ENGLISH

CODICO®

impulse

2/2018

Out of the MLCC dilemma!

INTEL: Movidius™ – Neural Compute Stick

C.C.P. – Experts for Pogo-Pins

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In addition to the high number of ceramic capacitors used in mobile phones and car phones of the latest generation, there is also a wide range of other applications such as IOT, network technology, and digitalization, all of witch count towards the massive increase in use. A better long-term solution for the MLCC dilemma might therefore be to check if similar results could be achieved with other technologies.

ACTIVE COMPONENTS

PASSIVE COMPONENTS

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CONNECTORS

CODICO IN-HOUSE

Supplier management at CODICO

At CODICO, we see a positive cooperation with suppliers as indispensable for offering quality to our customers at all levels. Respect and appreciation are prerequisites for fair and collaborative business dealings. From supplier selection through to supplier development, CODICO ensures that the focus constantly remains on the requirements of our customers.

Supplier basis

We carefully select our suppliers on the basis of predefined criteria such as, e.g. scope of services, product quality, and certification status. Supplier agency agreements and quality agreements foster legal certainty for all business partners involved.

Supplier evaluation

Collaboration with efficient suppliers guarantees an outstanding and lasting contribution to corporate success. It is the main prerequisite for our work, and is therefore annually assessed on the basis of comparable criteria. Delivery reliability, focus on service, the ability to innovate, co-operation, flexibility, and sustainability – these remained the central criteria for this year's Supplier Award, which CODICO presented to the best of its more than 150 suppliers. The CODICO QUALITY AWARDS for performance during 2017 were presented to:

DINKLE, TAITEK, 8DEVICES, CELAIN TECHNOLOGIES, ASAHI KASEI MICRODEVICES, TOREX, RUBYCON, SUMIDA, NIDEC COPAL

Supplier development & promotion

Promoting a partnership relationship with our suppliers is essential to us. With several of our suppliers, we maintain an intensive partnership that has lasted for decades. The creation of interdisciplinary quality networks, a quicker and more direct information flow, the ability to identify trends, and the possibility to exert influence on the manufacturer with regard to design makes us a strong partner for our suppliers, so we can deliver added value to our customers together. Do you want to find out more about our QSM system? Please contact

D01

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Sven Krumpel
CEO CODICO

Cooking-Event at the »CODICO Academy Week«

Editorial

Dear readers!

Today pluralism has become a dominant topic in our society. For most of the time, however, it is used in a negative context. Newspapers are strewn with hostile headlines, politics is turning more radical, and we are becoming increasingly apathetic toward extreme utterances! I sometimes have the feeling that our society is being thrown off balance.

What does the notion of tolerance mean today? Are we just using the word, without being fully aware of its meaning? Just to hide under a veil of innocence? Do we practice tolerance? Or is restraint the only step we are willing to take for the sake of others?

People from 18 nations are employed at CODICO, we speak a multitude of languages, we celebrate different festivities, and we belong to different religions! I personally find this diversity enriching, a challenge that brings with it dynamism and innovative solutions!

In 2018, we placed a particular focus on the topic of diversity within the company, implementing several exciting projects under this theme. For instance, we organised a cooking evening on the 19th of September, which introduced us to the culinary treasures of different cultures. For more on this, go to page 53.

I see a lot of potential in our diversity, because it opens opportunities and an awareness of appreciation. This is what CODICO stands for – and I am proud of our employees, because we do treat each other in the spirit of »Everyone smiles in the same language!« It could all be so simple – and not just within a company!

This cooperation, this sense of solidarity are the main pillars of our success! You, our customers, have acknowledged this by presenting us with the »Distributor of the Year« award. I am very proud to receive this distinction – which I pass on to my team, who live and breathe diversity.

D02

Sven Krumpel

MOVIDIUS™

Neural Compute Stick

The INTEL® Movidius™ Neural Compute Stick (NCS) is a tiny, fanless deep learning device that you can use to learn AI programming at the edge. NCS is powered by the same low power high performance INTEL® Movidius™ Vision Processing Unit (VPU) that can be found in millions of smart security cameras, gesture controlled drones, industrial machine vision equipment, and more.

Enabling Machine Intelligence at High Performance & Low Power

INTEL® Movidius™ VPUs are uniquely designed for high performance at ultra-low power for computer vision and AI workloads. According to the specification the Myriad 2 VPU needs only 1 Watt for 100 GigaFLOPs with half precision.

Unique VPU Architecture

The design principles for INTEL® Movidius™ Myriad™ VPUs follows a careful balance of programmable vector-processors, dedicated hardware accelerators and memory architecture for optimized data flow. Myriad VPUs feature a software-controlled, multi-core, multi-ported memory subsystem and caches which can be configured to allow a large range of workloads. This proprietary technology allows for exceptionally high sustainable on-chip data and instruction bandwidth to support an array of SHAVE processors, 2 CPUs and high-performance video hardware accelerators.

In order to guarantee sustained high performance and minimize power, the Movidius™ proprietary processor called SHAVE (Streaming Hybrid Architecture Vector Engine) contains wide and deep register-files coupled with a Variable-Length Long Instruction-Word (VLLIW) controlling multiple functional units including extensive SIMD capability for high parallelism and throughput at both a functional unit and processor level.

The SHAVE processor is a hybrid stream processor architecture combining the best features of GPUs, DSPs and RISC with both 8/16/32 bit integer and 16/32 bit floating point arithmetic as well as unique features such as hardware support for sparse data structures. The architecture is designed to maximize performance-per-watt while maintaining ease of programmability, especially in terms of computer vision and machine learning workloads.

Deep Neural Networks on Myriad™ VPUs

In order to deploy on-device Deep Learning applications, performance and precision at very low power are critical. INTEL's Movidius™ Myriad™ VPU platform has a number of key elements suited to running deep neural networks.

- Performance: the raw performance of Myriad's SHAVE processor engines achieve the hundreds of GFLOPS required in fundamental matrix multiplication compute that's required for deep learning networks of various topologies.

- On Chip RAM: deep neural networks create large volumes of intermediate data. Keeping all of this on chip enables our customers to vastly reduce the bandwidth that would otherwise create performance bottlenecks.

- Flexible Precision: Native Support for Mixed Precision and Hardware Flexibility – the ability to support Deep Learning networks with industry-leading performance at best-in-class power efficiency is supported by Myriad's flexibility in terms of mixed precision support. Both 16 and 32 bit floating point datatypes, as well as u8 and unorm8 types are supported. Additionally, various hardware accelerators are utilized to provide the flexibility needed to achieve high performance for convolution computation.

- High performance libraries: The development kit includes dedicated software libraries that go hand-in-hand with the architecture to support sustained performance on matrix multiplication and multidimensional convolution.

Applications for Intelligent Machine Vision

SMART Security

Security and surveillance technology is getting a huge boost from deep learning based video analytics. Imagine, a doorbell camera that not only alerts you to a visitor, but has already identified them as a courier. Visually intelligent cameras can detect fires from heat maps and home security products will be able to not only detect who is at home, but also be able to flag unusual situations automatically.

By bringing INTEL's Movidius™ Myriad™ VPU intelligence to our security and surveillance, these new systems can detect and then intelligently act on data in real-time, providing safe and personalized security to homeowners and businesses alike.

Robotics

Drones and household robots are increasingly small and affordable enough to become serious consumer product categories. As new types of service, companion and collaborative robots emerge, these devices are demanding visual intelligence in order to navigate, understand and proactively assist us in our daily lives. INTEL® Movidius™ provides the platform to create visually intelligent drones and robots without sacrificing size, battery life or performance.

Augmented and Virtual Reality

Virtual Reality (VR) and Augmented Reality (AR) devices are hitting the market and technological demands on the hardware are huge: gesture recognition, head tracking and object recognition are just a few of the necessary technologies to convincingly blend the real world with the digital.

INTEL's Movidius™ Myriad™ VPU technology allows VR and AR devices to crunch huge amounts of data at low power and ultra-low latency, two absolute must-haves for compact head-worn devices.

Wearables

Wearables are emerging as a category of devices that can augment our lives in meaningful ways. By passively filtering visual information and acting on cues relevant to their user, the dream of a truly capable digital assistant is in sight. Ultra-low power, high performance vision processors mean that even the smallest wearable devices can benefit from visual intelligence.

Movidius™ VPUs allow devices to remain small and battery efficient, yet provide powerful new applications based on the rich variety of visual information available as users go about their daily lives.

Read more: *http://developer.movidius.com*
If you have further questions, please contact:

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BOOST-CONVERTER FOR »PORTABLES«

The superior properties of Li-ion batteries, such as high energy density, light weight, no memory effect, and less self-discharge, make them a very popular option in portable applications.

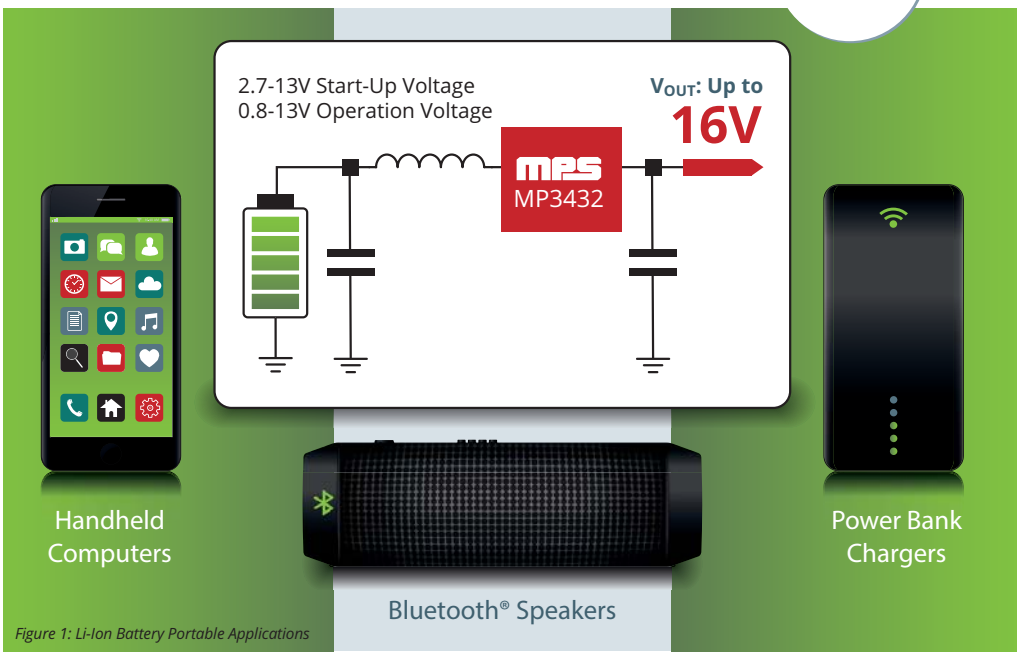


Figure 1: Li-Ion Battery Portable Applications

ICs with boost topology are needed in portable applications since the voltage fluctuation of most Li-ion batteries ranges from 4.2V (fully charged) to 3.0V (fully discharged), while the post-circuit input voltage is up to 12V or more. Portable applications, such as Bluetooth audio, quick-charge power banks, and portable POS systems employ various boost products available in the market, including discrete controller with external MOSFETs, non-synchronous boost converters with external diode, limited input/output voltage range or features (Figure 1).

These solutions take up more space, require more components while providing less efficiency, and compromise performance in terms of noise and reliability.

The MP3432 from Monolithic Power Systems (MPS) operates from an input voltage as low as 2.7V, supports an operating input voltage from 0.8V to 13V, and an output voltage up to 16V. Furthermore, the MP3432 integrates two synchronous MOSFETs with optimized features, such as a programmable switching current limit up to 21.5A, up to 30W of load power from a 1-cell battery, pass-through mode in pulse-skip mode (PSM) operation, various operation modes, and high power density in a QFN (3×4mm) package.

The MP3432 achieves peak efficiency up to 97% at a 4.2V input voltage and more than 85% in the main operating range with excellent thermal performance (Figure 2 & 3).

Small Size, High Power Density

The MP3432 eliminates the need for inefficient and bulky external Schottky diodes by integrating small 6.5mΩ and 10mΩ RDS (ON) power MOSFETs using MPS' latest process technology, advanced circuit design techniques, and packaging technology.

Residing in a (3×4×0.9mm) QFN package, the power density of the MP3432 is 40.9kW/inch³, making it one of the only commercially available boost converters with the highest power density in the 30W class. Additionally, the MP3432 adopts a constant-off-time (COT) control topology, which provides fast transient response and reduces the output capacitance, which further contributes to reducing the overall solution size.

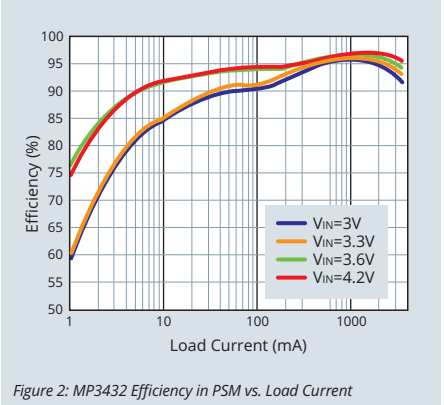


Figure 2: MP3432 Efficiency in PSM vs. Load Current

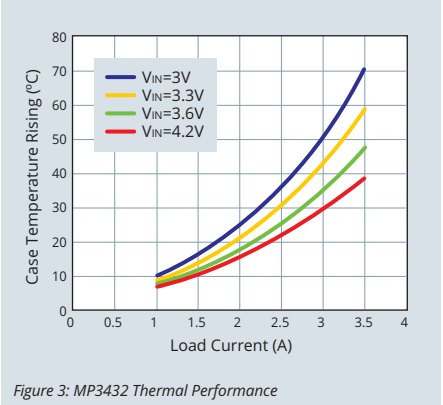
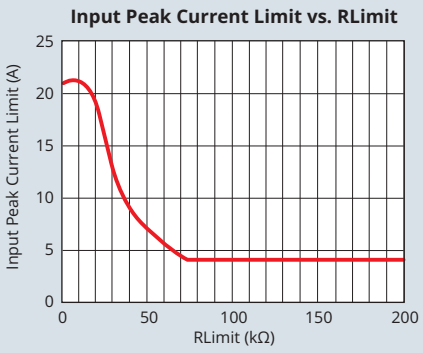


Figure 3: MP3432 Thermal Performance

Enhanced Performance & Reliability

In battery-powered Bluetooth audio applications, not only is the audio quality critical, but so is the battery life. The MP3432's MODE pin supports the selection of PSM, forced continuous conduction mode (FCCM), and ultrasonic mode (USM) in light-load condition. The MP3432 can achieve high efficiency in PSM, produce a very small V_{OUT} ripple in FCCM, and prevent audible noise in USM. The MP3432 uses a programmable



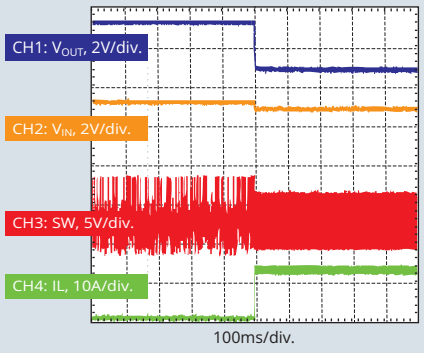


Figure 4: MP3432 Offers Accurate Input Peak Current Limit

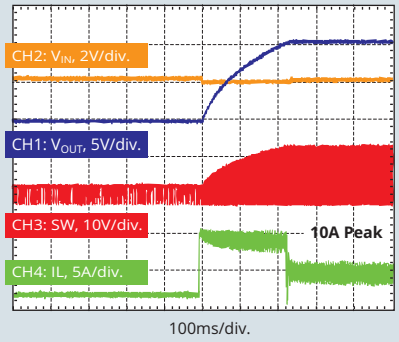


Figure 5: MP3432 Output Voltage Transient

switching peak-current limit to provide accurate overload protection for many different applications. The peak current limit can be programmed accurately through a resistor on the I_{LIM} pin and can be calculated with Equation:

$$I_{LIM} = \frac{320}{R_{ILIM} - 4}$$

Where R_{ILIM} is the resistor on I_{LIM}. With this resistor, the MP3432 peak current can be programmable from 4A to 21.5A. In each cycle, the internal current sensing circuit monitors the lowside MOSFET (LS-FET) current signal. Once the sensed current reaches the setting current limit, the LS-FET Q1 turns off (Figure 4). The programmable peak current limit can meet different requirements in many applications. Figure 5 shows that MP3432 can charge the output voltage quickly at the maximum power, and there is no overshoot in the transient if the output voltage transitions to a higher value. The MP3432 can work in pass-through mode (PSM) by setting the MODE pin low. In PSM, if V_{IN} is higher than V_{OUT_SET}, the MP3432 runs into auto-pass-through mode, in which the high-side MOSFET (HS-FET) is always on and the LS-FET always off (see Figure 6). Pass-through mode prevents HS-FET body-diode conduct power loss when V_{IN} is higher than V_{OUT_SET}. Figure 7 shows the performance when V_{IN} is larger than V_{OUT} in a similar device without pass-through mode in PSM and the body diode is working.

Pass-through mode is very useful in Bluetooth speakers. The output voltage of the boost converter must be directly proportionate to the audio signal of a Bluetooth speaker. If the audio signal or the airflow is very small, the output voltage must decrease to as low as V_{IN} to save boost switching power loss. However, traditional solutions can only support high output boost switching mode. This may cause bad sound quality at the small audio signal. Even if the body diode of the old solutions work, the efficiency and thermal performances are not optimal, and the worst-case scenario would result in power MOSFET damages at a high load current due to the body diode temperature rising (see Figure 8).

However, the MP3432 can work in pass-through mode, providing excellent sound quality and no smoking without high temperature or damage issues. Figure 9 shows the performance when V_{OUT} is decreasing to be equal to VIN for another device without pass-through mode in PSM and the body diode is working.

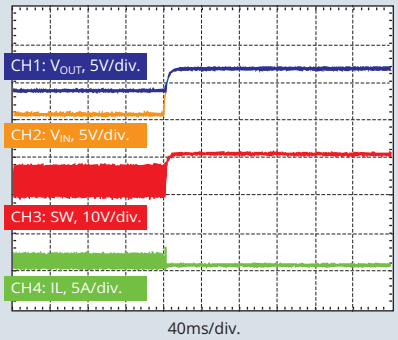


Figure 6: MP3432 Pass-Through Mode in PSM

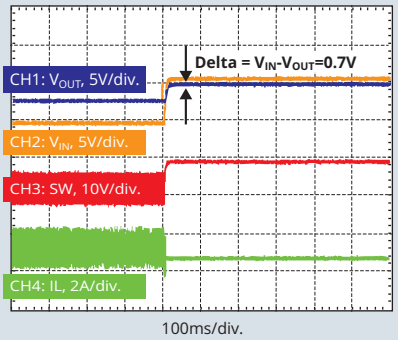


Figure 7: Another Device without Pass-Through Mode in PSM

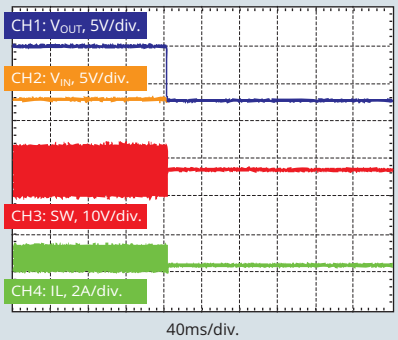


Figure 8: MP3432 Pass-Through Mode in PSM, V_{OUT} Decreasing

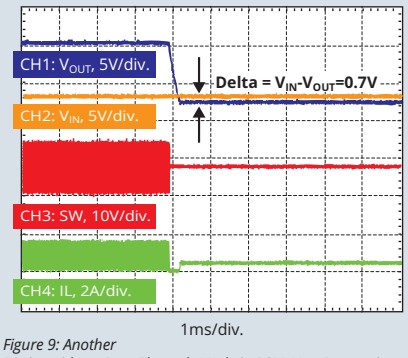


Figure 9: Another Device without Pass-Through Mode in PSM, V_{OUT} Decreasing

Conclusion

The MP3432 from MPS is a perfect choice for the first stage of battery-powered systems. The MP3432 can supply 30~40W of power to systems from the battery input target for portable applications and consumes the lowest power possible in standby and idle modes while still providing high efficiency at very low current levels, resulting in a longer battery life and application run time.

The MP3432 enables excellent performances at all load ranges and offers the most efficient and extensive product portfolio for portable solutions on the market today.

A02

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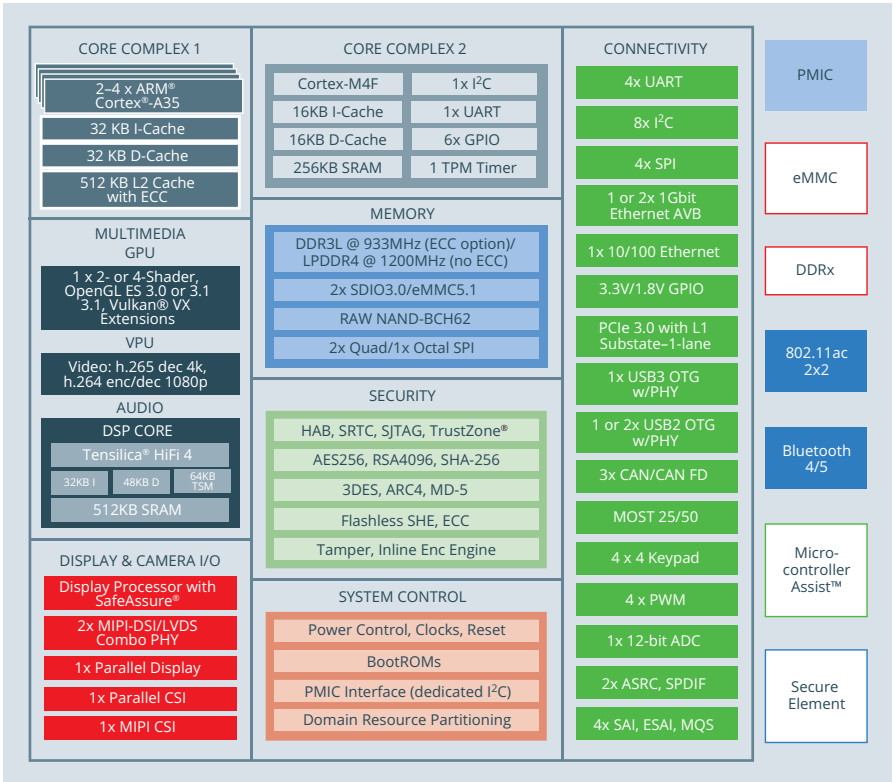
CONNECTCORE® 8X

DIGI continues to be at the forefront of delivering embedded technology tailored to the needs of industrial and medical device manufacturers. As the next generation member in the DIGI ConnectCore® family, built on NXP's new i.MX 8X application processor, the DIGI ConnectCore® 8X provides a complete and secure system platform to build connected intelligent devices.



NEXT GENERATION IOT EDGE INTELLIGENCE

DIGI removes the complexity of IoT integration by delivering a complete system for secure next-generation cloud and compute services enablement, including AWS IoT, AWS Greengrass, and Microsoft Azure integration.

SMTplus®: SMALLEST SIZE, NO COMPROMISE

Unique, patent-pending form factor simplifies and reduces costs while increasing manufacturing flexibility with LGA or castellated edge via mounting options. DIGI SMTplus® eliminates the need for board connectors and provides access to all 474 pins maximizing performance and functionality.

IT'S ALL ABOUT CONNECTIVITY

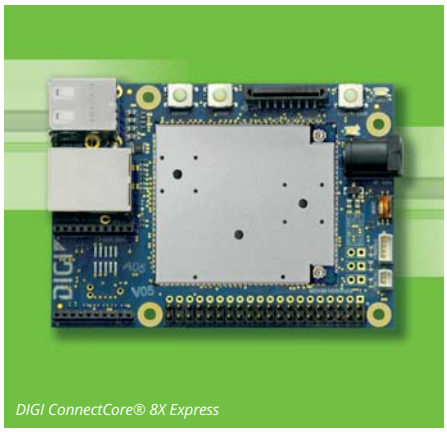
DIGI ConnectCore® 8X is the intelligent communication engine for today's secure connected devices. It seamlessly integrates dual-band Wi-Fi (802.11ac), dual gigabit Ethernet, Bluetooth Smart Ready connectivity, and is ready for cellular modem and DIGI XBee integration right out of the box.

BUILT FOR DEMANDING APPLICATIONS

DIGI ConnectCore® 8X is built for reliability in medical, transportation, security, building automation, and industrial applications including IEC 60068 transportation certifications, IEC 60601 certifications, HALT, making it ideal for use in highly regulated industries and harsh environments.

DIGI Trustfence®: SECURITY BUILT IN

Device security is a critical design aspect for every connected device. The DIGI ConnectCore® 8X combines a secure module platform with a complete embedded device security framework. Build products today that deliver security and peace of mind now and in the future.



DIGI ConnectCore® 8X Express

Here a just a few of the many features in ConnectCore® 8X:

- Industrial i.MX 8X quad/dual core SOM and SBC platform family
- DIGI SMTplus® form factor (40×45 mm) for ultimate reliability and design freedom
- Power Management – both hardware and software support for low-power designs
- Multi-display and camera capabilities with hardware acceleration
- Pre-certified dual-band 802.11ac 2×2 and Bluetooth 4.2 connectivity
- Seamless cellular modem and DIGI XBee3™ connectivity integration
- Cloud and compute services integration
- DIGI TrustFence® device security built in
- Yocto Project Linux and Android support

A03

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POWER FOR IOT

RECOM

RECOM's latest 15W and 20W AC/DC power supplies are designed for low power IoT and household applications. Based on the footprint of the compact RAC10-K modules, these new releases feature high-efficiency over a wide load range and minimal standby power consumption.

The RAC15-K and RAC20-K series are PCB-mount AC/DC modules with ultra-low energy losses especially under light load conditions. This makes them ideal for the always-on and standby mode operation needed for IoT and smart home devices.

Based on the latest developments of integrated power, efficiency reached the next level, allowing 20W of power in a 2×1" footprint design. These AC/DC converters come with universal input voltage range of 85VAC up to 264VAC for worldwide use and feature international safety certifications for industrial, AV and ITE as well as household standards.

Both the RAC15-K and RAC20-K are able to operate within a temperature range of -40 to +80°C and offer fully protected 5-48VDC single outputs as well as 12 and 15VDC dual outputs. Optional wired versions for off-board installations are available on demand. The RAC15/20-K stay way beneath EMC class B limits with no need for any external components. Samples are available from CODICO as of now.

A04

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RED-BEAN

Devices

Radio-Module for Wi-Fi + Bluetooth

The new RED-BEAN module from 8DEVICES is based on the QCA9377-3 radio chip from QUALCOMM and allows the connectivity of Wi-Fi and Bluetooth® applications to a host processor.

The radio-module is available in two versions, with integrated antenna in 24×12mm (BLUE-BEAN-A) or with MURATA HSC type connector MM4829-2702RB0 in 17×12mm (BLUE-BEAN-C).

In Wi-Fi mode, the bandwidths 20MHz, 40MHz and 80MHz are supported with a maximum data rate of 433Mbps (Single Stream, Multi User, Wave 2, 11ac) and an output power of maximum 20dBm. Beside 802.11ac @ 5GHz the module offers also the 2.4GHz band, which ends up in the support of all established Wi-Fi standards 802.11 b/g/n/a/ac.

Wi-Fi is connected to the host via SDIO3.0 whereas Bluetooth v4.2 + HS (backwards compatible with v1.x and v2.x) finds connectivity via UART. The modules are supported by Linux and Windows drivers. The temperature grade is defined for -40 to +85°C.

Further information is provided here:
http://downloads.codico.com/misc/AEH/8Devices
If you have further questions, please contact:

A05

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BUILD A SMARTER WORLD

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With a broad portfolio of cellular and positioning modules, QUECTEL M2M modules can be applied in wide range of applications including but not limited to automotive, telematics, smart metering, wireless POS, tracking and tracing, security and mobile health. All QUECTEL modules conform to international quality standards and are pre-certified.

As an example: LTE BG96G Cat.M1-NB1 & EGPRS Module

BG96G is a LTE Cat M1/Cat NB1/EGPRS module offering a maximum data rate of 300kbps downlink and 375kbps uplink. It features ultra-low power consumption, and provides pin-to-pin compatibility with QUECTEL LTE module EG91/EG95, Cat NB1 (NB-IoT) module BC95, UMTS/HSPA module UG95/UG96 and GSM/GPRS module M95. With a cost-effective SMT form factor of 26.5×22.5×2.3mm and high integration level, BG96G enables integrators and developers to easily design their applications and take advantage from the module's low power consumption and mechanical intensity. Its advanced LGA package allows fully automated manufacturing for high-volume applications.

A rich set of Internet protocols, industry-standard interfaces (USB/UART/I2C/Status Indicator) and abundant functionalities (USB drivers for Windows XP, Windows Vista, Windows 7/8/8.1/10, Linux and Android) extend the applicability of the module to a wide range of M2M applications such as wireless POS, smart metering, tracking, etc. The BG96G is a Modul that is global certified and easy to use in a lot of IoT applications.

For more power full solutions: Android LTE SC20 Smart Module

The SC20 System on Module is based on QUALCOMM's MSM8909 with a Quad Core A7 CPU @ 1.1GHz, running under Android 7.1 OS. In its standard version, it integrates 8GB NAND and 1GB DDR3 and a plethora of peripherals including 4G Cat 4 modem with 3G fallback, 2.4/5G Wi-Fi, BT, GNSS, K/B, Touch Screen Display and 2 Cameras. Interfaces include USB2, 2×RS232 @4Mbps, Audio, Video, I2C, SPI, ADC and GPIO.

Delivering up to 150Mbps downlink and 50Mbps uplink, the SC20 is ideal for industrial and consumer applications such as CPE, wireless POS, router, data card, automotive, digital signage, alarm panel, security and industrial PDA. It contains seven variants: SC20-E, SC20-A, SC20-J, SC20-AU, SC20-CE and a Wi-Fi & BT only version SC20-W. For the regions EMEA, Korea, Thailand, India, America, Japan, Australia, Taiwan, Brazil, China (CMCC, CUCC).

All modules use QUECTEL's powerful and intuitive HW development tools and SDK, users can quickly design competitive, feature rich products while maintaining a significant price advantage. »SC20 - Smart EVB Kit« are available.

A06

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The »SC20 - Smart EVB Kit« !

QCC3026

QCC3026, an Entry-Level Flash Bluetooth Audio SoC designed for Low Power consumption.

QUALCOMM has released a new entry-level flash programmable Bluetooth Audio SoC that is based on an ultra-low power architecture.

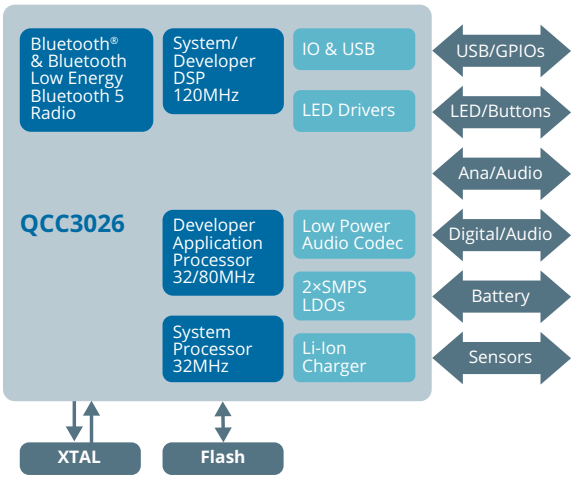
QCC3026 is designed for use in compact feature optimized QUALCOMM TrueWireless™ earbuds. The QCC3026 builds on the heritage of the QUALCOMM QCC51XX family but it is also optimized for small form factor, 3.98×4.02×0.5mm, for In-Ear applications enabling a totally wireless experience by eliminating the cord from one side to the other. To further enhance the functionality in these designs it also contains the TrueWireless™ Stereo Plus technology developed by QUALCOMM. This will be explained in more detail below but in short it gives even higher quality audio working together with QUALCOMM Snapdragon 845 based phones.

Looking at the feature set of the QCC3026, it is a Bluetooth 5 qualified product with a Dual Mode Bluetooth Radio, which means it has both a Bluetooth Low Energy Radio and a Classic Bluetooth Radio. On the BLE side it does have a Sensor Hub solution for managing sensors like for example heart rate, presence, ambient light etc. The Classic Bluetooth is then the bearer of the Audio stream.

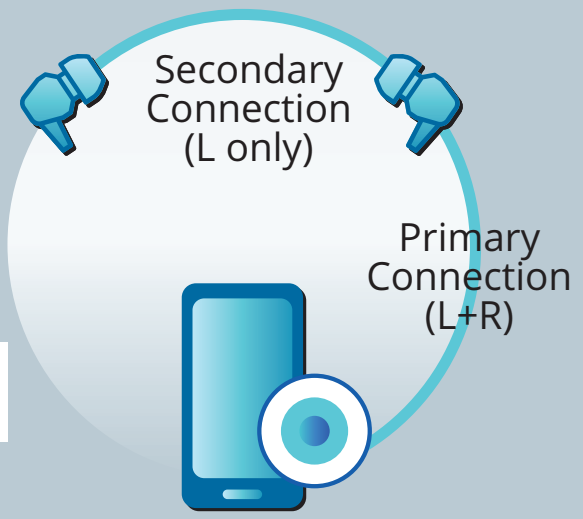
The QCC3026 also has a built in support for a button press activated Digital Assistant access mode, where the audio stream is relayed for processing in the handset or in a cloud service.

Furthermore the QCC3026 obviously have support for the QUALCOMM aptX audio streaming, giving proven high quality audio over Bluetooth as well as for the Echo and Noise cancellation features in the QUALCOMM cVc technology.

Example designs for different In-Ear based headphones will be released by QUALCOMM during the back end of Q4 2018 and Q1 2019. A more schematic view on architecture look like this:



Qualcomm TrueWireless Stereo



This is the functionality you can get if your Smartphone or table builds on a QUALCOMM Snapdragon 845 device. Here you can see that the Earbuds pair as a left and right unit to the phone and hereby bypass the whole challenge of getting the signal around the head from one side to the other. This gives an even more reliable link and also frees up even more bandwidth to the link for even more stability. If your phone does not contain a Snapdragon 845, the system reverts to the True Wireless Stereo functionality in the previous section automatically.

A07

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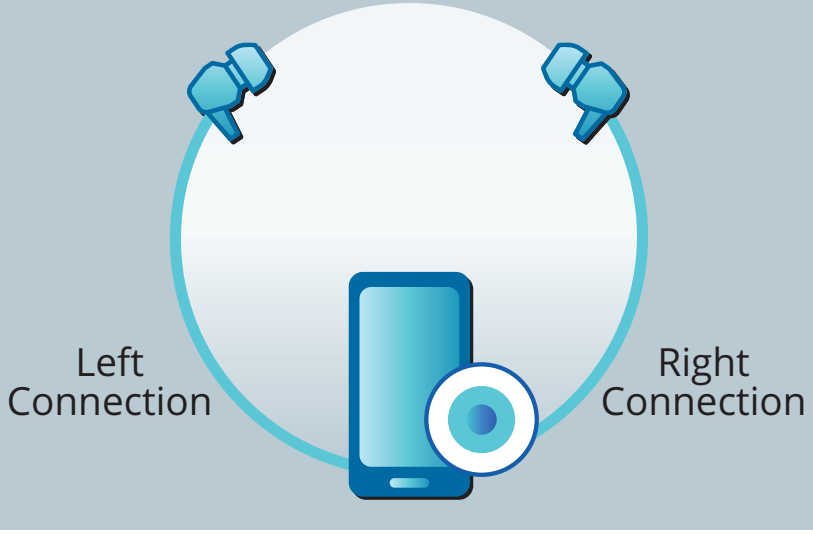
A more detailed look at TrueWireless Stereo and TrueWireless Stereo Plus:

With the release of TWS, or True Wireless Stereo, QUALCOMM was a pioneer in the effort to totally remove the wires in a headphone design. With the new version(s) of TrueWireless this has been taken a couple of steps further. If we start by looking at the TrueWireless Stereo in its latest shape it looks like shown.

This is the base of TWS functionality today and this is what will work with all Bluetooth 4.2 and above enabled sources (handsets, tablets etc.) What it does is that it takes the stream to one earbud, but instead of as previously streaming it all on to the other side it now breaks the stream up and just forward one channel to the other side. This frees up bandwidth for retransmissions not only cross head, but also cross body from source to the first Earbud giving you a much more reliable and robust link.

If we then move on to look at the True Wireless Stereo Plus technology, it enhances this even further:

Qualcomm TrueWireless Stereo Plus



ELECTRO VEHICLE & CHARGING STATIONS

New Products!

Amongst other things initiated by the pollution situation in our cities and worldwide, the automotive market is in transition. Hardly a week goes by without new announcements in the area of eMobility, which make realize that these change – away from the classical petrol or diesel drive towards electro vehicle is going to take place now.

Be it the domestic vehicle manufacturer who are now with increased intensity bring electro and hybrid vehicles into the market or new providers out of the Empire of the middle, China who are now as well pushing towards Europe with their electro vehicles or american manufacturers with new ideas and cars. The fleets of the parcel deliverers and craftsmen are increasingly electrified and city bus operators rebuild their fleets as well. Other commercial vehicle manufacturers do it right away and even lorries and two-wheelers are getting electrified. Constantly new alliances formed to position themselves as best in the just emerging market.

Besides the transition of the vehicle fleets a new marked is currently being created in the area of charging infrastructure, namely charging stations, starting with pure AC current charging over to high power DC charging, Combined Charging – CCS called all the way to the also new and upcoming wireless charging of electro vehicles. Up to now many market participants in the area of electro mobility cooked their own soup using different connector systems and different charging communication systems.

Japan used in their car which they expert to Europe the so called »CHAdeMO« charging system, Tesla put all their eggs into their own developed Supercharger, the Chinese developed with »GB/T« their own standard – all three based on CAN bus communication for charge control and billing. Also France went their own ways with their chameleon charging system used in Renault Zoe. The German car manufacturer set very early on international standards and helped decisively to develop the ISO/IEC 15118 standard. Due to the fact that it took long time to develop this standard they decided to freeze a certain level and issue it as German Industrial Norm DIN 70121. America later followed this example and derived applied the American standard SAE J2847/2 out of DIN 70121.

All these charging systems have not been and are still not compatible nor interoperable among themselves. This resulted in spending restraint at many potential customers and was certainly

besides the not too high battery range and the high cost one of the factors why electro mobility so far could not prevail. Meanwhile the international charging standard ISO/IEC 15118 and the associated test requirements have been developed to such an extent that almost all market participants have decided to use and to apply it. The website of the society CharIn E.V. under: *www.harinev.org/ccs-at-a-glance/design-guide-for-ccs/* provides a good overview about these activities. It contains a CCS Design Guide besides others. The agreement on a common standard gives hope that in the future all new vehicles can be charged on each ISO/IEC 15118 conform charging station and that the billing of the costs can be done correspondingly national and internationally. In the ISO/IEC 15118 it has been set that the communication between the electro vehicle and the charging station shall be based on HomePlug Green Phy Powerline communication. By doing this the PLC signal is modulated and transmitted onto the so-called »Control Pilot Wire« (CP) against protective earth.

One of the big supplier of semiconductors for HomePlug Green Phy Powerline communication is QUALCOMM with its products QCA7000 and QCA7005. CODICO as Design-In-Distributor for QUALCOMM in Europe is the partner for implementing HomePlug Green Phy solutions, either on the vehicle side in the so-called Onboard Charging Controller as well as on the infrastructure side; be it wallbox charger, charging cables or all other variants of charging stations or communications gateways for electro vehicle supply equipment (EVSE). It supports customers with own Field Application Engineer resources and appropriate reference designs and evaluation boards from QUALCOMM.

3: dLAN Green Phy Modul by DEVOLO

Besides the embedded chip design support with the QCA7000 and QCA7005 CODICO offers ready-to-use module solutions and evaluation systems form their partners I2SE and DEVOLO. They distinguish much in their construction and interfaces offered which result in different aptitudes in the customer applications.

In the CODICO sample shop as pre-configured versions for the electro vehicle side (PEV) and the charging station side (EVSE). With that pre-configuration the settings are done as required in the standard like for transmit power level, chose of Central Coordinator or Zero Cross detection. No solutions offered by CODICO contain the ISO/IEC 15118 Software Stack. This needs to be sourced from established providers or from Open Source projects and need to be operated on a separate controller. HomePlug Green Phy PLC is considered to be Layer 1 and 2 in the ISO layer model.

A08

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1: PL16, QCA7000 based Reference Design and Evaluation Board from QUALCOM


2: PLC Stamp Micro 2 from I2SE


4: PLC Stamp Micro 2 Evaluation Board from I2SE

FIRST CHOICE

InnoSwitch3-CE: Efficiency, accuracy, and protection for consumer applications.

The InnoSwitch™3-CE family of ICs has revolutionized power supply design, enabling highly efficient, very compact power supplies for consumer products such as set-top boxes, networking adaptors, wireless speakers and game terminals.

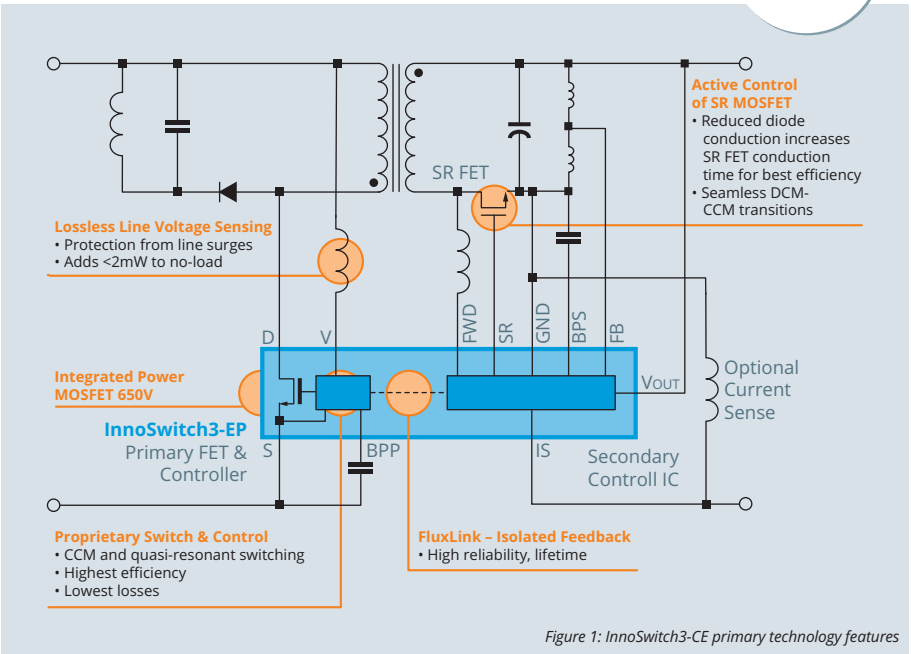

Figure 1: InnoSwitch3-CE primary technology features

Similar to other members of the InnoSwitch3 family, InnoSwitch3-CE parts feature a primary side Quasi-Resonant (QR,) Continuous and Discontinuous Conduction Mode (CCM/CDM) flyback controller and a 650V primary side power MOSFET. The benefits of secondary side regulation are achieved without optocouplers via the FluxLink™ isolated feedback link which also facilitates very precise control of secondary synchronous rectification.

With up to 94% flat-across-load efficiency that virtually eliminates heatsinks, excellent noise immunity and very low output ripple, InnoSwitch3-CE devices allow smaller power supplies to be embedded within a wide range of consumer products which have previously used external adapter power supplies. High switching efficiency is complemented by extremely low power consumption in standby – less than 15mW, no load – enabling power supply designs that meet existing and proposed global energy efficiency regulations.

A comprehensive array of protection and safety features have also been integrated into the InnoSwitch3-CE family that improve performance and reliability. These include synchronous rectification (SR) MOSFET, short circuit protection, line input over-voltage and under-voltage protection, open loop and pin-short, latching or hysteretic over-temperature protection as well as output over-current, and over-voltage protection.

Figure 1 illustrates the important technical features integrated into the new InnoSwitch3 family that result in the exceptional efficiency and reliability of these devices. InnoSwitch3-CE ICs incorporate POWER INTEGRATIONS' propriety inductive coupling communications link, FluxLink. Using this technology, InnoSwitch3-CE ICs are able to accurately control the operation of the primary side switch with secondary side synchronous rectification to maximise efficiency.

Accurate control prevents potentially damaging cross conduction or »shoot through«, even as load changes force the power supply to repeatedly transition between DCM and CCM operating modes. In addition, FluxLink is a safe barrier-crossing technology that is approved worldwide to provide galvanic isolation between the primary side high voltage and the low voltage secondary side. This removes the need for unreliable discrete isolation components such as optocouplers to provide feedback.

The primary side quasi-resonant flyback controller employs a combination of on-off control, variable frequency and variable current control techniques to achieve flat efficiency across the entire load range. This approach allows the InnoSwitch3 CE family to provide virtually noiseless power solutions delivering up to65 W – well beyond the power capability of traditional on-off control schemes.

The secondary side consists of a controller, transmitter circuit magnetically coupled to the primary side receiver, via the FluxLink feedback link, Constant Voltage (CV) and Constant Current (CC) control circuits for output voltage and current regulation, synchronous rectifier driver and numerous safety features that can be selected to provide either an auto-restart or latching shutdown fault response.

Excellent output voltage regulation (better than ±3% across line and load) and output current re-

gulation (better than ±5% across line and load is achieved by secondary sensing. The secondary side controller directs the operation of the primary side, initiating a primary side switching cycle only when it has finished its own switching cycle. QR or valley-switching forces the integrated primary side MOSFET to turn on at the minimum MOSFET drain-source voltage, induced by the DCM ring. This significantly reduces switching losses and EMI. Excellent noise immunity enables designs using the InnoSwitch3-CE to achieve class "A" performance levels for EN61000-4 suite; EN61000-4-2, 4-3 (30V/m),4-4, 4-5, 4-6, 4-8 (100A/m) and 4-9 (1000A/m), making regulatory compliance straightforward with integrated designs.

The schematic of a typical flyback design using the InnoSwitch3-CE shown in Figure 2 demonstrates the level of integration achieved. The schematic shows a universal input (90VAC-265VAC) 36W output power supply which delivers a well-regulated 3A 12V output.

The high voltage X-capacitor, C1, and common mode choke, L1, form a common mode filter and the line input is full wave rectified by bridge rectifier, BR1. Smoothing and filtering is performed by a π filter formed by capacitors C2, C3 and inductor, L2. Thermistor, RT1, limits inrush current and varistor, RV1, provides protection from line surge. The INN3166 InnoSwitch3 IC is self-starting using an internal high voltage current source which charges C6 – the primary side bypass capacitor connected to the BPP Pin. During normal operation, the primary side of the controller is powered from the auxiliary winding off the transformer, T1, via the diode, D2, and filtered by resistor, R5, and capacitor, C5. Line voltage is monitored via resistors R1 and R2 which feed a current into the high voltage V Pin that is proportional to the DC voltage across C3. This signal is used to provide accurate line overvoltage and undervoltage protection information whilst consuming less than 3mW.

Secondary side rectification is performed by the synchronous rectification (SR) FET, Q1. An RC snubber network comprising of R6 and C11 damps any high frequency ringing across the SR FET that may result from leakage inductance of the transformer windings and secondary parasitic capacitance. Q1 turn-on is controlled the winding voltage sensed at the Forward Pin (FWD) via R7. In CCM operation, the power MOSFET is turned off the instant before the secondary controller initiates a new switching cycle on the primary side via the FluxLink communications medium.

In DCM operation, the power MOSFET is turned off when the voltage drop across the MOSFET falls below zero. Secondary side control of the primary side MOSEFT ensures that it is never turned on simultaneously with the secondary side SR FET. This accurate control allows an InnoSwitch3 circuit to operate in both DCM and CCM modes. This seamless transition greatly simplifies the design and optimization of power solutions for applications with widely varying loads. Output voltage is sensed via the potential divider formed by resisters R8 and R9 with the midpoint connected to the Feedback Pin (FB). Zener Diode, VR1, along with R12 provides secondary side output over-voltage protection. When the Zener starts to conduct it is detected as a fault condition by the secondary Bypass (BPS) Pin. Output current information is generated across R11 and monitored by the ISense (IS) Pin that has a low threshold voltage of 33mV to reduce losses. The InnoSwitch3-CE is available in the new compact InSOP 24D package that provides reinforced isolation up to 4,000 V and carries UL1577 and TUV (EN60950) safety approval. All parts are 100% production tested for HIPOT and partial-discharge.

Full details of this design example can be found on the POWER INTEGRATIONS' web site along with an online selection tool, Build Your Own InnoSwitch (BYOI), which guides designers to the InnoSwitch device that is equipped with the features that best matches their need. The online BYOI tool and full information on all the InnoSwitch3 IC families are available from the Power Integrations web site:

https://ac-dc.power.com/products/innoswitch-family

A09

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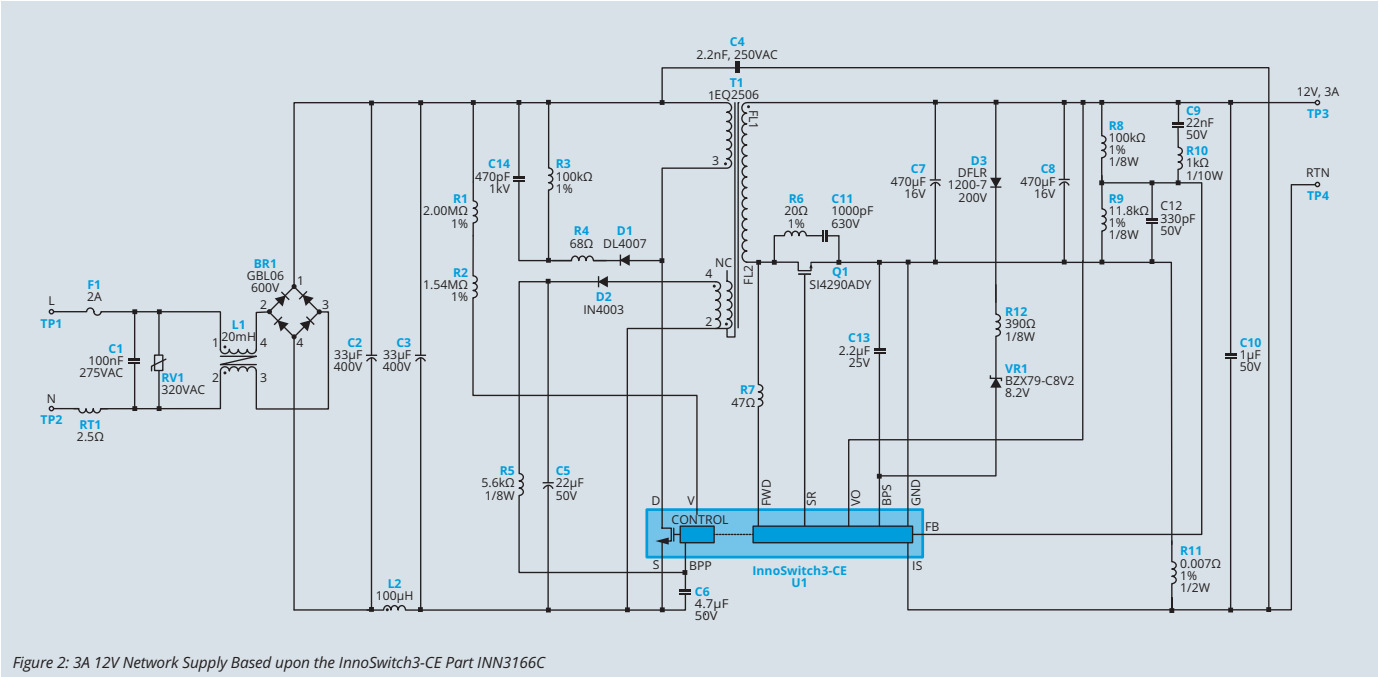


Figure 2: 3A 12V Network Supply Based upon the InnoSwitch3-CE Part INN3166C

REFERENCE-DESIGN

Universal Power Supply for Industrial Applications with 5V, 13V and 24V Rail, 40W

Many suppliers offer well-documented reference designs for AC/DC power supplies, but most of those are targeting high-volume consumer applications like wall-adapters or notebook-supplies, stuffed with external components mainly used in non-European regions. For our European customers yet the usability in industrial usability and the availability of the external components used in the reference-design are crucial.

The InnoSwicth3-EP series offers not only a very high efficiency, but is also capable of an exact cross-regulation of several output rails.

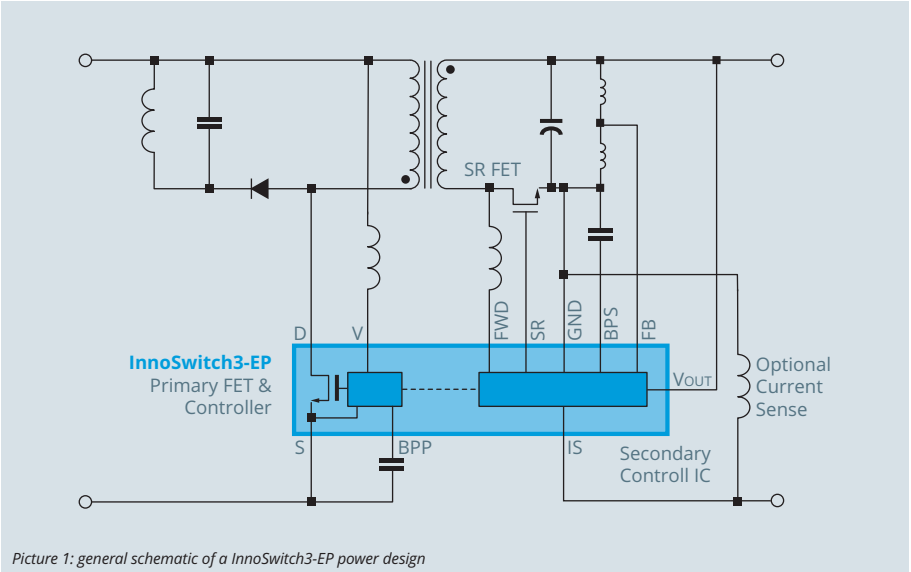
The details that lead to the choice of this IC:

- 725V MOSFET = Standard
- Over and Under Voltage Protection = Standard
- Over Temperature Protection = Standard
- Primary Current Limit = Standard
- ±3% Output Voltage regulation = Above standard
- Adjustable Output Current Limiting = Above standard
- Fastest Transient Response in the world = Ok, keep on talking
- 15mW Standby Power Consumption = Ok, that is pretty good
- Secondary Synchronous Rectification Driver = Nice
- Built in Digital Interface between Primary and Secondary = Very nice
- Up to 94% Efficiency due to Quasi Resonant Switching = Ok, I take it

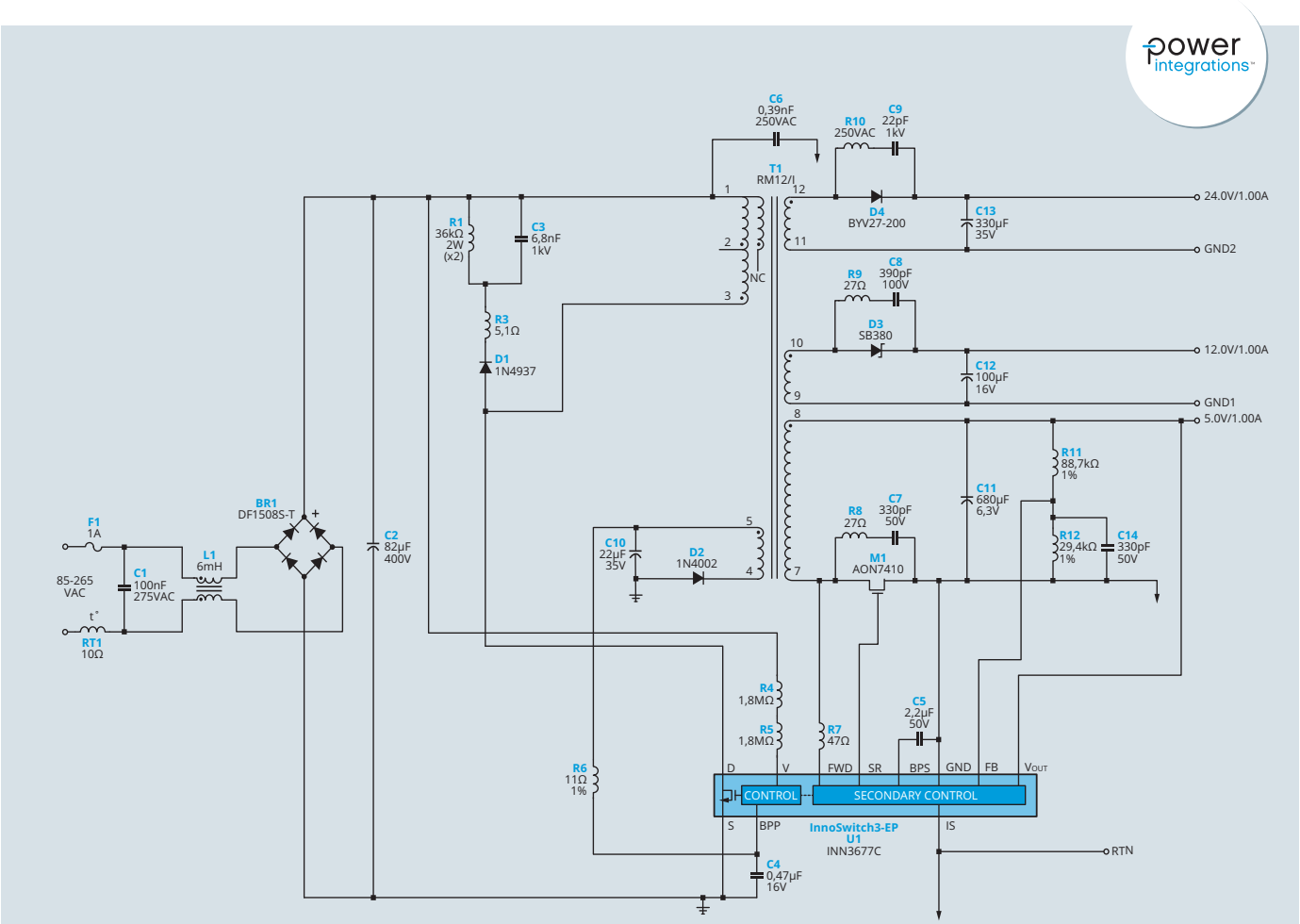
After the IC was identified quite fast the specification of the power supply had to be finalized by mulitiple discussion with our customers:
Universal Input Voltage: 85-265VAC
Common Output Voltages: 5V, 12V and 24V

Choosing the output power again lead to two options: higher power, in order to demonstrate capabilities of the IC, or less power in order to meet the financial targets of the project designers. In the end, we compromised on 40W, distributed through the three output voltages.

A power of 40W covers a variety of industrial applications, and downgrading the power-level is the easier option, if necessary. So now development could start, and the schematic on Picture 2 was the result.



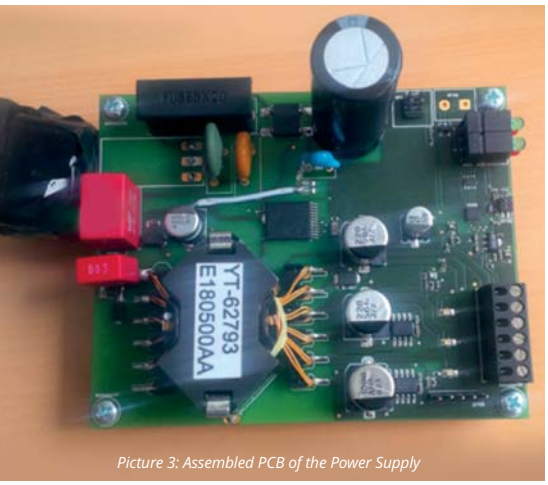
Picture 1: general schematic of a InnoSwitch3-EP power design



Picture 2: Schematic of the power supply with universal input and three output-rails

After specification and choice of the external components the layout could start, and after we received first PCB the hardware was built, in order to verify the specifications.

Flexibility is important in the industrial arena, and so the power supply was trimmed to deliver 20W on each rail, in total not more than 40W though.



Picture 3: Assembled PCB of the Power Supply

As expected EMI was the last remaining challenge, but a good old common mode choke helped out to solve this problem. In the end the designer was happy as he saw measurements way below the red borderlines.

Interested in our design? Schematic, BOM and Layout date are available on request.

A10

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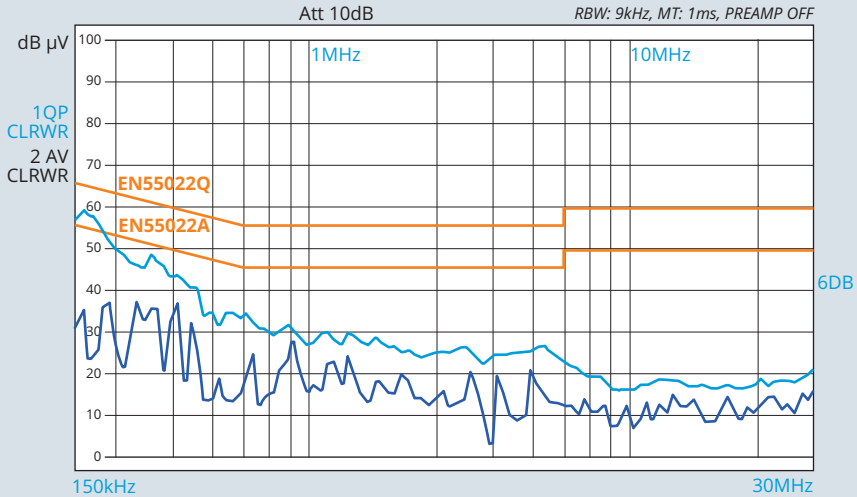

Picture 4: EMI behavior measured by spectrum analyzer

»COOLPOST« FACTOR

Thermally Improved Buck Micro DC/DC Solutions for Industrial Applications.

The new XCL225/26 (18V) and XCL230/31 (36V) synchronous step-down Micro DC/DCs are ideally suited for use in Industrial Sensors & Encoders as well as a host of Industrial IoT applications where low power consumption at higher voltages is the key.

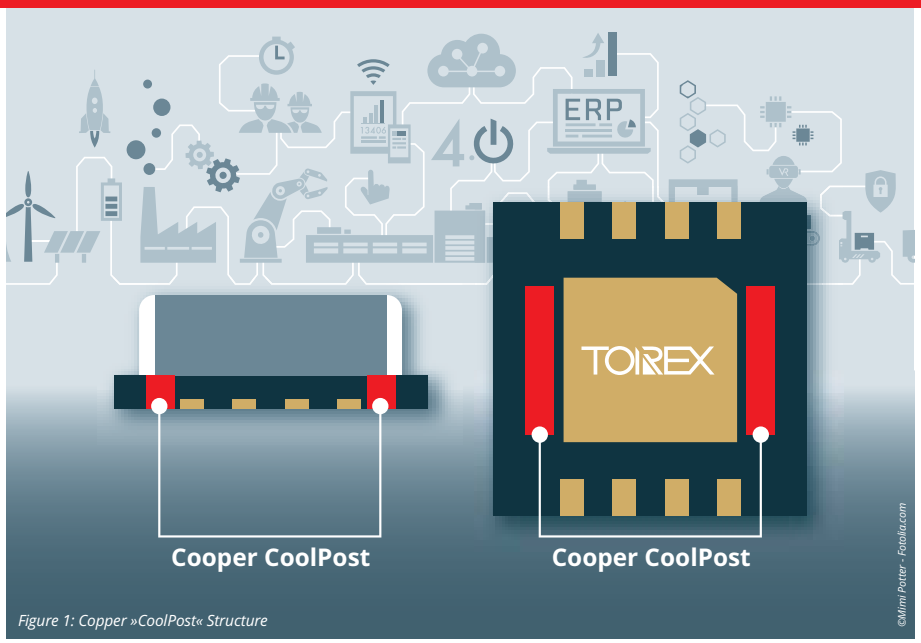

Figure 1: Copper »CoolPost« Structure

Their ultra-small size (only 2 caps needed externally), low EMI (integration of the coil simplifies the board layout and minimises any unwanted radiated noise) and greatly improved thermal performance as a result of a new & unique »CoolPost« technology incorporated into both solutions, means that the TOREX can now offer the same high performance solution for both 12V & 24V rails.

Copper »CoolPost« Technology

Similar existing DC/DC modules embed the DC/DC IC within the PCB substrate but in our experience, this can bring added thermal issues that need to be addressed and which can possibly be remedied by adding additional copper layers to the board to help dissipate the heat generated by the DC/DC but that is just another problem to solve.

With the XCL225/26 & XCL230/31, the IC is not embedded in the PCB substrate so these new DC/DCs don't have the same problem. In Addition, our unique and patented copper »CoolPost« structure increases thermal efficiency by around 30% in comparison to similar modules that don't have this feature. This improved thermal performance is achieved by embedding 2 copper posts directly through our IC as shown in figure 1 (the inductor is mounted directly on top of the DC/DC).

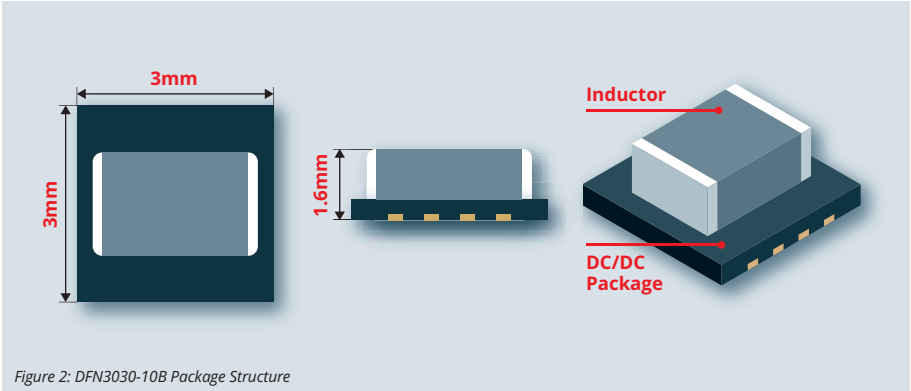

Figure 2: DFN3030-10B Package Structure

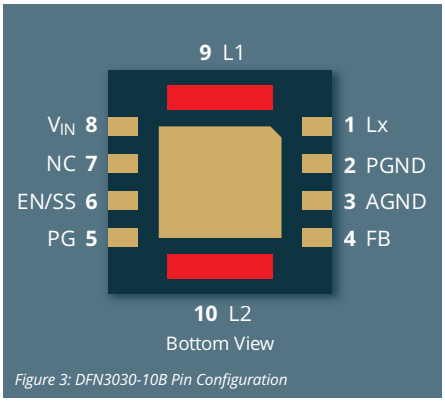

Figure 3: DFN3030-10B Pin Configuration

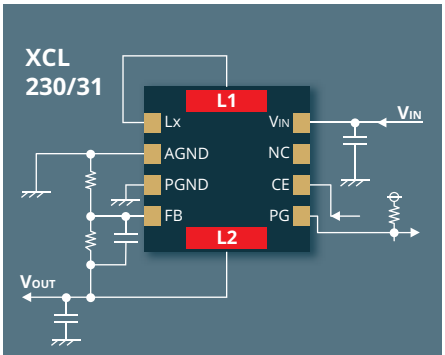

Figure 4: Typical Application Circuit

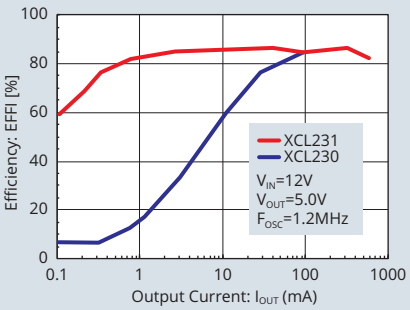

Figure 5: Efficiency vs. Output Current, V_{OUT}=3.3V

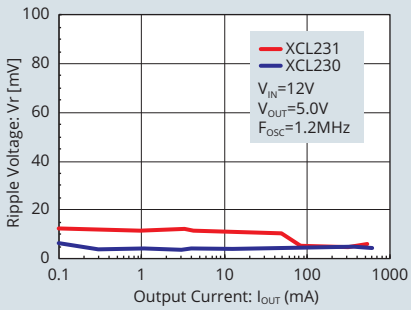

Figure 6: Ripple Voltage vs. Output Current, V_{OUT}=3.3V

DFN3030-10B Package

Both the XCL225/26 & XCL230/31 are available in the same ultra-small DFN3030-10B package which measures just 3.0×3.0×1.6mm (Figure 2). The pin layout for both the 18V Micro DC/DC and the 36V Micro DC/DC are the same making it easy for design engineers to change the Micro DC/DC in the middle of the design cycle should they find that they need to move from a 12V rail (XCL225/26) to a 24V rail (XCL230/31), for example look at figure 3.

XCL230/31 Series

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

The XCL230/31 series is a 1.2MHz synchronous step-down Micro DC/DC converter with integrated inductor that operates between 3.0~36.0V and delivers load currents up to 600mA. Output voltage is set externally within a range of 1.0~25.0V and in operation, the IC's quiescent current is only 11.6µA (XCL231). The XCL230/31 has an enable pin, which allows the DC/DC to be placed in stand-by mode with a stand-by current of just 1.65µA.

Integration of the inductor simplifies the board layout and minimizes any unwanted radiated noise. A stable and efficient power supply circuit can be configured by simply adding only two ceramic capacitors externally thereby contributing to PCB space saving and the shortening of development time (figure 4). Whilst the XCL230 is fixed PWM control, the XCL231 is automatic PFM/PWM control and is designed for high efficiencies at low output loads as can be seen in figure 5. In addition, this new Micro DC/DC features low output ripple voltage (figure 6).

XCL225/26 Series

18V, 500mA Synchronous Step-Down Micro DC/DC Converter

With a quiescent current of only 12.5µA (XCL226), this new 18V, 500mA buck Micro DC/DC is a welcome addition to the expanding range of ultra-small Micro DC/DCs from TOREX!

The XCL225/26 series is a 1.2MHz synchronous step-down Micro DC/DC converter with integrated inductor and like its 36V sibling, only requires 2 capacitors externally (figure 7). With a P-Ch High Side Switch to ensure low voltage operation and 100% max duty ratio, the XCL225/26 can operate from 3.0~18.0V and deliver loads up to 500mA making it an ideal replacement for inefficient linear regulators used in many industrial applications. Output voltage is set externally within a range of 1.0~15.0V and the new XCL225/26 is designed for very high efficiencies at low output loads (figure 8) as well as ultra-low output ripple voltage (figure 9).

Both the XCL230/31 & XCL225/26 also feature Over Current, Under Voltage, Short-Circuit & Thermal Shutdown protection circuits as well as an adjustable soft start function. Both Micro DC/DCs also feature a Power Good (PG) function which can monitor the output state so that when the FB voltage drops below 90% (TYP.), the PG pin outputs an »L« signal. The PG pin is an N-ch open drain output, therefore a pull-up resistor (approx.100kΩ) must be connected to the PG pin as shown in figures 4 & 7. The operating ambient temperature range is -40°C to +105°C for both series.

Samples and/or evaluation boards for both the XCL225/26 & XCL230/31 can be requested via CODICO. The evaluation boards are made to the customer's specific requirements. Test data is provided with each board.

A11

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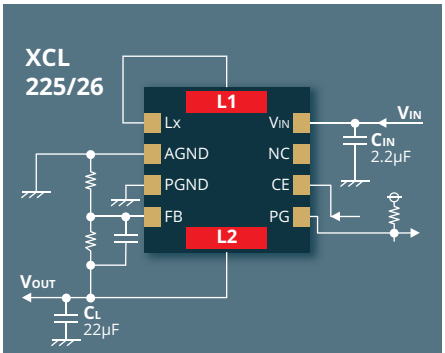


Figure 7: Typical Application Circuit

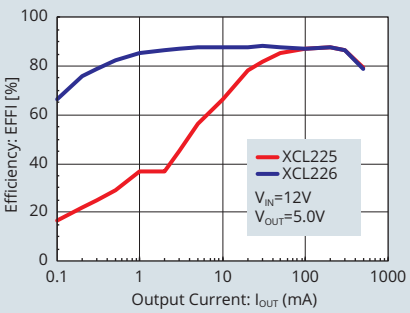


Figure 8: Efficiency vs. Output Current, V_{OUT}=5.0V

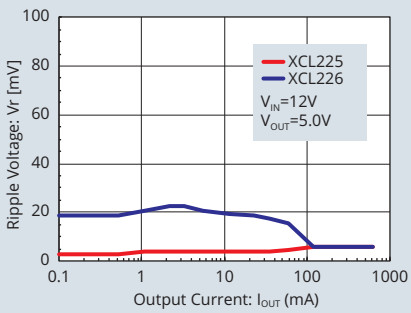


Figure 9: Ripple Voltage vs. Output Current, V_{OUT}=5.0V

DISPLAY & INTERFACE

In addition to parameters such as size, resolution, or brightness, when choosing a display developers must also consider the issue of control. The display interface constitutes an important component, since it is responsible for transferring the data (images) to be displayed from the computer to the screen as efficiently as possible. On the one hand, the choice will depend on the interfaces offered by the panel manufacturers and, on the other, one must also take into account the parameters of the controlling CPU.

The following will focus on what I refer to as the »internal interfaces«. These involve the direct connection of a display to a processor or controller, and in most cases both the latter are situated in the same package. In contrast, the "external interfaces" require a signal conversion, in some cases from digital to analogue and vice versa. These interfaces (VGA, Composite Video, S-Video, DVI, HDMI or DisplayPort) can be found in monitors or LCD projectors, which are connected to a computer. Their advantage are standardized ports (connector, pin assignment), which allow for an easy connection using commercial cables.

Let's return to the display interfaces, however, and examine their pros and cons in detail:

I²C (Inter-Integrated Circuit)

I²C was invented by Philips in 1982, but it was brought to the market by competitors, with Motorola, NEC, TI, Intersil and Siemens leading the way. This interface was developed as a multi-master, multi-slave, single-ended serial bus system to allow for the simple communication of peripheral components such as EEPROMs, AD/DA converters, and even keyboards with a microcontroller. The system requires only 2 lines (SCL – serial clock and SDA – serial data), uses an asynchronous protocol, and works on short distances on a printed circuit board or within a device.

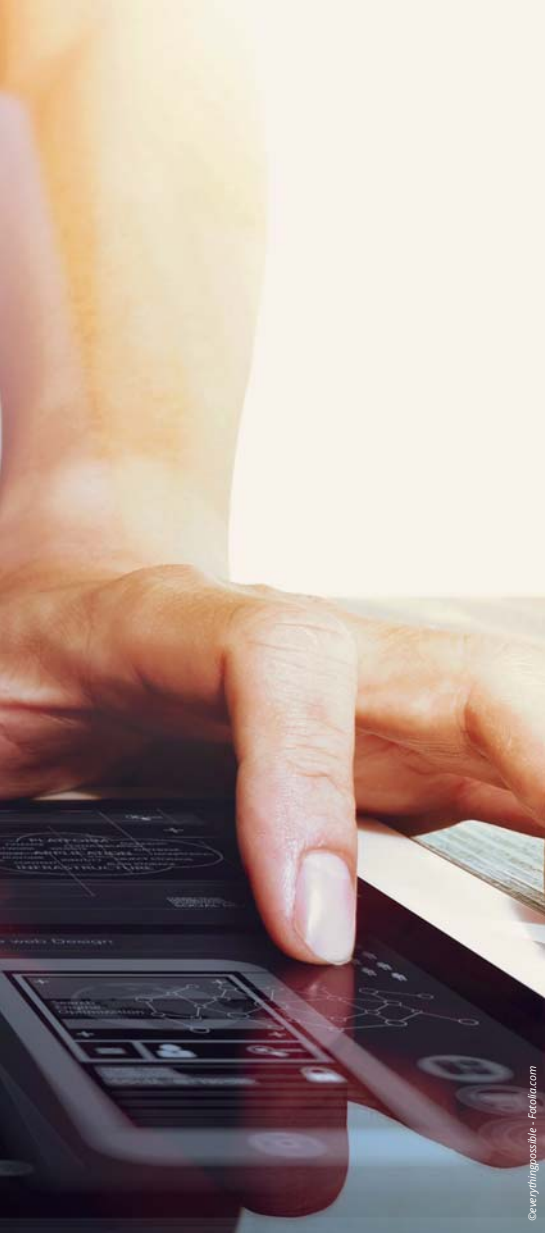
This interface is used in small displays with low resolution, since the data speed required for the transmission of image information does not need to be so high. Naturally, these are small TFTs with up to 320×240 pixels, graphic LCDs, or PMOLED displays. I²C, however, is also one of the most widespread interfaces used for the connection of projected capacitive touch sensors.

Advantages

- Low energy consumption
- Insensitive to interference
- Simple application and troubleshooting
- Bandwidth up to 1Mbit/sec

SPI (Serial Peripheral Interface)

SPI, a bus system developed by Motorola in 1987, is a synchronous serial interface for data interchange between two devices such as, e.g. memory, sensors, AD converters, or real-time clocks.



The system works bi-directionally in full duplex mode, i.e. data are transferred on a carrier simultaneously in both directions. A master communicates with several slaves independently of each other. This means that data can be transferred to the display but not vice versa. A small disadvantage of this interface is the number of pins required – each slave needs its own chip-select pin on the master.

SPI is also used in small displays with low resolution. In order to fit higher resolution displays with SPI, one must provide for additional intelligence (memory, controller) on the panel side, since the interface speed does not suffice for direct image transmission. The data must be buffered in the display before they can be displayed.

Advantages
- Simple implementation
- Longer lines possible
- Faster than I²C
- Bandwidth up to approx. 10Mbit/sec

MCU (Microcontroller Unit)

In order to keep the connection of a display as simple as possible while increasing the speed of data transmission, manufacturers have always resorted to parallel interfaces. Already developed back in the 1970s, this interface was already part of the first microcontrollers. A 8(9)-bit or 16(18)-bit wide data bus connects all peripheral units in a microprocessor system with the CPU. The display can be easily integrated in this bus. Based on the two original µC technologies, the interfaces can be operated both in 8080 and 6800 compatible modes. Due to the parallel data processing and the resulting higher bandwidth, it is possible to control medium-size displays and a medium colour depth.

Advantages
- Easy integration in the system
- Also suitable for medium-size displays
- Bandwidth up to approx. 120Mbit/sec

RGB (red, green, blue)

The RGB interface is an exceptional case of a parallel interface. No video memory is required on the display side, and the processor is completely responsible for the control. Data words 6 or 8 bits wide are sent for each colour (red, green, and blue). This allows for significantly larger amounts of data to be made available in a short time. Its disadvantage, however, is the large number of lines, which requires more expensive connectors and results in a worse EMC behaviour. RGB is widely used in small and medium-size displays.

Advantages
- Relatively low costs as a result of its mature technology
- High performance
- Bandwidth up to 1.2Gbit/s

LVDS (Low-Voltage Differential Signalling)

LVDS was developed in 1994 and is currently the most widely used interface standard for displays. It delivers the required high bandwidth for high-resolution graphics and videos at high refresh rates. The 18-bit or 24-bit colour information is converted into a serial data stream, transferred at a high speed (7 times the frequency of the original), and then reconverted to the original information. The interface works with differential signals, i.e. the information is read by the receiver as a difference between the voltages on the pair of lines. This reduces noise levels, improves EMC behaviour, and keeps power consumption low. Therefore, the transmission is also immune from external interference.

The LVDS interface is used in medium-sized and large displays. Where the resolution requires a higher bandwidth (this is the case at approx. 1.5 million pixels or more), the interface can be easily expanded to two (dual LVDS) or four ports (quad LVDS).

Advantages
- Low power consumption
- Very good EMC behaviour
- Small number of lines
- Bandwidth up to 3.125Gbit/s

eDP (embedded Display Port)

eDP is a standard which was defined by VESA (Video Electronics Standards Association) in 2008. It uses hardware similar to the LVDS, yet with fewer line pairs and a higher speed. The basic idea behind it was to circumvent the limitations posed by LVDS in large, high-resolution displays. Inter was one of the first to embed the interface into its Bay Trail Atom processors, and is planning to support only eDP in the future. In practice, the interface is usually encountered in large monitor panels, though it is not widely used in industrial applications.

Advantages
- Scalable
- Easy integration
- Low system costs
- Bandwidth of 1.62Gbits/s per lane

MIPI DSI (Mobile Industry Processor Interface – Display Serial Interface)

The MIPI Alliance is behind a whole series of standards for mobile devices. In view of the widespread use of mobile phones, it also designed an interface for such displays. Similar to LVDS, DSI is built as a differential interface with 4 or 8 line pairs, so-called lanes, and a clock line pair. A disadvantage of this interface is the complex protocol and driver software. The latter supports high-speed and energy-saving modes and also offers

the possibility to read data back from the display at a low speed.

Currently, only a small number of displays using MIPI DSI are available for industrial applications. The displays offered are mostly those originating from mobile telephone or tablet applications, i.e. medium-size (5", 10.1") displays with high resolution. It is becoming evident, however, that this range will gradually increase in the future. Manufacturers like QUALCOMM have embedded the interface in their chipsets and believe that there is also a market for this interface among industrial customers. Moreover, the MIPI consortium is encouraging its adoption in other areas as well, for instance in automotive or digital signage applications.

Advantages

- Low energy consumption,
- High data throughput
- Little electromagnetic interference
- Small number of pins
- Bandwidth up to 6/12Gbit/s

Vx1 (V-by-One)

In 2007, Thine Electronics, too, developed an interface intended to replace LVDS in large displays. The advantage of Vx1 is that despite having a similar structure to LVDS, it is also possible to use affordable twisted-pair copper cables (merely the impedance of 100Ω must be met), and the achievable transmission speed is nevertheless higher. Despite the advantage of low-cost hardware, this interface has (so far) failed to make a breakthrough.

Advantages

- It is possible to use standard cables
- No software adjustment
- Bandwidth up to 4 Gbit/s

Therefore, when choosing a suitable display, optics is not the end of the story; selecting the right interface requires an equal amount of attention.

We will support you in your considerations.

A12

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INTERFACE	NUMBER OF PINS W/O SUPPLY	MAX. BANDWIDTH	CLOCK	APPLICATION
I²C	2	100kb/s, 400kb/s, 1Mb/s	100kHz, 400kHz, 1MHz	Small Displays with Low Resolution and Color Depth
SPI	3	10Mb/s	10MHz	Small Displays with Low Resolution and Color Depth
MCU	8/9/16/18bit Data + 5 Control, Total max. 23	120Mb/s, 240Mb/s*	15MHz*	Small & mid-sized Displays with Low Resolution and Color Depth
RGB	6/8bit pro Color + 4 Control, Total max. 28	1,5Gb/s*	65MHz*	Small & mid-sized Displays also with great Color Depth
LVDS	4/5/10 Pairs (incl. Clk) Total max. 20	1,89Gb/s	270MHz	Mid-sized & large Displays also with great Color Depth
eDP	1/2/4 Pairs Total max. 8	1.6Gb/s per Pair	8B/10B Embedded Clock	Large Displays with High Resolution and Color Depth
Vx1	1/.../32 Pairs Total max. 64	4Gb/s per Lane	Embedded Clock	Large Displays with High Resolution and Color Depth
MIPI DSI V1.1	4/8 Pairs +1 Clock Pair, Total max. 17	1,5Gb/s per Lane	~130MHz	Small & mid-sized Displays with High Resolution and Color Depth

**depends on datawidth and controller used*

FILLING THE GAP!

The main benefit of the nearly finalized IEEE802.3bt standard is the improved efficiency and the lower »maintenance power« being only one tenth of its predecessors IEEE802.3af and IEEE802.3at.

In order to maintain the PSE power connection, legacy POE systems require a 10mA PD current draw, over the link, for a minimum duty cycle of 20%. Assuming 50V on the cable, this equates to a standby power loss of 100mW per PD. With any large scale projects with high numbers of connected devices, this can quickly add up to a lot of wasted power. The major improvement of the all-new IEEE802.3bt allows a 2.2% duty cycle. Hence, the standby power loss got reduced to way under 20mW per port.

Whereas SILVERTEL focusses with their modules on embedded designs for both – injectors (PSEs) and PDs – many industries center around one or the other. PHIHONG so far, has established a whole lot of different versions to fill the gap, providing complementary products to support their applications. Injectors for PD designers and splitters for Power Sourcing Equipment for the legacy standards of Poe and Poe+. Due to the introduction of the new *.bt Standard, PHIHONG has also swept out its classic Poe product range.

Type	Standard	PSE minimum Output Power	PD minimum Input Power	Cable Category	Cable Length	Power Over
Type 1	IEEE802.3af	1.4W	12.95W	Cat5e	100m	2 Pairs
Type 2	IEEE802.3at	30W	25.5W	Cat5e	100m	2 Pairs
Type 3	IEEE802.3bt	60W	51-60W	Cat5e	100m	2 Pairs Class 0-4 4 Pairs Class 0-4 & 5-6
Type 4	IEEE802.3bt	90W	71-90W	Cat5e	100m	4 Pairs

For IEEE802.3af (POE) applications, the POE29 series is available for (safety) Class I and Class II (either with C8 or C14 input connectors). Special builds with grounded RJ45 connectors are available on demand. In addition, PHIHONG has introduced a slimmer version, the POE15M, measuring only 106×40×27mm (L×W×H), for space critical applications whenever the power supply needs to be hidden behind a cover or under the ceiling.

For IEEE802.3at (POE+) applications, the POE29 series also includes stronger (30W nominal) versions. Again, the line-up is available with either C8 or C14 input connectors for safety Class I and II. Grounded RJ45 connectors to support sensitive applications by enlarging their EMC margin.

For the new IEEE802.3bt Standard introduced in the last CODICO Impulse (1/2018), PHIHONG has launched two new active injector desktop power supplies, to meet Type 3 and 4 requirements. The POE60U-1BT (Type 3) and the POE90U-1BT (Type 4) come as limited power sources, making the OCP and OVP protected equipment inherently safe. Just as their smaller siblings, the *.bt adapters feature optional SNMP and are Gigabit compatible. Hence, the PSEs can also be used in largescale high-speed networks.

PHIHONG's POE60U-1BT and POE90U-1BT are ideal for many applications including Pan Tilt Zoom cameras/IP cameras, VoIP video phones, building/access control equipment, WiFi access devices, POS terminals, thin clients, kiosks, and IP print servers.

SILVERTEL and PHIHONG Samples, as much as Evaluation boards, are available from CODICO stock.

A13

Andreas Hanausek, +43 1 86305 131
andreas.hanausek@codico.com

CODICO Calendar

ACTIVE COMPONENTS

BÁLINT Katalin

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BALOGH Gergely

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Welcome @ Booth

C4.402

November 13-16, 2018, Munich

electronica 2018

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ORDER ADMINISTRATION

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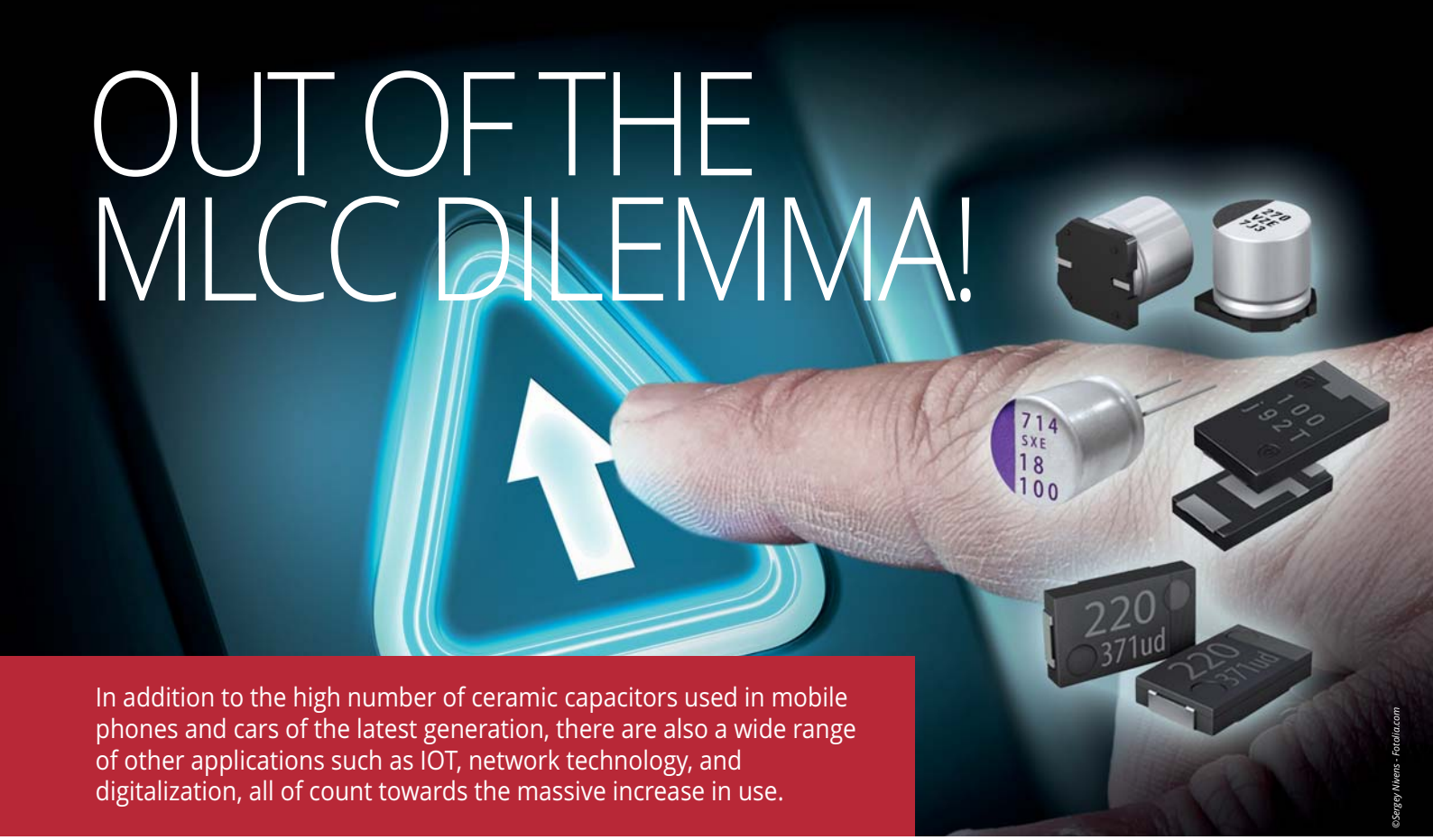
OUT OF THE MLCC DILEMMA!



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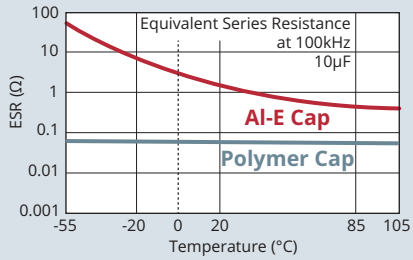
In addition to the high number of ceramic capacitors used in mobile phones and cars of the latest generation, there are also a wide range of other applications such as IOT, network technology, and digitalization, all of count towards the massive increase in use.

The gap between production capacity available worldwide and the demands of the electronics market is currently running at some 20-30%. The intense price pressure, resulting in only small profit margins over the past few years, has put off investments, and has led to reactions being too late. Expanding capacities is a long drawn-out process, and only progresses at a tediously slow rate, which means that in the short term there is no prospect of easing the tension. Even in the longer term, the tendency will be to increase capacities in the range of small case sizes such as 0201 or 01005, at the expense of the larger types. This means that production facilities which predominantly produce 0402, 0603, and larger case sizes, are being re-equipped accordingly. On the one hand, this is resulting in a higher output of the components required in the mobile communication sector, but it also means that the problems for the European market required components will be ongoing. It is true that there are manufacturers who are continuing to focus on larger case sizes, but when it comes to quantities they fall far short of bridging the gap which has been created by the big players.

Our advice to customers is therefore to investigate the extent to which products still in long-term focus can be used. In most cases, the changeover to smaller types incurs technical disadvantages, such as greater DC bias characteristics, leading to a reduction in effective capacitance. Miniaturization also often means only lower rated voltages being available, which further intensive this effect. Greater mechanical sensitivity can also bring corresponding difficulties in design.

A better solution in the long term out of the MLCC dilemma is to consider whether similar results can be achieved with other technologies. The most economical and simplest solution would be to switch to conventional low-Impedance aluminium electrolytic capacitors, but in the high-frequency range these exhibit poorer properties. To attain similar ESR values substantially larger case sizes are needed, which also makes a solution in SMD construction difficult.

Thanks to the use of polymers, the ESR, and therefore also the size needed, can be substantially reduced, and the ESR is also stable over the entire temperature range (Picture 1).



Picture 1

Basically, there are four different technologies available:

- Ta-Polymer Chip-Type
- Al-Polymer Multilayer Chip-Type
- Al-Polymer wound Can-Type
- Al-Polymer-Hybrid-Type

See in the overview below the different properties and advantages of these:

Ta-Polymer Capacitor Chip Type	Al-Polymer Capacitor Multilayer Chip Type
Low ESR & high capacitance in small dimensions	Ultra low ESR & high ripple current in low profile
Al-Polymer Capacitor Wound Can Type	**Al-Polymer Hybrid Capacitor**
High ripple current & long life for industrial	High ripple current & long life for automotive
High rated voltage & capacitance	High rated voltage & capacitance

Which MLCC's can now be replaced and how?

Basically, a distinction must be made here between a 1:1 substitution component for component, and a solution as an alternative to a parallel connection of several MLCC's. The capacitance actually necessary for your application should fall in the µF range.

For the most pin-compatible possible replacement, polymer capacitors in case size 0805 and larger are available. Table 1 provides an overview.

Since the possibilities of a 1:1 replacement are very limited, it is useful for new developments, or in the course of re-designs, for several parallel-connected MLCC's to be replaced by one or two polymer capacitors. This is made possible thanks to the positive property that polymer capacitors do not exhibit any DC bias effect. This not only saves space, but also reduces costs.

We have set out a comparison in picture 2 with identical rated values.

If, because of the DC bias effect, you use an MLCC with a higher rated voltage than your application actually requires, you can also select a polymer capacitor with a lower specification.

CASE MLCC	Dimensions MLCC (mm)	Dimensions Polymercap (mm)	Case Polymercap	Capacitance Range	Voltage Range
0805	2.0×1.25	2.0×1.25	S (Panasonic POSCAP) P (Kemet KO-CAP)	10 ~ 100µF	2,5 ~ 25V
1206	3.2×1.6	3.2×1.6	A (Panasonic POSCAP) A, I, S (Kemet KO-CAP)	10 ~ 220µF	2,5 ~ 10V
1210	3.2×2.5	3.5×2.8	B (Panasonic POSCAP) B, M, T (Kemet KO-CAP)	680nF ~ 470µF	2 ~ 63V
1812 2220	4.5×3.2 5.7×5.0	6.0×3.2	C, L, U (Kemet KO-CAP)	4,7 ~ 470µF	2,5 ~ 63V

Table 1

They also have advantages over tantalum capacitors: Account is to be taken not of a basic voltage derating, but only in part of a much lower derating value (depending on product und manufacturer). As well as this, polymer has a self-healing effect, meaning that no ignition occurs in the event of an extreme overloading of the capacitor (Picture 3).

Regardless of design and technology, our portfolio offers you the following values:

Polymer Chip Type	
Capacitance Range	3.9 ~ 1,500µF
Voltage Range	2 ~ 75V
ESR down to	3mOhm
Ripple Current up to	10,200mA rms
Polymer Can Type	
Capacitance Range	3.3 ~ 2,700µF
Voltage Range	2 ~ 100V
ESR down to	8mOhm
Ripple Current up to	7,200mA rms

For a lower capacitance range, SMD film capacitors can be a solution, or also what are known as PMLCAP's, from RUBYCON.

With products from the manufacturers KEMET, MURATA, PANASONIC, RUBYCON and SUN, CODICO offers a great selection of alternatives to MLCCs, in all ranges and sectors.

Tell us what your actual conditions of use and requirements are for the corresponding capacitors in your particular application. We'll find the right solution for you.

For more detailed information, feel free to contact

P01

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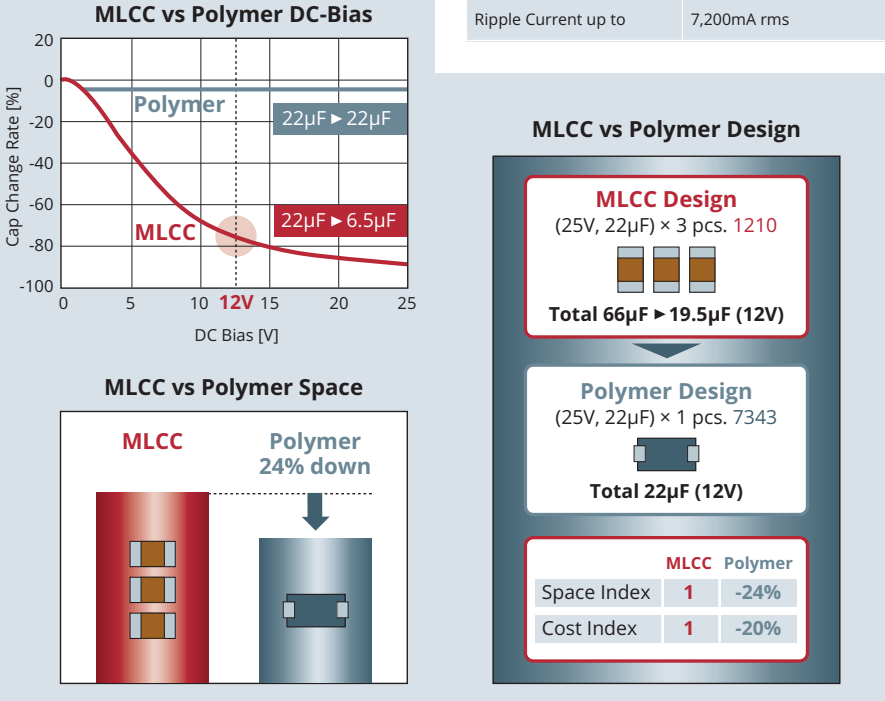
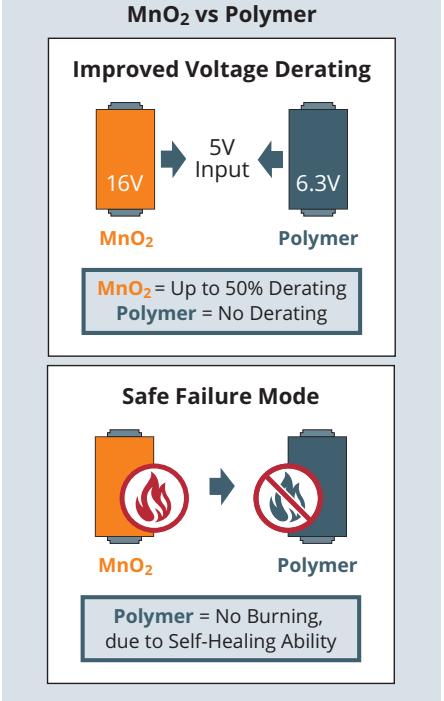
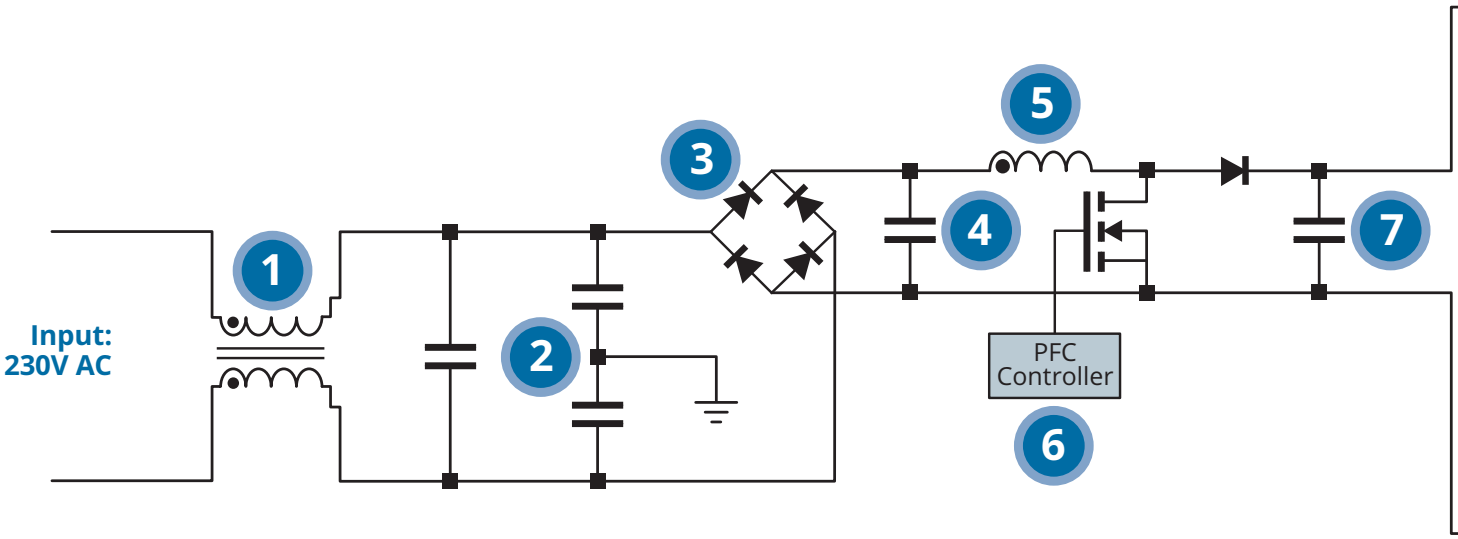


Picture 2



Picture 3



ON BOARD CHARGER

Electric vehicles (EV) and plug-in hybrid vehicles (PHEV) for the European market are in general prepared for both AC and DC Charging. Ultra-fast charging is realized by high power DC charging and is suitable for a quick refill on the road. For recharging the battery level to 80% in 10-20 minutes the charging power range of few hundred kW is necessary. This effects in charging currents in the range of 300-500A where the charging cables need to be designed with big wire diameter and sometimes even water cooling. The main power conversion and the charger is located in the charging station so called electric vehicle supply equipment (EVSE). For AC charging on the other hand the power conversion mainly takes place on board. The difference between AC 3 phase fast and 1 phase slow to DC charging is the comparatively low power level of up to 22kW in AC charging. AC Charging is mainly for longer charging cycles e.g. during night- or worktime.

In this article the focus is on LLC full bridge converter which has a higher power density than comparable half bridge designs. Even though there is bigger design effort required to achieve a proper result, the benefits are clearly higher efficiency and lower EMI.

Let us show you how CODICO can help in your design:

1. Common Mode Choke

Depending on the current consumption, the Common Mode Choke needs to be designed to accordingly to filter all symmetric grid bound interferences.

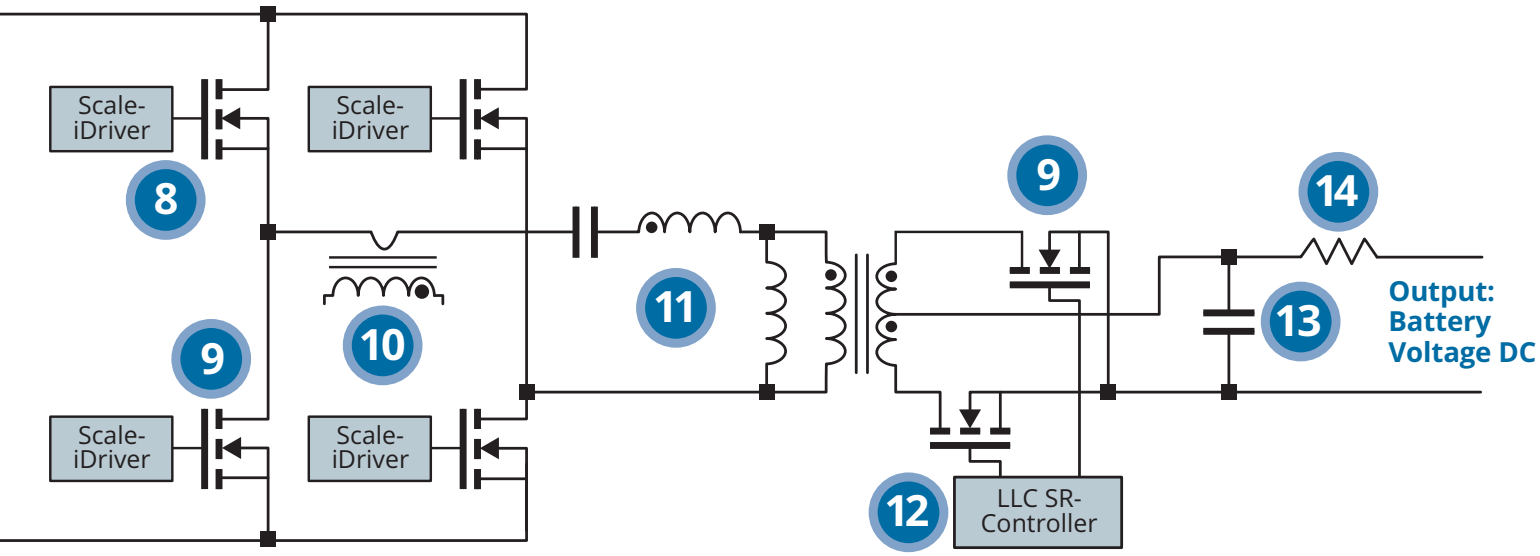
As all other items in the OBC need to fulfill automotive requirements these CMCs need to be designed according to at least AEC-Q200 requirements. Amorphous and nanocrystalline cores help to achieve up to AEC-Q200 grade 2 and reduce the overall dimensions of the Choke.

2. Noise Suppression

For noise suppression CODICO offers different versions of X- and Y-film capacitors. Beside AEC-Q200 certified standard items also long term capacitance stable products from KEMET belong to our portfolio. Those are 85°C/85% r.h./240VAC tested, and AEC-Q200 certified as well.

3. Bridge-Rectifier

PANJIT offers a wide range of Bridge Rectifiers. Schottky Bridge (VRRM=40V–100V) and General Purpose Bridge (VRRM=50V–1200V). Currents 0.5 to 25A. SANREX offers high power 3-phase bridge rectifier modules from 800-1600V and 20A to 200A.



FOR AC CHARGING

4. PFC-Capacitors

For the power factor correction KEMET provides special film capacitors with high current capability. Depending on your requirements AEC-Q200 certified single or double metallized versions are available.

5. PFC Choke

For this power level an active PFC in CCM (continuous conduction mode) is mandatory. The PFC boost stage advantageously smooths out mains voltage fluctuation and regulates the current draw so the full bridge can be continuously supplied. For CCM the chokes need to be designed with sintered powder cores(such as Sendust and HighFlux) and wound with massive wire to prevent the choke from unintentional saturation during operation. Compared to appropriate ferrite solutions, this setup benefits from lower core losses and can save up to 50% in volume.


KEMET C4AQ

6. PFC-Controller

For applications above 70W a PFC is mandatory. MPS offers boundary conduction PFC controllers for high efficiency. The MP440xx series from MPS offers powerful gate drivers, low cost and pin-compatibility to the L6562 controllers.

7. DC-Link Capacitors

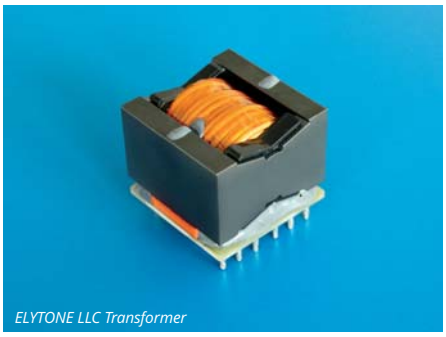
For the DC-link stage the product portfolio of CODICO offers a wide selection of capacitors based on different technologies and versions. KEMET has developed a power film capacitor, which is specially designed for this application. The new C4AQ-series, which of course is AEC-Q200 certified, offers a high rated voltage of up to 1.500VDC (starting from 500VDC). The capacitance range is up to 210µF. But we are not only talking about standard products, much more we provide solutions well fitted to your requirements. With our partner for electrolytic capacitors, RUBYCON, we realize many customized solutions. Most popular RUBYCON series used in this stage are MXC and MXG series. These series are Snap-in type electrolytic capacitor with a lifetime of 1.000 hours under -25 to 105°C. Normal conditions exist at a rated voltage 450V and capacitance 300~500µF. This capacitance range is mostly the same as the required capacitance value on each 1kW output power. So the number of capacitors will be multiplied by how much output power (kW) you request. Some might prefer to use radialelectrolytic capacitor rather than larger types. Especially talking about vibration proof, the radial type is less effected from vibration. In this case, the BXW series is highly recommended due to higher capacitance density in smaller case sizes. Of course, all items are certified under AEC-Q200.

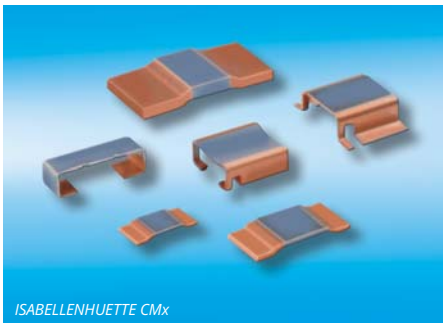
8. Gate-Driver

The high power switching MOSFETs or IGBTs demand a powerful driver. POWER INTEGRATIONS offers isolated Gate Drivers with a lot of integrated features. The SID11x2K Family of gate driver ICs are single-channel IGBT and MOSFET drivers in a standard eSOP package. Reinforced galvanic isolation is delivered using POWER INTEGRATIONS' innovative solid insulator FluxLink™ technology. Output drive current up to 8A (peak) enables the product to drive devices up to 600A (typical) without requiring any additional active components. Additional features such as short-circuit protection (DESAT) with advanced soft shut down (ASSD), undervoltage lock-out (UVLO) for primary-side/secondary-side and rail-to-rail output with temperature and process compensated output impedance guarantee safe operation even in harsh conditions.

9. MOSFETs

Apart of using advance high-performance cellular density designing, PANJIT's Power MOSFET products has lower conduction losses and switching losses. BVDSS 400~1000V can be used for AC-DC power supplies.


ELYTONE LLC Transformer


ISABELLENHUETTE CMx

10. Current Sensing

For current sensing CODICO can provide shunt resistors and current sense transformers for automotive purpose. The advantages of shunt resistors are mainly the high current capability and the low price. On the other hand current sense transformers are more expensive and only perform under AC but the efficiency is better because of lower losses. Depending on the switching frequency, measuring current and size standard items sometimes don't fulfill the requirements. For your customized solution from ELYTONE please contact us.

11. LLC Resonant Circuit

In general there are two different options how to arrange the resonant inductance when designing a LLC circuit. The cheapest solution is to build up a transformer whose leakage inductance is controlled and acts like a serial inductor. The second one has a dedicated serial inductor and a low-leakage transformer which requires more PCB space paired with higher cost, compared to the first solution. Independent of which solution will be chosen, the values of the resonant inductance, resonant capacity and the magnetizing inductance of the transformer are mandatory for the efficiency at all operating points under each load condition. All inductive components related to the LLC circuit can be customized by ELYTONE to have the best result in your circuit. The necessary AEC-Q200 testing will be done in house after the design is fixed.

As resonant capacitor KEMET provides AC-rated metallized polypropylene film caps, which are specially designed for this application. R74-series is AEC-Q200 certified up to pitch 22.5 and is capable of handling high currents.

12. SR-LLC Controller

For low losses a secondary side synchronous rectifier controller is often used. Fast Turn-Off, High Noise Immunity, CCM/DCM compatible, Dual Synchronous Rectifiers for LLC Topology are offered from MPS.

13. Output Filter

The, for the DC-link stage already introduced new power film cap series C4AQ from KEMET, is also well usable for output filtering. Besides for in electric vehicles used batteries needed high voltage, this capacitor additionally provides the advantage of a low ESR. Also electrolytic capacitors series MXC, MXG and BXW from RUBYCON, which are also recommended fort he DC-link stage, are well suitable for voltage filtering at the output.

14. Current Sense Resistors

Products of ISABELLENHUETTE meet the highest requirements in temperature coefficient (TC), thermo-electric voltage against copper, long-term stability, inductance and load capacity, which make them perfectly suitable for applications such as On-Board Chargen. Since these characteristics are influenced by the resistive material as well as design and technology, there are two fundamentally different Shunt technologies to choose between:

- ISA-PLAN® technology, where the elements of a precision and power resistor are etched from the films of the resistance alloys (MANGANIN®, ZERANIN®), which are electrically isolated and applied to a good heat-conducting metal substrate.
- ISA-WELD® technology, which is made of solid, electron beam-welded composite material made of copper and one of ISABELLENHUETTE'S resistance alloys (MANGANIN®, ZERANIN®, ISA-OHM®, Aluchrom).

Power (W): 0.5 to 15

Resistance range (Ω): 0.0001 to 4

TCR (ppm/K): >20

Type: standard SMD and open Air SMD

P02

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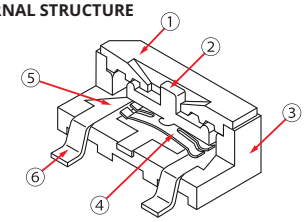
Roland Trimmel *+43 1 86305 144* *roland.trimmel@codico.com*	CAPACITORS KEMET
Srecko Drazic *+43 1 86305 104* *srecko.drazic@codico.com*	RESISTIVE COMPONENTS
Sebastian Gebhart *+43 1 86305 205* *sebastian.gebhart@codico.com*	INDUCTIVE COMPONENTS

COMPACT SLIDE SWITCHES

CAS & CJS Series

INTERNAL STRUCTURE



Part Name		Material	Flammability
①	Cover	Polyphenylenesulphide	UL94V-0
②	Slider	Polyamide	
③	Housing	Polyphenylenesulphide	
④	Slider Contact	Copper alloy, Gold-plated	—
⑤	Fixed Contact		
⑥	Terminal Pin		

Compact SMD slide switches are ideal for replacing jumper pins or certain setting applications for sensor products.

Jumper pins might be inconvenient for handling especially when they are positioned very close to each other. By replacing jumper pins with slide switches, users can adjust the settings on a PC board easily with a screwdriver instead of having to insert or remove jumper pin shunts.

It may also save space on the PC board in cases where multiple jumpers are needed by using the CAS 2 pole version instead. In addition, those switches are compatible with pick and place machines. Product height is only 2,5mm. Excellent contact stability is secured by bifurcated gold plated contacts. The switch is able to carry a load of maximum 50VDC and 100mA, the operating range is from -40°C to +85°C.

Both series are available in non-sealed version with or without seal tape or washable with sealed tape. Packing is done on reels or in plastic bags.

CAS series has three types of circuit configurations, SPDT, 2PDT and Dual SPDT with dot marking on the housing for clear recognition of the slider position. While featuring lower cost, CJS series provides bold white line marking on the housing for easy setting and SPDT circuit with or without neutral detent option.

Both series are available with Gull-wing and J-hook type terminal pins. Typical applications are PLC's, inverters, machine tools and peripheral controls.

By replacing jumper pins with CJS/CAS slide switches:

- Circuits can be switched instantly using a screwdriver
- No need to worry about losing jumper holder

P03

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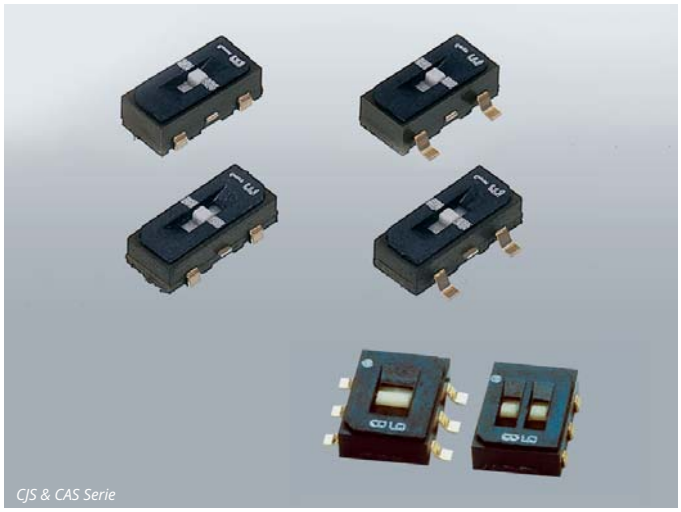
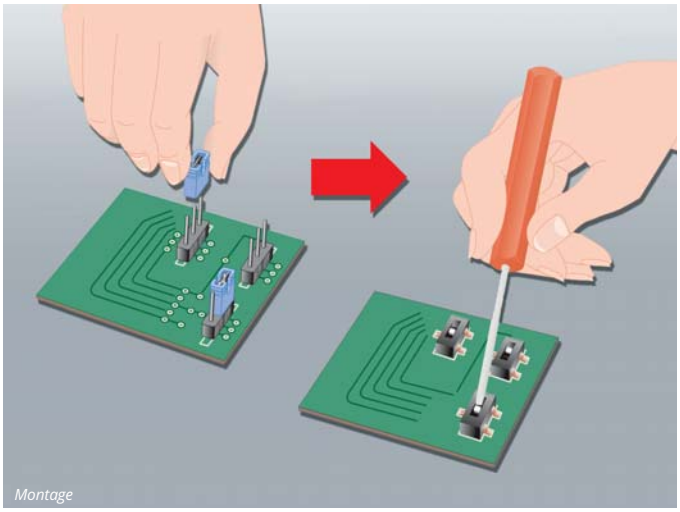


CJS & CAS Serie



Montage

Author: Osamu Bessho, Product Marketing Panasonic Industry Europe GmbH

HIGH VIBRATION

High Vibration Acceleration-Resistant Power Choke Coil **ETQP5MR68YSC** for Automotive use.

Panasonic

With the growing demand for energy efficiency of eco-friendly cars and the need to comply with environmental regulation, computerization of cars has been rapidly expanding, and ECUs are being incorporated, more frequently and on larger scales in cars.

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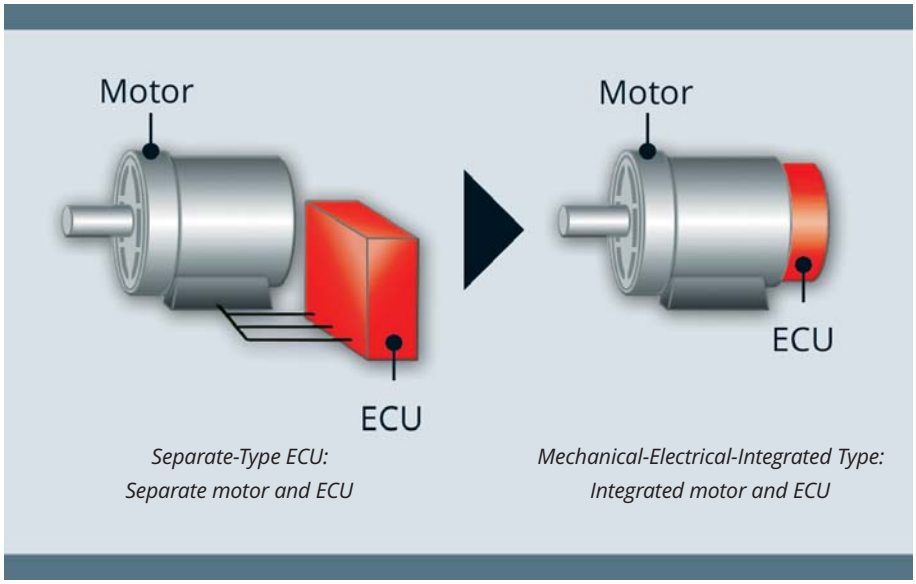


Separate-Type ECU: Separate motor and ECU

Mechanical-Electrical-Integrated Type: Integrated motor and ECU

In addition, more ECUs are being placed within the engine itself, elevating integration of mechanical and electronic in-vehicle components. This trend has created a need for automotive ECUs that can be installed in high-temperature environments that have more severe vibration conditions and support large current. Choke coils with high resistance to vibration and heat as well as support for large current are essential for removing noise and smoothing the power supply of power circuits that constitute automotive ECUs. PANASONIC is launching its surface-mounted type power choke coil ETQP5MR68YSC for automotive use achieving resistivity of 50G or higher vibration acceleration.

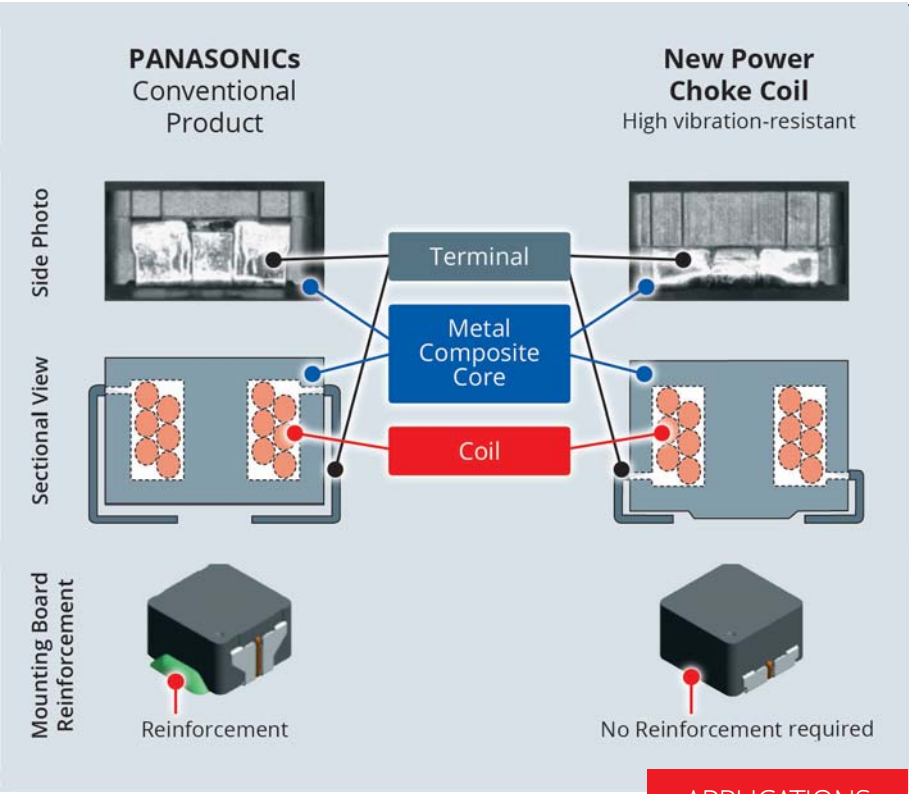
What is high vibration acceleration-resistant, power choke coil for automotive use? Excellent vibration resistance, heat resistance, and large current support allow customers to streamline their production process and contribute to the

placement of ECUs in the engine itself and integration of mechanical and electrical components.

Features of the Power Choke Coil

- **High resistance to vibration acceleration, enabling the automotive ECU to be more resistant to vibration.** The new power choke coil withstands vibration acceleration of 50G or higher in 150°C environments (490m/s²). The conventional product only withstands vibration acceleration of 15G (147m/s²). Conventional products structurally have a low self-resonant frequency around 2,000Hz and have an issue with vibration resistance. By utilizing the company's unique metal composite material using its unique metal magnetic material and unique winding and molding technologies, PANASONIC created a coil with a high self-resonant frequency of 3,000Hz or higher leading to high resistance to vibration acceleration of 50G or higher, contributing to more vibration-resistant automotive ECUs.

- **Remove the need for the anti-vibration reinforcement as part of the board mounting process, allowing the streamlining of the production process.** The new power choke coil removes the need for anti-vibration reinforcement as part of the board mounting process, allowing the streamlining of the production process. The conventional automotive ECU board mounting process requires anti-vibration measures, such as anchoring components with bonding agents (adhesives), to make the ECU resistant to vibration. The height of the developed power choke coil's terminal pull-out position is reduced to half that of the company's conventional product through the adoption of the company's unique winding and molding technologies, allowing its placement near the mounting board and achieving excellent vibration resistance. This has made conventional anti-vibration measures unnecessary and allowing the streamlining of the production process.



- **Its excellent heat-resistance and support for large current, contributes to the ability to place of automotive ECUs in the engine itself.** Coils used in automotive ECUs are required to be heat-resistant and support high current, in addition to being highly resistant to vibration. Previously, coils with high resistance to vibration acceleration of 30G or higher had an issue of not being able to support large current due to their low profile and small size. The developed power choke coil achieves a vibration acceleration resistance of 50G or higher while also having excellent heat resistance and supporting large current, through the adoption of the company's unique metal composite material, thereby contributing to the placement of automotive ECUs in the engine itself.

APPLICATIONS

Input filters for:

- Electric pumps
- Electric fan motor
- Direct injection (boost choke)
- Brake systems
- Exhaust gas recirculation systems (EGR)
- Electric compressors
- Electric Power Steering (EPS)
- Start & Stop Systems (Buck-Boost Choke & Output Filters)

P04

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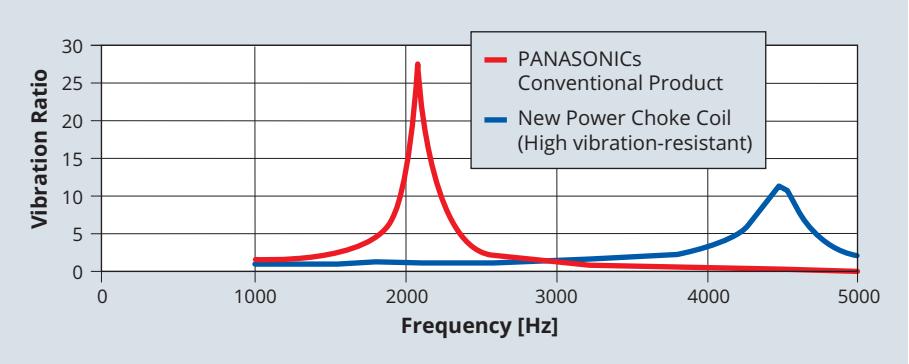
ETQP5MR68YSC	
Vibration Acceleration	50G (490m/s²)
Frequency	5 ~ 2000Hz
Amplitude	5mm max.
Vibration Directions Number of Times	X, Y, Z Directions, 108 Times (equivalent to 100h)
Temperature	150°C (including product's self-heating when energized)



HIGH VOLTAGE DC SWITCHING

Due to the high expectations of a strong market growth for applications in e-mobility in the domestic market as well as all other markets outside of China, SANYOU decided to do a major investment for the development and production of High Voltage DC Contactors.

The typical applications for such relays is found in electric car, battery energy storage system and charging stations. The relay portfolio ranges from nominal load currents of 10A up to 300A and maximum voltages of 1.000VDC. The series SEV with cubical housings is available in the following current classes: 10A, 20A, 40A, 100A, 150A, 200A and 300A. SEC is the series with cylindrical shape; here four versions with nominal currents of 100A, 150A, 200A and 300A are available. Currently the focus is on the following three models (see chart).

Design Features

Special copper alloy contacts

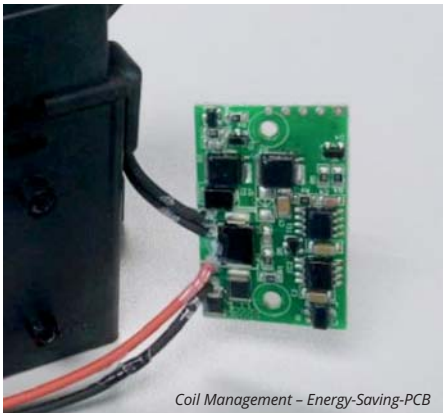
- Melting point of 1.300°C to avoid contact welding
- Low contact resistance is kept after welding with ceramics
- Alloy can be reliable brazed with ceramics to achieve a welding strength of 2.000N

Oxygen free copper on parts carrying current

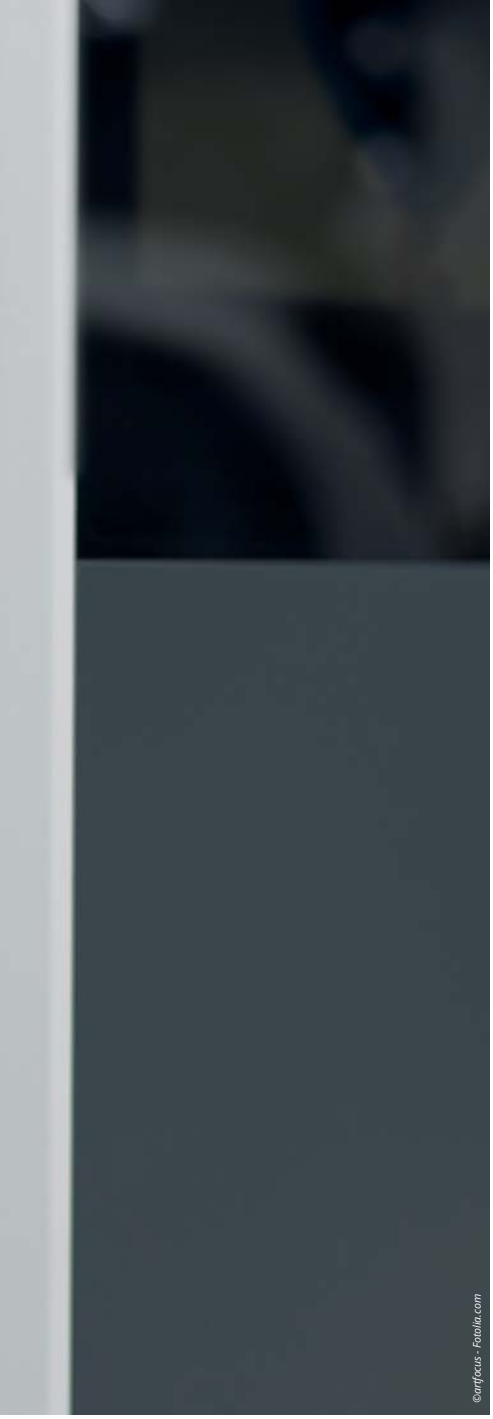
- Together with the copper alloy contacts relay can bear abnormal situation and break/carry 10 times overcurrent

Some products provide energy saving board in series to coil

- A special pcb-circuit helps to save power when relay is closed – hold power of 2W
- Coil voltage may vary from 12 to 24VDC



Coil Management – Energy-Saving-PCB



Ceramic switching chamber

- Use of high quality 95% Al2O3 special ceramics
- Top ceramic metal welding sealing technology in industry
- Arc is sealed in ceramic cave
- High mechanical resistance against deformation, pressure and temperature
- Some versions with integrated auxiliary contact

Arc extinguish solution

- Contact room filled with hydrogen to cool arc rapidly and avoid contact oxidation
- Permanent magnets outside ceramic chamber secure blow out of arc and accelerate arc extinguishing

High-end equipment

The production of the ceramics-switching element is a key process for this product. The contacts are connected to the ceramics in special ovens. Installed capacity on the critical component is currently 30.000 pieces per month.


CNC milling center

Contacts are processes afterwards with CNC equipment milling machines to secure precise contact planarity and contact gap.

P05

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		SEV40	SEV100	SEV250
				
Contact Form		1 Form A	1 Form A	1 Form A
Nominal Load Current		40A	100A	200A
Max. Switching Voltage		750VDC	750VDC	450VDC/750VDC
Mechanical Endurane		500,000 Cycles	500,000 Cycles	500,000 Cycles
Electriacl Endurance	Resistive Load	20,000 Cycles @ 450VDC 40A	10,000 Cycles @ 360VDC 50A	10,000 Cycles @ 450VDC 200A
		1,000 Cycles @ 750VDC 40A	1,000 Cycles @ 750VDC 100A	3,000 Cycles @ 250VDC 250A
Dielectric Strength	Coil-Contact	4,000VAC	4,000VAC	4,000VAC
	Open Contact	3,000VAC	3,000VAC	3,000VAC
Coil Voltage		12, 24, 48VDC	12, 24, 48VDC	range from 12 to 24VDC
Initial Power		3W	4.5W	42W/100ms
Holding Power		3W	4.5W	2W
Ambient Temperature		-40°C to 85°C	-40°C to 85°C	-40°C to 85°C
Humidity Range		5% to 95% RH	5% to 95% RH	5% to 95% RH
Main Application		Precharge for Motor Launch Normal Charge Contactor	High Voltage Auxiliary Systems Normal Charge Contactor	Main Contactor e-Car Fast Charge Contactor

EXTENSION: HYBRID CAPACITOR PORTFOLIO

Polymer-hybrid capacitors are the focus product of several manufacturers. More and more applications, especially in the automotive industry, are realized with such capacitors due to the outstanding features and advantages of this technology. So those products are steadily further developed and the parameters continuously improved. Our suppliers are looking back on many years of experience in developing this technology.

A brief overview of the main advantages compared to Al-electrolytic capacitors:

- High ripple current capability in compact case sizes
- Low and over the entire temperature range stable ESR
- Long life time

Additionally, compared to pure polymer caps, they provide higher voltage/capacitance values, a lower leakage current and a general AEC-Q200 certification. Furthermore, in case of a failure, they do not generate a short circuit. With our manufacturers PANASONIC, RUBYCON and SUN the product portfolio of CODICO provides a wide selection of hybrid capacitors with different specifications. The developments are heading in the direction of higher ripple current capability, higher temperature resistance and downsizing, which means cost optimization and increased reliability of your assemblies. On this double-page, we present the latest products of this technology.

PANASONIC's ZS & ZF Series

With the SMD-series ZS, PANASONIC is introducing a new case size for the first time that provides higher capacitances and a higher ripple current capability. Dimensions 10×16.5mm are already available – 10×12.5mm will follow later. In 10×16.5mm for example 560µF/25V and 4A r.m.s. are achieved. The guaranteed lifetime is 4.000hrs at 125°C. This allows the replacement of large THT electrolytic capacitors by significantly smaller SMD components. The number of capacitors required can also be reduced by using ZS series.

- Rated Voltage: 25V~63V
- Capacitance Range: 150µF~560µF
- ESR: down to 11mOhm

The THT-series ZF is aimed at applications with extremely high ambient temperatures. For automotive applications, which are located directly next to the engine, PANASONIC developed its first THT-version. This offers a temperature range of up to 150°C, with a guaranteed lifetime of 1.000hrs under full, specified ripple current load.

- Rated Voltage: 25V~63V
- Capacitance Range: 33µF~270µF
- ESR: down to 20mOhm
- Ripple Current: up to 1A r.m.s. at 150°C
- Case Sizes: 8×9.5mm, 10×9.5mm

SUN's SMD-Series HVPX & HVPC

With the new HVPX and HVPC series, SUN enables further miniaturization of assemblies. This is achieved by a higher ripple current capability on the one hand and on the other hand by higher capacitances per case size. The guaranteed lifetime is specified with 4.000hrs at 125°C.

With the HVPX series, SUN achieves a ripple current capability of up to 3.8 A r.m.s. at 125°C in dimensions 10×12.5mm. The guaranteed lifetime under these conditions is 4.000hrs.

- Rated Voltage: 25V, 35V
- Capacitance Range: 150µF~470µF
- ESR: down to 16mOhm

The new HVPC series provides more capacitance per case size, and additionally a significantly higher ripple current capability than previous comparable versions. In dimensions 10×12.5mm for example 25V/560µF and 3A r.m.s. are achieved at 125°C and a guaranteed lifetime of 4.000hrs.

- Rated Voltage: 25V, 35V
- Capacitance Range: 180µF~560µF
- ESR: down to 20mOhm

These properties offer you not only the possibility of miniaturizing your assembly, but possibly even a reduction in the number of components required.

P06

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RUBYCON's PJV & PLV Series

The PJV series is miniaturized version of today's RUBYCON PFV series. Compares to same size PJV series owes 20~40% higher capacitance and rated ripple current.

- Rated Voltage: 25V, 35V
- Capacitance Range: 180µF~470µF
- Rated Ripple Current: 1.920~2.800mArms/150°C,100kHz

For PLV series the temperature endurance is expanded up to 150°C 1.000hrs lifetime. As written in Impulse 01-2018, the strengths of RUBYCON hybrid capacitors are ESR stableness against lower temperature and higher ripple current endurance. These features are also affected to both PJV and PLV series. Especially PLV series reaches the lowest ESR and highest ripple current in the market for 150°C condition.

- Rated Voltage: 25V, 35V
- Capacitance Range: 100µF~270µF
- Rated Ripple Current: 1.400~1.800mArms/150°C,100kHz

More and more, the capacitors are required to have higher heat resistance due to the mounting of in-vehicle electrical components in the engine room and electromechanical integration.

RUBYCON hybrid capacitor will for sure be the solution of your robustness requirements.

P07

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REVOLUTION GQ

The Next Generation of the 16A Relay Class!

GOODSKY

Since the introduction of the famous and today widely used RT style relay 25 years ago the market is waiting for a next generation solution offering new features and advantages to hardware designers. The brand new GQ 16A version of GOODSKY represents the next level of miniaturization as this component reduces the space needed on the PC board compared to the standard available today by half.

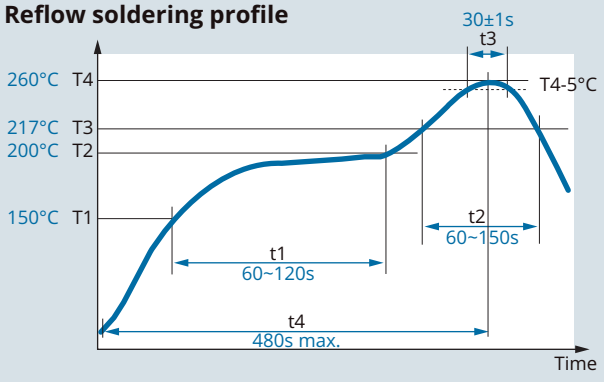
Based on the strong partnership of CODICO and GOODSKY the two companies decided to work on the roadmap of a next generation 16A relay to provide the market a smarter solution compared to today's well introduced RT standard and took the GQ relay platform as the basis to design this new product.

The objectives for the specification of this next generation relay were as follows:

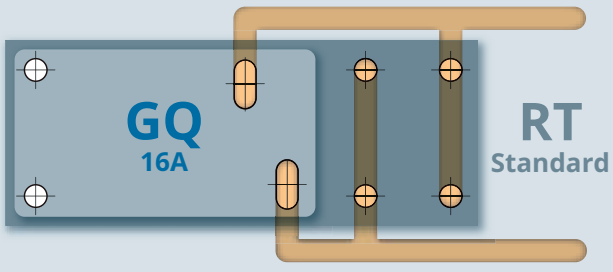
- Considerable reduction of space requirement in comparison to todays solution
- Reinforced insulation despite reduced length
- Enable double layout to RT/RZ style relays
- High ambient temperature up to 105°C
- Less coil sensitivity to save energy
- A reflow version with reasonable price adder
- Fully automated production line to secure highest product reliability and quality level

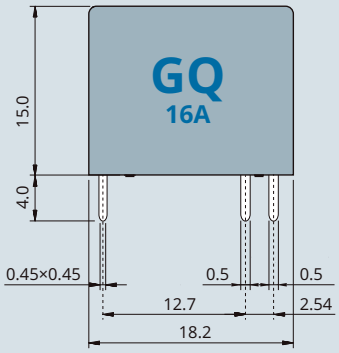
The designers of GOODSKY took the challenge and worked on modification of the inner structure both coil- and contact system. Intensive testing of the electrical performance for resistive as well as high capacitive inrush loads showed that the design objectives are meet. We are now able to offer a very small and powerful universal

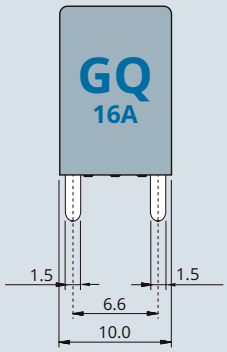
Reflow soldering profile

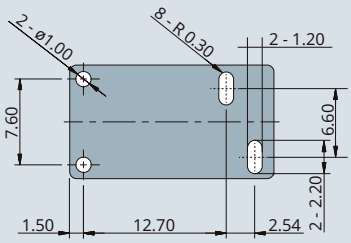


Double Layout GQ/RT-Standard

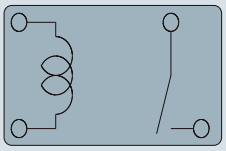








P.C.B Layout
Bottom View



Bottom View

power-pcb-relay for a number of applications such as for wet-, cool- and hot platforms in the appliances industry, applications in smart home and building automation, light controls, motor controls, heating controls, industrial controls and the use in measurement and instrumentation circuits.

GQ 16A at a glance

- 16A/277VAC, 50,000 Operations at 105°C
- 1 NO contact, contact material AgSnO plus Indium to secure best inrush performance
- Reinforced contact pins – double layout possible to combine with RT class NO versions
- TV-8 rating demonstrating a high inrush performance
- Coil voltages from 5 to 48VDC
- 360mW coil sensitivity
- Coil System class F
- 105°C maximum ambient temperature
- Compact dimensions of 18.2×10.0×15.0mm (L×W×H), 50% less demand in space on pcb compared to today's standard
- Product meets the needs of reinforced insulation of 7mm clearance and 8mm creepage and solid insulation 2mm with 4.000VAC dielectric strength between coil and contacts
- Version meeting the glow wire requirement acc. to IEC 60335-1 on finished product available
- Halogen free version on request
- Reflow version available on request for both flux tight and sealed version
- TÜV listed, UL and VDE are in progress

P08

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POGO PINS

A trend-setting technology that captures new markets!

Pogo-pins are a special type of contact technology based on spring force. In the past few years, this reliable technology has been accepted by many world-class customers and applied for a hundred different kinds of electronic products, such as mobile phones, GPS devices, car stereos, notebooks, TV game peripherals, LED road lamps, hearing aids, mobile radios, etc.

The high grade in customization and the durability in extreme environmental conditions makes the Pogo-Pin technology also a perfect match in various applications from Measurement and Testing, Automotive and Industrial (MIL/AERO/Transportation).

CODICO´s preferably supplier C.C.P. is one of the world´s leading manufacturer of spring-loaded pogo-pins in a wide variety of length and stroke configurations which can easily be modified without any additional NRE or tooling costs.

Multiple pins may be assembled in a plastic housing to a complete connector system optionally with magnets for easier handling. By customizing the internal and external structure these connectors even reach IPX7 waterproof requirement on demand.

C.C.P. is even offering pogo-pin connectors that are fully USB 3.1 Gen. 2 compatible. Shielded pogo-pins are well suited to prevent cross-talking while transmitting high-speed signals.

Magnetic Pins

Waterproof Pins

Further high-lights of pogo-pin solutions from C.C.P.

Lateral Movement Rolling Connector

C.C.P. introduces a newly developed rolling pogo pin for lateral movement. These pogo-pins are designed to roll on a mating surface which can be a circular track with 360° rotation.

They are capable of overcoming uneven mating surfaces with floating height requirements and can handle up to 3 Ampere. Due to the high life-time of min. 10.000 compressions or 25km travel distance the rolling pins are a perfect solution for product displays, rotating cameras, robots, etc.

Rolling Pins

Specifications

- Length: 3.50mm (min.)
- Diameter: 1.70mm (min.)
- Pitch: 2.50mm (min.)
- Current: 3A (max.)
- Spring Force: 80g, ±20g
- Life time: 10.000 compressions or 25km travel distance

High Current Pin

C.C.P.´s high current pogo-pins fully meet the market trend of transferring higher currents while reducing the space and cost requirement at the same time. They are using the embedded crown spring technology which has been proven in the field of EV chargers to be one of the most durable solution for transmitting high electrical current in a very efficient way.

The new pogo-pins are capable of carrying up to 13 Ampere which makes them an ideal solution for any design requiring a high current transfer with narrow space. The contacts provide a high life cycle with a stable performance at low resistance. Typical applications are charging stations or charging connectors for any kind of industrial or consumer product like robots, smart home devices, electrical bicycles and other battery systems. By employing a special structure to the charging interface it can even reach IPX7 and higher.

Specifications

- Length: 7mm (min.) under 1mm working travel
- Diameter: 2.41mm (min.)
- Current: 13A (max.)
- Spring Force: 120g, ±20g
- Life time: 10.000 compressions

S01

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High Power Pogo-Pins

ix INDUSTRIAL™

Supporting high transmission speeds up to 10Gbps, the ix Industrial™ series I/O connector is designed for next-generation industrial modules.

Ethernet communication between electronic equipment has increased with the Industry 4.0 trend of automation and data exchange in manufacturing technologies. This brings efficiency of manufacturing with ICT (Information & Communications Technology). HIROSE developed a rugged I/O connector that combines a small robust design with high-speed data transmission capabilities.

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

The ix Industrial™ offers a reduced size of 75% compared to conventional RJ-45 modular solutions. This size reduction allows for reduced installation space. The receptacles allow for a parallel 10mm pitch mounting for daisy-chaining in compact units contributing to size reduction of end use products. Supporting CAT5e and CAT6a (10G) cabling, the IX Series I/O connector features an optimized EMI/ESD shielding design for safe and secure data transmission up to 10Gbps.

Available with two keying codes for Ethernet and non-Ethernet applications, the ix Series I/O connector is compliant with IEC PAS 61076-3-124. The ix Industrial™ Series can be used as a next generation standard connector in equipment such as factory automation controllers, industrial robotics, programmable logic controllers, security systems, servo amps, servers, robotics and more.

Keying variations:

- Type A – bottom left – for Ethernet applications
- Type B – top left – for non-Ethernet applications

Offered in upright right angle and horizontal right angle versions, the ix Series I/O has maximum dimensions of 22.9×8.4×14.3mm. The upright right angle connector receptacles can be mounted in parallel with a pitch distance of only 10mm. The narrow width of the receptacle is particularly beneficial when multiple connectors are positioned on a single PCB side-by-side.

Featuring a rugged and reliable design, the snap-in I/O connector has a positive metal lock with a preload spring mechanism that provides a clear tactile click and ensures complete, secure mating. The preloaded springs are designed to prevent unintended cable removal, and to extend the operating life to more than 5.000 mating/unmating cycles.

Because the IX Series connector's receptacle supports THR soldering as a substitute for manual soldering, the receptacle can be mounted on the PCB containing both THT and SMT components in a single SMT process. This also contributes to the high PCB retention force.

HIROSE offers both solder and insulation displacement connector (IDC) plug types. IDC plugs can reduce working hours as compared with solder plug. The plug cover supports a wide cable size from 22 to 28 AWG wire.

The IX Series I/O connector has a rated current of 0.5A (all pins), 1A (any 2 pins), 2A (pin No. 1 and No. 8 only). With an operating temperature range of -40°C to +80°C, the IX Series connector has a rated voltage of 30V AC.

S02

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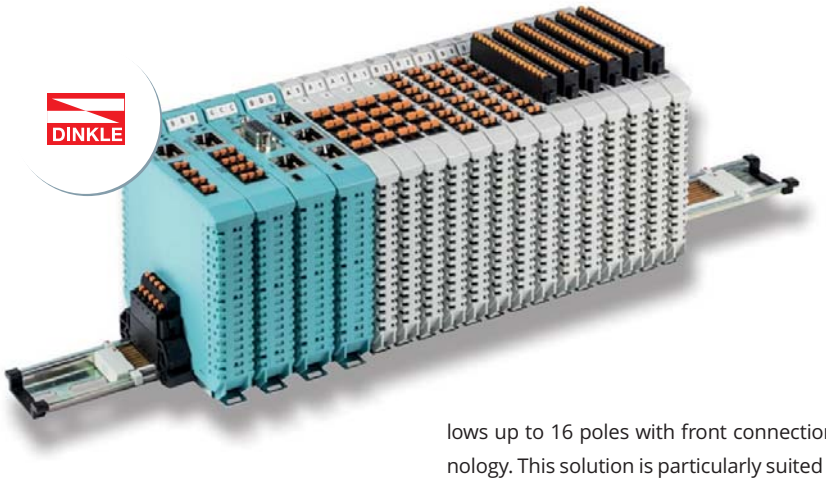
DINKLE BUS

The multifunctional housing system from DINKLE!



You are still searching for a suitable housing for your electronic control systems and don't want to renounce on modern fieldbus technology?

The DINKLE BUS system is a universal housing system for interface and system solutions, which sets new standards in flexibility and miniaturization.

Compact design and integration of the latest communication interfaces

The standard housing with thickness 12mm allows up to 16 poles with front connection technology. This solution is particularly suited where space is a critical factor. A wide range of connection technologies, for example USB, RJ45 and D-Sub, are compatible with IoT (Internet of Things) and Industry 4.0 applications.

Fast and simple wiring

In order to save time and costs, all cable connections of DINKLE Bus system are with push-in design even the bus connector itself.

Optical LED-displays on the terminal blocks

Appropriate terminal blocks are also available as pluggable solution and offer direct LED light pipes to indicate the operational status.

Safe connection of the power supply including reverse-pole protection

The patented bus connector make sure that modules are protected by a grounding contact while connecting to the bus plate to ensure signal interference-free and safety in power supply. It connects several electronic modules, which are mounted on the DIN rail.

Great choice and flexibility

The bus plate consists of up to 8 gold-plated terminals which can be installed on all common TS-35 DIN rails. There are standard lengths, as well as customized lengths up to 1.000mm available.

Accessories like marking labels for clear designation of the LED indicators, expansion connectors for extending the bus plates, bus covers for DIN rails and end clamps complement the product range.

If you also want to use a separate serial bus for communication in addition to the parallel supply lines, then DINKLE has the perfect solution with its multifunctional Etherbus-system.

S03

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COOL EDGE

Cool Edge is a high speed and high power hybrid card edge connector that can support most of board-to-board applications in electronics market.

Amphenol ICC

These versatile solutions address multiple standards like PCIe, SAS/SATA, networking and offer multiple board-to-board configurations such as mezzanine, coplanar and midplane/backplane. Moreover, the connectors are designed as Open Pin Field and are hot plug capable.

Micro Cool Edge 0.50mm

CARD EGDE CONNECTOR FOR SSD APPLICATIONS

NGSFF (Next Generation Small Form Factor) is a new small form factor card edge connector to support enterprise and data center SSD (Solid State Drive) for high capacity and high density applications. Vertical and right angle NGSFF has the same interface as orthogonal NGSFF that can be used inside the system for high density applications. With 0.5mm pitch, 67pin, M-Key that is similar to the M.2 connector, NGSFF supports NVMe SSD and meet speed up to 16GT/s.

- SSD PCB thickness 0.80mm
- Supports hot plug and front loading
- Supports NVMe, speed up to 16GT/s
- NGSFF form factor for 1U system application
- Gang mechanical framework can be 1×1, 1×2 and 1×4
- Vertical, right angle and orthogonal options

Mini Cool Edge 0.60mm

HIGH DENSITY HIGH SPEED CONNECTOR FOR VERSATILE BOARD-TO-BOARD APPLICATIONS

Mini Cool Edge is a 0.60mm high density, high speed card edge connector for new generation small form factor system. These fine pitch solutions offer multiple BTB applications like right angle, mezzanine and coplanar and support cable interconnect options. Mini Cool Edge 0.60mm meets SFF TA-1002, Gen Z, EDSFF and OCP NIC 3.0 specifications.

- Common applications include Solid State Drive, Network Interface Card, Add-In Card

Micro Cool Edge 0.50mm		Mini Cool Edge 0.60mm		Slim Cool Edge 0.65mm	
					
FEATURES	**BENEFITS**	**FEATURES**	**BENEFITS**	**FEATURES**	**BENEFITS**
0.5mm pitch, 67pins, M key	Small form factor for 1U server system	Signal pin pitch at 0.60mm with current rating of 1.1A, up to 12 pins for power application	Supports small power BTB applications	Power pin pitch at 1.30mm and current rating of 3A per pin	Supports small power BTB applications
Orthogonal design	Simplifies system design		Provides power for module card	Signal pin pitch at 0.65mm and current rating of 0.5A per pin	Supports most mating board applications
Vertical design	Supports high density internal SSD drive application	Signal pins options from 56, 84, 140, 168	Supports different board-to-board, module applications like FPGA, SSD, NIC	Power pins from 4 to 12	Allows flexible power-signal combinations
Right angle design	Suitable for low profile design	Customization is also available		Signal pins range from 20 to 200	
Air slot between connector	Provides good thermal performance	Small form factor	Serves as a space-saving connector	Offset signal pin with SMT termination	Provides better signal integrity performance
Gang mechanical framework in 1×1, 1×2 and 1×4 configuration with staggered mounting feature	Increases drive density in system	Discrete pin design	Supports single-ended, high speed differential pairs up to 32G NRZ, 56G PAM4	Open pin field design	Supports both single-ended and differential pairs with speeds up to 32Gb/s (or 56Gb/s PAM4)
Special pin design	Supports hot pluggable applications	Supports 1.6mm thick mating board	For most standard BTB applications	Vertical, right angle, and straddle mount configurations for coplanar, mezzanine, and midplane applications	Supports multiple applications ranging from ICT to consumer
Robust gang bracket with metal key	Provides good mechanical support for drive front loading			Supports 1.6mm thick mating board, different boardlock options available	For most standard BTB applications, allows flexible PCB hold-down option

- Vertical, right angle, straddle mount and orthogonal options are available
- High Speed up to 32GT/s (or 56GT/s PAM4 capability)

Slim Cool Edge 0.65mm

SPACE-SAVING HYBRID CONNECTOR FOR VERSATILE BOARD-TO-BOARD APPLICATIONS

Slim Cool Edge Hybrid Power and Signal connectors provide one-piece high speed and high power card-edge package. These connectors offer cost competitive and high density solutions. These versatile solutions based on a 0.65mm signal pitch design offer multiple BTB configurations like right angle, mezzanine and coplanar. Moreover, the connectors are designed as Open Pin Field and are hot plug capable. These connectors feature modular tooling that allows multiple power-signal combinations for vertical configurations.

- Right angle and straddle mount options are available upon request
- High Speed up to 32GT/s (or 56GT/s PAM4 capability)
- Supports multiple impedance systems

Cool Edge 0.80mm

HYBRID CONNECTOR FOR VERSATILE BOARD-TO-BOARD APPLICATIONS

Cool Edge Hybrid Power and Signal connectors provide one-piece high speed and high power card-edge package. These versatile solutions address multiple standards like PCIe, SAS, SATA, and offer multiple BTB configurations such as mezzanine, coplanar and midplane/backplane. Moreover, the connectors are designed as Open Pin Field and are hot plug capable. These connectors feature modular tooling that allows multiple power-signal combinations for vertical configurations. It is also available in right angle and straddle mount options.

- Right angle and straddle mount options are available upon request
- Comes with cable-to-board option
- High Speed up to 32 GT/s (or 56GT/s PAM4 capability)
- Supports multiple impedance systems

Cool Stack 0.80mm

HYBRID CONNECTOR FOR COPLANAR BOARD-TO-BOARD APPLICATIONS

Cool Stack Hybrid Power and Signal connectors provide one-piece high speed and high power solution while addressing multiple networking standards like PCIe, and SAS/SATA. It offers a maximum current rating of 16A per power pin, which aids in supporting applications with medium power requirement. Moreover, these connectors provide robust and reliable interconnection between two large boards with its screw locking features. It comes in a low profile 3mm design for coplanar applications.

- Comes in coplanar configuration
- 16Gb/s high speed performance
- Supports multiple impedance systems

Cool Edge 1.00mm

HIGH SPEED SPACE SAVING CONNECTOR FOR BOARD-TO-BOARD APPLICATIONS

Cool Edge Signal connectors bring high speed PCIe support into a one-piece card edge package with 16Gb/s Gen4 and 32Gb/s Gen5 capabilities. Slim connector design saves space on the motherboard while facilitating other higher density applications. Housing design is kept simple with an overall reduced footprint, providing additional benefits over standard PCIe solutions.

- Supports speeds up to 32Gb/s
- Saves more space than standard PCIe solutions
- Enhanced signal integrity using conductive plastic design
- Simple housing design allow vertical AOI inspection

S04

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Cool Edge 0.80mm

FEATURES	BENEFITS
Power pin pitch at 9.10mm with current rating of 25A per pin	Supports medium to high power BTB applications
Signal pin pitch at 0.80mm with current rating of 0.5A per pin	Supports most mating board applications
Power pins from 2 to 6 and signal pins range from 20 to 200	Allows flexible power-signal combinations
Through hole power pin termination	Provides higher power through several power layers
Open pin field design	Supports both single-ended and differential pairs with speeds up to 32Gb/s (or 56Gb/s PAM4)
Vertical, right angle, and straddle mount configurations for coplanar, mezzanine, and backplane applications	Supports multiple applications ranging from ICT to consumer
Built-in guide block optionn	Tolerates mis-alignment and facilitates blind-mating conditions
Slimmer form factor than standard PCIe	Serves as a space-saving alternative compared to the standard

Cool Stack 0.80mm

FEATURES	BENEFITS
Current rating of 16A per power pin	Supports medium power applications
Signal pins with 0.80mm pitch and current rating of 0.7A per signal pin	Supports most mating board applications
Screw locking	Provides robust and reliable interconnection between two large boards
Open pin field design	Supports both single-ended and differential pairs signal with speed up to 16Gb/s
Low profile 3mm design for coplanar application	Ideal for high density applications where drives are positioned above connectors
Supports PCB thicknesses of 3.00mm and abover	Flexibility in accommodating various PCB board-to-board thicknesses

Cool Edge 1.00mm

FEATURES	BENEFITS
Signal pin pitch at 1.00mm, based on PCIe interface	Supports Board-to-Board applications
1.1A/pin for power applications	
0.7A/pin for signal applications	
Supports speeds from 16 up to 25 and 32Gb/s	Backward compatibility toward PCIe Gen3 and forward compatibility toward PCIe Gen5
PCIe slots of X16	Support most add-in card and next generation GPU application
Supports 1.6mm thick mating board	Multiple applications served from ICT to consumer
Simple housing design in vertical configuration	Allows for easy Automated Optical Inspection (AOI)
Contact pads extend outwards from housing	Makes inspection easier compared to standard PCIe

CIRCULAR CONNECTOR SheerPwr™

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Amphenol ICC

APPLICATIONS

- AC/DC pluggable power supplies
- Pluggable circuit breakers
- Networking equipment
- Switches
- Server & Storage
- Industrial PC
- Industrial controls & instrumentation

SheerPwr™ circular is a high-current, low-resistance interface designed for connecting busbars to circuit boards. It uses a robust and compliant power contact assembled in a circular orientation.

The result is a power socket, designed to mate with traditional machined pins, which provides repeated low resistance, high mis-alignment and high current carrying capabilities.

Advantages when mating with busbars:

- Redundant contact points for improved reliability and lower resistance
- Low profile socket regardless of pin size
- Permanent misalignment capability of ±0.64mm
- Provides a minimum of 4.0mm of gatherability (increases with pin diameter)
- AGT® silver-based plating for maximum efficiency

Design Advantage:

Permanent Misalignment

Large beam deflection range handles up to ±0.64mm permanent misalignment. When fully misaligned, all of the beams still make contact with the pin. Alternate products, at 0.64mm misalignment lose contact with several spring beams.

Specifications

- Current Ratings:
  3.6mm – 70A, 6mm – 120A, 8mm – 160A
- Contact Resistance: 0.05-0.1mΩ (depending on size)
- Durability: 100 mating cycles
- Mating force: 20-50N (depending on pin diameter)
- Unmating force: 10-20N (depending on pin diameter)
- Operating Temperature: -40 to +105°C

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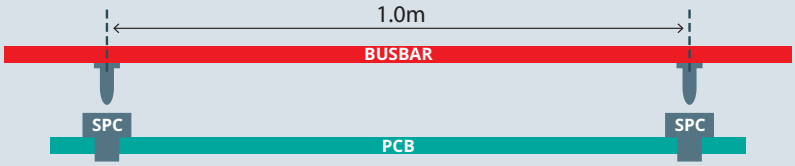

FEATURES	BENEFITS
Large beam deflection range handles up to ±0.64mm permanent misalignment	When fully misaligned, all of the beams still make contact with the pin
Redundant contact points	Low and stable resistance
Large gatherability	For blind-mate applications
AGT® silver plated contacts	Lower resistance
3.6mm, 6mm, and 8mm mating pin sizes	Current carrying range delivering 70A, 120A, or 160A, depending on pin diameter
Low 6.8mm connector height	Compact size fits in many applications and allows for greater airflow
Low halogen materials	Meets JEDEC JS709 Electronics Industry Standards

Exzellent Transmission

AMPHENOL-LTW: Shielded cables available with M12 A, B and D-coding: Providing the Highest-Performance and most Reliable Connection!

AMPHENOL-LTW (ALTW) broaden its M12 A, B and D-coded product range with the new M12 shielded connector, ideally designed to resist electro-magnetic interference (EMI) as it transmits signals and maintains its data quality. The M12 shielded connectors comply with IEC standards and is specifically made for applications where the uncompromising full 360° EMI/RFI shielding is required.

The metal connector has an anti-corrosion protection offering 96 hours of salt spray test. In mated condition the connectors reach IP68 waterproof requirement. Typical applications can be found in the Industrial Automation, MRT/Railway, Marine, Heavy Vehicles, Surveillance Systems or Broadband Wireless Access.

The UL-certified cables are delivered with black PU or PVC (UV resistant) coating and come with an ergonomically designed overmoulding for easy hand and tool use. Single or double ended assemblies in various lengths up to 99 meters are available and any customization is welcome.

Features

- A, B and D-coding
- 9 layouts available from 3 to 12 contacts
- Screw locking mechanism
- Temperature range from -25 to +85°C
- IP68 waterproof in mated condition (1M/24h)
- Min. 100 mating cycles
- IEC 61076-2-101 compliant

S06

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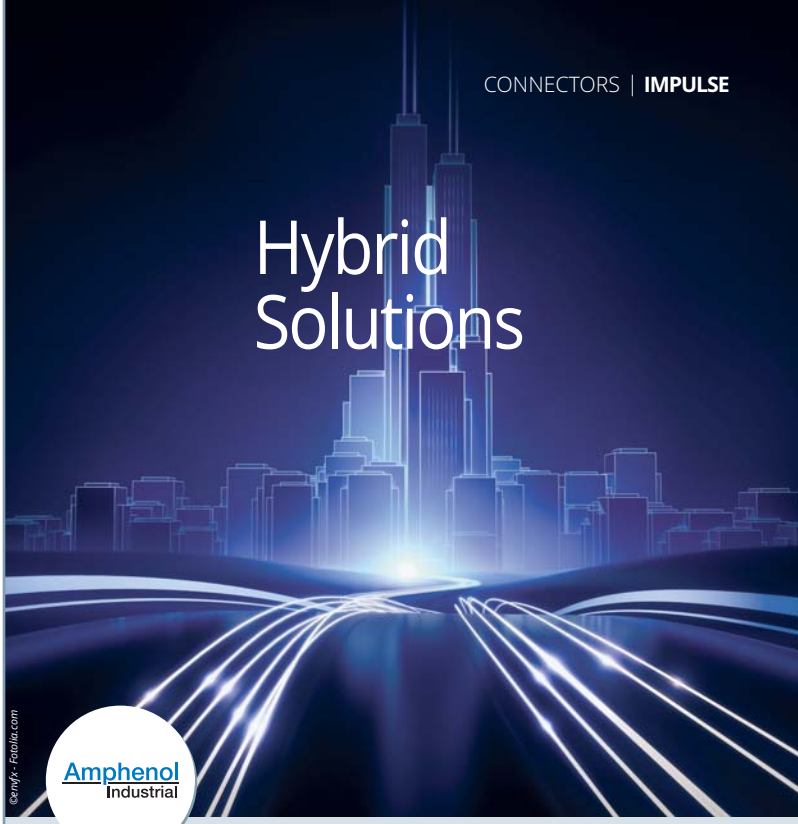

Hybrid Solutions

A new Connector of the M12 Series

HC32: Hybrid connectors for panel mounting.

Hybrid solutions are not only a popular trend in the car industry, but also in the connection technology layouts with contacts for high-powers and signals are called hybrids. The benefits are obvious: Instead of using two seperate connections, the new HC32 series from AMPHENOL combines the power and signal transmission in one single connector system.

HC32 connectors are available as cable to cable connection with flange and ergonomic locking lever. The hybrid contact arrangement with 6× 16 and 26× 20 eco|mate® RM series contacts allows currents of 6× 13A and 26× 5A within one connector. The robust design is ideal for the usage of HC32 in harsh environments.

Power & Signal Transmission in one single Connector System!

Features

- 32-pin rectangular connector with mixed layout
- Cable to cable connection for rear panel mounting
- Max. current 6× 13A and 26× 5A
- Stamped and formed contacts from eco|mate® RM series
- Ergonomic locking lever for easy handling
- Operating temperature from -40 to +125°C
- IP67 water protection in mated condition

S07

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MAGNETICS & LIGHTPIPES

The Y-Con® Jack-7x is a reflow-capable RJ45 connector for industrial applications

The socket for 100 Mbit/s basically consists of a base body with 90° orientation of the connector to the solder pins, along with the »Tab-up« tab orientation. The individual types vary in features to ensure that the right product can be selected to meet customer needs.

The jack optionally has machine-wound transformers, additional integrated power contacts and reflow-capable light pipes. For the power contacts and reflow-capable light pipes, YAMAICHI Electronics relies on a mature design that provides customers the greatest possible flexibility in the transmission of power up to 100W as well as in the transmission of optical signals.

With the two additional power contacts, up to 2.1A can be transmitted at 70°C without affecting signal transmission. This is significantly more than provided by PoE and it also saves another cable.

When using light pipes, on the other hand, optical signals can be transmitted from the PCB on the front of the jack just as with an optical fibre. In contrast with the LEDs, however, light pipes have a nearly unlimited lifetime and a cost advantage. The use of light pipes in reflow soldering is also not limited by the high solder temperature, and there is still complete freedom in the selection of light colour.

The integrated machine-wound transformers ensure optimum, consistently good signal transmission, for example if there is no space on the PCB for magnetics when using Ethernet. In contrast with hand-wound transformers, in which performance can depend on the capability of the maker, machine-wound transforms ensure consistent transmission quality. They are also insensitive to vibrations, since the coil bodies are always cast. The series can therefore meet the strictest of requirements in the industrial sector.

Features

- 100 Mbit/s (CAT5)
- 90° Tab-up
- THT-reflow (260°C for 10 sec.)
- Optional power contacts
- Power transmission through power contacts: 2.1A @ 70°
- Optional light pipes
- Optional magnetics
- Contact area: 30µ" Au
- 1,500 mating cycles
- Compatible with any common RJ45 plug

S08

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Customized Lead Frames

Lead frames are used wherever high currents must be transmitted on a small space – predominantly in the automobile industry.

Their design and development are done exclusively according to the customer's requirements with respect to layout, material, surface treatment, electrical connections, overmoulding, and more. The only restriction applies to the maximum possible size of 120×250mm.

Lead frames are manufactured using punching machines. Punching and bending machines are used in manufacturing whenever the customer requires contour shapes.

In addition, it is possible to choose different surface coatings and finishes (selective, full, or special finishing) and to fit the lead frames with plastic overmoulds, e.g. in order to fit them into an existing frame.

Electrical connections can also be tailored to the customer's requirements. Everything is possible, ranging from simple connections in the shape of fast-on receptacles to high-quality direct connectors.

After the installation of the lead frames, their precise design and manufacture will subsequently allow an exact positioning of other components on these with the help of robots.

The key facts at a glance

- Transmission of high currents on a small space
- With or without overmoulding
- Contour-forming, also 3D
- Part size up to 120×250mm
- Full, selective, or special finishing
- Various metals and plastics, standard to high temperature
- Direct connectors optionally available

S09

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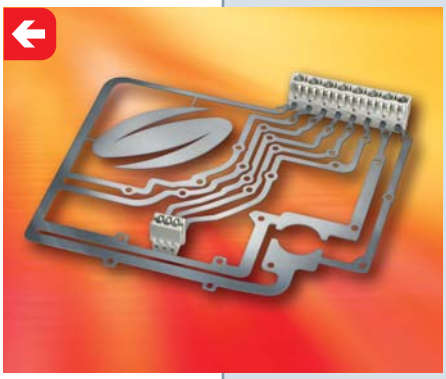

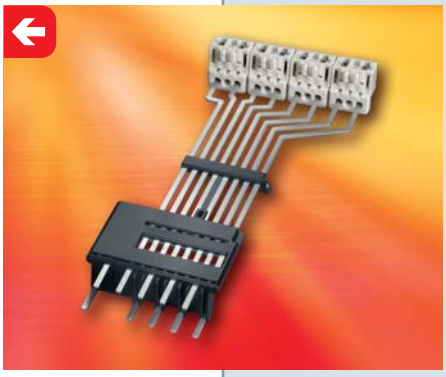

Y-Circ® P – Overmoulded

The push-pull circular connector series Y-Circ® P from YAMAICHI Electronics is available with overmoulded bent relief.

YAMAICHI Electronics now also offers the Y-Circ® P series with overmoulded bent relief. Upon request, the cable outlet in connection with a cable assembly for the Y-Circ® P can be equipped with an overmoulded bent relief. This prevents unwanted unscrewing of the connector without the need for gluing. The proven bent relief design increases its flexibility in comparison with standard bent reliefs.

YAMAICHI produces the Y-Circ® P in its factory in Frankfurt (Oder). Cable assemblies for in-house and third-party products are also manufactured there. Customer-specific designs and adaptations to the requirements of cable assemblies can also be easily realised thanks to long-standing know-how in the overmoulding of connectors.

This product portfolio makes YAMAICHI the only manufacturer capable of offering complete cable assemblies with overmoulded in-house M12 and push-pull connectors. In addition, adapter cable assemblies for connecting M12 or push-pull connectors to RJ45 or USB interfaces are possible with the legally protected industrial connector series Y-Con®.

YAMAICHI Electronics thus offers the advantage that all required components are available onsite and the entire cable assembly including the overmoulding can be manufactured at a single production location.

S10

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CODICO Team

Business Run 2018

Keeping to the slogan »NEVER CHANGE A WINNING TEAM«, CODICO again took part this year with a total of five teams in the Vienna Business Run.

The 18th Vienna Business Run took place on Thursday, 6th September 2018, around the Ernst-Happel Stadium in Vienna. The weather was perfect, and almost 30,000 runners put their speed to the test and competed for their companies. Among them were five highly motivated CODICO teams, who with the inspiration of drummers, set out to tackle the 4.1 kilometre course in double-quick time.

The euphoria was terrific, with all the CODICO teams achieving fantastic results as well as achieving all their personal aims. Lisa Polovitzer found the atmosphere overwhelming: It was the first time I had taken part in the Business Run, and it was really impressive, on the one hand because of the location at the Ernst-Happel Stadium, and generally because so many companies were represented, with a total of more than 30,000 people taking part. On the other hand, the run itself was very successful for me personally, because I have never run such a fast kilometre time before. It was a really exciting evening, and great fun as well. The beer afterwards was just as tasty as my colleagues who had already done the run before told me it would be ;-). To round things off perfectly, there were still a few of us in the Prater, and pulses really got racing (keyword Black Mamba. It was a great way of ending the whole event. I'm really looking forward to taking part again next year.

D03

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CODICO Team

CODICO World Cup betting game: Play & win!

Although we did not have the chance to enjoy the much-anticipated battle of titans between Ronaldo and Messi at the 2018 World Cup in Russia, the most expensive World Cup in history enriched our lives with some memorable moments.

Sweden got a 60,000 euro penalty for unauthorized socks branding. Rabio the octopus was (later on) eaten, although he correctly predicted some hits. Neymar delivered an Oscar-worthy performance. Modric and his team showed the English press and the whole world that they were not tired yet and did not let England »take football home«. And in a spectacular World Cup final France prevailed against the underdog Croatia and thus won the title of world champion again – after exactly 20 years!

Drum roll: and the first prize goes to ...

The whole world followed this great football spectacle. Our customers additionally had the opportunity to prove their personal sense of football in our online betting game! On our own CODICO betting platform enthusiastic players were allo-

Jan Müller (PRIMEDIC METRAX GmbH)

CODICO Team

wed to place bets on the outcome of the games and collect valuable points. In life as in football, you will not get far, if you do not know where your goal is. Our 533 players had one clear goal in mind – to win one of our coveted prizes. Every single one of them hoped and played on their football know-how and a dose of luck to win attractive prizes!

Mr. **Jan Müller from PRIMEDIC METRAX GmbH** prevailed and won the main prize. Especially with our bonus questions, which catapulted him to the top of the list at the last moment, he has shown exquisite football knowledge. Our winner can now look forward to the »Myth Liverpool« prize package and enjoy a home game of Liverpool FC in the 2018/2019 season together with the companion of his choice! A visit to the society museum and the museum »The Beatles Story«, a boat trip on the Mersey and accommodation with food and flight tickets are also given! We congratulate our lucky winner and wish him lots of fun in Liverpool!

The football fever grabs the CODICO Team

We did not want to miss out on the whole fun around the world cup so an internal betting game was also organized for CODICO's employees. We were very pleased about a high number of participants and an exciting competition. With a shared score three of our collegues became winners of our world cup game. As a reward, they were able to opt for an original World Cup dress or a Smart Watch Activity Tracker.

D04

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The key to success lies in diversity

CODICO has grown strongly in recent years, not only in terms of number of employees, but also in terms of their diversity. As a company employing people with more than 20 different nationalities, CODICO brings together a multitude of languages, cultures and skills under one roof. Appreciation of our colleagues and all the peculiarities that make them who they are, as well as an open, respectful togetherness are the core of our company. We therefore took the chance and dedicated one whole evening during an internal Academy Week to a special topic – diversity.

Boredom is not on the CODICO menu

On 19th September the „Möbeldepot Wien" was transformed into a huge open kitchen for one special occasion - the CODICO Cooking Event. After a splendid reception with an aperitif and equipped with CODICO aprons, we began by creating random cooking groups drawn from lots. As a result, we were given nine colourfully mixed but fully motivated teams. Then, the professional cooks of the Wrenkh salon gave us some important cooking advice before opening the CODICO Cooking event at 7 o'clock.

Our nine teams had been assigned various international dishes – from Mediterranean to Asian specialties. Each group was also provided with their own chef, who gave solid advice but also made sure we stayed on track. Our exquisite culinary masterpieces were then enjoyed with one – or more – glasses of wine. As icing on the cake, we were able to finish the dinner with a sensational chocolate dessert. With full bellies, we then moved the party to the bar, where tasty cocktails and great music were waiting for us.

Sharing is caring

»It was important for us to combine movement, variety and diversity in this event. Additionally, we find that cooking and eating together connects people and is very matey and familiar– and family is a value we at CODICO hold dearly, because that's exactly where our roots lie«, remarked CEO Karin Krumpel.

D05

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The CODICO TEAM says hello!

Michaela Kronfellner

Hello, dear Impulse readers,
My name is Michaela Kronfellner. I joined CODICO back in March 2014, and I would like to introduce myself in this issue. I work in the Order Administration department, where my tasks include the management of key accounts in Austria and Germany. So my job is to ensure a smooth supply chain from our suppliers to you. In turbulent times, this is not a particularly easy task, but I find it all the more motivating and encouraging.

I love organising things and working together with people – both at my job and in my free time. A great part of my private life is dedicated to »my« scout group in Vienna. I have been an active member of the scouts for almost 25 years, and now I myself lead a group of youths aged 16 to 20. This summer, I organised a summer camp for our group in the Danube Delta on the Black Sea. As you can imagine, this was a very exciting and challenging task.

Nature generally plays an important role in my free time. I enjoy spending my weekends in our garden in Burgenland. There is no better place for me to recharge my batteries after a challenging week at work. My absolute favourite hobbies are long walks in the forest, reading, and gardening.

I have met a lot of nice people at CODICO, and even made some new friends. CODICO's very special sense of community and its motto "We live and breathe family" perfectly suits my own approach. I am a family person to the core, and I love spending time with my loved ones. I particularly enjoy it when my nephew and my niece come to visit me and we do something together.

D06

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Klaus Buchenberg

My name is Klaus Buchenberg. I'm an electronic engineer and I work with CODICO for over 4 years now. Since more than 20 years I have been working in the semiconductor industry, gathering expertise and I have seen quite a bit. My current task is the technical support of CODICO's customers in the area of »power«. Everything, about AC/DC power supplies, DC/DC stages, LED-drivers, battery-chargers and motor control falls into my responsibility.

In cases, where customers experience problems during the development of their products, I support them in the troubleshooting. The more easy cases are clarifying descriptions and parameters in datasheets, in most cases however it is guidance in the troubleshooting activities and in rare cases it goes to the extent of parallel troubleshooting on customer's boards in the lab. Design-In is another important task. As such, I provide our customers advice on suitable parts matching their requirements, often enough delivering a first circuit sketch.

The 1st step is the evaluation of the customer's requirements. In many cases, the requirements are not fully defined yet or every so often unrealistic. Long and behold it does happen, that technical project requirements are derived from the most advanced competitors offering on the market, while the commercial requirements do come from another low cost product of far east origin. In such cases, I help customers to come up with realistic requirements. At the end of the day, the product features and price have to fit the market segment the customer plies or is targeting. In the 2nd step my colleagues and me provide tailored suggestions, which contain BOMs, pricing, schematics and evaluation boards.

In the 3rd step we supply samples and provide help in the prototyping. In addition to these two most important tasks, I write technical articles and give product trainings. CODICO's power team is comprised of excellent people, working together very efficiently and thus achieving outstanding results. The power sector of CODICO's lines showed strong and continuous growth over the last 10+ years. Sometimes I do get granted some spare time, which I mostly spend with my family and if at all possible, I do some sports as well (skiing, cycling, swimming and running).

D07

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Michael Blaha

Since the beginning of 2014 I have been responsible at CODICO for the introduction and business development of electromechanical relays in the product portfolio. Since completing my studies in 1989 I have been involved in a very wide range of different global functions in the sectors of product management, business development and strategy, sales and basic engineering for relays at Schrack, Siemens, and TE Connectivity. As the first step, we at CODICO concentrated on applications in industry, building technology, white goods, and the energy management sector. The Smart Home sector in particular is growing at a disproportional rate and the search is constantly on for new, innovative solutions. Initial projects are also under way in the automotive applications sector. With my long years of know how in relay technology, of the regulations and standards and of the market and the applications, in close interaction with the superb team of marketing engineers, we succeeded in implementing the Design-In concept created by CODICO with the best possible results. We function in this context as an interface between the European customers and the Asian headquarters of our partners, so as to provide the customers with the best possible technical and commercial solutions for their particular problem when it comes to switching, as well as presenting new, innovative products. In this context, the focus is on miniaturisation in particular, which you can read more about in the article about the new 16A GQ. I love working on projects, and being with our out-of-house team at the customer's own location. It is great fun working at CODICO. 35 years ago, when I was a student, I was on board for five years as an auxiliary employee, and during that time I was able to carry out a number of very widely differing projects. A lot has happened since then. CODICO has established themselves as major players on the European market for components which require intensive consultation and advice. I have been able to gain 25 years of experience with global producers of electromechanical relays in the most widely differing corporate cultures. Now I can bring this to fruition at CODICO. Despite the company's rapid growth and the diversity of the staff, CODICO has succeeded in retaining a culture of »we are a family« for many years and live that philosophy to the full. We feel this among ourselves and our customers sense it too. Working as a team, enjoying what we do, taking advantage of the individual strengths of our colleagues and the sense of commitment which can be felt and be seen in pursuing the same aims and goals, as well as the closeness of our links for communications and taking decisions, make that major difference in comparison with working in global corporations and are essential parts of our culture. When it comes to building up a new area of business, this is an absolute must in achieving our aims.

My hobbies include travelling and enjoying nature. Now that our two sons are grown up, my wife and I can plan vacations outside the school holidays and in most cases that means travelling far away, to discover new cultures, new people and new landscapes. We often take round trips, combined with a beach holiday to round things off. I find that striking a balance and getting out and about in natural surroundings are very important, especially because at work I spend most of my time sitting down. I am often out on my mountain bike, but I also like being in the mountains, whether it be on foot or on skis. I enjoy the peace and beauty and recharge my batteries ready to take on the next tasks.

D08

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Petr Roček

My name is Petr Rocek, I´m almost 55 years old and I come from Czech Republic.

I studied at Czech Technical University in Prague, Faculty of Electrical Engineering. All my professional life I worked in support and distribution of electric components. In the 90s I owned a distribution firm which I sold by the end of 1999. After two years at home, I started at CODICO in 2002 as a Sales Representative and later as a Field Sales Engineers for the Czech Republic. I work in this field up to now. Starting this July I´m responsible for the Slovakia market too. My office is located in the north part of the Czech Republic, near the Giant Mountains.

I really enjoy this job because it is very dynamic and keeps me informed about latest market trends. In my function I look for and support design activities through the Czech and Slovak market. I always try to find the best solution based on customer requirements from our portfolio. This give me the possibility to discover different customers, study and learn a lot about their products and applications, so I can provide them with added value solutions which also benefits CODICO.

I prefer to speak personally with our customers. It provides me with new inputs for my job. Attending the Gustav Käser sales training inspired me to interact and negotiate with our customers more, to bring both sides benefits. I´m an optimistic person and I like to have people around me that are also optimistic like me. At the same time, I´m a rational person. When problems arise, I try to solve them with sensitivity, but consistently. I am also open to change, which is especially important nowadays, when things around us change so quickly.

To find a healthy balance in my daily work I spend as much time as possible in nature, working out or with my dog. Whenever is possible I go cycling, play basketball, downhill or cross-country skiing or go for a walk. I feel the need to explore new places all over the world. Each year I plan to make an adventurous holiday. I have already visited almost all the countries in Latin America and South-East Asia. I would love to see the Himalayas, Russia and the Eastern part of the US. Let´s see!

CODICO is an international and multicultural company and for me this is a wonderful thing. It is very interesting to speak with our suppliers, coming from different parts all over the world. Every single day gives me opportunities to learn something new and interesting and makes my business live tremendously exciting. Sometimes the job can be challenging, of course, but after all, my goal is to constantly improve myself. I´m really proud to be a part of CODICO's great multicultural team.

If you want to get to know me better, just visit me or give me a call! I´m looking forward to meeting you in person.

D09

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