novitronic
powered by endrich

endrich
components of life

# LINECARD



ENGLISH

# Content


| | |
|---|---|
| Design-In Concept | 3 |
| IoT Platform | 6 |
| 3BIG-MOD | 8 |
| Product Overview | 10 |
| Sensors | 11 |
| Temperature Sensors / Thermistors | 13 |
| Displays / Embedded Systems | 14 |
| Quartz / Oscillators / Filters | 16 |
| RF Modules / Antennas | 18 |
| Analog ICs | 20 |
| Memory ICs | 21 |
| Protection Devices | 22 |
| Thermal Management | 24 |
| Electromechanics | 25 |
| Lighting Solutions | 26 |
| Capacitors | 28 |
| Resistors | 29 |
| Inductive Components | 30 |
| Acoustics | 31 |
| Connectors | 32 |
| Batteries / Power Supplies | 33 |

# Design-In Concept

## Our Service

- Solution-oriented, competent consulting by our technically experienced employees
- Personal and individual solutionoriented support
- Cross-product project management
- Implementation of customer-specific requirements
- Network of service providers

## Our Claim

- Innovative products and customized solutions
- High quality standards
- Regular trend analysis
- Great flexibility in product development
- Long partnerships with suppliers

## Your Advantages

- endrich as reliable partner
- Optimized product design
- R&D support in hardware and software
- Suitable product selection
- Focus on own core competence
- Reduced development times through endrich support





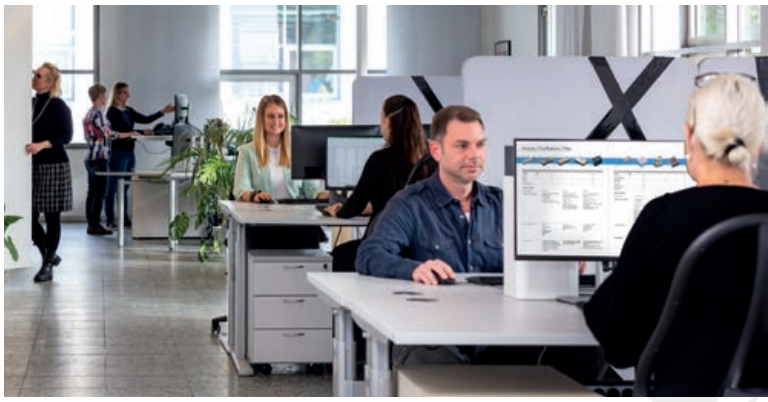
*Dr. Christiane Endrich*

## „Where the Future of Electrical Engineering is at Home“



**Quality and technical support** Quality is not a question of being demanding, but a key for success. Who recommends quality, shows that he is an expert himself. Every good engineer is perfectly aware that he needs excellent instruments to be successful. Business relationships which last over 30 years have become rare in the struggle for orders and yield. And it is exactly for this reason why we focus on continuity and close cooperation, not only for what concerns the relationships towards our suppliers, but also with regard to our colleagues. Thus on one hand we can guarantee competitive advantages and a maximum of product availability, on the other hand a positive social environment generates a major efficiency and a higher motivation in the daily business. Together with Novitronic AG, we have excellent access to the market for electromechanical components, which we will further extend in the future.

Our colleague in Asia, who directly knows the problems on-site and the appropriate solutions and thus affords a smooth workflow, proves that closeness has nothing to do with distance. The marketing teams of endrich and their colleagues are sophisticated but not detached, because they possess excellent technical skills, which are completed by many years of professional experience in design. Surely at this point we can be a little bit proud of our uniqueness: all the product ranges are taken care of for you by **endrich** teams of experts and by professionals operating for our producers. In short, we are capable of exactly providing the technical support you desire. The figures but first and foremost the high level of customer satisfaction show that this strategy works.





Jens Mollitor

„This is how it should be, this is how it can stay' ... no longer works"



Markus Kummert

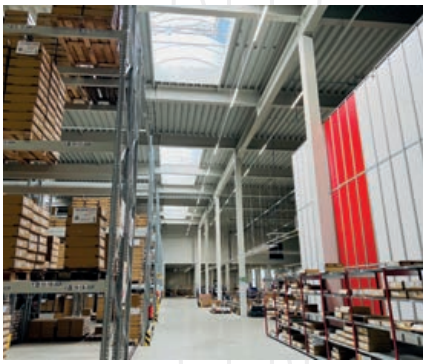
„We want to understand your need behind the need to offer the best solution for you"

One fourth of the yearly turnover of **endrich** is generated by its activities in the automotive supply industry, considered particularly delicate. This result is only feasible thanks to the permanent contact and the growing relationships with our partners. In this way we manage to operate successfully for our customers and to be profitable for ourselves. Medium-sized manufacturers as well as big enterprises in Asia, Europe and the USA form the basis for our design-in in the technically oriented distribution business.

## „A Family with more than 10,000 Children"

**Facts:** From our central stock in Nagold we deliver to 50 countries worldwide with standards like "just in time", buffer stocks or consignment stock, 100% bar code labelled and therefore traceable. Our customised logistic strategies enable us to supply our products quickly wherever you need them. We remain in constant contact on-site with the supplier and are at the same time always close to you. We always act locally and think globally in the truest sense of the word.

**Philosophy:** In the procurement of true innovations from Asia we do not only see a challenge – it really is a central driving force for our company. Top service and highest quality are our gauge, in a sector known for its worldwide quality competition. When costs and product development spin like turbines we remain composed and keep thinking goal-oriented. We do not abandon our clients, but provide advice about the right products and their potentialities already in the forefront. The advantages of familiar thinking are possible only in a family enterprise. **endrich** stands for the dialogue from person to person drawn from long relationships with our customers and manufacturers and inspired by our claim **"endrich – components of life"**.



# IoT Platform

## Entering the Internet of Things with the endrich IoT Platform

**The Internet of Things** is growing continuously and the number of connected devices continues to rise. Today, approximately 30 billion are connected to the IoT, and research institutes expect 75 billion devices to be directly or indirectly connected by 2025. The introduction and installation of the 5G network will ensure that the data generated via edge computing is available and can be used everywhere quickly and without latency. The IoT offers many scenarios and possible applications that are still in the early stages of development today. Companies in the manufacturing industry in particular can and must consistently use modern technologies in order to remain competitive. In particular, control, measurement and regulation technology can be optimized through digitization. Embedded systems are increasingly finding their way into equipment and power engineering, machine and plant construction, the automotive sector and medical technology.

**The digitization of processes** ensures the competitiveness of a company. Existing business models can be shifted and new business models can be integrated. A fast and flexible reaction to the dynamic market and to individual customer requirements is ensured. The digitalization process creates very complex requirements that can only be solved by individual IoT developments. Holistic solution approaches consisting of hardware and software are increasingly important in order to keep the overall system as simple as possible. Sensors make it possible to monitor machines and devices and keep downtimes as low as possible (predictive maintenance).



**Embedded systems** are in many end devices today and the number will continue to grow. The goal is to make effective tracking of device usage visible through networking. Other benefits include possible predictions of errors in the system or retrieving information about other negative influences such as theft or vandalism from anywhere in the world. Lives can also be saved through fast and well-developed networks.

**Industrial equipment, refrigerators, washing machines, vehicles** – whether on the road, on the water or in the air – are or will become part of the IoT and the networking of devices will continue to advance. Companies must follow this development in order to remain competitive and secure the market share of their own products. endrich Bauelemente Vertriebs GmbH supports its customers in the technical development and implementation of systems and solutions.

**The self-developed and modular** endrich IoT platform is an affordable industrial single board computer for IoT applications and offers the three main functions acquisition via sensors, control and communication. Thus, the platform is the entry point into the world of IoT, but also serves as a development platform for experienced developers. The basis is the board v052 with a RISC-V microcontroller architecture and a wide area network using a NB-IoT/LTE-M/2G-GSM modem. Power is supplied via a separate battery and can be selected between 3.6 V or 5 V.

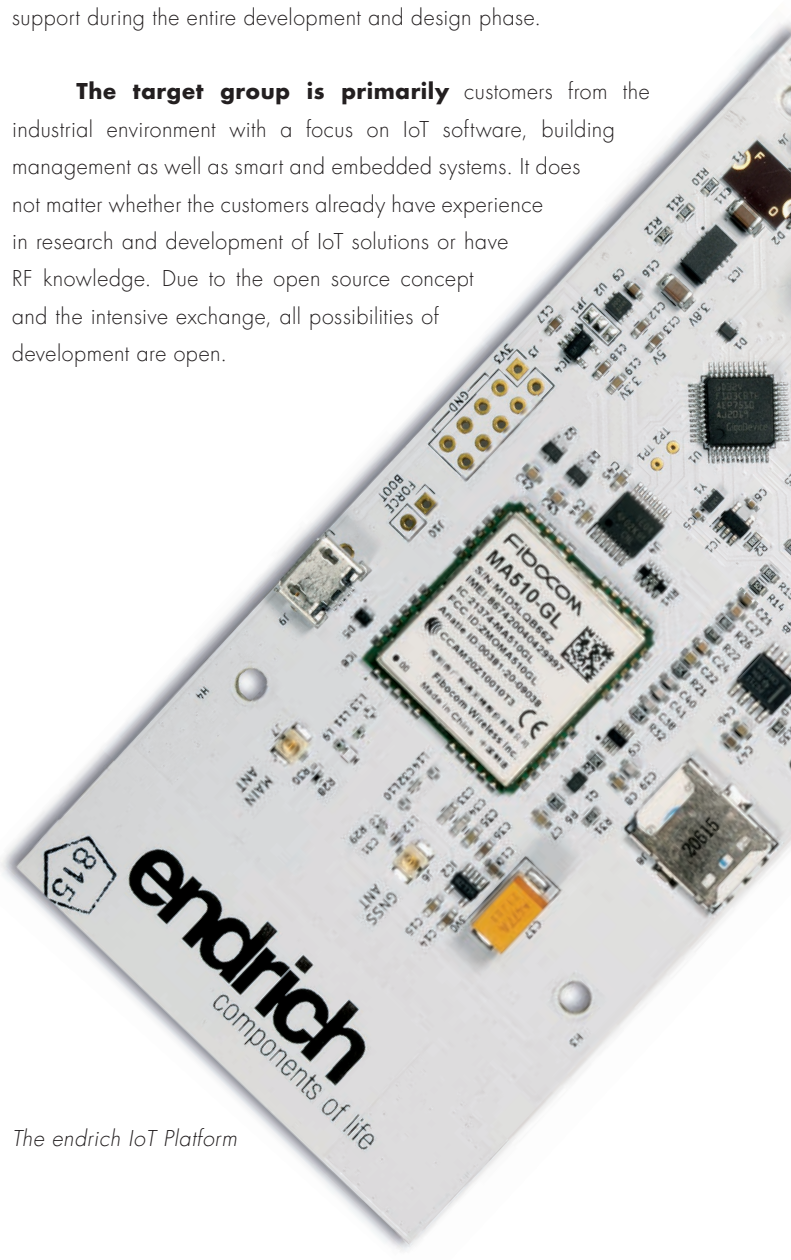
**The v052 base board of the endrich IoT platform** already integrates numerous sensors to detect various environmental parameters such as ambient light, magnetic fields, temperature, air pressure, vibration, noise, altitude and position. Adapter boards such as the CLS sensor board based on Everlight's RGBW colored light sensor can detect red, green, blue and white light as well as infrared. Another sensor board is based on Everlight's ALS-DPDIC17-78C/L749/TR8 digital light sensor and detects ambient light in the spectrum of the human eye. This allows light and dark conditions to be determined and the intensity of visible light to be measured. The temperature sensor board based on Everlight's EMT34-1220-A/L906/TR8 sensor provides an external thermometer. The VS1/2 vibration sensor detects vibrations to monitor a machine run or motor start. Rain or vandalism can also be detected via this. The air pressure sensor determines the air pressure, records the altitude or measures the fan speed. RPM and speed can also be measured, as can the localization and physical location of the device via GNSS coordinates. In this way, device tracking is also possible.

**External cards based on various display standards** such as pmOLED or TFT are available for visualization. These boards can be connected via standard interfaces either to the endrich IoT SBC board or to third-party MCU boards. The pmOLED display board with I2C and SPI interfaces provides basic visualization functions based on Raystar's 0.96-inch pmOLED display REX012864DWPP3N00F00 with a resolution of 128 x 64 pixels. The TFT expansion card with SPI interface is suitable for customized designs. It provides visualization functions based on Raystar's RFJ240I-AYW-DNN 2.4-inch color TFT with 320 x 24 pixel resolution.

**All acquired sensor values** are stored in the endrich cloud and retrieved or visualized via the endrich Visualization Database, a dedicated website for all endrich IoT SBC cards or customerspecific devices.

**The platform is based exclusively** on components from endrich Bauelemente Vertriebs GmbH and is built on the open source concept. It is flexible in design and allows own process design. It is completely independent of existing solutions. endrich guarantees full support during the entire development and design phase.

**The target group is primarily** customers from the industrial environment with a focus on IoT software, building management as well as smart and embedded systems. It does not matter whether the customers already have experience in research and development of IoT solutions or have RF knowledge. Due to the open source concept and the intensive exchange, all possibilities of development are open.




*The endrich IoT Platform*

# 3BIG-MOD

## The IoT Module 3BIG-MOD from endrich

**The Internet of Things networks** physical and virtual objects globally. Many applications in the consumer and business sectors are based on IoT technology. Wearables such as smartwatches and fitness bracelets, smart home applications such as heating control and entertainment, connected cars or Industry 4.0 are based on data collection by sensors, data processing by means of controllers and the provision of the collected data material in the cloud. Almost every company, whether mediumsized or large, is now integrating this technology into its products. Digitization is increasing every day. Almost everyone owns a smartphone that has several sensors on its own, collects data and makes it available to its user or many users. The collected data is analyzed and offers potential for new business models and personalized information. Processes in factories and productions are recorded with sensors. The data is passed on and processed to make processes more efficient, detect machine failures in advance and monitor the quality of products. In this way, processes along the value chain are automated and continuously improved.

**The mass of data obtained** and sent to the cloud means that existing technologies are being replaced by new and even faster ones. One of the consequences of this increasing data traffic and the ever more extensive networking of „things" is the introduction of mMTC (Massive Machine Type Communication). The foundations were already laid in the fourth generation of mobile communications, i.e. 4G, and have since been integrated into the 5G network. In order to network as many devices as possible and to keep the amount of data as low as possible, it is already necessary to consider during the development of an application which data should be sent to the cloud and which should only be kept or stored at the point of origin – in the socalled edge.

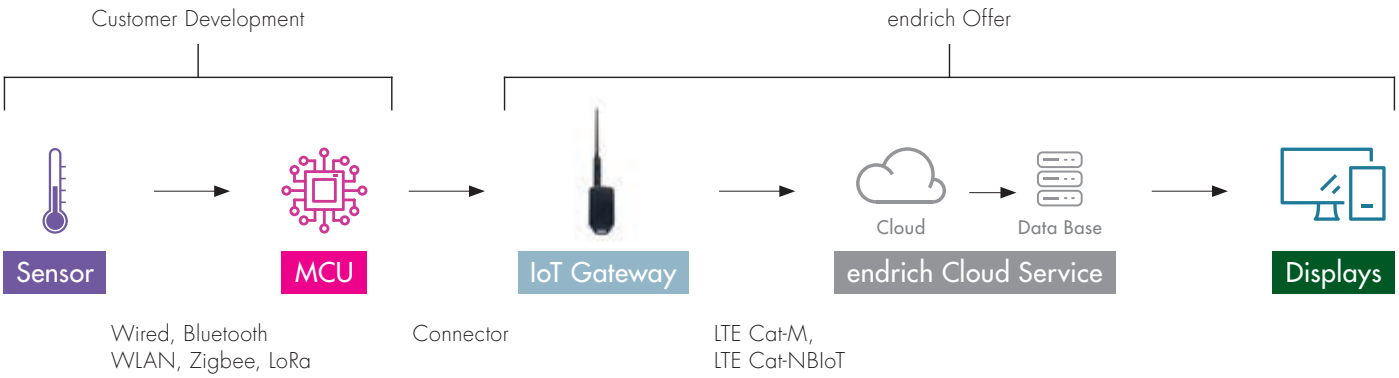


*3BIG-MOD*

**endrich Bauelemente Vertriebs GmbH** supports its customers in entering the complex topic environment of the Internet of Things. The self-developed and modular endrich IoT platform is an affordable industrial single board computer for IoT applications and offers the three main functions acquisition, control and communication. The platform is based almost exclusively on endrich components and is built on the open-source concept. Based on this „proof-of-concept", own developments can be built up, which involve higher labor and personnel costs at the start, but offer a price advantage from high volumes.

**The alternative solution** endrich offers its customers is the IoT module 3BIG-MOD. It is based on Fibocom's MA510-GL series. Based on the Qualcomm chip platform, the MA510 module is a high-performance IoT module that supports different technologies such as LTE Cat M1 or Cat NB2 and EGPRS. After starting in the 4G network, these technologies are now part of the Massive Machine Type Communication (mMTC) of the 5G network. In order to be able to guarantee the connection to the cloud in previously less developed regions, 2G fallback can be used. In addition, the MA510 also supports GNSS, so that tracking and time determination are also possible. With its small size and low power consumption, a variety of Internet protocols, industry standard interfaces and other features, the MA510 is suitable for IoT industrial applications such as smart metering, asset tracking, smart parking, smart home, wearable devices, wireless POS, etc. The Fibocom module itself is certified by FCC/ PTCRB/ CE-RED/ GCF/ IC/ RCM/ JATE/ TELEC/ Anatel/ NCC and received the certifications from telecom operators such as AT&T, Sprint, KDDI, Vodafone, Deutsche Telekom, etc. The 3BIG-MOD based on it is also certified according to CE-RED (Europe), FCC (USA), and IC (Canada). The certifications of mobile network operators are pending.

**The 3BIG-MOD serves as a modem** to send data from existing platforms over the LTE Cat-M1/Cat-NB2/EGPRS network to the endrich cloud. It can also provide data connections on the LTE FDD, GPRS and EGPRS networks and supports GNSS to acquire and transmit position data. The free selection of the communication protocol and the adaptation of the respective application are guaranteed by the protocol stacks PPP / TCP / UDP / SSL / TLS / FTP(S) / HTTP(S) / MQTT / CoAP / LWM2M. For development purposes, the endrich cloud is available. The direct communication to the 3BIG-MOD is done via the serial interface. The easy-to-use IoT modem is available from stock and ready for immediate use. So there are no additional costs and efforts for radio certification and development. As a result, the time-to-market factor is very short. Special RF knowledge is not required. During the development phase, a cloud database and various visualization tools are available free of charge. The user can use his own developed sensor or MCU platforms. endrich provides sample Python scripts and C code. This also includes detailed documentation on how to access endrich cloud services and all available sensor boards that can be connected to the 3BIG MOD. Technical support is provided by endrich or an external partner. The target group is industrial customers in the fields of energy management, smart building, smart factory and smart city as well as engineering companies. The module can also be used as a communication modem for diagnostics. The advantages of the solution are low development and production costs, no storage requirements or certification costs.




## Features

- LTE CAT-M1 / CAT-NB2
- 2G/ EGPRS fallback
- Optional GNSS
- UART interface
- Integration support
- Supported protocol stacks: PPP / TCP / UDP / SSL / TLS / FTP(S) / HTTP(S) / MQTT / CoAP / LWM2M

## Applications

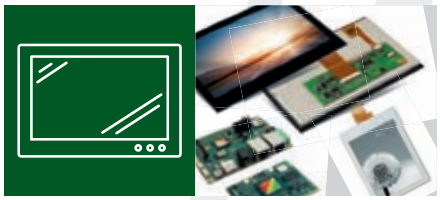
- Smart city
- Smart building
- Factory automation
- Energy management

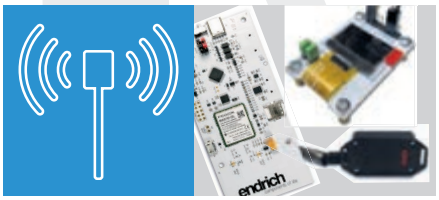
# Product Overview

## Programm

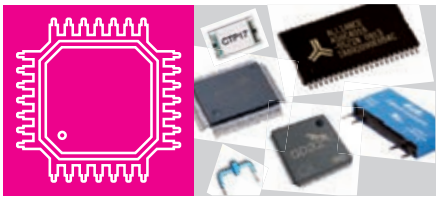
With the constantly expanding product portfolio in the areas of Displays + Embedded, Active, Passive, Radio, Sensors, Acoustics, Lighting Solutions, Power Supplies as well as Electromechanics, endrich always offers its customers the right product for the respective application. The quality of the products is not a question of pretension, but the key to success. Who recommends quality shows that he is an expert himself.

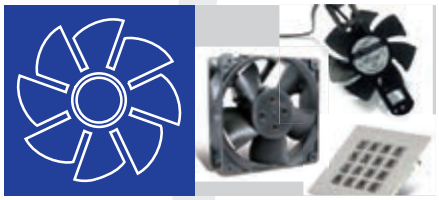

Sensors


Displays & Embedded Systems

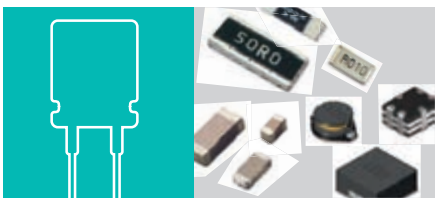


Wireless Connectivity & IoT Solutions


Active Components


Electromechanics


Lighting Solutions


Passive Components


Acoustics


Power Supplies & Batteries Systems

# Sensors




| Manufacturer | Crocus Technology | Everlight | Micronas | Nicera | Panasonic |
|---|---|---|---|---|---|
| Grid Eye – Thermopile Array | | | | | ■ |
| Magnetic Field | ■ | | ■ | ■ | |
| Infrared | | ■ | | ■ | |
| Solar Cells | | | | | ■ |
| Current Sensor | ■ | | ■ | ■ | |

## Features

| | | | | | |
|---|---|---|---|---|---|
| Certifications | ISO 9001<br>AECQ-100 | ISO 9001<br>IATF 16949 partly | ISO 9001<br>IATF 16949 | ISO 9001<br>IATF 16949 partly | ISO 9001 |
| General Information | Innovative manufacturer of TMR-sensors with licensed XtremeSense®-technology<br>Wide portfolio of current sensors, switches, linear and angle sensors | Famous Taiwanese manufacturer with a high production capability<br>Large product range of IR sensors | Development and production with own chipfab in Germany<br>Large portfolio of switches, linear and angle sensors<br>Leading manufacturer of linear sensors in the automotive sector | Long standing partner for electronic components on ceramic basis: pyrosensors (PIR-sensors), fresnel lenses, hall sensors, current sensors | Global player with a wide product range<br>Manufacturer of e.g. solar cells and thermopile sensors |
| Applications | Current Measurement<br>Automotive<br>Industrial Applications<br>White Goods<br>Metering Applications | Industrial<br>White Goods<br>Measurement Equipment<br>Light Barriers | Automotive<br>Industrial<br>White Goods<br>Medical Equipment | Home Automation<br>Measurement Equipment<br>White Goods<br>Security (e.g. burglar alarm)<br>Battery Management<br>Industrial | Grid-Eye:<br>Object & Person Recognition<br>Non-contact Temperature Measurement<br>Solar Cells: Watches<br>Shutters & Lighting Control<br>Home Automation |
| Specifics | CT4xx – high precision current sensor, with integrated current path down to 5 mA resolution<br>CT813x – omnipolar switch with low current consumption between 200 nA and 1,6 mA | Ambient light sensors with digital output<br>Ambient light sensors with proximity sensors | HAL39xy – real 3D sensor with internal strayfield compensation<br>HAC – hallsensor with integrated capacitors<br>HAR – hallsensor as dual-die version (redundancy) | Digital pyrosensor with I2C or UART interface<br>Current sensors for automotive | Grid-Eye generation 2 with better accuracy and detection distance<br>Foil cell with thickness 0.18 mm<br>Energy harvesting applications |

CROCUS TECHNOLOGY  EVERLIGHT  MICRONAS  NiCeRa  Panasonic

# Sensors



| Manufacturer | Audiowell | Nisshinbo | Micro Sensor | RFbeam | OmniPreSense |
|---|---|---|---|---|---|
| Radar | | ■ | | ■ | ■ |
| Ultrasonic | ■ | | | | |
| Pressure | | | ■ | | |

## Features

| | | | | | |
|---|---|---|---|---|---|
| Certifications | ISO 9001, ISO 45001, ISO 14001, QC 80000, CNAS, IATF 16949 | ISO 14001<br>IATF 16949 | ISO9001:2015, ISO14001, ISO18001 | ISO 9001 | AS9100D / ISO9001:2015 |
| General Information | Established in 1999, Audiowell Electronics is a leading provider of position, distance and speed sensor components and sensing solutions | Japanese manufacturer for analog and microwave components | Since the 1970s, Microsensor is engaged in the research and development of pressure microsensors and transmitters designed around piezoresistive measurement principles. | Swiss company<br>Specialist for consumer and special applications in the area of radar sensors<br>Development of HF applications | OmniPreSense provides short range radar sensors for traffic monitoring, drones, robotics, and IoT systems. |
| Applications | Smart Home<br>Smart Meter<br>Sercurity Systems<br>Medical | Movement Detector<br>Door Opener<br>People Counting | Process Control<br>Smart Manufacturing<br>Smart City<br>Precision Control<br>Specific Applications | Traffic Control<br>Door Opener<br>Movement Detector<br>Lighting Control<br>Speed Measurement | Traffic Monitoring (Vehicle, People)<br>Robotics<br>IoT Systems<br>Drones |
| Specifics | Ultrasonic rangefinder UM0034-002 | Detection of heart and breathing rate<br>Low power module<br>NJR4266F2A3 short range radar sensor for touchless applications | M20 M-series pressure transmitter for general industrial applications<br>MPM3801 digital pressure sensor with I²C/SPI interface<br>MPM280Au Pressure Sensor for hydrogen pressure measurement | Digital 3D radar | OPS243-C FMCW and doppler radar sensor with WiFi/Bluetooth interface |

AUDIOWELL SENSOR TECHNOLOGY NISSHINBO MICROSENSOR RFbeam OmniPreSense Sensing a Safer World

# Temperature Sensors / Thermistors



| Hersteller | Semitec | Tateyama | Tewa |
|---|---|---|---|
| NTC SMD | ■ | ■ | ■ |
| NTC Leaded | ■ | | ■ |
| PTC Leaded | | ■ | |
| NTC Film Type | ■ | | ■ |
| NTC Thermistor Probes | ■ | ■ | ■ |
| PTC Thermistor Probes | | | ■ |
| Assembled Sensors | ■ | ■ | ■ |

## Features

| | | | |
|---|---|---|---|
| Certificates | IATF 16949<br>ISO 9001<br>ISO 14001<br>ISO 13485 | IATF 16949<br>ISO 9001<br>ISO 14001 | ISO 9001<br>ATEX |
| General Information | Semiconducting ceramic resistors<br>Guaranteed long term stability of minimum 10 years<br>High precision thermistors featuring extremely small B-value tolerance and resistance<br>High quality with best price/performance ratio | Thick film thermistors based on $Al_2O_3$ substrate<br>Tateyama patented core material technology<br>Wide variety and customization of R/T curves<br>Guaranteed long-term stability of minimum 10 years<br>High quality with best price/performance ratio | Semiconductor based ceramic resistors<br>Most responsive and flexible temperature sensor supplier in Europe<br>Wide range of assembled NTC/PTC/PtRTD temperature probes<br>Custom sensors on demand<br>High quality with best price/performance ratio |
| Applications | Automotive<br>Battery Management<br>HVAC<br>Electro Domestics<br>Industrial<br>Metering<br>Medical | Automotive<br>Battery Management<br>HVAC<br>Electro Domestics<br>Industrial<br>Metering<br>Medical | Automotive<br>Battery Management<br>HVAC<br>Electro Domestics<br>Industrial<br>Metering<br>Medical |
| Specifics | Temperature sensors for e-mobility applications (HV/EV)<br>µ-pressure and temperature sensor for medical applications | Temperature sensor with a fast thermal response for e-motor (Coil & Hairpin) | Assembled temperature sensors up to IP68 for refrigerators and freezers |

# Displays / Embedded Systems






| Manufacturer | DLogic | Faytech | FS Elektronik Systeme | Logic Technologies |
|---|---|---|---|---|
| Touch PCs | ■ | ■ | | |
| Touch Monitors | ■ | ■ | | |
| Boxed Industrial PCs | | ■ | | |
| Embedded Boards | | | ■ | |
| TFT-Displays | | | | ■ |
| Monochrome LC-Displays | | | | ■ |
| Passive Matrix OLED-Displays | | | | |
| E-Paper | | | | |

## Features

| | | | | |
|---|---|---|---|---|
| Certifications | ISO9001, QS9000, ISO14000, ISO14001, OHSAS18000, UL, TUV, TS16949-1/2 | ISO9001<br>EN 60601-1 | ISO9001:2015<br>ISO13485:2016 | ISO9001, ISO13485, ISO/TS16949, ISO14001, QC-080000 |
| General Information | Headquarters in Switzerland, subsidiaries in Germany, Hongkong and China<br>Established: 2008<br>Key products: Premium touch PCs; touch monitors up to 42"<br>Deep in-house development<br>Linux software support with local FAE | Headquarters in Germany with subsidiaries in Hongkong, China, USA, India and Japan<br>Established: 2001<br>Key products: Touch PCs; touch monitors up to 84"<br>Global market leader in large size optical bonding<br>Microsoft Gold partner | Headquarters and production in Germany<br>Established: 1990<br>Key products: Embedded boards<br>Excellent hard- and software support<br>Longterm availability up to 15 years guaranteed | Headquarters in Hongkong, subsidiaries in China and USA<br>Established: 2008<br>Key products: TFT-displays with touch option; monochrome LC-modules<br>Deep in-house development<br>Partner for iSi30 / iSi50-TFT-display series |
| Applications | Industry, Marine, Medical | Industry, Telecommunication, Digital Signage | Medical, Industry, Building Automation | Industry, Medical, Marine |
| Specifics | Touch PCs 5.0" ... 12.1"<br>NXP i.MX6 based UltraLite/ DualCore processing units<br>NXP i.MX8 platform in development<br>Touch monitors with LVDS or HDMI interface 7.0" ... 42"<br>Aluminium, stainless steel and plastic housing<br>4mm safety glass cover lens (UL751 S46B)<br>HTML5-web-terminals with gigabit Ethernet<br>CODESYS TargetVisu option available<br>Customizations upon request<br>Development-kits available | Touch PCs 7.0" ... 55.0"<br>ARM boards with Allwinner V40 QuadCore and Rockchip RK3399 processing units<br>X86 boards with Intel® N3350/N4200 Dual-/Quad-Core as well as i3, i5 and i7 Kaby Lake processing units<br>Touch monitors 7.0" ... 21.5" / 32" ... 84"<br>Patented optical bonding process up to 104" diagonal<br>Broad standard portfolio available in small batches | armStone Single-Board-Computer (SBC), ARM Cortex™-A5/A9/A9r2<br>efus Computer-on-Module (COM), ARM-Cortex™-A7/A9<br>PicoCore (CoM), ARM Cortex™-A7 / A53<br>Operating systems: Windows, Linux<br>NXP i.MX6, i.MX7 and i.MX8 UltraLite/Single-/ Dual-/ Quad-Core processing units, Snapdragon QuadCore<br>Modules with WiFi/Bluetooth 5.0 and camera<br>Developmentkits available | endrich iSi30-displays with standard LVDS interface 7.0" ... 10.1"<br>endrich iSi50-displays with standard TTL-RGB interface 4.3" ... 7.0"<br>TFT-displays 2.4" ... 15.6"<br>Customized monochrome LC-modules<br>Customerspecific PCB and subassembly production |







| Manufacturer | Eagleeye Tech | Multi-Inno | Raystar | RiT | SGD |
|---|---|---|---|---|---|
| Touch PCs | | | | | |
| Touch Monitors | | | | | |
| Boxed Industrial PCs | | | | | |
| Embedded Boards | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| TFT-Displays | ■ | ■ | ■ | | ■ |
| Monochrome LC-Displays | ■ | ■ | ■ | | ■ |
| Passive Matrix OLED-Displays | | ■ | ■ | ■ | |
| E-Paper | ■ | | | | |

## Features

| | | | | | |
|---|---|---|---|---|---|
| Certifications | ISO9001<br>ISO14001 | ISO9001<br>ISO14001 | ISO9001<br>ISO14001 | ISO9001<br>ISO14001<br>ISO45001 | ISO9001<br>ISO14001<br>IATF46946 |
| General Information | Headquarters in Hong Kong with subsidiaries in China<br>Established: 2010<br>Key products: TFT-displays, OLED-displays, E-paperdisplays<br>On-cell/In-cell bonding process, optical bonding and full assembly<br>Touch panel full assembly | Headquarters in China with subsidiary in Hongkong<br>Established: 2005<br>Key products: TFT-displays with touch option<br>Broad portfolio of cost optimized modules<br>Specialist for industrial displays | Headquarters in Taiwan with subsidiaries in China<br>Established: 2007<br>Key products: passive matrix OLED-displays; TFT-displays; monochrome LC-modules<br>Own OLED-glass production<br>TFT-displays with innovative interfaces | Headquarters in Taiwan with subsidiaries in China<br>Established: 1997<br>Key products: passive matrix OLED-displays<br>Own OLED-glass production<br>Global market leader for passive matrix OLED-displays | Headquarters in Taiwan with subsidiaries in Hongkong and China<br>Established: 1989<br>Key products: TFT-displays with touch option; monochrome LC-modules<br>Focused on extended requirements for material and lifetime of TFT-displays |
| Applications | Industry, Telecommunication, White Goods, Building Automation | Industry, Telecommunication, White Goods, Building Automation | Industry, Telecommunication, Medical | Wearables, Medical, Consumer, White Goods | Industry, Telecommunication, White Goods, Medical |
| Specifics | endrich iSi30+-Displays with standard MIPI and LVDS interface 7.0"<br>TFT-Displays 1.3" ... 24.5"<br>E-paper-displays 1.54" ... 8.0"<br>Customizations of cover lens, backlight and interfaces<br>Monochrome LC-modules | TFT-displays 1.45" ... 10.4"<br>Special resolutions and sizes upon request<br>PCAP touch sensors 2.8" ... 10.4"<br>Customizations of cover lens, backlight and interfaces<br>Monochrome LC-modules<br>Passive matrix OLED-displays | Passive matrix OLED-displays 0.49" ... 5.5"<br>TFT-displays with HDMI and RaspberryPi interface 5.0" ...10.1"<br>TFT-displays with 36-pin MCU interface 3.5" ... 10.2"<br>TFT-displays with PIC24-controller 3.5" ... 5.7"<br>Monochrome STN/FSTN LC-modules, alphanumeric and graphic | Passive matrix OLED-displays 0.42" ... 3.2"<br>Full-color OLED-displays 0.96" ... 1.8"<br>OLED-displays with special shapes and materials upon request | TFT-displays 1.44" ... 21.5"<br>Minimum backlight lifetime up to 50k hours<br>Extended operating temperature -30°C ... +85°C<br>Super high brightness up to 1.600 cd/m²<br>Touch sensors for almost all displays<br>Customized monochrome LC-modules |

# Quartz / Oscillators / Filters



| Manufacturer | | Citizen | Maruwa | SMI |
|---|---|---|---|---|
| Quartz Crystals | MHz | ■ | | ■ |
| Clock Crystals | kHz | ■ | | ■ |
| Oscillators | | ■ | ■ | ■ |
| MCF Filter | | | | ■ |
| SAW Filter | | | | ■ |
| Dielectric Filters | | | ■ | |

## Features

| | | | |
|---|---|---|---|
| Certificates | ISO 9001 | ISO 9001 | ISO 9001 |
| General Information | Through-hole and SMD tuning fork crystals<br>Smallest size: 1.6 x 1.0 mm<br>Tight tolerances: up to ± 5 ppm<br>Extended temperature range: - 40 ... + 85 °C (+125 °C) | Compact, high performance sub miniature VCOs and LTCC<br>Operating frequency: 1 MHz ... 5 GHz<br>Through-hole and SMD<br>Small size: up to 3.2 x 4.5 mm<br>Excellent tolerance over temperature range<br>Custom made products | Crystals, clock OSC, TCXO, VCXO, MCF<br>Frequencies: 16 kHz ... 300 MHz<br>Wide range SMD and through-hole packages<br>LVPECL, LVDS oscillators<br>Tight tolerances and excellent temperature stability<br>Package down to 1.2 x 1.0 mm<br>RTC (real time clock) |
| Applications | Smart Metering<br>GPS<br>Home Automation<br>BTM/IoT<br>Industrial Controls<br>Token<br>Wrist Watch<br>RFID | RF Audio<br>Wireless Microphone<br>Industrial RF Control<br>Base Station<br>Wi-Fi | Industry Electronics<br>Medical Equipment<br>Computer Gaming<br>Reference Clock<br>TV / Audio<br>RFID |
| Specifics | Low ESR SMD tuning fork 3.2 x 1.5 mm<br>SMD tuning fork 3.2 x 1.5 mm with parallelcontacts (better EMI performance)<br>SMD 1.6 x 1.0 mm tuning fork<br>SMD tuning fork 3.2 x 1.5 mm with tolerance of ±50 ppm incl. stability over temp. range CM315G) | Smallest size VCO<br>Base station: Wireless microphone transceiver | SMD oscillator 32.768 kHz with extremely low current consumption<br>High stability VC-TCXO, meets STRATUM3 TCXO with ±0.5 ppm tolerance<br>HF-CMOS oscillator 55 ... 160 MHz with excellent temperature stability<br>LVDS and LVPECL osc. |

CITIZEN MARUWA SMI




| Manufacturer | | Chequers | SiTime | TST |
|---|---|---|---|---|
| Quartz Crystals | MHz | ■ | | ■ |
| Clock Crystals | kHz | ■ | | ■ |
| Ceramic Resonators | | ■ | | |
| Oscillators | | ■ | ■ | ■ |
| MCF Filter | | ■ | | ■ |
| SAW Filter | | ■ | | ■ |
| Dielectric Filters | | ■ | | ■ |
| Ceramic Filters | | ■ | | |

## Features

| | | | |
|---|---|---|---|
| Certificates | IATF 16949 | IATF 16949<br>AEC-Q100 | IATF 16949:2016<br>AEC-Q200 / AEC-Q100 |
| General Information | Ceramic resonators:<br>1 ... 60 MHz, 2.5 x 2.0 mm or smaller<br>Temp.: - 40 °C ... + 8 °C<br>Ceramic filters:<br>e.g. 455 kHz / 10.7 MHz / 27 / 45 MHz<br>Dielectric filters:<br>433 MHz ... 5 GHz<br>Temp: - 40 ... + 85 °C<br>Quartz:<br>up to 200 MHz, 1.6 x 1.2 mm,<br>Temp.: - 40 ... + 125 °C<br>Oscillators:<br>up to 200 MHz, 2.5 x 2.0 mm,<br>Temp.: - 40 ... + 125 °C | MEMS-based silicon timing solutions from 1 Hz ... 900 MHz<br>Low power, ultra-performance oscillators<br>Differential and high-temp. oscillators, Automotive<br>Extended temperature:<br>- 55 ... 125 °C<br>Clock generators, VCXO, DCXO & VCTCXO<br>(Stratum 3) / OCXO<br>Spread spectrum and field prog. oscillators<br>Size down to 1.5 x 0.8 CSP or SOT23 | SAW & BAW filters:<br>200 MHz ... 3 GHz<br>IF filter:<br>33 MHz ... 900 MHz<br>Extended temp. range:<br>-40 °C ... 125 °C<br>Dielectric and Notch filter<br>Duplexer and Diplexer<br>Quartz and quartz-osc.<br>for automotive use<br>Extended temperature:<br>- 40 ... + 125 °C<br>Standard and customized size:<br>1.6 x 1.0 mm |
| Applications | Industry Electronics<br>Consumers<br>RF Modules<br>Lighting<br>White Goods | Automotive, Electric Vehicles<br>Ethernet, DDR and PCI Applications<br>Industrial controls<br>Medical<br>Wireless & Backhaul<br>Fiber Optic, DSL | Vehicle Electronics, Digital Radio<br>Cellular (GSM, LTE)<br>GNSS, RF Modules<br>Wi-Fi & Bluetooth®<br>V2X Application |
| Specifics | Smallest 2.0 mm x 1.6 mm ceramic resonator for 20 ... 60 MHz<br>SMD quartz down to 1.6 x 1.2 mm<br>IF filter e.g 10.7 m 450/455 kHz | Elite Platform™ Super-TCXOs are tight stability (±0.1 ppm to ±2.5 ppm), replace legacy quartz OCXOs in emerging 5G and IEEE 1588 synchronization applications while reducing power consumption and size<br>SiTime's automotive (AEC-Q100) deliver ±20 ppm frequency stability from -55 °C to 125 °C<br>SiTime's EMI reduction oscillators (spread spectrum) ensure emissions compliance<br>through spread spectrum clocking<br>OCXO (±0.005 ~ 0.008 ppm) | FEM (Front End Module, Filter + LNA) for GNSS and WiFi<br>Dual filter für RKE application<br>Miniature VC-TCXO and TCXO<br>Narrow band BAW, TC-SAW, SAW filters for mobile phone, IoT, GNSS<br>LTE filter for world wide used bands |

Chequers Electronic (China) Limited

SiTime

TST

# RF Modules / Antennas




| Manufacturer | Aurel | Fibocom | Panasonic | Feasycom |
|---|---|---|---|---|
| RF-Modules (315 MHz ... 2.4 GHz) | ■ | | | |
| Bluetooth® | | | ■ | ■ |
| WiFi™ | | | ■ | ■ |
| GSM/GPRS/EDGE | | ■ | | |
| UMTS | | ■ | | |
| LTE | | ■ | | |
| LPWA (Cat NB1/NB2, Cat M1) | | ■ | | |
| 5G | | ■ | | |
| LoRa™ Transceiver | ■ | | | |

## Features

| | | | | |
|---|---|---|---|---|
| Certificates | ISO 9001 | ISO 9001, ISO 14001 | ISO 9001, ISO 14001 | ISO 9001, ISO 14001, IATF 16949 |
| General Information | Radio modules for ISM bands 315, 433.92, 868, 915 MHz and 2.4 GHz<br>Products conform to valid European standards (RED)<br>Transmitters, receivers, transceivers and handheld transmitters AM & FM<br>Transceiver/transmitter with antennas<br>Receivers with extremely low power consumption for use in battery powered systems<br>Customized developments and production Electronics with radio | 2G/3G/4G/5G cellular modules<br>LTE-Cat NB1/2/LTE-Cat M1 modules<br>SoC (System on Chip) modules<br>LGA, M.2 or MiniPCIe form factor<br>Backward compatible global and regional modules<br>Qualcomm, MediaTek & Intel based modules | Bluetooth® 4.2/5.0/5.1 Low Energy Module<br>Supports IEEE® 802.15.4<br>Combo WiFi™ 2.4 GHz and 5 GHz<br>802.11 a/b/g/n/ac + Bluetooth® 5.0 (BR, DER, LE) Modules<br>Modules with integrated antenna or U.FL Connector<br>Solderable modules<br>Industrial modules with extended temperature range | Bluetooth® 4.2/5.0/5.1/5.2 Low Energy Module<br>Supports IEEE® 802.15.4<br>Combo WiFi™ 2.4 GHz and 5 GHz<br>802.11 a/b/g/n/ac + Bluetooth® 5.2 (BR, DER, LE) Modules<br>Modules with integrated antenna or U.FL connector<br>Solderable modules<br>Industrial modules with extended temperature range |
| Applications | Door / gate opener access systems<br>Home alarm systems / smoke detectors<br>Home automation<br>Measuring and dosing systems<br>Telemetry / radio control<br>IoT applications<br>Long Range Communication | Remote control / Maintenance<br>E-Call / Emergency call systems<br>Smart Home<br>Smart Metering<br>Smart City<br>Security monitoring<br>POS/cash register systems | Diagnostic and maintenance systems<br>Industrial IoT<br>Telemetry / radio control<br>Smart Home / Home Automation<br>Medical Healthcare<br>Sensor Applications | Consumer products<br>Industrial IoT<br>Telemetry / radio control<br>Smart Home / Home automation<br>Smart City<br>Sensor Applications |
| Specifics | **Long Range Transceiver for ranges up to 12 km**<br>SMD Transceiver 868 MHz<br>Rain sensor for applications in weather stations Rolling code handheld transmitter in<br>different variants | **5G MBB (Mobile Broadband) and mMTC (Massive Machine Type Communication) modules**<br>- LGA and M.2 form factor<br>- GNSS support<br>- BT / WiFi scan (5G MBB)<br>- LPWAN technology LTE-M/NB-IoT (mMTC) | **PAN1781 – Bluetooth® 5.1, IEEE® 802.15.4**<br>Supports Bluetooth direction finding AoA & AoD<br>**PAN9520 – Dual band 2.4 GHz and 5 GHz**<br>802.11 a/b/g/n/ac Wi-Fi + Bluetooth combo module | **FSC-BT690** Nano Sized Bluetooth 5.1 Module 5.4 x 5.8 x 1.2 mm<br>**FSC-BW126** 2.4G&5G Wi-Fi 6 and Bluetooth 5.2 Combo Module<br>**FSC-BT986** SPP BLE Bluetooth 5.2 UART Module |




| Manufacturer | 2J antennas | Locosys | Inpaq |
|---|---|---|---|
| GPS/GNSS Receiver Modules | | ■ | |
| GPS/GNSS Smart Antenna Modules | | ■ | |
| Antennas f. ISM Band, Bluetooth®/WiFi™ | ■ | | ■ |
| Antennas f. GPS/GNSS | ■ | | ■ |
| Antennas f. Cellular | ■ | | ■ |
| Antennas f. Car2Car Communication | | | ■ |
| Antennas f. NFC (Near Field Communication) | | | ■ |
| WPC (Wireless Power Charging) | | | ■ |

## Features

| | | | |
|---|---|---|---|
| Certificates | IATF 16949, ISO 9001, ISO 14001 | IATF 16949, ISO 9001, ISO 16750, ISO 26262 | IATF 16949, ISO 9001, ISO 14001, QS 9000 |
| General Information | High product variety: PCB and flexible foil antennas, SMD/SMT antennas, omnidirectional antennas and patch antennas<br>Standard and customized internal and external antennas with high efficiency for Cellular, GNSS, Bluetooth®/WiFi™ and ISM band<br>Multi-band antennas<br>Customized cables and connectors<br>Custom colors of enclosures – logo printing possible<br>Antennas certified according to IP67, IP69K, IK09 | GNSS (GPS/GLONASS/BeiDou/Galileo) modules and GNSS-mouse<br>GNSS RTD/RTK modules<br>GNSS antenna modules<br>ADR & UDR solutions<br>RTK solutions<br>Products comply with AEC Q100 | High product variety: patch antennas, chip antennas, active antennas, dipole antennas, SMT antennas, LCT/LDS, NFC and WPC solutions<br>Customized patch antennas with high gain for GPS, GLONASS, Galileo, BeiDou, SDARS, DAB, etc.<br>Patch antennas with small sizes (to 6 x 6 mm) and low profiles (to 2 mm)<br>Chip antennas for GNSS,cellular, Bluetooth®/WiFi™ and ISM band<br>Multi-band antennas<br>Customized solutions for WPC and NFC<br>LDS (Laser Direct Structure) solutions |
| Applications | Tracking / Tracing<br>Telematics / Navigation<br>Automation<br>M2M<br>Telecommunications<br>Smart City<br>Smart Home<br>Marine Applications | Tracking / Tracing<br>Telematics / Navigation<br>Car Infotainment<br>E-Call<br>Autonomous Driving<br>Precision Agriculture<br>Offshore / Marine Applications<br>AGV Robotics | Tracking / Tracing<br>Telematics / Navigation<br>Car Infotainment<br>V2X / V2V Communication<br>Wireless Charging Applications<br>Keyless Systems<br>E-Call<br>Autonomous Driving |
| Specifics | **5G NR antennas**<br>High-performance antennas for 5G networks<br>Ground plane independent and dependent antennas for internal and external use<br>Antenna solutions up to 4 x 5G NR MIMO | **High-precision GNSS RTK solutions**<br>for centimeter navigation – from modules to base stations<br>RTK-1010 as GNSS-RTK module solution<br>RTK-4057 as GNSS-RTK board solution<br>RTK-Mx00 as a system solution suitable (rover or base station) | **L1/L2/L5/L6 antenna series**<br>Stacked patch antennas with/without housing for the high accuracy navigation system with centimeter-level<br>Narrow band and wideband antennas<br>2 pin or 4 pin solutions |

# Analog ICs









| Manufacturer | Azoteq | Holtek | MPS | Nisshinbo | SG Micro Corp |
|---|---|---|---|---|---|
| Analog Switches | | | ■ | ■ | |
| Audio ICs | | ■ | ■ | ■ | |
| Communication ICs | | ■ | | ■ | |
| Display Drivers | | ■ | | ■ | |
| GaAs MMICs | | | | ■ | |
| LED Drivers | | ■ | ■ | ■ | |
| Microcontroller | | ■ | | | |
| Motor ICs | | ■ | ■ | ■ | ■ |
| Operational Amplifiers | | ■ | ■ | ■ | ■ |
| Power Supply ICs | | ■ | ■ | ■ | ■ |
| Video ICs | | ■ | | ■ | ■ |
| Logik IC | | | | | ■ |
| Touch & Multisensor IC | ■ | ■ | | | |

## Features

| | | | | | |
|---|---|---|---|---|---|
| Certificates | ISO 9001 / 14001 | ISO 9001<br>ISO 14001 | ISO 9001 / 14001<br>IATF 16949 | ISO 9001 / 14001<br>IATF 16949 | ISO 9001 / 14001 |
| General Information | Azoteq is a South Afrika based company focussedon multi-sensor, single chip solution and LED power control device.<br>The latest generations of sensors combine up to 6 different sensors in one IC, such as touch, proxy, inductive, Hall, ALS and temperature sensors. | Taiwanese company with product development focus in the area of microcontrollers and their peripheral products.<br>The microcontroller range includes fully integrated digital and analog functions such as A/D converters, LCD drivers, PWM generators, high current LED drivers, touch switches, SPI/I2C interfaces, USB drivers, voice functions, RF functions, Telecom functions etc. Microcontroller devices meet with full industry specifications, and are as OTP and flash type available | Monolithic Power Systems (MPS) is a USA based high performance analog<br>semiconductor company<br>DC/DC converter ICs, LED driver ICs, Class D audio amplifier ICs that are wellsuited for small form factors<br>Linear ICs including<br>operational and current sense amplifiers<br>Battery chargers and protection devices<br>Power over Ethernet (PoE) Motor ICs | Nisshinbo Micro Devices Inc. is a Japanese company with its development focus in analog ICs<br>Leading company for operational amplifiers (OPA) and LDO<br>Beside this Nisshinbo Micro Devices Inc. offers a large diversity of ICs for communication, automotive, industrial and RF applications<br>For automotive applications, special parts can be provided with AEC-Q qualification | SG Micro Corp is specialized in high performance, high quality analog IC design, marketing and sales.<br>Experts for analog IC design with more than 20 years of experience in IC design, layout, process, assembly, test and quality control.<br>Assurance of performance and quality of the products<br>Leading supplier of analog ICs |
| Applications | Industrial and Communication Market<br>White Goods<br>Entertainment<br>Medical | Industrial and Communication Market<br>White Goods<br>Entertainment | Sensors, TV, White Goods, Rooter, Navigation Systems, Mobile Applications, Automotive, General Lighting, Industrial Applications | Sensors, Head Sets, Automotive, Entertainment Equipment, TV, White Goods, PLC, Navigation Systems, Mobile Phones, RF-Applications, GPS | Industrial and Communication Market<br>White Goods<br>Entertainment<br>Medical |
| Specifics | ProxFusion® | 32-Bit MCU<br>PIR sensor | Mini module<br>Motordriver IC with intergreted Hall sensor | Special high- and low-side switches for sensors, high power OPA, GPS front-end-module | Levelshifter |

Azoteq HOLTEK MPS NISSHINBO SGMICRO

# Memory ICs












| Manufacturer | Alliance | ESMT | Fidelix | GigaDevice |
|---|---|---|---|---|
| SRAM/pSRAM | ■ | | ■ | |
| SDRAM/DDR/DDR2/DDR3/ DDR4 | ■ | ■ | ■ | |
| Flash | ■ | ■ | ■ | ■ |
| MCP | | ■ | ■ | |
| Audio IC | | ■ | | |
| Microcontroller | | | | ■ |
| Power Supply ICs | | ■ | | |

## Features

| | | | | |
|---|---|---|---|---|
| Certificates | ISO 9001<br>ISO 14001 | ISO 9001<br>ISO 14001 | ISO 9001<br>ISO 14001 | ISO 9001<br>ISO 14001 |
| General Information | Alliance Memory Inc. is an American company manufacturing discontinued components to provide durable industrial and communications applications to support.<br>Product extension to SDRAM and DDR1/2/3/4 and parallel flash | Elite Semiconductor Memory Technology Inc. („ESMT"), is a Taiwanese IC design house.<br>Wide range of memory densities (1 Mb – 8 Gb) and various DRAM products (SDRAM, DDR, mobile SD/DDR1 to DDR4)<br>16 Mb – 4 Gb<br>Selection of NOR and NAND flash 1 Mb – 8 Gb | Korean company without own production. Development of efficient and cost-effective storage solutions.<br>PSRAMs 4 Mb - 32 Mb, Low power SDRAMs, Low power DDR1/2/3, SDRAMs 32 Mb – 2 Gb and memory for mobile applications | GigaDevice stands for advanced memory technology and microcontroller in China.<br>No own production.<br>Large product range of NOR flash and NAND flash<br>The 32Bit MCU extends the product portfolio. |
| Applications | Industrial and Communication Market | PCs, Servers and Workstations<br>PC Peripherals, Industrial Products, Consumer Products, Communication Devices | Low Power and Fast Speed<br>Memory solutions for mobile communication and point-to-point applications | Industrial<br>Medical and Consumer Area |
| Specifics | Psram: 8 Mb – 128 Mb<br>8 Gb DDR3<br>2 Gb DDR2<br>4 Gb DDR4<br>1 Gb-16 Mb Parallel NOR flash | 8 Gb DDR3<br>4 Gb DDR4<br>SPI NAND Flash:<br>1 Gb – 4 Gb<br>Parallel NAND flash:<br>1 Gb – 8 Gb | SPI Nand flash:<br>1 Gb – 8 G | 1 Gb NAND parallel<br>1 Gb – 4 Gb NAND SPI<br>Microcontroller Cortex M23 and Risc-V |

ALLIANCE MEMORY ESMT FIDELIX GigaDevice

# Protection Devices




| Manufacturer | | cosmo | CT Micro | ECE | Semitec |
|---|---|---|---|---|---|
| Overcurrent | PPTC | | | ■ | |
| | Power Thermistor | | | | ■ |
| | CRD | | | | ■ |
| Coupler/SSR | Opto Coupler | ■ | ■ | | |
| | MOS Relay | ■ | ■ | ■ | |
| | Solid State Relay | ■ | | ■ | |

## Features

| | | | | |
|---|---|---|---|---|
| Certificates | ISO 9001<br>ISO 14001 | ISO 9001<br>ISO 14001<br>IATF16969 | ISO 9001<br>ISO 14001<br>IATF16969 | ISO 9001<br>ISO 14001 |
| General Information | DIL, SMD, mini-flat (SOP), LSOP and SSOP-housing<br>Single- and multi-channel<br>CTR 50 ... 2000%<br>High-speed coupler up to 10 MBit<br>Isolating voltage up to 5 KV<br>UL, VDE and TÜV approved | DFN, DIL, SMD, mini-flat (SOP), LSOP, SSOP and new wide body-housing<br>Single- and multi-channel<br>CTR 50 ... 15000%<br>High-speed coupler up to 10 MBit<br>Isolating voltage up to 5 KV<br>UL, VDE and TUV approved | DIL, SMD and mini-flat (SOP) housing<br>Load current: 130 mA ... 40 A<br>Load voltage: 60 ... 800 V<br>On-resistance: 0.83 ... 28 Ohm<br>Isolation voltage: up to 5 KV<br>Trigger current: 10 ... 25 mA<br>UL and TÜV approved | Unique current regulative characteristic<br>Pinch off currents from 0.1 ... 22 mA<br>Voltages up to 100 V<br>High dynamic impedance<br>Low temperature drift |
| Applications | Power Supply<br>Home Appliances<br>Industrial<br>Telecommunication<br>Network<br>Point of Sales<br>Testing Instruments | Power Supply<br>Home Appliances<br>Industrial<br>Telecommunication<br>Network<br>Point of Sales<br>Testing Instruments | Power Supply<br>Home Appliances<br>Industrial<br>Telecommunication<br>Network<br>Point of Sales<br>Testing Instruments | PLC (Programmable Logic Controller)<br>Sensor Applications<br>LED Control Circuits |
| Specifics | | CTP17 – smallest and flat-test optocoupler worldwide<br>CT816L low input current phototransistor optocou-pler with higher operating temperature of 110 °C<br>CTH214 & CTH217 – new 4-pin half pitch mini-flat phototransistor optocoupler | High current MOS relays including the EPR311A038005 with a continuous peak load current of 6A | CRD S-223T ... 22 mA and 500 mW rated current<br>regulative diode in compact SOD-123FL package |




| Manufacturer | | Eris | Protek | Inpaq | SFI |
|---|---|---|---|---|---|
| Overvoltage Protection | TVS-Diode/Array | ■ | ■ | | |
| | Multilayer Varistor | | | ■ | ■ |
| | CSPD | | | | ■ |
| | ESD Suppressor | | | ■ | |
| | Protection Thyristor | | ■ | | |
| | Protection Module | | ■ | | |

## Features

| | | | | |
|---|---|---|---|---|
| Certificates | ISO 9001 / 14001<br>IATF 16949<br>AEC-Q101 (partly) | ISO 9001<br>AEC-Q101 (partly)<br>IATF 16949 (partly) | ISO 9001 / 14001<br>IATF 16949<br>AEC-Q200 | ISO 9001 / 14001<br>IATF 16949<br>AEC-Q200 (Teilbereiche) |
| General Information | Eris Technology Corporation, is a Taiwanese ODM providing a variety of support services to design, manufacturing and aftermarketing services for diode products.<br>Eris business scope comprises Schottky diodes, TVS diodes, Zener diodes, bridge diodes, wafers, and much more. | Size: SMD 0201, modules and throughhole options<br>Uni- and bi-directional<br>Voltage: 1 ... 440 V<br>High surge capability up to 2.2 MW<br>Ultra low capacitances down to 0.15 pF<br>High ESD handling ability (>30 kV Contact/Air)<br>No ageing | Sizes: 0201 ... 1812<br>Voltage: 4 ... 42 VAC<br>Extremely quick response time (< 1 ns)<br>Extremely low capacitance (0.2 pF)<br>Extremely low leakage current<br>Zero signal distortion | Sizes: 0201 to 6420<br>Voltage: 3.3 to 385 VDC<br>Up to 5.5 kA (8/20 µs)<br>Special parts with 0.05 pF for RF-applications<br>High ESD handling ability (ESD types >30 kV)<br>CSPDs with superior high surge and high voltage protection capability |
| Applications | Automotive<br>Telecommunication<br>Consumer<br>Computer + IT<br>Industrial Electronics | Automotive<br>Industrial<br>Telecommunication<br>Networking<br>Medical<br>Test + Measurement<br>Security<br>Point of Sales | Automotive<br>RF Modules<br>Antenna Circuits<br>HDMI + USB<br>Handheld Devices<br>Set-top Boxes | Telecom + Networking:<br>Ethernet<br>Access Points<br>IP Cameras<br>Base Stations<br>Security Systems<br>Power Line Modems |
| Specifics | New CRD series in SMA & SMB package | SM3/5/10KW series – super flat DFN 2 package, high power surge protection<br>AEC-Q101 qualified<br>PAM8S series, pulse 5A/5B load dump suppression<br>DFN8-36-T73 for I/O link protection | ESD Guard™ in miniature size 0201<br>AEC-Q200 specified<br>MLVS AM & EGA AM series for automotive applications | SHV series, high voltage protection up to 385 V DC, from 1210 up to 3220<br>SHA series, load dump protection up to 80 joule<br>From 1210 up to 3220 |

# Thermal Management



| Manufacturer | ADDA | Sinwan | Ecofit | Fulltech | Minebea | QianYuang | Thoptec |
|---|---|---|---|---|---|---|---|
| Fan | ■ | ■ | ■ | ■ | ■ | | |
| Heatsink | ■ | | | | | | |
| Fan Accessories | | | | | | ■ | ■ |
| Customized Complete Systems | ■ | ■ | | | | | |

## Features

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Certificates | IECQ QC080000, ISO14064, ISO14001, ISO/IATF 16949, OHSAS18001, ISO9001 | ISO9001 EN60529 | ISO 9001 | ISO9001 | ISO 9001 ISO 14001 | ISO9001 | ISO9001 |
| General Information | Adda, one of the largest major cooling fan manufacturers worldwide, was established in 1978, and has been specialized in cooling fans and modules. Adda provides intensive service and technical cooperation to the clients for more than 40 years. | Sinwan was founded in Taiwan in 1976. Design, production & assembly Hundreds of product combinations including: AC/DC axial, EC fans, all-metal, centrifugal and tangential fans, blower, motors, dust-proof / splash-proof, all IP protection classes | Ecofit was founded 1976 in Vendôme (Frankreich) and belongs since 1994 to the Rosenberg group. From standard products to made-to-measure developments, Ecofit has been offering all customers an invaluable expertise based on more than 40 years know-how. | Fulltech is one of the professional AC cooling fan manufacturers based in Taiwan and has been selling fans worldwide since 1990. Fulltech commits themselves to fan's design, development and manufacturing. | NMB was founded in 1951 in Tokyo. With 60% market share for ball bearings and extension in the product range, NMB is one of the global players worldwide. | Qianyuan was founded in 2003 The main products are such as wire form fan guards for cooling systems, grills, net racks for white goods (roaster, oven, etc.). | The Thoptec Entwicklungs & Vertriebs GmbH is not only a manufacturer of fasteners for electronic components, but also supports its customers with special solutions from product planning and construction to series production. |
| Applications | White Goods<br>Cooling Technology (Automotive)<br>Pico Projectors<br>Drones<br>Industrial PC<br>Appliance<br>Industrial Automation<br>Medical Technology<br>IT & Telecom etc. | Medical<br>Industrial Drive Technology<br>Air Purification<br>Industrial Trucks<br>Food Industry<br>Home Appliances | Residential Ventilation<br>Heating<br>Railway<br>Professional Dryers<br>Filtration<br>Refrigeration<br>Wind Energy Industry<br>Thermal Management of Electrical Cabinets<br>HVAC (Heating, Ventilation, Air Conditioning) | Photography Lighting Device<br>Control Panels<br>Stage Lights<br>Refrigerators<br>Freezers<br>LED Display Cooling<br>Heat Exchangers<br>Fog Machines<br>Electricity Control<br>Elevators<br>Photovoltaic Industry<br>Medical Equipment | Air Conditioning and Ventilation Industry<br>Agricultural Industry<br>Industrial Technology<br>Heating and Burner Technology<br>Household Appliances<br>Compressors<br>Railway Technology<br>Food Industry<br>Medical Technology<br>Personal Protection etc. | | |
| Specifics | | IPRating + 30 days (GR-487) Salt spray certified fan (EN60529) | 125D-A ETRI fans (higher airflow, w/o noise level increase; wider power range; 0 ... 10 V or PWM) | EC fans<br>Cross flow fan with right sided motor | | | |

# Electromechanics



| Manufacturer | Diptronics | ECE | knitter-switch | win |
|---|---|---|---|---|
| Tactile Switches | ■ | | ■ | |
| Push-Button Switches | ■ | | ■ | |
| Micro Switches | ■ | ■ | ■ | |
| Silicone Keypads & Membrane Keyboards | | | ■ | ■ |
| Relays | | ■ | | |
| Tilt Switches | | ■ | ■ | |
| DIP-/Piano Switches | ■ | ■ | | |
| Rotary DIP Switches | ■ | ■ | ■ | |
| Slide Switches | ■ | ■ | ■ | |
| Industiral Control Switches | ■ | ■ | | |
| Detector-/Manipulation Switches | | ■ | ■ | |

## Features

| | | | | |
|---|---|---|---|---|
| Certificates | IATF 16949, ISO 9001, ISO 14001 | ISO 9001, ISO 14001, IATF 16949, OHSAS18001 | ISO 9001/ISO 14001 | ISO 9001/ISO 14001 TS 16949 |
| General Information | Diptronics Manufacturing Inc., founded in 1985, specializing in tactile switches and DIP/ rotary DIP switches manufacturing. Complete production lines, in six large production facilities, enable a timely delivery of highest quality. Strength: integration of core competence, complete in-house manufacturing, in-house engineering team, in-house LED switch assembly line, support in production and design, flexible delivery. | In 1981, the Excel Cell Electronic Co., Ltd. was founded. While button cells were the original pillar, ECE has meanwhile expanded its portfolio with a wide range of switches, plugs and small stamping parts. ECE is characterized through vertical integration, production capability, strict quality assurance and in-house development. | Since its founding in 1966 knitter-switch has remained at the forefront of switch technology.<br>The large selection of switches, supplemented by keyboards, is constantly being expanded using the latest technologies and materials, and shortest delivery times are achieved. The focus is on quality and service (support for customized solutions and in the design process). | Win Industry Company was founded in 1978 in Taipei as an original supplier of silicone rubberproducts. Meanwhile, Win producesat two locations on a total areaof approx. 90,000 m² and has steadily expanded its product range. In the meantime, toolingand mold making as well as the finishing treatment such as screen printing, spraying, laser etching takes places in-house. |
| Applications | 3C Industry / IT Industry<br>Medical Devices<br>Cloud Devices<br>Industrial Control Field<br>Automobile Industry<br>White Goods<br>Automatic Home Appliances<br>Security<br>Smart Wearables etc. | Industrial Control<br>Instrument Equipment<br>Security Systems<br>Consumer Electronics<br>Household Appliance<br>Power Energy Industry<br>Optoelectronic Industry<br>Automotive Electronic Industry<br>Computer and Peripherals<br>Network & Communication etc. | Home Appliances<br>Building Automation<br>Industry<br>Mechanical Engineering<br>Automotive Applications<br>HVAC<br>Medical Technology<br>Safety Technology<br>Ground Conveyor etc. | Human Machine Interface (HMI)<br>Home Appliances<br>Building Automation<br>Industry<br>Mechanical Engineering<br>Automotive Applications<br>HVAC<br>Medical Technology<br>Safety Technology<br>Ground Conveyor etc. |
| Specifics | Diptronics continues to focus on the switch business, but is constantly developing new technologies (smartphone, automotive and illuminated switches) to meet rapidly changing market demands. | | ICE series (Industrial Control Switches which are compliant to all relevant safety standards) | |

DIPTRONICS ECE knitter-switch win

# LED



| Manufacturer | | Citizen | Everlight | Harvatek | Dominant | osa opto light | Audax | Ledil | Crystal IS |
|---|---|---|---|---|---|---|---|---|---|
| Low Power LEDs | SMD | ■ | ■ | ■ | ■ | ■ | | | |
| | THT | | ■ | ■ | ■ | ■ | | | |
| | 7-Segment Displays | | ■ | ■ | | | | | |
| High Power LEDs | SMD | | ■ | | | | | | ■ |
| | COB | ■ | | | | | | | |
| Modules | | ■ | | | | | ■ | | |
| Optics | | | | | | | | ■ | |
| Light Engines | | | | | | | ■ | | |

## Features

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Certifications | ISO 9001<br>ISO 14001 | ISO 9001<br>ISO 14001 | ISO 9001<br>IATF 16949<br>ISO 14001 | ISO 9001<br>ISO 14001<br>IATF 16949 | ISO 9001 | ISO 9001 | ISO 9001 | ISO 9001 |
| General Information | COB and SMD LEDs for general lighting, horticulture and industry with superior performance, efficiency and reliability. | Leading global optoelectronics manufacturer of low and high power VISIBLE LEDs, SMD and Thru-Hole LEDs, digital displays, INFRARED emitters, optical sensors, fiber optic and optocoupler components. | As one of the world leaders in SMD LED technology, Harvatek is proficient in the design and manufacture of SMD LEDs and offers excellent solutions for backlighting, displays and keyboard illumination. | Wide variety of automotive certified LEDs in different colors and package sizes. All automotive certifications available.<br>Automotive interior and exterior lighting status LED. | OSA OPTO designs and manufactures special, custom and standard High Brightness & High Power LED chips, SMD LEDs. | Audax Electronics was founded in 2012 and has focused on the development of LED light engines. The product portfolio is continuously expanded with state-of-the-art LED solutions. | As an undisputed leader in the field of LED optics, LEDiL strongly believes in light that is right for increased well-being and safety, optimised functionality and improved sustainability with energy efficiency | Crystal IS' product line leverages the unique properties of Aluminum Nitride to provide superior UVC LED products |
| Applications | Spot Light<br>Down Light<br>High Bay<br>Street Light<br>Flood Light<br>Horticulture<br>UV Module | LED lighting<br>UV<br>Status LED for industry<br>Horticulture | LED lighting<br>UV<br>Status LED for industry | Industry<br>Status<br>Automotive | LED Lighting<br>UV<br>Customized LED | LED lighting<br>UV<br>Horticulture<br>Customized LED Modules | Interior lighting<br>Outdoor lighting<br>UV<br>Horticulture<br>Street and traffic lighting | Water Treatment<br>Surface Treatment<br>Air Treatment |
| Specifics | COB Gen 9<br>COB HI Intensity<br>GEN 4<br>UV Module<br>RGB SMD LED | Deep RED High Power and Royal Blue Horticulture LED<br>2835 Standard & High Efficiency<br>Signage RGB LED<br>4 in 1 RGBW | IC RGB | SpicePlus Color / RGB<br>Sideway LED<br>Smart Embedded Digital Driver LED | LED for hyperspectral imaging and metrology | LED Boards<br>UV Boards<br>Horticulture<br>LED Boards<br>RGB/W LED Boards | New series DAISY, STRADELLA, LISA | Ultraviolet light in the wavelength range (260 nm to 270 nm) |

CITIZEN EVERLIGHT HARVATEK DOMINANT Semiconductors osa opto light AUDAX ELECTRONICS LEDiL KLARAN by Crystal IS



| Manufacturer | | Inventronics | LiFud | ELT | Fulham | Bender+Wirth | TE Connectivity | cooliance |
|---|---|---|---|---|---|---|---|---|
| Accessories for High Power LEDs | Holder | | | | | ■ | ■ | |
| | Heat Sink | | | | | | | ■ |
| Power Supplies | Indoor | ■ | ■ | ■ | ■ | | | |
| | Outdoor | ■ | ■ | ■ | | | | |

## Features

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Certifications | ISO 9001 | ISO 9001 / 14001 | ISO 9001<br>ISO 14001 | ISO 9001 | ISO 9001<br>ISO 14001 | ISO 9001<br>ISO 14001 | |
| General Information | Established in 2007, Inventronics is one of the world's top LED driver manufacturers specializing in building innovative, highly reliable and long-life products that are certified compliant to all major international safety and performance standards | Lifud was founded in 2007. They are dedicated to technological innovation and the development of energy-saving, healthy and environmentally friendly LED drivers to achieve the mission of improving people's living environment and quality of life, as well as the long-term vision of a more efficient and cleaner energy supply. | ELT is a Spanish business group specialised in the design, manufacture and marketing of LED drivers and which, over its more than 40 years, has achieved a leading position in the market. | Decades of experience puts Fulham at the forefront of innovative technology in essential lighting products, intelligent lighting controls combined with healthcare and sanitation that offer quality, versatility and sustainability that add value for their customers. | Since 1899, Bender+Wirth has been supplying the global lighting industry with the highest quality components. Their current product portfolio includes LED holders, LED connectors and lamp sockets. | TE Connectivity designs and manufactures an extensive range of advanced connectors.<br>LUMAWISE LED mounts feature an LED snap-in function, eliminating the need for soldering. Poke-in wire connections provide tool-less termination of solid, fused and strande wire. | With a global footprint, Cooliance is a designer and manufacturer of a wide range of high reliability thermal solutions & heat sinks. |
| Applications | Interior and Exterior Lighting<br>Tunnel and stadium Lighting<br>Industrial Lighting<br>Horticulture | Interior and Exterior Lighting<br>Shop Lighting<br>Industrial Lighting<br>Smart Lighting | Interior and Exterior Lighting | Interior Lighting | General Lighting | Spot Lights<br>Down Lights<br>Track Lights<br>Street Lights<br>General Lighting | General Lighting<br>Custom design |
| Specifics | Mx & MGS Series for Horticulture Applications | Dali2 DT8 LED driver LF-GS-DxxxYG Series<br>Triac Dimming LFAAT Series | | Lumo Series European LED Drivers | COB holder for UV-C (430 series made of a UV-resistant mineral) | | |

# Capacitors



| Manufacturer | | Panasonic | PDC | SunCon |
|---|---|---|---|---|
| SMD | Electrolytic | | | ■ |
| | Hybrid | | | ■ |
| | Polymer | ■ | | |
| | MLCC | | ■ | |
| THT | Electrolytic | | | ■ |
| | Hybrid | | | ■ |
| | Polymer | ■ | | |
| | MLCC | | | |

## Features

| | | | |
|---|---|---|---|
| Certifications | IATF16949 partly, ISO 14001, AEC-Q200 partly | ISO 9001, IATF 16949, ISO 14000, OHSAS 18000, AS 9100 | IATF 16949, ISO 14001, AEC-Q200 |
| General Information | Inventor as well as leading manufacturer of polymer technology<br>Life time up to 5.000 h / 105 °C > 100.000 h / 85 °C<br>Low ESR, up to 5 mOhm<br>High ripple load (@ Oscon SVPE 10 x 13 mm)<br>Poscap / Oscon / SP-cap<br>Voltage range: 2 ... 35 V<br>Capacity range: up to 1500 uF | PDC is the only manufacturer of MLCC in Taiwan with true vertical integration. PDC manufactures the finished products as well as the ceramic powder for them.<br>The product range includes MLCC capacitors for special requirements, such as<br>High voltages: up to 10 kV<br>High capacitance: up to 330 µF<br>Tight tolerance: up to +/-1 %.<br>For safety relevant applications: X1/Y2, X2<br>Large sizes: 3035 / 4252 / 5550 / 5780 / 6560/ 7680/ 8850/ 13060<br>Further features such as low ESR, soft termination, AEC-Q200 qualification and many more. | Large portfolio of SMD and polymer hybrid capacitors<br>**Hybrid technology:** Aluminium electrolyte capacitor combined with polymer hybrid material<br>Extremly high ampacity in comparison with identical SMD capacitors<br>High voltage, up to 125 V in a temperaturerange from 105 °C ... 150 °C<br>Radial type HEH up to 100 V / 10.000 h |
| Applications | Automotive<br>Telecommunication<br>Computer & IT<br>Measurement<br>Sensors<br>Consumer<br>Power Supplies<br>Industrial<br>Medical | Automotive<br>Telecommunication<br>Power Supplies<br>Industrial | Automotive<br>Telecommunication<br>Computer & IT<br>Measurement<br>Sensors<br>Consumer<br>Power Supplies<br>Industrial<br>Medical |
| Specifics | Voltage range up to 50 V for Poscap<br>Ultra low SP-cap with 3 mOhm | | For 2017 new SMD series with higher capacity in same case size, available for 105 °C and 125 °C |

Panasonic PDC SunCon

# Resistors




| Manufacturer | E&C | PDC | RCD | Susumu |
|---|---|---|---|---|
| Thin Film Resistors | | | | ■ |
| Current Sense Resistors (Shunts) | | ■ | ■ | ■ |
| High Frequency Resistors | | | | ■ |
| Thick Film Resistors | | ■ | ■ | |
| Special Resistors | ■ | ■ | ■ | ■ |

## Features

| | | | | |
|---|---|---|---|---|
| Certifications | ISO 9001 | ISO 9001<br>IATF 16949 | ISO 9001 | ISO 9001<br>IATF 16949 |
| General Information | Specialized in high ohmic values in the range of Mega Ohm to Peta Ohm<br>High voltages up to 750,000 V<br>Custom types available | Thick film chip resistors optimized for special purposes<br>Surge resistors with double/triple power rating<br>High voltage safety resistors with UL certificate | Industries' widest portfolio containing film- foil- wire-woundceramic-, metal glaze-, metal oxide-resistors in chip, melf, though hole, leaded, ceramic, heat sink construction<br>Custom types available<br>SWIFT „TM" program for faster production | Thin film chip resistors with excellent long term stability<br>Metal foil current sensing resistors with short- & longside terminals.<br>High frequency products such as attenuators, terminators and splitters |
| Applications | Industrial<br>Test & Measurement<br>Medical Equipment<br>Sensors<br>Institutes and Universities | Automotive<br>Industrial<br>White Goods<br>Medical Equipment<br>General Purpose | Industrial<br>White Goods<br>Medical Equipment<br>Aerospace & Avionic<br>General Purpose | Automotive<br>Industrial<br>Test & Measurement<br>White Goods<br>Medical Equipment |
| Specifics | HC Series:<br>Smallest high Ohm chip resistor in the market<br>Case 0402 is available vup to 150 G Ohm | Thin film melf resistors with improved reliability<br>Green resistors with lead content less than 100 ppm (10 times lower than RoHS requirement for chip resistors) | CM300 type – ultra low profile 300 Watt power film resistor with proprietary flame retardant epoxy insulation<br>Attached to a suitable air- or water-cooled heat sink CM300 ensures optimal environmental protection & dielectric strength | Precision chip resistors with fuse function<br>Chip attenuator for frequency up to 50 GHz<br>Thin film resistors with extended Ohm ranges up to 7.5 Mega Ohm |

E&C® PDC RCD SUSUMU Thin Film Specialist and Innovator

# Inductive Components




| Manufacturer | ABC | PDC | Inpaq |
|---|---|---|---|
| Chip Inductors | ■ | ■ | ■ |
| Power Inductors | ■ | ■ | ■ |
| Line Filters | ■ | ■ | ■ |
| Chip Ferrit Beads | ■ | ■ | ■ |
| Transformers and Through Hole | ■ | ■ | |

## Features

| | | | |
|---|---|---|---|
| Certifications | ISO 9001<br>IATF 16949 | ISO 9001, ISO 14000<br>IATF 16949 | ISO 9001<br>IATF 16949 |
| General Information | Very wide range of SMD and THT inductors for DC/DC power – HF and general purpose applications<br>Following the trend of automatic production, ABC is still capable to maintain a very high flexibility for small MOQ and quick delivery<br>Holding more than 100 patents, ABC offers products of high quality by following the popular shapes in the market<br>ABC is capable to produce semi custom and custom inductors and transformers | PDC offers a wide portfolio of standard inductors. The focus of PDC's investments is on the modernization of production facilities and the expansion of production capacities.<br>The product range includes:<br>HF inductors: Wire-wound, also as common mode and common or differential mode filters, air core coils and baluns<br>Power and filter chokes: unshielded, shielded, with iron powder- or ferrite core as choke, filter or transformer | RF components such as chip beads and line filters in the technologies: multilayer, wire wound and thin film<br>Power components such as wire wound chip inductors and high current chip beads<br>Inpaq's WIP series is referenced by Qualcomm for their Snapdragon platforms |
| Applications | Automotive<br>Industrial<br>White Goods<br>Medical Equipment<br>General Purpose | Industrial<br>Telecommunikation<br>Power Supply<br>White Goods | Automotive<br>Industrial<br>White Goods<br>Medical Equipment<br>General Purpose |
| Specifics | Extended lineup for iron powder high current power choke coils:<br>HC series: very low profile<br>CIP: middle size, with focus on lowest DCR or highest current rating<br>HE series: universal series from ~4 x 4 mm to 17 x 18 mm | | TNF0605 is the smallest thin film common mode choke in the market supporting USB 3.0 for up to 10 GHz cutoff frequency<br>WIP-Y performance upgrade to the existing WIP-P and WIP-S types. WPASX / WPAPX series is qualified according to AEC-Q200 for automotive applications |

# Acoustics



| Manufacturer | Baolong | BSE | ChinaSound | KOTL | Ariose | Vansonic |
|---|---|---|---|---|---|---|
| Piezoelectric Transducer | | | ■ | | | |
| Piezoelectric Buzzer | | | ■ | | | |
| Piezoelectric Speaker | | | ■ | | | |
| Piezoelectric Element | | | ■ | | | |
| E-magnetic Transducer | | | | | ■ | |
| E-magnetic Buzzer | | | | | ■ | |
| Dynamic Speakers | | | ■ | | | ■ |
| SMD Microphones, Reflow Solderable | | ■ | | | | ■ |
| Standard Microphones | | ■ | | | | ■ |
| MEMS Microphones | | ■ | | | | |
| Coin Type Vibration Motors | ■ | | | ■ | | |
| Cylinder Type Vibration Motors | ■ | | | ■ | | |
| SMD Vibration Motors | ■ | | | ■ | | |
| Linear Vibration Motors | ■ | | | ■ | | |

## Features

| | | | | | | |
|---|---|---|---|---|---|---|
| Certificates | ISO9001, ISO14001, OHSAS18001 | ISO9001, ISO14001, IATF 16949 | ISO9001, ISO14001 | ISO9001, ISO14001 | ISO 9001:2015 | ISO9001, ISO14001, IATF 16949 |
| General Information | Baolong is located in Wenzhou, established in 1986.<br>Focus:<br>Micro vibration motors, micro driving motors, possibility of customization<br>Advantage:<br>Long life, small size, light weight and low power consumption. | BO SUNG ELECTRONICS Co., Ltd. (B S E) was founded in 1987 in Incheon, South Korea. Later renamed into BSE (Best Sound Electronics) BSE develops and produces acoustic solutions, consisting of ECM & MEMS microphones | Chinasound is producing in Changzhou (China)<br>Main focus are piezo parts and buzzers, also alarm buzzers and mylar speakers,own R&D facilities | KOTL has its location in Wenzhou<br>Focus: micro vibration motors; well experienced in mechanical engineering, stable construction motors with excellent performance, light weight, low power consumption | Company located in Taiwan, was founded in 1996. Manufacturer of electronic acoustic products, such as buzzers, speakers and microphones, as well as piezoelectric ceramic elements.<br>Quality and customer satisfaction has the highest priority | Main subject are speakers of all kind, also microphones (ECM technology, conventional & reflowable)<br>Strong commitment to R&D, state-of-the-art laboratories, meets customer requirements with regard to size, sound and/or power consumption |
| Applications | Mobile Phones<br>Sports Bracelets<br>Smart Watches<br>Electronic Cigarette<br>High-end Electric Toothbrushes<br>Devices with Haptic Feedback, etc. | Mainly Utilized in the leading consumer mobile devices<br>MP3<br>Computers<br>Communication<br>Automotive Applications | Piezo Alarms for Fire and Security<br>Industry<br>Home Appliances<br>POS | Vibration Alarm<br>Silent Alarm<br>Haptic Feedback<br>Smartphone<br>Razor<br>Toothbrush | Automotive<br>Medical instruments<br>Home appliances | Waterproof speakers, microphones and receivers (up to IP67)<br>Speakers in small boxes<br>SMD-loudspeaker |
| Specifics | Smallest SMT vibration motor-BLT-3211H<br>Small coin vibration motor 0720 & 0625<br>LRA vibration motor 0832 & 0412 | Earphone receiver | Customer specific piezo alarms<br>SMD loudspeaker | Reflow solderable SMD types<br>Linear vibration motors | Soon automotive certification IATF16949 in quarter 01/2023<br>Smallest existing electromagnetic transducer | Waterproof speakers, microphones and receivers (up to IP67)<br>Speakers in small boxes SMD-loudspeaker |

# Connectors



| Manufacturer | | Adam Tech | ECE | Amphenol Industrial | TE connectivity |
|---|---|---|---|---|---|
| Data | USB | ■ | ■ | ■ | ■ |
| | RJ | ■ | ■ | ■ | ■ |
| | D-Sub | ■ | | ■ | ■ |
| | HDMI / SATA | ■ | | | ■ |
| | FFC / FPC | ■ | ■ | | ■ |
| | IDC / Flat Cable | ■ | | ■ | ■ |
| Power | Terminal Blocks | ■ | ■ | | ■ |
| | Header / Housing | ■ | | ■ | ■ |

## Features

| | | | | |
|---|---|---|---|---|
| Certificates | ISO 9001<br>TS 16949<br>ISO 13485 | ISO 9001<br>TS 16949<br>ISO 9000<br>ISO 14001 | ISO 9001<br>TS 16949<br>ISO14001<br>VG und TüV<br>New: IRIS Certification | ISO 9001<br>TS 16949<br>ISO 14001<br>OHSAS 18001<br>TüV (Solar) |
| General Information | Producer of connectors for data- and power connections<br>Best price/performance ratio | High value PCB connectors | Wide variety of quality connectors for high end performance applications | TE-Connectivity is a unique component manufacturer for automotive industry as well as further branches |
| Applications | Telecommunication<br>Automotive<br>Computer & IT<br>Sensors<br>Retail Industry<br>Power Units | Telecommunication<br>Automotive<br>Computer & IT<br>Sensors<br>Retail Industry<br>Power Untis | Telecommunication<br>Automotive<br>Computer & IT<br>Power Units<br>Industry<br>Military<br>Marine<br>Railway<br>Audio<br>LED Cabling<br>Solar Connectors AC/DC | Telecommunication<br>Automotive<br>Computer & IT<br>Measurement Systems<br>Sensors<br>Retail Industry<br>Power Units<br>Industry<br>Solar |
| Specifics | USB Type-C<br>(USB4 Gen 3)<br>High speed data (HSD)<br>FAKRA connectors<br>Magnetic cable assemblies and connectors | | ComboLock®<br>Wire-to-Board<br>Minitek® Pwr PCIe®<br>BarKlip® BK200 I/O | Dynamic series<br>USB Type-C (USB4 Gen 3)<br>Mini I/O |

# Batteries / Power Supplies






| Manufacturer | EVE | Fanso | Friwo |
|---|---|---|---|
| Li-SOCl2 / Li-MnO2 | ■ | ■ | |
| Super Pulse Cap | ■ | ■ | |
| Lithium 9 V | | ■ | |
| Li-Ion / Li-Polymer | ■ | | ■ |
| AC/DC Switching Power Supply | | | ■ |
| DC/DC Converter | | | ■ (in the future)) |
| Custom Design Batteries | | | ■ |

## Features

| | | | |
|---|---|---|---|
| Certificates | ISO 9001, ISO 14001, IATF 16949 | ISO 9001, UL, RoHs, UN38.3, IATF16949 | ISO 8000, ISO 9001, ISO 14001, ISO 13485, TS 16949, SIQ (ENEC), UL, C-Tick, UKCA, PSA, CCC, EAC, UN38.3 |
| General Information | One of the biggest manufacturers for lithium primary cells<br>Own engineering and production facility<br>Li-SOCl2 and Li-MnO2<br>High temperature cells Temp.: - 40 ... + 145 °C<br>SPC – super pulse capacitors<br>Customized battery packs with PCB<br>ICR18650 with 2000 mAh and 2900 mAh | Qualified manufacturer of primary lithium batteries specialied in:<br>3.6 V Li-SOCl2 batteries and<br>3.0 V Li-MnO2 batteries<br>Ultra thin Li-SoCl2 / Li-MnO2 pouch batteries<br>9 V lithium batteries<br>Super capacitors SLS1016/1025 | Leading manufacturer of power supplies<br>Plug-in power supplies 6-60W AC/DC converter<br>Table power supplies 6-60W AC/DC converter<br>AC/DC switching power supplies 6 - 175 W (with/without active PFC)<br>Enclosures: plug-in, desktop and openframe<br>Certifications according to SIQ (ENEC), UL, C-Tick, UKCA, PSA, CCC, EAC<br>Professional technical support and own production facilities |
| Applications | Automotive<br>Industrial<br>White Goods<br>Medical Equipment<br>General Purpose | FANSO Batteries are mainly applied to Commercial Market – LWD & MWD for Oil Exploration, Electronic Pressure Gauge, Flow Meter, TPMS, Smart Meters, RFID, RAM and CMOS Circuit, Geothermal Heat Detector, Underwater Ordnance, Sonar, GPS and IoT Devices | Industry<br>Tools<br>Medical Technology<br>E-Mobility |
| Specifics | | Revolutionary Li-MnO2 ultra-thin battery CP104851<br>Ultra thin Li-MnO2 battery pack for medical application<br>Super capacitor 1520 and 1550 | Openframe power supplies HERC up to 175W<br>FOXNeo series 6-30W<br>IPX2 protection |

EVE ENERGY VERY ENDURE

FANSO

FRIWO

# Batteries / Power Supplies



| Manufacturer | Jauch | maxell | Mornsun |
|---|---|---|---|
| Li-MnO2 | | ■ | |
| Li-Ion / Li-Polymer | ■ | | |
| AC/DC Converter | | | ■ |
| DC/DC Converter | | | ■ |
| Powerbanks | ■ | | |
| Custom Design Batteries | ■ | | |
| Transceiver Modul | | | ■ |
| AC/DC Switching Power supply | | | ■ |
| Mangan Dioxide | | ■ | |
| Alkaline | | ■ | |
| Silver Oxide | | ■ | |

## Features

| | | | |
|---|---|---|---|
| Certificates | ISO 9001, UL, RoHs, UN38.3, IATF16949 | ISO 9001, ISO 14001, UL | ISO 9001, ISO 14001, IATF 16949 |
| General Information | German leading specialist for battery technology recognized for in-depth technical consulting, high application and certification expertise on:<br>Li-Ion / Li-Po batteries<br>Li-SoCl2 / Li-MnO2<br>Li-button cells<br>Lithium iron phosphate<br>NiMH batteries<br>Mobile lithium energy storage<br>(XT Powerbanks) | Leading manufacturer of batteries<br>Primary batteries<br>CR manganese dioxide button cells<br>CR manganese dioxide cylindrical cells<br>SR silver oxide button cells<br>Alkaline batteries<br>Rechargeable batteries<br>ML lithium manganese button cells<br>Solid state batteries<br>Professional technical support and own production<br>Facilities | Leading manufacturer of modules for power supply<br>Successful in research and use of electromagnetic insulation technologies<br>Isolated 0.25 – 200 W DC/DC converter<br>Isolated 1 – 350 W AC/DC converter<br>Isolated CAN/RS-485/RS-232 transceiver modules<br>Enclosed AC/DC power supply<br>35 – 350 W (with/without active PFC)<br>Different power pupply IC solutions<br>Packages: SMD, SIP, DIP, DIN rail etc.<br>Certifications according to EN, UL, CB and CSA<br>Professional technical support<br>Own production sites |
| Applications | JAUCH Batteries are mainly integrated in: Industrial Electronics, Medical Technologies, Measurement & Control Tech., Safety Engineering, Automotive Tooling Equipment, Military & Defense, E-Mobility, Smart metering, Communication Technologies | Industry, Automotive, Medical Technology, Telecommunication, Consumer, Transportation, Test and Measurement | Industry<br>Transportation<br>Energy Technology, Medical<br>Testing and Measuring Technology<br>Automotive, Telecommunications, Consumer, Photovoltaics |
| Specifics | New battery own brand „JAUCH“ with own lithium polymer, lithium ion, lithium manganese dioxide and lithium thionyl chloride batteries. | Solid batteries | 3W AC/DC converter with transient ouput power up to 12 W – LDE03-20Bxx-O<br>Ultra-compact size 5 – 15 W AC/DC converter – LSxx-13Bxx |

# Batteries / Power Supplies

Only available in Switzerland








| Manufacturer | Yuasa | Energizer | Ansmann |
|---|---|---|---|
| PB Battery 6 V and 12 V (VRLA / Industry) | ■ | | |
| NiMH Battery | ■ | | |
| Chargers for PB Battery 6 V, 12 V and 24 V | ■ | | |
| Alkaline Batteries 1,5 V | | ■ | |
| Lithium Metal Batteries 1,5 V | | ■ | |
| NiMH Battery 1,2 V | | ■ | ■ |
| Button Cells 3V | | ■ | ■ |
| Chargers for NiMH Battery | | | ■ |
| Power Supplies | | | ■ |
| Li-Ion Battery Packs | | | ■ |
| Portable Spotlight | | | ■ |

## Features

| | | | |
|---|---|---|---|
| Certificates | ISO9001, UL, VDS (only some types from NP series), IATA (No limitation), UN2800 | ISO9001, UL, UN3090 (Lithium metal cells), IATA 62nd Edition, ICAO, IEC 60086-1 | ISO9001, UL, UN3480 (Lithium-ion Battery Packs), UN3496 (NiMH-Batteries), IEC 60086-1, IATA |
| General Information | One of the leading manufacturers of lead-acid batteries<br>Sealed construction<br>Maintenance free<br>Valve regulated (low pressure)<br>Leak proof<br>Can be operated in any position without loss of capacity, except continuous upside down operation<br>Electrolyte bonded in fiberglass mat<br>Gas recombination cycle<br>Excellent fast charge and discharge characteristics<br>Cycle operation or continuous charging possible<br>Low self discharge<br>Easily recyclable<br>No restriction for air transport (IATA)<br>UL listed, File No.: MH12970 | One of the leading manufacturers of alkaline cells<br>Leak proof<br>Low self discharge<br>Long storage time<br>No restriction for air transport (IATA)<br>UL listed | A manufacturer of NiMH battery<br>Leak proof<br>Low self discharge<br>Long storage time |
| Applications | Emergency power systems / Emergency lighting<br>Fire protection<br>Cyclic applications such as golf cars and e-mobility<br>Wind energy systems<br>UPSs<br>Medical (not for life support equipment)<br>Electric drives in industry | Batteries for professional applications<br>Fire protection<br>Small applications, sensors, remote controls<br>Medical (not for life support equipment) | Batteries for professional applications<br>Small applications, sensors, remote controls |

YUASA Energizer ANSMANN

# Passive Components

| | Panasonic | SunCon | E&C | PDC | RCD | Susumu | ABC | Inpaq |
|---|---|---|---|---|---|---|---|---|
| **Capacitors** | | | | | | | | |
| Electrolytic (SMD, THT) | | ✓ | | | | | | |
| Hybrid (SMD, THT) | | ✓ | | | | | | |
| Polymer (SMD, THT) | ✓ | | | | | | | |
| MLCC | | | | ✓ | | | | |
| **Inductive Components** | | | | | | | | |
| Chip Inductors | | | | ✓ | | | ✓ | ✓ |
| Power Inductors | | | | ✓ | | | ✓ | ✓ |
| Line Filters | | | | ✓ | | | ✓ | ✓ |
| Chip Ferrit Beads | | | | ✓ | | | ✓ | ✓ |
| Transformers and Throug Hole | | | | ✓ | | | ✓ | |
| **Resistors** | | | | | | | | |
| Thin Film Resistors | | | | | | ✓ | | |
| Current Sense Resistors (Shunts) | | | | ✓ | ✓ | ✓ | | |
| High Frequency Resistors | | | | | | ✓ | | |
| Thick Film Resistors | | | | ✓ | ✓ | | | |
| Special Resistors | | | ✓ | ✓ | ✓ | ✓ | | |

# Sensors

| | Crocus Technology | Everlight | Micronas | Nicera | Panasonic | Audiowell | Nisshinbo | Micro Sensor | RFbeam | OmniPreSense | Semitec | Tateyama | Tewa |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grid Eye – Thermopile Array | | | | | ✓ | | | | | | | | |
| Magnetic Field | ✓ | | ✓ | ✓ | | | | | | | | | |
| Infrared | | ✓ | | ✓ | | | | | | | | | |
| Solar Cells | | | | | ✓ | | | | | | | | |
| Radar | | | | | | ✓ | | ✓ | ✓ | | | | |
| Ultrasonic | | | | | | ✓ | | | | | | | |
| Pressure | | | | | | | ✓ | | | | | | |
| Current Sensors | ✓ | | ✓ | ✓ | | | | | | | | | |
| **Temperature Sensors** | | | | | | | | | | | | | |
| NTC, SMD | | | | | | | | | | ✓ | ✓ | ✓ | |
| NTC leaded | | | | | | | | | | ✓ | | ✓ | |
| PTC leaded | | | | | | | | | | | ✓ | | |
| NTC Film Type | | | | | | | | | | ✓ | | ✓ | |
| NTC Thermistor Probes | | | | | | | | | | ✓ | ✓ | ✓ | |
| PTC Thermistor Probes | | | | | | | | | | | | ✓ | |
| Assembled Sensors | | | | | | | | | | ✓ | ✓ | ✓ | |

# Displays / Embedded Systems

| | DLogic | Faytech | FS Elektronik Systeme | Eagleey Tech | Logic Technologies | Multi-Inno | Raystar | RiT | SGD |
|---|---|---|---|---|---|---|---|---|---|
| Touch PCs | ✓ | ✓ | | | | | | | |
| Touch Monitors | ✓ | ✓ | | | | | | | |
| Boxed Industrial PCs | | ✓ | | | | | | | |
| Embedded Boards | | | ✓ | | | | | | |
| TFT-Displays | | | | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Monochrome LC-Displays | | | | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Passive Matrix OLED-Displays | | | | | | ✓ | ✓ | ✓ | |
| E-Paper | | | | ✓ | | | | | |

## Semiconductors

| Analog ICs | Azoteq | Holtek | MPS | Nisshinbo | SG Micro | Alliance | ESMT | Fidelix | GigaDevice |
|---|---|---|---|---|---|---|---|---|---|
| Analog Switches | | | ✓ | ✓ | ✓ | | | | |
| Audio ICs | | ✓ | ✓ | ✓ | ✓ | | ✓ | | |
| Communication ICs | | ✓ | | ✓ | | | | | |
| Display Drivers | | ✓ | | ✓ | | | | | |
| GaAs MMIC | | | | ✓ | | | | | |
| LED-Driver | | ✓ | ✓ | | | | ✓ | | |
| Micro Controller | | ✓ | | | | | | | ✓ |
| Motor ICs | | ✓ | ✓ | ✓ | ✓ | | | | |
| Operational Amplifiers | | ✓ | ✓ | ✓ | ✓ | | | | |
| Power Supply ICs | | ✓ | ✓ | ✓ | ✓ | | ✓ | | |
| Video ICs | | ✓ | | ✓ | ✓ | | | | |
| Logic ICs | | | | | ✓ | | | | |
| Touch & Multisensor IC | ✓ | ✓ | | | | | | | |
| **Memory ICs** | | | | | | | | | |
| SRAM/pSRAM | | | | | | ✓ | ✓ | ✓ | |
| SDRAM/DDR/DDR2/DDR3/DDR4 | | | | | | ✓ | ✓ | ✓ | |
| Flash | | | | | | ✓ | ✓ | ✓ | ✓ |
| MCP | | | | | | | ✓ | ✓ | |

## Protection Devices

| Overcurrent Protection | CT Micro | cosmo | Eris | ECE | Inpaq | Protek | Semitec | SFI |
|---|---|---|---|---|---|---|---|---|
| PPTC | | | | ✓ | | | | |
| Power Thermistor | | | | | | ✓ | | |
| CRD | | | | | | ✓ | | |
| **Coupler/SSR** | | | | | | | | |
| Opto Coupler | ✓ | ✓ | | | | | | |
| MOS Relay | ✓ | ✓ | | ✓ | | | | |
| Solid State Relay | | ✓ | | ✓ | | | | |
| **Overvoltage Protection** | | | | | | | | |
| TVS Diode-/Array | | | ✓ | | | ✓ | | |
| Multilayer Varistor | | | | | ✓ | | | ✓ |
| CSPD (Chip Surge Protection Device) | | | | | | | | ✓ |
| ESD Suppressor | | | | | ✓ | | | |
| Protection Thyristor | | | | | | ✓ | | |
| Protection Module | | | | | | ✓ | | |

## Batteries / Power Supplies

| | EVE | Fanso | Friwo | Jauch | maxell | Mornsun |
|---|---|---|---|---|---|---|
| Li-SOCl2 / Li-MnO2 | ✓ | ✓ | | ✓ | ✓ | |
| Super Pulse Cap | ✓ | ✓ | | ✓ | | |
| Li-Ion / Li-Polymer | ✓ | ✓ | ✓ | ✓ | | |
| AC/DC Converter | | | | | | ✓ |
| DC/DC Converter | | | ✓ | | | ✓ |
| Transceiver Module | | | | | | ✓ |
| AC/DC Power Supplies | | | ✓ | | | ✓ |

## LED

| | Citizen | Everlight | Harvatek | Dominant | osa opto light | Audax | Ledil | Crystal IS | Inventronics | LiFud | ELT | Fulham | Bender + Wirth | TE Connectivity | cooliance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Low Power LED, SMD | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| Low Power LED, THT | | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 7-Segment Displays | | ✓ | ✓ | | | | | | | | | | | | |
| Power Supplies | | | | | | | | ✓ | ✓ | ✓ | ✓ | | | | |
| Optics | | | | | | | ✓ | | | | | | | | |
| Heat Sink | | | | | | | | | | | | | | | ✓ |
| Connection Elements | | | | | | | | | | | | | ✓ | ✓ | |
| Light Engines (Zhaga) | | | | | | ✓ | | | | | | | | | |

## RF Products

| | Chequers | Citizen | Maruwa | SiTime | SMI | TST | 2J antennas | Aurel | Fibocom | Locosys | Panasonic | Inpaq | Feasycom |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Crystals / Oscillators / Filter** | | | | | | | | | | | | | |
| Quartz Crystals (MHz) / (kHz) | ✓ | ✓ | | | ✓ | ✓ | | | | | | | |
| Ceramic Resonators | ✓ | | | | | | | | | | | | |
| Oscillators | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| MCF / SAW Filters | ✓ | | | | ✓ | ✓ | | | | | | | |
| Dielectric Filters | ✓ | | ✓ | | | ✓ | | | | | | | |
| Ceramic Filters / Resonators | ✓ | | | | | | | | | | | | |
| **RF Modules / Antennas** | | | | | | | | | | | | | |
| RF Modules (315 MHz … 2.4 GHz) | | | | | | | | ✓ | | | | | |
| WiFi™-, Bluetooth®-Modules | | | | | | | | | | | ✓ | | ✓ |
| GPS/GNSS Modules | | | | | | | | | ✓ | | | | |
| LPWA (Cat NB1/NB2, Cat M1) Modules | | | | | | | | ✓ | | | | | |
| GSM/UMTS/LTE Modules | | | | | | | | ✓ | | | | | |
| 5G Modules | | | | | | | | ✓ | | | | | |
| Antennas f. ISM Band, WiFi™, Bluetooth® | | | | | | | ✓ | | | | | ✓ | |
| Antennas f. GPS/GNSS | | | | | | | ✓ | | | | | ✓ | |
| Antennas f. Cellular | | | | | | | ✓ | | | | | ✓ | |
| Antennas f. Car2Car Communication | | | | | | | | | | | | ✓ | |
| Antennas f. NFC (Near Field Comm.) | | | | | | | | | | | | ✓ | |
| WPC (Wireless Power Charging) | | | | | | | | | | | | ✓ | |
| LoRa™ Transceiver | | | | | | | ✓ | | | | | | |

## Acoustics

| | Baolong | BSE | ChinaSound | KOTL | Ariose | Vansonic |
|---|---|---|---|---|---|---|
| Piezoel. Transducers | | | ✓ | | | |
| Magnetic Transducers | | | | | ✓ | |
| Dynamic Speakers (4 … 50 Ω) | | | ✓ | | | ✓ |
| Electret Condenser Microphones | | ✓ | | | | ✓ |
| MEMS Microphones | | ✓ | | | | |
| Vibration Motors | ✓ | | | ✓ | | |

# Electromechanics

| | Sinwan | ADDA | Ecofit | Fulltech | MinebeaMitsumi | QianYuan | Thoptec | ECE | Diptronics | knitter-switch | win | Adam Tech | Amphenol Industrial | TE connectivity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Air Mover** | | | | | | | | | | | | | | |
| Fan | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| Heatsink | | ✓ | | | | | | | | | | | | |
| Fan Accessories | | | | | | ✓ | ✓ | | | | | | | |
| Customized Complete Systems | ✓ | ✓ | | | | | | | | | | | | |
| **Switches/Keypads** | | | | | | | | | | | | | | |
| Tactile Switches | | | | | | | | | ✓ | ✓ | | | | |
| Push-Button Switches | | | | | | | | | ✓ | ✓ | | | | |
| Micro Switches | | | | | | | | ✓ | ✓ | ✓ | | | | |
| Silicone Keypads & Membrane Keyboards | | | | | | | | | | ✓ | ✓ | | | |
| Relays | | | | | | | | ✓ | | | | | | |
| Tilt Switches | | | | | | | | ✓ | | ✓ | | | | |
| DIP-/ Piano Switch | | | | | | | | ✓ | ✓ | | | | | |
| Rotary Dip Switch | | | | | | | | ✓ | ✓ | ✓ | | | | |
| Slide Switch | | | | | | | | ✓ | ✓ | | | | | |
| Industiral Control Switch | | | | | | | | ✓ | ✓ | | | | | |
| Detectors-/Manipulation Switches | | | | | | | | ✓ | | | | | | |
| **Connectors** | | | | | | | | | | | | | | |
| Data | | | | | | | | ✓ | | | | ✓ | ✓ | ✓ |
| Power | | | | | | | | ✓ | | | | ✓ | ✓ | ✓ |

# Batteries / Power Supplies (CH only)

| | Yuasa | Energizer | Ansmann |
|---|---|---|---|
| PB Battery 6 V and 12 V (VRLA / Industry) | ✓ | | |
| NiMH Battery | ✓ | | |
| Chargers for PB Battery 6 V, 12 V and 24 V | ✓ | | |
| Alkaline Batteries 1,5 V | | ✓ | |
| Lithium Metal Batteries 1,5 V | | ✓ | |
| NiMH Battery 1,2 V | | ✓ | ✓ |
| Button Cells 3 V | | ✓ | ✓ |
| Chargers for NiMH Battery | | | ✓ |
| Power Supplies | | | ✓ |
| Li-Ion Battery Packs | | | ✓ |
| Portable Spotlight | | | ✓ |


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