Powering
data centers from grid to chip

flex

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Introduction

The advance of AI, machine learning (ML), cryptocurrencies, and cloud computing is dramatically reshaping data centers.

From high-resolution video streaming to complex, AI-driven data processing, data centers must support an array of services that require intensive computational power. Data centers are rapidly becoming one of the largest consumers of global energy resources.

According to the International Energy Agency (IEA)[1], global electricity consumption by data centers is projected to be more than double by 2030, reaching approximately 945 terawatt-hours (TWh) per year, up from about 415 TWh in 2024.

[1] Source: https://www.iea.org/reports/energy-and-ai/energy-demand-from-ai

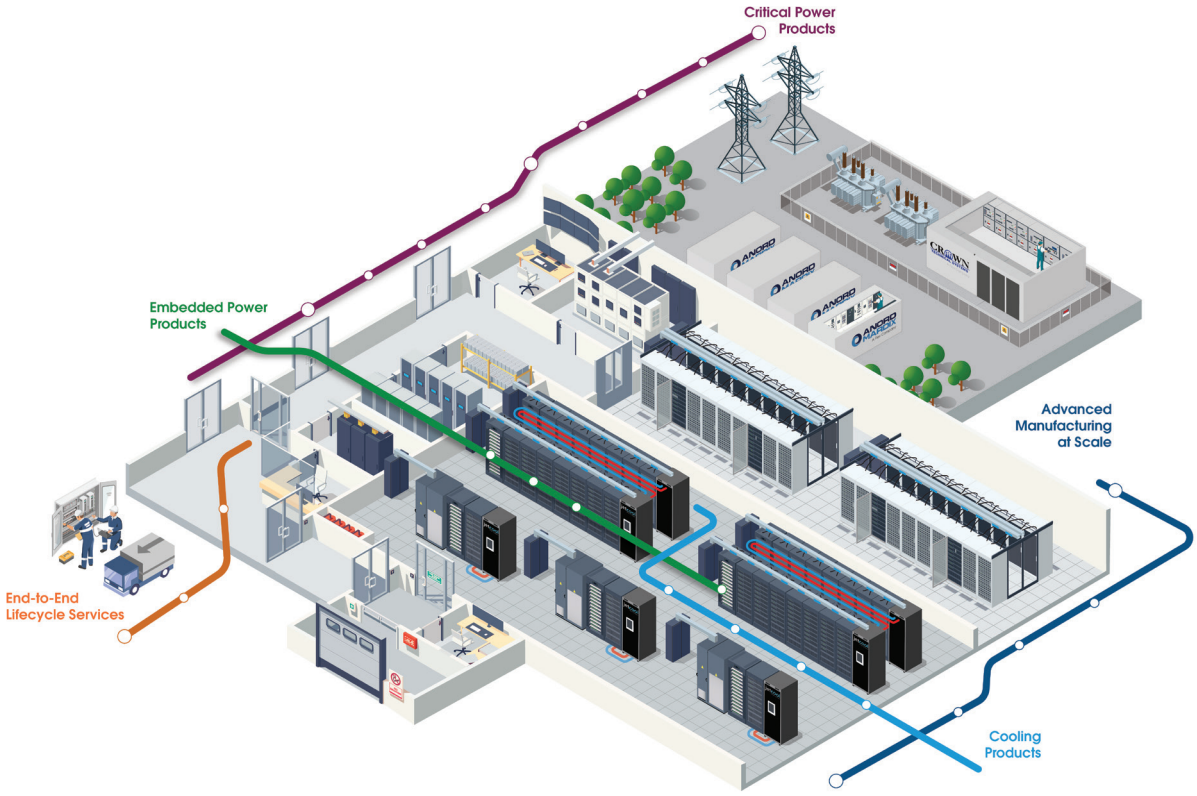
Power solutions for data centers

As data centers continue to grow and adapt to keep up with processing demands, operators encounter significant challenges. In an era of unprecedented data throughput, power distribution strategies are evolving to ensure energy efficiency, reduce heat generation, optimize space utilization, and to improve cost management. Traditional data centers manage approximately 12 kW per rack, but AI data centers are seeing a dramatic increase, with current ultra-high-density racks consuming 250 kW per cabinet. Future projections suggest that this could rise beyond 1+ MW per rack as AI workloads become more demanding.[2]

In this brochure, we will highlight how Flex addresses data center infrastructure requirements to support accelerated customer expansion plans and timelines.

We do this through a comprehensive portfolio of data center IT and power infrastructure solutions and advanced manufacturing services spanning the entire product lifecycle, including design, fulfilment, and circular economy services with global scale and local impact.

Flex is the only manufacturer of data center infrastructure with a power portfolio that extends from grid to chip. Our power solutions are designed to meet the demands of tomorrow's data center requirements.



[2] Source: https://spectra.mhi.com/data-center-cooling-the-unexpected-challenge-to-ai

Critical power

Our commitment to engineering excellence helps ensure that our products and services deliver safe, reliable, and high-quality critical power solutions. We deliver innovative engineering solutions to our clients, effortlessly meeting even the most complex technical requirements, no matter the challenge.

We operate on a global scale, with manufacturing facilities strategically located across the Americas, EMEA, and APAC regions. Our customers trust us to provide high-quality field support for the seamless commissioning of our products and solutions.

ANORD MARDIX
A Flex Company

CROWN TECHNICAL SYSTEMS
A Flex Company

Our end-to-end critical power solutions spanning low-voltage (LV) and medium-voltage (MV) infrastructure and services are delivered through Anord Mardix and Crown Technical Systems, a Flex company. These solutions empower customers to enhance energy efficiency, simplify complex power architectures, and accelerate build times while reducing costs. Purpose-built for the demanding requirements of modern data centers, they ensure reliability, scalability, and safety at every stage of the power chain.

Engineering excellence

Delivering safe, reliable, and high-quality critical power products

Hyperscale innovation

Committed to innovation leadership

Customized solutions

Completely custom built to meet your requirements and timelines

We are powering the future for a resilient world

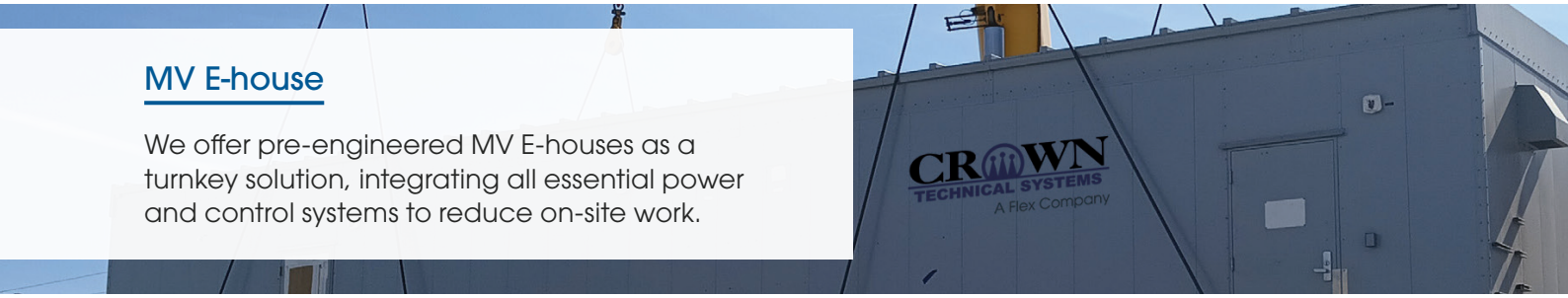
Earning customer trust with more than a century of experience developing innovative, reliable, and safe critical power solutions

Critical power solution portfolio

In addition to showcasing our main product lines, we also provide a range of support services.

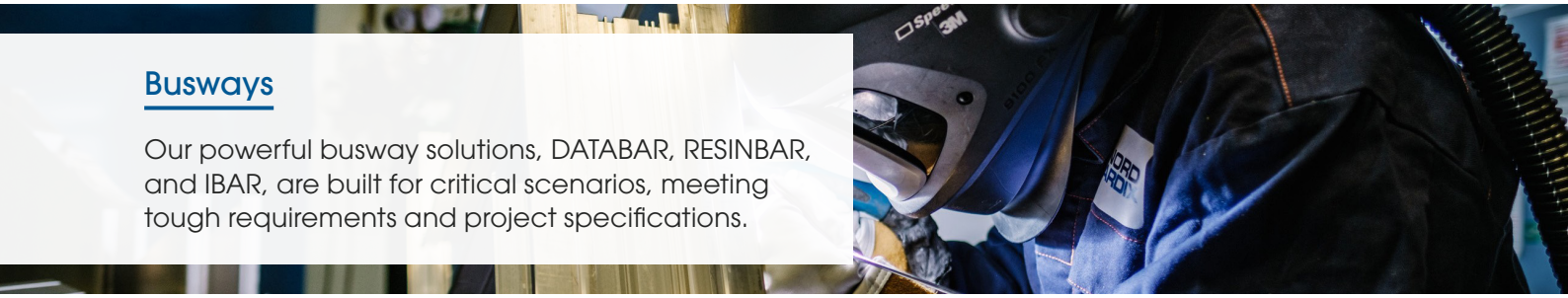
Modular Solutions

We specialize in custom-designed, factory-built modular power pods and skids that are fully outfitted and ready for integration.



MV E-house

We offer pre-engineered MV E-houses as a turnkey solution, integrating all essential power and control systems to reduce on-site work.

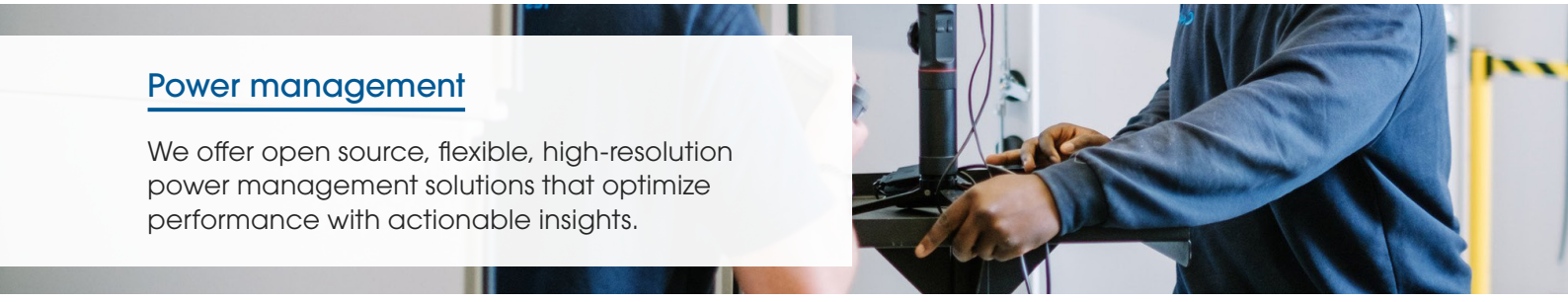


Busways

Our powerful busway solutions, DATABAR, RESINBAR, and IBAR, are built for critical scenarios, meeting tough requirements and project specifications.

Switchgear

Our MV and LV switchboards feature high fault withstand ratings, OEM breaker/meter integration, and uncompromising power control.



Power management

We offer open source, flexible, high-resolution power management solutions that optimize performance with actionable insights.

MODULAR SOLUTIONS

Medium voltage switchgear and control e-house

Crown MV E-houses deliver prefabricated, fully-integrated medium-voltage power solutions that accelerate energization and reduce complexity. Built to customer specifications and tested for reliability, these modular systems cut commissioning time by up to 25%, lower Capex by 10–15% and minimize on-site labor enabling faster deployment and scalability for AI-driven growth.

POWER PODS
Scalable, flexible, hyperscale

Deploy power capacity in greenfield and brownfield data centers with plug-and-play, modular power pods. We build, test, and commission a complete solution that is vertically integrated with everything needed to connect directly to the grid. This solution leads to 75% reduction in onsite assembly and testing, which translates into cost savings.

POWER SKIDS
Redefining off-site construction

Reduce complexity, cost, and build times with vertically integrated power subsystems. Our power skids are pre-assembled on an open metal frame structure and include critical power components, such as UPS, batteries, static transfer switches, and switchgear.

BUSWAYS
DATABAR, IBAR, RESINBAR

Patented designs are built to connect and distribute power across transformers, switchgear, panelboards, and racks. Flex busway products can be configured for single- and multi-story facilities, indoor and outdoor applications, and unique regional requirements.

SWITCHGEAR

LV switchgear

High-quality switchgear with the smallest footprint in the industry. Available in flexible configurations with cable access in the front, rear, top, or bottom.

MV switchgear

Well-engineered, expertly commissioned switchgear with vacuum, gas-insulated (GIS), and sulfur hexafluoride (SF6) options.

Power distribution units

We deliver basic or intelligent PDUs to meet customer requirements. Customizable basic and intelligent PDUs and their critical components, including generators, switchgear, transformers, and UPS, along with remote monitoring and management capabilities.

Remote power panel

Custom-engineered with the highest level of protection and performance for distributing power to racks. Highly compact footprint as small as 450mm x 300mm reduces operating costs, increases floor space, and allows for flexible expansion.

Packaged substations

Support remote mounting of low voltage (LV) transformers, options for medium voltage incomer (main incoming supply source from substation), top or bottom high-voltage (HV) cable connections, fluid-filled air cooled or forced, and in-house PLC programming for dual redundancy.

Distribution panelboards

Modular design to suit user configuration requirements such as metering on each outgoing way or top/bottom cable-entry

POWER MANAGEMENT

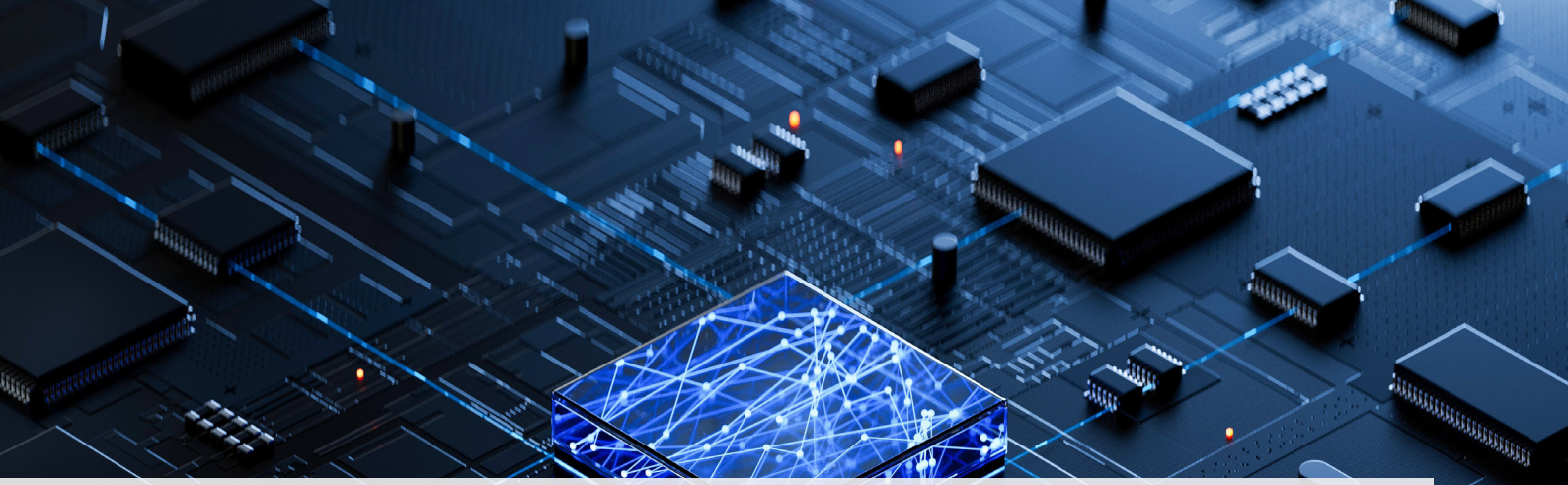
MCMS, Energy Management Systems, IMS DCIM, SCADA Systems

Our metering systems can be retrofitted into existing power infrastructure and SCADA systems. Modular circuit monitoring system (MCMS) supports hardware and software integration with a variety of SCADA or Energy Monitoring Systems. This ensures a single, tested system that gives you the most reliable results.

CRITICAL POWER SERVICES

We offer end-to-end design and engineering for critical power systems, delivering custom equipment specifications, electrical and mechanical layouts, and documented compliance with applicable codes and manufacturer standards.

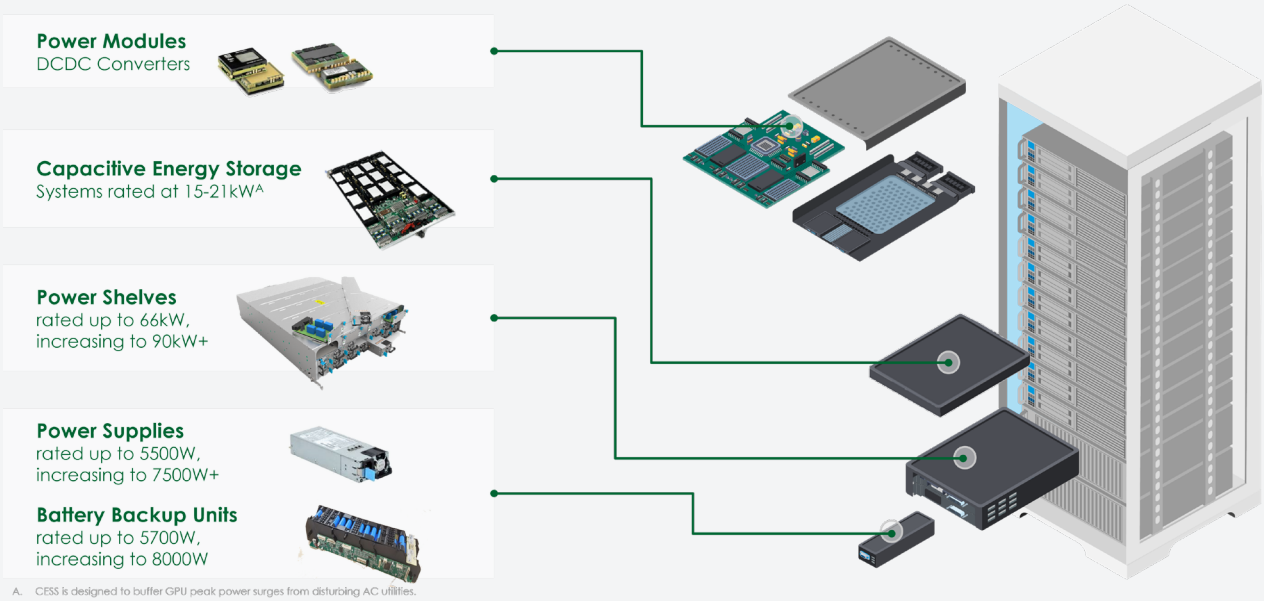
We offer live servicing methodologies that sustain operations in business-critical environments while minimizing downtime, supported by comprehensive post-service reporting to inform maintenance and risk decisions. We offer priority access to technical specialists and OEM-grade spare parts to reduce mean time to repair and accelerate restoration of capacity. All services are executed to industry and manufacturer requirements, with audit-ready regulatory documentation.



Embedded power

Flex's embedded power portfolio addresses power density requirements in the data center by improving efficiency at the board and rack levels, reducing latency and space, and accelerating time to market.

Flex delivers a broad range of embedded power solutions, including AC/DC and DC/DC converters, racks, shelves, and battery backup.



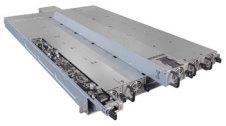
Embedded power's portfolio

Power Shelves

Our Power Shelves are customized solutions and are adapted to our customers' unique needs and requirements.

FLEX GB200/GB300

The Flex GB200 latest generation of power shelf for demanding GPUs. It provides DC power to all the payloads inside a rack and consists of 6 PSUs with a maximum output power of 33kW in total.



1RU power shelf

PSC module

Bus bar clip

5500W PSU

Main features

- 50V 1RU 19" power shelf
- AI / Data Center / Cloud Server / 6+0
- Hot pluggable PSUs and PSC
- Telemetry and monitoring over Redfish
- Bootloader to field upgrade PSC and PSU firmware
- Current sharing between multiple shelves
- Wide input voltage range of 200 – 240 V_{ac} (346 – 457V_{ac} WYE 5 wires 3L+N+PE)

Dimensions

19" - 43.6 x 448 x 718.8mm (HxWxL)

POWER SHELF 3RU MGC NVL72 (110kW)

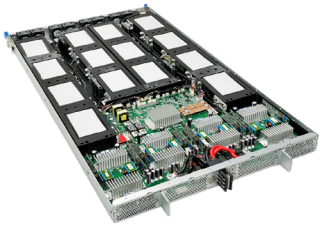
Main features

- Power shelf supports up to 6 PSUs for up to 110kW DC output power
- AC input voltage range 342-480 V_{ac}
- 54V_{dc} output
- Hot pluggable PSUs and Power Shelf Controller (PSC)
- Current sharing between multiple shelves

Dimensions

21" – 130.5 x 534 x 946mm (HxWxL)

CAPACITIVE ENERGY STORAGE SYSTEM (CESS)



The Flex CESS is the first to market Capacitive Energy Storage System which balances utility power in datacenters

Main features

- Supports and balances power supply systems during large power transients
- Long lifespan
- Operating temperature +10°C to +45°C
- 16kW Local Energy Storage Tray (LEST)
- Parallelable up to 8 units per Rack Power Zone

Dimensions

44 x 465 x 788 mm (HxWxL)

DC/DC converters by Flex Power Modules

Flex Power Modules has a comprehensive product portfolio of board-mounted DC/DC modules for data centers that typically run on a narrow 40-60V supply voltage in order to feed power-hungry applications. These power modules come in small form factors for board-space efficiency and serve power needs up to 3 kW.

Manage extremely high power density with inductor-inductor-capacitor (LLC) topologies and leading-edge components for cloud, storage, and hyperscale computing needs.

Vertical power delivery (VPD) is transforming the way data centers manage their power needs, offering a groundbreaking approach that significantly reduces energy losses and enhances overall efficiency. Traditional lateral power delivery methods often result in substantial power dissipation across the printed circuit board (PCB), leading to higher energy costs and increased thermal management challenges. By contrast, VPD minimizes the distance power travels by positioning voltage regulators directly beneath high-demand processors, such as those used in generative AI (GenAI) applications. This proximity reduces power plane resistance and improves current density, leading to a dramatic decrease in power losses and a more reliable, efficient power supply.

Our Vertical power delivery designs facilitate direct underside connections to the power pins of processors and ASICs, further enhancing efficiency and performance in demanding data center environments.

Our products can be categorized as follows:

- 48V non-isolated unregulated DC/DC converters
- 48V non-isolated regulated DC/DC converters
- 48V isolated regulated DC/DC converters
- Integrated power stages / VRM
- Vertical power delivery

More detailed information about the products is found on the Flex Power Modules website.

48V NON-ISOLATED UNREGULATED DC/DC CONVERTERS

Main features

- High power density IBC
- Fixed ratios of 4:1 for BMR31x series
- Fixed ratios of 8:1 for BMR32x series and BMR317
- Digital interface with PMBus

ARTIFICIAL INTELLIGENCE | CLOUD | MACHINE LEARNING | HYPERSCALE

PRODUCT		V_{in} (V)	V_{out} (V)	P_{TDP} / P_{peak}(W)	EFFICIENCY (%)	DIMENSIONS (mm/in)
	BMR314	38-60	9.5-15	800 /1500	97.4	23.4 x 17.8 x 9.65 mm / 0.92 x 0.7 x 0.38 in
	BMR316	38-60	9.5-15	1000 /3000	97.7	23.4 x 17.8 x 7.65 mm / 0.92 x 0.7 x 0.3 in
	BMR317	40-60	5-7.5	800 / 2000	97.2	23.4 x 17.8 x 8.7 mm / 0.92 x 0.7 x 0.34 in
	BMR320	40-60	5-7.5	400 /740	97.6	27 x 18 x 6.4 mm / 1.06 x 0.71 x 0.25 in
	BMR321	40-60	5-7.5	750 /1500	98.1	41.47 x 17.67 x 6.9 mm / 1.63 x 0.69 x 0.27 in
	BMR323	40-60	5-7.5	600 / 1350	97.8	27 x 18 x 6.7 mm / 1.06 x 0.71 x 0.26 in

48V NON-ISOLATED REGULATED DC/DC CONVERTERS

Main features

- Non-isolated, digital quarter brick
- Fully regulated output
- Peak power capabilities

CLOUD | HYPERSCALE

PRODUCT		V_{in} (V)	V_{out} (V)	P_{TDP} / P_{peak} (W)	EFFICIENCY (%)	DIMENSIONS (mm / in)
	BMR350	38-60	8-13.2	600-1300 / up to 1700	97.2	58.4 × 36.8 × 12 mm / 2.3 × 1.45 × 0.47 in
	BMR351	40-60	8-13.2	1600 / 2300	97.8	58.4 × 36.8 × 14.2–14.7 mm / 2.3 × 1.45 × 0.56–0.58 in
	BMR352	40-60	8-13.2	2000 / 3000	97.7	58.4 x 36.8 x 14.7 mm 2.30 x 1.45 x 0.58 in

48V ISOLATED REGULATED DC/DC CONVERTERS

Main features

- Isolated, digital converter
- Fully regulated output
- HRR (Hybrid Regulated Ratio)

CLOUD HYPERSCALE

PRODUCT		V_{in} (V)	V_{out} (V)	P_{TDP} / P_{peak} (W)	EFFICIENCY (%)	DIMENSIONS (mm/in)
	BMR492	40-60	8-13.2	450-800 / up to 1100	Up to 97.5	58.4 × 22.7 × 12.7 mm / 2.3 × 0.89 × 0.5 in
	BMR491	40-60	8-13.2	1300-1540 / 2450	Up to 97.5	58.4 × 36.8 × 14 mm / 2.3 × 1.45 × 0.55 in

INTEGRATED POWER STAGES / VRM

Main features

- 2-phase voltage regulation modules
- Non-isolated, digital converter
- Power stage on top for optimal cooling
- RRV series in collaboration with Renesas

ARTIFICIAL INTELLIGENCE CLOUD HYPERSCALE

PRODUCT		V_{in} (V)	V_{out} (V)	I_{TDC} / peak (A)	EFFICIENCY (%)	DIMENSIONS (mm / in)
	BMR510	4.5-15	0.5-1.3	80 / 160	92	10 × 9 × 7.63 mm / 0.39 × 0.35 × 0.3 in
	RRV28830*	3-15	0.4-1.8	80 /160	90	10 x 9 x 5 mm / 0.39 x 0.35 x 0.2 in
	RRV29830	3-15	0.4-1.8	80 / 160	87	10 x 9 x 5 mm / 0.39 x 0.35 x 0.2 in

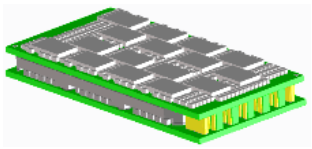
*TLVR variant

VERTICAL POWER DELIVERY

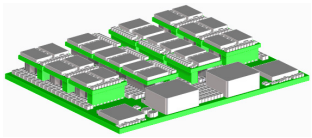
Vertical power delivery is applied to feed power hungry applications to supply high current, low voltage, and extremely fast load transient response by placing the voltage regulators directly under the processors on the bottom of a PCB.

These solutions are always customized and developed in close collaboration with our customers.

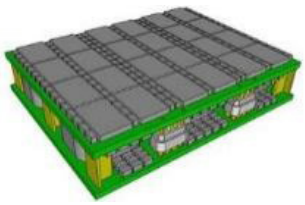
We have already developed various VPD solutions from 1-25 rails and up to 288 phases and gained a deep knowledge and expertise in this complex technology.



VPD | 16 phases, 1 rail



VPD | 48 phases, 5 rails



VPD | 24 phases, 5 rails

POINT OF LOAD

We also have a wide range of Point of Load (PoL) products applicable for data center applications with input ranges from 4.5–15 V and output ranges 0.6-5 V.

These devices incorporate a digital interface for easy monitoring, configuration, and control. To find out more, please refer to our PoL section on the Flex Power Modules website.

Connect with us

Flex data center

flex.com/industries/data-center

linkedin.com/company/flexintl

Flex (Reg. No. 199002645H) is the manufacturing partner of choice that helps a diverse customer base design and build products that improve the world. Through the collective strength of a global workforce across 30 countries and responsible, sustainable operations, Flex delivers technology innovation, supply chain, and manufacturing solutions to various industries and end markets.

For more information, visit flex.com.

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