



Battery Energy Storage Systems (BESS) for Data Centers

Bourns® Circuit Protection Solutions Brochure



BOURNS®



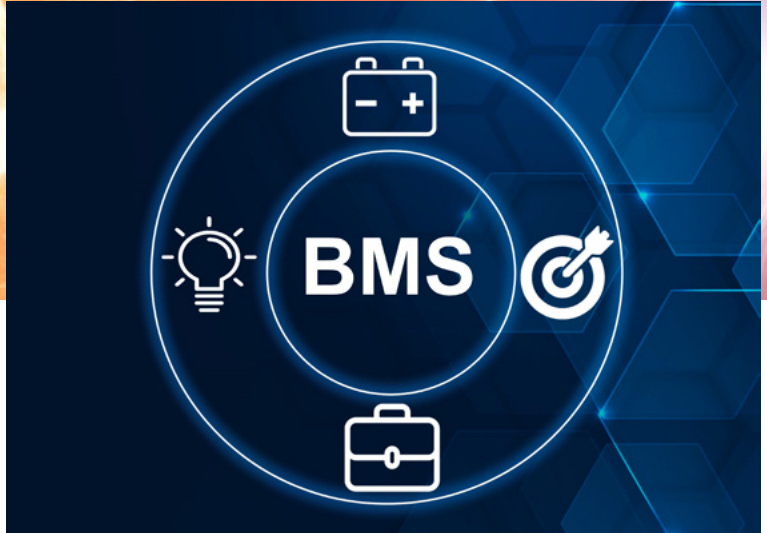
Introduction

Cloud computing, internet connectivity, and artificial intelligence are key drivers in the modern world for development. Data centers are the primary infrastructure for these innovations. As these technologies develop, the power required by these data centers will also increase. To meet growing power demands, supporting infrastructure has to be developed. One of these supporting structures is the Battery Energy Storage System (BESS).

BESS are utilized to store electrical energy and deliver it reliably when needed, supporting grid stability, renewable energy integration, and critical load continuity. These systems operate at high voltages and power levels, requiring precise control, monitoring, and protection to ensure safe and continuous operation. BESS architectures are built to maintain availability during charge and discharge cycles, grid disturbances, and maintenance events, enabling energy assets to remain online while adapting to dynamic operating conditions.

If a BESS does not contain any circuit protection, then preventable surges can easily damage sensitive and critical components or propagate downstream to the data center servers.

Bourns offers many robust and reliable components perfectly suited for BESS applications. Bourns offers various resistors, MOVs, GDTs, fuses, and more that are ideal for BESS. These components can be integrated in not only the input protection for the BESS but also the BMS, EMS, and the power conversion systems.





What is BESS?

BESS is an external management system utilized to store power for use during critical stages and to maximize energy efficiency. BESS stores energy from the power grid or renewable energy sources and provides energy to the applicable load while also handling circuit protection, power conversion, energy monitoring, and energy storage. A BESS makes sure the load is not exposed to too much or too little power, keeping it optimized and efficient. Within the BESS, several key systems are utilized, including a BMS (Battery Management System) and an EMS (Energy Management System).

The EMS is utilized to properly measure and track incoming energy from the grid and outgoing energy to the system. The EMS makes high-level algorithmic decisions for the BESS, such as charging, discharging, and other macro-level energy decisions. The BMS is utilized to protect, manage, and optimize battery cells. The BMS and EMS systems work together with power conversion systems to properly manage and optimize energy usage.

A BESS is used commonly in conjunction with renewable energy to store excess capacity to provide efficient power utilization and reduce operational expenditures. To optimize energy management, a BESS is used for grid support, which is what keeps the energy from the grid stable and reliable. To properly support the grid, the BESS provides peak shaving, frequency regulation, and other ancillary services. Peak shaving reduces energy drawn from the grid during peak hours. A BESS is charged during lower energy demand times and then utilized during peak times to provide energy independence and lower energy costs. Frequency regulation stabilizes the frequency of incoming power. The BESS provides very fast response times and precise execution to stabilize the frequency; this frequency regulation ensures all connections are in sync to promote grid stability.

Excess energy is stored within battery cells within the BESS, which is managed by the BMS. The energy from the battery cells is then converted to AC power and fed back into the system to ensure optimal energy levels. Many different battery chemistries can be utilized within BESS, with the most common being lithium-ion due to its energy density, high performance, and robust nature.

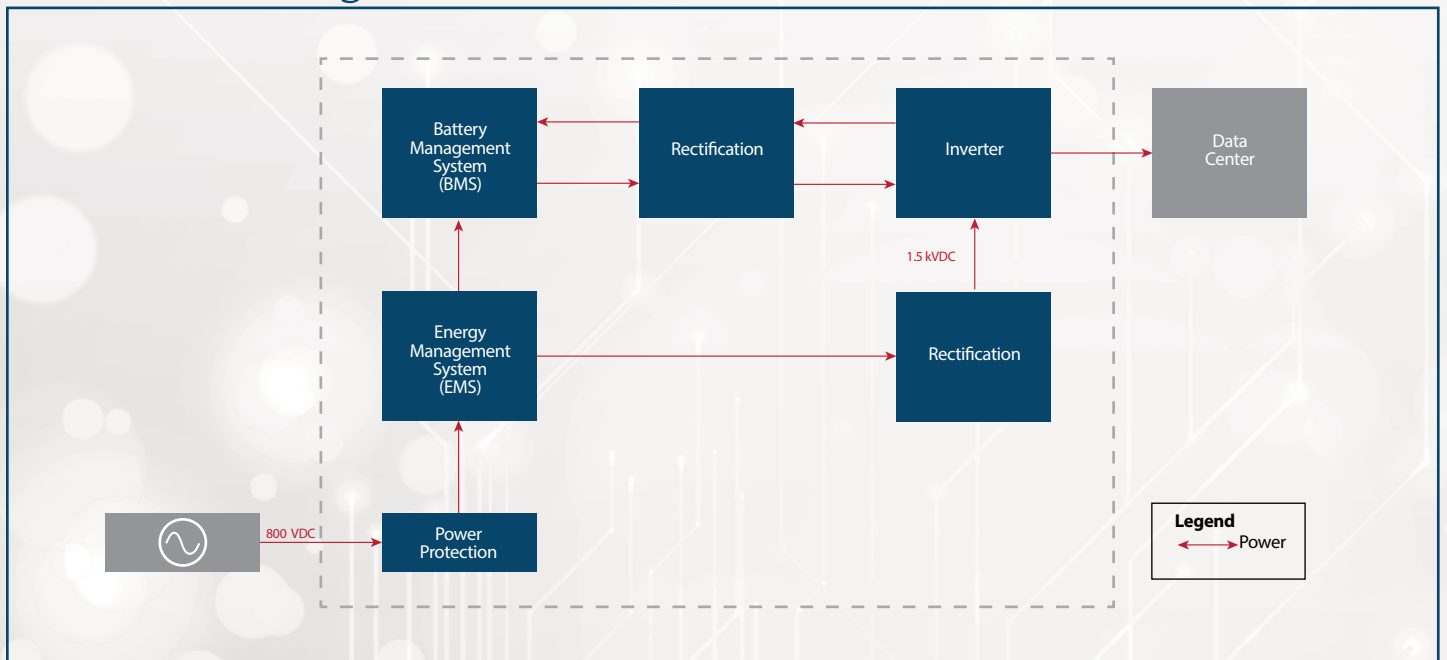
Overview



Bourns® Product Offerings

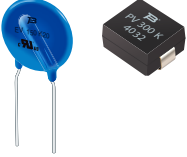





- Gas Discharge Tubes (GDTs)
- NTC Thermistors
- Thermal Jumper Chips
- Silicon Carbide (SiC) Schottky Diodes
- Power TVS Diodes
- Thick Film on Steel (TFOS)
- Transformers
- Standard Power Inductors
- Custom Magnetics
- Power Resistors
- Wirewound Resistors
- Current Sense Resistors
- IsoMOV® Hybrid Protectors
- POWrFuse™ High-Power Fuses
- Surge Protective Devices (SPDs)
- Multilayer Varistors (MLVs)
- Varistors

BESS Block Diagram



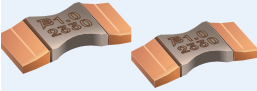


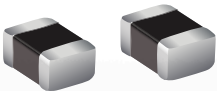
BESS Input Protection

Bourns® Product Recommendations

Product Image	Recommended Products	Description	Specifications and Features
	<p>Varistors</p> <p>Through-hole: EV Series</p> <p>SMD: PV Series</p>	<p>These varistors are available in disc sizes up to 23 mm and are offered in both through-hole and surface-mount packages. UL 1449 listed, the through-hole MOVs use an industry-standard form factor and provide effective overvoltage protection by clamping excess voltage conditions.</p>	<ul style="list-style-type: none"> • Max. voltage: 14-1465 VDC • Max. peak current: 100-15000 A, 8/20 μs • Operating temperature: -55 to +125 °C • Up to 23 mm disc sizes • Through-hole and SMD packages available • UL 1449 listed
	<p>IsoMOV® Hybrid Protectors IsoM5</p>	<p>Combination of MOV and GDT technology in one package. These components have extremely low leakage current and extended reliability. Well-suited for industrial applications that require minimal downtime.</p>	<ul style="list-style-type: none"> • Max. voltage: 56-745 VDC • Max. peak current: 6-15 kA, 8/20 μs • Operating temperature: -40 to +125 °C • Disc size: 10-20 mm • Through-hole components
	<p>Gas Discharge Tubes (GDTs) GDT25, 2035-xx-XX</p>	<p>Gas Discharge Tubes (GDTs) are a conventional overvoltage protection component with high surge current capacities. These components “crowbar” when excess voltage is present.</p>	<ul style="list-style-type: none"> • Breakdown voltage: 75-800 V • Up to 25 kA peak current, 8/20 μs waveform • Operating temperature: -55 to +125 °C • Through-hole and SMD packages available
	<p>POWrFuse™ High-Power Fuses PF-FB2-400</p>	<p>Designed to UL 248 and IEC 60269 standards, POWrFuse™ High-Power Fuses are available in multiple mounting configurations, with automotive-grade versions offered per ISO 8820-8. These fuses are rated for extremely high interrupting currents, providing reliable overcurrent and short-circuit protection.</p>	<ul style="list-style-type: none"> • Rated voltage: up to 1000 VDC/800 VAC • Rated current: 6-400 A • Interrupt rating: up to 160 kA
	<p>Surge Protective Devices (SPDs) 1260</p>	<p>Bourns® Surge Protective Devices (SPDs) are designed to protect sensitive equipment from damage caused by lightning and electrical transient surges. SPDs integrate discrete circuit protection devices into an assembly that provides an enhanced level of functionality and protection.</p>	<ul style="list-style-type: none"> • Surge protection: up to 200 kA • AC & DC surge protection: 12-1500 VDC • UL1449, IEC/EN 61643-11 compliant • Available in single pole and multipole configurations
	<p>Transformers HCTSM150102HLF</p>	<p>Bourns® HCT Series Transformers offer high creepage and clearance corresponding to multiple standards where designers are working with voltages up to 1500 VDC. The HCT Series meets safety and isolation standards in a compact footprint.</p>	<ul style="list-style-type: none"> • Working voltage: up to 1500 VDC • Hi-pot: 7640 VDC, 1 mA, 2 s • Creepage, clearance distance > 15 mm • UL compliant

BESS – Battery Management System (BMS) and Energy Management

Bourns® Product Recommendations

Product Image	Recommended Products	Description	Specifications and Features
	Current Sense Resistors CSS2H-2512R-L500FE	Bare metal SMD shunts for precision monitoring of current. All blocks will incorporate some form of current monitoring for accurate switching characteristics.	<ul style="list-style-type: none"> Resistance range: 0.2-5 mΩ Power rating: 1.5-15 W Tolerance: 1%, 2%, 5% Temperature coefficient: 50 PPM/°C Surface mount Low thermal EMF
	Wirewound Power Resistors UB Series	Wirewound resistors are known for precision and robustness. Used for high precision applications and to manage high power and pulse loads.	<ul style="list-style-type: none"> Resistance range: 0.02-260 kΩ Power rating: 1-15 W Tolerance: 0.01-10% Low TCR: ±20 PPM/°C Through-hole package Wirewound technology
	BMS Transformers SM91501AL	BMS Transformers are high-reliability isolation and signal transformers designed for Battery Management Systems (BMS) in energy storage systems to provide reinforced galvanic isolation for cell voltage sensing and communication.	<ul style="list-style-type: none"> OCL: 150-600 Working voltage: 1000-1600 V Hi-pot isolation: 4300-7640 VDC AEC-Q200 compliant Supports serial daisy chain isoSPI interface
	NTC Thermistors BTN04G	Bourns® NTC Thermistors are compact, surface-mount components that provide precise temperature sensing and compensation. With stable electrical performance and tight tolerance options, they are ideal for managing thermal conditions in battery packs and energy storage systems.	<ul style="list-style-type: none"> Power rating: 36-50 W R = 10–100 kΩ (±1-5%) Max power rating: 170 mW Operating temperature: -40 °C to +125 °C SMD thermistor for thermal sensing

BESS – Rectification and Inverter

Bourns® Product Recommendations

Product Image	Recommended Products	Description	Specifications and Features
	Silicon Carbide (SiC) Schottky Barrier Diodes BSDH10G120E Series	High efficiency diodes that allow the best performance for high-voltage and high-power applications with practically no switching losses. Best used for PFC and other switch-mode topologies. Also used in high-efficiency snubber and free-wheeling designs.	<ul style="list-style-type: none"> • Max. reverse voltage: 650-1200 V • Max. Forward Current: 5-10 A • Junction temperature: -55 to +175 °C • Through-hole and surface mount packages available • Low Q_{rr}
	Power TVS Diodes PTVS1-240C-M Series	Power TVS diodes provide outstanding protection for direct current (DC) bus applications. TVS diodes provide tighter clamping with superior speed over traditional varistor technology.	<ul style="list-style-type: none"> • Standoff voltage: 15-470 V • Max. peak current: 1-20 kA, 8/20 μs • Offered in through-hole and SMD packages • Bidirectional
	Power Resistors PF2472 Series	Bourns offers a broad range of PWR-series high power thick film resistors with standard packages. Well-suited for use in motor braking and snubbing circuits.	<ul style="list-style-type: none"> • Resistance range: 0.02 Ω-130 kΩ • Power rating: 20-50 W • Tolerance: 1 %, 5 % • TO-220, DPAK, and D²PAK package options • Low inductance
	Current Sense Resistors CSS2H-5930 Series	Bare metal SMD shunts for precision monitoring of current. All blocks will incorporate some form of current monitoring for accurate switching characteristics.	<ul style="list-style-type: none"> • Resistance range: 0.2-5 mΩ • Power rating: 1.5-15 W • Tolerance: 1 %, 2 %, 5 % • Temperature coefficient: 50 PPM/°C • Surface mount • Low thermal EMF
	Thick Film on Steel (TFOS) TFOS30-1-150T	Bourns® Thick Film on Steel offers high-power capability for braking resistor applications. Available with standard solder pads or push-on terminal connections. Designed for easy mounting to heat sinks.	<ul style="list-style-type: none"> • Power rating: 260 W • Maximum element temperature: 365 °C • Low profile thick-film on steel • Low inductance
	Standard Power Inductors and Customized Magnetics	With over 50 years of magnetics innovation, Bourns offers end-to-end design and manufacturing for custom transformers, inductors, and common mode chokes. Engineering teams leverage advanced simulation tools and rapid prototyping to deliver high-performance, application-specific magnetics from prototype to full-volume production.	<ul style="list-style-type: none"> • Stable inductance vs. current • Low profile • Low coupling • Minimal leakage • Contact Bourns for custom designs
	Thermal Jumper Chip BTJ Series	A unique SMD that provides high thermal conductivity while maintaining insulating properties. Enables thermal dissipation without electrical conduction.	<ul style="list-style-type: none"> • Thermal conductivity: 170 W/m-K • High insulation resistance • Operating temp: -55 to 155 °C • Low capacitance

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