

## **Power Magnetics Component Roundup**

by David G. Morrison, Editor, [How2Power.com](#)

This article highlights the latest introductions of power magnetic components, presenting news about power inductors, transformers, current sensors, chokes and filters, and magnetic cores introduced over the past six months. In this latest batch of magnetics products, battery and electric vehicle (EV) requirements figure heavily.

First, we have multiple signal transformers developed to provide isolation in battery management systems, covering EVs but also other applications such as energy storage systems. Additionally, there are inductors targeting onboard chargers (also for EVs) and the usual variety of automotive-grade inductors and chokes targeting a range of automotive subsystems. Some of these components are candidates for broader usage as well, being suitable for dc-dc converters and power supplies in consumer, industrial and telecom applications.

Other notable parts among the recent introductions are space-grade magnetics including planar transformers and common-mode chokes. These introductions highlight both the growth of space applications as well as their demands for small size. Furthermore, the chokes are designed to operate at the higher frequencies associated with wide-bandgap power devices.

Similar requirements were top of mind in a series of current transducers, which were crafted to achieve exceptionally wide bandwidth to accommodate the high switching frequencies associated with SiC and GaN devices. Yet another current transducer series features a very large aperture to accommodate large power connectors encountered on EV test benches. Other interesting products include high permeability nanocrystalline cut cores suitable for use in power transformers in renewable energy systems and smart grids.

This article represents a follow-up to the Power Magnetics Component Roundup published in the December 2023 issue and earlier [magnetics articles](#) published in How2Power Today.

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## Power Inductors

### Shielded Inductor Complements Battery Charger ICs

[Bourns](#)' Model SRP3212-1R0MR21 is a compact, low-profile form factor product extension to the Model SRP3212 series of high-current shielded power inductors. The mini-molding power inductor measures 3.2 x 2.5 x 1 mm and is manufactured with a metal alloy powder core and shielded construction featuring high saturation currents, high heating currents, and low magnetic field radiation. This model is developed for use and is part of a reference design with Texas Instruments' BQ25638/BQ25638D battery chargers.

Due to its flat-wire construction that improves efficiency, this model offers a significant reduction in DCR compared to other similarly-sized power inductors that use conventional wire. Offering an operating temperature range of -40°C to +125°C, and combined with its compact footprint, low magnetic field radiation, high saturation currents and high heating currents, the SRP3212-1R0MR21 inductor is well-suited for use in dc-dc converters and consumer electronics.



The SRP3212-1R0MR21 inductors are available now, and are RoHS compliant and halogen free. For more information, see the SMD High Current, Shielded Power Inductors [page](#).

### Inductors Feature Ferrite Core And Ferrite Shield For Low Magnetic Field Radiation

[Bourns](#)' Model SRR5228A and SRR5828A series shielded power inductors are AEC-Q200 compliant, automotive-grade power inductors designed with a ferrite core and ferrite shield. This construction delivers low magnetic field radiation, which is essential for applications that operate in low noise environments such as in automotive driver assistant devices, infotainment systems and lighting designs. These inductors are also well-suited for dc-dc converters and power supplies in consumer, industrial and telecom applications where higher inductor reliability is a frequent requirement.

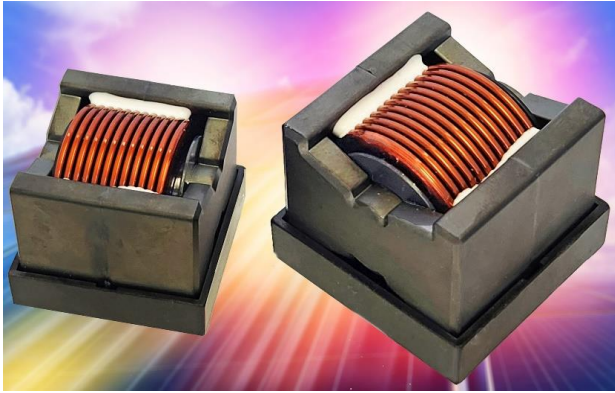
Providing industry-leading inductance and heating current, the SRR5228A and SRR5828A series feature an inductance range up to 1000  $\mu$ H and heating current up to 5.2 A. These inductors also offer a broad operating temperature range of -40°C to +150°C.

The SRR5228A and SRR5828A series are available now and are RoHS compliant and halogen free. For more detailed product information, see Power Inductors - AEC-Q200 Compliant [page](#).

### Magnetically Shielded Inductors Feature Flat-Wire Windings

[Sumida's](#) DPQ3535/T150 and DPQ5050/T150 series AEC-Q200-qualified power inductors are magnetically shielded and have a pin-type base for surface mounting on printed circuit boards. High surface area flat-wire windings minimize internal resistance at high frequencies and allow space savings and higher current ratings.

The DPQ3535/T150 series offers a range of inductance values from 3.3  $\mu\text{H}$  to 22  $\mu\text{H}$ . Maximum saturation current ranges from 28 to 152 A at 150°C. The larger DPQ5050/T150 is of similar design, with an inductance value of 10  $\mu\text{H}$  and a saturation current of 112 A at 20°C. The absolute maximum voltage across the inductor is 500 Vdc for each. Operating temperature is -40°C to +150°C (including the device's self-temperature rise).



The flat-wire inductor is encased in ferrite and mounted on an insulating base. Circuit connectivity is by two robust flat, tinned copper pins. Two additional pins provide additional mounting stability. Size for the DPQ3535/T150 is (HWD) 33 mm x 38.7 mm x 38.2 mm. The DPQ5050/T150 measures 44 mm x 53.5 mm x 53.3 mm.

Applications include use as a buck/boost inductor for onboard chargers (OBCs) in electric vehicles (xEVs), dc-dc converters, point-of-load converters, LED drivers, class D audio amplifiers, and other general high-performance power applications.

The devices are RoHS-compliant and halogen-free. Solder reflow temperature is up to 260°C peak. Complies with IPC/JEDEC Moisture Sensitivity Level 1, for unlimited floor life at  $\leq 30^\circ\text{C}/85\% \text{ RH}$ . Full application engineering support is available.

The DPQ3535/T150 and DPQ5050/T150 series inductors are available for sampling. For more information, see the Power Inductors [page](#).

### **Low-Profile Edge-Wound Inductor Delivers Saturation Current To 230 A**

[Vishay Intertechnology's](#) Vishay Custom Magnetics IHDF-1300AE-1A is an automotive-grade IHDF edge-wound, through-hole inductor with rated current up to 72 A and saturation currents up to 230 A. Featuring ferrite core technology and a low 15.4-mm maximum profile, the inductor operates over a demanding temperature range from -55°C to +155°C with low ac and dc power losses and excellent heat dissipation.

The edge-wound coil construction provides a low DCR of 1.1 m $\Omega$  maximum, which minimizes losses and improves rated current performance for increased efficiency. Compared to competing ferrite-based solutions, the IHDF-1300AE-1A offers 75% higher rated current. The device's low-profile package allows designers to meet the harsh mechanical shock and vibration requirements needed for AEC-Q200 qualification while minimizing board height to save space.

With an operating voltage up to 500 Vdc, the AEC-Q200 qualified inductor is well suited for dc-dc converters, inverters, and motor and switching noise suppression. Target applications include high-current, high-temperature automotive systems, such as on-board chargers for electric (EV) and hybrid electric vehicles (HEV).

Vishay can customize the IHDF-1300AE-1A's mounting orientation, termination type, nominal inductance, and isolation voltage rating on request. To reduce the risk of whisker growth, the inductor features a hot-dipped tin plating.

The device is RoHS-compliant, halogen-free, and Vishay Green. Samples and production quantities of the inductor are available now, with lead times of 12 weeks. Pricing for U.S. delivery only is \$6.00 per piece in 1,000-piece quantities.



Table. Key specs for the IHDF-1300AE-1A inductor.

Parameter	Value
Case size	1300
Profile (mm)	15.4
Inductance ( $\mu\text{H}$ )	1.0 to 5.0
DCR max. ( $\text{m}\Omega$ )	0.79 to 1.11
Heat rating current	59 to 72
Saturation current (A)	78 to 230 <sup>(1)</sup>
SRF typ. (MHz)	15 to 39

(<sup>1</sup>) Dc current (A) that will cause  $L_0$  to drop approximately 20%.

For more information, see the IHDF-1300AE-1A [page](#).

### Shielded Flat-Wire Inductors Are Well Suited For Onboard Chargers

[Sumida America's](#) CDPQ\*\*\*\*/T150 series high-current power inductors offer a combination of precision flat-wire windings and large tinned copper surface-mounting pads to maximize current handling capacity. These inductors are magnetically shielded, AEC-Q200 qualified, and a good match for on-board chargers.

The flat-wire coil is closely wound together to increase its effective cross-sectional area. This coil is encased in a high-permeability ferrite core minimizing physical size. The high surface area of the flat-wire windings is also effective at minimizing internal resistance at high frequencies.

The CDPQ2014/T150 series is available in three inductance values, which are 1, 2.2, and 3.3  $\mu\text{H}$ . Maximum saturation current ranges from 16 to 48 A at 150° C.

The larger CDPQ2717/T150 is of a similar design and is available in three inductance values of 2.2, 3.3, and 4.7  $\mu\text{H}$ . Its maximum saturation current range is also from 16 to 48 A at 150°C. The absolute maximum voltage across the inductor is 300 Vdc for each. Operating temperature is -40°C to +150°C (including the device's self-temperature rise). Other values are also available for OEM orders.



The CDPQ2014/T150 measures (HWD) 14.5 x 21.4 x 23.5 mm. The CDPQ2717/T150 measures 16.5 x 27.5 x 27.5 mm.

Applications include use as a buck/boost inductor for onboard chargers in electric vehicles (xEV), dc-dc converters, point-of-load converters, computer peripherals, LED drivers, class D audio amplifiers, and other general high-performance power applications

The devices are RoHS-compliant and halogen-free. Solder reflow temperature is up to 260°C peak. The inductors comply with IPC/JEDEC Moisture Sensitivity Level 1, for unlimited floor life at  $\leq 30^\circ\text{C}/85\% \text{ RH}$ . Full application engineering support is available.

The CDPQ2014/T150 and CDPQ2717/T150 series power inductors are available for sampling. For more information see the Power Inductors [page](#) or see the [CDPQ2014/T150](#) and [CDPQ2717/T150](#) product pages.

**Transformers**

**Planar Signal BMS Transformer Benefits EV And Energy Storage Systems**

Bourns' Model SM91806 is described as the industry's first planar signal BMS (battery management system) transformer. Meeting the need for planar technology that can provide reliable and safe communication in a growing group of high-voltage electric vehicle (EV) and other high energy storage systems, the AEC-Q200 compliant, U.S. patented model SM91806 meets basic electric insulation requirements per IEC 60664-1, IEC 61558-1 and IEC 62368-1 standards.



Planar-style signal transformers have been introduced to increase design flexibility and robustness. They are also known to deliver cost efficiency and reliability advantages over conventional wire-wound transformer designs due to their multilayer PCB isolation and full automation. Offering these benefits and more, Bourns' planar signal BMS transformer features a working voltage up to 1000 Vdc, superior clearance/creepage distance features and complies with Overvoltage Category II. It also provides a partial discharge level up to 1200 V for ESS usage.

The SM91806 is available now and is RoHS compliant. For more detailed product information, see the Transformers - Planar [page](#).

**BMS Transformers For EVs Offer Functional, Basic And Reinforced Insulation**

iNRCORE has expanded its battery management system (BMS) transformer for electric vehicle (EV), data center, energy storage system, and smart grid industries. In October of 2022, iNRCORE released the first BMS Transformer, RA1055NL, with AEC-Q200 qualification. To complement this product and expand upon its offering, iNRCORE has released seven new BMS transformers—the RA1058NL, RA1059NL, RA1060NL, RA1061NL, RA1062NL, RA1063NL and RA2055NL.

Table. Key specs for iNRCORE's BMS transformers.

Part Number	No. of Channels	Insulation	Hi-Pot (VDC)	Creepage Distance MIN (mm)	Package Size LxWxH MAX (mm)	Include CMC
RA1055NL	1	Functional	4300		9.28 x 7.87 x 5.72	Yes
RA1058NL	1	Basic	4300	10	19.50 x 10.00 x 5.30	Yes
RA1059NL	1	Basic	4300	10	17.09 x 8.50 x 6.00	No
RA1060NL	1	Reinforced	7640	15	28.38 x 12.48 x 10.00	Yes
RA1061NL	1	Basic	7300	10	17.09 x 8.50 x 6.00	Yes
RA1062NL	1	Functional	4300	N/A	9.28 x 7.87 x 5.72	No
RA1063NL	1	Reinforced	7640	15	28.38 x 12.48 x 10.00	No
RA2055NL	2	Functional	4300	5	15.24 x 15.5 x 5.30	Yes

"The expansion of BMS transformers offer functional, basic and reinforced insulation in five different packages. With proven 'double connection', we solved a common issue, namely open failure for this type of construction," said Leo Pan, regional sales manager, iNRCORE.

iNRCORE's BMS transformers resolve the key customer pain point of open failure at wire termination by using spot welding and adding post soldering processes. Once coil wound, wires are spot welded to terminals, which melts enamel wires to leads. Post soldering then prevents oxidation. Together these processes deliver a robust connection to increase reliability by avoiding open failure.

The BMS transformers provide safety isolation and EMI noise suppression. They support serial daisy chain, isoSPI, SPI, and other applications. The transformers have an operating temperature of -40°C to more than +125°C and functional, basic and reinforced insulation are available.

To ensure quality, iNRCORE operates full automation for coil winding, spot welding, soldering, testing and packing processes. For more information, see the [RA1058NL](#), [RA1059NL](#), [RA1060NL](#), [RA1061NL](#), [RA1062NL](#), [RA1063NL](#) and [RA2055NL](#) pages.

### **Signal Transformer Is Optimized For Higher Energy Storage Battery Management Systems**

[Bourns](#)' Model SM91801AL is a single-channel basic insulation transformer with a planar structure optimized for battery management system (BMS) applications. This signal planar transformer product is developed for use with several prominent semiconductor supplier IC series: Analog Device's LTC6815 series, NXP's MC33771C series and Texas Instruments' BQ79616 ICs that are primarily used in multi-cell battery monitoring designs.

This latest BMS planar signal transformer from Bourns is AEC-Q200 compliant and automotive grade. It features a basic insulation layer that complies with IEC 60664-1 and IEC 62368-1 standards, and is manufactured using a fully automated process to deliver a high quality and cost-effective solution for next-generation applications.

It offers a working voltage of up to 1000 Vdc and a hi-pot isolation voltage up to 4300 Vdc or 2500 Vac with an extended operating temperature range of -40°C to +125°C. The SM91801AL is available now and is RoHS compliant and halogen free. For more information, see the Transformers BMS - AEC-Q200 Compliant [page](#).

### **Compact SMT Transformers For Gate-Driver Applications**

[TDK's](#) B78541A EPCOS InsuGate series features compact SMT transformers with high working voltage. These transformers are suitable for gate-driver applications for IGBTs and MOSFETs in e-mobility (qualification according to AEC-Q200 as well as according to AQG vibration profile) and in industrial electronics.

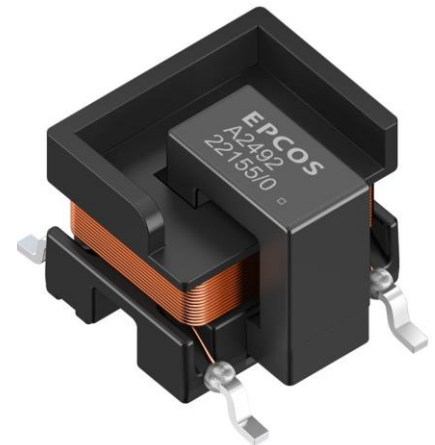
Constructed using a MnZn ferrite core, these devices are designed for operating frequencies of 100 kHz to 500 kHz and operating temperatures of -40°C to +150°C. Depending on the type, the transformation ratios of the windings are 1:1.08 (B78541A2467A003) or 1:1.07:0.6 (B78541A2492A003). With a low coupling capacitance of only 4 pF, the SMT transformers are also suitable for use with SiC or GaN semiconductors.

Combining the highly resistive plastic material with a CTI  $\geq$  600 and the special coil design, shorter clearances and creepage distances are possible compared to conventional insulated or potted components, despite the dimensions of only 13.85 x 10.5 x 9.2 mm (L x W x H). The UI7 platform, for example, offers creepage distances between primary and secondary windings of  $>$ 9.2 mm.

With a partial discharge extinction voltage of at least 840 V (peak voltage) and ac high voltage testing at 3 kV (50 Hz, 1 s), the 2-g lightweight components meet IEC 61558 for reinforced insulation for working voltages up to 300 V (ac) or 700 V (dc) for basic insulation. This is sufficient for many industrial and automotive applications.

The UI7 family includes two reference models to allow possible winding configurations for forward and push-pull topologies with the appropriate number of outputs.

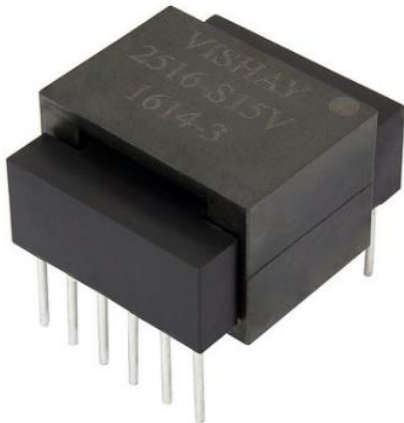
Main applications include switched power supplies (bridge topologies), gate driver circuits, isolated dc-dc converters and galvanically isolated single-channel IGBT driver ICs. For more information, see the Transformers for IGBT/FET [page](#).



### **Space-Grade Planar Transformers Offer Lower Cost And Smaller Size Than Traditional Planars**

[Vishay Intertechnology's](#) Vishay Custom Magnetics SGTPL-2516 is a series of low-profile, space-grade planar transformers for power conversion applications. Offering a lower cost, smaller size, and higher density than traditional planar transformers, the customizable devices meet the requirements of MIL-STD-981 class S.

Available with through-hole terminations and multiple package sizes, the devices will be used in switch mode power supplies, dc-dc and ac-dc converters. Designed for the harshest of environments, the transformers combine their MIL-STD-981 qualification with a rugged package featuring molded windings and high temperature operation to +130°C. SGTPL-2516 series devices operate over a frequency range from 80 kHz to 300 kHz and provide high dielectric withstand voltage to 1500 Vac, power of 150 W, and leakage inductance of 0.5 µH.



Featuring a unique winding structure and build technique, the transformers provide a greater copper fill factor than can be achieved with traditional planar devices, resulting in a smaller package size and improved efficiency and power density. The SGTPL-2516 series' winding technology allows for easy modification to meet design-specific requirements for operating voltage, inductance, power, and package size and height with no up-front tooling charges.

In addition to S level MIL-STD-981 A and B group screening, the devices are available with P level screening for design validation testing and other custom screening options. Samples and production quantities of the new transformers are available now, with lead times of eight weeks for devices with P level screening and 21 weeks for devices with S level screening. For more information, see the SGTPL-2516 [page](#).

## Current Sensors

### Current Transducer With Large Aperture For EV Test Benches And Battery Testing

[Danisense's](#) DN1000ID current transducer is mainly aimed at automotive (EV) test benches, and battery testing and evaluation systems. Featuring a very large aperture of 41.2 mm, the current transducer enables power cables with large power connectors to be easily fitted to EV test benches allowing for quick changeovers.

The large aperture is an important advantage as test bench operators often face the issue that the power connectors fitted to the power cables are bigger than the diameter of the cable, making it difficult to fit them in the aperture of the current transducer and often requiring additional work to solve this issue. Comments Loic Moreau, sales & marketing director at Danisense, "Our new DN1000ID device now offers the best compromise between the 1000-A nominal current and aperture size by keeping the best measuring performances in accuracy and phase shift."

Like all Danisense products the DN1000ID current transducers benefit from the high-stability, closed-loop fluxgate technology. Further technical details include a linearity of 1 ppm, 5 ppm offset and a compact aluminium housing. Additional target applications for the product are power measurement and power analysis, MPS for particles accelerators, gradient amplifiers for MRI devices, precision drives as well as current calibration purposes.

For more on the DN1000ID, see the [datasheet](#).



### Current Transducer Offers Extra-Large Bandwidth For High-Frequency Applications

[Danisense's](#) DW series of closed-loop compensated zero-flux current transducer measures up to 750 A and offers excellent accuracy with 10-ppm linearity and low offset at 15 ppm. To meet the increased requirements in terms of high frequency coming from the latest power conversion products based on wide bandgap semiconductor technologies such as GaN and SiC, Danisense has revised its winding processes and now achieves an exceptionally wide bandwidth of up to 10 MHz with its latest DW500UB-2V product.



The DW series devices benefit from a full aluminium body for superior EMI shielding and a wide operating temperature range from -45°C up to +40°C. A very low phase

shift allowing a high power measurement accuracy, low noise and an industry-standard BNC connection are further features.

The main target application is power measurement in laboratories for the design optimization of power converters—typically for e-mobility applications. DW series current transducers can also be used for power measurement and power analysis for stable power supplies, SMPS for particles accelerators, gradient amplifiers for MRI devices, precision drives, battery testing and evaluation systems and current calibration purposes.

For more details of the DW series, see the [datasheet](#).

## Chokes And Filters

### Single-Phase EMI Filters For DIN Rail And DC Applications

[TDK's](#) B84742A\*R725 series single-phase EMC filters serve ac as well as dc applications up to 250 V and rated currents from 6 A to 30 A. This means they can be used for increasingly popular dc infrastructure in the industrial and building sectors. Available in five versions, the 97- x 60- x 34.5-mm (L x W x H) small single-phase filters, weighing no more than 310 g, can be snapped quickly and conveniently onto the TH35 DIN rail, also known as a top-hat rail. The conductors are fastened with M4 screws, and the screw connection is equipped with touch protection.



In particular, the insertion loss of the filters is very high: Depending on the model, this is 40 dB for common mode and over 80 dB for differential mode noise at frequencies between 70 kHz and 10 MHz. At the same time, leakage currents are very low at less than 2 mA, which prevents unintentional tripping of RCDs. All types of this product family are UL-approved and specified for a rated temperature of up to 55°C.

For short periods of time, the EMC filters can handle higher currents; 150% of the rated current is allowed for three minutes per hour and even 250% for 30 seconds per hour. This is particularly useful in drive applications when starting electric motors. Other typical applications are power supplies as well as ICT equipment.

For more information, see the Power Line EMC Filters [page](#) or see the [datasheet](#).

### Common-Mode Chokes Shrink Device Size For Space And Other High-Rel Applications

[Vanguard Electronics](#), under the iNRCORE Family of Brands, has expanded its CMN and SCM series common-mode choke inductors with the addition of eight new series: the CMN4, CMN6, CMN7, CMN9, SCM4, SCM6, SCM7 and SCM9. These series are the latest addition to Vanguard's growing high-reliability and corresponding space-grade product lines.

"These are truly game changing parts. Many of our high end industrial, military and aerospace customers are designing power supplies with high voltages and higher switching and need high power densities in a smaller package size with lower parasitics. Vanguard has risen to the challenge and has developed these series to address the needs of today's technology. Compared to the competition, these series provide better performance in a smaller package size," said Scott Harris, director of sales at Vanguard Electronics

The expanded product line of both high-reliability and space-grade common-mode choke inductors has been designed to operate in extreme conditions, work in frequency ranges from 100 kHz to 600 kHz+ which make them well suited for GaN, GaS or SiC based power supplies or even traditional switching supplies operating at lower frequencies. These parts feature a compact low profile making them suitable for automatic placement as well as demands of high shock and vibration. Ten unique case sizes are available, making customization to fit your design easier.

These common-mode chokes operate over a temperature range of -55°C to 125°C. According to the vendor, they offer the widest available combination of inductance and current ratings on the market and are available from stock to a few weeks. The inductor's overload current is one-and-a-half times its rated current.

The SCM series is designed, built, tested, and qualified to MIL-STD-981. The inductors are designed to serve military, high-end industrial, extreme temperatures, and aerospace markets as well as anywhere noise



suppression is needed. Other electrical configurations and performance characteristics are available in various sizes and package types. For more information, see the Common & Differential Mode Inductors [page](#).

Table. Key specs for Vanguard’s expanded line of CM chokes.

Series	Inductance Range (mH)	DCR (Ohms)	Current Rating (A)	Grade
CMN4	0.07 – 10.4	0.011 – 0.25	0.48 – 2.70	Hi-Rel
CMN6	0.06 – 10.3	0.006 – 0.262	0.94 – 4.89	Hi-Rel
CMN7	0.07- 10.7	0.004 – 0.262	0.99 – 7.45	Hi-Rel
CMN9	0.09 – 10.6	0.007 – 0.076	1.95 – 8.26	Hi-Rel
SCMN4	0.07 – 10.4	0.011 – 0.25	0.48 – 2.70	Space
SCMN6	0.06 – 10.3	0.006 – 0.262	0.94 – 4.89	Space
SCMN7	0.07 – 10.7	0.004 – 0.262	0.99 – 7.45	Space
SCMN9	0.09 – 10.6	0.007 – 0.076	1.95 – 8.26	Space

**Automotive-Grade Common-Mode Chip Inductors Withstand Up To 4 A In A Compact Size**

[Bourns’](#) Model SRF4532TA AEC-Q200-compliant, automotive-grade common-mode chip inductor series is designed to withstand current up to 4 A. These common-mode chip inductors are well suited as noise suppression solutions in advanced driver-assistance system (ADAS) infotainment, body electronics, and many other automotive applications.

Offered in a compact footprint, the common-mode chip inductor model series is designed with a ferrite core, providing high impedance across a broad frequency range to suppress unwanted incoming or outgoing EMI signals. These common-mode chip inductors address stringent shock and vibration requirements, as the core is constructed with 0.3-/0.4-mm-high sidewall terminals that help to enhance the component's mechanical strength on the PCB. The SRF4532TA inductors also feature shielded construction for low radiation and have an operating temperature range of -55°C to +125°C.

The SRF4532TA series is available now and is RoHS compliant and halogen free. For more information, see the [datasheet](#).

**Cores**

**High-Permeability Nanocrystalline Cores Come In C Shape**

[Magnetics](#) now offers a wide variety of high-permeability nanocrystalline cores now in C shape (cut cores) for power transformers. Nanocrystalline’s high-permeability and low-core-loss characteristics help in reducing energy losses and improving the efficiency of these transformers. This is particularly beneficial in applications where energy efficiency is critical, such as in renewable energy systems and smart grids.



Nanocrystalline cut cores may also be used in inductors, chokes, EMI filters, and current sensors. Find new standard sizes listed on the company’s [website](#) or request a custom size [quote](#).