

# Embedded Highlights

 **RUTRONIK**  
**EMBEDDED**



Combine Technologies  
Realize EMBEDDED Designs

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



## 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

At the heart of every PC for (semi-)industrial applications are boards and systems specially developed for a specific purpose. 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 customer's requirement. Additionally, RUTRONIK EMBEDDED offers important components like processors, wired communication, power supply, and a wide range of accessories, from graphic cards over cooling solutions to stereo depth cameras.



### Displays & Monitors

With our portfolio of active TFT solutions, passive LCDs, E-Paper, 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.



### Storage

Flash memory is becoming increasingly more important in industrial applications, even as a simple 2.5" SSD or as a flash card in various form factors. Also HDDs, DRAM and ODDs for industrial and harsh applications with high reliability in industrial grade quality and with a reasonable longevity are demanded by the IoT market. Together with its partners RUTRONIK EMBEDDED can offer all the required solutions with a good balance between reliability and price.



### Wireless

Make your application embedded by connecting it wirelessly to the Internet of Things. RUTRONIK EMBEDDED has the newest solutions for using a smartphone, Wi-Fi 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, compatibility and consortia.



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## 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.

### New Division



**RUTRONIK  
IT ELECTRONICS**



Data Center | Server | Enterprise



Business | Office



Gaming | Consumer

## Computer Systems and Computer Parts. All from one single source.

The launch of the RUTRONIK IT ELECTRONICS division was a logical step in our company's development, enabling us to focus even more strongly on our expertise in the field of computer components and complete systems. This initiative emerged out of RUTRONIK EMBEDDED, as our linecard has long included a large number of manufacturers who offer components and systems for data centers and standard IT in addition to the embedded market. Of course, these products address completely different customer segments than we have been targeting with RUTRONIK EMBEDDED to date.

Consequently, products targeted at these customer segments are now offered under the brand RUTRONIK IT ELECTRONICS.

RUTRONIK IT ELECTRONICS offers all components required to build PCs and Data Centers, as well as complete systems ranging from business or gaming PCs to complete servers and many more. For IT system integrators and resellers, RUTRONIK IT ELECTRONICS offers an extensive range of products from carefully selected manufacturers and fast response to lead time and price request.







Boards & Systems



Boards & Systems



Storage



Displays



Wireless



Storage



Displays



**RUTRONIK  
EMBEDDED**

The Result:  
More Capabilities



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**

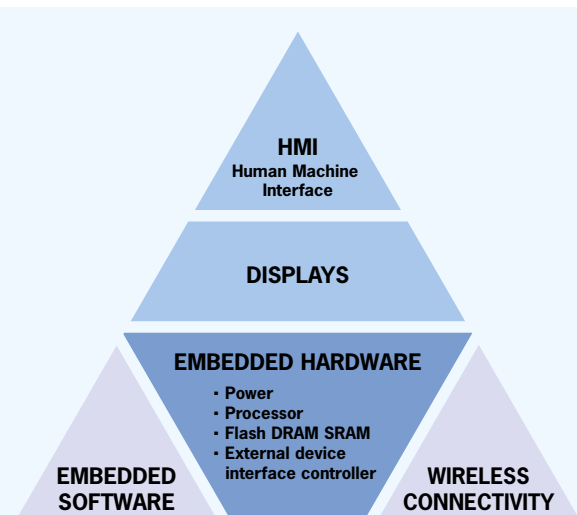
solutions in compact sizes with any number of read/write cycles with the highest storage density

■ **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

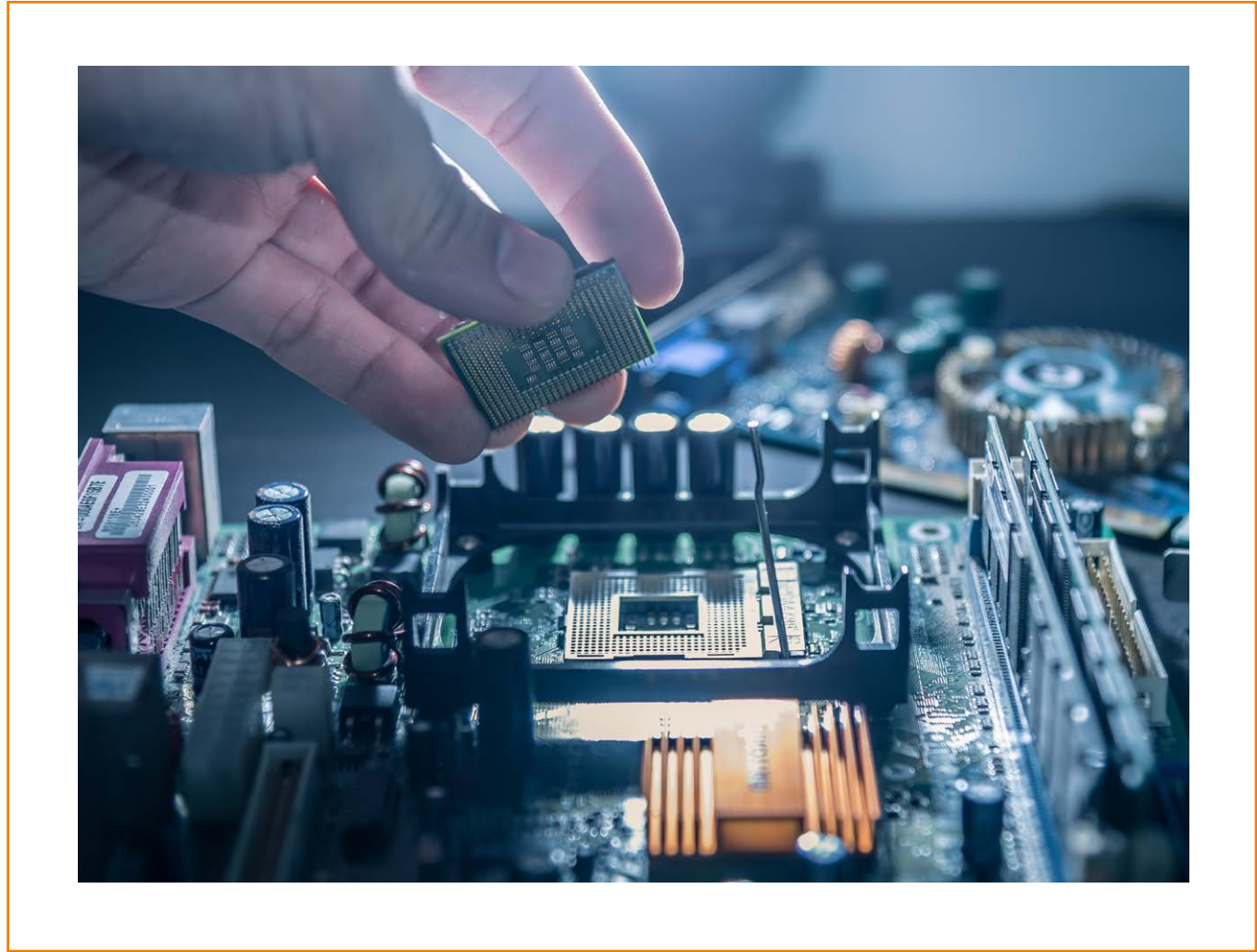






# Boards & Systems

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



## Boards

|                            | Adlink | Advantech | ASUS | Cherry | DFI | F&S | 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            |        | ■         |      |        |     |     | ■       |      |     |

## Wired Communication

|                                     | Adlink | Advantech | Cherry | HMS | Intel | Kontron | Seco |
|-------------------------------------|--------|-----------|--------|-----|-------|---------|------|
| Network Cards                       | ■      | ■         |        |     | ■     | ■       | ■    |
| Network Switches / KVM Switches     |        |           |        |     |       |         |      |
| Industrial Bus & Protocol Solutions | ■      | ■         |        | ■   |       |         |      |
| Wired Long-Range Network Solutions  |        |           | ■      |     |       |         |      |

## Processors

|                    | Intel |
|--------------------|-------|
| Mobile Processors  | ■     |
| Desktop Processors | ■     |
| Server Processors  | ■     |
| Chipsets           | ■     |

## Embedded Systems

|   | Adlink | Advantech | ASUS | DFI | EMKO | Extra Computer | Kontron | Seco | Via |
|---|--------|-----------|------|-----|------|----------------|---------|------|-----|
| Embedded Box-PCs                            | ■      | ■         | ■    | ■   | ■    | ■              | ■       | ■    | ■   |
| Embedded Panel PCs / Touch Panel PCs        | ■      | ■         | ■    | ■   | ■    | ■              | ■       | ■    | ■   |
| Desktop PCs                                 | ■      | ■         | ■    | ■   | ■    | ■              | ■       | ■    | ■   |
| Mobile PCs / Ind. Tablet PCs / Comp.-Sticks | ■      | ■         | ■    | ■   | ■    | ■              | ■       | ■    | ■   |
| Embedded Servers                            | ■      | ■         | ■    | ■   | ■    | ■              | ■       | ■    | ■   |

## Power Supplies

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

## Accessories

|   | Aaeon | Adlink | Advantech | ASUS | Cocom | DELTA | DFI | ECOUNT | EKL | F&S | FSP | HMS | HSM Zamecki | IEI | Intel | Kontron | Seco | Via |
|---|-------|--------|-----------|------|-------|-------|-----|--------|-----|-----|-----|-----|-------------|-----|-------|---------|------|-----|
| Digital LCD Controllers (Scaler)                    |       |        |           |      |       |       |     | ■      |     |     |     |     |             |     |       |         |      |     |
| Artificial intelligence Accelerator Modules & Cards | ■     |        | ■         | ■    |       |       |     |        |     | ■   |     |     |             | ■   |       |         |      |     |
| Controller Cards (Digital / Analog / Mixed Signal)  |       |        | ■         | ■    |       |       |     |        |     |     |     | ■   |             |     | ■     |         |      |     |
| Industrial Chassis / Cases                          |       |        |           | ■    |       |       | ■   |        |     |     |     |     |             |     |       | ■       |      |     |
| Graphic Cards                                       |       | ■      | ■         | ■    |       |       |     |        |     |     |     |     |             |     | ■     |         |      |     |
| HPC Cards   |       |        | ■         | ■    |       |       |     |        |     |     |     |     |             |     |       |         |      |     |
| Coolers & Heatspreaders                             |       |        |           |      |       |       | ■   |        | ■   | ■   |     |     | ■           |     | ■     | ■       | ■    | ■   |
| Cables & Adapters                                   |       |        | ■         | ■    |       | ■     | ■   | ■      | ■   | ■   | ■   | ■   | ■           |     | ■     | ■       | ■    | ■   |





# Industrial Motherboards by Kontron



Kontron offers a comprehensive portfolio of high quality, long-term available and competitive motherboards - designed and made in Germany. The comprehensive line-up, from compact Mini-STX up to full-sized ATX form factor fulfills most different requirements for various applications from diverse vertical markets like Industrial Automation, POS/POI, KIOSK, Digital Signage, Medical, Casino Gaming, Video Surveillance or Transportation. Kontron motherboards support latest processors and chipset platforms and utilize advanced technology components. 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

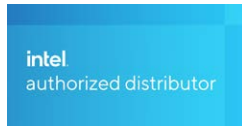
- Optimized Feature and design to reduce power consumption
- Simplify product selection with new features

## 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® Core™ Processors (12th/13th/14th Gen.)

|  |  |  |   |
|--|--|--|---|
|  |  |  |   |
| <b>K3831-H mITX</b>  | <b>K383x mITX</b>  | <b>K384x µATX</b>  | <b>K3851-R ATX</b>  |
| <ul style="list-style-type: none"> <li>■ Thin Mini-ITX</li> <li>■ Intel® H610 chipset</li> <li>■ LGA1700 Socket</li> </ul> | <ul style="list-style-type: none"> <li>■ Mini-ITX</li> <li>■ Intel® Q670E chipset</li> <li>■ LGA1700 Socket</li> </ul> | <ul style="list-style-type: none"> <li>■ µATX</li> <li>■ Intel® Q670E/Q670/B660 chipset</li> <li>■ LGA1700 Socket</li> </ul> | <ul style="list-style-type: none"> <li>■ ATX</li> <li>■ Intel® R680E chipset</li> <li>■ LGA1700 Socket</li> </ul> |

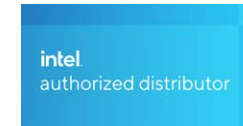
### Intel® Core™ i3 Processors & Intel® Processors N-Series (Alder Lake N)

|  |   |
|--|---|
|  |   |
| <b>K3921-N-H mSTX</b>  | <b>K3931-N mITX</b>   |
| <ul style="list-style-type: none"> <li>■ Mini-STX</li> <li>■ Intel® N50/N97/N200</li> <li>■ Intel® Core™ i3-N305</li> <li>■ Intel® N100</li> </ul> | <ul style="list-style-type: none"> <li>■ Mini-ITX</li> <li>■ Intel® N50/N97/N200</li> <li>■ Intel® Core™ i3-N305</li> </ul> |

### AMD Ryzen™ Embedded R2000 Processor Series (SoC)

|   |   |
|---|---|
|   |   |
| <b>D3724-R mSTX</b>   | <b>D3723-R mITX</b>   |
| <ul style="list-style-type: none"> <li>■ Mini-STX</li> <li>■ AMD FP5 SoC</li> </ul> | <ul style="list-style-type: none"> <li>■ Mini-ITX</li> <li>■ AMD FP5 SoC</li> </ul> |

## SMARTCASE™ Kit Solution



### Flexible. Versatile. Long Term Availability.

The chassis kit solutions are the perfect choice to build a tiny box PC tailored to individual requirements. They are designed for selected Kontron motherboards. They are optimally matched and climate-tested as well as CE-certified at system level and provides ample space on the front for your logo.



### SMARTCASE™ Series

|  |  |   |  |
|--|--|---|--|
|  |  |   |  |
| <b>S501</b>  | <b>S511</b>  | <b>S720</b>   | <b>S730</b>  |
| <ul style="list-style-type: none"> <li>■ Mini-STX</li> <li>■ Intel® Core™ i3 &amp; Intel® Processors N-Series</li> <li>■ 0.87 liter</li> </ul> | <ul style="list-style-type: none"> <li>■ Mini-STX</li> <li>■ AMD Ryzen™ Embedded R2000 Technology</li> <li>■ 0.87 liter</li> </ul> | <ul style="list-style-type: none"> <li>■ Mini-ITX</li> <li>■ 9th Gen Intel® Core™ i technology (LGA1151)</li> <li>■ 2.48 liter</li> </ul> | <ul style="list-style-type: none"> <li>■ Mini-ITX</li> <li>■ AMD Ryzen™ &amp; Intel® N-Series</li> <li>■ 2.48 liter</li> </ul> |





# 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

Pin Compatible

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

### i.MX 8M Mini Family

Pin Compatible

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

### i.MX 8M Nano Family

Pin Compatible

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

Software Compatible (Including GPU Tools)

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

**SECO SOM-Q7-MX8**  
(formerly MIRA)

- i.MX 8M Quad
- i.MX 8M Dual
- i.MX 8M QuadLite

**SECO SBC-3.5-MX8**  
(formerly THEMIS)

- Single Board Computer with NXP i.MX8 applications
- Processors in 3.5" form factor

**SECO SOM-Q7-MX8M**  
(formerly MAIA)

- i.MX 8QuadMax
- i.MX 8QuadPlus
- i.MX 8Quad

**SECO SBC-3.5-MX8M**  
(formerly ALBION)

- SBC with NXP i.MX 8M applications
- Processors in 3.5" form factor

**SECO SBC-3.5-MX8M-Mini**  
(formerly SBC-C61)

SBC with the NXP i.MX 8M Mini Processors

**SECO SOM-SMARC-MX8M**  
(formerly LEXELL)

SMARC standard module with NXP i.MX 8M processor



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

|                             | intel<br>CELERON | intel<br>PENTIUM | intel<br>ATOM | intel<br>ATOM | intel<br>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          |
| Scenario Design Power (SDP) | 4 W              | 4 W              |               |               |               |

**SECO SOM-Q7-APL**  
(formerly NAOS)

Qseven® Rel. 2.1 with the Intel® Atom® E39xx family, Intel® Celeron® N3350 and Intel® Pentium® N4200 SoCs

**SECO SOM-SMARC-APL**  
(formerly JAGER)

SMARC with the Intel® Atom® E39xx Intel® Celeron® N3350 family, and Intel® Pentium® N4200 SoCs

**SECO SOM-COMe-CT6-APL**  
(formerly MIRANDA)

COM Express™ 3.0 Compact Type 6 Module with the Intel® Atom® X Series, Intel® Celeron® J/N and Intel® Pentium® N Series

**SECO SBC-eNUC-BSW**  
(formerly NOLAN)

Embedded NUC™ SBC with the N-series Intel® Pentium®/Celeron®

**SECO SBC-eNUC-APL**  
(formerly ALVIN)

Embedded NUC™ SBC with the Intel® Atom® E39xx family, Intel® Celeron® N3350 and Intel® Pentium® N4200

**SECO SBC-piTX-APL**  
(formerly ADLER)

Intel® Atom™ X Series, Intel® Celeron® J / N Series and Intel® Pentium® N Series Processors

**SECO SOM-COMe-CT6-V1000**  
(formerly CHARON)

COM Express™ Compact 3.0 Type 6 Module with the AMD Ryzen™ Embedded V1000 processors

**SECO SOM-COMe-BT7-E3000**  
(formerly THEBE)

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

| Industrial   |                                 |                                 |   | Semi-Industrial & Developer    |                               |
|--|---------------------------------|---------------------------------|---|--------------------------------|-------------------------------|
|  |                                 |                                 |   |                                |                               |
| <b>Micro ATX</b><br>244 x 244 mm   | <b>Mini ITX</b><br>170 x 170 mm | <b>3.5" SBC</b><br>146 x 105 mm | <b>Pico ITX</b><br>100 x 72 mm  | <b>Pico ITX</b><br>100 x 72 mm | <b>Nano SBC</b><br>86 x 54 mm |
|  |                                 |                                 |   |                                |                               |
|  |                                 |                                 |   |                                |                               |
| 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

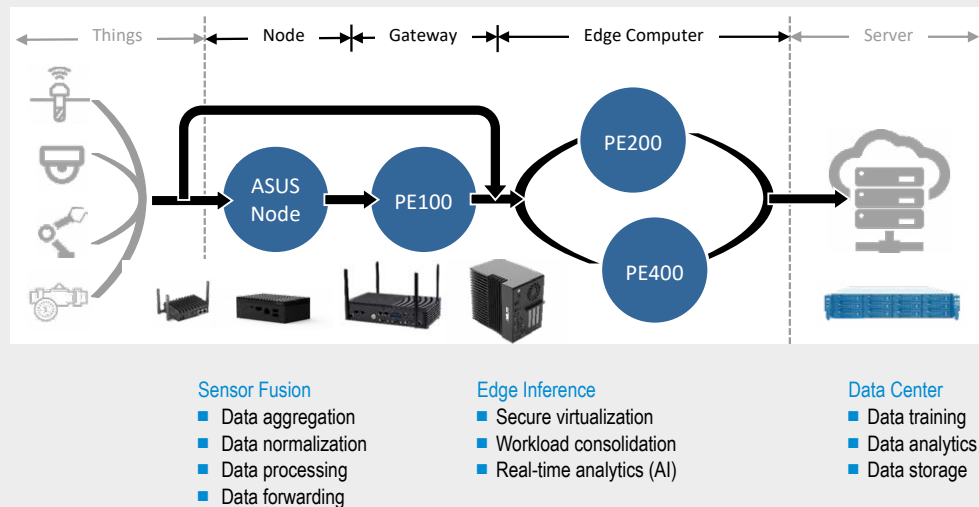
At the very frontier of AIoT and Cloud computing, edge computer is in charge of processing, filtering, analyzing and acting on data received in real-time, which not only reduces the traffic of data also provides lower latency and the cost of data transmission. ASUS IoT Edge computer is built for 24/7 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



## ASUS NUC Mini PCs, Kits & Boards

### High-End Computing, Low-Profile Style

#### Pint-sized Power

The ASUS 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 ASUS 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 ASUS NUC makes it easy to add devices and scale up rapidly based on changing productivity needs.

## ASUS NUC Elements

High-Performance, Modular Elements for a Range of Verticals

Start with an ASUS NUC Compute Element with the exact processor you need and plug it into an ASUS 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 ASUS NUC Elements let you deliver custom solutions with minimal R&D time



# 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 lightweight 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 @ 24Hz
- 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

## 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 expandibility.



### 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

## 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

| Applications | Panel | Box | Demand Panel PC |
|--------------|-------|-----|-----------------|
|              | 7"    | A   |                 |
|              | 15"   | B   |                 |
|              | 21"   | C   |                 |

Different Requirements      Configure by Demand      Application Ready

## 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-XXN

- 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

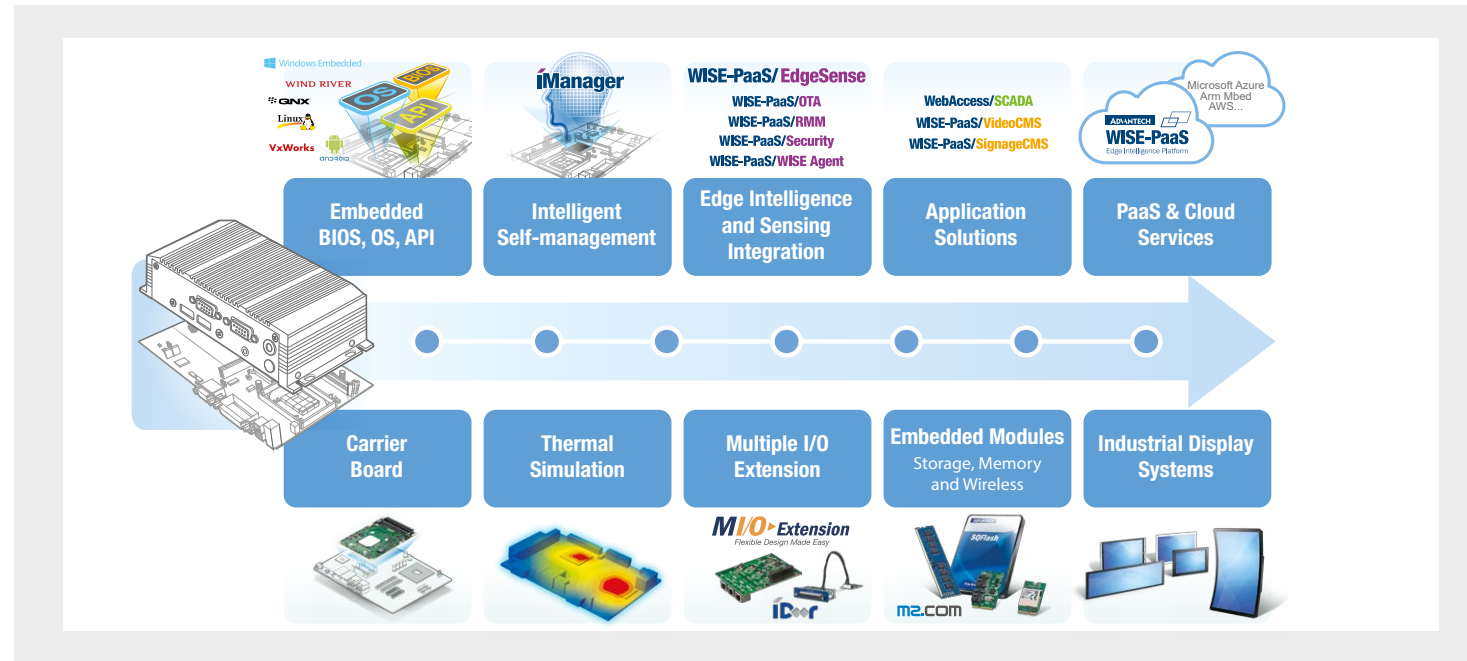




# Embedded Boards & Systems by Advantech



Worldwide Leader in Embedded Design and Services



# Fanless Embedded Computers

## Modular System for Quick Equipment Integration

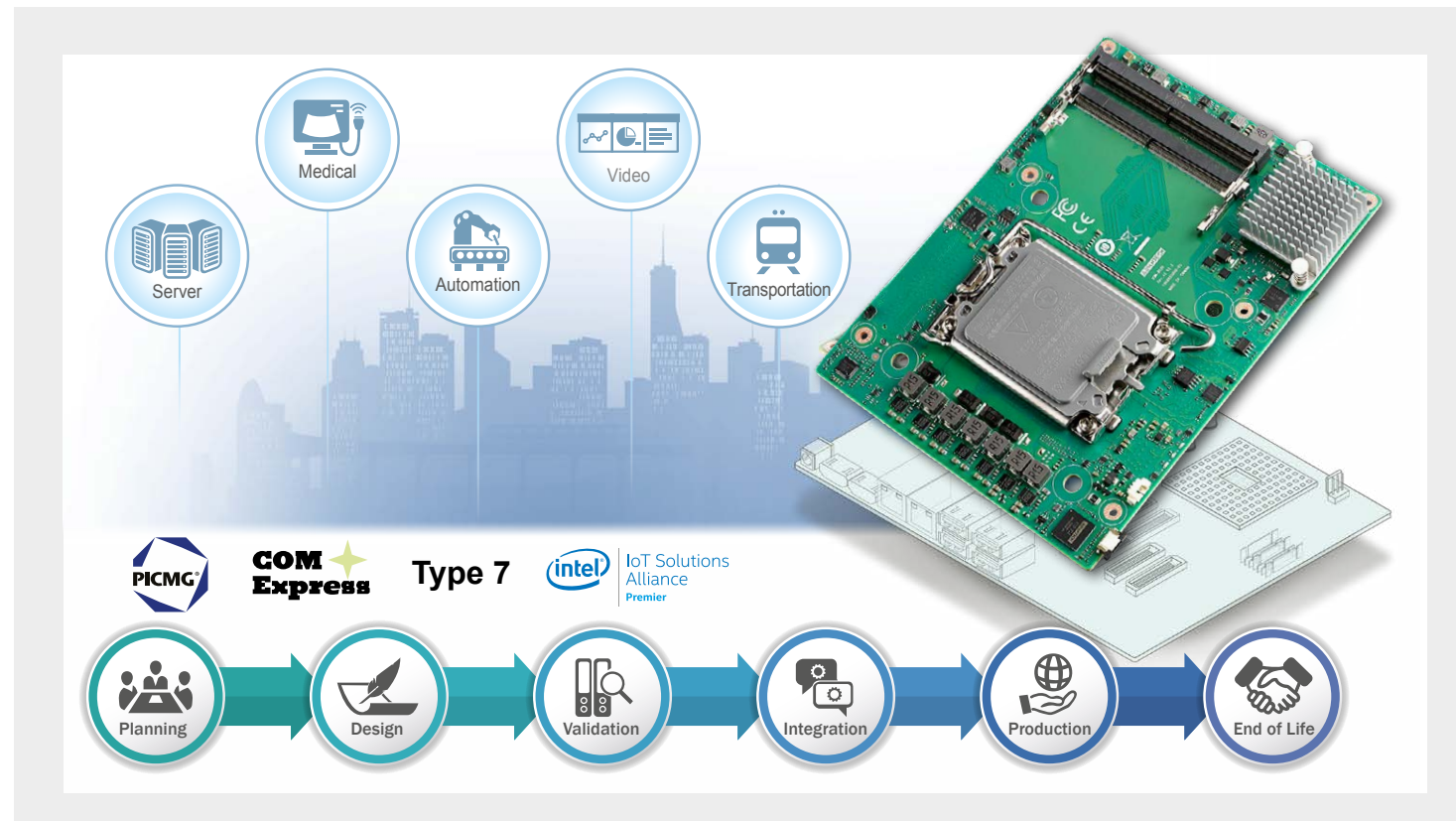
Advantech provides full customization services including a selection of offerings for I/O modules, OS software, and peripherals. You can choose from a flexible range of modular I/O options without concern for additional customization time, NRE, or costs. With our modular I/O design, you can rapidly implement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



# 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.



# 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.





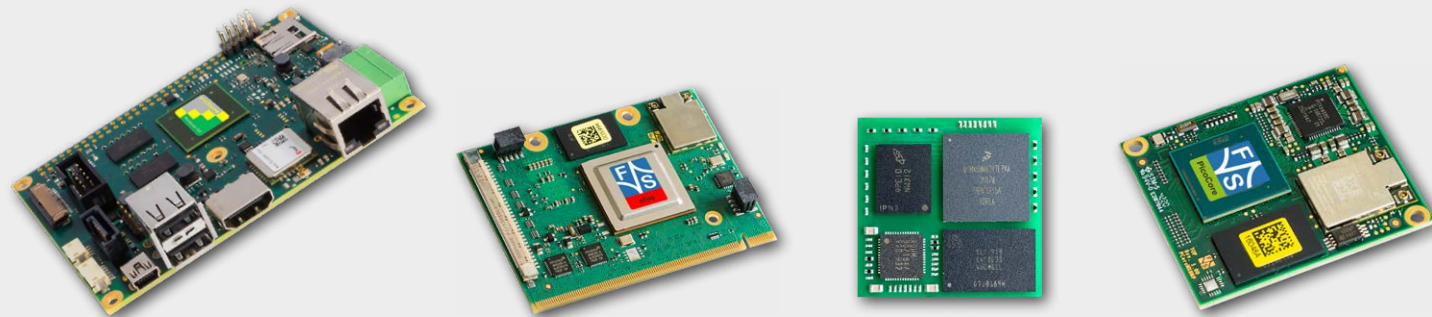
# Embedded Boards with F&S

## 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 up-coming 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

| 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                      | PicoTX Formfaktor |              |                     | Qseven second source |               |           | OSM (Open Standard Module) |           |
| 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    |

# Embedded Systems & Industrial PCs

Founded 1989 in southern Germany, Extra Computer has established to a leading German manufacturer for PC Systems. With three brands, Extra Computer 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, Extra Computer is proud to offer quality computer Systems made in Germany.

## Industrial Systems with Long Time Availability



### Calmo Tiny – Small, Smaller, Tiny

The Calmo TINY - a mini industrial system at the highest level! 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. Additional functions such as TPM, GPIO, and Watch Dog are also included.

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



### Calmo XS – x-trasmall Box-IPC with Professional Interfaces

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

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



## Ruggedized IT Hardware for Rough Environments



### Pokini F2 – Smart, Powerful, Customizable

The Pokini F2 is a small and fanless PC with great performance, 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.

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



### Industrial Panel PCs – 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. With compact and innovative housing design for easy integration in standard production control cabinets or for mounting on corresponding mounting systems, we only offer exactly fitting solutions.

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





# Embedded Solutions powered by MediaTek



The MediaTek Genio chipsets offer fast multicore performance with extreme power-efficiency, optimizing the user experience for even the most compute-intensive AI applications. The CPU, GPU, and AI Processing Unit (APU) in each Genio chipset work together to enhance intelligent autonomous capabilities at the edge and support high-quality displays, cameras, and more. Additionally, each chipset offers support for the latest Wi-Fi and Bluetooth protocols to deliver seamless connectivity. MediaTek Genio is a complete platform stack for the IoT with powerful and ultra-efficient chipsets, open platform software development kits (SDKs), and a developer portal with comprehensive resources and tools. The open standards platform for the development of industry, commercial, and enterprise IoT applications reduces development costs and enables faster time-to-market. Based on Mediatek Genio chipsets RUTRONIK EMBEDDED can also offer embedded boards & solutions by adding, power supplies, storage components and TFT displays, as well as wireless connectivity solutions, sensors and all electromechanical components required to build up an intelligent embedded system for the emerging IoT market.

## MediaTek Genio 1200

MediaTek's flagship-grade SoC with leading 6nm design provides incredible performance, advanced multimedia and power efficiency for Edge computing and Edge AI applications. Its flexible I/O supports GbE, WiFi-6/5G modules suitable for IoT applications.

Octa-Core CPU: 4X Arm Cortex-A78 @ 2.2 GHz & 4X Cortex-A55 @ 2.0 GHz



Evaluation Kits, System-on-Modules (SoMs), and Single-Board Computers (SBCs) – based on Genio 1200

|  |  |  |  |
|--|--|--|--|
| <br><br><b>RSB-3810 &amp; EPC-R3810</b><br>2.5" Pico-ITX SBC & Edge AI Box | <br><br><b>I-Pi SMARC 1200</b><br>I-Pi SMARC Development Kit | <br><br><b>3.5"-SBC-i1200</b><br>3.5" SBC + I/O Extension Socket | <br><br><b>SOM-7000*</b><br>SMARC Module + Carrier Board |
|--|--|--|--|

## MediaTek Genio 700

High-performance edge-AI IoT platform for smart home, interactive retail, industrial and commercial applications. Provides highly responsive edge processing, advanced multimedia, multi-tasking OS and more.

**Octa-core CPU**  
 2X Arm Cortex-A78 @ 2.2 GHz  
 + 6X Cortex-A55 @ 2.0 GHz

**SOM-SMARC-Genio700**  
 SMARC® Rel. 2.1.1 Module

## MediaTek Genio 500

Powerful yet efficient IoT platform designed for portable, home or commercial IoT applications, advanced multimedia capabilities, multiple high-res. cameras, connected touch-screen displays, and multi-tasking OS.

**Octa-core CPU**  
 4X Arm Cortex-A73 @ 2.0 GHz  
 + 4X Cortex-A53 @ 2.0 GHz

**SOM-9X50\***  
 SOM Module w/ Carrier Board (optional)

## MediaTek Genio 350

Competitive platform with capable computing performance and light-AI application. A fitting solution for designing competitive product of portable, home or commercial IoT applications.

**CPU**  
 4X Arm-Cortex A55 @ 2.0 GHz

**SOM-9X35\***  
 SOM Module w/ Carrier Board (optional)

\* VIA modules available soon

# Embedded Solutions powered by Rockchip



## CHERRY Embedded Solutions

High-quality System-on-Modules and Single-Board Computers for a Wide Range of Applications

### JAGUAR SBC-RK3588-AMR

Single-Board Computer designed from scratch for the series production of cost-efficient autonomous mobile robots (AMR). It features simultaneous localization and mapping, obstacle detection, easy integration with standard connectors, single power input and simple thermal design.



### RINGNECK SOM-PX30-μQ7

System-on-Module designed for cost-effective and power-efficient smart devices. In particular, it supports low-cost touch screens and app-based user interaction via WiFi and Bluetooth.



### PUMA SOM-RK3399-Q7

Versatile System-on-Module for smart devices that collect, process and output high resolution video streams. It is typically used to run 2 MIPI-CSI high-resolution cameras and a 4K / 60fps display.



### TIGER SOM-RK3588-Q7

System-on-Module that delivers cutting-edge computational performance, connects multiple high-resolution cameras (1 HDMI and 4 MIPI-CSI), and provides deep learning capabilities to apply computer vision algorithms.



### CHERRY Embedded Solutions' (formerly Theobroma Systems') Modules combine performance and cost efficiency

- Production capacities from small batches to large-scale series
- Lead times of as little as two weeks
- Availability of up to ten years
- Seamlessly integrated software / hardware guarantee reliable operation
- The modules are supported mainline in Linux kernel and U-Boot bootloader
- Developed and manufactured in Austria, the heart of Europe

## Overview – Embedded Boards & Systems



| Supplier  | PX30            | RK3328                  | RK3568              | RK3399   | RK3588                      |
|-----------|-----------------|-------------------------|---------------------|--|-----------------------------|
| CHERRY    | RINGNECK (SOM)  |                         |                     | PUMA (SOM)   | JAGUAR (SBC)<br>TIGER (SOM) |
| SECO      | SBC-3.5-PX30    |                         | SBC-3.5-RK3568      | Titan 220/225 (BOX PC)<br>SBC-3.5-RK3399 (SBC)               |                             |
| ADLINK    | LEC-PX3 (SMARC) |                         |                     |  |                             |
| ADVANTECH |                 | EPC-R4680 (BOX PC)      | RSB-4810 (SBC 3.5") | ROM-5780 (SMARC) / EPC-R3710 (System)<br>RSB-4710 (SBC 3.5") |                             |
| ASUS      |                 | Tinker Board (SBC 1.8") |                     | Tinker Board 2 (SBC 1.8")<br>Tinker Edge R (SBC 2.5")        |                             |





# Intel® Processors for Every Usage



Deploy edge applications quickly with Intel's portfolio of edge-ready compute and connectivity technologies. Enhanced processing at the edge to get critical insights and business value from your data with compute resources where you need them most.



## Intel® Atom® Processors



Intel Atom® C5000, P5300, and P5700 processors enable businesses to optimize the balance of performance and cost for modern network infrastructure, security accelerators, and storage appliances. Intel Atom processors are available with a broad range of core counts and hardware features to support different edge use cases. Advanced microarchitectures based on 10nm process technology and a robust set of accelerators combine to deliver high per-core performance and advanced packet processing. The platforms are based on energy efficient system-on-chip (SoC) form factors with integrated Intel® Ethernet and Intel® QuickAssist Technology (Intel QAT), ensuring high performance per watt for network edge implementations.

### Intel Atom C5000 SoCs

#### Power-Optimized for Networking and Storage

The Intel Atom C5000 processor series includes the Intel Atom C5100 series processors for storage and the Intel Atom C5300 processors for networking. Both include 4 to 8 cores and feature integrated Intel QAT Gen2, which is capable of 10 to 20 Gbps look-aside encryption throughput.

The Intel Atom C5000 processors are socket-compatible with the Intel Atom P5300 and P5700 SoCs to enhance platform upgradeability machines.

### Intel Atom P5300 SoCs

#### Performance-Optimized

Intel Atom P5300 processors are based on 8 to 24 cores and operate with a TDP of 55 to 85 watts. The platform is engineered to provide power-efficient computing for implementations such as network and security appliances or SD-WAN points of presence (POPs).

It integrates Intel QAT Gen3, which is capable of driving 100 Gbps of crypto and 70 Gbps of compression, and supports extended temperature operation.

### Intel Atom P5700 SoCs

#### Performance-Optimized with Integrated Switch

Intel Atom P5700 processors provide 8 to 20 cores, a power envelope of 48 to 75 watts, and extended temperature operation. The eight-port switch integrated into the Intel Atom P5700 processors provides a sophisticated 100 or 200 GbE programmable packet-processing pipeline and packet classifiers for advanced traffic management. This class of functionality is typically associated with higher-end network switches. Integrating the hardware resources into the SoC package provides cost and space efficiencies comparable to an external switch.

| Type                  | Intel Atom® C5000 Processors                                     | Intel Atom® P5300 Processors  | Intel Atom® P5700 Processors  |
|-----------------------|--|---|---|
| Cores                 | 4 - 8  | 8 - 24  | 8 - 20  |
| Operating Temp. Range | Extended and commercial  | Extended  |   |
| Integrated LAN        | Up to 8 Ethernet ports<br>Up to 50 Gb throughput                 | Up to 8 Ethernet ports<br>Up to 100 Gb throughput   |   |
| Integrated Switch     | No   | No  | Flexible packet processor and switch  |
| Accelerators          | Intel® QAT Gen2:<br>20 Gb crypto throughput<br>(look-aside only) | Intel QAT Gen3:<br>100 Gb crypto throughput<br>(look-aside only)<br>Intel Dynamic Load Balancer | Intel QAT Gen3:<br>100 Gb crypto throughput<br>(inline and look-aside)<br>Intel Dynamic Load Balancer |

## 5th Gen Intel® Xeon® Processors



These processors deliver impressive performance-per-watt gains across all workloads, plus outsized performance and lower total cost of ownership (TCO) for AI, databases, networking, storage, and high-performance computing (HPC). They offer more compute, larger shared last-level cache, and faster memory at the same power envelope as the previous generation. They are also software- and platform-compatible with the previous generation of 4th Gen Intel Xeon processors, so you can minimize testing and validation when deploying new systems for AI and other workloads. 5th Gen Intel Xeon processors excel in a range of AI use cases, including generative AI, recommender systems, natural language processing (NLP), machine learning (ML), and image classification. Memory and I/O technologies featured include DDR5 support, PCIe 5.0 support, and CXL support.

### Higher per-core performance

- More cores and more per-core performance
- Up to 64 cores per processor
- Reduced power consumption

### Advanced memory and I/O bandwidth capacity

- 8 memory channels per processor at up to 5,600 MT/s (1 DPC)
- 80 lanes of PCIe 5.0
- CXL 1.1 support

### AI acceleration

- Built-in Intel® AI Engines
- Intel AMX for a giant leap in DL inference and training performance



5th Gen Intel® Xeon® Processors support technologies that let you scale and adapt as workload requirements change.

## Intel® Xeon® D Processors

With better performance, a higher core count, and more flexible connectivity, Intel® Xeon® D processors offer speed and efficiency for edge and network solutions where density and low power are essential.

### Key features

- Improved performance at a similar TDP
- Workload-optimized performance, from the cloud to the edge
- higher core count and more flexible ethernet connectivity
- Intel® Speed Select Technology (Intel® SST)
- Supporting cloud-edge computing solutions with a range of integrated security, network, and acceleration capabilities







**PRODUCTIVITY THAT MEETS YOUR DEMANDS**  
INTEL® PENTIUM® PROCESSORS

**MAKES YOUR PC FASTER**  
2X  
Up to 2X better productivity than a 5-year-old PC<sup>1</sup>

**MAKES YOUR PC BETTER**  
4K UHD  
4X the pixel resolution than traditional HD  
Built-in security features

**DESIGNED FOR YOUR PC**  
Supports dual monitor setups

<sup>1</sup>Based on Intel® Pentium® 4415U processor. For more complete information about performance and benchmark results, visit [www.intel.com/benchmarks](http://www.intel.com/benchmarks). © 2017 Intel Corporation.



## 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 visually 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

### 14th Generation – Powerful Real-World CPU performance

The release of Intel's Core 14th Gen desktop stack gives businesses across various vertical markets and/or mainstream PC users further options to experience the performance of Intel's latest-gen desktop processors, all while enjoying the well-known Intel platform features. At the edge, Intel Core 14th Gen desktop processors enable powerful AI and compute-intensive workloads with more cores in LGA-socketed packaging. This empowers vertical markets to deliver innovative results more efficiently, safely and effectively. From controlled automation and robotics on the factory floor, detail-rich medical imaging displays to interactive whiteboards in school classrooms. The Intel Core 14th Gen desktop processor lineup offers a processor to meet the unique productivity, writing and gaming needs of various different applications in every price range.

### Features

- Broad memory support for DDR4 or DDR5 RAM
- Intel® Smart Cache
- Intel® Extreme Tuning Utility (XTU)
- Improved connectivity (Thunderbolt™ 47, Wi-Fi 7 and 6E, and up to Bluetooth 5.4)
- Intel® Thread Director

## Intel® RealSense™ Depth Cameras

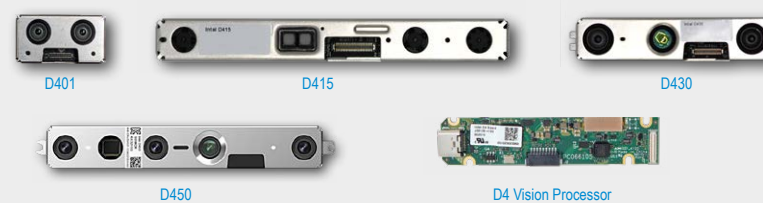


Intel® RealSense™ Stereo depth technology brings 3D to devices and machines that only see 2D today. Stereo image sensing technologies use two cameras to calculate depth and enable devices to see, understand, interact with, and learn from their environment. Designed for easy setup and portability, Intel® RealSense™ D400 series cameras feature high depth resolution and include active infrared (IR) stereo with standard or wide field of view.

| Type                        | D405  | D415   | D435 / D435i / D435f / D435if                                | D455 / D457 / D455f / D456                                    |
|-----------------------------|---|--|--|---|
| Typical Use Cases           | Pick & Place Defect Detection                 | Collision avoidance / Recognition and Interaction / Scanning | Collision avoidance / Recognition and Interaction / Scanning | Collision avoidance / Recognition and Interaction / Scanning  |
| Value                       | Shortest Range                                | Mid-Range Value  | Mid-Range WFOV/Flexibility (IMU or IR Pass Filter optional)  | Longest Range / Matched Depth & RGB FOV                       |
| Ideal Range                 | 7cm to 50 cm                                  | 0.5m to 3m   | 0.3m to 3m   | .6m to 6m   |
| Depth Accuracy <sup>2</sup> | 1.4% at 20cm                                  | 2% at 2m   | 2% at 2m   | 2% at 4m  |
| Min Z @Max Resolution       | Sub-mm @7cm                                   | Min Z ~45cm  | Min Z ~28cm  | Min Z ~52cm   |
| Depth Technology            | Stereoscopic                                  | Active IR Stereo   | Active IR Stereo   | Active IR Stereo  |
| Max Depth Resolution        | 1280x720 @ 30fps / 640x360 @ 90fps            | 1280x720 @ 30fps / 840x480 @ 90fps                           | 1280x720 @ 30fps / 840x480 @ 90fps                           | 1280x720 @ 30fps / 840x480 @ 90fps                            |
| Depth FOV1 HD / Shutter     | 87° x 58° / Global                            | 65° x 40° / Rolling  | 87° x 58° / Global   | 87° x 58° / Global  |
| RGB FOV1 / Shutter          | 1MP 87° x 58°<br>Global via Left Depth Imager | 2MP 69° x 42°<br>Rolling                                     | 2MP 69° x 42°<br>Rolling                                     | 1MP 90° x 65°<br>Global                                       |
| Dimensions (WxHxD mm)       | 42 x 42 x 22                                  | 99 x 23 x 20   | 90 x 25 x 25 / 90 x 25 x 25 / 90 x 25 x 26                   | 124 x 29 x 26 / 124 x 29 x 36 / 124 x 29 x 27 / 124 x 29 x 26 |
| Main Components             | D401 Depth Module<br>D4 Vision Processor V4   | D415 Depth Module<br>D4 Vision Processor                     | D430 Depth Module<br>D4 Vision Processor                     | D450 Depth Module<br>D4 Vision Processor V3/V5                |
| IMU                         | No  | No   | Optional (D435i & D435if)                                    | Yes   |
| Depth Filter                | IR Cut  | No   | IR Pass (D435f & D435if)                                     | No  |
| IP rate                     | No  | No   | No   | IP65 (D456 & D457)  |
| Connectors                  | USB3 Micro-B                                  | USB-C 3.1 Gen 1  | USB-C 3.1 Gen 1  | USB-C 3.1 Gen 1 / GMSL FAKRA                                  |
| Use Environment             | Indoor / Outdoor                              | Indoor / Outdoor   | Indoor / Outdoor   | Indoor / Outdoor  |

### Intel® RealSense™ Depth Modules & Processors

Intel® RealSense™ Stereo depth technology brings 3D to devices and machines that only see 2D today. Stereo image sensing technologies use two cameras to calculate depth and enable devices to see, understand, interact with, and learn from their environment. 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.



### High Speed Flexi Cables for Intel® RealSense™

Cocom® High Speed Flexi (HSF) cables are used to connect Intel® RealSense™ D4xx Depth Modules to the Vision Processor Boards. The wide variety of Cocom's HSF cable portfolio enables easy and flexible system integration of Intel® RealSense™ D4xx Series products, according to your specific product requirements.





# Vision Hardware

## Intel® Arc™ Pro A-Series Graphics



Introducing the professional range of GPUs from Intel: the Intel Arc Pro A-series graphics. With built-in ray tracing hardware, graphics acceleration, and machine learning capabilities, Intel Arc graphics unites fluid viewports, the latest in visual technologies, and rich content creation across mobile and desktop form factors.

| Type                 | Intel Arc Pro A40 GPU          | Intel Arc Pro A50 GPU          | Intel Arc Pro A60 GPU           |
|----------------------|--------------------------------|--------------------------------|---------------------------------|
|                      |                                |                                |                                 |
| Peak FP32 Throughput | Up to 5.02 TFLOPs              | Up to 5.02 TFLOPs              | Up to 10.04 TFLOPs              |
| Xe-Cores             | 8                              | 8                              | 16                              |
| Ray Tracing Units    | 8                              | 8                              | 16                              |
| Memory               | 6GB GDDR6                      | 6GB GDDR6                      | 12GB GDDR6                      |
| Display Output       | 4x mini-DP 2.0                 | 4x mini-DP 2.0                 | 4x DP 2.0                       |
| PCIe Support         | Gen 4.0 x8, Gen 3.0 compatible | Gen 4.0 x8, Gen 3.0 compatible | Gen 4.0 x16, Gen 3.0 compatible |
| Form Factor          | Single Slot                    | Dual Slot                      | Single Slot                     |
| Power Consumption    | 50 W (Peak Power)              | 75 W (Peak Power)              | 130 W (Peak Power)              |

## 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

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



| Type              | CRL-G18U-P3DF         | CRL-G116U-P3DF         |
|-------------------|-----------------------|------------------------|
|                   |                       |                        |
| Chipset           | 8x Google® Coral Edge | 16x Google® Coral Edge |
| Formfactor        | PCIe 3.0 x16 (M.2)    | PCIe 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                 |



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)  | miniPCIe 2.0 x1     | PCIe 2.0 x4         | PCIe 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             |

# 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

### 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

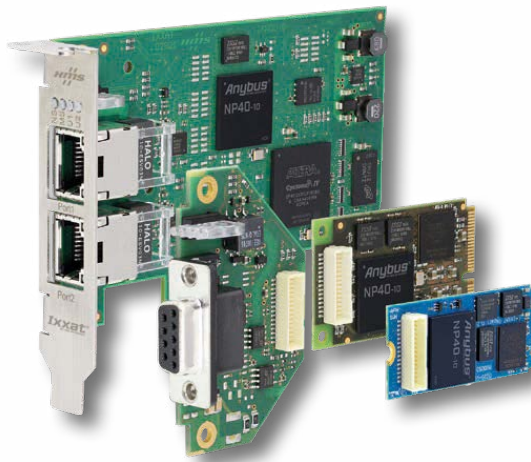
Intel® Ethernet products are customers' choice for extensive compatibility, performance assurance, broad product selection, and world-wide support.





# Ixxat INpact

## Multi-Protocol Technology

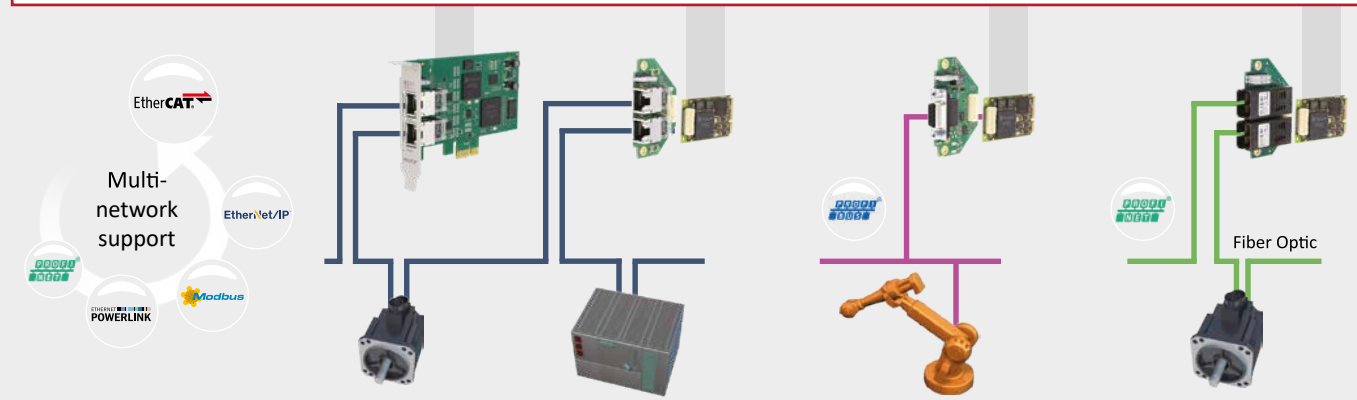
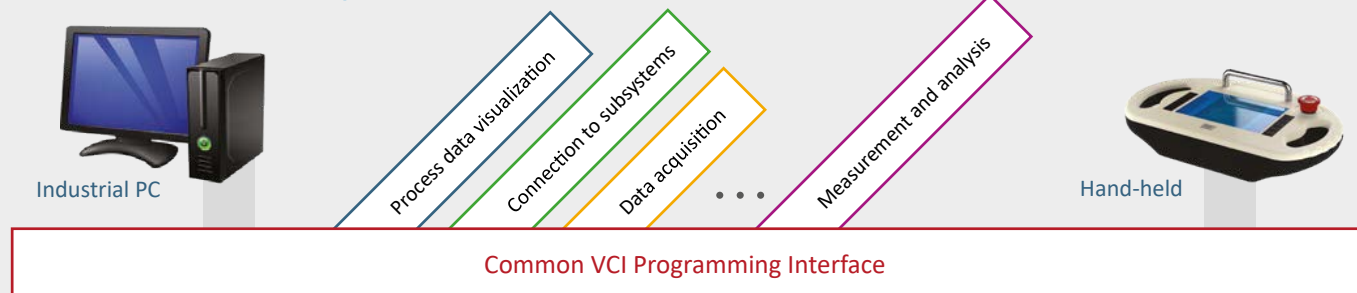


Ixxat INpact includes the Anybus CompactCom technology with the Anybus NP40 network processor – used within millions of industrial devices globally. The FPGA-based Anybus NP40 network processor provides all functions required to handle the communication between the different Industrial Ethernet and fieldbus 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         | ETHERNET POWERLINK | Modbus           | PROFINET         | PROFINET                 | PROFINET          |
|----------------------------------|------------------|------------------|--------------------|------------------|------------------|--------------------------|-------------------|
|                                  | 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



# Power Supply - the Heart of the System



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.

### DC/DC Converters

To convert a Single voltage DC power into the ATX voltages for a Main-board, 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.





# Storage & Memories – Linecard

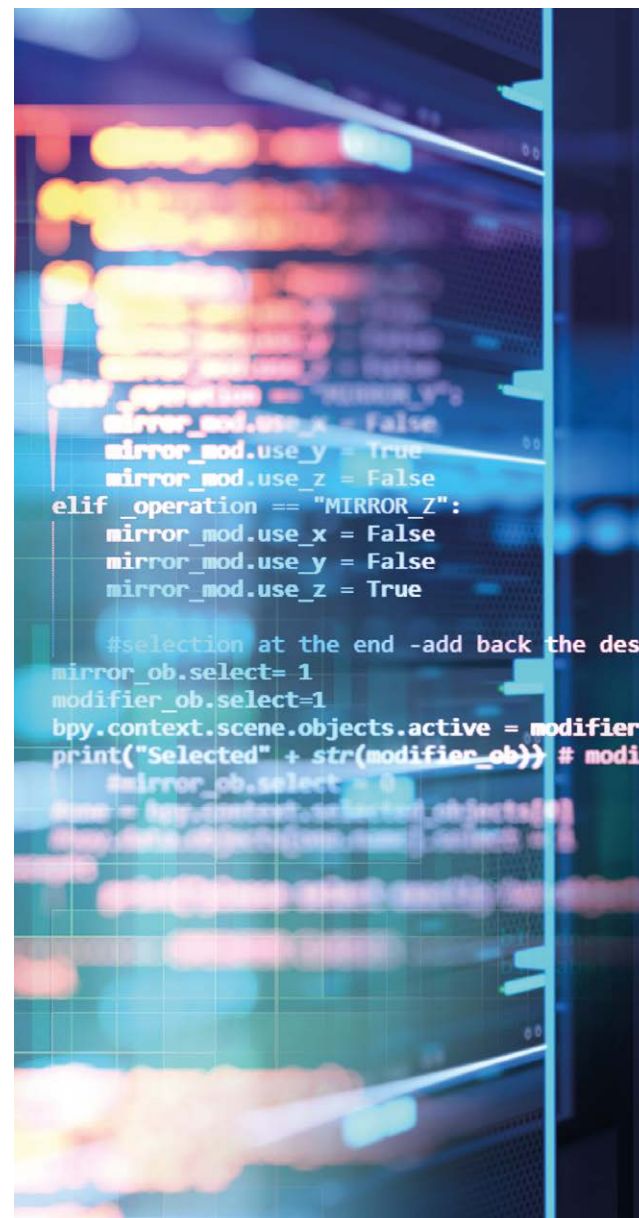
Rutronik offers hard disks, flash memory, DRAM modules and optical drives in all technologies and sizes which are explicitly suitable for industrial applications. Hard disks still remain a popular medium for storing data securely for long periods. However, flash-based memory solutions are the first choice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

## Suppliers



## Storage

|                              | Advantech | Apacer | ATP | GoodRam | KIOXIA | Swissbit | Teac | Toshiba | Transcend |
|------------------------------|-----------|--------|-----|---------|--------|----------|------|---------|-----------|
| <b>Memory Modules</b>        |           |        |     |         |        |          |      |         |           |
| DDR1                         |           | ■      | ■   | ■       |        |          |      |         | ■         |
| DDR2                         |           | ■      | ■   | ■       |        |          |      |         | ■         |
| DDR3                         | ■         | ■      | ■   | ■       |        |          |      |         | ■         |
| DDR4                         | ■         | ■      | ■   | ■       |        |          |      |         | ■         |
| DDR5                         | ■         | ■      | ■   | ■       |        |          |      |         | ■         |
| <b>Flash-Memory</b>          |           |        |     |         |        |          |      |         |           |
| SD/microSD                   |           | ■      | ■   | ■       | ■      | ■        |      |         | ■         |
| Compact-Flash                |           | ■      | ■   | ■       |        | ■        |      |         | ■         |
| CFast                        | ■         | ■      | ■   | ■       |        | ■        |      |         | ■         |
| CFexpress                    |           | ■      | ■   | ■       |        | ■        |      |         | ■         |
| Flash-Module (USB/PATA/SATA) |           | ■      | ■   |         |        | ■        |      |         | ■         |
| USB-Sticks                   |           | ■      | ■   | ■       |        | ■        |      |         | ■         |
| SSD 2.5"                     | ■         | ■      | ■   | ■       | ■      | ■        |      |         | ■         |
| mSATA                        | ■         | ■      | ■   | ■       | ■      | ■        |      |         | ■         |
| M.2                          | ■         | ■      | ■   | ■       | ■      | ■        |      |         | ■         |
| Add-in Card (AIC)            |           |        |     |         | ■      |          |      |         |           |
| U.2 SSD                      |           |        | ■   |         | ■      |          |      |         | ■         |
| U.3 SSD                      |           | ■      |     |         | ■      |          |      |         | ■         |
| EDSFF                        |           |        | ■   |         | ■      |          |      |         | ■         |
| <b>Hard Disc Drive</b>       |           |        |     |         |        |          |      |         |           |
| 2.5"                         |           |        |     |         |        |          |      |         | ■         |
| 3.5"                         |           |        |     |         |        |          |      |         | ■         |
| extern USB                   |           |        |     |         |        |          |      |         | ■         |
| <b>Optical Drives</b>        |           |        |     |         |        |          |      |         |           |
| CD-Drives for Audio/CE       |           |        |     |         |        |          |      |         | ■         |
| DVD-Drives                   |           |        |     |         |        |          |      |         | ■         |
| BluRay-Drives                |           |        |     |         |        |          |      |         | ■         |
| Medical Recorder             |           |        |     |         |        |          |      |         | ■         |
| <b>Accessories</b>           |           |        |     |         |        |          |      |         |           |
| Card Reader                  |           | ■      | ■   | ■       |        |          |      |         | ■         |



| Technology           | Type                         | Advantech | Alliance | Apacer | ATP | apmemory | ESMT / EliteMT | Fujitsu | Giantec | goodram | Infinion | Insignis | Kioxia | Nanya | Rohm | Swissbit | Transcend | Zentel |
|----------------------|------------------------------|-----------|----------|--------|-----|----------|----------------|---------|---------|---------|----------|----------|--------|-------|------|----------|-----------|--------|
| EEPROM               | Serial                       |           |          |        |     |          |                |         |         |         |          |          |        |       |      |          |           |        |
| ReRAM                | Serial                       |           |          |        |     |          |                |         |         |         |          |          |        |       |      |          |           |        |
| FRAM                 | I2C / SPI / Parallel         |           |          |        |     |          |                |         |         |         |          |          |        |       |      |          |           |        |
| Flash                | Serial NOR                   |           | ■        |        |     |          | ■              |         |         |         |          |          |        |       |      |          |           |        |
|                      | Parallel NOR                 |           | ■        |        |     |          | ■              |         |         |         |          |          |        |       |      |          |           |        |
|                      | Serial NAND                  |           | ■        |        |     |          | ■              |         |         |         |          |          |        |       |      |          |           |        |
|                      | Parallel 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               |                              | ■         |          |        |     | ■        |                |         |         |         |          |          |        |       |      |          |           |        |
| LPDDR4X              |                              | ■         |          |        |     | ■        |                |         |         |         |          |          |        |       |      |          |           |        |
| LPDDR5X              |                              |           |          |        |     |          |                |         |         |         |          |          |        |       |      |          |           |        |
| Pseudo SRAM          |                              | ■         |          |        |     | ■        |                |         |         |         |          |          |        |       |      |          |           |        |
| MCP / eMCP           |                              | ■         |          |        |     | ■        |                |         |         |         |          |          |        |       |      |          |           |        |
| SDRAM Module         |                              |           |          |        |     |          |                |         |         |         |          |          |        |       |      |          |           |        |
| DDR Module           |                              | ■         |          |        |     | ■        |                |         |         | ■       |          |          |        |       |      |          |           |        |
| DDR2 Module          |                              | ■         |          |        |     | ■        |                |         |         | ■       |          |          |        |       |      |          |           |        |
| DDR3 Module          |                              | ■         |          |        |     | ■        |                |         |         | ■       |          |          |        |       |      |          |           |        |
| DDR4 Module          |                              | ■         |          |        |     | ■        |                |         |         | ■       |          |          |        |       |      |          |           |        |
| DDR5 Module          |                              | ■         |          |        |     | ■        |                |         |         | ■       |          |          |        |       |      |          |           |        |
| SRAM                 | Low Power                    |           | ■        |        |     |          |                |         |         |         |          |          |        |       |      |          |           |        |
|                      | Fast                         |           | ■        |        |     |          |                |         |         |         |          |          |        |       |      |          |           |        |
|                      | Synchronous                  |           | ■        |        |     |          |                |         |         |         |          |          |        |       |      |          |           |        |
| NVRAM                |                              |           |          |        |     |          |                |         |         |         |          |          |        |       |      |          |           |        |

\* under Development

■ Embedded devices    ■ Removeable devices



Linecard



Linecard



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 | eMMC             | Industrial SH250-CFast | USB Sticks    |
| DDR         | DDR2                   | DDR3             | DDR4                   | DDR5          |

## Recommended Industrial SSD Solutions

| Model                         | SV24P-25               | SV250-25         | SV25V-25                  | PV25P-M280            | SV25P-M280                | PH250-M242                        | SH250-M242                        | SV250-300   |
|-------------------------------|------------------------|------------------|---------------------------|-----------------------|---------------------------|-----------------------------------|-----------------------------------|---|
| Features                      | CorePower              | DataDefender     | DataDefender Plus         | CorePower, Sidefill   | CorePower, Sidefill       | DataDefender, SLC-liteX, Sidefill | DataDefender, SLC-liteX, Sidefill | DataDefender, Write Protect Switch                            |
| Form Factor                   | 2.5"                   | 2.5"             | 2.5"                      | M.2 2280              | M.2 2280                  | M.2 2242                          | M.2 2242                          | JEDEC MO-300  |
| Interface                     | SATA 3.2 (6Gb/s)       | SATA 3.2 (6Gb/s) | SATA 3.2 (6Gb/s)          | PCIe Gen4 x4          | SATA 3.2 (6Gb/s)          | PCIe Gen4 x4                      | SATA 3.2 (6Gb/s)                  | SATA 3.2 (6Gb/s)  |
| Connector                     | (7+15) pin male        | (7+15) pin male  | (7+15) pin male           | M.2 M Key             | M.2 B & M Key             | M.2 M Key                         | M.2 B & M Key                     | 52-pin mSATA  |
| NAND Flash Type               | 3D TLC                 |                  |                           |                       |                           |                                   |                                   |   |
| Capacity                      | 240~1920 GB            | 120~1920 GB      | 120~960GB                 | 240~3840GB            | 120~960GB                 | 160~320 GB                        | 40~320GB                          | 120~1920GB  |
| External DRAM                 | Yes                    | No               | No                        | No                    | No                        | No                                | No                                | No  |
| Max. R/W Performance (MB/sec) | 560/510                | 560/500          | 560/485                   | 3700/3490             | 560/510                   | 3740/2855                         | 550/485                           | 560/470   |
| Standard Operating Temp. (°C) | 0 ~ +70                | 0 ~ +70          | 0 ~ +70                   | 240~3840GB: 0 ~ +70   | 0 ~ +70                   | 0 ~ +70                           | 0 ~ +70                           | 0 ~ +70   |
| Wide Temp. (°C)               | -40 ~ +85              | -40 ~ +85        | -40 ~ +85                 | 240~1920GB: -40 ~ +85 | -40 ~ +85                 | -40 ~ +85                         | -40 ~ +85                         | -40 ~ +85   |
| MTBF (Hours)                  | >3,000,000             |                  |                           |                       |                           |                                   |                                   |   |
| SED                           | AES256<br>TCG Opal 2.0 | Support          | Support                   | Support               | Support                   | Support                           | Support                           | Support   |
| Firmware PLP                  | Support                | Support          | Support                   | Support               | Support                   | Support                           | Support                           | Support   |
| Hardware PLP                  | Support                | -                | -                         | Support               | Support                   | Support                           | -                                 | -   |
| Recommended Applications      | IPC                    | AGV, AMR         | AGV, AMR, RPC, CNC System | AGV, AMR              | Auto Inspection Equipment | Motor Automation                  | CNC System                        | Wire Processing System, Semiconductor Manufacturing Equipment |

| Model                         | PV25P-CFX   | SV25P-CFast                        | Industrial CF6A   | Industrial SD H2-SL                    | CH120-MSD  | UV110-UFD5                               | UH110-UFD7                  | UH110-UFM1   |
|-------------------------------|---|------------------------------------|---|--|--|--|-----------------------------|--|
| Features                      | CorePower   | DataDefender, Write Protect Switch | High Endurance  | SLC-liteX                              | SLC-liteX  | ESD Air ± 15KV; Contact ± 8KV Prevention | Type-C Connector, SLC-liteX | SLC-liteX  |
| Form Factor                   | CFexpress 2.0 Type B  | CFast                              | CompactFlash Type I   | SDHC                                   | Micro SD   | USB Flash Drive                          | USB Flash Drive             | USB Disk Module                                      |
| Interface                     | PCIe Gen4 x2  | SATA 3.2 (6Gb/s)                   | PC Card Memory Mode; PC Card I/O Mode; True IDE Mode              | SD 3.0                                 | SD 6.1   | USB 3.2 Gen1                             | USB 3.2 Gen1                | USB 2.0  |
| Connector                     | -   | (7+17) pin                         | 50-pin  | -                                      | -  | USB Type-A                               | USB Type-C                  | 10-pin USB (2 x 5 header)                            |
| NAND Flash Type               | 3D TLC  | 3D TLC                             | SLC   | MLC                                    | 3D TLC   | 3D TLC                                   | 3D TLC                      | 3D TLC   |
| Capacity                      | 240~960GB   | 120~960GB                          | 256MB ~ 32GB  | 4~16GB                                 | 16~128GB   | 128~256GB                                | 32~64GB                     | 32~64GB  |
| External DRAM                 | No  | No                                 | No  | No                                     | No   | No                                       | No                          | No   |
| Max. R/W Performance (MB/sec) | 3740/2940   | 560/505                            | 60/65   | 90/55                                  | 90/80  | 270/185                                  | 270/195                     | 37/32  |
| Standard Operating Temp. (°C) | 0 ~ +70   | 0 ~ +70                            | 0 ~ +70   | -25 ~ +85                              | -25 ~ +85  | 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                         | >2,000,000  | >3,000,000                             | >3,000,000   | >3,000,000                               | >3,000,000                  | >3,000,000   |
| SED                           | AES256<br>TCG Opal 2.0  | Support                            | -   | -                                      | -  | -  | -                           | -  |
| Firmware PLP                  | Support   | Support                            | Support   | Support                                | Support  | -  | -                           | -  |
| Hardware PLP                  | Support   | Support                            | -   | -                                      | -  | -  | -                           | -  |
| Recommended Applications      | Semiconductor Manufacturing Equipment, Factory Machine Controller | Factory Machine Controller         | Semiconductor Manufacturing Equipment, Factory Machine Controller | CMC Machine, Plastic Injection Machine | Robot, Semiconductor Manufacturing Equipment, Inspection equipment | AIO Inspection System, Factory Machine   | IPC, AIO Inspection System  | 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 |                        |                        |                        |                        |                        |                        |                        |
| 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"                  |
| Operating / 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 / -40 to 85 | TC=0 to 85 / -40 to 85 | TC=0 to 85 / -40 to 85 | TC=0 to 85 / -40 to 85 |
| Value-added Technology             | 30µs                     |                        | 30µs                   |                        | 30µs                   |                        | 30µs                   |                        |

\*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

|                   |                      |                     |                       |
|-------------------|----------------------|---------------------|-----------------------|
| <br>2.5" SATA SSD | <br>PCIe SSD Modules | <br>SATA Modules    | <br>USB Products      |
| <br>SD Cards      | <br>microSD Cards    | <br>CFexpress Cards | <br>CFast Cards       |
| <br>CF Cards      | <br>eMMC             | <br>PCIe BGA        | <br>Security Products |

# 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, Compact-Flash™ 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  |
|--|---|---|--|--|
|  |   |   |  |  |
| SLC up to 32 GB  | MLC starting at 2GB   | SLC up to 32GB  | SLC  | m.2/u.2 up to 4TB<br>BGA up to 480GB<br>CFexpress up to 480GB  |
| MLC up to 128GB  | 3D TLC up to 256GB  | MLC up to 128GB   | MLC, 2D pSLC   | 3D TLC, 3D pSLC  |
| 3D TLC up to 512GB   |   | 3D TLC up to 256GB  | 3D TLC, 3D pSLC  |  |
| <ul style="list-style-type: none"> <li>- Up to SD 6.1</li> <li>- Power fail safety</li> <li>- SPI compliant</li> <li>- Heavy data logging vs. small data logging</li> <li>- Longevity support</li> </ul> | <ul style="list-style-type: none"> <li>- 5.1 eMMC, 153b, opt. 100b</li> <li>- 105 degree C option</li> <li>- Power fail safety</li> <li>- Advanced diagnostics</li> <li>- Data preload service</li> </ul> | <ul style="list-style-type: none"> <li>- USB 2.x, 3.x</li> <li>- Power fail safety</li> <li>- Advanced diagnostics</li> <li>- Long term availability</li> <li>- Customizable housing and connectors</li> <li>- 3D TLC planned</li> <li>- USB component BGA/LGA planned</li> </ul> | <ul style="list-style-type: none"> <li>- SATA III</li> <li>- Sustained performance</li> <li>- Low power consumption</li> <li>- Endurance optimized</li> <li>- E2E data path protection</li> <li>- Superior ECC and data care management</li> </ul> | <ul style="list-style-type: none"> <li>- Latest Gen3, 4-lane</li> <li>- Sustained performance</li> <li>- Endurance optimized</li> <li>- DRAM less options w/ HMB</li> <li>- E2E data path protection</li> <li>- Superior ECC and data care management</li> </ul> |
| <ul style="list-style-type: none"> <li>- Secure element, TPM</li> <li>- Swissbit Security API</li> <li>- Enhanced security</li> </ul>  | <ul style="list-style-type: none"> <li>- Enhanced security on request</li> </ul>  | <ul style="list-style-type: none"> <li>- Enhanced security on request</li> </ul>  | <p><b>powersafe™</b></p> <ul style="list-style-type: none"> <li>- AES-256</li> <li>- TCG Opal</li> <li>- Secure SSD firmware</li> </ul>  | <p><b>powersafe™</b></p> <ul style="list-style-type: none"> <li>- AES-256</li> <li>- TCG Opal</li> </ul>   |

# 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



## Security Editions

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



- Standard edition
- Premium Edition PE
- Data Protection DP

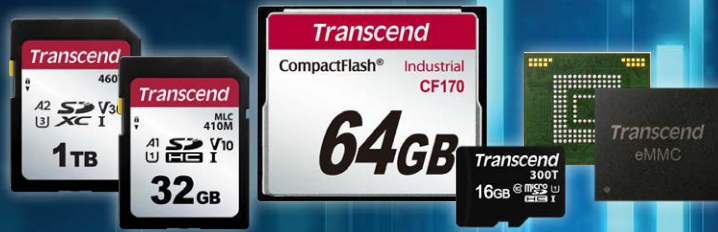
## Raspberry Pi Edition

Secure Boot Solution for Raspberry Pi





## Embedded Memory Cards & e.MMC Memory Solutions

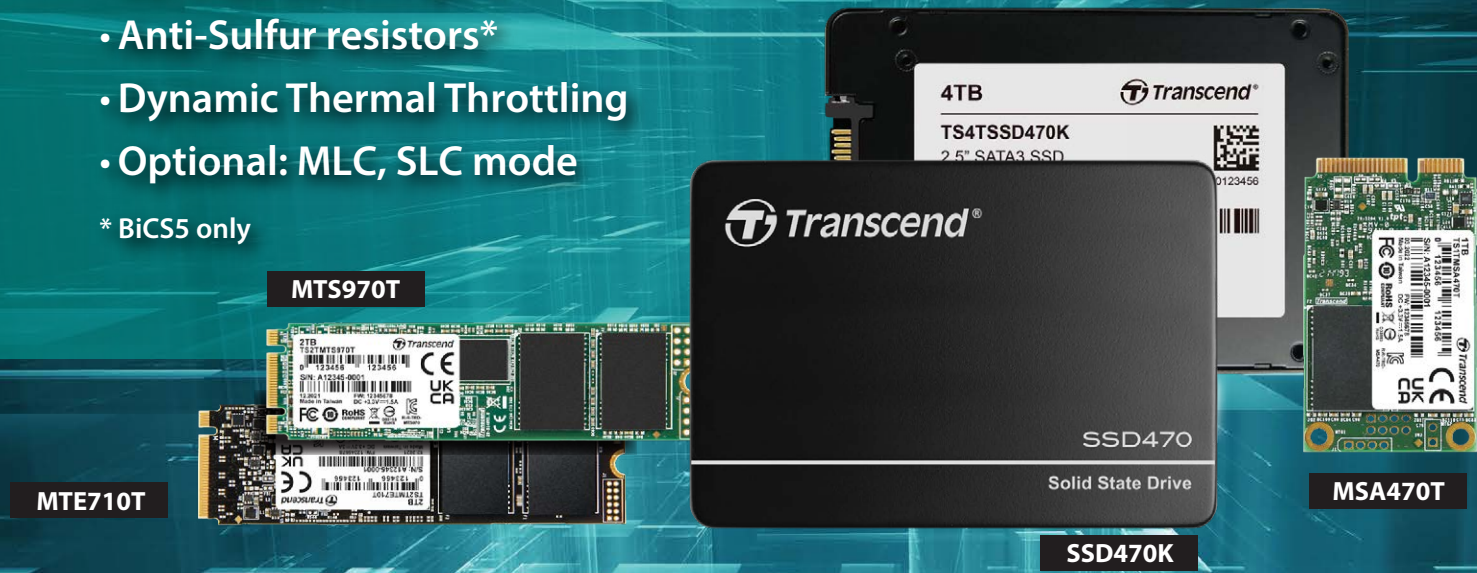


| SD Cards   | microSD Cards  | CompactFlash and CFast Cards  | e.MMC                                |
|--|--|---|--------------------------------------|
| Capacities:<br>2GB - 1TB   | Capacities:<br>2GB - 512GB   | Capacities:<br>512MB - 256GB  | Capacities:<br>8GB - 32GB            |
| Temperature: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

## Key features of Transcend 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



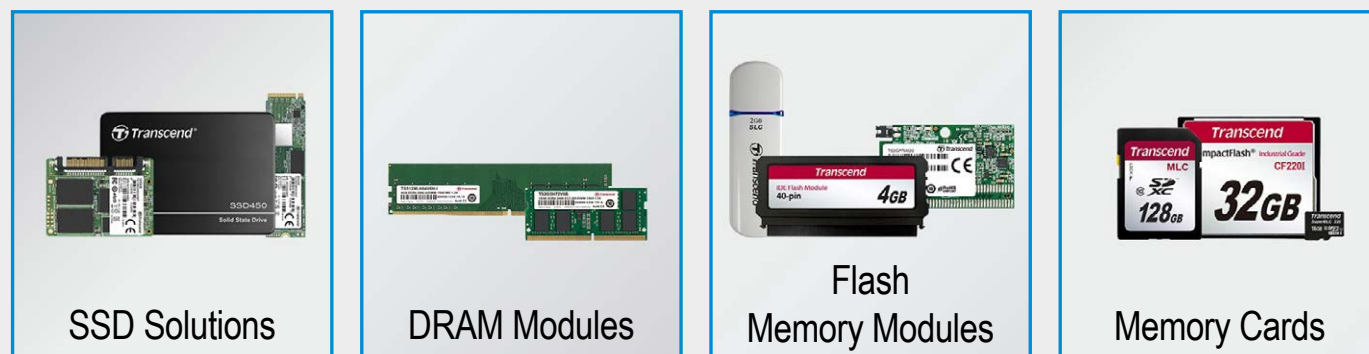
## Transcend – Good Memories Start Here



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



## DRAM Modules



| Wide Temperature (-40 to 95 Grad) | Server / Workstations        | Standard                        | Low Profile                  |
|-----------------------------------|------------------------------|---------------------------------|------------------------------|
| <b>DRAM Generation</b>            |                              |                                 |                              |
| DDR4, DDR3(L), DDR2               | DDR5, DDR4, DDR3(L), DDR2    | DDR5, DDR4, DDR3(L), DDR2       | DDR4, DDR3(L), DDR2          |
| <b>Modul Type</b>                 |                              |                                 |                              |
| 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                       |                              |                                 |                              |
| <b>Frequency</b>                  |                              |                                 |                              |
| 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             |                              |





# Solid State Drives



KIOXIA Europe GmbH (formerly Toshiba Memory Europe GmbH) is the European subsidiary of KIOXIA Corporation, a leading worldwide supplier of flash memory, solid state drives (SSDs) and software solutions. We are uniquely positioned with our broad product range to enable our customers to really drive their storage transformation. By working together with our customers across all growing markets like mobile, edge, cloud, data center and automotive, we provide our leading memory technology and are able to help accelerate the development of transformational solutions that really add value to end-users, creating new ways for them to interact and benefit from this technology, and create uplifting experiences that ultimately help to change the world.

## 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) to safeguard data in case of unexpected power loss.



### KIOXIA CD8 Series

Based on BiCS FLASH™ generation 5, the CD8 Series of PCIe® 4.0 (Gen4 x4) / NVMe™ SSDs is available in a 2.5-inch (15 mm thickness) form factor with capacities up to 15.36 TB and security options.

| Model Number | DWPD | Interface     | Form Factor                | User Capacity (GB) | Performance (up to)         |       |                        |       | Typical Power Consumption (W) | Operating Temperature (°C) | Dimensions T / W / L (mm) |
|--------------|------|---------------|----------------------------|--------------------|-----------------------------|-------|------------------------|-------|-------------------------------|----------------------------|---------------------------|
|              |      |               |                            |                    | Sequential (128 KiB) (MB/s) |       | Random (4 KiB) (KIOPS) |       |                               |                            |                           |
|              |      |               |                            |                    | Read                        | Write | Read                   | Write |                               |                            |                           |
| KCD81VUG12T8 | 3    | PCIe® Gen4 x4 | 2.5-inch (15 mm thickness) | 12,800             | 6,600                       | 6,000 | 1,050                  | 380   | 20                            | 0 to 74                    | 15.0 / 69.85 / 100.45     |
| KCD81VUG6T40 |      |               |                            | 6,400              | 7,100                       | 6,000 | 1,150                  | 380   | 19                            |                            |                           |
| KCD81VUG3T20 |      |               |                            | 3,200              | 3,800                       | 1,250 | 340                    | 14    | 0 to 75                       |                            |                           |
| KCD81VUG1T60 |      |               |                            | 1,600              | 7,200                       | 3,500 | 310                    | 13    |                               |                            |                           |
| KCD81VUG800G |      |               |                            | 800                | 1,800                       | 1,000 | 160                    | 11    |                               |                            |                           |
| KCD81RUG15T3 | 1    | PCIe® Gen4 x4 | 2.5-inch (15 mm thickness) | 15,360             | 6,600                       | 1,050 | 195                    | 20    | 0 to 74                       | 15.0 / 69.85 / 100.45      |                           |
| KCD81RUG7T68 |      |               |                            | 7,680              | 7,100                       | 6,000 | 1,150                  | 200   |                               |                            | 19                        |
| KCD81RUG3T84 |      |               |                            | 3,840              | 3,800                       | 1,250 | 195                    | 14    |                               |                            | 0 to 75                   |
| KCD81RUG1T92 |      |               |                            | 1,920              | 7,200                       | 3,500 | 150                    | 13    |                               |                            |                           |
| KCD81RUG960G |      |               |                            | 960                | 1,800                       | 1,000 | 80                     | 11    |                               |                            |                           |

### KIOXIA XD7P Series

Based on BiCS FLASH™ generation 5, the XD7P Series of PCIe® 5.0 (Gen4 x4) / NVMe™ SSDs is in E1.S (9.5 mm and 15 mm thickness) form factor with capacities up to 7.68 TB. These SSDs feature Power Loss Protection (PLP) and offer a range of security/encryption options.

| Model Number | DWPD | Interface     | Form Factor             | User Capacity (GB) | Performance (up to)         |       |                        |       | Typical Power Consumption (W) | Operating Temperature (°C) | Dimensions T / W / L (mm) |
|--------------|------|---------------|-------------------------|--------------------|-----------------------------|-------|------------------------|-------|-------------------------------|----------------------------|---------------------------|
|              |      |               |                         |                    | Sequential (128 KiB) (MB/s) |       | Random (4 KiB) (KIOPS) |       |                               |                            |                           |
|              |      |               |                         |                    | Read                        | Write | Read                   | Write |                               |                            |                           |
| KXDZ1RJ7T68  | 1    | PCIe® Gen4 x4 | E1.S (9.5 mm thickness) | 7,680              | 4,800                       | 1,550 | 200                    | 20    | 0 to 75                       | 9.5 / 33.75 / 118.75       |                           |
| KXDZ1RJ3T84  |      |               |                         | 3,840              | 7,200                       | 1,650 | 180                    | 16    |                               |                            |                           |
| KXDZ1RJ1T92  |      |               |                         | 1,920              | 3,100                       | 1,500 | 95                     | 16    |                               |                            |                           |
| KXDZ1RJ9T68  | 1    | PCIe® Gen4 x4 | E1.S (15 mm thickness)  | 7,680              | 4,800                       | 1,550 | 200                    | 20    | 0 to 75                       | 15.0 / 33.75 / 118.75      |                           |
| KXDZ1RJ3T84  |      |               |                         | 3,840              | 7,200                       | 1,650 | 180                    | 16    |                               |                            |                           |
| KXDZ1RJ1T92  |      |               |                         | 1,920              | 3,100                       | 1,500 | 95                     | 16    |                               |                            |                           |

## 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). KIOXIA enterprise SSDs offer a range of security options designed for business critical data storage.



### KIOXIA CM7 Series

Based on BiCS FLASH™ generation 5, the CM7 Series of dual-port PCIe® 5.0 / NVMe™ SSDs is available in 2.5-inch and E3.S form factor with capacities up to 30.72 TB. These SSDs feature Power Loss Protection (PLP) and offer a range of security/encryption options.

| Model Number | DWPD  | Interface                     | Form Factor | User Capacity (GB) | Performance (up to)         |       |                        |       | Typical Power Consumption (W) | Operating Temperature (°C) | Dimensions T / W / L (mm) |         |
|--------------|-------|-------------------------------|-------------|--------------------|-----------------------------|-------|------------------------|-------|-------------------------------|----------------------------|---------------------------|---------|
|              |       |                               |             |                    | Sequential (128 KiB) (MB/s) |       | Random (4 KiB) (KIOPS) |       |                               |                            |                           |         |
|              |       |                               |             |                    | Read                        | Write | Read                   | Write |                               |                            |                           |         |
| KCMY1VUG12T8 | 3     | PCIe® Gen5 single x4, dual x2 | 2.5-inch    | 12,800             | 7,000                       | 2,400 | 550                    | 25    | 0 to 73                       | 15.0 / 69.85 / 100.45      |                           |         |
| KCMY1VUG6T40 |       |                               |             | 6,400              | 14,000                      | 6,750 | 2,450                  |       |                               |                            | 550                       |         |
| KCMY1VUG3T20 |       |                               |             | 3,200              | 3,200                       | 2,700 | 600                    |       |                               |                            | 22                        | 0 to 76 |
| KCMY1VUG1T60 |       |                               |             | 1,600              | 3,500                       | 2,000 | 310                    |       |                               |                            |                           |         |
| KCM71VE12T8  | 3     | PCIe® Gen5 single x4, dual x2 | E3.S        | 12,800             | 13,000                      | 5,300 | 470                    | 25    | 0 to 73                       | 7.5 / 76.0 / 112.75        |                           |         |
| KCM71VE6T40  |       |                               |             | 6,400              | 14,000                      | 6,750 | 2,450                  |       |                               |                            | 550                       |         |
| KCM71VE3T20  |       |                               |             | 3,200              | 3,200                       | 2,700 | 600                    |       |                               |                            | 24                        | 0 to 76 |
| KCM71VE1T60  |       |                               |             | 1,600              | 3,500                       | 2,000 | 310                    |       |                               |                            |                           |         |
| KCMY1RUG30T7 | 1     | PCIe® Gen5 single x4, dual x2 | 2.5-inch    | 30,720             | 10,000                      | 4,900 | 150                    | 25    | 0 to 72                       | 15.0 / 69.85 / 100.45      |                           |         |
| KCMY1RUG15T3 |       |                               |             | 15,360             | 7,000                       | 2,400 | 300                    |       |                               |                            |                           |         |
| KCMY1RUG7T68 |       |                               |             | 7,680              | 14,000                      | 6,750 | 2,450                  |       |                               |                            | 300                       |         |
| KCMY1RUG3T84 |       |                               |             | 3,840              | 3,840                       | 2,700 | 310                    |       |                               |                            | 22                        | 0 to 76 |
| KCMY1RUG1T92 | 1,920 | 3,500                         | 2,000       | 155                |                             |       |                        |       |                               |                            |                           |         |
| KCM71RUE15T3 | 1     | PCIe® Gen5 single x4, dual x2 | E3.S        | 15,360             | 13,000                      | 5,300 | 260                    | 25    | 0 to 73                       | 7.5 / 76.0 / 112.75        |                           |         |
| KCM71RUE7T68 |       |                               |             | 7,680              | 14,000                      | 6,750 | 2,450                  |       |                               |                            | 300                       |         |
| KCM71RUE3T84 |       |                               |             | 3,840              | 3,840                       | 2,700 | 310                    |       |                               |                            | 24                        | 0 to 76 |
| KCM71RUE1T92 |       |                               |             | 1,920              | 3,500                       | 2,000 | 155                    |       |                               |                            |                           |         |

### KIOXIA PM7 Series

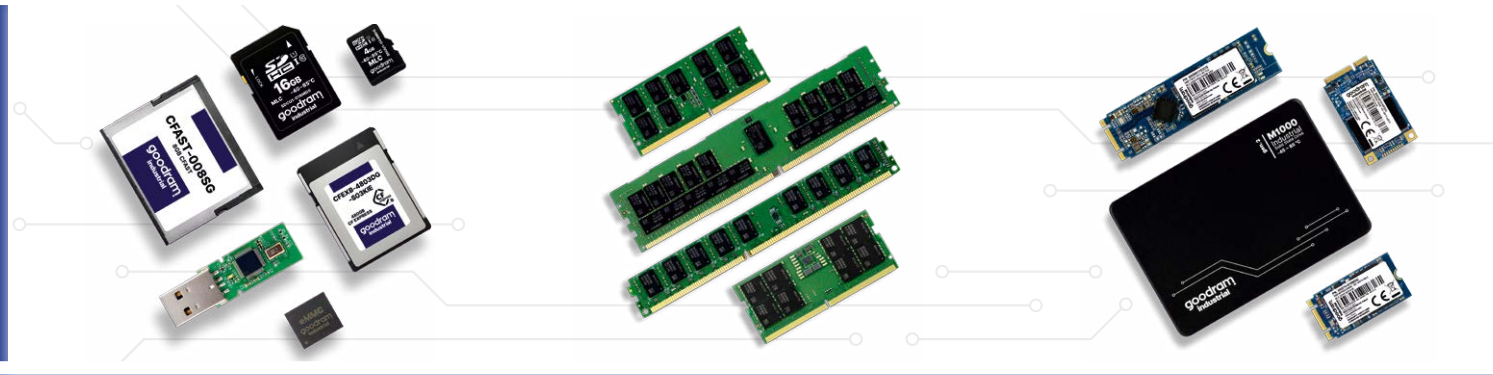
Based on BiCS FLASH™ generation 5, the PM7 Series of dual-port 24G SAS SSDs is available in a 2.5-inch form factor with capacities up to 30.72 TB. These SSDs feature Power Loss Protection (PLP) and offer a range of security/encryption options.

| Model Number | DWPD  | Interface                       | Form Factor | User Capacity (GB) | Performance (up to)         |       |                        |                  | Power Consumption Mode (W) | Operating Temperature (°C) | Dimensions T / W / L (mm) |
|--------------|-------|---------------------------------|-------------|--------------------|-----------------------------|-------|------------------------|------------------|----------------------------|----------------------------|---------------------------|
|              |       |                                 |             |                    | Sequential (128 KiB) (MB/s) |       | Random (4 KiB) (KIOPS) |                  |                            |                            |                           |
|              |       |                                 |             |                    | Read                        | Write | Read                   | Write            |                            |                            |                           |
| KPM71VUG12T8 | 3     | SAS-4 Narrow Single Narrow Dual | 2.5-inch    | 12,800             | 4,100                       | 720   | 330                    | 9 / 12 / 14 / 18 | 0 to 70                    | 15.0 / 69.85 / 100.45      |                           |
| KPM71VUG6T40 |       |                                 |             | 6,400              | 3,650                       |       | 355                    |                  |                            |                            |                           |
| KPM71VUG3T20 |       |                                 |             | 3,200              | 3,400                       |       | 340                    |                  |                            |                            |                           |
| KPM71VUG1T60 |       |                                 |             | 1,600              | 3,400                       |       | 320                    |                  |                            |                            |                           |
| KPM71RUG30T7 | 1     | SAS-4 Narrow Single Narrow Dual | 2.5-inch    | 30,720             | 4,150                       | 3,200 | 80                     | 9 / 12 / 14 / 18 | 0 to 70                    | 15.0 / 69.85 / 100.45      |                           |
| KPM71RUG15T3 |       |                                 |             | 15,360             | 4,100                       | 175   |                        |                  |                            |                            |                           |
| KPM71RUG7T68 |       |                                 |             | 7,680              | 3,650                       | 155   |                        |                  |                            |                            |                           |
| KPM71RUG3T84 |       |                                 |             | 3,840              | 3,400                       | 155   |                        |                  |                            |                            |                           |
| KPM71RUG1T92 | 1,920 | 3,400                           | 3,400       | 155                |                             |       |                        |                  |                            |                            |                           |





premium  
quality is  
blue



goodram  
industrial

Flash Memory

DRAM Memory Modules

SSD Drives

## Goodram Industrial - About the Brand

Goodram Industrial is owned by Wilk Elektronik SA - a Polish memory manufacturer and distributor with over 30 years of experience in the memory business. Known for its strict quality policy, flexibility and post-sales support, Wilk Elektronik SA is the only European memory manufacturer with its own laboratory, R&D department, state-of-the-art production site, test field and support team. The industrial brand was created out of the need to create reliable and durable memory products for advanced technologies. It includes a series of memory cards, USB, SSD and memory modules, used in internal and external industrial applications, often operating in extreme environmental conditions. The manufacturer provides customized memory for customers, in line with their expectations and meeting the technical requirements. Finished products go hand in hand with service and technical support for business partners.

### Applications of Industrial Solutions

- Industrial computers
- Home automation
- Point-of-sale (POS)
- Internet of Things (IoT)
- Industrial computing
- Video security systems
- Industrial automation
- Wireless systems
- Public communication
- Human-machine interfaces

## Flash Memory

NAND Flash-based memory devices are a distinct group of products with a range of different interfaces and applications. Depending on the type of NAND used, products vary in durability, speed and capacity. However, all are equipped with advanced mechanisms to ensure data integrity. Goodram Industrial offers a wide range of flash products such as CFast, CFexpress, microSD/SD, eMMC and USB flash drives.

### CFast Cards

are compatible with PCMCIA I or II standards with a SATA interface. Functionally compatible with typical SATA SSD controllers, the card's controller offers low power consumption and data transfer speeds of up to 550 MB/s. Other features include S.M.A.R.T., advanced power management and DRAM capture. CFast is available with 3D TLC, 3D pSLC, MLC, pSLC and SLC NAND, and capacity depends on the technology used.

### CFexpress Cards

are currently the newest solution supported by Compact Flash Association, which is capable of to fulfill the most rigid demands of industrial customer. By offering excellent performance and wide compatibility, Goodram's CFexpress™ Type B Card also provides a wide range of capacities available for users. In addition, industrial-grade CFexpress™ cards are available for any applications under rigorous environmental conditions including extensive temperature, shock and vibration.

### MicroSD and SD Cards

are available in three capacity standards: SDSC, SDHC and SDXC and with a bus to UHS-I. The small footprint, low power consumption, wide range of available capacities and wide selection of NAND types (3D TLC, 3D pSLC, MLC, pSLC and SLC) make microSD and SD cards a solution for many industrial designers.

### USB Flash Drives

are available in a variety of form factors and with a wide choice of NAND types (3D TLC, MLC, pSLC, SLC). With the USB 3.2 gen 1 interface backward compatible with USB 2.0 and USB 1.1, these devices are widely adopted and used as storage media for operating systems, data and application keys.

## DRAM Memory Modules

Goodram Industrial offers modules from the newest DDR5 to early DDR1 generation. Our industrial series includes DIMMs or SODIMMs, and optionally additional features such as ECC, extended temperature range and fixed bill of materials. 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.

| Type                      | DDR1   | DDR2  | DDR3                            | DDR4                            | DDR5  |
|---------------------------|--|---|---------------------------------|---------------------------------|---|
| Form Factors              | 184-pin DIMM<br>200-pin SO-DIMM  | 240-pin DIMM<br>200-pin SO-DIMM                       | 240-pin DIMM<br>204-pin SO-DIMM | 288-pin DIMM<br>260-pin SO-DIMM | 288-pin DIMM<br>262-pin SO-DIMM   |
| Capacity                  | 128 MB to 1024 MB  | 128 MB to 2048 MB                                     | 1 GB to 8 GB                    | 4 GB to 32 GB                   | 8 GB to 32 GB   |
| Peak Transfer Rate (MB/s) | Up to 3,200 (400 MHz)  | Up to 6,400 (800 MHz)                                 | Up to 14,900 (1,866 MHz)        | Up to 25,600 (3,200 MHz)        | Up to 51,200 (6,400 MHz)  |
| Voltage (V)               | 2.5  | 1.8   | 1.5/1.35                        | 1.2                             | 1.1   |
| ECC option                | No   | Yes   |                                 |                                 |   |
| Operating Temp. (°C)      | Standard grade: 0 to 70<br>Industrial grade: -40 to 85   | Standard grade: 0 + 85<br>Industrial grade: -40 to 85 |                                 |                                 |   |
| Storage Temp. (°C)        | -40 to 100   |   |                                 |                                 |   |
| Key Features & Options    | Single/Double Rank configuration DDR3/4. Very Low Profile size 100% functional tests. High/Low temperature testing. Build from major IC grades. Long lifetime project support. FIX BOM option. PCN and EOL notification. |   |                                 |                                 | Power Management IC. On-Die ECC. Dual 32-Bit Subchannels. Single/Double Rank configuration. 100% functional tests. High/Low temperature testing. Build from major IC grades. Long lifetime project support. FIX BOM option. PCN and EOL notification. |

## SSD Drives

Solid State Drives for industrial usage are available in all mainstream form factors like 2.5", mSATA and M.2 SATA / NVMe. This wide choice makes it much easier to match the right drive to the target application.

### Core Features

- Extended temperature range
- PCN and EOL management
- High quality products
- Fixed Bill of Material
- Long term support

### 2.5" SATA

is the most common form factor of Solid State Drives. All SSDs can be configured with 3D TLC, 3D pSLC, MLC, pSLC and SLC NAND Flash. They provide up to 550 MB/s of fast data transfer, low power consumption and advanced power management modes. It is an optimal for both desktop and mobile applications.

### SSD mSATA

is a type of Flash memory that can be installed directly on the motherboard, occupying a small amount of space – it is 80% smaller than the 2.5". Compatibility with the SATA I, II and III standards means that these devices can be installed in any device having an mSATA port.

### M.2

is another type of SSD with SATA or NVMe interface. M.2 SATA SSD can be installed directly onto motherboard. It can be configured with 3D TLC, MLC, pSLC and SLC NAND and PCBA can be delivered in two sizes: 42 x 22 mm and 80 x 22 mm. Small footprint, lack of moving parts and low power consumption make M.2 SATA SSD a great solution for mobile applications. Other form factors (2230, 2260, 22110) available upon request.



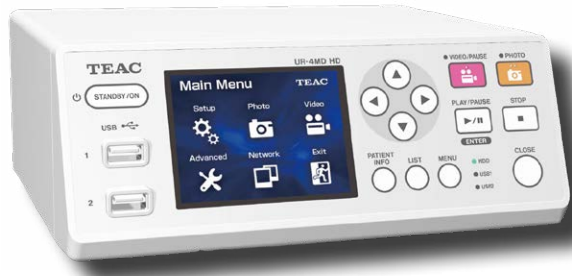


# HD Medical Video Recorder



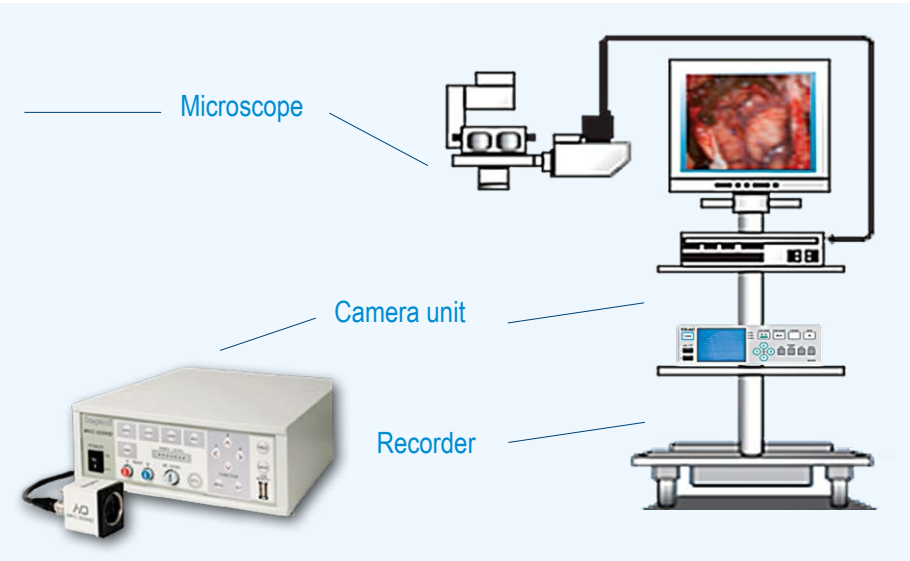
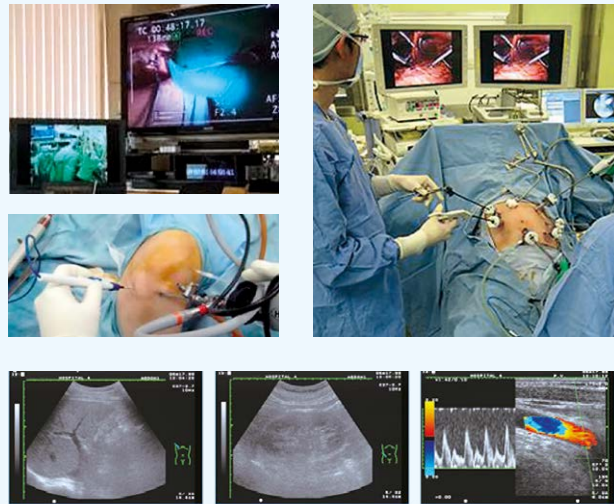
Based on many years of experience and product knowledge of medical imaging and recording, TEAC introduces the UR-4MD and UR-50BD, the solution for undiluted high-definition medical recording.

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



# RUTRONIK IT ELECTRONICS



## Computer Systems and Computer Parts. All from one single source.

Rutronik IT Electronics offers all components required to build PCs and Data Centers, as well as complete systems ranging from business or gaming PCs to complete servers and many more. For IT system integrators and resellers, Rutronik IT Electronics offers an extensive range of products from carefully selected manufacturers and comprehensive advice on which components and/or systems are best suited for the intended application.



Data Center | Server | Enterprise

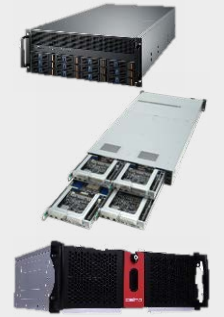
### Components:

- Motherboards
- Processors
- Accessories / Chassis
- Hard Disk Drives
- Solid State Drives
- DRAM modules
- Power supplies



### Systems:

- Single-node rack servers
- GPU Servers
- Tower Server
- Short-depth Server
- Multi-node/high-density Server
- Cloud systems
- CG Communications Servers



Business | Office

### Components:

- Motherboards
- Processors
- Power supplies
- Displays



### Systems:

- Desktop PCs / Mini PCs
- Mobile PCs / Laptops
- Panel PCs / Tablets



Gaming | Consumer

### Components:

- Motherboards
- Processors
- Storage (SSDs/DRAM)
- Graphic Cards



### Systems:

- Desktop PCs
- Mini PCs
- Mobile PCs
- Laptops



Rutronik IT Electronics builds on a strong network of certified partners with Intel at its center as its main strategic partner. This allows Rutronik to both respond quickly to specific customer demand as well as always offer the latest generation of technology.

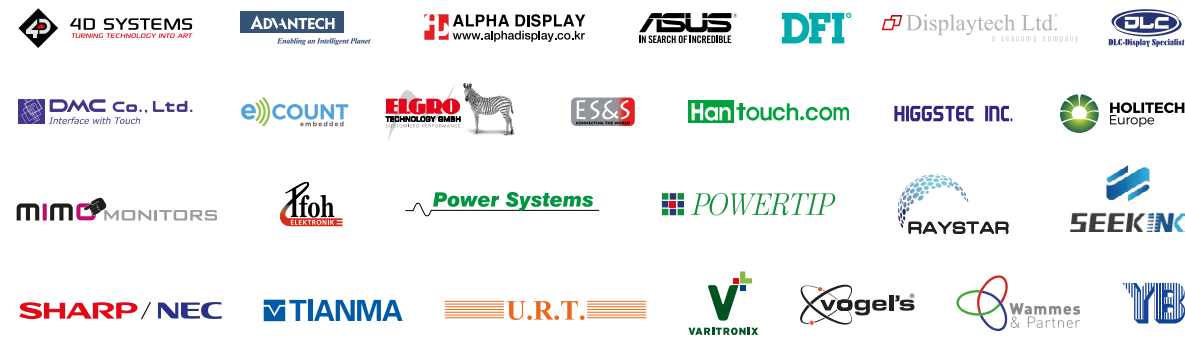




# Displays & Monitors – Linecard

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



## 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 | Seek'N'K | Tianma | URT | Varitronix | Yeebo |
|-------------------------------|------------|-----------|-------------|-----|----------|----------|---------|----------|--------|-----|------------|-------|
| Character- and 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

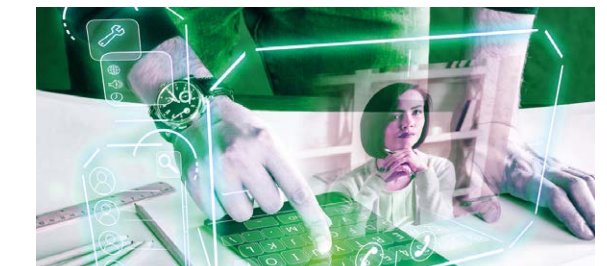
|                            | 4D Systems | DLC | Holitech | Mimo Monitors | PowerTip | Tianma | URT | Yeebo |
|----------------------------|------------|-----|----------|---------------|----------|--------|-----|-------|
| Brightness >= 500 cd/m²    | ■          | ■   | ■        | ■             | ■        | ■      | ■   | ■     |
| 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                 |     |     | ■        | ■        | ■        |

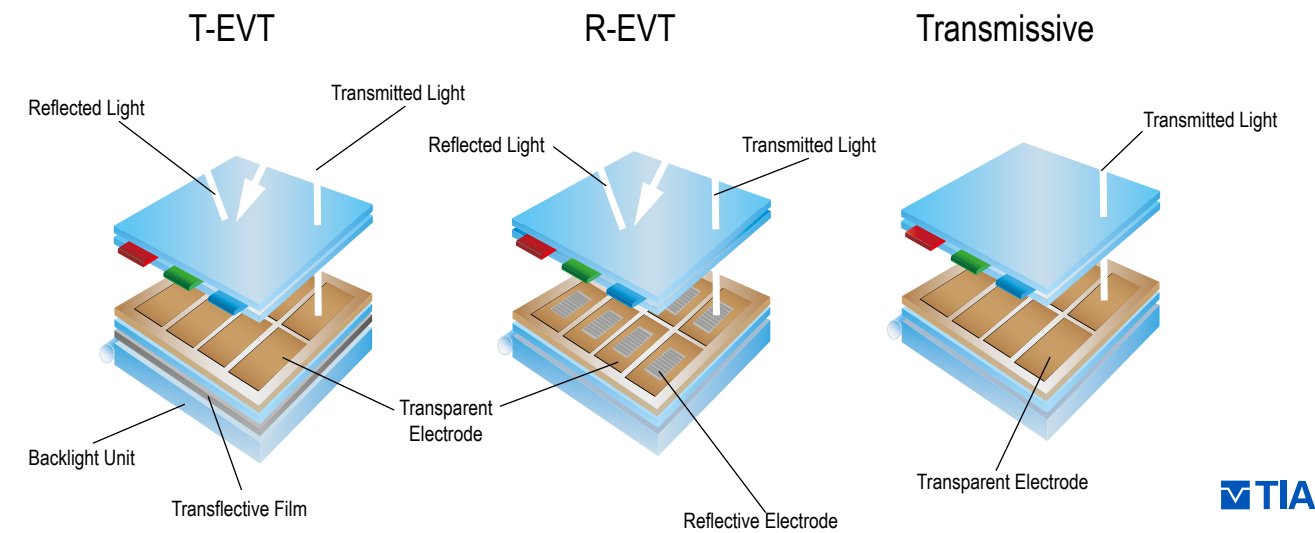
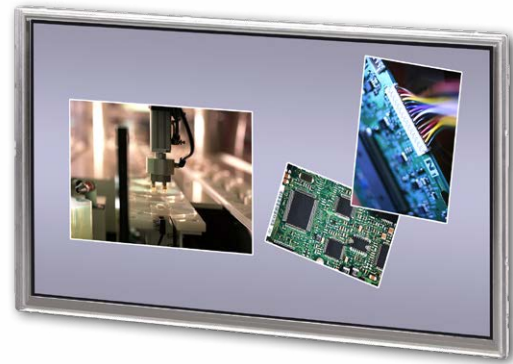


## Display & Monitoring Accessories

|  | Elgro-Technology | ES&S | Mimo Monitors | Pfoh | Power Systems | PowerTip | Sharp / NEC | Tianma | URT | Vogel's | Wammes & Partner Solution partner | Yeebo |
|--|------------------|------|---------------|------|---------------|----------|-------------|--------|-----|---------|-----------------------------------|-------|
| 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<br>Inch | cm   | Auflösung         | Techn. |     | Interface |      |     |        | Touch |     |
|-------------------|------|-------------------|--------|-----|-----------|------|-----|--------|-------|-----|
|                   |      |                   | 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    |     |        |       | 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   |           | 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 | WQXGA             |        | x   |           |      |     |        | eDP   |     |

### NEW P-Series

| Diagonale<br>Inch | cm   | Auflösung | Techn. |     | Interface |      | Special     |              | Touch     |    |
|-------------------|------|-----------|--------|-----|-----------|------|-------------|--------------|-----------|----|
|                   |      |           | 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 technology, 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.

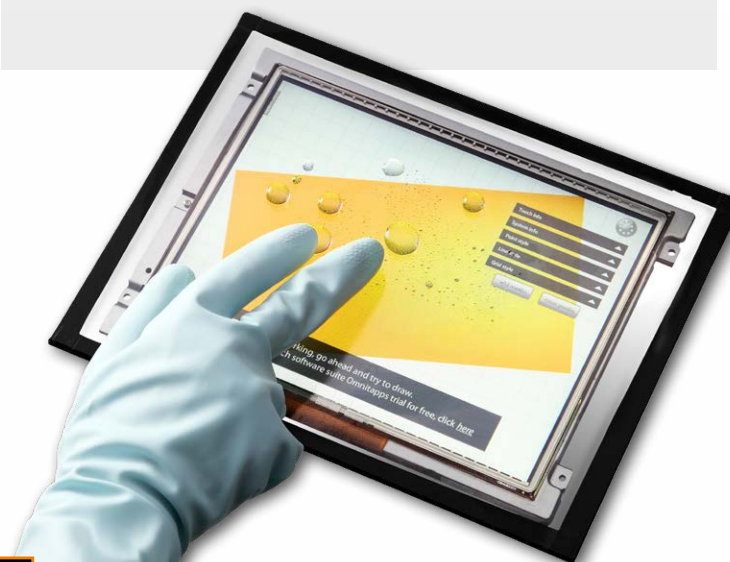
## Projected Capacitive Touch Panel

### 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

### 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.

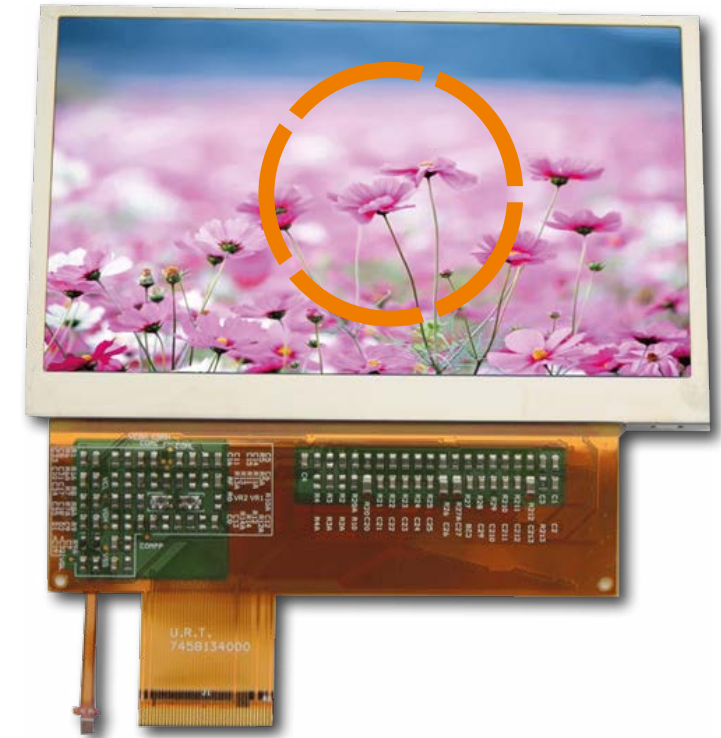
Tianma's products offer a lot of technical advantages such as wide viewing angle, high contrast, high brightness and fast response time and are produced for industrial, telecommunication and automotive applications.

### 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<br>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<br>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<br>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. products are widely applied in a broad range of applications and markets.

### 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    |

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    |







## 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. Seekink 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

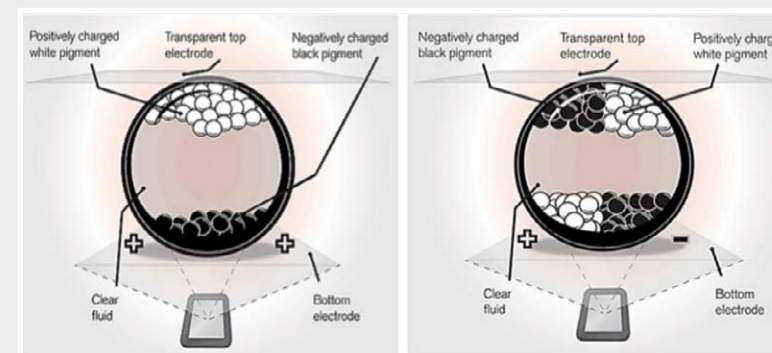
Segmented displays are intended for applications where the display requirements can be met using predefined segments that can be turned on or off.

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 ?

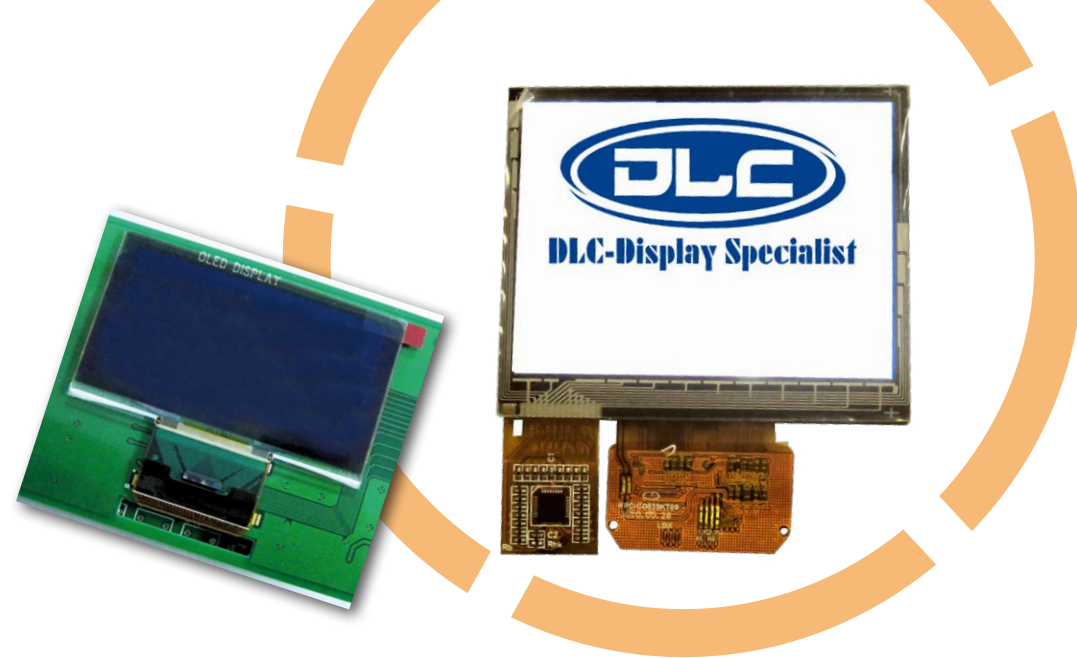
The two pigment electronic ink system is made up of millions of tiny microcapsules, each about the diameter of a human hair. Each microcapsule contains negatively charged white particles and positively charged black particles suspended in a clear fluid. When a positive or negative electric field is applied, corresponding particles move to the top of the microcapsule 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                 |







## 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 transfective, 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    |



## OLEDs Offer Many Advantages over Both LCDs and LEDs

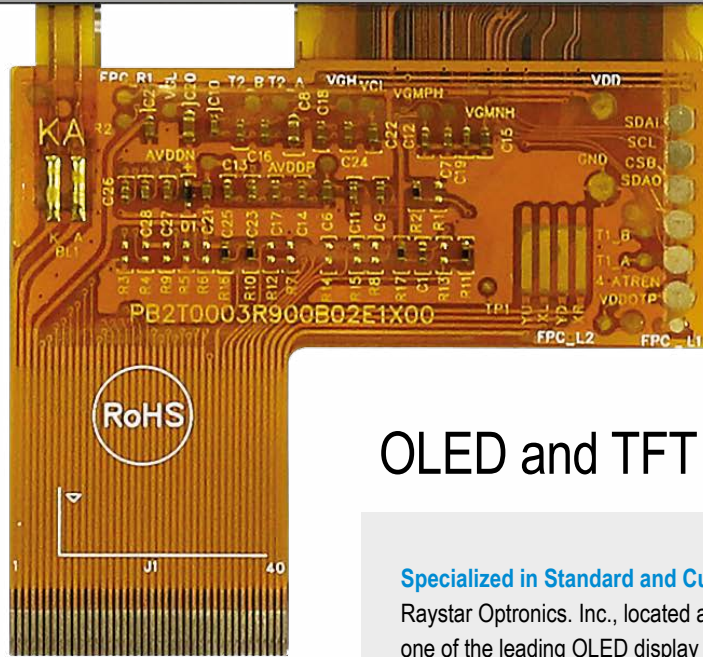
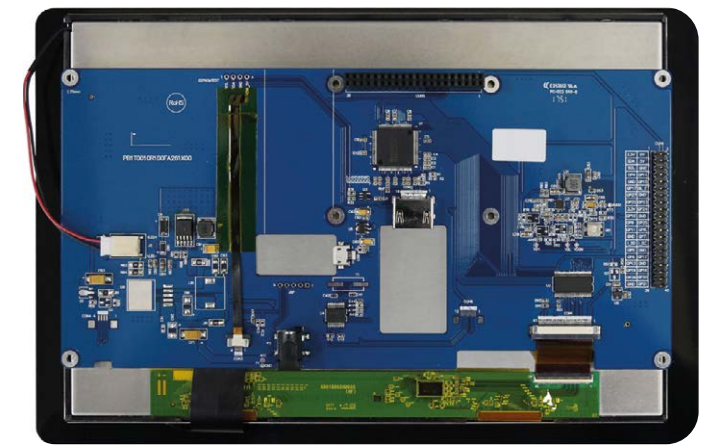
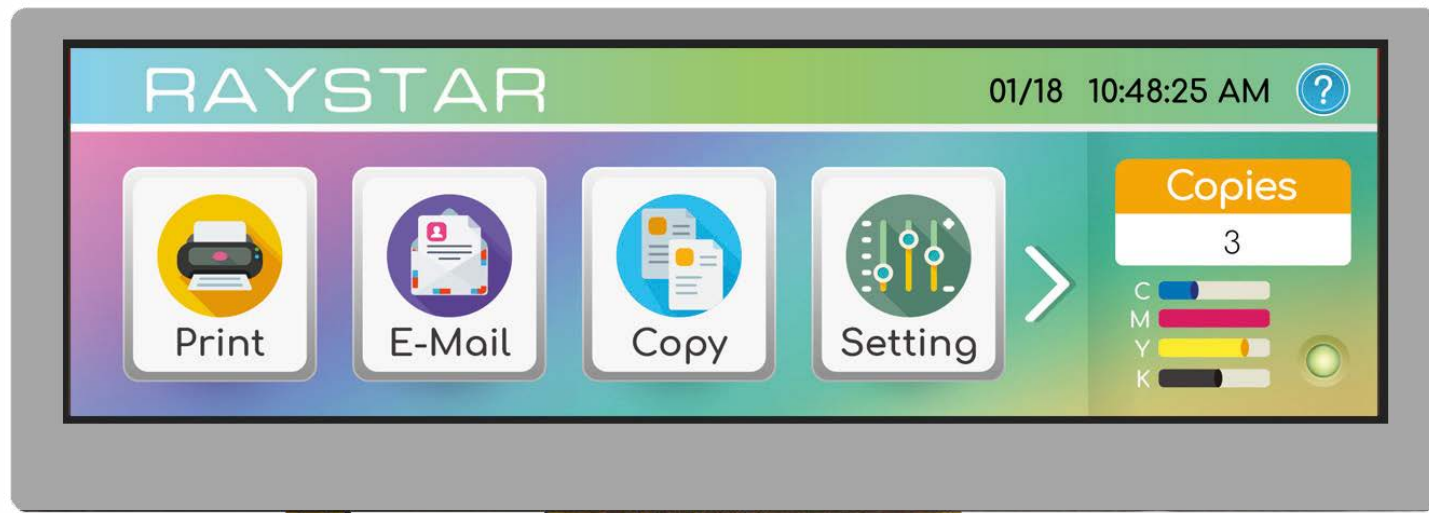
The plastic, organic layers of an OLED are thinner, lighter and more flexible than the crystalline layers in an LED or LCD. Because the light-emitting layers of an OLED are lighter, the substrate of an OLED can be flexible instead of rigid. OLED substrates can be plastic rather than the glass used for 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           |
|-----------------|-------------|-------------|---------------|-------------------|------------------|--------|-------------------|
| DLC0038AZOB     | 0.38        | 800xRGBx600 | 7.72x5.80     | 16.60x14.20       | Parallel         | 16.7M  | Micro OLED        |
| DLC0049AZOG-W-1 | 0.49        | 64x32       | 11.18x5.58    | 14.50x11.60       | I2C              | White  | Monochrome        |
| DLC0060AZOF     | 0.60        | 64xRGBx64   | 10.73x10.73   | 15.00x32.66       | SPI              | Color  | Passive Color     |
| DLC0066ANOG-3   | 0.66        | 64x48       | 13.42x10.06   | 18.46x18.10       | Parallel/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      | 22.38x5.584   | 30.00x11.50       | SPI              | White  | Monochrome        |
| DLC0091CNOG-W-4 | 0.91        | 128x32      | 22.38x5.58    | 30.00x8.90        | I2C              | White  | Monochrome        |
| DLC0095DNOG-2   | 0.95        | 96x64       | 20.14x13.42   | 25.70x22.20       | Parallel/SPI     | Color  | Passive Color     |
| DLC0096DNOG-W-5 | 0.96        | 128x64      | 21.74x10.86   | 24.74x16.90       | SPI/I2C          | White  | Monochrome        |
| DLC0110BNOG-1   | 1.10        | 96xRGBx96   | 19.85x19.85   | 25.90x30.10       | Parallel/SPI     | Color  | Passive Color     |
| DLC0119AEOG     | 1.19        | 390xRGBx390 | 30.42x30.42   | 33.22x33.75       | QSPI             | 16.7M  | AMOLED, Round     |
| DLC0129AZOF-1   | 1.29        | 128x96      | 26.28x19.71   | 33.00x25.80       | Parallel/SPI     | Color  | Passive Color     |
| DLC0130ANOG-B   | 1.30        | 128x64      | 29.42x14.70   | 34.50x23.00       | Parallel/SPI/I2C | Blue   | Monochrome        |
| DLC0130ANOG-W   | 1.30        | 128x64      | 29.42x14.70   | 34.50x23.00       | Parallel/SPI/I2C | White  | Monochrome        |
| DLC0130BEOG     | 1.30        | 360xRGBx360 | 32.94x32.94   | 35.34x36.84       | QSPI             | 16.7M  | AMOLED, Round     |
| 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     |
| 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        |
| DLC0150CNOG-Y   | 1.50        | 128x128     | 26.86x26.86   | 33.80x36.50       | Parallel/SPI/I2C | Yellow | Monochrome        |
| DLC0154BNOG-W-1 | 1.54        | 128x64      | 35.05x17.52   | 42.04x27.22       | Parallel/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     |
| DLC0178AEOG-C-3 | 1.78        | 368xRGBx448 | 28.70x34.94   | 30.70x38.04       | Parallel         | 16.7M  | AMOLED, With PCAP |
| DLC0200AEOG-1   | 2.00        | 240xRGBx296 | 32.04x39.52   | 33.74x42.98       | QSPI             | 16.7M  | AMOLED            |
| DLC0223ANOG-W-2 | 2.23        | 128x32      | 55.02x13.10   | 58.00x19.80       | Parallel/SPI/I2C | White  | Monochrome        |
| DLC0242BNOG-W-2 | 2.42        | 128x64      | 55.01x27.49   | 60.50x37.00       | Parallel/SPI/I2C | White  | Monochrome        |
| DLC0242BNOG-Y-1 | 2.42        | 128x64      | 55.01x27.49   | 60.50x37.00       | Parallel/SPI/I2C | Yellow | Monochrome        |
| DLC0293ANOG-B-2 | 2.93        | 20x2        | 73.52x11.52   | 84.50x19.28       | Parallel/SPI/I2C | Blue   | Monochrome        |
| DLC0550ANOF     | 5.5         | 256x64      | 135.65x33.89  | 146.00x45.00      | Parallel/SPI     | B/G    | Monochrome        |





## 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

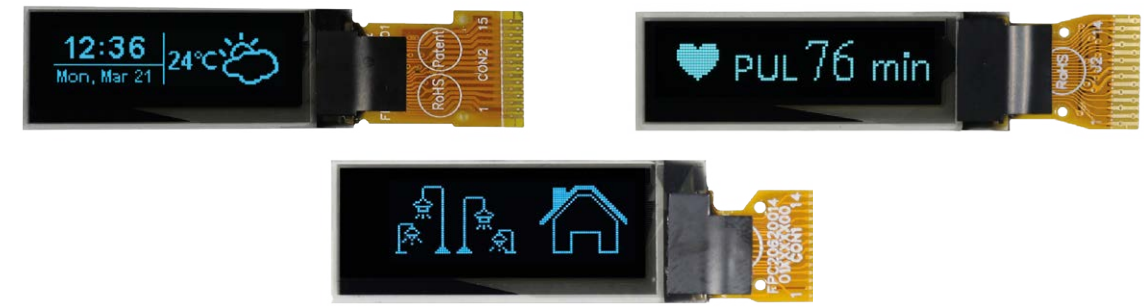
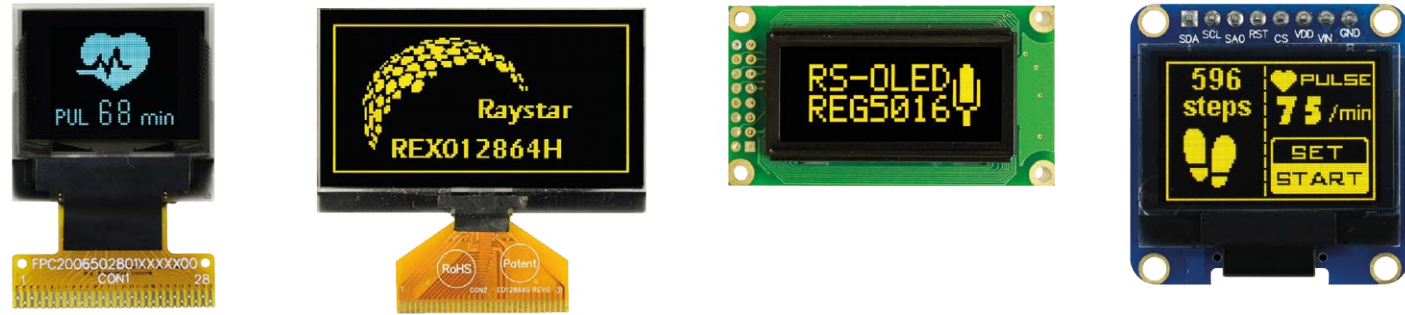
| Structure | Size (") | Size (cm) | Outline (mm) | Viewing Area (mm) | Active Area (mm) | Interface     | Type           |
|-----------|----------|-----------|--------------|-------------------|------------------|---------------|----------------|
| COB       | 1.2      | 3.0       | 58×32        | 38×16             | 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 |
| COF       | 2.8      | 7.1       | 84×25.8      | 71.104×19.264     | 69.098×17.258    | 6800,8080,SPI | Graphic OLED   |

### OLED Display Module – COF

| Structure  | Size (") | Size (cm) | Outline (mm) | Viewing Area (mm) | Active Area (mm) | Interface     | Type         |
|------------|----------|-----------|--------------|-------------------|------------------|---------------|--------------|
| 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   |
| COG        | 0.49     | 1.2       | 14.5×11.6    | 12.58×6.58        | 11.18×5.58       | I2C           | Graphic OLED |







### OLED Display Module – COG

| Structure | Size (") | Size (cm) | Outline (mm)    | Viewing Area (mm) | Active Area (mm) | Interface         | Type           |
|-----------|----------|-----------|-----------------|-------------------|------------------|-------------------|----------------|
| COG       | 0.66     | 1.7       | 18.46x18.10     | 15.42x12.06       | 13.42x10.06      | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 0.68     | 1.7       | 19.8x12.32x1.21 | 17.298x6.418      | 16.298x5.418     | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 0.71     | 1.8       | 13.9x22         | 12.14x16.3        | 10.54x14.7       | I2C               | Graphic OLED   |
| COG       | 0.84     | 2.1       | 29.1x9.2        | 23.104x5.504      | 21.104x3.504     | I2C               | Graphic OLED   |
| COG       | 0.91     | 2.3       | 30x11.5         | 24.384x7.584      | 22.384x5.584     | SPI               | Graphic OLED   |
| COG       | 0.91     | 2.3       | 30x11.5         | 24.384x7.584      | 22.384x5.584     | I2C               | Graphic OLED   |
| COG       | 0.95     | 2.4       | 24.9x22.95      | 21.953x15.424     | 19.946x13.418    | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 0.96     | 2.4       | 14x28           | 11.86x22.74       | 10.86x21.74      | SPI,I2C           | Graphic OLED   |
| COG       | 0.96     | 2.4       | 26.7x19.26      | 23.34x11.46       | 21.74x10.86      | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 0.96     | 2.4       | 26.7x19.26      | 23.938x12.058     | 21.738x10.858    | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 0.96     | 2.4       | 26.7x19.26      | 23.744x13.204     | 21.744x11.204    | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 0.96     | 2.4       | 24.74x16.9      | 22.74x11.86       | 21.74x10.86      | SPI,I2C           | Graphic OLED   |
| COG       | 0.96     | 2.4       | Ø39.4x24.8      | 22.74x11.86       | 21.74x10.86      | SPI,I2C           | OLED Knob      |
| COG       | 1.1      | 2.8       | 29x22.5         | 24.54x17.02       | 22.53x15.01      | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 1.18     | 3.0       | 37.18x41.23     | 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       | 34.5x23         | 31.32x15.62       | 29.42x14.2       | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 1.5      | 3.8       | 33.8x36.5       | 28.86x28.86       | 26.86x26.86      | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 1.54     | 3.9       | 42.04x27.22     | 37.05x19.52       | 35.05x17.51      | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 1.54     | 3.9       | 42.04x27.22     | 37.05x19.51       | 35.05x17.51      | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 1.54     | 3.9       | 45.24x29.14     | 37.05x19.51       | 35.05x17.51      | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 1.54     | 3.9       | 43.04x28.22     | 37.05x19.52       | 35.05x17.51      | 6800,8080,SPI,I2C | OLED Touch     |
| COG       | 1.71     | 4.3       | 50.50x15.75     | 44.22x12.54       | 42.22x10.54      | SPI,I2C           | Graphic OLED   |
| COG       | 1.92     | 4.9       | 34.5x48.8       | 30.908x41.34      | 28.908x39.34     | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 2        | 5.1       | 59x18.86        | 52.535x12.695     | 50.535x10.695    | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 2.08     | 5.3       | 60.5x19         | 53.18x14.78       | 51.18x12.78      | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 2.23     | 5.7       | 62x24           | 57.02x15.1        | 55.018x13.098    | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 2.26     | 5.7       | 68.5x17.5       | 58.22x13.52       | 56.22x11.52      | 6800,8080,SPI,I2C | Character OLED |
| COG       | 2.42     | 6.1       | 60.5x37         | 57.01x28.91       | 55.01x27.49      | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 2.42     | 6.1       | 60.5x37         | 57.01x28.91       | 55.01x27.49      | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 2.42     | 6.1       | 66.8x41.3       | 56.01x28.49       | 55.01x27.49      | 6800,8080,SPI,I2C | OLED Touch     |
| COG       | 2.7      | 6.9       | 73x41.86        | 63.41x32.69       | 61.41x30.69      | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 2.7      | 6.9       | 73x41.86        | 63.41x32.69       | 61.41x30.69      | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 2.7      | 6.9       | 73x41.86        | 63.41x32.69       | 61.41x30.69      | 6800,8080,SPI,I2C | Graphic OLED   |
| COG       | 2.7      | 6.9       | 73x41.16        | 63.41x32.69       | 61.41x30.69      | 6800,8080,SPI,I2C | OLED Touch     |
| COG       | 2.89     | 7.3       | 84.5x27.5       | 72.42x22.82       | 70.42x20.82      | 6800,8080,SPI,I2C | Character OLED |
| COG       | 2.93     | 7.4       | 84.5x19.28      | 75.52x13.52       | 73.52x11.52      | 6800,8080,SPI,I2C | Character OLED |
| COG       | 3.55     | 9.0       | 99.2x33.5       | 89.52x23.28       | 87.52x21.28      | 6800,8080,SPI     | Graphic OLED   |
| COG       | 3.55     | 9.0       | 100.4x36.1      | 88.52x22.28       | 87.52x21.28      | 6800,8080,SPI     | OLED Touch     |
| COG+CTP   | 0.91     | 2.3       | 30.0 x 11.5     | 24.38x7.58        | 22.38 x 5.58     | 4-wire SPI,I2C    | Graphic OLED   |
| COG+PCB   | 0.49     | 1.2       | 14.85x16.6      | 12.58x6.58        | 11.18x5.58       | I2C               | Graphic OLED   |
| COG+PCB   | 0.66     | 1.7       | 19.9x23.1       | 15.42x12.06       | 13.42x10.06      | I2C               | Graphic OLED   |
| COG+PCB   | 0.71     | 1.8       | 15.9x27         | 12.14x16.3        | 10.54x14.7       | I2C               | Graphic OLED   |
| COG+PCB   | 0.84     | 2.1       | 33x10           | 23.104x5.504      | 21.104x3.504     | I2C               | Graphic OLED   |
| COG+PCB   | 0.91     | 2.3       | 32.5x20.5       | 24.384x7.584      | 22.384x5.584     | SPI               | Graphic OLED   |

| Structure  | Size (") | Size (cm) | Outline (mm) | Viewing Area (mm) | Active Area (mm) | Interface         | Type           |
|------------|----------|-----------|--------------|-------------------|------------------|-------------------|----------------|
| COG+PCB    | 0.91     | 2.3       | 35.8x12      | 24.384x7.584      | 22.384x5.584     | I2C               | Graphic OLED   |
| COG+PCB    | 0.96     | 2.4       | 38x28.5      | 23.94x12.06       | 21.74x10.86      | SPI,I2C           | Graphic OLED   |
| COG+PCB    | 0.96     | 2.4       | 27.3x27.3    | 23.94x12.06       | 21.74x10.86      | I2C               | Graphic OLED   |
| COG+PCB    | 0.96     | 2.4       | 27.3x27.3    | 23.746x13.206     | 21.746x11.206    | I2C               | Graphic OLED   |
| COG+PCB    | 1.04     | 2.6       | 35.4x23.5    | 27.58x8.38        | 25.58x6.38       | SPI               | Graphic OLED   |
| COG+PCB    | 1.1      | 2.8       | 31.5x31.5    | 24.54x17.02       | 22.53x15.01      | SPI,I2C           | Graphic OLED   |
| COG+PCB    | 1.23     | 3.1       | 53x20        | 36x10             | 30.69x5.94       | 6800,8080,SPI,I2C | Character OLED |
| COG+PCB    | 1.28     | 3.3       | 35.5x32      | 31.32x15.62       | 29.42x14.2       | I2C               | Graphic OLED   |
| COG+PCB    | 1.5      | 3.8       | 34.2x45.5    | 28.86x28.86       | 26.86x26.86      | SPI,I2C           | Graphic OLED   |
| COG+PCB    | 1.54     | 3.9       | 42.4x38      | 37.05x19.52       | 35.05x17.51      | SPI,I2C           | Graphic OLED   |
| COG+PCB    | 1.92     | 4.9       | 34.9x57.8    | 30.91x41.34       | 28.908x39.34     | SPI               | Graphic OLED   |
| COG+PCB    | 2.08     | 5.3       | 70x22        | 53.18x14.78       | 51.18x12.78      | SPI               | Graphic OLED   |
| COG+PCB    | 2.26     | 5.7       | 84x44        | 58.22x13.52       | 56.22x11.52      | 6800,8080,SPI,I2C | Character OLED |
| COG+PCB    | 2.42     | 6.1       | 75x52.7      | 57.01x29.49       | 55.01x27.49      | 6800,8080,SPI,I2C | Graphic OLED   |
| COG+PCB    | 2.89     | 7.3       | 92x31.5      | 72.42x22.82       | 70.42x20.82      | 6800,8080,SPI,I2C | Character OLED |
| COG+PCB    | 2.93     | 7.4       | 92.3x23.3    | 75.52x13.52       | 73.52x11.52      | 6800,8080,SPI,I2C | Character OLED |
| COG+PCB+FR | 2.23     | 5.7       | 66.5x35      | 59x17.1           | 55.018x13.098    | 6800,8080,SPI,I2C | Graphic OLED   |
| COG+PCB+FR | 2.23     | 5.7       | 66.5x35      | 56.02x14.1        | 55.018x13.098    | 6800,8080,SPI,I2C | OLED Touch     |
| COG+PCB+FR | 2.42     | 6.1       | 75x52.7      | 57.01x29.49       | 55.01x27.49      | 6800,8080,SPI,I2C | OLED Touch     |
| COG+PCB+FR | 2.7      | 6.9       | 82x47.5      | 63.41x32.69       | 61.41x30.69      | 6800,8080,SPI,I2C | OLED Touch     |
| COG+PCB+FR | 2.7      | 6.9       | 82x47.5      | 63.41x32.69       | 61.41x30.69      | 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 128x128 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.

Get a running demo of this high-end PMOLED now at Rutronik and lift your application to a new level!

### Further Specifications:

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







|  |  |  |  |
|--|--|--|--|
|  |  |  |  |
| <b>GEN4-HMI Intelligent Displays</b>   | <b>WORKSHOP4-IDE</b>   | <b>Intelligent Displays for ARDUINO</b>  | <b>Primary Displays for RASPBERRY PI &amp; ASUS Tinker Board</b> |
| 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  |

## Global Leaders in the Design and Development of Intelligent Graphic Solutions



### Smart TFT Modules

4D Systems Creates Tailored Display Solutions for Enterprise Manufacturers, Engineering Companies, Design Houses and Hobbyists

#### Jump Start Development Time



Deliver rapidly and efficiently with products designed specifically for ease of integration and swift application development.

#### 4D Systems Workshop4 IDE



Created for multiple development environments benefiting a range of users from the pro-maker to the most demanding engineer.

#### Scales With You



Seamless solutions from low volume to high volume applications without the need to invest in new software development.

#### Community Built for Sharing



Forums, code, documentation, and the latest new projects from 4D customers, and 4D engineers.

#### Human Services



Seasoned electronics and software engineers are on stand-by supporting fast implementation and troubleshooting.

#### Never Doubt Quality



ISO 9001 - certified production factories deliver the most secure supply chain in display solutions.

|   |  |   |
|---|--|---|
| <b>gen4 HMI Display Modules Picaso Series</b><br><br>2.4"-3.2"   240x320 px   ~150 cd/m <sup>2</sup><br>5V Adaptors: Arduino, Raspberry Pi & ASUS | <b>gen4 HMI Display Modules Diablo16 Series</b><br><br>2.4"-7.0"   320x240 - 800x480 px<br>5V Adaptors: Arduino, Raspberry Pi & ASUS | <b>microLCD Display Modules</b><br><br>1.44"-9.0"   128x128 - 800x480 px<br>5V Adaptors: Arduino, Raspberry Pi & ASUS           |
| <b>microOLED Display Modules</b><br><br>0.96"-1.77"   96x64 - 160x128 px<br>5V Non-Touch Displays   | <b>Integrated Display Solutions</b><br><br>3.5"-5.0"   480x320 - 480x854 px<br>5V Panel mountable smart display controller           | <b>Wifi Display Solutions</b><br><br>1.44"-9.0"   128x128 - 800x480 px<br>5V Adaptors: Arduino, Raspberry Pi & ASUS             |
| <b>gen4-IoD Display Modules</b><br><br>2.4"-3.2"   320x240 px   128 Kb RAM<br>5V Resistive Touch Displays   | <b>Primary Displays for Raspberry Pi</b><br><br>4.3"-7.0"   480x272 - 800x480 px<br>5V Resistive & Capacitive Touch Displays         | <b>Primary Displ. for ASUS Tinker Board</b><br><br>4.3"-7.0"   480x272 - 800x480 px<br>5V Resistive & Capacitive Touch Displays |
| <b>Audio &amp; Camera</b><br><br>Sound module and camera with different lenses available  | <b>Accessories</b><br><br>Programming adaptors, USB cables, bezels for open frame displays   | <b>Modules On The Go (MOTG)</b><br><br>Modules for WiFi, RS-232, RS-485, MP3, Bluetooth - adaptor PCB available                 |





# Touch Systems

Han touch.com

DMC Co., Ltd. Interface with Touch

Han touch.com

HIGGSTEC INC.

## 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                                      |            | 4 wire Glas / Glas                         |      | 5 wire resistive  |      |
|---|------------|--|------|---|------|
| Inch  | cm         | Inch                                       | cm   | Inch  | cm   |
| 2.9 - 4   | 7.4 - 10.2 | 5  | 12.7 | 6.5   | 16.2 |
| 4.3   | 11         | 5.7  | 14.5 | 7   | 17.8 |
| 5.7   | 14.5       | 7  | 17.8 | 8.4   | 21.4 |
| 6.4   | 16.3       | 8.4  | 21.3 | 10.4  | 26.4 |
| 7   | 17.8       | 10.4                                       | 24.5 | 12.1  | 30.7 |
| 7.5   | 19         | 12.4                                       | 30.7 | 15  | 38.1 |
| 8   | 20.3       | 15.1                                       | 38.5 | 17  | 43.2 |
| 8.4   | 21.3       | 17.1                                       | 43.5 | 19  | 48.3 |
| 10.4  | 26.5       | Available as clear type, and as AG/AR type |      | 20.1  | 51   |
| 12.1  | 30.8       |  | 22   | 55.9  |      |
| 15  | 38.1       |  |      | 24  | 61   |
| 17  | 43.2       |  |      | USB Controller: ETP-MB-5000UECG<br>RS-232 Contr.: ETP-MB-5000RECG |      |
| 19  | 48.3       |  |      |   |      |
| USB Controller: HT-EBU4-3<br>RS-232 Contr.: HT-EBS4-2 |            |  |      |   |      |



## 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 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.

## 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.

| Cap. Touch         |      | SAW-Touch   |      | IR Touch                   |       |
|--------------------|------|---|------|----------------------------|-------|
| Inch               | cm   | Inch  | cm   | Inch                       | cm    |
| 5.8                | 14.7 | 8.4   | 21.4 | 15                         | 38.1  |
| 6.8                | 17.3 | 10.4  | 26.4 | 17                         | 43.2  |
| 7.3                | 18.5 | 12.1  | 30.8 | 19                         | 48.3  |
| 8.5                | 21.6 | 15  | 38.1 | 32                         | 81.3  |
| 10.8               | 27.4 | 17  | 43.2 | 42                         | 106.7 |
| 12.4               | 31.5 | 19  | 48.3 | Options: AG / AR, 6mm Glas |       |
| 15.7               | 39.9 | 21  | 53.3 |                            |       |
| 17.5               | 44.5 | 22  | 55.9 |                            |       |
| 19.4               | 49.3 | Controller: HAT-EBUS-2<br>Options: clear, AG or AR and antivandalism type |      |                            |       |
| 22.4               | 56.9 |   |      |                            |       |
| 26.3               | 66.8 |   |      |                            |       |
| 31.8               | 80.8 |   |      |                            |       |
| Controller: C-3100 |      |   |      |                            |       |

| 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



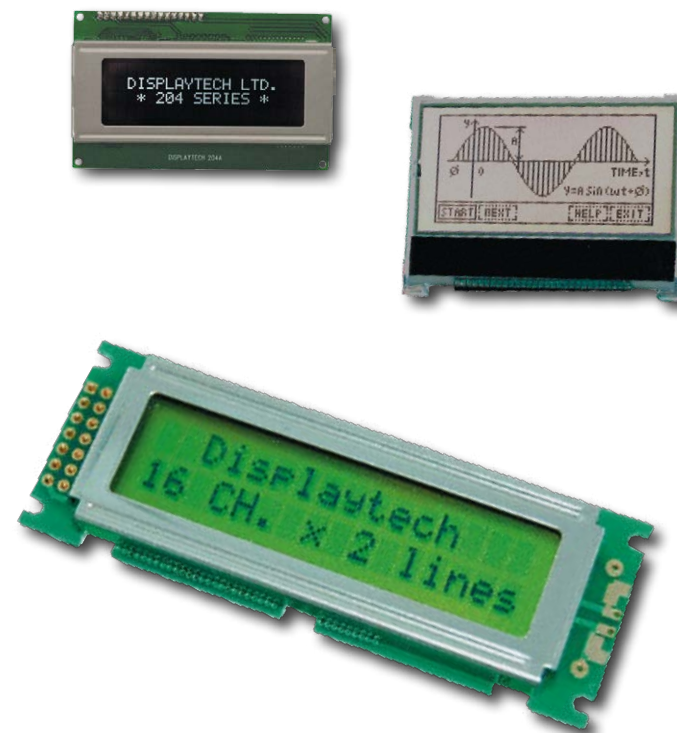


## Passive LCD Modules

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.



## 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, transreflective and reflective mode.

### Technologies

| 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  |



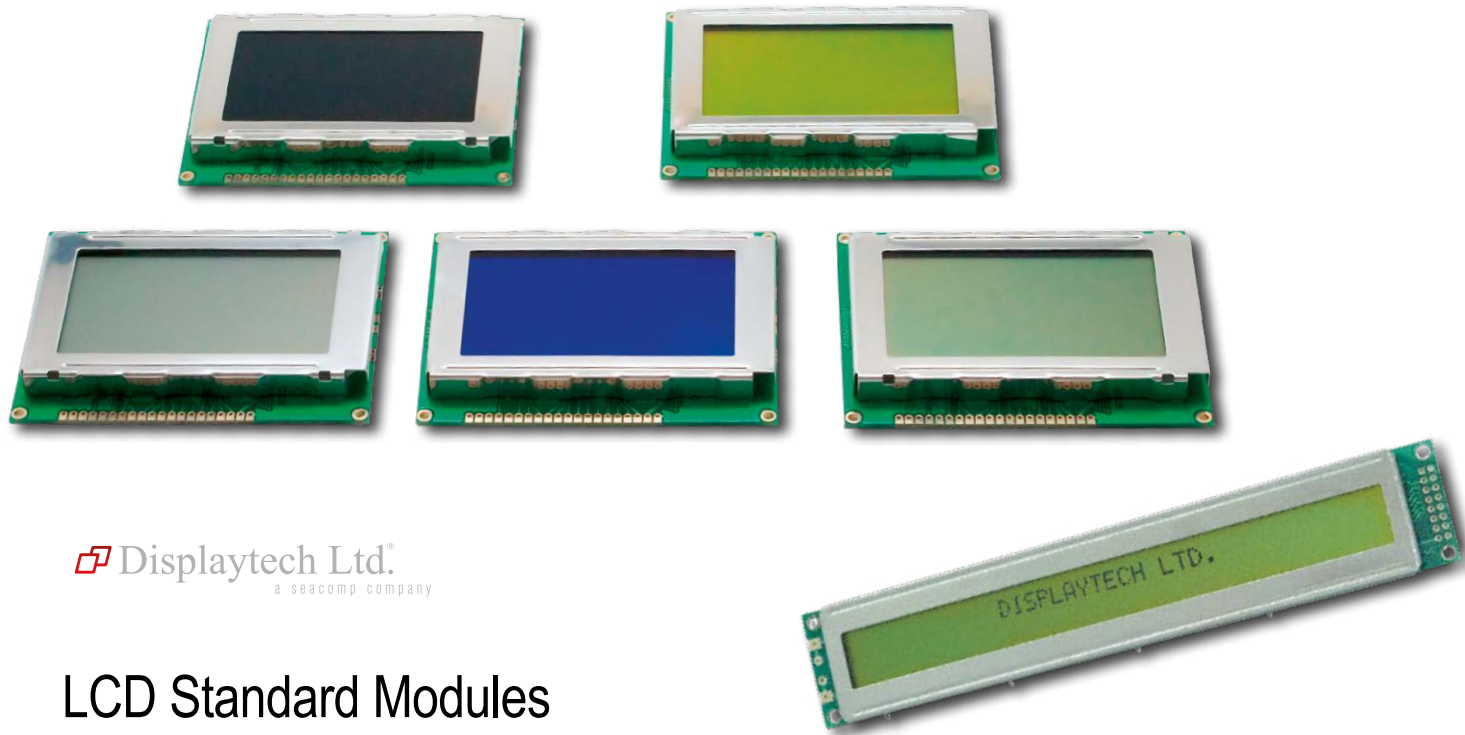
### Passive LCD Modules from Displaytech

| Characters x Lines | Model wwNumber | 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.





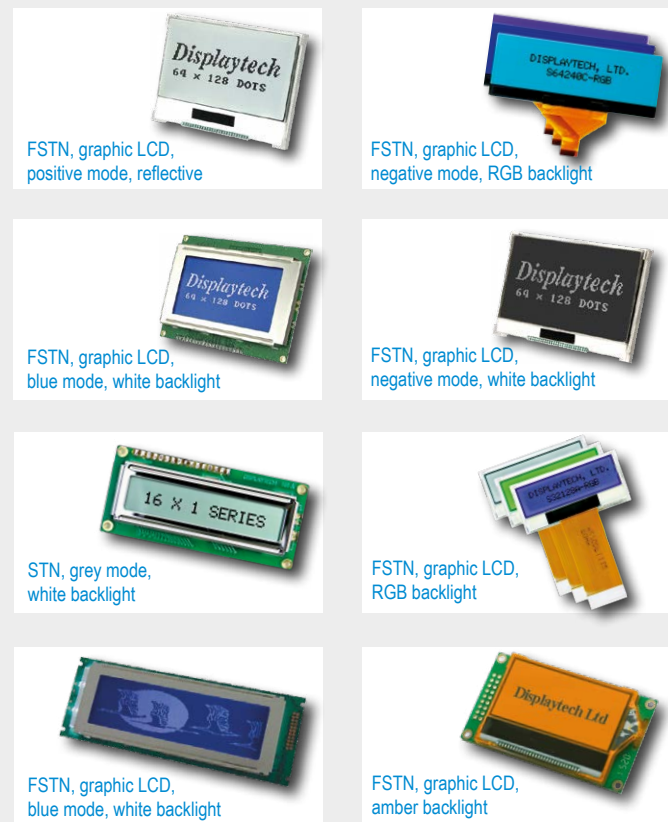
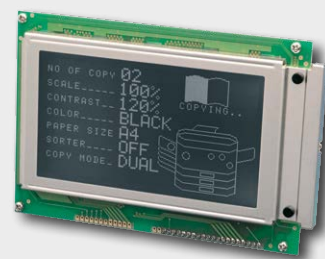
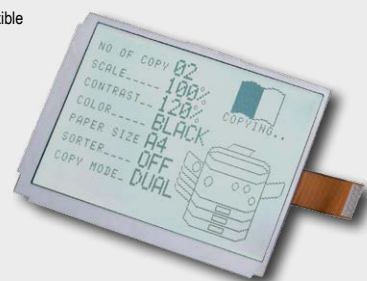
Displaytech Ltd.  
a seacomp company

## LCD Standard Modules

### Passive LCD Modules from Displaytech

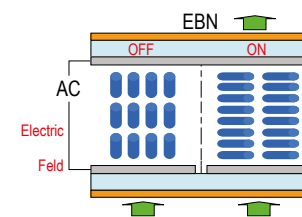
| Dots / Diagonal Size | Model Number | Module Size W x H [mm] | View Area W x H [mm] |
|----------------------|--------------|------------------------|----------------------|
| 122 x 32             | 32122A       | 65.6 x 29.2            | 54.8 x 19.1          |
| 122 x 32             | 32122B       | 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.



TIANMA U.R.T. YEB

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.

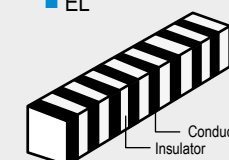
### Main Advantages of Vertical Alignment:

- 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.

- |                   |                  |              |                   |
|-------------------|------------------|--------------|-------------------|
| <b>Connectors</b> | <b>Backlight</b> | <b>Bezel</b> | <b>Touchpanel</b> |
| ■ Rubber          | ■ LED            | ■ Plastic    | ■ Resistive       |
| ■ Connector       | ■ CFL            | ■ Metal      |                   |
| ■ Pins            | ■ EL             |              |                   |
| ■ FPC             |                  |              |                   |
| ■ Heatseal        |                  |              |                   |



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 production and final mass production.







## Display Solutions

**SHARP / NEC**

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". 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. Whatever your application, need or environment, you'll find a digital display to suit in our range of visual solutions.

### Industries

|                            |                                     |                     |                  |
|----------------------------|-------------------------------------|---------------------|------------------|
| Avitation & Transportation | Cinema                              | DooH                | Education        |
| Energy & Utility           | Entertainment Leisure & Hospitality | Finance & Insurance | Food & Beverage  |
| Healthcare                 | Manufacturing & Engineering         | Media               | Rental & Staging |
| Retail                     |                                     |                     |                  |

### Applications

|                                 |                        |
|---------------------------------|------------------------|
| Digital Signage                 | Meeting & Conferencing |
| Command & Control /Surveillance | Large Venue            |
| Personal Workspace              |                        |

## Product Overview

**SHARP / NEC**

Whatever your needs, Sharp NEC Display Solutions has the right product. No other vendor today can offer such a comprehensive and solution oriented portfolio. Bringing together experts in the industry, Sharp NEC Display Solutions offers a single point of contact to provide total display solutions for a variety of vertical markets.

|                        |                      |                   |
|------------------------|----------------------|-------------------|
| What's new?            | ePaper Displays      | Desktop Displays  |
| Large Format Displays  | Interactive Displays | Signage Solutions |
| Meeting Room Solutions | Direct View LED      | Projectors        |
| Digital Cinema         | Computin Soltuions   | Software          |



# 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, compatibility and consortia.

## Suppliers



## Bluetooth

|   | Asus | EnOcean (Dolphin) | FCL Components | GARMIN | Infineon | Insight SIP | IVativ | Minew | Murata | NORDIC | Panasonic | ROHM | SILEX | TDK | TELIT |
|---|------|-------------------|----------------|--------|----------|-------------|--------|-------|--------|--------|-----------|------|-------|-----|-------|
| Bluetooth 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 | IVativ | Minew | Murata | NORDIC | TELIC | TELIT | Unicore |
|------------------------------------|-------------|-----------|-----|----------|--------|-------|--------|--------|-------|-------|---------|
| <b>GSM/GPRS/UMTS/LTE/NB-IoT/5G</b> |             |           |     |          |        |       |        |        |       |       |         |
| Modules                            |             |           |     |          |        |       |        |        |       |       |         |
| Cards                              |             |           |     |          |        |       |        |        |       |       |         |
| Terminals                          |             |           |     |          |        |       |        |        |       |       |         |
| With integrated GPS                |             |           |     |          |        |       |        |        |       |       |         |
| SIM-Card Connectivity              |             |           |     |          |        |       |        |        |       |       |         |
| <b>GNSS</b>                        |             |           |     |          |        |       |        |        |       |       |         |
| GPS/GNSS Modules                   |             |           |     |          |        |       |        |        |       |       |         |
| GPS/GNSS Cards                     |             |           |     |          |        |       |        |        |       |       |         |
| GPS/GNSS Chips                     |             |           |     |          |        |       |        |        |       |       |         |
| Ultra High Precision               |             |           |     |          |        |       |        |        |       |       |         |
| Modules with integrated Antenna    |             |           |     |          |        |       |        |        |       |       |         |

## Proprietary 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 | Insight SIP | IVativ | Kyocera AVX | Minew | Murata |
|--------|-----------|-------------|--------|-------------|-------|--------|
| LoRa   |           |             |        |             |       |        |
| Sigfox |           |             |        |             |       |        |

## RFID/ NFC

|                             | FCL Components | GARMIN | GIANTEC | IDTRONIC | Insight SIP | Minew | Murata | NORDIC | ROHM |
|-----------------------------|----------------|--------|---------|----------|-------------|-------|--------|--------|------|
| 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) | FCL Components | GARMIN | Infineon | Insight SIP | IVativ | Minew | NORDIC | Panasonic | ROHM |
|-----------------|-------------------|----------------|--------|----------|-------------|--------|-------|--------|-----------|------|
| System on Chips |                   |                |        |          |             |        |       |        |           |      |
| Modules         |                   |                |        |          |             |        |       |        |           |      |

## WiFi

|                                  | Advantech | Asus | FCL Components | Infineon | Insight SIP | 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 | CHINMORE | EnOcean (Dolphin) | GradConn | Kyocera AVX | Molex | Pulse | YAGEO comp. | YAGEO Group |
|----------------------------|-------------|-----------|----------|-------------------|----------|-------------|-------|-------|-------------|-------------|
| Adapter Cables             |             |           |          |                   |          |             |       |       |             |             |
| Antennas (internal)        |             |           |          |                   |          |             |       |       |             |             |
| Antennas (external)        |             |           |          |                   |          |             |       |       |             |             |
| Antennas (surface mounted) |             |           |          |                   |          |             |       |       |             |             |
| SIM-card Holders           |             |           |          |                   |          |             |       |       |             |             |
| Energy Harvester           |             |           |          |                   |          |             |       |       |             |             |

## Special Wireless Techn.

|       | GNS |
|-------|-----|
| ADS-B |     |
| TMC   |     |

## UWB

|         | Insight SIP | Minew | Murata |
|---------|-------------|-------|--------|
| Modules |             |       |        |





## Cellular 5G Modules and M.2 Mini Cards

FE910C04 5G Rel17 + LTE Cat 4 & FN920C04 5G Rel 17 + LTE Cat 4



### 5G

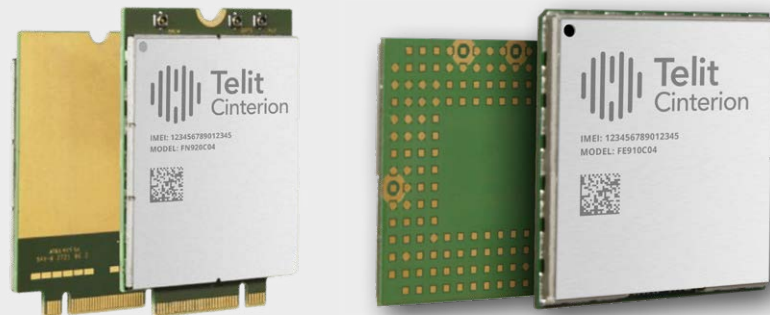
is the current cellular communication system generation. With IoT-enabled devices in mind, 5G connects a higher density of devices at higher speeds and makes things lag nearly non-existent. As a result, 5G creates an excellent user experience irrespective of what application, device or service you touch. Previously, the focus on 5G has been primarily on its remarkable speed and minimal latency. However, the truth is that 5G represents a novel and costly technology that remains inaccessible for numerous IoT applications, even in areas with coverage.

### 5G RedCap (Reduced Capacity)

emerges as a potential solution to this challenge, offering a compromise by providing some of the speed and low latency benefits of full-fledged 5G at a significantly lower cost. The technology is tailored for use cases where ultra-low latency isn't critical, but a decent level of data transfer speed is necessary to support the requirements of advanced applications in the future with throughput rates of 150Mbps for downloads and 50Mbps for uploads. It finds utility in applications such as wireless industrial sensors, video surveillance systems, and smart wearable devices.

#### Key Features

- 5G Sub.6 FDD and TDD operation in 5G NR Standalone: DL: 220 Mbps & UL: 50 Mbps
- LTE Cat 4: DL: 150 Mbps & UL: 50Mbps
- Support for GPS, GLONASS; Beidou, Galileo, QZSS
- Industrial temperature range: -40°C to +85°C
- GNSS with support for L1 und L5 frequencies and antenna port



| Product                        | Description  | Dimensions   | Applications   | Technology |
|--------------------------------|--|--|--|------------|
| FE910C04 5G Rel 17 + LTE Cat 4 | FE910C04/FN920C04 6G Rel 17 +LTE Cat 4 worldwide facilitates 5G mid-speed connectivity by utilizing the most recent 3GPP Release 17 Redcap technology. 5G connectivity provides resilient and future-proof performance and efficiency, providing 5G connectivity for the most demanding IoT applications | <ul style="list-style-type: none"> <li>■ FE910C04 is part of Telit Cinterions flagship xE910 module family</li> <li>■ Providing 5G NR radio access technology in a 28.2 x 28.2. x 2.2 mm family form factor</li> <li>■ Weight: 5g</li> </ul> | <ul style="list-style-type: none"> <li>■ Video surveillance and monitoring</li> <li>■ Industrial Routers and Gateways</li> <li>■ EV Charging infrastructure</li> <li>■ Machine Telematics</li> </ul> | 5G RedCap  |
| FN920C04 5G Rel 17 + LTE Cat 4 |  | <ul style="list-style-type: none"> <li>■ FN920C04 with M.2 form factor is part of Next Generation Form Factor (NGFF) compatible with Telit Cinterion 4G LTE and 5G data cards</li> <li>■ Dimensions: 30 x 42 x 2.3 mm</li> </ul>             | <ul style="list-style-type: none"> <li>■ Cellular Router and Gateways</li> <li>■ Fixed Wireless Access (FWA)</li> <li>■ Connected Healthcare</li> <li>■ Video Surveillance</li> </ul>                |            |

## Cellular LTE Cat 1 bis

LE910Q1 LTE Cat 1 bis 10/5 Mbps Mbps



LTE Cat 1 bis technology provides the latest wireless communication standard for IoT and M2M deployments, designed for optimized and power-efficient connectivity for IoT devices with its extended discontinuous reception (eDRX) and power-saving mode (PSM) for longer sleep cycles. With its enhanced power efficiency, Cat 1 bis is highly recommended for applications that require higher performance compared to Cat M1 and NB-IoT and where devices need to operate in remote or hard-to-reach locations.

Backed by field-proven technology, Telit Cinterion's LE910Q1 guarantees stable and reliable connectivity for uninterrupted operations. With a single-antenna operation and an optimized hardware design without compromising on performance while ensuring low-power consumption for efficiency. The module offers GNSS functionality concurrent with LTE, enabling continuous tracking for enhanced reliability.

#### Key Features

- Part of Telit Cinterions flagship xE910 module family
- LTE FDD Cat 1 bis 3GPP Rel 13 compliant
- LTE Cat1 bis: UL up to 5 Mbps & DL up to 10 Mbps
- Single-antenna operation for cost-efficient HW design
- Low power consumption
- GPS, GLONASS, Beidou, Galileo, QZSS
- Industrial temperature range: - 40° C to +85° C



| Description  | Dimensions                       | Applications  | Technology      |
|--|----------------------------------|---|-----------------|
| LE910Q1 Cat 1 bis module is suitable for various IoT applications for data transmission and IoT deployments where 3GPP LPWA technologies have not yet been activated. With use of only one single antenna, the costs are optimized | Dimensions: 28.2 x 28.2 x 2.4 mm | <ul style="list-style-type: none"> <li>■ Data and mobile applications</li> <li>■ Security panels (data-only)</li> <li>■ Telematics</li> <li>■ Asset tracking</li> </ul> | ■ LTE Cat 1 bis |







## IoT Terminals

### LT910-EUbis – LTE Cat.1 bis Terminal for cost-optimized application

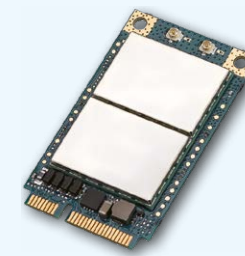
The LT910-EUbis is a small yet durable IoT device crafted for LTE network usage, with the capability to switch to GSM network when needed. It utilizes the TelitLE910R1-EU module and is tailored for industrial purposes, offering an economically efficient LTE Cat 1bis Terminal suitable for European applications.

#### Key Features

- LTE FDD Cat.1 bis, 3GPP release 10 compliant
- Operational temperature range: -30° C to +75° C
- Support of low-power mode
- Durable and compact housing for industrial use
- LTE Cat.1 bis uplink up to 5Mbps and Downlink up to 10 Mbps
- FME antenna connector, RS232 (V.24/V.28) on Sub-D; USB
- FOTA Update
- SIM application Tool Kit 3GPP TS
- 51.01
- Power connector 6P6C modular jack



| Description  | Dimensions      | Applications   | Technology    |
|--|-----------------|--|---------------|
| LT910-EUbis is based on Telit LTE Cat.1 bis module LE910R1-EU with GSM fallback. Terminal offers standard industrial interfaces and facilitates secure, speedy, and dependable data transmission | 77 x 66 x 26 mm | <ul style="list-style-type: none"> <li>■ Monitoring of vending machines</li> <li>■ Monitoring of data from industrial plants</li> <li>■ Intelligent control and monitoring of grids</li> <li>■ Transmission of meter readings from electricity, gas, and water meters</li> <li>■ Live transmission of video images</li> <li>■ Monitoring of heating, ventilation and air conditioning</li> </ul> | LTE Cat.1 bis |



EWM-C117FL



AIW-355



AIW-344



EWM-G109H01E

## Cellular Mini PCIe Data Cards



Enabling an Intelligent Planet

### 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

## ADVANTECH

Enabling an Intelligent Planet

### 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

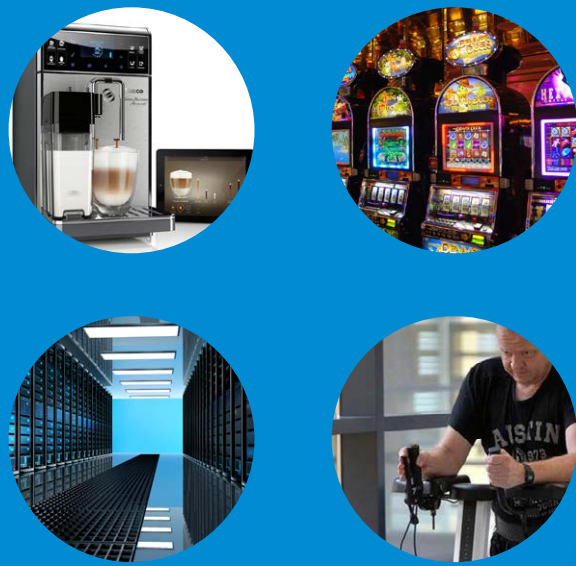
#### 802.11 ac/a/b/g/n + BT 5.0 Half Mini-PCIe Module

##### 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







## Intel WiFi 5, WiFi 6, WiFi 6E and WiFi 7 M.2 Cards



Since more than 20 years WiFi is connecting the world and the technology is developing fast. Intel is participating in this development and offers various solutions, to fulfill users different requirements. From WiFi 5 (IEEE 802.11 ac), over WiFi 6/6E (IEEE 802.11 ax) to the newest evolution WiFi 7 (IEEE 802.11 be), Intel offers M.2 cards in different versions.

| Type                        | WiFi 5 9560*                        | WiFi 5 9462*     | WiFi 5 9461*     |
|-----------------------------|-------------------------------------|------------------|------------------|
| Code Name                   | Jefferson Peak 2                    | Jefferson Peak 1 | Jefferson Peak 1 |
| Estimated SW support until  |                                     | Q4 2026          |                  |
| TX/RX Streams               | 2x2                                 |                  | 1x1              |
| Bands                       | 2.4 GHz, 5 GHz                      |                  |                  |
| Max Speed                   | 1.73 Gbps                           | 433 Mbps         | 433 Mbps         |
| Integrated Bluetooth        |                                     | V5.1             |                  |
| From Factor                 | M.2 2230<br>M.2 1216 (SMD)          |                  |                  |
| Supported Operating Systems | Microsoft Windows 10, Linux, Chrome |                  |                  |
| System Interface Type       | CNVio, GPIO                         |                  |                  |
| Use Conditions              | PC Client                           |                  |                  |
| vPRO support possible       | Yes                                 | No               | No               |

| Type                        | WiFi 6E AX210                               | WiFi 6E AX211*    | WiFi 6E AX411     | WiFi 7 BE200**                  | WiFi 7 BE201             | WiFi 7 BE202                  |
|-----------------------------|---|-------------------|-------------------|---------------------------------|--------------------------|-------------------------------|
| Code Name                   | Typhoon Peak 2                              | Garfield Peak 2   | Garfield Peak 4   | Gale Peak 2                     | Fillmore Peak 2          | Misty Peak 2                  |
| Estimated SW support until  | Q4 2028                                     | Q4 2028           | Q4 2028           | Q3 2030                         | N/A                      | Q3 2030                       |
| TX/RX Streams               | 2x2   |                   |                   |                                 |                          |                               |
| Bands                       | 2.4 GHz, 5 GHz, 6 GHz                       |                   |                   |                                 |                          |                               |
| Max Speed                   | 2.4 Gbps                                    | 2.4 Gbps          | 3 Gbps            | 5.8 Gbps                        | 5 Gbps                   | 2.4 Gbps                      |
| Integrated Bluetooth        | V5.2  |                   |                   | V5.4                            |                          |                               |
| From Factor                 | M.2 2230<br>M.2 1216 (SMD)                  |                   |                   |                                 |                          |                               |
| Supported Operating Systems | Windows 10, 64-bit, Google Chrome OS, Linux | Windows 10, Linux | Windows 10, Linux | Windows 11, Windows 10, Linux   | Windows, Linux, ChromeOS | Windows 11, Windows 10, Linux |
| System Interface Type       | PCIe (WiFi), USB (BT)                       | CnVio2            | CNVio2            | PCIe (WiFi), USB (BT)           | CNVio3                   | PCIe (WiFi), USB (BT)         |
| Use Conditions              | PC Client, Industrial, Embedded             | PC Client         | PC Client         | PC Client, Industrial, Embedded | PC Client                | PC Client                     |
| vPRO support possible       | Yes   | Yes               | Yes               | Yes                             | Yes                      | No                            |

\* CRF (Companion RF) modules  
\*\* Still in development phase of embedded and industrial versions

## 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

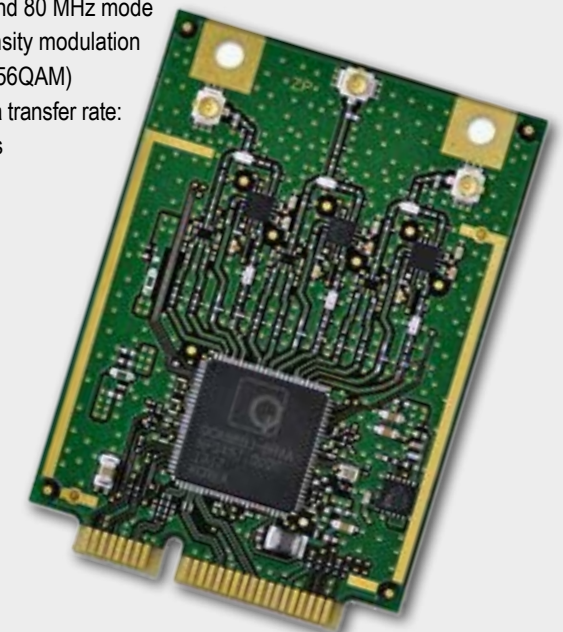


### SX-PCEAC

### 802.11a/n/ac PCI Express Wireless LAN Module

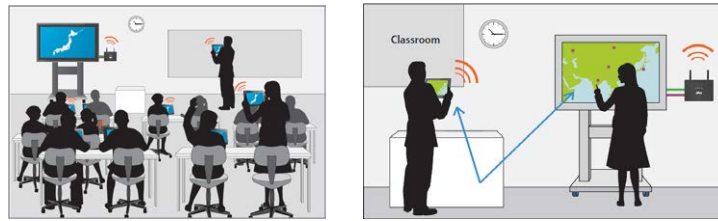
#### Features

- Qualcomm Atheros QCA9880 chipset
- 3x3 SU-MIMO enhances high speed and stability
- IEEE 802.11ac(Wave1)/ a/n/e/h/i
- Silex Linux reference driver with IEEE802.11x EAP support
- Wide band 80 MHz mode
- 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-stream 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

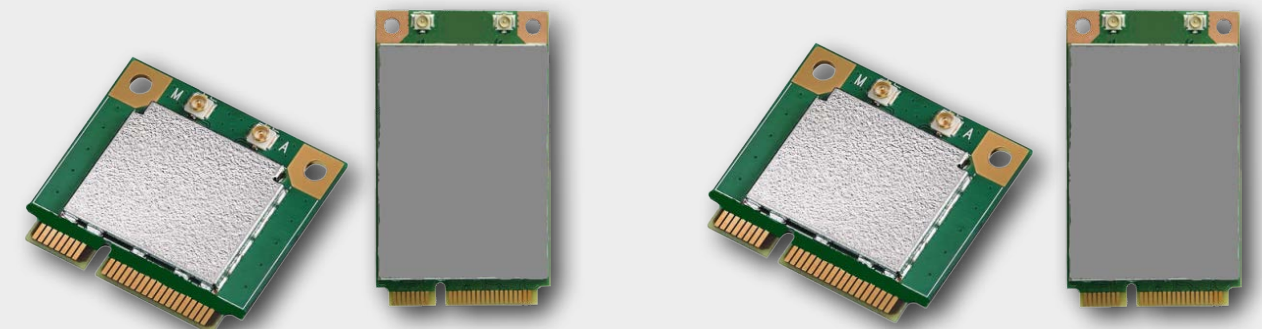
## iVativ EVIA

### 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.

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- 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

**EnOcean**  
Self-powered IoT

## EMSI Easyfit IoT Multi-Sensor

The EMSI, which is based on the STM 550 multi-sensor, 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<sup>1)</sup>
  - USB 500U: FSK 902 MHz<sup>1)</sup>
  - USB 400J: FSK 928 MHz<sup>1)</sup>
- 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)
- Radio Regulations:
  - USB 300: CE (EU) / UKCA (UK)
  - USB 500U: FCC (US) / ISED (CA)
  - USB 400J: MIC/ARIB (Japan)
- Sample image:
  - USB 300 / USB 500U (white housing)
  - USB 400J (transparent housing)



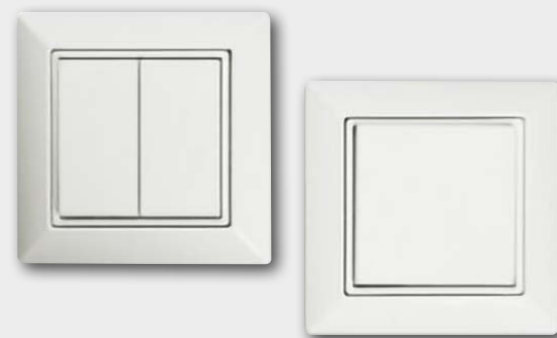
<sup>1)</sup> According to ISO/IEC 14543-3-1x

## 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)



**BKOOOL** Connect | Sport



ANT™

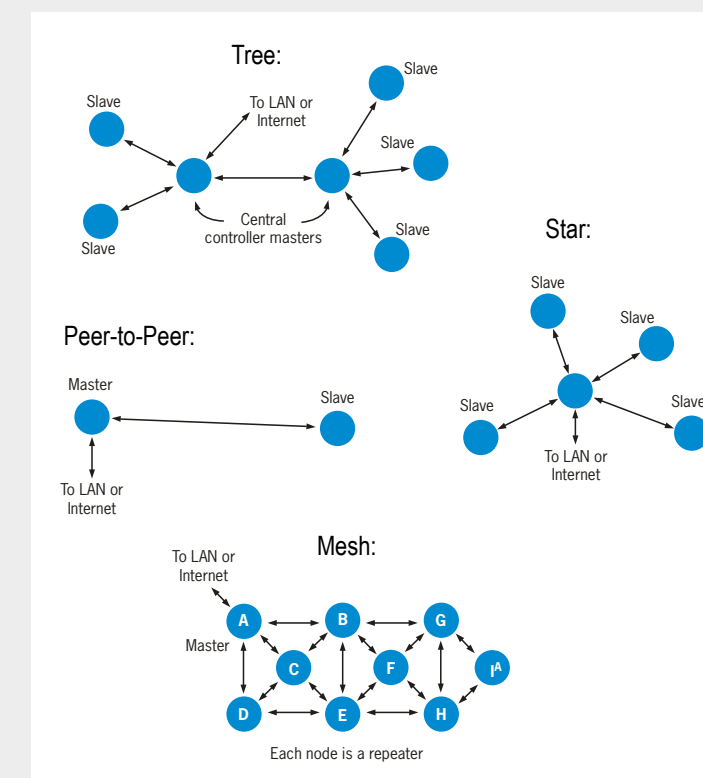
**GARMIN**

### 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 ad-hoc mesh techniques are also available.

### More Information

[www.rutronik-tec.com/ant](http://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 payload)
- 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.







## 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.



# 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

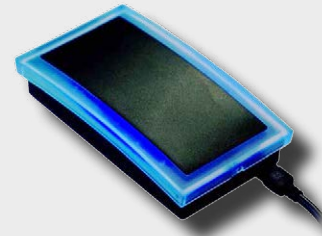
- Dimensions: 83.5 x 36 x 11.2 mm
- Housing-Material: ABS
- Power Supply: 5V DC, via USB
- Operating Systems: Windows XP, Vista, 7, 8, 8.1, 10
- Antenna: integrated
- Interface: USB VCP, HID

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<sub>DC</sub>, 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; SR1X4K (TYPE-B); I-Code2; TI RFID Tag-it HF-I; EM4135; EM4034<br>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  |

## 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)



| 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

## Passive RFID Transponders – Overview












With its large portfolio of chips iDTRONIC covers the total frequency bandwidth 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     |
|                             | 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         |             |
| HF                          | 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              |             |





# 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          |               |                          |                          |                    |                    |              |                   |                 |           |
| 2J              | 2JF0415P  |    |          |           |          | x            |              |           |               | 868 MHz       | 2.7                      | 58                       | 25 x 70 x 0.2      | Linear             | 100          | U.FL compatible   | 50              |           |
|                 |   |   |          |           |          |              |              |           |               | 915 MHz       | 3.6                      | 77                       |                    |                    |              |                   |                 |           |
|                 | 2JF0302Pa   |   |          |           |          |              |              |           | x             |               | 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        |              |              |           |               |               | 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         |          |              |              |           |               | 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 etherronics | WxP3015W08  |  |          |           |          |              |              |           | x             |               | 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%                      |                    |                    |              |                   |                 |           |
| AVX etherronics | 1002289   |  | x        | x         | x        |              |              |           |               |               | 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        |              |              |           |               |               | 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         |               |               | 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            |              |           |               |               | 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            |           |               | 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             |               | 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  |    |          |           |          |              |              |           |               |                 | 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        |              |              |           |               |                 | 698 MHz     | 1.8             | >70               | 140 x 20 x 0.1  | Linear       | 100               | U.FL / I-PEX    | 50        |                 |    |
|              |   |   |          |           |          |              |              |           |               | 1500 MHz        | 2.8         |                 |                   |                 |              |                   |                 |           |                 |    |
| 2072350100   |  | x   | x        | x         |          |              |              |           |               | 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               | 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               | 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         |          |              |              |           |               | 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          |                 |                   |                 |              |                   |                 |           |                 |    |
| W3312XXXXXX  |  |   |          |           |          |              |              |           |               | x               |             |                 | 863-928 MHz       | 0.8             | 45           | 75 x 15           | Linear          | 100       | U.FL compatible | 50 |
|              |   |   |          |           |          |              |              |           | 4900-6000 MHz | 3.5             | 37          |                 |                   |                 |              |                   |                 |           |                 |    |
| Yageo        | ANTX100P001B24553   |  |          |           |          |              |              |           |               |                 | x           | x               | 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         |          |              |              |           |               |                 |             |                 | 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 |
| 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      | Horizontal        | 2500          | C1(Mobile): FME-Female; C2 (Navigation): SMA-Male | 50   |
|               |            |         |          |           |          |              |              |           |                 |                          | 1575.42 MHz       | *        | *      | <1.2:1        |                  |                   |               |   |      |
|               | 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        |              |              |           |                 | 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 |               |                  |                   |               |   |      |
|               |            |         |          |           |          |              |              |           | 4920 - 5925 MHz |                          | -4.2              | -30      | -1.3:1 |               |                  |                   |               |   |      |
| 2J7624B       |            | 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 x 20 x 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    | 135x19x10     | 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    | 171x38x13.8   | 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 |
| AVX ethertronics | 1002857           |         |          |           |          |              |              |           | x               | Helical         | 1575 MHz        | -3.0     | 27      | 2.0:1 max    | Ø15.0 x 34.93 | RHCP              | -          | SMA-Male           | 50   |
|                  | 9000984           |         |          |           |          |              |              |           |                 | 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      | *       | 168x18       | 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           | 50   |
|                  | 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            |          |         |              |               |                   |            |                    |      |
|                  |                   |         |          |           |          |              |              |           |                 | 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        |         |          |           |          |              |              |           |                 | 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            |         |          |           |          |              |              |           |                 | Connector Mount | 2.4-2.5 GHz     | 1.9      | >80     | *            | Ø10 x 128     | Vertical          | -          | RP-SMA-Male        | 50   |
|                  |                   |         |          |           |          |              |              |           |                 |                 | 5.15-5.85GHz    | 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                 |      |





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