

ENGLISH

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Game Changer: RUBYCON's
PMLCAP HPB-Series

THUNDERCOMM's CM2290-Module for AIoT
New Top Supplier for Fans: STK



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Frequentis AG @ CODICO

In November 2022, CODICO welcomed the Frequentis purchasing team to our headquarters in Perchtoldsdorf. Frequentis AG develops solutions for safety-critical information and communication systems and has been an important business partner of CODICO for decades.

Our guests took the opportunity to visit our new state-of-the-art warehouse which was opened in March 2020 and has tripled its capacity thanks to the expansion of the small parts and pallet warehouse and the handling areas. The new CODICO warehouse, which is much more automated and equipped with conveyor technology, was enlarged from 2,140m² to a size of approx. 5,000m². This expansion has significantly increased the level of service.

»CODICO has been a preferred supplier to Frequentis for around 30 years. The largely automated, newly expanded logistics centre is just as impressive as the large recreational park for the employees. Many thanks for the open, warm welcome at CODICO«, says Ms. Berger, Strategic Procurement Manager Frequentis, after the visit.

If you too are interested in visiting CODICO's headquarters, please feel free to contact your personal contact at CODICO.

D01

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Sven Krumpel
CEO CODICO



Frequentis
Procurement &
FTM Team

Editorial

Right to the point!

Dear readers,
For me as CEO, there are currently two buzzwords that are constantly hovering in the air. Be it in our clients' projects, strategic decisions or simply in everyday life: digitalisation and sustainability. You can write books about it. Except, at this point I would like to give you my personal opinion on these long-term topics.

The last few years have seen a massive push on the topic of digitalisation. We could finally meet easily in all online meeting platforms (even without calling an IT colleague to the impromptu rescue) and we told ourselves that Teams and Skype were at least as good as meeting in person. Since electronica 2022 in Munich at the latest, I know that although we were forced to make the best of the circumstances, there is simply nothing better than meeting you in person! In our last issue we invited you to come and visit us at the CODICO booth. And I can only say THANK YOU for accepting this invitation. The conversations with you, the personal exchange, the joint development of projects is simply much more fun face-to-face! And as we know, success follows pleasure ;-)!

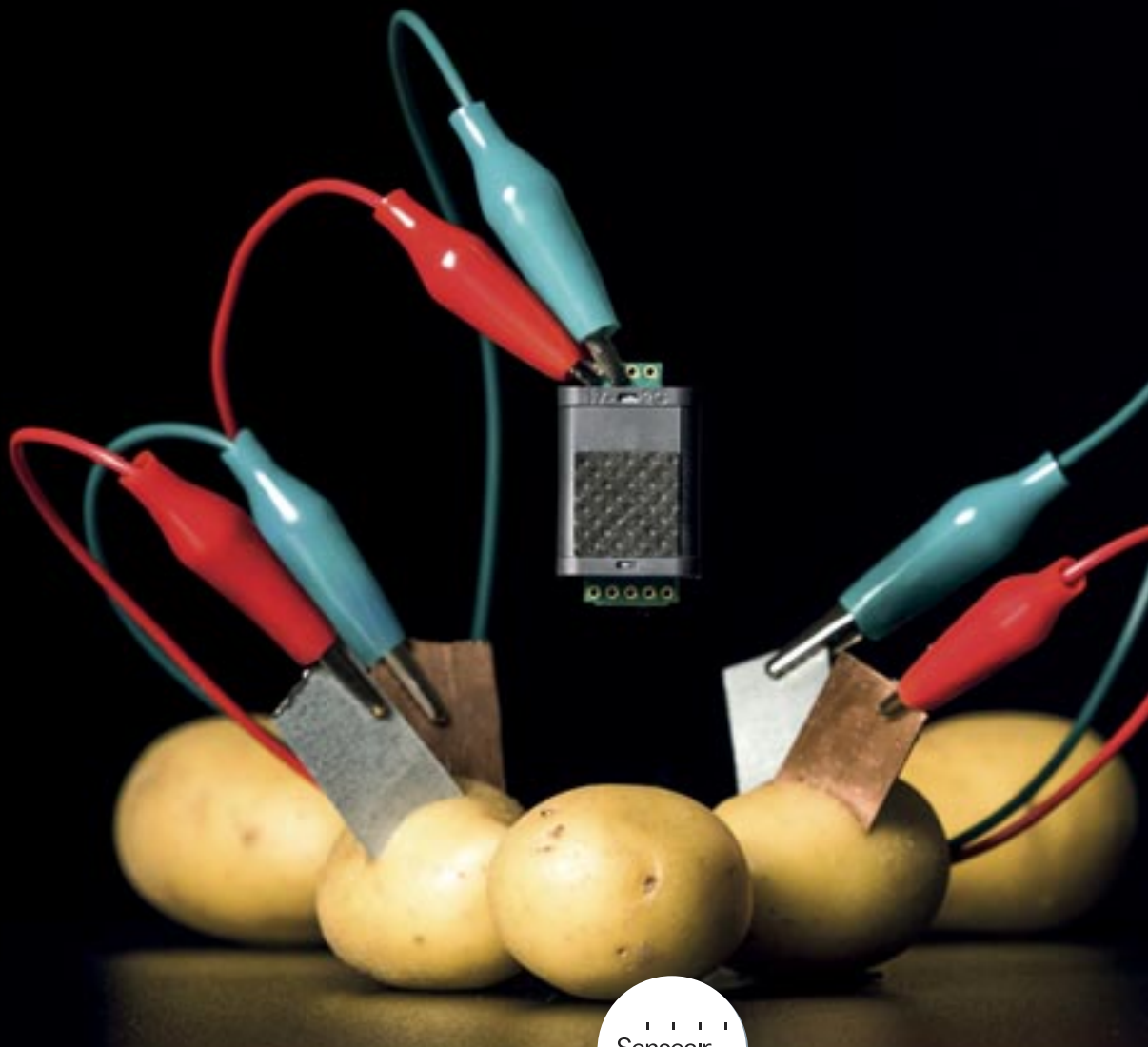
The topic of »sustainability« is also a buzzword that is omnipresent at the moment. I am often asked what strategy we are pursuing here, whether there is a concept, what measures we are taking and what milestones have been formulated. Meanwhile, I have the feeling that there is a real competition among companies to see who is »greener«. A large part of our projects deals with this topic, we have our own PV system, offer our employees e-charging stations and corporate farming, have our own bee colonies in the garden...

But please, with all the great projects, let's not lose sight of what this is really about: preserving what we have and what is, and passing it on to the next generation. Not to break something special, but to treat it respectfully and to appreciate it. That's all it takes to make sustainable action a matter of course without having to constantly talk about it and adulate ourselves.

▶ Sven Krumpel



SUNLIGHT



The World's Most Power-Efficient Sensors for CO2 & R32

Having made sense of air for the past 30 years, the air and gas sensing technology provider SENSEAIR has launched a new game changing product line: The Sunlight. It is the world's most power-efficient sensor built on NDIR technology (nondispersive infrared).

As with any gas measurement, you would want a sensor that you can always trust, without the need for maintenance. Equipped with a self-correcting algorithm (ABC: Automatic Baseline Correction), you can install your Sunlight sensor and then leave it alone for 15 years without maintenance and still receive reliable readings.

The Sunlight sensors are optimised for battery and wireless applications, or in places where you need a reliable and secure sensor with a long life.

Using an LED light source, the ultra-low power consumption of the Sunlight does not come at the expense of other features.

It is extremely power-efficient, has a miniature form factor, is mentioned self-correcting, high precision, based on LED technology, maintenance-free, has fast response time and offers immunity to poisoning (specially for Sunlight R32). There are two versions available: The Sunlight CO2 and the Sunlight R32.





Sunlight R32

Refrigerant leakage detectors are increasingly a requirement in air conditioners, particularly in the North American market. But also, in Europe the use cases exist and this fact opens up several applications for this sensor. The sensor complies to IEC standard 60079-29-1, sensor element part at IEC 60335-2-40 and UL 60335-2-40.

The NDIR technique featured in SENSEAIR's Sunlight products ensures that the sensor is immune to poisoning, and the optical solid-state design makes it physically robust and resistant to vibrations. Of course, equipped with the SENSEAIR Automatic Baseline Correction. A starter kit is also available.

If you need more information, please contact CODICO.

A01

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Sunlight CO2

With the roots in measuring indoor air quality, the natural first step for SENSEAIR will always be the CO₂ sensor. The Sunlight is a new milestone for them and you can power it with as little as five regular sized Swedish potatoes! It is compliant with: ANSI/ASHRAE Standard 62.1-2022, Standard RESET grade B and WELL Building Standard® (WELL v2™).

GOLDEN FUTURE PART 2: AG57XX-LPB

Check out our
unique website!
www.codico.com



Gold Block Terminals on SILVERTEL's Popular SMT Miniature Modules!



©Andreas.Hanausek

The introduction of the new format on the Ag99XX-MTB and Ag99XX-LPB range of IEEE802.3af PoE PD devices has stimulated a lot of market interest and hence, the natural thing would be to roll this out for higher power PD modules in a similar way.

Not wanting to disappoint, SILVERTEL announces the Ag57XX-LPB as the »smallest .at compliant PoE PD Module in the world«, extending SILVERTEL's dominance in this market sector. The module measures 33x22x13mm (LxWxH) taking up a mere 7.3cm² of area, making it the sensible choice for high power (PoE+) Ethernet applications where space is at a premium.

The Ag57XX-LPB is an IEEE802.3at compliant, Class 4 PD Module capable of delivering 30W of peak power to a peripheral device over the full Industrial Temperature Range and includes an AT-flag output to assist in determining the PSE connected at the power sourcing end of the link. The module provides 1.5kV of isolation between Input and Output and includes over-current and

thermal protection, making it a very robust and resilient PoE+ device. Over-voltage protection is performed externally.

The module is only available in surface mount format with a 12V output or 24V output, which can be adjusted up or down with an external resistor connected between either »+VDC« or »-VDC« and »ADJ«. Its low-profile, having a maximum seated height of 13mm, allows close-coupling to the host PCB so that thermal management can be achieved easily.

The module requires very few external components; 2x bridge rectifiers, a transorb and an electrolytic capacitor to provide a fully functional PoE+ solution.

This device is ideally-suited for applications where higher power and small form factor is important such as Wireless Access Points, Routers, Wi-Fi/IoT Gateways and Single Board Computers. Aimed at Design Engineers who are looking for IEEE compliance, an impressive feature list and a quick route to market, these modules provide a pain-free option for powering applications using a single Cat 5e/6a Ethernet cable. SILVERTEL provides evaluation boards that can be tried out before committing to CAD and prototyping, available through CODICO, whilst also offering schematic check services and support through SILVERTEL's Applications Support Team, prior to configuring and testing prototype hardware.

Regarding availability, contact CODICO for information on pricing, lead times and samples.

A02

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BOOST



TURBO-BOOST

SILVERTEL's new AG7300

SILVERTEL announces an extension of their range of DC/DC converters with the launch of the Ag7300 120W, high efficiency, boost converter.

With a wide input voltage range of 18-36V and providing a 48-57V output, the Ag7300 can make the conversion from a »passive« distributed power system to PoE-powering, an easy step to take. The converter runs at a typical efficiency of >95%, making it an energy efficient option for most applications. Designed to be used in conjunction with (but not limited to) SILVERTEL's PSE (Power Sourcing Equipment) modules or other IEEE802.3bt compliant PSE, the Ag7300 offers a quick conversion route. Implementation requires nothing more than electrolytic capacitors on both input and output and a fixed output adjust resistor, if required.

The Ag7300 can just as easily be used in a non-PoE system, to boost a nominal 24V input up to 48V and with power delivery of 120W over the full Industrial Temperature Range, which makes it an ideal choice for distributed power applications. For such a compact converter, measuring 40×35×17mm (L×W×H), the Ag7300 packs a mighty punch; available in a surface mount format using gold block terminals as the interconnect method, it ensures close physical coupling and makes thermal management less arduous.

The converter is internally protected from Over-current and Over-temperature and provides 1.5kV isolation between input and output termi-

nals. The output voltage can be adjusted very easily, with an external resistor, from 48V to 57V, to accommodate PoE PSE voltages.

The application areas include high power PoE (IEEE802.3bt, POE++ or 4-pair powering) systems or distributed power systems covering Communications, Healthcare, Industrial, Security, Smart

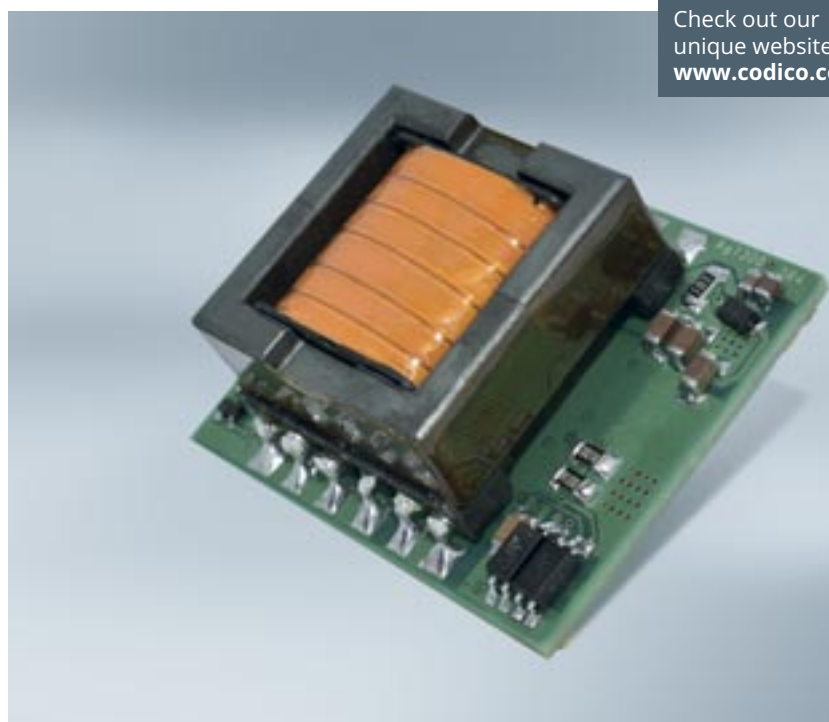
City, Smart Home, Transport, Automotive and AI sectors.

For more information please contact CODICO, who will support you technically and commercially with your implementation. Samples are available through CODICO now.

A03

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REALIZE INNOVATIVE PRODUCTS QUICKLY

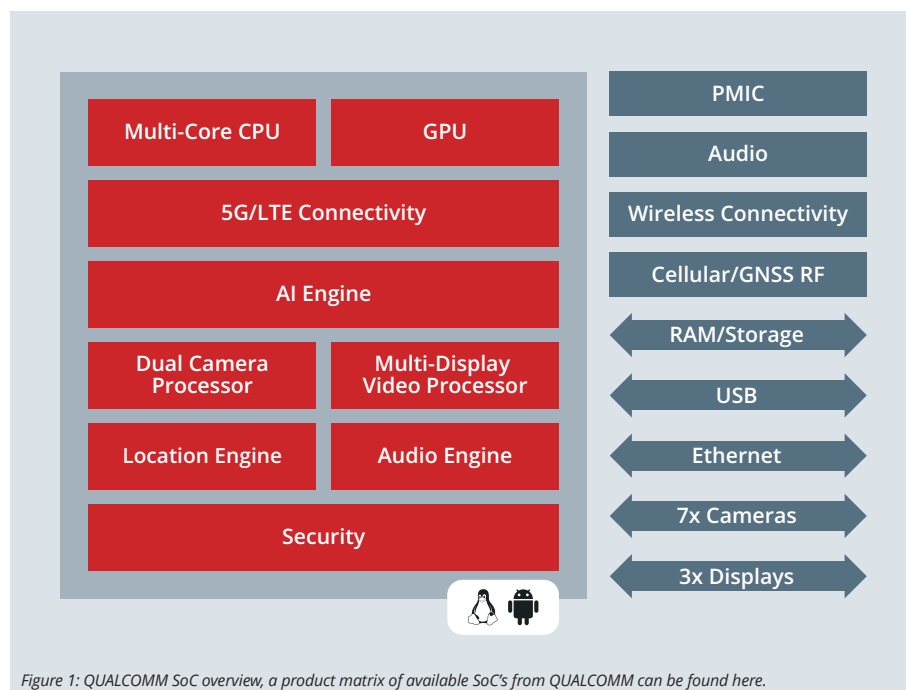


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Smart Camera, AI and Robotics Software Resources for QUALCOMM System on Chip Platforms

QUALCOMM's IoT roadmap offers a range of powerful and highly integrated system on chip devices for a broad set of IoT use cases and applications. These SoCs incorporate several subsystems into a single device from 5G and LTE cellular modem, multi-core CPU (up to 8 cores), GPU and AI capable DSPs to dual high-resolution camera ISP, sensor, audio and security subsystems.

In order to enable customers to realise innovative computer vision, AI and Robotics products quickly, a comprehensive suite of robust software development kits and libraries are needed. This article will focus on the software resources available for QUALCOMM's SOC roadmap.



The devices in QUALCOMM's SOC roadmap all follow the same hardware-based architecture as shown in figure 1, this enables developers to expand software applications and use cases that can be reused across SoCs with lower effort and risk. In order to investigate the software resources available to developers further let us focus on one of the QUALCOMM devices from the premium tier of the roadmap, the QRB5165 SOC better known as the RB5 platform for Robotics applications. The RB5 platform is provided with a complete Ubuntu linux based software release in addition to a separate Linux architecture based on Yocto embedded Linux. Let's take a closer look at the Ubuntu linux software release and architecture (Figure 2).

The latest release for the RB5 platform is based on Ubuntu version 20.04, running version 5.4 of the Linux kernel. As you can see in the figure in

Figure 1: QUALCOMM SoC overview, a product matrix of available SoCs from QUALCOMM can be found here.

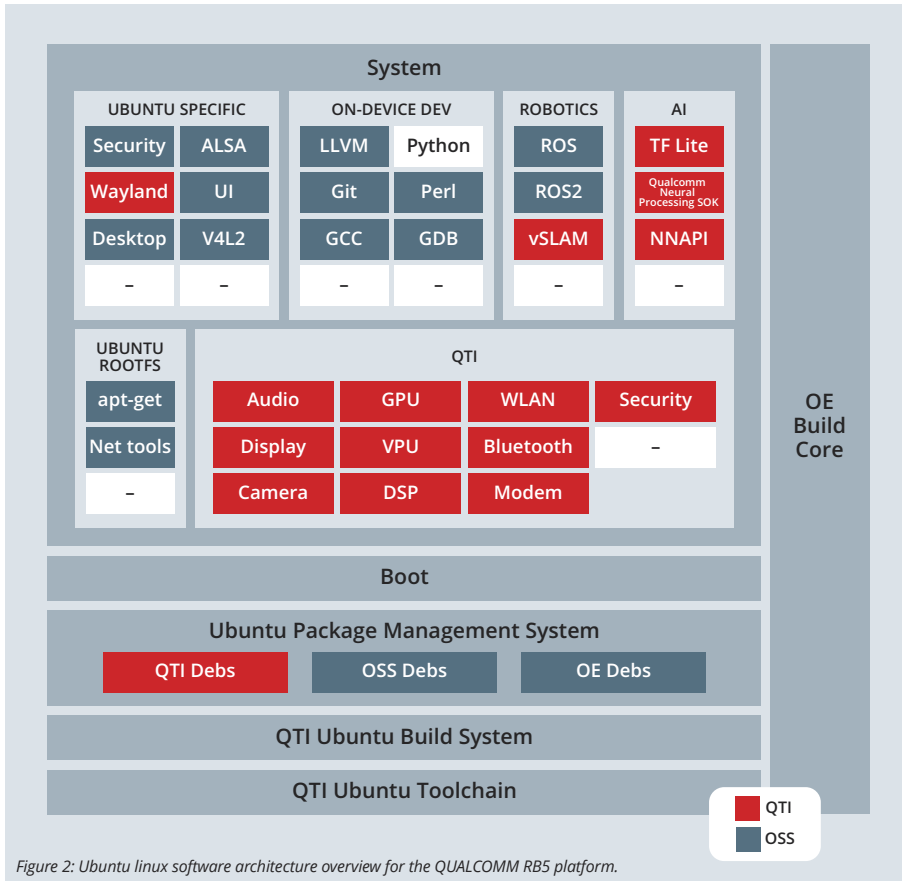


Figure 2: Ubuntu linux software architecture overview for the QUALCOMM RB5 platform.

authored by QUALCOMM in the proprietary and open-source sections of the code.

For developers that want to leverage the SoC's integrated dual camera ISP QUALCOMM provides a dedicated computer vision SDK for the RB5 and other SoCs. This SDK incorporates libraries of the most frequently used computer vision functions including object and face detection, optical flow, depth estimation and geometry correction. These functions run in a logical block in the SoC known as the Engine for Visual Analytics (EVA) which makes the libraries API's available across the SoC's, CPU and DSP cores. The computer vision libraries are optimised for ARM processors; however, they have been tuned by QUALCOMM to further reduce power consumption and latency by running on dedicated HW acceleration blocks integrated in QUALCOMM RB5 and other SoCs. These computer vision APIs are also available for use in the SoC's Hexagon Tensor Processor, a 6-thread scalar DSP with dedicated vector processing capability for pixel processing applications. The computer vision SDK is available for download from QUALCOMM's developer portal.

In addition to the Ubuntu components and operating system, QUALCOMM has combined their proprietary subsystem software (red), tools and other resources together with middleware to drive GUI applications (Wayland/Weston), integrate audio support (ALSA) to capture video (V4L2) as well as to manage device security (AppArmor). Additionally, to support development on the RB5 device QUALCOMM also provides a suite

of tools such as compilers (LLVM and GCC), version control (Git) and debugging (GDB) as well as support for programming languages Python and Perl. The apt-get tool allows the developer to enhance the RB5 software architecture with other Debian libraries, tools and resources. This Ubuntu package is maintained by QUALCOMM for a period of two years, this includes critical bug fixes and security patch updates for the components

In addition to the use of cameras and computer vision many applications today require the use of AI and machine learning to recognise people, objects and events of interest. The QUALCOMM RB5 and other SoCs offer a powerful and dedicated DSP optimised for running AI models along with a dedicated SDK to develop and optimise AI applications. The QUALCOMM Neural Processing SDK is a software accelerated inference-only run-

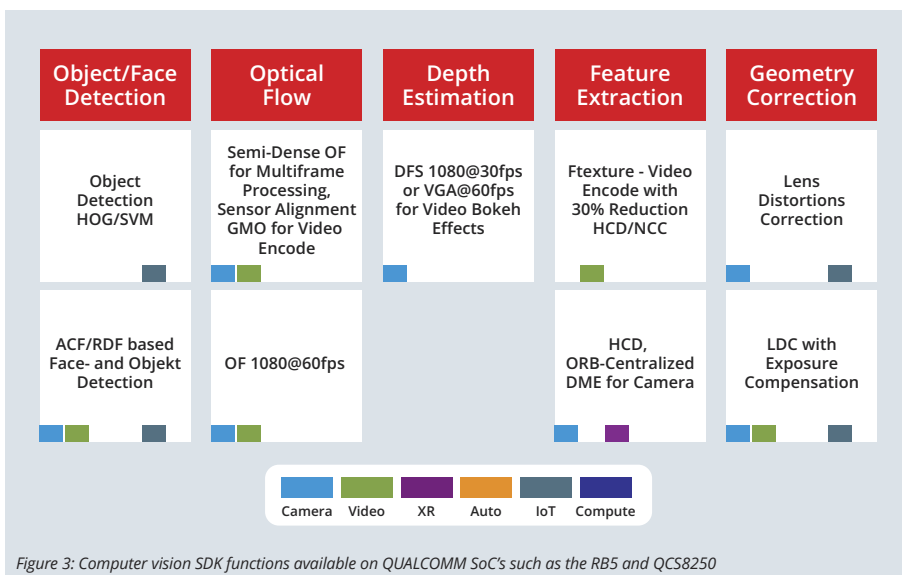


Figure 3: Computer vision SDK functions available on QUALCOMM SoC's such as the RB5 and QCS8250



time engine for the execution of deep neural networks. This SDK abstracts the underlying details on the model execution and provides flexibility for users to design and develop machine learning application pipelines with ease. It incorporates the tools to allow developers to take AI models from frameworks such as TensorFlow, Caffe, Caffe2 and ONNX and build an executable file, known as a deep learning container, which can take advantage of the dedicated AI hardware

in the SoC. The deep learning container file can be quantised to execute exclusively on the DSP leveraging 8-bit fixed point or it can be configured to execute across the DSP, ARM based multi-core CPU or GPU. Once the DLC file is created, tools can be used to optimise the model with compression and quantisation techniques. The QUALCOMM Neural Processing SDK can also be downloaded from QUALCOMM's Developers Portal.

QUALCOMM's SoC roadmap contains a number of SoCs which have been optimised for Robotics applications, here is a high-level summary of those devices and the robot applications they are targeting.

To enable robotic applications QUALCOMM SoCs such as the RB5 platform are offered with a suite of Robotics software and SDKs which incorporates ROS (Robotics Operating System) and ROS 2

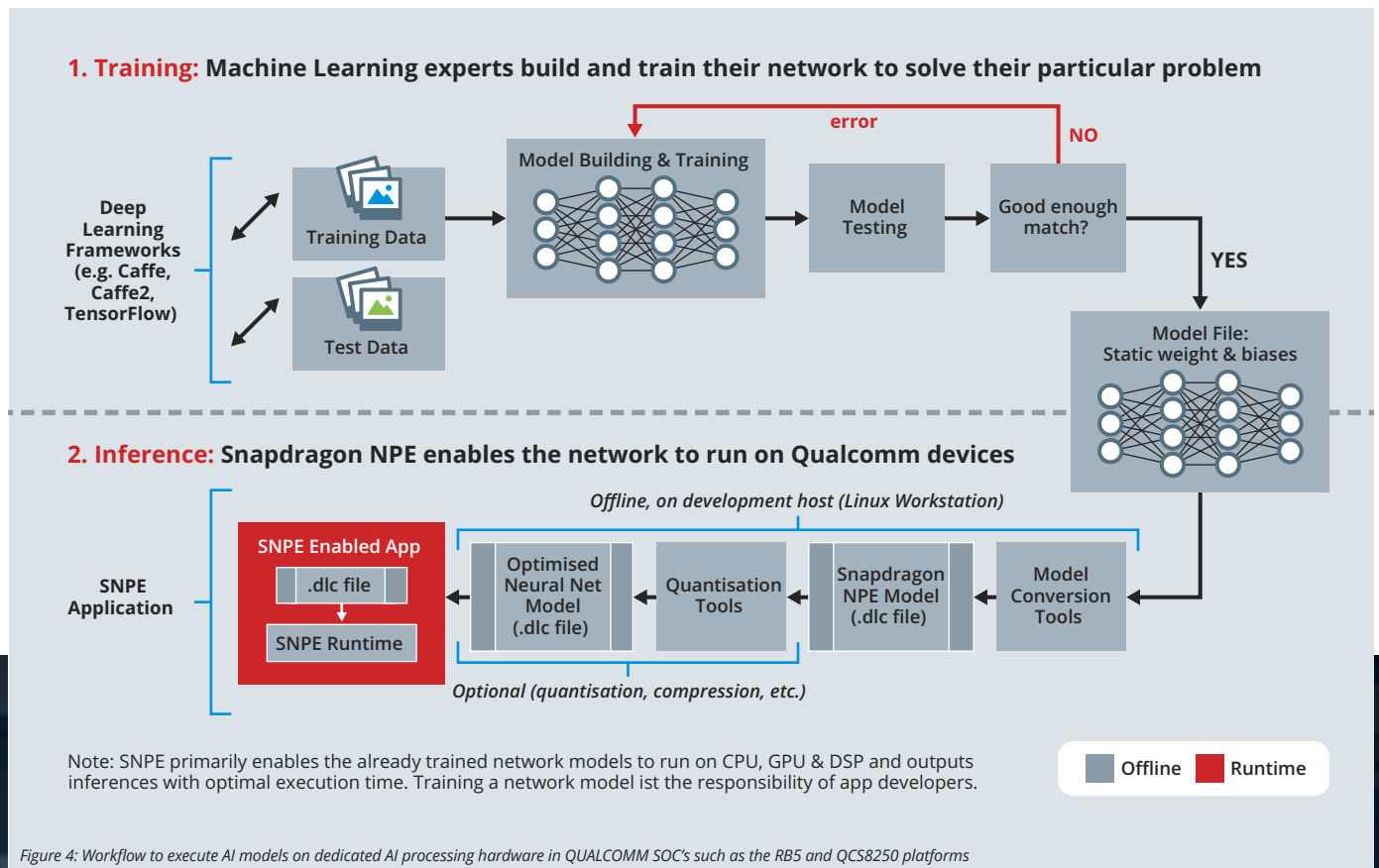


Figure 4: Workflow to execute AI models on dedicated AI processing hardware in QUALCOMM SoCs such as the RB5 and QCS8250 platforms



PLATFORM	QUALCOMM SOC	ROBOT APPLICATION
RB1 platform	Based on the QUALCOMM QRB2210 running Linux	Robot Vacuum cleaner
RB2 platform	Based on the QUALCOMM QRB4210 running Linux	Service Robot
RB3 platform	Based on the QUALCOMM SDA845 running Linux	Professional Cleaner Robot Agricultural Robot Drone
RB5 platform	Based on the QUALCOMM QRB5165 running Embedded Linux or Ubuntu Linux	Warehouse Robot Autonomous Guided Vehicle
RB6 platform	Based on the QUALCOMM QRB5165 running Embedded Linux or Ubuntu Linux and the AI100 inference accelerator	Logistics and delivery Robot

Figure 5: QUALCOMM SoCs for Robotics applications

support which are open source (under BSD license) tools and libraries for building Robotics applications. In addition, QUALCOMM offers AWS Robomaker as well as a dedicated Visual SLAM SDK to leverage the on-device computer vision hardware capabilities and multiple cameras to enable the Robot to detect and avoid objects to perform mapping, path planning and other essential robotic functions. Detailed instructions on how to deploy AWS Robomaker and ROS on QUALCOMM's RB5 Robotics development platform and a comprehensive set of documentation and software resources to enable Robotics developers can be found on QUALCOMM's developers' portal.



QUALCOMM SoCs are not only powerful and flexible hardware platforms they are accompanied by a rich suite of software tools, development kits and sample projects to get your project started quickly. QUALCOMM partner and joint venture company THUNDERCOMM complement the software resources provided by QUALCOMM by

adding their own IP (AI models, Camera and Sensor module integration) which can help a customer to reduce their project risk and accelerate time to market.

A04

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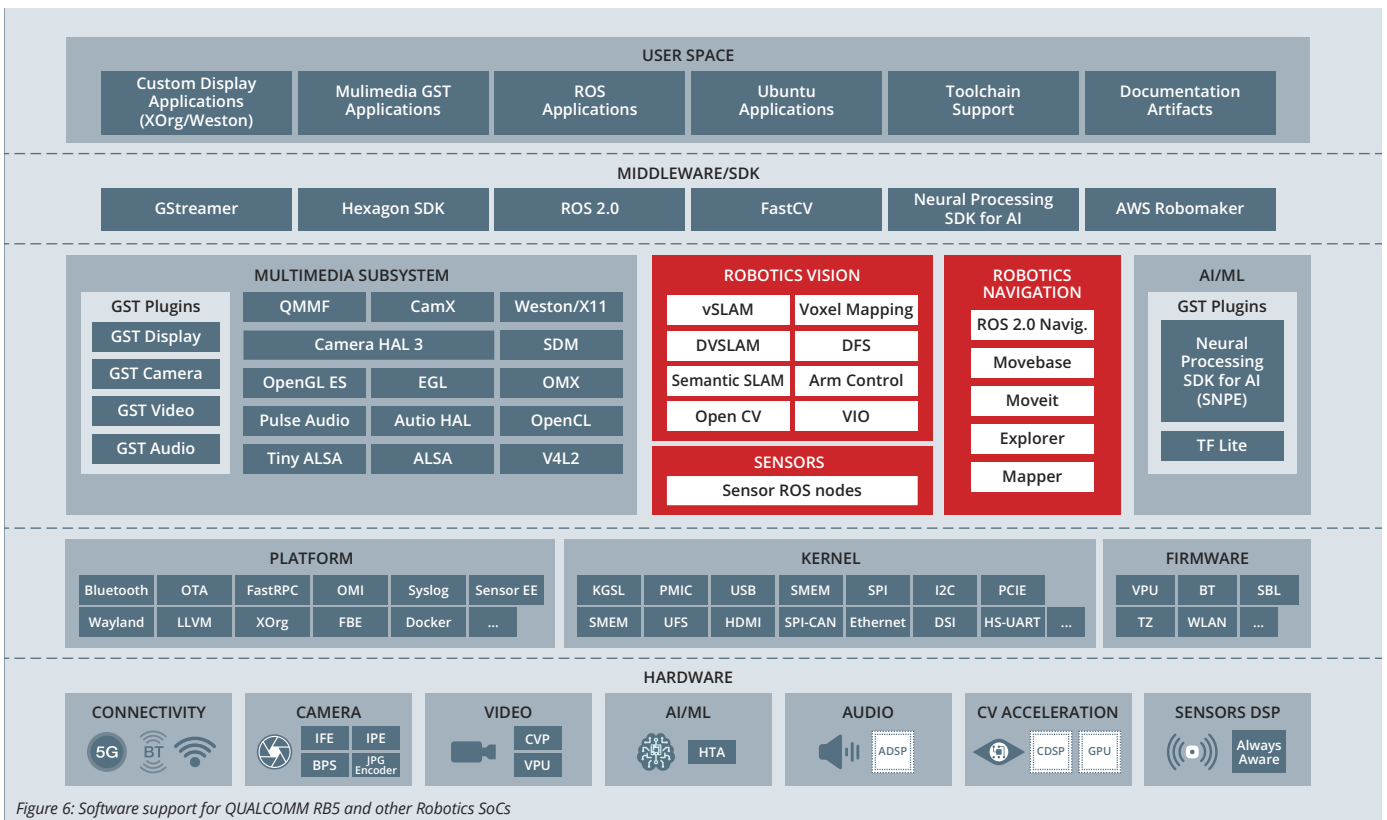
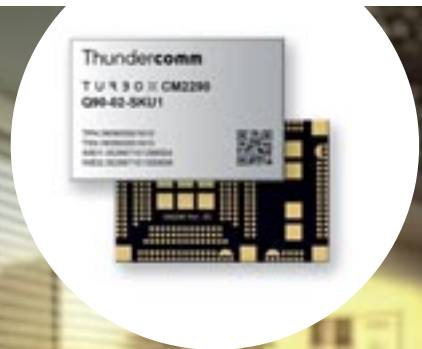


Figure 6: Software support for QUALCOMM RB5 and other Robotics SoCs

With THUNDERCOMM as a solution provider, CODICO is able to offer its customers a supply of SoMs and evaluation kits, as well as definition and follow-up of the development of a solution until it is launched. THUNDERCOMM, a QUALCOMM company, has recently launched a new family of pin-to-pin compatible SoMs (System on Module), the CM2290 (4G LTE) and the C2290 (Android) & C2210 (Linux) versions, a powerful and versatile platform for developing AIoT devices. Featuring a compact form factor, a neural processor, and 4G connectivity, the CM2290 module is a game-changer in the IoT space, reducing both risk and design complexity, lowering TCO (Total Cost of Ownership), maximizing RoI (Return-on-Invest) and accelerating TTM (Time To Market) for any customer developing a long-life industrial application, also considering its long lifespan.



THUNDERCOMM'S CM2290 MODULE

Powering Next-Gen AIoT Devices

The THUNDERCOMM CM2290 SoM is built on the QUALCOMM QCM2290 quad-core platform, providing an array of high-value features for low to mid-tier solutions. With support of advanced graphic features and an enhanced camera interface, the CM2290 LTE module's ultra-compact form factor (51×35×2.9mm LGA) is ideal for use in devices such as handheld terminals and tablets, translators, and more. With its low cost and ease of integration, the CM2290 module is the perfect platform for OEMs to quickly bring high-quality mobile devices to the market.

In addition to its processing power, the CM2290 module also features built-in 4G connectivity. It is fully certified with the major carriers worldwide and has the respective national regulatory approvals. This allows developers to create devices that

can leverage the full potential of LTE networks. The module also supports Wi-Fi 5 (802.11ac) and Bluetooth 5.0 for additional connectivity options.

Two of the standout features of the CM2290 module are its computer vision and integrated AI capabilities, which enable developers to build devices that can sense, reason, and perform almost in real-time at up to half a trillion operations per second (TOPS). In fact, the CM2290 embeds the Hexagon QDS6 v66, whose NPU (Neural Processing Unit) is designed to accelerate AI tasks on the module depending on the level of complexity and the specific use case. For example, simpler image recognition tasks such as object detection or face recognition could be well-suited to run on this NPU. This allows developers to create devices that can perform complex tasks, such as

machine learning, object recognition, natural language processing and more.

The CM2290 camera interfaces support 2x MIPI-CSI and 2 ISP (13MP + 13 MP or 21 MP) at 30 fps, which is a great feature for developers looking to create devices that can capture and process high-quality videos. The powerful combination of processing units enables the module to deliver outstanding performance and efficiency, making it ideal for a wide range of AIoT applications such as industrial handhelds, camera solutions, smart home solutions, miniature gateways, multi-sensor edge and monitoring devices.

Overall, the THUNDERCOMM CM2290 module is an exciting new platform for developing next-gen AIoT devices. With its powerful processing capa-



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CONCLUSION

bilities, integrated AI features, and 4G connectivity, the module is a versatile and powerful tool for developers looking to create innovative IoT solutions and anticipating future evolutions towards higher performances: the CM4290's footprint/pinout compatibility offers a migration path to any customers willing to maximise their investment in a future proof design.

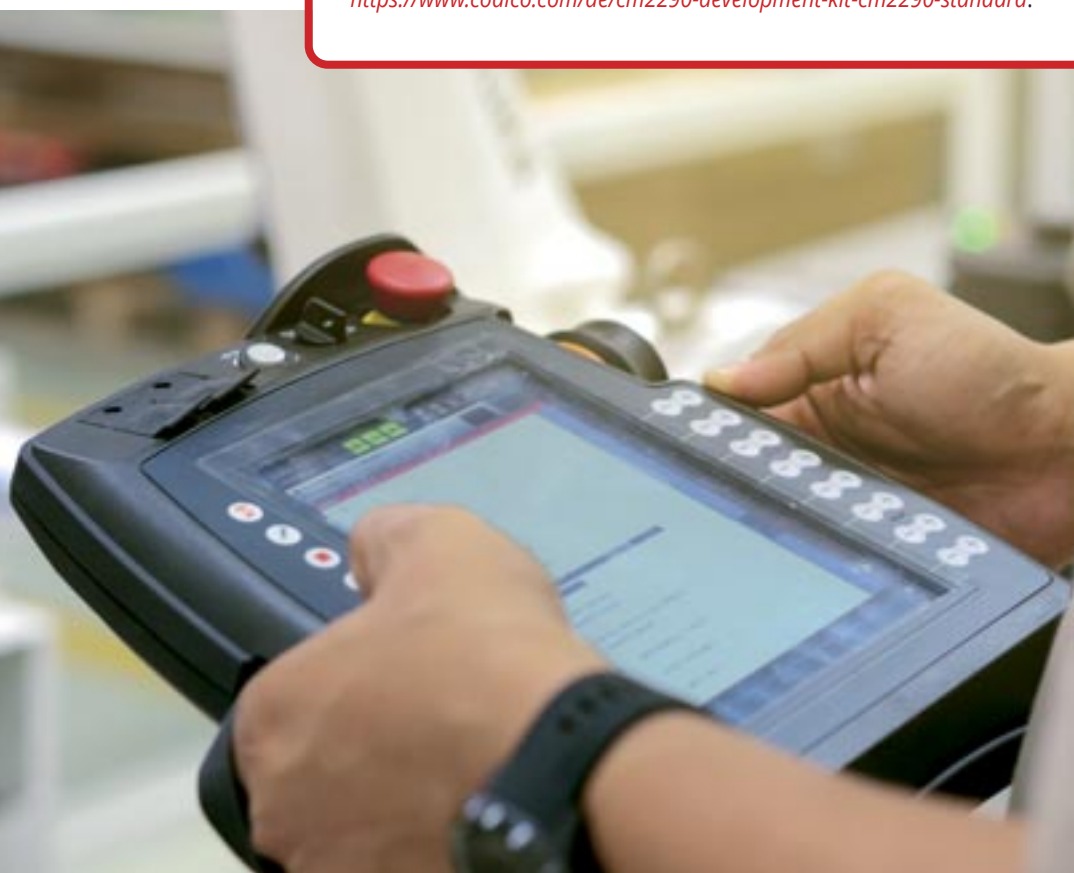
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As the IoT market continues to expand and the demand for powerful, versatile, and efficient platforms is continuously growing, the THUNDERCOMM CM2290 module is an excellent choice for OEMs looking to quickly bring low-cost, high-quality mobile devices to the market. With its support for fast LTE connectivity, advanced graphics, enhanced camera interface and low power consumption, the CM2290 module is an ideal platform for usage in a wide range of applications, including industrial handhelds, camera solutions, smart home solutions, miniature gateways, multi-sensor edge and monitoring devices.

CODICO supports its clients in developing projects and accessing QUALCOMM/ THUNDERCOMM's extensive technical documentation.

If you are interested in developing with the CM2290 module and the CM2290 Development Kit, they are now available for purchase at CODICO:
<https://www.codico.com/de/cm2290-development-kit-cm2290-standard>.



NEW BENCHMARK FOR LDOs

XC6705/06: Ultra-Low Power 20V 200mA »GO« LDO

TOREX
SEMICONDUCTOR LTD.

Traditionally, linear regulators have been classified as either being »Low Power«, meaning they consume low levels of quiescent current during operation, or »High-Speed«, meaning that the LDO responds very quickly to changes in load current (fast load transient response). High-speed LDOs also typically offer higher PSRR performance compared to low power solutions.

Incorporating our latest »Green Operation« (GO) technology, the XC6705/06 sets a new benchmark for high performance linear regulators and allows designers to achieve »Seamless Operation« independent of I_{OUT} value. As the output

voltage is fixed during the production process (selectable in 100mV steps between 2.5V~5.5V), only two small 1.0 μ F ceramic caps are needed externally, as shown in Figure 1.

By combining ultra-low quiescent current with high ripple rejection and fast transient response the XC6705/06 is a truly versatile linear regulator suitable for a wide range of applications.

Maximum operating voltage is 20V and maximum output current is 200mA. Drop-Out Voltage is 430mV ($V_{OUT}=5.0V@100mA$) and this new LDO features both current limit, short circuit protection & thermal shutdown as standard features. Additionally, the XC6705 includes an optional CL discharge function and both the XC6705 & XC6706 feature soft-start to suppress inrush current at start-up.

Seamless Green Operation

The GO (Green Operation) function of the XC6705/06 series enables a low quiescent current of 1.2 μ A with 50dB high power supply ripple rejection.

The supply current of the LDO will rise and fall as the output current demands changes. When the output load rises, the responsiveness of the internal error amplifier improves, which increases the LDO performance and as the output load

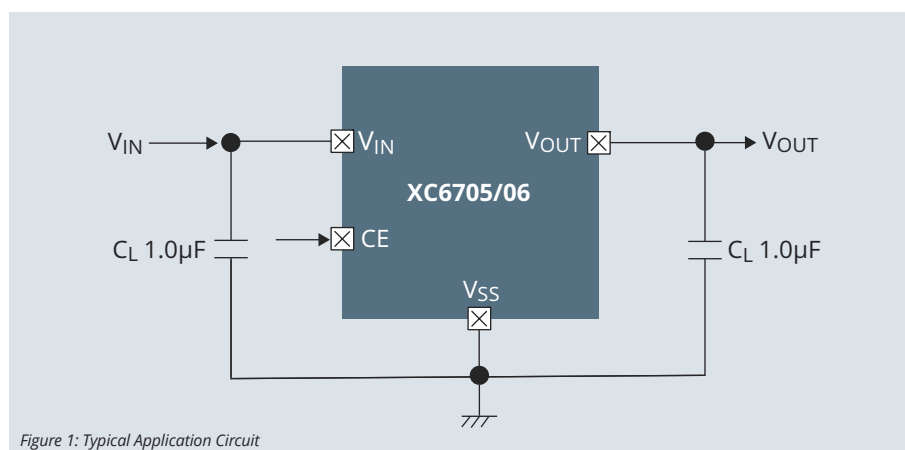
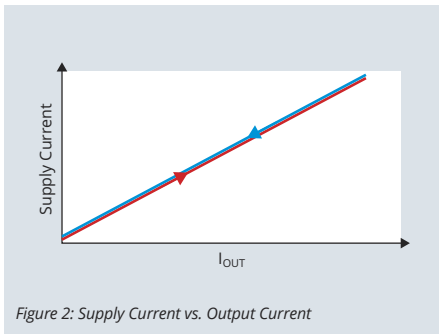


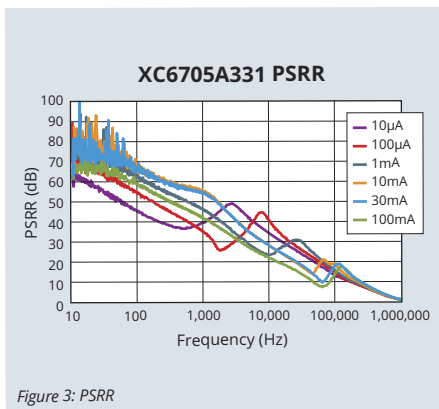
Figure 1: Typical Application Circuit



decreases the responsiveness of the error amplifier reduces and supply current falls, as shown in Figure 2. As a result, both low current consumption at light load and high-speed response at heavy load are achieved.

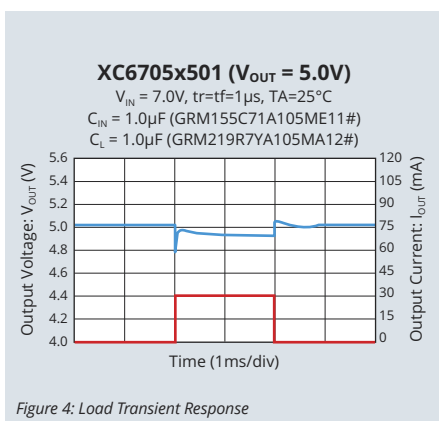
High PSRR

Our GO circuit automatically reduces quiescent current at low output loads down to only 1.2µA, whilst offering extremely fast ripple rejection of 50dB @ 1kHz (Figure 3).



Fast Load Transient Response

The XC6705/06 also provides fast load transient response performance ensuring that the output voltage remains stable as the load current changes as Figure 4 shows:



Typical Application: Industrial IoT Sensors

By combining Low Power Consumption with High-Speed Operation using our latest Green Operation »GO« mode circuitry, the XC6705/06 is the ideal solution for many applications. Whether it is a battery powered design or a

product with a 12V supply, this new family of LDO Voltage Regulators offers several beneficial features to help designers maximise system performance whilst conserving energy through adaptive power consumption:

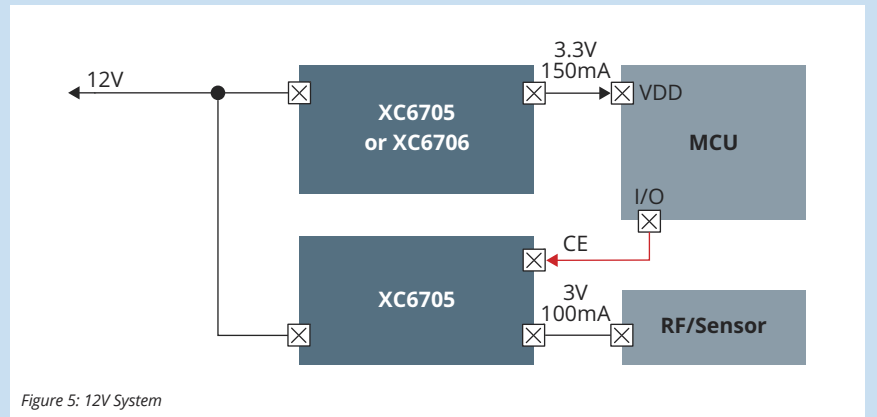


Figure 5: 12V System

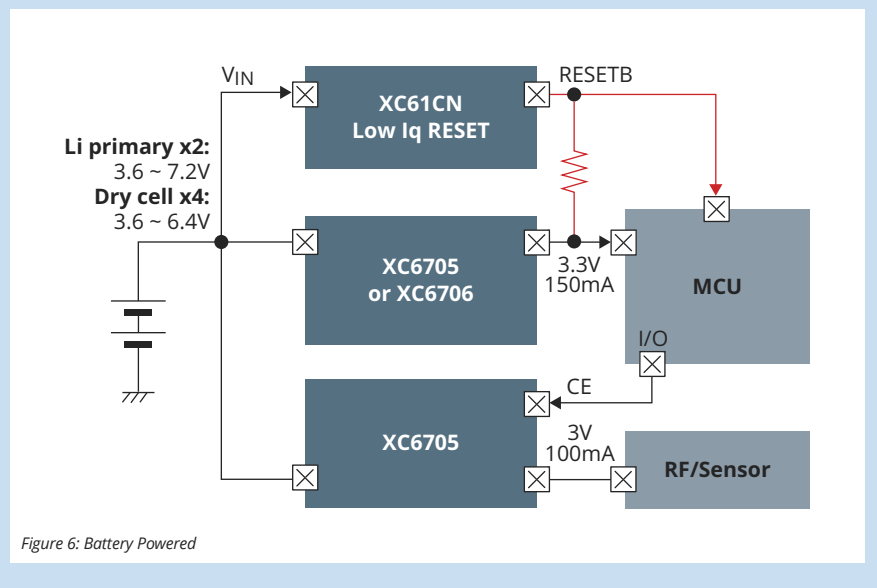


Figure 6: Battery Powered

Package Options

The XC6705 series is available in SOT-25 & USP-4 packages which both have a chip enable pin meaning that the LDO can be turned ON/OFF. The XC6706 is available in a SOT-89 package and has no chip enable pin and therefore is always

ON. For more information on the XC6705/06, please contact us.

A06

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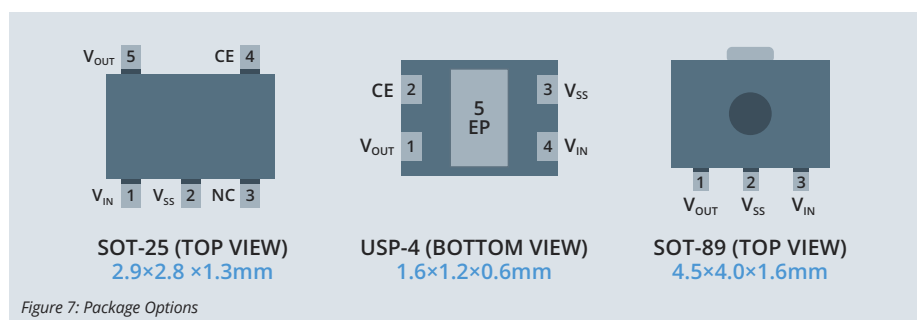


Figure 7: Package Options

BATTERY MANAGEMENT



Improving Battery Safety with the MP2797

Modern life has become more convenient due to battery-powered applications for electric tools, vacuum cleaners, electric bikes, and outdoor power supplies for camping. As wireless charging continues to be more widely used in applications, lithium battery safety is a growing concern. Therefore, designers are planning to develop battery monitoring and protection solutions.

A battery pack is made of multiple lithium batteries connected in series. Lithium-ion batteries have three different types of failure events: internal short circuit, high temperature, and overvoltage (OV). If any of these events occur, the cell temperature may reach a threshold that triggers a series of internal chemical reactions. These reactions generate heat and gas, which can result in fire or explosions.

The MP2797 is a robust battery management device that supports 7-cell to 16-cell battery management systems (BMS) to help prevent these failures and maintain battery safety. The MP2797 provides complete analog front-end (AFE) moni-

toring and protection, I2C or SPI communication, and supports an 8-bit cyclic redundancy check (CRC).

Battery Voltage and Current Monitoring

High-precision battery voltage and current monitoring are critical for obtaining the battery pack's status in real-time and allowing the battery to be used safely. The MP2797 integrates two separate analog-to-digital converters (ADCs): a 15-bit ADC and 16-bit ADC. The 15-bit ADC monitors the cell voltages by measuring the different battery voltages of each channel (up to 16 channels). The ADC voltage measurement error is $\pm 5\text{mV}$ at room temperature.

Meanwhile, the 16-bit ADC monitors the current by measuring the charge/discharge currents through an external current-sense resistor. The ADC measurement error does not exceed 0.5% at room temperature. Figure 1 shows the cell voltage measurement and current measurement error curves.

Battery Temperature Monitoring

During the battery's charging and discharging process, the internal resistance, battery layout, and other factors can cause discrepancies bet-

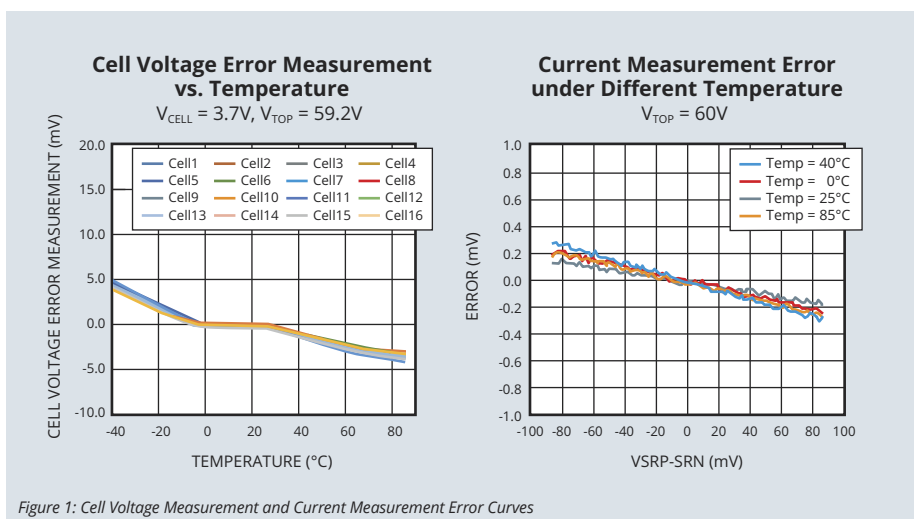


Figure 1: Cell Voltage Measurement and Current Measurement Error Curves

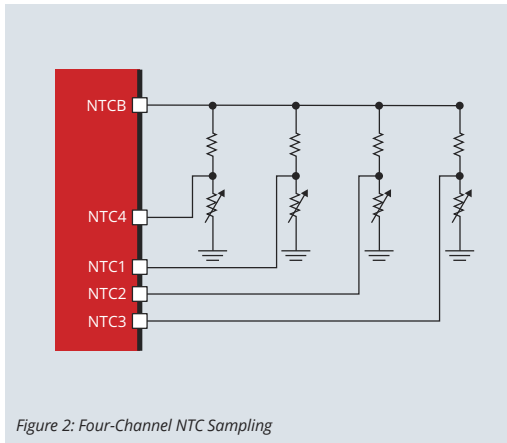


Figure 2: Four-Channel NTC Sampling

ween the battery temperature and the ambient temperature. Since batteries have different lifespans at varying temperatures, it is useful to know the temperature of the cells inside the multi-string battery pack.

In addition to measuring the chip's temperature, the MP2797 multiplexes the 15-bit ADC to provide four channels that can sample the temperature of an external NTC thermistor.

Cell Balancing Management

If the battery pack is charged and discharged for a long time, it can lead to an unbalanced voltage

in each cell, as well as a deviated chemical impedance. The battery pack's lifespan may be shortened if the pack continues to operate with unbalanced cells. If the difference between cell voltages is significant, to reduce these inconsistencies between cells it is crucial to implement cell balancing.

The MP2797 integrates a cell-balancing MOSFET that can support internal balancing with a current of up to 50mA. A larger balancing current can be achieved by driving an externally balanced MOSFET. Figure 3 shows a reference circuit for external balancing.

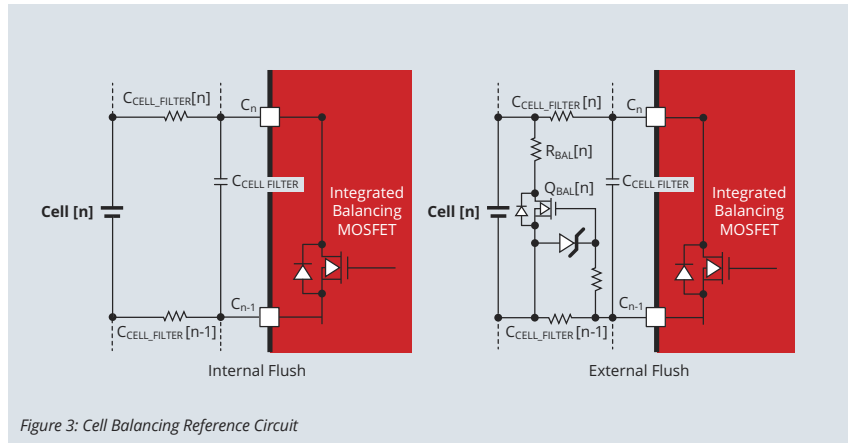


Figure 3: Cell Balancing Reference Circuit

Battery Protection

The MP2797 provides comprehensive and reliable protection for battery packs, where all protection thresholds are configurable. Some of the robust protections are listed below:

- Charge/discharge over-current protection (OCP)
- Charge/discharge short-circuit protection (SCP)
- Single cell under-voltage protection (UVP) and over-voltage protection (OVP)
- Battery UVP and OVP
- Cell low/high temperature protection
- Die high temperature protection



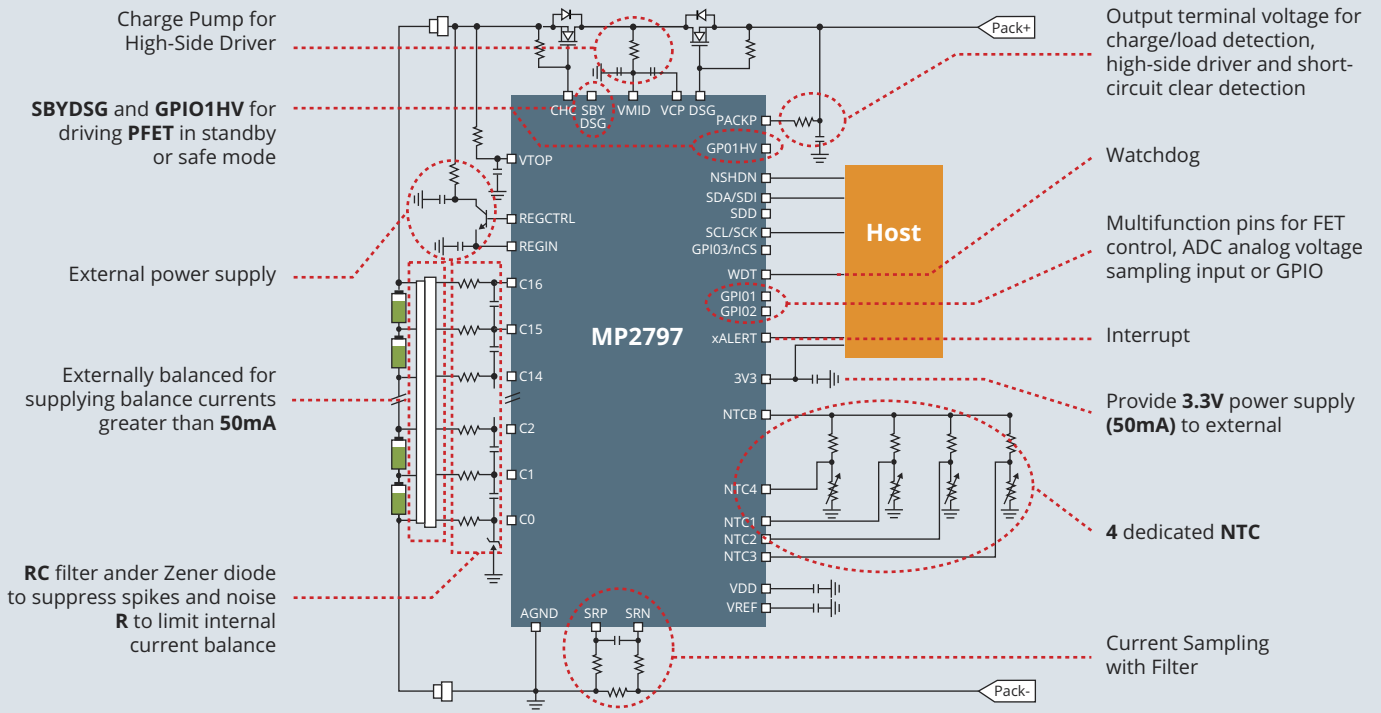


Figure 4: MP2797 Typical Application Circuit

The MP2797 also integrates a high-side (HS) drive that can drive multiple, parallel N-channel MOSFETs. Compared to the low-side (LS) drive, the HS drive can trigger a protection while maintaining communication with the microcontroller unit (MCU), ensuring that the system continuously obtains the real-time status of the battery pack.

Furthermore, the MP2797 can soft start the discharge MOSFET without using a pre-biased circuit. Figure 4 shows the typical application circuit of the MP2797.

Additional Features and Benefits

The MP2797's dedicated features include a low-current standby mode, load/charger insertion detection, high-voltage and low-voltage GPIO, open-circuit detection, and a continuous battery failure marker. The device also provides lockable multiple-time programmable (MTP) memory for protection thresholds and supports random battery



Figure 5: MP2797 IC

connection. It is available in a TQFP-48 (7x7mm) package (see Figure 5).

Design Scheme

The MP2797 is compatible with the MPF42790, a 2 to 16 stacked-cell battery pack fuel gauge (see Figure 6). The MPF42790 has a flexible design scheme that can be paired with any type of AFE by leveraging the system's MCU to provide the battery pack readings.

A07

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CONCLUSION

The MP2797 offers high-precision battery voltage and current monitoring, temperature monitoring, cell balancing, and comprehensive protection features. As lithium battery safety becomes more important for battery-powered applications, MPS will continue to provide a wide range of battery management system monitoring and protection solutions that guarantee safety and boost battery lifespan.

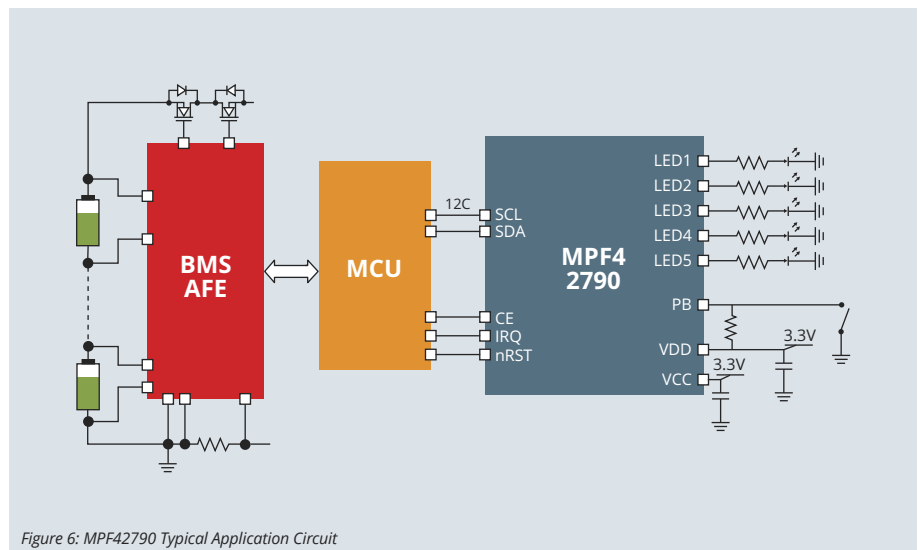


Figure 6: MPF42790 Typical Application Circuit

SRB, SJ, SJE



Electromechanical Relays are more in demand than ever before. One reason is the ability to adapt to new requirements. Miniaturisation with a simultaneous increase in switching capacity is just one aspect that makes it possible to replace larger components.

Specialising in market requirements such as e.g. EX-Proof, requires manufacturers to adapt the design of the relays constantly to fulfill the diverse requirements. Electromechanical relays continue to score with their unbeatable advantages, such as their robustness or their save galvanic isolation and in many cases, they are still a cost-effective alternative to electronic solutions. SANYOU offers a variety of excellent products. In the following we will go into 3 series in more detail, the series SRB with only 7mm width and the miniature Power relay series SJ and SJE. All series are certified acc. IEC 60079-15 (Explosive atmospheres - Part 15: Equipment protection by type of protection »n«).

SRB Series

- Overall width only 7mm, small size 20.5×7×15.1mm
- NO version with 5A rating
- Coil voltage from 5V, coil power 200mW or 360mW
- 4kV Dielectric strength between contact and coil
- VDE rating 80.000 switching cycles at 5A/250VAC and 85°C ambient temperature
- TV3 rating
- EX-Proof according IEC 60079-15, plastic material acc. IEC 60335-1 optional
- UL, TUV, VDE, CQC certified, RoHS conform



SRB



SJ

SJ Series

- Small size 18.2×10.2×15.5mm
- 10A rating (only NO version available)
- 10kV Dielectric strength between contact and coil
- Coil voltage from 3 Volt, coil power 200mW or 450mW
- VDE rating 100.000 switching cycles at 10A/277VAC and 85°C ambient temperature
- TV5 rating
- Product according IEC60335-1/IEC60079-15/ GWT 750°C
- UL, VDE, CQC certified, RoHS conform

SJE Series

- Small size 20.6×10.2×15.5mm
- 10A rating (NO and CO Version available)
- 8kV Dielectric strength between contact and coil
- Coil voltage from 3 Volt, coil power 200mW, 400mW or 450mW
- VDE rating von 60.000 switching cycles at 10A/250VAC and 105°C ambient temperature
- TV5 rating
- Product according IEC60335-1/IEC60079-15/GWT 750°C
- UL, VDE, CQC certified, RoHS conform

Applications

- Household Appliances
- Kitchen Appliances e.g. air conditioners and refrigerators (EX-Proof types needed)
- Kitchen Appliances with requirement 105°C and IEC60335
- Smart Home
- Industrial applications where General Power Relays are requested

P01

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SJE



SANYOU Lab

MORE FREEDOM AT DESIGN



Flat DC-Link Capacitors from KEMET

KEMET offers improved volume efficiency with its rectangular aluminum electrolytic capacitors. This shape means that there is no "lost" area around the capacitors compared to the conventional radial versions, which has a positive impact on the size of a design, especially when several capacitors are connected in series or parallel. Also, the realisation of a flat design is made possible.

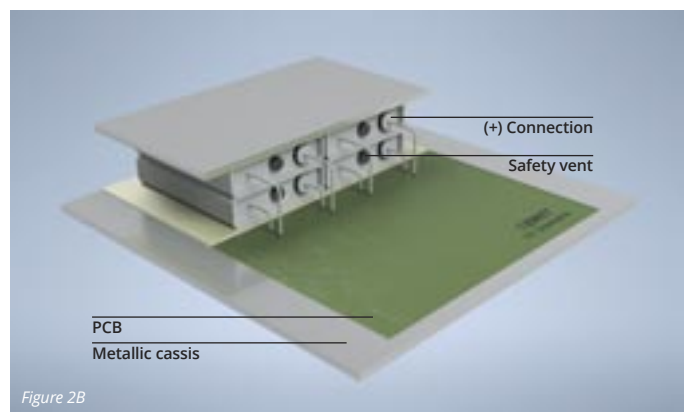
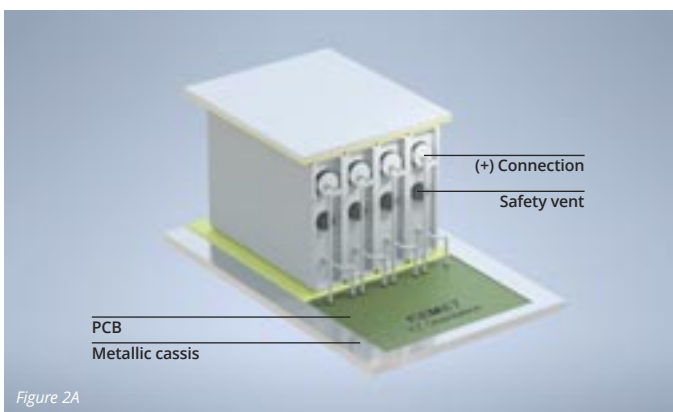
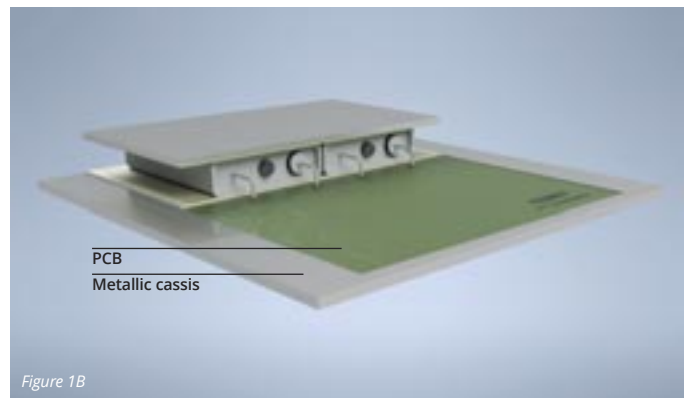
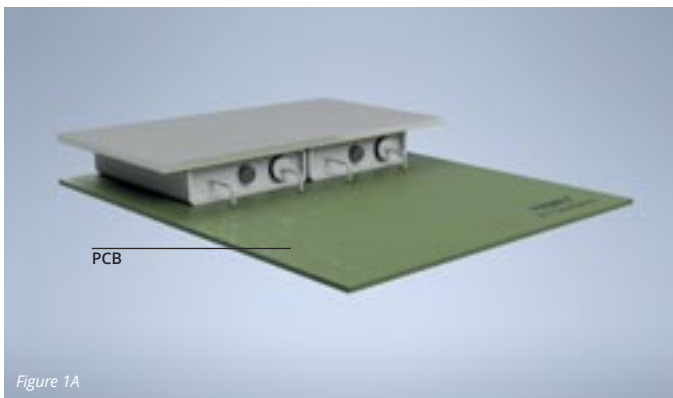
The internal structure is basically the same as a conventional Al electrolytic capacitor, except that the winding is flattened to obtain the rectangular shape. The AAR70/AAR80 series can be seen as an alternative to snap-in electrolytic capacitors, differing in the recommended mounting on the PCB. The capacitors can be mounted

in any horizontal position or in an upright position. Depending on the number and arrangement of the required capacitors, horizontal mounting can either save footprint or implement a flat design. It is also possible to stack the capacitors. Below you will find some recommendations.

Increase of lifetime and/or ripple current capability due to cooling

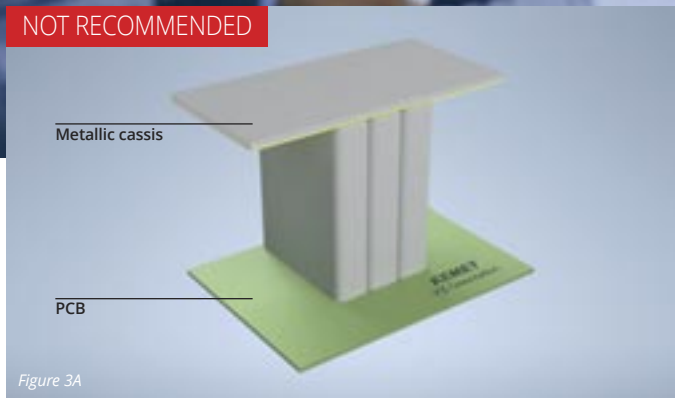
The capacitor is designed for mounting with or without cooling by a heat sink (the flat surface allows easy use of a heat sink). When mounting the capacitor on a metallic chassis, the ripple current capability is significantly improved, and the use of thermally conductive adhesive, paste or foil further improves the cooling conditions.

Depending on the load profile and cooling conditions, efficient cooling can increase the lifetime by a factor of 2-6. For an exact evaluation please contact us – we will have the expected lifetime calculated based on your mission profile. The ripple current capability can also be significantly improved when the capacitor is mounted on the metal housing using, for example, thermal paste due to the low thermal resistance.

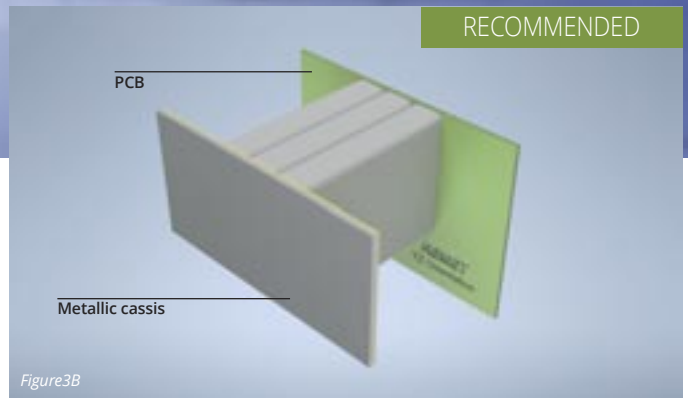




NOT RECOMMENDED



RECOMMENDED



Example:

AAR80-series (105°C/450V/270µF/1.89A rms at 100Hz, 105°C)

Capability at 85°C: 1.89A rms x1.6

AAR80-series (105°C/450V/270µF/3.93 A rms at 10kHz, 105°C)

Capability at 85°C: 3.93A rms x1.6

When cooled by heat sinks, the ripple current capability doubles. Thus, this capacitor is capable for 6A rms at 100Hz and 12.5A rms at 10kHz.

The use of multiple capacitors stacked or in a bank configuration can change the thermal dynamics and thus the ripple current capability compared to a single capacitor. In such cases, please contact us for assistance.

The capacitor should not be mounted with the safety vent facing downwards (Figure 3A). However, if the PCB is mounted vertically on the application, so that the capacitor is in a horizontal position, this position may be permissible (Figure 3B). The AAR80 and AAR70 series can withstand vibrations of up to 20g and 40g respectively. This

vibration resistance is only achieved when the capacitor is stiff mounted to the PCB and/or metal case by gluing it to the PCB or case. The use of thermally conductive adhesive ensures efficient heat dissipation of the capacitor. If the capacitor case is allowed to move during vibration (with respect to the PCB), this can easily cause the wire terminals to break due to fatigue. A capacitor rigidly mounted on the PCB is crucial. Furthermore, a rigidly mounted PCB with short distances between the mounting points is also required so that vibrations are not further amplified. Typical applications are the DC link in AC/DC power supplies or inverters for different industries.

SPECIFICATIONS AAR70 SERIES

- Operating Temperature: -40°C to +85°C
- Rated voltage: 400 ~ 450VDC
- Capacitance: 160µF ~ 360µF
- Lifetime: 10,000h at 85°C, rated voltage and ripple current
- Dimensions: 12x44.5x38.1mm ~ 12x44.5x57.2mm
- Vibration proof up to 40g
- AEC-Q200 qualified

SPECIFICATIONS AAR80 SERIES

- Operating Temperature: -40°C to +105°C
- Rated voltage: 450VDC
- Capacitance: 150µF ~ 270µF
- Lifetime: 2,000h at 105°C, rated voltage and ripple current
- Dimension: 13.5x46x38.1mm ~ 13.5x46x57.2mm
- Vibration proof up to 20g
- AEC-Q200 qualified

P02

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HIGH POWER CHARGING

The Forward-Thinking Way of Charging Electric Vehicles



Over the next ten years, there will be a significant shift from traditional combustion engines to electric and hybrid vehicles worldwide. However, the success and acceptance of electromobility also depends, among other things, on nationwide and fast charging options, which will lead to a massive expansion of the charging infrastructure in the near future.

High Power Charging (HPC) is a technology that is revolutionising the way electric vehicles are charged. With charging power ranging from 100 to 350kW, HPC offers electric vehicle owners an enormous advantage in terms of time savings, especially for long-distance and frequent drivers. In just three to five minutes, up to 100km of range can be charged, dramatically reducing the time spent at charging stations.

In comparison, DC charging stations typically have a charging power of 50-240kW. Fast charging stations are ideal for locations where electric vehicle drivers only stay briefly, such as highway

rest areas or supermarket parking lots. With the expansion of HPC stations, the charging infrastructure is significantly improved, and the electric mobility sector is further promoted. This will also rapidly increase the demand for inductive components, which play a key role in electronic modules and subsystems such as AC/DC and DC/DC converters.

SUMIDA's product strategy focuses on components and module solutions for power supplies in DC wall boxes, HPC charging columns and charging pads in wireless charging systems (Figure 1).

The product portfolio ranges from transformers for DC/DC converters, PFC power chokes, EMI filter chokes and modules, to wireless charging pads for the ground and in the car. In product technology and development, SUMIDA clearly focuses on topics such as high-power density, small size, high efficiency and robustness.

In-house development of magnetic materials and production of magnetic cores (ferrite and

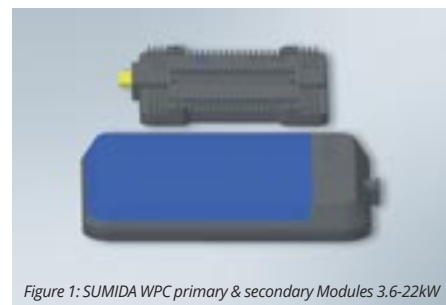


Figure 1: SUMIDA WPC primary & secondary Modules 3.6-22kW



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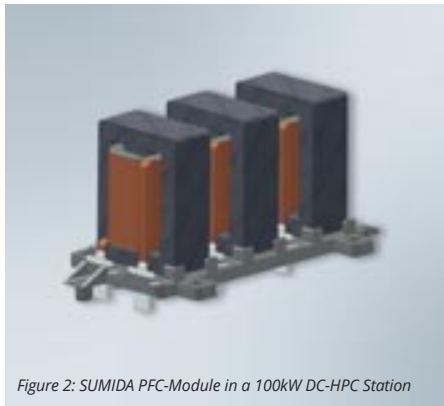


Figure 2: SUMIDA PFC-Module in a 100kW DC-HPC Station

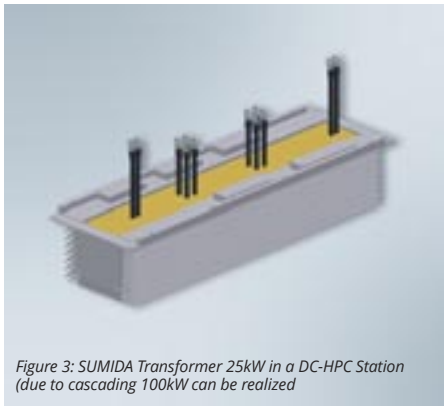


Figure 3: SUMIDA Transformer 25kW in a DC-HPC Station (due to cascading 100kW can be realized)

iron powder), which usually form the core of inductive components, provide the most important prerequisites for optimal solutions.

The power range of the components is currently around 50kW, although > 400kW can also be realised through scaling (Figure 2 & 3).

In addition to product development and validation, the range of services includes design-simulation, rapid prototyping and intensive support for customers during the project phase, as well as cost- and quality-optimised series production through to EOL support. Samples and pre-series

can be realised quickly in order to ensure optimal support for our customers with new projects. The block diagram (Figure 4) shows the power conversion architecture for DC wallboxes, HPC systems and the individual inductive components proposed in each stage as a customized solution.

CODICO is your reliable partner for future technologies. We are always at your disposal for further inquiries.

P03

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High-Power Components for DC-Charging and HPC Systems

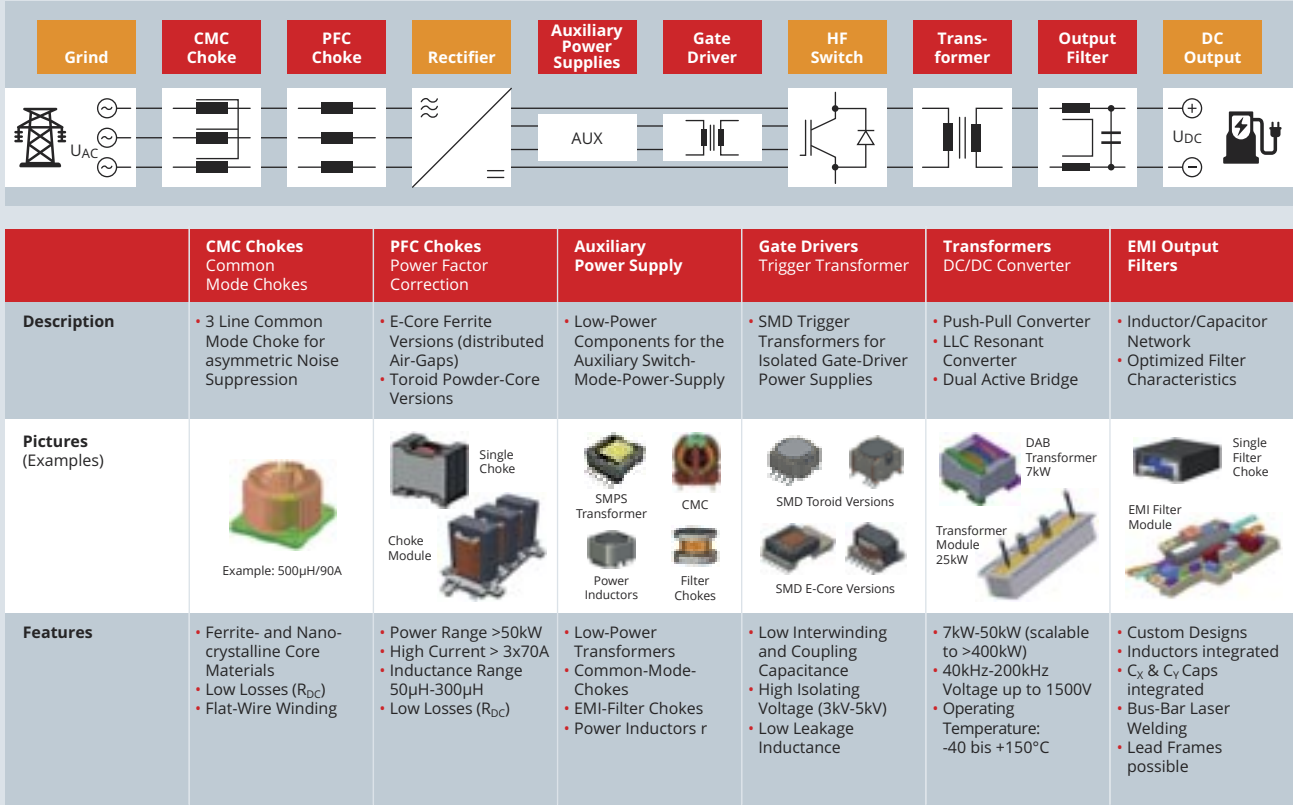


Figure 4



OUTSTANDING

The X2 and Y2 THB-Film Caps from KEMET



©AdobStock/IC121

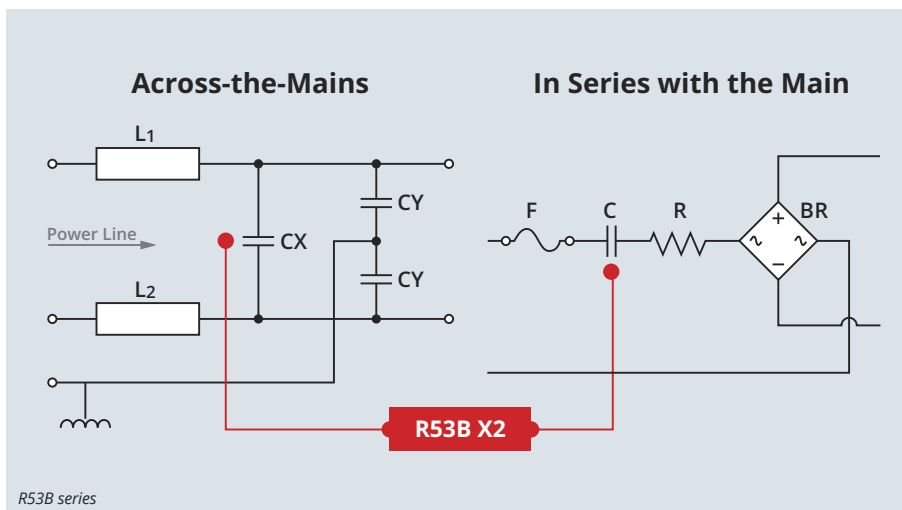
KEMET is launching one »first to market« product after another. Recently, two series with a rated voltage of 350VAC have been added to the EMI suppression film capacitor portfolio. Other features include a THB test grade IIIB and a high rated temperature of 125°C.

in across-the-line applications that require X2 safety classification. Typical applications include connection in series with the mains, capacitive power supplies and energy meters. A particular

R53B series

Following the introduction of the R53 X2-class series, R53B is the next level, offering a rated voltage of 350VAC/800VDC in addition to miniaturised dimensions, highest capacitance and THB III level (85°C/85% RH/1000h/Vr). The capacitance range goes from 68nF to 20µF. In addition, this version achieves an extended temperature range of -40°C to +125°C.

This series is ideal for harsh environmental conditions and meets the demanding Automotive Electronics Council's AEC-Q200 qualification requirements. It is suitable for worldwide use in electromagnetic interference (EMI) suppression



focus is on automotive applications for severe ambient conditions, such as On-Board Chargers.

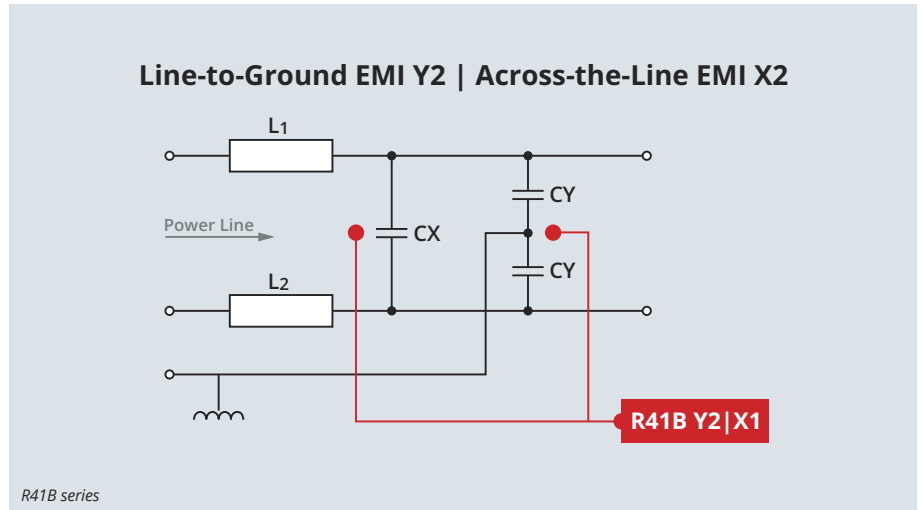
SPECIFICATION R53B

- Rated AC-voltage: 350VAC 50/60 Hz
- Rated DC-voltage: 800VDC
- Capacitance range: 68nF to 20µF
- Pitch: 15 to 52.5mm
- Approvals: ENEC, UL, cUL, CQC
- X2 Class (IEC 60384-14)
- THB class IIIB: 85°C, 85% R.H., 1,000h at 350 VAC/800 VDC acc. IEC 60384-14
- Operating temperature range: -40°C to +125°C
- Automotive (AEC-Q200) grade

R41B series

The situation is similar for the Y2 category. The high temperature R41T series has been further developed to achieve a rated voltage of 350VAC/1500VDC. This new R41B series thus offers a THB level IIIB (85°C/85% RH/Vr), an extended temperature range from -40°C to +125°C and a high dielectric strength. Of course, this series also meets the demanding qualification requirements of the Automotive Electronics Council (AEC-Q200).

It is suitable for use as filter for suppressing electromagnetic interference (EMI) in »line-to-ground« applications requiring



R41B series

safety classification Y2/X1. The capacitance range goes from 2.2nF to 1.2µF.

SPECIFICATION R41B

- Rated AC-voltage: 350VAC 50/60 Hz
- Rated DC-voltage: 1,500VDC
- Capacitance range: 2.2nF to 1.2µF
- Pitch: 10 to 37.5mm
- Approvals: ENEC, UL, cUL, CQC
- Y2/X1 class (IEC 60384-14)
- THB class IIIB: 85°C, 85% R.H., 1,000h at 350 VAC/1,500 VDC acc. IEC 60384-14
- Operating temperature range: -40°C - +125°C
- Automotive (AEC-Q200) grade

Those new series offer the best combined performance in terms of lead space, harsh environment, high-temperature and reliability in the electronic market.

P04

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WALLBOX #2

AC Wallbox System Design



In our last issue of Impulse, we described the current measurement for 32A in an AC wallbox. The following article will delve further into the topic of »architecture«.

In figure 1, we present the schematic layout of an AC wallbox. On the left side are the variators that divert overvoltage, e.g. in the case of lightning. A voltage divider is then used to measure voltage at the phase, which can be designed for the maximum measurement range. Here, one must make sure that pulse-resistant resistors are used, such as those supplied by our manufacturer VITHROM. Moreover, two lines are discernible, which branch off from flyback L and N. These represent the power supply for the control unit plus peripheral equipment, such as a 4G connection or a QCA 7005 PnC communications interface.

Figure 2 contains further proposals for the conceptual design.

Then follows the leakage current measurement using a KEMET FG-R0*-4A sensor, which is requi-

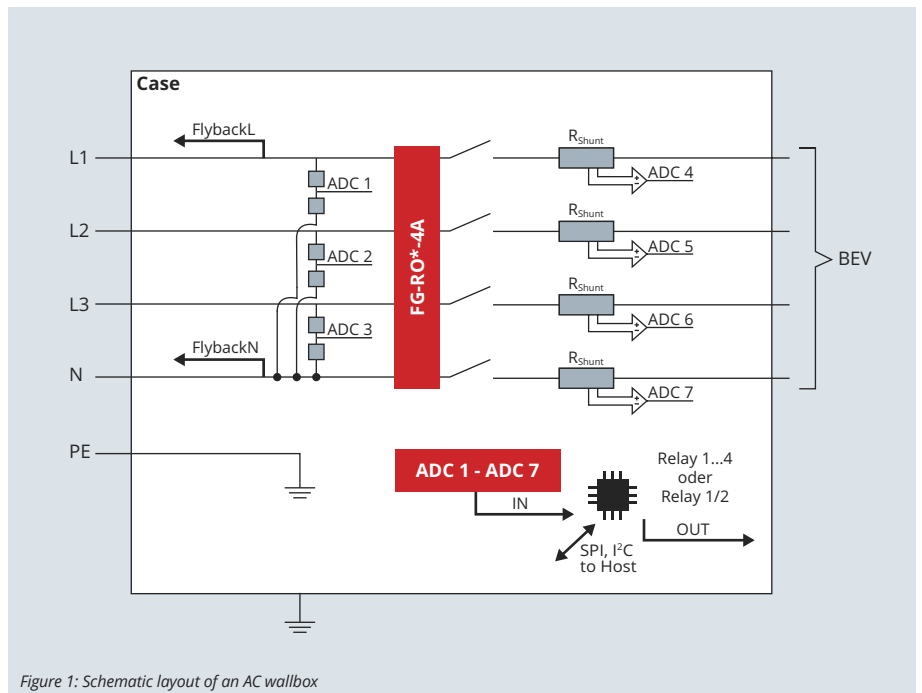


Figure 1: Schematic layout of an AC wallbox

red for the residual current measurement. The leakage current sensor is followed by the relays that disconnect the voltage supply. These relays are certified according to the IEC-62955 standard and have a switching capability of 3x500A and a switch-on capacity according to IEC62752 (230A for 100us, followed by 30A for one second). Both our 118 and 207 series relays meet and, in some cases, exceed all requirements for the AC wallbox standard.

The illustration shows three shunts on the right side after the relays. These measure the current flowing through the line. The advantage of this arrangement is that all measurement circuits are located in the HLV part and are transferred to the host controller via a small microcontroller. Moreover, it is obvious that this architecture allows for an electronic monitoring of the relay. Illustration 2 shows two different types of power supply for a wallbox. In both cases, it is possible to supply an HLV and a PELV circuit.



Song Chuan 207BX

The 207BX relay is capable of switching 35A at 277VAC. Strong short-circuit resistance $I_p=1.85kA/ I_{2t}=4.5kA2s$ at $I_n \leq 32A$ and 500A (three switching cycles) according to IEC62955 render the 207BX ideal for use in larger applications.

ADVANTAGES OF SINGLE-POLE RELAYS IN WALLBOXES

- Single-pole flexibility in board design
- Possibility of implementing network balancing
- Possibility of a zero crossing of voltage in case of error
- Simplest (HW) and robust product design with a maximum benefit for the customer
- Highest availability in the market

Song Chuan 118

Here, the required footprint on the PCB is a mere 48.5x26mm, though the single-pole relay can conduct 100A, the two-pole relay 50A.

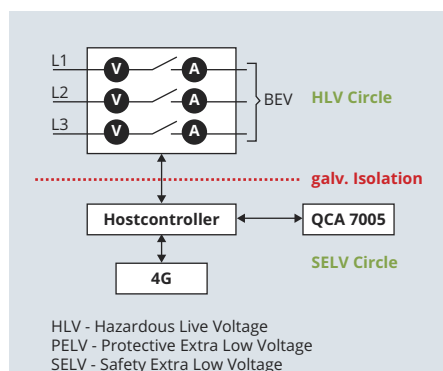


Figure 3: Superior hardware architecture of an AC Wallbox

The low, constant resistance throughout the entire life cycle of the relay and the low power requirements of the relay coil help avoid high cooling costs. The relay is UL and TÜV certified, and also meets the requirements of the IEC 62955 standard for Mode 3 charging of electric vehicles.

Moreover, it is RoHS compliant, has a reinforced insulation and is perfectly suited for use in charging installations thanks to its high resistance to ambient temperatures of up to a max. of 85°C.

ADVANTAGES OF TWO-POLE RELAYS IN WALLBOXES

- 2 poles offer more flexibility, since the same relay can be used in single-phase and three-phase applications
- No territorial conflict in case of system requirements
- Smaller vibration effect (40g)
- Lower weight for two 2-pole relays as compared to one 4-pole relay

P05

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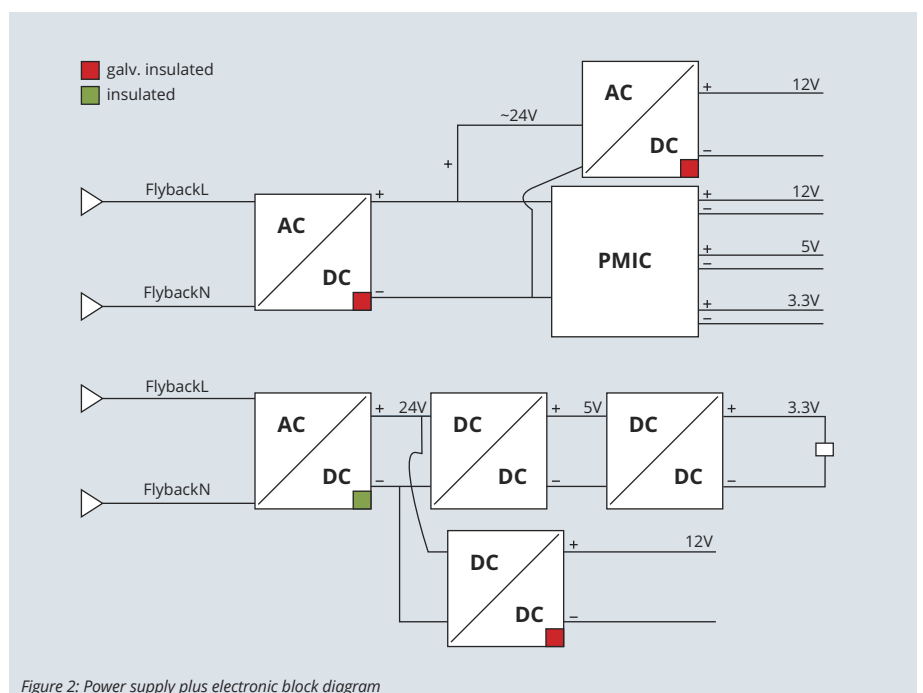


Figure 2: Power supply plus electronic block diagram

SAFE SHUTDOWN IN CASE OF FAILURE



Though blackouts are a hot topic nowadays, this article will only discuss a shutdown of the charging electronics in hyperchargers (HPC) caused by external influence. This may be a failure of the individual charging station due to an internal error, or a temporary outage of power supply to the charging stations. At first consideration, one may assume this is just a brief error that doesn't require any further action. Yet upon closer scrutiny, this does not seem conclusive.

Since charging stations for electric vehicles are increasingly regarded as part of the general infrastructure, it would seem useful to have an explanation for the reasons behind the failure. These devices are connected to the manufacturer over the Internet so as to communicate their availability and to report that they are no longer accessible in case of failure. For the manufacturer, a simple message that an HPC no longer works is not enough. As a rule, it is vital to know the cause before sending a technician to take a look at the HPC.

For the manufacturer to receive the correct data in case of a malfunction, the operator will need to backup the correct data.

The following must be checked:

- Are any relays or contactors disconnected?
- Which remanent variables need to be saved?
- Does the HPC send a status report to the back end via a 4G module?
- Is the locking actuator disengaged?
- Does the display show a malfunction?

These questions are very essential, since in case of a supply failure, a correspondingly high energy may be required as a result.

For example:

- Safe shutdown → Switch off relay and contactor (up to 100W for 2 seconds)
- Sending a report → 4G module needs higher power (2W for 30 seconds)
- The display informs that the HPC is not working (3mA for up to 8 hours)
- RTC – probably the best-known supercap application out there

What options do I have for storing power inside my HPC? In most cases, the choice will be between a battery and a supercapacitor. The table above shows a comparison between a battery,

Battery vs. Supercapacitor vs. Hybrid Supercapacitor

TRADITIONAL SUPERCAPACITOR		HYBRID SUPERCAPACITOR		LI-ION BATTERY	
+	Longest calendar life, up to 20 years	+	High energy density provides longer back up times	+	Highest energy density: discharge times 3 min. to hours
+	Ultra-low resistance (ESR) for higher power	+	Low leakage current provides long life when used with a primary battery	+	Lower self discharge
+	Higher efficiency, low self-heating in high current discharges	+	Low self-discharge maintains voltage over long periods with no charge source	+	Low cost per Wh
+	Discharge to zero volts for safety	+	High voltage single cell better match to battery voltages	-	High current recharge shortens life
+	Broad temperature range -40 to +85°C	+	High voltage can require fewer cells to meet system voltage	-	Higher internal resistance limits power
+	Environmentally friendly no heavy metals, no rare metals, easily recycled	+	Long lifetime: 10 years at 20°C	-	Must manage thermal load
+	Highest cycle life: 500k - 1M+	+	Long cycle life: 500k (HS), 250k (HSL)	-	Operating temperature range -10 to +40°C
+	Lowest cost per W/kg, W/cm ²	•	Minimum voltage required; cannot be short circuited	-	Sophisticated battery management
-	High self discharge in days/weeks			-	Must oversize to reach longer life times >5 years
-	Lowest energy density			-	Cycle life: 3k-10k

a supercapacitor, and a hybrid supercapacitor. This table lists the most common parameters. Though not all of them are relevant, a niche becomes apparent in which the supercapacitor stands out – short term storage.

CODICO's linecard includes a suitable manufacturer for such components. Here, we would like to present our suppliers EATON and KEMET. Figure 1 shows a pre-selection of different components from the EATON and KEMET product range. A few parameters are required for the calculation of the energy requirements for the system, which we must define beforehand.

These include:

- Operating voltage
- Cut-off voltage
- Current pulse (IRMS)
- Current pulse time
- I peak
- Minimum and maximum operating temperature
- ESR of the selected capacitor
- C of the selected capacitor
- Minimum temperature correction
- System efficiency
- Required output voltage

Most parameters can be estimated on the basis of system expertise, and the features that are specific to the supercapacitor can be found on the datasheet. However, please don't hesitate to contact us when the requirements are more specific, like, for instance, changing temperatures over time. As a rule, supercapacitors have an operating temperature range of -40°C to +65°C. Though there is also an extended range, it needs to be derated linearly.

Calculation example: $C = I * \frac{\Delta t}{\Delta V}$

In this calculation example, one only needs to add the missing values. If one doesn't want to add system efficiency, it is actually very simple, since we already listed the relevant parameters above. When it comes to system efficiency, we will be happy to help you.

P06

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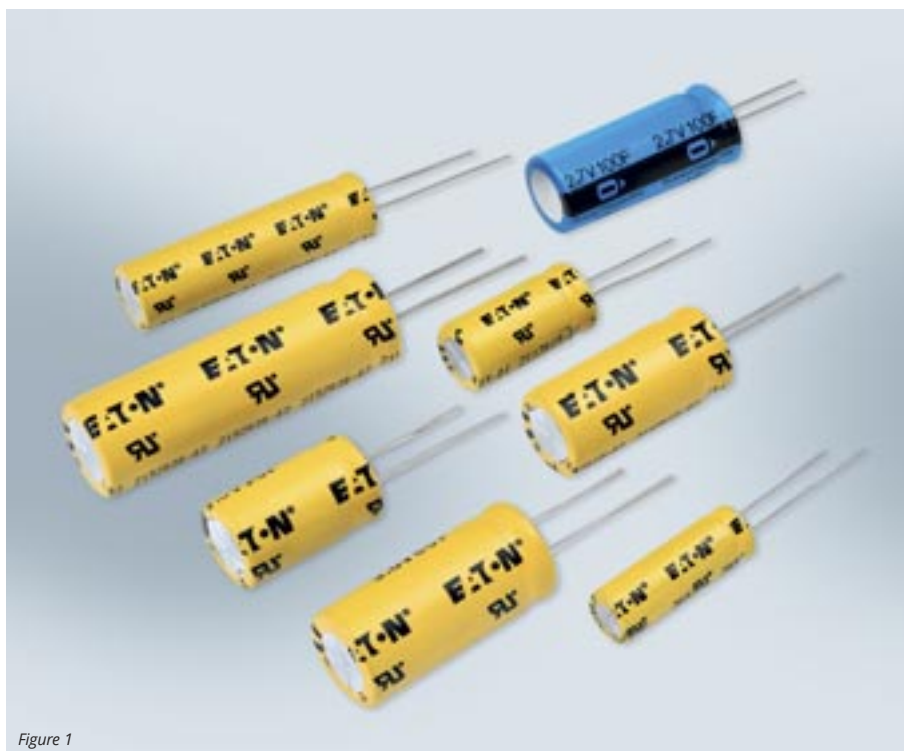


Figure 1





SYSTEM LAYOUT FOR SUPERCAPACITORS

© Adabas/Cor/Don130

Charging stations, especially hyperchargers (HPC) require a mechanical locking of the connection once the so-called »charging permission« has been granted. The relevant specifications are set out in the IEC61851-23 standard.

A large number of HPCs use a locking actuator, which secures the connector against accidental removal. Different requirements and parameters apply to such a locking actuator, and at this point we will make the following assumptions:

Electric parameters of a locking actuator

- Operating voltage: 12V
- Min. voltage: 9V
- Max. voltage: 15.5V
- Operating current: 2 A
- Duration t0 to t1: 7 seconds
- Temperature range up to 65°C

Electric parameters of a supercapacitor

- Nominal voltage: 3V
- Cut-off voltage: 1V
- ESR supercapacitor: 0.026Ω (TV1030-3R0106-R--@ Eaton)
- System efficiency: 85%
- Output voltage: 12V

We then need a circuit to charge the supercapacitor, and a boost converter to raise the voltage to 12V again. A possible proposal would be as follows:

The input voltage of the MPQ8883 was designed very generously, between 12V and 45V on the input side and from 0.6V to 5V at up to 3A on the output side. This allows for the charging of the

supercapacitor. The MPQ3431GL boost converter features an input voltage range of 0.8 to 13V and, on the output side, delivers 12V at up to 2.1A.

Formulas for calculating the energy required:

$$W = \frac{1}{2} * C * U^2 \quad F = \frac{C}{U} \quad C = I * \frac{\Delta t}{\Delta U}$$



Figure 1

Now we have everything we need to design the system. We will take the input supply of the MPQ8883 as a given, and only look at the output for charging the supercapacitor.

All parameters have already been chosen in the specification, and they are sufficient. Based on these parameters, we obtain a result of 7.49 F.

Here, we must use the next higher standard value (10uF), e.g. type TV1030-3R0106-R. In our example, the supercapacitor is discharged from 3V to 1.096V, resulting in a voltage drop of 1.804V.

The values can be verified in figure 2. The blue line represents the voltage at the capacitor over time (left vertical axis). The red curve represents

the current at the capacitor over time (right vertical axis).

You are welcome to order the above circuit proposal, the MP modules and supercapacitors are available upon request.

P07

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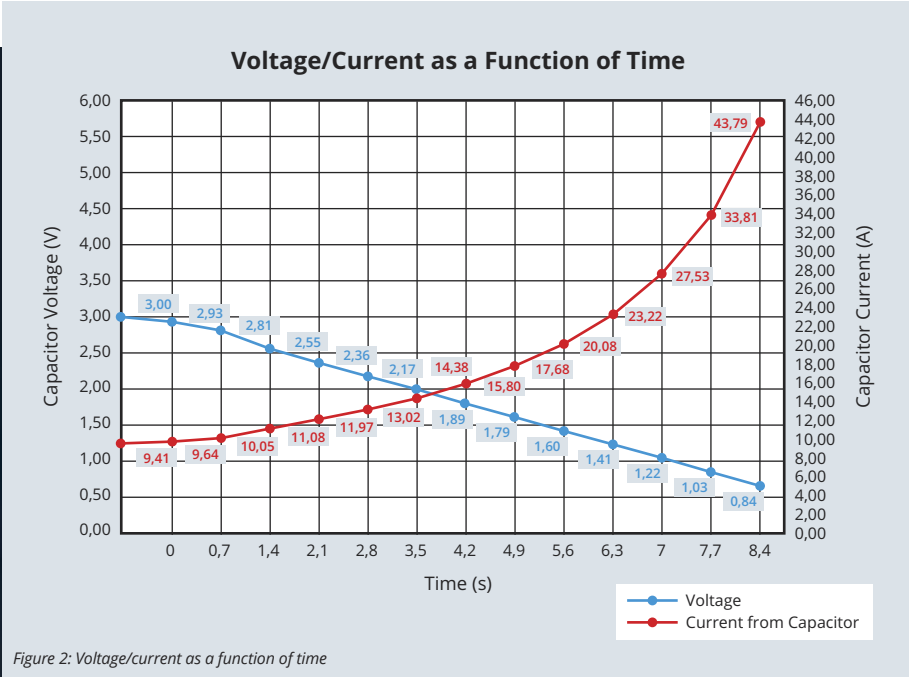


Figure 2: Voltage/current as a function of time





GAME CHANGER

High Voltage Capacitors of the PMLCAP HPB Series



RUBYCON is presenting another new high-voltage PMLCAP. In this article we will be introducing the new HPB series, which can replace DC-Link film capacitors, reducing size by up to 40%.

What is PMLCAP?

- PMLCAP stands for **Polymer Multi-Layer CAPacitor**
- No piezoelectric effect causing noise and sound
- No DC voltage bias
- Stable capacitance in wide temperature range
- No risk of short circuit, smoke or fire
- Mainly used today in high-end audio to replace MLCC or film
- Over 300 million pcs have already been shipped in the market
- Widely used, including automotive or the NASA Mars lander »InSight«

In the last 3 years, RUBYCON has accelerated the development of PMLCAPs for the high voltage market, especially for voltages above 500V. In our Impulse 01/2022, we introduced high voltage PMLCAPs called MH series for use as snubber capacitors. This series offers 250V to 500V and can replace the film capacitor used as snubber capacitor without the risk of short circuits, and at only 1/10 of the size.

In the last Impulse 02/2022, we presented the future target of high-voltage PMLCAP, i.e. to replace huge film capacitor modules in electric vehicle inverters. The series, recently called the HPM se-

ries, can reduce the size of today's film capacitor modules to less than 50%. However, it is currently still in the testing phase.

HPB series

We would like to introduce the HPB series, situated between those series. The specification of the HPB series is 500-900V with 5 to 25 μ F. The target applications are automotive motor-drive compressors, OBCs (On-Board Chargers) and DC/DC converters.

Compared to the same specification of the film capacitor, the size can be reduced to 70% through today's PMLCAP voltage gradient of 250V/ μ m. When the PMLCAP reaches the next voltage gradient of 300V/ μ m, size can be reduced to 55%.

The series name HPB stands for
 H = High Voltage
 P = PMLCAP
 B = Box

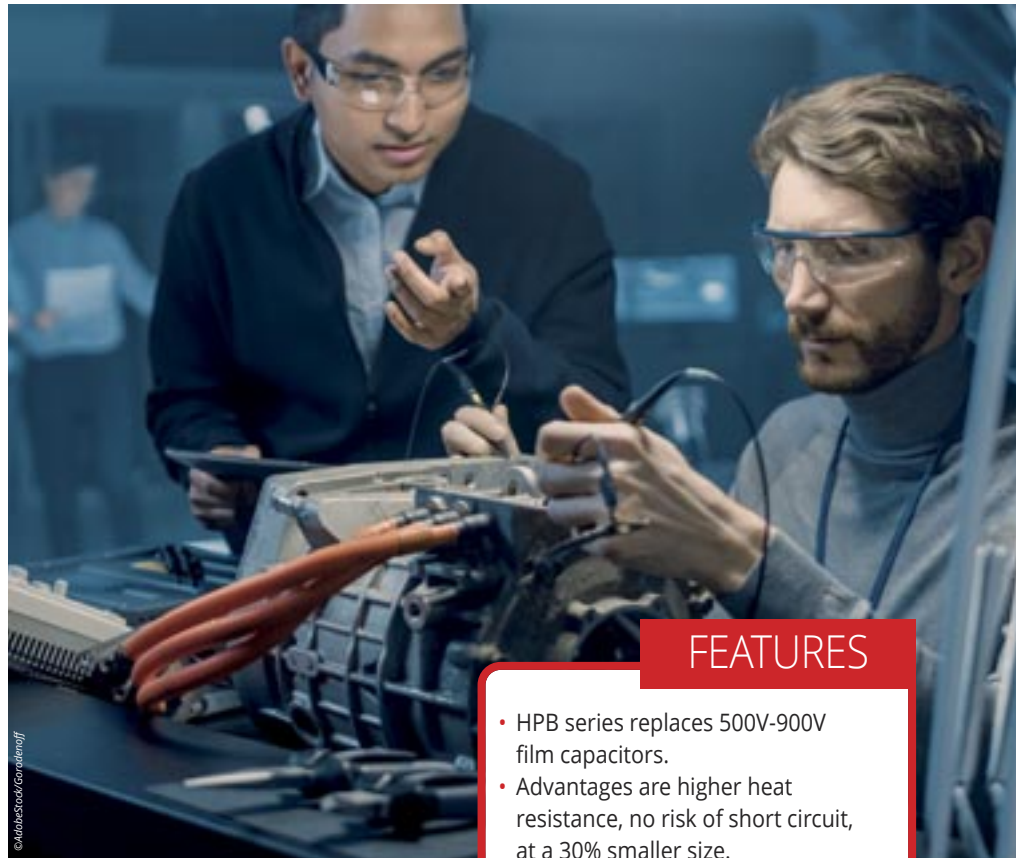
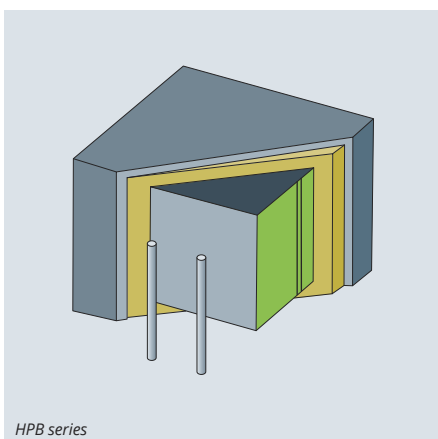
Up to the MH series, the PMLCAP is barely used. To withstand higher humidity, the HPB series is covered in a plastic case like film capacitors. Therefore, it is a small »box« type similar to the HPM series (M=Module).

Advantages

Compared to film capacitors, the HPB series offers two big advantages:

First, it has a much higher heat resistance. Whereas it is difficult for film capacitors to exceed 105°C, the HPB series can handle 125°C. But it's not just about the operating temperature range. SMD film capacitors use plastic films such as PPS (polyphenylene sulphide) or PEN (polyethylene naphthalate) for heat resistance, although these materials would melt at too high temperatures. In contrast, the PMLCAP does not melt even under such conditions. So, there is no risk of short-circuiting and you can even use it in a reflow oven for SMD soldering. As you can see in the picture, you can convert the cable for reflow soldering into a flat terminal or bus bar to reduce ESL. Another advantage is miniaturisation. Even at today's voltage gradient of 250V/μm (the same as a film capacitor), the PMLCAP can reduce its size by 30% compared to a film capacitor. With the next target of 300V/μm, a 45% reduction is possible. In the future, an increase of the voltage gradient is possible, so further miniaturisation can be expected.

The advantages of the HPB series may not be needed in all markets, though target applications



FEATURES

- HPB series replaces 500V-900V film capacitors.
- Advantages are higher heat resistance, no risk of short circuit, at a 30% smaller size.
- Voltage gradient of PMLCAP is now targeting 300V/μm.
- RUBYCON can start delivering samples after autumn 2023.

such as motor drive compressors or OBCs are increasing in proportion to the number of electric vehicles. These electric vehicles do not require an internal combustion engine, so a 105°C film capacitor could suffice as a suitable electronic component. Even with miniaturisation, a PMLCAP can reduce the size of the capacitor, but not the screw motor in the compressor itself.

Nevertheless, the advantages of the HPB series remain unchanged. No short-circuit risk, high heat resistance with a smaller size. However, the functions of vehicles are becoming more complex and require more components. If the brick-sized film capacitor can be converted to smartphone size by using PMLCAP, there is free room for more hardware.

Latest developments

The focus of today's PMLCAP technology is to increase the voltage gradient with a stable production. Recently, RUBYCON installed a new evaporation system that can stably produce 250V/μm. RUBYCON's PMLCAP development team is planning another phase of development in the summer of 2023, with a voltage gradient of 300V/μm. Once they have achieved this goal, they will take another development direction.

We can expect actual samples of the HPB and HPM series, most likely after this autumn. If you use film capacitors for high voltage snubber capacitors or DC link capacitors, you will benefit from PMLCAP's high heat resistance, small size and absence of short-circuit risks.

P08

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TRENDS

Crystal Components Package Size Trends

The quartz component market offers a high density of information regarding electrical features and details, but no trends regarding package sizes. Due to the lack of information, users can easily be misled into using products that are close to, or even past, the zenith of their life cycle. This article addresses this very issue to provide insight into future trends.

In this article, we refer exclusively to Surface Mount Crystals, as the radial-wire electrode crystal unit package (often referred to as »pin type« or »metal can package«) has become obsolete and almost disappeared from the market. In terms of quality, price and availability, we strongly recommend switching to SMD types.

MHz Crystals

Size 3225 (3,2×2,5mm)

The most popular package size today is the 3225 (3.2×2.5mm). A decade has already passed with this size at the top, so the price has already hit the bottom. The market share is gradually starting to decrease. In 2019 it was above 50%, today's level is about 45%. In the future, size 3225

will only remain for low frequencies from 8MHz to 16MHz, which cannot be produced in smaller sizes due to the quartz blank size.

CODICO recommended product:

KDS: DSX321G (Ceramic lid)

TXC: 7V (Ceramic lid) and 7M (Metal lid)

Size 2016 (2,0×1,6mm)

The 2016 size (2.0×1.6mm) is increasing its market share, replacing the 3225 as the predominant size. The 2520 size (2.5×2.0mm) is used less and less because it offers almost no advantage in size, frequency range and ESR value compared to the 2016 size. Many chipset manufacturers are already listing size 2016 crystal units in their new reference designs. Today, its market share is around

25%, prices are already competitive and frequency variety has developed sufficiently. We recommend the 2016 size for frequencies above 24MHz.

CODICO recommended product:

KDS: DSX211SH (Metal lid)

TXC: 8Y (Metal lid)

Size 1612 (1,6×1,2mm) and 1210 (1,2×1,0mm)

Smaller sizes than the 1612 (1.6×1.2mm) are still in an early stage in Europe. Main applications are mobile phones and wireless modules produced in China, and these markets are nowadays shifting their volume to the 1210 size (1.2×1.0mm).

32.768kHz/ Tuning Fork Crystals

Size 3215 (3,2×1,5mm)

The 3215 size is still the high-runner for all applications, from small size communication modules to big size control units. The last 3 years (2020-2022) were a period of very strict production allocation, which started a rethinking process in the market toward smaller sizes. The most important questions are, how quickly this replacement will take place and what will be the next preferred size.

The first question is difficult to answer. Big customers are already considering smaller sizes for new projects, which also increases the pressure on manufacturers to improve their production in terms of capacity and economic efficiency. How long the overall process will take is still not foreseeable, but a clearer picture will emerge in the next couple of years.

It is a little bit easier to guess what the next preferred size will be. The miniaturization trend is also relevant for tuning forks, so the direction is clear.

Size 2012 (2,0×1,6mm)

The next smaller size after 3215 is 2012, although customers tend to skip it. The reason for that is simply the 1610 size, which has already been established in the market for nearly a decade.

The mobile phone and consumer electronics market creates the biggest demand for tuning forks. In these applications, size and reasonable cost are the most crucial criteria. Since size 1610 has already achieved a stable supply, the main

difference between 2012 and 1610 is the ESR value. This difference is very small indeed, so there is no longer any reason to stick to the 2012 size.

Size 1610 (1,6×1,0mm)

Due to the aforementioned factors, global demand for size 1610 is on the rise.

Our two main suppliers, KDS and TXC, have also seen the signs and more than doubled their production capacity in last 2-3 years. Not just these two major suppliers, other suppliers also followed the trend. However, we have not yet heard from a supplier that increased their capacity for the 2012 size.

The price level of the 1610 size has also dropped in recent years. One reason is the strong allocation of the 3215 size, resulting in a higher price for the 3215 size to balance the market. Instead, many customers started to adapt size 1610 even for existing projects, so the production capacities for 1610 size were ramped up again, leading to the price decrease.

CODICO recommended product:
 KDS: DST1610A, TXC: 9H T12

Oscillators

Size 3225 (3,2×2,5mm) and 2520 (2,5×2,0mm)

These sizes are now the standard for SPXO (Simple Package Crystal Oscillator). It's up to the individual supplier to decide which size they want to focus on. My impression is that the 3225 size is more suitable for the industrial market, whereas the 2520 size is better suited for the automotive market. For TCXO (Temperature Compensated Crystal Oscillator), the standard size today is 2520, especially for GPS/GNSS applications in Europe.

Size 2016 (2,0×1,6mm)

For both SPXO and TCXO, the next package will be size 2016. Before the allocation, the shift was slower than for MHz and 32kHz crystal products, because customers did not want to change the existing design. However, the allocation also affected the trend regarding oscillator size. There are fewer benefits for sizes 2520 and 3225 compared to the 2016, as most of the specifications come from the IC in the oscillator. Nowadays, major customers tend to use size 2016 in their new projects. Therefore, the 2016 size will gradually



SUMMARY

- MHz crystals accelerate the size shift from 3225 to 2016, skipping size 2520
- 32kHz crystals finally started to shift from 3215 to 1610, skipping size 2012
- SPXO and TCXO oscillators (for GPS/GNSS) will be combined in a 2016 size

become more important in Europe in the coming decades.

CODICO recommended product:
 KDS: DSO211SXF (CMOS output SPXO), DSB211SDN (TCXO)
 TXC: 8N (CMOS output SPXO, DSB211SDN (TCXO)

Size 1612 (1,6×1,2mm)

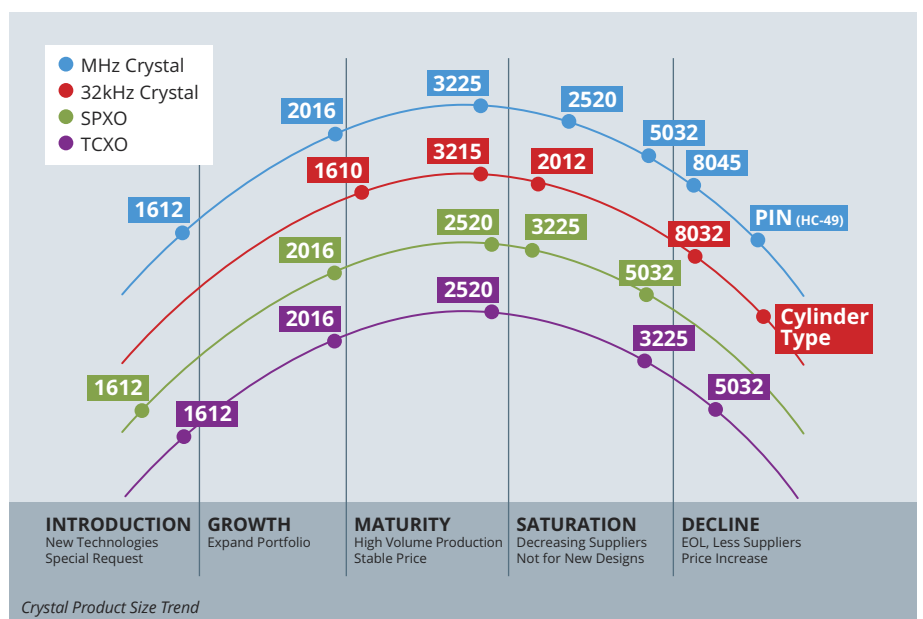
It is too early to use SPXO on a wide range, so we recommend using this size only for applications that offer a small mounting area.

One of the most popular applications using TCXO is mobile RF. Therefore, size 1612 TCXOs or even smaller are in high demand in this market. Mobile RF chipsets incorporate technical innovations that also make use of the temperature compensation function used in TCXOs. For this reason, these chipsets require TSX (Temperature Sensing Crystal), which contains a crystal blank and a temperature-sensitive thermistor instead of TCXOs.

There are some question marks regarding the direction of the TCXO market. Nevertheless, TCXO is an easier and more accurate solution compared to the technology using TSX. Therefore, TCXO will continue to be used in GPS/GNSS and other high-precision clock applications.

If you have any questions or requests for your design, please contact

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INDUSTRY 4.0 CONNECTION

Industrial Ethernet Connectors

Amphenol
COMMUNICATIONS SOLUTIONS

The focus of Industrial 4.0 is on intelligent machine-to-machine communication, robotics, and automation through faster and smarter networks. This is made possible with high-speed industrial Ethernet connectivity.

ix Industrial™ connectors enable IoT connectivity for Ethernet and other Industrial protocols through all levels of an operation from the Enterprise/Cloud to the sensors/actuators on the factory floor. It supports Ethernet/IP and common protocols including Profinet, DeviceNet, EtherCAT, Modbus, and others.

Looking for extra high durability in an IoT connector? Two new options have recently become available for AMPHENOL's ix Industrial™:

ix Industrial™ Magnetics Connector

ix Mag Series connectors offer CAT6A performance for up to 10Gb/s Ethernet communication, support PoE++ up to 90W as defined by IEEE 802.3bt, and shield for excellent EMC immunity. These connectors are compatible with 100BaseT, 1000BaseT & 10GBaseT.

- ix Industrial™ solution with integrated magnetics
- High data rate performance for 10G Ethernet, with PoE++ capability as per IEEE 802.3bt
- External tabs option for EMI shielding
- Robust 2-point metal latches for secure mating
- Field terminable IDC plugs provide installation flexibility
- Fully mateable with ix Industrial™ plugs from other authorized vendors



ix Industrial™ Magnetics Connector

ix Industrial™ IP67 for rugged applications

The ix Industrial™ IP6X Rectangular Push-Pull connector and cable solution provides Cat6A Ethernet connectivity using the IEC 61076-3-124 mating interface, and full sealing to IP65, IP66 and IP67 specifications. With its two-stage locking latch it engages to prevent unlatching for extra security.

Intended for use in industrial ethernet applications requiring additional environmental protection, it is suitable for any indoor and outdoor rugged/harsh environments.



ix Industrial™ IP67

- Weatherproof - IP6X, UV resistant
- Push-Pull positive locking latch
- Small, lightweight, ergonomic form factor
- Field terminable plug kits or pre-made cable assemblies
- Mates with standard IP20 Industrial™ receptacles, also from other authorized vendors

With the introduction of several new Ethernet standards, factory automation programs utilising Industrial Internet of Things (IIoT) connectivity now has expanded capabilities to communicate in the same language from sensors and input devices, all the way up to the cloud. Whether the requirement is for a single twisted pair up to 1km away (10BASE-T1L), or a 10GBASE-T connection (Cat6A) carrying real time inspection data over a four pair connection, AMPHENOL has a full range of Industrial Ethernet connectors to reliably help carry the load.

They offer a range of interconnect and cable assembly products which support Power over Ethernet (PoE) or Power over Data Line (PoDL), so that remote devices can be powered through the same connection that carries the signals.

S01

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Amphenol
COMMUNICATIONS SOLUTIONS



FloatCombo™

High Speed High Current

FloatCombo™ 0.50mm floating board-to-board connectors with power pin.

AMPHENOL's FloatCombo™ is a 0.50mm pitch floating board-to-board connector. This system is designed for applications that need high current and are limited in space. With its small pitch it saves space due to the reduced PCB footprint. The floating range is in X,Y-and Z-direction and is depending on the stacking height. The connector series is equipped with an independent power pin which supports 5A current per pin (power pin*4) and provides a high-speed transmission performance of up to 10Gb/s or 16Gb/s.

- High Speed transmission:
 - 10Gb/s @ stacking heights ≤15mm
 - 16Gb/s @ stacking heights >15mm
- Current rating up to 5A per power pin (5A/pin* 4)
- Wide operating temperature from -55°C to 125°C (including T-Rise)
- Floating range:
 - Stacking height ≤15mm: X,Y±0.60mm, Z±0.50mm
 - Stacking height >15mm: X,Y±0.80mm, Z±0.60mm

The FloatCombo™ can be used in automotive applications such as infotainment or powertrain as well as in industrial, consumer and medical field.

S02

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VIBRATION-PROOF

BergStak® 0.40mm Board-to-Board Connector



©Amphenol/Chor

AMPHENOL's BergStak® 0.40mm is a compact board-to-board connector on 0.40mm pitch with stack heights of 1.5mm and 4.0mm with 10 to up to 100 positions.

The lock feature on header contact for low pin count (10/20/24/30/34/40/50) provides high connection reliability. This works together with self-alignment features making the family also friendly for FPC applications. Shock-absorbing ribs on the housings make this connector highly

suitable for high vibration applications. The connector passed the USCAR-2 V2 shock and vibration test. BergStak® 0.40mm supports signal

speeds up to 16Gb/s (complies USB/PCIE/DP protocols) and can be soldered on FPC for flexible board-to-board connections.

S03

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FEATURES		BENEFITS
Fine pitch of 0.40mm	◀ ▶	Space-saving solution with small size, low weight, and high reliability
Various stack height and position combinations	◀ ▶	Application flexibility
Contact lock feature	◀ ▶	Provides tactile feedback during blind mating
Shock-absorbing ribs	◀ ▶	Withstands high level of vibration
Misalignment feature	◀ ▶	Ensures reliable and secure mating
High-speed performance of 16Gb/s (PCIe®/USB)	◀ ▶	Supports High-speed applications
Additional fix tap on the header	◀ ▶	Offers higher PCB retention force

PCIe® GEN 6

Mini Cool Edge IO Connector

Next-generation high-speed interconnect solution – up to 64G Pam4 for PCIe® Gen 6

AMPHENOL introduces the next-generation OverPass™ solution – Mini Cool Edge IO. The 0.60mm pitch connector comes with a slim form factor design, capable of transmitting high-speed signals up to 64G PAM4/PCIe® Gen 6 and allowing much greater signal path lengths while maintaining SI performance when compared to conventional PCB routing methods.

Supporting both cable and card edge applications with one connector 85Ω impedance, and various pin number options meeting PCIe®/NVMe/SAS specifications, the GH01 is a high-speed connector that provides flexibility in system design to meet the modular, scalable, and easy-to-repair requirements of enterprise server solution providers.

Mini Cool Edge IO not only provides a SI performance-ready signal transmission but also a new way of system design that is cost-effective, highly modular, scalable, and extremely easy to repair.

Product Availability

PCIe® Gen 6 Mini Cool Edge IO standard product offering of 74-pin 8X right angle and 74-pin 8X vertical connectors are now available along with options for customised features.

Product samples of 124-pin 16X vertical and 38-pin 4X vertical connectors are available.

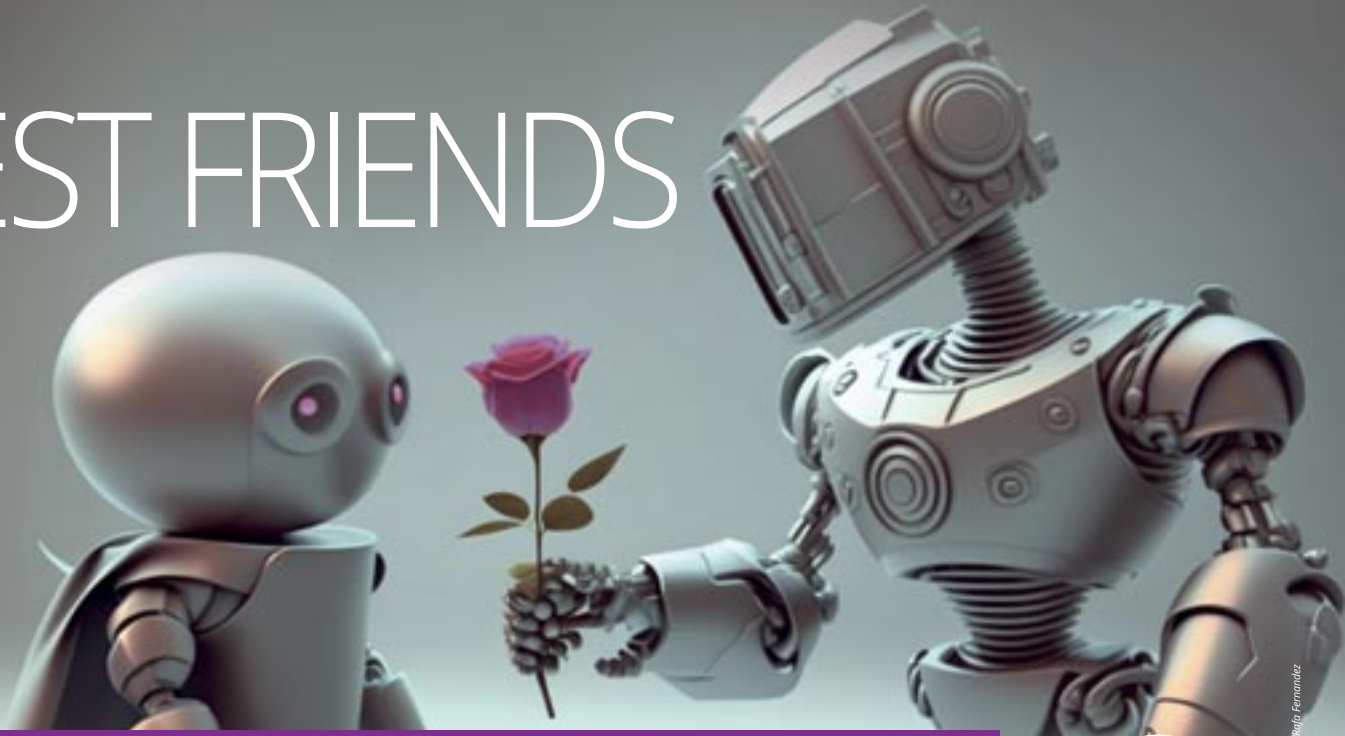


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FEATURES		BENEFITS
0.60mm pitch, vertical and right-angle configurations	◀ ▶	Slim form factor for compact data center system designs
Up to 64Gb/s PAM4, PCIe® Gen 6, over 1.0 meter transmission distance	◀ ▶	Extends transmission range far more over the conventional PCB routes
Supports both cable and card edge applications with one identical connector	◀ ▶	Provides flexibility in system design to meet highly modular, scalable, and easy-to-repair requirements
85Ω impedance and various pin number options – meeting PCIe®/NVMe/SAS specifications	◀ ▶	Saves system material cost, engineering, and certification expenses with a high succession of system design

BEST FRIENDS



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Optimise your Application with FFC-Cables and Connectors from CVILUX



CVILUX, a long-standing and renowned manufacturer, produces FFC cables and connectors in one location! When it comes to matching these products perfectly, CVILUX is the right choice!

CVILUX achieves the optimum design of FFC cables through contact numbers from 3 to 50 poles and the choice of individual lengths, as well as pitch dimensions from 0.5 to 2.54mm. Tin-plated or gold-plated surfaces are available for the mating area. Furthermore, this is reinforced with a PE tape. Temperature-resistant insulation materials allow the FFC cables to be used for a wide temperature range from -40°C to +125°C.

Foldings, according to customer requirements, achieve that the cables fit perfectly into their application. For applications that require additional locking, CVILUX offers FFC cables with latching tabs. CVILUX FFC cables are UL certified. Production according to TS 16949 is also possible on request.

This product group is rounded off with the matching FFC connectors. The range includes contact numbers from 3 to 50 poles, pitch dimensions from 0.5 to 1.25mm as well as straight and angled variants. For the solder connections the choice between SMT and THT is possible. Furthermore, FFC connectors are available in different heights.

Optionally, these are also available in halogen-free material, making them suitable for operating temperatures -40°C to +125 °C.

FFC connectors from CVILUX are ROHS compliant and meet the current REACH regulations. The CODICO team will be happy to answer any questions you may have.

S05

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FFC CABLES	FFC CONNECTORS
Individual number of contacts and lengths	Number of contacts 3 to 50 pins
Pitch from 0.5 to 2.54mm	Pitch from 0.5 to 1.25mm
Mating area tin or gold plated and reinforced with PE tape	SMT or THT
Temperature range from -40°C to +125 °C	Different heights
Individual foldings	Halogen free material optional
Interlocks / side catcher possible	ROHS and REACH compliant
UL certified and produced according to TS 16949	



DINKLE's 0150 SERIES



Pluggable Terminal Blocks for High Voltages

The 0150 series from DINKLE was specially developed for industrial applications and scores points wherever high currents and voltages have to be switched reliably and in the smallest of spaces.

An absolute milestone of the series is the unrestricted UL rating of 600V (1000V according to IEC) for cable connectors and PCB sockets in 6.35mm pitch. The pluggable terminal blocks are also available in 5.08mm and 7.50mm pitch sizes. The connectable conductor cross-section range extends from AWG 24 to AWG 12 and allows currents of up to 20A.

Thanks to the modern push-in connection, wiring can be carried out in a time-saving manner and without the use of special tools. The tulip-shaped design of the contact spring in combination with the flat contacts in the PCB socket ensures a high level of contact reliability. The cable connectors are available optionally with cable outlet parallel or 90° angled to the PCB. The innovative locking latch allows quick insertion and removal and ensures a robust connection even under strong vi-

brations. Supporting pins on both sides provide additional stability of the terminals on the PCB. The positioning of the retaining clips at the lower

edge of the connector enables a compact and space-saving housing design.

Typical applications for the 0150 Series from DINKLE are motion controllers and servo drives.

S06

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SMALL & HEAT-RESISTING

HIROSE's FH75 Series: FPC/FFC-Connector with 2mm Height

HIROSE has introduced a new FPC/FFC connector with 2mm height. The FH75 series is ideal for automotive applications and various industrial applications.

The FH75 series connector features an independent two-point contact design that ensures high contact reliability whilst reducing contact failure due to dust intrusion. Furthermore, the new actuator design (Front-flip) with housing side-catchers, increases the FPC retention force

significantly which provides a stable and secured hold of FPC/FFC connection. The FH75 series connector can support the MIPI D-PHY (1.5Gbps) requirement.

Currently, the FH75 series is available in 40 and 60 position contacts. However, various pin count options such as 8, 10, 15, 30, 50, 68, 80 are under development for this series.

Along with the innovative design of FH75 connector it can withstand harsh environment requirements, the adopted material supporting temperatures up to 125°C. This makes the FH75 series connector a unique resistance solution for severe automotive requirements. Also, the connector's design feature provides a visual check for the FPC/FFC tab detection to ensure the complete mating.

The FH75 series connectors are ideal solutions for automotive applications such as LiDAR, ADAS cameras, car navigation systems, Head-up displays, infotainment systems like Smart TV and for industrial applications such as robot camera systems and many more.

S07

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FEATURES

- Contact pitch: 0.5mm
- Height: 2mm
- Contact position: Bottom
- Rated current: 0.5A
- Rated voltage: 50 V AC/DC
- Number of contacts: 40, 60 (8, 10, 15, 30, 50, 68, 80 are under development)
- Temperature range: -40°C to + 125°C
- Mating cycles: 20
- RoHS compliant
- Halogen Free

ROBUST

Wire-to-Board Connector with 1 mm Pitch



HIROSE has introduced the GT50 series, wire-to-board connectors, ideal for automotive applications.

Combining its compact size with 1 mm pitch and 5.97 mm height, HIROSE's GT50 connectors reduce the mounting area in PCB designs. The GT50 series uses gold plating and can withstand operating temperature ranges of up to 125°C. With this heat resistance capability, the connector satisfies the needs of severe automotive requirements.

Even with its compact design, the GT50 series features a terminal lance that prevents the contact coming out from its housing cavity. This enables a retention force of 12N min. by only the »primary lock« (there is no secondary lock on GT50) during the handling operation of the wi-

ring. In addition, GT50 has sufficient locking strength and PCB peel-off strength, making it a robust connector for internal connections.

The 2-point contact is enclosed between two springs to provide a reliable connection by touching both sides of the header contact where the direction of the heat shrinkage is most likely to occur. This improves contact reliability by minimizing the impact of heat shrinkage.

The applicable wire size is 0.08 mm² (AWG 28), about 75% lighter than the 0.3 mm² (AWG 22) size wire that is often used for internal connection in automotive applications.

GT50 series connectors are ideal solutions for Automotive applications such as LiDAR, Head-up Display (HUD), combination lamp, display, array microphone/speaker, electric mirror.

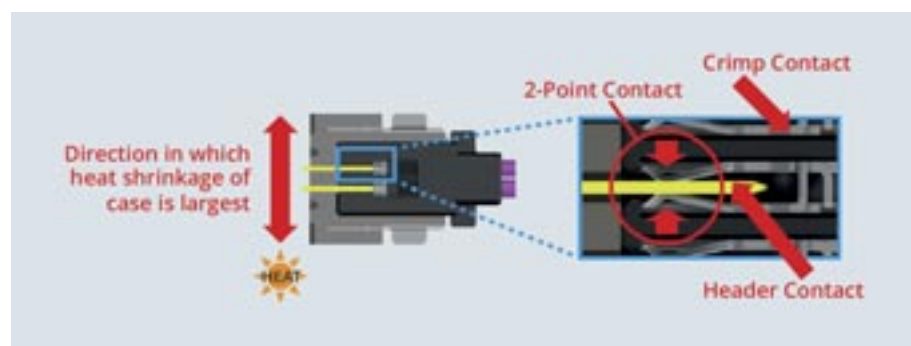
Additionally, other applications such as Automated Guided Robot (AGV), Autonomous Mobile Robot (AMR), and electric tools that are exposed to a harsh environment.

508

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FEATURES

- Contact pitch [mm]: 1.0
- Height [mm] / Depth [mm]: 5.97 / 10.5
- Rated Current [A]:
2 (2, 4 contacts)
1.5 (6, 8, 12, 16 contacts)
- Rated Voltage [V]: AC/DC 60
- Operating temperature range [°C] :
-40 to +125
- Number of contacts: 2, 16
(4, 6, 8, 12 under planning)
- Mating cycles: 10
- Termination AWG: 28
- Contact plating specification: Gold



WATERPROOF & COMPACT

BH12: Recommended for Charging & Power Connection

In recent years, the market for e-vehicles has grown rapidly, and a variety of products have been developed to meet the market demands. As a result, connection methods have changed.

In particular, the connection of drive units is shifting into the device. HIROSE has developed a smaller, waterproof, high-current hybrid connector for power and signal. The BH12 series is a small, waterproof, circular signal and power hybrid connector. It is ultra-compact and lightweight while supporting high currents of 20A on the power contact. BH12 contributes to space

reduction of the end product. The series is equipped with a robust locking mechanism that can withstand strong vibrations. It is used for E-bike battery connection and also ideal for electric wheelchairs and AGV's.

Space-saving

The power contact of the connector is designed to be connected at right angles to the cable. This can reduce the size of the drive unit by shortening the protruding part of the cable, which is usually thicker and has a larger bending radius for the power contacts.

Two variants are available for panel mounting – recommended panel thickness is 6-7.5mm.

Using the **front mount type**, the receptacle is inserted from the front of the enclosure and then wired. The receptacle is fixed with screws and protrudes only slightly beyond the enclosure.

For **rear mounting**, the receptacle is fixed from the rear of the housing. Pre-assembled cables can be attached in advance and no screws are visible from the outside.

Robust locking design to prevent damage and high vibration resistance

The locking spring of the double-ended support design prevents cable entanglement and damage during assembly and transportation. Therefore, the BH12 series is also suitable for use in E-Bikes. Mating is completed by simply pushing straight in. For the unmating operation pull straight out while pressing on the lock spring.

Applications

E-Bike, electric wheelchair, electric stroller, AGV/AMR, drone, LED lighting and any device with charging and power connection.



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S09

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WORK WONDERS

HIROSE: New In-Line Jack Variation Added to the ix Industrial™ Line-Up



HIROSE adds a new in-line jack variation to the ix Industrial™ series. This series is IEC 61076-3-124 standard compliant and a next-generation industrial equipment network connector. Cables can be connected when using the in-line jack with the plug, saving wiring space between devices.

ix Industrial™ was released in 2017 and has been used in a variety of industrial markets such as factory automation, robotics and machine vision. Due to its space-saving and durable design, the ix Industrial™ is used as a connector for data transmission, including Ethernet, by several large industrial equipment manufacturers.

The ix Industrial offers a reduced size of 75% compared to conventional RJ45 modular solutions. This size reduction allows for reduced installation space.

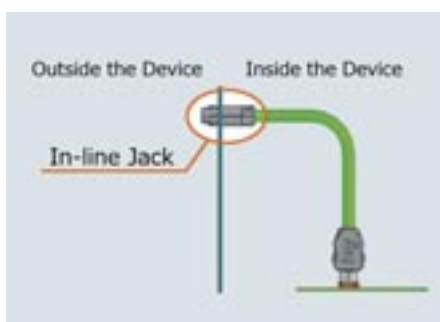
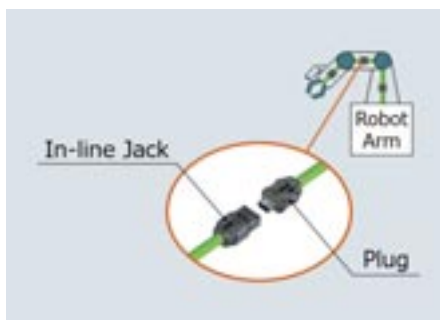
HIROSE released the new in-line jack in response to market needs for space-saving wiring when there is distance between equipment. Cables can be connected when used in combination with the ix Industrial™ plug for simpler, space-reducing wiring. In addition to the in-line connection,

the ix Industrial™ in-line jack supports panel mounting for use as an interface. The cover case accommodates two panel thicknesses of 1.5mm and 2mm for flexibility in equipment design. This new addition to the ix Industrial™ product lineup makes highly flexible wiring possible.

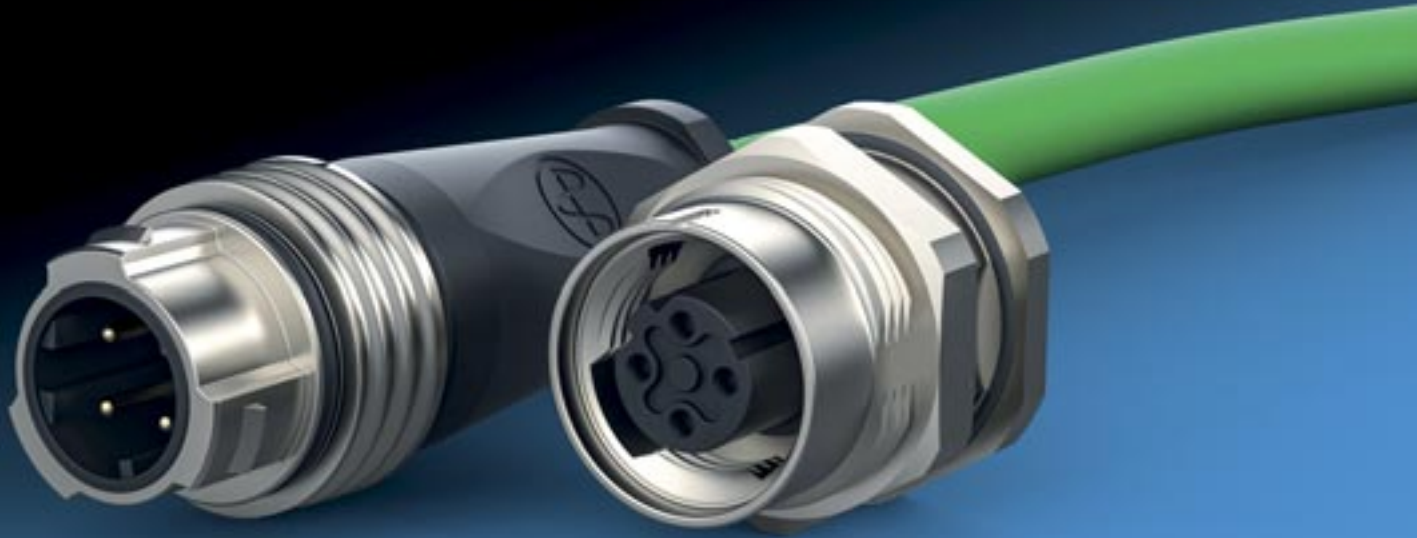
The termination portion of the ix Industrial™ in-line jack is the same size as the IX40G plug, enabling unification of cable selection and processing. The in-line jack supports a wide cable range of 22 to 28 AWG and outer diameter of up to $\varnothing 1.55\text{mm}$.

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NEW STANDARD



M12: Push-Pull Connectors with Inner Locking



The push-pull version with inner locking of the M12 connector from YAMAICHI Electronics is specified in the international standard IEC 61076-2-012. This makes design-ins for M12 push-pull systems possible without having to utilise proprietary solutions.

YAMAICHI Electronics has set a new standard with the M12 Push-Pull with inner locking. The plug on the cable side locks from the inside deep in the device socket via locking hooks. As a result, the push-pull system requires exactly the same installation space as a common M12 connection with screw locking.

With this technology, it is possible to integrate the M12 connector socket completely recessed into the end device, for example the distribution box. The connector socket can still accept conventional M12 connectors with screw locking. Users are therefore not necessarily dependent on a special cable connector and remain flexible.

The system is IP65/IP67 waterproof and uses independent sealing concepts for screw-type and

push-pull connectors. Mixed use of the connector is thus reliably possible. In addition, the connector socket uses a standard O-ring – ensuring the easiest possible assembly and integration.

The locking hooks of the cable connector are on the inside and metallic, so they are optimally resistant to mechanical stress for example by stepping on them when unmated. They are also particularly long and lock deeply into the socket. Thus, the system is guided and is mechanically extremely robust, for example under vibration.

This also offers significant advantages when exposed to torsional loads and rotational forces. All connectors are electrically shielded and ensure electrical performance even at high data rates.

The user benefits from all the advantages of push-pull locking: Significant time savings, miniaturisation, blind and tool-free mating with the easiest handling – and all this in accordance with the proven M12 specifications.

Standard means safety

During the international standardisation process, industry-standard requirements regarding device integration and functionality were integrated and complied with. This ensures perfect cross-manufacturer compatibility, which has already been proven between different manufacturers.

S11

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Y-HDE

The Single Pair Ethernet Series for Automotive

When looking into the future of the automobile, one sees – in addition to alternative drive concepts – above all, autonomous driving as a goal. Already today, driver assistance systems are an integral part of our everyday lives, offering us comfort, safety and reliable service. Inside the vehicle, one thing in particular takes place for this purpose: data exchange.

The data rates that are sent and processed are enormous and the networking of the automobile is one of the most important components of driver assistance systems and autonomous driving systems. The transmission of data must be secure and, above all, fast. Automotive Ethernet makes it possible to transmit these data volumes at high frequencies within the automobile.

Data rates up to 20Gbps

With the Y-HDE series (HF116), YAMAICHI Electronics offers the perfect connectors for this application. The High-Speed Data Ethernet connectors are capable of transmitting data rates of up to 20Gbps.

LV214 and USCAR standards

At the same time, the Y-HDE connector meets all the requirements placed on automotive systems, such as qualification based on LV214 and the USCAR standard.

Mechanical and colour coding

The core of the Y-HDE connector is the differential contact pair, which is delimited by an external contact. In the 90° version, the contacts are continued via a die-cast housing which shields the data. The front insulating body, the so-called coding, is available in a variety of colours. Each colour is also assigned a mechanical coding. Therefore, double security against accidentally plugging in the wrong side of the cable is provided.

Single, double and quad versions

The Y-HDE series is available as a single (i.e. with a differential contact pair), double or quad version. In addition, all versions are available in various colours and mechanical codings.

This allows the customer to make a flexible selection according to the application and the need for signal tracks. The Y-HDE series can be processed fully automatically using the THR process and is supplied in tape & reel packaging.

Of course, YAMAICHI also offers customised solutions for the Y-HDE series, e.g. as a panel version. In addition to the Y-HDE series, YAMAICHI Electronics has other I/O connectors for data transmission, such as HSD, Fakra and MiniFakra connectors in their portfolio.

S12

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NEW TOP SUPPLIER FOR FANS

Established in 2005, STK Fan is a high-tech AC/DC/EC fan company offering optimised thermal solutions with professional technology, fast delivery, competitive prices and trustworthy service.



STK Golf axial fans

Mini DC Fans

These miniaturised DC fans have dimensions of only 13x13x5.25mm and very low power consumption. Typical applications are 3D printing pens, micro projectors and portable air purifiers.

Golf Fans

The propellers of these high-performance fans have dimples similar to those of golf balls. This special design allows the airflow to stay in the dimples much longer, creating turbulent flows which generate an air membrane and delay the separation point of the boundary layer to reduce frictional resistance and noise. The Golf fan de-



STK Vane axial fans

Axial Fans

STK axial fans with vane shaped blades feature high static pressure and maximum airflow in a big variety of different frame sizes. They are equipped as standard with a polarity protected, brushless DC motor with automatic restart and a reliable two-ball bearing system.

Rapid availability is also guaranteed if the fans are supplied with a connector already mounted or if special functions such as speed or alarm signal are required. STK axial fans with vane blades are ideal for applications such as EV charging stations, industrial cabinets, telecommunications, networks and high-power medical equipment.

In addition to the standard models, STK offers some innovative axial fans with additional benefits depending on the application.



STK blower fans

sign has been proven to provide optimised performance in terms of pressure and noise levels.

Outer Rotor AC Fans

Following the trend towards energy saving, these fans can be operated with a low nominal current and power consumption. At the same time, they offer high torque and efficiency. Combined with a large metal impeller and small gap to the frame, they ensure stable speed and very good cooling performance. In addition, these fans have high temperature and chemical resistance. They are ideal for use in CNC machines, robot arms and oil coolers.

AC Fans with shaded poles

As the motors of these fans are completely covered and protected by a special housing, they can also be used in very harsh and cold environments. These AC fans are available in various sizes from 200mm to 910mm. Typical applications are air conditioners, refrigerators and dehumidifiers.

Fans with ARGB

»ARGB« stands for addressable RGB. This is an LED lighting technology that allows the user to program the colors displayed on the fan. A fan with ARGB provides a colorful and chic presentation of a chassis, especially in the field of consumer electronics.

Waterproof Fans

By using a vacuum coating, these fans achieve a protection class of up to IP68.

Radial Fans

Available as AC and DC radial fans, STK offers a wide range of high-performance blowers in sizes from 15×15×4mm to 220×244×95mm. These are designed to meet the varying requirements of different applications from electronics, industrial equipment, medical devices, home appliances and many others.

The powerful and reliable blowers are designed with maximum air flow, high pressure and low noise level. Customised blowers can also be supplied on request together with additional thermal solutions to dissipate the heat in the device.

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WEEF AWARD

On the occasion of the World Ethical Electronics Forum (WEEF), CODICO is honoured with the WEEF Award for its efforts on the topics of ethics and sustainability.

The WEEF INDEX and AWARD ceremony for the world's most influential person in the field of ethics and electronics took place in Munich on November, 15th 2022 and CODICO is delighted to be one of the four winners.

»At CODICO, we focus on values. Responsibility, family and dynamism – we exemplify this chain of values as entrepreneurs. The topics of ethics and sustainability are built up and implemented from the bottom up at our company,« emphasised Sven Krumpel, CEO, at the award ceremony. CODICO, an international design-in distributor, is involved in many projects that focus on sustainability: Power Management, E-Mobility, Renewable Energy. For this very reason, Sven Krumpel is pleased to accept this special award: »We make a significant contribution here in our daily work and are really proud of this award.«

In addition to its merits in project work, CODICO offers its employees the CODICO Central Park, which extends over more than 12,000m² in an open space directly adjacent to the office building. The park not only serves as

a place of tranquility, but above all provides a healthy habitat for people, plants and animals. An important component of the overall concept is corporate farming. CODICO offers cultivation areas for their employees that may be cultivated individually.

The World Ethical Electronics Forum WEEF provides a platform and analyses ethical issues for people and companies in the high-tech industry – with a focus on electronics and information technology. It advocates for sustainable discussion, awareness and practical implementation of the topic. Independent ethics experts have their say, as do people from research and teaching, from NGOs and associations and from companies.

Further information: www.codico.com
<https://www.elektormagazine.com/weef>

D02

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Johann Wiesböck presents the award to Sven Krumpel.

The CODICO TEAM says hello!



Peter Ullrich

Dear readers, it's a pleasure to have the opportunity to introduce myself. I have been working as an assistant in Product Management for Active Components at the company headquarters in Perchtoldsdorf for almost five years. My tasks include managing the sales and distribution processes of our partners, and processing POS data.

After graduating from the University of Vienna, I was in charge of data curation in a large multinational company before I found a new work home at CODICO. The friendly climate, the respectful behaviour towards others, and the endeavours of the management to advance the company in every respect without losing sight of the well-being of the employees bring a smile to my face when I look back.

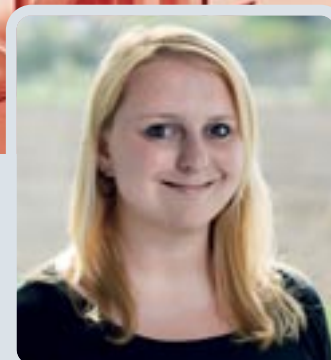
Of course, it takes considerable effort to tackle the sheer range of different crises – a seemingly never-ending pandemic and the allocation of semiconductor components, just to name two – but, as you know, even the greatest challenges can be managed together.

In my free time, I appreciate a good book, I enjoy walking through the park around the Schönbrunn palace with my partner, not even a ten-minute walk away from our flat, or I relish the quaint atmosphere at the grounds of a minor-league soccer club. When I feel like getting a bit more excitement, my first port of call is the Weststadion in Vienna's Hütteldorf district.

Music also plays a major role in my life. I like to attend festivals and rock concerts, I get together with friends to play music, and find great pleasure browsing through flea markets and fairs in search of vinyl records. Yet I won't say no to a good opera performance either.

D03

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Katharina Stummer

Dear Impulse readers, I have been part of the CODICO family for over five years, and today I would like to introduce myself to you. After my final exams at the secondary vocational school for tourism and commercial professions, I first took up a job in a travel agency, where I planned the dream holidays of countless customers for the next 10 years. It was a great start into professional life, and also gave me the opportunity to see a lot of the world. In my final years as a travel agent, I also put together my own group tours, which I would also accompany as a guide – and that was a different experience altogether.

Despite of it all, I felt the need for a change, something new outside the tourism industry. This is what brought me to order processing at CODICO. First, I was in charge of our customers in parts of Germany, in Switzerland, the Czech Republic, Slovakia, and Slovenia. Due to Covid-19 and the resulting market developments, the last couple of years have been a challenge, albeit one we could tackle very well as a team. In June last year, I was eventually put at the helm of Order Processing.

What impressed me from the very beginning at CODICO was the huge appreciation shown towards all employees. This is something truly special and, above all, not self-evident. Moreover, the company puts a great emphasis on solidarity – we all work together very closely across different departments to find solutions, and it's a pleasure to come to the office every day. Next to my varied daily work routine, I like to spend my free time with friends and family. We are a very large family: I have four siblings and, meanwhile, a couple of nephews and nieces as well, so there's always something going on! I love standing in the kitchen for hours, preparing whatever menu comes to mind. For me, the more guests sit around my table, the greater the pleasure of cooking.

When I am not busy in the kitchen, I head for the outdoors – cycling, hiking, skiing, or just a long walk through Perchtoldsdorf's vineyards. Fresh air and exercise help me quickly clear my mind of stress. During the summer months, I regularly spend my weekends at the wonderful lake Attersee in the Salzkammergut region, where friends of mine have a holiday home. Yet once a year I head south, my most preferable destination being the Greek islands. Tzatziki, a few olives, a lot of sun and a glass of wine – that's my definition of holidays.

I am very happy to have found my place here at CODICO, and I am very excited to see what the future holds in store. Feel free to contact me anytime if you have any questions or need further information.

D04

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Jürgen Sommer



Dear readers, my name is Jürgen Sommer and I am 55 years old. I've been working at CODICO for the last five years, and last year I got married. I live in Bödingen, a town near Stuttgart. My career in electronics began with a training course in radio electronics at the venerable AEG in Ulm. Towards the end of my training, there was already a lot of debate as to what should be my next step. To be honest, I wasn't harbouring any great ambitions to study at the time, yet I eventually did become inspired by a colleague of mine. So I took a second chance on education, did my vocational baccalaureate diploma, and began a university course in telecommunications. Already during my studies, I was determined not to end up as a development engineer in a laboratory, but to have contact to other people on a daily basis. Therefore, I improved my foreign languages and already began sharpening my skills in sales with elective subjects at the technical college. I then began working at a distributor in Stuttgart, and I have stayed loyal to electronics to this day. Five years ago, I received a call from a former colleague. He had been approached because of a vacancy at CODICO, but he had recently switched jobs and was not available at the time. Since he thought the time was ripe for me to try something new after 25 years with the same employer, he recommended me for the position. I then received an invitation for an interview in Perchtoldsdorf. I still remember as if it were yesterday. I was the first to arrive at the premises, so I stood before closed doors. A kind soul then opened the door and provided for me in a meeting room. Sven Krumpel was also up and about early that day, so he was the first one to look after me. What followed was an intensive, in-depth, and long interview that ended after 7 hours, when the nice lady from the front desk told us for the third time that the taxi was waiting outside, and that I would miss my flight home if I didn't board it immediately. We talked about anything and everything, and I quickly felt very much at ease, realising that CODICO's values were pretty much identical with mine. From there on, things went quite fast. CODICO sent me a contract, so I had a decision to take. At this point I wish to sincerely thank Sami Lamchaouri, whom I knew and appreciated from our time together at my previous employer. He always had a friendly ear for all my questions and doubts.

I am very happy to be part of the CODICO family and to be looking after our customers in Baden-Württemberg. Home office remained a challenge for me for quite some time. I missed the personal contact to colleagues and the talks over a cup of coffee in the kitchen. Meanwhile, I've adapted quite well to the situation, and also learned to appreciate the advantages. I like to spend my free time with our two cats, cycling, cooking, and travelling. We are currently planning our next trip to Porto and the Douro Valley in Portugal. Good food and drinking together with friends is also among our top favourites. Moreover, I have been interested in business topics and stocks for several years now. We still have some vacancies – seize your opportunity and join us!

D05

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Claudia Gotz

My name is Claudia Gotz and I have been part of the back-office sales team at Interconnect Systems since June 2018. In addition to Germany as my main area of responsibility, I also cater to customers in countries such as Switzerland, Great Britain, and France. I find great pleasure in working with customers, suppliers, and colleagues, and I especially enjoy finding solutions to ever new challenges.

I have been at the head of my team for two years now. I find this position hugely rewarding, because I greatly appreciate working and being in contact with other people. I may not manage to solve every problem, but I will always lend a friendly ear and take every concern seriously. I am very proud of my team and I extremely appreciate the strong solidarity we've shown through all the highs and lows. Yet even in difficult times, we never forget to have a fair share of fun. So, in a nutshell, I am very happy at CODICO, and I enjoy being part of this company with its many social benefits and events. Since I have had the opportunity to experience various other companies, I am well-positioned to draw a comparison, and I can safely say that »the work environment at CODICO is just right«.

Now a few lines about my private life. I love travelling, especially in Europe, and I feel attracted to both the cold north and the warm south. Norway, Scotland, Ireland, Italy, and Greece are admittedly my absolute favourites. Already as a child, I regularly spent part of my summer holidays on various Greek islands. They have such a relaxed, cosy atmosphere - the perfect place for recreation. Meanwhile, I can almost safely point to Norway as my favourite travel destination, because it's a country offering fascinating impressions all year round. I have already marvelled at the midnight sun on the Lofoten Islands and at the Northern Lights in Tromsø.

My sporting activities include running, spikeball, and hiking. I simply enjoy being in the outdoors. Even gardening on the roof terrace with an after-work drink helps me find a sense of inner balance. Moreover, I can find peace and a break from the daily grind buried in a good book. It often happens that I spend many hours reading, quickly coming to the end of a book I had just started. Music also means a lot to me, and is an indispensable part of my life, be it at home on my couch or at a live concert. I will often embark on a very long trip to a remote location just because my favourite musicians are staging a concert there.

My interests also include history and culture, and Vienna offers a wide range of opportunities to live out both passions. You will often find me in museums, exhibitions, and in the (English) theatre. Moreover, I like to test my logical thinking and my knowledge in escape rooms and board games.

My work at CODICO is as multifaceted as my private life, so I am looking forward to many more fulfilling years. I wish to close my introduction with a classic Austrian »Auf Wiedersehen«, it's been a pleasure!

D06

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