Flex Power Modules

DC/DC Converters for Data Center Applications

2020

flex.

Powering your innovation.

Introduction

Flex Power Modules, formerly Ericsson Power Modules, has a long, successful track record in DC/DC power solutions with more than 30 years in this business area.

> In the field of digital power, we are one of the leading players driven by innovations, technical know-how and open standard software.
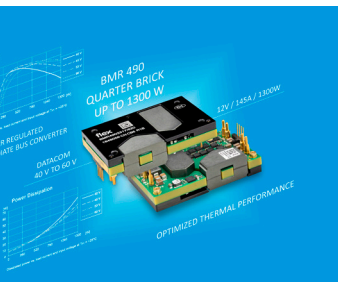
One of our main business areas is data center applications, which typically runs on a 40V-60V supply voltage compared to Telecom which uses a 48V supply voltage that typically requires a 36V-72V$_{input}$ voltage range. We have developed a comprehensive product portfolio of power solutions for this market segment.

In this brochure we provide an overview of our latest power solutions for data center applications, including:

- Digital DC/DC converters
- Direct Conversion
    – 48V to core voltage (< 1.0V) in a single conversion stage
- Switched capacitor intermediate bus converter
- Multi-phase VR Modules - High Density 8-phase for High Current Loads

You can find more technical and other information on our webpage: **www.flexpowermodules.com**

Table of Contents

We have an outstanding track record in digital power, and the products presented below represent the very latest generation of products. They achieve exceptionally high efficiency levels as well as offering superior thermal behavior.

HYBRID REGULATED RATIO IBCs = Higher Power Density

Many of our products mentioned in this category have the capability of Hybrid Regulated Ratio (HRR), which we would like to explain in some more detail.

Hybrid Regulated Ratio is a concept that adds the benefit of regulation to fixed ratio DC-DC conversion. Traditional fixed ratio conversion operates at a fixed duty cycle which can then lead to power train optimization for efficiency and filtering. Using a fixed duty cycle leads to an output to input voltage relationship that is a fixed scalar, typically a divide by an integer value such as divide by 4 or divide by 5.

Adding ratio regulation to the fixed ratio conversion can be accomplished by making the duty cycle a control element. A relatively small range is required to allow operation that controls the duty cycle to maintain a regulated ratio. Now, the benefits of regulation can be accrued where the ratio can be maintained as the load varies from no load to full load and much improved transient response can be achieved.

Further advantage can be gained by introducing the ability to transition from regulating the ratio to regulating a constant output voltage, this is called the HYBRID REGULATED RATIO (HRR). Combining the regulation schemes with the flexibility to choose the transition voltage provides the improved efficiency and filtering performance and reduces the variation of the output voltage over the input voltage range.
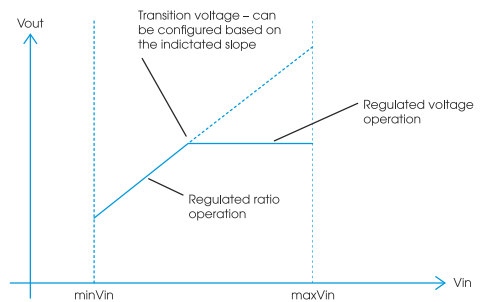
BMR480 – Digital quarter-brick DC/DC (900-1300W)

Main features

- Efficiency 97% at 53 V_{in} and half load

- Hybrid Regulated Ratio (HRR) technology

- Paralleling with two or more BMR480 modules via Droop Load Sharing (DLS) or Active Current Sharing (ACS)

- Digital interface and PMBus compliant

- Isolation 1500 V

- MTBF up to 6.2 Mhrs

Dimensions

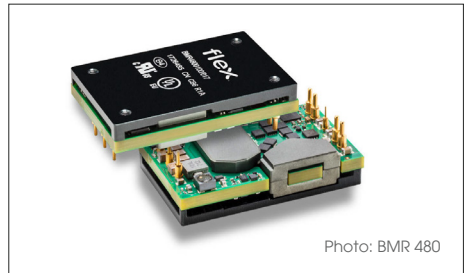58.4 x 36.8 x 14.5 mm; 2.3 x 1.45 x 0.57 in.

Photo: BMR 480

PRODUCT NO.	V_{OUT} (V)	V_{IN} (V)	I_{OUT} (A)	P_{OUT} (W)	η (%)
BMR4800114/003	10.4	40-60	96.2	1000	97.3
BMR4800100/001	10.4	45-56	96.2	1000	97.3
BMR4801102/xxx	12	40-60	75	900	96.7
BMR4800106/xxx	12	45-60	108.3	1300	97.3

BMR490 – Digital quarter-brick DC/DC (1300W)

Main features

- DC/DC converter with high power and high efficiency up to 97.7%

- Excellent thermal behavior

- Paralleling: two or more BMR490 modules can be connected in parallel either via Droop Load Sharing (DLS) or Active Current Sharing (ACS)

- Currently available as non-isolated version

- MTBF up to 6 Mhrs

Dimensions
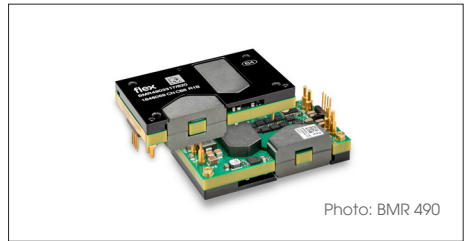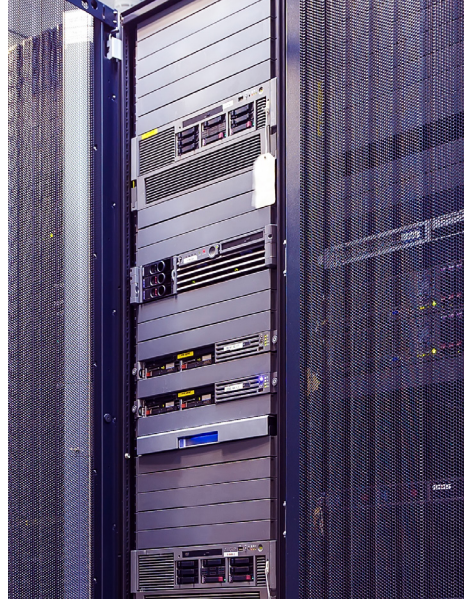
58.4 x 36.8 x 14.5 mm; 2.3 x 1.45 x 0.57 in.

Photo: BMR 490

PRODUCT NO.	V_{OUT} (V)	V_{IN} (V)	I_{OUT} (A)	P_{OUT} (W)	η (%)
BMR4903317/820	12	40-60	139	1300	97.7
BMR4904318/033*	12	40-60	139	1300	97.7

*Active Current Sharing

BMR491 – Digital quarter-brick DC/DC (1500W)

BMR491 is the latest generation of high-power digital DC/DC with continuous power up to 1500W and a peak capability up to 2200W.

Main features

- BMR491 HRR
    - Peak power < 1 sec up to 2200 W
- 1500V isolation

- BMR491 fixed regulated 12V output voltage

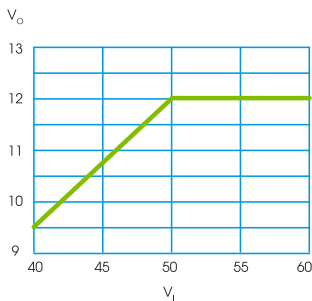- Digital interface available in 7 pin DOSA standard

Dimensions

58.4 x 36.8 x 14.5 mm; 2.3 x 1.45 x 0.57 in.
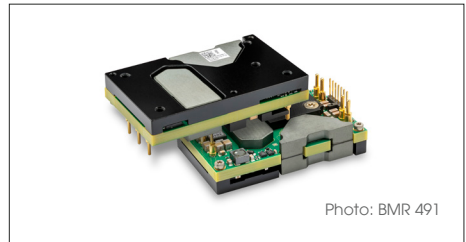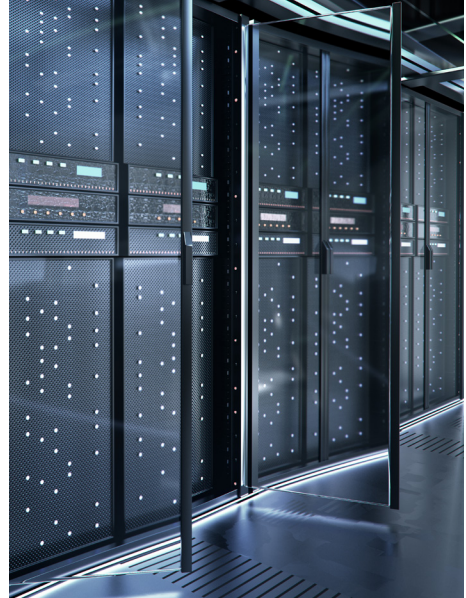
Photo: BMR 491

PRODUCT NO.	V_{OUT} (V)	V_{OUT} range (V)	V_{IN} (V)	I_{OUT} (A)	P_{OUT} (W)	η (%)
BMR491 (HRR)	12	9.2-12.3	40-60	200	1500	TBD
BMR491 (Fixed 12V)	12	11.7-12.3	40-60	—	1300	TBD

Graphs refer to BMR491 (HRR)
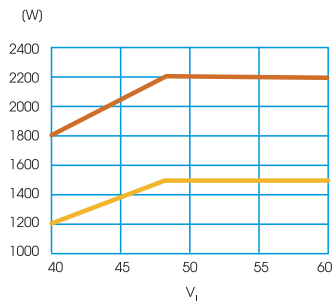
BMR492 – Digital eighth-brick DC/DC (700W)

Main features

- High power module with peak power up to 950W < 1 sec

- Employs HRR

- Digital interface in 7 pin DOSA standard

- Surface-mount package
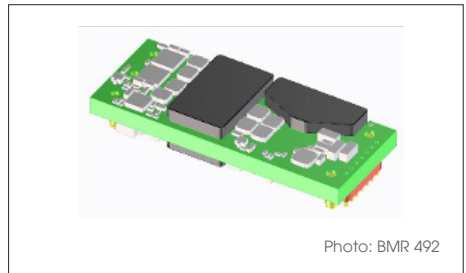
- 700V isolation

Dimensions

58.4 x 22.7 x 14.5 mm; 2.3 x 0.9 x 0.57 in.

Photo: BMR 492

PRODUCT NO.	V_{OUT} (V)	V_{OUT} range (V)	V_{IN} (V)	I_{OUT} (A)	P_{OUT} (W)	η (%)
BMR4921000/860	10.4	9.2-10.6	40-60	67	700	96.5

48V to Load Direct Conversion

High Performance Computing cloud applications, such as big data analytics, autonomous vehicles, AI and deep learning will demand an exponential increase in data center performance and on-board power requirements. Our direct conversion products convert 48V directly to silicon core voltages as low as 0.5 Vdc, thereby optimizing system level efficiencies and board space.

Main features

- 2-3% higher efficiency over dual stage conversion from 48V to 12V to 1V

- Reduction in board space due to the elimination of IBC and several power components

- Scalability through paralleling up to 6 modules delivering up to 600A +

- Supported by Flex Power Designer Tool

- BMR482 is Power Stamp Alliance compatible
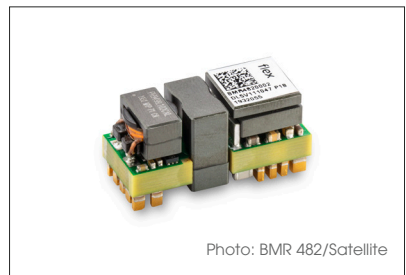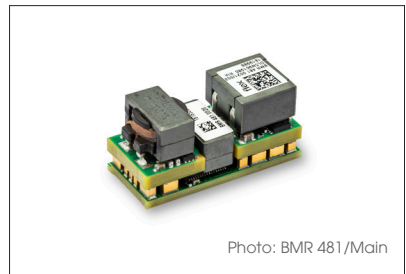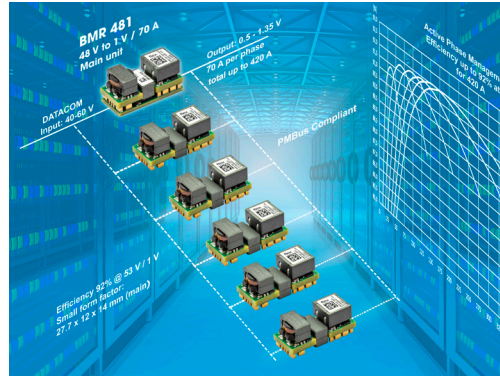

Photo: BMR 481/Main

Dimensions BMR481

Main: 27.7 x 12.0 x 14.0 mm; 1.07 x 0.47 x 0.55 in.
Satellite: 27.7 x 12.0 x 12.6 mm; 1.1 x 0.47 x 0.49 in.

Dimensions BMR482

Main: 30 x 12.7 x 16.8 mm; 1.18 x 0.5 x 0.66 in.
Satellite: 30 x 0.5 x 0.61 mm; 1.18 x 0.5 x 0.61 in.

Photo: BMR 482/Satellite

PRODUCT NO.	V_{OUT} (V)	V_{OUT} range (V)	V_{IN} (V)	I_{OUT} (A)	P_{OUT} (W)	η (%)
BMR4810021/002 (main unit)	1.0	0.5-1.35	40-60	70A	70	91.6
BMR4810022 (satellite unit)	1.0	0.5-1.35	40-60	70A	70	91.6
BMR482 0001/003 (main unit)	0.75	0.5-1.35	40-60	100A	75	92.0
BMR482 0002 (satellite unit)	0.75	0.5-1.35	40-60	100A	75	92.0

Power Surface Multiplier Package (PSMP)/ Vertical Blade IBC 300W

Main features

- BMR520 combines 1 Controller Assembly (CA) unit with 1, 2, or 3 Blades for 300W, 600W, or 900W operation

- 3 PSMP Blades mounted in parallel equals footprint of 1 quarter-brick

- Integrated heatsinks on both sides for self-contained thermal management

- Phase shifted full bridge technology

Dimensions

Blade: 40 x 17 x 20 mm; 1.57 x 0.67 x 0.8 in.
CA: 17 x 17 x 11.6 mm; 0.67 x 0.67 x 0.47 in.

PRODUCT NO.	V_{OUT} (V)	V_{IN} (V)	I_{OUT} (A)	P_{OUT} (W)	η (%)
BMR520 2010 001 (blade unit)	12	36-75	25	300	95
BMR4810022 (controller assembly unit)	-	36-75	-	-	-

Switched Capacitor Intermediate Bus Converter (600-900W)

Introducing the BMR310, an Intermediate Bus Converter based on switched capacitor technology providing >98% efficiency and power levels up to 900W continuous in compact laydown and vertical mount package.

Main features

- 6.5 mm height is ideal for low-profile systems with large heatsinks / cold plates

- Maximum power density improves board space utilization

- Vertical and horizontal mounting options

- Open-frame, base-plated, or integrated heatsink options

- Parallel design via passive **Droop Load Sharing**

- Digital communication and control with PMBus

- Non-isolated

Photo: BMR 310

Dimensions

Laydown: 58.0 x 25 x6 mm; 2.28 x 0.98 x 0.23 in.
Vertical: 58.0 x 6 x 25 mm; 2.28 x 0.23 x 0.98 in.
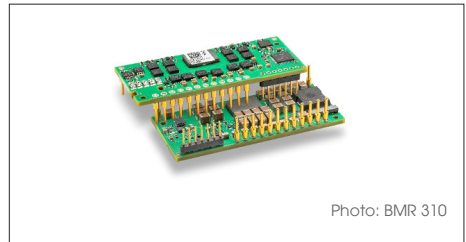
PRODUCT NO.	V_{OUT} range (V)	V_{IN} (V)	I_{OUT} (A)	P_{OUT} (W)	ŋ (%)
BMR310 0100/001 (SIP)	10-15*	40-60	45A	600W	>98
BMR310 0000/001 (laydown)	10-15*	40-60	70A	900W	>98

*Divide by 4

Multi-phase Power Module 320A VR Solution

The BMR510 is a multi-phase power module for VR applications. The power module includes 8 buck power stages with built-in drivers, MOSFETs, inductors and capacitors.

Main features

- Multi-phase buck power stages with 8 phases delivering 480A peak current

- Current and temperature sense

- Current limit and over temperature protection

- Accepts tri-state PWM signals
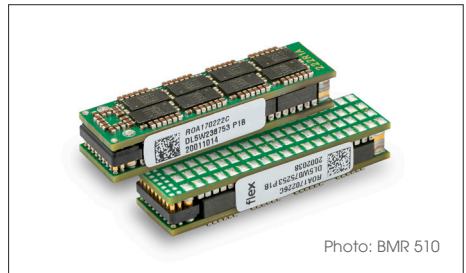
- Halogen-free

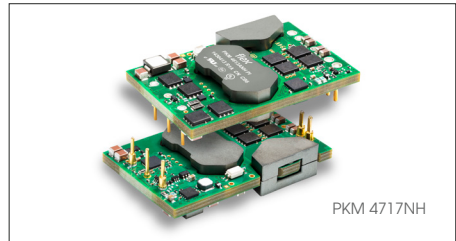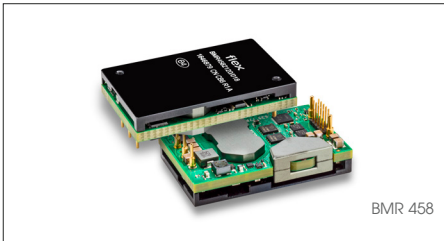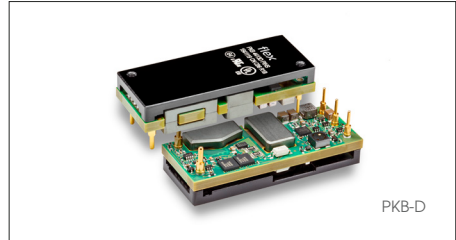## Dimensions

10.35 x 37.5 x 10.9 mm; 0.4 x 1.48 x 0.29 in.

Photo: BMR 510

PRODUCT NO.	V_{OUT} range (V)	V_{IN} (V)	I_{OUT} (A)	P_{OUT} (W)	η (%)
BMR5100001/008	0.5-1.5	4.5-16	480 peak	>300	>88*

* Vin=10.4V, Vout=1.0V, Iout=300A

Other High Performance DC/DC Converters

We also have a wide range of standard DC/DC converters with an input voltage range of 40V- 60V offering different form factors and power levels.
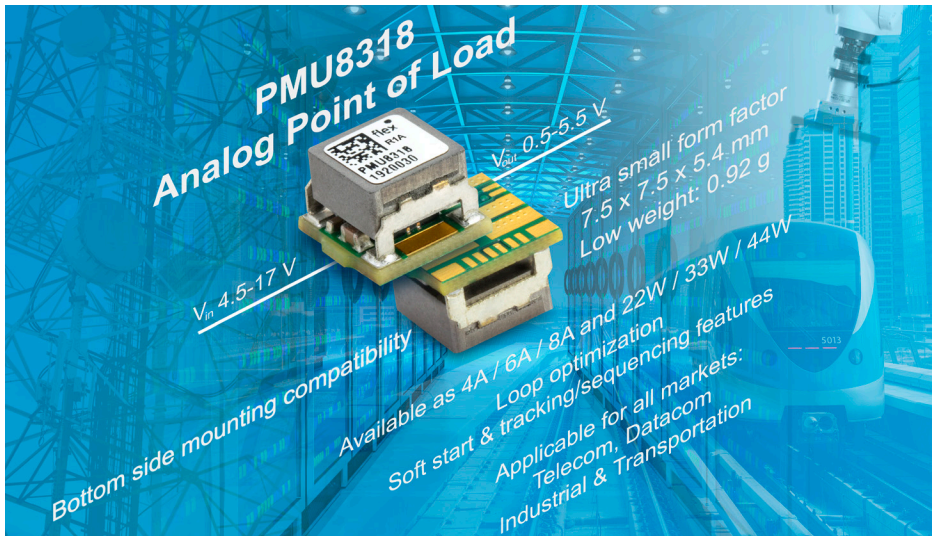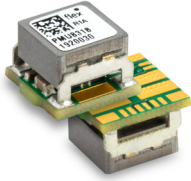

PKU-D

PKB-D

BMR 458

PKM 4717NH
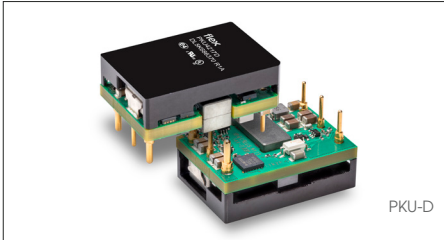
PRODUCT NAME	V_{IN} (V)	V_{OUT} (V)	P_{OUT} (W)	I_{OUT} (A)	Eff (%)	Dimensions
PKU4217D	36-60	10.4	260	62	94.4	Sixteenth brick
PKB 4413DPIHS	36-60	12	450	37.5	96	Eighth brick
BMR 458	40-60	12.2	650	54.2	96.6	Quarter brick
PKM4817NH	40-60	10.8	756	70	97	Quarter brick

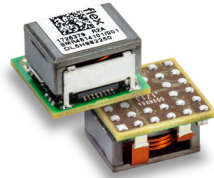# Point of Load Converters 4A to 120A

We also have a wide range of Point of Load (PoL) products. Here is a selection of our PoL options applicable for data center applications. The BMR-families below incorporate a digital interface for easy monitoring, configuration and control.

PRODUCT NO.	V_{IN} (V)	V_{OUT} (V)	I_{OUT} (A)	η (%)	Package
PMU8218	4.5-17	0.6-5	4	95.3	LGA
PMU8318	4.5-17	0.6-5	6		LGA
PMU8418	4.5-17	0.6-5	8		LGA
BMR461	4.5.-14	0.6-5	6/12/18		LGA (BGA)
BMR462	4.5.-14	0.6-5	12		TH/SMD/SIP
BMR463	4.5.-14	0.6-3	20/25		TH/SMD/SIP
BMR464	4.5.-14	0.6-3.3	40/50		TH/SMD/SIP
BMR466	4.5.-14	0.6-1.8	60		LGA (BGA)
BMR465	7.5-14	0.6-1.8	90		TH/SMD/SIP
BMR467	7.5-14	0.6-1.8	120		TH/SMD/SIP
BMR469	7.5-14	0.6-5	2x40A/2x25A		SMD

PMU8318
Analog Point of Load

V_{out} 0.5-5.5 V

Ultra small form factor
7.5 x 7.5 x 5.4 mm
Low weight: 0.92 g

V_{in} 4.5-17 V

Bottom side mounting compatibility

Available as 4A / 6A / 8A and 22W / 33W / 44W

Loop optimization

Soft start & tracking/sequencing features

Applicable for all markets:
Telecom, Datacom
Industrial & Transportation

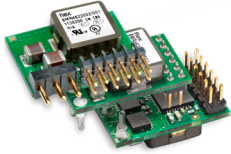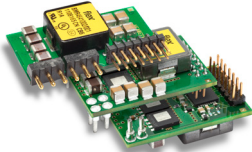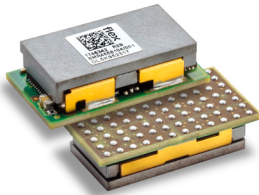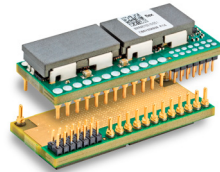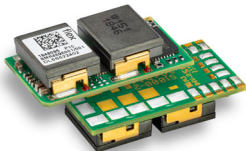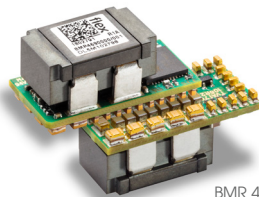PMU 8318

BMR 461

BMR 462

BMR 463

BMR 464

BMR 465

BMR 466

BMR 467

BMR 469 (2x25A)

BMR 469 (2x40A)

For more information, please visit www.flexpowermodules.com or mail us to pm.info@flex.com.

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Flex Power Modules, a division of Flex (NASDAQ: FLEX), designs and manufactures scalable power supply solutions that improve the operational efficiencies of advanced data center, IT information and communication networks. Flex Power Modules′ products provide a complete on-board system solution for cloud, storage and server applications and address customer challenges while delivering superior quality, cost and performance scale. Learn more at flex.com. Twitter: @Flexintl. Live Smarter™

flex.