

ENGLISH

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# impulse <sup>1/2018</sup>



MPS: **Angle Sensors**

ISABELLENHÜTTE: The BVF Precision Resistor

AMPHENOL ICC: Harsh Environment Connectors

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# CODICO @ Social Media

CODICO has taken another step towards brand visibility. Since February 2018, we have been informing you regularly via social media about future trends and technologies that may be important to your company, including product info, news from our manufacturers, industry information and events.

**S**ocial media platforms give you quick and easy access to all CODICO news. Several times a year we organize seminars to the highest technical level to bring you closer to the latest trends and developments. Furthermore, we would like to invite you to our various international trade fairs. If you follow us via social media, you will always be well informed at which trade fairs we are participating and where you can find us.

In addition, you will gain an insight into our product portfolio and manufacturers and be informed of news as soon as it is released. If you follow our company pages on the social media platforms, you will gain a greater understanding of our products and manufacturers as well as our company.

You wish to be kept up to date?

Then follow us on Facebook and LinkedIn:

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We will be delighted to welcome many followers, your likes and comments.

**D01**

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**Sven Krumpel**  
 CEO CODICO

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# Editorial

Dear Readers,  
 CODICO goes Social Media!

**D**igital media, digital communication, the online world – communication by the Smart Phone, whenever and wherever you want!

The development of modern communications channels is no longer just some short-lived hype; it is a key component of any corporate communication. You decide for yourself when you want to read, research, and experience what, and where you do it. But despite having won this individuality, this is not a one-sided information issue. We don't want to conduct a monologue. What we want is to enter into dialogue with you, consciously and deliberately, and exchange experience and ideas. This We-awareness is right at the top in CODICO's communications strategy.

Let's talk to each other a bit more often – when and by what means suit you best. We are trying here to find out more about what you want and what you need, and we're keen to keep you updated regularly through all our different channels of communication.

And now you can find out about CODICO on the social media Facebook and LinkedIn as well. Follow us; we really want to find out about your likes. Here you can find everything, the latest news, product highlights, events, and even vacancies on offer!

Or register for our Newsletter at [www.codico.com](http://www.codico.com). This is where we tell you about significant innovations from our manufacturers and their products, as well as updates about our own current seminars and events.

**D02**

▶ *Sven Krumpel*

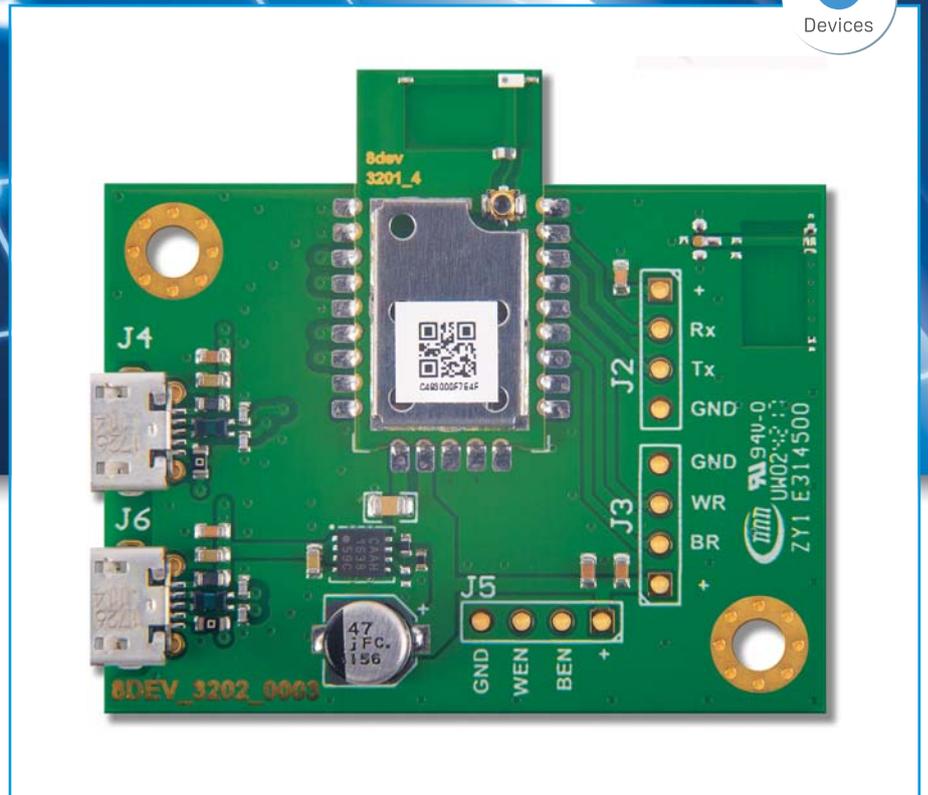
# BLUE bean

The new small combo-radio solution from 8DEVICES works on two bands and supports Wi-Fi as well as Bluetooth.



The new BLUE-BEAN module from 8DEVICES is based on the QCA9377-7 radio chip from QUALCOMM and provides two USB interfaces to connect single-stream 11ac Wave2 Wi-Fi and Bluetooth 4.2 applications to a host processor.

The radio-module is available in 2 versions, with integrated antenna in 24×12mm (BLUE-BEAN-A) or with Murata HSC type connector MM4829-2702RB0 in 17×12mm (BLUE-BEAN-C). In Wi-Fi mode the bandwidths 20MHz, 40MHz and 80 MHz are supported with a maximum data rate of 433Mbps (Multi User, Wave 2, 11ac) and an output power of maximum 20dBm. Beside 802.11ac @ 5 GHz the module offers also the



2.4GHz band, which ends up in the support of all popular Wi-Fi standards: 802.11 b/g/n/a/ac. Wi-Fi is connected to the host via USB2.0, whereas Bluetooth v4.2 + HS (backwards compatible with v1.x and v2.x) finds connection via USB1.1.

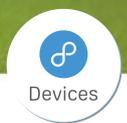
The modules are supported by Linux and Windows drivers. The temperature grade is defined for -40°C to +85°C.

## BLUE-BEAN-DVK: Development Kit

Samples and DVKs are available in our Sample Shop. Further information is provided here: <http://downloads.codico.com/misc/AEH/8DEVICES>

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# JALAPENO

## Embedded Wi-Fi Module with Quad Cortex-A7 for Linux based Applications

The new Wi-Fi module Jalapeno from 8DEVICES supports DBDC (Dual Band Dual Concurrency) 802.11a/b/g/n/ac in MU-MIMO 2x2 and provides 2x1000 Base-T and USB3.0 high-speed interfaces for high performance IoT-Hubs, Gateways, Routers und Access Points.

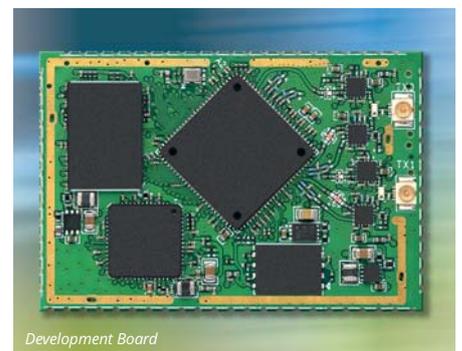
Jalapeno is based on the new SoC IPQ-4018 from QUALCOMM, which provides the special capability of serving two frequency bands 2.4GHz and 5GHz at the same time. This results in a maximum antenna data rate of 1.166Gbps; 866Mbps at 11ac 2x2 @ 5 GHz and 300Mbps for 11n 2x2 @ 2.4 GHz. To process the high data throughput, two Cortex-A7 CPUs are available as network processors and two more are available as application-processors.

All 4 CPUs are running at 700 MHz clock rate, each providing a NEON MPE (Media Processor Engine), one FPU (Floating Point Unit) as well

as a number of high-end security features like secure boot and crypto engines. Also the memory configuration of 256MB DDR3 @ 667MHz, 128MB NAND and 8MB NOR FLASH will meet your hardest requirements.

In addition to USB3.0 and 2 Gigabit Ethernet ports, Jalapeno offers numerous other interfaces like USB2.0, I2C, I2S, UART and GPIOs.

OpenWRT linux distribution source code is available on GitHub (<https://github.com/8DEVICES>) and is supported on the growing community forum (<http://www.8DEVICES.com/community>).



Development Board

Development Kits are now available at CODICO's Sample Shop ([www.codico.com/shop](http://www.codico.com/shop)). Further information is available here:

<http://downloads.codico.com/misc/AEH/8DEVICES>

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## New 12bit, Automotive-Grade, Magnetic Angle Sensors from MPS

# MAQ430 & MAQ470

Measuring angular movement or rotation in vehicles is becoming increasingly important as vehicles integrate more technologies and systems to aid their drivers. To simplify the number of user interfaces, many vehicle system options have become controllable via a single rotary knob selector.

At the same time, many previously manual features, such as seat position, door closure, and tailgate mechanisms, are being motorized, which require control of motor rotation, position, and speed. For both application areas, magnetic angle sensors can provide a highly reliable and contactless way to measure angles, rotation position, or speed. This article discusses how the MagAlpha MAQ470 and MAQ430 automotive-grade angle sensors from Monolithic Power Systems (MPS) can be used in such systems.

As vehicles become ever more sophisticated by providing drivers with electronic control of entertainment, communications, navigation, and engine systems, user interfaces must be simplified to keep the cabin uncluttered and to eliminate driver distractions. Typically, this results in a single, central, rotary control to scroll through and select options via a display panel menu of the various systems within the vehicle. Since that interface is used every time the vehicle is driven, it requires a highly reliable solution to guarantee

a long operating lifetime. Mechanical or potentiometer-based rotary switches suffer from mechanical wear and susceptibility to damage from environmental factors, such as moisture or dirt ingress, which can cause early failure. Because magnetic angle sensors are contactless, they provide a highly reliable way of implementing rotary position detection. They can also replace mechanical push buttons by measuring the change in magnetic field strength when a selection knob is pressed down or lifted up.

Some new, advanced user interfaces provide haptic feedback through the knob dependent on the specific feature selected. For example, in a telephone interface mode, selections for the numbers 0-9 are electrically transformed into 10

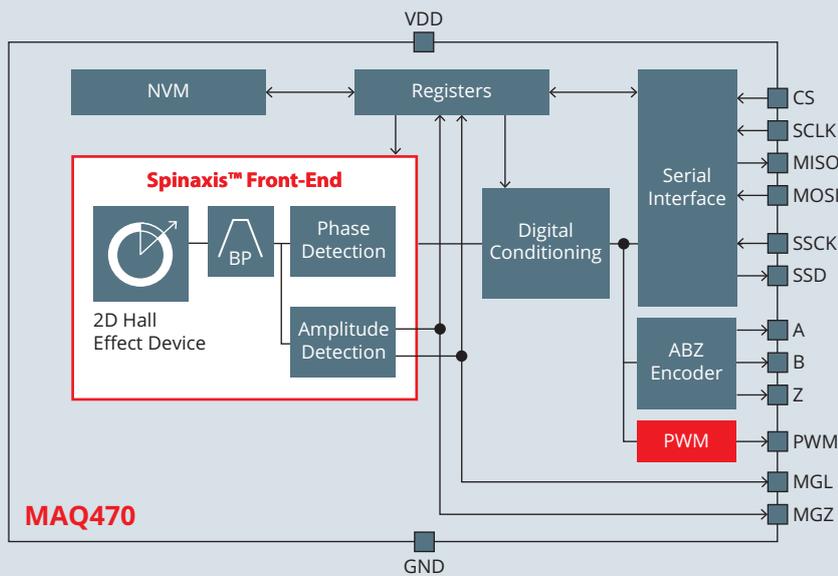


Figure 1: MAQ470 Magnetic Angle Sensor Block Diagram



Figure 2: Rotary Knob with Push Button Example

fixed knob indents. In an audio volume control mode, many small indents are created to give a smooth ratchet impression when turned. Such haptic systems adapt the mechanical threshold between steps using a motor or solenoid coils linked to the selector knob. They require angle sensing and rotation speed measurement in conjunction with the chosen feature to control the number of indents and the haptic effect fed back to the user.

The MAQ470 provides a number of convenient interfaces to read angle position information and detect the speed or direction of rotation (see Figure 1). The absolute rotary angle information is output via an SPI/SSI or PWM interface with 12bit (3-sigma) accuracy. The PWM signal can be further filtered externally to an analog voltage to mimic a potentiometer-based system. An ABZ quadrature incremental encoder interface with programmable pulse count is also provided. This can be used to provide speed and direction of rotation information, which is useful for scrolling through a menu display or adjusting an audio volume control function. Eight programmable magnetic field thresholds allow detection of changes in the distance between the magnet and the sensor so a contactless push button can be

implemented to select the chosen feature (see Figure 2).

The MAQ470 can operate over a wide magnetic field range of 30 to 150mT. The eight thresholds are programmable in approximate 15mT steps. The use of electric motors is proliferating within vehicles to both increase performance and efficiency in the drive train and to provide increased driver convenience and comfort by automating previously manual features (e.g.: seat position controls, air conditioner mix setting, pop-out

door handles, and powered assistance mechanisms for door closure, roof canopies, and tail gates, as shown in Figure 3).

With the popularity of larger vehicles, such as SUVs, it is common that doors and tailgates are now motorized due to their size and weight. In addition to sensing when the door or tailgate is fully open or closed, there is also a safety requirement that the system must be able to sense whether an obstruction, such as the driver's hand, is trapped and quickly deactivate or rever-



Figure 3: Motorized and Automated Controls

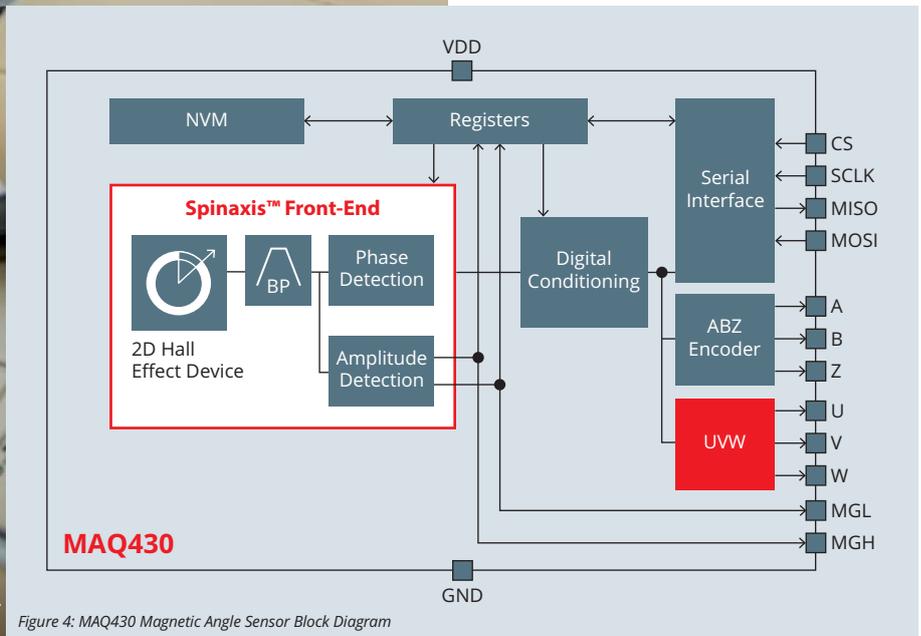
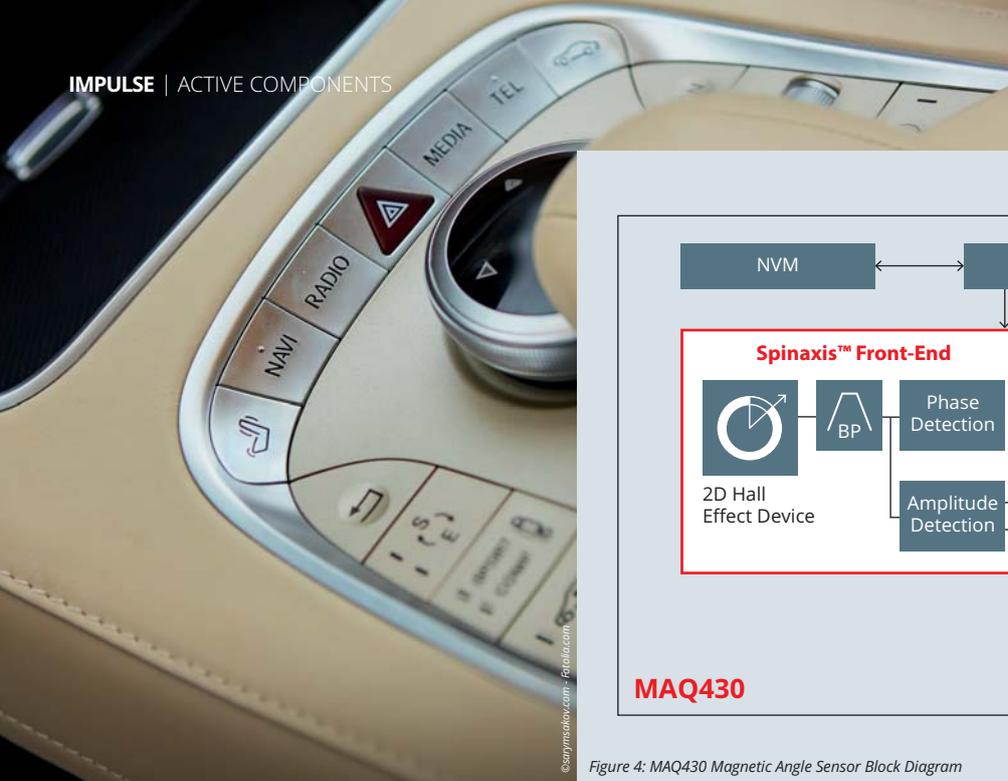


Figure 4: MAQ430 Magnetic Angle Sensor Block Diagram

se the motor drive to prevent injury. This requires rapid feedback of any change in the motor's rotation speed. Sensors such as the MAQ430 can provide two functions in this respect. Firstly, the absolute angle, speed, direction, or number of rotations can be monitored by either the SPI/SSI bus or the ABZ incremental encoder interface (see Figure 4).

Secondly, for brushless motor systems, the MAQ430 sensor can emulate traditional, 3-Hall sensor, UVW commutation signals that inform the motor driver when to energize each phase winding. With the addition of the MAQ430 sensor, the motor becomes a fully brushless servo implementation. Such motors in vehicles are sometimes referred to as compact brushless actuators (CBA).

Size is often a critical factor in the design of such actuators to minimize vehicle weight and fit within the tight mechanical constraints of the mechanism. The MAQ470 or MAQ430 are available in small QFN (3x3mm) packages, and the typical

disc magnet size is only 3mm diameter by 2mm height for an end-of-shaft topology, making these solutions compact and cost-effective.

A useful feature of these sensors is the ability to operate with several topologies of magnet and sensor position. In addition to the usual end-of-shaft magnet position, the MAQ470 and MAQ430 also support two types of side-shaft configuration (see Figure 5). Side-shaft configurations increase the choice of mechanical options, permitting designs that are more compact. For systems requiring redundancy for safety, side-shaft mode also permits the positioning of two sensors at 90° or 180° positions relative to each other around the magnet shaft axis.

For applications where the absolute position is not required, a multi-pole ring magnet can be used to increase the sensor's effective resolution. The sensor detects 360° of magnetic revolution for each magnet pole pair on the ring. For example, in a motor commutation application, the number of poles on the ring can be matched to

the rotor pole count. The sensor can store a programmable offset so the sensor magnet poles can be aligned to the rotor poles during motor production.

Both the MAQ470 and MAQ430 magnetic angle sensors are qualified to AECQ grade 1 and support operation from -40 to +125°C, satisfying the requirements for the typical in-cabin and vehicle body systems described above. The devices are packaged in a small, 3x3mm, 16pin, plastic, QFN with wettable flanks to aid production solder joint inspection.

The MagAlpha MAQ470 and MAQ430 sensors provide a highly reliable and contactless method to measure angles, position, and speed in automotive systems. Their compact size, multiple angle output formats, and flexible magnet position topologies ease the implementation of cost-effective angle sensors and actuators.

A03

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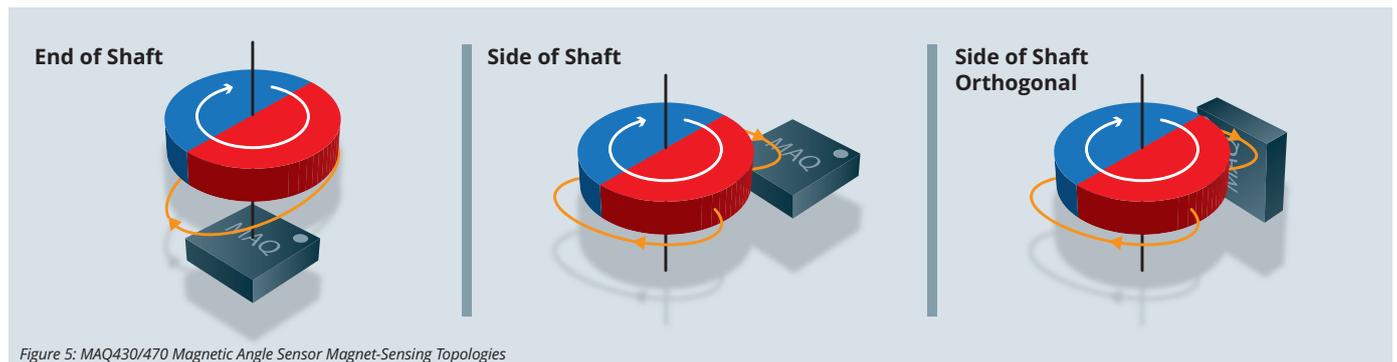
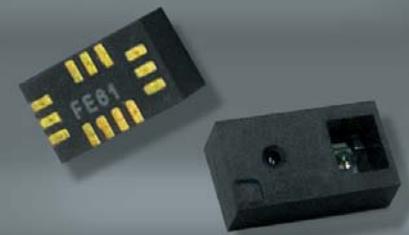


Figure 5: MAQ430/470 Magnetic Angle Sensor Magnet-Sensing Topologies

# GESTURE SENSOR



The PAC7620 provides touch-free user interaction with products to provide an easy and intuitive user experience.



PixArt Imaging Inc., a leading provider of human-machine interface (HMI) solutions introduces a the Gesture Sensor PAC7620.

The invisible IR image-based PixArt PAC7620 Gesture Sensor creates a three-dimensional gesture space extending 6 inches above the part to allow users to seamlessly interact with their product without the need to hold or touch the product. The PAC7620 provides hands-free user control of the product through simple hand gestures.

The nine user gestures (up, down, left, right, wave, forward, backward, clockwise, and counter-clockwise) allow intuitive interaction systems for gesture enabled applications. This can be an ideal interaction for hands-free or gloved operation if the user's hands are occupied or too dirty to touch the product.

The PixArt Gesture Engine addresses the shortcomings of existing human-machine interaction by enabling intuitive, simple gestures for users to easily control their product. Traditionally touch navigation requires full user attention and can be limited by the user's inability to use the touch screen at the time.

*«Our company vision is to develop innovative human/machine interface solutions with our advanced imaging technologies. Providing the capability for users to easily operate their phones with simple hand movements creates a smooth, intuitive interaction for users to heighten their enjoyment of advanced technologies,»* said Dennis Lo, President, PixArt Imaging USA. *«We think this innovative technology will expand the capabilities of your advanced product to show customers what the future of HMI and interaction can be.»*

Application tasks ranging from simple to complex can now be accomplished with natural hand movements. The PixArt Gesture Engine integrates easily into existing designs with its small form factor and standard I2C interface.

Operators can customize the gesture engines capabilities, creating their own user interaction and application usage to best fit their user's requirements and expectations. Additionally, the PAC7620 provides better and more gestures recognition in comparison to simple photodiode

approaches. It also provides lower power consumption and latency when compared to conventional camera solutions paired with software gesture recognition.

A04

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## Features

PixArt Gesture Engine can be used as example for:

- Basic navigation (Up, Down, Left, Right) for browsing or scrolling Web pages
- Zoom In/Out function for pictures or 3-D space movement
- Scroll gestures for forward and reverse movement and volume control through video or music
- Motion detection for wake-up or silence applications

# LTE BG96 CAT.M1-NB1 & EGPRS MODULE



The BG96 from QUECTEL is a LTE Cat M1/Cat NB1/EGPRS module, for world wide using, offering a maximum data rate of 300kbps downlink and 375kbps uplink.

It features ultra-low power consumption, and provides pin-to-pin compatibility with QUECTEL LTE module EG91/EG95, Cat NB1 (NB-IoT) module BC95, UMTS/HSPA module UG95/UG96 and GSM/GPRS module M95.

With a cost-effective SMT form factor of 26.5×22.5×2.3mm and high integration level, BG96 enables integrators and developers to easily design their applications and take advantage from the module's low power consumption (approx. 10uA in PSM mode) and mechanical intensity. Its advanced LGA package allows fully automated manufacturing for high-volume applications.

The GNSS support is optional and use GPS, GLO-NASS, BeiDou/Compass, Galileo, QZSS and the

VoLTE function (PCM digital audio interface) are also useful for many applications.

A rich set of Internet protocols, industry-standard interfaces (USB/UART/I2C/Status Indicator) and abundant functionalities (USB drivers for Wind-

ows XP, Windows Vista, Windows 7/8/8.1/10, Linux and Android) extend the applicability of the module to a wide range of M2M applications such as wireless POS, smart metering, tracking, etc. In case of further questions please contact:

A05

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## Features

- LTE Cat M1 & Cat NB1 & EGPRS module with ultra-low power consumption
- Compact SMT form factor ideal for size-constrained applications with tight space
- Easy migration from GSM/GPRS, UMTS/HSPA and LTE modules
- Super slim profile in LGA package
- Fast time-to-market: Reference designs, evaluation tools and timely technical support minimize design-in time and development efforts
- Robust mounting and interfaces

## R1DX series – following the success

Following the success of the R1SX 1W DC/DC converters, RECOM has extended its portfolio with the R1DX series to cover dual output voltage applications. The R1DX series is ideal for EIA/TIA-232 bus isolation and a wide range of industrial automation control equipment, sensors, isolated operational amplifiers and test & measurement equipment that require bipolar supply voltages.

The R1DX series are high-quality open-card SMD converters, which deliver stable performance on symmetric dual outputs at a very competitive price. They operate from 5V and offer  $\pm 5$ ,  $\pm 9$ ,  $\pm 12$  or  $\pm 15$  dual outputs. There is no minimum load required, and the quiescent consumption is less than 150mW.

The pin-out is industry standard and compatible with the R1S/R1D series. High isolation of up to 3kVDC (/H option) make them an ideal solution for isolating data transfer lines in legacy communication protocols (e.g. RS-232) and for isolated DAC and sensor applications. The modules operate at a wide temperature range from  $-40^{\circ}\text{C}$  to  $+95^{\circ}\text{C}$  without derating and can drive up to 1000 $\mu\text{F}$  capacitive loads, which is multiple times higher than the competition. The series is fully certified to IEC/UL/EN62368-1 and UL60950-1. Samples are now available from CODICO. For further details contact

A06

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New open card  
SMT 1W DC/DC with  
bipolar outputs!



RECOM



## Converters for Smart Home & IoT

Modern smart homes, as well as IoT systems require a high number of low power nodes, actuators and sensors to process information intelligently. To efficiently power these applications, RECOM once again steps forward and extends its low-power RAC-series with new 3W and 4W converters with EN60335 household certification. These new low cost additions to the RAC family represent a value for money proposition, which is unique in the marketplace.

RECOM's new RAC03-G and RAC04-G series were specially designed to supply smart building infrastructures continuously and efficiently. Their high efficiency and no-load power consumption of only 75mW make them exceptional energy-saving solutions, which are needed in energy critical systems.

Their standard 3.3, 5, 12, 15 and 24VDC outputs are suitable to power relays, gateways and building automation nodes. A universal input voltage range from 85VAC to 305VAC allows for worldwide use. These series operate over a wide temperature range from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ , are over-current and short-circuit protected. They are EN55022 Class A (RAC-GA) or Class B (RAC-GB) certified without the need of any additional components. The RACxx-GA series is also certified to the EN60335 household norm. All modules are also certified to EN60950 and EN62368 and come with a three-year warranty. Samples are available from CODICO now.

A07

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# THE BEST THINGS ARE WORTH WAITING FOR!

## A new IEEE 4-pair high power (71W) standard – IEEE802.3bt!



After a gap of 9 years, the IEEE are close to finalising and ratifying the latest POE standard, IEEE802.3bt for higher power for delivering up to 71W over 4-pairs. SILVERTEL will offer 2 new modules for the new standard: Ag5800 and Ag6800.

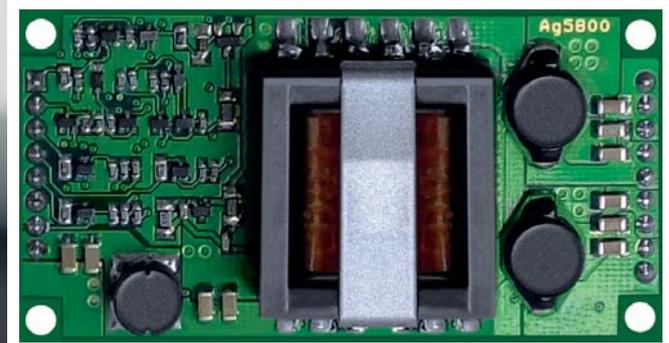
The history of IEEE POE standards started way back in 2003 with 802.3af for 12.95W devices, moving on slowly to 25.5W devices being catered for with 802.3at (often called POE+) back in 2009. However, there has always been demand for more power for larger and more power hungry devices. SILVERTEL and other major POE industry players have been catering for the slowly growing market demand for higher power POE systems since 2010. So much market demand now in fact that SILVERTEL have an extensive range of higher power POE modules (with Ag5500, Ag5510, Ag5600, Ag6110 and Ag6600) already widely used globally in a wide range of products and applications, such as high power Pan/Tilt/Zoom IP cameras, high end video conferencing systems and access control locking systems.

As many of SILVERTELS' customers are aware, the IEEE has been in the process of drafting a new Power over Ethernet standard, called 802.3bt. This is a new higher power standard for delivering up to 71W at the PD over the full 4 pairs of wires in a CAT5E cable to improve efficiency and minimise losses at the higher power levels. This standard is now at Draft 3.2, to which release level SILVERTEL are preparing a new set of mo-

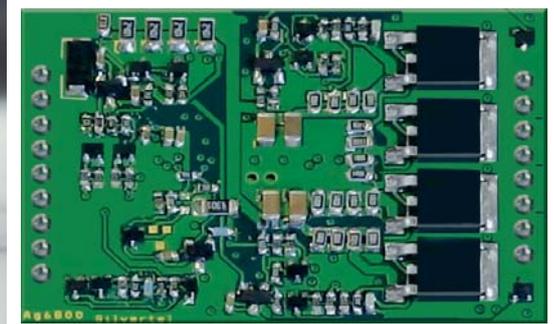
dules, the Ag6800 and Ag5800. Ag6800 will be a fully (draft) standards compliant, 90W nominal output PSE module and will be released first, followed shortly after by the draft compliant Ag5800 PD module, delivering up to 71W of usable power to the end device. Both modules will be cost and footprint size optimised, as you would expect from a world leader in POE module technology and design, to provide state of the art solutions at market leading prices for our customers for the next generation of POE applications. The Ag5800 PD module has been designed into a footprint of just 35x70mm, while the Ag6800 is just 35x51mm in area.

### Ag6800 versus Ag5800





Silvertel's Ag5800



Silvertel's Ag6800

nected devices, this can quickly add up to a lot of wasted power, strongly frowned upon in our Green and Eco friendly times. The new 802.3bt standard makes great progress with regards to this needless standby power loss by allowing a 2.2% duty cycle. The standby power loss per port is therefore reduced to less than 20mW, ten times smaller than previously.

The new standard, as you would expect, is fully backward compatible with the existing POE standards. In addition to much higher power levels, the new 802.3bt also introduces some new key important features for modern and trending technologies such as LED lighting. While the use of POE for powering such systems has been slowly growing, one major drawback for large scale implementation of POE as a power source

for lighting is the relatively high standby power requirements of POE.

In order to maintain the PSE power connection, legacy POE systems require a 10mA PD current draw, over the link, for a minimum duty cycle of 20%. Assuming 50V on the cable, this equates to a standby power loss of 100mW per PD. With any large scale projects with high numbers of con-

Of course, other features (already familiar to high power POE users) introduced are power delivered over all four pairs. This helps to reduce power losses in the cables by effectively halving the current through each pair of wires. The changes are partly enabled by introducing two new PSE types, Type 3 for power up to 51W and Type 4 for Power up to 71W. The POE classification range is also extended up to Class 8 for 90W output on the PSE and 71W delivered at the PD.

As ever, the modules have been designed and will be produced in the UK and backed up by SILVERTELS first class application support for any customers choosing them for their next generation of POE products. The IEEE may have taken its' time with the new higher power standard, but we think it will have been worth the wait!

## PoE Capabilities Awaiting Ratification

Type	Standard	PSE min. Output Power	PD min. Input Power	Cable Category	Cable Length	Power Over
Type 1	IEEE802.3af	1.4W	12.95W	Cat5e	100m	2 Pairs
Type 2	IEEE802.3at	30W	25.5W	Cat5e	100m	2 Pairs
Type 3	IEEE802.3bt	60W	51-60W	Cat5e	100m	2 Pairs Class 0-4 4 Pairs Class 0-4 & 5-6
Type 4	IEEE802.3bt	90W	71-90W	Cat5e	100m	4 Pairs

A08

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# SMALLEST SOLUTIONS

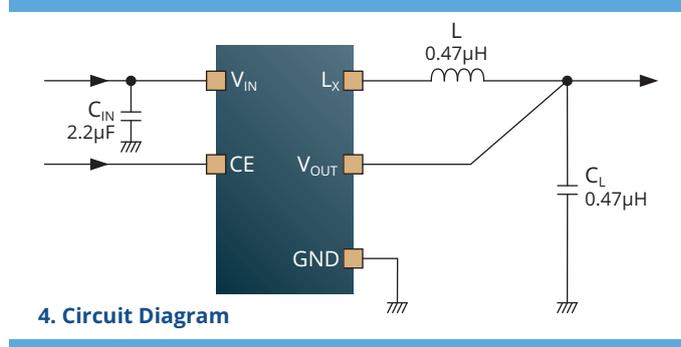
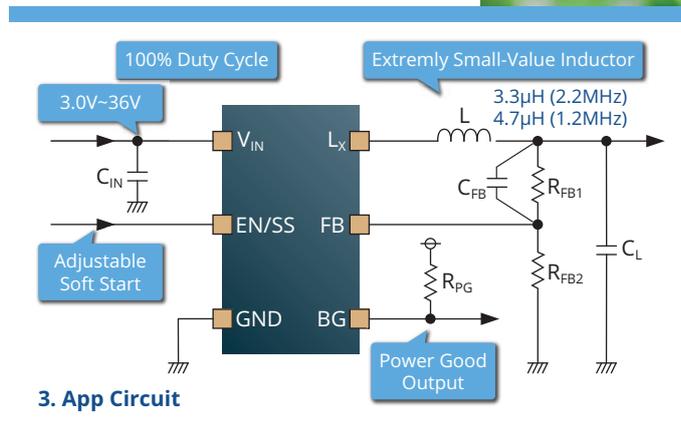


TOREX has released two new low quiescent current synchronous DC/DC converters which are not only low power but also the World's smallest in their respective categories.

The XC9267/68 is the World's smallest 36V synchronous buck DC/DC, an ideal solution for the industrial market and in particular, the Industrial IoT market where low power consumption at higher voltages is key. The XC9281/82 features TOREX's newest generation of Hi-SAT COT™ technology and is the World's smallest 600mA synchronous buck DC/DC making it an ideal solution for modules and other space sensitive applications.

## 36V, 600mA Synchronous Step-Down DC/DC Converter XC9267/68

The XC9267/68 is synchronous step-down DC/DC with an internal P-Ch High Side Switch to ensure low voltage operation with 100% max duty ratio, an advantage over N-Ch mid-voltage step-down DC/DCs where the max duty ratio is limited. It can operate from 3.0V~36V (absolute max. 40V) and deliver loads up to 600mA. Output voltage is set externally within a range of 1.0V~25V and the quiescent current is only 11.6uA (XC9268, 1.2MHz type) in operation. The XC9267/68 has an enable pin which allows the DC/DC to be placed in stand-by mode with a stand-by current

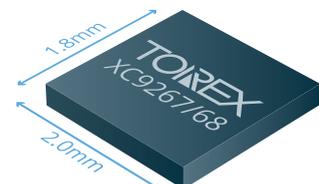


of just 1.65uA. Whilst the XC9267 is fixed PWM control, the XC9268 is automatic PFM/PWM control. The XC9267/68 works with small Low ESR ceramic capacitors and comes with a choice of two switching frequencies (1.2 or 2.2MHz).

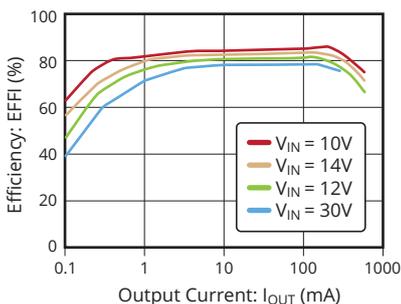
Adjustable soft start and a power good output (USP-6C package only) provides the design engineer with power sequencing capabilities, a feature that not many DC/DCs in a package of this size (2.0×1.8×0.6mm) can offer.

The series also features Over Current, Under Voltage, short-circuit & Thermal Shutdown protection circuits. An extremely small DC/DC circuit can be implemented with a minimal number of external components.

## 2. XC9267/68: Dimensions

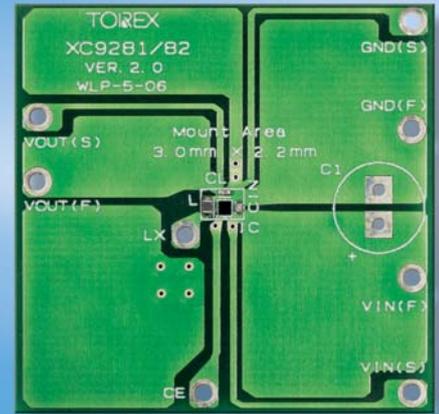


## 1. Efficiency Graph

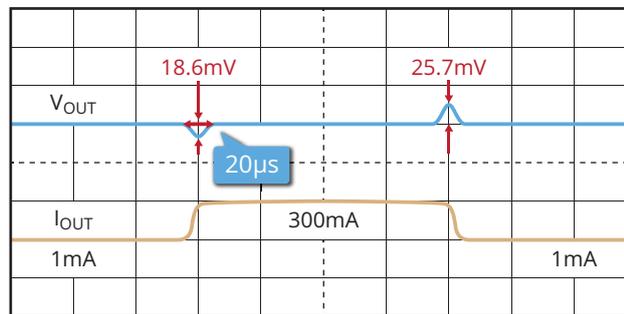


## 5.5V, 600mA Synchronous Step-Down DC/DC Converter XC9281/82

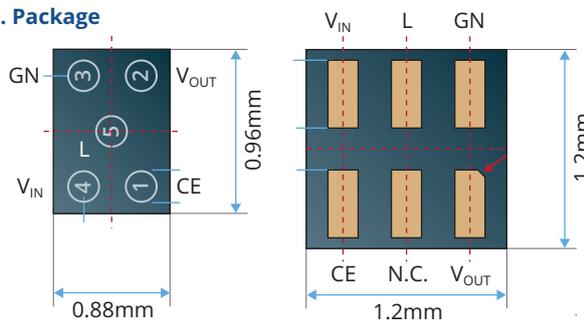
The XC9281/82 is a 600mA synchronous step-down DC/DC that can operate from 2.3V to 5.5V. Output voltage is selectable between 0.8V to 3.6V and the quiescent current is only 9.8uA (XC9282) in operation. The XC9281/82 has an enable pin which allows the DC/DC to be placed in stand-by mode with a stand-by current of just 1.0uA (max.). With a switching frequency of 6MHz, a



### 5. XC9281 Test Conditions: $V_{IN}=3.6V$ , $V_{OUT}=1.8V$ , $T_a=25^{\circ}C$



### 6. Package



small 0.47uH inductor can be selected to reduce total board space without sacrificing on efficiency. In fact, the XC9281/82 has shown to have a higher efficiency than some of our 3MHz buck DC/DCs thanks to improved switching loss and lower ON resistance.

Whilst the XC9281 is fixed PWM control, the XC9282 is automatic PFM/PWM control and is designed for high efficiencies at low output loads. The series can be used with small low ESR ceramic capacitors. In addition, the XC9281/82 supports very low EMI thanks to the flip chip packaging which reduces the parasitic inductance of noise normally associated with wiring inside the package and fast load transient response performance thanks to Hi-SAT COT™ control.

The XC9281/82 is available in either a LGA-6B01 package (1.2x1.2x0.3mm) or an ultra-small WLP-5-06 package measuring only 0.96x0.88x0.3mm. The total solution size of the XC9281/82 with the WLP-5-06 package is only 6.6mm<sup>2</sup>.

## Next Generation Hi-SAT COT™

The XC9281/82 is one of a number of new DC/DCs from TOREX that feature the latest generation of Hi-SAT COT™ technology, what we call »2nd Generation« Hi-SAT COT™. Our 2nd generation Hi-SAT COT™ products provide ultra-fast load transient response performance. In comparison to the previous generation of Hi-SAT COT™ products, have improved output voltage accuracy and a more stable switching frequency over load current and input voltage, something which is an inherent issue with traditional COT (Constant On-Time) architectures.

These new DC/DC families incorporate an improved Constant On-Time architecture and a higher accuracy voltage reference circuit which are required to regulate »Sub 1v Core Voltages« that are needed by many applications in the electronic market place today. In fact, all our 2nd generation Hi-SAT COT™ DC/DCs offer an output voltage range down to 0.8V.

Samples and/or evaluation boards for both the XC9267/68 & XC9281/82 can be requested. The evaluation boards are custom made to the customer's specific requirements. Test data is provided with each board.

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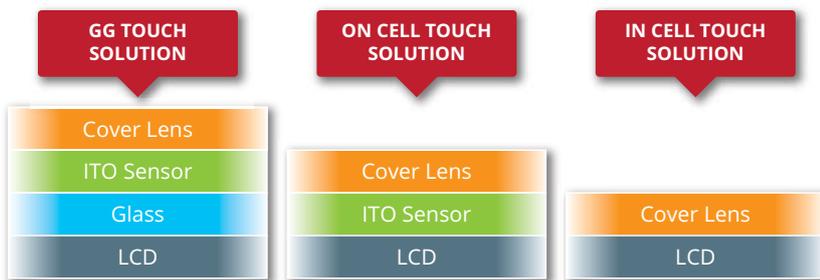
...for Liquid Crystal Displays

# TOUCH

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ness for the display unit, reduces the number of possible malfunctions for the touch sensor, and prevents optical reflections, thus making the display excellent to read. Its integration for the user is easier and the costs lower – compared to those of a separate solution – (display & touch sensor). The disadvantage is that only few manufacturers offer this technology, and it is only available for large screen sizes.

Touch on segment LCDs?  
Is it necessary, or even useful, and is it possible at all?



1: General Illustration of Touch-Technology

The third option is the in-cell touch technology. In this system, the electrodes required for the touch function, are situated within the display, i.e. between the glass substrate (bottom) and the cover glass (top). This technology is increasingly used in smartphones and is gradually gaining significance in this sector. It allows cost-efficiency for the production of very thin displays with a touch function (Image 1).

Let's begin with the question of necessity: Do we need a touch sensor in small, monochrome LC displays? As a rule, the answer to this question is YES. In the era of smartphones, people are used to and expect to have a possibility of interacting by touch with almost every display. So, why not in a small, monochrome display as well? This can help avoid additional buttons, thus reducing costs. In addition, the device can be given a more contemporary look and an attractive design.

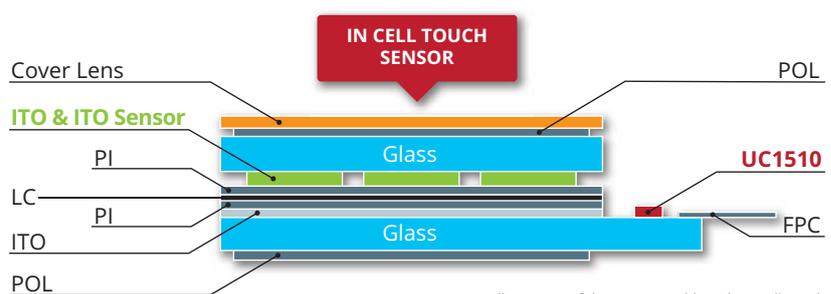
with TFTs. Therefore, a touch sensor would have to be specifically manufactured in the corresponding size for the display. This results in construction and tool costs that may sometimes amount to 1,000-2,000 US Dollars. So, all in all, not an ideal or cost-effective solution.

A second method is the so-called on-cell touch technology. It involves affixing the sensor directly on the LCD surface and bonding a protective glass on top of it. This results in a smaller thick-

YEEBO, a manufacturer of high-quality monochrome LCDs and TFTs has integrated the in-cell technology in LCDs. The liquid crystal is situated between two polyimide (PI) layers with conductive indium-zinc-oxide (IZO) layers above and below, and with the ITO layer housing the touch sensor affixed on the front glass (Image 2).

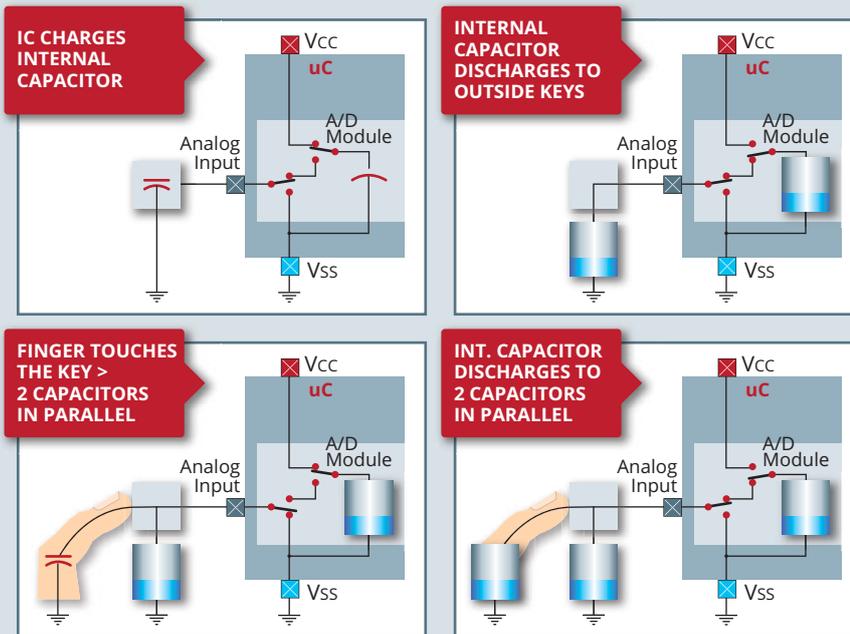
It is evident that this technology allows for the implementation of very thin displays with a touch function.

Now, as to the implementation: The meanwhile widespread projected capacitive touch sensor can now also be used in small displays. Essentially, this means installing a touch sensor on the display – the simple version featuring a carrier glass with an ITO layer, and perhaps an additional cover glass. The problem here, however, is the size. In most cases, LCDs are small and only partially available in standard sizes, as is the case



2: Illustration of the LCD Assembly with In-Cell Touch-Sensor

### CAPACITIVE TOUCH BASIC THEORY



3: Capacitive Touch Basic Theory

their own capacitance. The latter depends on their environment and will also change with it. Therefore, it is necessary to introduce a threshold, at which a key is recognised as »pressed«. This threshold value, too, must be adjusted individually for each ("pressure") point. When the capacitance exceeds this value, the key is considered »pressed« (Image 4).

Manufacturers of display controllers have taken this development into account and developed TTDI (Touch and Display Driver Integration) chips for this application. YEEBO, for instance, is using a controller made by UltraChip. This component is both responsible for the control of the display and in charge of the touch function (Image 5).

The data to and from the display are transferred via a serial interface (I<sup>2</sup>C or SPI). The chip can control up to 160 segments (4 backplanes with 40 segments each) and can accommodate up to 16 keys. Should a protective glass be required for the corresponding application, e.g. to provide protection against vandalism, such glass is supported up to a thickness of 5mm.

Of course, certain design rules must be observed: the touch surfaces must have a specific size, what is also referred to as a »standard finger« with a minimum diameter of 8mm, to ensure a proper function: Furthermore, these surfaces must also be positioned at a defined distance from each other. This, however, does not pose a problem in practice.

Several applications exist – for instance, in small industrial controls, service displays with entry option, household appliances, room thermostats with a control function, vending machines, etc. These can be manufactured without mechanical keys, thus increasing their fail safety (mechanical systems are prone to failure) while reducing overall costs.

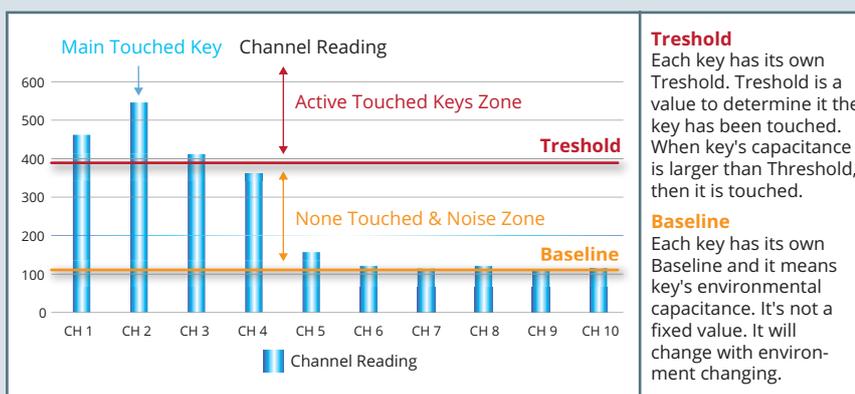
They represent a successful migration of a technology initially developed for smartphones, to industrial applications. Touch sensors can also be implemented in a segment LCD display without considerable effort. We will be happy to advise you in case you are interested in such a solution.

Contrary to projected capacitive touch screens that use electrical fields, in-cell touch sensors work with the parasitic capacitance of the liquid crystal. The controller charges the external capacitor (in the display). When a finger touches the display, two capacitors are connected in parallel.

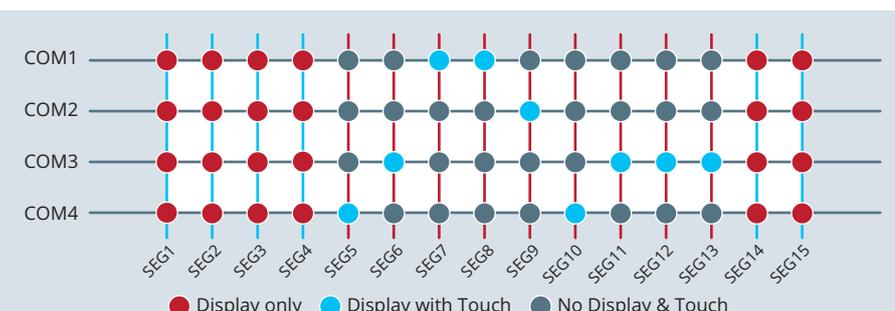
The touch controller must now charge a larger capacitance with the internal capacitor, thus detecting the touch event (Image 3).

Since analogue functions are involved, a basic algorithm must be applied. All (sensor) keys have

### CAPACITIVE TOUCH BASIC ALGORITHM



4: Capacitive Touch Basic Algorithm



5: Concurrent Operation of the Electrodes for LC-Display and Touch Function

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# OLED DISPLAYS

Thinner, lighter, and last longer

OLED  
Solution  
flexible



WiseChip is a leading provider of Passive Matrix OLED (PMOLED) display solutions, with more than ten years of production experience. Thanks to intense commitment to development, design, and manufacture of OLED products, innovative creations are constantly being presented, and the family of flexible OLED displays has recently been expanded.

Common to all flexible OLED displays is a flexure radius of  $\geq 40\text{mm}$ . The excellent contrast, a wide visual angle, rapid response time ( $\leq 10\mu\text{s}$ ), and the fact that OLEDs themselves light up and therefore no backlight is needed, are all strong arguments in favor of the use of OLED displays.

Flexible OLED displays also provide many advantages for portable devices in particular. They are thinner, lighter, and have a longer service life than LCDs. Another bonus is the rapid reaction speed even at low temperatures, while with LC displays the inertia with changes of content

in the cold is very noticeable. The new flexible variants operate at temperatures from  $-20^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$ .

But flexible displays can be used in many more situations than just mobile devices. For example, curved surfaces can also be provided with a display. This gives designers entirely new possibilities of integrating a display into a device. Regardless of whether this involves industrial applications, medical technology, or motor vehicles, flexible displays open up whole new horizons. To demonstrate unusual applications, a display was integrated into an insulated beaker, and then



## Features

The following sizes are currently available:

- **1.36"** white  
Resolution 128×16 pixels

---

- **1.71"** white (16 grey levels)  
Resolution 256×64 pixels

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- **1.81"** white (16 grey levels)  
Resolution 160×32 pixels

showed the temperature of the contents. And it is even possible to display what drink is contained.

WiseChip was honored with the 2018 Taiwan Excellence Award for the extended series of flexible displays by the Taiwan External Trade Development Council (TAITRA), by decision of the Ministry of Economic Affairs for outstanding new developments.

A11

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# MONOLITHIC CRYSTAL FILTER

Smaller Size!



KDS/Daishinku has developed smaller size 4-pole monolithic crystal filter (MCF) for smaller radio communication devices.

Filtering components are important for radio communication. If not properly used and designed you will get many unwanted signals, which causes interference from other lines and makes it hard to understand people speaking. Today, mobile phones are using SAW filter due to higher frequency range. But with professional radio communication devices, Monolithic crystal filters (MCF) are used because of their narrow pass bandwidth.

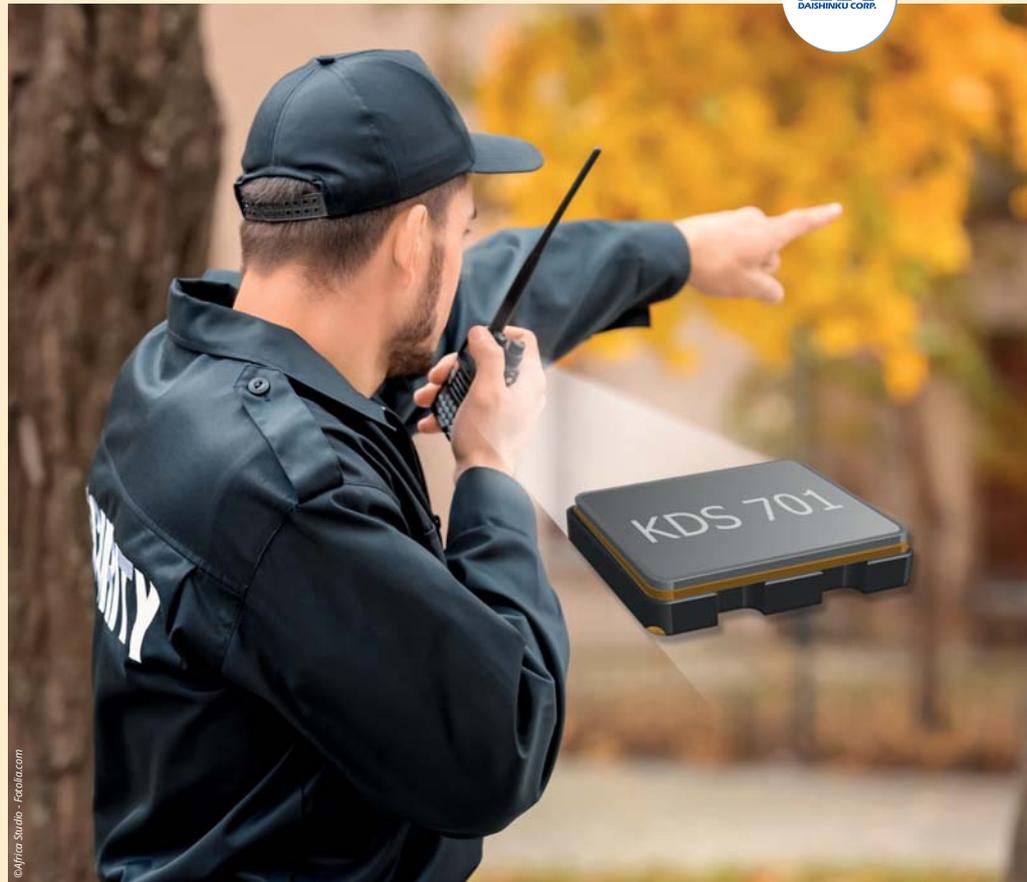
KDS offers the new 4pole MCF DSF633SDF with size 6.0×3.5mm. Currently, the market majority is 4pole MCF in the size of 7.0×5.0mm, which means that the new DSF633SDF will be one step smaller.

## What is the benefit of becoming smaller size?

Normally when you design the radio communication device, you need to be sensitive to avoid the radio interference or the ground connection of the PCB. Especially the filter is one of the sensitive components. The layout freedom will decrease when the communication devices become smaller. DSF633SDF therefore will for sure increase the freedom of the layout design.

Beside that the DSF633SDF has a better intermodulation (IM) characteristic than current MCFs have due to an improvement of the frequency adjustment process. Better IM characteristics result in better third-order intercept point (IP3) in communication, which makes the communication stronger against noises or interferences.

The price is also an advantage of smaller sizes. If you consider the long lifetime design especially on such professional radio communication



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devices, smaller size products will be more cost effective. As the next target KDS considers to have better insertion loss than today's MCFs.

This will result in more possibilities to customize DSF633SDF into your devices.

P01

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## Standard Specification

HOLDER	DSF633SDF		
Nominal Frequency	49.950MHz	49.950MHz	58.050MHz
Pass Bandwidth	±1.75kHz min./3dB	±3.5kHz min./3dB	±5.0kHz min./3dB
Stop Bandwidth	±6.25kHz max./20dB	±15kHz max./35dB	±12.5kHz max./25dB
Ripple	max. 1.5dB	max. 1dB	max. 1dB
Insertion Loss	max. 6.0dB	max. 5.0dB	max. 5.0dB
Guaranteed Attenuation	min. 80dB	min. 80dB	min. 80dB
Terminating Impedance	150Ω//11pF Cc=33pF	220Ω//7pF Cc=23pF	450Ω//4.5pF Cc=9.5pF
Operating Temperature Range	-20 to +70°C	-20 to +70°C	-20 to +70°C
Packing Unit	1,000pcs/reel (dia180mm)		



## The BVF Precision Resistor:



# OPTIMUM INTERPLAY OF MATERIAL AND GEOMETRY

With the BVF, ISABELLENHÜTTE has developed the smallest precision resistor currently available on the market, at just 3.1×3.3 mm. And it is not just the small dimensions which make it so impressive; it has enormous ability to tolerate loading, and phenomenal precision in operation. Smaller electrically-driven applications in particular can take advantage of the performance properties of this high-performance component.

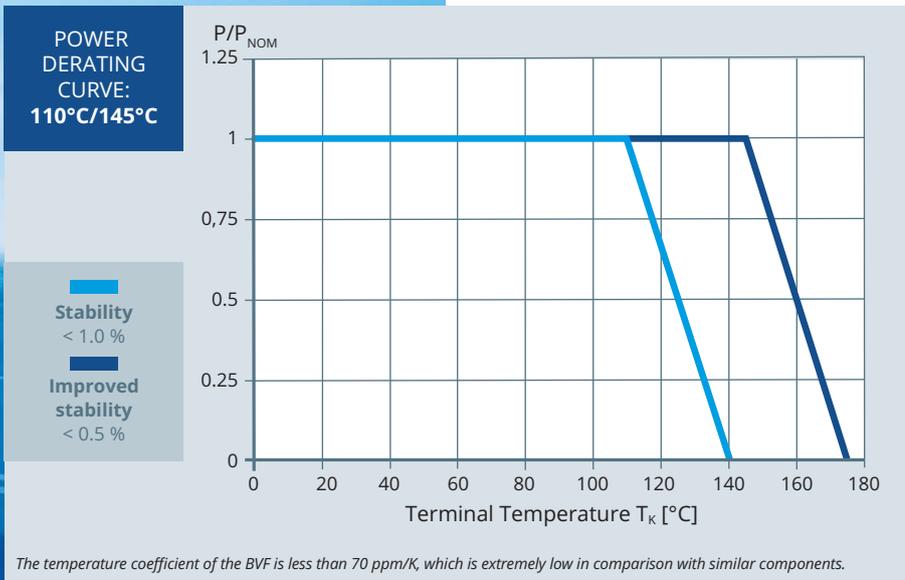
The BVF precision resistor is extremely compact, which means that it can be used in particularly small installation spaces with high performance density. It has AEC-Q200 classification, and can be used in all automobile applications. But it can perform equally well in devices such as washing machines or air-conditioning systems. The BVF shunt is installed in modules which actuate and control brushless DC motors (BLDC motors). These BLDC motors drive the load which could be the washing machine drum or controls the cooling performance of the air-conditioning system for example.

### Maximum performance, minimal size

With the development of the BVF, ISABELLENHÜTTE is once again taking on a pioneering role. With its minimal dimensions of only 3.3×3.1 mm, at the present time the precision resistor is unique anywhere in the world. The temperature coefficient of the BVF is less than 70ppm/K. The internal heat resistance  $R_{thi}$ , at 10K/W, is extremely low. It is these properties which result in the high loading capability of the BVF, of 3 Watt at up to 145°C at the contact point (TK). Even after 2,000 hours at rated performance, the precision resistor still delivers precise measurement

results, with only slight deviations of less than 1.0% (TK=145°C). The BVF can be used over a temperature range from -65°C to +175°C. Thanks to the method developed by ISABELLENHÜTTE and patented until 2014 for the production of precision resistors from electron beam-welded composite material, known as ISA-WELD® components, the copper contacts of the BVF and the centrally arranged resistance material NOVENTIN® can be connected cleanly and precisely. After the electron-beam welding this results in what is referred to as a Tri-Band, from which the component is then stamped out.

Up to now, for comparable components ISABELLENHÜTTE has made recourse in particular to resistance alloys such as ZERANIN®, MANGANIN®, and ISAOHM®. With these alloys, however, it was not possible to meet the specific requirements with regard to the size of the BVF.

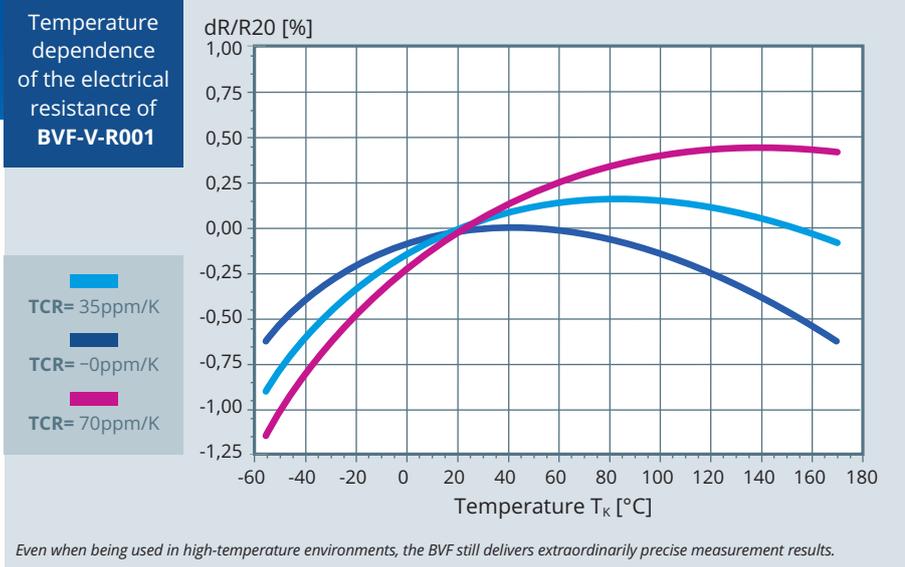


the measurement precision of the component would be restricted. This becomes a particular challenge because of the small size. In order for the heat which is incurred by the high performance of the BVF to flow off into the circuit board, the solder point must be of particularly high quality and well prepared. For integration in applications, the small size of the component not only imposes high demands on the soldering, but also on the arrangement of the measurement path beneath the component and the position of the measurement tapping points.

### From customer enquiry to series production

The BVF precision resistor was originally developed by ISABELLENHÜTTE in response to a customer request. What was wanted was a solution which, despite space limitations, could still deliver optimum results. In the course of the development process, ISABELLENHÜTTE decided to produce the BVF precision resistor in series as well, and to adopt it into the product range as a standard component.

ISABELLENHÜTTE has long been established as suppliers of resistors in the automotive sector in particular. But the use of the BVF is by no means restricted to automotive applications; it is extremely versatile. The company supplies the BVF, for example, for use in Asian countries for use in the E-scooters which are very popular there.



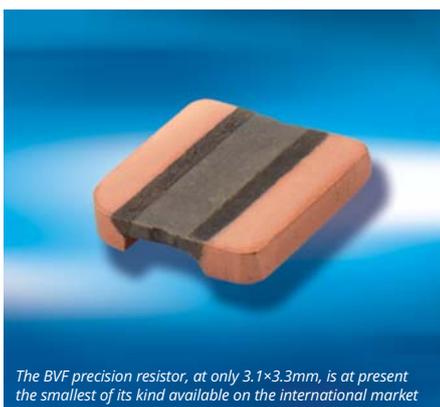
By using the new type of alloy, NOVENTIN®, developed by ISABELLENHÜTTE and registered as a trademark, as the resistance material, enormous performance can be achieved despite the small dimensions. The specific resistance of NOVENTIN®, at 90µOhm×cm, is around twice as high as the resistance of MANGANIN® (43µOhm×cm).

The resistance alloy also has a particularly low temperature coefficient in the range from +20°C and +50°C. The R(T) curve has a parabolic course. NOVENTIN® provides high long-term stability, extremely low thermoelectric power against copper, as well as being easy to process.

### Material and geometry complement one another

The material properties also allow for free range in the geometric design of the BVF precision resistor. The combination of the small geometry of the component, the resistance values required, of 1mOhm or 1.5mOhm respectively, and the need for flexibility of the BVF in application, made it necessary for a height difference to be provided of the external copper contacts in relation to the central resistance material. This height difference prevents the resistance material from being spattered with solder tin, since otherwise

The BVF is also integrated into air-conditioning systems and washing machines. Basically, the precision resistor can be used in all and any applications which are driven by BLDC motors. The shunt is built into power modules, which actuate and control these motors. And the focus is also being set more and more on the energy efficiency of the devices. An air-conditioning system, for example, can be controlled more accurately, and already provides the cooling effect required at low power consumption. And the torque required for a washing machine can be dynamically adjusted to accord with the load during the slow wash cycle. It is precision resistors such as the BVF that really deliver the measurement results needed.



P02

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# POLYMER CAPACITOR HYBRID TYPE

## Why RUBYCON selected not to use electrolyte in hybrid capacitor.

Among all Hybrid-type manufacturers, RUBYCON has chosen its own way of development and to avoid the usage of electrolyte. Instead of electrolyte, RUBYCON is using «functional liquid» which outperforms conventional electrolyte-types in the market. Benefit of this unique technology is to eliminate all the weak points of electrolyte. For example, ESR deviation over different temperatures. Furthermore, RUBYCON offers with this new type of hybrid by higher lifetime at high temperatures and high currents with highest reliability and stable characteristics over lifetime in parallel.

This »functional liquid« is not new to RUBYCON. RUBYCON has long experience with the liquid,

but the combination of functional liquid and polymer was new. This combination has the best from both sides. The polymer offers high conductivity and a correspondingly low ESR.

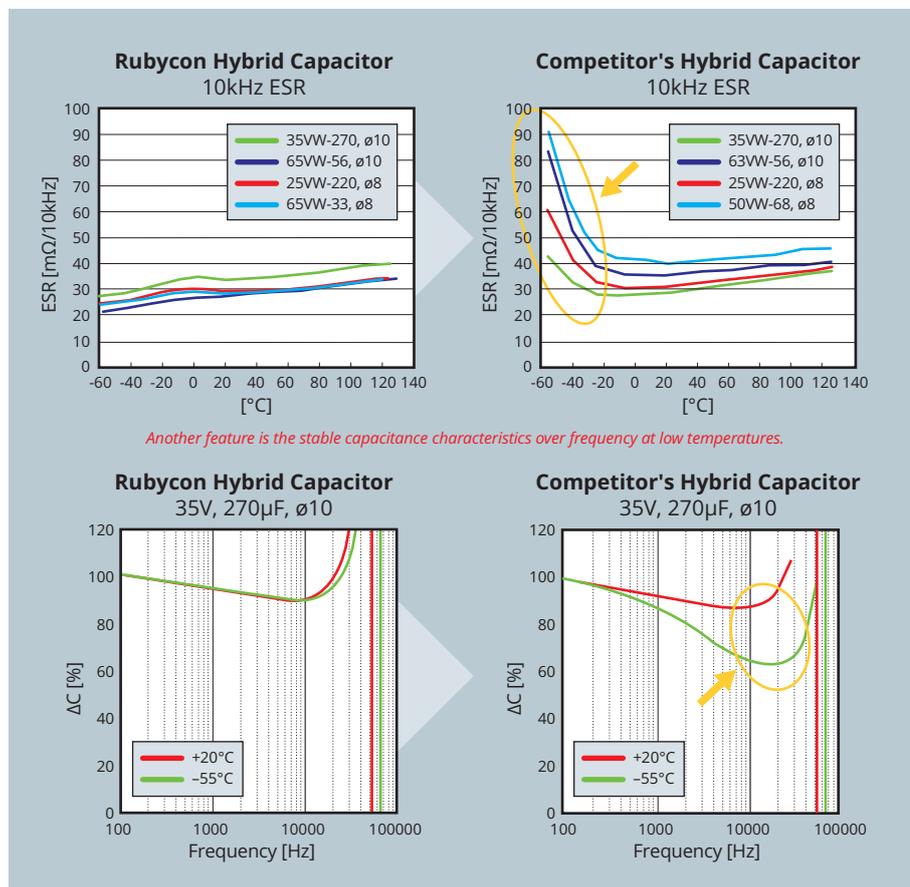
The functional liquid can provide higher capacitance ratings compared to standard solid polymer capacitors. RUBYCON hybrid capacitors offer a voltage range from 25 to 80V and capacitance values between 22 and 820µF.

Due to the usage of »functional liquid«, one of RUBYCON technology advantages is the stable ESR at low temperatures at important frequencies as 10kHz or 20kHz. See the graph shows comparison between RUBYCON functional liquid

hybrid type and conventional electrolyte hybrid type at 10kHz. You can see higher ESR value in lower temperature. At 20kHz, the same performances you can see.

Beside the advantages of ESR, RUBYCON hybrid type has outstanding temperature range. Already RUBYCON PHV series confirms up to 300 Hours (over ø8mm) and 150 Hours (ø6.3mm) of 150°C usage over lifetime. The endurance at 150°C is necessary when you consider automotive application. Which capacitor do you want when the engine and cooling fans cut off and temperature inside the car reached 150°C? RUBYCON products sure can assure such kind of severe condition.

Another feature of »functional liquid« approach is robustness. Based on test results of automotive customers, RUBYCON hybrid type had extremely better endurance on high temperature and



high ripple current condition. Those results showed RUBYCON customers as the »safest solution« among Polymer Hybrid capacitors.

»Functional liquid« also approach the very stable characteristics over lifetime. Especially the applications that focus on End of Life (EOL) ESR, this feature will be important. These features have a huge advantage for automotive powertrain applications such as cooling fan, belt integrated Starter Generator (BiSG), Inverter, electronic power steering (EPS), automotive pump systems, etc.

Based on your requirements RUBYCON is able to provide detailed technical information such as lifetime calculation, thermal models, vibration test results, analysis reports after customers test. More technical calculations and data are available to help you to define the best cost/performance solution. RUBYCON users across the industries worldwide are used to get such support for all RUBYCON technologies.

P03

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# YXS

New YXS series fulfills small size combined with high capacitance request for output filtering.



RUBYCON announced the new radial lead aluminum electrolytic capacitor YXS series as down sized series of YXG series which is known for low impedance, 105°C and 3,000 to 6,000hrs lifetime.

YXS SPECIFICATIONS	
Category Temperature Range	-40°C ~ +105°C
Rated Voltage Range	6.3Vdc ~ 50Vdc
Capacitance Range	22µF ~ 22000µF
Product Size	Ø5×11L ~ Ø18×40L
Lifetime @ 105°C	3,000 ~ 6,000hr

Compared to YXG series today, RUBYCON succeed to reduce the size of YXS series by 46% giving the same or even better performance in lifetime, ripple current and impedance.

Using a new technology of higher capacitance foil, low resistance electrolytic liquid and low density separator paper, YXS series comes in a smaller package size giving the same performance as YXG series.

YXG series is been in the market for a long time and it is a high runner product today. YXG series is mainly used in industrial applications as an output filter of power supply. Because of a good capacitance/cost ratio, YXG series is highly accepted by the market.

The next target for RUBYCON is downsizing of longer lifetime 10,000hrs. such as YXH series. Already case by case, customized items are available. If you have any special inquiry, please come to us that we can be your support.

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Usually, when the capacitor size gets smaller, the impedance becomes bigger, but not in this case.

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RATED VOLTAGE VDC	CAPACITANCE µF	SERIES	DIMENSION ΦD×L(mm)	LIFETIME Hours	RATED RIPPLE A/105°C,100kHz	IMPEDANCE Ω/20°C,100kHz
25	470	YXS	10×12.5	5,000	1.21	0.060
		YXG	10×16	5,000	1.21	0.060
25	1000	YXS	10×23	6,000	1.91	0.031
		YXG	10×28	5,000	1.91	0.031
25	2700	YXS	12.5×35	6,000	3.35	0.017
		YXG	12.5×40	6,000	3.35	0.017

# START UP



Authors: Patrick Weigand and Ayumi Kobo,  
Product Manager PANASONIC Industrie Europe GmbH

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...with Thermistors you need for smaller & reliable components.

Term thermistor itself is a contraction of the words »thermal« & »resistor«.

All resistors have some dependency on temperature, which is described by their temperature coefficient. In most case for (fixed or variable) resistors the temperature coefficient is minimized while for the thermistor resistance varies more significantly with temperature than in standard resistors. Generally, the resistance increases with the temperature for most metals but the thermistor respond negatively i.e. the resistance of the thermistor decrease with the increase in temperature. Or in other words: Their

distinguishing characteristics are a high temperature coefficient and the fact that their resistance is non-linear function of absolute temperature. Temperature sensing is one of the most sensitive properties or parameters for industries like petrochemical, automotive, aerospace, consumer electronics, and so on. The demand for thermistor has particularly increased in the automotive industry, especially, in applications such as powertrain, safety and controls and alternative fuel vehicle.

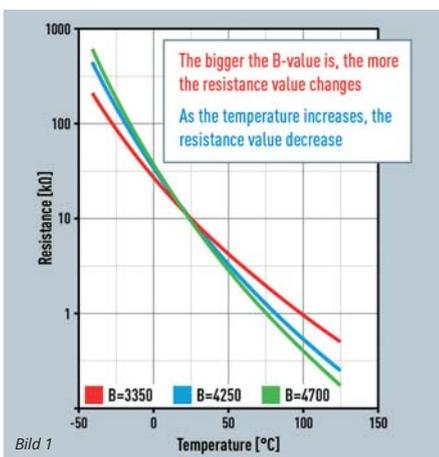
Negative temperature coefficient (NTC) thermistors are resistors with a negative temperature coefficient, which means that the resistance decreases with increasing temperature. As resistive temperature sensors they are mainly used for their stability and accuracy in domestic and industrial applications, e.g., aerospace, automotive, circuit compensation, control applications and temperature measurement. NTC thermistors have been recognized as the most effective electronic instruments in thermal sensor industry for the last decades [compare R. N. Jadhav, S. N. Mathad, Vijaya Puri; Studies on the properties of  $Ni_{0.6}Cu_{0.4}Mn_2O_4$  NTC ceramic due to Fe doping, 2012].

Many NTC thermistors are made from a pressed disc or cast chip of a semiconductor such as a sintered metal oxide. They work because raising the temperature of a semiconductor increases the number of electrons able to move about and carry charge – it promotes them into the conduction band.

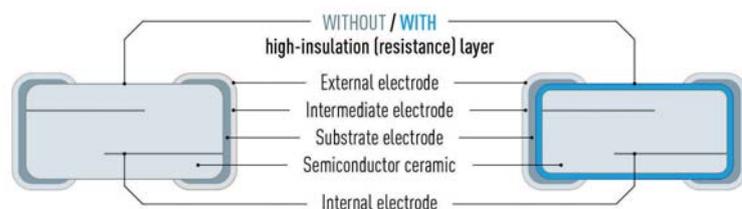
Typically NTC thermistors exhibit a change in resistance of between about 2% change of the R25 value during temperature cycling. The actual relationship follows a curve that is approximately exponential, with much higher changes in resistance at lower temperatures, and lowering considerably at higher temperatures (compare figure 1). NTC sensors are typically used in a range from  $-40^{\circ}C$  to  $150^{\circ}C$ .

## Thermistor Line-Up: Structure and Technology

Applications in modern microelectronics (temperature and heating sensors, fire detectors, power sensing terminations, temperature-compensating attenuators, etc.) require thick-film



### COMPETITIVE PRODUCT vs PANASONIC



Because of not having high-insulation layer, it has the tendency of being affected by external factors, such as reflow mounting, surrounding environment and atmosphere.

The internal electrodes are protected by high-insulating layer, so it's not easily affected by external factors, such as reflow mounting, surrounding environment and atmosphere.

HIGH PRECISION TYPE (narrow tolerance)	STANDARD TYPE	AUTOMOTIVE TYPE
*01005 - 1608 size R25: 10 - 220 kΩ ±1%, 2%	*01005 - 1608 size R25: 0.022 - 470 kΩ ±3%, 5%	0402, 0603 size R25: 1 - 470 kΩ ±1%, 2%, 3%, 5%
B25/50: 3380 - 4700 K ±1%	B25/50: 2750 - 4700 K ±2%, 3%	B25/50: 3380 - 4700 K ±1%

We realized narrow tolerance by controlling resistance value and B-value with a high degree of accuracy. It is perfect for temperature detection of secondary battery or temperature compensation of storage device such as HDD.



We have a wide variety of products having various sizes, wide range of resistance values and B-values. They are perfect for temperature compensation of cellular phone module, temperature detection for CPU in PC and so on.



Automotive type that has high heat-resisting property (up to 150°C) are available



performances. Making precision thermistors has always been labor intensive and time consuming. The main challenges in commercialization of high temperature are aging, lack of suitable lead attachment techniques and manufacturing delays. PANASONIC's low cost interchangeable glass encapsulated thermistors are manufactured using super stable, precision NTC chips. The result is a device which exhibits excellent long term reliability and stability even when subjected to severe environmental or thermal conditions. Through the baking process, glass components of external electrode melt and form high-insulating layer at the interface between ceramics and external electrode (chemical reaction). This makes them an excellent temperature measurement devices if you want precise accuracy in your temperature readings because the negative temperature coefficients of resistance [about -5%/°C] is ten times greater than those of metals and about 5 times greater than silicone temperature sensors. Their uniform dimensions and axial lead configuration make them especially suitable for use with automatic insertion equipment.

PANASONIC's NTC portfolio is available in small case sizes and therefore suitable for high density placements.

- Surface Mount Device, They are available in a variety of B-values, resistance values (01005, 0201, 0402, 0603 size )
- Wide lineup of resistance temp. coefficient (B value) and resistance value
- Highly reliable multilayer / monolithic structure / unique electrode design/ temperature operating range -40°C to 150°C
- Automotive qualified ACE -Q200

### User Case

NTC thermistor temperature sensors are a key component in Li-Ion battery charging and safety. They provide critical temperature data required to keep the Li-Ion battery in the optimum condition during the charging cycle.

Careful management of temperature during charging prolongs battery life and avoids hazards to Li-Ion batteries. Too low battery temperature will slow down the charging rate while too high

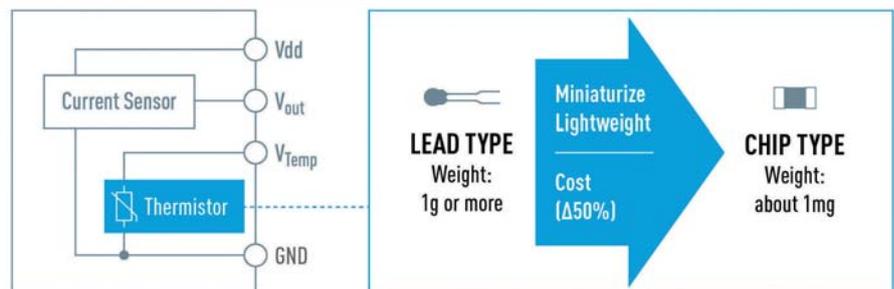
battery temperature will create a hazard. Maintaining the correct temperature range has the added benefit of increasing battery life expectancy. Li-Ion batteries typically increase 5°C in temperature during 2-3 hours required for charging. This temperature rise is normal and due to the chemical reaction occurring during the charging cycle. To avoid hazard, the battery must not allowed to increase more than 10°C during charging. NTC thermistors are the sensor of choice to provide temperature feedback to the ADC.

These analog-to-digital controllers employ temperature sensors, physically mounted on the Li-Ion batteries to provide temperature data to the controller. Using this feedback, the controller compensates for high or low battery temperature, excessive ambient temperature, and will stop charging altogether if the battery reaches critically high temperature. The charge controller requires multiple temperature sensors mounted on the Li-Ion battery. At least one sensor monitors each cell of the battery.

P05

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### AN EXAMPLE OF REPLACEMENT (current sensor of lithium battery for automobile)



<p><b>STEP 1</b> Please specify therequired conditions.</p>	<ul style="list-style-type: none"> <li>• A basic constitution of circuit</li> <li>• Reference voltage</li> <li>• A range of temperature control and a range of an output voltage</li> <li>• A target temperature and a target output voltage</li> </ul>
<p><b>STEP 2</b> We'll make a table and graphs of the main characteristics value.</p>	<ul style="list-style-type: none"> <li>• An output voltage (the upper and the lower limit)</li> <li>• Sensitivity (mV/°C)</li> <li>• Accuracy in temperature</li> <li>• Current of circuit</li> </ul>
<p><b>STEP 3</b> We'll change the circuit constant and simulate.</p>	<ul style="list-style-type: none"> <li>• Decide the part number</li> <li>• B-value and its tolerance</li> <li>• Resistance value R25 and its tolerance</li> <li>• Simulate the resistance value of the peripheries of a fixed resistorand its tolerance</li> </ul>

# Polymer Capacitors:

# OS-CON

Panasonic

## Why polymer capacitors?

- Extremely high ripple current capability in compact dimensions
- Extremely low, and over the entire temperature range stable, ESR

## Your advantage?

- Space saving
- Part reduction
- Cost reduction

PANASONIC is a leading manufacturer of polymer-aluminum-solid capacitors – SP-Caps and OS-CON, tantalum-polymer capacitors – POS-CAP plus hybrid polymer-aluminum-electrolytic capacitor technologies and has the longest design-in competence and -experience in the market. In this article we introduce the wound version »OS-CON« more detailed.

The design of a coil of aluminum foil, with highly conductive polymer inside, enables a higher dielectric strength, as at the layer structure. So rated voltages of up to 100V are achieved. There are SMD- as well as THT-versions available.

Also, if higher capacitances are required, those polymer capacitors could be the fitting solution for you. OS-CON are used in various applications, which we show you in image 1 exemplarily.

PANASONIC offers a variety of different versions – depending on requirement different characteristics are available for you. The standard temperature range is from -55°C to +105°C. Should however more than 105°C be reached, products applicable up to 125°C are available.

With the rule of thumb »20°C temperature reduction → 10× lifetime« (valid ≤105°C) OS-CON are especially suited for industrial applications,

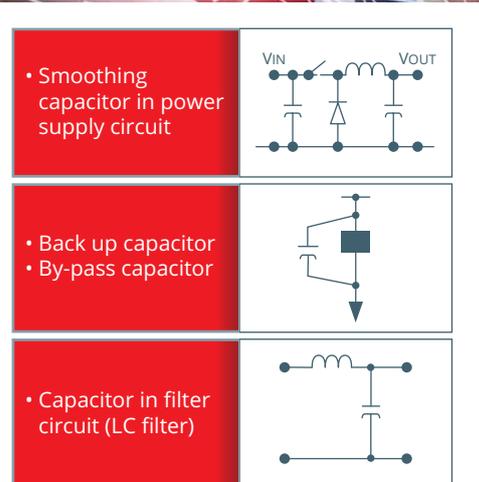


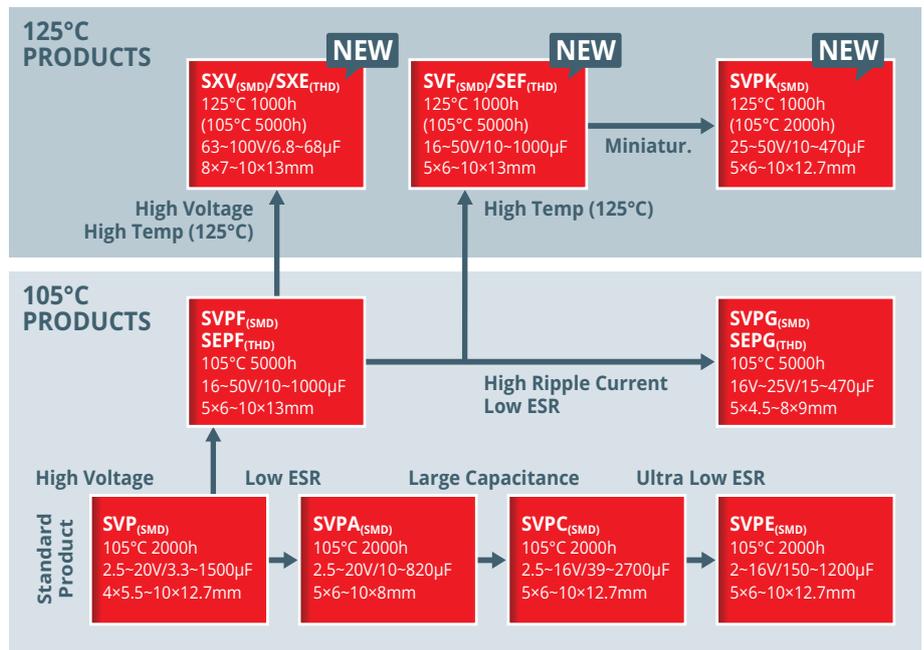
Image 1

where a long life time is required, and no extremely high temperatures are reached.

For further information please contact

P06

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# SIGNAL RELAY ST

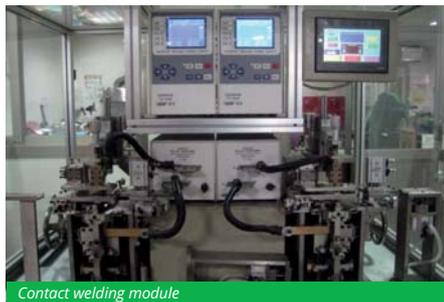
GOODSKY

GOODSKY decided to redesign the ST relay and to invest into a fully automated production line located in the Taiwan headquarter with latest assembly technologies such as a welding module for the cross bar contacts to secure highest contact reliability and product quality.

The ST closes the gap in the portfolio of miniature pcb relays with the ultra miniature signal relays being at the lower end and the miniature power pcb relays at the upper side of this

range. Listings for electrical life of 2A 120VAC at 85°C for 100,000 operations and 2A 24VDC at 85°C for 30,000 operations are submitted at UL.

Typical applications for this relay are controls in building management such as remote controls for doors, gates and blind controls, modules for use in cars such as mirror control or loudspeaker on off, controls in power supplies, office equipment and industrial control applications.



Contact welding module

P07

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Coil winding module

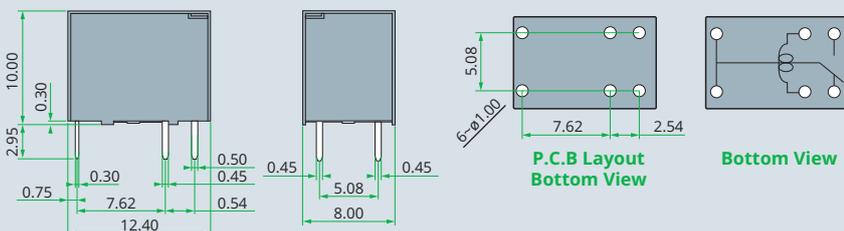


## Features

- 1 CO contact, Ag Alloy contacts with gold layer
- 2A rated current, minimum switching load 1mA/5VDC
- 240VA/48W allowable power force
- Coil voltage from 3 to 24VDC
- Low power consumption and 3 version of coils for design flexibility: 150, 200, 360mW
- Wide operation coil voltage range up to 130% of nominal voltage
- Ambient temperature up to 85°C
- Miniature size, dimensions of 12.4×8×10mm (L×W×H)
- Flux proof and plastic sealed type available
- New designed fully automated production line
- UL & C-UL in progress

## ST Relay Dimensions

(≤5mm ±0.2mm, >5mm ±0.3mm, the tolerance of PCB thru hole: +0.1mm)



# High End Miniature RELAYS

Since NEC industrialized telephone relays in Japan more than half a century ago, many technological innovations have taken place in its electromechanical devices. NEC divided and transferred its business and manufacturing and sales of relays to Tokin, as of April 1, 2002. Later the name was changed to NEC Tokin Corporation.

April 14, 2017, NEC Tokin Corporation split off the relays business and the new company EM Devices Corporation with its new brand name NEXEM was created. This company is now a 100% dedicated relay specialist focusing exclusively with all resources on relay technology and future innovation as well as roadmap in regards of R&D, manufacturing and field application engineering and sales.

NEXEM is among the top global relay players worldwide with a market share of 16% in signal

relays and 34% in automotive power relays. NEXEM was the first producer of SMD mount signal relays in 1988 and twin relay for automotive in 1990. NEXEM miniature relays can be classified into two types. Signal relays that are mainly used by communication equipment manufacturers in the world, and power relays that satisfy the needs of automobile electronic systems.

The signal relays are produced in the Shiroishi Head Office & Operations in Japan, the Power Relays are manufactured at EMD Technologies

EU2	EX2	EX1	ET1	ET2
				
EP2	EP1		EM1	EL1
				

**Power Relays**

- High power switching capability
- Compact and lightweight with twin relay structure
- Flux tight housing
- Washable with plastic-sealed package
- Semicustom-made-product available for various applications
- Reflow soldering type available
- -40 to +125°C temperature

Philippines Inc. EM Devices employees about 2,900 people. Annual installed capacity is about of 450 mio. pieces. Integrated production from raw materials to finished products and full automated assembly lines with minimum man power secures a high quality level of less than 1ppm. Shiroishi, Japan (Signal relays) is ISO9001 and ISO14001 certified, the operations in Philippines



UA2/UB2	UC2/UD2	EA2	EB2
EC2	EE2	ED2	EF2

### Signal Relays

- 2A switching capability
- 2-pol versions with change over contact
- 220VDC/250VAC max. switching voltage
- Compact and lightweight for dense packing
- Low power consumption
- Plastic-sealed package
- High withstand voltage
- Surface mounting product lineup

(Automotive Power relay) is approved according to TS16949 & ISO14001.

### Relays for automotive applications

NEXEM offers an extensive product range of printable versions for all kinds of applications in the automotive sector. Relays are used in body control modules (BCM) as well as the junction boxes (JBox). Typical applications are lamp control, fuel pump, blower motor, wiper, door lock, air condition, memory seat, sun roof, to name some typical. Currently 48V systems are under survey.

### Relays for signal applications

The range of signal relays from NEXEM includes ideal products for applications in traditional areas such as audio/video consumer equipment, telecommunication, inverters, robots and measurement equipment as well as in new business fields such as smart home, thermostats, security systems, medical equipment, office equipment, multimedia car applications.

The series of the so called 3rd and 4th generation are all 2 pole versions and change over contact from. Contact material is silver alloy with gold alloy overlay with bifurcated contact spring to secure highest contact reliability. The components are UL, CSA and TÜV approved.

**P08**

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# Planar Transformer ETP-SERI2518

ELYTONE released a new standard series of SMD planar transformers. The transformers are designed for DC/DC applications in the power range of 150W to 250W such as half/full bridge, forward and active clamp circuits.



ETP-SERI2518 is optimized for switching frequencies 200kHz to 700kHz and isolation requirements between 350VDC and 2.250VDC. The compact dimension allows small heat paths and good thermal conduction overall, which results in lower temperature rise.

Due to the big outer core surface the heat dissipation performance of the ETP-SERI2518 is much better compared to classic wire wound transformers. If necessary cooling fans or heatsinks might be installed quite easy as well. The flat wire design, in relatively low numbers of turns, helps to minimize the negative influence of the skin and proximity effect at higher switching frequencies.



ETP-SERI2518	
Dimensions L×W×H	26.67×29.30×11.0mm max.
Power Range	150W to 250W
Switching Frequency Range	200kHz to 700kHz
Operating Temperature	-40°C to +125°C

### ELYTONE's new Planar Transformer ETP-SERI2518

Besides the standard values customized and semi customized solutions are available on your request. For further details or requests please contact

**P09**

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## Connectors for

# HARSH ENVIRONMENT



### TARGET MARKETS



### USB mount Connector Generation 2

AMPHENOL ICC's MUSBR series is a line of ruggedized USB connectors with die cast housings and IP67 sealing, designed for Harsh Environment applications. Rugged series provide reliable performance in extreme conditions for the most demanding applications, and mate with standard USB plugs.

Rugged USB Connector Series serve many markets and applications across the globe including Automotive, Communications, Consumer, Data, Industrial and Medical.

- Multiple options including USB 2.0, 3.0, Type A, Mini B, Mini AB, Type C
- Similar in size compared to standard equivalents
- Internal and external seals made with flexible silicone rubber for IP67 sealing
- Operating temperature range from -55°C to +105°C for extreme conditions
- Wide variety of mounting and termination options



### TARGET MARKETS



### RJ Panel mount Connector IP67 Sealing

Ruggedized RJ connectors for Harsh Environment applications are available as MRJR series from AMPHENOL ICC providing reliable performance in extreme conditions and mate with standard RJ plugs.

- Internal and external seals made with flexible silicone rubber for IP67 sealing
- Wide variety of mounting and termination options
- Standard RJ interface where Ethernet/IP Protocol is used
- Operating temperature range from -55°C to +105°C for extreme conditions



### TARGET MARKETS



### USB mount Connector Lockable, Highly Reliable

The LUSB series lockable USB Connectors serve many markets and applications across the globe including Automotive, Communications, Consumer, Data, Industrial and Medical.

- LUSB series is offered in USB 2.0 and USB 3.0 connector interface
- Standard USB connector interface with unique latching mechanism
- Ensure secured data transmission
- Easy to install and remove
- Performs up to 1500 mating cycles

Amphenol  
ICC

A rugged connector is the ideal solution for data transfers in harsh or demanding environments. These connectors offer environmental sealing on the widely used connector standards for RJ, USB, D-Sub and HDMI all within standard package sizes. These harsh connectors are designed to provide outstanding corrosion resistance and rugged performance.

They can be used in a wide range of applications like in factory automation, outdoor communications, portable vehicle-mounted instrumentation or navigation system and security/surveillance equipment. All rugged connectors provide excellent strength and durability in the most demanding applications with a high-temperature-resistant housing and contacts made of a copper alloy with gold and nickel plating.

All of the connector series for harsh environment have the following characteristics:

- IP67 sealing protects against water and dust
- Die cast metal housings protect against mechanical damage
- Compact design saves panel space
- RoHS for environmental compliance

501

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AMPHENOL ICC'S ruggedized connectors with die cast housings and IP67 sealing for Harsh Environment applications, provide reliable performance in extreme conditions for the most demanding applications, and mate with standard connectors.



## TARGET MARKETS



### D-SUB mount Connector IP67 Sealing

The MDBR series is a line of ruggedized USB connectors with die cast housings and IP67 sealing, designed for Harsh Environment applications.

- Standard Density 9 pins to High Density 15 & 26 pins replace standard equivalents
- Extremely durable for demanding application due to machined contacts plated with 30u" gold
- Operating temperature range from -55°C to +105°C for extreme conditions



## TARGET MARKETS



### HDMI mount Connector IP67 Sealing

MHDR rugged HDMI receptacles provide reliable performance and mate with any standard type A HDMI plug.

- Electrical performance complies with HDMI specification 2.0
- Improved thermal cycling performance suitable for outdoor application
- Operating temperature range from -55°C to +105°C for extreme conditions



## TARGET MARKETS



### IP67 Boot Style Hood – Seals Interface of existing Harsh RJ & USB Connectors in the Mated Condition

Cost effective, easy to install IP67 flexible sealed boot for Harsh Environment or standard I/O connectors, can be used with standard plugs/cables.

- IP67 seal protects mating interface against water incursion
- Designed for AMPHENOL MRJR, MUSBR type A series
- Use with widely available standard RJ and USB Plugs/cables
- Easy installation



# ZERO SCREW™



## DIN Rail Terminal Block up to 400A

**ZERO SCREW™**

-   
High-Current
-   
Safety
-   
Time-Saving

HIROSE has developed Terminal Blocks up to 400A for quick and secure one-step connection while eliminating the need for contact screws.

The high-current EF2 series power connector offers a quick and secure one-step connection with standard ring terminals. The snap-in lock produces a secure, locking connection and eliminates the need for screws, ensuring a stable and consistent connection. This easy operation simplifies maintenance especially in narrow and dimly lit places.

The EF2 series has a highly reliable connection with unique contact spring structure. This design feature lowers the contact resistance and increases the current flow. The Zero Screw™ connector system is available for DIN rail mounting. Assembly is simple, and standard ring terminals can be used with wide variety of cable sizes up to 200mm².

HIROSE combines high-current capability with quick and easy assembly to offer a simple power connector solution for DIN rails. The EF2 eliminates the need for continued retightening, reducing maintenance time and cost, while increasing connector security and reliability.

HIROSE's EF2 series has a rated voltage up to 1,000V AC/1,500V DC, a contact resistance of 0.1 milliohms and an operating temperature of -25°C to +105°C.

S02

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PRODUCT	D150	D250	D400
Rated current	22mm² = 94A	150mm² = 310A	200mm² = 400A
	38mm² = 132A		
	60mm² = 175A		
Rated voltage	AC/DC 600V	AC 1,000V / DC 1,500V	AC 1,000V / DC 1,500V
Operating temperature range	-25°C to +105°C		
Storage temperature range	-10°C to +60°C		

## Heat-resistant FH65 Connector

HIROSE has designed a compact flexible printed circuit (FPC) / flat flexible connector (FFC) with a space-saving, low-profile design.

Featuring a pitch of only 0.50mm, a height of 1.20mm and depth of only 3.57mm, the FH65 series reduces the occupied mounting area by 47% (on average) compared to previous technologies. Designed for automotive and other high temperature application, the connector is resistant to extreme temperatures from -40°C to +125°C.

The FH65 series FPC/FFC connectors have a robust lock with a clear tactile click that confirms actuator locking. The flip-lock (one-touch rotation) ZIF design enables easy and reliable FPC/FFC connection operation. The design doesn't expose contacts on the bottom side of the connector, making the board area under the connector available for PCB pattern.

The actuator is positioned so that solder tabs and terminals firmly retain the actuator, particularly ideal for high-vibration applications like automotive. The space-saving I-shaped solder tabs not only allow visual inspection, but also offer a high-retention force of 23N. With a wide 120° FPC/FFC opening and guided positioning, the user-friendly FH65 series is easy to use.

This connector series is well suited for a wide range of automotive applications including camera, millimetre-wave radar, and head-up display systems. It is currently available in a 34-position version. The connector meets halogen-free requirements and is RoHS compliant. The FH65 connector has a rated current of 0.5A, a rated voltage of 50V AC/DC, and a contact resistance of 50 milliohms.

S03

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FH65 connector satisfies severe automotive requirements!



## Y-CIRC® P



YAMAICHI Electronics now also offers the Y-Circ® P series with overmoulded bent relief.

Upon request, the cable outlet in connection with a cable assembly for the Y-Circ® P can be equipped with an overmoulded bent relief. This prevents unwanted unscrewing of the connector without the need for gluing.

The proven bent relief design increases its flexibility in comparison with standard bent reliefs. YAMAICHI Electronics produces the Y-Circ® P in its factory in Germany. Cable assemblies for in-house and third-party products are also manufactured there. Customer-specific designs and adaptations to the requirements of cable assemblies can also be easily realised thanks to long-standing know-how in the overmoulding of connectors.

This product portfolio makes YAMAICHI Electronics the only manufacturer capable of offering complete cable assemblies with overmoulded in-house M12 and push-pull connectors. In addition, adapter cable assemblies for connecting M12 or push-pull connectors to RJ45 or USB interfaces are possible with the legally protected industrial connector series Y-Con®.

YAMAICHI Electronics thus offers the advantage that all required components are available onsite and the entire cable assembly including the overmoulding can be manufactured at a single production location.

S04

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## HIROSE's Lightweight Plastic Connector

# LIGHT & ROBUST



The robust lightweight, high current design is enabled by using high-quality plastic material which is resistant to rough handling. HIROSE's EM52M, EM40M, EM30M Series is ideal for the use in high current applications.

These connector systems are equipped with a push-on bayonet locking mechanism which enables complete locking in one quick mating action. High-currents up to 450A can be handled by using a multi surface contact spring design. The contacts can be easily crimped by

	EM52M	EM40M	EM30M	
Number of Contacts	4	1	1	
Rated Voltage	AC, DC 1000V AC 600V, DC 750V (TÜV)	AC, DC 1000V AC, DC 600V (UL)		
Rated Current	Waterproof (IP67)	TÜV: 100A (38SQ), 80A (22SQ) General: 130A (38SQ) @25°C	UL: 300A General: 410A @25°C	UL: 150A General: 175A @25°C
	Non-Waterproof	TÜV: 100A (38SQ), 80A (22SQ) General: 140A (38SQ) @25°C	UL: 300A General: 450A @25°C	UL: 150A General: 200A @25°C
Mating/Unmating Cycles	50			
Operating temperature range	-25°C to +105°C (Non-Waterproof), -20°C to +90°C (Waterproof)			
Storage temperature range	-10°C to +60°C			

### Features

- Quick and secure push-on bayonet lock
- Multi - surface contact spring design
- Standard crimp tool for easy crimp connection
- Available in a water-proof version

using a JIS Standard-meeting crimp tool (JIS C 9711). The EM-Series is available in a water-proof version (IP 67), guaranteeing water-proofness by using a cable gland.

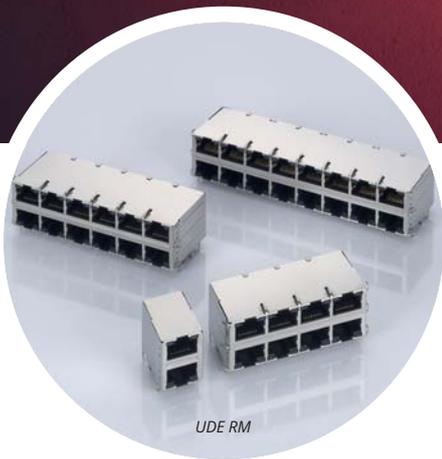
The plug of EM40M and 30M complies with the electric shock proof specification (IPX2) due to a finger protection design.

S05

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# MAG(NET)IC



UDE Corp. is a leading global manufacturer and worldwide supplier of UDEJack™ product for telecommunications, data communications, computer, industrial and medical markets.

UDE has manufacturing operations in Guangdong and Sichuan (China). Besides ISO 9001 and ISO14001 all factories got ISO/TS 16949 certification in 2015.

UDE can offer several kinds of high-quality magnetic jacks for Ethernet products. Magnetic jacks are available for 100 Base-T, 1000 Base-T (Gigabit), 2.5G Base-T, 5G Base-T, 10G Base-T speeds. Besides magnetic jacks UDE is also offering RJ45 connectors without integrated magnetics and separate transformers.

The portfolio fulfils all requirements for industrial applications such as:

- Single Port: 1×1 – Tab Up and Tab Down Type
- Multiple Ports: 1×2 (Dual Ports, both Tab up & Tab Down Type), 2×1 (Stack Ports), 1×4 (4 Ports), 2×2 (2 Stacked Ports), 2×4 (4 Stacked Ports), 2×6 (Triple Stacked Ports), 2×8 port (4 Stacked Ports)
- RJ45 Connector + USB (1 or 2 USB)
- Individual LED configurations

- Low-profile versions for space-critical applications
- Vertical type
- SMT type Magnetics Jack
- THT, Press fit, IR Reflow Options
- Industrial Temperature Range -40°C to +85°C
- POE, POE+, POE ++
- Optional Surge Protection
- UL File Listing Options

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## Magnetic Jacks for Ethernet applications from UDE!

# M8/M12 SMT CONNECTORS



AMPHENOL LTW (ALTW) presents M8/M12 SMT (Surface Mount Technology) connectors. ALTW's M8/M12 SMT connectors are two-piece connectors designed for PCBs that can be equipped on both sides and don't have via holes for the connection pins, making it cost-effective by reducing the printed circuit board surface area.



**A**LTW's M8/M12 SMT connectors are designed for waterproof protection in accordance with IP65 and IP68 standards. They are also UL2238 and IEC 61076-2-104 compliant, offering a secure and stable data as well as superior power transmission performance.

With packaging available for automated pick and place assembly, ALTW's M8/M12 SMT connectors provide the right solution for your various interconnection needs that meet the requirements of numerous field applications.

CODICO offers also cable plugs for the field assembly and on request overmolded cable assemblies according to the customers requirements. For more details or a tailor-made connector solution please do not hesitate to contact

**S07**

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M8 SMT	
Number of Positions	3 Pin 4 Pin
Current Rating	3A
Voltage Rating	3 Pin: 60VAC/DC 4 Pin: 60VAC/DC
Dielectric Withstand Voltage	3 Pin: 1000VAC 4 Pin: 650VAC
Insulation Resistance	100MΩ (Min.)
Contact Resistance	10MΩ (Max.)
Durability	100 Cycles
Vibration	10 to 500Hz, 5G
Insertion Force	10N (1.02kgf) Max.
Withdrawal Force	15N (1.53kgf) Max.
Temperature Range	-55 to 125°C
Connector Color	Black
Waterproof Rating	IP65, IP68 (Mated, 1M/24Hrs)
Safety Compliance	UL 2238, IEC 61076-2-104
RoHS Compliant	Yes

M12 SMT	
Number of Positions	A Code: 4, 5, 8 Pin B Code: 5 Pin D Code: 4 Pin
Current Rating	4 Pin: 5A (IEC: 4A) 5 Pin: 5A (IEC: 4A) 8 Pin: 2A
Voltage Rating	4 Pin: 250VAC/DC 5 Pin: 60VAC/DC 8 Pin: 30VAC/DC
Dielectric Withstand Voltage	4 Pin: 1400VAC 5 Pin: 1000VAC 8 Pin: 650VAC
Insulation Resistance	100MΩ (Min.)
Contact Resistance	10MΩ (Max.)
Durability	100 Cycles
Vibration	10 to 500Hz, 5G
Insertion Force	4 Pin: 10N (1.02kgf) Max. 5 Pin: 10N (1.02kgf) Max. 8 Pin: 23N (2.35kgf) Max.
Withdrawal Force	4 Pin: 15N (1.53kgf) Max. 5 Pin: 15N (1.53kgf) Max. 8 Pin: 30N (3.06kgf) Max.
Temperature Range	-55 to 125°C
Connector Color	Black
Waterproof Rating	IP65, IP68 (Mated, 1M/24Hrs)
Safety Compliance	UL 2238, IEC 61076-2-101
RoHS Compliant	Yes

# BERGSTAK®



Amphenol  
ICC

## AMPHENOL: 3-Axis Floating Board-to-Board Connector

AMPHENOL ICC's BergStak® 0.40mm is a floating type Board-to-Board connector with 32 pins and a stacking height of 5mm.

This solution comes with an all-round shield for superior EMI performance. Its unique connector design has a floating range of  $\pm 0.40\text{mm}$  in the X, Y and Z direction. The connector is ideal for use in automotive applications.

- Fine pitch design at 0.40mm
- Supports speed performance up to 3Gb/s
- Floating range of  $\pm 0.40\text{mm}$  in X, Y and Z direction
- Shielded design for superior EMI performance
- Polarized key for Poke-Yoke mating

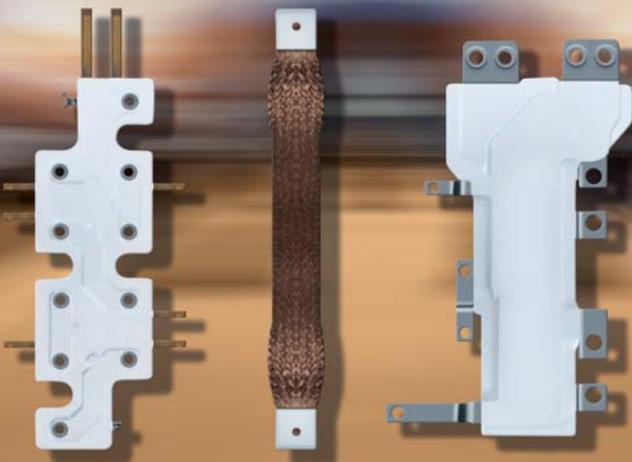
S08

Julia Reiterer, +43 1 86305 162  
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FEATURES	BENEFITS
Floating range of $\pm 0.40\text{mm}$ in X, Y and Z direction	Improves contact reliability
Shielded design	Minimizes misalignments in mating and vibrations
Supports speed performance up to 3Gb/s	Enables superior EMI performance
Fine pitch design at 0.40mm	Meets V-by-One HS standard
Poka Yoke polarization	Suitable for applications with space constraints
Spring-loaded shielded design	Visual mismatching prevention system
Wide operating temperature from $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	Ensures positive shielding even connector is floating
	High vibration and locking resistance
	Suitable for automotive and industrial applications

# CUSTOMIZED BUSBARS



LUXSHARE-ICT is a manufacturing company heavily invested in R&D.

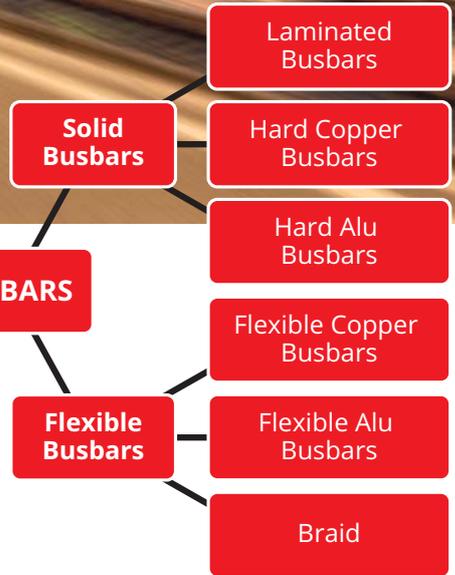
Their primary business is cable and connectors for the 3C markets (computer, communications and consumer electronics), also automotive and mobile. Dedicated in connection field, they are working with technology leaders to create innovative solutions that transform industries.

LUXSHARE ICT presents various types of mature busbar products and highly targeted solutions in specific applications. A busbar is a strip of metal used to conduct electricity within an electrical substation, distribution board, electric switchboard or other electrical equipment.

A busbar is usually a flat or hollow piece of copper, brass or aluminium. It allows heat to be released quickly because of its relatively large surface area. There are different categories with various techniques of busbars available (see graphic).

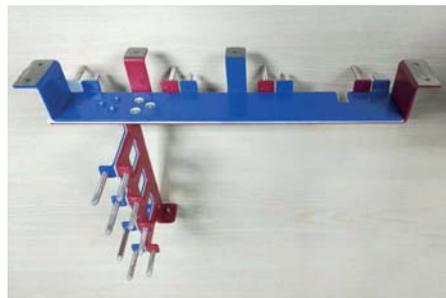
Different techniques can be dip coating, powder coating, dip curing, extrusion molding, insert molding, heat shrink tubing, pressing, etc.

## BUSBARS



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S09



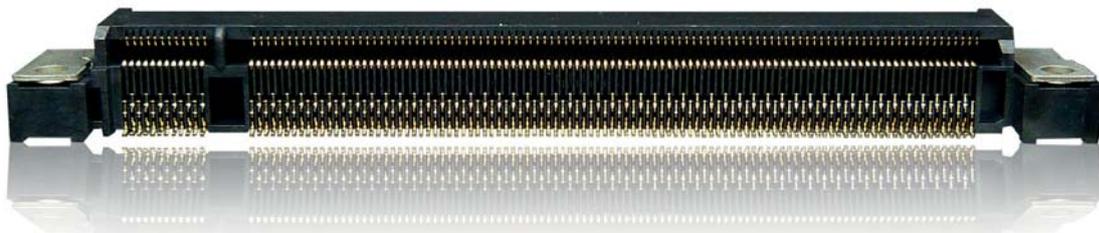
## Features

Interesting applications for busbars are:

- Electric vehicle (battery pack, motor and electric control system, PDU, BDU, energy storage)
- Telecommunication (data storage server, 5G system)
- Industrial application (inverter, converter, power, controller)
- Railway (Locomotive tractive system, station control system)

# BEC

The Next Generation of Automotive Board Edge Connectors!



**YAMAICHI Electronics has extended its MXM family for automotive and other demanding applications with a 314 pin variant.**

The success story for the board edge connector (BEC) developed and tested specifically for automotive applications began about six years ago. The BEC's were the first connectors for modules meeting the MXM and QSEVEN standards with 230 pins and a 0.5mm pitch. In 2013 a 230 pin high-speed version of the BEC for applications to 5Gbps was premiered.

To meet the requirements of MXM3.0, YAMAICHI now offers a 314 pin variant alongside the 230 pin high-speed version. Applications with an increased need for high-speed signal contacts are thus also accommodated. YAMAICHI draws

on a proven design for this. The contacts have the characteristics needed to ensure a stable contact force even when subject to vibrations and shock. The spring characteristic of the contacts also permits tolerance compensation and reliable data transmission if modules with dimensions close to the tolerance limits are used.

A new feature is the extended function of the module's side screw fitting. The tabs on the screw fitting can be folded out to facilitate insertion of the PCB. Following module assembly the tabs are returned to their original positions and screwed from above to the module and the connector.

Thus the module is securely fastened to withstand vibrations and shock.

The enlarged SMT tabs are used for the ground and SMT connection – along with the 314 contacts – to the motherboard. YAMAICHI has managed to combine 314 high-speed contacts and robustness in one single system.

The connector is currently available with a 0.1µm gold plating in the contact area. It is packaged and delivered in T&R. Production is nearly exclusively automated.

510

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# »OSCAR« for CODICO



## CODICO receives Award from SINBON for »Best New Partner«!

SINBON Electronics holds its Global Sales Meeting every two years, and it is an event to share strategy and experiences with its global partners. In November 2017 a special event was created for the »SINBON Oscars« at the after party in Suzhou, China. The party had a fancy dress theme of »Movie Characters« and there were many creative costumes! During the SINBON Oscars ceremony SINBON gave several awards to its valuable partners to show its appreciation for their contribution, innovation and collaboration with SINBON.

The votes were cast by key members of SINBON's various Business Units, and for the award of »Best New Partner 2017« CODICO were presented with the Oscar for being in 1st place.

Photos of the award made to Gerhard Strobl (Vice President) dressed as Inspector Clouseau – but most people thought he was Sherlock Holmes – and Mr. Christian Sichtar (Product Manager) as the Pink Panther. Award presented by »Annabelle«, which was Cindy Lin who is the Director of SINBON's iCS Business Unit.

S11

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# World Cup 2018

Play online and win with CODICO!

Only two weeks to go before kickoff for the 2018 football World Cup in Russia! To make it even more exciting for you, CODICO invites you to take part in the CODICO Online betting game. Place your bets to win one of 20 exciting prizes:

• **1. PRICE: Liverpool-VIP travel package**

*For 2 persons including a home game of Liverpool FC during the season 2018/2019*

*The package includes 2 nights (double room) in a 4-star hotel with breakfast, 2 VIP-tickets for a home game of Liverpool FC, 2 tickets for the Liverpool Football Club Museum, 2 tickets for »The Beatles Story« 2 tickets for a boat trip on the Mersey as well as the outbound and return flights*

• **2. PRICE: Welcome to Berlin**

*VIP travel package for 2 persons including a home game of Hertha BSC during the season 2018/2019*

*The package includes 2 nights (double room) in a 4-star hotel with breakfast, 2 VIP-tickets for a home game of Hertha BSC, 2 Berlin »Welcome Cards«, 2 tickets for »Quatsch Comedy Club«, as well as 2 tickets for a boat trip on the river Spree*

• **3.-10. PRICE: Each winner gets one original World Cup dress of his favourite team**

*(depends on availability)*

• **11.-20. PRICE: Each winner gets one Smart Watch Activity Tracker**

Register now on our Website and experience for yourself the excitement of the 2018 football World Cup! The CODICO team looks forward to you taking part in the game, and hopes you have a lot of fun!

D02

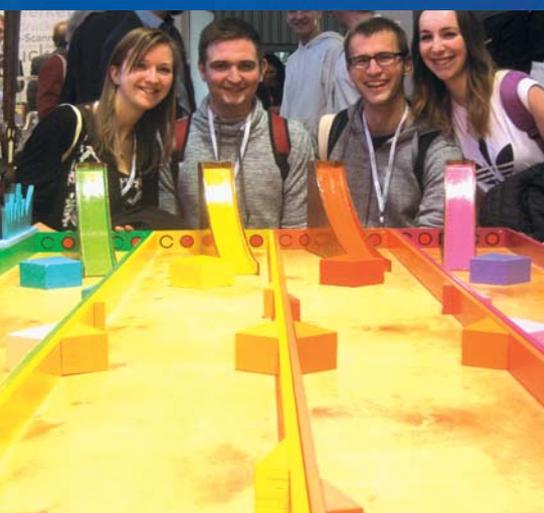
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# C O D I C O

the **con**ment **design-in** **com**pany

## NEW RECORD YEAR



The embedded world Exhibition & Conference 2018 was held from 27.02. to 01.03.2018 in Nuremberg, and once again excelled itself. In its 16th year as an event, the embedded world again provided impressive proof that it is rightly seen as the leading trade fair in the international Embedded Community calendar. More specialist visitors, more exhibitors, more space. 1,021 (+1%) companies from all over the world showed 32,217 (+7.3%) embedded sector experts from 77 countries, in six halls, where the journey is leading in the Internet of Things, and in an increasingly digitalized world.

CODICO was there in Nuremberg too, with its impressive product portfolio at the embedded world. On the CODICO stand visitors had the opportunity of exchanging views with product managers and sales engineers taking advice from them.

In addition to presenting their technical know-how, CODICO also featured as hosts, making sure that visitors were well catered for, with some fun in addition. To introduce something different, and see some action on the stand, a hand-made bowling alley was provided directly from Vienna's Museum Quarter: Art and skill combined on four lanes. And there were plenty of visitors ready to take on the challenge!

**D03**

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## CODICO at the embedded world 2018



# The CODICO TEAM says hello!

## Alexandra Tsinadze



Hallo Readers,

I have been with CODICO since February 2013, and I started as a part-timer in Reception. I liked the work there very much, and it gave me the opportunity to make contact with all the people who work at and with CODICO, staff and partners. My duties also included contact with our customers and suppliers. When, after three years, I had the opportunity of working in Logistics, I accepted it very gladly, and soon settled happily into dealing with new tasks and new challenges. In Logistics I am responsible for goods dispatch, in other words organizing sending out the products, with all the related tasks, and handling the consignments by way of our external depot in Hong Kong. I really enjoy the work, because there are always new situations arising, it is very varied, and there is always something to learn. We are also often confronted with tasks which in the first instance appear to be impossible to resolve, but in the end, after a lot of planning and thinking, there is always a solution for everything. Another important part of my work is provided by my colleagues, because without them my work would not be half as much fun! We help one another magnificently, we can rely on one another, and that makes us a really great team.

In my free time I like going to the cinema, and I am a passionate baker of pastries, biscuits, and cakes of all kinds. One of my latest projects is baking biscuits for dogs. Providing something nice for the four-legged friends belonging to my family and friends is always a great success, and the dogs adore the healthy tidbits I produce for them. My hobbies also include travelling. This covers a wide range, because I enjoy visiting cities as well as relaxing on the beach. The travelling I do is very important to me, because the cultural variety is the perfect counterpart to my everyday work.

I am glad that I am a member of CODICO, and I welcome every new task that I have to master. The absolute top priority with my work is making sure that our customers are satisfied, and that is the biggest challenge we have to face!

**D04**

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## Peter Degenhart



Hallo, my dear Impulse readers,

It is a great pleasure for me to be able to introduce myself.

My name is Degenhart Peter, I am 42 years old, and I have now been a part of the CODICO family for almost five years – and I am proud of it. As a sales engineer I am responsible for Active Components, and in that capacity I look after Eastern Austria, which includes the regions of Vienna, Lower Austria, Burgenland, Styria, and Carinthia. Before I came to CODICO, I worked at a number of big companies, with several thousand employees. There I occupied several different positions, such as a systems technician at a mobile radio firm, or as a project manager, responsible for the UMTS roll-out in Austria. Despite my busy schedule I started on a course of study to accompany my profession, successfully completing a Bachelor's degree in electronics/economics and a Master's in technology and innovation management. For me, that was the ideal combination of technology and commerce, to appreciate more than just the technical side of the picture.

CODICO is a very special company in my eyes, a company where talking about a »family concern« is not just a pleasant but empty expression, but still has a true meaning. Despite the fact, or, more accurately, because of the fact that in comparison with some of my previous employers CODICO is for me a medium-sized company, it is a place where one feels contented and valued, where one has (own) responsibilities, but still as an established and respected member of a really great team. Against a background of competitive pressure which is constantly becoming tougher, it is thanks to the highly motivated and highly skilled staff, and the careful, forward-looking management, that CODICO is able to grow faster than the competition. This achievement is not simply handed to CODICO on a plate; it is earned by the commitment and hard work of the entire team. This might give the impression that the pressure at work must be really intense, but because I truly enjoy my work, and get so much fun from it, I never feel it to be so. And as well as that there are the legendary festivities at CODICO, like the summer and Christmas celebrations, when everyone is relaxed and all have a really great time. I find my own balance with my family and friends, as well as my hobbies, such as diving, sport climbing, mountain biking, and photography.

If you have any questions about our products, or have an idea for a new application but are not sure which product could really suit the situation, then I suggest you contact me/us, and we shall be happy to advise you.

**D05**

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## Leonardo Bazzaco



My name is Leonardo Bazzaco, I'm almost 33 years old and I come from Italy. I started with CODICO in 2015 as Field Sales Engineer for Active components. Before joining CODICO I worked for a small Italian distributor, in the same market field and with similar strategy. I like this job because it's very dynamic and every day is different. You have the chances to meet a lot of people, know a lot companies, learn new technologies, all things that contribute to your personal grow.

I'm a solar person and I like smiling always, I think we don't have time to be sad and we should live every moment with intensity since you never know what the future holds for you. At the same time I'm a rational person, I don't see difficulties like a problem but as a challenge which I always try to overcome. I'm open to change, I think this is important especially nowadays where things move so quickly around us.

CODICO is really a multicultural company, working here is a sensational experience which brings you in contact with people from all Europe expanding your personal culture and viewing of the world. If I had to assign a color to the CODICO team, it would be the color of rainbow, a perfect mix of different minds which fits all together for a common goal. During University time I had a period of study abroad which I must thank because it gives you such capabilities which help you to be more open-minded and feel comfortable in such working environment. People are the most important resource in a company, and it is truly admirable how they are treated in CODICO. Working here, you always have the opportunity to be heard and talk to anyone freely.

I'm based in the North-East part of Italy, in the Venice region. Last year I became father of a very nice boy Nicola, now he has 6 months. Well yes, my life now is changed, for sure it's not easy, sometimes you miss your previous life in freedom but just a simple smile of your baby is enough to cancel the tiredness. I like sports a lot, not only at TV but also practically. I've been playing football since I was very young and I don't remember one year without participating in a team. I also play winter sports, ski and snowboard. My favorite holidays is seaside in summer and mountain in winter. So far I always tried to explore new places every year, now with the baby we will probably move to a more relaxed holidays. In the free time I like to go shopping, walking in the Prosecco's hills behind my home, I like food a lot not only eating but also cooking.

More than 3 years already passed from my first time at CODICO, it has been a period full of hard job, challenges, but also fun. I'm really proud of being part of the CODICO team and I'm at your disposal for any needs. I look forward to meet you personally.

D06

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## Romana Derkits

Dear Impulse Readers,

My name is Romana Derkits and I have been working in the interconnect system team since January 2013. I gained my first experience with CODICO at the Embedded and Electronica in 2012, where I supported the team on the information stand at the trade fair, and I was immediately impressed by the readiness of the team to provide help, and their friendliness. With regard to order management and the internal sales service, I am responsible for the region of Austria, Hungary, Slovakia, the Czech Republic and Poland. To ensure that the particular needs and requirements of our customers are fully satisfied, this activity calls for a high degree of precision, flexibility, and, in particular, a passion for the work.

In order to optimize the service for our clients and suppliers, some organizational restructuring took place within the company at the beginning of the year, which means that I can now concentrate exclusively on supporting our sales team. And as well as that, as from this year I have also been entrusted with the region of North Germany.

CODICO is characterized for me first and foremost by the strong cohesion among the people who work here. If a problem arises, you can rely on the support of the entire team, with solution concepts then being worked out and put into effect between the groups concerned. The focus of the firm is firmly on the customers and suppliers, but the staff too can put their trust entirely on the absolute backing of the company. I have the great good fortune of living and working in Perchtoldsdorf, and it was here too that last year I married my husband. Having taken my partner's surname, my name has changed from Schierer to Derkits. To create a good balance to an often stressful working day, I like to get out and enjoy nature. I go walking, I love cycling, and in the winter I indulge my great passion for snowboarding. As soon as the days start getting longer again, and the first rays of the sun start to bring out the buds, I dedicate myself with the greatest pleasure to our garden. Whether it be raised beds, rosebushes, or fruit trees, no stray twigs or weeds are safe from my garden shears.

I like spending the weekends in the company of friends and family. With them I can switch off from my everyday work, and charge up my batteries for the tasks ahead. And I take on those tasks with a lot of energy, reliance, and self-confidence. I am really happy to have arrived in the CODICO family.

D07

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