ENGLISH

CODICO®

impulse

2/2016

POWER INTEGRATIONS: Power Revolution

RUBYCON's latest strokes of genius

STOCKO's ECO-TRONIC News

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PASSIVE COMPONENTS

CONNECTORS

CODICO IN-HOUSE

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An Adventure - the ISO Review

Since May 2016 CODICO has been certified in accordance with ISO 9001:2015 at its locations in Austria, Germany, Italy, and Sweden!

The framework conditions of the business world are becoming increasingly more dynamic and complex, while at the same time it is important to formulate the QM system to be really user-friendly. The review for the ISO 9001:2015 Standard provided the opportunity to give the management systems a thorough make-over, and it was a challenge we were glad to take on! »Quality Austria«, our partner of many years standing, audited CODICO in May 2016 on the basis of the new requirements, and gave us the green light for certification for the locations.

- Our processes are clearly defined and aligned with the corporate strategy.
- We are aware of the risks and opportunities, and we assess them regularly.
- Process orientation, process performance, and the effectiveness of the processes themselves are ever more closely taken into account.

We are well equipped to face the challenges of the future; and we look forward to be successful together with you. Find our current certificates on our Homepage or feel free to ask for them personally from

D01

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CODICO achieved the second place in the category »embedded« regarding the criteria of product availability of volumes.

Editorial

Sven Krumpel
CEO CODICO

Dear readers, See you on Planet e!

The electronics industry is one of the world's major economic sectors, with a total market volume of 3.5 trillion Euros. Its components, systems, and applications are driving new developments and they have become an indispensable part of our everyday life.

On Planet e, also known as electronica, the industry's leading trade fair staged in Munich from 8 to 11 November 2016, you can gain an insight into this entire world of electronics. Of course, we will also be present at the fair, so don't miss the opportunity to visit us at stand 507 in hall A5.

CODICO will be presenting the latest technological innovations, and our staff will be happy to share its know-how with you in a personal meeting. We will also provide catering to help you through the exhausting fair day, and a game for some welcome distraction. Our forklift derby will be the artistic highlight of your day, though you will need a lot of skill to win this one.

You will find the names of the colleagues present at the fair in the middle part of this newsletter, so you can arrange a meeting right away. We are looking forward to your visit and the opportunity to pass on our expertise.

Speaking of expertise... it is my honour to announce that, for the first time in the ten year history of the reader's choice at the WEKA publishing house, CODICO won the »Distributor of the Year« award. The readers of the WEKA trade journals (in particular Markt & Technik, Elektronik and elektroniknet.de) also voted our company second best in the »embedded« category! Receiving an award that reflects customer opinion and experience means a lot to me. I am unbelievably proud of our company and our team!

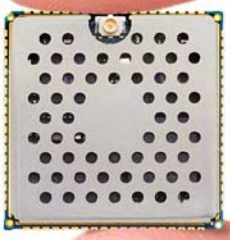
D02

Sven Krumpel

PS: Get a free entry voucher for a one-day ticket to electronica 2016! Send your request to marketing@codico.com!

Visit us @ electronica 2016 booth A5.507

CODICO won the »Distributor of the Year 2016« award.

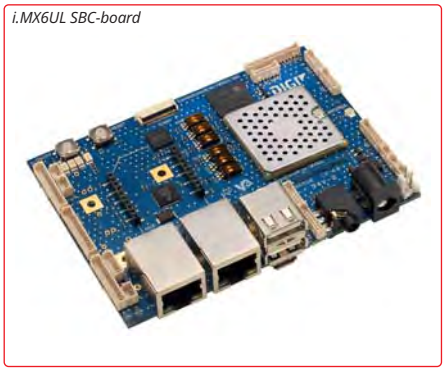


THE NEXT BIG THING IS SMALLER

i.MX6UL Development-Kit

i.MX6UL Starter-Kit

DIGI ConnectCore® for i.MX6UL



i.MX6UL SBC-board

DIGI is excited to announce the smallest and most secure i.MX6UL system-on-module available on the market today.

The DIGI ConnectCore® for i.MX6UL packs a lot into this stamp-sized module (29x29x3.5mm):

- NXP i.MX6UL-2, Cortex-A7 @528MHz processor
- Up to 2GB NAND Flash
- Pre-certified for 802.11a/b/g/n/ac
- Bluetooth 4.2
- Integrated dual-Ethernet 10/100
- Dedicated security and authentication controller
- Unique low-power and wake-up state management

System-on-modules, or SoMs, are an affordable way for OEMs to quickly enable their products to be smarter and connect to the Internet of Things. SoMs deliver the I/O, memory, and wireless connectivity necessary to connect a product to the IoT without having to become experts in electrical engineering. For many OEMs, building complex connected devices from the ground up is not a core competency. Furthermore, fast changing market requirements, global competitive pressures, and ever-changing technology and regulatory requirements make partnering with proven SoM manufacture like DIGI, a necessity. Whether it's a medical device or a mission-critical industrial controller, DIGI has the expertise to get you to market quickly.

Once you've connected a device to the Internet – you have to make sure it secured. The DIGI ConnectCore for i.MX6UL was built with DIGI TrustFence™, a security framework that removes the implementation barriers by providing you with a fully integrated, secure module platform with complete Linux software support.

DIGI ConnectCore for i.MX6UL delivers the smallest, smartest, most secure way to connect your product to the Internet of Things. Check out www.digi.com/cc6ul to learn more.

A01

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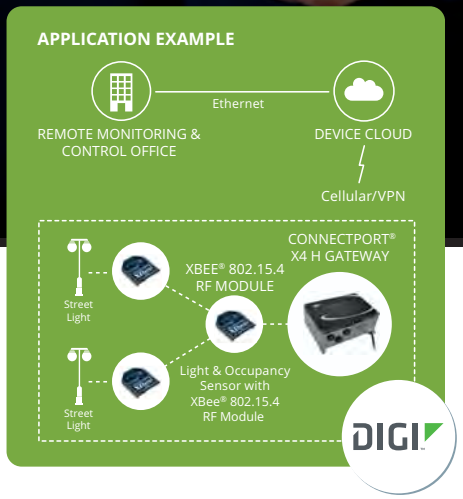
LET YOUR IMAGINATION RUN WIRELESS!

XBee® S2C 802.15.4 Module



DIGI XBee® is the world's #1 RF module because our common footprint is shared across protocols and frequencies.

Anything is possible with DIGI XBee – from the small science project in the lab to NASA monitoring payloads on a rocket, DIGI XBee gives you the tools and flexibility you need to rapidly innovate. The latest example in this broad line of modules is the DIGI XBee S2C 802.15.4 which is now available with the Silicon Labs Ember® EM35x transceiver.

This latest module is ideal for applications requiring low latency and predictable communication timing. The DIGI XBee S2C 802.15.4 is also ideal when your application requires robust multipoint wireless connectivity with reduced power consumption, support for the over-the-air firmware updates, and an upgrade path to DIGIMesh® or ZigBee® Mesh protocols.

New DIGI XBee S2C 802.15.4 Offered in Through-Hole & SMT Form Factors

Anyone deploying DIGI XBee can swap one DIGI XBee for another. You don't have to design a printed circuit board to take advantage of Silicon Labs' latest chip – DIGI has done it for you on the DIGI XBee platform saving you time and giving you the confidence to get connected quickly and easily. Providing quick, robust communication in point-to-point, peer-to-peer, and multipoint/star configurations, DIGI XBee S2C 802.15.4 products enable robust end-point connectivity with ease.

Whether deployed as a pure cable replacement for simple serial communication, or as part of a more complex hub-and-spoke network of sensors, DIGI XBee 802.15.4 modules maximize performance and ease of development.

DIGI XBee is a special product because of our customers: the innovators, the hackers, the problem-solvers — whatever you call yourself, DIGI is dedicated to providing you with everything you need to quickly create wireless connectivity solutions. Let your imagination run wireless!

A02

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QCA4010 & DNSA-MP1

HOSTLESS WI-FI SOLUTIO IOT APPLICAITONS!

With the recent hype and the successfull releases of IoT products in the last years, many companies are put under big pressure to follow this hype and to take the initiative of coming up with own IoT products or to extend the existing product portfolio respectively. With the increasing number of nodes connected to the Internet, also the demand for low cost solutions with reduced BOM cost has increased. One way to overcome this, is the integration of the application MCU, network-processor and Wi-Fi radio in one IC. The so-called SoC (System on Chip) allows the implementation of a complete IoT application on a single device without the need of an external MCU. As no external MCU is required, this kind of operation is named hostless mode. The new QCA4010 from QUALCOMM follows this approach and provides also special low power features and wake up scenarios. WISTRON, as an ODM partner, has released a Wi-Fi module (DNSA-MP1) that is based on the QCA4010.

NS FOR

The QCA4010 integrates an Xtensa CPU @ 130 MHz from Tensilica that is responsible to provide all IP services and to manage all Wi-Fi links. The QCA4010 provides no internal Flash, but SRAM and ROM. Therefore the network processor code, system configuration and persistent data sets are loaded from external serial flash memory into the internal SRAM before execution. The application code is executed on the same CPU and memory ressources like the network processing code. Because the sesnor measurement, actor control and data processing handled by the application is normally done before a Wi-Fi link is established for data snychonisation, there is no bottleneck from the processing point of view. So in the most IoT applications, network and application processing is done in a time division manner by the CPU.

But even if there is a demand to process both at the same time, the performance-rich 32 bit architecture of the Xtensa CPU together with the clock speed of 130MHz provide sufficient calculation power to overcome this demand.

To fulfill the different application memory requirements in the IoT world, the QCA4010 is released in two SRAM versions. The smaller version integrates 1MB SRAM, whereas ~400KB is reserved for application code. The bigger version provides 1.5MB, which allows the integration of ~800KB application code.

In order to reduce power consumption to a minimum, the QCA4010 provides an integrated Power Management Unit (PMU) that controls different power modes based on the following techniques:

Gating-Clock: Not required function blocks are disconnected from the clock network in order to prevent charge-reversal currents of parasite capacities.
Shut-Down High Speed Clock: When the high speed clock network is not needed, it can be entirely disconnected, including external pulse sources such as oscillators.
Reduction of the voltage level: The voltage levels of individual blocks can be reduced in order to keep the static leakage currents low. A minimum voltage guarantees a short wake-up time and maintains the data contents of all registers and of the volatile memory.

The different low power modes are also supported by a low speed clock network (32.768 kHz) and a wakeup manager unit. The low speed clock network is required to run the state machine and sleep timers. The wakeup manager resumes operation by detecting internal and external trigger signals. For example, in suspend mode it detects a wake up signal at a pin or from the internal sleep timer, after a predefined time has passed. In this mode it manages also a small RAM that stores state information. Further modes like POWER DOWN (~9µA), SLEEP and HOST_OFF extend the range of configurations and allows a fine power tuning of an IoT application. But even in network operation, when the CPU is running at high speed clock and a Wi-Fi link is operating, the user profits from the low power features like Green Tx power saving mode and low power listen mode supported by the radio.

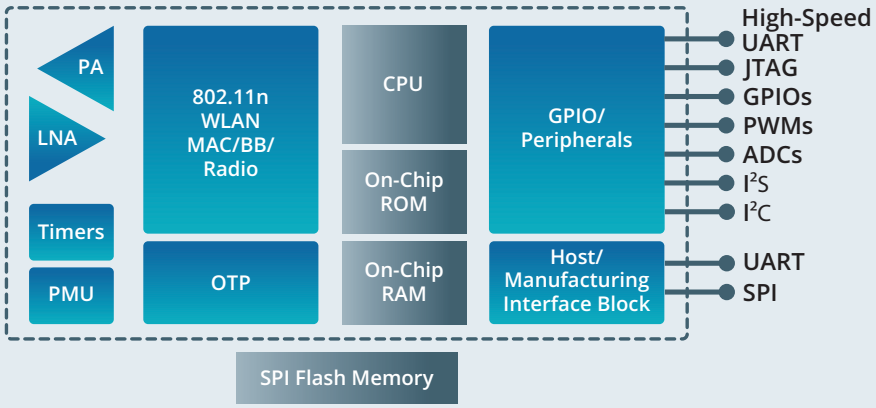
The QCA4010 provides many different interfaces that are required in typical IoT applications. For the measurement of analog sensors, a 12 bit ADC with 8 channels supports 400ksps for multiple channels and 1Msps for single channel operation. 8 independent 18 bit resolution PWMs with 8 bitclock prescaler are also available for e.g. motor control and lighting. For serial communication the user can chose from HS UART (3Mbps), low speed UART, SPI, I2S or I2C as well. The following list gives an overview about the features:

- Support for IEEE 802.11b/g/n
- Single stream 1 × 1
- Single-band 2.4GHz
- Integrated PA, LNA, with support for external PA and external LNA
- Single or dual Rx front end for antenna diversity
- Green Tx power saving mode
- Low power listen mode
- Data rates up to 150Mbps
- Full security support: WPS, WPA, WPA2, WAPI, WEP, TKIP
- 8 channels 12-bit accuracy ADC, maximum sampling rate is 400Ksps for multiple channels and 1Msps for single channel
- 18-bit resolution PWM with 8-bit clock prescaler
- 9x9mm DRQFN-116pin
- Case temperature range: 0°C to 85°C (standard); -45°C to 115°C (extended)

For dual band application (2.4GHz & 5GHz), QUALCOMM offers the QCA4012, which has exact the same system architecture and features like the »small« brother QCA4010, but provides just an additional 5GHz radio path. Therefor both parts are available in the same 9×9 ×0.9mm Dual-Row Quad Flat pack Nolead (DRQFN) package that includes a ground pad for improved grounding, mechanical strength, and thermal continuity. Moreover both parts are even pin compatible.

But it should be mentioned that the concurrent mode is not supported by the QCA4012 as only one Wi-Fi link (2.4GHz or 5GHz) can be served at a time. Anyhow, both devices (QCA4010 & QCA4012) support Rx diversity in the case that two Rx antennas are connected to the devices.

QCA4010 System Architecture



DNSA-MP1: Wi-Fi module based on QCA4010

DNSA-MP1-Spezification

- QCA4010 based Wi-Fi modules
- 2.4GHz IEEE 802.11b/g/n, single stream 1x1
- 11n support for HT20 and HT40 bandwidth
- Internal PA and LNA, with external RF Switch for antenna diversity
- Green Tx Power Saving Mode, Low Power Listen Mode
- Up to 800KB of on-chip memory available for customer application
- Integrated IPv4/IPv6 networking stack
- Full security support: WPS, WPA2, WEP, SSL, etc.
- Built in protocol stacks: HTTP, DHCP, DNS, NTP, etc.
- 30mmx16mm size, 4-layer
- Printed antenna or U.FL connector
- Single power supply: 3.3V
- Operation temperature: -40°C to 85°C (Industry Class Version)
- Regulatory compliances: CE, FCC

A03

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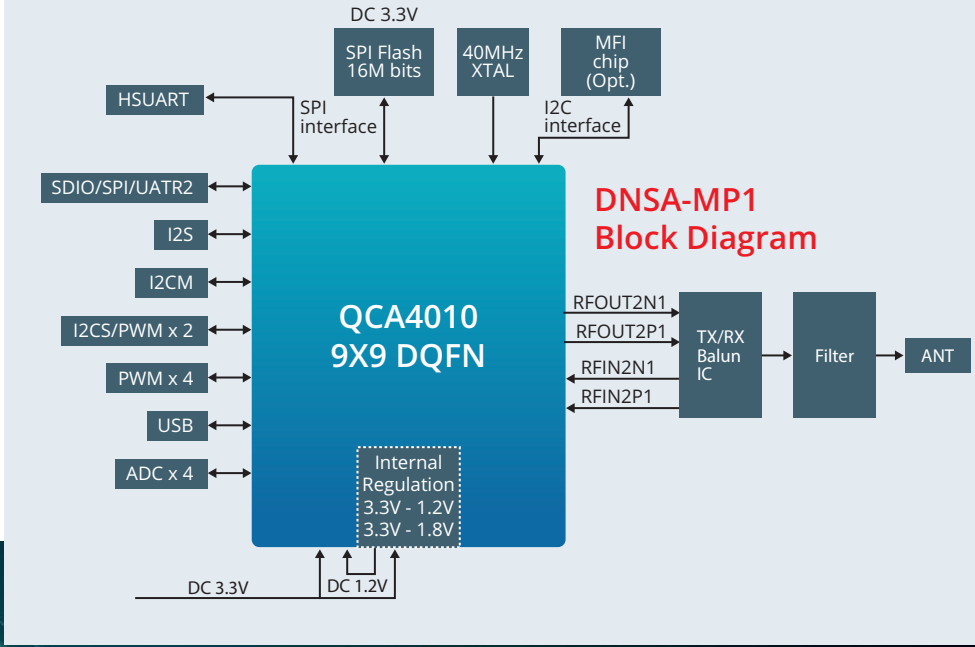
QUALCOMM is an IC but not a PCB module supplier. Therefore QUALCOMM works very closely with ODM partners like WISTRON, which manufacture and sells Wi-Fi modules based on the original reference designs/modules from QUALCOMM.

In case of QCA4010, WISTRON offers a module with the part number DNSA-MP1. MP1 is QUALCOMM's internal name for the QCA4010 reference module. WISTRON has extend this part number with the prefix DNSA- to create an internal one. Documentation, SW and technical support is provided by QUALCOMM, where as WISTRON provides the HW and the test reports based on the module name DNSA-MP1.

Block diagram DNSA-MP1



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WORLD SMALLEST

COMBO GSM/GNSS/Bluetooth 3.0

COMBO MODULE

The all new QUECTEL MC60 module is a multi-purpose module which integrates a Quad-band GSM/GPRS engine, a GNSS receiver and a Bluetooth 3.0 radio. The ultra-compact size of 16x18.7x2.1 mm makes MC60 a perfect platform for size sensitive applications such as wearable device, vehicle and personal trackers, telematics and other M2M applications.

The module comes with an adjustable GPRS class 1-12 for extremely low power consumption and the GNSS receiver comes with built in LNA for better sensitivity. GSM and GNSS engines can work as a whole (all-in-one solution) unit or work independently (stand-alone solution) according to customer demands.

In the all-in-one solution, the MC60 works as a whole unit and the GNSS part can be considered as a peripheral of the GSM part. In the stand-alone solution, GSM and GNSS parts work independently and thus have to be controlled separately by two different UART interfaces.

In terms of Bluetooth 3.0 connectivity the following profiles are supported: SPP for serial data transfer and HFP-AG for audio mono applications.

Advanced positioning techniques and assisted GPS functions are integrated in the module and allow improvement of the Time to First Fix and power consumption. MC60 module support also OpenCPU which is an embedded development system that allows the integration of the user application into the module memory avoiding the use of an external microcontroller.

FEATURES

- Size: 16x18.7x2.1mm
- LCC package
- Power supply 3.3~4.6V, 4.0V Typ.
- Quad Band GSM/GPRS
- Dual SIM Single Standby
- Embedded Internel protocols
- Fully synchronous GNSS receiver with built in LNA
- Advanced positioning technologies
- Bluetooth 3.0 (SPP, HFP)
- Interfaces: 2x UART, SD, Analog and digital audio, GPIO, ADC, 3x Antenna pads
- Industrial temperature range

A04

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At the size of a coffee bean!

RECOM

RECOM's all new 3 Watt DC/DC converter series, RI3, features a very compact size and ultra-high power density.

Despite their small size, these modules can be operated over a very wide temperature range from -40°C to +85°C without derating. The beauty of the product however, is its capability to work up to +100°C with 60% output power.

Fit into a compact SIP4 case (11.5x10.2x7.6mm), almost the size of a coffee bean – these converters are ideally suited for applications where space is limited. The converters have an operating efficiency up to 90% and can be operated down to 0% load. Available in multiple combinations of input (5, 12, 15, or 24VDC) and output voltages (5, 9, 12, or 15VDC) the midget can be ordered with different I/O isolations of 1, 2, or 3kVDC making it perfect for virtually any industrial application.

These modules additionally feature an integrated input filter (in accordance to EN 55022 class A) and do not require additional components. They are IEC/EN/UL-60950-1 certified and come with RECOM's standard 3 year warranty.

A05

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Make the transformer history

RECOM's grand new RAC05 series is designed to replace a 1x1" transformer PCB module, that used to be the first option for a cost efficient auxiliary, Standby or Remote power supply.

Such devices appear in various applications like white Goods, industrial applications and lately more important: IoT applications. Using a transformer over a switch mode power supply (SMPS) was eventually a commercial decision. In spite of all advantages (i.e.: efficiency, input voltage range, regulation, etc.) loads of applications were stuck with a transformer rather than moving on to a SMPS.

Green energy is on the agenda for most applications so the greener such device gets the better. The RAC05 series, features a no load power consumption under 0.2W whilst offering up to 5W output power in a small and popular 1x1" footprint. The midget complies with EN55022 Class B conduction and radiated emissions without the need for any further components such as filters and fuses. The (protection) class II module comes as a plug and play solution with output voltages ranging from 3.3VDC up to 48VDC and makes it perfect whenever small power is demanded, all with three year warranty.

A06

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RECOM

Just too cool!

EOS Power's new open-frame family offers up to 550W in a 3x5x1.5" standard profile and combines separately-ventilated or forced air, convection and conduction cooling.

The new WLC series offers the highest power density currently available (24W/in³) on the market. It combines unique cooling and performance adaptation for all end-devices requiring a standard footprint of 3x5x1.5" (76x127x38mm). The small open-frame AC/DC transformer in 3x5x1.5" standard format can be used for medical, IT, and industrial solutions with a power requirement of up to 550W, and can operate with forced cooling, contact cooled, or even in convection-cooled environments

Specifications

- Up to 550W power performance with forced air cooling
- Efficiencies up to 93%
- - 40 to +70°C operating temperature
- EMC in accordance with IEC60601-1-2:2014
- 3x5x1.5" industrial standard size
- Contact cooling & convection cooling optional

The (M)WLC 550 series is another powerful small solution with particularly flexible cooling and device integration. It complements the WLP and WLT series perfectly, which EOS Power has developed over the past few years.

The new (M)WLC550 series in standard size provides optimum performance in a small space, and opens up the possibility of working on a footprint of 3x5", contact-cooled up to 250W or up to 550W with forced cooling. Customers in the medical sector trust in BF Design compliance, risk management and compatibility, to meet the forthcoming EMC Directive EN60601-1-2-2014. Optimized space utilization, efficiency, and cooling possibilities with the new (M)WLC550 series offer customers a wide range of operational possibilities.

A07

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Get on the train!

RECOM's isolated 20W DC/DC converter, the RP20-FR series, is especially designed for railway applications.

The compact 2"x1" modules feature a wide 4:1 input voltage range (9-36V, 18-75V, 43-160V) and therefore cover all standard battery-board levels including the ±40% tolerance margin. Besides 3.3V, 5V, 12V and 15V single outputs, dual ±12V and ±15V outputs are also available. The control pin logic can be chosen to be positive or negative.

The converters have an efficiency of up to 89% and feature a wide operating temperature range of -40°C to +85°C (-HC versions). Cooling is achieved by natural convection, but if required, the modules are also available with a pre-mounted heatsink.

The modules are EN50155 certified with EN50121-1-3-2, EN61373 and UL/cUL-60950-1 approvals. They come with RECOM's standard 3 year warranty. Despite its original designation, the converter is also a reliable choice for industrial and telecom applications.

A08

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Electrical safety in medical technology:

SAFE ISN'T ALWAYS SAFE

RACM40_65: Ideally suited for medical technology – no derating with housing thanks to convection and contact cooling – and ambient temperatures of up to 80°C

Medical technology in general is a growth market, regardless of whether this involves devices for use in surgery or intensive care, or in the professional medical environment such as in the laboratory sector or diagnostics. Sales revenue in the USA and Europe was already up by three percent in 2014, with investments in research and development steadily growing by six percent. Firmly on the rise in line with the trend, however, the highest – two-figure – growth figures are in non-imaging diagnostics and in the therapy sector.

In addition to the professional field, the therapy sector is also steadily increasing in importance. Particularly interesting in this context is what is referred to as »mobile health«. Constant cost pressure on the health insurance funds means that stays in hospital as an inpatient should as far as possible be minimized, and that means remote treatment and therapy in the patient's own home, homecare, are becoming more and more significant. For electrical devices in the medical technology sector, however, use in the private environment means that conditions and regulations are becoming more stringent, too. Portable devices with direct mains connection must, according to IEC/EN60601-1, always be designed in protection class II, and, if appropriate, also in BF. The below should clarify these terms in greater detail.

Electrical safety with power supply units relates essentially to protection against electric shock. In this context, depending on the application, there are a number of different Standards to be applied. To ensure electrical safety for power supply units, there are two Standards which are relevant. On the one hand, there are IEC/EN60950-1 and IEC/EN60601-1. At this point, too, the IEC/EN 60335-1 (»Household and similar electrical appliances«) should be mentioned, which is sandwiched between the two other Standards referred to. Both of them serve the same purpose, but only one can be applied to medical technology. IEC/EN60601-1 differentiates between devices with direct and indirect patient contact, and a distinction is drawn between three classes: B (Non-Patient Contact), BF (Body Floating), and CF (Cardiac Floating).

Class B is suited for general medical applications, and therefore only for MOOP (Means of Operator Protection). This means medical personnel, or even members of the general public, who operate the device in a healthy state. A comparison in this case would be a PC which is approved in accordance with IEC/EN60950 (and likewise the external power supply unit which supplies it) and which is therefore in direct contact with the user, but a healthy user, and therefore, on the basis of use in the office or IT environment, is likewise »only« approved in accordance with IEC/EN60950. The much more stringent Classes BF and CF describe equipment which is in direct contact with the patient. In this situation, a distinction is made between on or under the skin, i.e. inside the body. Both classes also impose higher or safer isolating distances (MOPs – Means of Protection). In this case, this is designated as MOPP (Means of Patient Protection) – one of the innovations with IEC/EN60601 3rd Edition.

All the classifications referred to up to now relate – without exception – to equipment. The power supply unit or the power supply as a key component can indeed simplify this requirement, but this does not mean that they will fulfil it alone. For example, when combined with a DC/DC converter securing the additional insulating distance, a general B-classified IEC/EN60601 power supply unit can become one for direct patient contact. The same also applies to the maximum leakage currents. The table below provides an overview of the relevant air clearance and creepage distances.

1. Creepage and clearance distances

	INSULATION CATEGORY			WORK VOLTAGE	TEST VOLTAGE	CREEPAGE DIS-	AIR CLEARANCE
3rd Edition	Pri to Sec	Two MOPP	Double	150-250Vrms	4000Vac	8mm	5mm
	Pri to PE	One MOPP	Basic	150-250Vrms	1500Vac	4mm	2.5mm
	Pri to Pri	One MOPP	Basic	150-250Vrms	N/A	3mm	1.6mm
	Sec to PE	One MOPP	Basic	< 60Vdc	TBD	2.2mm	1.2mm
	Pri to Sec	Two MOOP	Double	150-250Vrms	3000Vac	5mm	4mm
	Pri to PE	One MOOP	Basic	150-250Vrms	1500Vac	2.5mm	2mm
	Pri to Pri	One MOOP	Basic	150-250Vrms	N/A	3mm	1.6mm
	Sec to PE	One MOOP	Basic	< 60Vdc	No test	1.3mm	1mm

In red: Amendement 1 (2012)

2. Leakage currents in µA

	LEAKAGE CURRENT		TYPE B		TYPE BF		TYPE CF	
			NC	SFC	NC	SFC	NC	SFC
3rd Edition	Earth Leakage Current		5000/500	10000	5000/500	10000	5000/500	10000
	Touch Current		100	500	100	500	100	500
	Patient Leakage Current (N/A to power supply)	DC	10	50	10	50	10	50
		AC	100	500	100	500	10	50

NC...normal condition, SFC...single failure condition

In addition to the air clearance and creepage distances, the IEC/EN60601 standard also imposes restrictions on what are referred to as patient leakage currents, under normal circumstances and in the event of a fault or failure, to much lower values than with ITE-classified devices. As well as the mains-side leakage current, a decisive role is also played in this situation by the »touch current« (formerly the enclosure Leakage current according to IEC/EN60601 2nd Ed.), effectively the same as the patient leakage current (see table 2).

If a power supply fulfils both criteria – on the one hand, the BF classification, and, on the other, the version in protection class II relevant to mobile devices – then it is perfectly suited for the growth market referred to at the beginning, homecare or mobile health. But caution is needed, because in April 2017 a new revision of IEC/EN60601 is coming into force – Edition 4. This tightens things up even more with regard to ESD tests (air discharge 15kV, contact discharge 8kV), as well as interference immunity (IEC61000-4-8 and IEC 61000-4-3) for home healthcare devices, as they are referred to in the Standard. Another exciting point to watch is the further development in miniaturization. Increasing efficiency, driven not least by the ErP L5 (Energy Reduction Program) and DoE VI (Department of Energy), means that standard sizes are constantly becoming smaller. For example, ten years ago, a 200W power supply unit still needed 3x5" of space, and even then 200W could only be achieved with forced cooling. Nowadays, a comparable device only needs 2x3", and is only 1" high. This miniaturisation will play a decisive role over the next few years; despite increased efficiencies, the trend is moving away from exclusively forced cooling, towards a combination with contact cooling. This means less noise and less maintenance, ideal for portable medical devices.

For a number of years CODICO has been focusing on medical technology products, and, with RECOM and EOS Power, calls two powerful players in the fields of power supply units and medical DC/DC modules their partners. New from EOS Power is the WLC series, which on just 5x3" (127x76.2mm) delivers up to 550W. The special feature with this series is the combination of contact cooling, natural convection, and forced cooling. Thanks to an offset contact plate, thermal contacting can be achieved at a cooling element or at the housing of the particular application. The new series is approved in accordance with IEC/EN60601-1-2 4th Edition, and provides classification in accordance with BF, as well as 2xMOPP between input and output. The series operates with a standby current consumption of only 0.5W, and is available a class I and II equipment.

Conversely, RECOM's RACM Series focuses on full power capacity without derating, no matter if housing is used or not (2x3", 40W-100W, convection/contact cooled up to 80°C ambient temperature).

RECOM's medical power supply units from the RACM Series can be operated with full capacity even in hermetically sealed housings. This is particularly advantageous in situations in which a fan cannot be used for reasons of hygiene, noise development, or safety, or in order to avoid contamination. There are three different series available, delivering constant output ratings from 40W to 100W and adjustable output voltages

RACM100

from 5V to 48VDC – and all without the need for a fan. All the power supply units are certified for medical use in accordance with UL, CE and 3rd Edition, with 2xMOPP/250VAC, and comprise a very low leakage current (<75µA) and BF-classification. Output voltages range from 5V to 48VDC.

The RACM Series provides a degree of efficiency of up to 93%, low power loss, and precise regulation over a broad load and input range. The standby consumption is less than 0.3W, which means that the modules also meet the ErP Directive. The 40W and 65W versions are certified both as a 2x3" open-frame variant as well as with a metal housing, which allows for optimum contact cooling combined with user protection. The PCB in the 100W version in the metal housing likewise measures just 2x3". The power supply units can be operated at temperatures from -40 to +80°C without derating. The Class II power supply units come with reinforced isolation of 4kVAC between the input and output, and 1.5kVAC between input and output and EMC ground. All the modules meet the Standards EN60601-1-2, FCC18 and EN55022 Class B EMC, and come with a 5-year guarantee.

These robust power supply units also meet the provisions of IEC60068 for shock and vibration. This makes them particularly well-suited for installation in portable medical devices for use in hospitals, medical practices, or homecare nursing. And, thanks to the classification for altitudes of 5000m above sea level, they can also be used in air ambulance flights or medical practices in high locations. The 2x3" family has just recently been complimended by a 150W version on 2x4". This delivers peak power values of 150W, and is optionally available with an intelligent fan for constant operation at 150W without derating.

A09

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3-phase Motor Drive as

INTELLIGENT MICROSYSTEM

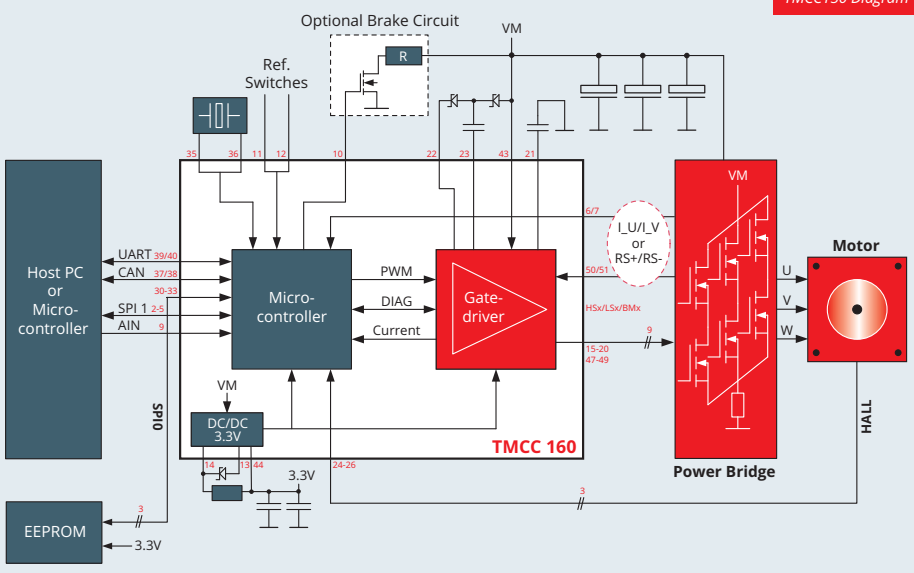
Drive design and motor actuation systems call for a detailed basic knowledge in working with electric motors. And in this context, account has to be taken in particular of the issues of commutation, motor regulation, sensor systems for the rotor position, and the connection of the motor control system to a number of different interfaces.

Typically, however, the core skills required of manufacturers of equipment and systems who integrate electric drives into their products lie on a much higher abstraction plane. Someone who is developing blood analyzers, for example, has outstandingly good skills in the fields of image processing or reagents, while the movement of probes and sensors is simply a necessary evil. Either the drive technology is bought in as a ready-to-use module, or the skills required are worked up in-house, which tends to detract from the focus on the core task.

This means that drives must be capable of integration in the simplest possible manner, in the form of hardware and software building blocks which come ready to use, in whatever products may be involved, without a detailed know-how of motor actuation and control being a prerequisite for the product developer.

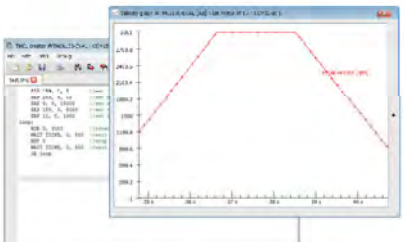
The newly presented TMCC Motion Cookie series from TRINAMIC addresses precisely this requirement. This is a microsystem with integrated driver hardware, application software and protocol stacks, which means that design and development cycles can be shortened to a bare minimum. In addition to the integrated application processor, on which the field-oriented regulating unit, a ramp controller, and the protocol stacks are executed, the TMCC160 also features a high performance gate driver with a gate flow of maximum ±1A, which means that it can reliably and rapidly control N-channel power switches for 3-phase control systems, with a power rating from a few tens of Watts to 1kW at 24V supply voltage. In order to reduce the total number of components required, an integrated switching controller provides the voltage to the module and other digital components in the system.

TMCC150 Diagram



For rapid design-in, the TMCC160-EVAL is available as a validated reference design. The reference design is divided into individual easily adaptable design blocks. Available as a basic block is the TMCC160 motionCookie, together with a perfect example of an output stage and the circuitry required for this, for current measurement

TMCC150 Screenshot



for a motor power of up to 500W. Circuitry units for bus communication via RS232, RS485, or CAN, as well as for analog and digital control signals are available as delimited building blocks which can easily be adopted into the developer's own design.

One of the key development aims was to reduce development times and costs for embedded servocontrollers to the minimum necessary, and for that purpose a field-oriented control unit is implemented onto the motionCookie microsystems, together with the superordinate speed and position controllers. With the TMCL-IDE, available free of charge, developers now have a powerful tool at their fingertips for quick implementation and parameter setting of the control system.

As a supplement to the TMCL protocol, later members of the motionCookie family will also be on offer with industry standard protocol stacks such as CANopen or CANopen over EtherCAT (CoE).

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A10

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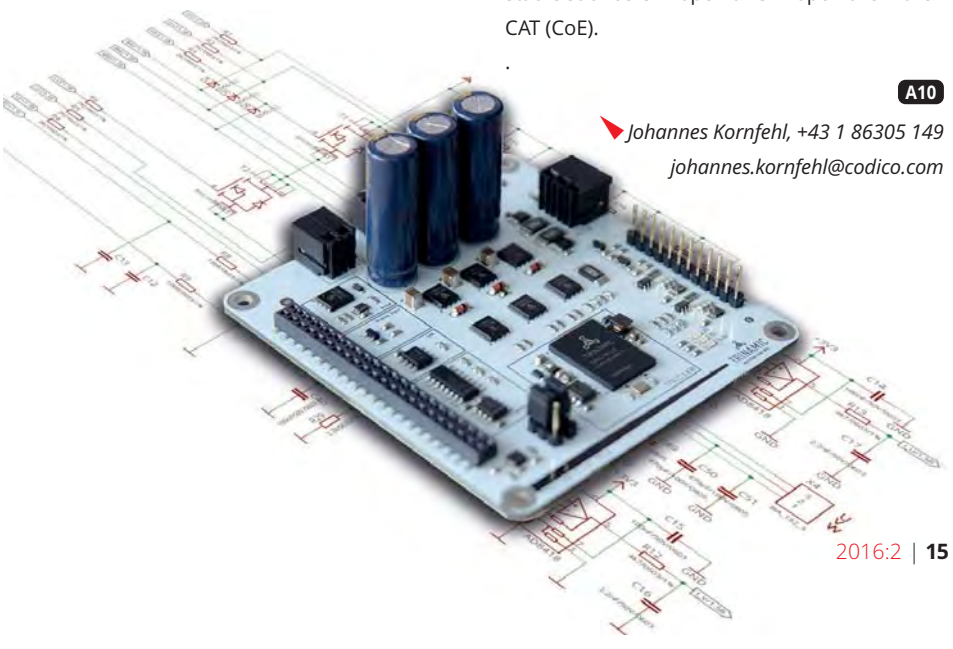

500 MBPS OVER TWO WIRES

New Powerline modules from ADATIS

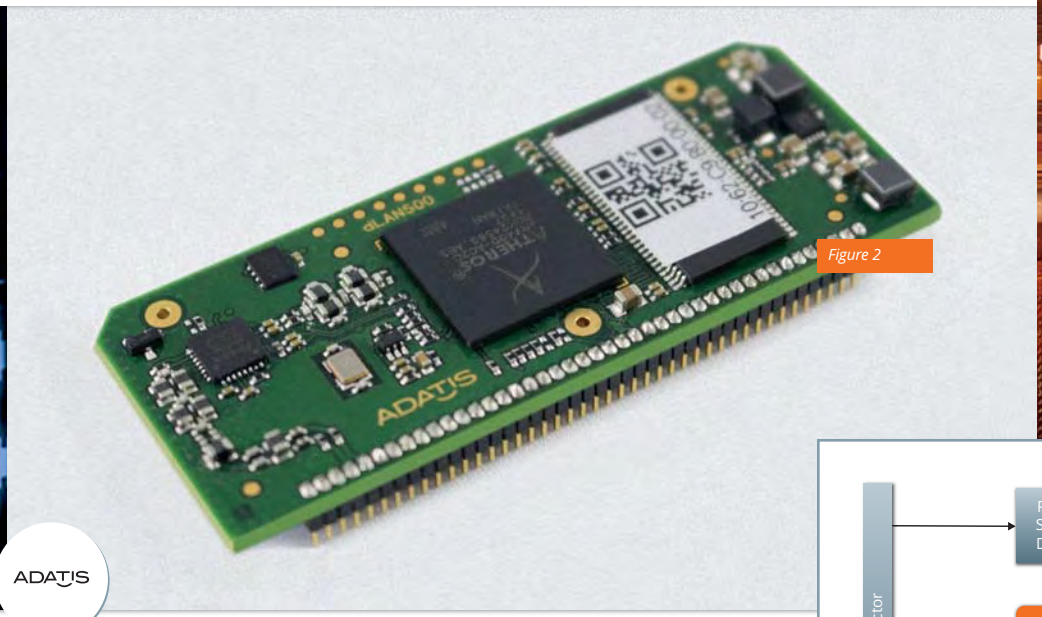

Figure 2

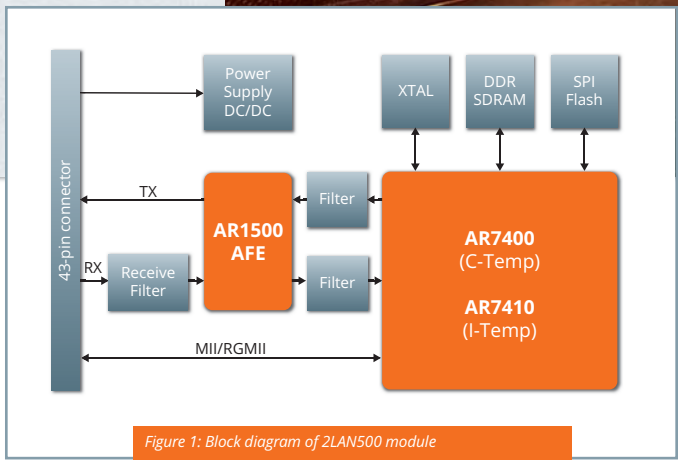

Figure 1: Block diagram of 2LAN500 module

In many industrial applications, there is a need to transport high data rates over longer distances. Examples for this are among other data communication in vessels over their onboard power system, transmission of data of all sorts in trains, buses, trams – also via swivel joints and hitching/coupling systems, via slewing rings, transmission of video and sensor data in agricultural and construction machines or in security systems, traffic monitoring systems, traffic lights and so on.

In order to face this trend, company ADATIS - the specialist for face recognition and door entry systems – did develop two new Power Line Communication (PLC) modules based on current QUALCOMM Chipsets.

The »2LAN500« named modules allow data rates of up to 500Mbps on the line and ranges of up to 500 meter. Thereby they can be used on any kind of wiring like for example bell wire - means a twisted pair of wires, CAT5 cables, Coax cables, one wire against protective earth, etc., regardless of whether the cable carries alternating or direct current in addition or the modules are operated on dead wires. Of course, the modules can be operated on classical power lines as well. They contain all major parts required in order to tunnel Ethernet data over the line, except the line-coupling transformer as well as the Ethernet PHY and Ethernet transformer.

Both modules do have a size of 27.5x69.5mm. They are available in following variants:

Commercial Temperature
One variant in commercial temperature range (0°to +70°C), based on QUALCOMM AR7400/ AR1500 chipset, with MII interface for Ethernet communication, one version each for vertical mount and one for horizontal mount.

Industrial Temperature
One variant in industrial temperature range (-40° to +85°C), based on QUALCOMM AR7410/ AR1500 chipset, with rGMII interface for Ethernet communication, one version each for vertical mount and one for horizontal mount.

Figure 2 shows the 2LAN500 module in horizontal mount version. In order to evaluate the power line technology in practice and in order to check out the modules a so called »2Wire Converter« is available from ADATIS, see Figure 3.

Figure 3: 2Wire Converter from ADATIS

Figure 5: 2Wire Converter with open case

It is fitted into a stainless steel casing, supplies the module with power, provides the line coupling and routes the PLC signal to wire clamps on the outside of the box. It also provides the Ethernet connection to a standard Ethernet socket. Beside that, it allows to provide power to devices connected by using »Power over Ethernet (PoE)« technology of up to 20 Watt. Figure 4 shows the outside connection of the 2Wire Converters.

The 2Wire Converter is available as 10/100Mbit/s Ethernet type using a 2LAN500 module in commercial temperature range as well as Gigabit Ethernet type using a 2LAN500 module in industrial temperature range. Figure 5 shows the 2Wire Converter with open case and plugged in 2LAN500 module in horizontal mount version. Since normally for evaluation of the modules or the PLC technology it is required to use two converter, CODICO sells them as a kit, one each for 10/100Mbit/s respectively Gigabit-Ethernet including two pieces of 2Wire Converters each as well as power plug in one box.

Figure 4: Connections

As of now the new modules and the 2Wire Sets are available from CODICO.

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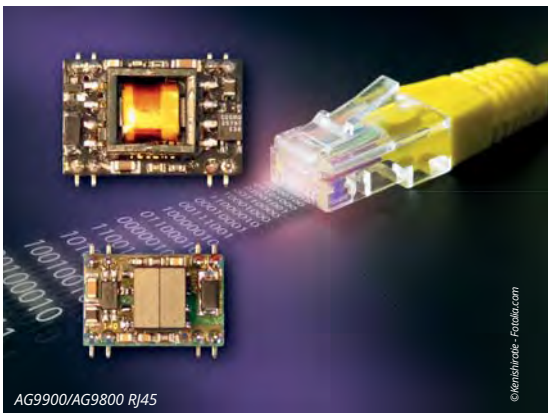
SMALL POE WORLD

This tiny ultra-miniature POE PD module is truly the smallest POE module and POE solution in the market. Capable of delivering up to 12W of power, and even rated for up to 7W at +85°C, it packs an incredible performance into the smallest of spaces. It is the culmination of years of development in high power and size reduction from SILVERTEL.

AG5300

We said in our last article [Impulse 1/2016, A17] about solar power energy harvesting that there are many trends in electronics. One such long standing and pervasive trend is the need and drive for continual miniaturisation. With many technologies it can be relatively straightforward, but in the world of power, it's never easy, as power components, transformers and heat dissipation all create difficult to overcome barriers to miniaturisation. Meanwhile, cutting-edge miniaturization typically becomes more expensive as sizes are reduced.

Luckily, SILVERTEL now have years of experience in pushing the boundaries of POE back with modules for up to 100W and squeezing high power into ever smaller packages through creative and innovative engineering. This expertise has



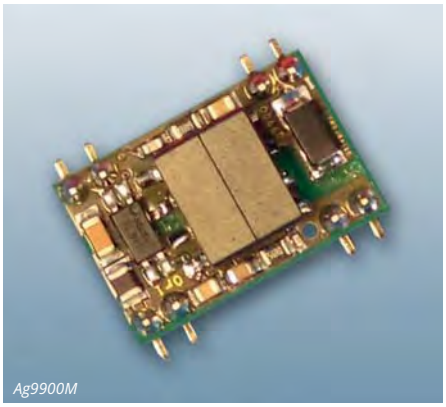
AG9900/AG9800 RJ45

The ever shrinking world of POE from SILVERTEL – take a look at the new Ag9900M!

delivered the miniaturised Ag9900M series, at almost the same price point and with improved performance over the larger Ag9800M.

The expertise comes in part from experience gained in producing the world's highest power 100W POE modules. High power POE is typically used in high end AV HDBaseT applications, IP Cameras, marine sensors, access control systems and video conferencing systems. SILVERTEL's SIL range of 802.3af compliant Ag9XXX modules has also been used extensively throughout the world since 2005 and the format of the modules and package will be familiar to everyone in the industry.

At first the driving force behind the evolution of the module range was to reduce cost, resulting in the Ag9700 series, the lowest cost module SILVERTEL produce. Then the real miniaturisation work began.


Ag9900M

With requests and demand for smaller footprint POE the Ag9700M first isolated SMT package POE module was designed and released. While well received, the height of the Ag9700M series (18mm) was a restricting factor, as it used the standard transformer package from the earlier SILVERTEL ranges. With IOT applications such as sensors and home automation systems requiring small packages and fingerprint readers housings continuing to shrink, pressure to further reduce package sizes continued.

The SILVERTEL engineering team embraced the challenge, to produce an even smaller footprint and lower profile SMT package POE, Ag9800M, using a new much smaller transformer. The redesign created the smallest ever POE module in a tiny footprint, Ag9800 series.

Amazingly, SILVERTEL's R&D team identified during the Ag9800 design, that significant further reductions were still possible, through improvements in efficiency and an even smaller footprint transformer.

The Ag9900M

Now released, Ag9900M is the newest POE from SILVERTEL, displacing the Ag9800M as the world's smallest POE module, in an amazingly tiny 21x 14mm footprint.

With a rapidly increasing number of remote sensors and gateways being designed for the Internet of Things, all in increasingly small packages, with low power consumption, and frequently requiring external installation, the advent of the Ag9900M is perfectly timed to deliver all the advantages of industrial temperature low power POE in the smallest of footprints.

To put the package reductions into context, the footprint size reductions from the Ag9700SIL package to the current Ag9900 ultra miniature SMT package are illustrated in the graphic below.

Samples of the all new midget are available from CODICO Stock and via our Sample shop.

A12

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That's the overall package size reduction from Ag9700S to Ag9900M of 71%

36V SOLUTIONS

Low Quiescent from TOREX

The number of devices that will be connected to the Industrial Internet of Things (IIoT) is forecast to grow to almost 2.5 billion per annum by 2021, from about 1.2 billion in 2015. IIoT is essentially adding intelligence and connectivity to ever smaller, remote industrial devices such as proximity sensors, motion detectors and pressure measurement equipment. The M2M wireless communication between these devices is provided via Bluetooth Low Energy (BLE), LoRa, WiFi and other low energy solutions that need to be powered by equally low power, power management devices.

To meet the demands of this growing IIoT market, TOREX has introduced two low quiescent current solutions, a 36V synchronous step-down DC/DC that only consumes 11.6uA in operation and a 36V high speed, low noise LDO with a quiescent current of just 40uA. The extended +105ºC operating temperature range of both products, makes them ideal solutions for the industrial market and in particular the IIoT market where low power consumption at higher voltages are the key.

XC9267/68 Series (36V, 600mA Synchronous Step-Down DC/DC Converter)

The XC9267/68 is synchronous step-down DC/DC with an internal P-Ch High Side Switch to ensure low voltage operation with 100% max duty ratio. It can operate from 3.0V~36V (absolute max. 40V) and deliver loads up to 600mA. Output voltage is set externally within a range of 1.0V~25V and the quiescent current is only 11.6uA (XC9268, 1.2MHz type) in operation. The XC9267/68 has an enable pin which allows the DC/DC to be placed in stand-by mode with a stand-by current of just 1.65uA.

Whilst the XC9267 is fixed PWM control, the XC9268 is automatic PFM/PWM control and is designed for high efficiencies at low output loads without burst modes (Fig.1):

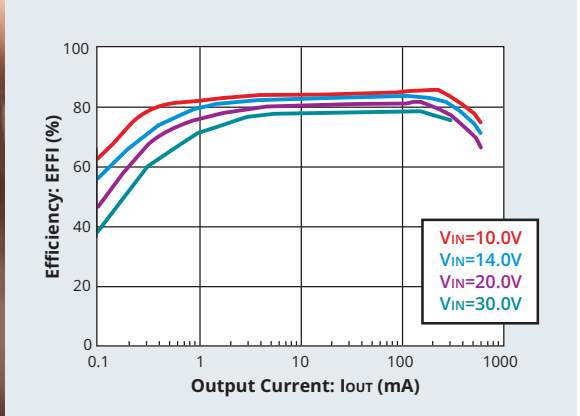
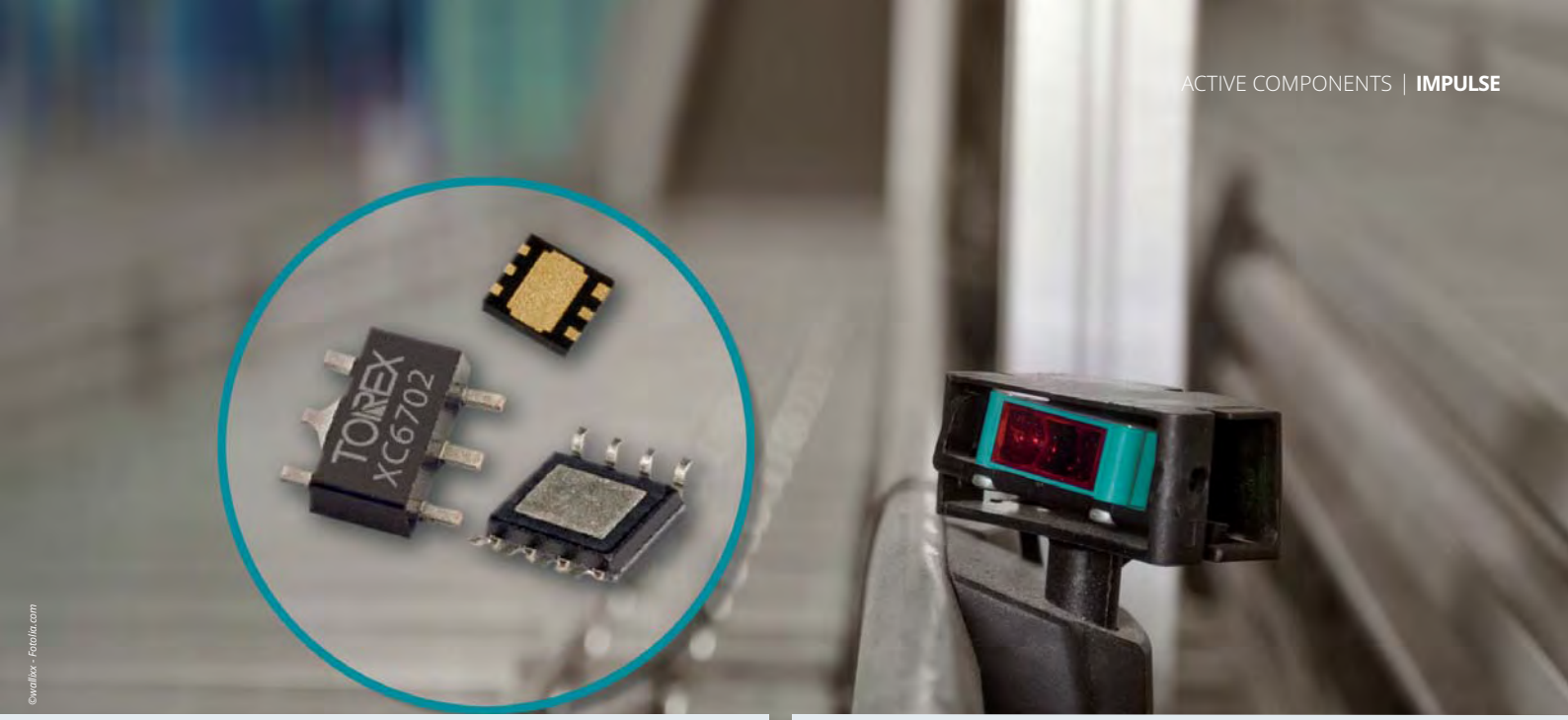


Figure 1: Efficiency vs. Output Current, VOUT=3.3V



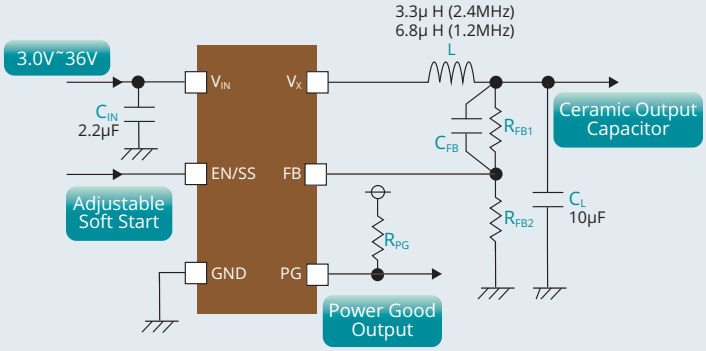


Figure 2: Typical Application Circuit

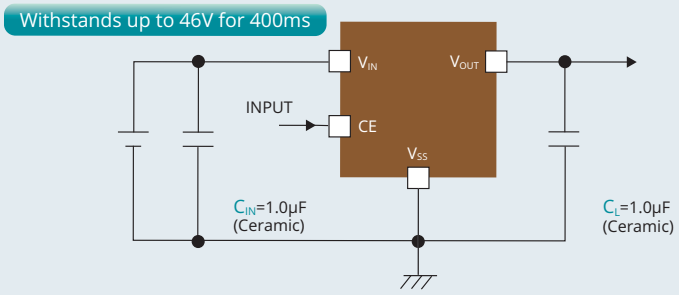


Figure 3: Typical Application Circuit

The XC9267/68 works with small Low ESR ceramic capacitors and comes with a choice of two switching frequencies (1.2MHz or 2.4MHz). Adjustable soft start and a power good output (USP-6C package only) provides the design engineer with power sequencing capabilities, a feature that not many DC/DCs in a package of this size (2.0x1.8x0.6mm) can offer. The series also features Over Current, Under Voltage, short-circuit & Thermal Shutdown protection circuits. Available in SOT-89-5 and the ultra-small USP-6C package, an extremely small DC/DC circuit can be implemented with a minimal number of external components (Fig.2)

XC6702 (36V, 300mA High Speed, Low Noise LDO Regulator)

If a LDO is preferred, this 36V CMOS high speed voltage regulator also offers the designer a low quiescent current (40uA). The XC6702 can support output voltages from as low as 1.8V up to 18V (±1.0%) and although operating voltage is up to 36V, the XC6702 can withstand surge voltages of up to 46V for 400ms and can be used with small low ESR ceramic capacitors (Fig.3).

The over-current protection circuit and over-heat protection circuits are built-in. As with the XC9267/68, the XC6702 can also be put in stand-by mode via the chip enable pin, thereby reducing current consumption to just 0.01uA. The soft start circuit limits the inrush current that flows from VIN to VOUT when the IC starts, enabling a stable start-up sequence (Fig.4).

In addition, the XC6702 provides fast load transient response performance ensuring that the output voltage remains stable as the load current changes (Fig.5).

The XC6702 is available in SOP-8FD, SOT-89-5 and an ultra-small USP-6C package measuring only 1.8x2.0x0.6mm.

Samples for both families plus evaluation boards for the XC9267/68, can be requested already. The evaluation boards for the XC9267/68 are custom made to the customer's specific requirements. Test data is provided with each Board.

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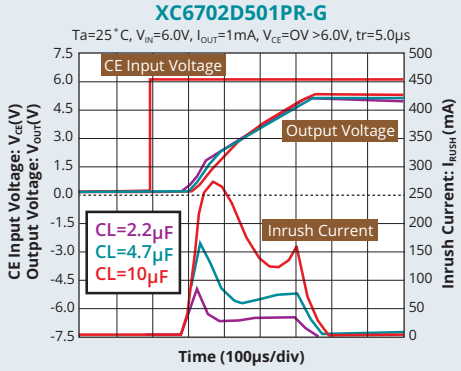


Figure 4: Example of the Inrush Current Waveform at IC Start-Up

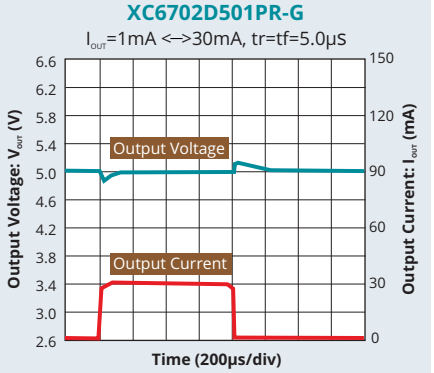
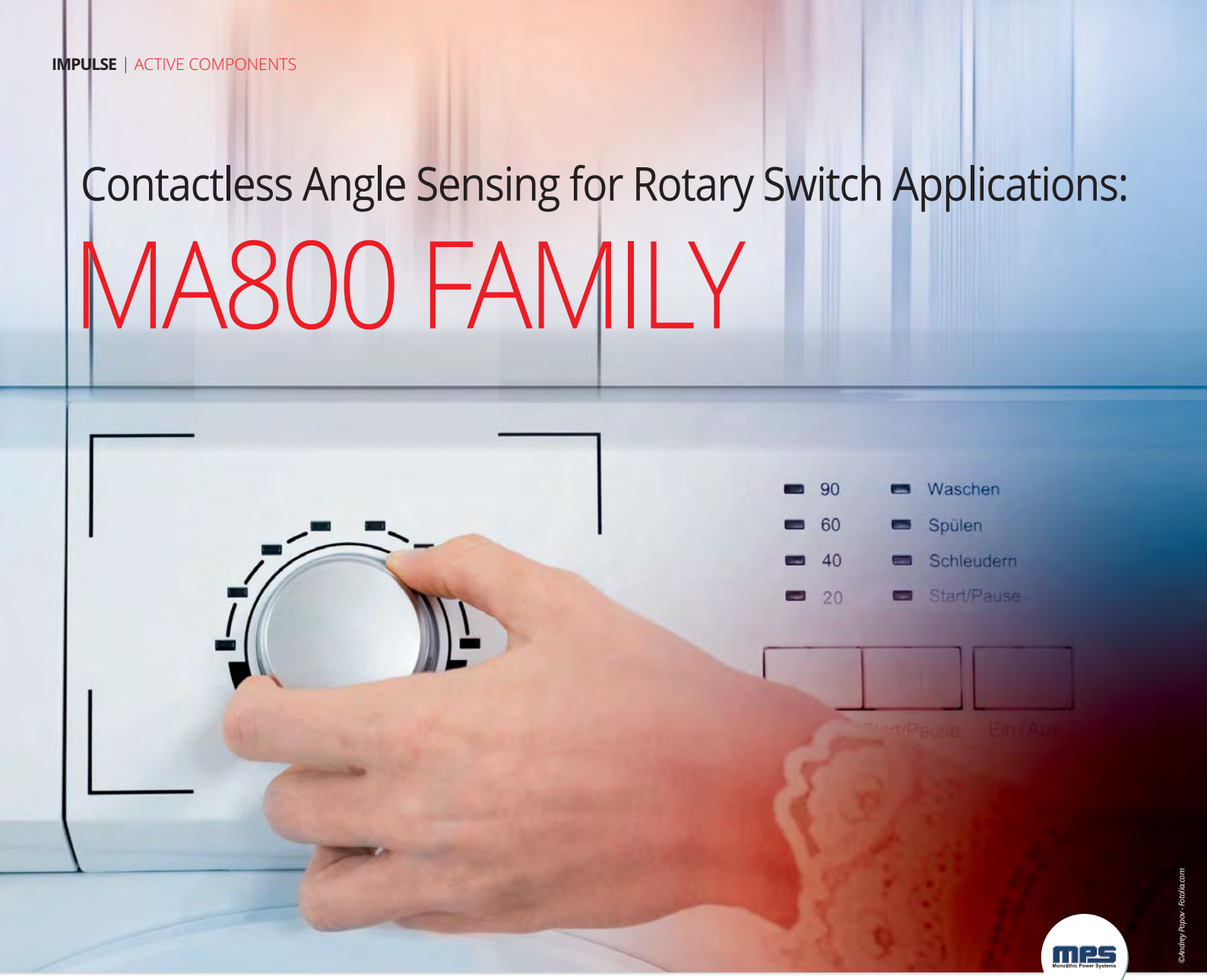


Figure 5: Load Transient Response

Contactless Angle Sensing for Rotary Switch Applications: MA800 FAMILY



Rotary knobs are used in a diversity of human to machine interface applications from the program selector on a washing machine, to the infotainment and navigation control system in the car, or even the temperature control knob of an oven. These applications typically use a conventional potentiometer or in some case a mechanical rotary switch.

The drawback of such approaches is operating lifetime. The resistive tracks on a potentiometer or the contacts on a switch wear out over repeated turns, and often such solutions are limited to around one hundred thousand cycles. They are also prone to failure due to environmental factors such as dirt or moisture ingress via the rotary shaft mechanism.

The use of magnetic angle sensors to implement contactless sensing has distinct advantages for rotary interfaces. The obvious advantage is much longer life time since there are no contacting parts to wear out. In addition, the fact that the sensor is physically separate to the magnet means that complete hermetic isolation of the sensor is possible, removing the possibility of dirt or moisture ingress.

The MagAlpha MA800 family is a new simple to use digital magnetic sensor range designed to replace analogic potentiometers or rotary switches in such applications. The sensor detects the absolute angular position of a permanent magnet, attached to the rotating knob. Typically a simple diametrically magnetized cylinder of 3 to 8mm diameter is suitable.

A wide field strength range is supported which allows flexibility in the mechanical arrangement of rotary knob and sensor. At the heart of the MA800 family is a proprietary angular Hall sensing technology called »SpinAxis™« which converts the mechanical angle information into a digital format directly without the need for complex analog to digital conversion and angle computation.

This unique approach provides high performance, but also cost effectiveness due to its simplicity. As such, the MA800 family is competitive

Contactless Angle Sensing Increases Reliability In Rotary Switch Applications

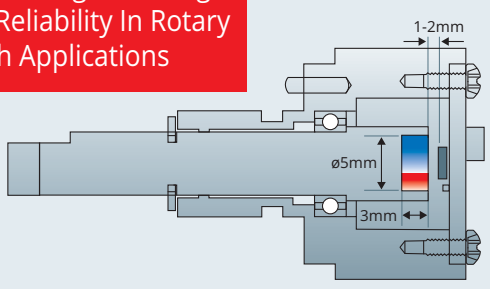


Figure 1: Example of a potentiometer with MA800

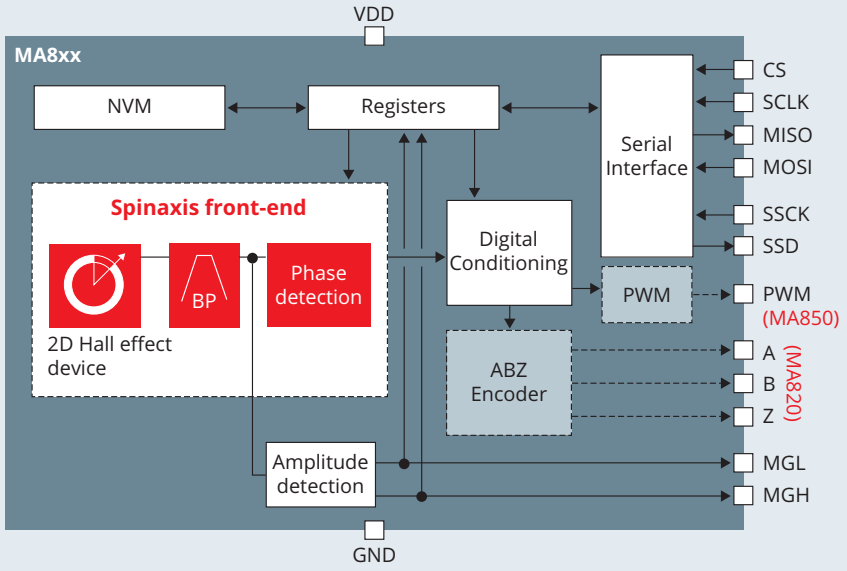


Figure 2: Block diagram of sensor

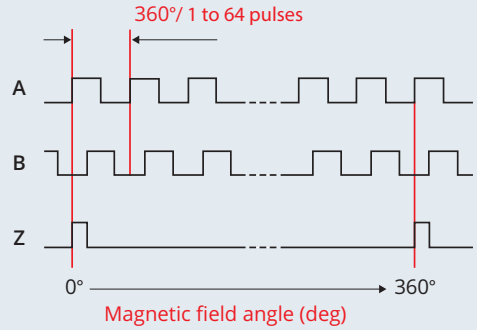


Figure 5: Quadrature ABZ waveform

against existing potentiometer or mechanical switch solutions even in price sensitive consumer applications.

The MA800 sensor outputs the digital angle reading via an SPI or SSI interface. This allows for easy interface to all types of microcontroller. The digital angle is an absolute value with 8 bit resolution between 0 and 360 mechanical degrees, and because it is absolute, the position information is always true even after power is cycled.

Some rotary interfaces also require a push button functionality to implement program selection – for example to scroll through a set of radio stations and then select the one you wish to listen to. In the past this has only been possible by adding further mechanical complexity in the form of a contacting switch.

The MA800 family provides the possibility to implement a push or pull button function by having programmable magnetic field strength thresholds which detect the distance of the magnet to the sensor and provide dedicated signals to indicate if those thresholds are triggered. A non-contacting push button function is therefore easy to implement with a simple spring action on the rotary knob to move the magnet closer or further from the sensor.

The graph shows how this may be implemented in practice, with a change in position of 0.9mm causing the MGH signal to change from logic 0 to logic 1.

The MA820 version of the sensor also features a programmable incremental ABZ encoder interface. This provides 2 channels A and B of quadrature encoded signals with a programmable number of pulses per channel for each full turn. The pulses per channel can be set from 1 to a maximum of 64 per revolution. The 90 deg quadrature spacing of the two channels also provides direction of turn information.

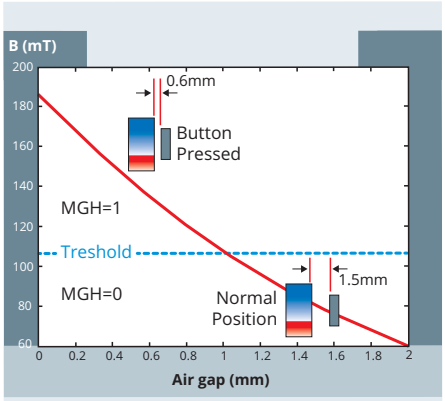


Figure 4: Push Button detection B(mT) v air gap

An index pulse output (Z) is provided to reference the knobs zero position. The zero reference can be set during system production and programmed into the non-volatile memory of the device.

For applications wanting to retrofit to the analogue output of a potentiometer solution, the MA850 version features a PWM output which can be filtered to provide a linear voltage that is proportional to the angle. The PWM has an 8 bit resolution and frequency of approximately 3KHz. Adding an RC network to the output provides an output voltage over the range from 0 to the chips supply voltage of 3.3V.

For a 0 to 5V application the RC network can be buffered by a simple OP-AMP circuit to give a wider output voltage range.

Configuration parameters are automatically stored in the MA800 devices non-volatile memory whenever a register is written via the SPI interface. The non-volatile memory provides storage for the reference zero angle position and the magnetic field detection thresholds.

The MA800 family operates from a 3.3V supply and is packaged in a 3x3mm QFN package. Operating temperature is -40 to +125°C.

The unique flexibility of the MA8xx family provides designers with an innovative way to improve reliability in rotary interface applications, whilst at the same time adding increased functionality to the end user experience. Its small size and cost effectiveness make it suited to a wide variety of consumer and industrial and automotive applications.

Contact MPS for further details:
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www.monolithicpower.com

A14

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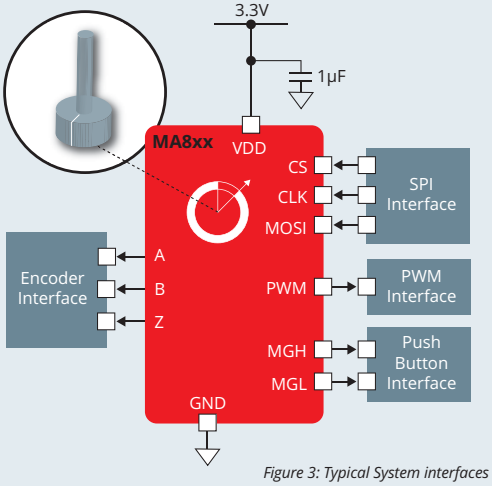

Figure 3: Typical System interfaces

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POWER REVOLUTION

power integrations™

POWER INTEGRATIONS Revolutionises Auxiliary and Standby Power Supply Design with the 900V InnoSwitch-EP Family

When we look at the available switching power topologies there are many types that have evolved to suit specific requirements like higher power, improved efficiency, lower cost or reduced size but few can be considered revolutionary. The InnoSwitch™ family of power switching ICs from Power Integrations combine new technical innovations in power semiconductors that will revolutionise power supply design.

This new high voltage CV/CC flyback switching IC family features an integrated 900V power MOSFET, synchronous rectification and a precise secondary-side controller. Like all of the InnoSwitch families, the new InnoSwitch-EP ICs employ POWER INTEGRATIONS' high speed magneto-inductive communication – termed FluxLink™, incorporated into the device package which creates a magnetic coupling between the primary and secondary side. FluxLink technology can provide very precise control of both of the primary and secondary switching functions, allowing synchronous rectification to be employed, delivering high efficiency without complex control circuitry (Figure 1).

Replacing the traditional Schottky diode with a MOSFET is the basis of synchronous rectification. MOSFETs have a very low on-resistance, RDS (ON), so the voltage drop across the transistor is much lower than for diodes, resulting in a significant increase in efficiency. However, moving to synchronous rectification is not straightforward. Control circuitry is required to correctly phase the drive for the MOSFET on the primary side with that of the synchronous MOSFET on the secondary side. This control circuit must ensure that current only flows through one of the transistors at any given time.

To prevent overlap in the switching of the primary (flyback) and synchronous rectification MOSFETs (which would result in highly destructive cross conduction), controllers typically introduce a delay between the turn-off of one transistor and the turn-on of the other.

This »dead-time« must be sufficient to account for the variable propagation delays associated with the circuitry necessary to drive transistors

POWER REVOLUTION

on opposite sides of the isolation barrier. Integration of key switching elements (controller, MOSFETs and drivers) reduces this uncertainty and allows the dead-time to be reduced with a corresponding increase in efficiency. So although synchronous rectification has advantages, it can be difficult to implement because the timing of the MOSFET's switching is challenging.

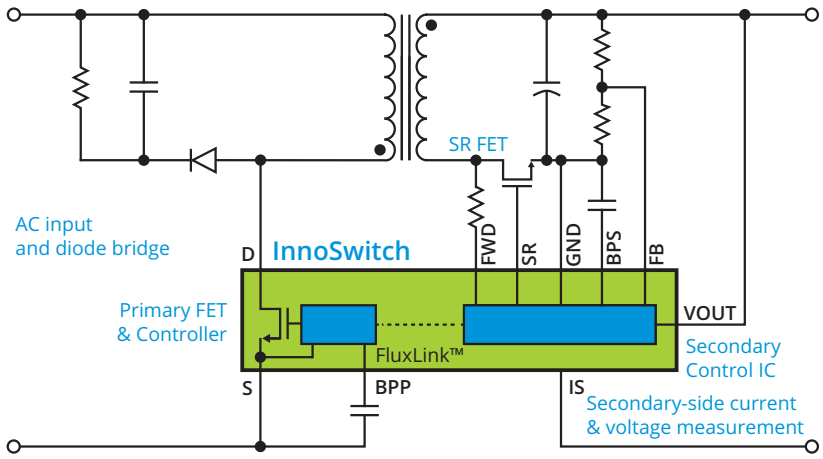
The ideal approach is to control the primary-side switch from the secondary-side of the power supply. This avoids the need to predict of the state of either MOSFET allowing greatly reduced dead-time whilst ensuring that the two MOSFETs are never simultaneously in the on-state. However, until recently, synchronous rectification required additional external optocoupler circuitry, limiting the utility of synchronous rectification in compact and/or high-reliability applications.

The FluxLink technology (fig. 2) within InnoSwitch ICs eliminates the need for this extra circuitry. Precise control ensures that the dead time is neither too conservative – which would adversely affect efficiency – nor too aggressive which would risk the damaging effects of shoot-through.

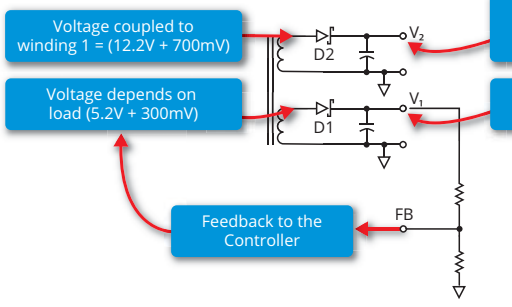
As well as increasing efficiency, InnoSwitch-EP CV/CC flyback switching ICs enable excellent multi-output cross-regulation, and provide line protection and very fast transient response. Industrial applications increasingly require robust, reliable power supplies that provide long life and uninterrupted service reducing down time and service costs.

Multiple regulated outputs are often required to drive different functions that need power – clocks, motors, network interfaces, microprocessors, etc. Some functions require very tight

Figure 1



Typical SSR with Diodes and single feedback for Dual output



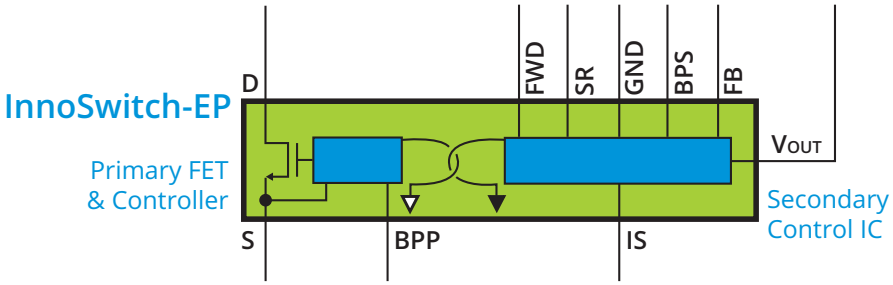


Figure 2

voltage limits and to meet this engineers have previously used post-regulators that reduced efficiency and added cost to the solution. The forward voltage drop of a Schottky diode is current dependent (due to the epitaxial parasitic resistance in the Schottky structure) causing forward voltage drop to increase with rising load current. A single loop controller can only directly regulate a single output and is therefore unable to compensate for this change across multiple rectification stages.

The circuit shown in the right hand side of the diagram (figure 3) – based on InnoSwitch-EP – uses a synchronous rectification MOSFET which has a relatively small change in voltage drop across load. This reduces cross regulation effects on the other outputs. Output voltage regulation at light and no-load is also improved by synchronous rectification.

The MOSFET switch greatly reduces the peak-charging of the output capacitor that typically causes a significant increase in output voltage when output load is insufficient.

These highly efficient power supply switchers are the ideal solution for engineers looking to address increasingly demanding Total Energy Consumption (TEC) regulations with an easy-to-implement solution that improves power supply efficiency from standby to full load.

For example, InnoSwitch-EP ICs enable a 20W power supply to achieve 90% efficiency in a multi-output design, while reducing no load consumption to less than 20mW. Voltage regulation across line is highly accurate, better than ±3%, along with accurate controlled over-current protection also provided (Figure 4).

Robustness is improved by having an integrated 900V power MOSFET capable of withstanding the significant line voltage fluctuations found in motor control, grid monitoring, industrial metering and renewable energy applications. Designs can be made that support both line-neutral and phase-to-phase voltages. The 900V devices provide a high margin of safety in 450VAC systems and continue to operate during voltage swells and surges.

The IC also integrates advanced protection and safety features including: primary sensed output OVP; output over-current protection; hysteretic thermal shutdown; and line voltage monitoring with programmable under-voltage and overvoltage protection.

Companies designing for worldwide markets can be sure that a single 900V InnoSwitch-EP design will function reliably in even the most challenging regional conditions.

The 900V InnoSwitch-EP is UL1577 and TUV (EN60950) safety-approved and EN61000-4-8 (100A/m) and EN61000-4-9 (1000A/m) compliant. InnoSwitch-EP based power supplies can also help enable electronic products to meet product-specific efficiency requirements mandated by the U.S. DOE, ENERGY STAR (R), European Commission (Ecodesign Directive for ErP and Code of Conduct), California Energy Commission and other agencies.

Due to the high efficiency the devices do not require a heatsink and the unique eSOP package allows 900V InnoSwitch-EP ICs to be positioned across the isolation barrier which would otherwise be dead-space on the board.

Full details can be found on the InnoSwitch-EP page of the Power Integrations web site: https://ac-dc.power.com/products/innoswitch-family/innoswitch-ep/

A15

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Figure 3

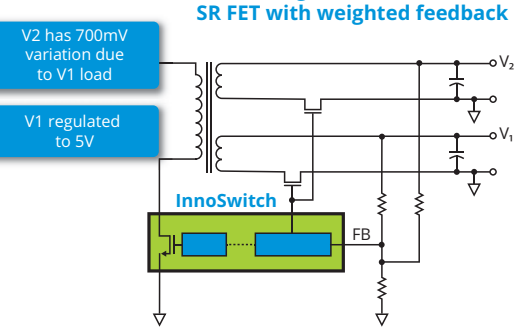
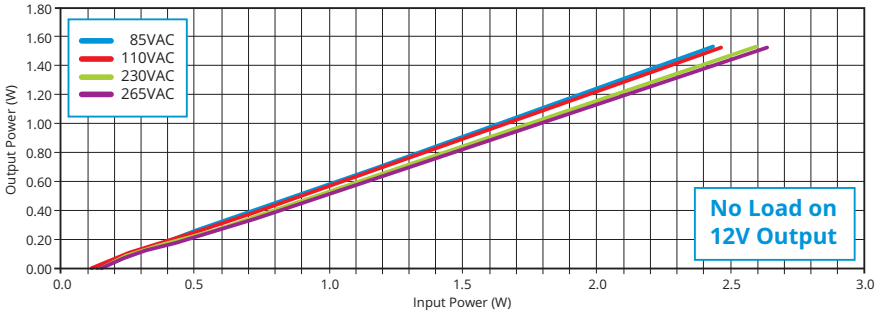


Figure 4



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NEWS FROM RUBYCON

MXH

105ºC Snap-in E-Cap with 550V Rated Voltage

For industrial applications like inverter RUBYCON has added a 550V-version of the miniaturized 105ºC snap-in e-cap **MXH** to their standard portfolio. In following table we show you some examples of the available values:

Voltage (V)	Capacitance (µF)	Case Size DxL (mm)	Ripple-current (mA@105°C, 120Hz)	Guaranteed Lifetime (hrs)
550	100	30x25	800	2000
550	180	30x40	1210	2000
550	390	35x55	1880	2000

High Ripple Currents in compact SMD Case Sizes

The E-Cap series **TPV**, which is known for it´s high ripple current capability and high capacitances in compact case sizes, was supplemented with small dimensions with diameter 6.3mm. Thus the advantages of this technology can also be used at even smaller available space.

Here a comparson with RUBYCON series TKV (both have a temperature range of -55 to +105°C):

TPV

Series	Voltage (V)	Capacitance (µF)	Case Size DxL (mm)	Ripple-current (mA@105°C, 100kHz)	ESR (Ohm max@20°C, 100kHz)	Guaranteed Lifetime (hrs)
TPV	16	220	6.3x6.1	300	0.26	2000
TKV	16	100	6.3x6.1	300	0.26	2000
TPV	16	330	6.3x8	600	0.16	2000
TKV	16	220	6.3x8	600	0.16	2000
TPV	35	100	6.3x6.1	300	0.26	2000
TKV	35	47	6.3x6.1	300	0.26	2000
TPV	35	150	6.3x8	600	0.16	2000
TKV	35	100	6.3x8	600	0.16	2000

PMLCAP

PMLCAP for harsh Using Conditions

The polymer-multilayer-capacitor **PMLCAP** is now also introduced for a usage in harsh environmental conditions. This »MS«-series is tested for 1000hrs at 85°C and 85% r.h. Here some examples of available values:

Voltage (V)	Capacitance (µF)	Dimensions LxWxH (mm)
10	0.15	2.0x1.25x1.0
16	0.47	3.2x1.6x1.0
16	1	3.2x2.5x1.4
25	0.047	2.0x1.25x1.0
25	0.68	3.2x2.5x1.8
35	0.022	2.0x1.25x0.8
50	0.1	3.2x2.5x1.8

E-Cap Miniaturization proceeds

In the voltage range of 50V and 63V RUBYCON improves the performance of the 105ºC-THT-series **ZLJ**, which was developed for specific high ripple currents. So in the new versions not only a higher capacitance at same case size is provided, but also an even higher ripple current capability. In following table we show you a comparison:

ZLJ-Series	Voltage (V)	Capacitance (µF)	Case Size DxL (mm)	Ripple-current (mA@105°C, 100kHz)	Impedance (Ohm max@20°C, 100kHz)	Guaranteed Lifetime (hrs)
old	50	220	10x16	1650	0.053	10000
new	50	330	10x16	2100	0.052	10000
old	50	680	12.5x25	2800	0.025	10000
new	50	1000	12.5x25	3000	0.022	10000
old	63	82	8x11.5	720	0.18	8000
new	63	100	8x11.5	1000	0.13	8000
old	63	820	16x25	2890	0.025	10000
new	63	1000	16x25	3200	0.02	10000

MXK

Ultra miniaturized 105°C Snap-in E-Cap

RUBYCON expands their **MXK**-series by a version with even higher capacitance and ripple current capability per case size. As follows we introduce a small selection of those caps to you:

MXK-Series	Voltage (V)	Capacitance (µF)	Case Size DxL (mm)	Ripple-current (mA@105°C, 120Hz)	Guaranteed Lifetime (hrs)
old	400	180	22x30	1190	3000
new	400	220	22x30	1260	3000
old	400	270	30x25	1370	3000
new	400	330	30x25	1390	3000
old	450	330	22x55	1880	3000
new	450	390	22x55	1980	3000

135°C low ESR Automotive E-Caps

The 135ºC-series **HGX** (THT) and **HGV** (SMD) were expanded by rated voltages of 50V and 70V. In addition to an extremely high ripple current capability those caps also provide specific high capacitance values per case size. They were specially designed for automotive applications.

- Temperature range: -40°C ~ 135°C
- Voltage range: 25V ~ 70V
- Capacitance range: 240µF ~ 6800µF
- Lifetime: 3000h

HGX

Here a small selection of the 70V-version:

Capacitance (µF)	Case Size DxL (mm)	Ripple-current (mA@135°C, 100kHz)	Ripple-current (mA@125°C, 100kHz)	ESR (Ohm max@20°C, 100kHz)
360	12.5x20	1300	1940	0.099
750	18x20	1840	2750	0.058
1300	18x30	2760	4120	0.034

SMD E-Cap with 450V Rated Voltage

RUBYCON expands their already well known 105°C series **SGV** with a voltage range of 160V ~ 450V. At the same time it is a further development of the since some time available 400V-version. At 400V with dimensions 18x21.5 there are 47µF realized now instead of 33µF. The guaranteed lifetime is 5000hrs. Some further examples:

Voltage (V)	Capacitance (µF)	Case Size DxL (mm)	Ripple-current (mA@105°C, 120Hz)
200	120	18x21.5	620
250	22	12.5x13.5	190
400	2.7	8x10.5	55
450	15	16x16.5	195
450	33	18x21.5	345

New 125°C THT E-Cap »RXF«

With the new series **RXF** RUBYCON offers a high-temperature E-Cap, which is a budget alternative with high a ripple current capability and high capacitances in compact dimensions, and thus a nice middle course between specifications and price. This capacitor is best suitable for automotive and LED-lighting applications.

- Temperature range: -40°C ~ 135°C
- Voltage range: 25V ~ 70V
- Capacitance range: 240µF ~ 6800µF
- Lifetime: 3000hrs

In following table we show you a selection out of the datasheet:

Voltage (V)	Capacitance (µF)	Case Size DxL (mm)	Ripple-current (mA@125°C, 100kHz)	Impedance (Ohm max@20°C, 100kHz)	Guaranteed Lifetime (hrs)
35	680	10x20	1540	0.058	2000
35	1500	12.5x25	2280	0.030	3000
63	390	12.5x20	1310	0.094	3000
63	1100	16x30	2940	0.037	3000

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From vision to reality

SMART HOME

If you're looking for suitable relays for your application, don't look any further. CODICO offers a comprehensive range of relays by GOODSKY, SANYOU and NEC-TOKIN, including technical consulting during the design-in phase to help you determine the ideal component for your application.

The smart heating adapts to the occupants' needs, the lighting control guarantees a comfortable atmosphere, and the photovoltaic system on the roof supplies electricity to the smart grid. All this is possible in a smart home. This term is used to describe a multitude of solutions for connecting and controlling home installations, home appliances, and consumer electronics.

The residents of a smart home benefit from a more efficient energy use, greater comfort, and thus a higher quality of life. One of the greatest potentials of a smart home lies in heating control, since heating greatly contributes to improve the living comfort – while reducing energy consumption and heating costs.

In the beginnings of building management, attention was focused mainly on large public buildings and office buildings, factories, and shops. As a result of the boom in information technology, embedded control and smartphones, the possibility of controlling systems via app, and the desire for greater comfort and safety coupled with the need to save energy, this topic has recently entered the segment of family houses and flats.

For a simple flat or a normal house to become a smart home, the individual components such as heating, lighting, shadowing or air conditioning need to be fitted with sensors and actuators. By integrating sensors and software, these devices become intelligent and capable of reacting to environmental changes such as temperature, and acting through actuators. Networking these individual elements allows them to communicate with each other. Apart from the design of attractive user interfaces and the entire range of communication technology and sensor control issues, an essential part of the smart solution lies in the switching of the respective load in the actuators. The key components include first and foremost modern power and signal relays that need to be properly dimensioned.

The following will look at the questions that a developer must deal with when selecting the appropriate relay. It will also present two special applications that demonstrate the benefits when choosing the right relay.

THE RIGHT RELAY

First of all, one must establish the loads that need to be switched and the required operating life. Especially in building management, loads are usually not resistive. In many cases, the actuators are inductive consumers such as motors, pumps, or valves. They include, for instance, roller blinds, and gate drives, fan motors, as well as pumps and valves in heating and watering systems. On the other side are capacitive loads, such as most types of interior and exterior lighting systems. What all these types of load have in common is that the inrush currents can be a multiple of the nominal current indicated in the datasheet, and harsher turn-off conditions may prevail in practice than those for the indicated resistive switching powers.

As a rule, the operating life of a relay will depend on the type and power of the load to be switched, the switching frequency, and the ambient temperature.

In general, datasheets will only contain information about the nominal values of the relays and the predefined environmental conditions. In most cases, only ohmic loads or information on the operating life under low ambient temperatures will be shown. Moreover, there is usually no information on the impact of switching frequency or switching ratio which corresponds to the actual practice. In some cases, all tested load cases are listed, yet without specifying the respective expected operating life.

In the case of relays with monostable coil systems, one must also consider that the NC (normally closed) contact with its design-specific low contact pressure is weaker than the NO (normally open) contact and therefore has a lower operating life under the same switching current. In order to achieve the same operating life as with the NO contact, some manufacturers opt to specify the NC contact for a lower current.

The material chosen for the contact has a very decisive impact on the operating life of the relay. In the past, AgCdO was considered the universal material for contacts, but following the RoHS Directive, the choice is now mostly between AgNi or AgSnO. The AgSnO contact is recommended when switch-on peaks are expected, while AgNi is the more appropriate choice for also lower level loads. AgSnO-Indium contacts and systems with a Tungsten pre-make contact show a particularly high welding resistance. In the case of small switching currents and signal loads, the most important issue is the resistance across contacts. For this reason, signal relays usually feature gold-plated bifurcated contacts. These are used, for instance, in smart homes to switch video signals such as those in intercom systems with cameras and monitors.

At this point, one should also mention that the loads tested in accordance with the international norms and standards do not reflect the respective actual practice. For instance, switching rarely takes place at regular intervals or under constant temperatures.

One can draw the conclusion that the nominal values indicated in the datasheet on currents and voltages, ambient temperature, and load type, as well as the information provided on operating life do provide support in the choice of components, though the user's exact load case is usually not represented. It is often advisable to send a query to the manufacturer to obtain information about the expected operating life on the basis of the manufacturer's tested loads obtained at independent labs. When doing so, it is important to have the most precise information possible about the actual loads and temperatures. In some cases, the only option is to test the exact load, especially when operating at the limits of the chosen component.

In addition, there are certain measures that can increase operating life, such as lowering the coil voltage to the holding voltage in monostable systems after relay operation. This will help reduce the coil's self-heating. Contact protection circuits support arc surpression when switching off. Since today printed circuit boards are very rarely washed after component placement, preference must be given to fluxtight relays, since their electrical operating life is usually longer because the relay can »breathe«.

When switching the rotation direction of motors, the relay often only conducts the current while a semiconductor is responsible for switching the load. This type of switching allows for a significant reduction in the number of components and, under certain circumstances, also the use of automotive relays or smaller SMD signal relays.

The second aspect relates to the choice of the right relay drive. Here, the user must choose between monostable and bistable systems. Bistable systems are more complex as regards the relay structure and their control, making them more expensive. In addition, they present the disadvantage of not having a clear default position. Their great benefit lies in the low power consumption, since power is required only for the switching process, but not for holding. Moreover, the contact pressures for maker and breaker contact are similar – thus improving electrical operating life as well as shock and vibration resistance. In addition, the coil's self heating almost disappears, since the coil must only be activated for a very short time.

Another criterion is coil sensitivity. The lower the coil power, the less heat is generated. This can be of significance in temperature-critical applications, especially when the relays are densely pakked or arranged in small casings. Choosing the correct coil system will help avoid causing thermal damage to the coil. With a maximum temperature specification of 155°C, class F coil systems allow more reserves in case of high ambient temperature.

Finally, one must also consider the mechanical dimensions, the environmental parameters (ambient temperature, vibration and shock resistance) as well as other safety-related criteria. These include insulation, the creep age and clearance distances required for the application, and safety approvals. The use of modern plastics allows for even greater miniaturisation in this field. The following table provides an overview of the most common designs for applications in smart homes available with our partners GOODSKY, SANYOU and NEC- TOKIN, and their typical application scenarios.

TRENDS

Today the implementation of a smart home is unthinkable without relays.
The growing importance of energy saving (heating, AC, photovoltaics, etc.) and the desire to enjoy greater comfort while saving energy, will inevitably lead to growth in the relay sector. The trend is moving toward higher power densities and smaller designs, driven by a greater function density, the typical loads, and the demand for miniaturisation.

For relays, this development translates into:

- Great growth potential
- Requirement to cope with high inrush currents
- High performance for non-resistive loads
- High coil sensitivity (lower power) and bistable coil systems
- Smaller size (surface and height)
- Higher ambient temperatures
- Small designs and processability – SMD
- Requirement for high short-circuit resistance
- Safety-related aspects: Stronger insulation and glow-wire testing
- Environmental aspects: Halogen-free

APPLICATION EXAMPLES

Application in the heating sector using the example of the simulation for the switching of a high-efficiency pump with a synthetic load:
The objective was to find a next-generation solution so as to deliver a smaller component design in the future.

The following load was simulated with capacitive inrush characteristics:
Inrush 45A (250VDC/47µF) with a switching frequency of 2.5sec (on) and 2.5sec (off) at an ambient temperature of 25°C. The objective was to reach 25,000 switching cycles.

The design used today was compared with 2 relays that require 35% less footprint, 10% lower coil power, and can cope with a 25% higher nominal current.

Moreover, the new designs can be used in ambient temperatures of up to 105°C. The result of this test showed hardly any signs of wear and tear at the contact, nor any welding, while the contacts of the previously used relays presented signs of welding.

The following two images show the enormous reduction in space obtained with the new solution, especially when several relays are used on the PCB. The pin-identical relays GQ and SJ of GOODSKY and SANYOU respectively offer a significantly improved alternative to the solutions commonly used today.

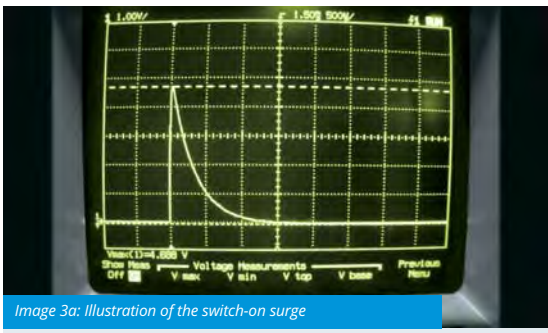

Image 3a: Illustration of the switch-on surge

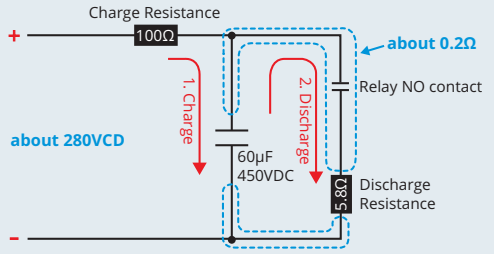

Image 3b: Wiring of the test design

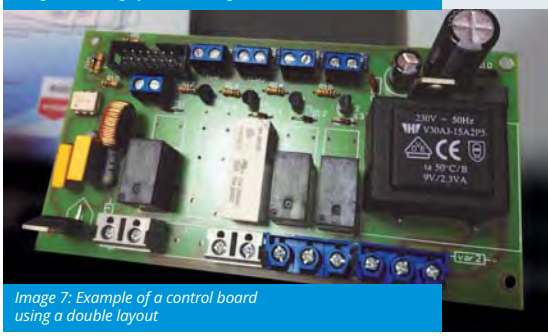

Image 7: Example of a control board using a double layout

RELAY SELECTION						
SERIES	**SIGNAL RELAYS**	**JE**	**SRB/SRC**	**SJ/GQ**	**SJE**	**SRD(I)/SRD(I)-L**
Highlights	up to 2A	low profile 10.5mm	small size for high density PCB mounting	GQ: TV-5 approved	10A standard, 5A version optional	SRD(I)-L to 20A
	SMD and THT	IEC 60335-1 version optional	IEC 60335-1 version optional	IEC 60335-1 version optional	IEC 60335-1 version optional	low profile
	minimal height of 5.3mm	5.5mm clearance 5.0mm creepage	SRC: 5.5mm clearance, 8.0mm creepage	5.5mm clearance 8.0mm creepage		ISRDI/SRDI-L: IEC 60335-1 as standard
Agency approvals		UL&C-UL, VDE	UL&C-UL, VDE	UL&C-UL, VDE	UL&C-UL, VDE	UL&C-UL, VDE
Contact form	1CO/2CO	1NO/1CO	1NO	1NO	1NO/1CO	1NO/1NC/1CO
Rated current	up to 2A	NO: 8A / CO: 5A	SRB: up to 5A SRC: up to 10A	5A & 10A versions	NO: 10A / NC: 5A	NO: 10A / NC: 7A SRD(I)-L: 12A (NO)
Contact material	Ag gold plated	AgNi, AgNi gold plated, AgSnO	AgNi, AgSnO	AgNi, AgSnO	AgNi, AgSnO	AgNi, AgSnO
Coil voltage	3 to 24VDC Monostable & latching	3 to 48VDC	5 to 24VDC	5 to 24VDC	5 to 48VDC	5 to 60VDC
Coil power	100 to 360mW	200mW	200mW/360mW	200mW/450mW	200mW/400mW/450mW	360mW
Dielectric strenght coil-contact	up to 1.500VAC	4.000VAC	4.000VAC	4.000VAC	4.000VAC	SRD: 1.500 SRDI: 2.500VAC
Ambient temperature	+85°C	+85°C	SRB: +85°C / SRC: +105°C	+105°C	+105°C	+105°C
Type of sealing	RTII, RTIII	RTIII	RTII, RTIII	RTII, RTIII	RTII, RTIII	RTII, RTIII
Terminal type	THT, SMD	THT	THT	THT	THT	THT
Mounting	PCB, SMD	PCB	PCB	PCB	PCB	PCB
Dimensions LxWxH		20.0x10.0x10.5mm	20.5x7.2x15.1 (SRC: 16,6)mm	18.4x10.2x15.5mm	20.6x10.2x15.5mm	19.6x15.4x15.5mm
Typical applications	fire detectors, radio transmitters, image transmisson in camera systems	blinds- & shutterdrives, actuators in flush-mounted box, ventilation control	blinds- & shutterdrives	heating pumps, valves control	blinds- & shutterdrives	garage door drives, dimmer switch, watering systems

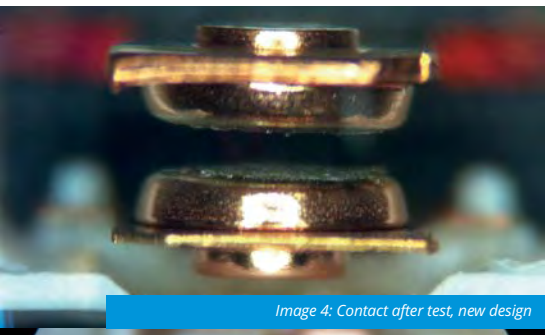

Image 4: Contact after test, new design

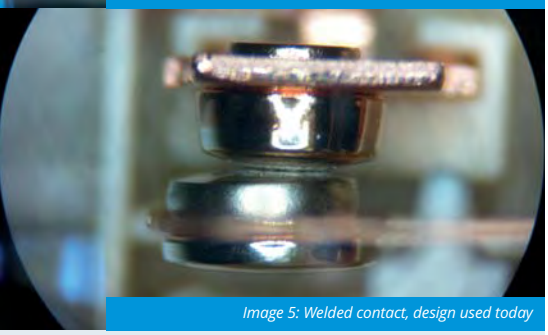

Image 5: Welded contact, design used today

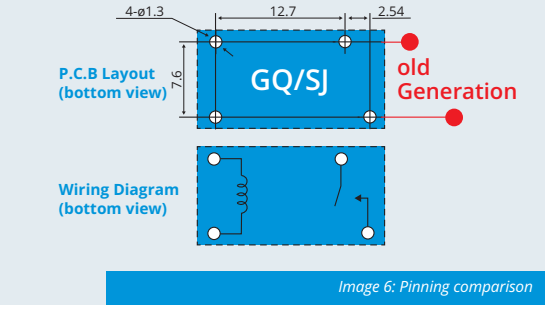

Image 6: Pinning comparison

LIGHT CONTROL

By using an innovative contact system, this solution is capable of coping with high switch-on peaks.

It combines a Tungsten pre-make contact with a main contact made of AgSnO. Seen from the outside, this system represents a relay with a normally closed (NO) contact. The special structure inside the relay ensures that the Tungsten contact closes before the main contact, thus absorbing the switch-on peak. Tungsten possesses a very high melting point of 3,422°C, thus preventing a welding of the contact.

Shortly afterwards, the AgSnO closes the contact and ensures a low contact resistance, which compensates for the disadvantage of Tungsten's high specific resistance.

The demand for such switching performance is given in the areas of light control technology, building automation (e.g. in bus systems or movement sensors), energy management, and motor controls, just to name a few application possibilities.

Image 8

With its compact dimensions of only 29.0x2.6x 15.7mm, the EML by GOODSKY offers advantages for compact designs, e.g. for actuators installed in flush-mounted boxes.

By optimizing the contact system - in addition to the previous loads for fluorescent lamps, low-voltage halogen lamps with inductive transformers, and high-voltage halogen lamps - it is now possible to also switch those synthetic loads used in the simulation of 400W LED lamps for the retrofitting of filament lamps, which simulates surges of 235A and an energy of 24.5A²s. With UL it was possible to achieve a listing for a output of 3,000W/230VAC Tungsten load at 40°C for 50,000 switching cycles.

P03

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SRG	**SF**	**SM**	**EML**	**SFK**	**SLA/SLC**	**LATCHING RELAYS**
17A / 105°C	low profile of 11.0mm	1 and 2 polig / up to 105°C	W pre-make contact	»H« version with contact gap > 1.8mm	many housings options	up to 200A
TV-8 approved	sensitive coil 200mW	in acc. with IEC 60335-1	tungsten load: 3.000VA/230VAC	8.0mm clearance 8.0mm creepage	»H« version with contact gap > 1.5mm	bistable coilsystem with one or two coils
in acc. with IEC 60335-1	TV5 rating for high inrush	clearance of 5.5mm creepage of 8.0mm	235A peak & 24.5A²s for 400W LED retrofit lamps	IEC 60335-1 version optional	IEC 60335-1 version optional	IEC 602055-31 UC3 versions
UL&C-UL, VDE	UL&C-UL, TÜV	UL&C-UL, VDE	UL&C-UL	UL&C-UL, VDE	UL&C-UL, VDE	UL&C-UL, VDE
1NO/1NC/1CO	1NO	1NO/1NC/1CO	1NO	1NO	1NO/1NC/1CO	1NO/1NC/1CO
NO: 17A / NC: 10A	16A	1 pole: 12A/16A 2 pole: 8A	16A	25A	30A/15A/20A & 10A	60 to 200A
AgNi, AgSnO	AgSnO	AgNi, AgSnO	W pre-make & AgSnO	AgSnO	AgSnO	silver alloy
5 to 48VDC	5 to 48VDC	5 to 110VDC	3 to 60VDC	5 to 24VDC	5 to 110VDC	5 to 48VDC / latching
360mW	200mW	400mW	400mW	900mW/H: 1.400mW	900mW/H: 1.1W/S: 1.6W	1 to 30W
2.500VAC	1.500VAC	5.000VAC	5.000VAC	4.500VAC	1.500/4.000VAC optional	4.000VAC
+105°C	+85°C	+85°C	+85°C	+85°C	+105°C	+85°C
RTII, RTIII	RTII, RTIII	RTII, RTIII	RTII, RTIII	RTII	open, RTII, RTIII	RTI
THT	THT/QC	THT	THT	THT/QC	THT/QC	THT/QC
PCB	PCB	PCB	PCB	PCB	PCB	PCB
21.0x16.0x21.6mm	22.2x16.2x11.0mm	29.0x12.7x15.7mm	29.0x12.6x15.7mm	30.1.x15.7x23.3mm	SLA: 31.5x27.4x19.8mm	
garage door drives, dimmer switch, watering systems	actuators in flush-mounted box, light controls	garage door drives, heating pump, remote switch	light actuators: halogen lamps, fluorescent tubes, LED retrofit lamps	PV systems, compressor and motor loads	PV systems, compressor and motor loads	electricity meters, chargers, charging cables

AUTHOR: Victor Hou, Product Marketing Director
of THINKING Electronic Industrial Company

PROTECTION FOR E-VEHICLES

The increasing awareness on use of renewable energy leads to the prosperous development of e-vehicles, and this is a revolution in automotive industry. Compared with conventional automobile, major difference is power train.

In other words, the combustion engine is replaced by an electric motor and on-board-charger/converter. A rechargeable battery becomes the energy source and the electricity charging station takes over the role of gasoline station. Just like for all the other electronics, common threats, including over heat, over voltage, and over current, will occur in daily operation.

This might reduce the reliability of e-vehicles which is not acceptable in case of automotive standards. Because of that, robust design for protecting the motor, board charger/converter,

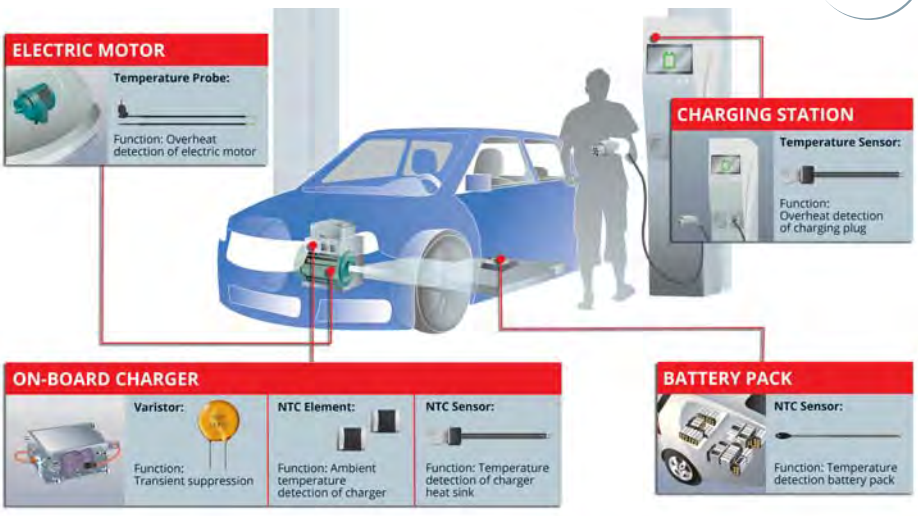

Figure 1: Power train and related protective components of the e-vehicle

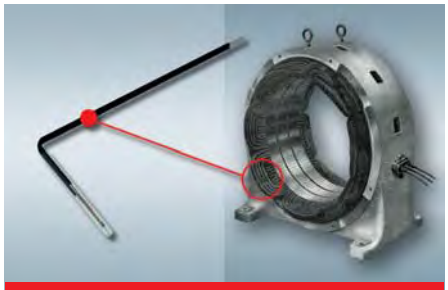

Figure 2: NTC sensor designed for temperature detection on the stator of a motor, and its conceptual installation location.

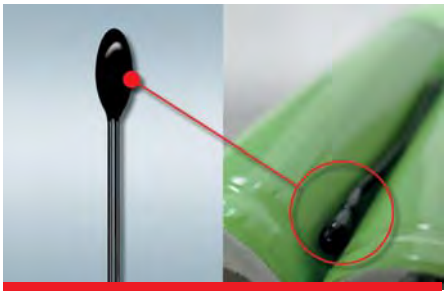

Figure 5: Miniature NTC sensor and conceptual installation in cylinder battery pack

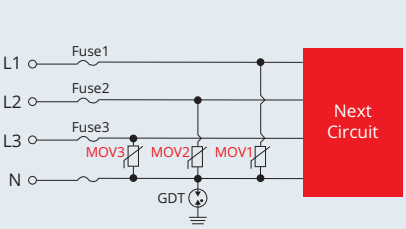

Figure 6: Over voltage protection concept by a varistor

rechargeable battery pack, and even charging station is a must for the e-vehicle industry. A brief idea about this system is illustrated in figure 1.

Different mechanism of power train also faces similar problems. Over heat shortens life of an electric motor, and that is just like what it does on engines. For sensors used to detect temperatures inside the motor, not only high working temperature but also quick response is the basic requirement. More than that, this sensor is installed inside the motor and the device is fully loaded by electricity. Therefore, the higher the dielectric withstand voltage is, the better protective level it gives. At the same time, the space inside the motor is more limited compared to a combustion engine.

Thanks to the state of art design of NTC thermistors, advanced packing material and robust assembly technique enable sensors to detect temperature in the motor's stator. That means 250°C working environment, 1.5 seconds response time, 2500V (1 minute) dielectric withstand capability and tiny size (2 or 4mm in diameter) for the sensor (figure 2).

The bridge among the energy source (battery pack), fuel (electricity charged from outside, as well as the electricity generated by the generator in the vehicle) and the power source (motor) is the on-board charger (as known as »OBC«). Like all the other electrical power converting equipment, energy loss due to high frequency switching circuit brings the increase of temperature, and that drives engineers to consider about temperature sensing and cooling designs.

Physical contact to the heat sink (so-called »screw-on«) is one of best installation designs for temperature sensors. Regulation on power output /input could be coordinated with temperature measurement inputs from this sensor and cooling duct. Examples are shown in figure 3 and figure 4.

Meanwhile, since over heat might be occurred while the battery cell is charging/discharging, a similar idea on temperature detection inside the battery pack is applicable. The only difference lies on the temperature sensor designed for direct contact to the battery cell. Please refer to Fig. 5 for the most adopted NTC sensor in battery packs, and its simple structure and tiny size is suitable to fit into space among the cells.

Another threat of OBC is over voltage. It might be caused by the surge from the power grid when it is charging, or transients generated by electrical-magnetic interaction in the system. Such threat might temporarily shut down the OBC, or even damages the whole power train. A protection circuit is the most adapted solution for such a threat. Metal oxide varistors are widely adapted in this design. Figure 6 is a common diagram for this protection.

Now it comes to the charging station. It is not part of the mobility, but it is the infrastructure for e-vehicle. Since its major function is converting the electricity from power grid to the e-vehicle it is basically a »huge charger.« It faces over voltage threat as well. All the design ideas on over voltage protection used for OBC (figure 5) are applicable. Most interconnections inside the e-vehicle are robustly fixed. However, this interconnection mechanism is plugged in and removed several times. The risks for poor connection causing electricity leakage (even electricity shock) is high. Detection of abnormal temperature rise is the design trend as well as some national regulation. Both NTC thermistor (refer to figure 5) and Pt element are common solutions for temperature sensing inside the charging plug because offer compact size to fit in. An example of charging plug is illustrated in figure 7.

Fig. 7: Charging plug, where the temperature sensor could be installed alone with the interconnection area to detect the abnormal temperature rise when charging.

As mentioned above, protective components play an important role in e-vehicle applications, although it is usually underestimated. THINKING Electronic Industrial Co., Ltd, a trusted manufacturer who is qualified for automotive standard/ system (including AEQ, IMDS, TS-16949, and etc.) and endeavors in developing reliable product, will help your product design for e-vehicle applications.

P04

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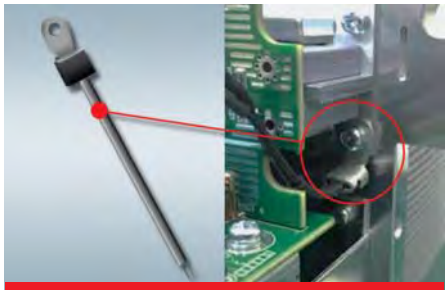

Fig 3: Screw-on sensor for heat sink temperature detection

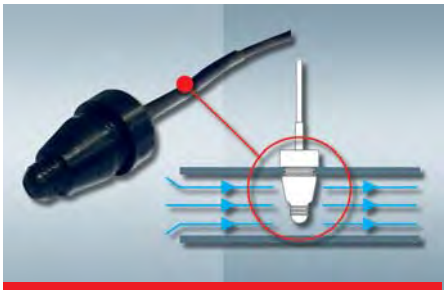

Fig 4: Hole fit-in sensor for cooling duct temperature detection

Author: Eugen Löwen, Application Management Sales Components at ISABELLENHÜTTE

READING BETWEEN THE

Using datasheets correctly to choose resistors

What needs to be borne in mind when it comes to choosing a resistor for a particular application? More than you might think. To make a choice on the basis of a product datasheet, developers need a fair amount of background information, and they have to calculate some values themselves. An example from actual practice will show how to use a datasheet properly.

Which resistor is best suited for measuring current? A quick look at the datasheet alone isn't enough, because there are a great many factors which exert an influence on precision, temperature characteristic, and long-term stability. ISABELLENHÜTTE provides some guidance here with regard to the basic calculation and rating of the components.

When it comes to measuring the current by means of a resistor, consideration has to be given in particular to the parameters of spatial requirement, operational temperature, power loss, temperature behavior, tolerance, and the manufacturing technology. The datasheet will provide important information with regard to the optimum design in the particular application. The structure, the material used, and the general concept of the layout, however, could lead to differing results in application. Based on calculations and background information, developers can better understand the specifics of the individual parameters and their interaction, and use them in their design.

While it is true that a datasheet cannot replace technical consultation, it can provide valuable help choosing the right component.

Basic principles of current measurement

With regard to current measurement by way of a resistor, Ohm's Law is applied to define the voltage drop as a direct measurement of the current. This is entirely uncritical with resistance values above 1Ω and currents of a few 100mA. But the situation is completely different when currents in the range above 10A and up to 20A. Because in this case, in general, the power loss incurred in the resistor, $P = I^2 \times R$, can no longer be disregarded. Every developer will try to limit the power loss by way of lower resistance values. But at the same time the measurement voltage

LINES

is getting lower, the resistance value is often limited by the resolution and the performance of the measuring electronics.

In general, for the voltage drop measured at the resistor the formula of U = R × I applies. However, if the influences of the component, the material, and the structure are added in, we then have:

$$U = R \times I \times U_{th} + U_{ind} + U_{iext}$$

Where
U_{th} = Thermo-electric voltage
U_{ind} = Induced voltage
U_{iext} = Voltage drop at the leads

The fault voltages which are not caused by a current flow can seriously distort the measurement result. Accordingly, their influence should be minimized by choosing suitable components and a carefully matched layout.

Interfering influences

A resistor value never stands alone, but is always dependent on parameters such as temperature, time, voltage, frequency, and others. Table 1 shows the influence of material, design, and the manufacturing process on the measurement signal from the resistor. Thanks to the use of optimized amplifier circuits, nowadays it is possible to work with a very low measurement signal.

It follows from this that a low-Ohmic resistance value is sufficient, which at the same current leads to a perceptibly lower power loss, and therefore also less heating of the component.

As well as the influence of offset, temperature coefficient (TC) and noise from operation amplifiers, the resistance values can be lowered in the range, so that the power loss $P = I^2 \times R$, which occurs when measuring with a resistor at high currents, reduces significantly.

TABLE 1

PROPERTIES/ REQUIREMENTS	MATERIAL	DESIGN	PROCESS
Lower TC	xxx	x	x
High long-term stability	xxx	x	xx
Low thermo-electric voltage	xxx		
Low inductivity	x	xxx	
High precision			xxx
High loadability	x	xxx	
Low thermal resistance		xxx	x
Four-wire version		xxx	
Low total resistance		xxx	x
High level of safety	xx	x	x
Low price	x	xx	xxx

xxx = High influence, xx = Medium influence,
x = Minor influence, but still to be taken into account

An example from actual practice

Taking a practical example, as may occure in the automotive sector and in industrial drive technology, it can be demonstrated which influencing parameters are relevant when it comes to choosing a suitable resistor. In this example, the considerations are:

- A current of 17A is to be measured with high precision
- A measurement signal of 170mV is required
- The component is intended to be used as an SMD resistor

The requirement of measuring a current of 17A and obtaining a measurement signal of 170mV results by calculation in a resistance value of 10mΩ:

$$R = U/I = 0.170V / 17A = 0.010\ \Omega$$

From this the power loss can now be determined: $P = I^2 \times R$ gives a power loss of 2.89W.

Optimum component size

In order to choose the correct component size, it is important to know the maximum operating temperature in the application. The datasheets from ISABELLENHÜTTE relate in this context to the contact point temperature of the resistor. This is easy to check; infrared images will also show here the temperature difference between hotspot and contact point. ISABELLENHÜTTE makes reference in the datasheet to the parameter of »Internal Heat Resistance« (abbreviated as Rthi), which describes the thermal conductivity of the component design. With the help of this parameter, the temperature increase in the component can be calculated.

With the assumed value P = 2.89W, the VMS resistor from the VMx resistor series from ISABELLENHÜTTE is accordingly the choice to be made, with a power rating of 3W. With the VMS, a temperature rise is derived of 2.89Wx25K/W = 72K. According to the datasheet, the VMS achieves the power of 2.89W, even with a contact point temperature of 98°C, which is plainly above the possible operational temperature of competitor products. As far as the component size in relation to the power loss is concerned, ISABELLENHÜTTE is the technology market leader. Above all, however, in the industrial sector the considerations are usually of a temperature at 70°C. The calculated increase by 72K would lead to a heating of the component to only 142°C. With a maximum permitted temperature of 170°C, for which all ISABELLENHÜTTE components are specified, there is still plenty of room upwards to play with.

Raising the temperature

Besides the standard value of P70°C, the datasheets from ISABELLENHÜTTE also show the temperature at which the component can still achieve its specific power. With the VMS, for example, this is 3W at P95°C. These considerations are relevant in particular to applications in the automotive sector, where higher temperatures are

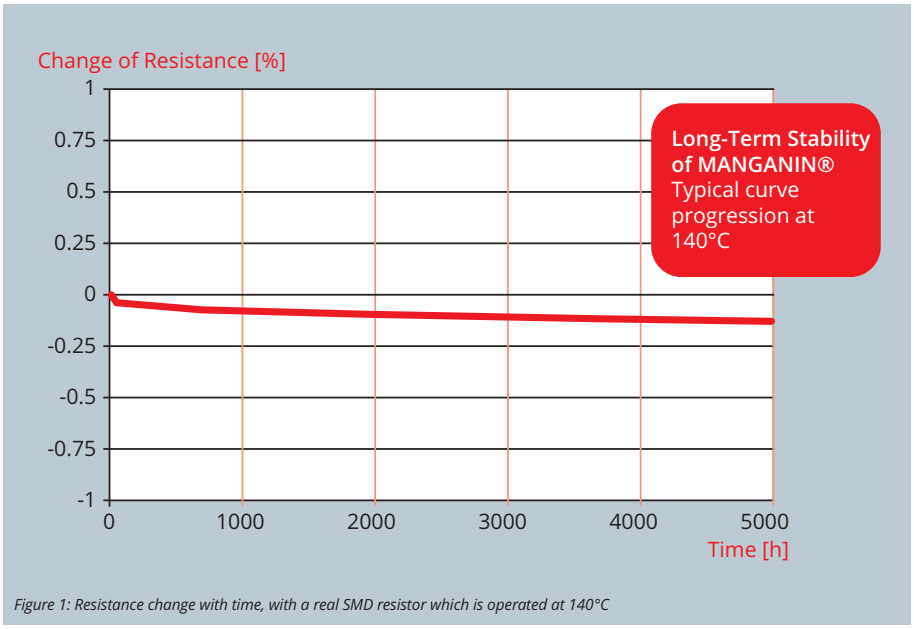

Figure 1: Resistance change with time, with a real SMD resistor which is operated at 140°C

the issue. In the case described, a smaller size could also be used. In this case, once again, the value of the power loss P70°C is to be considerd; with the VMP (2010) this is indicated as 3W. The size 2010 is therefore suitable without any problem, even if, with a calculated power loss of 2.89W the VMP, with its 2W, does not immediately catch the eye. Customers must be aware of the maximum operating temperature of their application: By means of the power derating curve in the datasheet, the maximum temperature of the component can be defined at the certain power.

In principle, for higher currents, a reduction in the resistance value is to be recommended. This makes it possible, under certain circumstances, for the use of a smaller and more favorable size, and, due to the lower power loss, less heat would be emitted into the system.

The layout is the decider

The temperature coefficient is determined by the resistor material used. Resistors can indeed be manufactured with very high reproducibility. However, because the measurement over the layout of a »two-terminal resistor« also has a certain influence, this distorts the temperature coefficient. The usual practice in datasheets of indicating the TC of the resistor material used, is, according to Eugen Löwen, of little significance: *»In our data-sheets we always refer to the TC in the soldered-in state. With our example VMS component, we can take as a basis a very good TC of <20 ppm/K for the measurement, if the customer sticks to the layout proposal. The competitors can in comparison achive significantly higher values.«*

Figure 2 shows what a suitable layout could look like in order to optimize the TC value. For the calculations on the basis of the datasheet, it is decisive for the customer to use the layout specified. Only in this way can the maximum tolerance within the measurement circuit be checked. The temperature behavior of the component also has an influence on this maximum tolerance. Only if the user holds to the specifications can the very good TC of <20ppm/K be achieved.

The layout too has a major part to play in the inductivity of the component, which is likewise shown in the datasheet. In order to keep this as low as possible, developers should follow the layout from Figure 2, in other words run the two conductor paths together on the board as close to each other as possible in order not to form a loop. This is an optimized layout for the lowest possible inductivity, and a low temperature coefficient.

High stability

A further important detail in the datasheet is the long-term stability, which is indicated as a function of the operating temperature. In this situation, the principle applies that the lower the temperature, the less the drift of the resistance value. The values in the datasheet show the contact point temperature; the hotspot temperature caused by the power loss is perceptibly higher.

Figure 1 shows the resistance change in percent of a real SMD resistor when the component has been operated for over 5000 hours at 140°C. The low drift of some -0.2% is caused by the change of metallographic structure in the resistor material, and shows that the initial draft will remain low over the lifetime of the component.

Because the drifts depend very heavily on the level of the temperature, this effect is almost no longer present at 100°C. With the example described at the beginning, however, with regard to the long-term stability, it must be weighed up, in connection with the overall tolerance, as to which resistor is to be chosen: With the VMS, which heats up less with the same power value, the long-term stability is better than with the VMP, which gets hotter. *»In the final analysis we often have to reach a compromise, together with the customer, with which the size stands in relationship to the suitable resistance, the heating, the maximum tolerance, and the price resulting from this«*, says Eugen Löwen, and adds: *»Because all the parameters interact, the customer has to decide which conditions are most important to him. And that's how the right component is determined in the end.«*

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P05

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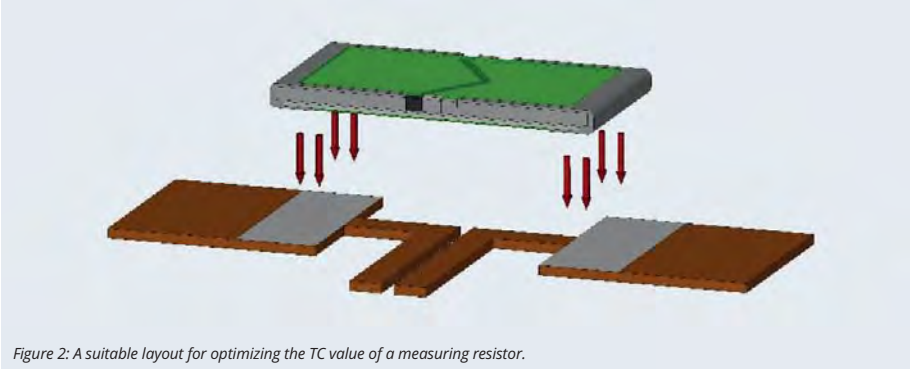
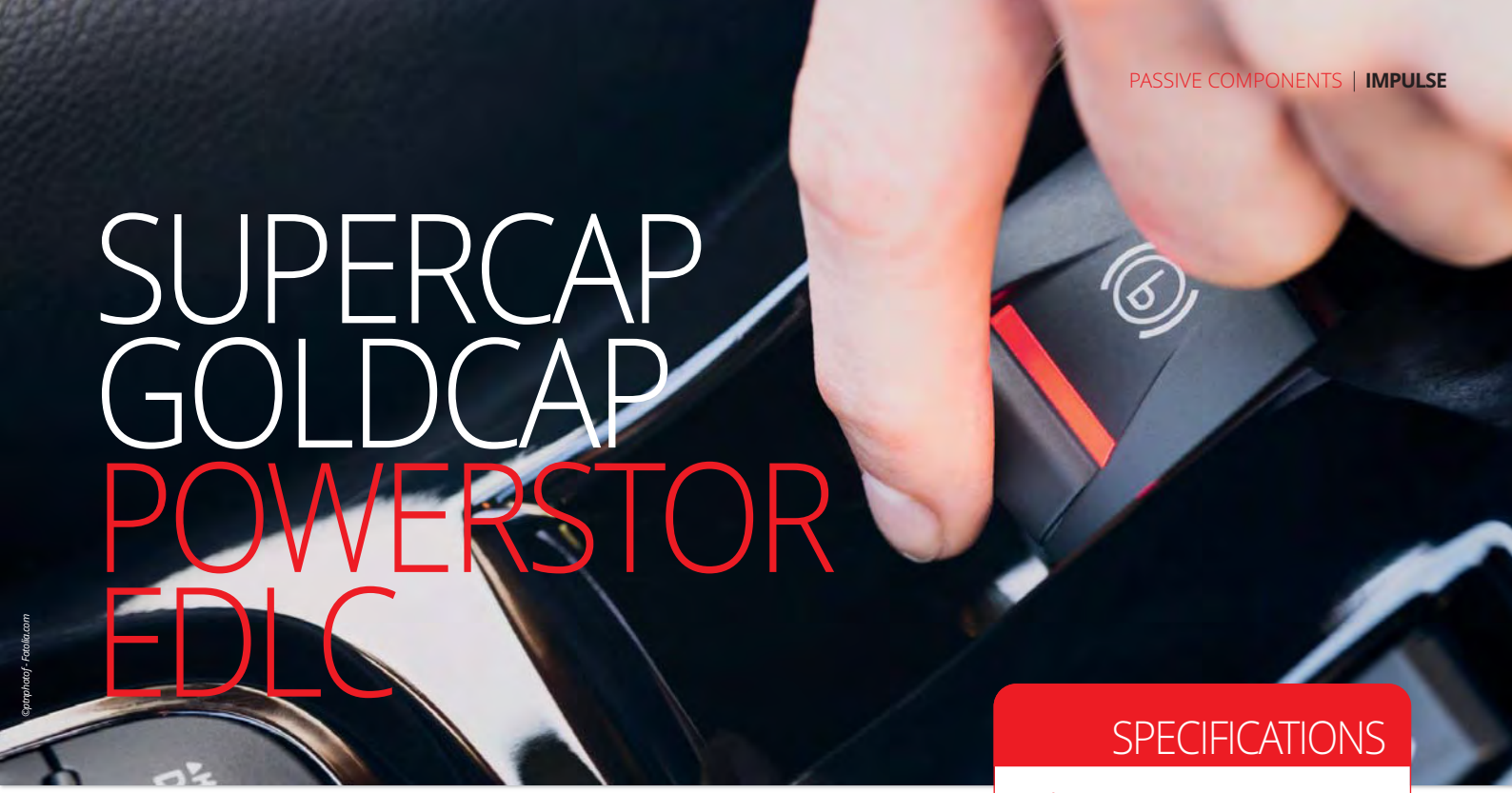


Figure 2: A suitable layout for optimizing the TC value of a measuring resistor.



SUPERCAP GOLDCAP POWERSTOR EDLC

SPECIFICATIONS

- Voltage Range 2.1V ~ 12V
- Capacitance Range 0.01F ~ 3,000F
- Temperature Range of up to -40°C/+85°C

Thanks to their special features, double-layer capacitors are ideally suited for situations and applications in which a high energy or storage capacity must be provided, such as:

- Smart Metering
- UPS and emergency power supply
- Electrical braking systems
- Actuation systems for electromagnetic valves
- Power supply for fork-lifts, stacker and cranes
- Energy harvesting and support for solar-operated end-consumers

In this situation, the capacitors undertake functions such as

- Buffering the energy supply in case of mains fluctuations
- Bridging of mains failures and outages
- Support for batteries or power supplies thanks to high pulse power
- Absorption of surplus energy
- Increasing reliability

In comparison with rechargeable batteries, double-layer capacitors provide advantages such as:

- High power and energy densitiy
- Long lifetime
- More than 100,000 charging and discharging cycles
- Rapid charging and discharging
- No chemical reaction
- Very safe, no risk of explosion or ignition
- Environment-friendly, no heavy metals
- Maintenance-free

EDLCs are charged and discharged by the physical reaction of the adsorption and desorption of ions. Thanks to the use of specific materials by the various different manufacturers, different properties and features are achieved, such as, for example, a particularly long lifetime, a wide operating temperature range, or an even higher energy density and therefore more compact designs and even better storage capability. Special series with a particularly low ESR are also available.

CODICO can provide both, the »coin« types as well as the cylindrical wound formats. For maximum design flexibility, our manufacturers offer SMD versions as well as types with THT (horizontal and vertical), snap-in and screw terminals (including axial). For systems which require a higher rated voltage, ready-made modules are also provided, consisting of several capacitors, with which the »voltage balancing« is already integrated. This means that these components can be used without further circuitry having to be taken into account.

P06

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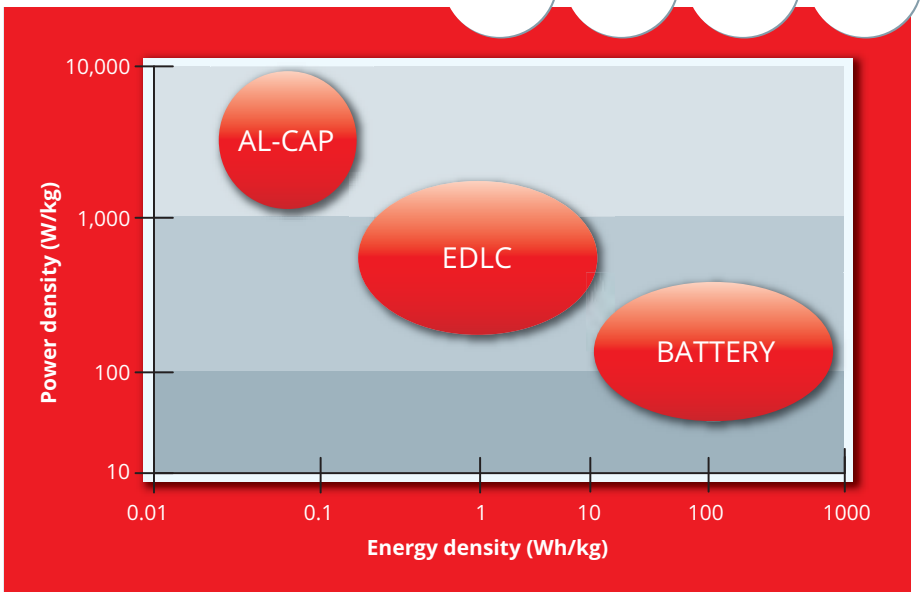
EATON NEC/TOKIN Panasonic Rubycon



MEMS

Oszillator for your new solution

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As we already informed in last Impulse, KDS expanded their product lineup to MEMS oscillator from strategic partnership agreement with SiTime Corporation. With this MEMS oscillator and own crystal product line up, now KDS can cover a much wider range of your timing device demand. Today, it is a fact that below specification for MEMS oscillator has strength against crystal oscillator.

- Smaller Sizing
- Tighter Frequency Stability
- Wider Frequency Range
- Better Aging

Moreover let us introduce some KDS MEMS oscillators that have advantages against crystal oscillators:

MO1532/MO1533

Lower current consumption (max 1.4µA) compares to usual 32.768kHz crystal oscillator (max 5µA~15µA).

MO1566/MO1568

Tighter stability (±5ppm) compares to usual 32.768kHz crystal oscillator (±35ppm~50ppm). MO1568 has auto-calibration function.

MO8021

Lower current consumption (max 270µA) compares to usual MHz crystal oscillator (max around 5mA).

MO8208/MO8209

Tighter stability (±10ppm) with same phase jitter level (max 1ps in 12kHz~20MHz) compares to usual MHz crystal oscillator (±35ppm~50ppm and max 1ps in 12kHz~20MHz).

Today, still crystal oscillators have advantages from their long history. But MEMS oscillators become more and more a choice of new solutions. We would recommend to test these items, even your demand today is covered by crystal type.

Tell us what you need, from crystal units to MEMS oscillator, and we will offer you the best product which fits perfectly to your application.

Features

MO1532/MO1533	
Available Size	1.5×0.8mm (MO1532) 2.0×1.2mm (MO1533)
Frequency	32.768kHz
Temperature Tolerance	±20ppm
Temperature Range	-40°C ~ +85°C
Temperature Characteristic	±75ppm ~ ±100ppm
Supply Voltage	1.2V ~ 3.63V
Current Consumption	max. 1.4µA
MO1566/MO1568	
Available Size	1.5×0.8mm
Frequency	32.768kHz
Temperature Range	-40°C ~ +85°C
Overall Temperature Stability	±5ppm
Supply Voltage	1.8V
Current Consumption	max. 5,3µA
MO8021	
Available Size	1.5×0.8mm
Frequency	1MHz ~ 26MHz
Temperature Tolerance	±20ppm (bei 25°C)
Temperature Range	-40°C ~ +85°C
Overall Temperature Stability	±100ppm
Supply Voltage	1.8V
Current Consumption	max 270µA
MO8208/MO8209	
Available Size	2.7×2.4mm, 3.2×2.5mm 5.0×3.2mm, 7.0×5.0mm
Frequency	1MHz ~ 80MHz (MO8208) 80MHz ~ 220MHz (MO8209)
Temperature Range	-40°C~ +85°C
Overall Temperature Stability	±10ppm ~ ±50ppm
Supply Voltage	1.8V ~ 3.3V
Phase Jitter	max. 1ps (12kHz ~ 20MHz)

P07

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NEW PARTNER

The EATON Corporation is an Irish industrial company operating on a global scale with headquarters in Dublin and a major administration facility in the EATON Center in Cleveland. EATON develops and distributes components and systems for mobile and industrial hydraulics, electrical systems and energy distribution, and components for motor vehicles and aircrafts. EATON has approx. 120,000 employees, and sells products to customers in more than 150 countries. Turnover comes to more than 22.6 billion USD.

CODICO and EATON have concluded a co-operation agreement in the business sectors of inductors (Coiltronics/Bussmann) and super capacitors (Powerstor/Bussmann), which now extends our line card by two powerful product sectors, which will provide support in future for our project and design-in work as well.

Coiltronics, a division of Cooper Industries acquired by EATON, offers a wide range of leading power magnetics products that are primarily used in DC-DC and AC-DC applications. The innovative line includes SMD power inductors/transformers, high-frequency buck/boost chokes, high-density SMD chip coils, and best price metal alloy inductors.

PowerStor, a department of Cooper Industries which has likewise been acquired by EATON, covers the sector of super capacitors.

The particular feature of these EDLCs is the use of Aerogel carbon, which is well-known for its high grade of purity, its usable surface, and its high conductivity. As a result, particularly low resistance values as well as a high energy density, and therefore uniquely high energy storage for electronic circuits and portable devices are achieved.

Double-layer capacitors are ideally suited for pulsed power supply, and for buffering in case of mains and battery power failures and outages.

They are available in cylindrical and so called »coin« type, so as to suit preferably all requirements. As the companies acquired are certified in accordance with TS16949, some series can also be used for the automotive sector.

P08

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PLEASE DO NOT DISTURB!

Power factor correction chokes from SUMIDA

The introduction of more and more electronic appliances into industry and ordinary households is becoming a problem for power network suppliers, as well as for the electricity supply network itself.

While in the past the current obtained had a sinus-shaped form, nowadays the loading tends to be in pulses. The resultant harmonics create an apparent power incurred by the phase displacement between current and voltage. To intervene in this situation, at January 1st 2001 the Standard EN61000-3-2 was introduced on an EU basis with devices of more than 75W.

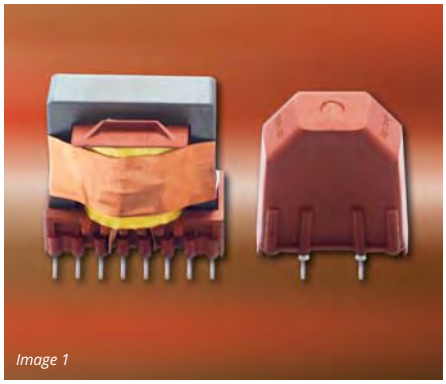


Image 1

The provisions established in the Standard can only be fulfilled by means of a power factor correction (PFC). This type of filtering is put into effect so as to minimise the portions of interfering harmonics, and to bring the power factor towards direction 1. To achieve this, CODICO can offer special winding products from SUMIDA.

Passive Power Factor Correction

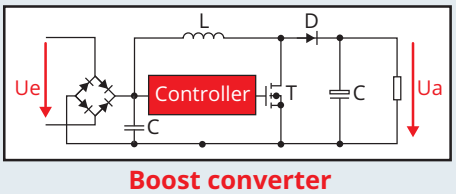
With this variant, only chokes and RC combinations are connected ahead of the rectifier.

Their purpose is to provide intermediate storage of the electrical energy drawn off, and to suppress the harmonics incurred. Due to this rather economical solution, the result attained is not higher than 70% to 80%. This solution is generally used in devices with smaller power ratings.

Active Power Factor Correction

This solution is more elaborate in terms of circuit technology, but it provides a correction of close on 99%.

In this case, predominantly active components are used, which regulate the current draw in such a way that it runs largely in a similar manner to the load resistance. Active PFC also works well with a wide voltage range (85VAC to 265VAC), and advantageously smoothes out mains voltage fluctuations. Active PFC's are based on a double-regulated step-up converter, for which SUMIDA can provide the matching booster chokes.



Boost converter

Image 2

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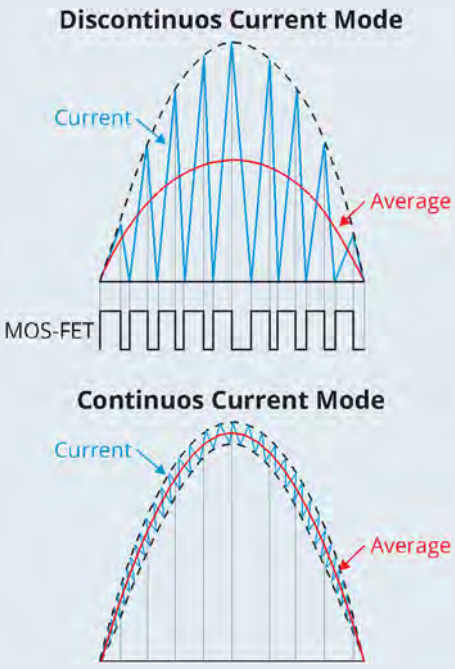

Image 3 and 4

As with conventional step-up converters, the operating modes include both discontinuous-current mode and continuous-current mode.

For lower outputs of up to about 150W, a PFC step in discontinuous current mode can be used. The inductors required for this are in most cases based on a ferrite core with a relatively large air gap, wound with litz or multiple wire. The core losses occurring with this can be kept within limits by the use of special materials, and can also be effectively reduced.

By contrast, the continuous current mode is suitable for higher outputs from 150W. Sintered powder cores (such as Sendust and HighFlux) wound with massive wire, prevent unintentional saturation of the chokes. Compared to appropriate Ferrite Solutions, this Setup benefits from lower Core Losses and can save up to 50% in Volume. As each Power Factor Correction is different, we are looking forward to receiving requests and finding the best solution for your application.

P09

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GOOD VIBRATIONS

Anti-Vibration Terminal Block with push in design

The brand new 0150 series from DINKLE is designed for the industry of motion controller. Due to the push in design the wiring can be done time-saving and without the use of special tools.

- Innovative smart clips helps to plug and unplug quickly and easily and provides a reliable connection
- Rated voltage 300V/600V and rated current 16A/20A according to UL; pitch 5.08 and 6.35mm
- Push in design terminal block with integrated structure to make the wiring reliable and fast without special tools
- 0150 series provides a wide range of conductor cross section – AWG 24~12
- 0150-20/30 plugs are space saving with ultra-mini housing design of height 13.80mm
- The product can be applied in different fields, such as motion controller or servo driver

FEATURES: ANTI-VIBRATION TERMINAL BLOCK WITH PUSH IN DESIGN	0150-20XX	0150-30XX	0150-26XX	0150-36XX
				
Pitch	5.08mm	6.35mm	5.08mm	6.35mm
Rated voltage [UL/IEC]	300/500V	600/800V	300/500V	600/800V
Rated current [UL/IEC]	16/20A	20/24A	16/20A	20/24A
Number of contacts	2 – 16	2 – 12	2 – 16	2 – 12
Cross-section [AWG]	24~12	24~12	–	–

S01

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WE SELL **SOLUTIONS** – NOT JUST PART NUMBERS!

From the ideal connection and customer-specific assembly to your individual final product!

Customer-specific assemblies:

- Customized overmolding parts, including customer logo for corporate design
- Design of special sleeves and strain reliefs
- 3D drawings of assemblies and moldings
- Advice in the selection of suitable raw cables
- Large number of specialized partner firms from Europe and Asia
- Commercially feasible as of 1,000 units
- Electrical tests for polarity, continuity, and short circuits, as well as hi-pot high voltage testing
- Custom-made packaging and labelling (incl. UL label)
- All customary certifications

Your individual final products!

- Development of new products
- Modification of existing solutions (special surfaces, high-temperature resistant plastics,...)
- Complete solutions
- Special designs for housings, locking systems and coding
- Status displays, e.g. with integrated LEDs
- Integration of electronic and mechanical components such as (flexible) printed circuit boards according to customer specifications
- Support in layout development possible
- Personal assistance from engineers with several years of design-in experience
- Value-added products

For more information, please contact:

S02

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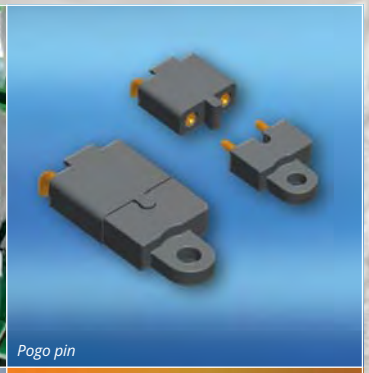
High-power, high-speed, high-density, high-quality, downsizing!

Design-in support, 3D drawings, samples, logistics concepts!


SMD jumper


Pogo pin


Terminal blocks and connectors


Molded Connectors
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FFC/FPC connectors
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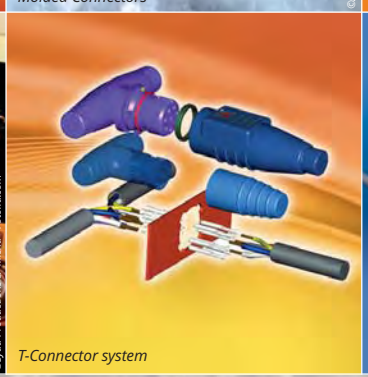
T-Connector system


Antenna solution

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Small Waterproof High Current Circular Connectors

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FEATURES

- Contact positions: 3, 5
- Current rating: 10A
- Voltage rating: AC 250V/DC 350V
- Lightning surge protection: 15kV
- Waterproof rating: IP68
- Locking mechanism: Bayonet

The HR41A was introduced to meet the requirements for compact, high powered connectors offering advanced reliability in outdoor harsh environments.

The connector range consists of push-on bayonet locking cable mount plugs and panel mount receptacles that have the capacity to handle up to 10A.

The user friendly push-on bayonet locking mechanism allows an easy one-step mating process. Visual and tactile raised mating indicators are present on the plug and receptacle to aid the mating operation in dark or concealed conditions. In addition, a tactile and audible click confirms correct mating engagement guaranteeing secure locking.

The HR41A is optimised for easy field assembly. The waterproof gasket and cable can be clamped and sealed in one simultaneous step. The crimps can be easily and reliably terminated with the crimp hand tool.

The sequential contact structure ensures the ground contact is connected before the power and signal contacts during the mating process to ensure safety.

The lightweight housing is robust and resistant to harsh environmental conditions such as 15kV lightning surges. This is due to the special housing wall structure that protects the contacts and ensures a long creepage distance.

Ideal applications are LED lighting, construction lighting, fishing lighting, offshore lighting, robots, electronic toll systems and other industrial applications.

S03

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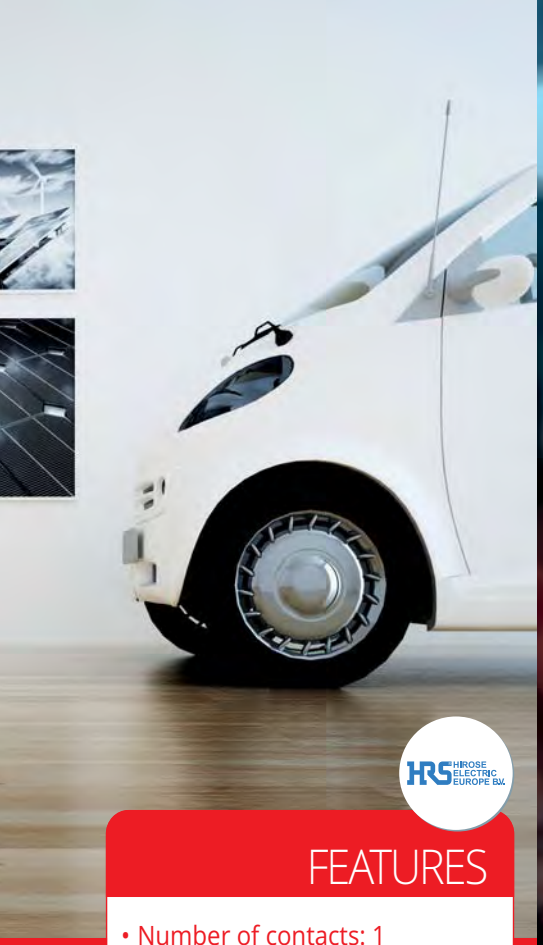
150A High-power Connector for Storage Batteries

With the PS3C series HIROSE provides a space-saving, high-power connectivity solution for front cable connection in storage battery applications.

The PS3C consists of a single-position cable-mount right angle plug that can be easily assembled with screws and without any special tooling. The crimp contacts are commercially available to facilitate easy field assembly. The corresponding mating half receptacle size is minimised and the low height profile is only 20mm.

The right angle plug design allows the connector to be positioned closer to the battery unit to save space. In addition the plug can be 180° reversibly mated to the receptacle to allow different cable layout options to give flexible placement options on the battery unit. An optional hard lock nut is available to reduce mechanical stress from the cable to the plug and prevent screw loosening.



Robust Wire-to-Board Connectors, 0.8mm Pitch

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FEATURES

- Number of contacts: 1
- Current rating: 150A
- Voltage rating: AC/DC 1000V
- Cable size: 14 - 50mm²
- Mating cycles: 100
- Operating temperature: -40°C to +105°C

The receptacle is simple to assemble by screwing the cable to the contact. In addition, the receptacle incorporates a unique clipping contact design with a bellows type contact to deliver the high-power. This allows multiple contact points to reliably engage with the mating blade contact on the plug, suppress contact resistance and support high current flow. Safety is assured with the finger protection design that complies to IP2X evaluated by IEC 60950 test finger to ensure the contacts cannot be touched on the plug or receptacle.

PS3C is available in black or red coloured housing to prevent incorrect mating. Guide keys are provided to prevent incorrect insertion between the plus (+) and minus (-) electrode.

Ideal applications are industrial and storage battery applications where space-saving connectors are needed.

S04

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FEATURES

- Contact positions: 2 – 20
- Contact pitch: 0.8mm
- Current rating: 2.5A (max)
- Voltage rating: AC/DC 100V
- Mating cycles: 20
- Cable size: AWG 28 - 32

HIROSE has introduced the DF52 series to deliver a space-saving, robust, wire-to-board connectivity solution for applications requiring more strength and durability.

The connector range consists of crimp plugs and right angle receptacles in a single row. The mated height profile is minimised to 1.75mm and the depth to 4.1mm to reduce the space needed on the board.

The housings have been designed with thicker and more robust walls to prevent breakage and resistance against mechanical stress during the cabling process. In addition, a higher cable pull force of approximately 20N can be achieved.

The crimp plug features a robust and reliable lance structure which keeps the contacts securely in place even when high forces are applied to the cable.

Highly reliable box shape crimp contacts are utilised to prevent deformation and provide strong resistance against breakage, snaring and rough operation.

The crimp plug has visible slits embedded into the housing structure to act as an indicator. When the slits are no longer visible this indicates the connectors are fully engaged guaranteeing complete electrical and mechanical connection and thus prevents incomplete mating.

A wide range of applications are suitable such as digital cameras, PDA, LCD displays, digital video recorders, car navigation, access control units, measurement devices, set top box and many other portable devices.

S05

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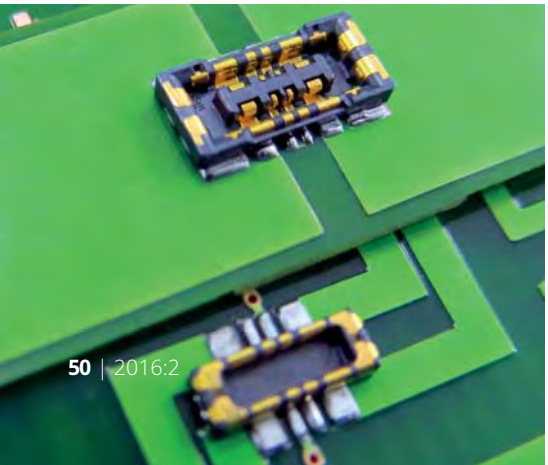
Power/Signal FPC-to-Board-Connectors

BM-SERIES

HIROSE has introduced its BM-series of connectors to provide a high power connectivity solution for miniature application and high-speed signal transmission. The range of connectors consists of plugs and receptacles to allow a flat printed circuit (FPC) to board connection. The parallel stacking height is low-profile at only 0.7mm/0.8mm high in mated condition.

The connector features a hybrid design to include signal and power contacts. This reduces the requirement for separate power and signal connectors which saves costs and space on the board. The pin assignment and the impedance characteristic of BM24 support USB 3.1 Type-C gen.2 (10Gbps) high-speed signal transmission.



Although the dimensions are compact, performance is not compromised, and the parts are able to offer highly reliable mechanical connection. This is due to the provision of unique four-point contacts and a long effective mating length. Guide ribs are incorporated into the housing body, providing a wide self-alignment range in the XY direction and permitting smoother mating operation.

The robust housing incorporates a metal guide structure to prevent any damage due to incorrect mating. Multipoint metal locks are provided to prevent any unintended unmating due to drop impact and increase retention force. In addition, a tactile click is generated upon mating completion, preventing incomplete mating and enhancing operability. The integral moulding features no gaps to prevent solder wicking.

Key Features

	BM24	BM25
Number of contacts	10, 20, 24, 30 & 40 signal / 2 power	4 signal / 2 power
Contact pitch	0.35mm	0.4 mm
Current rating	0.25A signal / 5A power	0.3A signal / 10A power
Stacking height	0.8mm	0.7mm
Voltage rating	30V	30V
Mating cycles	10	10

Suitable applications are point-of-sale equipment, portable handheld devices, and any other devices using USB 3.1 high-speed transmission.

S06

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CLARITY IN THE USB JUNGLE

USB Connectors & Cable Assemblies from YAMAICHI Electronics

YAMAICHI Electronics offers an extensive portfolio of USB 2.0 and USB 3.1 versions as well as cable assemblies. Contact us! We will be pleased to help you find the right solution.

As the USB 3.1 specification has penetrated the market starting in 2013, more and more devices are available with USB 3.1 interfaces. This USB 3.1 specification, also called Superspeed+, is known for its fast transmission rates of 10Gbps. The predecessor USB 3.0 specification, called Superspeed, was able to transmit data only half as fast, at 5Gbps.

For unknown reasons, the USB Implementers Forum (USB IF) renamed the USB 3.0 specification to USB 3.1 Gen 1, with »Gen« standing for »generation«. The latest USB 3.1 standard is therefore now USB 3.1 Gen 2. However, this convention has not yet established itself on the market. As a result, different manufacturers now use different names in equivalent ways: USB 3.0, USB 3.1 Gen 1 or Superspeed for the 5 Gbps variant from 2008, or USB 3.1, USB 3.1 Gen 2, Superspeed+ for the 10Gbps specification defined in 2013. The table below clarifies the changes and names used in parallel for USB specifications:

FORMER DESCRIPTION	NEW DESCRIPTION	ALSO KNOWN AS	DATA TRANSFER RATE
USB 1.0	USB 1.0	Low Speed	1,5Mbit/s
USB 1.1	USB 1.1	Full Speed	12Mbit/s
USB 2.0	USB 2.0	Hi-Speed	480Mbit/s
USB 3.0	**USB 3.1 Gen 1**	Superspeed	5Gbps
USB 3.1	**USB 3.1 Gen 2**	Superspeed+	10Gbps

USB Type C doesn't necessarily mean USB 3.1 Gen 2

In parallel with the USB 3.1 Gen 2 specification, the USB Implementers Forum has also introduced the USB Type C plug onto the market. As a result, many customers and users are now uncertain and believe that USB 3.1 Gen 2 and USB Type C are the same thing. However, the following should be noted:

USB Type C is a new plug type that defines the physical characteristics of the connector itself. USB 3.1 Gen 2, on the other hand, defines the software and the electrical protocol that is transmitted.

The technical requirements for transmission of USB 3.1 Gen 2 are provided by USB Type 3, but slower protocols such as USB 2.0 can also be transmitted on a USB Type C plug.

Analogously, USB 3.1 Gen 2, for example, can also be transmited using a suitable USB Type A plug.

The advantages of USB Type C

The particular novelty is a new plug form, the USB type »C«. Although to date only types A and B have been used, with a defined upper and lower side, version C is truly something new. The upper and lower sides are identical, so there is no need to pay attention to the orientation of the plug in the connection. The size of the connector has also been reduced, corresponding roughly to the dimensions of a Micro-USB Type B.

Type C also supports power up to 100 watts (20V at 5A) for charging processes, for example for batteries, laptops or even to power monitors. The requirement for this, however, is that suitable cables and devices be used that support USB Power Delivery.

In addition to USB, under certain circumstances USB Type C plugs can also transmit other protocols such as Display Port, Thunderbolt, HDMI or MHL.

S07

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ECO-TRONIC

Today, ECO-TRONIC connectors are used in several applications of domestic appliances and the automotive industry, as well as industrial electronics. STOCKO CONTACT has now added two new products to its successful series. For the end user, these additions open up several new fields of use and universal applications. Through continuous adaptation and upgrading of its product range, STOCKO CONTACT meets the demands of the market for functional and economical products.

ECO-TRONIC wire-to-wire connection

As a replacement for its existing MS 7320 connector with IDC technology, STOCKO has added the new wire-to-wire connections MS 7322 and MS 7323 to its product portfolio. The plastics used by STOCKO in these pin connectors meets the requirements of the market for glow wire resistance GWT 750°C according to IEC 60335-1.

Another advantage of these pin connectors is the use of wire cross sections from 0.22 to 0.50 mm². The housings are available in individual magazines for more efficient processing.

ECO-TRONIC crimp housing in IDC technology for AWG 26

Two new crimp housing versions have been added to the ECO-TRONIC connector system . Both new product series were specially designed having individual conductors with small cross sections of 0.12 - 0.14mm² (AWG 26) in mind. While the MF 7274 series can be used as direct and indirect connectors, the MF 7278 series was designed exclusively for direct contacting.

Previously it was possible to connect IDC crimp housings (IDC = Insulation Displacement Connection) of this system usually with copper wires having cross sections of 0.22 - 0.35mm². STOCKO meets the increasing customer requirements in the industry for the use of smaller cross sections of its ECO-TRONIC connector system.

S08

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MS-SERIES

MS 7322
3 - 17 pins
Pitch: 2.5mm
Wire cross sections 0.22mm² to 0.35mm²
MS 7323
2 - 9 pins
Pitch: 5.0mm
Wire cross section 0.50mm²
Rated voltage 32V / 250V
Rated current 2A / 6A
DIN EN 61984 and UL/ULC E96569 approvals

MF-SERIES

IDC technology
Cable exit angle 90°C
2 - 20 pins
MF 7274 as mating connector for ECO-TRONIC pin connectors
MF 7278 for direct contacting of PCBs
Rated voltage 32V
Rated current 2A
Approvals acc. to DIN EN 61984 & UL/ULC E96569

BARKLIP®

SPECIFICATIONS

- Current Rating: up to 170A
- Contact Resistance: 0.2mΩ max.
- Durability: Min. 50 mating cycles
- Wipe length: 6.0mm
- Dielectric Withstanding Voltage: 1000Vac
- Mating force: 40N max.
- Unmating force: 12.5N min.
- Operating Temperature -40°C to 105°C

AFCI expands its product portfolio of power solutions with the right angle BarKlip® busbar connector. A laminated bus bar is an electrical conductor made of several layers of stamped and formed copper sheets. Each layer is individually insulated so the bar can distribute current, AC or DC, at different voltages. Layers can also be used to transmit signals.

BarKlip® busbar connectors offer some key improvements. One of the most important difference are the 10 independent conducting beams which all make contact with the mating busbar. These power beams provide lower resistance by maintaining contact with the mating busbar through common misaligned conditions.

The BarKlip® contact also includes a stainless-steel helper spring to ensure proper mating force and contact resistance is maintained during the life of the connection. Finally, the entire contact is plated with AFCI's proprietary silver-based plating to reduce the resistance and eliminate fretting corrosion found in tin-plated connectors.

Advantages of BarKlip®

- Low resistance and long term reliability
- Handles adverse tolerances through the unique feature allowing reliable mating to misaligned busbar, offset 0.75mm max.
- Satisfies the demand for low insertion/ extraction forces
- Hot plug capable for controlled and reliable separation of high power
- Host different thickness Busbar, 2mm, 3mm and 4mm, longer wipe length
- Ideal for high current busbar power supply/ distribution applications up to 170A
- AGT™ silver–based plating enables low contact resistance and high melting point

Typical applications

- AC/DC pluggable power supplies in data, telecon & datacom/ networking equipment
- Rack mounted power distribution applications involving busbar to busbar connection
- Industrial equipment requiring high current density connections between busbars & PCBs
- Hyperscale computing architectures using busbars for power distribution

S09

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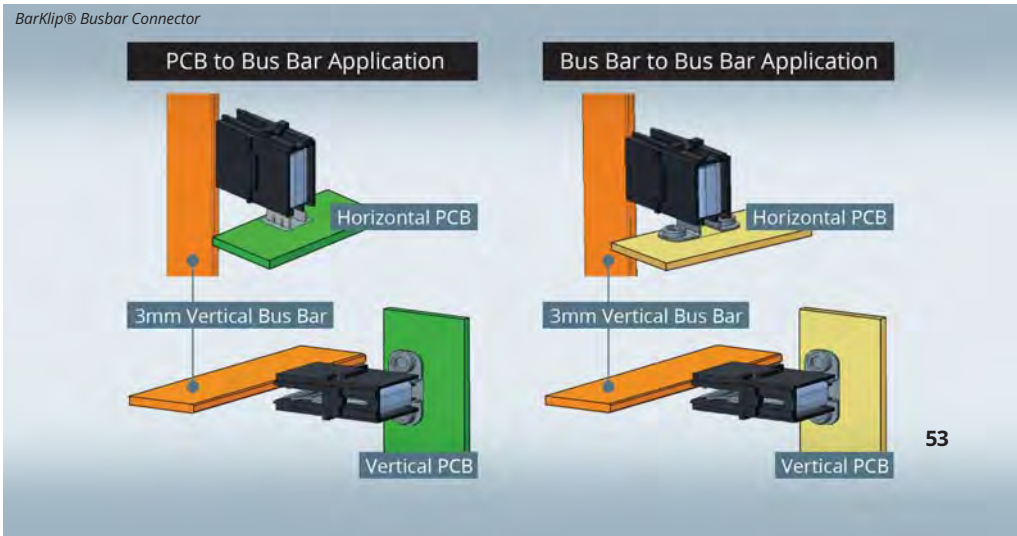
BarKlip® Busbar Connector



New Push-Lock Connector Series HS-LOK

ALTW Technology is part of the AMPHENOL Industrial group and a world-wide leader in rugged and harsh environment interconnects with the largest array of I/O and products ranging from IP65 to IP69K. This includes also M-series connector families like M8 and M12 which are well established in the industrial market.

Now AMPHENOL LTW extends its M8-series with an exclusive pushlock connector for your space-constraint applications. With audible feedback and guided key design, this HS-LOK Series ensures error-proof and easy assembly for blind mating. Designed to meet IP68 waterproof protection and rated to UL-F1 UV resistance, these connectors are fit for use to either indoor or outdoor wet locations. The HS-LOK connector series is rated up to 5A for both Low Voltage Power and Data transmissions. The product range includes 2 to 6 contact configuration and Hybrid (Power+Data) solution to suit your variable requirements. Typical Applications: LED lighting, communication systems, IP CCTV & security, industrial automation, electric vehicle,..

S10

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Connection System of the ePower-Lite Series

The ePower-Lite series from AMPHENOL Industrial Products Group has been especially designed for the hybrid and electric vehicle markets. These connectors feature a lightweight plastic shell and compact design to provide both weight and space savings in vehicle architecture

With this series AMPHENOL offers a medium amperage connection system that is rated to up to 70A of continuous current and which has an operating voltage of 800VDC.

The ePower-Lite features 2-way, 3-way and 4-way systems with optional HVIL and EMI shielding for safety and performance. It incorporates 3.6mm terminals with AMPHENOL's patented RADSOK® technology to achieve higher current ratings, lower insertion forces and lower temperature rise and contact resistance. Due to the low insertion force, no mechanical assist is required.

These touch-proof connectors are RoHS compliant and can be used for charging, for accessory power or anywhere a sealed medium power connector is required. The ePower-Lite can be mated a minimum of 100 times. This connector series has a UL 94V-0 flammability rating, an IP67 rating and an operating temperature range from -40°C to 125°C.

Here again, a list of the essential specifications:

- 70A continuous current
- Operating voltage of 800VDC
- 100 mating cycles minimum
- IP67 rated
- Operating temperature range from -40°C to 125°C

S11

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Connect your World with SPEEDTECH

A Global supplier for highly precision components and services

SPEEDTECH is specialized in the manufacturing of connectors and is certified according to ISO9001 and 14000. The company primarily provides high speed, high frequency and highly precision connectors, with fully automatic technology, including stamping, injection molding, auto assembly, CCD inspection and packaging. Due to the fully in-house design customer specific solutions, e.g. different colours of the plastic materials, are possible.

Focus products of SpeedTech are:

RJ45

- Up to 10G Base-T
- Integrated magnetics
- Extended temperature range from -40°C to +85°C
- Large variety of different port combinations
- Combo connector with USB option
- Individual LED configurations
- Optional surge protection
- PoE/PoE+ on request
- Low-profile versions for space-critical applications

USB Typ C

- 3.1 Gen2 certification for plug/receptacle
- High-speed transmission up to 10Gbps
- Supporting high current
- Symmetrical design – a type C plug can be inserted in both orientations into the receptacle
- Special waterproof type
- Different types of connectors for various applications

S12

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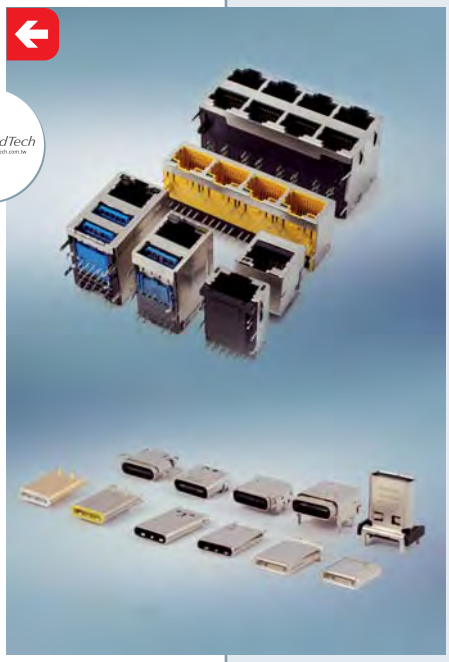

New S-Series in the Y-Circ® P Family

After the successful establishment of the B series on the market, the S series is now available with a hermaphroditic connector. The S series, like the B series, is implemented in protection class IP50.

YAMAICHI Electronics is continuing to develop the push-pull circular connector series Y-Circ® P. Now, in addition to the B series (IP50), there is also an S series (IP50) available with a hermaphroditic connector configuration. The same advantages of the B series are provided and assembly is just as easy and error-free using identical half-shells.

The hermaphroditic connector means that the insulator is divided, with male and female contacts installed in both plug and socket. That makes the connection easy and secure.

All connectors in the S series also have a marking in the form of a blue dot with the YAMAICHI logo. That makes connection and finding the coding particularly easy.

S13

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THE 2016 UEFA EUROPEAN CHAMPIONSHIP AT CODICO

Some of the people at CODICO scored well in the in-house European Championship Tip Game, and were delighted about the prizes received!

Thomas Pointner, Company Fronius was happy to win one of CODICO's Smart Activity Trackers

CODICO's Sales Engineer Michael Sukal handed over a soccer trikot to our winner Florian Lehner, Company Technosert Electronic

In the run-up to the 2016 UEFA European Championship, CODICO thought a lot about how to let their customers participate in the football event of the year. What they came up with was the Championship calendar, in which the results of the games could be recorded. These were distributed not only by the CODICO's sales teams, but were also attached to the tenth edition of ElektronikPraxis.

Fans who were keeping their fingers crossed for the German or Austrian national teams were particularly enthusiastic about fan tattoos with the appropriate national flag. Another highlight for our customers was the online Tip Game, where they could put their football knowledge and feeling for the outcome of the game to the test. The CODICO European Championship Tip Website took in the tips on results submitted by the participants, and points were awarded for those which turned out to be correct – or at least almost correct.

This drew a lot of would-be winners in, especially with the really great prizes on offer for the top twenty scorers: CODICO's top prize winner can look forward to two VIP tickets for a home game at Arsenal in London, with the »Gunners« in the Premier League, including travel and accommodation in a four-star hotel – the trip of the year. CODICO's second prize is also a fabulous trip out, this time to Hamburg, to the football charity event, »Spiel der Legenden«, Game of the Legends, at the Millerntor Stadium. Winners 3 to 10 can choose a European Championship outfit of their favourite team, while 11 to 20 can be motivated to peak sports performance with a Smart Watch Activity Tracker.

We are really pleased if you shared in the passion with CODICO, and we'd really like to have your feedback about this really exciting time!

D03

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CODICO - the Fastest Distributor*

*according to Business Run results in 2016

»NEVER CHANGE A WINNING TEAM« – that's the motto which saw five COIDCO teams with their famous blue running shirts at the start line again this year, and all set to go.

The weather was ideal on Thursday, 8 September 2016, with more than 30,000 runners at the Ernst Happel Stadium to take part in the 16th Wien Energie Business Run. Of course, CODICO was there again, with five sensational teams all eager to prove just how fast they could be. The course runs for 4.1km through the Wiener Prater and ends with three-quarters of a lap of the Ernst Happel Stadium. CODICO's runners took it in their stride, and the results speak for themselves: The competition was only really worth a semi-serious glance, with CODICO right in the lead. No contest - CODICO is the fastest distributor in Austria! And that makes their motto all the more relevant. »NEVER CHANGE A WINNING TEAM« – that's how CODICO started, and that's how they won. Actually, our teams did their best! We offer our warmest congratulations to those who took part – and we're looking forward to doing it again, at the Business Run 2017!

D04

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CODICO honours best suppliers with »Supplier Awards«

Delivery reliability, focus on service, innovation, co-operation, flexibility, and sustainability – these were the key criteria for granting the Supplier Awards, with which CODICO has honoured the best from among a total of more than 150 suppliers.

Close co-operation with highly competent and capable suppliers is a particularly important and ongoing contribution to the success of the company. It is one of the fundamental preconditions for our work, and that means it is assessed every year on the basis of comparable criteria. The regular evaluation of our suppliers is a tried and trusted means of identifying particular and special capacities and capabilities easily and meaningfully. The CODICO QUALITY AWARDS for services provided in 2015 were granted to:

DINKLE INTERNATIONAL CO.,LTD.	99
Celain Technologies Enterprise Ltd.	96
MPS International.	96
Silver Telecom	95
Taitek Comp. Co. Ltd.	94
Power Integrations International, Ltd.	92
Rubycon Corporation	91
Sagami Electronics Co Ltd.	91
MURATA	90

We wish every success and our grateful thanks to our suppliers for their excellent performance and for a co-operation firmly founded on trust.

D05

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CODICO TEAM

Hello readers!

Michael Sukal

Hello, dear Impulse readers! After 4 years of working at CODICO, I now also get the opportunity to introduce myself.

After attending the technical secondary school, completing my studies in electronics, and acquiring the first 6 years of professional experience in the field of interconnect systems, I joined CODICO in November 2012. As a sales engineer, I am in charge of support for the West of Austria and responsible for the development and expansion of interconnect systems. The combination of my professional education, experience and the warm welcome I received at CODICO, as well as the support of the entire CODICO team made it easy for me to quickly feel at home and perform to the full.

What makes my job particularly exciting and diversified is the continuous emergence of new technologies in the area of interconnect systems. The main focus of my work is to present the resulting trends and future opportunities to our customers. A customized design and the ensuing technical conversations and explanations both with the customer and the supplier are what makes our projects so attractive and demands our full expertise on a daily basis.

For me, sports represents a perfect balance to the work routine. Whether running, cycling, weight training, or tennis, 3 to 4 times a week is a must. It's a wonderful way to unwind. The only thing that beats that is my absolute favourite, scuba diving. Most holidays are planned and organised in a way that allows me to spend as much time under water as possible. Of course, this also requires training in Austria's lakes on several weekends. When the winter time comes, however, I have to swap diving in Austria for skiing. Just like in sports, the following applies to my working life: Keep fit and continue learning, then you will stay ahead.

D06

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Christine Antoniuk

My name is Christine Antoniuk. I have two daughters aged 6 and 2, and I live in Austria, south of Vienna. I can count myself as one of the »old hand«, having been part of the Codico team for 14 years. I have had the good fortune to have worked in several different sectors over the past few years, and that has allowed me to gain a broad knowledge from a variety of viewpoints. For the first few years I worked in the Accounting department, and then I moved to the Sales department. In September 2009, while still working, I achieved my Bachelor's degree »BWL – Business consultancy with specialisation in Market Communications and Marketing«, with Distinction. Following this, my private life took priority, and in 2010 I gave birth to my daughter Caroline. After 20 exciting months of nappy and picture book management, I came back to CODICO, and for two years I worked as a marketing assistant. My second daughter Isabella was born in 2014, and again I spent some lively and intensive time with my girls. Since the beginning of March this year I have been bolstering our Passive Components team in the Sales department. Being responsible for Key Accounts in Austria and Germany, I am the first line of contact for our customers, and at the moment I am setting my focus on becoming precisely acquainted with the full breadth of our product portfolio in passive component elements, which means I can sometimes get very wrapped up in details. I particularly enjoy the direct contact with the customers, working on projects together, supporting great ideas, and bringing them to success. I look forward to coming to the office every day, because I know there's a highly motivated and good-humoured team waiting for me. And, as well as that, I can be certain of support from my colleagues, all the time, every time.

I most like spending my leisure time with my husband and my two girls, in the fresh air. My husband is a passionate photographer, and I love it when he immortalises many of our moments together, so that we can take pleasure in little things too. If there's any time left over between professional activity and family, I try to keep myself fit with sport: In winter it's skiing, and in summer with all kinds of outdoor activities. I need music and coffee in my everyday life, and without them I'm only half-operational. I relax best in the evenings, with a good book.

D07

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Andreas Hanausek

After almost four years, I'm back with CODICO again, and that lets me join the ranks of those who have rejoined CODICO. Fifteen years after my first presentation, here I am to introduce myself to you once more. My name is Andreas Hanausek, I'm 36 years old, and I live in the district of Mödling. After completing my studies at a technical college in electrical engineering and gaining my first experience in sales at CODICO, I moved further afield, not least due to my advanced technical studies at the University of Applied Sciences (FH), this time in electronics and economics. During this period I worked in Milton Keynes in England, at an American-Japanese power supplier manufacturer, in the distribution control sector and as a group leader for indirect marketing for Eastern Europe and the Middle East at an American telecoms and measuring technology provider. It was in this position in particular that I acquired my passion for travelling, since, among other things, I had to go to offices in the USA, as well as sales offices outside the EU. Much travelled but still with a few places to go, I was happy to be back with CODICO at the beginning of 2013, this time as product manager and FAE for power supply systems. What really draws me to my present position at a now much larger CODICO is the opportunity actually to build up a product sector and develop it further. »Build it up« may well be the wrong term to use here, because I inherited this sector from my former mentor, who was the »power man« at CODICO for fifteen years. I particularly like being able to get close to the customers – that is, to you and your colleagues – which simply wouldn't happen any longer in this position at the bigger companies. After a good ten years in the sector, I really value the opportunity to develop the product sector and the very wide range of possibilities for shaping it, thanks to the close co-operation with suppliers. There is something unique about the variety and versatility of working in a position which enables me to be on the spot, both at the developer as well as at the supplier audit at the other end of the world. And that's precisely what our suppliers also appreciate. In my private life I love travelling, as far away as possible, and always close to the sea. When it comes to sport, I'm a fine weather runner, not too hot and not too cold, but still always highly motivated. I spend my leisure time with my family, which is constantly growing without too much input from me, and due largely to my partner's siblings, who have a wealth of children. The large number of birthdays and other family holidays again explains my motivation when it comes to sport.... And so now I've been back almost four years again with CODICO. I'm excited about how the company is developing – and I'm proud to be part of that development. I hope soon to be able to meet you personally.

D08

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Sergio Rossi

Hello CODICO Impulse readers, my name is Sergio Rossi, I am 53 years old and from Italy. In December 2012 I started to work for CODICO and today I'm responsible for the Italian Active division. It will been 4 years with CODICO in December but it only feels like yesterday that I started this new challenge. Currently, as Italian Active division, we have a beautiful office in Treviso. We are four Italian colleagues for the Active team while we are constantly increasing revenue, enlarging customers' base and deepening our customer relationship - mainly in industrial, medical and automotive markets. I love my job which allows to create new fields of business, increasing them steadily and having the consent of the people and companies.

Our customers appreciate our professional work – from offering devices to help their R&D and to deliver always on time. The market is appreciating our skills and our efforts, so today more people are asking us for our advice in their projects.

My personal work experience started in 1985 with a small Italian distributor. Afterwards I worked for other electronic distributors for 15 years. I have gained experience in sales, marketing and taking over responsibility for a sales team. In 2001 I was part of Xilinx, the biggest FPGA maker, where I spent 8 years being responsible of the two tier Italian customers and part of the sales team of the Xilinx's distributor. It was a good experience for some markets segments like military, medical, and industrial.

I'm based in Nova Milanese which is a small city 8kms north of Milan and I am working from home office. I'm married and I've a 21 year old daughter. In my private life I spend my free time travelling with the family in Italy and lately around Europe. My favorite hobby is model aircraft which gives me the possibility to spend time with friends in an airfield club for this type of aircraft. I'm also part of an Italian acrobatic team, we participate in contests in Italy during the spring and summer. In the cold seasons we prepare the aircraft for the coming year.

Back to CODICO again, I value CODICO as a very good company and a very positive place to work. As I've already said before regarding the organization: CODICO is similar to bigger Silicon companies like Xilinx, Altera, etc. which gives us the opportunity for a personal and professional common growth.

That's why I'm happy to be part of this team.

D09

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