


ENGLISH

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MPM54304 from MPS  
Small, Smart, Powerhouse

KDS Crystals are ready for Wi-Fi 6

HIROSE: One Action Connector

# CONTENTS



## 04 | MPM54304

A small, complete Solution for the Processor or FPGA Power Supply: MPS Power Module for 4V to 16V Input, Quad 3A, 3A, 2A, 2A Output, PC & MTP in Ultra-Thin LGA Package. With its four integrated inductors it is so far unique and enables unbeatably compact product developments.

## ACTIVE COMPONENTS

- 04** | MPM54304: Small, Smart, Powerhouse
- 07** | Flexible Physicians: New AME Series by COSEL
- 08** | Pulsed Coherent Radar Sensor and Modules by ACCONEER
- 10** | RECOM: 20kVDC Isolation for DC/DC Converters
- 10** | Lighting Market: Ag210-PoE by SILVERTEL
- 11** | Ready for the Future: SILVERTEL's Ag6120
- 12** | MPS MA782: The World's Smallest True Absolute IC Encoder™
- 14** | GateMate™ by COLOGNE CHIP: FPGAs made in Germany
- 16** | THUNDERCOMM: Solutions for IoT, Audio and AI Applications
- 18** | The Modular Mini PC System: INTEL® NUC Elements
- 20** | OSB DA14585: Smart-BLE 5.0 MESH Module
- 22** | Ultra-Low Power 150mA Buck DC/DC with  $V_{SET}$  by TOREX
- 24** | Displays: A Comparison of Technologies
- 27** | E-CAR Gate-Drivers by POWER INTEGRATIONS

## PASSIVE COMPONENTS

- 30** | Design Challenge with SAGAMI's High Voltage Buck Converter
- 31** | Small & Low-Ohmic: New FM Shunt Family by ISABELLENHÜTTE
- 32** | New DC-Power Film Capacitors by PANASONIC
- 33** | High Ripple Current in Small Sizes by SUNCON
- 34** | EATON: High-Power-Density Inductors for Automotive Lighting
- 36** | SFM-Relays with Forcibly Guided Contacts by PANASONIC
- 37** | Billionfold Benefits: PANASONIC's Polarized Power Relays
- 38** | RUBYCON leads price with new Hybrid C Series
- 39** | KEMET's new 125°C/AEC-Q200 MKP Pulse Capacitors
- 40** | KDS Crystals: Ready for Wi-Fi 6
- 42** | TXC: Reliable 5G - Benefits of OCXO
- 43** | Y2/X1 film capacitors for harsh environments from KEMET

## CODICO IN-HOUSE

- 03** | Our Quality Management Team
- 56** | »Central Park« in Perchtoldsdorf
- 58** | The CODICO Team says Hello

## CONNECTORS

- 44** | Roger: HIROSE's Floating Card Edge Connector
- 45** | Modular, Reliable & Compact – Cross-Mate™ by AMPHENOL ICC
- 46** | AMPHENOL ICC: Minitek® 2mm Blind Mate Interface Connector
- 47** | Fine Pitch Solution with Self-Alignment Feature by AMPHENOL ICC
- 48** | DINKLE Bus – more flexible Enclosure System
- 49** | Simple & Easy: HIROSE's One Action FPC/FFC Connector
- 50** | HIROSE's ix Industrial™: Connector for Industrial Ethernet
- 51** | SINBON: Partner for ix Industrial Cable Assemblies
- 51** | Watertight Disposable Connectors by NEXTRON
- 52** | YAMAICHI: M12 Y-Circ M with Push-Pull Locking
- 53** | New Partner for Motor-Driven Applications: NIDEC SERVO
- 54** | Lightweight & Robust – SOURIAU's new UTGX Series
- 55** | SUMIDA Flex: PANTA® IDC Jumper

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## Our quality team introduces itself!

Implementing a quality management system (QMS) will result in numerous benefits for every company. This becomes especially important – if not essential for survival – when faced with particular challenges.

Since our first certification in 1995, we have permanently advanced and improved our quality management system. Our processes are constantly becoming leaner, more transparent, and automated, making more and more information available. Our QMS offers a stable, yet flexible backbone for our actions.

### Who's behind it?

Our QM team is headed by our Managing Director *Karin Krumpel*. As a personality, she doesn't just prescribe quality to the team, she lives and breathes quality. Since February 2020, the new group leader *Petra Landschau* (formerly Huynh) stands for a vibrant quality management system appreciated and backed by all the staff. *Marlene Giesinger* is our data protection coordinator, and a genuine enrichment for our QM team.

Especially in these demanding times, our QM team provides support and orientation for the CODICO staff members and for you, our customers. Do you want to find out more about our QM system? Please contact

**D01**

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**Sven Krumpel**  
CEO CODICO

## Editorial

»One cannot not communicate!«

For me, this probably best-known quote by the Austrian-American communication scientist Paul Watzlawick has taken on a completely new meaning in recent months. I do not wish to express my thoughts on the issue of Covid-19 here, since too much has already been said and too many, partly self-appointed specialists have been quoted. When our quality management team chose to focus on the theme of »communication« for 2020 at the beginning of the year, I was not aware that I myself was going to be left speechless for a while this year. »One cannot not communicate.« Yet one is sometimes allowed to not know what to say. This is because - and this is where I must quote Paul Watzlawick for a second time - »everyone thinks their reality is the true reality«. How are we supposed to recognise a reality in the face of the current unprecedented circumstances, and how can we be expected to communicate it? As CEO, I am responsible for a staff of almost 200 people and their families. Our success is based on our knowledge and, in particular, on our exchange and communication with customers and manufacturers. Suddenly - from one day to the next - I am forced to send (almost) my entire team to home office, I recognise a completely new reality, and I must rely on a type of communication completely unknown to me so far (and, I admit, one I regarded with scepticism). Without personal contact, without face-to-face meetings, without recognizable impulses, reduced emotions and facial expressions, without the possibility to intervene situationally.

But I was speechless only for a short while. Reality quickly caught up with me, and I was able to acknowledge this new reality: it actually works! We did not not communicate! I can even say that we have communicated even more in recent weeks. Therefore, allow me to use a third quote by Watzlawick: »The most dangerous delusion of all is that there is only one reality«.

I wish to wholeheartedly thank my team for their flexibility, their commitment, and our communication. Together we have been able to manage these challenges well - I am very proud of that.

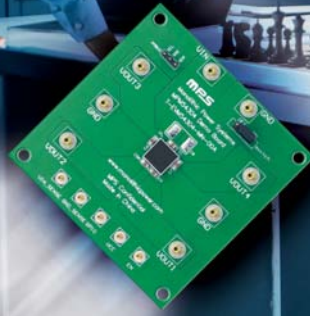
**D02**

▶ *Sven Krumpel*





# SMALL, SMART, POWERHOUSE



## MPM54304: A small, complete Solution for the Processor or FPGA Power Supply!

MPS Power Module for 4V to 16V Input, Quad 3A, 3A, 2A, 2A Output, I<sup>2</sup>C and MTP in Ultra-Thin LGA Package.

Always the same story. It's getting crowded again. No more space on the PCB and the colleagues from the mechanical design department simply don't want to make their housing any bigger. The colleague winks as he teases you: As long as you can still see the green solder resist, it can't be that bad with the lack of space.

Thereby another 4 switching regulators have to be placed on the circuit board, the FPGA demands supply on several rails. It's damn fast, but – nothing comes from nothing – hungry for current. To top it all off, you have to make sure that the power-on sequence is correct as well. (Often gladly forgotten: Almost always as well the power-off sequence. Here at the latest it gets complicated with a discrete solution.) Fortunately, the MPM54304 MPS makes life a little easier. This is not only a power management IC (PMIC) with 4 integrated bucks. This one is already well known.

The MPM54304 is a power management module that combines 4 highly efficient synchronous step-down DC/DC regulators in one PMIC and ad-

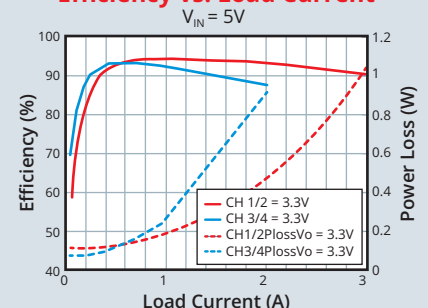
ditionally integrates the 4 power inductors together with a flexible logic interface, programmable via I<sup>2</sup>C bus, so that output voltages, power-up sequence, slew rate and much more can be configured via software. A module with 4 integrated inductors is so far unique on the market and enables an unbeatable compact solution.

### Input Voltage, Output Voltage, Power

The input voltage range between 4V and 16V (18V abs. max.) is perfectly suited for the usual 5V, 9V or 12V input voltage rails. The 4 step-down converters can regulate output voltages between 0.55V and 7V and supply their loads with up to 3A per output 1 and 2, and 2A per output 3 and 4. Parallel operation of 2 of the outputs is possible, then you get 6A respectively 4A output current. So there is enough power available to supply quite powerful processors or FPGAs as well.

The fact that extensive protective circuits are integrated, e.g. against undervoltage, overcurrent and thermal overload, goes almost without saying nowadays.

### Efficiency vs. Load Current

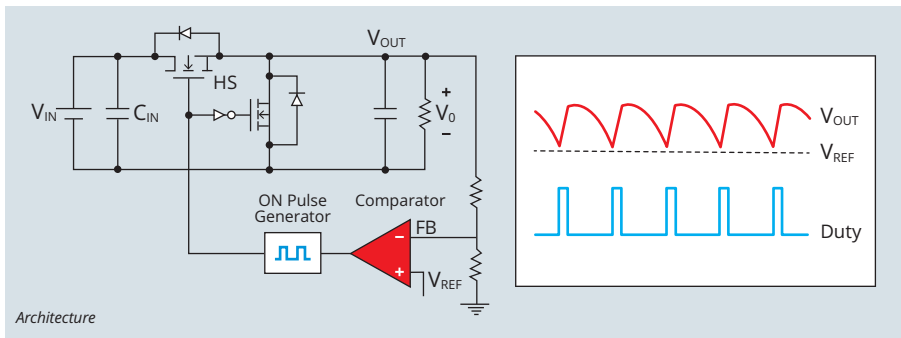


### COT Topologie

The modern constant-on-time (COT) control topology guarantees fast transient response. Compared to traditional current-mode controllers, the control design is relatively simple. The output voltage is read back (internal or external) via a feedback divider and fed to the inverting input of a comparator.

The non-inverting input carries the reference voltage. If the divided output voltage falls below the reference voltage, a pulse with fixed width is triggered (constant on time), which switches on the high-side MOSFET. At the valley of the output ripple, the switching takes place. With the falling edge of the on-pulse the high-side MOSFET is





switched off again (and after a corresponding dead time the low-side MOSFET is switched on). The MPM54304 does not require an external compensation network; ramp generation is done internally, saving space and, above all, design time.

### Tiny!

MPS integrates optimized inductors into the module, which is beneficial to the overall size. The result is a »module« that is worth seeing. The MPM54304 comes in an ultra-thin LGA package of just 7×7×2mm, so you will have a hard time, distinguishing it from the conventional ICs on the PCB.

Due to the 1.5MHz switching frequency, small ceramic MLCCs are sufficient as input and output capacitors, which further reduce the space requirements of the solution. The pinout was chosen carefully, so the optimum placement of the few remaining necessary components (often only the input and output capacitors) is easy to achieve and the fanout does not cause any headaches even when the routing is done with wide traces. Routing out of the pins with wide traces is a good idea anyway. As usual, MPS builds this module using flip-chip technology. The die is placed »upside down« on the leadframe and is contacted via copper bumpers, which are applied in a complex galvanic process. Bonding wires with high parasitic inductance and poor thermal conductivity are thus outdated.

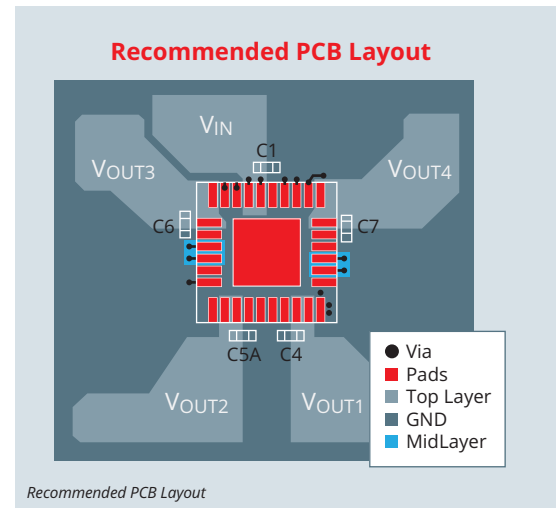
This also enables direct heat dissipation via the pins; the copper bumpers bring the thermal resistance further down. This is what makes such a tiny package with this power rating possible in the first place. Of course, despite all these measures and the high achievable efficiency of sometimes well over 90%, careful thermal management still has to be taken into account. The physics are still valid and considering the high power even small losses cause heat that needs to be dissipated. In the past, voluminous and expensive heat sinks were often required for this purpose.

Fortunately, these times are now a thing of the past. The heat dissipation of the MPM54304 is done via the copper of the circuit board. The design of the PCB is determining the maximum achievable performance of the device. There are layout suggestions for this in the data sheet. If the pins are routed with wide traces and a nice ground plane on the inner layer or BOT is thermally well connected, usually you are fine. However, if you want to bring the device to the limits of its specification, thermal management is essential.

So this guy is a real delight, when things get crowded on the PCB. For a typical solution, we estimate about 120mm<sup>2</sup> including MLCC »chicken feed«. Regarding these are 4 complete switching regulators, with 2mm height, this is not bad at all!

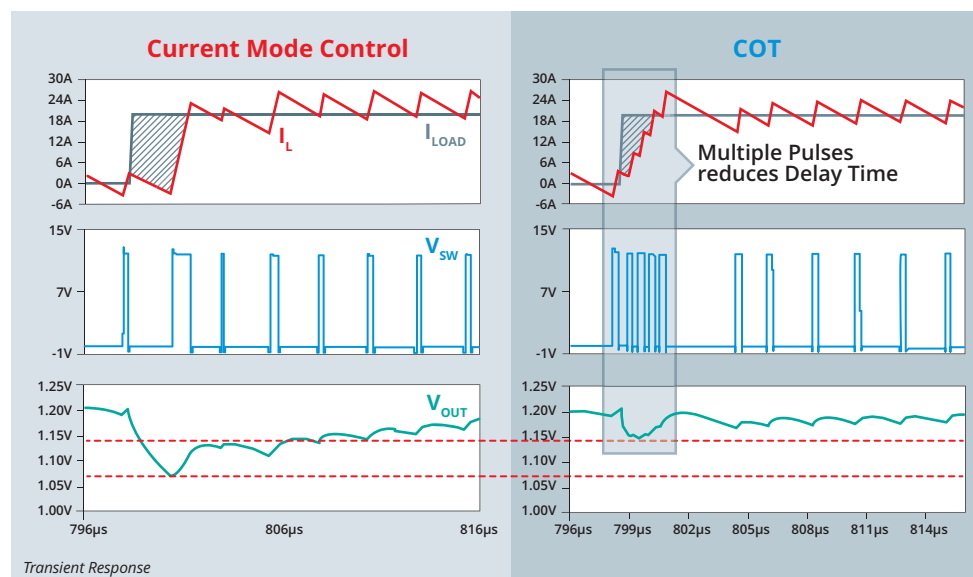
### Small Loops - Small Emissions

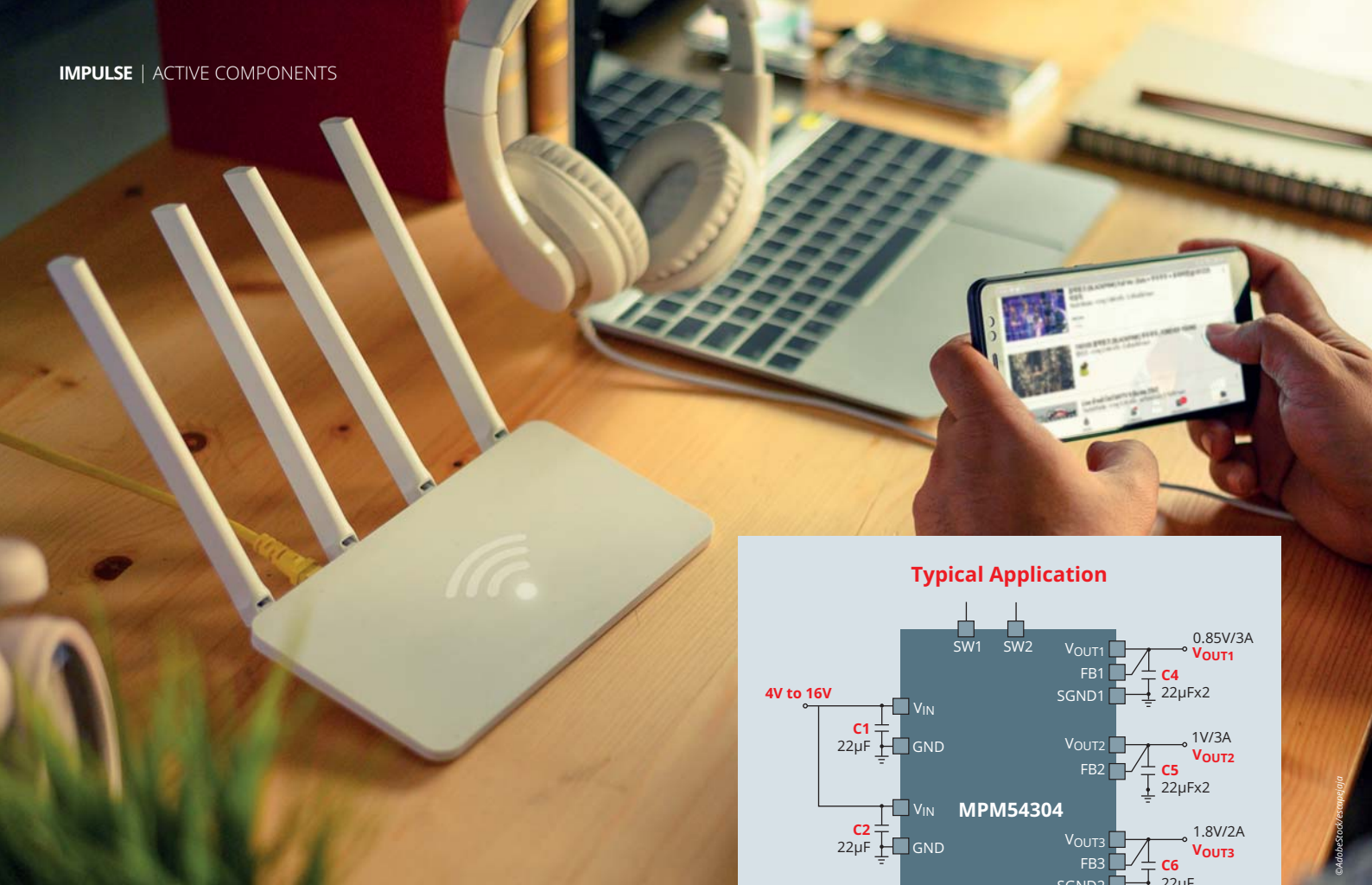
The compact design naturally benefits EMI. The switching regulator remains one of the top candidates when it comes to finding the cause of EMI problems. The currents are getting bigger and bigger, the required small sizes can only be achieved switching in higher frequencies (with correspondingly steep edges). If the component



selection, placement or layout is not optimal, the values required by the norms are quickly exceeded. Troubleshooting begins, and it is particularly annoying when a design in an advanced state requires another design cycle. Especially since the layout is often the heart of the matter. The switching regulator module has here a crucial advantage. By integrating the inductance on the lead frame, the areas of the current loops become unbeatably small, with correspondingly positive effects on radiation.

Of course, it is still necessary to ensure that the input and output capacitors (MLCCs are usually sufficient and the best choice) or any components in the feedback path are correctly dimensioned and placed, if external feedback dividers are used. Nevertheless, this is making life definitely easier for the designer, the well thought-out pinout is helping further. Another advantage of the 4 integrated regulators: the 4 bucks each switch 90 degrees out of phase, so the switching





edges do not add up and cause high spikes in the emissions. In a discrete design, this is not so easy to achieve. With the MPM54304, the phase angles are even programmable. As with everything else.

### Fully programmable

The MPM54304 is fully programmable via the integrated I<sup>2</sup>C interface. The MPM54304 starts up with its default values. It can be supplied by MPS already preprogrammed with the desired register set. Using the MPS evaluation board, the included USB I<sup>2</sup>C dongle and the MPS GUI, the developer can easily configure the device according to his requirements and can test it extensively. The programming file can then be transferred to MPS via CODICO, a special part number is generated, and the device is programmed and tested by MPS in the fab. So the controller, perfectly matched to the circuit, can be purchased ready for use and no additional programming and testing is required during production.

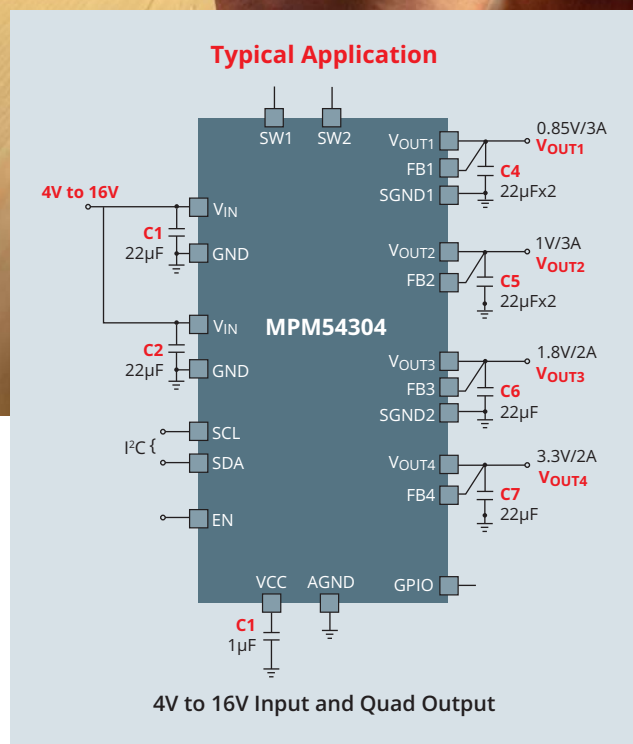
Of course, the device can be reprogrammed on-the-fly during operation, e.g. if a voltage has to be compensated, if the light load mode has to be activated in a certain operating state to save power, or vice versa to switch to forced PWM mode to reduce the output ripple and prevent fre-

quency fluctuations. The changed configuration then can be saved up to three times in an OTP memory, thus overwriting the basic configuration.

The output voltage can be adjusted in the range from 0.55V to 5.4V by adjusting the reference voltage and/or by connecting an internal 1/3 voltage divider. An external feedback voltage divider often is not needed, which again saves some components and prevents incorrectly set output voltage due to assembly errors.

Many processors and FPGAs that are powered by multiple voltage rails require power-on and power-off sequences. The former can be achieved by connecting several switching regulators (power-good output to enable input of the regulator of the next rail), as well.

The latter is more complicated and often forgotten anyway, although it often is required by the specifications of the device. Crossing fingers... With the MPM54304 sequencing is easy. The timeslots of the power-on and power-off sequence are programmable via I<sup>2</sup>C.



The switching frequency can be set in 4 steps in the range from 533kHz to 1.6MHz, depending on the requirements of the circuit. As well the thresholds of the over-current and over-voltage protection.

The soft start, i.e. the controlled ramp-up of the reference voltage during power-up to avoid overshoots on the rails, is also adjustable and thus can be adapted to the respective input and output capacities.

### Try it!

You have a project in mind and want to try out the MPM54304? Contact us and CODICO will gladly provide you with an evaluation board.

A01

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# FLEXIBLE PHYSICIANS



For Medical Applications of highest standard COSEL has launched their all new AME Series. The Japanese Manufacturer adds yet another configurable Power Supply Family to their High Quality Product Range, succeeding the established ACE Series.

The AME embraces 2xMOPP isolation requirements and covers a power range from 400 up to 1200W. The leakage current(s) are less than 500µA to meet in class safety requirements. For this series, Cosel offers a five year warranty.

## The AME Family is available in four Power Grades

Its mainframes: AME400F, AME600F, AME800F and AME1200F come with 4-6 output slots for DC cards currently offering single output voltages. Bipolar as much as asymmetric output voltages will follow throughout the year. The currently available output modules come with 120W and 240W per slot.

Every mainframe can host independent output DC-Modules, to be combined in every possible way creating literally any output voltage. The galvanic barrier allows creating negative, as well as positive output voltages. The output voltages of 24 and 48VDC offer a nominal output power of 240W plus peak/pulse currents of +50% for 5s at a duty cycle of 35% max. Perfect for medical laser

and pulse generators! The 120W cards developed for less complexity such as control circuits feature a reduced set of capabilities such as remote on/off and alarm functionality. All modules come with overvoltage and overcurrent protection featuring automatic restart (hiccup).

The configurable power supply is EN/IEC and (c)UL acc. to \*60601-1 und \*62368-1 approved. Control and surveillance signals can be integrated into literally any application via a single connector (e.g. Remote on/off). The 240W Module

comes with an additional sense port to support output voltage or current adjustability via analogue signals including but not limited to Alarm signals.

The new series stands out due to its small footprint and especially the low profile of 41mm i.e. less than 1U. The COSEL Online Configurator is available via the COSEL Product Selector App and supports design-in allowing seamless integration. For further information or support, please get in touch with CODICO.

A02

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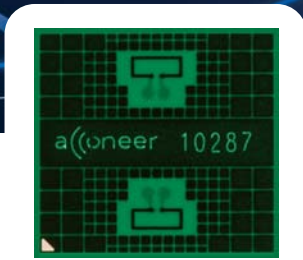
**COSEL Product Selector App:**  
[www.CODICO.com/de/COSEL-app.htm](http://www.CODICO.com/de/COSEL-app.htm)







PULSED



# COHERENT RADAR SENSOR

## Pulsed Coherent Radar Technology

ACCONEER's radar sensor is based on Pulsed Coherent Radar (PCR) technology, a breakthrough in sensor technology. This technology offers several great advantages, including high range resolution with a power consumption of less than one milliwatt.

In the A1 radar sensor, ACCONEER combines the advantages of two technologies, Pulsed Radar and Coherent Radar. Thanks to patented technology, the low power consumption of a pulsed radar is combined with the high accuracy of a coherent radar, everything integrated into a single component occupying only 29mm<sup>2</sup> PCB area.

The PCR technology opens for a wide range of innovative use cases in areas such as robotics, IoT, smart cities, automotive, and consumer electronics like mobile and wearables. Thanks to the capabilities to measure distance and movements with very high accuracy, object detection, level measurement and gesture detection can be carried out with great precision.

### A1 Radar Sensor

The A1 radar sensor is a low power, high precision, pulsed short-range radar sensor with a footprint of only 29mm<sup>2</sup>. The A1 radar sensor is delivered as a one chip system in package (SiP) solution with embedded radio and antenna. The small size and low power consumption are ideal for integration into compact battery-driven and mobile devices.

### Features

- Pulsed Coherent Radar
- Range up to 10 meters (dependent on object size, shape & dielectric properties)
- Millimeter accuracy
  - Absolut: mm
  - Relativ: µm
- Can detect multiple objects
- 57-64GHz unlicensed ISM band
- Power consumption:
  - 0.1Hz updatarate: 0.2mW
  - 10Hz updatarate: 1mW
  - 100Hz updatarate: 20mW

# MODULES

To make evaluation, application development and integration easier, ACCONEER provides pre-integrated modules and evaluation kits.

## XM112 High Performance Module

ACCONEER's XM112 pulsed coherent radar module offers high precision distance measurement with mm accuracy and high update rate frequency.

The pulsed coherent radar module XM112 from ACCONEER is a 24x16mm module that integrates the A111 pulsed coherent radar and a 32Bit ARM® Cortex®-M7 ATSAME70Q20A microprocessor on the same printed circuit board (PCB). The ATSAME70Q20A is equipped with 384Kbytes SRAM and 1MB Flash and has a maximum core processor frequency of 300MHz.

The XM112 is a reference module that can be integrated into a product via the slim 30-pin board-to-board connector to decrease users cost and time for bringing a product to market. The XM112 can also be used as an evaluation kit together with the breakout board XB112.



## XM122 IoT Module

The XM122 IoT Module from ACCONEER is a low power connected radar module with optimized circular form factor with a diameter of 33mm. It is the world's first radar system that can run on a coin-cell battery for several years, depending on use case.

This IoT module integrates the A111 Pulsed Coherent Radar and the Nordic nRF52840 System on Chip that supports a 32Bit 64MHz ARM® Cortex®-M4 CPU with 256KB SRAM and 1MB Flash including support for Bluetooth 5, Bluetooth mesh, Thread, Zigbee, 802.15.4 and ANT. The XM122 IoT module features integrated 2.4GHz antenna and support for external 2.4GHz antenna.

The XM122 IoT module has been developed as a reference module that can be used to support customers in their own design for commercial use, as well as for evaluation and development purpose with the XB122 breakout board.

A03

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©RECOM

## 20kVDC Isolation for DC/DC Converters!

RECOM

RECOM announces the launch of its RHV2 and RHV3 series of certified, ultra-high isolation DC/DC converters with single and dual outputs rated at 2W or 3W in a compact SIP16 package.

RECOM has extended its range of unregulated DC/DC converters with the RHV2 and RHV3 series which feature ultra-high isolation ratings of 12.5kVAC/one minute or 20kVDC/one second in a compact SIP16 package, that measures just 45×15×17mm.

With more than 30mm input-to-output pin separation, the converters are certified to IEC/EN 62368 and IEC/EN 61010 for 12.5kVAC reinforced isolation up to 5000m altitude. The RHV2 provides 2W up to 85°C and the RHV3 up to 3W at 80°C without load derating.

Both series have nominal 5, 12 or 24V inputs and a choice of 5, 12, 24 single or ±5 or ±12V dual outputs. Efficiency is up to 81.5%, isolation capacitance is very low at 4pF typical and the parts comply with EN 55032 (class B) EMI limits with a simple external LC input filter. Reliability is very high with MTBF at 14.6M hours for the RHV2 series at 25°C (13.4 Mio. hours for RHV3). Samples of both series are available via CODICO.

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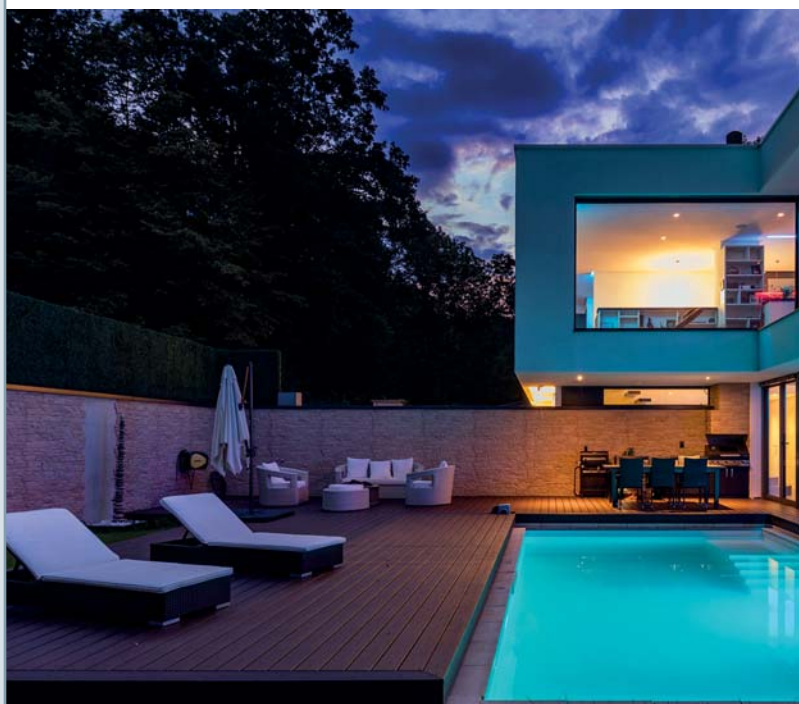
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## Lighting Market: The new Ag210-PoE!

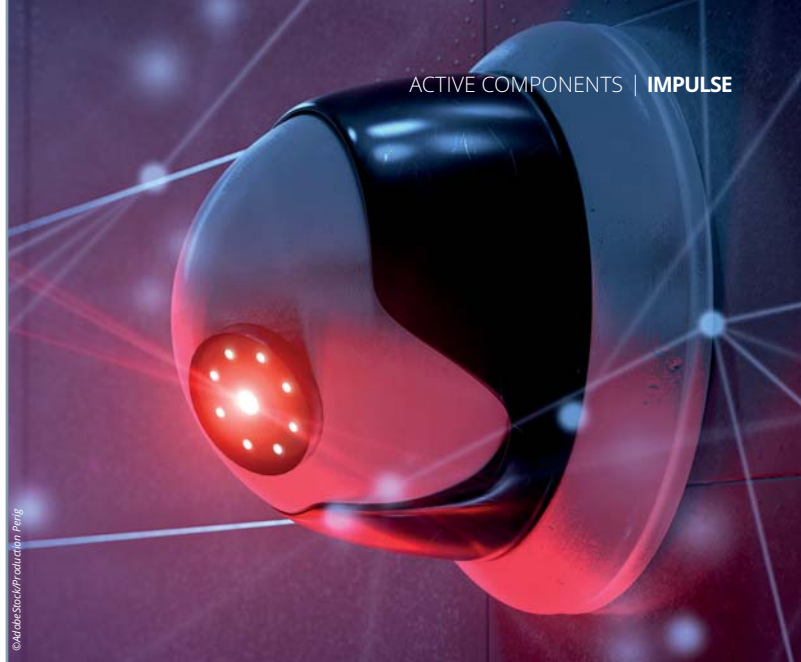
SILVERTEL introduces its newest addition to the product portfolio, the Ag210 PoE-enabled High Power LED Driver Module. The Ag210 is aimed specifically at Smart Lighting applications and provides a hardware configurable constant current, 40W power output.

Configured as a fixed Type 3, Class 6 Powered Device, the Ag210 complies with the latest IEEE PoE Standard, 802.3bt, transferring higher power over all 4 pairs of a Cat 5e/Cat 6a cable. The Ag210 is available in a dual-in-line format package measuring 51×30mm (L×W) providing a compact, feature-rich device, requiring very few external components.

A high-efficiency DC-to-DC converter delivers a regulated output with built-in short-circuit and over-voltage protection. Additionally, the module also has an auxiliary supply output, configurable between 5-12V, which can be used to power a lighting controller. The Ag210 provides identification and signature control circuitry required to support PoE functionality. The module also incorporates an I2C user interface with which to gain access to features commonly used in Smart Lighting applications such as, Dim-







## Ready for the Future: SILVERTEL Ag6120!

 Silvertel

ming Control, Brightness on Power-on, 15 user-defined dimming levels for scene setting, the ability to program the I2C address and a second address for »Broadcast« commands to multiple drivers and read-back of PoE classification.

The Ag210's ease of integration and its simplicity to program makes this module an ideal choice for designers and system integrators looking to get the most out of their LED lighting solution. Samples are available via the CODICO Sample Shop.

**A05**

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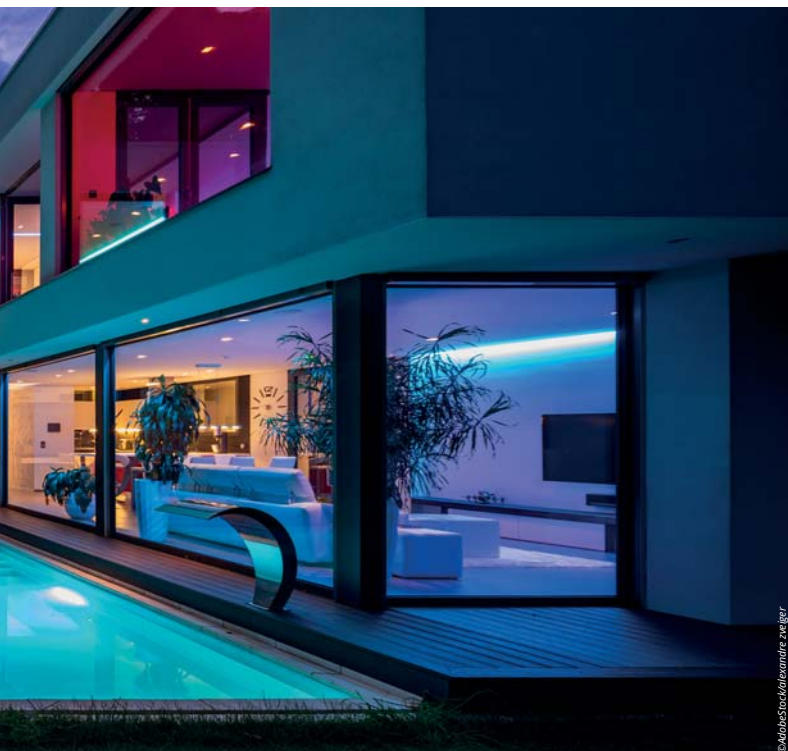
Check out our new  
Sample Shop:  
[www.codico.com/shop](http://www.codico.com/shop)

Backwards compatibility is the big challenge with various standards and non-standards established in the PoE (Power over Ethernet) world.

By releasing the IEEE802.3bt standard, the old terms such as »ultra«, »super« or »high power« became some sort of obsolete. The Ag6120 offers a one size fit all to overcome the compatibility hurdle. The Ag6120 is the latest addition to SILVERTEL's range of PoE PSE modules. The Ag6120 is compliant to IEEE802.3af, \*.at and \*.bt standards, as much as most semi-standards and is available as a compact single-in-line device measuring 53x14mm (LxH). The Ag6120 is a pin compatible device to the existing Ag6100 and Ag6110 PSE modules, which has been optimised and improved to provide compliance to the new \*.bt PoE standard (whilst being compatible with previous versions of the standard) for single port, two pair operation up to 30W. The Ag6120 can be hardware configured to supply different power levels up to 75W for Ultra PoE applications, by simply connecting a resistor between lead-frame pins. The device is fully compatible with SILVERTEL's PD product range including the new .bt compliant devices, Ag5800 and Ag5810. The module incorporates over-current, -voltage and short-circuit protection, requiring very few external components and is ideal for space-constrained applications. Typical applications for this module include CCTV DVR, home networking and Industrial Ethernet equipment. Samples are available via the CODICO Sample Shop.

**A06**

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# IF SMALL IS TOO BIG

## MA782: The World's Smallest True Absolute IC Encoder™!



### The Problem

Over the last several decades, product development has become more and more dominated by design and ergonomic aspects. We all happily embrace this as consumers, but as developing engineers we are also aware of the implications on our daily work. Complex functions get squeezed into tiny packages, and increasing numbers of applications are now battery-powered and mobile.

This also has a significant impact on sensor system development: Where it was once sufficient to attach a commercial encoder, you now often need to design a sensor configuration specific for given mechanical constraints. In response to these major trends, MPS has developed the MA782 as a new member of our MagAlpha family of position sensors.

### Optimal Use of Space

The MA782 uses MPS's proprietary SpinAxis™ technology. SpinAxis™ technology enables monolithic integration of the complete angle sensor, and allows the lateral dimensions of the internal sensor front-end to only take up fractions of a square millimeter. This is in sharp contrast to other approaches, which often need to combine separate sensor front-ends (e.g. magnetoresistive) to a processing unit (e.g. an interpolator).

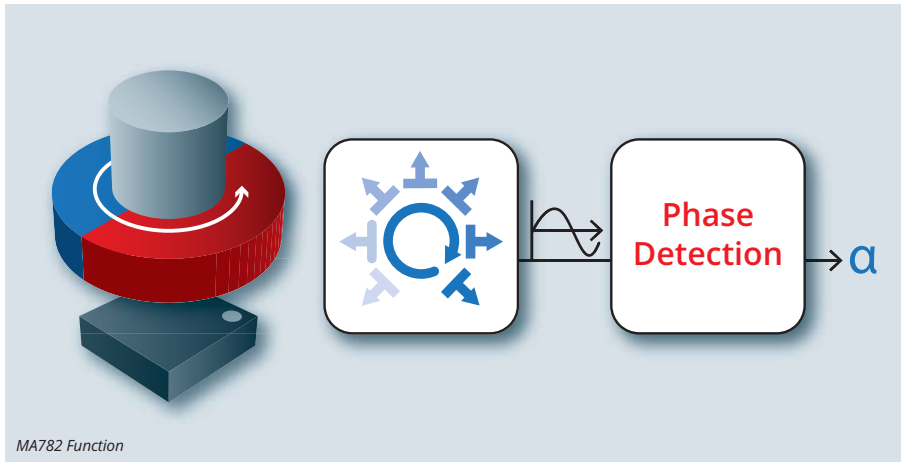
Classic IC packages connect the pads to the lead frame using wire-bond connections that extend across the edge of the silicon die. Modern flip-chip technologies reduce this circumferential edge by flipping the die and connecting the pads directly to the lead frame through solder bumps. Using this technology makes it possible to shrink the footprint of the MA782 down to 2x2mm –

more than 50% smaller than the already industry-leading form factors of MPS's other MagAlpha sensors.

The mechanical design of a product often blocks access to the center of the rotation that is being sensed. Here, another perk of MPS's SpinAxis™ technology comes into effect: The MA782 can be positioned either directly facing the center of a rotating magnet (end-of-shaft), displaced laterally (side-of-shaft), or even orthogonal to the edge of the magnet's plane (orthogonal side-of-shaft).

Diametric magnets, ring magnets, or multi-pole ring magnets are suitable targets. This versatility enables sensor positions that can suit even the most challenging constraints.





MA782 Function

## Energy-Saving Functions

Typical examples of systems that impose strict energy budgets on sensors are residential electronic door locks or modern Wi-Fi-connected room thermostats. Both applications have movement that is triggered rather infrequently (just a few times a day), but users expect the system to react without any noticeable delay. And although the internal complexity demands a microcontroller-based implementation, users expect it to operate over weeks or months on a single battery charge. The MA782 offers several mechanisms to optimize power consumption.

First, it is a true absolute encoder that delivers full angle information with each and every sampling – even immediately after an extended standby period.

Second, the MA782 has configurable sample rates. An integrated power-down logic wakes up the sensor core at an interval tuned to the particular application, measures the actual angle, and returns the sensor to an ultra-low power standby mode. Only the communication interface remains active, and a host microcontroller can fetch the latest angle information at any time. In typical configurations, the average consumption is between 4mA and 4 $\mu$ A, depending on the sample rate and required angle resolution.

While these measures aim to reduce the sensor's energy consumption, the MA782 goes one step further and helps optimize the efficiency of the complete system. The sensor can be configured to generate an IRQ signal for the microcontroller once a position change exceeds a predetermined threshold. Therefore, the processing system – which is often responsible for a large portion of

a system's power consumption – can remain in sleep mode and is only being reactivated when necessary. The interrupt criteria are defined by a reference angle and a threshold for deviation from this reference.

## Sensor Performance

The sensing core of the MA782 is based on an array of integrated Hall-effect devices that measure the direction of the in-plane magnetic field. A fast digital filter that generates 8Bit to 12Bit angle resolution and efficient SPI communication enables control cycles as short as 6.25 $\mu$ s for highly dynamic systems. With the SpinAxis™ method, minimal calibration is required, limited to just a zero-point shift and possible symmetry compensation.

The novel MA782 sensor enables a new generation of position-sensing applications:

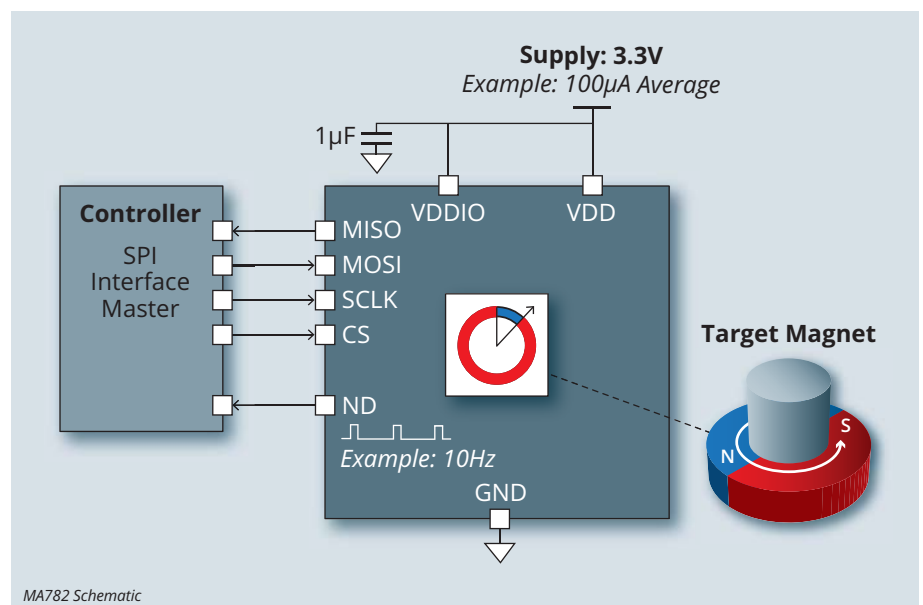
- The small QFN-14 (2x2mm) package makes it the smallest integrated angle sensor on the market.
- Its power consumption is lower than any counterpart, going as low as a few micro-amps.
- The SpinAxis™ sensor core can be tuned to your needed resolution, and allows for flexible magnetic configurations.

This makes the MA782 the best sensor choice for applications that are constrained by mechanics, power requirements, or both. For more information please contact:

A07

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Author: M. Hepp, MPS



MA782 Schematic



# FPGAs

## Made in Germany



### Features

- Logic capacity from 40.000 to more than a million LUT-4 equivalent cells
- DPSRAM 1.280Mbit
- Novel architecture with new programmable element (CPE)
- CPE consists of LUT tree with 8 inputs
- 3 operation areas: low power, economy, speed
- FPGA in ball grid package for low size and high pin count
- CPEs have 2x4 or 8 inputs connected to a LUT tree
- Design conversion free of charge for GateMate™ customers
- Only 2 signal layers on PCB necessary
- Low configuration bit count
- Very fast configuration using 4Bit SPI interface up to 100MHz
- No excessive start-up currents
- Multiple clocking schemas
- Only two supply voltages needed, that can be applied in any order
- Dual ported Block RAMs with 20-80Bit data width, also configurable as FIFO
- Multipliers with arbitrary factor width implementable
- SERDES 2.5Gb/s
- General Purpose IOs (GPIO) configurable as single-ended or differential
- Pullup/Pulldown resistors configurable
- Support for ADC and DAC with additional IP cores
- Core voltage depending on application mode: 0.9 V, 1.0 V, 1.1 V
- Low Power 28nm SLP Globalfoundries™ process technology
- EasyConvert™ software to migrate existing designs to GateMate™
- GateMate™ Place&Route with automatic clock Skew analysis and fixing
- Static Timing Analysis for performance evaluation

GateMate™ is the name of the FPGA family of the Cologne-based company COLOGNE CHIP. The first available devices have a medium capacity from 40k logic gates to 120k. Higher densities are under development. With its FPGAs the company addresses a wide range of applications in automation, communication, security, automotive, IoT, lighting, etc.

The focus of the development was to use a manufacturing process that allows high densities as well as low power consumption, usually a major problem with SRAM based FPGAs. COLOGNE CHIP was thus able to combine logic density, power consumption and package size with the »lowest specific costs on the market« in its GateMate™ family, making the devices suitable for small quantities in the research sector but also for high-volume applications.

The chips were not only designed in Germany, but are also manufactured in Germany. The successful product development was carried out in cooperation with Globalfoundries. The production takes place in the GF-Factory 1 in Dresden on the basis of the energy-saving 28SLP technology.

This minimizes the risk of trade restrictions or high customs duties with GateMate™ FPGA.

The GateMate™ FPGA program is supported by the Federal Ministry of Economics and Technology as part of the IPCEI project for microelectronics. IPCEI stands for »Important Project of Common European Interest«. This initiative is also supported by the European Commission.

COLOGNE CHIP is a semiconductor manufacturer based in Cologne. The company, which celebrates its 25th anniversary this year, has excellent industry knowledge and an experienced team of developers. The design and production location »Made in Germany« represents a unique sales position in the market.

GateMate™ FPDA Sizes FBGA 320 ball 15x15mm		
CCGM1A1	CCGM1A2	CCGM1A4
20,480 CPEs	40,960 CPEs	81,920 CPEs

### COLOGNE CHIP offers hardware to support customers GateMate™ FPGA development:

- A GateMate™ FPGA CCGM1A1 evaluation board is available. This can connect all GPIOs and it is feature-rich to achieve fast hardware installation at the customers side.
- A programming adapter for the GateMate™ FPGA is available as well. This can be used to connect the users hardware to a computer system in order to load the FPGA configuration.

### The Architecture of GateMate™ FPGA

The basic functional elements of GateMate™ FPGA are setup in an array structure of 128x160 size. These elements are called Cologne Programmable Element (CPE). All CPEs are interconnected by a routing structure of 132x164 size.

The routing structure is mainly buildup with so called SwitchBoxes. These Boxes provide sufficient structures to connect all functional elements of the GateMate™ FPGAs. Additional functional blocks are available, like Dual Port SRAM, PLLs, GPIOs, JTAG interface and SerDes interface.

### CPE in Detail

General purpose combinatorial and sequential circuits are implemented using the Cologne Programmable Elements (CPE). CCGM1A1 has 20,480 CPEs arranged in a 160x128 matrix. Every CPE can be setup to the following combinatorial functions:

- 8 inputs with LUT-2tree
- 6 inputs with MUX-4 function
- Dual 4 inputs with LUT- 2 tree each
- 1Bit full adder element, expandable to any length in horizontal or vertical CPE arrangement
- 2Bit full adder element, expandable to any length in horizontal or vertical CPE arrangement
- 2x2Bit multiplier element, expandable to any multiplier size

### FPGA Workflow

The Workflow from the concept up to the GateMate™ FPGA configuration file is shown in the picture 1. Typically, a software framework for FPGA design is already installed at the customer side. The design flow starts with HDL source generation with direct HDL implementation or any programming language like C/C++ or Python, e.g., with conversion to HDL afterwards.

Then logic synthesis and FPGA implementation, which means mapping, placement, routing and timing extraction, leads to a Verilog netlist. A SDF file can be extracted to provide timing parameters. Verilog netlist and SDF file are passed to EasyConvert™. This program converts the design data to the data format used by the GateMate™ FPGA Place&Route software. The EasyConvert™ tool enables the implementation of every other legacy FPGA, no matter how the design was realized. So every legacy generator tool can be used.

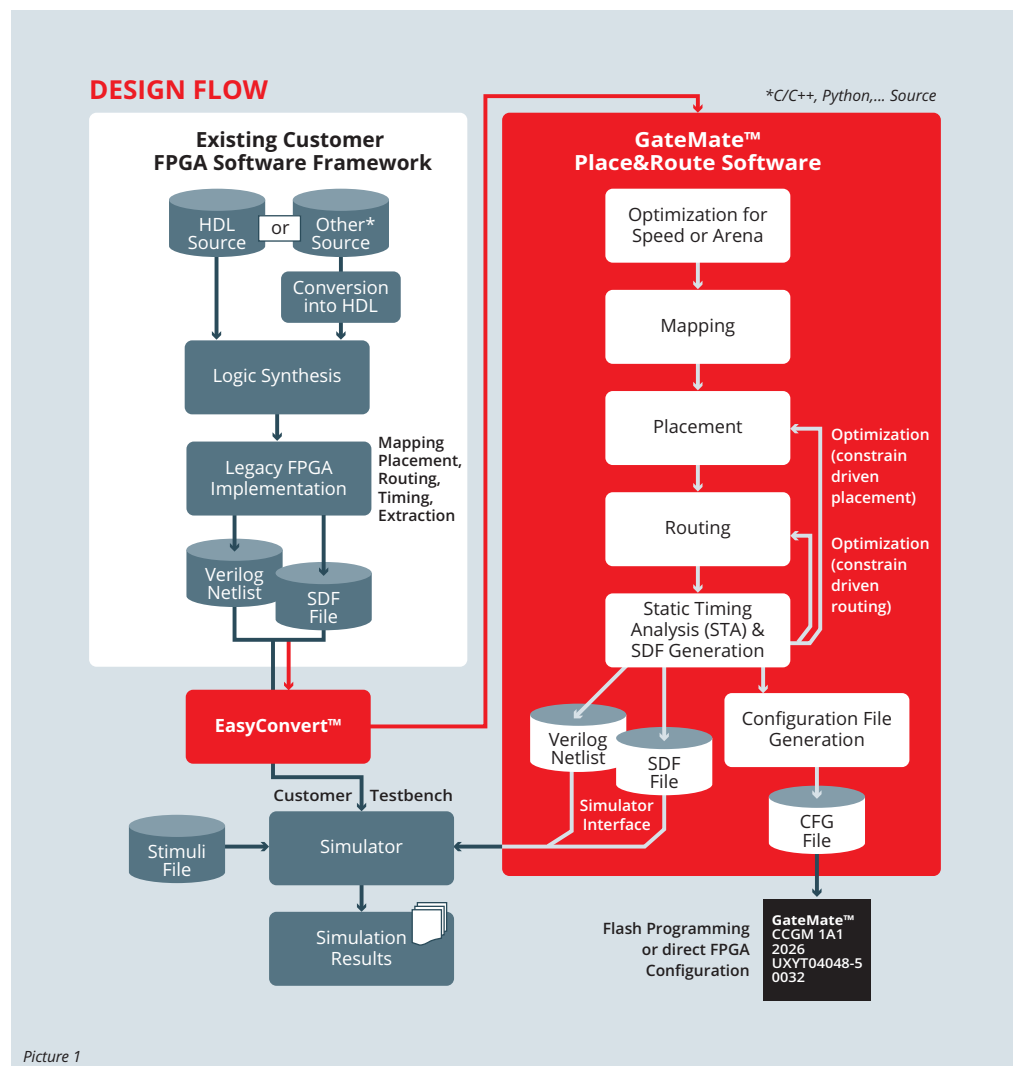
In the first step of Place&Route a procedure for speed or area optimization is executed and these results are passed to the mapping module. After placement and routing, the static timing analysis (STA) might lead to further optimization steps. This design closure is an iterative process of constraint driven replacement and re-routing steps to finally achieve user requirements.

Finally, a Verilog netlist and SDF file are written. These can be used by the customer test bench for simulation. The FPGA configuration file is written as well. This can either be written in to a Flash memory or it can directly be loaded from the GateMate FPGA.

Please contact for further questions:

A08

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# THUNDERCOMM

## New Module Solutions for IoT, Audio and AI Applications.



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We had already reported in detail about our new module supplier THUNDERCOMM in the last Impulse release in 2019. In the meantime, THUNDERCOMM has expanded its product range with 3 more SOMs (System on Module), which we like to introduce briefly. Of course these modules are again based on Snapdragon processors from Qualcomm, which leave nothing to be desired for 32Bit and 64Bit based Linux and Android applications and surprise with many extra features.

The smallest module S212 SOM is based on the application processor APQ8009, which is known for its extremely low power dissipation and has been used in numerous applications such as smartwatches and wearables in general.

The APQ8009 is based on 4xCortex-A7@1.3GHz (32Bit) cores and has 1GB LPDDR3 RAM and 8GB eMMC Flash. For display and camera applications, the user can take advantage of the integrated Adreno 304 GPU and a Hexagon 536 DSP.

The module is suitable for all IoT applications that need to process multimedia content in HD format and have to master their inputs and outputs via cameras and displays despite a low energy supply. Qualcomm's integrated combo-radio WCN3660B also enables connectivity to Wi-Fi and Bluetooth networks.

The twins C404 SOM and C405 SOM are equipped with a Snapdragon QCS404 and QCS405 respectively and therefore feature 4x Cortex-A53 @1.4GHz (64Bit) cores and 2x Hexagon QDSP6 v66 that are optimized to process audio codecs like MP3, AAC, ALAC, FLAC, He-AAC, WMA 6/Pro, Dolby Digital TuHD, DTS, Atmos or Far-Field-Voice and noise-cancellation algorithms. Taking also the extended audio interfaces such as 5x I2S, 8x DMIC and Soundwire into account, these SOMs are particularly suitable for audio applications such as smart speakers, audio assistants and audio conference applications. The modules are offered with either 512MB LPDDR3 + 4GB eMMC or the double memory size. Since the C405 SOM is based on the QCS405, it also integrates the GPU Adreno 306 and enables 720p and 1080p video stream output through the additional MIPI-DSI and HDMI interfaces. The twins both include Qualcomm's WCN3999 combo radio device, supporting Wi-Fi at 802.11a/b/g/ac in MIMO 2x2 and Bluetooth 5.0.



©AdobeStock/Matvey Popov



Especially for AI applications with high and time critical computing requirements THUNDERCOMM proudly presents the C865 SOM that is based on the new Snapdragon SM8250.

The user has access to the new Cryo 585 architecture, which consists of 4x Cortex-A77 (1x Prime@2.84GHz, 3x Gold@2.42GHz) and 4x Cortex-A55@1.8GHz Silver cores. An Adreno 650 GPU and a parallel working DSP architecture for digital signal processing are also available.

The RAM memory is connected via a 6GB LPDDR5 BGA device that is assembled directly on the SM8250 using a POP (Package on Package) manufacturing technique. This enables a clock rate of 2750MHz for a 4x16Bit data bus leading to a data transfer rate of unbelievable 44GBps (Giga Bytes per second) in terms of figures. The flash is equipped with 128GB UFS. The



C865 SOM enables also the connectivity of 2 displays and 6 cameras for 8K@60fps video content. The integration of the new combo radio devices QCA6391 supports the new Wi-Fi standard 11ax and Bluetooth 5.1.

More information: <http://downloads.codico.com/misc/AEH/Thundercomm>

A09

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		S212 SOM	C404/405 <sup>[1]</sup> SOM	C865 SOM
<b>THUNDERCOMM Modules for IoT, Audio and AI Applications</b>				
<b>Platform</b>	Snapdragon	APQ8009, 28nm LP CMOS	QCS404/QCS405	SM8250, 7nm
	Part Number	APQ8009-0-504NSP-TR-00-0-VV	QCS-404-0-NSP722-TR-01-1-AA	SM8250-0-MPSP1099-TR-02-0-AA
	CPU	4x Cortex-A7@1.3GHz	4x Cortex-A53@1.4GHz	8x Kryo 585 <sup>[2]</sup> 1x Kryo 585 Prime@2.84GHz 3x Kryo 585 Gold@2.42GHz 4x Kryo 585 Silver@1.80GHz
	GPU	Adreno 304 GPU	Adreno 306 (C405 only)	Adreno 650 GPU, 665 VPU, 995 DPU
	DSP	Hexagon 536 DSP	2x Hexagon QDSP6 v66 Low Power Audio Subsystem & Compute DSP	Hexagon DSP with quad HVX
	OS	Android 5.1, Linux OS (Yocto), Kernel 3.18	Linux 4.10 (Yocto)	Android 10
	Memory & Storage	1GB LPDDR3 + 8GB eMMC	512MB LPDDR3 + 4GB eMMC or (1GB+8GB)	6GB LPDDR5 (POP) + 128GB UFS
<b>Multimedia</b>	Display	1x MIPI-DSI 4-Lane, supports HD (1280x720)@60fps	C405 only: 1x MIPI-DSI 4-Lane, 720P 1x HDMI, 1080p@30fps	2x MIPI-DSI 4-Lane, 5040*2160@60fps
	Camera	2x MIPI-CSI, 2-Lane, 1.5Gbps per Lane, supports CMOS & CCD Sensors up to 8MP	-	6x MIPI-CSI, 4-Lane, 2.5Gbps per Lane, supports CMOS & CCD Sensors up to 64MP
	Decode	1080p@30fps (HEVC/H.264/MPEG-4/DivX/VP8) WVGA@30fps (H.263)	-	8K@60fps (H.264/H.265/ VP8/VP9)
	Encode	720p@30fps (H.264) WVGA@30fps (H.263/VP8/MPEG-4)	-	8K@30fps (H.264/H.265/VP8)
<b>Connectivity</b>	Wi-Fi	802.11a/b/g/n, MIMO 1x1, FM (WCN3660B)	802.11a/b/g/ac, MIMO 2x2 (WCN3999)	802.11a/b/g/n/ac/ax (QCA6391)
	Bluetooth	Bluetooth 4.x (BR/EDR + BLE) (WCN3660B)	Bluetooth 5.0 (WCN3999)	Bluetooth 5.1 (QCA6391)
	Interfaces	1x USB2.0, 6x I2C, 6x SPI, 2x UART, 1x TF Card, I2S_2 TX & RX, I2S_1A/B RX only, 2x PMU GPIO, 1x PWM, 10x GPIOs, 1x ADC	1x USB3.0, 1x USB2.0, 6x BLSP, 1x TF Card, 1x PCIe, 2x/3x SPDIF, RGMII, GPIOs, SLIMBus, 5x I2S (C404), 6x I2S (C405), 8x DMIC, Soundwire	1x Sound Wire, 2x RF Connector for Wi-Fi/BT, 2x USB 3.1, 2x SSC I/F for Sensor, 2x PCIe, 1x UART, 1x SDC for SD Card, 6x DMICs, 2x Speakers, GPIOs
<b>Module Spec</b>	Dimension [mm]	LGA: 40x41x3.0	LGA: 33.8x33.8x2.5	BTB: 45x56x9
	Power Supply	+3.8V/3A Input	+3.8V/3A Input	3.8V ~ 4.2V
	Operating Temp.	-20 to 70°C	-20 to 55°C	-20 to 70°C
	Storage Temp.	-20 to 80°C	-20 to 70°C	-20 to 70°C
	Relative Humidity	5 to 95% non-condensing	5 to 95% non-condensing	5 to 95% non-condensing
	Certification	RED, FCC	RED, FCC	RED, FCC

[1] For C405 SOM: QCS-405-0-NSP722-TR-01-1-AA or QCS-405-2-NSP722-TR-01-1-AA

[2] CPUs features semi-custom Prime/Gold and Silver cores derivative of ARM's Cortex-A77 and Cortex-A55 respectively

# INTEL® NUC ELEMENTS



## The Modular Mini PC System.



The INTEL® NUC 8 Compute element (U-series) is the heart of the concept. It is a compact system-on-a-card that forms the basis of a powerful modular computer ecosystem. The compute element can be plugged into an INTEL owned NUC like the robust rugged chassis, codenamed Austin Beach, or into an INTEL carrier system, ButlerBeach, focused on business applications.

ment philosophy is to accelerate the development of complex system level designs and to cover a wide range of applications with the modular concept to create ultra-compact desktop computers.

All INTEL® NUC 8 compute elements are equipped with a processor, memory and several I/O options and are housed in a small enclosure. The NUC 8 compute elements are offered with a wide range of processor options from Celeron to Pentium, to the iCore 3, 5 and 7 versions. The compute element can be plugged into a robust INTEL® NUC Pro board element and integrated into the user's own system. It can also be housed in a rugged Intel NUC chassis element for systems in harsh environments or in business and vertical environments. The modularity of INTEL's NUC elements gives users the flexibility to design the right solution to meet their customer or market needs and deliver high-performance systems that can be integrated and deployed in more locations than ever before.

Flexible, simple and powerful, these are the objectives for the new architecture. The NUC Ele-

### INTEL® NUC 8 COMPUTE ELEMENT - TECHNICAL DATA

Processors	<ul style="list-style-type: none"> <li>• INTEL® Core™ i7-8665U-Processor with INTEL® vPro®-Technology (1,9GHz bis 8GHz Turbo, Quad-Core, 8MB Cache, 15W)</li> <li>• INTEL® Core™ i7-8565U-Processor (1,8GHz to 4,6GHz Turbo, Quad-Core, 8MB Cache, 15W)</li> <li>• INTEL® Core™ i5-8365U-Processor with INTEL® vPro®-Technology (1,6GHz bis 1GHz Turbo, Quad-Core, 6MB Cache, 15W)</li> <li>• INTEL® Core™ i5-8265U-Processor (1,6GHz to 3,9GHz Turbo, Quad-Core, 6MB Cache, 15W)</li> <li>• INTEL® Core™ i3-8145U-Processor (2,1GHz to 3,9GHz Turbo, Dual-Core, 4MB Cache, 15W)</li> <li>• INTEL® Pentium® Gold 5405U-Processor (2,3GHz, Dual-Core, 2MB Cache, 15W)</li> <li>• INTEL® Celeron® 4305U-Processor (2,2GHz, Dual-Core, 2MB Cache, 15W)</li> </ul>
Graphics	<ul style="list-style-type: none"> <li>• INTEL® UHD-Graphics 620 (INTEL® Core™-Processors)</li> <li>• INTEL® UHD-Graphics 610 (INTEL® Pentium®- and Celeron®-Processors)</li> </ul>
Storage Capabilities	<ul style="list-style-type: none"> <li>• 64GB eMMC-Storage (soldered-down on INTEL Pentium- and Celeron-Processor-SKUs)</li> <li>• Storage not included on INTEL Core Processor Skus</li> </ul>
System Memory	4-8GB RAM, dual-channel (soldered-down)
Peripheral Connectivity	<ul style="list-style-type: none"> <li>• INTEL® Wireless-AC 9560 soldered-down, 802.11ac 2x2 1,73Mbit/s</li> <li>• BLUETOOTH® 5</li> </ul>
System-BIOS	<ul style="list-style-type: none"> <li>• 64MB Flash-EEPROM with INTEL® Platform Innovation Framework for EFI Plug&amp;Play</li> <li>• Advanced Configuration and Power Interface V5.0b, SMBIOS 2.5</li> </ul>
Hardware Management	<ul style="list-style-type: none"> <li>• Voltage and Temperature Sensing</li> <li>• ACPI-compliant Power Management Control</li> </ul>
Supported I/O	4× USB 1, 3× USB 0, 2× DDI (configurable as DP or HDMI*), 1× eDP, 1× GbE-PHY, 1× PCIe x4/SATA, 1× PCIe x4, 1× PCIe x1, 1× HD-Audio, eSPI (EC-Interface)
Module Size	95×65×6mm
Environment	<ul style="list-style-type: none"> <li>• Qualified for permanent 24/7-operation</li> <li>• Operation temperature: 0 bis +55°C, Storage temperature: -20 bis +40°C</li> </ul>



The NUC Element is based on the U-series of INTEL processors from Core Pentium Gold and Celeron and can achieve a thermal dissipation of up to 15 watts.

The modules are equipped with either 4GB or 8GB soldered memory, 2 channel DRAMs, on some product lines with up to 64GB eMMC SSDs and Wi-Fi5 and Bluetooth 5.0, based on the INTEL Wi-Fi 9560 11ac radio. Each NUC 8 Compute Element has a connector strip on the side for power supply and I/Os.

The connector can offer USB3.1/2.0, Display-Port/HDMI, eDP, Gigabit Ethernet, PCIe, HD Audio and an eSPI interface. The OEMs and case suppliers have the possibility to use different configurations and to implement additional USB and PCI interfaces.

### INTEL NUC8 Rugged Board and Chassis Element

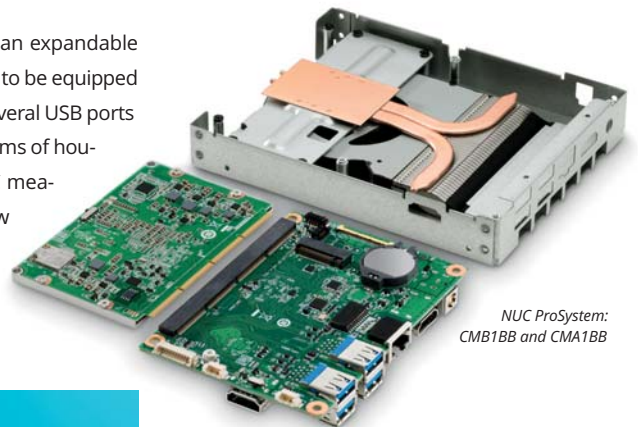
The INTEL NUC Rugged Mini-PC is codenamed »Austin Beach« and features a passively cooled design that is dust-proof and extremely robust according to INTEL. The Mini-PC was developed especially for INTEL's NUC Compute Element.

The Rugged INTEL NUC has two M.2 2280 slots for PCIe x4 NVMe and SATA SSDs. The Mini-PC also has two HDMI 2.0a ports, Gigabit Ethernet, three USB 3.1 Gen 2 Type A ports and one USB



Austin Beach – Rugged Board with DUAL LAN Option

2.0 Type A port. It also includes an expandable section that allows some systems to be equipped with a second Ethernet port or several USB ports or an additional HDMI port. In terms of housing size, the new INTEL Mini-PC measures 10×6×1.4 inches. The new Mini-PC is therefore slightly larger than the typical INTEL NUC devices.



NUC ProSystem: CMB1BB and CMA1BB

Optionally there is another Rugged Chassis Board with a Dual Gigabit Ethernet LAN connection, which also fits into the Rugged NUC (Austin Beach).

The INTEL NUC Pro board Element is a modular carrier board designed to work with a range of INTEL® NUC Compute Elements (U-Series). Also available with a thermal assembly solution.

### Available Products

- CMB1BB-INTEL® NUC Pro Board
- CMA1BB-INTEL® NUC Pro Board & Assembly

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Rugged Chassis Board with Dual Gigabit Ethernet LAN Option

# CLEVER & SMART

## DA14585: Smart-BLE 5.0 MESH Module.

osb  
ENGINEERING & IT

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### A MESH option is available for Bluetooth Low Energy (BLE 4.x).

In contrast to the current Bluetooth Classic (BL 1-3), which is designed for data streaming, Bluetooth Low-Energy has been optimised for irregular, packetized communication at low bandwidths and is therefore ideally suited for the transmission of measurement and control information. Bluetooth Low-Energy is not backwards compatible with BL Classic (BL 1-3).

Most Bluetooth LE devices communicate in a point-to-point connection, which allows direct communication from one device to another device; master-slave connections are most common in a BLE connection. In a master-slave topology, a BLE master can network with several slave devices whereas a slave can only connect to one master; this is very suitable for small, asymmetrical networks but less suitable for networking many devices in a local area network.

In a BLE-MESH network, each device can communicate with any other device in the network. The most important two functions in the BLE-MESH network are a message memory in the

nodes and a counter for the »lifetime« of the message. Each radio node in the BLE network stores received messages in a list. When a message received, it compared in the node with the messages stored in the list. Only if a node does not find the message in its memory, the message sent out and thus forwarded. This prevents the message from being sent repeatedly.

With the lifetime counter, called »time to live« (TTL) in the Bluetooth MESH standard, you can limit the number of forwarding's. The value of the counter can be set to a maximum of 127 by the creator of the message and is reduced by the value 1 by each BLE node through which it is forwarded when it sends the message.

In the past there were only pure BLE radio modules or BLE modules for which the customer had to write the basic functions himself. Not all customers want to use an additional controller for their applications, but if possible they want to use the  $\mu$ C from the BLE module.

### Further customer requests for a new Bluetooth 5.0 module were:

The module design should be extremely compact but still manageable for an optimal and comfortable integration into the hardware. The module firmware should be »Plug&Play«, i.e. it should provide quick access to all Bluetooth 5.0 MESH features without complex software development activities. The module firmware should allow a fast »Software Update Over-the-Air« at any time.

With all these requirements in mind, CODICO turned to OSB Innovations and Products, a Competence Center of OSB AG. In close cooperation, a module was developed that meets all of the aforementioned requirements and offers a variety of additional functions.

The result is the »OSB DA14585« radio module, which was developed in accordance with the Bluetooth 5.0 LE specification and is based on the »System on Chip« DA14585 module from Dialog. The module comes with the Bluetooth 5.0



LE stack, an »Embedded AI OS« and a comprehensive demo app, so that it can be used »Plug & Play«. The module enables a data rate of up to 2Mbit/s master to slave (1Mbit/s slave to slave), with a range of 90 meters in open field.

Due to the MESH topology of the modules any distance can be covered. The module algorithm improves the connection stability of the module in environments where a large number of products already transmit in the 2.4GHz band. In addition, new »Low Energy Extensions« enable the transmission of much larger amounts of data, are therefore advantageous for beacon, and MESH applications.

In contrast to most Bluetooth 5.0 modules on the market, which connect no more than 64 MESH nodes, the »OSB DA14585« module can integrate more than 4,000 nodes into a MESH network. The BLE module with the »Embedded AI OS« (from the OSB »Swarm Intelligent Network« <https://www.osb-innovations.com/produkte/swarm-intelligence.html>) enables access to new technologies that previously seemed unthinkable in this price segment.

Therefore the »Embedded AI OS« can combine the computing power and the memory of the modules connected in the BLE-MESH. With a network of e.g. 12 »Smart BLE 5.0 MESH« modules, a virtual system with a computing power of 12 ARM Cortex M0 with 12MB Flash can be created.

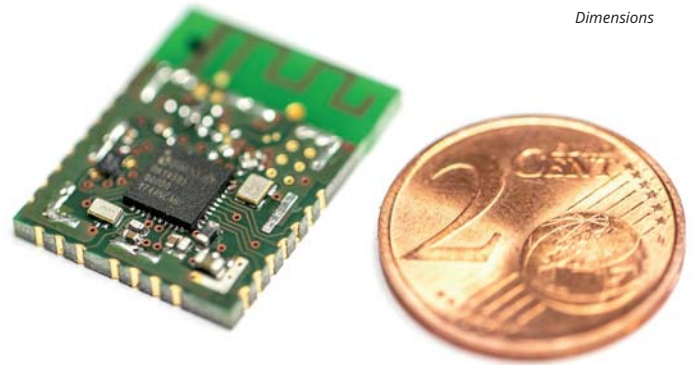
A connection between a module and Android or iOS device can be established with a data rate of 2MBit. In a MESH network with 4,000 nodes, 1MBit from slave to slave is achieved. A MESH Networking Background Repeater function for other modules is integrated, as well as an unusual function that hides the modules in the MESH network (Hidden MESH network function).

The encrypted communication stack and the real-time audio transmission function is integrated in the current firmware, as well as the possibility of exact position location via the »OSB MESH Antenna Grid« function of the »Embedded AI OS«. On the 16MHz 32Bit ARM Cortex-M0 controller and the additional 1MB Flash, the customer can run his application and/or use the functions of the integrated firmware, which can be further extend and played on the module via Over-the-Air function.

The output power of up to 0dBm and the high sensitivity -93dBm of the module, as well as the ability to forward messages over 4,000 nodes, makes it very attractive for applications where a long range is required.

The extremely low power consumption of the »OSB DA14585« Smart Bluetooth 5.0 LE MESH module makes the module the ideal choice for battery-powered devices. Various sleep modes can be used to minimize power consumption and extend battery life. For maximum flexibility, the module can be operated in both »hosted« (with an external  $\mu$ C) and standalone mode. In standalone mode, no external processor is required that saving complexity, space and cost.

Simple functions such as switching or querying IO's, playback of audio signals from the flash memory, the MESH function including the »Hidden MESH« network function are already integrated in the firmware. The usual functions like encrypted communication, over-the-air software and application update, ... and interface like I2C, SPI+, UART, 14 GPIOs, 4 ADC (10Bit), PWM audio output are available with the »OSB DA14585« module as well as audio transmission in real time



Dimensions

or delayed and a 2D-relative geo-positioning function and the possibility to use the module as a beacon.

The »OSB DA14585« Smart Bluetooth 5.0 LE MESH module is ideal for applications such as remote controls, medical devices, smart home applications or virtual reality controllers-applications with extremely low power consumption and high data rate.

The modules are available from stock at CODICO as well as evaluation boards to make it easier for customers to test the modules and functions. The module complies with Bluetooth 5.0, ETSI EN 300 328 and EN 300 440 Class 2 (Europe), FCC CFR47 Part 15 (USA) and ARIB STDT66 (Japan) and has a SWD interface and an integrated PCB antenna.

A11

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**DA14585 - Get your own  
Eval Board at CODICO now!**



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# XC9276

## Ultra-Low Power 150mA Buck DC/DC with V<sub>SET</sub>!



The XC9276 Series is an ultra-low power 150mA PFM step-down synchronous DC/DC converter which has an output voltage select function (V<sub>SET</sub>) that enables two separate voltages to be pre-selected. Operating voltage range is from 1.8V~6.0V and quiescent current is only 200nA.

Ultra-low quiescent current is important as during stand-by mode in most of today's IoT & wearable devices, the supply current of the Power Management IC itself accounts for a major

share of the total power consumption and this has a big impact on battery life so the lower the better. In addition, consumers expect their devices to have longer operating time with less fre-

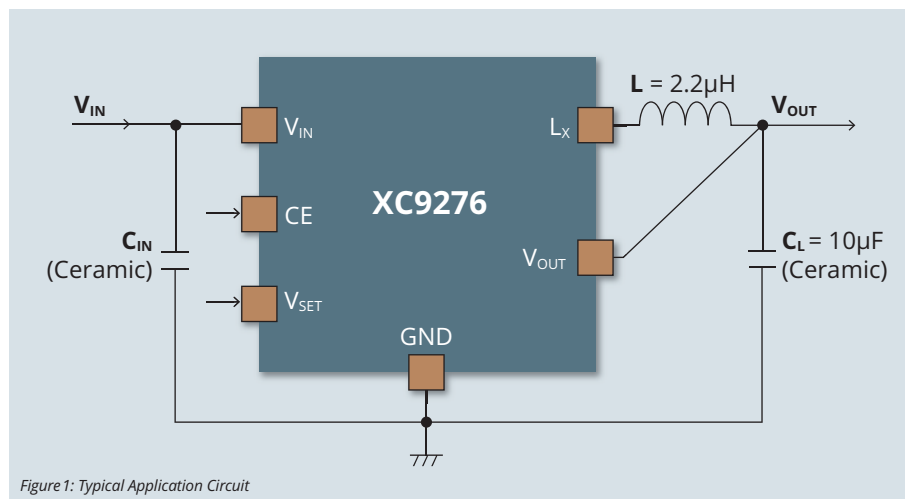
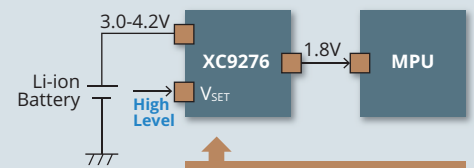


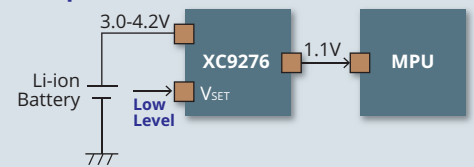
Figure 1: Typical Application Circuit

### MPU Active Mode



Select the output voltage based on the operation status

### MPU Sleep Mode



#### Test Condition

V<sub>IN</sub> = 3.0V~4.2V ⇒ V<sub>OUT</sub> = 1.8V  
**XC9276** V<sub>OUT</sub> = 1.8V (Active) / 1.1V (Sleep)  
 I<sub>OUT</sub> (Active) = 10mA@1ms  
 I<sub>OUT</sub> (Sleep) = 10µA@10s

Figure 2: V<sub>SET</sub> Function & MPU

quent charging. The new XC9276 helps to solve both issues!

This new ultra-low power buck DC/DC is an ideal solution for powering modern MCUs which can operate over a wide voltage range but when in sleep or suspend mode, only require a relatively low voltage to operate. The XC9276's V<sub>SET</sub> function supports this and is explained in more detail above. An efficient step-down circuit can be configured using only 2 external caps and a small 2.2µH inductor. Shown in Figure 1.

### V<sub>SET</sub> Function

As mentioned, modern MCUs can operate over a wide voltage range but when in sleep mode, the MCU only requires a relatively low voltage to operate. Being able to provide a lower VDD vol-



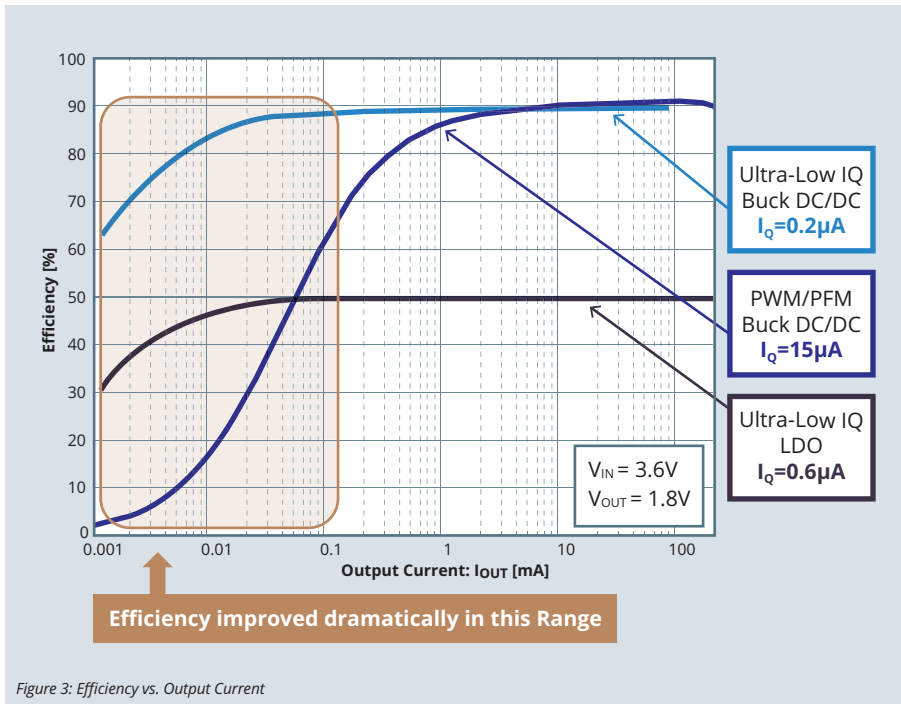


Figure 3: Efficiency vs. Output Current

### High Efficiency at Light Loads

The 200nA quiescent current also contributes to high efficiency at a light load currents and this, combined with the V<sub>SET</sub> function, makes the XC9276 a solution that really helps to extend battery life in battery powered applications. As can be seen in Figure 3, the efficiency of the XC9276 at low load currents (within the range of 1µA to 100µA), is much improved when compared to a standard low power PWM/PFM auto switching buck DC/DC and is almost double the efficiency of a low power LDO. At 10µA, the efficiency of the XC9276 is still >80%!

### Maximise Battery Life

Based on the test conditions given in Figure 2, compared to a low power LDO (XC6504), a typical low power buck DC/DC (XC9265) will provide 76% more battery life. However, the new XC9276 will provide an additional 28% on top of that meaning that the XC9276 can more than double battery life when compared to a low power LDO.

The power consumption is also much lower, particularly in sleep mode, where the XC9276 is only consuming 13.1µW, which is nearly half that consumed by the XC9265 ultra-low power buck DC/DC and around a third of that consumed by the XC6504 ultra-low power LDO (see Figure 4).

The XC9276 series is available in SOT-26W, USP-8B06 and an ultra-small WLP-6-03 which measure 1.07×1.7×0.33mm (see Figure 5).

For more information just contact us.

A12

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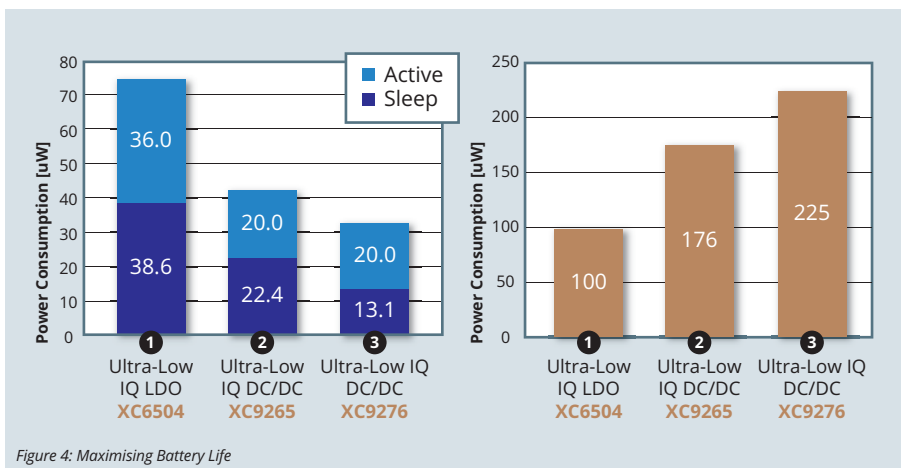


Figure 4: Maximising Battery Life

tage to the MCU during sleep/suspend mode helps to reduce total current consumption which in turn means longer battery life. The XC9276's V<sub>SET</sub> function supports this as shown in Figure 2. As shown, the V<sub>SET</sub> pin allows for 2 pre-set voltages to be selected:

- V<sub>OUT1</sub> (lower set voltage for sleep mode)
- V<sub>OUT2</sub> (higher set voltage for active mode)

Voltages between 0.6V–3.6V can be selected for V<sub>OUT1</sub> & V<sub>OUT2</sub> so, for example, V<sub>OUT1</sub> can be set to 1.1V & V<sub>OUT2</sub> can be set to 1.8V (as shown in Figure 2). The XC9276 is then provided with those two voltages pre-fixed. For operation, a »L« signal to the V<sub>SET</sub> pin would output 1.1V (for when the MCU is in sleep mode) and a »H« signal would output 1.8V (for when the MCU is in active mode).

Any combination of voltages can be provided within the 0.6V–3.6V range.

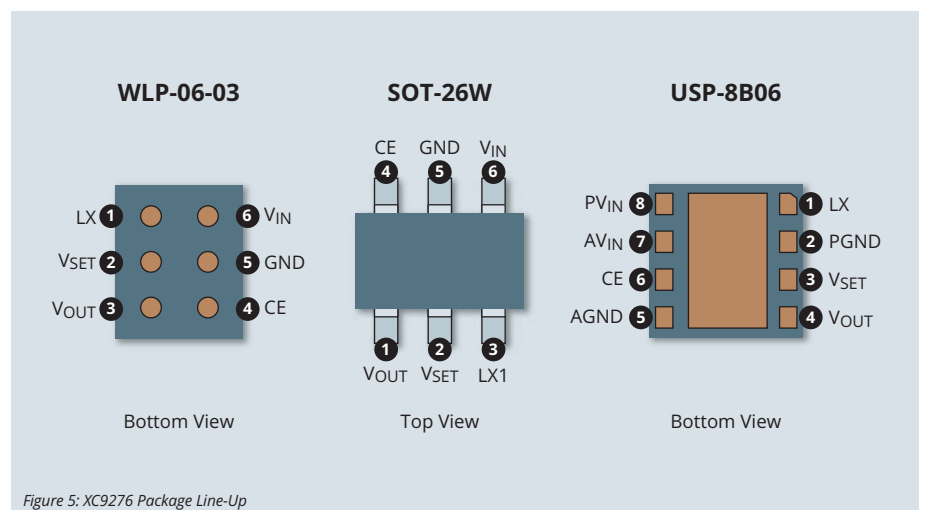
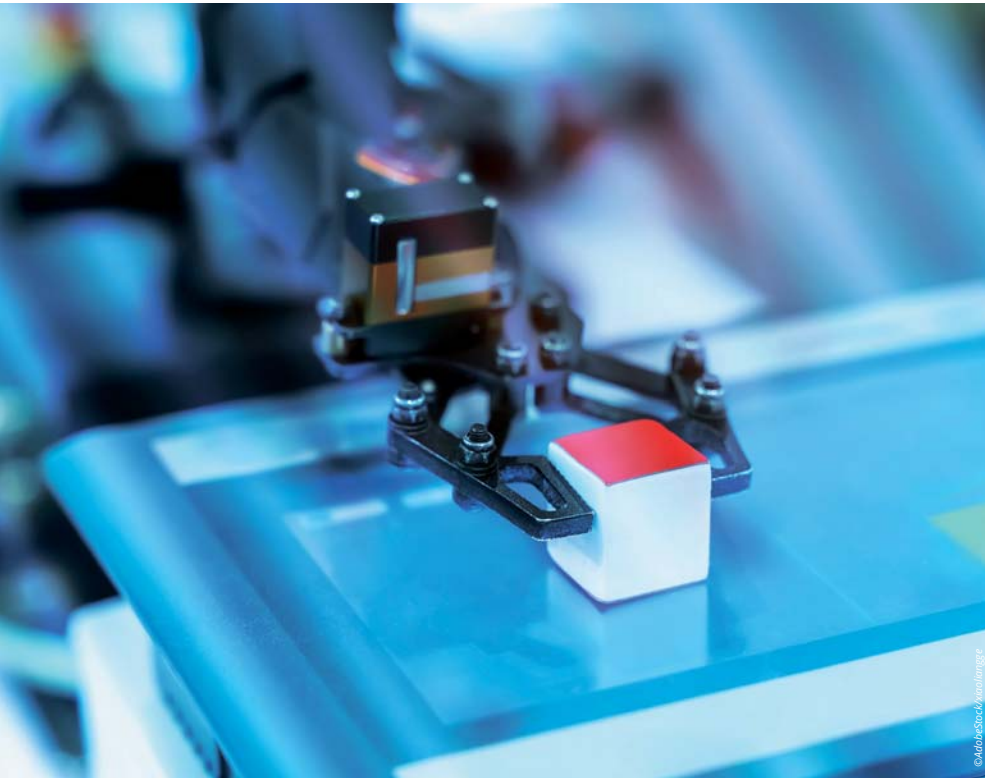


Figure 5: XC9276 Package Line-Up



what is also important for our comparison, certain parameters will change. This is also the reason why we included this (sub)type in our list.

#### TFT LCD (Thin Film Transistor & Liquid Crystal Display)

This is a variant of the liquid crystal display. It uses thin film transistors to address the individual pixels, with the objective of achieving a higher pixel density. They are also known as active matrix displays. Similar to LCD, there is a huge number of TFT LCDs used in industrial environments.

#### OLED (Organic Light Emitting Diode)

Unlike liquid crystal displays, this type of display uses light diodes consisting of organic material to project images. In this particular case, we will be looking at so-called passive matrix OLED displays. In contrast to active matrix OLED displays, the individual pixels are addressed directly, similar to LCDs. For some time now, OLED displays have also been used in industrial applications. This is because they present certain advantages we will discuss below in greater detail.

#### EPD (ElectroPhoretic Display)

This type of display is better known as e-paper or electronic paper. The system consists of tiny microcapsules containing negatively charged white particles and positively charged black particles. Depending on the electric field applied, the corresponding particles move to the surface and become visible. Electrophoretic technology is the latest display technology making its way into industrial applications.

#### AMOLED (Active Matrix Organic Light Emitting Diode)

As a matter of form, we should also be mentioning this technology in our comparison. As in the case of TFT displays, this technology also addresses individual pixels using thin-film transistors. Its most striking benefits are brilliant images and high resolutions. Its drawbacks mostly include an uncertain long-term availability and a relatively high power consumption. These displays can be found in large volumes in consumer products such as smartphones, but they are not really interesting for industrial applications. Therefore, we will not be examining them in greater detail in this article.

# DISPLAYS

## A Comparison of Technologies.

Nowadays we are all familiar with displays, we are literally surrounded by them. And they come in a large variety of quite different technologies. In many devices, displays serve as a user interface and, combined with a touchscreen, they allow the user to interact with the respective device.

In industrial environments, yet also in the consumer sector, requirements for displays can differ significantly. Not every type of display is necessarily suitable for the task at hand. So what's behind each of the current display designs? What are their respective advantages or disadvantages? Which technology is suitable for which application?

For a closer examination, we chose one representative from each of the technologies most widely used in the industry, and we will be studying their features in the following. To allow for a fair comparison of the features of each technology, we chose displays with an almost identical size.

#### So who are the candidates for comparison?

##### LCD (Liquid Crystal Display)

As you may have already guessed, this type of display uses liquid crystals to polarize light and to project an image in this manner. From a technological point of view, this is the oldest representative, and belongs to the group of passive matrix or direct-driven displays. LCDs are still being used today in countless applications and in large volumes. This technology continues to be the best choice for a number of projects.

##### LCD/BL (Liquid Crystal Display with Backlight)

When backlight is added to a standard LCD, it can be used in a range of new applications and,



So what exactly will we be comparing?

## Size and Resolution

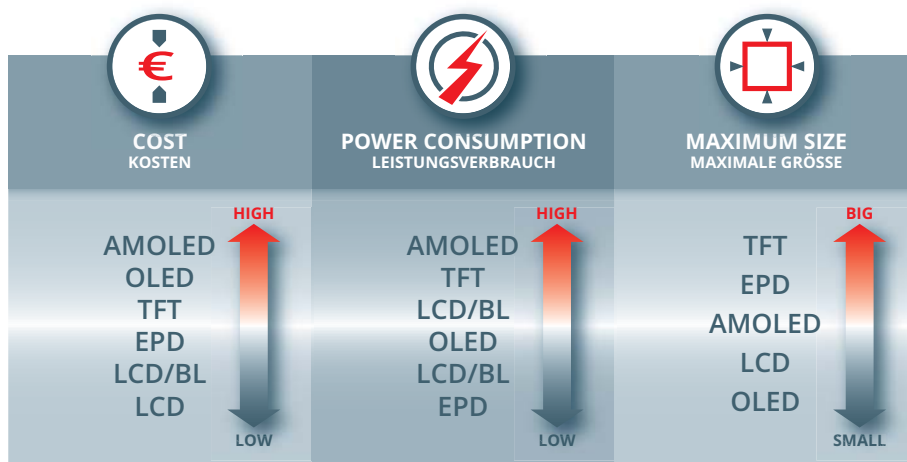
As already mentioned, we selected displays of the same size for the sake of a fair comparison. The screen size ranges between 2.7" and 2.8", since this represents the standard size for TFTs. It is interesting to note that passive matrix displays (LCD, OLED) have a lower resolution than active matrix displays (TFT, EPD). This is discernible on the basis of their ppi (pixels per inch) value. In the case of passive displays, the number of pixels is limited by the length of addressing lines (voltage drop). This means that, when higher resolutions are desired or required, one must resort to active matrix technology.

A size comparison, however, should also mention the maximum possible screen sizes. TFTs are currently available up to a maximum size of 120". The largest EPDs available do not exceed 32". Passive matrix OLED displays are available up to 5.5", graphic LCD displays are currently only manufactured up to a size of approx. 5-6".

Let's dwell on the mechanical dimensions: at a height of 1.00mm, EPD is in a class of its own. All other displays - especially those requiring a backlight - are thicker. This comparison, however, also demonstrates that modern backlight displays are quite able to hold their own. The chosen TFT display with backlight, for instance, is just as thick as the self-luminous OLED. In general, however, one can say that TFT LCDs are in many instances slightly thicker than OLED displays. LCDs, too, are significantly thicker when background lighting is required.

## Optical Parameters

Let us start with the viewing angle. With viewing angles of 180°, OLED displays and e-paper are unbeatable. The displayed content can be seen from all directions without any difficulty. TFT LCDs get close to these two, with viewing angles of 160°. It should be noted, however, that the selected display was made using in-plane-switching (IPS) technology, and thus possesses a higher viewing angle, which, above all, remains the same from all directions. Other TFT LCDs made using TN technology have a slightly smaller viewing an-



gle and a preferred direction from which they can be best looked at. At 90°, LCDs lag somewhat behind, though viewing angle is usually not an issue in the applications that employ LCDs. Now let us look at the contrast ratio, which corresponds to the maximum relative difference in luminance between black and white. It immediately becomes clear that, with a contrast ratio of over 10,000:1, the OLED technology offers by far the richest contrast. At a typical contrast ratio of 800:1, TFT technology cannot match up to that. LCD and EPD are trailing far behind, with contrast ratios of 4:1 and 8:1 respectively. Why are the above values so extremely different?

In the case of OLED, the background is extremely dark, whereas TFT and LCD are using background lighting for better readability, which in turn has a negative impact on contrast. As to LCD without backlight and e-paper, the display's light-reflecting background reduces contrast, since there is no internal lighting installed.

Better readability, however, also greatly depends on a display's brightness. In the case of TFTs,

350cd/m<sup>2</sup> is more than adequate for use indoors. OLED's value of 80cd/m<sup>2</sup> seems low in comparison. If one considers the latter's contrast, however, OLED displays are perfectly readable even outdoors. The maximum brightness of LCDs with backlight is approx. 90cd/m<sup>2</sup>. If they are to be used in bright conditions, it is advisable to opt for a transfective version, which also reflects extraneous light, thus improving readability. Reflective displays such as LCD and EPD require extraneous light to be readable, which makes them perfectly readable under direct sunlight. The above comparison did not take colour display quality into consideration.

## Electric Parameters

There is essentially little to say about display control. The selected displays are fitted with both a parallel and a serial interface (with the exception of EPD, which only has a serial one). Both allow for a direct connection to a controller. Let us now take a look at display response time. As most of you will know, response time is the time it takes a display to go from black to white and back to black again. Although LCDs may seem to be slow,

DISPLAY TECHNOLOGY	LCD	LCD/BL	TFT	OLED	EPD
Size [inch]	2.7	2.7	2.8	2.7	2.7
Resolution [pixel]	128*64	128*64	240*320	128*64	176*264
PPI	54	54	141	53	117
Thickness [mm]	2.50	5.00	2.00	2.00	1.00
Viewing Angle [°]	90	90	160	180	180
Contrast [x:1] [3]	4	4	800	10,000	8
Brightness [cd/m <sup>2</sup> ]	-	90	350	80	-
Lighting	Reflektiv	LED Backlight	LED Backlight	Luminous	Reflektiv
Response Time	300ms	300ms	30ms	10-15µs	14s
Interface	MCU 8Bit/SPI	MCU 8Bit/SPI	MCU 8/16Bit	MCU 8Bit/SPI	SPI/I <sup>2</sup> C
Power Consumption [mW]	1	330	430	480 [4]	10/0.003 [1]
Temp. Range [°C] Operation	-20 to +70	-20 to +70	-20 to +70	-40 to +70	0 to +40
Temp. Range [°C] Storage	-30 to +80	-30 to +80	-30 to +80	-40 to +85	-25 to +40
Lifetime [h]	∞	50,000	50,000	30,000	44,000 [2]
Durability	high	high	medium	high	medium

[1] deep sleep mode, [2] or 1.000.000 write cycles,

[3] CR = luminance/reflection at »white« state, luminance/reflection at »black« state, [4] 50% checkerboard



their response time is more than adequate. After all, they usually do not display moving images, which would require a quicker response. TFT technology has a much higher response time, allowing it to display video sequences even in small sizes without any lag.

Now to the two extremes in our group: since there is no need to move liquid crystals into position, OLED displays possess excellent response times of 10-15µs. This is perhaps comparable with the difference between hard disk drives (HDD) and solid state drives (SSD). At 14s, EPD is the slowest technology in our group. Changing the contents of e-paper can take quite some time. E-paper displays use an electric field to bring microcapsules in the desired state, which makes them perfectly suitable for static images. The latest developments in this technology allow for partial changes in the displayed content, which can reduce response time accordingly.

What about power consumption? Technologies using backlight, or those that are self-luminous inherently have a higher power consumption. In the case of LCDs (and TFTs), power consumption is significantly impacted by the backlight. As to OLEDs, it very much depends on how many pixels are lit and their respective brightness. This may lead to sometimes significant differences as compared to LCDs. An LCD display without background lighting, on the other hand, will consume very little power. Of all display types, however, EPDs are the least energy-consuming. As a result of their bistable technology - i.e. the displayed content is held on the screen even without power - their power consumption is zero. Once the displayed image changes, however, and when this happens in short intervals, power consumption will climb even higher than that of an LCD, and occasionally even an OLED display will fair better in terms of power consumption.

### Temperature Range

The working temperature range required for industrial use is -20 to +70°C. LCD and TFT displays have no difficulties meeting these requirements. OLED displays have an even greater range extending from -40 to +70°C, sometimes to +80°C, and can occasionally reach even +105°C. EPD technology has not advanced to that level yet. There are versions used in applications with a range of e.g. 0 to +40°C, while others can operate as low as -20 or -25°C, yet no product is available to this date that can cover a really wide temperature range. Even in the case of EPD, however, development toward a greater temperature range is foreseeable.

### Lifespan & Long-Term Availability

In each of the above technologies, the lifespan of a display will depend on different conditions and definitions. The life expectancy of LCD glass is virtually unlimited. When no mechanical damage occurs, the display will last almost forever.

When the display features a backlight, one determines the lifespan on the basis of the light-emitting diodes. It is defined as the time until the LEDs reach half their brightness. This will depend on the type of LEDs used, the driver current, and the temperature. Similar considerations apply to OLED displays. Here, too, the lifespan is defined as the time until the display reaches 50% of its initial brightness. This applies to each individual LED in the display. However, not all pixels are equally activated. It may well be that some light-emitting diodes are brighter than others because they are activated less frequently or not at all, while others are constantly lit. Since the human eye can easily detect differences in brightness, this should be taken into account when programming the display content. The situation is different in the case of EPD. The lifespan indicated by the manufacturer is 5 years or 1 million

update cycles. In general, one can say that both EPD as well as TFT and LCD displays possess the same average lifespan.

Since the lifespan for industrial products is longer than those for consumer products, and their development time is usually longer, particular attention must be given to their long-term availability. OLED displays are available for very long periods. These are manufactured using semiconductor technology and can be made over several years without changes. Due to their simple design, LCDs can be easily made, and there are many manufacturers that have the necessary equipment, so that their availability is guaranteed for a long time. The situation is somehow different for TFTs and EPDs. These products are more complex and only a limited number of companies make these displays. One must always expect that the order situation for glass suppliers may change, making it necessary for a factory to convert to a different size, or that the technology is no longer profitable so that preference is given to different products. The estimated availability for these products is between 3 and 5 years.

Should you require long availability periods for your own product, you should carry out an analysis of the display situation as well, so as to secure future availability, e.g. through supplier agreements or a suitable design.

### Conclusion

In principle, one is well advised to take a good look at the application's requirements. Depending on the product's envisaged properties, one should choose the appropriate display technology. One should nevertheless always bear in mind that there is no perfect display for a specific application. At the end, it will always be a very good and sometimes not so good compromise between the technically feasible option and the necessary requirement.

Are you now asking yourself how you should classify these data, parameters, and possibilities, and how you could apply them for your project in a sensible manner? Don't hesitate to ask us, we will be happy provide advice on how to match your requirements with the possibilities available.

**A13**

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# E-CAR GATE-DRIVERS

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Gate Drivers are needed in a number of applications in and around Electric Cars.

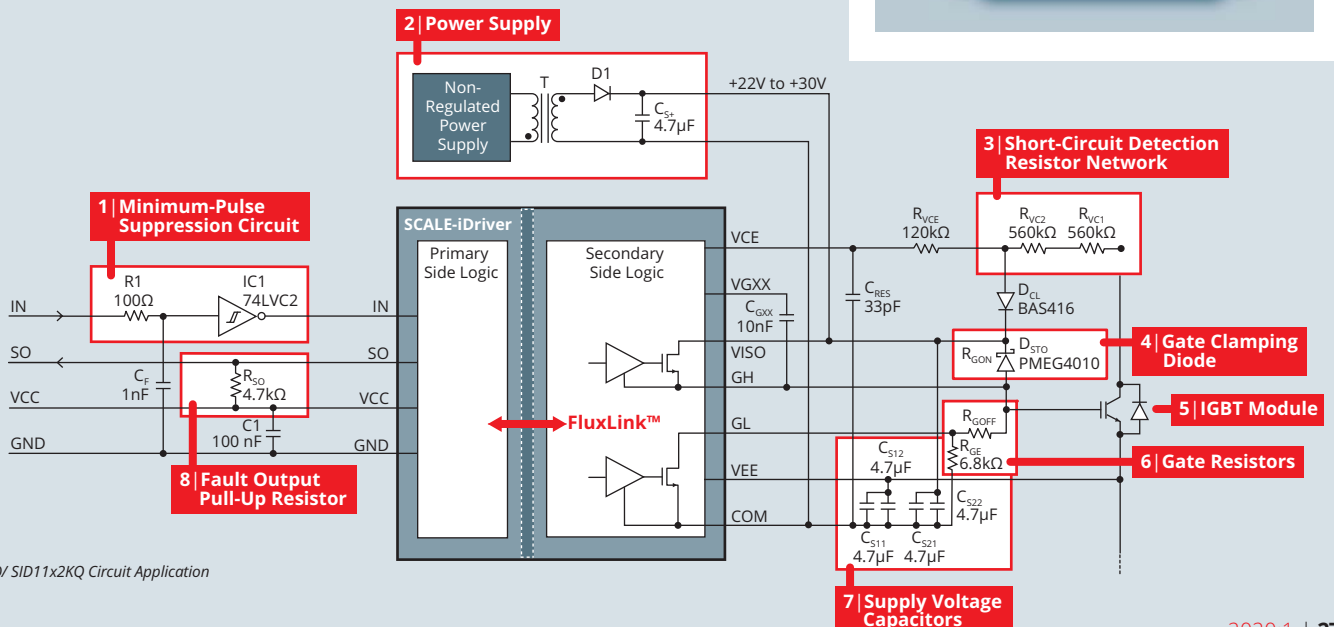
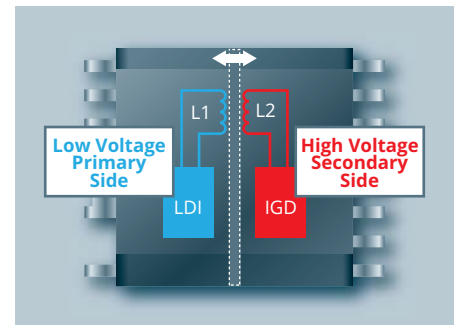
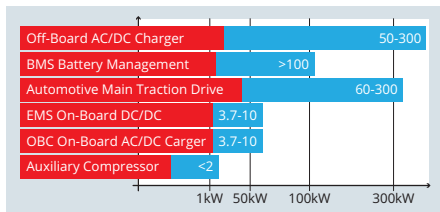
Due to the high voltages (>800VDC) isolated gate drivers are the much safer approach to switch IGBTs. The high powers and the high efficiency required demand gate drivers which supply the necessary gate charge without degradation. Cost is an additional factor, which has a very high rating in all automotive designs. To com-

plete with these demands, POWER INTEGRATIONS has developed a gate driver family, the Scale-iDrivers, specifically for the use in electric cars, meeting all of the above requirements and even added more features on top.

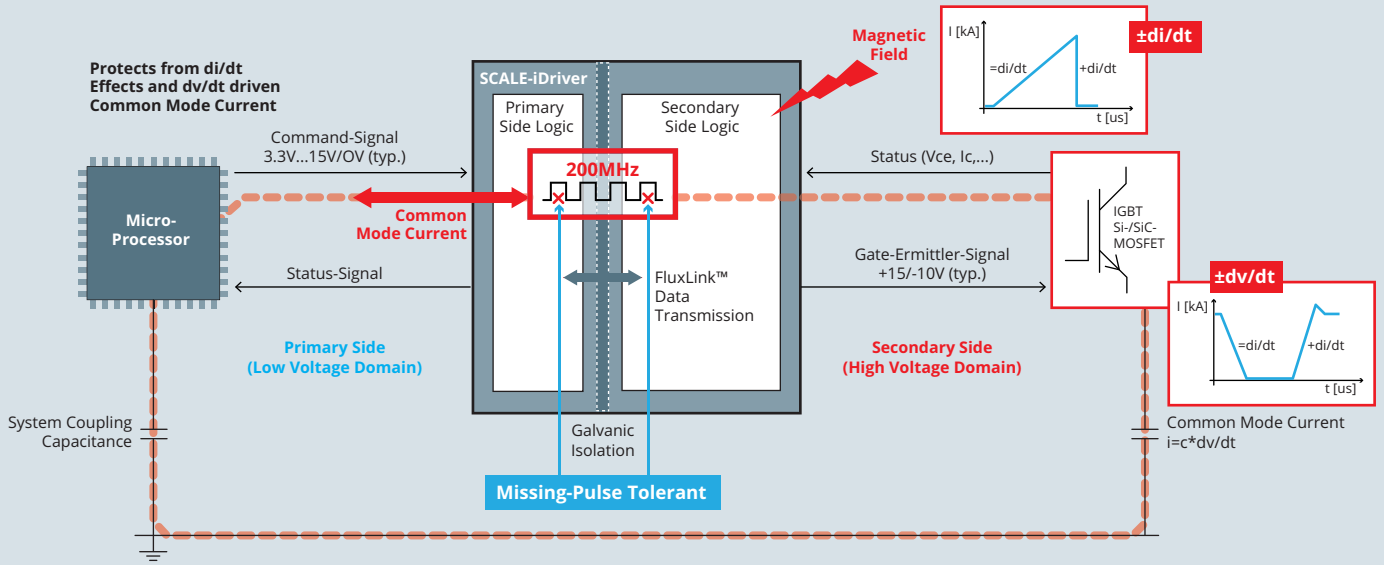
### What are these features then?

Most importantly, the isolation barrier. With FluxLink, POWER INTEGRATIONS developed a very robust and cost effective way to implement the isolation and the communication between the primary and secondary side. It consists of a primary and a secondary side IC and a coreless transformer. The physical principle is ages old,

but the implementation is very modern and nifty. The isolation barrier sits between the windings of the transformer and the ICs. This barrier proves to be very robust, voltages well beyond 10kV and currents well beyond 100 Amps would be necessary to destroy it. Besides, if circumstances like these should occur in a car, the survival of the isolation barrier would be meaningless. So the isolation barrier is very well suited for the use in cars.



SID1181KQ/ SID11x2KQ Circuit Application



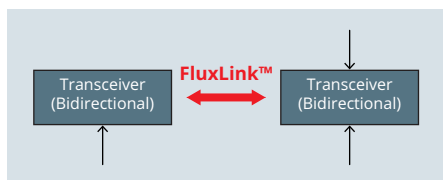
FluxLink™ robust against di/dt and dv/dt Effects

### What about the robustness of the signal transmission?

First of all, the coreless transformer cannot saturate. Therefore, magnetic DC fields do not influence the signal transmission. Magnetic AC fields could in theory influence the signal transmission, if they had the very same frequency as the transmission itself. As the signal transmission is in the high megahertz range (200MHz), such fields cannot be very strong.

The powerful magnetic fields in a car are all below 30kHz. Even DC/DC converters operate well below the transmission frequency. Now let's assume something would produce a magnetic field with the exact frequency in the vicinity of the gate driver. What about that? To avoid such interference, the designers of FluxLink have implemented a digital low data rate On/Off protocol with error correction.

With all these safety measures, so far, the data transmission could not be disturbed to the point of non-functionality. Below is the technical specification of the isolation barrier:

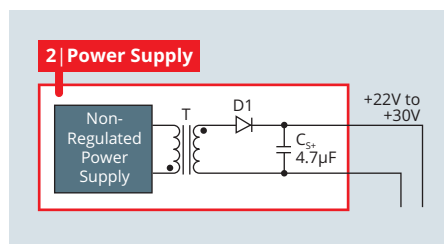


- Working voltage 1000V<sub>RMS</sub>
- System voltage 1414V<sub>Peak</sub>
- Isolation voltage 8000V, 100% production tested
- Surge voltage 12800V, qualification test
- Partial discharge 2652V, 100% production tested

### What else would need to be mentioned about the Scale-iDrivers?

IGBTs have to be turned on with a positive gate voltage and turned off with a negative gate voltage. Therefore, IGBT gate drivers do need a positive and a negative supply. Often enough, the supply does come from low voltage rails on the primary side, but needs to power the output stage on the secondary side.

An isolated and regulated flyback, which generates a positive and negative voltage on the secondary, is obviously considerably more expensive than a simple non-regulated forward converter with just one output voltage. The Scale-iDrivers just need a single rail power supply, because they generate the positive and negative voltages for



the gate drive internally. This, of course, leads to a significant BOM cost reduction of the power supply. In addition, these gate drivers have a number of protection functions built in.

- Advanced Soft Shut Down (ASSD)
- Short Circuit Protection
- UVLO Primary and Secondary Side

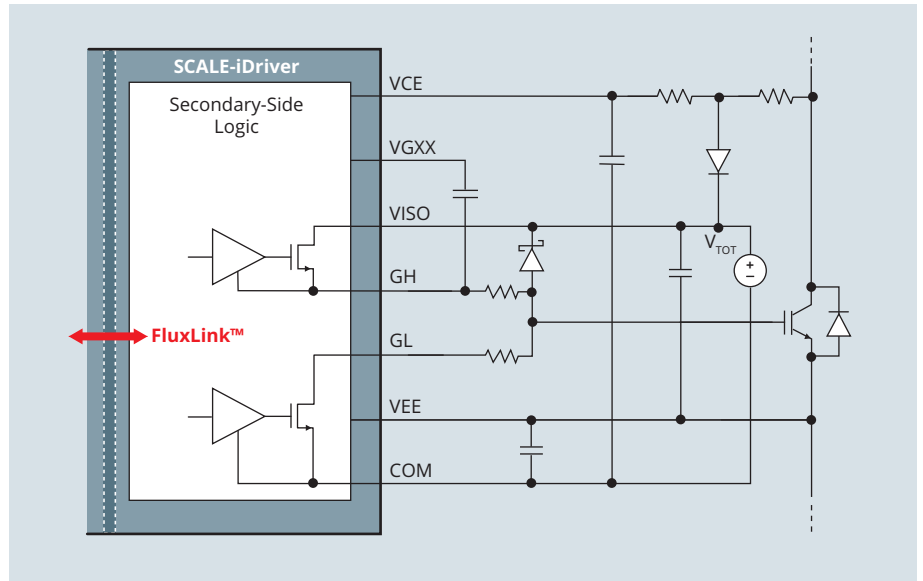
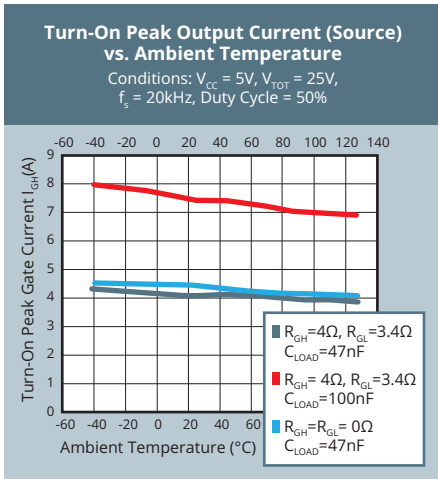
### Short Circuit Protection ... how?

Scale-iDrivers do have advanced detection circuitry to measure the VCE voltage when the IGBT is turned on. This value is used for controlled turn-off. It also controls the current slope, to ensure, parasitic inductances won't drive the VCE voltage above the limits and also inhibit parasitic turn-On through the Miller-capacitance. At the same time, the powerful output stage keeps the gate of the IGBT well below the turn-on threshold.

### What is Advanced Soft Shut Down?

The ASSD is activated in case of a short circuit. Obviously, the IGBT is turned off as fast as possible. The fast current decay however, could lead to a potential latch-on of the parasitic thyristor in the IGBT, which in turn would lead to a catastrophic shoot through. With the energies available in electric cars, we're talking about a lot of charcoal and smoke. To avoid such medieval inconveniences, the Scale-iDrivers have logic ma-





making sure the VCE stays below  $V_{CEsat}$ , thus inhibiting the thyristor latch-on. The ASSD manages a safe turn-off in less than 10µsec.

### How good is the stability of the output stage?

The Scale-iDrivers have an output stage with little degradation over temperature. The output stage has a gate high and a low drive pin, GH and GL. It allows for having different resistors for turn-on and turn-off. It gives some influence on the rise and fall times of the IGBT.

### Fault logic

A low SO pin indicates a fault situation, like short circuit or undervoltage.

### Input logic

The IN pin is for 5V CMOS levels. The input signal is equivalent to the gate drive with about 260nsec propagation delay.

Scale-iDrivers are available with AEC-Q100, UL and VDE certification. Please visit the CODICO Sample Shop if you'd like to have samples.

A14

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### SCALE-iDriver SID11xxKQ Product Family

TYPE DESIGNATION	BUS VOLTAGE	POWER SEMICONDUCTOR	MAX. GATE PEAK [A] AT@125°C	MAX. TRANSIENT ISOLATION VOLTAGE [V]	CREEPAGE & CLEARANCE DISTANCE
SID1181KQ	350V/400V	IGBT	8A	8000	9.5
SID1132KQ	800V	IGBT	2.5A	8000	9.5
SID1182KQ	800V	IGBT	8A	8000	9.5



# DESIGN CHALLENGE

## High Voltage Buck Converter.

There are applications needing an AC/DC power supply, but isolation is not mandatory. Typically, smart LED drivers, appliances or applications with mechanical protection against human contact with dangerous voltages.

For these applications, a High Voltage Buck Converter (Picture 1) can be a quick and relatively easy path to solve the problem.

### On one hand, the advantages are obvious:

- Few components
- Easy design
- Small size
- Low height
- Low cost

### On the other hand, a few topics have to be considered:

The current, delivered by the HV-Buck, is rather small. The HV-Buck produces a relatively high ripple in light load mode, which is getting worse with higher peak currents. With higher currents and lower output voltages, the difference in the forward voltage of the two diodes D3 and D4 becomes more apparent. For the HV-Buck converter, one with a 900V internal MOSFET is required to sustain the stress. POWER INTEGRATIONS LinkSwitch-TN2 family is ideally suited for these demands, offering a wide range of HV-Bucks for either constant-current-mode or mostly-discontinuous-current-mode, reducing also no-load-power to <30mW and regulating the output voltage in the range of ±5%. Both inductors L1

and L2 need to be able to withstand the high voltages, so they need a rating of at least 400V. For a wide range input voltage, the DC-bus voltage is 371VDC with 265VAC at the input. L2 has to sustain that over temperature and lifetime. The inductor selection thus gets narrow, as most inductors have their limit below 100V.

SAGAMI's recently launched CHVR1277 series comes in a 12×12×8mm SMD package and an inductance range from 150µH to 1.4mH. The inductor design meets the mandatory clearance requirements (Pin to Pin) as well as the isolation between the windings. That way, the CHVR1277 series can withstand up to 600VDC and thus is perfectly suited for the above-mentioned tasks.



Picture 1: CHVR

Samples and technical Design-In-Support are provided by CODICO.

P01

POWER INTEGRATIONS & Design-In-Support:

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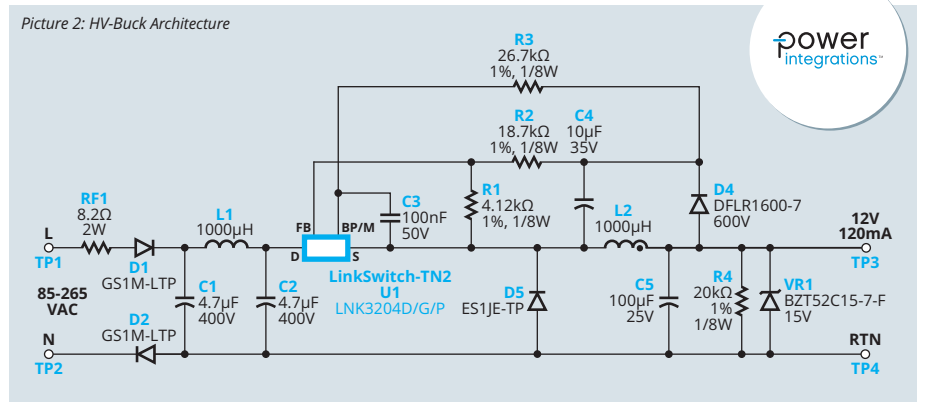
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Picture 2: HV-Buck Architecture



power integrations



# SMALL & LOW-OHMIC

## New FMx Shunt Family.

ISABELLENHÜTTE introduces a new range of 1-6mΩ precision resistors.

ISABELLENHÜTTE has developed a new range of precision resistors in standard sizes with resistances ranging from 1-6mΩ for applications which require small and low-ohmic shunts. In terms of their construction, the components are less complex than the existing ISA-PLAN® resistance families. And yet, they offer the same performance quality: very good long-term stability, a low temperature coefficient, and low thermoelectric voltages.

With the FMx shunt family, ISABELLENHÜTTE has now closed a gap in the standard size range for precision resistances. It has not been possible with the previous product ranges to realize the usual (2512, 2010 and 1206) standard sizes in the resistance range from 1-6mΩ. The impetus for

this new development was provided by increasing demand for these resistances as well from a wide range of industries, including the automotive sector (for in-car chargers and assistance systems) and industry (for BLDC drive units), but also from the consumer market (e.g. for white goods).

### The Development Approach

The large cross-sectional areas required for low-ohmic components have been achieved by a change in construction, and the production process has also been significantly simplified. A further milestone for the FMx shunts has been the development of the NOVENTIN® resistance alloy to make it possible to realize these low-ohmic values in defined sizes. Until now, the ISA-PLAN®

resistances (SMx, VMx and CMx) have followed a sandwich construction, consisting of a substrate – usually copper – an adhesive and a resistance film made out of the ZERANIN® and MANGANIN® resistance alloys developed in-house by ISABELLENHÜTTE. The FM in the title of the new range stands for »full metal«, i.e. the components are fashioned in the corresponding thickness out of a full metal plate made of the resistance material in question and directly soldered onto the underside. This variant is very low-ohmic due to the large cross-sectional areas.

1mΩ is realized with the ZERANIN® alloy, 2mΩ with MANGANIN®, and, for the first time, NOVENTIN® is being used in ISA-PLAN® products for the resistance range from 3-6mΩ. The new design has given rise to a particularly robust construction, which also makes it possible to leave out some work stages and reduce costs. An important point for the automotive industry is this: The components form a soldering point meniscus to guarantee the possibility of automated inspection of the soldering points.

Less complex with the same quality parameters despite the reduction in complexity, the FMx range still offers the same high performance quality as the existing high-ohmic product family. This is ensured by the high-class, massive resistance material, the very good long-term stability, a low temperature coefficient and low thermoelectric voltages. These aspects give rise to good measurement resistance.

P02

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An FMx shunt under construction: The resistance material, e.g. NOVENTIN®, is made of a robust full metal plate which is directly soldered with its underside. Very low-ohmic resistances are achievable thanks to the large cross-sectional areas.



© Adipol/stock/melip

## New DC-Power Film Capacitors!

PANASONIC Industry Europe has recently released new metallized polypropylene film capacitors for filter- and DC-link applications. EZPV series enables designs of high safety and high reliability for automotive and industrial applications.

These capacitors benefit from PANASONIC's original in-house patterned metallization process with fuse mechanism function. This unique technology delivers stable capacitance level over the product lifetime and therefore guarantees a higher reliability of the application. A flame-retardant plastic case and non-combustible resin are utilized leading to accreditation in accordance with UL/regulation. EZPV series capacitors have products available for both industrial and automotive (AEC-200 compliant) applications. EZPV series is ideal for a broad spectrum of applications including industrial power supplies, inverter circuit in appliance, renewable energy infrastructure such as solar inverter and wind power generation; as well as automotive applications such as on board charger, AC/DC, DC/DC converter for xEV.

### Features

- Rated Voltage Range: 600 to 1,100VDC
- Capacitance Range: 3 to 110µF
- Operating Temperature Range: -40 to 105°C
- Lead Spacing: 37.5 to 52.5mm
- Capacitance Tolerance: ±10%

P03

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Panasonic  
INDUSTRY



## Polymer Capacitors with 20,000h Lifetime

PANASONIC Industry Europe has added a new long-life surface mount type series to its industry-leading product line of OS-CON conductive polymer-aluminum solid capacitors.

Available with a rated voltage of 2.5VDC, 6.3VDC and 16VDC, SVPT products benefit from huge capacitance values (100µF up to 560µF) and low ESR characteristics (15-24mΩ max.). The components are able to withstand +105°C for up to 20,000 hours making them ideal for use in demanding applications such as power circuits in servers, base stations, as well as smart meters or other power management systems.

With reducing the temperature by 20°C the guaranteed lifetime increases 10 times. Thus a high and long reliability is reached for high ripple currents in small case sizes.

As all OS-CON range capacitors, SVPT series devices feature excellent noise reduction capability and frequency characteristics, a long life span and their ESR values have little change even at low temperatures since the electrolyte is solid. The components are RoHS compliant and halogen free.

P04

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# Hybrid Capacitors for extreme Conditions

The automotive industry in particular is subject to harsh conditions that place high demands on the components used. Especially electronics installed directly in the engine compartment must be designed to withstand extreme temperatures.

Japanese manufacturer SUN continuously improves on the performance of its products using a wealth of know-how and decades-long experience. SUN is now the first manufacturer to offer a hybrid capacitor with a guaranteed lifetime of 4,000h at 150°C, and full ripple current capability. This makes the new FVF series ideally suitable for applications requiring long and high reliability under extreme conditions and high electrical loads.

Moreover, these capacitors are also available in a vibration-resistant version with a special socket designed to withstand high mechanical stress. Compared to the conventional high-temperature series, FVF also offers a higher capacitance per case size. In addition, SUN implemented a new, larger size that offers an even higher capacitance and current load capability with the same diameter.

Next to high reliability, these properties also translate into a reduction of the space required on the PCB. Of course, this series is also AEC-Q200 certified. It can make your designs more reliable, more powerful, and smaller.

## Features

- Rated voltage: 25 to 63V
- Capacitance range: 82 to 560 $\mu$ F
- Ripple current: 950 to 1,750mArms
- ESR: 13 to 24m $\Omega$
- Dimensions: 10×10.5 to 10×13.8mm

P05

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## High Ripple Current in Small Sizes!

Japanese manufacturer SUN already offers a wide range of hybrid capacitors, and it's constantly expanding. Its product portfolio includes versions with different ripple current capabilities. High ripple currents now can also be managed with small-size capacitors.

We already introduced the HVPY and HVTY series for extremely high currents in our last issue of IMPULSE. These, however, are only available in case size 10×10.5 and 10×12.5mm. SUN's HVPX (125°C) and HVTX (135°C) versions with high ripple current capability now offer a remarkable electrical load of up to 2,100mArms also in small dimensions (6.3×6.0 and 6.3×7.7 mm). Moreover, they have a guaranteed lifetime of up to 4,000 hours. These capacitors are also AEC-Q200 certified, making them suitable for use in automotive applications. For details, check the following list:

## Features

- HVPX 6.3×6.0mm 1,400mArms 25V/56 $\mu$ F, 35V/47 $\mu$ F
- HVPX 6.3×7.7mm 2,100mArms 25V/100 $\mu$ F, 35V/68 $\mu$ F
- HVTX 6.3×6.0mm 900mArms 25V/56 $\mu$ F, 35V/47 $\mu$ F
- HVTX 6.3×7.7mm 1,400mArms 25V/100 $\mu$ F, 35V/68 $\mu$ F

P06

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SUN Electronic Industries Corp.





# LIGHTS ON

## High-Power-Density Inductors for Automotive Lighting!

Today, advanced LED driver designs are being developed with electronic components that deliver higher luminescence and improved energy efficiency at lower cost. Newer technology also has an operational advantage of approximately half the cost of HID or Xenon. The foremost feature is the flexibility and »cool« look that enhances the vehicle's design and increases customer appreciation.

These products enable manufacturers to develop higher-power LED headlight clusters that perform well at elevated current in a smaller footprint. Specific inductors support a more advanced LED driver design that handles higher voltages and a wider array of high-power LEDs that can operate »bend light« and dimming functions to improve roadway safety. Applications are becoming more and more sophisticated, trending well beyond two or three LED drivers per car. Today, full LED lighting solutions specifying 20 power inductors per board and 40 boards per car are realistic.

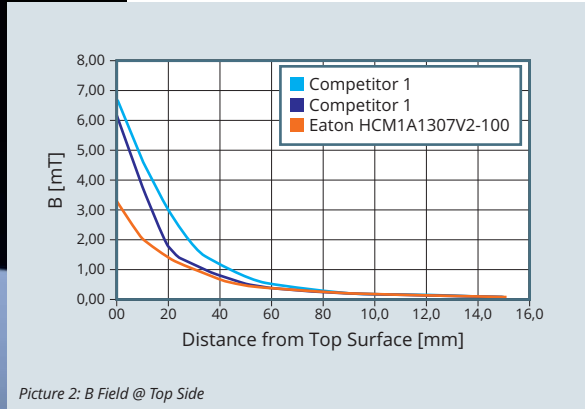
Boost and buck circuits (Picture 1) are used for the most sophisticated LED headlights, providing sufficient power to drive multiple light features all the way up to 120W per lamp.

This type of circuit topology includes a powerful boost converter, which normally boosts the battery voltage to a maximum 60V. This elevated voltage is then bucked down to the required voltage level to power different LED strings of the headlight. The different light strings may be composed of a matrix of uniform LEDs (normally 32-1024 pixels) or strings of power LEDs and some

standalone power LEDs. The complex LED drivers adjust the light intensity and focus automatically for ride enhancing safety on the road, whether day or night. Some laser LED diodes may illuminate all the way up to 600 meters, allowing high-speed driving during the night. These drivers require robust inductors with high power density and 10-20 pieces per lamp, to properly manage the various voltage and current requirements.

When selecting components, it is important to choose those with high efficiency, high temperature capability, high heat dissipation capability and stable operation at all temperatures ranging from -40 to +125°C ambient.

EATONS's HCM1A-V2 inductor product line is designed specifically to take this challenge with a wide variety of inductances and size options.



Picture 2: B Field @ Top Side

tiple high-power LED arrays for headlights and daytime running lights. With the rapid increase of automotive electronics components in vehicles, maintaining a low EMI is essential.

Inductors are recommended to be magnetically shielded, making them suitable for virtually all applications throughout the vehicle. Due to a special winding structure, the HCM1A-V2 series has an excellent shielding (Picture 2). That way, external shielding plates can be spared. This gives automotive engineers design flexibility.

Additionally, these inductors should be AEC-Q200 Grade-1 qualified and appropriate to operate in temperatures of up to +155°C, making them popular for engine compartment applications including electric motors, pumps, and en-

gine control modules, as well as for lighting body and security systems.

It should be noted that the solutions discussed in this article are not commodity products. They must be designed into various automotive applications. In order to successfully optimize their designs, LED designers demand strong support from EATON and CODICO.

Order your samples at the CODICO Sample Shop. Engineering Kits are available on request.

P07

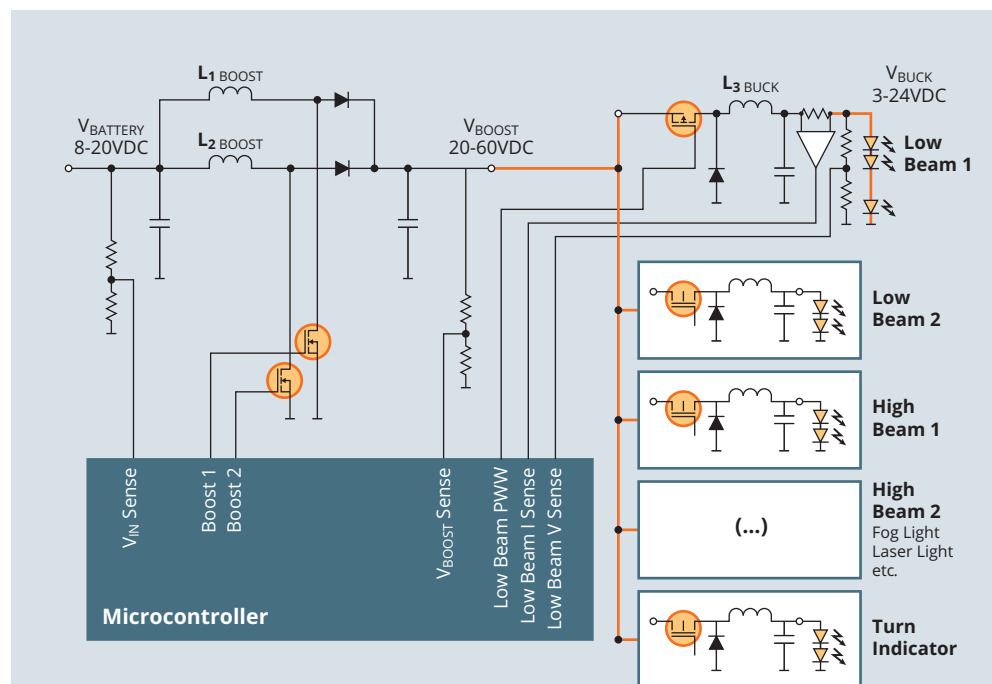
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Author: A. Labady, EATON Electronics

### Identifying the Right Inductors for Challenging Applications

It is critical for manufacturers to work with suppliers who can deliver automotive-grade, high power inductors that offer low electromagnetic interference (EMI) and higher operating temperature, which are essential for obtaining efficient DC-DC conversion. These robust inductors are designed to withstand harsh environmental, electrical, and mechanical conditions.

Many of the more recent applications demand that the inductors perform at temperatures from -40 to +155°C, representing the same inductance roll-off characteristics across the entire temperature range. Tight thermal coupling can ensure effective heat dissipation under high current conditions. Utilizing a variety of sizes and higher inductance values allows automotive designers to operate at higher voltages needed to drive mul-



Picture 1: Boost&Buck LED Driver Topology





# HIGHEST SECURITY

## SFM Relay with Forcibly Guided Contacts.

### Features

- NO/1NC relay with forcibly guided contacts according to EN 61810-3
- Extremely low height of 7.8mm
- Rating 6A (NO), 4A (NC) @ 250VAC, 30VDC
- 100mW coil holding power
- High shock resistance >20g
- THT & THR type available
- Reinforced insulation  $\geq 5.5\text{mm}$  (V=230V overvoltage category III, 6KV) on NO side
- Coil voltage from 3-24V
- Ambient temperature -40 to +85°C

**Panasonic**  
INDUSTRY

After 30 years in the market and a vast portfolio of 4-and 8-pole safety relays, PANASONIC Industry Europe's new SFM series is sort of a blueprint going the next step towards the future of safety relay technology.

The SFM relays with forcibly guided contacts according to EN 61810-3 ensure the safe operation of machinery and other automation, building or transportation equipment. This prevents people from being hurt and assets from being damaged. By using mechanically linked contacts that are monitoring each other, it is quite easy to create a safety circuit for any kind of safety control or safety application.

It is the first time that 1NO and 1NC power contacts are available in a super flat housing with a height of only 7.8mm. This makes it possible to miniaturize all kinds of safety modules by keeping the ability to switch high loads on both contacts.

The second novelty on the global market is the reflow soldering capability of SFM including availability of tape & reel packing.

The power contacts can switch 6A on the NO and 4A on the NC side means SFM can handle loads like valves directly without any other relay in between. For signaling, on the other hand, the silver alloy contacts can handle low level loads down to 10V/1mA as well. This is important not only in a lot of railway applications but more & more also in the industrial field.

A very high shock and vibration resistance  $\geq 20\text{g}$ , low coil holding power of 100mW, an ambient temperature of -40 to +85°C and reinforced in-

sulation  $\geq 5.5\text{mm}$  (V=230V overvoltage category III, 6KV) on NO side makes the SFM safety relays form PANASONIC an ideal choice where operational safety is an essential prerequisite.

### Applications

- Safety relay modules
- Safety controller
- Safe motion control
- Elevator/escalator control
- Railway signaling
- Train door control
- Access control

P08

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# BILLIONFOLD BENEFITS

How PANASONIC Industry Europe's Polarized Power Relays minimize power consumption.

It has been already half a century ago, back in the 1960s, when Matsushita Electric Works started questioning the energy consumption of the offered components. Soon the company, now well known throughout the world as PANASONIC, started to develop and launch a new generation of energy efficient components – long time before saving energy has become a crucial criterion in requirement specs.

Nowadays, and more than ever before, taking a responsible use of energy into consideration in all aspects of daily life has fortunately become sort of common sense – as well within the world of economy and industry. That's why the focus is also set on the energy efficient evolution of

components that are used in billionfold dimensions – for example electromechanical relays.

Here, the key future is an integrated permanent magnet, whose magnetic field overlies the one generated by the coil, much less energy is needed to switch the device. This results not only in a reduced transient response performance but also in a higher sensitivity – which in turn makes it possible to resort to significantly smaller coils and hence an overall more compact design.

Above that, there are bistable types where the ON or OFF state of relay contact can be held merely using pulse input – without any energy consumption at all. This is undoubtedly highly effi-

cient as there will be no self-heating and therefore no coil power losses. Currently PANASONIC Industry Europe offers polarized relays for a wide set of applications in the fields of home & building, industrial or smart city automation. Next to being particularly more shock and vibration resistant than their non-polarized counterparts, the main advantage of the polarized relays is to be seen in their efficiency: Within the entire switching requirement range up to 90A, energy consumption of electromechanical relays will not only be reduced, but can be entirely eliminated.

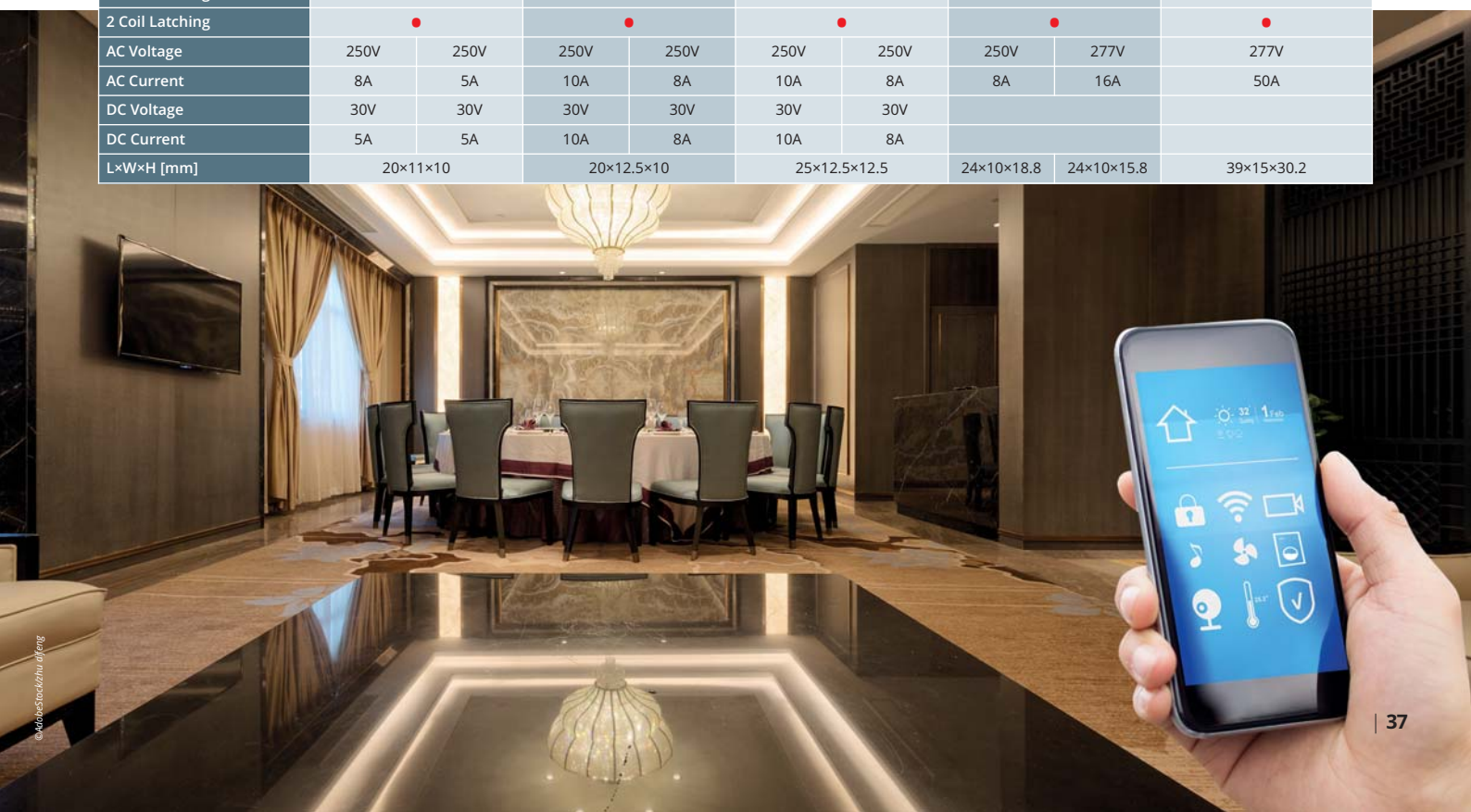
That's good news for the environment: When thinking of the tremendous quantities of relays being in use, the difference between little power consumption and no power consumption is an extraordinary relevant one!

P09

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PANASONIC POWER RELAYS	DSP		DK		DE		DW		DJ-H
Contact Configuration	1A	1A1B, 2A	1A	1A1B, 2A	1A	1A1B, 2A	1A	1A	1A
Single Side Stable		•		•		•			•
1 Coil Latching		•		•		•		•	•
2 Coil Latching		•		•		•		•	•
AC Voltage	250V	250V	250V	250V	250V	250V	250V	277V	277V
AC Current	8A	5A	10A	8A	10A	8A	8A	16A	50A
DC Voltage	30V	30V	30V	30V	30V	30V			
DC Current	5A	5A	10A	8A	10A	8A			
L×W×H [mm]	20×11×10		20×12.5×10		25×12.5×12.5		24×10×18.8	24×10×15.8	39×15×30.2



# RESILIENT



## RUBYCON leads price with new Hybrid C Series!

RUBYCON announced a new conductive polymer aluminum solid electrolytic capacitors (hybrid capacitor) series named CEV (105°C, 10,000hrs) and CFV (125°C, 4,000hrs).

RUBYCON currently has a hybrid capacitor line under a name starting with P. This P line already features six series, from 105°C PEV to 150°C PLV. The new CEV and CFV series will have the same specifications as PEV and PFV.

### What happens with the P series?

The P series is now preparing to become a more customized capacitor, with much better specifications. Especially if you have very high current requirements for automotive inverters in EV mo-

tors, the RUBYCON P series will be your solution for using fewer capacitors.

P10

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As already announced in our previous Impulse issues or newsletters, RUBYCON's hybrid capacitor has a unique feature called »functional liquid«. It offers the benefit of

1. higher ripple current and
2. less ESR in a lower temperature range.

The higher ripple current in particular is major advantage of RUBYCON. In several excess current tests, RUBYCON's hybrid capacitor has shown a significantly high endurance against higher ripple current than the rated one.

The C series will also have this endurance. Moreover, the top CFV-series boasts two rated ripple currents, with a lifetime endurance of 3,000hrs and 4,000hrs respectively. This specification will surely meet the requirements of many of your applications.

RATED VOLTAGE [VDC]	CAPACITANCE [µF]	SIZE øD×L [mm]		[tan δ] 120Hz, 20°C	ESR [mΩ max.] 20°C, 100Hz	RATED RIPPLE CURRENT [mArms/105°C,100Hz]	
		CEV (SMD)	CZE (Radial)			Endurance	
25	220	8×10.5	8×9	0.14	27	2300	
	330	10×10.5	10×9	0.14	20	2500	
35	150	8×10.5	8×9	0.12	27	2300	
	270	10×10.5	10×9	0.12	20	2500	
50	68	8×10.5	8×9	0.10	30	1800	
	100	10×10.5	10×9	0.10	28	2000	
63	33	8×10.5	8×9	0.08	40	1700	
	56	10×10.5	10×9	0.08	30	1800	

RATED VOLTAGE [VDC]	CAPACITANCE [µF]	SIZE øD×L [mm]		[tan δ] 120Hz, 20°C	ESR [mΩ max.] 20°C, 100Hz	RATED RIPPLE CURRENT [mArms/125°C,100Hz]	
		CFV (SMD)	CZF (Radial)			Endurance 1	Endurance 2
25	220	8×10.5	8×9	0.14	27	1600	1900
	330	10×10.5	10×9	0.14	20	2000	2900
35	150	8×10.5	8×9	0.12	27	1600	1900
	270	10×10.5	10×9	0.12	20	2000	2900
50	68	8×10.5	8×9	0.10	30	1250	-
	100	10×10.5	10×9	0.10	28	1600	-
63	33	8×10.5	8×9	0.08	40	1100	-
	56	10×10.5	10×9	0.08	30	1400	-



# STRONG

## 125°C AEC-Q200 MKP Pulse Capacitors from KEMET!



Pulse capacitors are defined as polypropylene film capacitors for applications that use the stable low dissipation factors required to handle high dV/dt and high ripple currents in power conversion applications.

There are three different designs with following advantages available:

**Single metallized Film**

- High energy density
- High voltage and high current
- Self-healing

**Double metallized Film**

- Higher dV/dt performance
- Higher current capabilities
- Self-healing

**Aluminum Metal Foil**

- Highest peak current support
- Highest pulse current capabilities
- No self-healing

**Highlights of the new R76H series**

- For automotive (AEC-Q200) and harsh environmental applications
- THB : 85°C, 85% RH, 1,000 hours at 700VAC/2.000VDC bias
- Highest Irms capability per volume in the industry

The R76H Series is constructed of polypropylene film and double metallized polyester film as electrodes with radial leads of tinned wire. The radial leads are electrically welded to the metal layer on the ends of the capacitor winding. The capacitor is encapsulated in a self-extinguishing solvent resistant plastic case with thermosetting

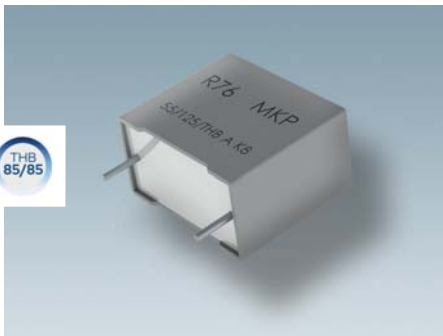
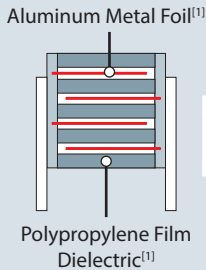
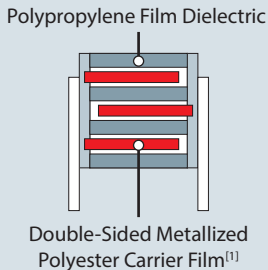
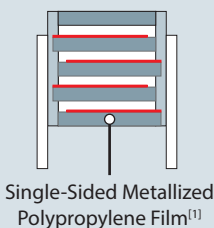
resin material meeting UL 94V-0 requirements. Two different winding constructions are used depending on voltage parameters. Typical applications include resonant circuit, high frequency high current, snubber and silicon-controlled rectifier (SCR and IGBT) and SiC (e.g. MOSFET) commutation circuits as well as applications with high voltage and high current in combination with a high ambient temperature.

**P11**

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Rated Voltage Range	250 to 2,000VDC
Capacitance Range	100pF to 15µF
Operating Temperature Range	-55 to +125°C
Lead Spacing	10 to 37.5mm
Capacitance Tolerance	±2,5%, ±5%, ±10%

[1] Winding constructions used depend on voltage parameters



# READY FOR WI-FI 6



## KDS Crystals made with Photolithographic Technology!



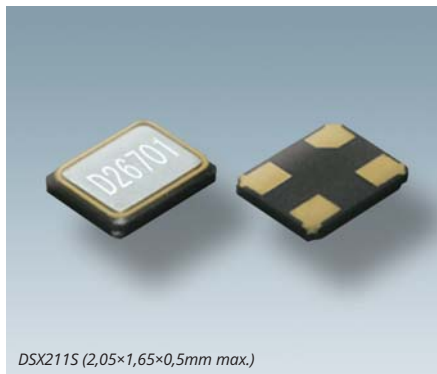
Wi-Fi is already a basic standard in our lives. When people select their hotel prior to travelling, one option they always check is the Wi-Fi connection. Hotel booking websites even provide the rate of the hotel Wi-Fi connection. So Wi-Fi has become a fixed part of our daily life.

Now there is a new movement on the Wi-Fi front, called Wi-Fi 6 (IEEE 802.11ax). Wi-Fi 6 is the latest Wi-Fi standard which comes with a maximum communication speed of up to 9.6Gbps. While remaining compatible with the current IEEE 802.11ac/n/a/g/b standards, Wi-Fi 6 improves speed and multi-user connectivity.

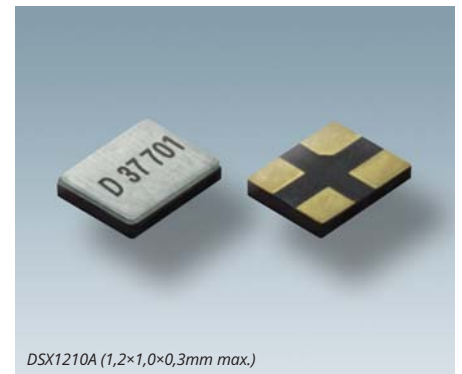
For such large data traffic, the chipset puts greater requirements on the timing device. High accuracy in any range is one of these. Even today, Wi-Fi crystals have an overall tolerance of around  $\pm 25$ ppm in a  $-20$  to  $+70^\circ\text{C}$  temperature range. Wi-Fi 6 crystals will require a much wider temperature range, up to  $-40$  to  $+105^\circ\text{C}$ . Moreover, higher frequencies like 80MHz or 96MHz are given

preference. This requirement is easily met with miniaturization. The trend in crystal sizes is now shifting from  $3.2 \times 2.5\text{mm}$  or  $2.5 \times 2.0\text{mm}$  to  $2.0 \times 1.6\text{mm}$ . The crystal blank size is proportional

to frequency, so smaller size crystals will become more popular with Wi-Fi 6. Wi-Fi 6 is also supposed to bring greater power efficiency. This requires crystals to have a low ESR such as max. 20 to  $40\Omega$ . The crystal's ESR relates to how easy the blank can oscillate. With conventional blank processing technology, achieving this was very difficult. Usually, as the size becomes smaller, the higher the ESR gets, and more power is needed



DSX211S (2,05×1,65×0,5mm max.)



DSX1210A (1,2×1,0×0,3mm max.)



to make the crystal oscillate. In order to achieve this, flatness is key. The oscillation part of AT-cut crystals is at the center of the surface. If you make the center oscillation part flatter and more parallel to the other surface side, the easier the crystal blank can oscillate. Unfortunately, conventional blank processing technology reaches its limits when it comes to creating such parallel flatness.

The crystal blank process can be explained in three steps: »cut«, »polish« and »flatten«. With conventional technology, the cutting is done physically by wire-saw. This causes tiny cracks on the edge the crystal blank. »Polishing« and »flattening« is done by a beveling machine. Crystal blanks are put into a beveling cylinder with abrasive materials. The cylinder rotates for a certain time polishing and flattening the crystal blanks at the same time. Even when flattened, however, it is still far from having a wide flattened oscillation part. The shape is more »ellipse« than the ideal »rectangle« (see cross section of crystal blank shape).

To process the crystal blank closer to the ideal »rectangle« shape, a photolithographic blank process was used. With photolithography, you can achieve the required flatness even in a smaller size. All »cutting«, »polishing« and »flattening« processes are done by exposure. With this technology, the crystal blank can achieve both the necessary high frequency and low ESR. Of course, this technology is not simple.

One needs several steps for masking, photoresist covering, exposure, etc. From a production cost point of view, conventional beveling technology is much easier and more affordable. A high technology level is required for each step in the process. Which means that quality is related to the supplier's blank process technology level.

WI-FI 6 CHIPSET EXAMPLE	
Chipset Vendor	Chipset Name
Qualcomm	IPQ8072, IPQ8074, IPQ8078
Marvell	88W9064, 88W9068, 88W9098
Broadcom	BCM43684, BCM43694, BCM96750, BCM96755
Quantenna	QSR10G-AX
Other Suppliers	Celena, Intel, Mediatek,...

KDS is one of the highest quality quartz crystal suppliers, who has their own synthetic quartz-making and blank-processing factory.

Though there are many crystal rebranding suppliers, KDS maintains control of its manufacturing from quartz material production to product assembling.

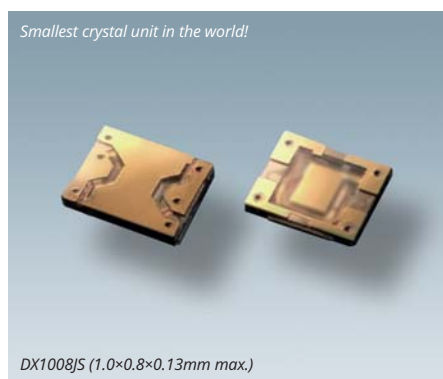
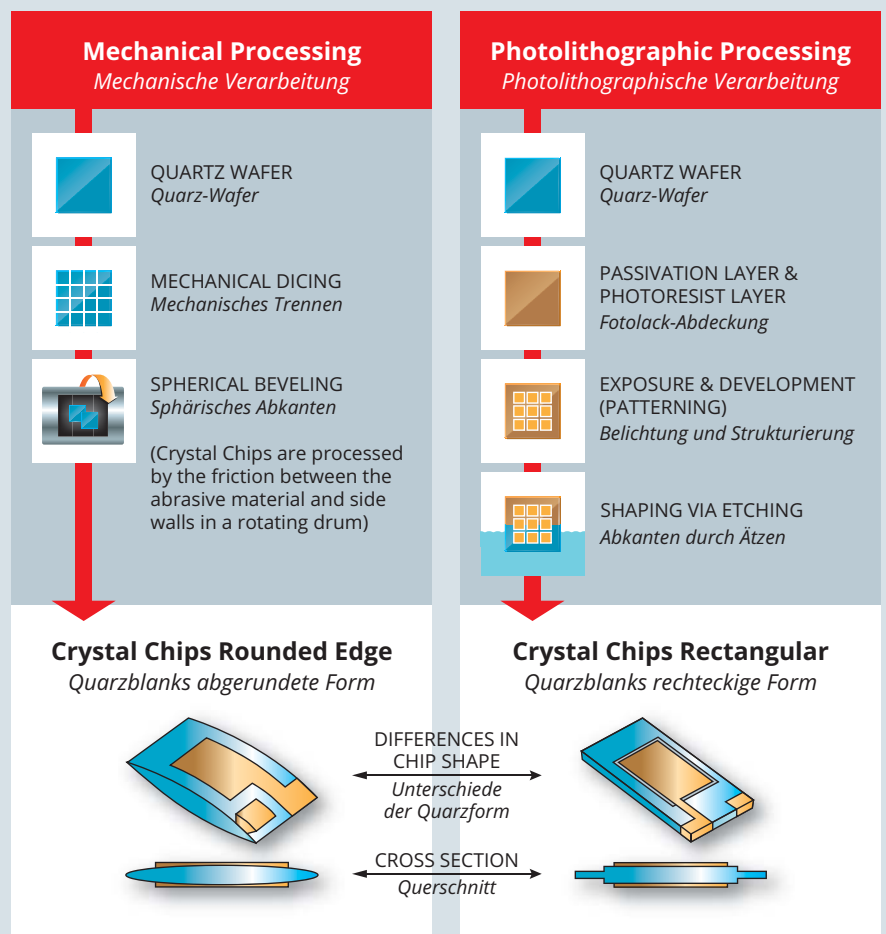
For your Wi-Fi 6 chipset, we recommend DSX210S (2.0×1.6mm) and DSX1210A (1.2×1.0mm) with 80MHz or 96MHz. If you need a much smaller size, KDS also has DX1008JS (1.0×0.8mm), with all material processed using photolithographic technology. This is the smallest crystal in the world.

There is a good reason why we promote our suppliers: KDS simply has the best quality and technology. If you have any inquiries, please feel free to contact me:

**P12**

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### Difference between conventional blank processing and photolithographic blank processing:





# RELIABLE 5G

## The two key benefits of OCXO.



5G is now the hottest keyword in the wireless communication market. Already today, we humans are using an enormous amount of data communication. But as IoT expands into all corners of our lives and future applications like VR, AI and autonomous driving are starting, demand for data will further rise.

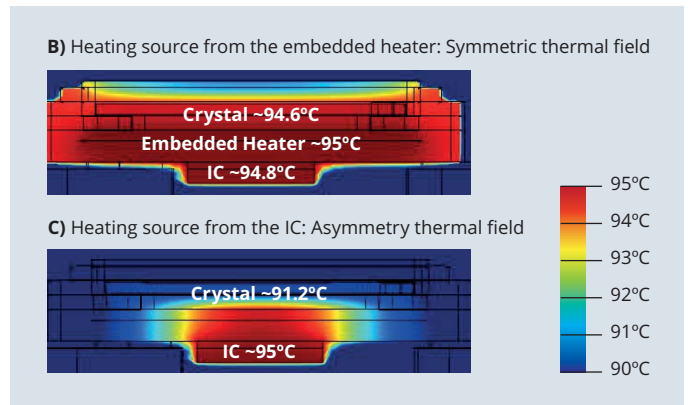
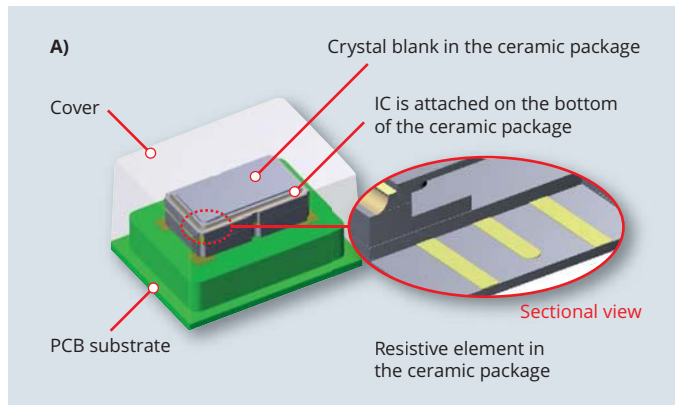
For 5G technology, base stations are not enough to cover the necessary infrastructure density. Low-power nodes, such as small cells installed indoors or outdoors, will satisfy the demands for 5G applications by achieving a high dense deployment of infrastructure. To cope with such high density, the key components inside those nodes need to deliver more than today. That is, to have lower power consumption, smaller-size packages, etc.

OCXO (oven controlled crystal oscillator) basically are well-positioned to satisfy those demands.

Heating is the most important advantage of OCXO, since it can maintain the temperature inside and allow crystals to oscillate at the same temperature under any conditions. The way of heating has a major impact on the power consumption and is a key fact.

However, conventional packaging presents one critical problem. Even when the oven keeps the temperature stable inside, there is a temperature discrepancy between the IC and the crystal. Especially if the size were to become smaller and IC and crystal come closer, more thermal asymmetry would occur between the IC and the crystal (Picture C).

To respond to this problem, TXC developed the unique heating structure ThermSym™ used in OCXO OE series (14.4x9.4x6.5mm max.) and OG series (9.7x7.5x5.65mm max.). Here, the heater was embedded in between the crystal blank and the IC layer. The IC and a crystal blank are positioned at two opposite sides of an embedded





# In any circumstance!



## Y2/X1 film capacitors for harsh environments from KEMET

**K**EMET's safety certified film capacitors are specifically designed for conducted emissions attenuation in AC line filtering applications. The self healing capability of film capacitors makes them a great choice for safety across power lines as well as having internationally recognized safety certifications. These capacitors are well-suited for applications that require keeping potentially disruptive or damaging line transients and EMI out of susceptible equipment.

### Highlights of new R41-T-Series (Y2/X1, 125°C)

- For harsh environments
- Automotive (AEC-Q200) grades available
- IEC-60384-14 THB Grade IIIB: 85°C, 85% RH, 1,000 hours at 300VAC/1,500VDC

The introduction of the R41T series provides the capability of using film capacitors in harsh environments where 85°C/85% RH is a requirement as well as the 125°C operating temperature capability. R41T is constructed of metallized polypropylene film encapsulated with self-extinguishing resin, in a box of material meeting the requirements of UL 94V-0.

### Applications

- For use in electromagnetic interference (EMI) suppression filter in »line-to-ground« and »across-the-line« applications, requiring Y2/X1 safety classification.
- Suitable for use in situations where failure of the capacitor could lead to danger of electric shock.

**P14**

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Rated Voltage	300VAC 50/60Hz
Capacitance Range	4,7 to 220nF
Operating Temperature Range	-40 to +125°C
Lead Spacing	15 to 22,5mm
Capacitance Tolerance	±10%, ±20%
Approvals	ENEC, UL, cUL, CQC



### OCXO SERIES ELECTRICAL SPECIFICATIONS

Item/Type	OG
Dimension	9.7×7.5mm Typ.
Nominal Frequency <sup>[1]</sup>	10, 19.2, 20, 25, 30.72, 38.4, 40MHz
Output Type <sup>[2]</sup>	CMOS, CS
Output Load	15pF, 10kΩ/10pF Typ.
Supply Voltage	3.3V <sup>[2]</sup>
Power Consumption	2.0W max. while Warm-Up 0.5W max. at Steady State
Warm-up Time	3 Minute Typ.
Initial Tolerance	±0.5ppm max.
Operating Temp. Range <sup>[3]</sup>	-40 to +85°C
Frequency Stability vs. Operating Temp. Range	±20 to ±50ppb
Frequency Stability vs. Load Variation	±10ppb Typ. for ±5% Variation
Frequency Stability vs. Supply Voltage Variation	±10ppb Typ. for ±5% Variation
Aging	±1.0ppm/Year
Control Voltage Range	0 to 3.3V
Frequency Pulling Range	±3ppm Typ.
Linearity	10% max.
Phase Noise	1Hz: < -60dBc/Hz 100Hz: < -120dBc/Hz 10kHz: < -150 dBc/Hz

[1] Contact sales agent for other frequency requirement  
[2] Contact sales agent for other supply voltage requirement  
[3] Contact sales agent for other temperature range requirement

heater layer (resistive element), whereby the embedded heater layer establishes a symmetric thermal field so as to achieve good thermal uniformity, maintain oven stability and reduce power consumption. In addition, an SC-cut crystal is utilized for the proposed miniaturized OCXO to further improve temperature stability, aging, and phase noise. As a result, this 9.7×7.5mm OCXO achieves temperature stability of ±3ppb in a range from -40 to 85°C.

The second advantage of this key TXC technology is 2D barcode traceability. Data on all products is kept. For more information, please feel free to contact me:

**P13**

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# CARD-EDGE. ROGER.

## Floating Card Edge Connector.

HIROSE has introduced the FX27 series of floating Card Edge Connector, to support applications requiring PCI Express Gen 1 (2.5Gbps) High-Speed Transmissions.

The structure of the FX27 series features a flexible stacking height, dependent on the interposer PCB length. By using an interposer, a stacking height of 22mm (minimum) can be achieved. In addition, a wide self-alignment guide range of  $\pm 0.7$  mm allows for easy mating in X and Y directions.

The FX27 provides the ultimate design flexibility with the option for designers to customize their original interposer printed circuit board with chip components.

A highlight of the FX27 series is that it can be used as a power connector, by using the entire surface of the interposer as a conductor for applications with good heat dissipation efficiency. The floating structure offers a degree of play between the contacts during mating and allows the connector to absorb any alignment errors. The FX27 series provides a  $\pm 1.2$ mm floating with double floating in XY directions.

Furthermore, benefits from the floating function include the option of having multiple floating connectors used on the same PCB, which helps to avoid assembly errors and reduces the need for corrective re-work operations. The spring portion of the terminal absorbs stress imparted by alignment errors. This reduces the stress applied to the mounted parts, which enhances reliability and prevents solder cracking.

FX27 series is part of the FunctionMAX product family. FunctionMAX consists of board-to-board connectors designed to meet the requirements of the industrial market with maximum functionality. FunctionMAX is designed based on a differential transmission system and offers excellent noise resistance of high-speed signals.

Suitable applications are FA control devices, broadcasting camera/projector, base transition station, car navigation and smart meters.



### Features

- Contact positions: 40, 60, 80, 100, 120
- Pitch: 0.8mm
- Rated current: 0.5A/contact
- Rated voltage: AC 100V | DC 141V
- Stacking Height: 22mm Min.
- Operating temperature: -55 to +105°C
- Floating Range: 0.6mm Max. in X and Y directions
- High-Speed Transmission: 2.5Gbps (PCIe-Gen. 1)
- Customizable interposer PCB
- Pick & Place Mounting (suction tape attached as standard)
- RoHS compliant

501

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# CROSS-MATE™

## Modular, Reliable & Compact!

### Highlights

- Active latch
- 4 point contacts
- Terminal-Position-Assurance (TPA)
- Touch-proof

AMPHENOL's FCI Basics Cross-Mate™ series is a wire-to-board system that offers compact design and active latching for applications requiring good mating retention.

The particular cross section of the mating area guarantees a reliable 4 point contact interface with an improved current rating up to 2A per contacts. Therefore the connector system is highly reliable even in harsh environments.

### Advantages of four points of cross-matching:

- Conventional contact mode is single point or double point contact, but AMPHENOL's solution is four-point contact, which can effectively reduce contact resistance and provide higher contact reliability.
- This solution provides excellent electrical performance especially in vibration application environment.
- The transmission current capacity is better than normal configuration.

It is equipped with a Terminal-Position-Assurance (TPA), which guarantees that the contact is properly mounted into the cable housing, elimin-

ating functional problems due to wrong connector assembly. The Cross-Mate™ series is available in 2 to 12 positions per row with horizontal configurations. Applicable wire range is from AWG 30-24.

### Markets & Applications:

- Industrial & Instrumentation: power tool, PLC
- Automotive: Infotainment system, head light, head up display modules
- Consumer: home automation, IOT device
- Medical: portable devices

502

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# CONNECT YOUR SYSTEM!

## Minitek® 2.00mm Blind Mate Interface (BMI) Connectors.

A robust and a versatile self-aligning connector.

**A**MPHENOL's FCI Basics Minitek® 2.00mm Blind Mate Interface (BMI) is a flexible and comprehensive solution designed for applications with a current rating up to 2A per circuit. It allows misalignment and provides floating for easy blind mate connections. BMI option is available in dual row with 8 or 12 circuits. These connectors provide an ideal solution for panel-to-board applications.

- Fully isolated receptacle to prevent terminals from damage
- Polarized mating geometry to prevent mismatching
- Passive locking to secure mating operation

Blind Mate is primarily a panel mount solution made from one receptacle and one header. The header can be used either with a fixed or a floating receptacle.



FEATURES	BENEFITS
Blind mate interface	Allows ±2.00mm catching for blind mating
Floating receptacle option available	Allows ±1.00mm misalignment in x and y axes
Passive locking on housing with low thumb latch operation	Ensures secured mating retention
Fully polarized housings	Prevents accidental mismatching
Scoop-proof housings	Ensures that terminals and header pins are not damaged from misuse
Available in through hole, PIP and SMT as option	Compatible with multiple manufacturing processes
Existing crimp section and automated crimp tooling from 30AWG to 22AWG	No specific industrial tools required
Glow wire compliant	Complies with International Standard IEC 60335-1 for household appliances
UL flammability	Allows better safety
RoHS compliant, halogen free and lead-free	Meets environmental, health and safety requirements





## Fine Pitch Solution with Self-Alignment Feature!

Amphenol  
ICC

The floating design is an advanced feature new on the market. This feature allows a self-alignment of receptacle in order to admit a positioning error between board and panel. This is very convenient when several headers have to be plugged in one time because there is no longer a risk of high constraints on the header solder tails anymore.

Typical applications can be power converter and amplifier as well as data and medical systems.

### Mechanical performance

- Floating range:  $\pm 2\text{mm}$  in x and y axes
- Misalignment with floating option:  $\pm 1\text{mm}$  or  $15^\circ$  in x and y axes,  $\pm 0.3\text{mm}$  in z axis
- Durability: 100 mating cycles for gold plating
- Operating temperature:  $-40$  to  $+125^\circ\text{C}$

S03

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### BergStak® 0.50mm Self-Alignment Board-to-Board Connector.

AMPHENOL's FCI Basics BergStak® 0.50mm self-alignment connectors come with a stack height of 3mm and 50 positions extendable across 20 to 60 positions in increments of 10. It has a unique self-alignment feature that supports blind mating.

### BergStak®: For automatic pick & place process!

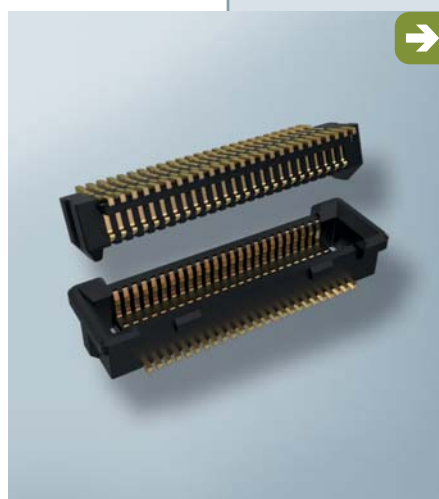
The housing has a special design with drainage feature and can be exposed to a wash process after installation. Furthermore, the housings are scoop-proof and ensure that the terminals are not damaged during mating. With its support of speed performance up to 5Gb/s the connector system meets PCIe® Gen 2 standards.

### Features

- Current rating: 0.5A per contact
- Voltage rating: 100V AC
- High temperature thermoplastic UL94V-0, LCP
- Operating temperature:  $-40$  to  $+125^\circ\text{C}$
- Durability: 50 mating cycles
- Tape & reel packaging for automatic pick and place process

S04

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# DINKLE BUS

More flexible Enclosure System!



Busplate to click into the mounting rail



©AndreasStoed/Alexander Umbach

Dinkle Bus System



The DINKLE BUS enclosure system has been extended by the module widths 40mm and 60mm in order to make the PCB design even more flexible.

Modern housings for future-oriented IoT and Industry 4.0 applications do not have to be only functional, but at least as flexible as the electronics they contain. The modular DINKLE BUS system with side-by-side enclosures already set innovative accents with its unique bus system and state-of-the-art LED operation display, when it was introduced to the market about 5 years ago. In order to be able to pack as much electronics as possible into the housings, the series has now been extended by further options.

### New Module Widths

In addition to the extremely compact housing widths of 12mm and 20mm, DINKLE has expanded its portfolio to include 40mm and 60mm versions for additional electronics installation space. The new standard widths offer sufficient space to accommodate capacitors, relays or other high electronic components on the PCB.

All enclosures can be supplied with pre-determined interfaces or a closed lid to allow individual

assembly by reworking with holes, cut-outs and apertures. Optionally, a mini-USB connector is now available on the side of the housing to allow fast and efficient programming of the electronics.

### Technology

The heart of the DINKLE BUS system is an innovative busbar consisting of 8 gold-plated contact profiles which can be integrated into all common TS-35 standard rails and connects the electronics housings by means of a patented bus connector. Standard lengths as well as customer-specific lengths up to 1 meter are possible. Accessories available include a wide range of different terminal connectors, power supply modules, marking material for clear designation of the LED displays and expansion connectors for extending the bus plates.

### Features

- Housing widths from 12mm for space-critical applications and up to 60mm for additional electronics installation space
- Integration of the latest communication interfaces for IoT (Internet of Things) and Industry 4.0 (RJ45, SUB-D, Mini-USB, W-LAN antennas,...)
- Save time and money with fast wiring thanks to tool-free push-in connections
- Optical LED-displays on the terminal blocks indicate the operational status.
- Safe connection of the power supply including reverse-pole protection with a patented bus connector plus grounding contact

If you need a new design or redesign, please contact your CODICO specialist. Our Sample Shop also stocks selected DINKLE BUS products to give you the best possible support for your product design.



Enclosure 12mm with RS485-Interface



Enclosure 40mm for individual Interfaces

S05

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# SIMPLE & EASY

## One Action FPC/FFC Connector!

One Action FH™ can be connected by simply inserting the FPC/FFC without touching the actuator. It is also effective for robot assembly, and by lowering the number of operations steps from three to one, the work time can be greatly reduced.

3 features of One Action FH™ that realize design freedom and automatic assembly:

### Feature 1: Connection by Insertion

One Action FH™ opens the actuator, inserts the FPC/FFC and closes the actuator. Unlike conventional connection methods only FPC/FFC insertion is needed to complete the connection. To prevent damage to the actuator, do not touch it when connecting. Locking is completed at the same time as the FPC/FFC insertion, so incomplete mating does not occur. The work time and the number of operation steps are reduced to 1/3rd for a significant reduction in man hours.



### Feature 2: Automation

One Action FH™ features a large taper on the opening to allow smooth insertion. The unique spring design reduces the insertion force of the FPC/FFC and dramatically improves the insertion performance, enabling easy operability for both humans and robots.

### Feature 3: Design Flexibility

Conventional products are completed by lifting the actuator, inserting FPC/FFC, and then closing the actuator. Therefore, it is difficult to open and close the actuator if there is another component nearby. With One Action FH, only insertion is required. As long as there is space for FPC/FFC insertion then connection can be achieved even in narrow spaces.



### Applications

- Mobile devices: display, smartwatch
- Home automation: smart speaker, smart door lock
- Automotive equipment: car navigation, motion sensor camera

S06

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	FH62 SERIES	FH72 SERIES	FH63S SERIES	FH67 SERIES
Pitch	0.25mm	0.3mm	0.5mm	0.5mm
Height	1.1mm	0.9mm	2.8mm	5.2mm
FPC/FFC thickness	0.3 ±0.03mm	0.2 ±0.03mm	0.3 ±0.05mm	0.33 ±0.03mm
Supported wiring	FPC		FPC/FFC/Shielded FFC	
Pos. Varieties	13, 17, 21, 31, 35, 39, 41, 55, 61	11 (7, 15, 21, 31 planned)	30 (10, 20, 40 planned)	30, 40 (10, 20 planned)
Rated Current	0.5A		0.5A	
Rated Voltage	30V AC/DC		50V AC/DC	
Operating Temperature	-55 to +85°C		-55 to +125°C	

# ix INDUSTRIAL™

## A miniaturized new Connector for Industrial Ethernet!



Ethernet communication between electronic equipment has increased with the “Industry 4.0” trend of automation and data exchange in manufacturing technologies. This brings efficiency of manufacturing with ICT (Information & Communications Technology).

The ix Industrial™ connector features small robust design for use in industrial environments. The high-speed transmission design contributes to equipment evolution and smart manufacturing applications. It is a compact interface connector for industrial applications up to

10Gb/s, which is compliant to IEC standard (IEC 61076-3-124). It can be widely used as a next-generation standard connector.

The IX offers an overwhelming compact size compared to conventional connector solutions for in-

dustrial applications. The unique shell design is strong against shock and vibration. It offers 5,000 mating cycles to ensure excellent durability.

### There are three receptacle types within the range:

1. The upright right angle type can be mounted in parallel with a pitch distance of only 10mm to save space.
2. The vertical type allows the mating plug to be mated from the top giving design flexibility.
3. The low profile right angle receptacle is 5.7 mm, less than half the height of the RJ-45 connector, and is very low.

The receptacle shell is mounted on the board via through-hole solder legs to enhance the retention to the board and to resist the wrenching of the cable assembly, protecting the surface-mount contacts.

The ix Industrial™ is available with two different codings to prevent accidental mismatching. The A-coded version is suitable for Ethernet applications. Coding B was developed for signals and serial BUS systems. The cable plugs are available in IDC or solder type for AWG28-22. The wire-termination unit and cable clamp are integrated into a single plug shell, which prevents the connec-







## Watertight Disposable Connectors

nexttron®

Due to the increasing deployment of disposable devices, lower-cost medical solutions are becoming more and more important.

NEXTRON's SnapLatch Series has been adapted in catheter surgeries over 20 years. As one of SnapLatch family, the disposable series is getting more attention than ever at this moment. To achieve lower-cost target, designer utilized standard parts, customized contacts and simplified molds, and retained critical quality attributes. Reliability and operating performance cannot be compromised.

### NEXTRON's Watertight Disposable Connectors

#### Features:

- Locking function with SnapLatch system
- 2 to 34 contacts
- Solder cup contacts
- Touch and scoop proof
- IP64 rating in mated condition (selected items)
- Working temperature for PSU material: -50 up to +150°C

	MATING FORCE (N)	UNMATING FORCE (N)	RETENTION FORCE (N)
PSU	8	8	100
PEI	6,5	6,5	120

Note 1: Except plastic 1P basic type disposable socket  
Note 2: 1N = 0.102kg

More than disposable series, the SnapLatch family includes also the well-known plastic 1P and 2P series. Metal versions B, K, S series are also available. For higher-resolution imaging requirements, high-density contact solutions are possible as an optional selection.

S07

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S08

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SINBON

SINBON is our partner for ix Industrial™ cable assemblies.

#### ix Industrial™ cable assemblies:

Fully shielded for demanding applications, including factory automation & robotics, data-centers, security systems, transportation.

- Two coding options are available - A and B
- Choice of ix to ix connector and ix to RJ45 connector
- Other combinations on request, e.g. ix-M12, ix-D-Sub, etc.
- Cable: 4x2xAWG26/7, Cat.7, 600MHz, S/FTP (overall and pairs shielded), FRNC
- Patch cable: Cat.6A, wire map EIA/TIA 568B, all Ethernet up to 10Gb/s
- Ready for HDBaseT



ting part of the cable assembly from being affected by the load on the cable. A selection of different combination options is available in our CODICO Sample Shop.



# M12

## Y-Circ M with internal Push-Pull Locking!

With the M12 push-pull inner locking, YAMAICHI is taking the next innovation step in the field of M12 connectors.

### Technology

The cable-side connector engages into the device socket from the inside with locking hooks. As a result, the push-pull system requires only the same installation space as a common M12 connection with screw locking. With this technology, it is possible to completely insert the M12 socket into the device, e.g. to integrate it into a distribution box, aligned flush with its housing.

The system is IP65/IP67 water and dust proof. Mechanically, it is extremely robust due to the particularly long locking hooks, even when subjected to torsional loads. This means the user takes advantage of all the benefits of the push-pull locking system: time saving, miniaturisation, blind and tool-free contact mating with simple

handling – all in accordance with the standardized M12 specification.

### Standardization brings security

The system is currently in the process of international standardization for CDV IEC 61076-2-012. In contrast to many other proprietary quick locking systems, this ensures cross-manufacturer compatibility and procureability.

### Fully backward compatible

The wall-mount socket can still be mated with conventional M12 connectors with screw locking.

Therefore, users are not necessarily dependent on a special cable connector and thus remain flexible.

### Different codings

The system is already available in the coding A, B and D. X-coding for high data rates according to CAT.6A and L-coding for power transmission will follow shortly.

A detailed leaflet and an overview about the whole M12 portfolio from YAMAICHI is available at CODICO.

508

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Stepping Motors Range

## Our new Partner for Motor-Driven Applications:

# NIDEC SERVO

CODICO can now offer brushless, stepping, fan and blower motors from a worldwide market leader.

NIDEC SERVO has been developing and producing high quality and high-performance miniature DC- and hybrid stepping-motors for more than 70 years. They were the first company in the world to develop miniature DC motors for HDDs and is still the global market leader in this field today.

Nowadays the number of applications for these products are countless, ranging from high-precision positioning systems for industrial use to demanding medical applications such as blood- and infusion pumps.

As a Japanese company, NIDEC SERVO traditionally puts a high emphasis on the quality and reliability of its products. High-quality standards are a basic requirement and are implemented right from the start of every new product development. The company understands the needs of all customers who want tailored motor products to technologically improve the functionality

and performance of their devices, also when markets and applications are concerned which have a high mix-medium volume character.

DC motors are available from dimensions as small as 25mm in diameter, and the smallest hybrid stepping motors measure just an astonishing 20mm in square. For all motors there are a wide number of options to choose from, such as cable and connector assemblies, adjusted windings to increase torque, gearboxes, and different angles depending on the series.

The stepping motors from NIDEC are equipped with double ball bearings and are designed specifically to minimize resonant vibrations, so as to warrant trouble-free operation, delivering extended life expectancy.

NIDEC SERVO is committed to the development of innovative technologies to make your next generation equipment even more reliable, efficient, and smaller. For more detailed information or inquiries please contact:

509

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**Nidec**  
-All for dreams



DC Motors Range

# LIGHTWEIGHT & ROBUST

## SOURIAU's new UTGX Series!

With the UTGX series, SOURIAU offers a new vision of a robust connector for harsh environment applications in the industrial area.

The new UTGX series is a plastic connector with metallic coupling system combining light weight with extra robustness for high performance applications. This connection design withstands up to 500 mating/unmatings cycles. The 1/3 bayonet coupling guarantees the proper connection to quickly connect the system and secure it with an audible «click».

Developed to maintain mechanical/electrical functionality and withstand climate ingress, salt spray and corrosive atmospheres or industrial-

type fluids and oils, the UTGX will comply with all main industrial standards, such as UL1977, IEC61984 or the ISO21207 method B, which simulates a severe industrial or traffic environment.

In line with the TRIM TRIO® family design, UTGX will be interchangeable and intermatable (under conditions) with other industrial series like UTS, UTG or UT0 series. The UTGX will also leverage SOURIAU's current industrial offer with layouts common to the UTS and UT0. And it shares the



UTGX Plug Family



UTGX Receptacle Family

same TRIM TRIO® contacts available from AWG30 to AWG8.

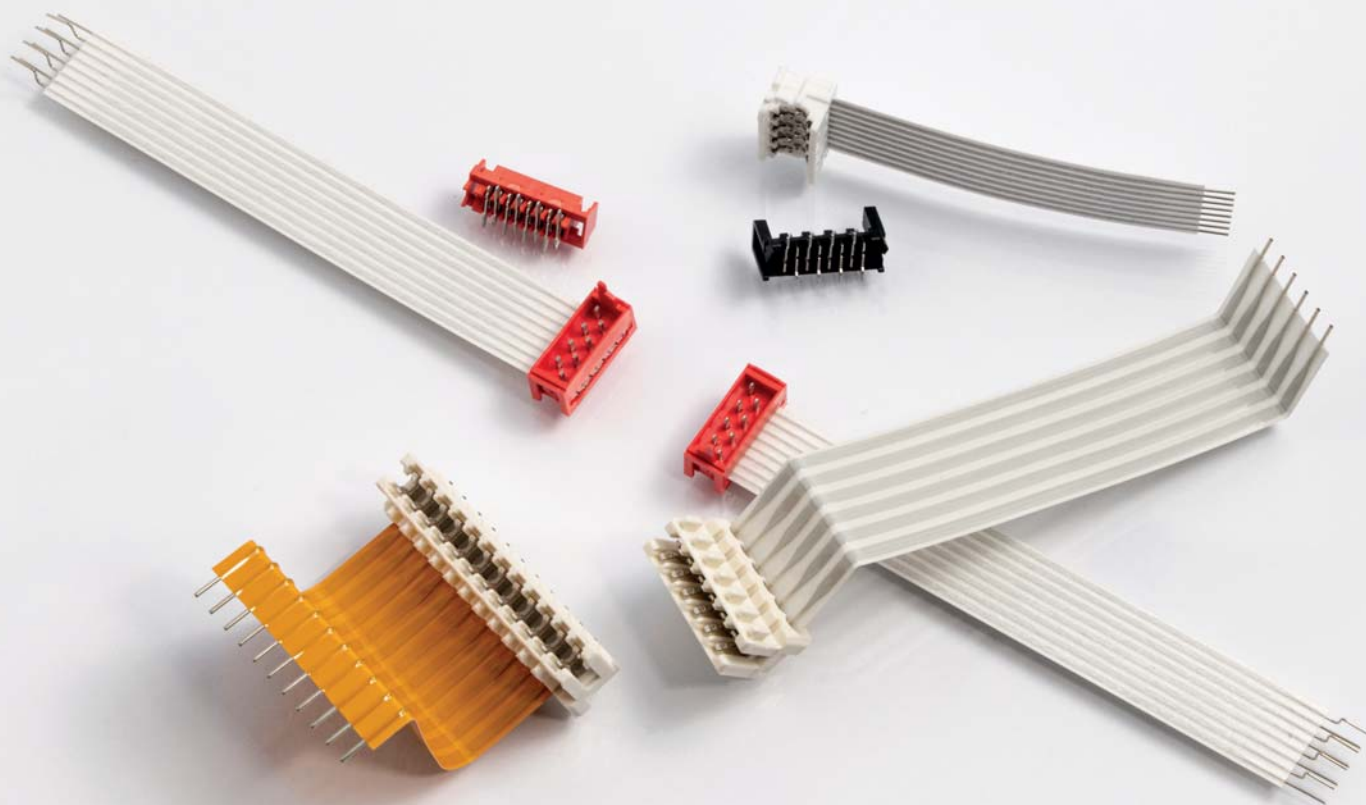
The UTGX series, which is IP68/69K dynamic in both mated & unmated conditions (high seal version for unmated) is the ideal answer for outdoor and indoor dynamic applications requiring continuous underwater immersion, routine pressure washing and dust protection. It guarantees safety conditions with UL94V0 approval and environmental REACH and RoHS qualifications.

Non exhaustive list of examples of typical applications where UTGX series can be found are building automation & control, off-road, mining, robotic, machinery, measurement, instrumentation, traffic monitoring, metal work and many others.

S10

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# PANTA<sup>®</sup> IDC JUMPER

SUMIDA Flex is expanding its portfolio with IDC jumpers in various combinations.

The IDC insulation displacement technology is suitable for applications that require a particularly robust design, first-class transmission characteristics and a high degree of flexibility. The PANTA<sup>®</sup> IDC jumper combines the advantages of the flexible THT solderable PANTA<sup>®</sup> FIX jumper on

one side with the pluggable interfaces of LUMBERG, PANCON, STOCKO and TE on the other.

This design enables use in difficult assembly and erection situations and also permits simple replacement of individual components thanks

to the pluggability and detachability of the plug connection during servicing.

## Product Benefits

- Pluggable and detachable connection of assemblies/PCBs
- Connectors with standardized interfaces from Lumberg, Pancon, STOCKO and TE
- The conductors of the PANTA<sup>®</sup> FIX Jumper are protected, corrosion- and vibration-proof in the insulation displacement terminals
- Flexibility between the modules to be connected through the PANTA<sup>®</sup> FIX Jumper
- Loose contacts, contact resistances and overheating are avoided
- Long-term stability of the connection and contact reliability

POSSIBLE IDC PLUGS	SUMIDA JUMPER			
	Supplier	Article group	Pitch A (2.54mm)	Pitch F (2.5mm)
LUMBERG CONNECT GMBH	RAST-2.5		•	
LUMBERG CONNECT GMBH	MICA Micromodul			•
PANCON GMBH	MAS-CON	•		
STOCKO CONTACT	Eco-Tronic		•	
STOCKO CONTACT	RFK 2		•	
TE CONNECTIVITY	Micro MaTch			•

S11

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# »CENTRAL PARK« IN PERCHTOLDSDORF



Since last summer, heavy excavators have been rolling across the field on the west side of the CODICO building.

Now hills are being piled up and paths are laid where, just a while ago, crops were farmed under strict organic criteria. Later, a pond was dug by the landscapers and countless trees and bushes were planted.

### So what's cooking?

As already reported, we are not only enlarging our office and warehouse space, we've also

seized the opportunity to create something unique, the »CODICO Central Park«. In today's professional environment, work-life-balance is an essential motivation factor, so CODICO decided to take a new, innovative approach in this respect. A 12,000m<sup>2</sup> sports and recreational park with an integrated corporate farming concept will be built on an empty plot adjacent to the CODICO building.

»Those who sow flowers for others, they themselves will bloom«

The Central Park is not only meant as a place of calmness and relaxation, it will most of all provide a healthy living space for people, plants, and animals, thus reflecting the core values of our family business.

### We assume responsibility!

We are also planning a corporate farming project, which will give green-thumbed staff members the opportunity to get their hands dirty when-







ever they feel like it. We want to harvest our first fruits, berries, and vegetables as early as this year. In implementing the project, we decided from the very beginning that we would not be using any chemical or synthetic pesticides, fertilisers, or peat.

### We are dynamic!

As a modern company, we want to enable our staff to move work outside the office by creating an outdoor working space. Moreover, we put in place the conditions for working outdoors by providing the necessary technical infrastructure.

### We embrace family values!

In addition to sports and fitness facilities, the park will also offer space for relaxed get-togethers. Our staff members will have the opportu-

If you want to be happy for an hour, then get drunk.  
 If you want to be happy for three days, then get married.  
 If you want to be happy for eight days, then slaughter a pig and have a feast.  
 But if you want to be happy for a lifetime, plant a garden.  
*Japanese saying*

nity to practice in a dedicated yoga space, compete with each other on the pétanque grounds, or just relax next to the ornamental pond.

Moreover, the said get-togethers are not exclusive for members of the CODICO team, the families of our staff are also welcome!

D02

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## CODICO »Central Park«



# The CODICO TEAM says hello!



**Doris Grundtner**

I have been part of the CODICO family for 11 years, and the time has now come to introduce myself. My name is Doris Grundtner, and I was appointed head of the DISPO group in February 2020.

Just four years after receiving my secondary school-leaving certificate, I joined Perchtoldsdorf-based CODICO, located 50km away from my home. I started in the Interconnect group in 2001, working there in inside sales and order administration for around 6 years.

In 2006, my husband and I were presented with a new challenge: the birth of our first son, Niklas. Three and a half years later, our second son Timo arrived to complete our small family. From there on, my life was full and wonderful – but completely turned on its head. Therefore, I took the very difficult decision to terminate my employment at CODICO and look for a new job close to home.

I was never able to get the CODICO family out of my head, though, so I was over the moon when, after 10 years away, I was given the opportunity to return to CODICO in 2016.

My free time belongs exclusively to my family. We try to go on family outings together, and we love hiking, swimming, and cycling. The most important thing for my family and myself is to spend every free minute we have in nature. I continue to enjoy my work a lot, and I am looking forward to numerous new challenges with a fantastic group.

**D03**

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**Jürgen Walker**

You've reached the last pages of our current issue. This is where the young and young-at-heart members of the CODICO team usually introduce themselves. At 57, I would say I belong to the second group ;-).

Once a sales person, always a sales person! This statement almost exhaustively describes my entire professional career. Electronics engineer training, business administration, and part of the CODICO team since 2003. Add a two-year professional hiatus to that. At this point, I should say: »You only miss something once you no longer have it.« After my return to the job, my colleagues received me as if I had never left. You can't possibly make it any easier for someone in such a situation – Dear colleagues, I thank you all for that!

At CODICO, I am responsible for Passive Components, covering the region of Baden-Württemberg and part of Bavaria. As with almost all aspects of our daily life, the requirements for electronic circuits are changing in (almost) all applications. The market is permanently driven by the demand for even smaller designs with better parameters and higher quality requirements. I will be happy to advise you here! Together with our high-quality manufacturers, I will be presenting the latest developments to you. According to your specifications, you will be receiving component recommendations on the basis of technical feasibility, quality, availability, and price. All from a single source, that is, the entire CODICO team. With your approval, we will gladly think out of the box (with regard to your application) and show you other possibilities and solution approaches you may be interested in using. The ultimate decision, of course, is yours.

Even in my private life, I try to think in different directions and move in different dimensions: Paragliding - a special way of experiencing freedom, of moving freely in space and even taking some of those experiences over into daily routine. For me, this is a special way of striking a life balance. Please don't hesitate to contact me if you have any questions. I look forward to your call. Stay safe!

**D04**

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## Christian Sichtar

I already introduced myself to you as a new employee at CODICO from this very magazine almost exactly 22 years ago. A career entrant at the time, I had to undergo intensive training in many of the task areas relevant for the sales process, such as order processing and inside sales. After two years, I was given my first independent sales territory in the field, and spent the subsequent 10 years successfully building up the market in Eastern European countries for the Interconnect Systems group.

I was able to further advance my professional skills by venturing into other jobs for 5 years at companies within the sector, including a connector manufacturer. I celebrated my comeback to CODICO as product manager in 2015. From this position, I can best combine my passion for technology with the pleasure of dealing directly with customers and suppliers. Thanks to my exceptionally kind colleagues and the excellent team spirit in the Interconnect Systems group, I feel extremely comfortable in the CODICO family.

In my private life, I have also been a happy member of a large family for the last 5 years. My girlfriend has four children, three of whom are already adults and have left home. Thanks to Simon, her youngest 12-year old son and our equally old female Jack Russel »Sunny«, we are never bored. When we need a break from the daily grind, we like to travel somewhere. We most often head to Alicante in Spain, where we have a magnificent holiday home directly by the sea at our disposal. I began learning Spanish a while ago, so that I can communicate with our local friends without the help of a translation app.

Apart from keeping mentally fit, I also try to stay in shape physically. In this regard, my preference goes to endurance sports. Apart from running and cycling, swimming is my greatest passion. Following a severe injury in 2018, my dream would be to compete again soon at the Open Water Swimming Events. It's a series of competitions involving lake crossings of up to 10 kilometres. My absolute favourite memories are from the Fuschlsee Crossing and the Lake Hallstatt Swimming Marathon. Conveniently, I can train for my comeback in a lake at my doorstep, so I am desperately yearning for some warmer weather to dive into the water.

»I'm not hiding from anyone!« I have been true to this motto for the last 22 years. On that note, I am looking forward to embarking on numerous new projects together with you in the future.

**D05**

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## Karin Kwet

This is already my fourth year at CODICO. I started working at the reception in the afternoon, and soon afterwards I took over service, repair, and maintenance – i.e. facility management. I could never have imagined that this would involve such comprehensive, wide-ranging activities: from fending off a mice infestation and broken forklifts to blinds with ripped cords, malfunctioning toilet flushes, and de-scaling the coffee machine. There is always something going on here!

In the meantime - after an initial training period with a number of in-house technicians -, Peter Strieg, Claus Simon and I have become a well-functioning facility management team. And that was a good thing, because then came the major challenge of the reconstruction and enlargement project. We had to empty the archives, prepare all sorts of things for electricians and plumbers, install locks in the LOG office, organise the logistics for the relocation, and give on-site instructions to 8 men from the forwarding company. Moreover, calm down a number of people, and accept the fact that facility management is a male-dominated world in which I gradually found my way. For me, facility management means the following: a lot of organisation, a lot of asking around, to listen well and closely (especially during construction consultation meetings), to take a deep breath (especially during those meetings – 12 men and myself ;-) sometimes even motivating people, playing Sherlock Holmes and finding out things - and last but definitely not least: Communication! Communication! Communication! I must admit, that very old saying that men come from Mars and women come from Venus, well, it may actually be true. The diversity of tasks and the people I meet on a daily basis give my job a breadth I very much appreciate.

We currently find ourselves in an exceptional situation, and I still come to the office every day. Even if life in general has been put on hold, there is still a lot going on here, because of the park and the extension works. Moreover, there are additional tasks to manage, such as carrying out disinfections 2 to 3 times a day, distributing protective masks and, in my role as safety officer, making sure that the construction workers on the CODICO premises protect themselves and others. Which brings me back to the topic of communication, which has accompanied me throughout my professional life. Be it as a language trainer in Sweden, where I lived for 10 years, as a yoga instructor in England, or as a trainer in India for 2 years. Communication is such an exciting topic, because it takes place on so many levels. This is one of the reasons why, after spending 16 years abroad, I studied psychology and consulting after returning to Austria, to learn even more and delve deeper into the subject. I have been working in the evenings and on weekends as a psychological counsellor for the last 8 years. Nothing is more exciting than communication, and it's a particular pleasure when it actually works!

**D06**

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