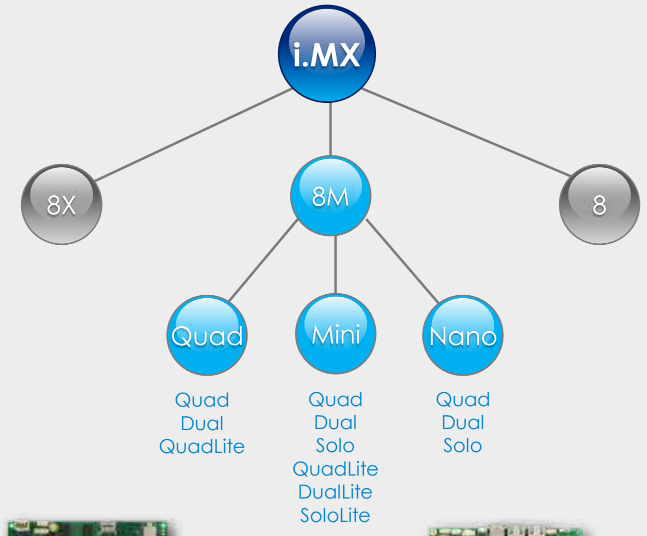
Pin Compatible

Advanced Audio, 3D GPU, ML,
Power Efficient 14FF,
Lowest Cost

Software Compatible (Including GPU Tools)

High-end ($$$) => Mid-end ($$) => Low-end ($)

MIRA **(formerly Q7-C25)**
- i.MX 8M Quad
- i.MX 8M Dual
- i.MX 8M QuadLite



THEMIS **(formerly SBC-C43)**
Single Board Computer with NXP i.MX8 applications Processors in 3.5” form factor

MAIA **(formerly Q7-C26)**
- i.MX 8QuadMax
- i.MX 8QuadPlus
- i.MX 8Quad

ALBION **(formerly SBC-C20)**
SBC with NXP i.MX 8M applications Processors in 3.5” form factor

ASTRID **(formerly SBC-C61)**
SBC with the NXP i.MX 8M Mini Processors

LEXELL **(formerly SM-C12)**
SMARC standard module with NXP i.MX 8M processor

N-Series Intel Pentium / Celeron and x5-Series Atom SOCs

	intel CELERON	intel PENTIUM	intel ATOM	intel ATOM	intel ATOM
# of Cores	2	4	2	4	4
# of Threads	2	4	2	4	4
Processor Base Frequency	1.10 GHz	1.10 GHz	1.30 GHz	1.60 GHz	1.60 GHz
Burst Frequency	2.40 GHz	2.50 GHz	1.80 GHz	1.80 GHz	2.00 GHz
Cache	2 MB L2	2 MB L2	2 MB L2	2 MB L2	2 MB L2
TDP	6 W	6 W	6.5 W	9.5 W	12 W
Sceanrio Design Power (SDP)	4 W	4 W			

NAOS **(formerly Q7-B03)**
Qseven® Rel. 2.1 with the Intel® Atom® E39xx family, Intel® Celeron® N3350 and Intel® Pentium® N4200 SoCs

JAGER **(formerly SM-B69)**
SMARC with the Intel® Atom® E39xx family, Intel® Celeron® N3350 family, and Intel® Pentium® N4200 SoCs

MIRANDA **(formerly COMe-C24-CT6)**
COM Express™ 3.0 Compact Type 6 Module with the Intel® Atom® X Series, Intel® Celeron® J/N and Intel® Pentium® N Series

NOLAN **(formerly SBC-A80-eNUC)**
Embedded NUC™ SBC with the N-series Intel® Pentium®/Celeron®

ALVIN **(formerly SBC-B68-eNUC)**
Embedded NUC™ SBC with the Intel® Atom® E39xx family, Intel® Celeron® N3350 and Intel® Pentium® N4200

ADLER **(formerly SBC-C41-pITX)**
Intel® Atom™ X Series, Intel® Celeron® J / N Series and Intel® Pentium® N Series Processors

Ryzen Series

CHARON **(formerly COMe-B75-CT6)**
COM Express™ Compact 3.0 Type 6 Module with the AMD Ryzen™ Embedded V1000 processors

Epyc Series

THEBE **(formerly COMe-C42-BT7)**
COM Express™ Rel.3.0 Basic Type 7 module with the AMD EPYC™ Embedded 3000 Series of SoCs

Embedded Edge Computer Solutions by ASUS

Industrial Motherboards and Single Board Computers

ASUS offers a wide range of long-lifecycle industrial motherboards and single board computer in various form factors to serve different applications from customers. ASUS industrial motherboards and single board computer are manufactured with extremely durable, industrial-grade components to ensure 24/7 reliable operation in industrial settings and harsh environments like extreme temperatures, power fluctuations and high humidity. Also, ASUS provides the longevity supply guarantee, optimized service and completed reference documents for our customers. ASUS not only provides international industry standard form factor models, but also offers customized hardware and software solutions for specific applications.

Wide Range Portfolio

H310M-IM-A Micro-ATX, H310I-IM-A R2.0 Mini-ITX, Q370I-IM-A Mini-ITX, C582S-IM-AA 3.5" SBC, E394S-IM-AA 3.5" SBC, E395S-IM-AA 3.5" SBC, IMX8P-IM-A Pico-ITX

Tinker Board Nano SBC, Tinker Edge R Pico-ITX, Tinker Edge T Pico-ITX

ASUS Edge Computer Proposition

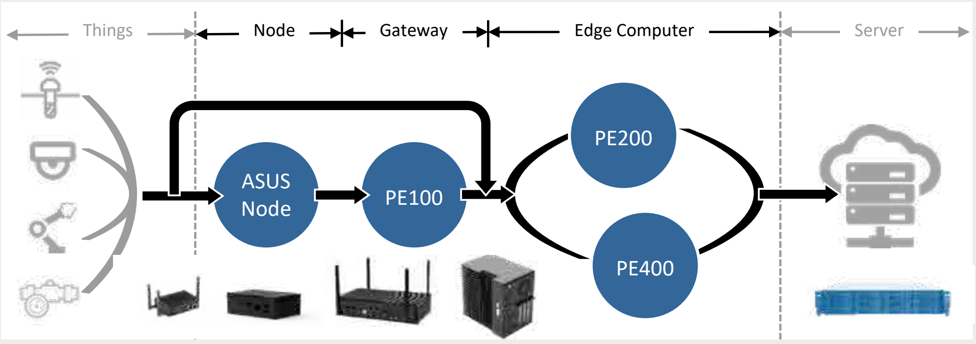
At the very frontier of AIoT and Cloud computing, edge computer is in charge of processing, filtering, analyzing and acting on data received in real-time, which not only reduces the traffic of data also provides lower latency and the cost of data transmission. ASUS IoT Edge computer is built for 24/7 stability and reliability, combined with our world-class after-sales service and guaranteed long-term availability – your investment for the duration of the product lifecycle is maximized.

PE200U

Intel® Core™ i7/i5/i3 Processor, Intelligent Edge Computer with mini PCIe slot, DDR4 2400 MHz, DP, HDMI, Dual-LAN, Multiple COM, 12-24 V DC

PE200S

Intel®Atom® X Series Processor, Intelligent Edge Computer with mini PCIe slot, DDR3L 1866 MHz, DP, HDMI, Dual-LAN, Multiple COM, 12-24 V DC



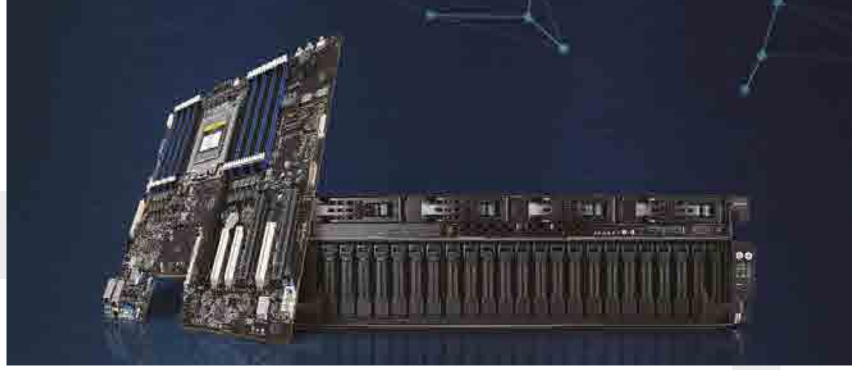
Sensor Fusion
- Data aggregation
- Data normalization
- Data processing
- Data forwarding

Edge Inference
- Secure virtualization
- Workload consolidation
- Real-time analytics (AI)

Data Center
- Data training
- Data analytics
- Data storage

IN SEARCH OF INCREDIBLE

ASUS Server and Workstations



Why ASUS for Server Business?

Accelerator Server

For AI and visual computing, the ESC series accelerator servers deliver extreme performance and stability with patterned electronic designs and high availability (HA) thermal solutions.

Rack/Tower Server

ASUS offers a comprehensive rack/tower server product line featuring high computing density, high expandability, and high manageability, ideal for multi-workload.

Workstation

Professional, ISV certified ESC/E series workstations have server-grade computing power, incredible expandability and advanced I/O, best suited for content creators, professional VR applications, and heavy entertainment loads.

Server and Workstation Motherboard

ASUS offers the most reliable server and workstation motherboards with industry-leading performance, high power-efficiency, and complete IT infrastructure management.

Accessories

OCP Mezzanine cards, high speed LAN cards, and ASUS-exclusive PIKE RAID cards provide the fastest interconnects and highest storage expandability for datacenter topology.

Benefits
- Focused and unique flexibility + customization
- 5yr longevity supply
- NL hub operation fulfill demand 80+% in 1 week
- Warranty service
- 3 year advanced replacement service
- A local FAE team provide technical support in zero time difference

ESC8000 G4 Series (C621)

HIGH-END Accelerator Server
- Asus-Exclusive PCIe Routing Switching design for 8 x GPUs
- Supports up to 8 double-deck active & passive GPUs in 4U

ESC4000 G4 Series (C621)

MAINSTREAM Accelerator Server
- Maximum flexible expansion slots 8+3 in the
- depth of 800 mm and 2U height
- Supports up to 4 double-deck active & passive
- GPUs in 2U

E900 G4 (C621)

HIGH-END WS SYSTEM
- Dual CPU Socket > 4 Double Deck Graphics

E800 (TBD)

HIGH-END WS SYSTEM
- Single CPU Socket > 4 Double Deck Graphics

ESC700 G4 (C422)

MAINSTREAM WS SYSTEM
- Single CPU Socket > 2 Double Deck Graphics

ESC500 G4 (C236)
E500 GS (C246)

ENTRY WS SYSTEM
- Single CPU Socket > 1 Double Deck Graphics

ESC500/510 G4 SFF (C236)
E500 GS SFF (C246)

ENTRY WS SYSTEM
- Single CPU Socket > 1 Low Profile Graphic

E900 G4
- Extreme 2P performance
- 4-Way NVIDIA® Quadro RTX™ support
- ECC memory
- Scale up & scale out
- Independent software vendor (ISV) certification

ESC700 G4
- Powerful performance and ECC memory
- Comprehensive IT infrastructure management software
- Multiple graphics card support
- Ultrafast storage and I/O options
- Dual Intel server-class Gigabit LAN

ESC500 G4
- Powerful performance with Intel® Xeon® E processor and ECC memory
- Supports up to three independent displays simultaneously via HDMI, DisplayPort, DVI-D and VGA
- High Speed USB 3.1
- Graphics card support, including NVIDIA® Quadro® M5000 (option)
- Independent software vendor (ISV) certification

Embedded Boards & Systems by DFI

Founded in 1981, DFI is a global leading provider of high-performance computing technology across multiple embedded industries. With its innovative design and premium quality management system, DFI's industrial-grade solutions enable customers to optimize their equipment and ensure high reliability, long-term life cycle, and 24/7 durability in a breadth of markets including factory automation, medical, gaming, transportation, smart energy, defense, and smart retail.

1.8" SBC

The 1.8" SBC board (84 mm x 55 mm) is a motherboard in an ultra-small and light-weight Pi size , not only has the specification complying with industrial requirements, but also offers the product life cycle up to 15 years to ensure device operation and maintenance with seamless drivers, software, and BIOS update.

PCSF51

- AMD Ryzen™ Embedded R2000 Series - Picasso
- Small form factor 1.8" SBC for space-limited applications
- Single Channel DDR4 Memory Down up to 4GB/8GB
- HDMI 1.4 resolution supports up to 4096 x 2160 @ 24 Hz
- Storage up to 128GB: eMMC 32/64/128 GB
- 10-Year CPU Life Cycle Support Until Q2' 32 (Based on AMD Roadmap)

3.5" SBC

DFI's 3.5" embedded SBC board (146 x 102 mm) is featured with rich I/O, and supports various internet connections. Extended operating temperature and wide input voltage range are industrial features that can meet most of industrial grade applications.

M8MP553

- ARM® i.MX 8M plus 2/4 Core Processor
- Industry-Leading Wide Voltage Support 9 to 36V
- Ultra-High-Speed Connectivity for 4G/5G Network
- Outstanding Graphic Performance, supports LVDS and HDMI with dual display
- CAN bus for automation equipment integration
- 1 M.2 2230, 1 M.2 3052
- 15-Year CPU Life Cycle Support Until Q1' 36 (Based on NXP Roadmap

2.5" Pico-ITX

DFI's Pico-ITX SBC board (100 x 72 mm) support low power consumption and fanless design with rich I/O connectivity in order to target space-limited embedded applications like site management and IoT gateway.

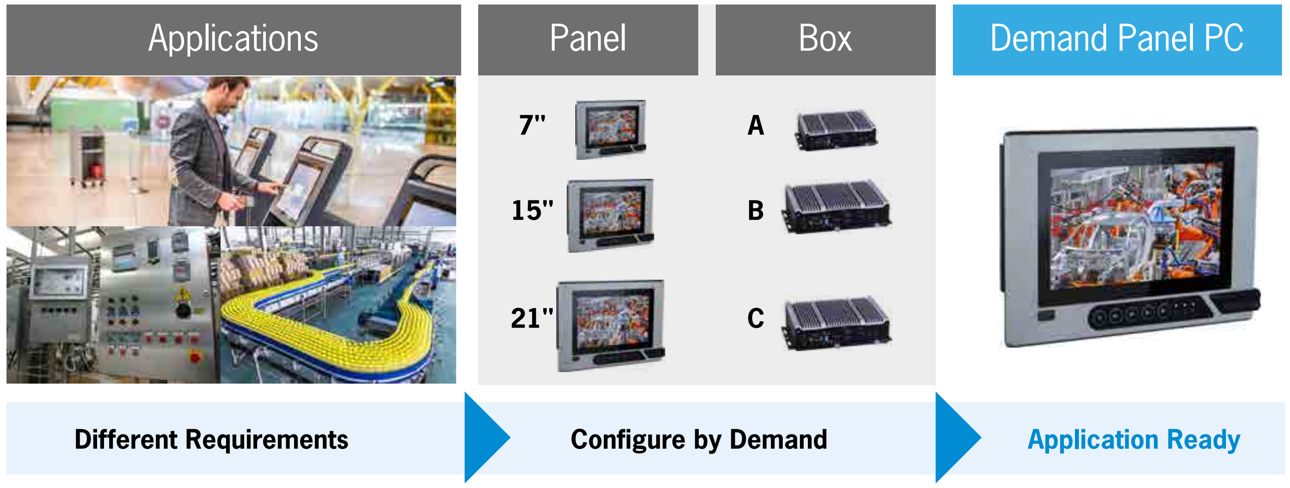
EHL051

- Intel Elkhart Lake Atom® x6000 Series, up to 12W Support Elkhart Lake SKU
- Ideal for Retail and Industrial Automation
- Rich I/O: 2 GbE Lan , 2 COM, 3 USB 3.2 Gen 2, 2 USB 2.0
- Expansion and Storage: 1 M.2 2230 E key, 1 M.2 B key 2242/3042, 1 SATA 3.0, 1 SIM Slot (Opt.), 1 SMBus/I2C (Opt.)
- Dual independent displays: HDMI + eDP
- 1 DDR4 SO-DIMM up to 32GB

Module Panel PC

Adaptive Display Platform (ADP) Technology is an advanced configure solution for Panel PC. It is a flexible modular system which provides easy maintenance, installation and configuration for customers.

Configure by Demand



Mini-ITX

DFI's embedded Mini-ITX motherboard (measuring to only 170 mm x 170 mm) is designed with a variety of I/O connectors for low power solution with passive cooling and DC input features and for desktop solution with high performance.

This compact and highly integrated board delivers rich I/O and expansion slots; which makes it an ideal solution for KIOSK, gaming, and digital signage, etc.

TGU171 / TGU173

- 11th Gen Intel® Core™ Processors
- 2 DDR4 3200 MHz SODIMM up to 64 GB
- Support 5G Communication
- 4 displays: 1 DP++/HDMI (Auto-detecting), 1 USB Type C, 1 eDP, 1 LVDS; up to 4096x2304 @60Hz
- Multiple expansion: 1 PCIe x4, 1 M.2 M Key, 1 M.2 B key (SATA/PCIe), 1 M.2 E key (PCIe/USB), 1 Nano-SIM Socket
- Rich I/O: 1 x 2.5Gbe, 2 Intel GbE, 4 COM, 4 USB 3.1 Gen2, 1 USB Type-C, 4 USB 2.0

EHL171 / EHL173

- Intel Atom® Processor X Series
- 2 DDR4 SODIMM up to 32 GB
- 3 Displays: 1 DP++/VGA, 1 HDMI/ DP++, 1 eDP/LVDS
- Multiple Expansion: 1 PCIe x4 (x1/x2 signal), 1 M.2 B Key, 1 M.2 E Key, 1 Nano SIM
- Rich I/O: 2 x 2.5GbE, 2 USB 3.1 Gen2, 2 USB 3.1 Gen1, 6 COM, up to 4 USB 2.0

ATX

DFI's ATX (measuring 305 mm x 244 mm) embedded motherboards feature a high computing capability, rich I/O connectivity, high integration, and great expandability for graphics cards, motion control cards, and memory. The robust processors and add-on powerful GPU make it an ideal solution for industrial automation and medical imaging, like machine vision, defect inspection, MRI, and CT imaging that require reliability & add-on-card expansibility.

ICX610-C621A

- 3rd Gen Intel® Xeon® Scalable Processor Family
- 8 DDR4 ECC-RDIMM up to 512 GB
- Support IPMI OOB Remote Management
- Multiple Expansion: 3 PCIe x16, 2 PCIe x8, 1 M.2 M key
- Rich I/O: 2 x 10GbE, 2 Intel GbE, 1 Dedicated IPMI LAN, 2 COM, 6 USB 3.1 Gen1, 5 USB 2.0

Fanless Embedded System

DFI's compact embedded systems, including fanless embedded computer and fanless embedded box pc powered by state-of-the-art processors, deliver low power consumption in an ultra-small size as well as efficient fanless thermal solutions. The systems are also designed with IP30-rating, wide voltage input, and extended operating temperature. Making them ideal candidates for industrial applications in harsh environments.

EC70A-TGU

- 11th Gen Intel® Core™ i7/i5/i3 Processors
- On board memory 8 GB and 1 SO-DIMM DDR4
- Triple Displays: 2 HDMI (4K@30Hz) + 1 VGA (2K@60Hz)
- Support M.2 B key 3042/3052 5G-NR module
- Up to 4 LAN or 6 USB

EC90A-GH

- AMD Ryzen™ Embedded R1000 Series
- Ultra Small Size: 112.29 x 80 x 56.20mm (W x H x D)
- Expansion Options of 2 serial ports or LTE or WiFi
- User friendly of installing SIM card design
- I/O: 1 Intel GbE, 1 USB 3.1 Gen 2, 2 Micro HDMI

EC100-XNX

- AI Inference/Training System
- Support NVIDIA® Jetson Xavier™ NX
- 8 x 10/100 MbE with PoE
- Fanless chassis technology
- 20 pins with 1 x UART, 2 x I2C, 9 x GPIOs
- 1 x HDMI 2.0a/b Type-A supports 4K@60Hz

Embedded Boards & Systems by Advantech

ADVANTECH
Enabling an Intelligent Planet

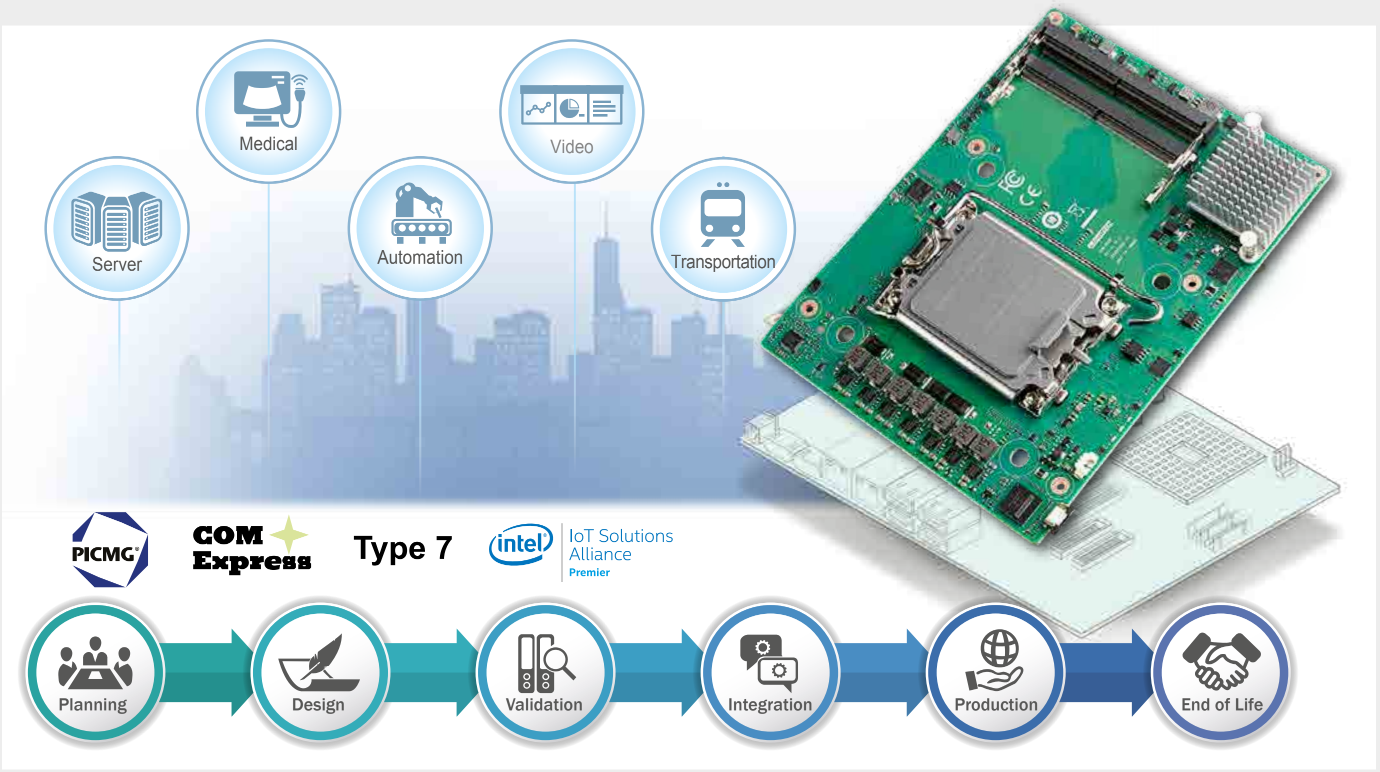
Worldwide Leader in Embedded Design and Services

Computer On Modules

Accelerate Application Development with Dedicated Design-In Services

To help customers accelerate the development of their core competencies, computer-on-module (COM) systems can be utilized to reduce the time and effort involved in designing new carrier boards.

Advantech's COM series includes the COM-Express series, COM-HPC, and Qseven, all of which offer additional design-in services that provide small form factor support while also supporting the latest Intel and AMD CPUs.



Fanless Embedded Computers

Modular System for Quick Equipment Integration

Advantech provides full customization services including a selection of offerings for I/O modules, OS software, and peripherals. You can choose from a flexible range of modular I/O options without concern for additional customization time, NRE, or costs. With our modular I/O design, you can rapidly implement your applications with maximal benefits.

Embedded Single Board Computers

Enabling Next-Generation Industrial Applications

Advantech offers compact industrial-grade embedded single-board computers (SBCs) with rugged design, high flexibility, and easy expansion capabilities. Our range of product offerings vary from the 2.5" Pico-ITX and 3.5" SBC, to PC/104 and 5.25" EBX. Moreover, our innovative multi-I/O expansion design, which features multiple integrated I/Os and flexible design can facilitate system development, maximize resource efficiency, and assist integrators in providing optimized solutions that are more cost-effective.

Embedded Boards with F&S

Board Strategy

If during development phase or a later redesign the requirement for higher processor power or more interfaces comes up, this can lead to serious problems. But this is not valid for boards by F&S Elektronik Systeme. Every board family by F&S Elektronik Systeme offers pin and software compatible boards. More boards are introduced annually and are added to the board family or replace faced out boards (not before 10 years).With this board strategy by F&S Elektronik, the customer has to take no risks. Depending on the customer's requirements, one of the board families can be employed, every board family meets different conditions.

F&S Project Guarantee

F&S Elektronik Systeme offers a project guarantee for all its customers. We will solve together all upcoming problems during development (hardware, as well as software) and fulfill your wishes. Aim is to complete the customer's project successfully and to continue supporting after the start of the series production and throughout the lifetime of the project. Another important feature of the project guarantee is the long-term availability of at least 10 years. Our project guarantee paved the way for F&S boards in numerous applications of major customers all over Europe.


armStoneA9r2


efusMX8X


OSM


PicoCoreMX8MP

Boards – Overview

Board Family	armStone™	efus™	PicoCore™	QBliss	PicoCOM™	PicoMOD	OSM	NetDCU
Board Type	SBC	COM	COM	COM	COM	COM	COM	SOM
Baseboard Complexity	-	easy	easy	advanced	easy	easy	-	very easy
CPU Performance Up To (Cores)	Cortex-A9 (4)	Cortex-A53	Cortex-A53 (4)	Cortex-A9 (4)	Cortex-A9 (1)	Cortex-A9	Cortex A53 (4)	Cortex-A9
Windows	✓	✓		✓	✓	✓		✓
Linux	✓	✓	✓	✓	✓	✓	✓	✓
Standard	PicoITX Formfaktor	FS	FS	Qseven second source	FS	FS	OSM (Open Standard Module)	FS
LCD Interface	RGB LVDS	RGB LVDS	RGB, LVDS, MIPI-DSI	LVDS	RGB	RGB LVDS	TFT MIPI-DSI	RGB
Screen	DVI	DVI	-	DVI	-	DVI		-
Color Depth Up To	24Bit	24Bit	24Bit	24Bit	18Bit	24Bit		24Bit
Resolution Up To	FullHD	FullHD	1080p60	FullHD	WXGA	WXGA	1080p60	FullHD
DATA-BUS	-	-	-	-	-	✓	-	✓
Camera	-	✓	✓	✓	-	✓	✓	-
Ethernet	2x	2x	2x	2x	2x	1x	1x	2x
Power Supply	5V	5V	5V	5V	3.3V	3.3V	5V	5V
Size (mm)	100x72	47x62.1	35x40	70x70	40x50	80x50	30x30	100x80
Plug Connector	66pin	MXM-2 230pin	2x 80pin	MXM-2 230pin	80pin	140pin	-	142pin

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Intel® 1/2.5/10/25/40/100 GbE Ethernet Adapters

The Intel® Ethernet 800 Series with flexible Ethernet port configuration supports different link modes and speeds, includes powerful capabilities to accelerate network performance, and delivers workload-optimized performance and consistent application performance for latency-sensitive workloads. Move data faster with Intel® Ethernet 800 Series with throughput up to 100Gb/s.

Features

- Supports multiple port speeds with a single architecture: 100/50/25/10/1GbE
- Application Device Queues (ADQ)
- Dynamic Device Personalization (DDP)
- Enhanced Data Plane Development Kit (DPDK)
- iWARP and RoCEv2 Remote Direct Memory Access (RDMA)
- Intel® Ethernet Adaptive Virtual Function (Intel® Ethernet AVF)
- Enhanced server virtualizations: 256 VFs, 768 VSIs
- Optimized Advanced Transmission Scheduler
- Extensive Network protocol support
- IEEE1588/Precision Time Protocol

Intel® Ethernet products are customers' choice for extensive compatibility, performance assurance, broad product selection, and world-wide support.

Overview Intel® Ethernet 800 Series supports up to 100Gb/s throughput for a variety of workloads.

Enterprise

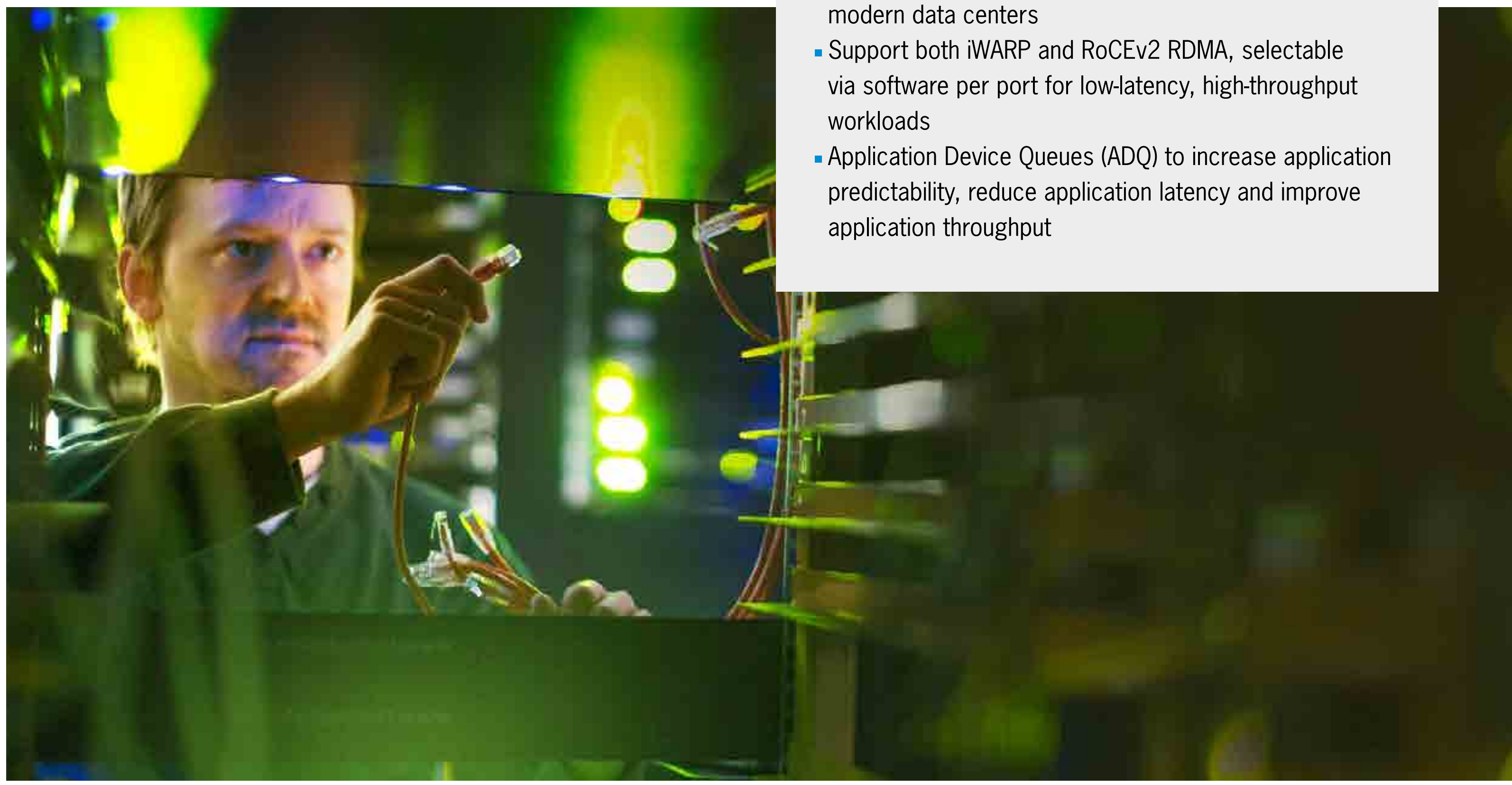
- Broad physical interfaces support, thorough test and validation with ecosystem devices for compatibility
- Extensive Microsoft solution support

Communications

- Flexible Ethernet Port Configuration with link modes supporting different fan-in or fan-out connections
- DDP, with fully programmable pipeline, can add or modify protocols on-demand allowing for fast-paced innovations
- Enhanced DPDK for Network Functions Virtualization acceleration, advanced packet forwarding, and highly efficient packet processing
- IEEE1588 Precision Time Protocol (v1 and v2) with per-packet time stamping

Cloud

- Up to 100Gb/s throughput for diverse workloads in modern data centers
- Support both iWARP and RoCEv2 RDMA, selectable via software per port for low-latency, high-throughput workloads
- Application Device Queues (ADQ) to increase application predictability, reduce application latency and improve application throughput



Intel® NUC Kits, Boards & Mini PCs

High-End Computing, Low-Profile Style

Ultra Small Form Factor | Space Saving | Versatile Usage | Performance | Stunning Visuals | Low Power Usage

Pint-sized Power

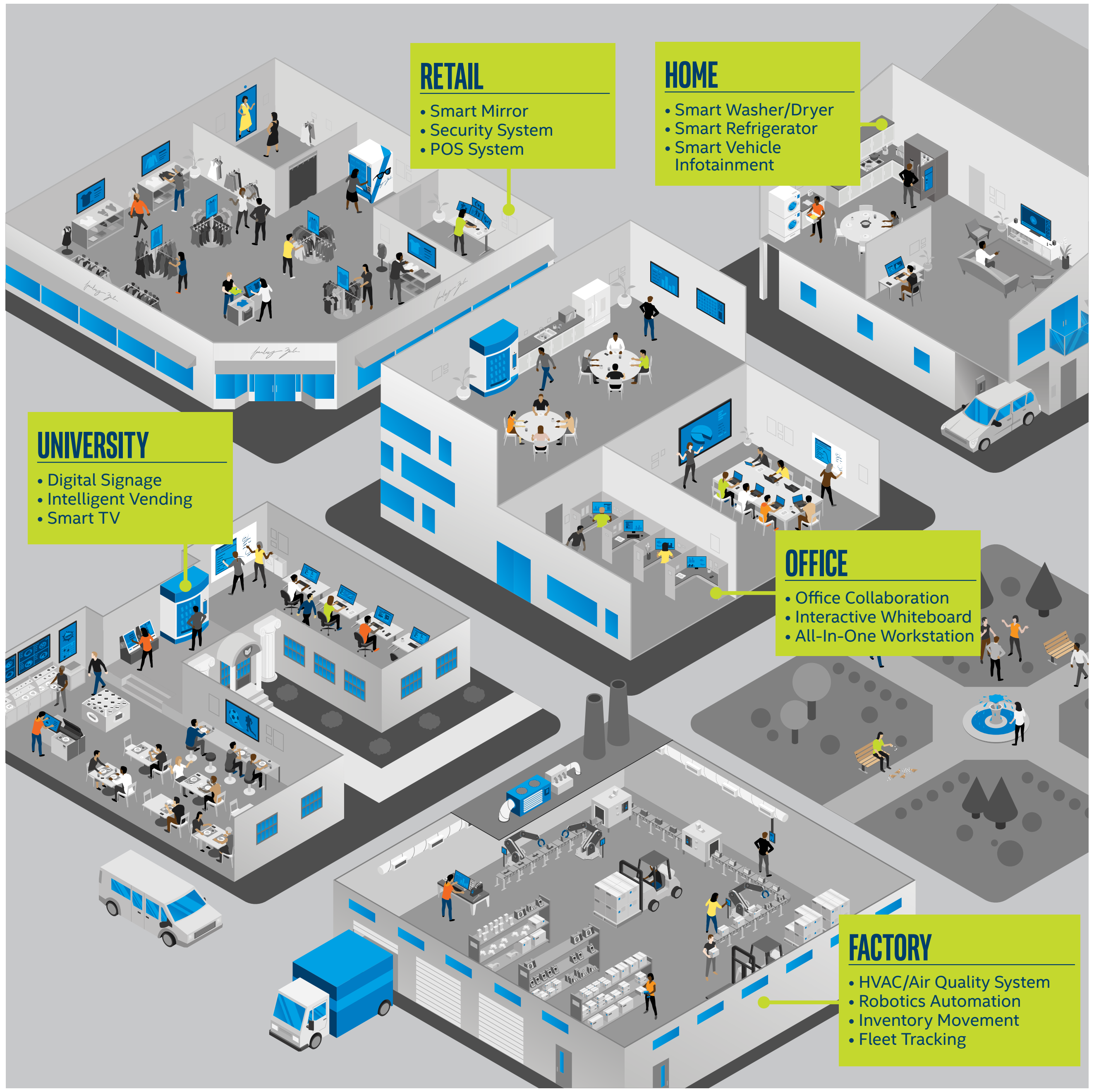
The Intel® NUC is a mini PC with the power of a desktop, packing features for entertainment, gaming, and productivity in a 4x4 form factor.

Energy Optimized, Media Savvy

With Intel® NUC, you get an immersive media experience and responsive interaction while consuming a small amount of power relative to a full-sized PC.

Flexibility for Future Growth

Due to its portable size and ease of installation, the Intel® NUC makes it easy to add devices and scale up rapidly based on changing productivity needs.



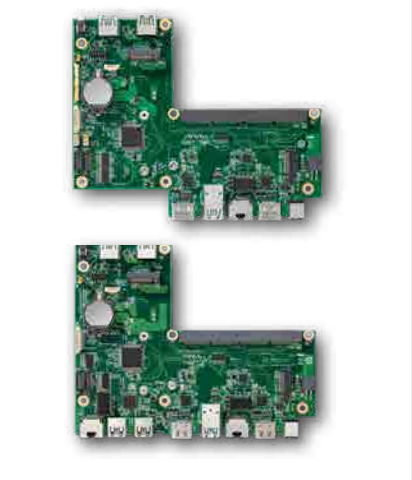
Intel® NUC Elements

Intel® NUC Elements High-Performance, Modular Elements for a Range of Verticals

Start with an Intel NUC Compute Element with the exact processor you need and plug it into an Intel NUC Board Element, your own board, or another third-party board, then embed it into your solution to create unique solutions for your customers' needs. From embedded deployments to rugged systems in unique environments, to full systems in a business or vertical environment, the Intel NUC Elements let you deliver custom solutions with minimal R&D time.

Intel® NUC Compute Elements

Intel® NUC Rugged Board Elements



Intel® NUC Pro Board and Assembly Element

Intel® NUC Pro Chassis Element

Intel® NUC Rugged Chassis

Embedded Systems & Industrial PCs

Founded 1989 in southern Germany, exone has established to a leading german manufacturer for PC Systems. With three brands, exone covers professional IT-Systems for the classical business field, industrial PCs, tablets, workstations and servers. Their fanless Box-PCs, Panels and Gateways are made for harsh environments and long time availability. With now over 30 years of experience, an own R&D department and two production lines, exone is proud to offer quality computer Systems made in germany.

Industrial Systems with Long Time Availability

Calmo Tiny – Small, Smaller, Tiny

The demand for small computer systems is constantly increasing in industrial environments. However, the performance of these systems must not be limited by the compactness of the housing dimensions. With the Calmo TINY series you can rely on the smallest PCs, with the latest and most powerful Intel CPU technology and 100% industrial quality. Designed for 24x7 continuous operation and stability in the temperature range of 0 - 55 °C, we offer additional functions such as TPM, GPIO, Watch Dog and a wide range input of 8 – 24 volts in addition to these two core features. The Calmo TINY - a mini industrial system at the highest level!

Highlights

- Latest Intel® Gemini Lake processor technology
- Two monitor operation with UDH possible
- Optional serial interface
- Optional USB 3.1 type C (fuse-proof)
- Wide range input from 8 to 24 V
- Suitable for digital signage

Calmo E

Calmo E can do both deskop and automation tasks. With up to 32 GB RAM and NVMe SSD it is providing enough power for nearly every usecase in business, production environment and even in digital signage. The simple design of the Calmo E is fanless and therefore noiseless, the integrated VESA-Mount makes it easier to fix the ipc to machines, displays or shelves. Calmo E is reduced to the essential interfaces, this is shown also by the price.

Highlights

- Only focused interfaces
- German case design
- Intel Core CPUs
- Passive cooling

Calmo XS – x-Trasmall Box-IPC with Professional Interfaces

Control-units, digital-signage-player and hardware-firewalls are getting smaller but smarter, Besides that, they are often installed in production inviroenments or badly reachable. Our new Calmo XS gives you all features of our Calmo TINY, but you get something on top!

It is IP40 dustproof and gives you room for a 2.5" SSD, two serial ports, 8 – 24 V direct input and WiFi 6. Use the Power of its embedded Celeron and Pentium CPUs and benefit from their energy-saving architecture. Bring your display-solution, your dusty workspace and your machine-control-unit to the next level – with our new Calmo XS.

Highlights

- WiFi 6
- 1x RS485/422/232, 1x serial 4-wire
- Phoenixport or DC-Jack usable
- 8 to 24 VDC-In
- 2.5" SSD
- USB 3.1 Type C

Pokini F2

Small, Powerful, Customizable

The Pokini F2 is a small and fanless PC with great performace, various interfaces and excellent graphics. The embedded Intel CPU has enough power for handling digital-signage and office apps as well as machine control programs. The full aluminum case is fanless and able to cool the unit. Trust in our experience, get 5 years of full warranty for free. Only rely on quality IPCs ready for 24/7 use, only rely on the Pokini F2.

Highlights

- Fanless case
- Powerful and flexible
- Intel embedded CPU
- Available through 2028

Panel-PC

Industrial Hardware – Made in Germany

On the way to unstoppable digitization, traditional production sites need high-performance and robust computers. Clear and brilliant images combined with intuitive operation using the latest touch technology, help to increase the degree of effectiveness in process flows. The classic operation of the computing unit with mouse, keyboard and a separate display is replaced and combined by the industrial panel-pc at the same time. A compact and innovative housing design for integration in standard production control cabinets or for mounting on corresponding mounting systems is assembled in our german factory.
Our panel-PC series fit today's and tomorrow's requirements, we only offer exactly fitting solutions.

Highlights

- State-of-the-art capacitive P-CAP touch technology (10-point touch)
- Operation with latex, work and ESD gloves possible
- Fanless and attractive housing design
- Variety of interfaces through expansion options
- Concept, development and production in Germany
- Customizable, celeron up to Intel embedded CPU
- Available through 2028

Depth Cameras

Intel® RealSense™ D400 Series

Designed for easy setup and portability, Intel® RealSense™ D400 series cameras feature high depth resolution and include active infrared (IR) stereo with standard or wide field of view. For high-precision applications, choose the D415 with rolling shutter. If your application is fast-moving or outdoors, select either the D435 or D435i camera which feature a global shutter. For longer range applications, the D455 features wide field of view and global shutter on the depth and RGB sensors.

Specifications

Type	**D415**	**D435 / D435i / D435f**	**D455 / D457**	**D405**
				
Depth Technology	Active IR Stereo	Active IR Stereo	Active IR Stereo	Stereoscopic
Technology	Rolling Shutter	Global Shutter	Global Shutter	Global Shutter
Depth FOV[1] (H x V)	65° × 40°	87° × 58°	87° × 58°	87° × 58°
Depth Resolution	up to 1280x720			
Depth Accuracy[2]	<2% at 2 m	<2% at 2 m	<2% at 4 m	± 2% at 0.5 m
Depth Frame Rate	Up to 90 fps			
RGB Sensor Technology	Rolling Shutter	Rolling Shutter	Global Shutter	Global Shutter
RGB Frame Rate & Resol.	1920 × 1080 at 30 fps	1920 × 1080 at 30 fps	1280 × 800 at 30 fps	1280 x 720 at 90 fps
RGB Sensor FOV[1] (H x V)	69° × 42°	69° × 42°	90° × 65°	87° x 58°
IMU	—	— / Yes	Yes	–
Min-Z at Max Resolution	~45 cm	~28 cm	~52 cm	~7 cm
Ideal Range	0.5 m to 3 m	0.3 m to 3 m	0.6 m to 6 m	0.07 m - 0.5 m
Main components	D415 Depth Module D4 Vision Processor	D430 Depth Module D4 Vision Processor	D450 Depth Module D4 Vision Processor	D401 Depth Module D4 Vision Processor v4
Dimensions (L x D x H)	99 mm × 20 mm × 23 mm	90 mm × 25 mm × 25 mm / 90 mm × 25 mm × 25 mm / 90 mm × 25.8 mm × 25 mm	124 mm × 26 mm × 29 mm / 124 mm × 26 mm × 36 mm	42 mm x 421 mm x 23 mm
Connectors	USB-C* 3.1 Gen 1		USB-C 3.1 Gen 1 / GMSL/FAKRA	USB3 Micro-B
Use Environment	Indoor/Outdoor			

[1] measured +/-3° of stated value [2] measured as out of the factory

Ordering Information

D415 (Retail) 82635ASRCDVKHV	**D435** (Retail) 82635AWGDVKPRQ	**D435i** (Retail) 82635D435IDK5P	**D435f** (Retail) 82635D435FDK	**D455** (Retail) 82635DSD455	**D457** (Retail) 82635DSD457	**D405** (Retail) 82635DSD405
D415 (Bulk) 82635ASRCDVKMP	**D435** (Bulk) 82635AWGDVKPMP	**D435i** (Bulk) 82635D435IDKMP	**D435f** (Bulk) 82635D435FDKMP	**D455** (Bulk) 82635DSD455MP	**D457** (Bulk) 82635DSD457MP	**D405** (Bulk) 82635DSD405MP

Retail: Package contains camera, USB cable and Tripod | **Bulk**: Package contains only the camera

Depth Modules & Processors

Intel® RealSense™ D400 Series

For the integration of Intel® RealSense™ technology into higher volume products, depth modules can offer the best compromise between price and flexibility. Multiple different configurations are offered to better suit your needs and product requirements. Designed for easy system integration, all modules feature an imaging sub-system with stereo sensors. When paired with an Intel® RealSense™ Vision Processor, depth data can be output via USB to any platform.

Specifications

Type	**D415**	**D430**	**D450**	**D401**
				
Use Environment	Indoor/Outdoor			
Image Sensor Technology	Global Shutter			
Depth FOV (H x V)	65° × 40°	87° × 58°	87° × 58°	84° x 58°
Depth Resolution	1280x720			
Depth Frame Rate	Up to 90 fps			
RGB Sensor Technology	- / Rolling Shutter	–	Global Shutter	Global Shutter
RGB Frame Rate & Resol.	1920 × 1080 at 30 fps	–	1280 × 800 at 30 fps	1280 x 720 at 30 fps
Interface	50-pin Board to Board Connector			
Dimensions (L x D x H)	99 mm x 20 mm x 23 mm	90 mm x 25 mm x 25 mm	124 mm x 26 mm x 29 mm	42 mm x 42 mm x 23 mm

Also available: Phased-out Depth Modules **D410** and **D420**

Ordering Information

Intel® RealSense™ Depth Modules

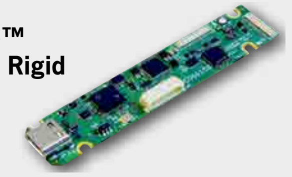
D415 (Bulk) 82635DSASRCPRQ	**D430** (Bulk) 82635DSAWGPRQ	**D450** (Bulk) 82635DSD450	**D401** (Bulk) 82635DSD401

Recommended Accessories

D415 & D430 - Intel® RealSense™ Vision Processor D4 Card
82635DSASMDLPRQ

D450 - Intel® RealSense™ Vision Proc. D4 Board V3
82635DSASICBDIF

Intel® RealSense™ D400 Interposer Rigid
82635DSITR50P



Intel RealSense SDK 2.0

- Intel® OpenVINO™ integration
- Fast and easy data integration tool
- Open Source cross platform library

More information
https://www.intelrealsense.com/sdk-2/

with

Operating Systems
- Windows
- Linux
- mac OS
- Android

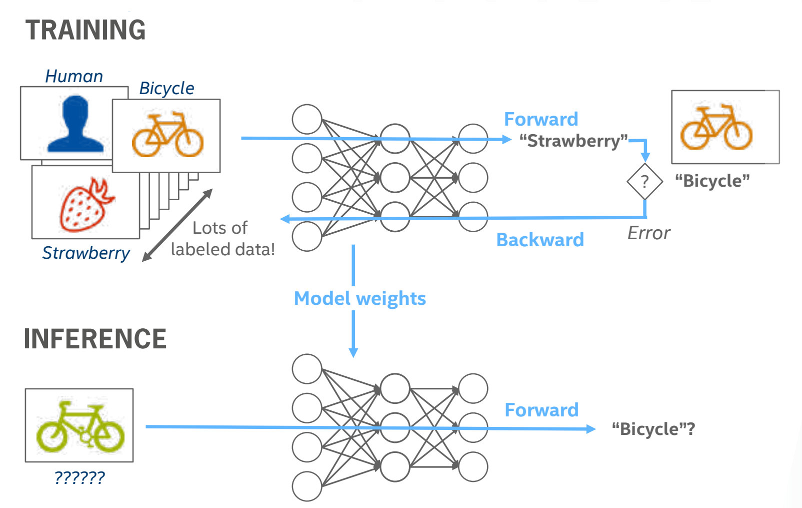
Programming Languages
- Python
- C/C++
- C#/.NET
- Node.js

Frameworks and Wrappers
- ROS
- OpenNI
- PCL
- LabVIEW
- OpenCV
- MATLAB
- UnrealEngine4
- Unity

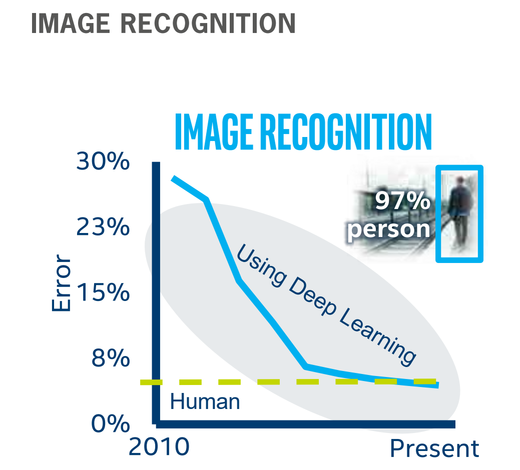
Artificial Intelligence Vision Accelerator Cards

Vision hardware is popular. Without difficulty it provides a wide range of information which can be extracted. What appears simple on the one hand can be difficult to manage on the other hand when it comes to requirements like:

- A minimum of processing time and power consumption when thinking of edge applications
- Possibility to deal with huge amounts of data and scale with different workloads
- Maximum precision in image recognition is like to find a needle in the haystack



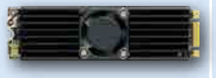
Training with a large data set AND deep (many layered) neural network often leads to the highest accuracy inference



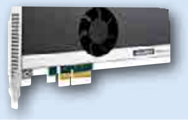
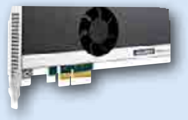
Machines are able to meet or exceed human image & speech recognition e.g. tumor detection, document sorting, oil & gas search, defect detction, genome sequencing

All cards are based on Intel Movidius Myriad X, Intel Arria FPGA and Google Coral Edge.
Cards are designed to run pretrained models (inference).

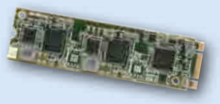
iEi

Type	Mustang-M2AE-MX1	Mustang-M2BM-MX2	Mustang-MPCIE-MX2	Mustang-V100-MX4	Mustang-V100-MX8	Mustang-F100	MUSTANG-T100
							
Chipset	1x Intel® Myriad™ X	2x Intel® Myriad™ X	2x Intel® Myriad™ X	4x Intel® Myriad™ X	8x Intel® Myriad™ X	Intel® Arria® 10	5x Google® Coral Edge
Formfactor	M.2 2230 (A+E Key)	M.2 2280 (B+M Key)	miniPCle	PCle 2.0 x2	PCle 2.0 x4	PCle 3.0 x8	PCle 2.0 x4
Dimensions	22 x 30 mm	22 x 80 mm	30 x 51 mm	113 x 56 x 23 mm	170 x 56 x 23 mm	170 X 82 X 44 mm	168 x 64 x 18 mm
Operating Temp.	-20 to +60 °C	-20 to +60 °C	-20 to +60 °C	-20 to +60 °C	-20 to +60 °C	+5 to +60 °C	-20 to +55 °C
Power Consumption	~4.5 W	~7.5 W	~7.5 W	~15 W	~25 W	~40 W	~15 W

ADVANTECH
Enabling an Intelligent Planet

Type	VEGA-320	VEGA-330	VEGA-340-04A1	VEGA-340-08A1
				
Chipset	1x Intel® Myriad™ X	2x Intel® Myriad™ X	4x Intel® Myriad™ X	8x Intel® Myriad™ X
Formfactor	M.2 2230 (A+E Key)	miniPCle 2.0 x1	PCle 2.0 x4	PCle 2.0 x4
Dimensions	22 x 30 mm	30 x 51 mm	171 x 69 mm	171 x 69 mm
Operating Temp.	-20 to +60 °C	-20 to +55 °C	-20 to +60 °C	-20 to +60 °C
Power Consumption	~ 3.8 W	~ 7.6 W	~ 6.7 W	~ 9.6 W

AAEON

Type	AI Core X	AI Core XM 2280	AI Core XP4/ XP8
			
Chipset	1x Intel® Myriad X	2x Intel® Myriad X	4 / 8 Intel® Myriad X (via M.2 M Key Card)
Formfactor	Mini PCle	M.2 B+M Key	PCle
Dimensions	30 x 51 mm	22 x 80 mm	167 x 111 mm
Operating Temp.	0 ° to 60 °C	0 °C to 50 °C	0 °C to 50 °C
Power Consumption	< 4 W	~ 15 W	Depending on config.

ASUS
IN SEARCH OF INCREDIBLE

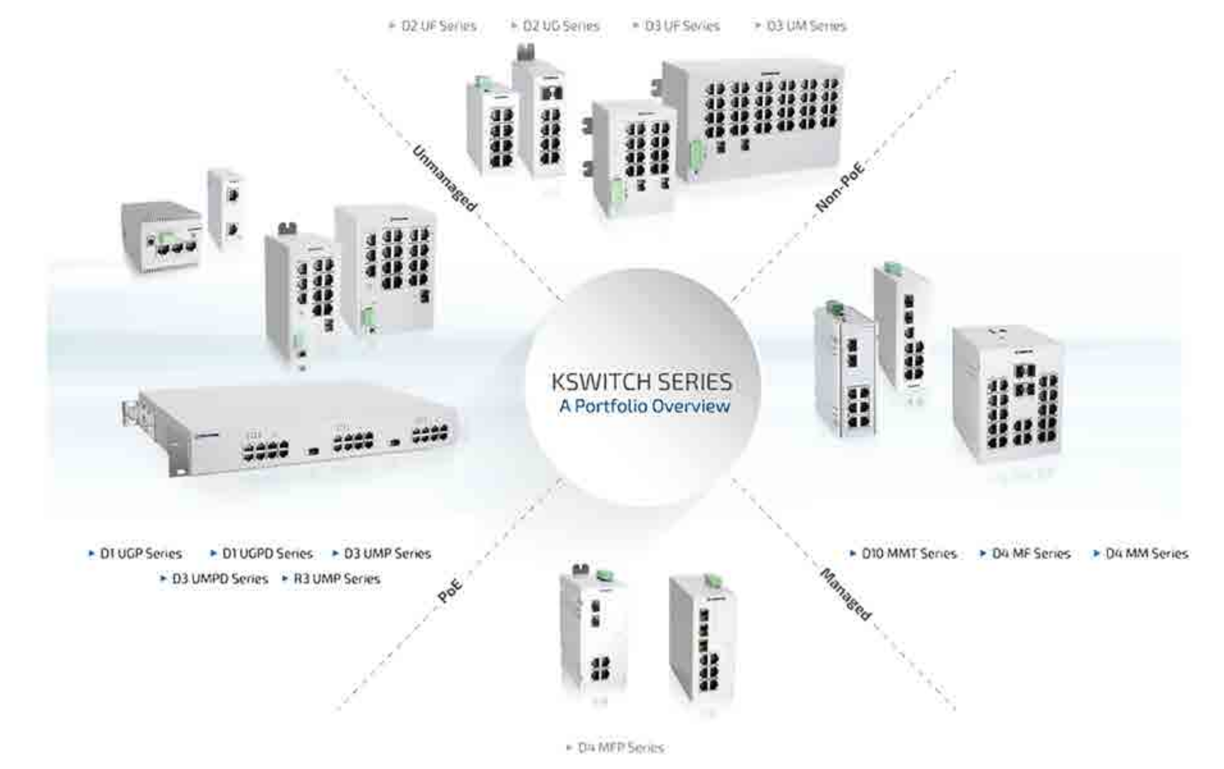
Type	CRL-G18U-P3DF	CRL-G116U-P3DF
		
Chipset	8x Google® Coral Edge	16x Google® Coral Edge
Formfactor	PCle 3.0 x16 (M.2)	PCle 3.0 x16 (M.2)
Dimensions	42 x 126 x 186 mm	42 x 126 x 186 mm
Operating Temp.	0 to +55 °C	0 to +55 °C
Power Consumption	~ 36 W	~ 52 W

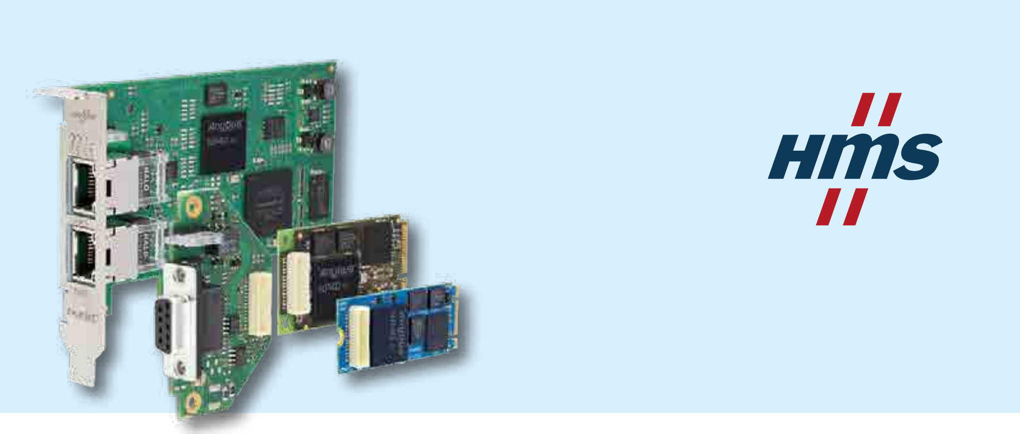
Industrial Ethernet Switches

KSwitch Family

Kontron has launched its new KSwitch portfolio for the Industrial Automation market, which provides a lot of options to enable wired Ethernet connectivity at the Edge. The Industrial Ethernet Switches of the KSwitch portfolio are suitable for Fast Ethernet, Gigabit Ethernet and in the future also 10 Gigabit networks. The new single-chip design offers more reliability and cost-efficiency in smaller mechanical dimensions, combined with a performance increase and a reduction of the power consumption, which pays back over the product's life-cycle. Recently, a new family of Industrial Ethernet Switches enabled for Time Sensitive Networking (TSN) has been added to the portfolio: the KSwitch D10 MMT Series.

KSwitch Series Portfolio Overview





Ixxat INpact

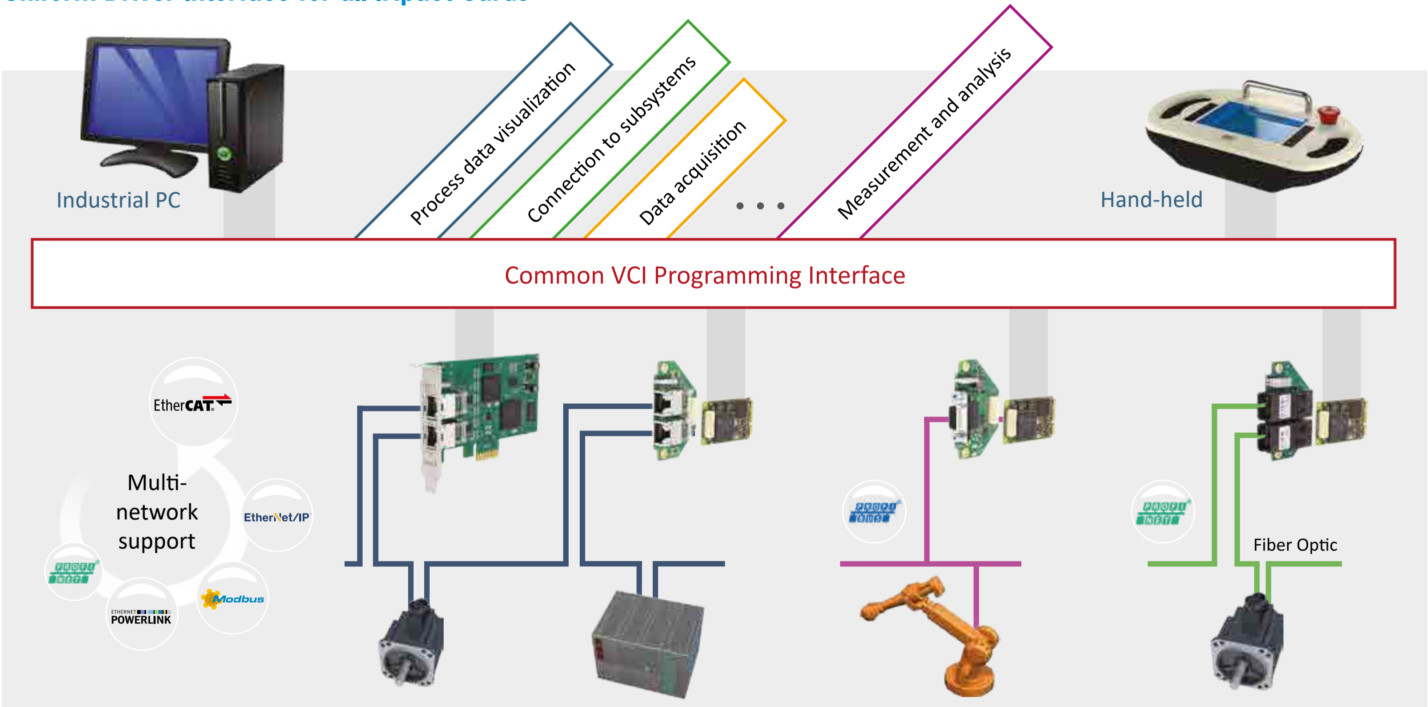
Multi-Protocol Technology

Ixxat INpact includes the Anybus CompactCom technology with the Anybus NP40 network processor – used within millions of industrial devices globally. The FPGA-based Anybus NP40 network processor provides all functions required to handle the communication between the different Industrial Ethernet and fieldbus networks and the PC-based application. The powerful multi-network approach of the NP40-based Ixxat INpact enables easy connection of PC-based or embedded slave applications to EtherNet/IP, EtherCAT, Powerlink, Modbus TCP, PROFINET IRT, PROFINET IRT Fiber Optic and PROFIBUS. Anybus NP40 provides high performance for real-time applications, making Ixxat INpact the ideal choice for demanding industrial applications.

Supported Protocols and Formats

Protocol / Interface Format	EtherNet/IP	EtherCAT	Powerlink	Modbus	Profinet IRT	Profinet IRT Fiber Optic	Profibus
Interface name	**INpact EIP Slave**	**INpact ECT Slave**	**INpact EPL Slave**	**INpact EIT Slave**	**INpact PIR Slave**	**INpact PIRFO Slave**	**INpact DPV1 Slave**
PCIe (standard slot-brackets)	✓	✓	✓	✓	✓	✓	✓
PCIe (low-profile slot-brackets)	✓	✓	✓	✓	✓	✓	✓
PCIe Mini	✓	✓	✓	✓	✓	✓	✓
M.2	✓	✓	✓	✓	✓		✓

Uniform Driver Interface for all INpact Cards



Intel® Processors for Every Usage

All embedded products based on Intel's 14nm technology are available for 15 years from launch, helping to minimize engineering, maintenance and support costs.

Intel® Atom® Processors

The Intel® Atom® x5 and x7 processors offer 2 to 4 cores with a clockrate of up to 1.6 GHz. The development of this CPU was focused on power saving and an extended temperature range. This makes this an ideal processor for a wide range of industrial use cases. Thanks to the BGA socket it can be used in extreme working conditions.

Extended Temperature Range

The Intel® Atom® x5 and x7 processors support the industrial extended temperature range of -40 to +85 °C with a junction temperature of up to 110 °C.

They can be used outdoors in public applications like digital signage or vending machines.

Stunning Visual Experiences

Intel® Atom® x5 and x7 support up to 24MP still image capture and 1080p60 video encode/decode.

It could be used for entry-level single-display surveillance devices like body cams or mobile streaming devices.

Long-Lasting Performance

Enhanced battery life and Intel® Display Power Saving Technology (DPST) and Intel® Display Refresh Rate Switching Technology (DRRS Technology) allow you to keep working and playing by reducing panel backlight and refresh rate opportunistically.

The TDP range from 5 to 12W makes this an ideal energy saving processor to reduce your costs.

Intel Atom® C Processor

Intel Atom® C processor, a system-on-a-chip (SoC) design, delivers efficient intelligence into smaller spaces at the network edge. Used in a variety of light scale-out workloads that require very low power, high density and high I/O integration including network routers, switches, storage, security appliances, dynamic web serving, and more.

With a junction temperature of up to 100 °C this processor is also ready for the use in extreme environmental conditions.

Atom® C3000 Processors – Use Less Energy

Atom® C3000 processors deliver a range of Thermal Design Power from 8.5 to 32 watts.

Flexible Design To The Edge

From 2 to 16 cores with speeds up-to 2.2 GHz, these processors allow you to deploy light scale-out workloads to the network edge. Integrated Intel® QuickAssist Technology (Intel® QAT) and Intel® Ethernet deliver additional value-add throughput in data transmission, security and compression acceleration.

4th Gen Intel® Xeon® – Scalable Processors

Designed to accelerate performance across the fastest-growing workloads in artificial intelligence (AI), data analytics, networking, storage, and high-performance computing (HPC). These processors have the most built-in accelerators of any CPU on the market. They help bring a zero-trust security strategy to life while unlocking new opportunities for business collaboration and insights - even with sensitive or regulated data - with advanced security technologies. You can scale across multiple clouds and edges to meet your deployment needs. And Intel Xeon Scalable processors offer the most choice and flexibility in cloud selection, with smooth application portability.

Higher per-core performance

New architecture with higher per-core performance than the previous generation. Up to 60 cores per socket and one, two, four, or eight sockets per system.

Advanced memory bandwidth/capacity

DDR5 memory provides up to 1.5x the bandwidth and speed of DDR4, for 4,800 megatransfers per second (MT/s).

Improved I/O:

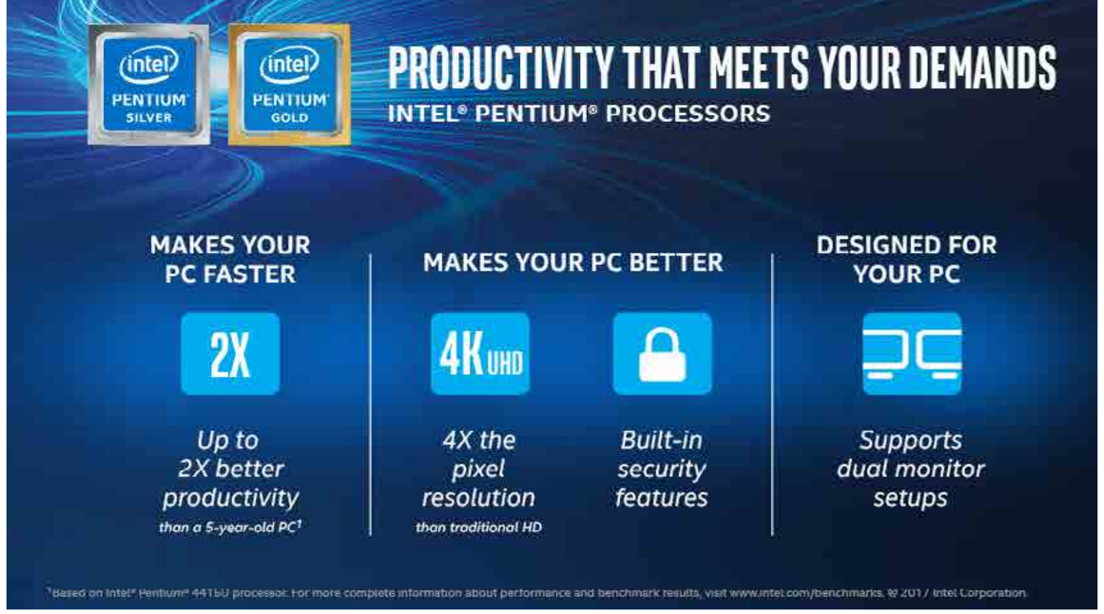
The platform features 80 lanes of PCIe Gen5 per socket, for dramatically improved I/O compared to earlier platforms. It provides CXL 1.1 to support high fabric bandwidth and attached accelerator efficiency.

AI HPC Data Analytics Storage Networking Security Cloud IoT/Edge

4th Gen Intel® Xeon® Scalable processors support technologies that let you scale and adapt as workload requirements change.

Intel® Xeon® D-2100 Processor

The Intel® Xeon® D-2100 processor delivers Intel's most transformative and ground-breaking data center processor architecture in a form factor optimized for flexible, scalable, high-density network, storage, and cloud edge solutions. It brings the architectural innovations of the Intel® Xeon® Scalable Platform to a system-on-a-chip (SoC) processor for lower-power, high-density solutions, integrating essential network, security, and acceleration capabilities. The 4-16 Cores that run with up to 3.00 GHz offer an impressive performance level in every network based scenario. Thanks to it's high core count and the amazing performance this CPU is optimal for big data analytics, cloud services or all other demanding applications in data centers for example.



Intel® Pentium® and Celeron® Processors

These processors are great options for value-segment buyers who need basic functionality at an affordable price. The processors are ideal for everyday computing like basic productivity, browsing vis7ually stunning webpages, streaming 4K Ultra HD video, and editing photos.Whether it's a notebook, convertible, Chromebook*, All-in-One, mini PC or desktop PC, Intel® Pentium® and Celeron® processor-based PCs offer reliable performance at an affordable price for value-oriented buyers. With 2 to 4 cores and clockrates of up to 3.7 GHz this processor offers a wide field of applications in the entry-level segment.

Intel® Core™ Processors

13th Generation – Beyond performance

The 13th Gen Intel® Core desktop processors deliver the next generation of breakthrough core performance. Now with up to 24 cores (8 Performance-cores and 16 Efficient-cores) and up to 32 threads, plus Performance-cores are capable of reaching 5.8 GHz with Intel® Thermal Velocity Boost to elevate performance. Intel® Turbo Boost Max Technology 3.07 further strengthens lightly threaded performance by identifying the best-performing Performance-cores. Meanwhile, additional E-cores enable an increase in Intel® Smart Cache (L3) for more efficient processing of larger data sets and better performance. The P-core and E-core L2 cache has also increased compared to the previous generation of Intel® processors, minimizing the amount of time spent swapping data between cache and memory to speed up your workflow. Unleash the power of next-level performance with the 13th Gen Intel® Core desktop processor advantage.

Features

- Performance-core (P-core)
- Efficient-core (E-core)
- Performance Hybrid Architecture
- Intel® Thread Director
- PCIe 5.0 up to 16 Lanes
- Up to DDR5 5600 MT/s
- L3 and L2 Cache

12th Generation – Performance where you need it most

The 13th Gen Intel® Core desktop processors deliver the next generation of breakthrough core performance. Now with up to 24 cores (8 Performance-cores and 16 Efficient-cores) and up to 32 threads, plus Performance-cores are capable of reaching 5.8 GHz6 with Intel® Thermal Velocity Boost to elevate performance. Intel® Turbo Boost Max Technology 3.07 further strengthens lightly threaded performance by identifying the best-performing Performance-cores. Meanwhile, additional E-cores enable an increase in Intel® Smart Cache (L3) for more efficient processing of larger data sets and better performance. The P-core and E-core L2 cache has also increased compared to the previous generation of Intel® processors, minimizing the amount of time spent swapping data between cache and memory to speed up your workflow. Unleash the power of next-level performance with the 13th Gen Intel® Core desktop processor advantage.

Features

- Intel® Thread Director
- Built for gaming on the go
- Best overclocking experience
- Smart solutions for enthusiasts and creators
- Nearly 3x faster connectivity

Power Supply – the Heart of the System

FSP POWER SOLUTION GMBH

Since Rutronik understands its role in the embedded market as a provider of all components that are needed to build an embedded system, power supplies round off our portfolio to meet the demands for one stop sourcing.
The field of industrial power supplies is huge and it is the job of an embedded partner to support customers from the beginning of a project to its mass production stage.
In the following we are providing an overview of the different fields of power supplies to show our competence and to give our customers an idea what they can expect.

FSP Product Conversion Notice
According to the implementation date of the new norm EN62368-1:201 (valid on 20.12.2020) for Audio/Video, Information and Communication technology equipment, FSP Group has started the transition of its complete range of power supply products for the safty standard EN62368-1.

Uninterruptable Power Supplies (UPS)

If a system has to be available also in cases when the power grid is down and if there is demand for taking care of a reliable system shutdown in power failure situations an UPS is needed. We can propose also typical UPS solutions for the industrial market and we will show you in the following the range of available designs.

Line Interactive Solutions

As a typical solution with pure sine wave AC output, line interactive UPS systems are recommended for various applications to take care of power failures in industrial power grids.
It stabilizes the power in any IT installation.

- Wattage: 880W / 1.6kW / 2.4kW
- Chassis Designs: Rack / Tower
- Typical applications: systems with demand for availability in case of power failures (Industrial Workstations, Industrial Servers, Medical Systems)

Online Solutions

For higher demands in case of reliability, throughput and for Input Power Factor Correction and if it is necessary to also cover current fluctuations in the power grid, online systems are the more powerful and more reliable solutions.
Such systems can also be used in combination with generators and are recommended in real industrial power grids, like factories with many different machines with high lagging loads or even in generator grids.

- Wattage:
  800W / 1.6kW / 1.8kW / 2.4kW / 2.7kW / 4.8kW / 5.4kW
  8.0kW / 9.0kW / 16kW / 24kW / 30kW - 210kW
- Chassis Designs: Rack / Tower
- Typical applications: systems with demand for highest availability in case of power failures (Industrial Networks, Industrial Servers, Server Farms, Complete Networks)

Power Supply –
the Heart of the System

Industrial PC (IPC) Power Supplies

A typical IPC Power Supply is converting AC or DC voltage into the ATX standard output voltages, so that it can power up a standard Industrial Mainboard in mini-ITX, micro-ATX or ATX form factor used in all possible industrial applications. Under FSP IPC Power Supply portfolio, there are a lot of different form factors and power levels available. We also supply fanless ATX PSU, DC/DC ATX PSU, and specially designed PSU for POE or medical applications. The power consumption of the target system has to be investigated and calculated well. Also the chassis dimension and the cooling solution has to be considered in order to match with the Power Supply.

1U Form Factor

A 1U PSU is designed for 1U rack mount server or desktop chassis with a maximum height of 40.5 mm.

- Wattage: 250 W – 750 W
- 80 Plus Efficiency Levels: Standard/Bronze/Gold/Platinum
- Cable assembly: project based customization possible
- Medical versions available
- Typical applications: 1U 19” rack mountable systems (Industrial Servers, Telecom Devices)

2U Form Factor

With a height of max 70 mm, the 2U PSU is designed for 19” rack mountable systems with demand for more internal drive bays and more interface cards.

- Wattage: 300 W – 750 W
- 80 Plus Efficiency Levels: Standard/Bronze/Gold/Platinum
- Cable assembly: project based customization possible
- Typical applications: 2U 19” rack mountable systems (Industrial Servers, Network Appliances, Data Center)

Flex Form Factor

The Flex format is often used in small computer cases and sometimes called “mini-ITX” PSU. It can be used with a mini-ITX board, to reduce the system dimensions and so it is better for custom designs with its compact size. Now with Flex form factor we could achieve to supply up to 400W power max.

- Wattage: 100 W – 500 W
- 80 Plus Efficiency Levels: Standard/Bronze/Silver/Gold
- Cable assembly: project based customization possible
- Medical versions available
- Typical applications: small systems with mini-ITX boards (POS/POI, Digital Signage, Small IPC, KIOSK)

ATX PS/2

- The most popular form factor in the IT market is the typical ATX PSU, also called PS/2. Here we have the biggest portfolio up to 1.200 W for high performance workstations.
- Wattage: 250W – 1.200W
- 80 Plus Efficiency Levels: Standard/Bronze/Silver/Gold/Platinum
- Cable assembly: project based customization possible
- Medical versions available
- Typical applications: typical PC Systems and Workstations, mainly combined with ATX Boards (IPC’s, Industrial Automation, Industrial Workstations, Gaming)

Redundant Solutions

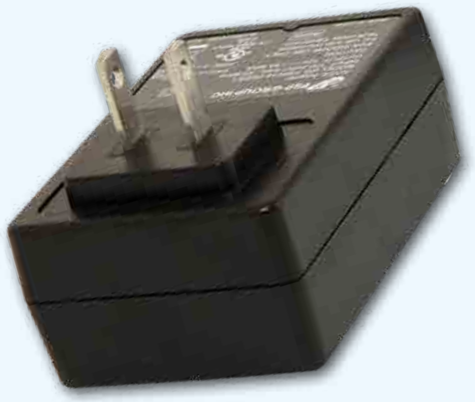
For a better fail-safe performance sometimes it is necessary to use a redundant PSU to take care of the system runtime in the maintenance of the PSU itself. So the second (redundant) part can take over the job from the down one. Therefor we provide several designs from slim compact 1U (1HE) form factor up to solutions for high performance servers or workstations with high power load up to 1.400 W. Interesting are also the versions in standard ATX PS/2 format with 190x150x86 mm, that can be used in standard ATX chassis.

- Wattage: 80 W – 1.400 W
- 80 Plus Efficiency Levels:Standard/Silver/Gold/Platinum
- Cable assembly:project based customization possible
- Typical applications: systems with demand for redundancy (Data Center, Networking, Surveillance, Storage Server, Broadcasting)

Power Supply –
the Heart of the System

AC/DC Adapter

Even when the PSU shouldn't be integrated into the system itself, an AC/DC adapter is recommended. So the variety of possible applications is huge, same as our adapter provided by FSP Group. In your daily life we can find external AC/DC power supplies everywhere e.g. for mobile phones, tablets or notebooks. Also a lot of medical devices are getting their power from AC/DC adapters. FSP AC/DC adapter wide range portfolio offers high efficiency, high altitude and slim size for special applications & medical application.



Wall Mount Adapters

The easiest and lightest way to bring the converted DC power to a system is a Wall Mount Adapter that is plugged into an AC wall socket with only one DC cable to the device.

- Wattage: 10W– 65W
- Output DC Voltages: 5V / 6V / 9V / 12V / 15V / 24V
- Medical versions available
- Typical applications: typical transportable systems and systems with special demands regarding EMC (Tablets, Charger, Medical Devices, Set-top Box)

Desktop Adapters

If more power is needed and if it is useful for the environment and the application itself, a Desktop Adapter is the more sufficient way to drive a device without integrating a PSU with DC voltages.

- Wattage: 15W – 250W
- Output DC Voltages:
  5V / 9V / 12V / 15V / 19V / 24V / 30V / 36V / 48V
- Medical versions available
- Typical applications: systems without an integrated PSU and a demand for more than 24W (Notebooks, Medical Devices, POS/POI, Digital Signage, Thermal Printer)

DC/DC Converters

To convert a Single voltage DC power into the ATX voltages for a Mainboard, a DC/DC converter might be the smallest and easiest solution. It can be mounted into small cases and approved together with the whole system. In combination with one of our AC/DC Adapters it could be an interesting solution to drive a mini-ITX board with ATX voltage input with an external PSU to reduce the size of the chassis.

- Wattage: 67W – 150W
- Input DC Voltages: 12V
- Output Voltages:
  ATX (+3.3V / +5V / +12V / -12V / 5V Stdby)
- Typical applications: systems without an integrated PSU and the demand for ATX voltages
  (POS/POI, Digital Signage, Industrial Printer Systems)

ITX Solutions

To integrate a PSU into a small custom chassis without external converters an ITX solution can fulfill the requirements better than any other solution. It combines the AC input with the ATX output voltages in an efficient way in one solution, suitable in small chassis.

- Wattage: 55W – 150W
- Output Voltages:
  ATX (+3,3V / +5V / +12V / -12V / 5V Stdby)
- Typical applications: systems with the demand for ATX voltages and less on space, where the PSU can't or shouldn't be external (Industrial Printer Systems, Small IPC's, Portables)

Other Open Frame Solutions

The more specific a system solution is designed, the more specific the PSU has to be. To cut down the costs for a fully custom design for an AC/DC converter, we offer a broad range of open frame solutions in 2" by 4" and smaller, with or without a metal case around. Many solutions are also available for the medical market.

- Wattage: 25W – 1.100W
- Output Single DC Voltages: diverse from 3.3V to 48V
- Output Multi DC Voltages: diverse from 3.3V to 48V in dual or triple voltage designs
- Typical applications: custom system designs with integrated PSU to drive Boards and peripheral components, like TFT's, thermal printers or FAN's (Medical Systems, Industrial, Automation, Gaming, Specific Systems with demand for DC voltages)

Open Frame Solutions

When it comes to specific custom chassis designs or voltage combinations, it can't be served from one of the former shown standards, an Open Frame PSU could be the best solution compared to a complete separate and fully custom designed PSU. The field of available solutions is various and there are many different combinations between AC or DC input and DC output possible. To give an idea about this area of PSU solutions we show in the following only the big range in general. To find the best compromise between size, power and availability, we support you in your projects as detailed as possible.

Server Components

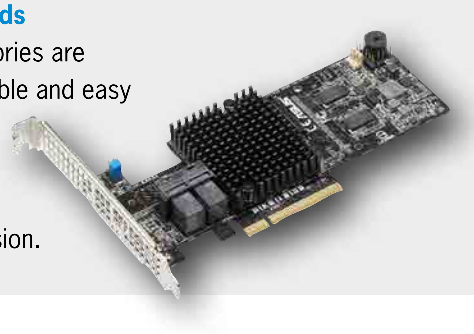
Server Mainboards & Accessories

Server Motherboards

ASUS server motherboards combine high-quality components, feature-rich design and superior in-house design expertise for your custom compute needs.

Server Motherboards

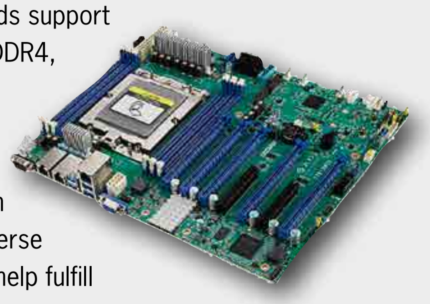
ASUS server accessories are compatible, dependable and easy to adopt, enabling smooth server-system performance upgrades and expansion.



Server Mainboards & Chassis

Server Motherboards

Advantech server boards support Intel Xeon Processor, DDR4, IPMI 2.0 with iKVM and Quad LANs features. Our server board enables various system configurations and diverse options of modules to help fulfill various field application.



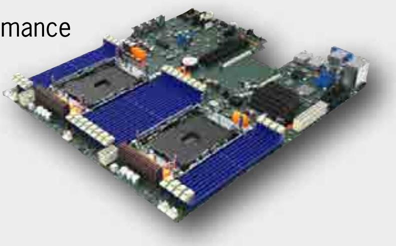
Server Chassis

From 1U to 4U Rackmount Server Chassis, Advantech aim to provide the best solutions and fulfill the most complex requests from different industrials. The tower chassis series are IPC chassis featuring enhanced storage and high-efficiency power supplies beneficial to Industrial server and application such as AOI.

Server Boards & Accessories

Server Boards

Optimized for high-performance computing, hyper-converged infrastructure, outstanding storage performance.



Whether customers need a server under their desk or a high-performance data center workhorse, Intel Server Boards deliver performance, security, and flexibility.

SAS/RAID

Intel® RAID solutions deliver custom storage options for a variety of business needs, at a range of price points.

Server Chassis

Built on a foundation of industry-leading, high-quality technology and with the purpose to work with Intel server boards and Intel Xeon processors to meet the most demanding compute use requirements.

Enterprise Hard Drives

Enterprise Performance HDD – AL Series

- 2.5'' SAS Hard Drive
- Dual-port SAS interface
- 24/7 operation
- 5-year warranty
- Unlimited workload (TB/year)
- MTTF of 2 mill. hours
- Persistent Write Cache technology
- Flexibility in block size and SIE and SED options

Use for:
Enterprise server & storage systems | Business database server with high workloads | Big data analytics | Virtualized storage systems

Enterprise Capacity HDD – MG Series

- 3.5'' SATA or SAS Hard Drive
- 24/7 operation
- 5-year warranty
- Toshiba Stable Platter Technology
- Persistent Write Cache technology
- 550 TB/year workload
- Rotational Vibrations sensor
- Flexibility in block size and SIE and SED options

Use for:
Enterprise server & storage systems | Enterprise storage arrays | Cloud & hyperscale storage systems | Big data, distributed file systems | Enterprise archive & data recovery systems | Industrial server & storage systems

Data Center SSDs

Explore drives optimized for real-world performance with industry-leading quality and reliability. Solidigm draws on decades of technical innovation to offer a broad portfolio of drives – all with industry-leading quality and reliability, optimized for the data center, the edge, and everything in between.

- **D7 Series:** SSD D7 Series drives are tuned for real-world mixed and performance-sensitive read workloads. The highest performing family of TLC 3D NAND SSDs delivers the right balance of speed, endurance, and capacity.
- **D5 Series:** The SSD D5 Series performance is optimized for read and sequential workloads. This value-optimized family of SSDs features capacities ranging from 960 GB to 30.72 TB.

Data Center SSDs

PCIE U.3 Data Center SSD

Swissbit's N4200 U.3 Data Center SSD enables server engineers to achieve reliable, high storage capacity that delivers consistently high performance and low latency. The N4200 is able to measure its respective workload. Thanks to this unique feature, the workload profile can be analyzed and the firmware configured accordingly, tailored to a specific workload profile, e.g. for web, streaming, application and cache servers.
The firmware optimally matched to the workload profile keeps write amplification low and improves endurance. This innovative approach is designed specifically to tackle complex cloud applications delivering the best and most consistent throughput and latency in the industry.

Server Components

Data Center SSDs

Data Center SSDs

KIOXIA Data Center SSDs which are equipped with flash memory, firmware and a controller developed by KIOXIA are suitable for cloud-based applications run in an industry standard server environment to be scaled out in a cloud. These data center SSDs are optimized for a balance of performance, low latency and data protection, and provide power loss protection (PLP) to safeguard data in case of unexpected power loss.

CD Series

- PCIe® / NVMe™ SSDs
- Scale-out and cloud applications
- 2.5“ / E3.S form factor
- Up to 15.36TB (2.5“) and 7.68TB (E3.S) capacity

XD Series

- EDSFF E1.S (9.5 / 15 mm) form factor
- Addresses specific requirements of hyperscale applications
- Performance, power and thermal requirements according to OCP Datacenter NVMe™ SSD Specification

Enterprise SSDs

Enterprise SSDs are suitable for high-performance Tier 0 computing, server and storage systems that require high levels of performance and reliability. KIOXIA Enterprise SSDs equip the flash memory and controller developed by KIOXIA and offer high reliability, data protection incorporating power-loss-protection (PLP) and encryption technology to support enterprise environments and applications. Light weight and low power consumption will make the systems more energy efficient.

FL Series

- Dual-port PCIe® 4.0/NVMe™ SSD
- Fast system response for latency-sensitive applications
- Server caching / write logging for enterprise & large data centers
- Read/write caching in tiered storage

CM Series

- Dual-port PCIe®/NVMe™ SSDs
- Capacities up to 30.72TB
- 2.5“ / E3.S form factor
- Power Loss Protection (PLP)
- Range of security/encryption options

PM Series

- Dual-port 24G SAS SSDs
- Capacities up to 30.72TB
- 2.5” (15 mm Z-height)
- Power Loss Protection (PLP)
- Range of security/ encryption options

DRAM Solutions

Industrial DRAM Solutions

RDIMM (ECC Registered DIMM) is a JEDEC-compliant design applicable for enterprise servers and cloud data centers. With a register between the memory module and the system's memory controller, the RDIMM improves overall system stability and increases memory module quantity.

Furthermore, it supports ECC function to detect and correct data errors, and a built-in temperature-monitoring thermal sensor to prevent overheating and improve the memory module's reliability.

Registered DRAM	2 GB	4 GB	8 GB	16 GB	32 GB	64 GB
DDR3 REG DIMM 1600 Mhz 0 °C- tp +85 °C			x			
DDR4 REG DIMM 2400 Mhz 0 °C- tp +85 °C		x	x	x		
DDR4 REG DIMM 2666 Mhz 0 °C- tp +85 °C		x	x	x		
DDR4 REG DIMM 3200 Mhz 0 °C- tp +85 °C		x	x	x	x	
DDR4 REG DIMM 3200 Mhz -40°C to +85°C			x	x	x	

x = ready to order at Rutronik

DRAM Solutions

Server-grade DRAM modules

Transcend offers a full range of high-performance and large-capacity memory solutions that meet the needs of cloud computing applications. These server-grade DRAM modules provide high transfer speeds, allowing large amounts of data to be moved efficiently.

Transcend's DRAM modules for servers feature built-in Error Correcting Code (ECC) that automatically detects and corrects transfer errors, increasing overall reliability. As servers operate continuously, temperature control is also essential.

Registered DRAM	2 GB	4 GB	8 GB	16 GB	32 GB	64 GB
DDR3						
DDR3 REG DIMM 1066 Mhz 0°C- +85°C			x			
DDR3 REG DIMM 1333 Mhz 0°C- +85°C	x		x	x		
DDR3 REG DIMM 1600 Mhz 0°C- +85°C		x	x			
DDR4						
DDR4 REG DIMM 2133 Mhz 0°C- +85°C			x	x		
DDR4 REG DIMM 2400 Mhz 0°C- +85°C		x	x	x		
DDR4 REG DIMM 2666 Mhz 0°C- +85°C		x	x	x	x	
DDR4 REG DIMM 2666 Mhz -40°C - +85°C				x	x	
DDR4 REG DIMM 3200 Mhz 0°C- +85°C			x	x	x	x
DDR4 REG DIMM 3200 Mhz -40°C - +85°C				x	x	
DDR5						
DDR5 REG DIMM 4800 Mhz 0°C- +85°C				x	x	

x = ready to order at Rutronik

DRAM Solutions

Server DRAM

While experiencing exponential expansion, storage server and cloud service providers also confront difficulties with data integrity, reliability, and other factors that are crucial to perpetual up-time. Boot drives, server DRAM, and other uncommon embedded form factors are areas of expertise for ATP.

Today, ATP is regarded as a strategic supplier by more than 70% of the businesses included in Gartner's Magic Quadrant reports for Primary Storage, Data Center and Cloud Computing, and WAN-Edge Infrastructure.

Registered DRAM	2 GB	4 GB	8 GB	16 GB	32 GB	64 GB
DDR3						
DDR3 REG DIMM 1066 Mhz 0°C- +85°C	x	x	x	x		
DDR3 REG DIMM 1333 Mhz 0°C- +85°C	x	x	x	x		
DDR3 REG DIMM 1600 Mhz 0°C- +85°C	x	x	x	x		
DDR3 REG DIMM 1866 Mhz 0°C- +85°C		x	x			
DDR4						
DDR4 REG DIMM 2133 Mhz 0°C- +85°C		x	x	x	x	
DDR4 REG DIMM 2400 Mhz 0°C- +85°C		x	x	x	x	
DDR4 REG DIMM 2666 Mhz 0°C- +85°C		x	x	x	x	
DDR4 REG DIMM 2666 Mhz -40°C - +85°C						
DDR4 REG DIMM 2933 Mhz 0°C- +85°C		x	x	x	x	
DDR4 REG DIMM 3200 Mhz 0°C- +85°C		x	x	x	x	x
DDR4 REG DIMM 3200 Mhz -40°C - +85°C						
DDR5						
DDR5 REG DIMM 4800 Mhz 0°C- +85°C						

x = ready to order at Rutronik

Server Components

Processors & FPGAs

Intel® Xeon® Scalable Processors

4th Gen Intel® Xeon® Scalable processors feature built-in accelerators and advanced security technologies for the most in-demand workload requirements – all while offering the greatest cloud choice and application portability.

Intel® Xeon® Platinum
Advanced 2, 4 & 8 socket performance, designed for the most demanding workloads & services from the edge to cloud.

Intel® Xeon® Gold
Up to 4 socket scalable performance, advanced reliability, and advanced security solutions.

Intel® Xeon® Silver
Performance and power efficiency for entry compute, network and storage.

Intel® Xeon® Bronze
Reliability and serviceability for small business and storage server solutions.

Intel® Xeon® CPU Max Series

Maximize bandwidth with the Intel® Xeon® CPU Max Series, the only x86-based processor with high-bandwidth memory (HBM).
Architected to supercharge the Intel® Xeon® platform with HBM, Intel® Max Series CPUs deliver up to 4.8x better performance compared to competition on real-world workloads, such as modeling, artificial intelligence, deep learning, high performance computing (HPC) and data analytics.

Intel® Xeon® Processors

Optimized performance, scale and efficiency across a broad range of data center, edge and workstation workloads. Elevate business productivity with the consistent open Intel® architecture you know and trust.

Intel® Xeon® W
Designed for creative professionals, delivering performance for VFX, 3D rendering, 3D CAD (workstation).

Intel® Xeon® D
Innovative system-on-a-chip processors for workload optimized performance at limited space and power.

Intel® Xeon® E
Essential, business-ready performance, expandability and reliability for entry server solutions.

Intel® FPGA Portfolio

Accelerate innovation with a comprehensive suite of innovative FPGA products unified by a single architecture, enhanced by Intel's design, software, and manufacturing leadership, with optimizations across all levels of performance, power efficiency, and form factor to address a wide breadth of workloads.

Server PSU

Redundant power solutions

for data center / cloud, storage server, 5G & AI applications.

Uninterruptable power supplies (UPS)

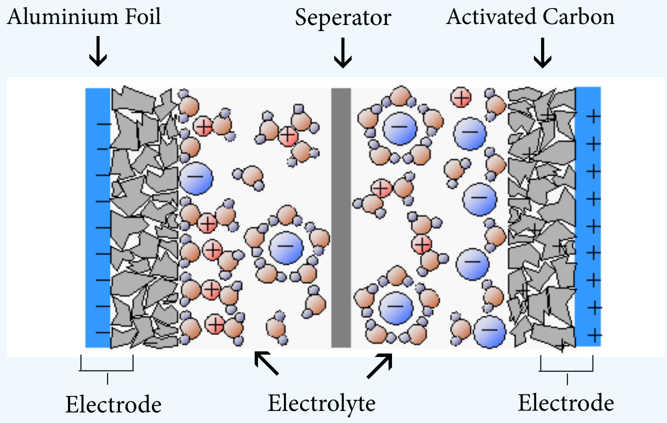
for the server room – highest power factor with the most compact size, modular design decreases MTTR and increases reliability of UPS system.

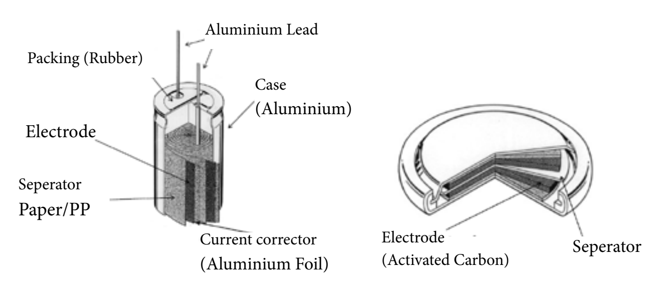
Server PSU

Delta offers some of the most energy efficient power products in the industry, including switching power supplies, telecom power, and PV inverters. Delta has also developed the world's first server power supply certified as 80 Plus Titanium.

Electric Double Layer Capacitors (EDLC)

Electric Double Layer Capacitors (EDLC) also known as Ultracapacitors or Supercapacitors are proven rechargeable alternative energy storage devices. The EDLC-technology is not a new one and was developed in the middle of the last century, but now the technology becomes more and more important and the number of different applications are uncountable. The Electric Double Layer Capacitors are mainly used in tandem with a battery but in some cases the real option is to replace the battery. The EDLCs are an ideal source of back-up and peak-power.





The charge in an Ultracapacitor is stored electrostatically by separating positive and negative charges. This means it is not a chemical reaction to store energy.

That is the reason why an Electric Double Layer Capacitor can be charged and discharged up to 1,000,000 times and much faster than a battery.

Basically, there are two different types of constructions: On the one hand the stacked and on the other hand the wound construction forms. The construction of the wound types is similar to the construction of ordinary radial electrolytic capacitors. Available with a maximum cell voltage between 2.1 and 3.3 V, capacities of up to 3400 F can be reached with these cells.

The stacked construction form called "coin types" generally offers a capacitor voltage of 5.5 V (integrating cells in row). Available with capacities of up to 1.5 F, these cells are used especially in RTC applications and as memory backup.

The key point of this technology is the special electrode with its surface coated with activated carbon.
The porous structure of this coating expands the surface significantly and allows a capacity up to thousands of Farad. The Electric Double Layer Capacitor does not have a typical dielectric rather it uses the electrolyte solution as a function of the dielectric.

Benefits

- Fast charge-/discharge cycles (only a few seconds)
- High charge-/discharge currents (up to hundreds of Amps)
- Long lifetime (up to over 1 million cycles)
- Very long operating lifetime (up to 10 years and even more)
- No memory effect
- Reliable operation in harsh environments
- Wide operating temperature range (-40 °C up to +85 °C)
- Virtually maintenance free
- Higher energy vs. electrolytic capacitors
- Higher power vs. batteries
- Series- and parallel-connection possible

Comparison to Batteries

Type	Batteries	EDLC	Conventional Capacitors
			
Time of Charge	1 to 5 h	0.3 to 30 s	10^{-3} to 10^{-6} s
Time of Discharge	0.3 to 3 h	0.3 to 30 s	10^{-3} to 10^{-6} s
Spec. Energy [Wh/kg]	20 to ~ 100	< 10	< 0.1
Lifetime [Cycles]	1,000	~ 1,000,000	~ 1,000,000
Spec. Power [W/kg]	< 1000	> 10,000	> 100,000
Efficiency	0.7 to 0.85	0.9 to 0.98	> 0.95

Electric Double Layer Capacitors (EDLC)

Typical Shapes

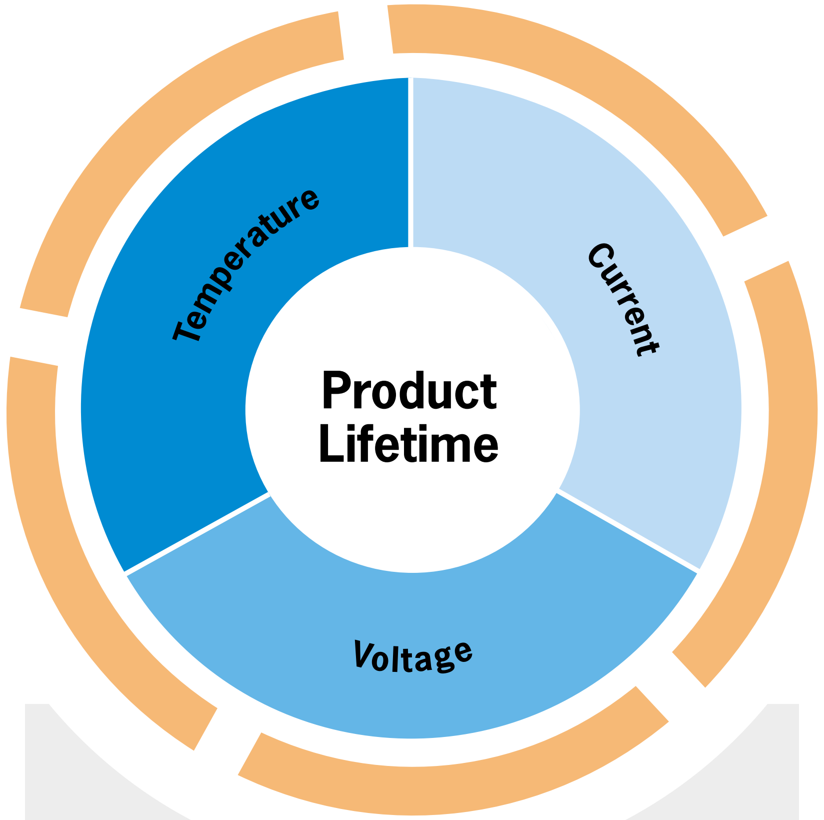
Technology	**Flatpacks / Pouch Cells**	**SMD**	**Coin**	**Radial / Leaded**	**Snap-In**	**Screw / Weldable**	**Module**
							
Capacitance	0.0068 F – 600 F	0.020 F – 0.47 F	0.047 F – 1.5 F	1.0 F – 100 F	100 F – 400 F	650 F – 3400 F	variable
Temperature	-20/-25 – 70/75/85 °C	-10/-25 – 60/70 °C	-25/-40 – 70/85 °C	-25/-40 – 60/65/70/85 °C	-25/-40 – 60/65/70/85 °C	-25/-40 – 60/65/85 °C	-40 – 60/65 °C
Operating Currents	mA / A	µA	µA / mA	mA / A	A	A	A

Portfolio

Technology	**Flatpacks / Pouch Cells**	**Coin**	**Radial / Leaded**	**Snap-In**	**Screw / Weldable**	**Module**
						
AVX	■		■	■	🟦	🟦
Eaton		■	■	■	■	■
Kemet		■	🟦			
Korchip		🟦	🟦	🟦		
Maxwell			🟦	🟦	🟦	🟦
SECH			■	■	■	■
Samwha			🟦	🟦	🟦	🟦
Vishay			🟦			
Examples	■ Barcode scanner ■ Metering ■ Personal locators (GPS/GSM) ■ Wireless modems	■ Backup of CMOS microcomputers ■ Memory backup ■ RTC ■ Metering	■ UPS ■ Garden light ■ Toys ■ Solar battery operated circuits ■ Metering ■ Emergency light	■ UPS ■ Wind mill ■ Electric car ■ Electric scooter ■ Power tools	■ UPS ■ Wind mill ■ Electric car ■ Electric scooter ■ Power tools	■ UPS ■ Wind mill ■ Electric car ■ Electric scooter ■ Power tools

■ Focus Supplier

🟦 Product Available



Lifetime Advantage over Batteries

The lifetime of an Electric Double Layer Capacitor is significantly affected by three factors: voltage, temperature and current.

Due to its construction and the very low-viscosity state-of-the-art electrolytic acetonitrile, electric double layer capacitors operate at very low voltages of 2.5 V – 3.3 V. Since overvoltages can decompose the electrolyte and thus irreversibly damage the capacitor, the EDLC should be operated only within its specifications. In order to obtain a positive influence on the service life over the voltage, it is recommended to operate the capacitor below its rated voltage.

Another critical factor related to the lifetime is the temperature - the ambient temperature and the resulting self-heating. The self-heating depends largely on the strength of the currents and the cycle frequency (charging and discharging). The higher the currents are and the higher the frequency of the cycles, the higher is the self-heating, which must be added to the ambient temperature in order to estimate the actual temperature load of the supercaps.

In a supercap, high temperatures lead to a decrease in capacity and an increase in the ESR over time. The higher the temperature (ambient temperature + self-heating), the faster the aging process progresses and the faster the so-called end-of-life criteria (ie 30% loss of capacity, doubling of the ESR) are achieved. It is important to know that the EDLC is functional even after reaching the end-of-life criteria.

Compared to batteries, the technology of the supercaps has a higher current carrying capacity as well as a higher cycle stability, which allow a significantly longer life of up to 10 years compared to batteries.

Storage & Memories – Linecard

Rutronik offers hard disks, flash memory, DRAM modules and optical drives in all technologies and sizes which are explicitly suitable for industrial applications. Hard disks still remain a popular medium for storing data securely for long periods. However, flash-based memory solutions are the first choice for applications which are exposed to stronger vibrations or shocks. A number of factors determine selection of the appropriate memory.

Suppliers

Apacer
ATP
goodram industrial
intel
KIOXIA
swissbit
SOLIDIGM
TEAC
TOSHIBA
Transcend

Storage

	Apacer	ATP	GoodRam	Intel	KIOXIA	Soldigm	Swissbit	Teac	Toshiba	Transcend
Memory Modules										
DDR1	■	■	■							■
DDR2	■	■	■							■
DDR3	■	■	■							■
DDR4	■	■	■							■
DDR5	■	■	■							■
Flash-Memory										
SD/microSD	■		■		■		■			■
Compact-Flash	■		■				■			■
CFast	■		■				■			■
Flash-Module (USB/PATA/SATA)	■						■			■
USB-Sticks	■		■				■			■
SSD 2.5"	■		■		■	■	■			■
mSATA	■		■		■	■	■			■
M.2	■		■		■	■	■			■
Add-in Card (AiC)					■	■				
EDSFF					■	■				
Persistent Memory Module				■						
Hard Disc Drive										
2.5"									■	
3.5"									■	
extern USB									■	■
Optical Drives										
CD-Drives for Audio/CE								■		
DVD-Drives								■		
BluRay-Drives								■		
Medical Recorder								■		
Accessories										
Card Reader										■

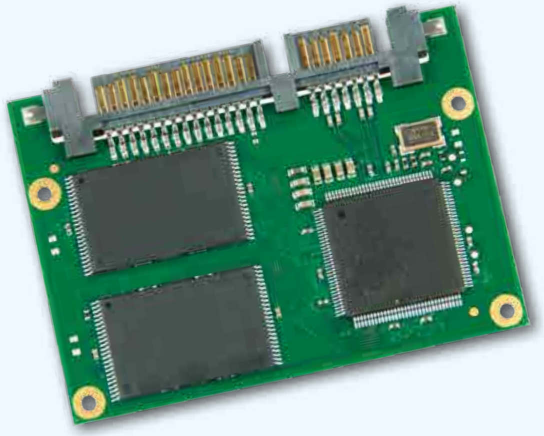
Suppliers

ALLIANCE MEMORY
Apacer
ATP
apmemory
ESMT / EliteMT
FUJITSU
聚辰半导体股份有限公司 Giantec Semiconductor Corporation
goodram industrial
infineon
INSIGNIS
intel
SK hynix
SOLIDIGM
KIOXIA
NANYA
ROHM
swissbit
Transcend
Zentel

Memories

Technology	Type	Alliance	Apacer	ATP	AP Memory	ESMT / EliteMT	Fujitsu	Giantec	Goodram	Infineon	Insignis	Intel	SOLIDIGM SK hynix	Kioxia	Nanya	Rohm	Swissbit	Transcend	Zentel
EEPROM	Serial							🟩								🟩			
ReRAM	Serial						🟩												
FRAM	I2C / SPI / Parallel / Exelon						🟩			🟩						🟩			
Flash	Serial NOR	🟩				🟩				🟩									
	Parallel NOR	🟩				🟩				🟩									
	Serial NAND	🟩				🟩								🟩					
	NAND					🟩								🟩					
	e·MMC™	🟩				🟩					🟩			🟩			🟩	🟩	
	UFS													🟩					
	SD / micro SD		🟧						🟧					🟧			🟧	🟧	
	Compact Flash / Cfast		🟧						🟧								🟧	🟧	
	Flash Module (USB/PATA/SATA)		🟧														🟧	🟧	
	Cfexpress		🟧														🟧	🟧	
	SSD (2.5"/mSATA/M.2)		🟧						🟧				🟧	🟧			🟧	🟧	
	EDSFF												🟧	🟧					
	Add-in Card												🟧	🟧					
	USB Sticks		🟧						🟧								🟧	🟧	
SDRAM	SDR	🟩				🟩					🟩					🟩			🟩
	DDR	🟩				🟩					🟩								🟩
	DDR2	🟩				🟩					🟩				🟩				🟩
	DDR3/DDR3L	🟩				🟩					🟩				🟩				🟩
	DDR4	🟩				🟩					🟩				🟩				🟩
	DDR5														🟩				
	LPSDR	🟩				🟩													
	LPDDR	🟩				🟩													
	LPDDR2	🟩				🟩									🟩				
	LPDDR3					🟩									🟩				
	LPDDR4/4X	🟩				🟩									🟩				
	Pseudo SRAM / IoT RAM / HyperRAM	🟩			🟩					🟩									
	SDRAM Module																	🟧	
	DDR Module		🟧	🟧					🟧									🟧	
	DDR2 Module		🟧	🟧					🟧									🟧	
	DDR3 Module		🟧	🟧					🟧									🟧	
	DDR4 Module		🟧	🟧					🟧									🟧	
	DDR5 Module		🟧	🟧					🟧									🟧	
SRAM	Low Power	🟩								🟩									
	Fast	🟩								🟩									
	Synchronous	🟩								🟩									
	NVRAM	🟩						🟩		🟩									
3D Xpoint	M.2 /2,5"											🟧							
	Add-in Card											🟧							
	Persistent Memory Module											🟧							

🟧 Embedded devices
🟩 Removeable devices



What Really Counts for a Flash Card

Unfortunately, it happens far too often that flash cards from one and the same manufacturer sometimes fail in an application. How is it possible, that one card works in an application and another one suddenly fails in the same application, although according to the product code, it is the same card?

There is a simple and plausible answer to this question.

A flash card's function has four main characteristics which must be considered: The PCB, the Flash Chips, the controller and the firmware. The so-called bill of materials (BOM).
When these 4 components are put together you have a finished flash card that is ready for use.

In the industry, before an application goes into production, a sample is tested to establish the functionality. If the tests are
successful, the item will be approved for purchase by the development department. If a batch should suddenly have a BOM that differs from the tested sample, the card may completely fail in the application owing to incompatibility.
This can be compared with a small faulty cog in a large mechanism.

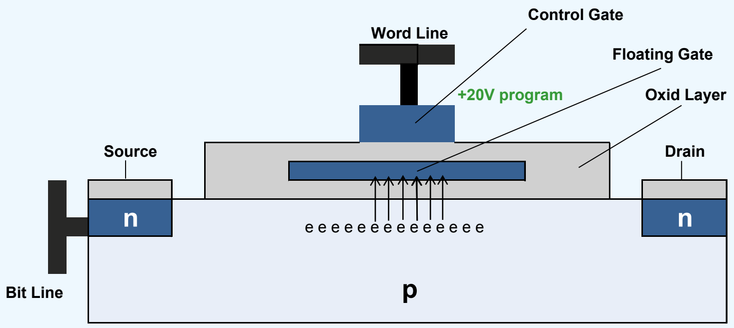
In other words: production stops and significant costs result. This is not just a theoretical scenario. Almost all manufacturers frequently change their BOM to reduce costs, without publishing this or marking the items. Without further ado, new firmware is introduced for example, or a new controller, which can have catastrophic consequences in certain applications. Cards from manufacturers like these are not suited for industrial applications.

The leading manufactures Swissbit and Apacer have by contrast addressed this problem and have focussed on the industrial market.

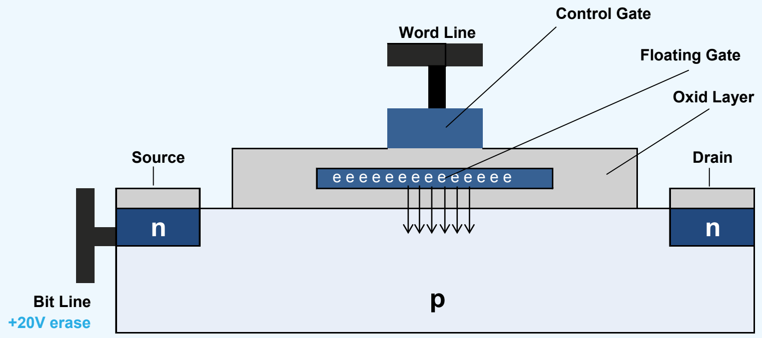
They offer special industrial compact flash cards and guarantee a fixed bill of materials, so that all of the cards supplied will be identical to the tested samples with no changes being made without a published product change notification (PCN).

To guarantee and check this continuity, Swissbit item designations, specify exactly which controller and which flash chips etc. are used. If anything in the BOM is changed, the item designation is also changed.

In addition to the fixed BOM, Swissbit and Apacer exclusively use flash chips with SLC technology as, in contrast to the cheaper MLC technology, these are suitable for industrial use due to longer life, higher speed, lower error rate and lower power consumption.



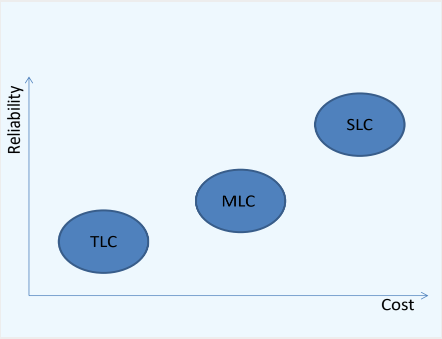
Program of a Flash Cell



Erase of a Flash Cell

Flash Type	SLC	pSLC	MLC	TLC	pSLC	TLC	QLC
	2D	2D	2D	2D	3D	3D	3D
Bit per cell	1 Bit	1 Bit	2 Bit	3 Bit	1 Bit	3 Bit	4 Bit
ECC requirement (up to)	40bit	48bit	48bit	72bit	120bit	120 bit	160 bit
Program/Erase PEcycle	60k - 100k	20k	3k	500	20k - 50k	300 - 3k	250
Industrial Temperature Range	x	x	x		x	x	
Fixed BOM (Bill of Materials	x	x	x		x	x	
Cost advantage per GB		+	++	+++	++	++++	+++++
Longevity products	+++	+	+		++	++	
Write Performance	++++++	++++	++	+	+++++	+++	

NAND Flash Technology
(Reliability vs. Cost)



SLC	PSLC	MLC	TLC	QLC
1	1	11	111	1111
				1110
			110	1101
				1100
		10	101	1011
				1010
			100	1001
				1000
0		01	011	0111
				0110
			010	0101
				0100
	0	00	001	0011
				0010
			000	0001
				0000

Founded in 1997

Headquartered in Taiwan

Offices in 6 countries

580+ employees worldwide

Production in own manufactory

**ISO 9001, ISO 14001,
OHSAS 18001, IECQ CQ080000**

Apacer – Industrial Memory Solutions

Apacer Technology offers a wide range of industrial SSDs, digital consumer products, and memory modules. With its strong R&D, design, manufacturing, and marketing, the company has become a leading global manufacturer in the industry. Apacer is devoted to implementing our core value "Becoming Better Partners" and continually creates innovative, diversified storage solutions and hardware/software integration services for various industries.

Storage Technologies – Overview


M.2 SSD


1.8" / 2.5" SSD


mSATA/mSATA mini


Half-slim SSD


Flash Modules


SDXC 128 GB


micro SDXC (WT)
128 GB


Industrial
CH710-CF


Industrial
SH250-CFast

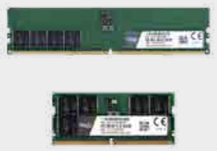

USB Sticks

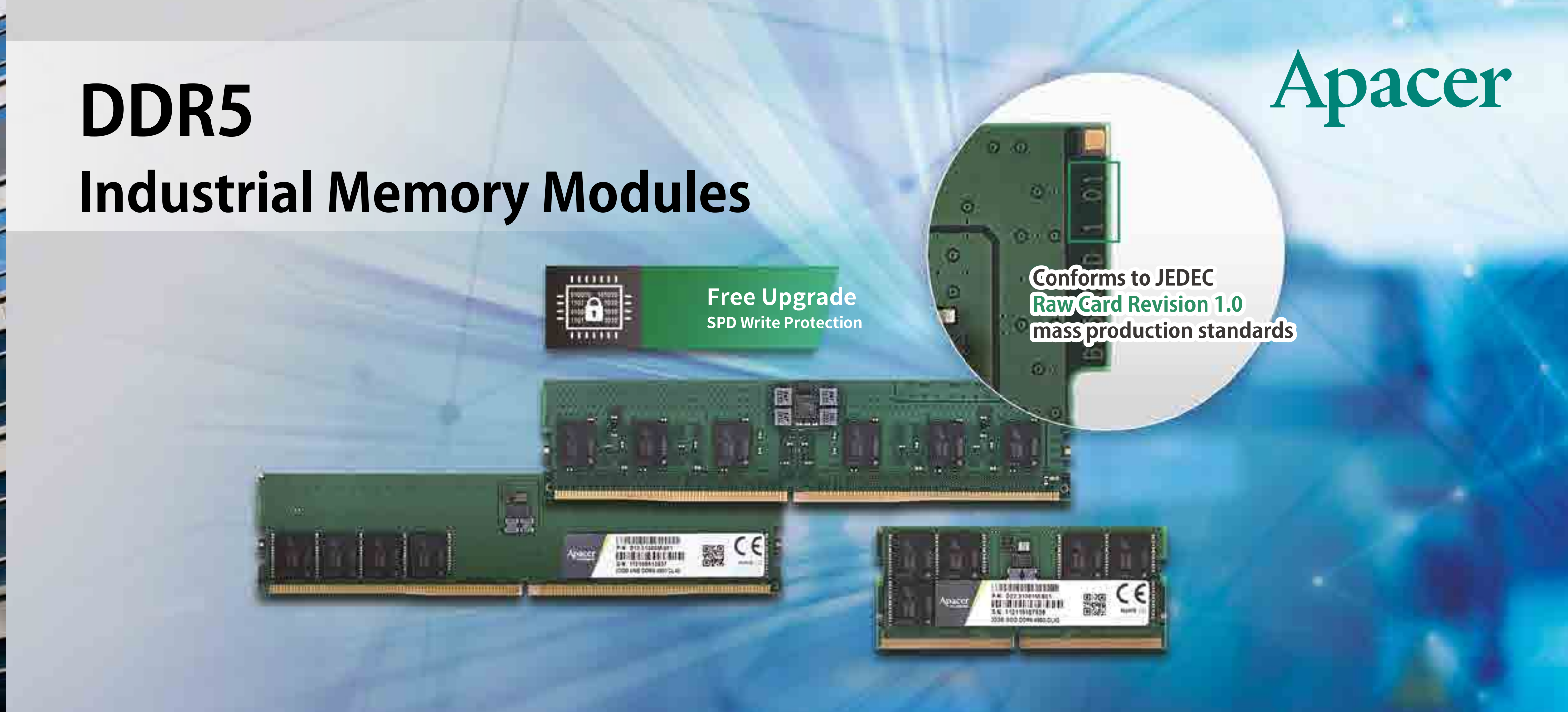

DDR


DDR2


DDR3


DDR4


DDR5



DDR5
Industrial Memory Modules

DRAM Module

Apacer's DRAM module technology development is focused on vertically integrating know-how in the semiconductor industry, which allows it to manufacture memory modules that satisfy the requirements of both quality and performance, yet can be easily integrated into various platforms. As leading memory module maker, Apacer has long been devoted to the industrial computer field, particularly the embedded systems.

Anti-Sulfuration

PATENTED

Anti-sulfuration memory modules are mainly used in equipment exposed in highly contaminated environment.

- World's first anti-sulfuration memory modules
- Solves corrosion problems effectively and increases overall system lifespan
- Ensures product reliability and durability
- Widely recognized and awarded patents in many countries

Underfill

Apacer underfill technology ensures products continue to operate normally in high vibration and in extreme environmental conditions.

- Strengthens the solder joints between solder balls and printed circuit board
- Increases the product's resistance against shock and vibration
- Reduces thermal stress damage
- Complies with MIL-STD-810G
- Increases product reliability and lifespan

Conformal Coating

**Enhances reliability of products by applying coatings on the surface of printed circuit boards.
The protective film can safeguard devices from dust ingression and liquid immersion.**

- Uses automated spraying to maintain precise
- coating thickness
- Enhances product reliability
- Prolongs DRAM modules lifespan

Wide Temperature

Especially designed for harsh climates and special environmental conditions.

- Operating temperature range: -40 °C ≤ TC ≤ 85 °C
- All industrial-grade components
- (DRAM, resistors and capacitors) ensure stability
- and reliability
- High/Low temp. test/Temp.cycling test
- Power cycling test

Industrial SSD & DRAM Solutions

For Factory Automation Applications

Factory automation provides a compelling way to boost quality, efficiency, sustainability and security. Developing truly independent automated facilities requires not only components with incredible reliability and robust designs, but also excellent data integrity. In order to meet the demands of the factory automation industry, Apacer offers high-performance industrial SSD and memory solutions, and provides a variety of value-adding technologies to help ensure reliability, stability and data integrity.

Featured Technologies for Factory Automation Applications

Anti-Sulfuration

Apacer's world's first patented anti-sulfuration DRAM modules and anti-sulfuration SSDs with the industry's highest level of anti-corrosion ANSI/ISA 71.04 G3 Certification can meet the needs of industrial products facing harsh environments.

SLC-liteX

Apacer's 3D NAND SLC-liteX technology breaks through the limitations of existing technology and provides up to 100,000 P/E cycles, which is over 33 times more than MLC or industrial 3D TLC.

Data Integrity

· CoreSnapshot

Power Stability

· CorePower
· DataDefender™

Longevity

· SLC-liteX
· Over-provisioning
· Fixed BOM
· 6+6 PCN/EOL Policy

Survivability

· Anti-Sulfuration
· Conformal Coating
· Nano Coating (IP57)
· Sidefill
· Wide Temperature

Recommended Industrial SSD Solutions

Model	PV220-M280	PV220-M242	SV240-25	SV24P-25	SV250-M280	SV24P-M280	SH250-M242	SV250-300
Features	**Anti-Sulfuration, CoreGlacier™**	**DataDefender™**	**AES 256-bit Encryption**	**CorePower**	**CoreSnapshot, Anti-Sulfuration**	**CorePower**	**AES 256-bit Encryption, High Endurance, SLC-liteX**	**AES 256-bit Encryption, TCG Opal 2.0, Write Protect Switch**
Form Factor	M.2 2280	M.2 2242	2.5″	2.5″	M.2 2280	M.2 2280	M.2 2242	JEDEC MO-300
Interface	PCIe Gen3 x4	PCIe Gen3 x4	SATA 3.2 (6Gb/s)	SATA 3.2 (6Gb/s)	SATA 3.2 (6Gb/s)	SATA 3.2 (6Gb/s)	SATA 3.2 (6Gb/s)	SATA 3.2 (6Gb/s)
Connector	M.2 M Key	M.2 M Key	(7+15) pin	(7+15) pin	M.2 B & M Key	M.2 B & M Key	M.2 B & M Key	52-pin mSATA
NAND Flash Type	3D TLC							
Capacity	120~1920 GB	240~960 GB	120~1920 GB	120~1920 GB	30~1920 GB	120~1920 GB	10~160 GB	30~1920 GB
External DRAM	No	No	Yes	Yes	No	Yes	No	No
Max. R/W Performance (MB/sec)	2350/2230	2390/2205	560/505	560/495	560/520	560/495	560/520	560/515
Standard Operating Temp. (°C)	0 ~ + 70	0 ~ + 70	0 ~ + 70	0 ~ + 70	0 ~ + 70	0 ~ + 70	0 ~ + 70	0 ~ + 70
Wide Temp. (°C)	- 40 ~ + 85	- 40 ~ + 85	- 40 ~ + 85	- 40 ~ + 85	- 40 ~ + 85	- 40 ~ + 85	- 40 ~ + 85	- 40 ~ + 85
MTBF (Hours)	>3,000,000	>3,000,000	>3,000,000	>3,000,000	>3,000,000	>3,000,000	>3,000,000	>3,000,000
Recommended Applications	Motor Automation		IPC		Wafer Die Cutting		CNC System	Wire Processing System, Semiconductor Manufacturing Equipment

Model	SV250-CFast	Industrial SD R1	CH120-MSD	Industrial CF6A	CH710-CF	UV110-UFD1	UH110-UFM1
Features	**TCG Opal 2.0, Write Protect Switch**		**High Endurance, SLC-liteX (CH120-MSD)**		**High Endurance, SLC-liteX**	**Bidirectional Security Identification**	**High Endurance, SLC-liteX**
Form Factor	CFast	SD	Micro SD	CompactFlash Type I	CompactFlash Type I	USB Flash Drive	USB Disk Module
Interface	SATA 3.2 (6Gb/s)	SD 3.0	SD 6.1	PC Card Memory Mode; PC Card I/O Mode; True IDE Mode	PC Card Memory Mode; PC Card I/O Mode; True IDE Mode	USB 3.1 Gen1	USB 2.0
Connector	(7+17) pin	-	-	50-pin	50-pin	USB Type A Plug	10-pin (2x5) Female Header in 2.54mm
NAND Flash Type	3D TLC	SLC	3D TLC	SLC	3D TLC	3D TLC	3D TLC
Capacity	30~480 GB	512MB, 1~16 GB	16~128 GB	256MB ~ 32GB	8~64 GB	16~256 GB	8~32 GB
External DRAM	No	-	-	No	No	No	No
Max. R/W Performance (MB/sec)	560/515	43/41	90/80	60/65	115/80	260/125	41/25
Standard Operating Temp. (°C)	0 ~ + 70	-	-25 ~ + 85	0 ~ + 70	0 ~ + 70	0 ~ + 70	0 ~ + 70
Wide Temp. (°C)	- 40 ~ + 85	- 40 ~ + 85	- 40 ~ + 85	- 40 ~ + 85	- 40 ~ + 85	-40 ~ + 85 *Not supported on 16GB	- 40 ~ + 85
MTBF (Hours)	>3,000,000	>3,000,000	>3,000,000	>2,000,000	>3,000,000	>3,000,000	>3,000,000
Recommended Applications	Factory Machine Controller	Robot, Semiconductor Manufacturing Equipment, Inspection equipment		Semiconductor Manufacturing Equipment, Factory Machine Controller		Welding, Solar Energy, Charging, Farming Ventilation	

Recommended Industrial DRAM Solutions

Module Type	UDIMM	SODIMM	ECC UDIMM	ECC SODIMM	UDIMM	SODIMM	ECC UDIMM	ECC SODIMM
Memory Technology	DDR4	DDR4	DDR4	DDR4	DDR5	DDR5	DDR5	DDR5
Frequency	2133/2400/2666/2933/3200				4800			
Density	2GB/4GB/8GB/16GB/32GB		4GB/8GB/16GB/32GB		8GB / 16GB / 32GB		16GB / 32GB	
Voltage	1.2v	1.2v	1.2v	1.2v	1.1V	1.1V	1.1V	1.1V
Pin Count	288-Pin	260-Pin	288-Pin	260-Pin	288-Pin	262-Pin	288-Pin	262-Pin
Width	64-Bit	64-Bit	72-Bit	72-Bit	64-Bit	64-Bit	72-Bit	72-Bit
PCB Height	1.23"	1.18"	1.23"	1.18"	1.23"	1.18"	1.23"	1.18"
Operation / Wide Temperature. (°C)	TC= 0 to 85 / -40 to 85	TC= 0 to 85 / -40 to 85	TC= 0 to 85 / -40 to 85	TC= 0 to 85 / -40 to 85	TC= 0 to 85	TC= 0 to 85	TC= 0 to 85	TC= 0 to 85
Value-added Technology	Wide Temperature Underfill * Conforma Coating * Anti-Sulfuration *		30μ Gold Finger Thermal Sensor Wide Temperature Underfill * Conforma Coating * Anti-Sulfuration *		30μ Gold Finger * Underfill * Conforma Coating * Anti-Sulfuration *		30μ Gold Finger Thermal Sensor Underfill * Conforma Coating * Anti-Sulfuration *	

*Optional

MADE IN GERMANY

Certificates:

IATF 16949 – ISO 9001 - ISO 14001 – ISO 27001 - ISO 50001

Swissbit – Reliable Storage & Embedded IoT Solutions

Data is the fuel of the future and is driving global growth and change. As trusted partner Swissbit empowers the digital and connected world by reliably storing and protecting data in industrial, security and IoT applications. As a leader in industrial storage and embedded IoT (Internet of Things) solutions, Swissbit develops and manufactures true industrial storage and security products "Made in Germany" with long-term availability, high reliability, custom optimization and low total cost of ownership.

Product Categories


2.5" SATA SSD


PCIe SSD Modules


SATA Modules


USB Products

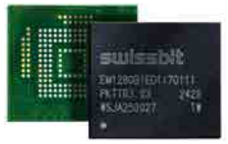

SD Cards


microSD Cards


CFexpress Cards


CFast Cards


CF Cards


eMMC


PCIe BGA


Security Products

Swissbit Market Segments

Industry

Netcom

IoT

Automotive

Swissbit System Competency

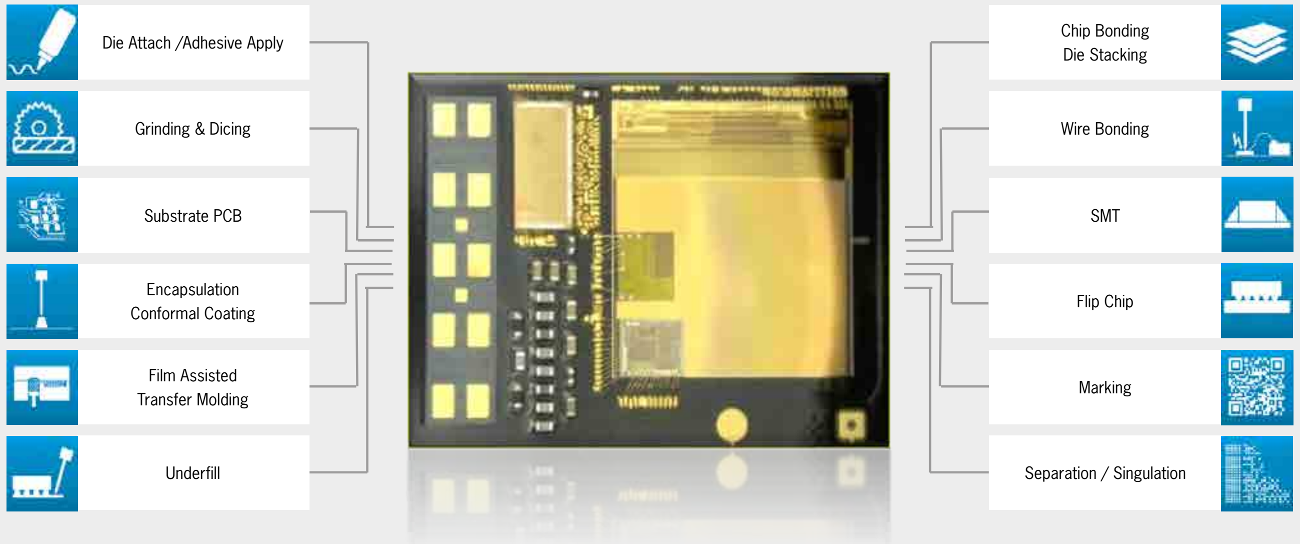
Swissbit owns all core processes from the conception to volume production of our products. This allows us to design and produce optimal solutions for demanding applications.


Conception
Development
Verification
Qualification
Production & Test
Supply Chain Service

MADE IN GERMANY

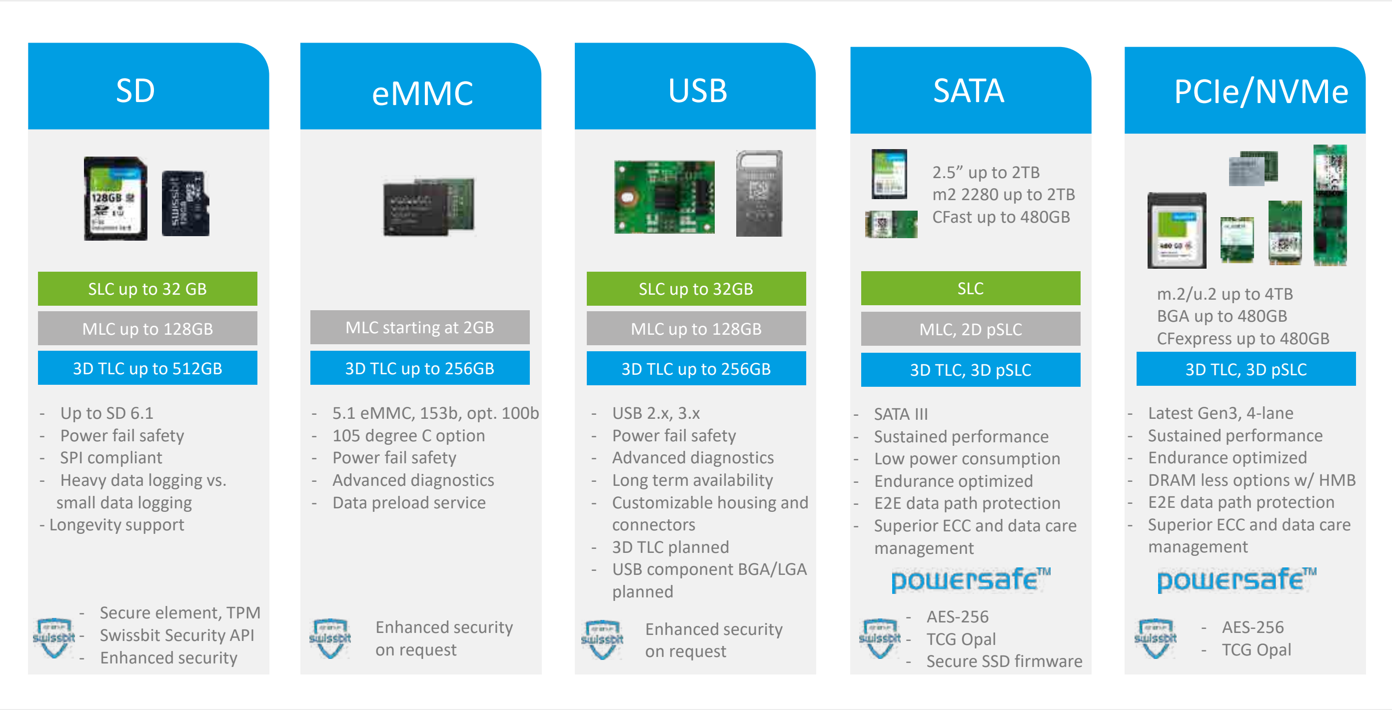
System-in-Package

System-in-Package (SiP) is the umbrella term for using advanced packaging and assembly technologies to integrate and test sensitive bare silicon dies or chips (active circuits) and supporting components (passives) into robust finished modules or components. Together with integrated software or firmware this will create a fully functional system solution.



Swissbit 3D NAND Products

OEM's of various industries require a variety of memory and storage solutions. In contrast to typical consumer devices, Swissbit's embedded memory and storage solutions are designed for highest reliability under extreme environmental conditions. They come with a large feature set tailored to the demands of the industrial, automotive, and Netcom markets and with our commitment to longterm availability. Swissbit's embedded memory and storage solutions portfolio covers all relevant interfaces and form factors including SD and microSD memory cards, CompactFlash™ and CFast™ cards, 2.5" SATA SSDs, SLIM SATA and mSATA SSDs, M.2 in SATA and PCIe NVMe, USB Flash Drives (UFD) and modules. Our sophisticated flash handling algorithms optimize performance and life of the SLC, MLC and 3D NAND flash used in our products.



SD	eMMC	USB	SATA	PCIe/NVMe
			2.5" up to 2TB m2 2280 up to 2TB CFast up to 480GB	m.2/u.2 up to 4TB BGA up to 480GB CFexpress up to 480GB
SLC up to 32 GB		SLC up to 32GB	SLC	
MLC up to 128GB	MLC starting at 2GB	MLC up to 128GB	MLC, 2D pSLC	
3D TLC up to 512GB	3D TLC up to 256GB	3D TLC up to 256GB	3D TLC, 3D pSLC	3D TLC, 3D pSLC
- Up to SD 6.1 - Power fail safety - SPI compliant - Heavy data logging vs. small data logging - Longevity support	- 5.1 eMMC, 153b, opt. 100b - 105 degree C option - Power fail safety - Advanced diagnostics - Data preload service	- USB 2.x, 3.x - Power fail safety - Advanced diagnostics - Long term availability - Customizable housing and connectors - 3D TLC planned - USB component BGA/LGA planned	- SATA III - Sustained performance - Low power consumption - Endurance optimized - E2E data path protection - Superior ECC and data care management	- Latest Gen3, 4-lane - Sustained performance - Endurance optimized - DRAM less options w/ HMB - E2E data path protection - Superior ECC and data care management
			powersafe™	powersafe™
- Secure element, TPM - Swissbit Security API - Enhanced security	Enhanced security on request	Enhanced security on request	- AES-256 - TCG Opal - Secure SSD firmware	- AES-256 - TCG Opal

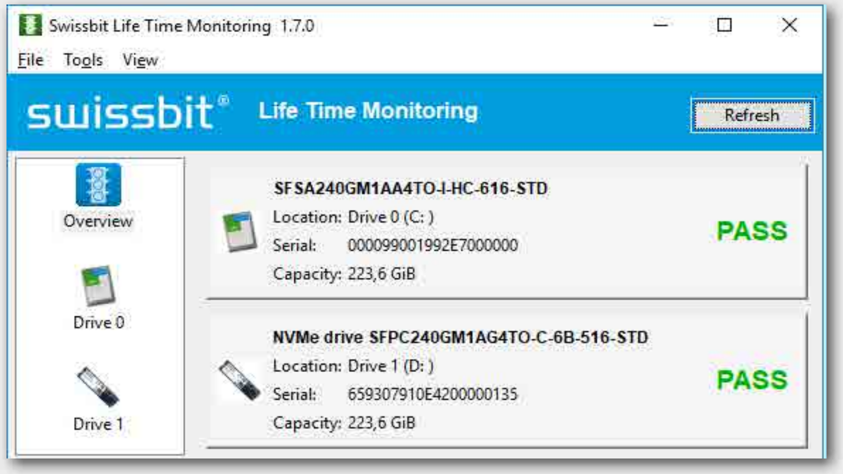
Swissbit Life Time Monitoring

The Swissbit Life Time Monitoring Tool (SBLTM) provides a detailed overview of the life time status of Swissbit products.

This includes the standard S.M.A.R.T. parameter as well as down to the single block Flash utilization numbers.

The tool can be used to extrapolate the life time expectation of a product in a real application by taking two snapshots before and after the test and evaluating the consumption through the test phase.

Download: www.swissbit.com/en/support/sbltm



SFSA240GM1AA4TO-I-HC-616-STD
Location: Drive 0 (C:)
Serial: 000099001992E7000000
Capacity: 223,6 GiB
PASS

NVMe drive SFPC240GM1AG4TO-C-6B-516-STD
Location: Drive 1 (D:)
Serial: 659307910E4200000135
Capacity: 223,6 GiB
PASS

Swissbit Security Products

Swissbit offers unique hardware security for reliably protecting data and devices. Swissbit's modular security products are based on standard interfaces and offer system manufacturers a range of hard-ware-based cyber security solutions for the protection of data and devices. Security products are variations of storage products with various security features. The security product series in USB, microSD, and SD form factors address the growing demand for mobile, portable and industrial security. They offer unique hardware security which is very suitable for retrofit and updates in the field.

iShield Products

Secure Data, Video and Photo Recording

The microSD card Swissbit iShield Camera is a simple and retrofittable security solution especially for the encryption and access protection of video recordings. It is host-independent, i.e. plug-and-play, and can be used with a large number of camera types. The solution also includes the "iShield Camera Card Tool" (iCCT) software.

Security Editions

Easy-to-integrate and Retrofittable Hardware-based Security Products

Swissbit provides easy-to-integrate and retrofittable hardware-based security products together with software development kits (SDK) and customization services, enabling manufacturers to offer systems with secured devices, secure data storage, and secure data communication.

Standard Edition SE	Premium Edition PE	Data Protection DP
The Standard Edition SE fits best into authentication and PKI (Public Key Infrastructure) use cases.	The Premium Edition PE combines high end smartcard security with state of the art data protection.	The Data Protection DP cards and USB drive offer AES encrypted data protection.

Raspberry Pi Edition

Secure Boot Solution for Raspberry Pi

The Swissbit Secure Boot Solution for Rasberry Pi allows encryption and access protection of data stored on the microSD card by various configurable security policies. It protects the boot image and software installation against manipulation, unwanted copying, or removal of a system from a defined network The Swissbit Secure Boot Solution for Raspberry Pi consists of a Swissbit PS-45u DP microSD card "Raspberry Edition" and a Swissbit Secure Boot SDK for Raspberry Pi with secured devices, secure data storage, and secure data communication.

- Founded in 1988
- Headquartered & made in Taiwan
- 13 offices worldwide
- Provider of various embedded flash and DRAM products
- Local sales & support in Germany
- Monthly production 10M pcs
- Guaranteed quality & reliability
- Efficient life-cycle-management
- Customized solutions for any application

Transcend – Good Memories Start Here

Transcend Information Inc. was founded 1988 by Peter Shu. It is headquartered in Taipei, Taiwan. Today, Transcend has become a leading global brand of digital storage, multimedia and industrial products with 13 offices worldwide. All products are designed, developed, manufactured, tested and sold inhouse. Highest quality, professional service and the ability to quickly respond to the market's changing needs are the main focus of the company.

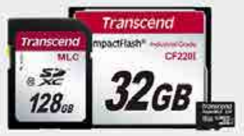
Complete Product Portfolio

Our Products Fulfill All Your Storage Needs

SSD Solutions

DRAM Modules

Flash Memory Modules



Memory Cards

Embedded Memory Cards & e.MMC Memory Solutions

SD Cards	microSD Cards	CompactFlash and CFast Cards	e.MMC
Capacities: 2GB - 1TB	Capacities: 2GB - 512GB	Capacities: 512MB - 256GB	Capacities: 8GB - 32GB
Temperature: -25°C up to 85°C (Wide Temp. : -40°C up to 85°C)	Temperature: -25°C up to 85°C (Wide Temp. : -40°C up to 85°C)	Temperature: -5°C up to 70°C (Extended Temp. : -25°C up to 85°C Wide Temp. : -40°C up to 85°C)	Temperature: -25°C up to 85°C
NAND Flash Technologies: TLC, MLC, SLC mode	NAND Flash Technologies: TLC, MLC, SLC mode	NAND Flash Technologies: MLC, SLC, SLC mode	NAND Flash Technologies: TLC, MLC

Advanced Technologies

Durability:

112-layer 3D NAND Flash

96-layer 3D NAND Flash

SLC Mode

30µ" PCB Gold Finger

Early Move

Over-Provisioning

Read Disturbance

Garbage Collection

Wear Leveling

TRIM

Bad Block Management

Reliability:

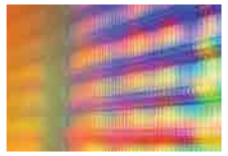
Conformal Coating

Corner Bond

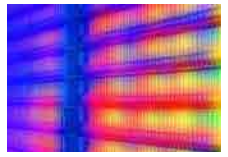
Underfill

Extended Temperature

Wide Temperature



Dynamic Thermal Throttling

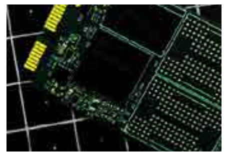


Thermal Sensor

Anti-Sulfur Technology

Security:

AES Encryption



Hardware Purge

TCG Opal

Stability:

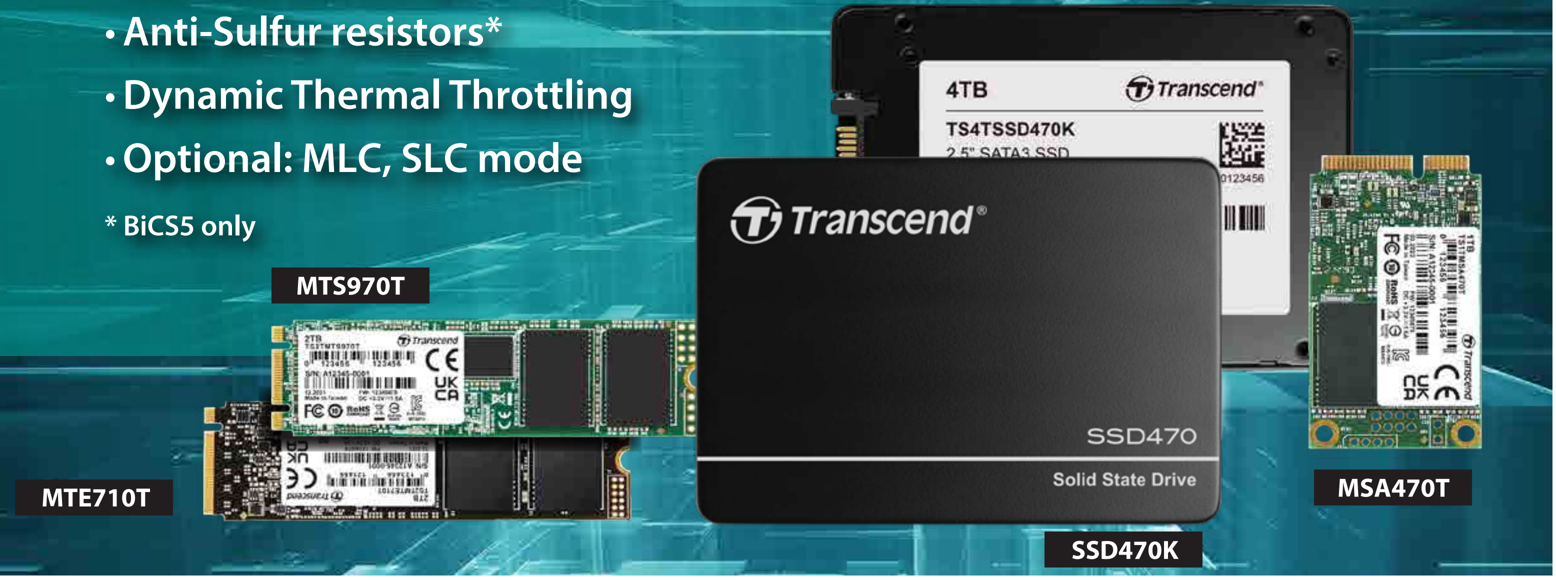
Power Loss Protection (PLP)

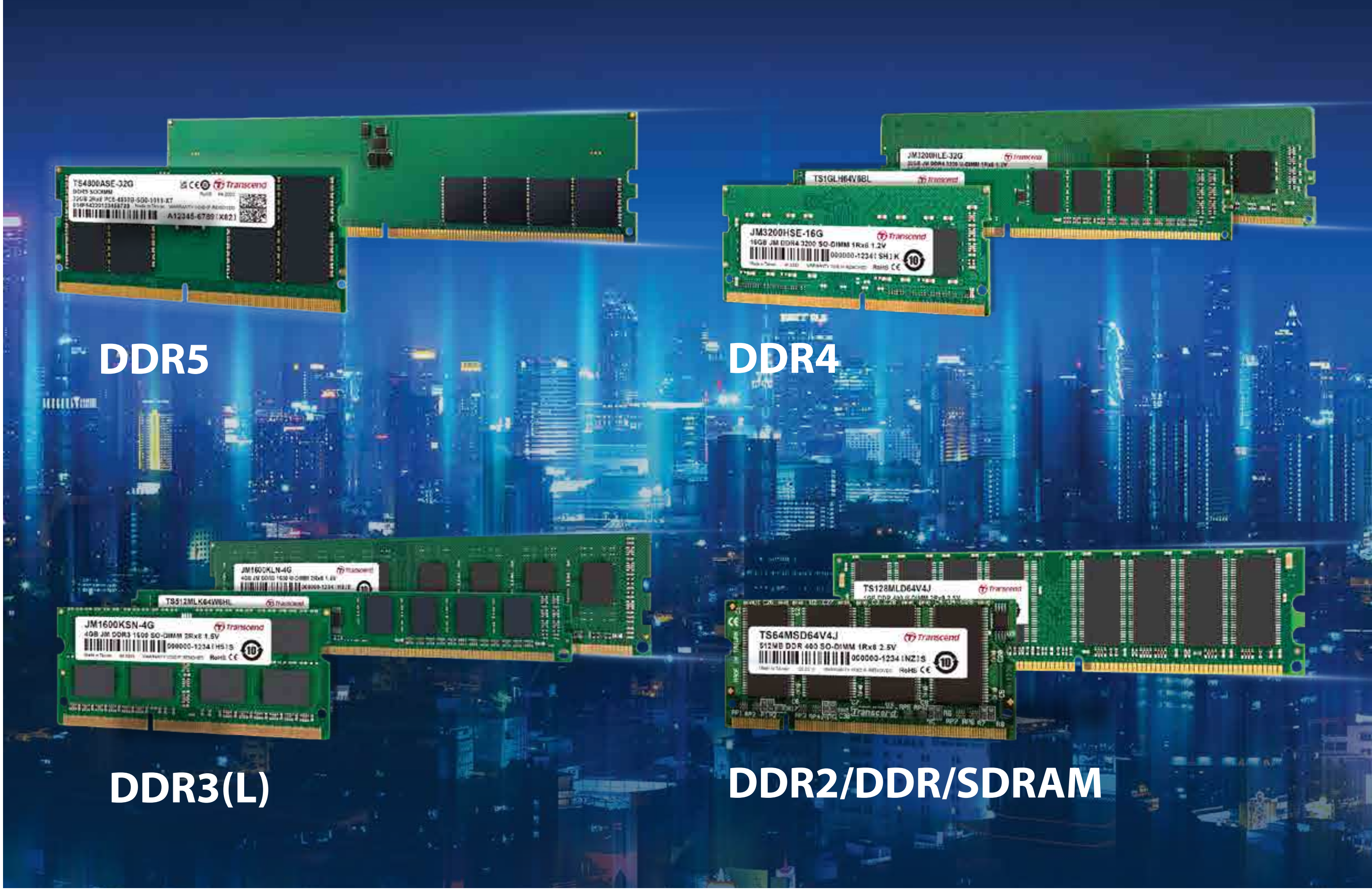
Power Shield (PS)

Key features of Transcends BiCS5 and BiCS4 SSDs

- BiCS5 112-layer write performance UP 50% compared to BiCS4
- Extended temp. (-20°C - 75°C), optional wide temp. (-40°C - 85°C)
- Corner Bond (Controller + DRAM)
- 30µ" PCB Gold Fingers
- Anti-Sulfur resistors*
- Dynamic Thermal Throttling
- Optional: MLC, SLC mode

* BiCS5 only





Flash Types

Transcend®

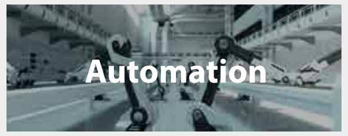
Type	3D TLC BiCS5	3D TLC BiCS4	3D TLC SLC Mode BiCS4	MLC	MLC SLC Mode
Layer	112-Layer	96-Layer	96-Layer	-	-
Endurance (P/E Cycles)	3.000	3.000	50.000	3.000	30.000
Bit per Cell	3	3	1	2	1
Performance	■■	■	■■■■	■■	■■■
Cost	■	■	■■■	■■	■■■
Features	For price sensitive applications, that need high endurance/ performance	Suitable for SSDs and most embedded applications	High endurance solution that substitutes SLC	Majorly used in SSD and most embedded applications	More affordable than SLC, better performance than MLC

Embedded Applications - Transcend products are widely used in various areas of industry

- In-Vehicle Infotainment System
- Navigation System

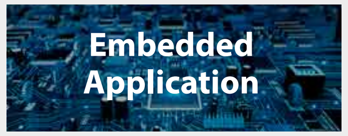
- Medical Tablet
- MRI and Ultrasound System

- Data Center Server
- Video Streaming Server

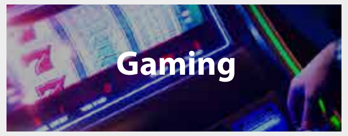


- Robot Control
- Process Control Unit and Terminal

- Rugged PC and Laptop
- Ground Control and Communication Station



- Industrial and Panel PC
- Fanless PC



- Slot Machine
- VR / AR Gaming Machine

- Smart Manufacturing Factory
- Self-service Store

DRAM Modules

Transcend®

Wide Temperature (-40 to 95 Grad)	Server / Workstations	Standard	Low Profile
DRAM Generation			
DDR4, DDR3(L), DDR2	DDR5, DDR4, DDR3(L), DDR2	DDR5, DDR4, DDR3(L), DDR2	DDR4, DDR3(L), DDR2
Modul Type			
U-DIMM	ECC-DIMM	U-DIMM	U-DIMM
SO-DIMM	ECC SO-DIMM	SO-DIMM	ECC DIMM
ECC-DIMM	R-DIMM		R-DIMM
ECC SO-DIMM			
Frequency			
DDR4: 3200, 2666, 2400, 2133	DDR5: 4800	DDR5: 4800	DDR4: 3200, 2666, 2400, 2133
DDR3(L): 1866, 1600, 1333	DDR4: 3200, 2666, 2400, 2133	DDR4: 3200, 2666, 2400, 2133	DDR3(L): 1600, 1333
DDR2: 800, 667	DDR3(L): 1866, 1600, 1333	DDR3(L): 1866, 1600, 1333, 1066	
	DDR2: 800, 667, 400	DDR2: 800, 667, 533	

Toshiba Memory is now KIOXIA

Our company name has changed. But our product range, quality, service and reliability are still the same.

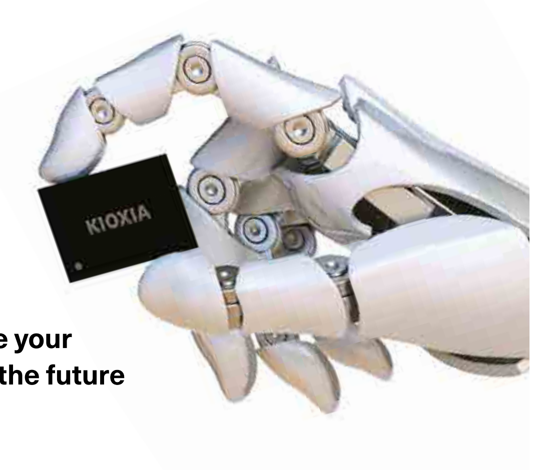
KIOXIA Europe GmbH (formerly known as Toshiba Memory Europe GmbH) is the European based subsidiary of KIOXIA Corporation, a worldwide leading supplier of Flash Memory, Solid State Drives (SSDs) and Retail Products (USB, Memory Cards, SSDs).

Toshiba Memory is known as the inventor of NAND flash memory in 1987 and was the first in the world to begin mass-producing it in 1991. Under its new name, KIOXIA remains a storage leader today with its BiCS FLASH™ 3D technology, focusing on innovation, quality and reliability. This technology is an important component in almost all electronic devices where data need to be stored. KIOXIA is leading a new era by providing advanced memory solutions to enrich people's lives. By evolving "memory", KIOXIA creates uplifting experiences and changes the world.

A new start with a new unique name

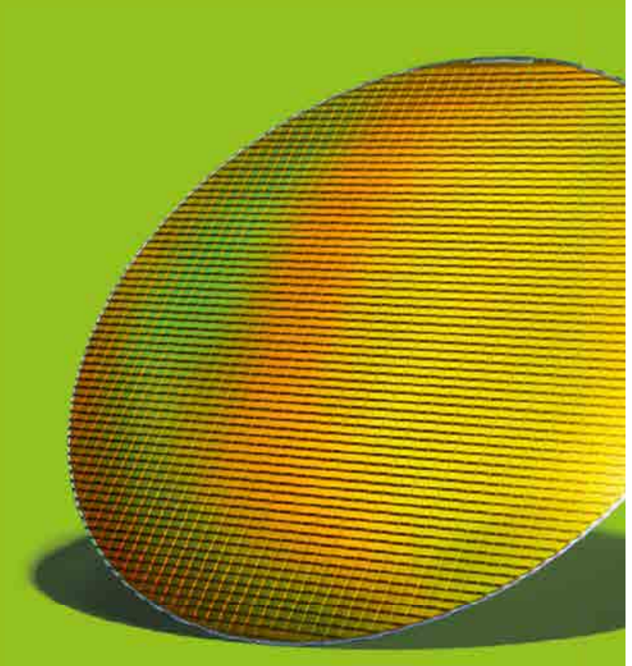
The name KIOXIA is a merger of two different words: the Japanese word kioku means "memory" and the Greek word axia means "value".

How to pronounce KIOXIA?



Store and save your memories for the future with KIOXIA

The Inventor of Flash Memory



Made in Japan

WORLD'S LARGEST FABRICATION*

All KIOXIA flash memory wafer manufacturing is done in Japan (Yokkaichi and Kitakami).

HIGH QUALITY & RELIABILITY

With stringent quality control, we are dedicated to providing high quality products.

100% IN-HOUSE FLASH MEMORY

KIOXIA flash memory is used in 100% of our consumer memory and storage products.

BG4 Series

Client SSD

The BG4 series is a line-up of compact single package NVMe™ SSDs with capacities up to 1,024 GB, and leverages a PCIe® Gen3x4 interface and KIOXIA's 96-layer TLC BiCS FLASH™. With higher bandwidth and improved flash management and Host Memory Buffer (HMB) technology, BG4 SSDs deliver best-in-class read performance in single package SSDs, of up to 2,300 MB/s (sequential read) and up to 390K IOPS (random read), with active power consumption of up to 3.7 W (Typ.).

The BG4 series is available in four capacities of 128 GB, 256 GB, 512 GB and 1,024 GB in surface-mount M.2 1620 single package or removable M.2 2230 module form factor options, making them suitable for thin and light system designs for ultra-thin PCs, as well as embedded devices and server boot in data centers.

The BG4 series is with the option of a Self-Encrypting Drive (SED) model* supporting TCG Opal Version 2.01.

*Availability of the SED model line-up may vary by region. The specification of BG4 self-encrypting drive (SED) will be released Q3 calendar year of 2019.

Product image may differ from the actual product.

Key Features

- KIOXIA 96-Layer BiCS FLASH™
- PCIe® Gen3 x4 NVMe™
- Capacities up to 1,024 GB
- M.2 1620 single package and M.2 2230 single-sided form factor
- TCG OPAL 2.01 Optional for SED

Key Applications

- Ultra-mobile PCs
- 2-in-1 notebook PCs
- IoT/embedded devices
- Server and storage array boot drives

XG6 Series

Client SSD

The XG6 series utilizes KIOXIA's latest 96-layer, 3D TLC (3-bit-per-cell) flash memory. With 4th generation BiCS FLASHTM and SLC cache features, XG6 SSDs reach up to sequential read/write speeds of 3180 MB/s and 2960 MB/s respectively and deliver up to 355,000 random read and 365,000 random write IOPS. In addition to high performance, XG6 carries on the low power design of the XG family, consuming 4.7 W or less in active mode and less than 3 mW in stand-by mode.

The new XG6 series is optimized for power-sensitive mobile PCs, performance-oriented gaming PCs, as well as data center environments for server-boot, caching and logging.

Available in a compact M.2 2280 single-sided form factor, the XG6 series comes in three capacity models of 256 GB, 512 GB and 1,024 GB, each with the option of a Self-Encrypting Drive (SED) model supporting TCG Opal Version 2.01.

Product image may differ from the actual product.

Key Features

- KIOXIA 96-Layer BiCS FLASH™
- PCIe® Gen3 x4, NVMe™
- Capacities up to 1,024 GB
- M.2 2280 Single-sided
- TCG OPAL 2.01 Optional for SED*

Key Applications

- Thin performance notebook PCs
- High-performance desktop PCs
- Gaming PCs
- Server-boot, caching & logging use in data centers

* Availability of the SED model line-up may vary by region.

Client SSDs

Leveraging state-of-the-art BiCS FLASH™ 3D flash memory with in-house designed controllers and firmware, KIOXIA client SSDs come in a variety of form factors, including a compact and lightweight "single-package SSD." They also offer a variety of capacities, performance and security options, and are well-suited for mobile computing, desktop PCs and workstations.

XG6 Series
PCIe® / NVMe™ SSD
M.2 2280

XG6-P Series
PCIe® / NVMe™ SSD
M.2 2280

BG4 Series
PCIe® / NVMe™ SSD
M.2 2230

BG4 Series
PCIe® / NVMe™ SSD
M.2 1620

Product image may differ from the actual product.

XG6 Series

Utilizing 96-layer BiCS FLASH™ 3D flash memory, the XG6 Series is available in an M.2 2280, single-sided form factor with a PCIe® Gen3 x4 interface, supporting the NVMe™ command set. This provides a powerful combination power efficiency and high performance, consuming 4.7 W or less with over 3,000 MB/s sequential read performance, respectively. The XG6 Series offers a Self-encrypting Drive (SED) option that supports TCG Opal version 2.01, under a different model number.

Model Number	Security Feature	Interface	Form Factor	User Capacity (GB) *1	Performance (up to) *2		Typical Power Consumption (W)	Operating Temperature (˚C)	Dimensions H / W / L (mm)	Typical Weight (g)	Power Supply Voltage (V)
					Sequential Read (MB/s)	Sequential Write (MB/s)					
KXG60ZNV256G	–	PCIe® Gen3 x4	M.2 2280	256	3,050	1,550	4.0	0 to 85	2.23 / 22.15 / 80.15	7.0	3.3
KXG60ZNV512G				512	3,100	2,800	4.1			7.3	
KXG60ZNV1T02				1,024	3,180	2,960	4.7				

XG6-P Series

Utilizing 96-layer BiCS FLASH™ 3D flash memory, the XG6-P Series is available in capacities up to 2,048 GB and has higher sequential write bandwidth than the previous generation. This series is designed for high-end workstations, gaming systems and for cost-optimized composable data center infrastructures. The XG6-P Series offers a Self-encrypting Drive (SED) option that supports TCG Opal version 2.01, under a different model number.

Model Number	Security Feature	Interface	Form Factor	User Capacity (GB) *1	Performance (up to) *2		Typical Power Consumption (W)	Operating Temperature (˚C)	Dimensions H / W / L (mm)	Typical Weight (g)	Power Supply Voltage (V)
					Sequential Read (MB/s)	Sequential Write (MB/s)					
KXG60PNV2T04	–	PCIe® Gen3 x4	M.2 2280	2,048	3,180	2,920	4.7	0 to 85	2.23 / 22.15 / 80.15	7.3	3.3

BG4 Series

In a compact, single-package form factor and based on 96-layer BiCS FLASH™ 3D flash memory, the BG4 Series is designed for thin and light performance-oriented use cases, such as ultra-mobile PCs, IoT devices and data center server boot. Available in capacities up to 1 TB, this series features Host Memory Buffer (HMB), PCIe® Gen3 x4 interface and supports the NVMe™ command set. The BG4 Series offers a Self-encrypting Drive (SED) option that supports TCG Opal version 2.01, under a different model number.

Model Number	Security Feature	Interface	Form Factor	User Capacity (GB) *1	Performance (up to) *2		Typical Power Consumption (W)	Operating Temperature (˚C)	Dimensions H / W / L (mm)	Typical Weight (g)	Power Supply Voltage (V)
					Sequential Read (MB/s)	Sequential Write (MB/s)					
KBG40ZNS128G	–	PCIe® Gen3 x4	M.2 2230	128	2,000	800	3.4	0 to 85 (T_{SMART})	2.23 / 22.15 / 30.15	2.5	3.3
KBG40ZNS256G				256	2,200	1,400	3.6				
KBG40ZNS512G				512			3.5				
KBG40ZNS1T02				1,024	2,300	1,800	3.7		2.38 / 22.15 / 30.15	2.6	
KBG40ZPZ128G			M.2 1620	128	2,000	800	3.0		1.30 / 16.15 / 20.15	0.85	3.3 / 1.8 / 1.2
KBG40ZPZ256G				256	2,200	1,400	3.2				
KBG40ZPZ512G				512			3.1				
KBG40ZPZ1T02				1,024	2,300	1,800	3.4		1.50 / 16.15 / 20.15	1.00	

*T_{SMART} : Composite Temperature in SMART/Health Information

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*1 : Definition of capacity: KIOXIA defines a megabyte (MB) as 1,000,000 bytes, a gigabyte (GB) as 1,000,000,000 bytes and a terabyte (TB) as 1,000,000,000,000 bytes. A computer operating system, however, reports storage capacity using powers of 2 for the definition of 1GB = 2^30 = 1,073,741,824 bytes and therefore shows less storage capacity. Available storage capacity (including examples of various media files) will vary based on file size, formatting, settings, software and operating system, such as Microsoft Operating System and/or pre-installed software applications, or media content. Actual formatted capacity may vary.

*2 : Read and write speeds may vary depending on the host device, read and write conditions, and file size.

- Optional security feature compliant drives are not available in all countries due to export control and local regulations.

All information provided in this catalog is subject to change without any prior notice. For the latest and detail specification, please send an inquiry through the "Contact us" form in each region's website, https://business. kioxia.com/

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- NVMe™ and NVM Express™ are trademarks of NVM Express, Inc.
- All other company names, product names, and service names mentioned herein may be trademarks of their respective companies.

Data Center SSDs

Leveraging state-of-the-art BiCS FLASH™ 3D flash memory with in-house designed controllers and firmware, KIOXIA data center SSDs are designed for cloud-based applications running on scale-out cloud and traditional server deployments. These data center SSDs are optimized for a balance of performance, low latency and data protection, and provide power loss protection (PLP)*1 to safeguard data in case of unexpected power loss.

XD5 Series
PCIe® / NVMe™ SSD
M.2 22110

XD5 Series
PCIe® / NVMe™ SSD
2.5 inch

HK6 Series
SATA SSD
2.5 inch

Product image may differ from the actual product.

XD5 Series

Based on 64-layer BiCS FLASH™ 3D flash memory, the XD5 Series of PCIe® Gen3 x4 / NVMe™ SSDs is available in an M.2 Type 22110 or a 2.5 inch (7mm Z-height) form factor with capacities up to 3.84 TB and <7 W of active power consumption.

Model Number	DWPD *3	Interface	Form Factor	User Capacity (GB) *4	Performance (up to)				Typical Power Consumption (W)	Operating Temperature (˚C)	Dimensions H / W / L (mm)
					Sequential (128 KiB) (MB/s)		Random (4 KiB) (KIOPS)				
					Read	Write	Read	Write			
KXD5YLN13T84	< 1	PCIe® Gen3 x4	M.2 22110	3,840	2,700	815	240	21	< 7 W	0 to 70	3.88 / 22.15 / 110.15
KXD51LN11T92				1,920		895	250				
KXD51RUE3T84	1	PCIe® Gen3 x4	2.5 inch (7 mm Z-height)	3,840	2,700	815	240	21	< 7 W	0 to 70	7.2 / 70.1 / 100.75
KXD51RUE1T92				1,920		895	250				
KXD51RUE960G				960							

*KXD5YLN13T84 (3,840GB) is Sanitize Instant Erase (SIE) model. Regarding SIE feature, please refer to *2 note. *Regarding XD5 series performance, please refer to *9 notes.

HK6-R Series / HK6-V Series

The HK6-R Series of 6 Gbit/s SATA SSDs is built with 64-layer BiCS FLASH™ 3D flash memory, and comes in a 2.5 inch (7 mm Z-height) form factor and capacities up to 7.68 TB. The HK6-R Series delivers a balance of reliability, performance and low power, and is designed for read-intensive workloads running on servers. The HK6-V Series of 6 Gbit/s SATA SSDs is built with 64-layer BiCS FLASH™ 3D flash memory, and comes in a 2.5 inch (7 mm Z-height) form factor and capacities up to 3.84 TB. The HK6-V Series delivers a balance of reliability, performance and low power, and is designed for mixed workloads running on servers and hyperconverged systems.

Model Number	DWPD *3	Interface	Form Factor	User Capacity (GB)	Performance (up to)				Typical Power Consumption (W) *8	Operating Temperature (˚C)	Dimensions H / W / L (mm)
					Sequential (128 KiB) (MB/s) *5 *6		Random (4 KiB) (KIOPS) *5 *6 *7				
					Read	Write	Read	Write			
KHK61RSE7T68	1	SATA 6 Gbit/s	2.5 inch (7 mm Z-height)	7,680	550	530	83	23	5.5	0 to 70	7.2 / 70.1 / 100.4
KHK61RSE3T84				3,840			84	24			
KHK61RSE1T92				1,920				22			
KHK61RSE960G				960			85	18	5.0		
KHK61RSE480G				480		450	82	20	4.0		
KHK61VSE3T84	3	SATA 6 Gbit/s	2.5 inch (7 mm Z-height)	3,840	550	530	83	54	5.5	0 to 70	7.2 / 70.1 / 100.4
KHK61VSE1T92				1,920			84	55			
KHK61VSE960G				960				54	5.0		
KHK61VSE480G				480		450	82	43	4.0		

*There is no optional lineup which has security features in the HK6-V and HK6-R series.

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*1 : PLP (Power Loss Protection): PLP supports the recording of data in buffer memory into flash memory, utilizing back up power of a capacitor in case of unexpected power loss.

*2 : Optional security features
  - PM5 and 2.5 inch of CM5 Series offer a range of security options; Sanitize Instant Erase (SIE), Self-Encrypting Drive (SED), and Self-Encrypting Drive (SED) with FIPS 140-2 validation or compliance. The Add-in card version of the CM5 has SIE and SED options.
  - Drive models with different security options have different part numbers.
  - The Sanitize Instant Erase (SIE) option supports Crypto Erase, which is a standardized feature defined by the technical committees (T10) of INCITS (the Inter National Committee for Information Technology Standards) or by NVM Express Inc..
  - SED (Self-Encrypting Drive) SSDs support TCG Enterprise SSC or TCG Opal SSC (Unsupported features are included in CM5 / SED optional model).
  - FIPS drives are designed to comply with FIPS 140-2 Level 2, which defines "Security Requirements for Cryptographic Modules" by NIST (the National Institute of Standards and Technology). PM5 Series is validated, CM5 series is planning to make FIPS 140-2 validated drives available.
  - For more details and the latest validation status of CM5 Series, please send an inquiry through the "Contact us" form in each region's website, https://business.kioxia.com/
  - Optional security feature compliant drives are not available in all countries due to export control and local regulations.

*3 : DWPD: Drive Write Per Day. One full drive write per day means the drive can be written and re-written to full capacity once a day every day for five years, the stated product warranty period. Actual results may vary due to system configuration, usage and other factors.

*4 : Definition of capacity: 1 terabyte (1 TB) = 1,000 gigabytes (GB), 1 GB = 1,000,000,000 (10^9) bytes

*5 : A kibibyte (KiB) means 2^10, or 1,024 bytes.

*6 : The performance specifications of the PM5 Series is based on testing in dual-port mode, running at 14 W of power. The performance of the CM5 Series is based on single-port mode (1x4).

*7 : Read and Write speeds may vary depending on the host device, read and write conditions, and file size.

*8 : IOPS: Input Output Per Second (or the number of I/O operations per second)

*9 : The PM5 Series can operate in a range of power modes: 9 W, 12 W, 14 W, 18 W (for MultiLink). The CM5 Series can operate in a range of power modes: 9 W, 11 W, 14 W, 16 W, 18 W.

Customers must refer to and comply with the latest versions of all relevant KIOXIA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the KIOXIA Reliability Handbook and the instructions for the application with which the Product will be used with or for.

All information provided in this catalog is subject to change without any prior notice. For the latest and detail specification, please send an inquiry through "Contact us" in each region's website, https://business. kioxia.com/

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- NVMe is trademark of NVM Express, Inc.
- MultiLink SAS is a trademark of the SCSI Trade Association.
- All other company names, product names and service names mentioned herein may be trademarks of their respective companies.

Enterprise SSDs

Leveraging state-of-the-art BiCS FLASH™ 3D flash memory with in-house designed controllers and firmware, KIOXIA enterprise SSDs optimize high performance, endurance and reliability to run mission critical applications in enterprise data center environments. To meet the demands of highly transactional and high-bandwidth workloads, these SSDs feature high levels of performance and data protection with power-loss-protection (PLP)*1. KIOXIA enterprise SSDs offer a range of security options*2 designed for business critical data storage.

PM5 Series
SAS SSD
2.5 inch

CM5 Series
PCIe® / NVMe™ SSD
2.5 inch

BiCS FLASH™

Product image may differ from the actual product.

PM5 Series

Based on 64-layer BiCS FLASH™ 3D flash memory, the PM5 Series of dual-port 12 Gb/s SAS SSDs is available in a 2.5 inch (15 mm Z-height) form factor with capacities up to 15.3 TB. These SSDs feature Power Loss Protection (PLP) and offer a range of security/encryption options.*2.

Model Number	DWPD *3	Interface	Form Factor	User Capacity (GB) *4	Performance (up to)				Typical Power Consumption (W) *9	Operating Temperature (˚C)	Dimensions H / W / L (mm)
					Sequential (128 KiB) *5 *6 *7 (MB/s)		Random (4 KiB) *5 *6 *7 *8 (KIOPS)				
					Read	Write	Read	Write			
KPM51MUG3T20	10	SAS-3.0, single/dual port and MultiLink SAS™ support	2.5 inch	3,200	2,100	2,100	385	230	9 / 12 / 14	0 to 60	15.0 / 70.1 / 100.45
KPM51MUG1T60				1,600			370				
KPM51MUG800G				800			340				
KPM51MUG400G				400		1,260	270	150			
KPM51VUG6T40	3	SAS-3.0, single/dual port and MultiLink SAS™ support	2.5 inch	6,400	2,100	2,100	385	120	9 / 12 / 14	0 to 60	15.0 / 70.1 / 100.45
KPM51VUG3T20				3,200			370				
KPM51VUG1T60				1,600			340				
KPM51VUG800G				800		1,260	270	80			
KPM51VUG400G				400	1,470	680	180	70			
KPM51RUG15T3	1	SAS-3.0, single/dual port and MultiLink SAS™ support	2.5 inch	15,360	2,100	2,100	300	35	9 / 12 / 14	0 to 60	15.0 / 70.1 / 100.45
KPM51RUG7T68				7,680			385	55			
KPM51RUG3T84				3,840			370				
KPM51RUG1T92				1,920			340				
KPM51RUG960G				960		1,260	270	45			
KPM51RUG480G				480	1,470	680	180				

CM5 Series

Based on 64-layer BiCS FLASH™ 3D flash memory, the CM5 Series of dual-port PCIe®/ NVMe™ SSDs is available in 2.5 inch form factor. These SSDs feature Power Loss Protection (PLP) and offer a range of security/encryption options*2. The CM5 series is also available in 3 DWPD.

Model Number	DWPD *3	Interface	Form Factor	User Capacity (GB) *4	Performance (up to)				Typical Power Consumption (W) *9	Operating Temperature (˚C)	Dimensions H / W / L (mm)
					Sequential (128 KiB) *5 *6 *7 (MB/s)		Random (4 KiB) *5 *6 *7 *8 (KIOPS)				
					Read	Write	Read	Write			
KCM51RUG15T3	1	PCIe® Gen3 x4, single/dual port support	2.5 inch	15,360	3,350	3,040	590	35	18	0 to 60	15.0 / 70.1 / 100.45
KCM51RUG7T68				7,680			770	80	16		
KCM51RUG3T84				3,840			750	70	15		
KCM51RUG1T92				1,920	3,250	2,460	650	65	13		
KCM51RUG960G				960		1,250	370	50	11		

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*1 : PLP (Power Loss Protection): PLP supports the recording of data in buffer memory into flash memory, utilizing back up power of a capacitor in case of unexpected power loss.

*2 : Optional security features
  - PM5 and 2.5 inch of CM5 Series offer a range of security options ; Sanitize Instant Erase (SIE), Self-Encrypting Drive (SED), and Self-Encrypting Drive (SED) with FIPS 140-2 validation or compliance. The Add-in card version of the CM5 has SIE and SED options.
  - Drive models with different security options have different part numbers.
  - The Sanitize Instant Erase (SIE) option supports Crypto Erase, which is a standardized feature defined by the technical committees (T10) of INCITS (the Inter National Committee for Information Technology Standards) or by NVM Express Inc..
  - SED (Self-Encrypting Drive) SSDs support TCG Enterprise SSC or TCG Opal SSC (Unsupported features are included in CM5 / SED optional model).
  - FIPS drives are designed to comply with FIPS 140-2 Level 2, which defines “Security Requirements for Cryptographic Modules” by NIST (the National Institute of Standards and Technology). PM5 Series is validated, CM5 series is planning to make FIPS 140-2 validated drives available.
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*5 : A kibibyte (KiB) means 2^10, or 1,024 bytes.

*6 : The performance specifications of the PM5 Series is based on testing in dual-port mode, running at 14 W of power. The performance of the CM5 Series is based on single-port mode (1x4).

*7 : Read and Write speeds may vary depending on the host device, read and write conditions, and file size.

*8 : IOPS: Input Output Per Second (or the number of I/O operations per second)

*9 : The PM5 Series can operate in a range of power modes: 9 W, 12 W, 14 W, 18 W (for MultiLink). The CM5 Series can operate in a range of power modes: 9 W, 11 W, 14 W, 16 W, 18 W.

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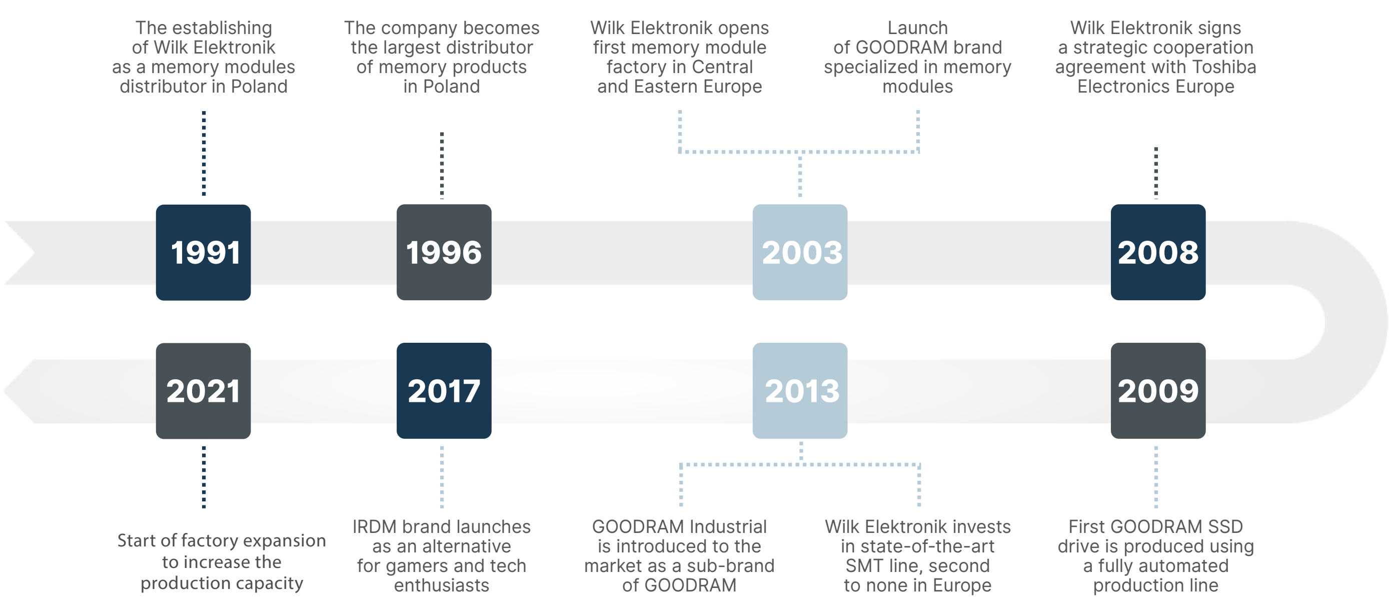
- NVMe is trademark of NVM Express, Inc.
- MultiLink SAS is a trademark of the SCSI Trade Association.
- All other company names, product names and service names mentioned herein may be trademarks of their respective companies.

- **Founded in 1991**
- **Headquartered in Poland**
- **200 employees**
- **Own production line**
- **Certificate: ISO 9001**

Wilk Elektronik – About Company

goodram industrial

GOODRAM Industrial is a brand of Wilk Elektronik SA – Polish memory manufacturer and distributor with nearly 30 years of experience in the memory business. Known for its strict quality policy, flexibility and post-sales support, GOODRAM is the only European memory manufacturer with its own lab, R&D department, state-of-the-art production site, test field and support team. All in-house, under one roof. GOODRAM stands for quality, reliability and support – we believe the industry needs customized solutions for very specific needs. Designing our own testing procedures ensures the modules we produce are tailored to match our customers needs perfectly. Add low MOQ's, fixed BOM and long-term post-sales support to the mix to achieve the highest possible quality of customer service. It all boils down to guaranteeing our partners the highest reliability possible throughout the module's lifetime.



1991 The establishing of Wilk Elektronik as a memory modules distributor in Poland

1996 The company becomes the largest distributor of memory products in Poland

2003 Wilk Elektronik opens first memory module factory in Central and Eastern Europe

2003 Launch of GOODRAM brand specialized in memory modules

2008 Wilk Elektronik signs a strategic cooperation agreement with Toshiba Electronics Europe

2009 First GOODRAM SSD drive is produced using a fully automated production line

2013 Wilk Elektronik invests in state-of-the-art SMT line, second to none in Europe

2013 GOODRAM Industrial is introduced to the market as a sub-brand of GOODRAM

2017 IRDM brand launches as an alternative for gamers and tech enthusiasts

2021 Start of factory expansion to increase the production capacity

DRAM

DRAM (Dynamic Random Access Memory) modules are easy to install components, available for wide range of industrial applications including IPC, Rugged PC, Barebone systems etc. GOODRAM DRAM memory modules are available in all the most popular types (DDR1-DDR4) and form factors (DIMM, VLP DIMM, SODIMM), as well supporting ECC Register or ECC, standard (0/+70°C) or extended (-40/+85°C) temperature range. During the production process all DRAM memory modules are tested in motherboards using our state-of-art testing software, ensuring 100% of modules leaving our production line are working.

DRAM Memory Modules

Type	DDR1*	DDR2	DDR3	DDR4	DDR5
Form Factors	184-pin DIMM 200-pin SO-DIMM	240-pin DIMM 200-pin SO-DIMM	240-pin DIMM 204-pin SO-DIMM	288-pin DIMM 260-pin SO-DIMM	288-pin DIMM 262-pin SO-DIMM
Capacity	512 MB to 1 GB	1 GB to 2 GB	1 GB to 8 GB	4 GB to 16 GB	16 GB to 32 GB
Peak Transfer Rate (MB/s)	Up to 3,200	Up to 6,400	Up to 14,900	Up to 25,600 (3,200 MHz)	Up to 38,400 (4,800 MHz)
Voltage (V)	2.5	1.8	1.5/1.35	1.2	1.1
ECC option	Yes				
Operating Temperature (°C)	Standard grade: 0 to 70 Industrial grade: -40 to 85	Standard grade: 0 ÷ 85 Industrial grade: -40 to 85			
Storage Temperature (°C)	-40 to 85				
Key Features & Options	Single/Double Rank configuration DDR3/4 Very Low Profile size 100% functional tests High/Low temempartaure testing Build from major IC grades Long lifetime project support FIX BOM option PCN and EOL notification				

*DDR1 modules only for special request

NAND Base Solutions

SSD drives (Solid-state drives) for industrial usage are available in all mainstream form factors (2.5", mSATA, M.2 SATA). FLASH product group include SD/microSD, CompactFlash®, CFast and eMMC cards. MicroSD cards are currently the smallest standard memory form factor with implemented controller. It is widely used in industrial solutions because of small dimensions and relatively low cost. The smallest capacities are usually enough for industrial SDK and OS like Linux. The Industrial FLASH cards, beside the form factor, vary from consumer cards. Most important differences is NAND grade, which is the same as used in SSD's – so called Major Grade and they have fixed list of components.

Industrial cards based on wide range of NAND technologies:

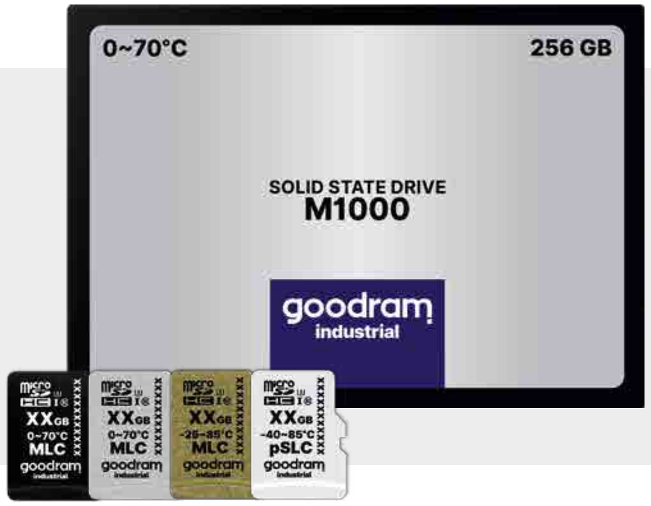
- 3D TLC: 3,000 P/E cycles
- MLC: 3,000 P/E cycles
- pSLC: 20,000 P/E cycles
- SLC: 60,000 P/E cycles

The industrial cards controller is more complex, with available options helping to increase the endurance and reliability – software power loss protection and general FLASH management.

Our products support standard (0/+70°C) and extended (-40/+85°C) temperature range. Depending on customer's requirements we can offer 3D TLC, MLC, pSLC, SLC type flash solutions, which provide a range of Program/Erase cycles between 3,000 and 60,000.

Features

- Static and Dynamic Wear Levelling
- Bad Block Management
- TRIM
- S.M.A.R.T.
- NCQ
- Over-provisioning
- Low Power Management



Solid-State Drive Client Products

Go faster, store more on your PC

Performance, reliability, and capacity - all in a single, affordable PC drive

Take your PC to a new level of responsiveness and reliability. Designed for work and play, Solidigm SSDs deliver excellent storage for any application with exceptional reliability and power efficiency.

Key Advantages

- Boost your PC performance by replacing your HDD or SATA with an Solidigm PCIe SSD
- Reliable Quality - Every Solidigm SSD is subject to rigorous testing standards above and beyond the standard quality requirements
- Easy Upgrade or Install - With Intel® Data Migration Software, you can conveniently copy data form your old drive to a new SSD
- Industry leading innovation - 96-Layer 3D NAND technology
- Solidigm quality and reliability - backed by 5 years warranty

Target Applications

- High-end computing
- Performance gaming
- Workstation
- Digital content creation
- Engineering: FEA, fluid dynamics, CAD
- Mobile computing
- Digital Signage
- POS, Kiosk, Vending machines

About Solidigm

Solidigm is a leading global provider of innovative NAND flash memory solutions. Solidigm technology unlocks data's unlimited potential for customers, enabling them to fuel human advancement. Born of the combination of Intel's longstanding innovation in memory products and SK hynix's international leadership and scale in the semiconductor industry, Solidigm became a standalone U.S. subsidiary under SK hynix in December 2021. Headquartered in San Jose, CA, Solidigm is powered by the inventiveness of close to 2,000 employees in 20 locations around the world.

High-capacity NVMe SSDs for everyday computing

The PC has evolved to reach performance levels once thought unachievable

But the ultimate measure of innovation is the real-world experience of users – whether they are working, playing, or creating content.

- Accomplish more. Work and stay productive on data-intensive applications with performance that supports read/write tasks
- Play more. Enjoy each new level while gaming with reduced load times and accelerated performance
- Create more. Design, edit, and save graphics, photos, videos, and more with high capacity and responsiveness

	P44 Pro Series Ultra-fast and power-efficient PCIe 4.0 NVMe SSDs, delivering class-leading performance for the most demanding PC use cases including gaming, content creation, and more.	**P41 Plus Series** Cutting-edge PCIe 4.0 SSDs, engineered for real-world workload and applications from daily student and office work to enthusiast-level gaming and content creation.
Interface	PCIe 4.0 x4, NVMe	PCIe 4.0 x4, NVMe
Form Factor	M.2 2280	M.2 2280; M.2 2230
Capacity	2 TB - 512 GB	2 TB - 512 GB

SOLIDIGM™

Solid-State Drive Data Center Products

Modernize your Data Center

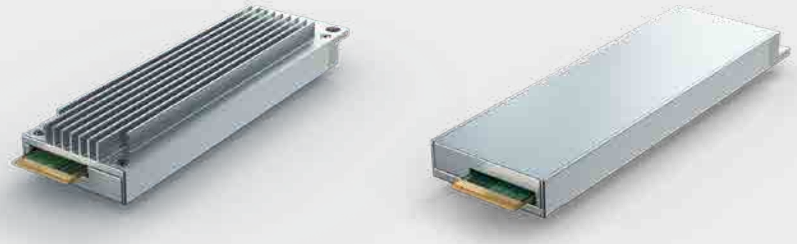
Solidigm draws on decades of technical innovation to offer a broad portfolio of drives all with industry-leading quality and reliability, optimized for the data center, the edge, and everything in between

Key Advantages

- High capacity per drive, server and rack
- Improved manageability and serviceability
- Efficient thermal design
- Reduced maintenance cost and total cost of ownership
- High throughput (IOPS/s)
- Ultra-low latency
- Excellent quality of service
- Ultra-high endurance

Target Applications

- Cloud storage
- Scale out storage
- Hard drive replacement
- Virtualization
- In-memory database



D7 Series (formerly manufactured by Intel Corporation)

SSD D7 Series drives are tuned for real-world mixed and performance-sensitive read workloads. The highest performing family of TLC 3D NAND SSDs delivers the right balance of speed, endurance, and capacity.

D7-P5510

- High performing PCIe 4.0 drives
- Standard endurance
- Up to 7.68TB of capacity
- Performance-sensitive, read-intensive, and/or sequential workloads

D7-P5620

- Mid-endurance PCIe 4.0 SSDs
- Capacities up to 12.8 TB
- Designed for mixed-workload applications

D7-P5520

- High-performing PCIe 4.0 SSDs
- Standard endurance
- Up to 15.36 TB of capacity
- Designed for read-intensive workloads

D7-P5600

- Balanced read/write performance for mixed workload applications
- Available in 1.6TB, 3.2 TB and 6.4TB capacities
- Strong blend of performance, endurance, and capacity

D7-P5500

- Consistently high performance
- Capacities up to 7.68TB
- Ideal for performance-sensitive read-intensive workloads

D5 Series (formerly manufactured by Intel Corporation)

The SSD D5 Series performance is optimized for read and sequential workloads. This value-optimized family of SSDs features capacities ranging from 960 GB to 30.72 TB.

D5-P5316

- Read-optimized PCIe 4.0 drives
- Available in capacities up to 30.72TB
- Delivering industry-leading storage efficiency for read-intensive and sequential workloads

D5-P4420

- Drop-in ready SSDs
- Read-optimized performance with 7.68TB of capacity
- Essential endurance, helping reduce storage costs for compute servers

D5-P4320

- Value endurance drives with good read performance
- Massive capacities up to 30.72TB
- Ideal for consolidating storage footprints and reducing operational costs

D3 Series (formerly manufactured by Intel Corporation)

The SSD D3 Series includes a wide range of products tuned for mixed read/write and read-intensive workloads. This SATA family of TLC NAND SSDs accelerates storage performance and reduces operating expenses (OpEx) on legacy infrastructure.

D3-S4620

- Mid-endurance SATA drives
- Available in a range of capacities up to 3.84TB
- Increased server efficiency and boosting IOPS/TB performance over legacy HDDs for compute server workloads

D3-S4520

- Standard-endurance SATA drives
- Capacities up to 7.68TB
- Increasing server efficiency and boosting IOPS/TB performance over legacy HDDs for cloud storage

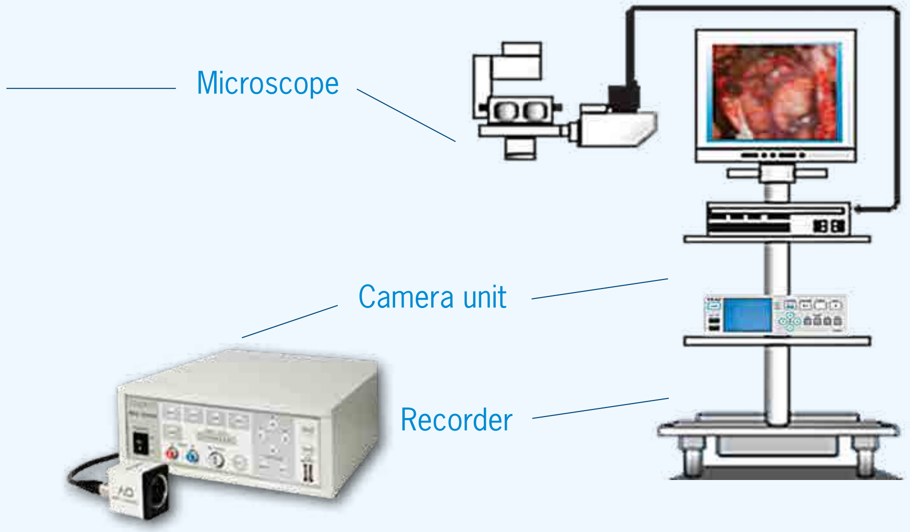
HD Medical Video Recorder

Based on many years of experience and product knowledge of medical imaging and recording, TEAC introduces the UR-4MD and UR-50BD, the solution for undiluted high-definition medical recording.

Excellent quality recording provided by TEAC UR-4MD and UR-50BD maximizes the efficiency of studies.

UR-4MD

- Intuitive & Easy to Use
- Auto-sensing detects I/O & Video Resolution "automatically"
- Wide range of recording resolutions
  - 640x480~1920x1080 (30Hz/29.97Hz): Undiluted recoding resolution
  - 1920x1200 (Resize to 1728x1080): Supported Input resolution
- Multiple HD & SD inputs/outputs (SDI, DVI-D, S-Video and Composite)
- Simultaneous recording to multiple media (up to 2 External USB drives & 1 Internal HD)
- Networking (FTP & CIFS) RJ45 10/100/1000 Ethernet
- Remote control, Foot-switch, Card/Barcode reader and Keyboard (Optional)
- Compliance with Medical Standards



Optical Drives –

Ideal for Industrial Applications

Advantages at a glance

- Space-saving "SlimLine" housing
- Attractive design
- Innovative technology
- Has been on the market as long as the PC
- Very high quality standard
- Long life cycle
- High compatibility
- Modified to industrial standards
- Custom solutions possible

DV-W5600 – Industrial Writer

TEAC's new professional DV-W5600 is the world's most efficient and accurate CD/DVD recorder and verifier for qualified applications. It offers hundred per cent quality control for all discs. Originally designed for PC use, DV-W5600 has some special functions added to fulfil requirements in industrial use.

Equipped with TEAC's typical very long product lifecycle a stable and reliable platform is assured.

Features

- SATA Interface
- High accuracy of try open position
- Reduces the mis-loading of the disc by Auto-Loader
- Improving the throughput by immediate transition to verify mode
- Very quick verify mode
- Fast tray operation
- Improvement of reliability and maintenance system
- Support new discs by adjusting new write strategies
- Error report by blinking LED
- Accumulative turn-on time on Laser Diode
- Measure PI/PO error
- Total Power-on-Hour, CD/DVD write/read accumulate time

DV-W28SS-B93 – Slim Slot Loading DVD / CD Recorder

TEAC´s slimline 8x DVD-Recorder DV-W28SS-W offers the most comfortable slot-in mechanism for your convenience. DV-W28SS-W combines fast DVD-recording, smooth DVD video playback with impressive CD-ROM performance.

Whether you are watching high definition movies, listening music or playing DVD title, the TEAC 8x slimline DVD-Recorder DV-W28SS-W with its robust and extremely reliable slot-in mechanism is the perfect multimedia companion for your notebook or PC.

Interface	SerialATA Revision 3.1
Access Time	140ms typ CD-ROM 150ms typ DVD-ROM
Data Buffer	1MB
Loading Mechanism	Slot Loading Type
Ambient Temp.	Operating: 5 to 45 °C
Relative Humidity	Operating: 10 to 80% (non-condensing) Non Operating: 10 to 95% (non-condensing) Transportation: 10 to 95% (non-condensing)
Current Consumtion	Standby/Sleep: 50mA (Avarage current max.) During starting / Seek: 1500mA (Max spikes less then 1ms)
MTBF	60.000POH (10% duty)
Safety Standards	Approved by UL, CUL, TÜV, CE and BSMI

Displays & Monitors – Linecard

For up-to-date HMI solutions, RUTRONIK EMBEDDED offers all types of TFT & LCD displays with separate or integrated touch function in all technologies. These include high-end and low-cost models, displays for indoor and outdoor use with excellent clarity of display even in direct sunlight, expanded temperature range and a high degree of robustness. The sizes range from diagonals of 0.9 to 90 inches for active TFT and many different passive LCD solutions. In addition semi and full customization is possible.

Suppliers

4D SYSTEMS TURNING TECHNOLOGY INTO ART · ADVANTECH Enabling an Intelligent Planet · ALPHA DISPLAY www.alphadisplay.co.kr · ASUS IN SEARCH OF INCREDIBLE · DFI · Displaytech Ltd. · DLC DLC-Display Specialist

DMC Co., Ltd. Interface with Touch · ecount embedded · ELGRO TECHNOLOGY GMBH · ES&S · Hantouch.com · HIGGSTEC INC. · HOLITECH Europe

mimo MONITORS · Pfoh ELEKTRONIK · Power Systems · POWERTIP · RAYSTAR · SHARP / NEC

TIANMA · U.R.T. · VARITRONIX · Wammes & Partner · YB · vogel's

TFTs

	4D Systems	Advantech	Alphadisplay	Displaytech	DLC	Ecount	Holitech	Mimo Monitors	Powertip	Raystar	Sharp / NEC	Tianma	URT	Yeebo
1,5" - 2,4" Diagonals	■			■	■		■		■	■		■	■	■
2,5" - 3,4" Diagonals	■			■	■		■		■	■			■	■
3,5" - 5,7" Diagonals	■			■	■		■		■	■		■	■	■
5,7" - 7,0" Diagonals	■			■	■		■	■	■	■		■	■	■
8,4" - 15,0" Diagonals	■				■		■	■	■	■		■	■	■
15,1" - 21,3" Diagonals			■		■		■	■				■	■	
21,4" - 42" Diagonals		■	■		■	■	■	■			■	■	■	
42" - 65" Diagonals		■	■			■	■				■			

Passive Displays

	4D Systems	Advantech	Displaytech	DLC	Holitech	Powertip	Raystar	Tianma	URT	Varitronix	Yeebo
Character- & Graphic Module			■	■	■	■	■	■	■	■	■
Customized Module / Panel			■	■	■	■	■	■	■	■	■
OLED	■			■			■		■		■
ePaper		■			■						
Turn Key Solutions	■	■	■	■	■	■	■	■	■	■	■

Open Frames

incl. Controller, Cable, PowerSupply

	Advantech	Alphadisplay	Mimo Monitors
7" - 32"	■	■	■
37" - 82"	■	■	

Smart Panels

incl. Controller

	4D Systems	Alphadisplay	Displaytech	Mimo Monitors	Powertip	Raystar	URT
0,96" - 1,8" Diagonals	■		■		■	■	
1,8" - 7" Diagonals	■		■	■	■	■	■
7" - 15" Diagonals	■						
15" - 19" Diagonals		■		■	■		
High Bright Versions	■	■		■	■		■

Special TFT Applications

	4D Systems	DLC	Holitech	Mimo Monitors	Powertip	Tianma	URT	Yeebo
Brightness >= 500 cd/m²	■	■	■	■	■	■	■	■
Enhanced Temperature Range		■	■	■	■	■	■	■
Rough Environment			■	■	■	■	■	■

Monitors & LED Walls

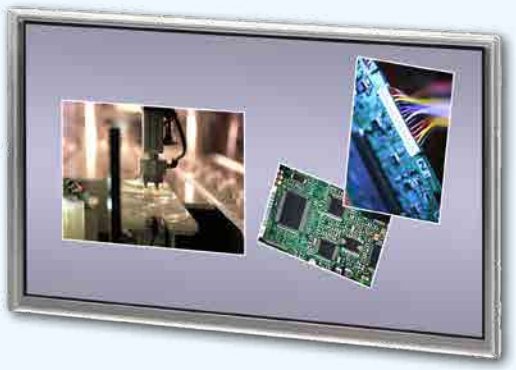
	4D Systems	Advantech	Alphadisplay	Asus	DFI	Ecount	Holitech	Mimo Monitors	Sharp/NEC
Professional Monitor		■		■	■	■		■	■
Gaming Monitor		■	■	■		■		■	■
USB Monitor / Tablet								■	
Bar Type		■			■	■	■	■	
Open Frame Display	■	■	■		■	■		■	
Collaborative Solutions									■
Beamer									■
LED Walls/Panels									■

Touch-Screen Panels & Controllers

	DLC	DMC	Hantouch	Higgstec	Holitech
Four+five wire resistive Touch Panel	■	■	■	■	■
Surface Wave Touch Panel			■	■	
Capacitive Touch Panel		■	■	■	■
Infrared Touch Panel			■	■	

Display & Monitoring Accessories

	Elgro-Technology	ES&S	Mimo Monitors	Pfoh	Power Systems	Powertip	Sharp/NEC	Tianma	URT	Wammes & Partner	Yeebo	Vogel´s
Standard Cables and Connectors		■	■	■								
Customer-specific Cables		■		■								
Inverter					■							
Backlight						■		■	■		■	
Trouble Shooting										■		
Beamer accessoires & Computing solutions							■					
Wall Mount Solutions			■									■
Digital Signage Player							■					
Zebra Connectors (Elastomeric)	■											



Cap Touch included

TFT Technology by Tianma

Standard Industrial Line

- Long-term availability
- Long time phase-out-strategy for industrial applications
- Low power consumption
- 3.3 V operation
- True Colour with brilliant colours
- Dual clock interface for EMI reduction
- Flicker-free
- Fast response times
- Wider viewing angle with Super-Fine technology (up/down ±85°)

Standard industrial (NL - Line)

Diagonale		Auflösung	Techn.		Interface				Touch	
Inch	cm		TN	SFT	RGB	LVDS	CPU	others	res	cap
5.7	14.5	QVGA / VGA	x		x	x				
6.5	16.5	VGA / XGA	x		x	x				x
7.0	17.8	WVGA	x			x				x
8.0	20.3	WVGA		x		x				
8.4	21.3	VGA / SVGA / XGA	x	x	x	x				x
9.0	22.9	WVGA / FHD	x	x		x				
10.1	25.7	WXGA		x		x				
10.4	26.4	VGA / SVGA / XGA	x	x	x	x				x
10.6	26.9	WXGA		x		x				x
11.6	29.5	FHD		x				eDP		
12.1	30.7	SVGA / XGA / WXGA	x	x	x	x				x
15.0	38.1	XGA	x	x		x				x
15.3	38.9	WXGA		x		x				x
15.6	39.6	FWXGA / FHD	x	x		x		eDP		
18.5	47.0	FHD		x		x		eDP		
19.0	48.3	SXGA		x		x				
30.0	76.2	WQSXGA		x				eDP		

NEW P-Series

Diagonale		Auflösung	Techn.		Interface		Special		Touch	
Inch	cm		TN	SFT	RGB	LVDS	high-bright	Longlife LED	Res / Cap	No
3.5	8.9	QVGA		x	x					x
6.5	16.5	VGA		x		x	x	x		x
7	17.8	WVGA		x		x	x	x		x
8.0	20.3	WVGA		x		x	x	x		x
8.4	21.3	XGA		x		x	x	x		x
10.1	25.7	WSVGA	x		x					x
10.4	26.4	XGA		x		x	x	x		x
11.6	29.5	FULLHD		x		x	x	x		x
12.1	30.7	XGA		x		x	x	x		x
13.3	33.8	FHD		x		x	x	x		x
18.5	47.0	FULLHD		x		x		x		x

SFT Technology

(Super Fine TFT)

High Luminance, Wide Color Gamut

With the SA-SFT and UA-SFT technologies Tianma has achieved improved panel transmissivity, resulting in higher luminance and wider color gamut displays allowing customers to view clear and vivid color images in bright environments.

High Definition

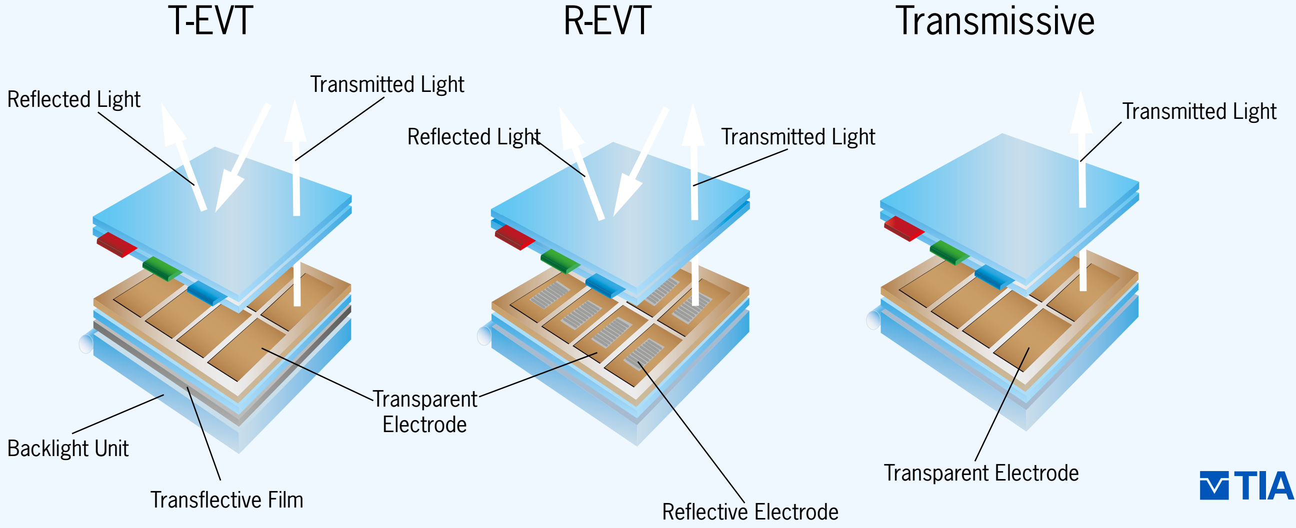
Tianma offers products with pixel density of up to 200 pixels/inch and resolution of up to 5M pixel displays. That means customers enjoy faithful reproduction of high-precision images down to the finest details – from the fine text and lines of CAD and DTP to the delicate nuances of nature images and imaging data for medical purposes.

Quick Response

Tianma is developing the SFT tewwwwchnology, which features low dependence on response time between gray-scale levels, to achieve uninterrupted full-motion video.

Ultra-wide Viewing Angle, Reduced Color Shift

LCDs with SFT Technology feature a new ultra-wide 170° (right/left and up/down) viewing angle while minimizing the color shift phenomenon that occurs as luminance changes with viewing angle. The result is a new and definitive benchmark in image quality with virtually no color deviation -
a great picture no matter how you look at it.



EVT Technology

(Enhanced View TFT)

R-EVT Guarantees High-visibility in All Outdoor Light Environments

R-EVT maximizes the high ambient light visibility features of a reflective-type LCD along with the low ambient light visibility features of a transmissive-type LCD to deliver high picture quality in all possible light environments.

R-EVT: Reflective EVT

T-EVT: Transmissive EVT

T-EVT Brings You the Clearest, Sharpest Pictures Under the Sun

This revolutionary new T-EVT is a transmissive type that guarantees bright, easy-viewing displays even in bright sunlight. It's the history-making forerunner of a new generation of LCDs unaffected by changes in natural light – for bright, vivid color displays anytime.

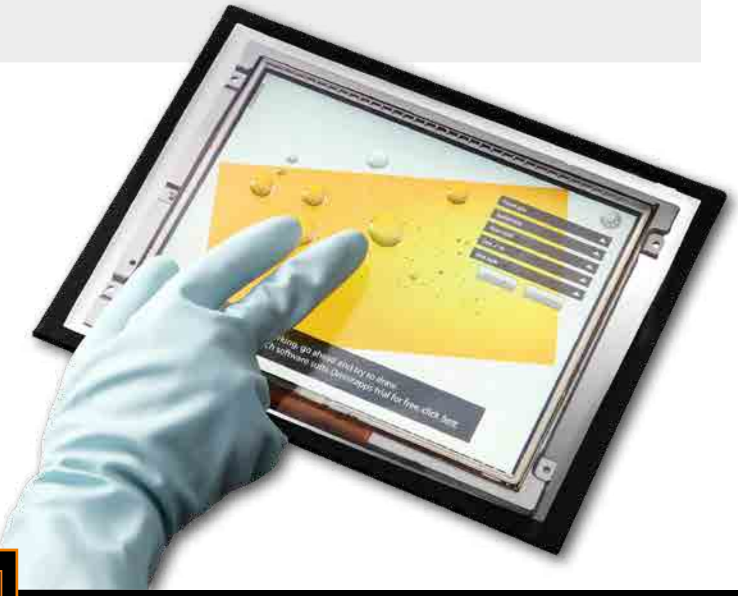
Projected Capacitive Touch Panel

PCAP by Tianma as a One-stop Shop Solution

Tianma provides factory installed touch panels which have an external touch controller as option. Thanks to the in-house design and manufacturing capabilities they are able to offer high quality, integrated PCAP products direct from the factory as a one stop shop solution with full factory warranty.

Tianma provides factory tuned PCAP products, drivers and offer special tuning software as part of Tianma total PCAP solutions, in order to better support customer´s needs and help ease adoption of Tianma´s PCAP based modules.

Due to the fact that the requirements of the customers are very individually, most requests need to be handled as a custom solution. Customized options are different surface film, optical bonding and customized cover glasses.



TFT Color Modules

TIANMA

TFT Color Modules

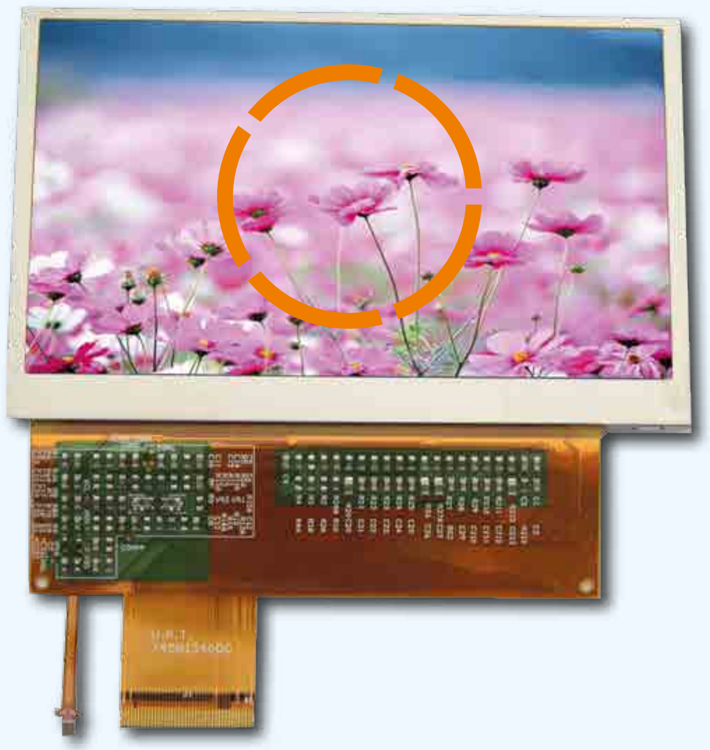
The following TFT Color graphic modules are produced in their own TFT factory in Shanghai. This will greatly benefit Tianma and their customers by guaranteeing long-term availability of the products. With currently three 4.5 TFT production lines and one 5.0G TFT production line Tianma Group is now one of the largest manufacturers of small and medium size TFT modules worldwide.
Tianma's products offer a lot of technical advantages such as wide viewing angle, high contrast, high brightness and fast response time and are produced for industrial, telecommunication and automotive applications.

Standard Products

Diagonale		Auflösung	Interface				Touch	
Inch	cm		RGB	LVDS	CPU	others	Res	Cap
4.3	10.9	480x272	x				x	
5.0	12.7	800x480	x					
5.7	14.5	320x240 / 640x480	x					
7.0	17.8	800x480 / 1024x600 1280x800	x	x			x	x
8.4	21.3	800x600	x	x				
10.1	25.7	1024x600 / 1280x800		x				
10.4	26.4	800x600	x	x				
12.1	30.7	800x600 / 1024x768 1280x800		x				
15.0	38.1	1024x768		x				

Foster Products

Diagonale		Auflösung	Interface				Touch	
Inch	cm		RGB	LVDS	CPU	others	Res	Cap
3.5	8.9	320x240	x					x
4.3	10.9	480x272 / 480x800	x				x	x
7.0	17.8	800x480 / 1024x600 1280x800	x	x				x
8.0	20.3	1024x768		x				
10.1	25.7	1024x600 / 1280x800	x	x				x
10.4	26.4	1024x768		x				
11.6	29.5	1920x1080		x				
15.0	38.1	1024x768		x		eDP		x
15.6	39.6	1920x1080		x		eDP		
18.5	47.0	1920x1080		x		eDP		



TFT Technology by U.R.T.

U.R.T.

U.R.T. products are widely applied in a broad range of applications and markets.

With advancing technologies in digital, dot matrix and graphic LCD panels and modules, U.R.T. is always committed to produce LCD products with the highest level of contrast, wide viewing angles, long life, and high reliability.

Bartype TFT Portfolio

Size		Resolution	Interface	Touch Panel
Inch	Cm			
2,9	7,37	320x120	RGB	Optional
3,9	9,91	480x128	RGB	Optional
4,6	11,68	800x320	RGB	Optional
5,8	14,73	800x320	RGB	Optional
6,1	15,49	800x240	RGB	Optional
6,5	16,51	800x320	RGB	Optional
8,8	22,35	1280x320	LVDS	Optional
9	22,86	1280x240	LVDS	Optional
12,3	31,24	1920x720	LVDS	Optional

Product Portfolio TFT

Size		Resolution	Interface	Touch Panel
Inch	Cm			
2,4	6,10	QVGA	MPU	PCAP, RTP
2,8	7,11	QVGA	MPU	PCAP, RTP
3,5	8,89	QVGA, VGA	RGB, MPU	PCAP, RTP
4,3	10,92	480RGBx272, 800x480	RGB	PCAP, RTP
5,0	12,70	800x480	RGB	PCAP, RTP
5,7	14,48	QVGA, VGA	RGB, MPU, LVDS	PCAP, RTP
7,0	17,78	800RGBx480, 1024x600	RGB, LVDS	PCAP, RTP
10,1	25,65	1280x800	LVDS	PCAP, RTP
10,4	26,42	XGA	LVDS	Optional
12,1	30,73	XGA, 1280x800	LVDS	Optional
15	38,10	XGA	LVDS	Optional
15,6	39,62	1366x768	LVDS	Optional
18,5	46,99	1366x768	LVDS	Optional

TFT Technology by Yeebo

Yeebo with the headquarter located in Hong Kong is producing with multiple, highly automated production lines which have latest state of the art equipment to meet the requirements of most applications.

With their experienced and professional design team they are able to tailor their service to meet every individual need from the customers. With a portfolio with a focus on 1.44" up to 7" and some additional panels up to 12.1" they meet the requested sizes and features for the European industrial market.

TFT Portfolio

Size		Interface			Resolution	Technology	Lifetime in Hours	Touch incl.
Inch	Cm	RGB	LVDS	Others				
1.44	3.6			CPU	128x128	TN	20k	
1.77	4.5			MCU	128x160	TN	50k	
2.0	5.1	xx		MCU	160x240 / 176x220	TN	20k / 50k	
2.4	6.1	xx		MCU / SPI	240x320	TN / IPS	20k / 50k	PCAP
2.8	7.1	xx		MCU / SPI	240x320	TN / IPS	20k / 50k	RTP / PCAP
3.2	8.1			MCU / SPI	240x320	TN	50k	
3.5	8.9	xx		MCU / SPI	320x240 / 320x480	TN / IPS	20k / 50k	RTP / PCAP
3.97	10.1	xx			480x800	IPS	20k	
4.3	10.9	xx	xx		480x272	TN / IPS	20k / 50k	RTP / PCAP
4.5	11.4			MIPI	480x854	IPS	50k	RTP
5.0	12.7	xx			800x480	TN	20k	RTP / PCAP
5.5	14.0			MIPI	720x1280	IPS	50k	
7.0	17.8	xx			800x480	TN	50k	PCAP
9.0	22.9	xx			800x480	TN	20k	
10.1	25.6		xx		1280x800 / 1024x600	IPS	50k	PCAP
12.1	30.7		xx		1024x768	TN	50k	

E-Papers

1-Dot-Matrix E-Papers

Matrix displays are intended for applications requiring the display of many different forms of text and images. These displays comprise of a large array of pixels. These individual pixels are controlled by a TFT array.

Holitech offers a range of standard products for 1.5" up to 42".

Most of the sizes are available in:

- Black white | Black White Red | Black White Yellow
- Frozen (supports temperatures below 0°C)

Tooling for Dot-Matrix displays should be discussed case by case and could only be done for big volumes if we get the needed TFT support.

Segmented E-Papers

Segmented displays are intended for applications where the display requirements can be met using predefined segments that can be turned on or off.

Segmented Displays are in general customized solutions.

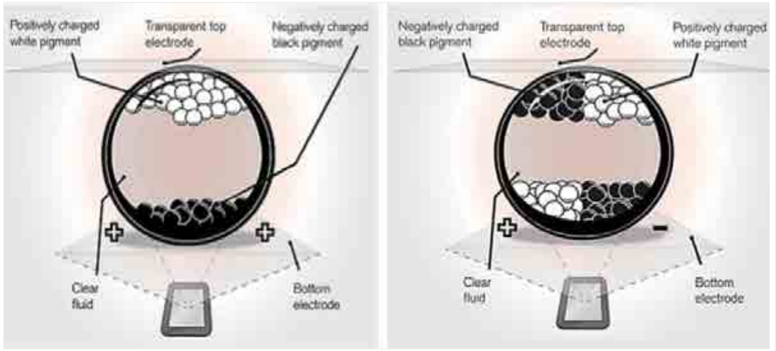
Only one or two displays are available as standard products.

Tooling for segmented displays can be made for small quantities (starting from 10kpcs) and costs between 8k$ ~ 10k$

How does E-Paper work ?

The two pigment electronic ink system is made up of millions of tiny microcapsules, each about the diameter of a human hair. Each microcapsule contains negatively charged white particles and positively charged black particles suspended in a clear fluid.

When a positive or negative electric field is applied, corresponding particles move to the top of the micro-capsule where they become visible to the viewer. This makes the surface appear white or black at that spot.



Size (Inch)	cm	Color	Resolution	OD (mm)	AA (mm)	DPI (mm)	IC
1.30	3.3	BW/BWY/BWR	144 x 200	24,69 x 36,64	19,44 x 27,00	189	SSD1680
1.50	3.8	BW/BWY/BWR/ BW-Low Temp	200 x 200	37,32 x 31,80	27,00 x 27,00	188	SSD1681
1.54	3.9	BW/BWY/BWR/ BW-Low Temp	152 x 152	31,8 x 37,32	27,51 x 27,51	140	SSD1680
1.80	4.8	BW/BWR	224 x 168	45,00 x 32,00	27,05 x 36,06	158	SSD1680
2.13	5.4	BW/BWY/BWR/BW-Low Temp	212 x 104	29,20 x 59,20	23,71 x 48,55	110	SSD1680/UC8251D
2.13	5.4	BW/BWY/BWR/BW-Low Temp	250 x 122	29,2 x 59,2	23,7 x 48,55	130	SSD1680/UC8252C/JD79656
2.15	5.5	BW/BWY/BWR/BW-Low Temp	112 x 208	32,2 x 59,2	25,76 x 48,05	110	SSD1680
2.66	6.8	BW/BWY/BWR/BW-Low Temp	296 x 152	36,3 x 71,82	30,70 x 60,09	125	SSD1680/UC8251D
2.70	6.9	BW/BWY/BWR	200 x 300	43,79 x 69,72	38,18 x 57,27	133	SSD1685
2.90	7.4	BW/BWY/BWR/BW-Low Temp	296 x 128	36,7 x 79,0	29,06 x 66,90	112	SSD1680
3.45	8.8	BW/BWR	184 x 384	44,14 x 89,28	37,92 x 79,14	123	SSD1685
3.70	9.4	BW/BWY/BWR/BW-Low Temp	240 x 416	53,00 x 92,99	47,04 x 81,54	130	UC8253
4.20	10.7	BW/BWY/BWR/BW-Low Temp	400 x 300	91,0 x 77,00	84,8 x 63,6	119	SSD1683/UC8276
5.83	14.8	BW/BWY/BWR/BW-Low Temp	648 x 480	125,4 x 99,5	118,78 x 88,22	138	JD79686/UC8179
7.50	19.1	BW/BWY/BWR	640 x 384	170,2 x 111,2	163,2 x 97,92	99	UC8159
7.50	19.1	BW/BWY/BWR/BW-Low Temp	800 x 480	170,2 x 111,20	163,2 x 97,92	124	UC8179/JD79686
10.20	25.9	BW/BWY/BWR/ BW-Low Temp	960 x 640	224,00 x 157,00	215,52 x 143,68	113	SSD1677
11.60	29.5	BW/BWY/BWR/ BW-Low Temp	960 x 640	254,31 x 176,35	244,51 x 163,01	99	SSD1677
13.30	33.8	BW/BWY/BWR/ BW-Low Temp	960 x 680	286,32 x 212,26	275,52 x 195,16	88	SSD1677

DLC-Display Specialist

TFTs & OLEDs

Rutronik's new partner DLC offers monochrome, TFT and OLEDs including further components related to displays. DLCs convinces with its wide range of products, especially in the field of TFTs and OLEDs. We are able to offer a big choice of transflective, high-brightness and IPS technologies and guarantee excellent viewing angles and high temperature ranges. Our collection boasts more than 200 TFT and monochrome displays, as well as over 20 models of monochrome OLED displays, all of which are available in sizes ranging from 1.4 to 19 inches.

Size		Resolution	Interface	Touch Panel
Size (Inch)	Cm			
0.9	2.29	80RGBx160	SPI	Optional
1.3	3.30	240RGBx240	SPI	Optional
1.44	3.66	128RGBx128	CPU	Optional
1.54	3.91	240x240	SPI	Optional
1.77	4.50	128RGBx160	CPU	Optional
1.9	4.83	170RGBx320	CPU	PCAP
2.0	5.08	QVGA, 480x360	CPU, RGB, MIPI	Optional
2.4	6.10	QVGA	CPU	Optional
2.45	6.22	272RGBx480	RGB	Optional
2.83	7.19	QVGA	CPU/RGB	Optional
3.2	8.13	QVGA	RGB	Optional
3.5	8.89	320RGBx480, QVGA	SPI, MCU, RGB,	PCAP, RTP
3.95	10.03	480RGBx480	MIPI	Optional
4.3	10.92	480RGBx272, 800x480	RGB, MCU	PCAP, RTP
5.0	12.70	480x272, 640RGBx480, 800x480	RGB	PCAP, RTP
5.6	14.22	640RGBx480	RGB	Optional
5.7	14.48	QVGA, VGA	RGB, TTL, LVDS	PCAP, RTP
6.5	16.51	800RGBx480	RGB	PCAP
6.86	17.42	480x1280	MIPI	Optional
7.0	17.78	800RGBx480, 1024x600	RGB, TTL, LVDS	PCAP, RTP
8.0	20.32	800RGBx480, 800x600, 1024x600	RGB, LVDS	PCAP, RTP
8.4	21.34	800xRGBx600	LVDS	Optional
9.0	22.86	800RGBX480	RGB	Optional
10.1	25.65	1024RGBx600, 1280x800	RGB, LVDS	PCAP, RTP
10.2	25.91	800RGBx480	RGB	Optional
10.25	26.04	1920RGBx720	LVDS	Optional
10.3	26.16	1280RGBx480	LVDS	Optional
10.4	26.42	VGA, SVGA, XGA	TTL, LVDS	Optional
12.1	30.73	SVGA, XGA, 1280x800	LVDS	PCAP, RTP
12.3	31.24	1920RGBx720	LVDS	Optional
15	38.10	XGA	LVDS	Optional

DLC-Display Specialist

OLEDs Offer Many Advantages over Both LCDs and LEDs

The plastic, organic layers of an OLED are thinner, lighter and more flexible than the crystalline layers in an LED or LCD. Because the light-emitting layers of an OLED are lighter, the substrate of an OLED can be flexible instead of rigid. OLED substrates can be plastic rather than the glass used for LEDs and LCDs.

OLEDs are brighter than LEDs. Because the organic layers of an OLED are much thinner than the corresponding inorganic crystal layers of an LED, the conductive and emissive layers of an OLED can be multi-layered. Also, LEDs and LCDs require glass for support, and glass absorbs some light. OLEDs do not require glass. OLEDs do not require backlighting like LCDs. LCDs work by selectively blocking areas of the backlight to make the images that you see, while OLEDs generate light themselves.

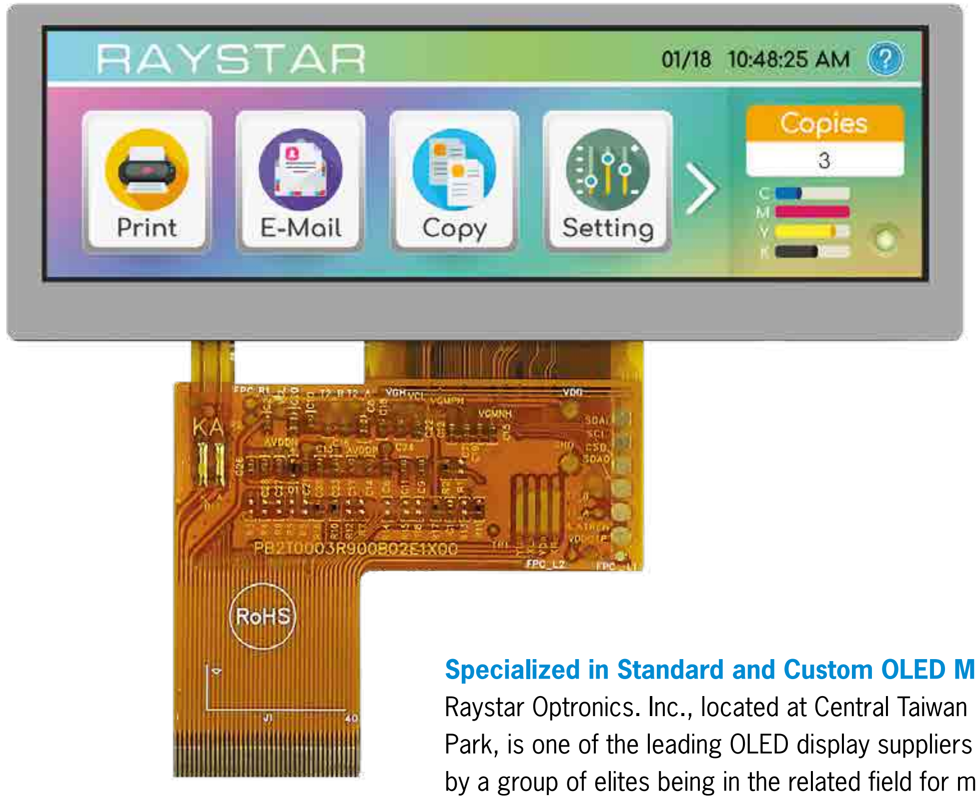
Because OLEDs do not require backlighting, they consume much less power than LCDs. This is especially important for battery-operated devices such as cell phones.

OLEDs are easier to produce and can be made to larger sizes. Because OLEDs are essentially plastics, they can be made into large, thin sheets. It is much more difficult to grow and lay down so many liquid crystals.

OLEDs have large fields of view, about 170 degrees. Because LCDs work by blocking light, they have an inherent viewing obstacle from certain angles. OLEDs produce their own light, so they have a much wider viewing range.

DLC P/N	Size (inch)	Dot Format	A.A (mm)	Outline Size (mm)	Interface	Colors	Remarks
DLC0049AZOG-W-1	0.49	64x32	11.18x5.58	14.50x11.60	I2C	White	Monochrome
DLC0066ANOG-3	0.66	64x48	13.42x10.06	18.46x18.10	Parellel/SPI/I2C	Blue	Monochrome
DLC0066ANOG-W-4	0.66	64x48	13.42x10.06	18.46x18.10	Parallel/SPI/I2C	White	Monochrome
DLC0069AZOG-W	0.69	96x16	17.26x3.18	26.30x8.00	SPI	White	Monochrome
DLC0091CNOG-W	0.91	128x32	22.384x5.584	30.00x11.50	SPI	White	Monochrome
DLC0095DNOG-2	0.95	96x64	20.14x13.42	25.70x22.20	Parellel/SPI	Color	Passive Color
DLC0096DNOG-W-5	0.96	128x64	21.74x10.86	24.74x16.90	SPI/I2C	White	Monochrome
DLC0112AZOG	1.12	96x96	20.14x20.14	25.80x30.10	Parellel/SPI	Color	Passive Color
DLC0129AZOF-1	1.29	128x96	26.28x19.71	33.00x25.80	Parallel/SPI	Color	Passive Color
DLC0130ANOG-W	1.30	128x64	29.42x14.70	34.50x23.00	Parellel/SPI/I2C	White	Monochrome
DLC0132AZOG-W	1.32	128x96	26.86x20.14	32.50x29.20	Parallel/SPI/I2C	White	Monochrome
DLC0139BQOG	1.39	400x400	Φ35.40	38.60x40.50	MIPI	16.7M	AMOLED,Round
DLC0141BEOG	1.41	320x360	23.84x26.82	26.04x31.78	MIPI	16.7M	AMOLED
DLC0145BNOF	1.45	160x128	28.78x23.02	35.80x30.80	Parallel/SPI	Color	Passive Color
DLC0146AZOF-1	1.46	128x128	26.279x26.284	33.50x33.50	Parallel/SPI	Color	Passive Color
DLC0150CNOG-W	1.50	128x128	26.86x26.86	33.80x36.50	Parallel/SPI/I2C	White	Monochrome
DLC0154BNOG-W-1	1.54	128x64	35.05x17.52	42.04x27.22	Parellel/SPI/I2C	White	Monochrome
DLC0160AZOG-Y	1.60	128x64	36.45x18.21	41.90x28.00	Parallel/SPI	Yellow	Monochrome
DLC0177AZOF-1	1.77	160x128	35.02x28.01	42.80x33.50	Parallel/SPI	Color	Passive Color
DLC0223ANOG-W-2	2.23	128x32	55.02x13.10	58.00x19.80	Parellel/SPI/I2C	White	Monochrome
DLC0242BNOG-W-2	2.42	128x64	55.01x27.49	60.50x37.00	Parallel/SPI/I2C	White	Monochrome
DLC0293ANOG-B-2	2.93	20x2	73.52x11.52	84.50x19.28	Parellel/SPI/I2C	Blue	Monochrome
DLC0295AZOM	2.95	1080x1200	50.11x55.68	52.91x62.58	MIPI	16.7M	AMOLED
DLC0550ANOF	5.50	256x64	135.65x33.89	146.00x45.00	Parallel/SPI	B/G	Monochrome
DLC0544AEOG	5.50	1080x1920	67.82x120.58	69.74x126.60	MIPI	16.7M	AMOLED

OLED and TFT Display Modules



Specialized in Standard and Custom OLED Modules

Raystar Optronics. Inc., located at Central Taiwan Science Park, is one of the leading OLED display suppliers founded by a group of elites being in the related field for more than 10 years. Its production line includes small to medium size OLED modules for a variety of industrial and consumable applications. Raystar is one of the leading display providers of monochrome character, graphic and alphanumeric OLED panels. Our Portfolio covers all types of PM OLEDs in the size of 0.49 inch upto 5.85 inch in every color variation without a MOQ.

TFTs

Raystar is also a professional TFT (Thin Film Transistor) Modules Manufacturer. The TFT display modules include TFT LCD displays, TFT displays with resistive or capacity touch screen options and TFT displays with control board, higher brightness or wider viewing angle TFT display modules, monochrome TFT and Bar Type TFT display modules. We can offer customization in backlight or FPC service. Available small TFTs from 0.96“ to 5”, midsize TFT from 5.7 to 10.4” and bartype TFTs in 3.9”, 4.6”, 5.2” and 12.3”.

OLED Display Module – COB

Structure	Size (")	Size (cm)	Outline (mm)	Viewing Area (mm)	Active Area (mm)	Interface	Type
COB	1.2	3.0	58×32	38×16	28.16×11.86	6800,8080,SPI	Character OLED
COB	1.26	3.2	58×32	38×16	29.96×11.16	6800,8080,SPI	Graphic OLED
COB	1.6	4.1	55.7×32	46×14.5	38.95×11.8	6800,8080,SPI	Character OLED
COB	1.7	4.3	55.7×32	46×14.5	47.7×11.1	6800,8080,SPI	Graphic OLED
COB	2.25	5.7	80×36	66×16	56.95×5.55	6800,8080,SPI	Character OLED
COB	2.29	5.8	80×36	66×16	56.95×11.85	6800,8080,SPI	Character OLED
COB	2.29	5.8	85×36	66×16	56.95×11.85	6800,8080,SPI	Character OLED
COB	2.29	5.8	85×30	66×16	56.95×11.85	6800,8080	Character OLED
COB	2.29	5.8	84×44	66×16	56.95×11.85	6800,8080,SPI	Character OLED
COB	2.4	6.1	80×36	66×16	59.95×11.15	6800,8080,SPI	Graphic OLED
COB	2.4	6.1	85×36	66×16	59.95×11.15	6800,8080,SPI	Graphic OLED
COB	2.4	6.1	85×30	66×16	59.95×11.15	6800,8080	Graphic OLED
COB	2.4	6.1	84×44	66×16	59.95×11.15	6800,8080,SPI	Graphic OLED
COB	2.44	6.2	98×60	77×25.2	58.95×19.15	6800,8080,SPI	Graphic OLED
COB	2.44	6.2	98×60	77×25.2	58.95×19.15	6800,8080,SPI	Graphic OLED
COB	2.59	6.6	116×37	85×18.6	64.95×11.15	6800,8080,SPI	Graphic OLED
COB	2.88	7.3	98×60	77×25.2	70.16×20.95	6800,8080,SPI	Character OLED
COB	2.88	7.3	98×60	77×25.2	70.16×20.95	6800,8080,SPI	Character OLED
COB	3.08	7.8	116×37	85×18.6	77.3×11.85	6800,8080,SPI	Character OLED
COB	3.67	9.3	122×44	98×21	91.14×18.98	6800,8080,SPI	Character OLED
COB	3.84	9.8	122×44	98×21	95.94×17.86	6800,8080,SPI	Graphic OLED
COB	4.9	12.4	182×38.5	154.4×16.5	123.95×11.15	6800,8080,SPI	Graphic OLED
COB	5.85	14.9	182×38.5	154.4×16.5	148.13×11.85	6800,8080,SPI	Character OLED

OLED Display Module – COF

Structure	Size (")	Size (cm)	Outline (mm)	Viewing Area (mm)	Active Area (mm)	Interface	Type
COF	2.8	7.1	84×25.8	71.104×19.264	69.098×17.258	6800,8080,SPI	Graphic OLED
COF	3.12	7.9	88×27.8	78.78×21.18	76.778×19.178	6800,8080,SPI	Graphic OLED
COF	3.12	7.9	89.2×29	78.78×21.18	76.778×19.178	6800,8080,SPI	OLED Touch
COF	5.5	14.0	146×45	137.65×35.89	135.65×33.89	6800,8080,SPI	Graphic OLED
COF+PCB+FR	2.8	7.1	85×39.8	71.1×19.26	69.1×17.26	6800,8080,SPI	OLED Touch
COF+PCB+FR	3.12	7.9	89.2×44	78.78×21.18	76.78×19.18	6800,8080,SPI	OLED Touch
COF+PCB+FR	5.5	14.0	147×59	137.5×35.59	135.65×33.89	6800,8080,SPI	OLED Touch

OLED Display Module – COG

Structure	Size (")	Size (cm)	Outline (mm)	Viewing Area (mm)	Active Area (mm)	Interface	Type
COG	0.49	1.2	14.5×11.6	12.58×6.58	11.18×5.58	I2C	Graphic OLED
COG	0.66	1.7	18.46×18.10	15.42×12.06	13.42×10.06	6800,8080,SPI,I2C	Graphic OLED
COG	0.68	1.7	19.8×12.32×1.21	17.298×6.418	16.298×5.418	6800,8080,SPI,I2C	Graphic OLED
COG	0.71	1.8	13.9×22	12.14×16.3	10.54×14.7	I2C	Graphic OLED
COG	0.84	2.1	29.1×9.2	23.104×5.504	21.104×3.504	I2C	Graphic OLED
COG	0.91	2.3	30×11.5	24.384×7.584	22.384×5.584	SPI	Graphic OLED
COG	0.91	2.3	30×11.5	24.384×7.584	22.384×5.584	I2C	Graphic OLED
COG	0.95	2.4	24.9×22.95	21.953×15.424	19.946×13.418	6800,8080,SPI,I2C	Graphic OLED
COG	0.96	2.4	14×28	11.86×22.74	10.86×21.74	SPI,I2C	Graphic OLED
COG	0.96	2.4	26.7×19.26	23.34×11.46	21.74×10.86	6800,8080,SPI,I2C	Graphic OLED
COG	0.96	2.4	26.7×19.26	23.938×12.058	21.738×10.858	6800,8080,SPI,I2C	Graphic OLED
COG	0.96	2.4	26.7×19.26	23.744×13.204	21.744×11.204	6800,8080,SPI,I2C	Graphic OLED
COG	0.96	2.4	24.74×16.9	22.74×11.86	21.74×10.86	SPI,I2C	Graphic OLED
COG	0.96	2.4	Ø39.4×24.8	22.74×11.86	21.74×10.86	SPI,I2C	OLED Knob
COG	1.1	2.8	29×22.5	24.54×17.02	22.53×15.01	6800,8080,SPI,I2C	Graphic OLED
COG	1.18	3.0	37.18×41.23	Ø31	Ø30	6800,8080,SPI,I2C	Graphic OLED
COG	1.18	3.0	Ø50.5	Ø31	Ø30	SPI,I2C	OLED Touch
COG	1.18	3.0	Ø56	Ø31	Ø30	SPI,I2C	OLED Knob
COG	1.28	3.3	34.5×23	31.32×15.62	29.42×14.2	6800,8080,SPI,I2C	Graphic OLED
COG	1.5	3.8	33.8×36.5	28.86×28.86	26.86×26.86	6800,8080,SPI,I2C	Graphic OLED
COG	1.54	3.9	42.04×27.22	37.05×19.52	35.05×17.51	6800,8080,SPI,I2C	Graphic OLED
COG	1.54	3.9	42.04×27.22	37.05×19.51	35.05×17.51	6800,8080,SPI,I2C	Graphic OLED
COG	1.54	3.9	45.24×29.14	37.05×19.51	35.05×17.51	6800,8080,SPI,I2C	Graphic OLED
COG	1.54	3.9	43.04×28.22	37.05×19.52	35.05×17.51	6800,8080,SPI,I2C	OLED Touch
COG	1.71	4.3	50.50×15.75	44.22×12.54	42.22×10.54	SPI,I2C	Graphic OLED
COG	1.92	4.9	34.5×48.8	30.908×41.34	28.908×39.34	6800,8080,SPI,I2C	Graphic OLED
COG	2	5.1	59×18.86	52.535×12.695	50.535×10.695	6800,8080,SPI,I2C	Graphic OLED
COG	2.08	5.3	60.5×19	53.18×14.78	51.18×12.78	6800,8080,SPI,I2C	Graphic OLED
COG	2.23	5.7	62×24	57.02×15.1	55.018×13.098	6800,8080,SPI,I2C	Graphic OLED
COG	2.26	5.7	68.5×17.5	58.22×13.52	56.22×11.52	6800,8080,SPI,I2C	Character OLED
COG	2.42	6.1	60.5×37	57.01×28.91	55.01×27.49	6800,8080,SPI,I2C	Graphic OLED
COG	2.42	6.1	60.5×37	57.01×28.91	55.01×27.49	6800,8080,SPI,I2C	Graphic OLED
COG	2.42	6.1	66.8×41.3	56.01×28.49	55.01×27.49	6800,8080,SPI,I2C	OLED Touch
COG	2.7	6.9	73×41.86	63.41×32.69	61.41×30.69	6800,8080,SPI,I2C	Graphic OLED
COG	2.7	6.9	73×41.86	63.41×32.69	61.41×30.69	6800,8080,SPI,I2C	Graphic OLED
COG	2.7	6.9	73×41.86	63.41×32.69	61.41×30.69	6800,8080,SPI,I2C	Graphic OLED
COG	2.7	6.9	73×41.16	63.41×32.69	61.41×30.69	6800,8080,SPI,I2C	OLED Touch
COG	2.89	7.3	84.5×27.5	72.42×22.82	70.42×20.82	6800,8080,SPI,I2C	Character OLED
COG	2.93	7.4	84.5×19.28	75.52×13.52	73.52×11.52	6800,8080,SPI,I2C	Character OLED
COG	3.55	9.0	99.2×33.5	89.52×23.28	87.52×21.28	6800,8080,SPI	Graphic OLED
COG	3.55	9.0	100.4×36.1	88.52×22.28	87.52×21.28	6800,8080,SPI	OLED Touch
COG+CTP	0.91	2.3	30.0 × 11.5	24.38×7.58	22.38 × 5.58	4-wire SPI,I2C	Graphic OLED
COG+PCB	0.49	1.2	14.85×16.6	12.58×6.58	11.18×5.58	I2C	Graphic OLED
COG+PCB	0.66	1.7	19.9×23.1	15.42×12.06	13.42×10.06	I2C	Graphic OLED
COG+PCB	0.71	1.8	15.9×27	12.14×16.3	10.54×14.7	I2C	Graphic OLED
COG+PCB	0.84	2.1	33×10	23.104×5.504	21.104×3.504	I2C	Graphic OLED
COG+PCB	0.91	2.3	32.5×20.5	24.384×7.584	22.384×5.584	SPI	Graphic OLED
COG+PCB	0.91	2.3	35.8×12	24.384×7.584	22.384×5.584	I2C	Graphic OLED
COG+PCB	0.96	2.4	38×28.5	23.94×12.06	21.74×10.86	SPI,I2C	Graphic OLED
COG+PCB	0.96	2.4	27.3×27.3	23.94×12.06	21.74×10.86	I2C	Graphic OLED
COG+PCB	0.96	2.4	27.3×27.3	23.746×13.206	21.746×11.206	I2C	Graphic OLED
COG+PCB	1.04	2.6	35.4×23.5	27.58×8.38	25.58×6.38	SPI	Graphic OLED
COG+PCB	1.1	2.8	31.5×31.5	24.54×17.02	22.53×15.01	SPI,I2C	Graphic OLED
COG+PCB	1.23	3.1	53×20	36×10	30.69×5.94	6800,8080,SPI,I2C	Character OLED
COG+PCB	1.28	3.3	35.5×32	31.32×15.62	29.42×14.2	I2C	Graphic OLED
COG+PCB	1.5	3.8	34.2×45.5	28.86×28.86	26.86×26.86	SPI,I2C	Graphic OLED
COG+PCB	1.54	3.9	42.4×38	37.05×19.52	35.05×17.51	SPI,I2C	Graphic OLED
COG+PCB	1.92	4.9	34.9×57.8	30.91×41.34	28.908×39.34	SPI	Graphic OLED
COG+PCB	2.08	5.3	70×22	53.18×14.78	51.18×12.78	SPI	Graphic OLED
COG+PCB	2.26	5.7	84×44	58.22×13.52	56.22×11.52	6800,8080,SPI,I2C	Character OLED
COG+PCB	2.42	6.1	75×52.7	57.01×29.49	55.01×27.49	6800,8080,SPI,I2C	Graphic OLED
COG+PCB	2.89	7.3	92×31.5	72.42×22.82	70.42×20.82	6800,8080,SPI,I2C	Character OLED
COG+PCB	2.93	7.4	92.3×23.3	75.52×13.52	73.52×11.52	6800,8080,SPI,I2C	Character OLED
COG+PCB+FR	2.23	5.7	66.5×35	59×17.1	55.018×13.098	6800,8080,SPI,I2C	Graphic OLED
COG+PCB+FR	2.23	5.7	66.5×35	56.02×14.1	55.018×13.098	6800,8080,SPI,I2C	OLED Touch
COG+PCB+FR	2.42	6.1	75×52.7	57.01×29.49	55.01×27.49	6800,8080,SPI,I2C	OLED Touch
COG+PCB+FR	2.7	6.9	82×47.5	63.41×32.69	61.41×30.69	6800,8080,SPI,I2C	OLED Touch
COG+PCB+FR	2.7	6.9	82×47.5	63.41×32.69	61.41×30.69	6800,8080,SPI,I2C	OLED Touch

OLED with Rotary Switch and Capacitive Touchscreen

Raystar has developed a new OLED rotary switch module which adopts REX128128D COG OLED module with Projected Capacitive Touch Panel (PCAP).

The diameter of active area is Ø30.0 mm (1.18" diagonal), and the resolution is 128×128 pixels. This OLED module uses IC SSD1327 supporting 4-line SPI and I2C interfaces. PCAP touch panel with surface hardness 6H uses IC IT7259 which supports I2C interface and 1-point touch. There are 3 emitting colors to choose from, including white, yellow, sky blue. It also features 4-bit grayscale; there are 16 shades of gray which can represent different intensity information.

This OLED switch is suitable for applications that require to be operated through rotation or touch, for instance, coffee maker, audio visual equipment, smart appliances, and so on.

Further Specifications:

- Module dimension: Ø56 × 21.56 mm
- Pixel size: 0.210 × 0.210 mm
- Pixel pitch: 0.235 × 0.235 mm
- Display Mode: Passive Matrix
- Duty: 1/128 Duty
- Display Color: White / Yellow / Sky Blue

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GEN4-HMI Intelligent Displays	**WORKSHOP4-IDE**	**Intelligent Displays for ARDUINO**	**Primary Displays for RASPBERRY PI & ASUS Tinker Board**
Powerful, Sleek, Standalone. Rapid Application development for Fast Time-to-market	Software development suite for all the 4D range of intelligent displays. Fast development and deployment	4D Systems provides the hardware to easily connect Arduino to intelligent Displays	Showcasing your Pi output

gen4 HMI Display Modules Picaso Series

2.4"-3.2" | 240x320 px | ~150 cd/m²
5V Adaptors: Arduino, Raspberry Pi & ASUS

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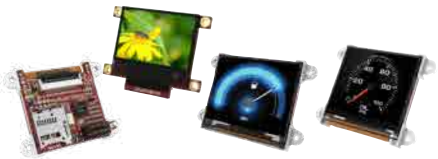
5V Adaptors: Arduino, Raspberry Pi & ASUS

microLCD Display Modules

1.44"-9.0" | 128x128 - 800x480 px
5V Adaptors: Arduino, Raspberry Pi & ASUS

microOLED Display Modules



0.96"-1.77" | 96x64 - 160x128 px
5V Non-Touch Displays

Integrated Display Solutions

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5V Panel mountable smart display controller

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5V Resistive Touch Displays

Primary Displays for Raspberry Pi

4.3"-7.0" | 480x272 - 800x480 px
5V Resistive & Capacitive Touch Displays

Primary Displ. for ASUS Tinker Board

4.3"-7.0" | 480x272 - 800x480 px
5V Resistive & Capacitive Touch Displays

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Sound module and camera with different lenses available

Accessories

Programming adaptors, USB cables, bezels for open frame displays

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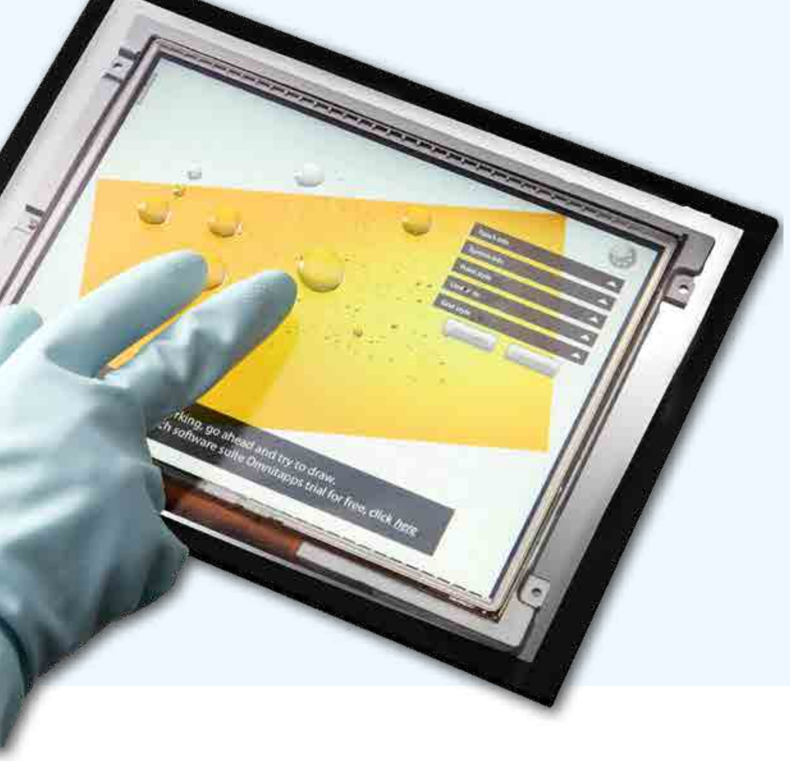
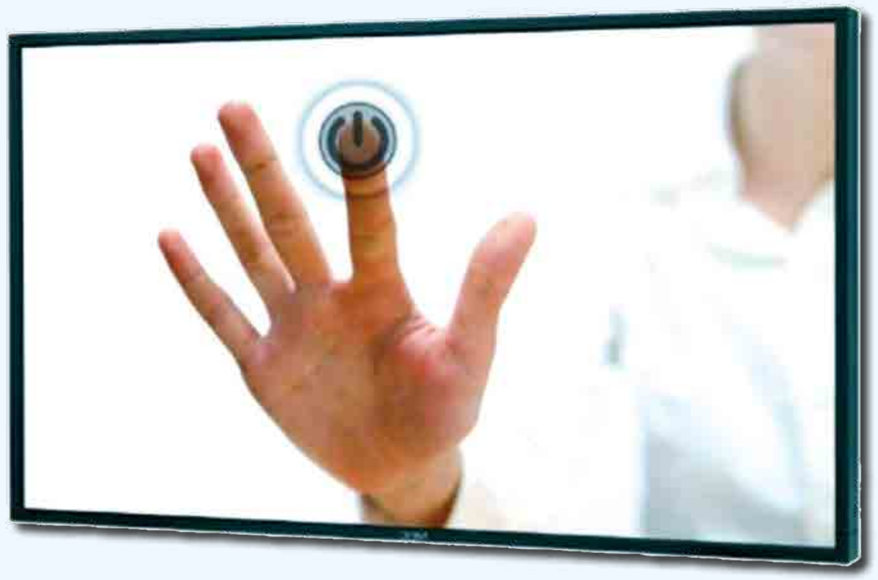




Touch Systems

Resistive Touch Technologies

A resistive touch sensor has two layers that are not in contact with each other

- An outside flexible layer, coated on the inside with a conductor, e.g. ITO (Indium Tin Oxide)
- Non-conductive separator "dots", e.g. mica or silica, small enough to not be noticeable
- An inside supporting layer of glass, coated on its face with conductor (ITO)

Around the outside of the viewing area is a printed circuit pattern. When the outside flexible layer is pressed against the inside layer, the resulting voltages can be measured in more than one direction. By comparing these voltages to the starting voltage, the point where the touch happened can be calculated. Resistive sensors are simple and relatively inexpensive. The flex required to push the surfaces together can eventually fail the flexible layer.

The flex requires some pressure, so force is required to make contact. The presence of two layers in addition to the LCD can reduce brightness by 10-20%. On the plus side, a new flexible glass outer layer is now available to improve wear and chemical resistance. Overall, the technology is simple and predictable, so resistive sensors remain the most common form of touch sensor.

4 wire resistive	
Inch	**cm**
2.9 - 4	7.4 - 10.2
4.3	11
5.7	14.5
6.4	16.3
7	17.8
7.5	19
8	20.3
8.4	21.3
10.4	26.5
12.1	30.8
15	38.1
17	43.2
19	48.3
USB Controller: HT-EBU4-3 RS-232 Contr.: HT-EBS4-2	

4 wire Glas / Glas	
Inch	**cm**
5	12.7
5.7	14.5
7	17.8
8.4	21.3
10.4	24.5
12.4	30.7
15.1	38.5
17.1	43.5
Available as clear type, and as AG/AR type	

5 wire resistive	
Inch	**cm**
6.5	16.2
7	17.8
8.4	21.4
10.4	26.4
12.1	30.7
15	38.1
17	43.2
19	48.3
20.1	51
22	55.9
24	61
USB Controller: ETP-MB-5000UECG RS-232 Contr.: ETP-MB-5000RECG	

Capacitive Touch Technologies

A capacitive touch sensor is a simple supporting sheet of glass with a conductive coating on one side. Around the outside of the viewing area is a printed circuit pattern. This pattern sets a charge across the surface, which is disturbed by the finger touching the screen. There are various technologies that detect the touch differently: some can even detect near-touches without making contact. All capacitive sensing methods look for electrical disturbance, so the electrical characteristics of the touching object are important.
One finger is much like another, but a glove, a stylus or other types of objects may change the response or not respond at all. Capacitive sensors are built right on a single glass layer. They don't break down by from flexing, but they may be subject to abrasion of the ITO coating. The single layer transmits light well, so brightness reduction is only 5-15%. The contact requires no pressure, so the force required to make touch is insignificant.

Cap. Touch	
Inch	**cm**
5.8	14.7
6.8	17.3
7.3	18.5
8.5	21.6
10.8	27.4
12.4	31.5
15.7	39.9
17.5	44.5
19.4	49.3
22.4	56.9
26.3	66.8
31.8	80.8
Controller: C-3100	

SAW-Touch	
Inch	**cm**
8.4	21.4
10.4	26.4
12.1	30.8
15	38.1
17	43.2
19	48.3
21	53.3
22	55.9
Controller: HAT-EBUS-2 Options: clear, AG or AR and antivandalism type	

IR Touch	
Inch	**cm**
15	38.1
17	43.2
19	48.3
32	81.3
42	106.7
Options: AG / AR, 6mm Glas	

Projected Capacitive Technology

Projected Capacitive Touch (PCT, also PCAP) technology is a variant of capacitive touch technology. This technology allows two points recognition and light touch inputs. Work with gloves as well as cover glass make flat designs possible. These features make the technology a good choice for industrial and medical applications.

Proj. Cap. Touch	
Inch	**cm**
5.7	15.5
6.5	16.4
7 wide	17.8
8.4	21.3
9 wide	23
10.4	26.4
12.1	30.8
15	38.1
17	43.2
19	48.3
22 wide	55.9
Controller USB/RS232 available	

Features

- High durability
- High transmission
- Water resistance
- Two points touch is available
- Input with glove is possible
- High resolution

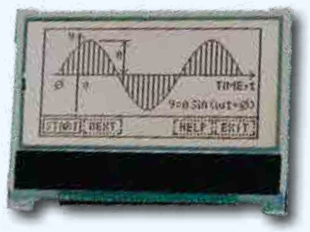
Passive LCD Modules

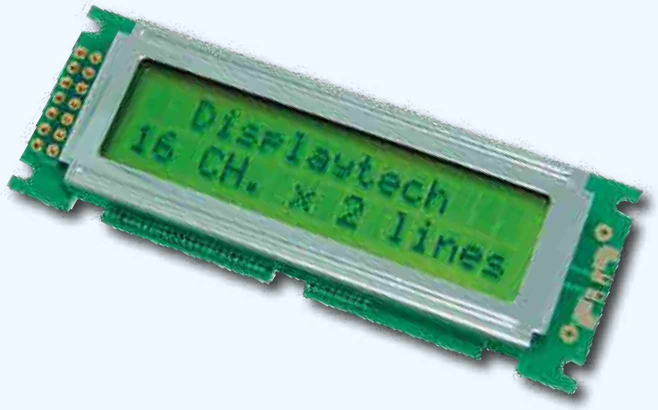
Rutronik's application team – the engineering bridge to a wide field of display solutions with an excellent supplier portfolio.

The main area of activities of our display department is to offer customized solutions. Due to our experience in the display market we will provide you with the best solution and the most suitable manufacturers for your requirements.

The philosophy of the display department is to give you our best engineering consultancy in project work. We are the worldwide interface between customers, suppliers, R+D, Quality Management, Production and Purchase Department.

Technology	Dot Color / Background	Features
TN, HTN	black / grey optional other	TN (Twisted Nematic) / HTN (Higher Twisted Nematic) is the most cost-effective technology
STN / grey, silver, blue	dark blue / yellow green	STN (Super Twisted Nematic) twisting angle up to 270° which gives almost ideal steepness of the characteristic optoelectronic curves improvement of the viewing angle
FSTN	black / white	FSTN (Film Super Twisted Nematic) high-contrast black and white representation by utilization of a decelerating film more cost-effective, lighter and flatter than DSTN
Vertical Alignment	Optional / black	VA, super black background, super wide viewing angle, high contrast ratio
FSC	Optional / positive, negative	FSC (Field Sequential Colour) No need of colour filter, low power consumption
FFSTN	black / white negative	FFSTN (Double Film Super Twisted Nematic) high-contrast black and white negative mode display optimal performance with white or multicolor backlights more cost-effective, lighter and flatter than DSTN ISTN for best contrast through the whole temp. range
CSTN	color	FSTN with color filter mask (passive matrix) passive driven not matrix white LED or CCFL illumination
ASTN	color/dark	compensation retardation film, low transmittance & high contrast





TN (Twisted Nematic) Displays

FSTN with green backlight

STN, Yellow-Green

STN, Blue mode

STN yellow-green, positive

STN, COG

FSTN, positive, white Backlight

FSC (Field Sequential Colour)

STN blue mode, positive, white Backlight

FSTN, negative, white Backlight

FSTN, graphic LCD, RGB Backlight with FPC Connection

Vertical Alignment with different backlights

STN yellow-green, positive, yellow-green Backlight

FSTN, negative, blue Backlight

LCD Standard Modules

Liquid crystal displays, in the form of passive matrix LCDs, are increasingly found in all areas of everyday life. Their use is no longer restricted to technical applications. We are able to fulfil your standard passive LCD requirements with a lot of different module types. In which you can choose several individual parameters, like nearly all kinds of backlight colours, different temperature ranges and different technologies.

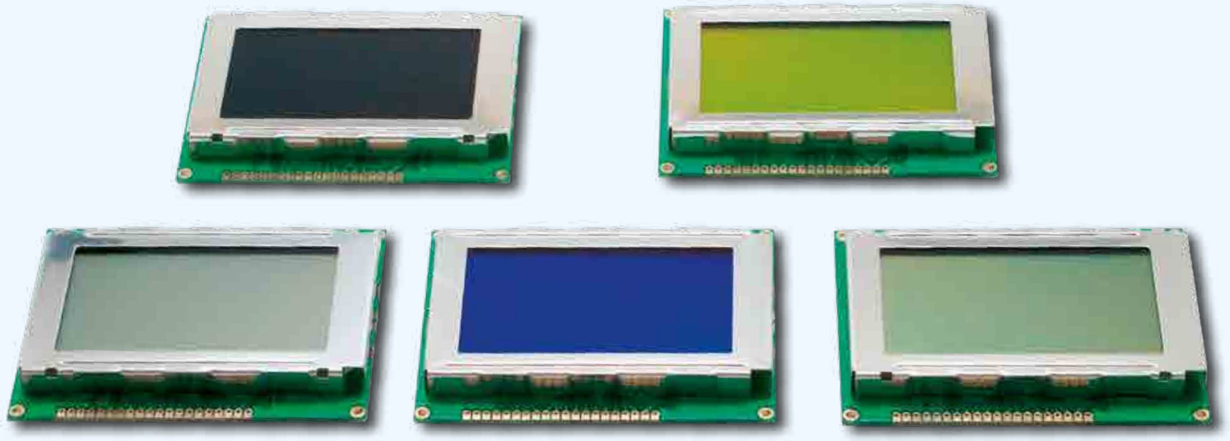
We cover the most common alphanumeric and graphic LCD sizes. All displays are available in transmissive, transflective and reflective mode.

Passive LCD Modules from Displaytech

Characters x Lines	Model Number	Module Size W x H [mm]	View. Area W x H [mm]
16 x 1	161A	80.0 x 36.0	64.5 x 13.8
16 x 2	162A	80.0 x 36.0	64.5 x 13.8
16 x 2	162B	84.0 x 44.0	65.6 x 16.0
16 x 2	162C	80.0 x 36.0	64.5 x 14.8
16 x 2	162COG	66.0 x 27.7	61.0 x 15.7
16 x 2	162D	85.0 x 30.0	62.0 x 16.0
16 x 2	162E	80.0 x 36.0	65.6 x 16.0
16 x 2	162F	122.0 x 44.0	99.0 x 24.0
16 x 4	164A	87.0 x 60.0	61.8 x 25.2
20 x 2	202A	116.0 x 37.0	85.0 x 19.8
20 x 2	202B	122.0 x 44.0	99.0 x 24.0
20 x 4	204A	98.0 x 60.0	76.0 x 25.2
20 x 4	204B	98.0 x 60.0	76.0 x 25.2
24 x 2	242A	118.0 x 36.0	93.5 x 15.8
40 x 2	402A	182.0 x 33.5	154.5 x 15.8

Displaytech offers a wide variety of standard display products to meet the requirements of your specific application. From monochrome graphic displays to segmented TN LCDs, Displaytech has many standard products that are commercially available off the shelf and suitable for most industrial, medical and consumer products.

Each of the standard products is unique due to the display technology, diagonal size or integrated display controller. To simplify your search for the perfect display, Displaytech provides all documentation relevant to each LCD module on the specific product page. Next to each product you will find the following items: data sheets for both the display and the integrated driver IC.



Displaytech Ltd.
a seacomp company

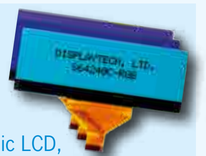
LCD Standard Modules

Passive LCD Modules from Displaytech

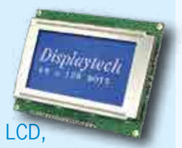
Dots / Diagonal Size	Model Number	Module Size W x H [mm]	View. Area W x H [mm]
122 x 32	32122A	65.6 x 29.2	54.8 x 19.1
122 x 32	32122B	56.1 x 29.2	49.1 x 19.0
128 x 32	32128A	41.3 x 19.7	36.1 x 9.9
160 x 32	32160A	100.0 x 38.8	80.0 x 20.5
128 x 64	64128K	58.2 x 41.7	50.0 x 25.0
128 x 64	64128KX	58.2 x 41.7	50.0 x 25.0
128 x 64	64128L	68.8 x 49.2	60.6 x 33.1
128 x 64	64128LX	68.8 x 49.2	60.6 x 33.1
128 x 64	64128M	77.4 x 52.4	70.0 x 40.0
128 x 64	64128MX	77.4 x 52.4	70.0 x 40.0
128 x 64	64128N	74.0 x 41.7	50.0 x 25.0
128 x 64	64128P	93.0 x 70.0	70.7 x 38.8
128 x 64	64128Q	75.0 x 52.7	60.0 x 32.5
240 x 64	64240B	180.0 x 65.0	132.6 x 39.0
240 x 64	64240C	144.9 x 56.4	132.6 x 39.0
320 x 240 3.9" QVGA	240320E	91.5 x 70.5	80.55 x 61.1
320 x 240	240320FP	91.4 x 109.7	100.0 x 76.0
320 x 240 4.7" QVGA	240320G	109.7 x 91.4	100.0 x 76.0
320 x 240 3.9" QVGA	240320H	9.0 x 70.5	80.5 x 61.1
320 x 240	240320JP	70.5 x 91.5	61.1 x 80.55
240 x 128	128240A	144.0 x 104.0	114.0 x 64.0
240 x 128	128240C	77.4 x 52.4	70.0 x 35.0
240 x 128	128240D	98.7 x 67.7	92.0 x 53.0

Displaytech offers a full line of monochrome COG and graphic LCD modules with or without your choice of backlight. Our selection of 128x64, 128x32, 128x240 and 240x64 graphic FSTN LCD modules are our most popular! The popularity of these displays allows Displaytech to offer highly competitive pricing and flexible stocking options.

FSTN, graphic LCD, positive mode, reflective



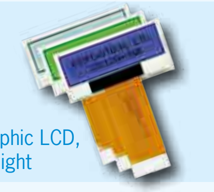
FSTN, graphic LCD, negative mode, RGB backlight



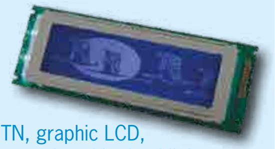
FSTN, graphic LCD, blue mode, white backlight

FSTN, graphic LCD, negative mode, white backlight

STN, grey mode, white backlight

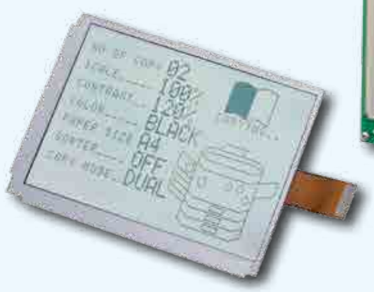


FSTN, graphic LCD, RGB backlight



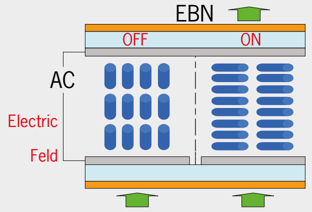
FSTN, graphic LCD, blue mode, white backlight

FSTN, graphic LCD, amber backlight



TIANMA U.R.T. YB HOLITECH Europe

Custom Design LCD Modules



Custom Design LCD Modules

Customized displays are manufactured according to the specification of our customers. Depending up on the size of the LCD panel and the LCD technology a reasonable minimum order quantity is required.

Module Technologies

Rutronik´s partners are implementing a variety of integrated circuit mounting techniques in designs of printed circuit boards used with standard and custom made liquid crystal modules. The company has a full production line for incorporating surface mount technology (SMT), chip on board (COB), tape automated bonding (TAB) and flexible print circuit (FPC). TIANMA contributes solutions to the markets burgeoning demand for chip on glass (COG) technology.

Field Sequential Color (FSC)

With the new FSC-Technology there is no need to insert color filters to portray the colored Icons. In a FSC module a conventional TN-Cell is combined with a RGB Backlight. The 3 colors of the LED Backlight are sequentially switched on.
The frequency of the backlight is synchronous with the frequency of the display segments. As a result you can show up to 8 different colors (black, blue, green, cyan, red, magenta, yellow or white).

Main Advantages of FSC:

- No need of color filters
- Low power consumption
- LCD glass is very economical due to the TN COG technology
- No need of high-end microprocessors

Vertical Alignment

With the Vertical Alignment technology the Liquid Crystal molecules are perpendicular. Vertical Alignment leads to a very dark background and wide viewing angle.
Suitable for low and medium information content, automotive, industrial and medical applications.

Main Advantages of Vertical Alignment:

- Super black background
- Super high contrast ratio
- Super wide viewing angle
- Suitable for all kinds of color backlight and white backlight
- Wide temperature range (-30 °C to 85 °C)

Display Accessories

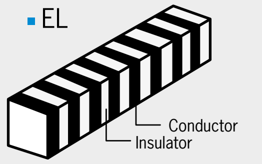
Rutronik is also able to supply different accessories for your LCDs from selected suppliers, as well as integration of turn key components.
It is possible to add other components like keys, LED or special connectors to a custom design LCD module.
With these options Rutronik and its partners can offer the complete solution to customers.

Connectors
- Rubber
- Connector
- Pins
- FPC
- Heatseal

Backlight
- LED
- CFL
- EL

Bezel
- Plastic
- Metal

Touchpanel
- Resistive



Customized displays are manufactured according to the specification of our customers. Depending upon the size of the LCD panel and LCD technology a reasonable minimum order quantity is required. Our team will consult you with the most fitting supplier for your customized LCD project. We will support you for the whole project-life-time, beginning from the first drawings up to the first samples producion and final mass producion.

Visual Solutions

SHARP

From commercial displays for digital signage, through to interactive displays for a true pen-on-paper experience, Sharp has a visual solution for every need. Our professional display solutions and video walls are ideal for any environment where clear communication of complex information is essential. Our large format display will get your message across in crowded and busy locations such as shopping malls and transport hubs. And for smaller spaces, we have a range of best-in-class visual business solutions with sizes starting from 32”. Whatever your application, need or environment, you’ll find a digital display to suit in our range of visual solutions.

PN-40TC1

- BIG PAD for Huddle Office Meeting Spaces and Interactive Retail Signage
- 40" (100.33 cm) size with 1920 x 1080 pixels
- Fast and Responsive PCAP Capacitive 10 point Touch - up to 4 users
- Mini OPS Slot for flexible enhancement
- Sharp Pen Software for intuitive writing, drawing and annotation
- Sharp Touch Viewing Software for organising collaboration data
- Sharp Display Connect for latest BYOD wireless collaboration

Windows Collaboration Display

- Certified for Skype for Business and supported by Microsoft teams
- Integrated microphone, speakers and high-quality camera
- Seamless operation and conferencing with Microsoft Office 365
- Fast 'Plug and play' with single 8 m USB-C connector
- Brilliant eye-catching 4K image content
- Elegant edge to edge highly responsive PCAP 10-point touch
- Smart building management using the data from the IoT sensor hub

PN-86HC1

- 4K BIG PAD for Education, Training and Meeting Rooms
- 86" (217.4 cm) size with 3840 x 2160 pixels
- Fast Infrared (IR) 20 point touch
- Two built-in (10W) stereo loudspeakers which clearly and effectively fill larger rooms
- Integrated SoC Controller player for PC-less Whiteboarding and Media playback
- OPS slot for optional function enhancement
- Provides a natural ‘Pen-on-Paper’ experience using a passive pen or finger
- Intuitive control with full bezel button controls and on screen touch menu

Professional Monitors

SHARP

Our innovative choice of professional smart displays ranges from a conveniently-sized 40” right through to our attention-grabbing 90” large format display. You can bring content to life with our 8K resolution display and see fine details clearly with our Ultra High Definition (UHD) 4K resolution displays. Even our standard High Definition (HD) displays will help your business communicate easily and colleagues to collaborate effectively. We have a solution to suit every application including retail stores, design studios, public spaces, transport hubs, corporate buildings, meetings rooms and more!

PN-R706

- 70" (176.6 cm) display for professional 24/7 signage
- 1920 x 1080 pixels with 700 cd/m^2
- Flexible installation with Mini-OPS extension slot
- Contrast 5,000:1
- LED, Edge Lit
- Slim Bezel design with Speakers 10 W + 10 W
- Portrait, Landscape, Face-Up installation support
- Sharp UV²A Display Technology

PN-M501

- 50" (125.7 cm) display for professional 24/7 signage
- 1920 x 1080 pixels with 450 cd/m^2
- Powerful and flexible stand-alone operation with embedded Android SoC
- Flexible performance upgrade with Mini-OPS Extension Slot
- Portrait, Landscape, Face-Up and Face-Down installation support
- Slim Bezel Design with speakers 7 W + 7 W
- Sharp e-Signage S player pre-installed on Android SoC

PN-HW861

- Make a bigger impact with the 86" display
- Showcase images and video in detail with 4K Ultra HD resolution (3840 x 2160 pixels)
- Enhanced and true representation of colour
- Continous display of content during business hours 16/7
- Show and hear content easily with integrated 4K USB media player and speakers
- Latest HDMI connectivity for 4 K at 60 Hz
- Slim, sleek and elegant design to suit any setting
- Flexible installation in portrait and landscape

Wireless Technologies – Linecard

Make your application smart by connecting it wirelessly to the Internet of Things. RUTRONIK EMBEDDED has the newest solutions for using a smartphone, WiFi access point or a mobile communication network as gateway for your device. Our understanding of the right wireless solution covers hardware, drivers or transmission protocol, application profiles, security aspects, certifications, long-term considerations as well as political aspects regarding standards, compatiblity and consortia.

Suppliers

2J antennas
ASUS IN SEARCH OF INCREDIBLE
ADVANTECH Enabling an Intelligent Planet
EnOcean Self-powered IoT
FUJITSU
GARMIN
聚辰半导体股份有限公司 Giantec Semiconductor Corporation
GNS
GradConn
iDTRONIC
Infineon
INSIGHTSIP
intel
iVativ
KYOCERA AVX
Melexis
MINEW
molex
muRata INNOVATOR IN ELECTRONICS
NORDIC SEMICONDUCTOR
Panasonic
Pulse a YAGEO company
ROHM
silex technology
TDK
Telic
Telit Cinterion
unicorecomm 和芯星通
YAGEO Group

Bluetooth

	Asus	EnOcean (Dolphin)	FUJITSU	GARMIN	Infineon	Insight SiP	iVativ	Minew	Murata	NORDIC	Panasonic	ROHM	SILEX	TDK	TELIT
Bluetooh Classic Modules												■			■
Bluetooth LE (Low Energy) Modules		■	■	■	■	■	■	■	■		■	■	■	■	■
Bluetooth Dual Mode Modules			■		■				■		■				
Bluetooth Dual Mode System on Chips					■										
Bluetooth LE (Low Energy) System on Chips					■					■					
Bluetooth devices (Beacons, Key Finder, Dongles etc.)	■		■			■	■	■							

GSM/GPRS/UMTS/LTE/NB-IoT/5G GNSS

	2J Antennas	Advantech	GNS	Infineon	intel	iVativ	Minew	Murata	NORDIC	TELIC	TELIT	Unicore
GSM/GPRS/UMTS/LTE/NB-IoT/5G												
Modules								■	■		■	
Cards		■									■	
Terminals		■				■				■	■	
With integrated GPS		■							■	■	■	
SIM-Card Connectivity											■	
GNSS												
GPS/GNSS Modules			■				■	■			■	■
GPS/GNSS Cards		■										
GPS/GNSS Chips				■								■
Ultra High Precision												■
Modules with integrated Antenna	■		■								■	

Propritary Wireless

	Advantech	EnOcean (Dolphin)	GARMIN	Infineon	Insight SiP	Minew	NORDIC	Panasonic	ROHM
Receiver Chips				■					
Transceiver Modules		■	■		■	■		■	
Transceiver Chips				■			■		■
Transmitter Chips				■			■		
Gateway Solution	■					■			
USB Sticks		■	■			■	■		

Long Range Wide Area Network

	Advantech	Kyocera AVX	Insight SiP	iVativ	Minew	Murata
LoRa	■	■	■	■	■	■
Sigfox						■

RFID/ NFC

	FUJITSU	GARMIN	GIANTEC	iDTRONIC	Insight SiP	Melexis	Minew	Murata	NORDIC	Rohm	TELIT
Passive Reader Modules	■		■	■						■	
Passive Transponder Chips			■					■			
Passive Transponder Devices			■	■				■			
Passive Reader Chips			■			■					
NFC Pairing Chip		■			■		■	■	■		■

Hardware Security Solutions

	Infineon
Authentication	■
Trusted Computing	■

ZigBee

	EnOcean (Dolphin)	FUJITSU	GARMIN	Infineon	Insight SiP	iVativ	Minew	NORDIC	Panasonic	ROHM
System on Chips				■				■		
Modules	■	■	■		■	■	■		■	■

WIFI

	Asus	Fujitsu	Infineon	intel	iVativ	Minew	Murata	NORDIC	Panasonic	ROHM	SILEX	TELIT
Modules WiFi a/b/g/n/ac		■		■	■		■		■	■	■	■
Modules WiFi 6 (ax)				■		■	■		■		■	
Modules SubGHz-WiFi (ah)											■	
Cards WiFi a/b/g/n/ac				■	■						■	
Cards WiFi 6 (ax)				■					■			
Chips WiFi a/b/g/n/ac/ax			■				■	■				
Access Points/ Gateways/ Routers	■				■	■					■	

Accessories

	2J Antennas	Advantech	Chilisin	CHINMORE	EnOcean	Kyocera AVX	GradConn	Molex	Pulse	YAGEO
Adapter Cables	■	■		■			■	■	■	
Antennas (internal)	■		■	■		■		■	■	■
Antennas (external)	■		■	■		■		■	■	■
Antennas (surface mounted)	■		■	■		■		■	■	■
SIM-card Holders						■	■	■		
Energy Harvester					■					

Special Wireless Techn.

	GNS
ADS-B	■
TMC	■

UWB

	Insight SiP	Murata
Modules	■	■

Cellular Data Cards

mPCIe and M.2 (NGFF)

The robust line from Telit of high-speed industrial-grade PCI-SIG® standards-based modules come in the architecture your project needs whether it be to enable mobile computing, networking, or industrial IoT. The plug-and-play design simplifies integration and is available in two form factors: Mini PCI Express (mPCIe) and M.2.

Dimensions & Key Features

- mini PCIe full-size single-sided
- M.2 (NGFF)
- Industrial temperature range: -40 to 85 °C
- Optional GNSS
- Certified with regulatory bodies and mobile operators worldwide

mPCIe and M.2 Modules in Global Variants

Telit Card	Description	Region	Technology
FN990A40/FN990A28	M.2 Data Card, sub-6 GHz only version, up to 4.9 Gbps Downlink, 7x Carrier Aggregation DL (2x UL), 4x4 MIMO, 256 QAM, full GNSS support	Worldwide	5G 3GPP Release 16
FN980/FN980m	M.2 Data & Voice Card, sub-6 GHz + mmWave version, up to 5.5 Gbps Downlink, 7x Carrier Aggregation DL (2x UL), 4x4 MIMO, 256 QAM, full GNSS support	Worldwide	5G 3GPP Release 15
LM960	Mini PCIe Data Card, up to 1.2 Gbps Downlink, 5x Carrier Aggregation DL, 4x4 MIMO, full GNSS support	Worldwide	LTE Cat 18
LN920A12	M.2 Data Card, up to 600 Mbps Downlink, 3x Carrier Aggregation DL, 2x2 MIMO, 256 QAM, full GNSS support	Worldwide	LTE Cat. 12
LM940	Mini PCIe Data Card, up to 600 Mbps Downlink, 3x Carrier Aggregation DL, MIMO, full GNSS support	Worldwide	LTE Cat 11
LN920A6	M.2 Data Card, up to 300 Mbps Downlink, 2x Carrier Aggregation DL, 2x2 MIMO, 64 QAM, full GNSS support	Worldwide	LTE Cat. 6
LE910C4	Mini PCIe Data & Voice Card, up to 150 Mbps Downlink, MIMO, full GNSS support	Regional & Worldwide Versions available	LTE Cat. 4
LE910C1	Mini PCIe Data & Voice Card, up to 10 Mbps Downlink, MIMO, full GNSS support	Regional & Worldwide Versions available	LTE Cat. 1
ME910C1/ME910G1	Mini PCIe Data Card, up to 1 Mbps Downlink, full GNSS support	Worldwide	LTE-M / NB-IoT

FN990A40 / FN990A28

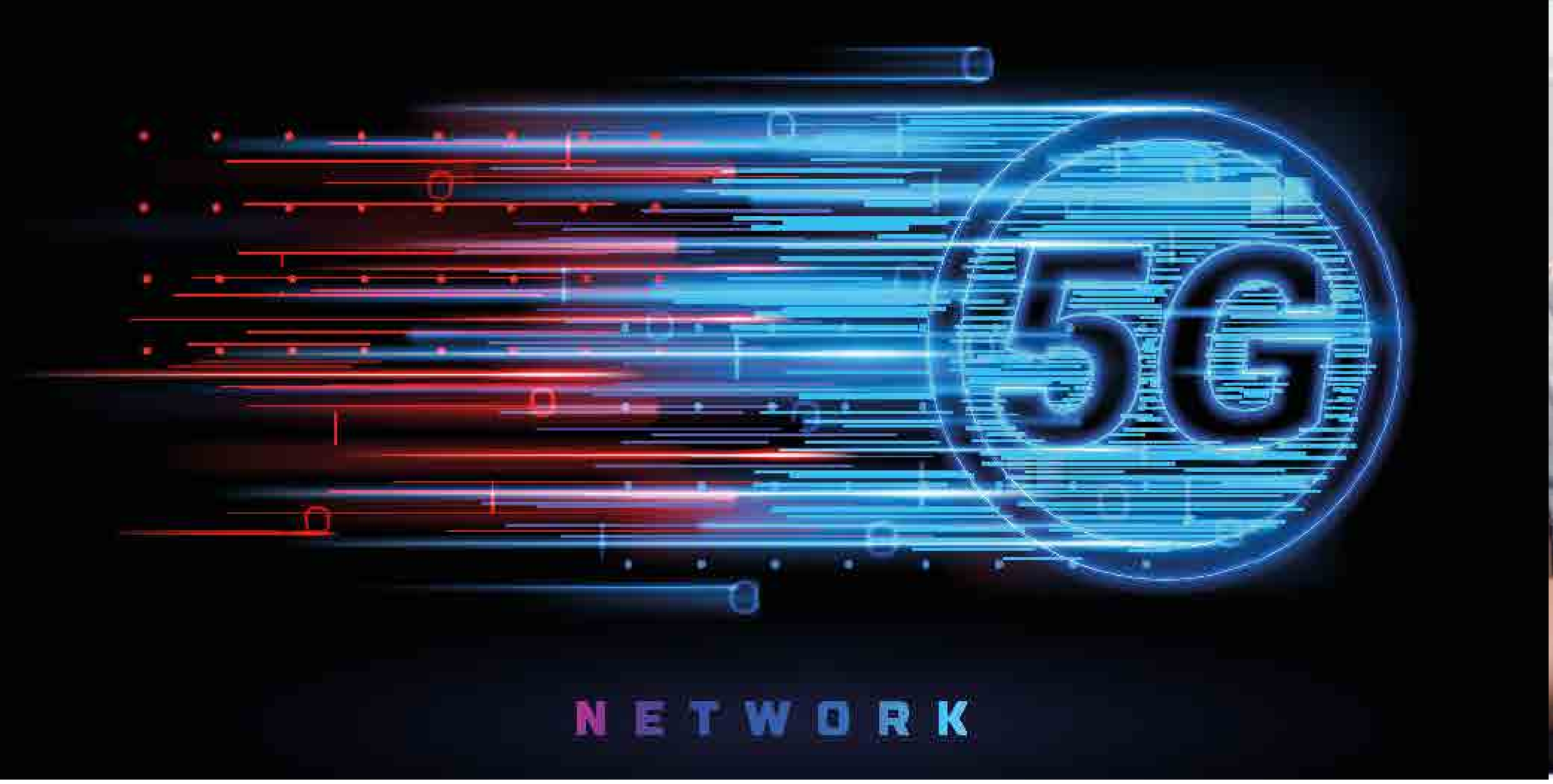
Next Generation 5G M.2 Data Cards

Telit FN990Axx data cards enable the next generation of state-of-the-art 5G data cards. They feature sub-6 GHz only technology with LTE, WCDMA and GNSS support. These data cards lay the foundation for business worldwide to future-proof IoT, enterprise applications and video.

Features & Specifications

- 5G sub-6 FDD and TSS, SA and NSA operations
- 5G core network Opt. 3a/3x and Opt. 2
- 3G: HSPA+ Rel. 8
- GNSS gpsOne Gen 9 Band L1 on dedicated RF connector
- 4x4 MIMO DL support
- 2x2 MIMO UL support
- 4 antenna connectors for LTE/Sub-6
- 1 antenna connector for GNSS
- 5G FR1 Bands: n1, n2, n3, n5, n7, n8, n12, n13, n14, n18, n20, n25, n26, n28, n29, n30, n34, n38, n39, n40, n41, n48, n66, n71, n75, n76, n77, n78, n79
- LTE Bands: 1, 2, 3, 4, 5, 7, 8, 12, 13, 14, 17, 18, 19, 20, 25, 26, 28, 29, 30, 32, 34, 38, 39, 40, 41, 42, 43, 46, 48, 66, 71
- WCDMA Bands: 1, 2, 3, 4, 5, 6, 8, 9, 19
- FOTA support
- Dimensions: 30 x 52 x 2.3 mm
- Operating temperature range: -40 °C to +85 °C
- 1.8/3 V SIM Interface
- Interfaces: USB 3.1 Gen2, PCIe Gen3/4 on lane
- Drivers support: Windows 10, Linux
- Supply voltage: 3.3 VDC
- Approvals: FCC, IC, RED, NCC, JATE/TELEC, KCC, RCM, PTCRB, GCF, various MNOs

Type	FN990A40	FN990A28
4G Carrier Aggregation	4G Cat 20, up to 7xCA	4G Cat 19, up to 5xCA
5G (NSA) Data Throughput	Up to 4.9 Gbps DL 0.55 Gbps UL	Up to 3.4 Gbps DL 0.55 Gbps UL
5G (SA) Data Throughput	Up to 4.1 Gbps DL 0.90 Gbps UL	Up to 2.5 Gbps DL 0.90 Gbps UL
Chipset	Qualcomm® Snapdragon™ X65	Qualcomm® Snapdragon™ X62



FN980m

Advanced LTE/5G M.2 Data Card

Telit Cinterion

Enabling a new generation of 5G state-of-the-art data cards featuring Sub-6 and mmWave technologies with LTE, WCDMA & GNSS support. Industrial-grade M.2 form factor suitable - among others - for following applications: High Power Fixed Wireless access, enterprise routers and gateways, indoor/outdoor CPE, video broadcasting & surveillance. Support of Qualcomm QTM525 & QTM527 mmWave antennas.

Features & Specifications

- 5G Sub-6 and mmWave FDD and TDD, SA & NSA operations
- 5G core network Opt. 3a/3x and Opt. 2
- 4G: 7CA, up to 20 layers DL / 2CA UL, 256 QAM DL/UL
- 3G: HSPA+ Rel. 8 (DL/UL 42/11 Mbps)
- GNSS: gpsOne Gen9 L1 band on dedicated RF connector, L5 shared with cellular
- Voice support: VoLTE, VoNR (under evaluation), PCM audio over USB
- 4 antenna connectors for LTE/Sub-6
- 4 mmWave antennas supported
- 5G FR1 Bands: n1, n2, n3, n7, n8, n12, n20, n25, n28, n38, n40, n41, n48, n66, n71, n77, n78, n79
- 5G FR2 Bands: n257, n258, n260, 261
- LTE Bands:
  1, 2, 3, 4, 5, 7, 8, 12, 13, 14, 17, 18, 19, 20, 25, 26, 28, 29, 30, 32, 34, 38, 39, 40, 41, 42, 43, 46, 48, 66, 71
- 4x4 MIMO support
- WCDMA Bands: 1, 2, 3, 4, 5, 6, 8, 9, 19
- Dimensions: 30 x 50 x 3.5 mm
- Data throughput with 5G: up to 5.5 DL / 1.5 UL Gbps
- Operating temperature range: -40°C to +85°C
- 1.8/3 V SIM Interface
- Interfaces: USB 3.1 gen2, 2.0 and PCIe gen3
- Drivers support: Windows 10, Linux
- Supply voltage: 3.3 VDC
- Approvals: KCC, FCC, PTCRB, RED, GCF, Various MNOs

Key Benefits

- Standard M.2 (NGFF) Data-card form factor
- 4G/5G 3GPP Release 15
- 4G Cat. 20 up to 7x Carrier Aggregation
- 3G HSPA+ 3GPP Release 8
- State of the art GNSS receiver

LN920A12 / LN920A6

High Speed LTE M.2 Data Cards

Telit Cinterion

Telit family LN920 is a compact data card with versions available in Category 12 and 6 worldwide. Designed in M.2 (NGFF) form factor, it is the natural evolution towards 5G technology. It's suitable for high-performance industrial as well as consumer applications including fixed wireless access, enterprise routers and gateways, indoor and outdoor CPE and mobile computing.

Features & Specifications

- 3GPP Release 12 compliant
- Standard M.2 (NGFF) form factor
- LTE Bands: 1, 2, 3, 4, 5, 7, 8, 12, 13, 14, 17, 18, 19, 20, 25, 26, 28, 29, 30, 38, 39, 40, 41, 42, 43, 48, 66, 71
- WCDMA Bands: 1, 2, 4, 5, 6, 8, 9, 19
- Embedded GNSS receiver (GPS, GLONASS, Beidou, Galileo)
- Chipset: Qualcomm® SDX12
- 2x2 MIMO support
- 2 antenna connectors for LTE
- 1 antenna connector for GNSS
- FOTA support
- Dimensions: 30 x 42 x 2.4 mm
- Operating temperature range: -40 °C to +85 °C
- 1.8/3 V SIM Interface
- Interfaces: GPIOs, USB 3.0
- Drivers support: Windows 10, Linux
- Supply voltage: 3.3 VDC
- Approvals: CE/RED, FCC, IC, JATE/TELEC, PTCRB, GCF, various MNOs

Type	LN920A12	LN920A6
LTE Category	12	6
Max. DL Throughput	600 Mbps	300 Mbps
Max. UL Throughput	150 Mbps	50 Mbps
DL Carrier Aggregation	Up to 3xCA	Up to 2xCA

LE910C1 / LE910C4

LTE Cat 1 & Cat 4 Mini PCIe Data Cards

The LE910Cx series Mini PCIe (mPCIe) modules are optimized for LTE low category networks and are available in single mode and 3G/2G fallback options. In addition to VoLTE support, the LE910Cx series are swappable with other modules in the xE910 mPCIe family.

The LE910Cx series has an additional GNSS Receiver integrated. It comes with built in UDP/TCP/FTP and SMTP stacks. Both, LE910C1 and LE910C4, can be controlled over AT commands according to 3GPP TS 27.005, 27.007 as well as Telit Custom AT commands. They operate at an industrial temperature range from -40 to +85°C and support several interfaces like GPIOs, USB 2.0, UART and PCM. Data throughput of LTE Cat 1 cards reach max. speeds of 10/5 Mbps in DL/UL whereas LTE Cat 4 versions offer up to 150/50 Mbps in DL/UL. The LE910C1 and LE910C4 families from Telit are either available with Linux OS, some dedicated versions with ThreadX OS.

The Mini PCIe Cards have following country approvals:
FCC/IC, PTCRB, GCF, RCM, Jade/Telec, RED

Application Fields

Ideal platform for IoT applications, mobile data and computing devices with ultra-compact design and extended operating temperature range.

Version*	LE910Cx-EU	LE910Cx-NF	LE910Cx-AP	LE910Cx-LA	LE910Cx-CN	LE910Cx-WWX
Market	EMEA	North America (all MNOs)	APAC	LATAM	China, India	Worldwide
4G Bands	1, 3, 7, 8, 20, 28A	2, 4, 5, 12, 13, 14, 66, 71	1, 3, 5, 8, 9, 18, 19, 26, 28	1, 2, 3, 4, 5, 7, 28	1, 3, 5, 8, TDD: 38-41, TD-SCDMA: 34, 39	1, 2, 3, 4, 5, 7, 8, 12, 13, 14, 19, 20, 26, 28
3G Bands	1, 3, 8	2, 4, 5	1, 5, 6, 8, 19	1, 2, 4, 5	1, 8	1, 2, 4, 5, 8, 19
2G Bands	3, 8	-	-	2, 3, 5, 8	3, 8	2, 3, 5, 8
OS	Linux	Linux	Linux	Linux	Linux	ThreadX
available as LTE Cat 1	x	x	x	x	-	x
available as LTE Cat 4	x	x	x	x	x	X

*Various further regional versions are available both of Linux as well as ThreadX based OS.

M2M Terminals

GSM, NB-IoT and 4G Terminals for M2M Applications

Telic's GSM, NB-IoT and LTE terminals are targeted towards professional and industrial M2M applications which require wireless connectivity provided in a robust and reliable casing.

Key Features

- Modules based on the Telit module series xE910
- Industial interfaces according to RS232-standard integrated in all products
- Extremely efficient low-power mode for battery-powered applications

Key Benefits

- By integrating terminals from Telic, you can fully focus on the core competencies required in your specific application area and avoid the cost of developing, testing and certifying terminal related functionality
- Easily swap 2G, 3G with 4G terminals when required by having a real migration path for these mobile network technologies

Categories	Features	GT910 G	LT910 E	NT910 G
Modules	Supplier	Telit	Telit	Telit
Category	Product Category	Basic 2G	LTE/GSM/GPRS	LTE-M/NB-IoT
General	Part Number	06308	06307	06311
Air Interface	2G Frequency Band	2G Quad	2G Dual (900/1800 MHz)	2G Quad
	3G Frequency Band			
	LTE DL		10 Mbit/s	300 kbps
	LTE UL		5 Mbit/s	375 kbps
Interfaces	RS232 Interface	D-Sub (9-pin)	D-Sub (9-pin)	D-Sub (9-pin)
	USB 2.0	Mini-USB	Mini-USB	
	Audio (analog)			Mini-USB
	Antenna	FME	FME	FME
	LEDs	1 GSM + 2 Configurable	1 GSM+ 2 Configurable	1 GSM + 2 Configurable
	Robust 1.8/3 V SIM Card Holder	•	•	•
Software	Programmable		AppZone	AppZone
	Firmware Update	Serial/FOTA	FOTA	FOTA
	TCP/IP Stack	•	•	•
Input/ Outputs	Analog Inputs		1	1
	Digital Inputs			
	Outputs		1 (optional)	1 (optional)
Electrical Characteristics	Voltage Range	5V - 36V	5V - 32 V	5V - 32V
	Standby (@ 12V)	≈ 19 mA (*)	~12 mA (*)	~12 mA (*)
	Low Power Mode (@ 12V)	~2 mA (*)	~ 2 mA (*)	~ 2 mA (*)
Hardware Characteristics	Operating Temp.	-30 to +75°C	-30 to +80°C	-30 to +75°C
	Size	77 x 66 x 26mm		
	Weight	91g	91g	91g
Certificates	CE	•	•	•
	e1	•		
	FCC	•		

* Measurement averaged (including peaks) over a 1 min measurement intervall.

EWM-C117FL

AIW-355

AIW-344

EWM-G109H01E

Cellular Mini PCIe Data Cards

EWM-C117FL

Wide-Temp 4G/LTE, Full-size Mini PCIe Card

Features

- 4G/LTE Bands Cat. 4, 3G UMTS/HSPA, 2G GSM/GPRS/EDGE
- HSDPA 7.2Mbps, HSUPA 5.76Mbps
- U-blox TOBY-L2
- Operating temperature: -40 to +85 °C
- PCI Express mini-card rev. 1.2
- 2 RF Antenna Coaxial Connectors
- Windows 7/8.x/10, WinCE 5.0/6.0, Linux 2.4.x/2.6.x, Mac
- 50.85 x 29.9 x 6.2 mm

AIW-355

5G(Sub-6G)/LTE/WCDMA M.2 3052 Card

Features

- M.2 Key-B Card
- 5G NR SUB6:
  NR: n1, n3, n5, n8, n20, n28, n38, n41, n77, n78, n79
- 4G LTE FDD:
  Band 1, 3, 5, 7, 8, 19, 20, 28
- 4G LTE TDD: Band 38, 40, 41, 42, 43
- Qualcomm SDX55 Chipset
- 4 x 4 NR Sub6 EN-DC MAX 4.1 Gbps (DL) / 525 Mbps (UL)
- USB 3.0/3.1 Interface
- Windows 10, Linux (Ubuntu 20.04)
- Dimension: 30 x 52 x 2.3 mm

AIW-344

Wide-Temp 4G/LTE, Full-size Mini PCIe Card

Features

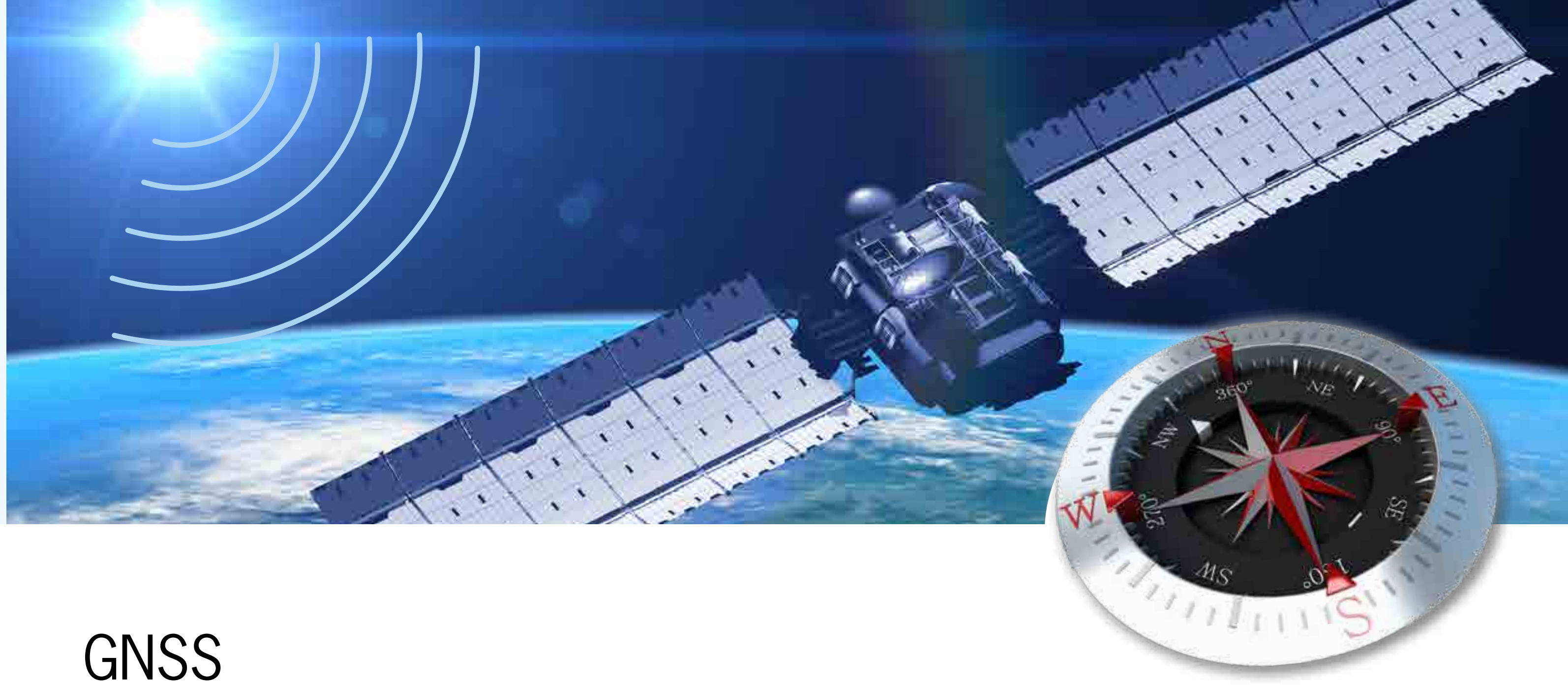
- Qualcomm MDM9X07
- 4G LTE FDD: Band 1, 3, 5, 7, 8, 20, 28
- 4G LTE TDD: Band 38, 40, 41,
- HSPA/UMST: Band 1, 5, 8
- Antenna: 2 LTE Antenna coaxial Connectors + 1GPS antenna connector
- Low power idle mode current
- Windows 7/8.x/10, Linux
- Standard mini PCIe full-size 29.9 mm x 50.85 mm

EWM-G109H01E

Embedded Multi-GPS/ GNSS Module

Features

- Half-size Mini PCIe card
- Multi-GNSS
  (GPS, GLONASS, BeiDou Galileo, QZSS and SBAS)
- Receiver Type
  - 72 Channels
  - GPS/QZSS L1 C/A, GLONASS L1 L10F, BeiDou B1, SBAS L1 C/A: WAAS/EGNOS/MSAS,
  - Galileo-ready E1B/C
- Time-To-First-Fix
  (GPS + GLONASS)
  - Cold Start: 26 s
  - Hot Start: 1.5 s
  - Aiding Start: 2 s
- Sensitivity (GPS + GLONASS)
  Tracking & Navigation: -167 dBm
  - Reacquisition: -160 dBm
  - Cold Start: -148 dBm
- Horizontal Pos. Accuracy
  SBAS: 2.0 m
- Time Pulse Config.:
  f=0.25…10 MHz
- Dynamics < 4 g
- Operating Temperature
  -40 to +85 °C



GNSS

EWM-G110H01E

Industrial GPS USB Half Mini PCI-E Card

Features

- 72-channel u-blox NEO-M8 engine
  - GPS/QZSS L1 C/A,
  - GLONASS L1 L10F,
- BeiDou B1, SBAS L1 C/A:
  WAAS/EGNOS/MSAS,
  Galileo-ready E1B/C.
- U-Blox M8 position engine with over 2 million effective correlators featuring < 1 s acquisition, -160 dBm cold start acquisition sensitivity and 20 Hz update rate.
- Supports u-blox' Assist Now Online / Assist Now Offline / AssistNow Autonomous A-GPS services and is OMA SUPL / 3GPP compliant
- Open sky cold start 26 second / Aided starts 3 second
- SBAS: WAAS, EGNOS, MSAS
- Accuracy 2.5 m CEP
- RoHS compliance
- 1 USB 2.0
- PCI-Express Mini or Half Mini Card form factor

2JR02ba2

GNSS USB Receiver with Telit SL869 Receiver

Features

- Interface: USB 2.0
- Cable length: up to 10 m
- Impedance: 50 Ohm
- Polarization: RHCP
- Gain: 3dBiC
- Voltage supply: 3.7 V to 6 V
- Current: 65 mA Max.
- Operating temperature: -45 °C to +85 °C

WiFi

EWM-W172H01E

USB 802.11ac/a/b/g/n 2T2R Wi-fi + Bluetooth 4.2 Mini PCIe Card

Features
- Main Chipset: Realtek RTL8822BU-CG
- Interface: PCI Express mini-card rev. 1.2
- Form Factor: USB signal with Half-size Mini PCIe card
- Security: WEP 64/128-bitm WPA, WPA2
- OS Supported: Windows 7,8.1,10 / Linux / Android
- Operating temperature: -20 to +70 °C

EWM-W157M201E

USB 802.11ac/a/b/g/n 2T2R Wi-fi + Bluetooth 4.2 Mini PCIe Card

Features
- Main Chipset: Realtek RTL8821CE-CG
- Interface:
  - Wi-Fi: PCI-E
  - Bluetooth: USB
- Form Factor: M.2 2230, A-E Key card
- Security: 64 / 128-bit WEP
- OS Supported: Windows 7/8.x/10
- Operating temperature: 0 to +70°C

AIW-154

IEEE 802.11ac/a/b/g/n and BT 5.0 M.2 2230 Module

Features
- Main Chipset: NXP 88W8997
- WiFi: PCI-E Bluetooth: UART
- Linux (open source), Recommend Kernel V4.0 and above
- 2Tx/2Rx
- WAPI, WEP 64 / 128-bit, WPA, WPA2, WPA3
- Operating temperature: -30 to +85 °C
- 30 x 22 x 2.85 mm

EWM-W193H01E

802.11 ac/a/b/g/n + 'BT 5.0 Half Mini-PCIe Module

Features
- Windows 10, Linux (Open Source), Recommend Kernel v4.0 and above
- Support for BT & WLAN Co-existence
- RoHS Compliance
- Frequency Band (2.4/5Ghz)
- WAPI, WEP 64/128-bit, WPA, WPA2 security support
- 2Tx/2Rx
- Operating temperature: 0 to +70 °C
- 30 x 26.8 x 2.5 mm

WiFi

SX-PCEAN2

802.11 a/b/g/n Mini PCIe Radio Module with Industrial Temperature Support

Features
- Atheros AR9582 [commercial] / AR9592 [Industrial] highly integrated chip set
- IEEE 802.11a/b/g/n compliant 2.4/5 GHz dual band
- 2x2 MIMO performance with data rate up to 300 Mbps
- PCI Express Mini Card 1.2 compliant
- Supports open source ath9k driver
- Linux supplicant available on request for WPA/WPA2-PSK & 802.1x EAP
- Customized Driver development available on request
  - Freescale i.MX 6 support
  - IEEE 802.11e QOS support available
- IEEE 802.11e QOS support

SX-PCEAC

802.11a/n/ac PCI Express Wireless LAN Module

Features
- Qualcomm Atheros QCA9880 chipset
- 3x3 SU-MIMO enhances high speed and stability
- IEEE 802.11ac(Wave1)/ a/n/e/h/i
- Wide band 80 MHz mode
- Silex Linux reference driver with IEEE802.11x EAP support
- High density modulation mode (256QAM)
- Max data transfer rate: 1.3 Gbps

WiFi

SX-PCEAX – Next Generation

IEEE 802.11 a/b/g/n/ac/ax (2x2) plus Bluetooth PCIe Combo Module

Features:

- Based on Qualcomm QCA2066
- Tri-Band Wi-Fi Module with 802.11ax WLAN plus BT 5.2
- Bluetooth v5.2 (BR/EDR/HS/LE Compliant)
- Interface:
  - WLAN: PCIe 3.0
  - Bluetooth: USB 1.1
- Form Factors:
  - SX-PCEAX-SMT: 14.0mm x 8.0mm x 1.9mm
  - SX-PCEAX-HMC: 29.85mm x 26.65mm x 2.9mm
  - SX-PCEAX-M2: 22.0mm x 30.0mm x 2.7mm
- FCC/IC/CE/TELEC Certification

SX-USBAC-TAC

IEEE 802.11 a/b/g/n/ac Plus Bluetooth USB Combo Module USB Type A Connector

Features:

- Dual Band Support for both 2.4 GHz /5 GHz
- Single stream, 1x1 and 80 MHz band mode (when using 5 GHz)
- PHY Data Rate up to 433 Mbps
- Bluetooth v5.0 (BR/EDR/LE Compliant)
- Rx Diversity with Wi-Fi/BT co-existence
- Interface:
  - WLAN: USB 2.0
  - Bluetooth: USB 1.1
- Surface mount, USB Type-A connector
- FCC/IC/CE/TELEC Certification

SD-330AC

802.11 a/b/g/n/ac Wireless Serial Device Server

Features

- Device interface: Single serial port: RS-232C
- Industry-leading security including WPA and WPA2, plus 802.1x authentication with the most commonly used EAP types
- Dual band IEEE 802.11a/b/g/n/ac support on the SD-330AC allows communication in the 2.4GHz and 5GHz bands. Radio interference in the commonly used 2.4GHz band can be avoided by utilizing 5 GHz
- Virtually any client device can remotely control and monitor your serial devices including computers (Windows, Mac, Linux), mobile devices (Android, iOS), and virtual servers (VMware, Citrix, Microsoft Terminal Server and Hyper-V)
- No special drivers or applications are needed to use the serial devices: Drivers and applications that worked when the serial device is directly connected to the computer will continue to work across the network connected to the SD-320AN

SX-NEWAH

Industry's First 802.11ah Wi-Fi Solution for IoT Devices

Features

- IEEE 802.11ah (1x1) Wi-Fi module with Sub 1 GHz license-exempt band
- Newracom NRC7292 SoC
- Dedicated SPI interface for host
- Hosted wireless station and AP radio module
- PHY Data rate of 150 Kbit/s to 15 Mbit/s

This unique solution enables optimized interoperability of data transfer with existing Wi-Fi networks and performs a data transfer with a range of up to 1 km with low power consumption.

SX-NEWAH opens up unlimited possibilities for various remote monitoring applications such as industrial sensors, elderly monitoring, security surveillance, building automation and agricultural IoT.

iVativ´s Dual Band Wi-Fi AC Cards

iVativ is a global wireless technology company offering a wide range of certified infrastructure products targeting applications suited to the next-generation Internet of Things (IoT).

The iVativ products are ideally suited for existing and emerging markets such as smart medical, smart retail, wearables, industry 4.0, smart energy, smart home, automotive and in-vehicle infotainment. The team at iVativ strives to support customers in realizing and achieve their end product vision, to which iVativ brings decades of experience in wireless IoT technology. iVativ's solutions include wireless modules with software drivers for hosted and embedded architectures as well as intelligent sensor platforms. Device management, data collection and analytics are enabled through device and connectivity management software.

iVativ BALI

IEEE802.11a/b/g/n/ac Wi-Fi + Bluetooth 5.0 Combo Module

The BALI is a high-performance multi-protocol certified wireless module supporting dual-band 1-stream (1T1R) 802.11 a/b/g/n/ac Wi-Fi and BT5.0. It is based on the Qualcomm QCA9377 SoC. The BALI module is available with different Host interface supports e.g. PCIe, USB, SDIO. It is also available as solderable M.2 version also as M.2Card (1630, 2230) and Full and Half sized mini PCIe Card.

Wi-Fi Features

- Industry proven best performing Wi-Fi Technology supporting low power dual band (2.4 and 5 GHz)
- 1-steam MU-MIMO 802.11ac
- WLAN Encryption: WEP, TKIP, AES
- 802.11ai: FILS-Skin STA mode
- Operating modes: STA and SoftAP, P2P Group owner, P2P Client, Support for multiple BSSID

Bluetooth Features

- Bluetooth 5.0 HS and BLE
- Supports Bluetooth for Class-1 and Class-2 transmissions

iVativ EVIA

IEEE802.11a/b/g/n/ac Wi-Fi Module

The EVIA is a high-performance multi-protocol certified wireless module supporting dual-band 1-stream (1T1R) 802.11 a/b/g/n/ac Wi-Fi. It is based on the Qualcomm QCA9377 SoC. The EVIA module is available with different Host interface supports e.g. PCIe, USB, SDIO. It is also available as solderable M.2 version also as M.2Card (1630, 2230) and Full as well as Half sized mini PCIe Card.

Wi-Fi Features

- Industry proven best performing Wi-Fi Technology supporting low power dual band (2.4 and 5 GHz)
- 1-steam MU-MIMO 802.11ac
- WLAN Encryption: WEP, TKIP, AES
- 802.11ai: FILS-Skin STA mode
- Operating modes: STA + SoftAP, P2P Group owner, P2P Client, Support for multiple BSSID

Ready to use Energy Harvesting Solutions

EMSI Easyfit IoT Multi-Sensor

The EMSI, which is based on the STM 550 multisensor, is a true all-round talent among the energy self-sufficient wireless sensors. EMSI enables the realization of wireless energy harvesting sensors that communicate on the basis of the BLE and the EnOcean radio standard.

The EMSI is available in 868 MHz (Europe), 902 MHz (North America), 928 MHz (Japan) and 2.4 GHz BLE. Wall or device mounted sensor applications for measuring humidity, temperature, acceleration/orientation or lighting are the key applications of the EMSI Multi-Sensor.

Features

- Self-powered via ambient indoor light – maintenance-free, no battery changes required thanks to energy harvesting technology
- One size fits all – easy product integration into different housing designs (Original PTM form factor)
- Highly flexible, simply attach it where the data is required – on walls, ceilings, windows, doors, furniture, on active devices such as air-conditioning units, towel dispensers and valuable assets (printers, copiers, medical equipment and vending machines etc.)
- Seamless integration into smart systems due to wireless communication based on open standards (EnOcean; Bluetooth®)
- One sensor equals a basket of metadata for highly efficient building automation, smart home, IoT (e.g. space optimization management, digitized facilities services, predictive, maintenance, activity measurement, artificial intelligence)
- AES-128 security

USB Gateway: USB300 / USB 400J / USB500U

USB 300/400J/500U is a small USB stick which connects gateways and smart home servers to the world of EnOcean based radio products.

Features

- Frequency/antenna:
  - USB 300: 868.300 MHz / PCB antenna
  - USB 500U: 902.875 MHz / PCB antenna
  - USB 400J: 928.350 MHz / PCB antenna
- Modulation type:
  - USB 300: ASK 868 MHz[1]
  - USB 500U: FSK 902 MHz[1]
  - USB 400J: FSK 928 MHz[1]
- Operating temperature:
  - -20°C to +50°C (max. 90% r.h.)
- Output Power:
  - USB 300: max. 6,7 dBm (radiated)
  - USB 500U: typ. 1 dBm (conducted)
  - USB 400J: typ. 0 dBm (conducted)
- Sample image: USB 300 / USB 500U (white housing)

- Radio Regulations:
  - USB 300: CE (EU) / UKCA (UK)
  - USB 500U: FCC (US) / ISED (CA)
  - USB 400J: MIC/ARIB (Japan)
- Sample image: USB 400J (transparent housing)

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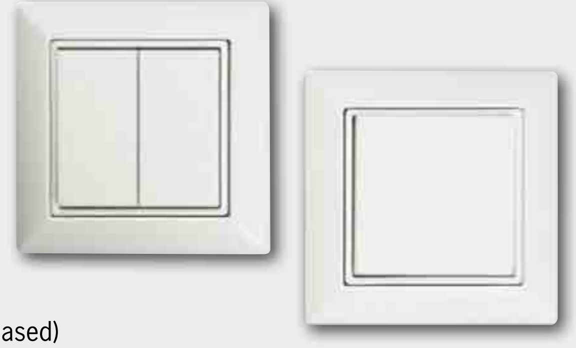
[1] According to ISO/IEC 14543-3-1x

Easyfit Bluetooth Single / Double Rocker Wall Switch EWSSB / EWSDB

USB 300/400J/500U is a small USB stick which connects gateways and smart home servers to the world of EnOcean based radio products.



Features

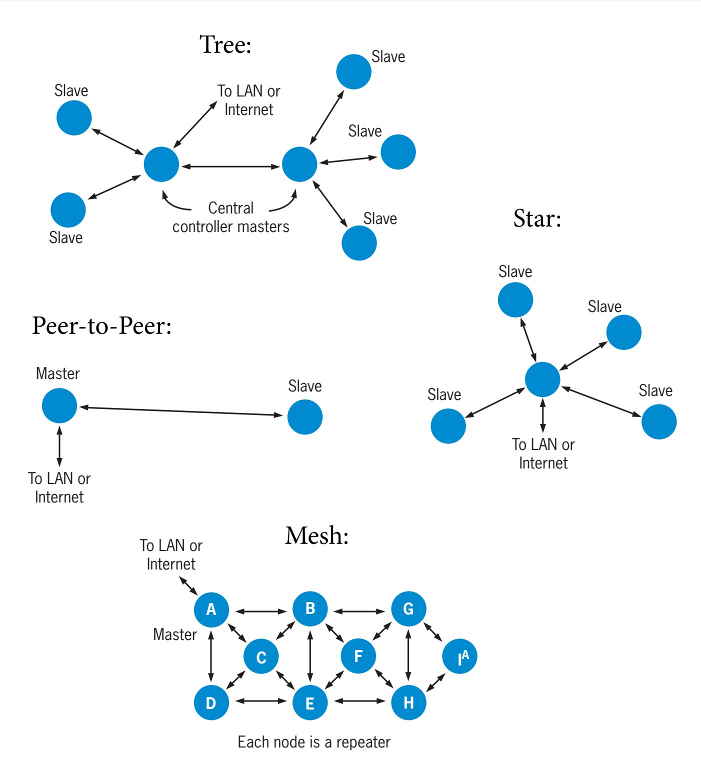
- Radio Transmitter: PTM 215B pushbutton module with integrated antenna
- Energy Source: Electro-dynamic energy generator, maintenance free
- Frequency / Protocol: 2.4 GHz / Bluetooth Low Energy (BLE)
- Range: Within one room (up to 10 m line of sight)
- Channels: 2 or 4 (single or double rocker with medial position, pressed/released)

ANT TM

What is ANT™

ANT™ is a practical wireless sensor network protocol. It offers an ultra-low-power, short-range wireless technology running on the 2.4 GHz ISM band. It handles peer-to-peer, star, tree and fixed mesh topologies. Application examples for adhoc mesh techniques are also available.

More Information
www.rutronik-tec.com/ant



ANT USB Stick – ANT USB-m

Key Benefits

- The ANTUSB-m is a USB dongle that provides a quick and easy solution for Windows PC, Mac and Android equipment with an USB type A port to connect to ANT wireless networks
- Provides enhanced ANT core features, such as proximity search and frequency agility
- Up to 8 ANT channels available
- WHQL certified Windows driver for Windows XP, Vista, 7 and 8
- No driver installation required on Mac OS X10 and above

Key Features

- 78 selectable RF channel
- ANT channel combined message rate up to 190 Hz (8byte data playload)
- Minimum message rate per ANT channel 0.5 Hz
- Burst transfer rate up to 60 Kbps (true data throughput)
- -40 °C to +85 °C operating temperature

Application Fields

Applications running on computers or equipment often act as the hub node of a network. Through the use of the ANT USB stick the application can receive, store, analyze and display data collected from ANT sensors or other wearable or portable hub devices, e.g. watches and bike computers.
The application may also serve as the gateway to the Internet for cloud computing.
The ANTUSB-m is a miniature design. When plugged in, the majority of the body is buried inside the computer or equipment.





Intel Dual Band IEEE 802.11 ac and ax M.2 Cards

Intel Wireless M.2 cards with Bluetooth offer the industry's most advanced connectivity technologies, including highly integrated system platforms, power-saving functionality and advanced WiFi features that optimize any WiFi environment.

Intel Dual Band IEEE 802.11 ac M.2 Cards

Devices with Intel® Wireless-AC technology inside (IEEE 802.11 ac) offer up to three times higher data rates, a better network coverage and the possibility to connect more devices to one network, compared to previous WiFi standards.

Type	Intel Dual Band Wireless	Intel Dual Band Wireless	Intel Dual Band Wireless	Intel Dual Band Wireless
	AC 9560*	**AC 9260**	**AC 9462***	**AC 9461***
Code Name	Jefferson Peak 2	Thunder Peak 2	Jefferson Peak 1	Jefferson Peak 1
Estimated SW support until	Q4 2024	Q4 2024	Q4 2024	Q4 2024
TX/RX Streams	2x2	2x2	1x1 diversity	1x1
Bands	2.4 GHz, 5 GHz	2.4 GHz, 5 GHz	2.4 GHz, 5 GHz	2.4 GHz, 5 GHz
Max Speed	1.73 Gbps	1.73 Gbps	433 Mbps	433 Mbps
Integrated Bluetooth	**V5.1**	**V5.1**	**V5.1**	**V5.1**
From Factor	M.2 2230 M.2 1216 (SMD)	M.2 2230	M.2 2230 M.2 1216 (SMD	M.2 2230 M.2 1216 (SMD
Supported Operating Systems	Microsoft Windows 10, Linux, Chrome			
System Interface Type	CNVio, GPIO	PCIe, USB	CNVIo, GPIO	CNVIo, GPIO

*CRF (Companion RF) modules

Intel Dual Band IEEE 802.11 ax M.2 Cards

Compared to the WiFi 5 solutions (IEEE 802.11 ac), WiFi 6 solutions (IEEE 802.11 ax) provide higher data rates, lower latency and longer battery lifetime.

Type	Intel Wi-Fi 6 AX200	Intel Wi-Fi 6 AX201*	Intel Wi-Fi 6E AX210 (E = extended/enhanced)	Intel Wi-Fi 6E AX211*	Intel Wi-Fi 6E AX411 (802.11abgn+acR2+axR2 (Pre-Standard)
Code Name	Cyclone Peak 2	Harrison Peak 2	Typhoon Peak 2	Garfield Peak 2	Garfield Peak 4
Estimated SW support until	Q4 2025	Q4 2025			
TX/RX Streams	2x2				
Bands	2.4 GHz, 5 GHz		2.4 GHz, 5 GHz, 6 GHz		
Max Speed	2.4 Gbps	2.4 Gbps	2.4 Gbps	2.4 Gbps	3 Gbps
Integrated Bluetooth	**V5.2**				
From Factor	M.2 2230 M.2 1216 (SMD	M.2 2230 M.2 1216 (SMD)	M.2 2230 M.2 1216 (SMD	M.2 2230 M.2 1216	M.2 2230 M.2 1625
Supported Operating Systems	Windows 10, 64-bit, Google Chrome OS, Linux				Windows 10, Linux
System Interface Type	PCIe (WiFi), USB (BT)	CNVio2	PCIe (WiFi), USB (BT)	CNVio2	CNVio28

*CRF (Companion RF) modules

Applications

- Consumer
- PCs / Laptops
- Transportation / Surveillance
- Medical devices
- POS / Kiosk
- Logistics
- Digital Signage

Intel Dual Band Wireless-AC 9260

The Intel Dual Band Wireless-AC 9260 supports the WLAN standard IEEE 802.11 ac and is the first WLAN module providing Gigabit WiFi speeds with 1.73 Gbps when using 160 MHz channels. Fast downloads and longer battery life times are therefore possible. The Bluetooth v5 functionality offers 4x the range of Bluetooth v4.2 at the same power consumption, 2x speed and better broadcasting functionality.

Improved Gigabit download speed is provided in combination with Intel Core processors. Simultaneous data transmission from one access point to multiole clients and 3x better downlink network capacity are possible due to downlink MU-MIMO.

Intel WiFi 6 AX200

The Intel WiFi 6 AX200 supports the WLAN standard IEEE 802.11 ax. With the new features UL and DL OFDMA and 1024QAM, Target Wake Time and spatial reuse, the AX200 enables smooth streaming of high-resolution videos, stable and faster connections farther away from the router and in dense environments. Fast up- and downloads, lower latency and longer battery life compared to previous WiFi standards are supported as well.

Bluetooth 5.2 provides 4x range over Bluetooth 4.2, doubles data rates and adds new enhanced data braodcasting, enabling seamless location-based services and simpler pairing for Bluetooth devices.

Intel WiFi 6E AX210

The Intel WiFi 6E AX210 supports dual-stream WiFi in the 2.4 GHz, 5 GHz and 6GHz bands as well as Bluetooth 5.2 and WiFi 6 R2 features with UL MU-MIMO. By implementing WiFi 6E technology supporting the 6 GHz band that includes 1200 MHz of new contiguous spectrum (>2x compared to 5 GHz) with more Gigabit WiFi options and exclusivity to WiFi 6 products.

Intel WiFi 63 AX210 module maximizes WiFi 6 and Gigabit WiFi benefits enabling greater network flexibiliy, faster downloads, sharing and backups as well as reduced latency and improved reliability.

Kit Options

Intel Dual Band Wireless-AC 9260 Embedded IoT Kit	Intel Dual Band Wireless-AC 9260 Industrial Kit	Intel WiFi 6 (Gig+) Desktop Kit, AX200
9260.NGWGIE.NVK	9260.NGWGII.NVK	AX210.NGWG.DTK
0°C to +70°C	-40°C to +85°C	0°C to +70°C
Intel WiFi 5 AC-9260 Embedded module	Intel WiFi 5 AC-9260 Industrial ET module	Intel WiFi 6 AX200 module
Common Features		
▪ Optimized external antenna (2 pcs.) ▪ Standard size mounting bracket with RF cables installed ▪ Low profile mounting bracket ▪ Quick Start Guide ▪ Safety and Regulatory information ▪ Requires motherboard with available M.2 connecter key E for wireless		

RFID

RFID Stick Reader Evo

The RFID Stick Reader EVO is a compact RFID reader and writer with adjustable performance. Its practical USB interface is used for the fast transfer of data as well as the power supply. Thanks to the IP40 protection class, it can withstand dust and other foreign objects up to 1 mm.

Product Features

- Dimensions: 83.5 x 36 x 11.2 mm
- Housing-Material: ABS
- Power Supply: 5V DC, via USB
- Operating Systems: Windows XP, Vista, 7, 8, 8.1, 10
- Antenna: integrated
- Interface: USB VCP, HID

The RFID Stick Reader EVO is Available in the Following Versions

Freq.-Range	Frequency	Standard
UHF	868 – 916 MHz	Standard ISO 18000-6C incl. Class 1 Gen 2
HF	13.56 MHz	ISO 14443 A/B, ISO 15693 MIFARE Family

Desktop Reader EVO

iDTRONIC's Desktop Reader EVO is an easy-to-use RFID Reader/Writer which uses the USB 2.0 interface for high-speed data transfer. A Multi-LED illuminated frame is included, turning on during reading process. It comes with a full SDK and a MS Windows based application SW. Additionally, Keyboard Emulation (KEMU) is optional for all Versions.

Product Features

- Dimensions: 125 x 70 x 26 mm
- Housing-Material: ABS
- Power Supply: 5 V_{DC} , via USB
- Operating Systems: Windows XP/7, Linux
- Antenna: Integrated
- Interface: USB 2.0, cable length 1.2 m

The Desktop Reader EVO is Available in the Following Versions

Freq.-Range	Supported Standards / Card Types
UHF	ISO 18000-6C incl. Class1 Gen2
HF	MIFARE® Classic 1K, 4K; MIFARE Ultralight®; MIFARE Pro; AT88RF020; 66CL160S; SR176; SRIX4K (TYPE-B); I-Code2; TI RFid Tag-it HF-I; EM4135; EM4034 Read only UID of all other ISO 14443A/B, ISO 15693 cards
LF	ISO 11784, ISO 11785
LEGIC	ISO 14443A/B; ISO 15693; LEGIC Prime/Advant
TEMIC	TEMIC 55x7

Transponder Applications Examples

ISO and Hybrid Cards
Available 125 kHz, 13.56 MHz and UHF IC technologies. Cards can be customized with different personalization and encoding options.

Smartlabels and Tickets
Adhesive labels, Windshield Labels, Multi-Purpose Labels, Logistic Single Labels

Special Tags
On-Metal Tags, High Temperature Tags, Laundry Tags, Heavy Duty Tags, etc.

Keyfobs and Wristbands
All keyfobs and wristbands are waterproof and can be printed and personalized.

Disctags
These tags are all available with different diameters, with printing and with/without centre hole.

BLUEBOX Professional RFID

BLUEBOX professional RFID is a family of highly sophisticated RFID controllers, readers, antennas and solutions allowing easy system integration.

BLUEBOX Unique Advantages:

- Ruggedized product design and enclosures (All components minimum IP67 or IP54)
- Available for
  - UHF 860–960 MHz (ISO18000-6C, EPC Class1 Gen2),
  - HF 13.56 MHz (ISO15693, ISO14443A/B, ISO 18000-3)
  - LF 125 kHz (ISO18000-2, ISO11784/11785)
- Solutions for Near Field, Short-, Mid- and Long-Range appl.
- Contr. with integr. antenna or for running 1, 2 and 4 antennas
- Extended range of application specific antennas
- Outstanding read / write performance and reading distances
- Possibility of using diff. RFID standards in parallel in one application
- Multiple Interface Options (USB, CANbus, RS232/485, Ethernet, Profibus, Profinet, etc.)
- Integrated Webserver for remote access to Controller
- Suitable for Stand-Alone operation
- Integrated I/O ports
- Micro SD slot for memory extension
- Diagnostic interface
- Several Standard Read Modes like Buffered Read Mode, Scan Mode, Notification Mode, RSSI Mode
- Unique SDK for all BLUEBOX products
- BLUEBOX SHOW applications software
- M12 connections for trouble-free and secure connection and installation (optional RJ45 for UHF CX Controller)

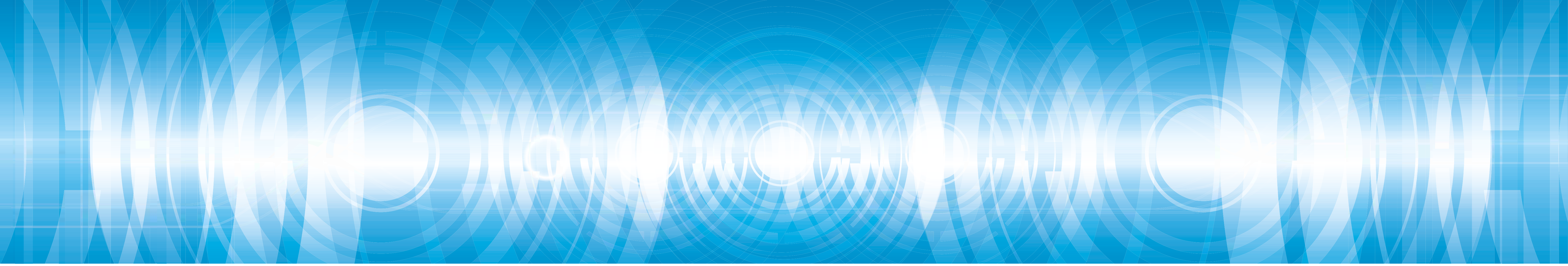
Passive RFID Transponders – Overview

With its large portfolio of chips iDTRONIC covers the total frequency bandwith of LF, HF and UHF RFID Transponders.

Freq.	IC Version	ISO-Standard	Memory Cap.
UHF	NXP NTAG203	ISO/IEC 14443A	168 Byte
	Alien UHF Higgs 3 Gen2	ISO/IEC 18000-6C	64 Byte
	UHF U-Code Gen2	ISO 18000-6C	16 Byte
HF	NXP Mifare Ultralight (UL)	ISO 14443 A	64 Byte
	NXP Mifare Ultralight (UL) C	ISO 14443 A	192 Byte
	NXP Mifare Classic Mini	ISO 14443 A (1-3)	320 Byte
	NXP Mifare Classic 1K	ISO 14443 A	1024 Byte
	NXP Mifare Classic 4K	ISO 14443 A	4096 Byte
	NXP Mifare MF1S20 (mini)	ISO 14443	A 320 Byte
	NXP Mifare MF1S50 (1K)	ISO 14443 A	1024 Byte
	NXP Mifare MF1S70 (4K)	ISO 14443 A	4096 Byte
	NXP Mifare DESFire EV1 (2K)	ISO 14443 A (1-3)	2048 Bytes
	NXP Mifare DESFire EV1 (4K)	ISO 14443 A (1-3)	4096 Byte
	NXP Mifare DESFire EV1 (8K)	ISO 14443 A (1-3)	8192 Byte
	NXP Mifare Plus S 2K	ISO 14443 A	1 kB
	NXP Mifare Plus S 4K	ISO 14443 A	4 kB
	NXP Mifare Plus X 2K	ISO 14443 A	1 kB
	NXP Mifare Plus X 4K	ISO 14443 A	4 kB
	NXP I-Code SLI	ISO 15693	128 Byte
	NXP I-Code SLI-S (2K)	ISO 15693	256 Byte
	LEGIC MIM256	ISO 14443 A	256 Byte
	LEGIC MIM1024	ISO 14443 A	1024 Byte
	TI Tag-it HF-I	ISO 15693	256 Byte
	LEGIC Advant 1024	ISO 14443 / 15693	128 Byte
	LEGIC Advant 2048	ISO 14443 / 15693	256 Byte
	STM SRI512	ISO 14443 B	64 Byte
	STM LRI2K	ISO 15693	256 Byte
	STM SRI4K	ISO 14443 B	512 Byte
LF	Contactl. EM4100/4200	Read Only	8 Byte
	Contactl. Card EM4450/4550	ISO 11784/85	125 Byte
	Atmel Temic 5567	ISO 11784/88	363 Byte
	NXP Hitag 1	ISO 11784/88	256 Byte
	NXP Hitag 2	ISO 11784/88	32 Byte
	NXP Hitag S256	ISO 11784/88	256 Byte
	NXP Hitag S2048	ISO 11784/88	2 kB

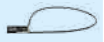
Freq.-Range	Desktop Reader	Various Controller with integrated Antenna	Various Controller with up to 4 ports for external Antenna	M30 Cylindrical Reader (metal)	Various M18/M30 Cylindrical Antennas	Various other short range, mid range and long range Antennas
UHF Reading Distance	Up to 30 cm	Up to 3 m	Up to 10 m	up to 50 cm*	Up to 20 cm	
HF Reading Distance	Up to 15 cm	Up to 15 cm	Up to 15 cm	Up to 8 cm	Up to 6 cm	Up to 80 cm
LF Reading Distance	Up to 10 cm	Up to 15 cm	Up to 30 cm	Up to 6 cm	Up to 8 cm	Up to 13 cm

*IP67



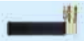
Internal Antennas

Manufacturer	Part	Picture	Standard								Antenna Type	Frequencies	Peak Gain (dBi)	Efficiency (%)	Size (mm)	Polarization	Cable Length (mm)	Connector	Impedance
			GSM / 2G	UMTS / 3G	LTE / 4G	5G (Sub6Ghz)	ISM Standard	Bluetooth	WLAN	GNSS									
2J	2JF0415P						x				FPC / Adhesive	868 MHz	2.7	58	25 x 70 x 0.2	Linear	100	U.FL compatible	50
												915 MHz	3.6	77					
	2JF0302Pa								x		FPC	2.4 GHz	3.2	>50%	22.4 x 20.6 x 0.2	Linear	100	U.FL / I-PEX	50
												5 GHz	5.0	>64%					
	2JF0424P		x	x	x						FPC	968-960 MHz	1.5	58%	136.8 x 32.6 x 0.2	Linear	150	U.FL / I-PEX	50
												1710-2170 MHz	3.1	74%					
												2500-2700 MHz	3.5	61%					
	2JP0424P		x	x	x						FPC	968-960 MHz	1.2	56%	113 x 8.5 x 0.8	Linear	100	U.FL / I-PEX	50
												1710-2170 MHz	4.0	66%					
												2500-2700 MHz	5.6	78%					
AVX ethertronics	WxP3015W08								x		FPC	2.4-2.48 GHz	< 3.0	65%	30 x 15.5 x 0.8	Linear	100	U.FL compatible	50
												5.15-5.85 GHz	< 6.7	61%					
	1002289		x	x	x						FPC	698-960 MHz	*	7400%	53.6 x 25.1 x 0.2	Linear	25	U.FL / I-PEX	50
												1710-2690 MHz	*	5800%					
molex	1052630003		x	x	x						FPC / Adhesive	824-960 MHz	2.2	*	106.7 x 13 x 0.1	Linear	200	U.FL / I-PEX	50
												1710-2690 MHz	3.0						
	479501011						x	x	x		FPC / Adhesive	2.4 GHz	3.0	>80	35.9 x 15.9 x 0.1	Linear	150	U.FL / I-PEX	50
												5 GHz	4.8	>75					
	1052620001						x				FPC / Adhesive	868 MHz	0.4	*	79 x 10 x 0.1	Linear	100	U.FL / I-PEX	50
												915 MHz	1.4						
	2084820150						x	x	x		FPC / Adhesive	2.4 GHz	3.2	62% (Port1), 72% (Port2)	55.2 x 19.2 x 0.16	Linear	150	U.FL / I-PEX	50
												5 GHz	5.7	70% (Port1), 66% (Port2)					
	2065600100									x	FPC / Adhesive	1561 MHz	0.9	>72	40.4 x 15.4 x 0.1	Linear	100	U.FL / I-PEX	50
												1575 MHz	1.0	>72					
												1602 MHz	1.37	>73					

Manufacturer	Part	Picture	Standard								Antenna Type	Frequencies	Peak Gain (dBi)	Efficiency (%)	Size (mm)	Polarization	Cable Length (mm)	Connector	Impedance
			GSM / 2G	UMTS / 3G	LTE / 4G	5G (Sub6Ghz)	ISM Standard	Bluetooth	WLAN	GNSS									
molex	2069950150						x	x	x		FPC / Adhesive	2.4 GHz	2.6	>55	20.5 x 20.5 x 3	Linear	150	U.FL / I-PEX	50
												5 GHz	3.4	>71					
	1462340100		x	x	x						FPC / Adhesive	698 MHz	1.8	>70	140 x 20 x 0.1	Linear	100	U.FL / I-PEX	50
												1500 MHz	2.8						
												2.7 GHz	5.0						
	2072350100		x	x	x						FPC / Adhesive	824 MHz	0	>30	40.4 x 15.4 x 0.1	Linear	100	U.FL / I-PEX	50
												1710 MHz	4.3	>60					
Pulse	W3915		x	x						x	PCB	880-960 MHz	1	50	74 x 19	Linear	100	U.FL compatible	50
												1710-2170 MHz	2	75					
												1565-1605 MHz	0.5	55					
	W3334B0150						x	x	x		Adhesive	2400-2500 MHz	4	50	4.3 x 15.3 x 0.1	Linear	150	U.FL compatible	50
												4900-6000 MHz	5.5	70					
	W3554B0140		x	x	x						FPC / Adhesive	698-960 MHz	1.9	45	30 x 120 x 0.2	Linear	143	U.FL compatible	50
												1400-1600 MHz	2.5	53					
												1710-2690 MHz	3.2	66					
												3300-3800 MHz	3.3	57					
												4900-6000 MHz	3.5	37					
	W3312XXXXXX						x				FPC / Adhesive	863-928 MHz	0.8	45	75 x 15	Linear	100	U.FL compatible	50
Yageo	ANTX100P001B24553							x	x		PCB	2400 - 2500 MHz	4.6	81	50 x 10 x 0,95	Linear	100	U.FL / I-PEX	50
												5150 - 5875 MHz	3.9	62					
	ANTX100P001BWPEN3		x	x							PCB	850-960 MHz	5.1	68	50 x 10 x 0,95	Linear	100	U.FL / I-PEX	50
												1800-2100 MHz	5.0	76					

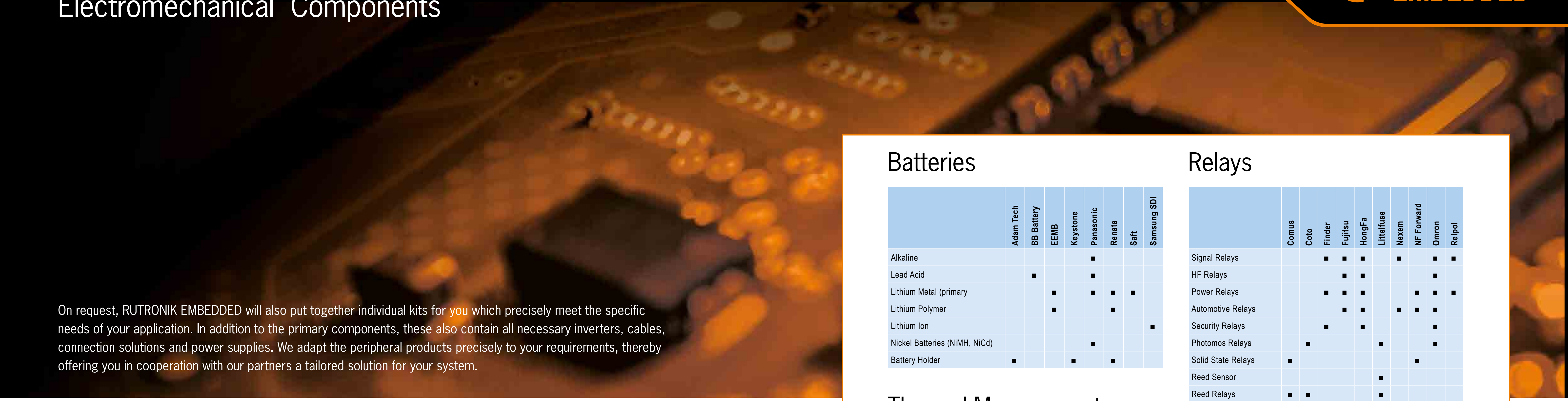
*Not specified by supplier

External Antennas

Manufacturer	Part	Picture	Standard								Antenna Type	Frequencies	Peak Gain (dBi)	Eff. (%)	VSWR	Size (mm)	Polarization	Cable Length (mm)	Connector	Impedance (Ohm)
			GSM / 2G	UMTS / 3G	LTE / 4G	5G (Sub6Ghz)	ISM Standard	Bluetooth	WLAN	GNSS										
2J	2J3704M		x	x							Magnetic Mount	824 - 960 MHz	~1.7	~49	~1.6:1	30.9 x 71.5	Linear	3000	SMA-Male	50
												1710 - 2170 MHz	~0.3	~28	~1.8:1	30.9 x 71.5	Linear	3000	SMA-Male	50
	2J6604B		x	x			x	x	x		Body Mount	824 - 2400 MHz	~2.2	*	<2.6:1	77.4 x 15.9	Linear	2500	FME-Female	50
	2J6200PF		x	x						x	Adhesive Mount	824 - 960 MHz	~1.5	~43	~1.6:1	Ø77 x 12	Linear	3000	SMA-Male	50
												1710 - 2170 MHz	~0.5	~32	~2.4:1					
	2J6602B						x	x	x		Screw Mount	2410 - 2490 GHz	~4.9	~48.7	~1.5:1	Ø77.3 x 15	Linear	3000	RP-SMA-Male	50
												4920 - 5925 GHz	~4.5	~29.2	~1.5:1					
	2J5115-XXX						x				Adhesive Mount, Flexible	433/ 868/ 915 MHz	3,4	62,4	1,2	122 x 14 x 6	Linear	3000	multiple connectors available	50
	2J0102						x	x	x		Connector Mount	2410 - 2490 GHz	~4.0	~60	~1.4:1	56 x 9.5	Linear	-	RP-SMA-Male	50
												4920 - 5925 GHz	~5.2	~83	~1.7:1					
	2J6A24BA		x	x	x						Screw Mount	698 - 960 MHz	~-0.8	~35	~2.8:1	Ø77.3 x 65.5	Linear	3000	SMA-Male	50
												1710 - 2170 MHz	~2.5	~51	~1.7:1	Ø77.3 x 65.6				
												2500 - 2700 MHz	~3.4	~49	~1.3:1	Ø77.3 x 65.7				
	2J3024M		x	x	x						Magnetic Mount	698-960 MHz	~1.0	~47	~1.9:1	Ø31 x 72	Linear	3000	SMA-Male	50
												1710 - 2170 MHz	~2.4	~39	~1.5:1					
												2500 - 2700 MHz	~2.1	~36	~1.3:1					
	2J6700B		x	x				x	x	x	Body Mount	824 - 2170 MHz	2.2 max	*	<2:1	77.3 x 36.5	Hori-zontal	2500	C1(Mobile): FME-Female; C2 (Navigation): SMA-Male	50
												1575.42 MHz	*	*	<1.2:1		RHCP			
	2J0B15						x				Connector Mount	433/ 868/ 915 MHz	1.2	69.3	1.8	44-48 x 19,1 x 9	Linear	-	SMA-Male-R/A	50
	2J6050PGF		x	x	x		x	x	x	x	Adhesive Mount	698-960 MHz	~2.9	~55.6	~2.2:1	80 x 76 x 16	Linear	3000	SMA-Male	50
												1710 - 2170 MHz	~3.2	~56.0	~1.2:1					
												2500 - 2700 MHz	~2.1	~38.7	~2.2:1					
												2410 - 2490 MHz	~3.2	~50	~1.3:1				RP-SMA-Male	
												4920 - 5925 MHz	~4.2	~30	~1.3:1					
												1575 - 1606 MHz	*	*	<=1.4:1 dB		RHCP		SMA-Male	
	2J7624B		x	x	x		x	x	x	x	Screw Mount	698-960 MHz	2.6	56	2.1:1	Ø50 x 50.08	Linear	3000	SMA-Male	50
												1710 - 2170 MHz	3.2	56	1.8:1					
												2500 - 2700 MHz	1.4	38	2.5:1					
	2jw1483		x	x	x	x					Connector Mount	617-960 MHz	0.4	~50	1.6	192 × 20 × 18	Linear	-	SMA-Male	50
												1427 - 2690 MHz	0.6	~52	1.7					
												3300 - 3800 MHz	1.6	~28	6.3					
	2JW1183-C952B		x	x	x	x					Connector Mount	617-960 MHz	1.1	~37.1	2.0	135×19×10	Linear	-	SMA-Male	50
												1427 - 2690 MHz	0.5	~43.3	2.6					
												3300 - 5000 MHz	0.3	~35.1	2.3					
												5150 - 5925 MHz	1.6	~41.9	2.2					
	2JW0124		x	x	x						Connector Mount	698-960 MHz	0.4	~62	2.4	171×38×13.8	Linear	-	(RP-)SMA-Male	50
												1710 - 2170 MHz	2.6	~75	1.6					
												2500 - 2700 MHz	1.3	~50	2.2					

Manufacturer	Part	Picture	Standard								Antenna Type	Frequencies	Peak Gain (dBi)	Eff. (%)	VSWR	Size (mm)	Polarization	Cable Length (mm)	Connector	Impedance (Ohm)
			GSM / 2G	UMTS / 3G	LTE / 4G	5G (Sub6Ghz)	ISM Standard	Bluetooth	WLAN	GNSS										
AVX ethertronics	1002857									x	Helical	1575 MHz	~3.0	27	2.0:1 max	Ø15.0 x 34.93	RHCP	-	SMA-Male	50
	9000984						x				Screw Mount	790 MHz	~2.2	40	2.0:1	196 x 13	Linear	-	SMA-Male	50
												868 MHz	~2.2	80						
												915 MHz	~3.4	75						
	X9001546		x	x	x						Connector Mount	698-960 MHz	*	~40	*	168×18	Linear	-	SMA-Male	50
												1710 - 2690 MHz	*	~50	*					
chinmore	AA-C02MT07FME -397		x								Magnetic Mount	900 MHz	~0.45	75	1.26:1	Ø26.7 x 79	Linear	3000	FME-Female	50
												1800 MHz	~1.05	48	1.69:1					
	AA-C13M05SMA -1107		x								Magnetic Mount	900 MHz	~1.71	60	1.85:1	Ø52.2 x 343.7	Linear	3000	SMA-Male	50
												1800 MHz	~3.68	63	1.69:1					
	EM-B10.0X106-069							x	x		Connector Mount	2.4 GHz	~3.5	45	1.7:1	Ø67.5 x 108.0	Linear	-	SMA-Male	
	EM-W117G-2ANT -240						x				Connector Mount	868 MHz	0~3	*	2.0:1	Ø37 x 112.6	Vertical	-	SMA-Male	50
	GS-10D174MCX -198									x	Adhesive Mount	1575.42 MHz	~3.8	*	2.0:1	38.2 x 34.2	RHCP	300	MCX-Male	50
	CA-C09-1SMAM -094		x								Adhesive Mount	840-960 MHz	~3.06	59	1.72:1	129.5 x 22.8	Linear	3000	SMA-Male (90°)	50
												1760 - 1860 MHz	~5.23	88	1.30:1					
	EM-B9.3X33.0-168							x	x		Connector Mount	2.4 GHz	1.3	*	2.0:1	Ø9.4 x 33	Vertical	-	SMA-Male	50
	EM-9.10X55.8-058		x	x							Connector Mount	824-960 MHz	~2.3	*	2.5:1	Ø6.5 x 56.6	Vertical	-	SMA-Male	50
												1710 - 2170 MHz	~2.5							
	EM-W79B-7ANT-108		x	x							Connector Mount	824 - 2170 MHz	~2.8	*	5.6:1	Ø9.3 x 114	Vertical	-	FME-Female	50
	CA-C09-1FMEF-019		x	x							Adhesive Mount	900 - 1800 MHz	~1,78	42	1.36:1	129.5 x 22.8	Linear	3000	FME-Female	50
													~4.77	81	1.45:1					
molex	2068663000				x			x	x	x	Adhesive Mount	824 - 1710 MHz	~0.5	21	3 max	Ø77 x 15	Linear, RHCP	3000	FAKRA	50
												1575 MHz	~2.7	23						
												2.4 GHz	3.0	27						
Pulse	W5028x						x	x	x		Connector Mount	2.4-2.5 GHz	1.9	>80	*	Ø10 x 128	Vertical	-	RP-SMA-Male	50
												5.15-5.85 GHz	3.8	>50						
	W5084x		x	x	x						Connector Mount	698-960 MHz	2	58	3 max	228.84	Vertical	-	TNC-Male/ SMA-Male	50
												1400 - 2690 MHz	4	78	3.6 max					
												3400 - 3700 MHz	5	60	3 max					
	W5017						x				Connector Mount	868-928 MHz	0.9	70	2.5 max	179	Vertical	-	SMA-Male	50

Electromechanical Components



On request, RUTRONIK EMBEDDED will also put together individual kits for you which precisely meet the specific needs of your application. In addition to the primary components, these also contain all necessary inverters, cables, connection solutions and power supplies. We adapt the peripheral products precisely to your requirements, thereby offering you in cooperation with our partners a tailored solution for your system.

Suppliers

ADAM TECH
ADDA
ALYSIUM
Amphenol
ASSMANN WSW components
BB
C&K
COMUS
CONQUER
COTO TECHNOLOGY
DELTA
DIPTRONICS
EATON
EEMB
finder
fischer elektronik
FUJITSU
GradConn
HONGFA
INNO TAPE
JAE
JAMICON
KEYSTONE
knitter-switch
KYOCERA AVX
Littelfuse
Lumberg
Lutronic
MECHATRONICS
molex
mpe GARRY
NEXEM
NF
OMRON
Panasonic
PANCON
preci-dip
Pulse
relpol S.A.
renata batteries
SAFT
SAMSUNG SDI
sauro
SCHURTER
SIBA
sumida

Batteries

	Adam Tech	BB Battery	EEMB	Keystone	Panasonic	Renata	Saft	Samsung SDI
Alkaline					■			
Lead Acid		■			■			
Lithium Metal (primary			■		■	■	■	
Lithium Polymer			■			■		
Lithium Ion								■
Nickel Batteries (NiMH, NiCd)					■			
Battery Holder	■			■		■		

Thermal Management

	ADDA	Assmann WSW	Delta	Fischer Elektronik	InnoTape	Jamicon	Mechatronics	Panasonic
AC Fans	■					■	■	
DC Fans	■		■			■	■	
EC Fans			■					
CPU Cooler	■		■					
Blowers	■		■			■	■	
Heatsinks	■	■	■	■				
Heat Contacting Foils				■	■			■
Heatpipes	■		■	■				
Housing				■				

Fuses

	Conquer	Eaton	Littelfuse	Schurter	Siba
5x20/6.3x32 Fuses	■	■	■	■	■
Automotive Fuses		■	■		
Subminiature Fuses	■	■	■	■	■
SMT Fuses	■	■	■	■	■
Resettable Fuses		■	■	■	
Fuseholders	■	■	■	■	■
High Voltage Fuses	■		■	■	■

Relays

	Comus	Coto	Finder	Fujitsu	HongFa	Littelfuse	Nexem	NF Forward	Omron	Relpol
Signal Relays			■	■	■		■		■	■
HF Relays				■	■				■	
Power Relays			■	■	■			■	■	■
Automotive Relays				■	■		■	■	■	
Security Relays			■		■				■	
Photomos Relays		■				■			■	
Solid State Relays	■							■		
Reed Sensor						■				
Reed Relays	■	■				■				
Reed Switch	■	■				■				
Proximity	■					■				
Tilt & Tip-Over Switches	■					■				
Timer Relays			■							■
Industrial Relays			■		■			■	■	■
Sockets			■		■			■	■	■

Switches

	C&K	Diptronics	Knitter-Switch	Omron	Panasonic	Schurter
Automotive Switches	■	■	■		■	
Tact Switches	■	■	■	■	■	■
DIP Switches	■	■	■	■		
Slide Switches	■	■	■			
Pushbutton Switches	■	■	■			■
Rotary Position Switches	■		■			
Rotary Coded Switches	■	■	■	■		
Encoder Switches	■		■		■	
Toggle Switches	■		■			
Membran Keypads			■			■
Rubber Keypads			■			■
Navigation Switches	■	■	■			
Industrial Switches	■		■			■
Rocker Switches	■		■	■		
Detect / Micro Switch	■	■	■	■	■	

Electromechanical Components

Interconnect Solutions

	Adam Tech	Alysium	Amphenol	Assmann WSW	KYOCERA AVX	Gradconn	JAE	Lumberg	Lutronic	Molex	MPE Garry	Pancon	Preci-Dip	Pulse	Sauro	Sumida
Connectors																
Board to Board	■		■	■	■	■	■	■		■	■	■	■			
Wire to Board	■		■	■	■		■	■		■	■	■				
Wire to Wire	■		■	■	■		■	■		■						
Crimp Terminals	■		■	■			■			■	■	■				
FFC/FPC	■	■	■	■	■		■			■						
Floating - BTB			■		■		■			■						
Socket	■		■	■							■		■			
USB	■		■	■						■				■		
USB Type C	■		■	■			■			■				■		
Memory	■		■	■	■	■	■			■						
Audio/Video	■		■	■			■	■		■						
Modular Jacks	■		■	■						■				■		
Power Inlet, Power Outlet, IEC 60320, Valve	■		■	■						■	■					
D-Sub	■		■	■						■						
Highspeed	■		■	■						■				■		
FAKRA	■		■							■						
DIN 41612	■		■	■	■					■		■				
DIN Connector, Mini I/O, Chinch, Military, Tool, Audio, DC Power	■		■	■				■								
Circular Connectors M8, M12, others	■		■	■					■	■						
EV charging AC, DC, Combined	■		■				■									
Coaxial Connector	■	■	■			■				■						
Terminal Blocks	■		■	■				■							■	
Accessory like Jumper, Cap, Holder, Clip	■										■	■				■
Customized Connectors	■		■	■	■	■	■				■	■				
Tools			■				■	■		■						
Cable & Cable Assembly																
EV Charging Cable	■		■				■									
FFC/FPC	■	■	■	■						■						■
Flat Cable				■												
MCX Cable			■			■				■						
Round Cable		■	■	■												
USB-Type-C Cable	■	■	■	■			■			■						
Accessory like Cable tie				■												
Standard Assembly, PnP cable (like patch cable)	■	■		■			■			■						
Customized Assembly	■	■	■	■		■	■			■						■

Electromechanical Components

I/O Connector

JAE

DX07 – USB Type-C Connector

Features

- Reversible plug - insertion in the right side up or up side down orientation
- USB4 receptacle up to 40Gbps data rates (20Gbps×2), else USB 3.1/3.2
- Maximum 5 A of power supply (USB Power Delivery Support)
- Plugs, receptacles and harnesses
- Waterproof receptacle - IPX7 or higher
- 16-position version, supporting USB2.0 (480Mbps) transmission

Benefits

- Design for high mechanical strength
- Lock structure with high durability
- 2-row SMT type space-saving contact mounting area (pure and hybrid)
- Available in on-board, mid-mount and vertical type

I/O Connector

Amphenol

USB Type-C Connector

Features

- Reversible plug - insertion in the right side up or up side down orientation
- High-speed transmission up to 40 Gb/s
- Up to 10,000 mating cycles
- Extended 5 A current rating for USB power delivery and up to 100 W
- 16 and 24 pin version
- IP68

Benefits

- Plugs and receptacles
- Supports audio and video signal output with alternate mode
- Enhanced side wall of middle plate stabilizes contact performance
- Wiggle free

I/O Connector

molex

USB Type-C Solutions

Features

- Reversible plug - insertion in the right side up or up side down orientation
- USB4 receptacle up to 40 Gbps (USB4 Gen 4 speed), else Gen 3
- Supports up to 5.0A current
- Plugs and receptacles
- Waterproof receptacle - IP67-rated up to IP*8 rating/waterproof
- 16 circuits version (480 Mbps data rates), 6 circuits version (power only)

Benefits

- Long outer shell - allows usage in both thin / thick device housings
- Mid-plate "tongue" design - helps ensure high reliability
- Friction design with spring shell - delivers strong mating force
- Available in on-board, top-mount, mid-mount and vertical type

Amphenol

I/O Connector

Modular Jacks & Magnetic Jacks RJ45

Features

- Voltage rating up to 150 V AC
- Current rating up to 1.5 A
- Contact resistance: Max. 20 mΩ (initial)
- Operating temperature: -40 °C to +85 °C

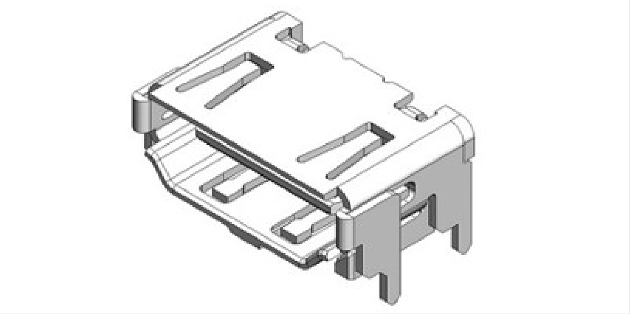
Benefits

- Magnetic and ferrite-filtered types available
- 4, 6, 8, and 10 positions available
- Single, stacked or ganged
- Through-hole or SMT mounting

I/O Connector

JAE

HDMI 2.1 DC04



Features

- HDMI Category 3 approved connector
- Supporting formats such as 4K120 Hz, 8K60Hz, and dynamic HDR
- Specification approved connectors (supporting 48 Gbps bandwidth)
- Number of Positions: 19 positions
- Operating Temperature Range -20 °C to +85 °C

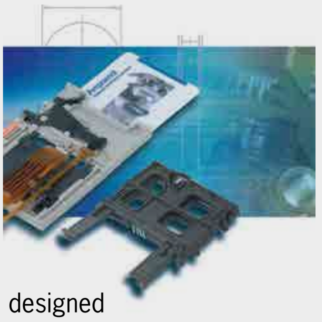
Benefits

- Reduced crosstalk by optimizing isolation between terminals for each channel
- Impedance characteristics improved with molded-in contacts
- Enhanced robustness with original shell structure
- Contact tip in mating area is protected by insulator for improved reliability

Amphenol

Server and Storage System

Memory & Media Card Reader



Features

- Operating temperature: -20 °C to +60 °C
- Mechanical lifetime 300,000 mating cycles
- SMT and TMT available
- Secure contact to all cards designed according to ISO 7816

Benefits

- Highly reliable data transmission
- Landing, self-cleaning contacts
- Suitable for automatic reflow process or wave soldering
- Correct orientation of SIM card

Server and Storage System

molex

Memory Card Combo Connector

Features

- Compact size with small footprint and low profile height
- Free insertion and withdrawal of microSD card
- Anti-stubbing contact terminal design
- Card polarization feature
- Pull-lever and push-pull card eject options
- Multiple PCB hold-down poin

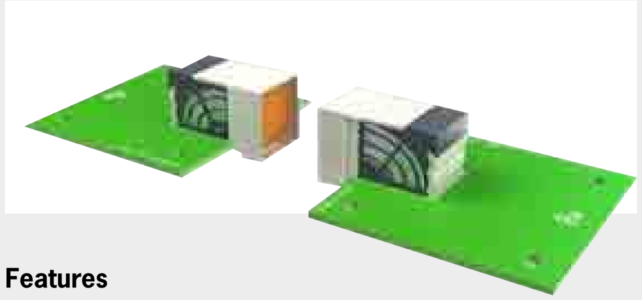
Benefits

- Prevents microSD card from becoming stuck when inserted incorrectly into the micro SIM slot
- Prevents contact stubbing and ensures smooth insertion and withdrawal of the card

Electromechanical Components

Board-to-Board Connector

Airmax Backplane Connectors



Features

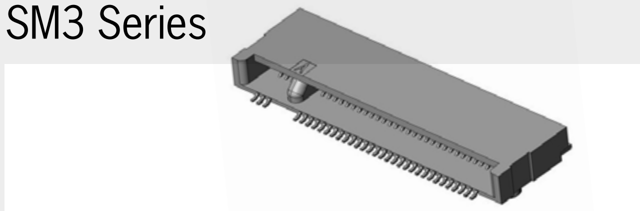
- Up to 25 Gbs per differential pair
- Over 10 years history of high volume production
- Full product platform (right angle, coplanar, orthogonal, cable
- PCIe, CompactPCI, SAS, SBB, SSI, OIF 25G, QPI 8G

Benefits

- Front housing provides guidance and protect pins
- Standard guidance and power modules can be placed as needed
- Rear plastic organizers unitize the block
- Enhanced for optimized cost & improved performance

PCI-SIG M.2 Connector

SM3 Series



Features

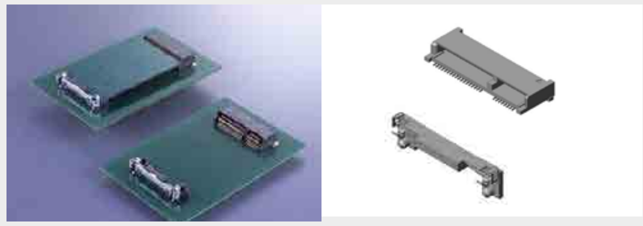
- Compliant with PCI Express M.2 Specification
- Transmission of PCIe Gen4 (on board type)/ PCIe Gen3 (mid mount type), USB3.0, DisplayPort, SATA, and others
- Number of Contacts: 67 positions
- Operating Temperature Range: -40 °C to +80 °C
- Mating Cycles: 60 times

Benefits

- Three on-board types of different product height and two mid-mount types
- Products with 4.1 mm product height can mount 1 mm height arts on the bottom side of the module
- 4 polarizing keys are available for compatibility with multiple modules used in different applications.

Server and Storage System

PCIex Mini Card MM60 Series



Features

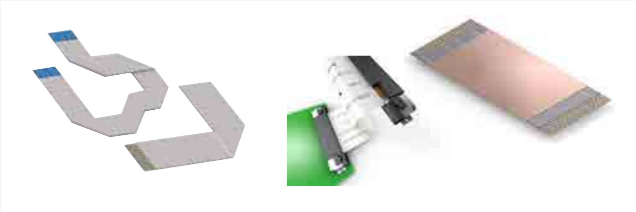
- Compatible with the PCI Express Mini Card Electromechanical Specification
- Connecting with modules, PCI Express communication
- Number of Contacts: 52 positions
- Operating Temperature Range: -40 °C to +85 °C
- Durability Mating Cycles: 50 times

Benefits

- Retention latch part available to fix module to connector
- Latch has mechanisms on both sides for module ejection
- Two types of module mounting heights are available
- Connector and latch are compatible with automatic mounting

Server and Storage System

Alysium FFC



Features

- Pitch: 0.5, 0.8, 1.0, 1.25 mm (Cable)
- Pitch: 0.3 mm to 0.50 mm (Connectors for Alysium and I-PEX products)
- Pin Count: 4 to 60 (Connectors)
- Type: ZIF, Non-ZIF, Non-ZIF Auto-lock
- Horizontal and vertical types

Benefits

- High wiring density with reduced connection costs
- Shielding for high frequency applications
- Custom design
- Impedance matched LVDS FFCs
- Anti-whisker designs (incl. inhouse Au plating).
- Eco-GreenTM - zero halogen, non-phosphorus types

I/O Connector

D-Sub Connector FCT Series

Features

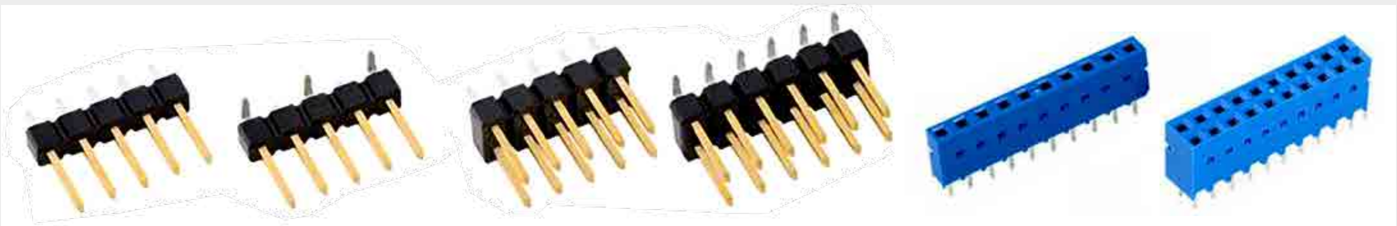
- Power and Signal, Standard / High-Density / Mixed Layout / Backshells / Hoods
- Current: 5.0, 7.5, 40.0 A
- IP Rating: IP20, IP67
- Coaxial, High Power, High Voltage contacts
- Machined, Pneumatic, Stamped Crimp contacts

Benefits

- Still a reliable solution in a broad range of applications and various industries
- Time-tested for signal transmission, communications, power distribution
- Readily available in a wide variety of materials and plating combinations
- Cable assemblies incl. backshell, strain-relief, connector protection and cable dressing

Wire to Board Connectors

2.54 mm Pin Header



BergStik

Features

- B2B connections
- THT, SMT, PIP, PF options
- 2 to 72 positions
- Stack heights up to 65 mm
- Current rating of 3 A per contact
- Up to 100 mating cycles
- Operating temp. -65°C to +125°C

Benefits

- A standard, proven family
- Cost-efficient solution

EconoStik

Features

- B2B connections
- THT and SMT options (only vertical SMT)
- 2 to 72 positions
- Current rating of 3A per contact
- Up to 50 mating cycles (1 µ" gold)
- Operating temp. -55 °C to +105 °C

Benefits

- For mid-end applications

Dubox

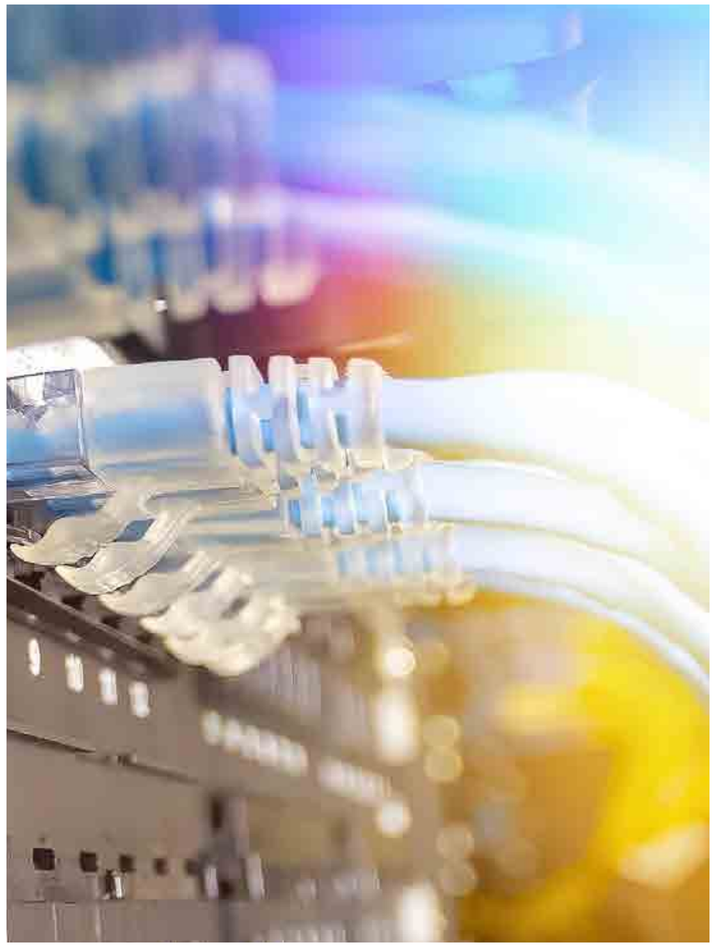
Features

- B2B and W2B connections
- THT, SMT options
- 1 to 130 positions
- current rating of 3 A per contact
- up to 200 mating cycles
- Operating temp. -65 °C to +125 °C

Benefits

- For mid-end applications
- pre-stressed, dual beam contact design
- Cost-efficient solution

Electromechanical Components



Wire to Board Connector **Amphenol**

Minitek Pwr 3.0 Connector

Features
- 2 to 24 circuits for dual row and 2 to 12 circuits for single row.
- 3.00 mm pitch power contacts
- Current rating up to 5 A per contact, 12 A per contact (HCC)
- Voltage Rating: 600 Vrms
- Operating Temperature: -40 °C to +105 °C

Benefits
- Wire-to-wire and wire-to-board configurations
- Blind mating interface (BMI) option
- Flexible and comprehensive solution
- Glow wire compliant option

I/O Connector **Amphenol**

Industrial Mini I/O Connector

Features
- Voltage rating 30 V
- Current rating 0.5 A
- Operating temperature: -40 °C to +85 °C
- Durability: up to 1.500 mating cycles

Benefits
- Saves up to 75 % of space
- Reduces contact failure
- Protects plug from accidental pulling and unplugging
- More compact size compared to conventional RJ45
- Ensures high temperature resistance

I/O Connector **Amphenol**

ix Industrial™ IP20 Connector

Features
- 75 % smaller than RJ45
- 360° shielding through mated pair
- High data rate perform. for 10G Ethernet, with PoE capability
- 5000 mating cycles
- Field terminable IDC plugs with solder options

Benefits
- Fully qualified second source intermateable with other vendors' products
- Supports Ethernet/IP and common protocols including Profinet, DeviceNet, EtherCAT, Modbus and others
- High durability
- Controlled mating for Ethernet, Signal/Bus, other ports

Wire-to-Wire, Wire-to-Board, Board-to-Board **molex**

Micro-Fit Connector System

Features
- 2 to 24 loaded circuits; single and dual row
- Pitch: 3.00 mm
- Current rating: 10.5 A per contact max (Micro-Fit), 12.5 A (Micro-Fit+)
- Voltage rating: 600 V
- Operating temp. range : -40° to +105 °C (up-to 125°C)
- Terminal Position Assurance (TPA) available

Benefits
- Wire-to-Wire, Wire-to-Board, Board-to-Board configurations
- Blind Mate Interface (BMI) system available (Micro-Fit)
- Compact pitch
- UL94-V0/Glow-Wire Combo Resin

Wire-to-Wire, Wire-to-Board, Board-to-Board **molex**

Mini-Fit Connector System

Features
- 2 to 24 loaded circuits; single and dual row
- Pitch: 4.20 mm
- Current rating: 13.0 A per contact max (Mini-Fit), 20.5 A (Mini-Fit MAX)
- Voltage rating: 600 V
- Operating temp. range: -40 ° to +105 °C (up-to 125 °C)
- Terminal Position Assurance (TPA) available (Mini-Fit MAX)

Benefits
- Wire-to-Wire, Wire-to-Board, Board-to-Board configurations
- Blind Mate Interface (BMI) system available (Mini-Fit)
- Compact pitch
- UL94-V0/Glow-Wire Combo Resin

Power Connector **Amphenol**

RADLOK Series

Features
- DC current up to 500 A @ 85°C (Radlok), DC voltage up to 1000 V
- Operating temperature: -40 °C to +125 °C
- Single wire connection, 90° plug orientation
- Field installable plug or overmolded plug / cable assemly
- 2.4 mm to 14 mm contact diameter, 10 mm^2 to 150 mm^2 cable diamater
- Different color coding (available in black, red and orange color)
- Quick lock and press-to-release design
- IP40 mated

Benefits
- Quick audible lock clip, current Rating: 750 A at 25 °C
- termination: busbar, termination crimp, pin to pin, screw

Electromechanical Components

Amphenol

Industrial Connector

X-LOK Series

Features

- Push and lock design
- Various sealing caps
- Large variety of receptacles and cable assemblies available
- Ruggedized design for tough location
- Ruggedized design for tough location
- Audible and tactile feedback

Benefits

- Waterproof/IP68
- Temperature Range -40 °C to 105 °C
- High durability (up to 1000 mating cycles)
- Easy-grip design

Amphenol

Power Connector

Heavymate MPN Series C146

Features

- Hybrid interconnection
- High current up to 250 A
- Pole size: 3 up to 280 poles
- Voltage up to 1000 V
- IP65 to IP68

Benefits

- High corrosion resistance
- Superior contact technology (Radsok & stamped contacts)
- Very robust & vibration proof housing

Amphenol

Industrial Connector

FLO Series

Features

- Intermateable* with Fischer, Lemo and ODU
- Easy auto-latching plug, fast and secure
- Reliable connection for signal/power transmission
- Metal shell for 360° EMI shielding
- Flexibility & capability of customization (Double ended, overmolded 180/90, adaptors…)

Benefits

- High mating cycles 2000 up to 5.000 times *
- Waterproof rating up to IPX8*
- Push-Pull locking system
- Working voltage up to 1.000 V*

*depends on series

Lumberg
passion for connections

I/O Connector

Serie 15: Audio 3.5 mm Connector

Features

- Regarding JIS C6560 JC35J3A
- 3.5mm 3 way / Stereo
- Right Angle for PCB
- Surface Mount Technology (SMT)
- Temperature Range -20 °C to 70 °C
- 34 V AC/DC and 1 Amps

Benefits

- Mating Cycles >5000
- Plastic Bag
- On Reel

molex

Antenna

Antenna Solutions for 5G

Features

- Cable Length: 100.00 mm, 150.00 mm, 200.00 mm
- Protocol: BLE, BT, Thread, Wi-Fi, Zigbee
- Cabled 2x2 MIMO Antenna, 4x4 MIMO Antenna
- Compatible with U.FL / I-PEX MHF Connectors

Benefits

- Double sided TESA adhesive
- Self adhesive mounting on metal and non-metal surface
- Highly compact, sidefed monopole antenna
- Solder pad for Core, Solder pad for Ground
- Micro-coaxial cable (50, 100, 150, 200, 250, 300 mm options)
- 4x4 MIMO design

molex

Antenna

5G External Antenna

Features

- Frequency: 698-960 MHz, 1.71-2.69 GHz, 698-960 MHz, 4.2 GHz, 4.4-5 GHz
- RF Power (Watt): 2.0
- Impedance (Ohm): 50
- Size (mm): 171.50 by 19.40 (straight mode), 151.00 by 19.40 (folded mode)
- High efficiency and peak gain for all major cellular bands

Benefits

- Antenna connectors in straight and folded modes with SMA-J and RP-SMA-J mounting options
- Multi-protocol solution that supports GSM, CDMA, UMTS, LTE, 5G NR and other cellular bands
- Hinge joint allows 90° rotation on the vertical plane and SMA-J connector allows 180° rotation on the horizontal plane

Amphenol

Server and Storage System

DDR4 Memory Module Sockets

DDR4 SO-DIMM Sockets

Features

- 260 position connectors on 0.50 mm pitch

Benefits

- Right angle and vertical orientation

DDR4 DIMM Sockets

Features

- Provide 288 contacts on 0.85mm pitch
- Complies to JEDEC POD12, conform to JEDEC MO-309

Benefits

- Vertical orientation
- Smaller pitch and lower operating voltage

Amphenol

Server and Storage System

DDR5 Memory Module Sockets

DDR5 SO-DIMM Sockets

Features

- 262 positions connector on 0.50 mm pitch

Benefits

- Right angle and vertical orientation

DDR5 DIMM Sockets

Features

- Provide 288 contacts on 0.85 mm pitch
- Complies to JEDEC SO-023, conform to JEDEC MO-329

Benefits

- Vertical orientation
- Smaller pitch and lower operating voltage
- Different color options for housing and latches

Electromechanical Components

Power Supply Connector

Power in- and Outlets acc. IEC 60320

Features
- Design: Inlet, outlet, combi/multi
- Mounting: Horizontal, vertical, bottom, snap-in, rewireable cable connector
- Cable termin.: Screw, quick connection, solder lug
- Board termin.: Through hole
- Voltage selector: With, without
- Rated current: 2.5 A, 6.3 A, 10 A (15 A acc. UL), 16 A (20 A acc. UL)
- Configuration: C8, C14-C18, C20-C24,

Relays

Industrial Relays

Focus at Rutronik is the Power Relay Group

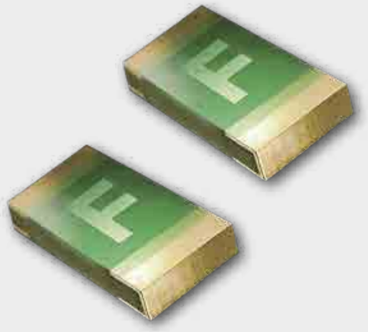
Rutronik offers a broad range of high quality products for all applications as well as special approved parts for white good applications, home automation, renewable energy, and industrial exercise. Our suppliers provide all approvals like UL, VDE, CSA, TÜV etc.
We offer different contact materials so you can select the best solution for your need. All available coil voltages can be offered.

Applications
- Fans (motors)
- Door motors
- Alarm lighting
- Contact loads
- Pump motors
- Heater element
- Lighting applications
- Smart meter
- White goods

Fuses

SMD-Chip Fuses

SCHURTER offers a broad range of high-quality chip fuses, which are developed specially for low-loss and precise overcurrent protection in secondary circuitry.



Type
USFF 1206, USF 1206,
USI 1206, UST 1206,
USF 0603, USF 0402

Features and Benefits
- Numerous current ratings from 50 mA to 25 A
- High rated voltages up to 125 V_{AC} / V_{DC}
- High breaking capacity of up to 600 A (internal tests)
- Super-Quick-Acting (FF), Quick-Acting (F) and Time-Lag (T) versions
- Precise, low power dissipation, resistant to vibrations and pulses

Applications
- Secondary protection on SMD PCBs
- Industrial electronics
- Smart meters
- Battery protection
- Sensors
- Lighting
- Mobile devices
- Semiconductor protection

Main Filter

1-Stage Filter for 1- and 3-phase Systems

DIN Rail Mounting

Description
- Chassis: DIN rail montage
- Line filter in industrial version, 1 stage, high attenuation
- Especially effective against asymmetrical interferences in the frequency range
- From 100 kHz up to 30 MHz
- Easy and time saving handling

Characteristics
- Protection against interference voltage from the mains
- Possible interferences generated in the equipment are strongly attenuated
- Especially designed for electric switch and control cabinets
- Suitable for use in equipment according to IEC/UL 60950

Approvals
- VDE Certification
- UL File

Switches

DIP & Code Switches

C&K Components is a leader in interface and switch technology. C&K offers more than 55,000 part numbers that are built, priced and delivered as standard catalog items, including tactile, navigation, detect, toggle, rocker, pushbutton, rotary, key, slide, DIP, thumbwheel and illuminated switch products, along with smart card and high-reliability connectors. C&K has built its reputation as a customer-focused organization, providing superior support, flexibility and solutions at competitive prices. Whether it's a standard, special or custom product, C&K will deliver a cost-effective component for all application-specific requirements.

CRD Series

10mm DIP Coded Rotary Switches

- Process sealed – withstands soldering and cleaning
- Thru-hole & surface mount models
- Crisp, positive detent ensures actuation
- Computer & peripherals
- RoHS compliant
- Mechan. life: 30,000 steps min.
- Operating temperature: -20 °C to 85 °C

RTE Series

Low Profile Rotary DIP Switches

- Miniature size with robust metal cover
- 2, 3, 4, 10 and 16 positions
- Variety of codings available
- Vertical and reverse versions
- RoHS compliant
- Mechanical life:
  RTE02/03:
  1,500 actuations;
  RTE04/10/16:
  20,000 actuations

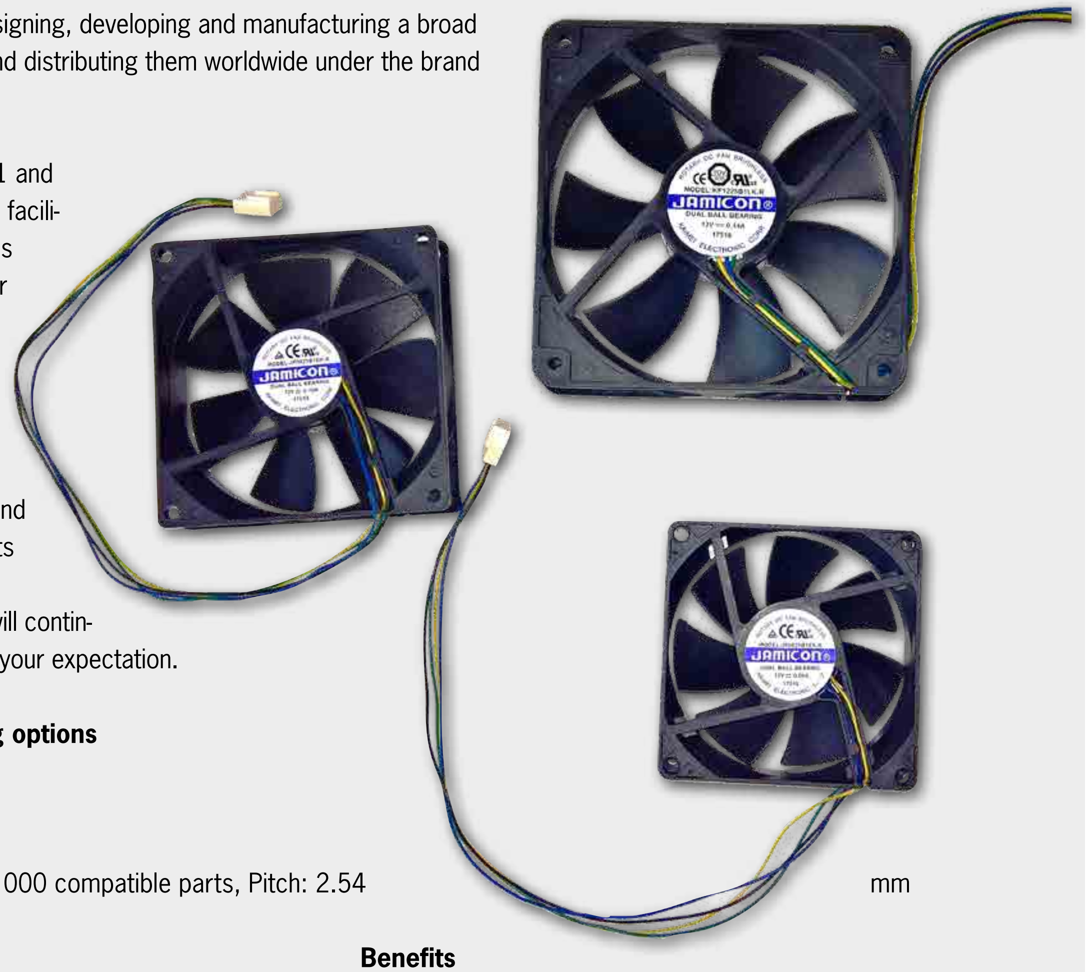
Brushless Fans Provide Cooling Solutions for Embedded Systems

JAMICON®

Kaimei Electronic Corp. has been designing, developing and manufacturing a broad line of AC and DC fans since 1990 and distributing them worldwide under the brand name Jamicon.

Kaimei Electronic Corp. has ISO 9001 and ISO14001 certificated manufacturing facilities in their home country of Taiwan as well as in China and Malaysia. In order to provide their services to various industries, recently their Shenzhen factory has obtained certification of TS16949 in 2014.

As the electronics industry matured and diversified, Jamicon always upholds its strict quality control policy.
We value our customers needs and will continually develop the products that meet your expectation.



FANs are equipped with following options

- Auto-Restart
- Speed Control
- PWM
- Connector: Housing Molex 470541000 compatible parts, Pitch: 2.54 mm

Features

- Operating Temperature: -10 °C to +70 °C
- Storage Temperature: -40 °C to 70 °C
- Safety Certificate: UL, CUL, TÜV, CE
- Insulation resistance: More than 10M ohm at 500 V.D.C. between lead and housing
- Dialectric strength: 700 V.A.C for 3 sec (max. 5 mA between lead and housing)

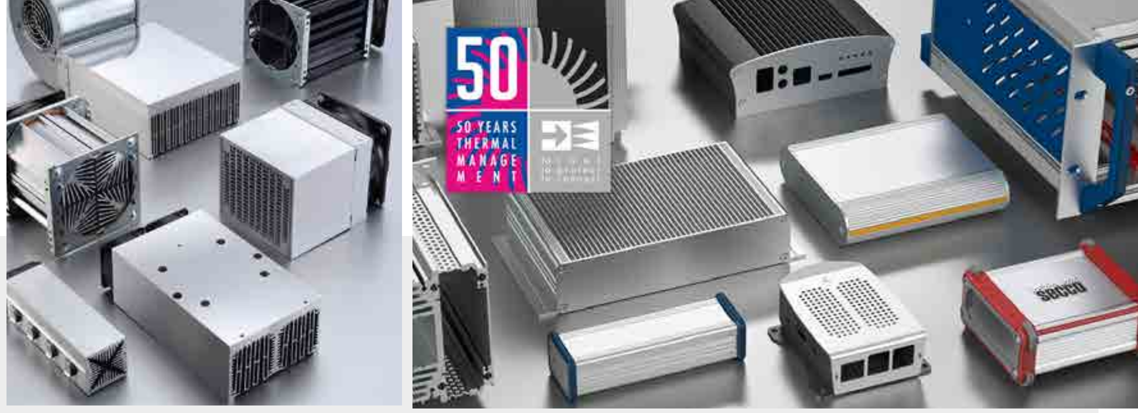
Benefits

- Exceptional airflow performance and high static pressure
- Locked Motor protection: designed to meet UL, CUL, TÜV
- Polarity protection: reverse connection at the rated voltage will not cause any damage
- 2 Ball Bearing (very long life time)

Model No.	JF0825B1EK01CCGJKR	JF0925B1EK00CCGJKR	KF1225B1LK02CCGJJR
Dimension (mm)	80x80x25	92x92x25	120x120x25
Type	DC	DC	DC
Voltage (V)	12	12	12
Bearing	2 Ball	2 Ball	2 Ball
Airflow (CFM)	18.93	30.86	56.29
Noise (dBA)	13.9	23.1	27.2
Speed (RPM)	1500	1700	1500
Input Power (W)	0.72	1.08	1.56
Input Current (A)	0.06	0.09	0.13
Cable Length (mm)	290+-10 mm	285+-10 mm	265+-10 mm
Rutronik No.	FAN4030	FAN4031	FAN4032

Cases

Aluminum & Design Cases



fischer elektronik
to cool to protect to connect

Features

- Extremely low losses of air due to optimized fin geometry
- Milled flat semiconductor mounting surface
- Segment cooling aggregates
- Miniature cooling aggregates
- Heatsink cooling aggregates
- Hollow fin cooling aggregates with axial fan
- High performance brazed cooling aggregates
- High performance heatsinks with hollow fin profile
- High performance cooling aggregates with radial fan
- Protection grid for fans

Aluminum Cases

- Shell and extruded assembled cases
- Combination cases
- Tube cases
- Heat dissipation cases
- Miniature Aluminum cases
- Customized cases

Design Cases

- Aluminum cases with plastic design elements
- Cases with high IP-protection
- Cases for heat dissipation
- Large selection between different sizes and options
- Customizing and individual configuration

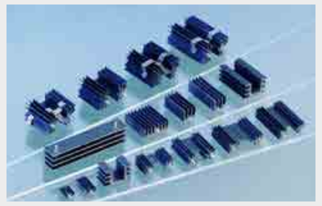
Heatsinks

ASSMANN WSW components
A company of BCS

Heatsinks with Solder Pin

- With solder pin
- Retaining spring for transistors
- Delivered in black anodized finish
- Thermal resistance 6 to 16K/W

Attachable Heatsinks



- For TO-220 packages
- For TO-220 packages with straight solder pin
- For TO-220 packages with angled solder pin
- Thermal resistance >16K/W

Small Heatsinks

- Heatsinks for IC-module
- U-heatsinks for transistor TO-220 packages
- Special heats. for TO-220/SOT-32 packages
- SMD heatsink for D-Pak packages
- Stamped finger-shaped heatsinks
- Thermal resistance > 16K/W

Stamped CPU Heatsink

For PGA (pin grid array), BGA (ball grid array) and other high power components.

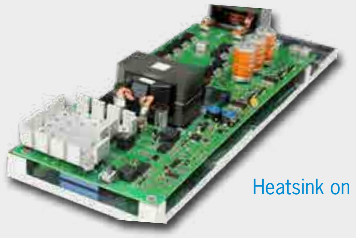
The new development series is a combination of cross-cut and finger-shaped heatsinks. Optimally used to mount the heatsink on the PCS via „Push Pins“.

Advantages

The advantage of this new heatsink design improves the air convection.

Optional

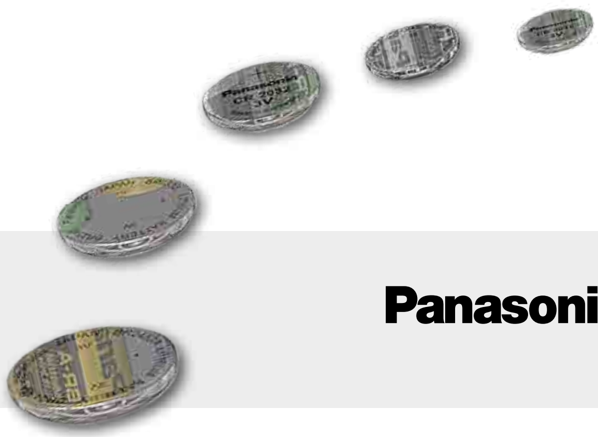
- Alternative material thickness
- Modifications of all dimensions and perforations
- Special surface treatments
- Customer made heatsink attachement methods



Heatsink on PCB

Stamped CPU heatsink

Stamped CPU heatsink + thermal pad



Batteries

Lithium Metal Coin Cells

Panasonic

Features	Benefits
Wide portfolio of coin sizes and variety of pin types	Different ways of contacting at different space
▪ Low self discharge rates ▪ High energy desities up to 375 Wh/kg ▪ Wide temperature range	Long-term energy, reliability and storability
Direct support at the world leading manufacturer of lithium metal coin cells	High quality, best technical solution, safety and conformity
Unique diversity of technologies	Special series for lasting back-up (BR), rechargeable usage (VL,ML,MT), high temp. up to 125°C (BR-A)

Type	Primary Battery		Rechargeable Battery		
	CR	BR	VL	ML	MT
Material Anode	MnO2	(CF)n	V2O5	LixMnOy	LixOy
Material Kathode	Li	Li	LiAl	LiAl	LixTiOy
Nom. Voltage (V)	3.0	3.0	3.0	3.0	1.5
Operating Temp. Range (°C)	–30 to +60	–30 to +80	–20 to +60	–20 to +60	–10 to +60
Self-discharge (per year) under standard conditions	1.0 %	1.0 %	2.0 %	2.0 %	2.0 %
Average Discharge Voltage (V)	-	-	2.85	2.5	1.2
Charge Voltage (V)	-	-	3.25 to 3.55	2.8 to 3.2	1.6 to 2.6
Cut-off Voltage (V)	2.0	2.0	2.5	2.0	1.0
Charge-discharge Cycles	-	-	1,000 charge/discharge partly (charge/discharge for 10% of discharge depth)	1,000 charge/discharge partly (charge/discharge for 10% of discharge depth)	500 charge/discharge up to 1V or discharge limit voltage (charge/discharge for 100% of discharge depth)

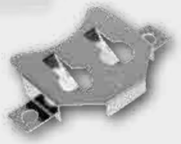
Battery Holders

Variety of Battery Holders

KEYSTONE ELECTRONICS CORP.

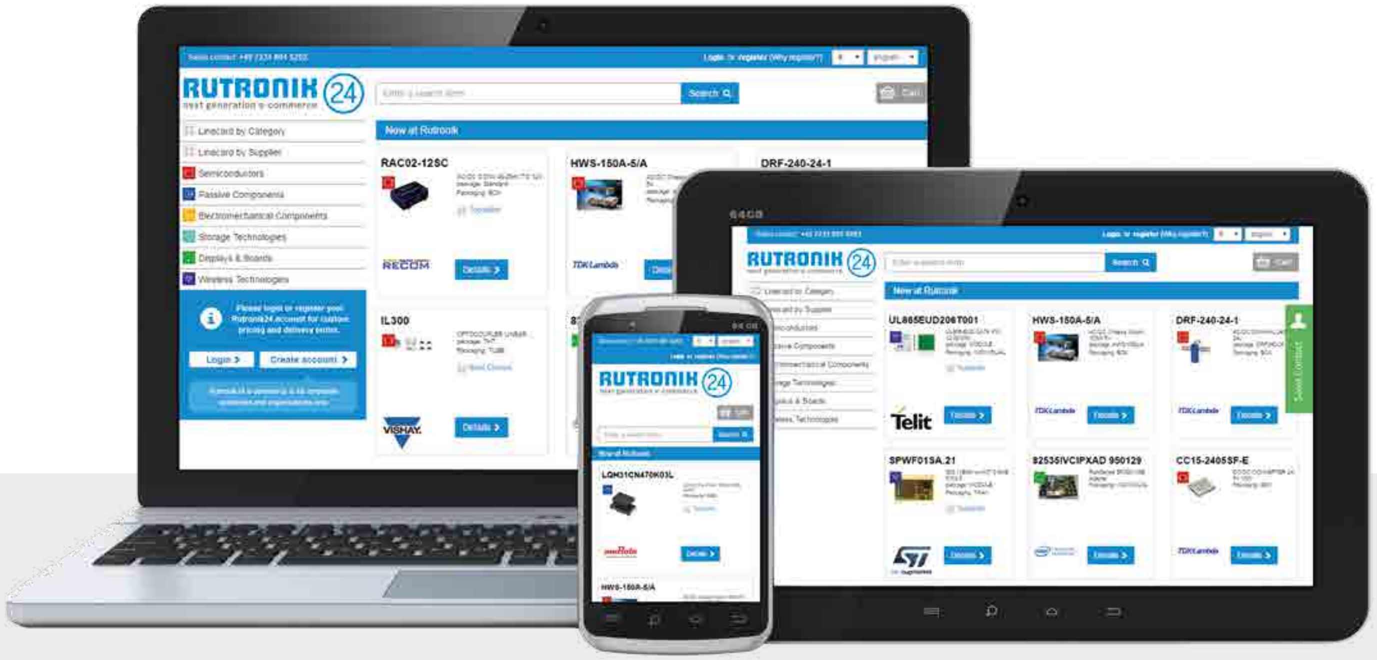
Coin, horizontal

Coin, vertical



Coin, retainer

Coin, contact



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