CODICO®

impulse 2/2019

CAR PARKING ROBOT

CP 24N91
FLOOR 9

1:14 min

THUNDERCOMM: Innovative Modules

Market Trends for Hybrid Capacitors

For industrial customers: SUMIDA Panta® SMD Jumper

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04 | THUNDERCOMM

Introducing an innovative module supplier and strong support partner for Qualcomm's »Snapdragon« processors. THUNDERCOMM is dedicated to providing module and software solutions for IoT, AI, automatization, machine service, smart cameras, robotics, VR/AR devices, mobile devices, drones and medical devices.

ACTIVE COMPONENTS

PASSIVE COMPONENTS

CODICO IN-HOUSE

CONNECTORS

Who are our best suppliers?

Once again this year, we evaluated our international suppliers on the basis of comparable criteria. Particular emphasis was given to the three categories »Delivery reliability, Logistics Service, and Sales Service«.

CODICO presents the QUALITY AWARD to its TOP suppliers, which include

- Torex Semiconductor Europe Ltd
- Asahi Kasei Microdevices Corporation
- Power Integrations International, Ltd
- Rubycon Corporation
- Celain Technologies Enterprise Ltd.
- FCI Deutschland GmbH
- Sagami Electronics Co Ltd.
- Nidec Copal Electronics GmbH

This award represents a tribute to those suppliers who, in addition to price and delivery time, best managed to meet the diverse requirements of our customers. Congratulations and many thanks to our suppliers for their outstanding performance and their trustful cooperation!

Do you want to find out more about our QSM system? Please contact

D01

▼ *Petra Landschau, +43 1 86305 169*
petra.landschau@codico.com

Special thanks go to TOREX, which secured the spot at thet op of the ranking. ∨

Andy Scott
Strategic Sales Manager,
Torex Semiconductor Europe Ltd.

Editorial

→ **Education is an asset**

Dear readers,

on Monday, September 2, 2019, we welcomed our first three apprentices at CODICO! This is uncharted territory for us, a new experience we see as an investment in the future, and an opportunity to pass on our expertise!

At CODICO, knowledge and education play a crucial role: every employee brings with them an individual package of qualifications, knowledge, experience, and individual competencies. We pass this knowledge, this know-how directly to you, our customers! After all, our core competence is not the distribution of goods alone – we deliver technical competence.

We are not just a trading company, we rather see ourselves as more of a service company! Using our expert knowledge, we provide you with the best possible support in product development, and we accompany you in all phases of the project cycle. We want to live up to your quality requirements!

Therefore, at CODICO we attach great importance to expanding our knowledge, which translates into regular training and instruction courses, and individual educational grants for our staff. Our objective is to encourage and demand access to knowledge. Targeted training and upskilling programmes help expand each individual's professional and personal perspectives. A well-trained staff are the company's backbone and contribute significantly to customer satisfaction and, eventually, to the long-term success of the company.

We see knowledge as an essential resource – access to and expansion of knowledge, however, is not an end in itself, but should reap direct benefits for you and boost your success!

D02

▼ *Sven Krumpel*

Sven Krumpel
CEO CODICO

THUNDERCOMM

Thundercomm

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CAR PARKING ROBOT

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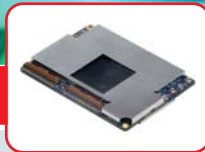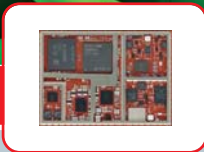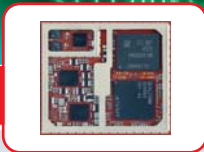
		D660 SOM	D660PRO SOM	D820 SOM
PLATFORM	Snapdragon	660, 14nm	660, 14nm	820, 14nm
	Part Number	SDA-660-0-692NSP-TR-01-0-AA	SDM-660-2-692NSP-TR-01-0-AA	APQ-8096-1-994CMNSP-MT-04-0-AB
	CPU	8x Kryo 260 • 4x 2.2GHz cores • 4x 1.9GHz low power cores	8x Kryo 260 • 4x 2.2GHz cores • 4x 1.9GHz low power cores	4x Kryo • 2x 2.15GHz cores • 2x 1.592GHz low power cores
	GPU	Adreno 512 OpenGL ES 3.2, OpenCL 2.0 full, Vulkan, DX12	Adreno 512 OpenGL ES 3.2, OpenCL 2.0 full, Vulkan, DX12	Adreno 530 with 64bit addressing OpenGL ES 3.1, OpenCL2.0
	DSP	Hexagon 680	Hexagon 680	Hexagon 680 DSP
	OS	Android Pie	Android Pie	Android Pie
	Memory/Storage	3GB LPDDR4x, 2GB eMMC / 4GB+64GB*	3GB LPDDR4x, 32GB eMMC / 4GB+64GB*	4GB LPDDR4, 64GB eMMC/UFS
MULTIMEDIA	Display	2x MIPI-DSI 4-lane, up to 2560×1600 10bit @ 60Hz	2x MIPI-DSI 4-lane up to 2560×1600 10bit @ 60Hz	2x MIPI-DSI 4-lane, up to 3840×2400 @ 60fps 1x HDMI out v2.0, up to 4096×2160@60fps
	Camera	Qualcomm Spectra 160 Camera ISP, Dual 14bit ISPs 3x MIPI-CSI4-lane, up to 25MP single cameras up to 16MP dual cameras	Qualcomm Spectra 160 Camera ISP, Dual 14bit ISPs 3x MIPI-CSI4-lane, up to 25MP single cameras up to 16MP dual cameras	Dual 14bit Spectra ISP, 3x MIPI-CSI 4-lane, Dual ISP, up to 28MP
	Decode	4K@30fps 8bit VP9, H264, VP8, MPEG4 and 10bit H.265	4K@30fps 8bit VP9, H.264, VP8, MPEG4 and 10bit H.265	1080p@240fps, 4K@60fps, 8x 1080p@30fps (H.264, VP8, H.265 8/10bit, VP9)
	Encode	4K@30fps H.265, H.264, VP8, MPEG4	4K@30fps H.265, H.264, VP8, MPEG4	1080p@120fps, 4K@30fps, 4x1080p@30fps (H.264, VP8, H.265)
CONNECTIVITY	Wi-Fi, Bluetooth	802.11a/b/g/n/ac, MU-MIMO 2x2 Bluetooth 5.0 (based on WCN3990)	802.11a/b/g/n/ac, MU-MIMO 2x2 Bluetooth 5.0 (based on WCN3990)	802.11 ac/a/b/g/n, MIMO 2x2 Bluetooth 4.2 (based on QCA6174A)
	Cellular/GNSS	no	GSM, WCDMA, CDMA, LTE-FDD, LTE-TDD, GPS, GLONAS, Beidou, Galileo	no
	Interfaces	1x USB3.1, 1x USB2.0, 1x SDIO3.0, 2x UIM , 1x JTAG, 1x Vibrator Driver, 3x Flash LED Driver, 3x LED Driver, 7x BLSP, GPIO	1x USB3.1, 1x USB2.0, 1x SDIO3.0, 2x UIM , 1x JTAG,1x Vibrator Driver, 3x Flash LED Driver, 3x LED Driver, 7x BLSP, GPIO	1x USB2.0, 1x USB3.0, 1x PCIe2.1, 4x I2C, 4x UART, 2x SPI, 1x I2S, 4(+)x GPIOs, 1x SDIO 3.0, 1x TF card
MODULE SPEC	Dimension (mm)	40×35×2.89	40×55×2.89	36×51×10.5
	Power Supply	+4.2V/3A Input	+4.2V/3A Input	+3.8V/3A Input
	Operating Temp.	-20 to +65°C	-20 to +65°C	-20 to +70°C
	Storage Temp.	-30 to +85°C	-30 to +85°C	-20 to +80°C
	Relative Humidity	5% to 95%, non-condensing	5% to 95%, non-condensing	5 to 95% non-condensing
	Certification	RED, FCC	RED, FCC, PTCRB, GCF	RED, FCC, IC

* D660 and D660Pro are also available with 4GB LPDDR4x and 64GB eMMC

Introducing an innovative module supplier & strong support partner for Qualcomm's Snapdragon processors.

THUNDERCOMM was founded in 2016 by ThunderSoft and Qualcomm. Based on Qualcomm's world-leading Snapdragon processors as well as ThunderSoft's powerful application and operating system technologies and service capability, THUNDERCOMM is dedicated to providing module and software solutions for IoT, AI, automatization, machine service, smart cameras, robotics, VR/AR devices, mobile devices, drones, and medical devices.

THUNDERCOMM develops and produces SOM (System on Modules) based on Qualcomm's Snapdragon processors, which are equipped with 4×Kryo or 8×Kryo CPU cores – in a 10nm or 14nm manufacturing process – clocked between 1.6GHz and 2.6GHz. Kryo is the marketing name for Qualcomm's customized ARM-based CPUs that are compatible with the ARMv8-A 64bit instruction set and serve as successors to the older

32bit Krait core. The processor cores are arranged in clusters divided into 4 or 2 gold cores and 4 or 2 silver cores. The latter work in a clock rate around 300-900MHz lower and allow the execution of low power applications. The gold cores are derived from ARM Coretx-A75 and Cortex-A73, the silver cores from Cortex-A55. The exception is the S626 SOM, which is equipped with 8 Cortex-A53, all clocked with 2.2GHz.

In addition to the CPUs mentioned above, further processors are available to outsource computation-intensive and complex algorithms for video, audio and AI applications for a delay-free and power-saving execution. The Hexagon DSP (Digit Signal Processor) developed by Qualcomm offers a VLIW and SIMD architecture that can execute up to 4 arithmetic operations in parallel with a single command.

A second DSP core within the Hexagon architecture allows the monitoring and evaluation of sensor applications in sleep mode. For graphics acceleration, all Snapdragon processors feature a GPU (Graphics Processing Units) called Adreno,

| D845 SOM	S626 SOM	S820 SOM		
845, 10nm	626, 14nm	820, 14nm	Snapdragon	PLATFORM
SDA-845-A-914BMPSP-TR-02-0-AA	APQ-8053-A-792NSP-TR-01-1-AC	APQ-8096-1-994CMNSP-MT-04-0-AB	Part Number	
8x Kryo 385 • 4x 2.649GHz cores, each 256KB L2 cache • 4x 1.766GHz, each 128KB L2 cache	8x Cortex-A53@2.2 GHz • 1x quad with 1MB L2 cache • 1x quad with 512KB L2 cache	4x Kryo • 2x 2.15GHz cores • 2x 1.592GHz low power cores	CPU	
Adreno 630 with 4K 60fps or 2x 2k 90fps OpenGL ES 3.2 + AEP, DX next, Vulkan 2 OpenCL 2.0 full profile, RenderScript	Adreno 506 OpenGLES 3.1+, OpenCL2.0 1.2f	Adreno 530 with 64bit addressing OpenGLES 3.1, OpenCL2.0	GPU	
Hexagon Vector Extensions (HVX) processor	mDSP Hexagon DSP V56 850MHz 768kB L2 caches aDSP Hexagon v56 850MHz	Hexagon 680 DSP with dual-Hexagon vector processor (HVX-512) @825MHz	DSP	
Android Pie, Linux 4.9, Linux 1.0 (Yocto), Ubuntu	Android Pie	Android Pie	OS	
4GB LPDDR4x, 64GB UFS	2GB LPDDR3, 16GB eMMC	4GB LPDDR4, 64GB eMMC	Memory/Storage	
2x MIPI-DSI 4-lane, up to 3840×2400 @ 60fps	FHD (1920×1200) at 60fps Dual MIPI DSI four lane D PHY 1.1	2x MIPI-DSI 4-lane, up to 3840×2400@60fps 1x HDMI out v2.0, up to 4096×2160@60fps	Display	MULTIMEDIA
Spectra 280 ISP, 3x 4-lane MIPI_CSI, 1x 2-lane MIPI_CSI, Dual 14bit ISP, one Lite ISP, up to 32MP	Dual ISP, 3x MIPI-CSI, 2.1Gbps per lane, 4-lane, Supports CMOS & CCDsensors up to 24MP sensors	Dual 14bit Spectra ISP, 3x MIPI-CSI 4-lane, Dual ISP, up to 28MP	Camera	
4K@60fps decode for H.264 High Profile, H.265 Main 10 PROFILE and VP9 Profile 2	4K@30fps,1080p@60fps (H.264, H.265, VP8, VP9)	1080p@240fps, 4K@60fps, 8x1080p@30fps (H.264, VP8, H.265 8/10bit, VP9)	Decode	
4K@60fps, H.264 High Profile, H.265 Main 10 Profile, 4K@30fps encode for VP8	4K@30fps,1080p@60fps (H.264, H.265, VP8)	1080p@120fps, 4K@30fps, 4x1080p@30fps (H.264, VP8, H.265)	Encode	
802.11a/b/g/a/n/ac MU-MIMO 2x2 Bluetoorth 5.0 (based on WCN3990)	802.11a/b/g/n/ac MIMO 1x1 Bluetooth 4.2 (based on WCN3680B)	802.11 ac/a/b/g/n, MIMO 2×2 Bluetooth 4.2 (based on QCA6174A)	Wi-Fi, Bluetooth	CONNECTIVITY
no	no	no	Cellular/GNSS	
2x USB3.1, 1x PCIe2.1, 1x PCIe3.0, 1x SDIO 3.0, 1x TF card, QUP for UART/I2C/SPIx5, 8x GPIOs, 4x MI2S	1x USB3.0, 15x GPIOs, 1x Slimbus, 1x SDIO, 2x I2S, BLSP for SPI, UART, 7x I2C	1x USB2.0, 1x USB3.0, 1x PCIe2.1, 4x I2C, 4x UART, 2x SPI, 1x I2S, 4(+)x GPIOs, 1x SDIO 3.0, 1x TF card	Interfaces	
60×37×7.1	37×52×10.5	40×55×10.5	Dimension (mm)	MODULE SPEC
+3.8V/3A Input	+3.8V/3A Input	+3.8V/3A Input	Power Supply	
-20 to +70°C	-20 to +70°C	-20 to +55°C	Operating Temp.	
-40 to +70°C	-20 to +80°C	-20 to +80°C	Storage Temp.	
5 to 95% non-condensing	5 to 95% non-condensing	5 to 95% non-condensing	Relative Humidity	
RED, FCC, Telec, Jate, VCCI	RED, FCC	RED*, FCC, IC	Certification	

whose architecture was originally developed by ATI Technologies (ATI) as Imageon and sold by AMD to Qualcomm in 2008 and is built exclusively into Qualcomm's Snapdragon. Video decoding supports a resolution of up to 4K@60fps (frames per second) and encoding 4K@30fps. Depending on the module version, the following APIs are supported: OpenGL ES, OpenCL, Open VG, Vulkan, RenderSrcipt, Direct X.

All SOMs are equipped with between 2GB and 4GB LPDDR SDRAM and partly support the extended standard LPDDR4+, which achieves a significantly lower power dissipation compared to the older standard LPDDR4 by lowering the I/O voltage (Vddq) from 1.1V to 0.6V. In addition, LPDDR4+ offers with 4266Mbps/pin a much higher data rate than LPDDR4 with only 3200 Mbps/pin. For the storage of data and program code, the user can choose between 16GB and 64GB eMMC (embedded MultiMediaCard) or UFS (Universal Flash Storage) Flash.

For connecting displays, the SOMs offer 2× MIPI-DSI 4-lane (Mobile Industry Processor Interface - Display Serial Interface) and some also HDMI 2.0 port. For the integration of cameras, 3× MIPI-CSI 4-lane (Camera Serial Interface) and a Spectra ISP (Image Sensor Processor) are available. In addition to the mentioned multimedia interfaces, the standard interfaces USB3.0/3.1, PCIe2.1/3.0, UART, I2S, I2C, SDIO3.0, GPIOs, etc. are also provided.

All SOM solutions support the Wi-Fi standards 802.11a/b/g/n/ac in MIMO 2x2 (except S626 SOM with MIMO 1×1) as well as Bluetooth/BLE. The D660Pro also offers the cellular standards GSM, WCDMA, CDMA, LTE-FDD and LTE-TDD as well as the GNSS standards GPS, GLONASS, Beidou and Galileo.

The SOMs are offered either as solderable or pluggable modules with a temperature range from -20 to +55°C or -20 to 70°C.
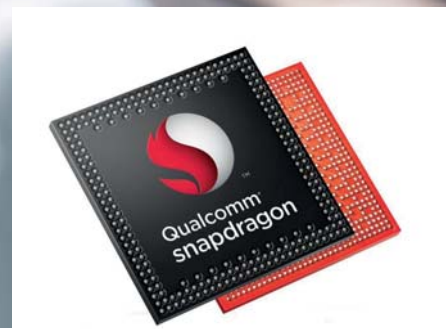
We offer customized Snapdragon solutions!
For CODICO THUNDERCOMM is not just a module supplier. In close co-operation with THUNDERCOMM and Qualcomm, CODICO can also support customized Snapdragon designs for the first time in its history. This support capability covers both HW and SW development.

An overview of further products and DVKs as well as brochures can be found here:
http://downloads.codico.com/misc/AEH/THUNDERCOMM

For more information, please contact

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TOUCH AS TOUCH CAN

A comparison of touchscreen technologies

As indispensable as they may seem in today's world of electronic equipment, keyboards are no longer the most widely used input tool – it's the touchscreen!

Meanwhile, touch technology is being used in millions of devices. Its most common applications include smartphones, ordering systems at restaurants, check-in terminals at airports, ticket dispensing machines at train stations, medical technology, car displays, and so on. The technology has also found its way into industrial applications, allowing users to interact with machinery without having to use a keyboard or a mouse. By slightly touching or wiping the screen or using a two-finger gesture, we can now easily, quickly, and intuitively open pages on the Internet, select and enlarge images, search for contacts, make a telephone call, or confirm a measurement value. Devices are simpler and quicker to operate with a touchscreen than with other aids.
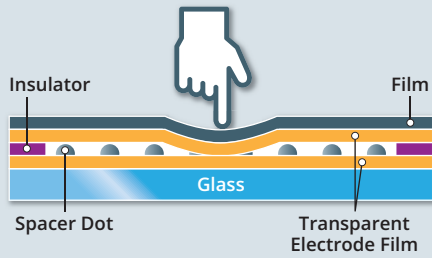
Since a touchscreen combines data entry and display unit, it helps reduce the size of the computer system, this advantage being most evident in portable devices. Mobile phones and tablets have long abandoned connected keyboards, allowing for direct input on a touch-sensitive user interface. This represents a significant plus, especially when space is a limiting factor. One need only think of POS terminals which, after having ditched a number of peripheral units, now allow for a far more ergonomic design.

A touchscreen in combination with a well-programmed user interface can significantly reduce training time for new employees. Since operating a device via a touchscreen is more intuitive and thus requires less concentration, such units are also better suited for employees who have to perform several different tasks at their workplace.
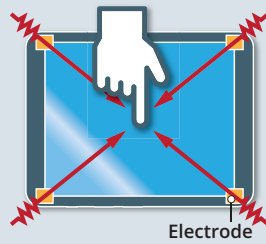
In short: Touchscreens, that is, those with a touch-sensitive surface, offer a series of advantages and have become an indispensable part of modern electronic devices.

	RESISTIVE		CAPACITIVE		ACOUSTIC	OPTICAL
Abbreviation	AR	GFG	SCAP	PCAP	SAW	IR
Design	Polyester-Glass	Glass-Film-Glass	Surface Capacitive	Projected Capacitive	Surface Acoustic Wave	Infrared
Surface Material	Polyester	Glass	Glass	Glass, PMMA	Glass	any
Operation	upon touching the surface two conductive ITO layers meet, causing a voltage drop (voltage divider)	upon touching the surface two conductive ITO layers meet, causing a voltage drop (voltage divider)	touching causes a change in an electric field	touching causes changes in an electric field, which are individually detected	touching causes a partial absorption of the wave energy	touching interrupts a light beam
Activation Object	any	any	Finger	Finger, Capacitive Stylus, (thin) Gloves	Finger, Gloves	any
Operation Mode	single touch	single touch	single touch	multi touch	dual touch	multi touch
Transmissivity	75-85%	75-85%	90-98%	85-98%	90-98%	95-100%
Sensitivity	★	★	★★	★★	★★	★★★
Calibration Stability	★★	★★	★	★★	★★	★★★
Accuracy & Repeatability	★★	★★	★	★★★	★	★
Scratch Resitance	NO	★★	★★	★★★	★★★	★★✦
Sensitivity to...						
Humidity	★★★	★★★	★★★	★★★	★★	★★
Rain/Snow	★★★	★★★	NO	★★	NO	★★★
Cleaning Chemicals	★★	★★	★★	★★★	★★	★★✦
Surface Contaminants	★★★	★★★	★	★★	NO	★
EMI/RFI	★★★	★★★	NO	★	★★	★★★
Vibration	★★★	★★★	★★	★★	★★	★★★
Ambient Light	★★★	★★★	★★★	★★★	★★★	★★
Temperature	NO	★★★	NO	★★★	★	★

1. Resistive Touch
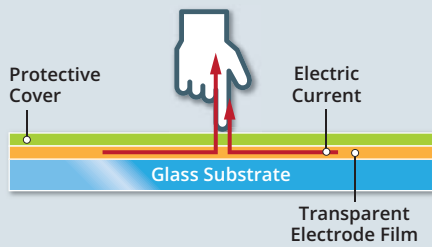
Insulator
Film
Spacer Dot
Glass
Transparent Electrode Film

2. Surface Capacitive Touch

Protective Cover
Electric Current
Glass Substrate
Transparent Electrode Film
Electrode

3. Projected Capacitive Touch

Protective Cover
Electric Field
Glass Substrate
Electrode Pattern Layer

X
Y
Transparent Electrode Pattern Layer

4. Surface Acoustic Wave Touch

Reflector
Survace Wave
Glass

Y
Y
X
X
X
■ X&Y Transmitter Transducer

5. Infrared Touch

Infrared LED/ Image Sensor
Triangulation
Retroreflective Tape
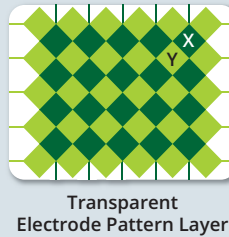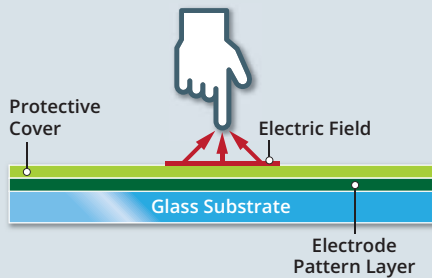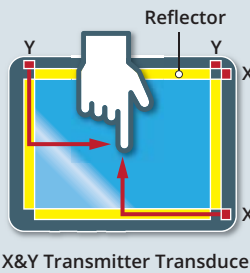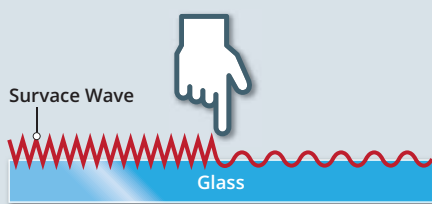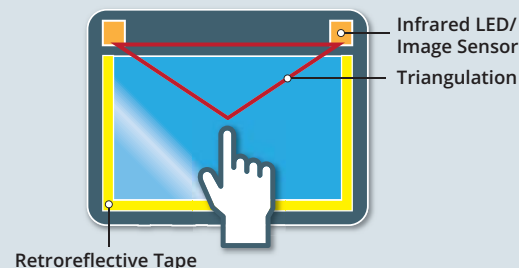
Which are the most significant touch technologies, how do they work in detail, and which one is the most suitable for your particular application?

Let's begin in medias res and look at both the advantages and disadvantages of the different technologies:

1. Resistive touch technology

Resistive touch technology is one of the most widely used worldwide. A resistive touchscreen consists of a glass substrate with an electrically conductive layer, and a polyester substrate also covered with an electrically conductive layer. The two substrates are kept apart by spacers. When the user presses on the touchscreen, the two conductive layers are pressed together, closing the circuit and creating a voltage divider. The exact touch point can be determined on the basis of the voltage value.

Resistive touchscreens exist as 4-wire, 5-wire, and 8-wire configurations. In the 4-wire type – the oldest of the three designs – the four sides of the contact surfaces feature one wire each. A 5-wire touchscreen design features an additional conductive layer (5th wire) that transmits the voltage, and 8-wire touchscreens have 4 additional wires that tap the measurement reading. Both of the above versions prevent a drop in accuracy, but they are also costlier to produce.

When the PET surface is replaced by glass, the design is referred to as a GFG (glass-film-glass) touchscreen. This considerably increases service life and also significantly improves resistance to scratching.

ADVANTAGES
- Most cost-effective solution
- Accepts all contact inputs (finger, stylus, gloved hand, etc.)
- Very precise
- Low power consumption
- Liquids do not impact behaviour
- Resistant to surface contaminants (dust, grease)

DISADVANTAGES
- Lower image sharpness than other touch technologies
- Polyester surface is prone to scratches
- Lower stability (35-70 million touches for PET)

2. Surface capacitive touch technology

Surface capacitive is another important touch technology, though it has been somewhat relegated in recent times. In this case, the touchscreen consists of a sheet of glass with a conductive electrode placed on top of it. The latter is then protected by a glass cover. When a finger touches the sensor, the sensor reacts to the electrical capacitance of the human body. Part of the electric charge flows from the touchscreen to the user. This drop in capacity is picked up over by four sensors positioned at the four corners of the glass sheet, allowing the controller to determine the exact touch point. This method, however, only works upon contact with the human skin, or with an electrically charged stylus pen.

ADVANTAGES
- Better clarity than resistive touchscreens
- High stability (225 million touches)
- Very precise
- Resistant to surface contaminants (dust, grease, oil) and liquids
- High resistance to scratching

DISADVANTAGES
- Works only with the human finger or a special stylus pen
- Sensitive to EMI/RFI

3. Projected capacitive touch technology

In principle, the technology is similar to that of the surface capacitive touchscreen, though it uses electrostatic fields instead of electric charges. The sensor consists of a sheet of glass with a conductive electrode film placed on top of it. In addition, the design uses a controller that generates a three-dimensional electrostatic field. When a finger touches the sensor, it interferes with the field. The controller detects the change and calculates the coordinates. As a result, PCAP touch technology offers two significant advantages. Surface capacitive touch sensors can only be operated with a naked finger, whereas projected capacitive touchscreens can also be used with gloves. In addition, this technology also supports multi-touch operation.

ADVANTAGES
- Very good clarity
- Very high resistance to scratching

- Multi-touch capable, including gestures
- Resistant to surface contaminants (dust, grease, oil) and liquids
- Can also be operated with gloves

DISADVANTAGES
- Operation only possible with the finger or an electrically charged stylus pen
- Sensitive to EMI/RFI (depending on the touch controller)

4. Surface acoustic wave touch technology

Surface acoustic wave (SAW) technology uses piezoelectric transducers and receivers positioned on a glass plate around the screen. The transducers generate ultrasound waves on the glass surface, which are absorbed by the finger when touching a certain point on the screen. This allows the receiver to determine the touch point and to transmit this data.

As a result of the method used, the touchscreen can be operated with almost any object, provided it is soft enough. Hard objects (fingernails, pens, etc.) are not suitable. Due to their ease of use, SAW touch sensors are mostly found in public space applications (ticketing machines, kiosk systems).

ADVANTAGES
- Excellent clarity
- Very high resistance to scratching
- Can be operated with the finger (even gloved) or stylus with a soft tip
- Very high stability
- Attractive price

DISADVANTAGES
- Not possible to operate with hard objects
- Sensitive to contamination of the surface (no-touch area)
- False activation by water droplets is possible
- Limited precision

5. Infrared touch technology

Contrary to the above-described technologies, infrared touch does not require anything to be placed on top of the display. Instead, a lattice of emitters and detectors positioned on the side or above or below the screen create an invisible light curtain above the display. As a result, the image quality (colours, brightness, etc.) of the display is not compromised. When an object approaches the display, it interrupts the infrared

light beams, allowing the sensor to detect its position. This may, however, also cause unintended activation by an object accidentally approaching the display. Work is being carried out, however, toward eliminating such »details«.

ADVANTAGES
- Best clarity and image sharpness
- Unlimited stability
- Can be operated with any object
- Insensitive to scratching & surface damage
- Can also be scaled to large displays
- Dual-touch/multi-touch capable

DISADVANTAGES
- Unintended activation is possible
- Dirt may cause false activation
- Droplets may cause false activation when they hit the surface
- Sensitive to ambient light
- Higher cost

The aforementioned touch technologies are the most widely used, with projected capacitive and resistive touch clearly leading the pack. They are followed at some distance by (surface) capacitive, with SAW and IR touch technologies coming well behind.

Of course, touch technologies are constantly evolving, and new approaches for simpler and safer communication with electronic devices are emerging on a regular basis. One of these methods is haptic touch technology, involving surfaces that do not just react to the touch but also deliver a tactile feedback to the user. As a result, it is no longer necessary to visually determine (i.e. by looking at the screen) whether the command was accepted or was correctly interpreted. This technology has been in the making for a few years now, but without achieving a real breakthrough as yet.

For the moment, serial deployment in large volumes remains reserved to the established and matured technologies.

If you are launching a project in which you will be using a touchscreen but you find the above description a bit short on detail, feel free to contact us. We will try to answer your questions.

A02

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THE 6TH GENERATION

INTEL's Wi-Fi transceiver solutions based on new 11ax Standard!

INTEL now supplies chips for the latest Wi-Fi standard called Wi-Fi 6, previously also known as IEEE 802.11ax. This is now the 6th generation of the successful wireless Ethernet transmission standard. Reason enough to take a closer look at what changes have been made and how they will affect the user experience in real life.

Each new Wi-Fi standard has brought significant improvements in performance, with the most recent, 802.11ac, offering an impressive theoretical maximum rate of 1.3Gbps. Unfortunately, these gains have not been enough to keep pace with demand, leading to that exasperated cry heard across airports, malls, hotels, stadiums, homes and offices: »Why is the wireless connection so slow?!«

The IEEE is taking another crack at boosting Wi-Fi performance with a new standard called 802.11ax or High-Efficiency Wireless, which promises a fourfold increase in average throughput per user. 802.11ax is designed specifically for high-density public environments, like trains, stadiums and airports. But it also will be beneficial in Internet of Things (IoT) deployments, in heavy-usage homes, in apartment buildings and in offices that use bandwidth-hogging applications like videoconferencing.

What problem is 802.11ax trying to solve?

The fundamental problems with Wi-Fi are that bandwidth is shared among endpoint devices, access points can have overlapping coverage areas, especially in dense deployments, and end users can be moving between access points.

The current solution, based on a technology from the old shared Ethernet days called Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA), requires endpoints to listen for an all-clear signal before transmitting. In the event of interference, congestion or collision, the endpoint goes into a back-off procedure, waits for the all-clear, then transmits.

In a crowded stadium, a busy airport or a packed train with hundreds, even thousands of end users attempting to stream video at the same time, the system loses efficiency and performance suffers.

The good news is that 802.11ax promises improved performance, extended coverage and longer battery life. 802.11ax can deliver a single stream at 3.5Gbps, and with new multiplexing technology borrowed from the world of LTE cellular, it can deliver four simultaneous streams to a single endpoint for a total theoretical bandwidth of an astounding 14Gbps.

How does 802.11ax work?

The 802.11ax standard takes a variety of well-understood wireless techniques and combines them in a way that achieves a significant advance over previous standards, yet maintains backward compatibility with 802.11ac and 802.11n.

802.11ax delivers a nearly 40 percent increase in pure throughput thanks to higher order QAM modulation, which allows for more data to be transmitted per packet. It also achieves more efficient spectrum utilization. For example, 802.11ax creates broader channels and splits them channels into narrower sub-channels. This increases the total number of available channels, making it easier for endpoints to find a clear path to the access point. When it comes to downloads from the access point to the end user, early Wi-Fi standards only permitted one transmission at a time per access point. The Wave 2 version of 802.11ac began using Multi-User, Multi-Input,

Multiple Output (MU-MIMO), which allowed access points to send up to four streams simultaneously. 802.11ax allows for eight simultaneous streams and makes use of explicit beamforming technology to aim those streams more accurately at the receiver's antenna. Even more importantly, 802.11ax piggybacks on MU-MIMO with an LTE cellular base station technology called Orthogonal Frequency Division Multiple Access (OFDMA). This allows each MU-MIMO stream to get split in four additional streams, boosting the effective bandwidth per user by four times.

How is 802.11ax different from 802.11ac?

802.11ac operates in the 5Ghz range only, while 802.11ax operates in both the 2.4Ghz and 5Ghz range, thus creating more available channels. For example, early chipsets support a total of 12 channels, eight in the 5Ghz and four in the 2.4Ghz range. With 802.11ac, MU-MIMO is limited to downlink transmissions only. 802.11ax creates full-duplex MU-MIMO so that with downlink MU-MIMO an access point may transmit concurrently to multiple receivers and with uplink MU-MIMO an endpoint may simultaneously receive transmissions from multiple transmitters.

802.11ax supports up to eight MU-MIMO transmissions at a time, up from four with 802.11ac. OFDMA is new with 802.11ax, as are several other technologies, like trigger-based random access, dynamic fragmentation and spatial frequency re-use, all aimed at improving efficiency. Finally, 802.11ax introduces a technology called »target wake time« to improve wake and sleep efficiency on smartphones and other mobile devices. This technology is expected to make a significant improvement in battery life.

INTEL Wav6xx Module for Gateways, Router and Access Points

INTEL is offering Wi-Fi 6 chipsets for home Wi-Fi router, gateways, and intelligent range extenders in cable, xDSL, fiber and consumer retail infrastructure, which are designed to deliver both fast and consistent connectivity.

Designed to Draft 3.0 of the IEEE 802.11ax standard, the WAV600 Series delivers speeds up to 4.8Gbps in the 5Ghz band and 1.14Gbps in the 2.4Ghz band. The WAV600 series is also engineered to deliver enhanced throughput rates for a mix of small and large packet sizes. This helps ensure optimal performance for devices and low latency for applications like gaming, video and voice calls. The Wi-Fi chipsets are optimized for the INTEL AnyWANTM SoCs to fully offload the wireless traffic with zero CPU utilization.

AX200 INTEL's Wi-Fi 6 solution for clients

The Intel® Wi-Fi 6 AX200 adapter is designed to support the upcoming IEEE 802.11ax standard – Wi-Fi 6 technology and the Wi-Fi Alliance Wi-Fi 61 certification. The product supports 2×2 Wi-Fi 6 technology, including new features such as UL and DL OFDMA as well as 1024QAM, delivering data rates of up to 2.4Gbps2 and increased network capacity as well as Bluetooth® 5 technology support. These new features deliver a significant improvement in user experience in dense deployments, supporting fast uploads and downloads, lower latency and longer battery life compared to solutions supporting 802.11ac. Combined with INTEL® Core™ processors and exceptional INTEL wireless innovations, the INTEL® Wi-Fi 6 AX200 module can provide Gigabit wireless speed2 and dramatically improve your connected experience at home, work, or on the go.

Bluetooth® 5 provides 4×[5] range over Bluetooth® 4.2 using the same Tx power, enabling coverage throughout the home. Bluetooth® 5 also doubles data rates speed for faster transmissions thereby reducing the overall power consumption. Additionally, Bluetooth® 5 adds new enhanced data broadcasting enabling seamless services such as location-based services and simpler pairing for Bluetooth® devices.

Full support for latest Microsoft Windows 10 OS, Linux drivers is available from the portal: *https://wireless.wiki.kernel.org/en/users/drivers/iwlwifi/core_release*

Features

- 15×16mm MRQFN 244 package
- Enhanced Maximum Likelihood, LDPC, STBC (2×1), Beamforming, OFDMA (1024 QAM), Target Wake Time (TWT), 4× Symbol Duration, spatial reuse/Bss Coloring
- Supports up to 256 clients and 32 Virtual Access Points
- PCIe Gen3/Gen2 (support for 1 & 2 lines)
- Standard temperature range 0 to +70°C
- Supports Linux Kernels 3.X and 4.X, Software packages enabling both OpenWRT (UCI) and RDK-B alignment

Form factor M.2 2230 and 1216 are available. M.2 2230 modules enable system configuration and platform usage flexibility with the use of a standard Key E socket for attaching the module. M.2 1216 modules enable platform design providing savings on motherboard space and BOM.

A03

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AUDIO
INTELLIGENCE

«‹ knowles

At the Edge!

Privacy is becoming a key require-ment for the adoption of voice command systems in the home or private environments.

K NOWLES has now introduced the first two members of their intelligent audio proces-sors. As a leader in audio machine learning at the edge, KNOWLES is redefining the audio experi-ence in next generation devices, having an exten-sible family of audio processors, adaptable across any form factor. The AiSonic™ Audio Edge Proces-

©AdobeStock/Andrey Popov

sors are optimized for machine learning, allowing for greater efficiency, high compute, low power and privacy to offer voice activation and contextu-al processing across a range of mobile devices, headsets, portable speakers and IoT devices.

The IA8201

Dual Core

The AISonic IA8201 is the industry's first proces-sor specifically designed for advanced audio and machine learning applications, enhancing power-efficient intelligence and privacy at the edge. It offers robust voice activation and multi-micro-phone audio processing optimized for power-sensitive applications with the compute power to perform advanced audio output, context awa-reness and gesture control for today's most ad-vanced consumer electronics.

The IA8201 includes a high compute 128bit core (DMX) with KNOWLES proprietary instruction set and a Tensilica HiFi3 core (HMD), both with KNOWLES audio enhancements. The DMX is a 4-way floating-point SIMD processor targeted towards efficient performance computing (e.g. beam-forming, barge-in, AEC), while the HMD is targeted towards efficient, low-power, wake-on-voice applications with a two-way floating-point

SIMD processor. Both cores contain dedicated accelerators for FFT, peak finding and DNNs. A rich set of audio, and general purpose high speed interfaces enable flexible interfacing with digital microphones, other sensors, and a host for further processing. 1MB of user RAM enables storage of multiple algorithms and voice key-words.

The IA8201 is a high-performance, ultra-low power audio-centric OpenDSP supporting up to 4 mics, multiple high speed interfaces and GPIOs in two package options (eWLB and QFN).

Highly Optimized, Advanced Instruction Set

The DSP SDK (Software Development Kit) with KNOWLES and Xtensa HiFi 3 instruction sets en-ables extensive audio capabilities for voice and audio processing, voice user interface, and am-bient sound processing. Optimized frame-based processing utilizes floating-point data types, SIMD, and a flexible extended instruction set for non-linear functions and accelerated DNN MACs.
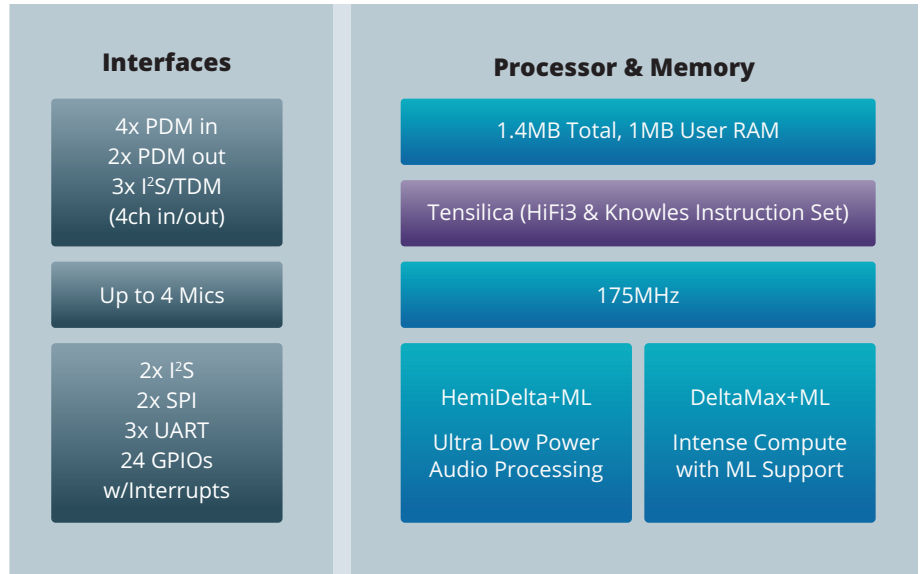
Open DSP

The IA8201, an open DSP platform, brings toget-her leading contributors to the intelligent voice ecosystem to improve audio performance in a variety of use cases. This KNOWLES partner pro-gram brings world-class algorithm and cloud con-tributors to an ecosystem where a multitude of solutions solve complex audio problems, increa-sing the versatility of an IA8201-based solution.

Use Case Examples

- **Low Power Voice Wake:** Listens for specific OEM keywords to wake the host processor. Large memory enables processing of multiple stages on-chip for accurate results.
- **Proximity Detection:** When combined with an ultrasonic capable speaker and microphone, detects the distance between the system and an object; can replace an IR-Prox sensor in bezel-less phones.
- **Hub:** Determines location of voice source while tuning out a noisy environment and lowering music to detect voice commands. Simultaneously takes metadata input and overrides beamformer to focus on camera-tracked objects.
- **Security System:** Activated with a voice command. Detects glass breakage/smoke-alarm, log direction of noise source, trigger alarm, and sends alerts through Wi-Fi connection.
- **Wireless Earbuds:** Delivers low power premium wake-on-voice performance, talk detection to eliminate false triggers, enhanced voice quality through advanced beam forming and noise reduction algorithms as well as support for local commands.

The IA8508

Quad Core

The AISonic IA8508 is a fully customizable, quad-core audio edge processor with four times the memory of the IA 8201, which allows for larger models and concurrent processing of multiple, high-performance algorithms for applications requiring intensive edge processing and privacy. All of this is designed with low-power in mind for audio context and voice assistants.

The IA8508 builds on the IA8201 by adding two additional cores, enhancing low latency (SSP) and control (Arm Cortex M4). The SSP is a 256bit single-cycle processor targeted toward low latency computing and hardware acceleration of asynchronous sample rate conversion (ASRC). Open DSP capability provides a robust platform for third-party solutions. The SDK with KNOWLES and Xtensa HiFi 3 instruction sets allows for extensive audio capabilities in voice and audio processing, voice user interfaces, ambient sound processing, voice processing and much more.

Interfaces

- 4x PDM in
- 2x PDM out
- 3x I²S/TDM (4ch in/out)

- Up to 4 Mics

- 2x I²S
- 2x SPI
- 3x UART
- 24 GPIOs w/Interrupts

Processor & Memory

- 1.4MB Total, 1MB User RAM
- Tensilica (HiFi3 & Knowles Instruction Set)
- 175MHz
- HemiDelta+ML — Ultra Low Power Audio Processing
- DeltaMax+ML — Intense Compute with ML Support

Product Features

- 8 PDM microphone interfaces
- Three heterogeneous Tensilica-based, audio-centric DSP cores and an Arm Cortex M4 for maximum design flexibility
- All four cores can simultaneously run high performance floating-point algorithms leveraging the IA8508's 5.7MB of RAM. The multicore audio processor can be configured into an ultra-low power system targeting power-conscious designs
- Low-latency is guaranteed by a single sample processor (SSP) core for real-time processing for audio applications such as ANC (active noise cancellation) or asynchronous sample rate conversions of various audio sources
- Audio algorithms are optimized with instruction sets that feature high capacity 4-way SIMD floating point processing
- Deep Neural Network (DNN) hardware acceleration is optimized with an instruction set that features high capacity 16-way SIMD for machine learning
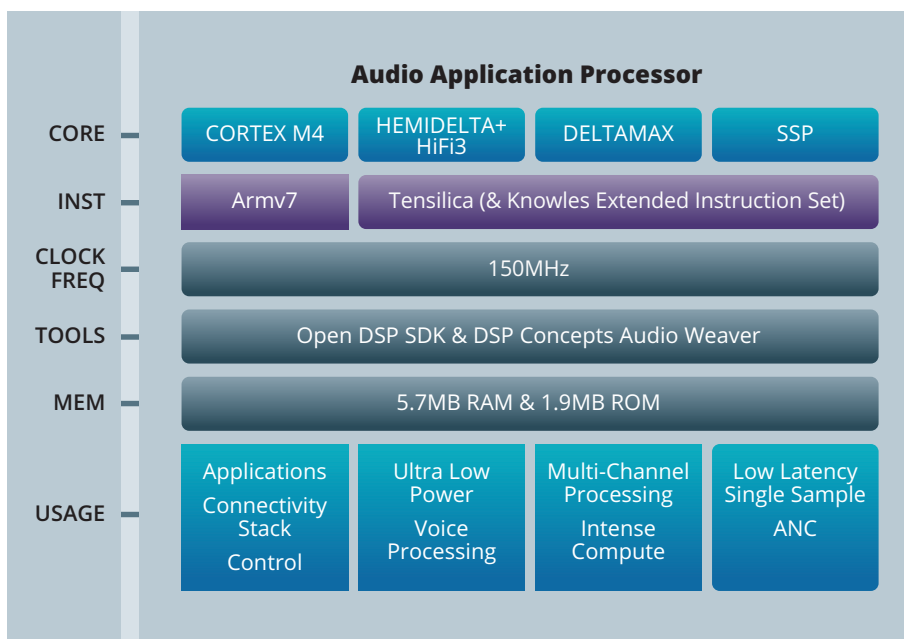
An IoT Development Kit for the IA8508 is already available. The IoT kit combines a IA8508 board, 8-mic array, standard PICO-PI-IMX7 kit, and auxiliary battery/amplifier board for stereo speakers. A custom housing ensures the development platform emulates an IoT product in smartspeaker/ soundbar categories.

Ordering Information:

A04

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Audio Application Processor

CORE	CORTEX M4	HEMIDELTA+ HiFi3	DELTAMAX	SSP
INST	Armv7	Tensilica (& Knowles Extended Instruction Set)		
CLOCK FREQ	150MHz			
TOOLS	Open DSP SDK & DSP Concepts Audio Weaver			
MEM	5.7MB RAM & 1.9MB ROM			
USAGE	Applications Connectivity Stack Control	Ultra Low Power Voice Processing	Multi-Channel Processing Intense Compute	Low Latency Single Sample ANC
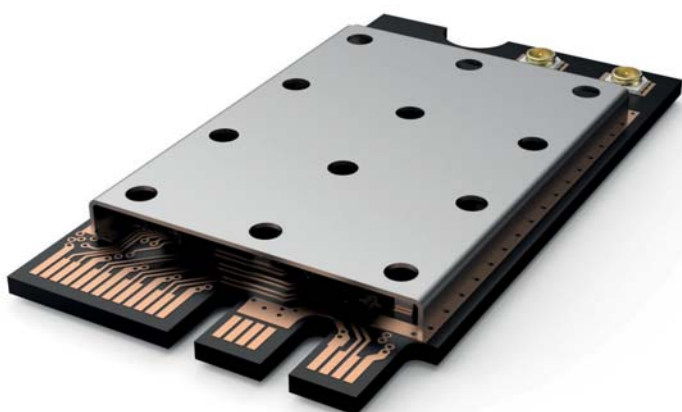
BLACK-BEAN
BOARDING COMPLETED!

Devices

With the new BLACK-BEAN, manufacturer 8DEVICES has now completed its family of combo radio modules from the Bean series. In addition to USB and SDIO, the user has now an additional option with PCIe/M.2 for an easy integration of a combo radio on a host processor.

BLACK-BEAN is based on the same basic part QCA9377 as its siblings BLUE-BEAN (USB) and RED-BEAN (SDIO). QCA9377 is a combo radio IC (combo stands for the combination of Wi-Fi and Bluetooth), which is offered with 3 different interfaces, but with always exact the same radio architecture. In line with the 3 possible interfaces, 8DEVICES has developed three different modules with identical radio features.

Wi-Fi is supported with bandwidths of 20MHz, 40MHz and 80MHz, with a maximum data rate of 433Mbps (Single Stream, MU-MIMO, Wave 2, 11ac) and an output power of 20dBm maximum.

In addition to 802.11ac/a/n on the 5GHz band, all beans also support 802.11b/g/n and Bluetooth 5.0/BLE on the 2.4GHz band.
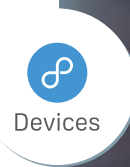
In case of BLACK-BEAN, Wi-Fi is connected to the host processor via PCIe2.0 and Bluetooth via USB1.1. Both interfaces are implemented in the M.2 connector.

All modules are supported by Linux and Windows drivers and are RED, FCC and IC certified. The temperature range is given as -40 to +85°C. Further information can be found at:
http://downloads.codico.com/misc/AEH/8Devices

For further questions, please contact:

A05

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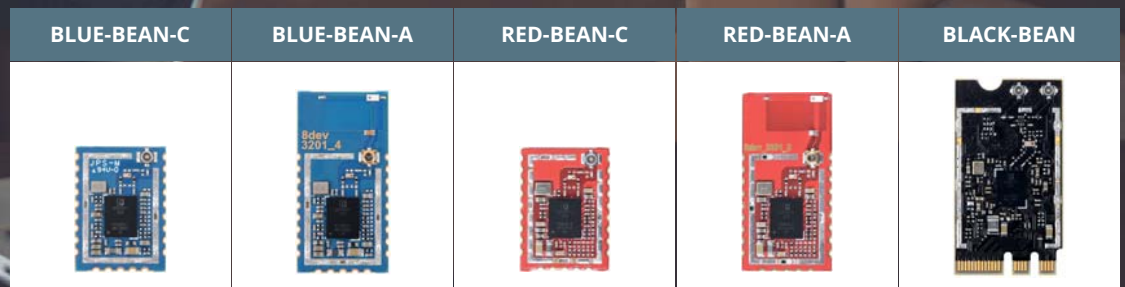
		BLUE-BEAN-C	BLUE-BEAN-A	RED-BEAN-C	RED-BEAN-A	BLACK-BEAN
PLATFORM	IC Part Number	QCA9377-7	QCA9377-7	QCA9377-3	QCA9377-3	QCA9377-5
	Interface Wi-Fi	USB 2.0	USB 2.0	SDIO 3.0	SDIO 3.0	PCIe 2.0 / M.2
	Interface Bluetooth	USB1.1	USB1.1	UART	UART	USB 1.1 / M.2
	Linux / Android	qcacld-3.0	qcacld-3.0	qcacld-3.0	qcacld-3.0	ath10k
	Linux Mainline Kernel	no	no	no	no	from V4.4 upwards
	Windows Support	Windows 10, 8.1, 7	Windows 10, 8.1, 7	Windows 10, 8.1, 7	Windows 10, 8.1, 7	Windows 10, 8.1, 7
WIRELESS	Wi-Fi Standards	802.11b/g/n/a/ac	802.11 b/g/n/a/ac	802.11b/g/n/a/ac	802.11b/g/n/a/ac	802.11b/g/n/a/ac
	Bluetooth Standards	BT 5.0 + HS, BLE, ANT+	BT 5.0 + HS, BLE, ANT+	BT 5.0 + HS, BLE, ANT+	BT 5.0 + HS, BLE, ANT+	BT 5.0 + HS, BLE, ANT+
	MIMO	MU 1x1	MU 1x1	MU 1x1	MU 1x1	MU 1x1
	Frequency	2.4GHz & 5GHz	2.4GHz & 5GHz	2.4GHz & 5GHz	2.4GHz & 5GHz	2.4GHz & 5GHz
	Bandwidth	HT20/HT40/HT80	HT20/HT40/HT80	HT20/HT40/HT80	HT20/HT40/HT80	HT20/HT40/HT80
	Antenna Data Rate	433Mbps	433Mbps	433Mbps	433Mbps	433Mbps
	Antenna Options	MURATA HSC Connector	Integrated Antenna	MURATA HSC Connector	Integrated Antenna	MURATA HSC Connector
	Output Power	20dBm	20dBm	20dBm	20dBm	20dBm
	No. of Clients	32	32	32	32	32
	Monitor Mode	yes	yes	yes	yes	yes
MODULE SPEC	Power Supply	3.3V	3.3V	3.3V	3.3V	3.3V
	Dimension (mm)	17×12	24×12	17×12	24×12	30×16,5
	Weight (g)	0,9	1,1	0,9	1,1	5
	Temperature Range	-40 to +85°C	-40 to +85°C	-40 to +85°C	-40 to +85°C	-40 to +85°C
	Mounting	Dual Side	Dual Side	Dual Side	Dual Side	Dual Side
	Certifications	RED, FCC, IC	RED, FCC, IC	RED, FCC, IC	RED, FCC, IC	RED, FCC, IC

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HABANERO

May it be a little hotter?

Devices

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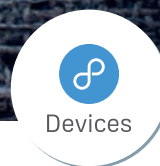
The new Habanero from 8DEVICES is a SOM (System on Module) with 4 Cortex-A7 cores and numerous high-speed interfaces that allow a fast and cost-effective realization of IoT hubs, gateways, routers and access points.

In the first Impulse magazine 2018, we already reported about the Jalapeno module, which is based on the SoC IPQ-4018 from QUALCOMM.

The new Habanero is based on its bigger brother IPQ-4019, which provides more interfaces and a higher memory addressing space. Consequently,

Habanero offers 512MB RAM (DDR3@672 MHz) instead of 256MB in case of Jalapeno.

With regard to the flash memory, 8DEVICES has taken a new approach. Instead of using a fixed integrated NAND memory of 128MB – as with the Jalapeno – they decided to keep the size of

this memory flexible by using a parallel interface. Thus, the customer can dimension the memory space of his application himself by using an external NAND Flash device. On the contrary, 32MB NOR Flash is directly integrated on Habanero, while Jalapeno supports 8MB.

Although IPQ-4018 offers a 5-port GE switch, only two of them are realized as interfaces on the Jalapeno. With the Habanero the developers have decided to provide all 5 interfaces and so the user has access to 5x1000 Base-T ports. While Jalapeno and Habanero equally support USB3.0,
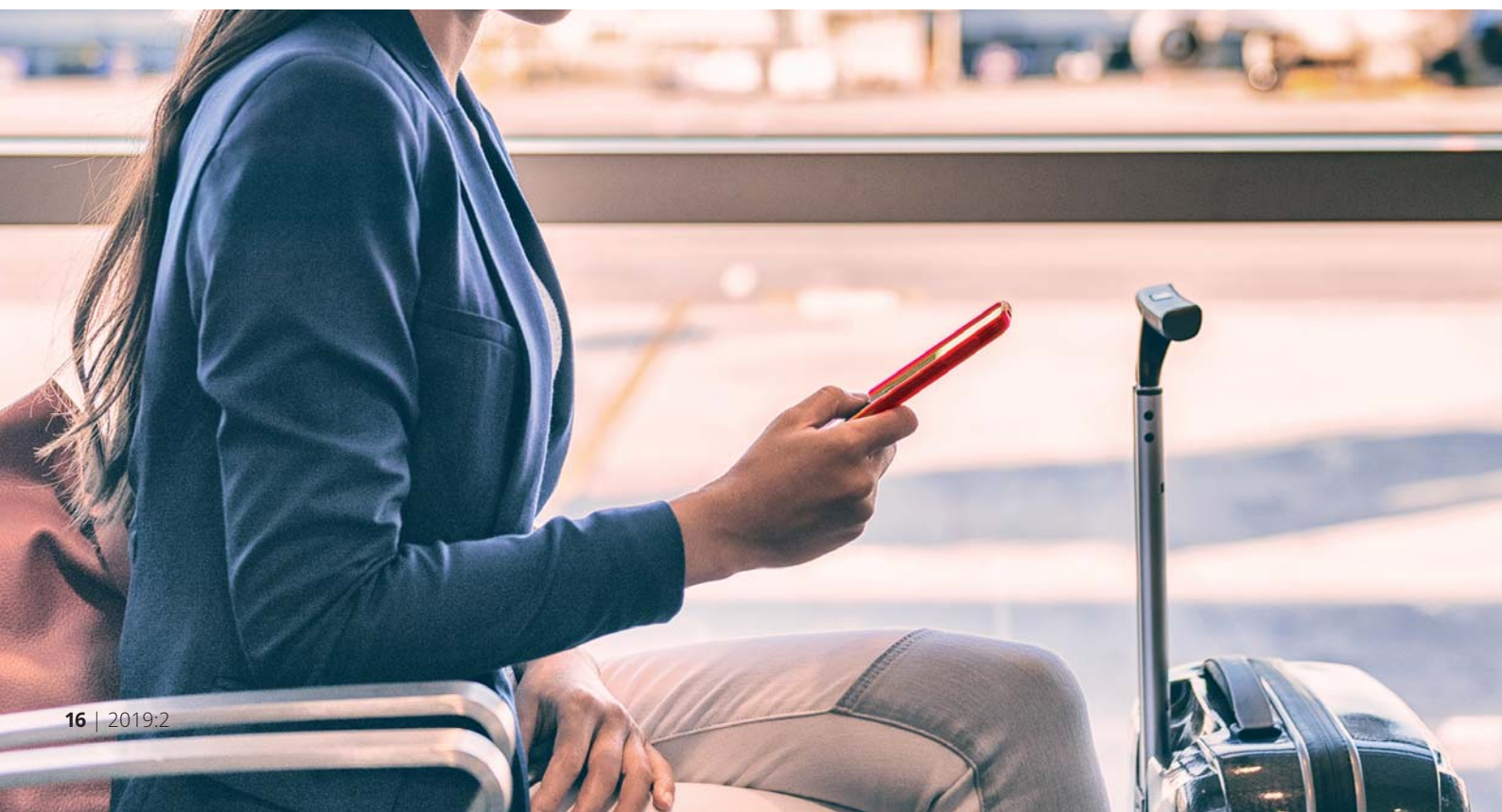
USB2.0, UART and I2S/TDM, Habanero offers many additional interfaces such as PCIe2.0, LCD, SDIO, eMMC, SPI, I2C and many GPIOs.

With regard to the CPU architecture and the supported Wi-Fi standards, both modules have the same features. Both offer true DBDC (Dual-Band Dual Concurrent), which means that both frequency bands 2.4GHz and 5GHz can serve at the same time. This fact results in a maximum antenna data throughput rate of 1.166Gbps: 866 Mbps at 11ac 2×2@5GHz and 300Mbps at 11n 2×2@ 2.4GHz. To process the high data rates over the wireless and wired interfaces, two Cortex-A7 CPUs are available as network processors and two more for the application. All 4 CPUs are clocked at 700MHz and each have a NEON MPE (Media Processor Engine), an FPU (Floating Point Unit) and numerous high-end security features such as Secure Boot and Crypto Engines.

A second module variant is equipped with the Enterprise version IPQ-4029, which, like its brother IPQ-4019, has the same architecture and interfaces, but also offers the following Enterprise features:

• Loopback mode for FIPS certification
• 4.9GHz 5/10/20/40 MHz channels
• Support for temperature compensation of transmitter amplifiers for low-power transmission
• Granular spectral analysis

For most users, however, the most important feature is that the IPQ-4029 is the only device in its family (Dakota) that covers the full industrial temperature range from -40 to 85°C, and therefore an industrial version of Habanero is also available, namely Habanero-I (I stands for Industrial).

For more Information:
http://downloads.codico.com/misc/AEH/8Devices
For further questions, please contact:

A06

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The Habanero Development Kit is now available in CODICO's Sample Shop!

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		HABANERO / HABANERO-I	JALAPENO
PLATFORM	SoC	IPQ-4019-2-583MSP-TR-00-0 / IPQ-4029-1-583MSP-TR-00-0*	IPQ-4018-0-180DRQFN-MT-00-0
	CPU	Quad Cortex-A7@700MHz	Quad Cortex-A7@700MHz
	Flash	32MB NOR and parallel NAND (external)	128MB NAND & 8MB NOR
	RAM	512MB DDR3@672MHz	256MB DDR3@667MHz
	OS	Linux OpenWRT	Linux OpenWRT
CONNECTIVITY	Ethernet	5x 1000 Base-T	2x 1000 Base-T
	USB	USB3.0, USB2.0	USB3.0, USB2.0
	PCIe	PCIe2.0	No
	Serial Interfaces	2x UART, SPI, 2x I2C, I2S, TDM, SDIO3.0, eMMC	UART, I2S, TDM
	GPIOs	46x GPIOs	9x GPIOs
	JTAG	Yes	Yes
	Miscellaneous	NAND, LCD	No
WIRELESS	Standards	802.11b/g/n/a/ac Wave2	802.11b/g/n/a/ac Wave2
	MIMO	Multi User 2x2 DBDC	Multi User 2x2 DBDC
	Frequency	2.4GHz & 5GHz	2.4GHz & 5GHz
	Bandwidth	HT20/HT40/HT80	HT20/HT40/HT80
	Antenna Data Rate	1.167Gbps	1.167Gbps
	Antenna Options	2x U.FL	2x U.FL
	Output Power	23dBm	23dBm
	No. of Clients	256	256
MODULE SPEC	Power Supply	3.3V	3.3V
	Dimension (mm)	45×49	32×47
	Weight (g)	9,5	8
	Temperature Range	0 to +65°C / -40 to +85°C	0 to +55°C
	Mounting	Dual Side	Dual Side
	Certifications	RED, FCC, IC	RED, FCC, IC

*Enterprise Features
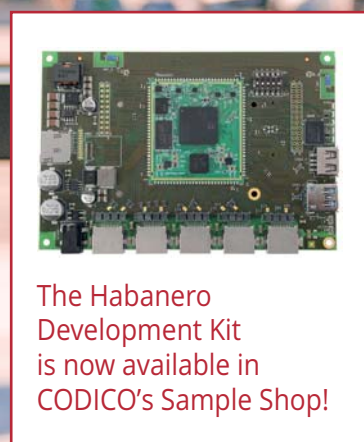
BULLET PROOF MACHINES

Resilient High Voltage & 3-Phase Power Supplies

power integrations™

Quite a number of industrial machinery operates from 3-phase mains or single phase mains with excessive voltage. For those machines it is beneficial when the control electronics operate as long as possible – even if only one of the phases is still alive. Often enough, this is not needed for normal operation, but more so in case of a failure. In addition, it makes the installation of such machines more bullet proof.

Another problem are unstable mains grids with high surges. Russia, Brasil and South Africa are infamous examples of such grids. In both cases, even a single phase PSU has be able to deal with excessive voltages. In both cases, the power supply for the control electronics has to withstand the unorthodox voltages. The design of the power supply is pretty similar in both of these cases. The difference is that the 3-phase power supply needs an input stage suitable for the 3 phases. The Flyback block is the same, however.

So going forward we will show examples of power supplies for 3-phase or unstable mains grids. Many motor control applications for example just need a small non-isolated auxiliary power

supply for the actual motor control electronics. The LNK3294 and LNK3296 are HV-Buck converters with a 900V MOSFET – see illustration **A**.

This power supply works from 85-440VAC and provides 12V/120mA (non-isolated). The shown HV-Buck is a very simple low cost supply.

In case more output power is required, the buck topology is hitting its physical limits and a Flyback topology is the better approach. For power demands of up to 8W, the LNK-XT2 **B** series is a good option, either for non-isolated or isolated PSU's.

A
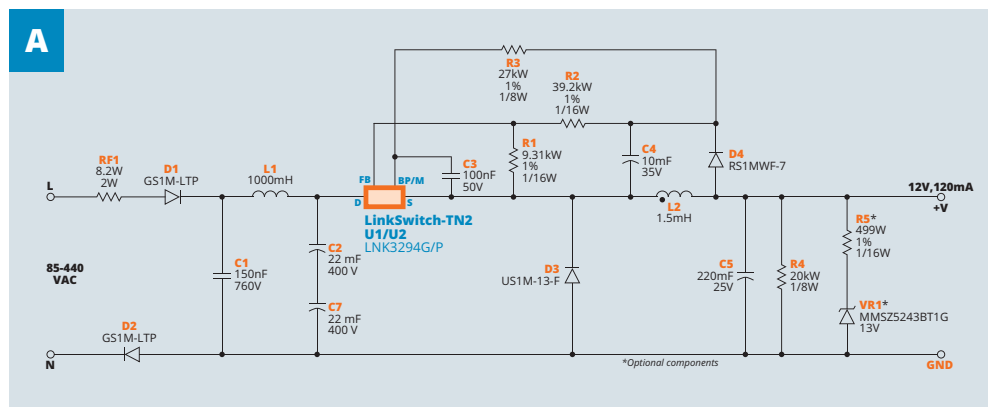
LNK3694 and LNK3696 both have a 900V MOS-FET integrated. The Flyback topology offers the nifty option to have two output voltages. So input voltage range is again 85-440VAC, but output is 12V/500mA and 5V/200mA.

For those who need more than 440VAC, POWER INTEGRATIONS offers a so-called Stack-FET solution C . V$_{IN}$-range of 57-580VAC with full-blown 3-phase input and 12V/250mA on the output made available. A standard LNK3204 stacked with an additional standard HV-MOSFET serves here.

For isolated applications with a power demand from 8W to 30W, the InnoSwitch series is an option. Inn3692C, Inn3694C and Inn3696C all do have a 900V MOSFET on board. On top of that InnoSwitch offers ultra low standby power consumption and an efficiency above 90%. Most importantly, InnoSwitch does have a UL certified digitial communication interface on-board replacing the opto-coupler. As such, it allows for a very good power vs. volume ratio. This PSU – shown in illustration D – has an input voltage range from 90-420VAC and an output of 12V/700mA and 5V/ 300mA.
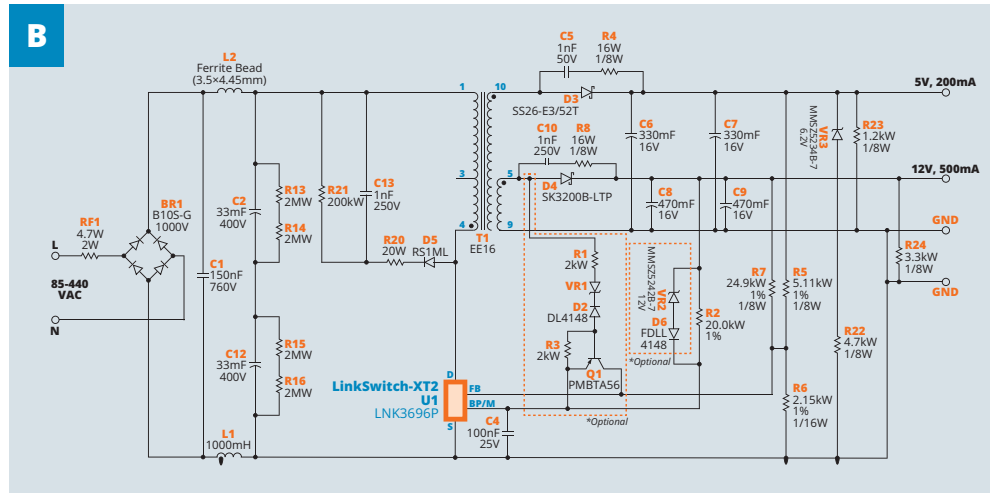
B

C

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D

C8
470pF
250VAC

BR1
B10S-G
1000V

R5 1.80MW 1%
R6 1.80MW 1%
R7 2.00MW 1%

R1 620kW 1/2W
C1 22mF 400V
R3 620kW 1/2W
C3 22mF 400V

C5 1000pF 630 V
R8 200kW

R9 68W
D1 S1ML

F1 1A
RT1 10W t°

R2 620kW 1/2W
C2 22mF 400V
R4 620kW 1/2W
C4 22mF 400V

90-420 VAC
N   L

L1 330mH

D3 DFLR1200-7 200V
D2 S1ML
VR1 MMSZ5231B-7-F
D4 BAV21WS-7-F
R12 36W 1/10W
R11 6.2kW 1/10W

C6 22mF 50 V
C7 4.7mF 25 V

R10 100kW 1/10W

FL1
FL2

C9 1nF 200V
R13 30W 1/8W
Q2 AO4486

C10 680mF 16V

R14 62W 1/8W
C11 1nF 200V
Q1 AO6420

C12 560mF 6.3V

R15 47W 1/10W

C13 2.2mF 25V
C14 330pF 50V

R16 33.2kW 1% 1/16W

NC

T1 EE1621

D V   FWD SR VO BPS GND

CONTROL
S   BPP   FB
IS

InnoSwitch3-EP
U1
INN3692C-H606

R18 100W 1/10W
R19 1.2MW 1% 1/16W

L2 10mH

12V, 0.7A

C15 2.2nF 50V
C16 2.2nF 50V

R20 100W 1/10W
R21 133kW 1% 1/16W
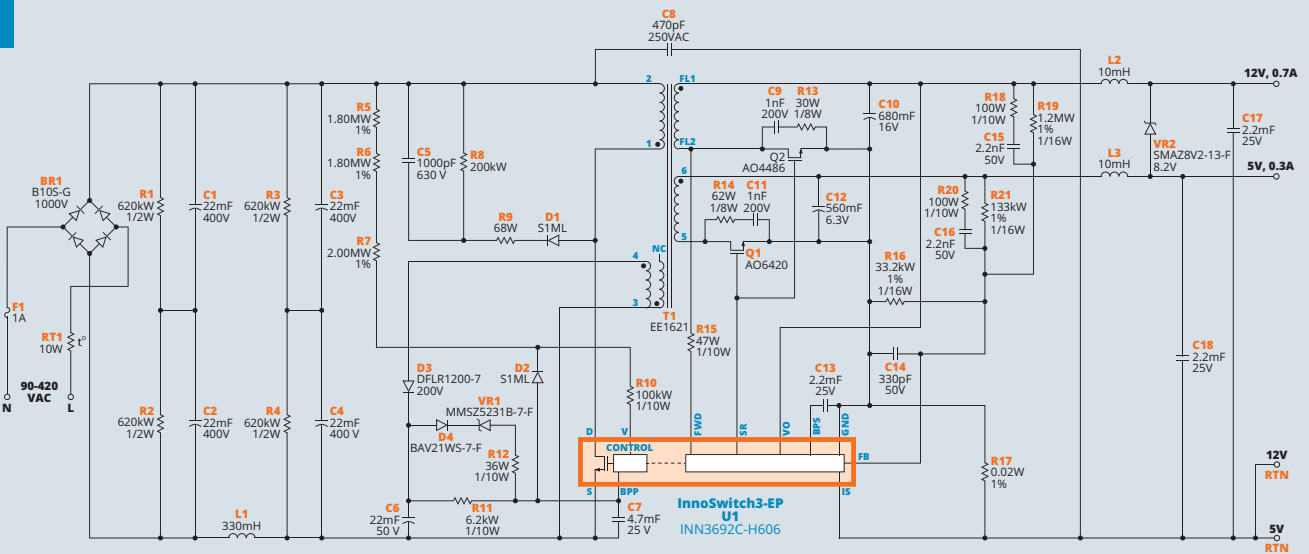
VR2 SMAZ8V2-13-F 8.2V

L3 10mH

C17 2.2mF 25V

5V, 0.3A

C18 2.2mF 25V

R17 0.02W 1%

12V
RTN

5V
RTN

In Illustration **E** you will find another example utilizing InnoSwitch, which offers even higher power: V_{IN}-range of 85-484VAC and 12V/1,35A and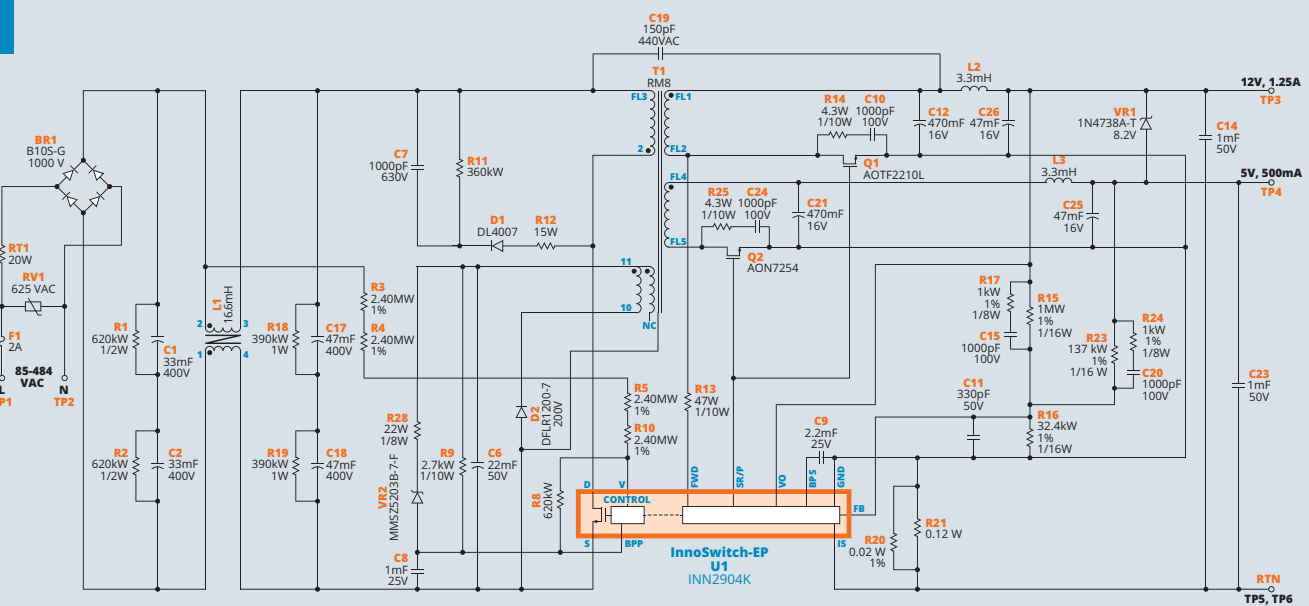 5V/ 500mA on the outputs. So for all those power supply applications with a demand of higher voltages than 265VAC, POWER INTEGRATIONS offers suitable and effective solutions. CODICO is happy to assist you with your design challenges.

Please contact us for more informations or any open questions:

A07

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E

C19 150pF 440VAC

BR1 B10S-G 1000 V

RT1 20W
RV1 625 VAC
F1 2A

C7 1000pF 630V
R11 360kW

D1 DL4007
R12 15W

L1 16.6mH

85-484 VAC
L   N
TP1   TP2

R1 620kW 1/2W
C1 33mF 400V
R2 620kW 1/2W
C2 33mF 400V

R18 390kW 1W
R19 390kW 1W

R3 2.40MW 1%
R4 2.40MW 1%

C17 47mF 400V
C18 47mF 400V

R28 22W 1/8W
VR2 MMSZ5203B-7-F

R9 2.7kW 1/10W
C6 22mF 50V

D2 DFLR1200-7 200V

C8 1mF 25V

R8 620kW

R5 2.40MW 1%
R10 2.40MW 1%

T1 RM8

FL3 FL1
FL2
FL4
FL5

11
10
NC

R14 4.3W 1/10W
C10 1000pF 100V
Q1 AOTF2210L

R25 4.3W 1/10W
C24 1000pF 100V
Q2 AON7254

C21 470mF 16V

R13 47W 1/10W

C9 2.2mF 25V

D V   FWD SR/P VO BPS GND

CONTROL
S   BPP   IS   FB

InnoSwitch-EP
U1
INN2904K

R20 0.02 W 1%
R21 0.12 W

L2 3.3mH

C12 470mF 16V
C26 47mF 16V

VR1 1N4738A-T 8.2V

C14 1mF 50V

12V, 1.25A
TP3

L3 3.3mH

C25 47mF 16V

5V, 500mA
TP4

R17 1kW 1% 1/8W
R15 1MW 1% 1/16W
R23 137 kW 1% 1/16 W
R24 1kW 1% 1/8W

C15 1000pF 100V
C20 1000pF 100V

C11 330pF 50V

R16 32.4kW 1% 1/16W

C23 1mF 50V

RTN
TP5, TP6

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MAGIC

Silvertel

Today's fast-paced world of social media, mobile apps, the »Smart Home« and the »Internet of Things« has engendered an expectation of immediate and reliable access to the internet; the ability to be »always on-line" whenever and wherever is not only expected, but is an absolute necessity.

The new Ag321T delivers 15W via air!

However, this relies on portable battery powered devices being charged and ready to use for as long as possible. The convenience of no wires or connectors to worry about is a huge benefit and provides a clean, safe and effective means of power transfer.

©AdobeStock/Cybrain

SILVERTEL has already tried to meet this market requirement by introducing its first generation of Qi compliant charging pairs (Ag301, Ag311, Ag312) back in 2014 at 5W usable output power.

The Qi standard has come a long way till SILVERTEL could introduce its new Wireless Power Transmitter Module, the Ag321T (T: Transmitter), which is a Qi-compliant device, designed to transfer sufficient power to another Qi-compliant wireless receiving device to deliver 15W consumable output power. It requires only an external 12V power supply and transmission coil.

This simple implementation allows system designers and integrators a very rapid route to providing wireless power in all manner of applications ranging from »Smart« furniture, portable low voltage lighting, portable Wi-Fi Gateways and of course, mobile phone/tablet charging. The Ag321T is also compatible with the (proprietary) Ag320R (R: Receiver).

The Ag321T is available in a dual-in-line format measuring approx. 31×20×6mm (L×W×H). Samples are now available from CODICO!
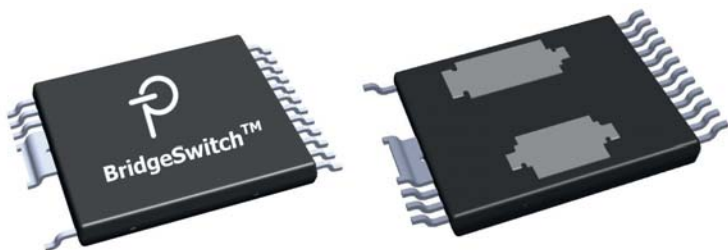
A08

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BridgeSwitch

## Maximum Power for Motor Controls

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BridgeSwitch, yet another Integrated Circuit from POWER INTEGRATIONS, is setting the bar higher. BridgeSwitch has a number of nifty features, which can give your application the extra improvements it needed.

BridgeSwitch is a High Voltage Half Bridge for mains powered motors, but it's not just another Half Bridge. As mentioned, POWER INTEGRATIONS's designers have put some nifty features into that silicon.

Lets take a look at these feature rich product and how it can serve you.

BridgeSwitch comes in a unique SoP-24C package, which has 3 points for sinking heat. Not only does the package provide for enough clearance, it also makes the layout a lot easier. Specifically on an in-motor electronics PCB, the 3 Bridge-Switches can be distributed around the rim of the board, rather than having to get placed in the
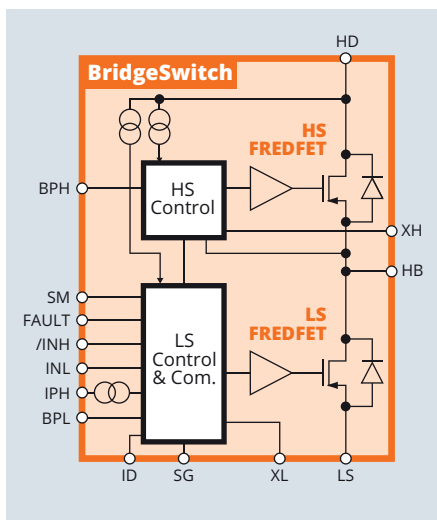
center. In average it saves about 1/3 of board space. The heat from the losses is delivered to 9 different points rather than just one single point. A small PCB heatsink is thus sufficient.
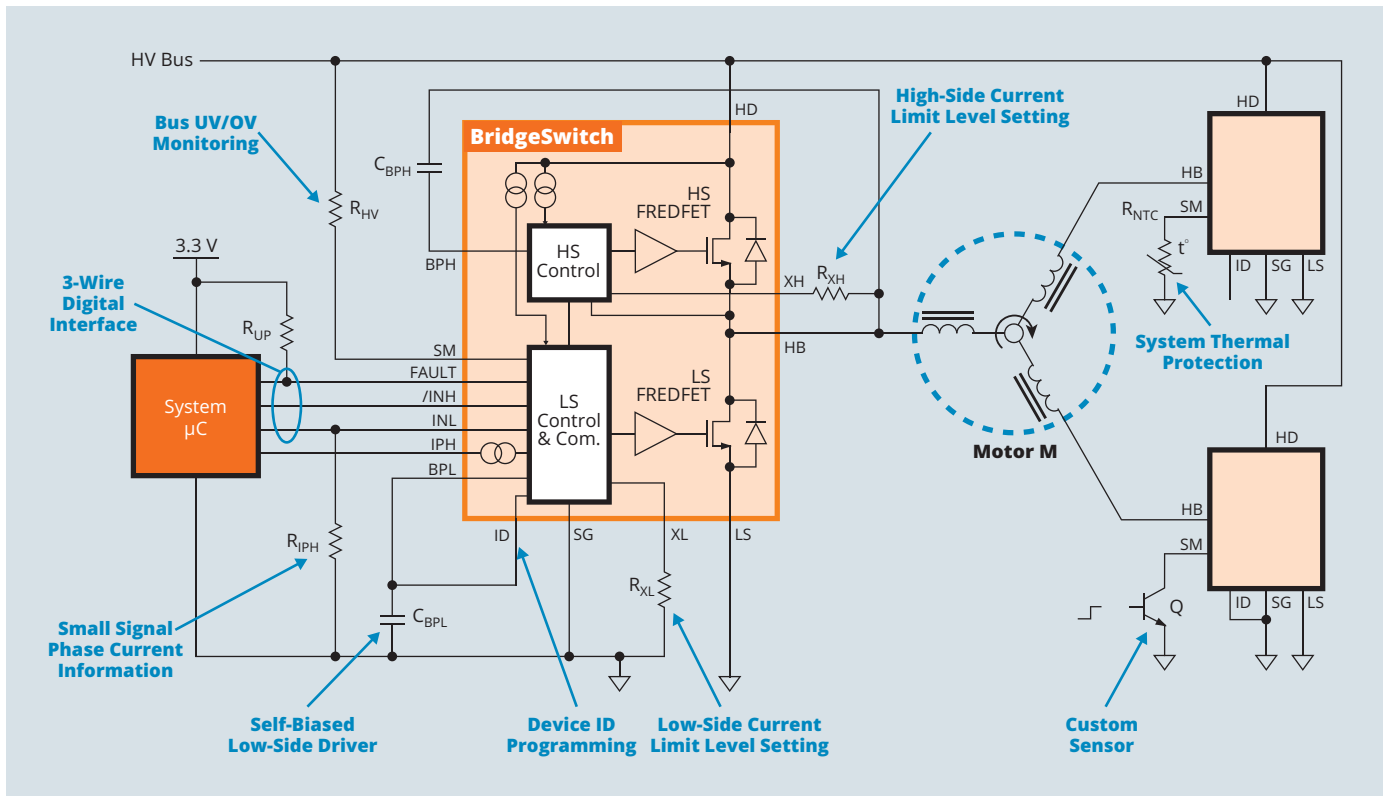
Latest generation High and Low Side 600V Fred-FETs provide for low RdsOn and fast switching, thus improving efficiency into the range of 96-98%. The two FredFETs both have lossless current sensors built in. As such, over current protection is done on the high and the low side. A fast soft recovery body diode further reduces the losses and EMI.

The two FETs are driven by high voltage logic level gate drivers, which have their own bias power supply (3,3V and 5V level available). BridgeSwitch does not need an auxiliary power supply, thus saving on BOM and PCB space. Bootstrapping is internal, no external diodes needed.

The designers of POWER INTEGRATIONS did not just stop right there. A unique Under – and Over Voltage protection has been integrated.

PRODUCT[3]	DC OUTPUT CURRENT[1]	CONTINOUS RMS CURRENT[2]
BRD1160C/BRD1260C	1.0A	0.22A
BRD1161C/BRD1261C	1.7A	0.50A
BRD1163C/BRD1263C	3.0A	0.75A
BRD1165C/BRD1265C	5.5A	1.00A

(1) Continuous DC output current per FREDFET, calculated at 25°C case and 125°C junction temperature. Normally limited by internal circuitry
(2) Continuous phase RMS current, internal self-supply, 340 V bus, trapezoidal commutation with 12 kHz high-side PWM, PCB heat sinking with 50°C package temperature
(3) Package: InSOP-24C

A resistor connected to the SM pin sets the threshold. Over temperature shut down against overheating, which includes a hysteresis, is off course standard. Moreover, an NTC controlling the Motor temperature can be connected to the SM pin.

Cycle by cycle current limiting both on the high and the low side are exceeding the standard. An external resistor will set the current limit for each side. Shoot through protection is another standard implemented.

All these protections will pull the fault line down, when triggered. That alone however was not enough for the PI designers. Therefore they implemented a simple digital interface (single wire bus on the fault pin). An MCU can inquire about the source of the fault out of three Bridge-Swit-

ches through a settable device ID and the respective protection circuitry, which got triggered. The on-chip protection functions are fully sufficient to trigger the shut down well within time and additional software protection is not required. Neither by good practice nor by Class A software requirements.
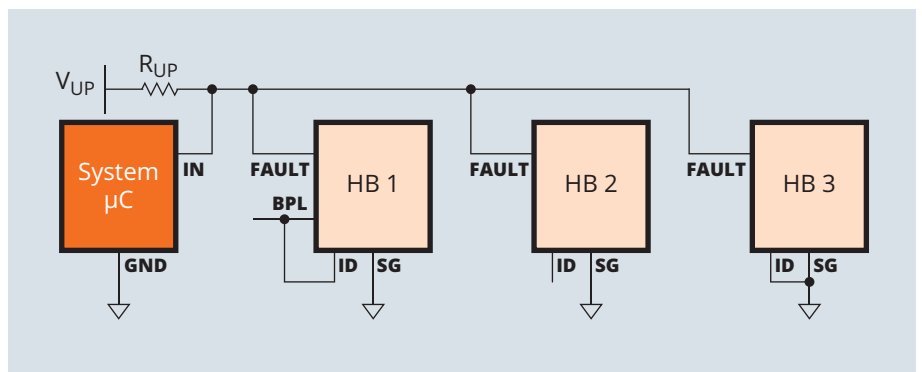
The device meets UL and IEC safety requirements.

Many of our customers are interested in Bridge-Switch. It is specifically beneficial for low cost mains motor applications with up to 300W power, like water pumps and fans.

Please contact us, in case you have any questions.

A09

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MORE POWER FOR C

Get in touch with conduction cooling from RECOM!

RECOM launches two highly compact 2"× 4" (RACM230-G, 230W) and 3"× 5" (RACM550-G, 550W) innovative baseplate-cooled power supply for 2× MOPP medical, household, industrial and ITE applications.

RACM230-G

The new, compact 2"× 4" RACM230-G series power supplies from RECOM supports up to 160W continuous output power and 230W for several seconds to back up loads with peak demands, without fan cooling. With forced air, dependent on model, line voltage and ambient temperature, 230W are available continuously. Output voltages embrace 12V, 24V, 36V, 48V and 54V nominal with conversion efficiency up to 92% and an operating temperature range from -40 to +80°C. International safety certifications include 2× MOPP (250VAC) medical, household, industrial and audio/video/ITE. The family, designed for operation up to 5000m altitude with universal 80-264VAC input, enabling worldwide

and compliant operation. The Standby power consumption is less than 500mW.

Additional features as standard include a smart fan output. For flexibility, the RACM230-G series is an open-frame design and comes with optional metal enclosure.

RACM550-G

The new ultra-compact compelling RACM550-G series from RECOM designed to support up to 300 watts of continuous output power without any forced-air cooling. This highly efficient 3"x 5" baseplate-cooled design measures just 38mm in total height (<1U) and enables direct heat dissipation through metal housings in the end application. Up to 550 watts of peak power with nominal outputs 24V, 36V, 48V, 56V are available to drive dynamic loads for several seconds, with forced air depending on model, line input and

REATIVE PRODUCTS

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In standby mode, the units consume less than 500mW of power and they deliver up to 5V/400mW output for display functions according to Ecodesign lot 6 requirements. The wide input range of 80 to 264 VAC, up to 5000m operating altitude, operating ambient temperatures of -40 to +70°C, and international safety agency certifications make the series worldwide-compliant for medical 2MOPP (250VAC), household, industrial and ITE applications. The RACM550 series is available with optional metal enclosure or comes as an open-frame design off the shelf.

Get your samples from CODICO now!

A10

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Sample Shop:
www.codico.com/shop

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ambient temperature even continuously. A 12V smart fan output is available as standard as well as a 5V/1A VSB output for applications with housekeeping circuits and on/off control.

Small as a pea!

With the RAC03-K, RECOM introduces the smallest 3W solution on the market. This versatile converter is convenient to use in a wide range of applications due to complete certifications for ITE & household standards.

A11

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RAC03-K

In a compact 1in² (6.5cm²) footprint, these modules deliver an output power of 3 Watts from -40°C to +60°C and 2W up to 80°C. Despite its high power density and small footprint, the RAC03-K series is a complete solution supporting Ecodesign Lot 6 (ErP) standby mode operation for worldwide applications in automation, industry 4.0, IoT and home automation.

With an input voltage ranging from 85 to 264VAC and international safety certifications for industrial, domestic, ITE, and household applications acc. to IEC/EN60335, they are some of the most competitive power modules on the market. Due to their reinforced class II installation rating (protection class II) and their significantly wide margin to class B emission limits (IEC/EN55032) without external components, they are amongst the easiest to design-in modules in the industry.

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Author: Dave Baker, Business Development Mgr., MPS

5G Base Station Complexity Drives the Need for Low-EMI DC/DC Module Solutions

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The 5G telecom standard is intended to support the ever-increasing data volume requirements from smartphones and smart connected devices in markets such as home and industrial automation, autonomous vehicles, healthcare, and smart wearables.

5G enables many more data connections per base station by using what are called »massive multiple-input multiple-output« (massive-MIMO) antenna arrays.

Existing 4G base stations can use up to four transmitter and four receiver elements per array (4×4 MIMO). In contrast, 5G is expected to use up to 64 transmitter and 64 receiver massive-MIMO arrays. In addition to having more channels per base station node, 5G can support data rates up to one hundred times greater than 4G networks with very low latencies of about 1ms.

All of this means that more modems, data converters, and high-speed baseband digital proces-

sing will be required per base station, which inevitably means more power. Estimates indicate that 5G base stations may need up to three times more power than existing 4G designs. Hardware designers are faced with the challenge of finding power solutions that enable all of this additional processing and electronics to be squeezed into form factors similar to those of existing 4G base station enclosures. Increased board component density demands space-saving solutions with higher efficiency and lower EMI than traditional discrete DC/DC IC and external inductor based solutions.

Base stations typically use a 48V input supply that is stepped down by DC/DC converters to 24V

or 12V, then further stepped down to the many sub-rails ranging from 3.3V to less than 1V to power ASICs in the baseband processing stages. With so many power rails to generate, the use of traditional discrete step-down DC/DC converters with a control IC and internal or external power MOSFETs – plus external inductors and capacitors – creates a complex and time-consuming task. The correct inductor sizing and construction, amount of input capacitance, input filtering, and output capacitance must be considered for each converter. Additional factors, such as frequency of operation and sequencing capabilities, must also be taken into account.

Careful component layout and placement of filter components are necessary to minimize conducted and radiated EMI caused by switching currents in the converter and inductor circuit. DC/DC converters typically generate conducted EMI via magnetic fields from the current loop path,
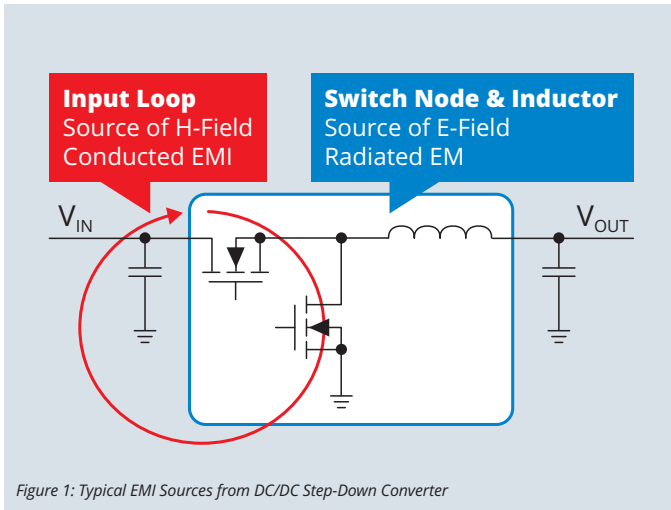
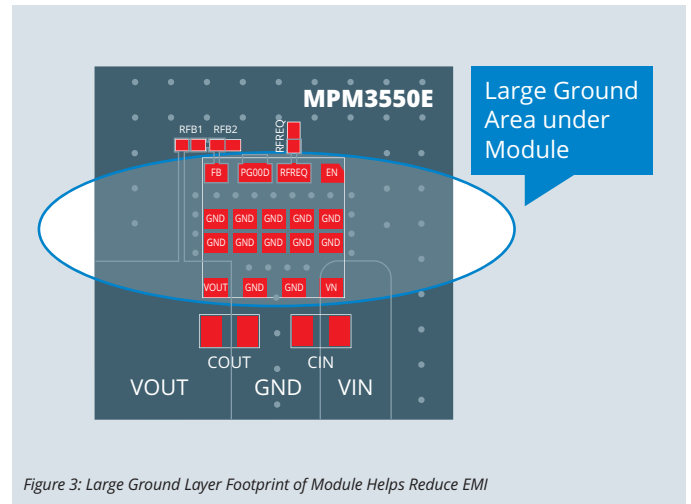Figure 1: Typical EMI Sources from DC/DC Step-Down Converter

Figure 3: Large Ground Layer Footprint of Module Helps Reduce EMI

formed between the output power MOSFET switching node to ground, and the input capacitor to ground. They also generate radiated electric field EMI from the MOSFET switching node to the inductor connection, which has a high dV/dt since it is switching from the high input voltage level to ground continuously, and from the electromagnetic fields generated in the inductor itself (see Figure 1).

Failure to get the design right can result in expensive design iterations and EMI lab retests.

An alternative approach to simplify design and speed time-to-market is to utilize self-contained DC/DC converter modules for each power rail. Advances in semiconductor process technology and package construction mean that the latest generations of DC/DC modules achieve very high power density, high efficiency, and good EMI performance in a small form factor. New construction techniques, such as in-package flip-chip and »mesh-connect« lead frame technology mean

that the IC, inductor, and passives can be mounted directly onto the lead frame without wire bonding or an additional internal PCB (see Figure 2).

This new form of construction utilizing the lead frame for interconnections has a number of advantages: EMI is better controlled, heat dissipation is improved, and footprint size is reduced. Compared to older construction styles that use an internal PCB substrate or wire bonding, connection trace lengths can be minimized and direct connection to passive components keep the inductance low to minimize EMI.

The use of a land grid array (LGA) package format that surface-mounts directly to the target PCB offers a lower EMI profile than alternative SIP/SIL style converters with leads that can radiate EMI.

The LGA package allows a solid ground plane to cover most of the area beneath the module, which helps close eddy current loops and further reduce EMI (see Figure 3).

For some module types, a metal can cover adds additional attenuation of radiated EMI.

Thermal conduction from the MOSFET power stage is improved by direct copper pillar connection from the MOSFET die source and drain to the module's lead frame, and to the target PCB copper below. This allows for a smaller module size than older constructions, in which bond wires or an internal circuit board presented a thermal isolation barrier to heat dissipation.

The MPM5550E from Monolithic Power Systems (MPS) highlights the space savings with an integrated module approach. This module accepts up to 36V input with 5A rated output current over an adjustable range of 12V to 1V. The package dimensions are 12×12×4.2mm in an LGA form factor.

Compared to a conventional 36V, 3.5A discrete DC/DC layout with an external inductor and passives, the footprint of the MPM5550 offer a space savings of approximately 30% (shown in Figure 4).
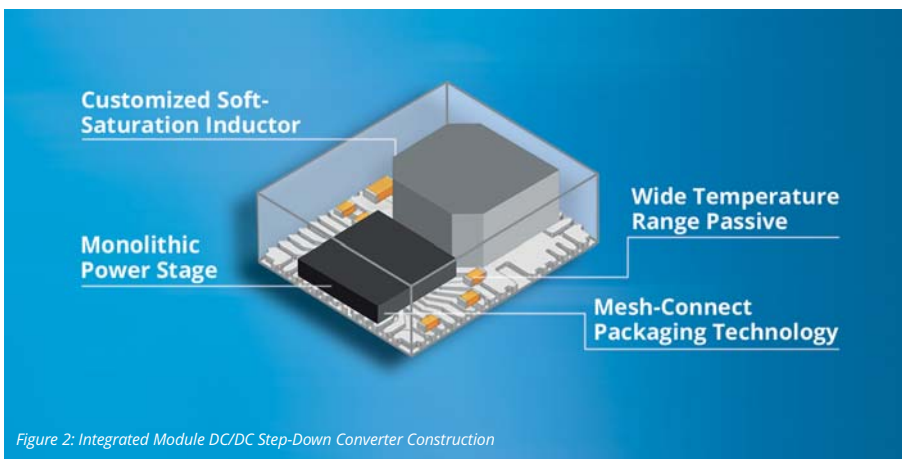

Figure 2: Integrated Module DC/DC Step-Down Converter Construction
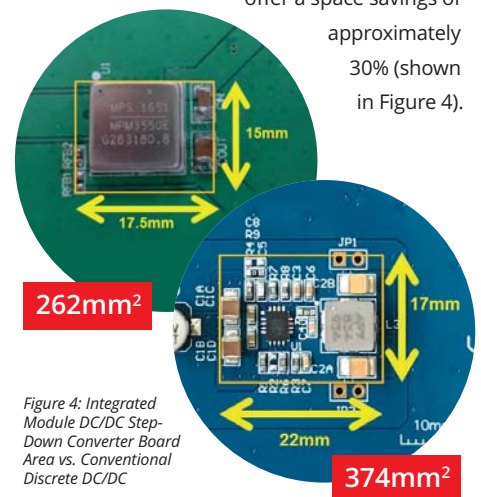

Figure 4: Integrated Module DC/DC Step-Down Converter Board Area vs. Conventional Discrete DC/DC
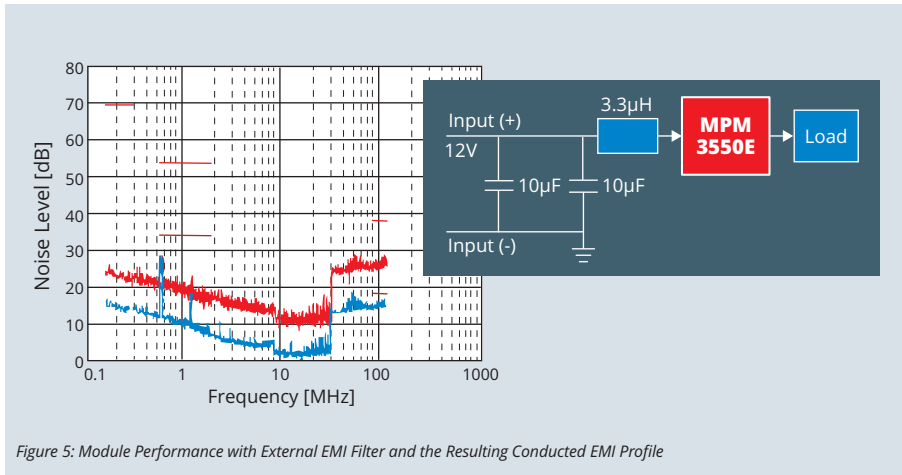
Figure 5: Module Performance with External EMI Filter and the Resulting Conducted EMI Profile

Figure 7: Compact, Four DC/DC Module Package

In addition to the space-saving gains, the designer no longer has the task of individual component selection or converter layout.

These issues have already been considered by the manufacturer in the internal construction of the module. The use of enclosed magnetic path inductors with a soft-saturation core, optimized current loop paths, and integrated input filtering simplify the task of ensuring the final design meets radiated and conducted EMI regulations.

A simple LC low-pass filter consisting of two 10µF capacitors and a 3.3µH inductor is sufficient to meet conducted emission specifications, including CISPR22 Class B and CISPR25 Class 5 (see Figure 5).

For further circuit board space savings, it is possible to extend the approach by combining multiple DC/DC converters into one module. This is particularly suited to lower voltage circuits, such as ASICs. The lower overall power level allows multiple converters to be integrated into a module while still achieving manageable power density and dissipation levels (see Figure 6 and Figure 7).

The board space-saving achieved by a multi-rail module approach can be as high as 90% compared to the use of individual DC/DC converters with external inductors and passives.

For example, Figure 8 shows the MPM54304 module from MPS, which integrates four step-down buck converters in a single 7×7×2mm module, including inductors and passives, compared with the area taken up by four discrete step-down converters.

It is a certainty that 5G will demand higher levels of electronic integration and power density in baseband and radio board design while also being constrained by the limits of the installation's cabinet size and the loading capabilities of radio masts. The use of integrated DC/DC modules can assist in board space area savings, as well as offering benefits that include simpler layout and reduced EMI. Together, these factors combine to reduce risk and provide faster time-to-market.

For further information please contact:

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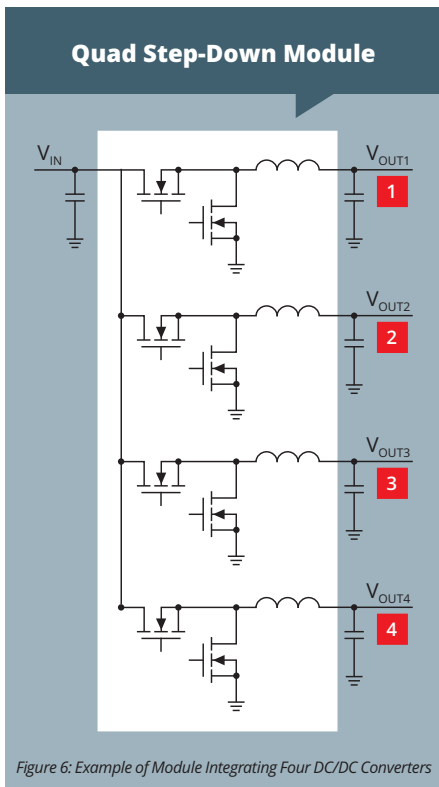*thomas.berner@codico.com*

Figure 6: Example of Module Integrating Four DC/DC Converters
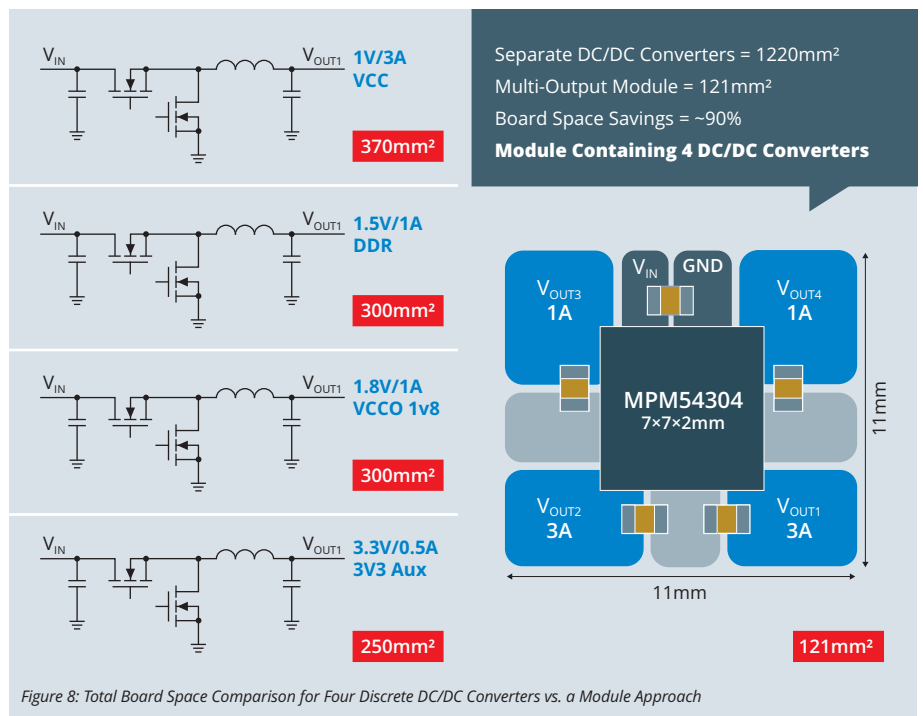
Figure 8: Total Board Space Comparison for Four Discrete DC/DC Converters vs. a Module Approach
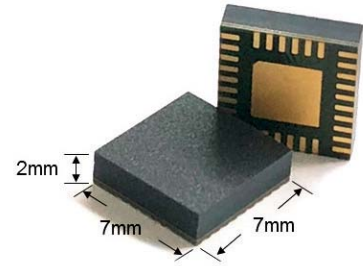
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REINFORCEMENT MOVES IN

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SILVERTELs Ag5810

PoE+ Ag5305

To complement SILVERTEL's popular and well-established Ag53xx series, the Welsh innovator launches the Ag5305, an IEEE802.3.at compliant PoE PD module with a fixed 5V output. The 57× 18×14mm (L×W×H) single-in-line module is the smallest IEEE-compliant solution available and is ideal for space-constrained applications such as Single Board Computers, Wireless Access Points and Door Access Equipment. The absence of a preferred supply sometimes forces the system designer to compromise, making design and implementation more complicated, time-consuming and expensive. However, with this PoE-enabled 5V output option, there is no need to make such compromise. Pin compatibility between all three output variants (5V, 12V and 24V)

allows standardisation on a common PCB in which to mount the PD. The Ag5305 is a fixed Class 4, Type 2 PD module incorporating the (signature) identification and classification features necessary for PoE interoperability, 1.5kV isolation and efficient DC-to-DC Conversion.

PoE bt Ag5810

The ratification of the IEEE802.3bt standard in January, 2019 has provided a foundation and assurance that high power 4-pair powering of peripheral devices over a Cat5e/Cat6 Ethernet link is both – safe and accepted practise. It has unearthed new applications for PoE which were previously inaccessible, specifically where higher power is required, for example, in Radio Communications equipment, Satellite Broadcast Receiver boards, Wireless Access Points (WiMax) and high power Pan-Tilt-Zoom Cameras. SILVERTEL's newest addition to the product range, the Ag5810,

is a Class 7, Type 4 PoE PD device designed to supply 60W and works with any*.bt compliant PSE.

Available in a dual-in-line format and measuring 70×30×15mm (L×W×H), it represents a very space-efficient, compact, plug & play solution for easy integration, with few external components. It features identification and classification functions, a configurable 12V or 24V isolated output, along with detection flag outputs to enable identification of the PSE type connected to the PD input.

Samples and datasheets are available from the CODICO Sample Shop now.

A13

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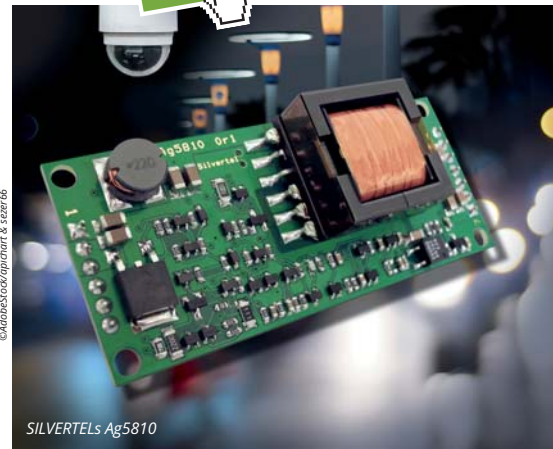
SILVERTELs Ag5305
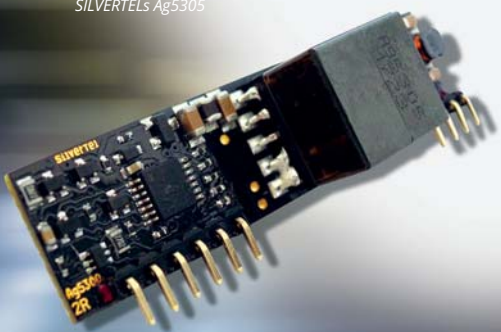
IEEE802.3BT CLASSES

POE TYPE	REQUESTED CLASS	PSE MINIMUM POWER(W)	CLASS EVENTS	CLASS RESPONSE
Type 3	5	45W	4	4,4,0,0
Type 3	6	60W	4	4,4,1,1
Type 4	7	75W	5	4,4,2,2,2
Type 4	8	90W	5	4,4,3,3,3

BUILD OR BUY?

Planning IoT-Product Design

DIGI

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At some point in almost every company's IoT product design planning process comes the decision of whether to build or buy.

Very often this choice is determined largely by a) the anticipated lifespan of the product and/or b) the projected volume of manufacture. However, there are actually several ingredients that are going into this complex equation. So, presuming that you're not building a one-off garage opener project, and that you have an innovative idea that you hope will be the next Dyson or the Google Nest, the key question is: what is also your value-add/intellectual property? Is it the hardware design – its innovation, connectivity, integration, simplicity and the sheer elegance of your design, OR is it in your software – its porting, GUI, analytics capability and cloud connectivity?

Evaluating a Modular vs. Integrated Design

The idea that modular design is more expensive than an integrated design is usually unfounded or based on an incorrect understanding of modular design. When in-house technical expertise or bandwidth is limited, a modular approach might be the easiest and most economical way to solve this problem. A modular design can also help deliver the product on-time even with internal resource bottlenecks.

Things to consider include:
- **Engineering opportunity cost:** If your team is building a custom product, is that sapping resources for another project that could be driving your business?
- **Technology debt:** You are responsible for your bespoke product - if it needs change or the outside environment evolves, it will cost (several) development cycles; that requires your team's time and company's cash.

Individual steps in the design process show where a modular design is advantageous. The time saved using a modular design is essential. Consider these three factors:

1. The processor or radio module is already completed and has already been tested, and thus a crucial component of the hardware design is already available before starting the project.
2. This makes it easier to design the application board. Some parts of that circuit can be deduced from the reference design in the starter kit, which allows the application board to be designed even more quickly and reliably.
3. The key software drivers are delivered with

the module BSP already and can be used immediately, so software development can start on day one since the target platform is already available.

As a result, real parallel engineering can take place. Performance tests are often necessary before a final design decision is made. This can be conducted with modules, reducing development time.

- **Direct cost:** Engineering time is always costly; your engineering team will have to design, test and verify your hardware design, and write some code.

The circuit board is a significant cost factor. The circuit board configuration is always determined by the most complex switching or structural element. For example, an ARM processor with a speed of 1.2GHz and DDR3 memory requires a multi-layer structure with micro-via and at least 10 to 12 layers. Using a modular design, the application or carrier board can be implemented easily with at least 2 to 4 fewer layers.

For long-term availability, memory is the most critical component in a processor application today. This means that redesign will be necessary in the lifecycle due to discontinued memory.

COSTS

1. Overhead 7%
2. Memory Selection 3%
3. Interface Selection 6%
4. Certification required 9%
5. Environment requirements 6%
6. Product length 4%
7. Design for cost 6%
8. Design for manufacturing 6%
9. Design for testability 6%
10. Design for quality 6%
11. Feasibility test 6%
12. Design specifications 9%
13. Draft concept 0%
14. Final concept 18%
15. Test concept 6%
16. Software outline 6%

Direct Costs

If modules are used, this is the responsibility of the module producer.

- **Production and QA:** It is critical to establish the minimum of flow disruption for manufacturing; the last item off the production line needs to works identically to the first, and that will take some time.
- **Negotiating on price with economies of scale:** Since the module will be used by many customers, each customer will benefit from the excess quantity produced by the module provider. And using a module in other products, at higher quantities, results in additional room to negotiate a price. In addition to avoiding pure development costs, continued investments for the acquisition of the appropriate tools for development, manufacture and test equipment may be required.

Managing Risk

Risk means time and costs. With a modular approach, the design for the application board is much simpler, and therefore the risk of eventual redesign is significantly lower. A redesign in the course of the lifecycle usually becomes necessary for the embedded module only because this is where the memory modules are located.

Less risk and timely completion of development can play a crucial role in contributing to a product's commercial success.
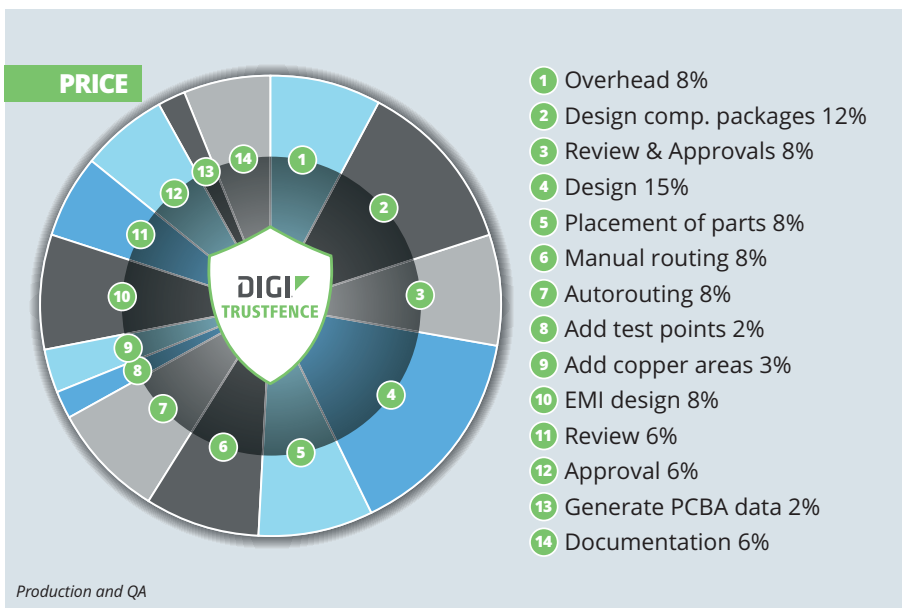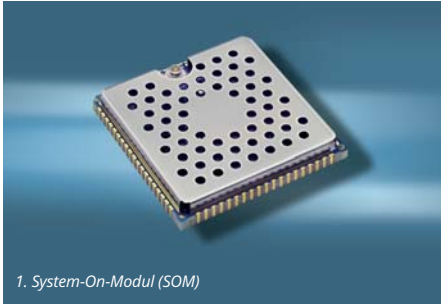
- **Upgradeability:** Is your design flexible enough to meet future needs? In a diverse and constantly evolving world, as your customers and their needs change, is your solution flexible enough to stay relevant?
- Application board is easier to redesign
- Module changes seldom force a redesign
- Contributes to a product's commercial success

Addressing Security

Security is a subject of much discussion with respect to IoT applications. Accordng to HP Security Research, 70% of IoT devices are vulnerable to attack. To thwart attackers, it is critical to invest in a device-security framework that simplifies the process of securing connected devices. A security framework should encapsulate:

- **SECURE BOOT:** Authentication capability to ensure only authenticated software updates that have been signed by the manufacturer are allowed.
- **SECURE STORAGE:** A file system-level encryption that enables data to be transparently encrypted offering secure storage of sensitive data.
- **AUTHENTICATION:** Data authentication and device identity management options that also ensure that products are not shipped with default user and password settings.
- **SECURE CONNECTIONS:** The latest encryption protocols for data in motion and over-the-air (OTA) transmissions to ensure the integrity of data flowing across a network.

PRICE

1. Overhead 8%
2. Design comp. packages 12%
3. Review & Approvals 8%
4. Design 15%
5. Placement of parts 8%
6. Manual routing 8%
7. Autorouting 8%
8. Add test points 2%
9. Add copper areas 3%
10. EMI design 8%
11. Review 6%
12. Approval 6%
13. Generate PCBA data 2%
14. Documentation 6%

Production and QA

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1. System-On-Modul (SOM)
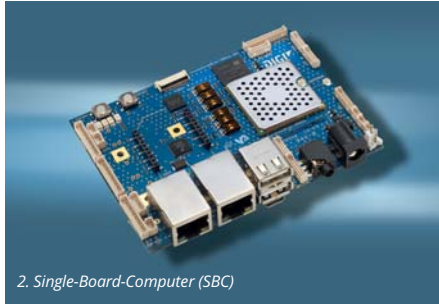
2. Single-Board-Computer (SBC)

3. XBee® RF-Module

- **ROTECTED HARDWARE PORTS:** Internal and external I/O ports are hardened and access-controlled to prevent unwanted local intrusion.
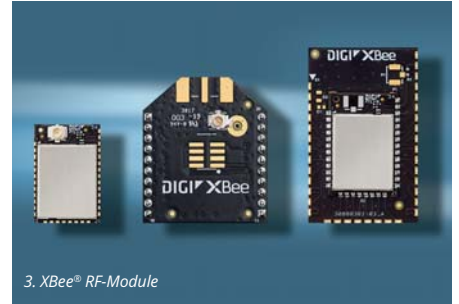- **ONGOING MONITORING AND SUPPORT:** Ongoing threat measurement and monitoring services as well as performing internal and external security audits and proactive communication regarding upcoming threats.

As a premier supplier of a full range of embedded solutions, including modules and SBCs as well as software and remote management capabilities. DIGI's suite of embedded solutions includes RF and cellular modules, as well as SoMs and SBCs to support your development requirements. Whether your chief concern is range, power, programmability, certification, security, or software tools, DIGI has your needs covered.

IoT Devices for
Rapid Time-to-Market

Take a brief tour of the device families that support rapid modular development in a world where you can't afford to have product development tied up in certification challenges.

Ultra-compact, highly integrated system-on-module solutions

DIGI's system-on-modules (SOMs) offer multiple embedded wireless solutions including pre-certified 802.11a/b/g/n/ac, Bluetooth and options to add cellular. Built on the latest processors, such as the NXP i.MX6UL, i.MX6 and soon i.MX8X, DIGI SOM's provide device security for connected IoT applications, and you can accelerate parallel software development with DIGI's support for embedded Android and Linux development environments including Yocto Project.

Versatile, off-the-shelf single board computers (SBCs)

Borne from our SOM's, DIGI's line of compact, cost-effective and versatile off-the-shelf single board computers (SBCs) offer significantly reduced time-to-market by virtually eliminating the traditional risk, effort, and complexity of custom board designs without sacrificing flexibility or capabilities. DIGI SBC's support ARM, NXP, Rabbit processors and multiple wireless interfaces. For our NXP SOM based SBC's, we also provide complete schematics, gerber files, bill of materi-

als and resources so developers can rapidly create their own carrier boards.

RF modules in multiple form factors for embedded IoT designs and pre-certified embedded cellular connectivity for rapid deployment

DIGI XBee® RF modules provide wireless connectivity in a range of protocols and form factors to support today's low-power applications. Easy-to-deploy, pre-certified, and configurable using XCTU and the XBee® mobile app, these low-cost modules support all of your wireless design requirements. DIGI XBee® also offers the easiest way to integrate cellular connectivity into an OEM device. With the introduction of 3GPP standards like LTE Cat 1, LTE-M and NB-IoT, as well as older standards like 3G HSPA/GSM, DIGI has the cellular modem for your design. DIGI XBee® Cellular modems provide easy cellular connectivity without having to go through a costly FCC or carrier end-device certification process.

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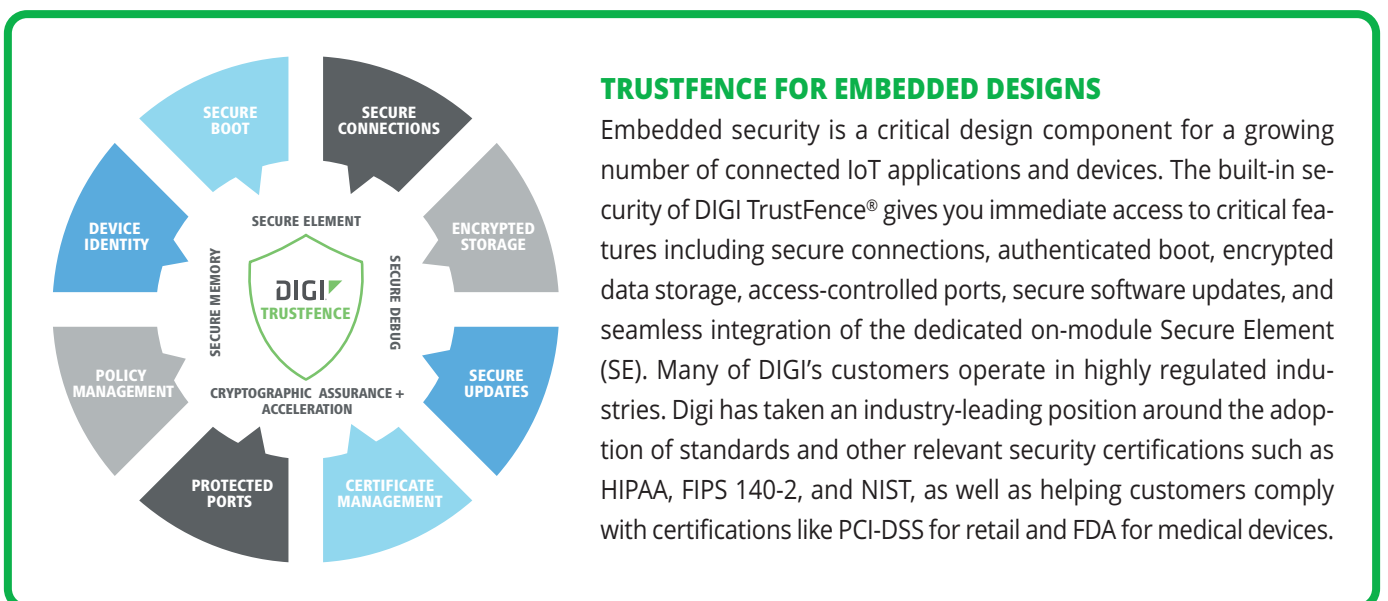
TRUSTFENCE FOR EMBEDDED DESIGNS

Embedded security is a critical design component for a growing number of connected IoT applications and devices. The built-in security of DIGI TrustFence® gives you immediate access to critical features including secure connections, authenticated boot, encrypted data storage, access-controlled ports, secure software updates, and seamless integration of the dedicated on-module Secure Element (SE). Many of DIGI's customers operate in highly regulated industries. Digi has taken an industry-leading position around the adoption of standards and other relevant security certifications such as HIPAA, FIPS 140-2, and NIST, as well as helping customers comply with certifications like PCI-DSS for retail and FDA for medical devices.

GO

©AdobeStock/kwest

XC6237 provides both: Low Power & High-Speed

USPQ-4B05 Package

XC6237x331
$V_{IN} = V_{CE} = 4.3V_{DC} + 0.5V_{P-PAC}$, Ta = 25°C
$C_{IN} = C_L = 1.0\mu F$ (ceramic)

- $I_{OUT} = 0.1mA$
- $I_{OUT} = 10mA$
- $I_{OUT} = 30mA$
- $I_{OUT} = 100mA$

Figure 3: Power Supply Rejection Ratio (PSRR)

Traditionally, linear regulators have been classified as either being »Low Power«, meaning they consume low levels of quiescent current during operation, or "High-Speed", meaning that the LDO responds very quickly to changes in load current (fast load transient response).

High-speed LDOs also typically offer higher PSRR performance compared to low power solutions. That has been the traditional viewpoint up until now! Welcome to the new XC6237 LDO which is both low power but also high-speed! Incorporating our proprietary »Green Operation« (GO) technology, the XC6237 sets a new benchmark for high performance linear regulators.

By combining ultra-low quiescent current with high ripple rejection and fast transient response the XC6237 is a truly versatile linear regulator suitable for a wide range of applications. As the output voltage is fixed during the production process (selectable in 50mV steps between 1.2V to 5.0V), only two, small 1.0µF ceramic caps are needed externally as shown in Figure 1. Maximum operating voltage is 6.0V and maximum output current is 150mA.
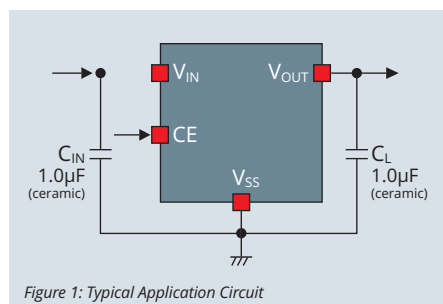
Drop-Out Voltage is only 165mV (V_{OUT}=3V@ 150mA) in high speed (HS) mode (I_{OUT}>10mA) and this new LDO features both current limit & short circuit protection as standard. Additionally, the XC6237A also includes a CL Discharge function.

Green Operation

The XC6237 incorporates our Green Operation function (GO). GO automatically switches between a high-speed mode (HS) and a power save mode (PS) depending upon the load current level. The switch point is fixed internally. Figure 2 below shows the switch point between HS mode & PS mode. Our GO circuit automatically reduces quiescent current at low output loads (I_{OUT} < 0.5mA) down to only 0.6µA, whilst offering extremely fast ripple rejection of 60dB@1kHz in HS mode (see Figure 3).

Load Transient Response

The XC6237 also provides fast load transient response performance ensuring that the output voltage remains stable as the load current changes as can be seen in Figure 4. The XC6237 is available in SOT-23, SSOT-24 and an ultra-small USPQ-4B05 package which measures only 1.0× 1.0×0.33mm.

With the SSOT-24 and USPQ-4B05 packages, the XC6237 can also be put in stand-by mode via the chip enable pin, thereby reducing current consumption to just 0.01µA.

For more information on the XC6237 (including the latest datasheet) just ask us!

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Figure 1: Typical Application Circuit

Figure 2: Switch Point between HS Mode & PS Mode

Figure 4: Load Transient Response

A TRULY SMART SPEAKER

The new QCS40X-Family

As a follow up to the article in last issue of Impulse 1/2019 we are now going to have a look at a more complex Smart Speaker platform.

The QCS40X-family of products are the first real integration of QUALCOMM and CSR IP in to one product that uses the Snapdragon processor platform, Wi-Fi, Bluetooth and Power Management combined in to a system for mid to high end Smart Speakers and Soundbars. This family consists of a number of different parts, ranging from mid range speaker platforms all the way to complex Sound Bars. It is therefore possible to build an entry level Voice Control product just like an Amazon Echo Dot-type product with the low end and then all the way to a Dolby Atmos enabled Soundbar via Multi Room synced speakers and Voice Controlled speaker systems with the more complex family members.

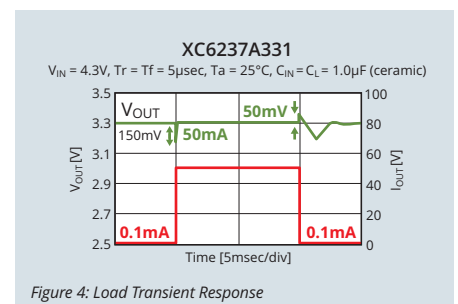The QUALCOMM QCS400 SoCs support the evolutionary improvements in voice UI that are critical to realizing the vision of the connected smart home. This is done with a combination of highly integrated technologies, such as QUALCOMM's AI Engine, far-field multi-keyword voice pickup with beamforming and low-power voice detection. These technologies give faster response times for voice commands, more robust voice pickup

when people are using their speaker in noisy environments. Local voice control is another feature that gives the end user a smart speaker that respond even when it is not connected to the internet.

Added to that, these SoCs can drive smarter, more immersive sound quality, particularly for home cinema experiences compared to previous SoCs. With its high-performance, low-power architecture, the QUALCOMM QCS400 can support rich audio features, including Dolby Atmos and DTS:X, that help people to have a powerful surround-sound experience with a soundbar and networked speaker set-up.

The third thing to call out is that QUALCOMM designed the QCS400 SoCs to make it easier for people to enjoy this great sounding audio virtually everywhere. There are two ways to achieve this. One is with robust, multi-channel connectivity that was engineered to enable smart speakers to be networked together in a room or around the home. This means people can have

more control of the audio devices on their home network and play back music and audio in different rooms or the whole home at the same time. The second way is by driving improvements in power performance and battery life – people can take their speakers with them into the yard or even to the park or beach and enjoy playback with voice commands.

Apart from low-latency streaming, there are other rich connectivity features on these SoCs – for example, support for tri-radio coexistence of Wi-Fi, Bluetooth, and Zigbee channels all at once. This is a complex feature that supports music streaming and home control at the same time, and by having it pre-integrated help save development time.

The QUALCOMM AI Engine is another exciting feature of the QUALCOMM QCS400 SoCs. AI is a growing force in all areas of technology because it gives devices the ability to learn ways of doing things, instead of relying on programmed logic – by learning in this way, they can be more efficient and effective. On Qualcomm QCS400, this AI capability was applied to help make a smarter, more robust Voice UI than in previous technology. Smart speakers with this technology can more accurately recognize wake words, respond faster, and perform many commands without connecting to the cloud. This is better for on-the-go use and at home control.

The QUALCOMM AI Engine is compatible both with third-party neural networking frameworks and the Qualcomm Neural Processing Engine (NPE) SDK – tools that will help developers utilize this advanced AI to create their own machine-learned features.

Features

- Highly-integrated architecture, with up to four cores, Dual-DSP, Wi-Fi, Bluetooth, powerful audio features and AI engine on a single chip
- QUALCOMM AI engine that supports highly efficient on device inferences and machine learning based, embedded automatic speech recognition
- Industry leading connectivity with advanced Wi-Fi, Bluetooth and Zigbee coexistence technology and low-latency streaming
- QUALCOMM® Adreno™ GPU and display (QCS407 and QCS405 only)

- Superior audio performance, with support for Dolby Atmos and DTS:X immersive home audio
- Pre-integrated low-latency in-room and multi-room networked audio
- High performance, low-power keyword detection pre-loaded and running on an integrated DSP
- Configurable multi-keyword detection with Local Automatic Speech Recognition for customizable user experiences
- Includes multi-mic beamforming noise suppression with mono, stereo and multichannel echo cancellation
- Support for leading cloud-based voice platforms
- Support for high resolution 32bit audio, with aptX audio codecs, DDFA, and powerful audio post-processing
- Compatible with DDFA amplifier technology and aptX audio
- Help to reduce product development time and cost with our Audio Development Kit (ADK), and Software Evaluation Kit, as well as hardware reference designs
- SoC variants at multiple tiers to help OEMs scale across a range of end-product types and applications

A16

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SPECIFICATIONS

	QCS403	QCS404	QCS405	QCS407
Processor	Dual Core	Quad Core	Quad Core	Quad Core
Adreno 306 GPU/Display	–	–	Yes	Yes
Audio DSP	Yes	Yes	Yes	Yes
Compute DSP with Qualcomm AI Engine	Yes	Yes	Yes	Yes
Voice and Machine Learning	Multi-mic Qualcomm Noice and Echo Cancellation			
	Simultaneous multi-keyword detection			
	ML based wake word detection			
	Local Automatic Speech Recognition			
Security Features	Security rich boot			
	Debug Security Features			
	Cryptographic Accelerators			
	Supports Trusted Execution Environment			
	Key provisioning security features			
Connectivity	Integrated 2x2 11ac			
	Co-Ex with Bluetooth and Zigbee / 802.15.4			
	Bluetooth 5.1 compliant			
	aptX Adaptive support			
	Low-latency whole-home multi-channel audio networking			
	Expandability to 1×1 or DBS (2×2 & 2×2/4×4)			
Audio I/F Channels (DMIC, SPDIF, ARC)	12	12	12	32
Wired I/F*	Yes	Yes	Yes & HDMI, SPI, RGB	Yes & HDMI, SPI, RGB

*USB 2.0, USB 3.0, SDIO 3.0, PCIe, Ethernet, UART/SPI/I2C

MARKET TRENDS

Hybrid Capacitors SMD-Versions

Leading hybrid capacitor manufacturer are continuously developing their product portfolio according to customer requirements, especially driven by the automotive market. The parts have to be smaller with high capacitance, high ripple current capability and high temperature withstanding. Not to forget about long lifetime in addition. Here are the latest news from PANASONIC Industry, RUBYCON and SUN.

Ultra miniaturization by PANASONIC Industry

PANASONIC Industry Europe presents a new hybrid capacitor of the ZKU series (125°C/4,000h), which currently offers the highest capacitance per case size on the market. For applications in which beside high ripple current capability, a certain capacitance value is also decisive, space can be saved by smaller dimensions or by reducing the number of components required. Compared to PANASONIC's already miniaturized ZK series, ZKU offers approximately 20% more capacity with the same case size and voltage, which is currently market leading.

With their consistently high ripple current capability and AEC-Q200 certification, these capacitors are ideal for demanding automotive and industrial applications. In addition, a compact design of your application is possible.

Focus-applications are e.g. DC/DC converter, battery management systems, power supplies, motor control, robotics and the like. Adoption of ZKU series in EPS applications decreases the PCB area by 25% when compared to other hybrid capacitors on the market. It is currently available with

a rated voltage of 25V and 35V and can also be supplied in a vibration resistant version up to 30G. In dimensions 10×10.2mm e.g. 560µF can be achieved at 25V. The guaranteed lifetime is 4,000 hours at 125°C and full ripple current load.

Capacitance range: 39µF to 560µF

Rated ripple current: 750 to 2,800mArms@100kHz/125°C

Dimensions: 5×5.8 to 10×10.2mm

Beside introducing new series to the market PANASONIC Industry also develops existing series further to be able to provide more capacitance per case size with keeping voltage and ripple current. New values in this context are following:

PANASONIC HYBRID LINE EXTENSION

ZA-SERIES (105°C/10,000HRS), 63V	
Up to now: 33µF in 8×10.2	new 47µF
Up to now: 56µF in 10×10.2	new 68µF & 82µF

ZK-SERIES (125°C/4,000HRS), 25V	
Up to now: 68µF in 6.3×5.8	new 82µF

High rated ripple current from SUN

The Japanese capacitor manufacturer SUN recently expanded their product portfolio of polymer-hybrid capacitors by versions with particularly high ripple current capability in compact dimensions. These are AEC-Q200 certified products with a nominal temperature range of up to 125°C (HVPY) or 135°C (HVTY) and a guaranteed lifetime of 4,000hrs at full ripple current load.

With 4.000mArms at 100kHz/125°C/4,000hrs in case size 10×10.5mm SUN is currently market leader with HVPY-series. In 10×12.5mm 4,700mA are achieved. HVTY-series specifies 2,500mArms at 100kHz/135°C in dimensions 10×10.5mm (10×12.5mm/2,750mA), which places it at the forefront in comparison with competition. Both series are available with 25V and 35V, the capacitance range is from 270µF to 470µF.

HVPX-series, which we introduced one year ago, has been extended by the voltage range 50V to 80V.

Capacitance range: 22 to 150µF

Rated ripple current: 2,000 to 3,500mArms@100kHz/125°C

Guaranteed lifetime: 4,000 hours

Dimensions: 8×10.5 to 10×12.5mm

P01

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High ripple current at high temperature from RUBYCON

RUBYCON launched the new PSV series (135°C, 3.000hrs) which has 1.5 times higher ripple current capability than today's PHV series with a very stable ESR over temperature.

RUBYCON offers a special hybrid capacitor technology based on the polymer materials combined with a proprietary functional gel (ARSII™). This structure has a big advantage to preserve a relative stable ESR over temperature because this new mixture does not solidify at low temperature (unlike most electrolytic caps) and has a low rate of evaporation at high temperature. From such low and stable ESR, the rated ripple current will be higher compared to standard technology.

PSV series is one of the leading products to show advantages of RUBYCON's hybrid technology. This capacitor fits perfectly for the automotive powertrain applications or motor controls where the space is a limiting factor. In this case, PSV series will make a difference offering smaller size and reducing the number of capacitors inside the application.

Voltage range: 25 to 63V

Capacitance range: 33 to 330µF

Rated ripple current: 1,650 to 3,000mArms@100kHz/135°C

Dimensions: 8×10.5 to 10×10.5mm

P02

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

PREFERRED INDUCTOR MANUFACTURERS

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

SAGAMI's 7E06NM Series

Especially in the area of shielded SMD inductors, the market is crowded with manufacturers from all corners of the world. In many cases, the single decision criterion is price, quite often leading to longer-term challenges regarding availability and even quality. In this day and age, it is becoming more important to rise above the competition than just being equally good. CODICO makes sure to include only leading, renowned manufactures in its portfolio. Each one of CODICO's following preferred manufacturers focuses on special priorities in order to stand out in their field.

SAGAMI Elec

SAGAMI Elec has made a name for itself above all in the field of low-pass filter inductors for class D amplifiers for commercial and automotive applications. What is much less known, however, is that as far as cost-benefit ratio is concerned, SAGAMI Elec's **7E06NB** is one of the best shielded ferrite SMD inductors in size 6x6×2mm out there.

The series has already established itself in all markets for over 15 years, so that these inductors are also available in a AEC-Q200-compliant version if required. Additional, customer-specific adjustments or special types are also available upon request.

Another distinctive feature of SAGAMI Elec is the relatively recent **HER(-C)** hybrid series. Though pure ferrite inductors may be quite low-cost, their currents are not a match for iron powder inductors. Iron powder inductors, on the other hand, are relatively expensive and clearly overdesigned for a number of applications. By introducing the HER hybrid series, SAGAMI Elec closed the gap between ferrite and iron powder – both from a price and a performance point of view.

For those applications that cannot exhaust or do not require the full potential of iron powder inductors, the **HER(-C)** series presents an extremely attractive alternative. Since miniaturisation is key, the required space on the PCB can be reduced by up to one size compared to conventional ferrite inductors. The complete series is available both in a commercial and an automotive* version.

at 3x3mm: AEC-Q200 Grade 2, Texcluding the Terminal Strength Test

SAGAMI's HER Series

PANASONIC's ETQP Series

PANASONIC's HF ETQP Series

PANASONIC Industry

Each new device generation must offer more performance on a smaller footprint: this is an unwritten law that applies to both automotive and industrial environments. In addition, features like high process capability and long-term reliability are increasingly coming to the fore. In the field of power choke coils (PCC), PANASONIC Industry has long recognised the outstanding properties of metal composite inductors, and is continuing its consistent strategy by integrating the advantages of this technology in the products of its **ETQP** series. This is only achievable with significant know-how and several years of experience in the production process. A particular feature of this series is that the iron powder pressed around the coil creates a body without an air gap.

Here, PANASONIC Industry uses a special technique to regulate pressure distribution. This method helps prevent cracks in the powder core and reduce deformations in the winding wire to a minimum. The result is an extremely low manufacturing tolerance and a particularly high production quality. Several hundred million units have been shipped since the product was launched in 2006, and no failures have been reported in the field to this day.

Another advantage offered by the **ETQP** coils can be found at the solder joint. In the case of conventional chokes, the coil ends are internally welded with the solder pads. The risk here is that the insulation of other windings can suffer damage as a result, causing a short circuit. In addition, cold soldering joins sometimes stay unnoticed until mounting. In contrast, PANASONIC Industry leads the winding ends through to the bottom side, thus creating a direct contact between the conductor path and the coil contact.

Another advantage of metal composite inductors lies in their soft saturation and an extremely low temperature drift. All products of the **ETQP** series are designed to be compliant with AEC-Q200 Gra-

de 2, making them suitable for tough automotive applications.

Depending on the area of application, PANASONIC Industry breaks down the series accordingly:

- **Metal Composite series:** This is the standard series of **ETQPs** and is available in sizes ranging from 5×5mm to 12×12mm.
- **Low Profile series:** This series has a lower height than the standard series. It comes in sizes from 5×5 to 10×10mm.
- **High Frequency series:** The optimised iron powder alloy minimises eddy current loss in the core (at frequencies above 2MHz) and DC loss in the coil. Can be used for up to 5MHz.
- **High Vibration Resistant series:** Designed especially for engine environments, the special terminal structure of these inductors allows them to reach a shock resistance of 50G (490m/s²) at operating temperatures of up to 150°C. As a result, it renders complicated glueing or other mechanical bonding processes redundant in many cases.

EATON Electronics

EATON Electronics has been a renowned manufacturer of winding materials for over 20 years. Its highly sophisticated development centres in Shanghai, Florida, and California are constantly working on innovations in the area of supercaps, circuit protection, and winding components. The company can directly develop and test customer requirements for special vibration profiles, soldering conditions, or even customer-specific

inductances. Using a special warm molding technique, EATON Electronics has developed a method allowing for the iron powder to be pressed particularly gently around the pre-wound air-cored coils, thus achieving excellent mechanical and electrical properties.

The first result was the launch of an improved version of the the miniature power inductors. The **MPI(A)-V2** series is available in sizes 2.7×2.2 and 4.75×4.45. The smallest iron powder core inductor series by EATON can reach up to 16Arms and 22Asat, and is AEC-Q200 Grade 3 certified. Due to its compact design, the **MPI-V2** series is particularly suitable for all types of wearable and portable devices. The main applications of the automotive **MPIA-V2** version, however, are ADAS, body electronics, and infotainment systems.

In a second step, EATON Electronics launched an update of its existing high current molded series for automotive Grade 1, under the name **HCM1A-V2**. Compared to its predecessor HCM1A, the new version intentionally did away with the additional coating and used a new alloy powder instead, yielding a number of advantages regarding performance. Its improved thermal conductivity combined with lower DCRs allows for higher RMS currents, and the new iron powder alloy improves saturation behaviour. **HCM1A-V2** is available in the already established sizes of 5.7×5.4x3 to 17.45×17.15×7mm. Furthermore, EATON used this opportunity to expand its portfolio by size 22.78×22.3×13mm with series **HCM1A2213V2**.

In the case of a new design or a re-design, please feel free to contact your CODICO specialist. Our specifically selected sample kits from the above manufacturers are available upon request. In addition to our inductors, our CODICO sample shop offers a multitude of other possibilities to support your project.

P03

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EATON's MPIA Series

EATON's HCM1A, V1 and V2

AUTONOMOUS

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Accurate Timing for Autonomous Driving

KDS/Daishinku has developed a new, tight-tolerance CMOS oscillator »DSO..SX series« for automotive application.

KDS announced their new CMOS output crystal oscillator series »DSO..SX« & »DSO..SXF« in 2016 and 2520 sizes. These series are designed for use in all CMOS oscillator circuits. Furthermore, these series feature side castellation designed for AOI (Automated Optical Inspection) to check proper soldering after the product is mounted on a PCB.

The DSO..SXF series is suitable for many other usages beside automotive application. Industrial PLC (Programmable Logic Controller) and motor control units in particular often use CMOS output oscillators due to their smaller mounting space and design flexibility. These also offer low-phase noise characteristics, which also renders them appropriate for use in communication applications.

The DSO..SX series was designed for use in automotive applications. It meets the automotive reliability standards AEC-Q100 and Q200. It was mainly designed for autonomous driving applications such as AEBS (Advanced Emergency Brea-

king System) which will become mandatory in the European Union from 2022.

AEBS is not only related to breaking applications. To achieve such advanced technology, many applications have to work together to collect information on distance, such as automotive cameras, IR radars and millimetre-wave radars. These

Features
- Package: Ceramic base + Metal lid
- Pb Free / RoHS compliant
- AEC-Q100 and AEC-Q200 compliant (SX series)

applications need to have a compact size to allow their installation inside the car. Therefore, SPXOs are often used in such circuits due to their smaller mounting area and design flexibility. AEBS, however, is only one part of ADAS (Advanced Driver Assistance Systems). An increasing number of sensor and communication applications will be implemented and high specifications will be required to achieve higher autonomous driving levels (1~5).

To reach a higher accuracy in the automotive range, DSO..SX series will offer a tight frequency tolerance (±25ppm) in a wider temperature range of -40 to +125°C. KDS meets such specifications with their unique quartz crystal design and suitable IC matching support. (These samples will be available as of October 2019.)

For more information, please feel free to contact:

P04

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	DSO..SX-SERIES	DSO..SXF-SERIES
Size 2.5x2.0mm (h=0.8mm)	DSO221SX	DSO221SXF
Size 2.0x1.6mm (h=0.7mm)	DSO211SX	DSO211SXF
Frequency Range	1MHz to 125MHz	
Operating Voltage Range	1.8V/2.5V/2.8V/3.3V	
Output Signal	CMOS Output	
Operating Temperature Range	-20 to +70°C, -40 to +85°C, -40 to +125°C	
Stability	±20ppm (-20 to +70°C)	
	±30ppm (-40 to +85°C)	
	±50ppm (-40 to +125°C)	
	±80ppm (-40 to +125°C)	
	±25ppm (-40 to +125°C) Samples from 4Q 2019	
Current Consumption	2.6mA Max. (40MHz/No Load)	

LONG LIVE THE INDUSTRY

OS-CON™

Although there is a growing demand by the automotive market for polymer-hybrid capacitors thanks to their properties pure polymer caps are still in focus for industrial applications.

New Polymer Capacitors from PANASONIC Industry

Panasonic INDUSTRY

The big advantage of AL-polymer capacitors is their very high ripple current capability combined with staying relatively compact in terms of dimensions.

Compared to AL-electrolytic and hybrid caps, only lower capacitance values per voltage and case size are achievable with this technology. Since voltage is also limited in many cases, PANASONIC Industry focuses on developing more capacitance per case size and higher voltage.

The advantage of PANASONIC's OS-CON is the rough calculation »20°C temperature reduction –> double lifetime«, providing an extremely long lifetime in industrial environment.

New features in this context are:

P05

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PANASONIC LINE EXTENSIONS OS-CON

SVPF-SERIES (105°C/5.000HRS/SMD)	
Up to now: 1000µF/16V in 10x12.6mm	new 10x10mm
SVF-SERIES (125°C/1.000HRS/SMD)	
Up to now: 1000µF/16V in 10x12.6mm	new 10x10mm
SXV-SERIES (125°C/1.000HRS/SMD)	
Up to now: 63V/39µF in 8x11.9mm	new 56µF
Up to now: 63V/68µF in 10x12.6mm	new 100µF
Up to now: 80V/27µF in 8x11.9mm	new 33µF
Up to now: 80V/47µF in 10x12.6mm	new 56µF
Up to now: 100V/15µF in 8x11.9mm	new 18µF
Up to now: 100V/22µF in 10x12.6mm	new 27µF
SXE-SERIES (125°C/1.000HRS/THT)	
Up to now: 63V/39µF in 8x12mm	new 56µF
Up to now: 63V/68µF in 10x13mm	new 100µF
Up to now: 80V/27µF in 8x12mm	new 33µF
Up to now: 80V/47µF in 10x13mm	new 56µF
Up to now: 100V/15µF in 8x12mm	new 18µF
Up to now: 100V/22µF in 10x13mm	new 27µF
SEPG (105°C/5.000HRS/THT)	
16V/560µF in 8x12.9mm	new case size (8x12.9mm)

STRONG CERAMIC CAPACITORS

KEMET introduced two new product lines to the market for applications with extremely high ripple current requirements – KC-LINK™ and KONNEKT™. Both provide extremely low ESR and ESL values and are ideal for high frequency usage.

KC-Link™

KC-Link™ is an AEC-Q200 certified, high voltage capacitor. The used C0G characteristic provides a stable capacitance over voltage and an extremely high thermal stability. Moreover, no piezo-electric noise is generated. This cap is ideal for high frequency operation (>10MHz) and has an operating temperature range of -55 to +150°C.

Used as snubber, DC-link or resonant capacitor, the typical target applications include:
- Wide bandgap (WBG), silicon carbide (SiC) and gallium nitride (GaN) systems
- EV/HEV (drive systems, charging)
- Wireless charging
- Photovoltaic systems
- Power converters
- Inverters
- LLC resonant converters

The characteristics of this capacitor offer following advantages for your application:

- Miniaturization enabling higher power densities
- Allowing higher systems switching frequency
- Increased power conversion efficiency
- Reduced ringing due to high frequency switching

Product Range

Currently one item with 500V and 220nF is launched. Further versions in a range of 500V to 1.700V are currently under development and partly available on request.

KONNEKT™

Due to space reduction on the PCB, stacked capacitors allow a miniaturization of designs. In addition, extremely high ripple current capabilities and high capacitances are achieved in a compact footprint. KONNEKT™, KEMET's special technology of stacking ceramic capacitors without lead frames is not only particularly space-saving, it also offers additional advantages.

The U2J ceramic used results in a very low capacitance change over temperature. Furthermore, only a very low DC-bias effect occurs, which results in a very high effective capacitance even at maximum voltage.

In addition to the horizontal standard version, KEMET KONNEKT™ is also available in a vertical low-loss orientation with lower self-heating. This provides an improved power density and efficiency.

The Advantages in a Nutshell
- Lower ESL (0.4nH instead of 1.6nH)
- Higher self-resonant frequency – suitable for high frequency applications
- Extremely low ESR (0.35mOhm instead 1.3mOhm at 1.4µF/50V, triple-stacked)
- Extremely high ripple current capability at high frequencies (up to 35Arms instead of 10Arms at 1.4µF/50V, triple-stacked)

©AdobeStock/Sergey Nivens
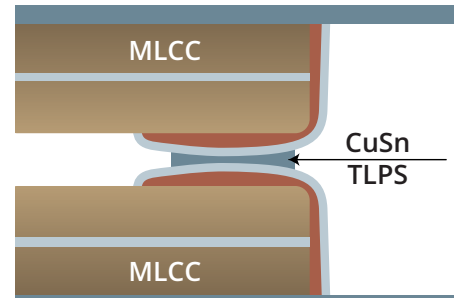
Construction: MLCCs are connected by TLPS, creating a »leadless« stack, thus reducing board space.

minations together. TLPS is a metal matrix composite bond that features copper-tin material and is used as a replacement for solder. The unique composite uses tin, which is a low-temperature reaction metal at 300°C, with copper as the high melting point metal at 1085°C, to form a reacted metal matrix, creating a distinct advantage over the use of solder. The TLPS forms a metallurgical bond between two surfaces, in this case our U2J MLCC.

Key Benefits for your Application

- Board space reduction & miniaturization
- Improved power density & efficiency
- Low-loss Mounting with lower self-heating

Product Range

50V/940nF (2-stacked) and 50V/1.4µF (3-stacked) are currently available.

KEMET is also working on KC-LINK™ caps with KONNEKT™ technology.

P06

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STANDARD

KONNEKT™ can be mounted on a circuit board using same assembly processes and footprint as standard MLCCs.

LOW-LOSS

Low-loss mounting (on side) lowers ESR, improving efficiency.

With their outstanding properties, these capacitors are ideal for use as DC-link-, snubber-, decoupling and resonant capacitors for high efficiency and high density power applications like wide-bandgap (WBG), silicon carbide (SiC) and gallium nitride (GaN) systems, wireless charging and various inverter and power supplies.

Structure

KEMET's patented KONNEKT™ package allows two to four ceramic capacitors to be stacked vertically or horizontally while retaining the integrity of the part. It uses transient liquid phase sintering (TLPS) technology to bond component ter-

CAP vs TEMP
Temperature Effects (TCC) - No Bias
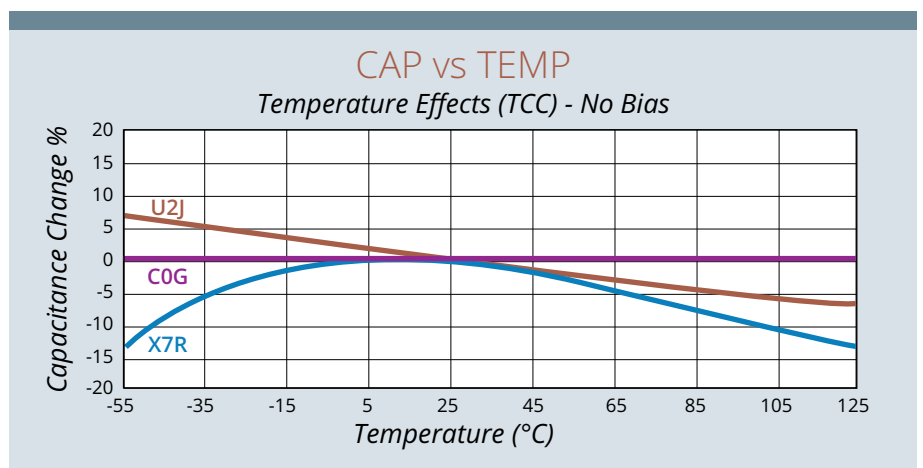
Author: Moritz Cehak, Senior Product Communication Manager, PANASONIC Industry Europe GmbH

SWITCHING HIGH LOADS ON THE PCB

The ecological challenges of today's society fuel the need of energy efficient solutions and optimization of energy generation for renewable sources like wind and solar.

More and more homeowners choose to use private units operating with alternative energies combined with battery storage systems to achieve an eco-friendly, self-sufficient power source that is in the long run cheap and environmentally friendly.

At the same time the ongoing transformation towards electrification of personal transportation in the automotive sector raises the need for new electrical solutions as well.

With the HE series PANASONIC Industry offers electromechanical relays with up to 120A swit-

ching capability and small dimensions, that can handle high currents in inverters, charging stations and battery storage applications. Utilizing the latest developments in PCB technology like high power connectors and advanced materials, the HE series with an improved internal architecture enables energy and space saving opportunities directly on the printed circuit board. In an IoT of applications, HE relays can even replace a large contactor.

The HE-S elays special features

The HE-S relays for example manages to integrate two NO contacts into extremely small dimen-

sions of 30×36×40mm. Thanks to the use of Pulse Width Modulation technology (PMW), a low operating power of 170mW for the HE-S relay (30% of coil holding voltage after applying min. 100ms of coil nominal voltage) can be achieved, which decreases the energy consumption significantly compared to standard contactors. This is further helped by the fact that, due to reduced waste heat, ventilation is no longer necessary in most cases.

The unique relay structure of the HE-S allows a 1B monitoring contact to be implemented, which recognizes when welding of the main contacts occurs. This feedback contact is compliant with EN60947-4-1 for safety circuits and conforms to EN61851-1, which makes it suitable for automotive charging solutions.

Form A contact

3.2mm

Form B contact
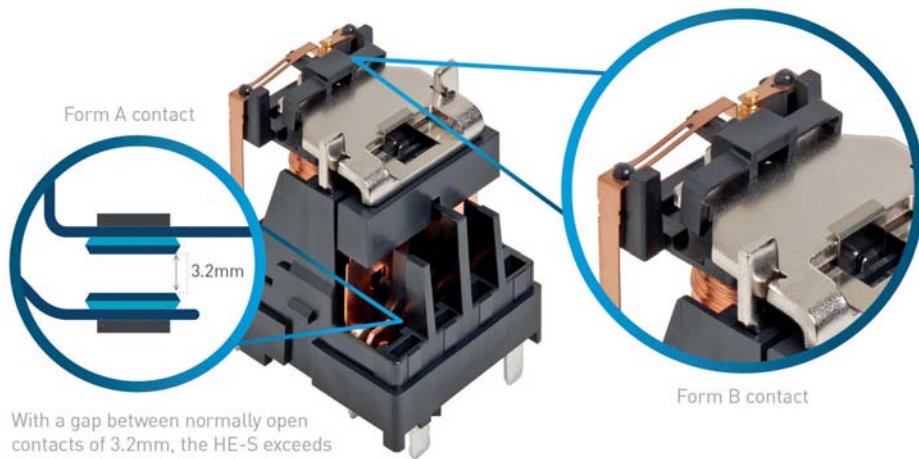
With a gap between normally open contacts of 3.2mm, the HE-S exceeds mandatory regulations.

All relays in the series offer a contact distance of at least 2.5mm up to 3.8mm and high creepage clearance. This makes them well-insulated and guarantees high dielectric strength and protection against surge voltages. Due to the fact that the HE relays are directly mounted on the PCB, they require no control cabinet. This leads to a second advantage: Assembly and installation of the relays on the PCB requires no complex wiring which contributes to cost savings in the production.

And there is another major benefit: the minimal energy consumption is the central feature of the HE relays series. Low power dissipation at the contacts is achieved by reducing the contact resistance to 1-3mΩ. As a consequence, no significant heating occurs at the contact and thermal losses are reduced. With a current of 35A and a contact resistance of 2mΩ, power dissipation is only 2.54W. With a mechanical life of at least one million operations, the HE series guarantees a

problem-free and long service life. Overall, the PCB relays help to cut back on space, energy consumption, and costs.

Improving efficiency, safety and occupied space

With all the benefits of the HE relays series compared to standard contactors, booming sectors like the electric vehicle market, the renewable energy market or the battery storage sector can

improve efficiency, safety as well as costs. In a nutshell, trading in secondary connectors for power relays mounted on the PCB means saving space, energy, and ultimately costs – without compromising on quality or performance.

More Information:

P07

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Panasonic INDUSTRY	HE-V	HE-S	HE-Y5	HE-Y6	HE-N
Switching Current	20A	5A	48A	90A	120A
Dimensions	41×50×39,4mm	30×36×40mm	38×33×36,3mm	38×33×38,8mm	50×40×43mm
Holding Power	210mW	170mW	310mW	310mW	400mW
Contact Gap	3.8mm	3.2mm	2.5mm	3.0mm	3.6mm
Ambient Temperature	-40 to +85°C	-40 to +85°C	-50 to +85°C	-40 to +85°C	-40 to +85°C
Contact Arrangement	2FormA	2FormA, 2FormA1, FormB	1FormA	1FormA	1FormA
Max. Switching Voltage	1000VDC	480VAC	277VAC	277VAC	800VAC

BIG STEPS

Next future targets for RUBYCON's Polymer Multilayer Capacitors

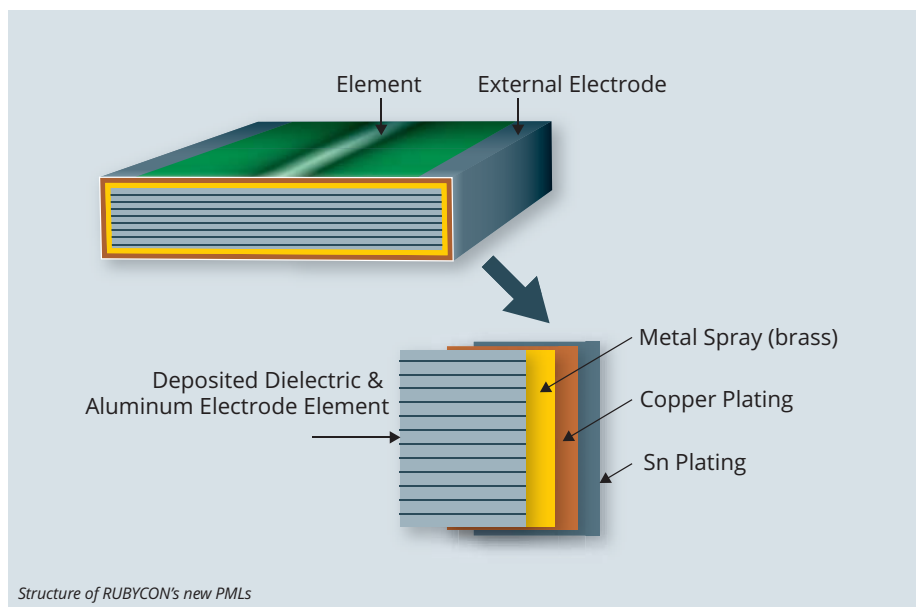*©AdobeStock/Gorodenkoff*

Once again, let us review the features of PML capacitors:

- Surface-mount type, small size with big capacitance
- Stable characteristics over a wide temperature range (-55 to +125°C)
- Flow/Reflow soldering (Pb Free) is available due to better heat resistance than conventional film capacitors
- Avoids the risk of ignition and smoke by using non-self-ignition materials.
- No magnetic materials are used, so signal processing supports original sound quality
- No piezo effect occurs, therefore free of acoustic noise

PML capacitor development has three targets for the future. One of these targets is miniaturization. Today, PML capacitors have already reached size 1608 (1.6×0.8mm) which is the smallest size for film-type capacitors. PML capacitors have established their position in the high sound quality market to replace MLCCs, since they do not suffer from capacitance change from DC-bias and harmonic distortion due to the piezoelectric effect. PML miniaturization enables high sound quality in small-size audio applications.

Another target is higher voltage and higher ripple current. Recently, PML capacitors reached a rated voltage of 200V. Rubycon's final target is to reach 500V, which is required for smoothing cir-
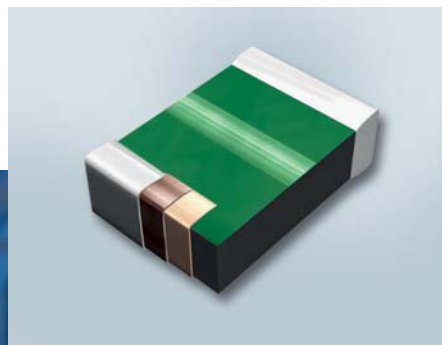

Element   External Electrode

Metal Spray (brass)

Copper Plating

Deposited Dielectric & Aluminum Electrode Element

Sn Plating

Structure of RUBYCON's new PMLs

cuits inside inverters. Today, this application often requires big, box-size film capacitors. With PML capacitors, however, further miniaturization down to a small hand-size is possible.

The last target is higher reliability. In addition to higher applicable voltage, PML capacitors withstand severe automotive conditions such as engine room applications. These applications require extremely high temperatures of up to +175°C.

PML capacitors can already operate within -55 to +125°C in unprotected construction. Just imagine the robustness after packaging the product! Moreover, PML capacitors do not use self-ignition materials. This significantly reduces any risk in automotive safety applications, while offering a compact size.

I hope the above provides a small insight into the upcoming future of PML capacitors. Should you be interested in this technology, please feel free to contact me.

	MU	**MS**	**MR**
Feature	Standard	Humidity Resistance 85°C, 85%RH 1,000 Std	Low ESL (LW Reversal Structure)
Temperature	-55°C to +125°C		
Rated Voltage	16 to 200VDC	10 to 50VDC	16 to 100VDC
Capacitance	0.0001 to 22µF	0.001 to 2.2µF	0.01 to 6.8µF
Soldering	Lead free, flow/reflow		
1.6×0.8mm	★		
2.0×1.25mm	★	★	
3.2×1.6mm	★	★	
1.6×3.2mm			★
3.2×2.5mm	★	★	
4.5×3.2mm	★		
3.2×4.5mm	★		★
5.7×5.0mm	★		

P08

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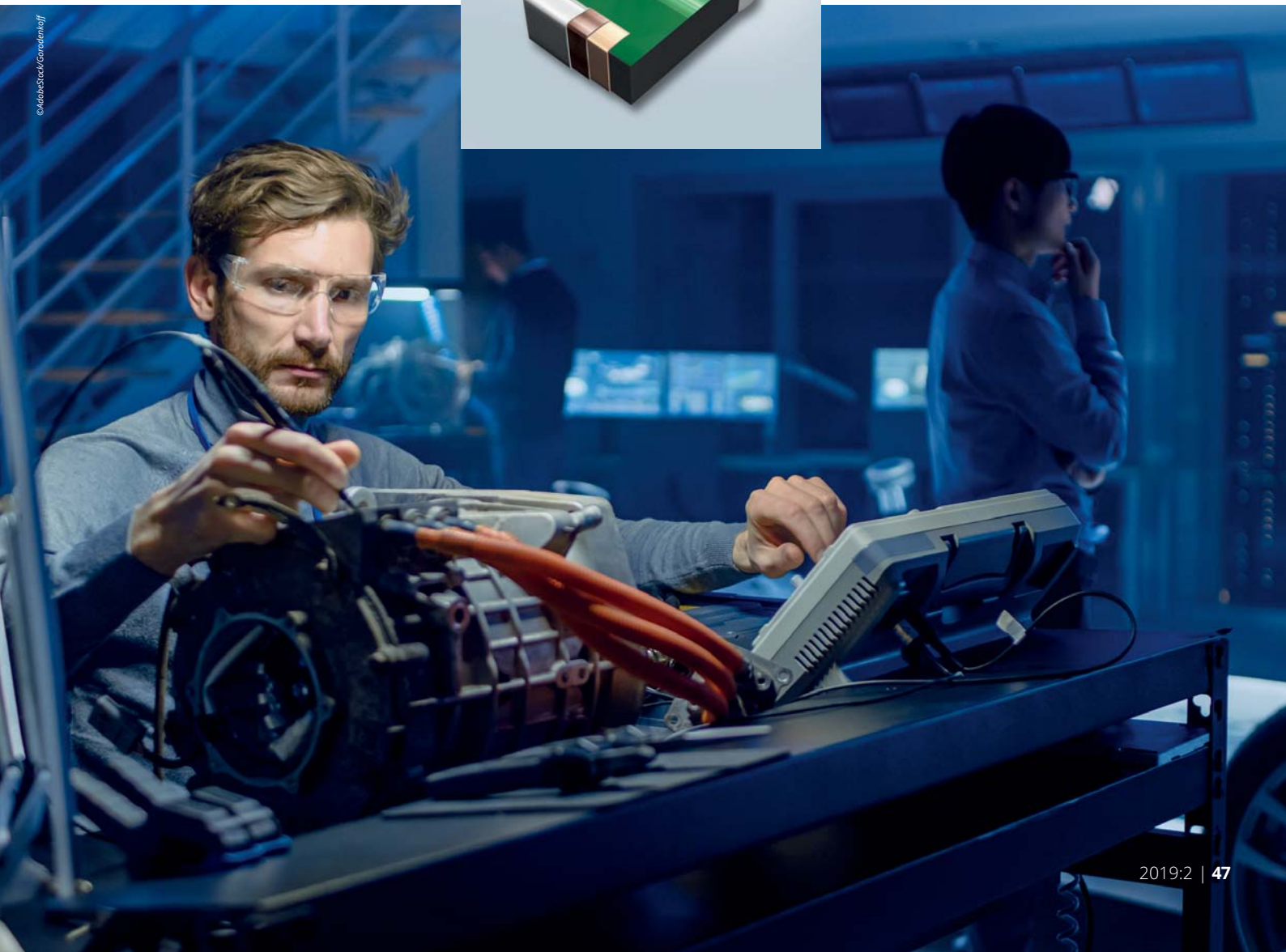
REALLY TOUGH

IP67 sealed waterproof Wire-to-Wire Connector

Amphenol
ICC

AMPHENOL ICC's Series Mini Sealed 2.50mm Pitch Connectors provide a Wire-to-Wire IP67 sealing in mated conditions. Its waterproof characteristics make it ideal for applications in harsh environments.

These connectors can generally be used in industiral, lighting appliances, HVAC and smart home. The compact design of FLH series is suitable for space-saving applications. This series is designed with high current capabilities up to 8A with 18AWG wire gauge.

Technical Information

- High temperature thermoplastic, UL94V-0
- Seals: Silicon rubber
- Voltage: 400V AC max.
- Current rating: 8A-18AWG;
  5A-20AWG, 3A-22AWG
- Operating temperature: -40 to +105°C
- Mating Cycles: 50

S01

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FEATURES		BENEFITS
Wire-to-Wire IP67 sealing in mated condition	>	Ensures waterproof and reliable connections in harsh environment
Compact Design	>	Space saving
High current design options (8A-18AWG; 5A-20AWG, 3A-22AWG)	>	Allows design flexibility and meets various power expectations
Offers connector system with header and receptacle counterparts	>	Ease of design and assembly
RoHs compliant	>	Meets environmental, health and safety requirements

Applications
- Commercial and residential indoor and outdoor Lighting
- Appliances, HVAC
- Harsh environment applications

UNDER ALL CONDITIONS

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Water and Dust Proof Circular Connectors

Amphenol ICC

Rugged MRD Series Circular Locking Connectors.

MRD series connectors from AMPHENOL ICC are available in 2, 3 and 4 position form factors. Housing options include an all plastic construction as well as metal locking bodies for greater durability. Locking options include 1/3 turn bayonet locking as well as quick release metal latches. Panel mount and cable termination options are available with or without finger proof protection.

IP67 Circular Solution:

- Power or signal connections
- 10A per pin, up to 500VAC
- Available in 2, 3 or 4 position form factors
- Locking latch system
- Width of panel mount connector 25.1mm
- Accommodates outdoor 3CX18/16AWG cable (4-9mm OD)
- Temperature -40 to +80°C
- RoHs compliant
- Field termination kits available

S02

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FEATURES		BENEFITS
Sealed connectors	>	IP67 water and dust proof
Available in 2, 3 and 4 positions	>	Design flexibility
Up to 10A current rating	>	Supports high power applications
Circular connector	>	Supports various industrial applications
Locking option	>	Secured connection and avoids data/power interruption

FOR HIGH-DENSITY APPLICATIONS
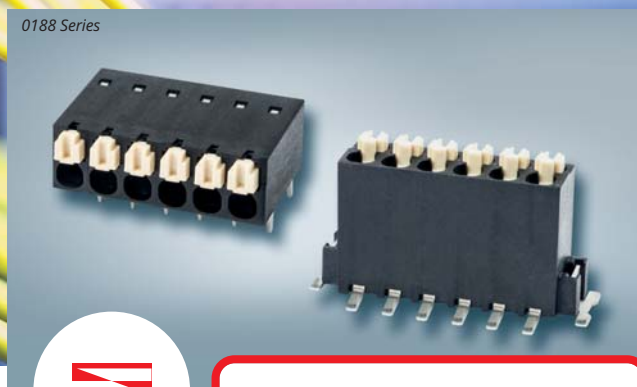
0188 Series

DINKLE

Applications
- Lighting & LED lighting
- Security & alarm monitoring systems
- Building automation and its sensor/actuator devices
- Space-limited power applications
- I/O components for industrial networks

DINKLE 0188 series is a hybrid very compact PCB terminal block with a pitch size of 2.5mm only.

Due to the small pitch size of 2.5mm the 0188 series can achieve high density wiring with limited space requirements. The contacts are formed in one-piece and thus provide high dimensional stability up to 20 poles in one row. Thanks to the push-in design, the 0188 series is suitable for quick wiring during the installation process. The terminal point can be easily loosened by pressing the lever without any special tools.

The insulating housing is made of high temperature material which is suitable for Through Hole Reflow soldering (»THR«) and Surface Mounting Technology (»SMT«).

Both of them are available in Tape & Reel package for automatic assembly processes. Furthermore, the series is available with a version suitable for horizontal as well as a version for vertical wire entry direction. The maximum current load reaches up to 6A.

THR and SMT soldering

THR technology is extremely reliable as it creates strong mechanical bonds between the connector and the PCB. Therefore this connection is ideal for components that might go through mechanical stress, such as connectors or transformers. Replacing or repairing parts in the testing and prototyping phase is much easier to handle.

PCB's using SMT components only have lower board costs and offer faster production times since it is not necessary to drill holes into the PCB. The automated assembly process for the components is simpler and faster. With additional soldering anchors the mechanical stress on the solder joints can be reduced to be more stable under vibration conditions.

S03

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SPECIFICATIONS

PART NUMBER	PITCH (mm)	HEIGHT ABOVE PCB (mm)	CONTACT POSITIONS	V/A (UL)	V/A (IEC)	WIRE ENTRY DIRECTION	SOLDERING METHOD
0188-01XXL	2.5	5.0	2-20	150V/5A	160V/6A	Horizontal	THR
0188-02XXL	2.5	10.7	2-20	150V/5A	160V/6A	Vertical	THR
0188-01XXSMD	2.5	5.1	2-20	150V/5A	160V/6A	Horizontal	SMT
0188-02XXSMD	2.5	10.8	2-20	150V/5A	160V/6A	Vertical	SMT

PHOTOVOLTAIC PRO

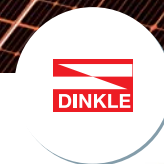©AdobeStock/4th Life Photography

0220 Series – NEMA Terminal Blocks for Photovoltaic Industry

DINKLE

The 0220 series from DINKLE is the ideal solution for applications in the photovoltaic industry which require high power transmission up to 50kW and a high standard of wiring safety.

The terminal blocks are available in two different pitch sizes with 17.4mm (0220-10) and 20.6mm (0220-11). Both versions are applicable for a rated voltage of 600V and suitable for high amperage (115A/150A). The improved external structural design allows a compact size with heights of 48/48.5mm which is excellent for space saving.

Each connection block has two mounting flanges for reliable and secure mounting. The wiring is done with an elevated wire cage connection on the front side and with a stud connection at the back side of the block suitable for Y/O ferrules.

The terminal blocks can be assembled into various pole sizes and are suitable for an installation in various conditions such as mountains, deserts or offshore.

Various Wiring Methods

Highlights

• Suitable for photovoltaic industry application.
• Product can be installed in various condition such as mountains, desert or offshore.
• Rated voltage 600V, Rated current 115A/150A; Pitch: 17.4/20.6mm; Height: 48/48.5mm
• Adopting hex nuts for secure and tight wiring.
• Terminal block can be assembled into various pole sizes.

S04

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0220-10 Series

0220-11 Series

0220-10

48mm

0220-11

48.5mm

DF60

Wire-to-Board Connector for Internal Power Supply

Features

- 1-6 contact positions (Right angle, in-line, vertical versions)
- Contact Pitch: 10.16 mm
- Current Rating: 65A (max)
- Cable Size: AWG 8-12
- Operating Temperature: -55 to +105°C
- 30 mating cycles
- Voltage Rating: AC/DC 1000V
- UL, C-UL, TÜV Certified

HIROSE ELECTRIC has extended the compact and low-profile DF60 series of robust Wire-to-Board and Wire-to-Wire connectors to meet the increased demand for high powered connectors offering advanced reliability for industrial equipment.

The connector range consists of cable mount female crimp sockets and board mount vertical, right angle and panel mount in-line male headers that have the capacity to handle up to 65A (max) current rating.

The overall size of the DF60 series has been designed with space saving in mind, the plug and receptacle housings are low profile with a mated height of only 30mm using the vertical header. The footprint dimensions are minimised by the small pitch size of 10.16mm.

The robust lock provides a positive tactile sensation and an audible click when mated. This confirms that the connector is fully engaged guaranteeing complete electrical and mechanical connection. The lock is in the centre of the housing to avoid uneven locking and cable entanglement which is common with side locks.

In addition, multiple connectors can be mounted closer together side by side.

The cable mount female socket housing utilises crimp contacts that have a unique 5-point contact internal structure. Two of the contact points are fixed in the upper section. The other three are in the lower section and are spring based allowing movement to follow the flat structure

DF60 Series - 65A, pitch size: 10.16mm

of the male contact during the mating operation. This provides high contact reliability, secure connection and strong resistance against vibration. Keying variations are available in black and red to prevent incorrect insertion when multiple connectors are used.

A new DF60F version has been introduced to provide contact touch protection to the user by eliminating finger contact with the contacts for safety.

DF60 series is part of the EnerBee product family. The EnerBee family features Wire-to-Board and Wire-to-Wire power connectors to provide technically advanced connectivity solutions for industrial power sources.

Suitable applications are robots, automotive devices, medical, servers, servo amplifiers and motors.

S05

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Floating Board-to-Board Connectors for 125°C

HRS HIROSE ELECTRIC EUROPE B.V.

HIROSE ELECTRIC has successfully developed a high contact reliability connector with a -40 to 140°C operating temperature that maintains the highest performance in vibration environments, including on-board powertrain.

©AdobeStock/phaisarnwong2517

caused by vibration. FX26 is a small, easy-to-assemble connector with outstanding performance in vibration environments. That product is the Board-to-Board floating connector »FX26«, designed to withstand heat and vibration.

Board-to-Board Floating Connector with Vibration Isolation Structure FX26

1. Thermal shock test at -40 to +140°C and 3,000 cycles cleared to confirm heat resistance.
2. Pass severe vibration conditions for equipment installed in the engine room, such as inside the inverter.
3. 1mm pitch, low height, space-saving, contributes to sets downsizes.

Product development based on the FX26 design concept

The newly developed FX26 can meet the requirements of powertrain control systems for existing electric vehicles and hybrid vehicles.

S06

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STRONG VIBES

Features

- Floating structure: ±1mm max. in XY directions
- Stack height ± 0.75mm: Effective contact length in Z direction
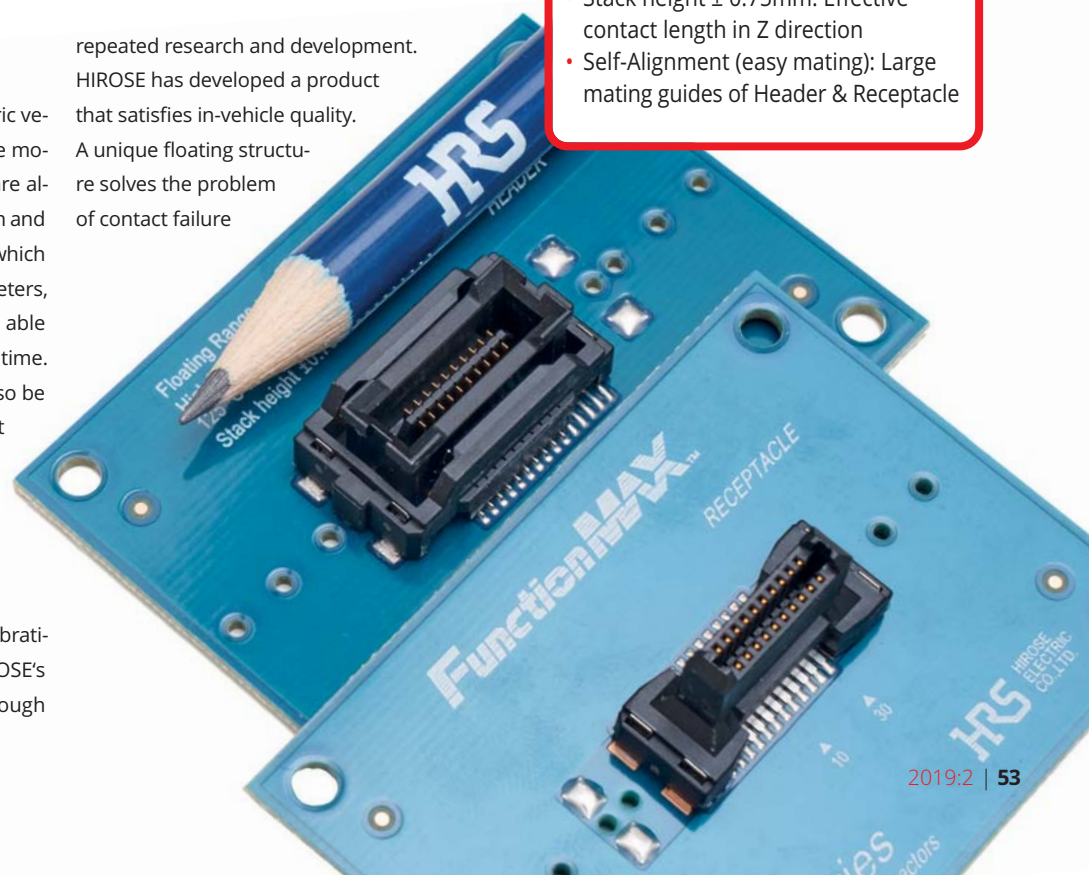- Self-Alignment (easy mating): Large mating guides of Header & Receptacle

High heat and vibration relief performance required

While the shift to hybrid cars and EV (electric vehicle) is gaining momentum worldwide, the motors and inverters used in these eco-cars are always subject to problems of heat generation and vibration. In addition, the lifespan of a car, which was said to be 10 years and 100,000 kilometers, is increasing rapidly, so vehicles need to be able to be operated safely for a long period of time. Therefore, automotive connectors must also be tough enough to withstand the high heat and vibration conditions of powertrains for long time spans.

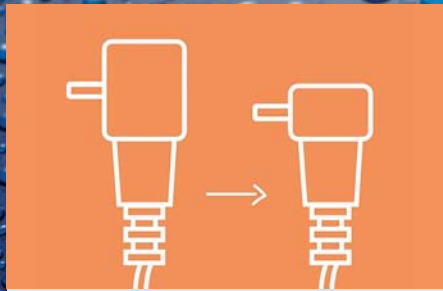## Pursuing vehicle quality that withstands heat and vibration

The market needs of heat resistance and vibration resistance were used as criteria for HIROSE's products. These criteria were cleared through

repeated research and development. HIROSE has developed a product that satisfies in-vehicle quality. A unique floating structure solves the problem of contact failure
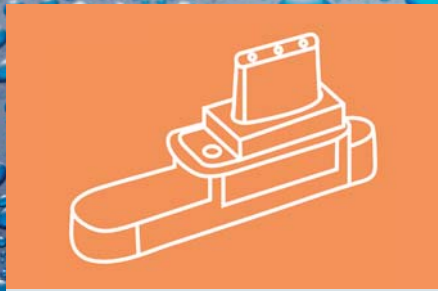
Industrial Camera Type C waterproof cable

- IP67 (Airtight test applied)
- Vertical-mount
- Molding with tiny PCB inside
- Product size reduced from 6.55 to 3.55mm

Industrial PDA Type C waterproof adapter

- IP67 (Airtight test applied)
- Vertical-mount
- Molding with tiny PCB inside
- Product size 14.3×28.9×7.5mm (H×L×W)

Industrial camera data cable

- Customized cable with 5 different thicknesses for different types of industrial camera
- Cable designed under terminal structure, which only has limited space for installing data cable. SINBON uses just a screw to ensure fixing instead of two screws

WATERPROOF MOLDING

Waterproofing has almost become a standard requirement in many business fields, including industrial applications and consumer electronics.

However, the design and manufacture of waterproof products is not a simple task, particularly if the product has certain mechanical constraints, or requires additional features, for example UV resistance, flame retardant, etc.

Collaborating closely with CODICO and SINBON Electronics is one good solution to achieve such requirements, and to also product high level customization of products where that is required. SINBON has long term experience as a »total solution provider« where they can provide vertically integrated solutions and services from raw cable design and manufacture, cable assemblies, antennas, PCB assembly, Box Build, and even system integration. SINBON has extensive in-house facilities including a tooling center, laboratory, and a raw cable factory, and we invest heavily in our research and development centers all over the world, which saves customers time and cost.

Manufacturing operations are located in Taiwan, China, Europe, and USA and so customers across the globe can benefit through collaborating with SINBON as their trustworthy partner.

Electric vehicle AC charging cable

- World first patented IP67 over molding design
- Double injection
- Button with anti-loose function
- Safe and durable, streamline design

Connection for photovoltaic module

- Customized solar module interconnection
- UV-, oil- and solvent-resistant and flame-retardant
- IP67

E-bike motor charging cable

- IPX7, Motor power requirement: 36V
- Battery specification: 36V/14Ah 504Wh
- Max discharge current: 20A
- Max charger current: 4A
- Com. interface: CANBus/Uart

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Walkie Talkie data cable

- Design for manufacturing proposal to improve its IP standards from IP67 to IP 68
- Durable coil cable
- Passed ageing test, salt spray test, humid heat test, cold bending test, etc.

In-house Facilities

Raw Cable
- Highly customized
- UL standards
- High flexibility (high mix, low volume)
- Outstanding experience: Manufacture of PVC cable for harsh environment

Component
- Design and manufacture antennas
- Suggest alternative and qualified components

Tooling Center
- Design and manufacture of crimping die and fixture (testing & assembly)
- Design and manufacture of Overmold tooling
- In-house fixture repair and maintain to ensure manufacturing precision

Laboratory
- Includes bending, cold bending, moisture resistance, salt spray, storage life, cold impact, coiled cable extraction, electricity, high-pot, pulling force, static humidity, thermal shock test, etc.

Don't hesitate to send us your application with individual requirements. We will be happy to support you in finding a proper connector and cable solution.

S07

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GECKO Series:

Breakaway Connector

Inspired by the amazing creature with high adaptability, NEXTRON's Gecko series is designed for flexibilities in limited space. Creative locking mechanisms allow amazing blind mating and de-mating experience.

Leverage a long-lasting experience in developing and manufacturing high speed connections, Gecko series provide USB 3.1 or CAT 5 versions in addition to Ethernet designs. The featured outer shell customizations realize a wide range of connectors from plastic to metal shells, from bayonet to push-pull coupling mechanisms, from rectangular to circular connector shells.

Special highlights break-away solutions complete with cables. A wide variety of materials, including various plastics and metal alloys, can be tailored for applications in medical, security, robotics, and industrial environments.

Testing:
MIL STD-1344,
RoHS, CE;

Highlights

- Lightweight, small and easy handling
- Robust, vibration and temperature resistant
- Hybrid contact in one connector: signals transmission, low/high power, coax, fluids
- Overmolding type cable selection available
- Waterproof up to IP 68
- High speed data transmission: HDMI, CAT 5 and USB 3.1

S08

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HIGH-SPEED M12 CAT6A

For Field Assembly!

YAMAICHI Electronics has expanded its Y-Circ M12 product portfolio with a new fieldmountable connector for 10 Gigabit Ethernet applications.

YAMAICHI Y-Circ-M CAT6A Field Assembly

Areas of application

The new connector is suitable for use in typical CAT6A applications, e.g. in the communication cabling of automation control systems. The field-assembled variant is used over moulded M12 cable assemblies, for example, when the cable has to be pulled through a cable duct and would be too bulky with the plug. Field assemblies are ideal, even if the exact cable length can not be defined in advance.

Features and advantages

The connector face complies with the standardized M12 X coding according to DIN EN 61076-2-109. Thanks to its die-cast zinc housing, the Y-Circ M CAT6A Field Assembly connector provides optimal transmission characteristics even in demanding environments. When plugged in, it reaches protection class of IP67 and is thus optimally protected against adverse environmental

influences. Its slim design also proves itself in space-critical installation situations.

The quick and easy assembly offers a time advantage during installation. The cable simply has to be stripped and the wires of the cable pressed into the colour-coded slots in the back of the two-piece connector. After the protruding wires are cut off, the IDC insulation displacement contacts

connect automatically when the two parts are screwed together.

A detailed leaflet and an overview of the whole M12 portfolio from YAMAICHI is available at CODICO.

S09

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General	Mechanical	Electrical	Chemical
M12 locking mechanism	Contacts (ø.6 | IDC)	CAT6$_A$	Halogen free
Field Assembly	Temperature Range: -40°C - 90°C	0.5A (per contact)	Silicon free
X-Coding	Cable Diameter: ø6.8mm - 9.0mm	48V (per contact)	FCKW free
IP67	Wire Diameter: AWG 26 - AWG 22	< 5mΩ	RoHS conformity
	Shape: ø16x50		
	Mating Cycles: > 100		

M12
FOR FIELD ASSEMBLY

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LET THERE BE LIGHT!

SOURIAU: UTL Series

The UTL series is a plastic connector suitable for outdoor industrial applications thanks to a high sealing performance (IP68/IP69K) and an extreme UV resistance with F1 material per UL746C. The UTL series guarantees extended outdoor life, making them ideal lighting connectors.

Designed and qualified according to the UL1977 and IEC61984 standards, the UTL connector series offers a 5VA flammability rating, hot wire, and current breaking capacity to meet all standards of industrial equipment. Due to the qualification by UL or IEC standards, the UTL series is highly suitable to be qualified as IEC power connectors on your equipment, making it easier and faster for you to pass certifications. The moisture proof capability of the UTL is achieved thanks to an unique technical concept that prevents condensation ingress into the equipment that causes damages to your systems. Available as an optional feature, it will prevent moisture within your system over-time.

In addition, the UTL series has a push and press to release coupling system which allows a quick and secure connection, even in blind conditions. The audible click guarantees the proper connection.

The UTL is compliant with RS485, DMX and DALI protocols which guarantees an easy implementation of the connector to your electrical architecture. Available with a large choice of shells and contact types, we propose a field installation solution through screw contact termination which allows you to terminate your cable assembly in the field with only one screwdriver, offering a flexible and easy solution.

We propose a standard cable assembly offering to provide you a complete interconnect solution to simplify your supply chain.

S10

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HIGHLIGHTS

- Operating temperature: -40 to +105°C
- Sealing: IP68/IP69K
- UV resistant with F1 material
- Moisture proof
- Current breaking capacity
- Standards: UL94V0 / UL94HB
- RoHS, REACH

SOURIAU-SUNBANK
Connection Technologies

SOURIAU UTL

NEW DEVELOPMENT

Panta® SMD Jumper for Industrial Applications

What is already firmly established in the automotive sector has been further developed by Sumida. Flexible connections of printed circuit boards, the PANTA® SMD-SYSTEM is now also available for the industrial sector.

All components are designed as SMD components. These can be placed directly on the printed circuit boards by »Pick & Place« and then pass through the soldering process. The SMD Jumper can be bended up to 180° after the soldering process. Use on single and multilayer PCB is possible and withstands operating temperatures up to 125°C.

Cost Saving

Cost-effective development and production – that is what Sumida achieved with the development of the PANTA® SMD component for the non-automotive sector.

Development & Realization

In close cooperation with SUMIDA, we support our customers during all development phases, from the initial idea through prototypes to production readiness.

Advantages

- Automatic placement by SMD assembly machines (Pick&Place) - Reflow solderable
- The SMD connection can be bended up to 180° after the soldering process. Use on single and multilayer PCB.
- Operating temperature up to 125°C
- No additional assembly and soldering process necessary

Features

- Bridging length: 11.2mm
- Total length: 15.2mm
- Number of pins: 4-25
- Pitch: 0,93mm
- Packaging unit: 1,500 pieces on returnable reel
- Special pitches and other pin counts on request
- Customized SMD solutions are possible
- Dimensional configuration on request

- Cost effective solution as an alternative to e.g. rigid-flex printed circuit boards
- Higher flexibility and break resistance compared to step milled PCBs

S11

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DIVERSITY AT CODICO

Everyone smiles in the same language!

The key to success is diversity. As a globally operating family company employing people from 18 nations, we put a great emphasis on understanding others. For CODICO this diversity is enriching, and a challenge that brings with it dynamism and innovative solutions!

We speak a multitude of languages, we celebrate different festivals, and we belong to different religions! Therefore, in recent years we placed a particular focus on the topic of diversity within the company, implementing several exciting projects under this theme.

»He who doesn't know foreign languages knows nothing about his own«
(J. W. von Goethe)

Our foreign language skills are an indispensable tool toward diversity because they allow unlimited communication across borders. For this reason, CODICO is particularly committed to promote language skills. English, French, Italian, and German language courses are continuously available to our staff.

Seizing the opportunities

Our society and our environment are subject to permanent change. Economic life is being transformed by demographic change, by topics like migration, the mixing of cultures, globalisation, etc. At CODICO, too, diversity is becoming an ever more significant topic as part of our continuous growth and our increasing internationalisation. The diversity of our staff, with their different skills, talents, and expectations, creates opportunities for innovative and creative solutions. In this particular area, our staff bears a great potential.

Promoting work-life balance

The reconciliation between work and child care is often a reason why only a small number of well-trained and motivated women can be found in leading positions. CODICO takes a different approach here, offering part-time leadership schemes to its staff. This is made possible by the use of modern means of communication, such as Skype, and by a change in corporate culture. Women have a different style of leadership, and a strong diversity at the executive level benefits everyone.

CODICO, however, also offers its male employees the opportunity to take paternity leave. Economic benefits and a family-friendly company culture need not contradict each other. CODICO has recognised the need to take measures to support fathers so as to keep well-trained employees in the company for the long term.

Work together, celebrate together

By organising joint training weeks and fantastic events, CODICO also endeavours to develop the staff members' social skills, indispensable for everyday collaboration. During a very special event all CODICO staff was given the opportunity to cook delicacies from all over the world under the professional guidance of the »Kochsalon Wrenkh«, and to enjoy a glass of wine together.

To get to know the cultures of our staff's different countries of origin, we expanded our Intranet calendar to include national and international holidays. The calendar describes special celebrations, so that we can share these days together.

Tolerance and understanding for others!

An open-minded climate among colleagues and mutual understanding helps bring the different skills and talents of each employee to the surface.

We firmly believe that diversity is essential for the company's success.

D03

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TRAINING COMPANY

CERTIFIED

We wish to extend a warm welcome to our first apprentices at CODICO!

In order to meet the high quality requirements of our international customers in the long run, to continue improving the level of services, and to invest in the future, we value committed staff members who are focused and motivated. We always endeavour to hire the best possible people for every position.

The current enlargement and reconstruction at our Perchtoldsdorf site, to be completed by 2020, will create more space and demand for a large number of new staff. Therefore, we are taking new, innovative approaches to recruiting to cover the rising personnel demands: we are pleased to announce that we are now certified as a vocational training company as of April 2019, and we wish to warmly welcome our first three apprentices at CODICO in September 2019!

In our state-of-the-art office building and our logistics centre, the future operating logistics agents will be trained by experienced colleagues, and will benefit from a team-oriented work environment. Early on, they will learn how to work independently and to take on responsibility. The apprenticeship period for a certified operating logistics agent is 3 years, and the training at

the Theresienfeld vocational training school (Lower Austria) is divided into block courses. This training arrangement means that the apprenticeships can alternately concentrate on work at school and on their working tasks at the company. In practical terms, for future apprentices this means that they will be spending ten continuous weeks per apprenticeship year (five in the last apprenticeship year) at school, and the rest of the time in the company.

Tasks of an operating logistics agent

Operating logistics agents learn all about the movement of merchandise from goods acceptance, order picking, storage, packing to the physical control of goods. In addition, they will be instructed in IT-aided monitoring of goods movement.

The daily work of our new colleagues will also include organising the dispatch and collection of shipments, and preparing various transport documents.

Working at CODICO

We place a great focus on basic values such as respect and appreciation toward everyone we

work with. CODICO values positive thinking, creativity, and ideas, as well as open communication.

»We live and breath family, responsibility, and dynamism«, explained Karin Krumpel, CEO of CODICO GmbH in an interview about the values of this family company. *»The objective of our apprentice training is to impart these values to young talents, along with solid future-safe skills«.*

As a company with international operations, we employ staff from many parts of Europe. On its continuous path of growth, CODICO offers not only a secure workplace but also a wide range of career opportunities both in Austria and abroad. Transparent structures and flat hierarchies make it possible for skills and knowledge to be applied quickly, and for employees to play an active part in shaping their area of work.

We warmly welcome Alen Pazari, Philipp Savic, and Marco Savic at CODICO and wish them a lot of joy and success in their new challenge!

D04

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Let's run together!

Business Run 2019

On 5th September 2019, the meanwhile 19th Wien Energie Business Run took place around the Ernst-Happel Stadium in Vienna, gathering a total of around 32,000 enthusiastic runners and walkers in one place under splendid weather conditions. Of course, CODICO could not miss the opportunity and showed up with a total of four, highly motivated teams.

Both the experienced CODICO Business Runners and the first-time participants successfully finished the 4.1-kilometre distance. As Astrid Piller from the »Legs Miserables« team reports: *»This was my first time at the run, and I must admit that the atmosphere was fantastic. For me, the highlight of the Business Run was the euphoria and sense of community that you feel when you cross the finish line together with your team.«*

The good results of our team were subsequently celebrated in a sporting spirit. The venue included three public areas, in which a total of 300 tavern table sets were arranged. The event also included a rich culinary programme for all participants, and the CODICO runners joined in for a good tasting. *»As the icing on the cake and a reward for the sensational team work, we all enjoyed some well-deserved after-work beer«,* Piller concludes.

We are dynamic!

Sports and exercise play a big role and are strongly encouraged at CODICO. For instance, employees at our headquarters have the opportunity to participate in yoga classes or HIIT workouts with a certified trainer every week, as an ideal balance to their work routine.

In addition, the company is currently building a 12,000m² recreational park - the »CODICO Central Park« –, which was featured in issue no. 01/2019 of our IMPULSE magazine. As a result, our sports and movement opportunities will soon include green areas, running tracks, fitness equipment, bunks for outdoor yoga and grill & chill, and a swimming pond.

D05

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CODICO won four bronze medals!

The CODICO Runners!

CODICO among the TOP distributors

Award in the reader's choice »Electronics Distributor of the Year«

On September 12, 2019, the trade medium »Elektronik« already awarded the »Distributor of the Year« for the 13th time. CODICO is delighted to have won a total of four bronze medals! In both the »Active Components« category and the »Passive Components« category, CODICO was honoured for its »Technical Competence & Support«.

»We are particularly pleased to receive the awards in a category in which our core competences are«, comments Sven Krumpel, CEO CODICO, on the award. *»With our design-in approach, we support customers in all project phases - and technical consulting is our strategic focus.«*

CODICO was also awarded two bronze medals in the categories active components/overall impression and optoelectronics/product availability volume.

In the 13th readers' vote for »Electronics Distributor of the Year«, a total of 1,795 readers gave their ratings in 6 categories (Active Components, Passive Components, Electromechanics, Optoelectronics, Displays, Embedded) in 7 different criteria (product portfolio, product availability samples, product availability volume, delivery service samples, delivery service volume, technical competence/support, overall impression).

The numerous awards, which CODICO has received with great pride, are a sign that our work is not only recognised and rewarded by our customers in Europe, but also that we are among the best from the point of view of our customers!

We would like to thank all of you who have contributed to our success! To further successful years together with our team, with our customers, with our partners!

D06

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The CODICO TEAM says hello!

Julia Reiterer

Dear readers, I have been part of CODICO for over four years, and today I would like to introduce myself to you.

After graduating from a higher-level secondary technical and vocational school, I attended the senior technical college in Wiener Neustadt, where I received a degree in industrial engineering. While still at college, I was given an exciting opportunity to work as product manager for interconnect systems at CODICO. It was a chance I just could not let pass by. I have been working closely with our suppliers ever since, trying to develop and further expand our product range. Since September 2018, I have also been part of our sales team, covering the western region of Austria as a sales engineer for interconnect systems. My task is to support our customers in their design activities and in finding suitable solutions.

What I really love about my work is having a direct contact to customers and developing technical solutions together with them. Every project is unique, it demands mental flexibility and an eagerness to never stop learning. This exciting combination of being both on the customer and on the supplier side presents me with new challenges on a daily basis, and no two days are the same. I am privileged to be working in a great team, in which mutual support and delight in one's work are self-evident. With time, work colleagues have become friends, and now we regularly plan joint activities outside work.

I like spending my free time with my friends and family, who give me the support I need in life. It's so relaxing to undertake something in nature or just have a cosy evening barbecue together. In recent years, sports has become an essential part of my life and a way to find my inner balance. Sports after work is a must, be it in the gym, on the bike, or running. It helps me wind down after a day at the office, and keeps me active and fit. I use my holidays to travel to near and distant places, be it on beach vacation or on city trips. I just love gathering new experiences and getting to know other cultures and traditions. Fascinating landscapes inspire me, and I love capturing such memorable moments on film.

I am proud to be part of the CODICO family, and I am looking forward to many more years of positive collaboration!

D07

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David Fandl

I am delighted to introduce myself in this issue of Impulse. After working 20 years in the handicraft industry, a company closure a few years ago marked the moment I decided that a change in my professional life was due. My sister, who was then employed in Inside Sales at CODICO and spoke with great enthusiasm about her work in the company, told me there was a vacancy in the warehouse and suggested I should apply for the job. Initially, I was rather sceptical about the idea. I, too, had that stereotype notion of a dull job that would involve pushing around packages and pallets. Already during the interview, however, I was presented with a completely different view.

Our work at CODICO includes plenty of different activities and processes, which often respond very specifically to the wishes of our customers. Since these occasionally extensive requirements are continuously evolving, we need to use our brains a lot in addition to the physical work we do. And then there is the human factor as well. One of our corporate values is »we live and breathe family«, and I believe that this motto is really practised here. Although our team is made up of people with very different characters and cultures, a family atmosphere prevails here, where you always feel at home. I have been part of this company for 4 years, and I can assure you that there hasn't been a single day I did not look forward to coming to work.

Of course, work is not everything in life. I like to engage in sports in my spare time, which include tennis, but I am also a committed and active member of the voluntary fire department. Due to the skills I acquired there, I am also responsible for all tasks involving preventive fire protection in our company. CODICO is a dynamic company, and the enlargement of our headquarters here in Perchtoldsdorf will bring many new duties and challenges, which we are willing and able to manage together for the benefit of our customers. One of these new developments is that CODICO will become a vocational training company, giving us the opportunity to train our own skilled staff. I will be actively contributing to achieving this, since I will be taking on trainer duties for our apprentices.

Finally, I wish to add that I am very happy to be part of the CODICO family and thank you for the interest you have shown in me.

D08

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Verena Schweizer

I have been part of the CODICO family for over five years, and today I would like to introduce myself to you. My name is Verena Schweitzer and I work in Human Resources, where I am responsible for our Austrian employees and for a number of projects. I am originally from the magnificent region of Kamptal (Langenlois), but I moved to Vienna in my younger years to study. It had long been my intention to study sports science and sports management; in addition, I was wanted to learn something "solid". Due to the business orientation of my secondary school education, studies in International Business Administration at the University of Economics in Vienna seemed like an obvious choice. I am very glad to have chosen these two disciplines, since they have furthered my career in the most different ways.

Having wide and diverse interests was one of the best requirements for joining CODICO as Assistant to the Management in 2014, after having worked in a sports organisation and as a press officer for Nikon. This position allowed me to become familiar with the company very quickly and to put my foreign language skills to good use. What I particularly enjoyed about my position was the ability to contribute my own ideas, the ongoing collaboration with my colleagues inside and outside the company, the organisation of our legendary Christmas celebrations, and the work in Human Resources.

2019 brought with it a few changes and a major adventure. In February, I began a round-the-world-trip carrying only a rucksack - on my own, of course, since it's best to have such a special experience without any distractions. Nine weeks and nine thousand car kilometres later, I had completed a fantastic journey across the South and North Island of New Zealand: vast expanses, glacier worlds, mountains, lakes, and unspoiled nature gave me fresh energy on my numerous hiking tours, allowing me to forget the outside world for a while. In mid-April, I continued my journey toward South-East Asia, where I experienced a proper cultural shock following New Zealand's serenity. Starting in Singapore, I then travelled to Malaysia, Indonesia, Vietnam and Thailand. In each country I learned something new, and each country had its own challenges. In Indonesia in particular, I was impressed by the friendliness and, most of all, by the calmness of the local population, which left a lasting impact on me. I am infinitely grateful for this opportunity and I wouldn't want to miss a moment of it.

Back in Austria, a new chapter began for me at CODICO in July. I was given a warm welcome in the Human Resources group, and I feel very happy in my new position. As part of my duties in personnel marketing, I am particularly happy to be visiting schools to introduce CODICO to young people and persuade them to join our company. During my free time, I very much enjoy doing voluntary work in various sports areas. For instance, I am a trainer and pacemaker of Austrian Women´s Run, a running event that brings together more than 30,000 enthusiastic women every year. In addition, I have been engaged as trainer for blind and visually impaired sportspersons for many years. You will often find me hiking with friends, in the ballet studio (won't be enough to make it to the stage in this lifetime, though), in the musical capitals of this world, or engage in nature photography.

D10

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Vanessa Zabehlicky

My name is Vanessa Zabehlicky, and I began working at CODICO in May 2015. During the last 4 years, I was in charge of a number of important key accounts in Order Administration. In the first two years, I was responsible for Passive Components in Order Administration and, after the groups were integrated, I was in charge of all component groups. Each order and each customer is unique. This makes my job quite diversified, and presents me with new tasks every day.

I very much enjoy working with my customers on a daily basis, and having a good relationship to my customers and suppliers is very important to me. Especially during difficult times, like the ones we experienced last year because of the allocation, you establish an especially strong bond to your customers and suppliers. In May 2019, I took the decision to change to Inside Sales and take up a few new challenges for myself. Both Order Administration and Inside Sales require a high degree of precision and flexibility.

My hobbies include travelling, sports, and photography. Weekly badminton matches with my colleagues are part of that. We have been playing with each other regularly for over two years now, and it's a pleasant diversion from everyday routine. Meanwhile, badminton has become a fixed part of our programme during the CODICO Academy Week, and I am very delighted about it. The main objective is fun, and the most diverse CODICO groups and countries get mixed together and play. Since I am very interested in other cultures and countries, one of my passions is travelling and discovering the world. Travelling is the perfect way for me to switch off, since my head empties completely as soon as I board the plane. A small quirk of mine is that I will send a postcard to myself as a souvenir from every journey. I am very fond of photography, so my camera is always part of my luggage. My absolute preference is capturing special moments in the often colourful lives of the locals at my destinations.

This year, a special challenge awaits me. The company allowed me to take seven weeks of leave to support a voluntary social project in Tanzania. I will be helping out in a kindergarten there, and it will certainly be a new and different experience for me. I am really very excited about what this yet unfamiliar continent has in store for me.

After almost 13 years in Distribution, my work is still a lot of fun, and my top priority remains to provide our customers with the best possible support in implementing their projects.

D09

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