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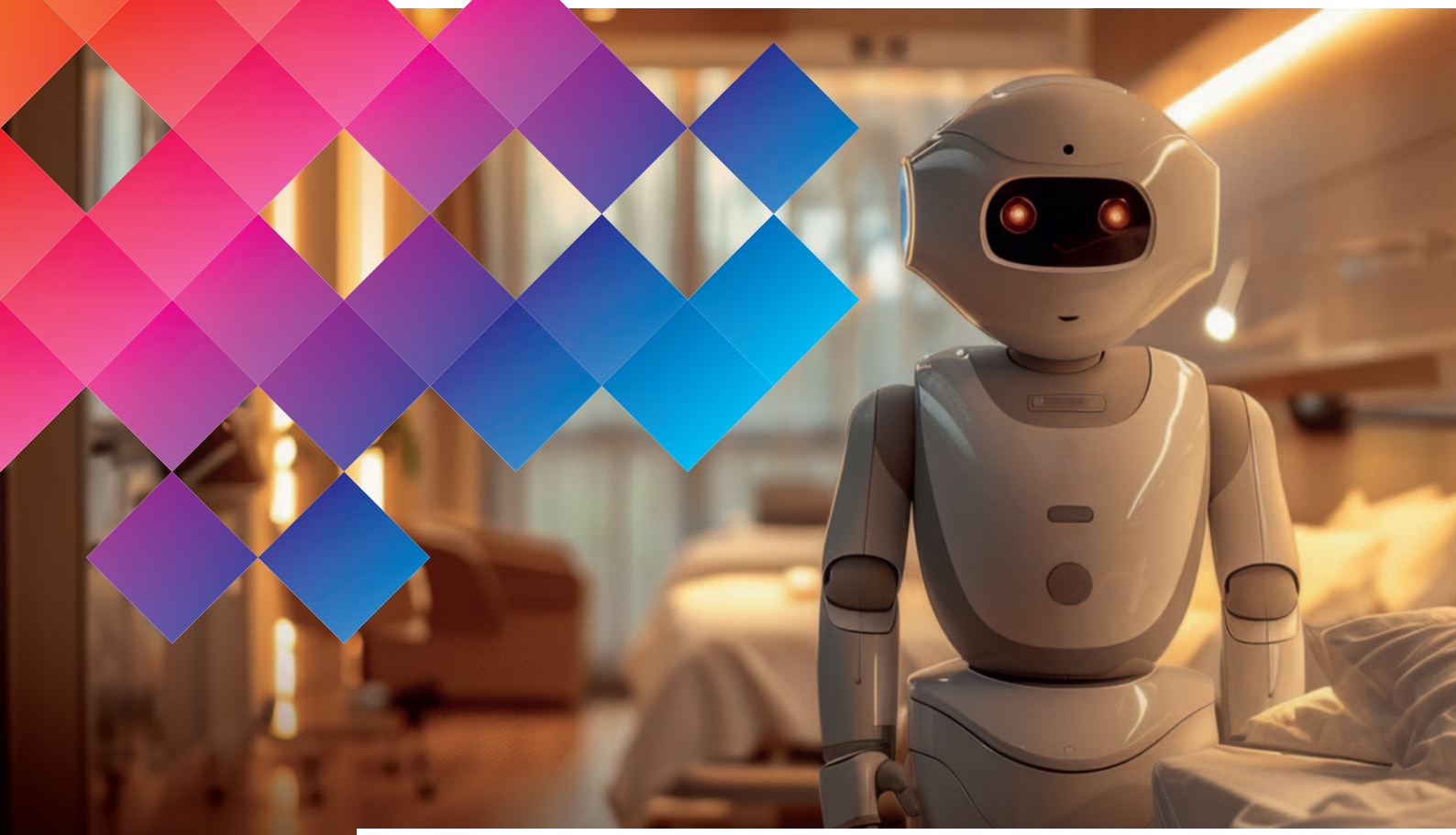

MPS: The Future of Work

TCXO Developments & New KDS Series

High-Performance Connectors from TECHNO

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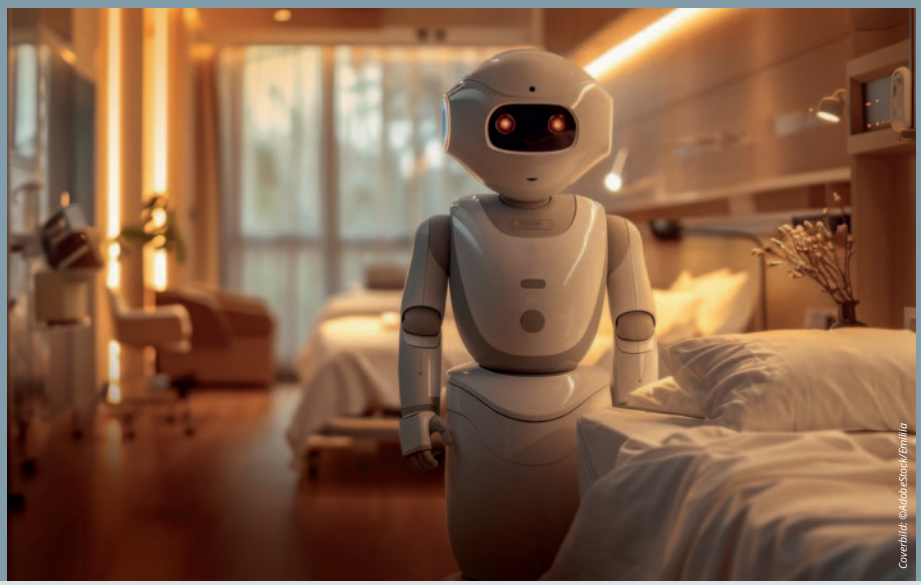

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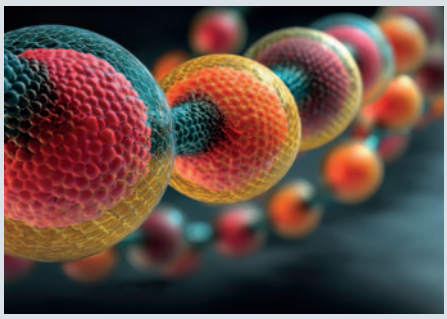
ACTIVE COMPONENTS



PASSIVE COMPONENTS

CONNECTORS

CODICO IN-HOUSE

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Why It Shouldn't Be Taken for Granted

Operating a Quality Management System (QMS) is no longer a novelty in the business world. The ISO 9001 standard has been established for many years and is considered the norm in our industry. For many of our customers, a valid certificate is a basic requirement for collaboration.

However, in a world where alternative facts are on the rise, lived quality takes on a new significance. A vibrant management system thrives on people who are committed with passion and responsibility to continuous improvement.

As an internationally active family business with employees from 18 nations, we place particular emphasis on understanding others. The diverse cultures of our team enrich our daily work.

Our long-term business success is built on the expertise of our employees, systematic error prevention, and a dedication to constant improvement. Forward-looking risk assessment and an open error culture help us identify issues early, analyze their causes, and implement effective solutions.

Since May 26, 2025, we proudly hold our current ISO certificate – and it is more than just a three-year extension. It is a visible sign of what we have achieved together.

Together, the CODICO team shapes progress.

Editorial

Karin Krumpel
CEO CODICO

Courage is the Beginning of Future

Dear Readers,
Looking back over the past years, one thing stands out above all: change.

The electronics industry is dynamic, innovation-driven, and full of opportunities. What drives us every day is constant progress – new applications, evolving markets, and ever-shorter innovation cycles. Especially in turbulent times, we see how resilient, inventive, and adaptable our industry truly is.

And within these developments lies our strength: at CODICO, we have learned that true stability requires dynamism. Long-term success demands a willingness to explore new paths – with foresight, but also with the courage to make decisions.

We are living in a time when technological advances such as AI, IoT, and sustainable energy systems are redefining many areas. For CODICO, this means not only responding flexibly to change but actively shaping the future with forward-looking technologies and strategic thinking. This role is demanding – but also meaningful. It requires people who understand technology and are ready to take responsibility and shape the future.

As a leader, I rely on three pillars: knowledge, digitalization, and partnership. Knowledge enables well-founded decisions. Digitalization serves as a tool to make processes more efficient and future-proof. Partnership means working together on equal footing and recognizing potential.

I see it as my responsibility to create space where ideas can grow, because innovation arises where people think differently – and then pursue those ideas together. The future belongs to those who shape it: as an industry, as a company, as individuals. This conviction guides us and gives us the courage to shape tomorrow's progress. The future is created through bold and visionary action – today.

Karin Krumpel

CAVLI WIRELESS

The Future of Energy-Efficient LTE IoT Connectivity

CAVLI Wireless develops industrial-grade cellular IoT modules with integrated eSIM and global connectivity. Combined with the CAVLI Hubble™ platform, they simplify modem management and speed up IoT deployments worldwide.

In today's IoT, devices need long-lasting, low-power connections, often in remote areas without grid access. LTE Cat 1bis offers an ideal balance of power efficiency, data speed, and cost. Unlike LTE-M or NB-IoT, Cat 1bis supports real-time data and wider compatibility, making it perfect for moderate data needs and long lifecycles. It's quickly replacing legacy 2G/3G globally.

With single antenna support and integrated eSIM & GNSS, Cat 1bis suits smart meters, fleet trackers, POS terminals, and remote monitoring.

The Evolution of Cat 1bis

Cellular IoT has evolved toward simpler, lower-power, and cost-effective solutions. With 2G/3G phased out and LTE-M/NB-IoT facing regional limits, LTE Cat 1bis emerges as the ideal choice for power-efficient, medium-throughput IoT.

YEAR	MILESTONE
2014	LTE Cat 1 standardized (3GPP Rel. 8)
2016	NB-IoT / LTE-M introduced (Rel. 13)
2017	Cat 1bis launched (3GPP Rel. 14)
2020	Global adoption began
2023	C-Series Cat 1bis modules deployed globally

Table1: Development from Cat 1bis

Introduced in 3GPP Release 14, Cat 1bis improves on LTE Cat 1 by removing dual antenna needs, perfect for compact, battery-powered devices without sacrificing latency or real-time performance.

Why Cat 1bis over NB-IoT / LTE-M?

As legacy networks phase out, LTE Cat 1bis offers OEMs a global, cost-effective solution with simplified single-antenna design – balancing coverage, cost, and performance for future-ready IoT devices (see Table 2).

Powering Global IoT: CAVLI C-Series

The CAVLI C-Series brings together a robust portfolio of LTE modules engineered for scalable IoT deployments across industries. Designed with a focus on low-power performance, global operability, and seamless cloud integration, the C-Series simplifies product development while accelerating time-to-market for OEMs worldwide. With integrated/in-built GNSS, eSIM support, and edge processing capabilities, CAVLI's C-Series modules are designed for real-world resilience and long-life field operation.

CQ16: Compact LTE Connectivity for Mass Deployment

The CQ16 from CAVLI is a compact and cost-effective LTE Cat 1bis module, perfectly suited for high-volume IoT applications. With its compact 17.7×15.8mm footprint and integrated eSIM sup-

port, CQ16 streamlines product design for applications such as smart meters, asset trackers, and point-of-sale terminals. Its low power consumption and single-antenna LTE design make it ideal for projects migrating from 2G/3G to LTE-grade performance.

C16QS: Versatility in Every Form Factor

Available in LGA, mini-PCIe, and USB dongle variants, the C16QS combines flexibility and performance. Powered by the Qualcomm QCX216 chipset with integrated GNSS and CAVLI Hubble™ platform connectivity via eSIM for remote management. Designed for applications such as fleet telematics, smart utilities, and portable monitoring systems, it enables fast global deployment with low power consumption.

C17QS: Union of Low Power LTE with SDK Capabilities

CAVLI's C17QS goes beyond IoT connectivity with integrated dual-band GNSS and iSIM compatibility. With available SDK support, developers can run custom applications directly on the FreeRTOS-based module, enabling cold chain tracking, predictive maintenance, and remote monitoring without an external host controller. It's ideal for real-time sensor insights and global LTE in a compact module.

FEATURES	NB-IoT	LTE-M	CAT 1BIS
Bandwidth	200KHz	1.4MHz	1.4MHz
Downlink Peak Speed	127Kbps	1Mbps	10Mbps
Uplink Peak Speed	158.5Kbps	1Mbps	5Mbps
Duplex Mode	Half Duplex	Full or Half Duplex	Full Duplex
Frequency Deployment	In-band, guard-band, standalone	In-band	In-band
Number of Antennae	1 (SISO)	1 (SISO)	1 (SISO)
Cells Capacity	50,000-100,000 devices per cell	1,000 devices per cell	1,000 device per cell
Data and Voice	Data only	Data and Voice *Capable of voice if there is a VoLTE license.*	Data and Voice *Capable of voice if there is a VoLTE license. Data also supports video.*
Mobility	Limited	Full mobility and handover	Full mobility and handover
Module Cost	Relatively lower cost	Relatively higher cost	Relatively moderate cost
Coverage/Penetration	Great coverage and indoor penetration	Moderate coverage and indoor penetration	Moderate coverage and indoor penetration
Roaming Capability	Technically possible, but non-existent in reality	Good roaming availability	Good roaming availability
Use Cases	Fits in static monitoring applications where a low data throughput is required	Best for tracking and mobility applications with moderate data transmission requirements	Best for tracking and mobility applications with higher data transmission requirements

Table 2: Advantages of Cat 1bis compared to NB-IoT and LTE-M

Built on the Qualcomm QCX217 chipset, it delivers 50% faster processing, 60% more RAM, and twice the flash storage compared to its sibling module. The SDK support is the key feature on the FreeRTOS platform, allowing OEMs to develop custom applications directly on the module for a cost-effective, all-in-one solution.

The onboard Wi-Fi scanning feature acts as a back-up to GNSS in signal-restricted environments,

©AdobeStock/jonasmaster

FEATURES	CQ16	C16QS	C17QS
			
Processor	ARM Cortex M3 @ 204MHz	ARM Cortex M3 @ 204MHz	ARM Cortex M3 @ 306MHz
Memory	1.25MB RAM + 4MB Flash	1.25MB RAM + 4MB Flash	2MB RAM + 8MB Flash
Operating System	FreeRTOS	FreeRTOS	FreeRTOS with SDK Support
Form Factor (LGA)	17.7×15.8×2.5mm	26.5×22.5×2.3mm	26.5×22.5×2.3mm
GNSS	–	L1 (Independent GNSS)	L1/L1+L5 (Dual band GNSS)
Constellation Support	–	GPS, BDS	GPS, GLO, GAL, BDU, QZSS, SBAS, NavIC
eSIM / iSIM	eSIM	eSIM	iSIM capable
Wi-Fi Scanning	–	available	available

Product overview of the C-Series

generation e-scooters and compact logistics trackers with the versatile C16QS to enabling always-on smart meters and Remote Monitoring applications through CQ16, CAVLI's solutions address the growing demand for low-power, high-reliability connectivity.

The C17QS brings together connectivity and SDK support, enabling devices to run custom logic and process sensor data on their own. This convergence of various form factors, optimized power consumption, and embedded intelligence positions CAVLI's Cat 1bis modules as a foundational enabler for future-ready IoT deployments across energy, infrastructure, and mobility sectors.

A01

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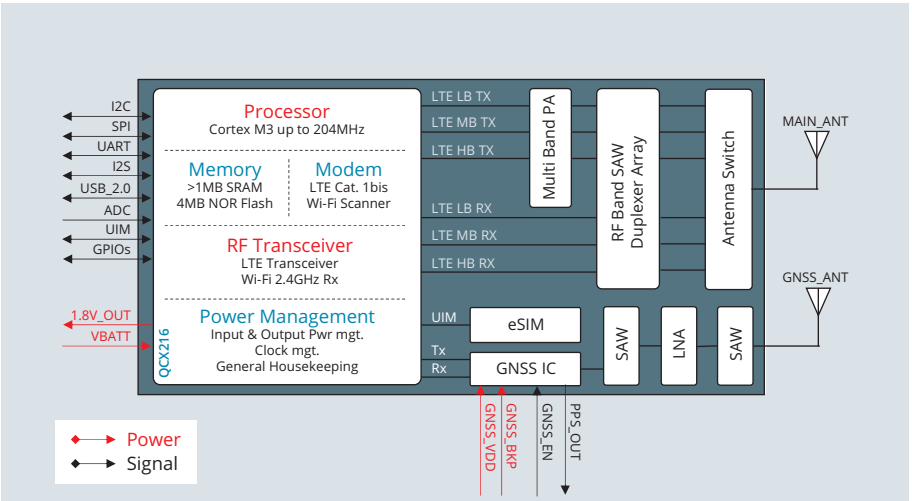
ensuring more reliable asset location. With multi-I/O support (UART, SPI, I²C, USB) and CAVLI's Hubble™ cloud compatibility, the C17QS helps engineers build smart, connected devices at scale, faster than before.

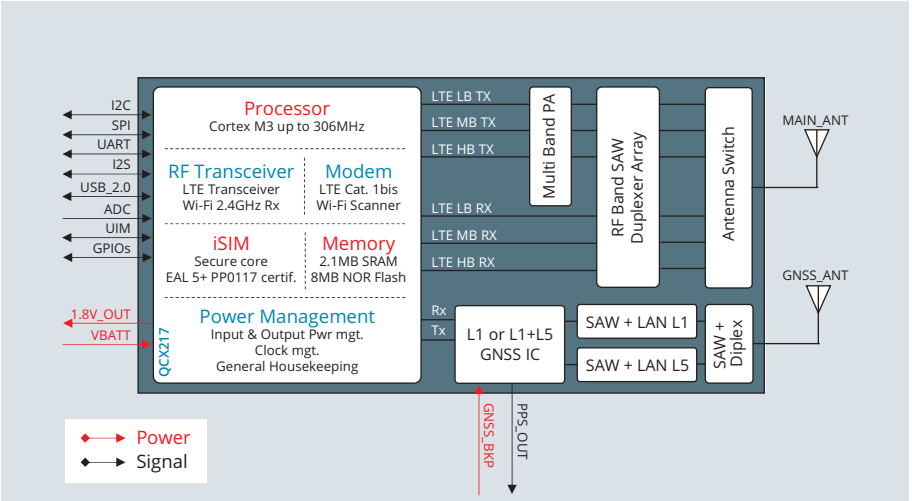
CAVLI modules come pre-integrated with CAVLI Hubble™ for connectivity management, diagnostics, and remote provisioning.

Cat 1bis in Action: Powering the Future of Low Power LTE Connectivity

Cavli's Cat 1bis module portfolio is engineered not just for today's applications, but for the connected world of tomorrow. From powering next-



Picture 1: Block Diagram of C17QS



Picture 2: Block Diagram of C16QS

Why choose CAVLI Wireless?

- In-house design & manufacturing
- Qualcomm-based, globally certified modules
- Hassle-free roaming with integrated eSIM/iSIM modules and extensive partnerships with Telecom Operators
- CAVLI Hubble™ platform for seamless connectivity & modem management
- Trusted by OEMs in 30+ countries

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AG53000

New Cost-Efficient PoE+ PD Module

Silvertel

SILVERTEL announces the launch of the Ag53000 product family, consisting of the Ag53012 and the Ag53024, which are pin-for-pin compatible with Single-in-Line (SIL) module Ag5300 family and offer a more cost-effective alternative.

In addition to all the expected PD module features such as identification, classification, and isolation, the Ag53000 integrates DC/DC conversion to deliver a low-noise, low-ripple, regulated 12V or 24V power supply. With a typical efficiency of 90%, it significantly reduces power loss compared to the Ag5300.

The Ag53000 is a fixed Class 4 PD module which is fully compliant to the IEEE802.3at standard and will output 24W continuous (30W peak) power. The Ag53000's full compatibility in the SIL format allows design engineers to easily replace the older, but still popular, Ag5300. The Ag53000, however, should be considered for all new designs.

As with the previous Ag5300 family, the Ag53000 output voltage can be adjusted to fine-tune the output voltage to your application. It is easily integrated and just as easy to use requiring very few external components to implement an Ethernet-powered peripheral device. With over-current, over-voltage and thermal protection included, this device offers a very robust PD solution.

As with all SILVERTEL products the Ag53000 is designed at their Newport, South Wales, UK headquaters and also manufactured in the UK. Evaluation boards are available from CODICO to support your design process, along with documentation such as data sheets, application notes, samples, and evaluation boards. SILVERTEL's application support team is also available to assist with implementation.

The Ag53000 Is Perfect for Applications Such As:

- Wireless access points / gateways
- Media extenders and converters
- IoT & IIoT applications
- Smart system solutions
- Touch screens / HDMI panels
- Card readers & Access control systems

A02

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SILVERTEL selected A-Supplier for the fifth year in a row by CODICO!

SILVER TELECOM (SILVERTEL) part of discoverIE Group was selected A-Supplier for the fifth year in a row. CODICO's annual supplier evaluation is based on long-term performance. SILVERTEL's excellent technical and commercial support was key to this top rating: off-the-shelf samples, 24-hour design support, and evaluation boards for nearly every product help significantly reduce development time in PoE applications.

The latest SILVERTEL products are available in the CODICO Sample Shop.

Robonode

Qualcomm-Powered Long-Range Communication for Robotics & Drones

Robonode, a Qualcomm Dragonwing™ solution that delivers long-range, low-latency, mission-critical communications for Robotics, Drone and Industrial equipment. It's an all in one, plug and play communications system that incorporates powerful CPU, DSP processing capabilities along with robust low-latency Wi-Fi communications for broadcasting over long distances.

The Robonode solution is the latest fully certified plug and play communications system from our partner 8DEVICES. Robonode is built using Qualcomm's latest SoC and Wi-Fi technologies, it incorporates all of the major components required for communications subsystems in drones, mobile and static robotics systems and industrial equipment. It integrates a powerful quad-core ARM based SoC, the Qualcomm QCS-405 which incorporates DSP processing for codecs as well as a dedicated GPU for video and graphics along with a rich set of external interfaces. The rich processing power in the QCS-405 is complemented by Qualcomm's latest MU-MIMO Wi-Fi6 solution the WNC9074 which was designed for long-range Wi-Fi communications.

Robonode also incorporates a secondary Wi-Fi device, the WCN9380 is a MU-MIMO Wi-Fi5 device and its purpose is to connect high-speed accessories within closer range of Robonode. The ready to deploy system is enclosed in a durable aluminium housing with an integrated ventilator for superior cooling efficiency. For more extreme installations fan fixtures have also been included.

8DEVICES is well known in this market as a communications specialist, and it has optimized the architecture of Robonode to increase the effective communications range and improve the robustness of its Wi-Fi capabilities. Robonode supports dual-band Wi-Fi communications and is configured to deliver an impressive 28dBm RF output power per chain and 27dBm RF output power per chain on the 2.4GHz and 5GHz radios respectively. Additionally, it offers support for 5MHz and 10MHz channel widths which ensures robust communication over longer distances. Other improvements incorporated by 8DEVICES include forward error correction, frequency range and frequency shifting modifications to use non-standard center frequencies to mitigate the effects of interference and congestion. In recent testing in real environments the Robonode effective communication was proven over 15km distances with further range improvements expected in upcoming Robonode software releases.

Robonode

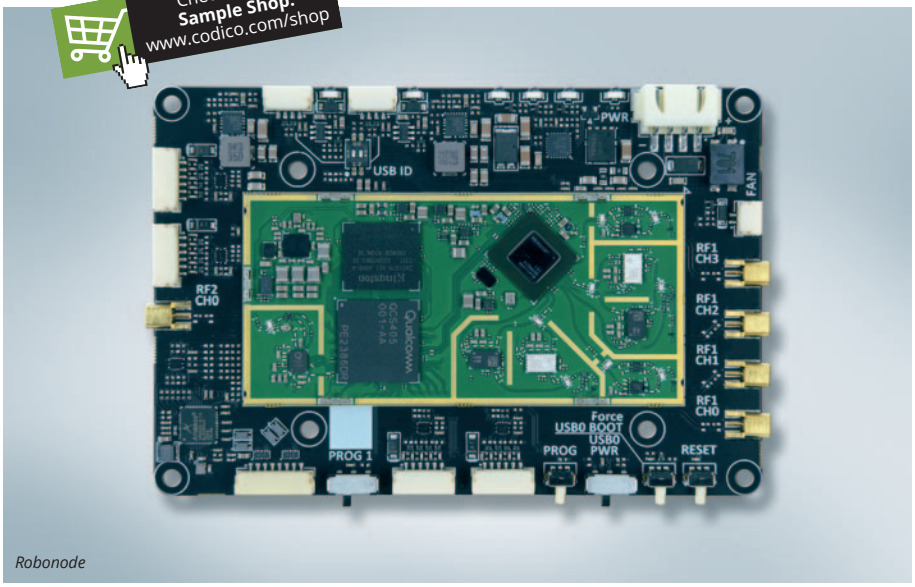
Devices

Access to the compute and communications capabilities of the Robonode are provided by the Robonode SDK which is based on Open Embedded/Yocto leveraging the LTS kernel v4.14. After installing the latest Robonode SDK, access to both Wi-Fi radios is provided by RoboNode API's. Additionally key features such as Wi-Fi broadcast using forward error correction which can be enabled in several different modes to enable streaming audio, video and telemetry between Robonodes installed in Drones, Robots and supporting ground equipment. A full list of the available API's is provided in the Robonode technical collateral.

Robonode Key Software Features

- Wi-Fi broadcast with FEC (Forward Error Correction)
- Narrow channels
- Wide frequency ranges
- Fast frequency shifting
- Easy USB configuration including system updates
- OpenHD support

Check out our **Sample Shop:** www.codico.com/shop



Robonode

Robonode Key Hardware Features

- Processor based on Qualcomm QCS405 SoC
- Qualcomm QCN9074 Wi-Fi6 (802.11a/g/n/ac/ax) 2.4GHz and 5GHz with 2×4
- 2.4GHz up to 28dBm, 5GHz 27dBm RF output power per chain
- Extended radio frequency ranges 2312-3000MHz and 4900-5925MHz
- Narrow bandwidth 5/10MHz with standard 20/40/80/160MHz in full extended range
- Reduced channel steps 1MHz for 2.4GHz and 5GHz
- Non-standard centre frequency channels for interference mitigation
- Optimized for reliable long-range communication (>10km wireless links)
- Qualcomm WCN9380 Wi-Fi5 (802.11a/g/n/ac) 2.4GHz and 5GHz with 1×1 MU-MIMO 20/40/80
- 2.4GHz up to 22dBm; 5GHz 20dBm RF output power per chain
- Memory eMCP: LPDDR3 1GB + eMMC 8GB
- LGA; size: 36.6×76.6mm
- USB 3.0; USB 2.0; RGMI; DSI, HDMI; I2S; DMIC; SDC; UART; SPI; I2C; GPIO

Robonode development kit is available in our Sample Shop. For further information please contact:

A03

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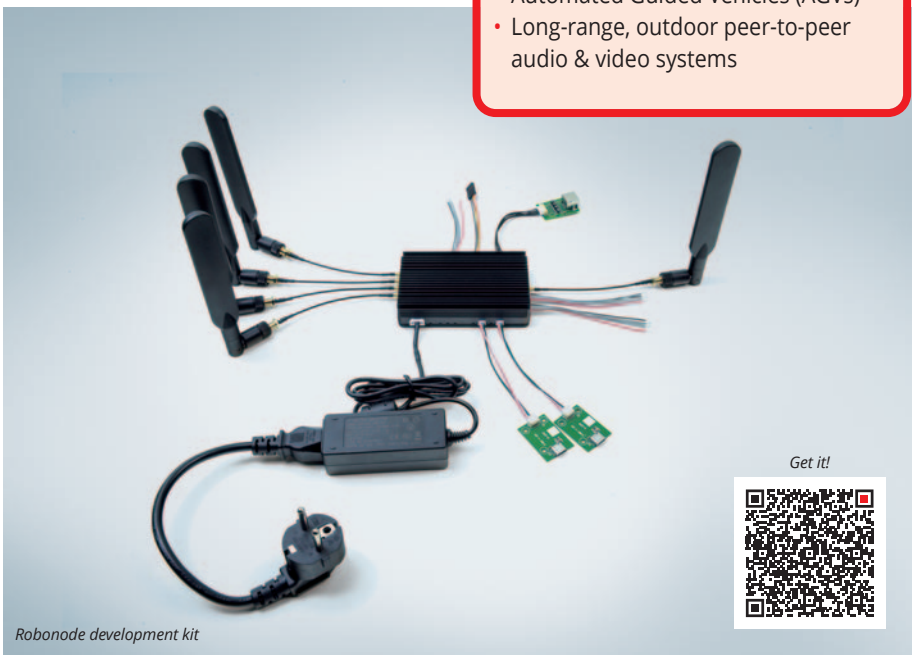
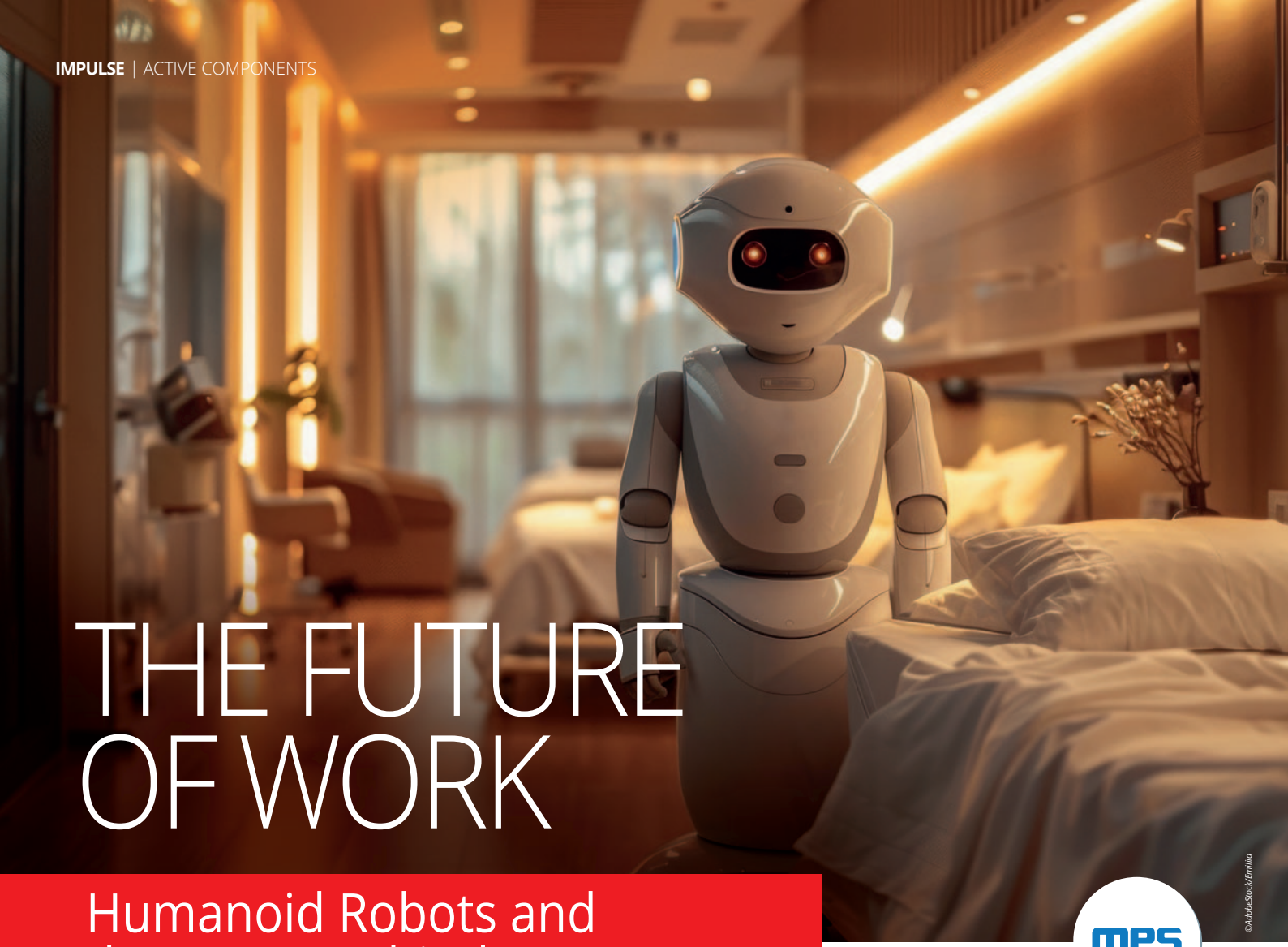
APPLICATIONS

- Drones
- Autonomous Mobile Robots (AMRs)
- Automated Guided Vehicles (AGVs)
- Long-range, outdoor peer-to-peer audio & video systems



Get it!

Robonode development kit



THE FUTURE OF WORK

Humanoid Robots and the Power Behind AI

The robotics industry is undergoing a major transformation driven by advancements in artificial intelligence (AI), machine learning, and real-time data processing. Today, AI-powered robots are transforming the future of robotics by making systems smarter, more adaptive, and more autonomous. Autonomous robots that were once a topic of futuristic writing are heading for mass production today.

Humanoid robots are rapidly transitioning from conceptual prototypes to practical tools across various industries, driven by advancements in AI, robotics, and substantial investments from major technology companies. This evolution is reshaping sectors such as healthcare, manufacturing, and personal assistance, positioning humanoid robots as integral components of the future workforce.

The surge in AI robots is propelled by advancements in AI due to increasing demands in healthcare, manufacturing, and supportive government policies. Humanoids are anticipated to fill 4% of the US manufacturing labor shortage by 2030, addressing the tasks that are dangerous, dirty, or dull. By 2030, these robots could meet 2% of the global elderly care demand, helping in environments facing caregiver shortages. In sectors like mining, disaster response, and chemical manufacturing, humanoid robots could undertake 5% to 15% of hazardous jobs, enhancing safety and efficiency. By 2050, 63 million humanoid robots could be used in the US alone. Countries like Japan emphasize caregiving robots for its aging population, while China scales production for industrial automation.

Market Growth and Adoption

The integration of humanoid robots into various industries is driven by technological advancements and the need to address labor shortages. Companies such as Tesla have introduced the Optimus Gen 2.0 – the latest iteration of its humanoid robot, which is designed to push the boundaries of automation in both industrial and personal care sectors. Boston Dynamics, known for its robots like Atlas, are capable of complex movement and push the boundaries of humanoid mobility and real-world applications. San Diego based Ainos has announced a strategic partnership with Ugo (based in Japan) to develop a robot equipped with scent detection.

As humanoid robots are poised to play a significant role in addressing labor shortages and enhancing efficiency across various industries, with substantial market growth anticipated in the coming years, their power demands will also increase.

The AI Hardware Revolution

AI hardware platforms such as Nvidia Jetson, Qualcomm Dragonwing IQ9 Series Processor and SYNAPTICS SL1680 provide high-perfor-

mance, energy-efficient computing that is essential for real-time perception, motion planning, and decision-making in humanoid robots.

The Qualcomm Dragonwing IQ9 Series Processor is a newly launched powerful platform for long lifetime robotics and industrial applications, delivering industry leading current consumption for edge processing while offering up to 100 trillion operations per second (TOPS) in a highly integrated, thermally efficient System-on-Chip (SoC) that also incorporates dedicated real time processing cores to manage the safety critical routines required to operate robots safely in close proximity to vulnerable users. The Qualcomm Dragonwing IQ9 Series processor also incorporates a camera ISP capable of connecting up to 16 concurrent high-resolution cameras. The SoC can utilize camera and sensor inputs for object detection, object recognition, path planning and other important robot navigation and decision tasks additionally the dedicated NPU in the devices is also powerful enough to execute language models such as Llama2 to allow people to interact with their robots in a natural fashion.

The SYNAPTICS SL1680 is based on a quad-core ARM Cortex-A73 64-bit CPU, a 7.9 TOPS NPU, a highly efficient, feature-rich GPU and a multimedia accelerator pipeline. It is ideal for home and industrial controls, smart devices, home security gateways, digital signage, displays, point-of-sale systems and scanners.

New Solutions to Meet Humanoid System-on-Chip (SoC) Power Needs

Sophisticated AI architectures demand advanced core power solutions to support their high computing density and real-time processing. These systems require multi-phase voltage regulation, dynamic power scaling, and low-noise, high-efficiency power delivery to maintain performance stability. As AI workloads in humanoid robots become more intensive, power architectures must ensure thermal efficiency, fast current response, and seamless integration with AI accelerators to avoid bottlenecks or overheating.

The core computing unit is the heart of the system, as it executes the computing and determines which specialized solutions are required for power rails. High-power core rails have stringent specifications to provide the power needed by the CPUs, GPUs, and accelerators embedded into the System-on-Chip (SoC). This article will focus on power solutions for the SoC core rails.

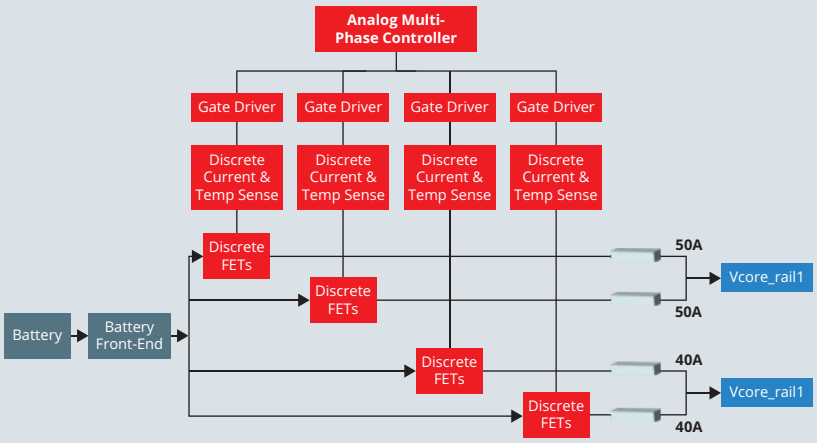


Figure 1: Traditional SoC solution

Traditional solutions for SoC core rails use analog pulse-width modulation (PWM) controllers, discrete MOSFETs, and discrete current- and temperature-sensing circuitry (Figure 1). These solutions require many external components, which raises costs, reduces reliability for some applications, and requires a larger PCB area. This can make traditional solutions difficult to design and susceptible to a lack of flexibility and scalability, which is a critical requirement for the types of SoCs used in high-performance computing (HPC) applications.

Figure 2 shows a state-of-the-art SoC core power solution using digital multi-phase controllers and monolithic DrMOS power stages. The DrMOS integrates the gate driver IC, current-sensing circuit, and temperature-sensing circuit. This enables a simpler solution by eliminating several external components that would be required by traditional solutions.

The DrMOS is a monolithic design that offers incredibly high-power density, accurate current-sensing, and accurate on-die temperature sensing. MPS has 22V and 6V DrMOS portfolios to support single-stage power conversion and two-stage power conversion. For example, the MPQ86760 is a DrMOS from the 6V portfolio, which makes it well-suited for autonomous driving SoCs and infotainment. Meanwhile, the MPQ86960 is a DrMOS from the 22V portfolio and can be used in humanoid robots.

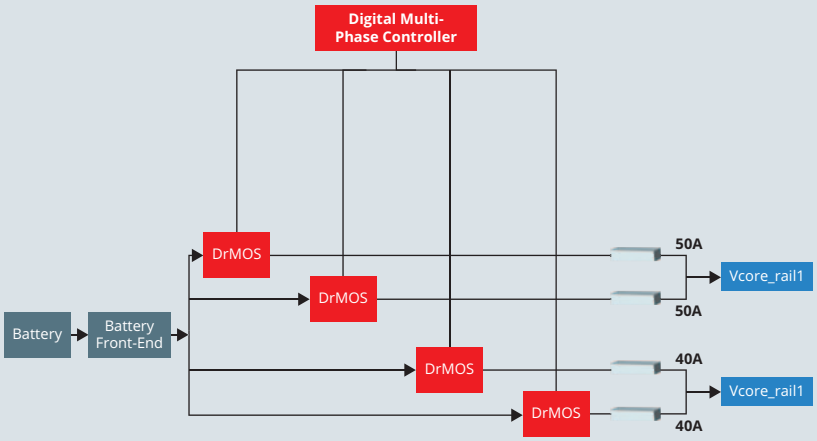


Figure 2: Digital PWM controllers and monolithic DrMOS

Figure 3 shows a DrMOS that can work in tandem with MPS's multi-phase controllers to supply power rails ranging from 30A to 80A (and can also go higher under certain conditions). This combination of a DrMOS and dedicated controller can be employed to efficiently regulate the core power rail of the SoC within a humanoid robot, ensuring compactness and high-power delivery performance.

These digital controllers offer flexibility and scalability since the number of phases can be configured depending on the current ratings of the given SoC core rail. Digital controllers do not require any external feedback loop compensation, which simplifies design work and cuts down on development time. They also feature a non-volatile memory (NVM) to configure and reconfigure the register settings up to 1,000 times.

In addition, the controller and DrMOS offer various monitoring and protection features that can be used to implement system-level telemetry.

Building SoC Power Delivery for Humanoid Robotics

Modern robotic platforms use either a 48V or a 22V lithium-ion battery. A 48V lithium-ion battery is emerging as the standard high-voltage rail for full-sized humanoid robots. MPS offers solutions to step down both 48V and 22V efficiently to supply the necessary voltage to the core rails.

Figure 3 shows a block diagram of a high-efficiency power delivery system for a robotics SoC. A battery feeds through the front-end protection to two MPQ2967 digital controllers, then each controller configures and manages 4× MPQ86960 DrMOS stages in multi-phase configurations. This ensures delivery to four power rails from 30A to 80A. Multi-phase operation improves efficiency, current sharing, and thermal performance. The controllers can communicate with the SoC via the I²C interface or any other standard interface that our controllers support. This set-up is ideal for high-performance robotics that require compact and reliable power delivery.

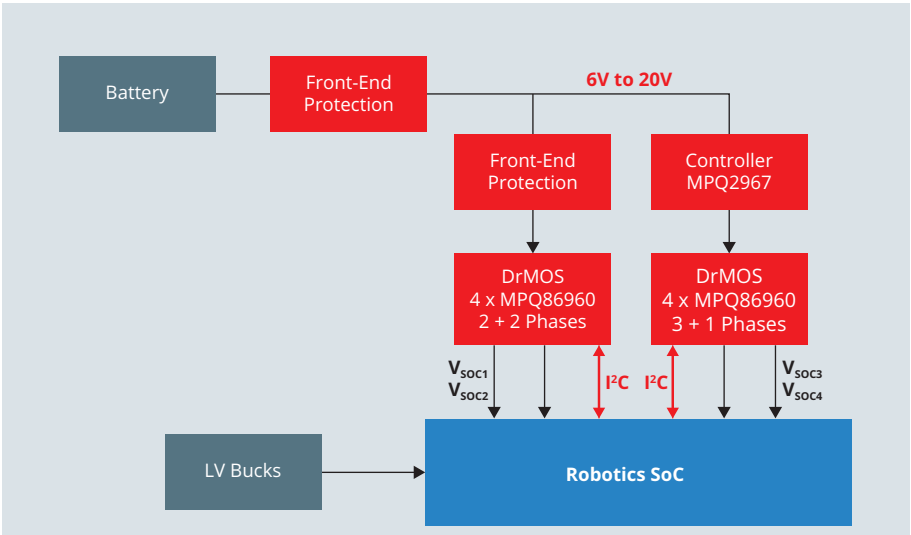


Figure 3: Example of a robotic SoC powertree

Conclusion

The robotics industry is shifting from distributed controllers to centralized, high-performance computing platforms. Modern robots use CPUs, GPUs, and AI accelerators to handle computer vision, motion planning, and control algorithms in real time. This transformation gives rise to the necessity of having powerful, low-voltage and high-current power delivery systems.

The SoCs used in central computing require advanced power management solutions, particularly for core voltage rails. Traditional power solutions are no longer well-suited for next-generation central compute power applications. With multi-phase digital controllers like the MPQ2967 and DrMOS power stages like the MPQ86960 used in robotic SoC core power applications can deliver scalable, flexible, and compact power solutions with high efficiency and fast transient response.

A04

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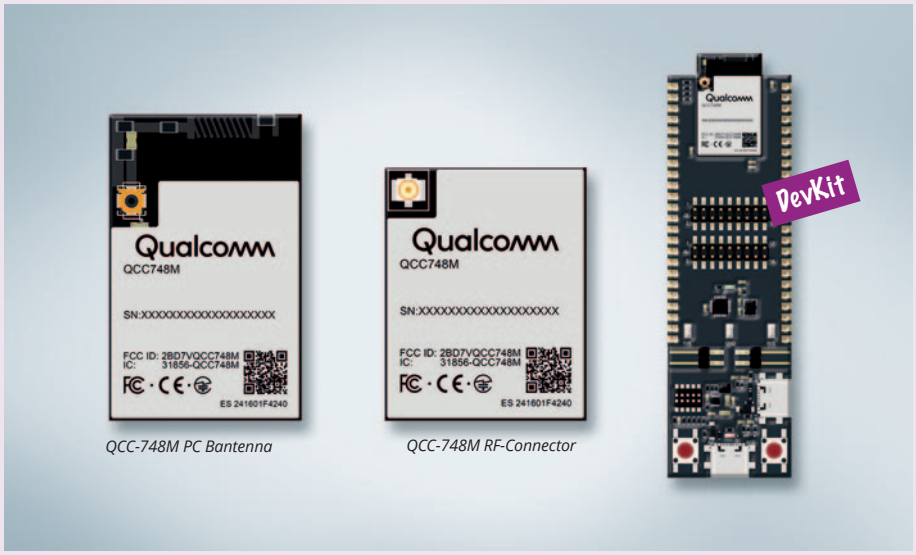
QCC74x

New Wi-Fi6 IoT Module Solutions With USB Interface From Qualcomm

Following the successful launch of IoT module solutions based on the Qualcomm® QCC730 (Wi-Fi4) and the Qualcomm® QCC743/QCC744 (Wi-Fi6) device families, Qualcomm Technologies, Inc. is expanding its product portfolio with the new Qualcomm® QCC748 SoC.

The QCC74x SoC family is based on a RISC-V architecture (@325MHz FPU + DSP) and offers Wi-Fi6 as well as Bluetooth® 5.4 wireless technology and IEEE 802.15.4 (Thread). Thanks to the integrated multimedia functions and the numerous digital and analog interfaces, this family is particularly suitable for applications requiring a high level of functional integration at a lower cost, such as smart appliances, industrial IoT, smart home devices, medical devices and IoT hubs/ gateways.



QCC-748M PC Bantenna *QCC-748M RF-Connector*

The module version QCC748M (M= Module), like the QCC744M, comes in two versions with 484KB SRAM + 4 or 8MB pSRAM (SiP) and both with an 8MB NOR Flash, significantly surpassing the memory configuration of the lower-cost QCC743M (484KB RAM + 4MB NOR Flash). In addition, the QCC748M is pin-compatible with the QCC744M family, available in two antenna versions and offers the same interfaces, along with USB.

You can find a feature list in the following product overview:
https://downloads.codico.com/misc/wifi-modules

Please click on the *»IoT«* button to open the product matrix and then select the *WiFi 6* sheet. In the *DevKit* sheet, you will find all Wi-Fi IoT development kits currently offered by Qualcomm Technologies, Inc. To place a free order, simply click on the corresponding link.

If you have any further questions, please contact:

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ALL UNDER CONTROL

Efficient Power Solutions for Industry 4.0 and IoT Systems

In today's rapidly evolving industrial landscape, where automation, connectivity, and miniaturization are essential, power efficiency and reliability are critical design priorities. Modern industrial applications, ranging from compact sensor nodes and communication modules to always-on control systems, demand robust power solutions that deliver stable performance while operating in tight spaces and under strict energy budgets.

A typical architecture for industrial systems features a primary step-down (buck) DC/DC converter for main power regulation, supported by one or more secondary rails dedicated to point-of-load (POL) conversion. Integrated supervisory functions such as voltage monitoring, reset generation, and power-up/down sequencing are essential to ensure safe, reliable and accurate system behaviour.

TOREX addresses these challenges with innovative power management solutions engineered for the demands of Industry 4.0, enabling smarter, smaller, and more sustainable industrial designs.

Solutions for the Primary DC/DC

TOREX recently expanded its DC/DC converter lineup with the XC9702 and XC9711 series, which are compact, pin-to-pin compatible, synchronous step-down converters designed for industrial and embedded applications. These models are ideal for ultra-compact solutions operating in ambient temperatures from -40°C to +125°C. Both support a wide 4.5V–60V input range and offer selectable PWM or PWM/PFM control via the MODE pin, allowing designers to optimize for low noise or high efficiency across varying loads. Sharing the same PCB footprint and external circuit design (Figure 1), they enable easy selection based on required output current.

They also integrate essential protection features such as under-voltage lockout, overcurrent protection, thermal shutdown, and Power Good monitoring to ensure reliable performance in demanding environments.

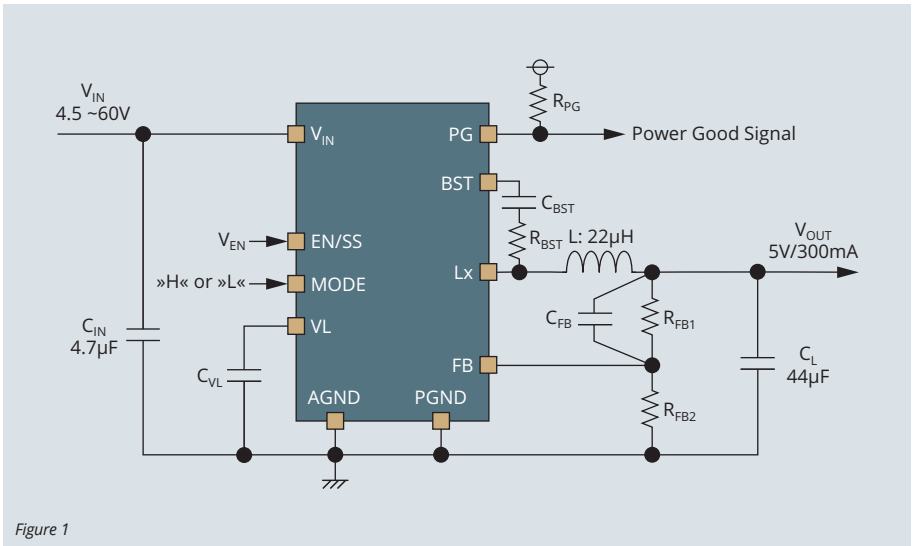

Figure 1

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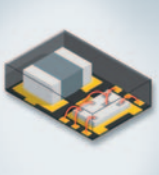
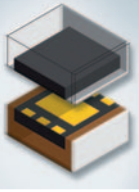
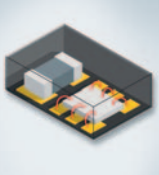
Figure 2: DC/DC Converter for Industrial and Embedded Applications			
	XC9702	**XC9711**	**XCL249**
Input Voltage	4.5V ~ 60V	4.5V ~ 60V	4.5V ~ 60V
Output Voltage	2.5V ~ 12V	2.5V ~ 15V	2.5V ~ 6.0V
Output Current	300mA	1A	150mA
Inductor	External	External	Internal
Packages	DFN3030-12A	DFN3030-12A	CL-3225
	HSOP-8N	HSOP-8N	
	USP-10B		

The main difference is the output current: the XC9702 supplies up to 300mA, ideal for compact designs with limited power, while the XC9711 delivers up to 1A for heavier loads like control modules or multiple sensors.

For even greater integration, TOREX will soon launch the XCL249 – a 60V, 150mA step-down converter with a built-in inductor (see Figure 2).

Solutions for Secondary Point-of-Load Rails

TOREX offers compact DC/DC converters for Point-of-Load applications, including several Micro DC/DCs with integrated inductors (Figure 3). Featuring Hi-SAT COT (Constant ON Time) architecture, they address key issues in powering FPGAs and MCUs, such as fast transient response, heat, and EMI.

Figure 3: DC/DC Converter for Point-of-Load Applications				
	XCL237/38	**XCL239/40**	**XCL241/42**	**XCL243/44**
I_{OUT} (max)	**1.5A**	**1.0A**	**0.5A**	**0.7A**
V_{IN} Range	2.5V ~ 5.5V			
V_{OUT} Range	0.8V ~ 3.6V, selectable in 0.5V steps, ±2.0%			
Switching Frequency	3.0MHz	3.0MHz	1.2MHz	3.0MHz
Quiescent Current (Typ.)	25µA	25µA	15µA	25µA
Amb. Op. Temp. Range	-40°C ~ +105°C			
Package	USP-9B01	CL-2025-02		USP-8B04
Dimensions (mm)	3.2×2.5×1.0	2.5×2.0×1.04		2.25×1.5×0.75
Package Construction				

Unlike monolithic PMICs, individual POL converters can be placed closer to FPGA or MCU pins, reducing impedance and improving stability. Additionally, separating each DC/DC helps manage heat and minimize electromagnetic interference through more effective PCB layout strategies.

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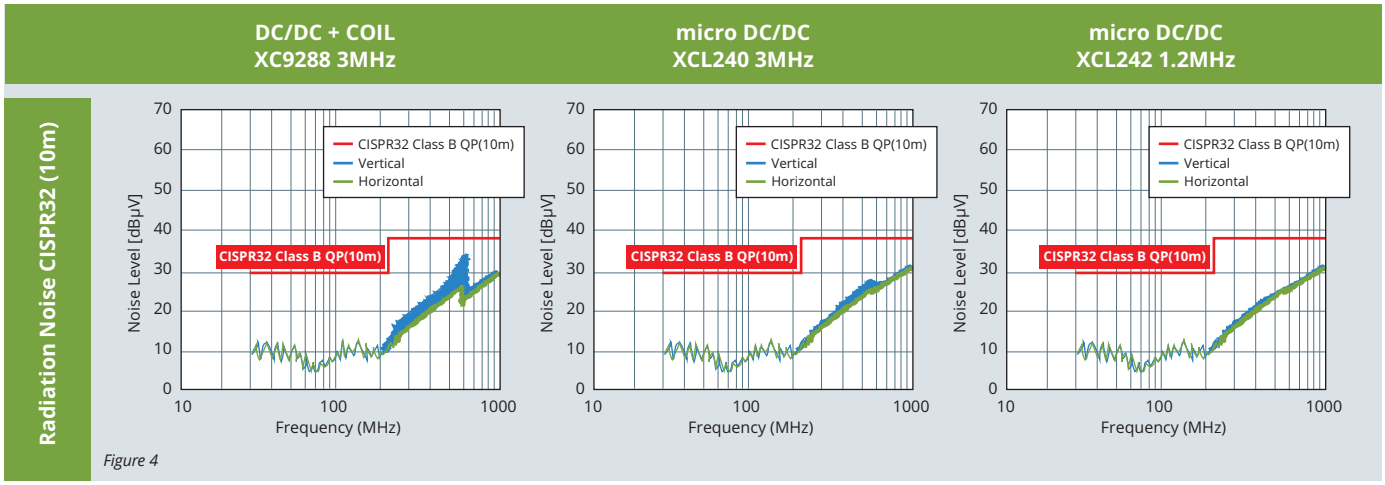

Figure 4

The Hi-SAT COT ensures fast voltage recovery and stable switching frequencies across load and input changes. TOREX Micro DC/DCs are compact, efficient, and simple to design in – offering reduced EMI (Figure 4), smaller size, and quicker development.

Solutions for Voltage Monitoring and Sequencing

The XC6138 is a high-precision voltage detector designed for industrial and battery-powered systems. It simplifies power rail monitoring in 12V and 24V systems without external voltage dividers. A key feature is its dedicated voltage sense pin (VSEN), which monitors up to 76V and handles surges up to 90V for ≤400ms, allowing direct connection to high-voltage rails without loss of accuracy.

In power-sensitive designs, the XC6138 ensures stability during voltage fluctuations using built-in hysteresis and delay timing to manage reliable system resets. Figure 5 shows a typical circuit with sequenced start-up and shut-down of primary and secondary rails.

As the primary input voltage rises and exceeds the Voltage Release threshold (VDR) of the XC6138, the RESETB output goes high after a predetermined release delay time (tDR) set by the external Cd. The RESETB signal releases the start-up sequence for the three secondary DC/DC and the rise-up timing for each DC/DC is fixed using the external RC delay, so the VDD_Core, VDD_Memory and VDD_IO rails rise up safely in the correct sequence.

When the VDD_IO rises, the GPIO_A rises slowly with the Rpull-up1 × C4 delay, therefore the

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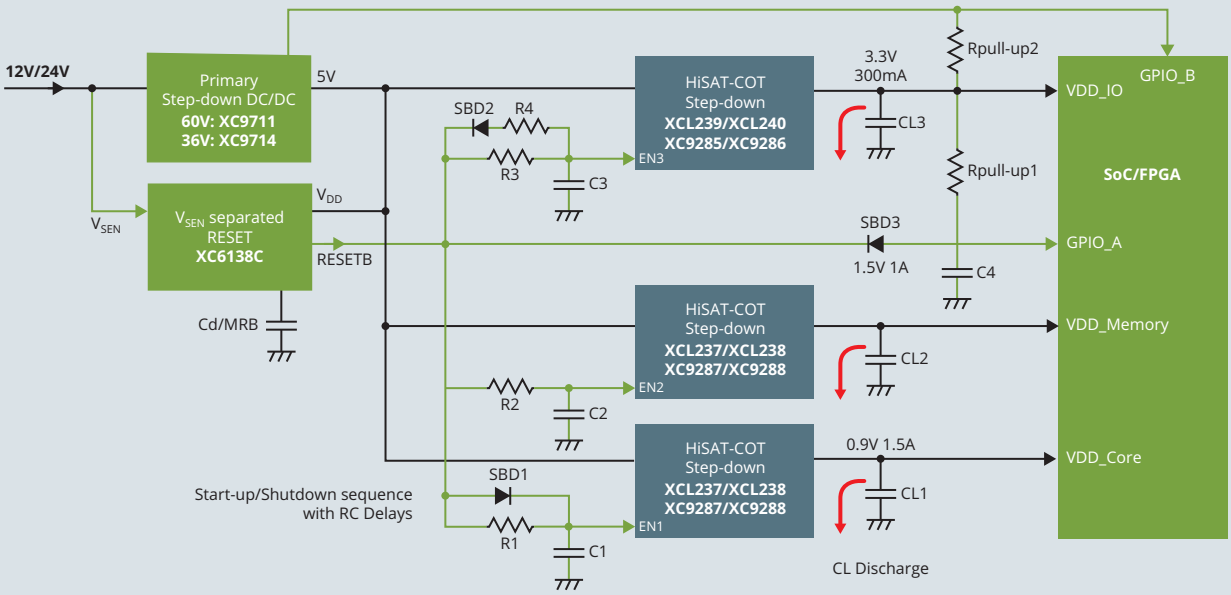

Figure 5

SoC/FPGA operation is held until all VDDs are fully start up. The internal Nch open drain of the PG pin in the primary DC/DC turns off when the 5V output rises enough, and when the VDD_IO rises, the GPIO_B rises by the Rpull-up2. The GPIO_B can monitor the status of the primary DC/DC.

If the primary input voltage were to fall-down unexpectedly, the XC6138 can also help to ensure the system shut-down correctly. In this case, when the primary input voltage starts to drop and goes below the Voltage Detect (VDF) threshold of the XC6138, the RESETB output goes low, and the GPIO_A falls by the RESETB signal passing through the SBD3. Then the SoC/FPGA starts the emergency shutdown sequence and performs any last gasp tasks, for example saving critical data to memory, before power is lost. For a safer shutdown sequence, a higher VDF value is selected so that the VDF can detect it while the 5V output is still sufficiently maintained.

The RESETB low signal from the XC6138, will also trigger the shut-down sequence for the secondary DC/DC rails, and with R4 x C3 delay, the EN3 falls slowly. When its voltage reaches the turn-off threshold of EN3, the top side DC/DC turns off.

Note that there is the SBD2 in series with the R4, so SBD2 blocks the signal at rising, but it passes the signal to R4, so the delay of R4 × C3 works. This is a way to switch between R3 and R4 at rising and falling the signal. The EN3 falls at first so R4 is much smaller than R3.

The RC delay circuits mean that VDD_IO falls first, followed by VDD_Memory, then VDD_Core (see Figure 6).

The XC6138 supports a wide detection voltage range from 2.3V to 20.0V, with a release voltage independently settable from 2.5V to 24.0V, allowing for various threshold combinations. Rated for operation up to 125°C, it ensures reliability even in harsh environments. Available in both SOT-25 and ultra-compact DFN1515-6A package, it fits a variety of applications and space requirements.

Before finalizing any DC/DC design, it is essential to validate its performance. TOREX offers an online DC/DC Simulation platform to evaluate efficiency, voltage stability, and transient response using actual TOREX products – helping optimize designs early and avoid issues before prototyping.

Samples and evaluation boards for all mentioned TOREX products are available via CODICO. Evaluation boards are customized to the customer's specific requirements and come with test data.

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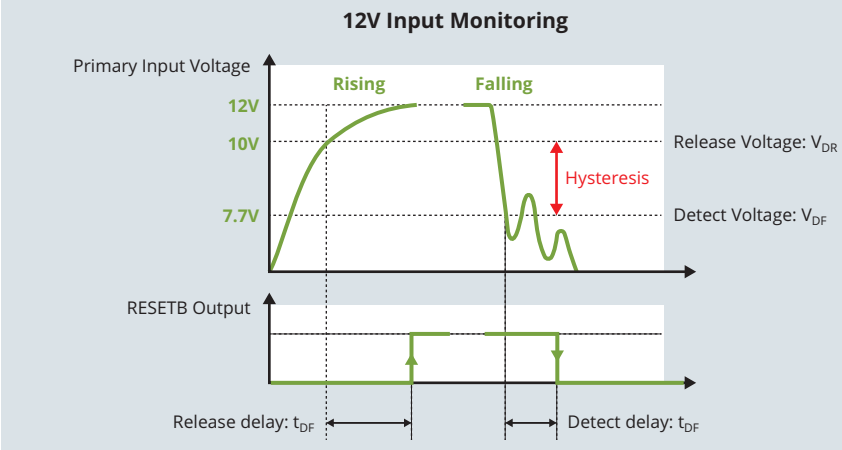
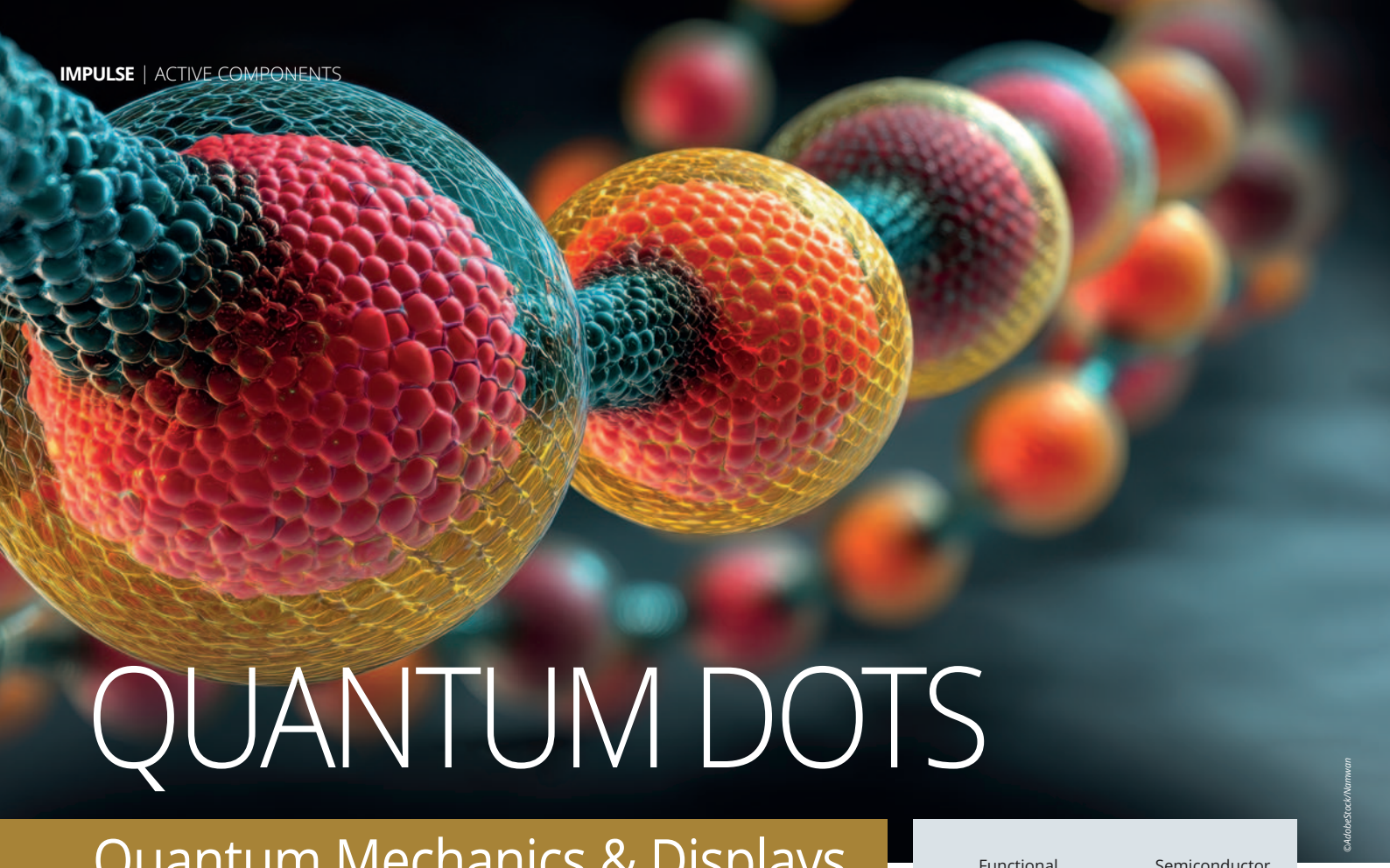


Figure 6



QUANTUM DOTS

Quantum Mechanics & Displays

Quantum physics, quantum mechanics, quantum dots. These are terms you may have heard before, and we want to give a brief explanation.

Since Austrian physicist Anton Zeilinger (together with Alain Aspect and John Clauser) received the Nobel Prize in Physics for his experiments with entangled photons, including the demonstration of quantum teleportation, the term »quantum« has become familiar to a wider audience.

Quantum physics describes the behavior and interaction of the smallest particles on the atomic and subatomic range. Quantum mechanics, a subset of quantum physics, focuses on the properties of states and processes of matter. The term quantum has its origin in the Latin word quantum, meaning »how much« or »how large«. It describes something measurable, something »quantifiable«. Today in physics, quantum is associated with the particle-like nature of a given property.

What are quantum dots?

Quantum dots (QDs) are tiny crystals in the nanometer range. They consist of a cluster of semiconductor atoms, often surrounded by an additional semiconductor layer. An outer functional polymer or lipid coating enables coupling with proteins, oligonucleotides (short DNA or RNA molecules), antibodies, or other molecules (Figure 1). Measuring between 2 and 10nm – roughly 10 to 150 atoms – they exhibit remarkable optical and electrical properties.

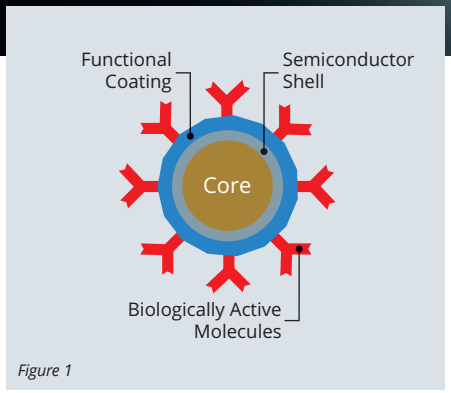


Figure 1

These characteristics can be tuned by adjusting particle size, material, and composition. These features make quantum dots interesting for a wide range of applications, including optical sensors, biomonitoring, drug delivery, solar cells, displays, and even photocatalysis (light-driven chemical reactions).

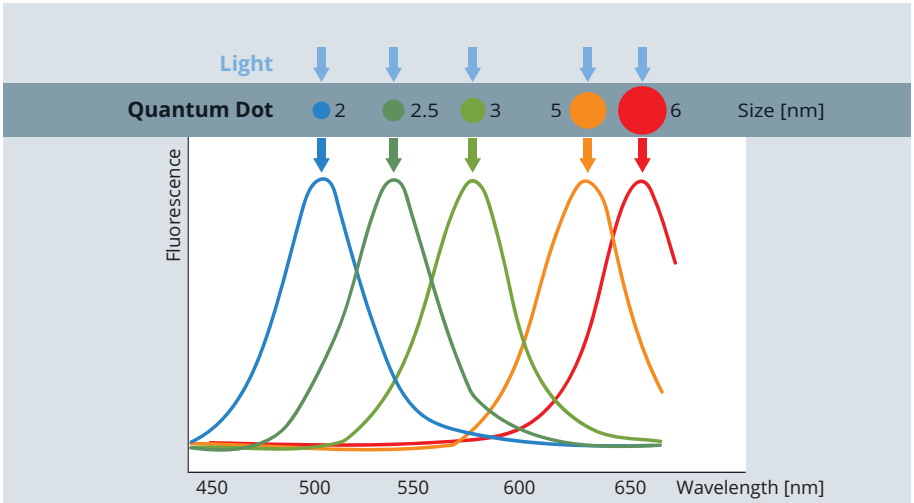


Figure 2: Light emission versus QD size

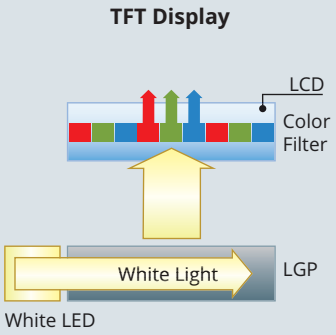


Figure 3: Structure of TFT (simplified)

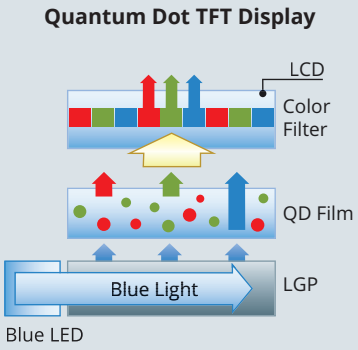


Figure 4: Structure of QD-TFT (simplified)

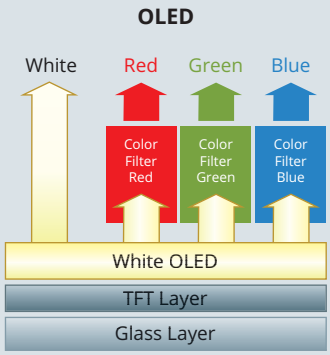


Figure 6: Structure of OLED (simplified)

In 2023, Alexei Ekimov, Louis Brus, and Moungi Bawendi were awarded the Nobel Prize in Chemistry for their three decades of pioneering research on quantum dots.

Quantum Dots – Applications in Displays

What makes quantum dot technology so interesting for displays is photoluminescence. Quantum dots can absorb light and re-emit it at a different wavelength. The color of the emitted light depends directly on the particle size – the smaller the dot, the shorter the wavelength. This is due to the fact that very small particles, only a few nanometers in size, provide less space for electron oscillation, directly affecting optical properties. Using InP (indium phosphide) and ZnS (zinc sulfide) quantum dots, 6nm dots emit long-wave red light, 3nm dots emit green light, and 2nm dots emit short-wave blue light. Typically, a blue light source with a wavelength of 450nm is used (Figure 2).

Comparing TFT-LCD Technology with New Quantum Dot TFTs

In general, a conventional TFT display uses a backlight. White LEDs produce light that passes through color filters, creating a colored image (Figure 3). White LEDs consist of a blue LED chip covered with YAG phosphor (yttrium aluminum garnet), which emits white light.

The downside of this technology is that the resulting colors are not as pure and vivid. This is due to the wide emission spectrum, causing colors to interfere with each other (Figure 5).

In a quantum dot display, however, blue LEDs replace the white ones for the backlight. The QD layer is placed directly on the light-guide. When simulated by the blue LEDs, the quantum dots emit vibrant red and green light, which combines with the blue light to produce white light. As in a regular LCD, the final image is formed by passing the light through a color filter (Figure 4).

Comparing OLED Displays with Quantum Dot OLED Displays

It's important to note that »OLED« here always refers to an AMOLED display, which is a display with a TFT layer (active matrix) that controls the individual organic LEDs for each pixel.

In standard OLED displays, white OLEDs are used for the pixels or subpixels. Like in TFT displays, color is generated using a color filter. The difference from TFT-LCDs is that OLED displays also make use of the white light emitted by the OLEDs (Figure 6).

When integrating quantum dot technology, the QD layer and color filter are placed directly above the light source – in this case, the OLEDs. White OLEDs are replaced by blue ones, and the quantum dots emit red and green light when excited by the blue light, while the blue is used directly (Figure 7).

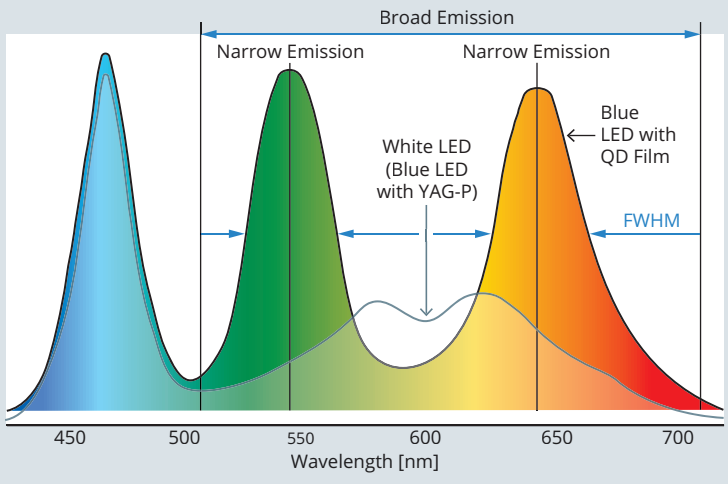


Figure 5: Color spectrum TFT versus QD-TFT

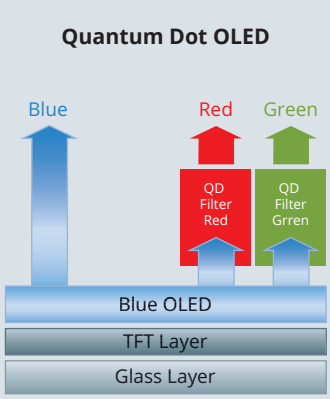


Figure 7: Structure of QD-LED (simplified)

Advantages of Quantum Dot Displays

Improved Color Accuracy

A major advantage is the significantly improved color reproduction. Quantum dots emit light at specific wavelengths and have a narrow full width at half maximum (FWHM) of about 20-35nm. Interference is minimized, resulting in purer colors and a more vibrant, lifelike visual experience.

Wider Color Gamut

Integrating quantum dots expands a display's color gamut, allowing it to render a broader range of colors. This enables manufacturers to reproduce colors that are closer to what we see in nature.

For a better understanding, the color gamut refers to the full range of colors perceivable by the human eye. In the CIE color system, colors are represented mathematically, producing a tongue-shaped diagram showing saturation and hue (wavelength).

One example is the sRGB (standard red-green-blue) color gamut, which defines the colors that can be displayed on a digital device (e.g., a monitor). Quantum dots can expand a display's sRGB gamut by 35-45% (Figure 8).

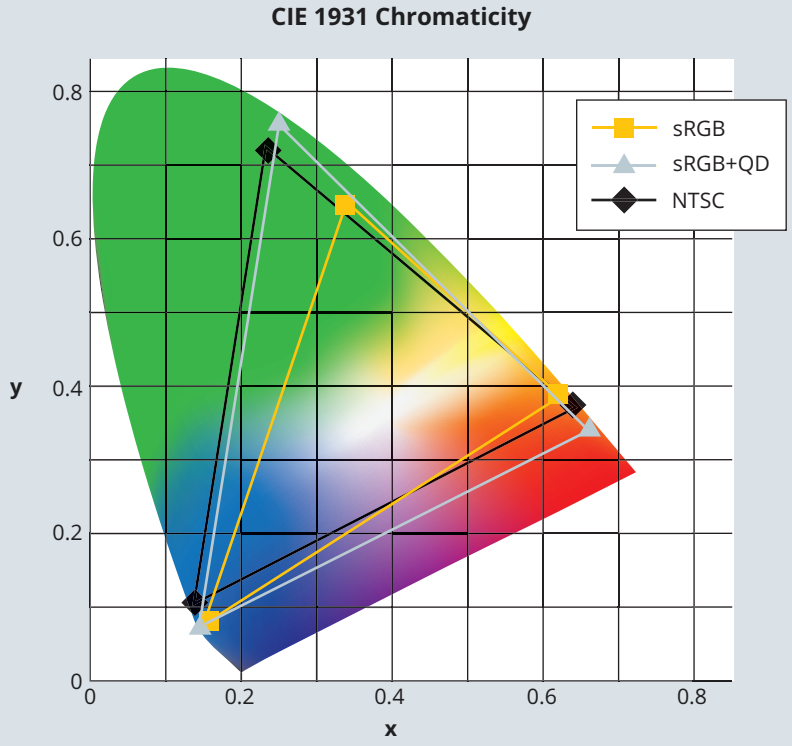


Figure 8: CIE color system sRGB versus sRGB+QD

Brightness and Energy Efficiency

Quantum dots also increase display brightness. Compared to a non-QD display, this can reduce power consumption while maintaining the same brightness. In LCDs, even better results are achieved by combining QD technology with a Micro-LED backlight. Such displays offer brilliant color, high contrast, and improved energy efficiency.

Summary

Displays using QD technology deliver outstanding color performance and a significantly wider color gamut than standard displays. This allows for rich, vivid colors that closely resemble those found in nature, offering viewers a more realistic visual experience. The main applications are in medical imaging and professional video production, where accurate color representation and a wide color range are crucial.

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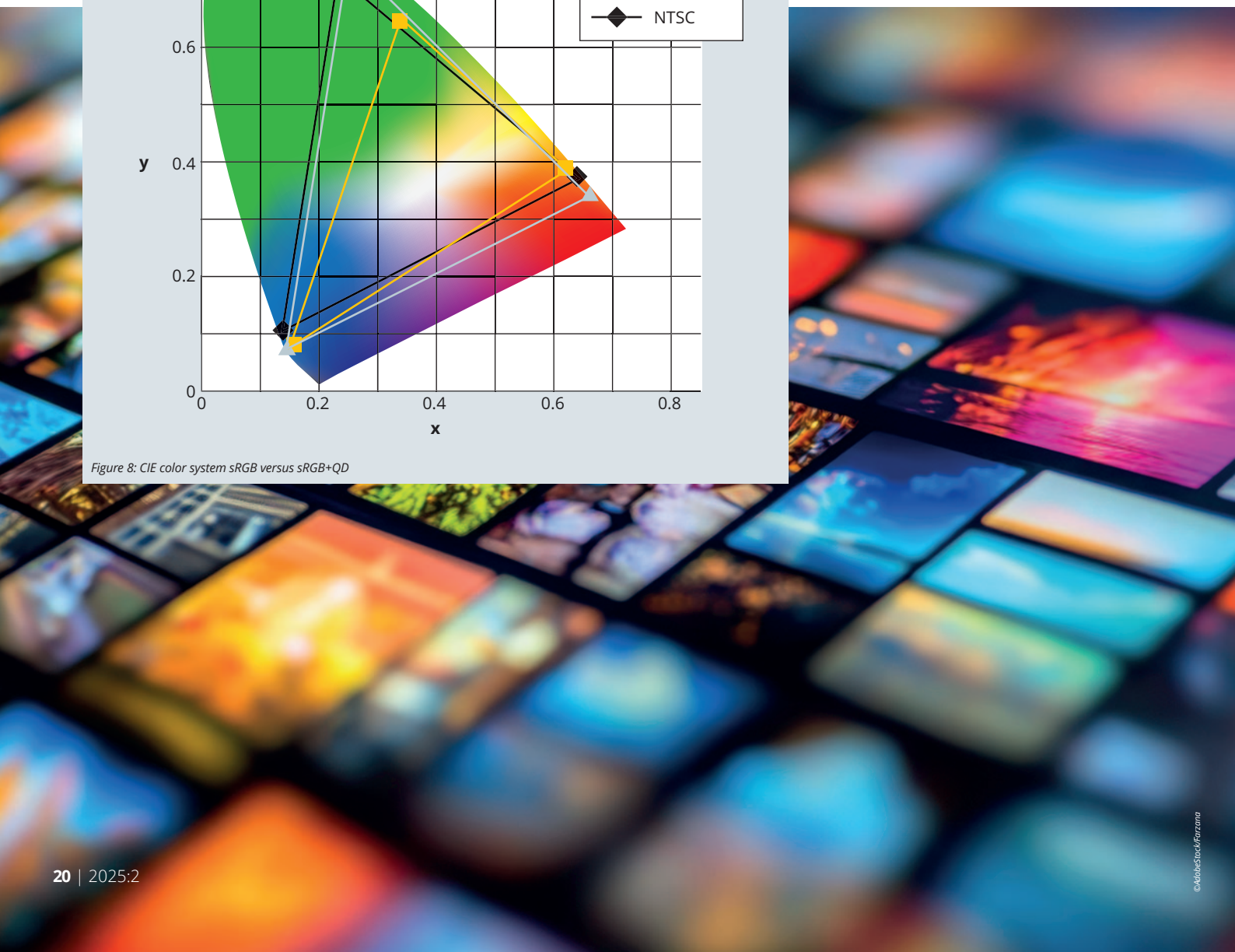

LFM SERIES

Power in a Compact Space

New to the product line-up is CINCON's unique 1" low profile LFM series. The product uses a unique thermal architecture referred to as a semi-potted design based on 100% conduction cooling.

LFM series

Traditional AC/DC open-frame power supplies are meant to be installed on the system chassis using four pillars in each corner. A heatsink would cover the top of PSU for heat dissipation of transformer, MOSFET and inductor components. By channelling an airflow through the system and over the heatsink, the overall power density of the PSU could be effectively increased.

Fan-based cooling systems, however raise concerns regarding long-term reliability (system MTBF) and the potentially loud noise generated during operation. The option of eliminating fans from the system emerges but this necessitates finding an alternative solution for heat dissipation. Hence, the inclusion of pure conduction cooling (integrated heatsinks) power supply concepts in the design methodology has been introduced to enhance power ratings under natural convection conditions. However, challenges persist in terms of overheating specific components like magnetic components.

Maximizing thermal performance with an enhanced conduction cooling design, utilizing potting material and the low-profile advantage to conduct heat from the unit to its baseplate, removes the need for an external fan. Additionally, semi-potting reinforces the mechanical structure to withstand shocks and vibrations.

The LFM series is available in three standard footprints: 3×2" for at a total power of 200W, 4×2" for 300W and finally 3×5" for 420W and 550W. CINCON's 1" midget offers both, industrial and medical approvals including 2xMOPP and »body floating« (BF) rating, which includes EMC Class II. The medical version also features the household standard IEC/EN60335-1. It meets Over Voltage Category (OVC) III up to 2000m altitude and OVC II up to 5000m.

The LFM series from CINCON is the perfect fit for a versatile range of applications like medical equipment, industrial automation or in telecom infrastructure projects.

Samples and comprehensive product documentation are available from CODICO.

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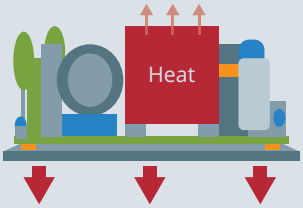
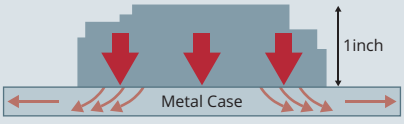


Heat dissipation



Semi-potted conduction cooling

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NEW at CODICO: Power Supplies from CINCON

CINCON is a publicly listed company in Taiwan, established in 1991 and a global supplier of module type power supplies. Factories are located in Chung Hua, Taiwan and Dongguan Guangdong, China with more sites to come. Along with ISO 14001 and 9001 certificates, CINCON offers state-of-the art manufacturing equipment, including SMT pick-and-place assembly machinery.

All AC/DC products and a variety of DC/DC products are UL listed or recognized, TUV approved and carry the CE mark. CINCON also certifies to other international safety standards, including PSE and CCC, upon request. Products are also designed to meet various international EMI standards.

CINCON's product line-up comprises over 3000 standard products, including:

- Single & multiple output DC/DC converters from 1W to 800W
- Single & multiple output AC/DC adapters from 5W to 220W
- AC/DC brick power from 70W to 750W
- AC/DC encapsulated power from 4W to 750W
- Open frame AC/DC power supplies from 4W to 550W

READY!

CODICO Supports New EU Regulation for Charging Stations

Starting January 1st, 2027, ISO 15118-20:2022 must be implemented for newly installed and refurbished charging stations. This standard regulates communication between electric vehicles (EVs) and charging stations (EVSEs) to ensure improved interoperability, charging safety, and V2G. CODICO is well-prepared to meet this challenge.

The regulations (EU) 2023/1804 and 2025/656 of the European Parliament and of the Council focuses on publicly accessible and private charging stations for alternating current and direct current (AC and DC), focusing on light and heavy-duty vehicles, Class L electric vehicles, and electric buses. The European Union is actively working on regulations to support and promote bidirectional charging, also known as V2G (vehicle-to-grid), as part of its broader strategy to integrate electric vehicles (EVs) into the energy system.

First of all: Existing charging infrastructure does not need to be retrofitted. Existing publicly accessible charging points for charging modes 3 and 4 with low-level communication solutions such as PWM, which are already capable of communicating with electric vehicles currently on the market and equipped with EN ISO 15118-2:2016, will be exempt from the implementation of Parts 1 to 5 of EN ISO 15118 or subsequent extended versions such as EN ISO 15118-20:2022. The term »refurbished« should be understood as a major or complete replacement of relevant charging point equipment. Regular maintenance updates, including the replacement of specific components such as charging cables, should not be considered as refurbished.

However, where technically feasible, charging point operators should update existing charging points already on the market to support EN ISO 15118-20:2022 in addition to EN ISO 15118-2:2016 and other potentially existing low-level communication solutions such as pulse width modulation (PWM) according to EN IEC 61851-1:2019.

This means the simultaneous presence of ISO 2:2016 and ISO-20:2022. DC chargers are already equipped with up to three software stacks: DIN 70121, ISO 15118-2, and ISO 15118-20. The charging station must offer these standards to the connected vehicle, as the vehicles may only support one of these specifications, and charging interruptions and subsequent switching between standards must be avoided.

A word about Plug-and-Charge (PnC): Operators of publicly accessible charging points can voluntarily decide whether to offer PnC services, in accordance with the options specified in the EN ISO 15118-2:2016 and EN ISO 15118-20:2022 standards. PnC services are a technological solution

enabled by the EN ISO 15118-2:2016 and EN ISO 15118-20:2022 standards. They provide automatic authentication and authorization between the electric vehicle and the charging station. This enables charging based on a contract between the end user and the mobility service provider, including billing information. To complete a charging session, drivers of electric vehicles simply connect the charging point connector to the vehicle, which automatically starts the process. The EU-wide implementation of PnC services and the possibility for end users to have interoperable access to these services across the EU are intended to further simplify EV charging and improve the overall user experience.

CODICO is ideally equipped to support the necessary design requirements with its portfolio of Powerline Communication (PLC) solutions based on ISO 15118-3:2016. Suitable for this purpose are both the proven RED-BEET 2.0 module from 8DEVICES as a hardware PLC modem and the DROPBEATS DB2605 System on Module (SOM) with integrated software stack. Support for chip-down designs is also available for projects of a certain size. All solutions are based on the latest QCA7006AQ PLC chip from Qualcomm. On the software side, CODICO works with various partners and can therefore offer hardware and software to the customers. The software partners, in turn, support the implementation of already verified ISO 15118 stacks to complete the integration. Corresponding evaluation boards are also available for these solutions.

Amendment 1 of ISO 15118-20 introduces new features such as the AC DER (Distributed Energy Resource) service, the Megawatt Charging System (MCS) service, and an enhanced security concept. This change is crucial for enabling expanded grid interaction, such as vehicle-to-grid (V2G) and vehicle-to-home (V2H) applications, by specifying how electric vehicles can communicate grid codes and contribute to grid stabilization.

In addition to the aforementioned EN ISO 15118-20:2022, the standards ISO 15118-1:2019, ISO 15118-2:2016, ISO 15118-3:2016, ISO 15118-4:2019, and ISO 15118-5:2019 will also form the basis for charging stations starting in 2027. ISO 15118-4, for example, describes »network and application protocol conformance tests« based on ISO 15118-2. For the ISO 15118-20 mentioned earlier, the corresponding conformance testing is described in ISO 15118-21. CODICO also offers application solutions for interoperability testing – simulators, sniffers, and conformance testers are available.

CODICO also offers a wide range of suitable PLC coupling transformers from ELYTONE for both EV and EVSE applications. These established couplers feature very low insertion loss in the 3-30MHz range, combined with all the required features (AEC-Q200, isolation, etc.) demanded by the markets.

For PLC applications, a 25MHz crystal unit from TXC (AM series, size 3225, 25MHz) is available. The crystal is compatible with the Qualcomm QCA7005 and QCA7006 chips, which require a total frequency tolerance of ±25ppm. Currently, TXC is the only one on the market that meets this ±25ppm requirement, including 10 years of aging.

In addition, CODICO offers everything needed for a reliable and efficient EV charging connection. The portfolio includes Type 2 charging sockets according to IEC 62196-2 and permanently installed EV charging cables. For secure electrical connections and strain relief, these are custom-equipped with terminal blocks on one end and cable glands on the device side. Direct PCB contacts for reliable power transmission are also supported – perfect for customized cost-down designs.

For the interior of the charging station, a wide range of flexible internal wiring and PCB connection solutions is available for various circuit board orientations, including tolerance-compensating board-to-board connectors and SMT jumper cables. Lever clamps ensure smooth, tool-free, and fast cable connections.

To keep everything cool, AC and DC fans for effective temperature management in compact enclosures round out the range.

A09

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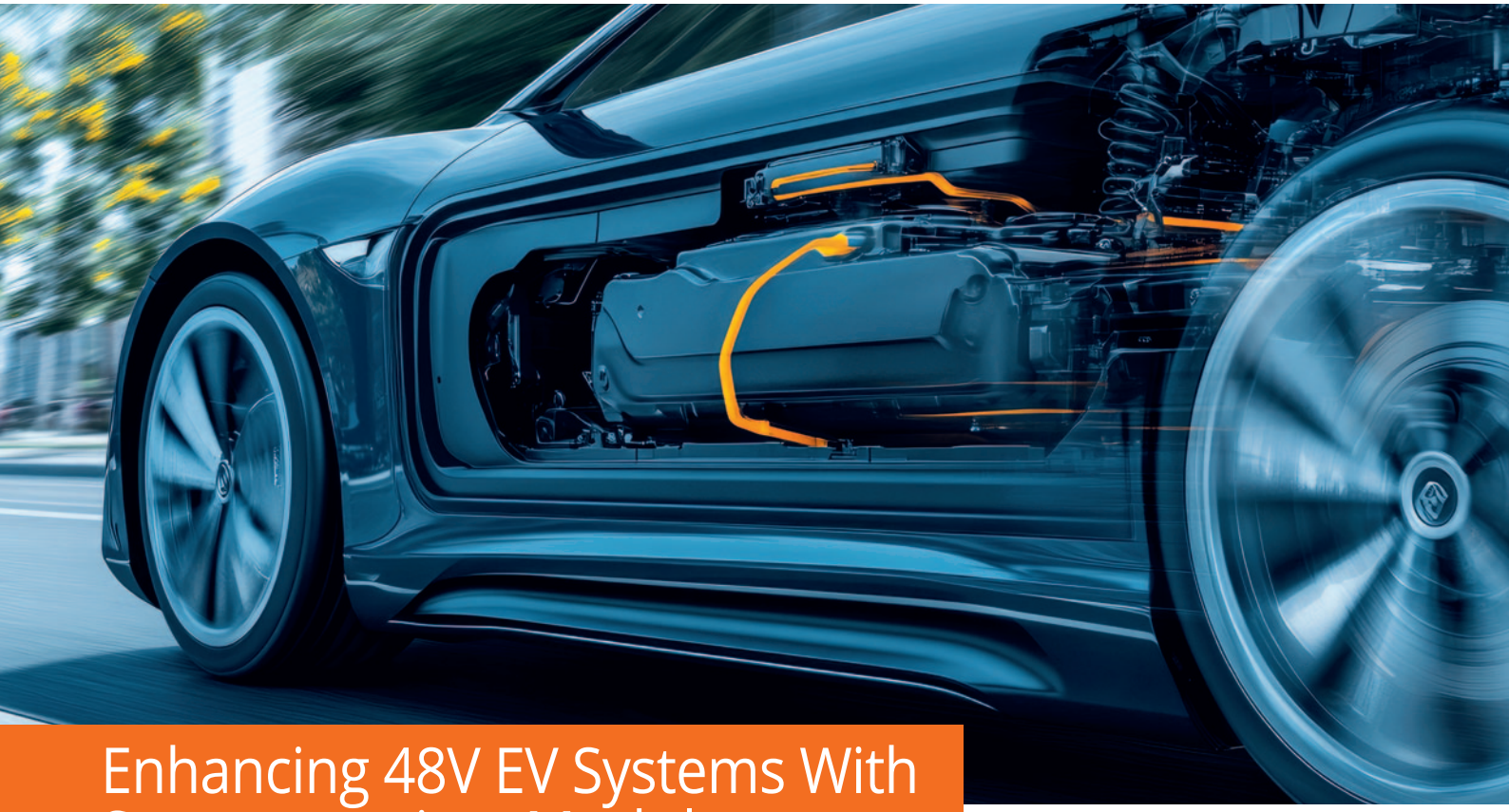
MORE AUTONOMY



Enhancing 48V EV Systems With Supercapacitor Modules

With the increasing electrification of modern vehicles, the demands on the energy supply within the vehicle are also rising – particularly in the area of 48V low-voltage systems. These systems offer an efficient way to power auxiliary electrical consumers such as steering, braking systems, compressors, or active suspension systems without relying on the main drive battery.

However, as the number and power consumption of these components grow, maintaining the stability of the onboard voltage becomes increasingly challenging. This is where supercapacitor modules come into play: they offer high power density, fast response times, and exceptional durability – making them an ideal solution for supporting and stabilizing 48V systems in electric and hybrid vehicles.

The following will illustrate how the targeted use of supercapacitors can improve vehicle efficiency and safety through concrete application examples, such as onboard network stabilization, emergency power supply, and active suspension systems.

Using 48V systems for the low-voltage bus can improve efficiency, as it allows for reduced current levels. This also saves on cable weight and cost. The higher voltage also increases the efficiency of high-power components.

However, as more electrical consumers are connected to the 48V bus, it becomes increasingly important to keep the bus voltage under control. For example, steering can draw significant power when turning the vehicle – several kilowatts toward the end of a trip. Air conditioning compressors and brake systems also draw high current when activated. Furthermore, if a high-voltage battery is disconnected or depleted, systems like brake-by-wire and steer-by-wire no longer function, posing a safety risk.

Why Use Supercapacitors Instead of Batteries:

- High power, up to 100 times that of a battery – no need for oversizing to meet the power requirements
- Less dependent on temperature which improves performance and life time – they can be placed closer to the loads that they support. This allows designers to reduce the costs of cabling.
- Higher power means also higher efficiency. Since there are no chemical reactions, supercaps can be charged and discharged millions of times, so they can last the time of the vehicle.
- Very safe and ideally suited for short duration charges and discharges.

Application Examples of How Power Issues in EVs Can Be Solved With Supercaps:

Board Net Stabilization

All the components/electrical loads on a 48V system are designed for a specific operating voltage range. In case one component pulls peak power, or several electrical loads pull a lot of power at the same time, the voltage can drop below the minimum required level. Pulling more power from the main battery is not an option in most cases as OEMs want to keep as much power and energy as they can for driving and not to be used by other subsystems. Furthermore, there can be delays in transferring the power from the 400V or 800V main battery, which can result in not holding up the voltage level on the 48V system in time.

Supercapacitor modules can be designed to keep the voltage above this minimum required level. They are typically designed to provide less than 3kW, more in a range of about 1kW. The voltage drop of the system is normally very quick, which is ideal for supercapacitors. While supercaps provide power to the whole system, they normally come into play when something like power steering or braking is working at its limits.

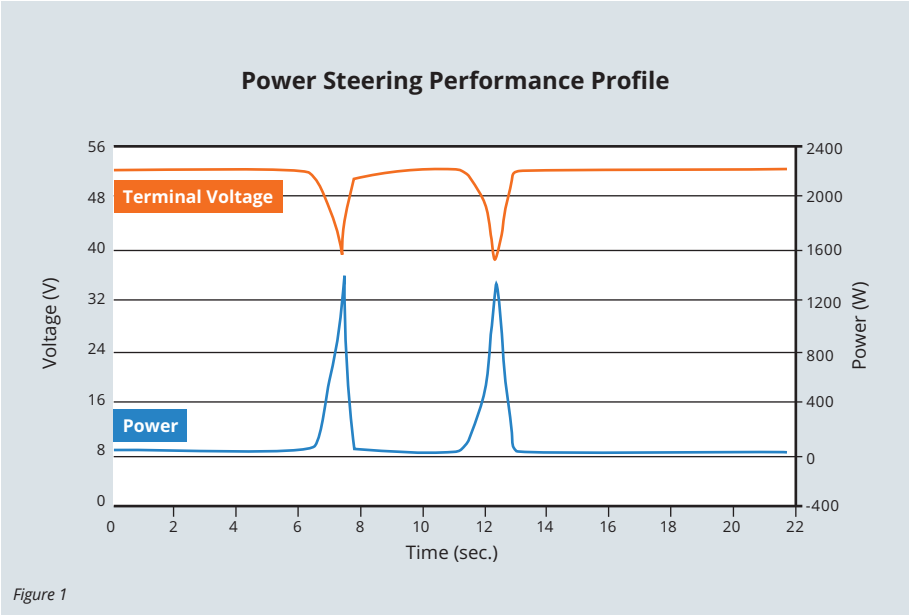


Figure 1

Here is an example of a power steering power profile and its effect on the board net. The blue line is the motor power, which is normally very low when the car is going straight. But when the driver turns, you can see up to 1,400W peaks for less than two seconds. This causes the 48V bus to drop which is shown with the orange line. In that event, the supercapacitor power storage will help to maintain the voltage level (Figure 1).

Depending on the balance of power, energy, size and costs, the module designs use 4 to 18 cells with 350 to 400F, or even 2 cells with 1000F may be used.

Backup Power

From the supercapacitor module design point of view, it is pretty similar to the one of the board net stabilization, particularly used at lower power for longer discharge times. But it is only used if the power of the system is lost. This might be the case if there is an accident that disconnects the main battery, or the main battery is fully depleted. Supercapacitors provide power to get the vehicle to safety, for example to the side of the road. They are selected for the wide temperature range and are designed for long lifetime, while being constantly charged, ensuring that they never need to be replaced. It´s still on the 48V bus, so designs typically use modules with 18 cells in the 400F range.

For safety reasons, there are other backup power applications in case of an accident that are not on the 48V bus. These can include door locks, sensors, communications, or lighting, where single smaller cylindrical supercapacitor cells are used.

Active Suspension

Active suspension is an application that is increasingly used by car manufacturers. It keeps the wheels in contact with the road as they hit bumps and potholes. There are motors on the suspension to drive the wheels down on a drop or absorb energy in a bump. The driving experience and drivability are improved as the wheels stay in better contact with the road, as well as the efficiency of the overall driving profile being improved.

Is this case, the supercapacitor modules are connected directly to the suspension motors, acting completely independently of the normal 48V bus. But as the system control works at up to 500Hz, local power storage is needed. The number of cycles makes batteries not an option. Also, the very quick reaction time is a big advantage of supercaps. For the majority, the designs use 18 cells in a 350-400F range.

We would be glad to support you with your designs. Do not hesitate to contact us for deeper discussions on your applications and solutions for them.

P01

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NOVELTY

Rectangular Al-Electrolytic and Polymer Capacitors

YAGEO-KEMET has further expanded its portfolio of rectangular capacitors. What's new?

Why Rectangular Capacitors?

The rectangular form factor is a game-changer in power electronics. These capacitors provide superior volumetric efficiency, high ripple current handling, and robust vibration resistance, making them ideal for demanding applications such as automotive, industrial power supplies, renewable energy systems and data centers. Additionally, their large flat surface area enables seamless integration with heat sinks, enhancing thermal dissipation and increasing ripple current capability or increasing life with the same ripple current. A further advantage is their stacking ability or a modular solution with the option of customizing the solutions according to the customer's needs.

AAR8S – The Industry's First Rectangular SMD Aluminum Electrolytic DC-Link Capacitor

AEC-Q200 qualified AAR8S is a new generation rectangular surface-mount Al-electrolytic capacitor designed for applications mainly in the field of e-mobility, such as inverters or on-board chargers, looking into full SMD capability. Also, UPS and Micro Inverters can benefit from this capacitor. This first-to-market product provides high capacitance, excellent ripple current capability, and superior thermal efficiency. With a low-profile design, it is ideal for applications where height constraints are critical. The operational lifetime is specified with 2,000 hours @105°C.

AAR7V – High-Voltage, High-Performance

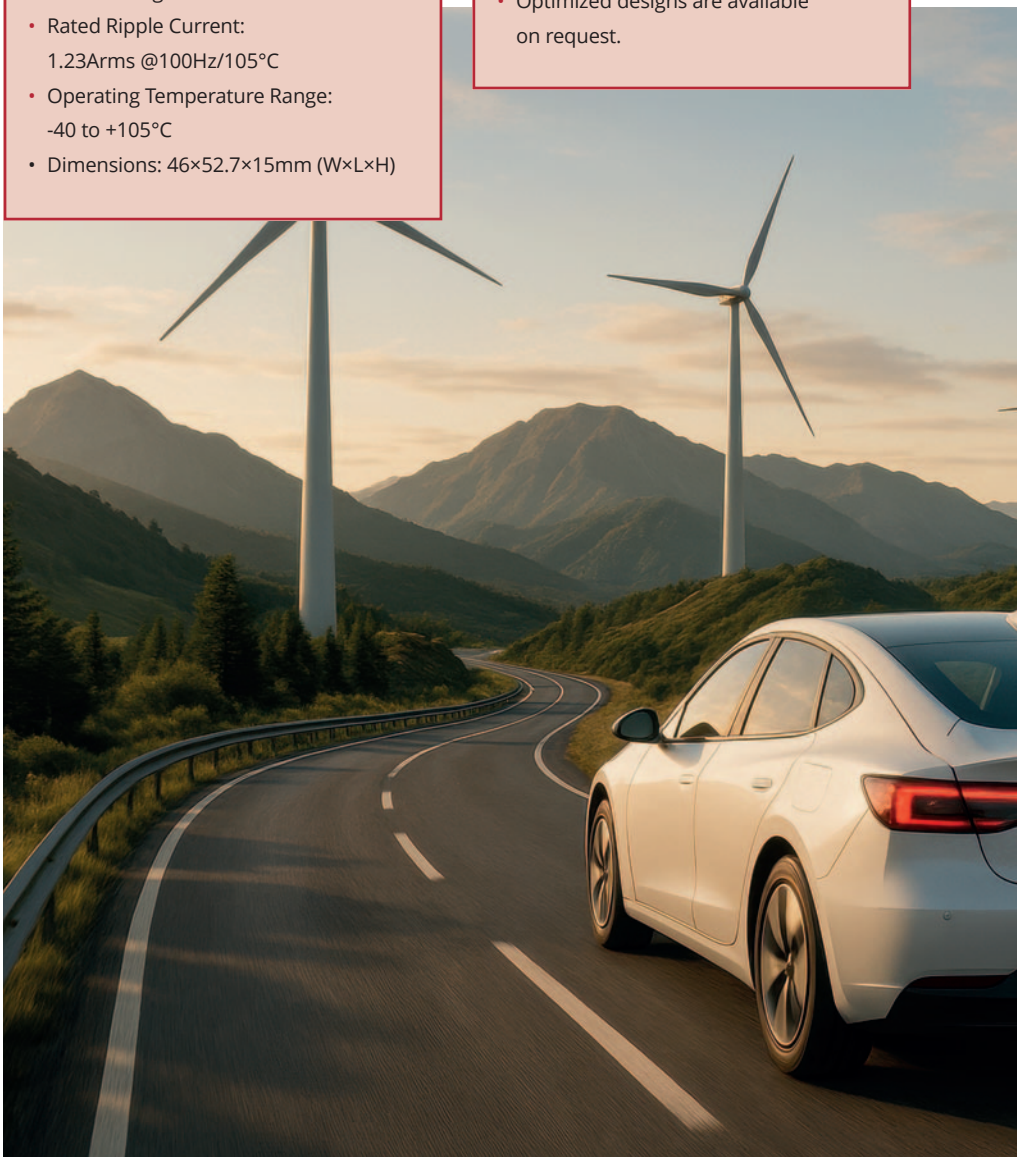
With a voltage rating of 500V, the AEC-Q200 qualified AAR7V is a high-voltage aluminum electrolytic capacitor engineered for EV powertrains, on-board chargers, industrial power supplies and renewable energy applications. It features a 10,000-hour lifespan at 85°C, excellent ripple current handling, optimized thermal performance, and a high vibration resistance of up to 40g.

AAR7V

- Capacitance Range: 110 to 200µF
- Rated Voltage: 500VDC
- Rated Ripple Current: 1.1 to 1.7Arms @100Hz/85°C
- Operating Temperature Range: -40 to +85°C
- Dimensions: 46×38.1×13.5mm to 46×57.2×13.5mm (W×L×H)
- Optimized designs are available on request.

AAR8S

- Capacitance: 150µF
- Rated Voltage: 450VDC
- Rated Ripple Current: 1.23Arms @100Hz/105°C
- Operating Temperature Range: -40 to +105°C
- Dimensions: 46×52.7×15mm (W×L×H)



APL90 – Compact 48V Polymer Capacitor with High Ripple Current Capability

The APL90 is an AEC-Q200 qualified aluminum polymer capacitor designed for 48V automotive and industrial applications. Its rectangular shape allows for efficient stacking and heat sink integration, optimizing thermal performance. With a very high ripple current capability of up to 25.8 Arms* and robust vibration resistance of 20g, it is ideal for DC-link in 48V systems like MHEV inverters or motor drives such as water pumps, power steering, or cooling fans, and input capacitor for 48V system data center power supplies. Applications requiring bulk capacitance, such as storage or radar systems, could also benefit from the low ESR performance of polymer capacitors.

- Capacitance: 1,100µF
- Rated Voltage: 63VDC
- Rated Ripple Current: 11.2 to 25.8Arms* @100kHz/125°C
- Operating Temperature Range: -55 to +125°C
- Dimensions: 24×53.8×8mm (W×L×H)
- Optimized designs are available on request.

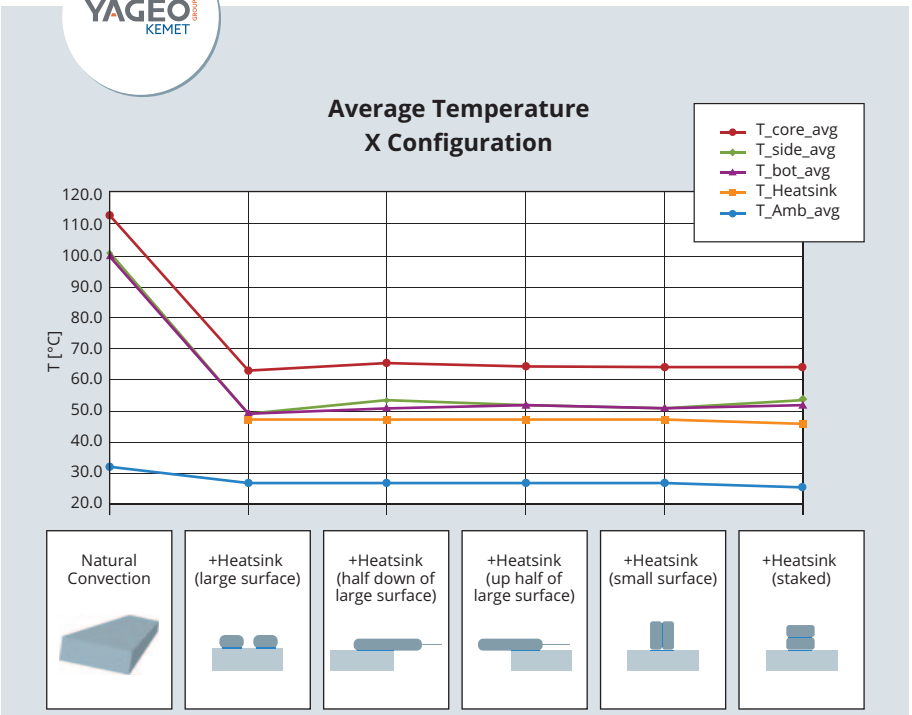


Figure 1: Average hot spot, case, heat sink, and ambient temperature according to capacitor mounting variations

APL9V – High-Voltage Polymer Capacitor with Superior Thermal Management

The APL9V is a high-voltage aluminum polymer capacitor designed for applications up to 250V (or 500V when used in series). Its solid polymer technology enables exceptional ripple current performance. This coupled with vibration resistance up to 20g, makes it suitable for HV inverters, e-compressors and motor control applications.

APL9V

- Capacitance: 60µF
- Rated Voltage: 250VDC
- Rated Ripple Current: 5.06 to 12.44Arms* @100kHz/125°C
- Operating Temperature Range: -55 to +125°C
- Dimensions: 26×53.8×9.5mm (W×L×H)

Figure 1 above shows a comparison of natural convection with different heatsink conditions, where capacitors were subjected to a ripple current of 20Arms to induce a temperature rise at the hot spot, aiming to investigate the capacitor's response.

Overall, the capacitors exhibit a consistent response in terms of thermal dissipation when subjected to various heat sink conditions. This uniformity is observed irrespective of differences in surface area contact or mounting disposition, highlighting the versatility of using this capacitor with a heat sink.

For more information about these products or this technology, samples or prices, please contact:

P02

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**The maximum ripple current capability is achieved with attaching the capacitor body to a heatsink using thermally conductive paste or adhesive to achieve optimal thermal conditions.*

SMALLER, SMARTER, MORE EFFICIENT

Power Inductors for Server AI and Edge Computing

AI servers are becoming increasingly advanced, and as a result, power inductors used for the power supply are also evolving. In particular, power inductors for Point of Load (PoL) applications are required to provide flexible options in terms of efficiency, size and cost within a rapidly growing market. As AI systems become more high-performant, power consumption increases, driving a higher demand for efficient and miniaturized inductors. Many companies, including SAGAMI Elec, respond to these needs by offering custom designs.

Comparison of Key Materials and Their Characteristics

The choice of material for power inductors has a significant impact on their performance. The most commonly used materials are MnZn ferrite and metal composites, each with unique properties. MnZn ferrite features low loss and excellent magnetic characteristics, making it ideal for applications where high efficiency is critical. However, it has limitations in saturation properties, and its performance can deteriorate in relatively high-power applications. In contrast, metal materials excel in saturation properties and can handle higher power densities, but they tend to have higher losses compared to ferrite.

Therefore, it is important to consider this trade-off when selecting materials for each application.

Trade-off Between Miniaturization and Low Loss

When designing a power inductor, miniaturization and low loss are often in a trade-off relationship. Achieving miniaturization requires improving magnetic properties by increasing the relative permeability of the inductor. However, higher permeability can also result in increased losses, potentially reducing efficiency.

Therefore, when high efficiency is the priority, miniaturization is not always the best option. The use of MnZn ferrite may increase the size, but it enables lower losses and higher efficiency. SAGAMI Elec's CDG series (Figure 1) is optimal for high-efficiency PoL applications and is also available in a custom version that reduces AC losses by up to one-third.

On the other hand, prioritizing miniaturization tends to decrease efficiency, making heat management more important.

Figure 1: CDG series from SAGAMI Elec

Proposal for Miniaturization

When miniaturization is prioritized, composite structures using metal powder are optimal. SAGAMI Elec's proprietary advanced material design achieves both high saturation magnetic flux density and high permeability, comparable to conventional FeSi materials, as well as overwhelmingly lower loss characteristics, far superior to those of FeSi and FeNi materials. These products are now attracting attention as ideal for backside power delivery (BPD) applications, such as direct mounting beneath xPUs (Figure 2).

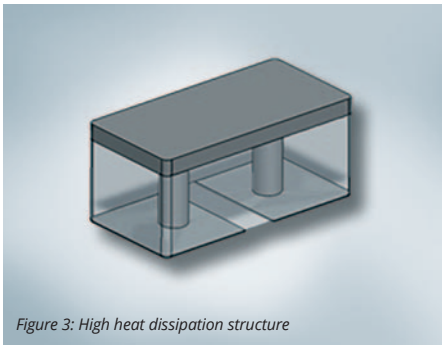

Figure 3: High heat dissipation structure

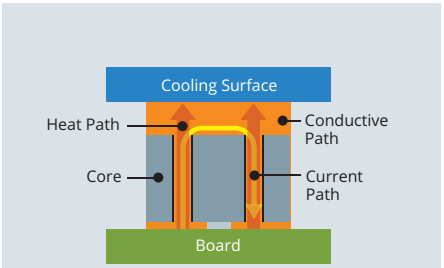

Figure 4: Innovative structure – heat and current path optimized

Proposals for Miniaturization and Heat Dissipation

An integrated approach that incorporates heat dissipation mechanisms is effective for inductor design. For example, designing the inductor's inner structure, top surface and solder pads from one-piece (Figure 3, allows efficient heat conduction. Additionally, by creating a heat path, heat can be efficiently transferred from the PCB to the inductor's top surface, where a heatsink can be attached (Figure 4). This design not only allows the inductor to dissipate heat generated by its own losses but also efficiently manages heat transferred from surrounding components, improving the overall heat dissipation efficiency of the module (see Figure 5).

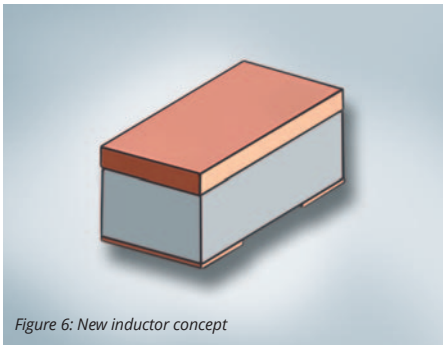

Figure 6: New inductor concept

This new inductor concept offers a small package size (4.2×8.4×3.6mm) and provides an ultra-high current density of 2.2A/mm². Even in this small size, the inductor can handle up to 80A (Figure 6).

In summary, when designing power inductors for AI servers, balancing material selection, efficiency, miniaturization, and heat dissipation features is crucial. Custom designs that meet customer needs will be key to success in the evolving market. Thus, SAGAMI Elec constantly develops new solutions that combine out-of-the-box thinking with technical know-how.

If you are looking for samples of the CDG series, please visit the CODICO Sample Shop. For further questions, please contact:

P03

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Author: Naoto Saegusa – Section Manager Development Department at SAGAMI Elec

Preliminary Specification

Part Number	Inductance (nH)	DC Resistance (mΩ)	DC Saturation allowable Current (A)	Temperature Rise allowable Current (A)
New Concept Inductor	85.3 typ.	0.2 typ.	80.0 typ.	80.0 typ.

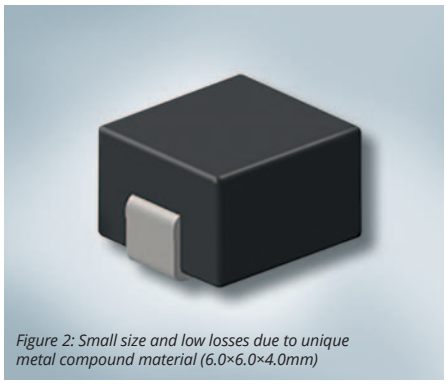

Figure 2: Small size and low losses due to unique metal compound material (6.0×6.0×4.0mm)

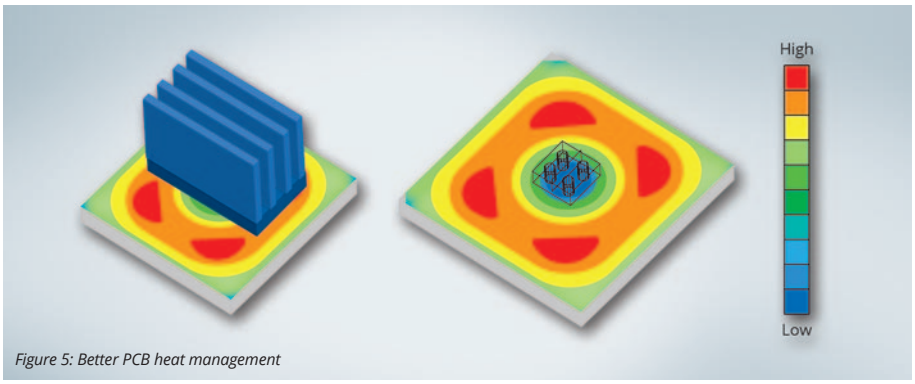

Figure 5: Better PCB heat management

POWER UP

Relay Selection for Safe AC Charging Stations: Standards, Requirements and Solutions

With the increasing popularity of electric vehicles, the need for safe, standard-compliant, and economical charging solutions is growing – both in private and public areas. Alternating current (AC) charging is the preferred method for locations with longer stays – such as homes, workplaces, parking garages, and hotels.

Foundation of AC Charging: Mode 2 & Mode 3 according to IEC 61851-1

The IEC 61851-1 standard distinguishes between two basic charging types for AC charging:

Mode 2: Charging via Existing Sockets

In Mode 2 charging, the energy flow occurs via a standard household socket, such as Schuko or CEE. A control and protection element integrated into the charging cable – the so-called »In-Cable Control and Protection Device« (IC-CPD) – takes over safety-relevant functions such as residual current detection and communication. These devices are subject to the IEC 62752 standard, which, among other things, requires protective functions for AC and DC residual currents.

Mode 3: Charging via Permanently Installed Charging Stations

Mode 3 charging is carried out via a permanently installed charging station, which must be planned and installed by a qualified electrician. Unlike Mode 2, safety-relevant functions can be distributed across the entire system, including the electrical installation and charging station. This gives developers more options, and the safety features integrated into the charging station can largely be selected and specified by the manufacturer.

Normative Requirements for Relays in Mode 3 Charging Stations

Relays in AC charging stations play a safety-critical role – especially in interrupting the flow of power in the event of a fault. The switching elements therefore need to comply with functional requirements as well as with safety-relevant standards in addition to IEC 61851-1, such as:

- IEC 62955: DC residual current monitoring
- IEC 61008-1 / IEC 62423 / IEC 60947-2: Residual current device (RCD)

Depending on the desired range of functions, these standards contain additional requirements for the relays installed in the charging station.

Technical Criteria for Relay Selection

When selecting suitable relays for AC charging stations, the following technical properties,

				Mode 3 Charger – Internal Integration Level		
				LOW Separate safety devices (e.g. RCD's) are installed in Wallbox, Switching done by DIN Rail Contactor, no switching element on PCB	**MID** 4 pole Relays on PCB → several safety responsibilites are fulfilled by the Relay Manufacturer	**FULL** 1 or 2 pole Relays → major safety responsibility is within the AC-Charger Manufacturer
Mode 3 Charger - Internal Features	RDC+RCD+ Load Leveling	Relevante Normen bzgl. Fehlerstromerkennung	IEC 62955 + IEC 61008-1 or IEC 61009-1 or IEC 62423 or IEC 60947-2	–	TYPICAL RELAYS: **1× 4-pole + 6× 1-pole** **SCP40 + 207BX, 110BZ, 117L, SMIC, 118-1**	TYPICAL RELAYS: **7× 1-pole** **207BX, 110BZ, 117L, SMIC, 118-1**
	RDC+RCD		IEC 62955 + IEC 61008-1 or IEC 61009-1 or IEC 62423 or IEC 60947-2	**NO RELAY** Typical Architecture: 1× DIN rail RCD + 1× 4-pole DIN rail contactor	TYPICAL RELAY: **1× 4-pole** **SCP40**	–
	RDC		IEC 62955	**NO RELAY** Typical Architecture: 1× 4-pole DIN rail contactor	TYPICAL RELAY: **1× 4-pole** **SCP40**	TYPICAL RELAYS: **4× 1-pole or 2× 2-pole** **207BX, 110BZ, 117L, SMIC, 118-1, SPV40, 118-2**
	No RDC functionality		must be coverd by Type B or Type A+EV RCD's	–	–	TYPICAL RELAYS: **4× 1-pole** **207BX, 110BZ, 117L, SMIC, 118-1**

among others, are crucial to ensure compliance with standard and functional requirements:

- Rated current and thermal behavior
- Short-circuit current rating
- Switching capacity (for example, up to 500A)
- Contact spacing and pulse resistance between the contacts
- Inrush current rating (for example, 230A inrush current)
- Mechanical coupling of the poles and timing behavior between the poles (for example, pre- or post-run for neutral)

All of these properties significantly influence the safety and standard compliance of the charging station.

1-, 2- and 4-Pole Relays: Technical and Commercial Considerations

When selecting suitable relays for Mode 3 charging stations, the economic environment and the desired level of integration play a key role alongside the technical requirements:

4-pole relays already meet many safety-relevant requirements at the component level. They reduce testing and development effort at the system level and are ideal for small and medium volumes where efficiency and development resources are crucial. Furthermore, their mechanical design makes them suitable for covering all types of residual current devices (RCD) standards.

1- and 2-pole relays are particularly cost-effective and well-suited for wallboxes with high production volumes. Major advantage is lower material cost and a compact design.

The table above shows various typical combinations of functionality and levels of integration, as well as typical product options from the suppliers SANYOU and SONG CHUAN.

Relay Solutions from CODICO: Suitable for Every Application

CODICO offers a broad portfolio of standards-compliant relay solutions for AC charging stations. Products from suppliers SANYOU and SONG CHUAN cover various power classes and meet the relevant standards for Mode 2 and Mode 3 charging systems.

Are you planning to develop an AC charging station or are you looking for a suitable relay solution? Our team of experts will be happy to support you – competent, solution-oriented, and standards-compliant. Simply contact us!

P04

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Relays for mode 3 charger

RISK-FREE

The Role of Solid-State Relays and Magnetic Sensors in Medical and Biotech Applications

More precision, safety, and reliability for critical applications.

Modern medical and biotechnology systems demand exceptional performance: from diagnostic accuracy and patient safety to uninterrupted operation in critical environments. Behind the scenes, solid-state relays (SSRs) and magnetic proximity sensors are key technologies that enable this performance. Offering contactless switching, high precision, and unmatched durability, these components are increasingly replacing mechanical alternatives across a wide range of applications.

In this article, we explore how these technologies contribute to greater efficiency, reliability, and safety in medical and biotech equipment – with real-world application examples and practical product options.

Solid-State Relays: Reliable Switching for Temperature and Motion Control

Unlike electromechanical relays, SSRs operate without moving parts, enabling faster, quieter, and more reliable switching of electrical loads. Their resistance to wear and ability to function in harsh or sensitive environments make them ideal for the stringent demands of healthcare and laboratory settings.

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Temperature Control in Critical Systems

Many medical and biotech processes require precise thermal management. SSRs are commonly used to control heating elements in:

- Dialysis machines, where fluids must be maintained at exact temperatures to avoid complications for patients
- Neonatal incubators, which simulate womb-like warmth for premature infants, requiring constant and stable temperatures
- Autoclaves and sterilizers, where controlled heat eliminates microorganisms while preserving the integrity of medical instruments
- Centrifuges and blood analyzers, where specific thermal conditions ensure accurate test results
- Medical glassware washers, which depend on stable water temperatures for effective cleaning without damaging sensitive tools

In each of these systems, SSRs provide precise switching and thermal stability, helping ensure safety, compliance, and performance.

Motor Control in Patient-Centric Devices

Motorized systems have become standard in patient care and rehabilitation. Solid-state relays are now commonly used in:

- Electrically adjustable hospital beds for greater comfort and mobility
- Rehabilitation equipment such as exoskeletons or therapy treadmills
- Dental treatment chairs that can be precisely positioned with up to six motors

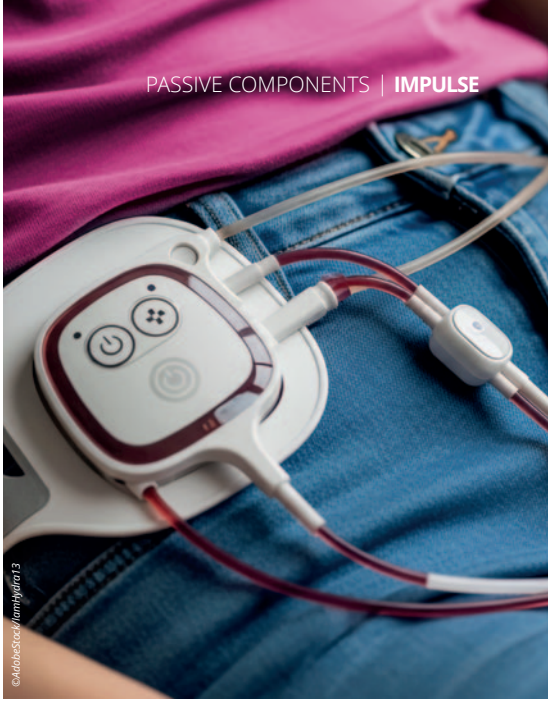
Compared to traditional relays, SSRs offer silent operation, fast response times, lower maintenance, and integrated voltage protection – all of which are essential for medical applications where safety and comfort are paramount.

CELDUC© SSR Product Highlights

- SK/XK Series – versatile relays for PCB or DIN-rail mounting
- SF5 Series – compact miniature relays for limited space
- SO8/SO9 Series – robust single-phase relays for general use

Magnetic Proximity Sensors: Contactless Sensing with Built-In Precision

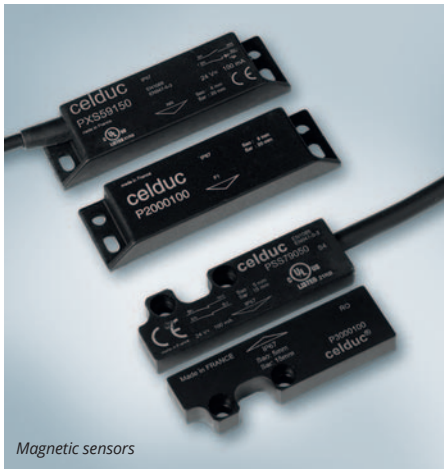
Magnetic proximity sensors are ideal for applications requiring non-contact detection, especially where hygiene, safety, or mechanical wear are concerns. In the medical and biotech sectors, these sensors enable precise, maintenance-free detection of movement, position, or system status.



Safety and Equipment Monitoring

In many medical systems, safety hinges on ensuring that covers, doors, or panels are securely closed before operation. Magnetic sensors are used to:

- Monitor door closures in imaging equipment, preventing accidental exposure
- Verify safety conditions in blood analyzers, protecting both samples and operators
- Detect protective enclosures in centrifuges or robotic arms, enabling safe automated processes



Magnetic sensors

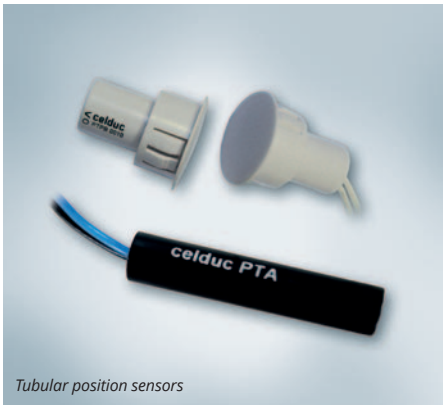
CELDUC®'s PXS and PSS safety sensor series are designed specifically for such high-reliability, safety-critical environments.

Monitoring Medical Refrigeration

Temperature-sensitive pharmaceuticals, blood products, and biological samples require strict storage conditions. Magnetic sensors help monitor:

- Refrigerator and freezer doors, ensuring that they are properly closed to prevent thermal deviations
- Cold rooms, where real-time door monitoring can support compliance and traceability
- Blood bank storage units, where stable temperatures directly impact the viability of stored components

The sensors provide reliable real-time door status data – a key contribution to product safety. CELDUC® offers a wide range of tubular position sensors.



Tubular position sensors

Liquid Level Detection in Medical Devices

Precise fluid management is essential in many medical and laboratory systems. Magnetic sensors are used for non-contact level detection in:

- Dialysis machines, to avoid fluid overload or depletion
- Bioreactors and reagent tanks, to ensure accurate chemical processes
- Balneotherapy equipment, to prevent pump damage from dry running
- Hospital fluid reservoirs, including saline and sterile water systems

CELDUC® provides a wide range of magnetic level sensors.


Magnetic level sensors

KEY ADVANTAGES AT A GLANCE

SOLID-STATE RELAYS

- High reliability – no mechanical wear, ideal for continuous operation
- Fast, silent switching – perfect for sensitive medical environments
- Compact and robust – easy to integrate into modern equipment
- Voltage protection – safeguards delicate electronics

MAGNETIC SENSORS

- Contactless detection – no physical wear, lower failure rates
- Miniaturization – easily fits into compact medical devices
- High durability – resists heat, cold, moisture, and corrosion
- Electromagnetic immunity – unaffected by electrical noise

Additional Applications

- Patient monitoring: sensors detect presence or unusual movements in beds or wheelchairs
- Infusion pumps and ventilators: internal components can be monitored with magnetic sensors for precise control
- Lab automation: robotic arms and pipetting systems rely on accurate position sensing

P05

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CONCLUSION

As the healthcare and biotech industries continue to advance, so does the need for smart, efficient, and maintenance-free components. CELDUC® relais offers a proven portfolio of solid-state relays and magnetic sensors designed specifically for the demands of medical technology. From temperature control to motor management, from refrigeration monitoring to lab automation – these components increase equipment uptime, enhance patient safety, and ensure compliance with stringent industry standards. Their reliability and performance make them indispensable building blocks for the medical technologies of tomorrow.

PRECISE & RELIABLE

TCXO Development Directions and New Series From KDS

The communication network is evolving day by day. It's not an exaggeration to say that almost everyone is connected to a communication network today. The volume of data transmission is increasing year by year, and the speed of communication is now much faster than in the past. The importance of high-precision clocks, which are the standard for high-data capacity and ultra-high-speed communications, is increasing day by day.

TCXOs are now required for applications where crystal units were previously sufficient, and oscillators are more demanded to higher frequency oscillation to save space and reduce design time compared to using crystal units.

TCXOs are used in the following applications:

- Advanced wireless communication devices
- Navigation systems such as GPS/GNSS
- IoT devices such as smart home and sensor networks
- Broadcasting equipment
- Aerospace and defense equipment
- Industrial equipment
- Medical equipment
- Automotive and transportation equipment
- Data centers and servers
- Advanced test and measurement equipment

Directions of TCXO Development

Which directions are TCXOs heading? In this article, we explore five key development trends: miniaturization, enhanced precision, reduced phase noise and jitter, higher operating frequencies, and lower power consumption.

1. Miniaturization

The word »miniaturization« may be very common for electronic components. However, in crystal devices, simple miniaturization has already been achieved, and the main question is what size will become the next mainstream. Of course, the cost and the need for miniaturization itself will guide the size transition.

For example, the most common sizes are 2520 (2.5×2.0mm), 2016 (2.0×1.6mm), and 1612 (1.6×1.2mm). These sizes have been produced in large quantities to date and have proven their stable quality. They differ according to market needs: the 1612 size is mostly used for mobile phones and small wireless communication devices, while the 2520 and 2016 sizes are mostly used for general and automotive applications. In the future, miniaturization may move to the 1210 size, but demand will remain low unless space-saving is necessary.

Typical KDS products: DSB221SDN (2520), DSB211SDN (2016), DSB1612SDN (1612)

2. High Precision

Demand also affects the high-precision segment. While general TCXOs have temperature characteristics of ±0.5ppm or ±1.5ppm, high-precision TCXOs can achieve ±0.1ppm or better, or even ppb-level accuracy. This does not mean that

higher-precision products will become the mainstream. Today, these products are mainly used for infrastructure applications, such as Stratum 3 network devices.

Therefore, even though their size differs from the mainstream, the 5032 (5.0×3.2mm) package plays the leading role in this market. Miniaturization from the 5032 size is possible as well, but there is currently little market demand for it.

Typical KDS product: DSB535SGA (5032)

3. Low Phase Noise / Low Jitter

Low phase noise and low jitter make crystal devices the mainstream choice among timing devices. Phase noise directly affects receiver sensitivity, modulation performance, and the frequency stability of communication systems. High phase noise degrades the bit error rate and communication speed, making accurate data transmission difficult at high volumes and rates.

MEMS oscillators have evolved remarkably in recent years. However, in terms of Q factor (quality factor), which represents the »sharpness« of the signal at the resonance frequency, they still lag behind quartz devices by two to three orders of magnitude. This results in a significant difference in phase noise and jitter, which are strongly dependent on the Q factor.

In the TCXO market, new products with lower phase noise than their predecessors typically become mainstream, unless manufacturing costs are significantly higher. In other words, current mainstream products offer better phase noise performance than earlier models. Therefore, if you are using an older TCXO, it may be worth replacing it with a newer one to improve communication performance.

Typical KDS products: DSB221SDN (2520), DSB211SDN (2016), DSB1612SDN (1612)

4. High Frequency

Wireless communications operate in the basic GHz band. Increasing the reference clock frequency can reduce the multiplication factor in the PLL circuit, thereby simplifying the design. However, higher frequencies also make phase noise and jitter more critical. As mentioned earlier, phase noise and jitter directly affect communication speed and accuracy, so even high-frequency devices can degrade performance if their phase noise is poor.

Currently, standard TCXOs support frequencies up to 52MHz, which corresponds to the common RF frequency for mobile phones. Chipset companies are now developing higher-frequency TCXOs, such as 76.8MHz or 104MHz (doubling 38.4MHz and 52MHz).

5. Low Power Consumption

Power saving is another crucial factor: the less energy individual components consume, the longer a device can operate. While TCXOs were mostly operated at 2.5V to 3.3V around 20 years ago, 1.8V is now the standard. However, the demand for even lower supply voltages continues to grow.

In this article, we would also like to introduce new KDS products that align with the development trends of high frequency and low power consumption.

High-Frequency TCXOs up to 104MHz with Low Phase Noise

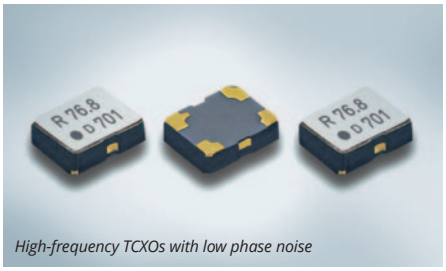
KDS has developed the TCXO DSB1612SEB series, which supports output frequencies up to 104MHz. 104MHz is expected to become the mainstream frequency for mobile phone RF in the future. The 70MHz, 80MHz, and 90MHz bands are also expected to be in demand, which can double the frequency range of other wireless communication clocks.

Features:

- Frequency up to max. 104MHz (76.81MHz to 104MHz is only for samples, mass production from January 2026)
- Extremely low phase noise and jitter characteristics (see chart below)
- Stable temperature characteristics: ±0,5ppm max. (-40 to+85°C) ±5,0×10^{-6} max. (-40 to +105°C)

Main Applications:

- Wireless Communication (Mobile RF, Wi-Fi, Bluetooth, etc.)
- GPS/GNSS Receiver
- High frequency signal sources such as ADC/DAC clocks

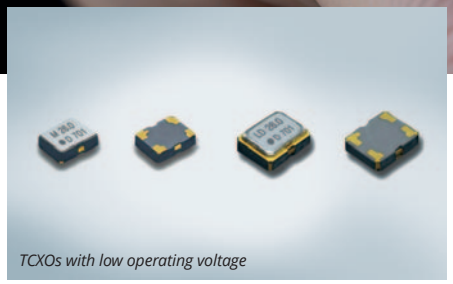


High-frequency TCXOs with low phase noise

Phase Noise Comparison between DSB1612SEB and DSB211SDN (Current Major Series)			
PHASE NOISE	**DSB1612SEB**	**DSB1612SEB**	**DSB211SDN**
Frequency	[f≤52MHz]	[f>52MHz]	[40MHz<f≤52MHz]*
Offset 100Hz	-110dBc/Hz	-108dBc/Hz	-105dBc/Hz
Offset 1kHz	-130dBc/Hz	-125dBc/Hz	-125dBc/Hz
Offset 10kHz	-152dBc/Hz	-150dBc/Hz	-145dBc/Hz
Offset 100kHz	-155dBc/Hz	-155dBc/Hz	-150dBc/Hz

Specifications of DSB1612SEB			
Frequency Range	26 to 76.8 76.8 to 104*	MHz	
Supply Voltage Range	+1.8 to +3.3	V	–
Current Consumption	+4.5	mA max.	[ff≤52MHz]
	+5.0	mA max.	[f>52MHz]
Stand-by Current	3	µA max.	–
Frequency Stability Tolerance	±2.0	ppm max.	After 2 reflows
vs. Temperature	±0.5	ppm max.	-40 to +85°C
vs. Temperature	±5.0	ppm max.	-40 to +105°C
vs. Supply Voltage	±0.2	ppm max.	Vcc ±5%
vs. Load Variation	±0.2	ppm max.	[10kΩ/10pF] ±5%
vs. Aging	±2.0	ppm max./year	
Start up Time	max. 2,0	ms	
Phase Noise [f>52MHz]			
Offset 100Hz	-108	dBc/Hz	[f>52MHz]
Offset 1kHz	-125	dBc/Hz	–
Offset 10kHz	-150	dBc/Hz	–
Offset 100kHz	-155	dBc/Hz	–

**under development*



TCXOs with low operating voltage

TCXO With Low Operating Voltage – 1.2V

Nowadays, IoT and wearable devices are widely used. The 1.2V-driven TCXOs, DSB1612SLD and DSB211SLD, meet the demands for longer battery life and smaller size. According to KDS, these models can reduce power consumption by up to 20% compared to conventional 1.8V TCXOs.

Features:

- Supply Voltage: 1.2V (Power consumption can be cut by 20% compared to conventional products)
- Stable temperature characteristics: ±0.5ppm max. at -40 to +85°C
- Available in 2016 and 1612 sizes
- Samples are available, mass production from October 2025

Main Applications:

- Wireless Communication (Mobile RF, Wi-Fi, Bluetooth, etc.)
- GPS/GNSS Receiver
- Wearable Devices driven by battery
- Medical Devices

Specifications of DSB1612SLD and DSB211SLD			
Frequency Range	13 to 52	MHz	–
Supply Voltage Range	+1.1 to +2.0	V	–
Current Consumption	1.7	mA max.	–
Stand-by Current	3	µA max.	–
Frequency Stability Tolerance	±1.5	ppm max.	After 2 reflows
vs. Temperature	±0.5	ppm max.	-30 to +85°C
vs. Supply Voltage	±0.2	ppm max.	Vcc ±5%
vs. Load Variation	±0.2	ppm max.	[10kΩ/10pF] ±5%
vs. Aging	±1.0	ppm max./year	–
Start up Time	max. 2.0	ms	–
Phase Noise			
Offset 100Hz	-116	dBc/Hz	–
Offset 1kHz	-134	dBc/Hz	–
Offset 10kHz	-150	dBc/Hz	–
Offset 100kHz	-150	dBc/Hz	–

Another Advantage: The Unique Construction of the KDS-TCXOs

DSB1612SEB, DSB1612SLD, and DSB211SLD all feature a single-chamber package design, meaning that both the crystal blank and the IC are placed in the same chamber. Most competitors use an H-shaped (two-chamber) structure, where the crystal blank and IC are housed in separate chambers. In such designs, the crystal blank is hermetically sealed, but the IC is only covered with resin. As a result, oscillators with an H-shaped structure typically have a Moisture Sensitivity Level (MSL) of 2 or higher, requiring reels to be packed in moisture-barrier bags with desiccant.

KDS TCXOs, however, all use a single-chamber structure with an MSL of 1, eliminating the need for special humidity control. This represents yet another clear advantage of choosing KDS products.

If you would like to know more details about those product series, please contact:

P06

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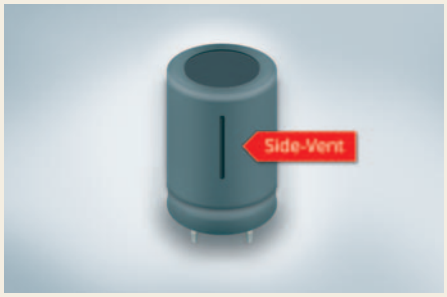
PROGRESS

Snap-In Capacitors With Side-Vent Technology

To meet the increasing demands for heat dissipation and ever-more compact designs, RUBYCON is currently developing an innovative alternative to the conventional top-vent version of snap-in capacitors: the side-vent design.

What is a Side-Vent?

Instead of the traditional rupture vent located at the top of the capacitor, this new design features a gas release opening on the side of the casing. This allows for the unrestricted use of top-cooling solutions and thus supports more efficient heat dissipation.



Why Side-Vent?

- More compact designs: In many applications, there is no space between the capacitor and the cooling plate above it – making top vents non-functional.
- Customer demand: Numerous customers have requested an alternative to top-vent technology.
- Reliable operation: The side vent functions reliably even with the plastic sleeve in place.
- Design flexibility: No clearance is required above the capacitor.

Note: At present, the exact position of the side-vent cannot be specified – it may be located anywhere along the 360° circumference of the capacitor.

Availability

The side-vent design is under development for snap-in capacitors ranging in size from 22×45mm to 35×60mm. Initial samples of the ø35mm size are already available.

Applications

The side-vent technology was specifically developed for applications where snap-in capacitors are actively cooled – especially in the DC-Link of on-board chargers (OBC) in electric vehicles. In these systems, capacitors are often thermally connected to cooling plates, making top-vent gas release not always feasible. The side vent ensures safe pressure relief even when the top of the capacitor is in direct contact with a surface.

Another potential application is in industrial inverters, where high component density and thermal constraints also call for lateral venting solutions.

Additional Solution: Gas-Escape Groove

For applications where the top of the capacitor is thermally connected, RUBYCON also offers a special housing design with a gas-escape groove. A notch at the upper edge of the casing enables lateral pressure relief – even when the top-vent is fully blocked. This solution is currently available only for ø25mm. Other sizes are under development, depending on demand.

P07

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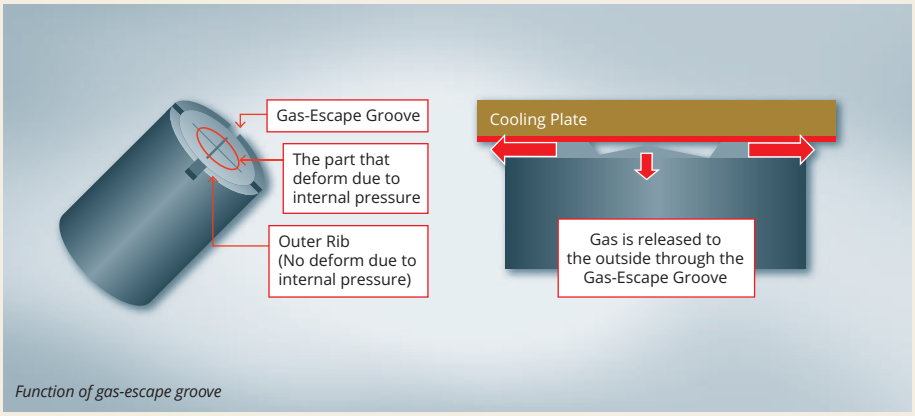


Function of gas-escape groove

HIGH-PERFORMANCE

Busbar Connectors for Modern Power Distribution

AMPHENOL CS offers high-performance, low-resistance busbar connectors that enable efficient and reliable power distribution between busbars, cables, and PCBs.

Energy Savings through Maximum Efficiency

- Ultra-low contact resistance: GCS® and AGT® technologies set industry standards with extremely low resistance – even at end of life.
- Up to 20% higher current-carrying capacity compared to conventional solutions
- Long-term cost savings: Designed for maximum energy efficiency with minimal power loss – ideal for next-generation system architectures.

High Performance for Demanding Applications

- Ultrasonic welding between wire and contact ensures minimal voltage drop and outstanding reliability.
- Broad product portfolio with current ratings ranging from 150A to 1250A (at a 45°C temperature rise), suitable for a wide range of system requirements.

Busbar I/O Products

AMPHENOL CS' BarKlip® I/O products provide a convenient and customizable method of distributing high-current power between busbars, cables, and circuit boards. These board-to-busbar connectors are designed to meet OCP V3 power distribution architecture standards and are ideal for use in power shelves, BBUs, server/storage sleds, EV charging stations, and other high-current applications in data centers.

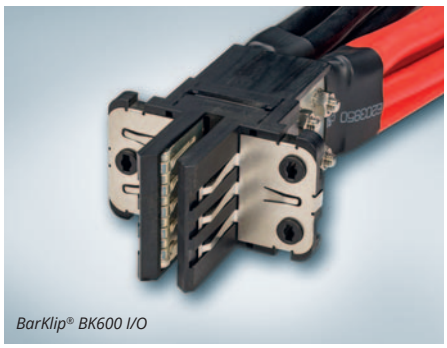
The ultrasonically welded connection between the wire and contact increases the efficiency and reliability of the current transition, while the direct pluggable connection to an uninsulated busbar generates very low energy loss.

Board/Busbar Mounted BarKlip® Connectors

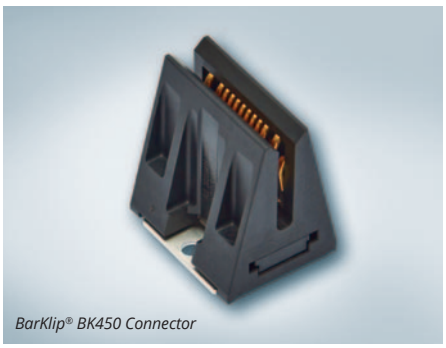
The range of Board-Mount BarKlip® connectors consists of high-power, low-resistance busbar connectors designed for hyper-scale computing architectures, energy storage systems, and EV charging stations. These power connectors feature independent points of contact, gold or silver-based plating for ultra-low contact resistance, and an integrated guide system for protection during mating and un-mating.

Industrial/Energy Storage/ EV Charging

AMPHENOL CS provides a broad range of power interconnect solutions tailored for industrial systems, energy storage, and EV charging infrastructure. The BarKlip® XP300 and XP200 busbar-mounted connectors support current ratings of up to 300A and 200A, respectively, and are engineered for single-pole busbar configurations with ultra-low contact resistance – even at end of life. Both variants are available in PCB-mount-

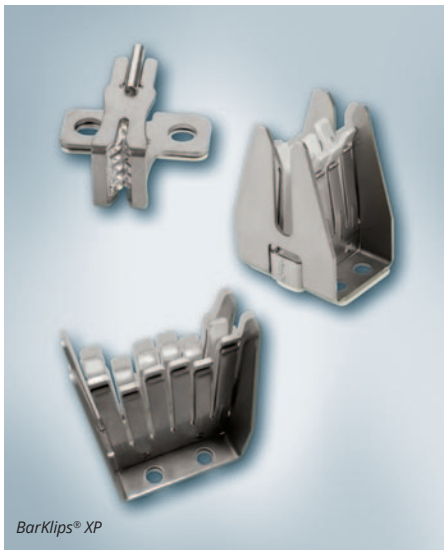


BarKlip® BK600 I/O



BarKlip® BK450 Connector

BarKlip® XP300



BarKlips® XP

ed configurations, making them well-suited for high-current busbar power distribution, hyperscale computing environments, and OCP 48V-compliant system architectures.

BarKlip® XP Connectors

BarKlip® XP connectors from AMPHENOL CS feature independent contact points that collectively deliver lower resistance and improved efficiency. They support current distribution from 150A to 1000A, making them suitable for applications such as energy storage systems, battery backup units, robotics, and other high-current distribution environments.

BarKlip® BK200 I/O for EV Charging

The BarKlip® BK200 I/O is a wire-to-busbar connector that provides a compliant spring to adjust for variations in busbar alignment and surface finish, making it an ideal solution for Level 2 and Level 3 EV charging stations, superfast charging stations, and power modules in EV charging. It carries up to 200A/contact (30°C T-rise in still air), with a maximum resistance of only 0.2mΩ per port.

S01

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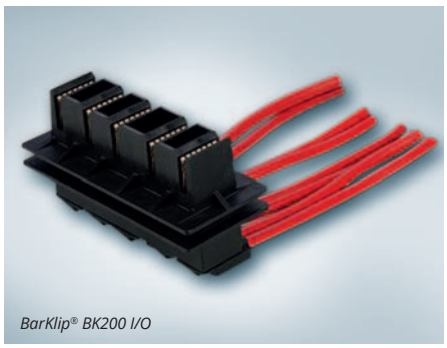
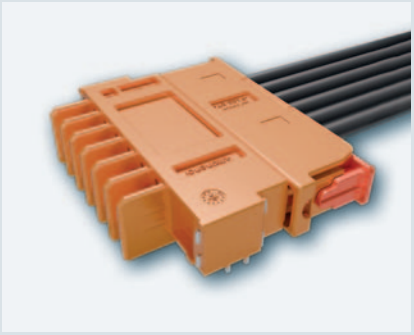


BarKlip® BK200 I/O

Intelligent Connection for Modern Battery Systems

The Battery Management System (BMS) continuously monitors the charging and discharging processes of the battery pack as well as individual cell voltages. Based on this data, the system reliably determines the state of charge and manages other safety-critical functions. Transmitting such sensitive information requires a robust, precise, and dependable connection – such as the HVLock® high-voltage connector from AMPHENOL CS.

The HVLock® high-voltage platform is specifically designed as a wire-to-board connector, optimized to meet the electrical performance, compact size, and integration requirements of modern OEM systems. The connector features a 4.50mm pitch, a rated current of 3A, and a single-row design. Key safety features include active locking, keying, as well as CPA (Connector Position Assurance) and PLR (Primary Lock Reinforcement).



HVLock® supports operating voltages up to 1200V, a current-carrying capacity of 3A, and wire sizes from 22AWG to 20AWG. It is available in 3- to 10-position variants, with options for right-angle or horizontal configurations, and in THT or SMT versions. The HVLock® also meets the requirements of automotive standards USCAR-2 T2V2 and LV-214 S2 (certification in progress).

S02

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FEATURES		BENEFITS
Multiple plating options (Tin/Gold/Silver) for terminal	◄ ►	Meets different mating cycles and spec requirements
Current rating of 3A with each contact	◄ ►	Meet higher power Amps performance
Connector Position Assurance (CPA)	◄ ►	Second lock to ensure the connection
Two different coding options	◄ ►	Mechanical mismatching prevention system
Primary Lock Reinforcement (PLR)	◄ ►	Ensures the receptacle terminal primary lock
Wire gauge up to 20AWG	◄ ►	Meets wide gauge application requirement

DC CHARGING GUN

With CCS2 Layout for 300A From C.C.P.

C.C.P. Contact Probes is a world leader in designing and manufacturing advanced test solutions and pogo pins. With decades of experience, cutting-edge technological expertise, and deep knowledge of electrical contacts, C.C.P. continues to set new benchmarks for innovation and quality in the industry.

C.C.P. Contact Probes is a globally leading design and manufacturing company specializing in test solutions and pogo pins. Building on decades of experience, technological expertise, and in-depth knowledge of electrical contacts, C.C.P. has developed a high-performance EV charging gun based on the standardized CCS2 layout. This solution enables fast DC charging with power levels of up to 300A – reliable, safe, and cost-effective. The charging gun combines high quality with an attractive price-performance ratio.

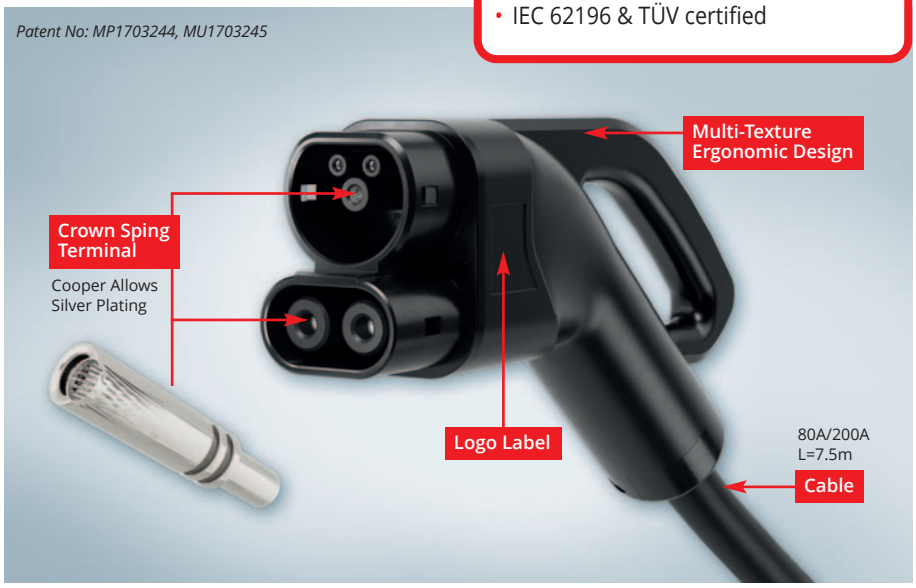
Features

Fast Charging and Wide Compatibility

The charging gun supports DC fast charging in accordance with the Combo 2 - IEC 62196 standard and is therefore compatible with the leading EV brands in Europe and worldwide.

HIGHLIGHTS

- IP Rating: IP54
- Mating Cycles: up to 10.000
- Flammability Class: UL 94-V0
- IEC 62196 & TÜV certified



High Safety and Durability

CCP's »crown spring« technology was used to provide safe and multi-contact point connections even under shock. Its high-quality design offers an advanced thermal management for high durability and up to 10,000 mating cycles. A UL 94-V0 certified material was selected for the robust, weather-resistant housing. The housing also fulfils protection class IP 54 and is suitable for public and private charging stations.

Comfortable to use

Its lightweight and ergonomic design enables comfortable and frequent daily use. The comfort factor is further enhanced by a 7.5m cable, providing greater flexibility.

Supporting Clean Energy Transition

The CCS2 standard promotes sustainable mobility and offers a future-proof solution for companies and end users.

C.C.P. Contact Probes and CODICO have shared a strong partnership for many years. As the official distributor of C.C.P. products in Europe, CODICO works closely with C.C.P. to provide comprehensive technical support – whether it's a basic pogo pin, a high-performance charging gun, or fully customized customer solutions.

S03

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FOR MODERN APPLICATIONS

Flexible and Robust Power Connections

With the growing demand for high-performance power connections in e-mobility, smart appliances, and industrial applications, CVILUX is expanding its portfolio to include flexible copper-based busbar solutions.

CVILUX's busbar products combine high current-carrying capacity, compact designs, and adaptable connection options. Thanks to various surface treatments such as nickel or silver plating, and optional insulation materials like PVC or heat-shrink tubing, these components can be precisely tailored to customer-specific requirements.

The comprehensive product range includes copper foil connections, tinned copper braids, flexible copper strands, and special grounding components.

Typical areas of application include:

- Energy storage systems
- Battery management systems
- Power electronics for electric vehicles
- Industrial systems
- Smart appliances
- Household appliances
- Mechanical engineering
- Industrial control engineering

S04

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FX31-SERIES

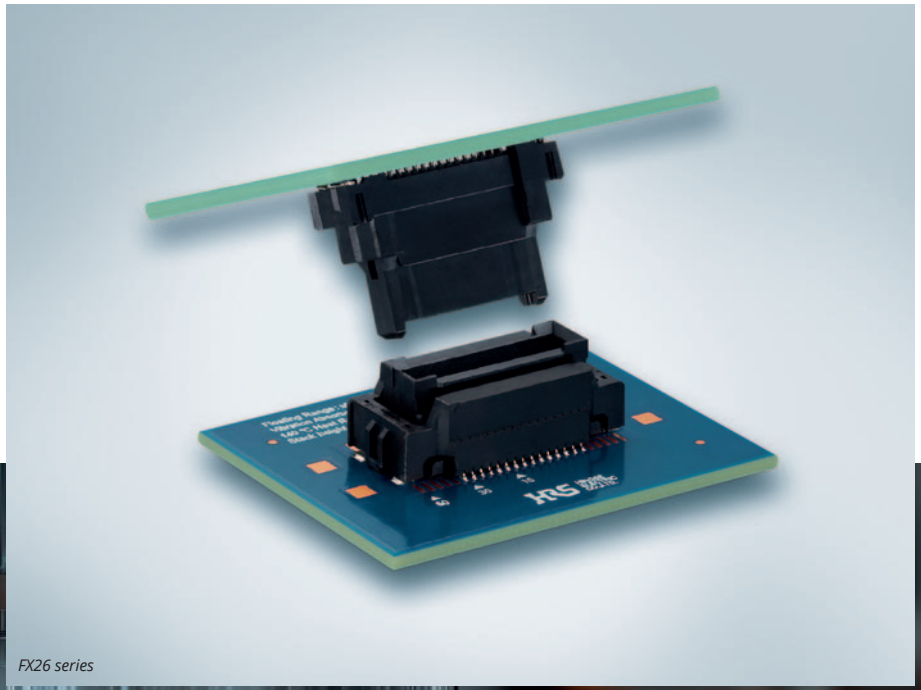
Floating Connector for High-Power Applications

HIROSE Electric has introduced the world's first board-to-board connector series, the FX31, which combines high current capability with a rugged, vibration-resistant design. In addition to passing rigorous vibration tests, the FX31 supports the miniaturization, weight reduction, and streamlined assembly of next-generation devices.

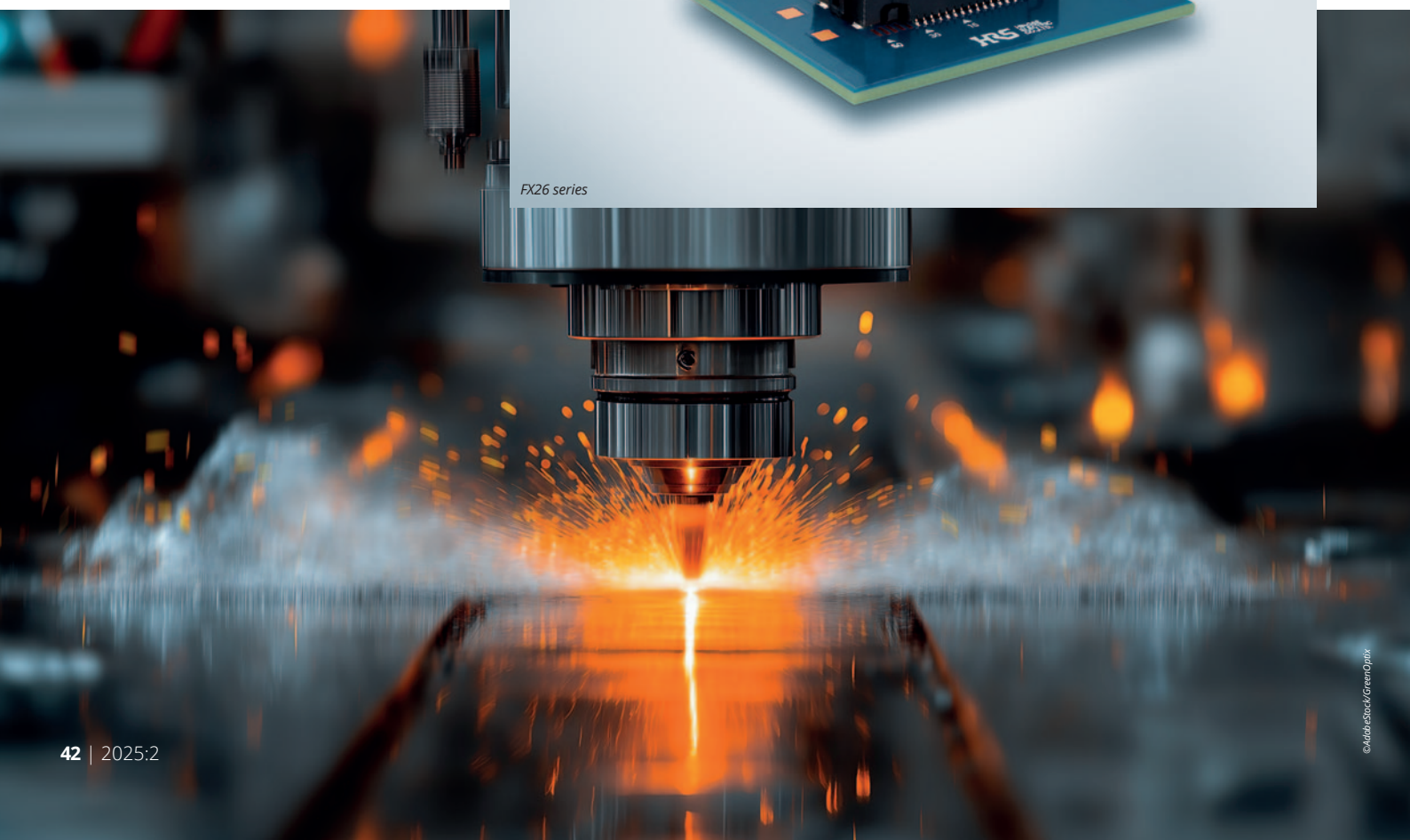
This connector series opens up new possibilities in powertrain innovation. Powertrain systems in EVs and HEVs require high current. Traditionally, busbars with screw-fastening methods have been used to ensure vibration resistance. However, this approach creates challenges such as large component size, limited design flexibility, and complex assembly.

HIROSE applied its proven expertise in vibration-resistant signal connectors to the development of power connectors, resulting in the FX31. Replacing conventional busbars with a connector-based solution reduces the size and weight, while also supporting assembly automation. It also simplifies processes and reduces labor costs by eliminating the need for screw fastening enabling seamless integration into automated assembly lines, including robotic systems.

When used with the FX26 series for signal transmission, the FX31 supports hybrid power and signal connections in a compact design. The bene-



FX26 series



©AdobeStock/GreenOptix

fits of this include high-density mounting, reduced overall size, and significant cost savings.

Features of the FX31 Series

The proprietary floating design absorbs vibration and shock while safely delivering a high current of up to 25A per contact. Depending on the ambient temperature and the width of the PCB trace, the connector can support up to approximately 40A per contact in a two-position configuration.

Vibration Resistance

It's designed to absorb board movement in the Z direction when the device is subjected to vibrations.

Heat Resistance up to 125°C

A specialized contact design supports the use in high-temperature environments. The four-point contact structure enhances reliability even further.

Floating Range

X and Y Directions: ±0.5mm
Z Direction: ±1.5mm

Designed to support powertrain system integration and meet the high current demands of next-generation applications, the FX31 series is set to play a key role in continued market expansion.

S05

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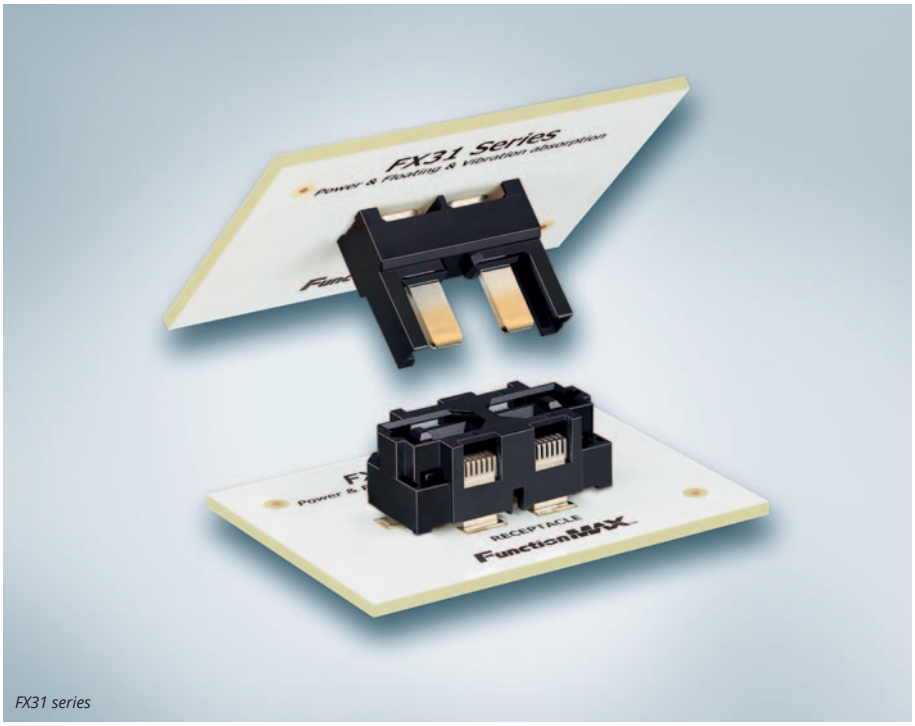
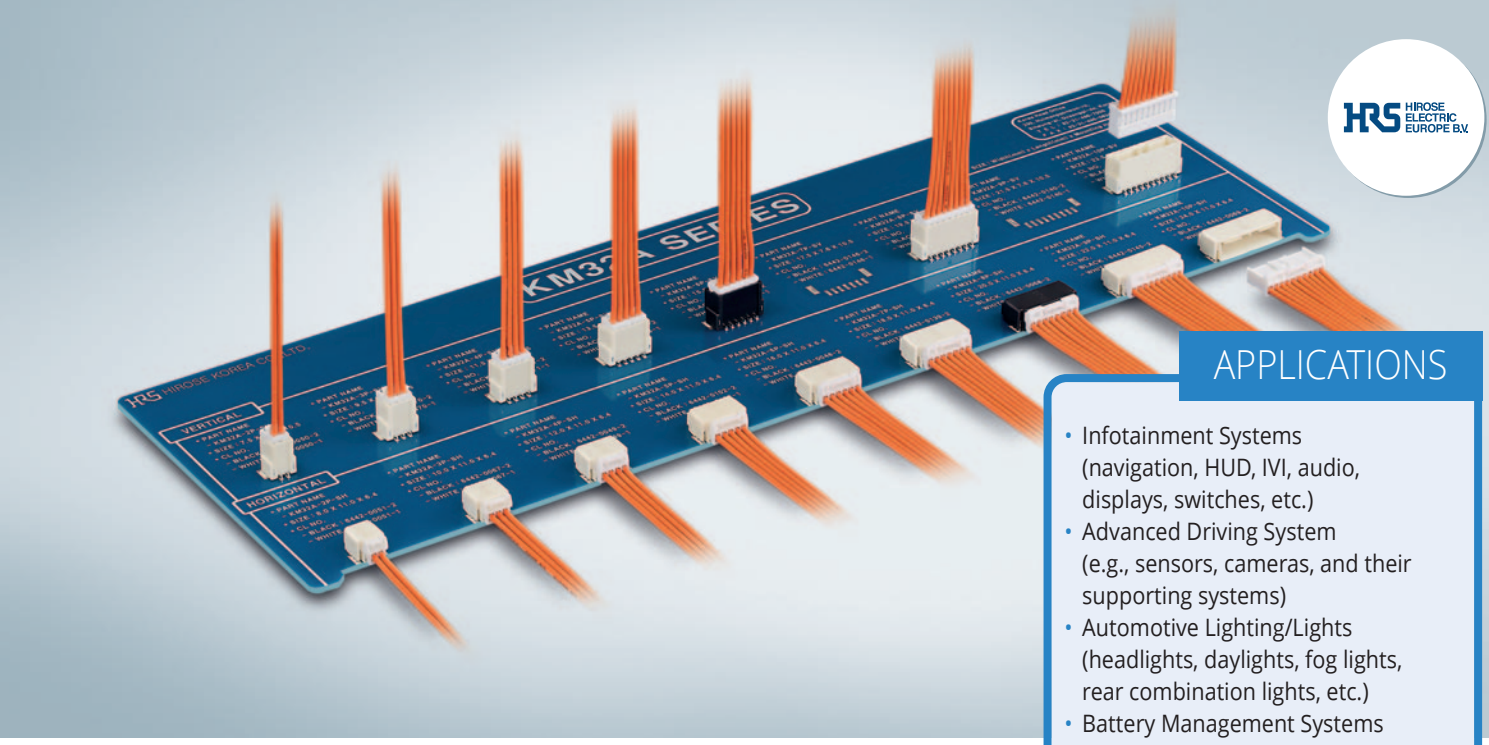
	FX31	FX26
	FOR POWER CONNECTION	FOR SIGNAL TRANSMISSION
Contact Pitch	9.5mm	1mm
Pin Count	2 (Planned for development: 3, 4)	20/30/40/50/60
Stacking Height	20mm (Planned for development: 25, 30mm)	15mm/18mm/20mm/23mm/25mm
Rated Current	25A/pin	0.5A/pin
Rated Voltage	800V AC/DC	125V AC/DC
Floating Range	X/Y: ±0.5mm Z: ±1.5mm	X/Y: ±0.7mm Z: ±0.75mm
Operating Temperature	-40°C to +125°C	-40°C to +140°C



FX31 series

PIONEERING

Compact, Heat/Vibration Resistant Board-to-Wire Connector – KM32A Series



APPLICATIONS

- Infotainment Systems (navigation, HUD, IVI, audio, displays, switches, etc.)
- Advanced Driving System (e.g., sensors, cameras, and their supporting systems)
- Automotive Lighting/Lights (headlights, daylights, fog lights, rear combination lights, etc.)
- Battery Management Systems
- Industrial & Instrumentation

Infotainment systems (IVI) and advanced driver assistance systems (ADAS) are constantly evolving to enhance safety, comfort, and the driving experience. With the increasing electrification of vehicles and rising battery density, the demands on electronic components are also increasing – particularly in terms of compact design and high performance.

The KM32A Series, a compact, heat- and vibration-resistant board-to-wire connector for internal connections with a 2mm pitch, has been introduced by HIROSE as a response.

It meets automotive-grade standards and offers heat resistance of up to 125°C, compatibility with AWG 20 to 22 cables and high vibration resistance. Compliance with the »GMW3191« standard for low-voltage connectors makes it a suitable solution for a wide range of applications - including vehicle displays, ADAS sensors and cameras, battery systems and lighting components.

PRODUCT SPECIFICATIONS	
Rated Current	5A (at AWG22)
Rated Voltage	60V AC/DC
Operating Temperature Range	-40°C to +125°C (including temperature rise due to energization)
Contact Resistance	25mΩ or less
Withstand Voltage	1,000V AC for 1 minute
Insulation Resistance	1,000MΩ or more (500V DC)
Mating Cycles	10
Insertion and Removal Force	Max. 75N
Number of Pins: 2, 3, 4, 5, 6, 7, 8, 9, 10 (straight, right-angled) Applicable Wires: AWG 20 to 22	

Automotive-Grade Connector with 125°C Heat & Vibration Resistance

The KM32A series has passed rigorous automotive tests, including a thermal shock test (-40°C to +125°C, 1,000 cycles) and a combined environment test (-40°C to +125°C/10 to 1,000Hz, 3.1Grms). Its unique contact structure ensures reliable performance in the face of driving vibrations.

Compact and Space-Saving Safety System

Designed for AWG 20 to 22 cables, this small 0.5-type connector offers versatility for a range of applications. The safety design with center lock prevents incomplete mating, misinsertion and lock damage. Its special design limits lock movement range and prevents cable snaring and lock damage.

Pursuing Connection Reliability and Meeting Various Automotive Standards

The design meets the GMW3191 standard for low-voltage automotive connectors and the ADM-F-0006 vibration test standard. This ensures the product's durability in automotive conditions.

Unique Contact Structure for High Vibration Resistance

A single contact spring presses against the terminal, providing strong vibration resistance and supporting a tensile/pry strength of up to 75N.

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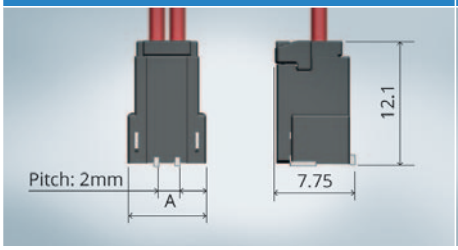
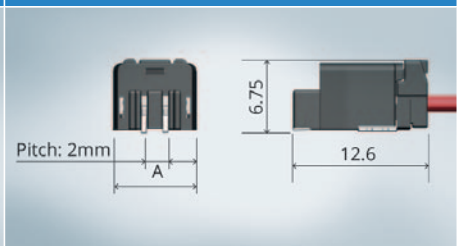
STRAIGHT TYPE (2-Pin)



RIGHT-ANGLE TYPE (2-Pin)



Number of Pins	2	3	4	5	6	7	8	9	10
Dimension A (mm)	7.5	9.5	11.5	13.5	15.5	17.5	19.5	21.5	23.5

CLEAN

A Safe and Space Saving Connector System

The new S-TECX 1.5 connector series from STOCKO with a pitch of 1.5mm enables particularly space-saving contacting of electronic components. Typical applications include control boards in household appliances such as washing machines, dishwashers and similar appliances. However, thanks to its versatility, the S-TECX 1.5 series is also suitable for numerous other electronic applications.

The classic double insulation displacement terminals for contacting wires with a cross-section of 0.13mm² and 0.22mm² guarantee an electrically and mechanically stable and safe connection between wire and contact. The wires are contacted in a simple way by closing the pre-assembled cover.

Concealment safety through polarizing elements and KOSHIRI safety ensure the quality of the connection in handling and application. To avoid mismating, numerous coding variants can be created, even with small numbers of poles. S-TECX connectors have a 90° cable outlet (Figure 1) and are designed for direct connections with FR4 PCBs using contact pads on the PCB (Figure 2). A cable direction of 180° can be achieved by using an additional PCB header and vertical insertion of the connector (Figure 3).

PCB header are available in SMT and THT technology, suitable for reflow soldering process.

Besides the connector system itself STOCKO provides also the necessary tools:

For sample and pre-series production the hand tool WZ/P-S-TECX 1.5 is available. For serial production the semi-automatic machine WT 415 is recommended.

HIGHLIGHTS

- Compact design
- KOSHIRI safety
- High contact safety because of double insulation displacement terminal
- Polarization and coding options

Features

- Pitch: 1.5mm
- Rated Voltage: 48V
- Rated Current: 2A
- Continuous operating temperature up to 130°C
- GWT 750°C according to IEC60335-1
- Mating cycles: 5
- Wire cross-section: 0.13 to 0.22mm²

Use the knowledge and the long-term partnership of CODICO and STOCKO to receive the best support and consulting for S-TECX 1.5.

S07

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Figure 1: S-TECX 1.5, free

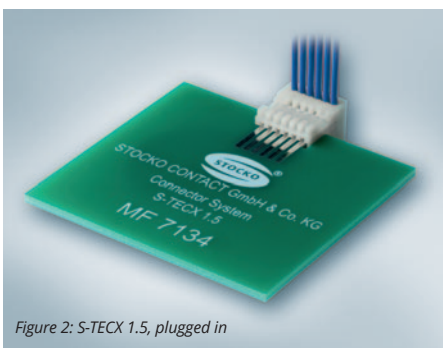

Figure 2: S-TECX 1.5, plugged in

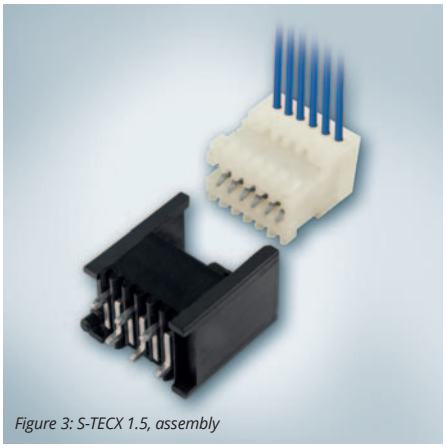

Figure 3: S-TECX 1.5, assembly

CONNECTING PART

PANTA© SMD-R Compact – Bridge PCB Distances Between 11 and 17mm

The Challenge: Secure Connections in Minimal Space.

In today's electronic designs, developers are often faced with the challenge of creating reliable connections in the smallest of spaces. Conventional interconnect solutions are often unsuitable, especially for small distances. At the same time simple integration into existing production processes is essential to ensure efficiency and cost savings.

The Solution: SMD-R compact from SUMIDA

The PANTA© SMD-R compact is the flexible connection solution for applications with minimal space requirements. With the ability to bridge PCB distances of just 11mm to 17mm, it enables secure connections even in the smallest installation spaces. Thanks to its SMD-mountable design, the SMD-R compact can be easily processed with standard SMD machines. Whether in automotive, industrial or consumer electronics, this connection technology enables precise and space-saving connections without compromising on quality and reliability.

Advantages of the PANTA© SMD-R Compact

- Versatile application possibilities: The PANTA© SMD-R compact makes it possible to bridge PCB distances of between 11mm and 17mm, enabling them to realise compact connections even in the smallest of installation spaces.
- Improved flex zone: Specially developed for short lengths, the SMD-R compact offers an optimised flex zone that ensures maximum reliability and durability.
- SMD connection: The PANTA© SMD-R compact is compatible with standard SMD machines, which guarantees simple and efficient assembly in the production process.
- High durability: The optimized flex zone ensures a robust and durable connection, even under mechanical stress or thermal influences.

These unique advantages make the SMD-R compact the ideal solution for modern electronic designs that require precise and space-saving connection technologies.

Features & Characteristics of the PANTA© SMD-R Compact

- Ideal for automotive, industrial and medical technology
- Compatible with standard pick-and-place machines
- Operating temperature: -40°C to +125°C (higher values on request)
- High vibration resistance
- Fulfils cleanliness standards (ISO 16232, VDA 19.1)
- Suitable for standard soldering profiles (DIN EN 61760-1, J-STD-020)
- Subsequent angling up to 180° possible

Discover new possibilities for your designs with the SMD-R compact and benefit from maximum precision and flexibility in your products and applications.

S08

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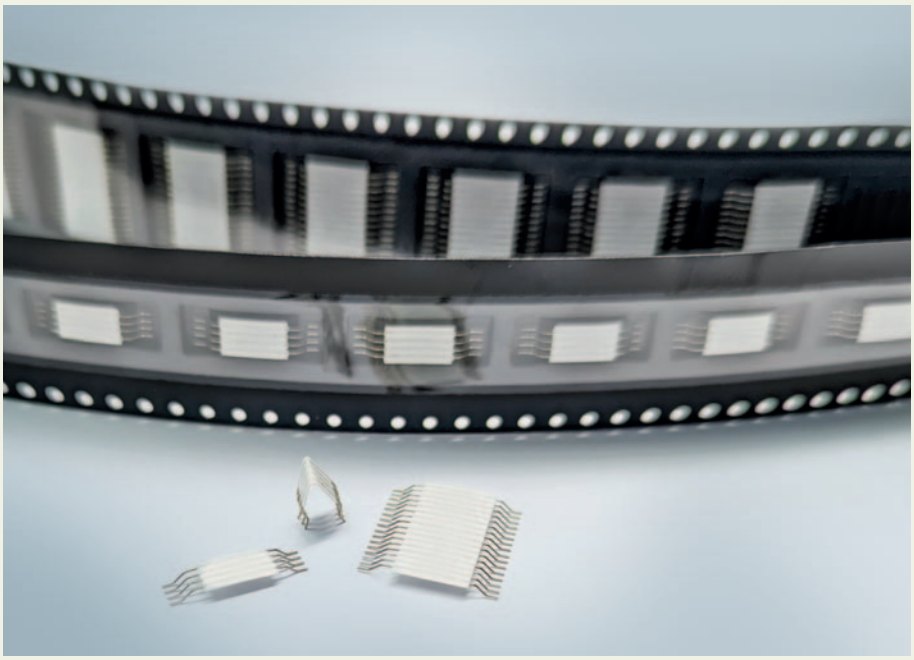
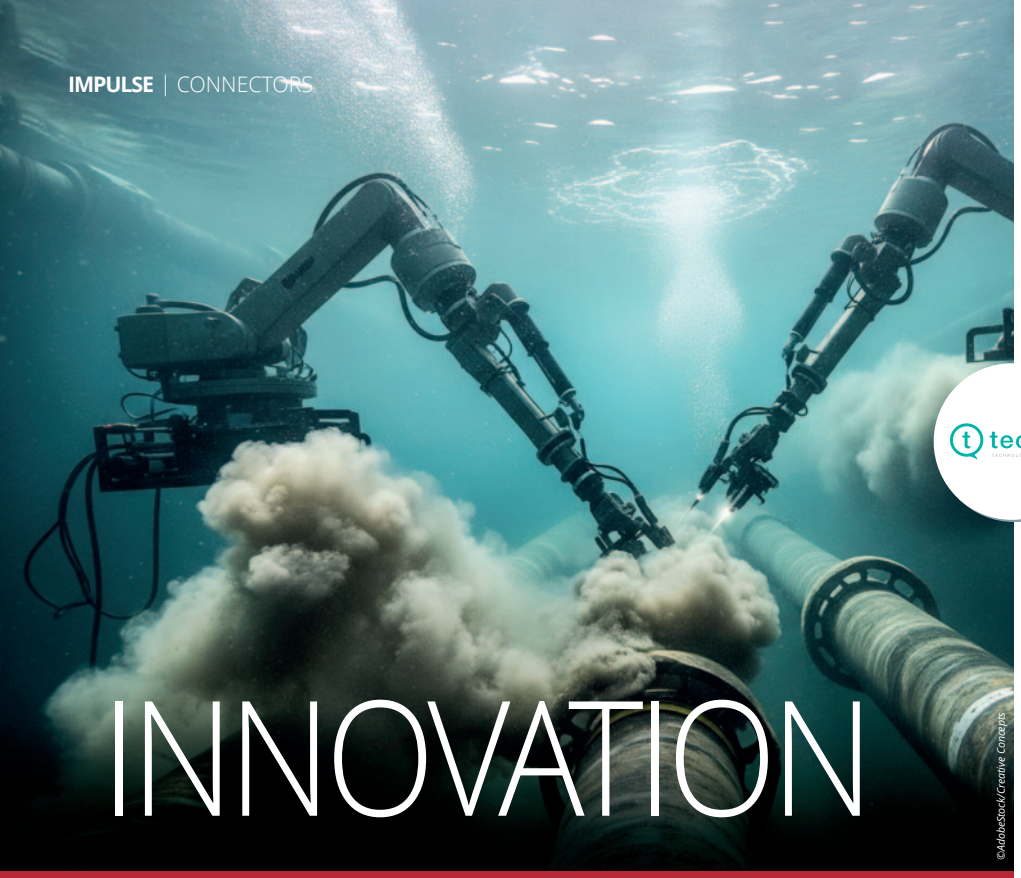


TECHNICAL DATA: SMD-R COMPACT	
Pitch (mm)	1
Number of Poles max.	4 - 16
Bridging Length (mm)	13 - 15
Total Length (mm)	15 - 21
Coplanarity (µm)	150
Insulation Material (Foil)	Aramid
Conductor Material (mm)	Cu ø0.254
Surface	NiSn
Rated Voltage VDC	200
Current Carrying Capacity at 20°C | Full Pin Assignment (after DIN EN 60512-5-2) *Derating curves on request*	2.2A
Operating Temperature (°C)	-40 to +125
Flammability	UL 94 V-0



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Circular Connectors for More Flexibility and Reliability

TECHNO introduces a new series of plastic circular connectors specifically designed for low-voltage AC and DC applications in professional and industrial environments.

The expanded TEEPLUG and TEETUBE product range features innovative, configurable, and ready-to-use designs that simplify installation while ensuring maximum reliability.

Available as junction boxes or plug-and-play connectors, these solutions support cable cross-sections of up to 6 mm² and can be flexibly adapted to a wide range of installation requirements.

Professional Connection Solutions – Designed for High-Performance Applications

TECHNO's TH405UP and TH406UP connectors provide a reliable solution for high-performance electrical connections across a wide range of industrial, commercial, and residential applications. As part of the TEEPLUG family, they offer robust protection against dust and water ingress (IP66/IP68) and are ideally suited for powering medium- and high-power equipment.

Power and Safety in a Compact Form Factor

These connectors are rated for nominal currents of up to 41A (2-pole), 32A (3-pole), and 17.5A (5- to 6-pole) configurations, with operating voltages up to 500 V AC (250 V AC for Class II applications). Available in 2-, 3-, 5-, 6-, and 8-pole versions with screw contacts, they accommodate cables with outer diameters ranging from 10mm to 16.5mm, depending on the configuration.

TH405UP stands out for its compact design: when coupled, the plug and socket together measure just 139mm, while separately they are 79mm and 76mm respectively. The TH406UP is designed for panel installation, accommodating panel thicknesses from 1mm to 10mm. Both can operate in environments with temperatures up to 100°C.

Key Features

These new connectors are equipped with silicone grommets and seals, offering outstanding elasticity and resistance to harsh environmental conditions and mechanical stress. They maintain performance across a wide temperature range, from -40°C to +125°C.

Thanks to silicone's excellent elastic memory, sealing performance is consistent over time, ensuring high IP protection ratings.

The contacts, rated for conductors up to 6mm², are silver-plated to guarantee excellent electrical conductivity and reduce energy loss. The bayonet locking system with tightening nut enhances resistance to vibrations and mechanical stress, ensuring electrical continuity. Disconnection is only possible using a tool, for added safety.

Inherent Safety

TH405UP and TH406UP are made from UL94 V0-rated PA66, the highest fire resistance class for thermoplastics. This is a critical feature for industrial and electronic applications, where flame retardancy is a key safety factor. The V0 rating certifies that the material self-extinguishes within 10 seconds without dripping.

Professional Junction Solutions – Versatility for Every Electrical Project

At the heart of the TEETUBE range are the TH400 and TH400UP junctions. Designed for maximum flexibility – even in demanding conditions – the TH400 supports 2- to 6-pole configurations, while

TH400UP

TH400

TH405UP and TH406UP

the TH400UP is available in 3- and 4-pole versions. Both can also be supplied as empty enclosures for integrating custom electrical or electronic components.

The TH400 offers a variety of contact types: spring, screw, IDC, and wire protector. It supports cable cross-sections up to 4 mm² and diameters up to 17mm.

For more demanding industrial environments, the TH400UP accommodates cables up to 6mm² and 21mm in diameter, providing a durable, customizable housing designed for low maintenance and high mechanical resistance. These junctions feature robust housings rated up to IK10 for impact resistance.

With IP66/IP68 protection, both the TH400 and TH400UP are ideal for harsh environments where complete protection from dust and water is essential. This makes them perfect for applications requiring durability, resilience, and flexibility.

Applications

TH405UP–TH406UP:

- Photovoltaic systems, inverters, and low-voltage distribution
- HVAC, pumps, ventilation, and outdoor lighting
- Marine and high-humidity or submerged environment

TH400–TH400UP:

- Industrial and street lighting
- Outdoor or damp inline and branch connections
- Infrastructure exposed to mechanical stress and harsh conditions

S09

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TH405UP

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Y-Lock V4

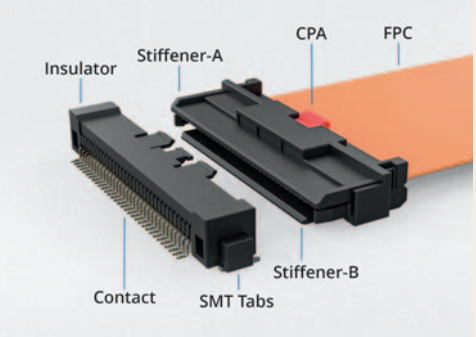
Perfect for Battery Systems

For over 15 years, the Y-Lock Pullforce connector system from YAMAICHI ELECTRONICS has been recognized as a reliable and process-secure solution for non-ZIF board-to-cable applications. With the introduction of Version 4, the system is now also ideally suited for battery applications and Cell Contacting Systems.

Y-Lock V4 combines the proven advantages of its predecessors with new features specifically developed to meet the unique requirements of modern battery systems.

Blind Contacting and Locking of FFC or FPC
A proven feature of the Y-Lock series, now also present in Version 4, is the one-push locking mechanism. The flexible flat cable (FFC) or flexible printed circuit board (FPC) is inserted into the connector using the pre-assembled stiffener. Version 4 features a dual locking system: first, via two lateral locking hooks, and second, via a central locking mechanism on the long side of the insulator. The design of the side hooks additionally enables blind-mating functionality. Cable removal remains unchanged – simply pull the cable to disconnect.

Protection Against Contact and Twisting
The stiffener also fulfils other functions: For example, the two-part stiffener design ensures that the pads of the FFC/FPC are protected against contact, so that the cable can also be handled safely during servicing. This feature also ensures that the plug cannot be inserted at an angle or upside down, thus preventing short circuits caused by incorrect insertion of the cable side. This ensures 10 mating cycles.



CPA – Connector Position Assurance
YAMAICHI offers the mechanical CPA (Connector Position Assurance) as an optional feature. This allows the stiffener to be permanently locked to the connector using an additional plastic component. The connection can then only be released once the CPA has been disengaged.

Low Overall Height 4.5mm
To ensure the greatest possible flexibility, the Y-Lock V4 series is available with gold or tin plating. This allows the possibilities of FPC suppliers to be catered for. The V4 is currently available in the 90° version and, with a complete height of 4.5mm, has a design that is perfectly adapted to the tight installation spaces in battery applications. Y-Lock V4 is available with different contact spacings: 1.0mm, 1.2mm, 1.8mm and 2mm in order to fulfil the various requirements for clearance and creepage distances. The system fulfils the requirements of LV214.

S10

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The CODICO TEAM says hello!

Laura Ringhofer

A warm hello,
I'm 23 years old, and I've been part of the CODICO family since September 2021. After graduating from HAK Oberwart, I was looking for an exciting job and more or less by chance, I came across CODICO.

I started my career here in Order Administration, where I was able to gain a solid foundation and learn many essential skills. During that time, I grew professionally, took on responsibility, and gathered valuable experience. What I enjoyed most was the strong team spirit – everyone supports one another, shares knowledge, and grows together.

Since February 2025, I've been part of the Material Planning team. As the two departments work closely together on a daily basis, the transition felt seamless and like a natural next step. I'm excited to continue working with familiar colleagues, while also exploring new areas and broadening my horizons. The open exchange within the team and our shared drive to achieve the best possible results keep me motivated every single day.

Outside of work, I love being on the go – whether it's traveling, going to concerts, or enjoying festivals. I'm passionate about discovering new places, getting to know different cultures, and simply making the most of life. Time with my family and friends is also very important to me, as it gives me energy, balance, and inspiration.

I enjoy working both in the office, where I appreciate direct contact with my colleagues, and from home, which allows me to focus while still maintaining strong team connections. The combination of both offers the perfect balance for me.

I'm truly grateful that with CODICO, I found an employer right from my very first job where I feel comfortable and can continue to grow both personally and professionally.

D01

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Markus Springer

Dear Readers,
My name is Markus Springer, and I've been with CODICO since August 12, 2021. I was born in Vienna 44 years ago, but thanks to my roots in the beautiful Weinviertel region, I'm not your typical grumpy, unfriendly Viennese (or whatever else people might say about us). I try to go through life with a smile and a friendly attitude.

By pure chance, I started my apprenticeship as a freight forwarding agent on 01.08.1997, and my path quickly led me into air and sea freight. I spent almost 23 years working at Vienna Airport, experiencing my fair share of highs and lows – valuable lessons that have shaped my life. Maybe I needed the »Corona period,« or maybe I simply made good use of it, to reflect on my career path and realign my goals.

In August 2021, I had the great honor of joining the logistics team as one of Ragnar Knotzer's »successors,« and since then I've been supporting the team in the areas of logistics and customs. My daily tasks range from customs matters such as tariff classifications, storing shipments in our bonded warehouse, handling import clearances for customers within the EU, and preparing export declarations for customers outside the EU to freight forwarding tasks like freight cost calculations, routing orders, invoice checks, and much more.

On a personal note, I'd describe myself as open-minded, but also calm, thoughtful, and very goal-oriented. My full attention and energy are dedicated to the two most important people in my life – my son Sebastian, who recently turned 12, and my daughter Leonie, who turned 9 in September. Anyone who has (or has had) children this age doesn't need me to explain how much stress a normal day can bring or how much time and energy it takes. But they'll also know how wonderful the free time outside of school and without extracurricular stress (football and cheerleading, in our case) can be. We love to spend that free time on seaside vacations, skiing in winter, sports, day trips or sometimes just shopping and relaxing. When I have time for myself, I mostly use it for sports, catching up on things I normally can't get to, or diving into my long-standing interest in global markets, which has been with me for many years.

I truly enjoy my work, and with CODICO fitting perfectly into my life right now, I really value the variety of tasks and all the benefits that come with it. I'm genuinely happy and proud to be a small part of the entire CODICO team.

D02

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Thomas Carmody

Hello everyone,
my name is Thomas Carmody, I am Head of Product Management and Business Development for Qualcomm products. I have been working at CODICO for over 4 years now, and I am based near Cambridge in the UK.

One of my main focus areas at CODICO is managing the business and the relationship with Qualcomm and their key engineering partners in Europe, including 8Devices, Thundercomm, JMO Technology and Cavli Wireless. As Qualcomm's largest distribution partner in Europe, we work closely with the Qualcomm team to ensure that our joint customers have access and support both technical and commercial to integrate Qualcomm's latest market leading technologies into an exciting list of products and solutions throughout Europe.

I work together with a large, dedicated team of 15 people supporting our business with Qualcomm, including product line managers, field application engineers, sales, business development and operations managers and so it is truly a team effort to manage this large and growing business.

Another important role I am responsible for is as Business Development and Product Manager for the new Qualcomm Dragonwing solutions for long-life edge AI industrial applications. This means that, on a daily basis, I get to interact with a lot of different customers throughout Europe, working on exciting automation and robotics applications where the Qualcomm Dragonwing solutions act as the processing, edge AI, and sensing hubs for these applications.

My hobbies include reading a lot of non-fiction material particularly science or history-related topics. I listen to lots of music, my tastes are pretty broad and they include drum and bass to jazz and classical music, often while I work as it helps me to focus. I also enjoy exercising, particularly road cycling, running and hitting the gym as often as possible to keep fit.

I trained as a computer scientist, and in the early part of my career, I was writing embedded software for the first generation of all-in-one Bluetooth devices. While I have long since stopped writing code, I continue to enjoy expanding my understanding of the latest technological trends. These days, I am spending my time trying to understand the new trends in leveraging AI across a broad range of industrial applications. AI is a topic which is moving so quickly it is quite exciting to see the impact it is having in our working and social lives.

I lived and worked for 4 years in Japan in the early 2000s, where I met my wife. Since that time, I have been visiting there for work and family reasons. Each year during the school vacation, we take our two sons and visit Japan, which I love. Our trips involve travelling to see new places all over Japan (which is over 3,000km long) and enjoying lots of delicious food. It is one of the highlights of our year.

D03

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Denise Oehler

Dear Readers,
I have been part of CODICO for almost four years now, and I'm very happy to take this opportunity to introduce myself to you today.

After graduating from the IBC – International Business College, it quickly became clear to me that I wanted to work in human resources. To build a solid foundation, I completed diploma programs in Payroll Accounting and Austrian Employment Law, and I was able to put my new knowledge into practice for the first time in the HR department of a budget retail chain.

After about ten years of working with Austrian employment law, I was eager to take on new challenges. In 2021, I was given the amazing opportunity to join CODICO and step into an international HR role. It was incredibly exciting to look beyond the familiar Austrian legal framework and to learn – and apply – the many differences across various countries. Connecting with colleagues from diverse national backgrounds has been deeply enriching, and I am truly grateful for their collaboration and support.

This role has allowed me to expand my knowledge every single day and to grow personally and professionally. I quickly realized that CODICO doesn't just write down the value "We live family"—it genuinely lives it, and on a global scale! I feel very fortunate to work in a team that strives to make the most of each member's strengths and continually develops together.

A little over a year ago, I returned to my original specialty – Austrian employment law. I am now responsible for supporting our Austrian and Swiss colleagues in payroll, contracts, and all other matters related to the employee life cycle. While my journey through the different employment law systems of various countries was an exciting and valuable experience – one I would never want to miss – I am glad to bring those years of experience back to my team.

What I particularly enjoy about my role is the direct contact I have with my colleagues. HR often deals with sensitive and emotional topics, so we always strive to find solutions together and to treat one another with genuine respect. This human connection is what brings me the most joy in my work.

Thanks to the quarterly Academy Weeks at our headquarters in Perchtoldsdorf, I can also stay connected with our internationally based colleagues, something I truly appreciate.

Outside of work, I love spending time outdoors with my eight-year-old daughter. Whether we're at playgrounds, taking long walks in the woods, or spending time by a lake, our conversations and her wonderfully carefree perspective always recharge my energy.

D04

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