Bourns Magnetics Capabilities

2021
Agenda

• Bourns Magnetics Division overview
• Bourns magnetic components
• Bourns custom magnetics
• Bourns Kaschke components
• Bourns Magnetics capabilities summary
Bourns Magnetics Division at a Glance

• Three entities to support all customer needs
• Global design, testing, manufacturing & engineering support in all three geospheres
• In excess of 50 years Magnetics components experience
• Broad and expanding line of power and signal magnetic components
• Design and production of ferrite cores
• Extensive fully custom magnetics design capabilities
• Miniaturized, automotive grade, high quality & high reliability components
• Strong commitment to R&D and product innovation
• Platinum Level Supplier excellence award
• Global reference designs with major IC suppliers
• Dedication to flawless execution for our customers
Bourns Magnetics Division

Three Bourns entities to support all needs:

• **Power and Signal Magnetic Components**
  • Over 7000 inductor and transformer part numbers
  • *Standard product families: Power Inductors, Chip Inductors, Signal Transformers, Chokes & Ferrite Beads*

• **Custom Magnetics**
  • *Direct support for customer specific application-driven requirements*
  • IATF 16949 and VDA6.3 fully approved design and factory to support critical application requirements for automotive grade applications
  • Design, development and production in China with Mexico option available

• **Kaschke Components**
  • Ferrite cores of power grade material
  • Custom development for industrial grade magnetic products
  • Design, development and production in Europe and North Africa (Germany and Tunisia)
1947
Bourns established

1968
Bourns Magnetics begins

2006
Bourns acquires JW Miller products

2016
Bourns acquires Custom Magnetics

2021
Bourns acquires Kaschke Components
## Global Infrastructure to Support Customers

<table>
<thead>
<tr>
<th>Location</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>China Dongguan</td>
<td>Custom Transformers, Integrated Assembly, Solenoids</td>
</tr>
<tr>
<td>China Xiamen</td>
<td>Signal Transformers, Isolation Transformers, Custom Inductors</td>
</tr>
<tr>
<td>Taiwan Taipei</td>
<td>Power Inductors, Chip Inductors, Chokes</td>
</tr>
<tr>
<td>Mexico Chihuahua</td>
<td>Custom Inductors, Integrated Assembly</td>
</tr>
<tr>
<td>Germany Gottingen</td>
<td>Ferrite Cores, Common Mode Chokes, Transponder Coils</td>
</tr>
<tr>
<td>Tunisia Zaghouan</td>
<td>Std. Platform Transformers, Common Mode Chokes, Custom Magnetic Designs</td>
</tr>
</tbody>
</table>
Magnetetics Solutions for Next-Gen Applications

- Automotive, industrial and renewable energy BMS
- On-board/off-board charging
- Advanced computer memory modules
- Advanced driving assistance systems (ADAS)
- Smart connected IoT devices
- Power conversion for most power levels
Power and Signal Catalog Components
Power and Signal Magnetic Components

• Broad portfolio of catalog Power and Signal Magnetic Components
• Portfolio matches increasingly complex and demanding application needs
• Portfolio makes it easy to select the right components for any application
• Strong technology roadmap, continuous new product releases
  • 40 new series introduced in 2020
  • >20 new series introduced in 2021 YTD
  • AEC-Q200 compliant components
  • Designed to support high current, high frequency, high temperature, low DCR, low core loss, small size requirements
• Multiple reference designs with global IC manufacturers
• Agency standards compliance
• Large and growing portfolio of automotive grade parts
• Platinum Level Supplier Excellence Award recipient
Power Inductors: Non-shielded, Semi-shielded, Shielded and High Current Shielded

<table>
<thead>
<tr>
<th>Inductor Model</th>
<th>SDE / SDR Non-shielded</th>
<th>SRN Semi-shielded</th>
<th>SRR / SRU Shielded</th>
<th>SRP High Current Shielded</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Appearance</strong></td>
<td>![Inductor Image]</td>
<td>![Inductor Image]</td>
<td>![Inductor Image]</td>
<td>![Inductor Image]</td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td>• Ferrite core&lt;br&gt;• Low cost&lt;br&gt;• High saturation current</td>
<td>• Ferrite core&lt;br&gt;• Semi-Shielded with epoxy resin&lt;br&gt;• Lower radiation than non-shielded&lt;br&gt;• Lower cost than shielded</td>
<td>• Ferrite core&lt;br&gt;• Shielded&lt;br&gt;• Low radiation&lt;br&gt;• Low DCR</td>
<td>• Alloy powder core&lt;br&gt;• Shielded&lt;br&gt;• Low radiation&lt;br&gt;• Low DCR&lt;br&gt;• High rated current</td>
</tr>
<tr>
<td><strong>Models Available</strong></td>
<td>24</td>
<td>28</td>
<td>64</td>
<td>83</td>
</tr>
<tr>
<td><strong>Footprint</strong></td>
<td>3 x 3 to 22 x 22 mm</td>
<td>2.6 x 1.6 to 10 x 10 mm</td>
<td>2.8 x 2.8 to 18 x 18 mm</td>
<td>2 x 1.6 to 23 x 23 mm</td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td>2.5 to 7 mm</td>
<td>1 to 6 mm</td>
<td>0.9 to 6.5 mm</td>
<td>1 to 7 mm</td>
</tr>
<tr>
<td><strong>Inductance</strong></td>
<td>0.8 to 15,000 µH</td>
<td>0.47 to 470 µH</td>
<td>0.47 to 15,000 µH</td>
<td>0.1 to 100 µH</td>
</tr>
<tr>
<td><strong>Rated Current</strong></td>
<td>0.02 to 16 A</td>
<td>0.28 to 10 A</td>
<td>0.02 to 20 A</td>
<td>1.2 to 55 A</td>
</tr>
</tbody>
</table>
### Transformers - Power / Signal / BMS / Chip LAN

<table>
<thead>
<tr>
<th>Inductor Model</th>
<th>BS6 – HCT – SM Power</th>
<th>SM Signal</th>
<th>SM915xx BMS</th>
<th>SM Chip LAN (Discrete &amp; Module)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Appearance</strong></td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
</tbody>
</table>
| **Features** | • Various input / output voltage  
• High isolation voltage  
• High clearance/ creepage distance  
• Design to meet IEC | • Toroid core  
• IEEE 802.3 Ethernet compatible  
• PoE / PoE+  
• Built-in common mode chokes  
• +125 °C operating temp. available | • Toroid core  
• One or two-channel  
• High isolation voltage  
• High working voltage  
• Built-in common mode chokes  
• High temperature +125 °C | • Ferrite drum core / ferrite plate cap  
• Shielded construction  
• IEEE 802.3 Ethernet compatible  
• PoE / PoE+  
Discrete:  
• Flexible PCB layout  
Module:  
• Pin-to-pin compatible to traditional LAN transformer  
• Built-in common mode chokes  
• Metal shield |
| **Models Available** | 4 | 14 | 7 | 5 (Discrete) + 5 (Module) |
| **Footprint** | 10.5 x 9.8 to 17.8 x 13.5 mm | 12.8 x 9.3 to 24.2 x 18.2 mm | 8.89 x 7.62 to 31.5 x 12.5 mm | 3.5 x 3.2 to 4.7 x 3.22 mm (Discrete)  
12.7 x 8.67 to 17.03 x 14.6 mm (Module) |
| **Height** | 6.5 to 12.7 mm | 5.65 to 12.8 mm | 5 to 9.5 mm | 2.9 mm (Discrete)  
4 - 4.5 mm (Module) |
| **Rated Power** | 1.8 – 13 W | N/A | N/A | N/A |
| **Bit Rate** | N/A | 10/100/1000M | N/A | 1 to 10G |
## Common Mode Chokes - Power / Signal

<table>
<thead>
<tr>
<th>Inductor Model</th>
<th>DR – SRF Power</th>
<th>SRF Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Appearance</strong></td>
<td><img src="image1" alt="Appearance" /> <img src="image2" alt="Appearance" /> <img src="image3" alt="Appearance" /></td>
<td><img src="image4" alt="Appearance" /></td>
</tr>
</tbody>
</table>
| **Features**   | • Ferrite core  
• Shielded construction  
• Bifilar and sector wound available | • Ferrite drum core / ferrite plate cap  
• Shielded construction  
• Bifilar wound - high common mode impedance |
| **Models Available** | 14 | 12 |
| **Footprint**   | 5.2 x 5 to 12.5 x 12.6 mm | 2 x 1.2 to 4.5 x 3.2 mm |
| **Height**      | 6.5 to 12.7 mm | 1.2 to 3 mm |
| **Impedance**   | 140 – 10,000 Ω | 30 – 10,000 Ω |
| **Rated Current** | 0.1 – 8.9 A | 100 – 400 mA |
Bourns® Automotive Grade Magnetics

Advanced Product Quality Planning (APQP)

Products are developed using the APQP structured approach to product and process design to ensure products satisfy customer needs.

IATF 16949:2016 Automotive Quality Management System

All Bourns® automotive grade products are produced in facilities certified to IATF 16949.

VDA 6.3 German Automotive Industry

Process based audits to evaluate and improve controls in our manufacturing operation and new product introduction; audit score of >80% for manuf. Facility.

Automotive Electronics Council

Component Technical Committee

AEC-Q200 for Passive Components; AEC-Q101 for Semiconductors

Automotive grade products are qualified to the stress tests specified in the latest AEC qualification standards.

PPAP Level 3 to be provided for all Auto Grade Components

Bourns® standard components must be presented to a customer for approval using PPAP.
Magnetics New Product Releases 2021 YTD

2021 YTD Key New Product Releases
• 21 new series released
• 128 new part numbers added
• New Power Inductors, Common Mode Chokes, Chip LAN Modules and BMS Transformers
Magnetics New Product Releases 2021 YTD-Continued

Bourns® Model SRF322STABM and SRF322STAFD Series
1276-Ohm Automotive Grade Common Mode Chip Inductors

Bourns® Model CWF1610 and CWF2414 Series
New Chip Inductors

Bourns® Model SRN6045HA Series
New Automotive Grade Semi-shielded Power Inductors

Bourns® Model SRP6530A Series
New AEC-Q200 Compliant High Current Shielded Power Inductors

Bourns® Model SM91076L
MMA Suggested Shielded EAN Transformer

Bourns® Model SM91501ALO
New AEC-Q200 Compliant BMS Signal Transformer

Bourns® Model SM91502ALA
New AEC-Q200 Compliant BMS Signal Transformer
Reference Designs with Global IC Manufacturers

- Reference designs help customers save time and minimize risk
- Bourns has multiple reference designs with major IC manufacturers

<table>
<thead>
<tr>
<th>Year</th>
<th>Semiconductor Company</th>
<th>IC Part Number</th>
<th>Application</th>
<th>Bourns Part Number</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>TI</td>
<td>TPA6304-Q1</td>
<td>Automotive Class D Amplifier</td>
<td>SRP5015T A-20Y</td>
<td>TPA6304-Q1 Evaluation Module</td>
</tr>
<tr>
<td>2021</td>
<td>TI</td>
<td>TPA6304-Q1</td>
<td>Automotive Class D Amplifier</td>
<td>SRP5015TA-R22Y</td>
<td>TPA6304-Q1 Evaluation Module</td>
</tr>
<tr>
<td>2021</td>
<td>TI</td>
<td>TPA6304-Q1</td>
<td>Automotive Class D Amplifier</td>
<td>SRP5015TA-R33M</td>
<td>TPA6304-Q1 Evaluation Module</td>
</tr>
<tr>
<td>2021</td>
<td>TI</td>
<td>SN6501-Q1</td>
<td>Isolated Power Supplies</td>
<td>HCTSM8</td>
<td>SN6501-Q1</td>
</tr>
<tr>
<td>2021</td>
<td>ADI</td>
<td>ADBMS6830M</td>
<td>Automotive BMS</td>
<td>SM91501ALE</td>
<td>LTC6812-1</td>
</tr>
<tr>
<td>2021</td>
<td>ADI</td>
<td>ADBMS682</td>
<td>Automotive BMS</td>
<td>SM91501ALE</td>
<td>LTC6812-1</td>
</tr>
<tr>
<td>2021</td>
<td>PI</td>
<td>INN3996CQ</td>
<td>High voltage input automotive isolated DC-DC Power Supply</td>
<td>SRP4020T A-1R5M</td>
<td>DER-889Q Design Example Report</td>
</tr>
</tbody>
</table>
Bourns Custom Magnetics
Dongguan, China

• Founded as Transtek in 1998
• Acquired by Bourns in November, 2016
• Highly Automated Production
• IATF 16949 Qualified
• AEC-Q200 Testing In-house
• Focused on Customized Magnetic Components for automotive power applications (OBC, EV Charging Stations, BMS), energy storage and renewable energy industry
Bourns Custom Magnetics Capabilities

• Broad portfolio of custom magnetic components and modules
  • Transformers, inductors, common mode chokes
• Designed for high-efficiency, compact size and excellent thermal management
• Produced in IATF 16949 and ISO 14000 certified factories
• Compliance with typical customer-requested safety agency standards
  • UL 2231, UL 60601, UL 60950-1, UL 62368-1, IEC 60664-1, IEC 61558-2, IEC 62752, IEC 62955, CSA 22.2
• Compliance with industry standards
  • UL 508, EN 61558-1, EN 60950, EN 60368-1
• High Frequency Power Topologies
  • Buck, boost, SEPIC, CUK, half and full bridge LLC, push-pull, forward, flyback
• Production facilities are equipped with test and design verification tools
  • AEC-Q200 testing in-house
  • Finite element analysis
Full Custom Capabilities

- Bobbins, cores, wires
- Aluminum housings
- Thermally conductive potting
- Litz wire & flat wire windings
- Almost all power levels
- High current inductors for PFCs, filter applications and common mode chokes
- High power SMPS transformers for any topology
- Fast prototypes
- Flexible & automated production
- Optimized design solution that meets cost and volume production goals
Custom Magnetics Examples

- <1 W Flyback transformers for LV applications
- Critical isolation/signal transmission for BMS (e.g., Li-ion cell)
- Filter inductors and CMCs
- PFCs
- Reinforced SMPS transformers - 50 W Class F rated
- Planar PCB transformers with high isolation and ultra-low variation between parts
- 6 kW Main LLC transformers for EV and inverter applications - UL Class F EIS
- 60 kW Multiple components, potted and heat sink housed units
Kaschke Components
Tunisia and Germany

- Founded as Kaschke >65 years ago
- Acquired by Bourns in February 2021
- Products are developed in Germany, manufactured at production sites in Tunisia
- End markets include industrial, automotive, medical, consumer, energy
- Design, development and production of ferrite cores
- Plants are ISO 9001:2015 certified
- Other certifications include
Kaschke Components Capabilities

• Broad range of custom components
  • From miniature SMD chokes for medical devices to high-performance boost chokes for inverters used in wireless energy transfer systems of up to 240 kW
  • SMPS transformers for any topologies
  • CMC, DMC, PFC and storage chokes
• Ultra-fine wire, Litz wire, edge wire and foil winding
• Modern soldering, joining, potting, testing technology for process control
• Flexible and automated production lines
Kaschke Ferrite Capabilities

- Internal material development
- Internal product design
- Internal powder production
- Material lines
  - NiZn ferrite
  - MnZn ferrite
- Internal tool and system manufacturing
- Big shapes, high flux density
- Low losses up to 100 kHz
- Ring cores up to R102 with very good insertion losses and high Q-factor
- Rod cores for antennas and transmitter/receiver coils in the 20 kHz–40 MHz range
- Pot cores for proximity switches and wireless power transfer
- Impeder cores for inductive welding
- Customized core shapes
Bourns Magnetics Capabilities Summary

• Broad magnetics product portfolio with extensive custom design capabilities
• Solutions that enable efficient, safe, high reliability and long-life operation
• Continued innovation in miniaturization, advanced construction materials, additional design parameters
• Experts in advanced magnetics designs that meet:
  • Superior power conversion efficiency
  • Isolation
  • EMC compliance
  • Signal integrity
  • Increased power density
  • Excellent thermal management
• Global design, testing, manufacturing & engineering support in all three geospheres
• More than 50 years magnetic components experience
Thank you!