ENGLISH

CODICO®

impulse

1/2025

Qualcomm Dragonwing™ IQ9 Series: Edge AI for Industry

EATON: Compact Size Supercapacitors

EMC Cable Glands From AMPHENOL

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12 | New: Qualcomm Dragonwing™ IQ9 Series

Pioneering Edge AI for Industrial Automation: The Dragonwing IQ9 Series – an expansion of Qualcomm's IoT SoC roadmap. These scalable edge AI SoCs enable the efficient operation of powerful AI models with minimal power consumption. They are designed for extreme temperature ranges and offer integrated security features for critical applications.

ACTIVE COMPONENTS

PASSIVE COMPONENTS

CONNECTORS

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IMPRINT: Issued by CODICO GmbH Zwingenstraße 6-8, A-2380 Perchtoldsdorf
Responsible for the content: Karin Krumpel | Editorship: Birgit Punzet
Design: www.rittbergerknapp.com | date of issue: 01-01052025
Print: Gutenberg Druck – Kooperationspartner der Print Alliance HAV Produktions GmbH, Druckhausstrasse 1, 2540 Bad Vöslau

30 Years of Quality Management!

CODICO is celebrating a special double anniversary: 30 years of ISO certification and three decades of successful partnership with Quality Austria.

These milestones are a testament to a trusted and productive collaboration built on a shared commitment to quality, sustainability, and continuous improvement.

To mark this occasion, Mr. Mag. Mondl, Managing Director of Quality Austria, and Mr. Christian Matzku, Head of Sales Steering, presented us with a special award. This honor recognizes our dedication and the reliability of our management standards – a testament to our consistent efforts in advancing our Quality Management System (QMS).

The decision to implement a certified QMS at CODICO was made back in 1995. Our goal was to optimize processes, enhance quality awareness, and provide additional security for our customers.

Since then, CODICO has grown into one of the leading distributors, with over 200 employees across more than 10 countries and a central logistics hub in Hong Kong. This strong foundation positions us well to tackle future challenges successfully.

With the upcoming revision of ISO 9001, key areas such as environmental responsibility, digitalization, and resilience are becoming even more integral. At CODICO, these principles have long been embedded in our management system and are actively practiced daily. The benefits are clear: a stronger market position, high adaptability, and a future-proof, sustainable business model.

We are proud of our long-standing partnership with Quality Austria. Together, we ensure that CODICO remains synonymous with quality and sustainability – today, tomorrow, and beyond.

D01

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Karin Krumpel
CEO CODICO

CODICO is celebrating a double anniversary

Editorial

CODICO – Enabling Success.

Dear Readers,
Success is born from vision – and a strong vision arises from people working together and inspiring each other. This is exactly what we experienced during our Strategy Days in February 2025, which, every five years, lay the foundation for CODICO's future development. The result: a clear direction that perfectly encapsulates our identity as a company. CODICO – Enabling Success.

This vision represents our commitment to being a design-in specialist. We see ourselves as a solution provider, working closely with you, our customers. Our goal is to support you on your path to success with technical expertise and creative solutions.

But »Enabling Success« means so much more to us. We view success from different perspectives – whether in the design-in process, in partnership-based collaboration, or in the personal growth and development of our employees. Because success is never achieved alone. It grows through teamwork, shared values, and the courage to take new paths.

This is where we come in: »Enabling Success« is not just a promise to our customers and partners but a living corporate culture. True success happens where people with passion, expertise, and a clear vision come together. This holistic approach drives us and is our responsibility. As a design-in distributor, we create real added value. We connect technological progress with deep industry knowledge and support our partners throughout the entire value chain. Especially in today's geopolitically challenging world, we focus on resilient supply chains, strong relationships, and sustainable strategies to offer our customers stability, security, and success – even in uncertain times.

With this Impulse issue, we bring you exciting insights into the latest trends in electronics. I look forward to shaping a successful future together with you and our team.

Best regards,
Karin Krumpel

VISIONARY CHARGING COMMUNICATION

DROPBEATS DB2605 Optimizes AC Charging Stations with ISO 15118

A charge controller based on Qualcomm Power Line Communication (PLC) chips combined with an ISO 15118 software stack enables EVSE manufacturers to seamlessly integrate proven HomePlug Green PHY technology into their charging stations.

Founded in March 2015 and headquartered in Shanghai, DROPBEATS Technology Co., Ltd. brings together a lot of years of combined experience in Power Line Communication (PLC) and ISO 15118. The company provides market-proven, intelligent charging solutions as well as professional services for global EV and EVSE customers. With more than 100 customers worldwide and over one million delivered products, DROPBEATS is one of the leading providers in the industry. Since 2024, the company has also been a core member of CharIN (*www.charin-global)*.

The portfolio includes well-tested charging and communication controllers for electric vehicles and charging stations. The EV charging communication controller DB2605 equips AC charging stations with ISO 15118 capabilities, enabling secure authentication, billing, and reliable data exchange. It supports innovative features such as Plug-and-Charge (PnC), allowing electric vehicles to be charged automatically without the need for separate RFID cards or mobile apps.

The DB2605 is based on the Qualcomm QCA7005 and a powerful, energy-efficient 32-bit MCU from Qualcomm. It runs a real-time operating system with a full software stack supporting the standards ISO 15118-2, ISO 15118-20, and IEC 61851. For customers who require a complete commu-

HIGHLIGHTS

- HomePlug Green PHY Chipset: HP GP Qualcomm QCA7005-AL33
- Powerful MCU: Qualcomm latest low power high performance MCU at 320MHz
- Memory: 4MB RAM/4MB Flash
- Security: build-in HSM support TL & firmware security, Common Criteria
- EAL 4+ certified, IPS 140-2 certified and NIST ECC curves (up to 521 bits key length)
- Compatibility: ISO 15118-2 and ISO 15118-20

DB-SECC-601 case/box

nication controller for their DC EVSE, it is worth taking a look at the latest product in the DROPBEATS portfolio: the DB-SECC-601 – a state-of-the-art Supply Equipment Communication Controller (SECC) for DC fast charging stations.

The DB-SECC-601 enables seamless and secure communication between electric vehicles (EVs) and charging stations. It ensures reliable authentication, secure data exchange, and compliance with global standards, making it a key component of modern charging infrastructures.

With Plug & Charge (PnC), remote firmware updates, and real-time security monitoring, the controller supports the intelligent integration of charging infrastructures into modern EV ecosystems. This makes it the ideal solution for charging station manufacturers, energy providers, and smart grid operators looking to optimize charging reliability, efficiency, and security within their networks.

Key Features & Capabilities

Comprehensive Charging Communication Support

- **Full Compliance with Global Charging Standards:** supports ISO 15118-2, ISO 15118-20, ISO 15118-3, and DIN SPEC 70121, enabling Plug & Charge (PnC) functionality, encrypted communication, and enhanced security for DC fast charging
- Compatible with IEC 61851-1 and IEC 61851-23, ensuring interoperability with various CCS1, CCS2, and NACS connectors for worldwide deployment.

Robust Communication Interfaces

- **CAN (Controller Area Network) interface:** serves as the primary interface for EVSE-to-EV communication, ensuring reliable and efficient data transmission during the charging session.
- **Ethernet (ETH) for Firmware Management & Security:** enables remote firmware updates, logging, and certificate installation or renewal, ensuring up-to-date security and feature enhancements.
- **Multi-protocol support:** supports MQTT, WebSocket, and FTP clients, allowing seamless cloud-based monitoring, data exchange, and remote management.
- **RS232 Debugging & Local Maintenance:** provides a direct interface for local troubleshooting, system diagnostics, and real-time debugging for maintenance teams

Intelligent Safety & Control Mechanisms

- **Control Pilot & Proximity Pilot Loss Detection:** ensures safe and reliable disconnection if the control or proximity pilot signals are lost, preventing electrical hazards and enhancing safety
- **High-speed Digital Output (DO) interface:** fast hardware detection mode: responds in less than 1ms for real-time system protection
- **Hybrid hardware/software detection mode:** ensures a response time of less than 5ms, balancing speed and flexibility. Standard CAN-based Interface for Normal Operations
- Supports vehicle and charging station status monitoring for precise charge control and fault detection

In summary, DROPBEATS offers a complete range of EVSE AC and DC chargers, powerline communication controllers, and EV charging controllers. The products are well-proven and widely used by many companies, primarily in the APAC region, but also in North America and Europe.

A01

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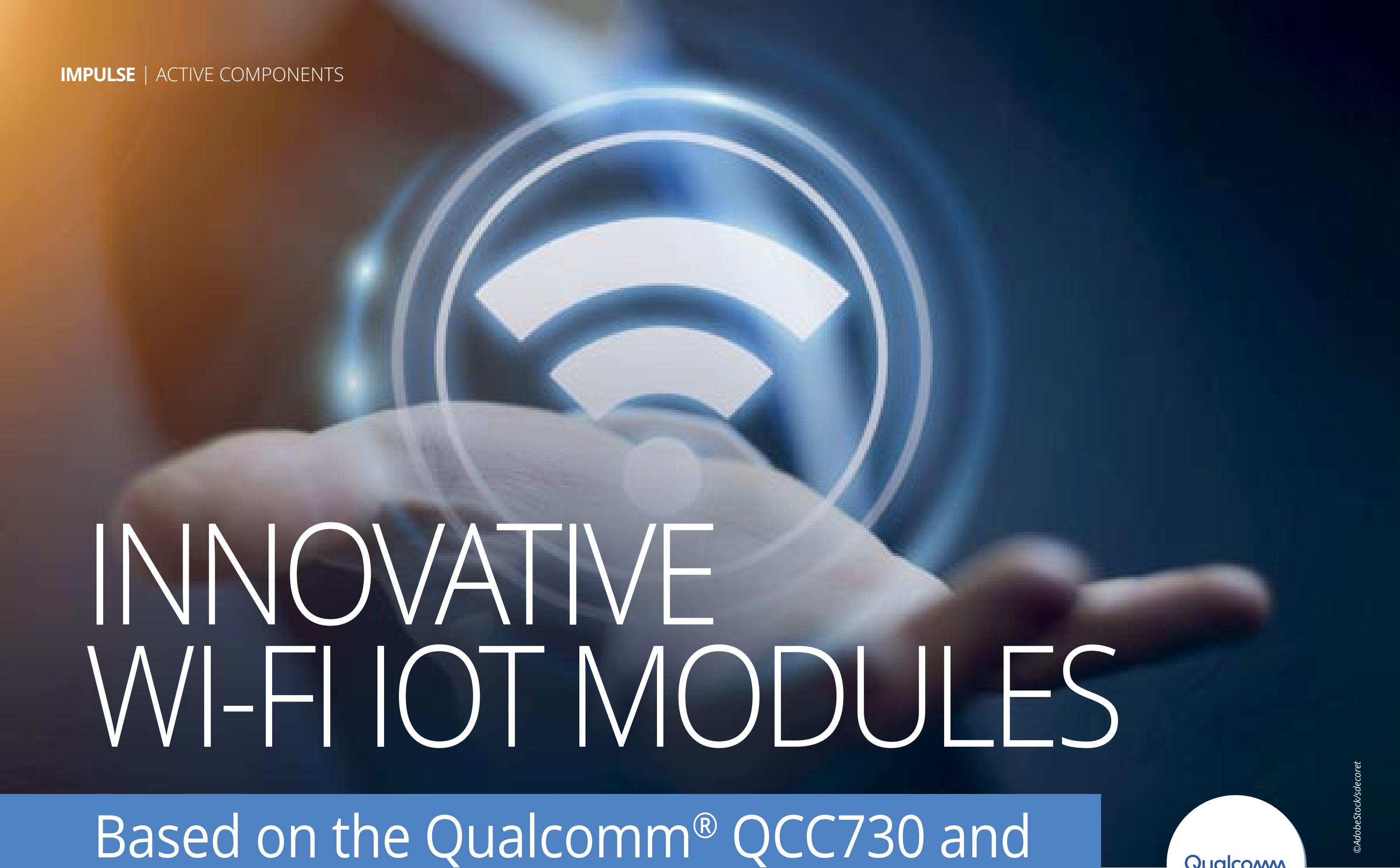

INNOVATIVE WI-FI IOT MODULES

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Based on the Qualcomm® QCC730 and Qualcomm® QCC74x Device Families

Following the successful launch of the QCC730 and QCC74x Wi-Fi IoT chipsets, Qualcomm is expanding its product portfolio with IoT module solutions built on these chips. These modules significantly reduce development time and costs while minimizing the risk of design errors. Having undergone extensive certification processes, they ensure Wi-Fi compatibility across various countries. Available certifications include FCC, CE, IC, UKCA, RCM, MIC, KC, and SRRC, with additional certifications in progress.

A Look at the Underlying Technology

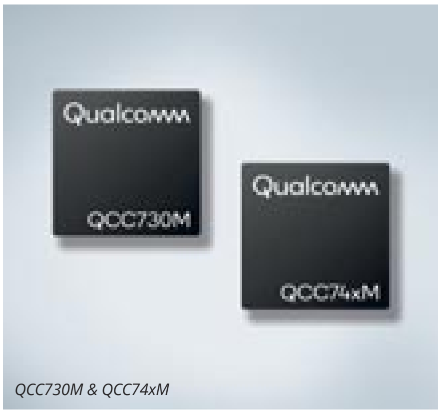
The QCC730 module family supports Wi-Fi4 in the 2.4GHz and 5GHz bands and is based on a Cortex-M4 architecture. Utilizing TSMC's advanced 22nm Ultra-Low-Leakage (ULL) process and Qualcomm's innovative power management, power consumption is reduced by up to 88% compared to previous solutions. This leads to significantly extended battery life, making it particularly advantageous for applications such as wireless cameras, video doorbells, door locks, sensors, smart buildings, and smart tags.

In contrast, the QCC74x module family is built on a RISC-V architecture and supports Wi-Fi6, Bluetooth 5.4, and IEEE 802.15.4 (Zigbee, Thread). Featuring powerful multimedia capabilities and a wide range of analog and digital interfaces, this product family is ideal for applications requiring high integration density while maintaining cost efficiency – such as smart appliances, industrial IoT, smart home devices, medical devices, and IoT hubs/gateways.

Flexibility Through Different Variants

Depending on the application requirements, Qualcomm offers two antenna configurations: one with an integrated PCB antenna and another with an RF antenna connector. Additionally, the QCC730 module family is available in two PA (Power Amplifier) variants:

- **xPA (external PA):** includes an additional power amplifier on the module to achieve higher transmission power and extended range
- **Standard version without xPA:** utilizes the integrated PA within the QCC730, resulting in reduced range but also lower power consumption



QCC730M & QCC74xM

A complete overview of all available module variants can be found in the product matrix on the next pages.

For easy evaluation, Qualcomm provides development kits, which can be ordered for free through our Sample Shop. Additional information, including documentation and software downloads, is available on our Wi-Fi support page:

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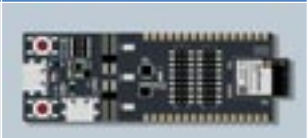
Wi-Fi4		PIN COMPATIBLE			
					
PART NUMBER		**QCC-730M-1-LGM42-MT-00-0-AA**	**QCC-730M-1-LGM42A-MT-00-0-AB**	**QCC-730M-1-LGM42B-MT-00-0-AD**	**QCC-730M-1-LGM42C-MT-00-0-AE**
PLATFORM	Chip Part Number	QCC730	QCC730	QCC730	QCC730
	CPU	Cortex-M4F @ 60MHz	Cortex-M4F @ 60MHz	Cortex-M4F @ 60MHz	Cortex-M4F @ 60MHz
	Flash	4MB NOR	4MB NOR	4MB NOR	4MB NOR
	RAM	640KB SRAM & 1.5MB RRAM (NVM)	640KB SRAM & 1.5MB RRAM (NVM)	640KB SRAM & 1.5MB RRAM (NVM)	640KB SRAM & 1.5MB RRAM (NVM)
	ROM	NA	NA	NA	NA
	Hosted Interface	SPI or UART	SPI or UART	SPI or UART	SPI or UART
	Hosted OS	Any	Any	Any	Any
	Hostless OS	FreeRTOS & Zephyr (coming soon)	FreeRTOS & Zephyr (coming soon)	FreeRTOS & Zephyr (coming soon)	FreeRTOS & Zephyr (coming soon)
CONNECTIVITY	SDIO	NA	NA	NA	NA
	USB	NA	NA	NA	NA
	SPI / QSPI	1 × SPI (slave) / 1 × QSPI (master)	1 × SPI (slave) / 1 × QSPI (master)	1 × SPI (slave) / 1 × QSPI (master)	1 × SPI (slave) / 1 × QSPI (master)
	UART	1 × UART	1 × UART	1 × UART	1 × UART
	I2C	1 × I2C (master)	1 × I2C (master)	1 × I2C (master)	1 × I2C (master)
	ADC	NA	NA	NA	NA
	DAC	NA	NA	NA	NA
	PWM	NA	NA	NA	NA
	GPIOs	15 × multiplexed GPIOs	15 × multiplexed GPIOs	15 × multiplexed GPIOs	15 × multiplexed GPIOs
	Securtiy	Crypto Accelerators	Crypto Accelerators	Crypto Accelerators	Crypto Accelerators
	Secure Boot/Storage/Debug	yes / yes / yes	yes / yes / yes	yes / yes/ yes	yes / yes / yes
	Miscellaneous	JTAG	JTAG	JTAG	JTAG
WIRELESS	Bluetooth Standard	NA	NA	NA	NA
	Wi-Fi Standard	Wi-Fi4	Wi-Fi4	Wi-Fi4	Wi-Fi4
	MIMO	1×1	1×1	1×1	1×1
	Frequency	2.4GHz & 5GHz	2.4GHz & 5GHz	2.4GHz & 5GHz	2.4GHz & 5GHz
	Bandwidth / MCS	HT20, MCS3	HT20, MCS3	HT20, MCS3	HT20, MCS3
	Antenna Data Rate	28.9Mbps	28.9Mbps	28.9Mbps	28.9Mbps
	Antenna Type	PCB	RF connector	PCB	RF connector
	PA on Chip / Module	yes / no	yes / no	yes / yes	yes / yes
	Soft AP	yes	yes	yes	yes
	Monitor Mode	yes	yes	yes	yes
MODULE SPEC	Power Supply	Main: 1.8V to 3.6V, IO:1.8V or 3.3V	Main: 1.8V to 3.6V, IO: 1.8V or 3.3V	Main: 1.8V to 3.6V, IO: 1.8V or 3.3V	Main: 1.8V to 3.6V, IO: 1.8V or 3.3V
	Dimension (mm)	12.28 × 19.0	12.28 × 14.82	12.28 × 22.0	12.28 × 18.0
	Package	36-pin, LGA	36-pin, LGA	36-pin, LGA	36-pin, LGA
	Temperature Range	-20°C to 85°C	-20°C to 85°C	-20°C to 85°C	-20°C to 85°C
	Mounting	single side	single side	single side	single side
	Carrier / QTY	Tape & Reel / 1000	Tape & Reel / 1000	Tape & Reel / 1000	Tape & Reel / 1000
	MOQ	1000	1000	1000	1000
	Weight	0.92g	0.82g	1.16g	1.07g
	Regulatory Compliance	CE, FCC, IC CA, SRRC, etc.	CE, FCC, IC CA, SRRC, etc.	CE, FCC, IC CA, SRRC, etc.	CE, FCC, IC CA, SRRC, etc.
DVK		yes	yes	yes	yes

Wi-Fi6		PIN COMPATIBLE		PIN COMPATIBLE	
					
PART NUMBER		**QCC-743M-1-LGM36-MT-01-0-AA**	**QCC-743M-1-LGM36A-MT-01-0-AB**	**QCC-744M-2-LGM52-MT-01-0-AA**	**QCC-744M-2-LGM52A-MT-01-0-AB**
PLATFORM	Chip Part Number	QCC743-1	QCC743-1	QCC744-2	QCC744-2
	CPU	RISC-V @ 325MHz with FPU + DSP	RISC-V @ 325MHz with FPU + DSP	RISC-V @ 325MHz with FPU + DSP	RISC-V @ 325MHz with FPU + DSP
	Flash	4MB NOR	4MB NOR	8MB NOR	8MB NOR
	RAM	484KB	484KB	484KB SRAM + 4MB pSRAM (SiP)	484KB SRAM + 4MB pSRAM (SiP)
	ROM	128KB	128KB	128KB	128KB
	Hosted Interface	SDIO, UART, SPI	SDIO, UART, SPI	SDIO, UART, SPI	SDIO, UART, SPI
	Hosted OS	Any	Any	Any	Any
	Hostless OS	FreeRTOS & Zephyr (coming soon)	FreeRTOS & Zephyr (coming soon)	FreeRTOS & Zephyr (coming soon)	FreeRTOS & Zephyr (coming soon)
CONNECTIVITY	SDIO	1 × SDIO	1 × SDIO	1 × SDIO	1 × SDIO
	USB	NA	NA	NA	NA
	SPI / QSPI	1 × SPI / 1 × QSPI	1 × SPI / 1 × QSPI	1 × SPI / 1 × QSPI	1 × SPI / 1 × QSPI
	UART	2 × UART	2 × UART	2 × UART	2 × UART
	I2C	2 × I2C	2 × I2C	2 × I2C	2 × I2C
	ADC	12 × channels 12/16 bit	12 × channels 12/16 bit	12 × channels 12/16 bit	12 × channels 12/16 bit
	DAC	2 × channels 12 bit	2 × channels 12 bit	2 × channels 12 bit	2 × channels 12 bit
	PWM	4 × PWM	4 × PWM	4 × PWM	4 × PWM
	GPIOs	19 × multiplexed GPIOs	19 × multiplexed GPIOs	35 × multiplexed GPIOs	35 × multiplexed GPIOs
	Securtiy	Crypto Accelerators	Crypto Accelerators	Crypto Accelerators	Crypto Accelerators
	Secure Boot/Storage/Debug	yes/yes/yes	yes/yes/yes	yes/yes/yes	yes/yes/yes
	Miscellaneous	I2S, SD/MMC, CAN, JTAG, ETH, Audio Codec, Video Codec	I2S, SD/MMC, CAN, JTAG, ETH, Audio Codec, Video Codec	I2S, SD/MMC, CAN, JTAG, ETH, Audio Codec, Video Codec	I2S, SD/MMC, CAN, JTAG, ETH, Audio Codec, Video Codec
WIRELESS	Bluetooth Standard + Others	BT 5.4, BLE + 802.15.4	BT 5.4, BLE + 802.15.4	BT 5.4, BLE + 802.15.4	BT 5.4, BLE + 802.15.4
	Wi-Fi Standard	Wi-Fi6	Wi-Fi6	Wi-Fi6	Wi-Fi6
	MIMO	MU 1×1	MU 1×1	MU 1×1	MU 1×1
	Frequency	2.4GHz	2.4GHz	2.4GHz	2.4GHz
	Bandwidth / MCS	HE20/HE40, MCS9	HE20/HE40, MCS9	HE20/HE40, MCS9	HE20/HE40, MCS9
	Antenna Data Rate	229.4Mbps	229.4Mbps	229.4Mbps	229.4Mbps
	Antenna Type	PCB	RF connector	PCB	RF connector
	PA on Chip / Module	yes / no	yes / no	yes / no	yes / no
	Soft AP	yes	yes	yes	yes
	Monitor Mode	yes	yes	yes	yes
MODULE SPEC	Power Supply	Main: 3.3V IO: 1.8V or 3.3V	Main: 3.3V IO: 1.8V or 3.3V	Main: 3.3V IO :1.8V or 3.3V	Main: 3.3V IO: 1.8V or 3.3V
	Dimension (mm)	12.28 × 17.28	12.28 × 12.28	14.82 × 23.63	14.82 × 18.63
	Package	32-pin, LGA	32-pin, LGA	46-pin, LGA	46-pin, LGA
	Temperature Range	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C
	Mounting	single side	single side	single side	single side
	Carrier / QTY	Tape & Reel / 1000	Tape & Reel / 1000	Tape & Reel / 1000	Tape & Reel / 1000
	MOQ	1000	1000	1000	1000
	Weight	0.85g	0.74g	1.41g	1.31g
	Regulatory Compliance	CE, FCC, IC CA, SRRC, etc.	CE, FCC, IC CA, SRRC, etc.	CE, FCC, IC CA, SRRC, etc.	CE, FCC, IC CA, SRRC, etc.
DVK		yes	yes	yes	yes

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

DevKits	QCC730M				QCC743M		QCC744M	
								
PART NUMBER	**65-79685-2**	**65-79685-1**	**65-79685-4**	**65-79685-3**	**65-79672-2**	**65-79672-1**	**65-79674-2**	**65-79674-1**
Feature List	iPA + RF Connector Power Amplifier in chip only	iPA + PCB Antenna Power Amplifier in chip only	xPA + RF Connector External Power Amplifier on Module	xPA + PCB Antenna External Power Amplifier on Module	RF Connector	PCB Antenna	RF Connector	PCB Antenna

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REVOLUTION

In Proven Display Technologies

The TFT-LCD displays have been on the market for a long time. The liquid crystal display was first used in a calculator 54 years ago, in 1970. Since then, the technology has been continually developed and remains indispensable today. LCDs are still widely used in countless applications.

In Issue 1/2024 of Impulse, we briefly covered the latest developments. This time, we will highlight and explain two of these advancements in more detail.

The direction of the optimizations is clear and can be summarized in two main areas: improving display quality and enhancing efficiency. Therefore, energy consumption must also be optimized. Which specific areas are being researched to achieve improvements in TFT-LCDs?

Liquid Crystals

The first thing that comes to mind is, of course, the liquid crystal itself – the fundamental material required to create an LCD. Research in this field remains vigorous. Merck, one of the largest and most renowned companies in liquid crystal research and manufacturing, has been developing a new LCD technology known as Blue Phase (BP).

Current technologies, such as TN (Twisted Nematic), IPS (In-Plane Switching), VA (Vertical Alignment), and FFS (Fringe Field Switching), are based on the nematic phase of liquid crystals. In contrast, the Blue Phase occurs between the chiral and isotropic phases of a liquid crystal. During production, the liquid crystal is introduced into the display in its isotropic state. The Blue Phase then forms and is subsequently polymer-stabilized. This stabilization extends the narrow temperature range in which the Blue Phase exists from about 3 Kelvin to up to 100 Kelvin.

Like traditional displays, Blue Phase Displays (BPD) or Blue Mode Displays (BMD) use electric fields to alter light transmission. Typically, components similar to those used in IPS or MVA technologies are employed, where both electrodes are located on one side.

A significant advantage of Blue Phase (BP) technology is its ability to achieve extremely fast switching times of under one millisecond. This is substantially faster than current LCDs, which have switching times in the range of several tens of milliseconds, and it approaches the switching speeds of OLED displays.

Another benefit is that no alignment layers for the liquid crystals are necessary, unlike in IPS or MVA displays. The Blue Phase appears optically isotropic, meaning that the liquid crystals only need to be aligned by the electric field. This eliminates the need for orientation layers and the associated production processes while still providing a wide viewing angle.

Advantages

- **Improved image quality:** enhanced image display due to faster frame rates resulting from quicker switching times
- **Better cost structure:** more cost-effective compared to similar technologies
- **Lower power consumption:** likely reduced power consumption as less effort is required for the electric field
- **Reduced backlight power:** potentially lower power requirements for backlighting due to the absence of alignment layers

Disadvantages

- **Availability:** Currently, Blue Phase (BP) displays are not expected to be available in the near future. It may take some time before manufacturers release a commercially viable product.

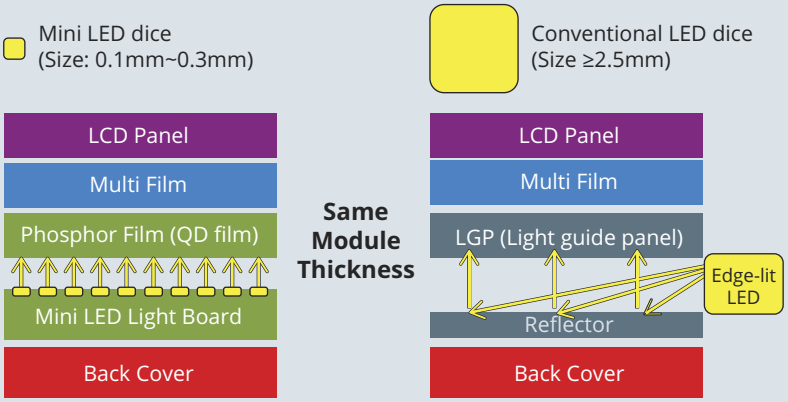


Figure 1: Comparison of Mini-LED and conventional backlight structure

Backlight

It is undisputed that backlighting is the largest energy consumer in LCDs. Therefore, improving energy efficiency in this area is crucial.

The current standard for backlighting in industrial LCDs is edge backlighting. This method involves placing light-emitting diodes (LEDs) along the edge of the display, with their light evenly distributed across the screen using a reflector and a light guide. While LEDs are relatively easy to integrate, designing the light guide requires significant expertise.

The first approach to improving energy efficiency is to use more efficient LEDs. This can quickly increase brightness and/or reduce the power consumption of the panel. However, a truly groundbreaking advancement is the use of Mini-LEDs. These are significantly smaller than the chip LEDs used in edge backlighting (Figure 1). The miniaturization of these LEDs opens up new possibilities: they can be placed directly behind the display without increasing the panel's thickness.

Apple has been using Mini-LED technology since 2021 in its iPad Pro series and has recently adopted it for the MacBook Pro. The technology is now gradually making its way into industrial displays. However, the fundamental idea behind this LED arrangement was conceived much earlier, with notable contributions from Samsung and LG. This technology has been, and continues to be, applied in large LCDs and TV panels, where larger chip LEDs are used, since the thickness of the display is not a critical factor.

How Does Full-Array Backlighting Work?

In a full-array backlight system, the LEDs are arranged in a dense matrix on an LED board. For example, a 14.2" MacBook Pro is equipped with more than 10,000 LEDs. Chip-On-Board (COB) technology is used for this arrangement, as the required density cannot be achieved with Surface-Mount Device (SMD) manufacturing.

Each LED can be individually controlled, ideally based on the content displayed on the screen.

Figure 2

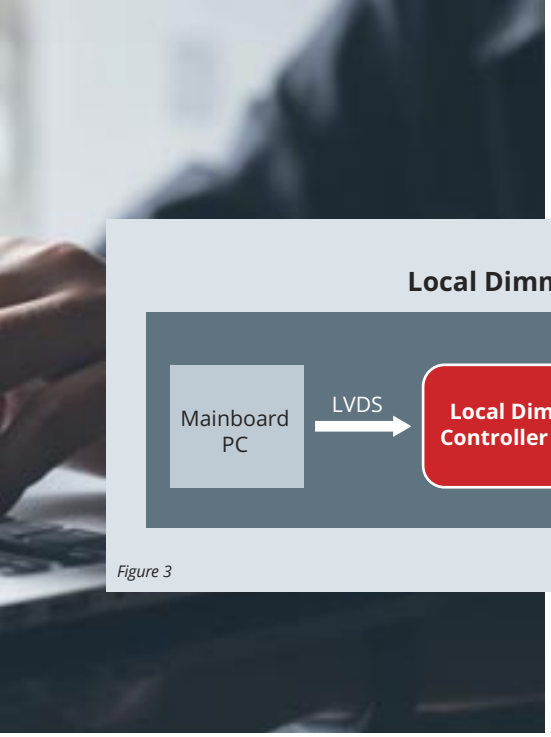
In practice, this means that LEDs in dark or black areas of the image are dimmed or completely turned off. The result is significantly improved contrast, high peak brightness, and an extended color gamut. In short: blacks become deeper, and colors more vivid (Figure 2). Additionally, the content-dependent control of the LEDs also leads to lower power consumption.

How is Mini-LED Control Implemented?

Since the LEDs need to be controlled based on the screen content, an additional circuit component is required. This component extracts and processes the information from the image data necessary for controlling the LEDs. There are generally two approaches: using a dedicated chip for LED driver control or using an FPGA. Both methods have their pros and cons.

Using a dedicated integrated circuit (IC) offers the advantage of lower cost. However, this solution is inflexible, as parameter adjustments, if possible, can only be made through software, requiring additional programming effort and a more powerful computer. Additionally, the choice of LED drivers is limited, as the combination of the LCD driver, LED driver, and local dimming controller is typically fixed. This solution is particularly practical for large production volumes.

When using an FPGA, the solution offers tremendous flexibility and can be tailored to specific requirements. It is also fast because data processing occurs in hardware, which allows unrestricted flexibility in selecting LED drivers. Additionally, non-recurring engineering (NRE) costs are lower, although per-unit costs may be slightly higher.



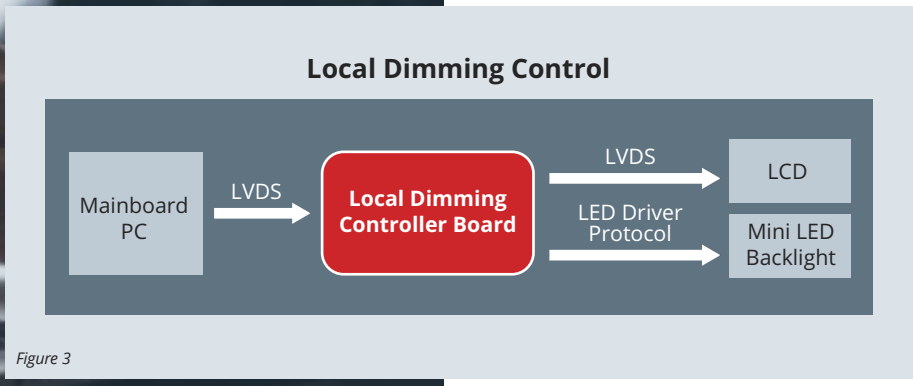


Figure 3

This variant is better suited for industrial applications (Figure 3).

In terms of image quality, a TFT-LCD with full-array backlighting matches an OLED display (Table). This is particularly significant for industries that have previously had to compromize on image quality compared to OLED displays. The main reasons for this include the longer lifespan of TFT-LCDs compared to OLEDs and the long-term availability of OLEDs, which are primarily driven by consumer applications (mainly mobile phones and televisions) with much shorter product cycles compared to industrial needs.

Advantages

The image quality is significantly enhanced, with deep blacks and vivid colors. Power consumption is significantly lower compared to traditional LCDs.

Disadvantages

Achieving these improvements requires additional measures, which are reflected in a higher price. As these displays are still emerging in the market, prices may eventually decrease with increased production volumes, approaching the levels of currently common displays. A good overview of the strengths and weaknesses is provided by a radar chart (Figure 4).

Applications

The initial applications for this technology are primarily found in medical devices. Here, the focus is on achieving the most precise display possible to detect subtle differences, such as in eye diagnostic equipment or monitors used to support surgeries.

The second major category includes specialized outdoor applications. Displays that can withstand sunlight interference and reflections are highly valuable in such environments. For instance, these displays are excellent alternatives for agricultural equipment (such as monitors in tractor cabins) or for use on ships. When combined with standard measures to enhance sunlight readability, these displays offer nearly perfect solutions. Additionally, their temperature range of -30°C to +80°C makes them suitable for outdoor use.

Another significant category is the video sector. Professional equipment demands highly accurate color reproduction and image quality. Whether for high-end cameras or monitors, a perfect image is both desired and expected. Numerous other applications also require excellent image quality, underscoring the versatility and necessity of these displays.

TABLE – PERFORMANCE COMPARISON

	TFT LCD WITH EDGE B/L	TFT LCD WITH DIRECT B/L	OLED DISPLAY
Contrast	800 ~ 1,000:1	>10,000:1	>10,000:1
Brightness	>1,000cd/m²	>1,500cd/m²	>500cd/m²
Color Gamut	>72%	>100%	>100%
Life Time	long	long	short
Power Consumption	high	low	medium

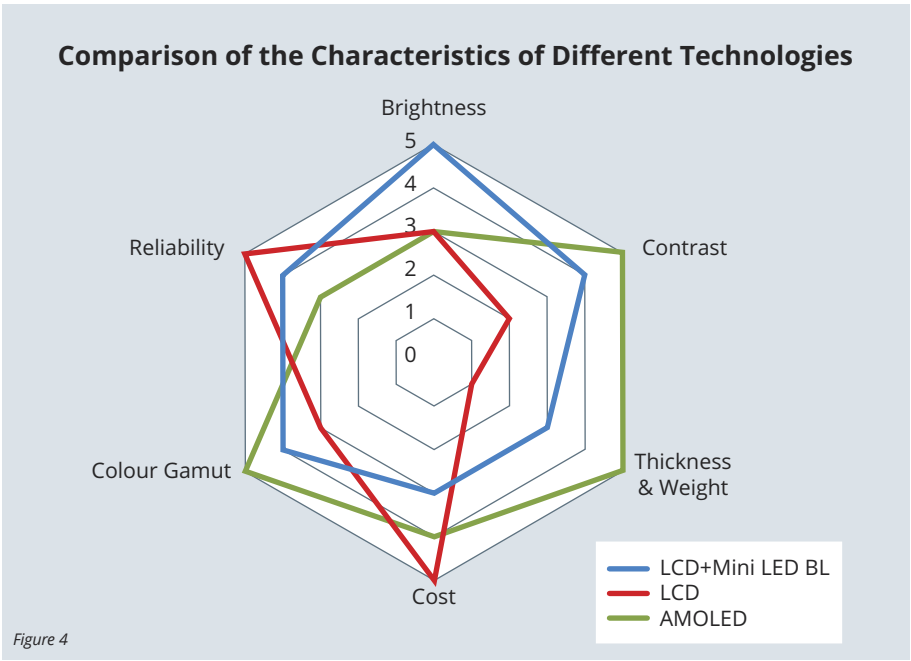


Figure 4

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CONCLUSION

Even with technologies that have been available for a long time, research continues to improve both quality and, increasingly important today, energy efficiency. Liquid crystal displays (LCDs), a technology established for decades, still undergo significant enhancements and remain competitive against »new« technologies such as OLED.

QUALCOMM DRAGONWING™ IQ9 SERIES

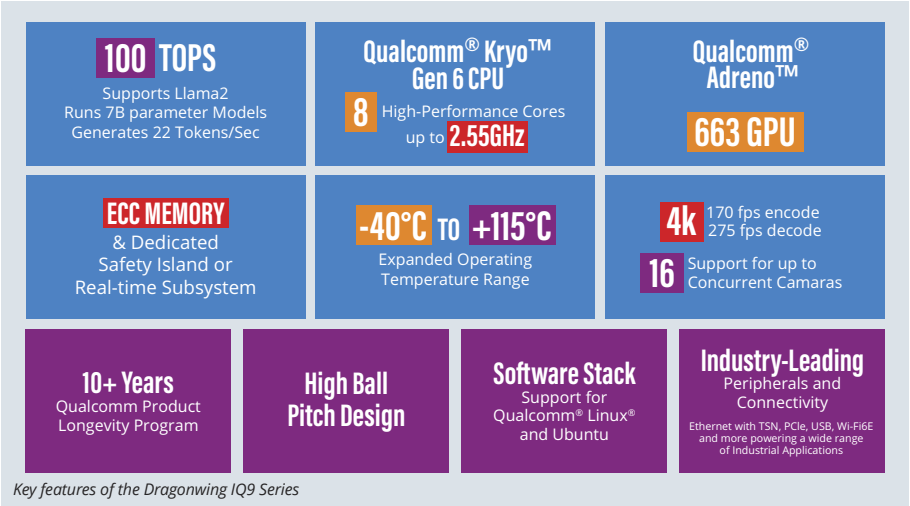
Pioneering Edge AI for Next-Generation Industrial Automation

Qualcomm Technologies has unveiled the Qualcomm Dragonwing™ iQ9 Series, a groundbreaking addition to its IoT SoC roadmap. Designed for scalability and high performance, these Edge AI SoCs enable powerful AI models to run efficiently with industry-leading power consumption. Built to withstand extreme temperatures, they integrate real-time functional safety, fault detection, and fault tolerance, making them ideal for mission-critical applications. With a commitment to long-term availability – exceeding 10 years – Qualcomm Technologies supports industrial-grade reliability and extended software support across multiple operating systems.

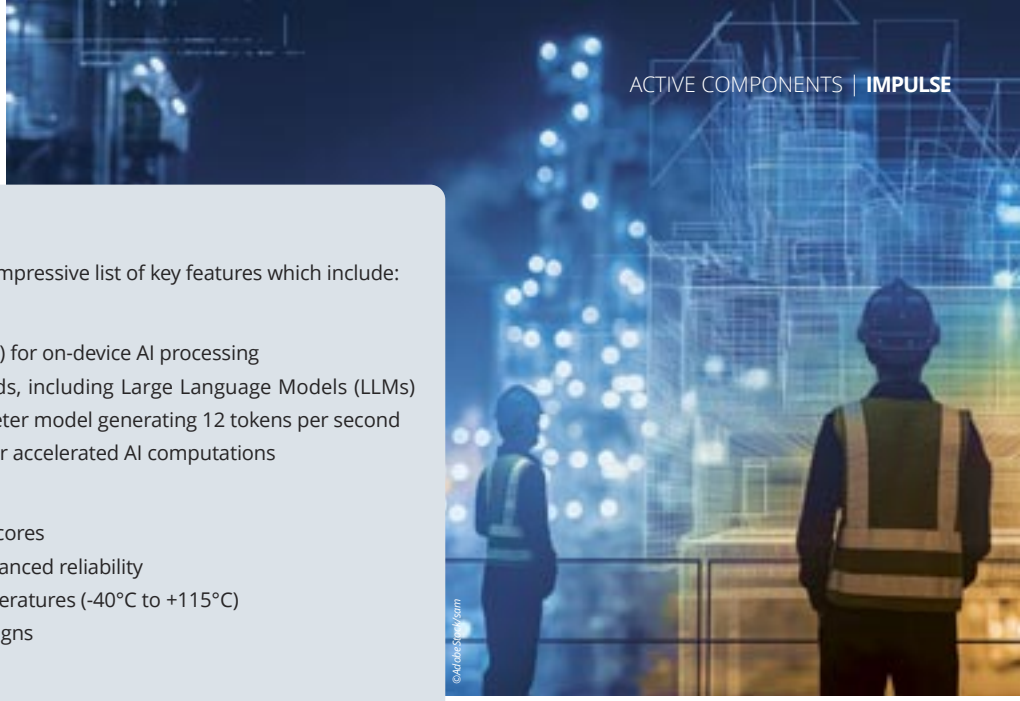
Anticipating the growing demand for AI-driven automation, Qualcomm Technologies has positioned the Dragonwing IQ9 Series to power a wide range of applications, from industrial machines and edge computing boxes to gateways, drones, and robotics. These SoCs are set to play a key role in integrating AI into environments where safety, reliability, and efficiency are paramount.

The need for AI at the edge is accelerating, as organizations look to harness large language models (LLMs) and advanced AI technologies to enhance productivity and streamline industrial operations. According to the World Economic Forum, generative AI and LLMs could impact up to 40% of working hours in the future. In sectors such as manufacturing, logistics, retail, and agriculture, AI-powered systems will enable real-time processing of vast sensor and camera data, allowing machines to interact naturally with untrained human operators.

This seamless collaboration between humans and intelligent machines will optimize production and logistics, reduce defects and waste, and enhance resource efficiency. Farmers, for instance, will be able to minimize fertilizer use while increasing yields, while retail supply chains will become more precise, cutting down on surplus stock. Additionally, LLMs will help preserve and transfer institutional knowledge, enabling faster and more effective worker training. These are just a few of the transformative possibilities AI-powered edge computing will bring to industrial applications.



Key features of the Dragonwing IQ9 Series



HIGHLIGHTS

The scalable Dragonwing IQ9 Series offers an impressive list of key features which include:

High Edge AI Performance

- Up to 100 TOPS (Tera Operations Per Second) for on-device AI processing
- Optimized for running complex AI workloads, including Large Language Models (LLMs)
- Capable of running Llama2 13 billion parameter model generating 12 tokens per second
- Qualcomm® Hexagon™ Tensor Processors for accelerated AI computations

Industrial-Grade Safety and Reliability

- Dedicated safety island (SAIL) with real-time cores
- Error Correction Code (ECC) memory for enhanced reliability
- Designed to operate in a wide range of temperatures (-40°C to +115°C)
- High ball pitch design to support rugged designs

Powerful Processing

- Kryo Gen 6 CPU with 8 high-performance cores.
- Adreno 663 GPU for graphics and multimedia.

Advanced Camera and Multimedia Capabilities

- Support for up to 16 concurrent camera inputs
- Qualcomm® Spectra™ ISP for advanced image processing
- High-performance 4K video encoding and decoding

Extensive Connectivity and Peripherals

- Dual Display Port
- Multiple PCIe, USB, and Gigabit Ethernet interfaces.
- Time-Sensitive Networking (TSN) support for real-time communication
- Wi-Fi6E capabilities
- Multiple CAN FD interfaces

Memory

- Support for LPDDR5 memory with ECC

MCU-like Subsystem

- Built in MCU-like subsystem for real time enhanced safety monitoring
- Can be used instead of external MCU or for added redundancy

Fi, and GNSS – can be added externally to complement the Edge AI capabilities of these modules.

Powering the Dragonwing IQ9 Series from a software perspective, Qualcomm Technologies uses the Qualcomm Developer Network, an ongoing initiative that provides an end-to-end software environment enabling engineers to develop and deploy powerful Edge AI applications based on the latest Qualcomm® SoCs. In recent years, Qualcomm Technologies has invested heavily to deliver a comprehensive suite of software, starting with the operating system and extending to developer SDKs (computer vision, AI, and robotics) as well as AI deployment tools and workflows, which streamline the development process and enable customers to deploy their applications more quickly.

The Dragonwing IQ9 Series consists of two SoCs – the Dragonwing IQ-9075 and the Dragonwing IQ-9100 processors – in the table shown on the right. Customers with applications requiring lower compute and edge AI performance can opt for the Dragonwing IQ-9075 IQ-9075 processor, with a seamless upgrade path to the Dragonwing IQ-9100 processor. Designed for more demanding applications, such as robotics, the Dragonwing IQ-9100 processor offers enhanced DSP and compute resources to handle concurrent AI workloads while meeting functional safety requirements.

To simplify the customer's board design and reduce supply chain complexity, Qualcomm® provides these powerful Edge AI devices as a module solution, which incorporates the Qualcomm SoC, power management ICs, and LPDDR5 RAM. Qualcomm Technologies' leading wired and wireless technologies – including 5G cellular, Bluetooth/Wi-

CHIPSETS	IQ-9075S	IQ-9100S
CPU	Octo-Core Kyro Gen 6	
	Scoles 1.632-255GHz	8 × Kryo Gold Prime @ 236GHz
GPU	Adreno 663 GPU	
Memory	6 × 16 LPDDR5 @ 3200MHz	
Addressable Memory	Up to 36GB with inline ECC	
Audio DSP (IPASS)	1980 MPPS, 7 × TDM/12S, 3 × High-Speed 12S for Radio FE	
AI Performance	Scoles 50 - 100 INT8 TOPS (Dense)	100 INT8 TOPS (Dense)
Display Support	Up to 12, typical 48MP - 5 × 4K	
Display Interfaces	2 × DSI, 2 × DP MST2, 2 × DP MST4	
Video Decode/ Encode	4K @ 275 Decode / 41 @ 170 Encode	
Camera	24b HDR safe 1SP, max 12MP Sensor Resolution, up to 16 Cameras over 4 × 44 Lane CSI2, 24Gpix/s throughput	
Peripherals	2 × PCIe Ports, 1 × 2-Lane + 1 × 4-Lange (Gen4) 2 × 2,5GbE w/TSN (SGSMII), 1 × QSPI	
USB Support	2 × USB 3.1, 1 × USB 2.0	
Storage	2 × UFS 3.1 G4 2-Lanes, 1 × 8-Bit SDCC5, NVMe over PCIe	
MCU-Like Subsystem	4 × Real-Time Cores @ 1.85GHz w/ 8 x CAN FD + 1 × 1 GbE (1 × RGMII)	Up to SIL3-compliant, dedicated safety island with 4 × Real-Time Cores @ 1.85GHz, w/ 8 × CAN FD + 1 x 1 GbE, (1 × RGMII)
Operating System	Linux Yocto, Ubuntu	Linux
Temperature Range	-40°C to 115°C (Tj)	
Build Design	FCBGA1723+HS, 25.0mm × 25.0mm, 0.6mm Ball Pitch	

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Many industrial applications require operating system and middleware support for up to 10 years alongside the SoCs. The Dragonwing IQ9 Series is the latest generation of industrial-grade Qualcomm Technologies SoCs, offering Qualcomm Linux, a comprehensive package of software, tools, and documentation specifically designed to meet industrial software requirements.

The Dragonwing IQ9 Series comes with a Yocto Linux LTS build and a separate Ubuntu Linux build, both provided with BSP and security patching for industrial timeframes. Access to the Dragonwing IQ9 Series software and tools is available to registered users on Qualcomm.com via the dedicated landing page for the Dragonwing IQ9 Series: *https://www.qualcomm.com/products/internet-of-things/industrial/industrial-automation/iq9-series*. For more information on Qualcomm Linux, product and function SDKs for the Qualcomm® IoT SoCs, please check the previous edition of Impulse for more details.

In addition to the available hardware and software resources, there is a wealth of technical collateral supporting new users of the Dragonwing IQ9 Series and other Qualcomm® industrial SoCs. The landing page for the Dragonwing IQ9 Series on Qualcomm.com offers registered users access to technical reference manuals, datasheets, layout guidelines, design guidelines, and much more. Additionally, Qualcomm Technologies has launched an open community forum for its family of industrial SoCs.

This platform allows customers to access technical Q&A and knowledge articles during their projects, based on the collective knowledge of an increasing number of engineers and organizations, as well as Qualcomm Technologies' own experts using Qualcomm Technologies' industrial products. The forum is organized around technical topics such as AI, operating systems, developer tools, profiles, and compilers and is accessible to all users. Once registered with Qualcomm Technologies, users can post their own questions and receive support.

The Dragonwing IQ9 Series landing pages and technical community forum are also complemented by tutorials and knowledge-based videos provided by Qualcomm on YouTube via the Qualcomm Technologies Developer channel: *https://www.youtube.com/@QualcommDeveloper*

Please contact CODICO if you would like to learn more about how to get started with the Dragonwing IQ9 Series of devices.

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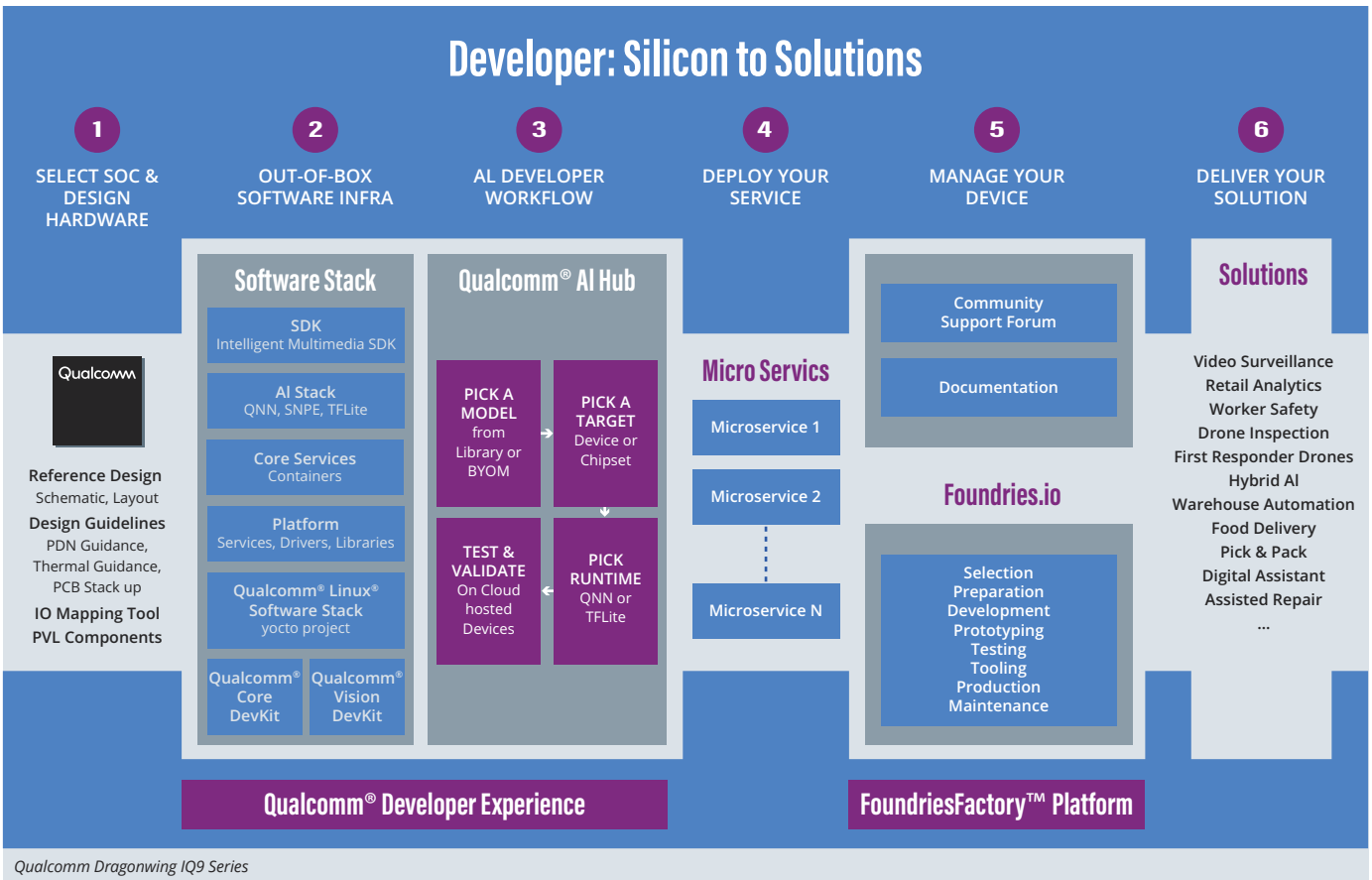

Qualcomm Dragonwing IQ9 Series

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COMPACT & RELIABLE

20W AC/DC DIN-Rail Power Supply

Low-power AC/DC converters used in cabinet and DIN-rail applications are often installed by non-specialists. Therefore, they must be designed to withstand worst-case supply conditions while remaining non-critical in terms of mounting orientation and airflow requirements.

The new cost-effective RAC20NE-K/277/EPID series from RECOM excels in these aspects, featuring a wide 85–305VAC input range, a Class II rating, and OVC III compliance up to 3000m. Their compact 26.4mm width occupies minimal space on a DIN rail or backplate, delivering the full 20W output power without airflow up to +55°C (with derating up to +85°C). Additionally, these units can be chassis-mounted in any orientation using the provided fixing holes. With IP40 ingress protection and tool-free push-in terminals for input and output connections, installation is fast and seamless.

The encapsulated RAC20NE-K/277/EPID models provide fully regulated DC outputs of 5V, 12V, 24V, or 36VDC, including a 24VDC version with active current limitation. With efficiencies reaching up to 88%, these power supplies ensure cool operation and a high MTBF exceeding 1 million hours. They comply with safety standards for reinforced isolation, meet Class B EMC levels (floating or grounded output), and fulfill Eco-design requirements for no-load and standby losses. Built-in protections against short circuits, over-current, over-voltage, and over-temperature further enhance reliability.

With dimensions of just 83,0×26.4×29,5mm (H×W×D), these units include a clip for tool-free »snap-on« installation on a standard DIN rail.

DIN rail power supplies are essential across numerous applications, from EV charging infrastructure to residential cabinets. They must be easy to install, cost-effective, and highly reliable.

Data sheets and samples are now available via CODICO.

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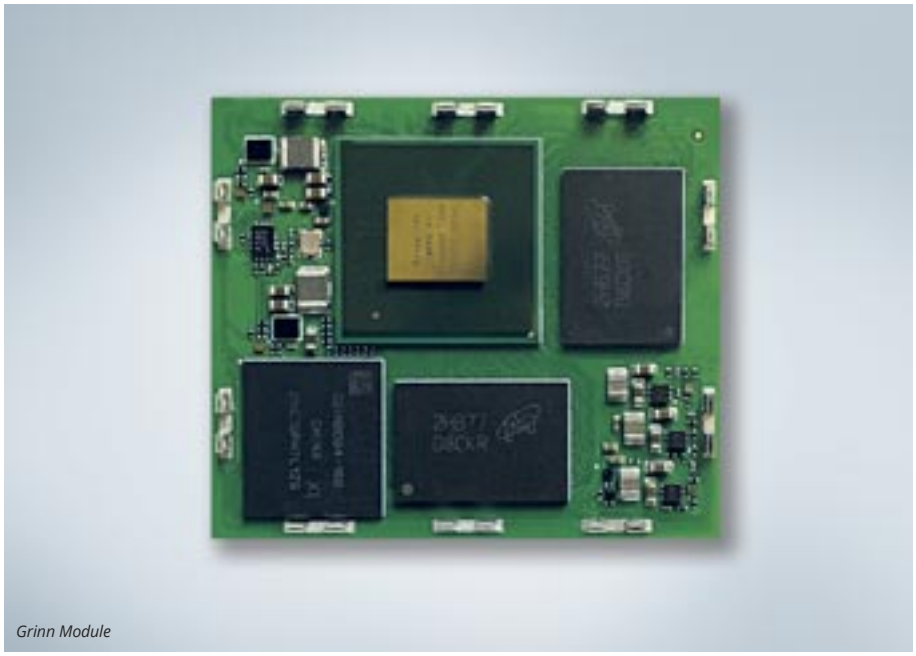
LOCAL AI VOICE ASSISTANTS

Without Cloud Dependency: A Powerful On-Device Solution

SYNAPTICS has released a development environment on GitHub that enables voice assistants to run locally – without requiring a cloud connection. This is made possible by the powerful architecture of the SYNAPTICS SL family, particularly the SL1680 and SL1640 models, which feature an integrated NPU and benefit from the ASTRA SDK software environment and SyNAP Tool Kit.



Grinn Module

In Smart City and Smart Building applications, voice control without an internet connection is often a key requirement. Thanks to advancements in Large Language Models (LLMs) and their optimization into Contextual Language Models (CLMs), these assistants can now operate efficiently on cost-effective hardware like the SL1680 or SL1640.

The context-aware AI voice assistant runs entirely on the device, without offloading or relying on the cloud. Built on the SYNAPTICS Astra™ Machina SL1680 Linux development board, it offers several key features:

- Context-aware speech processing for natural understanding of specific queries
- Fast response times of up to 500ms with high accuracy, independent of cloud services
- Extensibility via tool calls, enabling integration with peripheral devices or optional cloud services
- Multimodal interaction, including support for visual queries
- Answer generation from structured and clean Q&A datasets

This project leverages contributions from various open-source AI initiatives and developers, including:

- **Speech-to-Text:** Moonshine by Useful Sensors Inc., which operates 5× faster than Whisper with improved accuracy
- **Answer Generation:** context-aware Q&A matching using a specialized language model
- **Text-to-Speech:** Piper by the Open Home Foundation for natural speech synthesis

How It Works: Visualization

The assistant processes user queries by converting them into vectors that capture their semantic meaning using a sentence transformer. This data format is similar to the one used in vector databases within Retrieval-Augmented Generation (RAG) systems. As a result, the assistant enables semantic search, allowing users to phrase their queries naturally without needing exact wording.

The system is intentionally context-specific, combining a pure language model with pre-generated question-answer pairs. This ensures low latency, making it efficient for deployment on an embedded Linux board. The semantic matching process enables natural, private, and responsive interactions – ideal for focused use cases such as device control or support inquiries. This makes it particularly suitable for smart home, retail, or industrial applications that benefit from reliable voice control.

Process Overview

- **Voice Activity Detection (VAD):** detects when the user starts speaking
- **Speech-to-Text (STT):** converts spoken language into text using Moonshine
- **Embedding Generation:** transforms the user's query into a semantic embedding
- **Semantic Search:** performs a cosine similarity search against pre-generated question embeddings to find the most relevant answer
- **Text-to-Speech (TTS):** converts the retrieved response into natural-sounding speech (Piper)
- **Tool Invocation:** enables interactions with peripheral devices, vision models, or external APIs for additional functionalities

SOMs Based on SYNAPTICS Astra™

For integrating a voice assistant, CODICO offers a selection of System-on-Modules (SOMs), including the AP72xxx family from AMPAK and the SL1680 module from Grinn.

- **AP72xxx Family:** Based on the SL1620, these modules differ in Wi-Fi variants and memory capacity.
- **SL1620:** equipped with an Arm® Cortex®-A55 Quad-Core CPU and an Imagination BXE 2-32 GPU, delivering up to 700 GOPS of AI performance
- **SL1680:** features a powerful Quad-Core Arm® Cortex®-A73 CPU (2.1 GHz), an Imagination PowerVR Series9XE GE9920 GPU, and a secure 7.9+ TOPS NPU. It supports multiple DNN frameworks, making it ideal for on-device AI applications.

A detailed description of the implementation of a context-specific language model can be found on the ASTRA™ developer page:
https://developer.synaptics.com
Astra SDK Download from GitHub:
https://github.com/synaptics-astra
Astra Machina Kits in the CODICO Sample Shop:
https://www.codico.com/en/astra-machina-kit

A06

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FEATURES

SL1680 Modul Grinn

- 16GB eMMC memory
- 2× 2GB LPDDR4× RAM
- MIPI DSI® v1.2 output
- MIPI CSI-2 input with dual camera support
- Audio decoding/processing, including far-field voice (FFV) and keyword detection

SOM's with SYNAPTICS Astra™

MODEL NAME	PART NUMBER	COMMON FEATURES	WIRELESS MODEL	DDR SIZE	FLASH SIZE	IEEE802.15.4/ THREAD
AP72611	99P-W02-0656R	• 4 Embedded IoT SOM • 4 Wi-Fi6E Dual Band • Bluetooth 5.3 • 1T1R	AP6611S	2GB	8GB	No Support
AP72611_1D4M	99P-W02-0666R			1GB	4GB	No Support
AP72281	99P-W02-0667R		AP6281S	2GB	8GB	Support
AP72281_1D4M	99P-W02-0668R			1GB	4GB	Support
AP72212 1D4M	99P-W02-0672R	• Embedded IoT SOM • Wi-Fi4 • Bluetooth 5.2, integrated Class 1.5 PA • 1T1R	AP6212A	1GB	4GB	No Support

ULTRA-COMPACT

36V 600mA Buck DC/DC Solution

TOREX has developed a new synchronous DC/DC step-down (buck) converter with a 36V input voltage and 600mA output current, featuring ultra-low quiescent current consumption. This compact and efficient product is the ideal solution for space-constrained industrial applications operating at 12V/24V or higher input voltages.

Industrial electronics play a crucial role in modern manufacturing, automation, and process control systems. They encompass a broad range of technologies, including sensors, energy management solutions, control systems, and embedded computers, all designed for reliable operation in demanding environments.

With the emergence of Industry 4.0, the sector is undergoing a rapid transformation, driven by advancements in IoT, artificial intelligence, and edge computing. From smart factories to energy-efficient industrial solutions, electronics are at the heart of these innovations, enabling companies to enhance productivity, precision, and sustainability across various industries.

To meet the increasing demands of this evolving market, TOREX has developed the new XC9704/05 – a high-performance and reliable solution for the next generation of industrial electronics.

XC9704/05 Series

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

The XC9704/05 is a synchronous step-down DC/DC converter featuring an internal P-channel high-side switch, ensuring low-voltage operation with a maximum duty cycle of 100%. This offers a significant advantage over N-channel mid-voltage step-down DC/DC converters, where the maximum duty cycle is limited. With a 100% maximum duty cycle, the output voltage drop is minimized, even when the input voltage decreases significantly.

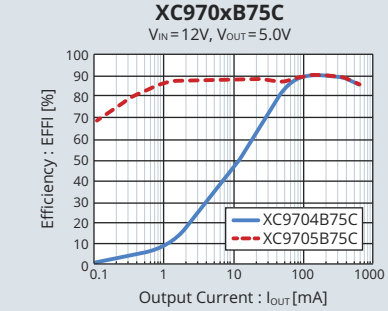

Figure 1: Efficiency vs. Output Current, V_{OUT} = 5.0V

The XC9704/05 operates within an input voltage range of 3.0V to 36V (absolute max. 40V) and delivers up to 600mA of output current. The output voltage is externally adjustable within a range of 2.8V to 18V, while the quiescent current consumption is just 11µA in operation (XC9705, 1.2MHz type). Additionally, the XC9704/05 features an enable pin, allowing the converter to enter standby mode, where the standby current is only 0.6µA (typ.).

While the XC9704 operates with fixed PWM control, the XC9705 features automatic PWM/PFM switching, designed to achieve high efficiency at low output loads without burst mode operation (see Figure 1).

The XC9704/05 is designed for operation with small low-ESR ceramic capacitors and can be configured with two switching frequencies (1.2MHz or 2.2MHz). An adjustable soft-start and a Power-Good output (available only in the USP-6C packa-

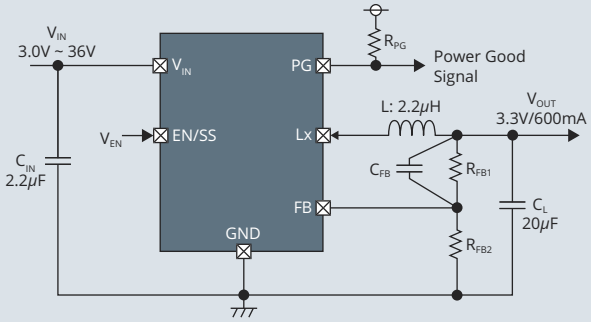

Figure 2: Typical Application Circuit

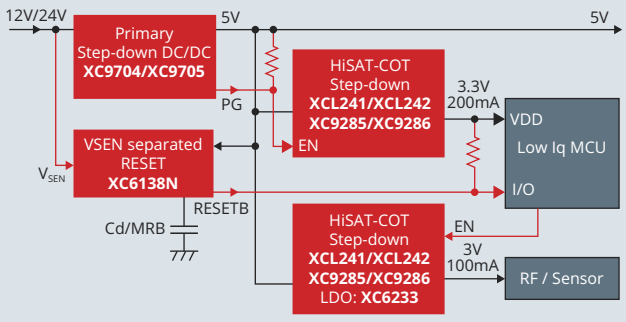

Figure 3: Small Industrial Sensor Block Diagram

ge) provide developers with valuable power sequencing options – a feature that only a few DC/DC converters offer in a package of this size (1.8×2.0×0.6mm).

Additionally, the device includes protection features such as overcurrent protection, undervoltage lockout, short-circuit protection, and thermal shutdown. This ultra-compact DC/DC converter can be implemented with a minimal number of external components (see Figure 2).

Application Block Diagrams for Small Industrial Sensors

12V/24V to 5.0V, then to 3.3V & 3.0V

The XC9704/05 can be used to supply power to MCUs, sensors, etc., by stepping down from 12V/24V or higher to 5V (for secondary regulation from 5V to 3.3V, 3.0V, etc., other TOREX small buck Micro DC/DC (integrated inductor) such as the XCL241/42 series or a TOREX LDO Voltage Regulator such as the XC6233 series can be implemented).

The sequence of the subsequent power supply can be controlled with the PG function of the XC9704/05. The XC6138 voltage detector can be used to supervise the 12V/24V power input and can also be used to monitor the output to the MCU (see Figure 3).

12V/24V directly to 3.3V

The XC9704/05 can also be used to supply power to MCUs, sensors, etc., directly by stepping down from 12V/24V or higher to 3.3V (see Figure 4).

The XC9705 as a Voltage Inverter

The XC9705 can also be used to create a compact and cost-effective inverting circuit, generating a negative output voltage from -15V to -2.8V from a 5V, 12V, or 24V input voltage. The maximum output current ranges from 50mA to 200mA.

Such a circuit is useful for operational amplifiers /instrumentation amplifiers with ±12V supply, gate-drive bias (isolated or negative power supply), and various other negative power supply applications. Figure 8 shows a typical application circuit.

Package Options

The XC9704/05 is available in either a SOT-89-5 package or a small USP-6C package measuring only 1.8×2.0×0.6mm (Figure 5).

The total solution size of the XC9704/05 with the USP-6C package is only 5.8×8.4mm which is 48.72mm² (Figure 6) and this achieves the world's smallest class mounting area for a comparable 36V IC.

Samples and Evaluation Boards for the XC9704/05 can be requested via CODICO.

36V 600mA Micro DC/DC

with Integrated Inductor

A 36V 600mA micro DC/DC version with integrated inductor is also now available. The XCL247/48 series is in a DFN3030-10B »CoolPost« package (3.0×3.0×1.6mm) and will support output voltages of between 2.8V~6.0V (Figure 7).

A07

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Figure 5

Figure 6

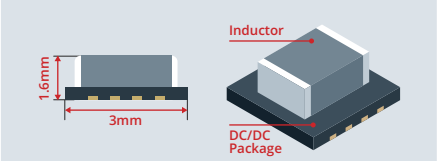

Figure 7: DFN3030-10B Package Structure

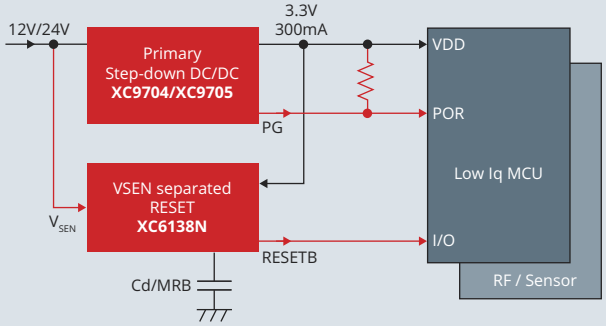

Figure 4: Small Industrial Sensor Block Diagram

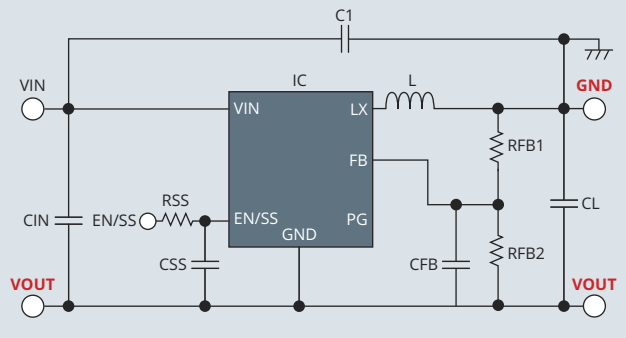

Figure 8: Voltage Inversion Circuit

MORE!

COMPEX Expands its Wi-Fi7 PCIe Radio Module Family

COMPEX Systems, a leading provider of Wi-Fi PCIe module solutions, is expanding its product portfolio of Wi-Fi7 modules, all of which are based on Qualcomm's new Waikiki QCN-6274 and QCN-9274 device family.

Following the introduction of modules with mPCIe and M.2 E Key interface for the 2.4GHz, 5GHz and 6GHz bands in a MU MIMO 2×2 antenna configuration, these modules are now also available with a B+M Key interface. In addition, all 3 interface variants have been extended by a further band configuration with 5GHz + 5GHz (20/40/80/160/240MHz) for 5G-Low and 5G-High.

PRODUCT MATRIX

		miniPCIe				M.2 E Key	
							
PART NUMBER		**WLE7002E25 / WLE7002E25-I**	**WLE7002E26 / WLE7002E26-I**	**WLE7002E55 / WLE7002E55-I**	**WLE7002E56 / WLE7002E56-I**	**WLTE7002E25 / WLTE7002E25-I**	**WLTE7002E26 / WLTE7002E26-I**
Platform	Module Supplier	Compex	Compex	Compex	Compex	Compex	Compex
	Chip Supplier	Qualcomm	Qualcomm	Qualcomm	Qualcomm	Qualcomm	Qualcomm
	Chip Part Number	QCN-6274/QCN-9274-1	QCN-6274/QCN-9274-1	QCN-6274/QCN-9274-1	QCN-6274/QCN-9274-1	QCN-6274/QCN-9274-1	QCN-6274/QCN-9274-1
	Interface Wi-Fi	PCIe 3.0, miniPCIe	PCIe 3.0, miniPCIe	PCIe 3.0, miniPCIe	PCIe 3.0, miniPCIe	PCIe 3.0, M.2 E Key	PCIe 3.0, M.2 E Key
	Interface Bluetooth	NA	NA	NA	NA	NA	NA
	Linux & Android / Mainline Driver	yes / from 5.4.213 upwards	yes / from 5.4.213 upwards	yes / from 5.4.213 upwards	yes / from 5.4.213 upwards	yes / from 5.4.213 upwards	yes / from 5.4.213 upwards
	Windows	NA	NA	NA	NA	NA	NA
Wireless	Bluetooth Standard	NA	NA	NA	NA	NA	NA
	Wi-Fi Standard	Wi-Fi7	Wi-Fi7	Wi-Fi7	Wi-Fi7	Wi-Fi7	Wi-Fi7
	MIMO	[MU 2×2 + 2×2, DBS]	[MU 2×2 + 2×2, DBS]	[MU 2×2 + 2×2]	[MU 2×2 + 2×2, DBS]	[MU 2×2 + 2×2, DBS]	[MU 2×2 + 2×2, DBS]
	Frequency	2.4GHz & 5GHz	2.4GHz & 6GHz	5L GHz & 5H GHz	5GHz & 6GHz	2.4GHz & 5GHz	2.4GHz & 6GHz
	Bandwidth	HT160	HT320	HT160	HT320	HT160	HT320
	Antenna Data Rate	688Mbps + 4324 Mbps	688Mbps + 5765Mbps	2882Mbps + 2882Mbps	2882Mbps + 5765Mbps	688Mbps + 4324Mbps	688Mbps + 5765Mbps
	Antenna Configuration	[2G,5G] + [2G,5G]	[2G,6G] + [2G,6G]	[5LG,5HG] + [5LG,5HG]	[5G,6G] + [5G,6G]	[2G,5G] + [2G,5G]	[2G,6G] + [2G,6G]
	Antenna Type	2 × U.FL	2 × U.FL	2 × U.FL	2 × U.FL	2 × U.FL	2 × U.FL
	Monitor Mode	yes	yes	yes	yes	yes	yes
	Full AP / Soft AP	yes / yes	yes / yes	yes / yes	yes / yes	yes / yes	yes / yes
Module Spec	Power Supply	3.3V	3.3V	3.3V	3.3V	3.3V	3.3V
	Dimension (mm)	30×50.8×13	30×50.8×13	30×52×13	30×52×13	30×52×13	30×50.8×13
	Package	miniPCIe	miniPCIe	miniPCIe	miniPCIe	M.2 3052 E Key	M.2 3052 E Key
	Temperature Range	-20°C to +70°C / -40°C to +85°C	-20°C to +70°C / -40°C to +85°C	-20°C to +70°C / -40°C to +85°C	-20°C to +70°C / -40°C to +85°C	-20°C to +70°C / -40°C to +85°C	-20°C to +70°C / -40°C to +85°C
	Mounting	dual side	dual side	dual side	dual side	dual side	dual side
	Carrier / QTY	Tray / 50	Tray / 50	Tray / 50	Tray / 50	Tray / 50	Tray / 50
	MOQ	10	10	10	10	10	10
	Weight	30g	30g	30g	30g	30g	30g
	Regulatory Compliance	CE, FCC, IC	CE, FCC, IC	TBD	TBD	CE, FCC, IC	CE, FCC, IC
DVK		no	no	no	no	no	no

All modules support DBS (Dual Band Simultaneous) and are available for the following band configurations:

- 2.4GHz + 5GHz
- 2.4GHz + 6GHz
- 5GHz (Low) + 5GHz (High)
- 5GHz + 6GHz

As all modules are available in both commercial and industrial temperature ranges, this module family with 3 different interface versions therefore comprises 24 Wi-Fi7 modules.

With the latest Qualcomm technology, this module family represents the next generation of Wi-Fi solutions and offers significant improvements in speed, efficiency, security, and reliability, addressing the following application areas in particular:

- **Enterprise:** providing fast and reliable wireless connectivity for office environments and conference rooms
- **Industry:** supporting the implementation of IoT devices and industrial automation with robust, low-latency connections
- **Transportation:** enabling seamless connectivity in vehicles, trains, and airplanes for both passengers and machines
- **Cybersecurity:** ensuring secure and fast connections for mission-critical applications and infrastructures

Further information and data sheets are available on our Wi-Fi support page:
https://downloads.codico.com/misc/wifi-modules

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		M.2 E Key		M.2 B+M Key			
							
PART NUMBER		**WLTE7002E55 / WLTE7002E55-I**	**WLTE7002E56 / WLTE7002E56-I**	**WLTB7002E25 / WLTB7002E25-I**	**WLTB7002E26 / WLTB7002E26-I**	**WLTB7002E55 / WLTB7002E55-I**	**WLTB7002E56 / WLTB7002E56-I**
Platform	Module Supplier	Compex	Compex	Compex	Compex	Compex	Compex
	Chip Supplier	Qualcomm	Qualcomm	Qualcomm	Qualcomm	Qualcomm	Qualcomm
	Chip Part Number	QCN-6274/QCN-9274-1	QCN-6274/QCN-9274-1	QCN-6274/QCN-9274-1	QCN-6274/QCN-9274-1	QCN-6274/QCN-9274-1	QCN-6274/QCN-9274-1
	Interface Wi-Fi	PCIe 3.0, M.2 E Key	PCIe 3.0, M.2 E Key	PCIe 3.0, M.2 B+M Key	PCIe 3.0, M.2 B+M Key	PCIe 3.0, M.2 B+M Key	PCIe 3.0, M.2 B+M Key
	Interface Bluetooth	NA	NA	NA	NA	NA	NA
	Linux & Android / Mainline Driver	yes / from 5.4.213 upwards	yes / from 5.4.213 upwards	yes / from 5.4.213 upwards	yes / from 5.4.213 upwards	yes / from 5.4.213 upwards	yes / from 5.4.213 upwards
	Windows	NA	NA	NA	NA	NA	NA
Wireless	Bluetooth Standard	NA	NA	NA	NA	NA	NA
	Wi-Fi Standard	Wi-Fi7	Wi-Fi7	Wi-Fi7	Wi-Fi7	Wi-Fi7	Wi-Fi7
	MIMO	[MU 2×2 + 2×2]	[MU 2×2 + 2×2, DBS]	[MU 2×2 + 2×2, DBS]	[MU 2×2 + 2×2, DBS]	[MU 2×2 + 2×2]	[MU 2×2 + 2×2, DBS]
	Frequency	5L GHz & 5H GHz	5GHz & 6GHz	2.4GHz & 5GHz	2.4GHz & 6GHz	5L GHz & 5H GHz	5GHz & 6GHz
	Bandwidth	HT160	HT320	HT160	HT320	HT160	HT320
	Antenna Data Rate	2882Mbps + 2882Mbps	2882Mbps + 5765Mbps	688Mbps + 4324Mbps	688Mbps + 5765Mbps	2882Mbps + 2882Mbps	2882Mbps + 5765Mbps
	Antenna Configuration	[5LG,5HG] + [5LG,5HG]	[5G,6G] + [5G,6G]	[2G,5G] + [2G,5G]	[2G,6G] + [2G,6G]	[5LG,5HG] + [5LG,5HG]	[5G,6G] + [5G,6G]
	Antenna Type	2 × U.FL	2 × U.FL	2 × U.FL	2 × U.FL	2 × U.FL	2 × U.FL
	Monitor Mode	yes	yes	yes	yes	yes	yes
	Full AP / Soft AP	yes / yes	yes / yes	yes / yes	yes / yes	yes / yes	yes / yes
Module Spec	Power Supply	3.3V	3.3V	3.3V	3.3V	3.3V	3.3V
	Dimension (mm)	30×52×13	30×52×13	30×52×13	30×50.8×13	30×52×13	30×52×13
	Package	M.2 3052 E Key	M.2 3052 E Key	M.2 3052 B+M Key	M.2 3052 E Key	M.2 3052 E Key	M.2 3052 E Key
	Temperature Range	-20°C to +70°C / -40°C to +85°C	-20°C to +70°C / -40°C to +85°C	-20°C to +70°C	-20°C to +70°C / -40°C to +85°C	-20°C to +70°C / -40°C to +85°C	-20°C to +70°C, -40°C to +85°C
	Mounting	dual side	dual side	dual side	dual side	dual side	dual side
	Carrier / QTY	Tray / 50	Tray / 50	Tray / 50	Tray / 50	Tray / 50	Tray / 50
	MOQ	10	10	10	10	10	10
	Weight	30g	30g	30g	30g	30g	30g
	Regulatory Compliance	TBD	TBD	CE, FCC, IC	CE, FCC, IC	TBD	TBD
DVK		no	no	no	no	no	no

MPM3695

Module Solutions With Flexible Output Voltage Configurations

Modern applications require high currents, precise transient control, and flexible voltage setups. FPGA power supplies demand strict ±1.5% V_{OUT} accuracy, even under temperature variations and aging. The common approach to configuring V_{OUT} uses internal or external voltage dividers, ensuring flexibility and precision. The MPM3695 family (MPM3695-10, -20, -25, -100) delivers up to 800A with ultra-fast transient response and tight voltage tolerance. Internal voltage dividers offer compactness and ease of use, ideal for space-constrained designs, while external dividers provide customization and improved thermal management.

Introduction

Advancing technology demands power supplies with higher I_{OUT} in compact, efficient designs. The MPM3695 family, a fully integrated power module with a PMBus interface, supports up to 800A (see Table 1) through paralleled connections. MPS's proprietary multi-phase constant-on-time (MCOT) control ensures ultra-fast transient response and simple loop compensation. The PMBus interface allows easy configuration, real-time monitoring, and dynamic V_{OUT} adjustments, eliminating manual updates and streamlining design. Comprehensive protections ensure reliable operation.

Setting the Output Voltage

The MPM3695 family offers two possible methods to adjust V_{OUT}. The first option is to use the internal resistor voltage divider. The second option is to change V_{OUT} via the external resistor divider.

Based on the design, it can be advantageous to utilize both methods for space-constrained applications with customization requirements. External resistor dividers can also improve thermal management, since the power dissipation can be spread across the PCB. However, one significant drawback of external resistors is that their tolerance can compromise V_{OUT} accuracy. Furthermore, resistor dividers have a temperature coefficient, which means their resistance can fluctuate with changes in temperature. This variation can lead to slight deviations in the feedback voltage (V_{FB}) and, consequently, V_{OUT}.

Table 1: MPM3695 Family

PART NUMBER	MPM3695-10	MPM3695-20	MPM3695-25	MPM3695-100
I_{OUT} (Max per Phase) (A)	10	25	20	100
Slave Phases (Max)	5	5	5	7
Total I_{OUT} (A)	60	150	120	800
Package Size (mm)	LGA-45 (8×8×2)	ECLGA-29 (5×6×4.4)	QFN-59 (10×12×4)	BGA (15×30×5.18)

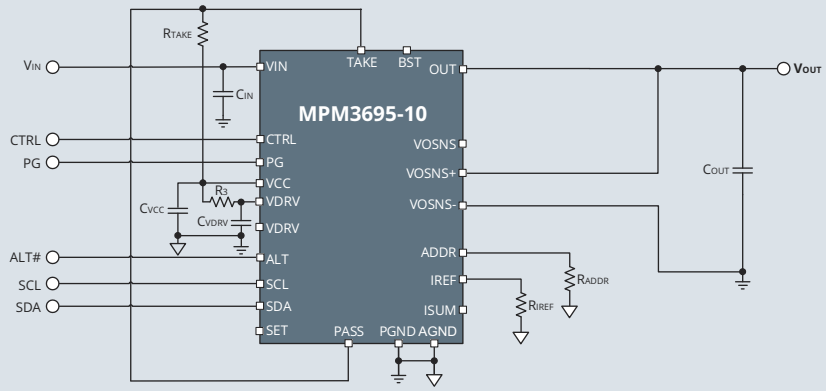


Figure 1: Typical Application Circuit Using an Internal Resistor Divider (Single-Module Operation)

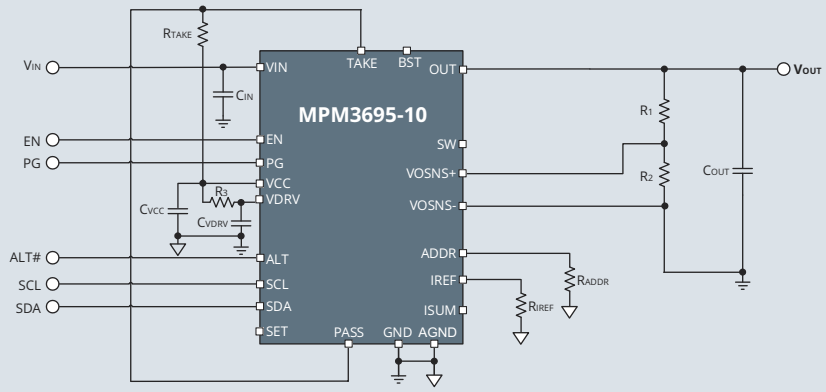


Figure 2: Typical Application Circuit Using an External Resistor Divider (Single-Module Operation)

The MPM3695 family supports the PMBus protocol for the V_{OUT} configurations. Table 2 shows the commands that can be used to change V_{OUT}.

The margin voltage commands verify the application's robustness and ensure that the device meets the application's specifications and can tolerate small changes in power supply voltages across time and temperature changes.

Once the selected voltage value is determined, it is compared to the V_{OUT} limits set by the VOUT_MAX and VOUT_MIN commands. This ensures that V_{OUT} remains within safe upper and lower thresholds. Finally, a scaling factor is applied to match a reference voltage.

The V_{OUT} command process for the MPM3695-10 involves using the OPERATION command to select one of the three inputs as the source of the nominal voltage (VOUT_COMMAND, VOUT_MARGIN_HIGH, or VOUT_MARGIN_LOW)

Table 2: PMBus Output Voltage Commands

COMMAND	CODE	DESCRIPTION
VOUT_COMMAND	0x21	Sets the device's target V_{OUT} during normal operation.
VOUT_MARGIN_HIGH	0x25	Sets the upper voltage limit so that V_{OUT} can be adjusted during margin testing (temporary margin testing and performance verification).
VOUT_MARGIN_LOW	0x26	Sets the lower voltage limit so that V_{OUT} can be adjusted during margin testing (temporary margin testing and performance verification)
VOUT_MAX	0x24	Sets the maximum allowable V_{OUT}. This is a permanent upper voltage limit that triggers a fault if exceeded, which could potentially damage the load or the power supply itself.
VOUT_MIN	0x2B	Sets the minimum allowable V_{OUT}. This is a permanent lower voltage limit that triggers a fault if exceeded, which could potentially damage the load or the power supply itself.
VOUT_SCALE_LOOP	0x29	Adjusts the feedback (FB) loop's gain, which can be necessary for stabilizing the power supply or archiving the target voltage regulation performance.
OPERATION	0x01	Controls the power supply's on/off state and the basic source of the V_{OUT} command (VOUT_COMMAND, VOUT_MARGIN_HIGH, or VOUT_MARGIN_LOW).

Internal Voltage Divider

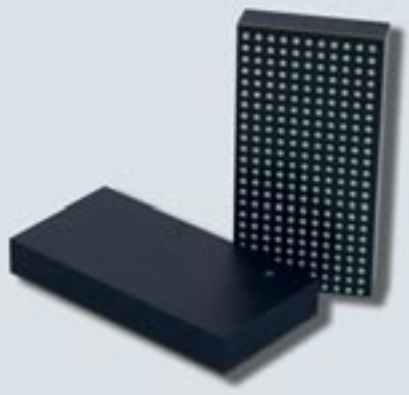
V_{OUT} is sensed through the VOSNS+ and VOSNS- pins. The internal resistor divider reduces V_{OUT} to match the reference voltage (V_{REF}).

Table 3 shows the V_{OUT} range using the internal voltage divider option through VOUT_SCALE_LOOP (29h) and MFR_CTRL_VOUT (D1h). While using the internal voltage divider, it is important to completely disconnect the external feedback (FB) resistors and select the appropriate voltage range according to the desired application.

A higher FB gain typically leads to faster response times to load transients. However, excessively high gains can introduce instability or overshoot. A lower FB gain can lead to slower settling times and reduced overshoot.

Table 3: MPM3695 Family V_{OUT} Range with an Internal Resistor Divider

FB DIVIDER	VOUT_SCALE_LOOP (29H)	MFR_CTRL_VOUT (D1h, Bits[1:0])
Internal	29h = 0×01F4	If D1h, bits[1:0] = 2'b01: V_{REF} / V_{OUT} = 0.5 V_{OUT} = 0.4V to 1.344V
	29h = 0×00FA	If D1h, bits[1:0] = 2'b10: V_{REF} / V_{OUT} = 0.25 V_{OUT} = 0.7V to 2.688V
	29h = 0×007D	If D1h, bits[1:0] = 2'b11: V_{REF} / V_{OUT} = 0.125 V_{OUT} = 1.3V to 5.376V



MPM3695-100

External Voltage Divider

When using an external voltage divider, the device's V_{OUT} is scaled using two resistors (R_1 and R_2) connected in series to form a voltage divider configuration. V_{FB} is sensed through the VOSNS+ and VOSNS- pins.

The values of the FB resistors (R_2 and R_1) can be calculated with Equation (1):

$$R_2\,(k\Omega) = \frac{V_{REF}}{V_{OUT} - V_{REF}} \times R_1\,(k\Omega) \quad (1)$$

Where V_{REF} is the reference voltage, which has a default value of 0.6V (and can be adjusted to be between 0.5V and 0.672V), and V_{OUT} is the target output voltage.

It is recommended to use 1% tolerance resistors with a low temperature coefficient for the FB divider. The V_{OUT} FB gain can be estimated with Equation (2):

$$G_{FB} = VOUT\_SCALE\_LOOP = \frac{R_2}{R_1 + R_2} \quad (2)$$

For a given FB resistor network, the upper (VOUT_MAX) and lower limits (VOUT_MIN) of V_{OUT} can be calculated with Equation (3) and Equation (4), respectively:

$$V_{OUT\_MAX} = \frac{0.672}{G_{FB}} \quad (3)$$

$$V_{OUT\_MIN} = \frac{0.5}{G_{FB}} \quad (4)$$

To optimize the load transient response, a feed-forward capacitor (CFF) must be placed in parallel with R_1 (see Figure 5). Table 4 shows the V_{OUT} range when using the external voltage divider through VOUT_SCALE_LOOP (29h) and MFR_CTRL_VOUT (D1h). Table 5 lists the values of the FB resistors and the feed-forward capacitor for common output voltages.

Table 4: MPM3695 Family V_{OUT} Range with an External Resistor Divider

FB DIVIDER	VOUT_SCALE_LOOP (29H)	MFR_CTRL_VOUT (D1H, BITS[1:0])
External	29h = R_{FB2} / (R_{FB1} + R_{FB2})	If D1h, bits[1:0] =2'b00: V_{REF} / V_{OUT} = 1 V_{OUT} = 0.4V to 5.5V

Table 5: Common Output Voltages

V_{OUT} (V)	R1 (kΩ)	R2 (kΩ)	CFF (nF)	VOUT_SCALE_LOOP (29H)
0.9	0.5	1	33	0.66
1.2	1	1	33	0.50
1.8	2	1	33	0.33
3.3	4.53	1	4.7	0.18
5	7.32	1	4.7	0.12

PRACTICAL DESIGN EXAMPLE

External Voltage Divider

The following section gives a practical example on how to set V_{OUT} through the external resistor voltage divider using the MPM3695-25. Table 6 shows all parameters considered for this example.

Table 6: Design Example Parameters

Input Voltage (V_{IN})	12V
Output Voltage (V_{OUT})	1.8V
Maximum Output Current (I_{O_MAX})	10A
Switching Frequency (f_{SW})	800kHz

Choose R_1 = 2kΩ and V_{REF} = 0.6V. Estimate R_2 with Equation (5):

$$R_2\,(k\Omega) = \frac{0.6}{1.8 - 0.6} \times 2 = 1k\Omega \quad (5)$$

Calculate the resistor divider gain with Equation (6):

$$G_{FB} = VOUT\_SCALE\_LOOP = \frac{1}{1 + 2} = 0.33 \quad (6)$$

VOUT_MAX and VOUT_MIN can be estimated with Equation (7) and Equation (8), respectively:

$$V_{OUT\_MAX} = \frac{0.672}{G_{FB}} \quad (3)$$

$$V_{OUT\_MIN} = \frac{0.5}{G_{FB}} \quad (4)$$

When using the resistor divider described above, failure to adhere to these limits reduces V_{OUT} accuracy.

Table 7 shows the configuration values for the nominal V_{OUT} command (VOUT_COMMAND) and the gain of the external resistor divider (VOUT_SCALE_LOOP) used in this example.

It also includes the margin V_{OUT} limit commands (VOUT_MARGIN_HIGH and VOUT_MARGIN_LOW) and the safeguard V_{OUT} limit command (VOUT_MAX and VOUT_MIN) values.

The real output voltage (VOUT_REAL) can be calculated with Equation (9):

$$V_{OUT\_REAL} = \left(1 + \frac{R_1}{R_2}\right) \times VOUT\_COMMAND \times VOUT\_SCALE\_LOOP \quad (9)$$

VOUT_REAL = VOUT_COMMAND if the following condition is satisfied, estimated with Equation (10):

$$\left(1 + \frac{R_1}{R_2}\right) \times VOUT\_SCALE\_LOOP \quad (10)$$

In our current example, VOUT_SCALE_LOOP matches the resistor divider's real gain, so VOUT_REAL is equal to the value configured via VOUT_COMMAND (21h).

The MPM3695-25's evaluation board (EVM3695-25-RF-02A) in a single-phase configuration was used for this example.

Table 7: Example PMBus V_{OUT} Command Values

COMMAND NAME	CODE	HEXADECIMAL VALUE	DECIMAL VALUE
VOUT_COMMAND	0×21	0×384	1.8V
VOUT_SCALE_LOOP	0×29	0×14A	0,33V
VOUT_MARGIN_HIGH	0×25	0×3E8	2V
VOUT_MARGIN_LOW	0×26	0×320	1.6V
VOUT_MIN	0×2B	0×1F4	1V
VOUT_MAX	0×24	0×4E2	2.5V
MRF_CTRL_VOUT	0×D1	0×00	0

Internal Voltage Divider

Consider the parameters in Table 6. This section describes how to configure V_{OUT} using the internal voltage divider.

Verify that the VOSNS+ and VOSNS- pins are connected directly to the V_{OUT} sense points (see Figure 4). In this scenario, R_3 is set to 0Ω, and R_4 was removed in Figure 6.

For safety considerations while switching between internal and external dividers, it is highly recommended to disable the part through the EN pin; otherwise, the device could sustain damage.

The V_{OUT} range was set via MFR_CTRL_VOUT (D1h), bits [1:0] (when set to 10b), and VOUT_SCALE_LOOP (29h) was set to 0×00FA (see Table 3). Table 8 shows the PMBus command sequence to set V_{OUT} to 1.8V using the internal resistor divider.

Adjusting V_{OUT} on-the-fly via the PMBus interface is particularly useful when changing the I/O voltage, such as when reconfiguring the functionality of new FPGAs like the Achronix Speedster7t solution. Additionally, this on-the-fly feature can also be utilized to adjust the FPGA's core voltage during operation to minimize power consumption.

Conclusion

Choosing between an internal or external voltage divider to configure V_{OUT} depends on the specific requirements of the application, including design flexibility, space constraints, precision needs, and susceptibility to environmental factors.

The MPM3695 family (MPM3695-10, MPM3695-20, MPM3695-25, and MPM3695-100) offers excellent flexibility to configure V_{OUT} by using either an external or internal voltage divider. Based on the results presented, both methods provide high accuracy for real-time V_{OUT} measurements. Furthermore, by including the margin levels and PMBus commands, the MPM3695 family is well-suited for applications where precise V_{OUT} control is needed.

For more power module solutions for your application, explore MPS's wide array of power modules.

This article with additional illustrations can be found on the CODICO website:
https://www.codico.com/en/current/news/mpm3695

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Table 8: PMBus Command Sequence to Configure the Internal Voltage Divider

STEP	COMMAND NAME	CODE	HEXADECIMAL VALUE	DECIMAL VALUE
1	MFR_CTRL_VOUT	0xD1	0×02	2
2	VOUT_SCALE_LOOP	0x29	0×14F	335
3	VOUT_COMMAND	0x21	0×384	1.8V
-	VOUT_MARGIN_HIGH	0x25	0×3E8	2V
-	VOUT_MARGIN_LOW	0x26	0×320	1.6V
-	VOUT_MIN	0x2B	0×1F4	1V
-	VOUT_MAX	0x24	0×4E2	2.5V

AG97000-FL

PD Module for Greater Reliability & Performance

HIGHLIGHTS

- 1500V isolation (input to output), a critical requirement for full IEEE 802.3af compliance
- Onboard bridge rectifiers, simplifying system design
- Available output voltages: 5V, 12V, and 24V DC

Silvertel

SILVERTEL has upgraded its highly popular Ag9700-FL PD module, offering designers even greater value with improved low-voltage start-up protection, making it a more robust and reliable solution. This latest enhancement further solidifies SILVERTEL's reputation for innovation and reliability in the PoE market.

In many PoE applications, system designers often do not have full control over both, the Power Sourcing Equipment (PSE) and the Powered Device (PD). In real-world installations, system installers are typically assigned a switch port to connect to, with the reasonable expectation that everything will work flawlessly. However, interoperability issues can arise. While manufacturers may claim compliance, and system specifications are written with compatibility in mind, there are no absolute guarantees, which can sometimes lead to hardware failures.

The new Ag97000-FL is designed to address these challenges. With its enhanced low-voltage start-up capability, it effectively prevents damage to the PD when exposed to »out-of-spec« voltages – a common issue during startup with certain PSEs. This enhancement significantly improves robustness and reliability. As always, SILVERTEL has also optimized performance and cost, ensuring the best possible solution for designers.

The Ag97000-FL is pin-to-pin compatible with its predecessor and supports Class Programmability, covering a wide range of IEEE 802.3af applications. It features comprehensive protection against over-current, over-voltage, and over-temperature conditions and is rated for operation across an industrial temperature range of -40°C to +85°C, making it a safe and reliable choice for system designers. Like its predecessor, it delivers a low-noise, low-ripple DC output, ensuring clean power for end applications.

Designed for Ethernet-based devices requiring up to 15W of power, the Ag97000-FL is ideal for applications such as:

- IP Cameras
- Door Access Control Systems
- Wireless Access Points
- Touch Screen Panels
- VoIP Phones and Terminals

As a fully IEEE 802.3af-compliant solution, the Ag97000-FL is engineered for seamless integration into modern PoE systems.

Designed and manufactured in the UK, this latest revision enhances Silvertel's range of IEEE 802.3af PD modules, delivering the full 15W output power while being more tolerant and robust in systems that may not be 100% compliant. Requiring only a few low-cost external components, the Ag97000-FL is designed to be:

- Cost-effective
- Easy to implement
- Minimal PCB footprint
- High performance

To support designers, SILVERTEL offers an Evaluation Board, along with comprehensive application notes and best-in-class technical support.

The Ag97000-FL complements SILVERTEL's extensive portfolio of PoE solutions, covering both PD and PSE applications. SILVERTEL also provides a complete range of fully compliant IEEE 802.3at and IEEE 802.3bt modules to meet higher power demands.

Datasheets, samples, and evaluation boards are now available via CODICO.

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NEW BENCHMARK

For Miniaturization & Performance

The GQ series from GOODSKY is now extended with a powerful 20A variant. This innovative miniature relay combines a compact design with high performance, setting a new benchmark in the 20A class.

The GQ relay family now covers the 10A, 16A, and – newly added – the 20A classes. The application areas of the new relay span across various industries such as white goods, building management, heating controls, and industrial automation. With this expansion, GOODSKY offers an even more versatile solution for demanding applications. Despite its high load capacity, the 20A relay maintains a compact size of just 18.2×15×10mm. Key features include:

- **Super miniaturized:** only 18×10mm footprint
- **Coil power:** 360 mW, coil voltages from 5 to 48VDC
- **High inrush performance:** ideal for loads with high inrush current; TV-8 ratings included
- **Long lifespan:** up to 10,000 switching cycles at 20A/250VAC and 85°C (TÜV-certified)
- **Glow-wire-resistant plastics:** compliant with IEC 60335-1
- **Explosion-proof version:** meets IEC 60079-15 (IECEx)
- **Optional reflow soldering:** available in tape & reel packaging for automated production
- **Reinforced insulation:** high clearance and creepage distances between coil and contacts
- **Certifications:** UL, TÜV, and IEC approvals

Your Benefits at a Glance

With the new 20A relay, you benefit from:

- **Higher switching capacity:** ideal for demanding applications
- **Temperature resistance:** reliable operation up to 85°C
- **Durability:** long mechanical and electrical lifespan
- **Flexibility:** compact design with versatile application options
- **Enhanced safety:** high clearance and creepage distances; impulse voltage withstand up to 10,000V
- **Eco-friendly:** RoHS and REACH compliant, halogen-free
- **THR version:** optimized for through-hole reflow soldering processes
- **Explosion-proof:** suitable for use in potentially explosive environments

Comparison: 16A Relay vs. 20A Relay		
FEATURE	**16A RELAY**	**20A RELAY**
Max. Load Capacity	4432VA / 384W	5000VA / 480W
Max. Current	16A	20A
Impulse Voltage Resistance	6,000V	10,000V
Temperature Range	-40°C bis 105°C	-40°C bis 85°C
Certifications	VDE, UL, TÜV	UL, TÜV

APPLICATIONS

The new 20A relay is ideal for:

- Heating control systems: high-efficiency pumps, burners, mixers, and fans
- Smart home & building automation: shutter control, actuators, and gate drives
- Household appliances: refrigerators, washing machines, ovens
- Industrial control systems: time relays and monitoring relays
- Measurement & control technology

We're happy to assist you!

P01

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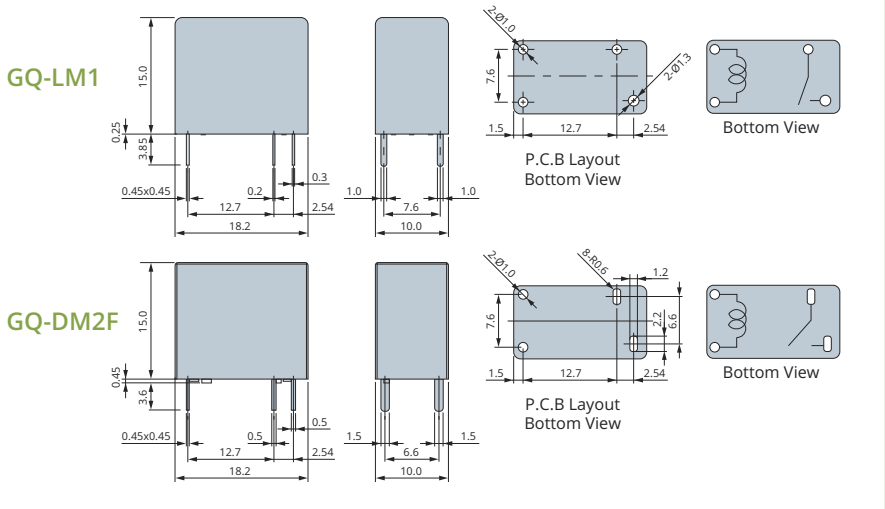

RELIABLE

High Energy Density Compact Size Supercapacitors

With the ever-increasing need for reliable power in industrial, energy and computing applications, the use of portable energy storage has become more commonplace than ever. Lithium batteries are rapidly giving way to the more reliable, efficient and long-lasting electric double layer capacitors (EDLCs, supercapacitors).

Key features of those components are the fast charging capabilities, temperature stability, flexibility and longevity. Supercapacitors deliver hundreds of thousands of charge/discharge cycles, compared to only hundreds (or a few thousand) in lithium-ion batteries. Moreover, supercapacitors pose zero thermal runaway risk over a wide range of temperatures, making them inherently safer than batteries.

EATON ELECTRONICS, offering a wide portfolio of EDLCs with different mechanical and electrical versions, has recently expanded their selection with particularly high energy density versions for long backup times and space saving. Additionally, the variety and range of available capacitances and sizes has been increased.

EDLC Technology

HVH (2.7V) and TVH (3V) series are versions of the radial leaded HV and TV series. HVH is available with 2F to 120F in dimensions of 8×12mm to 18×60mm, and TVH offers sizes of 8×12mm to 16×30mm with capacitances of 1F to 30F (table 1).

XVH (2.7V) and XTH (3V), high energy density versions of the large can snap-in series XV and XT, are available with 3 different terminal options (2-pin, 4-pin and lug terminals). The capacitance ranges from 120F to 600F with 22×47mm to 35×72mm for XVH and 100F to 400F with 22x47mm

XVH & XTH

Table 1: Comparison of THT EDLCs (not a complete list)

Dimensions (mm)	8×10	8×12	10×20	10×25	10×30	12.5×20	12.5×30	12.5×45	13×25	16×25	16×30	16×35	18×40	18×60
HV Capacitance	1F	–	5F	–	10F	–	–	35F	15F	25F	–	35F	60F	100F
HVH Capacitance	x	2F	7F	10F	12F	15F	20F	–	–	30F	35F	–	70F	120F

Dimensions (mm)	8×12	8×16	8×20	10×20	10×25	10×30	16×25	16×30	16×35
TV Capacitance	–	–	3.3F	6F	–	10F	25F	–	35F
TVH Capacitance	1F	2F	–	7F	10F	–	–	30F	–

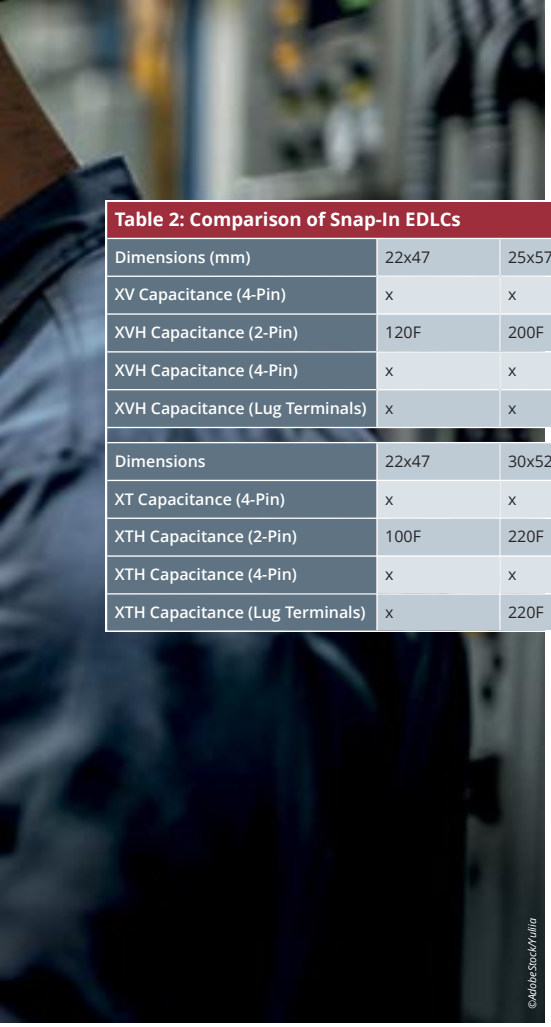

Table 2: Comparison of Snap-In EDLCs

Dimensions (mm)	22x47	25x57	30x57	35x53	35x57	35x63	35x68	35x72	35x87.5
XV Capacitance (4-Pin)	x	x	x	300F	x	400F	x	x	600F
XVH Capacitance (2-Pin)	120F	200F	300F	360F	400F	470F	500F	600F	x
XVH Capacitance (4-Pin)	x	x	x	360F	400F	470F	500F	600F	x
XVH Capacitance (Lug Terminals)	x	x	300F	360F	400F	470F	500F	600F	x

Dimensions	22x47	30x52	35x53	35x63	35x68	35x87.5
XT Capacitance (4-Pin)	x	x	275F	370F	x	555F
XTH Capacitance (2-Pin)	100F	220F	x	x	400F	x
XTH Capacitance (4-Pin)	x	x	x	x	400F	x
XTH Capacitance (Lug Terminals)	x	220F	x	x	400F	x

to 35x68mm for XTH. All of them are specified with an max. operating temperature range of -40°C to +85°C (+85°C with voltage derating) (see table 2).

Applications

- Smart/Automated Utility Meters
- Flash memory, RAID servers
- Industrial controls
- Vehicle tracking
- Valve, actuator power
- Automotive backup, pulse power
- Battery life and run time extension

Specifically for the large Snap-Ins:

- Industrial equipment backup
- Wind turbine pitch control
- Gaming machine backup
- Pulse power up to 15 kW
- Medical mobile X-ray power

Hybrid EDLC Technoloy

Another specialty of EATON ELECTRONICS are hybrid supercapacitors. Hybrid supercapacitors are variants of standard supercapacitors that combine the benefits of EDLCs and li-ion technology for improved performance. Inside a hybrid supercapacitor, one of the carbon-based electrodes is replaced with a lithium-doped carbon electrode similar to a battery. With this technology the energy density is increased even further to over 100% greater compared to conventional EDLCs with very long cycle lifetimes compared to lithium-ion batteries. Additionally, the rated voltage is increased as well, to 3.8V.

As with the conventional supercaps, EATON ELECTRONICS has also developed a high energy density version (HSH-series) of the hybrid supercaps.

Features

- 3.8V operating voltage for high power and high energy
- Up to 10 times energy density compared to standard supercapacitors
- Low ESR for high power density
- UL recognized
- Low self-discharge ideal for use with batteries

Specification HSH

- Maximum rated working voltage: 3.8V
- Minimum rated working voltage: 2.5V
- Minimum allowed working voltage: 2.2V
- Capacitance range: 3F to 1,400F
- Dimensions: 5×12mm to 18×60mm
- Operating temperature range: -25°C to +70°C

Applications

- Industrial backup/ride through
- Backup for storage servers


HSH

- Water and gas smart meters
- IoT energy storage
- Medical backup power/alarm
- Commercial trucks/containers asset tracking

This combination of advanced technologies allows EATON ELECTRONICS to offer a wide variety of capacitor solutions tailored to applications for backup power, pulse power and hybrid power systems. They can be applied as the sole energy storage or in combination with batteries to optimize cost, life time and run time. System requirements can range from a few microwatts to hundreds of watts. All products feature low ESR for high power density with environmentally friendly materials for a green power solution.

For further information and product details, prices or samples, kindly contact your CODICO sales contact or

P02

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Table 3: Comparison of Hybrid EDLCs

Dimensions (mm)	5×12	6×12	8×14	8×20	10×16	10×25	10×40	12.5×35	12.5×45	16×25	18×40	18×60
HS/HSL Capacitance	–	–	10F	25F	30F	70F	150F	–	–	220F	–	–
HSH Capacitance	3F	8F	25F	40F	55F	110F	200F	300F	400F	–	850F	1400F

MINIATURIZATION ON THE RISE

New PMLCAP MF Series and an Update on the HPB Series

Over the past few years, our Impulse magazine has featured RUBYCON's PMLCAP products in every issue. As you may be aware, recent advancements in PMLCAP technology have primarily focused on high-voltage applications. This technological evolution – particularly its expansion into the high-voltage domain – is expected to play a key role in enhancing the efficiency of future electrical systems across various sectors.

Notably, progress in high-voltage technology has also enabled further miniaturization of existing low-voltage models. As regular readers of Impulse will know, RUBYCON's PMLCAP has been on the market for over 15 years, proving its value in applications ranging from high-end car audio systems to NASA's Mars exploration missions. In this issue, we are excited to introduce a new addition to the low-voltage PMLCAP lineup: the MF Series.

Features of the PMLCAP

Compact and High-Capacity

PMLCAP (Polymer Multi-Layer CAPacitor) is a cutting-edge solution that combines excellent electrical characteristics with compact design. This series addresses the challenge of increasing capacitance in conventional surface-mounted capacitors by delivering high capacity in a remarkably small footprint.

Capacity/Size Comparison Between the MF and MU Series (Excerpt)

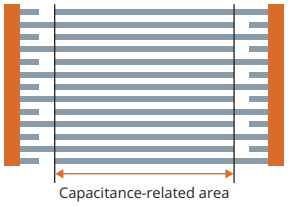
MF Series

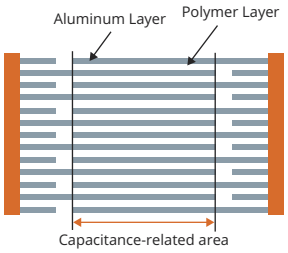
VDC	Cap. [µF]	Size [mm]		
		L	W	H
16	0.47	2.0	1.25	1.0
	4.7	3.2	2.5	1.8
25	0.33	2.0	1.25	1.0
	3.3	3.2	2.5	2.0
35	0.15	2.0	1.25	1.0
50	0.068	2.0	1.25	1.0
63	0.047	2.0	1.25	1.0

MU Series

VDC	Cap. [µF]	Size [mm]		
		L	W	H
16	0.22	2.0	1.25	1.0
	3.3	3.2	2.5	2.0
25	0.15	2.0	1.25	1.0
	2.2	3.2	2.5	1.8
35	0.10	2.0	1.25	1.0
50	0.047	2.0	1.25	1.0
63	0.033	2.0	1.25	1.0

Expansion of the capacitance-related area
Optimization of the polymer layer thickness





- Thin-film technology enables significant miniaturization compared to conventional capacitors.
- Polymer materials offer high resistance to temperature and humidity changes, ensuring high reliability.
- Proprietary manufacturing technology ensures stable quality.
- Long lifespan, allowing use in various environmental conditions

Superior Electrical Characteristics

- Stable temperature and frequency characteristics: Thin-film polymer multilayer technology enables stable operation over a wide temperature range (-55°C to 125°C).
- Low loss and excellent high-frequency characteristics
- High insulation resistance and low leakage current
- Fast charge and discharge properties reduce signal distortion.

Extensive Lineup

Unlike multilayer ceramic capacitors (MLCCs), PMLCAPs do not suffer from piezoelectric effects, reducing risks such as cracks, short circuits, smoke, and fire.

Technological Innovations in the MF Series

RUBYCON has announced the launch of the MF Series, which achieves a remarkable 40–210% increase in capacitance compared to the previous MU Series – all while maintaining the same compact dimensions. This significant improvement is the result of two key technological innovations:

1. Extending the oil margin (the discontinuous section of the aluminum layer) closer to the electrode
2. Reducing the thickness of the polymer resin layer

These advancements are the product of extensive research and development efforts, combined

with enhancements in vapor deposition technology. Looking ahead, further miniaturization is anticipated as these technologies continue to evolve.

Product Overview of MF Series

- Capacitance Range: 0.033 to 4.7µF
- Rated Voltage: 16 to 63V
- Operating Temperature Range: -55 to +125°C

Key Applications of the MF Series

- **Audio equipment:** expected to replace MLCCs, improving sound quality and reducing noise
- **Sensor circuits:** The absence of piezoelectric effects prevents disturbances from board vibrations, enabling highly precise signal processing.
- **RF circuits and PLL synthesizers:** stable characteristics make them ideal for RF power supply applications
- **Compact electronic devices:** enhances sound clarity and reduces noise in smartphones, tablets, and laptops
- **Industrial and medical wearable devices,** among other potential applications.

With the introduction of the MF Series, RUBYCON sets the stage for further innovation in miniaturization and high-performance design – supporting the advancement of next-generation electronic devices across a broad spectrum of industries.

Current Status of HPB Series (High Voltage Type)

In addition to the low-voltage type, there are also two news updates regarding the high-voltage type of the HPB series.

The first update is that the catalog specifications have been officially published on the website of RUBYCON. The second update is that, based on market research conducted over the past few years, a 900V 5µF specification has been added.

There may be slight differences between the values announced previously in our newsletters or Impulse. This is because the catalog specifications reflect the values that RUBYCON can guarantee at the present time. However, one important note is that RUBYCON is still actively engaged in technical research and development, meaning that the specifications may change in the future. If such changes occur, they will mainly focus on increasing ripple current, while the voltage, capacitance, and size configurations are expected to remain unchanged.


PMLCAP

If there are any further updates, please continue to check RUBYCON's website, our newsletters, and Impulse for announcements.

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Product Lineup of the HPB Series

Vr (V)	Cr (µF)	Dimensions (mm)					Number of pins	Ir (Arms/10kHz) Ta=85°C, ΔTe=40K	Part number (Intensive)
		T	H	L	S	S1			
500	5	11	25	23	18	–	2	6.84	500HPB505K
	10	16	25	23	18	–	2	10.8	500HPB106K
	15	27	25	23	18	10.2	4	16.4	500HPB156K
	20	27	25	23	18	10.2	4	20.3	500HPB206K
900	5	13	25	31	26	–	2	7.0	900HPB505K
	10	21	25	31	26	10.2	4	11.5	900HPB106K
	15	21	35	31	26	10.2	4	16.0	900HPB156K
	20	26	35	31	26	10.2	4	19.0	900HPB206K
	25	31	35	31	26	20.3	4	22.0	900HPB256K

INTELLIGENT

Analog Shunts for Precise Measurement

ISABELLENHÜTTE

High-precision shunt solutions go beyond merely providing resistive elements – they integrate voltage taps and contact points, customized to meet diverse application requirements. The analog sensor with PCB is a busbar shunt that can be tailored to specific customer needs or chosen from the standard product portfolio. This innovative solution incorporates a soldered-on printed circuit board (PCB), enabling direct measurement signal tapping while maintaining high accuracy and reliability.

ISABELLENHÜTTE's analog shunt solutions offer precision and reliability, making them the ideal choice for accurate current measurement in demanding applications. Each shunt comes with a unique serial number and manufacturing date, ensuring full traceability. Additionally, the measured resistance values and nominal Temperature Coefficient of Resistance (TCR) are stored in the DMC-code, providing essential data for precise performance tracking.

Another key advantage of this design is the integration of NTCs (Negative Temperature Coefficient Thermistors) on the PCB, allowing real-time temperature monitoring and compensation for temperature-related resistance variations. As a result, the analog sensor efficiently supports two critical battery management system (BMS) functions: current measurement (CSM) and temperature measurement (TMP).

By embedding the PCB directly onto the shunt, the analog shunt ensures precise and stable signal transmission, reducing external interference and minimizing additional assembly steps. A dedicated connector facilitates the extraction of voltage and temperature data, seamlessly transmitting analog signals to the customer's higher-level control system.

The user gets a very good measurement signal because the PCB is placed exactly where the temperature coefficient is most favorable. If the user chooses his own contacting, this could be at a point where the TCR cannot be measured optimally, so that the measurement result is negatively influenced. On the other hand, with the PCB applied directly to the edge of the resistance material, the best possible pickup of the measurement signal is guaranteed.

The analog sensor with PCB also promises greater flexibility in terms of installation space: The system does not need to be designed in a special way so that the shunt and separate PCB are as close to each other as possible. It should be noted that the lead to the higher-level PCB can act like an antenna and thus interference can be received. However, this problem can be solved with a twisted or shielded lead.

The high accuracy, temperature compensation capabilities, and seamless integration into battery management systems (BMS) make them ideal for both automotive and industrial energy applications (Figure 1).

The Application Areas for Analog Shunts Are Diverse:

Automotive & E-Mobility

Analog shunts play a crucial role in Battery Disconnection Units (BDU) and Battery Junction Boxes (BJB), ensuring accurate current sensing and

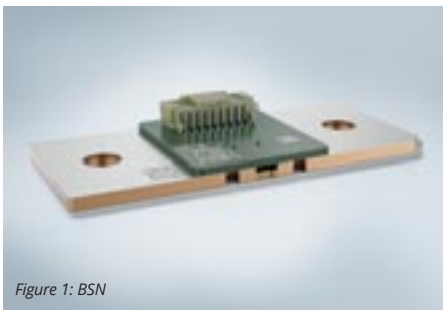

Figure 1: BSN

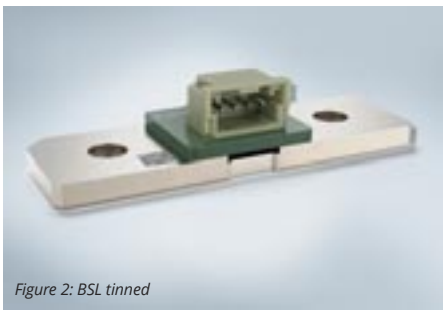

Figure 2: BSL tinned

Table 1: Analog Sensors

SERIES	SIZE	PART NAME	Continuous load up to [A]	10s load [A]	1s load [A]	100ms load [A]	Measurement Channels	NTC Channels
BSL	5216×3 (metric)	BSL-L100-xxx	± 310	± 500	± 800	± 2.300	1	1
BSS	8420×3 (metric)	BSS-L050-xxx	± 600	± 800	± 1,500	± 3,600	2	1
		BSS-L100-xxx	± 450	± 600	± 1,100	± 3,500		
BSN	8436×3 (metric)	BSN-L025-001	± 1,100	± 1,300	± 5,500	± 5,200	3	2
		BSN-L025-002 to 004	± 1,100	± 1,300	± 5,500	± 5,200	2	2

thermal monitoring in various electric vehicle platforms, including:

- **Passenger Cars** – supporting efficient energy distribution in electric and hybrid vehicles
- **Agricultural EVs** – used in electric tractors, automated farm machinery, and other off-road vehicles, where durability and precision are key
- **Trucks & Busses** – ensuring stable and safe power management in commercial electric fleets
- **Two- and Three-Wheelers** – providing compact and lightweight current sensing solutions for electric motorcycles, scooters, and rickshaws
- **Excavators & Mining Equipment** – used in heavy-duty electric and hybrid mining machinery, where reliable current measurement is essential for high power loads
- **Alternative Mobility Solutions** – including snowmobiles, electric wheelchairs, trains, and other specialized electric transport solutions that require highly accurate current measurement and monitoring

Energy Storage Systems

- **Battery Monitoring Units (BMU) & Pack Monitoring** – ensuring precise energy management in large-scale battery packs
- **Stationary Energy Storage Systems** – supporting grid storage, renewable energy systems, and backup power applications by providing real-time current monitoring
- **Mobile Energy Storage Systems** – used in portable and modular battery storage solutions, ensuring safe and efficient power distribution

Industrial & Power Electronics Applications

- **Industrial Inverters** – Though dominated by hall-effect sensors, analog shunts are used for high-accuracy measurements in industrial power conversion applications.
- **Phase Current Measurement –** enabling accurate phase current sensing in electric motor drives and inverters.
- **Sum Current Measurement –** supporting multi-phase power applications by providing aggregated current sensing across multiple circuits

What sets these shunts apart is the 100% TCR measurement performed on every unit – unlike many competitors that only measure TCR at the batch level. This guarantees high total tolerance over the product's lifetime, even under varying operational conditions, as validated by customer-specific mission profiles.

By integrating seamlessly with standalone shunts or active Current Shunt Monitor (CSM) solutions, these sensors provide an accurate and complete analog measurement package (Table 1).

Furthermore, ISABELLENHÜTTE presented the new BSX Shunt, with a continuous load up to 1340A (Figure 3).

Explaining the TCR and how to read from the DMC-Code

Each ISABELLENHÜTTE analog shunt features a unique polynomial stored in its Data Matrix Code (DMC), representing precise, component-specific characteristics. Unlike competitors who rely on batch-level approximations, ISABELLENHÜTTE ensures that every individual shunt undergoes End-of-Line (EOL) testing, where its Temperature Coefficient of Resistance (TCR) is measured and laser-etched directly onto the component.

The TCR defines how a material's resistance changes with temperature, and every alloy inherently has its own TCR value. In analog sensors, this value is influenced by both the material composition (alloy and copper) and the precise placement of sensing traces.

Don't hesitate to contact us for more details!

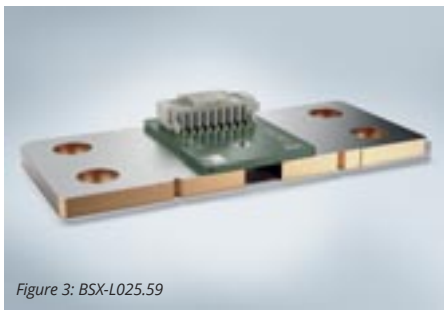

Figure 3: BSX-L025.59

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Example
(values fromDMC-code of the BSN):
a = 9,952E-08 / b = -1,712E-05 / c = 9,602E-04
Resistance value 25µΩ at
reference temperature of 20°C

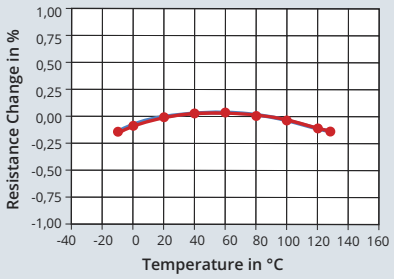

Figure 4

Rchange R/R20 [%]

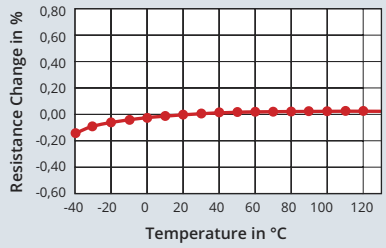

Figure 5

Table 2: Lookup-Table

TEMP	CHANGE [%]	R-VALUE [µOhm]
-20	-0,0722	24,982
-10	-0,0469	24,988
0	-0,0268	24,993
10	-0,0114	24,997
20	0,0000	25,000
30	0,0080	25,002
40	0,0132	25,003
50	0,0161	25,004
60	0,0174	25,004
70	0,0177	25,004
80	0,0175	25,004
90	0,0175	25,004
100	0,0182	25,005
110	0,0203	25,005
120	0,0243	25,006
130	0,0309	25,008

way2zero

Sustainability, environmental protection and the reduction of CO_2 emissions are extremely important topics that are part of our society on a daily basis in these times and will have a strong influence on economic activity in the future. CO_2 neutrality in the period from 2030 to 2045 is the declared goal of many industrial companies to meet these requirements.

This also poses major challenges for manufacturers of inductive components such as SUMIDA. The course for sustainable component concepts is already set in the development phase. By reducing the volume of components, the focus here is specifically on using less material, which has a positive effect on the CO_2 balance of the preliminary products.

The avoidance of problematic materials such as adhesives and potting agents also plays an important role at this stage in order to make the products easier to recycle later on. At SUMIDA, a new strategic development project »design4 sustainability« was launched specifically for this purpose, which takes into account all environmental aspects throughout the entire life cycle right from the early development stage (see Figure 1).

In the next step, the focus is on reducing Scope 1 and Scope 2 emissions during production. Important here are the reduction of process energy through optimized production processes, a modernized and adapted production infrastructure, as well as the switch to renewable energy sources. By equipping the buildings with photovoltaic modules wherever possible, SUMIDA was able to significantly increase the proportion of »green« energy.

Figure 1: »Green« transformer concepts by SUMIDA that operate without chemical potting compounds and meet the required safety standards through a special coil former design.

Figure 2: SUMIDA's »green« common mode chokes, designed without adhesives or potting compounds, enabling simple separation into core components – magnetic core, plastic frame, and copper – for high recyclability.

©AdobeStock/Yalcin

Optimizing the supply chain is the basis for a significant reduction in Scope 3 emissions, i.e. a reduction in CO_2 emissions from basic materials and during transport. A decisive approach here is active and sustainable cooperation with suppliers in order to sensitize them to environmental aspects and to demand a sustainable CO_2 reduction for their preliminary products such as magnetic cores, plastic parts, copper wires, etc.

Another aspect is the localization of activities and the associated noticeable shortening of transport routes (e.g. Europe ⬌ Europe as an alternative to Asia ⬌ Europe). Thanks to a global purchasing network, SUMIDA is able to make these sourcing and transportation routes as efficient and CO_2 -friendly as possible.

The subsequent operational use of the components in the final application, which can extend over many years, also has a major influence on the CO_2 balance. The optimization of efficiency and reduction of power loss is an important factor here. This is achieved primarily through the use of new magnetic materials (such as the new SUMIDA power ferrite Fi330), which exhibit the minimum power loss under the operating conditions of the applications. Furthermore, component concepts with a high filling factor lead to a significant reduction in copper losses.

In the final step, once the end-of-life stage has been reached, the components need to be broken down into their basic parts in order to return as many valuable raw materials as possible to the economic cycle (circular economy). In the case of inductive components, these are mainly copper, plastics and metal parts. In some cases, even magnetic cores can be separated without causing damage so that they can be reused for future projects (Figure 2).

Conclusion: Sustainability among component manufacturers is not a sure-fire success, but requires many individual steps in the product life cycle, as well as close interaction between all those involved in the entire supply chain. SUMIDA has set the course for this.

Fore more detailed information please contact:

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EMPLOYEE EXPERIENCE

People as the Key to Success

»Take care of your employees, and they will take care of your business.«, *Richard Branson*

Employees are the key to a company's success. They are the ones who develop ideas, drive innovation, and shape the DNA of a business. When they feel valued and supported, they can reach their full potential. That's why CODICO consistently invests in a strong employee experience – a corporate culture that fosters trust, motivation, and personal growth.

»The job interview was really pleasant. For the first time, I didn't just have to recite my CV – I felt a genuine interest in me as a person.«

In a rapidly changing work environment, it's not enough to simply attract talented employees. What really matters is offering them an environment from day one where they feel comfortable, can grow, and succeed. At CODICO, we see the employee experience as a shared journey – from the moment someone applies, to long after they leave the company. It encompasses not just the physical workspace, but also the company culture, collaboration with leaders and colleagues, and access to resources and development opportunities.

CODICO has already implemented numerous initiatives to improve the employee experience and will continue this focus in 2025. The goal is to inspire employees, earn their trust, challenge and support them – to achieve success together.

»During my first three months, I had a mentor who supported and helped me a lot. Even now – years later – I can still turn to her anytime.«

What matters is how employees perceive their work environment, company culture, leadership, and the available resources. A thoughtful employee experience requires commitment at all levels – from executive management to each individual employee.

»Clear, structured, and well-documented processes made it much easier for me to get started.«

When employees feel appreciated and supported, they're more creative, engaged, and better equipped to solve complex challenges. A healthy, positive work environment and working on equal footing contribute to resilience and flexibility. Moreover, an optimized employee experience not only increases job satisfaction, but also sustainably enhances the company's competitiveness.

»I had a well-thought-out onboarding plan that didn't overwhelm me and was actually followed through. All the colleagues involved took time for me and not only shared knowledge but also conveyed the CODICO spirit.«

At CODICO, strategies are more than just words. Here's an overview of the ongoing initiatives we use to support our colleagues throughout their employee journey:

- Regular employee surveys: We regularly assess employee satisfaction, engagement, and needs to make targeted improvements.
- Lived corporate culture: Our values were developed as a team and are regularly reviewed. Family, responsibility, and dynamism are core elements that strengthen our sense of belonging.
- Considering individual needs: Work-life balance, professional development, and health support are foundational to how we work together.
- Structured onboarding means more than just the first day. New colleagues receive tailored support over a period of 3–6 months.
- Training and development opportunities are discussed during annual performance reviews, leading to increased motivation and long-term retention.
- Health programs: Support for physical and mental health through our company doctor boosts wellbeing and performance.
- Flexible work models are part of our everyday practice. Options such as remote work and flexible hours help balance professional and personal lives.

»My work-life balance has significantly improved – not just thanks to remote work, but also because I can exercise during lunch breaks, polish my English with native speakers, and even get medical checkups right at the office.«

By putting the needs of our employees at the center and actively supporting their satisfaction and development, we create not only a positive work environment but also a foundation for long-term business success. The initiatives presented here are a clear commitment to a corporate culture built on appreciation, respect, and innovation.

Working at CODICO doesn't just mean being part of a successful company – it means being part of a team that makes success possible.

Many thanks to Monika, a colleague who has been with CODICO for five years – and who gave us the opportunity to contrast theory with real-life experience here!

D02

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INSIGHTS

Future of High-Performance Computing & Interconnect Technologies

High-performance computing (HPC) is transforming various fields, including science, engineering, and artificial intelligence, by enabling rapid data processing and analyzes. Anticipating the increased reliance of industries on HPC for data-intensive applications, this article brings to the spotlight how these technologies are evolving to meet growing demands for speed, efficiency, and scalability.

PCIe® 6.0

One of the most significant developments highlighted is the introduction of PCI Express® 6.0. This new standard offers substantial improvements in bandwidth, crucial for compute-intensive applications. With PCIe® 6.0 (Figure 1), data transfer speeds are significantly enhanced. This allows more efficient computations in HPC and cloud computing environments. This is particularly beneficial for AI training scenarios where rapid data flow across multiple processors is important.

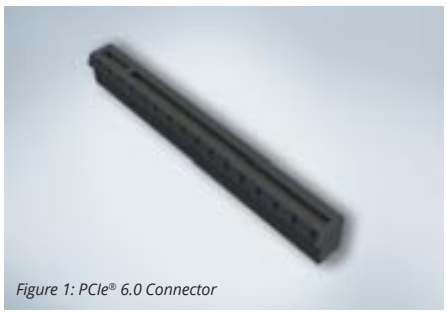

Figure 1: PCIe® 6.0 Connector

Compute Express Link (CXL)

Another important technology is Compute Express Link (CXL), a high-speed interconnect standard designed to facilitate efficient communication between components within data centers. CXL allows for coherent memory sharing between hosts and devices, enabling peer-to-peer communication that bypasses the host CPU. This capability opens up new possibilities for optimizing workloads across various applications, including AI, machine learning, and advanced enterprise storage.

Evolution of Storage Standards

The report also addresses the evolution of storage standards, particularly the Enterprise and Datacenter Standard Form Factor (EDSFF). These specifications are crucial for ensuring compatibility and interoperability among different storage solutions in data centers. The EDSFF E3 form factor represents a significant advancement that may replace traditional U.2 2.5-inch form factors in servers and storage systems. Designed to support next-generation PCI Express® devices such as GPUs and network interface cards (NICs),

Figure 2: Direct-Attached CEM Connectors

EDSFF E3 is positioned as a forward-looking solution for HPC environments.

JESD317A Standard

Additionally, the JESD317A standard defines interface parameters for CXL, simplifying system design and enhancing device specification. This standardization is vital for ensuring that various components can work seamlessly together within HPC infrastructures.

Rise of High-Speed Cable Solutions

Another interesting matter is the increasing demand for high-speed cable solutions tailored to meet the stringent requirements of next-generation HPC deployments. Manufacturers are focusing on delivering interconnect solutions that maximize bandwidth while ensuring signal integrity and minimizing loss.

Direct-Attached CEM Connectors

Direct-attached CEM connectors are highlighted as a superior alternative to traditional PCIe® riser cards. These connectors provide significant improvements in signal integrity and offer cost and space savings by eliminating the need for additional PCBs (Figure 2).

AMPHENOL's 1.0mm pitch DirectAttached™ CEM (DA CEM) is a hybrid card edge solution with high-speed signal pins designed to directly attach to the cable to eliminate PCB trace loss and press-fit termination type power pins for better rework.

Hybrid Cable Solutions

The E1/E3 orthogonal hybrid cable solution consolidates connectors on the mid-plane, addressing efficiency and cost-effectiveness in Gen5/6 technologies. This innovative design optimizes system space while improving airflow and organization within data centers.

Ideal for use in high-speed computing data center server systems by using a high-speed cable

Figure 3: EDSFF

to replace backplane and multi-level PCB motherboard routing for PCIe® highspeed signals (Figure3).

AMPHENOL provide reliable integrated signal integrity solutions across high speed IO, backplane, and mezzanine connectors and cables to meet the expansive goals of AI/ML. Adhering to PCIe and DDR standards, high performance storage and memory connectors along with high speed magnetic modular jacks and wire to board power connectors for all your applications.

S01

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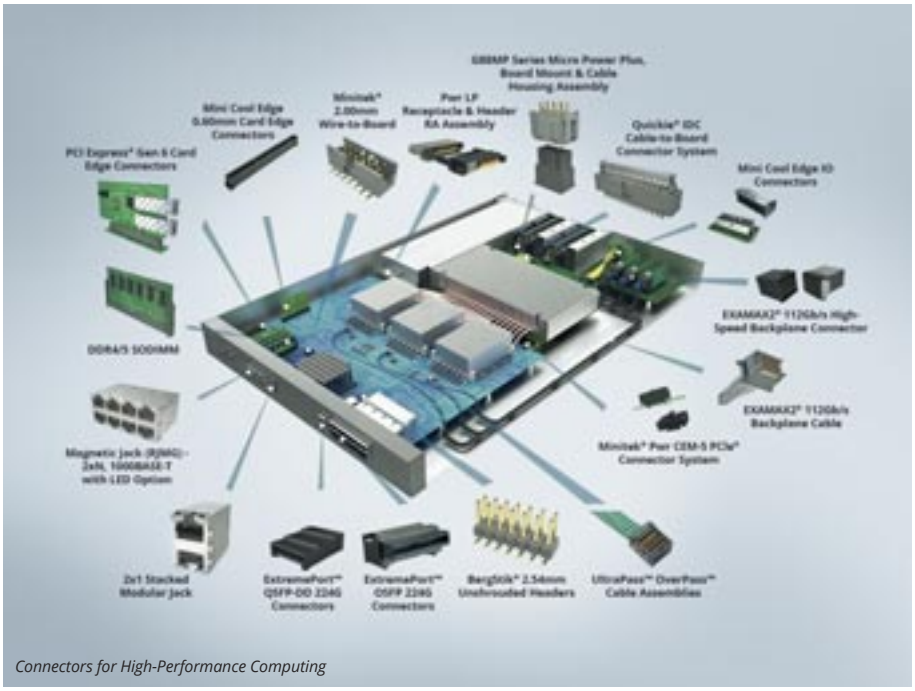


Connectors for High-Performance Computing

STABLE CONTACTS

Direct FPC/FFC-to-Board Connectors

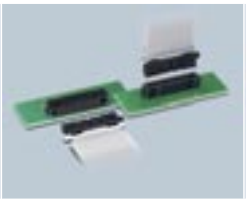
HIROSE ELECTRIC EUROPE B.V.

Efficient connectivity solutions for modern vehicle batteries.

E-Mobility is evolving rapidly, driving the demand for high-performance and compact battery systems. To maximize the range of electric vehicles (EVs), flexible and space-saving connection solutions are becoming increasingly important. The trend is shifting from discrete wiring to FPC/FFC connections.

This is where HIROSE comes in with its innovative two-piece FPC/FFC-to-board connectors, designed to simplify the wiring process. The FPC/FFC is inserted into the connector housing and then held in place by a retainer. This design eliminates the need for conventional contacts, reducing weight and saving space. The connectors feature a central locking mechanism that allows easy one-handed mating and unmating.

The design incorporates a protective guide which helps to prevent electric shocks during mating as the contacts are not exposed, increasing installation safety. Dust is also prevented from accumulating on the contacts, increasing their reliability. Suitable applications can be found in both the industrial and EV sectors.

SERIES			
	ZK1	TF70	TB4
Pitch	Contact Pitch: 2mm Mounting Pitch: 1mm	0.5mm	1mm
Number of Positions	Available: 32 Under Planning: 24, 40	Available: 50 Under Planning: 30	Available: 16, 30 Under Planning: 24, 40
Height	11mm	6mm	4.5mm
Depth	25.1mm	11mm	12mm
CPA	•	–	–
Vertical	–	•	•
Operating Temperature	-40°C to +125°C	-40°C to +105°C	-40°C to +125°C
Lock Strength	100N	98,1N	98,1N
Vibration	LC214-S3, USCAR-V2	–	USCAR-V2

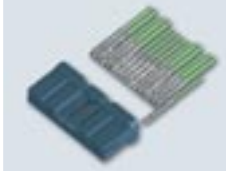
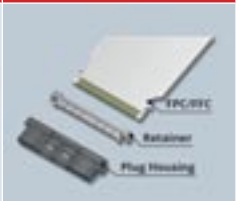
Advantages of Replacing FPC-to-Board Connectivity

The discrete wire method requires more labour to assemble the harness, as it requires soldering or crimping and inserting the contacts into the housing. In addition, the weight increases in proportion to the number of wires.

On the other hand, a direct FPC connection can be completed simply by inserting the FPC into the connector housing and attaching a retainer. There is little variation in quality and the advantage is that it is lightweight because it is FPC.

High Contact Reliability

These FPC/FFC connectors (ZK1, TF70, TB4 series) are designed with a long effective engagement length to ensure contact reliability.

Discrete Wire System	FPC Direct Connection
	
• Harness process is complex (soldering, crimping and contact insertion) • Requires crimp contacts and wires equal to the number of strands • Weight increases in proportion to the number of cores (electrical dose) • Space-saving for bending R of wires for routing is required	• Simply insert FPC and attach retainer • Lightweight • Can be routed with space-saving

In addition, the ZK1 and TB4 series have an independent two-point contact design to help remove foreign bodies during mating and maintain the connection if a foreign body is caught in one of the contacts.

S02

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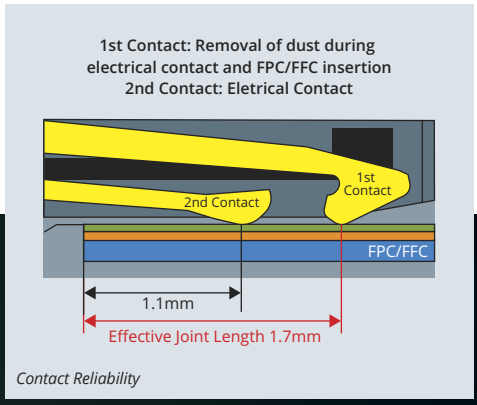
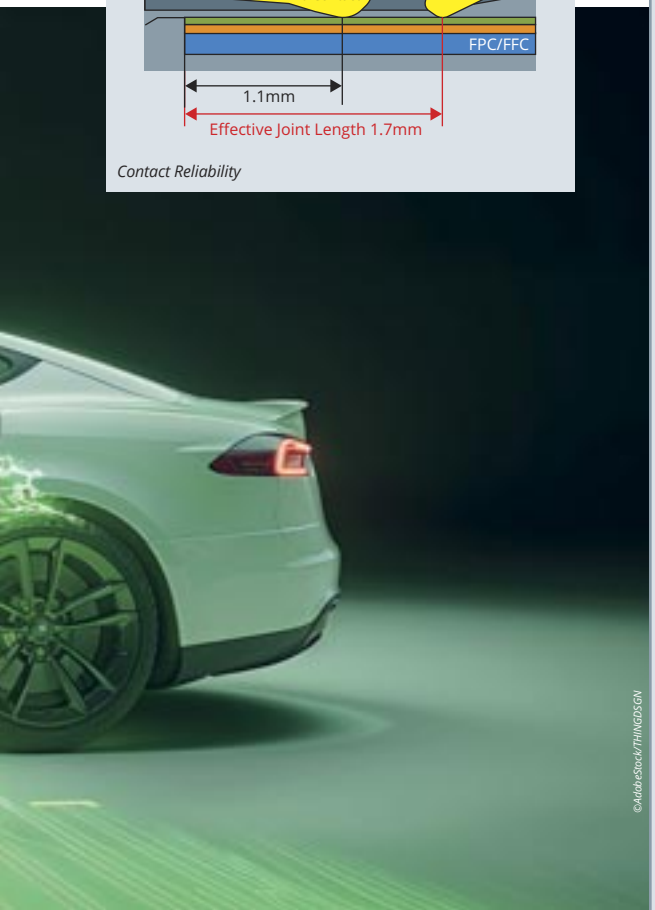


Contact Reliability



Shielded FFC Cables

The highly flexible flat conductor cables for contacting ZIF connectors are now also available in a shielded version!

The shielding of the cable minimizes electromagnetic interference from internal and external sources. This leads to improved signal integrity and reduced failures in demanding environments. By reducing EMI interference, the shielded flexible flat cable ensures high signal integrity. It minimizes signal loss and crosstalk, resulting in more reliable data transmission. The shielded cable is characterized by high reliability. It is resistant to vibration, temperature and mechanical stress, which guarantees a long lifetime and minimizes maintenance costs.

Defined stripping and the application of a stiffener in the contact area ensures a secure connection to all standard connectors. The shielded FFC cables are available in both tin-plated and gold-plated versions. The advantages of the gold plating are low contact resistance, high corrosion resistance and the prevention of the whisker effect.

FEATURES	CHARACTERISTICS	CUSTOMER BENEFITS
• Adjusted impedance of the FFC to 100Ω • Pitch dimensions: 0.5mm, 1mm, 1.25mm and 2.54mm • EMC optimization through shielding in combination with a ground plate for the ground connection • Suitable for high data rates	• High vibration and bending resistance • Break-proof and reliable connection • Temperature-resistant insulation materials (-40°C to +125°C) • Compatible with common connector types (e.g. Iriso, Hirose, TE, FCI, Molex etc.)	• Quick assembly through simple plugging > degrees of freedom • Automated assembly • Customized solutions • Weight reduction

Typical use cases are: electronic assemblies with EMC requirements and/or high data transmission rates, e.g., display connections, camera systems, smart home applications, control units, and inverters.

S03

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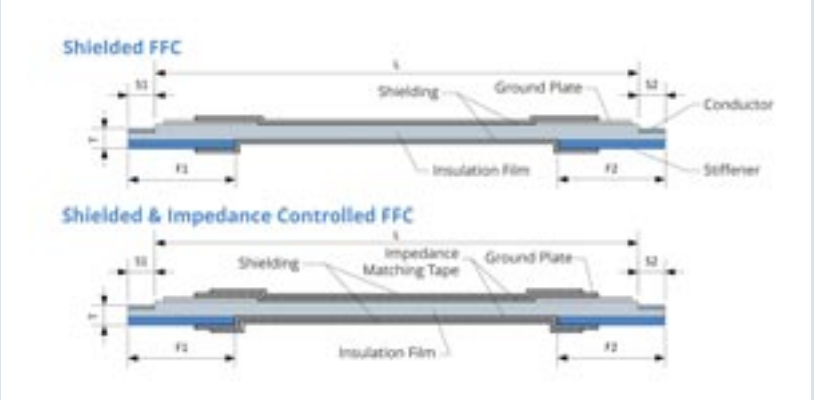

HIGH POWER

Board-to-Board and Wire-to-Board Solutions for Small Spaces

Nowadays more and more power applications face the challenge of shrinking mechanical space as a natural trend. NEXTRON follows this trend by offering a various range of Board-to-Board and Wire-to-Board products meeting a robust structure and advanced electrical properties to enable efficient power transmission in compact spaces.

Even though NEXTRON's high-current solutions were originally engineered to connect MCPCB in OBC system, Automotive Chargings stations, DC/DC converters, and traction inverters, they can be used for any other industrial application, too.

High-Current Connectors for Board-to-Board & Wire-to-Wire Applications

Originally developed for connecting metal core PCBs in on-board charging systems, DC/DC converters and traction inverters, NEXTRON's high-current connectors enable efficient power transmission in the smallest of spaces (Figure 1).

Figure 3

Figure 1

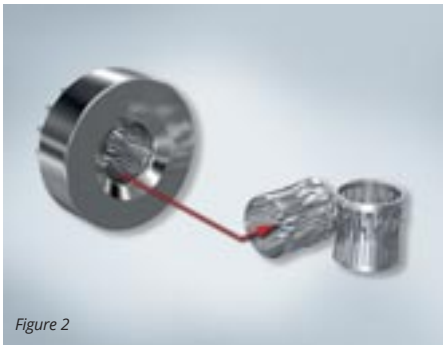

Figure 2

Depending on the contact diameter the available products enable rated currents from 10A to 200A and offer solutions in the field of DIP, SMT and press-fit technology. The contact length can be customized and adapted to the application. The design is completed by using crown spring technology to provide multiple contact points, stable connections and shock resistance (Figure 2).

High-current connectors are manufactured using a CNC process and this gives NEXTRON greater

flexibility to easily implement modifications or customisation as required by customers.

Highlight: High current connectors can be used for stacking multiple PCB boards (Figure 3).

Features

- Current rating: 10A to 200A max.
- Contact resistance: 0.5mΩ max.
- Durability: 5.000-10.000 cycles

Contact types

- Board-to-Board: DIP, Press-fit, SMT
- Wire-to-Wire: crimp, screw, welding (Figure 4)
- Contact length is adjustable (Figure 5)


Figure 4

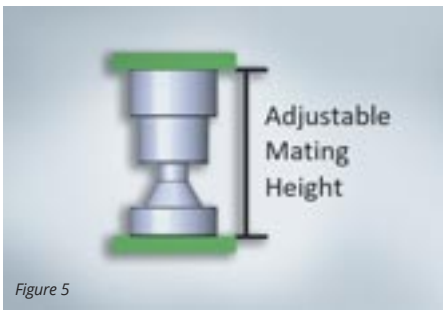

Figure 5

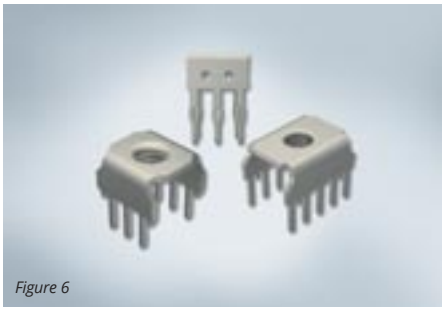
Figure 6

Power Terminals for Wire-to-Board Applications

Power terminals provide a kind of »terminal block« design made for space saving connections between wire and PCB for current ratings up to 40A (Figure 6). Contact types in press-fit and DIP designs are available. For a various range of screw lockings M3, M4, 6-32 UNC options are available. The available pin numbers are 4, 6, 8, and 10.

Features

- »Terminal block« design
- Contact types: Press-fit & DIP
- Screw-lockings: M3, M4, 6-32 UNC
- Pin counts: 4, 6, 8, 10
- Current rating: 40A max.

Power Elements for Wire-to-Board Applications

Even Power Elements are made for space saving connections between wire and PCB. But they enable a current rating up to 340A! Pin number options from 4-36P and a big range of different screw-lockings such as M3, M4, M5, M6, M8, and M10 offer a lot possibilities for different requirements. Multiple mounting types such us blind hole, external threads and holes with internal thread complete this product series.

The Power Elements are manufactured using a CNC process, and this gives NEXTRON greater flexibility to easily implement modifications or customisation as required by customers.


Figure 7

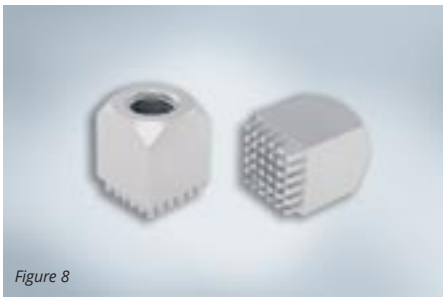
Figure 8

Features

- Contact types: SMT (picture 7) and DIP (Figure 8)
- Pin counts: 4-36
- Screw-lockings: M3, M4, M5, M6, M8, M10
- Operating temperature: -55°C to +150°C
- Current rating: up to 340A max. @20°C

Multiple mounting types

- Blind hole (Figure 9)
- Holes with internal thread (Figure 10 and 11)
- External thread (Figure 12)

Please use the support of CODICO and NEXTRON to find the perfect solution and to optimize existing systems!

S04

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Figure 9


Figure 10


Figure 11


Figure 12

SAFETY FIRST

The S-LINX 1.27D From STOCKO

S-LINX 1.27D by STOCKO is a compact connector wire-to-board system with 1.27mm pitch for direct connections to PCBs. It is suitable for cable cross-sections from 0.22 to 0.35mm² (AWG 24 to 22). Even for single conductors and for flat ribbon cables. It is also intended for use with FR4 PCBs.

During the development of S-LINX 1.27D, particular attention was paid to safety: Double insulation displacement connectors guarantee an electrically and mechanically stable connection between conductor and contact. Koshiri safety is achieved through correct PCB design and/or polarization and coding. Even an active interlock between the connector and the PCB is provided. Safety is rounded off by the material of the connector cover and housing, which is glow-wire resistant to GWT 750 °C in accordance with IEC 60335-1, UL 94V-0.

The single connector can be used as an end connector or as a bus connector (daisy chain) for looping through signals or currents with discrete wires or ribbon cables. The connector contacts on both sides, top side and bottom side, are classically HAL tinned contact pads on FR4 PCBs.

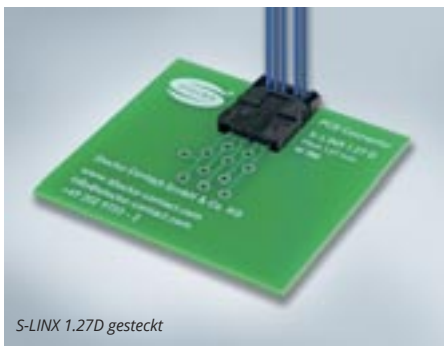
Another advantage of S-LINX 1.27D is the simple installation and contacting of the conductor by closing the pre-assembled cover. The appropriate processing technology is also available: Samples and small quantities can be produced by using the WZ 63 hand tool in combination with the tool head WK/P-S-LINX 1.27. Series quantities are produced with the WT400 semi-automatic machine or with the tool head WK/P-S-LINX 1.27 D combined with the adapter WA 30 for the usage with conventional crimping machines.

S-LINX 1.27D has its origins in LED lighting as well as sensor and control module contacts. However, it can of course also be used for any other application.

Take advantage of CODICO's professional support and advice for STOCKO's S-LINX 1.27D!

KEYFACTS

- Pitch: 1.27mm
- Rated current: 3A at 0.22mm² (AWG 24), 4A at 0.35mm² (AWG 22)
- Rated voltage: 50V
- Mating cycles: 5
- Number of poles: 2-8 (10-12 on request)
- Conductor cross-section: 0.22 to 0.35mm² (AWG 24 to AWG22)
- Colour: black
- Cable outlet: 90°



S-LINX 1.27D gesteckt

S-LINX 1.27D nicht gesteckt

S05

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ULTIMATE PROTECTION & PERFORMANCE

EMC-Shielded Cable Glands

AMPHENOL LTW's Cable Glands offer a cost-effective, high-performance solution for securing cables while protecting electrical equipment and enclosures from water, dust, and corrosion. Available in various sizes and materials, they ensure durability and reliability in any environment.

Cable Glands

Protect – Connect – Perform

To deliver exceptional electromagnetic shielding and waterproof protection in one solution, AMPHENOL LTW expands its cable gland portfolio with the innovative EMC Cable Gland. Designed with a conductive internal spring, it ensures direct contact with the cable's shield, effectively minimizing electromagnetic interference (EMI) while maintaining a secure, sealed connection. With industry-leading innovation and precision engineering, AMPHENOL LTW's EMC Cable Glands ensure maximum performance, shielding, and durability – making them the perfect choice for demanding environments.

Reliable, Waterproof & EMC-Shielded Cable Protection

Built for reliability, the internal stainless steel spring directly contacts the cable shield, providing 360° shielding, robust waterproofing and consistent connectivity. Its customizable design allows for long or short entry parts, making installation effortless. Perfect for harsh and humid environments, the EMC Cable Gland offers moisture-proofing, salt mist resistance, and protection against vapor and spray – ensuring uninterrupted connectivity in mission-critical applications.

Key Features & Benefits

- **EMC Protection & Waterproofing:** Internal stainless steel spring ensures a strong, reliable shield connection.
- **Quick & Easy Installation:** compact design with multiple entry lengths for a sleek, space-saving fit
- **Superior Durability:** resistant to moisture, liquids, corrosion, and dust
- **Reliable Sealing Function:** prevents environmental damage, enhancing cable longevity
- **Versatile Applications:** compatible with various wire sizes for broad usability
- **Meets Industry Standards:** complies with IEC 60423 and EN 62444

EMC Cable Glands

Overview of all Cable Glands from AMPHENOL LTW

Screw Thread Type

- IP67 & IP68 Rated (1M/24h) for extreme protection
- Available in Metal & Plastic Shells
- Cable O.D. Range: 1.5 to 32.0mm
- Nut Thread Options: M8 to M40 / PG9 to PG29 / 1"-20 UNF / 13/16"-28 UN

Square Flange Type

- IP67 Rated
- Available in Metal & Plastic Shells
- Cable O.D. Range: 5.0 to 9.3mm
- Nut Thread: 6-32UNC

Upgrade your cable protection with AMPHENOL LTW's EMC Cable Gland – where shielding meets reliability.

S06

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MARKETS

- Surveillance cameras
- Lighting display devices
- Solar PV modules
- Power supply switches, distribution box, and motors
- Wireless networking
- Telecommunications

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SMART CONTROL

Core AI Automation for Endless Connectivity

AI automation is revolutionizing industries, and with the rise of 5G, ultra-low latency applications are in high demand – especially in industrial automation. DINKLE's 0229 series terminal blocks bring cutting-edge innovation to automation control, offering seamless connectivity and superior efficiency through their unique Press-to-Release wiring and advanced design features.

Tool-Free Operation Experience

Traditional Push-In terminal blocks require tools for wire release, but the DINKLE 0229 series eliminates this need. Thanks to its Press-to-Release pushers, users can insert and release wires effortlessly, cutting operation time by up to 60%. Additionally, an optional ejection aid allows simultaneous actuation of all contact chambers, further streamlining control cabinet setup and maintenance.

Double-Row Wiring Design

Designed to handle up to 40 wire connections at once, the 0229 series meets the diverse demands of control products. Its adaptable design supports both Wire-to-Board and Wire-to-Wire connections, providing unmatched flexibility for control cabinet electrical connectivity.

High Power, High Performance

With an increased conductor area, the 0229 series ensures stable performance in high-load applications – critical for AI automation systems requiring extensive data processing and real-time response. The Push-In clamp design allows direct tool-free connection of solid or stranded wires from AWG #28 to AWG #14. Additionally, multiple locking options – including screw flanges, tabs and levers – provide vibration-proof connections for enhanced reliability.

Enhanced Contact Stability

Unlike traditional round pins, the 0229 series employs flat contacts, widening the contact area to maximize output current. This ensures stable operation at 300V and 12A (UL), while compliance with UL 1059 and IEC 61984 standards guarantees safety and reliability.

0229 Series

Empowering the Future of Automation

Control cabinets are at the heart of automation control systems, driving efficiency, reducing costs, and enhancing safety. DINKLE's 0229 series delivers high innovation and reliability, reinforcing control cabinet performance to enable next-level automation, optimize production efficiency, and enhance cost-effectiveness for your operations.

Step into the future of AI-driven automation with DINKLE's 0229 series – where connectivity meets innovation!

S07

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DF40/DF40T

HIROSE's Board-to-Board/ Board-to-FPC Connectors

Suitable for consumer, industrial and automotive equipment.

The DF40/DF40T series by HIROSE offers Board-to-Board and Board-to-FPC connectors with stack heights from 1.5 to 7.0mm in 0.5mm increments, available in up to 120 positions.

DF40 supports USB4 Gen.2 (20Gbps), while the DF40T series supports PCI Express 4.0 (16Gbps) for automotive applications. Shielded options are available to prevent interference from inside or outside the device.

The minimal depth of just 3.38mm reduces the mounting area to save board space and optimize the design. Despite its compact size, a vacuum pick-and-place area is available for automatic placement.

The contact design contributes to an effective mating length of 0.45mm, providing high contact reliability. In addition, a clear tactile click can be felt during mating to confirm correct engagement.

Guide ribs are incorporated into the body to allow a wide self-alignment range of ±0.33mm in the X and Y directions for design flexibility and smoother mating. The ribs are also reinforced to absorb shock and handle stress during impact.

In addition to the standard DF40 series, other versions are available

- **DF40T:** withstands high temperatures up to 125°C, ideal for automotive environments, maintaining performance even in extreme heat.
- **DF40GL:** shielded version
- **DF40F:** floating function in X, Y and Z directions

This versatility allows it to be used in a wide range of applications including consumer devices such as wearable devices and PCs, and industrial devices such as sensors, motors and embedded PCs. The high temperature version is also suitable for automotive applications, including sensing devices and infotainment systems.

S08

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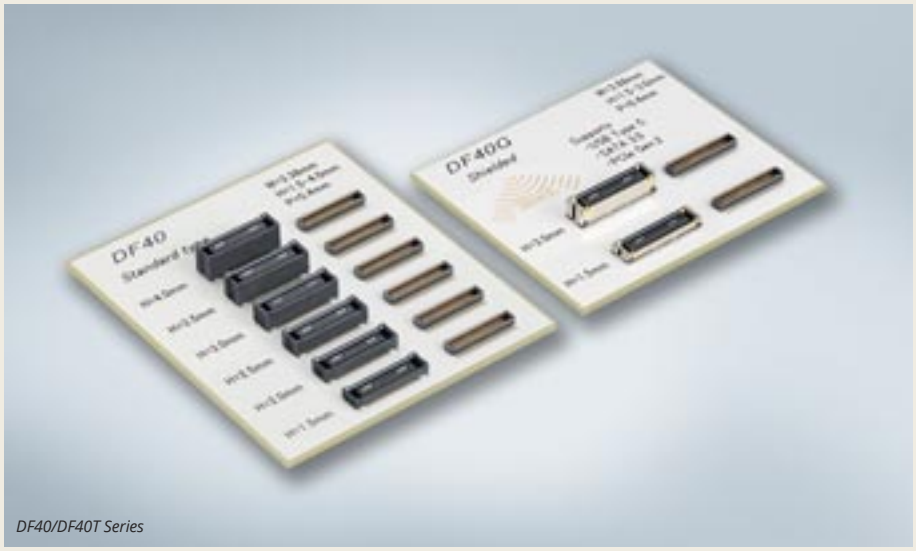

DF40/DF40T Series

Other Versions

The CODICO TEAM says hello!

Jakub Novák

Dear Impulse readers,

Allow me to introduce myself. My name is Jakub Novák, and I have been working at CODICO for five years as an FSE for passive components.

I have been in the trading sector for more than 15 years, and in the electrical sector for almost 10 years. I am responsible for the Czech and Slovak markets. Due to the size of these markets, I am able to manage this role on my own. My main task is, of course, to ensure sales for CODICO. However, unlike in similar companies, we also apply our technical knowledge, so the job is not just about selling items. This technical support is an added value for many of our customers.

Since I joined CODICO during the Covid era, the market has gone through many changes. Adapting to these shifts brings daily surprises – and a bit of stress. Since starting at CODICO, I have experienced only a few negative things. The vast majority of my experiences have been positive, and compared to my previous jobs, CODICO is simply incomparable. The company's approach to its employees is truly outstanding. I'm also grateful that in this role, I come into contact with many fascinating people – both on the customer and supplier side – and that I can contribute to the development of many exciting products.

In my free time, I try to spend as much of it as possible with my family. I have two daughters, aged 3 and 6, who keep me very busy. Two years ago, we also got a female border collie, who definitely knows how to demand attention as well.

My number one hobby is American football, which I now follow passively. As for active sports, I've taken up triathlon and plan to complete the Olympic distance this year (1.5 km swim, 40 km bike, and 10 km run). Due to the age of our daughters, we are currently spending our holidays at the seaside, but I'm already looking forward to going on a ski vacation again in the near future.

Yours sincerely

D03

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Imre Schebeck

Dear Readers,

My life journey has been shaped by a wide range of experiences, influenced by a deep connection to the earth, an insatiable thirst for knowledge, and a love of adventure. Born in the USA to an American mother and an Austrian father, I developed an early curiosity about the world and a desire to seek challenges. I began my undergraduate studies in Canada and completed them in the USA, where I built a solid academic foundation and a lasting passion for learning.

My professional path has been unconventional. I fought wildfires in the southwestern United States, worked as a landscaper, and was employed by the National Trust for Historic Preservation. In my mid-twenties, I spent seven months in Zimbabwe, helping an NGO establish agricultural cooperatives – an experience that deepened my appreciation for sustainability and community. Given my family's 100-year history in Austrian winemaking, I later founded an Austrian wine import business in the USA.

In 2007, I moved to Austria, started a family, and earned a Master of Science in Gas Plasma Energy Utilization and Renewable Energy from TU Wien. I then worked for an equity fund focused on renewable energy. However, my true passion lay in working with my hands and staying connected to nature. I founded a landscaping company, worked for a winery, ran a garden kitchen, and for five years produced and distributed my own gin.

A few years ago, I joined CODICO as a gardener and facility manager, where I found a way to align my professional skills with my personal values. Outside of work, I keep chickens and bees, tend my garden, and enjoy spending time with my two spirited teenage sons.

At 54, I look back on a life full of adventure – from scaling high cliffs and mountains to surfing untouched waves. Today, I find joy in quieter pursuits like hiking, baking sourdough bread, writing, and historical research. Exploring the past offers me insights into the present and future.

Looking back, I am deeply grateful for the diverse experiences that have shaped me into the person I am today. My journey has been one of growth, discovery, and connection. I remain committed to living with purpose, curiosity, and a profound appreciation for the world and the people around me.

D04

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Tamara Jeitler

Dear Impulse Readers,

For nearly four years now, I have been a proud and happy employee at CODICO in Perchtoldsdorf.

Thanks to my linguistic background – growing up bilingual in French and German in France – I had the opportunity to join the Inside Sales team for active components in June 2021. In this role, I support two FSEs covering the regions of France, BeNeLux, Iberia, and North Africa: Jean-Baptiste Pinchon, our Regional Sales Manager for Western Europe, based near Paris, and José David Cabezas, our newest colleague, based in Madrid.

I truly enjoy working with colleagues abroad and supporting our customers from the inside sales perspective, in parallel with the personal visits of our FSEs. It's always a pleasure to exchange thoughts – even beyond our daily work topics.

At the same time, I greatly value working with my colleagues in the Inside Sales team here in Perchtoldsdorf. Thanks to our spacious open-plan office, it's easy to support each other quickly and to keep learning something new every day. Our Product Managers and FAE, Vasily Budko, are also located in the same office area, which allows us to clarify things swiftly and efficiently.

Of course, an essential part of the great team atmosphere in our Perchtoldsdorf office is sharing coffee and lunch breaks. Whenever the weather allows, some of us enjoy lunch in our beautiful garden – affectionately known as »Central Park« – which provides a wonderful opportunity to recharge in the fresh air.

From March to October, we also benefit from weekly outdoor training sessions, helping us stay active and fit. I truly appreciate these sessions, as sports and physical activity are very important to me. In the summer months, when morning motivation is on my side, I even enjoy cycling to the office.

I am incredibly grateful to work for such a fantastic company as CODICO. The respectful interactions, the diverse stories of each colleague, and the many opportunities for continuous learning – especially during the CODICO Academy Weeks – are just a few of the reasons why being part of the CODICO family is so special.

D05

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Bernadette Mostler

Dear Readers,

»DREAMS DON'T WORK UNLESS YOU DO!« – this is the motto that guides me and the principle I try to live by. Instead of overthinking risks, I choose to follow the path I believe is right. I have a goal in mind – and I pursue it with passion and determination. It is a great pleasure to introduce myself. My name is Bernadette Mostler, I am 41 years old, and I have been part of CODICO for nine years now. I work in Inside Sales in the Passive Components department. But my journey here began with a major change.

I originally come from Upper Austria, but love brought me to Lower Austria – and with a new home, I also needed the right job. That's how I found my way to CODICO. The first years were filled with new experiences: a new job, new colleagues, a new environment. But thanks to the open and appreciative atmosphere, I quickly felt at home. At CODICO, family is not just a word – it's something we truly live by.

Three years later, my son Nicolas was born, and after just over a year, I was able to return to my previous position – an opportunity for which I am very grateful. Since then, I have been supporting not only my German customers but also the Spanish and Portuguese markets, which I particularly enjoy. It's not always easy to combine Austrian precision with Spanish temperament, but that's exactly what makes my job exciting. I love working with different people and cultures and always give my best for my customers.

Spain is more than just a country to me: I lived and worked there for eleven years, and both the language and culture remain an important part of my life. So much so that I am raising my son bilingually. He understands everything in Spanish but usually responds in German – which often leads to amusing moments.

My private life is equally lively and diverse. My family is a colorful patchwork: my husband brought two children into our relationship, and together, we have our little latecomer. So, boredom is never an issue! Nevertheless, I try to make time for my hobbies. Sports provide an important balance for me. I also love to dance, and my heart beats especially for salsa. The music and the feeling it brings give me energy and make me incredibly happy. Additionally, I enjoy traveling – and I travel quite a lot. My wide circle of friends takes me to various places regularly, and I love spending time with my favorite people. At least once a year, I have to go to Spain. A year without a trip to Spain? Unthinkable for me!

At CODICO, I'm also involved beyond my actual work and am part of the mentoring team. I support new employees as they start their journey, offer practical tips, and serve as a trusted point of contact. I believe that, thanks to my open and communicative nature, I can easily welcome new colleagues and help them integrate into the CODICO family.

At the end of the day, for me, it's all about continuous growth – both professionally and personally. I love my job, appreciate my colleagues, and enjoy my free time to the fullest. Those who are willing to grow and embrace new challenges can truly make their dreams come true.

D06

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